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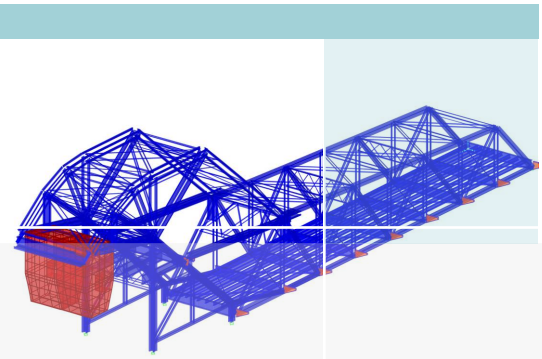
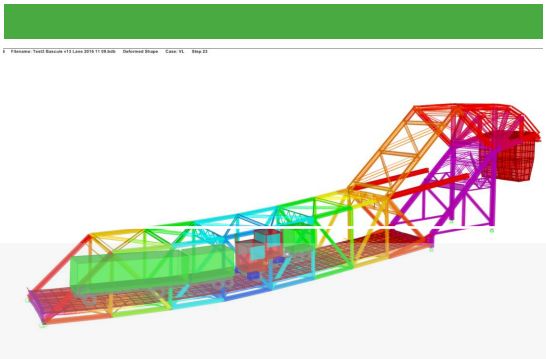
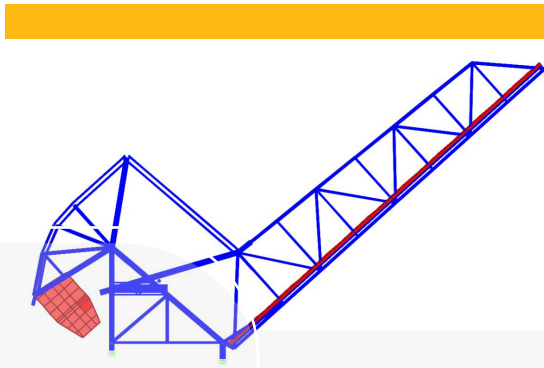
June, 2017

LaSalle Causeway Bascule Bridge 2017 Structural Evaluation Report







Project Number: R. 055058.002

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28 June 2017

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Toronto, ON M2N 6A6

Dear Mr.Afrooz:

RE: LaSalle Causeway
2017 Structural Evaluation Report
PWGSC Project No. R.055058.002

We are pleased to submit the final report for the 2017 Structural Evaluation Report of the LaSalle Causeway for your records.

Report prepared by,

Amir Tehranian, M.A.Sc., E.I.T
Structural Designer

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Senior Structural Engineer

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LaSalle Causeway Bascule Bridge

2017 Structural Evaluation Report

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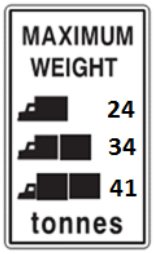
Executive Summary

Parsons was retained by Public Services and Procurement Canada (PSPC), formerly Public Works and Government Services Canada (PWGSC), in September 2016 to complete a structural evaluation of the LaSalle Causeway Bascule Bridge. This task has included the collection and review of all relevant available data; completion of a field condition survey, structural evaluation, establishing an appropriate load posting, and providing a report summarizing the findings and evaluations and any repairs deemed necessary. The bascule bridge also provides marine access to the inner harbour of Kingston, lifting an average of 900 times per year, and access to the southern entrance of the Rideau Canal.

The Canadian Highway Bridge Design Code (CHBDC) includes both standard loading (including highway live load) and special load cases for bascule moving bridges. The structural evaluation of the Bascule Bridge has been performed by Parsons as per Sections 3, 10, 13, and 14 of CAN/CSA-S6-14 CHBDC.

Our results show that with reinforcing of members 9N-12N and 9S-12S (Figure 1), the structural capacity of the bridge will be sufficient to meet the full live load of vehicular traffic without load posting (standard loading). A capital allowance of $250k should be made to complete these repairs. Prior to strengthening, in accordance with the CHBDC, the bridge must be triple-load posted at 41, 34, and 24 tonnes for CL1, CL2, and CL3 respectively. Load posting signs as shown below should be erected on the approaches:



The bridge does not satisfy CHBDC special load case code requirements for moveable bridges. The results of our analysis for these special load combinations are generally in agreement with the June 2015 report by MMM Group Limited, Trunnion Joint Inspection and Analysis Report. Per our analysis, during a bridge lift, the structure seems unable to satisfy the code requirements regarding the load combinations including operating impact forces, wind load, and horizontal force. The severity of member overstressing is the highest when the wind loads and impact forces are combined. It should be noted that the bridge would have been deficient on these demands from its time of construction, meaning the current design code has more stringent requirements than the bridge was originally designed for. Frame members governing the special load combinations are graphically shown in Figure 2.

It is unclear what, if any, formal design requirements would have been required at the time of design, however, the bridge has performed well since constructed. An upgrade to current code requirements may be cost prohibitive and require lengthy highway lane and marine traffic closures. It is likely the costs of such an upgrade could be unpractical compared with replacement, and a life cycle cost analysis should be completed.

A rationalization of the impact factors by PSPC is warranted. Consideration should be given to the merit of field measuring the operating impact factors of this bascule bridge which may be achieved with accelerometer readings taken during bridge operation. Implementing a structural health monitoring system (SHM) may extend the service life of the structure.

Given the absence of recorded operational issues with the current structural design, PSPC may choose to keep the existing bridge in operation without any major modifications, and accept the risk of not upgrading to current CHBDC requirements. However, the bridge should not be operated without any further repair and/or reinforcement to several members in conditions of high wind or ice accretion. In an effort to reduce operating impact factors it is also recommended that the capital project to upgrade the bridge controls be expedited.

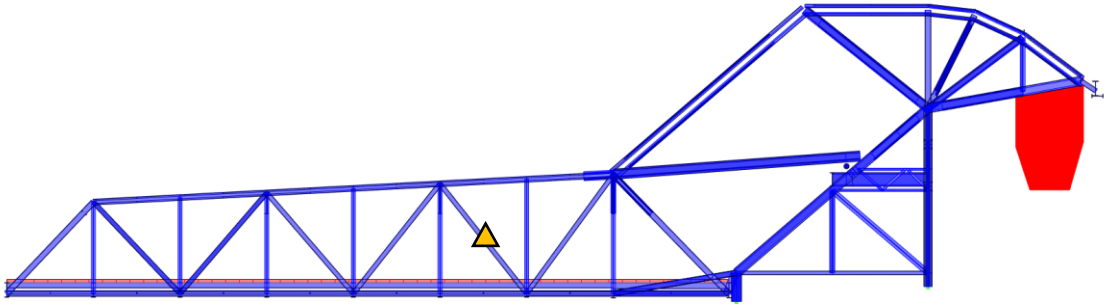


Figure 1 – Frame Members Governing the Vehicular Live Load Capacity

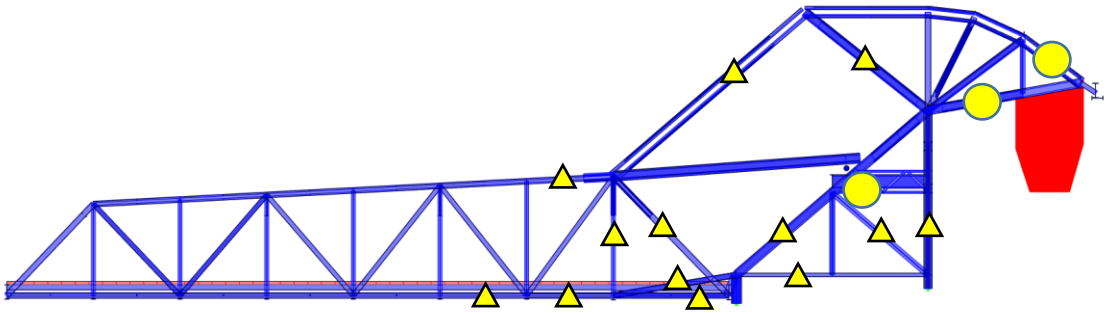


Figure 2 – Frame Members Governing the Load Capacity under Bascule Bridge Special Load Combinations

*(members highlighted with yellow circle fail at an opening of 84^0 which is outside the current operating range)

1.0 Introduction

1.1 General

The LaSalle Causeway, owned and operated by PSPC, carries County Road No. 2 across the Cataraqui River within the City of Kingston, providing a critical transportation link between the downtown area on the west side of the river with the Barriefield/CFB Kingston area on the east side of the river. Approximately 23,000 vehicles cross the Causeway daily. The Causeway consists of five (5) interconnecting structures: the west bridge (including its west approach), the west wharf, the bascule bridge, the east wharf, and the east bridge (including its east approach). The bascule bridge also provides marine access to the inner harbour of Kingston, lifting an average of 900 times per year, and access to the southern entrance of the Rideau Canal. Construction was completed on April 15, 1917. The location of the Causeway is shown on the key plan (Figure 3).

In September 2016, Parsons was retained by Public Services and Procurement Canada (PSPC), formerly Public Works and Government Services Canada (PWGSC), to complete a structural evaluation of the LaSalle Causeway Bascule Bridge. This task has included the collection and review of all relevant available data, completion of a field condition survey, structural evaluation, establishing an appropriate load posting, and providing a report summarizing the findings and evaluations and any repairs deemed necessary.

This report documents and summarizes the findings of the evaluations of the LaSalle Causeway Bascule Bridge, and includes recommended repairs for the structure.

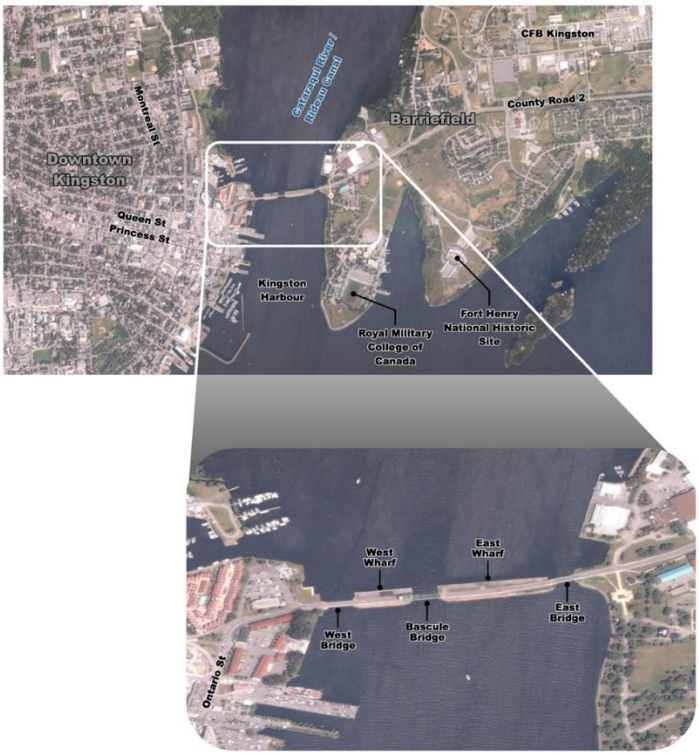


Figure 3 - Key Plan

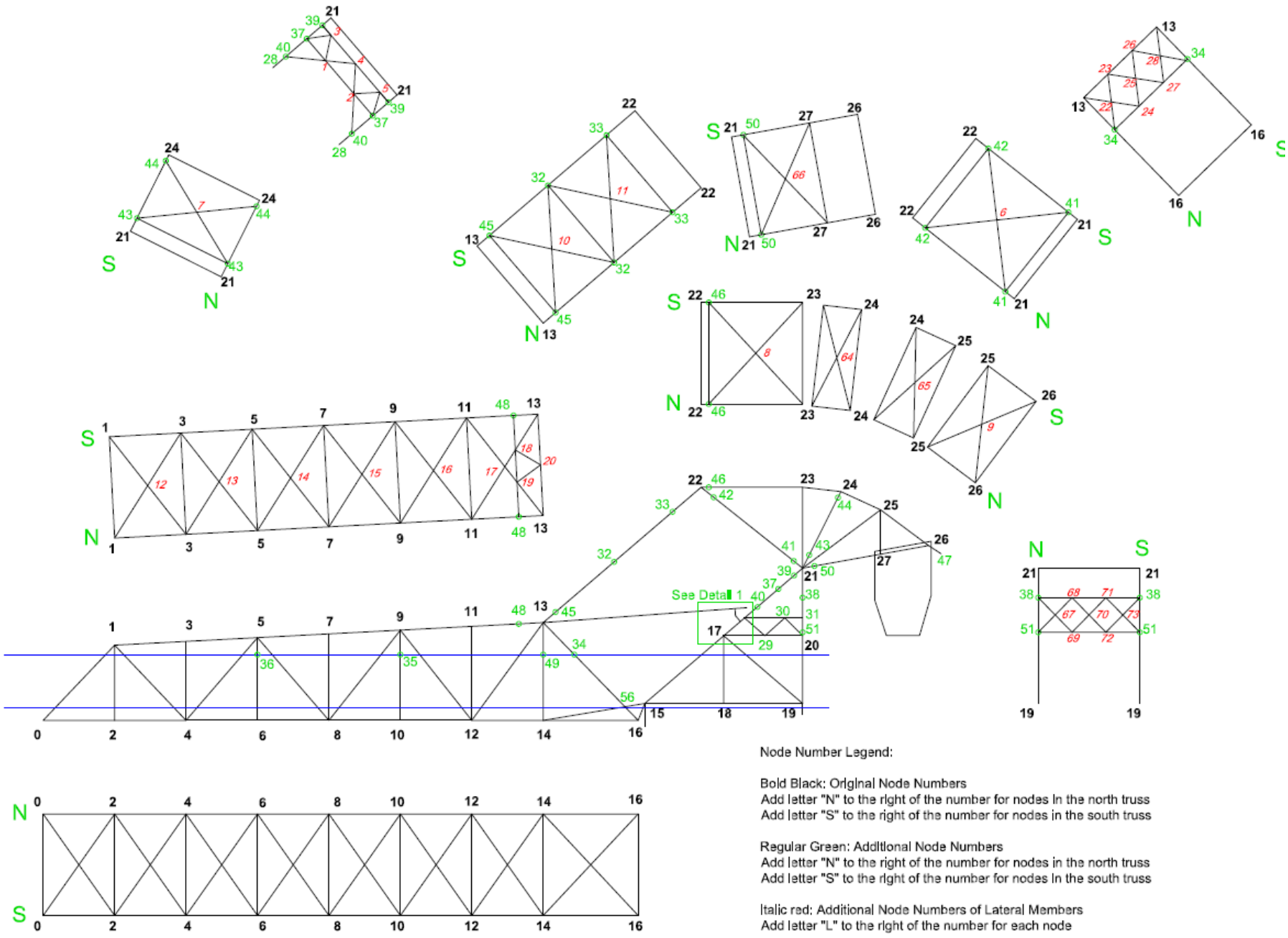


Figure 4 – LaSalle Causeway Bascule Bridge Node Numbering

A more detailed node layout can be found on SK-01 included in Appendix A of this report.

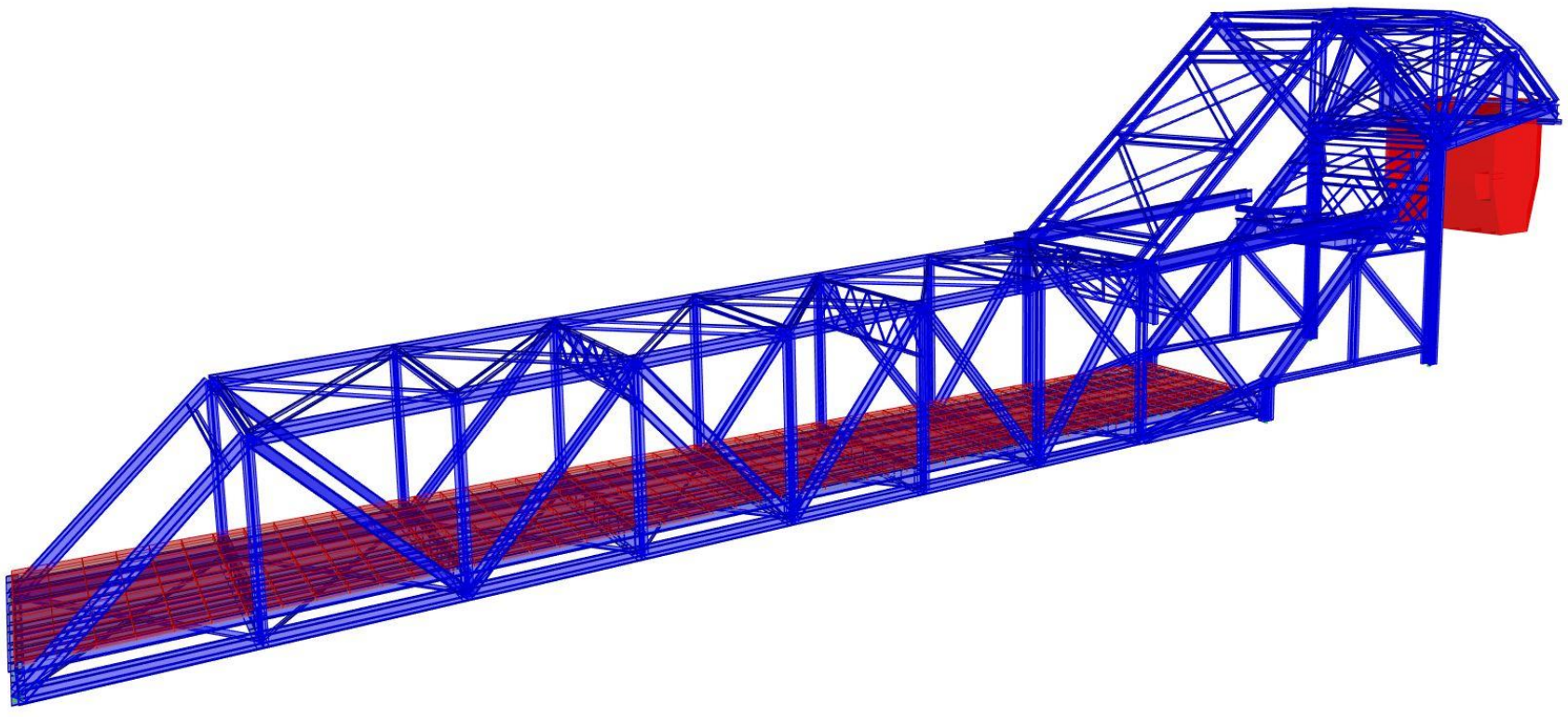


Figure 5 – LaSalle Causeway Bascule Bridge Finite Element Model

1.2 Scope of Work

1.2.1 FIELD WORK

The scope of superstructure field work included:

- Visual observations of the structural condition of members and connections
- A limited dimensional inspection to verify existing information and establish principal member sizes
- Photographic survey to record representative conditions
- Detailed measurement of member dimensions at most current conditions
- Measurements have included steel thickness (section loss) measurements at many locations

The results of these field studies were presented in previous reports including: LaSalle Causeway 2016 Annual Comprehensive Detailed Inspection Report, LaSalle Causeway Bascule Bridge 2015 Detailed Measurements, as well as LaSalle Causeway 2017 Deck Grating Inspection and Repair Report. Deterioration and section loss determinations for the structural evaluation were made from the data presented in these reference reports.

1.2.2 STRUCTURAL EVALUATION

A structural evaluation was carried out in accordance with Sections 3, 13, and 14 of CAN/CSA-S6-14 (CHBDC). The structure was evaluated for highway live loading and for moveable bridge loads in accordance with Sections 13 and 14 respectively. The scope of the structural analysis and evaluation included:

- Determination of load carrying capacity and load rating of the superstructure for vehicle live load
- Determination of load carrying capacity for special loads cases for the Bascule bridges during a bridge lift at selected open positions
- Recommendation of load postings for vehicle traffic
- Production of a schedule of repairs required
- Recommendations for repairs
- Performing structural evaluation for following structural members:
  - Through Truss Diagonal
  - Through Truss Vertical
  - Through Truss Bottom Chord
  - Through Truss Top Chord
  - Counterweight Link
  - Operating Strut
  - Through Truss Trunnion Bay
  - Counterweight Top Chord
  - Counterweight Diagonal
  - Counterweight Vertical
  - Counterweight Horizontal
  - Tower Truss Vertical
  - Tower Truss Diagonal
  - Tower Truss Horizontal
  - Tower Truss Vertical
  - Tower Truss Diagonal (secondary)
  - Tower Truss Secondary Truss
  - Floor Beams

- Stringers
- Major connections on the through truss for live load

- Members which were excluded from the structural evaluation;
  - Through Truss Bottom Lateral Bracing
  - Through Truss Sway Truss
  - Through Truss Strut
  - Through Truss Top Lateral Bracing
  - Internal counterweight members (these are inaccessible for inspection)
  - Counterweight Link Lateral Bracing
  - Tower Truss Lateral Bracing
  - Counterweight Truss Lateral Bracing
  - New Counterweight
  - Sidewalk Cantilever
  - Sidewalk decking
  - Bridge and Pedestrian Barriers
  - Machinery Room Beam
  - Mechanical Parts
  - Buried Parts of the structure
  - Connections for moveable loads
  - Substructure

1.2.3 EVALUATION FOR CLOSED POSITION

General Load Cases – Sections 3 and 14 of CAN/CSA-S6-14

- The following were included in the structural evaluation:
  - dead load
  - live load of vehicular traffic

- The following were not excluded in the structural evaluation:
  - ice accretion load
  - loads due to earth pressure and hydrostatic pressure
  - earthquake load
  - loads due to stream pressure and ice forces or to debris torrents
  - collision load arising from highway vehicles or vessels
  - all strains, deformations, and displacements and their effects, including the effects of their restraint and the effects of friction or stiffness in bearings. Strains and deformations include strains and deformations due to temperature change and temperature differential, but not elastic strains
  - load due to differential settlement and/or movement of the foundation
  - sidewalk loading per Clause 14.9.5.1 (significant sidewalk loading not considered likely to occur with maximum traffic loading)
  - snow loads per clause 14.9.5.2 (not deemed significant due to open deck grating system)
  - wind load on traffic per Clause 14.9.5.3 (not deemed significant in the closed position)
  - wind load on structure per Clause 14.9.5.3 (not deemed significant in the closed position)

1.2.4 EVALUATION FOR OPEN CONDITION

Special Load Cases for Bascule Bridges – Section 13 of CAN/CSA-S6-14

- Special Load cases for bascule bridges per Section 13 of CAN/CSA-S6-14 were applied to the bridge structure when the bridge is open in any of the 5 positions (0, 21, 42, 63, and 84˚); while position 0˚ represents the closed bridge with ends just touching. Following load cases of Section 13 of CAN/CSA-S6-14 for bascule bridges were included in the structural evaluation:
  - dead load;
  - horizontal force
  - wind load
  - operating impact

- Following load cases of Section 13 of CAN/CSA-S6-14 for bascule bridges were not included in the structural evaluation:
  - dead load; bridge closed; counterweight supported for repairs
  - live load (including dynamic load allowance); bridge closed; counterweight supported for repairs
  - maximum loads on structural parts caused by the operation of machinery, or by forces applied for moving or stopping the span.

1.2.5 MAXIMIUM OPERATING ANGLE

Although our terms of reference required us to evaluate the bridge at 84, the current maximum operating angle for the bridge of 65˚was confirmed in an email from PSPC bridge operations to Parsons dated 6 June 27, 2017. Therefore, any potential issues with overstress or counterweight interference with roadway beyond that angle have no impact on bridge operations

1.2.6 LIMIT STATE EVALUATION

In accordance with clause 14.5.2 the Ultimate Limit State was used in determining the load-carrying capacity, stability and load posting of the bridge.

Evaluation for the Fatigue Limit State was outside the scope of this assignment. In accordance with Clause 14.18, as an alternative to analysis fatigue-prone details may be monitored by regular inspections (stringer to floor beam connections for example).

1.3 Nomenclature

For primary members of the bascule bridge, truss node and member numbers were adopted from 1915 original drawings. For some secondary members, no node number is provided on the original drawings. To address these nodes in this evaluation report, additional node numbers were defined. Node numbering was graphically presented in Figure 4 and in more detail on SK-01 in Appendix A.

2.0 Desktop Study

2.1 Maintenance and Inspection History

A detailed maintenance and inspection history of LaSalle Causeway Bascule Bridge has been incorporated into the LaSalle Causeway 2016 Annual Comprehensive Detailed Inspection Report. It is summarized here as it outlines members which have been replaced or strengthened and forms part of the basis upon which the structural evaluation was conducted.

2.1.1 MAINTENANCE HISTORY

The LaSalle Causeway Bascule Bridge have undergone numerous repairs and rehabilitation works since its construction in 1916. The following is list of some of the major works undertaken:

- In 1966, the Bascule Bridge operating mechanism was renewed, including a new operator's cabin and control electronics.
- In 1973, the Bascule Bridge floor beams were replaced with welded wide flange beams.
- In 1981, the Bascule Bridge floor system stringers were replaced, along with the timber sidewalk stringers and deck planks.
- In 2001, two buffers were added to the Bascule Bridge to reduce impact when the bridge lands.
- In 2004, a maintenance contract on the Bascule Bridge was completed to replace rivets in fatigue prone members of the counterweight.
- In 2009-2013, the Bascule Bridge underwent a major rehabilitation, which included: removal of lead paint and application of low VOC protective coating system to all structural steel members of the bridge; structural repairs to deteriorating steel members (i.e. operating arm, bottom gusset plates, exterior splice plates in the bottom chord, etc.); reinforcing certain diagonal truss members; replacing timber sidewalk stringers and deck planks; installation of new pedestrian railing meeting CHBDC requirements for a combination pedestrian/bicycle barrier; replacing traffic barrier; and replacing wood stairway treads with steel treads; installation of a new steel counterweight for balancing the bridge.
- In 2016, new W-beam guide rails were installed on the northeast and northwest approaches of the West Bridge, along the south side of the sidewalk on the West Wharf, along the south side of the sidewalk on the East Wharf and along the northeast and southeast approaches of the East Bridge. New pedestrian railings were installed on the southeast and southwest wingwalls of the Bascule Bridge, and repairs were carried to the southeast and southwest training walls. New chain link fences were installed on the southeast and southwest embankments of the Bascule Bridge and at the westbound traffic barrier.
- In 2017, the following rehabilitation and inspection contracts for the Bascule Bridge were initiated: replacement of the buffers (construction completed); detailed inspection and repairs options report for the steel deck grating; repairs to the span locks and bottom chords of the leaf truss (construction in progress); upgrades to the motor drive and motor control upgrade (design in progress); rehabilitation of the guide assemblies (design completed).

The list of repairs and rehabilitation works above is not comprehensive, as not all information was available to the inspectors. However, it should highlight the major works undertaken to the structures on the LaSalle Causeway.

2.1.2 INSPECTION HISTORY

Parsons performed the following recent inspections on LaSalle Causeway Bascule Bridge:

- 2017 - LaSalle Causeway Deck Grating Inspection and Repair Report; PWGSC Project No. R.082857.001.
- 2016 - LaSalle Causeway 2016 Annual Comprehensive Detailed Inspection Report; Project Number: R. 055058.002
- 2015 - LaSalle Causeway Bascule Bridge 2015 Detailed Measurements; Project Number: R. 055058.002
- 2015 - LaSalle Causeway 2015 Annual Comprehensive Detailed Inspection Report Project Number: R. 055058.002
- 2015 – Document Review Report. Project Number R.055058.002

2.1.3 BRIDGE SPECIFIC REFERENCE MATERIAL

The following relevant reference material has been consulted during this evaluation.

- 2017 - Parsons Inc - LaSalle Causeway Deck Grating Inspection and Repair Report, PWGSC Project No. R.082857.001
- “LaSalle Causeway – Bascule Bridge, North and South Guide Assembly Repair”; Tender Drawings; Project No. R.082819.001; Parsons Inc.; June 2017.
- “Span Balance Analysis and Buffer Commissioning Report, LaSalle Causeway Bascule Bridge”; Report; Stafford Bandlow Engineering Inc.; May 2016.
- “LaSalle Causeway Bascule Bridge over the Cataraqui River – 2015 Secondary Mechanical Inspection Report”; Report; Stafford Bandlow Engineering Inc.; January 2016.
- “LaSalle Causeway – Bascule Bridge, Replacement of Span Locks”; Issued for Tender Drawings; Project No. R.082857.001; Parsons Inc.; November 2016.
- 2016 – Parsons Inc - LaSalle Causeway 2016 Annual Comprehensive Detailed (Bascule) & General Inspection Report, PWGSC Project No. R.055058.002
- “LaSalle Causeway Railing”; As-Built Drawings; Project No. R.079547.001; AECOM; June 2016.
- “LaSalle Causeway 2015 Annual Comprehensive Detailed Inspection Report”; Report; Parsons; September 2015.
- “LASALLE CAUSEWAY Trunnion Joint Inspection and Analysis Report”; Report; MMM Group; June 5, 2015.
- “2012 Railing Improvements 2012”; Public Works and Government Services Canada, September 2014.
- “Inspection of existing Buffers and existing Span Locks”; Letter; Parsons., New York; April 30, 2014
- “LaSalle Causeway Comprehensive Detailed Inspection”; Genivar, March 2014.
- “2011 Comprehensive Detailed Inspection Report for LaSalle Causeway”; Delcan Corporation; December 2011.
- “2010 Comprehensive Detailed Inspection Report for LaSalle Causeway”; McCormick Rankin Corporation; March 15, 2011.
- “LaSalle Causeway – Bascule Bridge, Repairs and New Coating”; As-Built Drawings S01 to S25; Project No. R.012359.001; McCormick Rankin Corporation; September 16, 2010.
- “LaSalle Causeway (Coating)”; Contract Specifications; Project No. R.012359.001; McCormick Rankin Corporation; July 2009.
- 2005 - McCormick Rankin Corporation - Kingston Bascule Bridge Fatigue Review and Rehabilitation of Counterweight Members, January, 2005
- “Kingston Bascule Bridge – Fatigue Review and Rehabilitation of Counterweight Members (Updated After Construction)”; McCormick Rankin Corporation; January, 2005.
- 2001 - McCormick Rankin Corporation – Seismic Structural Analysis of the LaSalle Bascule Bridge, October, 2001

- 1973 - C.C. Parker and Associates Limited - LaSalle Causeway – Repairs to Bridges As-Built Drawings, PWGSC Project Number 81254, prepared by C.C. Parker and Associates Limited, March 1973.
- "Bascule Bridge – Repairs to Floor System": Design Drawings: Sheet 1 of 1, Public Works of Canada, Ontario Region, December 1971.
- "Strauss Trunnion Bascule Bridge (Patented) over Cataraqui River, Kingston Harbor Improvements for Dept. of Public Works"; As-Built Drawings (1 to 22); The Strauss Bascule Bridge Co., Chicago; January 21, 1915.

2.2 Materials

In accordance with CAN/CSA-S6-14 Section 14, in lieu of original construction documents, strength of materials not showing signs of deterioration shall be determined based on test samples, date of construction or an approved method.

For this evaluation, since no material sample was undertaken, strength of material was estimated based on date of construction according to clause 14.7.4 of CAN/CSA-S6-14 CHBDC.

2.2.1 MATERIAL SAMPLING AND TESTING

For this evaluation, no material sample was undertaken.

2.2.2 STRUCTURAL STEEL

In the absence of other information, Table 14.1 of CHBDC states that for bridges constructed between 1905 and 1932, the specified yield strength of steel (F_y) shall be taken as 210 MPa and the ultimate strength (F_u) taken as 420 MPa. Since the LaSalle Causeway Bascule bridge is constructed between 1915 to 1917, the above values were taken as the strength of steel for the purposes of this evaluation.

The unit weight of steel was taken as 77.0 kN/m^3 (unit mass of 7850 kg/m^3) in accordance with Table 3.4 of CHBDC.

2.2.3 CONCRETE

In the absence of other information and per clause 14.7.4.3, the compressive strength of concrete with no visible signs of deterioration shall be taken as 15 MPa for the substructure and 20 MPa for the superstructure.

The unit weight of concrete was taken as 23.5 kN/m^3 (unit mass of 2400 kg/m^3) in accordance with Table 3.4 of CHBDC.

2.3 As Built Information

No as-built drawings were provided for this evaluation. Therefore, existing drawings from 1914 and 1915 were formed the basis of this study. Bridge specific reference material was also made available for use in this study by PSPC. Where appropriate, this body of available information was utilized. Much of the data previously collected is still valid and as such, a complete dimensional inspection was not repeated. However, some dimensional checks were performed and a complete review of the present members was conducted to highlight any changes/strengthening that has occurred in the interim. For example, the original drawing details show variation of counterweight and machine room area in the tower truss. Our structural model for these components reflects our field observations of these areas.

3.0 Condition Assessment

3.1 General

This sections summarizes the observed condition of the structure, in particular the components of the structure that play a significant role in structural integrity of the bascule bridge. Information provided here is based on the 2015 and 2016 Annual Comprehensive Detailed Inspections as well as 2017 LaSalle Causeway Deck Grating Inspection and Repair.

3.2 Deck Components

3.2.1 STEEL DECK GRATING

The current steel grating was installed in 1976 based on the as-built contract drawings "LaSalle Causeway – Repairs to Bridges" by C.C. Parker. The steel grating consists of 25mm x 6mm (1" x ¼") transverse cross bars supported on 64mm x 6mm (2 ½" x ¼") longitudinal bearing bars that are supported on small transverse rolled I-beam sills. The longitudinal bearing bars are welded to every second steel sill and the cross-bars are fillet welded to the bearing bars in one alternating corner at each intersection. The opening size of the grating is approximately 57mm (2 ¼") x 54mm (2 1/8"). There are 63 grating panels on the bascule bridge, 7 panels transversely (A-G) and 9 panels longitudinally (0-16, based on the nodes of the truss starting from the east). The longitudinal panel joints are centered on the steel sills and the transverse panel joints are separated by an angle at approximately 318mm (1' – 1/2") spacing. Both the cross-bars and the bearing bars were originally serrated to provide traction for vehicular traffic. The serrated surface of the grating system is completely worn under the travelled wheel path. In poor weather conditions this may pose a road safety issue.

Dead load for these components were calculated from the 1976 Parker drawings.

3.2.2 RAILINGS/TRAFFIC BARRIERS

The north and south roadway railings comprise a galvanized steel railing system installed between the truss members with a galvanized steel thrie beam guide rail attached to the side adjacent to the roadway.

The galvanized steel sidewalk railing on the structure was replaced in 2009-2010 as part of the rehabilitation project and is in good condition. An evaluation for barrier impact from live load was not undertaken as part of this assignment, but the dead load of these components was calculated using the rehabilitation drawings.

3.2.3 CURBS

Both the curbs on the deck are timber, with the south curb integrated into the south sidewalk. Both curbs were installed as part of the 2010 rehabilitation and are generally in good condition.

Detailed calculations were not undertaken but it is unlikely that the curb will withstand a vehicular impact, which could permit errant vehicles to impact the structure.

3.3 Superstructure

It is generally observed that the re-coating of the structural steel members has generally been effective in arresting or retarding the corrosion of the structural steel. However, section losses and pitting of structural steel members caused by corrosion still exist and have been measured where possible to provide accurate performance and condition ratings for the members. Detailed measurements are recorded in the 2015 and 2016 Parsons reports, however, Table 1 summarizes the percentage of section loss as measured in the field or else estimated from similar conditions. These values were applied in the structural evaluation of steel members of the bascule bridge.

Generally, the highest percentage section loss observed in our detailed inspections was around 20% overall section loss in the splash zones. Members above the splash zone were found to be in much better condition with the overall section loss generally not exceeding 5%.

Therefore 20%, and 5% section loss was applied in the first step of member evaluation in the areas in the splash zone and above the splash zone respectively. If a member was found to be understrength for the live load demands a more accurate determination of the actual section loss was established from the 2015 and 2016 inspection data (e.g. members 9N-12N and 9S-12S).

Based on field measurements floor beams and stringers were evaluated with 5% and 1% overall section loss respectively.

It is noted that with 0% section loss there would still be deficiencies for the moveable load cases of CHBDC.

Table 1 - Summary of Assumed Section Loss Applied to The Structural Evaluation

NO.	MEMBER LABEL IN CSIBRIDGE	MEMBER LABEL BY NODE NUMBER	ELEMENT GROUP	SECTION LOSS (%)
1	2	1N-0N	Through Truss Diagonal	20
2	3	4N-1N	Through Truss Diagonal	20
3	7	5N-4N	Through Truss Diagonal	20
4	8	5N-8N	Through Truss Diagonal	20
5	9	8N-9N	Through Truss Diagonal	20
6	10	9N-12N	Through Truss Diagonal	6
7	11	12N-13N	Through Truss Diagonal	10
8	178	1S-0S	Through Truss Diagonal	20
9	179	4S-1S	Through Truss Diagonal	20
10	183	5S-4S	Through Truss Diagonal	20
11	184	5S-8S	Through Truss Diagonal	20
12	185	8S-9S	Through Truss Diagonal	20
13	186	9S-12S	Through Truss Diagonal	6
14	187	12S-13S	Through Truss Diagonal	10
15	249	56N-34N	Through Truss Diagonal	20

Table 1 - Summary of Assumed Section Loss Applied to The Structural Evaluation

NO.	MEMBER LABEL IN CSIBRIDGE	MEMBER LABEL BY NODE NUMBER	ELEMENT GROUP	SECTION LOSS (%)
16	250	34N-13N	Through Truss Diagonal	5
17	400	56S-34S	Through Truss Diagonal	20
18	401	34S-13S	Through Truss Diagonal	5
19	240	2N-2N	Through Truss Vertical	20
20	241	2N-1N	Through Truss Vertical	20
21	242	4N-4N	Through Truss Vertical	20
22	243	4N-3N	Through Truss Vertical	20
23	244	8N-8N	Through Truss Vertical	20
24	245	8N-7N	Through Truss Vertical	20
25	246	12N-12N	Through Truss Vertical	20
26	247	12N-11N	Through Truss Vertical	20
27	319	6N-6N	Through Truss Vertical	20
28	320	6N-36N	Through Truss Vertical	20
29	321	36N-5N	Through Truss Vertical	20
30	322	6S-6S	Through Truss Vertical	20
31	324	6S-36S	Through Truss Vertical	20
32	325	36S-5S	Through Truss Vertical	20
33	326	10N-10N	Through Truss Vertical	20
34	327	10N-35N	Through Truss Vertical	20
35	328	35N-9N	Through Truss Vertical	20
36	329	10S-10S	Through Truss Vertical	20
37	331	10S-35S	Through Truss Vertical	20
38	332	35S-9S	Through Truss Vertical	20
39	546	14N-14N	Through Truss Vertical	20
40	547	14N-49N	Through Truss Vertical	20
41	548	49N-13N	Through Truss Vertical	20
42	549	14S-14S	Through Truss Vertical	20
43	551	14S-49S	Through Truss Vertical	20
44	552	49S-13S	Through Truss Vertical	20
45	567	2S-2S	Through Truss Vertical	20

Table 1 - Summary of Assumed Section Loss Applied to The Structural Evaluation

NO.	MEMBER LABEL IN CSIBRIDGE	MEMBER LABEL BY NODE NUMBER	ELEMENT GROUP	SECTION LOSS (%)
46	569	2S-1S	Through Truss Vertical	20
47	570	4S-4S	Through Truss Vertical	20
48	572	4S-3S	Through Truss Vertical	20
49	573	8S-8S	Through Truss Vertical	20
50	575	8S-7S	Through Truss Vertical	20
51	576	12S-12S	Through Truss Vertical	20
52	578	12S-11S	Through Truss Vertical	20
53	279	0N-2N	Through Truss Bottom Chord	20
54	280	2N-4N	Through Truss Bottom Chord	20
55	281	4N-6N	Through Truss Bottom Chord	20
56	282	6N-8N	Through Truss Bottom Chord	20
57	283	8N-10N	Through Truss Bottom Chord	20
58	284	10N-12N	Through Truss Bottom Chord	20
59	285	12N-14N	Through Truss Bottom Chord	20
60	286	14N-16N	Through Truss Bottom Chord	20
61	559	0S-2S	Through Truss Bottom Chord	20
62	560	2S-4S	Through Truss Bottom Chord	20
63	561	4S-6S	Through Truss Bottom Chord	20
64	562	6S-8S	Through Truss Bottom Chord	20
65	563	8S-10S	Through Truss Bottom Chord	20
66	564	10S-12S	Through Truss Bottom Chord	20
67	565	12S-14S	Through Truss Bottom Chord	20
68	566	14S-16S	Through Truss Bottom Chord	20
69	417	13N-48N	Through Truss Top Chord	5
70	418	48N-11N	Through Truss Top Chord	5
71	419	11N-9N	Through Truss Top Chord	5
72	420	9N-7N	Through Truss Top Chord	5
73	421	7N-5N	Through Truss Top Chord	5
74	422	5N-3N	Through Truss Top Chord	5
75	423	3N-1N	Through Truss Top Chord	5

Table 1 - Summary of Assumed Section Loss Applied to The Structural Evaluation

NO.	MEMBER LABEL IN CSIBRIDGE	MEMBER LABEL BY NODE NUMBER	ELEMENT GROUP	SECTION LOSS (%)
76	486	13S-48S	Through Truss Top Chord	5
77	487	48S-11S	Through Truss Top Chord	5
78	488	11S-9S	Through Truss Top Chord	5
79	489	9S-7S	Through Truss Top Chord	5
80	490	7S-5S	Through Truss Top Chord	5
81	491	5S-3S	Through Truss Top Chord	5
82	492	3S-1S	Through Truss Top Chord	5
83	431	22N-33N	Counterweight Link	5
84	432	33N-32N	Counterweight Link	5
85	433	32N-45N	Counterweight Link	5
86	434	45N-13N	Counterweight Link	5
87	435	22S-33S	Counterweight Link	5
88	436	33S-32S	Counterweight Link	5
89	437	32S-45S	Counterweight Link	5
90	438	45S-13S	Counterweight Link	5
91	27	13N-54N	Operating Strut	5
92	138	54N-55N	Operating Strut	5
93	142	54S-55S	Operating Strut	5
94	203	13S-54S	Operating Strut	5
95	14	15N-16N	Through Truss Trunnion Bay	20
96	189	15S-16S	Through Truss Trunnion Bay	20
97	248	16N-56N	Through Truss Trunnion Bay	20
98	251	15N-56N	Through Truss Trunnion Bay	20
99	252	56N-14N	Through Truss Trunnion Bay	20
100	399	16S-56S	Through Truss Trunnion Bay	20
101	579	15S-56S	Through Truss Trunnion Bay	20
102	580	56S-14S	Through Truss Trunnion Bay	20
103	29	23N-24N	Counterweight Top Chord	5
104	33	26N-25N	Counterweight Top Chord	5
105	157	23S-24S	Counterweight Top Chord	5

Table 1 - Summary of Assumed Section Loss Applied to The Structural Evaluation

NO.	MEMBER LABEL IN CSIBRIDGE	MEMBER LABEL BY NODE NUMBER	ELEMENT GROUP	SECTION LOSS (%)
106	160	24N-25N	Counterweight Top Chord	5
107	164	26S-25S	Counterweight Top Chord	5
108	206	24S-25S	Counterweight Top Chord	5
109	528	23N-46N	Counterweight Top Chord	5
110	529	46N-22N	Counterweight Top Chord	5
111	530	23S-46S	Counterweight Top Chord	5
112	531	46S-22S	Counterweight Top Chord	5
113	30	21N-25N	Counterweight Diagonal	5
114	205	21S-25S	Counterweight Diagonal	5
115	255	23N-21N	Counterweight Diagonal	5
116	273	21N-43N	Counterweight Diagonal	5
117	274	43N-44N	Counterweight Diagonal	5
118	275	44N-24N	Counterweight Diagonal	5
119	424	22N-42N	Counterweight Diagonal	5
120	425	42N-41N	Counterweight Diagonal	5
121	426	41N-21N	Counterweight Diagonal	5
122	583	23S-21S	Counterweight Diagonal	5
123	601	22S-42S	Counterweight Diagonal	5
124	602	42S-41S	Counterweight Diagonal	5
125	603	41S-21S	Counterweight Diagonal	5
126	604	21S-43S	Counterweight Diagonal	5
127	605	43S-44S	Counterweight Diagonal	5
128	606	44S-24S	Counterweight Diagonal	5
129	31	27N-25N	Counterweight Vertical	5
130	207	27S-25S	Counterweight Vertical	5
131	276	26N-27N	Counterweight Horizontal	5
132	277	27N-50N	Counterweight Horizontal	5
133	278	50N-21N	Counterweight Horizontal	5
134	607	26S-27S	Counterweight Horizontal	5
135	608	27S-50S	Counterweight Horizontal	5

Table 1 - Summary of Assumed Section Loss Applied to The Structural Evaluation

NO.	MEMBER LABEL IN CSIBRIDGE	MEMBER LABEL BY NODE NUMBER	ELEMENT GROUP	SECTION LOSS (%)
136	609	50S-21S	Counterweight Horizontal	5
137	256	21N-38N	Tower Truss Vertical	5
138	257	38N-31N	Tower Truss Vertical	5
139	258	31N-51N	Tower Truss Vertical	5
140	259	51N-20N	Tower Truss Vertical	5
141	260	20N-19N	Tower Truss Vertical	20
142	584	21S-38S	Tower Truss Vertical	5
143	585	38S-31S	Tower Truss Vertical	5
144	586	31S-51S	Tower Truss Vertical	5
145	587	51S-20S	Tower Truss Vertical	5
146	588	20S-19S	Tower Truss Vertical	20
147	262	21N-39N	Tower Truss Diagonal	5
148	263	39N-37N	Tower Truss Diagonal	5
149	264	37N-40N	Tower Truss Diagonal	5
150	265	40N-28N	Tower Truss Diagonal	5
151	266	28N-52N	Tower Truss Diagonal	5
152	267	52N-17N	Tower Truss Diagonal	5
153	268	17N-15N	Tower Truss Diagonal	20
154	590	21S-39S	Tower Truss Diagonal	5
155	591	39S-37S	Tower Truss Diagonal	5
156	592	37S-40S	Tower Truss Diagonal	5
157	593	40S-28S	Tower Truss Diagonal	5
158	594	28S-52S	Tower Truss Diagonal	5
159	595	52S-17S	Tower Truss Diagonal	5
160	596	17S-15S	Tower Truss Diagonal	20
161	253	15N-18N	Tower Truss Horizontal	20
162	254	18N-19N	Tower Truss Horizontal	20
163	581	15S-18S	Tower Truss Horizontal	20
164	582	18S-19S	Tower Truss Horizontal	20
165	19	18N-17N	Tower Truss Vertical	20

Table 1 - Summary of Assumed Section Loss Applied to The Structural Evaluation

NO.	MEMBER LABEL IN CSIBRIDGE	MEMBER LABEL BY NODE NUMBER	ELEMENT GROUP	SECTION LOSS (%)
166	194	18S-17S	Tower Truss Vertical	20
167	20	17N-19N	Tower Truss Diagonal	20
168	195	17S-19S	Tower Truss Diagonal	20
169	24	20N-30N	Tower Truss Secondary Truss	5
170	25	30N-29N	Tower Truss Secondary Truss	5
171	26	28N-29N	Tower Truss Secondary Truss	5
172	199	20S-30S	Tower Truss Secondary Truss	5
173	200	30S-29S	Tower Truss Secondary Truss	5
174	201	28S-29S	Tower Truss Secondary Truss	5
175	269	17N-29N	Tower Truss Secondary Truss	5
176	270	29N-20N	Tower Truss Secondary Truss	5
177	271	28N-30N	Tower Truss Secondary Truss	5
178	272	30N-31N	Tower Truss Secondary Truss	5
179	597	17S-29S	Tower Truss Secondary Truss	5
180	598	29S-20S	Tower Truss Secondary Truss	5
181	599	28S-30S	Tower Truss Secondary Truss	5
182	600	30S-31S	Tower Truss Secondary Truss	5
183	-	-	Floor Beams (All)	5
184	-	-	Stringers (All)	1

For gusset plates, the corrosion values based on inspection measurement are assumed as tabulated in Table 2.

Table 2 - Summary of Gusset Plates Assumed Section Loss Applied to The Structural Evaluation

NO.	NODE	MEMBER	SECTION LOSS %
1	1N	Gusset Plate	6
2	1S	Gusset Plate	6
3	2N	Gusset Plate	45
4	2S	Gusset Plate	45
5	3N	Gusset Plate	6
6	3S	Gusset Plate	6
7	4N	Gusset Plate	37
8	4S	Gusset Plate	37
9	5N	Gusset Plate	6
10	5S	Gusset Plate	6
11	6N	Gusset Plate	45
12	6S	Gusset Plate	45
13	7N	Gusset Plate	6
14	7S	Gusset Plate	6
15	8N	Gusset Plate	37
16	8S	Gusset Plate	37
17	9N	Gusset Plate	6
18	9S	Gusset Plate	6
19	10N	Gusset Plate	29
20	10S	Gusset Plate	53
21	11N	Gusset Plate	6
22	11S	Gusset Plate	6
23	12N	Gusset Plate	21
24	12S	Gusset Plate	21

3.3.1 COUNTERWEIGHT AND HOUSING

The reinforced concrete counterweight is enclosed by steel plates on the north and south faces, and by steel cladding on the east and west faces and the top and underside. Two pockets in the east face of the counterweight can be accessed by doors in the cladding. Four hatches are present on top of the counterweight and allow the

placement of ballast, one of which was opened during Parsons 2016 inspection. Small concrete blocks and a steel manhole frame were observed within the cavity.

The steel plates on the north and faces are connected by steel rods and washer plates. Additional anchor bolts and washer plates were added circa 1997, and some deteriorated existing washer plates replaced. The steel plates typically exhibit localized light to severe pitting, and several bolts are missing from the washer plate rods or anchors.

The only concrete visible for inspection was within the two pockets on the east side of the counterweight (each 1.5m high by 1.5m deep by 0.9m wide) and the single hatch opened on top of the counterweight. The concrete in both pockets typically exhibits spalling, extensive cracking, efflorescence and wet staining. There is a pile of disintegrated concrete in each of the pockets.

The remaining counterweight concrete is not visible for inspection; however, when the north and south steel plates were hammer sounded, several voids in the concrete were detected and the sound of loose concrete falling could be heard. Therefore, the internal integrity of the counterweight was not addressed in this evaluation.

3.4 Substructure

The abutments are generally in good condition with no significant defects noted above the waterline. Light corrosion is typical on the steel sheet piling. The east and west bearing seats are both in generally good condition. Some settlement was observed on both the east and west approaches.

Original details for the substructure were not available at the time of the evaluation and as such these elements have been omitted from the analyses.

4.0 Analysis – Vehicular Traffic Live Load

4.1 General

A structural analysis of the bridge superstructure concerning vehicular live load was conducted in accordance with the provisions outlined in Sections 3, 10, and 14 of CAN/CSA-S6-14 CHBDC, with Section 14 superseding clauses in other sections wherever applicable.

The structural analysis included the determination of:

- dead loads;
- critical and governing live loads from vehicular traffic;
- resulting forces on each individual truss member and at each node;
- the appropriate load factors for each load and each member per ultimate limit state ULS combination 1 of Section 3 of CAN/CSA-S6-14;
- the respective factored resistance of each element using the condition assessment data; and
- load posting.
- The following were excluded in the structural evaluation:
  - ice accretion load
  - loads due to earth pressure and hydrostatic pressure
  - earthquake load
  - loads due to stream pressure and ice forces or to debris torrents
  - collision load arising from highway vehicles or vessels
  - all strains, deformations, and displacements and their effects, including the effects of their restraint and the effects of friction or stiffness in bearings. Strains and deformations include strains and deformations due to temperature change and temperature differential, but not elastic strains
  - load due to differential settlement and/or movement of the foundation
  - sidewalk loading per Clause 14.9.5.1 (significant sidewalk loading not considered likely to occur with maximum traffic loading)
  - snow loads per clause 14.9.5.2 (not deemed significant due to open deck grating system)
  - wind load on traffic per Clause 14.9.5.3 (not deemed significant in the closed position)
  - wind load on structure per Clause 14.9.5.3 (not deemed significant in the closed position)

4.2 Analysis Methods

A three-dimensional finite element model of the LaSalle causeway bascule bridge was created in CSiBridge® 2016 - Version 18.2.0. Screenshots of the bridge model with extrusion of elements and wireframe were depicted in Figure 6 and Figure 7, respectively. However, our results processing and resistance calculations were conducted using a series of separate Excel spreadsheets and hand calculations.

Details of node and element numbering can be found in Appendix A of this report.

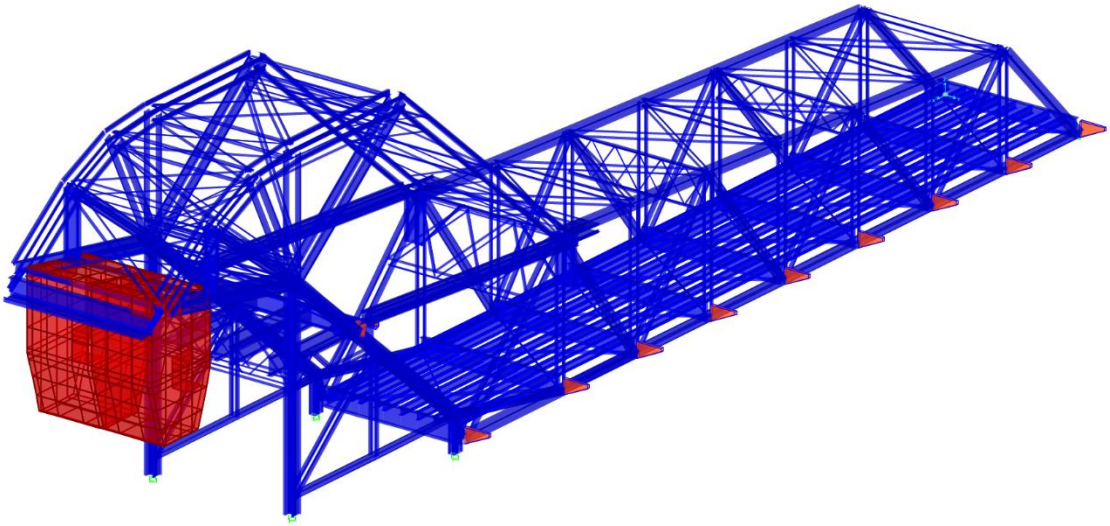


Figure 6 - Screenshot of LaSalle Causeway Bascule Bridge Finite Element Model – With Extrusion Shown

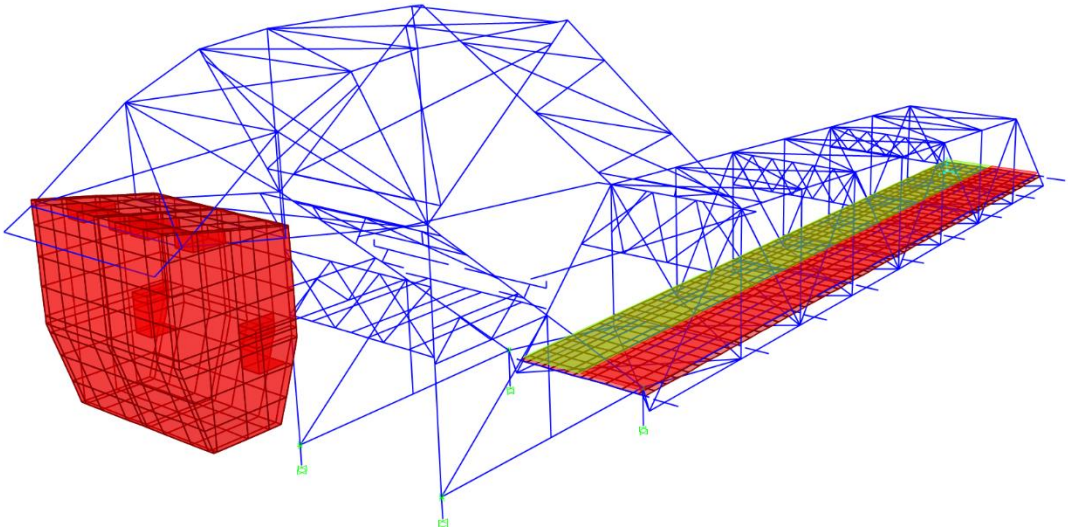


Figure 7 - Screenshot of LaSalle Causeway Bascule Bridge Finite Element Model- Wireframe and Lanes Shown

4.2.1 TRUSSES

Truss members of the bascule bridge were modeled with frame elements. For ULS analysis, as a common practice in truss analysis, bending moments about both major and minor axes were released at the ends of members which are connected to gusset plates unless they are continuous at the connection. For members, which are continuous through connections, no release of bending moments were applied.

Figure 8 shows the bending moment release of a sample member, while Figure 9. Shows a perspective view of location of end releases of the bascule bridge.

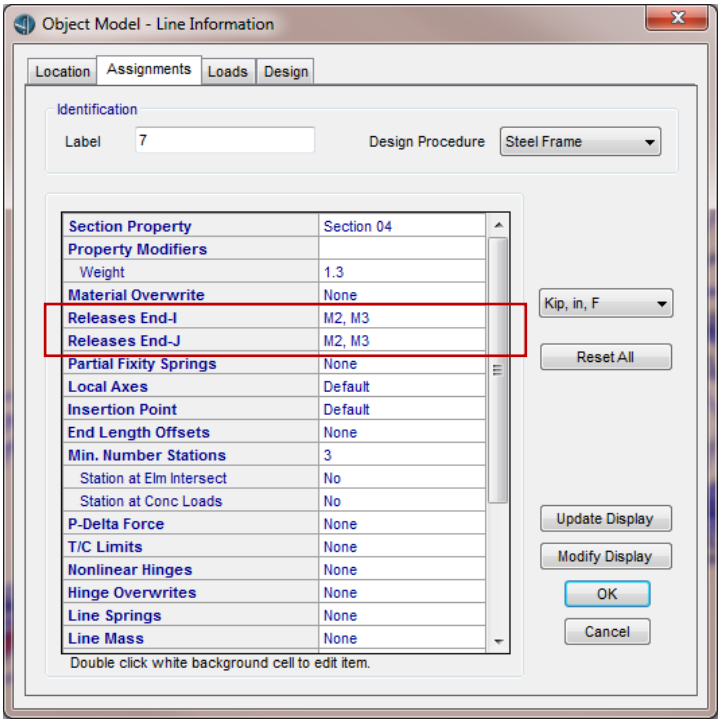


Figure 8 - Screenshot for End Release of Bending Moment for a Truss Member in CSiBridge Model

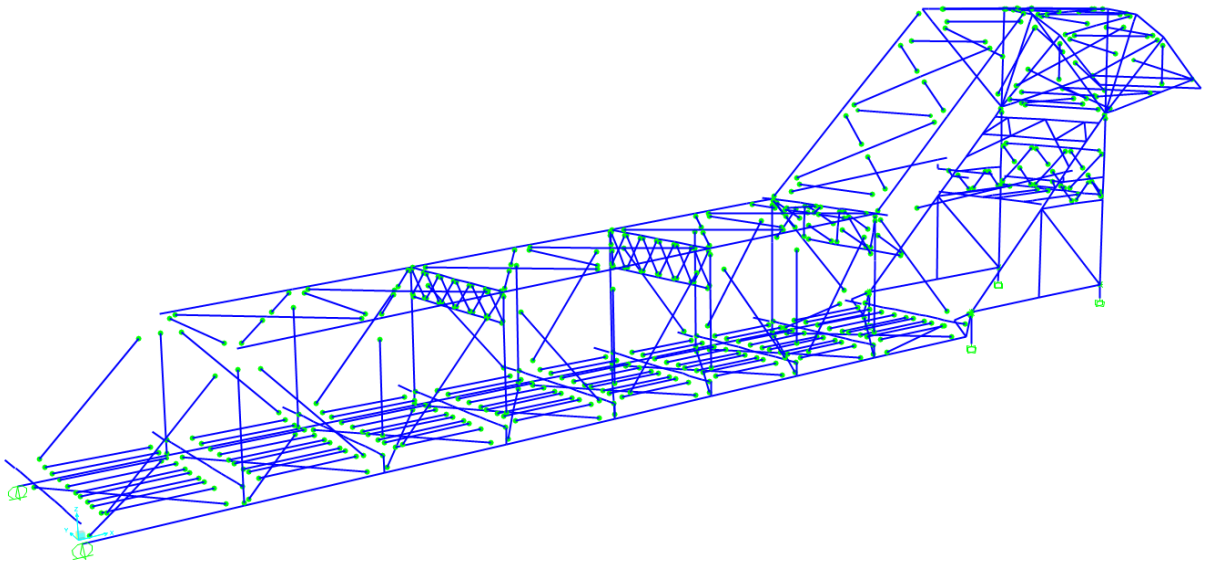


Figure 9 - Screenshot for End Release of Bending Moment for the Bascule Bridge in CSiBridge Model (The Deck and Concrete Conterweight were not shown for clarity)

The nodal coordinates and cross sections were extracted mainly from "1914 and 1915 Original Drawings" and then from available repair documents while randomly verified with the inspected current condition of the bridge.

4.2.2 DECK SYSTEM

The bridge deck is comprised of sill beams and steel grating. In the computer model, the bridge deck was represented by a series of 'dummy' shell elements. The purpose of these dummy elements was to provide load paths upon which dead load of the grating and various truck configurations and associated live uniformly distributed loads (UDL) could be applied. Given the physical dimensions of the bridge deck, Table 3.5 of CAN/CSA-S6-14 CHBDC, classifies that the structure should be evaluated for two design lanes. However, the width of each lane of the bascule bridge is 3.66 m, which is wider than the clearance envelope of a typical CL-W truck given in Figure 3.2 of CAN/CSA-S6-14 CHBDC. Hence, to find the governing load effects per truss member, CL-W trucks load were applied at the most critical lateral position within the lane. This was performed using the specified clearance envelope, and by allowing the truck to travel to the extreme left, centre, and extreme right of the lane that the physical deck and truck dimensions would allow.

4.2.3 FLOOR SYSTEM

The floor system is comprised of floor beams and stringers. In the computer model, both members were created by frame members.

To model the floor beams, an insertion point was defined above each original node in the bottom chord. An original node in the bottom chord, as can be seen in the original drawings, is the intersection of the centerline of the bottom chord and the centerline of a vertical member.

At the connection of floor beams and the bottom chord, the centerline of the floor beam does not intersect the bottom chord but intersects the vertical member at a distance above the original node. Consequently, to more accurately place floor beams at their actual locations, the insertion point was defined above each original node at the intersection of the vertical member and the top centre of the floor beam. This step was essential to model a more accurate position of the line of action of the weight of the deck and the floor system load when the bridge is at open position.

For each bottom connection, a joint constraint was defined between the original node and the insertion point for all 6 degrees of freedom. This causes the bottom portion of the vertical member, i.e. the length of the vertical member between the original node of the bottom chord and the insertion point, to behave as a rigid link.

The connection between the floor beam and the vertical member of the through truss was modeled as pinned. The connection between the vertical member and the insertion point as pinned for the north truss and fixed for the south truss. The fixity for south truss was applied in order for cantilever beams of the side walk to be supported by vertical members.

In reality the floor beam to vertical member connection has some partial fixity, but the connection has insufficient capacity to be modelled as fully fixed. In reality some moment transfer likely causes out-of-plane bending in these verticals. During our inspections, it was noted member 11N-12N appeared to show historic signs of distortion prior to a reinforcement. Members 3-4 and 7-8 also carry small compression forces but no signs of major distortion were observed during our inspections (with the exception of local defects due to vehicle impact).

For node equilibrium members 1-2, 5-6, 9-10, 13-14 only see tensile loads. Even with some out-of-plane bending sudden failure due to bifurcation is unlikely as the member would retain some capacity for tensile loading in a post buckled state.

4.2.4 STRINGERS

For stringers, connections to the floor beams were modeled as pinned. Given the bolted connection detail between the stringers and floor beams it was observed that the stringers attract axial forces and participate in axial action of the bottom chord. Conservatively the axial stiffness of these members was modified to reduce their axial force and consequently avoid reduction of forces in primary members of the bottom chord.

In most through trusses, test results show that the bottom chord forces are significantly smaller than those predicted by analysis, while the forces in the top chords and diagonals are within the usual tolerances from analytically predicted values. The difference is attributed to this load sharing between the deck system and the bottom chords. CHBDC indicates that this behavior can be utilized where required, it was not necessary in this instance.

4.2.5 CONNECTIONS

Using the member effects derived from the series of computer analyses, the effects of load transfer for primary connections on the through truss were investigated using hand calculations for live loads which are included in Appendix C of this report. Connections on the counterweight truss and tower truss were found to have a low participation for live load and were excluded from live load evaluation.

It was found that even with measured section losses that the connections had sufficient reserve capacity for live loads. The connections were evaluated using the Whitmore load dispersion method and the FHWA-IF-09-014 ‘Load Rating Guidance’ document for truss bridges.

4.2.6 ORIGINAL CONCRETE COUNTERWEIGHT

For modelling the original concrete counterweight, three-dimensional solid elements were used to more accurately distribute its dead load between the members of the counterweight truss.

The concrete counterweight has 6 pockets for balancing the leaf span. Four pockets are on the roof and two on the east face of the conterweight. These pockets were modeled by accurately meshing the counterweight and removing a number of the elements in the location of pockets (Figure 10).

During the inspection visit in 2016, it was found that two pockets on the east face were empty, while one of the top four pockets was filled with concrete blocks and random ballast such as catch basin cover, etc. Other three pockets on the roof were not opened during the inspection. In the model, it was assumed that 4 pockets were half full with the same material as the counterweight, while two side pockets were modeled as voids.

From field observation for the concrete counterweight, we noticed a descrepency in demensions from those given in 1915 drawings. Therefore, the dimensions from field observation was set as the basis for modeling the counterweight.

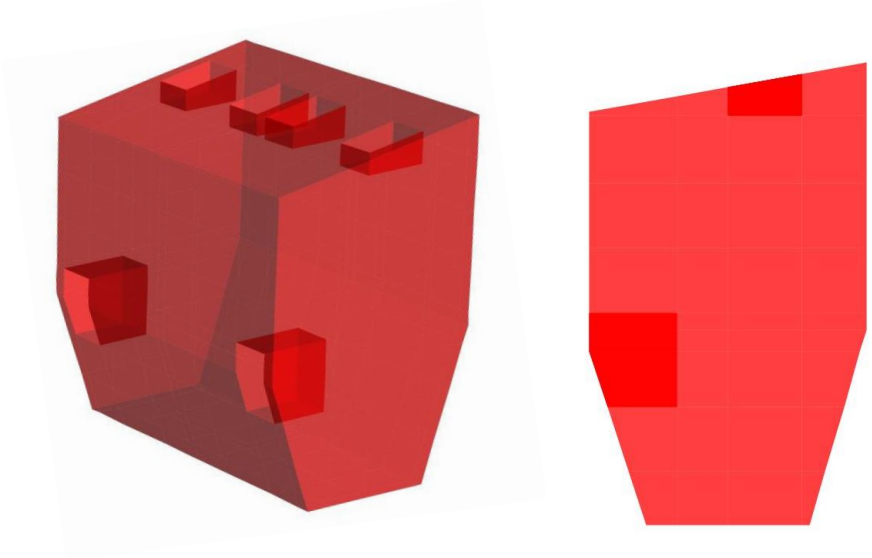


Figure 10 - Original Concrete Counterweight in CSiBridge Model – 3D View and North View

4.2.7 NEW STEEL COUNTERWEIGHT

For modelling the new steel counterweight, frame elements were used (Figure 11). The gusset plate connecting steel counterweight to the truss node was represented by a rigid link. We noted a discrepancy between the drawings from 2011 project on LaSalle Causeway Bascule Bridge Balancing and field observations concerning the orientation and centerline of the new beam. Therefore, the orientation and centerline from field observation was set as the basis for modeling the steel counterweight. Information such as cross sections and dimensions were extracted from the mentioned project documents. The number of steel plate weights were verified with field observations.

4.2.8 SPAN BALANCE ANALYIS

Our modelled dead loads were refined such that our toe reactions provided good agreement with the 2016 Span Balance Analysis and Buffer Commissioning Report.

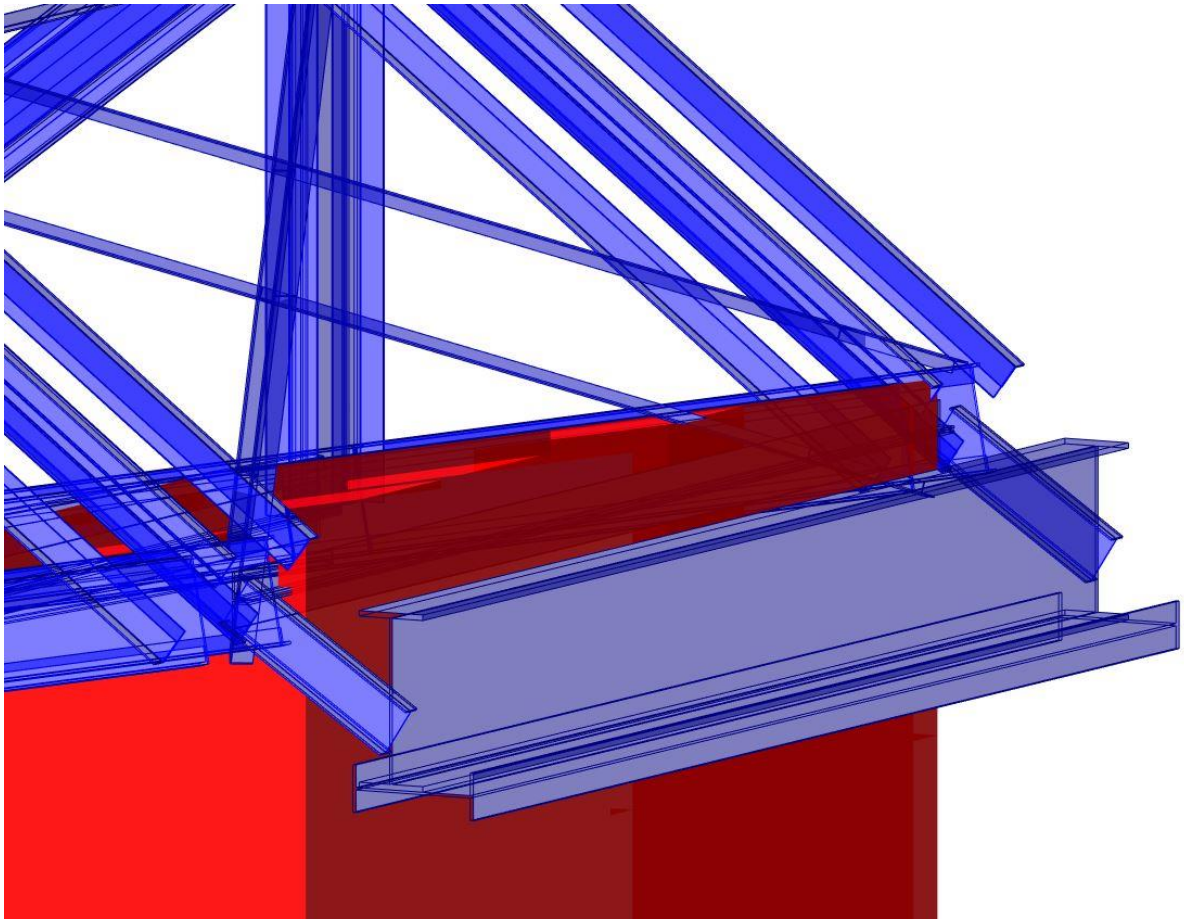


Figure 11 - New Steel Counterweight in CSiBridge Model – 3D View

4.3 Loadings

4.3.1 DEAD LOADS

For truss members, built-up sections consisting angles, channels, and plates are used in this bridge. These members were modeled by frame elements in CSiBridge with their own cross-section per original drawings as well as drawings for repairs. Verification of the dimensions is performed with detail measurements during previous field inspections.

Following a weight ratio analysis, a weight modifier of 1.3 is used for all truss members to account for the weight of lattices, batten plates, and bolts (Figure 12). This factor was determined by doing a detailed weight analysis on approximately a dozen different truss members including the weight of lacing, bolts, plates attached to those members. The weight modifier of 1.3 is in good agreement with the 1.2 and 1.28 values provided in CHBDC commentary clause 14.8.2.1 for 'through' and 'pony' trusses respectively.

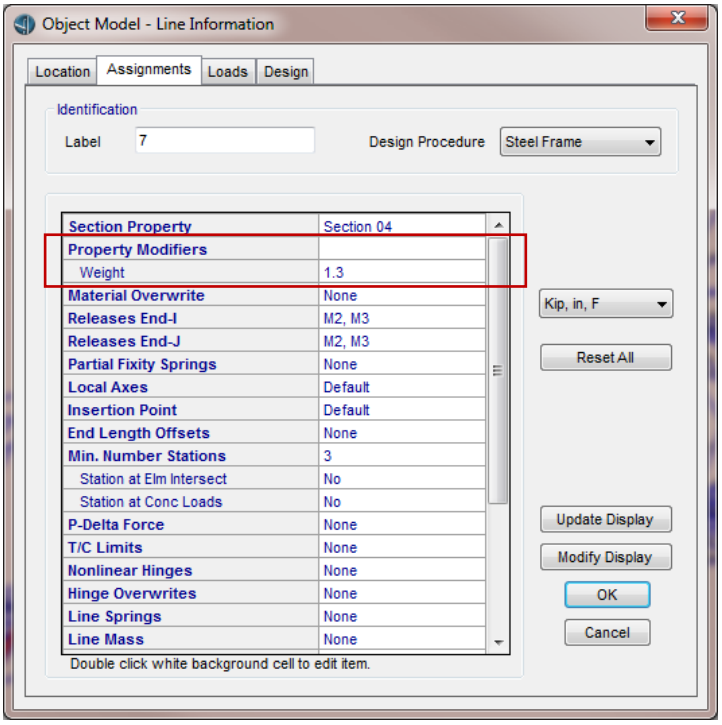


Figure 12 - Screenshot for Weight Modifier of a Truss Member in CSiBridge Model

Other truss members and floor system elements with standard rolled shapes, such as the new steel counterweight steel beam as well as stringers were modeled with no weight modifiers.

For modelling the original concrete counterweight, three-dimensional solid elements are used to more accurately capture the distribution behavior of the pertaining dead load between the counterweight truss members.

Per clause 14.13.2, dead load categories D1 to D3 as well as target reliability index ranging from 2.00 to 4.00 with different load factors were determined for each element.

Section 14 defines D1 as dead load of factory-produced components and cast-in-place concrete, excluding decks. For this bridge, D1 includes: steel members, concrete counterweight, new counterweight plates, and grating and sills of the deck (as they are factory-produced).

Section 14 defines D2 as cast-in-place concrete decks (including voided decks and cementitious concrete overlays), wood, field-measured bituminous surfacing, and non-structural components. For this bridge, D2 includes: the wood deck and railing of the sidewalk, inboard railing, and machinery room concrete slab. Railings were considered non-structural components. Figure 13 shows the definition of dead loads D1 and D2 in the software. The dead load called “DEAD” is auto generated by the software and was not used in the model. The Self Weight Multiplier function of the software was not used, instead, gravity load was applied to the members to activate their specified self-weight (Figure 14).

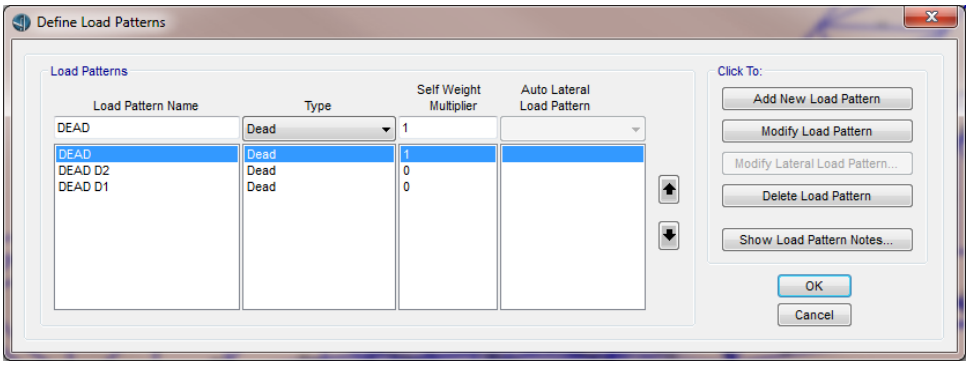


Figure 13 - Screenshot of Dead Load Definition in CSiBridge

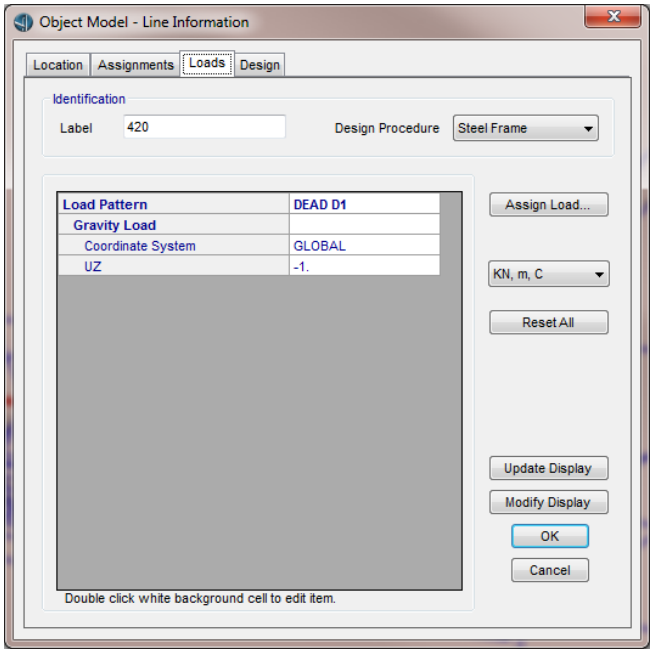


Figure 14 - Screenshot of Dead Load Definition for Gravity in CSiBridge

Section 14 defines D3 as bituminous surfacing where the nominal thickness is assumed to be 90 mm for the evaluation. Therefore, D3 was not applicable for this bridge.

The members were grouped together per target reliability index and load cases of D1 and D2 were defined to allow for applying appropriate load factors. Dead load factors range from 1.03 to 1.22 depending on the member category and load case.

The computer model accurately represents the geometric property of each principal and secondary member. Therefore, the dead load could be applied through a Gravity load in CSiBridge® which activates self-weight of the element using the material density and geometry to produce accurate dead loads. A linear static Gravity load is applied to all the truss members and the concrete counterweight.

However, dead load evaluations for element/members that do not form principal members of the truss system were undertaken by calculating the total weight of each element of the bridge by hand. These calculations included the weight of the bridge deck system, i.e. sills and steel grating, since this is not fully included in the model. These additional dead loads were totaled and converted to a UDL in kN/m^2 and applied to the model through a dummy deck which distributed the load to stringers and then to the floor beams. The north and south

truss each got a share from the load that came from the floor beams. These calculations were presented in Appendix A.

Similarly, for machinery room concrete slab, an equivalent UDL in kN/m is calculated by hand and applied to the east and west girders of the machinery room in the model. For the timber sidewalk, an equivalent UDL in kN/m is calculated by hand and applied to the cantilever. For other non-structural components such as sidewalk railings and inboard railings, a point load is calculated by hand and applied to the pertaining point of contact located at the tip of the cantilevers and on vertical truss members, respectively.

4.3.2 LIVE LOADS OF VEHICULAR TRAFFIC

The following live loads given in section 14 were applied to the bridge structural model:

Evaluation Level 1 (vehicle trains):	CL1-625-ONT Truck Load
	CL1-625-ONT Lane Load
Evaluation Level 2 (two-unit vehicles):	CL2-625-ONT Truck Load
	CL2-625-ONT Lane Load
Evaluation Level 3 (single-unit vehicles):	CL3-625-ONT Truck Load
	CL3-625-ONT Lane Load

For each frame element of the truss, 3 stations were defined at the beginning, middle, and end of each member. Maximum effects including 3 components, i.e. axial force and bending moments about major and minor axes, per element per station which were caused by each of the above load cases were found using the Moving Load capability of CSiBridge. For global behavior of the bridge, a dynamic load allowance (DLA) of 0.25 was applied to the model according to sections 14 and 3 when all axles of the CL-W Truck are used. Accordingly, higher values of DLA were used for local behavior of elements such as floor beams under vehicle live load.

4.3.3 CALCULATION OF POSTING LOADS

The live load capacity factor, *F*, is the factor by which the evaluation live load should be multiplied so that the factored capacity of the bridge is not exceeded for the combination of permanent and live loads under consideration.

Using the results of the evaluation analyses and the member resistances for each element, a complete set of live load factors for each member under each of the load combinations were calculated.

A posting factor, *P*, for gross vehicle weight for each evaluation level (CL1-W, CL2-W, and CL3-W) was determined using Figure 14.8 of CAN/CSA-S6-14 CHBDC, which plots the relationship between *F* and *P*.

The concept of posting for more than one evaluation level is a product of the wide variety of vehicle configurations that cannot be effectively controlled by any single posting load. The CL1-W, CL2-W, and CL3-W loading models are developed at a regulatory level, and operational overloads are covered by the live load factors. For any bridge component, values of the factor *F* will be in the order $F_{\text{Level 1}} \leq F_{\text{Level 2}} \leq F_{\text{Level 3}}$. When $F \geq 1$ for the Evaluation Level 1, it will be greater than 1 for the other levels also, and hence, the bridge will be capable of carrying the normal regulatory loads without restriction.

4.3.4 RELIABILITY INDEX TO DETERMINE DEAD AND LIVE LOAD FACTORS

Dead and live load factors (α_D and α_L) are determined using a reliability index (β) which is considered a measure of safety. In accordance with Section 14.12 CAN/CSA-S6-14 CHBDC, β is determined by considering:

- System Behavior (S1 - S3) - The effect of the element's failure on the entire structure.
- Element Behavior (E1 - E3) – Consideration for the element's ductility.
- Inspection Level (INSP1 - INSP3) – Consideration of the level of inspection on the element.

As each element may be subject to different conditions, β, and as such, α_D and α_L, are determined for each element on the structure. A list of structure elements and their associated factors are presented with the evaluation results in Appendix B.

CAN/CSA-S6-14 CHBDC Commentary Section 14.12 discusses how some jurisdictions have chosen to reduce β by 0.25 for normal traffic to achieve live load capacity factors similar to those achieved in the past. The resulting small reduction in the level of safety has been offset, in part, by a requirement to have regular inspections and the bridge replaced or rehabilitated within five years. However, as directed by PSPC, this reduction was not applied to the calculations.

4.4 Fatigue

Evaluation for the Fatigue Limit State was outside the scope of this assignment. In accordance with Clause 14.18, as an alternative to analysis fatigue-prone details may be monitored by regular inspections (stringer to floor beam connections for example).

The elements in the deck system of the bridge such as gratings and sill beams maybe subject to fatigue. Principal fracture critical members with riveted connections should also be monitored for signs of fatigue damage. Over the years there have been a number of attachments welded to principal tension members. Parsons have recommended that these attachments and welds be removed in our 2015 and 2016 inspection reports.

The counterweight truss members are also subject to fatigue. This was reported in MRC's 2005 report and subsequent repair contract. Monitoring of these members should be continued by regular inspection.

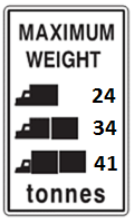
4.5 Calculated Load Postings

4.5.1 GENERAL

Our results show that with minor reinforcing of members 9N-12N and 9S-12S the structural capacity of the bridge is sufficient to meet the full live load of vehicular traffic without load posting. If these members are not strengthened, then in accordance with CAN/CSA-S6-14 CHBDC the bridge must be triple-load posted at 41, 34, and 24 tonnes for CL1, CL2, and CL3 respectively.

Load Posting

Prior to carrying out the strengthening of the structural steel members that were shown to have insufficient capacity to satisfy the live loading requirements of the CHBDC, load posting signs as shown in the image overleaf should be erected on the approaches:



4.5.2 LIVE LOAD CAPACITY FACTORS

Live load capacity factors have been calculated in accordance with Section 14.15 of CAN/CSA-S6-14 CHBDC. This factors can be defined as the factor by which the evaluation live load should be multiplied so that the factored capacity of the bridge is not exceeded for the combination of permanent and live loads under consideration.

In turn, bridge posting factors have been calculated in accordance with Section 14.17 of CAN/CSAS6-14 CHBDC. To determine these posting factors, the truss members are grouped by type, and results are based on an envelope of maximum forces extracted from computer analyses and post-processed using a series of Excel spreadsheets. Member resistances are generally calculated at the location of least section. However, if a member is in fact governing a load rating for that particular group or the entire span, then it has been ensured that the resistance is based on the condition of the member at the corresponding location of maximum force. This approach is seen as practical and valid.

4.5.3 THROUGH TRUSS

Analysis of factored loads using load conditions described in Section 4.3 of this report indicated that not all elements of the through truss meet the full live load requirements and require a load posting. The full lists of evaluation results are included in Appendix B of this report. A summary of the live load factors and load posting for deficient members is shown in Table 3.

Table 3 - Summary of Posted Loads for Members of Through Truss

	Live Load Capacity Factor			Posting (tonnes)		
Elements	CL1-625	CL2-625	CL3-625	CL1-625	CL2-625	CL3-625
9N-12N, 9S-12S	0.665	0.765	0.97	41	34	24

The load posting is governed by the resistance of the diagonal elements 9N-12N and 9S-12S, the member has inadequate resistance for the compression load required of it. The member has been evaluated with a field measured 6% section loss due to corrosion. However, with no section loss the original member would still have been deficient for current highway loading.

Vehicle definitions given for each evaluation level were extracted from clause 14.2 of CAN/CSAS6-14 CHBDC:

- 41 tonnes for CL1-W: Vehicle trains such as tractor-trailer-trailers, tractor–semi-trailer–trailers, tractor–semi-trailer–semi-trailers, and other vehicles consisting of three units
- 34 tonnes for CL2-W: Two-unit vehicles such as tractor–semi-trailers, car-trailers, truck-trailers, and other vehicles consisting of two units; and
- 24 tonnes for CL3-W: Single-unit vehicles such as trucks, buses, cars, and other vehicles consisting of a single unit.

5.0 Analysis – Special Load Cases for Movable Bascule Bridge

5.1 General

A structural analysis of the bridge superstructure concerning special load combination for movable bascule bridges at open positions was conducted in accordance with the provisions outlined in Sections 3, 10, 13, and 14 of CAN/CSA-S6-14 CHBDC, with Section 14 superseding clauses in other sections wherever applicable.

The structural analysis included the determination of:

- dead loads;
- effects of special load cases for the movable bascule bridge at open positions;
- resulting forces on each individual truss member and at each node;
- the appropriate load factors for each load and each member;
- the respective factored resistance of each element using the condition data; and
- frame member strength demand to capacity ratios.

5.2 Analysis Methods

The LaSalle Causeway Bascule bridge according to its original design has an operating range of 0 to 84 degrees, while 0˚ being the lowered position of the bridge deck and 84˚ being the fully raised position. A series of three-dimensional finite element models were created to study the behavior of the bridge at the operating range.

The three-dimensional finite element model of the LaSalle causeway bascule bridge which was created for the vehicular live load analysis in CSiBridge® 2016 - Version 18.2.0 became the basis to model the bridge at open positions. Screenshots of the bridge model at closed positions with extrusion of elements and wireframe were depicted in Figure 6 and Figure 7, respectively.

To find the position of the bridge at any rotation degree within the operating range of the movable bascule bridge, a series of formulations in the form of Excel spreadsheets were developed to accurately interact with CSiBridge and make appropriate modifications. The developed spreadsheet in combination with CSiBridge can model the bridge at any position during a lift.

Five open positions of the bridge, i.e. 0, 21, 42, 63, and 84˚, were considered for further processing, and separate finite element models in CSiBridge were created for each open position (Figure 15-Figure 17). However, our results processing and resistance calculations were conducted using a series of separate Excel spreadsheets and hand calculations.

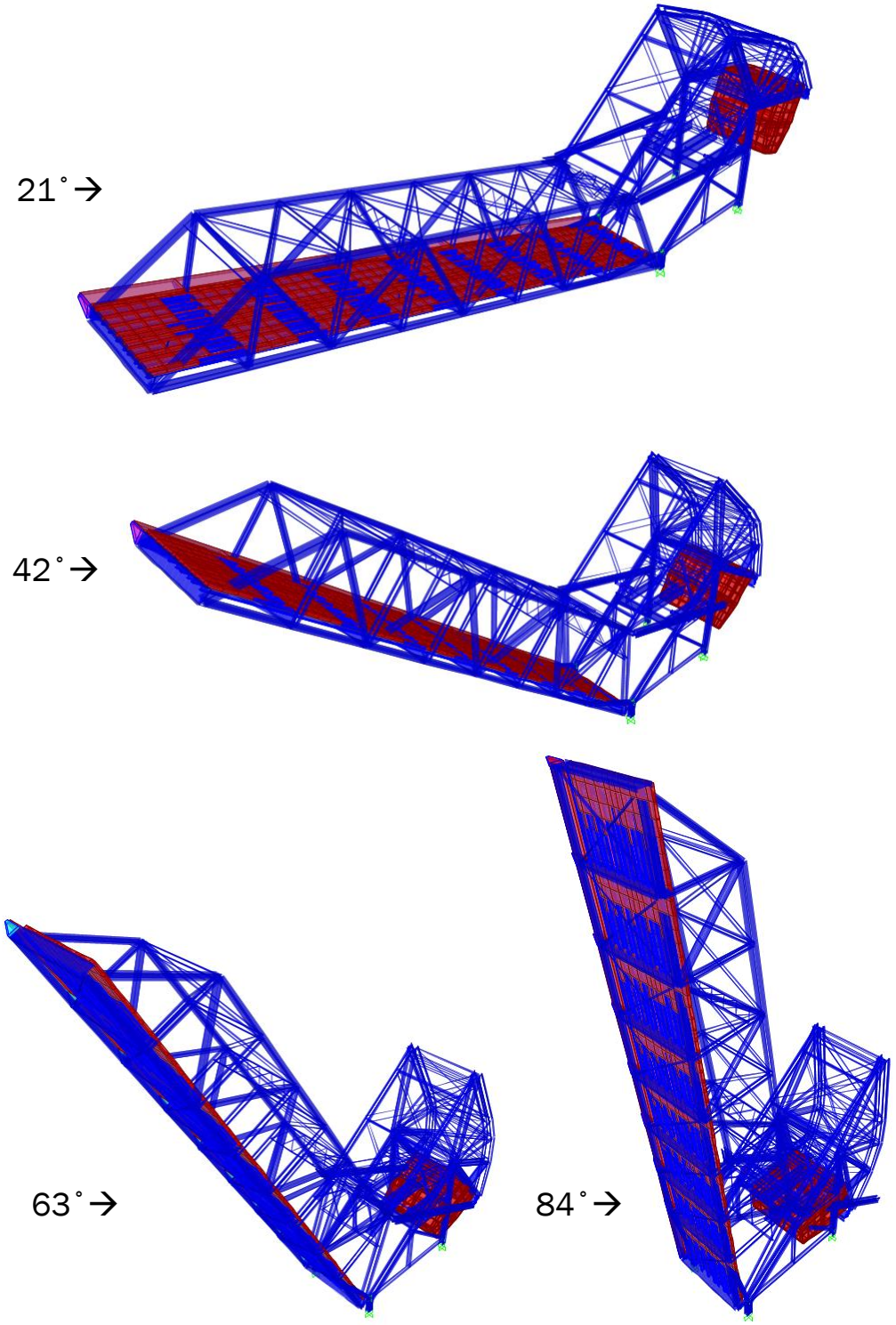


Figure 15 - Screenshot of LaSalle Causeway Bascule Bridge Finite Element Model at Various Open Positions

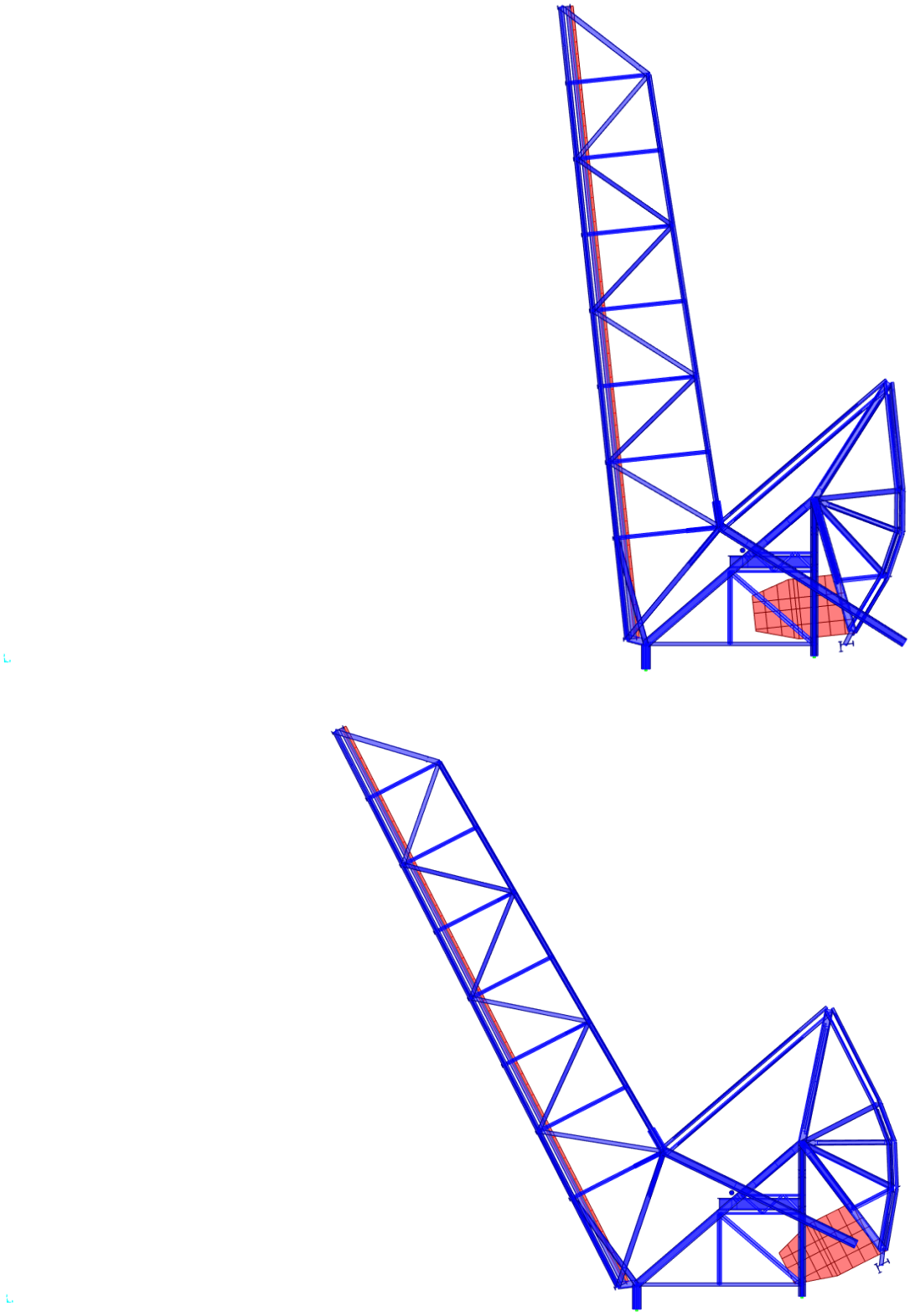


Figure 16 - Screenshot of LaSalle Causeway Bascule Bridge Finite Element Model- Various Open Positions – North View

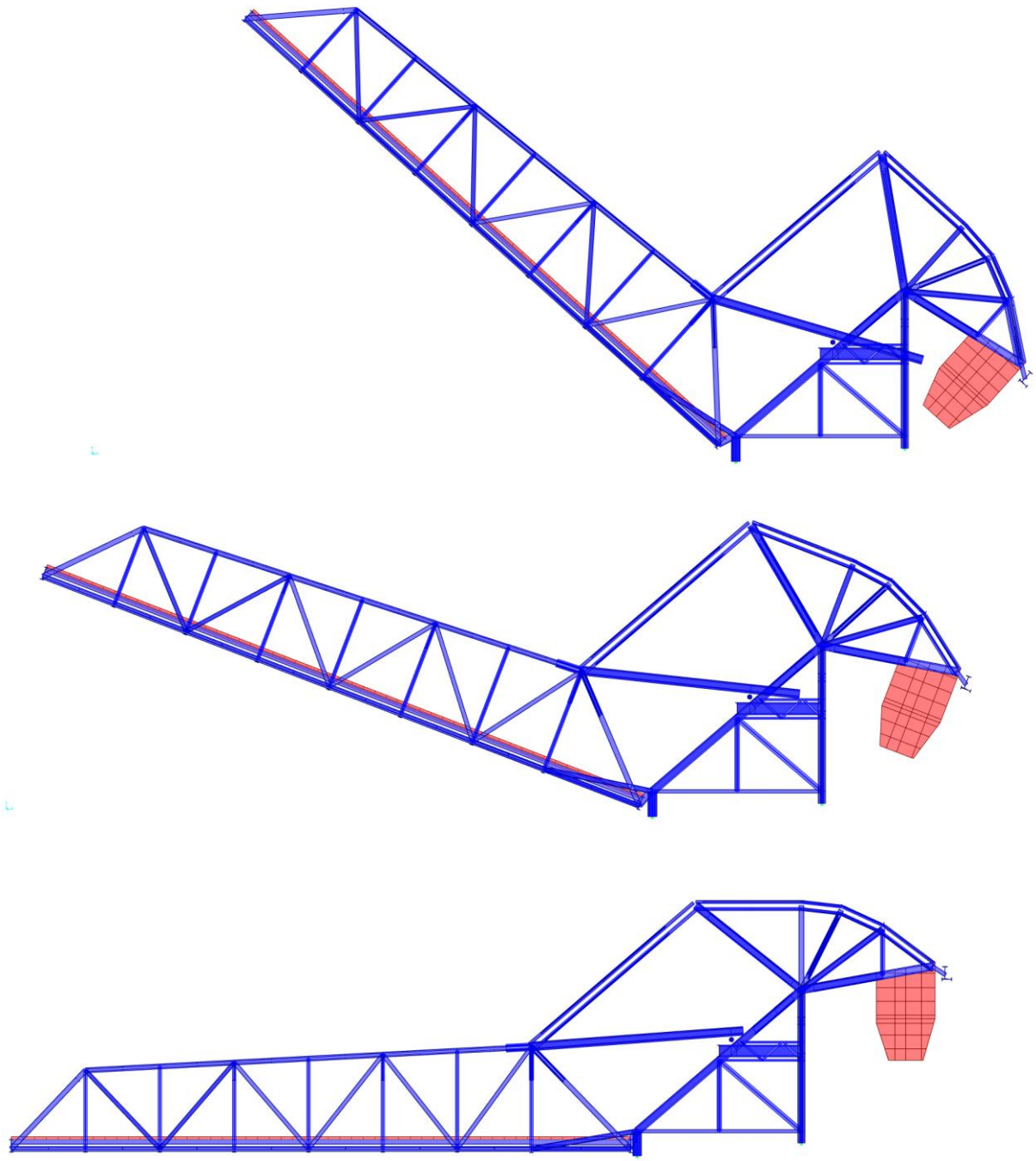


Figure 17 - Screenshot of LaSalle Causeway Bascule Bridge Finite Element Model- Various Open Positions – North View (continued)

5.2.1 TRUSSES

Truss members were modeled similar to the method described in section 4.2.1 of this report with modified nodal coordinates at each of rotated positions as noted in section 5.2 of this report.

5.2.2 DECK SYSTEM

The main bridge deck was modeled similar to the method described in section 4.2.2 of this report with modified nodal coordinates at each of rotated positions as noted in section 5.2 of this report. The sidewalk deck was modeled for any of the open position similar to the main bridge deck using dummy shell elements. The purpose of modeling the sidewalk deck was to apply longitudinal wind load to the entire width of the bridge which includes the timber sidewalk deck in addition to the main deck.

5.2.3 FLOOR SYSTEM

The floor system is comprised of floor beams and stringers. It was modeled similar to the method described in section 4.2.3 of this report with modified nodal coordinates at each of rotated positions as noted in section 5.2 of this report.

5.2.4 CONNECTIONS

Given the numerous member deficiencies in the through truss, tower truss, and counterweight truss for the moveable loads the connections were not evaluated for these special load cases at this time.

5.2.5 ORIGINAL CONCRETE COUNTER-WEIGHT

The original concrete counterweight was modeled similar to the method described in section 4.2.5 of this report with modified nodal coordinates at each of rotated positions as noted in section 5.2 of this report.

5.2.6 NEW STEEL COUNTERWEIGHT

The new steel counterweight was modeled similar to the method described in section 4.2.6 of this report with modified nodal coordinates at each of rotated positions as noted in section 5.2 of this report.

It was noted from the finite element model that at the fully lifted deck position, i.e. at 84˚, the new counterweight intersects with the top of the roadway, while this is not the case for open position at 64˚.

The current maximum operating angle for the bridge of 65˚was confirmed in an email from PSPC bridge operations to Parsons dated 6 June 27, 2017. Therefore, any potential issues with the counterweight beyond that angle have no impact on bridge operations

5.3 Special Loadings for the Bascule Bridge

Special load types and load combinations provided in clause 13.6.10.2 of CAN/CSA-S6-14 CHBDC were used to study structural integrity of the bascule bridge structure when the bridge is in the open positions. Applicable load types include: Dead load (D_o); horizontal force (H_o); wind load (W_o); operating impact (I_o); and machinery-induced forces (M_o). The following sections provide a description of each of these load types as well as calculation methods.

5.3.1 DEAD LOADS

According to clause 14.13.2.1 of CAN/CSA-S6-14 CHBDC, "when the dead load effect counteracts the effect due to transitory load, the minimum dead load factors specified in Section 3 shall be used for all dead load categories at any β value. Otherwise, the dead load factors specified in Table 14.7 shall apply". Moreover, Section 13 of the code specifies requirements for the design of bascule bridges and deals primarily with the components involved in the operation of such bridges. In this regard, moving loads (H_o, W_o, I_o, and M_o) during a bridge lift are considered "exceptional loads" per clause 14.10. Consequently, for analysis of the bascule bridge in this evaluation study, moving loads were considered "transitory loads", therefore, maximum dead load factors were extracted from Table 14.7 of the code, while minimum dead load factors given in Table 3.3 of the code were used.

Our justification for using section 14 of the code to supersede clauses 13.6.12 and 13.6.10.2 regarding the minimum and maximum values of α_D in load combinations relates to the need for section 13 to be conservative surrounding dead load factors and the ability to correctly balance a newly constructed moveable bridge. For new construction, this needs to be achieved by the addition and subtraction of counterweight. In this instance, we have an existing bridge which is balanced and requires very little external machinery input to move the span. The 2016 span balance report was used to validate our dead loads and this balanced condition, providing additional confidence in the bridge dead load.

The extracting of the appropriate maximum and minimum dead load factors are explained below:

Maximum Dead Load Factors

Per clause 14.13.2, dead load categories D1 to D3 as well as target reliability index (β) ranging from 2.00 to 4.00 with different load factors were determined for each element.

Section 14 defines D1 as dead load of factory-produced components and cast-in-place concrete, excluding decks. For this bridge, D1 includes: steel members, concrete counterweight, new counterweight plates, and grating and sills of the deck (as they are factory-produced).

Section 14 defines D2 as cast-in-place concrete decks (including voided decks and cementitious concrete overlays), wood, field-measured bituminous surfacing, and non-structural components. For this bridge, D2 includes: the wood deck and railing of the sidewalk, inboard railing, and machinery room concrete slab. Railings were considered non-structural components.

Section 14 defines D3 as bituminous surfacing where the nominal thickness is assumed to be 90 mm for the evaluation. Therefore, D3 was not applicable for this bridge.

Minimum Dead Load Factors

Per Table 3.3 of the code, a minimum dead load factor of 0.95 should be applied to factory-produced components, excluding wood. For this bridge, this includes: steel members, new counterweight plates, and grating and sills of the deck (as they are factory-produced).

The same table gives a minimum dead load factor of 0.90 to be applied to cast-in-place concrete, wood, and all non-structural components. For this bridge, this includes: the concrete counterweight, the wood deck and railing of the sidewalk, inboard railing, and machinery room concrete slab. Railings were considered non-structural components.

Applying the Dead Load to the Model

It should be noted that according the above load factors given in the code for the concrete counterweight, for the maximum dead load factor, the concrete counterweight is categorized under D1 which has the lowest values of load factors, while for the minimum dead load factor, the concrete counterweight is categorized under the

second lowest category of load factors. For other members in this bridge, load factor categories match between minimum and maximum load factors.

In addition to the above note, as there are moving parts in the structure, to find the counteracting effects of the dead load, the bridge members were grouped together as follows to enable applying the appropriate load factors:

D1CTWT: D1 Category – All steel members in the counterweight truss as well as steel counterweight plates

D2CTWT: D2 Category - For technical reason, a negligible load was assigned to the new counterweight

D1TT: D1 Category – All steel members in the through truss as well as grating and sills of the deck

D2TT: D2 Category - The wood deck and railing of the sidewalk as well as inboard railing

D1CTW: D1 Category – The concrete counterweight

D2CTW: D2 Category - The concrete counterweight

D1Other: D1 Category – All steel members in the tower truss, operating strut, and counterweight link

D2Other: D2 Category - Machinery room concrete slab

Figure 18 shows the definition of the above dead loads in the software. The dead load called "DEAD" is auto generated by the software and was not used in the model. The Self Weight Multiplier function of the software was not used, instead, gravity load was applied to the members to activate their specified self-weight (Figure 19).

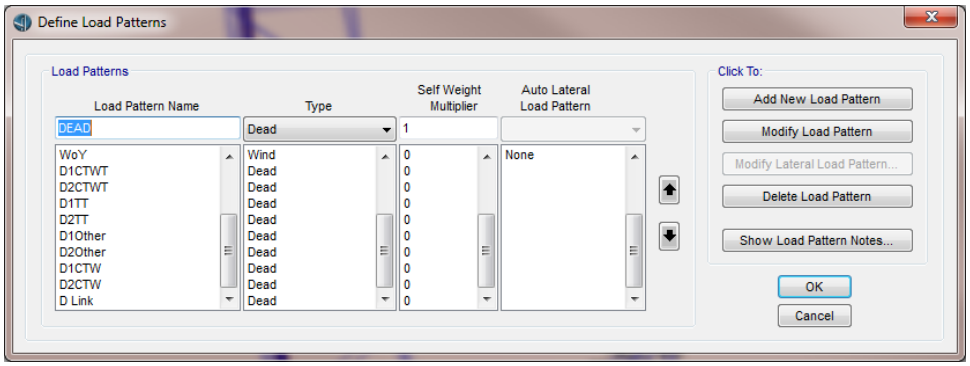


Figure 18 - Screenshot of Dead Load Definition in CSiBridge – For Open Positions

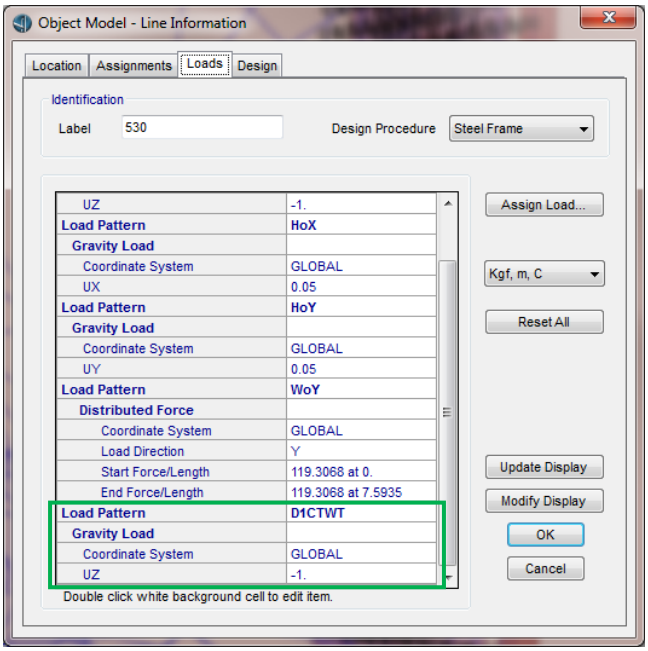


Figure 19 - Screenshot of a Sample of Dead Load Definition for Gravity in CSiBridge

The members were also grouped together per target reliability index and above load cases were applied to allow for applying appropriate load factors. Maximum dead load factors range from 1.03 to 1.22 depending on the member category and load case. Minimum dead load factors range from 0.9 to 0.95 depending on the member category and load case.

The computer model accurately represents the geometric property of each principal member. Therefore, the dead load could be applied through a Gravity load in CSiBridge® which activates self-weight of the element using the material density and geometry to produce accurate dead loads. A linear static Gravity load is applied to all the truss members and the concrete counterweight.

However, dead load evaluations for element/members that do not form principal members of the truss system were undertaken by calculating the total weight of each element of the bridge by hand. These calculations included the weight of the bridge deck system, i.e. sills and steel grating, since this is not fully included in the model. These additional dead loads were totaled and converted to a UDL in kN/m^2 and applied to the model through a dummy deck which distributed the load to stringers and then to the floor beams. The north and south truss each got a share from the load that came from the floor beams. These calculations were presented in Appendix C.

Similarly, for machinery room concrete slab, an equivalent UDL in kN/m is calculated by hand and applied to the east and west girders of the machinery room in the model. For the timber sidewalk, an equivalent UDL in kN/m is calculated by hand and applied to the cantilever. For other non-structural components such as sidewalk railings and inboard railings, a point load is calculated by hand and applied to the pertaining point of contact located at the tip of the cantilevers and on vertical truss members, respectively (Appendix C).

5.3.2 WIND LOAD

Detailed calculations of the wind load (W_o) can be found in Appendix C.

The following information were extracted from clause 13.6.4 of CAN/CSA-S6-14 CHBDC:

The horizontal transverse wind pressure

For bascule bridges, the horizontal transverse wind pressure as well as the horizontal longitudinal wind pressure shall be 1.50 kPa (Clause 13.6.4.9).

It is acknowledged that PSPC do not currently operate the bridge in high winds. A design exception to the code is currently being discussed with the ongoing motor control upgrade project. As part of this work a limiting operating wind speed is to be determined.

Horizontal transverse wind, normal to centerline

For truss spans, the surface area shall be considered to be the vertical projection of the floor system and any counterweight, plus twice the vertical projection of the members of one truss (Clause 13.6.4.2).

At closed position of the bridge, i.e. at zero degree, vertical projection of the floor system was considered as the entire span length multiplied by 85% of the distance from the bottom of the bottom chord to the top of the sidewalk railing. The justification to apply a reduction factor of 0.85 was to account for holes existing in this area. After multiplication of the surface by 1.50 kPa, the resultant load was divided by 2 and applied as a UDL in kN/m to the bottom chord members of both north and south sides.

For the concrete counterweight, the entire north surface was considered for applying the wind load. Therefore, 1.50 kPa was applied as a UDL in kN/m^2 to the north face of the concrete counterweight.

For truss members, other than the bottom chord members which were considered once in the floor system, a tributary width according to their vertical projection was calculated per member category and multiplied by 1.50 kPa. The resultant UDL in kN/m was applied to both north and south truss members in order to apply the term “twice the vertical projection of the members of one truss” (Clause 13.6.4.2).

This horizontal transverse wind force was applied to the bascule bridge at all the other open position to the rotated position of members.

Horizontal longitudinal wind, parallel to centreline

According to Clause 13.6.4.5, the floor plan area exposed to wind was taken as a quadrilateral whose length is equal to that of the floor of the moving span and whose width is that of the distance out-to-out of the north truss to the south side of the sidewalks.

Vertical wind, normal to the floor plan area

For bascule bridges, the code does not specify any vertical wind load normal to the floor plan area. Therefore, such loads were not considered.

5.3.3 OPERATING IMPACT LOAD

According to Clause 13.6.10.2, an operating impact load (I_o) of 20% was applied to the maximum dead load effect in all members that are in motion and to the load effect on a stationary member caused by the moving dead load. Due to the nature of impact forces, this load was applied in either upward or downward directions to find the maximum effect.

It is acknowledged that the code prescribed factors may be overconservative and more applicable to setting the standard for new bascule bridge construction rather than evaluating a structure that has already operated for 100 years. Further discussion is needed on the impact factor, with consideration given to the possible merits of field measuring the operating impact factor with accelerometer readings taken during bridge operation, and in turn refining the analysis.

5.3.4 HORIZONTAL FORCE

According to Clause 13.6.10.2, a horizontal force (H_o) taken as 5% of the total moving load carried by and frame members of the steel towers that support the counterweight assembly. This force was applied in any direction, through the centre of gravity of the moving load.

Its is noted that this force/load case is not included in either of the moveable bridge sections of AASHTO or AREMA. It is further acknowledged that this factor may be overconservative and PSPC may wish to consider a design exception to this requirement of CHBDC.

5.3.5 RELIABILITY INDEX TO DETERMINE DEAD LOAD FACTORS

Maximum dead load factors (α_D) are determined using a target reliability index (β) similar to section 4.3.4 of this report.

5.4 Calculated Strength Demand to Capacity (D/C) Ratios

5.4.1 GENERAL

Using a series of Excel spreadsheets, all the special load cases were combined according to load factors given in Clause 13.6.10.2 as well as those for dead loads explained in section 5.3.1 of this report. The results of strength demand to capacity ratios (D/C) for the bridge in open positions regarding strength of members are provided in Appendix B. A list of deficient members is also summarized in Table 4 and Table 5.

Table 4 - Summary of Member Strength of the Bascule Bridge Under Special Load Combinations – Normal Opening Range 0˚ to 65˚

@ 0˚ to 65˚	with Deterioration
Members (N and S)	**Pass/Fail**
10-12	FAIL
12-14	FAIL
14-16	FAIL
11-13	FAIL
13-14	FAIL
13-16	FAIL
13-22	FAIL
21-22	FAIL
15-17	FAIL
15-18	FAIL
17-19	FAIL

Table 5 - Summary of Member Strength of the Bascule Bridge Under Special Load Combinations – Open @ 84˚ (Beyond Normal Opening Limit)

@ 84˚	with Deterioration
Members (N and S)	Pass/Fail
17-21	FAIL
21-27	FAIL
25-26	FAIL

6.0 Conclusions and Recommendations

6.1 Evaluation Findings

6.1.1 HIGHWAY LIVE LOADS

Our results show that with minor reinforcing of members 9N-12N and 9S-12S the structural capacity of the bridge will be sufficient to meet the full live load of vehicular traffic without load posting. If these members are not strengthened, then in accordance with CAN/CSA-S6-14 CHBDC the bridge must be triple-load posted at 41, 34, and 24 tonnes for CL1, CL2, and CL3 respectively.

6.1.2 SPECIAL LOADS FOR BASCULE BRIDGES

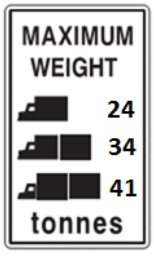
The bridge does not satisfy CHBDC special load case code requirements for moveable bridges. It is unclear what, if any, formal design requirements would have been required at the time of design, however, the bridge has performed well since constructed. An upgrade to current code requirements may be cost prohibitive and require lengthy highway lane and marine traffic closures. It is likely the costs of such an upgrade could be unpractical compared with replacement.

It should be noted that the bridge would have in fact been deficient on these demands from its time of construction. Meaning the current design code has more stringent requirements than the bridge was originally designed for.

6.2 Recommendations

6.2.1 LOAD POSTING

Prior to carrying out the strengthening of the structural steel members that were shown to have insufficient capacity to satisfy the live loading requirements of the CHBDC, load posting signs as shown in the image below should be erected on the approaches:



6.2.2 STRENGTHENING (FOR LIVE LOADS)

Due to high slenderness, members 9N-12N and 9S-12S have insufficient capacity to meet the demand for compression members under existing bridge code requirements. These compression members need to be strengthened such that the live load requirements of the bridge code are met.

6.2.3 RATIONALIZATION OF MOVEABLE BRIDGE LOADS

Further investigation into the special load combinations (clause 13.6.10.2 of CHBDC) by PSPC is warranted.

Consideration should be given to the merit of field measuring the operating impact factor of this bascule bridge which may be achieved with accelerometer readings taken during bridge operation. The analysis may be then refined with these field measurements. It may be possible to extend the service life of the structure through the implementation of a structural health monitoring system (SHM) the service life may be extended.

It is noted that ULS B4 which includes H_0 is not included in either of the moveable bridge sections of AASHTO or AREMA. PSPC

Given the absence of recorded operational issues with the current structural design, PSPC may choose to keep the existing bridge in operation without any major modifications, and accept the risk of not upgrading to current CHBDC requirements.

7.0 Suggested Repairs

7.1 Immediate repairs

7.1.1 STRENGTHENING (FOR LIVE LOADS)

Due to high slenderness, members 9N-12N and 9S-12S have insufficient capacity to meet the demand for highway loading. These compression members need to be strengthened such that the live load requirements of the bridge code are met. The strengthening of these members will be straightforward. The members in question comprise of two channels tied together via diagonal lacing.

Repair Option 1: Remove diagonal bracing and replace with castellated plate section. Install four (4) No. L (angle) sections at each channel corner to increase the section properties of the member. Alternatively, heavier cover plates may be installed to increase sectional resistance. Since strengthening is required to reduce slenderness, major modifications to the end connections should not be required.

Repair Option 2: Install a diagonal brace to reduce the effective length of the member.

Option 1 is preferred over Option 2 as it is believed that option 2 would change the aesthetic characteristics of this historic bridge.

A capital allowance of at least $250k should be made to complete these repairs

7.2 Deferred Repairs

The area around the main trunnion (node 16) is significantly deteriorated. Both our analysis and past studies have shown the area to be understrength when compared against current CHBDC requirements. It is difficult to assess an accurate cost for this trunnion rehabilitation without further investigation into the full scope of the repair, however, an initial allowance of $3M seems prudent. The repair would take several months to complete. It would require supporting of the counterweight and jacking on the superstructure near node 16. During this time the bridge would be closed to marine traffic. Repair works may also require lengthy road closures.

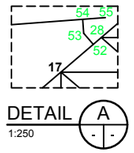
In addition, strengthening to members listed in Table 4 would also need to be undertaken to bring the bridge up to current CHBDC requirements for moveable bridges. This would be considered major rehabilitation work and CHBDC indicates that seismic upgrades (MRC 2001 report) should be undertaken in conjunction with this rehabilitation. Since the counterweight would also be temporarily supported the cladding should be removed such that the integrity of the concrete can be assessed and repaired as required. These additional works are likely to increase the cost of the rehabilitation significantly and as such a life cycle cost analysis should be completed to compare the upgrade costs to replacement.

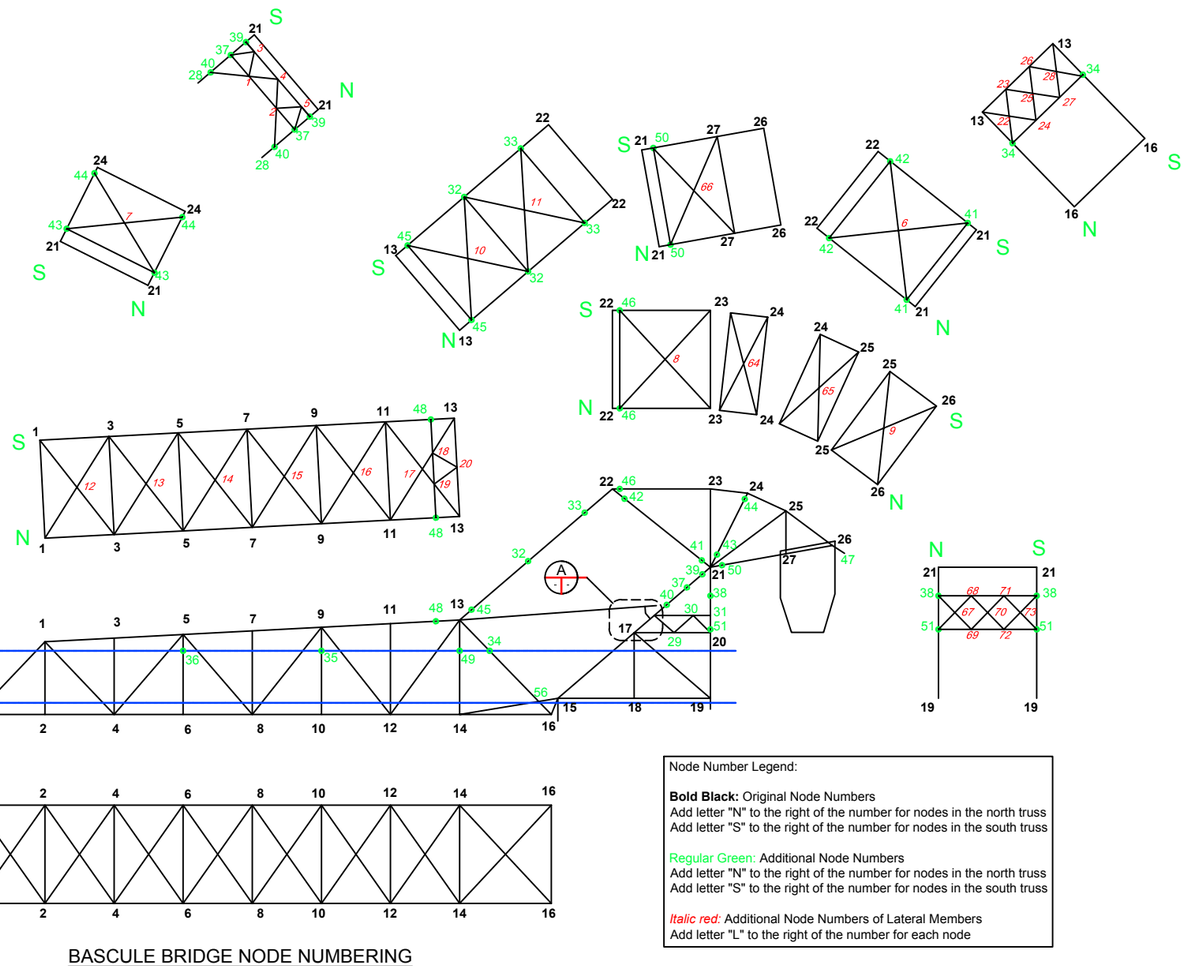
8.0 References

- 1998 – Theodore V. Galambos – Guide to Stability Design Criteria to Metal Structures (GSDCMS), 5th Edition
- 2009 - U.S. Department of Transportation Federal Highway Administration (FHWA) - Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges, Publication No. FHWA-IF-09-014, February 2009
- 2010 – American Railway Engineering and Maintenance-of-Way Association (AREMA) – Part 6, Moveable Bridges
- 2014 – Construction Challenges During Heel Trunnion Replacement for an Historic Strauss Bascule (Cherry Street Bridge Toronto), John Williams SBE, Ian Funkenhauser Facca, Heavy Moveable Structures 15th Biennial Symposium.
- 2014 – Canadian Standards Association (CSA) - Canadian Highway Bridge Design Code (CHBDC) S6-14, December 2014.
- 2015 – AASHTO LFRD Moveable Highway Bridge Design Specifications (2nd Edition) with 2008, 2010, 2011, 2012, 2014, and 2015 Interim Revisions.
- 2016 - Computers & Structures, Inc. (CSI) - Analysis Reference Manual for SAP2000, ETABS, SAFE, and CSiBridge - Berkeley, California, USA, July 2016

Appendix A

Node and Element Numbering





Node Number Legend:

Bold Black: Original Node Numbers
Add letter "N" to the right of the number for nodes in the north truss
Add letter "S" to the right of the number for nodes in the south truss

Regular Green: Additional Node Numbers
Add letter "N" to the right of the number for nodes in the north truss
Add letter "S" to the right of the number for nodes in the south truss

Italic red: Additional Node Numbers of Lateral Members
Add letter "L" to the right of the number for each node

Canada

Public Works and Government Services Canada / Travaux publics et services gouvernementaux Canada

PARSONS

Contractor to verify all dimensions & conditions on site and immediately notify the departmental representative of all discrepancies.

revisions	description	date

A detail no. / no. du detail
B location drawing no. / sur dessin no.
C drawing no. / dessin no.

project / projet

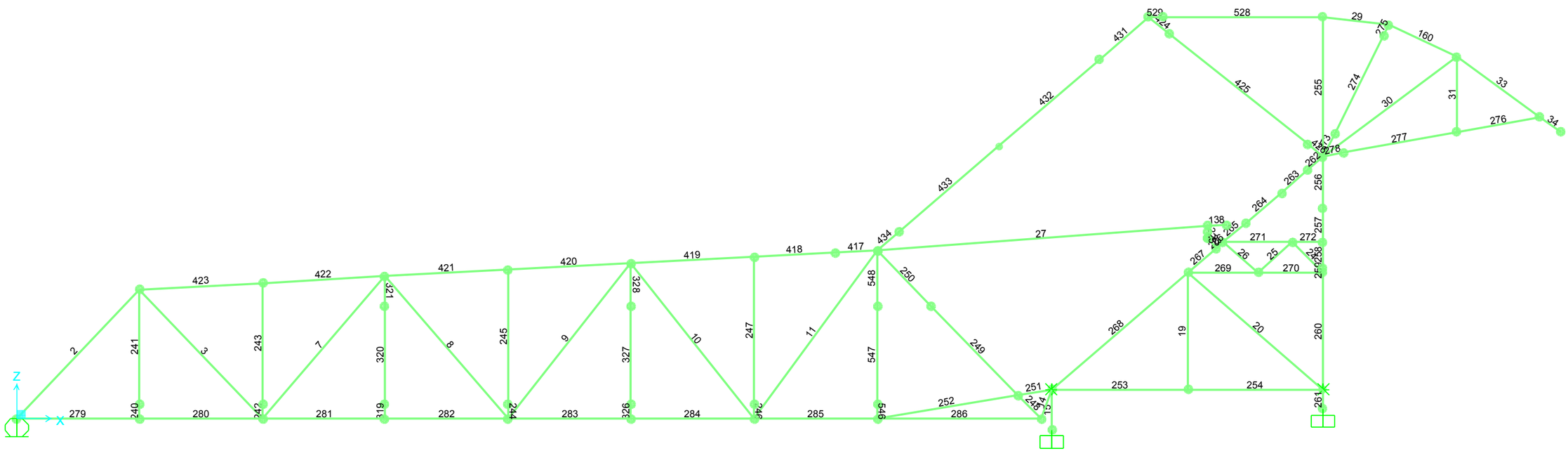
LASALLE CAUSEWAY BASCULE BRIDGE

KINGSTON
ONTARIO

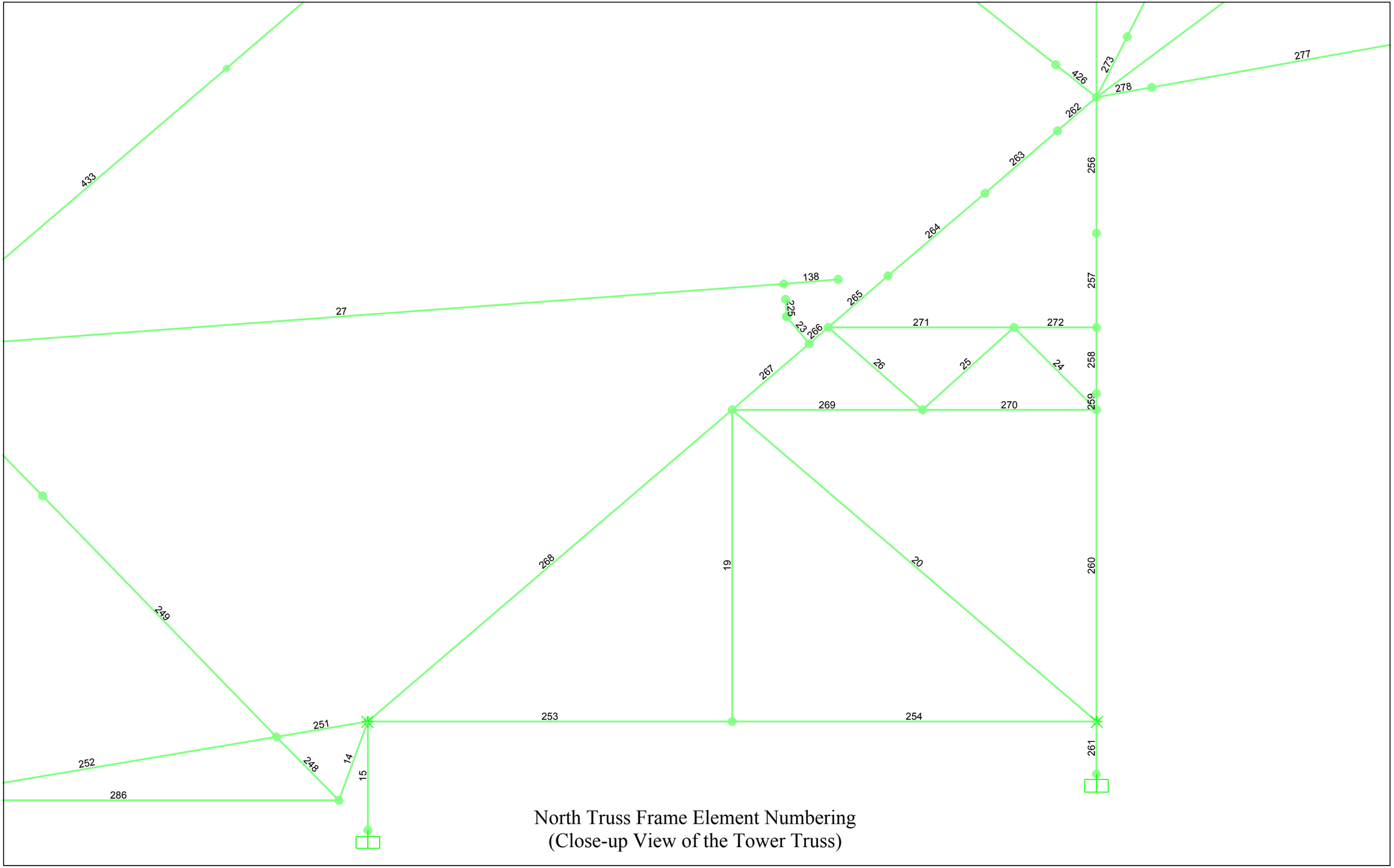
drawing / dessin

BASCULE BRIDGE NODE NUMBERING

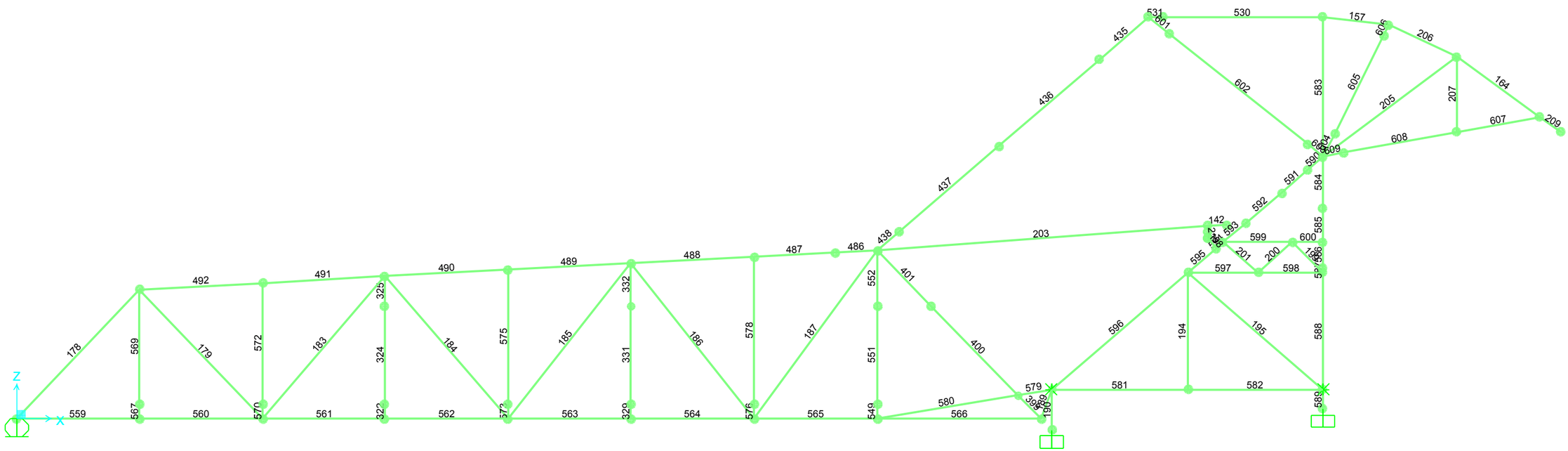
Designed By / Conçu par	AT
Date (yyyy/mm/dd)	2017/06/12
Drawn By / Dessiné par	JS
Date (yyyy/mm/dd)	2017/06/12
Reviewed By / Examiné par	MJPM
Date (yyyy/mm/dd)	2017/06/12
Approved By / Approuvé par	MJPM
Date (yyyy/mm/dd)	2017/06/12
Project Manager / Administrateur de projets	PA
Project no. / No. du projet	R.055058.002
Drawing no. / No. du dessin	SK-01



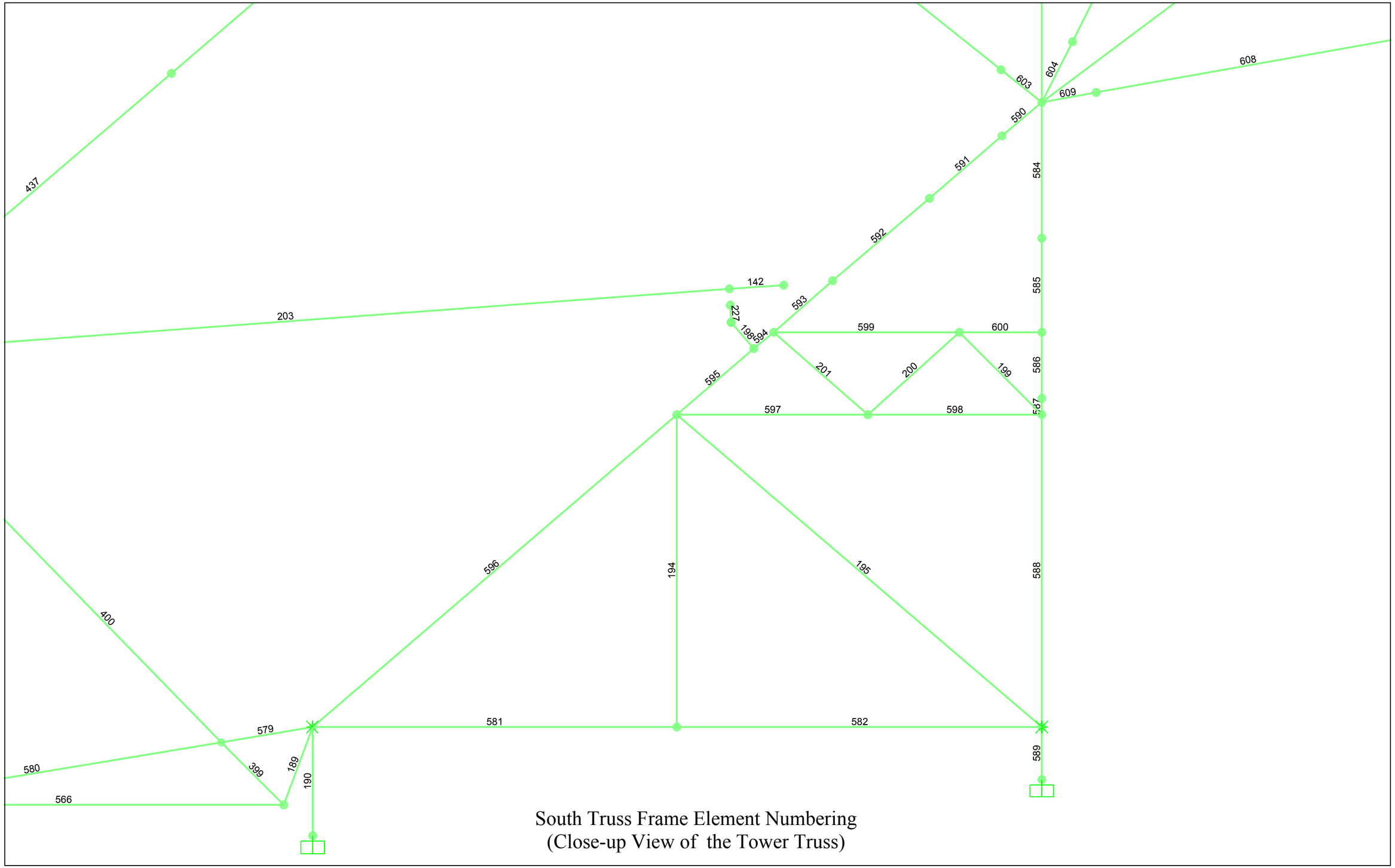
North Truss Frame Element Numbering



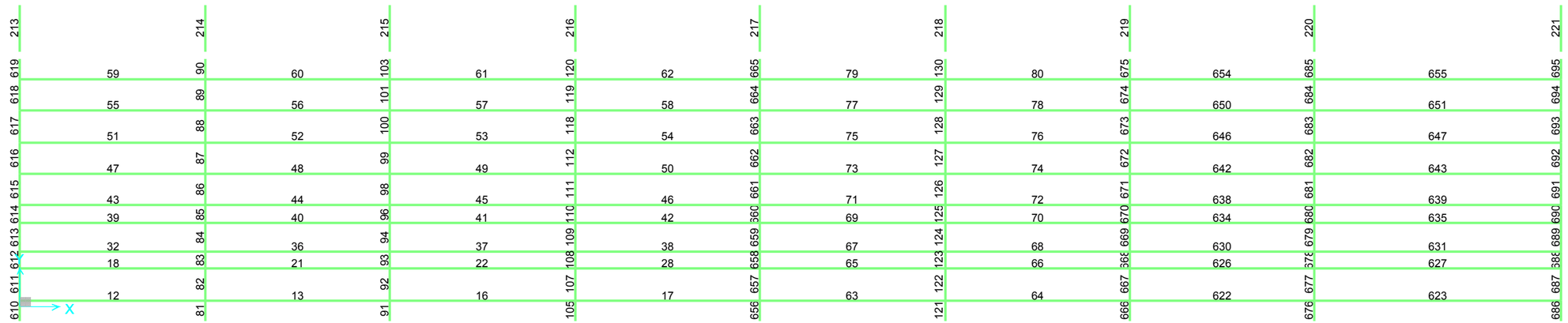
North Truss Frame Element Numbering
(Close-up View of the Tower Truss)



South Truss Frame Element Numbering



South Truss Frame Element Numbering
(Close-up View of the Tower Truss)



Floor Beams, Stringers, and Cantilevers
Frame Element Numbering

Appendix B

Summary of Evaluation Results

Bascule Bridge Structural Evaluation Table - Vehicular Live Load

Element Group	*Evaluation Criteria*								*Evaluation Results*					
	Target Reliability Index				$\alpha_{D,\,Max}$			α_L	Live Load Capacity Factor			Posting (tonnes)		
	System Behaviour	Element Behaviour	Inspection Level	β	D1	D2	D3		CL1-625	CL2-625	CL3-625	CL1-625	CL2-625	CL3-625
01 Through Truss Diagonal	S1	E1	INSP3	3.75	1.1	1.20	1.5	1.7	0.665	0.765	0.97	41.0	34.1	24.2
02 Through Truss Vertical	S1	E1	INSP3	3.75	1.1	1.20	1.5	1.7	1	1	1	62.5	45.0	25.0
03 Through Truss Bottom Chord	S1	E1	INSP3	3.75	1.1	1.20	1.5	1.7	1	1	1	62.5	45.0	25.0
04 Through Truss Top Chord	S1	E2	INSP3	3.25	1.08	1.16	1.4	1.56	1	1	1	62.5	45.0	25.0
05 Counter- weight Link	S1	E1	INSP3	3.75	1.1	1.2	1.5	1.7	1	1	1	62.5	45.0	25.0
06 Operating Strut	S3	E1	INSP3	3.25	1.08	1.16	1.4	1.56	1	1	1	62.5	45.0	25.0
07 Through Truss Trunnion Bay	S1	E1	INSP1	4	1.11	1.22	1.55	1.77	1	1	1	62.5	45.0	25.0
08 Counter- weight Top Chord	S1	E1	INSP3	3.75	1.1	1.2	1.5	1.7	1	1	1	62.5	45.0	25.0
09 Counter- weight Diagonal	S2	E2	INSP3	3	1.07	1.14	1.35	1.49	1	1	1	62.5	45.0	25.0
10 Counter- weight Vertical	S1	E1	INSP3	3.75	1.1	1.2	1.50	1.7	1	1	1	62.5	45.0	25.0
11 Counter- weight Horizontal	S1	E1	INSP1	4	1.11	1.22	1.55	1.77	1	1	1	62.5	45.0	25.0
12 Tower Truss Vertical	S1	E2	INSP3	3.25	1.08	1.16	1.4	1.56	1	1	1	62.5	45.0	25.0
13 Tower Truss Diagonal	S1	E2	INSP3	3.25	1.08	1.16	1.4	1.56	1	1	1	62.5	45.0	25.0
14 Tower Truss Horizontal	S3	E1	INSP3	3.25	1.08	1.16	1.40	1.56	1	1	1	62.5	45.0	25.0
15 Tower Truss Vertical	S3	E2	INSP3	2.75	1.06	1.12	1.30	1.42	1	1	1	62.5	45.0	25.0
16 Tower Truss Diagonal	S3	E2	INSP3	2.75	1.06	1.12	1.30	1.42	1	1	1	62.5	45.0	25.0
17 Tower Truss Secondary Truss	S3	E2	INSP3	2.75	1.06	1.12	1.30	1.42	1	1	1	62.5	45.0	25.0
18 Through Truss Bottom Lateral Bracing	S3	E1	INSP3	3.25	1.08	1.16	1.40	1.56	NC	NC	NC	NC	NC	NC
19 Through Truss Sway Truss	S3	E2	INSP3	2.75	1.06	1.12	1.30	1.42	NC	NC	NC	NC	NC	NC
20 Floor Beams	S2	E3	INSP3	2.75	1.06	1.12	1.30	1.42	1	1	1	62.5	45.0	25.0
21 Stringer	S3	E3	INSP3	2.5	1.05	1.1	1.25	1.35	1	1	1	62.5	45.0	25.0
22 Through Truss Strut	S3	E2	INSP3	2.75	1.06	1.12	1.30	1.42	NC	NC	NC	NC	NC	NC
23 Through Truss Top Lateral Bracing	S3	E1	INSP3	3.25	1.08	1.16	1.4	1.56	NC	NC	NC	NC	NC	NC
24 Counter- weight Link Lateral Bracing	S3	E1	INSP3	3.25	1.08	1.16	1.4	1.56	NC	NC	NC	NC	NC	NC
25 Tower Truss Lateral Bracing	S3	E1	INSP3	3.25	1.08	1.16	1.4	1.56	NC	NC	NC	NC	NC	NC
26 Counter- weight Truss Lateral Bracing	S3	E1	INSP3	3.25	1.08	1.16	1.4	1.56	NC	NC	NC	NC	NC	NC
27 New Counterweight	S2	E3	INSP3	2.75	1.06	1.12	1.3	1.42	NC	NC	NC	NC	NC	NC
28 Sidewalk Cantilever	S3	E3	INSP3	2.5	1.05	1.1	1.25	1.35	NC	NC	NC	NC	NC	NC
29 Machinery Room Beam	S3	E3	INSP3	2.5	1.05	1.1	1.25	1.35	NC	NC	NC	NC	NC	NC
30 Mechanical Parts	S1	E3	INSP1	3.5	1.09	1.18	1.45	1.63	NC	NC	NC	NC	NC	NC
31 Buried Parts	S2	E1	INSP1	3.75	1.1	1.2	1.5	1.7	NC	NC	NC	NC	NC	NC

NC: Not Calculated
NA: Not Applicable

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios Exceeding 1.00)

			Member #	10	10	10	186	186	186	249	249	249	250	250	400	400	400	401	401	547	551
			Member Label	9N-12N	9N-12N	9N-12N	9S-12S	9S-12S	9S-12S	56N-34N	56N-34N	56N-34N	34N-13N	34N-13N	56S-34S	56S-34S	56S-34S	34S-13S	34S-13S	14N-49N	14S-49S
			Station (m)	0.0	4.7	9.3	0.0	4.7	9.3	0.0	2.9	5.9	0.0	1.8	0.0	2.9	5.9	0.0	1.8	4.6	4.6
			Node Label at Station	9N	---	12N	9S	---	12S	56N	---	34N	34N	---	56S	---	34S	34S	---	49N	49S
Load Combination			Section #	Section 07	Section 07	Section 07	Section 07	Section 07	Section 07	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 03	Section 03
			Element Group	01 Through Truss Diagonal	01 Through Truss Diagonal	01 Through Truss Diagonal	01 Through Truss Diagonal	01 Through Truss Diagonal	01 Through Truss Diagonal	01 Through Truss Diagonal	01 Through Truss Diagonal	01 Through Truss Diagonal	01 Through Truss Diagonal	01 Through Truss Diagonal	01 Through Truss Diagonal	01 Through Truss Diagonal	01 Through Truss Diagonal	01 Through Truss Diagonal	01 Through Truss Diagonal	02 Through Truss Vertical	02 Through Truss Vertical
ID	Category	Name																			
1	Live	CL1	Highest Ratio	**1.07**	**1.16**	**1.08**	**1.12**	**1.22**	**1.12**												
2	Live	CL2	Highest Ratio		**1.08**		**1.04**	**1.13**	**1.05**												
3	Live	CL3	Highest Ratio					**1.01**													
4	@ 0˚	ULS B1	Highest Ratio																		
5	@ 0˚	ULS B2	Highest Ratio									**1.15**	**1.14**				**1.17**	**1.16**			
6	@ 0˚	ULS B3	Highest Ratio									**1.31**	**1.29**				**1.33**	**1.31**			
7	@ 0˚	ULS B4	Highest Ratio																		
8	@ 21˚	ULS B1	Highest Ratio																		
9	@ 21˚	ULS B2	Highest Ratio								**1.03**	**1.30**	**1.26**			**1.06**	**1.34**	**1.31**	**1.01**		
10	@ 21˚	ULS B3	Highest Ratio								**1.11**	**1.44**	**1.39**	**1.06**		**1.14**	**1.48**	**1.44**	**1.09**		
11	@ 21˚	ULS B4	Highest Ratio														**NA**	**NA**			
12	@ 42˚	ULS B1	Highest Ratio																		
13	@ 42˚	ULS B2	Highest Ratio								**1.07**	**1.31**	**1.26**	**1.03**		**1.11**	**1.37**	**1.33**	**1.08**		
14	@ 42˚	ULS B3	Highest Ratio							**1.00**	**1.14**	**1.42**	**1.38**	**1.10**	**1.02**	**1.18**	**1.49**	**1.45**	**1.15**		
15	@ 42˚	ULS B4	Highest Ratio									**NA**	**NA**				**NA**	**NA**			
16	@ 63˚	ULS B1	Highest Ratio																		
17	@ 63˚	ULS B2	Highest Ratio									**1.17**	**1.19**			**1.05**	**1.29**	**1.32**	**1.07**	**1.06**	**1.10**
18	@ 63˚	ULS B3	Highest Ratio								**1.04**	**1.27**	**1.30**	**1.05**		**1.12**	**1.40**	**1.44**	**1.15**	**1.22**	**1.26**
19	@ 63˚	ULS B4	Highest Ratio									**NA**					**NA**	**NA**			
20	@ 84˚	ULS B1	Highest Ratio																		
21	@ 84˚	ULS B2	Highest Ratio																		**1.05**
22	@ 84˚	ULS B3	Highest Ratio														**1.02**	**1.09**		**1.06**	**1.16**
23	@ 84˚	ULS B4	Highest Ratio																		
			Maximum Highest Ratio (Overall)	**1.07**	**1.16**	**1.08**	**1.12**	**1.22**	**1.12**	**1.00**	**1.14**	**1.44**	**1.39**	**1.10**	**1.02**	**1.18**	**1.49**	**1.45**	**1.15**	**1.22**	**1.26**
			Governing Load Combination per Member per Station (Overall)	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 21˚	ULS B3 @ 21˚	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 63˚
			Governing Member of the Element Group (Overall)														Governing (Overall)				Governing (Overall)
			Maximum Highest Ratio (Live Load Only)	**1.07**	**1.16**	**1.08**	**1.12**	**1.22**	**1.12**												
			Governing Load Combination per Member per Station (Live Load Only)	CL1	CL1	CL1	CL1	CL1	CL1												
			Governing Member of the Element Group (Live Load Only)					Governing (Live L.)													
			Maximum Highest Ratio (Movable L. Only)							**1.00**	**1.14**	**1.44**	**1.39**	**1.10**	**1.02**	**1.18**	**1.49**	**1.45**	**1.15**	**1.22**	**1.26**
			Governing Load Combination per Member per Station (Movable Load Only)							ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
			Governing Member of the Element Group (Movable Load Only)														Governing (Movable L.)				Governing (Movable L.)

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Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios Exceeding 1.00)

			Member #	284	284	284	285	285	285	286	286	286	564	564	565	565	565	566	566	566	418
			Member Label	10N-12N	10N-12N	10N-12N	12N-14N	12N-14N	12N-14N	14N-16N	14N-16N	14N-16N	10S-12S	10S-12S	12S-14S	12S-14S	12S-14S	14S-16S	14S-16S	14S-16S	48N-11N
			Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	3.9	7.7	2.9	5.8	0.0	2.9	5.8	0.0	3.9	7.7	0.0
			Node Label at Station	10N	---	12N	12N	---	14N	14N	---	16N	---	12S	12S	---	14S	14S	---	16S	48N
Load Combination			Section #	Section 02	Section 02	Section 02	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01	Section 02	Section 02	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01	Section 06
			Element Group	03 Through Truss Bottom Chord	03 Through Truss Bottom Chord	03 Through Truss Bottom Chord	03 Through Truss Bottom Chord	03 Through Truss Bottom Chord	03 Through Truss Bottom Chord	03 Through Truss Bottom Chord	03 Through Truss Bottom Chord	03 Through Truss Bottom Chord	03 Through Truss Bottom Chord	03 Through Truss Bottom Chord	03 Through Truss Bottom Chord	03 Through Truss Bottom Chord	03 Through Truss Bottom Chord	03 Through Truss Bottom Chord	03 Through Truss Bottom Chord	03 Through Truss Bottom Chord	04 Through Truss Top Chord
ID	Category	Name																			
1	Live	CL1	Highest Ratio																		
2	Live	CL2	Highest Ratio																		
3	Live	CL3	Highest Ratio																		
4	@ 0˚	ULS B1	Highest Ratio																		
5	@ 0˚	ULS B2	Highest Ratio			1.08	1.10	1.06	1.17		1.08	1.74		1.12	1.16	1.13	1.24		1.08	1.77	1.03
6	@ 0˚	ULS B3	Highest Ratio			1.15	1.16	1.12	1.24	1.01	1.19	1.96		1.19	1.22	1.18	1.30	1.01	1.20	1.99	1.05
7	@ 0˚	ULS B4	Highest Ratio									NA					NA			NA	
8	@ 21˚	ULS B1	Highest Ratio														1.04				
9	@ 21˚	ULS B2	Highest Ratio			1.24	1.15	1.09	1.22	1.19	1.30	1.84		1.19	1.18	1.14	1.31	1.11	1.26	1.79	
10	@ 21˚	ULS B3	Highest Ratio	1.01	1.04	1.32	1.22	1.15	1.28	1.26	1.42	2.04	1.00	1.26	1.25	1.20	1.37	1.18	1.38	1.98	1.03
11	@ 21˚	ULS B4	Highest Ratio						NA	NA	NA	NA					NA		NA	NA	
12	@ 42˚	ULS B1	Highest Ratio							1.02	1.08	1.32							1.04	1.31	
13	@ 42˚	ULS B2	Highest Ratio			1.27	1.20	1.03	1.20	1.34	1.49	2.12		1.21	1.25	1.07	1.32	1.23	1.46	2.08	1.08
14	@ 42˚	ULS B3	Highest Ratio		1.04	1.35	1.29	1.09	1.28	1.41	1.59	2.30		1.28	1.34	1.14	1.40	1.31	1.56	2.27	1.17
15	@ 42˚	ULS B4	Highest Ratio							NA	NA	NA					NA	NA	NA	NA	
16	@ 63˚	ULS B1	Highest Ratio									1.21								1.19	
17	@ 63˚	ULS B2	Highest Ratio			1.27	1.18		1.12	1.21	1.31	1.91		1.22	1.25		1.23	1.24	1.29	1.89	1.10
18	@ 63˚	ULS B3	Highest Ratio			1.38	1.30		1.23	1.30	1.40	2.08		1.32	1.38	1.02	1.34	1.33	1.38	2.05	1.26
19	@ 63˚	ULS B4	Highest Ratio							NA	NA	NA						NA	NA	NA	
20	@ 84˚	ULS B1	Highest Ratio																		
21	@ 84˚	ULS B2	Highest Ratio			1.22						1.07		1.20	1.06					1.07	
22	@ 84˚	ULS B3	Highest Ratio			1.37	1.13		1.07			1.22		1.33	1.21		1.14			1.21	1.16
23	@ 84˚	ULS B4	Highest Ratio																		
			Maximum Highest Ratio (Overall)	1.01	1.04	1.38	1.30	1.15	1.28	1.41	1.59	2.30	1.00	1.33	1.38	1.20	1.40	1.33	1.56	2.27	1.26
			Governing Load Combination per Member per Station (Overall)	ULS B3 @ 21˚	ULS B3 @ 21˚	ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 21˚	ULS B3 @ 21˚	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 21˚	ULS B3 @ 84˚	ULS B3 @ 63˚	ULS B3 @ 21˚	ULS B3 @ 42˚	ULS B3 @ 63˚	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 63˚
			Governing Member of the Element Group (Overall)									Governing (Overall)									
			Maximum Highest Ratio (Live Load Only)																		
			Governing Load Combination per Member per Station (Live Load Only)																		
			Governing Member of the Element Group (Live Load Only)																		
			Maximum Highest Ratio (Movable L. Only)	1.01	1.04	1.38	1.30	1.15	1.28	1.41	1.59	2.30	1.00	1.33	1.38	1.20	1.40	1.33	1.56	2.27	1.26
			Governing Load Combination per Member per Station (Movable Load Only)	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
			Governing Member of the Element Group (Movable Load Only)									Governing (Movable L.)									

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios Exceeding 1.00)

			Member #	487	431	431	432	432	435	435	436	436	14	189	248	248	248	251	251	251	252
			Member Label	48S-11S	22N-33N	22N-33N	33N-32N	33N-32N	22S-33S	22S-33S	33S-32S	33S-32S	15N-16N	15S-16S	16N-56N	16N-56N	16N-56N	15N-56N	15N-56N	15N-56N	56N-14N
			Station (m)	0.0	0.0	3.0	0.0	3.1	0.0	3.0	0.0	3.1	0.0	0.0	0.0	0.8	1.6	0.0	0.8	1.6	0.0
			Node Label at Station	48S	22N	33N	33N	---	22S	33S	33S	---	15N	15S	16N	---	56N	15N	---	56N	56N
Load Combination			Section #	Section 06	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 09	Section 09	Section 01	Section 01	Section 01	Section 08	Section 08	Section 08	Section 08
			Element Group	04 Through Truss Top Chord	05 Counter-weight Link	05 Counter-weight Link	05 Counter-weight Link	05 Counter-weight Link	05 Counter-weight Link	05 Counter-weight Link	05 Counter-weight Link	05 Counter-weight Link	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay
ID	Category	Name																			
1	Live	CL1	Highest Ratio																		
2	Live	CL2	Highest Ratio																		
3	Live	CL3	Highest Ratio																		
4	@ 0˚	ULS B1	Highest Ratio																		
5	@ 0˚	ULS B2	Highest Ratio	1.05	1.24	1.03	1.02		1.15	1.02	1.02	1.00			1.37			1.55	1.41	1.25	1.29
6	@ 0˚	ULS B3	Highest Ratio	1.08	1.36	1.07	1.07	1.02	1.27	1.07	1.06	1.03			1.52			1.75	1.56	1.36	1.40
7	@ 0˚	ULS B4	Highest Ratio	NA														NA			
8	@ 21˚	ULS B1	Highest Ratio												1.04						
9	@ 21˚	ULS B2	Highest Ratio	1.03	1.21	1.00			1.09						1.65	1.20		1.33	1.17	1.00	1.06
10	@ 21˚	ULS B3	Highest Ratio	1.06	1.33	1.05	1.05		1.21	1.04	1.04				1.78	1.28	1.04	1.51	1.31	1.11	1.16
11	@ 21˚	ULS B4	Highest Ratio												NA	NA					
12	@ 42˚	ULS B1	Highest Ratio												1.20	1.04					
13	@ 42˚	ULS B2	Highest Ratio	1.10	1.10										1.74	1.34	1.09	1.12			
14	@ 42˚	ULS B3	Highest Ratio	1.19	1.21				1.09						1.87	1.40	1.14	1.29	1.08		
15	@ 42˚	ULS B4	Highest Ratio												NA	NA	NA				
16	@ 63˚	ULS B1	Highest Ratio												1.04						
17	@ 63˚	ULS B2	Highest Ratio	1.11											1.58	1.22					
18	@ 63˚	ULS B3	Highest Ratio	1.26									1.05		1.71	1.28	1.03	1.12			
19	@ 63˚	ULS B4	Highest Ratio												NA	NA					
20	@ 84˚	ULS B1	Highest Ratio																		
21	@ 84˚	ULS B2	Highest Ratio															1.02			
22	@ 84˚	ULS B3	Highest Ratio	1.15									1.11	1.05	1.15			1.15	1.04		
23	@ 84˚	ULS B4	Highest Ratio																		
			Maximum Highest Ratio (Overall)	1.26	1.36	1.07	1.07	1.02	1.27	1.07	1.06	1.03	1.11	1.05	1.87	1.40	1.14	1.75	1.56	1.36	1.40
			Governing Load Combination per Member per Station (Overall)	ULS B3 @ 63˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚
			Governing Member of the Element Group (Overall)	Governing (Overall)	Governing (Overall)																
			Maximum Highest Ratio (Live Load Only)																		
			Governing Load Combination per Member per Station (Live Load Only)																		
			Governing Member of the Element Group (Live Load Only)																		
			Maximum Highest Ratio (Movable L. Only)	1.26	1.36	1.07	1.07	1.02	1.27	1.07	1.06	1.03	1.11	1.05	1.87	1.40	1.14	1.75	1.56	1.36	1.40
			Governing Load Combination per Member per Station (Movable Load Only)	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
			Governing Member of the Element Group (Movable Load Only)	Governing (Movable L.)	Governing (Movable L.)																

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Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios Exceeding 1.00)

			Member #	252	252	399	399	399	579	579	579	580	580	580	33	33	164	164	426	426	426
			Member Label	56N-14N	56N-14N	16S-56S	16S-56S	16S-56S	15S-56S	15S-56S	15S-56S	56S-14S	56S-14S	56S-14S	26N-25N	26N-25N	26S-25S	26S-25S	41N-21N	41N-21N	41N-21N
			Station (m)	3.4	6.7	0.0	0.8	1.6	0.0	0.8	1.6	0.0	3.4	6.7	2.4	4.8	2.4	4.8	0.0	0.5	0.9
			Node Label at Station	---	14N	16S	---	56S	15S	---	56S	56S	---	14S	---	25N	---	25S	41N	---	21N
Load Combination			Section #	Section 08	Section 08	Section 01	Section 01	Section 01	Section 08	Section 08	Section 08	Section 08	Section 08	Section 08	Section 25	Section 25	Section 25	Section 25	Section 16	Section 16	Section 16
			Element Group	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	08 Counter-weight Top Chord	08 Counter-weight Top Chord	08 Counter-weight Top Chord	08 Counter-weight Top Chord	09 Counter-weight Diagonal	09 Counter-weight Diagonal	09 Counter-weight Diagonal
ID	Category	Name																			
1	Live	CL1	Highest Ratio																		
2	Live	CL2	Highest Ratio																		
3	Live	CL3	Highest Ratio																		
4	@ 0˚	ULS B1	Highest Ratio																		
5	@ 0˚	ULS B2	Highest Ratio	1.38	1.29	1.37			1.58	1.45	1.30	1.34	1.44	1.34							
6	@ 0˚	ULS B3	Highest Ratio	1.50	1.40	1.52			1.77	1.60	1.41	1.45	1.55	1.45							
7	@ 0˚	ULS B4	Highest Ratio	NA					NA	NA			NA								
8	@ 21˚	ULS B1	Highest Ratio			1.03															
9	@ 21˚	ULS B2	Highest Ratio	1.14	1.05	1.63	1.20		1.33	1.18	1.02	1.08	1.17	1.08					1.02	1.02	1.02
10	@ 21˚	ULS B3	Highest Ratio	1.25	1.16	1.77	1.28	1.04	1.51	1.32	1.12	1.18	1.28	1.18					1.03	1.03	1.03
11	@ 21˚	ULS B4	Highest Ratio			NA	NA												NA	NA	NA
12	@ 42˚	ULS B1	Highest Ratio			1.20	1.05														
13	@ 42˚	ULS B2	Highest Ratio			1.75	1.35	1.10	1.12												
14	@ 42˚	ULS B3	Highest Ratio			1.87	1.42	1.15	1.29	1.09			1.01						1.01	1.01	1.01
15	@ 42˚	ULS B4	Highest Ratio			NA	NA	NA											NA	NA	NA
16	@ 63˚	ULS B1	Highest Ratio			1.06															
17	@ 63˚	ULS B2	Highest Ratio			1.61	1.25	1.02													
18	@ 63˚	ULS B3	Highest Ratio			1.74	1.33	1.07	1.13												
19	@ 63˚	ULS B4	Highest Ratio			NA	NA	NA													
20	@ 84˚	ULS B1	Highest Ratio													1.21		1.20			
21	@ 84˚	ULS B2	Highest Ratio						1.03						1.03	1.24	1.03	1.24			
22	@ 84˚	ULS B3	Highest Ratio			1.14			1.16	1.05					1.04	1.25	1.04	1.25			
23	@ 84˚	ULS B4	Highest Ratio												NA	NA	NA	NA			
Maximum Highest Ratio (Overall)				1.50	1.40	1.87	1.42	1.15	1.77	1.60	1.41	1.45	1.55	1.45	1.04	1.25	1.04	1.25	1.03	1.03	1.03
Governing Load Combination per Member per Station (Overall)				ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 21˚	ULS B3 @ 21˚	ULS B3 @ 21˚
Governing Member of the Element Group (Overall)						Governing (Overall)										Governing (Overall)					
Maximum Highest Ratio (Live Load Only)																					
Governing Load Combination per Member per Station (Live Load Only)																					
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				1.50	1.40	1.87	1.42	1.15	1.77	1.60	1.41	1.45	1.55	1.45	1.04	1.25	1.04	1.25	1.03	1.03	1.03
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)						Governing (Movable L.)										Governing (Movable L.)					

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Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios Exceeding 1.00)

				Member #	602	603	603	603	276	277	278	607	608	609	258	258	259	259	259	260	260	586
				Member Label	42S-41S	41S-21S	41S-21S	41S-21S	26N-27N	27N-50N	50N-21N	26S-27S	27S-50S	50S-21S	31N-51N	31N-51N	51N-20N	51N-20N	51N-20N	20N-19N	20N-19N	31S-51S
				Station (m)	8.3	0.0	0.5	0.9	3.9	0.0	1.0	3.9	0.0	1.0	0.6	1.2	0.0	0.1	0.3	0.0	5.5	0.6
				Node Label at Station	41S	41S	---	21S	27N	27N	21N	27S	27S	21S	---	51N	51N	---	20N	20N	19N	---
Load Combination				Section #	Section 16	Section 16	Section 16	Section 16	Section 26	Section 21	Section 21	Section 26	Section 21	Section 21	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20
				Element Group	09 Counter-weight Diagonal	09 Counter-weight Diagonal	09 Counter-weight Diagonal	09 Counter-weight Diagonal	11 Counter-weight Horizontal	11 Counter-weight Horizontal	11 Counter-weight Horizontal	11 Counter-weight Horizontal	11 Counter-weight Horizontal	11 Counter-weight Horizontal	12 Tower Truss Vertical	12 Tower Truss Vertical	12 Tower Truss Vertical	12 Tower Truss Vertical	12 Tower Truss Vertical	12 Tower Truss Vertical	12 Tower Truss Vertical	12 Tower Truss Vertical
ID	Category	Name																				
1	Live	CL1	Highest Ratio																			
2	Live	CL2	Highest Ratio																			
3	Live	CL3	Highest Ratio																			
4	@ 0˚	ULS B1	Highest Ratio																			
5	@ 0˚	ULS B2	Highest Ratio														1.02	1.00		1.19	1.44	
6	@ 0˚	ULS B3	Highest Ratio													1.06	1.13	1.10	1.07	1.30	1.60	
7	@ 0˚	ULS B4	Highest Ratio													1.07	1.10	1.07	1.04	1.27	1.51	
8	@ 21˚	ULS B1	Highest Ratio					1.02														
9	@ 21˚	ULS B2	Highest Ratio	1.01	1.04	1.04	1.06										1.02	1.00		1.19	1.45	
10	@ 21˚	ULS B3	Highest Ratio	1.02	1.05	1.05	1.07									1.07	1.13	1.10	1.08	1.31	1.62	
11	@ 21˚	ULS B4	Highest Ratio	NA	NA	NA	NA									1.07	1.10	1.07	1.04	1.26	1.52	
12	@ 42˚	ULS B1	Highest Ratio																			
13	@ 42˚	ULS B2	Highest Ratio		1.02	1.02	1.03									1.01	1.06	1.05	1.04	1.27	1.52	
14	@ 42˚	ULS B3	Highest Ratio	1.01	1.04	1.03	1.04									1.12	1.18	1.17	1.16	1.41	1.71	
15	@ 42˚	ULS B4	Highest Ratio	NA	NA	NA	NA									1.04	1.07	1.05	1.03	1.24	1.50	
16	@ 63˚	ULS B1	Highest Ratio																			
17	@ 63˚	ULS B2	Highest Ratio													1.09	1.15	1.14	1.14	1.40	1.62	
18	@ 63˚	ULS B3	Highest Ratio													1.23	1.29	1.28	1.27	1.57	1.84	
19	@ 63˚	ULS B4	Highest Ratio						NA			NA				1.03	1.06	1.04	1.02	1.22	1.46	
20	@ 84˚	ULS B1	Highest Ratio						1.10			1.10										
21	@ 84˚	ULS B2	Highest Ratio					1.02	1.15		1.02	1.14		1.01	1.21	1.28	1.26	1.25	1.54	1.72	1.01	
22	@ 84˚	ULS B3	Highest Ratio					1.03	1.16		1.03	1.15		1.12	1.37	1.44	1.43	1.41	1.74	1.97	1.12	
23	@ 84˚	ULS B4	Highest Ratio					NA	NA	NA	NA	NA	NA		1.04	1.07	1.04	1.01	1.21	1.40		
Maximum Highest Ratio (Overall)				1.02	1.05	1.05	1.07	1.03	1.16	NA	1.03	1.15	NA	1.12	1.37	1.44	1.43	1.41	1.74	1.97	1.12	
Governing Load Combination per Member per Station (Overall)				ULS B3 @ 21˚	ULS B3 @ 21˚	ULS B3 @ 21˚	ULS B3 @ 21˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B4 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B4 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚
Governing Member of the Element Group (Overall)							Governing (Overall)		Governing (Overall)													
Maximum Highest Ratio (Live Load Only)																						
Governing Load Combination per Member per Station (Live Load Only)																						
Governing Member of the Element Group (Live Load Only)																						
Maximum Highest Ratio (Movable L. Only)				1.02	1.05	1.05	1.07	1.03	1.16		1.03	1.15		1.12	1.37	1.44	1.43	1.41	1.74	1.97	1.12	
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3		ULS B3	ULS B3		ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	
Governing Member of the Element Group (Movable Load Only)							Governing (Movable L.)		Governing (Movable L.)													

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Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios Exceeding 1.00)

			Member #	586	587	587	587	588	588	266	266	266	267	267	267	268	268	268	594	594	594
			Member Label	31S-51S	51S-20S	51S-20S	51S-20S	20S-19S	20S-19S	28N-52N	28N-52N	28N-52N	52N-17N	52N-17N	52N-17N	17N-15N	17N-15N	17N-15N	28S-52S	28S-52S	28S-52S
			Station (m)	1.2	0.0	0.1	0.3	0.0	5.5	0.0	0.2	0.4	0.0	0.9	1.8	0.0	4.2	8.4	0.0	0.2	0.4
			Node Label at Station	51S	51S	---	20S	20S	19S	28N	---	52N	52N	---	17N	17N	---	15N	28S	---	52S
Load Combination			Section #	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11
			Element Group	12 Tower Truss Vertical	12 Tower Truss Vertical	12 Tower Truss Vertical	12 Tower Truss Vertical	12 Tower Truss Vertical	12 Tower Truss Vertical	13 Tower Truss Diagonal	13 Tower Truss Diagonal	13 Tower Truss Diagonal	13 Tower Truss Diagonal	13 Tower Truss Diagonal	13 Tower Truss Diagonal	13 Tower Truss Diagonal	13 Tower Truss Diagonal	13 Tower Truss Diagonal	13 Tower Truss Diagonal	13 Tower Truss Diagonal	13 Tower Truss Diagonal
ID	Category	Name																			
1	Live	CL1	Highest Ratio																		
2	Live	CL2	Highest Ratio																		
3	Live	CL3	Highest Ratio																		
4	@ 0˚	ULS B1	Highest Ratio									1.08									1.09
5	@ 0˚	ULS B2	Highest Ratio	1.00	1.06	1.04	1.02	1.24	1.47			1.20	1.34	1.08	1.14	1.47	1.06	1.95			1.20
6	@ 0˚	ULS B3	Highest Ratio	1.10	1.16	1.14	1.11	1.35	1.63			1.22	1.42	1.15	1.24	1.61	1.11	2.18			1.23
7	@ 0˚	ULS B4	Highest Ratio	1.10	1.14	1.11	1.08	1.31	1.54			1.26	1.31	1.08	1.02	1.30	1.07	1.54			1.27
8	@ 21˚	ULS B1	Highest Ratio																		
9	@ 21˚	ULS B2	Highest Ratio	1.00	1.06	1.04	1.02	1.24	1.48			1.10	1.31	1.02	1.08	1.39		1.84			1.13
10	@ 21˚	ULS B3	Highest Ratio	1.10	1.17	1.14	1.11	1.35	1.65			1.14	1.41	1.10	1.19	1.53	1.05	2.06			1.18
11	@ 21˚	ULS B4	Highest Ratio	1.10	1.13	1.10	1.07	1.30	1.55			1.08	1.24	1.01		1.22		1.42			1.11
12	@ 42˚	ULS B1	Highest Ratio																		
13	@ 42˚	ULS B2	Highest Ratio	1.04	1.10	1.08	1.07	1.31	1.55			1.26	1.40	1.03	1.02	1.31		1.64			1.31
14	@ 42˚	ULS B3	Highest Ratio	1.15	1.22	1.20	1.19	1.45	1.74			1.38	1.54	1.12	1.13	1.46		1.84			1.44
15	@ 42˚	ULS B4	Highest Ratio	1.08	1.11	1.08	1.06	1.28	1.53				1.13			1.12		1.28			
16	@ 63˚	ULS B1	Highest Ratio																		
17	@ 63˚	ULS B2	Highest Ratio	1.12	1.17	1.17	1.16	1.43	1.64			1.37	1.50			1.18		1.28			1.44
18	@ 63˚	ULS B3	Highest Ratio	1.25	1.32	1.31	1.30	1.60	1.86	1.01	1.00	1.55	1.71	1.10	1.04	1.33		1.44	1.05	1.05	1.62
19	@ 63˚	ULS B4	Highest Ratio	1.06	1.09	1.06	1.04	1.25	1.48									1.07			
20	@ 84˚	ULS B1	Highest Ratio																		
21	@ 84˚	ULS B2	Highest Ratio	1.22	1.29	1.27	1.26	1.55	1.74			1.19	1.34								1.25
22	@ 84˚	ULS B3	Highest Ratio	1.39	1.45	1.44	1.42	1.76	1.99			1.40	1.60						1.02		1.47
23	@ 84˚	ULS B4	Highest Ratio	1.05	1.08	1.05	1.02	1.22	1.41												
			Maximum Highest Ratio (Overall)	1.39	1.45	1.44	1.42	1.76	1.99	1.01	1.00	1.55	1.71	1.15	1.24	1.61	1.11	2.18	1.05	1.05	1.62
			Governing Load Combination per Member per Station (Overall)	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 63˚
			Governing Member of the Element Group (Overall)						Governing (Overall)									Governing (Overall)			
			Maximum Highest Ratio (Live Load Only)																		
			Governing Load Combination per Member per Station (Live Load Only)																		
			Governing Member of the Element Group (Live Load Only)																		
			Maximum Highest Ratio (Movable L. Only)	1.39	1.45	1.44	1.42	1.76	1.99	1.01	1.00	1.55	1.71	1.15	1.24	1.61	1.11	2.18	1.05	1.05	1.62
			Governing Load Combination per Member per Station (Movable Load Only)	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
			Governing Member of the Element Group (Movable Load Only)						Governing (Movable L.)									Governing (Movable L.)			

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Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios Exceeding 1.00)

			Member #	595	595	595	596	596	596	253	581	20	20	20	195	195	195	269	269	269	597
			Member Label	52S-17S	52S-17S	52S-17S	17S-15S	17S-15S	17S-15S	15N-18N	15S-18S	17N-19N	17N-19N	17N-19N	17S-19S	17S-19S	17S-19S	17N-29N	17N-29N	17N-29N	17S-29S
			Station (m)	0.0	0.9	1.8	0.0	4.2	8.4	0.0	0.0	0.0	4.2	8.4	0.0	4.2	8.4	0.0	1.7	3.3	0.0
			Node Label at Station	52S	---	17S	17S	---	15S	15N	15S	17N	---	19N	17S	---	19S	17N	---	29N	17S
Load Combination			Section #	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 12	Section 12	Section 14	Section 14	Section 14	Section 14	Section 14	Section 14	Section 15	Section 15	Section 15	Section 15
			Element Group	13 Tower Truss Diagonal	13 Tower Truss Diagonal	13 Tower Truss Diagonal	13 Tower Truss Diagonal	13 Tower Truss Diagonal	13 Tower Truss Diagonal	14 Tower Truss Horizontal	14 Tower Truss Horizontal	16 Tower Truss Diagonal	16 Tower Truss Diagonal	16 Tower Truss Diagonal	16 Tower Truss Diagonal	16 Tower Truss Diagonal	16 Tower Truss Diagonal	17 Tower Truss Secondary Truss	17 Tower Truss Secondary Truss	17 Tower Truss Secondary Truss	17 Tower Truss Secondary Truss
ID	Category	Name																			
1	Live	CL1	Highest Ratio																		
2	Live	CL2	Highest Ratio																		
3	Live	CL3	Highest Ratio																		
4	@ 0˚	ULS B1	Highest Ratio	**1.00**																	
5	@ 0˚	ULS B2	Highest Ratio	**1.37**	**1.10**	**1.16**	**1.50**	**1.08**	**1.94**												
6	@ 0˚	ULS B3	Highest Ratio	**1.45**	**1.18**	**1.27**	**1.65**	**1.13**	**2.17**	**1.13**	**1.17**										
7	@ 0˚	ULS B4	Highest Ratio	**1.34**	**1.11**	**1.04**	**1.33**	**1.09**	**1.53**												
8	@ 21˚	ULS B1	Highest Ratio																		
9	@ 21˚	ULS B2	Highest Ratio	**1.35**	**1.05**	**1.11**	**1.42**	**1.02**	**1.84**												
10	@ 21˚	ULS B3	Highest Ratio	**1.44**	**1.13**	**1.22**	**1.57**	**1.07**	**2.07**	**1.06**	**1.10**										
11	@ 21˚	ULS B4	Highest Ratio	**1.27**	**1.03**		**1.24**		**1.42**												
12	@ 42˚	ULS B1	Highest Ratio																		
13	@ 42˚	ULS B2	Highest Ratio	**1.44**	**1.06**	**1.05**	**1.36**		**1.67**												
14	@ 42˚	ULS B3	Highest Ratio	**1.58**	**1.15**	**1.17**	**1.51**	**1.01**	**1.87**					**1.05**			**1.06**				
15	@ 42˚	ULS B4	Highest Ratio	**1.16**			**1.15**		**1.29**												
16	@ 63˚	ULS B1	Highest Ratio																		
17	@ 63˚	ULS B2	Highest Ratio	**1.55**	**1.02**		**1.24**		**1.32**			**1.02**		**1.13**	**1.03**		**1.13**				
18	@ 63˚	ULS B3	Highest Ratio	**1.76**	**1.14**	**1.08**	**1.40**		**1.49**			**1.22**		**1.32**	**1.25**		**1.34**				
19	@ 63˚	ULS B4	Highest Ratio				**1.00**		**1.09**												
20	@ 84˚	ULS B1	Highest Ratio																		
21	@ 84˚	ULS B2	Highest Ratio	**1.39**								**1.20**		**1.21**	**1.23**		**1.24**				
22	@ 84˚	ULS B3	Highest Ratio	**1.66**			**1.06**					**1.47**	**1.11**	**1.46**	**1.51**	**1.16**	**1.50**	**1.04**	**1.08**	**1.08**	**1.06**
23	@ 84˚	ULS B4	Highest Ratio																		
Maximum Highest Ratio (Overall)				**1.76**	**1.18**	**1.27**	**1.65**	**1.13**	**2.17**	**1.13**	**1.17**	**1.47**	**1.11**	**1.46**	**1.51**	**1.16**	**1.50**	**1.04**	**1.08**	**1.08**	**1.06**
Governing Load Combination per Member per Station (Overall)				ULS B3 @ 63˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚
Governing Member of the Element Group (Overall)											Governing (Overall)				Governing (Overall)						
Maximum Highest Ratio (Live Load Only)																					
Governing Load Combination per Member per Station (Live Load Only)																					
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				**1.76**	**1.18**	**1.27**	**1.65**	**1.13**	**2.17**	**1.13**	**1.17**	**1.47**	**1.11**	**1.46**	**1.51**	**1.16**	**1.50**	**1.04**	**1.08**	**1.08**	**1.06**
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)											Governing (Movable L.)				Governing (Movable L.)						

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Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios Exceeding 1.00)

				Member #	597	597
				Member Label	17S-29S	17S-29S
				Station (m)	1.7	3.3
				Node Label at Station	---	29S
Load Combination				Section #	Section 15	Section 15
				Element Group	17 Tower Truss Secondary Truss	17 Tower Truss Secondary Truss
ID	Category	Name				
1	Live	CL1	Highest Ratio			
2	Live	CL2	Highest Ratio			
3	Live	CL3	Highest Ratio			
4	@ 0˚	ULS B1	Highest Ratio			
5	@ 0˚	ULS B2	Highest Ratio			
6	@ 0˚	ULS B3	Highest Ratio			
7	@ 0˚	ULS B4	Highest Ratio			
8	@ 21˚	ULS B1	Highest Ratio			
9	@ 21˚	ULS B2	Highest Ratio			
10	@ 21˚	ULS B3	Highest Ratio			
11	@ 21˚	ULS B4	Highest Ratio			
12	@ 42˚	ULS B1	Highest Ratio			
13	@ 42˚	ULS B2	Highest Ratio			
14	@ 42˚	ULS B3	Highest Ratio			
15	@ 42˚	ULS B4	Highest Ratio			
16	@ 63˚	ULS B1	Highest Ratio			
17	@ 63˚	ULS B2	Highest Ratio			
18	@ 63˚	ULS B3	Highest Ratio			
19	@ 63˚	ULS B4	Highest Ratio			
20	@ 84˚	ULS B1	Highest Ratio			
21	@ 84˚	ULS B2	Highest Ratio			
22	@ 84˚	ULS B3	Highest Ratio		**1.09**	**1.09**
23	@ 84˚	ULS B4	Highest Ratio			
Maximum Highest Ratio (Overall)					**1.09**	**1.09**
Governing Load Combination per Member per Station (Overall)					ULS B3 @ 84˚	ULS B3 @ 84˚
Governing Member of the Element Group (Overall)					Governing (Overall)	
Maximum Highest Ratio (Live Load Only)						
Governing Load Combination per Member per Station (Live Load Only)						
Governing Member of the Element Group (Live Load Only)						
Maximum Highest Ratio (Movable L. Only)					**1.09**	**1.09**
Governing Load Combination per Member per Station (Movable Load Only)					ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)					Governing (Movable L.)	

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios Exceeding 1.00)

			Member #	666	675	686	695
			Member Label	12N-	-12S	16N-	-16S
			Station (m)	0.0	0.6	0.0	0.6
			Node Label at Station	12N	12S	16N	16S
Load Combination			Section #	Section 57	Section 57	Section 62	Section 62
			Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
ID	Category	Name					
1	Live	CL1	Highest Ratio				
2	Live	CL2	Highest Ratio				
3	Live	CL3	Highest Ratio				
4	@ 0˚	ULS B1	Highest Ratio				
5	@ 0˚	ULS B2	Highest Ratio				
6	@ 0˚	ULS B3	Highest Ratio				
7	@ 0˚	ULS B4	Highest Ratio				
8	@ 21˚	ULS B1	Highest Ratio				
9	@ 21˚	ULS B2	Highest Ratio				
10	@ 21˚	ULS B3	Highest Ratio				
11	@ 21˚	ULS B4	Highest Ratio				
12	@ 42˚	ULS B1	Highest Ratio				
13	@ 42˚	ULS B2	Highest Ratio				
14	@ 42˚	ULS B3	Highest Ratio				**1.02**
15	@ 42˚	ULS B4	Highest Ratio				
16	@ 63˚	ULS B1	Highest Ratio				
17	@ 63˚	ULS B2	Highest Ratio				**1.00**
18	@ 63˚	ULS B3	Highest Ratio	**1.04**	**1.03**	**1.01**	**1.05**
19	@ 63˚	ULS B4	Highest Ratio				
20	@ 84˚	ULS B1	Highest Ratio				
21	@ 84˚	ULS B2	Highest Ratio			**1.01**	**1.08**
22	@ 84˚	ULS B3	Highest Ratio			**1.09**	**1.18**
23	@ 84˚	ULS B4	Highest Ratio				
Maximum Highest Ratio (Overall)				**1.04**	**1.03**	**1.09**	**1.18**
Governing Load Combination per Member per Station (Overall)				ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 84˚	ULS B3 @ 84˚
Governing Member of the Element Group (Overall)							Governing (Overall)
Maximum Highest Ratio (Live Load Only)							
Governing Load Combination per Member per Station (Live Load Only)							
Governing Member of the Element Group (Live Load Only)							
Maximum Highest Ratio (Movable L. Only)				**1.04**	**1.03**	**1.09**	**1.18**
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)							Governing (Movable L.)

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Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	2	2	2	3	3	3	7	7	7	8	8	8	9	9	9	10	10	10
			Member Label	1N-0N	1N-0N	1N-0N	4N-1N	4N-1N	4N-1N	5N-4N	5N-4N	5N-4N	5N-8N	5N-8N	5N-8N	8N-9N	8N-9N	8N-9N	9N-12N	9N-12N	9N-12N
			Station (m)	0.0	4.2	8.4	0.0	4.2	8.4	0.0	4.4	8.9	0.0	4.4	8.9	0.0	4.7	9.3	0.0	4.7	9.3
			Node Label at Station	1N	---	0N	4N	---	1N	5N	---	4N	5N	---	8N	8N	---	9N	9N	---	12N
Load Combination			Section #	Section 01	Section 01	Section 01	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 07	Section 07	Section 07
			Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.72	0.77	0.72	0.48	0.53	0.48	0.40	0.46	0.40	0.87	0.95	0.87	0.80	0.86	0.81	1.07	1.16	1.08
2	Live	CL2	Highest Ratio	0.63	0.68	0.63	0.40	0.45	0.40	0.40	0.46	0.40	0.84	0.93	0.85	0.76	0.81	0.76	0.99	1.08	1.00
3	Live	CL3	Highest Ratio	0.51	0.56	0.51	0.31	0.36	0.30	0.39	0.45	0.39	0.79	0.86	0.79	0.68	0.74	0.69	0.88	0.96	0.88
4	@ 0˚	ULS B1	Highest Ratio	0.05	0.09	0.04	0.21	0.28	0.20	0.25	0.31	0.25	0.51	0.59	0.52	0.43	0.51	0.44	0.56	0.64	0.57
5	@ 0˚	ULS B2	Highest Ratio	0.05	0.11	0.04	0.21	0.31	0.20	0.26	0.35	0.25	0.51	0.63	0.52	0.43	0.54	0.44	0.58	0.69	0.59
6	@ 0˚	ULS B3	Highest Ratio	0.05	0.11	0.04	0.21	0.31	0.20	0.26	0.36	0.25	0.51	0.64	0.52	0.43	0.55	0.44	0.58	0.70	0.59
7	@ 0˚	ULS B4	Highest Ratio	0.05	0.10	0.04	0.21	0.28	0.20	0.25	0.33	0.25	0.53	0.62	0.53	0.44	0.52	0.45	0.57	0.67	0.58
8	@ 21˚	ULS B1	Highest Ratio	0.04	0.10	0.04	0.20	0.23	0.19	0.23	0.32	0.23	0.47	0.52	0.48	0.40	0.50	0.41	0.52	0.57	0.53
9	@ 21˚	ULS B2	Highest Ratio	0.04	0.13	0.04	0.21	0.27	0.20	0.25	0.36	0.24	0.50	0.58	0.51	0.42	0.56	0.43	0.56	0.63	0.57
10	@ 21˚	ULS B3	Highest Ratio	0.05	0.13	0.04	0.21	0.28	0.20	0.25	0.38	0.25	0.51	0.59	0.52	0.43	0.58	0.43	0.57	0.65	0.58
11	@ 21˚	ULS B4	Highest Ratio	0.04	0.11	0.04	0.20	0.25	0.19	0.24	0.33	0.23	0.49	0.55	0.50	0.42	0.52	0.42	0.54	0.59	0.55
12	@ 42˚	ULS B1	Highest Ratio	0.03	0.10	0.03	0.16	0.16	0.15	0.18	0.28	0.18	0.38	0.38	0.39	0.32	0.44	0.33	0.42	0.43	0.43
13	@ 42˚	ULS B2	Highest Ratio	0.04	0.13	0.04	0.19	0.22	0.19	0.23	0.35	0.22	0.47	0.51	0.48	0.40	0.55	0.40	0.51	0.55	0.52
14	@ 42˚	ULS B3	Highest Ratio	0.04	0.13	0.04	0.20	0.23	0.19	0.24	0.37	0.23	0.49	0.54	0.50	0.41	0.57	0.42	0.54	0.58	0.55
15	@ 42˚	ULS B4	Highest Ratio	0.03	0.10	0.03	0.17	0.18	0.16	0.19	0.29	0.19	0.40	0.42	0.41	0.34	0.46	0.34	0.44	0.46	0.45
16	@ 63˚	ULS B1	Highest Ratio	0.01	0.08	0.01	0.10	0.13	0.09	0.11	0.20	0.11	0.23	0.28	0.24	0.20	0.30	0.20	0.25	0.30	0.26
17	@ 63˚	ULS B2	Highest Ratio	0.03	0.12	0.03	0.16	0.22	0.15	0.18	0.31	0.18	0.39	0.47	0.40	0.33	0.47	0.33	0.42	0.50	0.43
18	@ 63˚	ULS B3	Highest Ratio	0.03	0.12	0.03	0.18	0.24	0.17	0.20	0.34	0.20	0.42	0.52	0.44	0.36	0.51	0.36	0.46	0.55	0.47
19	@ 63˚	ULS B4	Highest Ratio	0.02	0.09	0.02	0.11	0.14	0.10	0.12	0.22	0.12	0.25	0.31	0.27	0.22	0.34	0.22	0.28	0.35	0.29
20	@ 84˚	ULS B1	Highest Ratio	0.01	0.06	0.00	0.03	0.08	0.02	0.02	0.10	0.02	0.05	0.12	0.06	0.05	0.15	0.05	0.05	0.13	0.06
21	@ 84˚	ULS B2	Highest Ratio	0.03	0.10	0.02	0.10	0.19	0.10	0.12	0.24	0.12	0.25	0.36	0.26	0.22	0.36	0.22	0.26	0.37	0.26
22	@ 84˚	ULS B3	Highest Ratio	0.03	0.11	0.03	0.12	0.21	0.11	0.15	0.28	0.15	0.29	0.41	0.30	0.27	0.43	0.28	0.30	0.42	0.31
23	@ 84˚	ULS B4	Highest Ratio	0.01	0.07	0.00	0.04	0.11	0.03	0.03	0.13	0.04	0.08	0.16	0.09	0.08	0.17	0.07	0.08	0.17	0.09
Maximum Highest Ratio (Overall)				0.72	0.77	0.72	0.48	0.53	0.48	0.40	0.46	0.40	0.87	0.95	0.87	0.80	0.86	0.81	1.07	1.16	1.08
Governing Load Combination per Member per Station (Overall)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
				Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.72	0.77	0.72	0.48	0.53	0.48	0.40	0.46	0.40	0.87	0.95	0.87	0.80	0.86	0.81	1.07	1.16	1.08
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.05	0.13	0.04	0.21	0.31	0.20	0.26	0.38	0.25	0.53	0.64	0.53	0.44	0.58	0.45	0.58	0.70	0.59
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B2	ULS B4	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B4	ULS B3	ULS B4	ULS B4	ULS B3	ULS B4	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)																					

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Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	11	11	11	178	178	178	179	179	179	183	183	183	184	184	184	185	185	185
			Member Label	12N-13N	12N-13N	12N-13N	1S-0S	1S-0S	1S-0S	4S-1S	4S-1S	4S-1S	5S-4S	5S-4S	5S-4S	5S-8S	5S-8S	5S-8S	8S-9S	8S-9S	8S-9S
			Station (m)	0.0	4.9	9.8	0.0	4.2	8.4	0.0	4.2	8.4	0.0	4.4	8.9	0.0	4.4	8.9	0.0	4.7	9.3
			Node Label at Station	12N	---	13N	1S	---	0S	4S	---	1S	5S	---	4S	5S	---	8S	8S	---	9S
Load Combination			Section #	Section 07	Section 07	Section 07	Section 01	Section 01	Section 01	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04
			Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.86	0.92	0.87	0.75	0.80	0.75	0.50	0.55	0.50	0.40	0.46	0.40	0.89	0.98	0.90	0.83	0.89	0.84
2	Live	CL2	Highest Ratio	0.80	0.85	0.80	0.66	0.71	0.66	0.42	0.47	0.42	0.40	0.46	0.40	0.87	0.95	0.88	0.79	0.85	0.79
3	Live	CL3	Highest Ratio	0.71	0.77	0.72	0.54	0.59	0.54	0.32	0.37	0.32	0.39	0.45	0.39	0.81	0.89	0.82	0.71	0.77	0.72
4	@ 0˚	ULS B1	Highest Ratio	0.44	0.51	0.45	0.05	0.10	0.05	0.26	0.32	0.25	0.30	0.37	0.30	0.56	0.64	0.57	0.49	0.56	0.49
5	@ 0˚	ULS B2	Highest Ratio	0.45	0.56	0.46	0.05	0.12	0.05	0.26	0.36	0.25	0.31	0.40	0.30	0.56	0.68	0.57	0.49	0.60	0.49
6	@ 0˚	ULS B3	Highest Ratio	0.46	0.57	0.46	0.05	0.12	0.05	0.26	0.36	0.25	0.31	0.41	0.30	0.56	0.69	0.57	0.49	0.61	0.49
7	@ 0˚	ULS B4	Highest Ratio	0.45	0.53	0.46	0.05	0.10	0.05	0.26	0.33	0.25	0.31	0.38	0.30	0.58	0.68	0.59	0.50	0.58	0.50
8	@ 21˚	ULS B1	Highest Ratio	0.41	0.51	0.42	0.05	0.11	0.04	0.24	0.27	0.24	0.28	0.37	0.28	0.53	0.57	0.54	0.46	0.55	0.46
9	@ 21˚	ULS B2	Highest Ratio	0.44	0.57	0.45	0.05	0.13	0.05	0.26	0.32	0.25	0.30	0.42	0.30	0.56	0.64	0.57	0.48	0.62	0.49
10	@ 21˚	ULS B3	Highest Ratio	0.45	0.58	0.45	0.05	0.14	0.05	0.26	0.33	0.25	0.31	0.43	0.30	0.57	0.66	0.58	0.49	0.64	0.50
11	@ 21˚	ULS B4	Highest Ratio	0.42	0.53	0.43	0.05	0.11	0.05	0.25	0.29	0.24	0.29	0.38	0.29	0.54	0.60	0.55	0.47	0.57	0.47
12	@ 42˚	ULS B1	Highest Ratio	0.33	0.45	0.33	0.03	0.10	0.03	0.20	0.19	0.19	0.22	0.32	0.22	0.41	0.42	0.42	0.36	0.48	0.36
13	@ 42˚	ULS B2	Highest Ratio	0.41	0.56	0.41	0.05	0.13	0.05	0.25	0.27	0.24	0.28	0.41	0.28	0.52	0.56	0.53	0.46	0.61	0.46
14	@ 42˚	ULS B3	Highest Ratio	0.43	0.58	0.43	0.05	0.14	0.05	0.26	0.29	0.25	0.30	0.44	0.30	0.55	0.60	0.56	0.48	0.64	0.48
15	@ 42˚	ULS B4	Highest Ratio	0.35	0.47	0.35	0.04	0.11	0.04	0.21	0.21	0.20	0.23	0.33	0.23	0.44	0.46	0.45	0.38	0.50	0.38
16	@ 63˚	ULS B1	Highest Ratio	0.20	0.32	0.20	0.02	0.09	0.02	0.12	0.15	0.11	0.13	0.23	0.13	0.25	0.30	0.26	0.22	0.32	0.22
17	@ 63˚	ULS B2	Highest Ratio	0.35	0.49	0.35	0.04	0.13	0.04	0.21	0.27	0.20	0.24	0.37	0.24	0.44	0.52	0.45	0.38	0.53	0.38
18	@ 63˚	ULS B3	Highest Ratio	0.38	0.53	0.38	0.04	0.13	0.04	0.23	0.30	0.22	0.26	0.40	0.26	0.48	0.58	0.49	0.42	0.57	0.42
19	@ 63˚	ULS B4	Highest Ratio	0.23	0.34	0.23	0.02	0.09	0.02	0.13	0.17	0.12	0.15	0.25	0.15	0.28	0.33	0.29	0.25	0.36	0.25
20	@ 84˚	ULS B1	Highest Ratio	0.05	0.15	0.05	0.00	0.06	0.00	0.03	0.08	0.02	0.02	0.10	0.03	0.05	0.12	0.06	0.05	0.15	0.05
21	@ 84˚	ULS B2	Highest Ratio	0.25	0.40	0.25	0.03	0.10	0.03	0.14	0.23	0.14	0.18	0.29	0.17	0.28	0.38	0.28	0.26	0.41	0.27
22	@ 84˚	ULS B3	Highest Ratio	0.32	0.48	0.32	0.04	0.11	0.04	0.17	0.26	0.16	0.22	0.35	0.22	0.33	0.45	0.34	0.33	0.49	0.34
23	@ 84˚	ULS B4	Highest Ratio	0.08	0.18	0.07	0.01	0.07	0.00	0.05	0.11	0.04	0.04	0.13	0.04	0.08	0.16	0.09	0.08	0.18	0.08
Maximum Highest Ratio (Overall)				0.86	0.92	0.87	0.75	0.80	0.75	0.50	0.55	0.50	0.40	0.46	0.40	0.89	0.98	0.90	0.83	0.89	0.84
Governing Load Combination per Member per Station (Overall)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
				Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.86	0.92	0.87	0.75	0.80	0.75	0.50	0.55	0.50	0.40	0.46	0.40	0.89	0.98	0.90	0.83	0.89	0.84
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.46	0.58	0.46	0.05	0.14	0.05	0.26	0.36	0.25	0.31	0.44	0.30	0.58	0.69	0.59	0.50	0.64	0.50
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B2	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B4	ULS B3	ULS B4	ULS B4	ULS B3	ULS B4
Governing Member of the Element Group (Movable Load Only)																					

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	186	186	186	187	187	187	249	249	249	250	250	250	400	400	400	401	401	401
			Member Label	9S-12S	9S-12S	9S-12S	12S-13S	12S-13S	12S-13S	56N-34N	56N-34N	56N-34N	34N-13N	34N-13N	34N-13N	56S-34S	56S-34S	56S-34S	34S-13S	34S-13S	34S-13S
			Station (m)	0.0	4.7	9.3	0.0	4.9	9.8	0.0	2.9	5.9	0.0	1.8	3.6	0.0	2.9	5.9	0.0	1.8	3.6
			Node Label at Station	9S	---	12S	12S	---	13S	56N	---	34N	34N	---	13N	56S	---	34S	34S	---	13S
Load Combination			Section #	Section 07	Section 07	Section 07	Section 07	Section 07	Section 07	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01
			Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal
ID	Category	Name																			
1	Live	CL1	Highest Ratio	1.12	1.22	1.12	0.90	0.96	0.91	0.56	0.58	0.64	0.61	0.53	0.44	0.61	0.62	0.70	0.67	0.58	0.48
2	Live	CL2	Highest Ratio	1.04	1.13	1.05	0.84	0.89	0.84	0.47	0.49	0.55	0.53	0.45	0.36	0.51	0.54	0.61	0.58	0.50	0.40
3	Live	CL3	Highest Ratio	0.93	1.01	0.93	0.75	0.81	0.76	0.33	0.37	0.43	0.41	0.34	0.26	0.38	0.42	0.48	0.46	0.39	0.30
4	@ 0˚	ULS B1	Highest Ratio	0.63	0.72	0.64	0.50	0.57	0.51	0.39	0.42	0.47	0.46	0.40	0.33	0.37	0.42	0.49	0.49	0.41	0.31
5	@ 0˚	ULS B2	Highest Ratio	0.65	0.76	0.66	0.51	0.62	0.52	0.58	0.85	1.15	1.14	0.82	0.48	0.56	0.85	1.17	1.16	0.82	0.46
6	@ 0˚	ULS B3	Highest Ratio	0.65	0.78	0.66	0.52	0.63	0.52	0.62	0.95	1.31	1.29	0.91	0.51	0.60	0.95	1.33	1.31	0.92	0.50
7	@ 0˚	ULS B4	Highest Ratio	0.64	0.74	0.65	0.51	0.59	0.52	0.48	0.61	0.77	0.76	0.58	0.39	0.46	0.61	0.79	0.78	0.59	0.38
8	@ 21˚	ULS B1	Highest Ratio	0.58	0.63	0.59	0.47	0.57	0.47	0.71	0.67	0.72	0.69	0.64	0.58	0.72	0.70	0.76	0.74	0.67	0.59
9	@ 21˚	ULS B2	Highest Ratio	0.63	0.70	0.64	0.50	0.63	0.51	0.86	1.03	1.30	1.26	0.98	0.68	0.86	1.06	1.34	1.31	1.01	0.69
10	@ 21˚	ULS B3	Highest Ratio	0.64	0.72	0.65	0.51	0.65	0.51	0.89	1.11	1.44	1.39	1.06	0.71	0.90	1.14	1.48	1.44	1.09	0.72
11	@ 21˚	ULS B4	Highest Ratio	0.60	0.66	0.61	0.48	0.59	0.48	0.80	0.85	1.00	0.96	0.81	0.65	0.81	0.88	1.05	1.02	0.84	0.66
12	@ 42˚	ULS B1	Highest Ratio	0.46	0.47	0.47	0.37	0.49	0.37	0.87	0.77	0.80	0.77	0.74	0.70	0.89	0.81	0.86	0.83	0.78	0.72
13	@ 42˚	ULS B2	Highest Ratio	0.58	0.62	0.59	0.47	0.62	0.48	0.98	1.07	1.31	1.26	1.03	0.79	1.00	1.11	1.37	1.33	1.08	0.81
14	@ 42˚	ULS B3	Highest Ratio	0.61	0.66	0.62	0.50	0.65	0.50	1.00	1.14	1.42	1.38	1.10	0.81	1.02	1.18	1.49	1.45	1.15	0.83
15	@ 42˚	ULS B4	Highest Ratio	0.49	0.51	0.50	0.39	0.51	0.39	0.97	0.96	1.09	1.05	0.92	0.79	0.99	1.00	1.15	1.11	0.96	0.81
16	@ 63˚	ULS B1	Highest Ratio	0.28	0.33	0.29	0.23	0.34	0.23	0.76	0.69	0.71	0.70	0.67	0.63	0.78	0.73	0.78	0.77	0.72	0.65
17	@ 63˚	ULS B2	Highest Ratio	0.48	0.56	0.49	0.40	0.55	0.40	0.88	0.97	1.17	1.19	0.98	0.76	0.92	1.05	1.29	1.32	1.07	0.81
18	@ 63˚	ULS B3	Highest Ratio	0.53	0.62	0.53	0.44	0.59	0.44	0.90	1.04	1.27	1.30	1.05	0.79	0.95	1.12	1.40	1.44	1.15	0.84
19	@ 63˚	ULS B4	Highest Ratio	0.31	0.37	0.32	0.25	0.37	0.25	0.91	0.91	1.02	1.00	0.88	0.75	0.93	0.95	1.10	1.08	0.93	0.77
20	@ 84˚	ULS B1	Highest Ratio	0.05	0.13	0.06	0.06	0.16	0.05	0.13	0.18	0.22	0.16	0.11	0.04	0.12	0.19	0.24	0.19	0.12	0.05
21	@ 84˚	ULS B2	Highest Ratio	0.30	0.41	0.30	0.31	0.46	0.31	0.48	0.59	0.72	0.76	0.61	0.44	0.50	0.67	0.87	0.92	0.70	0.46
22	@ 84˚	ULS B3	Highest Ratio	0.35	0.48	0.36	0.39	0.56	0.40	0.57	0.69	0.84	0.90	0.72	0.53	0.59	0.79	1.02	1.09	0.84	0.56
23	@ 84˚	ULS B4	Highest Ratio	0.09	0.17	0.10	0.08	0.19	0.08	0.56	0.64	0.76	0.68	0.54	0.39	0.55	0.65	0.78	0.70	0.55	0.39
Maximum Highest Ratio (Overall)				1.12	1.22	1.12	0.90	0.96	0.91	1.00	1.14	1.44	1.39	1.10	0.81	1.02	1.18	1.49	1.45	1.15	0.84
Governing Load Combination per Member per Station (Overall)				CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 21˚	ULS B3 @ 21˚	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 63˚	ULS B3 @ 63˚
Governing Member of the Element Group (Overall)																		Governing (Overall)			
Maximum Highest Ratio (Live Load Only)				1.12	1.22	1.12	0.90	0.96	0.91	0.56	0.58	0.64	0.61	0.53	0.44	0.61	0.62	0.70	0.67	0.58	0.48
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)					Governing (Live L.)																
Maximum Highest Ratio (Movable L. Only)				0.65	0.78	0.66	0.52	0.65	0.52	1.00	1.14	1.44	1.39	1.10	0.81	1.02	1.18	1.49	1.45	1.15	0.84
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)																		Governing (Movable L.)			

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Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	240	240	240	241	241	241	242	242	242	243	243	243	244	244	244	245	245	245
			Member Label	2N-2N	2N-2N	2N-2N	2N-1N	2N-1N	2N-1N	4N-4N	4N-4N	4N-4N	4N-3N	4N-3N	4N-3N	8N-8N	8N-8N	8N-8N	8N-7N	8N-7N	8N-7N
			Station (m)	0.0	0.4	0.7	0.0	2.7	5.4	0.0	0.4	0.7	0.0	2.8	5.7	0.0	0.4	0.7	0.0	3.1	6.3
			Node Label at Station	2N	---	2N	2N	---	1N	4N	---	4N	4N	---	3N	8N	---	8N	8N	---	7N
Load Combination			Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05
			Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.00	0.00	0.00	0.53	0.46	0.39	0.00	0.00	0.00	0.04	0.03	0.03	0.00	0.00	0.00	0.04	0.04	0.03
2	Live	CL2	Highest Ratio	0.00	0.00	0.00	0.52	0.46	0.39	0.00	0.00	0.00	0.04	0.03	0.03	0.00	0.00	0.00	0.04	0.03	0.03
3	Live	CL3	Highest Ratio	0.00	0.00	0.00	0.51	0.45	0.39	0.00	0.00	0.00	0.04	0.03	0.03	0.00	0.00	0.00	0.04	0.03	0.03
4	@ 0˚	ULS B1	Highest Ratio	0.00	0.00	0.00	0.05	0.05	0.05	0.00	0.00	0.00	0.04	0.03	0.03	0.00	0.00	0.00	0.04	0.04	0.03
5	@ 0˚	ULS B2	Highest Ratio	0.00	0.00	0.00	0.05	0.06	0.05	0.00	0.00	0.00	0.04	0.05	0.03	0.00	0.00	0.00	0.04	0.07	0.03
6	@ 0˚	ULS B3	Highest Ratio	0.00	0.00	0.00	0.05	0.06	0.05	0.00	0.00	0.00	0.04	0.06	0.03	0.00	0.00	0.00	0.04	0.07	0.03
7	@ 0˚	ULS B4	Highest Ratio	0.00	0.00	0.00	0.05	0.05	0.05	0.00	0.00	0.00	0.04	0.04	0.03	0.00	0.00	0.00	0.04	0.04	0.03
8	@ 21˚	ULS B1	Highest Ratio	0.00	0.00	0.00	0.05	0.08	0.05	0.00	0.00	0.00	0.04	0.06	0.03	0.00	0.00	0.00	0.04	0.10	0.03
9	@ 21˚	ULS B2	Highest Ratio	0.00	0.00	0.00	0.05	0.09	0.05	0.00	0.00	0.00	0.04	0.09	0.03	0.00	0.00	0.00	0.04	0.14	0.03
10	@ 21˚	ULS B3	Highest Ratio	0.00	0.00	0.00	0.05	0.09	0.05	0.00	0.00	0.00	0.04	0.10	0.03	0.00	0.00	0.00	0.04	0.14	0.03
11	@ 21˚	ULS B4	Highest Ratio	0.00	0.00	0.00	0.05	0.12	0.05	0.00	0.00	0.00	0.04	0.07	0.03	0.00	0.00	0.00	0.04	0.10	0.03
12	@ 42˚	ULS B1	Highest Ratio	0.00	0.00	0.00	0.04	0.14	0.04	0.00	0.00	0.00	0.03	0.09	0.02	0.00	0.00	0.00	0.03	0.13	0.02
13	@ 42˚	ULS B2	Highest Ratio	0.00	0.00	0.00	0.05	0.16	0.05	0.00	0.00	0.00	0.03	0.12	0.02	0.00	0.00	0.00	0.03	0.16	0.02
14	@ 42˚	ULS B3	Highest Ratio	0.00	0.00	0.00	0.05	0.16	0.05	0.00	0.00	0.00	0.03	0.13	0.02	0.00	0.00	0.00	0.03	0.16	0.02
15	@ 42˚	ULS B4	Highest Ratio	0.00	0.00	0.00	0.04	0.14	0.04	0.00	0.00	0.00	0.03	0.13	0.02	0.00	0.00	0.00	0.03	0.13	0.02
16	@ 63˚	ULS B1	Highest Ratio	0.00	0.00	0.00	0.03	0.16	0.03	0.00	0.00	0.00	0.02	0.12	0.01	0.00	0.00	0.00	0.02	0.15	0.01
17	@ 63˚	ULS B2	Highest Ratio	0.00	0.00	0.00	0.04	0.19	0.05	0.00	0.00	0.00	0.02	0.14	0.01	0.00	0.00	0.00	0.02	0.19	0.01
18	@ 63˚	ULS B3	Highest Ratio	0.00	0.00	0.00	0.05	0.19	0.05	0.00	0.00	0.00	0.02	0.15	0.01	0.00	0.00	0.00	0.02	0.19	0.01
19	@ 63˚	ULS B4	Highest Ratio	0.00	0.00	0.00	0.03	0.17	0.03	0.00	0.00	0.00	0.02	0.12	0.02	0.00	0.00	0.00	0.02	0.15	0.01
20	@ 84˚	ULS B1	Highest Ratio	0.00	0.00	0.00	0.01	0.15	0.01	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.14	0.00
21	@ 84˚	ULS B2	Highest Ratio	0.00	0.00	0.00	0.06	0.18	0.06	0.00	0.00	0.00	0.01	0.16	0.00	0.00	0.00	0.00	0.00	0.18	0.00
22	@ 84˚	ULS B3	Highest Ratio	0.00	0.00	0.00	0.08	0.20	0.08	0.00	0.00	0.00	0.01	0.17	0.00	0.00	0.00	0.00	0.01	0.18	0.00
23	@ 84˚	ULS B4	Highest Ratio	0.00	0.00	0.00	0.01	0.15	0.01	0.00	0.00	0.00	0.01	0.14	0.01	0.00	0.00	0.00	0.00	0.14	0.00
Maximum Highest Ratio (Overall)				0.00	0.00	0.00	0.53	0.46	0.39	0.00	0.00	0.00	0.04	0.17	0.03	0.00	0.00	0.00	0.04	0.19	0.03
Governing Load Combination per Member per Station (Overall)				CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	ULS B1 @ 0˚	ULS B3 @ 84˚	ULS B1 @ 0˚	CL1 Live	CL1 Live	CL1 Live	ULS B3 @ 0˚	ULS B3 @ 63˚	ULS B2 @ 0˚
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.00	0.00	0.00	0.53	0.46	0.39	0.00	0.00	0.00	0.04	0.03	0.03	0.00	0.00	0.00	0.04	0.04	0.03
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.00	0.00	0.00	0.08	0.20	0.08	0.00	0.00	0.00	0.04	0.17	0.03	0.00	0.00	0.00	0.04	0.19	0.03
Governing Load Combination per Member per Station (Movable Load Only)				ULS B1	ULS B1	ULS B1	ULS B3	ULS B3	ULS B3	ULS B1	ULS B1	ULS B1	ULS B1	ULS B3	ULS B1	ULS B1	ULS B1	ULS B1	ULS B3	ULS B3	ULS B2
Governing Member of the Element Group (Movable Load Only)																					

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	246	246	246	247	247	247	319	319	319	320	320	320	321	321	321	322	322	322
			Member Label	12N-12N	12N-12N	12N-12N	12N-11N	12N-11N	12N-11N	6N-6N	6N-6N	6N-6N	6N-36N	6N-36N	6N-36N	36N-5N	36N-5N	36N-5N	6S-6S	6S-6S	6S-6S
			Station (m)	0.0	0.4	0.7	0.0	3.4	6.9	0.0	0.4	0.7	0.0	2.3	4.6	0.0	0.7	1.4	0.0	0.4	0.7
			Node Label at Station	12N	---	12N	12N	---	11N	6N	---	6N	6N	---	36N	36N	---	5N	6S	---	6S
Load Combination			Section #	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03
			Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.00	0.00	0.00	0.06	0.05	0.05	0.00	0.00	0.00	0.48	0.65	0.83	0.77	0.62	0.48	0.00	0.00	0.00
2	Live	CL2	Highest Ratio	0.00	0.00	0.00	0.06	0.05	0.05	0.00	0.00	0.00	0.48	0.64	0.80	0.74	0.61	0.48	0.00	0.00	0.00
3	Live	CL3	Highest Ratio	0.00	0.00	0.00	0.06	0.05	0.05	0.00	0.00	0.00	0.48	0.61	0.74	0.69	0.58	0.48	0.00	0.00	0.00
4	@ 0˚	ULS B1	Highest Ratio	0.00	0.00	0.00	0.07	0.06	0.05	0.00	0.00	0.00	0.06	0.22	0.37	0.33	0.20	0.08	0.00	0.00	0.00
5	@ 0˚	ULS B2	Highest Ratio	0.00	0.00	0.00	0.07	0.10	0.05	0.00	0.00	0.00	0.06	0.24	0.42	0.37	0.22	0.08	0.00	0.00	0.00
6	@ 0˚	ULS B3	Highest Ratio	0.00	0.00	0.00	0.07	0.11	0.05	0.00	0.00	0.00	0.06	0.25	0.42	0.38	0.23	0.08	0.00	0.00	0.00
7	@ 0˚	ULS B4	Highest Ratio	0.00	0.00	0.00	0.07	0.06	0.05	0.00	0.00	0.00	0.06	0.32	0.58	0.51	0.30	0.08	0.00	0.00	0.00
8	@ 21˚	ULS B1	Highest Ratio	0.00	0.00	0.00	0.06	0.12	0.05	0.00	0.00	0.00	0.06	0.27	0.44	0.40	0.22	0.07	0.00	0.00	0.00
9	@ 21˚	ULS B2	Highest Ratio	0.00	0.00	0.00	0.06	0.16	0.05	0.00	0.00	0.00	0.06	0.34	0.57	0.51	0.28	0.08	0.00	0.00	0.00
10	@ 21˚	ULS B3	Highest Ratio	0.00	0.00	0.00	0.06	0.18	0.05	0.00	0.00	0.00	0.06	0.35	0.59	0.53	0.29	0.08	0.00	0.00	0.00
11	@ 21˚	ULS B4	Highest Ratio	0.00	0.00	0.00	0.06	0.12	0.05	0.00	0.00	0.00	0.06	0.38	0.61	0.55	0.33	0.08	0.00	0.00	0.00
12	@ 42˚	ULS B1	Highest Ratio	0.00	0.00	0.00	0.05	0.18	0.04	0.00	0.00	0.00	0.05	0.30	0.46	0.43	0.26	0.06	0.00	0.00	0.00
13	@ 42˚	ULS B2	Highest Ratio	0.00	0.00	0.00	0.05	0.22	0.04	0.00	0.00	0.00	0.06	0.41	0.65	0.59	0.35	0.08	0.00	0.00	0.00
14	@ 42˚	ULS B3	Highest Ratio	0.00	0.00	0.00	0.05	0.23	0.04	0.00	0.00	0.00	0.07	0.44	0.70	0.63	0.37	0.08	0.00	0.00	0.00
15	@ 42˚	ULS B4	Highest Ratio	0.00	0.00	0.00	0.05	0.18	0.04	0.00	0.00	0.00	0.05	0.40	0.58	0.53	0.32	0.06	0.00	0.00	0.00
16	@ 63˚	ULS B1	Highest Ratio	0.00	0.00	0.00	0.03	0.20	0.02	0.00	0.00	0.00	0.03	0.32	0.40	0.38	0.21	0.04	0.00	0.00	0.00
17	@ 63˚	ULS B2	Highest Ratio	0.00	0.00	0.00	0.03	0.24	0.03	0.00	0.00	0.00	0.06	0.47	0.68	0.62	0.34	0.07	0.00	0.00	0.00
18	@ 63˚	ULS B3	Highest Ratio	0.00	0.00	0.00	0.03	0.25	0.03	0.00	0.00	0.00	0.06	0.51	0.75	0.68	0.38	0.07	0.00	0.00	0.00
19	@ 63˚	ULS B4	Highest Ratio	0.00	0.00	0.00	0.03	0.20	0.03	0.00	0.00	0.00	0.03	0.36	0.52	0.45	0.25	0.04	0.00	0.00	0.00
20	@ 84˚	ULS B1	Highest Ratio	0.00	0.00	0.00	0.01	0.18	0.00	0.00	0.00	0.00	0.01	0.27	0.30	0.29	0.17	0.01	0.00	0.00	0.00
21	@ 84˚	ULS B2	Highest Ratio	0.00	0.00	0.00	0.01	0.22	0.01	0.00	0.00	0.00	0.09	0.49	0.68	0.65	0.38	0.08	0.00	0.00	0.00
22	@ 84˚	ULS B3	Highest Ratio	0.00	0.00	0.00	0.01	0.23	0.01	0.00	0.00	0.00	0.11	0.54	0.77	0.74	0.43	0.10	0.00	0.00	0.00
23	@ 84˚	ULS B4	Highest Ratio	0.00	0.00	0.00	0.01	0.18	0.01	0.00	0.00	0.00	0.01	0.30	0.36	0.34	0.19	0.01	0.00	0.00	0.00
Maximum Highest Ratio (Overall)				0.00	0.00	0.00	0.07	0.25	0.05	0.00	0.00	0.00	0.48	0.65	0.83	0.77	0.62	0.48	0.00	0.00	0.00
Governing Load Combination per Member per Station (Overall)				CL1 Live	CL1 Live	CL1 Live	ULS B3 @ 0˚	ULS B3 @ 63˚	ULS B2 @ 0˚	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.00	0.00	0.00	0.06	0.05	0.05	0.00	0.00	0.00	0.48	0.65	0.83	0.77	0.62	0.48	0.00	0.00	0.00
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.00	0.00	0.00	0.07	0.25	0.05	0.00	0.00	0.00	0.11	0.54	0.77	0.74	0.43	0.10	0.00	0.00	0.00
Governing Load Combination per Member per Station (Movable Load Only)				ULS B1	ULS B1	ULS B1	ULS B3	ULS B3	ULS B2	ULS B1	ULS B1	ULS B1	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B1	ULS B1	ULS B1
Governing Member of the Element Group (Movable Load Only)																					

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	324	324	324	325	325	325	326	326	326	327	327	327	328	328	328	329	329	329
			Member Label	6S-36S	6S-36S	6S-36S	36S-5S	36S-5S	36S-5S	10N-10N	10N-10N	10N-10N	10N-35N	10N-35N	10N-35N	35N-9N	35N-9N	35N-9N	10S-10S	10S-10S	10S-10S
			Station (m)	0.0	2.3	4.6	0.0	0.7	1.4	0.0	0.4	0.7	0.0	2.3	4.6	0.0	1.0	2.0	0.0	0.4	0.7
			Node Label at Station	6S	---	36S	36S	---	5S	10N	---	10N	10N	---	35N	35N	---	9N	10S	---	10S
Load Combination			Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03
			Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.70	0.78	0.81	0.76	0.61	0.49	0.00	0.00	0.00	0.47	0.60	0.72	0.68	0.58	0.47	0.00	0.00	0.00
2	Live	CL2	Highest Ratio	0.70	0.76	0.79	0.74	0.60	0.49	0.00	0.00	0.00	0.47	0.58	0.69	0.66	0.56	0.47	0.00	0.00	0.00
3	Live	CL3	Highest Ratio	0.69	0.71	0.75	0.71	0.59	0.49	0.00	0.00	0.00	0.47	0.55	0.64	0.61	0.54	0.47	0.00	0.00	0.00
4	@ 0˚	ULS B1	Highest Ratio	0.08	0.21	0.34	0.29	0.19	0.08	0.00	0.00	0.00	0.06	0.12	0.19	0.17	0.12	0.07	0.00	0.00	0.00
5	@ 0˚	ULS B2	Highest Ratio	0.08	0.24	0.38	0.33	0.21	0.08	0.00	0.00	0.00	0.06	0.28	0.48	0.43	0.25	0.08	0.00	0.00	0.00
6	@ 0˚	ULS B3	Highest Ratio	0.08	0.24	0.39	0.34	0.21	0.08	0.00	0.00	0.00	0.06	0.31	0.54	0.49	0.29	0.08	0.00	0.00	0.00
7	@ 0˚	ULS B4	Highest Ratio	0.08	0.32	0.55	0.47	0.28	0.09	0.00	0.00	0.00	0.06	0.14	0.25	0.24	0.14	0.07	0.00	0.00	0.00
8	@ 21˚	ULS B1	Highest Ratio	0.08	0.26	0.42	0.37	0.21	0.08	0.00	0.00	0.00	0.05	0.22	0.31	0.30	0.18	0.06	0.00	0.00	0.00
9	@ 21˚	ULS B2	Highest Ratio	0.08	0.33	0.54	0.48	0.26	0.08	0.00	0.00	0.00	0.06	0.39	0.64	0.58	0.33	0.07	0.00	0.00	0.00
10	@ 21˚	ULS B3	Highest Ratio	0.08	0.35	0.57	0.50	0.28	0.08	0.00	0.00	0.00	0.06	0.42	0.71	0.65	0.36	0.08	0.00	0.00	0.00
11	@ 21˚	ULS B4	Highest Ratio	0.08	0.38	0.58	0.51	0.31	0.08	0.00	0.00	0.00	0.06	0.22	0.33	0.31	0.19	0.07	0.00	0.00	0.00
12	@ 42˚	ULS B1	Highest Ratio	0.06	0.30	0.44	0.40	0.25	0.06	0.00	0.00	0.00	0.04	0.26	0.38	0.37	0.23	0.05	0.00	0.00	0.00
13	@ 42˚	ULS B2	Highest Ratio	0.08	0.41	0.63	0.56	0.34	0.08	0.00	0.00	0.00	0.05	0.44	0.71	0.66	0.38	0.06	0.00	0.00	0.00
14	@ 42˚	ULS B3	Highest Ratio	0.09	0.44	0.68	0.60	0.36	0.08	0.00	0.00	0.00	0.06	0.48	0.78	0.72	0.41	0.07	0.00	0.00	0.00
15	@ 42˚	ULS B4	Highest Ratio	0.06	0.40	0.56	0.51	0.30	0.07	0.00	0.00	0.00	0.04	0.31	0.40	0.39	0.24	0.05	0.00	0.00	0.00
16	@ 63˚	ULS B1	Highest Ratio	0.04	0.31	0.39	0.36	0.20	0.04	0.00	0.00	0.00	0.02	0.29	0.39	0.38	0.22	0.03	0.00	0.00	0.00
17	@ 63˚	ULS B2	Highest Ratio	0.07	0.48	0.67	0.60	0.33	0.07	0.00	0.00	0.00	0.04	0.47	0.71	0.67	0.38	0.05	0.00	0.00	0.00
18	@ 63˚	ULS B3	Highest Ratio	0.08	0.51	0.73	0.65	0.36	0.08	0.00	0.00	0.00	0.05	0.51	0.79	0.74	0.41	0.05	0.00	0.00	0.00
19	@ 63˚	ULS B4	Highest Ratio	0.04	0.36	0.47	0.43	0.24	0.04	0.00	0.00	0.00	0.02	0.32	0.44	0.43	0.24	0.03	0.00	0.00	0.00
20	@ 84˚	ULS B1	Highest Ratio	0.01	0.24	0.30	0.29	0.17	0.01	0.00	0.00	0.00	0.02	0.29	0.36	0.36	0.22	0.01	0.00	0.00	0.00
21	@ 84˚	ULS B2	Highest Ratio	0.13	0.51	0.68	0.63	0.37	0.07	0.00	0.00	0.00	0.10	0.46	0.65	0.63	0.38	0.07	0.00	0.00	0.00
22	@ 84˚	ULS B3	Highest Ratio	0.17	0.57	0.78	0.72	0.42	0.09	0.00	0.00	0.00	0.12	0.50	0.72	0.69	0.42	0.09	0.00	0.00	0.00
23	@ 84˚	ULS B4	Highest Ratio	0.01	0.30	0.36	0.34	0.19	0.01	0.00	0.00	0.00	0.03	0.33	0.43	0.43	0.26	0.02	0.00	0.00	0.00
Maximum Highest Ratio (Overall)				0.70	0.78	0.81	0.76	0.61	0.49	0.00	0.00	0.00	0.47	0.60	0.79	0.74	0.58	0.47	0.00	0.00	0.00
Governing Load Combination per Member per Station (Overall)				CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	ULS B3 @ 63˚	ULS B3 @ 63˚	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.70	0.78	0.81	0.76	0.61	0.49	0.00	0.00	0.00	0.47	0.60	0.72	0.68	0.58	0.47	0.00	0.00	0.00
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.17	0.57	0.78	0.72	0.42	0.09	0.00	0.00	0.00	0.12	0.51	0.79	0.74	0.42	0.09	0.00	0.00	0.00
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B1	ULS B1	ULS B1	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B1	ULS B1	ULS B1
Governing Member of the Element Group (Movable Load Only)																					

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	331	331	331	332	332	332	546	546	546	547	547	547	548	548	548	549	549	549
			Member Label	10S-35S	10S-35S	10S-35S	35S-9S	35S-9S	35S-9S	14N-14N	14N-14N	14N-14N	14N-49N	14N-49N	14N-49N	49N-13N	49N-13N	49N-13N	14S-14S	14S-14S	14S-14S
			Station (m)	0.0	2.3	4.6	0.0	1.0	2.0	0.0	0.4	0.7	0.0	2.3	4.6	0.0	1.3	2.6	0.0	0.4	0.7
			Node Label at Station	10S	---	35S	35S	---	9S	14N	---	14N	14N	---	49N	49N	---	13N	14S	---	14S
Load Combination			Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	S 13-49	S 13-49	S 13-49	Section 03	Section 03	Section 03
			Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.75	0.76	0.79	0.75	0.64	0.48	0.00	0.00	0.00	0.74	0.80	0.98	0.51	0.33	0.15	0.00	0.00	0.00
2	Live	CL2	Highest Ratio	0.72	0.74	0.77	0.73	0.59	0.48	0.00	0.00	0.00	0.73	0.78	0.95	0.51	0.33	0.15	0.00	0.00	0.00
3	Live	CL3	Highest Ratio	0.70	0.72	0.73	0.70	0.57	0.48	0.00	0.00	0.00	0.73	0.76	0.91	0.50	0.32	0.15	0.00	0.00	0.00
4	@ 0˚	ULS B1	Highest Ratio	0.08	0.11	0.14	0.13	0.11	0.08	0.00	0.00	0.00	0.37	0.41	0.51	0.24	0.16	0.08	0.00	0.00	0.00
5	@ 0˚	ULS B2	Highest Ratio	0.08	0.26	0.43	0.39	0.24	0.09	0.00	0.00	0.00	0.53	0.68	0.90	0.31	0.21	0.12	0.00	0.00	0.00
6	@ 0˚	ULS B3	Highest Ratio	0.08	0.30	0.50	0.45	0.27	0.09	0.00	0.00	0.00	0.57	0.75	0.99	0.32	0.22	0.13	0.00	0.00	0.00
7	@ 0˚	ULS B4	Highest Ratio	0.08	0.13	0.21	0.20	0.12	0.08	0.00	0.00	0.00	0.41	0.52	0.66	0.27	0.18	0.09	0.00	0.00	0.00
8	@ 21˚	ULS B1	Highest Ratio	0.07	0.20	0.27	0.26	0.17	0.07	0.00	0.00	0.00	0.28	0.41	0.53	0.28	0.19	0.08	0.00	0.00	0.00
9	@ 21˚	ULS B2	Highest Ratio	0.08	0.38	0.59	0.54	0.32	0.08	0.00	0.00	0.00	0.44	0.64	0.84	0.48	0.32	0.14	0.00	0.00	0.00
10	@ 21˚	ULS B3	Highest Ratio	0.08	0.41	0.67	0.61	0.35	0.09	0.00	0.00	0.00	0.50	0.69	0.92	0.53	0.35	0.15	0.00	0.00	0.00
11	@ 21˚	ULS B4	Highest Ratio	0.07	0.21	0.28	0.27	0.17	0.08	0.00	0.00	0.00	0.32	0.48	0.62	0.34	0.24	0.10	0.00	0.00	0.00
12	@ 42˚	ULS B1	Highest Ratio	0.05	0.25	0.35	0.34	0.21	0.06	0.00	0.00	0.00	0.18	0.37	0.47	0.27	0.19	0.06	0.00	0.00	0.00
13	@ 42˚	ULS B2	Highest Ratio	0.07	0.43	0.68	0.63	0.37	0.08	0.00	0.00	0.00	0.51	0.59	0.78	0.48	0.33	0.11	0.00	0.00	0.00
14	@ 42˚	ULS B3	Highest Ratio	0.08	0.47	0.76	0.70	0.41	0.08	0.00	0.00	0.00	0.68	0.70	0.93	0.56	0.38	0.14	0.00	0.00	0.00
15	@ 42˚	ULS B4	Highest Ratio	0.06	0.30	0.37	0.36	0.23	0.06	0.00	0.00	0.00	0.23	0.46	0.59	0.34	0.23	0.07	0.00	0.00	0.00
16	@ 63˚	ULS B1	Highest Ratio	0.03	0.28	0.37	0.37	0.21	0.03	0.00	0.00	0.00	0.10	0.40	0.55	0.26	0.18	0.03	0.00	0.00	0.00
17	@ 63˚	ULS B2	Highest Ratio	0.07	0.47	0.70	0.65	0.37	0.06	0.00	0.00	0.00	0.63	0.79	1.06	0.52	0.36	0.13	0.00	0.00	0.00
18	@ 63˚	ULS B3	Highest Ratio	0.10	0.51	0.78	0.72	0.41	0.07	0.00	0.00	0.00	0.80	0.92	1.22	0.60	0.41	0.16	0.00	0.00	0.00
19	@ 63˚	ULS B4	Highest Ratio	0.03	0.31	0.42	0.41	0.24	0.04	0.00	0.00	0.00	0.16	0.48	0.66	0.33	0.23	0.05	0.00	0.00	0.00
20	@ 84˚	ULS B1	Highest Ratio	0.01	0.28	0.35	0.35	0.21	0.00	0.00	0.00	0.00	0.16	0.47	0.60	0.28	0.21	0.04	0.00	0.00	0.00
21	@ 84˚	ULS B2	Highest Ratio	0.14	0.48	0.65	0.63	0.39	0.09	0.00	0.00	0.00	0.36	0.69	0.94	0.46	0.32	0.09	0.00	0.00	0.00
22	@ 84˚	ULS B3	Highest Ratio	0.18	0.53	0.73	0.69	0.43	0.11	0.00	0.00	0.00	0.51	0.78	1.06	0.52	0.37	0.11	0.00	0.00	0.00
23	@ 84˚	ULS B4	Highest Ratio	0.02	0.32	0.42	0.41	0.25	0.02	0.00	0.00	0.00	0.23	0.57	0.76	0.35	0.25	0.07	0.00	0.00	0.00
			Maximum Highest Ratio (Overall)	0.75	0.76	0.79	0.75	0.64	0.48	0.00	0.00	0.00	0.80	0.92	1.22	0.60	0.41	0.16	0.00	0.00	0.00
			Governing Load Combination per Member per Station (Overall)	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 63˚	CL1 Live	CL1 Live	CL1 Live
			Governing Member of the Element Group (Overall)																		
			Maximum Highest Ratio (Live Load Only)	0.75	0.76	0.79	0.75	0.64	0.48	0.00	0.00	0.00	0.74	0.80	0.98	0.51	0.33	0.15	0.00	0.00	0.00
			Governing Load Combination per Member per Station (Live Load Only)	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
			Governing Member of the Element Group (Live Load Only)												Governing (Live L.)						
			Maximum Highest Ratio (Movable L. Only)	0.18	0.53	0.78	0.72	0.43	0.11	0.00	0.00	0.00	0.80	0.92	1.22	0.60	0.41	0.16	0.00	0.00	0.00
			Governing Load Combination per Member per Station (Movable Load Only)	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B1	ULS B1	ULS B1	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B1	ULS B1	ULS B1
			Governing Member of the Element Group (Movable Load Only)																		

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	551	551	551	552	552	552	567	567	567	569	569	569	570	570	570	572	572	572
			Member Label	14S-49S	14S-49S	14S-49S	49S-13S	49S-13S	49S-13S	2S-2S	2S-2S	2S-2S	2S-1S	2S-1S	2S-1S	4S-4S	4S-4S	4S-4S	4S-3S	4S-3S	4S-3S
			Station (m)	0.0	2.3	4.6	0.0	1.3	2.6	0.0	0.4	0.7	0.0	2.7	5.4	0.0	0.4	0.7	0.0	2.8	5.7
			Node Label at Station	14S	---	49S	49S	---	13S	2S	---	2S	2S	---	1S	4S	---	4S	4S	---	3S
Load Combination			Section #	Section 03	Section 03	Section 03	S 13-49	S 13-49	S 13-49	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05
			Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.94	0.79	0.97	0.53	0.33	0.15	0.00	0.00	0.00	0.71	0.58	0.48	0.00	0.00	0.00	0.41	0.20	0.03
2	Live	CL2	Highest Ratio	0.93	0.77	0.94	0.52	0.33	0.15	0.00	0.00	0.00	0.68	0.58	0.48	0.00	0.00	0.00	0.38	0.20	0.03
3	Live	CL3	Highest Ratio	0.91	0.76	0.88	0.50	0.33	0.15	0.00	0.00	0.00	0.67	0.58	0.48	0.00	0.00	0.00	0.37	0.19	0.03
4	@ 0˚	ULS B1	Highest Ratio	0.40	0.42	0.51	0.26	0.17	0.09	0.00	0.00	0.00	0.08	0.08	0.08	0.00	0.00	0.00	0.04	0.03	0.03
5	@ 0˚	ULS B2	Highest Ratio	0.57	0.70	0.90	0.32	0.23	0.13	0.00	0.00	0.00	0.08	0.09	0.08	0.00	0.00	0.00	0.04	0.05	0.03
6	@ 0˚	ULS B3	Highest Ratio	0.61	0.76	0.99	0.34	0.24	0.14	0.00	0.00	0.00	0.08	0.09	0.08	0.00	0.00	0.00	0.04	0.06	0.03
7	@ 0˚	ULS B4	Highest Ratio	0.45	0.53	0.65	0.29	0.20	0.10	0.00	0.00	0.00	0.08	0.08	0.08	0.00	0.00	0.00	0.04	0.03	0.03
8	@ 21˚	ULS B1	Highest Ratio	0.31	0.42	0.52	0.32	0.22	0.09	0.00	0.00	0.00	0.08	0.11	0.08	0.00	0.00	0.00	0.04	0.06	0.03
9	@ 21˚	ULS B2	Highest Ratio	0.47	0.65	0.84	0.52	0.34	0.15	0.00	0.00	0.00	0.08	0.12	0.08	0.00	0.00	0.00	0.04	0.09	0.03
10	@ 21˚	ULS B3	Highest Ratio	0.50	0.70	0.91	0.56	0.37	0.16	0.00	0.00	0.00	0.08	0.13	0.08	0.00	0.00	0.00	0.04	0.10	0.03
11	@ 21˚	ULS B4	Highest Ratio	0.35	0.49	0.62	0.38	0.26	0.11	0.00	0.00	0.00	0.08	0.15	0.08	0.00	0.00	0.00	0.04	0.06	0.03
12	@ 42˚	ULS B1	Highest Ratio	0.21	0.40	0.52	0.31	0.22	0.07	0.00	0.00	0.00	0.06	0.16	0.07	0.00	0.00	0.00	0.03	0.09	0.02
13	@ 42˚	ULS B2	Highest Ratio	0.42	0.63	0.84	0.51	0.34	0.12	0.00	0.00	0.00	0.08	0.19	0.08	0.00	0.00	0.00	0.03	0.12	0.02
14	@ 42˚	ULS B3	Highest Ratio	0.58	0.69	0.92	0.57	0.38	0.13	0.00	0.00	0.00	0.08	0.19	0.09	0.00	0.00	0.00	0.03	0.13	0.02
15	@ 42˚	ULS B4	Highest Ratio	0.26	0.50	0.65	0.38	0.26	0.08	0.00	0.00	0.00	0.06	0.17	0.07	0.00	0.00	0.00	0.03	0.13	0.02
16	@ 63˚	ULS B1	Highest Ratio	0.13	0.44	0.60	0.29	0.20	0.04	0.00	0.00	0.00	0.04	0.18	0.04	0.00	0.00	0.00	0.02	0.12	0.01
17	@ 63˚	ULS B2	Highest Ratio	0.56	0.79	1.10	0.55	0.37	0.12	0.00	0.00	0.00	0.07	0.22	0.08	0.00	0.00	0.00	0.02	0.14	0.01
18	@ 63˚	ULS B3	Highest Ratio	0.72	0.92	1.26	0.62	0.42	0.15	0.00	0.00	0.00	0.08	0.23	0.08	0.00	0.00	0.00	0.02	0.15	0.01
19	@ 63˚	ULS B4	Highest Ratio	0.18	0.51	0.71	0.36	0.25	0.06	0.00	0.00	0.00	0.04	0.18	0.05	0.00	0.00	0.00	0.02	0.12	0.01
20	@ 84˚	ULS B1	Highest Ratio	0.17	0.48	0.62	0.29	0.22	0.05	0.00	0.00	0.00	0.01	0.15	0.01	0.00	0.00	0.00	0.00	0.14	0.00
21	@ 84˚	ULS B2	Highest Ratio	0.31	0.76	1.05	0.50	0.34	0.10	0.00	0.00	0.00	0.10	0.21	0.10	0.00	0.00	0.00	0.01	0.16	0.00
22	@ 84˚	ULS B3	Highest Ratio	0.44	0.83	1.16	0.56	0.38	0.11	0.00	0.00	0.00	0.13	0.23	0.13	0.00	0.00	0.00	0.01	0.17	0.00
23	@ 84˚	ULS B4	Highest Ratio	0.24	0.59	0.78	0.36	0.26	0.07	0.00	0.00	0.00	0.02	0.15	0.02	0.00	0.00	0.00	0.01	0.14	0.01
			Maximum Highest Ratio (Overall)	0.94	0.92	1.26	0.62	0.42	0.16	0.00	0.00	0.00	0.71	0.58	0.48	0.00	0.00	0.00	0.41	0.20	0.03
			Governing Load Combination per Member per Station (Overall)	CL1 Live	ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 21˚	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	ULS B1 @ 0˚
			Governing Member of the Element Group (Overall)			Governing (Overall)															
			Maximum Highest Ratio (Live Load Only)	0.94	0.79	0.97	0.53	0.33	0.15	0.00	0.00	0.00	0.71	0.58	0.48	0.00	0.00	0.00	0.41	0.20	0.03
			Governing Load Combination per Member per Station (Live Load Only)	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
			Governing Member of the Element Group (Live Load Only)																		
			Maximum Highest Ratio (Movable L. Only)	0.72	0.92	1.26	0.62	0.42	0.16	0.00	0.00	0.00	0.13	0.23	0.13	0.00	0.00	0.00	0.04	0.17	0.03
			Governing Load Combination per Member per Station (Movable Load Only)	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B1	ULS B1	ULS B1	ULS B3	ULS B3	ULS B3	ULS B1	ULS B1	ULS B1	ULS B1	ULS B3	ULS B1
			Governing Member of the Element Group (Movable Load Only)			Governing (Movable L.)															

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	573	573	573	575	575	575	576	576	576	578	578	578	279	279	279	280	280	280
			Member Label	8S-8S	8S-8S	8S-8S	8S-7S	8S-7S	8S-7S	12S-12S	12S-12S	12S-12S	12S-11S	12S-11S	12S-11S	0N-2N	0N-2N	0N-2N	2N-4N	2N-4N	2N-4N
			Station (m)	0.0	0.4	0.7	0.0	3.1	6.3	0.0	0.4	0.7	0.0	3.4	6.9	0.0	2.9	5.8	0.0	2.9	5.8
			Node Label at Station	8S	---	8S	8S	---	7S	12S	---	12S	12S	---	11S	0N	---	2N	2N	---	4N
Load Combination			Section #	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02
			Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.00	0.00	0.00	0.50	0.27	0.03	0.00	0.00	0.00	0.48	0.26	0.05	0.52	0.52	0.52	0.53	0.51	0.48
2	Live	CL2	Highest Ratio	0.00	0.00	0.00	0.49	0.25	0.03	0.00	0.00	0.00	0.47	0.26	0.05	0.47	0.46	0.47	0.48	0.46	0.42
3	Live	CL3	Highest Ratio	0.00	0.00	0.00	0.48	0.25	0.03	0.00	0.00	0.00	0.43	0.25	0.05	0.40	0.39	0.41	0.41	0.40	0.36
4	@ 0˚	ULS B1	Highest Ratio	0.00	0.00	0.00	0.04	0.04	0.03	0.00	0.00	0.00	0.07	0.06	0.06	0.15	0.04	0.05	0.03	0.03	0.05
5	@ 0˚	ULS B2	Highest Ratio	0.00	0.00	0.00	0.04	0.07	0.03	0.00	0.00	0.00	0.07	0.10	0.06	0.17	0.07	0.09	0.06	0.06	0.09
6	@ 0˚	ULS B3	Highest Ratio	0.00	0.00	0.00	0.04	0.07	0.03	0.00	0.00	0.00	0.07	0.11	0.06	0.18	0.07	0.10	0.07	0.07	0.09
7	@ 0˚	ULS B4	Highest Ratio	0.00	0.00	0.00	0.04	0.04	0.03	0.00	0.00	0.00	0.07	0.06	0.06	0.17	0.05	0.06	0.03	0.04	0.06
8	@ 21˚	ULS B1	Highest Ratio	0.00	0.00	0.00	0.04	0.10	0.03	0.00	0.00	0.00	0.06	0.12	0.05	0.07	0.05	0.04	0.05	0.05	0.08
9	@ 21˚	ULS B2	Highest Ratio	0.00	0.00	0.00	0.04	0.14	0.03	0.00	0.00	0.00	0.07	0.16	0.05	0.14	0.09	0.09	0.09	0.08	0.12
10	@ 21˚	ULS B3	Highest Ratio	0.00	0.00	0.00	0.04	0.14	0.03	0.00	0.00	0.00	0.07	0.18	0.06	0.16	0.10	0.10	0.10	0.09	0.13
11	@ 21˚	ULS B4	Highest Ratio	0.00	0.00	0.00	0.04	0.10	0.03	0.00	0.00	0.00	0.07	0.13	0.05	0.09	0.06	0.05	0.06	0.06	0.09
12	@ 42˚	ULS B1	Highest Ratio	0.00	0.00	0.00	0.03	0.13	0.02	0.00	0.00	0.00	0.05	0.18	0.04	0.08	0.06	0.09	0.07	0.06	0.10
13	@ 42˚	ULS B2	Highest Ratio	0.00	0.00	0.00	0.03	0.16	0.02	0.00	0.00	0.00	0.05	0.22	0.04	0.20	0.11	0.15	0.12	0.10	0.15
14	@ 42˚	ULS B3	Highest Ratio	0.00	0.00	0.00	0.03	0.16	0.02	0.00	0.00	0.00	0.05	0.24	0.04	0.23	0.12	0.17	0.13	0.11	0.15
15	@ 42˚	ULS B4	Highest Ratio	0.00	0.00	0.00	0.03	0.13	0.02	0.00	0.00	0.00	0.05	0.18	0.04	0.10	0.07	0.10	0.08	0.08	0.11
16	@ 63˚	ULS B1	Highest Ratio	0.00	0.00	0.00	0.02	0.15	0.01	0.00	0.00	0.00	0.03	0.20	0.02	0.17	0.08	0.13	0.09	0.07	0.11
17	@ 63˚	ULS B2	Highest Ratio	0.00	0.00	0.00	0.02	0.19	0.01	0.00	0.00	0.00	0.03	0.24	0.03	0.29	0.13	0.20	0.13	0.10	0.15
18	@ 63˚	ULS B3	Highest Ratio	0.00	0.00	0.00	0.02	0.19	0.01	0.00	0.00	0.00	0.03	0.25	0.03	0.32	0.13	0.22	0.15	0.11	0.16
19	@ 63˚	ULS B4	Highest Ratio	0.00	0.00	0.00	0.02	0.15	0.01	0.00	0.00	0.00	0.04	0.20	0.03	0.19	0.09	0.14	0.10	0.08	0.12
20	@ 84˚	ULS B1	Highest Ratio	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.18	0.00	0.24	0.09	0.16	0.09	0.07	0.10
21	@ 84˚	ULS B2	Highest Ratio	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.01	0.22	0.01	0.32	0.12	0.21	0.14	0.10	0.15
22	@ 84˚	ULS B3	Highest Ratio	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.01	0.23	0.01	0.35	0.13	0.23	0.14	0.11	0.15
23	@ 84˚	ULS B4	Highest Ratio	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.01	0.18	0.01	0.26	0.09	0.17	0.10	0.08	0.11
Maximum Highest Ratio (Overall)				0.00	0.00	0.00	0.50	0.27	0.03	0.00	0.00	0.00	0.48	0.26	0.06	0.52	0.52	0.52	0.53	0.51	0.48
Governing Load Combination per Member per Station (Overall)				CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	ULS B3 @ 0˚	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	ULS B2 @ 0˚	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.00	0.00	0.00	0.50	0.27	0.03	0.00	0.00	0.00	0.48	0.26	0.05	0.52	0.52	0.52	0.53	0.51	0.48
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.00	0.00	0.00	0.04	0.19	0.03	0.00	0.00	0.00	0.07	0.25	0.06	0.35	0.13	0.23	0.15	0.11	0.16
Governing Load Combination per Member per Station (Movable Load Only)				ULS B1	ULS B1	ULS B1	ULS B2	ULS B2	ULS B3	ULS B1	ULS B1	ULS B1	ULS B2	ULS B3	ULS B2	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)																					

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	281	281	281	282	282	282	283	283	283	284	284	284	285	285	285	286	286	286
			Member Label	4N-6N	4N-6N	4N-6N	6N-8N	6N-8N	6N-8N	8N-10N	8N-10N	8N-10N	10N-12N	10N-12N	10N-12N	12N-14N	12N-14N	12N-14N	14N-16N	14N-16N	14N-16N
			Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	3.9	7.7
			Node Label at Station	4N	---	6N	6N	---	8N	8N	---	10N	10N	---	12N	12N	---	14N	14N	---	16N	
Load Combination			Section #	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01
			Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord
ID	Category	Name																				
1	Live	CL1	Highest Ratio	0.68	0.74	0.76	0.75	0.73	0.67	0.64	0.68	0.69	0.69	0.66	0.74	0.80	0.77	0.82	0.59	0.69	0.88
2	Live	CL2	Highest Ratio	0.60	0.66	0.68	0.66	0.64	0.59	0.63	0.67	0.68	0.68	0.65	0.73	0.79	0.76	0.81	0.52	0.61	0.78
3	Live	CL3	Highest Ratio	0.47	0.53	0.55	0.53	0.51	0.47	0.63	0.66	0.68	0.68	0.65	0.72	0.78	0.76	0.81	0.42	0.49	0.64
4	@ 0˚	ULS B1	Highest Ratio	0.29	0.25	0.29	0.28	0.22	0.25	0.66	0.62	0.65	0.66	0.67	0.75	0.83	0.82	0.90	0.56	0.56	0.80
5	@ 0˚	ULS B2	Highest Ratio	0.35	0.31	0.39	0.39	0.33	0.37	0.82	0.77	0.83	0.88	0.90	1.08	1.10	1.06	1.17	0.92	1.08	1.74
6	@ 0˚	ULS B3	Highest Ratio	0.36	0.32	0.41	0.41	0.35	0.40	0.86	0.81	0.87	0.93	0.95	1.15	1.16	1.12	1.24	1.01	1.19	1.96
7	@ 0˚	ULS B4	Highest Ratio	0.32	0.27	0.33	0.32	0.25	0.29	0.70	0.65	0.69	0.72	0.72	0.83	0.89	0.86	0.96	0.71	0.77	1.17
8	@ 21˚	ULS B1	Highest Ratio	0.27	0.26	0.27	0.27	0.26	0.31	0.69	0.66	0.71	0.72	0.73	0.89	0.86	0.83	0.94	0.89	0.84	0.99
9	@ 21˚	ULS B2	Highest Ratio	0.34	0.32	0.38	0.41	0.37	0.44	0.86	0.81	0.88	0.96	0.99	1.24	1.15	1.09	1.22	1.19	1.30	1.84
10	@ 21˚	ULS B3	Highest Ratio	0.35	0.33	0.41	0.44	0.39	0.47	0.89	0.85	0.92	1.01	1.04	1.32	1.22	1.15	1.28	1.26	1.42	2.04
11	@ 21˚	ULS B4	Highest Ratio	0.30	0.28	0.31	0.31	0.29	0.35	0.73	0.69	0.74	0.77	0.80	0.98	0.92	0.89	1.01	1.05	1.06	1.36
12	@ 42˚	ULS B1	Highest Ratio	0.26	0.23	0.32	0.32	0.28	0.35	0.62	0.61	0.66	0.67	0.70	0.89	0.83	0.74	0.86	1.02	1.08	1.32
13	@ 42˚	ULS B2	Highest Ratio	0.34	0.31	0.47	0.48	0.40	0.49	0.81	0.78	0.87	0.93	0.97	1.27	1.20	1.03	1.20	1.34	1.49	2.12
14	@ 42˚	ULS B3	Highest Ratio	0.37	0.33	0.50	0.52	0.43	0.51	0.85	0.82	0.92	0.98	1.04	1.35	1.29	1.09	1.28	1.41	1.59	2.30
15	@ 42˚	ULS B4	Highest Ratio	0.28	0.25	0.35	0.37	0.31	0.39	0.67	0.64	0.71	0.74	0.77	0.99	0.90	0.81	0.94	1.20	1.31	1.72
16	@ 63˚	ULS B1	Highest Ratio	0.25	0.21	0.33	0.36	0.27	0.35	0.49	0.47	0.53	0.58	0.57	0.78	0.68	0.57	0.65	0.83	0.93	1.21
17	@ 63˚	ULS B2	Highest Ratio	0.37	0.30	0.51	0.52	0.40	0.48	0.74	0.70	0.81	0.88	0.92	1.27	1.18	0.90	1.12	1.21	1.31	1.91
18	@ 63˚	ULS B3	Highest Ratio	0.39	0.32	0.55	0.56	0.43	0.51	0.80	0.75	0.87	0.96	1.00	1.38	1.30	0.98	1.23	1.30	1.40	2.08
19	@ 63˚	ULS B4	Highest Ratio	0.28	0.23	0.37	0.40	0.30	0.38	0.54	0.52	0.59	0.65	0.65	0.88	0.76	0.65	0.73	1.04	1.21	1.63
20	@ 84˚	ULS B1	Highest Ratio	0.22	0.16	0.31	0.36	0.23	0.30	0.31	0.27	0.32	0.41	0.38	0.59	0.39	0.33	0.33	0.27	0.31	0.43
21	@ 84˚	ULS B2	Highest Ratio	0.35	0.27	0.48	0.50	0.37	0.46	0.62	0.57	0.67	0.79	0.81	1.22	0.99	0.71	0.93	0.75	0.67	1.07
22	@ 84˚	ULS B3	Highest Ratio	0.37	0.29	0.52	0.54	0.40	0.50	0.69	0.63	0.76	0.87	0.91	1.37	1.13	0.80	1.07	0.86	0.75	1.22
23	@ 84˚	ULS B4	Highest Ratio	0.25	0.18	0.35	0.40	0.26	0.34	0.37	0.33	0.38	0.50	0.47	0.70	0.49	0.41	0.42	0.56	0.70	0.95
Maximum Highest Ratio (Overall)				0.68	0.74	0.76	0.75	0.73	0.67	0.89	0.85	0.92	1.01	1.04	1.38	1.30	1.15	1.28	1.41	1.59	2.30
Governing Load Combination per Member per Station (Overall)				CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	ULS B3 @ 21˚	ULS B3 @ 21˚	ULS B3 @ 21˚	ULS B3 @ 21˚	ULS B3 @ 21˚	ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 21˚	ULS B3 @ 21˚	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 42˚	
Governing Member of the Element Group (Overall)																					Governing (Overall)	
Maximum Highest Ratio (Live Load Only)				0.68	0.74	0.76	0.75	0.73	0.67	0.64	0.68	0.69	0.69	0.66	0.74	0.80	0.77	0.82	0.59	0.69	0.88
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	
Governing Member of the Element Group (Live Load Only)																						
Maximum Highest Ratio (Movable L. Only)				0.39	0.33	0.55	0.56	0.43	0.51	0.89	0.85	0.92	1.01	1.04	1.38	1.30	1.15	1.28	1.41	1.59	2.30
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	
Governing Member of the Element Group (Movable Load Only)																					Governing (Movable L.)	

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	559	559	559	560	560	560	561	561	561	562	562	562	563	563	563	564	564	564
			Member Label	0S-2S	0S-2S	0S-2S	2S-4S	2S-4S	2S-4S	4S-6S	4S-6S	4S-6S	6S-8S	6S-8S	6S-8S	8S-10S	8S-10S	8S-10S	10S-12S	10S-12S	10S-12S
			Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
			Node Label at Station	0S	---	2S	2S	---	4S	4S	---	6S	6S	---	8S	8S	---	10S	10S	---	12S	
Load Combination			Section #	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02
			Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord
ID	Category	Name																				
1	Live	CL1	Highest Ratio	0.55	0.53	0.54	0.54	0.54	0.49	0.72	0.78	0.80	0.79	0.76	0.72	0.63	0.67	0.67	0.68	0.64	0.71
2	Live	CL2	Highest Ratio	0.50	0.48	0.49	0.49	0.49	0.44	0.63	0.69	0.72	0.70	0.68	0.63	0.62	0.66	0.66	0.67	0.63	0.70
3	Live	CL3	Highest Ratio	0.43	0.41	0.43	0.43	0.42	0.37	0.50	0.56	0.59	0.57	0.55	0.50	0.62	0.66	0.66	0.67	0.63	0.70
4	@ 0˚	ULS B1	Highest Ratio	0.14	0.05	0.05	0.03	0.04	0.05	0.34	0.29	0.31	0.32	0.26	0.29	0.73	0.69	0.71	0.70	0.71	0.80
5	@ 0˚	ULS B2	Highest Ratio	0.16	0.08	0.09	0.06	0.07	0.09	0.39	0.35	0.42	0.43	0.37	0.41	0.88	0.83	0.89	0.92	0.94	1.12
6	@ 0˚	ULS B3	Highest Ratio	0.17	0.08	0.10	0.07	0.07	0.10	0.40	0.35	0.44	0.45	0.39	0.44	0.92	0.87	0.93	0.97	1.00	1.19
7	@ 0˚	ULS B4	Highest Ratio	0.16	0.06	0.07	0.04	0.04	0.07	0.36	0.31	0.36	0.36	0.29	0.33	0.77	0.72	0.75	0.75	0.77	0.87
8	@ 21˚	ULS B1	Highest Ratio	0.08	0.05	0.03	0.06	0.05	0.06	0.33	0.27	0.28	0.30	0.28	0.29	0.77	0.70	0.71	0.70	0.72	0.87
9	@ 21˚	ULS B2	Highest Ratio	0.14	0.09	0.09	0.10	0.09	0.10	0.40	0.33	0.38	0.44	0.39	0.42	0.92	0.85	0.88	0.93	0.95	1.19
10	@ 21˚	ULS B3	Highest Ratio	0.16	0.10	0.10	0.12	0.10	0.11	0.41	0.34	0.41	0.47	0.41	0.45	0.96	0.88	0.92	0.97	1.00	1.26
11	@ 21˚	ULS B4	Highest Ratio	0.09	0.06	0.04	0.07	0.06	0.06	0.35	0.29	0.31	0.34	0.31	0.32	0.80	0.73	0.74	0.76	0.78	0.95
12	@ 42˚	ULS B1	Highest Ratio	0.08	0.06	0.09	0.07	0.07	0.09	0.30	0.27	0.33	0.32	0.29	0.32	0.67	0.64	0.68	0.69	0.70	0.88
13	@ 42˚	ULS B2	Highest Ratio	0.19	0.10	0.16	0.13	0.11	0.15	0.39	0.33	0.48	0.47	0.40	0.47	0.87	0.81	0.88	0.92	0.94	1.21
14	@ 42˚	ULS B3	Highest Ratio	0.21	0.11	0.17	0.14	0.12	0.16	0.41	0.35	0.51	0.51	0.43	0.51	0.91	0.85	0.93	0.98	0.99	1.28
15	@ 42˚	ULS B4	Highest Ratio	0.10	0.07	0.10	0.08	0.08	0.10	0.32	0.29	0.37	0.36	0.32	0.36	0.72	0.69	0.72	0.76	0.76	0.97
16	@ 63˚	ULS B1	Highest Ratio	0.16	0.08	0.13	0.09	0.08	0.12	0.27	0.23	0.35	0.35	0.28	0.33	0.50	0.51	0.57	0.61	0.58	0.78
17	@ 63˚	ULS B2	Highest Ratio	0.27	0.11	0.20	0.14	0.12	0.17	0.40	0.32	0.52	0.51	0.40	0.49	0.76	0.73	0.82	0.91	0.88	1.22
18	@ 63˚	ULS B3	Highest Ratio	0.29	0.12	0.22	0.16	0.13	0.19	0.43	0.35	0.56	0.54	0.42	0.52	0.82	0.79	0.88	0.98	0.95	1.32
19	@ 63˚	ULS B4	Highest Ratio	0.18	0.08	0.14	0.11	0.09	0.12	0.29	0.25	0.38	0.39	0.31	0.37	0.55	0.55	0.62	0.68	0.65	0.87
20	@ 84˚	ULS B1	Highest Ratio	0.23	0.08	0.16	0.11	0.08	0.12	0.24	0.17	0.31	0.35	0.23	0.30	0.35	0.30	0.38	0.47	0.40	0.62
21	@ 84˚	ULS B2	Highest Ratio	0.30	0.11	0.22	0.15	0.12	0.17	0.39	0.29	0.49	0.51	0.37	0.47	0.67	0.60	0.69	0.87	0.78	1.20
22	@ 84˚	ULS B3	Highest Ratio	0.32	0.12	0.23	0.16	0.12	0.19	0.42	0.31	0.54	0.54	0.40	0.51	0.74	0.67	0.77	0.97	0.87	1.33
23	@ 84˚	ULS B4	Highest Ratio	0.24	0.09	0.17	0.12	0.09	0.13	0.27	0.19	0.35	0.39	0.27	0.34	0.41	0.36	0.44	0.55	0.48	0.72
Maximum Highest Ratio (Overall)				0.55	0.53	0.54	0.54	0.54	0.49	0.72	0.78	0.80	0.79	0.76	0.72	0.96	0.88	0.93	0.98	1.00	1.33
Governing Load Combination per Member per Station (Overall)				CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	ULS B3 @ 21˚	ULS B3 @ 21˚	ULS B3 @ 0˚	ULS B3 @ 63˚	ULS B3 @ 21˚	ULS B3 @ 84˚
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.55	0.53	0.54	0.54	0.54	0.49	0.72	0.78	0.80	0.79	0.76	0.72	0.63	0.67	0.67	0.68	0.64	0.71
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.32	0.12	0.23	0.16	0.13	0.19	0.43	0.35	0.56	0.54	0.43	0.52	0.96	0.88	0.93	0.98	1.00	1.33
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)																					

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	565	565	565	566	566	566	417	417	417	418	418	418	419	419	419	420	420	420
			Member Label	12S-14S	12S-14S	12S-14S	14S-16S	14S-16S	14S-16S	13N-48N	13N-48N	13N-48N	48N-11N	48N-11N	48N-11N	11N-9N	11N-9N	11N-9N	9N-7N	9N-7N	9N-7N
			Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	1.0	2.0	0.0	1.9	3.8	0.0	2.9	5.8	0.0	2.9	5.8
			Node Label at Station	12S	---	14S	14S	---	16S	13N	---	48N	48N	---	11N	11N	---	9N	9N	---	7N
Load Combination			Section #	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01	S 13-48	S 13-48	S 13-48	Section 06	Section 06	Section 06	Section 06	Section 06	Section 06	Section 01	Section 01	Section 01
			Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.81	0.79	0.84	0.63	0.73	0.95	0.26	0.25	0.23	0.56	0.55	0.55	0.54	0.53	0.54	0.44	0.45	0.45
2	Live	CL2	Highest Ratio	0.80	0.78	0.83	0.56	0.64	0.86	0.26	0.25	0.23	0.56	0.54	0.55	0.54	0.53	0.54	0.38	0.38	0.39
3	Live	CL3	Highest Ratio	0.80	0.77	0.83	0.45	0.52	0.72	0.26	0.25	0.23	0.56	0.54	0.55	0.54	0.53	0.54	0.34	0.35	0.35
4	@ 0˚	ULS B1	Highest Ratio	0.89	0.88	0.96	0.55	0.57	0.83	0.39	0.35	0.30	0.91	0.71	0.71	0.69	0.63	0.64	0.39	0.35	0.36
5	@ 0˚	ULS B2	Highest Ratio	1.16	1.13	1.24	0.92	1.08	1.77	0.41	0.36	0.31	1.03	0.80	0.78	0.75	0.68	0.70	0.46	0.39	0.41
6	@ 0˚	ULS B3	Highest Ratio	1.22	1.18	1.30	1.01	1.20	1.99	0.42	0.37	0.32	1.05	0.82	0.79	0.76	0.69	0.72	0.47	0.40	0.42
7	@ 0˚	ULS B4	Highest Ratio	0.95	0.93	1.03	0.71	0.77	1.19	0.41	0.37	0.31	0.97	0.76	0.76	0.73	0.66	0.68	0.42	0.37	0.38
8	@ 21˚	ULS B1	Highest Ratio	0.90	0.89	1.04	0.81	0.80	0.96	0.31	0.28	0.26	0.85	0.65	0.65	0.63	0.57	0.58	0.35	0.30	0.31
9	@ 21˚	ULS B2	Highest Ratio	1.18	1.14	1.31	1.11	1.26	1.79	0.34	0.31	0.28	1.00	0.75	0.73	0.70	0.63	0.65	0.42	0.35	0.36
10	@ 21˚	ULS B3	Highest Ratio	1.25	1.20	1.37	1.18	1.38	1.98	0.35	0.32	0.28	1.03	0.77	0.75	0.72	0.65	0.66	0.43	0.36	0.38
11	@ 21˚	ULS B4	Highest Ratio	0.95	0.94	1.10	0.97	1.02	1.32	0.33	0.30	0.27	0.91	0.70	0.69	0.67	0.61	0.62	0.38	0.33	0.33
12	@ 42˚	ULS B1	Highest Ratio	0.86	0.80	0.96	0.94	1.04	1.31	0.21	0.20	0.19	0.68	0.51	0.50	0.49	0.44	0.45	0.27	0.23	0.23
13	@ 42˚	ULS B2	Highest Ratio	1.25	1.07	1.32	1.23	1.46	2.08	0.32	0.28	0.23	1.08	0.74	0.69	0.66	0.58	0.58	0.37	0.31	0.31
14	@ 42˚	ULS B3	Highest Ratio	1.34	1.14	1.40	1.31	1.56	2.27	0.35	0.30	0.24	1.17	0.80	0.73	0.70	0.62	0.61	0.39	0.33	0.33
15	@ 42˚	ULS B4	Highest Ratio	0.93	0.87	1.03	1.10	1.28	1.70	0.23	0.22	0.20	0.74	0.56	0.54	0.53	0.48	0.49	0.30	0.25	0.25
16	@ 63˚	ULS B1	Highest Ratio	0.70	0.61	0.73	0.85	0.90	1.19	0.09	0.09	0.10	0.43	0.31	0.29	0.28	0.25	0.26	0.15	0.12	0.12
17	@ 63˚	ULS B2	Highest Ratio	1.25	0.94	1.23	1.24	1.29	1.89	0.27	0.22	0.17	1.10	0.71	0.60	0.57	0.49	0.47	0.29	0.25	0.24
18	@ 63˚	ULS B3	Highest Ratio	1.38	1.02	1.34	1.33	1.38	2.05	0.32	0.25	0.19	1.26	0.80	0.68	0.63	0.54	0.52	0.33	0.27	0.27
19	@ 63˚	ULS B4	Highest Ratio	0.79	0.69	0.81	1.05	1.18	1.60	0.11	0.11	0.11	0.48	0.35	0.33	0.32	0.29	0.30	0.18	0.14	0.14
20	@ 84˚	ULS B1	Highest Ratio	0.40	0.35	0.36	0.30	0.34	0.43	0.03	0.03	0.02	0.14	0.07	0.04	0.03	0.03	0.03	0.04	0.02	0.02
21	@ 84˚	ULS B2	Highest Ratio	1.06	0.72	1.00	0.81	0.69	1.07	0.26	0.19	0.12	0.97	0.58	0.44	0.40	0.34	0.31	0.23	0.19	0.19
22	@ 84˚	ULS B3	Highest Ratio	1.21	0.81	1.14	0.92	0.77	1.21	0.31	0.22	0.14	1.16	0.70	0.54	0.49	0.41	0.37	0.27	0.23	0.23
23	@ 84˚	ULS B4	Highest Ratio	0.49	0.43	0.46	0.59	0.72	0.95	0.06	0.05	0.04	0.19	0.11	0.08	0.07	0.07	0.08	0.07	0.04	0.05
			Maximum Highest Ratio (Overall)	1.38	1.20	1.40	1.33	1.56	2.27	0.42	0.37	0.32	1.26	0.82	0.79	0.76	0.69	0.72	0.47	0.45	0.45
			Governing Load Combination per Member per Station (Overall)	ULS B3 @ 63˚	ULS B3 @ 21˚	ULS B3 @ 42˚	ULS B3 @ 63˚	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 63˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	CL1 Live	CL1 Live
			Governing Member of the Element Group (Overall)																		
			Maximum Highest Ratio (Live Load Only)	0.81	0.79	0.84	0.63	0.73	0.95	0.26	0.25	0.23	0.56	0.55	0.55	0.54	0.53	0.54	0.44	0.45	0.45
			Governing Load Combination per Member per Station (Live Load Only)	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
			Governing Member of the Element Group (Live Load Only)						Governing (Live L.)												
			Maximum Highest Ratio (Movable L. Only)	1.38	1.20	1.40	1.33	1.56	2.27	0.42	0.37	0.32	1.26	0.82	0.79	0.76	0.69	0.72	0.47	0.40	0.42
			Governing Load Combination per Member per Station (Movable Load Only)	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
			Governing Member of the Element Group (Movable Load Only)																		

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	421	421	421	422	422	422	423	423	423	486	486	486	487	487	487	488	488	488
			Member Label	7N-5N	7N-5N	7N-5N	5N-3N	5N-3N	5N-3N	3N-1N	3N-1N	3N-1N	13S-48S	13S-48S	13S-48S	48S-11S	48S-11S	48S-11S	11S-9S	11S-9S	11S-9S
			Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	1.0	2.0	0.0	1.9	3.8	0.0	2.9	5.8
			Node Label at Station	7N	---	5N	5N	---	3N	3N	---	1N	13S	---	48S	48S	---	11S	11S	---	9S
Load Combination			Section #	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	S 13-48	S 13-48	S 13-48	Section 06	Section 06	Section 06	Section 06	Section 06	Section 06
			Element Group	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.45	0.47	0.44	0.56	0.59	0.59	0.60	0.58	0.52	0.26	0.24	0.22	0.56	0.54	0.54	0.54	0.53	0.54
2	Live	CL2	Highest Ratio	0.39	0.41	0.37	0.48	0.52	0.51	0.53	0.51	0.45	0.26	0.24	0.22	0.56	0.54	0.54	0.54	0.53	0.54
3	Live	CL3	Highest Ratio	0.35	0.36	0.33	0.38	0.41	0.41	0.42	0.40	0.35	0.26	0.24	0.22	0.56	0.54	0.54	0.54	0.53	0.54
4	@ 0˚	ULS B1	Highest Ratio	0.35	0.33	0.36	0.12	0.09	0.11	0.11	0.11	0.09	0.41	0.35	0.30	0.93	0.74	0.74	0.74	0.67	0.68
5	@ 0˚	ULS B2	Highest Ratio	0.38	0.36	0.39	0.14	0.11	0.13	0.12	0.12	0.09	0.43	0.36	0.31	1.05	0.83	0.81	0.79	0.73	0.75
6	@ 0˚	ULS B3	Highest Ratio	0.39	0.36	0.39	0.14	0.11	0.13	0.12	0.12	0.09	0.43	0.37	0.32	1.08	0.85	0.82	0.81	0.74	0.77
7	@ 0˚	ULS B4	Highest Ratio	0.36	0.34	0.37	0.13	0.10	0.12	0.12	0.11	0.09	0.43	0.37	0.31	1.00	0.79	0.78	0.78	0.71	0.72
8	@ 21˚	ULS B1	Highest Ratio	0.31	0.29	0.32	0.11	0.08	0.10	0.10	0.10	0.08	0.32	0.28	0.26	0.88	0.69	0.68	0.68	0.62	0.63
9	@ 21˚	ULS B2	Highest Ratio	0.34	0.32	0.36	0.13	0.10	0.11	0.11	0.11	0.09	0.35	0.31	0.27	1.03	0.78	0.76	0.75	0.68	0.70
10	@ 21˚	ULS B3	Highest Ratio	0.35	0.33	0.37	0.13	0.10	0.11	0.11	0.11	0.09	0.36	0.32	0.28	1.06	0.80	0.78	0.77	0.69	0.72
11	@ 21˚	ULS B4	Highest Ratio	0.32	0.31	0.34	0.12	0.09	0.10	0.10	0.10	0.08	0.34	0.30	0.27	0.94	0.73	0.72	0.72	0.65	0.67
12	@ 42˚	ULS B1	Highest Ratio	0.23	0.22	0.25	0.08	0.06	0.07	0.07	0.07	0.06	0.21	0.20	0.18	0.70	0.53	0.51	0.52	0.47	0.49
13	@ 42˚	ULS B2	Highest Ratio	0.30	0.29	0.32	0.11	0.08	0.09	0.09	0.10	0.08	0.33	0.28	0.23	1.10	0.77	0.71	0.70	0.62	0.63
14	@ 42˚	ULS B3	Highest Ratio	0.31	0.30	0.34	0.12	0.08	0.10	0.10	0.10	0.08	0.35	0.29	0.24	1.19	0.83	0.75	0.74	0.66	0.67
15	@ 42˚	ULS B4	Highest Ratio	0.24	0.24	0.27	0.09	0.06	0.07	0.08	0.08	0.06	0.23	0.21	0.20	0.75	0.58	0.56	0.56	0.50	0.52
16	@ 63˚	ULS B1	Highest Ratio	0.12	0.12	0.14	0.05	0.02	0.03	0.03	0.04	0.03	0.09	0.09	0.09	0.43	0.31	0.28	0.29	0.26	0.28
17	@ 63˚	ULS B2	Highest Ratio	0.23	0.23	0.26	0.09	0.06	0.07	0.07	0.07	0.06	0.28	0.22	0.17	1.11	0.72	0.61	0.59	0.52	0.51
18	@ 63˚	ULS B3	Highest Ratio	0.26	0.25	0.28	0.10	0.07	0.07	0.08	0.08	0.07	0.32	0.25	0.18	1.26	0.81	0.68	0.67	0.58	0.57
19	@ 63˚	ULS B4	Highest Ratio	0.14	0.14	0.17	0.06	0.03	0.04	0.04	0.05	0.04	0.11	0.11	0.11	0.48	0.36	0.33	0.33	0.30	0.32
20	@ 84˚	ULS B1	Highest Ratio	0.01	0.00	0.02	0.03	0.02	0.01	0.01	0.01	0.01	0.04	0.03	0.02	0.13	0.06	0.03	0.03	0.02	0.03
21	@ 84˚	ULS B2	Highest Ratio	0.17	0.16	0.18	0.08	0.06	0.06	0.05	0.05	0.04	0.26	0.19	0.12	0.95	0.57	0.43	0.41	0.35	0.33
22	@ 84˚	ULS B3	Highest Ratio	0.21	0.19	0.22	0.10	0.07	0.07	0.06	0.06	0.05	0.32	0.23	0.14	1.15	0.69	0.53	0.50	0.43	0.40
23	@ 84˚	ULS B4	Highest Ratio	0.04	0.03	0.04	0.04	0.03	0.02	0.02	0.01	0.01	0.06	0.05	0.04	0.18	0.11	0.08	0.07	0.06	0.08
Maximum Highest Ratio (Overall)				0.45	0.47	0.44	0.56	0.59	0.59	0.60	0.58	0.52	0.43	0.37	0.32	1.26	0.85	0.82	0.81	0.74	0.77
Governing Load Combination per Member per Station (Overall)				CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 63˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚
Governing Member of the Element Group (Overall)																Governing (Overall)					
Maximum Highest Ratio (Live Load Only)				0.45	0.47	0.44	0.56	0.59	0.59	0.60	0.58	0.52	0.26	0.24	0.22	0.56	0.54	0.54	0.54	0.53	0.54
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.39	0.36	0.39	0.14	0.11	0.13	0.12	0.12	0.09	0.43	0.37	0.32	1.26	0.85	0.82	0.81	0.74	0.77
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)																Governing (Movable L.)					

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Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	489	489	489	490	490	490	491	491	491	492	492	492	431	431	431	432	432	432
			Member Label	9S-7S	9S-7S	9S-7S	7S-5S	7S-5S	7S-5S	5S-3S	5S-3S	5S-3S	3S-1S	3S-1S	3S-1S	22N-33N	22N-33N	22N-33N	33N-32N	33N-32N	33N-32N
			Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	1.5	3.0	0.0	3.1	6.2
			Node Label at Station	9S	---	7S	7S	---	5S	5S	---	3S	3S	---	1S	22N	---	33N	33N	---	32N
Load Combination			Section #	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10
			Element Group	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.47	0.48	0.49	0.48	0.50	0.47	0.59	0.63	0.62	0.64	0.62	0.54	0.90	0.82	0.84	0.83	0.82	0.74
2	Live	CL2	Highest Ratio	0.41	0.41	0.42	0.41	0.43	0.40	0.51	0.55	0.54	0.56	0.54	0.47	0.87	0.80	0.82	0.81	0.80	0.74
3	Live	CL3	Highest Ratio	0.32	0.33	0.33	0.33	0.34	0.31	0.41	0.45	0.44	0.45	0.43	0.37	0.81	0.76	0.78	0.78	0.78	0.73
4	@ 0˚	ULS B1	Highest Ratio	0.42	0.38	0.39	0.39	0.37	0.40	0.14	0.11	0.13	0.13	0.13	0.10	0.75	0.69	0.82	0.81	0.87	0.86
5	@ 0˚	ULS B2	Highest Ratio	0.49	0.42	0.44	0.43	0.40	0.43	0.15	0.13	0.14	0.14	0.14	0.11	1.24	0.82	1.03	1.02	0.99	0.94
6	@ 0˚	ULS B3	Highest Ratio	0.50	0.43	0.45	0.44	0.41	0.44	0.16	0.13	0.15	0.14	0.14	0.11	1.36	0.86	1.07	1.07	1.02	0.96
7	@ 0˚	ULS B4	Highest Ratio	0.45	0.40	0.41	0.41	0.39	0.42	0.14	0.12	0.13	0.13	0.13	0.11	0.95	0.77	0.93	0.92	0.95	0.91
8	@ 21˚	ULS B1	Highest Ratio	0.39	0.34	0.35	0.35	0.34	0.36	0.12	0.10	0.11	0.11	0.12	0.10	0.70	0.63	0.77	0.76	0.82	0.81
9	@ 21˚	ULS B2	Highest Ratio	0.45	0.39	0.40	0.39	0.37	0.40	0.14	0.12	0.13	0.13	0.13	0.11	1.21	0.78	1.00	1.00	0.95	0.89
10	@ 21˚	ULS B3	Highest Ratio	0.47	0.40	0.41	0.40	0.38	0.41	0.15	0.12	0.13	0.13	0.13	0.11	1.33	0.81	1.05	1.05	0.99	0.91
11	@ 21˚	ULS B4	Highest Ratio	0.41	0.36	0.37	0.37	0.35	0.38	0.13	0.10	0.12	0.12	0.12	0.10	0.87	0.70	0.87	0.86	0.89	0.86
12	@ 42˚	ULS B1	Highest Ratio	0.30	0.25	0.25	0.26	0.25	0.28	0.09	0.07	0.08	0.08	0.09	0.07	0.60	0.56	0.69	0.68	0.75	0.75
13	@ 42˚	ULS B2	Highest Ratio	0.40	0.34	0.34	0.35	0.33	0.37	0.13	0.10	0.11	0.11	0.12	0.10	1.10	0.70	0.93	0.93	0.89	0.84
14	@ 42˚	ULS B3	Highest Ratio	0.43	0.36	0.36	0.37	0.35	0.39	0.13	0.11	0.12	0.12	0.12	0.10	1.21	0.73	0.98	0.98	0.93	0.86
15	@ 42˚	ULS B4	Highest Ratio	0.32	0.28	0.28	0.28	0.27	0.30	0.10	0.08	0.09	0.09	0.09	0.08	0.73	0.61	0.79	0.78	0.82	0.80
16	@ 63˚	ULS B1	Highest Ratio	0.17	0.13	0.12	0.13	0.13	0.16	0.05	0.03	0.04	0.04	0.05	0.04	0.43	0.45	0.56	0.55	0.63	0.64
17	@ 63˚	ULS B2	Highest Ratio	0.33	0.28	0.26	0.27	0.27	0.30	0.10	0.08	0.08	0.09	0.09	0.08	0.87	0.57	0.78	0.78	0.77	0.76
18	@ 63˚	ULS B3	Highest Ratio	0.36	0.31	0.30	0.31	0.30	0.33	0.11	0.09	0.09	0.10	0.10	0.09	0.98	0.60	0.83	0.83	0.81	0.78
19	@ 63˚	ULS B4	Highest Ratio	0.20	0.16	0.15	0.16	0.15	0.18	0.06	0.04	0.04	0.05	0.05	0.05	0.49	0.52	0.64	0.64	0.70	0.72
20	@ 84˚	ULS B1	Highest Ratio	0.04	0.02	0.02	0.01	0.00	0.02	0.03	0.02	0.01	0.01	0.01	0.01	0.06	0.16	0.26	0.27	0.38	0.41
21	@ 84˚	ULS B2	Highest Ratio	0.25	0.21	0.20	0.20	0.19	0.21	0.10	0.08	0.07	0.07	0.06	0.06	0.27	0.25	0.38	0.43	0.52	0.61
22	@ 84˚	ULS B3	Highest Ratio	0.30	0.25	0.24	0.24	0.23	0.25	0.11	0.09	0.09	0.08	0.08	0.07	0.32	0.28	0.40	0.46	0.56	0.66
23	@ 84˚	ULS B4	Highest Ratio	0.07	0.05	0.05	0.04	0.03	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.37	0.35	0.44	0.53	0.62	0.66
Maximum Highest Ratio (Overall)				0.50	0.48	0.49	0.48	0.50	0.47	0.59	0.63	0.62	0.64	0.62	0.54	1.36	0.86	1.07	1.07	1.02	0.96
Governing Load Combination per Member per Station (Overall)				ULS B3 @ 0˚	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚
Governing Member of the Element Group (Overall)																Governing (Overall)					
Maximum Highest Ratio (Live Load Only)				0.47	0.48	0.49	0.48	0.50	0.47	0.59	0.63	0.62	0.64	0.62	0.54	0.90	0.82	0.84	0.83	0.82	0.74
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)													Governing (Live L.)			Governing (Live L.)					
Maximum Highest Ratio (Movable L. Only)				0.50	0.43	0.45	0.44	0.41	0.44	0.16	0.13	0.15	0.14	0.14	0.11	1.36	0.86	1.07	1.07	1.02	0.96
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)																Governing (Movable L.)					

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	433	433	433	434	434	434	435	435	435	436	436	436	437	437	437	438	438	438
			Member Label	32N-45N	32N-45N	32N-45N	45N-13N	45N-13N	45N-13N	22S-33S	22S-33S	22S-33S	33S-32S	33S-32S	33S-32S	32S-45S	32S-45S	32S-45S	45S-13S	45S-13S	45S-13S
			Station (m)	0.0	3.1	6.2	0.0	0.7	1.3	0.0	1.5	3.0	0.0	3.1	6.2	0.0	3.1	6.2	0.0	0.7	1.3
			Node Label at Station	32N	---	45N	45N	---	13N	22S	---	33S	33S	---	32S	32S	---	45S	45S	---	13S
Load Combination			Section #	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10
			Element Group	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.75	0.79	0.79	0.80	0.62	0.44	0.81	0.79	0.82	0.82	0.81	0.75	0.75	0.81	0.81	0.82	0.64	0.46
2	Live	CL2	Highest Ratio	0.74	0.78	0.77	0.77	0.61	0.44	0.77	0.76	0.80	0.80	0.80	0.74	0.75	0.79	0.78	0.79	0.62	0.45
3	Live	CL3	Highest Ratio	0.74	0.75	0.72	0.73	0.59	0.43	0.71	0.71	0.77	0.76	0.78	0.74	0.74	0.77	0.73	0.74	0.60	0.45
4	@ 0˚	ULS B1	Highest Ratio	0.86	0.82	0.75	0.76	0.62	0.49	0.66	0.66	0.81	0.81	0.88	0.88	0.88	0.85	0.77	0.78	0.66	0.52
5	@ 0˚	ULS B2	Highest Ratio	0.94	0.87	0.86	0.87	0.69	0.50	1.15	0.80	1.02	1.02	1.00	0.96	0.97	0.90	0.89	0.90	0.72	0.54
6	@ 0˚	ULS B3	Highest Ratio	0.97	0.89	0.89	0.90	0.70	0.51	1.27	0.83	1.07	1.06	1.03	0.97	0.98	0.91	0.92	0.93	0.74	0.54
7	@ 0˚	ULS B4	Highest Ratio	0.91	0.88	0.83	0.84	0.68	0.50	0.86	0.74	0.92	0.91	0.95	0.92	0.92	0.91	0.86	0.87	0.70	0.54
8	@ 21˚	ULS B1	Highest Ratio	0.80	0.77	0.68	0.69	0.57	0.44	0.57	0.59	0.76	0.75	0.82	0.82	0.83	0.79	0.71	0.71	0.59	0.47
9	@ 21˚	ULS B2	Highest Ratio	0.89	0.84	0.83	0.83	0.64	0.46	1.09	0.73	0.99	0.98	0.96	0.91	0.92	0.86	0.84	0.85	0.67	0.49
10	@ 21˚	ULS B3	Highest Ratio	0.91	0.85	0.85	0.86	0.67	0.46	1.21	0.76	1.04	1.04	0.99	0.93	0.94	0.87	0.88	0.89	0.69	0.49
11	@ 21˚	ULS B4	Highest Ratio	0.85	0.82	0.76	0.76	0.61	0.45	0.75	0.65	0.86	0.85	0.90	0.88	0.88	0.84	0.78	0.79	0.64	0.48
12	@ 42˚	ULS B1	Highest Ratio	0.74	0.69	0.60	0.60	0.49	0.37	0.47	0.52	0.67	0.66	0.74	0.75	0.75	0.71	0.60	0.61	0.51	0.40
13	@ 42˚	ULS B2	Highest Ratio	0.84	0.77	0.76	0.76	0.58	0.40	0.97	0.66	0.91	0.91	0.89	0.85	0.86	0.78	0.75	0.76	0.59	0.43
14	@ 42˚	ULS B3	Highest Ratio	0.87	0.80	0.79	0.80	0.60	0.41	1.09	0.69	0.97	0.97	0.92	0.87	0.88	0.80	0.78	0.79	0.61	0.44
15	@ 42˚	ULS B4	Highest Ratio	0.80	0.75	0.65	0.66	0.53	0.40	0.60	0.57	0.77	0.76	0.82	0.82	0.82	0.76	0.66	0.66	0.55	0.42
16	@ 63˚	ULS B1	Highest Ratio	0.64	0.58	0.46	0.46	0.38	0.28	0.35	0.42	0.54	0.54	0.63	0.65	0.65	0.58	0.46	0.46	0.38	0.29
17	@ 63˚	ULS B2	Highest Ratio	0.76	0.68	0.66	0.66	0.49	0.31	0.80	0.54	0.77	0.77	0.77	0.76	0.77	0.64	0.56	0.57	0.45	0.33
18	@ 63˚	ULS B3	Highest Ratio	0.78	0.70	0.70	0.70	0.51	0.32	0.90	0.57	0.83	0.83	0.81	0.78	0.79	0.66	0.58	0.59	0.46	0.34
19	@ 63˚	ULS B4	Highest Ratio	0.72	0.65	0.55	0.55	0.44	0.32	0.40	0.48	0.63	0.62	0.70	0.73	0.74	0.65	0.54	0.54	0.44	0.34
20	@ 84˚	ULS B1	Highest Ratio	0.41	0.34	0.21	0.19	0.11	0.04	0.06	0.14	0.24	0.25	0.36	0.39	0.40	0.30	0.16	0.14	0.08	0.03
21	@ 84˚	ULS B2	Highest Ratio	0.61	0.56	0.58	0.50	0.30	0.09	0.27	0.24	0.38	0.43	0.49	0.60	0.60	0.50	0.44	0.37	0.24	0.09
22	@ 84˚	ULS B3	Highest Ratio	0.66	0.60	0.66	0.57	0.34	0.10	0.32	0.26	0.41	0.48	0.53	0.65	0.65	0.55	0.50	0.43	0.27	0.10
23	@ 84˚	ULS B4	Highest Ratio	0.66	0.62	0.57	0.46	0.31	0.15	0.35	0.34	0.43	0.51	0.61	0.65	0.65	0.59	0.51	0.41	0.29	0.15
Maximum Highest Ratio (Overall)				0.97	0.89	0.89	0.90	0.70	0.51	1.27	0.83	1.07	1.06	1.03	0.97	0.98	0.91	0.92	0.93	0.74	0.54
Governing Load Combination per Member per Station (Overall)				ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.75	0.79	0.79	0.80	0.62	0.44	0.81	0.79	0.82	0.82	0.81	0.75	0.75	0.81	0.81	0.82	0.64	0.46
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.97	0.89	0.89	0.90	0.70	0.51	1.27	0.83	1.07	1.06	1.03	0.97	0.98	0.91	0.92	0.93	0.74	0.54
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)																					

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Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	27	27	27	138	138	138	142	142	142	203	203	203	14	14	14	189	189	189
			Member Label	13N-54N	13N-54N	13N-54N	54N-55N	54N-55N	54N-55N	54S-55S	54S-55S	54S-55S	13S-54S	13S-54S	13S-54S	15N-16N	15N-16N	15N-16N	15S-16S	15S-16S	15S-16S
			Station (m)	0.0	7.8	15.6	0.0	0.5	1.0	0.0	0.5	1.0	0.0	7.8	15.6	0.0	0.7	1.5	0.0	0.7	1.5
			Node Label at Station	13N	---	54N	54N	---	55N	54S	---	55S	13S	---	54S	15N	---	16N	15S	---	16S
Load Combination			Section #	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 09	Section 09	Section 09	Section 09	Section 09	Section 09
			Element Group	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.04	0.15	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.15	0.04	0.51	0.35	0.33	0.49	0.42	0.36
2	Live	CL2	Highest Ratio	0.04	0.15	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.15	0.04	0.48	0.33	0.30	0.45	0.39	0.32
3	Live	CL3	Highest Ratio	0.04	0.15	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.15	0.04	0.43	0.29	0.25	0.40	0.34	0.28
4	@ 0˚	ULS B1	Highest Ratio	0.18	0.28	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.28	0.17	0.18	0.11	0.27	0.08	0.11	0.22
5	@ 0˚	ULS B2	Highest Ratio	0.19	0.34	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.34	0.19	0.61	0.19	0.71	0.51	0.19	0.67
6	@ 0˚	ULS B3	Highest Ratio	0.19	0.35	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.35	0.19	0.70	0.21	0.82	0.61	0.20	0.77
7	@ 0˚	ULS B4	Highest Ratio	0.18	0.30	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.29	0.18	0.22	0.16	0.39	0.13	0.16	0.35
8	@ 21˚	ULS B1	Highest Ratio	0.11	0.16	0.12	0.03	0.01	0.00	0.03	0.01	0.00	0.11	0.16	0.11	0.26	0.13	0.32	0.10	0.17	0.25
9	@ 21˚	ULS B2	Highest Ratio	0.15	0.22	0.16	0.04	0.01	0.00	0.04	0.01	0.00	0.15	0.22	0.16	0.76	0.21	0.81	0.59	0.26	0.74
10	@ 21˚	ULS B3	Highest Ratio	0.16	0.24	0.17	0.04	0.01	0.00	0.04	0.01	0.00	0.16	0.24	0.17	0.89	0.23	0.93	0.70	0.28	0.85
11	@ 21˚	ULS B4	Highest Ratio	0.11	0.18	0.12	0.03	0.01	0.00	0.03	0.01	0.00	0.11	0.17	0.12	0.32	0.21	0.44	0.15	0.25	0.39
12	@ 42˚	ULS B1	Highest Ratio	0.05	0.06	0.16	0.10	0.02	0.00	0.10	0.02	0.00	0.05	0.05	0.16	0.29	0.12	0.33	0.18	0.17	0.22
13	@ 42˚	ULS B2	Highest Ratio	0.19	0.19	0.30	0.13	0.03	0.00	0.13	0.03	0.00	0.19	0.20	0.30	0.86	0.22	0.85	0.72	0.28	0.73
14	@ 42˚	ULS B3	Highest Ratio	0.22	0.23	0.33	0.14	0.04	0.00	0.14	0.04	0.00	0.23	0.23	0.34	0.99	0.24	0.97	0.84	0.30	0.84
15	@ 42˚	ULS B4	Highest Ratio	0.06	0.06	0.17	0.11	0.03	0.00	0.11	0.03	0.00	0.06	0.06	0.17	0.45	0.26	0.44	0.32	0.30	0.34
16	@ 63˚	ULS B1	Highest Ratio	0.04	0.14	0.27	0.21	0.05	0.00	0.21	0.05	0.00	0.04	0.14	0.27	0.26	0.11	0.30	0.18	0.14	0.22
17	@ 63˚	ULS B2	Highest Ratio	0.25	0.33	0.53	0.29	0.07	0.00	0.29	0.07	0.00	0.25	0.33	0.53	0.90	0.25	0.81	0.81	0.29	0.73
18	@ 63˚	ULS B3	Highest Ratio	0.30	0.38	0.59	0.31	0.08	0.00	0.31	0.08	0.00	0.31	0.38	0.60	1.05	0.28	0.92	0.95	0.33	0.85
19	@ 63˚	ULS B4	Highest Ratio	0.04	0.15	0.30	0.23	0.06	0.00	0.23	0.06	0.00	0.04	0.15	0.30	0.55	0.28	0.36	0.47	0.32	0.30
20	@ 84˚	ULS B1	Highest Ratio	0.03	0.24	0.44	0.36	0.09	0.00	0.36	0.09	0.00	0.03	0.24	0.44	0.11	0.07	0.22	0.06	0.07	0.19
21	@ 84˚	ULS B2	Highest Ratio	0.26	0.50	0.80	0.52	0.13	0.00	0.52	0.13	0.00	0.27	0.50	0.81	0.92	0.31	0.72	0.86	0.34	0.69
22	@ 84˚	ULS B3	Highest Ratio	0.33	0.57	0.91	0.56	0.14	0.00	0.56	0.14	0.00	0.34	0.58	0.92	1.11	0.37	0.83	1.05	0.40	0.80
23	@ 84˚	ULS B4	Highest Ratio	0.04	0.26	0.49	0.41	0.10	0.00	0.41	0.10	0.00	0.04	0.26	0.49	0.58	0.30	0.37	0.52	0.31	0.34
Maximum Highest Ratio (Overall)				0.33	0.57	0.91	0.56	0.14	0.00	0.56	0.14	0.00	0.34	0.58	0.92	1.11	0.37	0.97	1.05	0.42	0.85
Governing Load Combination per Member per Station (Overall)				ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	CL1 Live	ULS B3 @ 84˚	ULS B3 @ 84˚	CL1 Live	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 42˚	ULS B3 @ 84˚	CL1 Live	ULS B3 @ 21˚
Governing Member of the Element Group (Overall)															Governing (Overall)						
Maximum Highest Ratio (Live Load Only)				0.04	0.15	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.15	0.04	0.51	0.35	0.33	0.49	0.42	0.36
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)														Governing (Live L.)							
Maximum Highest Ratio (Movable L. Only)				0.33	0.57	0.91	0.56	0.14	0.00	0.56	0.14	0.00	0.34	0.58	0.92	1.11	0.37	0.97	1.05	0.40	0.85
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B1	ULS B3	ULS B3	ULS B1	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)															Governing (Movable L.)						

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	248	248	248	251	251	251	252	252	252	399	399	399	579	579	579	580	580	580
			Member Label	16N-56N	16N-56N	16N-56N	15N-56N	15N-56N	15N-56N	56N-14N	56N-14N	56N-14N	16S-56S	16S-56S	16S-56S	15S-56S	15S-56S	15S-56S	56S-14S	56S-14S	56S-14S
			Station (m)	0.0	0.8	1.6	0.0	0.8	1.6	0.0	3.4	6.7	0.0	0.8	1.6	0.0	0.8	1.6	0.0	3.4	6.7
			Node Label at Station	16N	---	56N	15N	---	56N	56N	---	14N	16S	---	56S	15S	---	56S	56S	---	14S
Load Combination			Section #	Section 01	Section 01	Section 01	Section 08	Section 08	Section 08	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01	Section 08	Section 08	Section 08	Section 08	Section 08	Section 08
			Element Group	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.79	0.61	0.62	0.65	0.69	0.72	0.73	0.78	0.73	0.86	0.66	0.67	0.71	0.73	0.75	0.76	0.81	0.76
2	Live	CL2	Highest Ratio	0.70	0.52	0.54	0.64	0.68	0.71	0.72	0.77	0.72	0.78	0.58	0.58	0.70	0.72	0.73	0.74	0.80	0.74
3	Live	CL3	Highest Ratio	0.58	0.41	0.42	0.61	0.64	0.67	0.69	0.74	0.69	0.66	0.46	0.46	0.66	0.68	0.70	0.71	0.77	0.71
4	@ 0˚	ULS B1	Highest Ratio	0.70	0.50	0.51	0.73	0.76	0.79	0.82	0.89	0.82	0.69	0.48	0.50	0.76	0.80	0.84	0.87	0.94	0.87
5	@ 0˚	ULS B2	Highest Ratio	1.37	0.89	0.77	1.55	1.41	1.25	1.29	1.38	1.29	1.37	0.87	0.76	1.58	1.45	1.30	1.34	1.44	1.34
6	@ 0˚	ULS B3	Highest Ratio	1.52	0.98	0.84	1.75	1.56	1.36	1.40	1.50	1.40	1.52	0.97	0.82	1.77	1.60	1.41	1.45	1.55	1.45
7	@ 0˚	ULS B4	Highest Ratio	0.98	0.68	0.61	1.02	0.97	0.90	0.94	1.01	0.94	0.98	0.67	0.60	1.05	1.01	0.96	0.99	1.06	0.99
8	@ 21˚	ULS B1	Highest Ratio	1.04	0.86	0.77	0.56	0.55	0.55	0.59	0.66	0.59	1.03	0.86	0.78	0.56	0.57	0.58	0.62	0.69	0.62
9	@ 21˚	ULS B2	Highest Ratio	1.65	1.20	0.99	1.33	1.17	1.00	1.06	1.14	1.05	1.63	1.20	0.99	1.33	1.18	1.02	1.08	1.17	1.08
10	@ 21˚	ULS B3	Highest Ratio	1.78	1.28	1.04	1.51	1.31	1.11	1.16	1.25	1.16	1.77	1.28	1.04	1.51	1.32	1.12	1.18	1.28	1.18
11	@ 21˚	ULS B4	Highest Ratio	1.32	1.04	0.88	0.84	0.76	0.68	0.72	0.79	0.72	1.32	1.04	0.89	0.84	0.78	0.70	0.75	0.82	0.75
12	@ 42˚	ULS B1	Highest Ratio	1.20	1.04	0.91	0.38	0.36	0.34	0.37	0.41	0.36	1.20	1.05	0.93	0.39	0.38	0.37	0.40	0.45	0.39
13	@ 42˚	ULS B2	Highest Ratio	1.74	1.34	1.09	1.12	0.95	0.79	0.82	0.89	0.82	1.75	1.35	1.10	1.12	0.96	0.80	0.84	0.91	0.83
14	@ 42˚	ULS B3	Highest Ratio	1.87	1.40	1.14	1.29	1.08	0.89	0.92	1.00	0.92	1.87	1.42	1.15	1.29	1.09	0.90	0.94	1.01	0.93
15	@ 42˚	ULS B4	Highest Ratio	1.48	1.22	1.04	0.65	0.57	0.49	0.51	0.56	0.50	1.48	1.24	1.06	0.66	0.58	0.51	0.54	0.59	0.53
16	@ 63˚	ULS B1	Highest Ratio	1.04	0.91	0.81	0.26	0.23	0.22	0.21	0.24	0.21	1.06	0.93	0.83	0.27	0.26	0.25	0.25	0.28	0.24
17	@ 63˚	ULS B2	Highest Ratio	1.58	1.22	0.99	0.96	0.80	0.65	0.66	0.71	0.65	1.61	1.25	1.02	0.96	0.81	0.66	0.67	0.72	0.67
18	@ 63˚	ULS B3	Highest Ratio	1.71	1.28	1.03	1.12	0.94	0.75	0.76	0.82	0.76	1.74	1.33	1.07	1.13	0.94	0.75	0.77	0.82	0.76
19	@ 63˚	ULS B4	Highest Ratio	1.33	1.13	0.99	0.51	0.44	0.37	0.37	0.40	0.36	1.35	1.15	1.01	0.53	0.46	0.40	0.40	0.44	0.40
20	@ 84˚	ULS B1	Highest Ratio	0.33	0.19	0.18	0.46	0.45	0.45	0.45	0.46	0.44	0.29	0.17	0.17	0.48	0.48	0.48	0.49	0.51	0.49
21	@ 84˚	ULS B2	Highest Ratio	1.00	0.64	0.52	1.02	0.93	0.83	0.85	0.88	0.85	0.98	0.65	0.53	1.03	0.94	0.85	0.87	0.90	0.87
22	@ 84˚	ULS B3	Highest Ratio	1.15	0.75	0.60	1.15	1.04	0.92	0.95	0.98	0.94	1.14	0.76	0.61	1.16	1.05	0.94	0.96	0.99	0.95
23	@ 84˚	ULS B4	Highest Ratio	0.75	0.58	0.58	0.70	0.69	0.67	0.67	0.69	0.66	0.72	0.57	0.57	0.73	0.72	0.71	0.71	0.73	0.70
Maximum Highest Ratio (Overall)				1.87	1.40	1.14	1.75	1.56	1.36	1.40	1.50	1.40	1.87	1.42	1.15	1.77	1.60	1.41	1.45	1.55	1.45
Governing Load Combination per Member per Station (Overall)				ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚
Governing Member of the Element Group (Overall)													Governing (Overall)								
Maximum Highest Ratio (Live Load Only)				0.79	0.61	0.62	0.65	0.69	0.72	0.73	0.78	0.73	0.86	0.66	0.67	0.71	0.73	0.75	0.76	0.81	0.76
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)													Governing (Live L.)								
Maximum Highest Ratio (Movable L. Only)				1.87	1.40	1.14	1.75	1.56	1.36	1.40	1.50	1.40	1.87	1.42	1.15	1.77	1.60	1.41	1.45	1.55	1.45
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)													Governing (Movable L.)								

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	29	29	29	33	33	33	157	157	157	160	160	160	164	164	164	206	206	206
			Member Label	23N-24N	23N-24N	23N-24N	26N-25N	26N-25N	26N-25N	23S-24S	23S-24S	23S-24S	24N-25N	24N-25N	24N-25N	26S-25S	26S-25S	26S-25S	24S-25S	24S-25S	24S-25S
			Station (m)	0.0	1.6	3.1	0.0	2.4	4.8	0.0	1.6	3.1	0.0	1.8	3.5	0.0	2.4	4.8	0.0	1.8	3.5
			Node Label at Station	23N	---	24N	26N	---	25N	23S	---	24S	24N	---	25N	26S	---	25S	24S	---	25S
Load Combination			Section #	Section 23	Section 23	Section 23	Section 25	Section 25	Section 25	Section 23	Section 23	Section 23	Section 24	Section 24	Section 24	Section 25	Section 25	Section 25	Section 24	Section 24	Section 24
			Element Group	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.79	0.67	0.59	0.63	0.62	0.62	0.80	0.67	0.60	0.60	0.59	0.60	0.64	0.63	0.63	0.60	0.60	0.61
2	Live	CL2	Highest Ratio	0.79	0.66	0.59	0.62	0.61	0.61	0.79	0.67	0.60	0.60	0.59	0.60	0.63	0.62	0.62	0.60	0.59	0.61
3	Live	CL3	Highest Ratio	0.78	0.66	0.59	0.61	0.60	0.60	0.79	0.66	0.59	0.59	0.58	0.60	0.62	0.61	0.61	0.60	0.59	0.60
4	@ 0˚	ULS B1	Highest Ratio	0.92	0.77	0.69	0.68	0.67	0.68	0.94	0.79	0.71	0.69	0.69	0.70	0.72	0.71	0.72	0.71	0.70	0.72
5	@ 0˚	ULS B2	Highest Ratio	0.94	0.78	0.70	0.71	0.70	0.71	0.95	0.80	0.72	0.71	0.69	0.71	0.75	0.74	0.75	0.72	0.70	0.73
6	@ 0˚	ULS B3	Highest Ratio	0.94	0.78	0.70	0.72	0.70	0.72	0.95	0.80	0.72	0.71	0.69	0.71	0.76	0.74	0.76	0.73	0.71	0.73
7	@ 0˚	ULS B4	Highest Ratio	0.96	0.82	0.75	0.74	0.75	0.77	0.97	0.84	0.77	0.76	0.73	0.75	0.78	0.79	0.81	0.78	0.74	0.78
8	@ 21˚	ULS B1	Highest Ratio	0.85	0.72	0.62	0.36	0.43	0.49	0.86	0.74	0.63	0.66	0.61	0.68	0.40	0.45	0.50	0.67	0.62	0.68
9	@ 21˚	ULS B2	Highest Ratio	0.87	0.73	0.63	0.39	0.45	0.52	0.89	0.75	0.65	0.67	0.62	0.70	0.43	0.47	0.53	0.68	0.63	0.70
10	@ 21˚	ULS B3	Highest Ratio	0.88	0.73	0.64	0.40	0.45	0.53	0.89	0.75	0.65	0.68	0.62	0.70	0.44	0.48	0.54	0.69	0.63	0.70
11	@ 21˚	ULS B4	Highest Ratio	0.89	0.77	0.68	0.44	0.52	0.59	0.90	0.79	0.69	0.73	0.66	0.74	0.47	0.54	0.60	0.74	0.67	0.74
12	@ 42˚	ULS B1	Highest Ratio	0.66	0.57	0.50	0.08	0.21	0.35	0.67	0.58	0.51	0.54	0.48	0.64	0.08	0.22	0.36	0.55	0.48	0.64
13	@ 42˚	ULS B2	Highest Ratio	0.69	0.59	0.53	0.12	0.24	0.38	0.70	0.60	0.54	0.57	0.49	0.65	0.12	0.26	0.40	0.58	0.50	0.66
14	@ 42˚	ULS B3	Highest Ratio	0.69	0.59	0.53	0.12	0.25	0.39	0.71	0.61	0.54	0.57	0.49	0.66	0.13	0.26	0.41	0.58	0.50	0.67
15	@ 42˚	ULS B4	Highest Ratio	0.71	0.62	0.57	0.16	0.31	0.47	0.72	0.64	0.58	0.62	0.53	0.71	0.17	0.32	0.48	0.63	0.54	0.71
16	@ 63˚	ULS B1	Highest Ratio	0.37	0.34	0.32	0.46	0.64	0.82	0.37	0.35	0.33	0.36	0.28	0.51	0.45	0.62	0.81	0.36	0.28	0.51
17	@ 63˚	ULS B2	Highest Ratio	0.40	0.36	0.35	0.51	0.68	0.86	0.41	0.37	0.36	0.38	0.29	0.53	0.50	0.67	0.85	0.39	0.30	0.53
18	@ 63˚	ULS B3	Highest Ratio	0.41	0.36	0.35	0.52	0.68	0.87	0.42	0.37	0.36	0.39	0.30	0.53	0.51	0.68	0.86	0.40	0.30	0.54
19	@ 63˚	ULS B4	Highest Ratio	0.43	0.40	0.39	0.55	0.74	0.95	0.43	0.40	0.40	0.43	0.34	0.58	0.54	0.73	0.94	0.44	0.34	0.59
20	@ 84˚	ULS B1	Highest Ratio	0.05	0.11	0.17	0.81	1.00	1.21	0.05	0.10	0.17	0.21	0.14	0.40	0.80	0.99	1.20	0.21	0.14	0.40
21	@ 84˚	ULS B2	Highest Ratio	0.08	0.12	0.20	0.85	1.03	1.24	0.08	0.12	0.19	0.24	0.15	0.42	0.85	1.03	1.24	0.24	0.15	0.42
22	@ 84˚	ULS B3	Highest Ratio	0.08	0.13	0.20	0.86	1.04	1.25	0.08	0.13	0.20	0.25	0.16	0.43	0.86	1.04	1.25	0.25	0.16	0.42
23	@ 84˚	ULS B4	Highest Ratio	0.12	0.17	0.24	0.89	1.10	1.33	0.12	0.17	0.24	0.29	0.20	0.48	0.88	1.09	1.32	0.29	0.20	0.48
Maximum Highest Ratio (Overall)				0.96	0.82	0.75	0.89	1.10	1.33	0.97	0.84	0.77	0.76	0.73	0.75	0.88	1.09	1.32	0.78	0.74	0.78
Governing Load Combination per Member per Station (Overall)				ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 84˚	ULS B4 @ 84˚	ULS B4 @ 84˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 84˚	ULS B4 @ 84˚	ULS B4 @ 84˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 0˚
Governing Member of the Element Group (Overall)									Governing (Overall)												
Maximum Highest Ratio (Live Load Only)				0.79	0.67	0.59	0.63	0.62	0.62	0.80	0.67	0.60	0.60	0.59	0.60	0.64	0.63	0.63	0.60	0.60	0.61
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)										Governing (Live L.)											
Maximum Highest Ratio (Movable L. Only)				0.96	0.82	0.75	0.89	1.10	1.33	0.97	0.84	0.77	0.76	0.73	0.75	0.88	1.09	1.32	0.78	0.74	0.78
Governing Load Combination per Member per Station (Movable Load Only)				ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4
Governing Member of the Element Group (Movable Load Only)									Governing (Movable L.)												

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	528	528	528	529	529	529	530	530	530	531	531	531	30	30	30	205	205	205
			Member Label	23N-46N	23N-46N	23N-46N	46N-22N	46N-22N	46N-22N	23S-46S	23S-46S	23S-46S	46S-22S	46S-22S	46S-22S	21N-25N	21N-25N	21N-25N	21S-25S	21S-25S	21S-25S
			Station (m)	0.0	3.8	7.6	0.0	0.3	0.6	0.0	3.8	7.6	0.0	0.3	0.6	0.0	3.9	7.9	0.0	3.9	7.9
			Node Label at Station	23N	---	46N	46N	---	22N	23S	---	46S	46S	---	22S	21N	---	25N	21S	---	25S
Load Combination			Section #	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 18	Section 18	Section 18	Section 18	Section 18	Section 18
			Element Group	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.70	0.59	0.52	0.53	0.53	0.53	0.70	0.60	0.53	0.55	0.54	0.53	0.52	0.45	0.45	0.53	0.46	0.45
2	Live	CL2	Highest Ratio	0.70	0.58	0.51	0.52	0.52	0.53	0.70	0.60	0.53	0.54	0.53	0.53	0.52	0.45	0.45	0.52	0.46	0.45
3	Live	CL3	Highest Ratio	0.69	0.58	0.50	0.52	0.51	0.52	0.70	0.59	0.52	0.53	0.52	0.52	0.52	0.45	0.45	0.52	0.45	0.45
4	@ 0˚	ULS B1	Highest Ratio	0.80	0.66	0.57	0.58	0.58	0.59	0.82	0.69	0.60	0.62	0.60	0.60	0.62	0.54	0.55	0.62	0.54	0.54
5	@ 0˚	ULS B2	Highest Ratio	0.82	0.67	0.61	0.62	0.62	0.63	0.84	0.70	0.64	0.65	0.64	0.64	0.67	0.58	0.56	0.68	0.58	0.55
6	@ 0˚	ULS B3	Highest Ratio	0.82	0.68	0.62	0.63	0.63	0.63	0.84	0.71	0.64	0.66	0.65	0.65	0.68	0.59	0.56	0.69	0.59	0.56
7	@ 0˚	ULS B4	Highest Ratio	0.84	0.69	0.61	0.62	0.62	0.62	0.85	0.72	0.64	0.65	0.64	0.64	0.75	0.64	0.60	0.76	0.64	0.60
8	@ 21˚	ULS B1	Highest Ratio	0.74	0.60	0.52	0.52	0.52	0.52	0.76	0.63	0.54	0.55	0.54	0.53	0.68	0.66	0.66	0.68	0.65	0.66
9	@ 21˚	ULS B2	Highest Ratio	0.77	0.62	0.56	0.57	0.57	0.57	0.78	0.65	0.58	0.60	0.59	0.58	0.72	0.68	0.67	0.72	0.68	0.66
10	@ 21˚	ULS B3	Highest Ratio	0.77	0.63	0.57	0.58	0.58	0.58	0.79	0.66	0.59	0.61	0.60	0.59	0.73	0.69	0.67	0.72	0.68	0.66
11	@ 21˚	ULS B4	Highest Ratio	0.77	0.63	0.55	0.56	0.56	0.56	0.79	0.66	0.58	0.59	0.58	0.57	0.80	0.74	0.71	0.80	0.74	0.71
12	@ 42˚	ULS B1	Highest Ratio	0.57	0.46	0.39	0.40	0.39	0.39	0.59	0.48	0.41	0.42	0.41	0.40	0.67	0.69	0.69	0.66	0.69	0.68
13	@ 42˚	ULS B2	Highest Ratio	0.60	0.48	0.43	0.44	0.44	0.44	0.62	0.51	0.45	0.47	0.46	0.45	0.69	0.71	0.69	0.69	0.71	0.69
14	@ 42˚	ULS B3	Highest Ratio	0.61	0.49	0.44	0.45	0.45	0.45	0.63	0.51	0.46	0.48	0.47	0.46	0.70	0.72	0.69	0.69	0.71	0.69
15	@ 42˚	ULS B4	Highest Ratio	0.61	0.50	0.43	0.43	0.43	0.43	0.63	0.52	0.45	0.46	0.44	0.43	0.78	0.77	0.74	0.77	0.77	0.73
16	@ 63˚	ULS B1	Highest Ratio	0.32	0.25	0.21	0.22	0.22	0.22	0.32	0.26	0.22	0.23	0.22	0.22	0.64	0.63	0.62	0.63	0.63	0.62
17	@ 63˚	ULS B2	Highest Ratio	0.35	0.28	0.25	0.26	0.25	0.25	0.36	0.29	0.26	0.27	0.27	0.26	0.65	0.65	0.63	0.65	0.64	0.63
18	@ 63˚	ULS B3	Highest Ratio	0.36	0.28	0.26	0.26	0.26	0.26	0.37	0.30	0.27	0.28	0.27	0.27	0.66	0.65	0.63	0.65	0.65	0.63
19	@ 63˚	ULS B4	Highest Ratio	0.37	0.29	0.25	0.25	0.25	0.25	0.38	0.31	0.26	0.27	0.26	0.25	0.74	0.71	0.68	0.74	0.71	0.67
20	@ 84˚	ULS B1	Highest Ratio	0.03	0.03	0.05	0.05	0.05	0.05	0.03	0.03	0.04	0.04	0.04	0.05	0.52	0.49	0.47	0.52	0.49	0.47
21	@ 84˚	ULS B2	Highest Ratio	0.06	0.06	0.07	0.07	0.07	0.07	0.06	0.06	0.07	0.07	0.07	0.07	0.55	0.50	0.48	0.55	0.50	0.48
22	@ 84˚	ULS B3	Highest Ratio	0.07	0.06	0.07	0.08	0.08	0.08	0.07	0.06	0.07	0.07	0.07	0.08	0.56	0.50	0.49	0.56	0.50	0.49
23	@ 84˚	ULS B4	Highest Ratio	0.10	0.08	0.09	0.09	0.09	0.09	0.09	0.08	0.09	0.09	0.09	0.09	0.62	0.56	0.53	0.62	0.56	0.53
Maximum Highest Ratio (Overall)				0.84	0.69	0.62	0.63	0.63	0.63	0.85	0.72	0.64	0.66	0.65	0.65	0.80	0.77	0.74	0.80	0.77	0.73
Governing Load Combination per Member per Station (Overall)				ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B4 @ 21˚	ULS B4 @ 42˚	ULS B4 @ 42˚	ULS B4 @ 21˚	ULS B4 @ 42˚	ULS B4 @ 42˚
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.70	0.59	0.52	0.53	0.53	0.53	0.70	0.60	0.53	0.55	0.54	0.53	0.52	0.45	0.45	0.53	0.46	0.45
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.84	0.69	0.62	0.63	0.63	0.63	0.85	0.72	0.64	0.66	0.65	0.65	0.80	0.77	0.74	0.80	0.77	0.73
Governing Load Combination per Member per Station (Movable Load Only)				ULS B4	ULS B4	ULS B3	ULS B3	ULS B3	ULS B3	ULS B4	ULS B4	ULS B3	ULS B3	ULS B3	ULS B3	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4
Governing Member of the Element Group (Movable Load Only)																					

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Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	255	255	255	273	273	273	274	274	274	275	275	275	424	424	424	425	425	425
			Member Label	23N-21N	23N-21N	23N-21N	21N-43N	21N-43N	21N-43N	43N-44N	43N-44N	43N-44N	44N-24N	44N-24N	44N-24N	22N-42N	22N-42N	22N-42N	42N-41N	42N-41N	42N-41N
			Station (m)	0.0	3.3	6.6	0.0	0.6	1.2	0.0	2.6	5.2	0.0	0.3	0.5	0.0	0.6	1.3	0.0	4.2	8.3
			Node Label at Station	23N	---	21N	21N	---	43N	43N	---	44N	44N	---	24N	22N	---	42N	42N	---	41N
Load Combination			Section #	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16
			Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.35	0.35	0.43	0.55	0.55	0.55	0.53	0.51	0.56	0.57	0.57	0.60	0.54	0.54	0.55	0.54	0.58	0.68
2	Live	CL2	Highest Ratio	0.35	0.35	0.42	0.55	0.55	0.55	0.53	0.51	0.55	0.57	0.57	0.60	0.54	0.53	0.55	0.53	0.57	0.67
3	Live	CL3	Highest Ratio	0.35	0.34	0.42	0.54	0.54	0.55	0.53	0.50	0.55	0.57	0.57	0.60	0.53	0.52	0.54	0.52	0.57	0.67
4	@ 0˚	ULS B1	Highest Ratio	0.41	0.39	0.48	0.64	0.64	0.64	0.62	0.60	0.67	0.68	0.68	0.72	0.61	0.59	0.60	0.59	0.65	0.79
5	@ 0˚	ULS B2	Highest Ratio	0.42	0.46	0.59	0.72	0.74	0.77	0.73	0.66	0.68	0.70	0.69	0.73	0.65	0.62	0.62	0.61	0.69	0.83
6	@ 0˚	ULS B3	Highest Ratio	0.42	0.47	0.62	0.73	0.76	0.79	0.76	0.67	0.69	0.70	0.69	0.74	0.65	0.62	0.62	0.61	0.70	0.84
7	@ 0˚	ULS B4	Highest Ratio	0.43	0.48	0.65	0.74	0.78	0.82	0.81	0.69	0.70	0.74	0.75	0.80	0.65	0.63	0.63	0.62	0.69	0.83
8	@ 21˚	ULS B1	Highest Ratio	0.38	0.37	0.46	0.66	0.65	0.65	0.63	0.56	0.68	0.70	0.70	0.74	0.72	0.70	0.72	0.70	0.79	0.94
9	@ 21˚	ULS B2	Highest Ratio	0.40	0.43	0.57	0.73	0.75	0.76	0.73	0.62	0.70	0.71	0.71	0.75	0.78	0.75	0.76	0.74	0.85	0.99
10	@ 21˚	ULS B3	Highest Ratio	0.40	0.45	0.60	0.75	0.77	0.78	0.75	0.63	0.71	0.72	0.71	0.75	0.80	0.76	0.77	0.76	0.86	1.00
11	@ 21˚	ULS B4	Highest Ratio	0.41	0.46	0.63	0.76	0.79	0.82	0.81	0.65	0.72	0.75	0.76	0.82	0.77	0.75	0.76	0.74	0.84	1.00
12	@ 42˚	ULS B1	Highest Ratio	0.31	0.29	0.38	0.60	0.58	0.57	0.55	0.46	0.61	0.62	0.62	0.66	0.71	0.69	0.68	0.66	0.78	0.91
13	@ 42˚	ULS B2	Highest Ratio	0.32	0.35	0.48	0.66	0.66	0.67	0.64	0.51	0.63	0.64	0.63	0.67	0.80	0.76	0.75	0.74	0.85	0.97
14	@ 42˚	ULS B3	Highest Ratio	0.33	0.37	0.50	0.67	0.68	0.69	0.67	0.52	0.63	0.64	0.63	0.67	0.82	0.78	0.76	0.75	0.86	0.98
15	@ 42˚	ULS B4	Highest Ratio	0.34	0.38	0.54	0.70	0.72	0.74	0.73	0.56	0.65	0.68	0.68	0.73	0.78	0.75	0.75	0.73	0.85	0.98
16	@ 63˚	ULS B1	Highest Ratio	0.19	0.17	0.24	0.46	0.44	0.42	0.41	0.31	0.45	0.46	0.47	0.49	0.54	0.51	0.50	0.48	0.58	0.67
17	@ 63˚	ULS B2	Highest Ratio	0.21	0.22	0.32	0.49	0.50	0.50	0.48	0.35	0.47	0.48	0.48	0.51	0.63	0.60	0.58	0.57	0.66	0.75
18	@ 63˚	ULS B3	Highest Ratio	0.21	0.23	0.34	0.50	0.51	0.52	0.50	0.36	0.48	0.48	0.48	0.51	0.66	0.62	0.60	0.59	0.68	0.76
19	@ 63˚	ULS B4	Highest Ratio	0.22	0.25	0.39	0.55	0.57	0.58	0.57	0.40	0.50	0.52	0.53	0.56	0.63	0.60	0.59	0.58	0.68	0.78
20	@ 84˚	ULS B1	Highest Ratio	0.14	0.08	0.16	0.28	0.25	0.23	0.22	0.13	0.25	0.25	0.27	0.28	0.10	0.08	0.06	0.06	0.08	0.12
21	@ 84˚	ULS B2	Highest Ratio	0.15	0.10	0.19	0.34	0.28	0.26	0.25	0.14	0.26	0.27	0.28	0.30	0.18	0.16	0.14	0.14	0.16	0.20
22	@ 84˚	ULS B3	Highest Ratio	0.16	0.11	0.19	0.35	0.29	0.26	0.25	0.15	0.27	0.27	0.28	0.31	0.19	0.17	0.15	0.15	0.18	0.22
23	@ 84˚	ULS B4	Highest Ratio	0.17	0.15	0.27	0.35	0.35	0.34	0.34	0.19	0.30	0.31	0.33	0.36	0.25	0.22	0.21	0.20	0.23	0.28
Maximum Highest Ratio (Overall)				0.43	0.48	0.65	0.76	0.79	0.82	0.81	0.69	0.72	0.75	0.76	0.82	0.82	0.78	0.77	0.76	0.86	1.00
Governing Load Combination per Member per Station (Overall)				ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 21˚	ULS B4 @ 21˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 21˚	ULS B4 @ 21˚	ULS B4 @ 21˚	ULS B4 @ 21˚	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 21˚	ULS B3 @ 21˚	ULS B3 @ 42˚	ULS B3 @ 21˚
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.35	0.35	0.43	0.55	0.55	0.55	0.53	0.51	0.56	0.57	0.57	0.60	0.54	0.54	0.55	0.54	0.58	0.68
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.43	0.48	0.65	0.76	0.79	0.82	0.81	0.69	0.72	0.75	0.76	0.82	0.82	0.78	0.77	0.76	0.86	1.00
Governing Load Combination per Member per Station (Movable Load Only)				ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)																					

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Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	426	426	426	583	583	583	601	601	601	602	602	602	603	603	603	604	604	604
			Member Label	41N-21N	41N-21N	41N-21N	23S-21S	23S-21S	23S-21S	22S-42S	22S-42S	22S-42S	42S-41S	42S-41S	42S-41S	41S-21S	41S-21S	41S-21S	21S-43S	21S-43S	21S-43S
			Station (m)	0.0	0.5	0.9	0.0	3.3	6.6	0.0	0.6	1.3	0.0	4.2	8.3	0.0	0.5	0.9	0.0	0.6	1.2
			Node Label at Station	41N	---	21N	23S	---	21S	22S	---	42S	42S	---	41S	41S	---	21S	21S	---	43S
Load Combination			Section #	Section 16	Section 16	Section 16	Section 17	Section 17	Section 17	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 17	Section 17	Section 17
			Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.69	0.70	0.72	0.35	0.36	0.44	0.54	0.55	0.57	0.55	0.59	0.68	0.69	0.71	0.73	0.56	0.56	0.56
2	Live	CL2	Highest Ratio	0.69	0.70	0.72	0.35	0.35	0.43	0.53	0.55	0.56	0.55	0.58	0.68	0.69	0.70	0.73	0.56	0.56	0.56
3	Live	CL3	Highest Ratio	0.68	0.69	0.71	0.35	0.35	0.43	0.53	0.54	0.55	0.54	0.58	0.67	0.69	0.70	0.72	0.55	0.55	0.56
4	@ 0˚	ULS B1	Highest Ratio	0.81	0.82	0.84	0.42	0.41	0.51	0.62	0.63	0.65	0.63	0.68	0.80	0.82	0.84	0.87	0.66	0.66	0.66
5	@ 0˚	ULS B2	Highest Ratio	0.86	0.86	0.87	0.42	0.48	0.62	0.66	0.66	0.66	0.65	0.72	0.84	0.87	0.88	0.90	0.74	0.76	0.79
6	@ 0˚	ULS B3	Highest Ratio	0.87	0.87	0.88	0.42	0.49	0.64	0.67	0.66	0.66	0.66	0.73	0.85	0.89	0.89	0.91	0.75	0.79	0.82
7	@ 0˚	ULS B4	Highest Ratio	0.85	0.86	0.88	0.43	0.50	0.68	0.66	0.67	0.68	0.66	0.72	0.85	0.86	0.88	0.91	0.75	0.80	0.85
8	@ 21˚	ULS B1	Highest Ratio	0.96	0.98	0.99	0.39	0.39	0.49	0.73	0.75	0.77	0.75	0.83	0.96	0.98	0.99	1.02	0.66	0.66	0.67
9	@ 21˚	ULS B2	Highest Ratio	1.02	1.02	1.02	0.40	0.45	0.60	0.80	0.80	0.81	0.80	0.89	1.01	1.04	1.04	1.06	0.73	0.76	0.78
10	@ 21˚	ULS B3	Highest Ratio	1.03	1.03	1.03	0.40	0.47	0.62	0.81	0.81	0.82	0.81	0.90	1.02	1.05	1.05	1.07	0.75	0.78	0.81
11	@ 21˚	ULS B4	Highest Ratio	1.02	1.03	1.04	0.41	0.48	0.66	0.78	0.79	0.82	0.80	0.88	1.02	1.04	1.05	1.08	0.75	0.80	0.84
12	@ 42˚	ULS B1	Highest Ratio	0.93	0.94	0.95	0.31	0.30	0.40	0.72	0.72	0.73	0.71	0.81	0.93	0.95	0.96	0.98	0.59	0.57	0.58
13	@ 42˚	ULS B2	Highest Ratio	1.00	1.00	1.00	0.33	0.37	0.50	0.81	0.80	0.80	0.79	0.89	0.99	1.02	1.02	1.03	0.65	0.66	0.68
14	@ 42˚	ULS B3	Highest Ratio	1.01	1.01	1.01	0.34	0.38	0.53	0.83	0.82	0.82	0.81	0.90	1.01	1.04	1.03	1.04	0.66	0.68	0.71
15	@ 42˚	ULS B4	Highest Ratio	1.01	1.02	1.03	0.34	0.40	0.56	0.79	0.79	0.80	0.78	0.88	1.01	1.03	1.04	1.06	0.69	0.71	0.75
16	@ 63˚	ULS B1	Highest Ratio	0.69	0.69	0.69	0.20	0.17	0.25	0.55	0.54	0.53	0.51	0.60	0.69	0.70	0.71	0.71	0.45	0.44	0.42
17	@ 63˚	ULS B2	Highest Ratio	0.76	0.76	0.76	0.22	0.23	0.34	0.65	0.63	0.62	0.61	0.69	0.77	0.79	0.78	0.78	0.49	0.50	0.50
18	@ 63˚	ULS B3	Highest Ratio	0.78	0.78	0.78	0.22	0.24	0.36	0.67	0.65	0.64	0.63	0.72	0.79	0.81	0.80	0.80	0.50	0.51	0.52
19	@ 63˚	ULS B4	Highest Ratio	0.80	0.81	0.82	0.23	0.26	0.40	0.63	0.63	0.63	0.61	0.71	0.80	0.82	0.82	0.83	0.55	0.56	0.58
20	@ 84˚	ULS B1	Highest Ratio	0.12	0.12	0.12	0.14	0.08	0.15	0.09	0.07	0.05	0.05	0.08	0.12	0.12	0.12	0.12	0.28	0.25	0.23
21	@ 84˚	ULS B2	Highest Ratio	0.20	0.20	0.20	0.15	0.10	0.18	0.17	0.15	0.13	0.13	0.17	0.21	0.21	0.21	0.21	0.34	0.28	0.26
22	@ 84˚	ULS B3	Highest Ratio	0.22	0.22	0.22	0.16	0.11	0.19	0.20	0.17	0.16	0.15	0.19	0.23	0.23	0.23	0.23	0.35	0.29	0.26
23	@ 84˚	ULS B4	Highest Ratio	0.28	0.30	0.31	0.17	0.14	0.26	0.26	0.22	0.21	0.21	0.24	0.29	0.29	0.30	0.31	0.35	0.35	0.35
			Maximum Highest Ratio (Overall)	1.03	1.03	1.04	0.43	0.50	0.68	0.83	0.82	0.82	0.81	0.90	1.02	1.05	1.05	1.08	0.75	0.80	0.85
			Governing Load Combination per Member per Station (Overall)	ULS B3 @ 21˚	ULS B3 @ 21˚	ULS B4 @ 21˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 21˚	ULS B3 @ 21˚	ULS B3 @ 42˚	ULS B3 @ 21˚	ULS B3 @ 21˚	ULS B3 @ 21˚	ULS B4 @ 21˚	ULS B4 @ 21˚	ULS B4 @ 21˚	ULS B4 @ 0˚
			Governing Member of the Element Group (Overall)															Governing (Overall)			
			Maximum Highest Ratio (Live Load Only)	0.69	0.70	0.72	0.35	0.36	0.44	0.54	0.55	0.57	0.55	0.59	0.68	0.69	0.71	0.73	0.56	0.56	0.56
			Governing Load Combination per Member per Station (Live Load Only)	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
			Governing Member of the Element Group (Live Load Only)															Governing (Live L.)			
			Maximum Highest Ratio (Movable L. Only)	1.03	1.03	1.04	0.43	0.50	0.68	0.83	0.82	0.82	0.81	0.90	1.02	1.05	1.05	1.08	0.75	0.80	0.85
			Governing Load Combination per Member per Station (Movable Load Only)	ULS B3	ULS B3	ULS B4	ULS B4	ULS B4	ULS B4	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B4	ULS B4	ULS B4	ULS B4
			Governing Member of the Element Group (Movable Load Only)															Governing (Movable L.)			

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Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	605	605	605	606	606	606	31	31	31	207	207	207	276	276	276	277	277	277
			Member Label	43S-44S	43S-44S	43S-44S	44S-24S	44S-24S	44S-24S	27N-25N	27N-25N	27N-25N	27S-25S	27S-25S	27S-25S	26N-27N	26N-27N	26N-27N	27N-50N	27N-50N	27N-50N
			Station (m)	0.0	2.6	5.2	0.0	0.3	0.5	0.0	1.8	3.6	0.0	1.8	3.6	0.0	2.0	3.9	0.0	2.7	5.5
			Node Label at Station	43S	---	44S	44S	---	24S	27N	---	25N	27S	---	25S	26N	---	27N	27N	---	50N
Load Combination			Section #	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 19	Section 19	Section 19	Section 19	Section 19	Section 19	Section 26	Section 26	Section 26	Section 21	Section 21	Section 21
			Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.54	0.51	0.56	0.57	0.58	0.60	0.26	0.26	0.27	0.26	0.26	0.26	0.29	0.26	0.31	0.29	0.27	0.34
2	Live	CL2	Highest Ratio	0.54	0.51	0.55	0.57	0.57	0.60	0.26	0.26	0.26	0.26	0.26	0.26	0.29	0.26	0.30	0.28	0.26	0.34
3	Live	CL3	Highest Ratio	0.54	0.51	0.55	0.57	0.57	0.60	0.26	0.26	0.26	0.26	0.26	0.26	0.28	0.26	0.30	0.28	0.26	0.33
4	@ 0˚	ULS B1	Highest Ratio	0.64	0.61	0.67	0.69	0.69	0.72	0.31	0.31	0.31	0.30	0.30	0.30	0.32	0.29	0.33	0.30	0.28	0.38
5	@ 0˚	ULS B2	Highest Ratio	0.76	0.67	0.69	0.71	0.70	0.74	0.32	0.32	0.32	0.31	0.31	0.31	0.35	0.32	0.41	0.37	0.32	0.41
6	@ 0˚	ULS B3	Highest Ratio	0.78	0.69	0.69	0.71	0.70	0.74	0.32	0.32	0.32	0.31	0.31	0.31	0.36	0.33	0.43	0.39	0.33	0.42
7	@ 0˚	ULS B4	Highest Ratio	0.84	0.71	0.71	0.75	0.75	0.81	0.35	0.35	0.36	0.34	0.35	0.35	0.37	0.38	0.48	0.46	0.38	0.45
8	@ 21˚	ULS B1	Highest Ratio	0.65	0.58	0.68	0.70	0.71	0.74	0.46	0.48	0.46	0.45	0.47	0.45	0.17	0.18	0.34	0.23	0.08	0.16
9	@ 21˚	ULS B2	Highest Ratio	0.75	0.63	0.71	0.72	0.71	0.75	0.46	0.49	0.47	0.46	0.48	0.46	0.20	0.22	0.42	0.30	0.11	0.21
10	@ 21˚	ULS B3	Highest Ratio	0.77	0.65	0.71	0.72	0.72	0.76	0.47	0.49	0.47	0.46	0.48	0.46	0.20	0.22	0.43	0.31	0.12	0.22
11	@ 21˚	ULS B4	Highest Ratio	0.83	0.67	0.72	0.76	0.76	0.82	0.50	0.54	0.51	0.49	0.53	0.50	0.23	0.28	0.50	0.38	0.17	0.25
12	@ 42˚	ULS B1	Highest Ratio	0.56	0.47	0.61	0.63	0.62	0.66	0.55	0.60	0.55	0.54	0.59	0.54	0.22	0.27	0.53	0.61	0.40	0.41
13	@ 42˚	ULS B2	Highest Ratio	0.66	0.52	0.63	0.64	0.64	0.68	0.55	0.60	0.56	0.55	0.60	0.55	0.23	0.30	0.59	0.67	0.42	0.46
14	@ 42˚	ULS B3	Highest Ratio	0.68	0.54	0.64	0.64	0.64	0.68	0.56	0.60	0.56	0.55	0.60	0.55	0.24	0.31	0.60	0.69	0.42	0.48
15	@ 42˚	ULS B4	Highest Ratio	0.74	0.57	0.65	0.68	0.68	0.73	0.59	0.64	0.59	0.59	0.63	0.59	0.27	0.37	0.68	0.77	0.49	0.51
16	@ 63˚	ULS B1	Highest Ratio	0.41	0.32	0.46	0.47	0.47	0.49	0.57	0.64	0.57	0.56	0.63	0.56	0.41	0.48	0.80	0.92	0.66	0.61
17	@ 63˚	ULS B2	Highest Ratio	0.49	0.36	0.48	0.48	0.48	0.51	0.58	0.65	0.58	0.57	0.64	0.57	0.42	0.52	0.85	0.97	0.69	0.67
18	@ 63˚	ULS B3	Highest Ratio	0.50	0.37	0.49	0.49	0.48	0.51	0.58	0.65	0.58	0.57	0.65	0.58	0.43	0.53	0.87	0.98	0.70	0.68
19	@ 63˚	ULS B4	Highest Ratio	0.57	0.40	0.50	0.52	0.53	0.57	0.61	0.68	0.61	0.61	0.68	0.61	0.45	0.59	0.97	1.09	0.75	0.72
20	@ 84˚	ULS B1	Highest Ratio	0.22	0.13	0.25	0.25	0.27	0.28	0.51	0.58	0.51	0.51	0.58	0.51	0.54	0.64	0.98	1.10	0.84	0.73
21	@ 84˚	ULS B2	Highest Ratio	0.25	0.15	0.27	0.27	0.28	0.30	0.52	0.59	0.52	0.52	0.59	0.52	0.55	0.67	1.02	1.15	0.87	0.79
22	@ 84˚	ULS B3	Highest Ratio	0.25	0.15	0.27	0.27	0.28	0.31	0.52	0.59	0.52	0.52	0.59	0.52	0.56	0.68	1.03	1.16	0.88	0.80
23	@ 84˚	ULS B4	Highest Ratio	0.34	0.20	0.30	0.31	0.33	0.36	0.56	0.63	0.56	0.56	0.63	0.56	0.57	0.74	1.16	1.28	0.92	0.85
			Maximum Highest Ratio (Overall)	0.84	0.71	0.72	0.76	0.76	0.82	0.61	0.68	0.61	0.61	0.68	0.61	0.57	0.74	1.16	1.28	0.92	0.85
			Governing Load Combination per Member per Station (Overall)	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 21˚	ULS B4 @ 21˚	ULS B4 @ 21˚	ULS B4 @ 21˚	ULS B4 @ 63˚	ULS B4 @ 63˚	ULS B4 @ 63˚	ULS B4 @ 63˚	ULS B4 @ 63˚	ULS B4 @ 63˚	ULS B4 @ 84˚	ULS B4 @ 84˚	ULS B4 @ 84˚	ULS B4 @ 84˚	ULS B4 @ 84˚	ULS B4 @ 84˚
			Governing Member of the Element Group (Overall)								Governing (Overall)								Governing (Overall)		
			Maximum Highest Ratio (Live Load Only)	0.54	0.51	0.56	0.57	0.58	0.60	0.26	0.26	0.27	0.26	0.26	0.26	0.29	0.26	0.31	0.29	0.27	0.34
			Governing Load Combination per Member per Station (Live Load Only)	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
			Governing Member of the Element Group (Live Load Only)									Governing (Live L.)									
			Maximum Highest Ratio (Movable L. Only)	0.84	0.71	0.72	0.76	0.76	0.82	0.61	0.68	0.61	0.61	0.68	0.61	0.57	0.74	1.16	1.28	0.92	0.85
			Governing Load Combination per Member per Station (Movable Load Only)	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4
			Governing Member of the Element Group (Movable Load Only)								Governing (Movable L.)								Governing (Movable L.)		

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Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	278	278	278	607	607	607	608	608	608	609	609	609	256	256	256	257	257	257
			Member Label	50N-21N	50N-21N	50N-21N	26S-27S	26S-27S	26S-27S	27S-50S	27S-50S	27S-50S	50S-21S	50S-21S	50S-21S	21N-38N	21N-38N	21N-38N	38N-31N	38N-31N	38N-31N
			Station (m)	0.0	0.5	1.0	0.0	2.0	3.9	0.0	2.7	5.5	0.0	0.5	1.0	0.0	1.2	2.4	0.0	0.8	1.6
			Node Label at Station	50N	---	21N	26S	---	27S	27S	---	50S	50S	---	21S	21N	---	38N	38N	---	31N
Load Combination			Section #	Section 21	Section 21	Section 21	Section 26	Section 26	Section 26	Section 21	Section 21	Section 21	Section 21	Section 21	Section 21	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20
			Element Group	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.34	0.37	0.39	0.29	0.26	0.30	0.29	0.27	0.34	0.34	0.37	0.40	0.42	0.43	0.46	0.46	0.47	0.47
2	Live	CL2	Highest Ratio	0.34	0.36	0.39	0.29	0.26	0.30	0.28	0.27	0.34	0.34	0.37	0.39	0.41	0.43	0.46	0.46	0.46	0.47
3	Live	CL3	Highest Ratio	0.34	0.36	0.38	0.29	0.25	0.29	0.28	0.26	0.33	0.34	0.36	0.39	0.41	0.42	0.45	0.46	0.46	0.46
4	@ 0˚	ULS B1	Highest Ratio	0.38	0.41	0.44	0.34	0.29	0.32	0.30	0.30	0.39	0.40	0.42	0.45	0.47	0.50	0.53	0.54	0.54	0.55
5	@ 0˚	ULS B2	Highest Ratio	0.42	0.46	0.50	0.37	0.32	0.40	0.37	0.34	0.43	0.43	0.47	0.51	0.64	0.52	0.70	0.71	0.58	0.75
6	@ 0˚	ULS B3	Highest Ratio	0.43	0.47	0.51	0.38	0.33	0.42	0.39	0.34	0.43	0.44	0.48	0.52	0.68	0.52	0.73	0.75	0.59	0.79
7	@ 0˚	ULS B4	Highest Ratio	0.47	0.53	0.59	0.39	0.38	0.47	0.45	0.40	0.47	0.48	0.54	0.60	0.77	0.58	0.79	0.78	0.60	0.81
8	@ 21˚	ULS B1	Highest Ratio	0.16	0.20	0.24	0.19	0.18	0.33	0.21	0.06	0.15	0.15	0.19	0.22	0.48	0.50	0.52	0.53	0.53	0.53
9	@ 21˚	ULS B2	Highest Ratio	0.21	0.26	0.32	0.21	0.21	0.41	0.27	0.09	0.20	0.20	0.25	0.30	0.66	0.53	0.68	0.69	0.58	0.74
10	@ 21˚	ULS B3	Highest Ratio	0.22	0.28	0.34	0.22	0.22	0.43	0.29	0.10	0.21	0.21	0.26	0.32	0.70	0.53	0.71	0.73	0.59	0.79
11	@ 21˚	ULS B4	Highest Ratio	0.25	0.33	0.41	0.24	0.28	0.49	0.36	0.15	0.24	0.24	0.32	0.39	0.82	0.62	0.77	0.76	0.62	0.82
12	@ 42˚	ULS B1	Highest Ratio	0.41	0.46	0.52	0.22	0.25	0.51	0.60	0.39	0.40	0.41	0.45	0.50	0.49	0.50	0.51	0.52	0.51	0.51
13	@ 42˚	ULS B2	Highest Ratio	0.47	0.53	0.60	0.23	0.29	0.57	0.66	0.41	0.46	0.46	0.52	0.58	0.70	0.54	0.66	0.67	0.57	0.74
14	@ 42˚	ULS B3	Highest Ratio	0.48	0.55	0.62	0.24	0.30	0.59	0.67	0.42	0.47	0.48	0.54	0.60	0.74	0.56	0.69	0.71	0.59	0.79
15	@ 42˚	ULS B4	Highest Ratio	0.52	0.61	0.70	0.27	0.36	0.67	0.76	0.48	0.50	0.52	0.59	0.68	0.86	0.66	0.73	0.72	0.63	0.81
16	@ 63˚	ULS B1	Highest Ratio	0.61	0.67	0.73	0.40	0.48	0.79	0.91	0.66	0.60	0.61	0.66	0.72	0.49	0.49	0.49	0.50	0.49	0.48
17	@ 63˚	ULS B2	Highest Ratio	0.68	0.75	0.82	0.42	0.51	0.85	0.96	0.69	0.66	0.67	0.74	0.81	0.74	0.56	0.63	0.64	0.57	0.73
18	@ 63˚	ULS B3	Highest Ratio	0.69	0.76	0.84	0.43	0.52	0.86	0.97	0.69	0.68	0.69	0.75	0.83	0.80	0.58	0.67	0.68	0.58	0.79
19	@ 63˚	ULS B4	Highest Ratio	0.74	0.83	0.93	0.45	0.58	0.97	1.08	0.75	0.71	0.73	0.82	0.92	0.89	0.68	0.67	0.66	0.63	0.79
20	@ 84˚	ULS B1	Highest Ratio	0.73	0.79	0.84	0.54	0.63	0.97	1.10	0.84	0.72	0.73	0.78	0.84	0.48	0.50	0.52	0.52	0.53	0.53
21	@ 84˚	ULS B2	Highest Ratio	0.80	0.87	0.93	0.55	0.67	1.02	1.14	0.87	0.79	0.80	0.86	0.93	0.80	0.61	0.66	0.66	0.62	0.82
22	@ 84˚	ULS B3	Highest Ratio	0.81	0.88	0.95	0.56	0.67	1.03	1.15	0.88	0.80	0.81	0.88	0.95	0.88	0.63	0.69	0.70	0.64	0.89
23	@ 84˚	ULS B4	Highest Ratio	0.87	0.96	1.06	0.57	0.74	1.15	1.27	0.92	0.85	0.87	0.96	1.05	0.89	0.70	0.67	0.66	0.67	0.85
			Maximum Highest Ratio (Overall)	0.87	0.96	1.06	0.57	0.74	1.15	1.27	0.92	0.85	0.87	0.96	1.05	0.89	0.70	0.79	0.78	0.67	0.89
			Governing Load Combination per Member per Station (Overall)	ULS B4 @ 84˚	ULS B4 @ 84˚	ULS B4 @ 84˚	ULS B4 @ 84˚	ULS B4 @ 84˚	ULS B4 @ 84˚	ULS B4 @ 84˚	ULS B4 @ 84˚	ULS B4 @ 84˚	ULS B4 @ 84˚	ULS B4 @ 84˚	ULS B4 @ 84˚	ULS B4 @ 84˚	ULS B4 @ 84˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 84˚	ULS B3 @ 84˚
			Governing Member of the Element Group (Overall)																		
			Maximum Highest Ratio (Live Load Only)	0.34	0.37	0.39	0.29	0.26	0.30	0.29	0.27	0.34	0.34	0.37	0.40	0.42	0.43	0.46	0.46	0.47	0.47
			Governing Load Combination per Member per Station (Live Load Only)	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
			Governing Member of the Element Group (Live Load Only)												Governing (Live L.)						
			Maximum Highest Ratio (Movable L. Only)	0.87	0.96	1.06	0.57	0.74	1.15	1.27	0.92	0.85	0.87	0.96	1.05	0.89	0.70	0.79	0.78	0.67	0.89
			Governing Load Combination per Member per Station (Movable Load Only)	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B3
			Governing Member of the Element Group (Movable Load Only)																		

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	258	258	258	259	259	259	260	260	260	584	584	584	585	585	585	586	586	586
			Member Label	31N-51N	31N-51N	31N-51N	51N-20N	51N-20N	51N-20N	20N-19N	20N-19N	20N-19N	21S-38S	21S-38S	21S-38S	38S-31S	38S-31S	38S-31S	31S-51S	31S-51S	31S-51S
			Station (m)	0.0	0.6	1.2	0.0	0.1	0.3	0.0	2.7	5.5	0.0	1.2	2.4	0.0	0.8	1.6	0.0	0.6	1.2
			Node Label at Station	31N	---	51N	51N	---	20N	20N	---	19N	21S	---	38S	38S	---	31S	31S	---	51S
Load Combination			Section #	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20
			Element Group	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.46	0.46	0.46	0.49	0.48	0.48	0.58	0.60	0.61	0.43	0.44	0.47	0.48	0.47	0.47	0.46	0.47	0.48
2	Live	CL2	Highest Ratio	0.46	0.45	0.46	0.48	0.48	0.47	0.58	0.59	0.61	0.43	0.43	0.47	0.47	0.47	0.47	0.45	0.47	0.48
3	Live	CL3	Highest Ratio	0.45	0.44	0.45	0.47	0.47	0.46	0.57	0.58	0.59	0.42	0.43	0.46	0.47	0.46	0.46	0.45	0.46	0.47
4	@ 0˚	ULS B1	Highest Ratio	0.53	0.54	0.55	0.57	0.57	0.57	0.71	0.66	0.74	0.50	0.50	0.56	0.56	0.55	0.55	0.54	0.56	0.58
5	@ 0˚	ULS B2	Highest Ratio	0.73	0.85	0.97	1.02	1.00	0.98	1.19	0.80	1.44	0.67	0.52	0.72	0.74	0.60	0.75	0.74	0.87	1.00
6	@ 0˚	ULS B3	Highest Ratio	0.78	0.92	1.06	1.13	1.10	1.07	1.30	0.84	1.60	0.70	0.53	0.76	0.78	0.61	0.80	0.78	0.94	1.10
7	@ 0˚	ULS B4	Highest Ratio	0.79	0.93	1.07	1.10	1.07	1.04	1.27	0.81	1.51	0.80	0.59	0.82	0.81	0.61	0.81	0.79	0.94	1.10
8	@ 21˚	ULS B1	Highest Ratio	0.52	0.52	0.53	0.56	0.56	0.56	0.69	0.65	0.74	0.48	0.50	0.55	0.55	0.54	0.54	0.52	0.54	0.56
9	@ 21˚	ULS B2	Highest Ratio	0.73	0.84	0.97	1.02	1.00	0.98	1.19	0.79	1.45	0.66	0.53	0.70	0.72	0.59	0.74	0.73	0.86	1.00
10	@ 21˚	ULS B3	Highest Ratio	0.77	0.92	1.07	1.13	1.10	1.08	1.31	0.82	1.62	0.71	0.53	0.74	0.76	0.60	0.79	0.78	0.94	1.10
11	@ 21˚	ULS B4	Highest Ratio	0.80	0.93	1.07	1.10	1.07	1.04	1.26	0.81	1.52	0.82	0.63	0.79	0.78	0.63	0.82	0.80	0.95	1.10
12	@ 42˚	ULS B1	Highest Ratio	0.50	0.50	0.51	0.53	0.54	0.54	0.67	0.64	0.72	0.47	0.50	0.53	0.53	0.52	0.52	0.50	0.52	0.54
13	@ 42˚	ULS B2	Highest Ratio	0.72	0.86	1.01	1.06	1.05	1.04	1.27	0.78	1.52	0.68	0.54	0.67	0.69	0.58	0.74	0.72	0.87	1.04
14	@ 42˚	ULS B3	Highest Ratio	0.77	0.94	1.12	1.18	1.17	1.16	1.41	0.81	1.71	0.73	0.55	0.70	0.72	0.59	0.79	0.78	0.96	1.15
15	@ 42˚	ULS B4	Highest Ratio	0.80	0.92	1.04	1.07	1.05	1.03	1.24	0.80	1.50	0.85	0.66	0.75	0.73	0.64	0.82	0.80	0.94	1.08
16	@ 63˚	ULS B1	Highest Ratio	0.47	0.48	0.50	0.53	0.53	0.54	0.66	0.62	0.68	0.48	0.49	0.50	0.51	0.49	0.49	0.48	0.49	0.53
17	@ 63˚	ULS B2	Highest Ratio	0.72	0.89	1.09	1.15	1.14	1.14	1.40	0.78	1.62	0.73	0.56	0.64	0.65	0.57	0.73	0.72	0.90	1.12
18	@ 63˚	ULS B3	Highest Ratio	0.78	0.99	1.23	1.29	1.28	1.27	1.57	0.82	1.84	0.78	0.58	0.67	0.68	0.58	0.79	0.77	1.00	1.25
19	@ 63˚	ULS B4	Highest Ratio	0.78	0.90	1.03	1.06	1.04	1.02	1.22	0.78	1.46	0.88	0.68	0.68	0.67	0.63	0.79	0.78	0.91	1.06
20	@ 84˚	ULS B1	Highest Ratio	0.52	0.52	0.52	0.54	0.54	0.54	0.66	0.61	0.62	0.48	0.50	0.52	0.52	0.52	0.53	0.53	0.53	0.53
21	@ 84˚	ULS B2	Highest Ratio	0.81	1.01	1.21	1.28	1.26	1.25	1.54	0.81	1.72	0.79	0.60	0.66	0.66	0.62	0.82	0.81	1.01	1.22
22	@ 84˚	ULS B3	Highest Ratio	0.88	1.12	1.37	1.44	1.43	1.41	1.74	0.85	1.97	0.87	0.63	0.69	0.70	0.64	0.89	0.88	1.12	1.39
23	@ 84˚	ULS B4	Highest Ratio	0.84	0.94	1.04	1.07	1.04	1.01	1.21	0.77	1.40	0.89	0.70	0.67	0.66	0.67	0.85	0.84	0.94	1.05
Maximum Highest Ratio (Overall)				0.88	1.12	1.37	1.44	1.43	1.41	1.74	0.85	1.97	0.89	0.70	0.82	0.81	0.67	0.89	0.88	1.12	1.39
Governing Load Combination per Member per Station (Overall)				ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B4 @ 84˚	ULS B4 @ 84˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.46	0.46	0.46	0.49	0.48	0.48	0.58	0.60	0.61	0.43	0.44	0.47	0.48	0.47	0.47	0.46	0.47	0.48
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.88	1.12	1.37	1.44	1.43	1.41	1.74	0.85	1.97	0.89	0.70	0.82	0.81	0.67	0.89	0.88	1.12	1.39
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)																					

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	587	587	587	588	588	588	262	262	262	263	263	263	264	264	264	265	265	265
			Member Label	51S-20S	51S-20S	51S-20S	20S-19S	20S-19S	20S-19S	21N-39N	21N-39N	21N-39N	39N-37N	39N-37N	39N-37N	37N-40N	37N-40N	37N-40N	40N-28N	40N-28N	40N-28N
			Station (m)	0.0	0.1	0.3	0.0	2.7	5.5	0.0	0.5	0.9	0.0	0.8	1.7	0.0	1.1	2.2	0.0	0.7	1.4
			Node Label at Station	51S	---	20S	20S	---	19S	21N	---	39N	39N	---	37N	37N	---	40N	40N	---	28N
Load Combination			Section #	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11
			Element Group	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.51	0.50	0.50	0.61	0.60	0.64	0.55	0.56	0.57	0.55	0.57	0.61	0.58	0.56	0.58	0.59	0.57	0.55
2	Live	CL2	Highest Ratio	0.50	0.50	0.49	0.60	0.59	0.63	0.55	0.56	0.56	0.55	0.57	0.61	0.58	0.56	0.58	0.59	0.57	0.55
3	Live	CL3	Highest Ratio	0.49	0.49	0.48	0.59	0.58	0.61	0.54	0.55	0.56	0.54	0.56	0.60	0.58	0.55	0.57	0.58	0.56	0.55
4	@ 0˚	ULS B1	Highest Ratio	0.61	0.61	0.61	0.75	0.66	0.77	0.64	0.64	0.65	0.63	0.66	0.72	0.69	0.67	0.70	0.71	0.70	0.69
5	@ 0˚	ULS B2	Highest Ratio	1.06	1.04	1.02	1.24	0.81	1.47	0.73	0.75	0.77	0.74	0.73	0.76	0.72	0.74	0.82	0.84	0.81	0.79
6	@ 0˚	ULS B3	Highest Ratio	1.16	1.14	1.11	1.35	0.84	1.63	0.75	0.77	0.79	0.77	0.75	0.77	0.73	0.76	0.85	0.87	0.84	0.82
7	@ 0˚	ULS B4	Highest Ratio	1.14	1.11	1.08	1.31	0.81	1.54	0.89	0.92	0.96	0.94	0.89	0.87	0.84	0.83	0.91	0.94	0.90	0.89
8	@ 21˚	ULS B1	Highest Ratio	0.59	0.59	0.59	0.73	0.65	0.77	0.57	0.57	0.58	0.57	0.60	0.65	0.62	0.59	0.63	0.64	0.64	0.64
9	@ 21˚	ULS B2	Highest Ratio	1.06	1.04	1.02	1.24	0.80	1.48	0.70	0.71	0.73	0.71	0.69	0.69	0.66	0.67	0.75	0.77	0.75	0.75
10	@ 21˚	ULS B3	Highest Ratio	1.17	1.14	1.11	1.35	0.83	1.65	0.73	0.75	0.76	0.74	0.71	0.70	0.67	0.69	0.78	0.80	0.78	0.78
11	@ 21˚	ULS B4	Highest Ratio	1.13	1.10	1.07	1.30	0.81	1.55	0.82	0.85	0.89	0.87	0.82	0.80	0.77	0.76	0.85	0.87	0.84	0.84
12	@ 42˚	ULS B1	Highest Ratio	0.57	0.57	0.58	0.71	0.64	0.75	0.48	0.49	0.50	0.49	0.51	0.55	0.53	0.50	0.53	0.54	0.54	0.56
13	@ 42˚	ULS B2	Highest Ratio	1.10	1.08	1.07	1.31	0.78	1.55	0.64	0.65	0.67	0.65	0.63	0.62	0.60	0.61	0.68	0.69	0.71	0.75
14	@ 42˚	ULS B3	Highest Ratio	1.22	1.20	1.19	1.45	0.81	1.74	0.67	0.69	0.71	0.69	0.66	0.64	0.62	0.63	0.71	0.73	0.74	0.80
15	@ 42˚	ULS B4	Highest Ratio	1.11	1.08	1.06	1.28	0.80	1.53	0.70	0.73	0.77	0.75	0.72	0.70	0.67	0.67	0.74	0.76	0.73	0.75
16	@ 63˚	ULS B1	Highest Ratio	0.56	0.56	0.56	0.68	0.62	0.71	0.34	0.35	0.37	0.36	0.38	0.40	0.38	0.36	0.38	0.39	0.42	0.46
17	@ 63˚	ULS B2	Highest Ratio	1.17	1.17	1.16	1.43	0.78	1.64	0.52	0.53	0.55	0.54	0.52	0.52	0.51	0.51	0.60	0.62	0.71	0.83
18	@ 63˚	ULS B3	Highest Ratio	1.32	1.31	1.30	1.60	0.81	1.86	0.57	0.57	0.59	0.58	0.55	0.55	0.54	0.54	0.66	0.67	0.78	0.91
19	@ 63˚	ULS B4	Highest Ratio	1.09	1.06	1.04	1.25	0.78	1.48	0.52	0.55	0.59	0.57	0.56	0.55	0.53	0.54	0.59	0.60	0.62	0.65
20	@ 84˚	ULS B1	Highest Ratio	0.55	0.55	0.55	0.67	0.61	0.64	0.05	0.05	0.04	0.04	0.04	0.05	0.05	0.08	0.12	0.12	0.15	0.18
21	@ 84˚	ULS B2	Highest Ratio	1.29	1.27	1.26	1.55	0.80	1.74	0.26	0.22	0.20	0.20	0.20	0.21	0.21	0.25	0.40	0.39	0.54	0.68
22	@ 84˚	ULS B3	Highest Ratio	1.45	1.44	1.42	1.76	0.84	1.99	0.31	0.27	0.24	0.24	0.23	0.24	0.25	0.29	0.47	0.46	0.63	0.80
23	@ 84˚	ULS B4	Highest Ratio	1.08	1.05	1.02	1.22	0.76	1.41	0.23	0.22	0.23	0.23	0.23	0.27	0.26	0.30	0.39	0.39	0.42	0.44
			Maximum Highest Ratio (Overall)	1.45	1.44	1.42	1.76	0.84	1.99	0.89	0.92	0.96	0.94	0.89	0.87	0.84	0.83	0.91	0.94	0.90	0.91
			Governing Load Combination per Member per Station (Overall)	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 0˚	ULS B3 @ 84˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B3 @ 63˚
			Governing Member of the Element Group (Overall)						Governing (Overall)												
			Maximum Highest Ratio (Live Load Only)	0.51	0.50	0.50	0.61	0.60	0.64	0.55	0.56	0.57	0.55	0.57	0.61	0.58	0.56	0.58	0.59	0.57	0.55
			Governing Load Combination per Member per Station (Live Load Only)	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
			Governing Member of the Element Group (Live Load Only)						Governing (Live L.)												
			Maximum Highest Ratio (Movable L. Only)	1.45	1.44	1.42	1.76	0.84	1.99	0.89	0.92	0.96	0.94	0.89	0.87	0.84	0.83	0.91	0.94	0.90	0.91
			Governing Load Combination per Member per Station (Movable Load Only)	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B3
			Governing Member of the Element Group (Movable Load Only)						Governing (Movable L.)												

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Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	266	266	266	267	267	267	268	268	268	590	590	590	591	591	591	592	592	592
			Member Label	28N-52N	28N-52N	28N-52N	52N-17N	52N-17N	52N-17N	17N-15N	17N-15N	17N-15N	21S-39S	21S-39S	21S-39S	39S-37S	39S-37S	39S-37S	37S-40S	37S-40S	37S-40S
			Station (m)	0.0	0.2	0.4	0.0	0.9	1.8	0.0	4.2	8.4	0.0	0.5	0.9	0.0	0.8	1.7	0.0	1.1	2.2
			Node Label at Station	28N	---	52N	52N	---	17N	17N	---	15N	21S	---	39S	39S	---	37S	37S	---	40S
Load Combination			Section #	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11
			Element Group	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.47	0.49	0.58	0.72	0.61	0.56	0.71	0.71	0.82	0.55	0.55	0.56	0.54	0.57	0.61	0.58	0.56	0.58
2	Live	CL2	Highest Ratio	0.47	0.48	0.57	0.71	0.60	0.55	0.70	0.70	0.81	0.54	0.55	0.56	0.54	0.57	0.61	0.58	0.55	0.58
3	Live	CL3	Highest Ratio	0.47	0.48	0.56	0.71	0.60	0.54	0.69	0.69	0.79	0.54	0.54	0.55	0.54	0.57	0.60	0.58	0.55	0.58
4	@ 0˚	ULS B1	Highest Ratio	0.66	0.82	1.08	0.97	0.75	0.68	0.85	0.84	0.96	0.63	0.64	0.65	0.63	0.68	0.73	0.70	0.67	0.72
5	@ 0˚	ULS B2	Highest Ratio	0.76	0.92	1.20	1.34	1.08	1.14	1.47	1.06	1.95	0.73	0.74	0.76	0.74	0.75	0.77	0.74	0.75	0.84
6	@ 0˚	ULS B3	Highest Ratio	0.78	0.94	1.22	1.42	1.15	1.24	1.61	1.11	2.18	0.75	0.77	0.79	0.77	0.77	0.78	0.74	0.77	0.86
7	@ 0˚	ULS B4	Highest Ratio	0.84	0.99	1.26	1.31	1.08	1.02	1.30	1.07	1.54	0.89	0.92	0.95	0.93	0.91	0.88	0.85	0.84	0.93
8	@ 21˚	ULS B1	Highest Ratio	0.61	0.69	0.90	0.91	0.68	0.62	0.77	0.76	0.87	0.57	0.57	0.58	0.57	0.62	0.66	0.63	0.61	0.65
9	@ 21˚	ULS B2	Highest Ratio	0.73	0.83	1.10	1.31	1.02	1.08	1.39	0.99	1.84	0.70	0.71	0.73	0.72	0.71	0.70	0.68	0.69	0.77
10	@ 21˚	ULS B3	Highest Ratio	0.76	0.86	1.14	1.41	1.10	1.19	1.53	1.05	2.06	0.73	0.74	0.76	0.75	0.73	0.71	0.69	0.71	0.79
11	@ 21˚	ULS B4	Highest Ratio	0.80	0.85	1.08	1.24	1.01	0.96	1.22	0.97	1.42	0.82	0.85	0.88	0.87	0.84	0.81	0.78	0.78	0.86
12	@ 42˚	ULS B1	Highest Ratio	0.53	0.58	0.76	0.81	0.61	0.54	0.68	0.67	0.77	0.48	0.49	0.50	0.50	0.53	0.57	0.54	0.52	0.55
13	@ 42˚	ULS B2	Highest Ratio	0.78	0.89	1.26	1.40	1.03	1.02	1.31	0.92	1.64	0.64	0.66	0.67	0.66	0.65	0.64	0.62	0.62	0.70
14	@ 42˚	ULS B3	Highest Ratio	0.84	0.96	1.38	1.54	1.12	1.13	1.46	0.98	1.84	0.68	0.70	0.71	0.70	0.68	0.66	0.64	0.65	0.73
15	@ 42˚	ULS B4	Highest Ratio	0.71	0.74	0.94	1.13	0.93	0.87	1.12	0.86	1.28	0.70	0.74	0.77	0.77	0.74	0.72	0.69	0.69	0.75
16	@ 63˚	ULS B1	Highest Ratio	0.45	0.46	0.59	0.63	0.48	0.41	0.53	0.52	0.59	0.36	0.36	0.37	0.37	0.39	0.41	0.40	0.38	0.39
17	@ 63˚	ULS B2	Highest Ratio	0.91	0.90	1.37	1.50	0.98	0.92	1.18	0.77	1.28	0.55	0.55	0.55	0.55	0.54	0.53	0.53	0.53	0.62
18	@ 63˚	ULS B3	Highest Ratio	1.01	1.00	1.55	1.71	1.10	1.04	1.33	0.83	1.44	0.59	0.59	0.60	0.59	0.58	0.56	0.55	0.57	0.68
19	@ 63˚	ULS B4	Highest Ratio	0.63	0.63	0.79	0.95	0.79	0.75	0.97	0.70	1.07	0.54	0.56	0.59	0.59	0.58	0.57	0.55	0.55	0.61
20	@ 84˚	ULS B1	Highest Ratio	0.23	0.23	0.28	0.25	0.15	0.13	0.18	0.14	0.18	0.05	0.04	0.03	0.03	0.03	0.04	0.04	0.07	0.11
21	@ 84˚	ULS B2	Highest Ratio	0.84	0.76	1.19	1.34	0.74	0.66	0.84	0.39	0.65	0.27	0.23	0.20	0.20	0.20	0.21	0.21	0.27	0.41
22	@ 84˚	ULS B3	Highest Ratio	0.99	0.88	1.40	1.60	0.87	0.79	0.99	0.45	0.76	0.32	0.28	0.24	0.24	0.24	0.25	0.25	0.31	0.48
23	@ 84˚	ULS B4	Highest Ratio	0.49	0.47	0.56	0.63	0.53	0.53	0.70	0.40	0.70	0.24	0.23	0.24	0.24	0.24	0.27	0.27	0.31	0.39
Maximum Highest Ratio (Overall)				1.01	1.00	1.55	1.71	1.15	1.24	1.61	1.11	2.18	0.89	0.92	0.95	0.93	0.91	0.88	0.85	0.84	0.93
Governing Load Combination per Member per Station (Overall)				ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B4 @ 0˚
Governing Member of the Element Group (Overall)												Governing (Overall)									
Maximum Highest Ratio (Live Load Only)				0.47	0.49	0.58	0.72	0.61	0.56	0.71	0.71	0.82	0.55	0.55	0.56	0.54	0.57	0.61	0.58	0.56	0.58
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				1.01	1.00	1.55	1.71	1.15	1.24	1.61	1.11	2.18	0.89	0.92	0.95	0.93	0.91	0.88	0.85	0.84	0.93
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4	ULS B4
Governing Member of the Element Group (Movable Load Only)												Governing (Movable L.)									

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	593	593	593	594	594	594	595	595	595	596	596	596	253	253	253	254	254	254
			Member Label	40S-28S	40S-28S	40S-28S	28S-52S	28S-52S	28S-52S	52S-17S	52S-17S	52S-17S	17S-15S	17S-15S	17S-15S	15N-18N	15N-18N	15N-18N	18N-19N	18N-19N	18N-19N
			Station (m)	0.0	0.7	1.4	0.0	0.2	0.4	0.0	0.9	1.8	0.0	4.2	8.4	0.0	3.2	6.4	0.0	3.2	6.4
			Node Label at Station	40S	---	28S	28S	---	52S	52S	---	17S	17S	---	15S	15N	---	18N	18N	---	19N
Load Combination			Section #	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 12	Section 12	Section 12	Section 12	Section 12	Section 12
			Element Group	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	14 TowerT Horizontal	14 TowerT Horizontal	14 TowerT Horizontal	14 TowerT Horizontal	14 TowerT Horizontal	14 TowerT Horizontal
ID	Category	Name																				
1	Live	CL1	Highest Ratio	0.59	0.57	0.55	0.47	0.49	0.57	0.74	0.62	0.58	0.73	0.72	0.83	0.23	0.09	0.14	0.10	0.07	0.16
2	Live	CL2	Highest Ratio	0.59	0.57	0.55	0.47	0.48	0.57	0.73	0.62	0.57	0.72	0.71	0.83	0.22	0.09	0.14	0.10	0.07	0.16
3	Live	CL3	Highest Ratio	0.59	0.57	0.55	0.47	0.48	0.56	0.72	0.61	0.56	0.71	0.70	0.81	0.22	0.08	0.14	0.09	0.07	0.15
4	@ 0˚	ULS B1	Highest Ratio	0.73	0.71	0.70	0.67	0.84	1.09	1.00	0.78	0.70	0.88	0.87	0.95	0.28	0.11	0.20	0.14	0.09	0.20
5	@ 0˚	ULS B2	Highest Ratio	0.86	0.83	0.81	0.77	0.93	1.20	1.37	1.10	1.16	1.50	1.08	1.94	0.96	0.49	0.70	0.58	0.53	0.67
6	@ 0˚	ULS B3	Highest Ratio	0.88	0.85	0.83	0.79	0.95	1.23	1.45	1.18	1.27	1.65	1.13	2.17	1.13	0.59	0.82	0.70	0.64	0.80
7	@ 0˚	ULS B4	Highest Ratio	0.95	0.91	0.90	0.85	1.00	1.27	1.34	1.11	1.04	1.33	1.09	1.53	0.50	0.25	0.36	0.27	0.21	0.37
8	@ 21˚	ULS B1	Highest Ratio	0.66	0.65	0.66	0.63	0.71	0.93	0.94	0.71	0.63	0.79	0.78	0.86	0.28	0.10	0.18	0.12	0.08	0.20
9	@ 21˚	ULS B2	Highest Ratio	0.79	0.77	0.77	0.75	0.86	1.13	1.35	1.05	1.11	1.42	1.02	1.84	0.89	0.45	0.63	0.52	0.48	0.61
10	@ 21˚	ULS B3	Highest Ratio	0.82	0.80	0.79	0.78	0.89	1.18	1.44	1.13	1.22	1.57	1.07	2.07	1.06	0.54	0.73	0.62	0.59	0.72
11	@ 21˚	ULS B4	Highest Ratio	0.88	0.85	0.86	0.82	0.88	1.11	1.27	1.03	0.98	1.24	1.00	1.42	0.48	0.24	0.34	0.26	0.20	0.35
12	@ 42˚	ULS B1	Highest Ratio	0.56	0.55	0.58	0.54	0.60	0.79	0.84	0.64	0.56	0.71	0.70	0.77	0.23	0.08	0.16	0.10	0.07	0.17
13	@ 42˚	ULS B2	Highest Ratio	0.71	0.72	0.77	0.81	0.92	1.31	1.44	1.06	1.05	1.36	0.95	1.67	0.70	0.34	0.48	0.41	0.39	0.50
14	@ 42˚	ULS B3	Highest Ratio	0.75	0.76	0.82	0.87	1.00	1.44	1.58	1.15	1.17	1.51	1.01	1.87	0.81	0.40	0.57	0.49	0.47	0.58
15	@ 42˚	ULS B4	Highest Ratio	0.77	0.75	0.77	0.73	0.77	0.97	1.16	0.95	0.89	1.15	0.90	1.29	0.46	0.24	0.31	0.24	0.19	0.33
16	@ 63˚	ULS B1	Highest Ratio	0.40	0.43	0.47	0.46	0.48	0.62	0.65	0.50	0.43	0.56	0.55	0.60	0.18	0.06	0.09	0.06	0.05	0.12
17	@ 63˚	ULS B2	Highest Ratio	0.64	0.74	0.85	0.94	0.94	1.44	1.55	1.02	0.96	1.24	0.81	1.32	0.42	0.22	0.35	0.29	0.27	0.34
18	@ 63˚	ULS B3	Highest Ratio	0.69	0.81	0.93	1.05	1.05	1.62	1.76	1.14	1.08	1.40	0.87	1.49	0.48	0.26	0.41	0.35	0.32	0.41
19	@ 63˚	ULS B4	Highest Ratio	0.62	0.63	0.67	0.65	0.65	0.82	0.97	0.82	0.77	1.00	0.73	1.09	0.42	0.24	0.28	0.20	0.17	0.28
20	@ 84˚	ULS B1	Highest Ratio	0.11	0.14	0.17	0.24	0.24	0.29	0.26	0.16	0.14	0.19	0.15	0.18	0.09	0.03	0.03	0.05	0.03	0.07
21	@ 84˚	ULS B2	Highest Ratio	0.41	0.55	0.70	0.87	0.79	1.25	1.39	0.76	0.70	0.89	0.42	0.70	0.27	0.20	0.26	0.25	0.20	0.24
22	@ 84˚	ULS B3	Highest Ratio	0.48	0.65	0.82	1.02	0.92	1.47	1.66	0.90	0.83	1.06	0.48	0.82	0.32	0.23	0.33	0.31	0.24	0.28
23	@ 84˚	ULS B4	Highest Ratio	0.40	0.42	0.45	0.50	0.48	0.57	0.64	0.54	0.54	0.72	0.41	0.71	0.38	0.22	0.23	0.21	0.17	0.23
Maximum Highest Ratio (Overall)				0.95	0.91	0.93	1.05	1.05	1.62	1.76	1.18	1.27	1.65	1.13	2.17	1.13	0.59	0.82	0.70	0.64	0.80
Governing Load Combination per Member per Station (Overall)				ULS B4 @ 0˚	ULS B4 @ 0˚	ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚
Governing Member of the Element Group (Overall)																						
Maximum Highest Ratio (Live Load Only)				0.59	0.57	0.55	0.47	0.49	0.57	0.74	0.62	0.58	0.73	0.72	0.83	0.23	0.09	0.14	0.10	0.07	0.16
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)															Governing (Live L.)	Governing (Live L.)						
Maximum Highest Ratio (Movable L. Only)				0.95	0.91	0.93	1.05	1.05	1.62	1.76	1.18	1.27	1.65	1.13	2.17	1.13	0.59	0.82	0.70	0.64	0.80
Governing Load Combination per Member per Station (Movable Load Only)				ULS B4	ULS B4	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)																						

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	581	581	581	582	582	582	19	19	19	194	194	194	20	20	20	195	195	195
			Member Label	15S-18S	15S-18S	15S-18S	18S-19S	18S-19S	18S-19S	18N-17N	18N-17N	18N-17N	18S-17S	18S-17S	18S-17S	17N-19N	17N-19N	17N-19N	17S-19S	17S-19S	17S-19S
			Station (m)	0.0	3.2	6.4	0.0	3.2	6.4	0.0	2.7	5.5	0.0	2.7	5.5	0.0	4.2	8.4	0.0	4.2	8.4
			Node Label at Station	15S	---	18S	18S	---	19S	18N	---	17N	18S	---	17S	17N	---	19N	17S	---	19S
Load Combination			Section #	Section 12	Section 12	Section 12	Section 12	Section 12	Section 12	Section 13	Section 13	Section 13	Section 13	Section 13	Section 13	Section 14	Section 14	Section 14	Section 14	Section 14	Section 14
			Element Group	14 TowerT Horizontal	14 TowerT Horizontal	14 TowerT Horizontal	14 TowerT Horizontal	14 TowerT Horizontal	14 TowerT Horizontal	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.23	0.09	0.14	0.08	0.07	0.16	0.07	0.03	0.13	0.07	0.03	0.13	0.25	0.27	0.38	0.26	0.28	0.39
2	Live	CL2	Highest Ratio	0.23	0.08	0.14	0.08	0.07	0.16	0.07	0.03	0.13	0.07	0.03	0.13	0.25	0.27	0.38	0.26	0.28	0.39
3	Live	CL3	Highest Ratio	0.22	0.08	0.13	0.07	0.06	0.15	0.07	0.02	0.13	0.07	0.03	0.13	0.25	0.27	0.38	0.26	0.28	0.39
4	@ 0˚	ULS B1	Highest Ratio	0.29	0.11	0.20	0.13	0.08	0.19	0.09	0.04	0.16	0.09	0.04	0.19	0.50	0.45	0.62	0.50	0.44	0.62
5	@ 0˚	ULS B2	Highest Ratio	0.98	0.52	0.71	0.60	0.54	0.68	0.14	0.05	0.24	0.14	0.05	0.25	0.66	0.56	0.87	0.66	0.56	0.86
6	@ 0˚	ULS B3	Highest Ratio	1.17	0.62	0.84	0.72	0.66	0.81	0.16	0.05	0.25	0.16	0.05	0.26	0.70	0.59	0.92	0.70	0.59	0.92
7	@ 0˚	ULS B4	Highest Ratio	0.52	0.26	0.38	0.27	0.22	0.36	0.12	0.06	0.25	0.12	0.07	0.26	0.61	0.49	0.74	0.61	0.49	0.74
8	@ 21˚	ULS B1	Highest Ratio	0.27	0.10	0.18	0.12	0.08	0.18	0.09	0.04	0.16	0.09	0.04	0.17	0.44	0.40	0.55	0.44	0.40	0.55
9	@ 21˚	ULS B2	Highest Ratio	0.93	0.49	0.65	0.54	0.50	0.63	0.14	0.05	0.23	0.14	0.05	0.23	0.63	0.54	0.82	0.63	0.54	0.81
10	@ 21˚	ULS B3	Highest Ratio	1.10	0.59	0.76	0.65	0.60	0.73	0.14	0.06	0.23	0.14	0.06	0.23	0.66	0.57	0.89	0.66	0.57	0.88
11	@ 21˚	ULS B4	Highest Ratio	0.51	0.26	0.36	0.27	0.22	0.36	0.12	0.06	0.24	0.12	0.06	0.24	0.54	0.43	0.69	0.55	0.43	0.69
12	@ 42˚	ULS B1	Highest Ratio	0.23	0.09	0.15	0.09	0.06	0.15	0.09	0.04	0.15	0.09	0.04	0.15	0.34	0.33	0.46	0.34	0.33	0.46
13	@ 42˚	ULS B2	Highest Ratio	0.72	0.36	0.51	0.43	0.41	0.50	0.11	0.06	0.23	0.11	0.06	0.23	0.77	0.65	0.94	0.76	0.66	0.94
14	@ 42˚	ULS B3	Highest Ratio	0.84	0.43	0.59	0.51	0.49	0.59	0.12	0.08	0.25	0.12	0.08	0.24	0.86	0.74	1.05	0.86	0.73	1.06
15	@ 42˚	ULS B4	Highest Ratio	0.49	0.26	0.33	0.26	0.21	0.33	0.11	0.06	0.21	0.11	0.06	0.22	0.44	0.35	0.58	0.44	0.35	0.58
16	@ 63˚	ULS B1	Highest Ratio	0.19	0.07	0.09	0.05	0.05	0.11	0.07	0.02	0.11	0.07	0.03	0.11	0.24	0.24	0.35	0.24	0.24	0.34
17	@ 63˚	ULS B2	Highest Ratio	0.43	0.23	0.34	0.29	0.27	0.35	0.09	0.08	0.27	0.07	0.08	0.27	1.02	0.82	1.13	1.03	0.84	1.13
18	@ 63˚	ULS B3	Highest Ratio	0.49	0.28	0.41	0.35	0.33	0.41	0.09	0.10	0.31	0.09	0.10	0.29	1.22	0.97	1.32	1.25	0.99	1.34
19	@ 63˚	ULS B4	Highest Ratio	0.45	0.25	0.29	0.22	0.19	0.28	0.09	0.04	0.18	0.09	0.04	0.19	0.33	0.27	0.46	0.33	0.27	0.46
20	@ 84˚	ULS B1	Highest Ratio	0.10	0.04	0.04	0.05	0.03	0.07	0.02	0.02	0.06	0.02	0.02	0.06	0.17	0.18	0.24	0.17	0.18	0.24
21	@ 84˚	ULS B2	Highest Ratio	0.25	0.18	0.25	0.24	0.18	0.22	0.06	0.11	0.29	0.06	0.11	0.29	1.20	0.94	1.21	1.23	0.97	1.24
22	@ 84˚	ULS B3	Highest Ratio	0.27	0.21	0.29	0.28	0.22	0.25	0.06	0.13	0.33	0.06	0.13	0.34	1.47	1.11	1.46	1.51	1.16	1.50
23	@ 84˚	ULS B4	Highest Ratio	0.39	0.23	0.24	0.21	0.16	0.23	0.06	0.04	0.14	0.06	0.04	0.14	0.27	0.21	0.36	0.28	0.21	0.36
Maximum Highest Ratio (Overall)				1.17	0.62	0.84	0.72	0.66	0.81	0.16	0.13	0.33	0.16	0.13	0.34	1.47	1.11	1.46	1.51	1.16	1.50
Governing Load Combination per Member per Station (Overall)				ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 0˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚
Governing Member of the Element Group (Overall)				Governing (Overall)											Governing (Overall)				Governing (Overall)		
Maximum Highest Ratio (Live Load Only)				0.23	0.09	0.14	0.08	0.07	0.16	0.07	0.03	0.13	0.07	0.03	0.13	0.25	0.27	0.38	0.26	0.28	0.39
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)												Governing (Live L.)									Governing (Live L.)
Maximum Highest Ratio (Movable L. Only)				1.17	0.62	0.84	0.72	0.66	0.81	0.16	0.13	0.33	0.16	0.13	0.34	1.47	1.11	1.46	1.51	1.16	1.50
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)				Governing (Movable L.)											Governing (Movable L.)				Governing (Movable L.)		

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	24	24	24	25	25	25	26	26	26	199	199	199	200	200	200	201	201	201
			Member Label	20N-30N	20N-30N	20N-30N	30N-29N	30N-29N	30N-29N	28N-29N	28N-29N	28N-29N	20S-30S	20S-30S	20S-30S	30S-29S	30S-29S	30S-29S	28S-29S	28S-29S	28S-29S
			Station (m)	0.0	1.0	2.0	0.0	1.1	2.2	0.0	1.1	2.2	0.0	1.0	2.0	0.0	1.1	2.2	0.0	1.1	2.2
			Node Label at Station	20N	---	30N	30N	---	29N	28N	---	29N	20S	---	30S	30S	---	29S	28S	---	29S
Load Combination			Section #	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15
			Element Group	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02
2	Live	CL2	Highest Ratio	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02
3	Live	CL3	Highest Ratio	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02
4	@ 0˚	ULS B1	Highest Ratio	0.10	0.10	0.10	0.08	0.08	0.08	0.09	0.10	0.10	0.10	0.10	0.10	0.08	0.08	0.08	0.09	0.09	0.09
5	@ 0˚	ULS B2	Highest Ratio	0.11	0.11	0.11	0.10	0.10	0.09	0.11	0.11	0.11	0.11	0.11	0.11	0.09	0.09	0.09	0.11	0.11	0.11
6	@ 0˚	ULS B3	Highest Ratio	0.12	0.12	0.12	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.11	0.11	0.11
7	@ 0˚	ULS B4	Highest Ratio	0.11	0.11	0.11	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.09	0.09	0.09	0.11	0.11	0.11
8	@ 21˚	ULS B1	Highest Ratio	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08
9	@ 21˚	ULS B2	Highest Ratio	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.12	0.12	0.12	0.11	0.11	0.11
10	@ 21˚	ULS B3	Highest Ratio	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
11	@ 21˚	ULS B4	Highest Ratio	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
12	@ 42˚	ULS B1	Highest Ratio	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.06	0.06	0.06	0.09	0.09	0.09	0.08	0.08	0.08
13	@ 42˚	ULS B2	Highest Ratio	0.19	0.19	0.19	0.22	0.22	0.22	0.20	0.20	0.20	0.19	0.19	0.19	0.22	0.22	0.22	0.20	0.20	0.20
14	@ 42˚	ULS B3	Highest Ratio	0.22	0.22	0.22	0.25	0.25	0.25	0.23	0.23	0.23	0.22	0.22	0.22	0.25	0.25	0.26	0.23	0.23	0.23
15	@ 42˚	ULS B4	Highest Ratio	0.08	0.08	0.08	0.09	0.10	0.10	0.09	0.09	0.09	0.08	0.08	0.08	0.10	0.10	0.10	0.09	0.09	0.09
16	@ 63˚	ULS B1	Highest Ratio	0.04	0.04	0.04	0.06	0.06	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.07	0.07	0.07	0.06	0.06	0.06
17	@ 63˚	ULS B2	Highest Ratio	0.28	0.28	0.28	0.33	0.33	0.33	0.30	0.30	0.30	0.29	0.29	0.29	0.34	0.34	0.34	0.31	0.31	0.31
18	@ 63˚	ULS B3	Highest Ratio	0.34	0.34	0.34	0.39	0.39	0.39	0.37	0.37	0.37	0.35	0.35	0.34	0.40	0.40	0.40	0.37	0.37	0.37
19	@ 63˚	ULS B4	Highest Ratio	0.05	0.05	0.05	0.08	0.08	0.08	0.07	0.07	0.07	0.06	0.06	0.06	0.08	0.08	0.08	0.08	0.08	0.08
20	@ 84˚	ULS B1	Highest Ratio	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02
21	@ 84˚	ULS B2	Highest Ratio	0.35	0.35	0.35	0.37	0.37	0.37	0.38	0.38	0.38	0.36	0.36	0.36	0.38	0.38	0.38	0.39	0.39	0.39
22	@ 84˚	ULS B3	Highest Ratio	0.43	0.42	0.42	0.45	0.45	0.45	0.46	0.46	0.46	0.44	0.44	0.44	0.46	0.46	0.46	0.47	0.47	0.47
23	@ 84˚	ULS B4	Highest Ratio	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03
			Maximum Highest Ratio (Overall)	0.43	0.42	0.42	0.45	0.45	0.45	0.46	0.46	0.46	0.44	0.44	0.44	0.46	0.46	0.46	0.47	0.47	0.47
			Governing Load Combination per Member per Station (Overall)	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚
			Governing Member of the Element Group (Overall)																		
			Maximum Highest Ratio (Live Load Only)	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02
			Governing Load Combination per Member per Station (Live Load Only)	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
			Governing Member of the Element Group (Live Load Only)																		
			Maximum Highest Ratio (Movable L. Only)	0.43	0.42	0.42	0.45	0.45	0.45	0.46	0.46	0.46	0.44	0.44	0.44	0.46	0.46	0.46	0.47	0.47	0.47
			Governing Load Combination per Member per Station (Movable Load Only)	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
			Governing Member of the Element Group (Movable Load Only)																		

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	269	269	269	270	270	270	271	271	271	272	272	272	597	597	597	598	598	598
			Member Label	17N-29N	17N-29N	17N-29N	29N-20N	29N-20N	29N-20N	28N-30N	28N-30N	28N-30N	30N-31N	30N-31N	30N-31N	17S-29S	17S-29S	17S-29S	29S-20S	29S-20S	29S-20S
			Station (m)	0.0	1.7	3.3	0.0	1.5	3.1	0.0	1.6	3.3	0.0	0.7	1.4	0.0	1.7	3.3	0.0	1.5	3.1
			Node Label at Station	17N	---	29N	29N	---	20N	28N	---	30N	30N	---	31N	17S	---	29S	29S	---	20S
Load Combination			Section #	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 27	Section 27	Section 27	Section 27	Section 27	Section 27	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15
			Element Group	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.07	0.11	0.06	0.03	0.03	0.08	0.12	0.08	0.17	0.11	0.07	0.16	0.07	0.11	0.06	0.03	0.03	0.08
2	Live	CL2	Highest Ratio	0.06	0.11	0.06	0.03	0.03	0.08	0.12	0.08	0.17	0.11	0.07	0.16	0.06	0.11	0.06	0.03	0.03	0.08
3	Live	CL3	Highest Ratio	0.06	0.11	0.06	0.03	0.03	0.08	0.12	0.08	0.17	0.11	0.07	0.16	0.06	0.11	0.06	0.03	0.03	0.08
4	@ 0˚	ULS B1	Highest Ratio	0.22	0.22	0.22	0.10	0.09	0.13	0.22	0.22	0.27	0.14	0.10	0.23	0.22	0.22	0.21	0.09	0.09	0.13
5	@ 0˚	ULS B2	Highest Ratio	0.31	0.27	0.28	0.14	0.12	0.15	0.31	0.26	0.31	0.16	0.11	0.23	0.30	0.27	0.27	0.13	0.12	0.15
6	@ 0˚	ULS B3	Highest Ratio	0.31	0.32	0.29	0.14	0.13	0.15	0.31	0.28	0.31	0.16	0.11	0.23	0.30	0.32	0.28	0.14	0.13	0.15
7	@ 0˚	ULS B4	Highest Ratio	0.30	0.29	0.27	0.13	0.11	0.15	0.32	0.26	0.31	0.15	0.11	0.24	0.30	0.28	0.27	0.13	0.11	0.16
8	@ 21˚	ULS B1	Highest Ratio	0.20	0.20	0.19	0.09	0.09	0.13	0.20	0.20	0.24	0.14	0.10	0.18	0.20	0.19	0.19	0.09	0.09	0.13
9	@ 21˚	ULS B2	Highest Ratio	0.26	0.26	0.27	0.12	0.11	0.14	0.28	0.25	0.29	0.16	0.11	0.24	0.26	0.27	0.27	0.12	0.11	0.14
10	@ 21˚	ULS B3	Highest Ratio	0.32	0.28	0.29	0.12	0.12	0.14	0.30	0.25	0.30	0.17	0.12	0.24	0.33	0.28	0.29	0.12	0.12	0.14
11	@ 21˚	ULS B4	Highest Ratio	0.29	0.27	0.26	0.12	0.11	0.14	0.29	0.24	0.28	0.15	0.11	0.25	0.29	0.28	0.26	0.12	0.11	0.15
12	@ 42˚	ULS B1	Highest Ratio	0.19	0.19	0.18	0.08	0.08	0.08	0.15	0.10	0.19	0.13	0.09	0.18	0.19	0.19	0.19	0.08	0.08	0.08
13	@ 42˚	ULS B2	Highest Ratio	0.52	0.50	0.46	0.11	0.11	0.14	0.32	0.33	0.38	0.19	0.14	0.27	0.53	0.51	0.47	0.11	0.11	0.13
14	@ 42˚	ULS B3	Highest Ratio	0.59	0.56	0.53	0.12	0.11	0.18	0.41	0.37	0.42	0.20	0.15	0.32	0.59	0.57	0.53	0.11	0.11	0.18
15	@ 42˚	ULS B4	Highest Ratio	0.28	0.27	0.25	0.11	0.10	0.09	0.20	0.19	0.23	0.15	0.10	0.20	0.29	0.27	0.26	0.11	0.10	0.10
16	@ 63˚	ULS B1	Highest Ratio	0.16	0.15	0.11	0.02	0.02	0.06	0.10	0.05	0.14	0.11	0.07	0.16	0.16	0.16	0.11	0.02	0.02	0.06
17	@ 63˚	ULS B2	Highest Ratio	0.76	0.74	0.75	0.16	0.11	0.18	0.49	0.44	0.49	0.21	0.21	0.33	0.78	0.75	0.75	0.15	0.10	0.18
18	@ 63˚	ULS B3	Highest Ratio	0.90	0.87	0.87	0.16	0.12	0.23	0.56	0.52	0.57	0.23	0.23	0.40	0.91	0.88	0.89	0.16	0.11	0.23
19	@ 63˚	ULS B4	Highest Ratio	0.24	0.23	0.21	0.10	0.04	0.08	0.14	0.13	0.18	0.13	0.09	0.17	0.25	0.24	0.22	0.10	0.04	0.08
20	@ 84˚	ULS B1	Highest Ratio	0.04	0.04	0.09	0.05	0.01	0.05	0.04	0.04	0.08	0.07	0.03	0.11	0.04	0.04	0.09	0.05	0.01	0.05
21	@ 84˚	ULS B2	Highest Ratio	0.87	0.84	0.90	0.20	0.12	0.24	0.55	0.51	0.55	0.22	0.18	0.35	0.89	0.86	0.92	0.20	0.11	0.24
22	@ 84˚	ULS B3	Highest Ratio	1.04	1.08	1.08	0.23	0.13	0.31	0.66	0.61	0.66	0.25	0.25	0.38	1.06	1.09	1.09	0.22	0.13	0.30
23	@ 84˚	ULS B4	Highest Ratio	0.17	0.15	0.14	0.09	0.04	0.07	0.11	0.06	0.15	0.14	0.09	0.14	0.17	0.15	0.14	0.09	0.03	0.07
			Maximum Highest Ratio (Overall)	1.04	1.08	1.08	0.23	0.13	0.31	0.66	0.61	0.66	0.25	0.25	0.40	1.06	1.09	1.09	0.22	0.13	0.30
			Governing Load Combination per Member per Station (Overall)	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 0˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 63˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 0˚	ULS B3 @ 84˚
			Governing Member of the Element Group (Overall)														Governing (Overall)				
			Maximum Highest Ratio (Live Load Only)	0.07	0.11	0.06	0.03	0.03	0.08	0.12	0.08	0.17	0.11	0.07	0.16	0.07	0.11	0.06	0.03	0.03	0.08
			Governing Load Combination per Member per Station (Live Load Only)	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
			Governing Member of the Element Group (Live Load Only)									Governing (Live L.)									
			Maximum Highest Ratio (Movable L. Only)	1.04	1.08	1.08	0.23	0.13	0.31	0.66	0.61	0.66	0.25	0.25	0.40	1.06	1.09	1.09	0.22	0.13	0.30
			Governing Load Combination per Member per Station (Movable Load Only)	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
			Governing Member of the Element Group (Movable Load Only)														Governing (Movable L.)				

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	599	599	599	600	600	600
			Member Label	28S-30S	28S-30S	28S-30S	30S-31S	30S-31S	30S-31S
			Station (m)	0.0	1.6	3.3	0.0	0.7	1.4
			Node Label at Station	28S	---	30S	30S	---	31S
Load Combination			Section #	Section 27	Section 27	Section 27	Section 27	Section 27	Section 27
			Element Group	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss	17 TowerT Second Truss
ID	Category	Name							
1	Live	CL1	Highest Ratio	**0.12**	**0.08**	**0.17**	**0.11**	**0.07**	**0.16**
2	Live	CL2	Highest Ratio	**0.12**	**0.08**	**0.17**	**0.11**	**0.07**	**0.16**
3	Live	CL3	Highest Ratio	**0.12**	**0.08**	**0.17**	**0.11**	**0.07**	**0.16**
4	@ 0˚	ULS B1	Highest Ratio	**0.22**	**0.22**	**0.27**	**0.14**	**0.10**	**0.23**
5	@ 0˚	ULS B2	Highest Ratio	**0.31**	**0.26**	**0.31**	**0.16**	**0.11**	**0.23**
6	@ 0˚	ULS B3	Highest Ratio	**0.31**	**0.27**	**0.31**	**0.16**	**0.11**	**0.23**
7	@ 0˚	ULS B4	Highest Ratio	**0.31**	**0.26**	**0.31**	**0.16**	**0.11**	**0.25**
8	@ 21˚	ULS B1	Highest Ratio	**0.19**	**0.19**	**0.24**	**0.14**	**0.10**	**0.23**
9	@ 21˚	ULS B2	Highest Ratio	**0.29**	**0.24**	**0.29**	**0.17**	**0.12**	**0.24**
10	@ 21˚	ULS B3	Highest Ratio	**0.29**	**0.25**	**0.29**	**0.17**	**0.12**	**0.24**
11	@ 21˚	ULS B4	Highest Ratio	**0.29**	**0.23**	**0.28**	**0.16**	**0.11**	**0.25**
12	@ 42˚	ULS B1	Highest Ratio	**0.14**	**0.10**	**0.19**	**0.13**	**0.09**	**0.18**
13	@ 42˚	ULS B2	Highest Ratio	**0.32**	**0.33**	**0.37**	**0.20**	**0.15**	**0.31**
14	@ 42˚	ULS B3	Highest Ratio	**0.41**	**0.37**	**0.41**	**0.21**	**0.20**	**0.32**
15	@ 42˚	ULS B4	Highest Ratio	**0.19**	**0.18**	**0.23**	**0.15**	**0.11**	**0.24**
16	@ 63˚	ULS B1	Highest Ratio	**0.10**	**0.05**	**0.14**	**0.12**	**0.07**	**0.16**
17	@ 63˚	ULS B2	Highest Ratio	**0.49**	**0.45**	**0.49**	**0.21**	**0.21**	**0.34**
18	@ 63˚	ULS B3	Highest Ratio	**0.57**	**0.52**	**0.58**	**0.24**	**0.24**	**0.40**
19	@ 63˚	ULS B4	Highest Ratio	**0.14**	**0.13**	**0.18**	**0.13**	**0.09**	**0.18**
20	@ 84˚	ULS B1	Highest Ratio	**0.04**	**0.04**	**0.08**	**0.07**	**0.03**	**0.11**
21	@ 84˚	ULS B2	Highest Ratio	**0.56**	**0.52**	**0.56**	**0.23**	**0.23**	**0.35**
22	@ 84˚	ULS B3	Highest Ratio	**0.67**	**0.62**	**0.68**	**0.26**	**0.25**	**0.38**
23	@ 84˚	ULS B4	Highest Ratio	**0.11**	**0.06**	**0.15**	**0.13**	**0.09**	**0.13**
			Maximum Highest Ratio (Overall)	**0.67**	**0.62**	**0.68**	**0.26**	**0.25**	**0.40**
			Governing Load Combination per Member per Station (Overall)	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 63˚
			Governing Member of the Element Group (Overall)						
			Maximum Highest Ratio (Live Load Only)	**0.12**	**0.08**	**0.17**	**0.11**	**0.07**	**0.16**
			Governing Load Combination per Member per Station (Live Load Only)	CL1	CL1	CL1	CL1	CL1	CL1
			Governing Member of the Element Group (Live Load Only)						
			Maximum Highest Ratio (Movable L. Only)	**0.67**	**0.62**	**0.68**	**0.26**	**0.25**	**0.40**
			Governing Load Combination per Member per Station (Movable Load Only)	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
			Governing Member of the Element Group (Movable Load Only)						

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	81	81	81	82	82	82	83	83	83	84	84	84	85	85	85	86	86	86
			Member Label	2N-	2N-	2N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
			Node Label at Station	2N	---			---			---			---			---			---		
Load Combination			Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
			Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
ID	Category	Name																				
1	Live	CL1	Highest Ratio	0.31	0.31	0.31	0.24	0.36	0.48	0.47	0.52	0.56	0.55	0.61	0.68	0.67	0.69	0.71	0.70	0.70	0.70
2	Live	CL2	Highest Ratio	0.31	0.31	0.31	0.24	0.36	0.48	0.47	0.51	0.56	0.54	0.61	0.68	0.67	0.69	0.71	0.70	0.70	0.70
3	Live	CL3	Highest Ratio	0.31	0.31	0.31	0.24	0.36	0.48	0.47	0.51	0.56	0.54	0.61	0.68	0.67	0.69	0.71	0.69	0.69	0.69
4	@ 0˚	ULS B1	Highest Ratio	0.05	0.04	0.04	0.03	0.04	0.05	0.05	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
5	@ 0˚	ULS B2	Highest Ratio	0.07	0.05	0.04	0.04	0.04	0.06	0.05	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
6	@ 0˚	ULS B3	Highest Ratio	0.07	0.06	0.05	0.05	0.05	0.06	0.05	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
7	@ 0˚	ULS B4	Highest Ratio	0.07	0.05	0.04	0.04	0.05	0.06	0.05	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
8	@ 21˚	ULS B1	Highest Ratio	0.04	0.04	0.05	0.04	0.04	0.05	0.04	0.05	0.06	0.06	0.07	0.08	0.08	0.08	0.09	0.09	0.09	0.09
9	@ 21˚	ULS B2	Highest Ratio	0.07	0.06	0.06	0.05	0.05	0.06	0.06	0.06	0.07	0.07	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09
10	@ 21˚	ULS B3	Highest Ratio	0.08	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.08	0.09	0.09	0.09	0.09	0.09	0.10	0.09
11	@ 21˚	ULS B4	Highest Ratio	0.06	0.05	0.06	0.05	0.05	0.05	0.04	0.05	0.06	0.06	0.07	0.09	0.08	0.09	0.09	0.09	0.10	0.09
12	@ 42˚	ULS B1	Highest Ratio	0.03	0.03	0.03	0.07	0.05	0.04	0.04	0.05	0.07	0.07	0.08	0.09	0.09	0.10	0.10	0.10	0.10	0.10
13	@ 42˚	ULS B2	Highest Ratio	0.15	0.12	0.09	0.08	0.07	0.06	0.06	0.07	0.08	0.08	0.10	0.11	0.11	0.11	0.12	0.12	0.12	0.12
14	@ 42˚	ULS B3	Highest Ratio	0.16	0.12	0.10	0.09	0.07	0.06	0.06	0.07	0.09	0.09	0.10	0.12	0.12	0.12	0.13	0.13	0.13	0.13
15	@ 42˚	ULS B4	Highest Ratio	0.12	0.09	0.07	0.07	0.05	0.04	0.04	0.06	0.07	0.07	0.09	0.10	0.10	0.10	0.10	0.10	0.11	0.10
16	@ 63˚	ULS B1	Highest Ratio	0.16	0.12	0.08	0.08	0.05	0.03	0.03	0.04	0.06	0.06	0.08	0.09	0.09	0.10	0.10	0.10	0.11	0.10
17	@ 63˚	ULS B2	Highest Ratio	0.21	0.16	0.11	0.11	0.08	0.06	0.06	0.07	0.09	0.09	0.11	0.13	0.13	0.13	0.14	0.14	0.14	0.14
18	@ 63˚	ULS B3	Highest Ratio	0.22	0.16	0.11	0.11	0.08	0.06	0.06	0.08	0.10	0.10	0.12	0.13	0.13	0.14	0.14	0.14	0.14	0.14
19	@ 63˚	ULS B4	Highest Ratio	0.18	0.13	0.09	0.09	0.05	0.04	0.04	0.05	0.06	0.06	0.08	0.10	0.10	0.10	0.11	0.11	0.11	0.11
20	@ 84˚	ULS B1	Highest Ratio	0.20	0.14	0.09	0.09	0.05	0.02	0.02	0.04	0.05	0.05	0.07	0.08	0.08	0.08	0.08	0.08	0.09	0.08
21	@ 84˚	ULS B2	Highest Ratio	0.23	0.17	0.11	0.11	0.08	0.06	0.06	0.07	0.09	0.09	0.10	0.12	0.12	0.12	0.13	0.13	0.13	0.13
22	@ 84˚	ULS B3	Highest Ratio	0.24	0.18	0.13	0.12	0.08	0.07	0.06	0.08	0.09	0.09	0.12	0.13	0.13	0.14	0.14	0.14	0.14	0.14
23	@ 84˚	ULS B4	Highest Ratio	0.21	0.15	0.09	0.09	0.05	0.02	0.02	0.04	0.05	0.05	0.07	0.09	0.09	0.09	0.09	0.09	0.09	0.09
			Maximum Highest Ratio (Overall)	0.31	0.31	0.31	0.24	0.36	0.48	0.47	0.52	0.56	0.55	0.61	0.68	0.67	0.69	0.71	0.70	0.70	0.70
			Governing Load Combination per Member per Station (Overall)	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
				Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live
			Governing Member of the Element Group (Overall)																		
			Maximum Highest Ratio (Live Load Only)	0.31	0.31	0.31	0.24	0.36	0.48	0.47	0.52	0.56	0.55	0.61	0.68	0.67	0.69	0.71	0.70	0.70	0.70
			Governing Load Combination per Member per Station (Live Load Only)	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
			Governing Member of the Element Group (Live Load Only)																		
			Maximum Highest Ratio (Movable L. Only)	0.24	0.18	0.13	0.12	0.08	0.07	0.06	0.08	0.10	0.10	0.12	0.13	0.13	0.14	0.14	0.14	0.14	0.14
			Governing Load Combination per Member per Station (Movable Load Only)	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
			Governing Member of the Element Group (Movable Load Only)																		

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Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	87	87	87	88	88	88	89	89	89	90	90	90	91	91	91	92	92	92
			Member Label	-	-	-	-	-	-	-	-	-	-2S	-2S	-2S	4N-	4N-	4N-	-	-	-
			Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
			Node Label at Station		---			---			---			---	2S	4N	---			---	
Load Combination			Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
			Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.71	0.67	0.62	0.63	0.54	0.46	0.48	0.36	0.24	0.31	0.31	0.31	0.31	0.31	0.31	0.25	0.36	0.49
2	Live	CL2	Highest Ratio	0.71	0.67	0.62	0.63	0.54	0.46	0.47	0.36	0.24	0.31	0.31	0.31	0.31	0.31	0.31	0.25	0.36	0.49
3	Live	CL3	Highest Ratio	0.69	0.65	0.60	0.62	0.54	0.46	0.47	0.35	0.24	0.31	0.31	0.31	0.31	0.31	0.31	0.25	0.36	0.49
4	@ 0˚	ULS B1	Highest Ratio	0.07	0.06	0.05	0.05	0.04	0.03	0.04	0.03	0.03	0.04	0.04	0.06	0.04	0.04	0.04	0.04	0.04	0.06
5	@ 0˚	ULS B2	Highest Ratio	0.07	0.07	0.06	0.06	0.06	0.04	0.05	0.03	0.03	0.04	0.05	0.07	0.08	0.06	0.05	0.05	0.06	0.07
6	@ 0˚	ULS B3	Highest Ratio	0.07	0.07	0.06	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.05	0.08	0.08	0.07	0.05	0.05	0.06	0.07
7	@ 0˚	ULS B4	Highest Ratio	0.07	0.07	0.06	0.06	0.05	0.04	0.04	0.03	0.03	0.04	0.04	0.07	0.06	0.05	0.04	0.04	0.05	0.06
8	@ 21˚	ULS B1	Highest Ratio	0.09	0.08	0.07	0.07	0.05	0.04	0.04	0.03	0.03	0.04	0.04	0.05	0.04	0.05	0.05	0.05	0.05	0.05
9	@ 21˚	ULS B2	Highest Ratio	0.09	0.09	0.07	0.07	0.06	0.05	0.05	0.04	0.04	0.05	0.06	0.09	0.08	0.07	0.07	0.07	0.07	0.06
10	@ 21˚	ULS B3	Highest Ratio	0.09	0.09	0.08	0.08	0.07	0.05	0.05	0.05	0.05	0.05	0.07	0.09	0.09	0.08	0.08	0.08	0.08	0.07
11	@ 21˚	ULS B4	Highest Ratio	0.09	0.08	0.07	0.07	0.05	0.04	0.04	0.04	0.04	0.05	0.05	0.07	0.06	0.06	0.06	0.06	0.05	0.06
12	@ 42˚	ULS B1	Highest Ratio	0.10	0.09	0.08	0.08	0.06	0.03	0.03	0.04	0.06	0.06	0.08	0.12	0.11	0.09	0.07	0.07	0.05	0.04
13	@ 42˚	ULS B2	Highest Ratio	0.12	0.11	0.10	0.10	0.07	0.05	0.05	0.06	0.08	0.08	0.11	0.17	0.16	0.12	0.10	0.10	0.08	0.06
14	@ 42˚	ULS B3	Highest Ratio	0.13	0.11	0.10	0.10	0.08	0.05	0.05	0.06	0.08	0.08	0.12	0.18	0.17	0.13	0.10	0.10	0.08	0.08
15	@ 42˚	ULS B4	Highest Ratio	0.10	0.10	0.08	0.09	0.06	0.03	0.03	0.04	0.07	0.07	0.09	0.13	0.12	0.10	0.08	0.08	0.06	0.04
16	@ 63˚	ULS B1	Highest Ratio	0.10	0.09	0.08	0.08	0.06	0.02	0.02	0.05	0.08	0.08	0.12	0.17	0.16	0.12	0.08	0.08	0.05	0.03
17	@ 63˚	ULS B2	Highest Ratio	0.14	0.12	0.10	0.10	0.08	0.05	0.05	0.07	0.10	0.10	0.15	0.22	0.21	0.16	0.11	0.11	0.08	0.07
18	@ 63˚	ULS B3	Highest Ratio	0.14	0.13	0.11	0.11	0.09	0.05	0.05	0.08	0.11	0.11	0.16	0.23	0.22	0.17	0.12	0.12	0.09	0.07
19	@ 63˚	ULS B4	Highest Ratio	0.11	0.10	0.08	0.08	0.06	0.03	0.03	0.06	0.09	0.09	0.13	0.18	0.18	0.13	0.09	0.09	0.05	0.03
20	@ 84˚	ULS B1	Highest Ratio	0.08	0.08	0.07	0.07	0.04	0.01	0.01	0.05	0.09	0.09	0.15	0.21	0.20	0.14	0.09	0.09	0.03	0.01
21	@ 84˚	ULS B2	Highest Ratio	0.13	0.12	0.10	0.10	0.08	0.04	0.04	0.07	0.11	0.11	0.17	0.24	0.24	0.17	0.12	0.12	0.07	0.05
22	@ 84˚	ULS B3	Highest Ratio	0.14	0.13	0.11	0.11	0.09	0.05	0.05	0.07	0.11	0.12	0.17	0.25	0.24	0.18	0.12	0.12	0.08	0.06
23	@ 84˚	ULS B4	Highest Ratio	0.09	0.09	0.07	0.07	0.05	0.02	0.02	0.05	0.10	0.10	0.16	0.22	0.21	0.15	0.09	0.09	0.04	0.01
Maximum Highest Ratio (Overall)				0.71	0.67	0.62	0.63	0.54	0.46	0.48	0.36	0.24	0.31	0.31	0.31	0.31	0.31	0.31	0.25	0.36	0.49
Governing Load Combination per Member per Station (Overall)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
				Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.71	0.67	0.62	0.63	0.54	0.46	0.48	0.36	0.24	0.31	0.31	0.31	0.31	0.31	0.31	0.25	0.36	0.49
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.14	0.13	0.11	0.11	0.09	0.05	0.05	0.08	0.11	0.12	0.17	0.25	0.24	0.18	0.12	0.12	0.09	0.08
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)																					

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Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	93	93	93	94	94	94	96	96	96	98	98	98	99	99	99	100	100	100
			Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
			Node Label at Station		---			---			---			---			---			---		
Load Combination			Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
			Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
ID	Category	Name																				
1	Live	CL1	Highest Ratio	0.46	0.49	0.54	0.55	0.61	0.67	0.65	0.67	0.69	0.71	0.71	0.71	0.71	0.66	0.62	0.64	0.56	0.47
2	Live	CL2	Highest Ratio	0.46	0.49	0.54	0.55	0.61	0.67	0.65	0.67	0.69	0.71	0.71	0.71	0.71	0.66	0.62	0.63	0.56	0.47
3	Live	CL3	Highest Ratio	0.46	0.49	0.54	0.55	0.61	0.67	0.65	0.67	0.69	0.71	0.71	0.71	0.71	0.66	0.62	0.62	0.55	0.47
4	@ 0˚	ULS B1	Highest Ratio	0.06	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.08	0.08	0.08	0.07	0.07	0.06	0.05
5	@ 0˚	ULS B2	Highest Ratio	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.08	0.08	0.08	0.07	0.07	0.07	0.06
6	@ 0˚	ULS B3	Highest Ratio	0.07	0.07	0.08	0.08	0.09	0.08	0.08	0.08	0.08	0.09	0.09	0.08	0.09	0.08	0.07	0.07	0.07	0.06
7	@ 0˚	ULS B4	Highest Ratio	0.06	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.08	0.08	0.08	0.07	0.07	0.06	0.06
8	@ 21˚	ULS B1	Highest Ratio	0.05	0.05	0.07	0.07	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.06	0.04
9	@ 21˚	ULS B2	Highest Ratio	0.06	0.07	0.08	0.08	0.09	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.07	0.06
10	@ 21˚	ULS B3	Highest Ratio	0.07	0.07	0.08	0.08	0.10	0.10	0.10	0.10	0.10	0.10	0.11	0.10	0.10	0.10	0.09	0.09	0.07	0.06
11	@ 21˚	ULS B4	Highest Ratio	0.06	0.06	0.07	0.07	0.08	0.09	0.09	0.09	0.09	0.10	0.10	0.09	0.09	0.09	0.08	0.08	0.07	0.04
12	@ 42˚	ULS B1	Highest Ratio	0.04	0.05	0.07	0.07	0.08	0.09	0.09	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.08	0.08	0.06	0.03
13	@ 42˚	ULS B2	Highest Ratio	0.06	0.08	0.10	0.10	0.11	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.13	0.12	0.11	0.11	0.08	0.06
14	@ 42˚	ULS B3	Highest Ratio	0.07	0.09	0.10	0.10	0.11	0.13	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.12	0.11	0.11	0.09	0.07
15	@ 42˚	ULS B4	Highest Ratio	0.04	0.06	0.07	0.07	0.09	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.10	0.09	0.09	0.07	0.04
16	@ 63˚	ULS B1	Highest Ratio	0.03	0.04	0.06	0.06	0.08	0.09	0.08	0.09	0.09	0.09	0.10	0.09	0.09	0.09	0.07	0.07	0.05	0.03
17	@ 63˚	ULS B2	Highest Ratio	0.07	0.09	0.10	0.10	0.12	0.13	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.13	0.11	0.11	0.09	0.06
18	@ 63˚	ULS B3	Highest Ratio	0.07	0.09	0.11	0.11	0.13	0.14	0.14	0.15	0.15	0.15	0.16	0.15	0.15	0.14	0.12	0.12	0.10	0.06
19	@ 63˚	ULS B4	Highest Ratio	0.03	0.05	0.06	0.06	0.08	0.10	0.10	0.10	0.10	0.11	0.11	0.10	0.10	0.09	0.08	0.08	0.06	0.03
20	@ 84˚	ULS B1	Highest Ratio	0.01	0.03	0.04	0.04	0.06	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.07	0.06	0.06	0.03	0.01
21	@ 84˚	ULS B2	Highest Ratio	0.05	0.07	0.09	0.09	0.11	0.12	0.12	0.13	0.13	0.13	0.14	0.13	0.13	0.12	0.10	0.10	0.08	0.05
22	@ 84˚	ULS B3	Highest Ratio	0.06	0.08	0.10	0.10	0.12	0.13	0.13	0.14	0.14	0.14	0.15	0.14	0.14	0.13	0.12	0.12	0.09	0.05
23	@ 84˚	ULS B4	Highest Ratio	0.01	0.03	0.05	0.05	0.06	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.08	0.06	0.06	0.05	0.01
Maximum Highest Ratio (Overall)				0.46	0.49	0.54	0.55	0.61	0.67	0.65	0.67	0.69	0.71	0.71	0.71	0.71	0.66	0.62	0.64	0.56	0.47
Governing Load Combination per Member per Station (Overall)				CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.46	0.49	0.54	0.55	0.61	0.67	0.65	0.67	0.69	0.71	0.71	0.71	0.71	0.66	0.62	0.64	0.56	0.47
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.07	0.09	0.11	0.11	0.13	0.14	0.14	0.15	0.15	0.15	0.16	0.15	0.15	0.14	0.12	0.12	0.10	0.07
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)																					

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Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	101	101	101	103	103	103	105	105	105	107	107	107	108	108	108	109	109	109
			Member Label	-	-	-	-4S	-4S	-4S	6N-	6N-	6N-	-	-	-	-	-	-	-	-	-
			Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
			Node Label at Station		---			---	4S	6N	---			---			---			---	
Load Combination			Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
			Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.49	0.37	0.25	0.31	0.31	0.31	0.32	0.29	0.39	0.28	0.44	0.61	0.53	0.57	0.61	0.64	0.69	0.73
2	Live	CL2	Highest Ratio	0.49	0.37	0.25	0.31	0.31	0.31	0.32	0.29	0.39	0.28	0.44	0.61	0.53	0.57	0.61	0.64	0.69	0.73
3	Live	CL3	Highest Ratio	0.49	0.37	0.25	0.31	0.31	0.31	0.32	0.29	0.39	0.28	0.44	0.61	0.53	0.57	0.61	0.64	0.69	0.73
4	@ 0˚	ULS B1	Highest Ratio	0.05	0.03	0.03	0.04	0.04	0.05	0.21	0.12	0.04	0.09	0.05	0.15	0.08	0.10	0.13	0.08	0.10	0.13
5	@ 0˚	ULS B2	Highest Ratio	0.06	0.05	0.04	0.04	0.05	0.08	0.32	0.18	0.04	0.14	0.06	0.20	0.10	0.13	0.17	0.10	0.13	0.16
6	@ 0˚	ULS B3	Highest Ratio	0.06	0.05	0.04	0.04	0.06	0.09	0.36	0.20	0.04	0.15	0.06	0.21	0.10	0.14	0.17	0.10	0.13	0.16
7	@ 0˚	ULS B4	Highest Ratio	0.06	0.04	0.03	0.04	0.04	0.07	0.26	0.15	0.05	0.12	0.06	0.18	0.09	0.12	0.15	0.09	0.12	0.14
8	@ 21˚	ULS B1	Highest Ratio	0.04	0.04	0.04	0.04	0.04	0.05	0.04	0.03	0.03	0.03	0.05	0.07	0.06	0.06	0.07	0.07	0.06	0.07
9	@ 21˚	ULS B2	Highest Ratio	0.06	0.06	0.06	0.06	0.07	0.09	0.20	0.12	0.05	0.10	0.06	0.15	0.08	0.10	0.13	0.09	0.11	0.12
10	@ 21˚	ULS B3	Highest Ratio	0.06	0.06	0.07	0.06	0.07	0.10	0.24	0.14	0.05	0.11	0.06	0.17	0.08	0.11	0.14	0.09	0.12	0.14
11	@ 21˚	ULS B4	Highest Ratio	0.04	0.05	0.05	0.05	0.05	0.07	0.07	0.05	0.04	0.05	0.05	0.09	0.07	0.07	0.08	0.08	0.08	0.09
12	@ 42˚	ULS B1	Highest Ratio	0.03	0.05	0.07	0.07	0.08	0.12	0.20	0.12	0.05	0.10	0.04	0.12	0.06	0.08	0.11	0.06	0.09	0.10
13	@ 42˚	ULS B2	Highest Ratio	0.06	0.06	0.09	0.09	0.12	0.17	0.45	0.25	0.07	0.19	0.06	0.24	0.10	0.16	0.21	0.11	0.15	0.19
14	@ 42˚	ULS B3	Highest Ratio	0.07	0.07	0.09	0.09	0.13	0.18	0.51	0.28	0.08	0.21	0.06	0.28	0.11	0.17	0.23	0.12	0.17	0.21
15	@ 42˚	ULS B4	Highest Ratio	0.04	0.05	0.08	0.08	0.10	0.14	0.24	0.15	0.05	0.11	0.04	0.14	0.07	0.10	0.13	0.07	0.10	0.12
16	@ 63˚	ULS B1	Highest Ratio	0.03	0.04	0.08	0.08	0.12	0.17	0.36	0.20	0.05	0.15	0.04	0.18	0.07	0.11	0.15	0.06	0.10	0.13
17	@ 63˚	ULS B2	Highest Ratio	0.06	0.08	0.11	0.11	0.16	0.22	0.61	0.33	0.07	0.24	0.06	0.32	0.12	0.18	0.26	0.12	0.18	0.23
18	@ 63˚	ULS B3	Highest Ratio	0.06	0.08	0.11	0.11	0.16	0.23	0.67	0.36	0.08	0.27	0.07	0.34	0.13	0.20	0.28	0.13	0.19	0.25
19	@ 63˚	ULS B4	Highest Ratio	0.03	0.05	0.09	0.09	0.13	0.19	0.41	0.22	0.06	0.17	0.04	0.21	0.08	0.12	0.16	0.07	0.11	0.15
20	@ 84˚	ULS B1	Highest Ratio	0.01	0.04	0.09	0.09	0.15	0.20	0.49	0.26	0.05	0.19	0.03	0.22	0.06	0.12	0.16	0.06	0.10	0.14
21	@ 84˚	ULS B2	Highest Ratio	0.05	0.07	0.11	0.11	0.17	0.24	0.65	0.35	0.07	0.25	0.06	0.32	0.12	0.19	0.25	0.12	0.17	0.22
22	@ 84˚	ULS B3	Highest Ratio	0.05	0.08	0.12	0.12	0.18	0.25	0.68	0.37	0.08	0.27	0.07	0.34	0.12	0.20	0.27	0.12	0.19	0.24
23	@ 84˚	ULS B4	Highest Ratio	0.01	0.04	0.09	0.09	0.15	0.21	0.53	0.29	0.06	0.21	0.04	0.24	0.07	0.13	0.18	0.07	0.11	0.15
Maximum Highest Ratio (Overall)				0.49	0.37	0.25	0.31	0.31	0.31	0.68	0.37	0.39	0.28	0.44	0.61	0.53	0.57	0.61	0.64	0.69	0.73
Governing Load Combination per Member per Station (Overall)				CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	ULS B3 @ 84˚	ULS B3 @ 84˚	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.49	0.37	0.25	0.31	0.31	0.31	0.32	0.29	0.39	0.28	0.44	0.61	0.53	0.57	0.61	0.64	0.69	0.73
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.07	0.08	0.12	0.12	0.18	0.25	0.68	0.37	0.08	0.27	0.07	0.34	0.13	0.20	0.28	0.13	0.19	0.25
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)																					

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	110	110	110	111	111	111	112	112	112	118	118	118	119	119	119	120	120	120
			Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-6S	-6S	-6S
			Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
			Node Label at Station		---			---			---			---			---				---	6S
Load Combination			Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
			Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.71	0.72	0.73	0.74	0.76	0.75	0.77	0.74	0.72	0.71	0.63	0.56	0.65	0.46	0.28	0.42	0.30	0.32
2	Live	CL2	Highest Ratio	0.71	0.72	0.73	0.74	0.76	0.75	0.77	0.74	0.72	0.71	0.63	0.56	0.65	0.46	0.28	0.42	0.30	0.32
3	Live	CL3	Highest Ratio	0.71	0.72	0.73	0.74	0.76	0.75	0.77	0.74	0.72	0.71	0.63	0.56	0.65	0.46	0.28	0.42	0.30	0.32
4	@ 0˚	ULS B1	Highest Ratio	0.10	0.10	0.11	0.11	0.11	0.10	0.12	0.10	0.09	0.13	0.09	0.05	0.13	0.04	0.09	0.04	0.11	0.20
5	@ 0˚	ULS B2	Highest Ratio	0.11	0.12	0.12	0.11	0.11	0.10	0.13	0.12	0.09	0.17	0.12	0.06	0.18	0.04	0.13	0.04	0.18	0.31
6	@ 0˚	ULS B3	Highest Ratio	0.12	0.12	0.12	0.11	0.11	0.10	0.13	0.12	0.09	0.18	0.12	0.06	0.19	0.05	0.14	0.05	0.18	0.34
7	@ 0˚	ULS B4	Highest Ratio	0.11	0.11	0.11	0.11	0.11	0.10	0.13	0.11	0.09	0.15	0.10	0.06	0.16	0.04	0.11	0.05	0.14	0.25
8	@ 21˚	ULS B1	Highest Ratio	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.05	0.04	0.05	0.03	0.03	0.03	0.04	0.04
9	@ 21˚	ULS B2	Highest Ratio	0.10	0.10	0.11	0.10	0.10	0.10	0.11	0.10	0.09	0.13	0.10	0.06	0.13	0.04	0.09	0.04	0.11	0.20
10	@ 21˚	ULS B3	Highest Ratio	0.10	0.11	0.11	0.11	0.10	0.10	0.12	0.11	0.10	0.14	0.10	0.06	0.16	0.05	0.11	0.05	0.13	0.24
11	@ 21˚	ULS B4	Highest Ratio	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.09	0.07	0.05	0.08	0.04	0.04	0.04	0.04	0.06
12	@ 42˚	ULS B1	Highest Ratio	0.08	0.09	0.09	0.08	0.09	0.09	0.10	0.09	0.07	0.12	0.08	0.05	0.12	0.04	0.09	0.03	0.12	0.20
13	@ 42˚	ULS B2	Highest Ratio	0.13	0.14	0.15	0.13	0.14	0.14	0.17	0.15	0.12	0.22	0.15	0.07	0.25	0.05	0.19	0.06	0.25	0.46
14	@ 42˚	ULS B3	Highest Ratio	0.15	0.16	0.16	0.14	0.15	0.15	0.18	0.16	0.13	0.25	0.16	0.07	0.27	0.06	0.20	0.06	0.28	0.52
15	@ 42˚	ULS B4	Highest Ratio	0.09	0.10	0.10	0.09	0.09	0.09	0.11	0.10	0.08	0.14	0.10	0.06	0.15	0.05	0.11	0.04	0.14	0.25
16	@ 63˚	ULS B1	Highest Ratio	0.08	0.09	0.10	0.08	0.09	0.09	0.11	0.10	0.08	0.16	0.11	0.04	0.18	0.04	0.14	0.05	0.20	0.36
17	@ 63˚	ULS B2	Highest Ratio	0.15	0.16	0.17	0.15	0.16	0.15	0.20	0.17	0.13	0.27	0.18	0.07	0.31	0.06	0.24	0.08	0.33	0.60
18	@ 63˚	ULS B3	Highest Ratio	0.17	0.18	0.19	0.17	0.17	0.17	0.22	0.18	0.15	0.30	0.19	0.08	0.33	0.06	0.26	0.09	0.36	0.67
19	@ 63˚	ULS B4	Highest Ratio	0.09	0.10	0.11	0.10	0.10	0.10	0.13	0.11	0.09	0.17	0.12	0.05	0.20	0.04	0.16	0.05	0.22	0.41
20	@ 84˚	ULS B1	Highest Ratio	0.08	0.09	0.10	0.08	0.08	0.08	0.11	0.10	0.07	0.18	0.11	0.03	0.21	0.03	0.19	0.05	0.26	0.49
21	@ 84˚	ULS B2	Highest Ratio	0.14	0.16	0.16	0.14	0.14	0.14	0.19	0.16	0.12	0.27	0.17	0.06	0.31	0.05	0.25	0.08	0.35	0.64
22	@ 84˚	ULS B3	Highest Ratio	0.16	0.17	0.18	0.15	0.16	0.15	0.21	0.17	0.14	0.29	0.18	0.07	0.33	0.06	0.27	0.08	0.37	0.68
23	@ 84˚	ULS B4	Highest Ratio	0.09	0.10	0.11	0.09	0.09	0.09	0.12	0.11	0.08	0.20	0.12	0.04	0.24	0.04	0.21	0.06	0.29	0.53
Maximum Highest Ratio (Overall)				0.71	0.72	0.73	0.74	0.76	0.75	0.77	0.74	0.72	0.71	0.63	0.56	0.65	0.46	0.28	0.42	0.37	0.68
Governing Load Combination per Member per Station (Overall)				CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	ULS B3 @ 84˚	ULS B3 @ 84˚
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.71	0.72	0.73	0.74	0.76	0.75	0.77	0.74	0.72	0.71	0.63	0.56	0.65	0.46	0.28	0.42	0.30	0.32
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.17	0.18	0.19	0.17	0.17	0.17	0.22	0.18	0.15	0.30	0.19	0.08	0.33	0.06	0.27	0.09	0.37	0.68
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)																					

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	121	121	121	122	122	122	123	123	123	124	124	124	125	125	125	126	126	126
			Member Label	10N-	10N-	10N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
			Node Label at Station	10N	---			---			---			---			---			---	
Load Combination			Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
			Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.31	0.31	0.31	0.24	0.36	0.48	0.46	0.51	0.56	0.55	0.62	0.68	0.65	0.66	0.68	0.70	0.70	0.70
2	Live	CL2	Highest Ratio	0.31	0.31	0.31	0.24	0.36	0.48	0.46	0.51	0.56	0.54	0.60	0.65	0.64	0.66	0.67	0.69	0.70	0.70
3	Live	CL3	Highest Ratio	0.31	0.31	0.31	0.24	0.36	0.48	0.44	0.48	0.53	0.54	0.60	0.65	0.64	0.66	0.67	0.69	0.70	0.70
4	@ 0˚	ULS B1	Highest Ratio	0.04	0.05	0.06	0.06	0.07	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.10
5	@ 0˚	ULS B2	Highest Ratio	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.11	0.10	0.10
6	@ 0˚	ULS B3	Highest Ratio	0.14	0.13	0.12	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.10	0.10	0.11	0.10	0.10
7	@ 0˚	ULS B4	Highest Ratio	0.06	0.06	0.07	0.07	0.08	0.08	0.08	0.09	0.09	0.09	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.10
8	@ 21˚	ULS B1	Highest Ratio	0.11	0.10	0.09	0.09	0.08	0.07	0.07	0.08	0.09	0.09	0.10	0.11	0.11	0.11	0.11	0.11	0.12	0.11
9	@ 21˚	ULS B2	Highest Ratio	0.20	0.16	0.14	0.14	0.12	0.10	0.10	0.10	0.12	0.12	0.12	0.13	0.12	0.13	0.13	0.13	0.13	0.13
10	@ 21˚	ULS B3	Highest Ratio	0.22	0.18	0.15	0.15	0.13	0.11	0.11	0.11	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.13	0.13	0.13
11	@ 21˚	ULS B4	Highest Ratio	0.13	0.11	0.09	0.10	0.08	0.08	0.08	0.08	0.09	0.10	0.11	0.11	0.11	0.12	0.12	0.12	0.12	0.12
12	@ 42˚	ULS B1	Highest Ratio	0.17	0.14	0.10	0.10	0.08	0.06	0.06	0.08	0.09	0.09	0.11	0.12	0.12	0.12	0.12	0.12	0.13	0.13
13	@ 42˚	ULS B2	Highest Ratio	0.27	0.21	0.16	0.16	0.13	0.11	0.11	0.12	0.12	0.12	0.14	0.15	0.15	0.15	0.15	0.15	0.15	0.15
14	@ 42˚	ULS B3	Highest Ratio	0.28	0.23	0.17	0.17	0.14	0.11	0.11	0.12	0.13	0.14	0.15	0.16	0.15	0.16	0.16	0.17	0.17	0.16
15	@ 42˚	ULS B4	Highest Ratio	0.20	0.16	0.12	0.12	0.09	0.07	0.07	0.08	0.10	0.10	0.11	0.12	0.12	0.13	0.13	0.13	0.13	0.13
16	@ 63˚	ULS B1	Highest Ratio	0.21	0.16	0.10	0.10	0.06	0.05	0.04	0.06	0.07	0.07	0.09	0.11	0.11	0.11	0.11	0.11	0.11	0.11
17	@ 63˚	ULS B2	Highest Ratio	0.30	0.23	0.17	0.17	0.13	0.10	0.10	0.11	0.13	0.13	0.14	0.16	0.16	0.16	0.16	0.17	0.17	0.17
18	@ 63˚	ULS B3	Highest Ratio	0.33	0.25	0.19	0.19	0.14	0.12	0.11	0.13	0.14	0.14	0.16	0.17	0.16	0.17	0.17	0.18	0.18	0.18
19	@ 63˚	ULS B4	Highest Ratio	0.24	0.18	0.12	0.12	0.08	0.06	0.06	0.07	0.08	0.08	0.10	0.11	0.11	0.12	0.12	0.12	0.13	0.12
20	@ 84˚	ULS B1	Highest Ratio	0.22	0.16	0.09	0.10	0.04	0.02	0.02	0.04	0.05	0.05	0.07	0.08	0.08	0.09	0.09	0.09	0.09	0.09
21	@ 84˚	ULS B2	Highest Ratio	0.31	0.23	0.16	0.16	0.11	0.08	0.08	0.10	0.11	0.11	0.13	0.14	0.14	0.14	0.15	0.15	0.15	0.14
22	@ 84˚	ULS B3	Highest Ratio	0.33	0.25	0.18	0.18	0.13	0.10	0.10	0.12	0.13	0.13	0.14	0.15	0.15	0.16	0.16	0.16	0.16	0.16
23	@ 84˚	ULS B4	Highest Ratio	0.26	0.18	0.11	0.11	0.06	0.03	0.03	0.05	0.06	0.06	0.08	0.09	0.09	0.09	0.09	0.09	0.10	0.09
Maximum Highest Ratio (Overall)				0.33	0.31	0.31	0.24	0.36	0.48	0.46	0.51	0.56	0.55	0.62	0.68	0.65	0.66	0.68	0.70	0.70	0.70
Governing Load Combination per Member per Station (Overall)				ULS B3 @ 84˚	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.31	0.31	0.31	0.24	0.36	0.48	0.46	0.51	0.56	0.55	0.62	0.68	0.65	0.66	0.68	0.70	0.70	0.70
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.33	0.25	0.19	0.19	0.14	0.12	0.11	0.13	0.14	0.14	0.16	0.17	0.16	0.17	0.17	0.18	0.18	0.18
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)																					

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	127	127	127	128	128	128	129	129	129	130	130	130	610	610	610	611	611	611
			Member Label	-	-	-	-	-	-	-	-	-	-10S	-10S	-10S	0N-	0N-	0N-	-	-	-
			Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
			Node Label at Station		---			---			---			---	10S	0N	---			---	
Load Combination			Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
			Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.70	0.65	0.61	0.61	0.54	0.46	0.48	0.36	0.24	0.31	0.31	0.31	0.74	0.52	0.39	0.46	0.47	0.61
2	Live	CL2	Highest Ratio	0.70	0.65	0.61	0.61	0.53	0.46	0.48	0.36	0.24	0.31	0.31	0.31	0.74	0.52	0.39	0.46	0.46	0.61
3	Live	CL3	Highest Ratio	0.70	0.65	0.61	0.61	0.53	0.46	0.48	0.36	0.24	0.31	0.31	0.31	0.74	0.52	0.39	0.46	0.46	0.61
4	@ 0˚	ULS B1	Highest Ratio	0.10	0.09	0.09	0.09	0.08	0.07	0.07	0.06	0.05	0.05	0.04	0.04	0.20	0.11	0.04	0.08	0.03	0.11
5	@ 0˚	ULS B2	Highest Ratio	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.10	0.11	0.21	0.11	0.05	0.08	0.04	0.13
6	@ 0˚	ULS B3	Highest Ratio	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.12	0.13	0.21	0.11	0.05	0.08	0.04	0.14
7	@ 0˚	ULS B4	Highest Ratio	0.10	0.10	0.09	0.09	0.09	0.08	0.08	0.07	0.06	0.06	0.05	0.05	0.22	0.13	0.04	0.09	0.03	0.12
8	@ 21˚	ULS B1	Highest Ratio	0.11	0.11	0.10	0.10	0.09	0.06	0.06	0.07	0.07	0.07	0.08	0.09	0.07	0.02	0.02	0.03	0.03	0.06
9	@ 21˚	ULS B2	Highest Ratio	0.13	0.12	0.12	0.12	0.11	0.10	0.10	0.11	0.12	0.12	0.15	0.19	0.16	0.09	0.04	0.07	0.04	0.10
10	@ 21˚	ULS B3	Highest Ratio	0.13	0.13	0.13	0.13	0.12	0.10	0.10	0.11	0.13	0.13	0.17	0.20	0.17	0.11	0.04	0.07	0.04	0.12
11	@ 21˚	ULS B4	Highest Ratio	0.12	0.12	0.10	0.10	0.09	0.07	0.07	0.08	0.08	0.08	0.10	0.12	0.09	0.05	0.02	0.04	0.03	0.07
12	@ 42˚	ULS B1	Highest Ratio	0.13	0.11	0.10	0.10	0.08	0.06	0.06	0.07	0.09	0.09	0.12	0.16	0.07	0.05	0.04	0.04	0.02	0.05
13	@ 42˚	ULS B2	Highest Ratio	0.15	0.15	0.14	0.14	0.12	0.10	0.10	0.12	0.15	0.15	0.20	0.25	0.23	0.14	0.06	0.10	0.04	0.12
14	@ 42˚	ULS B3	Highest Ratio	0.16	0.15	0.15	0.15	0.13	0.11	0.11	0.13	0.16	0.16	0.22	0.28	0.27	0.16	0.07	0.11	0.04	0.13
15	@ 42˚	ULS B4	Highest Ratio	0.13	0.12	0.11	0.11	0.09	0.07	0.07	0.08	0.10	0.10	0.14	0.19	0.10	0.06	0.04	0.05	0.03	0.06
16	@ 63˚	ULS B1	Highest Ratio	0.11	0.10	0.09	0.09	0.07	0.04	0.04	0.06	0.10	0.10	0.15	0.20	0.20	0.12	0.05	0.09	0.01	0.09
17	@ 63˚	ULS B2	Highest Ratio	0.17	0.15	0.14	0.14	0.12	0.09	0.09	0.12	0.16	0.16	0.23	0.31	0.36	0.21	0.08	0.15	0.03	0.17
18	@ 63˚	ULS B3	Highest Ratio	0.18	0.16	0.15	0.15	0.13	0.11	0.11	0.13	0.18	0.18	0.25	0.32	0.40	0.24	0.09	0.16	0.04	0.19
19	@ 63˚	ULS B4	Highest Ratio	0.12	0.11	0.10	0.10	0.08	0.05	0.05	0.08	0.12	0.12	0.17	0.24	0.22	0.13	0.06	0.09	0.02	0.10
20	@ 84˚	ULS B1	Highest Ratio	0.09	0.08	0.07	0.07	0.04	0.02	0.02	0.05	0.10	0.10	0.16	0.23	0.30	0.17	0.06	0.12	0.01	0.11
21	@ 84˚	ULS B2	Highest Ratio	0.14	0.14	0.13	0.13	0.11	0.08	0.08	0.11	0.17	0.17	0.23	0.32	0.41	0.23	0.08	0.17	0.03	0.18
22	@ 84˚	ULS B3	Highest Ratio	0.16	0.15	0.14	0.14	0.12	0.09	0.09	0.12	0.18	0.18	0.25	0.33	0.44	0.25	0.09	0.17	0.04	0.20
23	@ 84˚	ULS B4	Highest Ratio	0.09	0.09	0.08	0.08	0.05	0.03	0.03	0.06	0.12	0.12	0.19	0.25	0.31	0.18	0.06	0.12	0.02	0.12
			Maximum Highest Ratio (Overall)	0.70	0.65	0.61	0.61	0.54	0.46	0.48	0.36	0.24	0.31	0.31	0.33	0.74	0.52	0.39	0.46	0.47	0.61
			Governing Load Combination per Member per Station (Overall)	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	ULS B3 @ 84˚	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live
			Governing Member of the Element Group (Overall)																		
			Maximum Highest Ratio (Live Load Only)	0.70	0.65	0.61	0.61	0.54	0.46	0.48	0.36	0.24	0.31	0.31	0.31	0.74	0.52	0.39	0.46	0.47	0.61
			Governing Load Combination per Member per Station (Live Load Only)	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
			Governing Member of the Element Group (Live Load Only)																		
			Maximum Highest Ratio (Movable L. Only)	0.18	0.16	0.15	0.15	0.13	0.11	0.11	0.13	0.18	0.18	0.25	0.33	0.44	0.25	0.09	0.17	0.04	0.20
			Governing Load Combination per Member per Station (Movable Load Only)	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
			Governing Member of the Element Group (Movable Load Only)																		

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	612	612	612	613	613	613	614	614	614	615	615	615	616	616	616	617	617	617
			Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
			Node Label at Station		---			---			---			---			---			---		
Load Combination			Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
			Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.51	0.59	0.68	0.62	0.71	0.80	0.75	0.78	0.81	0.79	0.82	0.81	0.84	0.78	0.73	0.79	0.66	0.51
2	Live	CL2	Highest Ratio	0.51	0.59	0.68	0.62	0.71	0.80	0.75	0.78	0.81	0.79	0.82	0.81	0.84	0.78	0.73	0.79	0.66	0.51
3	Live	CL3	Highest Ratio	0.51	0.59	0.68	0.62	0.71	0.80	0.75	0.78	0.81	0.79	0.82	0.81	0.84	0.78	0.73	0.79	0.66	0.51
4	@ 0˚	ULS B1	Highest Ratio	0.06	0.09	0.11	0.07	0.09	0.11	0.09	0.10	0.10	0.09	0.10	0.09	0.10	0.09	0.08	0.11	0.08	0.04
5	@ 0˚	ULS B2	Highest Ratio	0.08	0.10	0.12	0.08	0.10	0.12	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.08	0.12	0.09	0.05
6	@ 0˚	ULS B3	Highest Ratio	0.08	0.10	0.13	0.08	0.11	0.13	0.10	0.10	0.11	0.10	0.10	0.10	0.11	0.09	0.08	0.13	0.09	0.05
7	@ 0˚	ULS B4	Highest Ratio	0.07	0.09	0.12	0.08	0.10	0.12	0.10	0.10	0.11	0.10	0.10	0.10	0.11	0.09	0.08	0.12	0.09	0.04
8	@ 21˚	ULS B1	Highest Ratio	0.04	0.05	0.06	0.05	0.05	0.06	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.05	0.04	0.06	0.04	0.02
9	@ 21˚	ULS B2	Highest Ratio	0.06	0.08	0.10	0.07	0.09	0.10	0.08	0.09	0.09	0.08	0.08	0.08	0.09	0.08	0.07	0.10	0.07	0.04
10	@ 21˚	ULS B3	Highest Ratio	0.06	0.09	0.11	0.07	0.09	0.11	0.09	0.09	0.10	0.09	0.09	0.09	0.10	0.09	0.08	0.11	0.07	0.04
11	@ 21˚	ULS B4	Highest Ratio	0.04	0.06	0.07	0.06	0.06	0.07	0.06	0.06	0.06	0.07	0.07	0.06	0.06	0.06	0.05	0.07	0.05	0.03
12	@ 42˚	ULS B1	Highest Ratio	0.03	0.04	0.05	0.04	0.06	0.06	0.05	0.06	0.06	0.05	0.06	0.06	0.06	0.06	0.05	0.06	0.05	0.03
13	@ 42˚	ULS B2	Highest Ratio	0.06	0.10	0.12	0.08	0.10	0.13	0.11	0.11	0.12	0.11	0.11	0.11	0.12	0.11	0.09	0.13	0.10	0.05
14	@ 42˚	ULS B3	Highest Ratio	0.07	0.11	0.13	0.09	0.12	0.15	0.12	0.13	0.13	0.12	0.12	0.12	0.13	0.12	0.10	0.15	0.11	0.05
15	@ 42˚	ULS B4	Highest Ratio	0.04	0.05	0.06	0.05	0.06	0.07	0.06	0.06	0.07	0.06	0.06	0.06	0.07	0.06	0.05	0.07	0.06	0.04
16	@ 63˚	ULS B1	Highest Ratio	0.04	0.07	0.09	0.05	0.08	0.10	0.07	0.08	0.08	0.08	0.08	0.08	0.09	0.08	0.07	0.10	0.07	0.03
17	@ 63˚	ULS B2	Highest Ratio	0.09	0.13	0.17	0.11	0.14	0.18	0.14	0.15	0.16	0.14	0.15	0.14	0.16	0.14	0.12	0.19	0.13	0.06
18	@ 63˚	ULS B3	Highest Ratio	0.10	0.14	0.19	0.12	0.16	0.20	0.15	0.16	0.17	0.16	0.16	0.16	0.18	0.16	0.13	0.20	0.14	0.06
19	@ 63˚	ULS B4	Highest Ratio	0.05	0.08	0.10	0.06	0.09	0.11	0.08	0.09	0.09	0.08	0.09	0.08	0.10	0.09	0.07	0.12	0.08	0.04
20	@ 84˚	ULS B1	Highest Ratio	0.05	0.09	0.12	0.07	0.10	0.12	0.09	0.10	0.10	0.09	0.09	0.09	0.12	0.10	0.08	0.13	0.09	0.04
21	@ 84˚	ULS B2	Highest Ratio	0.09	0.14	0.18	0.11	0.15	0.18	0.14	0.16	0.16	0.15	0.15	0.15	0.17	0.15	0.12	0.19	0.13	0.06
22	@ 84˚	ULS B3	Highest Ratio	0.10	0.15	0.20	0.12	0.16	0.20	0.15	0.17	0.18	0.16	0.16	0.15	0.18	0.16	0.13	0.21	0.14	0.06
23	@ 84˚	ULS B4	Highest Ratio	0.06	0.09	0.13	0.07	0.10	0.13	0.10	0.10	0.11	0.10	0.10	0.10	0.12	0.11	0.09	0.14	0.10	0.05
Maximum Highest Ratio (Overall)				0.51	0.59	0.68	0.62	0.71	0.80	0.75	0.78	0.81	0.79	0.82	0.81	0.84	0.78	0.73	0.79	0.66	0.51
Governing Load Combination per Member per Station (Overall)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
				Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.51	0.59	0.68	0.62	0.71	0.80	0.75	0.78	0.81	0.79	0.82	0.81	0.84	0.78	0.73	0.79	0.66	0.51
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.10	0.15	0.20	0.12	0.16	0.20	0.15	0.17	0.18	0.16	0.16	0.16	0.18	0.16	0.13	0.21	0.14	0.06
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)																					

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	618	618	618	619	619	619	656	656	656	657	657	657	658	658	658	659	659	659
			Member Label	-	-	-	-0S	-0S	-0S	8N-	8N-	8N-	-	-	-	-	-	-	-	-	-
			Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
			Node Label at Station		---			---	0S	8N	---			---			---			---	
Load Combination			Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
			Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.65	0.47	0.48	0.40	0.57	0.82	0.31	0.31	0.31	0.24	0.36	0.48	0.44	0.49	0.53	0.54	0.60	0.66
2	Live	CL2	Highest Ratio	0.65	0.47	0.48	0.40	0.57	0.82	0.31	0.31	0.31	0.24	0.36	0.48	0.44	0.49	0.53	0.54	0.60	0.66
3	Live	CL3	Highest Ratio	0.65	0.47	0.48	0.40	0.57	0.82	0.31	0.31	0.31	0.24	0.36	0.48	0.44	0.49	0.53	0.54	0.60	0.66
4	@ 0˚	ULS B1	Highest Ratio	0.10	0.02	0.08	0.04	0.10	0.18	0.04	0.04	0.04	0.04	0.05	0.07	0.07	0.07	0.08	0.08	0.09	0.09
5	@ 0˚	ULS B2	Highest Ratio	0.11	0.03	0.08	0.05	0.10	0.20	0.10	0.09	0.07	0.07	0.08	0.09	0.09	0.08	0.09	0.09	0.09	0.09
6	@ 0˚	ULS B3	Highest Ratio	0.12	0.03	0.08	0.06	0.11	0.20	0.12	0.10	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.10	0.09	0.09
7	@ 0˚	ULS B4	Highest Ratio	0.10	0.03	0.09	0.05	0.12	0.20	0.06	0.05	0.05	0.05	0.06	0.07	0.07	0.08	0.08	0.08	0.09	0.09
8	@ 21˚	ULS B1	Highest Ratio	0.05	0.02	0.03	0.02	0.03	0.06	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.07	0.08	0.08	0.09	0.11
9	@ 21˚	ULS B2	Highest Ratio	0.09	0.03	0.06	0.03	0.09	0.15	0.14	0.12	0.10	0.10	0.09	0.08	0.08	0.09	0.10	0.10	0.11	0.12
10	@ 21˚	ULS B3	Highest Ratio	0.10	0.03	0.07	0.04	0.09	0.17	0.16	0.13	0.11	0.11	0.10	0.09	0.09	0.09	0.10	0.10	0.11	0.12
11	@ 21˚	ULS B4	Highest Ratio	0.06	0.03	0.04	0.02	0.05	0.08	0.09	0.09	0.08	0.08	0.08	0.07	0.07	0.08	0.09	0.09	0.10	0.11
12	@ 42˚	ULS B1	Highest Ratio	0.05	0.01	0.04	0.02	0.05	0.09	0.14	0.12	0.09	0.09	0.07	0.06	0.06	0.07	0.08	0.09	0.10	0.12
13	@ 42˚	ULS B2	Highest Ratio	0.11	0.03	0.10	0.06	0.14	0.24	0.21	0.17	0.13	0.13	0.11	0.09	0.09	0.10	0.11	0.12	0.13	0.14
14	@ 42˚	ULS B3	Highest Ratio	0.13	0.03	0.11	0.06	0.16	0.28	0.22	0.18	0.14	0.14	0.11	0.09	0.09	0.10	0.12	0.12	0.13	0.15
15	@ 42˚	ULS B4	Highest Ratio	0.06	0.02	0.05	0.03	0.06	0.11	0.16	0.13	0.11	0.11	0.08	0.07	0.06	0.08	0.09	0.09	0.11	0.12
16	@ 63˚	ULS B1	Highest Ratio	0.08	0.01	0.08	0.04	0.12	0.21	0.19	0.14	0.10	0.10	0.07	0.05	0.05	0.07	0.07	0.08	0.09	0.11
17	@ 63˚	ULS B2	Highest Ratio	0.16	0.03	0.15	0.08	0.21	0.37	0.26	0.20	0.15	0.15	0.11	0.09	0.09	0.11	0.12	0.12	0.14	0.15
18	@ 63˚	ULS B3	Highest Ratio	0.18	0.03	0.16	0.09	0.23	0.41	0.28	0.21	0.16	0.16	0.12	0.10	0.10	0.11	0.13	0.13	0.15	0.16
19	@ 63˚	ULS B4	Highest Ratio	0.10	0.01	0.09	0.05	0.13	0.23	0.21	0.16	0.11	0.11	0.08	0.05	0.05	0.07	0.09	0.09	0.10	0.11
20	@ 84˚	ULS B1	Highest Ratio	0.11	0.01	0.12	0.07	0.18	0.30	0.22	0.16	0.10	0.10	0.05	0.03	0.03	0.04	0.06	0.06	0.07	0.09
21	@ 84˚	ULS B2	Highest Ratio	0.17	0.03	0.16	0.09	0.24	0.41	0.28	0.22	0.15	0.15	0.11	0.08	0.08	0.10	0.11	0.12	0.14	0.15
22	@ 84˚	ULS B3	Highest Ratio	0.18	0.03	0.17	0.09	0.25	0.43	0.30	0.23	0.16	0.16	0.11	0.09	0.09	0.11	0.12	0.13	0.15	0.16
23	@ 84˚	ULS B4	Highest Ratio	0.12	0.01	0.13	0.07	0.19	0.33	0.24	0.17	0.11	0.11	0.06	0.04	0.04	0.06	0.06	0.06	0.09	0.10
Maximum Highest Ratio (Overall)				0.65	0.47	0.48	0.40	0.57	0.82	0.31	0.31	0.31	0.24	0.36	0.48	0.44	0.49	0.53	0.54	0.60	0.66
Governing Load Combination per Member per Station (Overall)				CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.65	0.47	0.48	0.40	0.57	0.82	0.31	0.31	0.31	0.24	0.36	0.48	0.44	0.49	0.53	0.54	0.60	0.66
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.18	0.03	0.17	0.09	0.25	0.43	0.30	0.23	0.16	0.16	0.12	0.10	0.10	0.11	0.13	0.13	0.15	0.16
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)																					

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	660	660	660	661	661	661	662	662	662	663	663	663	664	664	664	665	665	665
			Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-8S	-8S	-8S
			Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
			Node Label at Station		---			---			---			---			---				---	8S
Load Combination			Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
			Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.64	0.66	0.68	0.70	0.70	0.70	0.70	0.66	0.61	0.63	0.54	0.47	0.48	0.36	0.24	0.31	0.31	0.31
2	Live	CL2	Highest Ratio	0.64	0.66	0.68	0.70	0.70	0.70	0.70	0.66	0.61	0.63	0.54	0.46	0.48	0.36	0.24	0.31	0.31	0.31
3	Live	CL3	Highest Ratio	0.64	0.66	0.68	0.70	0.70	0.70	0.70	0.66	0.61	0.61	0.53	0.45	0.47	0.35	0.24	0.31	0.31	0.31
4	@ 0˚	ULS B1	Highest Ratio	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.07	0.06	0.06	0.05	0.04	0.04	0.04	0.05
5	@ 0˚	ULS B2	Highest Ratio	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.07	0.07	0.07	0.08	0.08	0.09	0.11
6	@ 0˚	ULS B3	Highest Ratio	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.12
7	@ 0˚	ULS B4	Highest Ratio	0.09	0.09	0.09	0.10	0.09	0.09	0.09	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.05	0.05	0.06	0.07
8	@ 21˚	ULS B1	Highest Ratio	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.08	0.06	0.06	0.05	0.05	0.05	0.05	0.06
9	@ 21˚	ULS B2	Highest Ratio	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.11	0.11	0.11	0.10	0.08	0.08	0.08	0.09	0.09	0.10	0.12
10	@ 21˚	ULS B3	Highest Ratio	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.11	0.11	0.11	0.10	0.09	0.09	0.08	0.09	0.09	0.11	0.14
11	@ 21˚	ULS B4	Highest Ratio	0.10	0.11	0.11	0.12	0.12	0.11	0.12	0.11	0.10	0.10	0.08	0.07	0.07	0.05	0.06	0.06	0.07	0.08
12	@ 42˚	ULS B1	Highest Ratio	0.11	0.12	0.12	0.12	0.13	0.12	0.12	0.11	0.10	0.10	0.08	0.06	0.06	0.06	0.08	0.08	0.10	0.13
13	@ 42˚	ULS B2	Highest Ratio	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.12	0.12	0.11	0.08	0.08	0.08	0.12	0.12	0.15	0.21
14	@ 42˚	ULS B3	Highest Ratio	0.14	0.15	0.15	0.15	0.16	0.15	0.15	0.14	0.13	0.13	0.11	0.09	0.09	0.09	0.12	0.12	0.16	0.22
15	@ 42˚	ULS B4	Highest Ratio	0.12	0.12	0.13	0.13	0.13	0.13	0.13	0.12	0.10	0.10	0.09	0.07	0.07	0.06	0.08	0.08	0.12	0.15
16	@ 63˚	ULS B1	Highest Ratio	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.11	0.09	0.09	0.07	0.04	0.04	0.06	0.09	0.09	0.14	0.19
17	@ 63˚	ULS B2	Highest Ratio	0.15	0.15	0.15	0.16	0.16	0.16	0.16	0.15	0.14	0.14	0.11	0.08	0.08	0.10	0.14	0.14	0.19	0.26
18	@ 63˚	ULS B3	Highest Ratio	0.16	0.16	0.17	0.17	0.17	0.16	0.16	0.16	0.14	0.14	0.12	0.09	0.09	0.11	0.15	0.15	0.20	0.28
19	@ 63˚	ULS B4	Highest Ratio	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.11	0.10	0.10	0.08	0.06	0.06	0.07	0.11	0.11	0.16	0.20
20	@ 84˚	ULS B1	Highest Ratio	0.09	0.09	0.10	0.10	0.10	0.10	0.10	0.09	0.07	0.07	0.06	0.03	0.03	0.06	0.10	0.10	0.16	0.21
21	@ 84˚	ULS B2	Highest Ratio	0.14	0.15	0.15	0.15	0.16	0.15	0.15	0.14	0.12	0.12	0.10	0.07	0.07	0.10	0.14	0.14	0.21	0.29
22	@ 84˚	ULS B3	Highest Ratio	0.16	0.16	0.17	0.17	0.17	0.16	0.16	0.15	0.13	0.13	0.12	0.09	0.09	0.11	0.15	0.15	0.22	0.30
23	@ 84˚	ULS B4	Highest Ratio	0.09	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.08	0.08	0.06	0.04	0.04	0.07	0.11	0.11	0.17	0.24
Maximum Highest Ratio (Overall)				0.64	0.66	0.68	0.70	0.70	0.70	0.70	0.66	0.61	0.63	0.54	0.47	0.48	0.36	0.24	0.31	0.31	0.31
Governing Load Combination per Member per Station (Overall)				CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.64	0.66	0.68	0.70	0.70	0.70	0.70	0.66	0.61	0.63	0.54	0.47	0.48	0.36	0.24	0.31	0.31	0.31
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.16	0.16	0.17	0.17	0.17	0.16	0.16	0.16	0.14	0.14	0.12	0.09	0.09	0.11	0.15	0.15	0.22	0.30
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)																					

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	666	666	666	667	667	667	668	668	668	669	669	669	670	670	670	671	671	671
			Member Label	12N-	12N-	12N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
			Node Label at Station	12N	---			---			---			---			---			---		
Load Combination			Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
			Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
ID	Category	Name																				
1	Live	CL1	Highest Ratio	0.32	0.30	0.36	0.28	0.43	0.59	0.53	0.56	0.60	0.64	0.69	0.73	0.71	0.73	0.73	0.75	0.76	0.75
2	Live	CL2	Highest Ratio	0.32	0.30	0.36	0.28	0.43	0.59	0.53	0.56	0.60	0.64	0.69	0.73	0.71	0.73	0.73	0.75	0.76	0.75
3	Live	CL3	Highest Ratio	0.32	0.30	0.36	0.28	0.43	0.59	0.53	0.56	0.60	0.64	0.69	0.73	0.71	0.73	0.73	0.75	0.76	0.75
4	@ 0˚	ULS B1	Highest Ratio	0.15	0.11	0.07	0.10	0.07	0.13	0.08	0.11	0.13	0.10	0.12	0.13	0.11	0.11	0.12	0.12	0.12	0.12
5	@ 0˚	ULS B2	Highest Ratio	0.42	0.25	0.09	0.20	0.08	0.24	0.12	0.16	0.20	0.12	0.16	0.19	0.13	0.14	0.15	0.12	0.12	0.12
6	@ 0˚	ULS B3	Highest Ratio	0.48	0.29	0.10	0.22	0.08	0.26	0.12	0.17	0.22	0.12	0.16	0.21	0.14	0.14	0.15	0.13	0.13	0.12
7	@ 0˚	ULS B4	Highest Ratio	0.23	0.15	0.07	0.13	0.08	0.16	0.10	0.13	0.15	0.10	0.13	0.15	0.12	0.12	0.13	0.13	0.13	0.12
8	@ 21˚	ULS B1	Highest Ratio	0.36	0.22	0.08	0.18	0.07	0.22	0.10	0.15	0.19	0.11	0.15	0.19	0.14	0.15	0.16	0.14	0.14	0.14
9	@ 21˚	ULS B2	Highest Ratio	0.67	0.38	0.12	0.29	0.08	0.35	0.14	0.21	0.28	0.14	0.20	0.26	0.17	0.18	0.19	0.16	0.17	0.17
10	@ 21˚	ULS B3	Highest Ratio	0.73	0.42	0.13	0.32	0.08	0.38	0.15	0.23	0.30	0.15	0.21	0.28	0.18	0.19	0.21	0.17	0.18	0.17
11	@ 21˚	ULS B4	Highest Ratio	0.44	0.26	0.09	0.20	0.08	0.25	0.12	0.16	0.21	0.12	0.17	0.20	0.15	0.16	0.16	0.14	0.15	0.15
12	@ 42˚	ULS B1	Highest Ratio	0.53	0.31	0.10	0.23	0.07	0.28	0.11	0.17	0.23	0.12	0.17	0.21	0.14	0.15	0.17	0.15	0.16	0.15
13	@ 42˚	ULS B2	Highest Ratio	0.88	0.50	0.14	0.37	0.09	0.44	0.16	0.26	0.35	0.17	0.25	0.32	0.21	0.22	0.24	0.20	0.21	0.20
14	@ 42˚	ULS B3	Highest Ratio	0.96	0.55	0.15	0.40	0.09	0.48	0.18	0.28	0.38	0.18	0.26	0.34	0.22	0.24	0.25	0.22	0.23	0.22
15	@ 42˚	ULS B4	Highest Ratio	0.62	0.35	0.10	0.26	0.07	0.32	0.13	0.19	0.25	0.13	0.18	0.23	0.16	0.16	0.18	0.15	0.16	0.16
16	@ 63˚	ULS B1	Highest Ratio	0.63	0.36	0.09	0.26	0.05	0.30	0.10	0.17	0.24	0.11	0.16	0.21	0.14	0.15	0.16	0.14	0.14	0.14
17	@ 63˚	ULS B2	Highest Ratio	0.96	0.54	0.14	0.40	0.10	0.47	0.17	0.28	0.38	0.18	0.26	0.34	0.21	0.23	0.25	0.22	0.22	0.21
18	@ 63˚	ULS B3	Highest Ratio	1.04	0.59	0.15	0.43	0.10	0.51	0.19	0.30	0.41	0.19	0.28	0.37	0.23	0.25	0.27	0.23	0.24	0.23
19	@ 63˚	ULS B4	Highest Ratio	0.71	0.40	0.10	0.29	0.06	0.34	0.12	0.19	0.27	0.12	0.18	0.24	0.15	0.15	0.17	0.14	0.15	0.14
20	@ 84˚	ULS B1	Highest Ratio	0.64	0.35	0.08	0.25	0.03	0.28	0.09	0.15	0.22	0.08	0.14	0.19	0.11	0.12	0.13	0.11	0.12	0.11
21	@ 84˚	ULS B2	Highest Ratio	0.90	0.51	0.13	0.37	0.08	0.43	0.16	0.25	0.35	0.16	0.23	0.30	0.19	0.21	0.22	0.19	0.19	0.19
22	@ 84˚	ULS B3	Highest Ratio	0.97	0.55	0.15	0.40	0.09	0.47	0.17	0.27	0.37	0.17	0.25	0.33	0.21	0.23	0.24	0.21	0.22	0.21
23	@ 84˚	ULS B4	Highest Ratio	0.72	0.40	0.09	0.28	0.04	0.32	0.10	0.18	0.24	0.09	0.16	0.21	0.12	0.13	0.14	0.11	0.12	0.12
Maximum Highest Ratio (Overall)				1.04	0.59	0.36	0.43	0.43	0.59	0.53	0.56	0.60	0.64	0.69	0.73	0.71	0.73	0.73	0.75	0.76	0.75
Governing Load Combination per Member per Station (Overall)				ULS B3 @ 63˚	ULS B3 @ 63˚	CL1 Live	ULS B3 @ 63˚	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live
Governing Member of the Element Group (Overall)																						
Maximum Highest Ratio (Live Load Only)				0.32	0.30	0.36	0.28	0.43	0.59	0.53	0.56	0.60	0.64	0.69	0.73	0.71	0.73	0.73	0.75	0.76	0.75
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																						
Maximum Highest Ratio (Movable L. Only)				1.04	0.59	0.15	0.43	0.10	0.51	0.19	0.30	0.41	0.19	0.28	0.37	0.23	0.25	0.27	0.23	0.24	0.23
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)																						

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	672	672	672	673	673	673	674	674	674	675	675	675	676	676	676	677	677	677
			Member Label	-	-	-	-	-	-	-	-	-	-12S	-12S	-12S	14N-	14N-	14N-	-	-	-
			Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
			Node Label at Station		---			---			---			---	12S	14N	---			---	
Load Combination			Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
			Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.76	0.74	0.72	0.69	0.62	0.55	0.61	0.44	0.28	0.37	0.30	0.32	0.31	0.31	0.31	0.26	0.38	0.50
2	Live	CL2	Highest Ratio	0.76	0.74	0.72	0.68	0.62	0.55	0.60	0.44	0.28	0.36	0.30	0.32	0.31	0.31	0.31	0.26	0.38	0.50
3	Live	CL3	Highest Ratio	0.76	0.74	0.72	0.68	0.62	0.55	0.60	0.44	0.27	0.36	0.30	0.32	0.31	0.31	0.31	0.26	0.38	0.49
4	@ 0˚	ULS B1	Highest Ratio	0.12	0.11	0.10	0.13	0.10	0.08	0.12	0.07	0.07	0.04	0.08	0.11	0.07	0.07	0.07	0.07	0.07	0.08
5	@ 0˚	ULS B2	Highest Ratio	0.16	0.14	0.12	0.20	0.15	0.09	0.22	0.07	0.17	0.07	0.21	0.37	0.24	0.20	0.16	0.16	0.15	0.14
6	@ 0˚	ULS B3	Highest Ratio	0.17	0.15	0.13	0.23	0.16	0.09	0.25	0.08	0.19	0.08	0.24	0.43	0.27	0.23	0.19	0.19	0.17	0.15
7	@ 0˚	ULS B4	Highest Ratio	0.13	0.13	0.11	0.15	0.12	0.09	0.16	0.07	0.10	0.05	0.12	0.19	0.13	0.12	0.10	0.10	0.10	0.10
8	@ 21˚	ULS B1	Highest Ratio	0.16	0.14	0.12	0.19	0.14	0.08	0.21	0.07	0.15	0.07	0.19	0.32	0.17	0.15	0.11	0.11	0.10	0.09
9	@ 21˚	ULS B2	Highest Ratio	0.22	0.19	0.15	0.30	0.20	0.10	0.33	0.08	0.26	0.10	0.35	0.62	0.33	0.26	0.21	0.21	0.18	0.15
10	@ 21˚	ULS B3	Highest Ratio	0.23	0.20	0.16	0.32	0.21	0.10	0.36	0.09	0.29	0.11	0.39	0.69	0.36	0.29	0.23	0.23	0.19	0.16
11	@ 21˚	ULS B4	Highest Ratio	0.17	0.15	0.13	0.22	0.16	0.09	0.24	0.08	0.18	0.07	0.23	0.40	0.23	0.19	0.15	0.15	0.13	0.11
12	@ 42˚	ULS B1	Highest Ratio	0.18	0.16	0.13	0.24	0.16	0.08	0.27	0.07	0.21	0.08	0.29	0.50	0.24	0.19	0.14	0.14	0.12	0.09
13	@ 42˚	ULS B2	Highest Ratio	0.26	0.23	0.18	0.37	0.24	0.10	0.42	0.08	0.35	0.12	0.48	0.85	0.39	0.31	0.24	0.24	0.19	0.15
14	@ 42˚	ULS B3	Highest Ratio	0.28	0.24	0.20	0.41	0.26	0.12	0.47	0.09	0.39	0.14	0.53	0.94	0.43	0.34	0.26	0.26	0.22	0.17
15	@ 42˚	ULS B4	Highest Ratio	0.20	0.17	0.14	0.27	0.18	0.09	0.30	0.07	0.24	0.09	0.33	0.58	0.30	0.24	0.18	0.18	0.15	0.11
16	@ 63˚	ULS B1	Highest Ratio	0.17	0.15	0.12	0.25	0.17	0.07	0.30	0.06	0.25	0.08	0.34	0.61	0.28	0.21	0.14	0.14	0.11	0.07
17	@ 63˚	ULS B2	Highest Ratio	0.28	0.24	0.19	0.41	0.26	0.10	0.46	0.08	0.39	0.14	0.54	0.96	0.42	0.33	0.24	0.25	0.19	0.14
18	@ 63˚	ULS B3	Highest Ratio	0.31	0.26	0.21	0.44	0.28	0.12	0.50	0.09	0.42	0.15	0.58	1.03	0.45	0.36	0.27	0.27	0.21	0.16
19	@ 63˚	ULS B4	Highest Ratio	0.19	0.16	0.13	0.28	0.18	0.07	0.33	0.06	0.28	0.09	0.39	0.69	0.33	0.25	0.18	0.18	0.13	0.09
20	@ 84˚	ULS B1	Highest Ratio	0.15	0.13	0.10	0.23	0.14	0.04	0.29	0.04	0.24	0.08	0.35	0.64	0.25	0.18	0.10	0.10	0.05	0.01
21	@ 84˚	ULS B2	Highest Ratio	0.26	0.22	0.17	0.37	0.24	0.09	0.43	0.07	0.37	0.14	0.51	0.91	0.39	0.30	0.21	0.21	0.14	0.09
22	@ 84˚	ULS B3	Highest Ratio	0.28	0.24	0.18	0.41	0.26	0.10	0.46	0.08	0.40	0.15	0.55	0.97	0.42	0.32	0.23	0.23	0.16	0.11
23	@ 84˚	ULS B4	Highest Ratio	0.16	0.14	0.10	0.26	0.16	0.05	0.32	0.04	0.28	0.09	0.39	0.72	0.31	0.22	0.14	0.14	0.08	0.04
Maximum Highest Ratio (Overall)				0.76	0.74	0.72	0.69	0.62	0.55	0.61	0.44	0.42	0.37	0.58	1.03	0.45	0.36	0.31	0.27	0.38	0.50
Governing Load Combination per Member per Station (Overall)				CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	ULS B3 @ 63˚	CL1 Live	ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 63˚	CL1 Live	ULS B3 @ 63˚	CL1 Live	CL1 Live
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.76	0.74	0.72	0.69	0.62	0.55	0.61	0.44	0.28	0.37	0.30	0.32	0.31	0.31	0.31	0.26	0.38	0.50
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.31	0.26	0.21	0.44	0.28	0.12	0.50	0.09	0.42	0.15	0.58	1.03	0.45	0.36	0.27	0.27	0.22	0.17
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)																					

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Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	678	678	678	679	679	679	680	680	680	681	681	681	682	682	682	683	683	683
			Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
			Node Label at Station		---			---			---			---			---			---		
Load Combination			Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
			Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.48	0.52	0.57	0.56	0.63	0.69	0.68	0.70	0.72	0.71	0.71	0.71	0.72	0.68	0.63	0.64	0.56	0.48
2	Live	CL2	Highest Ratio	0.48	0.52	0.57	0.56	0.63	0.69	0.68	0.70	0.72	0.71	0.71	0.71	0.72	0.68	0.63	0.64	0.56	0.47
3	Live	CL3	Highest Ratio	0.48	0.52	0.57	0.56	0.63	0.68	0.68	0.70	0.72	0.71	0.71	0.71	0.72	0.67	0.62	0.63	0.56	0.47
4	@ 0˚	ULS B1	Highest Ratio	0.08	0.08	0.09	0.09	0.09	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.08
5	@ 0˚	ULS B2	Highest Ratio	0.13	0.13	0.13	0.13	0.13	0.13	0.12	0.12	0.11	0.11	0.10	0.12	0.12	0.12	0.12	0.12	0.13	0.13
6	@ 0˚	ULS B3	Highest Ratio	0.14	0.14	0.14	0.14	0.13	0.13	0.12	0.12	0.12	0.12	0.10	0.12	0.12	0.12	0.13	0.13	0.14	0.14
7	@ 0˚	ULS B4	Highest Ratio	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.10	0.11	0.11	0.10	0.09
8	@ 21˚	ULS B1	Highest Ratio	0.09	0.10	0.11	0.12	0.13	0.14	0.13	0.13	0.14	0.15	0.14	0.14	0.14	0.14	0.12	0.12	0.11	0.09
9	@ 21˚	ULS B2	Highest Ratio	0.15	0.15	0.15	0.15	0.16	0.16	0.15	0.16	0.16	0.16	0.15	0.16	0.16	0.16	0.15	0.16	0.15	0.14
10	@ 21˚	ULS B3	Highest Ratio	0.16	0.16	0.16	0.16	0.17	0.17	0.16	0.17	0.16	0.16	0.15	0.16	0.16	0.16	0.16	0.16	0.16	0.15
11	@ 21˚	ULS B4	Highest Ratio	0.11	0.12	0.13	0.13	0.14	0.15	0.14	0.15	0.15	0.15	0.15	0.15	0.15	0.14	0.14	0.14	0.13	0.11
12	@ 42˚	ULS B1	Highest Ratio	0.09	0.11	0.12	0.12	0.14	0.15	0.15	0.15	0.16	0.16	0.16	0.16	0.16	0.15	0.13	0.13	0.11	0.08
13	@ 42˚	ULS B2	Highest Ratio	0.15	0.16	0.17	0.18	0.18	0.19	0.18	0.19	0.19	0.19	0.18	0.19	0.19	0.18	0.18	0.18	0.17	0.15
14	@ 42˚	ULS B3	Highest Ratio	0.17	0.17	0.18	0.19	0.19	0.20	0.20	0.19	0.19	0.20	0.19	0.19	0.19	0.19	0.19	0.19	0.18	0.16
15	@ 42˚	ULS B4	Highest Ratio	0.11	0.13	0.14	0.14	0.15	0.17	0.16	0.16	0.17	0.17	0.17	0.17	0.17	0.16	0.15	0.15	0.13	0.11
16	@ 63˚	ULS B1	Highest Ratio	0.07	0.08	0.10	0.10	0.12	0.14	0.14	0.14	0.14	0.15	0.14	0.14	0.14	0.13	0.12	0.12	0.10	0.06
17	@ 63˚	ULS B2	Highest Ratio	0.14	0.16	0.16	0.17	0.19	0.19	0.19	0.19	0.19	0.19	0.18	0.19	0.19	0.18	0.17	0.17	0.15	0.13
18	@ 63˚	ULS B3	Highest Ratio	0.16	0.17	0.19	0.19	0.19	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.19	0.19	0.17	0.15
19	@ 63˚	ULS B4	Highest Ratio	0.09	0.11	0.13	0.13	0.14	0.16	0.15	0.15	0.15	0.16	0.16	0.16	0.16	0.15	0.13	0.13	0.11	0.09
20	@ 84˚	ULS B1	Highest Ratio	0.01	0.03	0.04	0.04	0.06	0.07	0.07	0.08	0.08	0.08	0.09	0.08	0.08	0.08	0.06	0.06	0.04	0.02
21	@ 84˚	ULS B2	Highest Ratio	0.09	0.10	0.12	0.12	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.13	0.13	0.11	0.09
22	@ 84˚	ULS B3	Highest Ratio	0.11	0.12	0.13	0.13	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.16	0.16	0.15	0.15	0.15	0.13	0.10
23	@ 84˚	ULS B4	Highest Ratio	0.04	0.06	0.07	0.07	0.09	0.09	0.09	0.10	0.10	0.10	0.11	0.10	0.10	0.10	0.09	0.09	0.07	0.04
Maximum Highest Ratio (Overall)				0.48	0.52	0.57	0.56	0.63	0.69	0.68	0.70	0.72	0.71	0.71	0.71	0.72	0.68	0.63	0.64	0.56	0.48
Governing Load Combination per Member per Station (Overall)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
				Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.48	0.52	0.57	0.56	0.63	0.69	0.68	0.70	0.72	0.71	0.71	0.71	0.72	0.68	0.63	0.64	0.56	0.48
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.17	0.17	0.19	0.19	0.19	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.19	0.19	0.18	0.16
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)																					

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	684	684	684	685	685	685	686	686	686	687	687	687	688	688	688	689	689	689
			Member Label	-	-	-	-14S	-14S	-14S	16N-	16N-	16N-	-	-	-	-	-	-	-	-	-
			Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
			Node Label at Station		---			---	14S	16N	---			---			---			---	
Load Combination			Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
			Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.49	0.38	0.26	0.31	0.31	0.31	0.31	0.29	0.54	0.39	0.60	0.82	0.71	0.75	0.80	0.76	0.80	0.85
2	Live	CL2	Highest Ratio	0.49	0.38	0.26	0.31	0.31	0.31	0.31	0.29	0.54	0.38	0.60	0.82	0.71	0.75	0.80	0.76	0.80	0.85
3	Live	CL3	Highest Ratio	0.49	0.37	0.26	0.31	0.31	0.31	0.31	0.29	0.54	0.38	0.60	0.81	0.71	0.75	0.80	0.76	0.80	0.84
4	@ 0˚	ULS B1	Highest Ratio	0.08	0.06	0.05	0.05	0.05	0.06	0.39	0.24	0.12	0.17	0.06	0.16	0.09	0.13	0.17	0.12	0.15	0.17
5	@ 0˚	ULS B2	Highest Ratio	0.13	0.13	0.14	0.14	0.18	0.22	0.50	0.38	0.29	0.29	0.19	0.31	0.22	0.24	0.28	0.21	0.22	0.23
6	@ 0˚	ULS B3	Highest Ratio	0.14	0.15	0.17	0.17	0.21	0.26	0.53	0.40	0.32	0.31	0.23	0.35	0.24	0.28	0.30	0.24	0.25	0.24
7	@ 0˚	ULS B4	Highest Ratio	0.09	0.08	0.08	0.08	0.09	0.12	0.50	0.35	0.22	0.25	0.13	0.22	0.14	0.18	0.21	0.16	0.17	0.20
8	@ 21˚	ULS B1	Highest Ratio	0.09	0.08	0.09	0.09	0.12	0.15	0.61	0.38	0.18	0.25	0.08	0.23	0.13	0.19	0.24	0.17	0.21	0.25
9	@ 21˚	ULS B2	Highest Ratio	0.14	0.16	0.19	0.19	0.25	0.30	0.81	0.52	0.33	0.37	0.20	0.39	0.25	0.31	0.36	0.27	0.29	0.33
10	@ 21˚	ULS B3	Highest Ratio	0.15	0.18	0.21	0.21	0.27	0.34	0.86	0.55	0.36	0.39	0.23	0.42	0.28	0.33	0.38	0.29	0.32	0.34
11	@ 21˚	ULS B4	Highest Ratio	0.11	0.11	0.12	0.12	0.17	0.20	0.70	0.47	0.28	0.33	0.14	0.29	0.18	0.23	0.28	0.20	0.23	0.27
12	@ 42˚	ULS B1	Highest Ratio	0.08	0.10	0.13	0.13	0.17	0.22	0.76	0.48	0.22	0.31	0.08	0.27	0.15	0.22	0.28	0.19	0.25	0.29
13	@ 42˚	ULS B2	Highest Ratio	0.15	0.18	0.22	0.22	0.30	0.38	0.95	0.60	0.36	0.42	0.20	0.42	0.26	0.33	0.40	0.29	0.33	0.36
14	@ 42˚	ULS B3	Highest Ratio	0.16	0.20	0.24	0.24	0.32	0.42	0.99	0.63	0.39	0.44	0.23	0.45	0.29	0.36	0.42	0.31	0.35	0.38
15	@ 42˚	ULS B4	Highest Ratio	0.11	0.13	0.16	0.16	0.22	0.28	0.82	0.54	0.30	0.37	0.14	0.32	0.20	0.26	0.32	0.23	0.27	0.31
16	@ 63˚	ULS B1	Highest Ratio	0.06	0.09	0.14	0.14	0.20	0.26	0.79	0.49	0.23	0.32	0.07	0.26	0.14	0.21	0.27	0.18	0.24	0.28
17	@ 63˚	ULS B2	Highest Ratio	0.13	0.18	0.23	0.23	0.32	0.42	0.96	0.60	0.34	0.40	0.18	0.41	0.24	0.32	0.38	0.28	0.32	0.36
18	@ 63˚	ULS B3	Highest Ratio	0.15	0.20	0.25	0.25	0.36	0.45	1.01	0.62	0.37	0.42	0.21	0.43	0.27	0.34	0.41	0.29	0.33	0.37
19	@ 63˚	ULS B4	Highest Ratio	0.09	0.12	0.18	0.18	0.24	0.31	0.82	0.53	0.28	0.35	0.12	0.32	0.18	0.25	0.32	0.22	0.26	0.31
20	@ 84˚	ULS B1	Highest Ratio	0.02	0.06	0.11	0.11	0.18	0.25	0.67	0.40	0.18	0.25	0.04	0.19	0.10	0.15	0.21	0.14	0.18	0.22
21	@ 84˚	ULS B2	Highest Ratio	0.09	0.13	0.20	0.20	0.30	0.40	1.01	0.62	0.30	0.41	0.12	0.34	0.21	0.28	0.35	0.24	0.30	0.34
22	@ 84˚	ULS B3	Highest Ratio	0.10	0.15	0.22	0.22	0.33	0.44	1.09	0.68	0.33	0.44	0.15	0.38	0.22	0.30	0.38	0.27	0.32	0.37
23	@ 84˚	ULS B4	Highest Ratio	0.04	0.09	0.15	0.15	0.22	0.31	0.76	0.46	0.21	0.29	0.07	0.24	0.14	0.20	0.25	0.18	0.22	0.26
Maximum Highest Ratio (Overall)				0.49	0.38	0.26	0.31	0.36	0.45	1.09	0.68	0.54	0.44	0.60	0.82	0.71	0.75	0.80	0.76	0.80	0.85
Governing Load Combination per Member per Station (Overall)				CL1 Live	CL1 Live	CL1 Live	CL1 Live	ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 84˚	ULS B3 @ 84˚	CL1 Live	ULS B3 @ 84˚	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.49	0.38	0.26	0.31	0.31	0.31	0.31	0.29	0.54	0.39	0.60	0.82	0.71	0.75	0.80	0.76	0.80	0.85
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.16	0.20	0.25	0.25	0.36	0.45	1.09	0.68	0.39	0.44	0.23	0.45	0.29	0.36	0.42	0.31	0.35	0.38
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)																					

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	690	690	690	691	691	691	692	692	692	693	693	693	694	694	694	695	695	695
			Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-16S	-16S	-16S
			Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
			Node Label at Station		---			---			---			---			---				---	16S
Load Combination			Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
			Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.81	0.84	0.86	0.84	0.86	0.86	0.88	0.86	0.84	0.88	0.81	0.74	0.88	0.64	0.40	0.58	0.29	0.31
2	Live	CL2	Highest Ratio	0.81	0.83	0.85	0.84	0.86	0.86	0.88	0.86	0.84	0.87	0.81	0.74	0.88	0.64	0.40	0.58	0.29	0.31
3	Live	CL3	Highest Ratio	0.80	0.83	0.85	0.83	0.86	0.86	0.87	0.85	0.83	0.87	0.81	0.74	0.87	0.63	0.40	0.57	0.29	0.31
4	@ 0˚	ULS B1	Highest Ratio	0.14	0.15	0.16	0.15	0.15	0.15	0.17	0.15	0.13	0.18	0.13	0.08	0.15	0.04	0.14	0.09	0.23	0.38
5	@ 0˚	ULS B2	Highest Ratio	0.20	0.19	0.18	0.17	0.15	0.17	0.19	0.20	0.21	0.27	0.24	0.20	0.31	0.17	0.26	0.26	0.35	0.49
6	@ 0˚	ULS B3	Highest Ratio	0.21	0.20	0.19	0.18	0.15	0.18	0.20	0.22	0.23	0.29	0.26	0.23	0.34	0.21	0.29	0.29	0.38	0.51
7	@ 0˚	ULS B4	Highest Ratio	0.16	0.16	0.17	0.16	0.16	0.16	0.18	0.17	0.16	0.21	0.17	0.13	0.21	0.11	0.22	0.19	0.32	0.49
8	@ 21˚	ULS B1	Highest Ratio	0.20	0.21	0.22	0.21	0.21	0.21	0.24	0.21	0.19	0.26	0.19	0.10	0.22	0.07	0.25	0.18	0.39	0.63
9	@ 21˚	ULS B2	Highest Ratio	0.27	0.27	0.26	0.25	0.24	0.25	0.28	0.28	0.27	0.37	0.29	0.21	0.37	0.19	0.36	0.32	0.53	0.84
10	@ 21˚	ULS B3	Highest Ratio	0.28	0.28	0.27	0.26	0.25	0.26	0.29	0.29	0.29	0.39	0.31	0.24	0.40	0.22	0.39	0.35	0.55	0.89
11	@ 21˚	ULS B4	Highest Ratio	0.23	0.23	0.23	0.22	0.22	0.22	0.25	0.23	0.21	0.29	0.23	0.15	0.28	0.13	0.32	0.26	0.47	0.70
12	@ 42˚	ULS B1	Highest Ratio	0.24	0.25	0.26	0.24	0.25	0.24	0.27	0.25	0.22	0.31	0.22	0.12	0.26	0.08	0.31	0.23	0.48	0.78
13	@ 42˚	ULS B2	Highest Ratio	0.30	0.30	0.30	0.28	0.28	0.29	0.32	0.31	0.30	0.40	0.32	0.22	0.40	0.19	0.41	0.35	0.61	0.97
14	@ 42˚	ULS B3	Highest Ratio	0.31	0.31	0.31	0.29	0.29	0.29	0.33	0.32	0.31	0.42	0.34	0.24	0.43	0.22	0.43	0.37	0.63	1.02
15	@ 42˚	ULS B4	Highest Ratio	0.25	0.26	0.27	0.25	0.25	0.25	0.28	0.27	0.24	0.34	0.25	0.16	0.31	0.14	0.37	0.30	0.55	0.83
16	@ 63˚	ULS B1	Highest Ratio	0.23	0.24	0.24	0.23	0.24	0.23	0.26	0.23	0.21	0.30	0.21	0.11	0.25	0.07	0.32	0.23	0.50	0.81
17	@ 63˚	ULS B2	Highest Ratio	0.29	0.30	0.29	0.27	0.27	0.28	0.32	0.30	0.28	0.40	0.30	0.20	0.39	0.18	0.42	0.35	0.63	1.00
18	@ 63˚	ULS B3	Highest Ratio	0.30	0.30	0.31	0.29	0.28	0.28	0.33	0.32	0.30	0.42	0.32	0.22	0.41	0.20	0.44	0.37	0.66	1.05
19	@ 63˚	ULS B4	Highest Ratio	0.25	0.25	0.26	0.25	0.24	0.24	0.28	0.26	0.24	0.34	0.24	0.14	0.30	0.12	0.36	0.28	0.54	0.84
20	@ 84˚	ULS B1	Highest Ratio	0.17	0.19	0.19	0.18	0.18	0.18	0.20	0.19	0.16	0.24	0.16	0.07	0.18	0.05	0.26	0.19	0.42	0.69
21	@ 84˚	ULS B2	Highest Ratio	0.28	0.29	0.30	0.28	0.28	0.28	0.32	0.29	0.27	0.37	0.26	0.16	0.32	0.13	0.44	0.34	0.68	1.08
22	@ 84˚	ULS B3	Highest Ratio	0.30	0.31	0.32	0.30	0.30	0.30	0.34	0.32	0.29	0.41	0.29	0.18	0.36	0.16	0.48	0.37	0.74	1.18
23	@ 84˚	ULS B4	Highest Ratio	0.21	0.22	0.22	0.21	0.22	0.21	0.24	0.22	0.20	0.28	0.19	0.11	0.23	0.08	0.31	0.22	0.48	0.79
Maximum Highest Ratio (Overall)				0.81	0.84	0.86	0.84	0.86	0.86	0.88	0.86	0.84	0.88	0.81	0.74	0.88	0.64	0.48	0.58	0.74	1.18
Governing Load Combination per Member per Station (Overall)				CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	ULS B3 @ 84˚	CL1 Live	ULS B3 @ 84˚	ULS B3 @ 84˚
Governing Member of the Element Group (Overall)																					Governing (Overall)
Maximum Highest Ratio (Live Load Only)				0.81	0.84	0.86	0.84	0.86	0.86	0.88	0.86	0.84	0.88	0.81	0.74	0.88	0.64	0.40	0.58	0.29	0.31
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)										Governing (Live L.)											
Maximum Highest Ratio (Movable L. Only)				0.31	0.31	0.32	0.30	0.30	0.30	0.34	0.32	0.31	0.42	0.34	0.24	0.43	0.22	0.48	0.37	0.74	1.18
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)																					Governing (Movable L.)

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Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	12	12	12	13	13	13	16	16	16	17	17	17	18	18	18	21	21	21
			Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
			Node Label at Station		---			---			---			---			---			---		
Load Combination			Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
			Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
ID	Category	Name																				
1	Live	CL1	Highest Ratio	0.20	0.86	0.39	0.30	0.89	0.30	0.40	0.87	0.23	0.20	0.86	0.39	0.20	0.70	0.35	0.26	0.71	0.26
2	Live	CL2	Highest Ratio	0.20	0.86	0.39	0.30	0.89	0.30	0.40	0.87	0.23	0.20	0.86	0.39	0.20	0.70	0.35	0.26	0.71	0.26
3	Live	CL3	Highest Ratio	0.20	0.86	0.39	0.30	0.89	0.30	0.40	0.87	0.23	0.20	0.86	0.39	0.20	0.70	0.35	0.26	0.71	0.26
4	@ 0˚	ULS B1	Highest Ratio	0.02	0.00	0.02	0.02	0.00	0.01	0.03	0.00	0.03	0.01	0.00	0.03	0.01	0.00	0.02	0.01	0.00	0.01
5	@ 0˚	ULS B2	Highest Ratio	0.03	0.01	0.02	0.02	0.00	0.01	0.04	0.01	0.05	0.03	0.01	0.03	0.01	0.00	0.02	0.01	0.00	0.01
6	@ 0˚	ULS B3	Highest Ratio	0.03	0.01	0.02	0.02	0.00	0.01	0.04	0.01	0.05	0.03	0.01	0.03	0.01	0.00	0.02	0.01	0.00	0.01
7	@ 0˚	ULS B4	Highest Ratio	0.03	0.01	0.02	0.02	0.00	0.01	0.03	0.01	0.04	0.02	0.00	0.03	0.01	0.00	0.02	0.01	0.00	0.01
8	@ 21˚	ULS B1	Highest Ratio	0.00	0.00	0.03	0.01	0.00	0.01	0.03	0.00	0.01	0.01	0.00	0.03	0.00	0.00	0.02	0.01	0.00	0.01
9	@ 21˚	ULS B2	Highest Ratio	0.02	0.00	0.03	0.02	0.00	0.01	0.03	0.00	0.03	0.02	0.00	0.03	0.01	0.00	0.02	0.01	0.00	0.01
10	@ 21˚	ULS B3	Highest Ratio	0.02	0.01	0.03	0.02	0.00	0.01	0.04	0.01	0.04	0.03	0.00	0.03	0.01	0.00	0.02	0.01	0.00	0.01
11	@ 21˚	ULS B4	Highest Ratio	0.01	0.00	0.03	0.02	0.00	0.01	0.03	0.00	0.02	0.01	0.00	0.03	0.01	0.00	0.02	0.01	0.00	0.01
12	@ 42˚	ULS B1	Highest Ratio	0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.02	0.00	0.03	0.01	0.00	0.02	0.01	0.00	0.01
13	@ 42˚	ULS B2	Highest Ratio	0.04	0.01	0.03	0.02	0.00	0.02	0.03	0.01	0.04	0.05	0.01	0.03	0.02	0.00	0.02	0.01	0.00	0.01
14	@ 42˚	ULS B3	Highest Ratio	0.04	0.01	0.03	0.02	0.00	0.02	0.04	0.01	0.05	0.05	0.01	0.03	0.03	0.00	0.02	0.01	0.00	0.01
15	@ 42˚	ULS B4	Highest Ratio	0.02	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.02	0.03	0.00	0.03	0.01	0.00	0.02	0.01	0.00	0.01
16	@ 63˚	ULS B1	Highest Ratio	0.03	0.00	0.02	0.01	0.00	0.01	0.01	0.01	0.03	0.04	0.01	0.02	0.02	0.00	0.01	0.01	0.00	0.01
17	@ 63˚	ULS B2	Highest Ratio	0.05	0.01	0.03	0.02	0.00	0.02	0.03	0.01	0.06	0.06	0.01	0.04	0.03	0.00	0.02	0.01	0.00	0.01
18	@ 63˚	ULS B3	Highest Ratio	0.06	0.01	0.03	0.02	0.00	0.02	0.04	0.01	0.07	0.06	0.01	0.04	0.03	0.00	0.03	0.01	0.00	0.01
19	@ 63˚	ULS B4	Highest Ratio	0.03	0.00	0.02	0.01	0.00	0.01	0.01	0.01	0.04	0.04	0.01	0.02	0.02	0.00	0.01	0.01	0.00	0.01
20	@ 84˚	ULS B1	Highest Ratio	0.04	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.05	0.05	0.01	0.02	0.02	0.00	0.01	0.00	0.00	0.00
21	@ 84˚	ULS B2	Highest Ratio	0.05	0.01	0.03	0.01	0.00	0.01	0.03	0.01	0.07	0.06	0.01	0.03	0.03	0.00	0.02	0.01	0.00	0.01
22	@ 84˚	ULS B3	Highest Ratio	0.05	0.01	0.03	0.02	0.00	0.02	0.04	0.01	0.07	0.06	0.01	0.04	0.03	0.00	0.02	0.01	0.00	0.01
23	@ 84˚	ULS B4	Highest Ratio	0.05	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.05	0.05	0.01	0.02	0.03	0.00	0.01	0.00	0.00	0.00
Maximum Highest Ratio (Overall)				0.20	0.86	0.39	0.30	0.89	0.30	0.40	0.87	0.23	0.20	0.86	0.39	0.20	0.70	0.35	0.26	0.71	0.26
Governing Load Combination per Member per Station (Overall)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
				Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.20	0.86	0.39	0.30	0.89	0.30	0.40	0.87	0.23	0.20	0.86	0.39	0.20	0.70	0.35	0.26	0.71	0.26
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.06	0.01	0.03	0.02	0.00	0.02	0.04	0.01	0.07	0.06	0.01	0.04	0.03	0.00	0.03	0.01	0.00	0.01
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3	ULS B1	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B2	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B1	ULS B3
Governing Member of the Element Group (Movable Load Only)																					

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	22	22	22	28	28	28	32	32	32	36	36	36	37	37	37	38	38	38
			Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
			Node Label at Station		---			---			---			---			---			---		
Load Combination			Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
			Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
ID	Category	Name																				
1	Live	CL1	Highest Ratio	0.36	0.70	0.21	0.20	0.69	0.35	0.17	0.65	0.23	0.20	0.66	0.20	0.23	0.65	0.18	0.17	0.64	0.23
2	Live	CL2	Highest Ratio	0.36	0.70	0.21	0.20	0.69	0.35	0.17	0.65	0.23	0.20	0.66	0.20	0.23	0.65	0.18	0.17	0.64	0.23
3	Live	CL3	Highest Ratio	0.36	0.70	0.21	0.20	0.69	0.35	0.17	0.65	0.23	0.20	0.66	0.20	0.23	0.65	0.18	0.17	0.64	0.23
4	@ 0˚	ULS B1	Highest Ratio	0.02	0.00	0.02	0.01	0.00	0.02	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.01
5	@ 0˚	ULS B2	Highest Ratio	0.03	0.00	0.03	0.01	0.00	0.02	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.01
6	@ 0˚	ULS B3	Highest Ratio	0.03	0.00	0.03	0.01	0.00	0.02	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.01
7	@ 0˚	ULS B4	Highest Ratio	0.03	0.00	0.02	0.01	0.00	0.02	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.02	0.00	0.00	0.01
8	@ 21˚	ULS B1	Highest Ratio	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01
9	@ 21˚	ULS B2	Highest Ratio	0.03	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01
10	@ 21˚	ULS B3	Highest Ratio	0.03	0.00	0.02	0.02	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.01
11	@ 21˚	ULS B4	Highest Ratio	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01
12	@ 42˚	ULS B1	Highest Ratio	0.01	0.00	0.00	0.01	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.01
13	@ 42˚	ULS B2	Highest Ratio	0.03	0.00	0.02	0.03	0.00	0.03	0.02	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.02	0.00	0.01
14	@ 42˚	ULS B3	Highest Ratio	0.03	0.00	0.03	0.03	0.00	0.03	0.02	0.00	0.01	0.01	0.00	0.01	0.02	0.00	0.01	0.02	0.00	0.01
15	@ 42˚	ULS B4	Highest Ratio	0.02	0.00	0.01	0.02	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.01
16	@ 63˚	ULS B1	Highest Ratio	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.01
17	@ 63˚	ULS B2	Highest Ratio	0.02	0.00	0.03	0.03	0.00	0.03	0.02	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.02	0.02	0.00	0.01
18	@ 63˚	ULS B3	Highest Ratio	0.03	0.01	0.04	0.03	0.00	0.03	0.02	0.00	0.01	0.01	0.00	0.01	0.02	0.00	0.02	0.02	0.00	0.02
19	@ 63˚	ULS B4	Highest Ratio	0.01	0.00	0.02	0.02	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.01
20	@ 84˚	ULS B1	Highest Ratio	0.00	0.00	0.03	0.03	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00
21	@ 84˚	ULS B2	Highest Ratio	0.02	0.01	0.04	0.03	0.00	0.02	0.02	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.03	0.02	0.00	0.01
22	@ 84˚	ULS B3	Highest Ratio	0.03	0.01	0.04	0.03	0.00	0.03	0.02	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.03	0.02	0.00	0.01
23	@ 84˚	ULS B4	Highest Ratio	0.00	0.00	0.03	0.03	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.01	0.00	0.00
Maximum Highest Ratio (Overall)				0.36	0.70	0.21	0.20	0.69	0.35	0.17	0.65	0.23	0.20	0.66	0.20	0.23	0.65	0.18	0.17	0.64	0.23
Governing Load Combination per Member per Station (Overall)				CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.36	0.70	0.21	0.20	0.69	0.35	0.17	0.65	0.23	0.20	0.66	0.20	0.23	0.65	0.18	0.17	0.64	0.23
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.03	0.01	0.04	0.03	0.00	0.03	0.02	0.00	0.01	0.01	0.00	0.01	0.02	0.00	0.03	0.02	0.00	0.02
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B2	ULS B2	ULS B3	ULS B2	ULS B1	ULS B3	ULS B3	ULS B1	ULS B2	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)																					

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	39	39	39	40	40	40	41	41	41	42	42	42	43	43	43	44	44	44
			Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
			Node Label at Station		---			---			---			---			---			---		
Load Combination			Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
			Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
ID	Category	Name																				
1	Live	CL1	Highest Ratio	0.24	0.74	0.36	0.28	0.74	0.27	0.36	0.73	0.23	0.23	0.73	0.36	0.25	0.87	0.31	0.27	0.83	0.27
2	Live	CL2	Highest Ratio	0.24	0.74	0.36	0.28	0.74	0.27	0.36	0.73	0.23	0.23	0.73	0.36	0.25	0.87	0.31	0.27	0.83	0.27
3	Live	CL3	Highest Ratio	0.24	0.74	0.36	0.28	0.74	0.27	0.36	0.73	0.23	0.23	0.73	0.36	0.25	0.87	0.31	0.27	0.83	0.27
4	@ 0˚	ULS B1	Highest Ratio	0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.00	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.01
5	@ 0˚	ULS B2	Highest Ratio	0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.01
6	@ 0˚	ULS B3	Highest Ratio	0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.01
7	@ 0˚	ULS B4	Highest Ratio	0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.00	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.01
8	@ 21˚	ULS B1	Highest Ratio	0.01	0.00	0.01	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.01
9	@ 21˚	ULS B2	Highest Ratio	0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.01
10	@ 21˚	ULS B3	Highest Ratio	0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.01
11	@ 21˚	ULS B4	Highest Ratio	0.01	0.00	0.01	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.01
12	@ 42˚	ULS B1	Highest Ratio	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01
13	@ 42˚	ULS B2	Highest Ratio	0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.01
14	@ 42˚	ULS B3	Highest Ratio	0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.01
15	@ 42˚	ULS B4	Highest Ratio	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01
16	@ 63˚	ULS B1	Highest Ratio	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01
17	@ 63˚	ULS B2	Highest Ratio	0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.01
18	@ 63˚	ULS B3	Highest Ratio	0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.01
19	@ 63˚	ULS B4	Highest Ratio	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01
20	@ 84˚	ULS B1	Highest Ratio	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	@ 84˚	ULS B2	Highest Ratio	0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.01
22	@ 84˚	ULS B3	Highest Ratio	0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.01
23	@ 84˚	ULS B4	Highest Ratio	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maximum Highest Ratio (Overall)				0.24	0.74	0.36	0.28	0.74	0.27	0.36	0.73	0.23	0.23	0.73	0.36	0.25	0.87	0.31	0.27	0.83	0.27
Governing Load Combination per Member per Station (Overall)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
				Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.24	0.74	0.36	0.28	0.74	0.27	0.36	0.73	0.23	0.23	0.73	0.36	0.25	0.87	0.31	0.27	0.83	0.27
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.01
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B1	ULS B3	ULS B3	ULS B1	ULS B2	ULS B3	ULS B2	ULS B2	ULS B3	ULS B1	ULS B3	ULS B3	ULS B3	ULS B3	ULS B2	ULS B1	ULS B3
Governing Member of the Element Group (Movable Load Only)																					

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	45	45	45	46	46	46	47	47	47	48	48	48	49	49	49	50	50	50
			Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
			Node Label at Station		---			---			---			---			---			---		
Load Combination			Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
			Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
ID	Category	Name																				
1	Live	CL1	Highest Ratio	0.31	0.86	0.23	0.23	0.85	0.31	0.27	0.95	0.39	0.31	0.91	0.31	0.39	0.93	0.26	0.26	0.93	0.39
2	Live	CL2	Highest Ratio	0.31	0.86	0.23	0.23	0.85	0.31	0.27	0.95	0.39	0.31	0.91	0.31	0.39	0.93	0.26	0.26	0.93	0.39
3	Live	CL3	Highest Ratio	0.31	0.86	0.23	0.23	0.85	0.31	0.27	0.95	0.39	0.31	0.91	0.31	0.39	0.93	0.26	0.26	0.89	0.39
4	@ 0˚	ULS B1	Highest Ratio	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02
5	@ 0˚	ULS B2	Highest Ratio	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02
6	@ 0˚	ULS B3	Highest Ratio	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02
7	@ 0˚	ULS B4	Highest Ratio	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02
8	@ 21˚	ULS B1	Highest Ratio	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02
9	@ 21˚	ULS B2	Highest Ratio	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02
10	@ 21˚	ULS B3	Highest Ratio	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02
11	@ 21˚	ULS B4	Highest Ratio	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02
12	@ 42˚	ULS B1	Highest Ratio	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01
13	@ 42˚	ULS B2	Highest Ratio	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02
14	@ 42˚	ULS B3	Highest Ratio	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.01	0.03	0.00	0.01	0.01	0.00	0.03
15	@ 42˚	ULS B4	Highest Ratio	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02
16	@ 63˚	ULS B1	Highest Ratio	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.01
17	@ 63˚	ULS B2	Highest Ratio	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02
18	@ 63˚	ULS B3	Highest Ratio	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.03	0.02	0.00	0.01	0.03	0.00	0.01	0.01	0.00	0.03
19	@ 63˚	ULS B4	Highest Ratio	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.01
20	@ 84˚	ULS B1	Highest Ratio	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	@ 84˚	ULS B2	Highest Ratio	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02
22	@ 84˚	ULS B3	Highest Ratio	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.01	0.03	0.00	0.01	0.01	0.00	0.03
23	@ 84˚	ULS B4	Highest Ratio	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Maximum Highest Ratio (Overall)				0.31	0.86	0.23	0.23	0.85	0.31	0.27	0.95	0.39	0.31	0.91	0.31	0.39	0.93	0.26	0.26	0.93	0.39
Governing Load Combination per Member per Station (Overall)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
				Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.31	0.86	0.23	0.23	0.85	0.31	0.27	0.95	0.39	0.31	0.91	0.31	0.39	0.93	0.26	0.26	0.93	0.39
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.03	0.02	0.00	0.01	0.03	0.00	0.01	0.01	0.00	0.03
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B2	ULS B1	ULS B3	ULS B1	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B1	ULS B3	ULS B3	ULS B2	ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)																					

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	51	51	51	52	52	52	53	53	53	54	54	54	55	55	55	56	56	56
			Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
			Node Label at Station		---			---			---			---			---			---		
Load Combination			Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
			Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
ID	Category	Name																				
1	Live	CL1	Highest Ratio	0.22	0.78	0.33	0.26	0.79	0.26	0.33	0.78	0.21	0.21	0.77	0.33	0.23	0.82	0.40	0.31	0.84	0.31
2	Live	CL2	Highest Ratio	0.22	0.78	0.33	0.26	0.79	0.26	0.33	0.78	0.21	0.21	0.77	0.33	0.23	0.82	0.40	0.31	0.84	0.31
3	Live	CL3	Highest Ratio	0.22	0.78	0.33	0.26	0.79	0.26	0.33	0.78	0.21	0.21	0.77	0.33	0.23	0.82	0.40	0.31	0.84	0.31
4	@ 0˚	ULS B1	Highest Ratio	0.00	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.00	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.01
5	@ 0˚	ULS B2	Highest Ratio	0.00	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.01
6	@ 0˚	ULS B3	Highest Ratio	0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.01
7	@ 0˚	ULS B4	Highest Ratio	0.00	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.00	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.01
8	@ 21˚	ULS B1	Highest Ratio	0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.01
9	@ 21˚	ULS B2	Highest Ratio	0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.01
10	@ 21˚	ULS B3	Highest Ratio	0.01	0.00	0.02	0.01	0.00	0.01	0.03	0.00	0.02	0.01	0.00	0.02	0.02	0.00	0.02	0.01	0.00	0.01
11	@ 21˚	ULS B4	Highest Ratio	0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.01
12	@ 42˚	ULS B1	Highest Ratio	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.01
13	@ 42˚	ULS B2	Highest Ratio	0.02	0.00	0.02	0.01	0.00	0.01	0.03	0.00	0.01	0.01	0.00	0.03	0.03	0.00	0.02	0.01	0.00	0.01
14	@ 42˚	ULS B3	Highest Ratio	0.02	0.00	0.02	0.01	0.00	0.01	0.03	0.00	0.01	0.02	0.00	0.03	0.03	0.00	0.02	0.01	0.00	0.01
15	@ 42˚	ULS B4	Highest Ratio	0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.00	0.01	0.00	0.02	0.02	0.00	0.02	0.01	0.00	0.01
16	@ 63˚	ULS B1	Highest Ratio	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.01
17	@ 63˚	ULS B2	Highest Ratio	0.01	0.00	0.02	0.01	0.00	0.01	0.03	0.00	0.02	0.02	0.00	0.03	0.03	0.00	0.03	0.01	0.00	0.01
18	@ 63˚	ULS B3	Highest Ratio	0.01	0.00	0.03	0.01	0.00	0.01	0.03	0.00	0.02	0.02	0.00	0.03	0.03	0.00	0.03	0.01	0.00	0.01
19	@ 63˚	ULS B4	Highest Ratio	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.03	0.00	0.01	0.01	0.00	0.01
20	@ 84˚	ULS B1	Highest Ratio	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.03	0.00	0.01	0.00	0.00	0.00
21	@ 84˚	ULS B2	Highest Ratio	0.02	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.02	0.02	0.00	0.02	0.03	0.00	0.02	0.01	0.00	0.01
22	@ 84˚	ULS B3	Highest Ratio	0.02	0.00	0.03	0.01	0.00	0.01	0.03	0.00	0.03	0.02	0.00	0.03	0.03	0.00	0.03	0.01	0.00	0.01
23	@ 84˚	ULS B4	Highest Ratio	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.03	0.00	0.01	0.00	0.00	0.00
Maximum Highest Ratio (Overall)				0.22	0.78	0.33	0.26	0.79	0.26	0.33	0.78	0.21	0.21	0.77	0.33	0.23	0.82	0.40	0.31	0.84	0.31
Governing Load Combination per Member per Station (Overall)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
				Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.22	0.78	0.33	0.26	0.79	0.26	0.33	0.78	0.21	0.21	0.77	0.33	0.23	0.82	0.40	0.31	0.84	0.31
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.02	0.00	0.03	0.01	0.00	0.01	0.03	0.00	0.03	0.02	0.00	0.03	0.03	0.00	0.03	0.01	0.00	0.01
Governing Load Combination per Member per Station (Movable Load Only)				ULS B2	ULS B3	ULS B3	ULS B3	ULS B1	ULS B3	ULS B3	ULS B1	ULS B3	ULS B3	ULS B3	ULS B3	ULS B2	ULS B2	ULS B3	ULS B2	ULS B1	ULS B3
Governing Member of the Element Group (Movable Load Only)																					

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Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	57	57	57	58	58	58	59	59	59	60	60	60	61	61	61	62	62	62
			Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
			Node Label at Station		---			---			---			---			---			---		
Load Combination			Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
			Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
ID	Category	Name																				
1	Live	CL1	Highest Ratio	0.41	0.83	0.25	0.23	0.82	0.41	0.20	0.91	0.40	0.31	0.94	0.31	0.41	0.92	0.24	0.21	0.91	0.41
2	Live	CL2	Highest Ratio	0.41	0.83	0.25	0.23	0.82	0.41	0.20	0.91	0.40	0.31	0.94	0.31	0.41	0.92	0.24	0.21	0.91	0.41
3	Live	CL3	Highest Ratio	0.41	0.83	0.25	0.23	0.82	0.41	0.20	0.91	0.40	0.31	0.94	0.31	0.41	0.92	0.24	0.21	0.91	0.41
4	@ 0˚	ULS B1	Highest Ratio	0.02	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.02	0.02	0.00	0.01	0.03	0.00	0.03	0.01	0.00	0.03
5	@ 0˚	ULS B2	Highest Ratio	0.03	0.00	0.03	0.01	0.00	0.02	0.02	0.00	0.03	0.02	0.00	0.01	0.04	0.01	0.04	0.03	0.01	0.03
6	@ 0˚	ULS B3	Highest Ratio	0.03	0.00	0.03	0.02	0.00	0.02	0.02	0.01	0.03	0.02	0.00	0.01	0.04	0.01	0.05	0.03	0.01	0.03
7	@ 0˚	ULS B4	Highest Ratio	0.03	0.00	0.02	0.01	0.00	0.02	0.02	0.00	0.03	0.02	0.00	0.01	0.03	0.01	0.03	0.02	0.00	0.03
8	@ 21˚	ULS B1	Highest Ratio	0.02	0.00	0.01	0.01	0.00	0.02	0.00	0.00	0.03	0.01	0.00	0.01	0.03	0.00	0.01	0.01	0.00	0.03
9	@ 21˚	ULS B2	Highest Ratio	0.03	0.00	0.02	0.02	0.00	0.02	0.02	0.00	0.03	0.02	0.00	0.01	0.04	0.00	0.03	0.03	0.00	0.03
10	@ 21˚	ULS B3	Highest Ratio	0.03	0.00	0.03	0.02	0.00	0.02	0.02	0.00	0.03	0.02	0.00	0.01	0.04	0.01	0.03	0.03	0.00	0.03
11	@ 21˚	ULS B4	Highest Ratio	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.03	0.02	0.00	0.01	0.03	0.00	0.01	0.01	0.00	0.03
12	@ 42˚	ULS B1	Highest Ratio	0.01	0.00	0.01	0.01	0.00	0.02	0.02	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.03	0.00	0.03
13	@ 42˚	ULS B2	Highest Ratio	0.03	0.00	0.03	0.03	0.00	0.03	0.04	0.01	0.03	0.02	0.00	0.02	0.04	0.01	0.04	0.05	0.01	0.03
14	@ 42˚	ULS B3	Highest Ratio	0.03	0.00	0.03	0.03	0.00	0.03	0.05	0.01	0.03	0.02	0.00	0.02	0.04	0.01	0.05	0.05	0.01	0.04
15	@ 42˚	ULS B4	Highest Ratio	0.02	0.00	0.01	0.02	0.00	0.02	0.02	0.00	0.03	0.01	0.00	0.01	0.02	0.00	0.02	0.03	0.00	0.03
16	@ 63˚	ULS B1	Highest Ratio	0.01	0.00	0.02	0.02	0.00	0.01	0.03	0.00	0.02	0.01	0.00	0.01	0.01	0.01	0.03	0.04	0.01	0.02
17	@ 63˚	ULS B2	Highest Ratio	0.03	0.01	0.04	0.04	0.00	0.03	0.05	0.01	0.03	0.02	0.00	0.02	0.03	0.01	0.06	0.06	0.01	0.04
18	@ 63˚	ULS B3	Highest Ratio	0.03	0.01	0.05	0.04	0.00	0.03	0.05	0.01	0.04	0.02	0.00	0.02	0.04	0.01	0.07	0.07	0.01	0.04
19	@ 63˚	ULS B4	Highest Ratio	0.01	0.00	0.02	0.03	0.00	0.01	0.04	0.01	0.02	0.01	0.00	0.01	0.01	0.01	0.04	0.04	0.01	0.02
20	@ 84˚	ULS B1	Highest Ratio	0.00	0.00	0.03	0.03	0.00	0.01	0.04	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.05	0.05	0.01	0.02
21	@ 84˚	ULS B2	Highest Ratio	0.02	0.01	0.05	0.04	0.00	0.03	0.05	0.01	0.03	0.01	0.00	0.01	0.03	0.01	0.07	0.06	0.01	0.04
22	@ 84˚	ULS B3	Highest Ratio	0.03	0.01	0.05	0.04	0.01	0.03	0.05	0.01	0.04	0.02	0.00	0.02	0.04	0.01	0.07	0.06	0.01	0.04
23	@ 84˚	ULS B4	Highest Ratio	0.00	0.00	0.03	0.03	0.00	0.01	0.05	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.05	0.05	0.01	0.02
Maximum Highest Ratio (Overall)				0.41	0.83	0.25	0.23	0.82	0.41	0.20	0.91	0.40	0.31	0.94	0.31	0.41	0.92	0.24	0.21	0.91	0.41
Governing Load Combination per Member per Station (Overall)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
				Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.41	0.83	0.25	0.23	0.82	0.41	0.20	0.91	0.40	0.31	0.94	0.31	0.41	0.92	0.24	0.21	0.91	0.41
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.03	0.01	0.05	0.04	0.01	0.03	0.05	0.01	0.04	0.02	0.00	0.02	0.04	0.01	0.07	0.07	0.01	0.04
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B2	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B2	ULS B1	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)																					

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	63	63	63	64	64	64	65	65	65	66	66	66	67	67	67	68	68	68
			Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
			Node Label at Station		---			---			---			---			---			---	
Load Combination			Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
			Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
ID	Category	Name																			
1	Live	CL1	Highest Ratio	0.30	0.89	0.30	0.39	0.86	0.20	0.26	0.71	0.26	0.35	0.69	0.19	0.20	0.65	0.20	0.23	0.64	0.17
2	Live	CL2	Highest Ratio	0.30	0.89	0.30	0.39	0.86	0.20	0.26	0.71	0.26	0.35	0.69	0.19	0.20	0.65	0.20	0.23	0.64	0.17
3	Live	CL3	Highest Ratio	0.30	0.89	0.30	0.39	0.86	0.20	0.26	0.71	0.26	0.35	0.69	0.19	0.20	0.65	0.20	0.23	0.64	0.17
4	@ 0˚	ULS B1	Highest Ratio	0.01	0.00	0.01	0.03	0.00	0.01	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.00
5	@ 0˚	ULS B2	Highest Ratio	0.01	0.00	0.01	0.03	0.01	0.04	0.01	0.00	0.01	0.03	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.01
6	@ 0˚	ULS B3	Highest Ratio	0.01	0.00	0.01	0.03	0.01	0.05	0.01	0.00	0.01	0.03	0.00	0.03	0.01	0.00	0.01	0.01	0.00	0.01
7	@ 0˚	ULS B4	Highest Ratio	0.01	0.00	0.01	0.03	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01
8	@ 21˚	ULS B1	Highest Ratio	0.01	0.00	0.01	0.03	0.01	0.03	0.01	0.00	0.01	0.02	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.01
9	@ 21˚	ULS B2	Highest Ratio	0.01	0.00	0.01	0.03	0.01	0.06	0.01	0.00	0.01	0.02	0.00	0.04	0.01	0.00	0.01	0.01	0.00	0.02
10	@ 21˚	ULS B3	Highest Ratio	0.02	0.00	0.01	0.03	0.01	0.07	0.01	0.00	0.01	0.03	0.00	0.04	0.01	0.00	0.01	0.01	0.00	0.02
11	@ 21˚	ULS B4	Highest Ratio	0.01	0.00	0.01	0.03	0.01	0.04	0.01	0.00	0.01	0.02	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.01
12	@ 42˚	ULS B1	Highest Ratio	0.01	0.00	0.01	0.02	0.01	0.05	0.01	0.00	0.01	0.01	0.00	0.03	0.01	0.00	0.01	0.01	0.00	0.01
13	@ 42˚	ULS B2	Highest Ratio	0.02	0.00	0.01	0.03	0.01	0.09	0.01	0.00	0.01	0.02	0.01	0.05	0.01	0.00	0.01	0.01	0.00	0.03
14	@ 42˚	ULS B3	Highest Ratio	0.02	0.00	0.02	0.03	0.05	0.09	0.01	0.00	0.01	0.03	0.01	0.05	0.01	0.00	0.01	0.01	0.00	0.03
15	@ 42˚	ULS B4	Highest Ratio	0.01	0.00	0.01	0.02	0.01	0.06	0.01	0.00	0.01	0.01	0.00	0.03	0.01	0.00	0.01	0.01	0.00	0.02
16	@ 63˚	ULS B1	Highest Ratio	0.01	0.00	0.01	0.01	0.01	0.06	0.00	0.00	0.00	0.01	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.02
17	@ 63˚	ULS B2	Highest Ratio	0.02	0.00	0.02	0.03	0.06	0.09	0.01	0.00	0.01	0.02	0.01	0.05	0.01	0.00	0.01	0.01	0.00	0.03
18	@ 63˚	ULS B3	Highest Ratio	0.02	0.00	0.02	0.03	0.07	0.10	0.01	0.00	0.01	0.03	0.04	0.05	0.01	0.00	0.01	0.01	0.00	0.03
19	@ 63˚	ULS B4	Highest Ratio	0.01	0.00	0.01	0.01	0.01	0.07	0.01	0.00	0.00	0.01	0.00	0.04	0.00	0.00	0.00	0.01	0.00	0.02
20	@ 84˚	ULS B1	Highest Ratio	0.00	0.00	0.01	0.01	0.01	0.07	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.02
21	@ 84˚	ULS B2	Highest Ratio	0.01	0.00	0.01	0.03	0.08	0.09	0.01	0.00	0.01	0.02	0.01	0.05	0.01	0.00	0.01	0.01	0.00	0.03
22	@ 84˚	ULS B3	Highest Ratio	0.02	0.00	0.02	0.04	0.08	0.10	0.01	0.00	0.01	0.02	0.05	0.05	0.01	0.00	0.01	0.01	0.00	0.03
23	@ 84˚	ULS B4	Highest Ratio	0.00	0.00	0.01	0.01	0.01	0.07	0.00	0.00	0.00	0.00	0.01	0.04	0.00	0.00	0.00	0.00	0.00	0.03
Maximum Highest Ratio (Overall)				0.30	0.89	0.30	0.39	0.86	0.20	0.26	0.71	0.26	0.35	0.69	0.19	0.20	0.65	0.20	0.23	0.64	0.17
Governing Load Combination per Member per Station (Overall)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
				Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.30	0.89	0.30	0.39	0.86	0.20	0.26	0.71	0.26	0.35	0.69	0.19	0.20	0.65	0.20	0.23	0.64	0.17
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.02	0.00	0.02	0.04	0.08	0.10	0.01	0.00	0.01	0.03	0.05	0.05	0.01	0.00	0.01	0.01	0.00	0.03
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B1	ULS B3	ULS B3	ULS B3	ULS B3	ULS B2	ULS B1	ULS B3	ULS B2	ULS B3	ULS B3	ULS B1	ULS B1	ULS B2	ULS B1	ULS B2	ULS B2
Governing Member of the Element Group (Movable Load Only)																					

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	69	69	69	70	70	70	71	71	71	72	72	72	73	73	73	74	74	74
			Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
			Node Label at Station		---			---			---			---			---			---		
Load Combination			Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
			Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
ID	Category	Name																				
1	Live	CL1	Highest Ratio	0.27	0.74	0.27	0.36	0.72	0.22	0.27	0.83	0.27	0.31	0.85	0.23	0.31	0.91	0.31	0.39	0.93	0.25
2	Live	CL2	Highest Ratio	0.27	0.74	0.27	0.36	0.72	0.22	0.27	0.83	0.27	0.31	0.85	0.23	0.31	0.91	0.31	0.39	0.93	0.25
3	Live	CL3	Highest Ratio	0.27	0.74	0.27	0.36	0.72	0.22	0.27	0.83	0.27	0.31	0.85	0.23	0.31	0.91	0.31	0.39	0.93	0.25
4	@ 0˚	ULS B1	Highest Ratio	0.01	0.00	0.01	0.02	0.00	0.00	0.01	0.00	0.01	0.02	0.00	0.00	0.01	0.00	0.01	0.02	0.00	0.00
5	@ 0˚	ULS B2	Highest Ratio	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.01	0.02	0.00	0.00	0.01	0.00	0.01	0.02	0.00	0.00
6	@ 0˚	ULS B3	Highest Ratio	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.01	0.02	0.00	0.00	0.01	0.00	0.01	0.02	0.00	0.01
7	@ 0˚	ULS B4	Highest Ratio	0.01	0.00	0.01	0.02	0.00	0.00	0.01	0.00	0.01	0.02	0.00	0.00	0.01	0.00	0.01	0.02	0.00	0.00
8	@ 21˚	ULS B1	Highest Ratio	0.01	0.00	0.01	0.02	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.02	0.00	0.00
9	@ 21˚	ULS B2	Highest Ratio	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.01	0.02	0.00	0.00	0.01	0.00	0.01	0.02	0.00	0.01
10	@ 21˚	ULS B3	Highest Ratio	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.01	0.02	0.00	0.00	0.01	0.00	0.01	0.02	0.00	0.01
11	@ 21˚	ULS B4	Highest Ratio	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.02	0.00	0.01
12	@ 42˚	ULS B1	Highest Ratio	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.01
13	@ 42˚	ULS B2	Highest Ratio	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.01	0.02	0.00	0.01
14	@ 42˚	ULS B3	Highest Ratio	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.01	0.03	0.00	0.01
15	@ 42˚	ULS B4	Highest Ratio	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.02	0.00	0.01
16	@ 63˚	ULS B1	Highest Ratio	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.01
17	@ 63˚	ULS B2	Highest Ratio	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.01	0.02	0.00	0.01
18	@ 63˚	ULS B3	Highest Ratio	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.01	0.03	0.00	0.01
19	@ 63˚	ULS B4	Highest Ratio	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.01
20	@ 84˚	ULS B1	Highest Ratio	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01
21	@ 84˚	ULS B2	Highest Ratio	0.01	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.02	0.00	0.02
22	@ 84˚	ULS B3	Highest Ratio	0.01	0.00	0.01	0.02	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.01	0.02	0.00	0.02
23	@ 84˚	ULS B4	Highest Ratio	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01
Maximum Highest Ratio (Overall)				0.27	0.74	0.27	0.36	0.72	0.22	0.27	0.83	0.27	0.31	0.85	0.23	0.31	0.91	0.31	0.39	0.93	0.25
Governing Load Combination per Member per Station (Overall)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
				Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.27	0.74	0.27	0.36	0.72	0.22	0.27	0.83	0.27	0.31	0.85	0.23	0.31	0.91	0.31	0.39	0.93	0.25
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.01	0.00	0.01	0.02	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.01	0.03	0.00	0.02
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B1	ULS B1	ULS B3	ULS B1	ULS B2	ULS B3	ULS B1	ULS B2	ULS B3	ULS B1	ULS B3	ULS B3	ULS B1	ULS B3	ULS B3	ULS B1	ULS B3
Governing Member of the Element Group (Movable Load Only)																					

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	75	75	75	76	76	76	77	77	77	78	78	78	79	79	79	80	80	80
			Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
			Node Label at Station		---			---			---			---			---			---		
Load Combination			Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
			Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
ID	Category	Name																				
1	Live	CL1	Highest Ratio	0.26	0.79	0.26	0.33	0.77	0.20	0.30	0.84	0.30	0.41	0.82	0.23	0.31	0.94	0.31	0.41	0.90	0.21
2	Live	CL2	Highest Ratio	0.26	0.79	0.26	0.33	0.77	0.20	0.30	0.84	0.30	0.41	0.82	0.23	0.31	0.94	0.31	0.41	0.90	0.21
3	Live	CL3	Highest Ratio	0.26	0.79	0.26	0.33	0.77	0.20	0.30	0.84	0.30	0.41	0.82	0.23	0.31	0.94	0.31	0.41	0.90	0.21
4	@ 0˚	ULS B1	Highest Ratio	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.01	0.03	0.00	0.01
5	@ 0˚	ULS B2	Highest Ratio	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.01	0.03	0.00	0.03	0.01	0.00	0.01	0.04	0.01	0.04
6	@ 0˚	ULS B3	Highest Ratio	0.01	0.00	0.01	0.02	0.00	0.02	0.01	0.00	0.01	0.03	0.00	0.03	0.01	0.00	0.01	0.04	0.01	0.05
7	@ 0˚	ULS B4	Highest Ratio	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.01	0.03	0.00	0.02
8	@ 21˚	ULS B1	Highest Ratio	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.01	0.02	0.00	0.02	0.01	0.00	0.01	0.03	0.01	0.03
9	@ 21˚	ULS B2	Highest Ratio	0.01	0.00	0.01	0.02	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.04	0.01	0.00	0.01	0.03	0.01	0.06
10	@ 21˚	ULS B3	Highest Ratio	0.01	0.00	0.01	0.03	0.00	0.02	0.01	0.00	0.01	0.03	0.01	0.05	0.02	0.00	0.01	0.03	0.01	0.07
11	@ 21˚	ULS B4	Highest Ratio	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.01	0.02	0.00	0.03	0.01	0.00	0.01	0.03	0.01	0.04
12	@ 42˚	ULS B1	Highest Ratio	0.01	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.03	0.01	0.00	0.01	0.02	0.01	0.05
13	@ 42˚	ULS B2	Highest Ratio	0.01	0.00	0.01	0.03	0.00	0.03	0.01	0.00	0.01	0.03	0.01	0.06	0.02	0.00	0.02	0.03	0.04	0.09
14	@ 42˚	ULS B3	Highest Ratio	0.01	0.00	0.01	0.03	0.00	0.03	0.01	0.00	0.01	0.03	0.01	0.06	0.02	0.00	0.02	0.04	0.05	0.09
15	@ 42˚	ULS B4	Highest Ratio	0.01	0.00	0.01	0.02	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.04	0.01	0.00	0.01	0.02	0.01	0.06
16	@ 63˚	ULS B1	Highest Ratio	0.00	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.01	0.00	0.04	0.01	0.00	0.01	0.01	0.01	0.06
17	@ 63˚	ULS B2	Highest Ratio	0.01	0.00	0.01	0.03	0.00	0.03	0.01	0.00	0.01	0.02	0.04	0.06	0.02	0.00	0.02	0.03	0.06	0.09
18	@ 63˚	ULS B3	Highest Ratio	0.01	0.00	0.01	0.03	0.00	0.03	0.01	0.00	0.01	0.03	0.05	0.07	0.02	0.00	0.02	0.03	0.08	0.10
19	@ 63˚	ULS B4	Highest Ratio	0.01	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.01	0.01	0.05	0.01	0.00	0.01	0.01	0.01	0.07
20	@ 84˚	ULS B1	Highest Ratio	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.01	0.05	0.00	0.00	0.01	0.01	0.01	0.07
21	@ 84˚	ULS B2	Highest Ratio	0.01	0.00	0.01	0.02	0.00	0.03	0.01	0.00	0.01	0.02	0.06	0.06	0.01	0.00	0.01	0.03	0.08	0.09
22	@ 84˚	ULS B3	Highest Ratio	0.01	0.00	0.01	0.02	0.00	0.04	0.01	0.00	0.01	0.03	0.06	0.07	0.02	0.00	0.02	0.04	0.09	0.10
23	@ 84˚	ULS B4	Highest Ratio	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.01	0.01	0.05	0.00	0.00	0.01	0.01	0.01	0.08
Maximum Highest Ratio (Overall)				0.26	0.79	0.26	0.33	0.77	0.20	0.30	0.84	0.30	0.41	0.82	0.23	0.31	0.94	0.31	0.41	0.90	0.21
Governing Load Combination per Member per Station (Overall)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
				Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.26	0.79	0.26	0.33	0.77	0.20	0.30	0.84	0.30	0.41	0.82	0.23	0.31	0.94	0.31	0.41	0.90	0.21
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.01	0.00	0.01	0.03	0.00	0.04	0.01	0.00	0.01	0.03	0.06	0.07	0.02	0.00	0.02	0.04	0.09	0.10
Governing Load Combination per Member per Station (Movable Load Only)				ULS B2	ULS B1	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B1	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B1	ULS B3	ULS B2	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)																					

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	622	622	622	623	623	623	626	626	626	627	627	627	630	630	630	631	631	631
			Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
			Node Label at Station		---			---			---			---			---			---		
Load Combination			Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
			Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
ID	Category	Name																				
1	Live	CL1	Highest Ratio	0.21	0.86	0.40	0.28	0.95	0.16	0.20	0.69	0.36	0.24	0.74	0.20	0.17	0.64	0.23	0.18	0.72	0.18
2	Live	CL2	Highest Ratio	0.21	0.86	0.40	0.28	0.95	0.15	0.20	0.69	0.36	0.24	0.74	0.20	0.17	0.64	0.23	0.18	0.72	0.18
3	Live	CL3	Highest Ratio	0.21	0.86	0.40	0.28	0.95	0.15	0.20	0.69	0.36	0.24	0.74	0.20	0.17	0.64	0.23	0.18	0.72	0.18
4	@ 0˚	ULS B1	Highest Ratio	0.01	0.00	0.03	0.01	0.00	0.05	0.01	0.00	0.03	0.01	0.00	0.03	0.01	0.00	0.01	0.01	0.00	0.01
5	@ 0˚	ULS B2	Highest Ratio	0.04	0.01	0.04	0.02	0.01	0.09	0.02	0.00	0.03	0.01	0.00	0.04	0.01	0.00	0.02	0.01	0.00	0.02
6	@ 0˚	ULS B3	Highest Ratio	0.05	0.01	0.04	0.02	0.01	0.09	0.03	0.00	0.03	0.01	0.00	0.05	0.02	0.00	0.02	0.01	0.00	0.02
7	@ 0˚	ULS B4	Highest Ratio	0.02	0.00	0.03	0.01	0.00	0.06	0.01	0.00	0.03	0.01	0.00	0.03	0.01	0.00	0.01	0.01	0.00	0.01
8	@ 21˚	ULS B1	Highest Ratio	0.03	0.01	0.04	0.01	0.01	0.09	0.02	0.00	0.03	0.01	0.00	0.05	0.01	0.00	0.02	0.00	0.00	0.02
9	@ 21˚	ULS B2	Highest Ratio	0.06	0.01	0.04	0.01	0.01	0.13	0.04	0.01	0.03	0.01	0.00	0.07	0.02	0.00	0.02	0.01	0.00	0.04
10	@ 21˚	ULS B3	Highest Ratio	0.07	0.01	0.04	0.01	0.01	0.14	0.04	0.01	0.03	0.01	0.00	0.08	0.02	0.00	0.02	0.01	0.00	0.04
11	@ 21˚	ULS B4	Highest Ratio	0.04	0.01	0.04	0.01	0.01	0.10	0.02	0.00	0.03	0.01	0.00	0.05	0.01	0.00	0.02	0.01	0.00	0.02
12	@ 42˚	ULS B1	Highest Ratio	0.05	0.01	0.04	0.00	0.01	0.11	0.03	0.00	0.03	0.00	0.00	0.06	0.02	0.00	0.02	0.00	0.00	0.03
13	@ 42˚	ULS B2	Highest Ratio	0.09	0.01	0.04	0.01	0.01	0.16	0.05	0.01	0.03	0.01	0.00	0.09	0.03	0.01	0.02	0.01	0.00	0.05
14	@ 42˚	ULS B3	Highest Ratio	0.09	0.01	0.04	0.02	0.01	0.17	0.05	0.01	0.03	0.01	0.00	0.10	0.03	0.01	0.02	0.01	0.00	0.05
15	@ 42˚	ULS B4	Highest Ratio	0.06	0.01	0.04	0.00	0.01	0.12	0.03	0.01	0.03	0.00	0.00	0.07	0.02	0.00	0.02	0.00	0.00	0.03
16	@ 63˚	ULS B1	Highest Ratio	0.06	0.01	0.03	0.00	0.01	0.12	0.03	0.00	0.02	0.00	0.00	0.07	0.02	0.00	0.01	0.00	0.00	0.04
17	@ 63˚	ULS B2	Highest Ratio	0.09	0.01	0.03	0.02	0.01	0.16	0.05	0.01	0.02	0.02	0.00	0.09	0.03	0.01	0.01	0.01	0.00	0.05
18	@ 63˚	ULS B3	Highest Ratio	0.10	0.01	0.04	0.02	0.01	0.17	0.06	0.01	0.02	0.02	0.01	0.10	0.03	0.01	0.01	0.02	0.00	0.05
19	@ 63˚	ULS B4	Highest Ratio	0.07	0.01	0.03	0.00	0.01	0.13	0.04	0.01	0.02	0.00	0.00	0.08	0.02	0.00	0.01	0.00	0.00	0.04
20	@ 84˚	ULS B1	Highest Ratio	0.06	0.01	0.02	0.00	0.01	0.10	0.03	0.00	0.01	0.00	0.00	0.06	0.01	0.00	0.01	0.00	0.00	0.03
21	@ 84˚	ULS B2	Highest Ratio	0.09	0.01	0.02	0.02	0.01	0.15	0.05	0.01	0.01	0.02	0.01	0.08	0.03	0.00	0.01	0.02	0.00	0.04
22	@ 84˚	ULS B3	Highest Ratio	0.09	0.01	0.03	0.03	0.01	0.16	0.05	0.01	0.01	0.02	0.01	0.09	0.03	0.00	0.01	0.02	0.00	0.05
23	@ 84˚	ULS B4	Highest Ratio	0.07	0.01	0.02	0.00	0.01	0.12	0.03	0.00	0.01	0.01	0.00	0.07	0.02	0.00	0.01	0.01	0.00	0.04
Maximum Highest Ratio (Overall)				0.21	0.86	0.40	0.28	0.95	0.17	0.20	0.69	0.36	0.24	0.74	0.20	0.17	0.64	0.23	0.18	0.72	0.18
Governing Load Combination per Member per Station (Overall)				CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	ULS B3 @ 42˚	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live
Governing Member of the Element Group (Overall)																						
Maximum Highest Ratio (Live Load Only)				0.21	0.86	0.40	0.28	0.95	0.16	0.20	0.69	0.36	0.24	0.74	0.20	0.17	0.64	0.23	0.18	0.72	0.18
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																						
Maximum Highest Ratio (Movable L. Only)				0.10	0.01	0.04	0.03	0.01	0.17	0.06	0.01	0.03	0.02	0.01	0.10	0.03	0.01	0.02	0.02	0.00	0.05
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B2	ULS B2	ULS B3	ULS B3	ULS B3	ULS B3	ULS B2	ULS B2	ULS B3	ULS B3	ULS B3	ULS B3	ULS B2	ULS B1	ULS B3	ULS B2	ULS B3
Governing Member of the Element Group (Movable Load Only)																						

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	634	634	634	635	635	635	638	638	638	639	639	639	642	642	642	643	643	643
			Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
			Node Label at Station		---			---			---			---			---			---		
Load Combination			Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
			Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
ID	Category	Name																				
1	Live	CL1	Highest Ratio	0.22	0.72	0.36	0.26	0.80	0.26	0.23	0.85	0.31	0.25	0.92	0.25	0.25	0.93	0.39	0.29	0.99	0.28
2	Live	CL2	Highest Ratio	0.22	0.72	0.36	0.26	0.80	0.26	0.23	0.85	0.31	0.25	0.92	0.25	0.25	0.93	0.39	0.29	0.99	0.28
3	Live	CL3	Highest Ratio	0.22	0.72	0.36	0.26	0.80	0.26	0.23	0.85	0.31	0.25	0.92	0.25	0.25	0.93	0.39	0.29	0.99	0.28
4	@ 0˚	ULS B1	Highest Ratio	0.00	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.02	0.01	0.00	0.01	0.00	0.00	0.02	0.01	0.00	0.01
5	@ 0˚	ULS B2	Highest Ratio	0.01	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.01	0.00	0.00	0.02	0.01	0.00	0.01
6	@ 0˚	ULS B3	Highest Ratio	0.01	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.01
7	@ 0˚	ULS B4	Highest Ratio	0.01	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.02	0.01	0.00	0.01	0.00	0.00	0.02	0.01	0.00	0.01
8	@ 21˚	ULS B1	Highest Ratio	0.01	0.00	0.03	0.01	0.00	0.00	0.01	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.03	0.01	0.00	0.00
9	@ 21˚	ULS B2	Highest Ratio	0.01	0.00	0.03	0.01	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.03	0.01	0.00	0.01
10	@ 21˚	ULS B3	Highest Ratio	0.01	0.00	0.03	0.01	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.03	0.01	0.00	0.01
11	@ 21˚	ULS B4	Highest Ratio	0.01	0.00	0.03	0.01	0.00	0.00	0.01	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.03	0.01	0.00	0.00
12	@ 42˚	ULS B1	Highest Ratio	0.01	0.00	0.02	0.00	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.00	0.01	0.00	0.03	0.00	0.00	0.00
13	@ 42˚	ULS B2	Highest Ratio	0.01	0.00	0.03	0.01	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.03	0.01	0.00	0.01
14	@ 42˚	ULS B3	Highest Ratio	0.01	0.00	0.03	0.01	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.03	0.02	0.00	0.01
15	@ 42˚	ULS B4	Highest Ratio	0.01	0.00	0.03	0.00	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.00	0.01	0.00	0.03	0.01	0.00	0.00
16	@ 63˚	ULS B1	Highest Ratio	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.00
17	@ 63˚	ULS B2	Highest Ratio	0.01	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02	0.02	0.00	0.02
18	@ 63˚	ULS B3	Highest Ratio	0.02	0.00	0.02	0.02	0.00	0.03	0.01	0.00	0.02	0.02	0.00	0.01	0.01	0.00	0.02	0.02	0.00	0.02
19	@ 63˚	ULS B4	Highest Ratio	0.01	0.00	0.02	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.01
20	@ 84˚	ULS B1	Highest Ratio	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01
21	@ 84˚	ULS B2	Highest Ratio	0.01	0.00	0.01	0.02	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.01	0.03	0.00	0.01
22	@ 84˚	ULS B3	Highest Ratio	0.01	0.00	0.01	0.03	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.01	0.03	0.00	0.02
23	@ 84˚	ULS B4	Highest Ratio	0.01	0.00	0.01	0.01	0.00	0.02	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01
Maximum Highest Ratio (Overall)				0.22	0.72	0.36	0.26	0.80	0.26	0.23	0.85	0.31	0.25	0.92	0.25	0.25	0.93	0.39	0.29	0.99	0.28
Governing Load Combination per Member per Station (Overall)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
				Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live	Live
Governing Member of the Element Group (Overall)																				Governing (Overall)	
Maximum Highest Ratio (Live Load Only)				0.22	0.72	0.36	0.26	0.80	0.26	0.23	0.85	0.31	0.25	0.92	0.25	0.25	0.93	0.39	0.29	0.99	0.28
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																				Governing (Live L.)	
Maximum Highest Ratio (Movable L. Only)				0.02	0.00	0.03	0.03	0.00	0.03	0.01	0.00	0.02	0.02	0.00	0.01	0.01	0.00	0.03	0.03	0.00	0.02
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B1	ULS B2	ULS B3	ULS B2	ULS B3	ULS B2	ULS B2	ULS B2	ULS B3	ULS B2	ULS B3	ULS B3	ULS B1	ULS B3	ULS B3	ULS B2	ULS B2
Governing Member of the Element Group (Movable Load Only)																					

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios For All Primary Members)

			Member #	646	646	646	647	647	647	650	650	650	651	651	651	654	654	654	655	655	655
			Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
			Node Label at Station		---			---			---			---			---			---		
Load Combination			Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
			Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
ID	Category	Name																				
1	Live	CL1	Highest Ratio	0.20	0.77	0.34	0.24	0.87	0.23	0.23	0.82	0.41	0.28	0.88	0.22	0.22	0.91	0.41	0.29	0.94	0.16
2	Live	CL2	Highest Ratio	0.20	0.77	0.34	0.24	0.87	0.23	0.23	0.82	0.41	0.28	0.88	0.22	0.22	0.91	0.41	0.29	0.94	0.16
3	Live	CL3	Highest Ratio	0.20	0.77	0.33	0.24	0.87	0.23	0.23	0.82	0.41	0.28	0.88	0.22	0.22	0.91	0.41	0.29	0.94	0.16
4	@ 0˚	ULS B1	Highest Ratio	0.00	0.00	0.03	0.01	0.00	0.01	0.01	0.00	0.03	0.01	0.00	0.03	0.01	0.00	0.03	0.01	0.00	0.05
5	@ 0˚	ULS B2	Highest Ratio	0.01	0.00	0.03	0.01	0.00	0.02	0.02	0.00	0.03	0.01	0.00	0.05	0.04	0.01	0.04	0.02	0.01	0.09
6	@ 0˚	ULS B3	Highest Ratio	0.01	0.00	0.03	0.01	0.00	0.02	0.03	0.00	0.03	0.01	0.00	0.06	0.05	0.01	0.04	0.02	0.01	0.10
7	@ 0˚	ULS B4	Highest Ratio	0.01	0.00	0.03	0.01	0.00	0.01	0.01	0.00	0.03	0.01	0.00	0.04	0.02	0.00	0.03	0.01	0.00	0.06
8	@ 21˚	ULS B1	Highest Ratio	0.01	0.00	0.03	0.01	0.00	0.02	0.02	0.00	0.03	0.01	0.00	0.06	0.03	0.01	0.04	0.01	0.01	0.09
9	@ 21˚	ULS B2	Highest Ratio	0.02	0.00	0.03	0.01	0.00	0.03	0.04	0.01	0.03	0.01	0.01	0.09	0.06	0.01	0.04	0.01	0.01	0.13
10	@ 21˚	ULS B3	Highest Ratio	0.02	0.00	0.03	0.01	0.00	0.04	0.04	0.01	0.03	0.01	0.01	0.09	0.07	0.01	0.04	0.01	0.01	0.14
11	@ 21˚	ULS B4	Highest Ratio	0.01	0.00	0.03	0.01	0.00	0.02	0.03	0.00	0.03	0.01	0.00	0.06	0.04	0.01	0.04	0.01	0.01	0.10
12	@ 42˚	ULS B1	Highest Ratio	0.01	0.00	0.03	0.00	0.00	0.03	0.03	0.01	0.03	0.00	0.00	0.08	0.05	0.01	0.03	0.00	0.01	0.12
13	@ 42˚	ULS B2	Highest Ratio	0.03	0.01	0.03	0.01	0.00	0.05	0.05	0.01	0.03	0.01	0.01	0.11	0.09	0.01	0.04	0.01	0.01	0.16
14	@ 42˚	ULS B3	Highest Ratio	0.03	0.01	0.03	0.01	0.00	0.05	0.06	0.01	0.03	0.01	0.01	0.12	0.09	0.01	0.04	0.01	0.01	0.17
15	@ 42˚	ULS B4	Highest Ratio	0.02	0.00	0.03	0.00	0.00	0.03	0.04	0.01	0.03	0.00	0.00	0.08	0.06	0.01	0.04	0.00	0.01	0.13
16	@ 63˚	ULS B1	Highest Ratio	0.02	0.00	0.02	0.00	0.00	0.04	0.04	0.01	0.02	0.00	0.00	0.08	0.06	0.01	0.03	0.00	0.01	0.12
17	@ 63˚	ULS B2	Highest Ratio	0.03	0.01	0.02	0.02	0.00	0.05	0.06	0.01	0.02	0.02	0.01	0.11	0.09	0.01	0.03	0.02	0.01	0.16
18	@ 63˚	ULS B3	Highest Ratio	0.03	0.01	0.03	0.02	0.00	0.05	0.07	0.01	0.02	0.02	0.01	0.12	0.10	0.02	0.03	0.02	0.01	0.17
19	@ 63˚	ULS B4	Highest Ratio	0.02	0.00	0.02	0.00	0.00	0.04	0.04	0.01	0.03	0.00	0.00	0.09	0.07	0.01	0.03	0.00	0.01	0.14
20	@ 84˚	ULS B1	Highest Ratio	0.01	0.00	0.01	0.01	0.00	0.03	0.03	0.00	0.01	0.00	0.00	0.07	0.06	0.01	0.02	0.00	0.01	0.11
21	@ 84˚	ULS B2	Highest Ratio	0.03	0.00	0.01	0.03	0.00	0.04	0.06	0.01	0.01	0.02	0.01	0.11	0.09	0.01	0.02	0.02	0.01	0.16
22	@ 84˚	ULS B3	Highest Ratio	0.03	0.00	0.01	0.03	0.00	0.05	0.06	0.01	0.01	0.03	0.01	0.11	0.09	0.01	0.03	0.03	0.01	0.17
23	@ 84˚	ULS B4	Highest Ratio	0.01	0.00	0.02	0.01	0.00	0.04	0.04	0.00	0.01	0.01	0.00	0.08	0.07	0.01	0.02	0.00	0.01	0.12
Maximum Highest Ratio (Overall)				0.20	0.77	0.34	0.24	0.87	0.23	0.23	0.82	0.41	0.28	0.88	0.22	0.22	0.91	0.41	0.29	0.94	0.17
Governing Load Combination per Member per Station (Overall)				CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	ULS B3 @ 63˚
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				0.20	0.77	0.34	0.24	0.87	0.23	0.23	0.82	0.41	0.28	0.88	0.22	0.22	0.91	0.41	0.29	0.94	0.16
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				0.03	0.01	0.03	0.03	0.00	0.05	0.07	0.01	0.03	0.03	0.01	0.12	0.10	0.02	0.04	0.03	0.01	0.17
Governing Load Combination per Member per Station (Movable Load Only)				ULS B3	ULS B2	ULS B3	ULS B3	ULS B2	ULS B3	ULS B3	ULS B2	ULS B2	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B2	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)																					Governing (Movable L.)

PARSONS

Bascule Bridge Structural Evaluation - Gusset Plates Nodes 1-12 (Demand To Capacity Ratios)

Load Combination			Node	1N	1S	2N	2S	3N	3S	4N	4S	5N	5S	6N	6S	7N	7S	8N	8S	9N	9S
			Element Group	Through Truss Gusset Plates	Through Truss Gusset Plates	Through Truss Gusset Plates	Through Truss Gusset Plates	Through Truss Gusset Plates	Through Truss Gusset Plates	Through Truss Gusset Plates	Through Truss Gusset Plates	Through Truss Gusset Plates	Through Truss Gusset Plates	Through Truss Gusset Plates	Through Truss Gusset Plates	Through Truss Gusset Plates	Through Truss Gusset Plates	Through Truss Gusset Plates	Through Truss Gusset Plates	Through Truss Gusset Plates	Through Truss Gusset Plates
ID	Category	Name																			
1	Live	CL1	Highest Ratio	**0.38**	**0.41**	**0.45**	**0.46**	**0.01**	**0.01**	**0.36**	**0.38**	**0.64**	**0.65**	**0.63**	**0.67**	**0.01**	**0.01**	**0.65**	**0.67**	**0.66**	**0.69**
2	Live	CL2	Highest Ratio	**0.33**	**0.36**	**0.45**	**0.46**	**0.01**	**0.01**	**0.32**	**0.33**	**0.62**	**0.63**	**0.55**	**0.59**	**0.01**	**0.01**	**0.61**	**0.63**	**0.62**	**0.64**
3	Live	CL3	Highest Ratio	**0.27**	**0.29**	**0.45**	**0.46**	**0.01**	**0.01**	**0.31**	**0.31**	**0.57**	**0.58**	**0.45**	**0.47**	**0.01**	**0.01**	**0.54**	**0.56**	**0.54**	**0.57**
4	@ 0˚	ULS B1	Highest Ratio	**0.09**	**0.11**	**0.06**	**0.08**	**0.01**	**0.01**	**0.20**	**0.24**	**0.38**	**0.42**	**0.22**	**0.26**	**0.01**	**0.01**	**0.35**	**0.39**	**0.38**	**0.42**
5	@ 0˚	ULS B2	Highest Ratio	**0.09**	**0.11**	**0.06**	**0.08**	**0.01**	**0.01**	**0.20**	**0.25**	**0.38**	**0.42**	**0.29**	**0.32**	**0.01**	**0.01**	**0.42**	**0.45**	**0.41**	**0.44**
6	@ 0˚	ULS B3	Highest Ratio	**0.09**	**0.11**	**0.06**	**0.08**	**0.01**	**0.01**	**0.20**	**0.25**	**0.38**	**0.42**	**0.31**	**0.34**	**0.01**	**0.01**	**0.44**	**0.47**	**0.42**	**0.45**
7	@ 0˚	ULS B4	Highest Ratio	**0.09**	**0.11**	**0.06**	**0.08**	**0.01**	**0.01**	**0.20**	**0.24**	**0.39**	**0.43**	**0.23**	**0.28**	**0.01**	**0.01**	**0.36**	**0.40**	**0.41**	**0.44**
8	@ 21˚	ULS B1	Highest Ratio	**0.08**	**0.10**	**0.06**	**0.08**	**0.01**	**0.01**	**0.19**	**0.23**	**0.35**	**0.39**	**0.25**	**0.27**	**0.01**	**0.01**	**0.36**	**0.37**	**0.35**	**0.38**
9	@ 21˚	ULS B2	Highest Ratio	**0.09**	**0.11**	**0.06**	**0.08**	**0.01**	**0.01**	**0.20**	**0.24**	**0.37**	**0.42**	**0.34**	**0.34**	**0.01**	**0.01**	**0.44**	**0.44**	**0.38**	**0.41**
10	@ 21˚	ULS B3	Highest Ratio	**0.09**	**0.11**	**0.06**	**0.08**	**0.01**	**0.01**	**0.20**	**0.25**	**0.38**	**0.42**	**0.36**	**0.36**	**0.01**	**0.01**	**0.46**	**0.46**	**0.38**	**0.42**
11	@ 21˚	ULS B4	Highest Ratio	**0.08**	**0.10**	**0.06**	**0.08**	**0.01**	**0.01**	**0.19**	**0.23**	**0.36**	**0.40**	**0.28**	**0.28**	**0.01**	**0.01**	**0.38**	**0.39**	**0.37**	**0.40**
12	@ 42˚	ULS B1	Highest Ratio	**0.07**	**0.08**	**0.05**	**0.06**	**0.01**	**0.01**	**0.14**	**0.18**	**0.28**	**0.31**	**0.26**	**0.27**	**0.01**	**0.01**	**0.33**	**0.34**	**0.26**	**0.29**
13	@ 42˚	ULS B2	Highest Ratio	**0.08**	**0.10**	**0.08**	**0.08**	**0.01**	**0.01**	**0.18**	**0.23**	**0.35**	**0.39**	**0.35**	**0.35**	**0.01**	**0.01**	**0.42**	**0.43**	**0.34**	**0.37**
14	@ 42˚	ULS B3	Highest Ratio	**0.08**	**0.11**	**0.08**	**0.09**	**0.01**	**0.01**	**0.19**	**0.24**	**0.36**	**0.41**	**0.37**	**0.37**	**0.01**	**0.01**	**0.44**	**0.44**	**0.35**	**0.39**
15	@ 42˚	ULS B4	Highest Ratio	**0.07**	**0.08**	**0.06**	**0.07**	**0.01**	**0.01**	**0.15**	**0.19**	**0.30**	**0.33**	**0.29**	**0.30**	**0.01**	**0.01**	**0.35**	**0.36**	**0.29**	**0.31**
16	@ 63˚	ULS B1	Highest Ratio	**0.04**	**0.05**	**0.06**	**0.07**	**0.01**	**0.00**	**0.10**	**0.12**	**0.17**	**0.19**	**0.24**	**0.26**	**0.00**	**0.00**	**0.26**	**0.27**	**0.16**	**0.18**
17	@ 63˚	ULS B2	Highest Ratio	**0.07**	**0.09**	**0.08**	**0.09**	**0.01**	**0.01**	**0.15**	**0.19**	**0.29**	**0.32**	**0.34**	**0.34**	**0.00**	**0.00**	**0.38**	**0.39**	**0.27**	**0.30**
18	@ 63˚	ULS B3	Highest Ratio	**0.07**	**0.10**	**0.09**	**0.10**	**0.01**	**0.01**	**0.16**	**0.21**	**0.32**	**0.36**	**0.36**	**0.36**	**0.01**	**0.00**	**0.41**	**0.41**	**0.30**	**0.33**
19	@ 63˚	ULS B4	Highest Ratio	**0.05**	**0.06**	**0.07**	**0.08**	**0.01**	**0.01**	**0.11**	**0.13**	**0.19**	**0.21**	**0.27**	**0.28**	**0.00**	**0.00**	**0.29**	**0.29**	**0.18**	**0.20**
20	@ 84˚	ULS B1	Highest Ratio	**0.01**	**0.01**	**0.07**	**0.08**	**0.00**	**0.00**	**0.07**	**0.08**	**0.04**	**0.04**	**0.19**	**0.21**	**0.00**	**0.00**	**0.15**	**0.16**	**0.04**	**0.04**
21	@ 84˚	ULS B2	Highest Ratio	**0.04**	**0.06**	**0.09**	**0.09**	**0.00**	**0.00**	**0.12**	**0.14**	**0.19**	**0.21**	**0.30**	**0.32**	**0.00**	**0.00**	**0.30**	**0.32**	**0.16**	**0.19**
22	@ 84˚	ULS B3	Highest Ratio	**0.05**	**0.07**	**0.09**	**0.10**	**0.00**	**0.00**	**0.13**	**0.16**	**0.22**	**0.25**	**0.33**	**0.34**	**0.00**	**0.00**	**0.34**	**0.35**	**0.19**	**0.22**
23	@ 84˚	ULS B4	Highest Ratio	**0.02**	**0.02**	**0.07**	**0.08**	**0.00**	**0.00**	**0.08**	**0.09**	**0.06**	**0.07**	**0.22**	**0.23**	**0.00**	**0.00**	**0.18**	**0.19**	**0.06**	**0.06**
Maximum Highest Ratio (Overall)				**0.38**	**0.41**	**0.45**	**0.46**	**0.01**	**0.01**	**0.36**	**0.38**	**0.64**	**0.65**	**0.63**	**0.67**	**0.01**	**0.01**	**0.65**	**0.67**	**0.66**	**0.69**
Governing Load Combination per Member per Station (Overall)				CL1 Live	CL1 Live	CL1 Live	CL1 Live	ULS B3 @ 0˚	ULS B3 @ 0˚	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	ULS B3 @ 0˚	ULS B3 @ 0˚	CL1 Live	CL1 Live	CL1 Live	CL1 Live
Governing Member of the Element Group (Overall)																					
Maximum Highest Ratio (Live Load Only)				**0.38**	**0.41**	**0.45**	**0.46**	**0.01**	**0.01**	**0.36**	**0.38**	**0.64**	**0.65**	**0.63**	**0.67**	**0.01**	**0.01**	**0.65**	**0.67**	**0.66**	**0.69**
Governing Load Combination per Member per Station (Live Load Only)				CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1	CL1
Governing Member of the Element Group (Live Load Only)																					
Maximum Highest Ratio (Movable L. Only)				**0.09**	**0.11**	**0.09**	**0.10**	**0.01**	**0.01**	**0.20**	**0.25**	**0.39**	**0.43**	**0.37**	**0.37**	**0.01**	**0.01**	**0.46**	**0.47**	**0.42**	**0.45**
Governing Load Combination per Member per Station (Movable Load Only)				ULS B4	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B4	ULS B4	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)																					

PARSONS

Bascule Bridge Structural Evaluation - Gusset Plates Nodes 1-12 (Demand To Capacity Ratios)

Designed By: AT
Checked By: MJPM

Load Combination			Node	10N	10S	11N	11S	12N	12S
			Element Group	Through Truss Gusset Plates	Through Truss Gusset Plates	Through Truss Gusset Plates	Through Truss Gusset Plates	Through Truss Gusset Plates	Through Truss Gusset Plates
ID	Category	Name							
1	Live	CL1	Highest Ratio	**0.53**	**0.54**	**0.01**	**0.01**	**0.88**	**0.92**
2	Live	CL2	Highest Ratio	**0.53**	**0.53**	**0.01**	**0.01**	**0.82**	**0.85**
3	Live	CL3	Highest Ratio	**0.53**	**0.53**	**0.01**	**0.01**	**0.72**	**0.76**
4	@ 0˚	ULS B1	Highest Ratio	**0.61**	**0.66**	**0.02**	**0.02**	**0.67**	**0.72**
5	@ 0˚	ULS B2	Highest Ratio	**0.81**	**0.86**	**0.02**	**0.02**	**0.86**	**0.91**
6	@ 0˚	ULS B3	Highest Ratio	**0.86**	**0.90**	**0.02**	**0.02**	**0.90**	**0.95**
7	@ 0˚	ULS B4	Highest Ratio	**0.65**	**0.69**	**0.02**	**0.02**	**0.70**	**0.75**
8	@ 21˚	ULS B1	Highest Ratio	**0.66**	**0.66**	**0.01**	**0.01**	**0.70**	**0.72**
9	@ 21˚	ULS B2	Highest Ratio	**0.87**	**0.85**	**0.01**	**0.02**	**0.89**	**0.90**
10	@ 21˚	ULS B3	Highest Ratio	**0.92**	**0.90**	**0.01**	**0.02**	**0.94**	**0.95**
11	@ 21˚	ULS B4	Highest Ratio	**0.70**	**0.70**	**0.01**	**0.01**	**0.73**	**0.75**
12	@ 42˚	ULS B1	Highest Ratio	**0.61**	**0.62**	**0.01**	**0.01**	**0.63**	**0.65**
13	@ 42˚	ULS B2	Highest Ratio	**0.84**	**0.83**	**0.01**	**0.01**	**0.84**	**0.85**
14	@ 42˚	ULS B3	Highest Ratio	**0.89**	**0.88**	**0.01**	**0.01**	**0.89**	**0.90**
15	@ 42˚	ULS B4	Highest Ratio	**0.67**	**0.67**	**0.01**	**0.01**	**0.68**	**0.70**
16	@ 63˚	ULS B1	Highest Ratio	**0.49**	**0.51**	**0.01**	**0.01**	**0.48**	**0.50**
17	@ 63˚	ULS B2	Highest Ratio	**0.75**	**0.76**	**0.01**	**0.01**	**0.74**	**0.75**
18	@ 63˚	ULS B3	Highest Ratio	**0.82**	**0.81**	**0.01**	**0.01**	**0.81**	**0.81**
19	@ 63˚	ULS B4	Highest Ratio	**0.55**	**0.57**	**0.01**	**0.01**	**0.54**	**0.55**
20	@ 84˚	ULS B1	Highest Ratio	**0.29**	**0.33**	**0.00**	**0.00**	**0.26**	**0.28**
21	@ 84˚	ULS B2	Highest Ratio	**0.61**	**0.64**	**0.00**	**0.00**	**0.58**	**0.58**
22	@ 84˚	ULS B3	Highest Ratio	**0.69**	**0.71**	**0.00**	**0.00**	**0.65**	**0.65**
23	@ 84˚	ULS B4	Highest Ratio	**0.36**	**0.40**	**0.00**	**0.00**	**0.33**	**0.34**
			Maximum Highest Ratio (Overall)	**0.92**	**0.90**	**0.02**	**0.02**	**0.94**	**0.95**
			Governing Load Combination per Member per Station (Overall)	ULS B3 @ 21˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 21˚	ULS B3 @ 0˚
			Governing Member of the Element Group (Overall)						Governing (Overall)
			Maximum Highest Ratio (Live Load Only)	**0.53**	**0.54**	**0.01**	**0.01**	**0.88**	**0.92**
			Governing Load Combination per Member per Station (Live Load Only)	CL1	CL1	CL1	CL1	CL1	CL1
			Governing Member of the Element Group (Live Load Only)						Governing (Live L.)
			Maximum Highest Ratio (Movable L. Only)	**0.92**	**0.90**	**0.02**	**0.02**	**0.94**	**0.95**
			Governing Load Combination per Member per Station (Movable Load Only)	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
			Governing Member of the Element Group (Movable Load Only)						Governing (Movable L.)

Bascule Bridge - Gusset Plates - Structural Evaluation Table

Element Group	Description	Evaluation Criteria								Evaluation Results					
		Target Reliability Index				$\alpha_{D,\,Max}$			α_L	Live Load Capacity Factor			Posting (tonnes)		
		System Behaviour	Element Behaviour	Inspection Level	β	D1	D2	D3		CL1-625	CL2-625	CL3-625	CL1-625	CL2-625	CL3-625
01 Through Truss Diagonal	For Gusset Plates Evaluation	S1	E1	INSP3	3.75	1.10	1.20	1.50	1.70	1	1	1	62.5	45.0	25.0
02 Through Truss Vertical	For Gusset Plates Evaluation	S1	E1	INSP3	3.75	1.10	1.20	1.50	1.70	1	1	1	62.5	45.0	25.0
03 Through Truss Bottom Chord	For Gusset Plates Evaluation	S1	E1	INSP3	3.75	1.10	1.20	1.50	1.70	1	1	1	62.5	45.0	25.0
04 Through Truss Top Chord	For Gusset Plates Evaluation	S1	E1	INSP3	3.75	1.10	1.20	1.50	1.70	1	1	1	62.5	45.0	25.0
05 Counter- weight Link	For Gusset Plates Evaluation	S1	E1	INSP3	3.75	1.10	1.20	1.50	1.70	NC	NC	NC	NC	NC	NC
06 Operating Strut	For Gusset Plates Evaluation	S1	E1	INSP3	3.75	1.10	1.20	1.50	1.70	NC	NC	NC	NC	NC	NC
07 Through Truss Trunnion Bay	For Gusset Plates Evaluation	S1	E1	INSP1	4.00	1.11	1.22	1.55	1.77	NC	NC	NC	NC	NC	NC
08 Counter- weight Top Chord	For Gusset Plates Evaluation	S1	E1	INSP3	3.75	1.10	1.20	1.50	1.70	NC	NC	NC	NC	NC	NC
09 Counter- weight Diagonal	For Gusset Plates Evaluation	S1	E1	INSP3	3.75	1.10	1.20	1.50	1.70	NC	NC	NC	NC	NC	NC
10 Counter- weight Vertical	For Gusset Plates Evaluation	S1	E1	INSP3	3.75	1.10	1.20	1.50	1.70	NC	NC	NC	NC	NC	NC
11 Counter- weight Horizontal	For Gusset Plates Evaluation	S1	E1	INSP1	4.00	1.11	1.22	1.55	1.77	NC	NC	NC	NC	NC	NC
12 Tower Truss Vertical	For Gusset Plates Evaluation	S1	E1	INSP3	3.75	1.10	1.20	1.50	1.70	NC	NC	NC	NC	NC	NC
13 Tower Truss Diagonal	For Gusset Plates Evaluation	S1	E1	INSP3	3.75	1.10	1.20	1.50	1.70	NC	NC	NC	NC	NC	NC
14 Tower Truss Horizontal	For Gusset Plates Evaluation	S1	E1	INSP3	3.75	1.10	1.20	1.50	1.70	NC	NC	NC	NC	NC	NC
15 Tower Truss Vertical	For Gusset Plates Evaluation	S1	E1	INSP3	3.75	1.10	1.20	1.50	1.70	NC	NC	NC	NC	NC	NC
16 Tower Truss Diagonal	For Gusset Plates Evaluation	S1	E1	INSP3	3.75	1.10	1.20	1.50	1.70	NC	NC	NC	NC	NC	NC
17 Tower Truss Secondary Truss	For Gusset Plates Evaluation	S1	E1	INSP3	3.75	1.10	1.20	1.50	1.70	NC	NC	NC	NC	NC	NC
18 Through Truss Bottom Lateral Bracing	For Gusset Plates Evaluation	S1	E1	INSP3	3.75	1.10	1.20	1.50	1.70	NC	NC	NC	NC	NC	NC
19 Through Truss Sway Truss	For Gusset Plates Evaluation	S1	E1	INSP3	3.75	1.10	1.20	1.50	1.70	NC	NC	NC	NC	NC	NC
20 Floor Beams	For Gusset Plates Evaluation	S1	E1	INSP3	3.75	1.10	1.20	1.50	1.70	NC	NC	NC	NC	NC	NC
21 Stringer	For Gusset Plates Evaluation	S1	E1	INSP3	3.75	1.10	1.20	1.50	1.70	NC	NC	NC	NC	NC	NC
22 Through Truss Strut	For Gusset Plates Evaluation	S1	E1	INSP3	3.75	1.10	1.20	1.50	1.70	NC	NC	NC	NC	NC	NC
23 Through Truss Top Lateral Bracing	For Gusset Plates Evaluation	S1	E1	INSP3	3.75	1.10	1.20	1.50	1.70	NC	NC	NC	NC	NC	NC
24 Counter- weight Link Lateral Bracing	For Gusset Plates Evaluation	S1	E1	INSP3	3.75	1.10	1.20	1.50	1.70	NC	NC	NC	NC	NC	NC
25 Tower Truss Lateral Bracing	For Gusset Plates Evaluation	S1	E1	INSP3	3.75	1.10	1.20	1.50	1.70	NC	NC	NC	NC	NC	NC
26 Counter- weight Truss Lateral Bracing	For Gusset Plates Evaluation	S1	E1	INSP3	3.75	1.10	1.20	1.50	1.70	NC	NC	NC	NC	NC	NC
27 New Counterweight	For Gusset Plates Evaluation	S1	E1	INSP3	3.75	1.10	1.20	1.50	1.70	NC	NC	NC	NC	NC	NC
28 Sidewalk Cantilever	For Gusset Plates Evaluation	S1	E1	INSP3	3.75	1.10	1.20	1.50	1.70	NC	NC	NC	NC	NC	NC
29 Machinery Room Beam	For Gusset Plates Evaluation	S1	E1	INSP3	3.75	1.10	1.20	1.50	1.70	NC	NC	NC	NC	NC	NC
30 Mechanical Parts	For Gusset Plates Evaluation	S1	E1	INSP1	4.00	1.11	1.22	1.55	1.77	NC	NC	NC	NC	NC	NC
31 Buried Parts	For Gusset Plates Evaluation	S1	E1	INSP1	4.00	1.11	1.22	1.55	1.77	NC	NC	NC	NC	NC	NC

NC: Not Calculated
NA: Not Applicable

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios Exceeding 1.00) - Theoretical Analysis with Zero Corrosion

			Member #	10	10	10	186	186	186	249	249	250	250	400	400	401	401	547	551	284	285
			Member Label	9N-12N	9N-12N	9N-12N	9S-12S	9S-12S	9S-12S	56N-34N	56N-34N	34N-13N	34N-13N	56S-34S	56S-34S	34S-13S	34S-13S	14N-49N	14S-49S	10N-12N	12N-14N
			Station (m)	0.0	4.7	9.3	0.0	4.7	9.3	2.9	5.9	0.0	1.8	2.9	5.9	0.0	1.8	4.6	4.6	5.8	0.0
			Node Label at Station	9N	---	12N	9S	---	12S	---	34N	34N	---	---	34S	34S	---	49N	49S	12N	12N
Load Combination			Section #	Section 07	Section 07	Section 07	Section 07	Section 07	Section 07	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 03	Section 03	Section 02	Section 08
			Element Group	01 Through Truss Diagonal	01 Through Truss Diagonal	01 Through Truss Diagonal	01 Through Truss Diagonal	01 Through Truss Diagonal	01 Through Truss Diagonal	01 Through Truss Diagonal	01 Through Truss Diagonal	01 Through Truss Diagonal	01 Through Truss Diagonal	01 Through Truss Diagonal	01 Through Truss Diagonal	01 Through Truss Diagonal	01 Through Truss Diagonal	02 Through Truss Vertical	02 Through Truss Vertical	03 Through Truss Bottom Chord	03 Through Truss Bottom Chord
ID	Category	Name																			
1	Live	CL1	Highest Ratio	**1.00**	**1.09**	**1.01**	**1.05**	**1.14**	**1.06**												
2	Live	CL2	Highest Ratio		**1.02**			**1.06**													
3	Live	CL3	Highest Ratio																		
4	@ 0˚	ULS B1	Highest Ratio																		
5	@ 0˚	ULS B2	Highest Ratio								**1.10**	**1.08**			**1.11**	**1.10**					
6	@ 0˚	ULS B3	Highest Ratio								**1.24**	**1.23**			**1.26**	**1.25**					
7	@ 0˚	ULS B4	Highest Ratio																		
8	@ 21˚	ULS B1	Highest Ratio																		
9	@ 21˚	ULS B2	Highest Ratio								**1.24**	**1.20**		**1.00**	**1.28**	**1.24**					
10	@ 21˚	ULS B3	Highest Ratio							**1.06**	**1.37**	**1.32**	**1.00**	**1.08**	**1.40**	**1.36**	**1.03**			**1.06**	
11	@ 21˚	ULS B4	Highest Ratio																		
12	@ 42˚	ULS B1	Highest Ratio																		
13	@ 42˚	ULS B2	Highest Ratio							**1.02**	**1.24**	**1.20**		**1.06**	**1.30**	**1.27**	**1.02**			**1.01**	
14	@ 42˚	ULS B3	Highest Ratio							**1.09**	**1.35**	**1.31**	**1.04**	**1.13**	**1.41**	**1.38**	**1.09**			**1.08**	**1.03**
15	@ 42˚	ULS B4	Highest Ratio								**NA**				**NA**	**NA**					
16	@ 63˚	ULS B1	Highest Ratio																		
17	@ 63˚	ULS B2	Highest Ratio								**1.11**	**1.13**			**1.22**	**1.25**	**1.02**	**1.01**	**1.04**	**1.01**	
18	@ 63˚	ULS B3	Highest Ratio								**1.21**	**1.24**		**1.06**	**1.33**	**1.37**	**1.10**	**1.16**	**1.20**	**1.11**	**1.04**
19	@ 63˚	ULS B4	Highest Ratio												**NA**	**NA**					
20	@ 84˚	ULS B1	Highest Ratio																		
21	@ 84˚	ULS B2	Highest Ratio																**1.00**		
22	@ 84˚	ULS B3	Highest Ratio													**1.03**		**1.01**	**1.10**	**1.10**	
23	@ 84˚	ULS B4	Highest Ratio																		
			Maximum Highest Ratio (Overall)	**1.00**	**1.09**	**1.01**	**1.05**	**1.14**	**1.06**	**1.09**	**1.37**	**1.32**	**1.04**	**1.13**	**1.41**	**1.38**	**1.10**	**1.16**	**1.20**	**1.11**	**1.04**
			Governing Load Combination per Member per Station (Overall)	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	CL1 Live	ULS B3 @ 42˚	ULS B3 @ 21˚	ULS B3 @ 21˚	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 63˚
			Governing Member of the Element Group (Overall)												Governing (Overall)				Governing (Overall)		
			Maximum Highest Ratio (Live Load Only)	**1.00**	**1.09**	**1.01**	**1.05**	**1.14**	**1.06**												
			Governing Load Combination per Member per Station (Live Load Only)	CL1	CL1	CL1	CL1	CL1	CL1												
			Governing Member of the Element Group (Live Load Only)					Governing (Live L.)													
			Maximum Highest Ratio (Movable L. Only)							**1.09**	**1.37**	**1.32**	**1.04**	**1.13**	**1.41**	**1.38**	**1.10**	**1.16**	**1.20**	**1.11**	**1.04**
			Governing Load Combination per Member per Station (Movable Load Only)							ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
			Governing Member of the Element Group (Movable Load Only)												Governing (Movable L.)				Governing (Movable L.)		

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Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios Exceeding 1.00) - Theoretical Analysis with Zero Corrosion

			Member #	285	286	286	286	564	565	565	566	566	566	418	487	431	431	432	435	435	436
			Member Label	12N-14N	14N-16N	14N-16N	14N-16N	10S-12S	12S-14S	12S-14S	14S-16S	14S-16S	14S-16S	48N-11N	48S-11S	22N-33N	22N-33N	33N-32N	22S-33S	22S-33S	33S-32S
			Station (m)	5.8	0.0	3.9	7.7	5.8	0.0	5.8	0.0	3.9	7.7	0.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
			Node Label at Station	14N	14N	---	16N	12S	12S	14S	14S	---	16S	48N	48S	22N	33N	33N	22S	33S	33S
Load Combination			Section #	Section 08	Section 01	Section 01	Section 01	Section 02	Section 08	Section 08	Section 01	Section 01	Section 01	Section 06	Section 06	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10
			Element Group	03 Through Truss Bottom Chord	03 Through Truss Bottom Chord	03 Through Truss Bottom Chord	03 Through Truss Bottom Chord	03 Through Truss Bottom Chord	03 Through Truss Bottom Chord	03 Through Truss Bottom Chord	03 Through Truss Bottom Chord	03 Through Truss Bottom Chord	03 Through Truss Bottom Chord	04 Through Truss Top Chord	04 Through Truss Top Chord	05 Counter-weight Link	05 Counter-weight Link	05 Counter-weight Link	05 Counter-weight Link	05 Counter-weight Link	05 Counter-weight Link
ID	Category	Name																			
1	Live	CL1	Highest Ratio																		
2	Live	CL2	Highest Ratio																		
3	Live	CL3	Highest Ratio																		
4	@ 0˚	ULS B1	Highest Ratio																		
5	@ 0˚	ULS B2	Highest Ratio				1.39						1.41		1.00	1.18			1.09		
6	@ 0˚	ULS B3	Highest Ratio				1.57			1.04			1.59	1.00	1.03	1.29	1.02	1.01	1.20	1.01	1.01
7	@ 0˚	ULS B4	Highest Ratio																		
8	@ 21˚	ULS B1	Highest Ratio																		
9	@ 21˚	ULS B2	Highest Ratio			1.04	1.47			1.04		1.01	1.43			1.15			1.03		
10	@ 21˚	ULS B3	Highest Ratio	1.03	1.01	1.13	1.64	1.01		1.10		1.10	1.59		1.01	1.26			1.14		
11	@ 21˚	ULS B4	Highest Ratio				NA						NA								
12	@ 42˚	ULS B1	Highest Ratio				1.06						1.05								
13	@ 42˚	ULS B2	Highest Ratio		1.07	1.19	1.69			1.05		1.17	1.66	1.02	1.04	1.04					
14	@ 42˚	ULS B3	Highest Ratio	1.03	1.13	1.27	1.84	1.03	1.07	1.12	1.04	1.25	1.81	1.11	1.13	1.15			1.03		
15	@ 42˚	ULS B4	Highest Ratio			NA	NA					NA	NA								
16	@ 63˚	ULS B1	Highest Ratio																		
17	@ 63˚	ULS B2	Highest Ratio			1.05	1.53					1.03	1.51	1.05	1.05						
18	@ 63˚	ULS B3	Highest Ratio		1.04	1.12	1.66	1.05	1.10	1.08	1.07	1.10	1.64	1.20	1.20						
19	@ 63˚	ULS B4	Highest Ratio				NA						NA								
20	@ 84˚	ULS B1	Highest Ratio																		
21	@ 84˚	ULS B2	Highest Ratio																		
22	@ 84˚	ULS B3	Highest Ratio					1.07						1.10	1.09						
23	@ 84˚	ULS B4	Highest Ratio																		
			Maximum Highest Ratio (Overall)	1.03	1.13	1.27	1.84	1.07	1.10	1.12	1.07	1.25	1.81	1.20	1.20	1.29	1.02	1.01	1.20	1.01	1.01
			Governing Load Combination per Member per Station (Overall)	ULS B3 @ 21˚	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 84˚	ULS B3 @ 63˚	ULS B3 @ 42˚	ULS B3 @ 63˚	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚
			Governing Member of the Element Group (Overall)				Governing (Overall)								Governing (Overall)	Governing (Overall)					
			Maximum Highest Ratio (Live Load Only)																		
			Governing Load Combination per Member per Station (Live Load Only)																		
			Governing Member of the Element Group (Live Load Only)																		
			Maximum Highest Ratio (Movable L. Only)	1.03	1.13	1.27	1.84	1.07	1.10	1.12	1.07	1.25	1.81	1.20	1.20	1.29	1.02	1.01	1.20	1.01	1.01
			Governing Load Combination per Member per Station (Movable Load Only)	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
			Governing Member of the Element Group (Movable Load Only)				Governing (Movable L.)								Governing (Movable L.)	Governing (Movable L.)					

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Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios Exceeding 1.00) - Theoretical Analysis with Zero Corrosion

				Member #	248	248	251	251	251	252	252	252	399	399	579	579	579	580	580	580	33	33
				Member Label	16N-56N	16N-56N	15N-56N	15N-56N	15N-56N	56N-14N	56N-14N	56N-14N	16S-56S	16S-56S	15S-56S	15S-56S	15S-56S	56S-14S	56S-14S	56S-14S	26N-25N	26N-25N
				Station (m)	0.0	0.8	0.0	0.8	1.6	0.0	3.4	6.7	0.0	0.8	0.0	0.8	1.6	0.0	3.4	6.7	2.4	4.8
				Node Label at Station	16N	---	15N	---	56N	56N	---	14N	16S	---	15S	---	56S	56S	---	14S	---	25N
Load Combination				Section #	Section 01	Section 01	Section 08	Section 08	Section 08	Section 08	Section 08	Section 08	Section 01	Section 01	Section 08	Section 08	Section 08	Section 08	Section 08	Section 08	Section 25	Section 25
				Element Group	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	07 Through Truss Trunnion Bay	08 Counter-weight Top Chord	08 Counter-weight Top Chord
ID	Category	Name																				
1	Live	CL1	Highest Ratio																			
2	Live	CL2	Highest Ratio																			
3	Live	CL3	Highest Ratio																			
4	@ 0˚	ULS B1	Highest Ratio																			
5	@ 0˚	ULS B2	Highest Ratio	**1.09**		**1.24**	**1.12**	**1.00**	**1.03**	**1.11**	**1.03**	**1.09**		**1.27**	**1.16**	**1.04**	**1.07**	**1.15**	**1.08**		
6	@ 0˚	ULS B3	Highest Ratio	**1.22**		**1.40**	**1.25**	**1.09**	**1.12**	**1.20**	**1.12**	**1.22**		**1.42**	**1.28**	**1.13**	**1.16**	**1.24**	**1.16**		
7	@ 0˚	ULS B4	Highest Ratio																			
8	@ 21˚	ULS B1	Highest Ratio																			
9	@ 21˚	ULS B2	Highest Ratio	**1.32**		**1.06**						**1.30**		**1.07**								
10	@ 21˚	ULS B3	Highest Ratio	**1.43**	**1.02**	**1.21**	**1.05**			**1.00**		**1.41**	**1.02**	**1.21**	**1.06**			**1.02**				
11	@ 21˚	ULS B4	Highest Ratio	**NA**								**NA**										
12	@ 42˚	ULS B1	Highest Ratio																			
13	@ 42˚	ULS B2	Highest Ratio	**1.40**	**1.07**							**1.40**	**1.08**									
14	@ 42˚	ULS B3	Highest Ratio	**1.50**	**1.12**	**1.03**						**1.50**	**1.13**	**1.03**								
15	@ 42˚	ULS B4	Highest Ratio	**NA**								**NA**										
16	@ 63˚	ULS B1	Highest Ratio																			
17	@ 63˚	ULS B2	Highest Ratio	**1.27**								**1.29**	**1.00**									
18	@ 63˚	ULS B3	Highest Ratio	**1.37**	**1.03**							**1.39**	**1.06**									
19	@ 63˚	ULS B4	Highest Ratio	**NA**								**NA**										
20	@ 84˚	ULS B1	Highest Ratio																			**1.15**
21	@ 84˚	ULS B2	Highest Ratio																			**1.18**
22	@ 84˚	ULS B3	Highest Ratio																			**1.19**
23	@ 84˚	ULS B4	Highest Ratio																		**NA**	**NA**
Maximum Highest Ratio (Overall)					**1.50**	**1.12**	**1.40**	**1.25**	**1.09**	**1.12**	**1.20**	**1.12**	**1.50**	**1.13**	**1.42**	**1.28**	**1.13**	**1.16**	**1.24**	**1.16**	**NA**	**1.19**
Governing Load Combination per Member per Station (Overall)					ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 42˚	ULS B3 @ 42˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B4 @ 84˚	ULS B3 @ 84˚
Governing Member of the Element Group (Overall)													Governing (Overall)									Governing (Overall)
Maximum Highest Ratio (Live Load Only)																						
Governing Load Combination per Member per Station (Live Load Only)																						
Governing Member of the Element Group (Live Load Only)																						
Maximum Highest Ratio (Movable L. Only)					**1.50**	**1.12**	**1.40**	**1.25**	**1.09**	**1.12**	**1.20**	**1.12**	**1.50**	**1.13**	**1.42**	**1.28**	**1.13**	**1.16**	**1.24**	**1.16**		**1.19**
Governing Load Combination per Member per Station (Movable Load Only)					ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3		ULS B3
Governing Member of the Element Group (Movable Load Only)													Governing (Movable L.)									Governing (Movable L.)

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Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios Exceeding 1.00) - Theoretical Analysis with Zero Corrosion

			Member #	164	164	603	603	276	277	278	607	608	609	258	258	259	259	259	260	260	586
			Member Label	26S-25S	26S-25S	41S-21S	41S-21S	26N-27N	27N-50N	50N-21N	26S-27S	27S-50S	50S-21S	31N-51N	31N-51N	51N-20N	51N-20N	51N-20N	20N-19N	20N-19N	31S-51S
			Station (m)	2.4	4.8	0.0	0.9	3.9	0.0	1.0	3.9	0.0	1.0	0.6	1.2	0.0	0.1	0.3	0.0	5.5	0.6
			Node Label at Station	---	25S	41S	21S	27N	27N	21N	27S	27S	21S	---	51N	51N	---	20N	20N	19N	---
Load Combination			Section #	Section 25	Section 25	Section 16	Section 16	Section 26	Section 21	Section 21	Section 26	Section 21	Section 21	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20
			Element Group	08 Counter-weight Top Chord	08 Counter-weight Top Chord	09 Counter-weight Diagonal	09 Counter-weight Diagonal	11 Counter-weight Horizontal	11 Counter-weight Horizontal	11 Counter-weight Horizontal	11 Counter-weight Horizontal	11 Counter-weight Horizontal	11 Counter-weight Horizontal	12 Tower Truss Vertical	12 Tower Truss Vertical	12 Tower Truss Vertical	12 Tower Truss Vertical	12 Tower Truss Vertical	12 Tower Truss Vertical	12 Tower Truss Vertical	12 Tower Truss Vertical
ID	Category	Name																			
1	Live	CL1	Highest Ratio																		
2	Live	CL2	Highest Ratio																		
3	Live	CL3	Highest Ratio																		
4	@ 0˚	ULS B1	Highest Ratio																		
5	@ 0˚	ULS B2	Highest Ratio																	1.15	
6	@ 0˚	ULS B3	Highest Ratio												1.01	1.07	1.05	1.02	1.04	1.28	
7	@ 0˚	ULS B4	Highest Ratio												1.01	1.05	1.02		1.02	1.21	
8	@ 21˚	ULS B1	Highest Ratio																		
9	@ 21˚	ULS B2	Highest Ratio				1.01													1.16	
10	@ 21˚	ULS B3	Highest Ratio			1.00	1.01								1.01	1.07	1.05	1.03	1.05	1.29	
11	@ 21˚	ULS B4	Highest Ratio				NA								1.01	1.04	1.01		1.01	1.21	
12	@ 42˚	ULS B1	Highest Ratio																		
13	@ 42˚	ULS B2	Highest Ratio													1.01			1.02	1.22	
14	@ 42˚	ULS B3	Highest Ratio												1.06	1.12	1.11	1.10	1.13	1.37	
15	@ 42˚	ULS B4	Highest Ratio				NA									1.02				1.20	
16	@ 63˚	ULS B1	Highest Ratio																		
17	@ 63˚	ULS B2	Highest Ratio												1.04	1.09	1.09	1.08	1.12	1.30	
18	@ 63˚	ULS B3	Highest Ratio												1.17	1.23	1.22	1.21	1.26	1.47	
19	@ 63˚	ULS B4	Highest Ratio						NA			NA				1.01				1.17	
20	@ 84˚	ULS B1	Highest Ratio		1.14				1.05			1.04									
21	@ 84˚	ULS B2	Highest Ratio		1.18				1.09			1.09			1.15	1.21	1.20	1.19	1.23	1.37	
22	@ 84˚	ULS B3	Highest Ratio		1.19				1.10			1.10		1.06	1.31	1.37	1.36	1.34	1.40	1.58	1.07
23	@ 84˚	ULS B4	Highest Ratio	NA	NA			NA	NA	NA	NA	NA	NA			1.02				1.12	
			Maximum Highest Ratio (Overall)	NA	1.19	1.00	1.01	NA	1.10	NA	NA	1.10	NA	1.06	1.31	1.37	1.36	1.34	1.40	1.58	1.07
			Governing Load Combination per Member per Station (Overall)	ULS B4 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 21˚	ULS B3 @ 21˚	ULS B4 @ 84˚	ULS B3 @ 84˚	ULS B4 @ 84˚	ULS B4 @ 84˚	ULS B3 @ 84˚	ULS B4 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚
			Governing Member of the Element Group (Overall)				Governing (Overall)		Governing (Overall)												
			Maximum Highest Ratio (Live Load Only)																		
			Governing Load Combination per Member per Station (Live Load Only)																		
			Governing Member of the Element Group (Live Load Only)																		
			Maximum Highest Ratio (Movable L. Only)		1.19	1.00	1.01		1.10			1.10		1.06	1.31	1.37	1.36	1.34	1.40	1.58	1.07
			Governing Load Combination per Member per Station (Movable Load Only)		ULS B3	ULS B3	ULS B3		ULS B3			ULS B3		ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
			Governing Member of the Element Group (Movable Load Only)				Governing (Movable L.)		Governing (Movable L.)												

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios Exceeding 1.00) - Theoretical Analysis with Zero Corrosion

			Member #	586	587	587	587	588	588	266	267	267	267	268	268	594	595	595	595	596	596
			Member Label	31S-51S	51S-20S	51S-20S	51S-20S	20S-19S	20S-19S	28N-52N	52N-17N	52N-17N	52N-17N	17N-15N	17N-15N	28S-52S	52S-17S	52S-17S	52S-17S	17S-15S	17S-15S
			Station (m)	1.2	0.0	0.1	0.3	0.0	5.5	0.4	0.0	0.9	1.8	0.0	8.4	0.4	0.0	0.9	1.8	0.0	8.4
			Node Label at Station	51S	51S	---	20S	20S	19S	52N	52N	---	17N	17N	15N	52S	52S	---	17S	17S	15S
Load Combination			Section #	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11
			Element Group	12 Tower Truss Vertical	12 Tower Truss Vertical	12 Tower Truss Vertical	12 Tower Truss Vertical	12 Tower Truss Vertical	12 Tower Truss Vertical	13 Tower Truss Diagonal	13 Tower Truss Diagonal	13 Tower Truss Diagonal	13 Tower Truss Diagonal	13 Tower Truss Diagonal	13 Tower Truss Diagonal	13 Tower Truss Diagonal	13 Tower Truss Diagonal	13 Tower Truss Diagonal	13 Tower Truss Diagonal	13 Tower Truss Diagonal	13 Tower Truss Diagonal
ID	Category	Name																			
1	Live	CL1	Highest Ratio																		
2	Live	CL2	Highest Ratio																		
3	Live	CL3	Highest Ratio																		
4	@ 0˚	ULS B1	Highest Ratio							1.03						1.04					
5	@ 0˚	ULS B2	Highest Ratio		1.01				1.17	1.14	1.27	1.02	1.08	1.17	1.56	1.14	1.30	1.05	1.10	1.20	1.55
6	@ 0˚	ULS B3	Highest Ratio	1.04	1.11	1.08	1.05	1.08	1.30	1.16	1.35	1.09	1.18	1.29	1.75	1.17	1.38	1.12	1.20	1.32	1.74
7	@ 0˚	ULS B4	Highest Ratio	1.05	1.08	1.05	1.03	1.05	1.23	1.20	1.25	1.03		1.04	1.23	1.21	1.28	1.05		1.07	1.22
8	@ 21˚	ULS B1	Highest Ratio																		
9	@ 21˚	ULS B2	Highest Ratio		1.01				1.19	1.04	1.25		1.03	1.11	1.47	1.07	1.28		1.05	1.14	1.47
10	@ 21˚	ULS B3	Highest Ratio	1.05	1.11	1.08	1.06	1.08	1.32	1.08	1.34	1.05	1.13	1.23	1.65	1.12	1.37	1.07	1.16	1.25	1.66
11	@ 21˚	ULS B4	Highest Ratio	1.04	1.07	1.05	1.02	1.04	1.24	1.03	1.18				1.14	1.06	1.21				1.14
12	@ 42˚	ULS B1	Highest Ratio																		
13	@ 42˚	ULS B2	Highest Ratio		1.04	1.03	1.02	1.05	1.24	1.20	1.33			1.05	1.31	1.25	1.37	1.00	1.00	1.09	1.33
14	@ 42˚	ULS B3	Highest Ratio	1.10	1.16	1.14	1.13	1.16	1.39	1.31	1.46	1.06	1.08	1.17	1.48	1.36	1.50	1.09	1.11	1.21	1.50
15	@ 42˚	ULS B4	Highest Ratio	1.02	1.05	1.03	1.01	1.03	1.22		1.08				1.02		1.10				1.03
16	@ 63˚	ULS B1	Highest Ratio																		
17	@ 63˚	ULS B2	Highest Ratio	1.06	1.12	1.11	1.10	1.14	1.32	1.30	1.43				1.03	1.36	1.48				1.06
18	@ 63˚	ULS B3	Highest Ratio	1.19	1.25	1.24	1.23	1.28	1.49	1.47	1.62	1.04		1.06	1.15	1.54	1.67	1.08	1.03	1.12	1.19
19	@ 63˚	ULS B4	Highest Ratio	1.00	1.03	1.01		1.00	1.19												
20	@ 84˚	ULS B1	Highest Ratio																		
21	@ 84˚	ULS B2	Highest Ratio	1.16	1.22	1.21	1.20	1.24	1.39	1.13	1.28					1.19	1.32				
22	@ 84˚	ULS B3	Highest Ratio	1.32	1.38	1.37	1.35	1.41	1.59	1.33	1.52					1.40	1.57				
23	@ 84˚	ULS B4	Highest Ratio		1.02				1.13												
			Maximum Highest Ratio (Overall)	1.32	1.38	1.37	1.35	1.41	1.59	1.47	1.62	1.09	1.18	1.29	1.75	1.54	1.67	1.12	1.20	1.32	1.74
			Governing Load Combination per Member per Station (Overall)	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 63˚	ULS B3 @ 63˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚	ULS B3 @ 0˚
			Governing Member of the Element Group (Overall)						Governing (Overall)						Governing (Overall)						
			Maximum Highest Ratio (Live Load Only)																		
			Governing Load Combination per Member per Station (Live Load Only)																		
			Governing Member of the Element Group (Live Load Only)																		
			Maximum Highest Ratio (Movable L. Only)	1.32	1.38	1.37	1.35	1.41	1.59	1.47	1.62	1.09	1.18	1.29	1.75	1.54	1.67	1.12	1.20	1.32	1.74
			Governing Load Combination per Member per Station (Movable Load Only)	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
			Governing Member of the Element Group (Movable Load Only)						Governing (Movable L.)						Governing (Movable L.)						

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios Exceeding 1.00) - Theoretical Analysis with Zero Corrosion

			Member #	20	20	195	195	269	269	597	597	597
			Member Label	17N-19N	17N-19N	17S-19S	17S-19S	17N-29N	17N-29N	17S-29S	17S-29S	17S-29S
			Station (m)	0.0	8.4	0.0	8.4	1.7	3.3	0.0	1.7	3.3
			Node Label at Station	17N	19N	17S	19S	---	29N	17S	---	29S
Load Combination			Section #	Section 14	Section 14	Section 14	Section 14	Section 15	Section 15	Section 15	Section 15	Section 15
			Element Group	16 Tower Truss Diagonal	16 Tower Truss Diagonal	16 Tower Truss Diagonal	16 Tower Truss Diagonal	17 Tower Truss Secondary Truss	17 Tower Truss Secondary Truss	17 Tower Truss Secondary Truss	17 Tower Truss Secondary Truss	17 Tower Truss Secondary Truss
ID	Category	Name										
1	Live	CL1	Highest Ratio									
2	Live	CL2	Highest Ratio									
3	Live	CL3	Highest Ratio									
4	@ 0˚	ULS B1	Highest Ratio									
5	@ 0˚	ULS B2	Highest Ratio									
6	@ 0˚	ULS B3	Highest Ratio									
7	@ 0˚	ULS B4	Highest Ratio									
8	@ 21˚	ULS B1	Highest Ratio									
9	@ 21˚	ULS B2	Highest Ratio									
10	@ 21˚	ULS B3	Highest Ratio									
11	@ 21˚	ULS B4	Highest Ratio									
12	@ 42˚	ULS B1	Highest Ratio									
13	@ 42˚	ULS B2	Highest Ratio									
14	@ 42˚	ULS B3	Highest Ratio									
15	@ 42˚	ULS B4	Highest Ratio									
16	@ 63˚	ULS B1	Highest Ratio									
17	@ 63˚	ULS B2	Highest Ratio									
18	@ 63˚	ULS B3	Highest Ratio		**1.06**		**1.07**					
19	@ 63˚	ULS B4	Highest Ratio									
20	@ 84˚	ULS B1	Highest Ratio									
21	@ 84˚	ULS B2	Highest Ratio									
22	@ 84˚	ULS B3	Highest Ratio	**1.18**	**1.17**	**1.21**	**1.20**	**1.02**	**1.02**	**1.01**	**1.04**	**1.04**
23	@ 84˚	ULS B4	Highest Ratio									
			Maximum Highest Ratio (Overall)	**1.18**	**1.17**	**1.21**	**1.20**	**1.02**	**1.02**	**1.01**	**1.04**	**1.04**
			Governing Load Combination per Member per Station (Overall)	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚	ULS B3 @ 84˚
			Governing Member of the Element Group (Overall)			Governing (Overall)					Governing (Overall)	
			Maximum Highest Ratio (Live Load Only)									
			Governing Load Combination per Member per Station (Live Load Only)									
			Governing Member of the Element Group (Live Load Only)									
			Maximum Highest Ratio (Movable L. Only)	**1.18**	**1.17**	**1.21**	**1.20**	**1.02**	**1.02**	**1.01**	**1.04**	**1.04**
			Governing Load Combination per Member per Station (Movable Load Only)	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3	ULS B3
			Governing Member of the Element Group (Movable Load Only)			Governing (Movable L.)					Governing (Movable L.)	

Bascule Bridge Structural Evaluation - Frame Members (Demand To Capacity Ratios Exceeding 1.00) - Theoretical Analysis with Zero Corrosion

Load Combination				Member #	686	695
				Member Label	16N-	-16S
				Station (m)	0.0	0.6
				Node Label at Station	16N	16S
				Section #	Section 62	Section 62
				Element Group	20 Floor Beams	20 Floor Beams
ID	Category	Name				
1	Live	CL1	Highest Ratio			
2	Live	CL2	Highest Ratio			
3	Live	CL3	Highest Ratio			
4	@ 0˚	ULS B1	Highest Ratio			
5	@ 0˚	ULS B2	Highest Ratio			
6	@ 0˚	ULS B3	Highest Ratio			
7	@ 0˚	ULS B4	Highest Ratio			
8	@ 21˚	ULS B1	Highest Ratio			
9	@ 21˚	ULS B2	Highest Ratio			
10	@ 21˚	ULS B3	Highest Ratio			
11	@ 21˚	ULS B4	Highest Ratio			
12	@ 42˚	ULS B1	Highest Ratio			
13	@ 42˚	ULS B2	Highest Ratio			
14	@ 42˚	ULS B3	Highest Ratio			
15	@ 42˚	ULS B4	Highest Ratio			
16	@ 63˚	ULS B1	Highest Ratio			
17	@ 63˚	ULS B2	Highest Ratio			
18	@ 63˚	ULS B3	Highest Ratio			**1.00**
19	@ 63˚	ULS B4	Highest Ratio			
20	@ 84˚	ULS B1	Highest Ratio			
21	@ 84˚	ULS B2	Highest Ratio			**1.03**
22	@ 84˚	ULS B3	Highest Ratio		**1.04**	**1.12**
23	@ 84˚	ULS B4	Highest Ratio			
Maximum Highest Ratio (Overall)					**1.04**	**1.12**
Governing Load Combination per Member per Station (Overall)					ULS B3 @ 84˚	ULS B3 @ 84˚
Governing Member of the Element Group (Overall)						Governing (Overall)
Maximum Highest Ratio (Live Load Only)						
Governing Load Combination per Member per Station (Live Load Only)						
Governing Member of the Element Group (Live Load Only)						
Maximum Highest Ratio (Movable L. Only)					**1.04**	**1.12**
Governing Load Combination per Member per Station (Movable Load Only)					ULS B3	ULS B3
Governing Member of the Element Group (Movable Load Only)						Governing (Movable L.)

Bascule Bridge Structural Evaluation - Special Load Factors for Movable Bridges

Element Group	Evaluation Criteria							Bascule Bridge - Special Load Combinations															
	Target Reliability Index				$\alpha_{D,\,Max}$			$\alpha_{D,\,Min}$			ULS B1			ULS B2			ULS B3			ULS B4		
	System Behaviour	Element Behaviour	Inspection Level	β	D1	D2	D3	D'1	D'2	D'3	Ho	Wo	Io	Ho	Wo	Io	Ho	Wo	Io	Ho	Wo	Io
01 Through Truss Diagonal	S1	E1	INSP3	3.75	1.1	1.20	1.5	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2
02 Through Truss Vertical	S1	E1	INSP3	3.75	1.1	1.20	1.5	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2
03 Through Truss Bottom Chord	S1	E1	INSP3	3.75	1.1	1.20	1.5	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2
04 Through Truss Top Chord	S1	E2	INSP3	3.25	1.08	1.16	1.4	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2
05 Counter- weight Link	S1	E1	INSP3	3.75	1.1	1.2	1.5	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2
06 Operating Strut	S3	E1	INSP3	3.25	1.08	1.16	1.4	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2
07 Through Truss Trunnion Bay	S1	E1	INSP1	4	1.11	1.22	1.55	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2
08 Counter- weight Top Chord	S1	E1	INSP3	3.75	1.1	1.2	1.5	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2
09 Counter- weight Diagonal	S2	E2	INSP3	3	1.07	1.14	1.35	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2
10 Counter- weight Vertical	S1	E1	INSP3	3.75	1.1	1.2	1.50	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2
11 Counter- weight Horizontal	S1	E1	INSP1	4	1.11	1.22	1.55	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2
12 Tower Truss Vertical	S1	E2	INSP3	3.25	1.08	1.16	1.4	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2
13 Tower Truss Diagonal	S1	E2	INSP3	3.25	1.08	1.16	1.4	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2
14 Tower Truss Horizontal	S3	E1	INSP3	3.25	1.08	1.16	1.40	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2
15 Tower Truss Vertical	S3	E2	INSP3	2.75	1.06	1.12	1.30	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2
16 Tower Truss Diagonal	S3	E2	INSP3	2.75	1.06	1.12	1.30	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2
17 Tower Truss Secondary Truss	S3	E2	INSP3	2.75	1.06	1.12	1.30	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2
18 Through Truss Bottom Lateral Bracing	S3	E1	INSP3	3.25	1.08	1.16	1.40	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2
19 Through Truss Sway Truss	S3	E2	INSP3	2.75	1.06	1.12	1.30	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2
20 Floor Beams	S2	E3	INSP3	2.75	1.06	1.12	1.30	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2
21 Stringer	S3	E3	INSP3	2.5	1.05	1.1	1.25	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2
22 Through Truss Strut	S3	E2	INSP3	2.75	1.06	1.12	1.30	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2
23 Through Truss Top Lateral Bracing	S3	E1	INSP3	3.25	1.08	1.16	1.4	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2
24 Counter- weight Link Lateral Bracing	S3	E1	INSP3	3.25	1.08	1.16	1.4	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2
25 Tower Truss Lateral Bracing	S3	E1	INSP3	3.25	1.08	1.16	1.4	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2
26 Counter- weight Truss Lateral Bracing	S3	E1	INSP3	3.25	1.08	1.16	1.4	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2
27 New Counterweight	S2	E3	INSP3	2.75	1.06	1.12	1.3	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2
28 Sidewalk Cantilever	S3	E3	INSP3	2.5	1.05	1.1	1.25	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2
29 Machinery Room Beam	S3	E3	INSP3	2.5	1.05	1.1	1.25	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2
30 Mechanical Parts	S1	E3	INSP1	3.5	1.09	1.18	1.45	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2
31 Buried Parts	S2	E1	INSP1	3.75	1.1	1.2	1.5	0.95	0.9	0.65	0	0	1.2	0	1.3	1.2	0	1.6	1.2	1.55	0	1.2

Appendix C

Load Calculation Sheets

Table S4-1 - Timber Deck Weight Calculation (Report by Delcan, 2013)

1:59 PM
19/04/2013
Proj. No. B02235

Lasalle Bascule Bridge
EXISTING RAILING AND TIMBER DECK WEIGHT

Description	Material Density	Flange Width	Flange Thickness	Web Height	Web Thickness	Section Area	Unit Weight	No.	Length	Weight	Nominal Weight	Added	Weight Added	Total Weight	Notes
	kg/m^3	mm	mm	mm	mm	mm^2	kg/m		m	kg	tonnes	%	tonnes	tonnes	
WOOD DECKING															
Stringer Trunion Panel	612														Softwood Density from Table 3.3 of CHBDC used
64x343				343	64	21952	13.4	5	3.850	259	0.3	5%	0.01	0.3	+5% for lap over cantilever
Subtotal										*259*	*0.3*		*0.01*	*0.3*	
Stringer Other Panels															
64x343				343	64	21952	13.4	3	2.895	117	0.1	5%	0.01	*0.1*	+5% for lap over cantilever
Subtotal										*117*	*0.1*		*0.01*	*0.1*	
TOTAL										**2151**	**2.2**			**2.3**	*2 Panels @ Trunion End, 14 Other Panels*
Wood Decking - Trunion Panel															
64mm decking	340	n/sqm				8951250				310	0.3	-5%	-0.02	0.3	*Pressure of 340N/sqm for douglas fir taken from handbook of wood construction - Bridge code would have an equivalent of 384N/sqm*
Subtotal										*310*	*0.3*		*-0.02*	*0.3*	*Full panel width of 2.325m used throughout*
Wood Decking - Other Panels															
64mm decking	340	n/sqm				6730875				233	0.2	-5%	-0.01	0.2	*Pressure of 340N/sqm for douglas fir taken from handbook of wood construction - Bridge code would have an equivalent of 384N/sqm*
Subtotal										*233*	*0.2*		*-0.01*	*0.2*	*Full panel width of 2.325m used throughout*
TOTAL										3886	3.9			3.7	*2 Panels @ Trunion End, 14 Other Panels*
											Total structural steel weight			**6.0**	**tonnes**
			Notes:											5950	kg
			- (-5%) used to account for deck area removed for vertical and diagonal truss members											58	kN
													Length	48.23	m Total Length of Wood Decking
References:													Width	2.35	m Average Width of Wood Decking
1 -RPS_ONT-#405847-v1-S7574-11													Area	113	m^2
2- RPS_ONT-#405848-v1-S7574-12													Pressure	**0.52**	*kPa*

	kg	lb.
Total W	5950.4	13120.6
	kg/m^2	psf
Total W	52.5	10.8

Table S4-2 – Existing Railing Weight Calculation (Report by Delcan, 2013)

Description	Material Density	Flange Width	Flange Thickness	Web Height	Web Thickness	Section Area	Unit Weight	No.	Length	Weight	Nominal Weight	Added	Weight Added	Total Weight	Notes
	kg/m^3	mm	mm	mm	mm	mm^2	kg/m		m	kg	tonnes	%	tonnes	tonnes	
STEEL RAILING															
Main Post	7850														
HSS 152x152x6.4						3610	28.3	1	1.835	52	0.1	0%	0.00	0.1	
Subtotal										*52*	*0.1*		*0.00*	*0.1*	
HSS Stub on Post						2800	22.0	4	0.165	15	0.0	0%	0.00	*0.0*	
Top Plate				152	12	1824	14.3	1	0.152	2	0.0	0%	0.00	*0.0*	*152x152x12*
Post Cap Plate				190	25	4750	37.3	1	0.190	7	0.0	0%	0.00	*0.0*	*190x190x25*
Base Plate				168	10	1680	13.2	1	0.168	2	0.0	0%	0.00	*0.0*	*168x168x10*
Subtotal										*26*	*0.0*		*0.00*	*0.0*	
Total per Post										*78*	*0.1*			*0.08*	
TOTAL										**702**	**0.7**			**0.7**	*9 Main posts on bridge*
Intermediate Post	7850														
HSS 152x152x6.4						3610	28.3	1	1.435	41	0.0	0%	0.00	0.0	
Subtotal										*41*	*0.0*		*0.00*	*0.0*	
HSS Stub on Post						2800	22.0	4	0.165	15	0.0	0%	0.00	*0.0*	
Stiffener plate below post				300	11	3300	25.9	2	0.190	10	0.0	0%	0.00	*0.0*	*equivalent rec. area 11mm thickness instead of 10mm used.*
Top Plate				152	12	1824	14.3	1	0.152	2	0.0	0%	0.00	*0.0*	*152x152x12*
Post Cap Plate				190	25	4750	37.3	1	0.190	7	0.0	0%	0.00	*0.0*	*190x190x25*
Base Plate				170	10	1700	13.3	1	0.300	4	0.0	0%	0.00	*0.0*	*300x170x10*
Subtotal										*38*	*0.0*		*0.00*	*0.0*	
Total per Post										*78*	*0.1*			*0.08*	
TOTAL										**626**	**0.6**			**0.6**	*8 Intermediate posts on bridge*
Railing - Other Panels	7850														
HSS 152x102x4.8						2280	17.9	4	2.895	207	0.2	0%	0.00	0.2	
Subtotal										*207*	*0.2*		*0.00*	*0.2*	
Total per Panel										*207*	*0.2*			*0.21*	
TOTAL										**2902**	**2.9**			**2.9**	*14 panels on bridge*
Railing - Trunion End Panel	7850														
HSS 152x102x4.8						2280	17.9	4	3.850	276	0.3	0%	0.00	0.3	
Subtotal										*276*	*0.3*		*0.00*	*0.3*	
Total per Panel										*276*	*0.3*			*0.28*	
TOTAL										**551**	**0.6**			**0.6**	*2 panels on bridge*
											Total structural steel weight			**4.8**	**tonnes**
														4781	kg
														47	kN
													Length	48.23	m
													Unit Weigth	**0.97**	*kN/m*

		kg	lb.
Total W	4781.0		10542.1
		kg/m	lb./ft.
Total W	99.1		0.7

Total Railing Length

Table S4-3 – Bridge Deck Weight Calculation – Intermediate Bays (Report by Delcan, 2013)

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Proj. No. B02235

Lasalle Bascule Bridge
Bridge Deck Weight

Description	Material Density	Flange Width	Flange Thickness	Web Height	Web Thickness	Section Area	Unit Weight	No.	Length	Weight	Nominal Weight	Added	Weight Added	Total Weight	Notes					
	kg/m^3	mm	mm	mm	mm	mm^2	kg/m		m	kg	tonnes	%	tonnes	tonnes						
STRUCTURAL STEEL Intermediate Bays																				
Stringer	7850														14 WF 34 (W360x51)					
W360x51						6450	50.6	1	5.791	293	0.3	0%	0.00	0.3						
Subtotal										*293*	*0.3*		*0.00*	*0.3*						
Stringer. - Misc. Steel																				
Clip angles						1730	13.6	4	0.356	19	0.0	0%	0.00	*0.0*	*L4x3.5x3/8 (L102*89*9.5)*					
Subtotal										*19*	*0.0*		*0.00*	*0.0*						
Total per stringer										*313*	*0.3*			*0.31*						
TOTAL										**2813**	**2.8**			**2.8**	*9 Stringers per bay*					
Grating Sills	7850														6" I @ 12.5 sills @ 1'-6" O.C.	1973 repair				
S150x19						2370	18.6	12.6	7.772	1822	1.8	10%	0.18	2.0	*increased to account for lap*					
Subtotal										*1822*	*1.8*		*0.18*	*2.0*						
Grating - Misc. Steel																				
Bearing bars				63.5	6.35	403.225	3.2	127	5.791	2328	2.3	10%	0.23	2.6	*2-1/2"x1/4" serated*	increased to account for joints betwwen panels				
Cross bars				25.4	6.35	161.29	1.3	91	7.772	895	0.9	10%	0.09	1.0	*1"x1/4" serated*	increased to account for joints betwwen panels				
Subtotal										*3223*	*3.2*		*0.32*	*3.5*						
Total per Bay										*5045*	*5.0*			*5.55*						
TOTAL										**5045**	**5.0**			**5.5**						
											Total structural steel weight			**8.4**	**tonnes**						
														8363	kg					
														82	kN					
											Bay Area		Length	5.791	m					
													Width	7.772	m					
													Area	45	m^2		kg/m^2	psf		
													Pressure	**1.82**	*kPa*	Total W	186	38		
													Stringers	**0.61**	*kPa*	Stringers	63	13		
													Sills	**0.44**	*kPa*	Sills	45	9		
													Grating	**0.77**	*kPa*	Grating	79	16		

Table S4-4 – Bridge Deck Weight Calculation – Trunnion End Bay (Report by Delcan, 2013)

STRUCTURAL STEEL Trunion End Bay																					
Stringer	7850													16 WF 40 (W410x60)							
W410x60						7580	59.5	1	7.696	458	0.5	0%	0.00	0.5							
Subtotal										*458*	*0.5*		*0.00*	*0.5*							
Stringer. - Misc. Steel																					
Clip angles						1730	13.6	2	0.356	10	0.0	0%	0.00	*0.0*	*L4x3.5x3/8 (L102*89*9.5)*						
Plate				250	9.5	2375	18.6	2	0.500	19	0.0	0%	0.00	*0.0*	*equivalent rectangular section*						
Subtotal										*28*	*0.0*		*0.00*	*0.0*							
Total per stringer										*486*	*0.5*			*0.49*							
TOTAL										**4246**	**4.2**			**4.2**	*9 Stringers per bay, weight of 14 plates subtracted as plates only present on 2 of 9 stringers*						
Grating Sills	7850														6" I @ 12.5 sills @ 1'-6" O.C.						
S150x19						2370	18.6	17	7.772	2458	2.5	10%	0.25	2.7	*increased to account for lap*						
Subtotal										*2458*	*2.5*		*0.25*	*2.7*							
Grating - Misc. Steel																					
Bearing bars				63.5	6.35	403.225	3.2	127	7.696	3094	3.1	10%	0.31	3.4	*2-1/2"x1/4" serated*	increased to account for joints betwwen panels					
Cross bars				25.4	6.35	161.29	1.3	121	7.772	1191	1.2	10%	0.12	1.3	*1"x1/4" serated*	increased to account for joints betwwen panels					
Subtotal										*4284*	*4.3*		*0.43*	*4.7*							
Total per Bay										*6743*	*6.7*			*7.42*							
TOTAL										**6743**	**6.7**			**7.4**	*1 bay*						
											Total structural steel weight			**11.7**	**tonnes**						
														11663	kg						
														114	kN						
											Bay Area		Length	7.696	m						
													Width	7.772	m						
													Area	60	m^2		kg/m^2	psf		
													Pressure	**1.91**	*kPa*	Total W	195	40		
													Stringers	**0.70**	*kPa*	Stringers	71	15		
													Sills	**0.44**	*kPa*	Sills	45	9		
													Grating	**0.77**	*kPa*	Grating	79	16		

Sheet: Lift Span Weight
H:\ISO\BO2235\BOA\DOCS\Design Concept for closed deck\Existing Steel Span Weight - Lasalle Bascule Bridge

Table S4-5 – Bridge Dead Load Calculation – Dead D1

Dead D1	**Sub-category Loads**			
1	**New CTWT Plates**	Unit	Value	In CSiBridge
	Number of Plates		17	
	Dim1	mm	50	
	Dim2	mm	860	
	Dim3	mm	1330	
	Material Density	kg/m^3	7850	
	Girder Length	m	8.2296	
	Total Mass	Ton	7.632006	
	Weight/length	kN/m	9.097644	9.1
2	**Steel Members**	Unit	Value	
	Material Density	kg/m^3	7850	
	Weight modifier for all except stringers		1.3	*

3	**Deck (Grating and Sills)**	Unit	Value	
	Grating	kN/m^2	0.77	See "Deck".
	Sills	kN/m^2	0.44	See "Deck".
	Total	kN/m^2	1.21	
	Deck Thickness	m	0.2159	
	New Steel Density	**kg/m^3**	571.2993	
	New Steel Unit Weight	kN/m^3	5.604447	
4	**Machinery Room Steel Members**			
5	**CTWT**	Gravity		
		Uz		
		-1		

*Note: According to the weight study of a group of truss members.

Table S4-6 – Bridge Dead Load Calculation – Dead D2

Dead D2 **Sub-category Loads**

1 **Wood Deck** Ton 6 See "Timber Deck Sidewalk".

Cantilever Length m 1.4478

	Tributary width		Mass on Cantilever		UDL on Cantilever		In CSI Bridge
	m	in	Ton		kN/m		kN/m
cantilever at 0S	2.8956	114	0.36		2.439287		2.44
cantilever at 2S	5.7912	228	0.72		4.878574		4.88
cantilever at 4S	5.7912	228	0.72		4.878574		4.88
cantilever at 6S	5.7912	228	0.72		4.878574		4.88
cantilever at 8S	5.7912	228	0.72		4.878574		4.88
cantilever at 10S	5.7912	228	0.72		4.878574		4.88
cantilever at 12S	5.7912	228	0.72		4.878574		4.88
cantilever at 14S	6.7564	266	0.84		5.69167		5.69
cantilever at 16S	3.8608	152	0.48		3.252383		3.25
Total	48.26	1900	6				

2 **Sidewalk Railing** kN/m 1

	Tributary width		Point Load at Tip		In CSI Bridge
	m	in	kN		kN
cantilever at 0S	2.8956	114	2.8956		2.9
cantilever at 2S	5.7912	228	5.7912		5.79
cantilever at 4S	5.7912	228	5.7912		5.79
cantilever at 6S	5.7912	228	5.7912		5.79
cantilever at 8S	5.7912	228	5.7912		5.79
cantilever at 10S	5.7912	228	5.7912		5.79
cantilever at 12S	5.7912	228	5.7912		5.79
cantilever at 14S	6.7564	266	6.7564		6.76
cantilever at 16S	3.8608	152	3.8608		3.86
Total	48.26	1900	48.26		48.3

3	**Inboard Railing**	kN/m	0.4
	Thrie Beam Length	m	1.018
	Thrie Beam Thickness	m	0.00267
	Thrie Beam Dead Load	kN/m	0.20931
	Total of Inboard Railing and Thrie b	kN/m	0.60931

	Tributary width		Point Load at Node		In CSI Bridge
	m	in	kN		kN
Node 0S	2.8956	114	1.764329		1.76
Node 2S	5.7912	228	3.528658		3.53
Node 4S	5.7912	228	3.528658		3.53
Node 6S	5.7912	228	3.528658		3.53
Node 8S	5.7912	228	3.528658		3.53
Node 10S	5.7912	228	3.528658		3.53
Node 12S	5.7912	228	3.528658		3.53
Node 14S	6.7564	266	4.116767		4.12
Node 16S	3.8608	152	2.352438		2.35
Total	48.26	1900	29.40548		29.4

Machinery Room

4 **Concrete**

Assume 10" concrete slab to account for all the loading in the machinery room

	Unit	Value	
Concrete slab thickness	m	0.254	
RC Unit Weight	kN/m^3	24	
Slab Width (along X)	m	6.4008	
Slab Length (along Y)	m	8.2296	
Area	m^2	52.67602	
Total Weight	kN	321.113	
UDL on beam 17N-17S	kN/m	19.50964	19.5
UDL on beam 51N-51S	kN/m	19.50964	19.5

WoY (Wind Load - Open position	Sub-category Loads								
		Unit	Value						
	Horizontal Transverse Pressure	kN/m^2	1.5	Y-dir					
		Max Tributary Width		UDL Y-dir	In CSI Bridge				
		in	m	kN/m	kN				
	01 TT Diagonal	15	0.381	0.5715	0.572				
	02 TT Vertical		0.26	0.39	0.39				
	03 TT Bottom Chord	46.325	1.176655	1.764983	1.76		see IMG_0237 For WindLoad.pdf		
	04 TT Top Chord	15	0.381	0.5715	0.572				
	05 CTWT Link		0.663	0.9945	0.995				
	06 Oper Strut		0.68	1.02	1.02				
	07 TT Trunnion Bay		NA				accounted for in 03 TT Bottom Chord		
	08 CTWT Top Chord		0.78	1.17	1.17				
	09 CTWT Diagonal		0.6	0.9	0.9				
	10 CTWT Vertical		0.32	0.48	0.48				
	11 CTWT Horizontal		0.6	0.9	0.9				
	12 TowerT Vertical		0.56	0.84	0.84				
	13 TowerT Diagonal		0.6	0.9	0.9				
	14 TowerT Horizontal		0.26	0.39	0.39				
	15 TowerT Vertical		0.34	0.51	0.51				
	16 TowerT Diagonal		0.36	0.54	0.54				
	17 TowerT Second Truss		0.16	0.24	0.24				
	18 TT Bot Lateral Bracing		NA						
	19 TT Sway Truss		NA						
	20 Floor Beams		NA						
	21 Stringer		NA						
	22 TT Strut		NA						
	23 TT Top Lateral Bracing		NA						
	24 CTWT Link Lateral Bracing		NA						
	25 TowerT Lateral Bracing		NA						
	26 CTWT Truss Lateral Bracing		NA						
	27 New CTWT		NA						
	28 Sidewalk Cantilever		NA						
	29 Machinery Room Beam		3.512	5.268	5.27		Only on the outside beams		
	30 Mechanical Parts		NA						
	31 Buried Parts		NA						

WoX (Wind Load - Open position **Sub-category Loads**

CTWT Nodal Force Calc.

	Unit	Value	
Horizontal Longitudinal Pressure	kN/m^2	1.5	X-dir
Tributary Width	m	3.683	

CTWT Initial Coordinates *see notes pages 97-99

	P1	P2	P3	P4
x (in)	2797.2	2834	2834	2654.1
y (in)	0	0	0	0
z (in)	271	398	571.6	539.4

β (deg)	73.84033
γ (deg)	10.14782
P1-P2 (m)	3.358495
P2-P3 (m)	4.40944
P3-P4 (m)	4.642078

		Opening Position (deg)				
		0	21	42	63	84
Projected Areas (m^2)	1	11.88062	9.857807	6.525491	2.326334	0
	2	16.23997	15.16132	12.06865	7.372791	1.697539
	3	0	3.21891	9.022474	13.6275	16.42226

Nodal Forces X-dir (kN)	P1	8.910466	7.393356	4.894118	1.74475	0
	P2	21.09044	18.76434	13.9456	7.274343	1.273154
	P3	12.17998	13.78517	15.81834	15.75022	13.58985
	P4	0	2.414182	6.766856	10.22063	12.3167

Nodal Forces X-dir (kN) In CSI Bridge	P1	8.91	7.39	4.89	1.74	0
	P2	21.1	18.8	13.9	7.27	1.27
	P3	12.2	13.8	15.8	15.8	13.6
	P4	0	2.41	6.77	10.2	12.3

Deck Longitudinal Pressure

	Unit	Value		
Horizontal Longitudinal Pressure	kN/m^2	1.5	X-dir	X-Projection

D1CTW, D1CTWT, D1TT, D1Other	**Sub-category Loads**									
1: D1CTW	**CTWT**	Gravity								
		Uz								
		-1								
2: D1CTWT	**New CTWT Plates**	Unit	Value							
	Number of Plates		17							
	Dim1	mm	50							
	Dim2	mm	860							
	Dim3	mm	1330							
	Material Density	kg/m^3	7850							
	Girder Length	m	8.2296							
	Total Mass	Ton	7.632006							
	Weight/length	kN/m	9.097644	9.1						
3: D1CTWT, D1TT, D1Other	**Steel Members**	Unit	Value							
	Material Density	kg/m^3	7850							
	Weight modifier for all except stringers		1.3	*Note: According to the weight study of a group of truss members.						
		D1CTWT Gravity	**D1TT Gravity**	**D1Other Gravity**						
		Uz	Uz	Uz						
	01 TT Diagonal		-1							
	02 TT Vertical		-1							
	03 TT Bottom Chord		-1							
	04 TT Top Chord		-1							
	05 CTWT Link			-1						
	06 Oper Strut			-1						
	07 TT Trunnion Bay		-1							
	08 CTWT Top Chord	-1								
	09 CTWT Diagonal	-1								
	10 CTWT Vertical	-1								
	11 CTWT Horizontal	-1								
	12 TowerT Vertical			-1						
	13 TowerT Diagonal			-1						
	14 TowerT Horizontal			-1						
	15 TowerT Vertical			-1						
	16 TowerT Diagonal			-1						
	17 TowerT Second Truss			-1						
	18 TT Bot Lateral Bracing		-1							

	19 TT Sway Truss		-1		
	20 Floor Beams		-1		
	21 Stringer		-1		
	22 TT Strut		-1		
	23 TT Top Lateral Bracing		-1		
	24 CTWT Link Lateral Bracing			-1	
	25 TowerT Lateral Bracing			-1	
	26 CTWT Truss Lateral Bracing	-1			
	27 New CTWT	-1			
	28 Sidewalk Cantilever		-1		
	29 Machinery Room Beam			-1	
	30 Mechanical Parts			-1	
	31 Buried Parts			-1	
4: D1TT	**Deck (Grating and Sills)**	Unit	Value		
	Grating	kN/m^2	0.77	See "Deck".	
	Sills	kN/m^2	0.44	See "Deck".	
	Total	kN/m^2	1.21		
	Deck Thickness	m	0.2159		
	New Steel Density	**kg/m^3**	571.2993		

D2CTW, D2CTWT, D2TT, D2Other	Sub-category Loads			
1: D2CTW	CTWT	Gravity		
		Uz		
		-1		
2: D2TT	**Wood Deck**	Ton	6	See "Wood Deck Sidewalk".
	Cantilever Length	m	1.4478	

	Tributary width		Mass on Cantilever		UDL on Cantilever		In CSI Bridge
	m	in	Ton		kN/m		kN/m
cantilever at 0S	2.8956	114	0.36		2.439287		2.44
cantilever at 2S	5.7912	228	0.72		4.878574		4.88
cantilever at 4S	5.7912	228	0.72		4.878574		4.88
cantilever at 6S	5.7912	228	0.72		4.878574		4.88
cantilever at 8S	5.7912	228	0.72		4.878574		4.88
cantilever at 10S	5.7912	228	0.72		4.878574		4.88
cantilever at 12S	5.7912	228	0.72		4.878574		4.88
cantilever at 14S	6.7564	266	0.84		5.69167		5.69
cantilever at 16S	3.8608	152	0.48		3.252383		3.25
Total	48.26	1900	6				

3: D2TT	**Sidewalk Railing**	kN/m	1	

	Tributary width		Point Load at Tip		In CSI Bridge
	m	in	kN		kN
cantilever at 0S	2.8956	114	2.8956		2.9
cantilever at 2S	5.7912	228	5.7912		5.79
cantilever at 4S	5.7912	228	5.7912		5.79
cantilever at 6S	5.7912	228	5.7912		5.79
cantilever at 8S	5.7912	228	5.7912		5.79
cantilever at 10S	5.7912	228	5.7912		5.79
cantilever at 12S	5.7912	228	5.7912		5.79
cantilever at 14S	6.7564	266	6.7564		6.76
cantilever at 16S	3.8608	152	3.8608		3.86
Total	48.26	1900	48.26		48.3

4: D2TT	**Inboard Railing**	kN/m	0.4					
	Thrie Beam Length	m	1.018					
	Thrie Beam Thickness	m	0.00267					
	Thrie Beam Dead Load	kN/m	0.20931					
	Total of Inboard Railing and Thrie b	kN/m	0.60931					
			Tributary width		Point Load at Node		In CSI Bridge	
			m	in	kN		kN	
		Node 0S	2.8956	114	1.764329		1.76	
		Node 2S	5.7912	228	3.528658		3.53	
		Node 4S	5.7912	228	3.528658		3.53	
		Node 6S	5.7912	228	3.528658		3.53	
		Node 8S	5.7912	228	3.528658		3.53	
		Node 10S	5.7912	228	3.528658		3.53	
		Node 12S	5.7912	228	3.528658		3.53	
		Node 14S	6.7564	266	4.116767		4.12	
		Node 16S	3.8608	152	2.352438		2.35	
		Total	48.26	1900	29.40548		29.4	
5: D2Other	**Machinery Room Concrete**							
	Assume 10" concrete slab to account for all the loading in the machinery room							
		Unit	Value					
	Concrete slab thickness	m	0.254					
	RC Unit Weight	kN/m^3	24					
	Slab Width (along X)	m	6.4008					
	Slab Length (along Y)	m	8.2296					
	Area	m^2	52.67602					
	Total Weight	kN	321.113					
	UDL on beam 17N-17S	kN/m	19.50964	19.5				
	UDL on beam 51N-51S	kN/m	19.50964	19.5				
6: D2CTWT	Reserve Zero Load Case	New CTWT						
		Gravity						
		Uz						
		-1.00E-07						

Io (Impact Load - Open position)	Sub-category Loads		
	0.2 x the following load cases		
	D Link		
	D1CTWT		
	D1TT		
	D2CTWT		
	D2TT		
	D1CTW		
	D2Other		
		Gravity	
		Uz	
		-1	

H_o = *horizontal force, taken as 5% of the total moving load carried by the steel towers and/or special parts of the structure that support the counterweight assembly; bridge open in any position; this force shall be applied in any direction, through the centre of gravity of the moving load*

| Sub-category Loads | | |

Sidewalk Railing	kN/m	1

	Tributary width		Point Load at Tip		In CSI Bridge
	m	in	kN		kN
cantilever at 0S	2.8956	114	2.8956		2.9
cantilever at 2S	5.7912	228	5.7912		5.79
cantilever at 4S	5.7912	228	5.7912		5.79
cantilever at 6S	5.7912	228	5.7912		5.79
cantilever at 8S	5.7912	228	5.7912		5.79
cantilever at 10S	5.7912	228	5.7912		5.79
cantilever at 12S	5.7912	228	5.7912		5.79
cantilever at 14S	6.7564	266	6.7564		6.76
cantilever at 16S	3.8608	152	3.8608		3.86
Total	48.26	1900	48.26		48.3

Ho 5% Component (Cl13.6.10.2)
In CSI Bridge
kN
0.145
0.29
0.29
0.29
0.29
0.29
0.29
0.338
0.193
2.41

Inboard Railing	kN/m	0.4

Thrie Beam Length	m	1.018
Thrie Beam Thickness	m	0.00267
Thrie Beam Dead Load	kN/m	0.20931
Total of Inboard Railing and Thrie b	kN/m	0.60931

	Tributary width		Point Load at Node		In CSI Bridge
	m	in	kN		kN
Node 0S	2.8956	114	1.764329		1.76
Node 2S	5.7912	228	3.528658		3.53
Node 4S	5.7912	228	3.528658		3.53
Node 6S	5.7912	228	3.528658		3.53
Node 8S	5.7912	228	3.528658		3.53
Node 10S	5.7912	228	3.528658		3.53
Node 12S	5.7912	228	3.528658		3.53
Node 14S	6.7564	266	4.116767		4.12
Node 16S	3.8608	152	2.352438		2.35
Total	48.26	1900	29.40548		29.4

Ho 5% Component (Cl13.6.10.2)
In CSI Bridge
kN
0.0882
0.176
0.176
0.176
0.176
0.176
0.176
0.206
0.118
1.47

Appendix D

Evaluation Calculation Sheets

Bascule Bridge Structural Evaluation - Frame Member Group Names and Abbreviation - ULS B4 Check Inclusions

Abbreviation Name	Full Name	Check ULS B4
01 TT Diagonal	01 Through Truss Diagonal	NA
02 TT Vertical	02 Through Truss Vertical	NA
03 TT Bottom Chord	03 Through Truss Bottom Chord	NA
04 TT Top Chord	04 Through Truss Top Chord	NA
05 CTWT Link	05 Counter- weight Link	Yes
06 Oper Strut	06 Operating Strut	Yes
07 TT Trunnion Bay	07 Through Truss Trunnion Bay	NA
08 CTWT Top Chord	08 Counter- weight Top Chord	NA
09 CTWT Diagonal	09 Counter- weight Diagonal	NA
10 CTWT Vertical	10 Counter- weight Vertical	NA
11 CTWT Horizontal	11 Counter- weight Horizontal	NA
12 TowerT Vertical	12 Tower Truss Vertical	Yes
13 TowerT Diagonal	13 Tower Truss Diagonal	Yes
14 TowerT Horizontal	14 Tower Truss Horizontal	Yes
15 TowerT Vertical	15 Tower Truss Vertical	Yes
16 TowerT Diagonal	16 Tower Truss Diagonal	Yes
17 TowerT Second Truss	17 Tower Truss Secondary Truss	Yes
18 TT Bot Lateral Bracing	18 Through Truss Bottom Lateral Bracing	NA
19 TT Sway Truss	19 Through Truss Sway Truss	NA
20 Floor Beams	20 Floor Beams	NA
21 Stringer	21 Stringer	NA
22 TT Strut	22 Through Truss Strut	NA
23 TT Top Lateral Bracing	23 Through Truss Top Lateral Bracing	NA
24 CTWT Link Lateral Bracing	24 Counter- weight Link Lateral Bracing	Yes
25 TowerT Lateral Bracing	25 Tower Truss Lateral Bracing	Yes
26 CTWT Truss Lateral Bracing	26 Counter- weight Truss Lateral Bracing	NA
27 New CTWT	27 New Counterweight	NA
28 Sidewalk Cantilever	28 Sidewalk Cantilever	NA
29 Machinery Room Beam	29 Machinery Room Beam	NA
30 Mechanical Parts	30 Mechanical Parts	NA
31 Buried Parts	31 Buried Parts	NA

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	2	2	2	3	3	3	7	7	7	8	8	8	9	9	9	10	10	10
Member Label	1N-0N	1N-0N	1N-0N	4N-1N	4N-1N	4N-1N	5N-4N	5N-4N	5N-4N	5N-8N	5N-8N	5N-8N	8N-9N	8N-9N	8N-9N	9N-12N	9N-12N	9N-12N
Station (m)	0.0	4.2	8.4	0.0	4.2	8.4	0.0	4.4	8.9	0.0	4.4	8.9	0.0	4.7	9.3	0.0	4.7	9.3
Node Label at Station	1N	---	0N	4N	---	1N	5N	---	4N	5N	---	8N	8N	---	9N	9N	---	12N
Section #	Section 01	Section 01	Section 01	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 07	Section 07	Section 07
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal

Member Factored Load Effects:

C_f (kN)	1164	1168	1172	323	320	317	365	369	372	884	887	891	0	0	0	1438	1443	1447
$M_{fx\ (comp)}$ (kNm)	0	9	0	0	6	0	0	7	0	0	7	0	0	0	0	0	8	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	104	100	96	719	722	725	608	604	601	59	55	52	1205	1209	1213	0	0	0
$M_{fx\ (tension)}$ (kNm)	0	9	0	0	6	0	0	7	0	0	7	0	0	7	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fy} (kN)	4	0	4	3	0	3	3	0	3	3	0	3	3	0	3	4	0	4

Gross Section Properties:

Ag (mm^2)	12774	12774	12774	9428	9428	9428	9428	9428	9428	9428	9428	9428	9428	9428	9428	11336	11336	11336
I_x (mm^4)	2.61E+08	2.61E+08	2.61E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.35E+08	1.35E+08	1.35E+08
I_y (mm^4)	8.94E+08	8.94E+08	8.94E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	5.04E+08	5.04E+08	5.04E+08
J (mm^4)	7.19E+05	7.19E+05	7.19E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	6.28E+05	6.28E+05	6.28E+05
r_x (mm)	143	143	143	113	113	113	113	113	113	113	113	113	113	113	113	109	109	109
r_y (mm)	265	265	265	211	211	211	211	211	211	211	211	211	211	211	211	211	211	211
S_x (mm^3)	1.37E+06	1.37E+06	1.37E+06	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05	8.83E+05	8.83E+05	8.83E+05
S_y (mm^3)	2.73E+06	2.73E+06	2.73E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	2.21E+06	2.21E+06	2.21E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	6	6	6
L (mm)	8408	8408	8408	8408	8408	8408	8860	8860	8860	8860	8860	8860	9330	9330	9330	9330	9330	9330

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	2	2	2	3	3	3	7	7	7	8	8	8	9	9	9	10	10	10
Member Label	1N-0N	1N-0N	1N-0N	4N-1N	4N-1N	4N-1N	5N-4N	5N-4N	5N-4N	5N-8N	5N-8N	5N-8N	8N-9N	8N-9N	8N-9N	9N-12N	9N-12N	9N-12N
Station (m)	0.0	4.2	8.4	0.0	4.2	8.4	0.0	4.4	8.9	0.0	4.4	8.9	0.0	4.7	9.3	0.0	4.7	9.3
Node Label at Station	1N	---	0N	4N	---	1N	5N	---	4N	5N	---	8N	8N	---	9N	9N	---	12N
Section #	Section 01	Section 01	Section 01	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 07	Section 07	Section 07
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels	5.2	5.2	5.2	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.3	6.3	6.3
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	37.5	37.5	37.5	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	23.5	23.5	23.5
Webs in flexural compression	37.5	37.5	37.5	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	23.5	23.5	23.5
Webs in combined flexural and axial compression	37.5	37.5	37.5	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	23.5	23.5	23.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	2	2	2	3	3	3	7	7	7	8	8	8	9	9	9	10	10	10
Member Label	1N-0N	1N-0N	1N-0N	4N-1N	4N-1N	4N-1N	5N-4N	5N-4N	5N-4N	5N-8N	5N-8N	5N-8N	8N-9N	8N-9N	8N-9N	9N-12N	9N-12N	9N-12N
Station (m)	0.0	4.2	8.4	0.0	4.2	8.4	0.0	4.4	8.9	0.0	4.4	8.9	0.0	4.7	9.3	0.0	4.7	9.3
Node Label at Station	1N	---	0N	4N	---	1N	5N	---	4N	5N	---	8N	8N	---	9N	9N	---	12N
Section #	Section 01	Section 01	Section 01	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 07	Section 07	Section 07
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	8408	8408	8408	8408	8408	8408	8860	8860	8860	8860	8860	8860	9330	9330	9330	9330	9330	9330
L_y (mm)	8408	8408	8408	8408	8408	8408	8860	8860	8860	8860	8860	8860	9330	9330	9330	9330	9330	9330
λ_{max}	0.606	0.606	0.606	0.767	0.767	0.767	0.809	0.809	0.809	0.809	0.809	0.809	0.852	0.852	0.852	0.883	0.883	0.883
C_r (kN)	1623.7	1623.7	1623.7	1057.5	1057.5	1057.5	1019.9	1019.9	1019.9	1019.9	1019.9	1019.9	980.9	980.9	980.9	1345.9	1345.9	1345.9
$(kL/r)_{max}$	58.8	58.8	58.8	74.4	74.4	74.4	78.4	78.4	78.4	78.4	78.4	78.4	82.6	82.6	82.6	85.6	85.6	85.6
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	7284	7284	7284	3343	3343	3343	3011	3011	3011	3011	3011	3011	2715	2715	2715	3051	3051	3051

Shear Flexibility Factor:

1. Lacing:

a (mm)	657	657	657	439	439	439	439	439	439	439	439	439	439	439	439	435	435	435
b (mm)	569	569	569	380	380	380	380	380	380	380	380	380	380	380	380	376	376	376
ε_aa (mm)	657	657	657	439	439	439	439	439	439	439	439	439	439	439	439	435	435	435
ε_bb (mm)	569	569	569	380	380	380	380	380	380	380	380	380	380	380	380	376	376	376
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	5528	5528	5528	5893	5893	5893	6423	6423	6423	6423	6423	6423	6893	6893	6893	6930	6930	6930
A_c (mm^2)	6387	6387	6387	4714	4714	4714	4714	4714	4714	4714	4714	4714	4714	4714	4714	5668	5668	5668
A_d (mm^2)	845	845	845	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
A_b (mm^2)	845	845	845	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
μ	0.1582	0.1582	0.1582	0.0712	0.0712	0.0712	0.0599	0.0599	0.0599	0.0599	0.0599	0.0599	0.0520	0.0520	0.0520	0.0607	0.0607	0.0607
P_{cr}/P_e (Fig.3.51)	0.70	0.70	0.70	0.81	0.81	0.81	0.84	0.84	0.84	0.84	0.84	0.84	0.85	0.85	0.85	0.83	0.83	0.83
k'(sqrt(P_e/P_{cr}))	1.198	1.198	1.198	1.109	1.109	1.109	1.094	1.094	1.094	1.094	1.094	1.094	1.082	1.082	1.082	1.095	1.095	1.095
λ_v	0.392	0.392	0.392	0.456	0.456	0.456	0.474	0.474	0.474	0.474	0.474	0.474	0.494	0.494	0.494	0.499	0.499	0.499
Cr' (kN)	1822.0	1822.0	1822.0	1308.4	1308.4	1308.4	1297.0	1297.0	1297.0	1297.0	1297.0	1297.0	1283.7	1283.7	1283.7	1808.1	1808.1	1808.1
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	2	2	2	3	3	3	7	7	7	8	8	8	9	9	9	10	10	10
Member Label	1N-0N	1N-0N	1N-0N	4N-1N	4N-1N	4N-1N	5N-4N	5N-4N	5N-4N	5N-8N	5N-8N	5N-8N	8N-9N	8N-9N	8N-9N	9N-12N	9N-12N	9N-12N
Station (m)	0.0	4.2	8.4	0.0	4.2	8.4	0.0	4.4	8.9	0.0	4.4	8.9	0.0	4.7	9.3	0.0	4.7	9.3
Node Label at Station	1N	---	0N	4N	---	1N	5N	---	4N	5N	---	8N	8N	---	9N	9N	---	12N
Section #	Section 01	Section 01	Section 01	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 07	Section 07	Section 07
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	6387	6387	6387	4714	4714	4714	4714	4714	4714	4714	4714	4714	4714	4714	4714	5668	5668	5668
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	1623.7	1623.7	1623.7	1057.5	1057.5	1057.5	1019.9	1019.9	1019.9	1019.9	1019.9	1019.9	980.9	980.9	980.9	1345.9	1345.9	1345.9

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	10219	10219	10219	7542	7542	7542	7542	7542	7542	7542	7542	7542	7542	7542	7542	10656	10656	10656
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	2039	2039	2039	1505	1505	1505	1505	1505	1505	1505	1505	1505	1505	1505	1505	2126	2126	2126
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	12012	12012	12012	6793	6793	6793	6793	6793	6793	6793	6793	6793	6793	6793	6793	8249	8249	8249
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	12012	12012	12012	6793	6793	6793	6793	6793	6793	6793	6793	6793	6793	6793	6793	8249	8249	8249
$A_{n(corrosion)}$ (mm^2)	9610	9610	9610	5435	5435	5435	5435	5435	5435	5435	5435	5435	5435	5435	5435	7754	7754	7754
$T_{r(b)}$ (kN)	3229	3229	3229	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	2605	2605	2605
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	9610	9610	9610	5435	5435	5435	5435	5435	5435	5435	5435	5435	5435	5435	5435	7754	7754	7754
$T_{r(c)}$ (kN)	3229	3229	3229	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	2605	2605	2605
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	2	2	2	3	3	3	7	7	7	8	8	8	9	9	9	10	10	10
Member Label	1N-0N	1N-0N	1N-0N	4N-1N	4N-1N	4N-1N	5N-4N	5N-4N	5N-4N	5N-8N	5N-8N	5N-8N	8N-9N	8N-9N	8N-9N	9N-12N	9N-12N	9N-12N
Station (m)	0.0	4.2	8.4	0.0	4.2	8.4	0.0	4.4	8.9	0.0	4.4	8.9	0.0	4.7	9.3	0.0	4.7	9.3
Node Label at Station	1N	---	0N	4N	---	1N	5N	---	4N	5N	---	8N	8N	---	9N	9N	---	12N
Section #	Section 01	Section 01	Section 01	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 07	Section 07	Section 07
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	3229	3229	3229	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	2605	2605	2605
$(kL/r)_{max}$	59	59	59	74	74	74	78	78	78	78	78	78	83	83	83	86	86	86
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	2039	2039	2039	1505	1505	1505	1505	1505	1505	1505	1505	1505	1505	1505	1505	2126	2126	2126
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	219	219	219	125	125	125	125	125	125	125	125	125	125	125	125	166	166	166
$M_{ry(Laterally\ Supported)}$ (kNm)	436	436	436	292	292	292	292	292	292	292	292	292	292	292	292	414	414	414
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	8408	8408	8408	8408	8408	8408	8860	8860	8860	8860	8860	8860	9330	9330	9330	9330	9330	9330
L_{uy} (mm)	8408	8408	8408	8408	8408	8408	8860	8860	8860	8860	8860	8860	9330	9330	9330	9330	9330	9330
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	635	635	635	312	312	312	296	296	296	296	296	296	281	281	281	384	384	384
M_{rx} (kNm)	218.6	218.6	218.6	125.4	125.4	125.4	125.4	125.4	125.4	125.4	125.4	125.4	125.4	125.4	125.4	165.5	165.5	165.5
M_{ry} (kNm)	374.4	374.4	374.4	220.2	220.2	220.2	214.0	214.0	214.0	214.0	214.0	214.0	207.5	207.5	207.5	315.1	315.1	315.1

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y/w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.717	0.719	0.722	0.305	0.303	0.300	0.358	0.362	0.365	0.867	0.870	0.874	0.000	0.000	0.000	1.068	1.072	1.075
(T_f/T_r)<=1	0.051	0.049	0.047	0.478	0.480	0.482	0.404	0.401	0.399	0.039	0.037	0.035	0.801	0.803	0.806	0.000	0.000	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.051	0.049	0.047	0.478	0.480	0.482	0.404	0.401	0.399	0.039	0.037	0.035	0.801	0.803	0.806	0.000	0.000	0.000
M_{fx}/M_{rx}<=1	0.000	0.041	0.000	0.000	0.048	0.000	0.000	0.056	0.000	0.000	0.056	0.000	0.000	0.056	0.000	0.000	0.000	0.000
M_{fy}/M_{ry}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r$<=1	0.051	0.090	0.047	0.478	0.528	0.482	0.404	0.457	0.399	0.039	0.092	0.035	0.801	0.859	0.806	0.000	0.000	0.000
$M_f/M_r-T_fS/M_tA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Member ID in CSiBridge	2	2	2	3	3	3	7	7	7	8	8	8	9	9	9	10	10	10
Member Label	1N-0N	1N-0N	1N-0N	4N-1N	4N-1N	4N-1N	5N-4N	5N-4N	5N-4N	5N-8N	5N-8N	5N-8N	8N-9N	8N-9N	8N-9N	9N-12N	9N-12N	9N-12N
Station (m)	0.0	4.2	8.4	0.0	4.2	8.4	0.0	4.4	8.9	0.0	4.4	8.9	0.0	4.7	9.3	0.0	4.7	9.3
Node Label at Station	1N	---	0N	4N	---	1N	5N	---	4N	5N	---	8N	8N	---	9N	9N	---	12N
Section #	Section 01	Section 01	Section 01	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 07	Section 07	Section 07
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1931	1931	1931	1426	1426	1426	1426	1426	1426	1426	1426	1426	1426	1426	1426	2014	2014	2014
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	7.28E+03	7.28E+03	7.28E+03	3.34E+03	3.34E+03	3.34E+03	3.01E+03	3.01E+03	3.01E+03	3.01E+03	3.01E+03	3.01E+03	2.72E+03	2.72E+03	2.72E+03	3.05E+03	3.05E+03	3.05E+03
U_{1x}	1.19	1.19	1.19	1.11	1.11	1.10	1.14	1.14	1.14	1.42	1.42	1.42	1.00	1.00	1.00	1.89	1.90	1.90
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	24971	24971	24971	11695	11695	11695	10532	10532	10532	10532	10532	10532	9498	9498	9498	11433	11433	11433
U_{1y}	1.05	1.05	1.05	1.03	1.03	1.03	1.04	1.04	1.04	1.09	1.09	1.09	1.00	1.00	1.00	1.14	1.14	1.14
C_f/C_r	**0.603**	**0.605**	**0.607**	**0.227**	**0.224**	**0.222**	**0.256**	**0.259**	**0.261**	**0.620**	**0.622**	**0.625**	**0.000**	**0.000**	**0.000**	**0.714**	**0.717**	**0.718**
$U_{1x}M_{fx}/M_{rx}$	**0.000**	**0.049**	**0.000**	**0.000**	**0.053**	**0.000**	**0.000**	**0.064**	**0.000**	**0.000**	**0.079**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.092**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.603**	**0.654**	**0.607**	**0.227**	**0.277**	**0.222**	**0.256**	**0.322**	**0.261**	**0.620**	**0.701**	**0.625**	**0.000**	**0.000**	**0.000**	**0.714**	**0.808**	**0.718**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.606	0.606	0.606	0.767	0.767	0.767	0.809	0.809	0.809	0.809	0.809	0.809	0.852	0.852	0.852	0.883	0.883	0.883
$C_{r\ (K=1)}$ (kN)	1624	1624	1624	1058	1058	1058	1020	1020	1020	1020	1020	1020	981	981	981	1346	1346	1346
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.19	1.19	1.19	1.11	1.11	1.10	1.14	1.14	1.14	1.42	1.42	1.42	1.00	1.00	1.00	1.89	1.90	1.90
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.05	1.05	1.05	1.03	1.03	1.03	1.04	1.04	1.04	1.09	1.09	1.09	1.00	1.00	1.00	1.14	1.14	1.14
C_f/C_r	**0.717**	**0.719**	**0.722**	**0.305**	**0.303**	**0.300**	**0.358**	**0.362**	**0.365**	**0.867**	**0.870**	**0.874**	**0.000**	**0.000**	**0.000**	**1.068**	**1.072**	**1.075**
$U_{1x}M_{fx}/M_{rx}$	**0.000**	**0.049**	**0.000**	**0.000**	**0.053**	**0.000**	**0.000**	**0.064**	**0.000**	**0.000**	**0.079**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.092**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.717**	**0.768**	**0.722**	**0.305**	**0.356**	**0.300**	**0.358**	**0.425**	**0.365**	**0.867**	**0.949**	**0.874**	**0.000**	**0.000**	**0.000**	**1.068**	**1.164**	**1.075**

3.3. Lateral Torsional Buckling:

λ_{max}	0.606	0.606	0.606	0.767	0.767	0.767	0.809	0.809	0.809	0.809	0.809	0.809	0.852	0.852	0.852	0.883	0.883	0.883
C_r (kN)	1624	1624	1624	1058	1058	1058	1020	1020	1020	1020	1020	1020	981	981	981	1346	1346	1346
U_{1x}	1.19	1.19	1.19	1.11	1.11	1.10	1.14	1.14	1.14	1.42	1.42	1.42	1.00	1.00	1.00	1.89	1.90	1.90
U_{1y}	1.05	1.05	1.05	1.03	1.03	1.03	1.04	1.04	1.04	1.09	1.09	1.09	1.00	1.00	1.00	1.14	1.14	1.14
M_{rx} (kNm)	219	219	219	125	125	125	125	125	125	125	125	125	125	125	125	166	166	166
M_{ry} (kNm)	374	374	374	220	220	220	214	214	214	214	214	214	207	207	207	315	315	315
C_f/C_r	**0.717**	**0.719**	**0.722**	**0.305**	**0.303**	**0.300**	**0.358**	**0.362**	**0.365**	**0.867**	**0.870**	**0.874**	**0.000**	**0.000**	**0.000**	**1.068**	**1.072**	**1.075**
$U_{1x}M_{fx}/M_{rx}$	**0.000**	**0.049**	**0.000**	**0.000**	**0.053**	**0.000**	**0.000**	**0.064**	**0.000**	**0.000**	**0.079**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.092**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.717**	**0.768**	**0.722**	**0.305**	**0.356**	**0.300**	**0.358**	**0.425**	**0.365**	**0.867**	**0.949**	**0.874**	**0.000**	**0.000**	**0.000**	**1.068**	**1.164**	**1.075**
Demand/Capacity ≤ 1	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**NOT OK**	**NOT OK**	**NOT OK**
Highest Ratio	**0.717**	**0.768**	**0.722**	**0.478**	**0.528**	**0.482**	**0.404**	**0.457**	**0.399**	**0.867**	**0.949**	**0.874**	**0.801**	**0.859**	**0.806**	**1.068**	**1.164**	**1.075**

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	11	11	11	178	178	178	179	179	179	183	183	183	184	184	184	185	185	185
Member Label	12N-13N	12N-13N	12N-13N	1S-0S	1S-0S	1S-0S	4S-1S	4S-1S	4S-1S	5S-4S	5S-4S	5S-4S	5S-8S	5S-8S	5S-8S	8S-9S	8S-9S	8S-9S
Station (m)	0.0	4.9	9.8	0.0	4.2	8.4	0.0	4.2	8.4	0.0	4.4	8.9	0.0	4.4	8.9	0.0	4.7	9.3
Node Label at Station	12N	---	13N	1S	---	0S	4S	---	1S	5S	---	4S	5S	---	8S	8S	---	9S
Section #	Section 07	Section 07	Section 07	Section 01	Section 01	Section 01	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal

Member Factored Load Effects:

C_f (kN)	0	0	0	1217	1221	1225	299	296	293	372	375	379	912	915	918	0	0	0
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	9	0	0	6	0	0	7	0	0	7	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	1752	1756	1761	58	54	49	750	753	756	606	603	599	35	31	28	1251	1255	1259
$M_{fx\ (tension)}$ (kNm)	0	9	0	0	9	0	0	6	0	0	7	0	0	7	0	0	7	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fy} (kN)	4	0	4	4	0	4	3	0	3	3	0	3	3	0	3	3	0	3

Gross Section Properties:

Ag (mm^2)	11336	11336	11336	12774	12774	12774	9428	9428	9428	9428	9428	9428	9428	9428	9428	9428	9428	9428
I_x (mm^4)	1.35E+08	1.35E+08	1.35E+08	2.61E+08	2.61E+08	2.61E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08
I_y (mm^4)	5.04E+08	5.04E+08	5.04E+08	8.94E+08	8.94E+08	8.94E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08
J (mm^4)	6.28E+05	6.28E+05	6.28E+05	7.19E+05	7.19E+05	7.19E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05
r_x (mm)	109	109	109	143	143	143	113	113	113	113	113	113	113	113	113	113	113	113
r_y (mm)	211	211	211	265	265	265	211	211	211	211	211	211	211	211	211	211	211	211
S_x (mm^3)	8.83E+05	8.83E+05	8.83E+05	1.37E+06	1.37E+06	1.37E+06	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05
S_y (mm^3)	2.21E+06	2.21E+06	2.21E+06	2.73E+06	2.73E+06	2.73E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	10	10	10	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
L (mm)	9815	9815	9815	8408	8408	8408	8408	8408	8408	8860	8860	8860	8860	8860	8860	9330	9330	9330

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	11	11	11	178	178	178	179	179	179	183	183	183	184	184	184	185	185	185
Member Label	12N-13N	12N-13N	12N-13N	1S-0S	1S-0S	1S-0S	4S-1S	4S-1S	4S-1S	5S-4S	5S-4S	5S-4S	5S-8S	5S-8S	5S-8S	8S-9S	8S-9S	8S-9S
Station (m)	0.0	4.9	9.8	0.0	4.2	8.4	0.0	4.2	8.4	0.0	4.4	8.9	0.0	4.4	8.9	0.0	4.7	9.3
Node Label at Station	12N	---	13N	1S	---	0S	4S	---	1S	5S	---	4S	5S	---	8S	8S	---	9S
Section #	Section 07	Section 07	Section 07	Section 01	Section 01	Section 01	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels	6.3	6.3	6.3	5.2	5.2	5.2	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	23.5	23.5	23.5	37.5	37.5	37.5	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0
Webs in flexural compression	23.5	23.5	23.5	37.5	37.5	37.5	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0
Webs in combined flexural and axial compression	23.5	23.5	23.5	37.5	37.5	37.5	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	11	11	11	178	178	178	179	179	179	183	183	183	184	184	184	185	185	185
Member Label	12N-13N	12N-13N	12N-13N	1S-0S	1S-0S	1S-0S	4S-1S	4S-1S	4S-1S	5S-4S	5S-4S	5S-4S	5S-8S	5S-8S	5S-8S	8S-9S	8S-9S	8S-9S
Station (m)	0.0	4.9	9.8	0.0	4.2	8.4	0.0	4.2	8.4	0.0	4.4	8.9	0.0	4.4	8.9	0.0	4.7	9.3
Node Label at Station	12N	---	13N	1S	---	0S	4S	---	1S	5S	---	4S	5S	---	8S	8S	---	9S
Section #	Section 07	Section 07	Section 07	Section 01	Section 01	Section 01	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	9815	9815	9815	8408	8408	8408	8408	8408	8408	8860	8860	8860	8860	8860	8860	9330	9330	9330
L_y (mm)	9815	9815	9815	8408	8408	8408	8408	8408	8408	8860	8860	8860	8860	8860	8860	9330	9330	9330
λ_{max}	0.929	0.929	0.929	0.606	0.606	0.606	0.767	0.767	0.767	0.809	0.809	0.809	0.809	0.809	0.809	0.852	0.852	0.852
C_r (kN)	1233.1	1233.1	1233.1	1623.7	1623.7	1623.7	1057.5	1057.5	1057.5	1019.9	1019.9	1019.9	1019.9	1019.9	1019.9	980.9	980.9	980.9
$(kL/r)_{max}$	90.0	90.0	90.0	58.8	58.8	58.8	74.4	74.4	74.4	78.4	78.4	78.4	78.4	78.4	78.4	82.6	82.6	82.6
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	2756	2756	2756	7284	7284	7284	3343	3343	3343	3011	3011	3011	3011	3011	3011	2715	2715	2715

Shear Flexibility Factor:

1. Lacing:

a (mm)	435	435	435	657	657	657	439	439	439	439	439	439	439	439	439	439	439	439
b (mm)	376	376	376	569	569	569	380	380	380	380	380	380	380	380	380	380	380	380
ε_aa (mm)	435	435	435	657	657	657	439	439	439	439	439	439	439	439	439	439	439	439
ε_bb (mm)	376	376	376	569	569	569	380	380	380	380	380	380	380	380	380	380	380	380
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	7415	7415	7415	5528	5528	5528	5893	5893	5893	6423	6423	6423	6423	6423	6423	6893	6893	6893
A_c (mm^2)	5668	5668	5668	6387	6387	6387	4714	4714	4714	4714	4714	4714	4714	4714	4714	4714	4714	4714
A_d (mm^2)	544	544	544	845	845	845	544	544	544	544	544	544	544	544	544	544	544	544
A_b (mm^2)	544	544	544	845	845	845	544	544	544	544	544	544	544	544	544	544	544	544
μ	0.0530	0.0530	0.0530	0.1582	0.1582	0.1582	0.0712	0.0712	0.0712	0.0599	0.0599	0.0599	0.0599	0.0599	0.0599	0.0520	0.0520	0.0520
P_{cr}/P_e (Fig.3.51)	0.85	0.85	0.85	0.70	0.70	0.70	0.81	0.81	0.81	0.84	0.84	0.84	0.84	0.84	0.84	0.85	0.85	0.85
k'(sqrt(P_e/P_{cr}))	1.084	1.084	1.084	1.198	1.198	1.198	1.109	1.109	1.109	1.094	1.094	1.094	1.094	1.094	1.094	1.082	1.082	1.082
λ_v	0.520	0.520	0.520	0.392	0.392	0.392	0.456	0.456	0.456	0.474	0.474	0.474	0.474	0.474	0.474	0.494	0.494	0.494
Cr' (kN)	1711.4	1711.4	1711.4	1822.0	1822.0	1822.0	1308.4	1308.4	1308.4	1297.0	1297.0	1297.0	1297.0	1297.0	1297.0	1283.7	1283.7	1283.7
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	11	11	11	178	178	178	179	179	179	183	183	183	184	184	184	185	185	185
Member Label	12N-13N	12N-13N	12N-13N	1S-0S	1S-0S	1S-0S	4S-1S	4S-1S	4S-1S	5S-4S	5S-4S	5S-4S	5S-8S	5S-8S	5S-8S	8S-9S	8S-9S	8S-9S
Station (m)	0.0	4.9	9.8	0.0	4.2	8.4	0.0	4.2	8.4	0.0	4.4	8.9	0.0	4.4	8.9	0.0	4.7	9.3
Node Label at Station	12N	---	13N	1S	---	0S	4S	---	1S	5S	---	4S	5S	---	8S	8S	---	9S
Section #	Section 07	Section 07	Section 07	Section 01	Section 01	Section 01	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	5668	5668	5668	6387	6387	6387	4714	4714	4714	4714	4714	4714	4714	4714	4714	4714	4714	4714
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	1233.1	1233.1	1233.1	1623.7	1623.7	1623.7	1057.5	1057.5	1057.5	1019.9	1019.9	1019.9	1019.9	1019.9	1019.9	980.9	980.9	980.9

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	10202	10202	10202	10219	10219	10219	7542	7542	7542	7542	7542	7542	7542	7542	7542	7542	7542	7542
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	2035	2035	2035	2039	2039	2039	1505	1505	1505	1505	1505	1505	1505	1505	1505	1505	1505	1505
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	7627	7627	7627	12012	12012	12012	6793	6793	6793	6793	6793	6793	6793	6793	6793	6793	6793	6793
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	7627	7627	7627	12012	12012	12012	6793	6793	6793	6793	6793	6793	6793	6793	6793	6793	6793	6793
$A_{n(corrosion)}$ (mm^2)	6864	6864	6864	9610	9610	9610	5435	5435	5435	5435	5435	5435	5435	5435	5435	5435	5435	5435
$T_{r(b)}$ (kN)	2306	2306	2306	3229	3229	3229	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	6864	6864	6864	9610	9610	9610	5435	5435	5435	5435	5435	5435	5435	5435	5435	5435	5435	5435
$T_{r(c)}$ (kN)	2306	2306	2306	3229	3229	3229	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	11	11	11	178	178	178	179	179	179	183	183	183	184	184	184	185	185	185
Member Label	12N-13N	12N-13N	12N-13N	1S-0S	1S-0S	1S-0S	4S-1S	4S-1S	4S-1S	5S-4S	5S-4S	5S-4S	5S-8S	5S-8S	5S-8S	8S-9S	8S-9S	8S-9S
Station (m)	0.0	4.9	9.8	0.0	4.2	8.4	0.0	4.2	8.4	0.0	4.4	8.9	0.0	4.4	8.9	0.0	4.7	9.3
Node Label at Station	12N	---	13N	1S	---	0S	4S	---	1S	5S	---	4S	5S	---	8S	8S	---	9S
Section #	Section 07	Section 07	Section 07	Section 01	Section 01	Section 01	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	2306	2306	2306	3229	3229	3229	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826
$(kL/r)_{max}$	90	90	90	59	59	59	74	74	74	78	78	78	78	78	78	83	83	83
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	2035	2035	2035	2039	2039	2039	1505	1505	1505	1505	1505	1505	1505	1505	1505	1505	1505	1505
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	158	158	158	219	219	219	125	125	125	125	125	125	125	125	125	125	125	125
$M_{ry(Laterally\ Supported)}$ (kNm)	396	396	396	436	436	436	292	292	292	292	292	292	292	292	292	292	292	292
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	9815	9815	9815	8408	8408	8408	8408	8408	8408	8860	8860	8860	8860	8860	8860	9330	9330	9330
L_{uy} (mm)	9815	9815	9815	8408	8408	8408	8408	8408	8408	8860	8860	8860	8860	8860	8860	9330	9330	9330
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	365	365	365	635	635	635	312	312	312	296	296	296	296	296	296	281	281	281
M_{rx} (kNm)	158.5	158.5	158.5	218.6	218.6	218.6	125.4	125.4	125.4	125.4	125.4	125.4	125.4	125.4	125.4	125.4	125.4	125.4
M_{ry} (kNm)	293.7	293.7	293.7	374.4	374.4	374.4	220.2	220.2	220.2	214.0	214.0	214.0	214.0	214.0	214.0	207.5	207.5	207.5

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.000	0.000	0.000	0.750	0.752	0.754	0.283	0.280	0.277	0.365	0.368	0.372	0.894	0.897	0.900	0.000	0.000	0.000
(T_f/T_r)<=1	0.861	0.863	0.865	0.028	0.026	0.024	0.498	0.500	0.502	0.403	0.401	0.398	0.023	0.021	0.019	0.831	0.834	0.837

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.861	0.863	0.865	0.028	0.026	0.024	0.498	0.500	0.502	0.403	0.401	0.398	0.023	0.021	0.019	0.831	0.834	0.837
M_{fx}/M_{rx}<=1	0.000	0.057	0.000	0.000	0.041	0.000	0.000	0.048	0.000	0.000	0.056	0.000	0.000	0.056	0.000	0.000	0.056	0.000
M_{fy}/M_{ry}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r$<=1	0.861	0.920	0.865	0.028	0.068	0.024	0.498	0.548	0.502	0.403	0.457	0.398	0.023	0.076	0.019	0.831	0.890	0.837
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.000	0.000	0.000	0.000

PARSONS

Member ID in CSiBridge	11	11	11	178	178	178	179	179	179	183	183	183	184	184	184	185	185	185
Member Label	12N-13N	12N-13N	12N-13N	1S-0S	1S-0S	1S-0S	4S-1S	4S-1S	4S-1S	5S-4S	5S-4S	5S-4S	5S-8S	5S-8S	5S-8S	8S-9S	8S-9S	8S-9S
Station (m)	0.0	4.9	9.8	0.0	4.2	8.4	0.0	4.2	8.4	0.0	4.4	8.9	0.0	4.4	8.9	0.0	4.7	9.3
Node Label at Station	12N	---	13N	1S	---	0S	4S	---	1S	5S	---	4S	5S	---	8S	8S	---	9S
Section #	Section 07	Section 07	Section 07	Section 01	Section 01	Section 01	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1928	1928	1928	1931	1931	1931	1426	1426	1426	1426	1426	1426	1426	1426	1426	1426	1426	1426
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	2.76E+03	2.76E+03	2.76E+03	7.28E+03	7.28E+03	7.28E+03	3.34E+03	3.34E+03	3.34E+03	3.01E+03	3.01E+03	3.01E+03	3.01E+03	3.01E+03	3.01E+03	2.72E+03	2.72E+03	2.72E+03
U_{1x}	1.00	1.00	1.00	1.20	1.20	1.20	1.10	1.10	1.10	1.14	1.14	1.14	1.43	1.44	1.44	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	10330	10330	10330	24971	24971	24971	11695	11695	11695	10532	10532	10532	10532	10532	10532	9498	9498	9498
U_{1y}	1.00	1.00	1.00	1.05	1.05	1.05	1.03	1.03	1.03	1.04	1.04	1.04	1.09	1.10	1.10	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.630	0.632	0.634	0.210	0.208	0.206	0.261	0.263	0.266	0.640	0.642	0.644	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.049	0.000	0.000	0.052	0.000	0.000	0.064	0.000	0.000	0.080	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.630	0.682	0.634	0.210	0.260	0.206	0.261	0.327	0.266	0.640	0.722	0.644	0.000	0.000	0.000

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.929	0.929	0.929	0.606	0.606	0.606	0.767	0.767	0.767	0.809	0.809	0.809	0.809	0.809	0.809	0.852	0.852	0.852
$C_{r\ (K=1)}$ (kN)	1233	1233	1233	1624	1624	1624	1058	1058	1058	1020	1020	1020	1020	1020	1020	981	981	981
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.20	1.20	1.20	1.10	1.10	1.10	1.14	1.14	1.14	1.43	1.44	1.44	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.05	1.05	1.05	1.03	1.03	1.03	1.04	1.04	1.04	1.09	1.10	1.10	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.750	0.752	0.754	0.283	0.280	0.277	0.365	0.368	0.372	0.894	0.897	0.900	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.049	0.000	0.000	0.052	0.000	0.000	0.064	0.000	0.000	0.080	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.750	0.801	0.754	0.283	0.332	0.277	0.365	0.431	0.372	0.894	0.977	0.900	0.000	0.000	0.000

3.3. Lateral Torsional Buckling:

λ_{max}	0.929	0.929	0.929	0.606	0.606	0.606	0.767	0.767	0.767	0.809	0.809	0.809	0.809	0.809	0.809	0.852	0.852	0.852
C_r (kN)	1233	1233	1233	1624	1624	1624	1058	1058	1058	1020	1020	1020	1020	1020	1020	981	981	981
U_{1x}	1.00	1.00	1.00	1.20	1.20	1.20	1.10	1.10	1.10	1.14	1.14	1.14	1.43	1.44	1.44	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.05	1.05	1.05	1.03	1.03	1.03	1.04	1.04	1.04	1.09	1.10	1.10	1.00	1.00	1.00
M_{rx} (kNm)	158	158	158	219	219	219	125	125	125	125	125	125	125	125	125	125	125	125
M_{ry} (kNm)	294	294	294	374	374	374	220	220	220	214	214	214	214	214	214	207	207	207
C_f/C_r	0.000	0.000	0.000	0.750	0.752	0.754	0.283	0.280	0.277	0.365	0.368	0.372	0.894	0.897	0.900	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.049	0.000	0.000	0.052	0.000	0.000	0.064	0.000	0.000	0.080	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.750	0.801	0.754	0.283	0.332	0.277	0.365	0.431	0.372	0.894	0.977	0.900	0.000	0.000	0.000
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.861	0.920	0.865	0.750	0.801	0.754	0.498	0.548	0.502	0.403	0.457	0.398	0.894	0.977	0.900	0.831	0.890	0.837

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	186	186	186	187	187	187	249	249	249	250	250	250	400	400	400	401	401	401
Member Label	9S-12S	9S-12S	9S-12S	12S-13S	12S-13S	12S-13S	56N-34N	56N-34N	56N-34N	34N-13N	34N-13N	34N-13N	56S-34S	56S-34S	56S-34S	34S-13S	34S-13S	34S-13S
Station (m)	0.0	4.7	9.3	0.0	4.9	9.8	0.0	2.9	5.9	0.0	1.8	3.6	0.0	2.9	5.9	0.0	1.8	3.6
Node Label at Station	9S	---	12S	12S	---	13S	56N	---	34N	34N	---	13N	56S	---	34S	34S	---	13S
Section #	Section 07	Section 07	Section 07	Section 07	Section 07	Section 07	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal

Member Factored Load Effects:

C_f (kN)	1503	1508	1512	0	0	0	864	861	858	809	807	805	942	939	936	885	883	881
$M_{fx\ (comp)}$ (kNm)	0	8	0	0	0	0	0	12	15	15	9	0	0	12	16	16	10	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	21	42	42	21	0	0	22	45	45	22	0
T_f (kN)	0	0	0	1833	1838	1843	451	454	457	438	440	442	376	379	382	373	375	377
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	9	0	0	12	15	15	9	0	0	12	16	16	10	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	21	42	42	21	0	0	22	45	45	22	0
V_{fx} (kN)	0	0	0	0	0	0	7	7	7	12	12	12	8	8	8	12	12	12
V_{fy} (kN)	4	0	4	4	0	4	5	3	0	2	4	6	6	3	0	3	5	6

Gross Section Properties:

Ag (mm^2)	11336	11336	11336	11336	11336	11336	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774
I_x (mm^4)	1.35E+08	1.35E+08	1.35E+08	1.35E+08	1.35E+08	1.35E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08
I_y (mm^4)	5.04E+08	5.04E+08	5.04E+08	5.04E+08	5.04E+08	5.04E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08
J (mm^4)	6.28E+05	6.28E+05	6.28E+05	6.28E+05	6.28E+05	6.28E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05
r_x (mm)	109	109	109	109	109	109	143	143	143	143	143	143	143	143	143	143	143	143
r_y (mm)	211	211	211	211	211	211	265	265	265	265	265	265	265	265	265	265	265	265
S_x (mm^3)	8.83E+05	8.83E+05	8.83E+05	8.83E+05	8.83E+05	8.83E+05	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06
S_y (mm^3)	2.21E+06	2.21E+06	2.21E+06	2.21E+06	2.21E+06	2.21E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	6	6	6	10	10	10	20	5	5	5	5	5	20	5	5	5	5	5
L (mm)	9330	9330	9330	9815	9815	9815	5896	5896	5896	3611	3611	3611	5896	5896	5896	3611	3611	3611

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	186	186	186	187	187	187	249	249	249	250	250	250	400	400	400	401	401	401
Member Label	9S-12S	9S-12S	9S-12S	12S-13S	12S-13S	12S-13S	56N-34N	56N-34N	56N-34N	34N-13N	34N-13N	34N-13N	56S-34S	56S-34S	56S-34S	34S-13S	34S-13S	34S-13S
Station (m)	0.0	4.7	9.3	0.0	4.9	9.8	0.0	2.9	5.9	0.0	1.8	3.6	0.0	2.9	5.9	0.0	1.8	3.6
Node Label at Station	9S	---	12S	12S	---	13S	56N	---	34N	34N	---	13N	56S	---	34S	34S	---	13S
Section #	Section 07	Section 07	Section 07	Section 07	Section 07	Section 07	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels	6.3	6.3	6.3	6.3	6.3	6.3	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	23.5	23.5	23.5	23.5	23.5	23.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5
Webs in flexural compression	23.5	23.5	23.5	23.5	23.5	23.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5
Webs in combined flexural and axial compression	23.5	23.5	23.5	23.5	23.5	23.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	186	186	186	187	187	187	249	249	249	250	250	250	400	400	400	401	401	401
Member Label	9S-12S	9S-12S	9S-12S	12S-13S	12S-13S	12S-13S	56N-34N	56N-34N	56N-34N	34N-13N	34N-13N	34N-13N	56S-34S	56S-34S	56S-34S	34S-13S	34S-13S	34S-13S
Station (m)	0.0	4.7	9.3	0.0	4.9	9.8	0.0	2.9	5.9	0.0	1.8	3.6	0.0	2.9	5.9	0.0	1.8	3.6
Node Label at Station	9S	---	12S	12S	---	13S	56N	---	34N	34N	---	13N	56S	---	34S	34S	---	13S
Section #	Section 07	Section 07	Section 07	Section 07	Section 07	Section 07	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	9330	9330	9330	9815	9815	9815	9508	9508	9508	9508	9508	9508	9508	9508	9508	9508	9508	9508
L_y (mm)	9330	9330	9330	9815	9815	9815	5896	5896	5896	3611	3611	3611	5896	5896	5896	3611	3611	3611
λ_{max}	0.883	0.883	0.883	0.929	0.929	0.929	0.686	0.686	0.686	0.686	0.686	0.686	0.686	0.686	0.686	0.686	0.686	0.686
C_r (kN)	1345.9	1345.9	1345.9	1233.1	1233.1	1233.1	1532.1	1819.4	1819.4	1819.4	1819.4	1819.4	1532.1	1819.4	1819.4	1819.4	1819.4	1819.4
$(kL/r)_{max}$	85.6	85.6	85.6	90.0	90.0	90.0	66.5	66.5	66.5	66.5	66.5	66.5	66.5	66.5	66.5	66.5	66.5	66.5
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	3051	3051	3051	2756	2756	2756	5697	5697	5697	5697	5697	5697	5697	5697	5697	5697	5697	5697

Shear Flexibility Factor:

1. Lacing:

a (mm)	435	435	435	435	435	435	657	657	657	657	657	657	657	657	657	657	657	657
b (mm)	376	376	376	376	376	376	569	569	569	569	569	569	569	569	569	569	569	569
ε_aa (mm)	435	435	435	435	435	435	657	657	657	657	657	657	657	657	657	657	657	657
ε_bb (mm)	376	376	376	376	376	376	569	569	569	569	569	569	569	569	569	569	569	569
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	6930	6930	6930	7415	7415	7415	4696	4696	4696	2411	2411	2411	4696	4696	4696	2411	2411	2411
A_c (mm^2)	5668	5668	5668	5668	5668	5668	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387
A_d (mm^2)	544	544	544	544	544	544	845	845	845	845	845	845	845	845	845	845	845	845
A_b (mm^2)	544	544	544	544	544	544	845	845	845	845	845	845	845	845	845	845	845	845
μ	0.0607	0.0607	0.0607	0.0530	0.0530	0.0530	0.2192	0.2192	0.2192	0.8314	0.8314	0.8314	0.2192	0.2192	0.2192	0.8314	0.8314	0.8314
P_{cr}/P_e (Fig.3.51)	0.83	0.83	0.83	0.85	0.85	0.85	0.65	0.65	0.65	0.50	0.50	0.50	0.65	0.65	0.65	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	1.095	1.095	1.095	1.084	1.084	1.084	1.236	1.236	1.236	1.414	1.414	1.414	1.236	1.236	1.236	1.414	1.414	1.414
λ_v	0.499	0.499	0.499	0.520	0.520	0.520	0.284	0.284	0.284	0.199	0.199	0.199	0.284	0.284	0.284	0.199	0.199	0.199
Cr' (kN)	1808.1	1808.1	1808.1	1711.4	1711.4	1711.4	1883.6	2236.7	2236.7	2271.3	2271.3	2271.3	1883.6	2236.7	2236.7	2271.3	2271.3	2271.3
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	186	186	186	187	187	187	249	249	249	250	250	250	400	400	400	401	401	401
Member Label	9S-12S	9S-12S	9S-12S	12S-13S	12S-13S	12S-13S	56N-34N	56N-34N	56N-34N	34N-13N	34N-13N	34N-13N	56S-34S	56S-34S	56S-34S	34S-13S	34S-13S	34S-13S
Station (m)	0.0	4.7	9.3	0.0	4.9	9.8	0.0	2.9	5.9	0.0	1.8	3.6	0.0	2.9	5.9	0.0	1.8	3.6
Node Label at Station	9S	---	12S	12S	---	13S	56N	---	34N	34N	---	13N	56S	---	34S	34S	---	13S
Section #	Section 07	Section 07	Section 07	Section 07	Section 07	Section 07	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	5668	5668	5668	5668	5668	5668	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	1345.9	1345.9	1345.9	1233.1	1233.1	1233.1	1532.1	1819.4	1819.4	1819.4	1819.4	1819.4	1532.1	1819.4	1819.4	1819.4	1819.4	1819.4

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	10656	10656	10656	10202	10202	10202	10219	12135	12135	12135	12135	12135	10219	12135	12135	12135	12135	12135
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	2126	2126	2126	2035	2035	2035	2039	2421	2421	2421	2421	2421	2039	2421	2421	2421	2421	2421
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	8249	8249	8249	7627	7627	7627	12012	12012	12012	12012	12012	12012	12012	12012	12012	12012	12012	12012
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	8249	8249	8249	7627	7627	7627	12012	12012	12012	12012	12012	12012	12012	12012	12012	12012	12012	12012
$A_{n(corrosion)}$ (mm^2)	7754	7754	7754	6864	6864	6864	9610	11411	11411	11411	11411	11411	9610	11411	11411	11411	11411	11411
$T_{r(b)}$ (kN)	2605	2605	2605	2306	2306	2306	3229	3834	3834	3834	3834	3834	3229	3834	3834	3834	3834	3834
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	7754	7754	7754	6864	6864	6864	9610	11411	11411	11411	11411	11411	9610	11411	11411	11411	11411	11411
$T_{r(c)}$ (kN)	2605	2605	2605	2306	2306	2306	3229	3834	3834	3834	3834	3834	3229	3834	3834	3834	3834	3834
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	186	186	186	187	187	187	249	249	249	250	250	250	400	400	400	401	401	401
Member Label	9S-12S	9S-12S	9S-12S	12S-13S	12S-13S	12S-13S	56N-34N	56N-34N	56N-34N	34N-13N	34N-13N	34N-13N	56S-34S	56S-34S	56S-34S	34S-13S	34S-13S	34S-13S
Station (m)	0.0	4.7	9.3	0.0	4.9	9.8	0.0	2.9	5.9	0.0	1.8	3.6	0.0	2.9	5.9	0.0	1.8	3.6
Node Label at Station	9S	---	12S	12S	---	13S	56N	---	34N	34N	---	13N	56S	---	34S	34S	---	13S
Section #	Section 07	Section 07	Section 07	Section 07	Section 07	Section 07	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	2605	2605	2605	2306	2306	2306	3229	3834	3834	3834	3834	3834	3229	3834	3834	3834	3834	3834
$(kL/r)_{max}$	86	86	86	90	90	90	66	66	66	66	66	66	66	66	66	66	66	66
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	2126	2126	2126	2035	2035	2035	2039	2421	2421	2421	2421	2421	2039	2421	2421	2421	2421	2421
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	166	166	166	158	158	158	219	260	260	260	260	260	219	260	260	260	260	260
$M_{ry(Laterally\ Supported)}$ (kNm)	414	414	414	396	396	396	436	517	517	517	517	517	436	517	517	517	517	517
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	9330	9330	9330	9815	9815	9815	9508	9508	9508	9508	9508	9508	9508	9508	9508	9508	9508	9508
L_{uy} (mm)	9330	9330	9330	9815	9815	9815	5896	5896	5896	3611	3611	3611	5896	5896	5896	3611	3611	3611
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	384	384	384	365	365	365	562	562	562	562	562	562	562	562	562	562	562	562
M_{rx} (kNm)	165.5	165.5	165.5	158.5	158.5	158.5	218.6	259.6	259.6	259.6	259.6	259.6	218.6	259.6	259.6	259.6	259.6	259.6
M_{ry} (kNm)	315.1	315.1	315.1	293.7	293.7	293.7	357.8	424.9	424.9	424.9	424.9	424.9	357.8	424.9	424.9	424.9	424.9	424.9

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	1.117	1.120	1.123	0.000	0.000	0.000	0.564	0.473	0.472	0.445	0.444	0.442	0.615	0.516	0.514	0.486	0.485	0.484
(T_f/T_r)<=1	0.000	0.000	0.000	0.901	0.903	0.905	0.221	0.188	0.189	0.181	0.182	0.183	0.184	0.157	0.158	0.154	0.155	0.156

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.000	0.000	0.000	0.901	0.903	0.905	0.221	0.188	0.189	0.181	0.182	0.183	0.184	0.157	0.158	0.154	0.155	0.156
M_{fx}/M_{rx}<=1	0.000	0.000	0.000	0.000	0.057	0.000	0.000	0.046	0.058	0.058	0.035	0.000	0.000	0.046	0.062	0.062	0.039	0.000
M_{fy}/M_{ry}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.049	0.099	0.099	0.049	0.000	0.000	0.052	0.106	0.106	0.052	0.000
$T_f/T_r+M_f/M_r$<=1	0.000	0.000	0.000	0.901	0.960	0.905	0.221	0.283	0.345	0.338	0.266	0.183	0.184	0.255	0.325	0.322	0.245	0.156
$M_f/M_r-T_fS/M_tA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	186	186	186	187	187	187	249	249	249	250	250	250	400	400	400	401	401	401
Member Label	9S-12S	9S-12S	9S-12S	12S-13S	12S-13S	12S-13S	56N-34N	56N-34N	56N-34N	34N-13N	34N-13N	34N-13N	56S-34S	56S-34S	56S-34S	34S-13S	34S-13S	34S-13S
Station (m)	0.0	4.7	9.3	0.0	4.9	9.8	0.0	2.9	5.9	0.0	1.8	3.6	0.0	2.9	5.9	0.0	1.8	3.6
Node Label at Station	9S	---	12S	12S	---	13S	56N	---	34N	34N	---	13N	56S	---	34S	34S	---	13S
Section #	Section 07	Section 07	Section 07	Section 07	Section 07	Section 07	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	2014	2014	2014	1928	1928	1928	1931	2294	2294	2294	2294	2294	1931	2294	2294	2294	2294	2294
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	3.05E+03	3.05E+03	3.05E+03	2.76E+03	2.76E+03	2.76E+03	5.70E+03	5.70E+03	5.70E+03	5.70E+03	5.70E+03	5.70E+03	5.70E+03	5.70E+03	5.70E+03	5.70E+03	5.70E+03	5.70E+03
U_{1x}	1.97	1.98	1.98	1.00	1.00	1.00	1.18	1.18	1.18	1.17	1.17	1.16	1.20	1.20	1.20	1.18	1.18	1.18
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	11433	11433	11433	10330	10330	10330	50778	50778	50778	135358	135358	135358	50778	50778	50778	135358	135358	135358
U_{1y}	1.15	1.15	1.15	1.00	1.00	1.00	1.02	1.02	1.02	1.01	1.01	1.01	1.02	1.02	1.02	1.01	1.01	1.01
C_f/C_r	0.746	0.749	0.751	0.000	0.000	0.000	0.447	0.375	0.374	0.353	0.352	0.351	0.488	0.409	0.408	0.386	0.385	0.384
$U_{1x}M_{fx}/M_{rx}$	0.000	0.096	0.000	0.000	0.000	0.000	0.000	0.054	0.068	0.067	0.040	0.000	0.000	0.055	0.074	0.073	0.046	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.041	0.083	0.082	0.041	0.000	0.000	0.043	0.089	0.088	0.043	0.000
Interaction	0.746	0.844	0.751	0.000	0.000	0.000	0.447	0.471	0.525	0.502	0.433	0.351	0.488	0.508	0.570	0.546	0.473	0.384

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.883	0.883	0.883	0.929	0.929	0.929	0.686	0.686	0.686	0.686	0.686	0.686	0.686	0.686	0.686	0.686	0.686	0.686
$C_{r\ (K=1)}$ (kN)	1346	1346	1346	1233	1233	1233	1532	1819	1819	1819	1819	1819	1532	1819	1819	1819	1819	1819
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.97	1.98	1.98	1.00	1.00	1.00	1.18	1.18	1.18	1.17	1.17	1.16	1.20	1.20	1.20	1.18	1.18	1.18
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.15	1.15	1.15	1.00	1.00	1.00	1.02	1.02	1.02	1.01	1.01	1.01	1.02	1.02	1.02	1.01	1.01	1.01
C_f/C_r	1.117	1.120	1.123	0.000	0.000	0.000	0.564	0.473	0.472	0.445	0.444	0.442	0.615	0.516	0.514	0.486	0.485	0.484
$U_{1x}M_{fx}/M_{rx}$	0.000	0.096	0.000	0.000	0.000	0.000	0.000	0.054	0.068	0.067	0.040	0.000	0.000	0.055	0.074	0.073	0.046	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.041	0.083	0.082	0.041	0.000	0.000	0.043	0.089	0.088	0.043	0.000
Interaction	1.117	1.216	1.123	0.000	0.000	0.000	0.564	0.569	0.622	0.594	0.525	0.442	0.615	0.615	0.677	0.647	0.574	0.484

3.3. Lateral Torsional Buckling:

λ_{max}	0.883	0.883	0.883	0.929	0.929	0.929	0.686	0.686	0.686	0.686	0.686	0.686	0.686	0.686	0.686	0.686	0.686	0.686
C_r (kN)	1346	1346	1346	1233	1233	1233	1532	1819	1819	1819	1819	1819	1532	1819	1819	1819	1819	1819
U_{1x}	1.97	1.98	1.98	1.00	1.00	1.00	1.18	1.18	1.18	1.17	1.17	1.16	1.20	1.20	1.20	1.18	1.18	1.18
U_{1y}	1.15	1.15	1.15	1.00	1.00	1.00	1.02	1.02	1.02	1.01	1.01	1.01	1.02	1.02	1.02	1.01	1.01	1.01
M_{rx} (kNm)	166	166	166	158	158	158	219	260	260	260	260	260	219	260	260	260	260	260
M_{ry} (kNm)	315	315	315	294	294	294	358	425	425	425	425	425	358	425	425	425	425	425
C_f/C_r	1.117	1.120	1.123	0.000	0.000	0.000	0.564	0.473	0.472	0.445	0.444	0.442	0.615	0.516	0.514	0.486	0.485	0.484
$U_{1x}M_{fx}/M_{rx}$	0.000	0.096	0.000	0.000	0.000	0.000	0.000	0.054	0.068	0.067	0.040	0.000	0.000	0.055	0.074	0.073	0.046	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.050	0.101	0.099	0.050	0.000	0.000	0.053	0.108	0.107	0.052	0.000
Interaction	1.117	1.216	1.123	0.000	0.000	0.000	0.564	0.578	0.640	0.611	0.534	0.442	0.615	0.624	0.696	0.666	0.583	0.484
Demand/Capacity ≤ 1	NOT OK	NOT OK	NOT OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	1.117	1.216	1.123	0.901	0.960	0.905	0.564	0.578	0.640	0.611	0.534	0.442	0.615	0.624	0.696	0.666	0.583	0.484

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	240	240	240	241	241	241	242	242	242	243	243	243	244	244	244	245	245	245
Member Label	2N-2N	2N-2N	2N-2N	2N-1N	2N-1N	2N-1N	4N-4N	4N-4N	4N-4N	4N-3N	4N-3N	4N-3N	8N-8N	8N-8N	8N-8N	8N-7N	8N-7N	8N-7N
Station (m)	0.0	0.4	0.7	0.0	2.7	5.4	0.0	0.4	0.7	0.0	2.8	5.7	0.0	0.4	0.7	0.0	3.1	6.3
Node Label at Station	2N	---	2N	2N	---	1N	4N	---	4N	4N	---	3N	8N	---	8N	8N	---	7N
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

Member Factored Load Effects:

C_f (kN)	0	0	0	0	0	0	0	0	0	20	18	16	0	0	0	20	18	15
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	0	0	0	631	634	636	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (tension)}$ (kNm)	0	0	0	15	8	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fy} (kN)	0	0	0	3	3	3	0	0	0	0	0	0	0	0	0	0	0	0

Gross Section Properties:

Ag (mm^2)	8409	8409	8409	8409	8409	8409	6603	6603	6603	6603	6603	6603	6603	6603	6603	6603	6603	6603
I_x (mm^4)	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08
I_y (mm^4)	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07
J (mm^4)	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05
r_x (mm)	204	204	204	204	204	204	209	209	209	209	209	209	209	209	209	209	209	209
r_y (mm)	54	54	54	54	54	54	60	60	60	60	60	60	60	60	60	60	60	60
S_x (mm^3)	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06
S_y (mm^3)	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
L (mm)	724	724	724	5372	5372	5372	724	724	724	5677	5677	5677	724	724	724	6287	6287	6287

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	240	240	240	241	241	241	242	242	242	243	243	243	244	244	244	245	245	245
Member Label	2N-2N	2N-2N	2N-2N	2N-1N	2N-1N	2N-1N	4N-4N	4N-4N	4N-4N	4N-3N	4N-3N	4N-3N	8N-8N	8N-8N	8N-8N	8N-7N	8N-7N	8N-7N
Station (m)	0.0	0.4	0.7	0.0	2.7	5.4	0.0	0.4	0.7	0.0	2.8	5.7	0.0	0.4	0.7	0.0	3.1	6.3
Node Label at Station	2N	---	2N	2N	---	1N	4N	---	4N	4N	---	3N	8N	---	8N	8N	---	7N
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression																		
Webs in combined flexural and axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	240	240	240	241	241	241	242	242	242	243	243	243	244	244	244	245	245	245
Member Label	2N-2N	2N-2N	2N-2N	2N-1N	2N-1N	2N-1N	4N-4N	4N-4N	4N-4N	4N-3N	4N-3N	4N-3N	8N-8N	8N-8N	8N-8N	8N-7N	8N-7N	8N-7N
Station (m)	0.0	0.4	0.7	0.0	2.7	5.4	0.0	0.4	0.7	0.0	2.8	5.7	0.0	0.4	0.7	0.0	3.1	6.3
Node Label at Station	2N	---	2N	2N	---	1N	4N	---	4N	4N	---	3N	8N	---	8N	8N	---	7N
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	724	724	724	5372	5372	5372	724	724	724	5677	5677	5677	724	724	724	6287	6287	6287
L_y (mm)	724	724	724	5372	5372	5372	724	724	724	5677	5677	5677	724	724	724	6287	6287	6287
λ_{max}	0.138	0.138	0.138	1.026	1.026	1.026	0.124	0.124	0.124	0.976	0.976	0.976	0.124	0.124	0.124	1.081	1.081	1.081
C_r (kN)	1266.7	1266.7	1266.7	738.3	738.3	738.3	995.6	995.6	995.6	609.6	609.6	609.6	995.6	995.6	995.6	548.5	548.5	548.5
$(kL/r)_{max}$	13.4	13.4	13.4	99.5	99.5	99.5	12.1	12.1	12.1	94.6	94.6	94.6	12.1	12.1	12.1	104.8	104.8	104.8
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing							1	1	1	1	1	1	1	1	1	1	1	1
Battens	1	1	1	1	1	1												
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	92753	92753	92753	1684	1684	1684	90077	90077	90077	1465	1465	1465	90077	90077	90077	1194	1194	1194

Shear Flexibility Factor:

1. Lacing:

a (mm)	0	0	0	0	0	0	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	0	0	0	0	0	0	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	0	0	0	0	0	0	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	0	0	0	0	0	0	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	6477	6477	6477	6477	6477	6477	6477	6477	6477	5461	5461	5461	6477	6477	6477	6477	6477	6477
A_c (mm^2)	4205	4205	4205	4205	4205	4205	3302	3302	3302	3302	3302	3302	3302	3302	3302	3302	3302	3302
A_d (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
A_b (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
μ	NA	NA	NA	NA	NA	NA	0.0388	0.0388	0.0388	0.0545	0.0545	0.0545	0.0388	0.0388	0.0388	0.0388	0.0388	0.0388
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.89	0.89	0.89	0.85	0.85	0.85	0.89	0.89	0.89	0.89	0.89	0.89
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	1.063	1.063	1.063	1.086	1.086	1.086	1.063	1.063	1.063	1.063	1.063	1.063
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	0.132	0.132	0.132	1.060	1.060	1.060	0.132	0.132	0.132	1.148	1.148	1.148
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	995.1	995.1	995.1	560.3	560.3	560.3	995.1	995.1	995.1	511.7	511.7	511.7
Lacing Governs?	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes

Member ID in CSiBridge	240	240	240	241	241	241	242	242	242	243	243	243	244	244	244	245	245	245
Member Label	2N-2N	2N-2N	2N-2N	2N-1N	2N-1N	2N-1N	4N-4N	4N-4N	4N-4N	4N-3N	4N-3N	4N-3N	8N-8N	8N-8N	8N-8N	8N-7N	8N-7N	8N-7N
Station (m)	0.0	0.4	0.7	0.0	2.7	5.4	0.0	0.4	0.7	0.0	2.8	5.7	0.0	0.4	0.7	0.0	3.1	6.3
Node Label at Station	2N	---	2N	2N	---	1N	4N	---	4N	4N	---	3N	8N	---	8N	8N	---	7N
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380			
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3			
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300			
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4			
ε_a	0.79	0.79	0.79	0.79	0.79	0.79	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	0.76	0.76	0.76	0.76	0.76	0.76	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3277	3277	3277	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	4205	4205	4205	4205	4205	4205	3302	3302	3302	3302	3302	3302	3302	3302	3302	3302	3302	3302
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	0.84	0.84	0.84	0.87	0.87	0.87	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	1.41	1.41	1.41	1.41	1.41	1.41	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	0.20	0.20	0.20	1.45	1.45	1.45	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	1260	1260	1260	478	478	478	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	1266.7	1266.7	1266.7	738.3	738.3	738.3	995.6	995.6	995.6	560.3	560.3	560.3	995.6	995.6	995.6	511.7	511.7	511.7

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6727	6727	6727	8150	8150	8150	5282	5282	5282	5282	5282	5282	5282	5282	5282	5282	5282	5282
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1342	1342	1342	1626	1626	1626	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	6885	6885	6885	15525	15525	15525	5841	5841	5841	5841	5841	5841	5841	5841	5841	5841	5841	5841
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	6885	6885	6885	15525	15525	15525	5841	5841	5841	5841	5841	5841	5841	5841	5841	5841	5841	5841
$A_{n(corrosion)}$ (mm^2)	5508	5508	5508	12420	12420	12420	4673	4673	4673	4673	4673	4673	4673	4673	4673	4673	4673	4673
$T_{r(b)}$ (kN)	1851	1851	1851	4173	4173	4173	1570	1570	1570	1570	1570	1570	1570	1570	1570	1570	1570	1570
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	5508	5508	5508	12420	12420	12420	4673	4673	4673	4673	4673	4673	4673	4673	4673	4673	4673	4673
$T_{r(c)}$ (kN)	1851	1851	1851	4173	4173	4173	1570	1570	1570	1570	1570	1570	1570	1570	1570	1570	1570	1570
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	240	240	240	241	241	241	242	242	242	243	243	243	244	244	244	245	245	245
Member Label	2N-2N	2N-2N	2N-2N	2N-1N	2N-1N	2N-1N	4N-4N	4N-4N	4N-4N	4N-3N	4N-3N	4N-3N	8N-8N	8N-8N	8N-8N	8N-7N	8N-7N	8N-7N
Station (m)	0.0	0.4	0.7	0.0	2.7	5.4	0.0	0.4	0.7	0.0	2.8	5.7	0.0	0.4	0.7	0.0	3.1	6.3
Node Label at Station	2N	---	2N	2N	---	1N	4N	---	4N	4N	---	3N	8N	---	8N	8N	---	7N
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	1851	1851	1851	4173	4173	4173	1570	1570	1570	1570	1570	1570	1570	1570	1570	1570	1570	1570
$(kL/r)_{max}$	13	13	13	99	99	99	12	12	12	95	95	95	12	12	12	105	105	105
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1342	1342	1342	1626	1626	1626	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	245	245	245	245	245	245	201	201	201	201	201	201	201	201	201	201	201	201
$M_{ry(Laterally\ Supported)}$ (kNm)	30	30	30	30	30	30	29	29	29	29	29	29	29	29	29	29	29	29
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	724	724	724	5372	5372	5372	724	724	724	5677	5677	5677	724	724	724	6287	6287	6287
L_{uy} (mm)	724	724	724	5372	5372	5372	724	724	724	5677	5677	5677	724	724	724	6287	6287	6287
M_{ux} (kNm) (y weak)	2598	2598	2598	350	350	350	978	978	978	125	125	125	978	978	978	113	113	113
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	271.9	271.9	271.9	209.1	209.1	209.1	213.9	213.9	213.9	94.7	94.7	94.7	213.9	213.9	213.9	85.6	85.6	85.6
M_{ry} (kNm)	29.8	29.8	29.8	29.8	29.8	29.8	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.036	0.032	0.029	0.000	0.000	0.000	0.039	0.035	0.029
(T_f/T_r)<=1	0.000	0.000	0.000	0.388	0.390	0.391	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.000	0.000	0.000	0.388	0.390	0.391	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
M_{fx}/M_{rx}<=1	0.000	0.000	0.000	0.072	0.038	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
M_{fy}/M_{ry}<=1	0.000	0.000	0.000	0.067	0.034	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r$<=1	0.000	0.000	0.000	0.527	0.462	0.391	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	240	240	240	241	241	241	242	242	242	243	243	243	244	244	244	245	245	245
Member Label	2N-2N	2N-2N	2N-2N	2N-1N	2N-1N	2N-1N	4N-4N	4N-4N	4N-4N	4N-3N	4N-3N	4N-3N	8N-8N	8N-8N	8N-8N	8N-7N	8N-7N	8N-7N
Station (m)	0.0	0.4	0.7	0.0	2.7	5.4	0.0	0.4	0.7	0.0	2.8	5.7	0.0	0.4	0.7	0.0	3.1	6.3
Node Label at Station	2N	---	2N	2N	---	1N	4N	---	4N	4N	---	3N	8N	---	8N	8N	---	7N
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1271	1271	1271	1271	1271	1271	998	998	998	998	998	998	998	998	998	998	998	998
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.32E+06	1.32E+06	1.32E+06	2.40E+04	2.40E+04	2.40E+04	1.09E+06	1.09E+06	1.09E+06	1.77E+04	1.77E+04	1.77E+04	1.09E+06	1.09E+06	1.09E+06	1.44E+04	1.44E+04	1.44E+04
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	92753	92753	92753	1684	1684	1684	90077	90077	90077	1465	1465	1465	90077	90077	90077	1194	1194	1194
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.02	1.02	1.01
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.020	0.018	0.016	0.000	0.000	0.000	0.020	0.018	0.015
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.020	0.018	0.016	0.000	0.000	0.000	0.020	0.018	0.015

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.138	0.138	0.138	1.026	1.026	1.026	0.124	0.124	0.124	0.976	0.976	0.976	0.124	0.124	0.124	1.081	1.081	1.081
$C_{r\ (K=1)}$ (kN)	1267	1267	1267	738	738	738	996	996	996	610	610	610	996	996	996	549	549	549
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.02	1.02	1.01
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.033	0.030	0.026	0.000	0.000	0.000	0.036	0.033	0.027
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.033	0.030	0.026	0.000	0.000	0.000	0.036	0.033	0.027

3.3. Lateral Torsional Buckling:

λ_{max}	0.138	0.138	0.138	1.026	1.026	1.026	0.124	0.124	0.124	0.976	0.976	0.976	0.124	0.124	0.124	1.081	1.081	1.081
C_r (kN)	1267	1267	1267	738	738	738	996	996	996	610	610	610	996	996	996	549	549	549
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.02	1.02	1.01
M_{rx} (kNm)	272	272	272	209	209	209	214	214	214	95	95	95	214	214	214	86	86	86
M_{ry} (kNm)	30	30	30	30	30	30	29	29	29	29	29	29	29	29	29	29	29	29
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.033	0.030	0.026	0.000	0.000	0.000	0.036	0.033	0.027
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.033	0.030	0.026	0.000	0.000	0.000	0.036	0.033	0.027
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.000	0.000	0.000	0.527	0.462	0.391	0.000	0.000	0.000	0.036	0.032	0.029	0.000	0.000	0.000	0.039	0.035	0.029

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	246	246	246	247	247	247	319	319	319	320	320	320	321	321	321	322	322	322
Member Label	12N-12N	12N-12N	12N-12N	12N-11N	12N-11N	12N-11N	6N-6N	6N-6N	6N-6N	6N-36N	6N-36N	6N-36N	36N-5N	36N-5N	36N-5N	6S-6S	6S-6S	6S-6S
Station (m)	0.0	0.4	0.7	0.0	3.4	6.9	0.0	0.4	0.7	0.0	2.3	4.6	0.0	0.7	1.4	0.0	0.4	0.7
Node Label at Station	12N	---	12N	12N	---	11N	6N	---	6N	6N	---	36N	36N	---	5N	6S	---	6S
Section #	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

Member Factored Load Effects:

C_f (kN)	0	0	0	27	24	22	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	0	0	0	0	0	0	0	0	0	638	640	642	636	637	638	0	0	0
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	39	77	77	39	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fy} (kN)	0	0	0	0	0	0	0	0	0	17	17	17	56	56	56	0	0	0

Gross Section Properties:

Ag (mm^2)	6603	6603	6603	6603	6603	6603	8409	8409	8409	8409	8409	8409	8409	8409	8409	8409	8409	8409
I_x (mm^4)	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08
I_y (mm^4)	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07
J (mm^4)	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05
r_x (mm)	209	209	209	209	209	209	204	204	204	204	204	204	204	204	204	204	204	204
r_y (mm)	60	60	60	60	60	60	54	54	54	54	54	54	54	54	54	54	54	54
S_x (mm^3)	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06
S_y (mm^3)	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
L (mm)	724	724	724	6896	6896	6896	724	724	724	4610	4610	4610	1372	1372	1372	724	724	724

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	246	246	246	247	247	247	319	319	319	320	320	320	321	321	321	322	322	322
Member Label	12N-12N	12N-12N	12N-12N	12N-11N	12N-11N	12N-11N	6N-6N	6N-6N	6N-6N	6N-36N	6N-36N	6N-36N	36N-5N	36N-5N	36N-5N	6S-6S	6S-6S	6S-6S
Station (m)	0.0	0.4	0.7	0.0	3.4	6.9	0.0	0.4	0.7	0.0	2.3	4.6	0.0	0.7	1.4	0.0	0.4	0.7
Node Label at Station	12N	---	12N	12N	---	11N	6N	---	6N	6N	---	36N	36N	---	5N	6S	---	6S
Section #	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression							16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Webs in combined flexural and axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	246	246	246	247	247	247	319	319	319	320	320	320	321	321	321	322	322	322
Member Label	12N-12N	12N-12N	12N-12N	12N-11N	12N-11N	12N-11N	6N-6N	6N-6N	6N-6N	6N-36N	6N-36N	6N-36N	36N-5N	36N-5N	36N-5N	6S-6S	6S-6S	6S-6S
Station (m)	0.0	0.4	0.7	0.0	3.4	6.9	0.0	0.4	0.7	0.0	2.3	4.6	0.0	0.7	1.4	0.0	0.4	0.7
Node Label at Station	12N	---	12N	12N	---	11N	6N	---	6N	6N	---	36N	36N	---	5N	6S	---	6S
Section #	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	724	724	724	6896	6896	6896	724	724	724	4610	4610	4610	1372	1372	1372	724	724	724
L_y (mm)	724	724	724	6896	6896	6896	724	724	724	5982	5982	5982	5982	5982	5982	724	724	724
λ_{max}	0.124	0.124	0.124	1.185	1.185	1.185	0.138	0.138	0.138	1.143	1.143	1.143	1.143	1.143	1.143	0.138	0.138	0.138
C_r (kN)	995.6	995.6	995.6	492.5	492.5	492.5	1266.7	1266.7	1266.7	655.6	655.6	655.6	655.6	655.6	655.6	1266.7	1266.7	1266.7
$(kL/r)_{max}$	12.1	12.1	12.1	114.9	114.9	114.9	13.4	13.4	13.4	110.8	110.8	110.8	110.8	110.8	110.8	13.4	13.4	13.4
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1				1	1	1	1	1	1
Battens										1	1	1						
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	90077	90077	90077	993	993	993	92753	92753	92753	1358	1358	1358	1358	1358	1358	92753	92753	92753

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	0	0	0	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	0	0	0	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	0	0	0	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	0	0	0	368	368	368	368	368	368
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477
A_c (mm^2)	3302	3302	3302	3302	3302	3302	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205
A_d (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
A_b (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
μ	0.0388	0.0388	0.0388	0.0388	0.0388	0.0388	0.0494	0.0494	0.0494	NA	NA	NA	0.0493	0.0493	0.0493	0.0494	0.0494	0.0494
P_{cr}/P_e (Fig.3.51)	0.89	0.89	0.89	0.89	0.89	0.89	0.86	0.86	0.86	0.50	0.50	0.50	0.86	0.86	0.86	0.86	0.86	0.86
k'(sqrt(P_e/P_{cr}))	1.063	1.063	1.063	1.063	1.063	1.063	1.078	1.078	1.078	N/A	N/A	N/A	1.078	1.078	1.078	1.078	1.078	1.078
λ_v	0.132	0.132	0.132	1.260	1.260	1.260	0.149	0.149	0.149	N/A	N/A	N/A	1.232	1.232	1.232	0.149	0.149	0.149
Cr' (kN)	995.1	995.1	995.1	456.1	456.1	456.1	1265.7	1265.7	1265.7	999999.0	999999.0	999999.0	597.7	597.7	597.7	1265.7	1265.7	1265.7
Lacing Governs?	No	No	No	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	246	246	246	247	247	247	319	319	319	320	320	320	321	321	321	322	322	322
Member Label	12N-12N	12N-12N	12N-12N	12N-11N	12N-11N	12N-11N	6N-6N	6N-6N	6N-6N	6N-36N	6N-36N	6N-36N	36N-5N	36N-5N	36N-5N	6S-6S	6S-6S	6S-6S
Station (m)	0.0	0.4	0.7	0.0	3.4	6.9	0.0	0.4	0.7	0.0	2.3	4.6	0.0	0.7	1.4	0.0	0.4	0.7
Node Label at Station	12N	---	12N	12N	---	11N	6N	---	6N	6N	---	36N	36N	---	5N	6S	---	6S
Section #	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.79	0.79	0.79	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.76	0.76	0.76	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	3302	3302	3302	3302	3302	3302	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.84	0.84	0.84	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.41	1.41	1.41	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.62	1.62	1.62	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	406	406	406	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	995.6	995.6	995.6	456.1	456.1	456.1	1266.7	1266.7	1266.7	655.6	655.6	655.6	655.6	655.6	655.6	1266.7	1266.7	1266.7

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	5282	5282	5282	5282	5282	5282	6727	6727	6727	6727	6727	6727	6727	6727	6727	6727	6727	6727
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1054	1054	1054	1054	1054	1054	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	5841	5841	5841	5079	5079	5079	7647	7647	7647	6885	6885	6885	6885	6885	6885	7647	7647	7647
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	5841	5841	5841	5079	5079	5079	7647	7647	7647	6885	6885	6885	6885	6885	6885	7647	7647	7647
$A_{n(corrosion)}$ (mm^2)	4673	4673	4673	4063	4063	4063	6118	6118	6118	5508	5508	5508	5508	5508	5508	6118	6118	6118
$T_{r(b)}$ (kN)	1570	1570	1570	1365	1365	1365	2056	2056	2056	1851	1851	1851	1851	1851	1851	2056	2056	2056
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	4673	4673	4673	4063	4063	4063	6118	6118	6118	5508	5508	5508	5508	5508	5508	6118	6118	6118
$T_{r(c)}$ (kN)	1570	1570	1570	1365	1365	1365	2056	2056	2056	1851	1851	1851	1851	1851	1851	2056	2056	2056
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	246	246	246	247	247	247	319	319	319	320	320	320	321	321	321	322	322	322
Member Label	12N-12N	12N-12N	12N-12N	12N-11N	12N-11N	12N-11N	6N-6N	6N-6N	6N-6N	6N-36N	6N-36N	6N-36N	36N-5N	36N-5N	36N-5N	6S-6S	6S-6S	6S-6S
Station (m)	0.0	0.4	0.7	0.0	3.4	6.9	0.0	0.4	0.7	0.0	2.3	4.6	0.0	0.7	1.4	0.0	0.4	0.7
Node Label at Station	12N	---	12N	12N	---	11N	6N	---	6N	6N	---	36N	36N	---	5N	6S	---	6S
Section #	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	1570	1570	1570	1365	1365	1365	2056	2056	2056	1851	1851	1851	1851	1851	1851	2056	2056	2056
$(kL/r)_{max}$	12	12	12	115	115	115	13	13	13	111	111	111	111	111	111	13	13	13
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1054	1054	1054	1054	1054	1054	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	201	201	201	201	201	201	245	245	245	245	245	245	245	245	245	245	245	245
$M_{ry(Laterally\ Supported)}$ (kNm)	29	29	29	29	29	29	30	30	30	30	30	30	30	30	30	30	30	30
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	724	724	724	6896	6896	6896	724	724	724	4610	4610	4610	1372	1372	1372	724	724	724
L_{uy} (mm)	724	724	724	6896	6896	6896	724	724	724	5982	5982	5982	5982	5982	5982	724	724	724
M_{ux} (kNm) (y weak)	978	978	978	103	103	103	2598	2598	2598	408	408	408	1371	1371	1371	2598	2598	2598
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	213.9	213.9	213.9	78.0	78.0	78.0	271.9	271.9	271.9	219.4	219.4	219.4	263.1	263.1	263.1	271.9	271.9	271.9
M_{ry} (kNm)	29.2	29.2	29.2	29.2	29.2	29.2	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.000	0.000	0.000	0.059	0.053	0.048	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
(T_f/T_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.475	0.477	0.478	0.474	0.475	0.475	0.000	0.000	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.475	0.477	0.478	0.474	0.475	0.475	0.000	0.000	0.000
M_{fx}/M_{rx}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.178	0.351	0.293	0.148	0.000	0.000	0.000	0.000
M_{fy}/M_{ry}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.475	0.655	0.829	0.767	0.623	0.475	0.000	0.000	0.000
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PARSONS

Member ID in CSiBridge	246	246	246	247	247	247	319	319	319	320	320	320	321	321	321	322	322	322
Member Label	12N-12N	12N-12N	12N-12N	12N-11N	12N-11N	12N-11N	6N-6N	6N-6N	6N-6N	6N-36N	6N-36N	6N-36N	36N-5N	36N-5N	36N-5N	6S-6S	6S-6S	6S-6S
Station (m)	0.0	0.4	0.7	0.0	3.4	6.9	0.0	0.4	0.7	0.0	2.3	4.6	0.0	0.7	1.4	0.0	0.4	0.7
Node Label at Station	12N	---	12N	12N	---	11N	6N	---	6N	6N	---	36N	36N	---	5N	6S	---	6S
Section #	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	998	998	998	998	998	998	1271	1271	1271	1271	1271	1271	1271	1271	1271	1271	1271	1271
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.09E+06	1.09E+06	1.09E+06	1.20E+04	1.20E+04	1.20E+04	1.32E+06	1.32E+06	1.32E+06	3.26E+04	3.26E+04	3.26E+04	3.68E+05	3.68E+05	3.68E+05	1.32E+06	1.32E+06	1.32E+06
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	90077	90077	90077	993	993	993	92753	92753	92753	1358	1358	1358	1358	1358	1358	92753	92753	92753
U_{1y}	1.00	1.00	1.00	1.03	1.02	1.02	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.027	0.024	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.027	0.024	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.124	0.124	0.124	1.185	1.185	1.185	0.138	0.138	0.138	1.143	1.143	1.143	1.143	1.143	1.143	0.138	0.138	0.138
$C_{r\ (K=1)}$ (kN)	996	996	996	492	492	492	1267	1267	1267	656	656	656	656	656	656	1267	1267	1267
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.03	1.02	1.02	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.055	0.049	0.045	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.055	0.049	0.045	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.3. Lateral Torsional Buckling:

λ_{max}	0.124	0.124	0.124	1.185	1.185	1.185	0.138	0.138	0.138	1.143	1.143	1.143	1.143	1.143	1.143	0.138	0.138	0.138
C_r (kN)	996	996	996	492	492	492	1267	1267	1267	656	656	656	656	656	656	1267	1267	1267
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.03	1.02	1.02	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	214	214	214	78	78	78	272	272	272	219	219	219	263	263	263	272	272	272
M_{ry} (kNm)	29	29	29	29	29	29	30	30	30	30	30	30	30	30	30	30	30	30
C_f/C_r	0.000	0.000	0.000	0.055	0.049	0.045	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.055	0.049	0.045	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.000	0.000	0.000	0.059	0.053	0.048	0.000	0.000	0.000	0.475	0.655	0.829	0.767	0.623	0.475	0.000	0.000	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	324	324	324	325	325	325	326	326	326	327	327	327	328	328	328	329	329	329
Member Label	6S-36S	6S-36S	6S-36S	36S-5S	36S-5S	36S-5S	10N-10N	10N-10N	10N-10N	10N-35N	10N-35N	10N-35N	35N-9N	35N-9N	35N-9N	10S-10S	10S-10S	10S-10S
Station (m)	0.0	2.3	4.6	0.0	0.7	1.4	0.0	0.4	0.7	0.0	2.3	4.6	0.0	1.0	2.0	0.0	0.4	0.7
Node Label at Station	6S	---	36S	36S	---	5S	10N	---	10N	10N	---	35N	35N	---	9N	10S	---	10S
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

Member Factored Load Effects:

C_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	654	657	659	657	658	659	0	0	0	626	628	631	625	626	627	0	0	0
$M_{fx\ (tension)}$ (kNm)	33	48	63	63	32	0	0	0	0	0	28	55	55	28	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fy} (kN)	14	14	14	46	46	46	0	0	0	12	12	12	28	28	28	0	0	0

Gross Section Properties:

Ag (mm^2)	8409	8409	8409	8409	8409	8409	8409	8409	8409	8409	8409	8409	8409	8409	8409	8409	8409	8409
I_x (mm^4)	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08
I_y (mm^4)	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07
J (mm^4)	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05
r_x (mm)	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204
r_y (mm)	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54
S_x (mm^3)	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06
S_y (mm^3)	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
L (mm)	4610	4610	4610	1372	1372	1372	724	724	724	4610	4610	4610	1981	1981	1981	724	724	724

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	324	324	324	325	325	325	326	326	326	327	327	327	328	328	328	329	329	329
Member Label	6S-36S	6S-36S	6S-36S	36S-5S	36S-5S	36S-5S	10N-10N	10N-10N	10N-10N	10N-35N	10N-35N	10N-35N	35N-9N	35N-9N	35N-9N	10S-10S	10S-10S	10S-10S
Station (m)	0.0	2.3	4.6	0.0	0.7	1.4	0.0	0.4	0.7	0.0	2.3	4.6	0.0	1.0	2.0	0.0	0.4	0.7
Node Label at Station	6S	---	36S	36S	---	5S	10N	---	10N	10N	---	35N	35N	---	9N	10S	---	10S
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Webs in combined flexural and axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	324	324	324	325	325	325	326	326	326	327	327	327	328	328	328	329	329	329
Member Label	6S-36S	6S-36S	6S-36S	36S-5S	36S-5S	36S-5S	10N-10N	10N-10N	10N-10N	10N-35N	10N-35N	10N-35N	35N-9N	35N-9N	35N-9N	10S-10S	10S-10S	10S-10S
Station (m)	0.0	2.3	4.6	0.0	0.7	1.4	0.0	0.4	0.7	0.0	2.3	4.6	0.0	1.0	2.0	0.0	0.4	0.7
Node Label at Station	6S	---	36S	36S	---	5S	10N	---	10N	10N	---	35N	35N	---	9N	10S	---	10S
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	4610	4610	4610	1372	1372	1372	724	724	724	4610	4610	4610	1981	1981	1981	724	724	724
L_y (mm)	5982	5982	5982	5982	5982	5982	724	724	724	6591	6591	6591	6591	6591	6591	724	724	724
λ_{max}	1.143	1.143	1.143	1.143	1.143	1.143	0.138	0.138	0.138	1.259	1.259	1.259	1.259	1.259	1.259	0.138	0.138	0.138
C_r (kN)	655.6	655.6	655.6	655.6	655.6	655.6	1266.7	1266.7	1266.7	581.3	581.3	581.3	581.3	581.3	581.3	1266.7	1266.7	1266.7
$(kL/r)_{max}$	110.8	110.8	110.8	110.8	110.8	110.8	13.4	13.4	13.4	122.1	122.1	122.1	122.1	122.1	122.1	13.4	13.4	13.4
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing				1	1	1	1	1	1				1	1	1	1	1	1
Battens	1	1	1							1	1	1						
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	1358	1358	1358	1358	1358	1358	92753	92753	92753	1119	1119	1119	1119	1119	1119	92753	92753	92753

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477
A_c (mm^2)	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205
A_d (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
A_b (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
μ	NA	NA	NA	0.0494	0.0494	0.0494	0.0494	0.0494	0.0494	NA	NA	NA	0.0494	0.0494	0.0494	0.0494	0.0494	0.0494
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.86	0.86	0.86	0.86	0.86	0.86	0.50	0.50	0.50	0.86	0.86	0.86	0.86	0.86	0.86
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	1.078	1.078	1.078	1.078	1.078	1.078	N/A	N/A	N/A	1.078	1.078	1.078	1.078	1.078	1.078
λ_v	N/A	N/A	N/A	1.232	1.232	1.232	0.149	0.149	0.149	N/A	N/A	N/A	1.358	1.358	1.358	0.149	0.149	0.149
Cr' (kN)	999999.0	999999.0	999999.0	597.6	597.6	597.6	1265.7	1265.7	1265.7	999999.0	999999.0	999999.0	525.2	525.2	525.2	1265.7	1265.7	1265.7
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	324	324	324	325	325	325	326	326	326	327	327	327	328	328	328	329	329	329
Member Label	6S-36S	6S-36S	6S-36S	36S-5S	36S-5S	36S-5S	10N-10N	10N-10N	10N-10N	10N-35N	10N-35N	10N-35N	35N-9N	35N-9N	35N-9N	10S-10S	10S-10S	10S-10S
Station (m)	0.0	2.3	4.6	0.0	0.7	1.4	0.0	0.4	0.7	0.0	2.3	4.6	0.0	1.0	2.0	0.0	0.4	0.7
Node Label at Station	6S	---	36S	36S	---	5S	10N	---	10N	10N	---	35N	35N	---	9N	10S	---	10S
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	0.79	0.79	0.79	N/A	N/A	N/A	N/A	N/A	N/A	0.79	0.79	0.79	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	0.76	0.76	0.76	N/A	N/A	N/A	N/A	N/A	N/A	0.76	0.76	0.76	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	0.84	0.84	0.84	N/A	N/A	N/A	N/A	N/A	N/A	0.84	0.84	0.84	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	1.41	1.41	1.41	N/A	N/A	N/A	N/A	N/A	N/A	1.41	1.41	1.41	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	1.62	1.62	1.62	N/A	N/A	N/A	N/A	N/A	N/A	1.78	1.78	1.78	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	406	406	406	999999	999999	999999	999999	999999	999999	347	347	347	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	655.6	655.6	655.6	655.6	655.6	655.6	1266.7	1266.7	1266.7	581.3	581.3	581.3	581.3	581.3	581.3	1266.7	1266.7	1266.7

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6727	6727	6727	6727	6727	6727	6727	6727	6727	6727	6727	6727	6727	6727	6727	6727	6727	6727
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885
$A_{n(corrosion)}$ (mm^2)	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508
$T_{r(b)}$ (kN)	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508
$T_{r(c)}$ (kN)	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	324	324	324	325	325	325	326	326	326	327	327	327	328	328	328	329	329	329
Member Label	6S-36S	6S-36S	6S-36S	36S-5S	36S-5S	36S-5S	10N-10N	10N-10N	10N-10N	10N-35N	10N-35N	10N-35N	35N-9N	35N-9N	35N-9N	10S-10S	10S-10S	10S-10S
Station (m)	0.0	2.3	4.6	0.0	0.7	1.4	0.0	0.4	0.7	0.0	2.3	4.6	0.0	1.0	2.0	0.0	0.4	0.7
Node Label at Station	6S	---	36S	36S	---	5S	10N	---	10N	10N	---	35N	35N	---	9N	10S	---	10S
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851
$(kL/r)_{max}$	111	111	111	111	111	111	13	13	13	122	122	122	122	122	122	13	13	13
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245
$M_{ry(Laterally\ Supported)}$ (kNm)	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	4610	4610	4610	1372	1372	1372	724	724	724	4610	4610	4610	1981	1981	1981	724	724	724
L_{uy} (mm)	5982	5982	5982	5982	5982	5982	724	724	724	6591	6591	6591	6591	6591	6591	724	724	724
M_{ux} (kNm) (y weak)	408	408	408	1371	1371	1371	2598	2598	2598	408	408	408	949	949	949	2598	2598	2598
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	219.4	219.4	219.4	263.1	263.1	263.1	271.9	271.9	271.9	219.4	219.4	219.4	254.9	254.9	254.9	271.9	271.9	271.9
M_{ry} (kNm)	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y/w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
(T_f/T_r)<=1	0.487	0.490	0.491	0.490	0.490	0.491	0.000	0.000	0.000	0.466	0.468	0.470	0.466	0.466	0.467	0.000	0.000	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.487	0.490	0.491	0.490	0.490	0.491	0.000	0.000	0.000	0.466	0.468	0.470	0.466	0.466	0.467	0.000	0.000	0.000
M_{fx}/M_{rx}<=1	0.150	0.219	0.287	0.239	0.122	0.000	0.000	0.000	0.000	0.000	0.128	0.251	0.216	0.110	0.000	0.000	0.000	0.000
M_{fy}/M_{ry}<=1	0.067	0.067	0.034	0.034	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r$<=1	0.705	0.776	0.812	0.763	0.612	0.491	0.000	0.000	0.000	0.466	0.596	0.721	0.681	0.576	0.467	0.000	0.000	0.000
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PARSONS

Member ID in CSiBridge	324	324	324	325	325	325	326	326	326	327	327	327	328	328	328	329	329	329
Member Label	6S-36S	6S-36S	6S-36S	36S-5S	36S-5S	36S-5S	10N-10N	10N-10N	10N-10N	10N-35N	10N-35N	10N-35N	35N-9N	35N-9N	35N-9N	10S-10S	10S-10S	10S-10S
Station (m)	0.0	2.3	4.6	0.0	0.7	1.4	0.0	0.4	0.7	0.0	2.3	4.6	0.0	1.0	2.0	0.0	0.4	0.7
Node Label at Station	6S	---	36S	36S	---	5S	10N	---	10N	10N	---	35N	35N	---	9N	10S	---	10S
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1271	1271	1271	1271	1271	1271	1271	1271	1271	1271	1271	1271	1271	1271	1271	1271	1271	1271
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	3.26E+04	3.26E+04	3.26E+04	3.68E+05	3.68E+05	3.68E+05	1.32E+06	1.32E+06	1.32E+06	3.26E+04	3.26E+04	3.26E+04	1.76E+05	1.76E+05	1.76E+05	1.32E+06	1.32E+06	1.32E+06
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	1358	1358	1358	1358	1358	1358	92753	92753	92753	1119	1119	1119	1119	1119	1119	92753	92753	92753
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.143	1.143	1.143	1.143	1.143	1.143	0.138	0.138	0.138	1.259	1.259	1.259	1.259	1.259	1.259	0.138	0.138	0.138
$C_{r\ (K=1)}$ (kN)	656	656	656	656	656	656	1267	1267	1267	581	581	581	581	581	581	1267	1267	1267
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.3. Lateral Torsional Buckling:

λ_{max}	1.143	1.143	1.143	1.143	1.143	1.143	0.138	0.138	0.138	1.259	1.259	1.259	1.259	1.259	1.259	0.138	0.138	0.138
C_r (kN)	656	656	656	656	656	656	1267	1267	1267	581	581	581	581	581	581	1267	1267	1267
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	219	219	219	263	263	263	272	272	272	219	219	219	255	255	255	272	272	272
M_{ry} (kNm)	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.705	0.776	0.812	0.763	0.612	0.491	0.000	0.000	0.000	0.466	0.596	0.721	0.681	0.576	0.467	0.000	0.000	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	331	331	331	332	332	332	546	546	546	547	547	547	548	548	548	549	549	549
Member Label	10S-35S	10S-35S	10S-35S	35S-9S	35S-9S	35S-9S	14N-14N	14N-14N	14N-14N	14N-49N	14N-49N	14N-49N	49N-13N	49N-13N	49N-13N	14S-14S	14S-14S	14S-14S
Station (m)	0.0	2.3	4.6	0.0	1.0	2.0	0.0	0.4	0.7	0.0	2.3	4.6	0.0	1.3	2.6	0.0	0.4	0.7
Node Label at Station	10S	---	35S	35S	---	9S	14N	---	14N	14N	---	49N	49N	---	13N	14S	---	14S
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	S 13-49	S 13-49	S 13-49	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

Member Factored Load Effects:

C_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	643	645	647	643	644	645	0	0	0	990	992	994	802	807	812	0	0	0
$M_{fx\ (tension)}$ (kNm)	30	46	61	61	31	0	0	0	0	0	46	93	403	201	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	4	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
V_{fy} (kN)	13	13	13	31	31	31	0	0	0	20	20	20	155	155	155	0	0	0

Gross Section Properties:

Ag (mm^2)	8409	8409	8409	8409	8409	8409	8409	8409	8409	8409	8409	8409	34302	34302	34302	8409	8409	8409
I_x (mm^4)	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	4.07E+09	4.07E+09	4.07E+09	3.51E+08	3.51E+08	3.51E+08
I_y (mm^4)	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	9.42E+07	9.42E+07	9.42E+07	2.46E+07	2.46E+07	2.46E+07
J (mm^4)	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	7.92E+06	7.92E+06	7.92E+06	9.45E+05	9.45E+05	9.45E+05
r_x (mm)	204	204	204	204	204	204	204	204	204	204	204	204	344	344	344	204	204	204
r_y (mm)	54	54	54	54	54	54	54	54	54	54	54	54	52	52	52	54	54	54
S_x (mm^3)	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	6.60E+06	6.60E+06	6.60E+06	1.53E+06	1.53E+06	1.53E+06
S_y (mm^3)	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	5.91E+05	5.91E+05	5.91E+05	1.86E+05	1.86E+05	1.86E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	20	20	20	20	20	20	20	20	20	20	5	5	20	20	20	20	20	20
L (mm)	4610	4610	4610	1981	1981	1981	724	724	724	4610	4610	4610	2591	2591	2591	724	724	724

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	331	331	331	332	332	332	546	546	546	547	547	547	548	548	548	549	549	549
Member Label	10S-35S	10S-35S	10S-35S	35S-9S	35S-9S	35S-9S	14N-14N	14N-14N	14N-14N	14N-49N	14N-49N	14N-49N	49N-13N	49N-13N	49N-13N	14S-14S	14S-14S	14S-14S
Station (m)	0.0	2.3	4.6	0.0	1.0	2.0	0.0	0.4	0.7	0.0	2.3	4.6	0.0	1.3	2.6	0.0	0.4	0.7
Node Label at Station	10S	---	35S	35S	---	9S	14N	---	14N	14N	---	49N	49N	---	13N	14S	---	14S
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	S 13-49	S 13-49	S 13-49	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	16.0	16.0	16.0	16.0	16.0	16.0												
Webs in combined flexural and axial compression							16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	331	331	331	332	332	332	546	546	546	547	547	547	548	548	548	549	549	549
Member Label	10S-35S	10S-35S	10S-35S	35S-9S	35S-9S	35S-9S	14N-14N	14N-14N	14N-14N	14N-49N	14N-49N	14N-49N	49N-13N	49N-13N	49N-13N	14S-14S	14S-14S	14S-14S
Station (m)	0.0	2.3	4.6	0.0	1.0	2.0	0.0	0.4	0.7	0.0	2.3	4.6	0.0	1.3	2.6	0.0	0.4	0.7
Node Label at Station	10S	---	35S	35S	---	9S	14N	---	14N	14N	---	49N	49N	---	13N	14S	---	14S
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	S 13-49	S 13-49	S 13-49	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	4610	4610	4610	1981	1981	1981	724	724	724	4610	4610	4610	2591	2591	2591	724	724	724
L_y (mm)	6591	6591	6591	6591	6591	6591	724	724	724	7201	7201	7201	7201	7201	7201	724	724	724
λ_{max}	1.259	1.259	1.259	1.259	1.259	1.259	0.138	0.138	0.138	1.375	1.375	1.375	1.428	1.428	1.428	0.138	0.138	0.138
C_r (kN)	581.3	581.3	581.3	581.3	581.3	581.3	1266.7	1266.7	1266.7	515.8	612.5	612.5	1994.1	1994.1	1994.1	1266.7	1266.7	1266.7
$(kL/r)_{max}$	122.1	122.1	122.1	122.1	122.1	122.1	13.4	13.4	13.4	133.4	133.4	133.4	138.5	138.5	138.5	13.4	13.4	13.4
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing				1	1	1	1	1	1									
Battens	1	1	1							1	1	1						
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	1119	1119	1119	1119	1119	1119	92753	92753	92753	937	937	937	3587	3587	3587	92753	92753	92753

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477
A_c (mm^2)	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	17151	17151	17151	4205	4205	4205
A_d (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
A_b (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
μ	NA	NA	NA	0.0494	0.0494	0.0494	0.0494	0.0494	0.0494	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.86	0.86	0.86	0.86	0.86	0.86	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	1.078	1.078	1.078	1.078	1.078	1.078	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	1.358	1.358	1.358	0.149	0.149	0.149	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	525.2	525.2	525.2	1265.7	1265.7	1265.7	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	331	331	331	332	332	332	546	546	546	547	547	547	548	548	548	549	549	549
Member Label	10S-35S	10S-35S	10S-35S	35S-9S	35S-9S	35S-9S	14N-14N	14N-14N	14N-14N	14N-49N	14N-49N	14N-49N	49N-13N	49N-13N	49N-13N	14S-14S	14S-14S	14S-14S
Station (m)	0.0	2.3	4.6	0.0	1.0	2.0	0.0	0.4	0.7	0.0	2.3	4.6	0.0	1.3	2.6	0.0	0.4	0.7
Node Label at Station	10S	---	35S	35S	---	9S	14N	---	14N	14N	---	49N	49N	---	13N	14S	---	14S
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	S 13-49	S 13-49	S 13-49	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	0.79	0.79	0.79	N/A	N/A	N/A	N/A	N/A	N/A	0.79	0.79	0.79	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	0.76	0.76	0.76	N/A	N/A	N/A	N/A	N/A	N/A	0.76	0.76	0.76	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	2743	2743	2743	3343	3343	3343	3343	3343	3343
A_c (mm^2)	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	17151	17151	17151	4205	4205	4205
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	0.84	0.84	0.84	N/A	N/A	N/A	N/A	N/A	N/A	1.25	1.25	1.25	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	1.41	1.41	1.41	N/A	N/A	N/A	N/A	N/A	N/A	1.41	1.41	1.41	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	1.78	1.78	1.78	N/A	N/A	N/A	N/A	N/A	N/A	1.95	1.95	1.95	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	347	347	347	999999	999999	999999	999999	999999	999999	299	355	355	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	581.3	581.3	581.3	581.3	581.3	581.3	1266.7	1266.7	1266.7	515.8	612.5	612.5	1994.1	1994.1	1994.1	1266.7	1266.7	1266.7

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6727	6727	6727	6727	6727	6727	6727	6727	6727	6727	7989	7989	27442	27442	27442	6727	6727	6727
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1594	1594	5475	5475	5475	1342	1342	1342
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	6885	6885	6885	6885	6885	6885	7647	7647	7647	6123	6123	6123	33540	33540	33540	7647	7647	7647
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	6885	6885	6885	6885	6885	6885	7647	7647	7647	6123	6123	6123	33540	33540	33540	7647	7647	7647
$A_{n(corrosion)}$ (mm^2)	5508	5508	5508	5508	5508	5508	6118	6118	6118	4898	5817	5817	26832	26832	26832	6118	6118	6118
$T_{r(b)}$ (kN)	1851	1851	1851	1851	1851	1851	2056	2056	2056	1646	1954	1954	9016	9016	9016	2056	2056	2056
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	5508	5508	5508	5508	5508	5508	6118	6118	6118	4898	5817	5817	26832	26832	26832	6118	6118	6118
$T_{r(c)}$ (kN)	1851	1851	1851	1851	1851	1851	2056	2056	2056	1646	1954	1954	9016	9016	9016	2056	2056	2056
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	331	331	331	332	332	332	546	546	546	547	547	547	548	548	548	549	549	549
Member Label	10S-35S	10S-35S	10S-35S	35S-9S	35S-9S	35S-9S	14N-14N	14N-14N	14N-14N	14N-49N	14N-49N	14N-49N	49N-13N	49N-13N	49N-13N	14S-14S	14S-14S	14S-14S
Station (m)	0.0	2.3	4.6	0.0	1.0	2.0	0.0	0.4	0.7	0.0	2.3	4.6	0.0	1.3	2.6	0.0	0.4	0.7
Node Label at Station	10S	---	35S	35S	---	9S	14N	---	14N	14N	---	49N	49N	---	13N	14S	---	14S
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	S 13-49	S 13-49	S 13-49	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	1851	1851	1851	1851	1851	1851	2056	2056	2056	1646	1954	1954	9016	9016	9016	2056	2056	2056
$(kL/r)_{max}$	122	122	122	122	122	122	13	13	13	133	133	133	138	138	138	13	13	13
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1594	1594	5475	5475	5475	1342	1342	1342
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	245	245	245	245	245	245	245	245	245	245	291	291	1053	1053	1053	245	245	245
$M_{ry(Laterally\ Supported)}$ (kNm)	30	30	30	30	30	30	30	30	30	30	35	35	94	94	94	30	30	30
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	4610	4610	4610	1981	1981	1981	724	724	724	4610	4610	4610	2591	2591	2591	724	724	724
L_{uy} (mm)	6591	6591	6591	6591	6591	6591	724	724	724	7201	7201	7201	7201	7201	7201	724	724	724
M_{ux} (kNm) (y weak)	408	408	408	949	949	949	2598	2598	2598	408	408	408	4110	4110	4110	2598	2598	2598
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	219.4	219.4	219.4	254.9	254.9	254.9	271.9	271.9	271.9	219.4	260.5	260.5	1096.6	1096.6	1096.6	271.9	271.9	271.9
M_{ry} (kNm)	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	35.3	35.3	94.3	94.3	94.3	29.8	29.8	29.8

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
(T_f/T_r)<=1	0.479	0.481	0.482	0.479	0.480	0.481	0.000	0.000	0.000	0.738	0.622	0.624	0.146	0.147	0.148	0.000	0.000	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.479	0.481	0.482	0.479	0.480	0.481	0.000	0.000	0.000	0.738	0.622	0.624	0.146	0.147	0.148	0.000	0.000	0.000
M_{fx}/M_{rx}<=1	0.137	0.210	0.278	0.239	0.122	0.000	0.000	0.000	0.000	0.000	0.177	0.357	0.368	0.183	0.000	0.000	0.000	0.000
M_{fy}/M_{ry}<=1	0.134	0.067	0.034	0.034	0.034	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r$<=1	0.750	0.758	0.794	0.752	0.635	0.481	0.000	0.000	0.000	0.738	0.799	0.981	0.514	0.331	0.148	0.000	0.000	0.000
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.080	0.000	0.000	0.000	0.000	0.000

PARSONS

Member ID in CSiBridge	331	331	331	332	332	332	546	546	546	547	547	547	548	548	548	549	549	549
Member Label	10S-35S	10S-35S	10S-35S	35S-9S	35S-9S	35S-9S	14N-14N	14N-14N	14N-14N	14N-49N	14N-49N	14N-49N	49N-13N	49N-13N	49N-13N	14S-14S	14S-14S	14S-14S
Station (m)	0.0	2.3	4.6	0.0	1.0	2.0	0.0	0.4	0.7	0.0	2.3	4.6	0.0	1.3	2.6	0.0	0.4	0.7
Node Label at Station	10S	---	35S	35S	---	9S	14N	---	14N	14N	---	49N	49N	---	13N	14S	---	14S
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	S 13-49	S 13-49	S 13-49	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1271	1271	1271	1271	1271	1271	1271	1271	1271	1271	1510	1510	5186	5186	5186	1271	1271	1271
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	3.26E+04	3.26E+04	3.26E+04	1.76E+05	1.76E+05	1.76E+05	1.32E+06	1.32E+06	1.32E+06	3.26E+04	3.26E+04	3.26E+04	1.20E+06	1.20E+06	1.20E+06	1.32E+06	1.32E+06	1.32E+06
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	1119	1119	1119	1119	1119	1119	92753	92753	92753	937	937	937	3587	3587	3587	92753	92753	92753
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.259	1.259	1.259	1.259	1.259	1.259	0.138	0.138	0.138	1.375	1.375	1.375	1.428	1.428	1.428	0.138	0.138	0.138
$C_{r\ (K=1)}$ (kN)	581	581	581	581	581	581	1267	1267	1267	516	613	613	1994	1994	1994	1267	1267	1267
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.3. Lateral Torsional Buckling:

λ_{max}	1.259	1.259	1.259	1.259	1.259	1.259	0.138	0.138	0.138	1.375	1.375	1.375	1.428	1.428	1.428	0.138	0.138	0.138
C_r (kN)	581	581	581	581	581	581	1267	1267	1267	516	613	613	1994	1994	1994	1267	1267	1267
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	219	219	219	255	255	255	272	272	272	219	260	260	1097	1097	1097	272	272	272
M_{ry} (kNm)	30	30	30	30	30	30	30	30	30	30	35	35	94	94	94	30	30	30
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.750	0.758	0.794	0.752	0.635	0.481	0.000	0.000	0.000	0.738	0.799	0.981	0.514	0.331	0.148	0.000	0.000	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	551	551	551	552	552	552	567	567	567	569	569	569	570	570	570	572	572	572
Member Label	14S-49S	14S-49S	14S-49S	49S-13S	49S-13S	49S-13S	2S-2S	2S-2S	2S-2S	2S-1S	2S-1S	2S-1S	4S-4S	4S-4S	4S-4S	4S-3S	4S-3S	4S-3S
Station (m)	0.0	2.3	4.6	0.0	1.3	2.6	0.0	0.4	0.7	0.0	2.7	5.4	0.0	0.4	0.7	0.0	2.8	5.7
Node Label at Station	14S	---	49S	49S	---	13S	2S	---	2S	2S	---	1S	4S	---	4S	4S	---	3S
Section #	Section 03	Section 03	Section 03	S 13-49	S 13-49	S 13-49	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

Member Factored Load Effects:

C_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	18	16
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26	13	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0
T_f (kN)	1021	1023	1026	834	839	843	0	0	0	644	646	649	0	0	0	0	0	0
$M_{fx\ (tension)}$ (kNm)	32	32	77	399	199	0	0	0	0	28	14	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	1	1	1	1	0	0	0	0	0	3	1	0	0	0	0	0	0	0
V_{fx} (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fy} (kN)	22	22	22	154	154	154	0	0	0	5	5	5	0	0	0	5	5	5

Gross Section Properties:

Ag (mm^2)	8409	8409	8409	34302	34302	34302	8409	8409	8409	8409	8409	8409	6603	6603	6603	6603	6603	6603
I_x (mm^4)	3.51E+08	3.51E+08	3.51E+08	4.07E+09	4.07E+09	4.07E+09	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08
I_y (mm^4)	2.46E+07	2.46E+07	2.46E+07	9.42E+07	9.42E+07	9.42E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07
J (mm^4)	9.45E+05	9.45E+05	9.45E+05	7.92E+06	7.92E+06	7.92E+06	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05
r_x (mm)	204	204	204	344	344	344	204	204	204	204	204	204	209	209	209	209	209	209
r_y (mm)	54	54	54	52	52	52	54	54	54	54	54	54	60	60	60	60	60	60
S_x (mm^3)	1.53E+06	1.53E+06	1.53E+06	6.60E+06	6.60E+06	6.60E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06
S_y (mm^3)	1.86E+05	1.86E+05	1.86E+05	5.91E+05	5.91E+05	5.91E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	20	5	5	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
L (mm)	4610	4610	4610	2591	2591	2591	724	724	724	5372	5372	5372	724	724	724	5677	5677	5677

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	551	551	551	552	552	552	567	567	567	569	569	569	570	570	570	572	572	572
Member Label	14S-49S	14S-49S	14S-49S	49S-13S	49S-13S	49S-13S	2S-2S	2S-2S	2S-2S	2S-1S	2S-1S	2S-1S	4S-4S	4S-4S	4S-4S	4S-3S	4S-3S	4S-3S
Station (m)	0.0	2.3	4.6	0.0	1.3	2.6	0.0	0.4	0.7	0.0	2.7	5.4	0.0	0.4	0.7	0.0	2.8	5.7
Node Label at Station	14S	---	49S	49S	---	13S	2S	---	2S	2S	---	1S	4S	---	4S	4S	---	3S
Section #	Section 03	Section 03	Section 03	S 13-49	S 13-49	S 13-49	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression																		
Webs in combined flexural and axial compression	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	551	551	551	552	552	552	567	567	567	569	569	569	570	570	570	572	572	572
Member Label	14S-49S	14S-49S	14S-49S	49S-13S	49S-13S	49S-13S	2S-2S	2S-2S	2S-2S	2S-1S	2S-1S	2S-1S	4S-4S	4S-4S	4S-4S	4S-3S	4S-3S	4S-3S
Station (m)	0.0	2.3	4.6	0.0	1.3	2.6	0.0	0.4	0.7	0.0	2.7	5.4	0.0	0.4	0.7	0.0	2.8	5.7
Node Label at Station	14S	---	49S	49S	---	13S	2S	---	2S	2S	---	1S	4S	---	4S	4S	---	3S
Section #	Section 03	Section 03	Section 03	S 13-49	S 13-49	S 13-49	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	4610	4610	4610	2591	2591	2591	724	724	724	5372	5372	5372	724	724	724	5677	5677	5677
L_y (mm)	7201	7201	7201	7201	7201	7201	724	724	724	5372	5372	5372	724	724	724	5677	5677	5677
λ_{max}	1.375	1.375	1.375	1.428	1.428	1.428	0.138	0.138	0.138	1.026	1.026	1.026	0.124	0.124	0.124	0.976	0.976	0.976
C_r (kN)	515.8	612.5	612.5	1994.1	1994.1	1994.1	1266.7	1266.7	1266.7	738.3	738.3	738.3	995.6	995.6	995.6	609.6	609.6	609.6
$(kL/r)_{max}$	133.4	133.4	133.4	138.5	138.5	138.5	13.4	13.4	13.4	99.5	99.5	99.5	12.1	12.1	12.1	94.6	94.6	94.6
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing							1	1	1				1	1	1	1	1	1
Battens	1	1	1							1	1	1						
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	937	937	937	3587	3587	3587	92753	92753	92753	1684	1684	1684	90077	90077	90077	1465	1465	1465

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	0	0	0	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	0	0	0	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	0	0	0	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	0	0	0	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	1.00	1.00	1.00	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	1.00	1.00	1.00	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	5563	5563	5563
A_c (mm^2)	4205	4205	4205	17151	17151	17151	4205	4205	4205	4205	4205	4205	3302	3302	3302	3302	3302	3302
A_d (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
A_b (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
μ	NA	NA	NA	NA	NA	NA	0.0494	0.0494	0.0494	NA	NA	NA	0.0388	0.0388	0.0388	0.0525	0.0525	0.0525
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.86	0.86	0.86	0.50	0.50	0.50	0.89	0.89	0.89	0.85	0.85	0.85
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	1.078	1.078	1.078	N/A	N/A	N/A	1.063	1.063	1.063	1.083	1.083	1.083
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	0.149	0.149	0.149	N/A	N/A	N/A	0.132	0.132	0.132	1.057	1.057	1.057
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	1265.7	1265.7	1265.7	999999.0	999999.0	999999.0	995.1	995.1	995.1	561.9	561.9	561.9
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes

Member ID in CSiBridge	551	551	551	552	552	552	567	567	567	569	569	569	570	570	570	572	572	572
Member Label	14S-49S	14S-49S	14S-49S	49S-13S	49S-13S	49S-13S	2S-2S	2S-2S	2S-2S	2S-1S	2S-1S	2S-1S	4S-4S	4S-4S	4S-4S	4S-3S	4S-3S	4S-3S
Station (m)	0.0	2.3	4.6	0.0	1.3	2.6	0.0	0.4	0.7	0.0	2.7	5.4	0.0	0.4	0.7	0.0	2.8	5.7
Node Label at Station	14S	---	49S	49S	---	13S	2S	---	2S	2S	---	1S	4S	---	4S	4S	---	3S
Section #	Section 03	Section 03	Section 03	S 13-49	S 13-49	S 13-49	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	0.79	0.79	0.79	N/A	N/A	N/A	N/A	N/A	N/A	0.79	0.79	0.79	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	0.76	0.76	0.76	N/A	N/A	N/A	N/A	N/A	N/A	0.76	0.76	0.76	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	2743	2743	2743	3343	3343	3343	3343	3343	3343	3277	3277	3277	3343	3343	3343	3343	3343	3343
A_c (mm^2)	4205	4205	4205	17151	17151	17151	4205	4205	4205	4205	4205	4205	3302	3302	3302	3302	3302	3302
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	1.25	1.25	1.25	N/A	N/A	N/A	N/A	N/A	N/A	0.87	0.87	0.87	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	1.41	1.41	1.41	N/A	N/A	N/A	N/A	N/A	N/A	1.41	1.41	1.41	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	1.95	1.95	1.95	N/A	N/A	N/A	N/A	N/A	N/A	1.45	1.45	1.45	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	299	355	355	999999	999999	999999	999999	999999	999999	478	478	478	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	515.8	612.5	612.5	1994.1	1994.1	1994.1	1266.7	1266.7	1266.7	738.3	738.3	738.3	995.6	995.6	995.6	561.9	561.9	561.9

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6727	7989	7989	27442	27442	27442	6727	6727	6727	6727	6727	6727	5282	5282	5282	5282	5282	5282
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1342	1594	1594	5475	5475	5475	1342	1342	1342	1342	1342	1342	1054	1054	1054	1054	1054	1054
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	6123	6123	6123	33540	33540	33540	7647	7647	7647	6885	6885	6885	5841	5841	5841	5841	5841	5841
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	6123	6123	6123	33540	33540	33540	7647	7647	7647	6885	6885	6885	5841	5841	5841	5841	5841	5841
$A_{n(corrosion)}$ (mm^2)	4898	5817	5817	26832	26832	26832	6118	6118	6118	5508	5508	5508	4673	4673	4673	4673	4673	4673
$T_{r(b)}$ (kN)	1646	1954	1954	9016	9016	9016	2056	2056	2056	1851	1851	1851	1570	1570	1570	1570	1570	1570
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	4898	5817	5817	26832	26832	26832	6118	6118	6118	5508	5508	5508	4673	4673	4673	4673	4673	4673
$T_{r(c)}$ (kN)	1646	1954	1954	9016	9016	9016	2056	2056	2056	1851	1851	1851	1570	1570	1570	1570	1570	1570
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	551	551	551	552	552	552	567	567	567	569	569	569	570	570	570	572	572	572
Member Label	14S-49S	14S-49S	14S-49S	49S-13S	49S-13S	49S-13S	2S-2S	2S-2S	2S-2S	2S-1S	2S-1S	2S-1S	4S-4S	4S-4S	4S-4S	4S-3S	4S-3S	4S-3S
Station (m)	0.0	2.3	4.6	0.0	1.3	2.6	0.0	0.4	0.7	0.0	2.7	5.4	0.0	0.4	0.7	0.0	2.8	5.7
Node Label at Station	14S	---	49S	49S	---	13S	2S	---	2S	2S	---	1S	4S	---	4S	4S	---	3S
Section #	Section 03	Section 03	Section 03	S 13-49	S 13-49	S 13-49	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	1646	1954	1954	9016	9016	9016	2056	2056	2056	1851	1851	1851	1570	1570	1570	1570	1570	1570
$(kL/r)_{max}$	133	133	133	138	138	138	13	13	13	99	99	99	12	12	12	95	95	95
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1342	1594	1594	5475	5475	5475	1342	1342	1342	1342	1342	1342	1054	1054	1054	1054	1054	1054
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	245	291	291	1053	1053	1053	245	245	245	245	245	245	201	201	201	201	201	201
$M_{ry(Laterally\ Supported)}$ (kNm)	30	35	35	94	94	94	30	30	30	30	30	30	29	29	29	29	29	29
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	4610	4610	4610	2591	2591	2591	724	724	724	5372	5372	5372	724	724	724	5677	5677	5677
L_{uy} (mm)	7201	7201	7201	7201	7201	7201	724	724	724	5372	5372	5372	724	724	724	5677	5677	5677
M_{ux} (kNm) (y weak)	408	408	408	4110	4110	4110	2598	2598	2598	350	350	350	978	978	978	125	125	125
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	219.4	260.5	260.5	1096.6	1096.6	1096.6	271.9	271.9	271.9	209.1	209.1	209.1	213.9	213.9	213.9	94.7	94.7	94.7
M_{ry} (kNm)	29.8	35.3	35.3	94.3	94.3	94.3	29.8	29.8	29.8	29.8	29.8	29.8	29.2	29.2	29.2	29.2	29.2	29.2

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
$(V_f/V_r)<=1$																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.036	0.032	0.028
$(T_f/T_r)<=1$	0.761	0.642	0.644	0.152	0.153	0.154	0.000	0.000	0.000	0.480	0.481	0.484	0.000	0.000	0.000	0.000	0.000	0.000

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.761	0.642	0.644	0.152	0.153	0.154	0.000	0.000	0.000	0.480	0.481	0.484	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fx}/M_{rx}<=1$	0.146	0.123	0.296	0.364	0.181	0.000	0.000	0.000	0.000	0.134	0.067	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fy}/M_{ry}<=1$	0.034	0.028	0.028	0.011	0.000	0.000	0.000	0.000	0.000	0.101	0.034	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r<=1$	0.940	0.793	0.968	0.527	0.335	0.154	0.000	0.000	0.000	0.715	0.582	0.484	0.000	0.000	0.000	0.000	0.000	0.000
$M_f/M_r-T_fS/M_tA<=1$	0.000	0.000	0.000	0.076	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Member ID in CSiBridge	551	551	551	552	552	552	567	567	567	569	569	569	570	570	570	572	572	572
Member Label	14S-49S	14S-49S	14S-49S	49S-13S	49S-13S	49S-13S	2S-2S	2S-2S	2S-2S	2S-1S	2S-1S	2S-1S	4S-4S	4S-4S	4S-4S	4S-3S	4S-3S	4S-3S
Station (m)	0.0	2.3	4.6	0.0	1.3	2.6	0.0	0.4	0.7	0.0	2.7	5.4	0.0	0.4	0.7	0.0	2.8	5.7
Node Label at Station	14S	---	49S	49S	---	13S	2S	---	2S	2S	---	1S	4S	---	4S	4S	---	3S
Section #	Section 03	Section 03	Section 03	S 13-49	S 13-49	S 13-49	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1271	1510	1510	5186	5186	5186	1271	1271	1271	1271	1271	1271	998	998	998	998	998	998
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	3.26E+04	3.26E+04	3.26E+04	1.20E+06	1.20E+06	1.20E+06	1.32E+06	1.32E+06	1.32E+06	2.40E+04	2.40E+04	2.40E+04	1.09E+06	1.09E+06	1.09E+06	1.77E+04	1.77E+04	1.77E+04
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	937	937	937	3587	3587	3587	92753	92753	92753	1684	1684	1684	90077	90077	90077	1465	1465	1465
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.020	0.018	0.016
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.129	0.065	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.104	0.035	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.254	0.117	0.016

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.375	1.375	1.375	1.428	1.428	1.428	0.138	0.138	0.138	1.026	1.026	1.026	0.124	0.124	0.124	0.976	0.976	0.976
$C_{r\ (K=1)}$ (kN)	516	613	613	1994	1994	1994	1267	1267	1267	738	738	738	996	996	996	610	610	610
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.033	0.030	0.026
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.129	0.065	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.104	0.035	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.266	0.129	0.026

3.3. Lateral Torsional Buckling:

λ_{max}	1.375	1.375	1.375	1.428	1.428	1.428	0.138	0.138	0.138	1.026	1.026	1.026	0.124	0.124	0.124	0.976	0.976	0.976
C_r (kN)	516	613	613	1994	1994	1994	1267	1267	1267	738	738	738	996	996	996	610	610	610
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01
M_{rx} (kNm)	219	260	260	1097	1097	1097	272	272	272	209	209	209	214	214	214	95	95	95
M_{ry} (kNm)	30	35	35	94	94	94	30	30	30	30	30	30	29	29	29	29	29	29
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.033	0.030	0.026
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.275	0.137	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.104	0.035	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.412	0.202	0.026
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.940	0.793	0.968	0.527	0.335	0.154	0.000	0.000	0.000	0.715	0.582	0.484	0.000	0.000	0.000	0.412	0.202	0.028

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	573	573	573	575	575	575	576	576	576	578	578	578	279	279	279	280	280	280
Member Label	8S-8S	8S-8S	8S-8S	8S-7S	8S-7S	8S-7S	12S-12S	12S-12S	12S-12S	12S-11S	12S-11S	12S-11S	0N-2N	0N-2N	0N-2N	2N-4N	2N-4N	2N-4N
Station (m)	0.0	0.4	0.7	0.0	3.1	6.3	0.0	0.4	0.7	0.0	3.4	6.9	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	8S	---	8S	8S	---	7S	12S	---	12S	12S	---	11S	0N	---	2N	2N	---	4N
Section #	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord

Member Factored Load Effects:

C_f (kN)	0	0	0	20	18	15	0	0	0	27	25	22	31	31	31	28	28	28
$M_{fx\ (comp)}$ (kNm)	0	0	0	28	14	0	0	0	0	22	11	0	21	23	24	24	24	15
$M_{fy\ (comp)}$ (kNm)	0	0	0	4	2	0	0	0	0	4	2	0	14	10	10	10	5	8
T_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	785	785	785	793	793	793
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	21	23	24	24	24	15
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	14	10	10	10	5	8
V_{fx} (kN)	0	0	0	1	1	1	0	0	0	1	1	1	4	4	4	3	3	3
V_{fy} (kN)	0	0	0	4	4	4	0	0	0	3	3	3	10	6	6	7	7	11

Gross Section Properties:

Ag (mm^2)	6603	6603	6603	6603	6603	6603	6603	6603	6603	6603	6603	6603	12774	12774	12774	12774	12774	12774
I_x (mm^4)	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08
I_y (mm^4)	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08
J (mm^4)	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05
r_x (mm)	209	209	209	209	209	209	209	209	209	209	209	209	143	143	143	143	143	143
r_y (mm)	60	60	60	60	60	60	60	60	60	60	60	60	208	208	208	208	208	208
S_x (mm^3)	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06
S_y (mm^3)	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
L (mm)	724	724	724	6287	6287	6287	724	724	724	6896	6896	6896	5791	5791	5791	5791	5791	5791

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	573	573	573	575	575	575	576	576	576	578	578	578	279	279	279	280	280	280
Member Label	8S-8S	8S-8S	8S-8S	8S-7S	8S-7S	8S-7S	12S-12S	12S-12S	12S-12S	12S-11S	12S-11S	12S-11S	0N-2N	0N-2N	0N-2N	2N-4N	2N-4N	2N-4N
Station (m)	0.0	0.4	0.7	0.0	3.1	6.3	0.0	0.4	0.7	0.0	3.4	6.9	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	8S	---	8S	8S	---	7S	12S	---	12S	12S	---	11S	0N	---	2N	2N	---	4N
Section #	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0						
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels													5.2	5.2	5.2	5.2	5.2	5.2
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression													37.5	37.5	37.5	37.5	37.5	37.5
Webs in flexural compression													37.5	37.5	37.5	37.5	37.5	37.5
Webs in combined flexural and axial compression	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	37.5	37.5	37.5	37.5	37.5	37.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	573	573	573	575	575	575	576	576	576	578	578	578	279	279	279	280	280	280
Member Label	8S-8S	8S-8S	8S-8S	8S-7S	8S-7S	8S-7S	12S-12S	12S-12S	12S-12S	12S-11S	12S-11S	12S-11S	0N-2N	0N-2N	0N-2N	2N-4N	2N-4N	2N-4N
Station (m)	0.0	0.4	0.7	0.0	3.1	6.3	0.0	0.4	0.7	0.0	3.4	6.9	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	8S	---	8S	8S	---	7S	12S	---	12S	12S	---	11S	0N	---	2N	2N	---	4N
Section #	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	724	724	724	6287	6287	6287	724	724	724	6896	6896	6896	5791	5791	5791	5791	5791	5791
L_y (mm)	724	724	724	6287	6287	6287	724	724	724	6896	6896	6896	5791	5791	5791	5791	5791	5791
λ_{max}	0.124	0.124	0.124	1.081	1.081	1.081	0.124	0.124	0.124	1.185	1.185	1.185	0.418	0.418	0.418	0.418	0.418	0.418
C_r (kN)	995.6	995.6	995.6	548.5	548.5	548.5	995.6	995.6	995.6	492.5	492.5	492.5	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3
$(kL/r)_{max}$	12.1	12.1	12.1	104.8	104.8	104.8	12.1	12.1	12.1	114.9	114.9	114.9	40.5	40.5	40.5	40.5	40.5	40.5
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	90077	90077	90077	1194	1194	1194	90077	90077	90077	993	993	993	15356	15356	15356	15356	15356	15356

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	439	439	439	439	439	439
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	380	380	380	380	380	380
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	439	439	439	439	439	439
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	380	380	380	380	380	380
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	6477	6477	6477	5658	5658	5658	6477	6477	6477	6206	6206	6206	6477	6477	6477	6477	6477	6477
A_c (mm^2)	3302	3302	3302	3302	3302	3302	3302	3302	3302	3302	3302	3302	6387	6387	6387	6387	6387	6387
A_d (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	907	907	907	907	907	907
A_b (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	907	907	907	907	907	907
μ	0.0388	0.0388	0.0388	0.0508	0.0508	0.0508	0.0388	0.0388	0.0388	0.0422	0.0422	0.0422	0.0479	0.0479	0.0479	0.0479	0.0479	0.0479
P_{cr}/P_e (Fig.3.51)	0.89	0.89	0.89	0.86	0.86	0.86	0.89	0.89	0.89	0.88	0.88	0.88	0.86	0.86	0.86	0.86	0.86	0.86
k'(sqrt(P_e/P_{cr}))	1.063	1.063	1.063	1.081	1.081	1.081	1.063	1.063	1.063	1.068	1.068	1.068	1.076	1.076	1.076	1.076	1.076	1.076
λ_v	0.132	0.132	0.132	1.168	1.168	1.168	0.132	0.132	0.132	1.266	1.266	1.266	0.309	0.309	0.309	0.309	0.309	0.309
Cr' (kN)	995.1	995.1	995.1	501.6	501.6	501.6	995.1	995.1	995.1	453.2	453.2	453.2	1871.7	1871.7	1871.7	1871.7	1871.7	1871.7
Lacing Governs?	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	No	No	No	No	No	No

Member ID in CSiBridge	573	573	573	575	575	575	576	576	576	578	578	578	279	279	279	280	280	280
Member Label	8S-8S	8S-8S	8S-8S	8S-7S	8S-7S	8S-7S	12S-12S	12S-12S	12S-12S	12S-11S	12S-11S	12S-11S	0N-2N	0N-2N	0N-2N	2N-4N	2N-4N	2N-4N
Station (m)	0.0	0.4	0.7	0.0	3.1	6.3	0.0	0.4	0.7	0.0	3.4	6.9	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	8S	---	8S	8S	---	7S	12S	---	12S	12S	---	11S	0N	---	2N	2N	---	4N
Section #	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	3302	3302	3302	3302	3302	3302	3302	3302	3302	3302	3302	3302	6387	6387	6387	6387	6387	6387
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	995.6	995.6	995.6	501.6	501.6	501.6	995.6	995.6	995.6	453.2	453.2	453.2	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	5282	5282	5282	5282	5282	5282	5282	5282	5282	5282	5282	5282	10219	10219	10219	10219	10219	10219
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054	2039	2039	2039	2039	2039	2039
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	5841	5841	5841	5079	5079	5079	5841	5841	5841	5079	5079	5079	8751	8751	8751	8751	8751	8751
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	5841	5841	5841	5079	5079	5079	5841	5841	5841	5079	5079	5079	8751	8751	8751	8751	8751	8751
$A_{n(corrosion)}$ (mm^2)	4673	4673	4673	4063	4063	4063	4673	4673	4673	4063	4063	4063	7001	7001	7001	7001	7001	7001
$T_{r(b)}$ (kN)	1570	1570	1570	1365	1365	1365	1570	1570	1570	1365	1365	1365	2352	2352	2352	2352	2352	2352
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	4673	4673	4673	4063	4063	4063	4673	4673	4673	4063	4063	4063	7001	7001	7001	7001	7001	7001
$T_{r(c)}$ (kN)	1570	1570	1570	1365	1365	1365	1570	1570	1570	1365	1365	1365	2352	2352	2352	2352	2352	2352
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	573	573	573	575	575	575	576	576	576	578	578	578	279	279	279	280	280	280
Member Label	8S-8S	8S-8S	8S-8S	8S-7S	8S-7S	8S-7S	12S-12S	12S-12S	12S-12S	12S-11S	12S-11S	12S-11S	0N-2N	0N-2N	0N-2N	2N-4N	2N-4N	2N-4N
Station (m)	0.0	0.4	0.7	0.0	3.1	6.3	0.0	0.4	0.7	0.0	3.4	6.9	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	8S	---	8S	8S	---	7S	12S	---	12S	12S	---	11S	0N	---	2N	2N	---	4N
Section #	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	1570	1570	1570	1365	1365	1365	1570	1570	1570	1365	1365	1365	2352	2352	2352	2352	2352	2352
$(kL/r)_{max}$	12	12	12	105	105	105	12	12	12	115	115	115	40	40	40	40	40	40
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054	2039	2039	2039	2039	2039	2039
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	201	201	201	201	201	201	201	201	201	201	201	201	219	219	219	219	219	219
$M_{ry(Laterally\ Supported)}$ (kNm)	29	29	29	29	29	29	29	29	29	29	29	29	386	386	386	386	386	386
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	724	724	724	6287	6287	6287	724	724	724	6896	6896	6896	5791	5791	5791	5791	5791	5791
L_{uy} (mm)	724	724	724	6287	6287	6287	724	724	724	6896	6896	6896	5791	5791	5791	5791	5791	5791
M_{ux} (kNm) (y weak)	978	978	978	113	113	113	978	978	978	103	103	103	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	922	922	922	922	922	922
M_{rx} (kNm)	213.9	213.9	213.9	85.6	85.6	85.6	213.9	213.9	213.9	78.0	78.0	78.0	218.6	218.6	218.6	218.6	218.6	218.6
M_{ry} (kNm)	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	375.5	375.5	375.5	375.5	375.5	375.5

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.000	0.000	0.000	0.040	0.036	0.030	0.000	0.000	0.000	0.060	0.055	0.049	0.017	0.017	0.017	0.016	0.016	0.016
(T_f/T_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.385	0.385	0.385	0.389	0.389	0.389

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.385	0.385	0.385	0.389	0.389	0.389
M_{fx}/M_{rx}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.096	0.105	0.110	0.110	0.110	0.069
M_{fy}/M_{ry}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.037	0.027	0.027	0.027	0.013	0.021
$T_f/T_r+M_f/M_r$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.518	0.517	0.521	0.525	0.512	0.479
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PARSONS

Member ID in CSiBridge	573	573	573	575	575	575	576	576	576	578	578	578	279	279	279	280	280	280
Member Label	8S-8S	8S-8S	8S-8S	8S-7S	8S-7S	8S-7S	12S-12S	12S-12S	12S-12S	12S-11S	12S-11S	12S-11S	0N-2N	0N-2N	0N-2N	2N-4N	2N-4N	2N-4N
Station (m)	0.0	0.4	0.7	0.0	3.1	6.3	0.0	0.4	0.7	0.0	3.4	6.9	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	8S	---	8S	8S	---	7S	12S	---	12S	12S	---	11S	0N	---	2N	2N	---	4N
Section #	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	998	998	998	998	998	998	998	998	998	998	998	998	1931	1931	1931	1931	1931	1931
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.09E+06	1.09E+06	1.09E+06	1.44E+04	1.44E+04	1.44E+04	1.09E+06	1.09E+06	1.09E+06	1.20E+04	1.20E+04	1.20E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	90077	90077	90077	1194	1194	1194	90077	90077	90077	993	993	993	32545	32545	32545	32545	32545	32545
U_{1y}	1.00	1.00	1.00	1.02	1.02	1.01	1.00	1.00	1.00	1.03	1.03	1.02	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.020	0.018	0.015	0.000	0.000	0.000	0.027	0.025	0.022	0.016	0.016	0.016	0.014	0.014	0.014
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.139	0.070	0.000	0.000	0.000	0.000	0.110	0.055	0.000	0.096	0.105	0.110	0.110	0.110	0.069
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.140	0.070	0.000	0.000	0.000	0.000	0.141	0.070	0.000	0.036	0.026	0.026	0.026	0.013	0.021
Interaction	0.000	0.000	0.000	0.299	0.157	0.015	0.000	0.000	0.000	0.278	0.150	0.022	0.149	0.147	0.152	0.150	0.137	0.104

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.124	0.124	0.124	1.081	1.081	1.081	0.124	0.124	0.124	1.185	1.185	1.185	0.418	0.418	0.418	0.418	0.418	0.418
$C_{r\ (K=1)}$ (kN)	996	996	996	549	549	549	996	996	996	492	492	492	1803	1803	1803	1803	1803	1803
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.02	1.02	1.01	1.00	1.00	1.00	1.03	1.03	1.02	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.036	0.033	0.027	0.000	0.000	0.000	0.055	0.051	0.045	0.017	0.017	0.017	0.016	0.016	0.016
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.139	0.070	0.000	0.000	0.000	0.000	0.110	0.055	0.000	0.096	0.105	0.110	0.110	0.110	0.069
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.140	0.070	0.000	0.000	0.000	0.000	0.141	0.070	0.000	0.036	0.026	0.026	0.026	0.013	0.021
Interaction	0.000	0.000	0.000	0.315	0.172	0.027	0.000	0.000	0.000	0.305	0.176	0.045	0.150	0.149	0.153	0.151	0.138	0.105

3.3. Lateral Torsional Buckling:

λ_{max}	0.124	0.124	0.124	1.081	1.081	1.081	0.124	0.124	0.124	1.185	1.185	1.185	0.418	0.418	0.418	0.418	0.418	0.418
C_r (kN)	996	996	996	549	549	549	996	996	996	492	492	492	1803	1803	1803	1803	1803	1803
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.02	1.02	1.01	1.00	1.00	1.00	1.03	1.03	1.02	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	214	214	214	86	86	86	214	214	214	78	78	78	219	219	219	219	219	219
M_{ry} (kNm)	29	29	29	29	29	29	29	29	29	29	29	29	375	375	375	375	375	375
C_f/C_r	0.000	0.000	0.000	0.036	0.033	0.027	0.000	0.000	0.000	0.055	0.051	0.045	0.017	0.017	0.017	0.016	0.016	0.016
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.328	0.164	0.000	0.000	0.000	0.000	0.283	0.141	0.000	0.096	0.105	0.110	0.110	0.110	0.069
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.140	0.070	0.000	0.000	0.000	0.000	0.141	0.070	0.000	0.037	0.027	0.027	0.027	0.013	0.021
Interaction	0.000	0.000	0.000	0.504	0.266	0.027	0.000	0.000	0.000	0.479	0.262	0.045	0.151	0.149	0.154	0.152	0.139	0.106
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.000	0.000	0.000	0.504	0.266	0.030	0.000	0.000	0.000	0.479	0.262	0.049	0.518	0.517	0.521	0.525	0.512	0.479

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	281	281	281	282	282	282	283	283	283	284	284	284	285	285	285	286	286	286
Member Label	4N-6N	4N-6N	4N-6N	6N-8N	6N-8N	6N-8N	8N-10N	8N-10N	8N-10N	10N-12N	10N-12N	10N-12N	12N-14N	12N-14N	12N-14N	14N-16N	14N-16N	14N-16N
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station	4N	---	6N	6N	---	8N	8N	---	10N	10N	---	12N	12N	---	14N	14N	---	16N
Section #	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord

Member Factored Load Effects:

C_f (kN)	382	382	382	371	371	371	980	980	980	993	993	993	1855	1855	1855	373	373	373
$M_{fx\ (comp)}$ (kNm)	15	28	32	30	26	15	17	23	25	23	18	32	35	27	38	38	58	96
$M_{fy\ (comp)}$ (kNm)	8	8	8	8	7	6	6	8	9	9	9	11	11	12	14	14	16	20
T_f (kN)	1209	1209	1209	1202	1202	1202	483	483	483	477	477	477	0	0	0	783	783	783
$M_{fx\ (tension)}$ (kNm)	15	28	32	30	26	15	17	23	25	23	18	32	0	0	0	38	58	96
$M_{fy\ (tension)}$ (kNm)	8	8	8	8	7	6	6	8	9	9	9	11	0	0	0	14	16	20
V_{fx} (kN)	2	2	2	2	2	2	2	2	2	3	3	3	4	4	4	4	4	4
V_{fy} (kN)	12	8	6	6	7	11	11	7	7	5	9	13	12	6	13	22	17	11

Gross Section Properties:

Ag (mm^2)	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	20903	20903	20903	12774	12774	12774
I_x (mm^4)	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	3.34E+08	3.34E+08	3.34E+08	2.61E+08	2.61E+08	2.61E+08
I_y (mm^4)	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	9.14E+08	9.14E+08	9.14E+08	8.94E+08	8.94E+08	8.94E+08
J (mm^4)	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	2.92E+06	2.92E+06	2.92E+06	7.19E+05	7.19E+05	7.19E+05
r_x (mm)	143	143	143	143	143	143	143	143	143	143	143	143	126	126	126	143	143	143
r_y (mm)	208	208	208	208	208	208	208	208	208	208	208	208	209	209	209	265	265	265
S_x (mm^3)	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.75E+06	1.75E+06	1.75E+06	1.37E+06	1.37E+06	1.37E+06
S_y (mm^3)	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	4.00E+06	4.00E+06	4.00E+06	2.73E+06	2.73E+06	2.73E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
L (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	7722	7722	7722

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	281	281	281	282	282	282	283	283	283	284	284	284	285	285	285	286	286	286
Member Label	4N-6N	4N-6N	4N-6N	6N-8N	6N-8N	6N-8N	8N-10N	8N-10N	8N-10N	10N-12N	10N-12N	10N-12N	12N-14N	12N-14N	12N-14N	14N-16N	14N-16N	14N-16N
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station	4N	---	6N	6N	---	8N	8N	---	10N	10N	---	12N	12N	---	14N	14N	---	16N
Section #	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	32.0	32.0	32.0	37.5	37.5	37.5
Webs in flexural compression	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	32.0	32.0	32.0	37.5	37.5	37.5
Webs in combined flexural and axial compression	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	32.0	32.0	32.0	37.5	37.5	37.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	281	281	281	282	282	282	283	283	283	284	284	284	285	285	285	286	286	286
Member Label	4N-6N	4N-6N	4N-6N	6N-8N	6N-8N	6N-8N	8N-10N	8N-10N	8N-10N	10N-12N	10N-12N	10N-12N	12N-14N	12N-14N	12N-14N	14N-16N	14N-16N	14N-16N
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station	4N	---	6N	6N	---	8N	8N	---	10N	10N	---	12N	12N	---	14N	14N	---	16N
Section #	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	7722	7722	7722
L_y (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	7722	7722	7722
λ_{max}	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.474	0.474	0.474	0.557	0.557	0.557
C_r (kN)	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	2875.0	2875.0	2875.0	1677.0	1677.0	1677.0
$(kL/r)_{max}$	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	46.0	46.0	46.0	54.0	54.0	54.0
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	15356	15356	15356	15356	15356	15356	15356	15356	15356	15356	15356	15356	19655	19655	19655	8638	8638	8638

Shear Flexibility Factor:

1. Lacing:

a (mm)	439	439	439	439	439	439	439	439	439	439	439	439	439	439	439	425	425	425
b (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	368	368	368
ε_aa (mm)	439	439	439	439	439	439	439	439	439	439	439	439	439	439	439	425	425	425
ε_bb (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	368	368	368
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477
A_c (mm^2)	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	10452	10452	10452	6387	6387	6387
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	0.0479	0.0479	0.0479	0.0479	0.0479	0.0479	0.0479	0.0479	0.0479	0.0479	0.0479	0.0479	0.0784	0.0784	0.0784	0.0450	0.0450	0.0450
P_{cr}/P_e (Fig.3.51)	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.80	0.80	0.80	0.87	0.87	0.87
k'(sqrt(P_e/P_{cr}))	1.076	1.076	1.076	1.076	1.076	1.076	1.076	1.076	1.076	1.076	1.076	1.076	1.118	1.118	1.118	1.072	1.072	1.072
λ_v	0.309	0.309	0.309	0.309	0.309	0.309	0.309	0.309	0.309	0.309	0.309	0.309	0.320	0.320	0.320	0.322	0.322	0.322
Cr' (kN)	1871.7	1871.7	1871.7	1871.7	1871.7	1871.7	1871.7	1871.7	1871.7	1871.7	1871.7	1871.7	3054.0	3054.0	3054.0	1864.9	1864.9	1864.9
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	281	281	281	282	282	282	283	283	283	284	284	284	285	285	285	286	286	286
Member Label	4N-6N	4N-6N	4N-6N	6N-8N	6N-8N	6N-8N	8N-10N	8N-10N	8N-10N	10N-12N	10N-12N	10N-12N	12N-14N	12N-14N	12N-14N	14N-16N	14N-16N	14N-16N
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station	4N	---	6N	6N	---	8N	8N	---	10N	10N	---	12N	12N	---	14N	14N	---	16N
Section #	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	10452	10452	10452	6387	6387	6387
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	2875.0	2875.0	2875.0	1677.0	1677.0	1677.0

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	10219	10219	10219	10219	10219	10219	10219	10219	10219	10219	10219	10219	16722	16722	16722	10219	10219	10219
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	3336	3336	3336	2039	2039	2039
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	16880	16880	16880	8751	8751	8751
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	16880	16880	16880	8751	8751	8751
$A_{n(corrosion)}$ (mm^2)	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	13504	13504	13504	7001	7001	7001
$T_{r(b)}$ (kN)	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	4537	4537	4537	2352	2352	2352
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	13504	13504	13504	7001	7001	7001
$T_{r(c)}$ (kN)	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	4537	4537	4537	2352	2352	2352
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	281	281	281	282	282	282	283	283	283	284	284	284	285	285	285	286	286	286
Member Label	4N-6N	4N-6N	4N-6N	6N-8N	6N-8N	6N-8N	8N-10N	8N-10N	8N-10N	10N-12N	10N-12N	10N-12N	12N-14N	12N-14N	12N-14N	14N-16N	14N-16N	14N-16N
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station	4N	---	6N	6N	---	8N	8N	---	10N	10N	---	12N	12N	---	14N	14N	---	16N
Section #	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	4537	4537	4537	2352	2352	2352
$(kL/r)_{max}$	40	40	40	40	40	40	40	40	40	40	40	40	46	46	46	54	54	54
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	3336	3336	3336	2039	2039	2039
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	219	219	219	219	219	219	219	219	219	219	219	219	280	280	280	219	219	219
$M_{ry(Laterally\ Supported)}$ (kNm)	386	386	386	386	386	386	386	386	386	386	386	386	638	638	638	436	436	436
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	7722	7722	7722
L_{uy} (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	7722	7722	7722
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	922	922	922	922	922	922	922	922	922	922	922	922	2102	2102	2102	692	692	692
M_{rx} (kNm)	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6	279.8	279.8	279.8	218.6	218.6	218.6
M_{ry} (kNm)	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5	651.9	651.9	651.9	384.7	384.7	384.7

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
$(V_f/V_r)<=1$																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.212	0.212	0.212	0.206	0.206	0.206	0.543	0.543	0.543	0.551	0.551	0.551	0.645	0.645	0.645	0.222	0.222	0.222
$(T_f/T_r)<=1$	0.593	0.593	0.593	0.590	0.590	0.590	0.237	0.237	0.237	0.234	0.234	0.234	0.000	0.000	0.000	0.384	0.384	0.384

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.593	0.593	0.593	0.590	0.590	0.590	0.237	0.237	0.237	0.234	0.234	0.234	0.000	0.000	0.000	0.384	0.384	0.384
$M_{fx}/M_{rx}<=1$	0.069	0.128	0.146	0.137	0.119	0.069	0.078	0.105	0.114	0.105	0.082	0.146	0.000	0.000	0.000	0.174	0.265	0.439
$M_{fy}/M_{ry}<=1$	0.021	0.021	0.021	0.021	0.019	0.016	0.016	0.021	0.024	0.024	0.024	0.029	0.000	0.000	0.000	0.036	0.042	0.052
$T_f/T_r+M_f/M_r<=1$	0.683	0.742	0.761	0.748	0.727	0.674	0.331	0.363	0.375	0.363	0.340	0.410	0.000	0.000	0.000	0.594	0.691	0.875
$M_f/M_r-T_fS/M_tA<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PARSONS

Member ID in CSiBridge	281	281	281	282	282	282	283	283	283	284	284	284	285	285	285	286	286	286
Member Label	4N-6N	4N-6N	4N-6N	6N-8N	6N-8N	6N-8N	8N-10N	8N-10N	8N-10N	10N-12N	10N-12N	10N-12N	12N-14N	12N-14N	12N-14N	14N-16N	14N-16N	14N-16N
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station	4N	---	6N	6N	---	8N	8N	---	10N	10N	---	12N	12N	---	14N	14N	---	16N
Section #	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	3161	3161	3161	1931	1931	1931
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.97E+04	1.97E+04	1.97E+04	8.64E+03	8.64E+03	8.64E+03
U_{1x}	1.03	1.03	1.03	1.02	1.02	1.02	1.07	1.07	1.07	1.07	1.07	1.07	1.10	1.10	1.10	1.05	1.05	1.05
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	32545	32545	32545	32545	32545	32545	32545	32545	32545	32545	32545	32545	53809	53809	53809	29610	29610	29610
U_{1y}	1.01	1.01	1.01	1.01	1.01	1.01	1.03	1.03	1.03	1.03	1.03	1.03	1.04	1.04	1.04	1.01	1.01	1.01
C_f/C_r	**0.198**	**0.198**	**0.198**	**0.192**	**0.192**	**0.192**	**0.507**	**0.507**	**0.507**	**0.514**	**0.514**	**0.514**	**0.587**	**0.587**	**0.587**	**0.193**	**0.193**	**0.193**
$U_{1x}M_{fx}/M_{rx}$	**0.070**	**0.131**	**0.150**	**0.141**	**0.122**	**0.070**	**0.083**	**0.112**	**0.122**	**0.112**	**0.088**	**0.157**	**0.138**	**0.107**	**0.150**	**0.182**	**0.277**	**0.459**
$U_{1y}M_{fy}/M_{ry}$	**0.021**	**0.021**	**0.021**	**0.021**	**0.018**	**0.016**	**0.016**	**0.021**	**0.024**	**0.024**	**0.024**	**0.029**	**0.018**	**0.019**	**0.023**	**0.033**	**0.037**	**0.046**
Interaction	**0.289**	**0.350**	**0.369**	**0.354**	**0.332**	**0.278**	**0.606**	**0.641**	**0.654**	**0.651**	**0.626**	**0.700**	**0.743**	**0.713**	**0.760**	**0.407**	**0.508**	**0.699**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.474	0.474	0.474	0.557	0.557	0.557
$C_{r\ (K=1)}$ (kN)	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	2875	2875	2875	1677	1677	1677
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.03	1.03	1.03	1.02	1.02	1.02	1.07	1.07	1.07	1.07	1.07	1.07	1.10	1.10	1.10	1.05	1.05	1.05
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.01	1.01	1.01	1.01	1.01	1.01	1.03	1.03	1.03	1.03	1.03	1.03	1.04	1.04	1.04	1.01	1.01	1.01
C_f/C_r	**0.212**	**0.212**	**0.212**	**0.206**	**0.206**	**0.206**	**0.543**	**0.543**	**0.543**	**0.551**	**0.551**	**0.551**	**0.645**	**0.645**	**0.645**	**0.222**	**0.222**	**0.222**
$U_{1x}M_{fx}/M_{rx}$	**0.070**	**0.131**	**0.150**	**0.141**	**0.122**	**0.070**	**0.083**	**0.112**	**0.122**	**0.112**	**0.088**	**0.157**	**0.138**	**0.107**	**0.150**	**0.182**	**0.277**	**0.459**
$U_{1y}M_{fy}/M_{ry}$	**0.021**	**0.021**	**0.021**	**0.021**	**0.018**	**0.016**	**0.016**	**0.021**	**0.024**	**0.024**	**0.024**	**0.029**	**0.018**	**0.019**	**0.023**	**0.033**	**0.037**	**0.046**
Interaction	**0.303**	**0.364**	**0.383**	**0.367**	**0.346**	**0.292**	**0.643**	**0.677**	**0.690**	**0.687**	**0.663**	**0.737**	**0.801**	**0.771**	**0.818**	**0.437**	**0.537**	**0.728**

3.3. Lateral Torsional Buckling:

λ_{max}	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.474	0.474	0.474	0.557	0.557	0.557
C_r (kN)	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	2875	2875	2875	1677	1677	1677
U_{1x}	1.03	1.03	1.03	1.02	1.02	1.02	1.07	1.07	1.07	1.07	1.07	1.07	1.10	1.10	1.10	1.05	1.05	1.05
U_{1y}	1.01	1.01	1.01	1.01	1.01	1.01	1.03	1.03	1.03	1.03	1.03	1.03	1.04	1.04	1.04	1.01	1.01	1.01
M_{rx} (kNm)	219	219	219	219	219	219	219	219	219	219	219	219	280	280	280	219	219	219
M_{ry} (kNm)	375	375	375	375	375	375	375	375	375	375	375	375	652	652	652	385	385	385
C_f/C_r	**0.212**	**0.212**	**0.212**	**0.206**	**0.206**	**0.206**	**0.543**	**0.543**	**0.543**	**0.551**	**0.551**	**0.551**	**0.645**	**0.645**	**0.645**	**0.222**	**0.222**	**0.222**
$U_{1x}M_{fx}/M_{rx}$	**0.070**	**0.131**	**0.150**	**0.141**	**0.122**	**0.070**	**0.083**	**0.112**	**0.122**	**0.112**	**0.088**	**0.157**	**0.138**	**0.107**	**0.150**	**0.182**	**0.277**	**0.459**
$U_{1y}M_{fy}/M_{ry}$	**0.022**	**0.022**	**0.022**	**0.022**	**0.019**	**0.016**	**0.016**	**0.022**	**0.025**	**0.025**	**0.025**	**0.030**	**0.017**	**0.019**	**0.022**	**0.037**	**0.042**	**0.053**
Interaction	**0.304**	**0.365**	**0.384**	**0.368**	**0.346**	**0.292**	**0.643**	**0.678**	**0.690**	**0.688**	**0.663**	**0.737**	**0.801**	**0.771**	**0.817**	**0.441**	**0.542**	**0.734**
Demand/Capacity ≤ 1	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
Highest Ratio	**0.683**	**0.742**	**0.761**	**0.748**	**0.727**	**0.674**	**0.643**	**0.678**	**0.690**	**0.688**	**0.663**	**0.737**	**0.801**	**0.771**	**0.818**	**0.594**	**0.691**	**0.875**

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	559	559	559	560	560	560	561	561	561	562	562	562	563	563	563	564	564	564
Member Label	0S-2S	0S-2S	0S-2S	2S-4S	2S-4S	2S-4S	4S-6S	4S-6S	4S-6S	6S-8S	6S-8S	6S-8S	8S-10S	8S-10S	8S-10S	10S-12S	10S-12S	10S-12S
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	0S	---	2S	2S	---	4S	4S	---	6S	6S	---	8S	8S	---	10S	10S	---	12S
Section #	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord

Member Factored Load Effects:

C_f (kN)	0	0	0	0	0	0	338	338	338	316	316	316	968	968	968	971	971	971
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	16	29	35	32	27	16	17	24	25	26	18	33
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	5	4	4	4	4	5	5	5	4	4	5	5
T_f (kN)	816	816	816	827	827	827	1288	1288	1288	1286	1286	1286	522	522	522	517	517	517
$M_{fx\ (tension)}$ (kNm)	24	24	26	25	25	16	16	29	35	32	27	16	17	24	25	26	18	33
$M_{fy\ (tension)}$ (kNm)	15	9	6	6	6	5	5	4	4	4	4	5	5	5	4	4	5	5
V_{fx} (kN)	3	3	3	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2
V_{fy} (kN)	11	7	6	7	7	11	12	8	6	6	8	12	11	7	7	5	9	13

Gross Section Properties:

Ag (mm^2)	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774
I_x (mm^4)	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08
I_y (mm^4)	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08
J (mm^4)	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05
r_x (mm)	143	143	143	143	143	143	143	143	143	143	143	143	143	143	143	143	143	143
r_y (mm)	208	208	208	208	208	208	208	208	208	208	208	208	208	208	208	208	208	208
S_x (mm^3)	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06
S_y (mm^3)	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
L (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	559	559	559	560	560	560	561	561	561	562	562	562	563	563	563	564	564	564
Member Label	0S-2S	0S-2S	0S-2S	2S-4S	2S-4S	2S-4S	4S-6S	4S-6S	4S-6S	6S-8S	6S-8S	6S-8S	8S-10S	8S-10S	8S-10S	10S-12S	10S-12S	10S-12S
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	0S	---	2S	2S	---	4S	4S	---	6S	6S	---	8S	8S	---	10S	10S	---	12S
Section #	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5
Webs in flexural compression	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5
Webs in combined flexural and axial compression	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	559	559	559	560	560	560	561	561	561	562	562	562	563	563	563	564	564	564
Member Label	0S-2S	0S-2S	0S-2S	2S-4S	2S-4S	2S-4S	4S-6S	4S-6S	4S-6S	6S-8S	6S-8S	6S-8S	8S-10S	8S-10S	8S-10S	10S-12S	10S-12S	10S-12S
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	0S	---	2S	2S	---	4S	4S	---	6S	6S	---	8S	8S	---	10S	10S	---	12S
Section #	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
L_y (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
λ_{max}	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418
C_r (kN)	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3
$(kL/r)_{max}$	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	15356	15356	15356	15356	15356	15356	15356	15356	15356	15356	15356	15356	15356	15356	15356	15356	15356	15356

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477
A_c (mm^2)	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450
P_{cr}/P_e (Fig.3.51)	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
k'(sqrt(P_e/P_{cr}))	1.072	1.072	1.072	1.072	1.072	1.072	1.072	1.072	1.072	1.072	1.072	1.072	1.072	1.072	1.072	1.072	1.072	1.072
λ_v	0.308	0.308	0.308	0.308	0.308	0.308	0.308	0.308	0.308	0.308	0.308	0.308	0.308	0.308	0.308	0.308	0.308	0.308
Cr' (kN)	1872.3	1872.3	1872.3	1872.3	1872.3	1872.3	1872.3	1872.3	1872.3	1872.3	1872.3	1872.3	1872.3	1872.3	1872.3	1872.3	1872.3	1872.3
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	559	559	559	560	560	560	561	561	561	562	562	562	563	563	563	564	564	564
Member Label	0S-2S	0S-2S	0S-2S	2S-4S	2S-4S	2S-4S	4S-6S	4S-6S	4S-6S	6S-8S	6S-8S	6S-8S	8S-10S	8S-10S	8S-10S	10S-12S	10S-12S	10S-12S
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	0S	---	2S	2S	---	4S	4S	---	6S	6S	---	8S	8S	---	10S	10S	---	12S
Section #	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	10219	10219	10219	10219	10219	10219	10219	10219	10219	10219	10219	10219	10219	10219	10219	10219	10219	10219
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751
$A_{n(corrosion)}$ (mm^2)	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001
$T_{r(b)}$ (kN)	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001
$T_{r(c)}$ (kN)	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	559	559	559	560	560	560	561	561	561	562	562	562	563	563	563	564	564	564
Member Label	0S-2S	0S-2S	0S-2S	2S-4S	2S-4S	2S-4S	4S-6S	4S-6S	4S-6S	6S-8S	6S-8S	6S-8S	8S-10S	8S-10S	8S-10S	10S-12S	10S-12S	10S-12S
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	0S	---	2S	2S	---	4S	4S	---	6S	6S	---	8S	8S	---	10S	10S	---	12S
Section #	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352
$(kL/r)_{max}$	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	219	219	219	219	219	219	219	219	219	219	219	219	219	219	219	219	219	219
$M_{ry(Laterally\ Supported)}$ (kNm)	386	386	386	386	386	386	386	386	386	386	386	386	386	386	386	386	386	386
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
L_{uy} (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	922	922	922	922	922	922	922	922	922	922	922	922	922	922	922	922	922	922
M_{rx} (kNm)	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6
M_{ry} (kNm)	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y/w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.187	0.187	0.187	0.175	0.175	0.175	0.537	0.537	0.537	0.538	0.538	0.538
(T_f/T_r)<=1	0.400	0.400	0.400	0.406	0.406	0.406	0.632	0.632	0.632	0.631	0.631	0.631	0.256	0.256	0.256	0.254	0.254	0.254

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.400	0.400	0.400	0.406	0.406	0.406	0.632	0.632	0.632	0.631	0.631	0.631	0.256	0.256	0.256	0.254	0.254	0.254
M_{fx}/M_{rx}<=1	0.110	0.110	0.119	0.114	0.114	0.073	0.073	0.133	0.160	0.146	0.124	0.073	0.078	0.110	0.114	0.119	0.082	0.151
M_{fy}/M_{ry}<=1	0.040	0.024	0.016	0.016	0.016	0.013	0.013	0.011	0.011	0.011	0.011	0.013	0.013	0.013	0.011	0.011	0.013	0.013
$T_f/T_r+M_f/M_r$<=1	0.550	0.534	0.535	0.536	0.536	0.492	0.718	0.775	0.803	0.788	0.765	0.717	0.347	0.379	0.381	0.383	0.349	0.418
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PARSONS

Member ID in CSiBridge	559	559	559	560	560	560	561	561	561	562	562	562	563	563	563	564	564	564
Member Label	0S-2S	0S-2S	0S-2S	2S-4S	2S-4S	2S-4S	4S-6S	4S-6S	4S-6S	6S-8S	6S-8S	6S-8S	8S-10S	8S-10S	8S-10S	10S-12S	10S-12S	10S-12S
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	0S	---	2S	2S	---	4S	4S	---	6S	6S	---	8S	8S	---	10S	10S	---	12S
Section #	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.02	1.02	1.02	1.02	1.02	1.02	1.07	1.07	1.07	1.07	1.07	1.07
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	32545	32545	32545	32545	32545	32545	32545	32545	32545	32545	32545	32545	32545	32545	32545	32545	32545	32545
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.03	1.03	1.03	1.03	1.03	1.03
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.175	0.175	0.175	0.164	0.164	0.164	0.501	0.501	0.501	0.503	0.503	0.503
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.075	0.136	0.164	0.149	0.126	0.075	0.083	0.117	0.122	0.127	0.088	0.161
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.013	0.010	0.010	0.010	0.010	0.013	0.013	0.013	0.011	0.011	0.013	0.013
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.263	0.321	0.349	0.324	0.300	0.251	0.598	0.632	0.634	0.640	0.604	0.677

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418
$C_{r\ (K=1)}$ (kN)	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.02	1.02	1.02	1.02	1.02	1.02	1.07	1.07	1.07	1.07	1.07	1.07
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.03	1.03	1.03	1.03	1.03	1.03
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.187	0.187	0.187	0.175	0.175	0.175	0.537	0.537	0.537	0.538	0.538	0.538
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.075	0.136	0.164	0.149	0.126	0.075	0.083	0.117	0.122	0.127	0.088	0.161
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.013	0.010	0.010	0.010	0.010	0.013	0.013	0.013	0.011	0.011	0.013	0.013
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.275	0.334	0.362	0.335	0.312	0.263	0.633	0.667	0.670	0.676	0.640	0.713

3.3. Lateral Torsional Buckling:

λ_{max}	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418
C_r (kN)	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.02	1.02	1.02	1.02	1.02	1.02	1.07	1.07	1.07	1.07	1.07	1.07
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.03	1.03	1.03	1.03	1.03	1.03
M_{rx} (kNm)	219	219	219	219	219	219	219	219	219	219	219	219	219	219	219	219	219	219
M_{ry} (kNm)	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.187	0.187	0.187	0.175	0.175	0.175	0.537	0.537	0.537	0.538	0.538	0.538
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.075	0.136	0.164	0.149	0.126	0.075	0.083	0.117	0.122	0.127	0.088	0.161
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.013	0.011	0.011	0.011	0.011	0.013	0.014	0.014	0.011	0.011	0.014	0.014
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.276	0.334	0.362	0.335	0.312	0.263	0.634	0.668	0.670	0.676	0.640	0.713
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.550	0.534	0.535	0.536	0.536	0.492	0.718	0.775	0.803	0.788	0.765	0.717	0.634	0.668	0.670	0.676	0.640	0.713

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	565	565	565	566	566	566	417	417	417	418	418	418	419	419	419	420	420	420
Member Label	12S-14S	12S-14S	12S-14S	14S-16S	14S-16S	14S-16S	13N-48N	13N-48N	13N-48N	48N-11N	48N-11N	48N-11N	11N-9N	11N-9N	11N-9N	9N-7N	9N-7N	9N-7N
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	1.0	2.0	0.0	1.9	3.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	12S	---	14S	14S	---	16S	13N	---	48N	48N	---	11N	11N	---	9N	9N	---	7N
Section #	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01	S 13-48	S 13-48	S 13-48	Section 06	Section 06	Section 06	Section 06	Section 06	Section 06	Section 01	Section 01	Section 01
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord

Member Factored Load Effects:

C_f (kN)	1905	1905	1905	324	324	324	0	0	0	0	0	0	0	0	0	813	813	813
$M_{fx\ (comp)}$ (kNm)	36	28	40	39	60	101	0	0	0	0	0	0	0	0	0	13	15	14
$M_{fy\ (comp)}$ (kNm)	5	9	13	13	16	29	0	0	0	0	0	0	0	0	0	2	3	7
T_f (kN)	0	0	0	851	851	851	1424	1424	1423	1423	1423	1423	1410	1410	1409	704	703	703
$M_{fx\ (tension)}$ (kNm)	0	0	0	39	60	101	15	24	25	15	12	12	12	10	13	13	15	14
$M_{fy\ (tension)}$ (kNm)	0	0	0	13	16	29	525	466	406	7	6	5	5	2	2	2	3	7
V_{fx} (kN)	3	3	3	5	5	5	68	68	68	2	2	2	1	1	1	1	1	1
V_{fy} (kN)	13	7	13	23	18	12	15	8	2	3	6	9	7	2	7	8	4	5

Gross Section Properties:

Ag (mm^2)	20903	20903	20903	12774	12774	12774	70701	70701	70701	15097	15097	15097	15097	15097	15097	12774	12774	12774
I_x (mm^4)	3.34E+08	3.34E+08	3.34E+08	2.61E+08	2.61E+08	2.61E+08	2.48E+09	2.48E+09	2.48E+09	2.89E+08	2.89E+08	2.89E+08	2.89E+08	2.89E+08	2.89E+08	2.61E+08	2.61E+08	2.61E+08
I_y (mm^4)	9.14E+08	9.14E+08	9.14E+08	8.94E+08	8.94E+08	8.94E+08	1.02E+10	1.02E+10	1.02E+10	1.05E+09	1.05E+09	1.05E+09	1.05E+09	1.05E+09	1.05E+09	8.94E+08	8.94E+08	8.94E+08
J (mm^4)	2.92E+06	2.92E+06	2.92E+06	7.19E+05	7.19E+05	7.19E+05	1.47E+09	1.47E+09	1.47E+09	1.05E+06	1.05E+06	1.05E+06	1.05E+06	1.05E+06	1.05E+06	7.19E+05	7.19E+05	7.19E+05
r_x (mm)	126	126	126	143	143	143	187	187	187	138	138	138	138	138	138	143	143	143
r_y (mm)	209	209	209	265	265	265	381	381	381	264	264	264	264	264	264	265	265	265
S_x (mm^3)	1.75E+06	1.75E+06	1.75E+06	1.37E+06	1.37E+06	1.37E+06	8.62E+06	8.62E+06	8.62E+06	1.52E+06	1.52E+06	1.52E+06	1.52E+06	1.52E+06	1.52E+06	1.37E+06	1.37E+06	1.37E+06
S_y (mm^3)	4.00E+06	4.00E+06	4.00E+06	2.73E+06	2.73E+06	2.73E+06	1.67E+07	1.67E+07	1.67E+07	3.18E+06	3.18E+06	3.18E+06	3.18E+06	3.18E+06	3.18E+06	2.73E+06	2.73E+06	2.73E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	20	20	20	20	20	20	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	5791	5791	5791	7722	7722	7722	1979	1979	1979	3821	3821	3821	5799	5799	5799	5799	5799	5799

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	565	565	565	566	566	566	417	417	417	418	418	418	419	419	419	420	420	420
Member Label	12S-14S	12S-14S	12S-14S	14S-16S	14S-16S	14S-16S	13N-48N	13N-48N	13N-48N	48N-11N	48N-11N	48N-11N	11N-9N	11N-9N	11N-9N	9N-7N	9N-7N	9N-7N
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	1.0	2.0	0.0	1.9	3.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	12S	---	14S	14S	---	16S	13N	---	48N	48N	---	11N	11N	---	9N	9N	---	7N
Section #	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01	S 13-48	S 13-48	S 13-48	Section 06	Section 06	Section 06	Section 06	Section 06	Section 06	Section 01	Section 01	Section 01
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels	5.2	5.2	5.2	5.2	5.2	5.2	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	32.0	32.0	32.0	37.5	37.5	37.5	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8
Webs in flexural compression	32.0	32.0	32.0	37.5	37.5	37.5	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8
Webs in combined flexural and axial compression	32.0	32.0	32.0	37.5	37.5	37.5	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	565	565	565	566	566	566	417	417	417	418	418	418	419	419	419	420	420	420
Member Label	12S-14S	12S-14S	12S-14S	14S-16S	14S-16S	14S-16S	13N-48N	13N-48N	13N-48N	48N-11N	48N-11N	48N-11N	11N-9N	11N-9N	11N-9N	9N-7N	9N-7N	9N-7N
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	1.0	2.0	0.0	1.9	3.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	12S	---	14S	14S	---	16S	13N	---	48N	48N	---	11N	11N	---	9N	9N	---	7N
Section #	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01	S 13-48	S 13-48	S 13-48	Section 06	Section 06	Section 06	Section 06	Section 06	Section 06	Section 01	Section 01	Section 01
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5791	5791	5791	7722	7722	7722	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799
L_y (mm)	5791	5791	5791	7722	7722	7722	1979	1979	1979	3821	3821	3821	5799	5799	5799	5799	5799	5799
λ_{max}	0.474	0.474	0.474	0.557	0.557	0.557	0.320	0.320	0.320	0.433	0.433	0.433	0.433	0.433	0.433	0.418	0.418	0.418
C_r (kN)	2875.0	2875.0	2875.0	1677.0	1677.0	1677.0	12265.5	12265.5	12265.5	2513.6	2513.6	2513.6	2513.6	2513.6	2513.6	2140.9	2140.9	2140.9
$(kL/r)_{max}$	46.0	46.0	46.0	54.0	54.0	54.0	31.0	31.0	31.0	42.0	42.0	42.0	42.0	42.0	42.0	40.6	40.6	40.6
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	19655	19655	19655	8638	8638	8638	145617	145617	145617	16962	16962	16962	16962	16962	16962	15313	15313	15313

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	670	670	670	670	670	670	670	670	670	670	670	670
b (mm)	368	368	368	368	368	368	580	580	580	580	580	580	580	580	580	580	580	580
ε_aa (mm)	425	425	425	425	425	425	670	670	670	670	670	670	670	670	670	670	670	670
ε_bb (mm)	368	368	368	368	368	368	580	580	580	580	580	580	580	580	580	580	580	580
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	6477	6477	6477	6477	6477	6477	1781	1781	1781	3439	3439	3439	5219	5219	5219	5219	5219	5219
A_c (mm^2)	10452	10452	10452	6387	6387	6387	35351	35351	35351	7549	7549	7549	7549	7549	7549	6387	6387	6387
A_d (mm^2)	907	907	907	907	907	907	845	845	845	845	845	845	845	845	845	845	845	845
A_b (mm^2)	907	907	907	907	907	907	845	845	845	845	845	845	845	845	845	845	845	845
μ	0.0736	0.0736	0.0736	0.0450	0.0450	0.0450	8.7695	8.7695	8.7695	0.5022	0.5022	0.5022	0.2180	0.2180	0.2180	0.1844	0.1844	0.1844
P_{cr}/P_e (Fig.3.51)	0.81	0.81	0.81	0.87	0.87	0.87	0.50	0.50	0.50	0.50	0.50	0.50	0.65	0.65	0.65	0.68	0.68	0.68
k'(sqrt(P_e/P_{cr}))	1.112	1.112	1.112	1.072	1.072	1.072	1.414	1.414	1.414	1.414	1.414	1.414	1.236	1.236	1.236	1.216	1.216	1.216
λ_v	0.318	0.318	0.318	0.322	0.322	0.322	0.076	0.076	0.076	0.211	0.211	0.211	0.280	0.280	0.280	0.274	0.274	0.274
Cr' (kN)	3055.5	3055.5	3055.5	1864.9	1864.9	1864.9	12685.0	12685.0	12685.0	2679.8	2679.8	2679.8	2645.8	2645.8	2645.8	2241.5	2241.5	2241.5
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	565	565	565	566	566	566	417	417	417	418	418	418	419	419	419	420	420	420
Member Label	12S-14S	12S-14S	12S-14S	14S-16S	14S-16S	14S-16S	13N-48N	13N-48N	13N-48N	48N-11N	48N-11N	48N-11N	11N-9N	11N-9N	11N-9N	9N-7N	9N-7N	9N-7N
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	1.0	2.0	0.0	1.9	3.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	12S	---	14S	14S	---	16S	13N	---	48N	48N	---	11N	11N	---	9N	9N	---	7N
Section #	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01	S 13-48	S 13-48	S 13-48	Section 06	Section 06	Section 06	Section 06	Section 06	Section 06	Section 01	Section 01	Section 01
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	10452	10452	10452	6387	6387	6387	35351	35351	35351	7549	7549	7549	7549	7549	7549	6387	6387	6387
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	2875.0	2875.0	2875.0	1677.0	1677.0	1677.0	12265.5	12265.5	12265.5	2513.6	2513.6	2513.6	2513.6	2513.6	2513.6	2140.9	2140.9	2140.9

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	16722	16722	16722	10219	10219	10219	67166	67166	67166	14342	14342	14342	14342	14342	14342	12135	12135	12135
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	3336	3336	3336	2039	2039	2039	13400	13400	13400	2861	2861	2861	2861	2861	2861	2421	2421	2421
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	16880	16880	16880	8751	8751	8751	65946	65946	65946	10342	10342	10342	10342	10342	10342	8019	8019	8019
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	16880	16880	16880	8751	8751	8751	65946	65946	65946	10342	10342	10342	10342	10342	10342	8019	8019	8019
$A_{n(corrosion)}$ (mm^2)	13504	13504	13504	7001	7001	7001	62649	62649	62649	9825	9825	9825	9825	9825	9825	7618	7618	7618
$T_{r(b)}$ (kN)	4537	4537	4537	2352	2352	2352	21050	21050	21050	3301	3301	3301	3301	3301	3301	2560	2560	2560
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	13504	13504	13504	7001	7001	7001	62649	62649	62649	9825	9825	9825	9825	9825	9825	7618	7618	7618
$T_{r(c)}$ (kN)	4537	4537	4537	2352	2352	2352	21050	21050	21050	3301	3301	3301	3301	3301	3301	2560	2560	2560
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	565	565	565	566	566	566	417	417	417	418	418	418	419	419	419	420	420	420
Member Label	12S-14S	12S-14S	12S-14S	14S-16S	14S-16S	14S-16S	13N-48N	13N-48N	13N-48N	48N-11N	48N-11N	48N-11N	11N-9N	11N-9N	11N-9N	9N-7N	9N-7N	9N-7N
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	1.0	2.0	0.0	1.9	3.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	12S	---	14S	14S	---	16S	13N	---	48N	48N	---	11N	11N	---	9N	9N	---	7N
Section #	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01	S 13-48	S 13-48	S 13-48	Section 06	Section 06	Section 06	Section 06	Section 06	Section 06	Section 01	Section 01	Section 01
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	4537	4537	4537	2352	2352	2352	21050	21050	21050	3301	3301	3301	3301	3301	3301	2560	2560	2560
$(kL/r)_{max}$	46	46	46	54	54	54	31	31	31	42	42	42	42	42	42	41	41	41
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	3336	3336	3336	2039	2039	2039	13400	13400	13400	2861	2861	2861	2861	2861	2861	2421	2421	2421
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	280	280	280	219	219	219	1634	1634	1634	288	288	288	288	288	288	260	260	260
$M_{ry(Laterally\ Supported)}$ (kNm)	638	638	638	436	436	436	3159	3159	3159	603	603	603	603	603	603	517	517	517
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	5791	5791	5791	7722	7722	7722	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799
L_{uy} (mm)	5791	5791	5791	7722	7722	7722	1979	1979	1979	3821	3821	3821	5799	5799	5799	5799	5799	5799
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	2102	2102	2102	692	692	692	128522	128522	128522	1168	1168	1168	1168	1168	1168	921	921	921
M_{rx} (kNm)	279.8	279.8	279.8	218.6	218.6	218.6	1633.9	1633.9	1633.9	287.5	287.5	287.5	287.5	287.5	287.5	259.6	259.6	259.6
M_{ry} (kNm)	651.9	651.9	651.9	384.7	384.7	384.7	3605.2	3605.2	3605.2	582.3	582.3	582.3	582.3	582.3	582.3	491.2	491.2	491.2

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.663	0.663	0.663	0.193	0.193	0.193	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.380	0.380	0.380
(T_f/T_r)<=1	0.000	0.000	0.000	0.417	0.417	0.417	0.106	0.106	0.106	0.497	0.497	0.497	0.493	0.493	0.492	0.291	0.290	0.290

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.000	0.000	0.000	0.417	0.417	0.417	0.106	0.106	0.106	0.497	0.497	0.497	0.493	0.493	0.492	0.291	0.290	0.290
M_{fx}/M_{rx}<=1	0.000	0.000	0.000	0.178	0.274	0.462	0.009	0.015	0.015	0.052	0.042	0.042	0.042	0.035	0.045	0.050	0.058	0.054
M_{fy}/M_{ry}<=1	0.000	0.000	0.000	0.034	0.042	0.075	0.146	0.129	0.113	0.012	0.010	0.009	0.009	0.003	0.003	0.004	0.006	0.014
$T_f/T_r+M_f/M_r$<=1	0.000	0.000	0.000	0.630	0.733	0.955	0.261	0.250	0.234	0.562	0.549	0.548	0.543	0.531	0.541	0.345	0.354	0.359
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PARSONS

Member ID in CSiBridge	565	565	565	566	566	566	417	417	417	418	418	418	419	419	419	420	420	420
Member Label	12S-14S	12S-14S	12S-14S	14S-16S	14S-16S	14S-16S	13N-48N	13N-48N	13N-48N	48N-11N	48N-11N	48N-11N	11N-9N	11N-9N	11N-9N	9N-7N	9N-7N	9N-7N
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	1.0	2.0	0.0	1.9	3.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	12S	---	14S	14S	---	16S	13N	---	48N	48N	---	11N	11N	---	9N	9N	---	7N
Section #	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01	S 13-48	S 13-48	S 13-48	Section 06	Section 06	Section 06	Section 06	Section 06	Section 06	Section 01	Section 01	Section 01
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	3161	3161	3161	1931	1931	1931	12694	12694	12694	2711	2711	2711	2711	2711	2711	2294	2294	2294
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.97E+04	1.97E+04	1.97E+04	8.64E+03	8.64E+03	8.64E+03	1.46E+05	1.46E+05	1.46E+05	1.70E+04	1.70E+04	1.70E+04	1.70E+04	1.70E+04	1.70E+04	1.53E+04	1.53E+04	1.53E+04
U_{1x}	1.11	1.11	1.11	1.04	1.04	1.04	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.06	1.06	1.06
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	53809	53809	53809	29610	29610	29610	5163085	5163085	5163085	142255	142255	142255	61744	61744	61744	52495	52495	52495
U_{1y}	1.04	1.04	1.04	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.02	1.02	1.02
C_f/C_r	**0.603**	**0.603**	**0.603**	**0.168**	**0.168**	**0.168**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.354**	**0.354**	**0.354**
$U_{1x}M_{fx}/M_{rx}$	**0.142**	**0.111**	**0.158**	**0.185**	**0.285**	**0.480**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.053**	**0.061**	**0.057**
$U_{1y}M_{fy}/M_{ry}$	**0.008**	**0.015**	**0.021**	**0.030**	**0.037**	**0.067**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.004**	**0.006**	**0.014**
Interaction	**0.753**	**0.728**	**0.782**	**0.383**	**0.490**	**0.715**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.411**	**0.421**	**0.425**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.474	0.474	0.474	0.557	0.557	0.557	0.320	0.320	0.320	0.433	0.433	0.433	0.433	0.433	0.433	0.418	0.418	0.418
$C_{r\ (K=1)}$ (kN)	2875	2875	2875	1677	1677	1677	12265	12265	12265	2514	2514	2514	2514	2514	2514	2141	2141	2141
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.11	1.11	1.11	1.04	1.04	1.04	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.06	1.06	1.06
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.04	1.04	1.04	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.02	1.02	1.02
C_f/C_r	**0.663**	**0.663**	**0.663**	**0.193**	**0.193**	**0.193**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.380**	**0.380**	**0.380**
$U_{1x}M_{fx}/M_{rx}$	**0.142**	**0.111**	**0.158**	**0.185**	**0.285**	**0.480**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.053**	**0.061**	**0.057**
$U_{1y}M_{fy}/M_{ry}$	**0.008**	**0.015**	**0.021**	**0.030**	**0.037**	**0.067**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.004**	**0.006**	**0.014**
Interaction	**0.813**	**0.788**	**0.842**	**0.409**	**0.516**	**0.741**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.437**	**0.447**	**0.450**

3.3. Lateral Torsional Buckling:

λ_{max}	0.474	0.474	0.474	0.557	0.557	0.557	0.320	0.320	0.320	0.433	0.433	0.433	0.433	0.433	0.433	0.418	0.418	0.418
C_r (kN)	2875	2875	2875	1677	1677	1677	12265	12265	12265	2514	2514	2514	2514	2514	2514	2141	2141	2141
U_{1x}	1.11	1.11	1.11	1.04	1.04	1.04	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.06	1.06	1.06
U_{1y}	1.04	1.04	1.04	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.02	1.02	1.02
M_{rx} (kNm)	280	280	280	219	219	219	1634	1634	1634	288	288	288	288	288	288	260	260	260
M_{ry} (kNm)	652	652	652	385	385	385	3605	3605	3605	582	582	582	582	582	582	491	491	491
C_f/C_r	**0.663**	**0.663**	**0.663**	**0.193**	**0.193**	**0.193**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.380**	**0.380**	**0.380**
$U_{1x}M_{fx}/M_{rx}$	**0.142**	**0.111**	**0.158**	**0.185**	**0.285**	**0.480**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.053**	**0.061**	**0.057**
$U_{1y}M_{fy}/M_{ry}$	**0.008**	**0.014**	**0.021**	**0.034**	**0.042**	**0.076**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.004**	**0.006**	**0.014**
Interaction	**0.813**	**0.788**	**0.842**	**0.413**	**0.520**	**0.749**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.437**	**0.447**	**0.451**
Demand/Capacity ≤ 1	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
Highest Ratio	**0.813**	**0.788**	**0.842**	**0.630**	**0.733**	**0.955**	**0.261**	**0.250**	**0.234**	**0.562**	**0.549**	**0.548**	**0.543**	**0.531**	**0.541**	**0.437**	**0.447**	**0.451**

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	421	421	421	422	422	422	423	423	423	486	486	486	487	487	487	488	488	488
Member Label	7N-5N	7N-5N	7N-5N	5N-3N	5N-3N	5N-3N	3N-1N	3N-1N	3N-1N	13S-48S	13S-48S	13S-48S	48S-11S	48S-11S	48S-11S	11S-9S	11S-9S	11S-9S
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	1.0	2.0	0.0	1.9	3.8	0.0	2.9	5.8
Node Label at Station	7N	---	5N	5N	---	3N	3N	---	1N	13S	---	48S	48S	---	11S	11S	---	9S
Section #	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	S 13-48	S 13-48	S 13-48	Section 06	Section 06	Section 06	Section 06	Section 06	Section 06
Element Group	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord

Member Factored Load Effects:

C_f (kN)	818	818	818	1067	1068	1068	1103	1103	1103	0	0	0	0	0	0	0	0	0
$M_{fx\ (comp)}$ (kNm)	14	19	12	12	19	15	15	13	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	7	6	4	4	7	13	13	6	0	0	0	0	0	0	0	0	0	0
T_f (kN)	694	694	694	211	211	211	209	209	209	1401	1400	1400	1400	1400	1400	1405	1405	1405
$M_{fx\ (tension)}$ (kNm)	14	19	12	12	19	15	15	13	0	15	9	13	15	12	12	12	10	13
$M_{fy\ (tension)}$ (kNm)	7	6	4	4	7	13	13	6	0	521	463	404	12	6	7	7	3	3
V_{fx} (kN)	1	1	1	3	3	3	2	2	2	68	68	68	4	4	4	2	2	2
V_{fy} (kN)	6	3	7	7	3	6	5	3	7	15	8	2	3	6	9	7	2	7

Gross Section Properties:

Ag (mm^2)	12774	12774	12774	12774	12774	12774	12774	12774	12774	70701	70701	70701	15097	15097	15097	15097	15097	15097
I_x (mm^4)	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.48E+09	2.48E+09	2.48E+09	2.89E+08	2.89E+08	2.89E+08	2.89E+08	2.89E+08	2.89E+08
I_y (mm^4)	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	1.02E+10	1.02E+10	1.02E+10	1.05E+09	1.05E+09	1.05E+09	1.05E+09	1.05E+09	1.05E+09
J (mm^4)	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	1.47E+09	1.47E+09	1.47E+09	1.05E+06	1.05E+06	1.05E+06	1.05E+06	1.05E+06	1.05E+06
r_x (mm)	143	143	143	143	143	143	143	143	143	187	187	187	138	138	138	138	138	138
r_y (mm)	265	265	265	265	265	265	265	265	265	381	381	381	264	264	264	264	264	264
S_x (mm^3)	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	8.62E+06	8.62E+06	8.62E+06	1.52E+06	1.52E+06	1.52E+06	1.52E+06	1.52E+06	1.52E+06
S_y (mm^3)	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	1.67E+07	1.67E+07	1.67E+07	3.18E+06	3.18E+06	3.18E+06	3.18E+06	3.18E+06	3.18E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	5799	5799	5799	5799	5799	5799	5799	5799	5799	1979	1979	1979	3821	3821	3821	5799	5799	5799

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	421	421	421	422	422	422	423	423	423	486	486	486	487	487	487	488	488	488
Member Label	7N-5N	7N-5N	7N-5N	5N-3N	5N-3N	5N-3N	3N-1N	3N-1N	3N-1N	13S-48S	13S-48S	13S-48S	48S-11S	48S-11S	48S-11S	11S-9S	11S-9S	11S-9S
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	1.0	2.0	0.0	1.9	3.8	0.0	2.9	5.8
Node Label at Station	7N	---	5N	5N	---	3N	3N	---	1N	13S	---	48S	48S	---	11S	11S	---	9S
Section #	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	S 13-48	S 13-48	S 13-48	Section 06	Section 06	Section 06	Section 06	Section 06	Section 06
Element Group	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8
Webs in flexural compression	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8
Webs in combined flexural and axial compression	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	421	421	421	422	422	422	423	423	423	486	486	486	487	487	487	488	488	488
Member Label	7N-5N	7N-5N	7N-5N	5N-3N	5N-3N	5N-3N	3N-1N	3N-1N	3N-1N	13S-48S	13S-48S	13S-48S	48S-11S	48S-11S	48S-11S	11S-9S	11S-9S	11S-9S
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	1.0	2.0	0.0	1.9	3.8	0.0	2.9	5.8
Node Label at Station	7N	---	5N	5N	---	3N	3N	---	1N	13S	---	48S	48S	---	11S	11S	---	9S
Section #	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	S 13-48	S 13-48	S 13-48	Section 06	Section 06	Section 06	Section 06	Section 06	Section 06
Element Group	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799
L_y (mm)	5799	5799	5799	5799	5799	5799	5799	5799	5799	1979	1979	1979	3821	3821	3821	5799	5799	5799
λ_{max}	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.320	0.320	0.320	0.433	0.433	0.433	0.433	0.433	0.433
C_r (kN)	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	12265.5	12265.5	12265.5	2513.6	2513.6	2513.6	2513.6	2513.6	2513.6
$(kL/r)_{max}$	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	31.0	31.0	31.0	42.0	42.0	42.0	42.0	42.0	42.0
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	15313	15313	15313	15313	15313	15313	15313	15313	15313	145617	145617	145617	16962	16962	16962	16962	16962	16962

Shear Flexibility Factor:

1. Lacing:

a (mm)	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670
b (mm)	580	580	580	580	580	580	580	580	580	580	580	580	580	580	580	580	580	580
ε_aa (mm)	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670
ε_bb (mm)	580	580	580	580	580	580	580	580	580	580	580	580	580	580	580	580	580	580
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	5219	5219	5219	5219	5219	5219	5219	5219	5219	1781	1781	1781	3439	3439	3439	5219	5219	5219
A_c (mm^2)	6387	6387	6387	6387	6387	6387	6387	6387	6387	35351	35351	35351	7549	7549	7549	7549	7549	7549
A_d (mm^2)	845	845	845	845	845	845	845	845	845	845	845	845	845	845	845	845	845	845
A_b (mm^2)	845	845	845	845	845	845	845	845	845	845	845	845	845	845	845	845	845	845
μ	0.1844	0.1844	0.1844	0.1844	0.1844	0.1844	0.1844	0.1844	0.1844	8.7695	8.7695	8.7695	0.5022	0.5022	0.5022	0.2180	0.2180	0.2180
P_{cr}/P_e (Fig.3.51)	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.50	0.50	0.50	0.50	0.50	0.50	0.65	0.65	0.65
k'(sqrt(P_e/P_{cr}))	1.216	1.216	1.216	1.216	1.216	1.216	1.216	1.216	1.216	1.414	1.414	1.414	1.414	1.414	1.414	1.236	1.236	1.236
λ_v	0.274	0.274	0.274	0.274	0.274	0.274	0.274	0.274	0.274	0.076	0.076	0.076	0.211	0.211	0.211	0.280	0.280	0.280
Cr' (kN)	2241.5	2241.5	2241.5	2241.5	2241.5	2241.5	2241.5	2241.5	2241.5	12685.0	12685.0	12685.0	2679.8	2679.8	2679.8	2645.8	2645.8	2645.8
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	421	421	421	422	422	422	423	423	423	486	486	486	487	487	487	488	488	488
Member Label	7N-5N	7N-5N	7N-5N	5N-3N	5N-3N	5N-3N	3N-1N	3N-1N	3N-1N	13S-48S	13S-48S	13S-48S	48S-11S	48S-11S	48S-11S	11S-9S	11S-9S	11S-9S
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	1.0	2.0	0.0	1.9	3.8	0.0	2.9	5.8
Node Label at Station	7N	---	5N	5N	---	3N	3N	---	1N	13S	---	48S	48S	---	11S	11S	---	9S
Section #	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	S 13-48	S 13-48	S 13-48	Section 06	Section 06	Section 06	Section 06	Section 06	Section 06
Element Group	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	6387	6387	6387	6387	6387	6387	6387	6387	6387	35351	35351	35351	7549	7549	7549	7549	7549	7549
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	12265.5	12265.5	12265.5	2513.6	2513.6	2513.6	2513.6	2513.6	2513.6

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	12135	12135	12135	12135	12135	12135	12135	12135	12135	67166	67166	67166	14342	14342	14342	14342	14342	14342
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	2421	2421	2421	2421	2421	2421	2421	2421	2421	13400	13400	13400	2861	2861	2861	2861	2861	2861
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	8019	8019	8019	8019	8019	8019	8019	8019	8019	65946	65946	65946	10342	10342	10342	10342	10342	10342
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	8019	8019	8019	8019	8019	8019	8019	8019	8019	65946	65946	65946	10342	10342	10342	10342	10342	10342
$A_{n(corrosion)}$ (mm^2)	7618	7618	7618	7618	7618	7618	7618	7618	7618	62649	62649	62649	9825	9825	9825	9825	9825	9825
$T_{r(b)}$ (kN)	2560	2560	2560	2560	2560	2560	2560	2560	2560	21050	21050	21050	3301	3301	3301	3301	3301	3301
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	7618	7618	7618	7618	7618	7618	7618	7618	7618	62649	62649	62649	9825	9825	9825	9825	9825	9825
$T_{r(c)}$ (kN)	2560	2560	2560	2560	2560	2560	2560	2560	2560	21050	21050	21050	3301	3301	3301	3301	3301	3301
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	421	421	421	422	422	422	423	423	423	486	486	486	487	487	487	488	488	488
Member Label	7N-5N	7N-5N	7N-5N	5N-3N	5N-3N	5N-3N	3N-1N	3N-1N	3N-1N	13S-48S	13S-48S	13S-48S	48S-11S	48S-11S	48S-11S	11S-9S	11S-9S	11S-9S
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	1.0	2.0	0.0	1.9	3.8	0.0	2.9	5.8
Node Label at Station	7N	---	5N	5N	---	3N	3N	---	1N	13S	---	48S	48S	---	11S	11S	---	9S
Section #	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	S 13-48	S 13-48	S 13-48	Section 06	Section 06	Section 06	Section 06	Section 06	Section 06
Element Group	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	2560	2560	2560	2560	2560	2560	2560	2560	2560	21050	21050	21050	3301	3301	3301	3301	3301	3301
$(kL/r)_{max}$	41	41	41	41	41	41	41	41	41	31	31	31	42	42	42	42	42	42
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	2421	2421	2421	2421	2421	2421	2421	2421	2421	13400	13400	13400	2861	2861	2861	2861	2861	2861
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	260	260	260	260	260	260	260	260	260	1634	1634	1634	288	288	288	288	288	288
$M_{ry(Laterally\ Supported)}$ (kNm)	517	517	517	517	517	517	517	517	517	3159	3159	3159	603	603	603	603	603	603
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799
L_{uy} (mm)	5799	5799	5799	5799	5799	5799	5799	5799	5799	1979	1979	1979	3821	3821	3821	5799	5799	5799
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	921	921	921	921	921	921	921	921	921	128522	128522	128522	1168	1168	1168	1168	1168	1168
M_{rx} (kNm)	259.6	259.6	259.6	259.6	259.6	259.6	259.6	259.6	259.6	1633.9	1633.9	1633.9	287.5	287.5	287.5	287.5	287.5	287.5
M_{ry} (kNm)	491.2	491.2	491.2	491.2	491.2	491.2	491.2	491.2	491.2	3605.2	3605.2	3605.2	582.3	582.3	582.3	582.3	582.3	582.3

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.382	0.382	0.382	0.498	0.499	0.499	0.515	0.515	0.515	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
(T_f/T_r)<=1	0.287	0.287	0.287	0.087	0.087	0.087	0.086	0.086	0.086	0.105	0.104	0.104	0.489	0.489	0.489	0.491	0.491	0.491

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.287	0.287	0.287	0.087	0.087	0.087	0.086	0.086	0.086	0.105	0.104	0.104	0.489	0.489	0.489	0.491	0.491	0.491
M_{fx}/M_{rx}<=1	0.054	0.073	0.046	0.046	0.073	0.058	0.058	0.050	0.000	0.009	0.006	0.008	0.052	0.042	0.042	0.042	0.035	0.045
M_{fy}/M_{ry}<=1	0.014	0.012	0.008	0.008	0.014	0.026	0.026	0.012	0.000	0.145	0.128	0.112	0.021	0.010	0.012	0.012	0.005	0.005
$T_f/T_r+M_f/M_r$<=1	0.355	0.372	0.341	0.142	0.175	0.171	0.171	0.149	0.086	0.258	0.238	0.224	0.562	0.541	0.543	0.545	0.531	0.541
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PARSONS

Member ID in CSiBridge	421	421	421	422	422	422	423	423	423	486	486	486	487	487	487	488	488	488
Member Label	7N-5N	7N-5N	7N-5N	5N-3N	5N-3N	5N-3N	3N-1N	3N-1N	3N-1N	13S-48S	13S-48S	13S-48S	48S-11S	48S-11S	48S-11S	11S-9S	11S-9S	11S-9S
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	1.0	2.0	0.0	1.9	3.8	0.0	2.9	5.8
Node Label at Station	7N	---	5N	5N	---	3N	3N	---	1N	13S	---	48S	48S	---	11S	11S	---	9S
Section #	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	S 13-48	S 13-48	S 13-48	Section 06	Section 06	Section 06	Section 06	Section 06	Section 06
Element Group	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	2294	2294	2294	2294	2294	2294	2294	2294	2294	12694	12694	12694	2711	2711	2711	2711	2711	2711
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.53E+04	1.53E+04	1.53E+04	1.53E+04	1.53E+04	1.53E+04	1.53E+04	1.53E+04	1.53E+04	1.46E+05	1.46E+05	1.46E+05	1.70E+04	1.70E+04	1.70E+04	1.70E+04	1.70E+04	1.70E+04
U_{1x}	1.06	1.06	1.06	1.07	1.07	1.07	1.08	1.08	1.08	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	52495	52495	52495	52495	52495	52495	52495	52495	52495	5163085	5163085	5163085	142255	142255	142255	61744	61744	61744
U_{1y}	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.357**	**0.357**	**0.357**	**0.465**	**0.466**	**0.466**	**0.481**	**0.481**	**0.481**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1x}M_{fx}/M_{rx}$	**0.057**	**0.077**	**0.049**	**0.050**	**0.079**	**0.062**	**0.062**	**0.054**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.014**	**0.012**	**0.008**	**0.008**	**0.014**	**0.026**	**0.026**	**0.012**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.427**	**0.446**	**0.413**	**0.523**	**0.558**	**0.553**	**0.569**	**0.547**	**0.481**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.320	0.320	0.320	0.433	0.433	0.433	0.433	0.433	0.433
$C_{r\ (K=1)}$ (kN)	2141	2141	2141	2141	2141	2141	2141	2141	2141	12265	12265	12265	2514	2514	2514	2514	2514	2514
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.06	1.06	1.06	1.07	1.07	1.07	1.08	1.08	1.08	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.382**	**0.382**	**0.382**	**0.498**	**0.499**	**0.499**	**0.515**	**0.515**	**0.515**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1x}M_{fx}/M_{rx}$	**0.057**	**0.077**	**0.049**	**0.050**	**0.079**	**0.062**	**0.062**	**0.054**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.014**	**0.012**	**0.008**	**0.008**	**0.014**	**0.026**	**0.026**	**0.012**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.453**	**0.471**	**0.439**	**0.556**	**0.591**	**0.587**	**0.603**	**0.581**	**0.515**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

3.3. Lateral Torsional Buckling:

λ_{max}	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.320	0.320	0.320	0.433	0.433	0.433	0.433	0.433	0.433
C_r (kN)	2141	2141	2141	2141	2141	2141	2141	2141	2141	12265	12265	12265	2514	2514	2514	2514	2514	2514
U_{1x}	1.06	1.06	1.06	1.07	1.07	1.07	1.08	1.08	1.08	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	260	260	260	260	260	260	260	260	260	1634	1634	1634	288	288	288	288	288	288
M_{ry} (kNm)	491	491	491	491	491	491	491	491	491	3605	3605	3605	582	582	582	582	582	582
C_f/C_r	**0.382**	**0.382**	**0.382**	**0.498**	**0.499**	**0.499**	**0.515**	**0.515**	**0.515**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1x}M_{fx}/M_{rx}$	**0.057**	**0.077**	**0.049**	**0.050**	**0.079**	**0.062**	**0.062**	**0.054**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.014**	**0.012**	**0.008**	**0.008**	**0.015**	**0.027**	**0.027**	**0.012**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.454**	**0.472**	**0.439**	**0.556**	**0.592**	**0.588**	**0.605**	**0.582**	**0.515**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Demand/Capacity ≤ 1	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
Highest Ratio	**0.454**	**0.472**	**0.439**	**0.556**	**0.592**	**0.588**	**0.605**	**0.582**	**0.515**	**0.258**	**0.238**	**0.224**	**0.562**	**0.541**	**0.543**	**0.545**	**0.531**	**0.541**

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	489	489	489	490	490	490	491	491	491	492	492	492	431	431	431	432	432	432
Member Label	9S-7S	9S-7S	9S-7S	7S-5S	7S-5S	7S-5S	5S-3S	5S-3S	5S-3S	3S-1S	3S-1S	3S-1S	22N-33N	22N-33N	22N-33N	33N-32N	33N-32N	33N-32N
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	1.5	3.0	0.0	3.1	6.2
Node Label at Station	9S	---	7S	7S	---	5S	5S	---	3S	3S	---	1S	22N	---	33N	33N	---	32N
Section #	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10
Element Group	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link

Member Factored Load Effects:

C_f (kN)	879	879	879	875	876	876	1131	1132	1132	1161	1161	1161	0	0	0	0	0	0
$M_{fx\ (comp)}$ (kNm)	13	15	15	15	20	13	13	20	16	16	14	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	3	3	7	7	4	2	2	8	13	13	7	0	0	0	0	0	0	0
T_f (kN)	649	649	649	650	650	650	157	157	157	162	162	162	2463	2460	2457	2429	2422	2416
$M_{fx\ (tension)}$ (kNm)	13	15	15	15	20	13	13	20	16	16	14	0	0	37	69	69	103	114
$M_{fy\ (tension)}$ (kNm)	3	3	7	7	4	2	2	8	13	13	7	0	59	37	28	28	15	2
V_{fx} (kN)	1	1	1	1	1	1	2	2	2	2	2	2	29	29	29	4	4	4
V_{fy} (kN)	8	4	5	6	3	7	7	3	6	4	3	7	26	23	19	15	7	1

Gross Section Properties:

Ag (mm^2)	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	29435	29435	29435	29435	29435	29435
I_x (mm^4)	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09
I_y (mm^4)	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08
J (mm^4)	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06
r_x (mm)	143	143	143	143	143	143	143	143	143	143	143	143	335	335	335	335	335	335
r_y (mm)	265	265	265	265	265	265	265	265	265	265	265	265	61	61	61	61	61	61
S_x (mm^3)	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06
S_y (mm^3)	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	3038	3038	3038	6248	6248	6248

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	489	489	489	490	490	490	491	491	491	492	492	492	431	431	431	432	432	432
Member Label	9S-7S	9S-7S	9S-7S	7S-5S	7S-5S	7S-5S	5S-3S	5S-3S	5S-3S	3S-1S	3S-1S	3S-1S	22N-33N	22N-33N	22N-33N	33N-32N	33N-32N	33N-32N
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	1.5	3.0	0.0	3.1	6.2
Node Label at Station	9S	---	7S	7S	---	5S	5S	---	3S	3S	---	1S	22N	---	33N	33N	---	32N
Section #	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10
Element Group	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge													8.0	8.0	8.0	8.0	8.0	8.0
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4						
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8						
Webs in flexural compression	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8						
Webs in combined flexural and axial compression	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8						
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	489	489	489	490	490	490	491	491	491	492	492	492	431	431	431	432	432	432
Member Label	9S-7S	9S-7S	9S-7S	7S-5S	7S-5S	7S-5S	5S-3S	5S-3S	5S-3S	3S-1S	3S-1S	3S-1S	22N-33N	22N-33N	22N-33N	33N-32N	33N-32N	33N-32N
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	1.5	3.0	0.0	3.1	6.2
Node Label at Station	9S	---	7S	7S	---	5S	5S	---	3S	3S	---	1S	22N	---	33N	33N	---	32N
Section #	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10
Element Group	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	16861	16861	16861	16861	16861	16861
L_y (mm)	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	3038	3038	3038	6248	6248	6248
λ_{max}	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.519	0.519	0.519	1.057	1.057	1.057
C_r (kN)	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	4693.1	4693.1	4693.1	2976.0	2976.0	2976.0
$(kL/r)_{max}$	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	50.3	50.3	50.3	102.4	102.4	102.4
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	15313	15313	15313	15313	15313	15313	15313	15313	15313	15313	15313	15313	22924	22924	22924	5495	5495	5495

Shear Flexibility Factor:

1. Lacing:

a (mm)	670	670	670	670	670	670	670	670	670	670	670	670	733	733	733	733	733	733
b (mm)	580	580	580	580	580	580	580	580	580	580	580	580	635	635	635	635	635	635
ε_aa (mm)	670	670	670	670	670	670	670	670	670	670	670	670	733	733	733	733	733	733
ε_bb (mm)	580	580	580	580	580	580	580	580	580	580	580	580	635	635	635	635	635	635
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	5219	5219	5219	5219	5219	5219	5219	5219	5219	5219	5219	5219	6477	6477	6477	6477	6477	6477
A_c (mm^2)	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	14718	14718	14718	14718	14718	14718
A_d (mm^2)	845	845	845	845	845	845	845	845	845	845	845	845	1148	1148	1148	1148	1148	1148
A_b (mm^2)	845	845	845	845	845	845	845	845	845	845	845	845	1148	1148	1148	1148	1148	1148
μ	0.1844	0.1844	0.1844	0.1844	0.1844	0.1844	0.1844	0.1844	0.1844	0.1844	0.1844	0.1844	0.2435	0.2435	0.2435	0.2435	0.2435	0.2435
P_{cr}/P_e (Fig.3.51)	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.64	0.64	0.64	0.64	0.64	0.64
k'(sqrt(P_e/P_{cr}))	1.216	1.216	1.216	1.216	1.216	1.216	1.216	1.216	1.216	1.216	1.216	1.216	1.250	1.250	1.250	1.250	1.250	1.250
λ_v	0.274	0.274	0.274	0.274	0.274	0.274	0.274	0.274	0.274	0.274	0.274	0.274	0.642	0.642	0.642	1.321	1.321	1.321
Cr' (kN)	2241.5	2241.5	2241.5	2241.5	2241.5	2241.5	2241.5	2241.5	2241.5	2241.5	2241.5	2241.5	4332.2	4332.2	4332.2	2267.5	2267.5	2267.5
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	489	489	489	490	490	490	491	491	491	492	492	492	431	431	431	432	432	432
Member Label	9S-7S	9S-7S	9S-7S	7S-5S	7S-5S	7S-5S	5S-3S	5S-3S	5S-3S	3S-1S	3S-1S	3S-1S	22N-33N	22N-33N	22N-33N	33N-32N	33N-32N	33N-32N
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	1.5	3.0	0.0	3.1	6.2
Node Label at Station	9S	---	7S	7S	---	5S	5S	---	3S	3S	---	1S	22N	---	33N	33N	---	32N
Section #	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10
Element Group	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	14718	14718	14718	14718	14718	14718
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	4693.1	4693.1	4693.1	2976.0	2976.0	2976.0

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	12135	12135	12135	12135	12135	12135	12135	12135	12135	12135	12135	12135	27963	27963	27963	27963	27963	27963
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	2421	2421	2421	2421	2421	2421	2421	2421	2421	2421	2421	2421	5579	5579	5579	5579	5579	5579
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	8019	8019	8019	8019	8019	8019	8019	8019	8019	8019	8019	8019	20596	20596	20596	20596	20596	20596
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	8019	8019	8019	8019	8019	8019	8019	8019	8019	8019	8019	8019	20596	20596	20596	20596	20596	20596
$A_{n(corrosion)}$ (mm^2)	7618	7618	7618	7618	7618	7618	7618	7618	7618	7618	7618	7618	19566	19566	19566	19566	19566	19566
$T_{r(b)}$ (kN)	2560	2560	2560	2560	2560	2560	2560	2560	2560	2560	2560	2560	6574	6574	6574	6574	6574	6574
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	7618	7618	7618	7618	7618	7618	7618	7618	7618	7618	7618	7618	19566	19566	19566	19566	19566	19566
$T_{r(c)}$ (kN)	2560	2560	2560	2560	2560	2560	2560	2560	2560	2560	2560	2560	6574	6574	6574	6574	6574	6574
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	489	489	489	490	490	490	491	491	491	492	492	492	431	431	431	432	432	432
Member Label	9S-7S	9S-7S	9S-7S	7S-5S	7S-5S	7S-5S	5S-3S	5S-3S	5S-3S	3S-1S	3S-1S	3S-1S	22N-33N	22N-33N	22N-33N	33N-32N	33N-32N	33N-32N
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	1.5	3.0	0.0	3.1	6.2
Node Label at Station	9S	---	7S	7S	---	5S	5S	---	3S	3S	---	1S	22N	---	33N	33N	---	32N
Section #	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10
Element Group	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	2560	2560	2560	2560	2560	2560	2560	2560	2560	2560	2560	2560	6574	6574	6574	6574	6574	6574
$(kL/r)_{max}$	41	41	41	41	41	41	41	41	41	41	41	41	50	50	50	102	102	102
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	2421	2421	2421	2421	2421	2421	2421	2421	2421	2421	2421	2421	5579	5579	5579	5579	5579	5579
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	260	260	260	260	260	260	260	260	260	260	260	260	1589	1589	1589	1589	1589	1589
$M_{ry(Laterally\ Supported)}$ (kNm)	517	517	517	517	517	517	517	517	517	517	517	517	128	128	128	128	128	128
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	16861	16861	16861	16861	16861	16861
L_{uy} (mm)	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	3038	3038	3038	6248	6248	6248
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	432	432	432	432	432	432
M_{uy} (kNm) (x weak)	921	921	921	921	921	921	921	921	921	921	921	921	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	259.6	259.6	259.6	259.6	259.6	259.6	259.6	259.6	259.6	259.6	259.6	259.6	389.8	389.8	389.8	389.8	389.8	389.8
M_{ry} (kNm)	491.2	491.2	491.2	491.2	491.2	491.2	491.2	491.2	491.2	491.2	491.2	491.2	128.3	128.3	128.3	128.3	128.3	128.3

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.411	0.411	0.411	0.409	0.409	0.409	0.528	0.529	0.529	0.542	0.542	0.542	0.000	0.000	0.000	0.000	0.000	0.000
(T_f/T_r)<=1	0.268	0.268	0.268	0.268	0.268	0.268	0.065	0.065	0.065	0.067	0.067	0.067	0.442	0.441	0.440	0.435	0.434	0.433

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.268	0.268	0.268	0.268	0.268	0.268	0.065	0.065	0.065	0.067	0.067	0.067	0.442	0.441	0.440	0.435	0.434	0.433
M_{fx}/M_{rx}<=1	0.050	0.058	0.058	0.058	0.077	0.050	0.050	0.077	0.062	0.062	0.054	0.000	0.000	0.095	0.177	0.177	0.264	0.292
M_{fy}/M_{ry}<=1	0.006	0.006	0.014	0.014	0.008	0.004	0.004	0.016	0.026	0.026	0.014	0.000	0.460	0.288	0.218	0.218	0.117	0.016
$T_f/T_r+M_f/M_r$<=1	0.324	0.332	0.340	0.341	0.354	0.323	0.119	0.158	0.153	0.155	0.135	0.067	0.901	0.824	0.836	0.831	0.815	0.741
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	489	489	489	490	490	490	491	491	491	492	492	492	431	431	431	432	432	432
Member Label	9S-7S	9S-7S	9S-7S	7S-5S	7S-5S	7S-5S	5S-3S	5S-3S	5S-3S	3S-1S	3S-1S	3S-1S	22N-33N	22N-33N	22N-33N	33N-32N	33N-32N	33N-32N
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	1.5	3.0	0.0	3.1	6.2
Node Label at Station	9S	---	7S	7S	---	5S	5S	---	3S	3S	---	1S	22N	---	33N	33N	---	32N
Section #	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10
Element Group	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	2294	2294	2294	2294	2294	2294	2294	2294	2294	2294	2294	2294	5285	5285	5285	5285	5285	5285
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.53E+04	1.53E+04	1.53E+04	1.53E+04	1.53E+04	1.53E+04	1.53E+04	1.53E+04	1.53E+04	1.53E+04	1.53E+04	1.53E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04
U_{1x}	1.06	1.06	1.06	1.06	1.06	1.06	1.08	1.08	1.08	1.08	1.08	1.08	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	52495	52495	52495	52495	52495	52495	52495	52495	52495	52495	52495	52495	23240	23240	23240	5495	5495	5495
U_{1y}	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.383**	**0.383**	**0.383**	**0.382**	**0.382**	**0.382**	**0.493**	**0.494**	**0.494**	**0.506**	**0.506**	**0.506**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1x}M_{fx}/M_{rx}$	**0.053**	**0.061**	**0.061**	**0.061**	**0.082**	**0.053**	**0.054**	**0.083**	**0.067**	**0.067**	**0.058**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.006**	**0.006**	**0.014**	**0.014**	**0.008**	**0.004**	**0.004**	**0.016**	**0.026**	**0.026**	**0.014**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.442**	**0.450**	**0.458**	**0.457**	**0.472**	**0.439**	**0.551**	**0.593**	**0.586**	**0.599**	**0.578**	**0.506**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.519	0.519	0.519	1.057	1.057	1.057
$C_{r\ (K=1)}$ (kN)	2141	2141	2141	2141	2141	2141	2141	2141	2141	2141	2141	2141	4693	4693	4693	2976	2976	2976
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.06	1.06	1.06	1.06	1.06	1.06	1.08	1.08	1.08	1.08	1.08	1.08	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.411**	**0.411**	**0.411**	**0.409**	**0.409**	**0.409**	**0.528**	**0.529**	**0.529**	**0.542**	**0.542**	**0.542**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1x}M_{fx}/M_{rx}$	**0.053**	**0.061**	**0.061**	**0.061**	**0.082**	**0.053**	**0.054**	**0.083**	**0.067**	**0.067**	**0.058**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.006**	**0.006**	**0.014**	**0.014**	**0.008**	**0.004**	**0.004**	**0.016**	**0.026**	**0.026**	**0.014**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.470**	**0.478**	**0.486**	**0.484**	**0.499**	**0.466**	**0.586**	**0.628**	**0.621**	**0.635**	**0.615**	**0.542**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

3.3. Lateral Torsional Buckling:

λ_{max}	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.519	0.519	0.519	1.057	1.057	1.057
C_r (kN)	2141	2141	2141	2141	2141	2141	2141	2141	2141	2141	2141	2141	4693	4693	4693	2976	2976	2976
U_{1x}	1.06	1.06	1.06	1.06	1.06	1.06	1.08	1.08	1.08	1.08	1.08	1.08	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	260	260	260	260	260	260	260	260	260	260	260	260	390	390	390	390	390	390
M_{ry} (kNm)	491	491	491	491	491	491	491	491	491	491	491	491	128	128	128	128	128	128
C_f/C_r	**0.411**	**0.411**	**0.411**	**0.409**	**0.409**	**0.409**	**0.528**	**0.529**	**0.529**	**0.542**	**0.542**	**0.542**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1x}M_{fx}/M_{rx}$	**0.053**	**0.061**	**0.061**	**0.061**	**0.082**	**0.053**	**0.054**	**0.083**	**0.067**	**0.067**	**0.058**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.006**	**0.006**	**0.014**	**0.014**	**0.008**	**0.004**	**0.004**	**0.017**	**0.027**	**0.027**	**0.015**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.470**	**0.478**	**0.486**	**0.484**	**0.499**	**0.466**	**0.587**	**0.629**	**0.622**	**0.636**	**0.615**	**0.542**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Demand/Capacity ≤ 1	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
Highest Ratio	**0.470**	**0.478**	**0.486**	**0.484**	**0.499**	**0.466**	**0.587**	**0.629**	**0.622**	**0.636**	**0.615**	**0.542**	**0.901**	**0.824**	**0.836**	**0.831**	**0.815**	**0.741**

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	433	433	433	434	434	434	435	435	435	436	436	436	437	437	437	438	438	438
Member Label	32N-45N	32N-45N	32N-45N	45N-13N	45N-13N	45N-13N	22S-33S	22S-33S	22S-33S	33S-32S	33S-32S	33S-32S	32S-45S	32S-45S	32S-45S	45S-13S	45S-13S	45S-13S
Station (m)	0.0	3.1	6.2	0.0	0.7	1.3	0.0	1.5	3.0	0.0	3.1	6.2	0.0	3.1	6.2	0.0	0.7	1.3
Node Label at Station	32N	---	45N	45N	---	13N	22S	---	33S	33S	---	32S	32S	---	45S	45S	---	13S
Section #	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10
Element Group	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link

Member Factored Load Effects:

C_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	2440	2434	2427	2476	2475	2474	2497	2494	2491	2474	2467	2461	2504	2498	2491	2549	2548	2546
$M_{fx\ (tension)}$ (kNm)	114	85	33	33	17	0	0	36	66	66	101	113	113	86	34	34	18	0
$M_{fy\ (tension)}$ (kNm)	2	18	35	35	17	0	46	32	26	26	14	2	2	18	35	35	17	0
V_{fx} (kN)	6	6	6	26	26	26	24	24	24	4	4	4	6	6	6	26	26	26
V_{fy} (kN)	5	13	21	23	25	27	25	22	18	15	8	0	5	13	20	24	26	28

Gross Section Properties:

Ag (mm^2)	29435	29435	29435	29435	29435	29435	29435	29435	29435	29435	29435	29435	29435	29435	29435	29435	29435	29435
I_x (mm^4)	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09
I_y (mm^4)	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08
J (mm^4)	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06
r_x (mm)	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335
r_y (mm)	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
S_x (mm^3)	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06
S_y (mm^3)	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	6248	6248	6248	1325	1325	1325	3038	3038	3038	6248	6248	6248	6248	6248	6248	1325	1325	1325

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	433	433	433	434	434	434	435	435	435	436	436	436	437	437	437	438	438	438
Member Label	32N-45N	32N-45N	32N-45N	45N-13N	45N-13N	45N-13N	22S-33S	22S-33S	22S-33S	33S-32S	33S-32S	33S-32S	32S-45S	32S-45S	32S-45S	45S-13S	45S-13S	45S-13S
Station (m)	0.0	3.1	6.2	0.0	0.7	1.3	0.0	1.5	3.0	0.0	3.1	6.2	0.0	3.1	6.2	0.0	0.7	1.3
Node Label at Station	32N	---	45N	45N	---	13N	22S	---	33S	33S	---	32S	32S	---	45S	45S	---	13S
Section #	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10
Element Group	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression																		
Webs in combined flexural and axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	433	433	433	434	434	434	435	435	435	436	436	436	437	437	437	438	438	438
Member Label	32N-45N	32N-45N	32N-45N	45N-13N	45N-13N	45N-13N	22S-33S	22S-33S	22S-33S	33S-32S	33S-32S	33S-32S	32S-45S	32S-45S	32S-45S	45S-13S	45S-13S	45S-13S
Station (m)	0.0	3.1	6.2	0.0	0.7	1.3	0.0	1.5	3.0	0.0	3.1	6.2	0.0	3.1	6.2	0.0	0.7	1.3
Node Label at Station	32N	---	45N	45N	---	13N	22S	---	33S	33S	---	32S	32S	---	45S	45S	---	13S
Section #	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10
Element Group	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861
L_y (mm)	6248	6248	6248	1325	1325	1325	3038	3038	3038	6248	6248	6248	6248	6248	6248	1325	1325	1325
λ_{max}	1.057	1.057	1.057	0.519	0.519	0.519	0.519	0.519	0.519	1.057	1.057	1.057	1.057	1.057	1.057	0.519	0.519	0.519
C_r (kN)	2976.0	2976.0	2976.0	4693.1	4693.1	4693.1	4693.1	4693.1	4693.1	2976.0	2976.0	2976.0	2976.0	2976.0	2976.0	4693.1	4693.1	4693.1
$(kL/r)_{max}$	102.4	102.4	102.4	50.3	50.3	50.3	50.3	50.3	50.3	102.4	102.4	102.4	102.4	102.4	102.4	50.3	50.3	50.3
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	5495	5495	5495	22924	22924	22924	22924	22924	22924	5495	5495	5495	5495	5495	5495	22924	22924	22924

Shear Flexibility Factor:

1. Lacing:

a (mm)	733	733	733	733	733	733	733	733	733	733	733	733	733	733	733	733	733	733
b (mm)	635	635	635	635	635	635	635	635	635	635	635	635	635	635	635	635	635	635
ε_aa (mm)	733	733	733	733	733	733	733	733	733	733	733	733	733	733	733	733	733	733
ε_bb (mm)	635	635	635	635	635	635	635	635	635	635	635	635	635	635	635	635	635	635
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477
A_c (mm^2)	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718
A_d (mm^2)	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148
A_b (mm^2)	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148
μ	0.2435	0.2435	0.2435	0.2435	0.2435	0.2435	0.2435	0.2435	0.2435	0.2435	0.2435	0.2435	0.2435	0.2435	0.2435	0.2435	0.2435	0.2435
P_{cr}/P_e (Fig.3.51)	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64
k'(sqrt(P_e/P_{cr}))	1.250	1.250	1.250	1.250	1.250	1.250	1.250	1.250	1.250	1.250	1.250	1.250	1.250	1.250	1.250	1.250	1.250	1.250
λ_v	1.321	1.321	1.321	0.280	0.280	0.280	0.642	0.642	0.642	1.321	1.321	1.321	1.321	1.321	1.321	0.280	0.280	0.280
Cr' (kN)	2267.5	2267.5	2267.5	5158.4	5158.4	5158.4	4332.2	4332.2	4332.2	2267.5	2267.5	2267.5	2267.5	2267.5	2267.5	5158.4	5158.4	5158.4
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	433	433	433	434	434	434	435	435	435	436	436	436	437	437	437	438	438	438
Member Label	32N-45N	32N-45N	32N-45N	45N-13N	45N-13N	45N-13N	22S-33S	22S-33S	22S-33S	33S-32S	33S-32S	33S-32S	32S-45S	32S-45S	32S-45S	45S-13S	45S-13S	45S-13S
Station (m)	0.0	3.1	6.2	0.0	0.7	1.3	0.0	1.5	3.0	0.0	3.1	6.2	0.0	3.1	6.2	0.0	0.7	1.3
Node Label at Station	32N	---	45N	45N	---	13N	22S	---	33S	33S	---	32S	32S	---	45S	45S	---	13S
Section #	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10
Element Group	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	2976.0	2976.0	2976.0	4693.1	4693.1	4693.1	4693.1	4693.1	4693.1	2976.0	2976.0	2976.0	2976.0	2976.0	2976.0	4693.1	4693.1	4693.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27963	27963	27963	27963	27963	27963	27963	27963	27963	27963	27963	27963	27963	27963	27963	27963	27963	27963
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596
$A_{n(corrosion)}$ (mm^2)	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566
$T_{r(b)}$ (kN)	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566
$T_{r(c)}$ (kN)	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	433	433	433	434	434	434	435	435	435	436	436	436	437	437	437	438	438	438
Member Label	32N-45N	32N-45N	32N-45N	45N-13N	45N-13N	45N-13N	22S-33S	22S-33S	22S-33S	33S-32S	33S-32S	33S-32S	32S-45S	32S-45S	32S-45S	45S-13S	45S-13S	45S-13S
Station (m)	0.0	3.1	6.2	0.0	0.7	1.3	0.0	1.5	3.0	0.0	3.1	6.2	0.0	3.1	6.2	0.0	0.7	1.3
Node Label at Station	32N	---	45N	45N	---	13N	22S	---	33S	33S	---	32S	32S	---	45S	45S	---	13S
Section #	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10
Element Group	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574
$(kL/r)_{max}$	102	102	102	50	50	50	50	50	50	102	102	102	102	102	102	50	50	50
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1589	1589	1589	1589	1589	1589	1589	1589	1589	1589	1589	1589	1589	1589	1589	1589	1589	1589
$M_{ry(Laterally\ Supported)}$ (kNm)	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861
L_{uy} (mm)	6248	6248	6248	1325	1325	1325	3038	3038	3038	6248	6248	6248	6248	6248	6248	1325	1325	1325
M_{ux} (kNm) (y weak)	432	432	432	432	432	432	432	432	432	432	432	432	432	432	432	432	432	432
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	389.8	389.8	389.8	389.8	389.8	389.8	389.8	389.8	389.8	389.8	389.8	389.8	389.8	389.8	389.8	389.8	389.8	389.8
M_{ry} (kNm)	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
(T_f/T_r)<=1	0.437	0.436	0.435	0.444	0.444	0.443	0.448	0.447	0.447	0.443	0.442	0.441	0.449	0.448	0.447	0.457	0.457	0.456

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.437	0.436	0.435	0.444	0.444	0.443	0.448	0.447	0.447	0.443	0.442	0.441	0.449	0.448	0.447	0.457	0.457	0.456
M_{fx}/M_{rx}<=1	0.292	0.218	0.085	0.085	0.044	0.000	0.000	0.092	0.169	0.169	0.259	0.290	0.290	0.221	0.087	0.087	0.046	0.000
M_{fy}/M_{ry}<=1	0.016	0.140	0.273	0.273	0.132	0.000	0.358	0.249	0.203	0.203	0.109	0.016	0.016	0.140	0.273	0.273	0.132	0.000
$T_f/T_r+M_f/M_r$<=1	0.745	0.795	0.792	0.801	0.620	0.443	0.806	0.789	0.818	0.815	0.810	0.747	0.754	0.809	0.806	0.817	0.635	0.456
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PARSONS

Member ID in CSiBridge	433	433	433	434	434	434	435	435	435	436	436	436	437	437	437	438	438	438
Member Label	32N-45N	32N-45N	32N-45N	45N-13N	45N-13N	45N-13N	22S-33S	22S-33S	22S-33S	33S-32S	33S-32S	33S-32S	32S-45S	32S-45S	32S-45S	45S-13S	45S-13S	45S-13S
Station (m)	0.0	3.1	6.2	0.0	0.7	1.3	0.0	1.5	3.0	0.0	3.1	6.2	0.0	3.1	6.2	0.0	0.7	1.3
Node Label at Station	32N	---	45N	45N	---	13N	22S	---	33S	33S	---	32S	32S	---	45S	45S	---	13S
Section #	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10
Element Group	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5285	5285	5285	5285	5285	5285	5285	5285	5285	5285	5285	5285	5285	5285	5285	5285	5285	5285
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	5495	5495	5495	122119	122119	122119	23240	23240	23240	5495	5495	5495	5495	5495	5495	122119	122119	122119
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.057	1.057	1.057	0.519	0.519	0.519	0.519	0.519	0.519	1.057	1.057	1.057	1.057	1.057	1.057	0.519	0.519	0.519
$C_{r\ (K=1)}$ (kN)	2976	2976	2976	4693	4693	4693	4693	4693	4693	2976	2976	2976	2976	2976	2976	4693	4693	4693
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.3. Lateral Torsional Buckling:

λ_{max}	1.057	1.057	1.057	0.519	0.519	0.519	0.519	0.519	0.519	1.057	1.057	1.057	1.057	1.057	1.057	0.519	0.519	0.519
C_r (kN)	2976	2976	2976	4693	4693	4693	4693	4693	4693	2976	2976	2976	2976	2976	2976	4693	4693	4693
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	390	390	390	390	390	390	390	390	390	390	390	390	390	390	390	390	390	390
M_{ry} (kNm)	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.745	0.795	0.792	0.801	0.620	0.443	0.806	0.789	0.818	0.815	0.810	0.747	0.754	0.809	0.806	0.817	0.635	0.456

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	27	27	27	138	138	138	142	142	142	203	203	203	14	14	14	189	189	189
Member Label	13N-54N	13N-54N	13N-54N	54N-55N	54N-55N	54N-55N	54S-55S	54S-55S	54S-55S	13S-54S	13S-54S	13S-54S	15N-16N	15N-16N	15N-16N	15S-16S	15S-16S	15S-16S
Station (m)	0.0	7.8	15.6	0.0	0.5	1.0	0.0	0.5	1.0	0.0	7.8	15.6	0.0	0.7	1.5	0.0	0.7	1.5
Node Label at Station	13N	---	54N	54N	---	55N	54S	---	55S	13S	---	54S	15N	---	16N	15S	---	16S
Section #	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 09	Section 09	Section 09	Section 09	Section 09	Section 09
Element Group	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay

Member Factored Load Effects:

C_f (kN)	130	127	125	0	0	0	0	0	0	132	129	127	307	314	320	238	245	251
$M_{fx\ (comp)}$ (kNm)	0	122	2	0	0	0	0	0	0	0	122	2	0	74	146	0	77	153
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	60	33	24	56	41	26
T_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	900	894	887	970	963	957
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	74	146	0	77	153
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	60	33	24	56	41	26
V_{fx} (kN)	0	0	0	0	0	0	0	0	0	0	0	0	56	56	56	40	40	40
V_{fy} (kN)	31	0	32	4	2	0	4	2	0	31	0	32	102	100	98	107	105	102

Gross Section Properties:

Ag (mm^2)	37576	37576	37576	37576	37576	37576	37576	37576	37576	37576	37576	37576	109680	109680	109680	109680	109680	109680
I_x (mm^4)	2.02E+09	2.02E+09	2.02E+09	2.02E+09	2.02E+09	2.02E+09	2.02E+09	2.02E+09	2.02E+09	2.02E+09	2.02E+09	2.02E+09	3.13E+09	3.13E+09	3.13E+09	3.13E+09	3.13E+09	3.13E+09
I_y (mm^4)	1.18E+09	1.18E+09	1.18E+09	1.18E+09	1.18E+09	1.18E+09	1.18E+09	1.18E+09	1.18E+09	1.18E+09	1.18E+09	1.18E+09	7.74E+07	7.74E+07	7.74E+07	7.74E+07	7.74E+07	7.74E+07
J (mm^4)	7.12E+06	7.12E+06	7.12E+06	7.12E+06	7.12E+06	7.12E+06	7.12E+06	7.12E+06	7.12E+06	7.12E+06	7.12E+06	7.12E+06	1.67E+07	1.67E+07	1.67E+07	1.67E+07	1.67E+07	1.67E+07
r_x (mm)	232	232	232	232	232	232	232	232	232	232	232	232	169	169	169	169	169	169
r_y (mm)	177	177	177	177	177	177	177	177	177	177	177	177	27	27	27	27	27	27
S_x (mm^3)	5.51E+06	5.51E+06	5.51E+06	5.51E+06	5.51E+06	5.51E+06	5.51E+06	5.51E+06	5.51E+06	5.51E+06	5.51E+06	5.51E+06	8.72E+06	8.72E+06	8.72E+06	8.72E+06	8.72E+06	8.72E+06
S_y (mm^3)	4.41E+06	4.41E+06	4.41E+06	4.41E+06	4.41E+06	4.41E+06	4.41E+06	4.41E+06	4.41E+06	4.41E+06	4.41E+06	4.41E+06	8.13E+05	8.13E+05	8.13E+05	8.13E+05	8.13E+05	8.13E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	20	20	20	20	20	20
L (mm)	15582	15582	15582	955	955	955	955	955	955	15582	15582	15582	1463	1463	1463	1463	1463	1463

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	27	27	27	138	138	138	142	142	142	203	203	203	14	14	14	189	189	189
Member Label	13N-54N	13N-54N	13N-54N	54N-55N	54N-55N	54N-55N	54S-55S	54S-55S	54S-55S	13S-54S	13S-54S	13S-54S	15N-16N	15N-16N	15N-16N	15S-16S	15S-16S	15S-16S
Station (m)	0.0	7.8	15.6	0.0	0.5	1.0	0.0	0.5	1.0	0.0	7.8	15.6	0.0	0.7	1.5	0.0	0.7	1.5
Node Label at Station	13N	---	54N	54N	---	55N	54S	---	55S	13S	---	54S	15N	---	16N	15S	---	16S
Section #	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 09	Section 09	Section 09	Section 09	Section 09	Section 09
Element Group	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	16.0	16.0	16.0	16.0	16.0	16.0
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3						
Webs in flexural compression	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3						
Webs in combined flexural and axial compression	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	16.0	16.0	16.0	16.0	16.0	16.0
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	27	27	27	138	138	138	142	142	142	203	203	203	14	14	14	189	189	189
Member Label	13N-54N	13N-54N	13N-54N	54N-55N	54N-55N	54N-55N	54S-55S	54S-55S	54S-55S	13S-54S	13S-54S	13S-54S	15N-16N	15N-16N	15N-16N	15S-16S	15S-16S	15S-16S
Station (m)	0.0	7.8	15.6	0.0	0.5	1.0	0.0	0.5	1.0	0.0	7.8	15.6	0.0	0.7	1.5	0.0	0.7	1.5
Node Label at Station	13N	---	54N	54N	---	55N	54S	---	55S	13S	---	54S	15N	---	16N	15S	---	16S
Section #	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 09	Section 09	Section 09	Section 09	Section 09	Section 09
Element Group	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	15582	15582	15582	955	955	955	955	955	955	15582	15582	15582	1463	1463	1463	1463	1463	1463
L_y (mm)	15582	15582	15582	955	955	955	955	955	955	15582	15582	15582	1463	1463	1463	1463	1463	1463
λ_{max}	0.908	0.908	0.908	0.056	0.056	0.056	0.056	0.056	0.056	0.908	0.908	0.908	0.559	0.559	0.559	0.559	0.559	0.559
C_r (kN)	4402.0	4402.0	4402.0	6744.6	6744.6	6744.6	6744.6	6744.6	6744.6	4402.0	4402.0	4402.0	14383.2	14383.2	14383.2	14383.2	14383.2	14383.2
$(kL/r)_{max}$	88.0	88.0	88.0	5.4	5.4	5.4	5.4	5.4	5.4	88.0	88.0	88.0	54.2	54.2	54.2	54.2	54.2	54.2
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1						
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	9621	9621	9621	2560940	2560940	2560940	2560940	2560940	2560940	9621	9621	9621	71449	71449	71449	71449	71449	71449

Shear Flexibility Factor:

1. Lacing:

a (mm)	675	675	675	675	675	675	675	675	675	675	675	675	425	425	425	425	425	425
b (mm)	584	584	584	584	584	584	584	584	584	584	584	584	368	368	368	368	368	368
ε_aa (mm)	675	675	675	675	675	675	675	675	675	675	675	675	425	425	425	425	425	425
ε_bb (mm)	584	584	584	584	584	584	584	584	584	584	584	584	368	368	368	368	368	368
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477
A_c (mm^2)	18788	18788	18788	18788	18788	18788	18788	18788	18788	18788	18788	18788	54840	54840	54840	54840	54840	54840
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	0.3330	0.3330	0.3330	0.3330	0.3330	0.3330	0.3330	0.3330	0.3330	0.3330	0.3330	0.3330	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	1.324	1.324	1.324	1.324	1.324	1.324	1.324	1.324	1.324	1.324	1.324	1.324	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	1.203	1.203	1.203	0.074	0.074	0.074	0.074	0.074	0.074	1.203	1.203	1.203	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	3270.0	3270.0	3270.0	6742.1	6742.1	6742.1	6742.1	6742.1	6742.1	3270.0	3270.0	3270.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	Yes	Yes	Yes	No	No	No	No	No	No	Yes	Yes	Yes	No	No	No	No	No	No

Member ID in CSiBridge	27	27	27	138	138	138	142	142	142	203	203	203	14	14	14	189	189	189
Member Label	13N-54N	13N-54N	13N-54N	54N-55N	54N-55N	54N-55N	54S-55S	54S-55S	54S-55S	13S-54S	13S-54S	13S-54S	15N-16N	15N-16N	15N-16N	15S-16S	15S-16S	15S-16S
Station (m)	0.0	7.8	15.6	0.0	0.5	1.0	0.0	0.5	1.0	0.0	7.8	15.6	0.0	0.7	1.5	0.0	0.7	1.5
Node Label at Station	13N	---	54N	54N	---	55N	54S	---	55S	13S	---	54S	15N	---	16N	15S	---	16S
Section #	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 09	Section 09	Section 09	Section 09	Section 09	Section 09
Element Group	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	18788	18788	18788	18788	18788	18788	18788	18788	18788	18788	18788	18788	54840	54840	54840	54840	54840	54840
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	3270.0	3270.0	3270.0	6744.6	6744.6	6744.6	6744.6	6744.6	6744.6	3270.0	3270.0	3270.0	14383.2	14383.2	14383.2	14383.2	14383.2	14383.2

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	35697	35697	35697	35697	35697	35697	35697	35697	35697	35697	35697	35697	87744	87744	87744	87744	87744	87744
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	7122	7122	7122	7122	7122	7122	7122	7122	7122	7122	7122	7122	17505	17505	17505	17505	17505	17505
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	25994	25994	25994	25994	25994	25994	25994	25994	25994	25994	25994	25994	108918	108918	108918	108918	108918	108918
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	25994	25994	25994	25994	25994	25994	25994	25994	25994	25994	25994	25994	108918	108918	108918	108918	108918	108918
$A_{n(corrosion)}$ (mm^2)	24694	24694	24694	24694	24694	24694	24694	24694	24694	24694	24694	24694	87134	87134	87134	87134	87134	87134
$T_{r(b)}$ (kN)	8297	8297	8297	8297	8297	8297	8297	8297	8297	8297	8297	8297	29277	29277	29277	29277	29277	29277
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	24694	24694	24694	24694	24694	24694	24694	24694	24694	24694	24694	24694	87134	87134	87134	87134	87134	87134
$T_{r(c)}$ (kN)	8297	8297	8297	8297	8297	8297	8297	8297	8297	8297	8297	8297	29277	29277	29277	29277	29277	29277
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	27	27	27	138	138	138	142	142	142	203	203	203	14	14	14	189	189	189
Member Label	13N-54N	13N-54N	13N-54N	54N-55N	54N-55N	54N-55N	54S-55S	54S-55S	54S-55S	13S-54S	13S-54S	13S-54S	15N-16N	15N-16N	15N-16N	15S-16S	15S-16S	15S-16S
Station (m)	0.0	7.8	15.6	0.0	0.5	1.0	0.0	0.5	1.0	0.0	7.8	15.6	0.0	0.7	1.5	0.0	0.7	1.5
Node Label at Station	13N	---	54N	54N	---	55N	54S	---	55S	13S	---	54S	15N	---	16N	15S	---	16S
Section #	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 09	Section 09	Section 09	Section 09	Section 09	Section 09
Element Group	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	8297	8297	8297	8297	8297	8297	8297	8297	8297	8297	8297	8297	29277	29277	29277	29277	29277	29277
$(kL/r)_{max}$	88	88	88	5	5	5	5	5	5	88	88	88	54	54	54	54	54	54
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	7122	7122	7122	7122	7122	7122	7122	7122	7122	7122	7122	7122	17505	17505	17505	17505	17505	17505
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1044	1044	1044	1044	1044	1044	1044	1044	1044	1044	1044	1044	1392	1392	1392	1392	1392	1392
$M_{ry(Laterally\ Supported)}$ (kNm)	836	836	836	836	836	836	836	836	836	836	836	836	130	130	130	130	130	130
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	15582	15582	15582	955	955	955	955	955	955	15582	15582	15582	1463	1463	1463	1463	1463	1463
L_{uy} (mm)	15582	15582	15582	955	955	955	955	955	955	15582	15582	15582	1463	1463	1463	1463	1463	1463
M_{ux} (kNm) (y weak)	2297	2297	2297	37470	37470	37470	37470	37470	37470	2297	2297	2297	9573	9573	9573	9573	9573	9573
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1031.4	1031.4	1031.4	1190.3	1190.3	1190.3	1190.3	1190.3	1190.3	1031.4	1031.4	1031.4	1515.2	1515.2	1515.2	1515.2	1515.2	1515.2
M_{ry} (kNm)	836.1	836.1	836.1	836.1	836.1	836.1	836.1	836.1	836.1	836.1	836.1	836.1	129.8	129.8	129.8	129.8	129.8	129.8

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y/w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
$(V_f/V_r)<=1$																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.040	0.039	0.038	0.000	0.000	0.000	0.000	0.000	0.000	0.040	0.039	0.039	0.021	0.022	0.022	0.017	0.017	0.017
$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.051	0.051	0.051	0.055	0.055	0.055

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.051	0.051	0.051	0.055	0.055	0.055
$M_{fx}/M_{rx}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.049	0.096	0.000	0.051	0.101
$M_{fy}/M_{ry}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.254	0.185	0.432	0.316	0.200
$T_f/T_r+M_f/M_r<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.514	0.354	0.332	0.487	0.422	0.356
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.364	0.205	0.184	0.325	0.261	0.196

Member ID in CSiBridge	27	27	27	138	138	138	142	142	142	203	203	203	14	14	14	189	189	189
Member Label	13N-54N	13N-54N	13N-54N	54N-55N	54N-55N	54N-55N	54S-55S	54S-55S	54S-55S	13S-54S	13S-54S	13S-54S	15N-16N	15N-16N	15N-16N	15S-16S	15S-16S	15S-16S
Station (m)	0.0	7.8	15.6	0.0	0.5	1.0	0.0	0.5	1.0	0.0	7.8	15.6	0.0	0.7	1.5	0.0	0.7	1.5
Node Label at Station	13N	---	54N	54N	---	55N	54S	---	55S	13S	---	54S	15N	---	16N	15S	---	16S
Section #	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 09	Section 09	Section 09	Section 09	Section 09	Section 09
Element Group	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	6747	6747	6747	6747	6747	6747	6747	6747	6747	6747	6747	6747	16584	16584	16584	16584	16584	16584
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.64E+04	1.64E+04	1.64E+04	4.38E+06	4.38E+06	4.38E+06	4.38E+06	4.38E+06	4.38E+06	1.64E+04	1.64E+04	1.64E+04	2.88E+06	2.88E+06	2.88E+06	2.88E+06	2.88E+06	2.88E+06
U_{1x}	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	9621	9621	9621	2560940	2560940	2560940	2560940	2560940	2560940	9621	9621	9621	71449	71449	71449	71449	71449	71449
U_{1y}	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.019**	**0.019**	**0.019**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.020**	**0.019**	**0.019**	**0.019**	**0.019**	**0.019**	**0.014**	**0.015**	**0.015**
$U_{1x}M_{fx}/M_{rx}$	**0.000**	**0.118**	**0.002**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.118**	**0.002**	**0.000**	**0.053**	**0.105**	**0.000**	**0.055**	**0.110**
$U_{1y}M_{fy}/M_{ry}$	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.464**	**0.255**	**0.186**	**0.433**	**0.317**	**0.201**
Interaction	**0.019**	**0.137**	**0.020**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.020**	**0.137**	**0.021**	**0.483**	**0.328**	**0.310**	**0.447**	**0.387**	**0.326**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.908	0.908	0.908	0.056	0.056	0.056	0.056	0.056	0.056	0.908	0.908	0.908	0.559	0.559	0.559	0.559	0.559	0.559
$C_{r\ (K=1)}$ (kN)	4402	4402	4402	6745	6745	6745	6745	6745	6745	4402	4402	4402	14383	14383	14383	14383	14383	14383
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.030**	**0.029**	**0.028**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.030**	**0.029**	**0.029**	**0.021**	**0.022**	**0.022**	**0.017**	**0.017**	**0.017**
$U_{1x}M_{fx}/M_{rx}$	**0.000**	**0.118**	**0.002**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.118**	**0.002**	**0.000**	**0.053**	**0.105**	**0.000**	**0.055**	**0.110**
$U_{1y}M_{fy}/M_{ry}$	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.464**	**0.255**	**0.186**	**0.433**	**0.317**	**0.201**
Interaction	**0.030**	**0.147**	**0.030**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.030**	**0.147**	**0.031**	**0.486**	**0.330**	**0.313**	**0.450**	**0.389**	**0.328**

3.3. Lateral Torsional Buckling:

λ_{max}	0.908	0.908	0.908	0.056	0.056	0.056	0.056	0.056	0.056	0.908	0.908	0.908	0.559	0.559	0.559	0.559	0.559	0.559
C_r (kN)	4402	4402	4402	6745	6745	6745	6745	6745	6745	4402	4402	4402	14383	14383	14383	14383	14383	14383
U_{1x}	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1031	1031	1031	1190	1190	1190	1190	1190	1190	1031	1031	1031	1515	1515	1515	1515	1515	1515
M_{ry} (kNm)	836	836	836	836	836	836	836	836	836	836	836	836	130	130	130	130	130	130
C_f/C_r	**0.030**	**0.029**	**0.028**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.030**	**0.029**	**0.029**	**0.021**	**0.022**	**0.022**	**0.017**	**0.017**	**0.017**
$U_{1x}M_{fx}/M_{rx}$	**0.000**	**0.119**	**0.002**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.119**	**0.002**	**0.000**	**0.049**	**0.096**	**0.000**	**0.051**	**0.101**
$U_{1y}M_{fy}/M_{ry}$	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.464**	**0.255**	**0.186**	**0.433**	**0.317**	**0.201**
Interaction	**0.030**	**0.148**	**0.030**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.030**	**0.149**	**0.031**	**0.486**	**0.326**	**0.304**	**0.450**	**0.385**	**0.320**
Demand/Capacity ≤ 1	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
Highest Ratio	**0.040**	**0.148**	**0.038**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.040**	**0.149**	**0.039**	**0.514**	**0.354**	**0.332**	**0.487**	**0.422**	**0.356**

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	248	248	248	251	251	251	252	252	252	399	399	399	579	579	579	580	580	580
Member Label	16N-56N	16N-56N	16N-56N	15N-56N	15N-56N	15N-56N	56N-14N	56N-14N	56N-14N	16S-56S	16S-56S	16S-56S	15S-56S	15S-56S	15S-56S	56S-14S	56S-14S	56S-14S
Station (m)	0.0	0.8	1.6	0.0	0.8	1.6	0.0	3.4	6.7	0.0	0.8	1.6	0.0	0.8	1.6	0.0	3.4	6.7
Node Label at Station	16N	---	56N	15N	---	56N	56N	---	14N	16S	---	56S	15S	---	56S	56S	---	14S
Section #	Section 01	Section 01	Section 01	Section 08	Section 08	Section 08	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01	Section 08	Section 08	Section 08	Section 08	Section 08	Section 08
Element Group	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay

Member Factored Load Effects:

C_f (kN)	948	947	946	1948	1948	1948	2013	2015	2016	1027	1027	1026	2016	2016	2017	2083	2085	2086
$M_{fx\ (comp)}$ (kNm)	52	19	29	0	16	29	0	13	0	52	18	31	0	16	31	0	13	0
$M_{fy\ (comp)}$ (kNm)	27	13	0	21	10	0	0	0	0	40	20	0	46	23	0	0	0	0
T_f (kN)	420	421	422	0	0	0	0	0	0	343	344	345	0	0	0	0	0	0
$M_{fx\ (tension)}$ (kNm)	52	19	29	0	0	0	0	0	0	52	18	31	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	27	13	0	0	0	0	0	0	0	40	20	0	0	0	0	0	0	0
V_{fx} (kN)	17	17	17	13	13	13	0	0	0	25	25	25	28	28	28	0	0	0
V_{fy} (kN)	46	46	47	20	18	16	8	0	8	46	47	48	21	19	17	8	0	8

Gross Section Properties:

Ag (mm^2)	12774	12774	12774	20903	20903	20903	20903	20903	20903	12774	12774	12774	20903	20903	20903	20903	20903	20903
I_x (mm^4)	2.61E+08	2.61E+08	2.61E+08	3.34E+08	3.34E+08	3.34E+08	3.34E+08	3.34E+08	3.34E+08	2.61E+08	2.61E+08	2.61E+08	3.34E+08	3.34E+08	3.34E+08	3.34E+08	3.34E+08	3.34E+08
I_y (mm^4)	8.94E+08	8.94E+08	8.94E+08	9.14E+08	9.14E+08	9.14E+08	9.14E+08	9.14E+08	9.14E+08	8.94E+08	8.94E+08	8.94E+08	9.14E+08	9.14E+08	9.14E+08	9.14E+08	9.14E+08	9.14E+08
J (mm^4)	7.19E+05	7.19E+05	7.19E+05	2.92E+06	2.92E+06	2.92E+06	2.92E+06	2.92E+06	2.92E+06	7.19E+05	7.19E+05	7.19E+05	2.92E+06	2.92E+06	2.92E+06	2.92E+06	2.92E+06	2.92E+06
r_x (mm)	143	143	143	126	126	126	126	126	126	143	143	143	126	126	126	126	126	126
r_y (mm)	265	265	265	209	209	209	209	209	209	265	265	265	209	209	209	209	209	209
S_x (mm^3)	1.37E+06	1.37E+06	1.37E+06	1.75E+06	1.75E+06	1.75E+06	1.75E+06	1.75E+06	1.75E+06	1.37E+06	1.37E+06	1.37E+06	1.75E+06	1.75E+06	1.75E+06	1.75E+06	1.75E+06	1.75E+06
S_y (mm^3)	2.73E+06	2.73E+06	2.73E+06	4.00E+06	4.00E+06	4.00E+06	4.00E+06	4.00E+06	4.00E+06	2.73E+06	2.73E+06	2.73E+06	4.00E+06	4.00E+06	4.00E+06	4.00E+06	4.00E+06	4.00E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
L (mm)	1557	1557	1557	1628	1628	1628	6715	6715	6715	1557	1557	1557	1628	1628	1628	6715	6715	6715

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	248	248	248	251	251	251	252	252	252	399	399	399	579	579	579	580	580	580
Member Label	16N-56N	16N-56N	16N-56N	15N-56N	15N-56N	15N-56N	56N-14N	56N-14N	56N-14N	16S-56S	16S-56S	16S-56S	15S-56S	15S-56S	15S-56S	56S-14S	56S-14S	56S-14S
Station (m)	0.0	0.8	1.6	0.0	0.8	1.6	0.0	3.4	6.7	0.0	0.8	1.6	0.0	0.8	1.6	0.0	3.4	6.7
Node Label at Station	16N	---	56N	15N	---	56N	56N	---	14N	16S	---	56S	15S	---	56S	56S	---	14S
Section #	Section 01	Section 01	Section 01	Section 08	Section 08	Section 08	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01	Section 08	Section 08	Section 08	Section 08	Section 08	Section 08
Element Group	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels	5.2	5.2	5.2	5.4	5.4	5.4	5.4	5.4	5.4	5.2	5.2	5.2	5.4	5.4	5.4	5.4	5.4	5.4
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	37.5	37.5	37.5	28.8	28.8	28.8	28.8	28.8	28.8	37.5	37.5	37.5	28.8	28.8	28.8	28.8	28.8	28.8
Webs in flexural compression	37.5	37.5	37.5	28.8	28.8	28.8	28.8	28.8	28.8	37.5	37.5	37.5	28.8	28.8	28.8	28.8	28.8	28.8
Webs in combined flexural and axial compression	37.5	37.5	37.5	28.8	28.8	28.8	28.8	28.8	28.8	37.5	37.5	37.5	28.8	28.8	28.8	28.8	28.8	28.8
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	248	248	248	251	251	251	252	252	252	399	399	399	579	579	579	580	580	580
Member Label	16N-56N	16N-56N	16N-56N	15N-56N	15N-56N	15N-56N	56N-14N	56N-14N	56N-14N	16S-56S	16S-56S	16S-56S	15S-56S	15S-56S	15S-56S	56S-14S	56S-14S	56S-14S
Station (m)	0.0	0.8	1.6	0.0	0.8	1.6	0.0	3.4	6.7	0.0	0.8	1.6	0.0	0.8	1.6	0.0	3.4	6.7
Node Label at Station	16N	---	56N	15N	---	56N	56N	---	14N	16S	---	56S	15S	---	56S	56S	---	14S
Section #	Section 01	Section 01	Section 01	Section 08	Section 08	Section 08	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01	Section 08	Section 08	Section 08	Section 08	Section 08	Section 08
Element Group	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	1557	1557	1557	1628	1628	1628	6715	6715	6715	1557	1557	1557	1628	1628	1628	6715	6715	6715
L_y (mm)	1557	1557	1557	1628	1628	1628	6715	6715	6715	1557	1557	1557	1628	1628	1628	6715	6715	6715
λ_{max}	0.112	0.112	0.112	0.133	0.133	0.133	0.550	0.550	0.550	0.112	0.112	0.112	0.133	0.133	0.133	0.550	0.550	0.550
C_r (kN)	1927.3	1927.3	1927.3	3149.9	3149.9	3149.9	2756.5	2756.5	2756.5	1927.3	1927.3	1927.3	3149.9	3149.9	3149.9	2756.5	2756.5	2756.5
$(kL/r)_{max}$	10.9	10.9	10.9	12.9	12.9	12.9	53.3	53.3	53.3	10.9	10.9	10.9	12.9	12.9	12.9	53.3	53.3	53.3
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens							1	1	1							1	1	1
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	212506	212506	212506	248806	248806	248806	14617	14617	14617	212506	212506	212506	248806	248806	248806	14617	14617	14617

Shear Flexibility Factor:

1. Lacing:

a (mm)	657	657	657	425	425	425	425	425	425	657	657	657	425	425	425	425	425	425
b (mm)	569	569	569	368	368	368	368	368	368	569	569	569	368	368	368	368	368	368
ε_aa (mm)	657	657	657	425	425	425	425	425	425	657	657	657	425	425	425	425	425	425
ε_bb (mm)	569	569	569	368	368	368	368	368	368	569	569	569	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	1401	1401	1401	6477	6477	6477	6477	6477	6477	1401	1401	1401	6477	6477	6477	6477	6477	6477
A_c (mm^2)	6387	6387	6387	10452	10452	10452	10452	10452	10452	6387	6387	6387	10452	10452	10452	10452	10452	10452
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	248	248	248	251	251	251	252	252	252	399	399	399	579	579	579	580	580	580
Member Label	16N-56N	16N-56N	16N-56N	15N-56N	15N-56N	15N-56N	56N-14N	56N-14N	56N-14N	16S-56S	16S-56S	16S-56S	15S-56S	15S-56S	15S-56S	56S-14S	56S-14S	56S-14S
Station (m)	0.0	0.8	1.6	0.0	0.8	1.6	0.0	3.4	6.7	0.0	0.8	1.6	0.0	0.8	1.6	0.0	3.4	6.7
Node Label at Station	16N	---	56N	15N	---	56N	56N	---	14N	16S	---	56S	15S	---	56S	56S	---	14S
Section #	Section 01	Section 01	Section 01	Section 08	Section 08	Section 08	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01	Section 08	Section 08	Section 08	Section 08	Section 08	Section 08
Element Group	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	0.79	0.79	0.79	N/A	N/A	N/A	N/A	N/A	N/A	0.79	0.79	0.79
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	0.76	0.76	0.76	N/A	N/A	N/A	N/A	N/A	N/A	0.76	0.76	0.76
l (mm)	3343	3343	3343	3343	3343	3343	6044	6044	6044	3343	3343	3343	3343	3343	3343	6044	6044	6044
A_c (mm^2)	6387	6387	6387	10452	10452	10452	10452	10452	10452	6387	6387	6387	10452	10452	10452	10452	10452	10452
A_b (mm^2)	800	800	800	800	800	800	1000	1000	1000	800	800	800	800	800	800	1000	1000	1000
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	0.50	0.50	0.50	N/A	N/A	N/A	N/A	N/A	N/A	0.50	0.50	0.50
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	1.41	1.41	1.41	N/A	N/A	N/A	N/A	N/A	N/A	1.41	1.41	1.41
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	0.47	0.47	0.47	N/A	N/A	N/A	N/A	N/A	N/A	0.47	0.47	0.47
Cr' (kN)	999999	999999	999999	999999	999999	999999	2883	2883	2883	999999	999999	999999	999999	999999	999999	2883	2883	2883
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	1927.3	1927.3	1927.3	3149.9	3149.9	3149.9	2756.5	2756.5	2756.5	1927.3	1927.3	1927.3	3149.9	3149.9	3149.9	2756.5	2756.5	2756.5

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	10219	10219	10219	16722	16722	16722	16722	16722	16722	10219	10219	10219	16722	16722	16722	16722	16722	16722
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	2039	2039	2039	3336	3336	3336	3336	3336	3336	2039	2039	2039	3336	3336	3336	3336	3336	3336
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	9238	9238	9238	14953	14953	14953	14953	14953	14953	9238	9238	9238	14953	14953	14953	14953	14953	14953
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	9238	9238	9238	14953	14953	14953	14953	14953	14953	9238	9238	9238	14953	14953	14953	14953	14953	14953
$A_{n(corrosion)}$ (mm^2)	7391	7391	7391	11963	11963	11963	11963	11963	11963	7391	7391	7391	11963	11963	11963	11963	11963	11963
$T_{r(b)}$ (kN)	2483	2483	2483	4019	4019	4019	4019	4019	4019	2483	2483	2483	4019	4019	4019	4019	4019	4019
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	7391	7391	7391	11963	11963	11963	11963	11963	11963	7391	7391	7391	11963	11963	11963	11963	11963	11963
$T_{r(c)}$ (kN)	2483	2483	2483	4019	4019	4019	4019	4019	4019	2483	2483	2483	4019	4019	4019	4019	4019	4019
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	248	248	248	251	251	251	252	252	252	399	399	399	579	579	579	580	580	580
Member Label	16N-56N	16N-56N	16N-56N	15N-56N	15N-56N	15N-56N	56N-14N	56N-14N	56N-14N	16S-56S	16S-56S	16S-56S	15S-56S	15S-56S	15S-56S	56S-14S	56S-14S	56S-14S
Station (m)	0.0	0.8	1.6	0.0	0.8	1.6	0.0	3.4	6.7	0.0	0.8	1.6	0.0	0.8	1.6	0.0	3.4	6.7
Node Label at Station	16N	---	56N	15N	---	56N	56N	---	14N	16S	---	56S	15S	---	56S	56S	---	14S
Section #	Section 01	Section 01	Section 01	Section 08	Section 08	Section 08	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01	Section 08	Section 08	Section 08	Section 08	Section 08	Section 08
Element Group	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	2483	2483	2483	4019	4019	4019	4019	4019	4019	2483	2483	2483	4019	4019	4019	4019	4019	4019
$(kL/r)_{max}$	11	11	11	13	13	13	53	53	53	11	11	11	13	13	13	53	53	53
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	2039	2039	2039	3336	3336	3336	3336	3336	3336	2039	2039	2039	3336	3336	3336	3336	3336	3336
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	219	219	219	280	280	280	280	280	280	219	219	219	280	280	280	280	280	280
$M_{ry(Laterally\ Supported)}$ (kNm)	436	436	436	638	638	638	638	638	638	436	436	436	638	638	638	638	638	638
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	1557	1557	1557	1628	1628	1628	6715	6715	6715	1557	1557	1557	1628	1628	1628	6715	6715	6715
L_{uy} (mm)	1557	1557	1557	1628	1628	1628	6715	6715	6715	1557	1557	1557	1628	1628	1628	6715	6715	6715
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	3430	3430	3430	7477	7477	7477	1812	1812	1812	3430	3430	3430	7477	7477	7477	1812	1812	1812
M_{rx} (kNm)	218.6	218.6	218.6	279.8	279.8	279.8	279.8	279.8	279.8	218.6	218.6	218.6	279.8	279.8	279.8	279.8	279.8	279.8
M_{ry} (kNm)	477.6	477.6	477.6	711.0	711.0	711.0	638.8	638.8	638.8	477.6	477.6	477.6	711.0	711.0	711.0	638.8	638.8	638.8

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
$(V_f/V_r)<=1$																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.492	0.491	0.491	0.618	0.618	0.618	0.730	0.731	0.731	0.533	0.533	0.532	0.640	0.640	0.640	0.756	0.756	0.757
$(T_f/T_r)<=1$	0.206	0.207	0.207	0.000	0.000	0.000	0.000	0.000	0.000	0.168	0.169	0.169	0.000	0.000	0.000	0.000	0.000	0.000

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.206	0.207	0.207	0.000	0.000	0.000	0.000	0.000	0.000	0.168	0.169	0.169	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fx}/M_{rx}<=1$	0.238	0.087	0.133	0.000	0.000	0.000	0.000	0.000	0.000	0.238	0.082	0.142	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fy}/M_{ry}<=1$	0.057	0.027	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.084	0.042	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r<=1$	0.500	0.321	0.340	0.000	0.000	0.000	0.000	0.000	0.000	0.490	0.293	0.311	0.000	0.000	0.000	0.000	0.000	0.000
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Member ID in CSiBridge	248	248	248	251	251	251	252	252	252	399	399	399	579	579	579	580	580	580
Member Label	16N-56N	16N-56N	16N-56N	15N-56N	15N-56N	15N-56N	56N-14N	56N-14N	56N-14N	16S-56S	16S-56S	16S-56S	15S-56S	15S-56S	15S-56S	56S-14S	56S-14S	56S-14S
Station (m)	0.0	0.8	1.6	0.0	0.8	1.6	0.0	3.4	6.7	0.0	0.8	1.6	0.0	0.8	1.6	0.0	3.4	6.7
Node Label at Station	16N	---	56N	15N	---	56N	56N	---	14N	16S	---	56S	15S	---	56S	56S	---	14S
Section #	Section 01	Section 01	Section 01	Section 08	Section 08	Section 08	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01	Section 08	Section 08	Section 08	Section 08	Section 08	Section 08
Element Group	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1931	1931	1931	3161	3161	3161	3161	3161	3161	1931	1931	1931	3161	3161	3161	3161	3161	3161
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	2.13E+05	2.13E+05	2.13E+05	2.49E+05	2.49E+05	2.49E+05	1.46E+04	1.46E+04	1.46E+04	2.13E+05	2.13E+05	2.13E+05	2.49E+05	2.49E+05	2.49E+05	1.46E+04	1.46E+04	1.46E+04
U_{1x}	1.00	1.00	1.00	1.01	1.01	1.01	1.16	1.16	1.16	1.00	1.00	1.00	1.01	1.01	1.01	1.17	1.17	1.17
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	728481	728481	728481	681145	681145	681145	40017	40017	40017	728481	728481	728481	681145	681145	681145	40017	40017	40017
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.05	1.05	1.05	1.00	1.00	1.00	1.00	1.00	1.00	1.05	1.05	1.05
C_f/C_r	0.491	0.490	0.490	0.616	0.616	0.616	0.637	0.638	0.638	0.532	0.532	0.531	0.638	0.638	0.638	0.659	0.660	0.660
$U_{1x}M_{fx}/M_{rx}$	0.239	0.087	0.133	0.000	0.058	0.104	0.000	0.054	0.000	0.239	0.083	0.143	0.000	0.058	0.112	0.000	0.054	0.000
$U_{1y}M_{fy}/M_{ry}$	0.062	0.030	0.000	0.033	0.016	0.000	0.000	0.000	0.000	0.092	0.046	0.000	0.072	0.036	0.000	0.000	0.000	0.000
Interaction	0.792	0.608	0.623	0.649	0.690	0.721	0.637	0.691	0.638	0.863	0.660	0.674	0.710	0.732	0.750	0.659	0.714	0.660

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.112	0.112	0.112	0.133	0.133	0.133	0.550	0.550	0.550	0.112	0.112	0.112	0.133	0.133	0.133	0.550	0.550	0.550
$C_{r\ (K=1)}$ (kN)	1927	1927	1927	3150	3150	3150	2756	2756	2756	1927	1927	1927	3150	3150	3150	2756	2756	2756
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.01	1.01	1.01	1.16	1.16	1.16	1.00	1.00	1.00	1.01	1.01	1.01	1.17	1.17	1.17
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.05	1.05	1.05	1.00	1.00	1.00	1.00	1.00	1.00	1.05	1.05	1.05
C_f/C_r	0.492	0.491	0.491	0.618	0.618	0.618	0.730	0.731	0.731	0.533	0.533	0.532	0.640	0.640	0.640	0.756	0.756	0.757
$U_{1x}M_{fx}/M_{rx}$	0.239	0.087	0.133	0.000	0.058	0.104	0.000	0.054	0.000	0.239	0.083	0.143	0.000	0.058	0.112	0.000	0.054	0.000
$U_{1y}M_{fy}/M_{ry}$	0.062	0.030	0.000	0.033	0.016	0.000	0.000	0.000	0.000	0.092	0.046	0.000	0.072	0.036	0.000	0.000	0.000	0.000
Interaction	0.793	0.609	0.624	0.651	0.692	0.723	0.730	0.785	0.731	0.864	0.662	0.675	0.712	0.734	0.752	0.756	0.811	0.757

3.3. Lateral Torsional Buckling:

λ_{max}	0.112	0.112	0.112	0.133	0.133	0.133	0.550	0.550	0.550	0.112	0.112	0.112	0.133	0.133	0.133	0.550	0.550	0.550
C_r (kN)	1927	1927	1927	3150	3150	3150	2756	2756	2756	1927	1927	1927	3150	3150	3150	2756	2756	2756
U_{1x}	1.00	1.00	1.00	1.01	1.01	1.01	1.16	1.16	1.16	1.00	1.00	1.00	1.01	1.01	1.01	1.17	1.17	1.17
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.05	1.05	1.05	1.00	1.00	1.00	1.00	1.00	1.00	1.05	1.05	1.05
M_{rx} (kNm)	219	219	219	280	280	280	280	280	280	219	219	219	280	280	280	280	280	280
M_{ry} (kNm)	478	478	478	711	711	711	639	639	639	478	478	478	711	711	711	639	639	639
C_f/C_r	0.492	0.491	0.491	0.618	0.618	0.618	0.730	0.731	0.731	0.533	0.533	0.532	0.640	0.640	0.640	0.756	0.756	0.757
$U_{1x}M_{fx}/M_{rx}$	0.239	0.087	0.133	0.000	0.058	0.104	0.000	0.054	0.000	0.239	0.083	0.143	0.000	0.058	0.112	0.000	0.054	0.000
$U_{1y}M_{fy}/M_{ry}$	0.057	0.027	0.000	0.030	0.014	0.000	0.000	0.000	0.000	0.084	0.042	0.000	0.065	0.032	0.000	0.000	0.000	0.000
Interaction	0.787	0.606	0.624	0.648	0.690	0.723	0.730	0.785	0.731	0.856	0.658	0.675	0.705	0.730	0.752	0.756	0.811	0.757
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.793	0.609	0.624	0.651	0.692	0.723	0.730	0.785	0.731	0.864	0.662	0.675	0.712	0.734	0.752	0.756	0.811	0.757

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	29	29	29	33	33	33	157	157	157	160	160	160	164	164	164	206	206	206
Member Label	23N-24N	23N-24N	23N-24N	26N-25N	26N-25N	26N-25N	23S-24S	23S-24S	23S-24S	24N-25N	24N-25N	24N-25N	26S-25S	26S-25S	26S-25S	24S-25S	24S-25S	24S-25S
Station (m)	0.0	1.6	3.1	0.0	2.4	4.8	0.0	1.6	3.1	0.0	1.8	3.5	0.0	2.4	4.8	0.0	1.8	3.5
Node Label at Station	23N	---	24N	26N	---	25N	23S	---	24S	24N	---	25N	26S	---	25S	24S	---	25S
Section #	Section 23	Section 23	Section 23	Section 25	Section 25	Section 25	Section 23	Section 23	Section 23	Section 24	Section 24	Section 24	Section 25	Section 25	Section 25	Section 24	Section 24	Section 24
Element Group	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord

Member Factored Load Effects:

C_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	3824	3824	3823	2141	2144	2147	3851	3851	3850	3605	3602	3599	2162	2165	2169	3627	3624	3621
$M_{fx\ (tension)}$ (kNm)	398	186	38	30	45	71	400	187	39	21	30	67	31	47	74	23	30	70
$M_{fy\ (tension)}$ (kNm)	39	33	68	80	42	4	34	37	70	64	30	5	86	45	4	66	31	5
V_{fx} (kN)	31	31	31	16	16	16	29	29	29	19	19	19	17	17	17	20	20	20
V_{fy} (kN)	145	139	133	4	8	13	147	141	134	19	25	31	4	9	13	20	26	32

Gross Section Properties:

Ag (mm^2)	36774	36774	36774	20927	20927	20927	36774	36774	36774	33871	33871	33871	20927	20927	20927	33871	33871	33871
I_x (mm^4)	3.53E+09	3.53E+09	3.53E+09	2.00E+09	2.00E+09	2.00E+09	3.53E+09	3.53E+09	3.53E+09	3.31E+09	3.31E+09	3.31E+09	2.00E+09	2.00E+09	2.00E+09	3.31E+09	3.31E+09	3.31E+09
I_y (mm^4)	7.35E+09	7.35E+09	7.35E+09	4.02E+09	4.02E+09	4.02E+09	7.35E+09	7.35E+09	7.35E+09	6.75E+09	6.75E+09	6.75E+09	4.02E+09	4.02E+09	4.02E+09	6.75E+09	6.75E+09	6.75E+09
J (mm^4)	1.28E+07	1.28E+07	1.28E+07	8.86E+05	8.86E+05	8.86E+05	1.28E+07	1.28E+07	1.28E+07	3.68E+06	3.68E+06	3.68E+06	8.86E+05	8.86E+05	8.86E+05	3.68E+06	3.68E+06	3.68E+06
r_x (mm)	310	310	310	309	309	309	310	310	310	312	312	312	309	309	309	312	312	312
r_y (mm)	447	447	447	438	438	438	447	447	447	446	446	446	438	438	438	446	446	446
S_x (mm^3)	9.12E+06	9.12E+06	9.12E+06	5.17E+06	5.17E+06	5.17E+06	9.12E+06	9.12E+06	9.12E+06	8.53E+06	8.53E+06	8.53E+06	5.17E+06	5.17E+06	5.17E+06	8.53E+06	8.53E+06	8.53E+06
S_y (mm^3)	1.36E+07	1.36E+07	1.36E+07	7.55E+06	7.55E+06	7.55E+06	1.36E+07	1.36E+07	1.36E+07	1.26E+07	1.26E+07	1.26E+07	7.55E+06	7.55E+06	7.55E+06	1.26E+07	1.26E+07	1.26E+07
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	3127	3127	3127	4847	4847	4847	3127	3127	3127	3539	3539	3539	4847	4847	4847	3539	3539	3539

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	29	29	29	33	33	33	157	157	157	160	160	160	164	164	164	206	206	206
Member Label	23N-24N	23N-24N	23N-24N	26N-25N	26N-25N	26N-25N	23S-24S	23S-24S	23S-24S	24N-25N	24N-25N	24N-25N	26S-25S	26S-25S	26S-25S	24S-25S	24S-25S	24S-25S
Station (m)	0.0	1.6	3.1	0.0	2.4	4.8	0.0	1.6	3.1	0.0	1.8	3.5	0.0	2.4	4.8	0.0	1.8	3.5
Node Label at Station	23N	---	24N	26N	---	25N	23S	---	24S	24N	---	25N	26S	---	25S	24S	---	25S
Section #	Section 23	Section 23	Section 23	Section 25	Section 25	Section 25	Section 23	Section 23	Section 23	Section 24	Section 24	Section 24	Section 25	Section 25	Section 25	Section 24	Section 24	Section 24
Element Group	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	8.0	8.0	8.0	16.0	16.0	16.0	8.0	8.0	8.0	8.0	8.0	8.0	16.0	16.0	16.0	8.0	8.0	8.0
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression																		
Webs in combined flexural and axial compression	11.1	11.1	11.1	18.0	18.0	18.0	11.1	11.1	11.1	13.0	13.0	13.0	18.0	18.0	18.0	13.0	13.0	13.0
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	29	29	29	33	33	33	157	157	157	160	160	160	164	164	164	206	206	206
Member Label	23N-24N	23N-24N	23N-24N	26N-25N	26N-25N	26N-25N	23S-24S	23S-24S	23S-24S	24N-25N	24N-25N	24N-25N	26S-25S	26S-25S	26S-25S	24S-25S	24S-25S	24S-25S
Station (m)	0.0	1.6	3.1	0.0	2.4	4.8	0.0	1.6	3.1	0.0	1.8	3.5	0.0	2.4	4.8	0.0	1.8	3.5
Node Label at Station	23N	---	24N	26N	---	25N	23S	---	24S	24N	---	25N	26S	---	25S	24S	---	25S
Section #	Section 23	Section 23	Section 23	Section 25	Section 25	Section 25	Section 23	Section 23	Section 23	Section 24	Section 24	Section 24	Section 25	Section 25	Section 25	Section 24	Section 24	Section 24
Element Group	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	3127	3127	3127	4847	4847	4847	3127	3127	3127	3539	3539	3539	4847	4847	4847	3539	3539	3539
L_y (mm)	3127	3127	3127	4847	4847	4847	3127	3127	3127	3539	3539	3539	4847	4847	4847	3539	3539	3539
λ_{max}	0.104	0.104	0.104	0.162	0.162	0.162	0.104	0.104	0.104	0.117	0.117	0.117	0.162	0.162	0.162	0.117	0.117	0.117
C_r (kN)	6591.4	6591.4	6591.4	3736.3	3736.3	3736.3	6591.4	6591.4	6591.4	6067.1	6067.1	6067.1	3736.3	3736.3	3736.3	6067.1	6067.1	6067.1
$(kL/r)_{max}$	10.1	10.1	10.1	15.7	15.7	15.7	10.1	10.1	10.1	11.3	11.3	11.3	15.7	15.7	15.7	11.3	11.3	11.3
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	713692	713692	713692	168307	168307	168307	713692	713692	713692	520848	520848	520848	168307	168307	168307	520848	520848	520848

Shear Flexibility Factor:

1. Lacing:

a (mm)	1129	1129	1129	1112	1112	1112	1129	1129	1129	1122	1122	1122	1112	1112	1112	1122	1122	1122
b (mm)	978	978	978	963	963	963	978	978	978	972	972	972	963	963	963	972	972	972
ε_aa (mm)	1129	1129	1129	1112	1112	1112	1129	1129	1129	1122	1122	1122	1112	1112	1112	1122	1122	1122
ε_bb (mm)	978	978	978	963	963	963	978	978	978	972	972	972	963	963	963	972	972	972
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	6477	6477	6477	4363	4363	4363	6477	6477	6477	3185	3185	3185	4363	4363	4363	3185	3185	3185
A_c (mm^2)	18387	18387	18387	10464	10464	10464	18387	18387	18387	16936	16936	16936	10464	10464	10464	16936	16936	16936
A_d (mm^2)	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206
A_b (mm^2)	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206
μ	0.3754	0.3754	0.3754	0.4563	0.4563	0.4563	0.3754	0.3754	0.3754	1.4119	1.4119	1.4119	0.4563	0.4563	0.4563	1.4119	1.4119	1.4119
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414
λ_v	0.102	0.102	0.102	0.161	0.161	0.161	0.102	0.102	0.102	0.116	0.116	0.116	0.161	0.161	0.161	0.116	0.116	0.116
Cr' (kN)	6591.9	6591.9	6591.9	3736.4	3736.4	3736.4	6591.9	6591.9	6591.9	6067.5	6067.5	6067.5	3736.4	3736.4	3736.4	6067.5	6067.5	6067.5
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	29	29	29	33	33	33	157	157	157	160	160	160	164	164	164	206	206	206
Member Label	23N-24N	23N-24N	23N-24N	26N-25N	26N-25N	26N-25N	23S-24S	23S-24S	23S-24S	24N-25N	24N-25N	24N-25N	26S-25S	26S-25S	26S-25S	24S-25S	24S-25S	24S-25S
Station (m)	0.0	1.6	3.1	0.0	2.4	4.8	0.0	1.6	3.1	0.0	1.8	3.5	0.0	2.4	4.8	0.0	1.8	3.5
Node Label at Station	23N	---	24N	26N	---	25N	23S	---	24S	24N	---	25N	26S	---	25S	24S	---	25S
Section #	Section 23	Section 23	Section 23	Section 25	Section 25	Section 25	Section 23	Section 23	Section 23	Section 24	Section 24	Section 24	Section 25	Section 25	Section 25	Section 24	Section 24	Section 24
Element Group	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	18387	18387	18387	10464	10464	10464	18387	18387	18387	16936	16936	16936	10464	10464	10464	16936	16936	16936
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	6591.4	6591.4	6591.4	3736.3	3736.3	3736.3	6591.4	6591.4	6591.4	6067.1	6067.1	6067.1	3736.3	3736.3	3736.3	6067.1	6067.1	6067.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	34935	34935	34935	19881	19881	19881	34935	34935	34935	32177	32177	32177	19881	19881	19881	32177	32177	32177
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	6970	6970	6970	3966	3966	3966	6970	6970	6970	6419	6419	6419	3966	3966	3966	6419	6419	6419
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	25289	25289	25289	20165	20165	20165	25289	25289	25289	23337	23337	23337	20165	20165	20165	23337	23337	21069
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	25289	25289	25289	20165	20165	20165	25289	25289	25289	23337	23337	23337	20165	20165	20165	23337	23337	21069
$A_{n(corrosion)}$ (mm^2)	24025	24025	24025	19157	19157	19157	24025	24025	24025	22170	22170	22170	19157	19157	19157	22170	22170	20016
$T_{r(b)}$ (kN)	8072	8072	8072	6437	6437	6437	8072	8072	8072	7449	7449	7449	6437	6437	6437	7449	7449	6725
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	24025	24025	24025	19157	19157	19157	24025	24025	24025	22170	22170	22170	19157	19157	19157	22170	22170	20016
$T_{r(c)}$ (kN)	8072	8072	8072	6437	6437	6437	8072	8072	8072	7449	7449	7449	6437	6437	6437	7449	7449	6725
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	29	29	29	33	33	33	157	157	157	160	160	160	164	164	164	206	206	206
Member Label	23N-24N	23N-24N	23N-24N	26N-25N	26N-25N	26N-25N	23S-24S	23S-24S	23S-24S	24N-25N	24N-25N	24N-25N	26S-25S	26S-25S	26S-25S	24S-25S	24S-25S	24S-25S
Station (m)	0.0	1.6	3.1	0.0	2.4	4.8	0.0	1.6	3.1	0.0	1.8	3.5	0.0	2.4	4.8	0.0	1.8	3.5
Node Label at Station	23N	---	24N	26N	---	25N	23S	---	24S	24N	---	25N	26S	---	25S	24S	---	25S
Section #	Section 23	Section 23	Section 23	Section 25	Section 25	Section 25	Section 23	Section 23	Section 23	Section 24	Section 24	Section 24	Section 25	Section 25	Section 25	Section 24	Section 24	Section 24
Element Group	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	8072	8072	8072	6437	6437	6437	8072	8072	8072	7449	7449	7449	6437	6437	6437	7449	7449	6725
$(kL/r)_{max}$	10	10	10	16	16	16	10	10	10	11	11	11	16	16	16	11	11	11
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	6970	6970	6970	3966	3966	3966	6970	6970	6970	6419	6419	6419	3966	3966	3966	6419	6419	6419
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1729	1729	1729	980	980	980	1729	1729	1729	1617	1617	1617	980	980	980	1617	1617	1617
$M_{ry(Laterally\ Supported)}$ (kNm)	2580	2580	2580	1432	1432	1432	2580	2580	2580	2382	2382	2382	1432	1432	1432	2382	2382	2382
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	3127	3127	3127	4847	4847	4847	3127	3127	3127	3539	3539	3539	4847	4847	4847	3539	3539	3539
L_{uy} (mm)	3127	3127	3127	4847	4847	4847	3127	3127	3127	3539	3539	3539	4847	4847	4847	3539	3539	3539
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	26518	26518	26518	3389	3389	3389	26518	26518	26518	12144	12144	12144	3389	3389	3389	12144	12144	12144
M_{rx} (kNm)	1729.2	1729.2	1729.2	980.2	980.2	980.2	1729.2	1729.2	1729.2	1617.1	1617.1	1617.1	980.2	980.2	980.2	1617.1	1617.1	1617.1
M_{ry} (kNm)	2877.6	2877.6	2877.6	1430.6	1430.6	1430.6	2877.6	2877.6	2877.6	2572.5	2572.5	2572.5	1430.6	1430.6	1430.6	2572.5	2572.5	2572.5

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
(T_f/T_r)<=1	0.549	0.549	0.549	0.540	0.541	0.541	0.553	0.553	0.552	0.562	0.561	0.561	0.545	0.546	0.547	0.565	0.565	0.564

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.549	0.549	0.549	0.540	0.541	0.541	0.553	0.553	0.552	0.562	0.561	0.561	0.545	0.546	0.547	0.565	0.565	0.564
M_{fx}/M_{rx}<=1	0.230	0.108	0.022	0.031	0.046	0.072	0.231	0.108	0.023	0.013	0.019	0.041	0.032	0.048	0.075	0.014	0.019	0.043
M_{fy}/M_{ry}<=1	0.014	0.011	0.024	0.056	0.029	0.003	0.012	0.013	0.024	0.025	0.012	0.002	0.060	0.031	0.003	0.026	0.012	0.002
$T_f/T_r+M_f/M_r$<=1	0.792	0.668	0.594	0.626	0.616	0.617	0.796	0.674	0.599	0.599	0.591	0.604	0.637	0.625	0.625	0.605	0.595	0.609
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	29	29	29	33	33	33	157	157	157	160	160	160	164	164	164	206	206	206
Member Label	23N-24N	23N-24N	23N-24N	26N-25N	26N-25N	26N-25N	23S-24S	23S-24S	23S-24S	24N-25N	24N-25N	24N-25N	26S-25S	26S-25S	26S-25S	24S-25S	24S-25S	24S-25S
Station (m)	0.0	1.6	3.1	0.0	2.4	4.8	0.0	1.6	3.1	0.0	1.8	3.5	0.0	2.4	4.8	0.0	1.8	3.5
Node Label at Station	23N	---	24N	26N	---	25N	23S	---	24S	24N	---	25N	26S	---	25S	24S	---	25S
Section #	Section 23	Section 23	Section 23	Section 25	Section 25	Section 25	Section 23	Section 23	Section 23	Section 24	Section 24	Section 24	Section 25	Section 25	Section 25	Section 24	Section 24	Section 24
Element Group	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	6603	6603	6603	3757	3757	3757	6603	6603	6603	6082	6082	6082	3757	3757	3757	6082	6082	6082
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	7.14E+05	7.14E+05	7.14E+05	1.68E+05	1.68E+05	1.68E+05	7.14E+05	7.14E+05	7.14E+05	5.21E+05	5.21E+05	5.21E+05	1.68E+05	1.68E+05	1.68E+05	5.21E+05	5.21E+05	5.21E+05
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	1483764	1483764	1483764	337684	337684	337684	1483764	1483764	1483764	1062886	1062886	1062886	337684	337684	337684	1062886	1062886	1062886
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.104	0.104	0.104	0.162	0.162	0.162	0.104	0.104	0.104	0.117	0.117	0.117	0.162	0.162	0.162	0.117	0.117	0.117
$C_{r\ (K=1)}$ (kN)	6591	6591	6591	3736	3736	3736	6591	6591	6591	6067	6067	6067	3736	3736	3736	6067	6067	6067
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.3. Lateral Torsional Buckling:

λ_{max}	0.104	0.104	0.104	0.162	0.162	0.162	0.104	0.104	0.104	0.117	0.117	0.117	0.162	0.162	0.162	0.117	0.117	0.117
C_r (kN)	6591	6591	6591	3736	3736	3736	6591	6591	6591	6067	6067	6067	3736	3736	3736	6067	6067	6067
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1729	1729	1729	980	980	980	1729	1729	1729	1617	1617	1617	980	980	980	1617	1617	1617
M_{ry} (kNm)	2878	2878	2878	1431	1431	1431	2878	2878	2878	2573	2573	2573	1431	1431	1431	2573	2573	2573
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.792	0.668	0.594	0.626	0.616	0.617	0.796	0.674	0.599	0.599	0.591	0.604	0.637	0.625	0.625	0.605	0.595	0.609

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	528	528	528	529	529	529	530	530	530	531	531	531	30	30	30	205	205	205
Member Label	23N-46N	23N-46N	23N-46N	46N-22N	46N-22N	46N-22N	23S-46S	23S-46S	23S-46S	46S-22S	46S-22S	46S-22S	21N-25N	21N-25N	21N-25N	21S-25S	21S-25S	21S-25S
Station (m)	0.0	3.8	7.6	0.0	0.3	0.6	0.0	3.8	7.6	0.0	0.3	0.6	0.0	3.9	7.9	0.0	3.9	7.9
Node Label at Station	23N	---	46N	46N	---	22N	23S	---	46S	46S	---	22S	21N	---	25N	21S	---	25S
Section #	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 18	Section 18	Section 18	Section 18	Section 18	Section 18
Element Group	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal

Member Factored Load Effects:

C_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	1936	1929	1922	1935	1928	1921
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	32	2	6	33	2	6
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	23	12	1	28	15	1
T_f (kN)	3759	3759	3759	3864	3864	3864	3798	3798	3798	3914	3914	3914	0	0	0	0	0	0
$M_{fx\ (tension)}$ (kNm)	388	166	8	8	1	9	391	168	10	10	2	8	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	39	58	89	89	91	93	34	74	114	114	94	73	0	0	0	0	0	0
V_{fx} (kN)	17	17	17	60	60	60	16	16	16	65	65	65	3	3	3	3	3	3
V_{fy} (kN)	67	50	33	28	26	25	67	50	33	30	28	27	13	4	6	13	4	6

Gross Section Properties:

Ag (mm^2)	41129	41129	41129	41129	41129	41129	41129	41129	41129	41129	41129	41129	27097	27097	27097	27097	27097	27097
I_x (mm^4)	3.88E+09	3.88E+09	3.88E+09	3.88E+09	3.88E+09	3.88E+09	3.88E+09	3.88E+09	3.88E+09	3.88E+09	3.88E+09	3.88E+09	6.94E+08	6.94E+08	6.94E+08	6.94E+08	6.94E+08	6.94E+08
I_y (mm^4)	8.28E+09	8.28E+09	8.28E+09	8.28E+09	8.28E+09	8.28E+09	8.28E+09	8.28E+09	8.28E+09	8.28E+09	8.28E+09	8.28E+09	3.83E+09	3.83E+09	3.83E+09	3.83E+09	3.83E+09	3.83E+09
J (mm^4)	7.46E+06	7.46E+06	7.46E+06	7.46E+06	7.46E+06	7.46E+06	7.46E+06	7.46E+06	7.46E+06	7.46E+06	7.46E+06	7.46E+06	5.16E+06	5.16E+06	5.16E+06	5.16E+06	5.16E+06	5.16E+06
r_x (mm)	307	307	307	307	307	307	307	307	307	307	307	307	160	160	160	160	160	160
r_y (mm)	449	449	449	449	449	449	449	449	449	449	449	449	376	376	376	376	376	376
S_x (mm^3)	1.00E+07	1.00E+07	1.00E+07	1.00E+07	1.00E+07	1.00E+07	1.00E+07	1.00E+07	1.00E+07	1.00E+07	1.00E+07	1.00E+07	3.04E+06	3.04E+06	3.04E+06	3.04E+06	3.04E+06	3.04E+06
S_y (mm^3)	1.52E+07	1.52E+07	1.52E+07	1.52E+07	1.52E+07	1.52E+07	1.52E+07	1.52E+07	1.52E+07	1.52E+07	1.52E+07	1.52E+07	9.60E+06	9.60E+06	9.60E+06	9.60E+06	9.60E+06	9.60E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	7594	7594	7594	636	636	636	7594	7594	7594	636	636	636	7895	7895	7895	7895	7895	7895

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	528	528	528	529	529	529	530	530	530	531	531	531	30	30	30	205	205	205
Member Label	23N-46N	23N-46N	23N-46N	46N-22N	46N-22N	46N-22N	23S-46S	23S-46S	23S-46S	46S-22S	46S-22S	46S-22S	21N-25N	21N-25N	21N-25N	21S-25S	21S-25S	21S-25S
Station (m)	0.0	3.8	7.6	0.0	0.3	0.6	0.0	3.8	7.6	0.0	0.3	0.6	0.0	3.9	7.9	0.0	3.9	7.9
Node Label at Station	23N	---	46N	46N	---	22N	23S	---	46S	46S	---	22S	21N	---	25N	21S	---	25S
Section #	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 18	Section 18	Section 18	Section 18	Section 18	Section 18
Element Group	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression																		
Webs in combined flexural and axial compression	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	24.0	24.0	24.0	24.0	24.0	24.0
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	528	528	528	529	529	529	530	530	530	531	531	531	30	30	30	205	205	205
Member Label	23N-46N	23N-46N	23N-46N	46N-22N	46N-22N	46N-22N	23S-46S	23S-46S	23S-46S	46S-22S	46S-22S	46S-22S	21N-25N	21N-25N	21N-25N	21S-25S	21S-25S	21S-25S
Station (m)	0.0	3.8	7.6	0.0	0.3	0.6	0.0	3.8	7.6	0.0	0.3	0.6	0.0	3.9	7.9	0.0	3.9	7.9
Node Label at Station	23N	---	46N	46N	---	22N	23S	---	46S	46S	---	22S	21N	---	25N	21S	---	25S
Section #	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 18	Section 18	Section 18	Section 18	Section 18	Section 18
Element Group	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	8230	8230	8230	8230	8230	8230	8230	8230	8230	8230	8230	8230	7895	7895	7895	7895	7895	7895
L_y (mm)	7594	7594	7594	636	636	636	7594	7594	7594	636	636	636	7895	7895	7895	7895	7895	7895
λ_{max}	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.509	0.509	0.509	0.509	0.509	0.509
C_r (kN)	7213.7	7213.7	7213.7	7213.7	7213.7	7213.7	7213.7	7213.7	7213.7	7213.7	7213.7	7213.7	4344.9	4344.9	4344.9	4344.9	4344.9	4344.9
$(kL/r)_{max}$	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	49.3	49.3	49.3	49.3	49.3	49.3
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1				1	1	1				1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	113029	113029	113029	113029	113029	113029	113029	113029	113029	113029	113029	113029	21981	21981	21981	21981	21981	21981

Shear Flexibility Factor:

1. Lacing:

a (mm)	1141	1141	1141	719	719	719	1141	1141	1141	719	719	719	759	759	759	759	759	759
b (mm)	988	988	988	622	622	622	988	988	988	622	622	622	657	657	657	657	657	657
ε_aa (mm)	1141	1141	1141	719	719	719	1141	1141	1141	719	719	719	759	759	759	759	759	759
ε_bb (mm)	988	988	988	622	622	622	988	988	988	622	622	622	657	657	657	657	657	657
ε_a	1.00	1.00	1.00	N/A	N/A	N/A	1.00	1.00	1.00	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	N/A	N/A	N/A	1.00	1.00	1.00	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	6834	6834	6834	572	572	572	6834	6834	6834	572	572	572	7106	7106	7106	7106	7106	7106
A_c (mm^2)	20565	20565	20565	20565	20565	20565	20565	20565	20565	20565	20565	20565	13549	13549	13549	13549	13549	13549
A_d (mm^2)	2206	2206	2206	1045	1045	1045	2206	2206	2206	1045	1045	1045	1008	1008	1008	1008	1008	1008
A_b (mm^2)	2206	2206	2206	1045	1045	1045	2206	2206	2206	1045	1045	1045	1008	1008	1008	1008	1008	1008
μ	0.3850	0.3850	0.3850	NA	NA	NA	0.3850	0.3850	0.3850	NA	NA	NA	0.2273	0.2273	0.2273	0.2273	0.2273	0.2273
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.65	0.65	0.65	0.65	0.65	0.65
k'(sqrt(P_e/P_{cr}))	1.414	1.414	1.414	N/A	N/A	N/A	1.414	1.414	1.414	N/A	N/A	N/A	1.241	1.241	1.241	1.241	1.241	1.241
λ_v	0.247	0.247	0.247	N/A	N/A	N/A	0.247	0.247	0.247	N/A	N/A	N/A	0.269	0.269	0.269	0.269	0.269	0.269
Cr' (kN)	7257.8	7257.8	7257.8	999999.0	999999.0	999999.0	7257.8	7257.8	7257.8	999999.0	999999.0	999999.0	4760.6	4760.6	4760.6	4760.6	4760.6	4760.6
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	528	528	528	529	529	529	530	530	530	531	531	531	30	30	30	205	205	205
Member Label	23N-46N	23N-46N	23N-46N	46N-22N	46N-22N	46N-22N	23S-46S	23S-46S	23S-46S	46S-22S	46S-22S	46S-22S	21N-25N	21N-25N	21N-25N	21S-25S	21S-25S	21S-25S
Station (m)	0.0	3.8	7.6	0.0	0.3	0.6	0.0	3.8	7.6	0.0	0.3	0.6	0.0	3.9	7.9	0.0	3.9	7.9
Node Label at Station	23N	---	46N	46N	---	22N	23S	---	46S	46S	---	22S	21N	---	25N	21S	---	25S
Section #	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 18	Section 18	Section 18	Section 18	Section 18	Section 18
Element Group	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	20565	20565	20565	20565	20565	20565	20565	20565	20565	20565	20565	20565	13549	13549	13549	13549	13549	13549
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	7213.7	7213.7	7213.7	7213.7	7213.7	7213.7	7213.7	7213.7	7213.7	7213.7	7213.7	7213.7	4344.9	4344.9	4344.9	4344.9	4344.9	4344.9

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	39073	39073	39073	39073	39073	39073	39073	39073	39073	39073	39073	39073	25742	25742	25742	25742	25742	25742
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	7795	7795	7795	7795	7795	7795	7795	7795	7795	7795	7795	7795	5136	5136	5136	5136	5136	5136
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	28327	28327	28327	28327	28327	28327	28327	28327	28327	28327	28327	28327	21001	21001	21001	21001	21001	21001
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	28327	28327	28327	28327	28327	28327	28327	28327	28327	28327	28327	28327	21001	21001	21001	21001	21001	21001
$A_{n(corrosion)}$ (mm^2)	26911	26911	26911	26911	26911	26911	26911	26911	26911	26911	26911	26911	19951	19951	19951	19951	19951	19951
$T_{r(b)}$ (kN)	9042	9042	9042	9042	9042	9042	9042	9042	9042	9042	9042	9042	6704	6704	6704	6704	6704	6704
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26911	26911	26911	26911	26911	26911	26911	26911	26911	26911	26911	26911	19951	19951	19951	19951	19951	19951
$T_{r(c)}$ (kN)	9042	9042	9042	9042	9042	9042	9042	9042	9042	9042	9042	9042	6704	6704	6704	6704	6704	6704
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	528	528	528	529	529	529	530	530	530	531	531	531	30	30	30	205	205	205
Member Label	23N-46N	23N-46N	23N-46N	46N-22N	46N-22N	46N-22N	23S-46S	23S-46S	23S-46S	46S-22S	46S-22S	46S-22S	21N-25N	21N-25N	21N-25N	21S-25S	21S-25S	21S-25S
Station (m)	0.0	3.8	7.6	0.0	0.3	0.6	0.0	3.8	7.6	0.0	0.3	0.6	0.0	3.9	7.9	0.0	3.9	7.9
Node Label at Station	23N	---	46N	46N	---	22N	23S	---	46S	46S	---	22S	21N	---	25N	21S	---	25S
Section #	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 18	Section 18	Section 18	Section 18	Section 18	Section 18
Element Group	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	9042	9042	9042	9042	9042	9042	9042	9042	9042	9042	9042	9042	6704	6704	6704	6704	6704	6704
$(kL/r)_{max}$	27	27	27	27	27	27	27	27	27	27	27	27	49	49	49	49	49	49
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	7795	7795	7795	7795	7795	7795	7795	7795	7795	7795	7795	7795	5136	5136	5136	5136	5136	5136
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1897	1897	1897	1897	1897	1897	1897	1897	1897	1897	1897	1897	576	576	576	576	576	576
$M_{ry(Laterally\ Supported)}$ (kNm)	2882	2882	2882	2882	2882	2882	2882	2882	2882	2882	2882	2882	1820	1820	1820	1820	1820	1820
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	8230	8230	8230	8230	8230	8230	8230	8230	8230	8230	8230	8230	7895	7895	7895	7895	7895	7895
L_{uy} (mm)	7594	7594	7594	636	636	636	7594	7594	7594	636	636	636	7895	7895	7895	7895	7895	7895
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	8059	8059	8059	8059	8059	8059	8059	8059	8059	8059	8059	8059	2957	2957	2957	2957	2957	2957
M_{rx} (kNm)	1897.3	1897.3	1897.3	1897.3	1897.3	1897.3	1897.3	1897.3	1897.3	1897.3	1897.3	1897.3	575.5	575.5	575.5	575.5	575.5	575.5
M_{ry} (kNm)	2946.3	2946.3	2946.3	2946.3	2946.3	2946.3	2946.3	2946.3	2946.3	2946.3	2946.3	2946.3	1693.4	1693.4	1693.4	1693.4	1693.4	1693.4

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.446	0.444	0.442	0.445	0.444	0.442
(T_f/T_r)<=1	0.482	0.482	0.482	0.496	0.496	0.496	0.487	0.487	0.487	0.502	0.502	0.502	0.000	0.000	0.000	0.000	0.000	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.482	0.482	0.482	0.496	0.496	0.496	0.487	0.487	0.487	0.502	0.502	0.502	0.000	0.000	0.000	0.000	0.000	0.000
M_{fx}/M_{rx}<=1	0.204	0.087	0.004	0.004	0.001	0.005	0.206	0.089	0.005	0.005	0.001	0.004	0.000	0.000	0.000	0.000	0.000	0.000
M_{fy}/M_{ry}<=1	0.013	0.020	0.030	0.030	0.031	0.032	0.012	0.025	0.039	0.039	0.032	0.025	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r$<=1	0.700	0.589	0.517	0.530	0.527	0.532	0.705	0.601	0.531	0.546	0.535	0.531	0.000	0.000	0.000	0.000	0.000	0.000
$M_f/M_r-T_fS/M_tA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PARSONS

Member ID in CSiBridge	528	528	528	529	529	529	530	530	530	531	531	531	30	30	30	205	205	205
Member Label	23N-46N	23N-46N	23N-46N	46N-22N	46N-22N	46N-22N	23S-46S	23S-46S	23S-46S	46S-22S	46S-22S	46S-22S	21N-25N	21N-25N	21N-25N	21S-25S	21S-25S	21S-25S
Station (m)	0.0	3.8	7.6	0.0	0.3	0.6	0.0	3.8	7.6	0.0	0.3	0.6	0.0	3.9	7.9	0.0	3.9	7.9
Node Label at Station	23N	---	46N	46N	---	22N	23S	---	46S	46S	---	22S	21N	---	25N	21S	---	25S
Section #	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 18	Section 18	Section 18	Section 18	Section 18	Section 18
Element Group	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	7385	7385	7385	7385	7385	7385	7385	7385	7385	7385	7385	7385	4865	4865	4865	4865	4865	4865
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	2.20E+04	2.20E+04	2.20E+04	2.20E+04	2.20E+04	2.20E+04
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.10	1.10	1.10	1.10	1.10	1.10
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	283591	283591	283591	40416161	40416161	40416161	283591	283591	283591	40416161	40416161	40416161	121219	121219	121219	121219	121219	121219
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.02	1.02	1.02	1.02	1.02	1.02
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.398	0.396	0.395	0.398	0.396	0.395
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.061	0.004	0.011	0.063	0.004	0.011
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.013	0.007	0.001	0.016	0.008	0.001
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.472	0.407	0.407	0.476	0.408	0.407

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.509	0.509	0.509	0.509	0.509	0.509
$C_{r\ (K=1)}$ (kN)	7214	7214	7214	7214	7214	7214	7214	7214	7214	7214	7214	7214	4345	4345	4345	4345	4345	4345
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.10	1.10	1.10	1.10	1.10	1.10
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.02	1.02	1.02	1.02	1.02	1.02
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.446	0.444	0.442	0.445	0.444	0.442
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.061	0.004	0.011	0.063	0.004	0.011
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.013	0.007	0.001	0.016	0.008	0.001
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.519	0.454	0.454	0.524	0.456	0.454

3.3. Lateral Torsional Buckling:

λ_{max}	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.509	0.509	0.509	0.509	0.509	0.509
C_r (kN)	7214	7214	7214	7214	7214	7214	7214	7214	7214	7214	7214	7214	4345	4345	4345	4345	4345	4345
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.10	1.10	1.10	1.10	1.10	1.10
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.02	1.02	1.02	1.02	1.02	1.02
M_{rx} (kNm)	1897	1897	1897	1897	1897	1897	1897	1897	1897	1897	1897	1897	576	576	576	576	576	576
M_{ry} (kNm)	2946	2946	2946	2946	2946	2946	2946	2946	2946	2946	2946	2946	1693	1693	1693	1693	1693	1693
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.446	0.444	0.442	0.445	0.444	0.442
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.061	0.004	0.011	0.063	0.004	0.011
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.014	0.007	0.001	0.017	0.009	0.001
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.520	0.455	0.454	0.525	0.457	0.454
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.700	0.589	0.517	0.530	0.527	0.532	0.705	0.601	0.531	0.546	0.535	0.531	0.520	0.455	0.454	0.525	0.457	0.454

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	255	255	255	273	273	273	274	274	274	275	275	275	424	424	424	425	425	425
Member Label	23N-21N	23N-21N	23N-21N	21N-43N	21N-43N	21N-43N	43N-44N	43N-44N	43N-44N	44N-24N	44N-24N	44N-24N	22N-42N	22N-42N	22N-42N	42N-41N	42N-41N	42N-41N
Station (m)	0.0	3.3	6.6	0.0	0.6	1.2	0.0	2.6	5.2	0.0	0.3	0.5	0.0	0.6	1.3	0.0	4.2	8.3
Node Label at Station	23N	---	21N	21N	---	43N	43N	---	44N	44N	---	24N	22N	---	42N	42N	---	41N
Section #	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal

Member Factored Load Effects:

C_f (kN)	632	636	641	1032	1031	1031	994	991	988	1018	1018	1017	2487	2488	2490	2404	2413	2421
$M_{fx\ (comp)}$ (kNm)	10	5	19	8	7	7	7	2	14	14	16	18	8	7	7	7	49	135
$M_{fy\ (comp)}$ (kNm)	4	16	28	11	13	14	14	12	10	10	6	20	56	50	79	79	54	29
T_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	4	4	4	4	4	4	3	3	3	52	52	52	45	45	45	10	10	10
V_{fy} (kN)	4	4	4	0	0	1	2	4	6	7	7	7	3	1	1	5	15	26

Gross Section Properties:

Ag (mm^2)	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	30968	30968	30968	30968	30968	30968
I_x (mm^4)	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	1.40E+09	1.40E+09	1.40E+09	1.40E+09	1.40E+09	1.40E+09
I_y (mm^4)	1.82E+09	1.82E+09	1.82E+09	1.82E+09	1.82E+09	1.82E+09	1.82E+09	1.82E+09	1.82E+09	1.82E+09	1.82E+09	1.82E+09	4.44E+09	4.44E+09	4.44E+09	4.44E+09	4.44E+09	4.44E+09
J (mm^4)	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	4.90E+06	4.90E+06	4.90E+06	4.90E+06	4.90E+06	4.90E+06
r_x (mm)	143	143	143	143	143	143	143	143	143	143	143	143	213	213	213	213	213	213
r_y (mm)	377	377	377	377	377	377	377	377	377	377	377	377	378	378	378	378	378	378
S_x (mm^3)	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	4.59E+06	4.59E+06	4.59E+06	4.59E+06	4.59E+06	4.59E+06
S_y (mm^3)	4.56E+06	4.56E+06	4.56E+06	4.56E+06	4.56E+06	4.56E+06	4.56E+06	4.56E+06	4.56E+06	4.56E+06	4.56E+06	4.56E+06	1.11E+07	1.11E+07	1.11E+07	1.11E+07	1.11E+07	1.11E+07
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	6553	6553	6553	1191	1191	1191	5202	5202	5202	542	542	542	1299	1299	1299	8300	8300	8300

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	255	255	255	273	273	273	274	274	274	275	275	275	424	424	424	425	425	425
Member Label	23N-21N	23N-21N	23N-21N	21N-43N	21N-43N	21N-43N	43N-44N	43N-44N	43N-44N	44N-24N	44N-24N	44N-24N	22N-42N	22N-42N	22N-42N	42N-41N	42N-41N	42N-41N
Station (m)	0.0	3.3	6.6	0.0	0.6	1.2	0.0	2.6	5.2	0.0	0.3	0.5	0.0	0.6	1.3	0.0	4.2	8.3
Node Label at Station	23N	---	21N	21N	---	43N	43N	---	44N	44N	---	24N	22N	---	42N	42N	---	41N
Section #	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge													8.0	8.0	8.0	8.0	8.0	8.0
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2						
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	34.8	34.8	34.8	34.8	34.8	34.8
Webs in flexural compression	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	34.8	34.8	34.8	34.8	34.8	34.8
Webs in combined flexural and axial compression	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	34.8	34.8	34.8	34.8	34.8	34.8
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	255	255	255	273	273	273	274	274	274	275	275	275	424	424	424	425	425	425
Member Label	23N-21N	23N-21N	23N-21N	21N-43N	21N-43N	21N-43N	43N-44N	43N-44N	43N-44N	44N-24N	44N-24N	44N-24N	22N-42N	22N-42N	22N-42N	42N-41N	42N-41N	42N-41N
Station (m)	0.0	3.3	6.6	0.0	0.6	1.2	0.0	2.6	5.2	0.0	0.3	0.5	0.0	0.6	1.3	0.0	4.2	8.3
Node Label at Station	23N	---	21N	21N	---	43N	43N	---	44N	44N	---	24N	22N	---	42N	42N	---	41N
Section #	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	6553	6553	6553	6934	6934	6934	6934	6934	6934	6934	6934	6934	10520	10520	10520	10520	10520	10520
L_y (mm)	6553	6553	6553	1191	1191	1191	5202	5202	5202	542	542	542	1299	1299	1299	8300	8300	8300
λ_{max}	0.473	0.473	0.473	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.509	0.509	0.509	0.509	0.509	0.509
C_r (kN)	2087.8	2087.8	2087.8	2058.2	2058.2	2058.2	2058.2	2058.2	2058.2	2058.2	2058.2	2058.2	4964.4	4964.4	4964.4	4964.4	4964.4	4964.4
$(kL/r)_{max}$	45.8	45.8	45.8	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	49.4	49.4	49.4	49.4	49.4	49.4
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	11992	11992	11992	10711	10711	10711	10711	10711	10711	10711	10711	10711	24954	24954	24954	24954	24954	24954

Shear Flexibility Factor:

1. Lacing:

a (mm)	821	821	821	821	821	821	821	821	821	821	821	821	763	763	763	763	763	763
b (mm)	711	711	711	711	711	711	711	711	711	711	711	711	660	660	660	660	660	660
ε_aa (mm)	821	821	821	821	821	821	821	821	821	821	821	821	763	763	763	763	763	763
ε_bb (mm)	711	711	711	711	711	711	711	711	711	711	711	711	660	660	660	660	660	660
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	5898	5898	5898	1072	1072	1072	4682	4682	4682	487	487	487	1170	1170	1170	7470	7470	7470
A_c (mm^2)	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	15484	15484	15484	15484	15484	15484
A_d (mm^2)	1008	1008	1008	1008	1008	1008	1008	1008	1008	1008	1008	1008	2206	2206	2206	2206	2206	2206
A_b (mm^2)	1008	1008	1008	1008	1008	1008	1008	1008	1008	1008	1008	1008	2206	2206	2206	2206	2206	2206
μ	0.1821	0.1821	0.1821	5.5125	5.5125	5.5125	0.2890	0.2890	0.2890	26.6643	26.6643	26.6643	4.4224	4.4224	4.4224	0.1084	0.1084	0.1084
P_{cr}/P_e (Fig.3.51)	0.68	0.68	0.68	0.50	0.50	0.50	0.61	0.61	0.61	0.50	0.50	0.50	0.50	0.50	0.50	0.75	0.75	0.75
k'(sqrt(P_e/P_{cr}))	1.215	1.215	1.215	1.414	1.414	1.414	1.280	1.280	1.280	1.414	1.414	1.414	1.414	1.414	1.414	1.153	1.153	1.153
λ_v	0.218	0.218	0.218	0.046	0.046	0.046	0.182	0.182	0.182	0.021	0.021	0.021	0.050	0.050	0.050	0.261	0.261	0.261
Cr' (kN)	2265.2	2265.2	2265.2	2293.1	2293.1	2293.1	2275.9	2275.9	2275.9	2293.5	2293.5	2293.5	5558.9	5558.9	5558.9	5449.3	5449.3	5449.3
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	255	255	255	273	273	273	274	274	274	275	275	275	424	424	424	425	425	425
Member Label	23N-21N	23N-21N	23N-21N	21N-43N	21N-43N	21N-43N	43N-44N	43N-44N	43N-44N	44N-24N	44N-24N	44N-24N	22N-42N	22N-42N	22N-42N	42N-41N	42N-41N	42N-41N
Station (m)	0.0	3.3	6.6	0.0	0.6	1.2	0.0	2.6	5.2	0.0	0.3	0.5	0.0	0.6	1.3	0.0	4.2	8.3
Node Label at Station	23N	---	21N	21N	---	43N	43N	---	44N	44N	---	24N	22N	---	42N	42N	---	41N
Section #	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	15484	15484	15484	15484	15484	15484
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	2087.8	2087.8	2087.8	2058.2	2058.2	2058.2	2058.2	2058.2	2058.2	2058.2	2058.2	2058.2	4964.4	4964.4	4964.4	4964.4	4964.4	4964.4

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	12135	12135	12135	12135	12135	12135	12135	12135	12135	12135	12135	12135	29420	29420	29420	29420	29420	29420
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	2421	2421	2421	2421	2421	2421	2421	2421	2421	2421	2421	2421	5869	5869	5869	5869	5869	5869
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	9238	9238	9238	9238	9238	9238	9238	9238	9238	9238	9238	9238	23482	23482	23482	23482	23482	23482
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	9238	9238	9238	9238	9238	9238	9238	9238	9238	9238	9238	9238	23482	23482	23482	23482	23482	23482
$A_{n(corrosion)}$ (mm^2)	8776	8776	8776	8776	8776	8776	8776	8776	8776	8776	8776	8776	22308	22308	22308	22308	22308	22308
$T_{r(b)}$ (kN)	2949	2949	2949	2949	2949	2949	2949	2949	2949	2949	2949	2949	7495	7495	7495	7495	7495	7495
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	8776	8776	8776	8776	8776	8776	8776	8776	8776	8776	8776	8776	22308	22308	22308	22308	22308	22308
$T_{r(c)}$ (kN)	2949	2949	2949	2949	2949	2949	2949	2949	2949	2949	2949	2949	7495	7495	7495	7495	7495	7495
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	255	255	255	273	273	273	274	274	274	275	275	275	424	424	424	425	425	425
Member Label	23N-21N	23N-21N	23N-21N	21N-43N	21N-43N	21N-43N	43N-44N	43N-44N	43N-44N	44N-24N	44N-24N	44N-24N	22N-42N	22N-42N	22N-42N	42N-41N	42N-41N	42N-41N
Station (m)	0.0	3.3	6.6	0.0	0.6	1.2	0.0	2.6	5.2	0.0	0.3	0.5	0.0	0.6	1.3	0.0	4.2	8.3
Node Label at Station	23N	---	21N	21N	---	43N	43N	---	44N	44N	---	24N	22N	---	42N	42N	---	41N
Section #	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	2949	2949	2949	2949	2949	2949	2949	2949	2949	2949	2949	2949	7495	7495	7495	7495	7495	7495
$(kL/r)_{max}$	46	46	46	48	48	48	48	48	48	48	48	48	49	49	49	49	49	49
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	2421	2421	2421	2421	2421	2421	2421	2421	2421	2421	2421	2421	5869	5869	5869	5869	5869	5869
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	260	260	260	260	260	260	260	260	260	260	260	260	870	870	870	870	870	870
$M_{ry(Laterally\ Supported)}$ (kNm)	865	865	865	865	865	865	865	865	865	865	865	865	2110	2110	2110	2110	2110	2110
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	6553	6553	6553	6934	6934	6934	6934	6934	6934	6934	6934	6934	10520	10520	10520	10520	10520	10520
L_{uy} (mm)	6553	6553	6553	1191	1191	1191	5202	5202	5202	542	542	542	1299	1299	1299	8300	8300	8300
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	815	815	815	770	770	770	770	770	770	770	770	770	3070	3070	3070	3070	3070	3070
M_{rx} (kNm)	259.6	259.6	259.6	259.6	259.6	259.6	259.6	259.6	259.6	259.6	259.6	259.6	869.9	869.9	869.9	869.9	869.9	869.9
M_{ry} (kNm)	667.0	667.0	667.0	648.0	648.0	648.0	648.0	648.0	648.0	648.0	648.0	648.0	1908.9	1908.9	1908.9	1908.9	1908.9	1908.9

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.303	0.305	0.307	0.501	0.501	0.501	0.483	0.481	0.480	0.495	0.495	0.494	0.501	0.501	0.502	0.484	0.486	0.488
(T_f/T_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
M_{fx}/M_{rx}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
M_{fy}/M_{ry}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PARSONS

Member ID in CSiBridge	255	255	255	273	273	273	274	274	274	275	275	275	424	424	424	425	425	425
Member Label	23N-21N	23N-21N	23N-21N	21N-43N	21N-43N	21N-43N	43N-44N	43N-44N	43N-44N	44N-24N	44N-24N	44N-24N	22N-42N	22N-42N	22N-42N	42N-41N	42N-41N	42N-41N
Station (m)	0.0	3.3	6.6	0.0	0.6	1.2	0.0	2.6	5.2	0.0	0.3	0.5	0.0	0.6	1.3	0.0	4.2	8.3
Node Label at Station	23N	---	21N	21N	---	43N	43N	---	44N	44N	---	24N	22N	---	42N	42N	---	41N
Section #	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	2294	2294	2294	2294	2294	2294	2294	2294	2294	2294	2294	2294	5560	5560	5560	5560	5560	5560
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.20E+04	1.20E+04	1.20E+04	1.07E+04	1.07E+04	1.07E+04	1.07E+04	1.07E+04	1.07E+04	1.07E+04	1.07E+04	1.07E+04	2.50E+04	2.50E+04	2.50E+04	2.50E+04	2.50E+04	2.50E+04
U_{1x}	1.06	1.06	1.06	1.11	1.11	1.11	1.10	1.10	1.10	1.11	1.11	1.10	1.11	1.11	1.11	1.11	1.11	1.11
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	83551	83551	83551	2529457	2529457	2529457	132609	132609	132609	12235257	12235257	12235257	5184951	5184951	5184951	127089	127089	127089
U_{1y}	1.01	1.01	1.01	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.02	1.02	1.02
C_f/C_r	**0.276**	**0.277**	**0.279**	**0.450**	**0.450**	**0.450**	**0.433**	**0.432**	**0.431**	**0.444**	**0.444**	**0.443**	**0.447**	**0.447**	**0.448**	**0.432**	**0.434**	**0.435**
$U_{1x}M_{fx}/M_{rx}$	**0.041**	**0.020**	**0.077**	**0.034**	**0.030**	**0.030**	**0.030**	**0.008**	**0.059**	**0.060**	**0.068**	**0.077**	**0.010**	**0.009**	**0.009**	**0.009**	**0.062**	**0.172**
$U_{1y}M_{fy}/M_{ry}$	**0.005**	**0.019**	**0.033**	**0.013**	**0.015**	**0.016**	**0.016**	**0.014**	**0.012**	**0.012**	**0.007**	**0.023**	**0.027**	**0.024**	**0.037**	**0.038**	**0.026**	**0.014**
Interaction	**0.321**	**0.316**	**0.389**	**0.497**	**0.494**	**0.496**	**0.479**	**0.455**	**0.502**	**0.515**	**0.519**	**0.543**	**0.484**	**0.480**	**0.494**	**0.479**	**0.522**	**0.621**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.473	0.473	0.473	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.509	0.509	0.509	0.509	0.509	0.509
$C_{r\ (K=1)}$ (kN)	2088	2088	2088	2058	2058	2058	2058	2058	2058	2058	2058	2058	4964	4964	4964	4964	4964	4964
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.06	1.06	1.06	1.11	1.11	1.11	1.10	1.10	1.10	1.11	1.11	1.10	1.11	1.11	1.11	1.11	1.11	1.11
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.01	1.01	1.01	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.02	1.02	1.02
C_f/C_r	**0.303**	**0.305**	**0.307**	**0.501**	**0.501**	**0.501**	**0.483**	**0.481**	**0.480**	**0.495**	**0.495**	**0.494**	**0.501**	**0.501**	**0.502**	**0.484**	**0.486**	**0.488**
$U_{1x}M_{fx}/M_{rx}$	**0.041**	**0.020**	**0.077**	**0.034**	**0.030**	**0.030**	**0.030**	**0.008**	**0.059**	**0.060**	**0.068**	**0.077**	**0.010**	**0.009**	**0.009**	**0.009**	**0.062**	**0.172**
$U_{1y}M_{fy}/M_{ry}$	**0.005**	**0.019**	**0.033**	**0.013**	**0.015**	**0.016**	**0.016**	**0.014**	**0.012**	**0.012**	**0.007**	**0.023**	**0.027**	**0.024**	**0.037**	**0.038**	**0.026**	**0.014**
Interaction	**0.348**	**0.344**	**0.417**	**0.548**	**0.546**	**0.547**	**0.529**	**0.504**	**0.551**	**0.566**	**0.570**	**0.594**	**0.538**	**0.534**	**0.548**	**0.531**	**0.575**	**0.674**

3.3. Lateral Torsional Buckling:

λ_{max}	0.473	0.473	0.473	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.509	0.509	0.509	0.509	0.509	0.509
C_r (kN)	2088	2088	2088	2058	2058	2058	2058	2058	2058	2058	2058	2058	4964	4964	4964	4964	4964	4964
U_{1x}	1.06	1.06	1.06	1.11	1.11	1.11	1.10	1.10	1.10	1.11	1.11	1.10	1.11	1.11	1.11	1.11	1.11	1.11
U_{1y}	1.01	1.01	1.01	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.02	1.02	1.02
M_{rx} (kNm)	260	260	260	260	260	260	260	260	260	260	260	260	870	870	870	870	870	870
M_{ry} (kNm)	667	667	667	648	648	648	648	648	648	648	648	648	1909	1909	1909	1909	1909	1909
C_f/C_r	**0.303**	**0.305**	**0.307**	**0.501**	**0.501**	**0.501**	**0.483**	**0.481**	**0.480**	**0.495**	**0.495**	**0.494**	**0.501**	**0.501**	**0.502**	**0.484**	**0.486**	**0.488**
$U_{1x}M_{fx}/M_{rx}$	**0.041**	**0.020**	**0.077**	**0.034**	**0.030**	**0.030**	**0.030**	**0.008**	**0.059**	**0.060**	**0.068**	**0.077**	**0.010**	**0.009**	**0.009**	**0.009**	**0.062**	**0.172**
$U_{1y}M_{fy}/M_{ry}$	**0.006**	**0.024**	**0.042**	**0.017**	**0.020**	**0.022**	**0.022**	**0.019**	**0.016**	**0.015**	**0.009**	**0.031**	**0.029**	**0.026**	**0.041**	**0.042**	**0.029**	**0.015**
Interaction	**0.349**	**0.349**	**0.427**	**0.553**	**0.551**	**0.552**	**0.534**	**0.509**	**0.555**	**0.570**	**0.572**	**0.602**	**0.541**	**0.536**	**0.552**	**0.535**	**0.577**	**0.675**
Demand/Capacity ≤ 1	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
Highest Ratio	**0.349**	**0.349**	**0.427**	**0.553**	**0.551**	**0.552**	**0.534**	**0.509**	**0.555**	**0.570**	**0.572**	**0.602**	**0.541**	**0.536**	**0.552**	**0.535**	**0.577**	**0.675**

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	426	426	426	583	583	583	601	601	601	602	602	602	603	603	603	604	604	604
Member Label	41N-21N	41N-21N	41N-21N	23S-21S	23S-21S	23S-21S	22S-42S	22S-42S	22S-42S	42S-41S	42S-41S	42S-41S	41S-21S	41S-21S	41S-21S	21S-43S	21S-43S	21S-43S
Station (m)	0.0	0.5	0.9	0.0	3.3	6.6	0.0	0.6	1.3	0.0	4.2	8.3	0.0	0.5	0.9	0.0	0.6	1.2
Node Label at Station	41N	---	21N	23S	---	21S	22S	---	42S	42S	---	41S	41S	---	21S	21S	---	43S
Section #	Section 16	Section 16	Section 16	Section 17	Section 17	Section 17	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 17	Section 17	Section 17
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal

Member Factored Load Effects:

C_f (kN)	2484	2485	2486	636	641	645	2515	2516	2517	2434	2443	2451	2518	2519	2520	1038	1038	1037
$M_{fx\ (comp)}$ (kNm)	135	149	163	10	5	19	8	7	8	8	49	135	135	149	164	7	7	7
$M_{fy\ (comp)}$ (kNm)	29	18	17	4	19	35	43	68	94	94	61	27	27	16	24	16	17	19
T_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	24	24	24	5	5	5	40	40	40	12	12	12	30	30	30	4	4	4
V_{fy} (kN)	29	30	31	4	4	4	2	0	2	5	15	26	30	31	33	1	1	0

Gross Section Properties:

Ag (mm^2)	30968	30968	30968	12774	12774	12774	30968	30968	30968	30968	30968	30968	30968	30968	30968	12774	12774	12774
I_x (mm^4)	1.40E+09	1.40E+09	1.40E+09	2.61E+08	2.61E+08	2.61E+08	1.40E+09	1.40E+09	1.40E+09	1.40E+09	1.40E+09	1.40E+09	1.40E+09	1.40E+09	1.40E+09	2.61E+08	2.61E+08	2.61E+08
I_y (mm^4)	4.44E+09	4.44E+09	4.44E+09	1.82E+09	1.82E+09	1.82E+09	4.44E+09	4.44E+09	4.44E+09	4.44E+09	4.44E+09	4.44E+09	4.44E+09	4.44E+09	4.44E+09	1.82E+09	1.82E+09	1.82E+09
J (mm^4)	4.90E+06	4.90E+06	4.90E+06	7.19E+05	7.19E+05	7.19E+05	4.90E+06	4.90E+06	4.90E+06	4.90E+06	4.90E+06	4.90E+06	4.90E+06	4.90E+06	4.90E+06	7.19E+05	7.19E+05	7.19E+05
r_x (mm)	213	213	213	143	143	143	213	213	213	213	213	213	213	213	213	143	143	143
r_y (mm)	378	378	378	377	377	377	378	378	378	378	378	378	378	378	378	377	377	377
S_x (mm^3)	4.59E+06	4.59E+06	4.59E+06	1.37E+06	1.37E+06	1.37E+06	4.59E+06	4.59E+06	4.59E+06	4.59E+06	4.59E+06	4.59E+06	4.59E+06	4.59E+06	4.59E+06	1.37E+06	1.37E+06	1.37E+06
S_y (mm^3)	1.11E+07	1.11E+07	1.11E+07	4.56E+06	4.56E+06	4.56E+06	1.11E+07	1.11E+07	1.11E+07	1.11E+07	1.11E+07	1.11E+07	1.11E+07	1.11E+07	1.11E+07	4.56E+06	4.56E+06	4.56E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	921	921	921	6553	6553	6553	1299	1299	1299	8300	8300	8300	921	921	921	1191	1191	1191

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	426	426	426	583	583	583	601	601	601	602	602	602	603	603	603	604	604	604
Member Label	41N-21N	41N-21N	41N-21N	23S-21S	23S-21S	23S-21S	22S-42S	22S-42S	22S-42S	42S-41S	42S-41S	42S-41S	41S-21S	41S-21S	41S-21S	21S-43S	21S-43S	21S-43S
Station (m)	0.0	0.5	0.9	0.0	3.3	6.6	0.0	0.6	1.3	0.0	4.2	8.3	0.0	0.5	0.9	0.0	0.6	1.2
Node Label at Station	41N	---	21N	23S	---	21S	22S	---	42S	42S	---	41S	41S	---	21S	21S	---	43S
Section #	Section 16	Section 16	Section 16	Section 17	Section 17	Section 17	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 17	Section 17	Section 17
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	8.0	8.0	8.0				8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0			
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels				5.2	5.2	5.2										5.2	5.2	5.2
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	34.8	34.8	34.8	37.5	37.5	37.5	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	37.5	37.5	37.5
Webs in flexural compression	34.8	34.8	34.8	37.5	37.5	37.5	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	37.5	37.5	37.5
Webs in combined flexural and axial compression	34.8	34.8	34.8	37.5	37.5	37.5	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	37.5	37.5	37.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	426	426	426	583	583	583	601	601	601	602	602	602	603	603	603	604	604	604
Member Label	41N-21N	41N-21N	41N-21N	23S-21S	23S-21S	23S-21S	22S-42S	22S-42S	22S-42S	42S-41S	42S-41S	42S-41S	41S-21S	41S-21S	41S-21S	21S-43S	21S-43S	21S-43S
Station (m)	0.0	0.5	0.9	0.0	3.3	6.6	0.0	0.6	1.3	0.0	4.2	8.3	0.0	0.5	0.9	0.0	0.6	1.2
Node Label at Station	41N	---	21N	23S	---	21S	22S	---	42S	42S	---	41S	41S	---	21S	21S	---	43S
Section #	Section 16	Section 16	Section 16	Section 17	Section 17	Section 17	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 17	Section 17	Section 17
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	10520	10520	10520	6553	6553	6553	10520	10520	10520	10520	10520	10520	10520	10520	10520	6934	6934	6934
L_y (mm)	921	921	921	6553	6553	6553	1299	1299	1299	8300	8300	8300	921	921	921	1191	1191	1191
λ_{max}	0.509	0.509	0.509	0.473	0.473	0.473	0.509	0.509	0.509	0.509	0.509	0.509	0.509	0.509	0.509	0.500	0.500	0.500
C_r (kN)	4964.4	4964.4	4964.4	2087.8	2087.8	2087.8	4964.4	4964.4	4964.4	4964.4	4964.4	4964.4	4964.4	4964.4	4964.4	2058.2	2058.2	2058.2
$(kL/r)_{max}$	49.4	49.4	49.4	45.8	45.8	45.8	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	48.5	48.5	48.5
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	24954	24954	24954	11992	11992	11992	24954	24954	24954	24954	24954	24954	24954	24954	24954	10711	10711	10711

Shear Flexibility Factor:

1. Lacing:

a (mm)	763	763	763	821	821	821	763	763	763	763	763	763	763	763	763	821	821	821
b (mm)	660	660	660	711	711	711	660	660	660	660	660	660	660	660	660	711	711	711
ε_aa (mm)	763	763	763	821	821	821	763	763	763	763	763	763	763	763	763	821	821	821
ε_bb (mm)	660	660	660	711	711	711	660	660	660	660	660	660	660	660	660	711	711	711
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	828	828	828	5898	5898	5898	1170	1170	1170	7470	7470	7470	828	828	828	1072	1072	1072
A_c (mm^2)	15484	15484	15484	6387	6387	6387	15484	15484	15484	15484	15484	15484	15484	15484	15484	6387	6387	6387
A_d (mm^2)	2206	2206	2206	1008	1008	1008	2206	2206	2206	2206	2206	2206	2206	2206	2206	1008	1008	1008
A_b (mm^2)	2206	2206	2206	1008	1008	1008	2206	2206	2206	2206	2206	2206	2206	2206	2206	1008	1008	1008
μ	8.8133	8.8133	8.8133	0.1821	0.1821	0.1821	4.4224	4.4224	4.4224	0.1084	0.1084	0.1084	8.8133	8.8133	8.8133	5.5125	5.5125	5.5125
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.68	0.68	0.68	0.50	0.50	0.50	0.75	0.75	0.75	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	1.414	1.414	1.414	1.215	1.215	1.215	1.414	1.414	1.414	1.153	1.153	1.153	1.414	1.414	1.414	1.414	1.414	1.414
λ_v	0.036	0.036	0.036	0.218	0.218	0.218	0.050	0.050	0.050	0.261	0.261	0.261	0.036	0.036	0.036	0.046	0.046	0.046
Cr' (kN)	5559.8	5559.8	5559.8	2265.2	2265.2	2265.2	5558.9	5558.9	5558.9	5449.3	5449.3	5449.3	5559.8	5559.8	5559.8	2293.1	2293.1	2293.1
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	426	426	426	583	583	583	601	601	601	602	602	602	603	603	603	604	604	604
Member Label	41N-21N	41N-21N	41N-21N	23S-21S	23S-21S	23S-21S	22S-42S	22S-42S	22S-42S	42S-41S	42S-41S	42S-41S	41S-21S	41S-21S	41S-21S	21S-43S	21S-43S	21S-43S
Station (m)	0.0	0.5	0.9	0.0	3.3	6.6	0.0	0.6	1.3	0.0	4.2	8.3	0.0	0.5	0.9	0.0	0.6	1.2
Node Label at Station	41N	---	21N	23S	---	21S	22S	---	42S	42S	---	41S	41S	---	21S	21S	---	43S
Section #	Section 16	Section 16	Section 16	Section 17	Section 17	Section 17	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 17	Section 17	Section 17
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	15484	15484	15484	6387	6387	6387	15484	15484	15484	15484	15484	15484	15484	15484	15484	6387	6387	6387
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	4964.4	4964.4	4964.4	2087.8	2087.8	2087.8	4964.4	4964.4	4964.4	4964.4	4964.4	4964.4	4964.4	4964.4	4964.4	2058.2	2058.2	2058.2

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	29420	29420	29420	12135	12135	12135	29420	29420	29420	29420	29420	29420	29420	29420	29420	12135	12135	12135
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5869	5869	5869	2421	2421	2421	5869	5869	5869	5869	5869	5869	5869	5869	5869	2421	2421	2421
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	23482	23482	23482	9238	9238	9238	23482	23482	23482	23482	23482	23482	23482	23482	23482	9238	9238	9238
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	23482	23482	23482	9238	9238	9238	23482	23482	23482	23482	23482	23482	23482	23482	23482	9238	9238	9238
$A_{n(corrosion)}$ (mm^2)	22308	22308	22308	8776	8776	8776	22308	22308	22308	22308	22308	22308	22308	22308	22308	8776	8776	8776
$T_{r(b)}$ (kN)	7495	7495	7495	2949	2949	2949	7495	7495	7495	7495	7495	7495	7495	7495	7495	2949	2949	2949
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	22308	22308	22308	8776	8776	8776	22308	22308	22308	22308	22308	22308	22308	22308	22308	8776	8776	8776
$T_{r(c)}$ (kN)	7495	7495	7495	2949	2949	2949	7495	7495	7495	7495	7495	7495	7495	7495	7495	2949	2949	2949
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	426	426	426	583	583	583	601	601	601	602	602	602	603	603	603	604	604	604
Member Label	41N-21N	41N-21N	41N-21N	23S-21S	23S-21S	23S-21S	22S-42S	22S-42S	22S-42S	42S-41S	42S-41S	42S-41S	41S-21S	41S-21S	41S-21S	21S-43S	21S-43S	21S-43S
Station (m)	0.0	0.5	0.9	0.0	3.3	6.6	0.0	0.6	1.3	0.0	4.2	8.3	0.0	0.5	0.9	0.0	0.6	1.2
Node Label at Station	41N	---	21N	23S	---	21S	22S	---	42S	42S	---	41S	41S	---	21S	21S	---	43S
Section #	Section 16	Section 16	Section 16	Section 17	Section 17	Section 17	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 17	Section 17	Section 17
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	7495	7495	7495	2949	2949	2949	7495	7495	7495	7495	7495	7495	7495	7495	7495	2949	2949	2949
$(kL/r)_{max}$	49	49	49	46	46	46	49	49	49	49	49	49	49	49	49	48	48	48
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5869	5869	5869	2421	2421	2421	5869	5869	5869	5869	5869	5869	5869	5869	5869	2421	2421	2421
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	870	870	870	260	260	260	870	870	870	870	870	870	870	870	870	260	260	260
$M_{ry(Laterally\ Supported)}$ (kNm)	2110	2110	2110	865	865	865	2110	2110	2110	2110	2110	2110	2110	2110	2110	865	865	865
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	10520	10520	10520	6553	6553	6553	10520	10520	10520	10520	10520	10520	10520	10520	10520	6934	6934	6934
L_{uy} (mm)	921	921	921	6553	6553	6553	1299	1299	1299	8300	8300	8300	921	921	921	1191	1191	1191
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	3070	3070	3070	815	815	815	3070	3070	3070	3070	3070	3070	3070	3070	3070	770	770	770
M_{rx} (kNm)	869.9	869.9	869.9	259.6	259.6	259.6	869.9	869.9	869.9	869.9	869.9	869.9	869.9	869.9	869.9	259.6	259.6	259.6
M_{ry} (kNm)	1908.9	1908.9	1908.9	667.0	667.0	667.0	1908.9	1908.9	1908.9	1908.9	1908.9	1908.9	1908.9	1908.9	1908.9	648.0	648.0	648.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y/w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
$(V_f/V_r)<=1$																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.500	0.501	0.501	0.305	0.307	0.309	0.507	0.507	0.507	0.490	0.492	0.494	0.507	0.507	0.508	0.504	0.504	0.504
$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fx}/M_{rx}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fy}/M_{ry}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PARSONS

Member ID in CSiBridge	426	426	426	583	583	583	601	601	601	602	602	602	603	603	603	604	604	604
Member Label	41N-21N	41N-21N	41N-21N	23S-21S	23S-21S	23S-21S	22S-42S	22S-42S	22S-42S	42S-41S	42S-41S	42S-41S	41S-21S	41S-21S	41S-21S	21S-43S	21S-43S	21S-43S
Station (m)	0.0	0.5	0.9	0.0	3.3	6.6	0.0	0.6	1.3	0.0	4.2	8.3	0.0	0.5	0.9	0.0	0.6	1.2
Node Label at Station	41N	---	21N	23S	---	21S	22S	---	42S	42S	---	41S	41S	---	21S	21S	---	43S
Section #	Section 16	Section 16	Section 16	Section 17	Section 17	Section 17	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 17	Section 17	Section 17
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5560	5560	5560	2294	2294	2294	5560	5560	5560	5560	5560	5560	5560	5560	5560	2294	2294	2294
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	2.50E+04	2.50E+04	2.50E+04	1.20E+04	1.20E+04	1.20E+04	2.50E+04	2.50E+04	2.50E+04	2.50E+04	2.50E+04	2.50E+04	2.50E+04	2.50E+04	2.50E+04	1.07E+04	1.07E+04	1.07E+04
U_{1x}	1.11	1.11	1.11	1.06	1.06	1.06	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	10332917	10332917	10332917	83551	83551	83551	5184951	5184951	5184951	127089	127089	127089	10332917	10332917	10332917	2529457	2529457	2529457
U_{1y}	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.02	1.02	1.02	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.447**	**0.447**	**0.447**	**0.277**	**0.279**	**0.281**	**0.452**	**0.452**	**0.453**	**0.438**	**0.439**	**0.441**	**0.453**	**0.453**	**0.453**	**0.453**	**0.453**	**0.452**
$U_{1x}M_{fx}/M_{rx}$	**0.172**	**0.190**	**0.208**	**0.041**	**0.020**	**0.077**	**0.010**	**0.009**	**0.010**	**0.010**	**0.062**	**0.172**	**0.173**	**0.191**	**0.210**	**0.030**	**0.030**	**0.030**
$U_{1y}M_{fy}/M_{ry}$	**0.014**	**0.009**	**0.008**	**0.005**	**0.022**	**0.041**	**0.020**	**0.032**	**0.045**	**0.045**	**0.029**	**0.013**	**0.013**	**0.008**	**0.011**	**0.019**	**0.020**	**0.022**
Interaction	**0.633**	**0.646**	**0.663**	**0.323**	**0.322**	**0.399**	**0.483**	**0.494**	**0.507**	**0.493**	**0.531**	**0.626**	**0.638**	**0.651**	**0.674**	**0.501**	**0.502**	**0.504**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.509	0.509	0.509	0.473	0.473	0.473	0.509	0.509	0.509	0.509	0.509	0.509	0.509	0.509	0.509	0.500	0.500	0.500
$C_{r\ (K=1)}$ (kN)	4964	4964	4964	2088	2088	2088	4964	4964	4964	4964	4964	4964	4964	4964	4964	2058	2058	2058
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.11	1.11	1.11	1.06	1.06	1.06	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.02	1.02	1.02	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.500**	**0.501**	**0.501**	**0.305**	**0.307**	**0.309**	**0.507**	**0.507**	**0.507**	**0.490**	**0.492**	**0.494**	**0.507**	**0.507**	**0.508**	**0.504**	**0.504**	**0.504**
$U_{1x}M_{fx}/M_{rx}$	**0.172**	**0.190**	**0.208**	**0.041**	**0.020**	**0.077**	**0.010**	**0.009**	**0.010**	**0.010**	**0.062**	**0.172**	**0.173**	**0.191**	**0.210**	**0.030**	**0.030**	**0.030**
$U_{1y}M_{fy}/M_{ry}$	**0.014**	**0.009**	**0.008**	**0.005**	**0.022**	**0.041**	**0.020**	**0.032**	**0.045**	**0.045**	**0.029**	**0.013**	**0.013**	**0.008**	**0.011**	**0.019**	**0.020**	**0.022**
Interaction	**0.686**	**0.699**	**0.717**	**0.350**	**0.350**	**0.427**	**0.537**	**0.548**	**0.562**	**0.546**	**0.584**	**0.679**	**0.693**	**0.706**	**0.729**	**0.553**	**0.554**	**0.556**

3.3. Lateral Torsional Buckling:

λ_{max}	0.509	0.509	0.509	0.473	0.473	0.473	0.509	0.509	0.509	0.509	0.509	0.509	0.509	0.509	0.509	0.500	0.500	0.500
C_r (kN)	4964	4964	4964	2088	2088	2088	4964	4964	4964	4964	4964	4964	4964	4964	4964	2058	2058	2058
U_{1x}	1.11	1.11	1.11	1.06	1.06	1.06	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
U_{1y}	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.02	1.02	1.02	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	870	870	870	260	260	260	870	870	870	870	870	870	870	870	870	260	260	260
M_{ry} (kNm)	1909	1909	1909	667	667	667	1909	1909	1909	1909	1909	1909	1909	1909	1909	648	648	648
C_f/C_r	**0.500**	**0.501**	**0.501**	**0.305**	**0.307**	**0.309**	**0.507**	**0.507**	**0.507**	**0.490**	**0.492**	**0.494**	**0.507**	**0.507**	**0.508**	**0.504**	**0.504**	**0.504**
$U_{1x}M_{fx}/M_{rx}$	**0.172**	**0.190**	**0.208**	**0.041**	**0.020**	**0.077**	**0.010**	**0.009**	**0.010**	**0.010**	**0.062**	**0.172**	**0.173**	**0.191**	**0.210**	**0.030**	**0.030**	**0.030**
$U_{1y}M_{fy}/M_{ry}$	**0.015**	**0.009**	**0.009**	**0.006**	**0.029**	**0.053**	**0.023**	**0.036**	**0.049**	**0.050**	**0.033**	**0.014**	**0.014**	**0.008**	**0.013**	**0.025**	**0.026**	**0.029**
Interaction	**0.688**	**0.700**	**0.718**	**0.351**	**0.356**	**0.439**	**0.539**	**0.551**	**0.567**	**0.551**	**0.587**	**0.680**	**0.694**	**0.706**	**0.730**	**0.559**	**0.560**	**0.563**
Demand/Capacity ≤ 1	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
Highest Ratio	**0.688**	**0.700**	**0.718**	**0.351**	**0.356**	**0.439**	**0.539**	**0.551**	**0.567**	**0.551**	**0.587**	**0.680**	**0.694**	**0.706**	**0.730**	**0.559**	**0.560**	**0.563**

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	605	605	605	606	606	606	31	31	31	207	207	207	276	276	276	277	277	277
Member Label	43S-44S	43S-44S	43S-44S	44S-24S	44S-24S	44S-24S	27N-25N	27N-25N	27N-25N	27S-25S	27S-25S	27S-25S	26N-27N	26N-27N	26N-27N	27N-50N	27N-50N	27N-50N
Station (m)	0.0	2.6	5.2	0.0	0.3	0.5	0.0	1.8	3.6	0.0	1.8	3.6	0.0	2.0	3.9	0.0	2.7	5.5
Node Label at Station	43S	---	44S	44S	---	24S	27N	---	25N	27S	---	25S	26N	---	27N	27N	---	50N
Section #	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 19	Section 19	Section 19	Section 19	Section 19	Section 19	Section 26	Section 26	Section 26	Section 21	Section 21	Section 21
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal

Member Factored Load Effects:

C_f (kN)	999	995	992	1022	1022	1022	0	0	0	0	0	0	1400	1401	1402	1805	1807	1809
$M_{fx\ (comp)}$ (kNm)	7	2	14	14	16	17	0	0	0	0	0	0	40	11	45	45	31	115
$M_{fy\ (comp)}$ (kNm)	19	14	10	10	7	21	0	0	0	0	0	0	26	35	54	53	27	19
T_f (kN)	0	0	0	0	0	0	1425	1431	1436	1416	1422	1428	0	0	0	0	0	0
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	2	2	2	52	52	52	0	0	0	0	0	0	11	11	11	13	13	13
V_{fy} (kN)	2	4	6	6	6	6	0	0	0	0	0	0	29	21	14	16	29	43

Gross Section Properties:

Ag (mm^2)	12774	12774	12774	12774	12774	12774	28589	28589	28589	28589	28589	28589	33185	33185	33185	44798	44798	44798
I_x (mm^4)	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.57E+09	2.57E+09	2.57E+09	2.57E+09	2.57E+09	2.57E+09	1.56E+09	1.56E+09	1.56E+09	1.92E+09	1.92E+09	1.92E+09
I_y (mm^4)	1.82E+09	1.82E+09	1.82E+09	1.82E+09	1.82E+09	1.82E+09	7.29E+07	7.29E+07	7.29E+07	7.29E+07	7.29E+07	7.29E+07	6.47E+09	6.47E+09	6.47E+09	8.82E+09	8.82E+09	8.82E+09
J (mm^4)	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	8.08E+06	8.08E+06	8.08E+06	8.08E+06	8.08E+06	8.08E+06	6.16E+06	6.16E+06	6.16E+06	8.85E+06	8.85E+06	8.85E+06
r_x (mm)	143	143	143	143	143	143	300	300	300	300	300	300	217	217	217	207	207	207
r_y (mm)	377	377	377	377	377	377	50	50	50	50	50	50	441	441	441	444	444	444
S_x (mm^3)	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	6.53E+06	6.53E+06	6.53E+06	6.53E+06	6.53E+06	6.53E+06	5.12E+06	5.12E+06	5.12E+06	6.30E+06	6.30E+06	6.30E+06
S_y (mm^3)	4.56E+06	4.56E+06	4.56E+06	4.56E+06	4.56E+06	4.56E+06	4.52E+05	4.52E+05	4.52E+05	4.52E+05	4.52E+05	4.52E+05	1.20E+07	1.20E+07	1.20E+07	1.61E+07	1.61E+07	1.61E+07
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	5202	5202	5202	542	542	542	3593	3593	3593	3593	3593	3593	3948	3948	3948	5451	5451	5451

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	605	605	605	606	606	606	31	31	31	207	207	207	276	276	276	277	277	277
Member Label	43S-44S	43S-44S	43S-44S	44S-24S	44S-24S	44S-24S	27N-25N	27N-25N	27N-25N	27S-25S	27S-25S	27S-25S	26N-27N	26N-27N	26N-27N	27N-50N	27N-50N	27N-50N
Station (m)	0.0	2.6	5.2	0.0	0.3	0.5	0.0	1.8	3.6	0.0	1.8	3.6	0.0	2.0	3.9	0.0	2.7	5.5
Node Label at Station	43S	---	44S	44S	---	24S	27N	---	25N	27S	---	25S	26N	---	27N	27N	---	50N
Section #	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 19	Section 19	Section 19	Section 19	Section 19	Section 19	Section 26	Section 26	Section 26	Section 21	Section 21	Section 21
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge							12.0	12.0	12.0	12.0	12.0	12.0	6.4	6.4	6.4	6.4	6.4	6.4
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels	5.2	5.2	5.2	5.2	5.2	5.2												
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	37.5	37.5	37.5	37.5	37.5	37.5	44.9	44.9	44.9	44.9	44.9	44.9	34.8	34.8	34.8	34.8	34.8	34.8
Webs in flexural compression	37.5	37.5	37.5	37.5	37.5	37.5	44.9	44.9	44.9	44.9	44.9	44.9	34.8	34.8	34.8	34.8	34.8	34.8
Webs in combined flexural and axial compression	37.5	37.5	37.5	37.5	37.5	37.5	44.9	44.9	44.9	44.9	44.9	44.9	34.8	34.8	34.8	34.8	34.8	34.8
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	605	605	605	606	606	606	31	31	31	207	207	207	276	276	276	277	277	277
Member Label	43S-44S	43S-44S	43S-44S	44S-24S	44S-24S	44S-24S	27N-25N	27N-25N	27N-25N	27S-25S	27S-25S	27S-25S	26N-27N	26N-27N	26N-27N	27N-50N	27N-50N	27N-50N
Station (m)	0.0	2.6	5.2	0.0	0.3	0.5	0.0	1.8	3.6	0.0	1.8	3.6	0.0	2.0	3.9	0.0	2.7	5.5
Node Label at Station	43S	---	44S	44S	---	24S	27N	---	25N	27S	---	25S	26N	---	27N	27N	---	50N
Section #	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 19	Section 19	Section 19	Section 19	Section 19	Section 19	Section 26	Section 26	Section 26	Section 21	Section 21	Section 21
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	6934	6934	6934	6934	6934	6934	3593	3593	3593	3593	3593	3593	3948	3948	3948	6425	6425	6425
L_y (mm)	5202	5202	5202	542	542	542	3593	3593	3593	3593	3593	3593	3948	3948	3948	5451	5451	5451
λ_{max}	0.500	0.500	0.500	0.500	0.500	0.500	0.741	0.741	0.741	0.741	0.741	0.741	0.188	0.188	0.188	0.320	0.320	0.320
C_r (kN)	2058.2	2058.2	2058.2	2058.2	2058.2	2058.2	3893.6	3893.6	3893.6	3893.6	3893.6	3893.6	5908.7	5908.7	5908.7	7771.1	7771.1	7771.1
$(kL/r)_{max}$	48.5	48.5	48.5	48.5	48.5	48.5	71.9	71.9	71.9	71.9	71.9	71.9	18.2	18.2	18.2	31.0	31.0	31.0
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1							1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	10711	10711	10711	10711	10711	10711	11143	11143	11143	11143	11143	11143	197674	197674	197674	91829	91829	91829

Shear Flexibility Factor:

1. Lacing:

a (mm)	821	821	821	821	821	821	425	425	425	425	425	425	1122	1122	1122	1122	1122	1122
b (mm)	711	711	711	711	711	711	368	368	368	368	368	368	972	972	972	972	972	972
ε_aa (mm)	821	821	821	821	821	821	425	425	425	425	425	425	1122	1122	1122	1122	1122	1122
ε_bb (mm)	711	711	711	711	711	711	368	368	368	368	368	368	972	972	972	972	972	972
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	N/A	N/A	N/A	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	N/A	N/A	N/A	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	4682	4682	4682	487	487	487	3234	3234	3234	3234	3234	3234	3553	3553	3553	4906	4906	4906
A_c (mm^2)	6387	6387	6387	6387	6387	6387	14295	14295	14295	14295	14295	14295	16593	16593	16593	22399	22399	22399
A_d (mm^2)	1008	1008	1008	1008	1008	1008	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	1008	1008	1008	1008	1008	1008	907	907	907	907	907	907	907	907	907	907	907	907
μ	0.2890	0.2890	0.2890	26.6643	26.6643	26.6643	NA	NA	NA	NA	NA	NA	2.7037	2.7037	2.7037	1.9149	1.9149	1.9149
P_{cr}/P_e (Fig.3.51)	0.61	0.61	0.61	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	1.280	1.280	1.280	1.414	1.414	1.414	N/A	N/A	N/A	N/A	N/A	N/A	1.414	1.414	1.414	1.414	1.414	1.414
λ_v	0.182	0.182	0.182	0.021	0.021	0.021	N/A	N/A	N/A	N/A	N/A	N/A	0.131	0.131	0.131	0.179	0.179	0.179
Cr' (kN)	2275.9	2275.9	2275.9	2293.5	2293.5	2293.5	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	5939.4	5939.4	5939.4	7984.2	7984.2	7984.2
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	605	605	605	606	606	606	31	31	31	207	207	207	276	276	276	277	277	277
Member Label	43S-44S	43S-44S	43S-44S	44S-24S	44S-24S	44S-24S	27N-25N	27N-25N	27N-25N	27S-25S	27S-25S	27S-25S	26N-27N	26N-27N	26N-27N	27N-50N	27N-50N	27N-50N
Station (m)	0.0	2.6	5.2	0.0	0.3	0.5	0.0	1.8	3.6	0.0	1.8	3.6	0.0	2.0	3.9	0.0	2.7	5.5
Node Label at Station	43S	---	44S	44S	---	24S	27N	---	25N	27S	---	25S	26N	---	27N	27N	---	50N
Section #	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 19	Section 19	Section 19	Section 19	Section 19	Section 19	Section 26	Section 26	Section 26	Section 21	Section 21	Section 21
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	6387	6387	6387	6387	6387	6387	14295	14295	14295	14295	14295	14295	16593	16593	16593	22399	22399	22399
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	2058.2	2058.2	2058.2	2058.2	2058.2	2058.2	3893.6	3893.6	3893.6	3893.6	3893.6	3893.6	5908.7	5908.7	5908.7	7771.1	7771.1	7771.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	12135	12135	12135	12135	12135	12135	27160	27160	27160	27160	27160	27160	31526	31526	31526	42558	42558	42558
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	2421	2421	2421	2421	2421	2421	5418	5418	5418	5418	5418	5418	6289	6289	6289	8490	8490	8490
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	9238	9238	9238	9238	9238	9238	19927	19927	19927	19927	19927	19927	25108	25108	25108	33978	33978	33978
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	9238	9238	9238	9238	9238	9238	19927	19927	19927	19927	19927	19927	25108	25108	25108	33978	33978	33978
$A_{n(corrosion)}$ (mm^2)	8776	8776	8776	8776	8776	8776	18930	18930	18930	18930	18930	18930	23852	23852	23852	32279	32279	32279
$T_{r(b)}$ (kN)	2949	2949	2949	2949	2949	2949	6361	6361	6361	6361	6361	6361	8014	8014	8014	10846	10846	10846
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	8776	8776	8776	8776	8776	8776	18930	18930	18930	18930	18930	18930	23852	23852	23852	32279	32279	32279
$T_{r(c)}$ (kN)	2949	2949	2949	2949	2949	2949	6361	6361	6361	6361	6361	6361	8014	8014	8014	10846	10846	10846
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	605	605	605	606	606	606	31	31	31	207	207	207	276	276	276	277	277	277
Member Label	43S-44S	43S-44S	43S-44S	44S-24S	44S-24S	44S-24S	27N-25N	27N-25N	27N-25N	27S-25S	27S-25S	27S-25S	26N-27N	26N-27N	26N-27N	27N-50N	27N-50N	27N-50N
Station (m)	0.0	2.6	5.2	0.0	0.3	0.5	0.0	1.8	3.6	0.0	1.8	3.6	0.0	2.0	3.9	0.0	2.7	5.5
Node Label at Station	43S	---	44S	44S	---	24S	27N	---	25N	27S	---	25S	26N	---	27N	27N	---	50N
Section #	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 19	Section 19	Section 19	Section 19	Section 19	Section 19	Section 26	Section 26	Section 26	Section 21	Section 21	Section 21
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	2949	2949	2949	2949	2949	2949	6361	6361	6361	6361	6361	6361	8014	8014	8014	10846	10846	10846
$(kL/r)_{max}$	48	48	48	48	48	48	72	72	72	72	72	72	18	18	18	31	31	31
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	2421	2421	2421	2421	2421	2421	5418	5418	5418	5418	5418	5418	6289	6289	6289	8490	8490	8490
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	260	260	260	260	260	260	1238	1238	1238	1238	1238	1238	971	971	971	1194	1194	1194
$M_{ry(Laterally\ Supported)}$ (kNm)	865	865	865	865	865	865	86	86	86	86	86	86	2284	2284	2284	3060	3060	3060
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	6934	6934	6934	6934	6934	6934	3593	3593	3593	3593	3593	3593	3948	3948	3948	6425	6425	6425
L_{uy} (mm)	5202	5202	5202	542	542	542	3593	3593	3593	3593	3593	3593	3948	3948	3948	5451	5451	5451
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	2633	2633	2633	2633	2633	2633	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	770	770	770	770	770	770	NA	NA	NA	NA	NA	NA	9683	9683	9683	7912	7912	7912
M_{rx} (kNm)	259.6	259.6	259.6	259.6	259.6	259.6	1215.6	1215.6	1215.6	1215.6	1215.6	1215.6	970.6	970.6	970.6	1194.2	1194.2	1194.2
M_{ry} (kNm)	648.0	648.0	648.0	648.0	648.0	648.0	85.7	85.7	85.7	85.7	85.7	85.7	2434.1	2434.1	2434.1	3096.9	3096.9	3096.9

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
$(V_f/V_r)<=1$																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.485	0.483	0.482	0.497	0.497	0.497	0.000	0.000	0.000	0.000	0.000	0.000	0.237	0.237	0.237	0.232	0.233	0.233
$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.263	0.264	0.265	0.261	0.262	0.264	0.000	0.000	0.000	0.000	0.000	0.000

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.263	0.264	0.265	0.261	0.262	0.264	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fx}/M_{rx}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fy}/M_{ry}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.263	0.264	0.265	0.261	0.262	0.264	0.000	0.000	0.000	0.000	0.000	0.000
$M_f/M_r-T_fS/M_tA<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	605	605	605	606	606	606	31	31	31	207	207	207	276	276	276	277	277	277
Member Label	43S-44S	43S-44S	43S-44S	44S-24S	44S-24S	44S-24S	27N-25N	27N-25N	27N-25N	27S-25S	27S-25S	27S-25S	26N-27N	26N-27N	26N-27N	27N-50N	27N-50N	27N-50N
Station (m)	0.0	2.6	5.2	0.0	0.3	0.5	0.0	1.8	3.6	0.0	1.8	3.6	0.0	2.0	3.9	0.0	2.7	5.5
Node Label at Station	43S	---	44S	44S	---	24S	27N	---	25N	27S	---	25S	26N	---	27N	27N	---	50N
Section #	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 19	Section 19	Section 19	Section 19	Section 19	Section 19	Section 26	Section 26	Section 26	Section 21	Section 21	Section 21
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	2294	2294	2294	2294	2294	2294	5133	5133	5133	5133	5133	5133	5958	5958	5958	8043	8043	8043
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.07E+04	1.07E+04	1.07E+04	1.07E+04	1.07E+04	1.07E+04	3.93E+05	3.93E+05	3.93E+05	3.93E+05	3.93E+05	3.93E+05	1.98E+05	1.98E+05	1.98E+05	9.18E+04	9.18E+04	9.18E+04
U_{1x}	1.10	1.10	1.10	1.11	1.11	1.11	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.02	1.02	1.02
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	132609	132609	132609	12235257	12235257	12235257	11143	11143	11143	11143	11143	11143	818907	818907	818907	586115	586115	586115
U_{1y}	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.436	0.434	0.433	0.446	0.446	0.446	0.000	0.000	0.000	0.000	0.000	0.000	0.235	0.235	0.235	0.224	0.225	0.225
$U_{1x}M_{fx}/M_{rx}$	0.030	0.008	0.059	0.060	0.068	0.072	0.000	0.000	0.000	0.000	0.000	0.000	0.042	0.011	0.047	0.038	0.026	0.098
$U_{1y}M_{fy}/M_{ry}$	0.022	0.016	0.012	0.012	0.008	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.015	0.024	0.017	0.009	0.006
Interaction	0.487	0.459	0.504	0.517	0.522	0.542	0.000	0.000	0.000	0.000	0.000	0.000	0.288	0.262	0.306	0.280	0.260	0.329

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.500	0.500	0.500	0.500	0.500	0.500	0.741	0.741	0.741	0.741	0.741	0.741	0.188	0.188	0.188	0.320	0.320	0.320
$C_{r\ (K=1)}$ (kN)	2058	2058	2058	2058	2058	2058	3894	3894	3894	3894	3894	3894	5909	5909	5909	7771	7771	7771
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.10	1.10	1.10	1.11	1.11	1.11	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.02	1.02	1.02
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.485	0.483	0.482	0.497	0.497	0.497	0.000	0.000	0.000	0.000	0.000	0.000	0.237	0.237	0.237	0.232	0.233	0.233
$U_{1x}M_{fx}/M_{rx}$	0.030	0.008	0.059	0.060	0.068	0.072	0.000	0.000	0.000	0.000	0.000	0.000	0.042	0.011	0.047	0.038	0.026	0.098
$U_{1y}M_{fy}/M_{ry}$	0.022	0.016	0.012	0.012	0.008	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.015	0.024	0.017	0.009	0.006
Interaction	0.537	0.508	0.553	0.568	0.573	0.593	0.000	0.000	0.000	0.000	0.000	0.000	0.290	0.264	0.308	0.288	0.268	0.337

3.3. Lateral Torsional Buckling:

λ_{max}	0.500	0.500	0.500	0.500	0.500	0.500	0.741	0.741	0.741	0.741	0.741	0.741	0.188	0.188	0.188	0.320	0.320	0.320
C_r (kN)	2058	2058	2058	2058	2058	2058	3894	3894	3894	3894	3894	3894	5909	5909	5909	7771	7771	7771
U_{1x}	1.10	1.10	1.10	1.11	1.11	1.11	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.02	1.02	1.02
U_{1y}	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	260	260	260	260	260	260	1216	1216	1216	1216	1216	1216	971	971	971	1194	1194	1194
M_{ry} (kNm)	648	648	648	648	648	648	86	86	86	86	86	86	2434	2434	2434	3097	3097	3097
C_f/C_r	0.485	0.483	0.482	0.497	0.497	0.497	0.000	0.000	0.000	0.000	0.000	0.000	0.237	0.237	0.237	0.232	0.233	0.233
$U_{1x}M_{fx}/M_{rx}$	0.030	0.008	0.059	0.060	0.068	0.072	0.000	0.000	0.000	0.000	0.000	0.000	0.042	0.011	0.047	0.038	0.026	0.098
$U_{1y}M_{fy}/M_{ry}$	0.030	0.022	0.016	0.015	0.011	0.032	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.014	0.022	0.017	0.009	0.006
Interaction	0.545	0.514	0.557	0.572	0.576	0.601	0.000	0.000	0.000	0.000	0.000	0.000	0.289	0.263	0.306	0.288	0.268	0.337
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.545	0.514	0.557	0.572	0.576	0.601	0.263	0.264	0.265	0.261	0.262	0.264	0.290	0.264	0.308	0.288	0.268	0.337

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	278	278	278	607	607	607	608	608	608	609	609	609	256	256	256	257	257	257
Member Label	50N-21N	50N-21N	50N-21N	26S-27S	26S-27S	26S-27S	27S-50S	27S-50S	27S-50S	50S-21S	50S-21S	50S-21S	21N-38N	21N-38N	21N-38N	38N-31N	38N-31N	38N-31N
Station (m)	0.0	0.5	1.0	0.0	2.0	3.9	0.0	2.7	5.5	0.0	0.5	1.0	0.0	1.2	2.4	0.0	0.8	1.6
Node Label at Station	50N	---	21N	26S	---	27S	27S	---	50S	50S	---	21S	21N	---	38N	38N	---	31N
Section #	Section 21	Section 21	Section 21	Section 26	Section 26	Section 26	Section 21	Section 21	Section 21	Section 21	Section 21	Section 21	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20
Element Group	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical

Member Factored Load Effects:

C_f (kN)	1848	1848	1849	1413	1415	1416	1833	1836	1838	1879	1879	1879	3175	3181	3187	3215	3219	3224
$M_{fx\ (comp)}$ (kNm)	115	139	164	40	10	43	43	33	116	116	139	164	30	29	40	40	32	25
$M_{fy\ (comp)}$ (kNm)	19	33	48	28	29	45	44	26	11	11	28	49	0	12	24	24	32	40
T_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	35	35	35	10	10	10	10	10	10	43	43	43	10	10	10	10	10	10
V_{fy} (kN)	48	50	53	28	21	14	16	29	43	46	48	51	29	29	29	31	31	31

Gross Section Properties:

Ag (mm^2)	44798	44798	44798	33185	33185	33185	44798	44798	44798	44798	44798	44798	46572	46572	46572	46572	46572	46572
I_x (mm^4)	1.92E+09	1.92E+09	1.92E+09	1.56E+09	1.56E+09	1.56E+09	1.92E+09	1.92E+09	1.92E+09	1.92E+09	1.92E+09	1.92E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09
I_y (mm^4)	8.82E+09	8.82E+09	8.82E+09	6.47E+09	6.47E+09	6.47E+09	8.82E+09	8.82E+09	8.82E+09	8.82E+09	8.82E+09	8.82E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09
J (mm^4)	8.85E+06	8.85E+06	8.85E+06	6.16E+06	6.16E+06	6.16E+06	8.85E+06	8.85E+06	8.85E+06	8.85E+06	8.85E+06	8.85E+06	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07
r_x (mm)	207	207	207	217	217	217	207	207	207	207	207	207	194	194	194	194	194	194
r_y (mm)	444	444	444	441	441	441	444	444	444	444	444	444	155	155	155	155	155	155
S_x (mm^3)	6.30E+06	6.30E+06	6.30E+06	5.12E+06	5.12E+06	5.12E+06	6.30E+06	6.30E+06	6.30E+06	6.30E+06	6.30E+06	6.30E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06
S_y (mm^3)	1.61E+07	1.61E+07	1.61E+07	1.20E+07	1.20E+07	1.20E+07	1.61E+07	1.61E+07	1.61E+07	1.61E+07	1.61E+07	1.61E+07	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	975	975	975	3948	3948	3948	5451	5451	5451	975	975	975	2394	2394	2394	1644	1644	1644

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	278	278	278	607	607	607	608	608	608	609	609	609	256	256	256	257	257	257
Member Label	50N-21N	50N-21N	50N-21N	26S-27S	26S-27S	26S-27S	27S-50S	27S-50S	27S-50S	50S-21S	50S-21S	50S-21S	21N-38N	21N-38N	21N-38N	38N-31N	38N-31N	38N-31N
Station (m)	0.0	0.5	1.0	0.0	2.0	3.9	0.0	2.7	5.5	0.0	0.5	1.0	0.0	1.2	2.4	0.0	0.8	1.6
Node Label at Station	50N	---	21N	26S	---	27S	27S	---	50S	50S	---	21S	21N	---	38N	38N	---	31N
Section #	Section 21	Section 21	Section 21	Section 26	Section 26	Section 26	Section 21	Section 21	Section 21	Section 21	Section 21	Section 21	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20
Element Group	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	8.0	8.0	8.0	8.0	8.0	8.0
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	28.0	28.0	28.0	28.0	28.0	28.0
Webs in flexural compression	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	28.0	28.0	28.0	28.0	28.0	28.0
Webs in combined flexural and axial compression	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	28.0	28.0	28.0	28.0	28.0	28.0
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	278	278	278	607	607	607	608	608	608	609	609	609	256	256	256	257	257	257
Member Label	50N-21N	50N-21N	50N-21N	26S-27S	26S-27S	26S-27S	27S-50S	27S-50S	27S-50S	50S-21S	50S-21S	50S-21S	21N-38N	21N-38N	21N-38N	38N-31N	38N-31N	38N-31N
Station (m)	0.0	0.5	1.0	0.0	2.0	3.9	0.0	2.7	5.5	0.0	0.5	1.0	0.0	1.2	2.4	0.0	0.8	1.6
Node Label at Station	50N	---	21N	26S	---	27S	27S	---	50S	50S	---	21S	21N	---	38N	38N	---	31N
Section #	Section 21	Section 21	Section 21	Section 26	Section 26	Section 26	Section 21	Section 21	Section 21	Section 21	Section 21	Section 21	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20
Element Group	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	6425	6425	6425	3948	3948	3948	6425	6425	6425	6425	6425	6425	2394	2394	2394	2805	2805	2805
L_y (mm)	975	975	975	3948	3948	3948	5451	5451	5451	975	975	975	4039	4039	4039	4039	4039	4039
λ_{max}	0.320	0.320	0.320	0.188	0.188	0.188	0.320	0.320	0.320	0.320	0.320	0.320	0.269	0.269	0.269	0.269	0.269	0.269
C_r (kN)	7771.1	7771.1	7771.1	5908.7	5908.7	5908.7	7771.1	7771.1	7771.1	7771.1	7771.1	7771.1	8182.2	8182.2	8182.2	8182.2	8182.2	8182.2
$(kL/r)_{max}$	31.0	31.0	31.0	18.2	18.2	18.2	31.0	31.0	31.0	31.0	31.0	31.0	26.1	26.1	26.1	26.1	26.1	26.1
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1						
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	91829	91829	91829	197674	197674	197674	91829	91829	91829	91829	91829	91829	135694	135694	135694	135694	135694	135694

Shear Flexibility Factor:

1. Lacing:

a (mm)	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	425	425	425	425	425	425
b (mm)	972	972	972	972	972	972	972	972	972	972	972	972	368	368	368	368	368	368
ε_aa (mm)	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	425	425	425	425	425	425
ε_bb (mm)	972	972	972	972	972	972	972	972	972	972	972	972	368	368	368	368	368	368
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	877	877	877	3553	3553	3553	4906	4906	4906	877	877	877	2155	2155	2155	1480	1480	1480
A_c (mm^2)	22399	22399	22399	16593	16593	16593	22399	22399	22399	22399	22399	22399	23286	23286	23286	23286	23286	23286
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	59.8944	59.8944	59.8944	2.7037	2.7037	2.7037	1.9149	1.9149	1.9149	59.8944	59.8944	59.8944	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	0.032	0.032	0.032	0.131	0.131	0.131	0.179	0.179	0.179	0.032	0.032	0.032	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	8042.9	8042.9	8042.9	5939.4	5939.4	5939.4	7984.2	7984.2	7984.2	8042.9	8042.9	8042.9	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	278	278	278	607	607	607	608	608	608	609	609	609	256	256	256	257	257	257
Member Label	50N-21N	50N-21N	50N-21N	26S-27S	26S-27S	26S-27S	27S-50S	27S-50S	27S-50S	50S-21S	50S-21S	50S-21S	21N-38N	21N-38N	21N-38N	38N-31N	38N-31N	38N-31N
Station (m)	0.0	0.5	1.0	0.0	2.0	3.9	0.0	2.7	5.5	0.0	0.5	1.0	0.0	1.2	2.4	0.0	0.8	1.6
Node Label at Station	50N	---	21N	26S	---	27S	27S	---	50S	50S	---	21S	21N	---	38N	38N	---	31N
Section #	Section 21	Section 21	Section 21	Section 26	Section 26	Section 26	Section 21	Section 21	Section 21	Section 21	Section 21	Section 21	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20
Element Group	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	22399	22399	22399	16593	16593	16593	22399	22399	22399	22399	22399	22399	23286	23286	23286	23286	23286	23286
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	7771.1	7771.1	7771.1	5908.7	5908.7	5908.7	7771.1	7771.1	7771.1	7771.1	7771.1	7771.1	8182.2	8182.2	8182.2	8182.2	8182.2	8182.2

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	42558	42558	42558	31526	31526	31526	42558	42558	42558	42558	42558	42558	44243	44243	44243	44243	44243	44243
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	8490	8490	8490	6289	6289	6289	8490	8490	8490	8490	8490	8490	8827	8827	8827	8827	8827	8827
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	44036	44036	44036	25108	25108	25108	33978	33978	33978	44036	44036	44036	37428	37428	37428	37428	37428	37428
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	44036	44036	44036	25108	25108	25108	33978	33978	33978	44036	44036	44036	37428	37428	37428	37428	37428	37428
$A_{n(corrosion)}$ (mm^2)	41834	41834	41834	23852	23852	23852	32279	32279	32279	41834	41834	41834	35557	35557	35557	35557	35557	35557
$T_{r(b)}$ (kN)	14056	14056	14056	8014	8014	8014	10846	10846	10846	14056	14056	14056	11947	11947	11947	11947	11947	11947
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	41834	41834	41834	23852	23852	23852	32279	32279	32279	41834	41834	41834	35557	35557	35557	35557	35557	35557
$T_{r(c)}$ (kN)	14056	14056	14056	8014	8014	8014	10846	10846	10846	14056	14056	14056	11947	11947	11947	11947	11947	11947
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	278	278	278	607	607	607	608	608	608	609	609	609	256	256	256	257	257	257
Member Label	50N-21N	50N-21N	50N-21N	26S-27S	26S-27S	26S-27S	27S-50S	27S-50S	27S-50S	50S-21S	50S-21S	50S-21S	21N-38N	21N-38N	21N-38N	38N-31N	38N-31N	38N-31N
Station (m)	0.0	0.5	1.0	0.0	2.0	3.9	0.0	2.7	5.5	0.0	0.5	1.0	0.0	1.2	2.4	0.0	0.8	1.6
Node Label at Station	50N	---	21N	26S	---	27S	27S	---	50S	50S	---	21S	21N	---	38N	38N	---	31N
Section #	Section 21	Section 21	Section 21	Section 26	Section 26	Section 26	Section 21	Section 21	Section 21	Section 21	Section 21	Section 21	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20
Element Group	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	14056	14056	14056	8014	8014	8014	10846	10846	10846	14056	14056	14056	11947	11947	11947	11947	11947	11947
$(kL/r)_{max}$	31	31	31	18	18	18	31	31	31	31	31	31	26	26	26	26	26	26
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	8490	8490	8490	6289	6289	6289	8490	8490	8490	8490	8490	8490	8827	8827	8827	8827	8827	8827
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1194	1194	1194	971	971	971	1194	1194	1194	1194	1194	1194	1069	1069	1069	1069	1069	1069
$M_{ry(Laterally\ Supported)}$ (kNm)	3060	3060	3060	2284	2284	2284	3060	3060	3060	3060	3060	3060	760	760	760	760	760	760
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	6425	6425	6425	3948	3948	3948	6425	6425	6425	6425	6425	6425	2394	2394	2394	2805	2805	2805
L_{uy} (mm)	975	975	975	3948	3948	3948	5451	5451	5451	975	975	975	4039	4039	4039	4039	4039	4039
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	20367	20367	20367	17384	17384	17384
M_{uy} (kNm) (x weak)	7912	7912	7912	9683	9683	9683	7912	7912	7912	7912	7912	7912	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1194.2	1194.2	1194.2	970.6	970.6	970.6	1194.2	1194.2	1194.2	1194.2	1194.2	1194.2	1209.8	1209.8	1209.8	1206.4	1206.4	1206.4
M_{ry} (kNm)	3096.9	3096.9	3096.9	2434.1	2434.1	2434.1	3096.9	3096.9	3096.9	3096.9	3096.9	3096.9	760.3	760.3	760.3	760.3	760.3	760.3

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
$(V_f/V_r)<=1$																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.238	0.238	0.238	0.239	0.239	0.240	0.236	0.236	0.237	0.242	0.242	0.242	0.388	0.389	0.390	0.393	0.393	0.394
$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fx}/M_{rx}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fy}/M_{ry}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	278	278	278	607	607	607	608	608	608	609	609	609	256	256	256	257	257	257
Member Label	50N-21N	50N-21N	50N-21N	26S-27S	26S-27S	26S-27S	27S-50S	27S-50S	27S-50S	50S-21S	50S-21S	50S-21S	21N-38N	21N-38N	21N-38N	38N-31N	38N-31N	38N-31N
Station (m)	0.0	0.5	1.0	0.0	2.0	3.9	0.0	2.7	5.5	0.0	0.5	1.0	0.0	1.2	2.4	0.0	0.8	1.6
Node Label at Station	50N	---	21N	26S	---	27S	27S	---	50S	50S	---	21S	21N	---	38N	38N	---	31N
Section #	Section 21	Section 21	Section 21	Section 26	Section 26	Section 26	Section 21	Section 21	Section 21	Section 21	Section 21	Section 21	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20
Element Group	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	8043	8043	8043	5958	5958	5958	8043	8043	8043	8043	8043	8043	8362	8362	8362	8362	8362	8362
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	9.18E+04	9.18E+04	9.18E+04	1.98E+05	1.98E+05	1.98E+05	9.18E+04	9.18E+04	9.18E+04	9.18E+04	9.18E+04	9.18E+04	6.05E+05	6.05E+05	6.05E+05	4.41E+05	4.41E+05	4.41E+05
U_{1x}	1.02	1.02	1.02	1.01	1.01	1.01	1.02	1.02	1.02	1.02	1.02	1.02	1.01	1.01	1.01	1.01	1.01	1.01
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	18332642	18332642	18332642	818907	818907	818907	586115	586115	586115	18332642	18332642	18332642	135694	135694	135694	135694	135694	135694
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.02	1.02	1.02	1.02	1.02	1.02
C_f/C_r	**0.230**	**0.230**	**0.230**	**0.237**	**0.237**	**0.238**	**0.228**	**0.228**	**0.229**	**0.234**	**0.234**	**0.234**	**0.380**	**0.380**	**0.381**	**0.384**	**0.385**	**0.386**
$U_{1x}M_{fx}/M_{rx}$	**0.098**	**0.119**	**0.140**	**0.042**	**0.010**	**0.045**	**0.037**	**0.028**	**0.099**	**0.099**	**0.119**	**0.140**	**0.028**	**0.027**	**0.038**	**0.038**	**0.030**	**0.024**
$U_{1y}M_{fy}/M_{ry}$	**0.006**	**0.011**	**0.016**	**0.012**	**0.013**	**0.020**	**0.014**	**0.009**	**0.004**	**0.004**	**0.009**	**0.016**	**0.000**	**0.016**	**0.032**	**0.032**	**0.043**	**0.054**
Interaction	**0.334**	**0.359**	**0.386**	**0.291**	**0.261**	**0.302**	**0.279**	**0.265**	**0.331**	**0.336**	**0.362**	**0.390**	**0.408**	**0.424**	**0.451**	**0.454**	**0.458**	**0.463**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.320	0.320	0.320	0.188	0.188	0.188	0.320	0.320	0.320	0.320	0.320	0.320	0.269	0.269	0.269	0.269	0.269	0.269
$C_{r\ (K=1)}$ (kN)	7771	7771	7771	5909	5909	5909	7771	7771	7771	7771	7771	7771	8182	8182	8182	8182	8182	8182
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.02	1.02	1.02	1.01	1.01	1.01	1.02	1.02	1.02	1.02	1.02	1.02	1.01	1.01	1.01	1.01	1.01	1.01
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.02	1.02	1.02	1.02	1.02	1.02
C_f/C_r	**0.238**	**0.238**	**0.238**	**0.239**	**0.239**	**0.240**	**0.236**	**0.236**	**0.237**	**0.242**	**0.242**	**0.242**	**0.388**	**0.389**	**0.390**	**0.393**	**0.393**	**0.394**
$U_{1x}M_{fx}/M_{rx}$	**0.098**	**0.119**	**0.140**	**0.042**	**0.010**	**0.045**	**0.037**	**0.028**	**0.099**	**0.099**	**0.119**	**0.140**	**0.028**	**0.027**	**0.038**	**0.038**	**0.030**	**0.024**
$U_{1y}M_{fy}/M_{ry}$	**0.006**	**0.011**	**0.016**	**0.012**	**0.013**	**0.020**	**0.014**	**0.009**	**0.004**	**0.004**	**0.009**	**0.016**	**0.000**	**0.016**	**0.032**	**0.032**	**0.043**	**0.054**
Interaction	**0.342**	**0.367**	**0.394**	**0.293**	**0.263**	**0.304**	**0.287**	**0.273**	**0.339**	**0.345**	**0.370**	**0.398**	**0.416**	**0.432**	**0.459**	**0.463**	**0.467**	**0.471**

3.3. Lateral Torsional Buckling:

λ_{max}	0.320	0.320	0.320	0.188	0.188	0.188	0.320	0.320	0.320	0.320	0.320	0.320	0.269	0.269	0.269	0.269	0.269	0.269
C_r (kN)	7771	7771	7771	5909	5909	5909	7771	7771	7771	7771	7771	7771	8182	8182	8182	8182	8182	8182
U_{1x}	1.02	1.02	1.02	1.01	1.01	1.01	1.02	1.02	1.02	1.02	1.02	1.02	1.01	1.01	1.01	1.01	1.01	1.01
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.02	1.02	1.02	1.02	1.02	1.02
M_{rx} (kNm)	1194	1194	1194	971	971	971	1194	1194	1194	1194	1194	1194	1210	1210	1210	1206	1206	1206
M_{ry} (kNm)	3097	3097	3097	2434	2434	2434	3097	3097	3097	3097	3097	3097	760	760	760	760	760	760
C_f/C_r	**0.238**	**0.238**	**0.238**	**0.239**	**0.239**	**0.240**	**0.236**	**0.236**	**0.237**	**0.242**	**0.242**	**0.242**	**0.388**	**0.389**	**0.390**	**0.393**	**0.393**	**0.394**
$U_{1x}M_{fx}/M_{rx}$	**0.098**	**0.119**	**0.140**	**0.042**	**0.010**	**0.045**	**0.037**	**0.028**	**0.099**	**0.099**	**0.119**	**0.140**	**0.025**	**0.024**	**0.033**	**0.033**	**0.027**	**0.021**
$U_{1y}M_{fy}/M_{ry}$	**0.006**	**0.011**	**0.016**	**0.012**	**0.012**	**0.019**	**0.014**	**0.008**	**0.004**	**0.004**	**0.009**	**0.016**	**0.000**	**0.016**	**0.032**	**0.032**	**0.043**	**0.054**
Interaction	**0.342**	**0.367**	**0.394**	**0.292**	**0.262**	**0.303**	**0.287**	**0.273**	**0.339**	**0.345**	**0.370**	**0.398**	**0.413**	**0.429**	**0.455**	**0.459**	**0.463**	**0.469**
Demand/Capacity ≤ 1	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
Highest Ratio	**0.342**	**0.367**	**0.394**	**0.293**	**0.263**	**0.304**	**0.287**	**0.273**	**0.339**	**0.345**	**0.370**	**0.398**	**0.416**	**0.432**	**0.459**	**0.463**	**0.467**	**0.471**

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	258	258	258	259	259	259	260	260	260	584	584	584	585	585	585	586	586	586
Member Label	31N-51N	31N-51N	31N-51N	51N-20N	51N-20N	51N-20N	20N-19N	20N-19N	20N-19N	21S-38S	21S-38S	21S-38S	38S-31S	38S-31S	38S-31S	31S-51S	31S-51S	31S-51S
Station (m)	0.0	0.6	1.2	0.0	0.1	0.3	0.0	2.7	5.5	0.0	1.2	2.4	0.0	0.8	1.6	0.0	0.6	1.2
Node Label at Station	31N	---	51N	51N	---	20N	20N	---	19N	21S	---	38S	38S	---	31S	31S	---	51S
Section #	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20
Element Group	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical

Member Factored Load Effects:

C_f (kN)	3221	3224	3227	3338	3339	3339	3356	3370	3384	3208	3214	3221	3254	3259	3263	3260	3263	3266
$M_{fx\ (comp)}$ (kNm)	25	30	46	46	44	42	42	50	59	39	28	48	48	33	18	18	41	64
$M_{fy\ (comp)}$ (kNm)	37	30	22	22	20	19	20	23	26	0	12	24	24	32	40	37	30	22
T_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	16	16	16	16	16	16	2	2	2	10	10	10	10	10	10	16	16	16
V_{fy} (kN)	31	31	31	17	17	17	17	17	17	36	36	36	40	40	40	40	40	40

Gross Section Properties:

Ag (mm^2)	46572	46572	46572	46572	46572	46572	46572	46572	46572	46572	46572	46572	46572	46572	46572	46572	46572	46572
I_x (mm^4)	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09
I_y (mm^4)	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09
J (mm^4)	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07
r_x (mm)	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194
r_y (mm)	155	155	155	155	155	155	155	155	155	155	155	155	155	155	155	155	155	155
S_x (mm^3)	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06
S_y (mm^3)	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	20	20	20	5	5	5	5	5	5	5	5	5
L (mm)	1161	1161	1161	287	287	287	5486	5486	5486	2394	2394	2394	1644	1644	1644	1161	1161	1161

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	258	258	258	259	259	259	260	260	260	584	584	584	585	585	585	586	586	586
Member Label	31N-51N	31N-51N	31N-51N	51N-20N	51N-20N	51N-20N	20N-19N	20N-19N	20N-19N	21S-38S	21S-38S	21S-38S	38S-31S	38S-31S	38S-31S	31S-51S	31S-51S	31S-51S
Station (m)	0.0	0.6	1.2	0.0	0.1	0.3	0.0	2.7	5.5	0.0	1.2	2.4	0.0	0.8	1.6	0.0	0.6	1.2
Node Label at Station	31N	---	51N	51N	---	20N	20N	---	19N	21S	---	38S	38S	---	31S	31S	---	51S
Section #	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20
Element Group	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0
Webs in flexural compression	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0
Webs in combined flexural and axial compression	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	258	258	258	259	259	259	260	260	260	584	584	584	585	585	585	586	586	586
Member Label	31N-51N	31N-51N	31N-51N	51N-20N	51N-20N	51N-20N	20N-19N	20N-19N	20N-19N	21S-38S	21S-38S	21S-38S	38S-31S	38S-31S	38S-31S	31S-51S	31S-51S	31S-51S
Station (m)	0.0	0.6	1.2	0.0	0.1	0.3	0.0	2.7	5.5	0.0	1.2	2.4	0.0	0.8	1.6	0.0	0.6	1.2
Node Label at Station	31N	---	51N	51N	---	20N	20N	---	19N	21S	---	38S	38S	---	31S	31S	---	51S
Section #	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20
Element Group	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	2805	2805	2805	5773	5773	5773	5773	5773	5773	2394	2394	2394	2805	2805	2805	2805	2805	2805
L_y (mm)	1448	1448	1448	1448	1448	1448	5486	5486	5486	4039	4039	4039	4039	4039	4039	1448	1448	1448
λ_{max}	0.149	0.149	0.149	0.307	0.307	0.307	0.365	0.365	0.365	0.269	0.269	0.269	0.269	0.269	0.269	0.149	0.149	0.149
C_r (kN)	8324.1	8324.1	8324.1	8108.0	8108.0	8108.0	6708.2	6708.2	6708.2	8182.2	8182.2	8182.2	8182.2	8182.2	8182.2	8324.1	8324.1	8324.1
$(kL/r)_{max}$	14.5	14.5	14.5	29.8	29.8	29.8	35.4	35.4	35.4	26.1	26.1	26.1	26.1	26.1	26.1	14.5	14.5	14.5
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	440698	440698	440698	104076	104076	104076	73527	73527	73527	135694	135694	135694	135694	135694	135694	440698	440698	440698

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	1045	1045	1045	258	258	258	4938	4938	4938	2155	2155	2155	1480	1480	1480	1045	1045	1045
A_c (mm^2)	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	258	258	258	259	259	259	260	260	260	584	584	584	585	585	585	586	586	586
Member Label	31N-51N	31N-51N	31N-51N	51N-20N	51N-20N	51N-20N	20N-19N	20N-19N	20N-19N	21S-38S	21S-38S	21S-38S	38S-31S	38S-31S	38S-31S	31S-51S	31S-51S	31S-51S
Station (m)	0.0	0.6	1.2	0.0	0.1	0.3	0.0	2.7	5.5	0.0	1.2	2.4	0.0	0.8	1.6	0.0	0.6	1.2
Node Label at Station	31N	---	51N	51N	---	20N	20N	---	19N	21S	---	38S	38S	---	31S	31S	---	51S
Section #	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20
Element Group	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	8324.1	8324.1	8324.1	8108.0	8108.0	8108.0	6708.2	6708.2	6708.2	8182.2	8182.2	8182.2	8182.2	8182.2	8182.2	8324.1	8324.1	8324.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	44243	44243	44243	44243	44243	44243	37258	37258	37258	44243	44243	44243	44243	44243	44243	44243	44243	44243
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	8827	8827	8827	8827	8827	8827	7433	7433	7433	8827	8827	8827	8827	8827	8827	8827	8827	8827
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428
$A_{n(corrosion)}$ (mm^2)	35557	35557	35557	35557	35557	35557	29942	29942	29942	35557	35557	35557	35557	35557	35557	35557	35557	35557
$T_{r(b)}$ (kN)	11947	11947	11947	11947	11947	11947	10061	10061	10061	11947	11947	11947	11947	11947	11947	11947	11947	11947
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	35557	35557	35557	35557	35557	35557	29942	29942	29942	35557	35557	35557	35557	35557	35557	35557	35557	35557
$T_{r(c)}$ (kN)	11947	11947	11947	11947	11947	11947	10061	10061	10061	11947	11947	11947	11947	11947	11947	11947	11947	11947
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	258	258	258	259	259	259	260	260	260	584	584	584	585	585	585	586	586	586
Member Label	31N-51N	31N-51N	31N-51N	51N-20N	51N-20N	51N-20N	20N-19N	20N-19N	20N-19N	21S-38S	21S-38S	21S-38S	38S-31S	38S-31S	38S-31S	31S-51S	31S-51S	31S-51S
Station (m)	0.0	0.6	1.2	0.0	0.1	0.3	0.0	2.7	5.5	0.0	1.2	2.4	0.0	0.8	1.6	0.0	0.6	1.2
Node Label at Station	31N	---	51N	51N	---	20N	20N	---	19N	21S	---	38S	38S	---	31S	31S	---	51S
Section #	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20
Element Group	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	11947	11947	11947	11947	11947	11947	10061	10061	10061	11947	11947	11947	11947	11947	11947	11947	11947	11947
$(kL/r)_{max}$	14	14	14	30	30	30	35	35	35	26	26	26	26	26	26	14	14	14
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	8827	8827	8827	8827	8827	8827	7433	7433	7433	8827	8827	8827	8827	8827	8827	8827	8827	8827
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1069	1069	1069	1069	1069	1069	901	901	901	1069	1069	1069	1069	1069	1069	1069	1069	1069
$M_{ry(Laterally\ Supported)}$ (kNm)	760	760	760	760	760	760	640	640	640	760	760	760	760	760	760	760	760	760
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	2805	2805	2805	5773	5773	5773	5773	5773	5773	2394	2394	2394	2805	2805	2805	2805	2805	2805
L_{uy} (mm)	1448	1448	1448	1448	1448	1448	5486	5486	5486	4039	4039	4039	4039	4039	4039	1448	1448	1448
M_{ux} (kNm) (y weak)	17384	17384	17384	8448	8448	8448	8448	8448	8448	20367	20367	20367	17384	17384	17384	17384	17384	17384
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1206.4	1206.4	1206.4	1181.5	1181.5	1181.5	995.0	995.0	995.0	1209.8	1209.8	1209.8	1206.4	1206.4	1206.4	1206.4	1206.4	1206.4
M_{ry} (kNm)	760.3	760.3	760.3	760.3	760.3	760.3	640.2	640.2	640.2	760.3	760.3	760.3	760.3	760.3	760.3	760.3	760.3	760.3

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
$(V_f/V_r)<=1$																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.387	0.387	0.388	0.412	0.412	0.412	0.500	0.502	0.504	0.392	0.393	0.394	0.398	0.398	0.399	0.392	0.392	0.392
$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fx}/M_{rx}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fy}/M_{ry}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Member ID in CSiBridge	258	258	258	259	259	259	260	260	260	584	584	584	585	585	585	586	586	586
Member Label	31N-51N	31N-51N	31N-51N	51N-20N	51N-20N	51N-20N	20N-19N	20N-19N	20N-19N	21S-38S	21S-38S	21S-38S	38S-31S	38S-31S	38S-31S	31S-51S	31S-51S	31S-51S
Station (m)	0.0	0.6	1.2	0.0	0.1	0.3	0.0	2.7	5.5	0.0	1.2	2.4	0.0	0.8	1.6	0.0	0.6	1.2
Node Label at Station	31N	---	51N	51N	---	20N	20N	---	19N	21S	---	38S	38S	---	31S	31S	---	51S
Section #	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20
Element Group	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	8362	8362	8362	8362	8362	8362	7042	7042	7042	8362	8362	8362	8362	8362	8362	8362	8362	8362
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	4.41E+05	4.41E+05	4.41E+05	1.04E+05	1.04E+05	1.04E+05	1.04E+05	1.04E+05	1.04E+05	6.05E+05	6.05E+05	6.05E+05	4.41E+05	4.41E+05	4.41E+05	4.41E+05	4.41E+05	4.41E+05
U_{1x}	1.01	1.01	1.01	1.03	1.03	1.03	1.03	1.03	1.03	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	1055855	1055855	1055855	1055855	1055855	1055855	73527	73527	73527	135694	135694	135694	135694	135694	135694	1055855	1055855	1055855
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.05	1.05	1.05	1.02	1.02	1.02	1.02	1.02	1.02	1.00	1.00	1.00
C_f/C_r	**0.385**	**0.386**	**0.386**	**0.399**	**0.399**	**0.399**	**0.477**	**0.479**	**0.481**	**0.384**	**0.384**	**0.385**	**0.389**	**0.390**	**0.390**	**0.390**	**0.390**	**0.391**
$U_{1x}M_{fx}/M_{rx}$	**0.024**	**0.028**	**0.043**	**0.044**	**0.043**	**0.041**	**0.048**	**0.057**	**0.068**	**0.037**	**0.026**	**0.045**	**0.045**	**0.031**	**0.017**	**0.017**	**0.039**	**0.060**
$U_{1y}M_{fy}/M_{ry}$	**0.049**	**0.040**	**0.029**	**0.029**	**0.026**	**0.025**	**0.033**	**0.038**	**0.043**	**0.000**	**0.016**	**0.032**	**0.032**	**0.043**	**0.054**	**0.049**	**0.040**	**0.029**
Interaction	**0.458**	**0.453**	**0.458**	**0.473**	**0.468**	**0.465**	**0.558**	**0.574**	**0.591**	**0.420**	**0.427**	**0.463**	**0.467**	**0.464**	**0.461**	**0.456**	**0.468**	**0.480**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.149	0.149	0.149	0.307	0.307	0.307	0.365	0.365	0.365	0.269	0.269	0.269	0.269	0.269	0.269	0.149	0.149	0.149
$C_{r\ (K=1)}$ (kN)	8324	8324	8324	8108	8108	8108	6708	6708	6708	8182	8182	8182	8182	8182	8182	8324	8324	8324
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.01	1.01	1.01	1.03	1.03	1.03	1.03	1.03	1.03	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.05	1.05	1.05	1.02	1.02	1.02	1.02	1.02	1.02	1.00	1.00	1.00
C_f/C_r	**0.387**	**0.387**	**0.388**	**0.412**	**0.412**	**0.412**	**0.500**	**0.502**	**0.504**	**0.392**	**0.393**	**0.394**	**0.398**	**0.398**	**0.399**	**0.392**	**0.392**	**0.392**
$U_{1x}M_{fx}/M_{rx}$	**0.024**	**0.028**	**0.043**	**0.044**	**0.043**	**0.041**	**0.048**	**0.057**	**0.068**	**0.037**	**0.026**	**0.045**	**0.045**	**0.031**	**0.017**	**0.017**	**0.039**	**0.060**
$U_{1y}M_{fy}/M_{ry}$	**0.049**	**0.040**	**0.029**	**0.029**	**0.026**	**0.025**	**0.033**	**0.038**	**0.043**	**0.000**	**0.016**	**0.032**	**0.032**	**0.043**	**0.054**	**0.049**	**0.040**	**0.029**
Interaction	**0.459**	**0.455**	**0.460**	**0.485**	**0.481**	**0.477**	**0.581**	**0.597**	**0.615**	**0.429**	**0.435**	**0.471**	**0.475**	**0.473**	**0.470**	**0.457**	**0.470**	**0.482**

3.3. Lateral Torsional Buckling:

λ_{max}	0.149	0.149	0.149	0.307	0.307	0.307	0.365	0.365	0.365	0.269	0.269	0.269	0.269	0.269	0.269	0.149	0.149	0.149
C_r (kN)	8324	8324	8324	8108	8108	8108	6708	6708	6708	8182	8182	8182	8182	8182	8182	8324	8324	8324
U_{1x}	1.01	1.01	1.01	1.03	1.03	1.03	1.03	1.03	1.03	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.05	1.05	1.05	1.02	1.02	1.02	1.02	1.02	1.02	1.00	1.00	1.00
M_{rx} (kNm)	1206	1206	1206	1182	1182	1182	995	995	995	1210	1210	1210	1206	1206	1206	1206	1206	1206
M_{ry} (kNm)	760	760	760	760	760	760	640	640	640	760	760	760	760	760	760	760	760	760
C_f/C_r	**0.387**	**0.387**	**0.388**	**0.412**	**0.412**	**0.412**	**0.500**	**0.502**	**0.504**	**0.392**	**0.393**	**0.394**	**0.398**	**0.398**	**0.399**	**0.392**	**0.392**	**0.392**
$U_{1x}M_{fx}/M_{rx}$	**0.021**	**0.025**	**0.038**	**0.040**	**0.038**	**0.037**	**0.044**	**0.052**	**0.061**	**0.032**	**0.023**	**0.040**	**0.040**	**0.028**	**0.015**	**0.015**	**0.034**	**0.053**
$U_{1y}M_{fy}/M_{ry}$	**0.049**	**0.040**	**0.029**	**0.029**	**0.026**	**0.025**	**0.033**	**0.038**	**0.043**	**0.000**	**0.016**	**0.032**	**0.032**	**0.043**	**0.054**	**0.049**	**0.040**	**0.029**
Interaction	**0.457**	**0.452**	**0.455**	**0.481**	**0.477**	**0.474**	**0.577**	**0.592**	**0.608**	**0.424**	**0.432**	**0.466**	**0.470**	**0.469**	**0.468**	**0.455**	**0.466**	**0.475**
Demand/Capacity ≤ 1	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
Highest Ratio	**0.459**	**0.455**	**0.460**	**0.485**	**0.481**	**0.477**	**0.581**	**0.597**	**0.615**	**0.429**	**0.435**	**0.471**	**0.475**	**0.473**	**0.470**	**0.457**	**0.470**	**0.482**

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	587	587	587	588	588	588	262	262	262	263	263	263	264	264	264	265	265	265
Member Label	51S-20S	51S-20S	51S-20S	20S-19S	20S-19S	20S-19S	21N-39N	21N-39N	21N-39N	39N-37N	39N-37N	39N-37N	37N-40N	37N-40N	37N-40N	40N-28N	40N-28N	40N-28N
Station (m)	0.0	0.1	0.3	0.0	2.7	5.5	0.0	0.5	0.9	0.0	0.8	1.7	0.0	1.1	2.2	0.0	0.7	1.4
Node Label at Station	51S	---	20S	20S	---	19S	21N	---	39N	39N	---	37N	37N	---	40N	40N	---	28N
Section #	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11
Element Group	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal

Member Factored Load Effects:

C_f (kN)	3382	3382	3383	3400	3414	3427	2325	2326	2327	2311	2313	2315	2296	2298	2300	2346	2347	2349
$M_{fx\ (comp)}$ (kNm)	64	60	57	57	46	73	0	8	15	15	27	37	24	29	32	32	29	26
$M_{fy\ (comp)}$ (kNm)	22	21	19	20	23	25	37	34	31	21	23	38	39	12	22	23	12	2
T_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	16	16	16	2	2	2	12	12	12	33	33	33	27	27	27	18	18	18
V_{fy} (kN)	24	24	24	24	24	24	17	16	15	15	13	12	6	4	1	3	5	6

Gross Section Properties:

Ag (mm^2)	46572	46572	46572	46572	46572	46572	26734	26734	26734	26734	26734	26734	26734	26734	26734	26734	26734	26734
I_x (mm^4)	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09
I_y (mm^4)	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09
J (mm^4)	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06
r_x (mm)	194	194	194	194	194	194	197	197	197	197	197	197	197	197	197	197	197	197
r_y (mm)	155	155	155	155	155	155	221	221	221	221	221	221	221	221	221	221	221	221
S_x (mm^3)	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06
S_y (mm^3)	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	20	20	20	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	287	287	287	5486	5486	5486	918	918	918	1675	1675	1675	2236	2236	2236	1377	1377	1377

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	587	587	587	588	588	588	262	262	262	263	263	263	264	264	264	265	265	265
Member Label	51S-20S	51S-20S	51S-20S	20S-19S	20S-19S	20S-19S	21N-39N	21N-39N	21N-39N	39N-37N	39N-37N	39N-37N	37N-40N	37N-40N	37N-40N	40N-28N	40N-28N	40N-28N
Station (m)	0.0	0.1	0.3	0.0	2.7	5.5	0.0	0.5	0.9	0.0	0.8	1.7	0.0	1.1	2.2	0.0	0.7	1.4
Node Label at Station	51S	---	20S	20S	---	19S	21N	---	39N	39N	---	37N	37N	---	40N	40N	---	28N
Section #	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11
Element Group	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	8.0	8.0	8.0	8.0	8.0	8.0	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	28.0	28.0	28.0	28.0	28.0	28.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0
Webs in flexural compression	28.0	28.0	28.0	28.0	28.0	28.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0
Webs in combined flexural and axial compression	28.0	28.0	28.0	28.0	28.0	28.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	587	587	587	588	588	588	262	262	262	263	263	263	264	264	264	265	265	265
Member Label	51S-20S	51S-20S	51S-20S	20S-19S	20S-19S	20S-19S	21N-39N	21N-39N	21N-39N	39N-37N	39N-37N	39N-37N	37N-40N	37N-40N	37N-40N	40N-28N	40N-28N	40N-28N
Station (m)	0.0	0.1	0.3	0.0	2.7	5.5	0.0	0.5	0.9	0.0	0.8	1.7	0.0	1.1	2.2	0.0	0.7	1.4
Node Label at Station	51S	---	20S	20S	---	19S	21N	---	39N	39N	---	37N	37N	---	40N	40N	---	28N
Section #	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11
Element Group	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5773	5773	5773	5773	5773	5773	6206	6206	6206	6206	6206	6206	6206	6206	6206	6206	6206	6206
L_y (mm)	1448	1448	1448	5486	5486	5486	918	918	918	1675	1675	1675	2236	2236	2236	1377	1377	1377
λ_{max}	0.307	0.307	0.307	0.365	0.365	0.365	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325
C_r (kN)	8108.0	8108.0	8108.0	6708.2	6708.2	6708.2	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3
$(kL/r)_{max}$	29.8	29.8	29.8	35.4	35.4	35.4	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing							1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	104076	104076	104076	73527	73527	73527	53055	53055	53055	53055	53055	53055	53055	53055	53055	53055	53055	53055

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	609	609	609	609	609	609	609	609	609	609	609	609
b (mm)	368	368	368	368	368	368	527	527	527	527	527	527	527	527	527	527	527	527
ε_aa (mm)	425	425	425	425	425	425	609	609	609	609	609	609	609	609	609	609	609	609
ε_bb (mm)	368	368	368	368	368	368	527	527	527	527	527	527	527	527	527	527	527	527
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	258	258	258	4938	4938	4938	826	826	826	1507	1507	1507	2012	2012	2012	1239	1239	1239
A_c (mm^2)	23286	23286	23286	23286	23286	23286	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	11.8556	11.8556	11.8556	3.5643	3.5643	3.5643	1.9998	1.9998	1.9998	5.2705	5.2705	5.2705
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	0.061	0.061	0.061	0.111	0.111	0.111	0.148	0.148	0.148	0.091	0.091	0.091
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	4798.1	4798.1	4798.1	4790.3	4790.3	4790.3	4779.0	4779.0	4779.0	4794.3	4794.3	4794.3
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	587	587	587	588	588	588	262	262	262	263	263	263	264	264	264	265	265	265
Member Label	51S-20S	51S-20S	51S-20S	20S-19S	20S-19S	20S-19S	21N-39N	21N-39N	21N-39N	39N-37N	39N-37N	39N-37N	37N-40N	37N-40N	37N-40N	40N-28N	40N-28N	40N-28N
Station (m)	0.0	0.1	0.3	0.0	2.7	5.5	0.0	0.5	0.9	0.0	0.8	1.7	0.0	1.1	2.2	0.0	0.7	1.4
Node Label at Station	51S	---	20S	20S	---	19S	21N	---	39N	39N	---	37N	37N	---	40N	40N	---	28N
Section #	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11
Element Group	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	23286	23286	23286	23286	23286	23286	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	8108.0	8108.0	8108.0	6708.2	6708.2	6708.2	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	44243	44243	44243	37258	37258	37258	25397	25397	25397	25397	25397	25397	25397	25397	25397	25397	25397	25397
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	8827	8827	8827	7433	7433	7433	5067	5067	5067	5067	5067	5067	5067	5067	5067	5067	5067	5067
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	37428	37428	37428	37428	37428	37428	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	37428	37428	37428	37428	37428	37428	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333
$A_{n(corrosion)}$ (mm^2)	35557	35557	35557	29942	29942	29942	19317	19317	19317	19317	19317	19317	19317	19317	19317	19317	19317	19317
$T_{r(b)}$ (kN)	11947	11947	11947	10061	10061	10061	6490	6490	6490	6490	6490	6490	6490	6490	6490	6490	6490	6490
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	35557	35557	35557	29942	29942	29942	19317	19317	19317	19317	19317	19317	19317	19317	19317	19317	19317	19317
$T_{r(c)}$ (kN)	11947	11947	11947	10061	10061	10061	6490	6490	6490	6490	6490	6490	6490	6490	6490	6490	6490	6490
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	587	587	587	588	588	588	262	262	262	263	263	263	264	264	264	265	265	265
Member Label	51S-20S	51S-20S	51S-20S	20S-19S	20S-19S	20S-19S	21N-39N	21N-39N	21N-39N	39N-37N	39N-37N	39N-37N	37N-40N	37N-40N	37N-40N	40N-28N	40N-28N	40N-28N
Station (m)	0.0	0.1	0.3	0.0	2.7	5.5	0.0	0.5	0.9	0.0	0.8	1.7	0.0	1.1	2.2	0.0	0.7	1.4
Node Label at Station	51S	---	20S	20S	---	19S	21N	---	39N	39N	---	37N	37N	---	40N	40N	---	28N
Section #	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11
Element Group	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	11947	11947	11947	10061	10061	10061	6490	6490	6490	6490	6490	6490	6490	6490	6490	6490	6490	6490
$(kL/r)_{max}$	30	30	30	35	35	35	32	32	32	32	32	32	32	32	32	32	32	32
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	8827	8827	8827	7433	7433	7433	5067	5067	5067	5067	5067	5067	5067	5067	5067	5067	5067	5067
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1069	1069	1069	901	901	901	644	644	644	644	644	644	644	644	644	644	644	644
$M_{ry(Laterally\ Supported)}$ (kNm)	760	760	760	640	640	640	788	788	788	788	788	788	788	788	788	788	788	788
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	5773	5773	5773	5773	5773	5773	6206	6206	6206	6206	6206	6206	6206	6206	6206	6206	6206	6206
L_{uy} (mm)	1448	1448	1448	5486	5486	5486	918	918	918	1675	1675	1675	2236	2236	2236	1377	1377	1377
M_{ux} (kNm) (y weak)	8448	8448	8448	8448	8448	8448	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	3444	3444	3444	3444	3444	3444	3444	3444	3444	3444	3444	3444
M_{rx} (kNm)	1181.5	1181.5	1181.5	995.0	995.0	995.0	643.6	643.6	643.6	643.6	643.6	643.6	643.6	643.6	643.6	643.6	643.6	643.6
M_{ry} (kNm)	760.3	760.3	760.3	640.2	640.2	640.2	841.7	841.7	841.7	841.7	841.7	841.7	841.7	841.7	841.7	841.7	841.7	841.7

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.417	0.417	0.417	0.507	0.509	0.511	0.502	0.502	0.502	0.499	0.499	0.500	0.496	0.496	0.497	0.507	0.507	0.507
(T_f/T_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
M_{fx}/M_{rx}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
M_{fy}/M_{ry}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	587	587	587	588	588	588	262	262	262	263	263	263	264	264	264	265	265	265
Member Label	51S-20S	51S-20S	51S-20S	20S-19S	20S-19S	20S-19S	21N-39N	21N-39N	21N-39N	39N-37N	39N-37N	39N-37N	37N-40N	37N-40N	37N-40N	40N-28N	40N-28N	40N-28N
Station (m)	0.0	0.1	0.3	0.0	2.7	5.5	0.0	0.5	0.9	0.0	0.8	1.7	0.0	1.1	2.2	0.0	0.7	1.4
Node Label at Station	51S	---	20S	20S	---	19S	21N	---	39N	39N	---	37N	37N	---	40N	40N	---	28N
Section #	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11
Element Group	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	8362	8362	8362	7042	7042	7042	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.04E+05	1.04E+05	1.04E+05	1.04E+05	1.04E+05	1.04E+05	5.31E+04	5.31E+04	5.31E+04	5.31E+04	5.31E+04	5.31E+04	5.31E+04	5.31E+04	5.31E+04	5.31E+04	5.31E+04	5.31E+04
U_{1x}	1.03	1.03	1.03	1.03	1.03	1.03	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	1055855	1055855	1055855	73527	73527	73527	3059815	3059815	3059815	919913	919913	919913	516117	516117	516117	1360263	1360263	1360263
U_{1y}	1.00	1.00	1.00	1.05	1.05	1.05	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.404**	**0.404**	**0.405**	**0.483**	**0.485**	**0.487**	**0.484**	**0.485**	**0.485**	**0.481**	**0.482**	**0.482**	**0.478**	**0.479**	**0.479**	**0.489**	**0.489**	**0.489**
$U_{1x}M_{fx}/M_{rx}$	**0.062**	**0.058**	**0.055**	**0.065**	**0.053**	**0.084**	**0.000**	**0.013**	**0.024**	**0.024**	**0.044**	**0.060**	**0.039**	**0.047**	**0.052**	**0.052**	**0.047**	**0.042**
$U_{1y}M_{fy}/M_{ry}$	**0.029**	**0.028**	**0.025**	**0.033**	**0.038**	**0.041**	**0.047**	**0.043**	**0.039**	**0.027**	**0.029**	**0.048**	**0.050**	**0.015**	**0.028**	**0.029**	**0.015**	**0.003**
Interaction	**0.495**	**0.490**	**0.485**	**0.581**	**0.575**	**0.611**	**0.531**	**0.541**	**0.549**	**0.533**	**0.555**	**0.591**	**0.567**	**0.541**	**0.559**	**0.570**	**0.551**	**0.534**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.307	0.307	0.307	0.365	0.365	0.365	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325
$C_{r\ (K=1)}$ (kN)	8108	8108	8108	6708	6708	6708	4631	4631	4631	4631	4631	4631	4631	4631	4631	4631	4631	4631
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.03	1.03	1.03	1.03	1.03	1.03	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.05	1.05	1.05	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.417**	**0.417**	**0.417**	**0.507**	**0.509**	**0.511**	**0.502**	**0.502**	**0.502**	**0.499**	**0.499**	**0.500**	**0.496**	**0.496**	**0.497**	**0.507**	**0.507**	**0.507**
$U_{1x}M_{fx}/M_{rx}$	**0.062**	**0.058**	**0.055**	**0.065**	**0.053**	**0.084**	**0.000**	**0.013**	**0.024**	**0.024**	**0.044**	**0.060**	**0.039**	**0.047**	**0.052**	**0.052**	**0.047**	**0.042**
$U_{1y}M_{fy}/M_{ry}$	**0.029**	**0.028**	**0.025**	**0.033**	**0.038**	**0.041**	**0.047**	**0.043**	**0.039**	**0.027**	**0.029**	**0.048**	**0.050**	**0.015**	**0.028**	**0.029**	**0.015**	**0.003**
Interaction	**0.508**	**0.503**	**0.497**	**0.605**	**0.599**	**0.636**	**0.549**	**0.558**	**0.566**	**0.550**	**0.573**	**0.608**	**0.584**	**0.559**	**0.577**	**0.588**	**0.569**	**0.552**

3.3. Lateral Torsional Buckling:

λ_{max}	0.307	0.307	0.307	0.365	0.365	0.365	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325
C_r (kN)	8108	8108	8108	6708	6708	6708	4631	4631	4631	4631	4631	4631	4631	4631	4631	4631	4631	4631
U_{1x}	1.03	1.03	1.03	1.03	1.03	1.03	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
U_{1y}	1.00	1.00	1.00	1.05	1.05	1.05	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1182	1182	1182	995	995	995	644	644	644	644	644	644	644	644	644	644	644	644
M_{ry} (kNm)	760	760	760	640	640	640	842	842	842	842	842	842	842	842	842	842	842	842
C_f/C_r	**0.417**	**0.417**	**0.417**	**0.507**	**0.509**	**0.511**	**0.502**	**0.502**	**0.502**	**0.499**	**0.499**	**0.500**	**0.496**	**0.496**	**0.497**	**0.507**	**0.507**	**0.507**
$U_{1x}M_{fx}/M_{rx}$	**0.056**	**0.052**	**0.050**	**0.059**	**0.048**	**0.076**	**0.000**	**0.013**	**0.024**	**0.024**	**0.044**	**0.060**	**0.039**	**0.047**	**0.052**	**0.052**	**0.047**	**0.042**
$U_{1y}M_{fy}/M_{ry}$	**0.029**	**0.028**	**0.025**	**0.033**	**0.038**	**0.041**	**0.044**	**0.040**	**0.037**	**0.025**	**0.027**	**0.045**	**0.047**	**0.014**	**0.026**	**0.027**	**0.014**	**0.002**
Interaction	**0.502**	**0.497**	**0.492**	**0.599**	**0.594**	**0.628**	**0.546**	**0.556**	**0.564**	**0.548**	**0.571**	**0.605**	**0.581**	**0.558**	**0.575**	**0.586**	**0.568**	**0.552**
Demand/Capacity ≤ 1	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
Highest Ratio	**0.508**	**0.503**	**0.497**	**0.605**	**0.599**	**0.636**	**0.549**	**0.558**	**0.566**	**0.550**	**0.573**	**0.608**	**0.584**	**0.559**	**0.577**	**0.588**	**0.569**	**0.552**

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	266	266	266	267	267	267	268	268	268	590	590	590	591	591	591	592	592	592
Member Label	28N-52N	28N-52N	28N-52N	52N-17N	52N-17N	52N-17N	17N-15N	17N-15N	17N-15N	21S-39S	21S-39S	21S-39S	39S-37S	39S-37S	39S-37S	37S-40S	37S-40S	37S-40S
Station (m)	0.0	0.2	0.4	0.0	0.9	1.8	0.0	4.2	8.4	0.0	0.5	0.9	0.0	0.8	1.7	0.0	1.1	2.2
Node Label at Station	28N	---	52N	52N	---	17N	17N	---	15N	21S	---	39S	39S	---	37S	37S	---	40S
Section #	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11
Element Group	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal

Member Factored Load Effects:

C_f (kN)	2064	2064	2065	2366	2368	2370	2448	2456	2464	2330	2330	2331	2316	2318	2319	2301	2303	2305
$M_{fx\ (comp)}$ (kNm)	27	12	46	125	57	25	11	17	62	0	7	14	14	26	37	24	29	31
$M_{fy\ (comp)}$ (kNm)	2	30	58	21	20	18	18	13	19	35	31	27	17	25	37	38	9	26
T_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	128	128	128	3	3	3	4	4	4	15	15	15	30	30	30	29	29	29
V_{fy} (kN)	155	155	156	80	82	84	7	8	17	17	16	15	15	13	11	6	3	1

Gross Section Properties:

Ag (mm^2)	26734	26734	26734	26734	26734	26734	26734	26734	26734	26734	26734	26734	26734	26734	26734	26734	26734	26734
I_x (mm^4)	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09
I_y (mm^4)	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09
J (mm^4)	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06
r_x (mm)	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197
r_y (mm)	221	221	221	221	221	221	221	221	221	221	221	221	221	221	221	221	221	221
S_x (mm^3)	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06
S_y (mm^3)	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	20	20	20	5	5	5	5	5	5	5	5	5
L (mm)	444	444	444	1781	1781	1781	8430	8430	8430	918	918	918	1675	1675	1675	2236	2236	2236

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	266	266	266	267	267	267	268	268	268	590	590	590	591	591	591	592	592	592
Member Label	28N-52N	28N-52N	28N-52N	52N-17N	52N-17N	52N-17N	17N-15N	17N-15N	17N-15N	21S-39S	21S-39S	21S-39S	39S-37S	39S-37S	39S-37S	37S-40S	37S-40S	37S-40S
Station (m)	0.0	0.2	0.4	0.0	0.9	1.8	0.0	4.2	8.4	0.0	0.5	0.9	0.0	0.8	1.7	0.0	1.1	2.2
Node Label at Station	28N	---	52N	52N	---	17N	17N	---	15N	21S	---	39S	39S	---	37S	37S	---	40S
Section #	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11
Element Group	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0
Webs in flexural compression	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0
Webs in combined flexural and axial compression	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	266	266	266	267	267	267	268	268	268	590	590	590	591	591	591	592	592	592
Member Label	28N-52N	28N-52N	28N-52N	52N-17N	52N-17N	52N-17N	17N-15N	17N-15N	17N-15N	21S-39S	21S-39S	21S-39S	39S-37S	39S-37S	39S-37S	37S-40S	37S-40S	37S-40S
Station (m)	0.0	0.2	0.4	0.0	0.9	1.8	0.0	4.2	8.4	0.0	0.5	0.9	0.0	0.8	1.7	0.0	1.1	2.2
Node Label at Station	28N	---	52N	52N	---	17N	17N	---	15N	21S	---	39S	39S	---	37S	37S	---	40S
Section #	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11
Element Group	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	444	444	444	1781	1781	1781	8430	8430	8430	6206	6206	6206	6206	6206	6206	6206	6206	6206
L_y (mm)	444	444	444	1781	1781	1781	8430	8430	8430	918	918	918	1675	1675	1675	2236	2236	2236
λ_{max}	0.023	0.023	0.023	0.093	0.093	0.093	0.441	0.441	0.441	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325
C_r (kN)	4799.9	4799.9	4799.9	4793.9	4793.9	4793.9	3735.0	3735.0	3735.0	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3
$(kL/r)_{max}$	2.3	2.3	2.3	9.0	9.0	9.0	42.8	42.8	42.8	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	10384804	10384804	10384804	644046	644046	644046	28748	28748	28748	53055	53055	53055	53055	53055	53055	53055	53055	53055

Shear Flexibility Factor:

1. Lacing:

a (mm)	609	609	609	609	609	609	609	609	609	609	609	609	609	609	609	609	609	609
b (mm)	527	527	527	527	527	527	527	527	527	527	527	527	527	527	527	527	527	527
ε_aa (mm)	609	609	609	609	609	609	609	609	609	609	609	609	609	609	609	609	609	609
ε_bb (mm)	527	527	527	527	527	527	527	527	527	527	527	527	527	527	527	527	527	527
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	399	399	399	1603	1603	1603	7587	7587	7587	826	826	826	1507	1507	1507	2012	2012	2012
A_c (mm^2)	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	50.8047	50.8047	50.8047	3.1508	3.1508	3.1508	0.1406	0.1406	0.1406	11.8556	11.8556	11.8556	3.5643	3.5643	3.5643	1.9998	1.9998	1.9998
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.71	0.71	0.71	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	1.414	1.414	1.414	1.414	1.414	1.414	1.184	1.184	1.184	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414
λ_v	0.029	0.029	0.029	0.118	0.118	0.118	0.466	0.466	0.466	0.061	0.061	0.061	0.111	0.111	0.111	0.148	0.148	0.148
Cr' (kN)	4799.8	4799.8	4799.8	4788.6	4788.6	4788.6	3692.0	3692.0	3692.0	4798.1	4798.1	4798.1	4790.3	4790.3	4790.3	4779.0	4779.0	4779.0
Lacing Governs?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	266	266	266	267	267	267	268	268	268	590	590	590	591	591	591	592	592	592
Member Label	28N-52N	28N-52N	28N-52N	52N-17N	52N-17N	52N-17N	17N-15N	17N-15N	17N-15N	21S-39S	21S-39S	21S-39S	39S-37S	39S-37S	39S-37S	37S-40S	37S-40S	37S-40S
Station (m)	0.0	0.2	0.4	0.0	0.9	1.8	0.0	4.2	8.4	0.0	0.5	0.9	0.0	0.8	1.7	0.0	1.1	2.2
Node Label at Station	28N	---	52N	52N	---	17N	17N	---	15N	21S	---	39S	39S	---	37S	37S	---	40S
Section #	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11
Element Group	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	4799.8	4799.8	4799.8	4788.6	4788.6	4788.6	3692.0	3692.0	3692.0	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	25397	25397	25397	25397	25397	25397	21387	21387	21387	25397	25397	25397	25397	25397	25397	25397	25397	25397
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5067	5067	5067	5067	5067	5067	4267	4267	4267	5067	5067	5067	5067	5067	5067	5067	5067	5067
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333
$A_{n(corrosion)}$ (mm^2)	19317	19317	19317	19317	19317	19317	16267	16267	16267	19317	19317	19317	19317	19317	19317	19317	19317	19317
$T_{r(b)}$ (kN)	6490	6490	6490	6490	6490	6490	5466	5466	5466	6490	6490	6490	6490	6490	6490	6490	6490	6490
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	19317	19317	19317	19317	19317	19317	16267	16267	16267	19317	19317	19317	19317	19317	19317	19317	19317	19317
$T_{r(c)}$ (kN)	6490	6490	6490	6490	6490	6490	5466	5466	5466	6490	6490	6490	6490	6490	6490	6490	6490	6490
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	266	266	266	267	267	267	268	268	268	590	590	590	591	591	591	592	592	592
Member Label	28N-52N	28N-52N	28N-52N	52N-17N	52N-17N	52N-17N	17N-15N	17N-15N	17N-15N	21S-39S	21S-39S	21S-39S	39S-37S	39S-37S	39S-37S	37S-40S	37S-40S	37S-40S
Station (m)	0.0	0.2	0.4	0.0	0.9	1.8	0.0	4.2	8.4	0.0	0.5	0.9	0.0	0.8	1.7	0.0	1.1	2.2
Node Label at Station	28N	---	52N	52N	---	17N	17N	---	15N	21S	---	39S	39S	---	37S	37S	---	40S
Section #	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11
Element Group	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	6490	6490	6490	6490	6490	6490	5466	5466	5466	6490	6490	6490	6490	6490	6490	6490	6490	6490
$(kL/r)_{max}$	2	2	2	9	9	9	43	43	43	32	32	32	32	32	32	32	32	32
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5067	5067	5067	5067	5067	5067	4267	4267	4267	5067	5067	5067	5067	5067	5067	5067	5067	5067
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	644	644	644	644	644	644	542	542	542	644	644	644	644	644	644	644	644	644
$M_{ry(Laterally\ Supported)}$ (kNm)	788	788	788	788	788	788	663	663	663	788	788	788	788	788	788	788	788	788
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	444	444	444	1781	1781	1781	8430	8430	8430	6206	6206	6206	6206	6206	6206	6206	6206	6206
L_{uy} (mm)	444	444	444	1781	1781	1781	8430	8430	8430	918	918	918	1675	1675	1675	2236	2236	2236
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	48177	48177	48177	11998	11998	11998	2535	2535	2535	3444	3444	3444	3444	3444	3444	3444	3444	3444
M_{rx} (kNm)	643.6	643.6	643.6	643.6	643.6	643.6	542.0	542.0	542.0	643.6	643.6	643.6	643.6	643.6	643.6	643.6	643.6	643.6
M_{ry} (kNm)	901.4	901.4	901.4	887.6	887.6	887.6	689.4	689.4	689.4	841.7	841.7	841.7	841.7	841.7	841.7	841.7	841.7	841.7

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y/w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.430	0.430	0.430	0.494	0.495	0.495	0.663	0.665	0.667	0.503	0.503	0.503	0.500	0.501	0.501	0.497	0.497	0.498
(T_f/T_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
M_{fx}/M_{rx}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
M_{fy}/M_{ry}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Member ID in CSiBridge	266	266	266	267	267	267	268	268	268	590	590	590	591	591	591	592	592	592
Member Label	28N-52N	28N-52N	28N-52N	52N-17N	52N-17N	52N-17N	17N-15N	17N-15N	17N-15N	21S-39S	21S-39S	21S-39S	39S-37S	39S-37S	39S-37S	37S-40S	37S-40S	37S-40S
Station (m)	0.0	0.2	0.4	0.0	0.9	1.8	0.0	4.2	8.4	0.0	0.5	0.9	0.0	0.8	1.7	0.0	1.1	2.2
Node Label at Station	28N	---	52N	52N	---	17N	17N	---	15N	21S	---	39S	39S	---	37S	37S	---	40S
Section #	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11
Element Group	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	4800	4800	4800	4800	4800	4800	4042	4042	4042	4800	4800	4800	4800	4800	4800	4800	4800	4800
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.04E+07	1.04E+07	1.04E+07	6.44E+05	6.44E+05	6.44E+05	2.87E+04	2.87E+04	2.87E+04	5.31E+04	5.31E+04	5.31E+04	5.31E+04	5.31E+04	5.31E+04	5.31E+04	5.31E+04	5.31E+04
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.09	1.09	1.09	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	13112165	13112165	13112165	813191	813191	813191	36298	36298	36298	3059815	3059815	3059815	919913	919913	919913	516117	516117	516117
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.07	1.07	1.07	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.430**	**0.430**	**0.430**	**0.493**	**0.493**	**0.494**	**0.606**	**0.608**	**0.610**	**0.485**	**0.485**	**0.486**	**0.482**	**0.483**	**0.483**	**0.479**	**0.480**	**0.480**
$U_{1x}M_{fx}/M_{rx}$	**0.042**	**0.019**	**0.071**	**0.195**	**0.089**	**0.039**	**0.022**	**0.034**	**0.125**	**0.000**	**0.011**	**0.023**	**0.023**	**0.042**	**0.060**	**0.039**	**0.047**	**0.050**
$U_{1y}M_{fy}/M_{ry}$	**0.003**	**0.038**	**0.074**	**0.027**	**0.025**	**0.023**	**0.029**	**0.021**	**0.031**	**0.044**	**0.039**	**0.034**	**0.022**	**0.032**	**0.047**	**0.048**	**0.011**	**0.033**
Interaction	**0.474**	**0.487**	**0.575**	**0.715**	**0.608**	**0.556**	**0.657**	**0.663**	**0.765**	**0.530**	**0.536**	**0.543**	**0.527**	**0.557**	**0.590**	**0.567**	**0.538**	**0.564**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.023	0.023	0.023	0.093	0.093	0.093	0.441	0.441	0.441	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325
$C_{r\ (K=1)}$ (kN)	4800	4800	4800	4794	4794	4794	3735	3735	3735	4631	4631	4631	4631	4631	4631	4631	4631	4631
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.09	1.09	1.09	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.07	1.07	1.07	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.430**	**0.430**	**0.430**	**0.494**	**0.494**	**0.494**	**0.655**	**0.658**	**0.660**	**0.503**	**0.503**	**0.503**	**0.500**	**0.501**	**0.501**	**0.497**	**0.497**	**0.498**
$U_{1x}M_{fx}/M_{rx}$	**0.042**	**0.019**	**0.071**	**0.195**	**0.089**	**0.039**	**0.022**	**0.034**	**0.125**	**0.000**	**0.011**	**0.023**	**0.023**	**0.042**	**0.060**	**0.039**	**0.047**	**0.050**
$U_{1y}M_{fy}/M_{ry}$	**0.003**	**0.038**	**0.074**	**0.027**	**0.025**	**0.023**	**0.029**	**0.021**	**0.031**	**0.044**	**0.039**	**0.034**	**0.022**	**0.032**	**0.047**	**0.048**	**0.011**	**0.033**
Interaction	**0.475**	**0.487**	**0.575**	**0.715**	**0.608**	**0.556**	**0.707**	**0.713**	**0.816**	**0.548**	**0.554**	**0.560**	**0.544**	**0.575**	**0.608**	**0.584**	**0.556**	**0.581**

3.3. Lateral Torsional Buckling:

λ_{max}	0.023	0.023	0.023	0.093	0.093	0.093	0.441	0.441	0.441	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325
C_r (kN)	4800	4800	4800	4794	4794	4794	3735	3735	3735	4631	4631	4631	4631	4631	4631	4631	4631	4631
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.09	1.09	1.09	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.07	1.07	1.07	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	644	644	644	644	644	644	542	542	542	644	644	644	644	644	644	644	644	644
M_{ry} (kNm)	901	901	901	888	888	888	689	689	689	842	842	842	842	842	842	842	842	842
C_f/C_r	**0.430**	**0.430**	**0.430**	**0.494**	**0.494**	**0.494**	**0.655**	**0.658**	**0.660**	**0.503**	**0.503**	**0.503**	**0.500**	**0.501**	**0.501**	**0.497**	**0.497**	**0.498**
$U_{1x}M_{fx}/M_{rx}$	**0.042**	**0.019**	**0.071**	**0.195**	**0.089**	**0.039**	**0.022**	**0.034**	**0.125**	**0.000**	**0.011**	**0.023**	**0.023**	**0.042**	**0.060**	**0.039**	**0.047**	**0.050**
$U_{1y}M_{fy}/M_{ry}$	**0.002**	**0.033**	**0.064**	**0.024**	**0.023**	**0.020**	**0.028**	**0.020**	**0.030**	**0.042**	**0.037**	**0.032**	**0.020**	**0.030**	**0.044**	**0.045**	**0.011**	**0.031**
Interaction	**0.474**	**0.482**	**0.566**	**0.712**	**0.605**	**0.554**	**0.706**	**0.712**	**0.814**	**0.545**	**0.551**	**0.558**	**0.543**	**0.573**	**0.605**	**0.581**	**0.555**	**0.579**
Demand/Capacity ≤ 1	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
Highest Ratio	**0.475**	**0.487**	**0.575**	**0.715**	**0.608**	**0.556**	**0.707**	**0.713**	**0.816**	**0.548**	**0.554**	**0.560**	**0.544**	**0.575**	**0.608**	**0.584**	**0.556**	**0.581**

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	593	593	593	594	594	594	595	595	595	596	596	596	253	253	253	254	254	254
Member Label	40S-28S	40S-28S	40S-28S	28S-52S	28S-52S	28S-52S	52S-17S	52S-17S	52S-17S	17S-15S	17S-15S	17S-15S	15N-18N	15N-18N	15N-18N	18N-19N	18N-19N	18N-19N
Station (m)	0.0	0.7	1.4	0.0	0.2	0.4	0.0	0.9	1.8	0.0	4.2	8.4	0.0	3.2	6.4	0.0	3.2	6.4
Node Label at Station	40S	---	28S	28S	---	52S	52S	---	17S	17S	---	15S	15N	---	18N	18N	---	19N
Section #	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 12	Section 12	Section 12	Section 12	Section 12	Section 12
Element Group	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont

Member Factored Load Effects:

C_f (kN)	2356	2357	2358	2070	2070	2070	2379	2381	2383	2461	2468	2476	0	0	0	0	0	0
$M_{fx\ (comp)}$ (kNm)	31	29	25	26	12	46	128	57	28	14	15	56	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	27	13	2	2	29	56	31	29	27	27	16	36	0	0	0	0	0	0
T_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	64	64	64	66	66	66
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	13	2	7	3	1	8
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	3	2	1	1	1	1
V_{fx} (kN)	21	21	21	123	123	123	3	3	3	7	7	7	0	0	0	0	0	0
V_{fy} (kN)	4	5	7	153	154	154	84	86	88	8	7	16	6	3	1	1	2	4

Gross Section Properties:

Ag (mm^2)	26734	26734	26734	26734	26734	26734	26734	26734	26734	26734	26734	26734	7547	7547	7547	7547	7547	7547
I_x (mm^4)	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	6.55E+07	6.55E+07	6.55E+07	6.55E+07	6.55E+07	6.55E+07
I_y (mm^4)	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	2.22E+08	2.22E+08	2.22E+08	2.22E+08	2.22E+08	2.22E+08
J (mm^4)	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.60E+05	2.60E+05	2.60E+05	2.60E+05	2.60E+05	2.60E+05
r_x (mm)	197	197	197	197	197	197	197	197	197	197	197	197	93	93	93	93	93	93
r_y (mm)	221	221	221	221	221	221	221	221	221	221	221	221	171	171	171	171	171	171
S_x (mm^3)	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	5.16E+05	5.16E+05	5.16E+05	5.16E+05	5.16E+05	5.16E+05
S_y (mm^3)	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	1.18E+06	1.18E+06	1.18E+06	1.18E+06	1.18E+06	1.18E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	20	20	20	20	20	20	20	20	20
L (mm)	1377	1377	1377	444	444	444	1781	1781	1781	8430	8430	8430	6401	6401	6401	6401	6401	6401

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	593	593	593	594	594	594	595	595	595	596	596	596	253	253	253	254	254	254
Member Label	40S-28S	40S-28S	40S-28S	28S-52S	28S-52S	28S-52S	52S-17S	52S-17S	52S-17S	17S-15S	17S-15S	17S-15S	15N-18N	15N-18N	15N-18N	18N-19N	18N-19N	18N-19N
Station (m)	0.0	0.7	1.4	0.0	0.2	0.4	0.0	0.9	1.8	0.0	4.2	8.4	0.0	3.2	6.4	0.0	3.2	6.4
Node Label at Station	40S	---	28S	28S	---	52S	52S	---	17S	17S	---	15S	15N	---	18N	18N	---	19N
Section #	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 12	Section 12	Section 12	Section 12	Section 12	Section 12
Element Group	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7						
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels													6.3	6.3	6.3	6.3	6.3	6.3
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	26.4	26.4	26.4	26.4	26.4	26.4
Webs in flexural compression	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	26.4	26.4	26.4	26.4	26.4	26.4
Webs in combined flexural and axial compression	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	26.4	26.4	26.4	26.4	26.4	26.4
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	593	593	593	594	594	594	595	595	595	596	596	596	253	253	253	254	254	254
Member Label	40S-28S	40S-28S	40S-28S	28S-52S	28S-52S	28S-52S	52S-17S	52S-17S	52S-17S	17S-15S	17S-15S	17S-15S	15N-18N	15N-18N	15N-18N	18N-19N	18N-19N	18N-19N
Station (m)	0.0	0.7	1.4	0.0	0.2	0.4	0.0	0.9	1.8	0.0	4.2	8.4	0.0	3.2	6.4	0.0	3.2	6.4
Node Label at Station	40S	---	28S	28S	---	52S	52S	---	17S	17S	---	15S	15N	---	18N	18N	---	19N
Section #	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 12	Section 12	Section 12	Section 12	Section 12	Section 12
Element Group	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	6206	6206	6206	444	444	444	1781	1781	1781	8430	8430	8430	6401	6401	6401	6401	6401	6401
L_y (mm)	1377	1377	1377	444	444	444	1781	1781	1781	8430	8430	8430	12802	12802	12802	12802	12802	12802
λ_{max}	0.325	0.325	0.325	0.023	0.023	0.023	0.093	0.093	0.093	0.441	0.441	0.441	0.772	0.772	0.772	0.772	0.772	0.772
C_r (kN)	4631.3	4631.3	4631.3	4799.9	4799.9	4799.9	4793.9	4793.9	4793.9	3735.0	3735.0	3735.0	843.1	843.1	843.1	843.1	843.1	843.1
$(kL/r)_{max}$	31.5	31.5	31.5	2.3	2.3	2.3	9.0	9.0	9.0	42.8	42.8	42.8	74.9	74.9	74.9	74.9	74.9	74.9
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	53055	53055	53055	10384804	10384804	10384804	644046	644046	644046	28748	28748	28748	2670	2670	2670	2670	2670	2670

Shear Flexibility Factor:

1. Lacing:

a (mm)	609	609	609	609	609	609	609	609	609	609	609	609	352	352	352	352	352	352
b (mm)	527	527	527	527	527	527	527	527	527	527	527	527	305	305	305	305	305	305
ε_aa (mm)	609	609	609	609	609	609	609	609	609	609	609	609	352	352	352	352	352	352
ε_bb (mm)	527	527	527	527	527	527	527	527	527	527	527	527	305	305	305	305	305	305
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	1239	1239	1239	399	399	399	1603	1603	1603	7587	7587	7587	5761	5761	5761	5761	5761	5761
A_c (mm^2)	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	3774	3774	3774	3774	3774	3774
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	544	544	544	544	544	544
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	544	544	544	544	544	544
μ	5.2705	5.2705	5.2705	50.8047	50.8047	50.8047	3.1508	3.1508	3.1508	0.1406	0.1406	0.1406	0.0384	0.0384	0.0384	0.0384	0.0384	0.0384
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.71	0.71	0.71	0.89	0.89	0.89	0.89	0.89	0.89
k'(sqrt(P_e/P_{cr}))	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.184	1.184	1.184	1.062	1.062	1.062	1.062	1.062	1.062
λ_v	0.091	0.091	0.091	0.029	0.029	0.029	0.118	0.118	0.118	0.466	0.466	0.466	0.820	0.820	0.820	0.820	0.820	0.820
Cr' (kN)	4794.3	4794.3	4794.3	4799.8	4799.8	4799.8	4788.6	4788.6	4788.6	3692.0	3692.0	3692.0	808.2	808.2	808.2	808.2	808.2	808.2
Lacing Governs?	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No

Member ID in CSiBridge	593	593	593	594	594	594	595	595	595	596	596	596	253	253	253	254	254	254
Member Label	40S-28S	40S-28S	40S-28S	28S-52S	28S-52S	28S-52S	52S-17S	52S-17S	52S-17S	17S-15S	17S-15S	17S-15S	15N-18N	15N-18N	15N-18N	18N-19N	18N-19N	18N-19N
Station (m)	0.0	0.7	1.4	0.0	0.2	0.4	0.0	0.9	1.8	0.0	4.2	8.4	0.0	3.2	6.4	0.0	3.2	6.4
Node Label at Station	40S	---	28S	28S	---	52S	52S	---	17S	17S	---	15S	15N	---	18N	18N	---	19N
Section #	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 12	Section 12	Section 12	Section 12	Section 12	Section 12
Element Group	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	3774	3774	3774	3774	3774	3774
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	4631.3	4631.3	4631.3	4799.8	4799.8	4799.8	4788.6	4788.6	4788.6	3692.0	3692.0	3692.0	843.1	843.1	843.1	843.1	843.1	843.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	25397	25397	25397	25397	25397	25397	25397	25397	25397	21387	21387	21387	6038	6038	6038	6038	6038	6038
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5067	5067	5067	5067	5067	5067	5067	5067	5067	4267	4267	4267	1205	1205	1205	1205	1205	1205
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	4636	4636	4636	4636	4636	4636
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	4636	4636	4636	4636	4636	4636
$A_{n(corrosion)}$ (mm^2)	19317	19317	19317	19317	19317	19317	19317	19317	19317	16267	16267	16267	3708	3708	3708	3708	3708	3708
$T_{r(b)}$ (kN)	6490	6490	6490	6490	6490	6490	6490	6490	6490	5466	5466	5466	1246	1246	1246	1246	1246	1246
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	19317	19317	19317	19317	19317	19317	19317	19317	19317	16267	16267	16267	3708	3708	3708	3708	3708	3708
$T_{r(c)}$ (kN)	6490	6490	6490	6490	6490	6490	6490	6490	6490	5466	5466	5466	1246	1246	1246	1246	1246	1246
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	593	593	593	594	594	594	595	595	595	596	596	596	253	253	253	254	254	254
Member Label	40S-28S	40S-28S	40S-28S	28S-52S	28S-52S	28S-52S	52S-17S	52S-17S	52S-17S	17S-15S	17S-15S	17S-15S	15N-18N	15N-18N	15N-18N	18N-19N	18N-19N	18N-19N
Station (m)	0.0	0.7	1.4	0.0	0.2	0.4	0.0	0.9	1.8	0.0	4.2	8.4	0.0	3.2	6.4	0.0	3.2	6.4
Node Label at Station	40S	---	28S	28S	---	52S	52S	---	17S	17S	---	15S	15N	---	18N	18N	---	19N
Section #	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 12	Section 12	Section 12	Section 12	Section 12	Section 12
Element Group	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	6490	6490	6490	6490	6490	6490	6490	6490	6490	5466	5466	5466	1246	1246	1246	1246	1246	1246
$(kL/r)_{max}$	32	32	32	2	2	2	9	9	9	43	43	43	75	75	75	75	75	75
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5067	5067	5067	5067	5067	5067	5067	5067	5067	4267	4267	4267	1205	1205	1205	1205	1205	1205
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	644	644	644	644	644	644	644	644	644	542	542	542	82	82	82	82	82	82
$M_{ry(Laterally\ Supported)}$ (kNm)	788	788	788	788	788	788	788	788	788	663	663	663	189	189	189	189	189	189
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.70	1.70	1.70	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	6206	6206	6206	444	444	444	1781	1781	1781	8430	8430	8430	6401	6401	6401	6401	6401	6401
L_{uy} (mm)	1377	1377	1377	444	444	444	1781	1781	1781	8430	8430	8430	12802	12802	12802	12802	12802	12802
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	3444	3444	3444	48177	48177	48177	20396	20396	20396	2535	2535	2535	252	252	252	252	252	252
M_{rx} (kNm)	643.6	643.6	643.6	643.6	643.6	643.6	643.6	643.6	643.6	542.0	542.0	542.0	82.3	82.3	82.3	82.3	82.3	82.3
M_{ry} (kNm)	841.7	841.7	841.7	901.4	901.4	901.4	895.2	895.2	895.2	689.4	689.4	689.4	157.1	157.1	157.1	157.1	157.1	157.1

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
$(V_f/V_r)<=1$																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.509	0.509	0.509	0.431	0.431	0.431	0.497	0.497	0.498	0.667	0.668	0.671	0.000	0.000	0.000	0.000	0.000	0.000
$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.053	0.053	0.053	0.055	0.055	0.055

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.053	0.053	0.053	0.055	0.055	0.055
$M_{fx}/M_{rx}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.158	0.024	0.085	0.036	0.012	0.097
$M_{fy}/M_{ry}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.019	0.013	0.006	0.006	0.006	0.006
$T_f/T_r+M_f/M_r<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.230	0.090	0.145	0.098	0.073	0.158
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.060	0.000	0.000	0.000	0.000	0.000

Member ID in CSiBridge	593	593	593	594	594	594	595	595	595	596	596	596	253	253	253	254	254	254
Member Label	40S-28S	40S-28S	40S-28S	28S-52S	28S-52S	28S-52S	52S-17S	52S-17S	52S-17S	17S-15S	17S-15S	17S-15S	15N-18N	15N-18N	15N-18N	18N-19N	18N-19N	18N-19N
Station (m)	0.0	0.7	1.4	0.0	0.2	0.4	0.0	0.9	1.8	0.0	4.2	8.4	0.0	3.2	6.4	0.0	3.2	6.4
Node Label at Station	40S	---	28S	28S	---	52S	52S	---	17S	17S	---	15S	15N	---	18N	18N	---	19N
Section #	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 12	Section 12	Section 12	Section 12	Section 12	Section 12
Element Group	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	4800	4800	4800	4800	4800	4800	4800	4800	4800	4042	4042	4042	1141	1141	1141	1141	1141	1141
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	5.31E+04	5.31E+04	5.31E+04	1.04E+07	1.04E+07	1.04E+07	6.44E+05	6.44E+05	6.44E+05	2.87E+04	2.87E+04	2.87E+04	3.16E+03	3.16E+03	3.16E+03	3.16E+03	3.16E+03	3.16E+03
U_{1x}	1.05	1.05	1.05	1.00	1.00	1.00	1.00	1.00	1.00	1.09	1.09	1.09	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	1360263	1360263	1360263	13112165	13112165	13112165	813191	813191	813191	36298	36298	36298	2670	2670	2670	2670	2670	2670
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.07	1.07	1.07	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.491**	**0.491**	**0.491**	**0.431**	**0.431**	**0.431**	**0.496**	**0.496**	**0.496**	**0.609**	**0.611**	**0.613**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1x}M_{fx}/M_{rx}$	**0.050**	**0.047**	**0.041**	**0.040**	**0.019**	**0.071**	**0.200**	**0.089**	**0.044**	**0.028**	**0.030**	**0.113**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.034**	**0.017**	**0.003**	**0.003**	**0.037**	**0.071**	**0.039**	**0.037**	**0.034**	**0.044**	**0.026**	**0.058**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.576**	**0.555**	**0.534**	**0.474**	**0.487**	**0.574**	**0.735**	**0.622**	**0.574**	**0.681**	**0.667**	**0.784**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.325	0.325	0.325	0.023	0.023	0.023	0.093	0.093	0.093	0.441	0.441	0.441	0.772	0.772	0.772	0.772	0.772	0.772
$C_{r\ (K=1)}$ (kN)	4631	4631	4631	4800	4800	4800	4794	4794	4794	3735	3735	3735	843	843	843	843	843	843
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.05	1.05	1.05	1.00	1.00	1.00	1.00	1.00	1.00	1.09	1.09	1.09	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.07	1.07	1.07	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.509**	**0.509**	**0.509**	**0.431**	**0.431**	**0.431**	**0.496**	**0.497**	**0.497**	**0.659**	**0.661**	**0.663**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1x}M_{fx}/M_{rx}$	**0.050**	**0.047**	**0.041**	**0.040**	**0.019**	**0.071**	**0.200**	**0.089**	**0.044**	**0.028**	**0.030**	**0.113**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.034**	**0.017**	**0.003**	**0.003**	**0.037**	**0.071**	**0.039**	**0.037**	**0.034**	**0.044**	**0.026**	**0.058**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.593**	**0.573**	**0.552**	**0.474**	**0.487**	**0.574**	**0.735**	**0.622**	**0.575**	**0.731**	**0.717**	**0.834**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

3.3. Lateral Torsional Buckling:

λ_{max}	0.325	0.325	0.325	0.023	0.023	0.023	0.093	0.093	0.093	0.441	0.441	0.441	0.772	0.772	0.772	0.772	0.772	0.772
C_r (kN)	4631	4631	4631	4800	4800	4800	4794	4794	4794	3735	3735	3735	843	843	843	843	843	843
U_{1x}	1.05	1.05	1.05	1.00	1.00	1.00	1.00	1.00	1.00	1.09	1.09	1.09	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.07	1.07	1.07	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	644	644	644	644	644	644	644	644	644	542	542	542	82	82	82	82	82	82
M_{ry} (kNm)	842	842	842	901	901	901	895	895	895	689	689	689	157	157	157	157	157	157
C_f/C_r	**0.509**	**0.509**	**0.509**	**0.431**	**0.431**	**0.431**	**0.496**	**0.497**	**0.497**	**0.659**	**0.661**	**0.663**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1x}M_{fx}/M_{rx}$	**0.050**	**0.047**	**0.041**	**0.040**	**0.019**	**0.071**	**0.200**	**0.089**	**0.044**	**0.028**	**0.030**	**0.113**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.032**	**0.015**	**0.002**	**0.002**	**0.032**	**0.062**	**0.035**	**0.032**	**0.030**	**0.042**	**0.025**	**0.056**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.591**	**0.572**	**0.552**	**0.474**	**0.482**	**0.565**	**0.731**	**0.618**	**0.571**	**0.729**	**0.716**	**0.832**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Demand/Capacity ≤ 1	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
Highest Ratio	**0.593**	**0.573**	**0.552**	**0.474**	**0.487**	**0.574**	**0.735**	**0.622**	**0.575**	**0.731**	**0.717**	**0.834**	**0.230**	**0.090**	**0.145**	**0.098**	**0.073**	**0.158**

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	581	581	581	582	582	582	19	19	19	194	194	194	20	20	20	195	195	195
Member Label	15S-18S	15S-18S	15S-18S	18S-19S	18S-19S	18S-19S	18N-17N	18N-17N	18N-17N	18S-17S	18S-17S	18S-17S	17N-19N	17N-19N	17N-19N	17S-19S	17S-19S	17S-19S
Station (m)	0.0	3.2	6.4	0.0	3.2	6.4	0.0	2.7	5.5	0.0	2.7	5.5	0.0	4.2	8.4	0.0	4.2	8.4
Node Label at Station	15S	---	18S	18S	---	19S	18N	---	17N	18S	---	17S	17N	---	19N	17S	---	19S
Section #	Section 12	Section 12	Section 12	Section 12	Section 12	Section 12	Section 13	Section 13	Section 13	Section 13	Section 13	Section 13	Section 14	Section 14	Section 14	Section 14	Section 14	Section 14
Element Group	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal

Member Factored Load Effects:

C_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	215	218	222	219	222	226
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	2	2
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	3	4	12	3	4	12
T_f (kN)	55	55	55	57	57	57	1	4	6	1	4	6	0	0	0	0	0	0
$M_{fx\ (tension)}$ (kNm)	13	2	7	2	1	8	0	1	1	0	1	1	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	4	3	1	1	1	2	4	1	7	4	1	7	0	0	0	0	0	0
V_{fx} (kN)	0	0	0	0	0	0	2	2	2	2	2	2	2	2	6	2	2	6
V_{fy} (kN)	6	3	0	1	2	4	0	0	0	0	0	0	0	0	0	0	0	0

Gross Section Properties:

Ag (mm^2)	7547	7547	7547	7547	7547	7547	9315	9315	9315	9315	9315	9315	11361	11361	11361	11361	11361	11361
I_x (mm^4)	6.55E+07	6.55E+07	6.55E+07	6.55E+07	6.55E+07	6.55E+07	2.69E+08	2.69E+08	2.69E+08	2.69E+08	2.69E+08	2.69E+08	3.28E+08	3.28E+08	3.28E+08	3.28E+08	3.28E+08	3.28E+08
I_y (mm^4)	2.22E+08	2.22E+08	2.22E+08	2.22E+08	2.22E+08	2.22E+08	6.25E+07	6.25E+07	6.25E+07	6.25E+07	6.25E+07	6.25E+07	9.07E+07	9.07E+07	9.07E+07	9.07E+07	9.07E+07	9.07E+07
J (mm^4)	2.60E+05	2.60E+05	2.60E+05	2.60E+05	2.60E+05	2.60E+05	2.80E+05	2.80E+05	2.80E+05	2.80E+05	2.80E+05	2.80E+05	4.63E+05	4.63E+05	4.63E+05	4.63E+05	4.63E+05	4.63E+05
r_x (mm)	93	93	93	93	93	93	170	170	170	170	170	170	170	170	170	170	170	170
r_y (mm)	171	171	171	171	171	171	82	82	82	82	82	82	89	89	89	89	89	89
S_x (mm^3)	5.16E+05	5.16E+05	5.16E+05	5.16E+05	5.16E+05	5.16E+05	1.44E+06	1.44E+06	1.44E+06	1.44E+06	1.44E+06	1.44E+06	1.75E+06	1.75E+06	1.75E+06	1.75E+06	1.75E+06	1.75E+06
S_y (mm^3)	1.18E+06	1.18E+06	1.18E+06	1.18E+06	1.18E+06	1.18E+06	3.68E+05	3.68E+05	3.68E+05	3.68E+05	3.68E+05	3.68E+05	4.96E+05	4.96E+05	4.96E+05	4.96E+05	4.96E+05	4.96E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
L (mm)	6401	6401	6401	6401	6401	6401	5486	5486	5486	5486	5486	5486	8430	8430	8430	8430	8430	8430

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	581	581	581	582	582	582	19	19	19	194	194	194	20	20	20	195	195	195
Member Label	15S-18S	15S-18S	15S-18S	18S-19S	18S-19S	18S-19S	18N-17N	18N-17N	18N-17N	18S-17S	18S-17S	18S-17S	17N-19N	17N-19N	17N-19N	17S-19S	17S-19S	17S-19S
Station (m)	0.0	3.2	6.4	0.0	3.2	6.4	0.0	2.7	5.5	0.0	2.7	5.5	0.0	4.2	8.4	0.0	4.2	8.4
Node Label at Station	15S	---	18S	18S	---	19S	18N	---	17N	18S	---	17S	17N	---	19N	17S	---	19S
Section #	Section 12	Section 12	Section 12	Section 12	Section 12	Section 12	Section 13	Section 13	Section 13	Section 13	Section 13	Section 13	Section 14	Section 14	Section 14	Section 14	Section 14	Section 14
Element Group	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge							16.3	16.3	16.3	16.3	16.3	16.3	16.0	16.0	16.0	16.0	16.0	16.0
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels	6.3	6.3	6.3	6.3	6.3	6.3												
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	26.4	26.4	26.4	26.4	26.4	26.4	16.3	16.3	16.3	16.3	16.3	16.3	16.0	16.0	16.0	16.0	16.0	16.0
Webs in flexural compression	26.4	26.4	26.4	26.4	26.4	26.4	16.3	16.3	16.3	16.3	16.3	16.3	16.0	16.0	16.0	16.0	16.0	16.0
Webs in combined flexural and axial compression	26.4	26.4	26.4	26.4	26.4	26.4	16.3	16.3	16.3	16.3	16.3	16.3	16.0	16.0	16.0	16.0	16.0	16.0
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	581	581	581	582	582	582	19	19	19	194	194	194	20	20	20	195	195	195
Member Label	15S-18S	15S-18S	15S-18S	18S-19S	18S-19S	18S-19S	18N-17N	18N-17N	18N-17N	18S-17S	18S-17S	18S-17S	17N-19N	17N-19N	17N-19N	17S-19S	17S-19S	17S-19S
Station (m)	0.0	3.2	6.4	0.0	3.2	6.4	0.0	2.7	5.5	0.0	2.7	5.5	0.0	4.2	8.4	0.0	4.2	8.4
Node Label at Station	15S	---	18S	18S	---	19S	18N	---	17N	18S	---	17S	17N	---	19N	17S	---	19S
Section #	Section 12	Section 12	Section 12	Section 12	Section 12	Section 12	Section 13	Section 13	Section 13	Section 13	Section 13	Section 13	Section 14	Section 14	Section 14	Section 14	Section 14	Section 14
Element Group	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	6401	6401	6401	6401	6401	6401	5486	5486	5486	5486	5486	5486	8430	8430	8430	8430	8430	8430
L_y (mm)	12802	12802	12802	12802	12802	12802	5486	5486	5486	5486	5486	5486	8430	8430	8430	8430	8430	8430
λ_{max}	0.772	0.772	0.772	0.772	0.772	0.772	0.690	0.690	0.690	0.690	0.690	0.690	0.977	0.977	0.977	0.977	0.977	0.977
C_r (kN)	843.1	843.1	843.1	843.1	843.1	843.1	1113.5	1113.5	1113.5	1113.5	1113.5	1113.5	1047.8	1047.8	1047.8	1047.8	1047.8	1047.8
$(kL/r)_{max}$	74.9	74.9	74.9	74.9	74.9	74.9	66.9	66.9	66.9	66.9	66.9	66.9	94.7	94.7	94.7	94.7	94.7	94.7
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	2670	2670	2670	2670	2670	2670	4096	4096	4096	4096	4096	4096	2518	2518	2518	2518	2518	2518

Shear Flexibility Factor:

1. Lacing:

a (mm)	352	352	352	352	352	352	330	330	330	330	330	330	330	330	330	330	330	330
b (mm)	305	305	305	305	305	305	286	286	286	286	286	286	286	286	286	286	286	286
ε_aa (mm)	352	352	352	352	352	352	330	330	330	330	330	330	330	330	330	330	330	330
ε_bb (mm)	305	305	305	305	305	305	286	286	286	286	286	286	286	286	286	286	286	286
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	5761	5761	5761	5761	5761	5761	4938	4938	4938	4938	4938	4938	7587	7587	7587	7587	7587	7587
A_c (mm^2)	3774	3774	3774	3774	3774	3774	4658	4658	4658	4658	4658	4658	5681	5681	5681	5681	5681	5681
A_d (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
A_b (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
μ	0.0384	0.0384	0.0384	0.0384	0.0384	0.0384	0.0567	0.0567	0.0567	0.0567	0.0567	0.0567	0.0293	0.0293	0.0293	0.0293	0.0293	0.0293
P_{cr}/P_e (Fig.3.51)	0.89	0.89	0.89	0.89	0.89	0.89	0.84	0.84	0.84	0.84	0.84	0.84	0.91	0.91	0.91	0.91	0.91	0.91
k'(sqrt(P_e/P_{cr}))	1.062	1.062	1.062	1.062	1.062	1.062	1.089	1.089	1.089	1.089	1.089	1.089	1.048	1.048	1.048	1.048	1.048	1.048
λ_v	0.820	0.820	0.820	0.820	0.820	0.820	0.752	0.752	0.752	0.752	0.752	0.752	1.024	1.024	1.024	1.024	1.024	1.024
Cr' (kN)	808.2	808.2	808.2	808.2	808.2	808.2	1059.1	1059.1	1059.1	1059.1	1059.1	1059.1	999.7	999.7	999.7	999.7	999.7	999.7
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes

Member ID in CSiBridge	581	581	581	582	582	582	19	19	19	194	194	194	20	20	20	195	195	195
Member Label	15S-18S	15S-18S	15S-18S	18S-19S	18S-19S	18S-19S	18N-17N	18N-17N	18N-17N	18S-17S	18S-17S	18S-17S	17N-19N	17N-19N	17N-19N	17S-19S	17S-19S	17S-19S
Station (m)	0.0	3.2	6.4	0.0	3.2	6.4	0.0	2.7	5.5	0.0	2.7	5.5	0.0	4.2	8.4	0.0	4.2	8.4
Node Label at Station	15S	---	18S	18S	---	19S	18N	---	17N	18S	---	17S	17N	---	19N	17S	---	19S
Section #	Section 12	Section 12	Section 12	Section 12	Section 12	Section 12	Section 13	Section 13	Section 13	Section 13	Section 13	Section 13	Section 14	Section 14	Section 14	Section 14	Section 14	Section 14
Element Group	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	3774	3774	3774	3774	3774	3774	4658	4658	4658	4658	4658	4658	5681	5681	5681	5681	5681	5681
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	843.1	843.1	843.1	843.1	843.1	843.1	1113.5	1113.5	1113.5	1113.5	1113.5	1113.5	999.7	999.7	999.7	999.7	999.7	999.7

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6038	6038	6038	6038	6038	6038	7452	7452	7452	7452	7452	7452	9089	9089	9089	9089	9089	9089
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1205	1205	1205	1205	1205	1205	1487	1487	1487	1487	1487	1487	1813	1813	1813	1813	1813	1813
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	4636	4636	4636	4636	4636	4636	6572	6572	6572	6572	6572	6572	8161	8161	8161	8161	8161	8161
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	4636	4636	4636	4636	4636	4636	6572	6572	6572	6572	6572	6572	8161	8161	8161	8161	8161	8161
$A_{n(corrosion)}$ (mm^2)	3708	3708	3708	3708	3708	3708	5257	5257	5257	5257	5257	5257	6528	6528	6528	6528	6528	6528
$T_{r(b)}$ (kN)	1246	1246	1246	1246	1246	1246	1766	1766	1766	1766	1766	1766	2194	2194	2194	2194	2194	2194
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	3708	3708	3708	3708	3708	3708	5257	5257	5257	5257	5257	5257	6528	6528	6528	6528	6528	6528
$T_{r(c)}$ (kN)	1246	1246	1246	1246	1246	1246	1766	1766	1766	1766	1766	1766	2194	2194	2194	2194	2194	2194
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	581	581	581	582	582	582	19	19	19	194	194	194	20	20	20	195	195	195
Member Label	15S-18S	15S-18S	15S-18S	18S-19S	18S-19S	18S-19S	18N-17N	18N-17N	18N-17N	18S-17S	18S-17S	18S-17S	17N-19N	17N-19N	17N-19N	17S-19S	17S-19S	17S-19S
Station (m)	0.0	3.2	6.4	0.0	3.2	6.4	0.0	2.7	5.5	0.0	2.7	5.5	0.0	4.2	8.4	0.0	4.2	8.4
Node Label at Station	15S	---	18S	18S	---	19S	18N	---	17N	18S	---	17S	17N	---	19N	17S	---	19S
Section #	Section 12	Section 12	Section 12	Section 12	Section 12	Section 12	Section 13	Section 13	Section 13	Section 13	Section 13	Section 13	Section 14	Section 14	Section 14	Section 14	Section 14	Section 14
Element Group	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	1246	1246	1246	1246	1246	1246	1766	1766	1766	1766	1766	1766	2194	2194	2194	2194	2194	2194
$(kL/r)_{max}$	75	75	75	75	75	75	67	67	67	67	67	67	95	95	95	95	95	95
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1205	1205	1205	1205	1205	1205	1487	1487	1487	1487	1487	1487	1813	1813	1813	1813	1813	1813
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	82	82	82	82	82	82	229	229	229	229	229	229	280	280	280	280	280	280
$M_{ry(Laterally\ Supported)}$ (kNm)	189	189	189	189	189	189	59	59	59	59	59	59	79	79	79	79	79	79
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	6401	6401	6401	6401	6401	6401	5486	5486	5486	5486	5486	5486	8430	8430	8430	8430	8430	8430
L_{uy} (mm)	12802	12802	12802	12802	12802	12802	5486	5486	5486	5486	5486	5486	8430	8430	8430	8430	8430	8430
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	297	297	297	297	297	297	299	299	299	299	299	299
M_{uy} (kNm) (x weak)	252	252	252	252	252	252	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	82.3	82.3	82.3	82.3	82.3	82.3	188.6	188.6	188.6	188.6	188.6	188.6	210.9	210.9	210.9	210.9	210.9	210.9
M_{ry} (kNm)	157.1	157.1	157.1	157.1	157.1	157.1	58.7	58.7	58.7	58.7	58.7	58.7	79.2	79.2	79.2	79.2	79.2	79.2

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.215	0.218	0.222	0.219	0.222	0.226
(T_f/T_r)<=1	0.046	0.046	0.046	0.047	0.047	0.047	0.001	0.003	0.004	0.001	0.003	0.004	0.000	0.000	0.000	0.000	0.000	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.046	0.046	0.046	0.047	0.047	0.047	0.001	0.003	0.004	0.001	0.003	0.004	0.000	0.000	0.000	0.000	0.000	0.000
M_{fx}/M_{rx}<=1	0.158	0.024	0.085	0.024	0.012	0.097	0.000	0.005	0.005	0.000	0.005	0.005	0.000	0.000	0.000	0.000	0.000	0.000
M_{fy}/M_{ry}<=1	0.025	0.019	0.006	0.006	0.006	0.013	0.068	0.017	0.119	0.068	0.017	0.119	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r$<=1	0.229	0.089	0.137	0.078	0.066	0.157	0.069	0.025	0.129	0.069	0.025	0.129	0.000	0.000	0.000	0.000	0.000	0.000
$M_f/M_r-T_fS/M_rA$<=1	0.083	0.000	0.000	0.000	0.000	0.006	0.067	0.016	0.116	0.067	0.016	0.116	0.000	0.000	0.000	0.000	0.000	0.000

PARSONS

Member ID in CSiBridge	581	581	581	582	582	582	19	19	19	194	194	194	20	20	20	195	195	195
Member Label	15S-18S	15S-18S	15S-18S	18S-19S	18S-19S	18S-19S	18N-17N	18N-17N	18N-17N	18S-17S	18S-17S	18S-17S	17N-19N	17N-19N	17N-19N	17S-19S	17S-19S	17S-19S
Station (m)	0.0	3.2	6.4	0.0	3.2	6.4	0.0	2.7	5.5	0.0	2.7	5.5	0.0	4.2	8.4	0.0	4.2	8.4
Node Label at Station	15S	---	18S	18S	---	19S	18N	---	17N	18S	---	17S	17N	---	19N	17S	---	19S
Section #	Section 12	Section 12	Section 12	Section 12	Section 12	Section 12	Section 13	Section 13	Section 13	Section 13	Section 13	Section 13	Section 14	Section 14	Section 14	Section 14	Section 14	Section 14
Element Group	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1141	1141	1141	1141	1141	1141	1408	1408	1408	1408	1408	1408	1718	1718	1718	1718	1718	1718
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	3.16E+03	3.16E+03	3.16E+03	3.16E+03	3.16E+03	3.16E+03	1.76E+04	1.76E+04	1.76E+04	1.76E+04	1.76E+04	1.76E+04	9.11E+03	9.11E+03	9.11E+03	9.11E+03	9.11E+03	9.11E+03
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.02	1.02	1.02	1.02	1.02	1.03
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	2670	2670	2670	2670	2670	2670	4096	4096	4096	4096	4096	4096	2518	2518	2518	2518	2518	2518
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.09	1.09	1.10	1.10	1.10	1.10
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.125	0.127	0.129	0.127	0.129	0.132
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.004	0.004	0.004	0.007	0.007
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.041	0.055	0.166	0.041	0.055	0.166
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.170	0.186	0.299	0.173	0.192	0.305

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.772	0.772	0.772	0.772	0.772	0.772	0.690	0.690	0.690	0.690	0.690	0.690	0.977	0.977	0.977	0.977	0.977	0.977
$C_{r\ (K=1)}$ (kN)	843	843	843	843	843	843	1113	1113	1113	1113	1113	1113	1048	1048	1048	1048	1048	1048
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.02	1.02	1.02	1.02	1.02	1.03
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.09	1.09	1.10	1.10	1.10	1.10
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.205	0.208	0.212	0.209	0.212	0.216
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.004	0.004	0.004	0.007	0.007
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.041	0.055	0.166	0.041	0.055	0.166
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.250	0.267	0.382	0.254	0.275	0.389

3.3. Lateral Torsional Buckling:

λ_{max}	0.772	0.772	0.772	0.772	0.772	0.772	0.690	0.690	0.690	0.690	0.690	0.690	0.977	0.977	0.977	0.977	0.977	0.977
C_r (kN)	843	843	843	843	843	843	1113	1113	1113	1113	1113	1113	1048	1048	1048	1048	1048	1048
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.02	1.02	1.02	1.02	1.02	1.03
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.09	1.09	1.10	1.10	1.10	1.10
M_{rx} (kNm)	82	82	82	82	82	82	189	189	189	189	189	189	211	211	211	211	211	211
M_{ry} (kNm)	157	157	157	157	157	157	59	59	59	59	59	59	79	79	79	79	79	79
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.205	0.208	0.212	0.209	0.212	0.216
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.005	0.005	0.005	0.010	0.010
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.041	0.055	0.166	0.041	0.055	0.166
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.251	0.268	0.383	0.255	0.277	0.392
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.229	0.089	0.137	0.078	0.066	0.157	0.069	0.025	0.129	0.069	0.025	0.129	0.251	0.268	0.383	0.255	0.277	0.392

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	24	24	24	25	25	25	26	26	26	199	199	199	200	200	200	201	201	201
Member Label	20N-30N	20N-30N	20N-30N	30N-29N	30N-29N	30N-29N	28N-29N	28N-29N	28N-29N	20S-30S	20S-30S	20S-30S	30S-29S	30S-29S	30S-29S	28S-29S	28S-29S	28S-29S
Station (m)	0.0	1.0	2.0	0.0	1.1	2.2	0.0	1.1	2.2	0.0	1.0	2.0	0.0	1.1	2.2	0.0	1.1	2.2
Node Label at Station	20N	---	30N	30N	---	29N	28N	---	29N	20S	---	30S	30S	---	29S	28S	---	29S
Section #	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T

Member Factored Load Effects:

C_f (kN)	29	29	28	0	0	0	18	18	19	29	29	28	0	0	0	18	18	19
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	0	0	0	22	21	21	0	0	0	0	0	0	22	21	21	0	0	0
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fy} (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Gross Section Properties:

Ag (mm^2)	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116
I_x (mm^4)	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07
I_y (mm^4)	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08
J (mm^4)	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05
r_x (mm)	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49
r_y (mm)	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175
S_x (mm^3)	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05
S_y (mm^3)	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	2048	2048	2048	2164	2164	2164	2200	2200	2200	2048	2048	2048	2164	2164	2164	2200	2200	2200

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	24	24	24	25	25	25	26	26	26	199	199	199	200	200	200	201	201	201
Member Label	20N-30N	20N-30N	20N-30N	30N-29N	30N-29N	30N-29N	28N-29N	28N-29N	28N-29N	20S-30S	20S-30S	20S-30S	30S-29S	30S-29S	30S-29S	28S-29S	28S-29S	28S-29S
Station (m)	0.0	1.0	2.0	0.0	1.1	2.2	0.0	1.1	2.2	0.0	1.0	2.0	0.0	1.1	2.2	0.0	1.1	2.2
Node Label at Station	20N	---	30N	30N	---	29N	28N	---	29N	20S	---	30S	30S	---	29S	28S	---	29S
Section #	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7
Webs in flexural compression	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7
Webs in combined flexural and axial compression	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	24	24	24	25	25	25	26	26	26	199	199	199	200	200	200	201	201	201
Member Label	20N-30N	20N-30N	20N-30N	30N-29N	30N-29N	30N-29N	28N-29N	28N-29N	28N-29N	20S-30S	20S-30S	20S-30S	30S-29S	30S-29S	30S-29S	28S-29S	28S-29S	28S-29S
Station (m)	0.0	1.0	2.0	0.0	1.1	2.2	0.0	1.1	2.2	0.0	1.0	2.0	0.0	1.1	2.2	0.0	1.1	2.2
Node Label at Station	20N	---	30N	30N	---	29N	28N	---	29N	20S	---	30S	30S	---	29S	28S	---	29S
Section #	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	2048	2048	2048	2164	2164	2164	2200	2200	2200	2048	2048	2048	2164	2164	2164	2200	2200	2200
L_y (mm)	2048	2048	2048	2164	2164	2164	2200	2200	2200	2048	2048	2048	2164	2164	2164	2200	2200	2200
λ_{max}	0.431	0.431	0.431	0.455	0.455	0.455	0.463	0.463	0.463	0.431	0.431	0.431	0.455	0.455	0.455	0.463	0.463	0.463
C_r (kN)	852.7	852.7	852.7	843.2	843.2	843.2	840.2	840.2	840.2	852.7	852.7	852.7	843.2	843.2	843.2	840.2	840.2	840.2
$(kL/r)_{max}$	41.8	41.8	41.8	44.2	44.2	44.2	44.9	44.9	44.9	41.8	41.8	41.8	44.2	44.2	44.2	44.9	44.9	44.9
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	5785	5785	5785	5180	5180	5180	5012	5012	5012	5785	5785	5785	5180	5180	5180	5012	5012	5012

Shear Flexibility Factor:

1. Lacing:

a (mm)	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344
b (mm)	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298
ε_aa (mm)	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344
ε_bb (mm)	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	1843	1843	1843	1947	1947	1947	1980	1980	1980	1843	1843	1843	1947	1947	1947	1980	1980	1980
A_c (mm^2)	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558
A_d (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
A_b (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
μ	0.2432	0.2432	0.2432	0.2178	0.2178	0.2178	0.2107	0.2107	0.2107	0.2432	0.2432	0.2432	0.2178	0.2178	0.2178	0.2107	0.2107	0.2107
P_{cr}/P_e (Fig.3.51)	0.64	0.64	0.64	0.65	0.65	0.65	0.66	0.66	0.66	0.64	0.64	0.64	0.65	0.65	0.65	0.66	0.66	0.66
k'(sqrt(P_e/P_{cr}))	1.250	1.250	1.250	1.236	1.236	1.236	1.232	1.232	1.232	1.250	1.250	1.250	1.236	1.236	1.236	1.232	1.232	1.232
λ_v	0.151	0.151	0.151	0.158	0.158	0.158	0.160	0.160	0.160	0.151	0.151	0.151	0.158	0.158	0.158	0.160	0.160	0.160
Cr' (kN)	914.3	914.3	914.3	913.8	913.8	913.8	913.6	913.6	913.6	914.3	914.3	914.3	913.8	913.8	913.8	913.6	913.6	913.6
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	24	24	24	25	25	25	26	26	26	199	199	199	200	200	200	201	201	201
Member Label	20N-30N	20N-30N	20N-30N	30N-29N	30N-29N	30N-29N	28N-29N	28N-29N	28N-29N	20S-30S	20S-30S	20S-30S	30S-29S	30S-29S	30S-29S	28S-29S	28S-29S	28S-29S
Station (m)	0.0	1.0	2.0	0.0	1.1	2.2	0.0	1.1	2.2	0.0	1.0	2.0	0.0	1.1	2.2	0.0	1.1	2.2
Node Label at Station	20N	---	30N	30N	---	29N	28N	---	29N	20S	---	30S	30S	---	29S	28S	---	29S
Section #	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	852.7	852.7	852.7	843.2	843.2	843.2	840.2	840.2	840.2	852.7	852.7	852.7	843.2	843.2	843.2	840.2	840.2	840.2

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516
$A_{n(corrosion)}$ (mm^2)	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340
$T_{r(b)}$ (kN)	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340
$T_{r(c)}$ (kN)	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	24	24	24	25	25	25	26	26	26	199	199	199	200	200	200	201	201	201
Member Label	20N-30N	20N-30N	20N-30N	30N-29N	30N-29N	30N-29N	28N-29N	28N-29N	28N-29N	20S-30S	20S-30S	20S-30S	30S-29S	30S-29S	30S-29S	28S-29S	28S-29S	28S-29S
Station (m)	0.0	1.0	2.0	0.0	1.1	2.2	0.0	1.1	2.2	0.0	1.0	2.0	0.0	1.1	2.2	0.0	1.1	2.2
Node Label at Station	20N	---	30N	30N	---	29N	28N	---	29N	20S	---	30S	30S	---	29S	28S	---	29S
Section #	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122
$(kL/r)_{max}$	42	42	42	44	44	44	45	45	45	42	42	42	44	44	44	45	45	45
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23
$M_{ry(Laterally\ Supported)}$ (kNm)	153	153	153	153	153	153	153	153	153	153	153	153	153	153	153	153	153	153
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	2048	2048	2048	2164	2164	2164	2200	2200	2200	2048	2048	2048	2164	2164	2164	2200	2200	2200
L_{uy} (mm)	2048	2048	2048	2164	2164	2164	2200	2200	2200	2048	2048	2048	2164	2164	2164	2200	2200	2200
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	304	304	304	288	288	288	283	283	283	304	304	304	288	288	288	283	283	283
M_{rx} (kNm)	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3
M_{ry} (kNm)	148.5	148.5	148.5	146.9	146.9	146.9	146.4	146.4	146.4	148.5	148.5	148.5	146.9	146.9	146.9	146.4	146.4	146.4

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
$(V_f/V_r)<=1$																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.034	0.034	0.033	0.000	0.000	0.000	0.021	0.021	0.023	0.034	0.034	0.033	0.000	0.000	0.000	0.021	0.021	0.023
$(T_f/T_r)<=1$	0.000	0.000	0.000	0.023	0.022	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.023	0.022	0.022	0.000	0.000	0.000

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.000	0.000	0.000	0.023	0.022	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.023	0.022	0.022	0.000	0.000	0.000
$M_{fx}/M_{rx}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fy}/M_{ry}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r<=1$	0.000	0.000	0.000	0.023	0.022	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.023	0.022	0.022	0.000	0.000	0.000
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PARSONS

Member ID in CSiBridge	24	24	24	25	25	25	26	26	26	199	199	199	200	200	200	201	201	201
Member Label	20N-30N	20N-30N	20N-30N	30N-29N	30N-29N	30N-29N	28N-29N	28N-29N	28N-29N	20S-30S	20S-30S	20S-30S	30S-29S	30S-29S	30S-29S	28S-29S	28S-29S	28S-29S
Station (m)	0.0	1.0	2.0	0.0	1.1	2.2	0.0	1.1	2.2	0.0	1.0	2.0	0.0	1.1	2.2	0.0	1.1	2.2
Node Label at Station	20N	---	30N	30N	---	29N	28N	---	29N	20S	---	30S	30S	---	29S	28S	---	29S
Section #	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	919	919	919	919	919	919	919	919	919	919	919	919	919	919	919	919	919	919
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	5.78E+03	5.78E+03	5.78E+03	5.18E+03	5.18E+03	5.18E+03	5.01E+03	5.01E+03	5.01E+03	5.78E+03	5.78E+03	5.78E+03	5.18E+03	5.18E+03	5.18E+03	5.01E+03	5.01E+03	5.01E+03
U_{1x}	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	73561	73561	73561	65872	65872	65872	63738	63738	63738	73561	73561	73561	65872	65872	65872	63738	63738	63738
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.032	0.032	0.030	0.000	0.000	0.000	0.020	0.020	0.021	0.032	0.032	0.030	0.000	0.000	0.000	0.020	0.020	0.021
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.032	0.032	0.030	0.000	0.000	0.000	0.020	0.020	0.021	0.032	0.032	0.030	0.000	0.000	0.000	0.020	0.020	0.021

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.431	0.431	0.431	0.455	0.455	0.455	0.463	0.463	0.463	0.431	0.431	0.431	0.455	0.455	0.455	0.463	0.463	0.463
$C_{r\ (K=1)}$ (kN)	853	853	853	843	843	843	840	840	840	853	853	853	843	843	843	840	840	840
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.034	0.034	0.033	0.000	0.000	0.000	0.021	0.021	0.023	0.034	0.034	0.033	0.000	0.000	0.000	0.021	0.021	0.023
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.034	0.034	0.033	0.000	0.000	0.000	0.021	0.021	0.023	0.034	0.034	0.033	0.000	0.000	0.000	0.021	0.021	0.023

3.3. Lateral Torsional Buckling:

λ_{max}	0.431	0.431	0.431	0.455	0.455	0.455	0.463	0.463	0.463	0.431	0.431	0.431	0.455	0.455	0.455	0.463	0.463	0.463
C_r (kN)	853	853	853	843	843	843	840	840	840	853	853	853	843	843	843	840	840	840
U_{1x}	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23
M_{ry} (kNm)	148	148	148	147	147	147	146	146	146	148	148	148	147	147	147	146	146	146
C_f/C_r	0.034	0.034	0.033	0.000	0.000	0.000	0.021	0.021	0.023	0.034	0.034	0.033	0.000	0.000	0.000	0.021	0.021	0.023
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.034	0.034	0.033	0.000	0.000	0.000	0.021	0.021	0.023	0.034	0.034	0.033	0.000	0.000	0.000	0.021	0.021	0.023
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.034	0.034	0.033	0.023	0.022	0.022	0.021	0.021	0.023	0.034	0.034	0.033	0.023	0.022	0.022	0.021	0.021	0.023

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	269	269	269	270	270	270	271	271	271	272	272	272	597	597	597	598	598	598
Member Label	17N-29N	17N-29N	17N-29N	29N-20N	29N-20N	29N-20N	28N-30N	28N-30N	28N-30N	30N-31N	30N-31N	30N-31N	17S-29S	17S-29S	17S-29S	29S-20S	29S-20S	29S-20S
Station (m)	0.0	1.7	3.3	0.0	1.5	3.1	0.0	1.6	3.3	0.0	0.7	1.4	0.0	1.7	3.3	0.0	1.5	3.1
Node Label at Station	17N	---	29N	29N	---	20N	28N	---	30N	30N	---	31N	17S	---	29S	29S	---	20S
Section #	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 27	Section 27	Section 27	Section 27	Section 27	Section 27	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T

Member Factored Load Effects:

C_f (kN)	0	0	0	0	0	0	57	57	57	25	25	25	0	0	0	0	0	0
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	1	0	2	2	1	3	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	62	62	62	33	33	33	0	0	0	0	0	0	62	62	62	32	32	32
$M_{fx\ (tension)}$ (kNm)	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1
$M_{fy\ (tension)}$ (kNm)	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
V_{fx} (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fy} (kN)	1	0	1	0	0	1	0	1	2	3	3	3	1	0	1	0	0	1

Gross Section Properties:

Ag (mm^2)	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116
I_x (mm^4)	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07
I_y (mm^4)	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08
J (mm^4)	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05
r_x (mm)	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49
r_y (mm)	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175
S_x (mm^3)	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05
S_y (mm^3)	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	3345	3345	3345	3056	3056	3056	3264	3264	3264	1448	1448	1448	3345	3345	3345	3056	3056	3056

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	269	269	269	270	270	270	271	271	271	272	272	272	597	597	597	598	598	598
Member Label	17N-29N	17N-29N	17N-29N	29N-20N	29N-20N	29N-20N	28N-30N	28N-30N	28N-30N	30N-31N	30N-31N	30N-31N	17S-29S	17S-29S	17S-29S	29S-20S	29S-20S	29S-20S
Station (m)	0.0	1.7	3.3	0.0	1.5	3.1	0.0	1.6	3.3	0.0	0.7	1.4	0.0	1.7	3.3	0.0	1.5	3.1
Node Label at Station	17N	---	29N	29N	---	20N	28N	---	30N	30N	---	31N	17S	---	29S	29S	---	20S
Section #	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 27	Section 27	Section 27	Section 27	Section 27	Section 27	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7
Webs in flexural compression	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7
Webs in combined flexural and axial compression	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	269	269	269	270	270	270	271	271	271	272	272	272	597	597	597	598	598	598
Member Label	17N-29N	17N-29N	17N-29N	29N-20N	29N-20N	29N-20N	28N-30N	28N-30N	28N-30N	30N-31N	30N-31N	30N-31N	17S-29S	17S-29S	17S-29S	29S-20S	29S-20S	29S-20S
Station (m)	0.0	1.7	3.3	0.0	1.5	3.1	0.0	1.6	3.3	0.0	0.7	1.4	0.0	1.7	3.3	0.0	1.5	3.1
Node Label at Station	17N	---	29N	29N	---	20N	28N	---	30N	30N	---	31N	17S	---	29S	29S	---	20S
Section #	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 27	Section 27	Section 27	Section 27	Section 27	Section 27	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	3345	3345	3345	3056	3056	3056	3264	3264	3264	1448	1448	1448	3345	3345	3345	3056	3056	3056
L_y (mm)	6401	6401	6401	6401	6401	6401	4712	4712	4712	4712	4712	4712	6401	6401	6401	6401	6401	6401
λ_{max}	0.704	0.704	0.704	0.643	0.643	0.643	0.687	0.687	0.687	0.305	0.305	0.305	0.704	0.704	0.704	0.643	0.643	0.643
C_r (kN)	718.2	718.2	718.2	752.4	752.4	752.4	728.0	728.0	728.0	891.2	891.2	891.2	718.2	718.2	718.2	752.4	752.4	752.4
$(kL/r)_{max}$	68.3	68.3	68.3	62.4	62.4	62.4	66.6	66.6	66.6	29.5	29.5	29.5	68.3	68.3	68.3	62.4	62.4	62.4
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	2167	2167	2167	2597	2597	2597	2276	2276	2276	11569	11569	11569	2167	2167	2167	2597	2597	2597

Shear Flexibility Factor:

1. Lacing:

a (mm)	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344
b (mm)	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298
ε_aa (mm)	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344
ε_bb (mm)	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	3011	3011	3011	2750	2750	2750	2938	2938	2938	1303	1303	1303	3011	3011	3011	2750	2750	2750
A_c (mm^2)	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558
A_d (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
A_b (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
μ	0.0911	0.0911	0.0911	0.1092	0.1092	0.1092	0.0957	0.0957	0.0957	0.4864	0.4864	0.4864	0.0911	0.0911	0.0911	0.1092	0.1092	0.1092
P_{cr}/P_e (Fig.3.51)	0.78	0.78	0.78	0.75	0.75	0.75	0.77	0.77	0.77	0.50	0.50	0.50	0.78	0.78	0.78	0.75	0.75	0.75
k'(sqrt(P_e/P_{cr}))	1.134	1.134	1.134	1.154	1.154	1.154	1.139	1.139	1.139	1.414	1.414	1.414	1.134	1.134	1.134	1.154	1.154	1.154
λ_v	0.428	0.428	0.428	0.435	0.435	0.435	0.316	0.316	0.316	0.393	0.393	0.393	0.428	0.428	0.428	0.435	0.435	0.435
Cr' (kN)	853.9	853.9	853.9	851.1	851.1	851.1	888.4	888.4	888.4	866.3	866.3	866.3	853.9	853.9	853.9	851.1	851.1	851.1
Lacing Governs?	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	No	No	No	No	No	No

Member ID in CSiBridge	269	269	269	270	270	270	271	271	271	272	272	272	597	597	597	598	598	598
Member Label	17N-29N	17N-29N	17N-29N	29N-20N	29N-20N	29N-20N	28N-30N	28N-30N	28N-30N	30N-31N	30N-31N	30N-31N	17S-29S	17S-29S	17S-29S	29S-20S	29S-20S	29S-20S
Station (m)	0.0	1.7	3.3	0.0	1.5	3.1	0.0	1.6	3.3	0.0	0.7	1.4	0.0	1.7	3.3	0.0	1.5	3.1
Node Label at Station	17N	---	29N	29N	---	20N	28N	---	30N	30N	---	31N	17S	---	29S	29S	---	20S
Section #	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 27	Section 27	Section 27	Section 27	Section 27	Section 27	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	718.2	718.2	718.2	752.4	752.4	752.4	728.0	728.0	728.0	866.3	866.3	866.3	718.2	718.2	718.2	752.4	752.4	752.4

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516
$A_{n(corrosion)}$ (mm^2)	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340
$T_{r(b)}$ (kN)	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340
$T_{r(c)}$ (kN)	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	269	269	269	270	270	270	271	271	271	272	272	272	597	597	597	598	598	598
Member Label	17N-29N	17N-29N	17N-29N	29N-20N	29N-20N	29N-20N	28N-30N	28N-30N	28N-30N	30N-31N	30N-31N	30N-31N	17S-29S	17S-29S	17S-29S	29S-20S	29S-20S	29S-20S
Station (m)	0.0	1.7	3.3	0.0	1.5	3.1	0.0	1.6	3.3	0.0	0.7	1.4	0.0	1.7	3.3	0.0	1.5	3.1
Node Label at Station	17N	---	29N	29N	---	20N	28N	---	30N	30N	---	31N	17S	---	29S	29S	---	20S
Section #	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 27	Section 27	Section 27	Section 27	Section 27	Section 27	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122
$(kL/r)_{max}$	68	68	68	62	62	62	67	67	67	30	30	30	68	68	68	62	62	62
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23
$M_{ry(Laterally\ Supported)}$ (kNm)	153	153	153	153	153	153	153	153	153	153	153	153	153	153	153	153	153	153
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	3345	3345	3345	3056	3056	3056	3264	3264	3264	1448	1448	1448	3345	3345	3345	3056	3056	3056
L_{uy} (mm)	6401	6401	6401	6401	6401	6401	4712	4712	4712	4712	4712	4712	6401	6401	6401	6401	6401	6401
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	186	186	186	204	204	204	191	191	191	430	430	430	186	186	186	204	204	204
M_{rx} (kNm)	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3
M_{ry} (kNm)	131.0	131.0	131.0	134.9	134.9	134.9	132.1	132.1	132.1	156.5	156.5	156.5	131.0	131.0	131.0	134.9	134.9	134.9

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
$(V_f/V_r)<=1$																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.078	0.078	0.078	0.029	0.029	0.029	0.000	0.000	0.000	0.000	0.000	0.000
$(T_f/T_r)<=1$	0.064	0.064	0.064	0.034	0.034	0.034	0.000	0.000	0.000	0.000	0.000	0.000	0.064	0.064	0.064	0.033	0.033	0.033

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.064	0.064	0.064	0.034	0.034	0.034	0.000	0.000	0.000	0.000	0.000	0.000	0.064	0.064	0.064	0.033	0.033	0.033
$M_{fx}/M_{rx}<=1$	0.000	0.043	0.000	0.000	0.000	0.043	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.043	0.000	0.000	0.000	0.043
$M_{fy}/M_{ry}<=1$	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r<=1$	0.072	0.107	0.064	0.034	0.034	0.077	0.000	0.000	0.000	0.000	0.000	0.000	0.072	0.107	0.064	0.033	0.033	0.076
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PARSONS

Member ID in CSiBridge	269	269	269	270	270	270	271	271	271	272	272	272	597	597	597	598	598	598
Member Label	17N-29N	17N-29N	17N-29N	29N-20N	29N-20N	29N-20N	28N-30N	28N-30N	28N-30N	30N-31N	30N-31N	30N-31N	17S-29S	17S-29S	17S-29S	29S-20S	29S-20S	29S-20S
Station (m)	0.0	1.7	3.3	0.0	1.5	3.1	0.0	1.6	3.3	0.0	0.7	1.4	0.0	1.7	3.3	0.0	1.5	3.1
Node Label at Station	17N	---	29N	29N	---	20N	28N	---	30N	30N	---	31N	17S	---	29S	29S	---	20S
Section #	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 27	Section 27	Section 27	Section 27	Section 27	Section 27	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	919	919	919	919	919	919	919	919	919	919	919	919	919	919	919	919	919	919
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	2.17E+03	2.17E+03	2.17E+03	2.60E+03	2.60E+03	2.60E+03	2.28E+03	2.28E+03	2.28E+03	1.16E+04	1.16E+04	1.16E+04	2.17E+03	2.17E+03	2.17E+03	2.60E+03	2.60E+03	2.60E+03
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.03	1.03	1.03	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	7527	7527	7527	7527	7527	7527	13891	13891	13891	13891	13891	13891	7527	7527	7527	7527	7527	7527
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.062	0.062	0.062	0.027	0.027	0.027	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.044	0.000	0.088	0.086	0.043	0.129	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.106	0.062	0.150	0.113	0.070	0.156	0.000	0.000	0.000	0.000	0.000	0.000

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.704	0.704	0.704	0.643	0.643	0.643	0.687	0.687	0.687	0.305	0.305	0.305	0.704	0.704	0.704	0.643	0.643	0.643
$C_{r\ (K=1)}$ (kN)	718	718	718	752	752	752	728	728	728	891	891	891	718	718	718	752	752	752
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.03	1.03	1.03	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.078	0.078	0.078	0.028	0.028	0.028	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.044	0.000	0.088	0.086	0.043	0.129	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.122	0.078	0.166	0.114	0.071	0.157	0.000	0.000	0.000	0.000	0.000	0.000

3.3. Lateral Torsional Buckling:

λ_{max}	0.704	0.704	0.704	0.643	0.643	0.643	0.687	0.687	0.687	0.305	0.305	0.305	0.704	0.704	0.704	0.643	0.643	0.643
C_r (kN)	718	718	718	752	752	752	728	728	728	891	891	891	718	718	718	752	752	752
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.03	1.03	1.03	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23
M_{ry} (kNm)	131	131	131	135	135	135	132	132	132	157	157	157	131	131	131	135	135	135
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.078	0.078	0.078	0.028	0.028	0.028	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.044	0.000	0.088	0.086	0.043	0.129	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.122	0.078	0.166	0.114	0.071	0.157	0.000	0.000	0.000	0.000	0.000	0.000
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.072	0.107	0.064	0.034	0.034	0.077	0.122	0.078	0.166	0.114	0.071	0.157	0.072	0.107	0.064	0.033	0.033	0.076

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	599	599	599	600	600	600
Member Label	28S-30S	28S-30S	28S-30S	30S-31S	30S-31S	30S-31S
Station (m)	0.0	1.6	3.3	0.0	0.7	1.4
Node Label at Station	28S	---	30S	30S	---	31S
Section #	Section 27	Section 27	Section 27	Section 27	Section 27	Section 27
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T

Member Factored Load Effects:

C_f (kN)	57	57	57	25	25	25
$M_{fx\ (comp)}$ (kNm)	1	0	2	2	1	3
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0
T_f (kN)	0	0	0	0	0	0
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0
V_{fx} (kN)	0	0	0	0	0	0
V_{fy} (kN)	0	1	2	3	3	3

Gross Section Properties:

Ag (mm^2)	5116	5116	5116	5116	5116	5116
I_x (mm^4)	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07
I_y (mm^4)	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08
J (mm^4)	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05
r_x (mm)	49	49	49	49	49	49
r_y (mm)	175	175	175	175	175	175
S_x (mm^3)	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05
S_y (mm^3)	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5
L (mm)	3264	3264	3264	1448	1448	1448

Material Properties:

F_Y (MPa)	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	599	599	599	600	600	600
Member Label	28S-30S	28S-30S	28S-30S	30S-31S	30S-31S	30S-31S
Station (m)	0.0	1.6	3.3	0.0	0.7	1.4
Node Label at Station	28S	---	30S	30S	---	31S
Section #	Section 27	Section 27	Section 27	Section 27	Section 27	Section 27
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T

Width-to-thickness ratio of elements in compression

Legs of angles and elements supported along one edge	13.7	13.7	13.7	13.7	13.7	13.7
angles in continuous contact with other elements						
Plate girder stiffeners						
Stems of T-sections						
Flanges of I- or T-sections						
plates projecting from compression elements						
outstanding legs of pairs of angles in continuous contact						
Flanges of channels						
Flanges of rectangular hollow structural shapes						
Flanges of box girder sections						
flange cover plates and diaphragm plates between lines of fasteners or welds						
Perforated cover plates						
Webs in axial compression	13.7	13.7	13.7	13.7	13.7	13.7
Webs in flexural compression	13.7	13.7	13.7	13.7	13.7	13.7
Webs in combined flexural and axial compression	13.7	13.7	13.7	13.7	13.7	13.7
Circular and multi-sided hollow sections in axial compression						
Circular and multi-sided hollow sections in axial compression						
Member Class	**3**	**3**	**3**	**3**	**3**	**3**
Member Class = 3	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**

Member ID in CSiBridge	599	599	599	600	600	600
Member Label	28S-30S	28S-30S	28S-30S	30S-31S	30S-31S	30S-31S
Station (m)	0.0	1.6	3.3	0.0	0.7	1.4
Node Label at Station	28S	---	30S	30S	---	31S
Section #	Section 27	Section 27	Section 27	Section 27	Section 27	Section 27
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	3264	3264	3264	1448	1448	1448
L_y (mm)	4712	4712	4712	4712	4712	4712
λ_{max}	0.687	0.687	0.687	0.305	0.305	0.305
C_r (kN)	728.0	728.0	728.0	891.2	891.2	891.2
$(kL/r)_{max}$	66.6	66.6	66.6	29.5	29.5	29.5
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1
Battens						
Perforated Plate						
Cover Plate						

P_e^{min} (Euler, kN)	2276	2276	2276	11569	11569	11569

Shear Flexibility Factor:

1. Lacing:

a (mm)	344	344	344	344	344	344
b (mm)	298	298	298	298	298	298
ε_aa (mm)	344	344	344	344	344	344
ε_bb (mm)	298	298	298	298	298	298
ε_a	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	2938	2938	2938	1303	1303	1303
A_c (mm^2)	2558	2558	2558	2558	2558	2558
A_d (mm^2)	544	544	544	544	544	544
A_b (mm^2)	544	544	544	544	544	544
μ	0.0957	0.0957	0.0957	0.4864	0.4864	0.4864
P_{cr}/P_e (Fig.3.51)	0.77	0.77	0.77	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	1.139	1.139	1.139	1.414	1.414	1.414
λ_v	0.316	0.316	0.316	0.393	0.393	0.393
Cr' (kN)	888.4	888.4	888.4	866.3	866.3	866.3
Lacing Governs?	No	No	No	Yes	Yes	Yes

Member ID in CSiBridge	599	599	599	600	600	600
Member Label	28S-30S	28S-30S	28S-30S	30S-31S	30S-31S	30S-31S
Station (m)	0.0	1.6	3.3	0.0	0.7	1.4
Node Label at Station	28S	---	30S	30S	---	31S
Section #	Section 27	Section 27	Section 27	Section 27	Section 27	Section 27
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T

2. Battens:

a (mm)	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343
A_c (mm^2)	2558	2558	2558	2558	2558	2558
A_b (mm^2)	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	728.0	728.0	728.0	866.3	866.3	866.3

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	4860	4860	4860	4860	4860	4860
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	970	970	970	970	970	970
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24
ΣW_n t (mm^2)	3516	3516	3516	3516	3516	3516
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0
A_n (mm^2)	3516	3516	3516	3516	3516	3516
$A_{n(corrosion)}$ (mm^2)	3340	3340	3340	3340	3340	3340
$T_{r(b)}$ (kN)	1122	1122	1122	1122	1122	1122
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	3340	3340	3340	3340	3340	3340
$T_{r(c)}$ (kN)	1122	1122	1122	1122	1122	1122
U_t	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	599	599	599	600	600	600
Member Label	28S-30S	28S-30S	28S-30S	30S-31S	30S-31S	30S-31S
Station (m)	0.0	1.6	3.3	0.0	0.7	1.4
Node Label at Station	28S	---	30S	30S	---	31S
Section #	Section 27	Section 27	Section 27	Section 27	Section 27	Section 27
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T

F_m	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	1122	1122	1122	1122	1122	1122
$(kL/r)_{max}$	67	67	67	30	30	30
kL/r<200	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	970	970	970	970	970	970
Ductile	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	23	23	23	23	23	23
$M_{ry(Laterally\ Supported)}$ (kNm)	153	153	153	153	153	153
ω_2	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	3264	3264	3264	1448	1448	1448
L_{uy} (mm)	4712	4712	4712	4712	4712	4712
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	191	191	191	430	430	430
M_{rx} (kNm)	23.3	23.3	23.3	23.3	23.3	23.3
M_{ry} (kNm)	132.1	132.1	132.1	156.5	156.5	156.5

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)						
w_y (mm)						
A_{wy} (mm^2)						
h_y/w_y						
F_{cr} (N/mm^2)						
F_t (N/mm^2)						
V_{ry} (kN)						
$(V_f/V_r)<=1$						

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.078	0.078	0.078	0.029	0.029	0.029
$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fx}/M_{rx}<=1$	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fy}/M_{ry}<=1$	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r<=1$	0.000	0.000	0.000	0.000	0.000	0.000
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.000	0.000	0.000	0.000	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	599	599	599	600	600	600
Member Label	28S-30S	28S-30S	28S-30S	30S-31S	30S-31S	30S-31S
Station (m)	0.0	1.6	3.3	0.0	0.7	1.4
Node Label at Station	28S	---	30S	30S	---	31S
Section #	Section 27	Section 27	Section 27	Section 27	Section 27	Section 27
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	919	919	919	919	919	919
ω_{1x}	1	1	1	1	1	1
C_{ex} (kN)	2.28E+03	2.28E+03	2.28E+03	1.16E+04	1.16E+04	1.16E+04
U_{1x}	1.03	1.03	1.03	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1
C_{ey} (kN)	13891	13891	13891	13891	13891	13891
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.062**	**0.062**	**0.062**	**0.027**	**0.027**	**0.027**
$U_{1x}M_{fx}/M_{rx}$	**0.044**	**0.000**	**0.088**	**0.086**	**0.043**	**0.129**
$U_{1y}M_{fy}/M_{ry}$	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.106**	**0.062**	**0.150**	**0.113**	**0.070**	**0.156**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.687	0.687	0.687	0.305	0.305	0.305
$C_{r\ (K=1)}$ (kN)	728	728	728	891	891	891
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.03	1.03	1.03	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.078**	**0.078**	**0.078**	**0.028**	**0.028**	**0.028**
$U_{1x}M_{fx}/M_{rx}$	**0.044**	**0.000**	**0.088**	**0.086**	**0.043**	**0.129**
$U_{1y}M_{fy}/M_{ry}$	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.122**	**0.078**	**0.166**	**0.114**	**0.071**	**0.157**

3.3. Lateral Torsional Buckling:

λ_{max}	0.687	0.687	0.687	0.305	0.305	0.305
C_r (kN)	728	728	728	891	891	891
U_{1x}	1.03	1.03	1.03	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	23	23	23	23	23	23
M_{ry} (kNm)	132	132	132	157	157	157
C_f/C_r	**0.078**	**0.078**	**0.078**	**0.028**	**0.028**	**0.028**
$U_{1x}M_{fx}/M_{rx}$	**0.044**	**0.000**	**0.088**	**0.086**	**0.043**	**0.129**
$U_{1y}M_{fy}/M_{ry}$	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.122**	**0.078**	**0.166**	**0.114**	**0.071**	**0.157**
Demand/Capacity ≤ 1	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
Highest Ratio	**0.122**	**0.078**	**0.166**	**0.114**	**0.071**	**0.157**

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	81	81	81	82	82	82	83	83	83	84	84	84	85	85	85	86	86	86
Member Label	2N-	2N-	2N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	2N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Member Factored Load Effects:

C_f (kN)	60	60	60	40	40	40	21	21	21	13	13	13	7	7	7	3	3	3
$M_{fx\ (comp)}$ (kNm)	0	172	343	334	527	720	700	779	858	842	950	1057	1047	1080	1112	1103	1101	1099
$M_{fy\ (comp)}$ (kNm)	0	2	4	4	4	4	4	4	4	4	3	3	3	3	3	3	3	3
T_f (kN)	3	3	3	24	24	24	82	82	82	132	132	132	162	162	162	191	191	191
$M_{fx\ (tension)}$ (kNm)	0	172	343	334	527	720	700	779	858	842	950	1057	1047	1080	1112	1103	1101	1099
$M_{fy\ (tension)}$ (kNm)	0	2	4	4	4	4	4	4	4	4	3	3	3	3	3	3	3	3
V_{fx} (kN)	6	6	6	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2
V_{fy} (kN)	531	530	529	416	414	413	308	308	307	268	267	265	169	168	167	129	130	132

Gross Section Properties:

Ag (mm^2)	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429
I_x (mm^4)	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09
I_y (mm^4)	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
J (mm^4)	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06
r_x (mm)	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383
r_y (mm)	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
S_x (mm^3)	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06
S_y (mm^3)	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	648	648	648	991	991	991	533	533	533	914	914	914	533	533	533	991	991	991

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	81	81	81	82	82	82	83	83	83	84	84	84	85	85	85	86	86	86
Member Label	2N-	2N-	2N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	2N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Webs in combined flexural and axial compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	81	81	81	82	82	82	83	83	83	84	84	84	85	85	85	86	86	86
Member Label	2N-	2N-	2N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	2N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	648	648	648	991	991	991	533	533	533	914	914	914	533	533	533	991	991	991
L_y (mm)	648	648	648	991	991	991	533	533	533	914	914	914	533	533	533	991	991	991
λ_{max}	0.108	0.108	0.108	0.165	0.165	0.165	0.089	0.089	0.089	0.152	0.152	0.152	0.089	0.089	0.089	0.165	0.165	0.165
C_r (kN)	5094.7	5094.7	5094.7	5074.3	5074.3	5074.3	5098.7	5098.7	5098.7	5080.1	5080.1	5080.1	5098.7	5098.7	5098.7	5074.3	5074.3	5074.3
$(kL/r)_{max}$	10.4	10.4	10.4	16.0	16.0	16.0	8.6	8.6	8.6	14.7	14.7	14.7	8.6	8.6	8.6	16.0	16.0	16.0
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	507435	507435	507435	216936	216936	216936	748208	748208	748208	254599	254599	254599	748208	748208	748208	216936	216936	216936

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	583	583	583	892	892	892	480	480	480	823	823	823	480	480	480	892	892	892
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	81	81	81	82	82	82	83	83	83	84	84	84	85	85	85	86	86	86
Member Label	2N-	2N-	2N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	2N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	5094.7	5094.7	5094.7	5074.3	5074.3	5074.3	5098.7	5098.7	5098.7	5080.1	5080.1	5080.1	5098.7	5098.7	5098.7	5074.3	5074.3	5074.3

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$A_{n(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(b)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(c)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	81	81	81	82	82	82	83	83	83	84	84	84	85	85	85	86	86	86
Member Label	2N-	2N-	2N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	2N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
$(kL/r)_{max}$	10	10	10	16	16	16	9	9	9	15	15	15	9	9	9	16	16	16
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619
$M_{ry(Laterally\ Supported)}$ (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	648	648	648	991	991	991	533	533	533	914	914	914	533	533	533	991	991	991
L_{uy} (mm)	648	648	648	991	991	991	533	533	533	914	914	914	533	533	533	991	991	991
M_{ux} (kNm) (y weak)	11689	11689	11689	7643	7643	7643	14194	14194	14194	8280	8280	8280	14194	14194	14194	7643	7643	7643
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1782.3	1782.3	1782.3	1740.0	1740.0	1740.0	1796.5	1796.5	1796.5	1749.4	1749.4	1749.4	1796.5	1796.5	1796.5	1740.0	1740.0	1740.0
M_{ry} (kNm)	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3
w_y (mm)	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
A_{wy} (mm^2)	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792
h_y/w_y	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
F_{cr} (N/mm^2)	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703
$(V_f/V_r)<=1$	0.312	0.311	0.311	0.244	0.243	0.243	0.181	0.181	0.180	0.157	0.157	0.156	0.099	0.099	0.098	0.076	0.076	0.078

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.012	0.012	0.012	0.008	0.008	0.008	0.004	0.004	0.004	0.003	0.003	0.003	0.001	0.001	0.001	0.001	0.001	0.001
$(T_f/T_r)<=1$	0.001	0.001	0.001	0.004	0.004	0.004	0.015	0.015	0.015	0.024	0.024	0.024	0.030	0.030	0.030	0.035	0.035	0.035

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.001	0.001	0.001	0.004	0.004	0.004	0.015	0.015	0.015	0.024	0.024	0.024	0.030	0.030	0.030	0.035	0.035	0.035
$M_{fx}/M_{rx}<=1$	0.000	0.097	0.192	0.192	0.303	0.414	0.390	0.434	0.478	0.481	0.543	0.604	0.583	0.601	0.619	0.634	0.633	0.632
$M_{fy}/M_{ry}<=1$	0.000	0.015	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023
$T_f/T_r+M_f/M_r<=1$	0.001	0.112	0.223	0.226	0.337	0.448	0.435	0.479	0.523	0.536	0.590	0.651	0.635	0.654	0.672	0.692	0.691	0.690
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.110	0.221	0.213	0.324	0.435	0.391	0.435	0.479	0.464	0.518	0.580	0.548	0.567	0.584	0.588	0.587	0.586

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	81	81	81	82	82	82	83	83	83	84	84	84	85	85	85	86	86	86
Member Label	2N-	2N-	2N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	2N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.96E+07	1.96E+07	1.96E+07	8.38E+06	8.38E+06	8.38E+06	2.89E+07	2.89E+07	2.89E+07	9.83E+06	9.83E+06	9.83E+06	2.89E+07	2.89E+07	2.89E+07	8.38E+06	8.38E+06	8.38E+06
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	507435	507435	507435	216936	216936	216936	748208	748208	748208	254599	254599	254599	748208	748208	748208	216936	216936	216936
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.012	0.012	0.012	0.008	0.008	0.008	0.004	0.004	0.004	0.003	0.003	0.003	0.001	0.001	0.001	0.001	0.001	0.001
$U_{1x}M_{fx}/M_{rx}$	0.000	0.106	0.212	0.206	0.325	0.445	0.432	0.481	0.530	0.520	0.587	0.653	0.647	0.667	0.687	0.681	0.680	0.679
$U_{1y}M_{fy}/M_{ry}$	0.000	0.015	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023
Interaction	0.012	0.133	0.254	0.244	0.363	0.483	0.466	0.515	0.564	0.553	0.612	0.678	0.670	0.691	0.711	0.704	0.703	0.702

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.108	0.108	0.108	0.165	0.165	0.165	0.089	0.089	0.089	0.152	0.152	0.152	0.089	0.089	0.089	0.165	0.165	0.165
$C_{r\ (K=1)}$ (kN)	5095	5095	5095	5074	5074	5074	5099	5099	5099	5080	5080	5080	5099	5099	5099	5074	5074	5074
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.012	0.012	0.012	0.008	0.008	0.008	0.004	0.004	0.004	0.003	0.003	0.003	0.001	0.001	0.001	0.001	0.001	0.001
$U_{1x}M_{fx}/M_{rx}$	0.000	0.106	0.212	0.206	0.325	0.445	0.432	0.481	0.530	0.520	0.587	0.653	0.647	0.667	0.687	0.681	0.680	0.679
$U_{1y}M_{fy}/M_{ry}$	0.000	0.015	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023
Interaction	0.012	0.133	0.254	0.244	0.363	0.483	0.466	0.515	0.564	0.553	0.612	0.678	0.670	0.691	0.711	0.704	0.703	0.702

3.3. Lateral Torsional Buckling:

λ_{max}	0.108	0.108	0.108	0.165	0.165	0.165	0.089	0.089	0.089	0.152	0.152	0.152	0.089	0.089	0.089	0.165	0.165	0.165
C_r (kN)	5095	5095	5095	5074	5074	5074	5099	5099	5099	5080	5080	5080	5099	5099	5099	5074	5074	5074
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1782	1782	1782	1740	1740	1740	1796	1796	1796	1749	1749	1749	1796	1796	1796	1740	1740	1740
M_{ry} (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
C_f/C_r	0.012	0.012	0.012	0.008	0.008	0.008	0.004	0.004	0.004	0.003	0.003	0.003	0.001	0.001	0.001	0.001	0.001	0.001
$U_{1x}M_{fx}/M_{rx}$	0.000	0.097	0.192	0.192	0.303	0.414	0.390	0.434	0.478	0.481	0.543	0.604	0.583	0.601	0.619	0.634	0.633	0.632
$U_{1y}M_{fy}/M_{ry}$	0.000	0.015	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023
Interaction	0.012	0.123	0.234	0.230	0.341	0.452	0.424	0.468	0.512	0.514	0.568	0.629	0.607	0.625	0.643	0.657	0.656	0.655
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.312	0.311	0.311	0.244	0.363	0.483	0.466	0.515	0.564	0.553	0.612	0.678	0.670	0.691	0.711	0.704	0.703	0.702

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	87	87	87	88	88	88	89	89	89	90	90	90	91	91	91	92	92	92
Member Label	-	-	-	-	-	-	-	-	-	-2S	-2S	-2S	4N-	4N-	4N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	2S	4N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Member Factored Load Effects:

C_f (kN)	4	4	4	7	7	7	22	22	22	36	36	36	0	0	0	6	6	6
$M_{fx\ (comp)}$ (kNm)	1110	1029	948	962	826	689	711	521	330	341	171	0	0	0	0	335	528	721
$M_{fy\ (comp)}$ (kNm)	3	4	4	4	4	5	5	4	4	4	2	0	0	0	0	5	5	6
T_f (kN)	155	155	155	111	111	111	42	42	42	10	10	10	0	0	0	50	50	50
$M_{fx\ (tension)}$ (kNm)	1110	1029	948	962	826	689	711	521	330	341	171	0	0	0	0	335	528	721
$M_{fy\ (tension)}$ (kNm)	3	4	4	4	4	5	5	4	4	4	2	0	0	0	0	5	5	6
V_{fx} (kN)	2	2	2	1	1	1	1	1	1	6	6	6	8	8	8	1	1	1
V_{fy} (kN)	205	207	208	283	284	286	405	407	408	526	527	528	532	531	530	416	415	413

Gross Section Properties:

Ag (mm^2)	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429
I_x (mm^4)	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09
I_y (mm^4)	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
J (mm^4)	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06
r_x (mm)	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383
r_y (mm)	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
S_x (mm^3)	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06
S_y (mm^3)	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	991	991	991	991	991	991	991	991	991	648	648	648	648	648	648	991	991	991

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	87	87	87	88	88	88	89	89	89	90	90	90	91	91	91	92	92	92
Member Label	-	-	-	-	-	-	-	-	-	-2S	-2S	-2S	4N-	4N-	4N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	2S	4N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Webs in combined flexural and axial compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	87	87	87	88	88	88	89	89	89	90	90	90	91	91	91	92	92	92
Member Label	-	-	-	-	-	-	-	-	-	-2S	-2S	-2S	4N-	4N-	4N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	2S	4N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	991	991	991	991	991	991	991	991	991	648	648	648	648	648	648	991	991	991
L_y (mm)	991	991	991	991	991	991	991	991	991	648	648	648	648	648	648	991	991	991
λ_{max}	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.108	0.108	0.108	0.108	0.108	0.108	0.165	0.165	0.165
C_r (kN)	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5094.7	5094.7	5094.7	5094.7	5094.7	5094.7	5074.3	5074.3	5074.3
$(kL/r)_{max}$	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	10.4	10.4	10.4	10.4	10.4	10.4	16.0	16.0	16.0
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	216936	216936	216936	216936	216936	216936	216936	216936	216936	507435	507435	507435	507435	507435	507435	216936	216936	216936

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	892	892	892	892	892	892	892	892	892	583	583	583	583	583	583	892	892	892
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	87	87	87	88	88	88	89	89	89	90	90	90	91	91	91	92	92	92
Member Label	-	-	-	-	-	-	-	-	-	-2S	-2S	-2S	4N-	4N-	4N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	2S	4N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5094.7	5094.7	5094.7	5094.7	5094.7	5094.7	5074.3	5074.3	5074.3

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$A_{n(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(b)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(c)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	87	87	87	88	88	88	89	89	89	90	90	90	91	91	91	92	92	92
Member Label	-	-	-	-	-	-	-	-	-	-2S	-2S	-2S	4N-	4N-	4N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	2S	4N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
$(kL/r)_{max}$	16	16	16	16	16	16	16	16	16	10	10	10	10	10	10	16	16	16
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619
$M_{ry(Laterally\ Supported)}$ (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	991	991	991	991	991	991	991	991	991	648	648	648	648	648	648	991	991	991
L_{uy} (mm)	991	991	991	991	991	991	991	991	991	648	648	648	648	648	648	991	991	991
M_{ux} (kNm) (y weak)	7643	7643	7643	7643	7643	7643	7643	7643	7643	11689	11689	11689	11689	11689	11689	7643	7643	7643
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1782.3	1782.3	1782.3	1782.3	1782.3	1782.3	1740.0	1740.0	1740.0
M_{ry} (kNm)	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3
w_y (mm)	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
A_{wy} (mm^2)	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792
h_y/w_y	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
F_{cr} (N/mm^2)	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703
$(V_f/V_r)<=1$	0.120	0.122	0.122	0.166	0.167	0.168	0.238	0.239	0.240	0.309	0.310	0.310	0.312	0.312	0.311	0.244	0.244	0.243

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.001	0.001	0.001	0.001	0.001	0.001	0.004	0.004	0.004	0.007	0.007	0.007	0.000	0.000	0.000	0.001	0.001	0.001
$(T_f/T_r)<=1$	0.029	0.029	0.029	0.021	0.021	0.021	0.008	0.008	0.008	0.002	0.002	0.002	0.000	0.000	0.000	0.009	0.009	0.009

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.029	0.029	0.029	0.021	0.021	0.021	0.008	0.008	0.008	0.002	0.002	0.002	0.000	0.000	0.000	0.009	0.009	0.009
$M_{fx}/M_{rx}<=1$	0.638	0.591	0.545	0.553	0.475	0.396	0.409	0.299	0.190	0.191	0.096	0.000	0.000	0.000	0.000	0.193	0.303	0.414
$M_{fy}/M_{ry}<=1$	0.023	0.030	0.030	0.030	0.030	0.038	0.038	0.030	0.030	0.030	0.015	0.000	0.000	0.000	0.000	0.038	0.038	0.045
$T_f/T_r+M_f/M_r<=1$	0.689	0.650	0.604	0.604	0.525	0.454	0.454	0.337	0.228	0.223	0.113	0.002	0.000	0.000	0.000	0.239	0.350	0.469
$M_f/M_r-T_fS/M_rA<=1$	0.605	0.566	0.519	0.543	0.465	0.394	0.431	0.314	0.205	0.218	0.107	0.000	0.000	0.000	0.000	0.212	0.323	0.442

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	87	87	87	88	88	88	89	89	89	90	90	90	91	91	91	92	92	92
Member Label	-	-	-	-	-	-	-	-	-	-2S	-2S	-2S	4N-	4N-	4N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	2S	4N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	1.96E+07	1.96E+07	1.96E+07	1.96E+07	1.96E+07	1.96E+07	8.38E+06	8.38E+06	8.38E+06
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	216936	216936	216936	216936	216936	216936	216936	216936	216936	507435	507435	507435	507435	507435	507435	216936	216936	216936
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.001	0.001	0.001	0.001	0.001	0.001	0.004	0.004	0.004	0.007	0.007	0.007	0.000	0.000	0.000	0.001	0.001	0.001
$U_{1x}M_{fx}/M_{rx}$	0.685	0.635	0.585	0.594	0.510	0.425	0.439	0.322	0.204	0.211	0.106	0.000	0.000	0.000	0.000	0.207	0.326	0.445
$U_{1y}M_{fy}/M_{ry}$	0.023	0.030	0.030	0.030	0.030	0.038	0.038	0.030	0.030	0.030	0.015	0.000	0.000	0.000	0.000	0.038	0.038	0.045
Interaction	0.709	0.666	0.616	0.625	0.541	0.464	0.481	0.356	0.238	0.248	0.128	0.007	0.000	0.000	0.000	0.246	0.365	0.491

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.108	0.108	0.108	0.108	0.108	0.108	0.165	0.165	0.165
$C_{r\ (K=1)}$ (kN)	5074	5074	5074	5074	5074	5074	5074	5074	5074	5095	5095	5095	5095	5095	5095	5074	5074	5074
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.001	0.001	0.001	0.001	0.001	0.001	0.004	0.004	0.004	0.007	0.007	0.007	0.000	0.000	0.000	0.001	0.001	0.001
$U_{1x}M_{fx}/M_{rx}$	0.685	0.635	0.585	0.594	0.510	0.425	0.439	0.322	0.204	0.211	0.106	0.000	0.000	0.000	0.000	0.207	0.326	0.445
$U_{1y}M_{fy}/M_{ry}$	0.023	0.030	0.030	0.030	0.030	0.038	0.038	0.030	0.030	0.030	0.015	0.000	0.000	0.000	0.000	0.038	0.038	0.045
Interaction	0.709	0.666	0.616	0.625	0.541	0.464	0.481	0.356	0.238	0.248	0.128	0.007	0.000	0.000	0.000	0.246	0.365	0.492

3.3. Lateral Torsional Buckling:

λ_{max}	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.108	0.108	0.108	0.108	0.108	0.108	0.165	0.165	0.165
C_r (kN)	5074	5074	5074	5074	5074	5074	5074	5074	5074	5095	5095	5095	5095	5095	5095	5074	5074	5074
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1740	1740	1740	1740	1740	1740	1740	1740	1740	1782	1782	1782	1782	1782	1782	1740	1740	1740
M_{ry} (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
C_f/C_r	0.001	0.001	0.001	0.001	0.001	0.001	0.004	0.004	0.004	0.007	0.007	0.007	0.000	0.000	0.000	0.001	0.001	0.001
$U_{1x}M_{fx}/M_{rx}$	0.638	0.591	0.545	0.553	0.475	0.396	0.409	0.299	0.190	0.191	0.096	0.000	0.000	0.000	0.000	0.193	0.303	0.414
$U_{1y}M_{fy}/M_{ry}$	0.023	0.030	0.030	0.030	0.030	0.038	0.038	0.030	0.030	0.030	0.015	0.000	0.000	0.000	0.000	0.038	0.038	0.045
Interaction	0.661	0.622	0.576	0.584	0.506	0.435	0.451	0.334	0.224	0.228	0.118	0.007	0.000	0.000	0.000	0.231	0.342	0.461
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.709	0.666	0.616	0.625	0.541	0.464	0.481	0.356	0.240	0.309	0.310	0.310	0.312	0.312	0.311	0.246	0.365	0.492

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	93	93	93	94	94	94	96	96	96	98	98	98	99	99	99	100	100	100
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Member Factored Load Effects:

C_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	967	830	693
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	6	6
T_f (kN)	113	113	113	161	161	161	188	188	188	214	214	214	176	176	176	128	128	128
$M_{fx\ (tension)}$ (kNm)	703	782	861	846	953	1060	1051	1084	1116	1108	1106	1103	1115	1034	952	967	830	693
$M_{fy\ (tension)}$ (kNm)	6	5	5	5	5	4	4	4	4	4	5	5	5	5	5	5	6	6
V_{fx} (kN)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
V_{fy} (kN)	309	308	307	267	266	265	169	168	167	129	131	132	206	207	209	284	285	287

Gross Section Properties:

Ag (mm^2)	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429
I_x (mm^4)	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09
I_y (mm^4)	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
J (mm^4)	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06
r_x (mm)	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383
r_y (mm)	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
S_x (mm^3)	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06
S_y (mm^3)	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	533	533	533	914	914	914	533	533	533	991	991	991	991	991	991	991	991	991

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	93	93	93	94	94	94	96	96	96	98	98	98	99	99	99	100	100	100
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Width-to-thickness ratio of elements in compression

Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Webs in combined flexural and axial compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	93	93	93	94	94	94	96	96	96	98	98	98	99	99	99	100	100	100
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	533	533	533	914	914	914	533	533	533	991	991	991	991	991	991	991	991	991
L_y (mm)	533	533	533	914	914	914	533	533	533	991	991	991	991	991	991	991	991	991
λ_{max}	0.089	0.089	0.089	0.152	0.152	0.152	0.089	0.089	0.089	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165
C_r (kN)	5098.7	5098.7	5098.7	5080.1	5080.1	5080.1	5098.7	5098.7	5098.7	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3
$(kL/r)_{max}$	8.6	8.6	8.6	14.7	14.7	14.7	8.6	8.6	8.6	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	748208	748208	748208	254599	254599	254599	748208	748208	748208	216936	216936	216936	216936	216936	216936	216936	216936	216936

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	480	480	480	823	823	823	480	480	480	892	892	892	892	892	892	892	892	892
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	93	93	93	94	94	94	96	96	96	98	98	98	99	99	99	100	100	100
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	5098.7	5098.7	5098.7	5080.1	5080.1	5080.1	5098.7	5098.7	5098.7	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$A_{n(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(b)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(c)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	93	93	93	94	94	94	96	96	96	98	98	98	99	99	99	100	100	100
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
$(kL/r)_{max}$	9	9	9	15	15	15	9	9	9	16	16	16	16	16	16	16	16	16
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619
$M_{ry(Laterally\ Supported)}$ (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	533	533	533	914	914	914	533	533	533	991	991	991	991	991	991	991	991	991
L_{uy} (mm)	533	533	533	914	914	914	533	533	533	991	991	991	991	991	991	991	991	991
M_{ux} (kNm) (y weak)	14194	14194	14194	8280	8280	8280	14194	14194	14194	7643	7643	7643	7643	7643	7643	7643	7643	7643
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1796.5	1796.5	1796.5	1749.4	1749.4	1749.4	1796.5	1796.5	1796.5	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0
M_{ry} (kNm)	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3
w_y (mm)	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
A_{wy} (mm^2)	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792
h_y/w_y	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
F_{cr} (N/mm^2)	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703
$(V_f/V_r)<=1$	0.181	0.181	0.180	0.157	0.156	0.156	0.099	0.099	0.098	0.076	0.077	0.078	0.121	0.122	0.123	0.167	0.167	0.169

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001
$(T_f/T_r)<=1$	0.021	0.021	0.021	0.030	0.030	0.030	0.035	0.035	0.035	0.040	0.040	0.040	0.033	0.033	0.033	0.024	0.024	0.024

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.021	0.021	0.021	0.030	0.030	0.030	0.035	0.035	0.035	0.040	0.040	0.040	0.033	0.033	0.033	0.024	0.024	0.024
$M_{fx}/M_{rx}<=1$	0.391	0.435	0.479	0.484	0.545	0.606	0.585	0.603	0.621	0.637	0.636	0.634	0.641	0.594	0.547	0.556	0.477	0.398
$M_{fy}/M_{ry}<=1$	0.045	0.038	0.038	0.038	0.038	0.030	0.030	0.030	0.030	0.030	0.038	0.038	0.038	0.038	0.038	0.038	0.045	0.045
$T_f/T_r+M_f/M_r<=1$	0.457	0.494	0.538	0.551	0.612	0.666	0.650	0.668	0.686	0.707	0.713	0.711	0.711	0.665	0.617	0.617	0.546	0.467
$M_f/M_r-T_fS/M_rA<=1$	0.397	0.433	0.477	0.464	0.525	0.578	0.549	0.567	0.585	0.590	0.597	0.595	0.615	0.569	0.522	0.547	0.476	0.398

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	93	93	93	94	94	94	96	96	96	98	98	98	99	99	99	100	100	100
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	2.89E+07	2.89E+07	2.89E+07	9.83E+06	9.83E+06	9.83E+06	2.89E+07	2.89E+07	2.89E+07	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	748208	748208	748208	254599	254599	254599	748208	748208	748208	216936	216936	216936	216936	216936	216936	216936	216936	216936
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.597	0.513	0.428
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.038	0.045	0.045
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.635	0.558	0.474

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.089	0.089	0.089	0.152	0.152	0.152	0.089	0.089	0.089	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165
$C_{r\ (K=1)}$ (kN)	5099	5099	5099	5080	5080	5080	5099	5099	5099	5074	5074	5074	5074	5074	5074	5074	5074	5074
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.597	0.513	0.428
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.038	0.045	0.045
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.635	0.558	0.474

3.3. Lateral Torsional Buckling:

λ_{max}	0.089	0.089	0.089	0.152	0.152	0.152	0.089	0.089	0.089	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165
C_r (kN)	5099	5099	5099	5080	5080	5080	5099	5099	5099	5074	5074	5074	5074	5074	5074	5074	5074	5074
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1796	1796	1796	1749	1749	1749	1796	1796	1796	1740	1740	1740	1740	1740	1740	1740	1740	1740
M_{ry} (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.556	0.477	0.398
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.038	0.045	0.045
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.594	0.523	0.444
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.457	0.494	0.538	0.551	0.612	0.666	0.650	0.668	0.686	0.707	0.713	0.711	0.711	0.665	0.617	0.635	0.558	0.474

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	101	101	101	103	103	103	105	105	105	107	107	107	108	108	108	109	109	109
Member Label	-	-	-	-4S	-4S	-4S	6N-	6N-	6N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	4S	6N	---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Member Factored Load Effects:

C_f (kN)	17	17	17	30	30	30	43	24	24	10	10	10	0	0	0	0	0	0
$M_{fx\ (comp)}$ (kNm)	715	524	333	344	172	0	0	145	306	256	468	679	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	6	6	6	6	3	0	0	12	26	14	20	25	0	0	0	0	0	0
T_f (kN)	55	55	55	16	16	16	16	40	40	129	129	129	233	233	233	307	307	307
$M_{fx\ (tension)}$ (kNm)	715	524	333	344	172	0	0	145	306	256	468	679	622	707	791	750	864	976
$M_{fy\ (tension)}$ (kNm)	6	6	6	6	3	0	0	12	26	14	20	25	19	18	17	21	18	15
V_{fx} (kN)	1	1	1	9	9	9	55	45	45	22	22	22	22	22	22	26	26	26
V_{fy} (kN)	407	409	410	530	531	532	538	502	501	440	438	437	333	332	331	282	281	280

Gross Section Properties:

Ag (mm^2)	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429
I_x (mm^4)	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09
I_y (mm^4)	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
J (mm^4)	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06
r_x (mm)	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383
r_y (mm)	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
S_x (mm^3)	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06
S_y (mm^3)	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	991	991	991	648	648	648	648	648	648	991	991	991	533	533	533	914	914	914

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	101	101	101	103	103	103	105	105	105	107	107	107	108	108	108	109	109	109
Member Label	-	-	-	-4S	-4S	-4S	6N-	6N-	6N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	4S	6N	---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Webs in combined flexural and axial compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	101	101	101	103	103	103	105	105	105	107	107	107	108	108	108	109	109	109
Member Label	-	-	-	-4S	-4S	-4S	6N-	6N-	6N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	4S	6N	---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	991	991	991	648	648	648	648	648	648	991	991	991	533	533	533	914	914	914
L_y (mm)	991	991	991	648	648	648	648	648	648	991	991	991	533	533	533	914	914	914
λ_{max}	0.165	0.165	0.165	0.108	0.108	0.108	0.108	0.108	0.108	0.165	0.165	0.165	0.089	0.089	0.089	0.152	0.152	0.152
C_r (kN)	5074.3	5074.3	5074.3	5094.7	5094.7	5094.7	5094.7	5094.7	5094.7	5074.3	5074.3	5074.3	5098.7	5098.7	5098.7	5080.1	5080.1	5080.1
$(kL/r)_{max}$	16.0	16.0	16.0	10.4	10.4	10.4	10.4	10.4	10.4	16.0	16.0	16.0	8.6	8.6	8.6	14.7	14.7	14.7
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	216936	216936	216936	507435	507435	507435	507435	507435	507435	216936	216936	216936	748208	748208	748208	254599	254599	254599

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	892	892	892	583	583	583	583	583	583	892	892	892	480	480	480	823	823	823
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	101	101	101	103	103	103	105	105	105	107	107	107	108	108	108	109	109	109
Member Label	-	-	-	-4S	-4S	-4S	6N-	6N-	6N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	4S	6N	---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	5074.3	5074.3	5074.3	5094.7	5094.7	5094.7	5094.7	5094.7	5094.7	5074.3	5074.3	5074.3	5098.7	5098.7	5098.7	5080.1	5080.1	5080.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$A_{n(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(b)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(c)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Member ID in CSiBridge	101	101	101	103	103	103	105	105	105	107	107	107	108	108	108	109	109	109
Member Label	-	-	-	-4S	-4S	-4S	6N-	6N-	6N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	4S	6N	---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
$(kL/r)_{max}$	16	16	16	10	10	10	10	10	10	16	16	16	9	9	9	15	15	15
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619
$M_{ry(Laterally\ Supported)}$ (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	991	991	991	648	648	648	648	648	648	991	991	991	533	533	533	914	914	914
L_{uy} (mm)	991	991	991	648	648	648	648	648	648	991	991	991	533	533	533	914	914	914
M_{ux} (kNm) (y weak)	7643	7643	7643	11689	11689	11689	11689	11689	11689	7643	7643	7643	14194	14194	14194	8280	8280	8280
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1740.0	1740.0	1740.0	1782.3	1782.3	1782.3	1782.3	1782.3	1782.3	1740.0	1740.0	1740.0	1796.5	1796.5	1796.5	1749.4	1749.4	1749.4
M_{ry} (kNm)	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3
w_y (mm)	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
A_{wy} (mm^2)	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792
h_y/w_y	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
F_{cr} (N/mm^2)	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703
(V_f/V_r)<=1	0.239	0.240	0.241	0.311	0.312	0.312	0.316	0.295	0.294	0.258	0.257	0.257	0.196	0.195	0.194	0.166	0.165	0.164

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.003	0.003	0.003	0.006	0.006	0.006	0.008	0.005	0.005	0.002	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000
(T_f/T_r)<=1	0.010	0.010	0.010	0.003	0.003	0.003	0.003	0.007	0.007	0.024	0.024	0.024	0.043	0.043	0.043	0.057	0.057	0.057

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.010	0.010	0.010	0.003	0.003	0.003	0.003	0.007	0.007	0.024	0.024	0.024	0.043	0.043	0.043	0.057	0.057	0.057
M_{fx}/M_{rx}<=1	0.411	0.301	0.191	0.193	0.097	0.000	0.000	0.081	0.172	0.147	0.269	0.390	0.346	0.394	0.440	0.429	0.494	0.558
M_{fy}/M_{ry}<=1	0.045	0.045	0.045	0.045	0.023	0.000	0.000	0.090	0.195	0.105	0.150	0.188	0.143	0.135	0.128	0.158	0.135	0.113
$T_f/T_r+M_f/M_r$<=1	0.466	0.356	0.247	0.241	0.122	0.003	0.003	0.179	0.375	0.276	0.443	0.602	0.532	0.572	0.611	0.644	0.686	0.728
$M_f/M_r-T_fS/M_rA$<=1	0.436	0.327	0.217	0.232	0.113	0.000	0.000	0.157	0.353	0.206	0.373	0.532	0.407	0.447	0.486	0.477	0.519	0.561

Member ID in CSiBridge	101	101	101	103	103	103	105	105	105	107	107	107	108	108	108	109	109	109
Member Label	-	-	-	-4S	-4S	-4S	6N-	6N-	6N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	4S	6N	---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.38E+06	8.38E+06	8.38E+06	1.96E+07	1.96E+07	1.96E+07	1.96E+07	1.96E+07	1.96E+07	8.38E+06	8.38E+06	8.38E+06	2.89E+07	2.89E+07	2.89E+07	9.83E+06	9.83E+06	9.83E+06
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	216936	216936	216936	507435	507435	507435	507435	507435	507435	216936	216936	216936	748208	748208	748208	254599	254599	254599
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.003**	**0.003**	**0.003**	**0.006**	**0.006**	**0.006**	**0.008**	**0.005**	**0.005**	**0.002**	**0.002**	**0.002**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1x}M_{fx}/M_{rx}$	**0.442**	**0.324**	**0.206**	**0.212**	**0.106**	**0.000**	**0.000**	**0.090**	**0.189**	**0.158**	**0.289**	**0.419**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.045**	**0.045**	**0.045**	**0.045**	**0.023**	**0.000**	**0.000**	**0.090**	**0.195**	**0.105**	**0.150**	**0.188**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.490**	**0.372**	**0.254**	**0.263**	**0.135**	**0.006**	**0.008**	**0.184**	**0.389**	**0.265**	**0.441**	**0.609**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.165	0.165	0.165	0.108	0.108	0.108	0.108	0.108	0.108	0.165	0.165	0.165	0.089	0.089	0.089	0.152	0.152	0.152
$C_{r\ (K=1)}$ (kN)	5074	5074	5074	5095	5095	5095	5095	5095	5095	5074	5074	5074	5099	5099	5099	5080	5080	5080
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.003**	**0.003**	**0.003**	**0.006**	**0.006**	**0.006**	**0.008**	**0.005**	**0.005**	**0.002**	**0.002**	**0.002**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1x}M_{fx}/M_{rx}$	**0.442**	**0.324**	**0.206**	**0.212**	**0.106**	**0.000**	**0.000**	**0.090**	**0.189**	**0.158**	**0.289**	**0.419**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.045**	**0.045**	**0.045**	**0.045**	**0.023**	**0.000**	**0.000**	**0.090**	**0.195**	**0.105**	**0.150**	**0.188**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.490**	**0.372**	**0.254**	**0.263**	**0.135**	**0.006**	**0.008**	**0.184**	**0.389**	**0.265**	**0.441**	**0.609**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

3.3. Lateral Torsional Buckling:

λ_{max}	0.165	0.165	0.165	0.108	0.108	0.108	0.108	0.108	0.108	0.165	0.165	0.165	0.089	0.089	0.089	0.152	0.152	0.152
C_r (kN)	5074	5074	5074	5095	5095	5095	5095	5095	5095	5074	5074	5074	5099	5099	5099	5080	5080	5080
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1740	1740	1740	1782	1782	1782	1782	1782	1782	1740	1740	1740	1796	1796	1796	1749	1749	1749
M_{ry} (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
C_f/C_r	**0.003**	**0.003**	**0.003**	**0.006**	**0.006**	**0.006**	**0.008**	**0.005**	**0.005**	**0.002**	**0.002**	**0.002**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1x}M_{fx}/M_{rx}$	**0.411**	**0.301**	**0.191**	**0.193**	**0.097**	**0.000**	**0.000**	**0.081**	**0.172**	**0.147**	**0.269**	**0.390**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.045**	**0.045**	**0.045**	**0.045**	**0.023**	**0.000**	**0.000**	**0.090**	**0.195**	**0.105**	**0.150**	**0.188**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.459**	**0.350**	**0.240**	**0.244**	**0.125**	**0.006**	**0.008**	**0.176**	**0.372**	**0.254**	**0.421**	**0.580**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Demand/Capacity ≤ 1	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
Highest Ratio	**0.490**	**0.372**	**0.254**	**0.311**	**0.312**	**0.312**	**0.316**	**0.295**	**0.389**	**0.276**	**0.443**	**0.609**	**0.532**	**0.572**	**0.611**	**0.644**	**0.686**	**0.728**

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	110	110	110	111	111	111	112	112	112	118	118	118	119	119	119	120	120	120
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-6S	-6S	-6S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	6S
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Member Factored Load Effects:

C_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	13	32
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	306	145	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	13	0
T_f (kN)	359	359	359	377	377	376	339	339	339	252	252	252	123	123	123	32	32	0
$M_{fx\ (tension)}$ (kNm)	947	980	1013	1004	1022	999	1019	934	847	897	753	607	678	467	256	306	145	0
$M_{fy\ (tension)}$ (kNm)	16	14	13	13	13	14	16	19	22	19	20	22	31	23	15	30	13	0
V_{fx} (kN)	30	30	30	33	33	33	27	27	27	22	22	22	27	27	27	53	53	64
V_{fy} (kN)	174	174	173	137	135	144	214	216	217	303	304	306	435	437	438	502	503	539

Gross Section Properties:

Ag (mm^2)	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429
I_x (mm^4)	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09
I_y (mm^4)	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
J (mm^4)	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06
r_x (mm)	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383
r_y (mm)	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
S_x (mm^3)	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06
S_y (mm^3)	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	533	533	533	991	991	991	991	991	991	991	991	991	991	991	991	648	648	648

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	110	110	110	111	111	111	112	112	112	118	118	118	119	119	119	120	120	120
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-6S	-6S	-6S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	6S
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Webs in combined flexural and axial compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	110	110	110	111	111	111	112	112	112	118	118	118	119	119	119	120	120	120
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-6S	-6S	-6S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	6S
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	533	533	533	991	991	991	991	991	991	991	991	991	991	991	991	648	648	648
L_y (mm)	533	533	533	991	991	991	991	991	991	991	991	991	991	991	991	648	648	648
λ_{max}	0.089	0.089	0.089	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.108	0.108	0.108
C_r (kN)	5098.7	5098.7	5098.7	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5094.7	5094.7	5094.7
$(kL/r)_{max}$	8.6	8.6	8.6	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	10.4	10.4	10.4
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	748208	748208	748208	216936	216936	216936	216936	216936	216936	216936	216936	216936	216936	216936	216936	507435	507435	507435

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	480	480	480	892	892	892	892	892	892	892	892	892	892	892	892	583	583	583
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	110	110	110	111	111	111	112	112	112	118	118	118	119	119	119	120	120	120
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-6S	-6S	-6S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	6S
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	5098.7	5098.7	5098.7	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5094.7	5094.7	5094.7

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$A_{n(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(b)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(c)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	110	110	110	111	111	111	112	112	112	118	118	118	119	119	119	120	120	120
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-6S	-6S	-6S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	6S
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
$(kL/r)_{max}$	9	9	9	16	16	16	16	16	16	16	16	16	16	16	16	10	10	10
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619
$M_{ry(Laterally\ Supported)}$ (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	533	533	533	991	991	991	991	991	991	991	991	991	991	991	991	648	648	648
L_{uy} (mm)	533	533	533	991	991	991	991	991	991	991	991	991	991	991	991	648	648	648
M_{ux} (kNm) (y weak)	14194	14194	14194	7643	7643	7643	7643	7643	7643	7643	7643	7643	7643	7643	7643	11689	11689	11689
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1796.5	1796.5	1796.5	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1782.3	1782.3	1782.3
M_{ry} (kNm)	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3
w_y (mm)	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
A_{wy} (mm^2)	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792
h_y/w_y	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
F_{cr} (N/mm^2)	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703
(V_f/V_r)<=1	0.102	0.102	0.102	0.080	0.079	0.085	0.126	0.127	0.127	0.178	0.179	0.180	0.255	0.257	0.257	0.295	0.295	0.317

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.003	0.006
(T_f/T_r)<=1	0.067	0.067	0.067	0.070	0.070	0.070	0.063	0.063	0.063	0.047	0.047	0.047	0.023	0.023	0.023	0.006	0.006	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.067	0.067	0.067	0.070	0.070	0.070	0.063	0.063	0.063	0.047	0.047	0.047	0.023	0.023	0.023	0.006	0.006	0.000
M_{fx}/M_{rx}<=1	0.527	0.546	0.564	0.577	0.587	0.574	0.586	0.537	0.487	0.516	0.433	0.349	0.390	0.268	0.147	0.172	0.081	0.000
M_{fy}/M_{ry}<=1	0.120	0.105	0.098	0.098	0.098	0.105	0.120	0.143	0.165	0.143	0.150	0.165	0.233	0.173	0.113	0.226	0.098	0.000
$T_f/T_r+M_f/M_r$<=1	0.714	0.717	0.728	0.745	0.755	0.749	0.769	0.743	0.715	0.705	0.630	0.561	0.646	0.464	0.283	0.403	0.185	0.000
$M_f/M_r-T_fS/M_rA$<=1	0.521	0.524	0.535	0.540	0.550	0.545	0.584	0.558	0.531	0.568	0.493	0.424	0.579	0.397	0.216	0.386	0.168	0.000

Member ID in CSiBridge	110	110	110	111	111	111	112	112	112	118	118	118	119	119	119	120	120	120
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-6S	-6S	-6S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	6S
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	2.89E+07	2.89E+07	2.89E+07	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	1.96E+07	1.96E+07	1.96E+07
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	748208	748208	748208	216936	216936	216936	216936	216936	216936	216936	216936	216936	216936	216936	216936	507435	507435	507435
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.003	0.006
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.189	0.090	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.226	0.098	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.417	0.190	0.006

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.089	0.089	0.089	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.108	0.108	0.108
$C_{r\ (K=1)}$ (kN)	5099	5099	5099	5074	5074	5074	5074	5074	5074	5074	5074	5074	5074	5074	5074	5095	5095	5095
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.003	0.006
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.189	0.090	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.226	0.098	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.417	0.190	0.006

3.3. Lateral Torsional Buckling:

λ_{max}	0.089	0.089	0.089	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.108	0.108	0.108
C_r (kN)	5099	5099	5099	5074	5074	5074	5074	5074	5074	5074	5074	5074	5074	5074	5074	5095	5095	5095
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1796	1796	1796	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740	1782	1782	1782
M_{ry} (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.003	0.006
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.172	0.081	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.226	0.098	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.400	0.182	0.006
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.714	0.717	0.728	0.745	0.755	0.749	0.769	0.743	0.715	0.705	0.630	0.561	0.646	0.464	0.283	0.417	0.295	0.317

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	121	121	121	122	122	122	123	123	123	124	124	124	125	125	125	126	126	126
Member Label	10N-	10N-	10N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	10N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Member Factored Load Effects:

C_f (kN)	29	29	29	25	25	25	9	9	9	2	2	2	0	0	0	0	0	0
$M_{fx\ (comp)}$ (kNm)	0	171	342	333	525	717	699	777	855	841	948	1054	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	2	4	4	4	4	4	4	4	4	4	4	0	0	0	0	0	0
T_f (kN)	27	27	27	53	53	53	113	113	113	158	158	158	186	186	186	213	213	213
$M_{fx\ (tension)}$ (kNm)	0	171	342	333	525	717	699	777	855	841	948	1054	1045	1078	1110	1101	1099	1096
$M_{fy\ (tension)}$ (kNm)	0	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
V_{fx} (kN)	6	6	6	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2
V_{fy} (kN)	529	528	527	414	412	411	307	306	306	266	265	263	168	167	167	128	130	131

Gross Section Properties:

Ag (mm^2)	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429
I_x (mm^4)	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09
I_y (mm^4)	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
J (mm^4)	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06
r_x (mm)	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383
r_y (mm)	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
S_x (mm^3)	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06
S_y (mm^3)	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	648	648	648	991	991	991	533	533	533	914	914	914	533	533	533	991	991	991

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	121	121	121	122	122	122	123	123	123	124	124	124	125	125	125	126	126	126
Member Label	10N-	10N-	10N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	10N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Webs in combined flexural and axial compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	121	121	121	122	122	122	123	123	123	124	124	124	125	125	125	126	126	126
Member Label	10N-	10N-	10N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	10N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	648	648	648	991	991	991	533	533	533	914	914	914	533	533	533	991	991	991
L_y (mm)	648	648	648	991	991	991	533	533	533	914	914	914	533	533	533	991	991	991
λ_{max}	0.108	0.108	0.108	0.165	0.165	0.165	0.089	0.089	0.089	0.152	0.152	0.152	0.089	0.089	0.089	0.165	0.165	0.165
C_r (kN)	5094.7	5094.7	5094.7	5074.3	5074.3	5074.3	5098.7	5098.7	5098.7	5080.1	5080.1	5080.1	5098.7	5098.7	5098.7	5074.3	5074.3	5074.3
$(kL/r)_{max}$	10.4	10.4	10.4	16.0	16.0	16.0	8.6	8.6	8.6	14.7	14.7	14.7	8.6	8.6	8.6	16.0	16.0	16.0
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	507435	507435	507435	216936	216936	216936	748208	748208	748208	254599	254599	254599	748208	748208	748208	216936	216936	216936

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	583	583	583	892	892	892	480	480	480	823	823	823	480	480	480	892	892	892
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	121	121	121	122	122	122	123	123	123	124	124	124	125	125	125	126	126	126
Member Label	10N-	10N-	10N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	10N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	5094.7	5094.7	5094.7	5074.3	5074.3	5074.3	5098.7	5098.7	5098.7	5080.1	5080.1	5080.1	5098.7	5098.7	5098.7	5074.3	5074.3	5074.3

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$A_{n(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(b)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(c)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	121	121	121	122	122	122	123	123	123	124	124	124	125	125	125	126	126	126
Member Label	10N-	10N-	10N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	10N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
$(kL/r)_{max}$	10	10	10	16	16	16	9	9	9	15	15	15	9	9	9	16	16	16
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619
$M_{ry(Laterally\ Supported)}$ (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	648	648	648	991	991	991	533	533	533	914	914	914	533	533	533	991	991	991
L_{uy} (mm)	648	648	648	991	991	991	533	533	533	914	914	914	533	533	533	991	991	991
M_{ux} (kNm) (y weak)	11689	11689	11689	7643	7643	7643	14194	14194	14194	8280	8280	8280	14194	14194	14194	7643	7643	7643
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1782.3	1782.3	1782.3	1740.0	1740.0	1740.0	1796.5	1796.5	1796.5	1749.4	1749.4	1749.4	1796.5	1796.5	1796.5	1740.0	1740.0	1740.0
M_{ry} (kNm)	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3
w_y (mm)	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
A_{wy} (mm^2)	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792
h_y/w_y	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
F_{cr} (N/mm^2)	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703
$(V_f/V_r)<=1$	0.311	0.310	0.310	0.243	0.242	0.241	0.180	0.180	0.180	0.156	0.156	0.154	0.099	0.098	0.098	0.075	0.076	0.077

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.006	0.006	0.006	0.005	0.005	0.005	0.002	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$(T_f/T_r)<=1$	0.005	0.005	0.005	0.010	0.010	0.010	0.021	0.021	0.021	0.029	0.029	0.029	0.035	0.035	0.035	0.040	0.040	0.040

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.005	0.005	0.005	0.010	0.010	0.010	0.021	0.021	0.021	0.029	0.029	0.029	0.035	0.035	0.035	0.040	0.040	0.040
$M_{fx}/M_{rx}<=1$	0.000	0.096	0.192	0.191	0.302	0.412	0.389	0.433	0.476	0.481	0.542	0.603	0.582	0.600	0.618	0.633	0.632	0.630
$M_{fy}/M_{ry}<=1$	0.000	0.015	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
$T_f/T_r+M_f/M_r<=1$	0.005	0.116	0.227	0.231	0.342	0.452	0.440	0.484	0.527	0.540	0.601	0.662	0.646	0.665	0.682	0.702	0.701	0.700
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.101	0.212	0.202	0.313	0.423	0.379	0.423	0.466	0.454	0.516	0.576	0.546	0.565	0.582	0.587	0.585	0.584

Member ID in CSiBridge	121	121	121	122	122	122	123	123	123	124	124	124	125	125	125	126	126	126
Member Label	10N-	10N-	10N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	10N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.96E+07	1.96E+07	1.96E+07	8.38E+06	8.38E+06	8.38E+06	2.89E+07	2.89E+07	2.89E+07	9.83E+06	9.83E+06	9.83E+06	2.89E+07	2.89E+07	2.89E+07	8.38E+06	8.38E+06	8.38E+06
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	507435	507435	507435	216936	216936	216936	748208	748208	748208	254599	254599	254599	748208	748208	748208	216936	216936	216936
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.006	0.006	0.006	0.005	0.005	0.005	0.002	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.106	0.211	0.206	0.324	0.443	0.432	0.480	0.528	0.519	0.585	0.651	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.015	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.006	0.126	0.247	0.241	0.359	0.478	0.463	0.512	0.560	0.550	0.616	0.681	0.000	0.000	0.000	0.000	0.000	0.000

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.108	0.108	0.108	0.165	0.165	0.165	0.089	0.089	0.089	0.152	0.152	0.152	0.089	0.089	0.089	0.165	0.165	0.165
$C_{r\ (K=1)}$ (kN)	5095	5095	5095	5074	5074	5074	5099	5099	5099	5080	5080	5080	5099	5099	5099	5074	5074	5074
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.006	0.006	0.006	0.005	0.005	0.005	0.002	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.106	0.211	0.206	0.324	0.443	0.432	0.480	0.528	0.519	0.585	0.651	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.015	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.006	0.126	0.247	0.241	0.359	0.478	0.463	0.512	0.560	0.550	0.616	0.681	0.000	0.000	0.000	0.000	0.000	0.000

3.3. Lateral Torsional Buckling:

λ_{max}	0.108	0.108	0.108	0.165	0.165	0.165	0.089	0.089	0.089	0.152	0.152	0.152	0.089	0.089	0.089	0.165	0.165	0.165
C_r (kN)	5095	5095	5095	5074	5074	5074	5099	5099	5099	5080	5080	5080	5099	5099	5099	5074	5074	5074
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1782	1782	1782	1740	1740	1740	1796	1796	1796	1749	1749	1749	1796	1796	1796	1740	1740	1740
M_{ry} (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
C_f/C_r	0.006	0.006	0.006	0.005	0.005	0.005	0.002	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.096	0.192	0.191	0.302	0.412	0.389	0.433	0.476	0.481	0.542	0.603	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.015	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.006	0.117	0.228	0.226	0.337	0.447	0.421	0.464	0.508	0.511	0.572	0.633	0.000	0.000	0.000	0.000	0.000	0.000
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.311	0.310	0.310	0.243	0.359	0.478	0.463	0.512	0.560	0.550	0.616	0.681	0.646	0.665	0.682	0.702	0.701	0.700

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	127	127	127	128	128	128	129	129	129	130	130	130	610	610	610	611	611	611
Member Label	-	-	-	-	-	-	-	-	-	-10S	-10S	-10S	0N-	0N-	0N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	10S	0N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Member Factored Load Effects:

C_f (kN)	0	0	0	0	0	0	12	12	12	23	23	23	876	856	856	809	809	809
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	711	521	331	342	171	0	207	88	134	116	296	476
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	5	5	5	5	2	0	59	39	19	30	17	21
T_f (kN)	174	174	174	127	127	127	54	54	54	15	15	15	0	0	0	0	0	0
$M_{fx\ (tension)}$ (kNm)	1109	1028	946	961	825	688	711	521	331	342	171	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	4	4	4	4	5	5	5	5	5	5	2	0	0	0	0	0	0	0
V_{fx} (kN)	2	2	2	2	2	2	1	1	1	7	7	7	85	76	76	45	45	45
V_{fy} (kN)	205	206	208	282	284	285	405	407	408	527	528	529	501	474	473	414	412	411

Gross Section Properties:

Ag (mm^2)	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429
I_x (mm^4)	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09
I_y (mm^4)	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
J (mm^4)	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06
r_x (mm)	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383
r_y (mm)	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
S_x (mm^3)	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06
S_y (mm^3)	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	991	991	991	991	991	991	991	991	991	648	648	648	648	648	648	991	991	991

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	127	127	127	128	128	128	129	129	129	130	130	130	610	610	610	611	611	611
Member Label	-	-	-	-	-	-	-	-	-	-10S	-10S	-10S	0N-	0N-	0N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	10S	0N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Webs in combined flexural and axial compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	127	127	127	128	128	128	129	129	129	130	130	130	610	610	610	611	611	611
Member Label	-	-	-	-	-	-	-	-	-	-10S	-10S	-10S	0N-	0N-	0N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	10S	0N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	991	991	991	991	991	991	991	991	991	648	648	648	648	648	648	991	991	991
L_y (mm)	991	991	991	991	991	991	991	991	991	648	648	648	648	648	648	991	991	991
λ_{max}	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.108	0.108	0.108	0.108	0.108	0.108	0.165	0.165	0.165
C_r (kN)	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5094.7	5094.7	5094.7	5094.7	5094.7	5094.7	5074.3	5074.3	5074.3
$(kL/r)_{max}$	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	10.4	10.4	10.4	10.4	10.4	10.4	16.0	16.0	16.0
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	216936	216936	216936	216936	216936	216936	216936	216936	216936	507435	507435	507435	507435	507435	507435	216936	216936	216936

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	892	892	892	892	892	892	892	892	892	583	583	583	583	583	583	892	892	892
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	127	127	127	128	128	128	129	129	129	130	130	130	610	610	610	611	611	611
Member Label	-	-	-	-	-	-	-	-	-	-10S	-10S	-10S	0N-	0N-	0N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	10S	0N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5094.7	5094.7	5094.7	5094.7	5094.7	5094.7	5074.3	5074.3	5074.3

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$A_{n(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(b)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(c)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	127	127	127	128	128	128	129	129	129	130	130	130	610	610	610	611	611	611
Member Label	-	-	-	-	-	-	-	-	-	-10S	-10S	-10S	0N-	0N-	0N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	10S	0N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
$(kL/r)_{max}$	16	16	16	16	16	16	16	16	16	10	10	10	10	10	10	16	16	16
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619
$M_{ry(Laterally\ Supported)}$ (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	991	991	991	991	991	991	991	991	991	648	648	648	648	648	648	991	991	991
L_{uy} (mm)	991	991	991	991	991	991	991	991	991	648	648	648	648	648	648	991	991	991
M_{ux} (kNm) (y weak)	7643	7643	7643	7643	7643	7643	7643	7643	7643	11689	11689	11689	11689	11689	11689	7643	7643	7643
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1782.3	1782.3	1782.3	1782.3	1782.3	1782.3	1740.0	1740.0	1740.0
M_{ry} (kNm)	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3
w_y (mm)	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
A_{wy} (mm^2)	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792
h_y/w_y	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
F_{cr} (N/mm^2)	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703
$(V_f/V_r)<=1$	0.120	0.121	0.122	0.166	0.167	0.167	0.238	0.239	0.240	0.310	0.310	0.311	0.294	0.278	0.278	0.243	0.242	0.241

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.002	0.002	0.005	0.005	0.005	0.172	0.168	0.168	0.159	0.159	0.159
$(T_f/T_r)<=1$	0.032	0.032	0.032	0.024	0.024	0.024	0.010	0.010	0.010	0.003	0.003	0.003	0.000	0.000	0.000	0.000	0.000	0.000

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.032	0.032	0.032	0.024	0.024	0.024	0.010	0.010	0.010	0.003	0.003	0.003	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fx}/M_{rx}<=1$	0.637	0.591	0.544	0.552	0.474	0.395	0.409	0.299	0.190	0.192	0.096	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fy}/M_{ry}<=1$	0.030	0.030	0.030	0.030	0.038	0.038	0.038	0.038	0.038	0.038	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r<=1$	0.700	0.653	0.606	0.606	0.535	0.457	0.456	0.347	0.238	0.232	0.114	0.003	0.000	0.000	0.000	0.000	0.000	0.000
$M_f/M_r-T_fS/M_rA<=1$	0.605	0.559	0.511	0.537	0.466	0.387	0.427	0.318	0.208	0.224	0.106	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Member ID in CSiBridge	127	127	127	128	128	128	129	129	129	130	130	130	610	610	610	611	611	611
Member Label	-	-	-	-	-	-	-	-	-	-10S	-10S	-10S	0N-	0N-	0N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	10S	0N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	1.96E+07	1.96E+07	1.96E+07	1.96E+07	1.96E+07	1.96E+07	8.38E+06	8.38E+06	8.38E+06
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	216936	216936	216936	216936	216936	216936	216936	216936	216936	507435	507435	507435	507435	507435	507435	216936	216936	216936
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.002	0.002	0.005	0.005	0.005	0.172	0.168	0.168	0.158	0.158	0.158
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.439	0.322	0.204	0.211	0.106	0.000	0.128	0.054	0.083	0.072	0.183	0.294
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.038	0.038	0.038	0.038	0.015	0.000	0.444	0.294	0.143	0.226	0.128	0.158
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.479	0.362	0.244	0.253	0.125	0.005	0.744	0.516	0.394	0.457	0.470	0.611

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.108	0.108	0.108	0.108	0.108	0.108	0.165	0.165	0.165
$C_{r\ (K=1)}$ (kN)	5074	5074	5074	5074	5074	5074	5074	5074	5074	5095	5095	5095	5095	5095	5095	5074	5074	5074
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.002	0.002	0.005	0.005	0.005	0.172	0.168	0.168	0.159	0.159	0.159
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.439	0.322	0.204	0.211	0.106	0.000	0.128	0.054	0.083	0.072	0.183	0.294
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.038	0.038	0.038	0.038	0.015	0.000	0.444	0.294	0.143	0.226	0.128	0.158
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.479	0.362	0.244	0.253	0.125	0.005	0.744	0.516	0.394	0.457	0.471	0.612

3.3. Lateral Torsional Buckling:

λ_{max}	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.108	0.108	0.108	0.108	0.108	0.108	0.165	0.165	0.165
C_r (kN)	5074	5074	5074	5074	5074	5074	5074	5074	5074	5095	5095	5095	5095	5095	5095	5074	5074	5074
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1740	1740	1740	1740	1740	1740	1740	1740	1740	1782	1782	1782	1782	1782	1782	1740	1740	1740
M_{ry} (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.002	0.002	0.005	0.005	0.005	0.172	0.168	0.168	0.159	0.159	0.159
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.409	0.299	0.190	0.192	0.096	0.000	0.116	0.049	0.075	0.067	0.170	0.274
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.038	0.038	0.038	0.038	0.015	0.000	0.444	0.294	0.143	0.226	0.128	0.158
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.449	0.339	0.230	0.234	0.115	0.005	0.732	0.511	0.386	0.453	0.458	0.592
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.700	0.653	0.606	0.606	0.535	0.457	0.479	0.362	0.244	0.310	0.310	0.311	0.744	0.516	0.394	0.457	0.471	0.612

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	612	612	612	613	613	613	614	614	614	615	615	615	616	616	616	617	617	617
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Member Factored Load Effects:

C_f (kN)	756	756	756	717	717	717	690	690	690	680	680	680	701	701	701	748	748	748
$M_{fx\ (comp)}$ (kNm)	447	524	601	579	685	791	775	806	837	832	850	827	838	756	674	701	567	432
$M_{fy\ (comp)}$ (kNm)	12	16	21	16	19	23	18	19	21	19	21	22	24	23	23	28	21	13
T_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	31	31	31	28	28	28	23	23	23	22	22	19	21	21	21	29	29	29
V_{fy} (kN)	313	312	312	266	265	263	163	162	161	132	130	140	204	206	207	285	287	288

Gross Section Properties:

Ag (mm^2)	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429
I_x (mm^4)	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09
I_y (mm^4)	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
J (mm^4)	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06
r_x (mm)	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383
r_y (mm)	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
S_x (mm^3)	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06
S_y (mm^3)	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	533	533	533	914	914	914	533	533	533	991	991	991	991	991	991	991	991	991

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	612	612	612	613	613	613	614	614	614	615	615	615	616	616	616	617	617	617
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Webs in combined flexural and axial compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	612	612	612	613	613	613	614	614	614	615	615	615	616	616	616	617	617	617
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	533	533	533	914	914	914	533	533	533	991	991	991	991	991	991	991	991	991
L_y (mm)	533	533	533	914	914	914	533	533	533	991	991	991	991	991	991	991	991	991
λ_{max}	0.089	0.089	0.089	0.152	0.152	0.152	0.089	0.089	0.089	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165
C_r (kN)	5098.7	5098.7	5098.7	5080.1	5080.1	5080.1	5098.7	5098.7	5098.7	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3
$(kL/r)_{max}$	8.6	8.6	8.6	14.7	14.7	14.7	8.6	8.6	8.6	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	748208	748208	748208	254599	254599	254599	748208	748208	748208	216936	216936	216936	216936	216936	216936	216936	216936	216936

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	480	480	480	823	823	823	480	480	480	892	892	892	892	892	892	892	892	892
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	612	612	612	613	613	613	614	614	614	615	615	615	616	616	616	617	617	617
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	5098.7	5098.7	5098.7	5080.1	5080.1	5080.1	5098.7	5098.7	5098.7	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$A_{n(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(b)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(c)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	612	612	612	613	613	613	614	614	614	615	615	615	616	616	616	617	617	617
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
$(kL/r)_{max}$	9	9	9	15	15	15	9	9	9	16	16	16	16	16	16	16	16	16
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619
$M_{ry(Laterally\ Supported)}$ (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	533	533	533	914	914	914	533	533	533	991	991	991	991	991	991	991	991	991
L_{uy} (mm)	533	533	533	914	914	914	533	533	533	991	991	991	991	991	991	991	991	991
M_{ux} (kNm) (y weak)	14194	14194	14194	8280	8280	8280	14194	14194	14194	7643	7643	7643	7643	7643	7643	7643	7643	7643
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1796.5	1796.5	1796.5	1749.4	1749.4	1749.4	1796.5	1796.5	1796.5	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0
M_{ry} (kNm)	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3
w_y (mm)	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
A_{wy} (mm^2)	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792
h_y/w_y	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
F_{cr} (N/mm^2)	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703
(V_f/V_r)<=1	0.184	0.183	0.183	0.156	0.156	0.154	0.096	0.095	0.095	0.078	0.076	0.082	0.120	0.121	0.122	0.167	0.169	0.169

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.148	0.148	0.148	0.141	0.141	0.141	0.135	0.135	0.135	0.134	0.134	0.134	0.138	0.138	0.138	0.147	0.147	0.147
(T_f/T_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
M_{fx}/M_{rx}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
M_{fy}/M_{ry}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Member ID in CSiBridge	612	612	612	613	613	613	614	614	614	615	615	615	616	616	616	617	617	617
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	2.89E+07	2.89E+07	2.89E+07	9.83E+06	9.83E+06	9.83E+06	2.89E+07	2.89E+07	2.89E+07	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	748208	748208	748208	254599	254599	254599	748208	748208	748208	216936	216936	216936	216936	216936	216936	216936	216936	216936
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.148**	**0.148**	**0.148**	**0.140**	**0.140**	**0.140**	**0.135**	**0.135**	**0.135**	**0.133**	**0.133**	**0.133**	**0.137**	**0.137**	**0.137**	**0.147**	**0.147**	**0.147**
$U_{1x}M_{fx}/M_{rx}$	**0.276**	**0.324**	**0.371**	**0.358**	**0.423**	**0.488**	**0.479**	**0.498**	**0.517**	**0.514**	**0.525**	**0.511**	**0.517**	**0.467**	**0.416**	**0.433**	**0.350**	**0.267**
$U_{1y}M_{fy}/M_{ry}$	**0.090**	**0.120**	**0.158**	**0.121**	**0.143**	**0.173**	**0.135**	**0.143**	**0.158**	**0.143**	**0.158**	**0.166**	**0.181**	**0.173**	**0.173**	**0.211**	**0.158**	**0.098**
Interaction	**0.514**	**0.592**	**0.677**	**0.619**	**0.707**	**0.802**	**0.749**	**0.776**	**0.810**	**0.790**	**0.817**	**0.810**	**0.836**	**0.778**	**0.727**	**0.791**	**0.655**	**0.511**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.089	0.089	0.089	0.152	0.152	0.152	0.089	0.089	0.089	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165
$C_{r\ (K=1)}$ (kN)	5099	5099	5099	5080	5080	5080	5099	5099	5099	5074	5074	5074	5074	5074	5074	5074	5074	5074
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.148**	**0.148**	**0.148**	**0.141**	**0.141**	**0.141**	**0.135**	**0.135**	**0.135**	**0.134**	**0.134**	**0.134**	**0.138**	**0.138**	**0.138**	**0.147**	**0.147**	**0.147**
$U_{1x}M_{fx}/M_{rx}$	**0.276**	**0.324**	**0.371**	**0.358**	**0.423**	**0.488**	**0.479**	**0.498**	**0.517**	**0.514**	**0.525**	**0.511**	**0.517**	**0.467**	**0.416**	**0.433**	**0.350**	**0.267**
$U_{1y}M_{fy}/M_{ry}$	**0.090**	**0.120**	**0.158**	**0.121**	**0.143**	**0.173**	**0.135**	**0.143**	**0.158**	**0.143**	**0.158**	**0.166**	**0.181**	**0.173**	**0.173**	**0.211**	**0.158**	**0.098**
Interaction	**0.515**	**0.592**	**0.677**	**0.619**	**0.707**	**0.803**	**0.749**	**0.776**	**0.810**	**0.791**	**0.817**	**0.811**	**0.837**	**0.778**	**0.728**	**0.792**	**0.656**	**0.512**

3.3. Lateral Torsional Buckling:

λ_{max}	0.089	0.089	0.089	0.152	0.152	0.152	0.089	0.089	0.089	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165
C_r (kN)	5099	5099	5099	5080	5080	5080	5099	5099	5099	5074	5074	5074	5074	5074	5074	5074	5074	5074
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1796	1796	1796	1749	1749	1749	1796	1796	1796	1740	1740	1740	1740	1740	1740	1740	1740	1740
M_{ry} (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
C_f/C_r	**0.148**	**0.148**	**0.148**	**0.141**	**0.141**	**0.141**	**0.135**	**0.135**	**0.135**	**0.134**	**0.134**	**0.134**	**0.138**	**0.138**	**0.138**	**0.147**	**0.147**	**0.147**
$U_{1x}M_{fx}/M_{rx}$	**0.249**	**0.292**	**0.335**	**0.331**	**0.392**	**0.452**	**0.431**	**0.449**	**0.466**	**0.478**	**0.489**	**0.475**	**0.482**	**0.435**	**0.387**	**0.403**	**0.326**	**0.248**
$U_{1y}M_{fy}/M_{ry}$	**0.090**	**0.120**	**0.158**	**0.121**	**0.143**	**0.173**	**0.135**	**0.143**	**0.158**	**0.143**	**0.158**	**0.166**	**0.181**	**0.173**	**0.173**	**0.211**	**0.158**	**0.098**
Interaction	**0.487**	**0.560**	**0.641**	**0.593**	**0.676**	**0.767**	**0.702**	**0.727**	**0.759**	**0.756**	**0.781**	**0.775**	**0.801**	**0.746**	**0.699**	**0.762**	**0.632**	**0.494**
Demand/Capacity ≤ 1	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
Highest Ratio	**0.515**	**0.592**	**0.677**	**0.619**	**0.707**	**0.803**	**0.749**	**0.776**	**0.810**	**0.791**	**0.817**	**0.811**	**0.837**	**0.778**	**0.728**	**0.792**	**0.656**	**0.512**

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	618	618	618	619	619	619	656	656	656	657	657	657	658	658	658	659	659	659
Member Label	-	-	-	-0S	-0S	-0S	8N-	8N-	8N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	0S	8N	---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Member Factored Load Effects:

C_f (kN)	815	815	815	863	863	883	0	0	0	5	5	5	0	0	0	0	0	0
$M_{fx\ (comp)}$ (kNm)	469	289	107	125	99	219	0	0	0	334	527	720	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	26	18	33	21	45	68	0	0	0	3	4	4	0	0	0	0	0	0
T_f (kN)	0	0	0	0	0	0	0	0	0	51	51	51	115	115	115	164	164	164
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	334	527	720	701	780	859	844	951	1058
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	3	4	4	4	4	4	4	4	3
V_{fx} (kN)	54	54	54	87	87	97	5	5	5	1	1	1	1	1	1	2	2	2
V_{fy} (kN)	413	414	416	478	479	505	531	530	529	416	414	413	308	308	307	267	266	265

Gross Section Properties:

Ag (mm^2)	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429
I_x (mm^4)	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09
I_y (mm^4)	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
J (mm^4)	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06
r_x (mm)	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383
r_y (mm)	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
S_x (mm^3)	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06
S_y (mm^3)	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	991	991	991	648	648	648	648	648	648	991	991	991	533	533	533	914	914	914

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	618	618	618	619	619	619	656	656	656	657	657	657	658	658	658	659	659	659
Member Label	-	-	-	-0S	-0S	-0S	8N-	8N-	8N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	0S	8N	---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Webs in combined flexural and axial compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	618	618	618	619	619	619	656	656	656	657	657	657	658	658	658	659	659	659
Member Label	-	-	-	-0S	-0S	-0S	8N-	8N-	8N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	0S	8N	---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	991	991	991	648	648	648	648	648	648	991	991	991	533	533	533	914	914	914
L_y (mm)	991	991	991	648	648	648	648	648	648	991	991	991	533	533	533	914	914	914
λ_{max}	0.165	0.165	0.165	0.108	0.108	0.108	0.108	0.108	0.108	0.165	0.165	0.165	0.089	0.089	0.089	0.152	0.152	0.152
C_r (kN)	5074.3	5074.3	5074.3	5094.7	5094.7	5094.7	5094.7	5094.7	5094.7	5074.3	5074.3	5074.3	5098.7	5098.7	5098.7	5080.1	5080.1	5080.1
$(kL/r)_{max}$	16.0	16.0	16.0	10.4	10.4	10.4	10.4	10.4	10.4	16.0	16.0	16.0	8.6	8.6	8.6	14.7	14.7	14.7
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	216936	216936	216936	507435	507435	507435	507435	507435	507435	216936	216936	216936	748208	748208	748208	254599	254599	254599

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	892	892	892	583	583	583	583	583	583	892	892	892	480	480	480	823	823	823
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	618	618	618	619	619	619	656	656	656	657	657	657	658	658	658	659	659	659
Member Label	-	-	-	-0S	-0S	-0S	8N-	8N-	8N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	0S	8N	---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	5074.3	5074.3	5074.3	5094.7	5094.7	5094.7	5094.7	5094.7	5094.7	5074.3	5074.3	5074.3	5098.7	5098.7	5098.7	5080.1	5080.1	5080.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$A_{n(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(b)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(c)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	618	618	618	619	619	619	656	656	656	657	657	657	658	658	658	659	659	659
Member Label	-	-	-	-0S	-0S	-0S	8N-	8N-	8N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	0S	8N	---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
$(kL/r)_{max}$	16	16	16	10	10	10	10	10	10	16	16	16	9	9	9	15	15	15
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619
$M_{ry(Laterally\ Supported)}$ (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	991	991	991	648	648	648	648	648	648	991	991	991	533	533	533	914	914	914
L_{uy} (mm)	991	991	991	648	648	648	648	648	648	991	991	991	533	533	533	914	914	914
M_{ux} (kNm) (y weak)	7643	7643	7643	11689	11689	11689	11689	11689	11689	7643	7643	7643	14194	14194	14194	8280	8280	8280
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1740.0	1740.0	1740.0	1782.3	1782.3	1782.3	1782.3	1782.3	1782.3	1740.0	1740.0	1740.0	1796.5	1796.5	1796.5	1749.4	1749.4	1749.4
M_{ry} (kNm)	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3
w_y (mm)	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
A_{wy} (mm^2)	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792
h_y/w_y	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
F_{cr} (N/mm^2)	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703
$(V_f/V_r)<=1$	0.243	0.243	0.244	0.281	0.281	0.297	0.312	0.311	0.311	0.244	0.243	0.243	0.181	0.181	0.180	0.157	0.156	0.156

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.161	0.161	0.161	0.169	0.169	0.173	0.000	0.000	0.000	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000
$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.009	0.009	0.021	0.021	0.021	0.030	0.030	0.030

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.009	0.009	0.021	0.021	0.021	0.030	0.030	0.030
$M_{fx}/M_{rx}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.192	0.303	0.414	0.390	0.434	0.478	0.482	0.544	0.605
$M_{fy}/M_{ry}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.023	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.023
$T_f/T_r+M_f/M_r<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.224	0.342	0.453	0.442	0.486	0.530	0.543	0.604	0.658
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.196	0.315	0.426	0.380	0.424	0.468	0.454	0.515	0.569

Member ID in CSiBridge	618	618	618	619	619	619	656	656	656	657	657	657	658	658	658	659	659	659
Member Label	-	-	-	-0S	-0S	-0S	8N-	8N-	8N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	0S	8N	---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.38E+06	8.38E+06	8.38E+06	1.96E+07	1.96E+07	1.96E+07	1.96E+07	1.96E+07	1.96E+07	8.38E+06	8.38E+06	8.38E+06	2.89E+07	2.89E+07	2.89E+07	9.83E+06	9.83E+06	9.83E+06
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	216936	216936	216936	507435	507435	507435	507435	507435	507435	216936	216936	216936	748208	748208	748208	254599	254599	254599
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.160**	**0.160**	**0.160**	**0.169**	**0.169**	**0.173**	**0.000**	**0.000**	**0.000**	**0.001**	**0.001**	**0.001**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1x}M_{fx}/M_{rx}$	**0.290**	**0.178**	**0.066**	**0.077**	**0.061**	**0.135**	**0.000**	**0.000**	**0.000**	**0.206**	**0.325**	**0.445**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.196**	**0.136**	**0.249**	**0.158**	**0.339**	**0.512**	**0.000**	**0.000**	**0.000**	**0.023**	**0.030**	**0.030**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.646**	**0.474**	**0.475**	**0.404**	**0.569**	**0.820**	**0.000**	**0.000**	**0.000**	**0.230**	**0.356**	**0.476**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.165	0.165	0.165	0.108	0.108	0.108	0.108	0.108	0.108	0.165	0.165	0.165	0.089	0.089	0.089	0.152	0.152	0.152
$C_{r\ (K=1)}$ (kN)	5074	5074	5074	5095	5095	5095	5095	5095	5095	5074	5074	5074	5099	5099	5099	5080	5080	5080
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.161**	**0.161**	**0.161**	**0.169**	**0.169**	**0.173**	**0.000**	**0.000**	**0.000**	**0.001**	**0.001**	**0.001**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1x}M_{fx}/M_{rx}$	**0.290**	**0.178**	**0.066**	**0.077**	**0.061**	**0.135**	**0.000**	**0.000**	**0.000**	**0.206**	**0.325**	**0.445**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.196**	**0.136**	**0.249**	**0.158**	**0.339**	**0.512**	**0.000**	**0.000**	**0.000**	**0.023**	**0.030**	**0.030**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.646**	**0.475**	**0.476**	**0.405**	**0.569**	**0.821**	**0.000**	**0.000**	**0.000**	**0.230**	**0.356**	**0.476**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

3.3. Lateral Torsional Buckling:

λ_{max}	0.165	0.165	0.165	0.108	0.108	0.108	0.108	0.108	0.108	0.165	0.165	0.165	0.089	0.089	0.089	0.152	0.152	0.152
C_r (kN)	5074	5074	5074	5095	5095	5095	5095	5095	5095	5074	5074	5074	5099	5099	5099	5080	5080	5080
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1740	1740	1740	1782	1782	1782	1782	1782	1782	1740	1740	1740	1796	1796	1796	1749	1749	1749
M_{ry} (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
C_f/C_r	**0.161**	**0.161**	**0.161**	**0.169**	**0.169**	**0.173**	**0.000**	**0.000**	**0.000**	**0.001**	**0.001**	**0.001**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1x}M_{fx}/M_{rx}$	**0.270**	**0.166**	**0.062**	**0.070**	**0.056**	**0.123**	**0.000**	**0.000**	**0.000**	**0.192**	**0.303**	**0.414**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.196**	**0.136**	**0.249**	**0.158**	**0.339**	**0.512**	**0.000**	**0.000**	**0.000**	**0.023**	**0.030**	**0.030**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.626**	**0.463**	**0.471**	**0.398**	**0.564**	**0.808**	**0.000**	**0.000**	**0.000**	**0.216**	**0.334**	**0.445**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Demand/Capacity ≤ 1	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
Highest Ratio	**0.646**	**0.475**	**0.476**	**0.405**	**0.569**	**0.821**	**0.312**	**0.311**	**0.311**	**0.244**	**0.356**	**0.476**	**0.442**	**0.486**	**0.530**	**0.543**	**0.604**	**0.658**

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	660	660	660	661	661	661	662	662	662	663	663	663	664	664	664	665	665	665
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-8S	-8S	-8S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	8S
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Member Factored Load Effects:

C_f (kN)	0	0	0	0	0	0	0	0	0	5	5	5	19	19	19	36	36	36
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	965	828	691	713	522	331	343	171	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	4	4	5	5	4	4	4	2	0
T_f (kN)	192	192	192	219	219	219	181	181	181	134	134	134	67	67	67	33	33	33
$M_{fx\ (tension)}$ (kNm)	1049	1082	1114	1106	1103	1100	1113	1032	950	965	828	691	713	522	331	343	171	0
$M_{fy\ (tension)}$ (kNm)	3	3	3	3	3	4	4	4	4	4	4	5	5	4	4	4	2	0
V_{fx} (kN)	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	6	6	6
V_{fy} (kN)	169	168	167	129	131	132	206	207	209	283	285	286	406	408	409	528	529	530

Gross Section Properties:

Ag (mm^2)	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429
I_x (mm^4)	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09
I_y (mm^4)	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
J (mm^4)	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06
r_x (mm)	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383
r_y (mm)	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
S_x (mm^3)	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06
S_y (mm^3)	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	533	533	533	991	991	991	991	991	991	991	991	991	991	991	991	648	648	648

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	660	660	660	661	661	661	662	662	662	663	663	663	664	664	664	665	665	665
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-8S	-8S	-8S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	8S
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Webs in combined flexural and axial compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	660	660	660	661	661	661	662	662	662	663	663	663	664	664	664	665	665	665
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-8S	-8S	-8S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	8S
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	533	533	533	991	991	991	991	991	991	991	991	991	991	991	991	648	648	648
L_y (mm)	533	533	533	991	991	991	991	991	991	991	991	991	991	991	991	648	648	648
λ_{max}	0.089	0.089	0.089	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.108	0.108	0.108
C_r (kN)	5098.7	5098.7	5098.7	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5094.7	5094.7	5094.7
$(kL/r)_{max}$	8.6	8.6	8.6	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	10.4	10.4	10.4
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	748208	748208	748208	216936	216936	216936	216936	216936	216936	216936	216936	216936	216936	216936	216936	507435	507435	507435

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	480	480	480	892	892	892	892	892	892	892	892	892	892	892	892	583	583	583
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	660	660	660	661	661	661	662	662	662	663	663	663	664	664	664	665	665	665
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-8S	-8S	-8S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	8S
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	5098.7	5098.7	5098.7	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5094.7	5094.7	5094.7

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$A_{n(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(b)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(c)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	660	660	660	661	661	661	662	662	662	663	663	663	664	664	664	665	665	665
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-8S	-8S	-8S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	8S
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
$(kL/r)_{max}$	9	9	9	16	16	16	16	16	16	16	16	16	16	16	16	10	10	10
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619
$M_{ry(Laterally\ Supported)}$ (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	533	533	533	991	991	991	991	991	991	991	991	991	991	991	991	648	648	648
L_{uy} (mm)	533	533	533	991	991	991	991	991	991	991	991	991	991	991	991	648	648	648
M_{ux} (kNm) (y weak)	14194	14194	14194	7643	7643	7643	7643	7643	7643	7643	7643	7643	7643	7643	7643	11689	11689	11689
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1796.5	1796.5	1796.5	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1782.3	1782.3	1782.3
M_{ry} (kNm)	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3
w_y (mm)	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
A_{wy} (mm^2)	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792
h_y/w_y	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
F_{cr} (N/mm^2)	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703
(V_f/V_r)<=1	0.099	0.099	0.098	0.076	0.077	0.078	0.121	0.122	0.123	0.166	0.167	0.168	0.238	0.240	0.240	0.310	0.311	0.311

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004	0.007	0.007	0.007
(T_f/T_r)<=1	0.036	0.036	0.036	0.041	0.041	0.041	0.034	0.034	0.034	0.025	0.025	0.025	0.012	0.012	0.012	0.006	0.006	0.006

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.036	0.036	0.036	0.041	0.041	0.041	0.034	0.034	0.034	0.025	0.025	0.025	0.012	0.012	0.012	0.006	0.006	0.006
M_{fx}/M_{rx}<=1	0.584	0.602	0.620	0.636	0.634	0.632	0.640	0.593	0.546	0.555	0.476	0.397	0.410	0.300	0.190	0.192	0.096	0.000
M_{fy}/M_{ry}<=1	0.023	0.023	0.023	0.023	0.023	0.030	0.030	0.030	0.030	0.030	0.030	0.038	0.038	0.030	0.030	0.030	0.015	0.000
$T_f/T_r+M_f/M_r$<=1	0.642	0.660	0.678	0.699	0.697	0.703	0.703	0.657	0.610	0.610	0.531	0.460	0.460	0.343	0.233	0.229	0.117	0.006
$M_f/M_r-T_fS/M_rA$<=1	0.539	0.557	0.575	0.580	0.578	0.584	0.605	0.558	0.511	0.537	0.458	0.387	0.423	0.306	0.196	0.211	0.099	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	660	660	660	661	661	661	662	662	662	663	663	663	664	664	664	665	665	665
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-8S	-8S	-8S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	8S
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	2.89E+07	2.89E+07	2.89E+07	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	1.96E+07	1.96E+07	1.96E+07
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	748208	748208	748208	216936	216936	216936	216936	216936	216936	216936	216936	216936	216936	216936	216936	507435	507435	507435
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004	0.007	0.007	0.007
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.596	0.511	0.427	0.440	0.322	0.204	0.212	0.106	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.030	0.030	0.038	0.038	0.030	0.030	0.030	0.015	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.627	0.542	0.465	0.482	0.356	0.238	0.249	0.128	0.007

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.089	0.089	0.089	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.108	0.108	0.108
$C_{r\ (K=1)}$ (kN)	5099	5099	5099	5074	5074	5074	5074	5074	5074	5074	5074	5074	5074	5074	5074	5095	5095	5095
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004	0.007	0.007	0.007
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.596	0.511	0.427	0.440	0.322	0.204	0.212	0.106	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.030	0.030	0.038	0.038	0.030	0.030	0.030	0.015	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.627	0.542	0.465	0.482	0.356	0.238	0.249	0.128	0.007

3.3. Lateral Torsional Buckling:

λ_{max}	0.089	0.089	0.089	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.108	0.108	0.108
C_r (kN)	5099	5099	5099	5074	5074	5074	5074	5074	5074	5074	5074	5074	5074	5074	5074	5095	5095	5095
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1796	1796	1796	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740	1782	1782	1782
M_{ry} (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004	0.007	0.007	0.007
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.555	0.476	0.397	0.410	0.300	0.190	0.192	0.096	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.030	0.030	0.038	0.038	0.030	0.030	0.030	0.015	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.586	0.507	0.436	0.451	0.334	0.224	0.230	0.118	0.007
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.642	0.660	0.678	0.699	0.697	0.703	0.703	0.657	0.610	0.627	0.542	0.465	0.482	0.356	0.240	0.310	0.311	0.311

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	666	666	666	667	667	667	668	668	668	669	669	669	670	670	670	671	671	671
Member Label	12N-	12N-	12N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	12N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Member Factored Load Effects:

C_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	1	53	53	150	150	150	257	257	257	332	332	332	386	386	386	404	404	404
$M_{fx\ (tension)}$ (kNm)	0	146	307	257	471	684	626	712	797	755	869	983	953	987	1019	1010	1030	1006
$M_{fy\ (tension)}$ (kNm)	0	10	23	14	18	22	18	16	15	20	17	14	15	14	12	13	12	13
V_{fx} (kN)	48	39	39	19	19	19	21	21	21	25	25	25	30	30	30	33	33	33
V_{fy} (kN)	543	505	504	444	443	441	336	335	334	285	284	282	176	175	175	140	139	146

Gross Section Properties:

Ag (mm^2)	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429
I_x (mm^4)	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09
I_y (mm^4)	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
J (mm^4)	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06
r_x (mm)	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383
r_y (mm)	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
S_x (mm^3)	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06
S_y (mm^3)	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	648	648	648	991	991	991	533	533	533	914	914	914	533	533	533	991	991	991

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	666	666	666	667	667	667	668	668	668	669	669	669	670	670	670	671	671	671
Member Label	12N-	12N-	12N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	12N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Webs in combined flexural and axial compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	666	666	666	667	667	667	668	668	668	669	669	669	670	670	670	671	671	671
Member Label	12N-	12N-	12N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	12N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	648	648	648	991	991	991	533	533	533	914	914	914	533	533	533	991	991	991
L_y (mm)	648	648	648	991	991	991	533	533	533	914	914	914	533	533	533	991	991	991
λ_{max}	0.108	0.108	0.108	0.165	0.165	0.165	0.089	0.089	0.089	0.152	0.152	0.152	0.089	0.089	0.089	0.165	0.165	0.165
C_r (kN)	5094.7	5094.7	5094.7	5074.3	5074.3	5074.3	5098.7	5098.7	5098.7	5080.1	5080.1	5080.1	5098.7	5098.7	5098.7	5074.3	5074.3	5074.3
$(kL/r)_{max}$	10.4	10.4	10.4	16.0	16.0	16.0	8.6	8.6	8.6	14.7	14.7	14.7	8.6	8.6	8.6	16.0	16.0	16.0
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	507435	507435	507435	216936	216936	216936	748208	748208	748208	254599	254599	254599	748208	748208	748208	216936	216936	216936

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	583	583	583	892	892	892	480	480	480	823	823	823	480	480	480	892	892	892
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	666	666	666	667	667	667	668	668	668	669	669	669	670	670	670	671	671	671
Member Label	12N-	12N-	12N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	12N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	5094.7	5094.7	5094.7	5074.3	5074.3	5074.3	5098.7	5098.7	5098.7	5080.1	5080.1	5080.1	5098.7	5098.7	5098.7	5074.3	5074.3	5074.3

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$A_{n(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(b)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(c)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	666	666	666	667	667	667	668	668	668	669	669	669	670	670	670	671	671	671
Member Label	12N-	12N-	12N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	12N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
$(kL/r)_{max}$	10	10	10	16	16	16	9	9	9	15	15	15	9	9	9	16	16	16
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619
$M_{ry(Laterally\ Supported)}$ (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	648	648	648	991	991	991	533	533	533	914	914	914	533	533	533	991	991	991
L_{uy} (mm)	648	648	648	991	991	991	533	533	533	914	914	914	533	533	533	991	991	991
M_{ux} (kNm) (y weak)	11689	11689	11689	7643	7643	7643	14194	14194	14194	8280	8280	8280	14194	14194	14194	7643	7643	7643
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1782.3	1782.3	1782.3	1740.0	1740.0	1740.0	1796.5	1796.5	1796.5	1749.4	1749.4	1749.4	1796.5	1796.5	1796.5	1740.0	1740.0	1740.0
M_{ry} (kNm)	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3
w_y (mm)	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
A_{wy} (mm^2)	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792
h_y/w_y	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
F_{cr} (N/mm^2)	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703
$(V_f/V_r)<=1$	0.319	0.297	0.296	0.261	0.260	0.259	0.197	0.197	0.196	0.167	0.167	0.166	0.103	0.103	0.103	0.082	0.082	0.086

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$(T_f/T_r)<=1$	0.000	0.010	0.010	0.028	0.028	0.028	0.048	0.048	0.048	0.062	0.062	0.062	0.072	0.072	0.072	0.075	0.075	0.075

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.000	0.010	0.010	0.028	0.028	0.028	0.048	0.048	0.048	0.062	0.062	0.062	0.072	0.072	0.072	0.075	0.075	0.075
$M_{fx}/M_{rx}<=1$	0.000	0.082	0.172	0.148	0.271	0.393	0.348	0.396	0.444	0.432	0.497	0.562	0.530	0.549	0.567	0.580	0.592	0.578
$M_{fy}/M_{ry}<=1$	0.000	0.075	0.173	0.105	0.135	0.165	0.135	0.120	0.113	0.150	0.128	0.105	0.113	0.105	0.090	0.098	0.090	0.098
$T_f/T_r+M_f/M_r<=1$	0.000	0.167	0.355	0.281	0.434	0.586	0.531	0.564	0.604	0.644	0.686	0.729	0.715	0.726	0.729	0.753	0.757	0.751
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.138	0.326	0.199	0.352	0.505	0.393	0.426	0.466	0.463	0.506	0.549	0.507	0.518	0.521	0.533	0.537	0.531

Member ID in CSiBridge	666	666	666	667	667	667	668	668	668	669	669	669	670	670	670	671	671	671
Member Label	12N-	12N-	12N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	12N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.96E+07	1.96E+07	1.96E+07	8.38E+06	8.38E+06	8.38E+06	2.89E+07	2.89E+07	2.89E+07	9.83E+06	9.83E+06	9.83E+06	2.89E+07	2.89E+07	2.89E+07	8.38E+06	8.38E+06	8.38E+06
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	507435	507435	507435	216936	216936	216936	748208	748208	748208	254599	254599	254599	748208	748208	748208	216936	216936	216936
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.108	0.108	0.108	0.165	0.165	0.165	0.089	0.089	0.089	0.152	0.152	0.152	0.089	0.089	0.089	0.165	0.165	0.165
$C_{r\ (K=1)}$ (kN)	5095	5095	5095	5074	5074	5074	5099	5099	5099	5080	5080	5080	5099	5099	5099	5074	5074	5074
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.3. Lateral Torsional Buckling:

λ_{max}	0.108	0.108	0.108	0.165	0.165	0.165	0.089	0.089	0.089	0.152	0.152	0.152	0.089	0.089	0.089	0.165	0.165	0.165
C_r (kN)	5095	5095	5095	5074	5074	5074	5099	5099	5099	5080	5080	5080	5099	5099	5099	5074	5074	5074
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1782	1782	1782	1740	1740	1740	1796	1796	1796	1749	1749	1749	1796	1796	1796	1740	1740	1740
M_{ry} (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.319	0.297	0.355	0.281	0.434	0.586	0.531	0.564	0.604	0.644	0.686	0.729	0.715	0.726	0.729	0.753	0.757	0.751

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	672	672	672	673	673	673	674	674	674	675	675	675	676	676	676	677	677	677
Member Label	-	-	-	-	-	-	-	-	-	-12S	-12S	-12S	14N-	14N-	14N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	12S	14N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Member Factored Load Effects:

C_f (kN)	0	0	0	0	0	0	0	0	0	0	0	10	58	58	58	42	42	42
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	180	360	350	553	756
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	3	6	6	6	6
T_f (kN)	368	368	368	281	281	281	154	154	154	64	64	26	0	0	0	9	9	9
$M_{fx\ (tension)}$ (kNm)	1026	940	854	904	759	613	683	471	259	308	147	0	0	0	0	350	553	756
$M_{fy\ (tension)}$ (kNm)	14	18	21	16	18	20	25	19	13	24	11	0	0	0	0	6	6	6
V_{fx} (kN)	27	27	27	21	21	21	21	21	21	43	43	52	9	9	9	1	1	1
V_{fy} (kN)	215	217	218	304	306	307	438	439	441	504	505	542	557	556	555	437	435	434

Gross Section Properties:

Ag (mm^2)	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	29034	29034	29034	29034	29034	29034
I_x (mm^4)	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09
I_y (mm^4)	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
J (mm^4)	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06
r_x (mm)	383	383	383	383	383	383	383	383	383	383	383	383	396	396	396	396	396	396
r_y (mm)	62	62	62	62	62	62	62	62	62	62	62	62	61	61	61	61	61	61
S_x (mm^3)	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06
S_y (mm^3)	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	991	991	991	991	991	991	991	991	991	648	648	648	648	648	648	991	991	991

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	672	672	672	673	673	673	674	674	674	675	675	675	676	676	676	677	677	677
Member Label	-	-	-	-	-	-	-	-	-	-12S	-12S	-12S	14N-	14N-	14N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	12S	14N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	60.9	60.9	60.9	60.9	60.9	60.9
Webs in combined flexural and axial compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	60.9	60.9	60.9	60.9	60.9	60.9
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	672	672	672	673	673	673	674	674	674	675	675	675	676	676	676	677	677	677
Member Label	-	-	-	-	-	-	-	-	-	-12S	-12S	-12S	14N-	14N-	14N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	12S	14N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	991	991	991	991	991	991	991	991	991	648	648	648	648	648	648	991	991	991
L_y (mm)	991	991	991	991	991	991	991	991	991	648	648	648	648	648	648	991	991	991
λ_{max}	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.108	0.108	0.108	0.110	0.110	0.110	0.167	0.167	0.167
C_r (kN)	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5094.7	5094.7	5094.7	5202.7	5202.7	5202.7	5180.9	5180.9	5180.9
$(kL/r)_{max}$	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	10.4	10.4	10.4	10.6	10.6	10.6	16.2	16.2	16.2
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	216936	216936	216936	216936	216936	216936	216936	216936	216936	507435	507435	507435	507495	507495	507495	216962	216962	216962

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	892	892	892	892	892	892	892	892	892	583	583	583	583	583	583	892	892	892
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14517	14517	14517	14517	14517	14517
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	672	672	672	673	673	673	674	674	674	675	675	675	676	676	676	677	677	677
Member Label	-	-	-	-	-	-	-	-	-	-12S	-12S	-12S	14N-	14N-	14N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	12S	14N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14517	14517	14517	14517	14517	14517
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5094.7	5094.7	5094.7	5202.7	5202.7	5202.7	5180.9	5180.9	5180.9

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27582	27582	27582	27582	27582	27582
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5503	5503	5503	5503	5503	5503
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	28272	28272	28272	28272	28272	28272
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	28272	28272	28272	28272	28272	28272
$A_{n(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26858	26858	26858	26858	26858	26858
$T_{r(b)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	9024	9024	9024	9024	9024	9024
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26858	26858	26858	26858	26858	26858
$T_{r(c)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	9024	9024	9024	9024	9024	9024
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	672	672	672	673	673	673	674	674	674	675	675	675	676	676	676	677	677	677
Member Label	-	-	-	-	-	-	-	-	-	-12S	-12S	-12S	14N-	14N-	14N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	12S	14N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	9024	9024	9024	9024	9024	9024
$(kL/r)_{max}$	16	16	16	16	16	16	16	16	16	10	10	10	11	11	11	16	16	16
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5503	5503	5503	5503	5503	5503
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1704	1704	1704	1704	1704	1704
$M_{ry(Laterally\ Supported)}$ (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	991	991	991	991	991	991	991	991	991	648	648	648	648	648	648	991	991	991
L_{uy} (mm)	991	991	991	991	991	991	991	991	991	648	648	648	648	648	648	991	991	991
M_{ux} (kNm) (y weak)	7643	7643	7643	7643	7643	7643	7643	7643	7643	11689	11689	11689	11774	11774	11774	7699	7699	7699
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1782.3	1782.3	1782.3	1871.8	1871.8	1871.8	1825.2	1825.2	1825.2
M_{ry} (kNm)	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	968.4	968.4	968.4	968.4	968.4	968.4
w_y (mm)	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
A_{wy} (mm^2)	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	15398	15398	15398	15398	15398	15398
h_y/w_y	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	60.9	60.9	60.9	60.9	60.9	60.9
F_{cr} (N/mm^2)	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1772	1772	1772	1772	1772	1772
$(V_f/V_r)<=1$	0.126	0.127	0.128	0.179	0.180	0.180	0.257	0.258	0.259	0.296	0.297	0.318	0.314	0.314	0.313	0.247	0.245	0.245

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.011	0.011	0.011	0.008	0.008	0.008
$(T_f/T_r)<=1$	0.068	0.068	0.068	0.052	0.052	0.052	0.029	0.029	0.029	0.012	0.012	0.005	0.000	0.000	0.000	0.002	0.002	0.002

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.068	0.068	0.068	0.052	0.052	0.052	0.029	0.029	0.029	0.012	0.012	0.005	0.000	0.000	0.000	0.002	0.002	0.002
$M_{fx}/M_{rx}<=1$	0.590	0.540	0.491	0.520	0.436	0.352	0.393	0.271	0.149	0.173	0.082	0.000	0.000	0.000	0.000	0.192	0.303	0.414
$M_{fy}/M_{ry}<=1$	0.105	0.135	0.158	0.120	0.135	0.150	0.188	0.143	0.098	0.180	0.083	0.000	0.000	0.000	0.000	0.045	0.045	0.045
$T_f/T_r+M_f/M_r<=1$	0.763	0.744	0.717	0.692	0.624	0.555	0.609	0.442	0.275	0.365	0.177	0.005	0.000	0.000	0.000	0.238	0.350	0.461
$M_f/M_r-T_fS/M_tA<=1$	0.563	0.544	0.517	0.539	0.471	0.402	0.525	0.358	0.191	0.331	0.143	0.000	0.000	0.000	0.000	0.234	0.345	0.456

PARSONS

Member ID in CSiBridge	672	672	672	673	673	673	674	674	674	675	675	675	676	676	676	677	677	677
Member Label	-	-	-	-	-	-	-	-	-	-12S	-12S	-12S	14N-	14N-	14N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	12S	14N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5213	5213	5213	5213	5213	5213
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	1.96E+07	1.96E+07	1.96E+07	2.14E+07	2.14E+07	2.14E+07	9.16E+06	9.16E+06	9.16E+06
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	216936	216936	216936	216936	216936	216936	216936	216936	216936	507435	507435	507435	507495	507495	507495	216962	216962	216962
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.011	0.011	0.011	0.008	0.008	0.008
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.106	0.211	0.205	0.324	0.444
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.023	0.045	0.045	0.045	0.045
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.011	0.139	0.267	0.259	0.378	0.497

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.108	0.108	0.108	0.110	0.110	0.110	0.167	0.167	0.167
$C_{r\ (K=1)}$ (kN)	5074	5074	5074	5074	5074	5074	5074	5074	5074	5095	5095	5095	5203	5203	5203	5181	5181	5181
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.011	0.011	0.011	0.008	0.008	0.008
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.106	0.211	0.205	0.324	0.444
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.023	0.045	0.045	0.045	0.045
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.011	0.139	0.268	0.259	0.378	0.497

3.3. Lateral Torsional Buckling:

λ_{max}	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.108	0.108	0.108	0.110	0.110	0.110	0.167	0.167	0.167
C_r (kN)	5074	5074	5074	5074	5074	5074	5074	5074	5074	5095	5095	5095	5203	5203	5203	5181	5181	5181
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1740	1740	1740	1740	1740	1740	1740	1740	1740	1782	1782	1782	1872	1872	1872	1825	1825	1825
M_{ry} (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.011	0.011	0.011	0.008	0.008	0.008
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.096	0.192	0.192	0.303	0.414
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.023	0.045	0.045	0.045	0.045
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.011	0.130	0.249	0.245	0.356	0.467
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.763	0.744	0.717	0.692	0.624	0.555	0.609	0.442	0.275	0.365	0.297	0.318	0.314	0.314	0.313	0.259	0.378	0.497

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	678	678	678	679	679	679	680	680	680	681	681	681	682	682	682	683	683	683
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Member Factored Load Effects:

C_f (kN)	29	29	29	23	23	23	19	19	19	17	17	17	20	20	20	29	29	29
$M_{fx\ (comp)}$ (kNm)	736	819	902	886	999	1111	1101	1135	1169	1160	1158	1154	1167	1082	996	1012	868	724
$M_{fy\ (comp)}$ (kNm)	6	5	5	5	5	4	4	4	4	4	4	4	4	5	5	5	6	6
T_f (kN)	75	75	75	125	125	125	153	153	153	180	180	180	142	142	142	96	96	96
$M_{fx\ (tension)}$ (kNm)	736	819	902	886	999	1111	1101	1135	1169	1160	1158	1154	1167	1082	996	1012	868	724
$M_{fy\ (tension)}$ (kNm)	6	5	5	5	5	4	4	4	4	4	4	4	4	5	5	5	6	6
V_{fx} (kN)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
V_{fy} (kN)	325	324	323	279	278	276	175	174	174	132	134	135	214	216	217	298	299	301

Gross Section Properties:

Ag (mm^2)	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034
I_x (mm^4)	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09
I_y (mm^4)	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
J (mm^4)	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06
r_x (mm)	396	396	396	396	396	396	396	396	396	396	396	396	396	396	396	396	396	396
r_y (mm)	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
S_x (mm^3)	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06
S_y (mm^3)	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	533	533	533	914	914	914	533	533	533	991	991	991	991	991	991	991	991	991

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	678	678	678	679	679	679	680	680	680	681	681	681	682	682	682	683	683	683
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Width-to-thickness ratio of elements in compression

Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9
Webs in combined flexural and axial compression	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	678	678	678	679	679	679	680	680	680	681	681	681	682	682	682	683	683	683
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	533	533	533	914	914	914	533	533	533	991	991	991	991	991	991	991	991	991
L_y (mm)	533	533	533	914	914	914	533	533	533	991	991	991	991	991	991	991	991	991
λ_{max}	0.090	0.090	0.090	0.155	0.155	0.155	0.090	0.090	0.090	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167
C_r (kN)	5206.9	5206.9	5206.9	5187.1	5187.1	5187.1	5206.9	5206.9	5206.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9
$(kL/r)_{max}$	8.7	8.7	8.7	15.0	15.0	15.0	8.7	8.7	8.7	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	748296	748296	748296	254629	254629	254629	748296	748296	748296	216962	216962	216962	216962	216962	216962	216962	216962	216962

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	480	480	480	823	823	823	480	480	480	892	892	892	892	892	892	892	892	892
A_c (mm^2)	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	678	678	678	679	679	679	680	680	680	681	681	681	682	682	682	683	683	683
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	5206.9	5206.9	5206.9	5187.1	5187.1	5187.1	5206.9	5206.9	5206.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272
$A_{n(corrosion)}$ (mm^2)	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858
$T_{r(b)}$ (kN)	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858
$T_{r(c)}$ (kN)	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	678	678	678	679	679	679	680	680	680	681	681	681	682	682	682	683	683	683
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024
$(kL/r)_{max}$	9	9	9	15	15	15	9	9	9	16	16	16	16	16	16	16	16	16
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704
$M_{ry(Laterally\ Supported)}$ (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	533	533	533	914	914	914	533	533	533	991	991	991	991	991	991	991	991	991
L_{uy} (mm)	533	533	533	914	914	914	533	533	533	991	991	991	991	991	991	991	991	991
M_{ux} (kNm) (y weak)	14298	14298	14298	8340	8340	8340	14298	14298	14298	7699	7699	7699	7699	7699	7699	7699	7699	7699
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1887.3	1887.3	1887.3	1835.6	1835.6	1835.6	1887.3	1887.3	1887.3	1825.2	1825.2	1825.2	1825.2	1825.2	1825.2	1825.2	1825.2	1825.2
M_{ry} (kNm)	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4
w_y (mm)	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
A_{wy} (mm^2)	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398
h_y/w_y	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9
F_{cr} (N/mm^2)	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772
$(V_f/V_r)<=1$	0.183	0.183	0.182	0.157	0.157	0.156	0.099	0.098	0.098	0.074	0.076	0.076	0.121	0.122	0.122	0.168	0.169	0.170

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.006	0.006	0.006	0.004	0.004	0.004	0.004	0.004	0.004	0.003	0.003	0.003	0.004	0.004	0.004	0.006	0.006	0.006
$(T_f/T_r)<=1$	0.014	0.014	0.014	0.023	0.023	0.023	0.028	0.028	0.028	0.033	0.033	0.033	0.026	0.026	0.026	0.017	0.017	0.017

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.014	0.014	0.014	0.023	0.023	0.023	0.028	0.028	0.028	0.033	0.033	0.033	0.026	0.026	0.026	0.017	0.017	0.017
$M_{fx}/M_{rx}<=1$	0.390	0.434	0.478	0.483	0.544	0.605	0.583	0.601	0.619	0.636	0.634	0.632	0.639	0.593	0.546	0.554	0.476	0.397
$M_{fy}/M_{ry}<=1$	0.045	0.038	0.038	0.038	0.038	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.038	0.038	0.038	0.045	0.045
$T_f/T_r+M_f/M_r<=1$	0.449	0.485	0.529	0.543	0.605	0.658	0.641	0.659	0.677	0.698	0.697	0.695	0.695	0.656	0.609	0.609	0.538	0.459
$M_f/M_r-T_fS/M_rA<=1$	0.409	0.446	0.490	0.476	0.538	0.592	0.561	0.579	0.597	0.602	0.601	0.599	0.620	0.580	0.533	0.558	0.487	0.408

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	678	678	678	679	679	679	680	680	680	681	681	681	682	682	682	683	683	683
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	3.16E+07	3.16E+07	3.16E+07	1.08E+07	1.08E+07	1.08E+07	3.16E+07	3.16E+07	3.16E+07	9.16E+06	9.16E+06	9.16E+06	9.16E+06	9.16E+06	9.16E+06	9.16E+06	9.16E+06	9.16E+06
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	748296	748296	748296	254629	254629	254629	748296	748296	748296	216962	216962	216962	216962	216962	216962	216962	216962	216962
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.006	0.006	0.006	0.004	0.004	0.004	0.004	0.004	0.004	0.003	0.003	0.003	0.004	0.004	0.004	0.006	0.006	0.006
$U_{1x}M_{fx}/M_{rx}$	0.432	0.481	0.529	0.520	0.586	0.652	0.646	0.666	0.686	0.681	0.680	0.677	0.685	0.635	0.584	0.594	0.509	0.425
$U_{1y}M_{fy}/M_{ry}$	0.045	0.038	0.038	0.038	0.038	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.038	0.038	0.038	0.045	0.045
Interaction	0.483	0.524	0.572	0.562	0.628	0.686	0.680	0.700	0.720	0.714	0.713	0.710	0.719	0.676	0.626	0.637	0.560	0.476

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.090	0.090	0.090	0.155	0.155	0.155	0.090	0.090	0.090	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167
$C_{r\ (K=1)}$ (kN)	5207	5207	5207	5187	5187	5187	5207	5207	5207	5181	5181	5181	5181	5181	5181	5181	5181	5181
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.006	0.006	0.006	0.004	0.004	0.004	0.004	0.004	0.004	0.003	0.003	0.003	0.004	0.004	0.004	0.006	0.006	0.006
$U_{1x}M_{fx}/M_{rx}$	0.432	0.481	0.529	0.520	0.586	0.652	0.646	0.666	0.686	0.681	0.680	0.677	0.685	0.635	0.584	0.594	0.509	0.425
$U_{1y}M_{fy}/M_{ry}$	0.045	0.038	0.038	0.038	0.038	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.038	0.038	0.038	0.045	0.045
Interaction	0.483	0.524	0.572	0.562	0.628	0.686	0.680	0.700	0.720	0.714	0.713	0.711	0.719	0.676	0.626	0.637	0.560	0.476

3.3. Lateral Torsional Buckling:

λ_{max}	0.090	0.090	0.090	0.155	0.155	0.155	0.090	0.090	0.090	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167
C_r (kN)	5207	5207	5207	5187	5187	5187	5207	5207	5207	5181	5181	5181	5181	5181	5181	5181	5181	5181
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1887	1887	1887	1836	1836	1836	1887	1887	1887	1825	1825	1825	1825	1825	1825	1825	1825	1825
M_{ry} (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
C_f/C_r	0.006	0.006	0.006	0.004	0.004	0.004	0.004	0.004	0.004	0.003	0.003	0.003	0.004	0.004	0.004	0.006	0.006	0.006
$U_{1x}M_{fx}/M_{rx}$	0.390	0.434	0.478	0.483	0.544	0.605	0.583	0.601	0.619	0.636	0.634	0.632	0.639	0.593	0.546	0.554	0.476	0.397
$U_{1y}M_{fy}/M_{ry}$	0.045	0.038	0.038	0.038	0.038	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.038	0.038	0.038	0.045	0.045
Interaction	0.441	0.477	0.521	0.525	0.586	0.640	0.617	0.635	0.653	0.669	0.668	0.666	0.673	0.634	0.587	0.598	0.526	0.447
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.483	0.524	0.572	0.562	0.628	0.686	0.680	0.700	0.720	0.714	0.713	0.711	0.719	0.676	0.626	0.637	0.560	0.476

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	684	684	684	685	685	685	686	686	686	687	687	687	688	688	688	689	689	689
Member Label	-	-	-	-14S	-14S	-14S	16N-	16N-	16N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	14S	16N	---			---			---			---	
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Member Factored Load Effects:

C_f (kN)	52	52	52	77	77	77	89	75	75	63	63	63	55	55	55	51	51	51
$M_{fx\ (comp)}$ (kNm)	748	548	347	359	180	0	0	157	321	290	507	722	692	779	866	843	957	1071
$M_{fy\ (comp)}$ (kNm)	6	6	6	6	3	0	0	22	45	27	39	51	39	38	38	34	31	28
T_f (kN)	34	34	34	9	9	9	6	18	18	55	55	55	107	107	107	147	147	147
$M_{fx\ (tension)}$ (kNm)	748	548	347	359	180	0	0	157	321	290	507	722	692	779	866	843	957	1071
$M_{fy\ (tension)}$ (kNm)	6	6	6	6	3	0	0	22	45	27	39	51	39	38	38	34	31	28
V_{fx} (kN)	1	1	1	9	9	9	94	72	72	30	30	30	21	21	21	23	23	23
V_{fy} (kN)	427	428	430	554	555	556	542	512	511	446	444	443	338	337	336	284	283	281

Gross Section Properties:

Ag (mm^2)	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034
I_x (mm^4)	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09
I_y (mm^4)	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
J (mm^4)	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06
r_x (mm)	396	396	396	396	396	396	396	396	396	396	396	396	396	396	396	396	396	396
r_y (mm)	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
S_x (mm^3)	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06
S_y (mm^3)	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	991	991	991	648	648	648	648	648	648	991	991	991	533	533	533	914	914	914

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	684	684	684	685	685	685	686	686	686	687	687	687	688	688	688	689	689	689
Member Label	-	-	-	-14S	-14S	-14S	16N-	16N-	16N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	14S	16N	---			---			---			---	
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9
Webs in combined flexural and axial compression	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	684	684	684	685	685	685	686	686	686	687	687	687	688	688	688	689	689	689
Member Label	-	-	-	-14S	-14S	-14S	16N-	16N-	16N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	14S	16N	---			---			---			---	
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	991	991	991	648	648	648	648	648	648	991	991	991	533	533	533	914	914	914
L_y (mm)	991	991	991	648	648	648	648	648	648	991	991	991	533	533	533	914	914	914
λ_{max}	0.167	0.167	0.167	0.110	0.110	0.110	0.110	0.110	0.110	0.167	0.167	0.167	0.090	0.090	0.090	0.155	0.155	0.155
C_r (kN)	5180.9	5180.9	5180.9	5202.7	5202.7	5202.7	5202.7	5202.7	5202.7	5180.9	5180.9	5180.9	5206.9	5206.9	5206.9	5187.1	5187.1	5187.1
$(kL/r)_{max}$	16.2	16.2	16.2	10.6	10.6	10.6	10.6	10.6	10.6	16.2	16.2	16.2	8.7	8.7	8.7	15.0	15.0	15.0
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	216962	216962	216962	507495	507495	507495	507495	507495	507495	216962	216962	216962	748296	748296	748296	254629	254629	254629

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	892	892	892	583	583	583	583	583	583	892	892	892	480	480	480	823	823	823
A_c (mm^2)	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	684	684	684	685	685	685	686	686	686	687	687	687	688	688	688	689	689	689
Member Label	-	-	-	-14S	-14S	-14S	16N-	16N-	16N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	14S	16N	---			---			---			---	
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	5180.9	5180.9	5180.9	5202.7	5202.7	5202.7	5202.7	5202.7	5202.7	5180.9	5180.9	5180.9	5206.9	5206.9	5206.9	5187.1	5187.1	5187.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272
$A_{n(corrosion)}$ (mm^2)	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858
$T_{r(b)}$ (kN)	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858
$T_{r(c)}$ (kN)	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Member ID in CSiBridge	684	684	684	685	685	685	686	686	686	687	687	687	688	688	688	689	689	689
Member Label	-	-	-	-14S	-14S	-14S	16N-	16N-	16N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	14S	16N	---			---			---			---	
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024
$(kL/r)_{max}$	16	16	16	11	11	11	11	11	11	16	16	16	9	9	9	15	15	15
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704
$M_{ry(Laterally\ Supported)}$ (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	991	991	991	648	648	648	648	648	648	991	991	991	533	533	533	914	914	914
L_{uy} (mm)	991	991	991	648	648	648	648	648	648	991	991	991	533	533	533	914	914	914
M_{ux} (kNm) (y weak)	7699	7699	7699	11774	11774	11774	11774	11774	11774	7699	7699	7699	14298	14298	14298	8340	8340	8340
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1825.2	1825.2	1825.2	1871.8	1871.8	1871.8	1871.8	1871.8	1871.8	1825.2	1825.2	1825.2	1887.3	1887.3	1887.3	1835.6	1835.6	1835.6
M_{ry} (kNm)	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4
w_y (mm)	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
A_{wy} (mm^2)	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398
h_y/w_y	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9
F_{cr} (N/mm^2)	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772
(V_f/V_r)<=1	0.241	0.241	0.243	0.313	0.313	0.314	0.306	0.289	0.288	0.252	0.251	0.250	0.191	0.190	0.190	0.160	0.160	0.159

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.010	0.010	0.010	0.015	0.015	0.015	0.017	0.014	0.014	0.012	0.012	0.012	0.011	0.011	0.011	0.010	0.010	0.010
(T_f/T_r)<=1	0.006	0.006	0.006	0.002	0.002	0.002	0.001	0.003	0.003	0.010	0.010	0.010	0.019	0.019	0.019	0.027	0.027	0.027

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.006	0.006	0.006	0.002	0.002	0.002	0.001	0.003	0.003	0.010	0.010	0.010	0.019	0.019	0.019	0.027	0.027	0.027
M_{fx}/M_{rx}<=1	0.410	0.300	0.190	0.192	0.096	0.000	0.000	0.084	0.171	0.159	0.278	0.396	0.367	0.413	0.459	0.459	0.521	0.583
M_{fy}/M_{ry}<=1	0.045	0.045	0.045	0.045	0.023	0.000	0.000	0.165	0.338	0.203	0.293	0.383	0.293	0.286	0.286	0.256	0.233	0.210
$T_f/T_r+M_f/M_r$<=1	0.461	0.352	0.241	0.239	0.120	0.002	0.001	0.253	0.513	0.372	0.581	0.789	0.679	0.718	0.764	0.742	0.781	0.821
$M_f/M_r-T_fS/M_rA$<=1	0.443	0.333	0.223	0.234	0.116	0.000	0.000	0.243	0.504	0.343	0.552	0.760	0.623	0.661	0.708	0.663	0.703	0.742

Member ID in CSiBridge	684	684	684	685	685	685	686	686	686	687	687	687	688	688	688	689	689	689
Member Label	-	-	-	-14S	-14S	-14S	16N-	16N-	16N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	14S	16N	---			---			---			---	
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	9.16E+06	9.16E+06	9.16E+06	2.14E+07	2.14E+07	2.14E+07	2.14E+07	2.14E+07	2.14E+07	9.16E+06	9.16E+06	9.16E+06	3.16E+07	3.16E+07	3.16E+07	1.08E+07	1.08E+07	1.08E+07
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	216962	216962	216962	507495	507495	507495	507495	507495	507495	216962	216962	216962	748296	748296	748296	254629	254629	254629
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.010**	**0.010**	**0.010**	**0.015**	**0.015**	**0.015**	**0.017**	**0.014**	**0.014**	**0.012**	**0.012**	**0.012**	**0.011**	**0.011**	**0.011**	**0.010**	**0.010**	**0.010**
$U_{1x}M_{fx}/M_{rx}$	**0.439**	**0.322**	**0.204**	**0.211**	**0.106**	**0.000**	**0.000**	**0.092**	**0.188**	**0.170**	**0.298**	**0.424**	**0.406**	**0.457**	**0.508**	**0.495**	**0.562**	**0.628**
$U_{1y}M_{fy}/M_{ry}$	**0.045**	**0.045**	**0.045**	**0.045**	**0.023**	**0.000**	**0.000**	**0.165**	**0.338**	**0.203**	**0.293**	**0.384**	**0.293**	**0.286**	**0.286**	**0.256**	**0.233**	**0.211**
Interaction	**0.494**	**0.377**	**0.259**	**0.271**	**0.143**	**0.015**	**0.017**	**0.272**	**0.541**	**0.385**	**0.603**	**0.819**	**0.710**	**0.753**	**0.804**	**0.760**	**0.804**	**0.849**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.167	0.167	0.167	0.110	0.110	0.110	0.110	0.110	0.110	0.167	0.167	0.167	0.090	0.090	0.090	0.155	0.155	0.155
$C_{r\ (K=1)}$ (kN)	5181	5181	5181	5203	5203	5203	5203	5203	5203	5181	5181	5181	5207	5207	5207	5187	5187	5187
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.010**	**0.010**	**0.010**	**0.015**	**0.015**	**0.015**	**0.017**	**0.014**	**0.014**	**0.012**	**0.012**	**0.012**	**0.011**	**0.011**	**0.011**	**0.010**	**0.010**	**0.010**
$U_{1x}M_{fx}/M_{rx}$	**0.439**	**0.322**	**0.204**	**0.211**	**0.106**	**0.000**	**0.000**	**0.092**	**0.188**	**0.170**	**0.298**	**0.424**	**0.406**	**0.457**	**0.508**	**0.495**	**0.562**	**0.628**
$U_{1y}M_{fy}/M_{ry}$	**0.045**	**0.045**	**0.045**	**0.045**	**0.023**	**0.000**	**0.000**	**0.165**	**0.338**	**0.203**	**0.293**	**0.384**	**0.293**	**0.286**	**0.286**	**0.256**	**0.233**	**0.211**
Interaction	**0.494**	**0.377**	**0.259**	**0.271**	**0.143**	**0.015**	**0.017**	**0.272**	**0.541**	**0.385**	**0.603**	**0.819**	**0.710**	**0.753**	**0.804**	**0.760**	**0.804**	**0.849**

3.3. Lateral Torsional Buckling:

λ_{max}	0.167	0.167	0.167	0.110	0.110	0.110	0.110	0.110	0.110	0.167	0.167	0.167	0.090	0.090	0.090	0.155	0.155	0.155
C_r (kN)	5181	5181	5181	5203	5203	5203	5203	5203	5203	5181	5181	5181	5207	5207	5207	5187	5187	5187
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1825	1825	1825	1872	1872	1872	1872	1872	1872	1825	1825	1825	1887	1887	1887	1836	1836	1836
M_{ry} (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
C_f/C_r	**0.010**	**0.010**	**0.010**	**0.015**	**0.015**	**0.015**	**0.017**	**0.014**	**0.014**	**0.012**	**0.012**	**0.012**	**0.011**	**0.011**	**0.011**	**0.010**	**0.010**	**0.010**
$U_{1x}M_{fx}/M_{rx}$	**0.410**	**0.300**	**0.190**	**0.192**	**0.096**	**0.000**	**0.000**	**0.084**	**0.171**	**0.159**	**0.278**	**0.396**	**0.367**	**0.413**	**0.459**	**0.459**	**0.521**	**0.583**
$U_{1y}M_{fy}/M_{ry}$	**0.045**	**0.045**	**0.045**	**0.045**	**0.023**	**0.000**	**0.000**	**0.165**	**0.338**	**0.203**	**0.293**	**0.384**	**0.293**	**0.286**	**0.286**	**0.256**	**0.233**	**0.211**
Interaction	**0.465**	**0.355**	**0.245**	**0.252**	**0.134**	**0.015**	**0.017**	**0.264**	**0.524**	**0.374**	**0.583**	**0.791**	**0.670**	**0.709**	**0.755**	**0.725**	**0.764**	**0.804**
Demand/Capacity ≤ 1	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
Highest Ratio	**0.494**	**0.377**	**0.259**	**0.313**	**0.313**	**0.314**	**0.306**	**0.289**	**0.541**	**0.385**	**0.603**	**0.819**	**0.710**	**0.753**	**0.804**	**0.760**	**0.804**	**0.849**

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	690	690	690	691	691	691	692	692	692	693	693	693	694	694	694	695	695	695
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-16S	-16S	-16S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	16S
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Member Factored Load Effects:

C_f (kN)	48	48	48	47	47	47	49	49	49	53	53	53	61	61	61	71	71	84
$M_{fx\ (comp)}$ (kNm)	1056	1089	1122	1118	1136	1112	1122	1036	949	976	829	681	720	505	290	321	157	0
$M_{fy\ (comp)}$ (kNm)	24	25	25	23	25	27	28	32	36	39	42	44	59	44	29	50	24	0
T_f (kN)	174	174	174	183	183	182	163	163	163	118	118	118	51	51	51	6	6	0
$M_{fx\ (tension)}$ (kNm)	1056	1089	1122	1118	1136	1112	1122	1036	949	976	829	681	720	505	290	321	157	0
$M_{fy\ (tension)}$ (kNm)	24	25	25	23	25	27	28	32	36	39	42	44	59	44	29	50	24	0
V_{fx} (kN)	22	22	22	26	26	27	24	24	24	20	20	20	35	35	35	81	81	103
V_{fy} (kN)	175	174	173	137	135	145	216	217	219	304	305	307	441	442	444	512	513	542

Gross Section Properties:

Ag (mm^2)	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034
I_x (mm^4)	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09
I_y (mm^4)	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
J (mm^4)	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06
r_x (mm)	396	396	396	396	396	396	396	396	396	396	396	396	396	396	396	396	396	396
r_y (mm)	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
S_x (mm^3)	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06
S_y (mm^3)	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	533	533	533	991	991	991	991	991	991	991	991	991	991	991	991	648	648	648

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	690	690	690	691	691	691	692	692	692	693	693	693	694	694	694	695	695	695
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-16S	-16S	-16S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	16S
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9
Webs in combined flexural and axial compression	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	690	690	690	691	691	691	692	692	692	693	693	693	694	694	694	695	695	695
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-16S	-16S	-16S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	16S
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	533	533	533	991	991	991	991	991	991	991	991	991	991	991	991	648	648	648
L_y (mm)	533	533	533	991	991	991	991	991	991	991	991	991	991	991	991	648	648	648
λ_{max}	0.090	0.090	0.090	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.110	0.110	0.110
C_r (kN)	5206.9	5206.9	5206.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5202.7	5202.7	5202.7
$(kL/r)_{max}$	8.7	8.7	8.7	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	10.6	10.6	10.6
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	748296	748296	748296	216962	216962	216962	216962	216962	216962	216962	216962	216962	216962	216962	216962	507495	507495	507495

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	480	480	480	892	892	892	892	892	892	892	892	892	892	892	892	583	583	583
A_c (mm^2)	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	690	690	690	691	691	691	692	692	692	693	693	693	694	694	694	695	695	695
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-16S	-16S	-16S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	16S
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	5206.9	5206.9	5206.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5202.7	5202.7	5202.7

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272
$A_{n(corrosion)}$ (mm^2)	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858
$T_{r(b)}$ (kN)	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858
$T_{r(c)}$ (kN)	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	690	690	690	691	691	691	692	692	692	693	693	693	694	694	694	695	695	695
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-16S	-16S	-16S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	16S
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024
$(kL/r)_{max}$	9	9	9	16	16	16	16	16	16	16	16	16	16	16	16	11	11	11
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704
$M_{ry(Laterally\ Supported)}$ (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	533	533	533	991	991	991	991	991	991	991	991	991	991	991	991	648	648	648
L_{uy} (mm)	533	533	533	991	991	991	991	991	991	991	991	991	991	991	991	648	648	648
M_{ux} (kNm) (y weak)	14298	14298	14298	7699	7699	7699	7699	7699	7699	7699	7699	7699	7699	7699	7699	11774	11774	11774
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1887.3	1887.3	1887.3	1825.2	1825.2	1825.2	1825.2	1825.2	1825.2	1825.2	1825.2	1825.2	1825.2	1825.2	1825.2	1871.8	1871.8	1871.8
M_{ry} (kNm)	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4
w_y (mm)	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
A_{wy} (mm^2)	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398
h_y/w_y	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9
F_{cr} (N/mm^2)	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772
(V_f/V_r)<=1	0.099	0.098	0.098	0.077	0.076	0.082	0.122	0.122	0.124	0.172	0.172	0.173	0.249	0.249	0.251	0.289	0.289	0.306

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.010	0.010	0.010	0.012	0.012	0.012	0.014	0.014	0.016
(T_f/T_r)<=1	0.032	0.032	0.032	0.033	0.033	0.033	0.030	0.030	0.030	0.021	0.021	0.021	0.009	0.009	0.009	0.001	0.001	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.032	0.032	0.032	0.033	0.033	0.033	0.030	0.030	0.030	0.021	0.021	0.021	0.009	0.009	0.009	0.001	0.001	0.000
M_{fx}/M_{rx}<=1	0.560	0.577	0.594	0.613	0.622	0.609	0.615	0.568	0.520	0.535	0.454	0.373	0.394	0.277	0.159	0.171	0.084	0.000
M_{fy}/M_{ry}<=1	0.180	0.188	0.188	0.173	0.188	0.203	0.210	0.241	0.271	0.293	0.316	0.331	0.444	0.331	0.218	0.376	0.180	0.000
$T_f/T_r+M_f/M_r$<=1	0.772	0.797	0.814	0.819	0.844	0.845	0.855	0.838	0.820	0.849	0.791	0.725	0.847	0.617	0.386	0.548	0.265	0.000
$M_f/M_r-T_fS/M_rA$<=1	0.680	0.705	0.722	0.721	0.746	0.748	0.768	0.751	0.733	0.786	0.728	0.662	0.820	0.590	0.359	0.545	0.262	0.000

Member ID in CSiBridge	690	690	690	691	691	691	692	692	692	693	693	693	694	694	694	695	695	695
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-16S	-16S	-16S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	16S
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	3.16E+07	3.16E+07	3.16E+07	9.16E+06	9.16E+06	9.16E+06	9.16E+06	9.16E+06	9.16E+06	9.16E+06	9.16E+06	9.16E+06	9.16E+06	9.16E+06	9.16E+06	2.14E+07	2.14E+07	2.14E+07
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	748296	748296	748296	216962	216962	216962	216962	216962	216962	216962	216962	216962	216962	216962	216962	507495	507495	507495
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.010	0.010	0.010	0.012	0.012	0.012	0.014	0.014	0.016
$U_{1x}M_{fx}/M_{rx}$	0.620	0.639	0.658	0.656	0.667	0.653	0.658	0.608	0.557	0.573	0.486	0.400	0.422	0.296	0.170	0.188	0.092	0.000
$U_{1y}M_{fy}/M_{ry}$	0.180	0.188	0.188	0.173	0.188	0.203	0.211	0.241	0.271	0.293	0.316	0.331	0.444	0.331	0.218	0.376	0.180	0.000
Interaction	0.809	0.836	0.856	0.838	0.864	0.865	0.878	0.858	0.837	0.876	0.812	0.741	0.878	0.639	0.400	0.578	0.286	0.016

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.090	0.090	0.090	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.110	0.110	0.110
$C_{r\ (K=1)}$ (kN)	5207	5207	5207	5181	5181	5181	5181	5181	5181	5181	5181	5181	5181	5181	5181	5203	5203	5203
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.010	0.010	0.010	0.012	0.012	0.012	0.014	0.014	0.016
$U_{1x}M_{fx}/M_{rx}$	0.620	0.639	0.658	0.656	0.667	0.653	0.658	0.608	0.557	0.573	0.486	0.400	0.422	0.296	0.170	0.188	0.092	0.000
$U_{1y}M_{fy}/M_{ry}$	0.180	0.188	0.188	0.173	0.188	0.203	0.211	0.241	0.271	0.293	0.316	0.331	0.444	0.331	0.218	0.376	0.180	0.000
Interaction	0.809	0.836	0.856	0.838	0.864	0.865	0.878	0.858	0.837	0.876	0.812	0.741	0.878	0.639	0.400	0.578	0.286	0.016

3.3. Lateral Torsional Buckling:

λ_{max}	0.090	0.090	0.090	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.110	0.110	0.110
C_r (kN)	5207	5207	5207	5181	5181	5181	5181	5181	5181	5181	5181	5181	5181	5181	5181	5203	5203	5203
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1887	1887	1887	1825	1825	1825	1825	1825	1825	1825	1825	1825	1825	1825	1825	1872	1872	1872
M_{ry} (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
C_f/C_r	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.010	0.010	0.010	0.012	0.012	0.012	0.014	0.014	0.016
$U_{1x}M_{fx}/M_{rx}$	0.560	0.577	0.594	0.613	0.622	0.609	0.615	0.568	0.520	0.535	0.454	0.373	0.394	0.277	0.159	0.171	0.084	0.000
$U_{1y}M_{fy}/M_{ry}$	0.180	0.188	0.188	0.173	0.188	0.203	0.211	0.241	0.271	0.293	0.316	0.331	0.444	0.331	0.218	0.376	0.180	0.000
Interaction	0.749	0.774	0.792	0.795	0.819	0.821	0.835	0.818	0.800	0.838	0.780	0.714	0.850	0.619	0.389	0.561	0.278	0.016
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.809	0.836	0.856	0.838	0.864	0.865	0.878	0.858	0.837	0.876	0.812	0.741	0.878	0.639	0.400	0.578	0.289	0.306

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	12	12	12	13	13	13	16	16	16	17	17	17	18	18	18	21	21	21
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Member Factored Load Effects:

C_f (kN)	3	0	7	5	0	4	9	0	2	3	0	5	2	0	4	3	0	3
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	1	2	2	1	2	1	1	2	1	0	2	2	1	1	1	0	2	0
$M_{fx\ (tension)}$ (kNm)	0	143	0	0	150	0	0	145	0	0	143	0	0	120	0	0	123	0
$M_{fy\ (tension)}$ (kNm)	0	3	0	0	3	0	0	3	0	0	3	0	0	2	0	0	2	0
V_{fx} (kN)	4	7	39	15	5	14	36	6	4	5	6	37	4	4	50	17	3	16
V_{fy} (kN)	69	43	137	105	40	105	139	45	79	71	44	138	69	44	123	91	40	91

Gross Section Properties:

Ag (mm^2)	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354
I_x (mm^4)	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08
I_y (mm^4)	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06
J (mm^4)	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05
r_x (mm)	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
r_y (mm)	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
S_x (mm^3)	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05
S_y (mm^3)	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791

Material Properties:

F_Y (MPa)	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	12	12	12	13	13	13	16	16	16	17	17	17	18	18	18	21	21	21
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Webs in combined flexural and axial compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	12	12	12	13	13	13	16	16	16	17	17	17	18	18	18	21	21	21
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
L_y (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1
$(kL/r)_{max}$	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5
(comp. only) kL/r<120	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	12	12	12	13	13	13	16	16	16	17	17	17	18	18	18	21	21	21
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$A_{n(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(b)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(c)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Member ID in CSiBridge	12	12	12	13	13	13	16	16	16	17	17	17	18	18	18	21	21	21
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
F_m	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335
$T_{r(Block\ Shear)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
$(kL/r)_{max}$	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177
$M_{ry(Laterally\ Supported)}$ (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
L_{uy} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
M_{ux} (kNm) (y weak)	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0
M_{ry} (kNm)	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1
w_y (mm)	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188
A_{wy} (mm^2)	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552
h_y/w_y	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
F_{cr} (N/mm^2)	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
$(V_f/V_r)<=1$	0.197	0.123	0.392	0.300	0.114	0.300	0.397	0.129	0.226	0.203	0.126	0.395	0.197	0.126	0.352	0.260	0.114	0.260

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.007	0.000	0.017	0.012	0.000	0.010	0.022	0.000	0.005	0.007	0.000	0.012	0.005	0.000	0.010	0.007	0.000	0.007
$(T_f/T_r)<=1$	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.000

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.000
$M_{fx}/M_{rx}<=1$	0.000	0.737	0.000	0.000	0.773	0.000	0.000	0.747	0.000	0.000	0.737	0.000	0.000	0.619	0.000	0.000	0.634	0.000
$M_{fy}/M_{ry}<=1$	0.000	0.117	0.000	0.000	0.117	0.000	0.000	0.117	0.000	0.000	0.117	0.000	0.000	0.078	0.000	0.000	0.078	0.000
$T_f/T_r+M_f/M_r<=1$	0.001	0.856	0.001	0.001	0.892	0.001	0.001	0.866	0.001	0.000	0.856	0.001	0.001	0.698	0.001	0.000	0.714	0.000
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.852	0.000	0.000	0.888	0.000	0.000	0.862	0.000	0.000	0.852	0.000	0.000	0.696	0.000	0.000	0.710	0.000

Member ID in CSiBridge	12	12	12	13	13	13	16	16	16	17	17	17	18	18	18	21	21	21
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569
U_{1y}	1.01	1.00	1.01	1.01	1.00	1.01	1.02	1.00	1.00	1.01	1.00	1.01	1.00	1.00	1.01	1.01	1.00	1.01
C_f/C_r	0.002	0.000	0.005	0.004	0.000	0.003	0.007	0.000	0.001	0.002	0.000	0.004	0.001	0.000	0.003	0.002	0.000	0.002
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.002	0.000	0.005	0.004	0.000	0.003	0.007	0.000	0.001	0.002	0.000	0.004	0.001	0.000	0.003	0.002	0.000	0.002

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
$C_{r\ (K=1)}$ (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.01	1.00	1.01	1.01	1.00	1.01	1.02	1.00	1.00	1.01	1.00	1.01	1.00	1.00	1.01	1.01	1.00	1.01
C_f/C_r	0.007	0.000	0.017	0.012	0.000	0.010	0.022	0.000	0.005	0.007	0.000	0.012	0.005	0.000	0.010	0.007	0.000	0.007
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.007	0.000	0.017	0.012	0.000	0.010	0.022	0.000	0.005	0.007	0.000	0.012	0.005	0.000	0.010	0.007	0.000	0.007

3.3. Lateral Torsional Buckling:

λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.01	1.00	1.01	1.01	1.00	1.01	1.02	1.00	1.00	1.01	1.00	1.01	1.00	1.00	1.01	1.01	1.00	1.01
M_{rx} (kNm)	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194
M_{ry} (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
C_f/C_r	0.007	0.000	0.017	0.012	0.000	0.010	0.022	0.000	0.005	0.007	0.000	0.012	0.005	0.000	0.010	0.007	0.000	0.007
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.007	0.000	0.017	0.012	0.000	0.010	0.022	0.000	0.005	0.007	0.000	0.012	0.005	0.000	0.010	0.007	0.000	0.007
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.197	0.856	0.392	0.300	0.892	0.300	0.397	0.866	0.226	0.203	0.856	0.395	0.197	0.698	0.352	0.260	0.714	0.260

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	22	22	22	28	28	28	32	32	32	36	36	36	37	37	37	38	38	38
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Member Factored Load Effects:

C_f (kN)	4	0	1	2	0	4	1	0	3	3	0	3	3	0	1	1	0	3
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1
$M_{fx\ (tension)}$ (kNm)	0	120	0	0	119	0	0	110	0	0	112	0	0	110	0	0	109	0
$M_{fy\ (tension)}$ (kNm)	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0
V_{fx} (kN)	47	4	4	4	4	48	5	5	41	16	4	15	39	5	5	5	5	39
V_{fy} (kN)	125	44	73	70	44	124	61	32	79	71	28	71	80	32	62	60	32	80

Gross Section Properties:

Ag (mm^2)	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354
I_x (mm^4)	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08
I_y (mm^4)	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06
J (mm^4)	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05
r_x (mm)	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
r_y (mm)	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
S_x (mm^3)	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05
S_y (mm^3)	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791

Material Properties:

F_Y (MPa)	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	22	22	22	28	28	28	32	32	32	36	36	36	37	37	37	38	38	38
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Webs in combined flexural and axial compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	22	22	22	28	28	28	32	32	32	36	36	36	37	37	37	38	38	38
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
L_y (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1
$(kL/r)_{max}$	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5
(comp. only) kL/r<120	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	22	22	22	28	28	28	32	32	32	36	36	36	37	37	37	38	38	38
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$A_{n(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(b)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(c)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	22	22	22	28	28	28	32	32	32	36	36	36	37	37	37	38	38	38
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
F_m	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335
$T_{r(Block\ Shear)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
$(kL/r)_{max}$	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177
$M_{ry(Laterally\ Supported)}$ (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
L_{uy} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
M_{ux} (kNm) (y weak)	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0
M_{ry} (kNm)	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1
w_y (mm)	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188
A_{wy} (mm^2)	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552
h_y/w_y	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
F_{cr} (N/mm^2)	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
$(V_f/V_r)<=1$	0.357	0.126	0.209	0.200	0.126	0.355	0.174	0.091	0.226	0.203	0.080	0.203	0.229	0.091	0.177	0.172	0.091	0.229

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.010	0.000	0.002	0.005	0.000	0.010	0.002	0.000	0.007	0.007	0.000	0.007	0.007	0.000	0.002	0.002	0.000	0.007
$(T_f/T_r)<=1$	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001
$M_{fx}/M_{rx}<=1$	0.000	0.619	0.000	0.000	0.613	0.000	0.000	0.567	0.000	0.000	0.577	0.000	0.000	0.567	0.000	0.000	0.562	0.000
$M_{fy}/M_{ry}<=1$	0.000	0.078	0.000	0.000	0.078	0.000	0.000	0.078	0.000	0.000	0.078	0.000	0.000	0.078	0.000	0.000	0.078	0.000
$T_f/T_r+M_f/M_r<=1$	0.000	0.698	0.001	0.001	0.692	0.001	0.001	0.646	0.001	0.001	0.656	0.000	0.001	0.646	0.001	0.001	0.641	0.001
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.696	0.000	0.000	0.690	0.000	0.000	0.644	0.000	0.000	0.654	0.000	0.000	0.644	0.000	0.000	0.639	0.000

PARSONS

Member ID in CSiBridge	22	22	22	28	28	28	32	32	32	36	36	36	37	37	37	38	38	38
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569
U_{1y}	1.01	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.01	1.01	1.00	1.01	1.01	1.00	1.00	1.00	1.00	1.01
C_f/C_r	0.003	0.000	0.001	0.001	0.000	0.003	0.001	0.000	0.002	0.002	0.000	0.002	0.002	0.000	0.001	0.001	0.000	0.002
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.003	0.000	0.001	0.001	0.000	0.003	0.001	0.000	0.002	0.002	0.000	0.002	0.002	0.000	0.001	0.001	0.000	0.002

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
$C_{r\ (K=1)}$ (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.01	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.01	1.01	1.00	1.01	1.01	1.00	1.00	1.00	1.00	1.01
C_f/C_r	0.010	0.000	0.002	0.005	0.000	0.010	0.002	0.000	0.007	0.007	0.000	0.007	0.007	0.000	0.002	0.002	0.000	0.007
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.010	0.000	0.002	0.005	0.000	0.010	0.002	0.000	0.007	0.007	0.000	0.007	0.007	0.000	0.002	0.002	0.000	0.007

3.3. Lateral Torsional Buckling:

λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.01	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.01	1.01	1.00	1.01	1.01	1.00	1.00	1.00	1.00	1.01
M_{rx} (kNm)	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194
M_{ry} (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
C_f/C_r	0.010	0.000	0.002	0.005	0.000	0.010	0.002	0.000	0.007	0.007	0.000	0.007	0.007	0.000	0.002	0.002	0.000	0.007
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.010	0.000	0.002	0.005	0.000	0.010	0.002	0.000	0.007	0.007	0.000	0.007	0.007	0.000	0.002	0.002	0.000	0.007
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.357	0.698	0.209	0.200	0.692	0.355	0.174	0.646	0.226	0.203	0.656	0.203	0.229	0.646	0.177	0.172	0.641	0.229

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	39	39	39	40	40	40	41	41	41	42	42	42	43	43	43	44	44	44
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Member Factored Load Effects:

C_f (kN)	1	0	4	3	0	4	4	0	2	2	0	4	1	0	4	4	0	4
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	1	1	1	1	2	0	1	2	1	1	2	1	1	2	1	1	2	1
$M_{fx\ (tension)}$ (kNm)	0	129	0	0	128	0	0	127	0	0	126	0	0	138	0	0	138	0
$M_{fy\ (tension)}$ (kNm)	0	2	0	0	2	0	0	2	0	0	2	0	0	4	0	0	3	0
V_{fx} (kN)	5	4	32	14	3	14	29	4	5	5	4	30	5	7	28	12	6	11
V_{fy} (kN)	84	47	126	97	43	96	126	47	80	80	47	127	86	43	107	95	37	95

Gross Section Properties:

Ag (mm^2)	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354
I_x (mm^4)	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08
I_y (mm^4)	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06
J (mm^4)	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05
r_x (mm)	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
r_y (mm)	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
S_x (mm^3)	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05
S_y (mm^3)	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791

Material Properties:

F_Y (MPa)	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	39	39	39	40	40	40	41	41	41	42	42	42	43	43	43	44	44	44
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Webs in combined flexural and axial compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	39	39	39	40	40	40	41	41	41	42	42	42	43	43	43	44	44	44
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
L_y (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1
$(kL/r)_{max}$	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5
(comp. only) kL/r<120	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	39	39	39	40	40	40	41	41	41	42	42	42	43	43	43	44	44	44
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$A_{n(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(b)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(c)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	39	39	39	40	40	40	41	41	41	42	42	42	43	43	43	44	44	44
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
F_m	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335
$T_{r(Block\ Shear)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
$(kL/r)_{max}$	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177
$M_{ry(Laterally\ Supported)}$ (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
L_{uy} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
M_{ux} (kNm) (y weak)	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0
M_{ry} (kNm)	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1
w_y (mm)	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188
A_{wy} (mm^2)	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552
h_y/w_y	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
F_{cr} (N/mm^2)	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
$(V_f/V_r)<=1$	0.240	0.134	0.360	0.277	0.123	0.274	0.360	0.134	0.229	0.229	0.134	0.363	0.246	0.123	0.306	0.272	0.106	0.272

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.002	0.000	0.010	0.007	0.000	0.010	0.010	0.000	0.005	0.005	0.000	0.010	0.002	0.000	0.010	0.010	0.000	0.010
$(T_f/T_r)<=1$	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
$M_{fx}/M_{rx}<=1$	0.000	0.665	0.000	0.000	0.660	0.000	0.000	0.655	0.000	0.000	0.650	0.000	0.000	0.711	0.000	0.000	0.711	0.000
$M_{fy}/M_{ry}<=1$	0.000	0.078	0.000	0.000	0.078	0.000	0.000	0.078	0.000	0.000	0.078	0.000	0.000	0.157	0.000	0.000	0.117	0.000
$T_f/T_r+M_f/M_r<=1$	0.001	0.744	0.001	0.001	0.740	0.000	0.001	0.734	0.001	0.001	0.729	0.001	0.001	0.869	0.001	0.001	0.830	0.001
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.742	0.000	0.000	0.735	0.000	0.000	0.730	0.000	0.000	0.725	0.000	0.000	0.865	0.000	0.000	0.826	0.000

Member ID in CSiBridge	39	39	39	40	40	40	41	41	41	42	42	42	43	43	43	44	44	44
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569
U_{1y}	1.00	1.00	1.01	1.01	1.00	1.01	1.01	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.01	1.01	1.00	1.01
C_f/C_r	0.001	0.000	0.003	0.002	0.000	0.003	0.003	0.000	0.001	0.001	0.000	0.003	0.001	0.000	0.003	0.003	0.000	0.003
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.001	0.000	0.003	0.002	0.000	0.003	0.003	0.000	0.001	0.001	0.000	0.003	0.001	0.000	0.003	0.003	0.000	0.003

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
$C_{r\ (K=1)}$ (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.01	1.01	1.00	1.01	1.01	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.01	1.01	1.00	1.01
C_f/C_r	0.002	0.000	0.010	0.007	0.000	0.010	0.010	0.000	0.005	0.005	0.000	0.010	0.002	0.000	0.010	0.010	0.000	0.010
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.002	0.000	0.010	0.007	0.000	0.010	0.010	0.000	0.005	0.005	0.000	0.010	0.002	0.000	0.010	0.010	0.000	0.010

3.3. Lateral Torsional Buckling:

λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.01	1.01	1.00	1.01	1.01	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.01	1.01	1.00	1.01
M_{rx} (kNm)	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194
M_{ry} (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
C_f/C_r	0.002	0.000	0.010	0.007	0.000	0.010	0.010	0.000	0.005	0.005	0.000	0.010	0.002	0.000	0.010	0.010	0.000	0.010
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.002	0.000	0.010	0.007	0.000	0.010	0.010	0.000	0.005	0.005	0.000	0.010	0.002	0.000	0.010	0.010	0.000	0.010
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.240	0.744	0.360	0.277	0.740	0.274	0.360	0.734	0.229	0.229	0.729	0.363	0.246	0.869	0.306	0.272	0.830	0.272

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	45	45	45	46	46	46	47	47	47	48	48	48	49	49	49	50	50	50
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Member Factored Load Effects:

C_f (kN)	4	0	2	2	0	4	1	0	4	4	0	4	4	0	2	2	0	5
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	1	2	1	1	2	1	1	2	1	1	2	0	1	2	1	1	2	1
$M_{fx\ (tension)}$ (kNm)	0	136	0	0	135	0	0	153	0	0	153	0	0	150	0	0	150	0
$M_{fy\ (tension)}$ (kNm)	0	4	0	0	4	0	0	4	0	0	3	0	0	4	0	0	4	0
V_{fx} (kN)	26	7	5	5	7	26	5	7	35	14	7	15	36	7	5	5	7	35
V_{fy} (kN)	107	43	82	82	43	107	95	52	135	110	46	109	135	51	90	90	51	135

Gross Section Properties:

Ag (mm^2)	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354
I_x (mm^4)	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08
I_y (mm^4)	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06
J (mm^4)	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05
r_x (mm)	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
r_y (mm)	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
S_x (mm^3)	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05
S_y (mm^3)	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791

Material Properties:

F_Y (MPa)	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	45	45	45	46	46	46	47	47	47	48	48	48	49	49	49	50	50	50
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Webs in combined flexural and axial compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	45	45	45	46	46	46	47	47	47	48	48	48	49	49	49	50	50	50
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
L_y (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1
$(kL/r)_{max}$	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5
(comp. only) kL/r<120	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	45	45	45	46	46	46	47	47	47	48	48	48	49	49	49	50	50	50
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$A_{n(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(b)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(c)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Member ID in CSiBridge	45	45	45	46	46	46	47	47	47	48	48	48	49	49	49	50	50	50
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
F_m	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335
$T_{r(Block\ Shear)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
$(kL/r)_{max}$	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177
$M_{ry(Laterally\ Supported)}$ (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
L_{uy} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
M_{ux} (kNm) (y weak)	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0
M_{ry} (kNm)	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1
w_y (mm)	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188
A_{wy} (mm^2)	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552
h_y/w_y	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
F_{cr} (N/mm^2)	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
$(V_f/V_r)<=1$	0.306	0.123	0.234	0.234	0.123	0.306	0.272	0.149	0.386	0.314	0.132	0.312	0.386	0.146	0.257	0.257	0.146	0.386

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.010	0.000	0.005	0.005	0.000	0.010	0.002	0.000	0.010	0.010	0.000	0.010	0.010	0.000	0.005	0.005	0.000	0.012
$(T_f/T_r)<=1$	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001
$M_{fx}/M_{rx}<=1$	0.000	0.701	0.000	0.000	0.696	0.000	0.000	0.789	0.000	0.000	0.789	0.000	0.000	0.773	0.000	0.000	0.773	0.000
$M_{fy}/M_{ry}<=1$	0.000	0.157	0.000	0.000	0.157	0.000	0.000	0.157	0.000	0.000	0.117	0.000	0.000	0.157	0.000	0.000	0.157	0.000
$T_f/T_r+M_f/M_r<=1$	0.001	0.859	0.001	0.001	0.854	0.001	0.001	0.947	0.001	0.001	0.908	0.000	0.001	0.931	0.001	0.001	0.931	0.001
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.855	0.000	0.000	0.850	0.000	0.000	0.943	0.000	0.000	0.903	0.000	0.000	0.927	0.000	0.000	0.927	0.000

Member ID in CSiBridge	45	45	45	46	46	46	47	47	47	48	48	48	49	49	49	50	50	50
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569
U_{1y}	1.01	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.01	1.01	1.00	1.01	1.01	1.00	1.00	1.00	1.00	1.01
C_f/C_r	0.003	0.000	0.001	0.001	0.000	0.003	0.001	0.000	0.003	0.003	0.000	0.003	0.003	0.000	0.001	0.001	0.000	0.004
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.003	0.000	0.001	0.001	0.000	0.003	0.001	0.000	0.003	0.003	0.000	0.003	0.003	0.000	0.001	0.001	0.000	0.004

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
$C_{r\ (K=1)}$ (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.01	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.01	1.01	1.00	1.01	1.01	1.00	1.00	1.00	1.00	1.01
C_f/C_r	0.010	0.000	0.005	0.005	0.000	0.010	0.002	0.000	0.010	0.010	0.000	0.010	0.010	0.000	0.005	0.005	0.000	0.012
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.010	0.000	0.005	0.005	0.000	0.010	0.002	0.000	0.010	0.010	0.000	0.010	0.010	0.000	0.005	0.005	0.000	0.012

3.3. Lateral Torsional Buckling:

λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.01	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.01	1.01	1.00	1.01	1.01	1.00	1.00	1.00	1.00	1.01
M_{rx} (kNm)	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194
M_{ry} (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
C_f/C_r	0.010	0.000	0.005	0.005	0.000	0.010	0.002	0.000	0.010	0.010	0.000	0.010	0.010	0.000	0.005	0.005	0.000	0.012
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.010	0.000	0.005	0.005	0.000	0.010	0.002	0.000	0.010	0.010	0.000	0.010	0.010	0.000	0.005	0.005	0.000	0.012
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.306	0.859	0.234	0.234	0.854	0.306	0.272	0.947	0.386	0.314	0.908	0.312	0.386	0.931	0.257	0.257	0.931	0.386

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	51	51	51	52	52	52	53	53	53	54	54	54	55	55	55	56	56	56
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Member Factored Load Effects:

C_f (kN)	1	0	4	4	0	4	4	0	2	2	0	4	2	0	4	4	0	4
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	1	2	1	1	2	0	1	2	1	1	2	0	0	2	1	0	2	0
$M_{fx\ (tension)}$ (kNm)	0	136	0	0	137	0	0	135	0	0	134	0	0	144	0	0	148	0
$M_{fy\ (tension)}$ (kNm)	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0
V_{fx} (kN)	5	5	41	17	4	18	42	4	5	5	4	41	5	4	54	20	3	21
V_{fy} (kN)	78	43	115	91	37	90	116	43	75	73	42	116	81	52	141	107	48	107

Gross Section Properties:

Ag (mm^2)	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354
I_x (mm^4)	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08
I_y (mm^4)	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06
J (mm^4)	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05
r_x (mm)	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
r_y (mm)	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
S_x (mm^3)	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05
S_y (mm^3)	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791

Material Properties:

F_Y (MPa)	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	51	51	51	52	52	52	53	53	53	54	54	54	55	55	55	56	56	56
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Webs in combined flexural and axial compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	51	51	51	52	52	52	53	53	53	54	54	54	55	55	55	56	56	56
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
L_y (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1
$(kL/r)_{max}$	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5
(comp. only) kL/r<120	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	51	51	51	52	52	52	53	53	53	54	54	54	55	55	55	56	56	56
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$A_{n(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(b)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(c)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Member ID in CSiBridge	51	51	51	52	52	52	53	53	53	54	54	54	55	55	55	56	56	56
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
F_m	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335
$T_{r(Block\ Shear)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
$(kL/r)_{max}$	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177
$M_{ry(Laterally\ Supported)}$ (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
L_{uy} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
M_{ux} (kNm) (y weak)	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0
M_{ry} (kNm)	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1
w_y (mm)	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188
A_{wy} (mm^2)	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552
h_y/w_y	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
F_{cr} (N/mm^2)	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
$(V_f/V_r)<=1$	0.223	0.123	0.329	0.260	0.106	0.257	0.332	0.123	0.214	0.209	0.120	0.332	0.232	0.149	0.403	0.306	0.137	0.306

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.002	0.000	0.010	0.010	0.000	0.010	0.010	0.000	0.005	0.005	0.000	0.010	0.005	0.000	0.010	0.010	0.000	0.010
$(T_f/T_r)<=1$	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.001	0.001	0.000	0.001	0.000

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.001	0.001	0.000	0.001	0.000
$M_{fx}/M_{rx}<=1$	0.000	0.701	0.000	0.000	0.706	0.000	0.000	0.696	0.000	0.000	0.691	0.000	0.000	0.742	0.000	0.000	0.763	0.000
$M_{fy}/M_{ry}<=1$	0.000	0.078	0.000	0.000	0.078	0.000	0.000	0.078	0.000	0.000	0.078	0.000	0.000	0.078	0.000	0.000	0.078	0.000
$T_f/T_r+M_f/M_r<=1$	0.001	0.781	0.001	0.001	0.786	0.000	0.001	0.776	0.001	0.001	0.770	0.000	0.000	0.822	0.001	0.000	0.843	0.000
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.777	0.000	0.000	0.782	0.000	0.000	0.772	0.000	0.000	0.766	0.000	0.000	0.818	0.000	0.000	0.839	0.000

Member ID in CSiBridge	51	51	51	52	52	52	53	53	53	54	54	54	55	55	55	56	56	56
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569
U_{1y}	1.00	1.00	1.01	1.01	1.00	1.01	1.01	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.01	1.01	1.00	1.01
C_f/C_r	0.001	0.000	0.003	0.003	0.000	0.003	0.003	0.000	0.001	0.001	0.000	0.003	0.001	0.000	0.003	0.003	0.000	0.003
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.001	0.000	0.003	0.003	0.000	0.003	0.003	0.000	0.001	0.001	0.000	0.003	0.001	0.000	0.003	0.003	0.000	0.003

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
$C_{r\ (K=1)}$ (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.01	1.01	1.00	1.01	1.01	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.01	1.01	1.00	1.01
C_f/C_r	0.002	0.000	0.010	0.010	0.000	0.010	0.010	0.000	0.005	0.005	0.000	0.010	0.005	0.000	0.010	0.010	0.000	0.010
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.002	0.000	0.010	0.010	0.000	0.010	0.010	0.000	0.005	0.005	0.000	0.010	0.005	0.000	0.010	0.010	0.000	0.010

3.3. Lateral Torsional Buckling:

λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.01	1.01	1.00	1.01	1.01	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.01	1.01	1.00	1.01
M_{rx} (kNm)	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194
M_{ry} (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
C_f/C_r	0.002	0.000	0.010	0.010	0.000	0.010	0.010	0.000	0.005	0.005	0.000	0.010	0.005	0.000	0.010	0.010	0.000	0.010
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.002	0.000	0.010	0.010	0.000	0.010	0.010	0.000	0.005	0.005	0.000	0.010	0.005	0.000	0.010	0.010	0.000	0.010
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.223	0.781	0.329	0.260	0.786	0.257	0.332	0.776	0.214	0.209	0.770	0.332	0.232	0.822	0.403	0.306	0.843	0.306

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	57	57	57	58	58	58	59	59	59	60	60	60	61	61	61	62	62	62
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Member Factored Load Effects:

C_f (kN)	5	0	2	2	0	4	3	0	7	5	0	4	9	0	2	3	0	5
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	0	2	1	0	2	1	1	2	3	1	2	1	1	2	1	0	2	3
$M_{fx\ (tension)}$ (kNm)	0	145	0	0	143	0	0	153	0	0	160	0	0	155	0	0	153	0
$M_{fy\ (tension)}$ (kNm)	0	2	0	0	2	0	0	3	0	0	3	0	0	3	0	0	3	0
V_{fx} (kN)	56	4	5	4	4	55	4	6	44	17	5	18	44	6	4	4	6	44
V_{fy} (kN)	143	53	86	81	52	142	71	44	141	109	40	108	144	46	83	73	45	142

Gross Section Properties:

Ag (mm^2)	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354
I_x (mm^4)	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08
I_y (mm^4)	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06
J (mm^4)	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05
r_x (mm)	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
r_y (mm)	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
S_x (mm^3)	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05
S_y (mm^3)	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791

Material Properties:

F_Y (MPa)	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	57	57	57	58	58	58	59	59	59	60	60	60	61	61	61	62	62	62
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Webs in combined flexural and axial compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	57	57	57	58	58	58	59	59	59	60	60	60	61	61	61	62	62	62
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
L_y (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1
$(kL/r)_{max}$	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5
(comp. only) kL/r<120	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	57	57	57	58	58	58	59	59	59	60	60	60	61	61	61	62	62	62
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$A_{n(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(b)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(c)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	57	57	57	58	58	58	59	59	59	60	60	60	61	61	61	62	62	62
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
F_m	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335
$T_{r(Block\ Shear)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
$(kL/r)_{max}$	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177
$M_{ry(Laterally\ Supported)}$ (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
L_{uy} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
M_{ux} (kNm) (y weak)	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0
M_{ry} (kNm)	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1
w_y (mm)	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188
A_{wy} (mm^2)	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552
h_y/w_y	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
F_{cr} (N/mm^2)	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
$(V_f/V_r)<=1$	0.409	0.152	0.246	0.232	0.149	0.406	0.203	0.126	0.403	0.312	0.114	0.309	0.412	0.132	0.237	0.209	0.129	0.406

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.012	0.000	0.005	0.005	0.000	0.010	0.007	0.000	0.017	0.012	0.000	0.010	0.022	0.000	0.005	0.007	0.000	0.012
$(T_f/T_r)<=1$	0.000	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.002

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.000	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.002
$M_{fx}/M_{rx}<=1$	0.000	0.747	0.000	0.000	0.737	0.000	0.000	0.789	0.000	0.000	0.825	0.000	0.000	0.799	0.000	0.000	0.789	0.000
$M_{fy}/M_{ry}<=1$	0.000	0.078	0.000	0.000	0.078	0.000	0.000	0.117	0.000	0.000	0.117	0.000	0.000	0.117	0.000	0.000	0.117	0.000
$T_f/T_r+M_f/M_r<=1$	0.000	0.827	0.001	0.000	0.817	0.001	0.001	0.908	0.002	0.001	0.944	0.001	0.001	0.918	0.001	0.000	0.908	0.002
$M_f/M_r-T_fS/M_tA<=1$	0.000	0.823	0.000	0.000	0.813	0.000	0.000	0.903	0.000	0.000	0.940	0.000	0.000	0.914	0.000	0.000	0.903	0.000

Member ID in CSiBridge	57	57	57	58	58	58	59	59	59	60	60	60	61	61	61	62	62	62
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569
U_{1y}	1.01	1.00	1.00	1.00	1.00	1.01	1.01	1.00	1.01	1.01	1.00	1.01	1.02	1.00	1.00	1.01	1.00	1.01
C_f/C_r	0.004	0.000	0.001	0.001	0.000	0.003	0.002	0.000	0.005	0.004	0.000	0.003	0.007	0.000	0.001	0.002	0.000	0.004
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.004	0.000	0.001	0.001	0.000	0.003	0.002	0.000	0.005	0.004	0.000	0.003	0.007	0.000	0.001	0.002	0.000	0.004

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
$C_{r\ (K=1)}$ (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.01	1.00	1.00	1.00	1.00	1.01	1.01	1.00	1.01	1.01	1.00	1.01	1.02	1.00	1.00	1.01	1.00	1.01
C_f/C_r	0.012	0.000	0.005	0.005	0.000	0.010	0.007	0.000	0.017	0.012	0.000	0.010	0.022	0.000	0.005	0.007	0.000	0.012
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.012	0.000	0.005	0.005	0.000	0.010	0.007	0.000	0.017	0.012	0.000	0.010	0.022	0.000	0.005	0.007	0.000	0.012

3.3. Lateral Torsional Buckling:

λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.01	1.00	1.00	1.00	1.00	1.01	1.01	1.00	1.01	1.01	1.00	1.01	1.02	1.00	1.00	1.01	1.00	1.01
M_{rx} (kNm)	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194
M_{ry} (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
C_f/C_r	0.012	0.000	0.005	0.005	0.000	0.010	0.007	0.000	0.017	0.012	0.000	0.010	0.022	0.000	0.005	0.007	0.000	0.012
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.012	0.000	0.005	0.005	0.000	0.010	0.007	0.000	0.017	0.012	0.000	0.010	0.022	0.000	0.005	0.007	0.000	0.012
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.409	0.827	0.246	0.232	0.817	0.406	0.203	0.908	0.403	0.312	0.944	0.309	0.412	0.918	0.237	0.209	0.908	0.406

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	63	63	63	64	64	64	65	65	65	66	66	66	67	67	67	68	68	68
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Member Factored Load Effects:

C_f (kN)	5	0	4	7	0	3	4	0	3	4	0	2	3	0	3	3	0	2
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	0	2	0	0	2	0	0	1	0	0	1	0	0	1	0	1	1	0
$M_{fx\ (tension)}$ (kNm)	0	149	0	0	143	0	0	122	0	0	118	0	0	111	0	0	108	0
$M_{fy\ (tension)}$ (kNm)	0	3	0	0	3	0	0	2	0	0	2	0	0	2	0	0	2	0
V_{fx} (kN)	14	5	14	37	6	5	16	3	16	47	4	4	16	4	15	38	5	5
V_{fy} (kN)	104	40	105	138	43	70	90	40	91	124	44	68	70	28	70	79	32	58

Gross Section Properties:

Ag (mm^2)	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354
I_x (mm^4)	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08
I_y (mm^4)	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06
J (mm^4)	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05
r_x (mm)	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
r_y (mm)	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
S_x (mm^3)	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05
S_y (mm^3)	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791

Material Properties:

F_Y (MPa)	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	63	63	63	64	64	64	65	65	65	66	66	66	67	67	67	68	68	68
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Webs in combined flexural and axial compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	63	63	63	64	64	64	65	65	65	66	66	66	67	67	67	68	68	68
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
L_y (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1
$(kL/r)_{max}$	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5
(comp. only) kL/r<120	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	63	63	63	64	64	64	65	65	65	66	66	66	67	67	67	68	68	68
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$A_{n(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(b)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(c)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Member ID in CSiBridge	63	63	63	64	64	64	65	65	65	66	66	66	67	67	67	68	68	68
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
F_m	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335
$T_{r(Block\ Shear)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
$(kL/r)_{max}$	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177
$M_{ry(Laterally\ Supported)}$ (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
L_{uy} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
M_{ux} (kNm) (y weak)	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0
M_{ry} (kNm)	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1
w_y (mm)	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188
A_{wy} (mm^2)	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552
h_y/w_y	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
F_{cr} (N/mm^2)	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
$(V_f/V_r)<=1$	0.297	0.114	0.300	0.395	0.123	0.200	0.257	0.114	0.260	0.355	0.126	0.194	0.200	0.080	0.200	0.226	0.091	0.166

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.012	0.000	0.010	0.017	0.000	0.007	0.010	0.000	0.007	0.010	0.000	0.005	0.007	0.000	0.007	0.007	0.000	0.005
$(T_f/T_r)<=1$	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.001	0.001	0.000

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.001	0.001	0.000
$M_{fx}/M_{rx}<=1$	0.000	0.768	0.000	0.000	0.737	0.000	0.000	0.629	0.000	0.000	0.608	0.000	0.000	0.572	0.000	0.000	0.557	0.000
$M_{fy}/M_{ry}<=1$	0.000	0.117	0.000	0.000	0.117	0.000	0.000	0.078	0.000	0.000	0.078	0.000	0.000	0.078	0.000	0.000	0.078	0.000
$T_f/T_r+M_f/M_r<=1$	0.000	0.887	0.000	0.000	0.856	0.000	0.000	0.708	0.000	0.000	0.687	0.000	0.000	0.651	0.000	0.001	0.636	0.000
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.883	0.000	0.000	0.852	0.000	0.000	0.706	0.000	0.000	0.685	0.000	0.000	0.649	0.000	0.000	0.634	0.000

Member ID in CSiBridge	63	63	63	64	64	64	65	65	65	66	66	66	67	67	67	68	68	68
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569
U_{1y}	1.01	1.00	1.01	1.01	1.00	1.01	1.01	1.00	1.01	1.01	1.00	1.00	1.01	1.00	1.01	1.01	1.00	1.00
C_f/C_r	0.004	0.000	0.003	0.005	0.000	0.002	0.003	0.000	0.002	0.003	0.000	0.001	0.002	0.000	0.002	0.002	0.000	0.001
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.004	0.000	0.003	0.005	0.000	0.002	0.003	0.000	0.002	0.003	0.000	0.001	0.002	0.000	0.002	0.002	0.000	0.001

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
$C_{r\ (K=1)}$ (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.01	1.00	1.01	1.01	1.00	1.01	1.01	1.00	1.01	1.01	1.00	1.00	1.01	1.00	1.01	1.01	1.00	1.00
C_f/C_r	0.012	0.000	0.010	0.017	0.000	0.007	0.010	0.000	0.007	0.010	0.000	0.005	0.007	0.000	0.007	0.007	0.000	0.005
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.012	0.000	0.010	0.017	0.000	0.007	0.010	0.000	0.007	0.010	0.000	0.005	0.007	0.000	0.007	0.007	0.000	0.005

3.3. Lateral Torsional Buckling:

λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.01	1.00	1.01	1.01	1.00	1.01	1.01	1.00	1.01	1.01	1.00	1.00	1.01	1.00	1.01	1.01	1.00	1.00
M_{rx} (kNm)	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194
M_{ry} (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
C_f/C_r	0.012	0.000	0.010	0.017	0.000	0.007	0.010	0.000	0.007	0.010	0.000	0.005	0.007	0.000	0.007	0.007	0.000	0.005
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.012	0.000	0.010	0.017	0.000	0.007	0.010	0.000	0.007	0.010	0.000	0.005	0.007	0.000	0.007	0.007	0.000	0.005
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.297	0.887	0.300	0.395	0.856	0.200	0.257	0.708	0.260	0.355	0.687	0.194	0.200	0.651	0.200	0.226	0.636	0.166

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	69	69	69	70	70	70	71	71	71	72	72	72	73	73	73	74	74	74
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Member Factored Load Effects:

C_f (kN)	4	0	4	4	0	2	4	0	4	4	0	2	4	0	4	4	0	2
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	0	2	0	1	1	0	0	2	0	1	2	0	0	2	0	1	2	0
$M_{fx\ (tension)}$ (kNm)	0	128	0	0	125	0	0	138	0	0	135	0	0	153	0	0	149	0
$M_{fy\ (tension)}$ (kNm)	0	2	0	0	2	0	0	3	0	0	4	0	0	3	0	0	4	0
V_{fx} (kN)	14	3	14	29	4	5	11	6	11	26	7	5	15	7	14	35	7	5
V_{fy} (kN)	96	43	96	126	47	77	95	37	95	107	42	79	109	46	109	135	51	87

Gross Section Properties:

Ag (mm^2)	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354
I_x (mm^4)	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08
I_y (mm^4)	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06
J (mm^4)	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05
r_x (mm)	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
r_y (mm)	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
S_x (mm^3)	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05
S_y (mm^3)	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791

Material Properties:

F_Y (MPa)	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	69	69	69	70	70	70	71	71	71	72	72	72	73	73	73	74	74	74
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Webs in combined flexural and axial compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	69	69	69	70	70	70	71	71	71	72	72	72	73	73	73	74	74	74
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
L_y (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1
$(kL/r)_{max}$	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5
(comp. only) kL/r<120	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	69	69	69	70	70	70	71	71	71	72	72	72	73	73	73	74	74	74
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$A_{n(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(b)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(c)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	69	69	69	70	70	70	71	71	71	72	72	72	73	73	73	74	74	74
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
F_m	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335
$T_{r(Block\ Shear)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
$(kL/r)_{max}$	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177
$M_{ry(Laterally\ Supported)}$ (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
L_{uy} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
M_{ux} (kNm) (y weak)	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0
M_{ry} (kNm)	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1
w_y (mm)	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188
A_{wy} (mm^2)	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552
h_y/w_y	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
F_{cr} (N/mm^2)	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
$(V_f/V_r)<=1$	0.274	0.123	0.274	0.360	0.134	0.220	0.272	0.106	0.272	0.306	0.120	0.226	0.312	0.132	0.312	0.386	0.146	0.249

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.010	0.000	0.010	0.010	0.000	0.005	0.010	0.000	0.010	0.010	0.000	0.005	0.010	0.000	0.010	0.010	0.000	0.005
$(T_f/T_r)<=1$	0.000	0.001	0.000	0.001	0.001	0.000	0.000	0.001	0.000	0.001	0.001	0.000	0.000	0.001	0.000	0.001	0.001	0.000

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.000	0.001	0.000	0.001	0.001	0.000	0.000	0.001	0.000	0.001	0.001	0.000	0.000	0.001	0.000	0.001	0.001	0.000
$M_{fx}/M_{rx}<=1$	0.000	0.660	0.000	0.000	0.644	0.000	0.000	0.711	0.000	0.000	0.696	0.000	0.000	0.789	0.000	0.000	0.768	0.000
$M_{fy}/M_{ry}<=1$	0.000	0.078	0.000	0.000	0.078	0.000	0.000	0.117	0.000	0.000	0.157	0.000	0.000	0.117	0.000	0.000	0.157	0.000
$T_f/T_r+M_f/M_r<=1$	0.000	0.740	0.000	0.001	0.723	0.000	0.000	0.830	0.000	0.001	0.854	0.000	0.000	0.908	0.000	0.001	0.926	0.000
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.735	0.000	0.000	0.721	0.000	0.000	0.826	0.000	0.000	0.850	0.000	0.000	0.903	0.000	0.000	0.922	0.000

PARSONS

Member ID in CSiBridge	69	69	69	70	70	70	71	71	71	72	72	72	73	73	73	74	74	74
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569
U_{1y}	1.01	1.00	1.01	1.01	1.00	1.00	1.01	1.00	1.01	1.01	1.00	1.00	1.01	1.00	1.01	1.01	1.00	1.00
C_f/C_r	0.003	0.000	0.003	0.003	0.000	0.001	0.003	0.000	0.003	0.003	0.000	0.001	0.003	0.000	0.003	0.003	0.000	0.001
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.003	0.000	0.003	0.003	0.000	0.001	0.003	0.000	0.003	0.003	0.000	0.001	0.003	0.000	0.003	0.003	0.000	0.001

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
$C_{r\ (K=1)}$ (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.01	1.00	1.01	1.01	1.00	1.00	1.01	1.00	1.01	1.01	1.00	1.00	1.01	1.00	1.01	1.01	1.00	1.00
C_f/C_r	0.010	0.000	0.010	0.010	0.000	0.005	0.010	0.000	0.010	0.010	0.000	0.005	0.010	0.000	0.010	0.010	0.000	0.005
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.010	0.000	0.010	0.010	0.000	0.005	0.010	0.000	0.010	0.010	0.000	0.005	0.010	0.000	0.010	0.010	0.000	0.005

3.3. Lateral Torsional Buckling:

λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.01	1.00	1.01	1.01	1.00	1.00	1.01	1.00	1.01	1.01	1.00	1.00	1.01	1.00	1.01	1.01	1.00	1.00
M_{rx} (kNm)	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194
M_{ry} (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
C_f/C_r	0.010	0.000	0.010	0.010	0.000	0.005	0.010	0.000	0.010	0.010	0.000	0.005	0.010	0.000	0.010	0.010	0.000	0.005
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.010	0.000	0.010	0.010	0.000	0.005	0.010	0.000	0.010	0.010	0.000	0.005	0.010	0.000	0.010	0.010	0.000	0.005
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.274	0.740	0.274	0.360	0.723	0.220	0.272	0.830	0.272	0.306	0.854	0.226	0.312	0.908	0.312	0.386	0.926	0.249

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	75	75	75	76	76	76	77	77	77	78	78	78	79	79	79	80	80	80
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Member Factored Load Effects:

C_f (kN)	4	0	4	4	0	2	4	0	4	5	0	2	6	0	4	8	0	3
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	0	2	0	0	2	0	0	2	0	0	2	0	0	2	1	0	2	0
$M_{fx\ (tension)}$ (kNm)	0	137	0	0	133	0	0	148	0	0	143	0	0	160	0	0	152	0
$M_{fy\ (tension)}$ (kNm)	0	2	0	0	2	0	0	2	0	0	2	0	0	3	0	0	3	0
V_{fx} (kN)	18	4	18	41	4	5	21	3	21	56	4	4	18	5	17	44	6	4
V_{fy} (kN)	90	37	90	115	42	70	106	47	106	142	52	79	108	40	109	143	45	73

Gross Section Properties:

Ag (mm^2)	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354
I_x (mm^4)	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08
I_y (mm^4)	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06
J (mm^4)	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05
r_x (mm)	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
r_y (mm)	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
S_x (mm^3)	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05
S_y (mm^3)	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791

Material Properties:

F_Y (MPa)	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	75	75	75	76	76	76	77	77	77	78	78	78	79	79	79	80	80	80
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Webs in combined flexural and axial compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	75	75	75	76	76	76	77	77	77	78	78	78	79	79	79	80	80	80
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
L_y (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1
$(kL/r)_{max}$	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5
(comp. only) kL/r<120	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	75	75	75	76	76	76	77	77	77	78	78	78	79	79	79	80	80	80
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$A_{n(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(b)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(c)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Member ID in CSiBridge	75	75	75	76	76	76	77	77	77	78	78	78	79	79	79	80	80	80
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
F_m	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335
$T_{r(Block\ Shear)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
$(kL/r)_{max}$	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177
$M_{ry(Laterally\ Supported)}$ (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
L_{uy} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
M_{ux} (kNm) (y weak)	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0
M_{ry} (kNm)	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1
w_y (mm)	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188
A_{wy} (mm^2)	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552
h_y/w_y	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
F_{cr} (N/mm^2)	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
(V_f/V_r)<=1	0.257	0.106	0.257	0.329	0.120	0.200	0.303	0.134	0.303	0.406	0.149	0.226	0.309	0.114	0.312	0.409	0.129	0.209

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.010	0.000	0.010	0.010	0.000	0.005	0.010	0.000	0.010	0.012	0.000	0.005	0.015	0.000	0.010	0.019	0.000	0.007
(T_f/T_r)<=1	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.001	0.000	0.001	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.001	0.000	0.001	0.000
M_{fx}/M_{rx}<=1	0.000	0.706	0.000	0.000	0.686	0.000	0.000	0.763	0.000	0.000	0.737	0.000	0.000	0.825	0.000	0.000	0.784	0.000
M_{fy}/M_{ry}<=1	0.000	0.078	0.000	0.000	0.078	0.000	0.000	0.078	0.000	0.000	0.078	0.000	0.000	0.117	0.000	0.000	0.117	0.000
$T_f/T_r+M_f/M_r$<=1	0.000	0.786	0.000	0.000	0.765	0.000	0.000	0.843	0.000	0.000	0.817	0.000	0.000	0.944	0.001	0.000	0.902	0.000
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.782	0.000	0.000	0.761	0.000	0.000	0.839	0.000	0.000	0.813	0.000	0.000	0.940	0.000	0.000	0.898	0.000

Member ID in CSiBridge	75	75	75	76	76	76	77	77	77	78	78	78	79	79	79	80	80	80
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569
U_{1y}	1.01	1.00	1.01	1.01	1.00	1.00	1.01	1.00	1.01	1.01	1.00	1.00	1.01	1.00	1.01	1.01	1.00	1.01
C_f/C_r	0.003	0.000	0.003	0.003	0.000	0.001	0.003	0.000	0.003	0.004	0.000	0.001	0.004	0.000	0.003	0.006	0.000	0.002
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.003	0.000	0.003	0.003	0.000	0.001	0.003	0.000	0.003	0.004	0.000	0.001	0.004	0.000	0.003	0.006	0.000	0.002

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
$C_{r\ (K=1)}$ (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.01	1.00	1.01	1.01	1.00	1.00	1.01	1.00	1.01	1.01	1.00	1.00	1.01	1.00	1.01	1.01	1.00	1.01
C_f/C_r	0.010	0.000	0.010	0.010	0.000	0.005	0.010	0.000	0.010	0.012	0.000	0.005	0.015	0.000	0.010	0.019	0.000	0.007
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.010	0.000	0.010	0.010	0.000	0.005	0.010	0.000	0.010	0.012	0.000	0.005	0.015	0.000	0.010	0.019	0.000	0.007

3.3. Lateral Torsional Buckling:

λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.01	1.00	1.01	1.01	1.00	1.00	1.01	1.00	1.01	1.01	1.00	1.00	1.01	1.00	1.01	1.01	1.00	1.01
M_{rx} (kNm)	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194
M_{ry} (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
C_f/C_r	0.010	0.000	0.010	0.010	0.000	0.005	0.010	0.000	0.010	0.012	0.000	0.005	0.015	0.000	0.010	0.019	0.000	0.007
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.010	0.000	0.010	0.010	0.000	0.005	0.010	0.000	0.010	0.012	0.000	0.005	0.015	0.000	0.010	0.019	0.000	0.007
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.257	0.786	0.257	0.329	0.765	0.200	0.303	0.843	0.303	0.406	0.817	0.226	0.309	0.944	0.312	0.409	0.902	0.209

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	622	622	622	623	623	623	626	626	626	627	627	627	630	630	630	631	631	631
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Member Factored Load Effects:

C_f (kN)	3	0	9	6	0	6	2	0	5	5	0	2	2	0	4	5	0	1
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	0	2	0	1	2	0	0	1	0	1	2	1	0	1	1	0	2	1
$M_{fx\ (tension)}$ (kNm)	0	144	0	0	208	0	0	119	0	0	173	0	0	109	0	0	158	0
$M_{fy\ (tension)}$ (kNm)	0	3	0	0	4	0	0	2	0	0	2	0	0	2	0	0	3	0
V_{fx} (kN)	4	6	38	17	6	8	4	4	48	19	4	8	5	5	40	19	5	8
V_{fy} (kN)	74	44	139	118	49	66	70	44	125	103	46	83	59	32	80	78	33	77

Gross Section Properties:

Ag (mm^2)	6354	6354	6354	7419	7419	7419	6354	6354	6354	7419	7419	7419	6354	6354	6354	7419	7419	7419
I_x (mm^4)	1.39E+08	1.39E+08	1.39E+08	2.10E+08	2.10E+08	2.10E+08	1.39E+08	1.39E+08	1.39E+08	2.10E+08	2.10E+08	2.10E+08	1.39E+08	1.39E+08	1.39E+08	2.10E+08	2.10E+08	2.10E+08
I_y (mm^4)	9.67E+06	9.67E+06	9.67E+06	1.19E+07	1.19E+07	1.19E+07	9.67E+06	9.67E+06	9.67E+06	1.19E+07	1.19E+07	1.19E+07	9.67E+06	9.67E+06	9.67E+06	1.19E+07	1.19E+07	1.19E+07
J (mm^4)	2.11E+05	2.11E+05	2.11E+05	2.87E+05	2.87E+05	2.87E+05	2.11E+05	2.11E+05	2.11E+05	2.87E+05	2.87E+05	2.87E+05	2.11E+05	2.11E+05	2.11E+05	2.87E+05	2.87E+05	2.87E+05
r_x (mm)	148	148	148	168	168	168	148	148	148	168	168	168	148	148	148	168	168	168
r_y (mm)	39	39	39	40	40	40	39	39	39	40	40	40	39	39	39	40	40	40
S_x (mm^3)	7.83E+05	7.83E+05	7.83E+05	1.03E+06	1.03E+06	1.03E+06	7.83E+05	7.83E+05	7.83E+05	1.03E+06	1.03E+06	1.03E+06	7.83E+05	7.83E+05	7.83E+05	1.03E+06	1.03E+06	1.03E+06
S_y (mm^3)	1.13E+05	1.13E+05	1.13E+05	1.34E+05	1.34E+05	1.34E+05	1.13E+05	1.13E+05	1.13E+05	1.34E+05	1.34E+05	1.34E+05	1.13E+05	1.13E+05	1.13E+05	1.34E+05	1.34E+05	1.34E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722

Material Properties:

F_Y (MPa)	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	622	622	622	623	623	623	626	626	626	627	627	627	630	630	630	631	631	631
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	7.4	7.4	7.4	7.0	7.0	7.0	7.4	7.4	7.4	7.0	7.0	7.0	7.4	7.4	7.4	7.0	7.0	7.0
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	49.4	49.4	49.4	56.5	56.5	56.5	49.4	49.4	49.4	56.5	56.5	56.5	49.4	49.4	49.4	56.5	56.5	56.5
Webs in combined flexural and axial compression	49.4	49.4	49.4	56.5	56.5	56.5	49.4	49.4	49.4	56.5	56.5	56.5	49.4	49.4	49.4	56.5	56.5	56.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	622	622	622	623	623	623	626	626	626	627	627	627	630	630	630	631	631	631
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722
L_y (mm)	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722
λ_{max}	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172
C_r (kN)	411.1	411.1	411.1	307.7	307.7	307.7	411.1	411.1	411.1	307.7	307.7	307.7	411.1	411.1	411.1	307.7	307.7	307.7
$(kL/r)_{max}$	148.5	148.5	148.5	193.0	193.0	193.0	148.5	148.5	148.5	193.0	193.0	193.0	148.5	148.5	148.5	193.0	193.0	193.0
(comp. only) kL/r<120	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	569	569	569	394	394	394	569	569	569	394	394	394	569	569	569	394	394	394

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	5212	5212	5212	6949	6949	6949	5212	5212	5212	6949	6949	6949	5212	5212	5212	6949	6949	6949
A_c (mm^2)	3177	3177	3177	3710	3710	3710	3177	3177	3177	3710	3710	3710	3177	3177	3177	3710	3710	3710
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	622	622	622	623	623	623	626	626	626	627	627	627	630	630	630	631	631	631
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	3177	3177	3177	3710	3710	3710	3177	3177	3177	3710	3710	3710	3177	3177	3177	3710	3710	3710
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	411.1	411.1	411.1	307.7	307.7	307.7	411.1	411.1	411.1	307.7	307.7	307.7	411.1	411.1	411.1	307.7	307.7	307.7

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6036	6036	6036	7048	7048	7048	6036	6036	6036	7048	7048	7048	6036	6036	6036	7048	7048	7048
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1434	1434	1434	1674	1674	1674	1434	1434	1434	1674	1674	1674	1434	1434	1434	1674	1674	1674
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	5592	5592	5592	6657	6657	6657	5592	5592	5592	6657	6657	6657	5592	5592	5592	6657	6657	6657
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	5592	5592	5592	6657	6657	6657	5592	5592	5592	6657	6657	6657	5592	5592	5592	6657	6657	6657
$A_{n(corrosion)}$ (mm^2)	5312	5312	5312	6324	6324	6324	5312	5312	5312	6324	6324	6324	5312	5312	5312	6324	6324	6324
$T_{r(b)}$ (kN)	1785	1785	1785	2125	2125	2125	1785	1785	1785	2125	2125	2125	1785	1785	1785	2125	2125	2125
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	5312	5312	5312	6324	6324	6324	5312	5312	5312	6324	6324	6324	5312	5312	5312	6324	6324	6324
$T_{r(c)}$ (kN)	1785	1785	1785	2125	2125	2125	1785	1785	1785	2125	2125	2125	1785	1785	1785	2125	2125	2125
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	622	622	622	623	623	623	626	626	626	627	627	627	630	630	630	631	631	631
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
F_m	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335
$T_{r(Block\ Shear)}$ (kN)	1785	1785	1785	2125	2125	2125	1785	1785	1785	2125	2125	2125	1785	1785	1785	2125	2125	2125
$(kL/r)_{max}$	148	148	148	193	193	193	148	148	148	193	193	193	148	148	148	193	193	193
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1434	1434	1434	1674	1674	1674	1434	1434	1434	1674	1674	1674	1434	1434	1434	1674	1674	1674
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	177	177	177	233	233	233	177	177	177	233	233	233	177	177	177	233	233	233
$M_{ry(Laterally\ Supported)}$ (kNm)	26	26	26	30	30	30	26	26	26	30	30	30	26	26	26	30	30	30
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
L_{uy} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
M_{ux} (kNm) (y weak)	1219	1219	1219	1578	1578	1578	1219	1219	1219	1578	1578	1578	1219	1219	1219	1578	1578	1578
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	194.0	194.0	194.0	256.1	256.1	256.1	194.0	194.0	194.0	256.1	256.1	256.1	194.0	194.0	194.0	256.1	256.1	256.1
M_{ry} (kNm)	25.5	25.5	25.5	30.2	30.2	30.2	25.5	25.5	25.5	30.2	30.2	30.2	25.5	25.5	25.5	30.2	30.2	30.2

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	355.1	355.1	355.1	406.4	406.4	406.4	355.1	355.1	355.1	406.4	406.4	406.4	355.1	355.1	355.1	406.4	406.4	406.4
w_y (mm)	7.188	7.188	7.188	7.62	7.62	7.62	7.188	7.188	7.188	7.62	7.62	7.62	7.188	7.188	7.188	7.62	7.62	7.62
A_{wy} (mm^2)	2552	2552	2552	3097	3097	3097	2552	2552	2552	3097	3097	3097	2552	2552	2552	3097	3097	3097
h_y/w_y	49.4	49.4	49.4	53.3	53.3	53.3	49.4	49.4	49.4	53.3	53.3	53.3	49.4	49.4	49.4	53.3	53.3	53.3
F_{cr} (N/mm^2)	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	350	350	350	424	424	424	350	350	350	424	424	424	350	350	350	424	424	424
$(V_f/V_r)<=1$	0.212	0.126	0.397	0.278	0.115	0.156	0.200	0.126	0.357	0.243	0.108	0.196	0.169	0.091	0.229	0.184	0.078	0.181

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.007	0.000	0.022	0.019	0.000	0.019	0.005	0.000	0.012	0.016	0.000	0.006	0.005	0.000	0.010	0.016	0.000	0.003
$(T_f/T_r)<=1$	0.000	0.001	0.000	0.001	0.001	0.000	0.000	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.001

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.000	0.001	0.000	0.001	0.001	0.000	0.000	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.001
$M_{fx}/M_{rx}<=1$	0.000	0.742	0.000	0.000	0.812	0.000	0.000	0.613	0.000	0.000	0.676	0.000	0.000	0.562	0.000	0.000	0.617	0.000
$M_{fy}/M_{ry}<=1$	0.000	0.117	0.000	0.000	0.132	0.000	0.000	0.078	0.000	0.000	0.066	0.000	0.000	0.078	0.000	0.000	0.099	0.000
$T_f/T_r+M_f/M_r<=1$	0.000	0.861	0.000	0.001	0.946	0.000	0.000	0.692	0.000	0.001	0.743	0.001	0.000	0.641	0.001	0.000	0.717	0.001
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.857	0.000	0.000	0.942	0.000	0.000	0.690	0.000	0.000	0.739	0.000	0.000	0.639	0.000	0.000	0.714	0.000

Member ID in CSiBridge	622	622	622	623	623	623	626	626	626	627	627	627	630	630	630	631	631	631
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1358	1358	1358	1586	1586	1586	1358	1358	1358	1586	1586	1586	1358	1358	1358	1586	1586	1586
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.18E+03	8.18E+03	8.18E+03	6.96E+03	6.96E+03	6.96E+03	8.18E+03	8.18E+03	8.18E+03	6.96E+03	6.96E+03	6.96E+03	8.18E+03	8.18E+03	8.18E+03	6.96E+03	6.96E+03	6.96E+03
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	569	569	569	394	394	394	569	569	569	394	394	394	569	569	569	394	394	394
U_{1y}	1.01	1.00	1.02	1.02	1.00	1.02	1.00	1.00	1.01	1.01	1.00	1.01	1.00	1.00	1.01	1.01	1.00	1.00
C_f/C_r	0.002	0.000	0.007	0.004	0.000	0.004	0.001	0.000	0.004	0.003	0.000	0.001	0.001	0.000	0.003	0.003	0.000	0.001
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.002	0.000	0.007	0.004	0.000	0.004	0.001	0.000	0.004	0.003	0.000	0.001	0.001	0.000	0.003	0.003	0.000	0.001

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172
$C_{r\ (K=1)}$ (kN)	411	411	411	308	308	308	411	411	411	308	308	308	411	411	411	308	308	308
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.01	1.00	1.02	1.02	1.00	1.02	1.00	1.00	1.01	1.01	1.00	1.01	1.00	1.00	1.01	1.01	1.00	1.00
C_f/C_r	0.007	0.000	0.022	0.019	0.000	0.019	0.005	0.000	0.012	0.016	0.000	0.006	0.005	0.000	0.010	0.016	0.000	0.003
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.007	0.000	0.022	0.019	0.000	0.019	0.005	0.000	0.012	0.016	0.000	0.006	0.005	0.000	0.010	0.016	0.000	0.003

3.3. Lateral Torsional Buckling:

λ_{max}	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172
C_r (kN)	411	411	411	308	308	308	411	411	411	308	308	308	411	411	411	308	308	308
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.01	1.00	1.02	1.02	1.00	1.02	1.00	1.00	1.01	1.01	1.00	1.01	1.00	1.00	1.01	1.01	1.00	1.00
M_{rx} (kNm)	194	194	194	256	256	256	194	194	194	256	256	256	194	194	194	256	256	256
M_{ry} (kNm)	26	26	26	30	30	30	26	26	26	30	30	30	26	26	26	30	30	30
C_f/C_r	0.007	0.000	0.022	0.019	0.000	0.019	0.005	0.000	0.012	0.016	0.000	0.006	0.005	0.000	0.010	0.016	0.000	0.003
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.007	0.000	0.022	0.019	0.000	0.019	0.005	0.000	0.012	0.016	0.000	0.006	0.005	0.000	0.010	0.016	0.000	0.003
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.212	0.861	0.397	0.278	0.946	0.156	0.200	0.692	0.357	0.243	0.743	0.196	0.169	0.641	0.229	0.184	0.717	0.181

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	634	634	634	635	635	635	638	638	638	639	639	639	642	642	642	643	643	643
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Member Factored Load Effects:

C_f (kN)	2	0	5	5	0	1	2	0	5	5	0	1	2	0	6	6	0	1
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	0	1	1	0	2	2	0	2	1	0	2	2	0	2	1	0	2	2
$M_{fx\ (tension)}$ (kNm)	0	125	0	0	187	0	0	134	0	0	201	0	0	149	0	0	220	0
$M_{fy\ (tension)}$ (kNm)	0	2	0	0	2	0	0	4	0	0	4	0	0	4	0	0	4	0
V_{fx} (kN)	5	4	29	17	4	9	4	7	26	13	7	8	5	7	35	17	7	9
V_{fy} (kN)	77	47	127	111	50	111	79	42	107	107	44	107	86	51	136	123	55	120

Gross Section Properties:

Ag (mm^2)	6354	6354	6354	7419	7419	7419	6354	6354	6354	7419	7419	7419	6354	6354	6354	7419	7419	7419
I_x (mm^4)	1.39E+08	1.39E+08	1.39E+08	2.10E+08	2.10E+08	2.10E+08	1.39E+08	1.39E+08	1.39E+08	2.10E+08	2.10E+08	2.10E+08	1.39E+08	1.39E+08	1.39E+08	2.10E+08	2.10E+08	2.10E+08
I_y (mm^4)	9.67E+06	9.67E+06	9.67E+06	1.19E+07	1.19E+07	1.19E+07	9.67E+06	9.67E+06	9.67E+06	1.19E+07	1.19E+07	1.19E+07	9.67E+06	9.67E+06	9.67E+06	1.19E+07	1.19E+07	1.19E+07
J (mm^4)	2.11E+05	2.11E+05	2.11E+05	2.87E+05	2.87E+05	2.87E+05	2.11E+05	2.11E+05	2.11E+05	2.87E+05	2.87E+05	2.87E+05	2.11E+05	2.11E+05	2.11E+05	2.87E+05	2.87E+05	2.87E+05
r_x (mm)	148	148	148	168	168	168	148	148	148	168	168	168	148	148	148	168	168	168
r_y (mm)	39	39	39	40	40	40	39	39	39	40	40	40	39	39	39	40	40	40
S_x (mm^3)	7.83E+05	7.83E+05	7.83E+05	1.03E+06	1.03E+06	1.03E+06	7.83E+05	7.83E+05	7.83E+05	1.03E+06	1.03E+06	1.03E+06	7.83E+05	7.83E+05	7.83E+05	1.03E+06	1.03E+06	1.03E+06
S_y (mm^3)	1.13E+05	1.13E+05	1.13E+05	1.34E+05	1.34E+05	1.34E+05	1.13E+05	1.13E+05	1.13E+05	1.34E+05	1.34E+05	1.34E+05	1.13E+05	1.13E+05	1.13E+05	1.34E+05	1.34E+05	1.34E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722

Material Properties:

F_Y (MPa)	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	634	634	634	635	635	635	638	638	638	639	639	639	642	642	642	643	643	643
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	7.4	7.4	7.4	7.0	7.0	7.0	7.4	7.4	7.4	7.0	7.0	7.0	7.4	7.4	7.4	7.0	7.0	7.0
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	49.4	49.4	49.4	56.5	56.5	56.5	49.4	49.4	49.4	56.5	56.5	56.5	49.4	49.4	49.4	56.5	56.5	56.5
Webs in combined flexural and axial compression	49.4	49.4	49.4	56.5	56.5	56.5	49.4	49.4	49.4	56.5	56.5	56.5	49.4	49.4	49.4	56.5	56.5	56.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	634	634	634	635	635	635	638	638	638	639	639	639	642	642	642	643	643	643
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722
L_y (mm)	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722
λ_{max}	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172
C_r (kN)	411.1	411.1	411.1	307.7	307.7	307.7	411.1	411.1	411.1	307.7	307.7	307.7	411.1	411.1	411.1	307.7	307.7	307.7
$(kL/r)_{max}$	148.5	148.5	148.5	193.0	193.0	193.0	148.5	148.5	148.5	193.0	193.0	193.0	148.5	148.5	148.5	193.0	193.0	193.0
(comp. only) kL/r<120	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	569	569	569	394	394	394	569	569	569	394	394	394	569	569	569	394	394	394

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	5212	5212	5212	6949	6949	6949	5212	5212	5212	6949	6949	6949	5212	5212	5212	6949	6949	6949
A_c (mm^2)	3177	3177	3177	3710	3710	3710	3177	3177	3177	3710	3710	3710	3177	3177	3177	3710	3710	3710
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	634	634	634	635	635	635	638	638	638	639	639	639	642	642	642	643	643	643
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	3177	3177	3177	3710	3710	3710	3177	3177	3177	3710	3710	3710	3177	3177	3177	3710	3710	3710
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	411.1	411.1	411.1	307.7	307.7	307.7	411.1	411.1	411.1	307.7	307.7	307.7	411.1	411.1	411.1	307.7	307.7	307.7

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6036	6036	6036	7048	7048	7048	6036	6036	6036	7048	7048	7048	6036	6036	6036	7048	7048	7048
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1434	1434	1434	1674	1674	1674	1434	1434	1434	1674	1674	1674	1434	1434	1434	1674	1674	1674
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	5592	5592	5592	6657	6657	6657	5592	5592	5592	6657	6657	6657	5592	5592	5592	6657	6657	6657
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	5592	5592	5592	6657	6657	6657	5592	5592	5592	6657	6657	6657	5592	5592	5592	6657	6657	6657
$A_{n(corrosion)}$ (mm^2)	5312	5312	5312	6324	6324	6324	5312	5312	5312	6324	6324	6324	5312	5312	5312	6324	6324	6324
$T_{r(b)}$ (kN)	1785	1785	1785	2125	2125	2125	1785	1785	1785	2125	2125	2125	1785	1785	1785	2125	2125	2125
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	5312	5312	5312	6324	6324	6324	5312	5312	5312	6324	6324	6324	5312	5312	5312	6324	6324	6324
$T_{r(c)}$ (kN)	1785	1785	1785	2125	2125	2125	1785	1785	1785	2125	2125	2125	1785	1785	1785	2125	2125	2125
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Member ID in CSiBridge	634	634	634	635	635	635	638	638	638	639	639	639	642	642	642	643	643	643
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
F_m	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335
$T_{r(Block\ Shear)}$ (kN)	1785	1785	1785	2125	2125	2125	1785	1785	1785	2125	2125	2125	1785	1785	1785	2125	2125	2125
$(kL/r)_{max}$	148	148	148	193	193	193	148	148	148	193	193	193	148	148	148	193	193	193
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1434	1434	1434	1674	1674	1674	1434	1434	1434	1674	1674	1674	1434	1434	1434	1674	1674	1674
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	177	177	177	233	233	233	177	177	177	233	233	233	177	177	177	233	233	233
$M_{ry(Laterally\ Supported)}$ (kNm)	26	26	26	30	30	30	26	26	26	30	30	30	26	26	26	30	30	30
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
L_{uy} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
M_{ux} (kNm) (y weak)	1219	1219	1219	1578	1578	1578	1219	1219	1219	1578	1578	1578	1219	1219	1219	1578	1578	1578
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	194.0	194.0	194.0	256.1	256.1	256.1	194.0	194.0	194.0	256.1	256.1	256.1	194.0	194.0	194.0	256.1	256.1	256.1
M_{ry} (kNm)	25.5	25.5	25.5	30.2	30.2	30.2	25.5	25.5	25.5	30.2	30.2	30.2	25.5	25.5	25.5	30.2	30.2	30.2

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	355.1	355.1	355.1	406.4	406.4	406.4	355.1	355.1	355.1	406.4	406.4	406.4	355.1	355.1	355.1	406.4	406.4	406.4
w_y (mm)	7.188	7.188	7.188	7.62	7.62	7.62	7.188	7.188	7.188	7.62	7.62	7.62	7.188	7.188	7.188	7.62	7.62	7.62
A_{wy} (mm^2)	2552	2552	2552	3097	3097	3097	2552	2552	2552	3097	3097	3097	2552	2552	2552	3097	3097	3097
h_y/w_y	49.4	49.4	49.4	53.3	53.3	53.3	49.4	49.4	49.4	53.3	53.3	53.3	49.4	49.4	49.4	53.3	53.3	53.3
F_{cr} (N/mm^2)	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	350	350	350	424	424	424	350	350	350	424	424	424	350	350	350	424	424	424
$(V_f/V_r)<=1$	0.220	0.134	0.363	0.262	0.118	0.262	0.226	0.120	0.306	0.252	0.104	0.252	0.246	0.146	0.389	0.290	0.130	0.283

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.005	0.000	0.012	0.016	0.000	0.003	0.005	0.000	0.012	0.016	0.000	0.003	0.005	0.000	0.015	0.019	0.000	0.003
$(T_f/T_r)<=1$	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.001

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.001
$M_{fx}/M_{rx}<=1$	0.000	0.644	0.000	0.000	0.730	0.000	0.000	0.691	0.000	0.000	0.785	0.000	0.000	0.768	0.000	0.000	0.859	0.000
$M_{fy}/M_{ry}<=1$	0.000	0.078	0.000	0.000	0.066	0.000	0.000	0.157	0.000	0.000	0.132	0.000	0.000	0.157	0.000	0.000	0.132	0.000
$T_f/T_r+M_f/M_r<=1$	0.000	0.723	0.001	0.000	0.798	0.001	0.000	0.849	0.001	0.000	0.918	0.001	0.000	0.926	0.001	0.000	0.993	0.001
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.721	0.000	0.000	0.794	0.000	0.000	0.845	0.000	0.000	0.915	0.000	0.000	0.922	0.000	0.000	0.989	0.000

Member ID in CSiBridge	634	634	634	635	635	635	638	638	638	639	639	639	642	642	642	643	643	643
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1358	1358	1358	1586	1586	1586	1358	1358	1358	1586	1586	1586	1358	1358	1358	1586	1586	1586
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.18E+03	8.18E+03	8.18E+03	6.96E+03	6.96E+03	6.96E+03	8.18E+03	8.18E+03	8.18E+03	6.96E+03	6.96E+03	6.96E+03	8.18E+03	8.18E+03	8.18E+03	6.96E+03	6.96E+03	6.96E+03
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	569	569	569	394	394	394	569	569	569	394	394	394	569	569	569	394	394	394
U_{1y}	1.00	1.00	1.01	1.01	1.00	1.00	1.00	1.00	1.01	1.01	1.00	1.00	1.00	1.00	1.01	1.02	1.00	1.00
C_f/C_r	0.001	0.000	0.004	0.003	0.000	0.001	0.001	0.000	0.004	0.003	0.000	0.001	0.001	0.000	0.004	0.004	0.000	0.001
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.001	0.000	0.004	0.003	0.000	0.001	0.001	0.000	0.004	0.003	0.000	0.001	0.001	0.000	0.004	0.004	0.000	0.001

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172
$C_{r\ (K=1)}$ (kN)	411	411	411	308	308	308	411	411	411	308	308	308	411	411	411	308	308	308
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.01	1.01	1.00	1.00	1.00	1.00	1.01	1.01	1.00	1.00	1.00	1.00	1.01	1.02	1.00	1.00
C_f/C_r	0.005	0.000	0.012	0.016	0.000	0.003	0.005	0.000	0.012	0.016	0.000	0.003	0.005	0.000	0.015	0.019	0.000	0.003
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.005	0.000	0.012	0.016	0.000	0.003	0.005	0.000	0.012	0.016	0.000	0.003	0.005	0.000	0.015	0.019	0.000	0.003

3.3. Lateral Torsional Buckling:

λ_{max}	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172
C_r (kN)	411	411	411	308	308	308	411	411	411	308	308	308	411	411	411	308	308	308
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.01	1.01	1.00	1.00	1.00	1.00	1.01	1.01	1.00	1.00	1.00	1.00	1.01	1.02	1.00	1.00
M_{rx} (kNm)	194	194	194	256	256	256	194	194	194	256	256	256	194	194	194	256	256	256
M_{ry} (kNm)	26	26	26	30	30	30	26	26	26	30	30	30	26	26	26	30	30	30
C_f/C_r	0.005	0.000	0.012	0.016	0.000	0.003	0.005	0.000	0.012	0.016	0.000	0.003	0.005	0.000	0.015	0.019	0.000	0.003
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.005	0.000	0.012	0.016	0.000	0.003	0.005	0.000	0.012	0.016	0.000	0.003	0.005	0.000	0.015	0.019	0.000	0.003
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.220	0.723	0.363	0.262	0.798	0.262	0.226	0.849	0.306	0.252	0.918	0.252	0.246	0.926	0.389	0.290	0.993	0.283

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	646	646	646	647	647	647	650	650	650	651	651	651	654	654	654	655	655	655
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Member Factored Load Effects:

C_f (kN)	2	0	5	6	0	1	2	0	6	6	0	3	3	0	10	7	0	6
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	0	2	1	0	2	1	0	2	0	1	2	0	0	2	0	2	2	0
$M_{fx\ (tension)}$ (kNm)	0	133	0	0	198	0	0	143	0	0	207	0	0	153	0	0	225	0
$M_{fy\ (tension)}$ (kNm)	0	2	0	0	3	0	0	2	0	0	2	0	0	3	0	0	3	0
V_{fx} (kN)	5	4	42	22	5	9	5	4	56	24	4	9	4	6	45	20	6	7
V_{fy} (kN)	70	42	118	100	44	99	81	52	144	120	54	95	77	45	144	122	49	69

Gross Section Properties:

Ag (mm^2)	6354	6354	6354	7419	7419	7419	6354	6354	6354	7419	7419	7419	6354	6354	6354	7419	7419	7419
I_x (mm^4)	1.39E+08	1.39E+08	1.39E+08	2.10E+08	2.10E+08	2.10E+08	1.39E+08	1.39E+08	1.39E+08	2.10E+08	2.10E+08	2.10E+08	1.39E+08	1.39E+08	1.39E+08	2.10E+08	2.10E+08	2.10E+08
I_y (mm^4)	9.67E+06	9.67E+06	9.67E+06	1.19E+07	1.19E+07	1.19E+07	9.67E+06	9.67E+06	9.67E+06	1.19E+07	1.19E+07	1.19E+07	9.67E+06	9.67E+06	9.67E+06	1.19E+07	1.19E+07	1.19E+07
J (mm^4)	2.11E+05	2.11E+05	2.11E+05	2.87E+05	2.87E+05	2.87E+05	2.11E+05	2.11E+05	2.11E+05	2.87E+05	2.87E+05	2.87E+05	2.11E+05	2.11E+05	2.11E+05	2.87E+05	2.87E+05	2.87E+05
r_x (mm)	148	148	148	168	168	168	148	148	148	168	168	168	148	148	148	168	168	168
r_y (mm)	39	39	39	40	40	40	39	39	39	40	40	40	39	39	39	40	40	40
S_x (mm^3)	7.83E+05	7.83E+05	7.83E+05	1.03E+06	1.03E+06	1.03E+06	7.83E+05	7.83E+05	7.83E+05	1.03E+06	1.03E+06	1.03E+06	7.83E+05	7.83E+05	7.83E+05	1.03E+06	1.03E+06	1.03E+06
S_y (mm^3)	1.13E+05	1.13E+05	1.13E+05	1.34E+05	1.34E+05	1.34E+05	1.13E+05	1.13E+05	1.13E+05	1.34E+05	1.34E+05	1.34E+05	1.13E+05	1.13E+05	1.13E+05	1.34E+05	1.34E+05	1.34E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	1	1	1
L (mm)	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722

Material Properties:

F_Y (MPa)	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge	646	646	646	647	647	647	650	650	650	651	651	651	654	654	654	655	655	655
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	7.4	7.4	7.4	7.0	7.0	7.0	7.4	7.4	7.4	7.0	7.0	7.0	7.4	7.4	7.4	7.0	7.0	7.0
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	49.4	49.4	49.4	56.5	56.5	56.5	49.4	49.4	49.4	56.5	56.5	56.5	49.4	49.4	49.4	56.5	56.5	56.5
Webs in combined flexural and axial compression	49.4	49.4	49.4	56.5	56.5	56.5	49.4	49.4	49.4	56.5	56.5	56.5	49.4	49.4	49.4	56.5	56.5	56.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	646	646	646	647	647	647	650	650	650	651	651	651	654	654	654	655	655	655
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722
L_y (mm)	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722
λ_{max}	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172
C_r (kN)	411.1	411.1	411.1	307.7	307.7	307.7	411.1	411.1	411.1	307.7	307.7	307.7	411.1	411.1	411.1	320.7	320.7	320.7
$(kL/r)_{max}$	148.5	148.5	148.5	193.0	193.0	193.0	148.5	148.5	148.5	193.0	193.0	193.0	148.5	148.5	148.5	193.0	193.0	193.0
(comp. only) kL/r<120	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	569	569	569	394	394	394	569	569	569	394	394	394	569	569	569	394	394	394

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	5212	5212	5212	6949	6949	6949	5212	5212	5212	6949	6949	6949	5212	5212	5212	6949	6949	6949
A_c (mm^2)	3177	3177	3177	3710	3710	3710	3177	3177	3177	3710	3710	3710	3177	3177	3177	3710	3710	3710
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	646	646	646	647	647	647	650	650	650	651	651	651	654	654	654	655	655	655
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	3177	3177	3177	3710	3710	3710	3177	3177	3177	3710	3710	3710	3177	3177	3177	3710	3710	3710
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	411.1	411.1	411.1	307.7	307.7	307.7	411.1	411.1	411.1	307.7	307.7	307.7	411.1	411.1	411.1	320.7	320.7	320.7

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6036	6036	6036	7048	7048	7048	6036	6036	6036	7048	7048	7048	6036	6036	6036	7345	7345	7345
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1434	1434	1434	1674	1674	1674	1434	1434	1434	1674	1674	1674	1434	1434	1434	1744	1744	1744
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	5592	5592	5592	6657	6657	6657	5592	5592	5592	6657	6657	6657	5592	5592	5592	6657	6657	6657
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	5592	5592	5592	6657	6657	6657	5592	5592	5592	6657	6657	6657	5592	5592	5592	6657	6657	6657
$A_{n(corrosion)}$ (mm^2)	5312	5312	5312	6324	6324	6324	5312	5312	5312	6324	6324	6324	5312	5312	5312	6590	6590	6590
$T_{r(b)}$ (kN)	1785	1785	1785	2125	2125	2125	1785	1785	1785	2125	2125	2125	1785	1785	1785	2214	2214	2214
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	5312	5312	5312	6324	6324	6324	5312	5312	5312	6324	6324	6324	5312	5312	5312	6590	6590	6590
$T_{r(c)}$ (kN)	1785	1785	1785	2125	2125	2125	1785	1785	1785	2125	2125	2125	1785	1785	1785	2214	2214	2214
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Member ID in CSiBridge	646	646	646	647	647	647	650	650	650	651	651	651	654	654	654	655	655	655
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
F_m	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335
$T_{r(Block\ Shear)}$ (kN)	1785	1785	1785	2125	2125	2125	1785	1785	1785	2125	2125	2125	1785	1785	1785	2214	2214	2214
$(kL/r)_{max}$	148	148	148	193	193	193	148	148	148	193	193	193	148	148	148	193	193	193
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1434	1434	1434	1674	1674	1674	1434	1434	1434	1674	1674	1674	1434	1434	1434	1744	1744	1744
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	177	177	177	233	233	233	177	177	177	233	233	233	177	177	177	243	243	243
$M_{ry(Laterally\ Supported)}$ (kNm)	26	26	26	30	30	30	26	26	26	30	30	30	26	26	26	32	32	32
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
L_{uy} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
M_{ux} (kNm) (y weak)	1219	1219	1219	1578	1578	1578	1219	1219	1219	1578	1578	1578	1219	1219	1219	1578	1578	1578
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	194.0	194.0	194.0	256.1	256.1	256.1	194.0	194.0	194.0	256.1	256.1	256.1	194.0	194.0	194.0	266.8	266.8	266.8
M_{ry} (kNm)	25.5	25.5	25.5	30.2	30.2	30.2	25.5	25.5	25.5	30.2	30.2	30.2	25.5	25.5	25.5	31.5	31.5	31.5

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	355.1	355.1	355.1	406.4	406.4	406.4	355.1	355.1	355.1	406.4	406.4	406.4	355.1	355.1	355.1	406.4	406.4	406.4
w_y (mm)	7.188	7.188	7.188	7.62	7.62	7.62	7.188	7.188	7.188	7.62	7.62	7.62	7.188	7.188	7.188	7.62	7.62	7.62
A_{wy} (mm^2)	2552	2552	2552	3097	3097	3097	2552	2552	2552	3097	3097	3097	2552	2552	2552	3097	3097	3097
h_y/w_y	49.4	49.4	49.4	53.3	53.3	53.3	49.4	49.4	49.4	53.3	53.3	53.3	49.4	49.4	49.4	53.3	53.3	53.3
F_{cr} (N/mm^2)	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	350	350	350	424	424	424	350	350	350	424	424	424	350	350	350	424	424	424
(V_f/V_r)<=1	0.200	0.120	0.337	0.236	0.104	0.233	0.232	0.149	0.412	0.283	0.127	0.224	0.220	0.129	0.412	0.287	0.115	0.163

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.005	0.000	0.012	0.019	0.000	0.003	0.005	0.000	0.015	0.019	0.000	0.010	0.007	0.000	0.024	0.022	0.000	0.019
(T_f/T_r)<=1	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.000	0.001	0.001	0.000	0.000	0.001	0.000	0.001	0.001	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.000	0.001	0.001	0.000	0.000	0.001	0.000	0.001	0.001	0.000
M_{fx}/M_{rx}<=1	0.000	0.686	0.000	0.000	0.773	0.000	0.000	0.737	0.000	0.000	0.808	0.000	0.000	0.789	0.000	0.000	0.843	0.000
M_{fy}/M_{ry}<=1	0.000	0.078	0.000	0.000	0.099	0.000	0.000	0.078	0.000	0.000	0.066	0.000	0.000	0.117	0.000	0.000	0.095	0.000
$T_f/T_r+M_f/M_r$<=1	0.000	0.765	0.001	0.000	0.874	0.001	0.000	0.817	0.000	0.001	0.876	0.000	0.000	0.908	0.000	0.001	0.940	0.000
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.761	0.000	0.000	0.870	0.000	0.000	0.813	0.000	0.000	0.872	0.000	0.000	0.903	0.000	0.000	0.936	0.000

Member ID in CSiBridge	646	646	646	647	647	647	650	650	650	651	651	651	654	654	654	655	655	655
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1358	1358	1358	1586	1586	1586	1358	1358	1358	1586	1586	1586	1358	1358	1358	1653	1653	1653
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.18E+03	8.18E+03	8.18E+03	6.96E+03	6.96E+03	6.96E+03	8.18E+03	8.18E+03	8.18E+03	6.96E+03	6.96E+03	6.96E+03	8.18E+03	8.18E+03	8.18E+03	6.96E+03	6.96E+03	6.96E+03
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	569	569	569	394	394	394	569	569	569	394	394	394	569	569	569	394	394	394
U_{1y}	1.00	1.00	1.01	1.02	1.00	1.00	1.00	1.00	1.01	1.02	1.00	1.01	1.01	1.00	1.02	1.02	1.00	1.02
C_f/C_r	0.001	0.000	0.004	0.004	0.000	0.001	0.001	0.000	0.004	0.004	0.000	0.002	0.002	0.000	0.007	0.004	0.000	0.004
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.001	0.000	0.004	0.004	0.000	0.001	0.001	0.000	0.004	0.004	0.000	0.002	0.002	0.000	0.007	0.004	0.000	0.004

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172
$C_{r\ (K=1)}$ (kN)	411	411	411	308	308	308	411	411	411	308	308	308	411	411	411	321	321	321
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.01	1.02	1.00	1.00	1.00	1.00	1.01	1.02	1.00	1.01	1.01	1.00	1.02	1.02	1.00	1.02
C_f/C_r	0.005	0.000	0.012	0.019	0.000	0.003	0.005	0.000	0.015	0.019	0.000	0.010	0.007	0.000	0.024	0.022	0.000	0.019
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.005	0.000	0.012	0.019	0.000	0.003	0.005	0.000	0.015	0.019	0.000	0.010	0.007	0.000	0.024	0.022	0.000	0.019

3.3. Lateral Torsional Buckling:

λ_{max}	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172
C_r (kN)	411	411	411	308	308	308	411	411	411	308	308	308	411	411	411	321	321	321
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.01	1.02	1.00	1.00	1.00	1.00	1.01	1.02	1.00	1.01	1.01	1.00	1.02	1.02	1.00	1.02
M_{rx} (kNm)	194	194	194	256	256	256	194	194	194	256	256	256	194	194	194	267	267	267
M_{ry} (kNm)	26	26	26	30	30	30	26	26	26	30	30	30	26	26	26	32	32	32
C_f/C_r	0.005	0.000	0.012	0.019	0.000	0.003	0.005	0.000	0.015	0.019	0.000	0.010	0.007	0.000	0.024	0.022	0.000	0.019
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.005	0.000	0.012	0.019	0.000	0.003	0.005	0.000	0.015	0.019	0.000	0.010	0.007	0.000	0.024	0.022	0.000	0.019
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.200	0.765	0.337	0.236	0.874	0.233	0.232	0.817	0.412	0.283	0.876	0.224	0.220	0.908	0.412	0.287	0.940	0.163

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge													
Member Label													
Station (m)													
Node Label at Station													
Section #													
Element Group													

Member Factored Load Effects:

C_f (kN)													
$M_{fx\ (comp)}$ (kNm)													
$M_{fy\ (comp)}$ (kNm)													
T_f (kN)													
$M_{fx\ (tension)}$ (kNm)													
$M_{fy\ (tension)}$ (kNm)													
V_{fx} (kN)													
V_{fy} (kN)													

Gross Section Properties:

Ag (mm^2)													
I_x (mm^4)													
I_y (mm^4)													
J (mm^4)													
r_x (mm)													
r_y (mm)													
S_x (mm^3)													
S_y (mm^3)													
C_w (mm^6)													
% Corrosion Loss													
L (mm)													

Material Properties:

F_Y (MPa)													
F_u (MPa)													

E (MPa)													
G (MPa)													

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge													
Member Label													
Station (m)													
Node Label at Station													
Section #													
Element Group													

Width-to-thickness ratio of elements in compression Ref: Cl. 10.9.2 S6-14

Legs of angles and elements supported along one edge													
angles in continuous contact with other elements													
Plate girder stiffeners													
Stems of T-sections													
Flanges of I- or T-sections													
plates projecting from compression elements													
outstanding legs of pairs of angles in continuous contact													
Flanges of channels													
Flanges of rectangular hollow structural shapes													
Flanges of box girder sections													
flange cover plates and diaphragm plates between lines of fasteners or welds													
Perforated cover plates													
Webs in axial compression													
Webs in flexural compression													
Webs in combined flexural and axial compression													
Circular and multi-sided hollow sections in axial compression													
Circular and multi-sided hollow sections in axial compression													
Member Class													
Member Class = 3													

Member ID in CSiBridge													
Member Label													
Station (m)													
Node Label at Station													
Section #													
Element Group													

Factored Axial Compression Resistance: Ref: Cl. 10.9.3 S6-14

1. based on fully composite section and flexural buckling:

ϕ_s													
k_x													
k_y													
L_x (mm)													
L_y (mm)													
λ_{max}													
C_r (kN)													
$(kL/r)_{max}$													
(comp. only) kL/r<120													

2. based on shear flexibility in interconnections: Interconnections (1 = YES, Interconnection Type is Present):

Lacing													
Battens													
Perforated Plate													
Cover Plate													

P_e^{min} (Euler, kN)													

Shear Flexibility Factor: Ref: Sections 3.4.3 and 3.4.4 of the Guide to Stability Design Criteria to Metal Structures (GSDCMS), 5th Edition

1. Lacing:

a (mm)													
b (mm)													
ε_aa (mm)													
ε_bb (mm)													
ε_a													
ε_b													
l (mm)													
A_c (mm^2)													
A_d (mm^2)													
A_b (mm^2)													
μ													
P_{cr}/P_e (Fig.3.51)													
k'(sqrt(P_e/P_{cr}))													
λ_y													
Cr' (kN)													
Lacing Governs?													

$\mu = \varepsilon_b/(1+\varepsilon_a)*(b/l)^2*A_c/A_d*((b/\varepsilon_a a)*(1+(\varepsilon_a a/b)^2)^{3/2} + b/(\varepsilon_a a)*A_d/A_b)$

where:

- μ is the shear flexibility factor
- ε_bb is the clear distance between interconnected member components
- ε_aa is the longitudinal distance measured between lacing end WP's
- b is the c/c distance between interconnected member components
- *l* is the member length between tie plates
- A_c is the area of one of the two long. elements
- A_d is the total area of diagonal components (lacing members) in an individual panel
- Ab is the strut member area of strut element in one panel
- a is the longitudinal panel length

Member ID in CSiBridge													
Member Label													
Station (m)													
Node Label at Station													
Section #													
Element Group													

2. Battens:

a (mm)													
b (mm)													
ε_aa (mm)													
ε_bb (mm)													
ε_a													
ε_b													
l (mm)													
A_c (mm^2)													
A_b (mm^2)													
r_c (mm)													
r_b (mm)													
η_c													
η_b													
μ													
P_{cr}/P_e (Fig.3.51)													
K'(sqrt(P_e/P_{cr}))													
λ_γ													
Cr' (kN)													
Battens Govern?													

$$\mu = (1/(l/r_c)^2+(b/2/l)^2)(A_c/A_b*(ab/6r_b^2 + 5.2a/b*\eta_b) + 2.6\varepsilon_a\eta_c+\varepsilon_a^3/12*(a/r_c)^2)$$

where:

A_c,A_b is the area of a single longitudinal and all battens within length a, respectively

r_c,r_b is the radius of gyration of longitudinal (single) and batten elements in plane of buckling, respectively

η_c,η_b is the shear shape factors of the longitudinal and batten elements, respectively

$$\eta_i = A_{gi}/A_{vi}$$

Minimum Factored Compressive Resistance:

C_r^{min} (kN)													

Factored Axial Tensile Resistance: Ref: Cl. 10.8 S6-14

$A_{g(corrosion)}$ (mm^2)													
ϕ_s													
$T_{r(a)}$ (kN)													
ϕ_u													
D_{Hole} (mm)													
ΣW_n t (mm^2)													
$\Sigma(s^2t/4g)$ (mm^2)													
A_n (mm^2)													
$A_{n(corrosion)}$ (mm^2)													
$T_{r(b)}$ (kN)													
Shear Lag Factor													
$A_{ne(corrosion)}$ (mm^2)													
$T_{r(c)}$ (kN)													
U_t													
A_{gv} (mm^2)													
$A_{gv(corrosion)}$ (mm^2)													

- $Tr_{(a)}$ accounts for yielding of the gross section with reduction in section due to corrosion being accounted for.

- $Tr_{(b)}$ accounts for rupture at the critical net section with reduction in section due to corrosion being accounted for.

- $Tr_{(C)}$ accounts for rupture at the critical net section with both corrosion reduction and shear lag effects being accounted for.

- $T_{r(Block\ Shear)}$ accounts for a potential failure involving the simultaneous development of tensile and shear component areas including corrosion.

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge													
Member Label													
Station (m)													
Node Label at Station													
Section #													
Element Group													

F_m													
$T_{r(Block\ Shear)}$ (kN)													
$(kL/r)_{max}$													
kL/r<200													

Minimum Factored Tensile Resistance:

T_r (min) (kN)													
Ductile													

Factored Moment Resistances: Ref: Cl. 10.10 S6-14

ϕ_s													
$M_{rx(Laterally\ Supported)}$ (kNm)													
$M_{ry(Laterally\ Supported)}$ (kNm)													
ω_2													
L_{ux} (mm)													
L_{uy} (mm)													
M_{ux} (kNm) (y weak)													
M_{uy} (kNm) (x weak)													
M_{rx} (kNm)													
M_{ry} (kNm)													

Shear resistance: Ref: Cl. 10.10.5 S6-14

ϕ_s													
h_y (mm)													
w_y (mm)													
A_{wy} (mm^2)													
h_y/w_y													
F_{cr} (N/mm^2)													
F_t (N/mm^2)													
V_{ry} (kN)													
$(V_f/V_r)<=1$													

Beam Column Checks: Ref: Cl. 10.9.4 & Cl. 10.8.3 S6-14

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$													
$(T_f/T_r)<=1$													

2. Axial Tension and Bending:

$(T_f/T_r)<=1$													
$M_{fx}/M_{rx}<=1$													
$M_{fy}/M_{ry}<=1$													
$T_f/T_r+M_f/M_r<=1$													
$M_f/M_r-T_fS/M_rA<=1$													

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS1 - Evaluation Level 1)

Member ID in CSiBridge													
Member Label													
Station (m)													
Node Label at Station													
Section #													
Element Group													

3. Axial Compression and Bending:

$C_f/C_r + U_{1x}M_{fx}/M_{rx} + U_{1y}M_{fy}/M_{ry} <= 1$

3.1. Cross-Sectional Strength (members in braced frames only):

C_{r0} (kN)													
ω_{1x}													
C_{ex} (kN)													
U_{1x}													
ω_{1y}													
C_{ey} (kN)													
U_{1y}													
C_f/C_r													
$U_{1x}M_{fx}/M_{rx}$													
$U_{1y}M_{fy}/M_{ry}$													
Interaction													

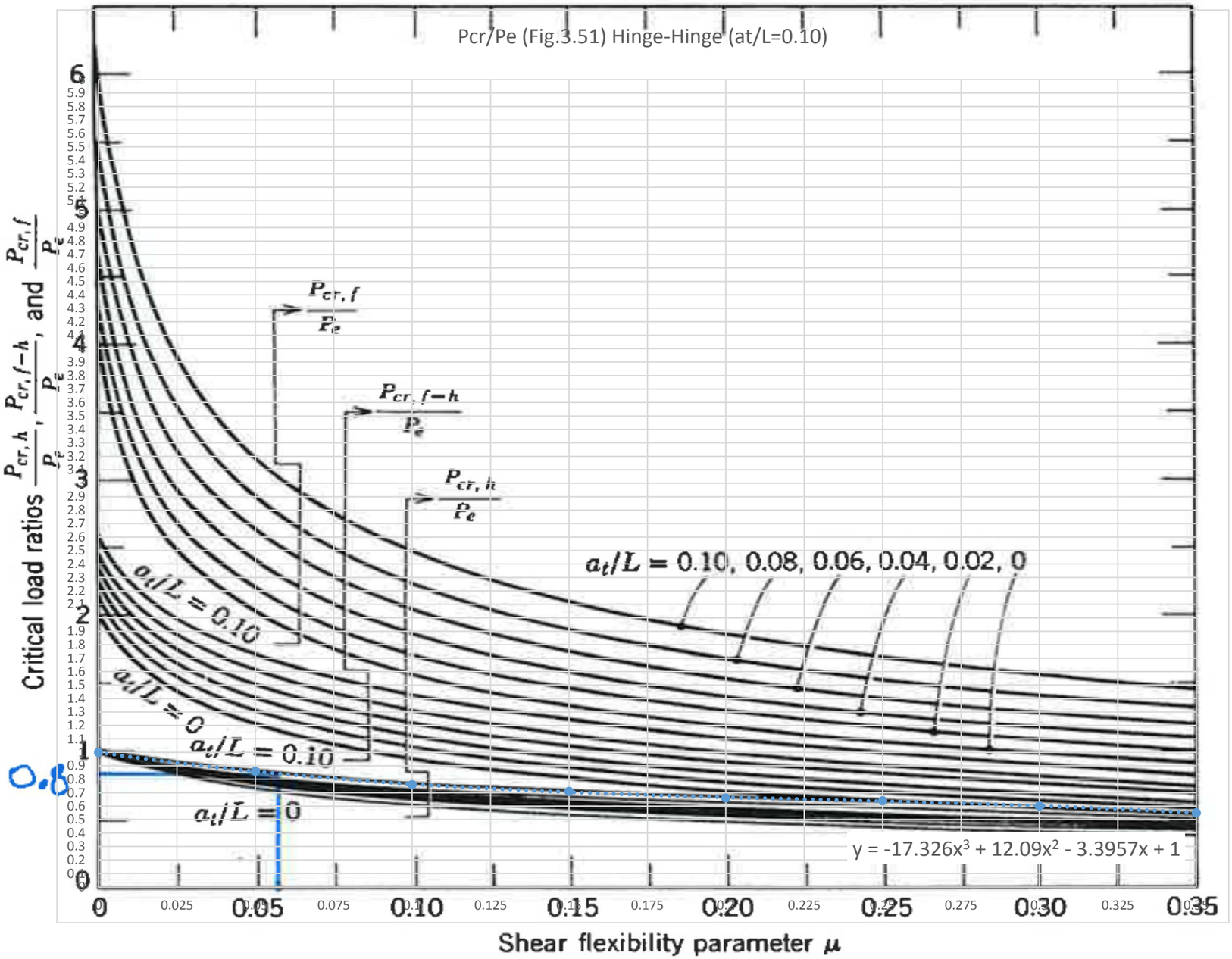
3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$													
$C_{r\ (K=1)}$ (kN)													
ω_{1x}													
U_{1x}													
ω_{1y}													
U_{1y}													
C_f/C_r													
$U_{1x}M_{fx}/M_{rx}$													
$U_{1y}M_{fy}/M_{ry}$													
Interaction													

3.3. Lateral Torsional Buckling:

λ_{max}													
C_r (kN)													
U_{1x}													
U_{1y}													
M_{rx} (kNm)													
M_{ry} (kNm)													
C_f/C_r													
$U_{1x}M_{fx}/M_{rx}$													
$U_{1y}M_{fy}/M_{ry}$													
Interaction													
Demand/Capacity ≤ 1													
Highest Ratio													

Bascule Bridge Structural Evaluation - Shear Flexibility Parameter



μ	P_{cr}/P_e (Fig.3.51) Hinge-Hinge (a_t/L=0.10)
0	1
0.01	
0.02	
0.03	
0.04	
0.05	0.86
0.06	
0.07	
0.08	
0.09	
0.1	0.76
0.11	
0.12	
0.13	
0.14	
0.15	0.71
0.16	
0.17	
0.18	
0.19	
0.2	0.66
0.21	
0.22	
0.23	
0.24	
0.25	0.64
0.26	
0.27	
0.28	
0.29	
0.3	0.6
0.31	
0.32	
0.33	
0.34	
0.35	0.55

Ref: Sections 3.4.3 and 3.4.4 of the Guide to Stability Design Criteria to Metal Structures (GSDCMS), 5th Edition

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	2	2	2	3	3	3	7	7	7	8	8	8	9	9	9	10	10	10
Member Label	1N-0N	1N-0N	1N-0N	4N-1N	4N-1N	4N-1N	5N-4N	5N-4N	5N-4N	5N-8N	5N-8N	5N-8N	8N-9N	8N-9N	8N-9N	9N-12N	9N-12N	9N-12N
Station (m)	0.0	4.2	8.4	0.0	4.2	8.4	0.0	4.4	8.9	0.0	4.4	8.9	0.0	4.7	9.3	0.0	4.7	9.3
Node Label at Station	1N	---	0N	4N	---	1N	5N	---	4N	5N	---	8N	8N	---	9N	9N	---	12N
Section #	Section 01	Section 01	Section 01	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 07	Section 07	Section 07
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal

Member Factored Load Effects:

C_f (kN)	25	24	23	186	181	176	55	54	54	433	438	444	84	85	85	615	622	628
$M_{fx\ (comp)}$ (kNm)	0	15	0	0	4	0	0	12	0	0	5	0	0	13	0	0	7	0
$M_{fy\ (comp)}$ (kNm)	0	8	0	0	8	0	0	9	0	0	9	0	0	10	0	0	10	0
T_f (kN)	66	68	70	22	25	28	298	300	301	79	76	73	547	546	544	98	95	92
$M_{fx\ (tension)}$ (kNm)	0	15	0	0	4	0	0	12	0	0	5	0	0	13	0	0	7	0
$M_{fy\ (tension)}$ (kNm)	0	8	0	0	8	0	0	9	0	0	9	0	0	10	0	0	10	0
V_{fx} (kN)	4	0	4	4	0	4	4	0	4	4	0	4	4	0	4	4	0	4
V_{fy} (kN)	7	0	7	2	0	2	5	0	5	2	0	2	6	0	6	3	0	3

Gross Section Properties:

Ag (mm^2)	12774	12774	12774	9428	9428	9428	9428	9428	9428	9428	9428	9428	9428	9428	9428	11336	11336	11336
I_x (mm^4)	2.61E+08	2.61E+08	2.61E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.35E+08	1.35E+08	1.35E+08
I_y (mm^4)	8.94E+08	8.94E+08	8.94E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	5.04E+08	5.04E+08	5.04E+08
J (mm^4)	7.19E+05	7.19E+05	7.19E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	6.28E+05	6.28E+05	6.28E+05
r_x (mm)	143	143	143	113	113	113	113	113	113	113	113	113	113	113	113	109	109	109
r_y (mm)	265	265	265	211	211	211	211	211	211	211	211	211	211	211	211	211	211	211
S_x (mm^3)	1.37E+06	1.37E+06	1.37E+06	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05	8.83E+05	8.83E+05	8.83E+05
S_y (mm^3)	2.73E+06	2.73E+06	2.73E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	2.21E+06	2.21E+06	2.21E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	6	6	6
L (mm)	8408	8408	8408	8408	8408	8408	8860	8860	8860	8860	8860	8860	9330	9330	9330	9330	9330	9330

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	2	2	2	3	3	3	7	7	7	8	8	8	9	9	9	10	10	10
Member Label	1N-0N	1N-0N	1N-0N	4N-1N	4N-1N	4N-1N	5N-4N	5N-4N	5N-4N	5N-8N	5N-8N	5N-8N	8N-9N	8N-9N	8N-9N	9N-12N	9N-12N	9N-12N
Station (m)	0.0	4.2	8.4	0.0	4.2	8.4	0.0	4.4	8.9	0.0	4.4	8.9	0.0	4.7	9.3	0.0	4.7	9.3
Node Label at Station	1N	---	0N	4N	---	1N	5N	---	4N	5N	---	8N	8N	---	9N	9N	---	12N
Section #	Section 01	Section 01	Section 01	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 07	Section 07	Section 07
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels	5.2	5.2	5.2	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.3	6.3	6.3
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	37.5	37.5	37.5	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	23.5	23.5	23.5
Webs in flexural compression	37.5	37.5	37.5	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	23.5	23.5	23.5
Webs in combined flexural and axial compression	37.5	37.5	37.5	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	23.5	23.5	23.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	2	2	2	3	3	3	7	7	7	8	8	8	9	9	9	10	10	10
Member Label	1N-0N	1N-0N	1N-0N	4N-1N	4N-1N	4N-1N	5N-4N	5N-4N	5N-4N	5N-8N	5N-8N	5N-8N	8N-9N	8N-9N	8N-9N	9N-12N	9N-12N	9N-12N
Station (m)	0.0	4.2	8.4	0.0	4.2	8.4	0.0	4.4	8.9	0.0	4.4	8.9	0.0	4.7	9.3	0.0	4.7	9.3
Node Label at Station	1N	---	0N	4N	---	1N	5N	---	4N	5N	---	8N	8N	---	9N	9N	---	12N
Section #	Section 01	Section 01	Section 01	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 07	Section 07	Section 07
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	8408	8408	8408	8408	8408	8408	8860	8860	8860	8860	8860	8860	9330	9330	9330	9330	9330	9330
L_y (mm)	8408	8408	8408	8408	8408	8408	8860	8860	8860	8860	8860	8860	9330	9330	9330	9330	9330	9330
λ_{max}	0.606	0.606	0.606	0.767	0.767	0.767	0.809	0.809	0.809	0.809	0.809	0.809	0.852	0.852	0.852	0.883	0.883	0.883
C_r (kN)	1623.7	1623.7	1623.7	1057.5	1057.5	1057.5	1019.9	1019.9	1019.9	1019.9	1019.9	1019.9	980.9	980.9	980.9	1345.9	1345.9	1345.9
$(kL/r)_{max}$	58.8	58.8	58.8	74.4	74.4	74.4	78.4	78.4	78.4	78.4	78.4	78.4	82.6	82.6	82.6	85.6	85.6	85.6
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	7284	7284	7284	3343	3343	3343	3011	3011	3011	3011	3011	3011	2715	2715	2715	3051	3051	3051

Shear Flexibility Factor:

1. Lacing:

a (mm)	657	657	657	439	439	439	439	439	439	439	439	439	439	439	439	435	435	435
b (mm)	569	569	569	380	380	380	380	380	380	380	380	380	380	380	380	376	376	376
ε_aa (mm)	657	657	657	439	439	439	439	439	439	439	439	439	439	439	439	435	435	435
ε_bb (mm)	569	569	569	380	380	380	380	380	380	380	380	380	380	380	380	376	376	376
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	5528	5528	5528	5893	5893	5893	6423	6423	6423	6423	6423	6423	6893	6893	6893	6930	6930	6930
A_c (mm^2)	6387	6387	6387	4714	4714	4714	4714	4714	4714	4714	4714	4714	4714	4714	4714	5668	5668	5668
A_d (mm^2)	845	845	845	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
A_b (mm^2)	845	845	845	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
μ	0.1582	0.1582	0.1582	0.0712	0.0712	0.0712	0.0599	0.0599	0.0599	0.0599	0.0599	0.0599	0.0520	0.0520	0.0520	0.0607	0.0607	0.0607
P_{cr}/P_e (Fig.3.51)	0.70	0.70	0.70	0.81	0.81	0.81	0.84	0.84	0.84	0.84	0.84	0.84	0.85	0.85	0.85	0.83	0.83	0.83
k'(sqrt(P_e/P_{cr}))	1.198	1.198	1.198	1.109	1.109	1.109	1.094	1.094	1.094	1.094	1.094	1.094	1.082	1.082	1.082	1.095	1.095	1.095
λ_v	0.392	0.392	0.392	0.456	0.456	0.456	0.474	0.474	0.474	0.474	0.474	0.474	0.494	0.494	0.494	0.499	0.499	0.499
Cr' (kN)	1822.0	1822.0	1822.0	1308.4	1308.4	1308.4	1297.0	1297.0	1297.0	1297.0	1297.0	1297.0	1283.7	1283.7	1283.7	1808.1	1808.1	1808.1
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	2	2	2	3	3	3	7	7	7	8	8	8	9	9	9	10	10	10
Member Label	1N-0N	1N-0N	1N-0N	4N-1N	4N-1N	4N-1N	5N-4N	5N-4N	5N-4N	5N-8N	5N-8N	5N-8N	8N-9N	8N-9N	8N-9N	9N-12N	9N-12N	9N-12N
Station (m)	0.0	4.2	8.4	0.0	4.2	8.4	0.0	4.4	8.9	0.0	4.4	8.9	0.0	4.7	9.3	0.0	4.7	9.3
Node Label at Station	1N	---	0N	4N	---	1N	5N	---	4N	5N	---	8N	8N	---	9N	9N	---	12N
Section #	Section 01	Section 01	Section 01	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 07	Section 07	Section 07
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	6387	6387	6387	4714	4714	4714	4714	4714	4714	4714	4714	4714	4714	4714	4714	5668	5668	5668
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	1623.7	1623.7	1623.7	1057.5	1057.5	1057.5	1019.9	1019.9	1019.9	1019.9	1019.9	1019.9	980.9	980.9	980.9	1345.9	1345.9	1345.9

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	10219	10219	10219	7542	7542	7542	7542	7542	7542	7542	7542	7542	7542	7542	7542	10656	10656	10656
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	2039	2039	2039	1505	1505	1505	1505	1505	1505	1505	1505	1505	1505	1505	1505	2126	2126	2126
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	12012	12012	12012	6793	6793	6793	6793	6793	6793	6793	6793	6793	6793	6793	6793	8249	8249	8249
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	12012	12012	12012	6793	6793	6793	6793	6793	6793	6793	6793	6793	6793	6793	6793	8249	8249	8249
$A_{n(corrosion)}$ (mm^2)	9610	9610	9610	5435	5435	5435	5435	5435	5435	5435	5435	5435	5435	5435	5435	7754	7754	7754
$T_{r(b)}$ (kN)	3229	3229	3229	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	2605	2605	2605
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	9610	9610	9610	5435	5435	5435	5435	5435	5435	5435	5435	5435	5435	5435	5435	7754	7754	7754
$T_{r(c)}$ (kN)	3229	3229	3229	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	2605	2605	2605
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	2	2	2	3	3	3	7	7	7	8	8	8	9	9	9	10	10	10
Member Label	1N-0N	1N-0N	1N-0N	4N-1N	4N-1N	4N-1N	5N-4N	5N-4N	5N-4N	5N-8N	5N-8N	5N-8N	8N-9N	8N-9N	8N-9N	9N-12N	9N-12N	9N-12N
Station (m)	0.0	4.2	8.4	0.0	4.2	8.4	0.0	4.4	8.9	0.0	4.4	8.9	0.0	4.7	9.3	0.0	4.7	9.3
Node Label at Station	1N	---	0N	4N	---	1N	5N	---	4N	5N	---	8N	8N	---	9N	9N	---	12N
Section #	Section 01	Section 01	Section 01	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 07	Section 07	Section 07
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	3229	3229	3229	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	2605	2605	2605
$(kL/r)_{max}$	59	59	59	74	74	74	78	78	78	78	78	78	83	83	83	86	86	86
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	2039	2039	2039	1505	1505	1505	1505	1505	1505	1505	1505	1505	1505	1505	1505	2126	2126	2126
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	219	219	219	125	125	125	125	125	125	125	125	125	125	125	125	166	166	166
$M_{ry(Laterally\ Supported)}$ (kNm)	436	436	436	292	292	292	292	292	292	292	292	292	292	292	292	414	414	414
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	8408	8408	8408	8408	8408	8408	8860	8860	8860	8860	8860	8860	9330	9330	9330	9330	9330	9330
L_{uy} (mm)	8408	8408	8408	8408	8408	8408	8860	8860	8860	8860	8860	8860	9330	9330	9330	9330	9330	9330
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	635	635	635	312	312	312	296	296	296	296	296	296	281	281	281	384	384	384
M_{rx} (kNm)	218.6	218.6	218.6	125.4	125.4	125.4	125.4	125.4	125.4	125.4	125.4	125.4	125.4	125.4	125.4	165.5	165.5	165.5
M_{ry} (kNm)	374.4	374.4	374.4	220.2	220.2	220.2	214.0	214.0	214.0	214.0	214.0	214.0	207.5	207.5	207.5	315.1	315.1	315.1

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y/w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.015	0.015	0.014	0.176	0.171	0.166	0.054	0.053	0.053	0.425	0.429	0.435	0.086	0.087	0.087	0.457	0.462	0.467
(T_f/T_r)<=1	0.032	0.033	0.034	0.015	0.017	0.019	0.198	0.199	0.200	0.053	0.051	0.049	0.364	0.363	0.362	0.046	0.045	0.043

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.032	0.033	0.034	0.015	0.017	0.019	0.198	0.199	0.200	0.053	0.051	0.049	0.364	0.363	0.362	0.046	0.045	0.043
M_{fx}/M_{rx}<=1	0.000	0.069	0.000	0.000	0.032	0.000	0.000	0.096	0.000	0.000	0.040	0.000	0.000	0.104	0.000	0.000	0.042	0.000
M_{fy}/M_{ry}<=1	0.000	0.021	0.000	0.000	0.036	0.000	0.000	0.042	0.000	0.000	0.042	0.000	0.000	0.048	0.000	0.000	0.032	0.000
$T_f/T_r+M_f/M_r$<=1	0.032	0.123	0.034	0.015	0.085	0.019	0.198	0.337	0.200	0.053	0.132	0.049	0.364	0.515	0.362	0.046	0.119	0.043
$M_f/M_r-T_fS/M_tA$<=1	0.000	0.018	0.000	0.000	0.030	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	2	2	2	3	3	3	7	7	7	8	8	8	9	9	9	10	10	10
Member Label	1N-0N	1N-0N	1N-0N	4N-1N	4N-1N	4N-1N	5N-4N	5N-4N	5N-4N	5N-8N	5N-8N	5N-8N	8N-9N	8N-9N	8N-9N	9N-12N	9N-12N	9N-12N
Station (m)	0.0	4.2	8.4	0.0	4.2	8.4	0.0	4.4	8.9	0.0	4.4	8.9	0.0	4.7	9.3	0.0	4.7	9.3
Node Label at Station	1N	---	0N	4N	---	1N	5N	---	4N	5N	---	8N	8N	---	9N	9N	---	12N
Section #	Section 01	Section 01	Section 01	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 07	Section 07	Section 07
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1931	1931	1931	1426	1426	1426	1426	1426	1426	1426	1426	1426	1426	1426	1426	2014	2014	2014
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	7.28E+03	7.28E+03	7.28E+03	3.34E+03	3.34E+03	3.34E+03	3.01E+03	3.01E+03	3.01E+03	3.01E+03	3.01E+03	3.01E+03	2.72E+03	2.72E+03	2.72E+03	3.05E+03	3.05E+03	3.05E+03
U_{1x}	1.00	1.00	1.00	1.06	1.06	1.06	1.02	1.02	1.02	1.17	1.17	1.17	1.03	1.03	1.03	1.25	1.26	1.26
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	24971	24971	24971	11695	11695	11695	10532	10532	10532	10532	10532	10532	9498	9498	9498	11433	11433	11433
U_{1y}	1.00	1.00	1.00	1.02	1.02	1.02	1.01	1.01	1.01	1.04	1.04	1.04	1.01	1.01	1.01	1.06	1.06	1.06
C_f/C_r	0.013	0.012	0.012	0.130	0.127	0.123	0.039	0.038	0.038	0.304	0.307	0.311	0.059	0.060	0.060	0.305	0.309	0.312
$U_{1x}M_{fx}/M_{rx}$	0.000	0.069	0.000	0.000	0.034	0.000	0.000	0.097	0.000	0.000	0.047	0.000	0.000	0.107	0.000	0.000	0.053	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.018	0.000	0.000	0.028	0.000	0.000	0.031	0.000	0.000	0.032	0.000	0.000	0.035	0.000	0.000	0.026	0.000
Interaction	0.013	0.100	0.012	0.130	0.188	0.123	0.039	0.166	0.038	0.304	0.386	0.311	0.059	0.201	0.060	0.305	0.388	0.312

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.606	0.606	0.606	0.767	0.767	0.767	0.809	0.809	0.809	0.809	0.809	0.809	0.852	0.852	0.852	0.883	0.883	0.883
$C_{r\ (K=1)}$ (kN)	1624	1624	1624	1058	1058	1058	1020	1020	1020	1020	1020	1020	981	981	981	1346	1346	1346
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.06	1.06	1.06	1.02	1.02	1.02	1.17	1.17	1.17	1.03	1.03	1.03	1.25	1.26	1.26
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.02	1.02	1.02	1.01	1.01	1.01	1.04	1.04	1.04	1.01	1.01	1.01	1.06	1.06	1.06
C_f/C_r	0.015	0.015	0.014	0.176	0.171	0.166	0.054	0.053	0.053	0.425	0.429	0.435	0.086	0.087	0.087	0.457	0.462	0.467
$U_{1x}M_{fx}/M_{rx}$	0.000	0.069	0.000	0.000	0.034	0.000	0.000	0.097	0.000	0.000	0.047	0.000	0.000	0.107	0.000	0.000	0.053	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.018	0.000	0.000	0.028	0.000	0.000	0.031	0.000	0.000	0.032	0.000	0.000	0.035	0.000	0.000	0.026	0.000
Interaction	0.015	0.102	0.014	0.176	0.233	0.166	0.054	0.181	0.053	0.425	0.508	0.435	0.086	0.228	0.087	0.457	0.541	0.467

3.3. Lateral Torsional Buckling:

λ_{max}	0.606	0.606	0.606	0.767	0.767	0.767	0.809	0.809	0.809	0.809	0.809	0.809	0.852	0.852	0.852	0.883	0.883	0.883
C_r (kN)	1624	1624	1624	1058	1058	1058	1020	1020	1020	1020	1020	1020	981	981	981	1346	1346	1346
U_{1x}	1.00	1.00	1.00	1.06	1.06	1.06	1.02	1.02	1.02	1.17	1.17	1.17	1.03	1.03	1.03	1.25	1.26	1.26
U_{1y}	1.00	1.00	1.00	1.02	1.02	1.02	1.01	1.01	1.01	1.04	1.04	1.04	1.01	1.01	1.01	1.06	1.06	1.06
M_{rx} (kNm)	219	219	219	125	125	125	125	125	125	125	125	125	125	125	125	166	166	166
M_{ry} (kNm)	374	374	374	220	220	220	214	214	214	214	214	214	207	207	207	315	315	315
C_f/C_r	0.015	0.015	0.014	0.176	0.171	0.166	0.054	0.053	0.053	0.425	0.429	0.435	0.086	0.087	0.087	0.457	0.462	0.467
$U_{1x}M_{fx}/M_{rx}$	0.000	0.069	0.000	0.000	0.034	0.000	0.000	0.097	0.000	0.000	0.047	0.000	0.000	0.107	0.000	0.000	0.053	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.021	0.000	0.000	0.037	0.000	0.000	0.042	0.000	0.000	0.044	0.000	0.000	0.049	0.000	0.000	0.034	0.000
Interaction	0.015	0.105	0.014	0.176	0.242	0.166	0.054	0.193	0.053	0.425	0.520	0.435	0.086	0.242	0.087	0.457	0.549	0.467
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.032	0.123	0.034	0.176	0.242	0.166	0.198	0.337	0.200	0.425	0.520	0.435	0.364	0.515	0.362	0.457	0.549	0.467

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	11	11	11	178	178	178	179	179	179	183	183	183	184	184	184	185	185	185
Member Label	12N-13N	12N-13N	12N-13N	1S-0S	1S-0S	1S-0S	4S-1S	4S-1S	4S-1S	5S-4S	5S-4S	5S-4S	5S-8S	5S-8S	5S-8S	8S-9S	8S-9S	8S-9S
Station (m)	0.0	4.9	9.8	0.0	4.2	8.4	0.0	4.2	8.4	0.0	4.4	8.9	0.0	4.4	8.9	0.0	4.7	9.3
Node Label at Station	12N	---	13N	1S	---	0S	4S	---	1S	5S	---	4S	5S	---	8S	8S	---	9S
Section #	Section 07	Section 07	Section 07	Section 01	Section 01	Section 01	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal

Member Factored Load Effects:

C_f (kN)	141	142	143	34	33	32	246	241	236	99	98	98	488	493	498	126	127	127
$M_{fx\ (comp)}$ (kNm)	0	18	0	0	15	0	0	4	0	0	12	0	0	5	0	0	13	0
$M_{fy\ (comp)}$ (kNm)	0	11	0	0	8	0	0	8	0	0	9	0	0	9	0	0	10	0
T_f (kN)	772	771	770	85	87	89	51	54	56	395	397	398	104	101	99	634	632	631
$M_{fx\ (tension)}$ (kNm)	0	18	0	0	15	0	0	4	0	0	12	0	0	5	0	0	13	0
$M_{fy\ (tension)}$ (kNm)	0	11	0	0	8	0	0	8	0	0	9	0	0	9	0	0	10	0
V_{fx} (kN)	4	0	4	4	0	4	4	0	4	4	0	4	4	0	4	4	0	4
V_{fy} (kN)	7	0	7	7	0	7	2	0	2	5	0	5	2	0	2	6	0	6

Gross Section Properties:

Ag (mm^2)	11336	11336	11336	12774	12774	12774	9428	9428	9428	9428	9428	9428	9428	9428	9428	9428	9428	9428
I_x (mm^4)	1.35E+08	1.35E+08	1.35E+08	2.61E+08	2.61E+08	2.61E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08	1.20E+08
I_y (mm^4)	5.04E+08	5.04E+08	5.04E+08	8.94E+08	8.94E+08	8.94E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08	4.19E+08
J (mm^4)	6.28E+05	6.28E+05	6.28E+05	7.19E+05	7.19E+05	7.19E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05	3.79E+05
r_x (mm)	109	109	109	143	143	143	113	113	113	113	113	113	113	113	113	113	113	113
r_y (mm)	211	211	211	265	265	265	211	211	211	211	211	211	211	211	211	211	211	211
S_x (mm^3)	8.83E+05	8.83E+05	8.83E+05	1.37E+06	1.37E+06	1.37E+06	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05	7.86E+05
S_y (mm^3)	2.21E+06	2.21E+06	2.21E+06	2.73E+06	2.73E+06	2.73E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06	1.83E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	10	10	10	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
L (mm)	9815	9815	9815	8408	8408	8408	8408	8408	8408	8860	8860	8860	8860	8860	8860	9330	9330	9330

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	11	11	11	178	178	178	179	179	179	183	183	183	184	184	184	185	185	185
Member Label	12N-13N	12N-13N	12N-13N	1S-0S	1S-0S	1S-0S	4S-1S	4S-1S	4S-1S	5S-4S	5S-4S	5S-4S	5S-8S	5S-8S	5S-8S	8S-9S	8S-9S	8S-9S
Station (m)	0.0	4.9	9.8	0.0	4.2	8.4	0.0	4.2	8.4	0.0	4.4	8.9	0.0	4.4	8.9	0.0	4.7	9.3
Node Label at Station	12N	---	13N	1S	---	0S	4S	---	1S	5S	---	4S	5S	---	8S	8S	---	9S
Section #	Section 07	Section 07	Section 07	Section 01	Section 01	Section 01	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels	6.3	6.3	6.3	5.2	5.2	5.2	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	23.5	23.5	23.5	37.5	37.5	37.5	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0
Webs in flexural compression	23.5	23.5	23.5	37.5	37.5	37.5	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0
Webs in combined flexural and axial compression	23.5	23.5	23.5	37.5	37.5	37.5	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	11	11	11	178	178	178	179	179	179	183	183	183	184	184	184	185	185	185
Member Label	12N-13N	12N-13N	12N-13N	1S-0S	1S-0S	1S-0S	4S-1S	4S-1S	4S-1S	5S-4S	5S-4S	5S-4S	5S-8S	5S-8S	5S-8S	8S-9S	8S-9S	8S-9S
Station (m)	0.0	4.9	9.8	0.0	4.2	8.4	0.0	4.2	8.4	0.0	4.4	8.9	0.0	4.4	8.9	0.0	4.7	9.3
Node Label at Station	12N	---	13N	1S	---	0S	4S	---	1S	5S	---	4S	5S	---	8S	8S	---	9S
Section #	Section 07	Section 07	Section 07	Section 01	Section 01	Section 01	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	9815	9815	9815	8408	8408	8408	8408	8408	8408	8860	8860	8860	8860	8860	8860	9330	9330	9330
L_y (mm)	9815	9815	9815	8408	8408	8408	8408	8408	8408	8860	8860	8860	8860	8860	8860	9330	9330	9330
λ_{max}	0.929	0.929	0.929	0.606	0.606	0.606	0.767	0.767	0.767	0.809	0.809	0.809	0.809	0.809	0.809	0.852	0.852	0.852
C_r (kN)	1233.1	1233.1	1233.1	1623.7	1623.7	1623.7	1057.5	1057.5	1057.5	1019.9	1019.9	1019.9	1019.9	1019.9	1019.9	980.9	980.9	980.9
$(kL/r)_{max}$	90.0	90.0	90.0	58.8	58.8	58.8	74.4	74.4	74.4	78.4	78.4	78.4	78.4	78.4	78.4	82.6	82.6	82.6
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	2756	2756	2756	7284	7284	7284	3343	3343	3343	3011	3011	3011	3011	3011	3011	2715	2715	2715

Shear Flexibility Factor:

1. Lacing:

a (mm)	435	435	435	657	657	657	439	439	439	439	439	439	439	439	439	439	439	439
b (mm)	376	376	376	569	569	569	380	380	380	380	380	380	380	380	380	380	380	380
ε_aa (mm)	435	435	435	657	657	657	439	439	439	439	439	439	439	439	439	439	439	439
ε_bb (mm)	376	376	376	569	569	569	380	380	380	380	380	380	380	380	380	380	380	380
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	7415	7415	7415	5528	5528	5528	5893	5893	5893	6423	6423	6423	6423	6423	6423	6893	6893	6893
A_c (mm^2)	5668	5668	5668	6387	6387	6387	4714	4714	4714	4714	4714	4714	4714	4714	4714	4714	4714	4714
A_d (mm^2)	544	544	544	845	845	845	544	544	544	544	544	544	544	544	544	544	544	544
A_b (mm^2)	544	544	544	845	845	845	544	544	544	544	544	544	544	544	544	544	544	544
μ	0.0530	0.0530	0.0530	0.1582	0.1582	0.1582	0.0712	0.0712	0.0712	0.0599	0.0599	0.0599	0.0599	0.0599	0.0599	0.0520	0.0520	0.0520
P_{cr}/P_e (Fig.3.51)	0.85	0.85	0.85	0.70	0.70	0.70	0.81	0.81	0.81	0.84	0.84	0.84	0.84	0.84	0.84	0.85	0.85	0.85
k'(sqrt(P_e/P_{cr}))	1.084	1.084	1.084	1.198	1.198	1.198	1.109	1.109	1.109	1.094	1.094	1.094	1.094	1.094	1.094	1.082	1.082	1.082
λ_v	0.520	0.520	0.520	0.392	0.392	0.392	0.456	0.456	0.456	0.474	0.474	0.474	0.474	0.474	0.474	0.494	0.494	0.494
Cr' (kN)	1711.4	1711.4	1711.4	1822.0	1822.0	1822.0	1308.4	1308.4	1308.4	1297.0	1297.0	1297.0	1297.0	1297.0	1297.0	1283.7	1283.7	1283.7
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	11	11	11	178	178	178	179	179	179	183	183	183	184	184	184	185	185	185
Member Label	12N-13N	12N-13N	12N-13N	1S-0S	1S-0S	1S-0S	4S-1S	4S-1S	4S-1S	5S-4S	5S-4S	5S-4S	5S-8S	5S-8S	5S-8S	8S-9S	8S-9S	8S-9S
Station (m)	0.0	4.9	9.8	0.0	4.2	8.4	0.0	4.2	8.4	0.0	4.4	8.9	0.0	4.4	8.9	0.0	4.7	9.3
Node Label at Station	12N	---	13N	1S	---	0S	4S	---	1S	5S	---	4S	5S	---	8S	8S	---	9S
Section #	Section 07	Section 07	Section 07	Section 01	Section 01	Section 01	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	5668	5668	5668	6387	6387	6387	4714	4714	4714	4714	4714	4714	4714	4714	4714	4714	4714	4714
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	1233.1	1233.1	1233.1	1623.7	1623.7	1623.7	1057.5	1057.5	1057.5	1019.9	1019.9	1019.9	1019.9	1019.9	1019.9	980.9	980.9	980.9

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	10202	10202	10202	10219	10219	10219	7542	7542	7542	7542	7542	7542	7542	7542	7542	7542	7542	7542
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	2035	2035	2035	2039	2039	2039	1505	1505	1505	1505	1505	1505	1505	1505	1505	1505	1505	1505
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	7627	7627	7627	12012	12012	12012	6793	6793	6793	6793	6793	6793	6793	6793	6793	6793	6793	6793
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	7627	7627	7627	12012	12012	12012	6793	6793	6793	6793	6793	6793	6793	6793	6793	6793	6793	6793
$A_{n(corrosion)}$ (mm^2)	6864	6864	6864	9610	9610	9610	5435	5435	5435	5435	5435	5435	5435	5435	5435	5435	5435	5435
$T_{r(b)}$ (kN)	2306	2306	2306	3229	3229	3229	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	6864	6864	6864	9610	9610	9610	5435	5435	5435	5435	5435	5435	5435	5435	5435	5435	5435	5435
$T_{r(c)}$ (kN)	2306	2306	2306	3229	3229	3229	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	11	11	11	178	178	178	179	179	179	183	183	183	184	184	184	185	185	185
Member Label	12N-13N	12N-13N	12N-13N	1S-0S	1S-0S	1S-0S	4S-1S	4S-1S	4S-1S	5S-4S	5S-4S	5S-4S	5S-8S	5S-8S	5S-8S	8S-9S	8S-9S	8S-9S
Station (m)	0.0	4.9	9.8	0.0	4.2	8.4	0.0	4.2	8.4	0.0	4.4	8.9	0.0	4.4	8.9	0.0	4.7	9.3
Node Label at Station	12N	---	13N	1S	---	0S	4S	---	1S	5S	---	4S	5S	---	8S	8S	---	9S
Section #	Section 07	Section 07	Section 07	Section 01	Section 01	Section 01	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	2306	2306	2306	3229	3229	3229	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826
$(kL/r)_{max}$	90	90	90	59	59	59	74	74	74	78	78	78	78	78	78	83	83	83
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	2035	2035	2035	2039	2039	2039	1505	1505	1505	1505	1505	1505	1505	1505	1505	1505	1505	1505
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	158	158	158	219	219	219	125	125	125	125	125	125	125	125	125	125	125	125
$M_{ry(Laterally\ Supported)}$ (kNm)	396	396	396	436	436	436	292	292	292	292	292	292	292	292	292	292	292	292
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	9815	9815	9815	8408	8408	8408	8408	8408	8408	8860	8860	8860	8860	8860	8860	9330	9330	9330
L_{uy} (mm)	9815	9815	9815	8408	8408	8408	8408	8408	8408	8860	8860	8860	8860	8860	8860	9330	9330	9330
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	365	365	365	635	635	635	312	312	312	296	296	296	296	296	296	281	281	281
M_{rx} (kNm)	158.5	158.5	158.5	218.6	218.6	218.6	125.4	125.4	125.4	125.4	125.4	125.4	125.4	125.4	125.4	125.4	125.4	125.4
M_{ry} (kNm)	293.7	293.7	293.7	374.4	374.4	374.4	220.2	220.2	220.2	214.0	214.0	214.0	214.0	214.0	214.0	207.5	207.5	207.5

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y/w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.114	0.115	0.116	0.021	0.020	0.020	0.233	0.228	0.223	0.097	0.096	0.096	0.478	0.483	0.488	0.128	0.129	0.129
(T_f/T_r)<=1	0.379	0.379	0.378	0.042	0.043	0.044	0.034	0.036	0.037	0.263	0.264	0.265	0.069	0.067	0.066	0.421	0.420	0.419

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.379	0.379	0.378	0.042	0.043	0.044	0.034	0.036	0.037	0.263	0.264	0.265	0.069	0.067	0.066	0.421	0.420	0.419
M_{fx}/M_{rx}<=1	0.000	0.114	0.000	0.000	0.069	0.000	0.000	0.032	0.000	0.000	0.096	0.000	0.000	0.040	0.000	0.000	0.104	0.000
M_{fy}/M_{ry}<=1	0.000	0.037	0.000	0.000	0.021	0.000	0.000	0.036	0.000	0.000	0.042	0.000	0.000	0.042	0.000	0.000	0.048	0.000
$T_f/T_r+M_f/M_r$<=1	0.379	0.530	0.378	0.042	0.133	0.044	0.034	0.104	0.037	0.263	0.402	0.265	0.069	0.149	0.066	0.421	0.572	0.419
$M_f/M_r-T_fS/M_tA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	11	11	11	178	178	178	179	179	179	183	183	183	184	184	184	185	185	185
Member Label	12N-13N	12N-13N	12N-13N	1S-0S	1S-0S	1S-0S	4S-1S	4S-1S	4S-1S	5S-4S	5S-4S	5S-4S	5S-8S	5S-8S	5S-8S	8S-9S	8S-9S	8S-9S
Station (m)	0.0	4.9	9.8	0.0	4.2	8.4	0.0	4.2	8.4	0.0	4.4	8.9	0.0	4.4	8.9	0.0	4.7	9.3
Node Label at Station	12N	---	13N	1S	---	0S	4S	---	1S	5S	---	4S	5S	---	8S	8S	---	9S
Section #	Section 07	Section 07	Section 07	Section 01	Section 01	Section 01	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04	Section 04
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1928	1928	1928	1931	1931	1931	1426	1426	1426	1426	1426	1426	1426	1426	1426	1426	1426	1426
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	2.76E+03	2.76E+03	2.76E+03	7.28E+03	7.28E+03	7.28E+03	3.34E+03	3.34E+03	3.34E+03	3.01E+03	3.01E+03	3.01E+03	3.01E+03	3.01E+03	3.01E+03	2.72E+03	2.72E+03	2.72E+03
U_{1x}	1.05	1.05	1.05	1.00	1.00	1.00	1.08	1.08	1.08	1.03	1.03	1.03	1.19	1.20	1.20	1.05	1.05	1.05
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	10330	10330	10330	24971	24971	24971	11695	11695	11695	10532	10532	10532	10532	10532	10532	9498	9498	9498
U_{1y}	1.01	1.01	1.01	1.00	1.00	1.00	1.02	1.02	1.02	1.01	1.01	1.01	1.05	1.05	1.05	1.01	1.01	1.01
C_f/C_r	**0.073**	**0.074**	**0.074**	**0.018**	**0.017**	**0.017**	**0.173**	**0.169**	**0.166**	**0.069**	**0.069**	**0.069**	**0.342**	**0.346**	**0.349**	**0.088**	**0.089**	**0.089**
$U_{1x}M_{fx}/M_{rx}$	**0.000**	**0.120**	**0.000**	**0.000**	**0.069**	**0.000**	**0.000**	**0.034**	**0.000**	**0.000**	**0.099**	**0.000**	**0.000**	**0.048**	**0.000**	**0.000**	**0.109**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.000**	**0.028**	**0.000**	**0.000**	**0.018**	**0.000**	**0.000**	**0.028**	**0.000**	**0.000**	**0.031**	**0.000**	**0.000**	**0.032**	**0.000**	**0.000**	**0.035**	**0.000**
Interaction	**0.073**	**0.222**	**0.074**	**0.018**	**0.104**	**0.017**	**0.173**	**0.231**	**0.166**	**0.069**	**0.199**	**0.069**	**0.342**	**0.426**	**0.349**	**0.088**	**0.233**	**0.089**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.929	0.929	0.929	0.606	0.606	0.606	0.767	0.767	0.767	0.809	0.809	0.809	0.809	0.809	0.809	0.852	0.852	0.852
$C_{r\ (K=1)}$ (kN)	1233	1233	1233	1624	1624	1624	1058	1058	1058	1020	1020	1020	1020	1020	1020	981	981	981
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.05	1.05	1.05	1.00	1.00	1.00	1.08	1.08	1.08	1.03	1.03	1.03	1.19	1.20	1.20	1.05	1.05	1.05
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.01	1.01	1.01	1.00	1.00	1.00	1.02	1.02	1.02	1.01	1.01	1.01	1.05	1.05	1.05	1.01	1.01	1.01
C_f/C_r	**0.114**	**0.115**	**0.116**	**0.021**	**0.020**	**0.020**	**0.233**	**0.228**	**0.223**	**0.097**	**0.096**	**0.096**	**0.478**	**0.483**	**0.488**	**0.128**	**0.129**	**0.129**
$U_{1x}M_{fx}/M_{rx}$	**0.000**	**0.120**	**0.000**	**0.000**	**0.069**	**0.000**	**0.000**	**0.034**	**0.000**	**0.000**	**0.099**	**0.000**	**0.000**	**0.048**	**0.000**	**0.000**	**0.109**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.000**	**0.028**	**0.000**	**0.000**	**0.018**	**0.000**	**0.000**	**0.028**	**0.000**	**0.000**	**0.031**	**0.000**	**0.000**	**0.032**	**0.000**	**0.000**	**0.035**	**0.000**
Interaction	**0.114**	**0.263**	**0.116**	**0.021**	**0.108**	**0.020**	**0.233**	**0.290**	**0.223**	**0.097**	**0.226**	**0.096**	**0.478**	**0.563**	**0.488**	**0.128**	**0.273**	**0.129**

3.3. Lateral Torsional Buckling:

λ_{max}	0.929	0.929	0.929	0.606	0.606	0.606	0.767	0.767	0.767	0.809	0.809	0.809	0.809	0.809	0.809	0.852	0.852	0.852
C_r (kN)	1233	1233	1233	1624	1624	1624	1058	1058	1058	1020	1020	1020	1020	1020	1020	981	981	981
U_{1x}	1.05	1.05	1.05	1.00	1.00	1.00	1.08	1.08	1.08	1.03	1.03	1.03	1.19	1.20	1.20	1.05	1.05	1.05
U_{1y}	1.01	1.01	1.01	1.00	1.00	1.00	1.02	1.02	1.02	1.01	1.01	1.01	1.05	1.05	1.05	1.01	1.01	1.01
M_{rx} (kNm)	158	158	158	219	219	219	125	125	125	125	125	125	125	125	125	125	125	125
M_{ry} (kNm)	294	294	294	374	374	374	220	220	220	214	214	214	214	214	214	207	207	207
C_f/C_r	**0.114**	**0.115**	**0.116**	**0.021**	**0.020**	**0.020**	**0.233**	**0.228**	**0.223**	**0.097**	**0.096**	**0.096**	**0.478**	**0.483**	**0.488**	**0.128**	**0.129**	**0.129**
$U_{1x}M_{fx}/M_{rx}$	**0.000**	**0.120**	**0.000**	**0.000**	**0.069**	**0.000**	**0.000**	**0.034**	**0.000**	**0.000**	**0.099**	**0.000**	**0.000**	**0.048**	**0.000**	**0.000**	**0.109**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.000**	**0.038**	**0.000**	**0.000**	**0.021**	**0.000**	**0.000**	**0.037**	**0.000**	**0.000**	**0.042**	**0.000**	**0.000**	**0.044**	**0.000**	**0.000**	**0.049**	**0.000**
Interaction	**0.114**	**0.273**	**0.116**	**0.021**	**0.111**	**0.020**	**0.233**	**0.299**	**0.223**	**0.097**	**0.237**	**0.096**	**0.478**	**0.575**	**0.488**	**0.128**	**0.287**	**0.129**
Demand/Capacity ≤ 1	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
Highest Ratio	**0.379**	**0.530**	**0.378**	**0.042**	**0.133**	**0.044**	**0.233**	**0.299**	**0.223**	**0.263**	**0.402**	**0.265**	**0.478**	**0.575**	**0.488**	**0.421**	**0.572**	**0.419**

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	186	186	186	187	187	187	249	249	249	250	250	250	400	400	400	401	401	401
Member Label	9S-12S	9S-12S	9S-12S	12S-13S	12S-13S	12S-13S	56N-34N	56N-34N	56N-34N	34N-13N	34N-13N	34N-13N	56S-34S	56S-34S	56S-34S	34S-13S	34S-13S	34S-13S
Station (m)	0.0	4.7	9.3	0.0	4.9	9.8	0.0	2.9	5.9	0.0	1.8	3.6	0.0	2.9	5.9	0.0	1.8	3.6
Node Label at Station	9S	---	12S	12S	---	13S	56N	---	34N	34N	---	13N	56S	---	34S	34S	---	13S
Section #	Section 07	Section 07	Section 07	Section 07	Section 07	Section 07	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal

Member Factored Load Effects:

C_f (kN)	707	713	719	210	210	211	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (comp)}$ (kNm)	0	7	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	10	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	142	139	135	904	903	901	1841	1845	1849	1915	1918	1921	1934	1939	1943	2039	2042	2045
$M_{fx\ (tension)}$ (kNm)	0	7	0	0	18	0	0	7	9	9	5	0	0	7	9	9	6	0
$M_{fy\ (tension)}$ (kNm)	0	10	0	0	11	0	0	105	202	202	102	0	0	124	241	241	122	0
V_{fx} (kN)	4	0	4	4	0	4	37	34	31	54	56	57	43	41	38	65	67	68
V_{fy} (kN)	3	0	3	7	0	7	3	1	0	1	2	3	3	2	0	2	3	4

Gross Section Properties:

Ag (mm^2)	11336	11336	11336	11336	11336	11336	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774
I_x (mm^4)	1.35E+08	1.35E+08	1.35E+08	1.35E+08	1.35E+08	1.35E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08
I_y (mm^4)	5.04E+08	5.04E+08	5.04E+08	5.04E+08	5.04E+08	5.04E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08
J (mm^4)	6.28E+05	6.28E+05	6.28E+05	6.28E+05	6.28E+05	6.28E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05
r_x (mm)	109	109	109	109	109	109	143	143	143	143	143	143	143	143	143	143	143	143
r_y (mm)	211	211	211	211	211	211	265	265	265	265	265	265	265	265	265	265	265	265
S_x (mm^3)	8.83E+05	8.83E+05	8.83E+05	8.83E+05	8.83E+05	8.83E+05	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06
S_y (mm^3)	2.21E+06	2.21E+06	2.21E+06	2.21E+06	2.21E+06	2.21E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	6	6	6	10	10	10	20	5	5	5	5	5	20	5	5	5	5	5
L (mm)	9330	9330	9330	9815	9815	9815	5896	5896	5896	3611	3611	3611	5896	5896	5896	3611	3611	3611

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	186	186	186	187	187	187	249	249	249	250	250	250	400	400	400	401	401	401
Member Label	9S-12S	9S-12S	9S-12S	12S-13S	12S-13S	12S-13S	56N-34N	56N-34N	56N-34N	34N-13N	34N-13N	34N-13N	56S-34S	56S-34S	56S-34S	34S-13S	34S-13S	34S-13S
Station (m)	0.0	4.7	9.3	0.0	4.9	9.8	0.0	2.9	5.9	0.0	1.8	3.6	0.0	2.9	5.9	0.0	1.8	3.6
Node Label at Station	9S	---	12S	12S	---	13S	56N	---	34N	34N	---	13N	56S	---	34S	34S	---	13S
Section #	Section 07	Section 07	Section 07	Section 07	Section 07	Section 07	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels	6.3	6.3	6.3	6.3	6.3	6.3	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	23.5	23.5	23.5	23.5	23.5	23.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5
Webs in flexural compression	23.5	23.5	23.5	23.5	23.5	23.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5
Webs in combined flexural and axial compression	23.5	23.5	23.5	23.5	23.5	23.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	186	186	186	187	187	187	249	249	249	250	250	250	400	400	400	401	401	401
Member Label	9S-12S	9S-12S	9S-12S	12S-13S	12S-13S	12S-13S	56N-34N	56N-34N	56N-34N	34N-13N	34N-13N	34N-13N	56S-34S	56S-34S	56S-34S	34S-13S	34S-13S	34S-13S
Station (m)	0.0	4.7	9.3	0.0	4.9	9.8	0.0	2.9	5.9	0.0	1.8	3.6	0.0	2.9	5.9	0.0	1.8	3.6
Node Label at Station	9S	---	12S	12S	---	13S	56N	---	34N	34N	---	13N	56S	---	34S	34S	---	13S
Section #	Section 07	Section 07	Section 07	Section 07	Section 07	Section 07	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	9330	9330	9330	9815	9815	9815	9508	9508	9508	9508	9508	9508	9508	9508	9508	9508	9508	9508
L_y (mm)	9330	9330	9330	9815	9815	9815	5896	5896	5896	3611	3611	3611	5896	5896	5896	3611	3611	3611
λ_{max}	0.883	0.883	0.883	0.929	0.929	0.929	0.686	0.686	0.686	0.686	0.686	0.686	0.686	0.686	0.686	0.686	0.686	0.686
C_r (kN)	1345.9	1345.9	1345.9	1233.1	1233.1	1233.1	1532.1	1819.4	1819.4	1819.4	1819.4	1819.4	1532.1	1819.4	1819.4	1819.4	1819.4	1819.4
$(kL/r)_{max}$	85.6	85.6	85.6	90.0	90.0	90.0	66.5	66.5	66.5	66.5	66.5	66.5	66.5	66.5	66.5	66.5	66.5	66.5
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	3051	3051	3051	2756	2756	2756	5697	5697	5697	5697	5697	5697	5697	5697	5697	5697	5697	5697

Shear Flexibility Factor:

1. Lacing:

a (mm)	435	435	435	435	435	435	657	657	657	657	657	657	657	657	657	657	657	657
b (mm)	376	376	376	376	376	376	569	569	569	569	569	569	569	569	569	569	569	569
ε_aa (mm)	435	435	435	435	435	435	657	657	657	657	657	657	657	657	657	657	657	657
ε_bb (mm)	376	376	376	376	376	376	569	569	569	569	569	569	569	569	569	569	569	569
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	6930	6930	6930	7415	7415	7415	4696	4696	4696	2411	2411	2411	4696	4696	4696	2411	2411	2411
A_c (mm^2)	5668	5668	5668	5668	5668	5668	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387
A_d (mm^2)	544	544	544	544	544	544	845	845	845	845	845	845	845	845	845	845	845	845
A_b (mm^2)	544	544	544	544	544	544	845	845	845	845	845	845	845	845	845	845	845	845
μ	0.0607	0.0607	0.0607	0.0530	0.0530	0.0530	0.2192	0.2192	0.2192	0.8314	0.8314	0.8314	0.2192	0.2192	0.2192	0.8314	0.8314	0.8314
P_{cr}/P_e (Fig.3.51)	0.83	0.83	0.83	0.85	0.85	0.85	0.65	0.65	0.65	0.50	0.50	0.50	0.65	0.65	0.65	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	1.095	1.095	1.095	1.084	1.084	1.084	1.236	1.236	1.236	1.414	1.414	1.414	1.236	1.236	1.236	1.414	1.414	1.414
λ_v	0.499	0.499	0.499	0.520	0.520	0.520	0.284	0.284	0.284	0.199	0.199	0.199	0.284	0.284	0.284	0.199	0.199	0.199
Cr' (kN)	1808.1	1808.1	1808.1	1711.4	1711.4	1711.4	1883.6	2236.7	2236.7	2271.3	2271.3	2271.3	1883.6	2236.7	2236.7	2271.3	2271.3	2271.3
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	186	186	186	187	187	187	249	249	249	250	250	250	400	400	400	401	401	401
Member Label	9S-12S	9S-12S	9S-12S	12S-13S	12S-13S	12S-13S	56N-34N	56N-34N	56N-34N	34N-13N	34N-13N	34N-13N	56S-34S	56S-34S	56S-34S	34S-13S	34S-13S	34S-13S
Station (m)	0.0	4.7	9.3	0.0	4.9	9.8	0.0	2.9	5.9	0.0	1.8	3.6	0.0	2.9	5.9	0.0	1.8	3.6
Node Label at Station	9S	---	12S	12S	---	13S	56N	---	34N	34N	---	13N	56S	---	34S	34S	---	13S
Section #	Section 07	Section 07	Section 07	Section 07	Section 07	Section 07	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	5668	5668	5668	5668	5668	5668	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	1345.9	1345.9	1345.9	1233.1	1233.1	1233.1	1532.1	1819.4	1819.4	1819.4	1819.4	1819.4	1532.1	1819.4	1819.4	1819.4	1819.4	1819.4

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	10656	10656	10656	10202	10202	10202	10219	12135	12135	12135	12135	12135	10219	12135	12135	12135	12135	12135
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	2126	2126	2126	2035	2035	2035	2039	2421	2421	2421	2421	2421	2039	2421	2421	2421	2421	2421
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	8249	8249	8249	7627	7627	7627	12012	12012	12012	12012	12012	12012	12012	12012	12012	12012	12012	12012
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	8249	8249	8249	7627	7627	7627	12012	12012	12012	12012	12012	12012	12012	12012	12012	12012	12012	12012
$A_{n(corrosion)}$ (mm^2)	7754	7754	7754	6864	6864	6864	9610	11411	11411	11411	11411	11411	9610	11411	11411	11411	11411	11411
$T_{r(b)}$ (kN)	2605	2605	2605	2306	2306	2306	3229	3834	3834	3834	3834	3834	3229	3834	3834	3834	3834	3834
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	7754	7754	7754	6864	6864	6864	9610	11411	11411	11411	11411	11411	9610	11411	11411	11411	11411	11411
$T_{r(c)}$ (kN)	2605	2605	2605	2306	2306	2306	3229	3834	3834	3834	3834	3834	3229	3834	3834	3834	3834	3834
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	186	186	186	187	187	187	249	249	249	250	250	250	400	400	400	401	401	401
Member Label	9S-12S	9S-12S	9S-12S	12S-13S	12S-13S	12S-13S	56N-34N	56N-34N	56N-34N	34N-13N	34N-13N	34N-13N	56S-34S	56S-34S	56S-34S	34S-13S	34S-13S	34S-13S
Station (m)	0.0	4.7	9.3	0.0	4.9	9.8	0.0	2.9	5.9	0.0	1.8	3.6	0.0	2.9	5.9	0.0	1.8	3.6
Node Label at Station	9S	---	12S	12S	---	13S	56N	---	34N	34N	---	13N	56S	---	34S	34S	---	13S
Section #	Section 07	Section 07	Section 07	Section 07	Section 07	Section 07	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	2605	2605	2605	2306	2306	2306	3229	3834	3834	3834	3834	3834	3229	3834	3834	3834	3834	3834
$(kL/r)_{max}$	86	86	86	90	90	90	66	66	66	66	66	66	66	66	66	66	66	66
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	2126	2126	2126	2035	2035	2035	2039	2421	2421	2421	2421	2421	2039	2421	2421	2421	2421	2421
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	166	166	166	158	158	158	219	260	260	260	260	260	219	260	260	260	260	260
$M_{ry(Laterally\ Supported)}$ (kNm)	414	414	414	396	396	396	436	517	517	517	517	517	436	517	517	517	517	517
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	9330	9330	9330	9815	9815	9815	9508	9508	9508	9508	9508	9508	9508	9508	9508	9508	9508	9508
L_{uy} (mm)	9330	9330	9330	9815	9815	9815	5896	5896	5896	3611	3611	3611	5896	5896	5896	3611	3611	3611
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	384	384	384	365	365	365	562	562	562	562	562	562	562	562	562	562	562	562
M_{rx} (kNm)	165.5	165.5	165.5	158.5	158.5	158.5	218.6	259.6	259.6	259.6	259.6	259.6	218.6	259.6	259.6	259.6	259.6	259.6
M_{ry} (kNm)	315.1	315.1	315.1	293.7	293.7	293.7	357.8	424.9	424.9	424.9	424.9	424.9	357.8	424.9	424.9	424.9	424.9	424.9

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.525	0.530	0.534	0.170	0.170	0.171	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
(T_f/T_r)<=1	0.067	0.065	0.064	0.444	0.444	0.443	0.903	0.762	0.764	0.791	0.792	0.793	0.949	0.801	0.803	0.842	0.843	0.845

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.067	0.065	0.064	0.444	0.444	0.443	0.903	0.762	0.764	0.791	0.792	0.793	0.949	0.801	0.803	0.842	0.843	0.845
M_{fx}/M_{rx}<=1	0.000	0.042	0.000	0.000	0.114	0.000	0.000	0.027	0.035	0.035	0.019	0.000	0.000	0.027	0.035	0.035	0.023	0.000
M_{fy}/M_{ry}<=1	0.000	0.032	0.000	0.000	0.037	0.000	0.000	0.247	0.475	0.475	0.240	0.000	0.000	0.292	0.567	0.567	0.287	0.000
$T_f/T_r+M_f/M_r$<=1	0.067	0.139	0.064	0.444	0.595	0.443	0.903	1.036	1.274	1.301	1.052	0.793	0.949	1.120	1.404	1.444	1.154	0.845
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	186	186	186	187	187	187	249	249	249	250	250	250	400	400	400	401	401	401
Member Label	9S-12S	9S-12S	9S-12S	12S-13S	12S-13S	12S-13S	56N-34N	56N-34N	56N-34N	34N-13N	34N-13N	34N-13N	56S-34S	56S-34S	56S-34S	34S-13S	34S-13S	34S-13S
Station (m)	0.0	4.7	9.3	0.0	4.9	9.8	0.0	2.9	5.9	0.0	1.8	3.6	0.0	2.9	5.9	0.0	1.8	3.6
Node Label at Station	9S	---	12S	12S	---	13S	56N	---	34N	34N	---	13N	56S	---	34S	34S	---	13S
Section #	Section 07	Section 07	Section 07	Section 07	Section 07	Section 07	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01
Element Group	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal	01 TT Diagonal

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	2014	2014	2014	1928	1928	1928	1931	2294	2294	2294	2294	2294	1931	2294	2294	2294	2294	2294
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	3.05E+03	3.05E+03	3.05E+03	2.76E+03	2.76E+03	2.76E+03	5.70E+03	5.70E+03	5.70E+03	5.70E+03	5.70E+03	5.70E+03	5.70E+03	5.70E+03	5.70E+03	5.70E+03	5.70E+03	5.70E+03
U_{1x}	1.30	1.31	1.31	1.08	1.08	1.08	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	11433	11433	11433	10330	10330	10330	50778	50778	50778	135358	135358	135358	50778	50778	50778	135358	135358	135358
U_{1y}	1.07	1.07	1.07	1.02	1.02	1.02	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.351	0.354	0.357	0.109	0.109	0.109	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.055	0.000	0.000	0.123	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.026	0.000	0.000	0.028	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.351	0.435	0.357	0.109	0.260	0.109	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.883	0.883	0.883	0.929	0.929	0.929	0.686	0.686	0.686	0.686	0.686	0.686	0.686	0.686	0.686	0.686	0.686	0.686
$C_{r\ (K=1)}$ (kN)	1346	1346	1346	1233	1233	1233	1532	1819	1819	1819	1819	1819	1532	1819	1819	1819	1819	1819
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.30	1.31	1.31	1.08	1.08	1.08	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.07	1.07	1.07	1.02	1.02	1.02	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.525	0.530	0.534	0.170	0.170	0.171	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.055	0.000	0.000	0.123	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.026	0.000	0.000	0.028	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.525	0.611	0.534	0.170	0.322	0.171	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.3. Lateral Torsional Buckling:

λ_{max}	0.883	0.883	0.883	0.929	0.929	0.929	0.686	0.686	0.686	0.686	0.686	0.686	0.686	0.686	0.686	0.686	0.686	0.686
C_r (kN)	1346	1346	1346	1233	1233	1233	1532	1819	1819	1819	1819	1819	1532	1819	1819	1819	1819	1819
U_{1x}	1.30	1.31	1.31	1.08	1.08	1.08	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.07	1.07	1.07	1.02	1.02	1.02	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	166	166	166	158	158	158	219	260	260	260	260	260	219	260	260	260	260	260
M_{ry} (kNm)	315	315	315	294	294	294	358	425	425	425	425	425	358	425	425	425	425	425
C_f/C_r	0.525	0.530	0.534	0.170	0.170	0.171	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.055	0.000	0.000	0.123	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.034	0.000	0.000	0.038	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.525	0.619	0.534	0.170	0.331	0.171	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	NOT OK	NOT OK	NOT OK	NOT OK	OK	OK	NOT OK	NOT OK	NOT OK	NOT OK	OK
Highest Ratio	0.525	0.619	0.534	0.444	0.595	0.443	0.903	1.036	1.274	1.301	1.052	0.793	0.949	1.120	1.404	1.444	1.154	0.845

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	240	240	240	241	241	241	242	242	242	243	243	243	244	244	244	245	245	245
Member Label	2N-2N	2N-2N	2N-2N	2N-1N	2N-1N	2N-1N	4N-4N	4N-4N	4N-4N	4N-3N	4N-3N	4N-3N	8N-8N	8N-8N	8N-8N	8N-7N	8N-7N	8N-7N
Station (m)	0.0	0.4	0.7	0.0	2.7	5.4	0.0	0.4	0.7	0.0	2.8	5.7	0.0	0.4	0.7	0.0	3.1	6.3
Node Label at Station	2N	---	2N	2N	---	1N	4N	---	4N	4N	---	3N	8N	---	8N	8N	---	7N
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

Member Factored Load Effects:

C_f (kN)	0	0	0	9	9	8	0	0	0	10	9	8	0	0	0	10	9	7
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	2	0	0	0	0	0	3	0	0	0	0	0	3	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	4	0	0	0	0	0	3	0	0	0	0	0	4	0
T_f (kN)	0	0	0	78	79	80	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	0	0	0	3	0	3	0	0	0	2	0	2	0	0	0	2	0	2
V_{fy} (kN)	0	0	0	2	0	2	0	0	0	2	0	2	0	0	0	2	0	2

Gross Section Properties:

Ag (mm^2)	8409	8409	8409	8409	8409	8409	6603	6603	6603	6603	6603	6603	6603	6603	6603	6603	6603	6603
I_x (mm^4)	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08
I_y (mm^4)	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07
J (mm^4)	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05
r_x (mm)	204	204	204	204	204	204	209	209	209	209	209	209	209	209	209	209	209	209
r_y (mm)	54	54	54	54	54	54	60	60	60	60	60	60	60	60	60	60	60	60
S_x (mm^3)	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06
S_y (mm^3)	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
L (mm)	724	724	724	5372	5372	5372	724	724	724	5677	5677	5677	724	724	724	6287	6287	6287

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	240	240	240	241	241	241	242	242	242	243	243	243	244	244	244	245	245	245
Member Label	2N-2N	2N-2N	2N-2N	2N-1N	2N-1N	2N-1N	4N-4N	4N-4N	4N-4N	4N-3N	4N-3N	4N-3N	8N-8N	8N-8N	8N-8N	8N-7N	8N-7N	8N-7N
Station (m)	0.0	0.4	0.7	0.0	2.7	5.4	0.0	0.4	0.7	0.0	2.8	5.7	0.0	0.4	0.7	0.0	3.1	6.3
Node Label at Station	2N	---	2N	2N	---	1N	4N	---	4N	4N	---	3N	8N	---	8N	8N	---	7N
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression																		
Webs in combined flexural and axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	240	240	240	241	241	241	242	242	242	243	243	243	244	244	244	245	245	245
Member Label	2N-2N	2N-2N	2N-2N	2N-1N	2N-1N	2N-1N	4N-4N	4N-4N	4N-4N	4N-3N	4N-3N	4N-3N	8N-8N	8N-8N	8N-8N	8N-7N	8N-7N	8N-7N
Station (m)	0.0	0.4	0.7	0.0	2.7	5.4	0.0	0.4	0.7	0.0	2.8	5.7	0.0	0.4	0.7	0.0	3.1	6.3
Node Label at Station	2N	---	2N	2N	---	1N	4N	---	4N	4N	---	3N	8N	---	8N	8N	---	7N
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	724	724	724	5372	5372	5372	724	724	724	5677	5677	5677	724	724	724	6287	6287	6287
L_y (mm)	724	724	724	5372	5372	5372	724	724	724	5677	5677	5677	724	724	724	6287	6287	6287
λ_{max}	0.138	0.138	0.138	1.026	1.026	1.026	0.124	0.124	0.124	0.976	0.976	0.976	0.124	0.124	0.124	1.081	1.081	1.081
C_r (kN)	1266.7	1266.7	1266.7	738.3	738.3	738.3	995.6	995.6	995.6	609.6	609.6	609.6	995.6	995.6	995.6	548.5	548.5	548.5
$(kL/r)_{max}$	13.4	13.4	13.4	99.5	99.5	99.5	12.1	12.1	12.1	94.6	94.6	94.6	12.1	12.1	12.1	104.8	104.8	104.8
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing							1	1	1	1	1	1	1	1	1	1	1	1
Battens	1	1	1	1	1	1												
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	92753	92753	92753	1684	1684	1684	90077	90077	90077	1465	1465	1465	90077	90077	90077	1194	1194	1194

Shear Flexibility Factor:

1. Lacing:

a (mm)	0	0	0	0	0	0	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	0	0	0	0	0	0	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	0	0	0	0	0	0	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	0	0	0	0	0	0	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	6477	6477	6477	6477	6477	6477	6477	6477	6477	5461	5461	5461	6477	6477	6477	6477	6477	6477
A_c (mm^2)	4205	4205	4205	4205	4205	4205	3302	3302	3302	3302	3302	3302	3302	3302	3302	3302	3302	3302
A_d (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
A_b (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
μ	NA	NA	NA	NA	NA	NA	0.0388	0.0388	0.0388	0.0545	0.0545	0.0545	0.0388	0.0388	0.0388	0.0388	0.0388	0.0388
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.89	0.89	0.89	0.85	0.85	0.85	0.89	0.89	0.89	0.89	0.89	0.89
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	1.063	1.063	1.063	1.086	1.086	1.086	1.063	1.063	1.063	1.063	1.063	1.063
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	0.132	0.132	0.132	1.060	1.060	1.060	0.132	0.132	0.132	1.148	1.148	1.148
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	995.1	995.1	995.1	560.3	560.3	560.3	995.1	995.1	995.1	511.7	511.7	511.7
Lacing Governs?	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes

Member ID in CSiBridge	240	240	240	241	241	241	242	242	242	243	243	243	244	244	244	245	245	245
Member Label	2N-2N	2N-2N	2N-2N	2N-1N	2N-1N	2N-1N	4N-4N	4N-4N	4N-4N	4N-3N	4N-3N	4N-3N	8N-8N	8N-8N	8N-8N	8N-7N	8N-7N	8N-7N
Station (m)	0.0	0.4	0.7	0.0	2.7	5.4	0.0	0.4	0.7	0.0	2.8	5.7	0.0	0.4	0.7	0.0	3.1	6.3
Node Label at Station	2N	---	2N	2N	---	1N	4N	---	4N	4N	---	3N	8N	---	8N	8N	---	7N
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380			
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3			
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300			
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4			
ε_a	0.79	0.79	0.79	0.79	0.79	0.79	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	0.76	0.76	0.76	0.76	0.76	0.76	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3277	3277	3277	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	4205	4205	4205	4205	4205	4205	3302	3302	3302	3302	3302	3302	3302	3302	3302	3302	3302	3302
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	0.84	0.84	0.84	0.87	0.87	0.87	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	1.41	1.41	1.41	1.41	1.41	1.41	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	0.20	0.20	0.20	1.45	1.45	1.45	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	1260	1260	1260	478	478	478	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	1266.7	1266.7	1266.7	477.7	477.7	477.7	995.6	995.6	995.6	560.3	560.3	560.3	995.6	995.6	995.6	511.7	511.7	511.7

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6727	6727	6727	8150	8150	8150	5282	5282	5282	5282	5282	5282	5282	5282	5282	5282	5282	5282
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1342	1342	1342	1626	1626	1626	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	6885	6885	6885	15525	15525	15525	5841	5841	5841	5841	5841	5841	5841	5841	5841	5841	5841	5841
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	6885	6885	6885	15525	15525	15525	5841	5841	5841	5841	5841	5841	5841	5841	5841	5841	5841	5841
$A_{n(corrosion)}$ (mm^2)	5508	5508	5508	12420	12420	12420	4673	4673	4673	4673	4673	4673	4673	4673	4673	4673	4673	4673
$T_{r(b)}$ (kN)	1851	1851	1851	4173	4173	4173	1570	1570	1570	1570	1570	1570	1570	1570	1570	1570	1570	1570
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	5508	5508	5508	12420	12420	12420	4673	4673	4673	4673	4673	4673	4673	4673	4673	4673	4673	4673
$T_{r(c)}$ (kN)	1851	1851	1851	4173	4173	4173	1570	1570	1570	1570	1570	1570	1570	1570	1570	1570	1570	1570
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	240	240	240	241	241	241	242	242	242	243	243	243	244	244	244	245	245	245
Member Label	2N-2N	2N-2N	2N-2N	2N-1N	2N-1N	2N-1N	4N-4N	4N-4N	4N-4N	4N-3N	4N-3N	4N-3N	8N-8N	8N-8N	8N-8N	8N-7N	8N-7N	8N-7N
Station (m)	0.0	0.4	0.7	0.0	2.7	5.4	0.0	0.4	0.7	0.0	2.8	5.7	0.0	0.4	0.7	0.0	3.1	6.3
Node Label at Station	2N	---	2N	2N	---	1N	4N	---	4N	4N	---	3N	8N	---	8N	8N	---	7N
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	1851	1851	1851	4173	4173	4173	1570	1570	1570	1570	1570	1570	1570	1570	1570	1570	1570	1570
$(kL/r)_{max}$	13	13	13	99	99	99	12	12	12	95	95	95	12	12	12	105	105	105
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1342	1342	1342	1626	1626	1626	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	245	245	245	245	245	245	201	201	201	201	201	201	201	201	201	201	201	201
$M_{ry(Laterally\ Supported)}$ (kNm)	30	30	30	30	30	30	29	29	29	29	29	29	29	29	29	29	29	29
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	724	724	724	5372	5372	5372	724	724	724	5677	5677	5677	724	724	724	6287	6287	6287
L_{uy} (mm)	724	724	724	5372	5372	5372	724	724	724	5677	5677	5677	724	724	724	6287	6287	6287
M_{ux} (kNm) (y weak)	2598	2598	2598	350	350	350	978	978	978	125	125	125	978	978	978	113	113	113
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	271.9	271.9	271.9	209.1	209.1	209.1	213.9	213.9	213.9	94.7	94.7	94.7	213.9	213.9	213.9	85.6	85.6	85.6
M_{ry} (kNm)	29.8	29.8	29.8	29.8	29.8	29.8	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.000	0.000	0.000	0.019	0.019	0.017	0.000	0.000	0.000	0.018	0.016	0.014	0.000	0.000	0.000	0.020	0.018	0.014
(T_f/T_r)<=1	0.000	0.000	0.000	0.048	0.049	0.049	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.000	0.000	0.000	0.048	0.049	0.049	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
M_{fx}/M_{rx}<=1	0.000	0.000	0.000	0.000	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
M_{fy}/M_{ry}<=1	0.000	0.000	0.000	0.000	0.134	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r$<=1	0.000	0.000	0.000	0.048	0.193	0.049	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_f/M_r-T_fS/M_tA$<=1	0.000	0.000	0.000	0.000	0.016	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Member ID in CSiBridge	240	240	240	241	241	241	242	242	242	243	243	243	244	244	244	245	245	245
Member Label	2N-2N	2N-2N	2N-2N	2N-1N	2N-1N	2N-1N	4N-4N	4N-4N	4N-4N	4N-3N	4N-3N	4N-3N	8N-8N	8N-8N	8N-8N	8N-7N	8N-7N	8N-7N
Station (m)	0.0	0.4	0.7	0.0	2.7	5.4	0.0	0.4	0.7	0.0	2.8	5.7	0.0	0.4	0.7	0.0	3.1	6.3
Node Label at Station	2N	---	2N	2N	---	1N	4N	---	4N	4N	---	3N	8N	---	8N	8N	---	7N
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1271	1271	1271	1271	1271	1271	998	998	998	998	998	998	998	998	998	998	998	998
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.32E+06	1.32E+06	1.32E+06	2.40E+04	2.40E+04	2.40E+04	1.09E+06	1.09E+06	1.09E+06	1.77E+04	1.77E+04	1.77E+04	1.09E+06	1.09E+06	1.09E+06	1.44E+04	1.44E+04	1.44E+04
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	92753	92753	92753	1684	1684	1684	90077	90077	90077	1465	1465	1465	90077	90077	90077	1194	1194	1194
U_{1y}	1.00	1.00	1.00	1.01	1.01	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.01	1.01	1.01
C_f/C_r	0.000	0.000	0.000	0.007	0.007	0.006	0.000	0.000	0.000	0.010	0.009	0.008	0.000	0.000	0.000	0.010	0.009	0.007
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.015	0.000	0.000	0.000	0.000	0.000	0.015	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.135	0.000	0.000	0.000	0.000	0.000	0.104	0.000	0.000	0.000	0.000	0.000	0.138	0.000
Interaction	0.000	0.000	0.000	0.007	0.150	0.006	0.000	0.000	0.000	0.010	0.127	0.008	0.000	0.000	0.000	0.010	0.162	0.007

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.138	0.138	0.138	1.026	1.026	1.026	0.124	0.124	0.124	0.976	0.976	0.976	0.124	0.124	0.124	1.081	1.081	1.081
$C_{r\ (K=1)}$ (kN)	1267	1267	1267	738	738	738	996	996	996	610	610	610	996	996	996	549	549	549
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.01	1.01	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.01	1.01	1.01
C_f/C_r	0.000	0.000	0.000	0.012	0.012	0.011	0.000	0.000	0.000	0.016	0.015	0.013	0.000	0.000	0.000	0.018	0.016	0.013
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.015	0.000	0.000	0.000	0.000	0.000	0.015	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.135	0.000	0.000	0.000	0.000	0.000	0.104	0.000	0.000	0.000	0.000	0.000	0.138	0.000
Interaction	0.000	0.000	0.000	0.012	0.156	0.011	0.000	0.000	0.000	0.016	0.133	0.013	0.000	0.000	0.000	0.018	0.170	0.013

3.3. Lateral Torsional Buckling:

λ_{max}	0.138	0.138	0.138	1.026	1.026	1.026	0.124	0.124	0.124	0.976	0.976	0.976	0.124	0.124	0.124	1.081	1.081	1.081
C_r (kN)	1267	1267	1267	738	738	738	996	996	996	610	610	610	996	996	996	549	549	549
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.01	1.01	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.01	1.01	1.01
M_{rx} (kNm)	272	272	272	209	209	209	214	214	214	95	95	95	214	214	214	86	86	86
M_{ry} (kNm)	30	30	30	30	30	30	29	29	29	29	29	29	29	29	29	29	29	29
C_f/C_r	0.000	0.000	0.000	0.012	0.012	0.011	0.000	0.000	0.000	0.016	0.015	0.013	0.000	0.000	0.000	0.018	0.016	0.013
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.010	0.000	0.000	0.000	0.000	0.000	0.032	0.000	0.000	0.000	0.000	0.000	0.035	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.135	0.000	0.000	0.000	0.000	0.000	0.104	0.000	0.000	0.000	0.000	0.000	0.138	0.000
Interaction	0.000	0.000	0.000	0.012	0.157	0.011	0.000	0.000	0.000	0.016	0.150	0.013	0.000	0.000	0.000	0.018	0.190	0.013
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.000	0.000	0.000	0.048	0.193	0.049	0.000	0.000	0.000	0.018	0.150	0.014	0.000	0.000	0.000	0.020	0.190	0.014

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	246	246	246	247	247	247	319	319	319	320	320	320	321	321	321	322	322	322
Member Label	12N-12N	12N-12N	12N-12N	12N-11N	12N-11N	12N-11N	6N-6N	6N-6N	6N-6N	6N-36N	6N-36N	6N-36N	36N-5N	36N-5N	36N-5N	6S-6S	6S-6S	6S-6S
Station (m)	0.0	0.4	0.7	0.0	3.4	6.9	0.0	0.4	0.7	0.0	2.3	4.6	0.0	0.7	1.4	0.0	0.4	0.7
Node Label at Station	12N	---	12N	12N	---	11N	6N	---	6N	6N	---	36N	36N	---	5N	6S	---	6S
Section #	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

Member Factored Load Effects:

C_f (kN)	0	0	0	15	14	12	0	0	0	19	19	18	24	24	24	0	0	0
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	4	0	0	0	0	0	54	106	106	53	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	5	0	0	0	0	0	6	6	6	3	0	0	0	0
T_f (kN)	0	0	0	0	0	0	0	0	0	81	83	84	99	100	100	0	0	0
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	54	106	106	53	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	6	6	6	3	0	0	0	0
V_{fx} (kN)	0	0	0	3	0	3	0	0	0	4	1	1	4	5	5	0	0	0
V_{fy} (kN)	0	0	0	2	0	2	0	0	0	24	23	22	77	77	77	0	0	0

Gross Section Properties:

Ag (mm^2)	6603	6603	6603	6603	6603	6603	8409	8409	8409	8409	8409	8409	8409	8409	8409	8409	8409	8409
I_x (mm^4)	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08
I_y (mm^4)	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07
J (mm^4)	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05
r_x (mm)	209	209	209	209	209	209	204	204	204	204	204	204	204	204	204	204	204	204
r_y (mm)	60	60	60	60	60	60	54	54	54	54	54	54	54	54	54	54	54	54
S_x (mm^3)	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06
S_y (mm^3)	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
L (mm)	724	724	724	6896	6896	6896	724	724	724	4610	4610	4610	1372	1372	1372	724	724	724

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	246	246	246	247	247	247	319	319	319	320	320	320	321	321	321	322	322	322
Member Label	12N-12N	12N-12N	12N-12N	12N-11N	12N-11N	12N-11N	6N-6N	6N-6N	6N-6N	6N-36N	6N-36N	6N-36N	36N-5N	36N-5N	36N-5N	6S-6S	6S-6S	6S-6S
Station (m)	0.0	0.4	0.7	0.0	3.4	6.9	0.0	0.4	0.7	0.0	2.3	4.6	0.0	0.7	1.4	0.0	0.4	0.7
Node Label at Station	12N	---	12N	12N	---	11N	6N	---	6N	6N	---	36N	36N	---	5N	6S	---	6S
Section #	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression							16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Webs in combined flexural and axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	246	246	246	247	247	247	319	319	319	320	320	320	321	321	321	322	322	322
Member Label	12N-12N	12N-12N	12N-12N	12N-11N	12N-11N	12N-11N	6N-6N	6N-6N	6N-6N	6N-36N	6N-36N	6N-36N	36N-5N	36N-5N	36N-5N	6S-6S	6S-6S	6S-6S
Station (m)	0.0	0.4	0.7	0.0	3.4	6.9	0.0	0.4	0.7	0.0	2.3	4.6	0.0	0.7	1.4	0.0	0.4	0.7
Node Label at Station	12N	---	12N	12N	---	11N	6N	---	6N	6N	---	36N	36N	---	5N	6S	---	6S
Section #	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	724	724	724	6896	6896	6896	724	724	724	4610	4610	4610	1372	1372	1372	724	724	724
L_y (mm)	724	724	724	6896	6896	6896	724	724	724	5982	5982	5982	5982	5982	5982	724	724	724
λ_{max}	0.124	0.124	0.124	1.185	1.185	1.185	0.138	0.138	0.138	1.143	1.143	1.143	1.143	1.143	1.143	0.138	0.138	0.138
C_r (kN)	995.6	995.6	995.6	492.5	492.5	492.5	1266.7	1266.7	1266.7	655.6	655.6	655.6	655.6	655.6	655.6	1266.7	1266.7	1266.7
$(kL/r)_{max}$	12.1	12.1	12.1	114.9	114.9	114.9	13.4	13.4	13.4	110.8	110.8	110.8	110.8	110.8	110.8	13.4	13.4	13.4
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1				1	1	1	1	1	1
Battens										1	1	1						
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	90077	90077	90077	993	993	993	92753	92753	92753	1358	1358	1358	1358	1358	1358	92753	92753	92753

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	0	0	0	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	0	0	0	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	0	0	0	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	0	0	0	368	368	368	368	368	368
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477
A_c (mm^2)	3302	3302	3302	3302	3302	3302	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205
A_d (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
A_b (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
μ	0.0388	0.0388	0.0388	0.0388	0.0388	0.0388	0.0494	0.0494	0.0494	NA	NA	NA	0.0493	0.0493	0.0493	0.0494	0.0494	0.0494
P_{cr}/P_e (Fig.3.51)	0.89	0.89	0.89	0.89	0.89	0.89	0.86	0.86	0.86	0.50	0.50	0.50	0.86	0.86	0.86	0.86	0.86	0.86
k'(sqrt(P_e/P_{cr}))	1.063	1.063	1.063	1.063	1.063	1.063	1.078	1.078	1.078	N/A	N/A	N/A	1.078	1.078	1.078	1.078	1.078	1.078
λ_v	0.132	0.132	0.132	1.260	1.260	1.260	0.149	0.149	0.149	N/A	N/A	N/A	1.232	1.232	1.232	0.149	0.149	0.149
Cr' (kN)	995.1	995.1	995.1	456.1	456.1	456.1	1265.7	1265.7	1265.7	999999.0	999999.0	999999.0	597.7	597.7	597.7	1265.7	1265.7	1265.7
Lacing Governs?	No	No	No	Yes	Yes	Yes	No	No	No	No	No	No	Yes	Yes	Yes	No	No	No

Member ID in CSiBridge	246	246	246	247	247	247	319	319	319	320	320	320	321	321	321	322	322	322
Member Label	12N-12N	12N-12N	12N-12N	12N-11N	12N-11N	12N-11N	6N-6N	6N-6N	6N-6N	6N-36N	6N-36N	6N-36N	36N-5N	36N-5N	36N-5N	6S-6S	6S-6S	6S-6S
Station (m)	0.0	0.4	0.7	0.0	3.4	6.9	0.0	0.4	0.7	0.0	2.3	4.6	0.0	0.7	1.4	0.0	0.4	0.7
Node Label at Station	12N	---	12N	12N	---	11N	6N	---	6N	6N	---	36N	36N	---	5N	6S	---	6S
Section #	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.79	0.79	0.79	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.76	0.76	0.76	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	3302	3302	3302	3302	3302	3302	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.84	0.84	0.84	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.41	1.41	1.41	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.62	1.62	1.62	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	406	406	406	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	995.6	995.6	995.6	456.1	456.1	456.1	1266.7	1266.7	1266.7	405.9	405.9	405.9	597.7	597.7	597.7	1266.7	1266.7	1266.7

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	5282	5282	5282	5282	5282	5282	6727	6727	6727	6727	6727	6727	6727	6727	6727	6727	6727	6727
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1054	1054	1054	1054	1054	1054	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	5841	5841	5841	5079	5079	5079	7647	7647	7647	6885	6885	6885	6885	6885	6885	7647	7647	7647
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	5841	5841	5841	5079	5079	5079	7647	7647	7647	6885	6885	6885	6885	6885	6885	7647	7647	7647
$A_{n(corrosion)}$ (mm^2)	4673	4673	4673	4063	4063	4063	6118	6118	6118	5508	5508	5508	5508	5508	5508	6118	6118	6118
$T_{r(b)}$ (kN)	1570	1570	1570	1365	1365	1365	2056	2056	2056	1851	1851	1851	1851	1851	1851	2056	2056	2056
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	4673	4673	4673	4063	4063	4063	6118	6118	6118	5508	5508	5508	5508	5508	5508	6118	6118	6118
$T_{r(c)}$ (kN)	1570	1570	1570	1365	1365	1365	2056	2056	2056	1851	1851	1851	1851	1851	1851	2056	2056	2056
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	246	246	246	247	247	247	319	319	319	320	320	320	321	321	321	322	322	322
Member Label	12N-12N	12N-12N	12N-12N	12N-11N	12N-11N	12N-11N	6N-6N	6N-6N	6N-6N	6N-36N	6N-36N	6N-36N	36N-5N	36N-5N	36N-5N	6S-6S	6S-6S	6S-6S
Station (m)	0.0	0.4	0.7	0.0	3.4	6.9	0.0	0.4	0.7	0.0	2.3	4.6	0.0	0.7	1.4	0.0	0.4	0.7
Node Label at Station	12N	---	12N	12N	---	11N	6N	---	6N	6N	---	36N	36N	---	5N	6S	---	6S
Section #	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	1570	1570	1570	1365	1365	1365	2056	2056	2056	1851	1851	1851	1851	1851	1851	2056	2056	2056
$(kL/r)_{max}$	12	12	12	115	115	115	13	13	13	111	111	111	111	111	111	13	13	13
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1054	1054	1054	1054	1054	1054	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	201	201	201	201	201	201	245	245	245	245	245	245	245	245	245	245	245	245
$M_{ry(Laterally\ Supported)}$ (kNm)	29	29	29	29	29	29	30	30	30	30	30	30	30	30	30	30	30	30
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	724	724	724	6896	6896	6896	724	724	724	4610	4610	4610	1372	1372	1372	724	724	724
L_{uy} (mm)	724	724	724	6896	6896	6896	724	724	724	5982	5982	5982	5982	5982	5982	724	724	724
M_{ux} (kNm) (y weak)	978	978	978	103	103	103	2598	2598	2598	408	408	408	1371	1371	1371	2598	2598	2598
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	213.9	213.9	213.9	78.0	78.0	78.0	271.9	271.9	271.9	219.4	219.4	219.4	263.1	263.1	263.1	271.9	271.9	271.9
M_{ry} (kNm)	29.2	29.2	29.2	29.2	29.2	29.2	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
$(V_f/V_r)<=1$																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.000	0.000	0.000	0.033	0.031	0.026	0.000	0.000	0.000	0.047	0.047	0.044	0.040	0.040	0.040	0.000	0.000	0.000
$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.060	0.062	0.063	0.074	0.075	0.075	0.000	0.000	0.000

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.060	0.062	0.063	0.074	0.075	0.075	0.000	0.000	0.000
$M_{fx}/M_{rx}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.246	0.483	0.403	0.201	0.000	0.000	0.000	0.000
$M_{fy}/M_{ry}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.202	0.202	0.202	0.101	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.060	0.510	0.747	0.678	0.377	0.075	0.000	0.000	0.000
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	0.552	0.462	0.158	0.000	0.000	0.000	0.000

Member ID in CSiBridge	246	246	246	247	247	247	319	319	319	320	320	320	321	321	321	322	322	322
Member Label	12N-12N	12N-12N	12N-12N	12N-11N	12N-11N	12N-11N	6N-6N	6N-6N	6N-6N	6N-36N	6N-36N	6N-36N	36N-5N	36N-5N	36N-5N	6S-6S	6S-6S	6S-6S
Station (m)	0.0	0.4	0.7	0.0	3.4	6.9	0.0	0.4	0.7	0.0	2.3	4.6	0.0	0.7	1.4	0.0	0.4	0.7
Node Label at Station	12N	---	12N	12N	---	11N	6N	---	6N	6N	---	36N	36N	---	5N	6S	---	6S
Section #	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	998	998	998	998	998	998	1271	1271	1271	1271	1271	1271	1271	1271	1271	1271	1271	1271
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.09E+06	1.09E+06	1.09E+06	1.20E+04	1.20E+04	1.20E+04	1.32E+06	1.32E+06	1.32E+06	3.26E+04	3.26E+04	3.26E+04	3.68E+05	3.68E+05	3.68E+05	1.32E+06	1.32E+06	1.32E+06
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	90077	90077	90077	993	993	993	92753	92753	92753	1358	1358	1358	1358	1358	1358	92753	92753	92753
U_{1y}	1.00	1.00	1.00	1.02	1.01	1.01	1.00	1.00	1.00	1.01	1.01	1.01	1.02	1.02	1.02	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.015	0.014	0.012	0.000	0.000	0.000	0.015	0.015	0.014	0.019	0.019	0.019	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.020	0.000	0.000	0.000	0.000	0.000	0.221	0.433	0.433	0.216	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.174	0.000	0.000	0.000	0.000	0.000	0.205	0.204	0.205	0.103	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.015	0.208	0.012	0.000	0.000	0.000	0.015	0.440	0.652	0.657	0.338	0.019	0.000	0.000	0.000

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.124	0.124	0.124	1.185	1.185	1.185	0.138	0.138	0.138	1.143	1.143	1.143	1.143	1.143	1.143	0.138	0.138	0.138
$C_{r\ (K=1)}$ (kN)	996	996	996	492	492	492	1267	1267	1267	656	656	656	656	656	656	1267	1267	1267
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.02	1.01	1.01	1.00	1.00	1.00	1.01	1.01	1.01	1.02	1.02	1.02	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.030	0.028	0.024	0.000	0.000	0.000	0.029	0.029	0.027	0.037	0.037	0.037	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.020	0.000	0.000	0.000	0.000	0.000	0.221	0.433	0.433	0.216	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.174	0.000	0.000	0.000	0.000	0.000	0.205	0.204	0.205	0.103	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.030	0.222	0.024	0.000	0.000	0.000	0.029	0.454	0.665	0.675	0.356	0.037	0.000	0.000	0.000

3.3. Lateral Torsional Buckling:

λ_{max}	0.124	0.124	0.124	1.185	1.185	1.185	0.138	0.138	0.138	1.143	1.143	1.143	1.143	1.143	1.143	0.138	0.138	0.138
C_r (kN)	996	996	996	492	492	492	1267	1267	1267	656	656	656	656	656	656	1267	1267	1267
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.02	1.01	1.01	1.00	1.00	1.00	1.01	1.01	1.01	1.02	1.02	1.02	1.00	1.00	1.00
M_{rx} (kNm)	214	214	214	78	78	78	272	272	272	219	219	219	263	263	263	272	272	272
M_{ry} (kNm)	29	29	29	29	29	29	30	30	30	30	30	30	30	30	30	30	30	30
C_f/C_r	0.000	0.000	0.000	0.030	0.028	0.024	0.000	0.000	0.000	0.029	0.029	0.027	0.037	0.037	0.037	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.051	0.000	0.000	0.000	0.000	0.000	0.246	0.484	0.403	0.201	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.174	0.000	0.000	0.000	0.000	0.000	0.205	0.204	0.205	0.103	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.030	0.254	0.024	0.000	0.000	0.000	0.029	0.480	0.715	0.645	0.341	0.037	0.000	0.000	0.000
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.000	0.000	0.000	0.033	0.254	0.026	0.000	0.000	0.000	0.060	0.510	0.747	0.678	0.377	0.075	0.000	0.000	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	324	324	324	325	325	325	326	326	326	327	327	327	328	328	328	329	329	329
Member Label	6S-36S	6S-36S	6S-36S	36S-5S	36S-5S	36S-5S	10N-10N	10N-10N	10N-10N	10N-35N	10N-35N	10N-35N	35N-9N	35N-9N	35N-9N	10S-10S	10S-10S	10S-10S
Station (m)	0.0	2.3	4.6	0.0	0.7	1.4	0.0	0.4	0.7	0.0	2.3	4.6	0.0	1.0	2.0	0.0	0.4	0.7
Node Label at Station	6S	---	36S	36S	---	5S	10N	---	10N	10N	---	35N	35N	---	9N	10S	---	10S
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

Member Factored Load Effects:

C_f (kN)	32	32	31	25	24	24	0	0	0	19	18	18	21	21	20	0	0	0
$M_{fx\ (comp)}$ (kNm)	0	50	98	98	49	0	0	0	0	0	50	97	97	49	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	6	6	6	3	0	0	0	0	0	7	9	9	5	0	0	0	0
T_f (kN)	111	112	113	101	101	101	0	0	0	62	63	64	72	73	73	0	0	0
$M_{fx\ (tension)}$ (kNm)	0	50	98	98	49	0	0	0	0	0	50	97	97	49	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	6	6	6	3	0	0	0	0	0	7	9	9	5	0	0	0	0
V_{fx} (kN)	4	1	1	4	5	5	0	0	0	4	2	0	4	5	6	0	0	0
V_{fy} (kN)	22	21	21	71	72	72	0	0	0	22	21	20	48	49	49	0	0	0

Gross Section Properties:

Ag (mm^2)	8409	8409	8409	8409	8409	8409	8409	8409	8409	8409	8409	8409	8409	8409	8409	8409	8409	8409
I_x (mm^4)	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08
I_y (mm^4)	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07
J (mm^4)	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05
r_x (mm)	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204
r_y (mm)	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54
S_x (mm^3)	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06
S_y (mm^3)	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
L (mm)	4610	4610	4610	1372	1372	1372	724	724	724	4610	4610	4610	1981	1981	1981	724	724	724

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	324	324	324	325	325	325	326	326	326	327	327	327	328	328	328	329	329	329
Member Label	6S-36S	6S-36S	6S-36S	36S-5S	36S-5S	36S-5S	10N-10N	10N-10N	10N-10N	10N-35N	10N-35N	10N-35N	35N-9N	35N-9N	35N-9N	10S-10S	10S-10S	10S-10S
Station (m)	0.0	2.3	4.6	0.0	0.7	1.4	0.0	0.4	0.7	0.0	2.3	4.6	0.0	1.0	2.0	0.0	0.4	0.7
Node Label at Station	6S	---	36S	36S	---	5S	10N	---	10N	10N	---	35N	35N	---	9N	10S	---	10S
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Webs in combined flexural and axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	324	324	324	325	325	325	326	326	326	327	327	327	328	328	328	329	329	329
Member Label	6S-36S	6S-36S	6S-36S	36S-5S	36S-5S	36S-5S	10N-10N	10N-10N	10N-10N	10N-35N	10N-35N	10N-35N	35N-9N	35N-9N	35N-9N	10S-10S	10S-10S	10S-10S
Station (m)	0.0	2.3	4.6	0.0	0.7	1.4	0.0	0.4	0.7	0.0	2.3	4.6	0.0	1.0	2.0	0.0	0.4	0.7
Node Label at Station	6S	---	36S	36S	---	5S	10N	---	10N	10N	---	35N	35N	---	9N	10S	---	10S
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	4610	4610	4610	1372	1372	1372	724	724	724	4610	4610	4610	1981	1981	1981	724	724	724
L_y (mm)	5982	5982	5982	5982	5982	5982	724	724	724	6591	6591	6591	6591	6591	6591	724	724	724
λ_{max}	1.143	1.143	1.143	1.143	1.143	1.143	0.138	0.138	0.138	1.259	1.259	1.259	1.259	1.259	1.259	0.138	0.138	0.138
C_r (kN)	655.6	655.6	655.6	655.6	655.6	655.6	1266.7	1266.7	1266.7	581.3	581.3	581.3	581.3	581.3	581.3	1266.7	1266.7	1266.7
$(kL/r)_{max}$	110.8	110.8	110.8	110.8	110.8	110.8	13.4	13.4	13.4	122.1	122.1	122.1	122.1	122.1	122.1	13.4	13.4	13.4
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	NOT OK	NOT OK	NOT OK	NOT OK	NOT OK	NOT OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing				1	1	1	1	1	1				1	1	1	1	1	1
Battens	1	1	1							1	1	1						
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	1358	1358	1358	1358	1358	1358	92753	92753	92753	1119	1119	1119	1119	1119	1119	92753	92753	92753

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477
A_c (mm^2)	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205
A_d (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
A_b (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
μ	NA	NA	NA	0.0494	0.0494	0.0494	0.0494	0.0494	0.0494	NA	NA	NA	0.0494	0.0494	0.0494	0.0494	0.0494	0.0494
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.86	0.86	0.86	0.86	0.86	0.86	0.50	0.50	0.50	0.86	0.86	0.86	0.86	0.86	0.86
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	1.078	1.078	1.078	1.078	1.078	1.078	N/A	N/A	N/A	1.078	1.078	1.078	1.078	1.078	1.078
λ_v	N/A	N/A	N/A	1.232	1.232	1.232	0.149	0.149	0.149	N/A	N/A	N/A	1.358	1.358	1.358	0.149	0.149	0.149
Cr' (kN)	999999.0	999999.0	999999.0	597.6	597.6	597.6	1265.7	1265.7	1265.7	999999.0	999999.0	999999.0	525.2	525.2	525.2	1265.7	1265.7	1265.7
Lacing Governs?	No	No	No	Yes	Yes	Yes	No	No	No	No	No	No	Yes	Yes	Yes	No	No	No

Member ID in CSiBridge	324	324	324	325	325	325	326	326	326	327	327	327	328	328	328	329	329	329
Member Label	6S-36S	6S-36S	6S-36S	36S-5S	36S-5S	36S-5S	10N-10N	10N-10N	10N-10N	10N-35N	10N-35N	10N-35N	35N-9N	35N-9N	35N-9N	10S-10S	10S-10S	10S-10S
Station (m)	0.0	2.3	4.6	0.0	0.7	1.4	0.0	0.4	0.7	0.0	2.3	4.6	0.0	1.0	2.0	0.0	0.4	0.7
Node Label at Station	6S	---	36S	36S	---	5S	10N	---	10N	10N	---	35N	35N	---	9N	10S	---	10S
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	0.79	0.79	0.79	N/A	N/A	N/A	N/A	N/A	N/A	0.79	0.79	0.79	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	0.76	0.76	0.76	N/A	N/A	N/A	N/A	N/A	N/A	0.76	0.76	0.76	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	0.84	0.84	0.84	N/A	N/A	N/A	N/A	N/A	N/A	0.84	0.84	0.84	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	1.41	1.41	1.41	N/A	N/A	N/A	N/A	N/A	N/A	1.41	1.41	1.41	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	1.62	1.62	1.62	N/A	N/A	N/A	N/A	N/A	N/A	1.78	1.78	1.78	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	406	406	406	999999	999999	999999	999999	999999	999999	347	347	347	999999	999999	999999	999999	999999	999999
Battens Govern?	Yes	Yes	Yes	No	No	No	No	No	No	Yes	Yes	Yes	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	405.9	405.9	405.9	597.6	597.6	597.6	1266.7	1266.7	1266.7	347.2	347.2	347.2	525.2	525.2	525.2	1266.7	1266.7	1266.7

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6727	6727	6727	6727	6727	6727	6727	6727	6727	6727	6727	6727	6727	6727	6727	6727	6727	6727
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885	6885
$A_{n(corrosion)}$ (mm^2)	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508
$T_{r(b)}$ (kN)	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508	5508
$T_{r(c)}$ (kN)	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	324	324	324	325	325	325	326	326	326	327	327	327	328	328	328	329	329	329
Member Label	6S-36S	6S-36S	6S-36S	36S-5S	36S-5S	36S-5S	10N-10N	10N-10N	10N-10N	10N-35N	10N-35N	10N-35N	35N-9N	35N-9N	35N-9N	10S-10S	10S-10S	10S-10S
Station (m)	0.0	2.3	4.6	0.0	0.7	1.4	0.0	0.4	0.7	0.0	2.3	4.6	0.0	1.0	2.0	0.0	0.4	0.7
Node Label at Station	6S	---	36S	36S	---	5S	10N	---	10N	10N	---	35N	35N	---	9N	10S	---	10S
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851	1851
$(kL/r)_{max}$	111	111	111	111	111	111	13	13	13	122	122	122	122	122	122	13	13	13
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245
$M_{ry(Laterally\ Supported)}$ (kNm)	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	4610	4610	4610	1372	1372	1372	724	724	724	4610	4610	4610	1981	1981	1981	724	724	724
L_{uy} (mm)	5982	5982	5982	5982	5982	5982	724	724	724	6591	6591	6591	6591	6591	6591	724	724	724
M_{ux} (kNm) (y weak)	408	408	408	1371	1371	1371	2598	2598	2598	408	408	408	949	949	949	2598	2598	2598
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	219.4	219.4	219.4	263.1	263.1	263.1	271.9	271.9	271.9	219.4	219.4	219.4	254.9	254.9	254.9	271.9	271.9	271.9
M_{ry} (kNm)	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.079	0.079	0.076	0.042	0.040	0.040	0.000	0.000	0.000	0.055	0.052	0.052	0.040	0.040	0.038	0.000	0.000	0.000
(T_f/T_r)<=1	0.083	0.083	0.084	0.075	0.075	0.075	0.000	0.000	0.000	0.046	0.047	0.048	0.054	0.054	0.054	0.000	0.000	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.083	0.083	0.084	0.075	0.075	0.075	0.000	0.000	0.000	0.046	0.047	0.048	0.054	0.054	0.054	0.000	0.000	0.000
M_{fx}/M_{rx}<=1	0.000	0.228	0.447	0.372	0.186	0.000	0.000	0.000	0.000	0.000	0.228	0.442	0.381	0.192	0.000	0.000	0.000	0.000
M_{fy}/M_{ry}<=1	0.000	0.202	0.202	0.202	0.101	0.000	0.000	0.000	0.000	0.000	0.235	0.302	0.302	0.168	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r$<=1	0.083	0.513	0.733	0.649	0.362	0.075	0.000	0.000	0.000	0.046	0.510	0.792	0.737	0.415	0.054	0.000	0.000	0.000
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.253	0.470	0.429	0.142	0.000	0.000	0.000	0.000	0.000	0.364	0.644	0.578	0.254	0.000	0.000	0.000	0.000

Member ID in CSiBridge	324	324	324	325	325	325	326	326	326	327	327	327	328	328	328	329	329	329
Member Label	6S-36S	6S-36S	6S-36S	36S-5S	36S-5S	36S-5S	10N-10N	10N-10N	10N-10N	10N-35N	10N-35N	10N-35N	35N-9N	35N-9N	35N-9N	10S-10S	10S-10S	10S-10S
Station (m)	0.0	2.3	4.6	0.0	0.7	1.4	0.0	0.4	0.7	0.0	2.3	4.6	0.0	1.0	2.0	0.0	0.4	0.7
Node Label at Station	6S	---	36S	36S	---	5S	10N	---	10N	10N	---	35N	35N	---	9N	10S	---	10S
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1271	1271	1271	1271	1271	1271	1271	1271	1271	1271	1271	1271	1271	1271	1271	1271	1271	1271
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	3.26E+04	3.26E+04	3.26E+04	3.68E+05	3.68E+05	3.68E+05	1.32E+06	1.32E+06	1.32E+06	3.26E+04	3.26E+04	3.26E+04	1.76E+05	1.76E+05	1.76E+05	1.32E+06	1.32E+06	1.32E+06
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	1358	1358	1358	1358	1358	1358	92753	92753	92753	1119	1119	1119	1119	1119	1119	92753	92753	92753
U_{1y}	1.02	1.02	1.02	1.02	1.02	1.02	1.00	1.00	1.00	1.02	1.02	1.02	1.02	1.02	1.02	1.00	1.00	1.00
C_f/C_r	0.025	0.025	0.024	0.020	0.019	0.019	0.000	0.000	0.000	0.015	0.014	0.014	0.017	0.017	0.016	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.204	0.401	0.400	0.200	0.000	0.000	0.000	0.000	0.000	0.204	0.396	0.396	0.200	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.207	0.206	0.205	0.103	0.000	0.000	0.000	0.000	0.000	0.239	0.307	0.308	0.171	0.000	0.000	0.000	0.000
Interaction	0.025	0.436	0.631	0.625	0.322	0.019	0.000	0.000	0.000	0.015	0.458	0.718	0.721	0.388	0.016	0.000	0.000	0.000

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.143	1.143	1.143	1.143	1.143	1.143	0.138	0.138	0.138	1.259	1.259	1.259	1.259	1.259	1.259	0.138	0.138	0.138
$C_{r\ (K=1)}$ (kN)	656	656	656	656	656	656	1267	1267	1267	581	581	581	581	581	581	1267	1267	1267
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.02	1.02	1.02	1.02	1.02	1.02	1.00	1.00	1.00	1.02	1.02	1.02	1.02	1.02	1.02	1.00	1.00	1.00
C_f/C_r	0.049	0.049	0.047	0.038	0.037	0.037	0.000	0.000	0.000	0.033	0.031	0.031	0.036	0.036	0.034	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.204	0.401	0.400	0.200	0.000	0.000	0.000	0.000	0.000	0.204	0.396	0.396	0.200	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.207	0.206	0.205	0.103	0.000	0.000	0.000	0.000	0.000	0.239	0.307	0.308	0.171	0.000	0.000	0.000	0.000
Interaction	0.049	0.460	0.654	0.644	0.339	0.037	0.000	0.000	0.000	0.033	0.474	0.735	0.740	0.407	0.034	0.000	0.000	0.000

3.3. Lateral Torsional Buckling:

λ_{max}	1.143	1.143	1.143	1.143	1.143	1.143	0.138	0.138	0.138	1.259	1.259	1.259	1.259	1.259	1.259	0.138	0.138	0.138
C_r (kN)	656	656	656	656	656	656	1267	1267	1267	581	581	581	581	581	581	1267	1267	1267
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.02	1.02	1.02	1.02	1.02	1.02	1.00	1.00	1.00	1.02	1.02	1.02	1.02	1.02	1.02	1.00	1.00	1.00
M_{rx} (kNm)	219	219	219	263	263	263	272	272	272	219	219	219	255	255	255	272	272	272
M_{ry} (kNm)	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
C_f/C_r	0.049	0.049	0.047	0.038	0.037	0.037	0.000	0.000	0.000	0.033	0.031	0.031	0.036	0.036	0.034	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.228	0.447	0.372	0.186	0.000	0.000	0.000	0.000	0.000	0.228	0.442	0.381	0.192	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.207	0.206	0.205	0.103	0.000	0.000	0.000	0.000	0.000	0.239	0.307	0.308	0.171	0.000	0.000	0.000	0.000
Interaction	0.049	0.483	0.701	0.616	0.325	0.037	0.000	0.000	0.000	0.033	0.498	0.781	0.725	0.400	0.034	0.000	0.000	0.000
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.083	0.513	0.733	0.649	0.362	0.075	0.000	0.000	0.000	0.055	0.510	0.792	0.740	0.415	0.054	0.000	0.000	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	331	331	331	332	332	332	546	546	546	547	547	547	548	548	548	549	549	549
Member Label	10S-35S	10S-35S	10S-35S	35S-9S	35S-9S	35S-9S	14N-14N	14N-14N	14N-14N	14N-49N	14N-49N	14N-49N	49N-13N	49N-13N	49N-13N	14S-14S	14S-14S	14S-14S
Station (m)	0.0	2.3	4.6	0.0	1.0	2.0	0.0	0.4	0.7	0.0	2.3	4.6	0.0	1.3	2.6	0.0	0.4	0.7
Node Label at Station	10S	---	35S	35S	---	9S	14N	---	14N	14N	---	49N	49N	---	13N	14S	---	14S
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	S 13-49	S 13-49	S 13-49	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

Member Factored Load Effects:

C_f (kN)	33	32	31	29	29	29	0	0	0	240	239	239	324	322	321	0	0	0
$M_{fx\ (comp)}$ (kNm)	0	46	89	89	45	0	0	0	0	0	40	77	286	143	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	7	9	9	5	0	0	0	0	0	10	14	14	10	0	0	0	0
T_f (kN)	91	93	94	91	92	92	0	0	0	405	406	408	544	547	550	0	0	0
$M_{fx\ (tension)}$ (kNm)	0	46	89	89	45	0	0	0	0	0	40	77	286	143	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	7	9	9	5	0	0	0	0	0	10	14	14	10	0	0	0	0
V_{fx} (kN)	4	2	0	4	5	5	0	0	0	5	3	1	0	5	11	0	0	0
V_{fy} (kN)	21	19	18	44	45	45	0	0	0	18	17	16	110	110	111	0	0	0

Gross Section Properties:

Ag (mm^2)	8409	8409	8409	8409	8409	8409	8409	8409	8409	8409	8409	8409	34302	34302	34302	8409	8409	8409
I_x (mm^4)	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	4.07E+09	4.07E+09	4.07E+09	3.51E+08	3.51E+08	3.51E+08
I_y (mm^4)	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	9.42E+07	9.42E+07	9.42E+07	2.46E+07	2.46E+07	2.46E+07
J (mm^4)	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	7.92E+06	7.92E+06	7.92E+06	9.45E+05	9.45E+05	9.45E+05
r_x (mm)	204	204	204	204	204	204	204	204	204	204	204	204	344	344	344	204	204	204
r_y (mm)	54	54	54	54	54	54	54	54	54	54	54	54	52	52	52	54	54	54
S_x (mm^3)	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	6.60E+06	6.60E+06	6.60E+06	1.53E+06	1.53E+06	1.53E+06
S_y (mm^3)	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	5.91E+05	5.91E+05	5.91E+05	1.86E+05	1.86E+05	1.86E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	20	20	20	20	20	20	20	20	20	20	5	5	20	20	20	20	20	20
L (mm)	4610	4610	4610	1981	1981	1981	724	724	724	4610	4610	4610	2591	2591	2591	724	724	724

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	331	331	331	332	332	332	546	546	546	547	547	547	548	548	548	549	549	549
Member Label	10S-35S	10S-35S	10S-35S	35S-9S	35S-9S	35S-9S	14N-14N	14N-14N	14N-14N	14N-49N	14N-49N	14N-49N	49N-13N	49N-13N	49N-13N	14S-14S	14S-14S	14S-14S
Station (m)	0.0	2.3	4.6	0.0	1.0	2.0	0.0	0.4	0.7	0.0	2.3	4.6	0.0	1.3	2.6	0.0	0.4	0.7
Node Label at Station	10S	---	35S	35S	---	9S	14N	---	14N	14N	---	49N	49N	---	13N	14S	---	14S
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	S 13-49	S 13-49	S 13-49	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	16.0	16.0	16.0	16.0	16.0	16.0												
Webs in combined flexural and axial compression							16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	331	331	331	332	332	332	546	546	546	547	547	547	548	548	548	549	549	549
Member Label	10S-35S	10S-35S	10S-35S	35S-9S	35S-9S	35S-9S	14N-14N	14N-14N	14N-14N	14N-49N	14N-49N	14N-49N	49N-13N	49N-13N	49N-13N	14S-14S	14S-14S	14S-14S
Station (m)	0.0	2.3	4.6	0.0	1.0	2.0	0.0	0.4	0.7	0.0	2.3	4.6	0.0	1.3	2.6	0.0	0.4	0.7
Node Label at Station	10S	---	35S	35S	---	9S	14N	---	14N	14N	---	49N	49N	---	13N	14S	---	14S
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	S 13-49	S 13-49	S 13-49	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	4610	4610	4610	1981	1981	1981	724	724	724	4610	4610	4610	2591	2591	2591	724	724	724
L_y (mm)	6591	6591	6591	6591	6591	6591	724	724	724	7201	7201	7201	7201	7201	7201	724	724	724
λ_{max}	1.259	1.259	1.259	1.259	1.259	1.259	0.138	0.138	0.138	1.375	1.375	1.375	1.428	1.428	1.428	0.138	0.138	0.138
C_r (kN)	581.3	581.3	581.3	581.3	581.3	581.3	1266.7	1266.7	1266.7	515.8	612.5	612.5	1994.1	1994.1	1994.1	1266.7	1266.7	1266.7
$(kL/r)_{max}$	122.1	122.1	122.1	122.1	122.1	122.1	13.4	13.4	13.4	133.4	133.4	133.4	138.5	138.5	138.5	13.4	13.4	13.4
(comp. only) kL/r<120	NOT OK	NOT OK	NOT OK	NOT OK	NOT OK	NOT OK	OK	OK	OK	NOT OK	NOT OK	NOT OK	NOT OK	NOT OK	NOT OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing				1	1	1	1	1	1									
Battens	1	1	1							1	1	1						
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	1119	1119	1119	1119	1119	1119	92753	92753	92753	937	937	937	3587	3587	3587	92753	92753	92753

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477
A_c (mm^2)	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	17151	17151	17151	4205	4205	4205
A_d (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
A_b (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
μ	NA	NA	NA	0.0494	0.0494	0.0494	0.0494	0.0494	0.0494	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.86	0.86	0.86	0.86	0.86	0.86	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	1.078	1.078	1.078	1.078	1.078	1.078	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	1.358	1.358	1.358	0.149	0.149	0.149	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	525.2	525.2	525.2	1265.7	1265.7	1265.7	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	331	331	331	332	332	332	546	546	546	547	547	547	548	548	548	549	549	549
Member Label	10S-35S	10S-35S	10S-35S	35S-9S	35S-9S	35S-9S	14N-14N	14N-14N	14N-14N	14N-49N	14N-49N	14N-49N	49N-13N	49N-13N	49N-13N	14S-14S	14S-14S	14S-14S
Station (m)	0.0	2.3	4.6	0.0	1.0	2.0	0.0	0.4	0.7	0.0	2.3	4.6	0.0	1.3	2.6	0.0	0.4	0.7
Node Label at Station	10S	---	35S	35S	---	9S	14N	---	14N	14N	---	49N	49N	---	13N	14S	---	14S
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	S 13-49	S 13-49	S 13-49	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	0.79	0.79	0.79	N/A	N/A	N/A	N/A	N/A	N/A	0.79	0.79	0.79	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	0.76	0.76	0.76	N/A	N/A	N/A	N/A	N/A	N/A	0.76	0.76	0.76	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	2743	2743	2743	3343	3343	3343	3343	3343	3343
A_c (mm^2)	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	4205	17151	17151	17151	4205	4205	4205
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	0.84	0.84	0.84	N/A	N/A	N/A	N/A	N/A	N/A	1.25	1.25	1.25	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	1.41	1.41	1.41	N/A	N/A	N/A	N/A	N/A	N/A	1.41	1.41	1.41	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	1.78	1.78	1.78	N/A	N/A	N/A	N/A	N/A	N/A	1.95	1.95	1.95	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	347	347	347	999999	999999	999999	999999	999999	999999	299	355	355	999999	999999	999999	999999	999999	999999
Battens Govern?	Yes	Yes	Yes	No	No	No	No	No	No	Yes	Yes	Yes	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	347.2	347.2	347.2	525.2	525.2	525.2	1266.7	1266.7	1266.7	299.2	355.4	355.4	1994.1	1994.1	1994.1	1266.7	1266.7	1266.7

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6727	6727	6727	6727	6727	6727	6727	6727	6727	6727	7989	7989	27442	27442	27442	6727	6727	6727
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1594	1594	5475	5475	5475	1342	1342	1342
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	6885	6885	6885	6885	6885	6885	7647	7647	7647	6123	6123	6123	33540	33540	33540	7647	7647	7647
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	6885	6885	6885	6885	6885	6885	7647	7647	7647	6123	6123	6123	33540	33540	33540	7647	7647	7647
$A_{n(corrosion)}$ (mm^2)	5508	5508	5508	5508	5508	5508	6118	6118	6118	4898	5817	5817	26832	26832	26832	6118	6118	6118
$T_{r(b)}$ (kN)	1851	1851	1851	1851	1851	1851	2056	2056	2056	1646	1954	1954	9016	9016	9016	2056	2056	2056
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	5508	5508	5508	5508	5508	5508	6118	6118	6118	4898	5817	5817	26832	26832	26832	6118	6118	6118
$T_{r(c)}$ (kN)	1851	1851	1851	1851	1851	1851	2056	2056	2056	1646	1954	1954	9016	9016	9016	2056	2056	2056
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	331	331	331	332	332	332	546	546	546	547	547	547	548	548	548	549	549	549
Member Label	10S-35S	10S-35S	10S-35S	35S-9S	35S-9S	35S-9S	14N-14N	14N-14N	14N-14N	14N-49N	14N-49N	14N-49N	49N-13N	49N-13N	49N-13N	14S-14S	14S-14S	14S-14S
Station (m)	0.0	2.3	4.6	0.0	1.0	2.0	0.0	0.4	0.7	0.0	2.3	4.6	0.0	1.3	2.6	0.0	0.4	0.7
Node Label at Station	10S	---	35S	35S	---	9S	14N	---	14N	14N	---	49N	49N	---	13N	14S	---	14S
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	S 13-49	S 13-49	S 13-49	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	1851	1851	1851	1851	1851	1851	2056	2056	2056	1646	1954	1954	9016	9016	9016	2056	2056	2056
$(kL/r)_{max}$	122	122	122	122	122	122	13	13	13	133	133	133	138	138	138	13	13	13
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1594	1594	5475	5475	5475	1342	1342	1342
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	245	245	245	245	245	245	245	245	245	245	291	291	1053	1053	1053	245	245	245
$M_{ry(Laterally\ Supported)}$ (kNm)	30	30	30	30	30	30	30	30	30	30	35	35	94	94	94	30	30	30
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	4610	4610	4610	1981	1981	1981	724	724	724	4610	4610	4610	2591	2591	2591	724	724	724
L_{uy} (mm)	6591	6591	6591	6591	6591	6591	724	724	724	7201	7201	7201	7201	7201	7201	724	724	724
M_{ux} (kNm) (y weak)	408	408	408	949	949	949	2598	2598	2598	408	408	408	4110	4110	4110	2598	2598	2598
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	219.4	219.4	219.4	254.9	254.9	254.9	271.9	271.9	271.9	219.4	260.5	260.5	1096.6	1096.6	1096.6	271.9	271.9	271.9
M_{ry} (kNm)	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	35.3	35.3	94.3	94.3	94.3	29.8	29.8	29.8

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.095	0.092	0.089	0.055	0.055	0.055	0.000	0.000	0.000	0.802	0.673	0.673	0.162	0.161	0.161	0.000	0.000	0.000
(T_f/T_r)<=1	0.068	0.069	0.070	0.068	0.069	0.069	0.000	0.000	0.000	0.302	0.255	0.256	0.099	0.100	0.100	0.000	0.000	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.068	0.069	0.070	0.068	0.069	0.069	0.000	0.000	0.000	0.302	0.255	0.256	0.099	0.100	0.100	0.000	0.000	0.000
M_{fx}/M_{rx}<=1	0.000	0.210	0.406	0.349	0.177	0.000	0.000	0.000	0.000	0.000	0.154	0.296	0.261	0.130	0.000	0.000	0.000	0.000
M_{fy}/M_{ry}<=1	0.000	0.235	0.302	0.302	0.168	0.000	0.000	0.000	0.000	0.000	0.283	0.396	0.149	0.106	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r$<=1	0.068	0.514	0.778	0.719	0.413	0.069	0.000	0.000	0.000	0.302	0.691	0.948	0.509	0.336	0.100	0.000	0.000	0.000
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.298	0.560	0.519	0.210	0.000	0.000	0.000	0.000	0.000	0.000	0.150	0.215	0.041	0.000	0.000	0.000	0.000

Member ID in CSiBridge	331	331	331	332	332	332	546	546	546	547	547	547	548	548	548	549	549	549
Member Label	10S-35S	10S-35S	10S-35S	35S-9S	35S-9S	35S-9S	14N-14N	14N-14N	14N-14N	14N-49N	14N-49N	14N-49N	49N-13N	49N-13N	49N-13N	14S-14S	14S-14S	14S-14S
Station (m)	0.0	2.3	4.6	0.0	1.0	2.0	0.0	0.4	0.7	0.0	2.3	4.6	0.0	1.3	2.6	0.0	0.4	0.7
Node Label at Station	10S	---	35S	35S	---	9S	14N	---	14N	14N	---	49N	49N	---	13N	14S	---	14S
Section #	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	S 13-49	S 13-49	S 13-49	Section 03	Section 03	Section 03
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1271	1271	1271	1271	1271	1271	1271	1271	1271	1271	1510	1510	5186	5186	5186	1271	1271	1271
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	3.26E+04	3.26E+04	3.26E+04	1.76E+05	1.76E+05	1.76E+05	1.32E+06	1.32E+06	1.32E+06	3.26E+04	3.26E+04	3.26E+04	1.20E+06	1.20E+06	1.20E+06	1.32E+06	1.32E+06	1.32E+06
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	1119	1119	1119	1119	1119	1119	92753	92753	92753	937	937	937	3587	3587	3587	92753	92753	92753
U_{1y}	1.03	1.03	1.03	1.03	1.03	1.03	1.00	1.00	1.00	1.34	1.34	1.34	1.10	1.10	1.10	1.00	1.00	1.00
C_f/C_r	0.026	0.025	0.024	0.023	0.023	0.023	0.000	0.000	0.000	0.189	0.158	0.158	0.062	0.062	0.062	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.188	0.364	0.363	0.184	0.000	0.000	0.000	0.000	0.000	0.139	0.267	0.272	0.136	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.242	0.311	0.311	0.173	0.000	0.000	0.000	0.000	0.000	0.380	0.532	0.163	0.117	0.000	0.000	0.000	0.000
Interaction	0.026	0.455	0.699	0.697	0.379	0.023	0.000	0.000	0.000	0.189	0.677	0.957	0.497	0.314	0.062	0.000	0.000	0.000

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.259	1.259	1.259	1.259	1.259	1.259	0.138	0.138	0.138	1.375	1.375	1.375	1.428	1.428	1.428	0.138	0.138	0.138
$C_{r\ (K=1)}$ (kN)	581	581	581	581	581	581	1267	1267	1267	516	613	613	1994	1994	1994	1267	1267	1267
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.03	1.03	1.03	1.03	1.03	1.03	1.00	1.00	1.00	1.34	1.34	1.34	1.10	1.10	1.10	1.00	1.00	1.00
C_f/C_r	0.057	0.055	0.053	0.050	0.050	0.050	0.000	0.000	0.000	0.465	0.390	0.390	0.162	0.161	0.161	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.188	0.364	0.363	0.184	0.000	0.000	0.000	0.000	0.000	0.139	0.267	0.272	0.136	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.242	0.311	0.311	0.173	0.000	0.000	0.000	0.000	0.000	0.380	0.532	0.163	0.117	0.000	0.000	0.000	0.000
Interaction	0.057	0.485	0.728	0.724	0.406	0.050	0.000	0.000	0.000	0.465	0.909	1.189	0.597	0.414	0.161	0.000	0.000	0.000

3.3. Lateral Torsional Buckling:

λ_{max}	1.259	1.259	1.259	1.259	1.259	1.259	0.138	0.138	0.138	1.375	1.375	1.375	1.428	1.428	1.428	0.138	0.138	0.138
C_r (kN)	581	581	581	581	581	581	1267	1267	1267	516	613	613	1994	1994	1994	1267	1267	1267
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.03	1.03	1.03	1.03	1.03	1.03	1.00	1.00	1.00	1.34	1.34	1.34	1.10	1.10	1.10	1.00	1.00	1.00
M_{rx} (kNm)	219	219	219	255	255	255	272	272	272	219	260	260	1097	1097	1097	272	272	272
M_{ry} (kNm)	30	30	30	30	30	30	30	30	30	30	35	35	94	94	94	30	30	30
C_f/C_r	0.057	0.055	0.053	0.050	0.050	0.050	0.000	0.000	0.000	0.465	0.390	0.390	0.162	0.161	0.161	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.210	0.406	0.349	0.177	0.000	0.000	0.000	0.000	0.000	0.155	0.298	0.261	0.130	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.242	0.311	0.311	0.173	0.000	0.000	0.000	0.000	0.000	0.380	0.532	0.163	0.117	0.000	0.000	0.000	0.000
Interaction	0.057	0.507	0.771	0.710	0.399	0.050	0.000	0.000	0.000	0.465	0.925	1.220	0.587	0.408	0.161	0.000	0.000	0.000
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	NOT OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.095	0.514	0.778	0.724	0.413	0.069	0.000	0.000	0.000	0.802	0.925	1.220	0.597	0.414	0.161	0.000	0.000	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	551	551	551	552	552	552	567	567	567	569	569	569	570	570	570	572	572	572
Member Label	14S-49S	14S-49S	14S-49S	49S-13S	49S-13S	49S-13S	2S-2S	2S-2S	2S-2S	2S-1S	2S-1S	2S-1S	4S-4S	4S-4S	4S-4S	4S-3S	4S-3S	4S-3S
Station (m)	0.0	2.3	4.6	0.0	1.3	2.6	0.0	0.4	0.7	0.0	2.7	5.4	0.0	0.4	0.7	0.0	2.8	5.7
Node Label at Station	14S	---	49S	49S	---	13S	2S	---	2S	2S	---	1S	4S	---	4S	4S	---	3S
Section #	Section 03	Section 03	Section 03	S 13-49	S 13-49	S 13-49	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

Member Factored Load Effects:

C_f (kN)	215	214	214	300	299	297	0	0	0	25	25	24	0	0	0	10	9	8
$M_{fx\ (comp)}$ (kNm)	0	53	104	325	163	0	0	0	0	0	2	0	0	0	0	0	3	0
$M_{fy\ (comp)}$ (kNm)	0	10	14	14	10	0	0	0	0	0	4	0	0	0	0	0	3	0
T_f (kN)	427	428	429	585	588	590	0	0	0	109	110	112	0	0	0	0	0	0
$M_{fx\ (tension)}$ (kNm)	0	53	104	325	163	0	0	0	0	0	2	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	10	14	14	10	0	0	0	0	0	4	0	0	0	0	0	0	0
V_{fx} (kN)	5	3	1	0	5	11	0	0	0	3	0	3	0	0	0	2	0	2
V_{fy} (kN)	23	23	22	125	125	126	0	0	0	2	0	2	0	0	0	2	0	2

Gross Section Properties:

Ag (mm^2)	8409	8409	8409	34302	34302	34302	8409	8409	8409	8409	8409	8409	6603	6603	6603	6603	6603	6603
I_x (mm^4)	3.51E+08	3.51E+08	3.51E+08	4.07E+09	4.07E+09	4.07E+09	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	3.51E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08
I_y (mm^4)	2.46E+07	2.46E+07	2.46E+07	9.42E+07	9.42E+07	9.42E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.46E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07
J (mm^4)	9.45E+05	9.45E+05	9.45E+05	7.92E+06	7.92E+06	7.92E+06	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	9.45E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05
r_x (mm)	204	204	204	344	344	344	204	204	204	204	204	204	209	209	209	209	209	209
r_y (mm)	54	54	54	52	52	52	54	54	54	54	54	54	60	60	60	60	60	60
S_x (mm^3)	1.53E+06	1.53E+06	1.53E+06	6.60E+06	6.60E+06	6.60E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.53E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06
S_y (mm^3)	1.86E+05	1.86E+05	1.86E+05	5.91E+05	5.91E+05	5.91E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.86E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	20	5	5	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
L (mm)	4610	4610	4610	2591	2591	2591	724	724	724	5372	5372	5372	724	724	724	5677	5677	5677

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	551	551	551	552	552	552	567	567	567	569	569	569	570	570	570	572	572	572
Member Label	14S-49S	14S-49S	14S-49S	49S-13S	49S-13S	49S-13S	2S-2S	2S-2S	2S-2S	2S-1S	2S-1S	2S-1S	4S-4S	4S-4S	4S-4S	4S-3S	4S-3S	4S-3S
Station (m)	0.0	2.3	4.6	0.0	1.3	2.6	0.0	0.4	0.7	0.0	2.7	5.4	0.0	0.4	0.7	0.0	2.8	5.7
Node Label at Station	14S	---	49S	49S	---	13S	2S	---	2S	2S	---	1S	4S	---	4S	4S	---	3S
Section #	Section 03	Section 03	Section 03	S 13-49	S 13-49	S 13-49	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression																		
Webs in combined flexural and axial compression	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	551	551	551	552	552	552	567	567	567	569	569	569	570	570	570	572	572	572
Member Label	14S-49S	14S-49S	14S-49S	49S-13S	49S-13S	49S-13S	2S-2S	2S-2S	2S-2S	2S-1S	2S-1S	2S-1S	4S-4S	4S-4S	4S-4S	4S-3S	4S-3S	4S-3S
Station (m)	0.0	2.3	4.6	0.0	1.3	2.6	0.0	0.4	0.7	0.0	2.7	5.4	0.0	0.4	0.7	0.0	2.8	5.7
Node Label at Station	14S	---	49S	49S	---	13S	2S	---	2S	2S	---	1S	4S	---	4S	4S	---	3S
Section #	Section 03	Section 03	Section 03	S 13-49	S 13-49	S 13-49	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	4610	4610	4610	2591	2591	2591	724	724	724	5372	5372	5372	724	724	724	5677	5677	5677
L_y (mm)	7201	7201	7201	7201	7201	7201	724	724	724	5372	5372	5372	724	724	724	5677	5677	5677
λ_{max}	1.375	1.375	1.375	1.428	1.428	1.428	0.138	0.138	0.138	1.026	1.026	1.026	0.124	0.124	0.124	0.976	0.976	0.976
C_r (kN)	515.8	612.5	612.5	1994.1	1994.1	1994.1	1266.7	1266.7	1266.7	738.3	738.3	738.3	995.6	995.6	995.6	609.6	609.6	609.6
$(kL/r)_{max}$	133.4	133.4	133.4	138.5	138.5	138.5	13.4	13.4	13.4	99.5	99.5	99.5	12.1	12.1	12.1	94.6	94.6	94.6
(comp. only) kL/r<120	NOT OK	NOT OK	NOT OK	NOT OK	NOT OK	NOT OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing							1	1	1				1	1	1	1	1	1
Battens	1	1	1							1	1	1						
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	937	937	937	3587	3587	3587	92753	92753	92753	1684	1684	1684	90077	90077	90077	1465	1465	1465

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	0	0	0	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	0	0	0	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	0	0	0	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	0	0	0	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	1.00	1.00	1.00	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	1.00	1.00	1.00	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	5563	5563	5563
A_c (mm^2)	4205	4205	4205	17151	17151	17151	4205	4205	4205	4205	4205	4205	3302	3302	3302	3302	3302	3302
A_d (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
A_b (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
μ	NA	NA	NA	NA	NA	NA	0.0494	0.0494	0.0494	NA	NA	NA	0.0388	0.0388	0.0388	0.0525	0.0525	0.0525
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.86	0.86	0.86	0.50	0.50	0.50	0.89	0.89	0.89	0.85	0.85	0.85
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	1.078	1.078	1.078	N/A	N/A	N/A	1.063	1.063	1.063	1.083	1.083	1.083
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	0.149	0.149	0.149	N/A	N/A	N/A	0.132	0.132	0.132	1.057	1.057	1.057
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	1265.7	1265.7	1265.7	999999.0	999999.0	999999.0	995.1	995.1	995.1	561.9	561.9	561.9
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes

Member ID in CSiBridge	551	551	551	552	552	552	567	567	567	569	569	569	570	570	570	572	572	572
Member Label	14S-49S	14S-49S	14S-49S	49S-13S	49S-13S	49S-13S	2S-2S	2S-2S	2S-2S	2S-1S	2S-1S	2S-1S	4S-4S	4S-4S	4S-4S	4S-3S	4S-3S	4S-3S
Station (m)	0.0	2.3	4.6	0.0	1.3	2.6	0.0	0.4	0.7	0.0	2.7	5.4	0.0	0.4	0.7	0.0	2.8	5.7
Node Label at Station	14S	---	49S	49S	---	13S	2S	---	2S	2S	---	1S	4S	---	4S	4S	---	3S
Section #	Section 03	Section 03	Section 03	S 13-49	S 13-49	S 13-49	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	0.79	0.79	0.79	N/A	N/A	N/A	N/A	N/A	N/A	0.79	0.79	0.79	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	0.76	0.76	0.76	N/A	N/A	N/A	N/A	N/A	N/A	0.76	0.76	0.76	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	2743	2743	2743	3343	3343	3343	3343	3343	3343	3277	3277	3277	3343	3343	3343	3343	3343	3343
A_c (mm^2)	4205	4205	4205	17151	17151	17151	4205	4205	4205	4205	4205	4205	3302	3302	3302	3302	3302	3302
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	1.25	1.25	1.25	N/A	N/A	N/A	N/A	N/A	N/A	0.87	0.87	0.87	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	1.41	1.41	1.41	N/A	N/A	N/A	N/A	N/A	N/A	1.41	1.41	1.41	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	1.95	1.95	1.95	N/A	N/A	N/A	N/A	N/A	N/A	1.45	1.45	1.45	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	299	355	355	999999	999999	999999	999999	999999	999999	478	478	478	999999	999999	999999	999999	999999	999999
Battens Govern?	Yes	Yes	Yes	No	No	No	No	No	No	Yes	Yes	Yes	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	299.2	355.4	355.4	1994.1	1994.1	1994.1	1266.7	1266.7	1266.7	477.7	477.7	477.7	995.6	995.6	995.6	561.9	561.9	561.9

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6727	7989	7989	27442	27442	27442	6727	6727	6727	6727	6727	6727	5282	5282	5282	5282	5282	5282
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1342	1594	1594	5475	5475	5475	1342	1342	1342	1342	1342	1342	1054	1054	1054	1054	1054	1054
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	6123	6123	6123	33540	33540	33540	7647	7647	7647	6885	6885	6885	5841	5841	5841	5841	5841	5841
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	6123	6123	6123	33540	33540	33540	7647	7647	7647	6885	6885	6885	5841	5841	5841	5841	5841	5841
$A_{n(corrosion)}$ (mm^2)	4898	5817	5817	26832	26832	26832	6118	6118	6118	5508	5508	5508	4673	4673	4673	4673	4673	4673
$T_{r(b)}$ (kN)	1646	1954	1954	9016	9016	9016	2056	2056	2056	1851	1851	1851	1570	1570	1570	1570	1570	1570
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	4898	5817	5817	26832	26832	26832	6118	6118	6118	5508	5508	5508	4673	4673	4673	4673	4673	4673
$T_{r(c)}$ (kN)	1646	1954	1954	9016	9016	9016	2056	2056	2056	1851	1851	1851	1570	1570	1570	1570	1570	1570
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	551	551	551	552	552	552	567	567	567	569	569	569	570	570	570	572	572	572
Member Label	14S-49S	14S-49S	14S-49S	49S-13S	49S-13S	49S-13S	2S-2S	2S-2S	2S-2S	2S-1S	2S-1S	2S-1S	4S-4S	4S-4S	4S-4S	4S-3S	4S-3S	4S-3S
Station (m)	0.0	2.3	4.6	0.0	1.3	2.6	0.0	0.4	0.7	0.0	2.7	5.4	0.0	0.4	0.7	0.0	2.8	5.7
Node Label at Station	14S	---	49S	49S	---	13S	2S	---	2S	2S	---	1S	4S	---	4S	4S	---	3S
Section #	Section 03	Section 03	Section 03	S 13-49	S 13-49	S 13-49	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	1646	1954	1954	9016	9016	9016	2056	2056	2056	1851	1851	1851	1570	1570	1570	1570	1570	1570
$(kL/r)_{max}$	133	133	133	138	138	138	13	13	13	99	99	99	12	12	12	95	95	95
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1342	1594	1594	5475	5475	5475	1342	1342	1342	1342	1342	1342	1054	1054	1054	1054	1054	1054
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	245	291	291	1053	1053	1053	245	245	245	245	245	245	201	201	201	201	201	201
$M_{ry(Laterally\ Supported)}$ (kNm)	30	35	35	94	94	94	30	30	30	30	30	30	29	29	29	29	29	29
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	4610	4610	4610	2591	2591	2591	724	724	724	5372	5372	5372	724	724	724	5677	5677	5677
L_{uy} (mm)	7201	7201	7201	7201	7201	7201	724	724	724	5372	5372	5372	724	724	724	5677	5677	5677
M_{ux} (kNm) (y weak)	408	408	408	4110	4110	4110	2598	2598	2598	350	350	350	978	978	978	125	125	125
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	219.4	260.5	260.5	1096.6	1096.6	1096.6	271.9	271.9	271.9	209.1	209.1	209.1	213.9	213.9	213.9	94.7	94.7	94.7
M_{ry} (kNm)	29.8	35.3	35.3	94.3	94.3	94.3	29.8	29.8	29.8	29.8	29.8	29.8	29.2	29.2	29.2	29.2	29.2	29.2

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.718	0.602	0.602	0.150	0.150	0.149	0.000	0.000	0.000	0.052	0.052	0.050	0.000	0.000	0.000	0.018	0.016	0.014
(T_f/T_r)<=1	0.318	0.269	0.269	0.107	0.107	0.108	0.000	0.000	0.000	0.081	0.082	0.083	0.000	0.000	0.000	0.000	0.000	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.318	0.269	0.269	0.107	0.107	0.108	0.000	0.000	0.000	0.081	0.082	0.083	0.000	0.000	0.000	0.000	0.000	0.000
M_{fx}/M_{rx}<=1	0.000	0.203	0.399	0.296	0.149	0.000	0.000	0.000	0.000	0.000	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000
M_{fy}/M_{ry}<=1	0.000	0.283	0.396	0.149	0.106	0.000	0.000	0.000	0.000	0.000	0.134	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r$<=1	0.318	0.755	1.065	0.552	0.362	0.108	0.000	0.000	0.000	0.081	0.226	0.083	0.000	0.000	0.000	0.000	0.000	0.000
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.226	0.235	0.044	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	551	551	551	552	552	552	567	567	567	569	569	569	570	570	570	572	572	572
Member Label	14S-49S	14S-49S	14S-49S	49S-13S	49S-13S	49S-13S	2S-2S	2S-2S	2S-2S	2S-1S	2S-1S	2S-1S	4S-4S	4S-4S	4S-4S	4S-3S	4S-3S	4S-3S
Station (m)	0.0	2.3	4.6	0.0	1.3	2.6	0.0	0.4	0.7	0.0	2.7	5.4	0.0	0.4	0.7	0.0	2.8	5.7
Node Label at Station	14S	---	49S	49S	---	13S	2S	---	2S	2S	---	1S	4S	---	4S	4S	---	3S
Section #	Section 03	Section 03	Section 03	S 13-49	S 13-49	S 13-49	Section 03	Section 03	Section 03	Section 03	Section 03	Section 03	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1271	1510	1510	5186	5186	5186	1271	1271	1271	1271	1271	1271	998	998	998	998	998	998
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	3.26E+04	3.26E+04	3.26E+04	1.20E+06	1.20E+06	1.20E+06	1.32E+06	1.32E+06	1.32E+06	2.40E+04	2.40E+04	2.40E+04	1.09E+06	1.09E+06	1.09E+06	1.77E+04	1.77E+04	1.77E+04
U_{1x}	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	937	937	937	3587	3587	3587	92753	92753	92753	1684	1684	1684	90077	90077	90077	1465	1465	1465
U_{1y}	1.30	1.30	1.30	1.09	1.09	1.09	1.00	1.00	1.00	1.02	1.02	1.01	1.00	1.00	1.00	1.01	1.01	1.01
C_f/C_r	0.169	0.142	0.142	0.058	0.058	0.057	0.000	0.000	0.000	0.020	0.020	0.019	0.000	0.000	0.000	0.010	0.009	0.008
$U_{1x}M_{fx}/M_{rx}$	0.000	0.183	0.360	0.309	0.155	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.015	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.367	0.513	0.162	0.116	0.000	0.000	0.000	0.000	0.000	0.136	0.000	0.000	0.000	0.000	0.000	0.104	0.000
Interaction	0.169	0.692	1.015	0.529	0.328	0.057	0.000	0.000	0.000	0.020	0.164	0.019	0.000	0.000	0.000	0.010	0.127	0.008

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.375	1.375	1.375	1.428	1.428	1.428	0.138	0.138	0.138	1.026	1.026	1.026	0.124	0.124	0.124	0.976	0.976	0.976
$C_{r\ (K=1)}$ (kN)	516	613	613	1994	1994	1994	1267	1267	1267	738	738	738	996	996	996	610	610	610
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.30	1.30	1.30	1.09	1.09	1.09	1.00	1.00	1.00	1.02	1.02	1.01	1.00	1.00	1.00	1.01	1.01	1.01
C_f/C_r	0.417	0.349	0.349	0.150	0.150	0.149	0.000	0.000	0.000	0.034	0.034	0.033	0.000	0.000	0.000	0.016	0.015	0.013
$U_{1x}M_{fx}/M_{rx}$	0.000	0.183	0.360	0.309	0.155	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.015	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.367	0.513	0.162	0.116	0.000	0.000	0.000	0.000	0.000	0.136	0.000	0.000	0.000	0.000	0.000	0.104	0.000
Interaction	0.417	0.900	1.223	0.621	0.421	0.149	0.000	0.000	0.000	0.034	0.178	0.033	0.000	0.000	0.000	0.016	0.133	0.013

3.3. Lateral Torsional Buckling:

λ_{max}	1.375	1.375	1.375	1.428	1.428	1.428	0.138	0.138	0.138	1.026	1.026	1.026	0.124	0.124	0.124	0.976	0.976	0.976
C_r (kN)	516	613	613	1994	1994	1994	1267	1267	1267	738	738	738	996	996	996	610	610	610
U_{1x}	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.30	1.30	1.30	1.09	1.09	1.09	1.00	1.00	1.00	1.02	1.02	1.01	1.00	1.00	1.00	1.01	1.01	1.01
M_{rx} (kNm)	219	260	260	1097	1097	1097	272	272	272	209	209	209	214	214	214	95	95	95
M_{ry} (kNm)	30	35	35	94	94	94	30	30	30	30	30	30	29	29	29	29	29	29
C_f/C_r	0.417	0.349	0.349	0.150	0.150	0.149	0.000	0.000	0.000	0.034	0.034	0.033	0.000	0.000	0.000	0.016	0.015	0.013
$U_{1x}M_{fx}/M_{rx}$	0.000	0.205	0.402	0.296	0.149	0.000	0.000	0.000	0.000	0.000	0.010	0.000	0.000	0.000	0.000	0.000	0.032	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.367	0.513	0.162	0.116	0.000	0.000	0.000	0.000	0.000	0.136	0.000	0.000	0.000	0.000	0.000	0.104	0.000
Interaction	0.417	0.921	1.265	0.609	0.414	0.149	0.000	0.000	0.000	0.034	0.180	0.033	0.000	0.000	0.000	0.016	0.150	0.013
Demand/Capacity ≤ 1	OK	OK	NOT OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.718	0.921	1.265	0.621	0.421	0.149	0.000	0.000	0.000	0.081	0.226	0.083	0.000	0.000	0.000	0.018	0.150	0.014

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	573	573	573	575	575	575	576	576	576	578	578	578	279	279	279	280	280	280
Member Label	8S-8S	8S-8S	8S-8S	8S-7S	8S-7S	8S-7S	12S-12S	12S-12S	12S-12S	12S-11S	12S-11S	12S-11S	0N-2N	0N-2N	0N-2N	2N-4N	2N-4N	2N-4N
Station (m)	0.0	0.4	0.7	0.0	3.1	6.3	0.0	0.4	0.7	0.0	3.4	6.9	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	8S	---	8S	8S	---	7S	12S	---	12S	12S	---	11S	0N	---	2N	2N	---	4N
Section #	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord

Member Factored Load Effects:

C_f (kN)	0	0	0	10	8	7	0	0	0	15	14	12	88	93	97	155	159	164
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	3	0	0	0	0	0	4	0	28	8	18	5	2	7
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	4	0	0	0	0	0	5	0	54	17	30	14	5	14
T_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	0	0	0	2	0	2	0	0	0	3	0	3	16	14	19	10	3	11
V_{fy} (kN)	0	0	0	2	0	2	0	0	0	2	0	2	6	8	10	2	2	4

Gross Section Properties:

Ag (mm^2)	6603	6603	6603	6603	6603	6603	6603	6603	6603	6603	6603	6603	12774	12774	12774	12774	12774	12774
I_x (mm^4)	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.88E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08
I_y (mm^4)	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	2.39E+07	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08
J (mm^4)	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	1.38E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05
r_x (mm)	209	209	209	209	209	209	209	209	209	209	209	209	143	143	143	143	143	143
r_y (mm)	60	60	60	60	60	60	60	60	60	60	60	60	208	208	208	208	208	208
S_x (mm^3)	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.26E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06
S_y (mm^3)	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
L (mm)	724	724	724	6287	6287	6287	724	724	724	6896	6896	6896	5791	5791	5791	5791	5791	5791

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	573	573	573	575	575	575	576	576	576	578	578	578	279	279	279	280	280	280
Member Label	8S-8S	8S-8S	8S-8S	8S-7S	8S-7S	8S-7S	12S-12S	12S-12S	12S-12S	12S-11S	12S-11S	12S-11S	0N-2N	0N-2N	0N-2N	2N-4N	2N-4N	2N-4N
Station (m)	0.0	0.4	0.7	0.0	3.1	6.3	0.0	0.4	0.7	0.0	3.4	6.9	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	8S	---	8S	8S	---	7S	12S	---	12S	12S	---	11S	0N	---	2N	2N	---	4N
Section #	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0						
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels													5.2	5.2	5.2	5.2	5.2	5.2
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression													37.5	37.5	37.5	37.5	37.5	37.5
Webs in flexural compression													37.5	37.5	37.5	37.5	37.5	37.5
Webs in combined flexural and axial compression	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	37.5	37.5	37.5	37.5	37.5	37.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	573	573	573	575	575	575	576	576	576	578	578	578	279	279	279	280	280	280
Member Label	8S-8S	8S-8S	8S-8S	8S-7S	8S-7S	8S-7S	12S-12S	12S-12S	12S-12S	12S-11S	12S-11S	12S-11S	0N-2N	0N-2N	0N-2N	2N-4N	2N-4N	2N-4N
Station (m)	0.0	0.4	0.7	0.0	3.1	6.3	0.0	0.4	0.7	0.0	3.4	6.9	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	8S	---	8S	8S	---	7S	12S	---	12S	12S	---	11S	0N	---	2N	2N	---	4N
Section #	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	724	724	724	6287	6287	6287	724	724	724	6896	6896	6896	5791	5791	5791	5791	5791	5791
L_y (mm)	724	724	724	6287	6287	6287	724	724	724	6896	6896	6896	5791	5791	5791	5791	5791	5791
λ_{max}	0.124	0.124	0.124	1.081	1.081	1.081	0.124	0.124	0.124	1.185	1.185	1.185	0.418	0.418	0.418	0.418	0.418	0.418
C_r (kN)	995.6	995.6	995.6	548.5	548.5	548.5	995.6	995.6	995.6	492.5	492.5	492.5	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3
$(kL/r)_{max}$	12.1	12.1	12.1	104.8	104.8	104.8	12.1	12.1	12.1	114.9	114.9	114.9	40.5	40.5	40.5	40.5	40.5	40.5
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	90077	90077	90077	1194	1194	1194	90077	90077	90077	993	993	993	15356	15356	15356	15356	15356	15356

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	439	439	439	439	439	439
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	380	380	380	380	380	380
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	439	439	439	439	439	439
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	380	380	380	380	380	380
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	6477	6477	6477	5658	5658	5658	6477	6477	6477	6206	6206	6206	6477	6477	6477	6477	6477	6477
A_c (mm^2)	3302	3302	3302	3302	3302	3302	3302	3302	3302	3302	3302	3302	6387	6387	6387	6387	6387	6387
A_d (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	907	907	907	907	907	907
A_b (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	907	907	907	907	907	907
μ	0.0388	0.0388	0.0388	0.0508	0.0508	0.0508	0.0388	0.0388	0.0388	0.0422	0.0422	0.0422	0.0479	0.0479	0.0479	0.0479	0.0479	0.0479
P_{cr}/P_e (Fig.3.51)	0.89	0.89	0.89	0.86	0.86	0.86	0.89	0.89	0.89	0.88	0.88	0.88	0.86	0.86	0.86	0.86	0.86	0.86
k'(sqrt(P_e/P_{cr}))	1.063	1.063	1.063	1.081	1.081	1.081	1.063	1.063	1.063	1.068	1.068	1.068	1.076	1.076	1.076	1.076	1.076	1.076
λ_v	0.132	0.132	0.132	1.168	1.168	1.168	0.132	0.132	0.132	1.266	1.266	1.266	0.309	0.309	0.309	0.309	0.309	0.309
Cr' (kN)	995.1	995.1	995.1	501.6	501.6	501.6	995.1	995.1	995.1	453.2	453.2	453.2	1871.7	1871.7	1871.7	1871.7	1871.7	1871.7
Lacing Governs?	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	No	No	No	No	No	No

Member ID in CSiBridge	573	573	573	575	575	575	576	576	576	578	578	578	279	279	279	280	280	280
Member Label	8S-8S	8S-8S	8S-8S	8S-7S	8S-7S	8S-7S	12S-12S	12S-12S	12S-12S	12S-11S	12S-11S	12S-11S	0N-2N	0N-2N	0N-2N	2N-4N	2N-4N	2N-4N
Station (m)	0.0	0.4	0.7	0.0	3.1	6.3	0.0	0.4	0.7	0.0	3.4	6.9	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	8S	---	8S	8S	---	7S	12S	---	12S	12S	---	11S	0N	---	2N	2N	---	4N
Section #	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	3302	3302	3302	3302	3302	3302	3302	3302	3302	3302	3302	3302	6387	6387	6387	6387	6387	6387
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	995.6	995.6	995.6	501.6	501.6	501.6	995.6	995.6	995.6	453.2	453.2	453.2	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	5282	5282	5282	5282	5282	5282	5282	5282	5282	5282	5282	5282	10219	10219	10219	10219	10219	10219
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054	2039	2039	2039	2039	2039	2039
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	5841	5841	5841	5079	5079	5079	5841	5841	5841	5079	5079	5079	8751	8751	8751	8751	8751	8751
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	5841	5841	5841	5079	5079	5079	5841	5841	5841	5079	5079	5079	8751	8751	8751	8751	8751	8751
$A_{n(corrosion)}$ (mm^2)	4673	4673	4673	4063	4063	4063	4673	4673	4673	4063	4063	4063	7001	7001	7001	7001	7001	7001
$T_{r(b)}$ (kN)	1570	1570	1570	1365	1365	1365	1570	1570	1570	1365	1365	1365	2352	2352	2352	2352	2352	2352
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	4673	4673	4673	4063	4063	4063	4673	4673	4673	4063	4063	4063	7001	7001	7001	7001	7001	7001
$T_{r(c)}$ (kN)	1570	1570	1570	1365	1365	1365	1570	1570	1570	1365	1365	1365	2352	2352	2352	2352	2352	2352
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	573	573	573	575	575	575	576	576	576	578	578	578	279	279	279	280	280	280
Member Label	8S-8S	8S-8S	8S-8S	8S-7S	8S-7S	8S-7S	12S-12S	12S-12S	12S-12S	12S-11S	12S-11S	12S-11S	0N-2N	0N-2N	0N-2N	2N-4N	2N-4N	2N-4N
Station (m)	0.0	0.4	0.7	0.0	3.1	6.3	0.0	0.4	0.7	0.0	3.4	6.9	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	8S	---	8S	8S	---	7S	12S	---	12S	12S	---	11S	0N	---	2N	2N	---	4N
Section #	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	1570	1570	1570	1365	1365	1365	1570	1570	1570	1365	1365	1365	2352	2352	2352	2352	2352	2352
$(kL/r)_{max}$	12	12	12	105	105	105	12	12	12	115	115	115	40	40	40	40	40	40
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054	2039	2039	2039	2039	2039	2039
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	201	201	201	201	201	201	201	201	201	201	201	201	219	219	219	219	219	219
$M_{ry(Laterally\ Supported)}$ (kNm)	29	29	29	29	29	29	29	29	29	29	29	29	386	386	386	386	386	386
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	724	724	724	6287	6287	6287	724	724	724	6896	6896	6896	5791	5791	5791	5791	5791	5791
L_{uy} (mm)	724	724	724	6287	6287	6287	724	724	724	6896	6896	6896	5791	5791	5791	5791	5791	5791
M_{ux} (kNm) (y weak)	978	978	978	113	113	113	978	978	978	103	103	103	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	922	922	922	922	922	922
M_{rx} (kNm)	213.9	213.9	213.9	85.6	85.6	85.6	213.9	213.9	213.9	78.0	78.0	78.0	218.6	218.6	218.6	218.6	218.6	218.6
M_{ry} (kNm)	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	375.5	375.5	375.5	375.5	375.5	375.5

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.000	0.000	0.000	0.020	0.016	0.014	0.000	0.000	0.000	0.033	0.031	0.026	0.049	0.052	0.054	0.086	0.088	0.091
(T_f/T_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
M_{fx}/M_{rx}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
M_{fy}/M_{ry}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_f/M_r-T_fS/M_tA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Member ID in CSiBridge	573	573	573	575	575	575	576	576	576	578	578	578	279	279	279	280	280	280
Member Label	8S-8S	8S-8S	8S-8S	8S-7S	8S-7S	8S-7S	12S-12S	12S-12S	12S-12S	12S-11S	12S-11S	12S-11S	0N-2N	0N-2N	0N-2N	2N-4N	2N-4N	2N-4N
Station (m)	0.0	0.4	0.7	0.0	3.1	6.3	0.0	0.4	0.7	0.0	3.4	6.9	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	8S	---	8S	8S	---	7S	12S	---	12S	12S	---	11S	0N	---	2N	2N	---	4N
Section #	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 05	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02
Element Group	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	02 TT Vertical	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	998	998	998	998	998	998	998	998	998	998	998	998	1931	1931	1931	1931	1931	1931
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.09E+06	1.09E+06	1.09E+06	1.44E+04	1.44E+04	1.44E+04	1.09E+06	1.09E+06	1.09E+06	1.20E+04	1.20E+04	1.20E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	90077	90077	90077	1194	1194	1194	90077	90077	90077	993	993	993	32545	32545	32545	32545	32545	32545
U_{1y}	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.02	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.01
C_f/C_r	0.000	0.000	0.000	0.010	0.008	0.007	0.000	0.000	0.000	0.015	0.014	0.012	0.046	0.048	0.050	0.080	0.082	0.085
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.015	0.000	0.000	0.000	0.000	0.000	0.020	0.000	0.129	0.037	0.083	0.023	0.009	0.032
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.138	0.000	0.000	0.000	0.000	0.000	0.174	0.000	0.140	0.044	0.078	0.036	0.013	0.036
Interaction	0.000	0.000	0.000	0.010	0.161	0.007	0.000	0.000	0.000	0.015	0.208	0.012	0.315	0.129	0.211	0.140	0.105	0.154

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.124	0.124	0.124	1.081	1.081	1.081	0.124	0.124	0.124	1.185	1.185	1.185	0.418	0.418	0.418	0.418	0.418	0.418
$C_{r\ (K=1)}$ (kN)	996	996	996	549	549	549	996	996	996	492	492	492	1803	1803	1803	1803	1803	1803
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.02	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.01
C_f/C_r	0.000	0.000	0.000	0.018	0.015	0.013	0.000	0.000	0.000	0.030	0.028	0.024	0.049	0.052	0.054	0.086	0.088	0.091
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.015	0.000	0.000	0.000	0.000	0.000	0.020	0.000	0.129	0.037	0.083	0.023	0.009	0.032
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.138	0.000	0.000	0.000	0.000	0.000	0.174	0.000	0.140	0.044	0.078	0.036	0.013	0.036
Interaction	0.000	0.000	0.000	0.018	0.168	0.013	0.000	0.000	0.000	0.030	0.222	0.024	0.318	0.133	0.215	0.146	0.110	0.160

3.3. Lateral Torsional Buckling:

λ_{max}	0.124	0.124	0.124	1.081	1.081	1.081	0.124	0.124	0.124	1.185	1.185	1.185	0.418	0.418	0.418	0.418	0.418	0.418
C_r (kN)	996	996	996	549	549	549	996	996	996	492	492	492	1803	1803	1803	1803	1803	1803
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01
U_{1y}	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.02	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.01
M_{rx} (kNm)	214	214	214	86	86	86	214	214	214	78	78	78	219	219	219	219	219	219
M_{ry} (kNm)	29	29	29	29	29	29	29	29	29	29	29	29	375	375	375	375	375	375
C_f/C_r	0.000	0.000	0.000	0.018	0.015	0.013	0.000	0.000	0.000	0.030	0.028	0.024	0.049	0.052	0.054	0.086	0.088	0.091
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.035	0.000	0.000	0.000	0.000	0.000	0.051	0.000	0.129	0.037	0.083	0.023	0.009	0.032
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.138	0.000	0.000	0.000	0.000	0.000	0.174	0.000	0.144	0.045	0.080	0.037	0.013	0.037
Interaction	0.000	0.000	0.000	0.018	0.188	0.013	0.000	0.000	0.000	0.030	0.254	0.024	0.322	0.134	0.217	0.147	0.111	0.161
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.000	0.000	0.000	0.020	0.188	0.014	0.000	0.000	0.000	0.033	0.254	0.026	0.322	0.134	0.217	0.147	0.111	0.161

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	281	281	281	282	282	282	283	283	283	284	284	284	285	285	285	286	286	286
Member Label	4N-6N	4N-6N	4N-6N	6N-8N	6N-8N	6N-8N	8N-10N	8N-10N	8N-10N	10N-12N	10N-12N	10N-12N	12N-14N	12N-14N	12N-14N	14N-16N	14N-16N	14N-16N
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station	4N	---	6N	6N	---	8N	8N	---	10N	10N	---	12N	12N	---	14N	14N	---	16N
Section #	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord

Member Factored Load Effects:

C_f (kN)	482	486	490	645	649	654	1308	1313	1317	1488	1492	1497	2585	2592	2599	1576	1581	1586
$M_{fx\ (comp)}$ (kNm)	13	6	31	19	7	13	7	3	18	12	27	72	68	6	70	49	58	118
$M_{fy\ (comp)}$ (kNm)	24	10	48	41	12	32	13	4	19	25	12	67	71	34	23	33	49	172
T_f (kN)	0	0	0	0	0	0	49	47	44	146	143	141	264	260	256	0	0	0
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	7	3	18	12	27	72	68	6	70	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	13	4	19	25	12	67	71	34	23	0	0	0
V_{fx} (kN)	14	12	18	14	12	19	9	4	12	14	16	23	16	16	23	16	27	37
V_{fy} (kN)	5	8	10	3	5	8	3	4	7	12	15	17	20	24	27	15	17	20

Gross Section Properties:

Ag (mm^2)	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	20903	20903	20903	12774	12774	12774
I_x (mm^4)	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	3.34E+08	3.34E+08	3.34E+08	2.61E+08	2.61E+08	2.61E+08
I_y (mm^4)	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	9.14E+08	9.14E+08	9.14E+08	8.94E+08	8.94E+08	8.94E+08
J (mm^4)	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	2.92E+06	2.92E+06	2.92E+06	7.19E+05	7.19E+05	7.19E+05
r_x (mm)	143	143	143	143	143	143	143	143	143	143	143	143	126	126	126	143	143	143
r_y (mm)	208	208	208	208	208	208	208	208	208	208	208	208	209	209	209	265	265	265
S_x (mm^3)	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.75E+06	1.75E+06	1.75E+06	1.37E+06	1.37E+06	1.37E+06
S_y (mm^3)	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	4.00E+06	4.00E+06	4.00E+06	2.73E+06	2.73E+06	2.73E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
L (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	7722	7722	7722

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	281	281	281	282	282	282	283	283	283	284	284	284	285	285	285	286	286	286
Member Label	4N-6N	4N-6N	4N-6N	6N-8N	6N-8N	6N-8N	8N-10N	8N-10N	8N-10N	10N-12N	10N-12N	10N-12N	12N-14N	12N-14N	12N-14N	14N-16N	14N-16N	14N-16N
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station	4N	---	6N	6N	---	8N	8N	---	10N	10N	---	12N	12N	---	14N	14N	---	16N
Section #	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	32.0	32.0	32.0	37.5	37.5	37.5
Webs in flexural compression	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	32.0	32.0	32.0	37.5	37.5	37.5
Webs in combined flexural and axial compression	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	32.0	32.0	32.0	37.5	37.5	37.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	281	281	281	282	282	282	283	283	283	284	284	284	285	285	285	286	286	286
Member Label	4N-6N	4N-6N	4N-6N	6N-8N	6N-8N	6N-8N	8N-10N	8N-10N	8N-10N	10N-12N	10N-12N	10N-12N	12N-14N	12N-14N	12N-14N	14N-16N	14N-16N	14N-16N
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station	4N	---	6N	6N	---	8N	8N	---	10N	10N	---	12N	12N	---	14N	14N	---	16N
Section #	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	7722	7722	7722
L_y (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	7722	7722	7722
λ_{max}	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.474	0.474	0.474	0.557	0.557	0.557
C_r (kN)	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	2875.0	2875.0	2875.0	1677.0	1677.0	1677.0
$(kL/r)_{max}$	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	46.0	46.0	46.0	54.0	54.0	54.0
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	15356	15356	15356	15356	15356	15356	15356	15356	15356	15356	15356	15356	19655	19655	19655	8638	8638	8638

Shear Flexibility Factor:

1. Lacing:

a (mm)	439	439	439	439	439	439	439	439	439	439	439	439	439	439	439	425	425	425
b (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	368	368	368
ε_aa (mm)	439	439	439	439	439	439	439	439	439	439	439	439	439	439	439	425	425	425
ε_bb (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	368	368	368
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477
A_c (mm^2)	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	10452	10452	10452	6387	6387	6387
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	0.0479	0.0479	0.0479	0.0479	0.0479	0.0479	0.0479	0.0479	0.0479	0.0479	0.0479	0.0479	0.0784	0.0784	0.0784	0.0450	0.0450	0.0450
P_{cr}/P_e (Fig.3.51)	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.80	0.80	0.80	0.87	0.87	0.87
k'(sqrt(P_e/P_{cr}))	1.076	1.076	1.076	1.076	1.076	1.076	1.076	1.076	1.076	1.076	1.076	1.076	1.118	1.118	1.118	1.072	1.072	1.072
λ_v	0.309	0.309	0.309	0.309	0.309	0.309	0.309	0.309	0.309	0.309	0.309	0.309	0.320	0.320	0.320	0.322	0.322	0.322
Cr' (kN)	1871.7	1871.7	1871.7	1871.7	1871.7	1871.7	1871.7	1871.7	1871.7	1871.7	1871.7	1871.7	3054.0	3054.0	3054.0	1864.9	1864.9	1864.9
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	281	281	281	282	282	282	283	283	283	284	284	284	285	285	285	286	286	286
Member Label	4N-6N	4N-6N	4N-6N	6N-8N	6N-8N	6N-8N	8N-10N	8N-10N	8N-10N	10N-12N	10N-12N	10N-12N	12N-14N	12N-14N	12N-14N	14N-16N	14N-16N	14N-16N
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station	4N	---	6N	6N	---	8N	8N	---	10N	10N	---	12N	12N	---	14N	14N	---	16N
Section #	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	10452	10452	10452	6387	6387	6387
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	2875.0	2875.0	2875.0	1677.0	1677.0	1677.0

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	10219	10219	10219	10219	10219	10219	10219	10219	10219	10219	10219	10219	16722	16722	16722	10219	10219	10219
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	3336	3336	3336	2039	2039	2039
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	16880	16880	16880	8751	8751	8751
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	16880	16880	16880	8751	8751	8751
$A_{n(corrosion)}$ (mm^2)	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	13504	13504	13504	7001	7001	7001
$T_{r(b)}$ (kN)	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	4537	4537	4537	2352	2352	2352
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	13504	13504	13504	7001	7001	7001
$T_{r(c)}$ (kN)	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	4537	4537	4537	2352	2352	2352
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	281	281	281	282	282	282	283	283	283	284	284	284	285	285	285	286	286	286
Member Label	4N-6N	4N-6N	4N-6N	6N-8N	6N-8N	6N-8N	8N-10N	8N-10N	8N-10N	10N-12N	10N-12N	10N-12N	12N-14N	12N-14N	12N-14N	14N-16N	14N-16N	14N-16N
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station	4N	---	6N	6N	---	8N	8N	---	10N	10N	---	12N	12N	---	14N	14N	---	16N
Section #	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	4537	4537	4537	2352	2352	2352
$(kL/r)_{max}$	40	40	40	40	40	40	40	40	40	40	40	40	46	46	46	54	54	54
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	3336	3336	3336	2039	2039	2039
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	219	219	219	219	219	219	219	219	219	219	219	219	280	280	280	219	219	219
$M_{ry(Laterally\ Supported)}$ (kNm)	386	386	386	386	386	386	386	386	386	386	386	386	638	638	638	436	436	436
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	7722	7722	7722
L_{uy} (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	7722	7722	7722
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	922	922	922	922	922	922	922	922	922	922	922	922	2102	2102	2102	692	692	692
M_{rx} (kNm)	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6	279.8	279.8	279.8	218.6	218.6	218.6
M_{ry} (kNm)	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5	651.9	651.9	651.9	384.7	384.7	384.7

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
$(V_f/V_r)<=1$																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.267	0.270	0.272	0.358	0.360	0.363	0.725	0.728	0.730	0.825	0.827	0.830	0.899	0.902	0.904	0.940	0.943	0.946
$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.024	0.023	0.022	0.072	0.070	0.069	0.079	0.078	0.077	0.000	0.000	0.000

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.024	0.023	0.022	0.072	0.070	0.069	0.079	0.078	0.077	0.000	0.000	0.000
$M_{fx}/M_{rx}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.032	0.014	0.082	0.055	0.124	0.329	0.243	0.021	0.250	0.000	0.000	0.000
$M_{fy}/M_{ry}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.035	0.011	0.051	0.067	0.032	0.178	0.109	0.052	0.035	0.000	0.000	0.000
$T_f/T_r+M_f/M_r<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.091	0.047	0.155	0.193	0.226	0.577	0.431	0.152	0.362	0.000	0.000	0.000
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.018	0.000	0.089	0.000	0.013	0.368	0.195	0.000	0.134	0.000	0.000	0.000

Member ID in CSiBridge	281	281	281	282	282	282	283	283	283	284	284	284	285	285	285	286	286	286
Member Label	4N-6N	4N-6N	4N-6N	6N-8N	6N-8N	6N-8N	8N-10N	8N-10N	8N-10N	10N-12N	10N-12N	10N-12N	12N-14N	12N-14N	12N-14N	14N-16N	14N-16N	14N-16N
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station	4N	---	6N	6N	---	8N	8N	---	10N	10N	---	12N	12N	---	14N	14N	---	16N
Section #	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	3161	3161	3161	1931	1931	1931
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.97E+04	1.97E+04	1.97E+04	8.64E+03	8.64E+03	8.64E+03
U_{1x}	1.03	1.03	1.03	1.04	1.04	1.04	1.09	1.09	1.09	1.11	1.11	1.11	1.15	1.15	1.15	1.22	1.22	1.22
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	32545	32545	32545	32545	32545	32545	32545	32545	32545	32545	32545	32545	53809	53809	53809	29610	29610	29610
U_{1y}	1.02	1.02	1.02	1.02	1.02	1.02	1.04	1.04	1.04	1.05	1.05	1.05	1.05	1.05	1.05	1.06	1.06	1.06
C_f/C_r	0.250	0.252	0.254	0.334	0.336	0.339	0.677	0.680	0.682	0.770	0.772	0.775	0.818	0.820	0.822	0.816	0.819	0.821
$U_{1x}M_{fx}/M_{rx}$	0.061	0.028	0.146	0.091	0.033	0.062	0.035	0.015	0.090	0.061	0.137	0.365	0.280	0.025	0.288	0.274	0.325	0.661
$U_{1y}M_{fy}/M_{ry}$	0.063	0.026	0.126	0.108	0.032	0.085	0.035	0.011	0.051	0.068	0.033	0.182	0.117	0.056	0.038	0.080	0.119	0.417
Interaction	0.374	0.306	0.526	0.533	0.401	0.485	0.747	0.706	0.823	0.899	0.942	1.322	1.215	0.901	1.149	1.170	1.262	1.900

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.474	0.474	0.474	0.557	0.557	0.557
$C_{r\ (K=1)}$ (kN)	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	2875	2875	2875	1677	1677	1677
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.03	1.03	1.03	1.04	1.04	1.04	1.09	1.09	1.09	1.11	1.11	1.11	1.15	1.15	1.15	1.22	1.22	1.22
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.02	1.02	1.02	1.02	1.02	1.02	1.04	1.04	1.04	1.05	1.05	1.05	1.05	1.05	1.05	1.06	1.06	1.06
C_f/C_r	0.267	0.270	0.272	0.358	0.360	0.363	0.725	0.728	0.730	0.825	0.827	0.830	0.899	0.902	0.904	0.940	0.943	0.946
$U_{1x}M_{fx}/M_{rx}$	0.061	0.028	0.146	0.091	0.033	0.062	0.035	0.015	0.090	0.061	0.137	0.365	0.280	0.025	0.288	0.274	0.325	0.661
$U_{1y}M_{fy}/M_{ry}$	0.063	0.026	0.126	0.108	0.032	0.085	0.035	0.011	0.051	0.068	0.033	0.182	0.117	0.056	0.038	0.080	0.119	0.417
Interaction	0.392	0.324	0.544	0.557	0.425	0.509	0.795	0.754	0.872	0.954	0.997	1.377	1.296	0.982	1.230	1.294	1.386	2.024

3.3. Lateral Torsional Buckling:

λ_{max}	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.474	0.474	0.474	0.557	0.557	0.557
C_r (kN)	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	2875	2875	2875	1677	1677	1677
U_{1x}	1.03	1.03	1.03	1.04	1.04	1.04	1.09	1.09	1.09	1.11	1.11	1.11	1.15	1.15	1.15	1.22	1.22	1.22
U_{1y}	1.02	1.02	1.02	1.02	1.02	1.02	1.04	1.04	1.04	1.05	1.05	1.05	1.05	1.05	1.05	1.06	1.06	1.06
M_{rx} (kNm)	219	219	219	219	219	219	219	219	219	219	219	219	280	280	280	219	219	219
M_{ry} (kNm)	375	375	375	375	375	375	375	375	375	375	375	375	652	652	652	385	385	385
C_f/C_r	0.267	0.270	0.272	0.358	0.360	0.363	0.725	0.728	0.730	0.825	0.827	0.830	0.899	0.902	0.904	0.940	0.943	0.946
$U_{1x}M_{fx}/M_{rx}$	0.061	0.028	0.146	0.091	0.033	0.062	0.035	0.015	0.090	0.061	0.137	0.365	0.280	0.025	0.288	0.274	0.325	0.661
$U_{1y}M_{fy}/M_{ry}$	0.065	0.027	0.130	0.111	0.033	0.087	0.036	0.011	0.053	0.070	0.033	0.187	0.114	0.055	0.037	0.091	0.135	0.472
Interaction	0.394	0.325	0.548	0.560	0.426	0.512	0.796	0.754	0.873	0.956	0.998	1.382	1.293	0.981	1.229	1.305	1.402	2.079
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	NOT OK	NOT OK
Highest Ratio	0.394	0.325	0.548	0.560	0.426	0.512	0.796	0.754	0.873	0.956	0.998	1.382	1.296	0.982	1.230	1.305	1.402	2.079

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	559	559	559	560	560	560	561	561	561	562	562	562	563	563	563	564	564	564
Member Label	0S-2S	0S-2S	0S-2S	2S-4S	2S-4S	2S-4S	4S-6S	4S-6S	4S-6S	6S-8S	6S-8S	6S-8S	8S-10S	8S-10S	8S-10S	10S-12S	10S-12S	10S-12S
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	0S	---	2S	2S	---	4S	4S	---	6S	6S	---	8S	8S	---	10S	10S	---	12S
Section #	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord

Member Factored Load Effects:

C_f (kN)	88	92	97	169	173	178	543	547	551	654	658	662	1326	1331	1335	1482	1486	1491
$M_{fx\ (comp)}$ (kNm)	26	5	22	7	4	12	16	4	29	16	5	15	12	7	21	20	18	63
$M_{fy\ (comp)}$ (kNm)	47	17	24	12	5	13	19	10	43	38	12	30	10	6	14	22	12	61
T_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	20	17	15	93	91	89
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	12	7	21	20	18	63
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	10	6	14	22	12	61
V_{fx} (kN)	15	12	18	10	3	10	13	10	17	12	11	18	8	3	11	13	14	21
V_{fy} (kN)	6	8	10	2	3	5	6	8	10	3	5	8	4	6	8	12	14	17

Gross Section Properties:

Ag (mm^2)	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774
I_x (mm^4)	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08
I_y (mm^4)	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08	5.53E+08
J (mm^4)	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05
r_x (mm)	143	143	143	143	143	143	143	143	143	143	143	143	143	143	143	143	143	143
r_y (mm)	208	208	208	208	208	208	208	208	208	208	208	208	208	208	208	208	208	208
S_x (mm^3)	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06
S_y (mm^3)	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06	2.42E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
L (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	559	559	559	560	560	560	561	561	561	562	562	562	563	563	563	564	564	564
Member Label	0S-2S	0S-2S	0S-2S	2S-4S	2S-4S	2S-4S	4S-6S	4S-6S	4S-6S	6S-8S	6S-8S	6S-8S	8S-10S	8S-10S	8S-10S	10S-12S	10S-12S	10S-12S
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	0S	---	2S	2S	---	4S	4S	---	6S	6S	---	8S	8S	---	10S	10S	---	12S
Section #	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5
Webs in flexural compression	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5
Webs in combined flexural and axial compression	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	559	559	559	560	560	560	561	561	561	562	562	562	563	563	563	564	564	564
Member Label	0S-2S	0S-2S	0S-2S	2S-4S	2S-4S	2S-4S	4S-6S	4S-6S	4S-6S	6S-8S	6S-8S	6S-8S	8S-10S	8S-10S	8S-10S	10S-12S	10S-12S	10S-12S
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	0S	---	2S	2S	---	4S	4S	---	6S	6S	---	8S	8S	---	10S	10S	---	12S
Section #	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
L_y (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
λ_{max}	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418
C_r (kN)	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3
$(kL/r)_{max}$	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	15356	15356	15356	15356	15356	15356	15356	15356	15356	15356	15356	15356	15356	15356	15356	15356	15356	15356

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477
A_c (mm^2)	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450
P_{cr}/P_e (Fig.3.51)	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
k'(sqrt(P_e/P_{cr}))	1.072	1.072	1.072	1.072	1.072	1.072	1.072	1.072	1.072	1.072	1.072	1.072	1.072	1.072	1.072	1.072	1.072	1.072
λ_v	0.308	0.308	0.308	0.308	0.308	0.308	0.308	0.308	0.308	0.308	0.308	0.308	0.308	0.308	0.308	0.308	0.308	0.308
Cr' (kN)	1872.3	1872.3	1872.3	1872.3	1872.3	1872.3	1872.3	1872.3	1872.3	1872.3	1872.3	1872.3	1872.3	1872.3	1872.3	1872.3	1872.3	1872.3
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	559	559	559	560	560	560	561	561	561	562	562	562	563	563	563	564	564	564
Member Label	0S-2S	0S-2S	0S-2S	2S-4S	2S-4S	2S-4S	4S-6S	4S-6S	4S-6S	6S-8S	6S-8S	6S-8S	8S-10S	8S-10S	8S-10S	10S-12S	10S-12S	10S-12S
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	0S	---	2S	2S	---	4S	4S	---	6S	6S	---	8S	8S	---	10S	10S	---	12S
Section #	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3	1803.3

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	10219	10219	10219	10219	10219	10219	10219	10219	10219	10219	10219	10219	10219	10219	10219	10219	10219	10219
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751	8751
$A_{n(corrosion)}$ (mm^2)	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001
$T_{r(b)}$ (kN)	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001	7001
$T_{r(c)}$ (kN)	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	559	559	559	560	560	560	561	561	561	562	562	562	563	563	563	564	564	564
Member Label	0S-2S	0S-2S	0S-2S	2S-4S	2S-4S	2S-4S	4S-6S	4S-6S	4S-6S	6S-8S	6S-8S	6S-8S	8S-10S	8S-10S	8S-10S	10S-12S	10S-12S	10S-12S
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	0S	---	2S	2S	---	4S	4S	---	6S	6S	---	8S	8S	---	10S	10S	---	12S
Section #	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352	2352
$(kL/r)_{max}$	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	219	219	219	219	219	219	219	219	219	219	219	219	219	219	219	219	219	219
$M_{ry(Laterally\ Supported)}$ (kNm)	386	386	386	386	386	386	386	386	386	386	386	386	386	386	386	386	386	386
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
L_{uy} (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	922	922	922	922	922	922	922	922	922	922	922	922	922	922	922	922	922	922
M_{rx} (kNm)	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6	218.6
M_{ry} (kNm)	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5	375.5

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y/w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
$(V_f/V_r)<=1$																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.049	0.051	0.054	0.094	0.096	0.099	0.301	0.303	0.306	0.363	0.365	0.367	0.735	0.738	0.740	0.822	0.824	0.827
$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.008	0.007	0.046	0.045	0.044

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.008	0.007	0.046	0.045	0.044
$M_{fx}/M_{rx}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.055	0.032	0.096	0.091	0.082	0.288
$M_{fy}/M_{ry}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.027	0.016	0.037	0.059	0.032	0.162
$T_f/T_r+M_f/M_r<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.091	0.056	0.141	0.196	0.159	0.494
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.062	0.031	0.118	0.058	0.024	0.362

PARSONS

Member ID in CSiBridge	559	559	559	560	560	560	561	561	561	562	562	562	563	563	563	564	564	564
Member Label	0S-2S	0S-2S	0S-2S	2S-4S	2S-4S	2S-4S	4S-6S	4S-6S	4S-6S	6S-8S	6S-8S	6S-8S	8S-10S	8S-10S	8S-10S	10S-12S	10S-12S	10S-12S
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	0S	---	2S	2S	---	4S	4S	---	6S	6S	---	8S	8S	---	10S	10S	---	12S
Section #	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02	Section 02
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04	1.54E+04
U_{1x}	1.01	1.01	1.01	1.01	1.01	1.01	1.04	1.04	1.04	1.04	1.04	1.05	1.09	1.09	1.10	1.11	1.11	1.11
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	32545	32545	32545	32545	32545	32545	32545	32545	32545	32545	32545	32545	32545	32545	32545	32545	32545	32545
U_{1y}	1.00	1.00	1.00	1.01	1.01	1.01	1.02	1.02	1.02	1.02	1.02	1.02	1.04	1.04	1.04	1.05	1.05	1.05
C_f/C_r	**0.046**	**0.048**	**0.050**	**0.087**	**0.090**	**0.092**	**0.281**	**0.283**	**0.285**	**0.339**	**0.341**	**0.343**	**0.687**	**0.689**	**0.691**	**0.767**	**0.769**	**0.772**
$U_{1x}M_{fx}/M_{rx}$	**0.120**	**0.023**	**0.101**	**0.032**	**0.019**	**0.056**	**0.076**	**0.019**	**0.138**	**0.076**	**0.024**	**0.072**	**0.060**	**0.035**	**0.105**	**0.101**	**0.091**	**0.319**
$U_{1y}M_{fy}/M_{ry}$	**0.122**	**0.044**	**0.062**	**0.031**	**0.013**	**0.034**	**0.050**	**0.026**	**0.113**	**0.100**	**0.032**	**0.079**	**0.027**	**0.016**	**0.038**	**0.060**	**0.033**	**0.166**
Interaction	**0.287**	**0.115**	**0.214**	**0.151**	**0.121**	**0.182**	**0.407**	**0.329**	**0.536**	**0.516**	**0.396**	**0.494**	**0.774**	**0.740**	**0.834**	**0.928**	**0.893**	**1.257**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418
$C_{r\ (K=1)}$ (kN)	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.01	1.01	1.01	1.01	1.01	1.01	1.04	1.04	1.04	1.04	1.04	1.05	1.09	1.09	1.10	1.11	1.11	1.11
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.01	1.01	1.01	1.02	1.02	1.02	1.02	1.02	1.02	1.04	1.04	1.04	1.05	1.05	1.05
C_f/C_r	**0.049**	**0.051**	**0.054**	**0.094**	**0.096**	**0.099**	**0.301**	**0.303**	**0.306**	**0.363**	**0.365**	**0.367**	**0.735**	**0.738**	**0.740**	**0.822**	**0.824**	**0.827**
$U_{1x}M_{fx}/M_{rx}$	**0.120**	**0.023**	**0.101**	**0.032**	**0.019**	**0.056**	**0.076**	**0.019**	**0.138**	**0.076**	**0.024**	**0.072**	**0.060**	**0.035**	**0.105**	**0.101**	**0.091**	**0.319**
$U_{1y}M_{fy}/M_{ry}$	**0.122**	**0.044**	**0.062**	**0.031**	**0.013**	**0.034**	**0.050**	**0.026**	**0.113**	**0.100**	**0.032**	**0.079**	**0.027**	**0.016**	**0.038**	**0.060**	**0.033**	**0.166**
Interaction	**0.291**	**0.118**	**0.217**	**0.157**	**0.127**	**0.188**	**0.427**	**0.349**	**0.556**	**0.540**	**0.421**	**0.518**	**0.822**	**0.789**	**0.883**	**0.983**	**0.948**	**1.312**

3.3. Lateral Torsional Buckling:

λ_{max}	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418
C_r (kN)	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803	1803
U_{1x}	1.01	1.01	1.01	1.01	1.01	1.01	1.04	1.04	1.04	1.04	1.04	1.05	1.09	1.09	1.10	1.11	1.11	1.11
U_{1y}	1.00	1.00	1.00	1.01	1.01	1.01	1.02	1.02	1.02	1.02	1.02	1.02	1.04	1.04	1.04	1.05	1.05	1.05
M_{rx} (kNm)	219	219	219	219	219	219	219	219	219	219	219	219	219	219	219	219	219	219
M_{ry} (kNm)	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375
C_f/C_r	**0.049**	**0.051**	**0.054**	**0.094**	**0.096**	**0.099**	**0.301**	**0.303**	**0.306**	**0.363**	**0.365**	**0.367**	**0.735**	**0.738**	**0.740**	**0.822**	**0.824**	**0.827**
$U_{1x}M_{fx}/M_{rx}$	**0.120**	**0.023**	**0.101**	**0.032**	**0.019**	**0.056**	**0.076**	**0.019**	**0.138**	**0.076**	**0.024**	**0.072**	**0.060**	**0.035**	**0.105**	**0.101**	**0.091**	**0.319**
$U_{1y}M_{fy}/M_{ry}$	**0.126**	**0.045**	**0.064**	**0.032**	**0.013**	**0.035**	**0.051**	**0.027**	**0.116**	**0.103**	**0.033**	**0.082**	**0.028**	**0.017**	**0.039**	**0.061**	**0.033**	**0.170**
Interaction	**0.294**	**0.119**	**0.219**	**0.158**	**0.128**	**0.189**	**0.428**	**0.349**	**0.560**	**0.542**	**0.421**	**0.520**	**0.823**	**0.790**	**0.884**	**0.985**	**0.949**	**1.316**
Demand/Capacity ≤ 1	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**NOT OK**
Highest Ratio	**0.294**	**0.119**	**0.219**	**0.158**	**0.128**	**0.189**	**0.428**	**0.349**	**0.560**	**0.542**	**0.421**	**0.520**	**0.823**	**0.790**	**0.884**	**0.985**	**0.949**	**1.316**

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	565	565	565	566	566	566	417	417	417	418	418	418	419	419	419	420	420	420
Member Label	12S-14S	12S-14S	12S-14S	14S-16S	14S-16S	14S-16S	13N-48N	13N-48N	13N-48N	48N-11N	48N-11N	48N-11N	11N-9N	11N-9N	11N-9N	9N-7N	9N-7N	9N-7N
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	1.0	2.0	0.0	1.9	3.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	12S	---	14S	14S	---	16S	13N	---	48N	48N	---	11N	11N	---	9N	9N	---	7N
Section #	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01	S 13-48	S 13-48	S 13-48	Section 06	Section 06	Section 06	Section 06	Section 06	Section 06	Section 01	Section 01	Section 01
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord

Member Factored Load Effects:

C_f (kN)	2594	2601	2608	1617	1622	1628	428	424	420	419	418	416	318	315	312	199	197	194
$M_{fx\ (comp)}$ (kNm)	91	14	100	56	52	122	15	20	21	8	5	8	8	6	15	15	4	3
$M_{fy\ (comp)}$ (kNm)	61	34	15	20	42	144	739	499	260	433	171	91	91	43	9	9	3	3
T_f (kN)	182	178	174	0	0	0	1382	1390	1398	1398	1401	1405	1280	1285	1290	606	610	614
$M_{fx\ (tension)}$ (kNm)	91	14	100	0	0	0	15	20	21	8	5	8	8	6	15	15	4	3
$M_{fy\ (tension)}$ (kNm)	61	34	15	0	0	0	739	499	260	433	171	91	91	43	9	9	3	3
V_{fx} (kN)	12	13	21	10	21	32	308	308	308	137	137	137	17	17	17	4	1	2
V_{fy} (kN)	30	33	36	17	20	23	9	4	2	2	4	6	3	2	5	5	3	2

Gross Section Properties:

Ag (mm^2)	20903	20903	20903	12774	12774	12774	70701	70701	70701	15097	15097	15097	15097	15097	15097	12774	12774	12774
I_x (mm^4)	3.34E+08	3.34E+08	3.34E+08	2.61E+08	2.61E+08	2.61E+08	2.48E+09	2.48E+09	2.48E+09	2.89E+08	2.89E+08	2.89E+08	2.89E+08	2.89E+08	2.89E+08	2.61E+08	2.61E+08	2.61E+08
I_y (mm^4)	9.14E+08	9.14E+08	9.14E+08	8.94E+08	8.94E+08	8.94E+08	1.02E+10	1.02E+10	1.02E+10	1.05E+09	1.05E+09	1.05E+09	1.05E+09	1.05E+09	1.05E+09	8.94E+08	8.94E+08	8.94E+08
J (mm^4)	2.92E+06	2.92E+06	2.92E+06	7.19E+05	7.19E+05	7.19E+05	1.47E+09	1.47E+09	1.47E+09	1.05E+06	1.05E+06	1.05E+06	1.05E+06	1.05E+06	1.05E+06	7.19E+05	7.19E+05	7.19E+05
r_x (mm)	126	126	126	143	143	143	187	187	187	138	138	138	138	138	138	143	143	143
r_y (mm)	209	209	209	265	265	265	381	381	381	264	264	264	264	264	264	265	265	265
S_x (mm^3)	1.75E+06	1.75E+06	1.75E+06	1.37E+06	1.37E+06	1.37E+06	8.62E+06	8.62E+06	8.62E+06	1.52E+06	1.52E+06	1.52E+06	1.52E+06	1.52E+06	1.52E+06	1.37E+06	1.37E+06	1.37E+06
S_y (mm^3)	4.00E+06	4.00E+06	4.00E+06	2.73E+06	2.73E+06	2.73E+06	1.67E+07	1.67E+07	1.67E+07	3.18E+06	3.18E+06	3.18E+06	3.18E+06	3.18E+06	3.18E+06	2.73E+06	2.73E+06	2.73E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	20	20	20	20	20	20	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	5791	5791	5791	7722	7722	7722	1979	1979	1979	3821	3821	3821	5799	5799	5799	5799	5799	5799

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	565	565	565	566	566	566	417	417	417	418	418	418	419	419	419	420	420	420
Member Label	12S-14S	12S-14S	12S-14S	14S-16S	14S-16S	14S-16S	13N-48N	13N-48N	13N-48N	48N-11N	48N-11N	48N-11N	11N-9N	11N-9N	11N-9N	9N-7N	9N-7N	9N-7N
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	1.0	2.0	0.0	1.9	3.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	12S	---	14S	14S	---	16S	13N	---	48N	48N	---	11N	11N	---	9N	9N	---	7N
Section #	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01	S 13-48	S 13-48	S 13-48	Section 06	Section 06	Section 06	Section 06	Section 06	Section 06	Section 01	Section 01	Section 01
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels	5.2	5.2	5.2	5.2	5.2	5.2	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	32.0	32.0	32.0	37.5	37.5	37.5	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8
Webs in flexural compression	32.0	32.0	32.0	37.5	37.5	37.5	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8
Webs in combined flexural and axial compression	32.0	32.0	32.0	37.5	37.5	37.5	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	565	565	565	566	566	566	417	417	417	418	418	418	419	419	419	420	420	420
Member Label	12S-14S	12S-14S	12S-14S	14S-16S	14S-16S	14S-16S	13N-48N	13N-48N	13N-48N	48N-11N	48N-11N	48N-11N	11N-9N	11N-9N	11N-9N	9N-7N	9N-7N	9N-7N
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	1.0	2.0	0.0	1.9	3.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	12S	---	14S	14S	---	16S	13N	---	48N	48N	---	11N	11N	---	9N	9N	---	7N
Section #	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01	S 13-48	S 13-48	S 13-48	Section 06	Section 06	Section 06	Section 06	Section 06	Section 06	Section 01	Section 01	Section 01
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5791	5791	5791	7722	7722	7722	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799
L_y (mm)	5791	5791	5791	7722	7722	7722	1979	1979	1979	3821	3821	3821	5799	5799	5799	5799	5799	5799
λ_{max}	0.474	0.474	0.474	0.557	0.557	0.557	0.320	0.320	0.320	0.433	0.433	0.433	0.433	0.433	0.433	0.418	0.418	0.418
C_r (kN)	2875.0	2875.0	2875.0	1677.0	1677.0	1677.0	12265.5	12265.5	12265.5	2513.6	2513.6	2513.6	2513.6	2513.6	2513.6	2140.9	2140.9	2140.9
$(kL/r)_{max}$	46.0	46.0	46.0	54.0	54.0	54.0	31.0	31.0	31.0	42.0	42.0	42.0	42.0	42.0	42.0	40.6	40.6	40.6
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	19655	19655	19655	8638	8638	8638	145617	145617	145617	16962	16962	16962	16962	16962	16962	15313	15313	15313

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	670	670	670	670	670	670	670	670	670	670	670	670
b (mm)	368	368	368	368	368	368	580	580	580	580	580	580	580	580	580	580	580	580
ε_aa (mm)	425	425	425	425	425	425	670	670	670	670	670	670	670	670	670	670	670	670
ε_bb (mm)	368	368	368	368	368	368	580	580	580	580	580	580	580	580	580	580	580	580
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	6477	6477	6477	6477	6477	6477	1781	1781	1781	3439	3439	3439	5219	5219	5219	5219	5219	5219
A_c (mm^2)	10452	10452	10452	6387	6387	6387	35351	35351	35351	7549	7549	7549	7549	7549	7549	6387	6387	6387
A_d (mm^2)	907	907	907	907	907	907	845	845	845	845	845	845	845	845	845	845	845	845
A_b (mm^2)	907	907	907	907	907	907	845	845	845	845	845	845	845	845	845	845	845	845
μ	0.0736	0.0736	0.0736	0.0450	0.0450	0.0450	8.7695	8.7695	8.7695	0.5022	0.5022	0.5022	0.2180	0.2180	0.2180	0.1844	0.1844	0.1844
P_{cr}/P_e (Fig.3.51)	0.81	0.81	0.81	0.87	0.87	0.87	0.50	0.50	0.50	0.50	0.50	0.50	0.65	0.65	0.65	0.68	0.68	0.68
k'(sqrt(P_e/P_{cr}))	1.112	1.112	1.112	1.072	1.072	1.072	1.414	1.414	1.414	1.414	1.414	1.414	1.236	1.236	1.236	1.216	1.216	1.216
λ_v	0.318	0.318	0.318	0.322	0.322	0.322	0.076	0.076	0.076	0.211	0.211	0.211	0.280	0.280	0.280	0.274	0.274	0.274
Cr' (kN)	3055.5	3055.5	3055.5	1864.9	1864.9	1864.9	12685.0	12685.0	12685.0	2679.8	2679.8	2679.8	2645.8	2645.8	2645.8	2241.5	2241.5	2241.5
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	565	565	565	566	566	566	417	417	417	418	418	418	419	419	419	420	420	420
Member Label	12S-14S	12S-14S	12S-14S	14S-16S	14S-16S	14S-16S	13N-48N	13N-48N	13N-48N	48N-11N	48N-11N	48N-11N	11N-9N	11N-9N	11N-9N	9N-7N	9N-7N	9N-7N
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	1.0	2.0	0.0	1.9	3.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	12S	---	14S	14S	---	16S	13N	---	48N	48N	---	11N	11N	---	9N	9N	---	7N
Section #	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01	S 13-48	S 13-48	S 13-48	Section 06	Section 06	Section 06	Section 06	Section 06	Section 06	Section 01	Section 01	Section 01
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	10452	10452	10452	6387	6387	6387	35351	35351	35351	7549	7549	7549	7549	7549	7549	6387	6387	6387
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	2875.0	2875.0	2875.0	1677.0	1677.0	1677.0	12265.5	12265.5	12265.5	2513.6	2513.6	2513.6	2513.6	2513.6	2513.6	2140.9	2140.9	2140.9

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	16722	16722	16722	10219	10219	10219	67166	67166	67166	14342	14342	14342	14342	14342	14342	12135	12135	12135
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	3336	3336	3336	2039	2039	2039	13400	13400	13400	2861	2861	2861	2861	2861	2861	2421	2421	2421
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	16880	16880	16880	8751	8751	8751	65946	65946	65946	10342	10342	10342	10342	10342	10342	8019	8019	8019
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	16880	16880	16880	8751	8751	8751	65946	65946	65946	10342	10342	10342	10342	10342	10342	8019	8019	8019
$A_{n(corrosion)}$ (mm^2)	13504	13504	13504	7001	7001	7001	62649	62649	62649	9825	9825	9825	9825	9825	9825	7618	7618	7618
$T_{r(b)}$ (kN)	4537	4537	4537	2352	2352	2352	21050	21050	21050	3301	3301	3301	3301	3301	3301	2560	2560	2560
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	13504	13504	13504	7001	7001	7001	62649	62649	62649	9825	9825	9825	9825	9825	9825	7618	7618	7618
$T_{r(c)}$ (kN)	4537	4537	4537	2352	2352	2352	21050	21050	21050	3301	3301	3301	3301	3301	3301	2560	2560	2560
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	565	565	565	566	566	566	417	417	417	418	418	418	419	419	419	420	420	420
Member Label	12S-14S	12S-14S	12S-14S	14S-16S	14S-16S	14S-16S	13N-48N	13N-48N	13N-48N	48N-11N	48N-11N	48N-11N	11N-9N	11N-9N	11N-9N	9N-7N	9N-7N	9N-7N
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	1.0	2.0	0.0	1.9	3.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	12S	---	14S	14S	---	16S	13N	---	48N	48N	---	11N	11N	---	9N	9N	---	7N
Section #	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01	S 13-48	S 13-48	S 13-48	Section 06	Section 06	Section 06	Section 06	Section 06	Section 06	Section 01	Section 01	Section 01
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	4537	4537	4537	2352	2352	2352	21050	21050	21050	3301	3301	3301	3301	3301	3301	2560	2560	2560
$(kL/r)_{max}$	46	46	46	54	54	54	31	31	31	42	42	42	42	42	42	41	41	41
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	3336	3336	3336	2039	2039	2039	13400	13400	13400	2861	2861	2861	2861	2861	2861	2421	2421	2421
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	280	280	280	219	219	219	1634	1634	1634	288	288	288	288	288	288	260	260	260
$M_{ry(Laterally\ Supported)}$ (kNm)	638	638	638	436	436	436	3159	3159	3159	603	603	603	603	603	603	517	517	517
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	5791	5791	5791	7722	7722	7722	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799
L_{uy} (mm)	5791	5791	5791	7722	7722	7722	1979	1979	1979	3821	3821	3821	5799	5799	5799	5799	5799	5799
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	2102	2102	2102	692	692	692	128522	128522	128522	1168	1168	1168	1168	1168	1168	921	921	921
M_{rx} (kNm)	279.8	279.8	279.8	218.6	218.6	218.6	1633.9	1633.9	1633.9	287.5	287.5	287.5	287.5	287.5	287.5	259.6	259.6	259.6
M_{ry} (kNm)	651.9	651.9	651.9	384.7	384.7	384.7	3605.2	3605.2	3605.2	582.3	582.3	582.3	582.3	582.3	582.3	491.2	491.2	491.2

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.902	0.905	0.907	0.964	0.967	0.971	0.035	0.035	0.034	0.167	0.166	0.165	0.127	0.125	0.124	0.093	0.092	0.091
(T_f/T_r)<=1	0.055	0.053	0.052	0.000	0.000	0.000	0.103	0.104	0.104	0.489	0.490	0.491	0.447	0.449	0.451	0.250	0.252	0.254

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.055	0.053	0.052	0.000	0.000	0.000	0.103	0.104	0.104	0.489	0.490	0.491	0.447	0.449	0.451	0.250	0.252	0.254
M_{fx}/M_{rx}<=1	0.325	0.050	0.357	0.000	0.000	0.000	0.009	0.012	0.013	0.028	0.017	0.028	0.028	0.021	0.052	0.058	0.015	0.012
M_{fy}/M_{ry}<=1	0.094	0.052	0.023	0.000	0.000	0.000	0.205	0.138	0.072	0.744	0.294	0.156	0.156	0.074	0.015	0.018	0.006	0.006
$T_f/T_r+M_f/M_r$<=1	0.473	0.156	0.433	0.000	0.000	0.000	0.317	0.254	0.189	1.260	0.801	0.675	0.631	0.544	0.518	0.326	0.273	0.271
$M_f/M_r-T_fS/M_rA$<=1	0.311	0.000	0.277	0.000	0.000	0.000	0.021	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	565	565	565	566	566	566	417	417	417	418	418	418	419	419	419	420	420	420
Member Label	12S-14S	12S-14S	12S-14S	14S-16S	14S-16S	14S-16S	13N-48N	13N-48N	13N-48N	48N-11N	48N-11N	48N-11N	11N-9N	11N-9N	11N-9N	9N-7N	9N-7N	9N-7N
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	1.0	2.0	0.0	1.9	3.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station	12S	---	14S	14S	---	16S	13N	---	48N	48N	---	11N	11N	---	9N	9N	---	7N
Section #	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01	S 13-48	S 13-48	S 13-48	Section 06	Section 06	Section 06	Section 06	Section 06	Section 06	Section 01	Section 01	Section 01
Element Group	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	03 TT Bottom Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	3161	3161	3161	1931	1931	1931	12694	12694	12694	2711	2711	2711	2711	2711	2711	2294	2294	2294
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.97E+04	1.97E+04	1.97E+04	8.64E+03	8.64E+03	8.64E+03	1.46E+05	1.46E+05	1.46E+05	1.70E+04	1.70E+04	1.70E+04	1.70E+04	1.70E+04	1.70E+04	1.53E+04	1.53E+04	1.53E+04
U_{1x}	1.15	1.15	1.15	1.23	1.23	1.23	1.00	1.00	1.00	1.03	1.03	1.03	1.02	1.02	1.02	1.01	1.01	1.01
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	53809	53809	53809	29610	29610	29610	5163085	5163085	5163085	142255	142255	142255	61744	61744	61744	52495	52495	52495
U_{1y}	1.05	1.05	1.05	1.06	1.06	1.06	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00
C_f/C_r	0.821	0.823	0.825	0.837	0.840	0.843	0.034	0.033	0.033	0.155	0.154	0.153	0.117	0.116	0.115	0.087	0.086	0.085
$U_{1x}M_{fx}/M_{rx}$	0.375	0.058	0.412	0.315	0.293	0.688	0.009	0.012	0.013	0.029	0.018	0.029	0.028	0.021	0.053	0.059	0.016	0.012
$U_{1y}M_{fy}/M_{ry}$	0.100	0.056	0.025	0.049	0.102	0.350	0.234	0.158	0.082	0.720	0.284	0.151	0.152	0.072	0.015	0.017	0.006	0.006
Interaction	1.296	0.937	1.262	1.201	1.235	1.880	0.277	0.204	0.128	0.903	0.457	0.333	0.297	0.209	0.183	0.163	0.107	0.102

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.474	0.474	0.474	0.557	0.557	0.557	0.320	0.320	0.320	0.433	0.433	0.433	0.433	0.433	0.433	0.418	0.418	0.418
$C_{r\ (K=1)}$ (kN)	2875	2875	2875	1677	1677	1677	12265	12265	12265	2514	2514	2514	2514	2514	2514	2141	2141	2141
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.15	1.15	1.15	1.23	1.23	1.23	1.00	1.00	1.00	1.03	1.03	1.03	1.02	1.02	1.02	1.01	1.01	1.01
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.05	1.05	1.05	1.06	1.06	1.06	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00
C_f/C_r	0.902	0.905	0.907	0.964	0.967	0.971	0.035	0.035	0.034	0.167	0.166	0.165	0.127	0.125	0.124	0.093	0.092	0.091
$U_{1x}M_{fx}/M_{rx}$	0.375	0.058	0.412	0.315	0.293	0.688	0.009	0.012	0.013	0.029	0.018	0.029	0.028	0.021	0.053	0.059	0.016	0.012
$U_{1y}M_{fy}/M_{ry}$	0.100	0.056	0.025	0.049	0.102	0.350	0.234	0.158	0.082	0.720	0.284	0.151	0.152	0.072	0.015	0.017	0.006	0.006
Interaction	1.377	1.018	1.344	1.328	1.362	2.008	0.278	0.205	0.129	0.916	0.469	0.345	0.307	0.218	0.192	0.169	0.113	0.108

3.3. Lateral Torsional Buckling:

λ_{max}	0.474	0.474	0.474	0.557	0.557	0.557	0.320	0.320	0.320	0.433	0.433	0.433	0.433	0.433	0.433	0.418	0.418	0.418
C_r (kN)	2875	2875	2875	1677	1677	1677	12265	12265	12265	2514	2514	2514	2514	2514	2514	2141	2141	2141
U_{1x}	1.15	1.15	1.15	1.23	1.23	1.23	1.00	1.00	1.00	1.03	1.03	1.03	1.02	1.02	1.02	1.01	1.01	1.01
U_{1y}	1.05	1.05	1.05	1.06	1.06	1.06	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00
M_{rx} (kNm)	280	280	280	219	219	219	1634	1634	1634	288	288	288	288	288	288	260	260	260
M_{ry} (kNm)	652	652	652	385	385	385	3605	3605	3605	582	582	582	582	582	582	491	491	491
C_f/C_r	0.902	0.905	0.907	0.964	0.967	0.971	0.035	0.035	0.034	0.167	0.166	0.165	0.127	0.125	0.124	0.093	0.092	0.091
$U_{1x}M_{fx}/M_{rx}$	0.375	0.058	0.412	0.315	0.293	0.688	0.009	0.012	0.013	0.029	0.018	0.029	0.028	0.021	0.053	0.059	0.016	0.012
$U_{1y}M_{fy}/M_{ry}$	0.098	0.055	0.024	0.055	0.115	0.396	0.205	0.138	0.072	0.746	0.295	0.157	0.157	0.074	0.016	0.018	0.006	0.006
Interaction	1.375	1.017	1.343	1.334	1.376	2.055	0.249	0.185	0.119	0.941	0.479	0.351	0.312	0.221	0.193	0.170	0.114	0.108
Demand/Capacity ≤ 1	NOT OK	NOT OK	NOT OK	NOT OK	NOT OK	NOT OK	OK	OK	OK	NOT OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	1.377	1.018	1.344	1.334	1.376	2.055	0.317	0.254	0.189	1.260	0.801	0.675	0.631	0.544	0.518	0.326	0.273	0.271

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	421	421	421	422	422	422	423	423	423	486	486	486	487	487	487	488	488	488
Member Label	7N-5N	7N-5N	7N-5N	5N-3N	5N-3N	5N-3N	3N-1N	3N-1N	3N-1N	13S-48S	13S-48S	13S-48S	48S-11S	48S-11S	48S-11S	11S-9S	11S-9S	11S-9S
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	1.0	2.0	0.0	1.9	3.8	0.0	2.9	5.8
Node Label at Station	7N	---	5N	5N	---	3N	3N	---	1N	13S	---	48S	48S	---	11S	11S	---	9S
Section #	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	S 13-48	S 13-48	S 13-48	Section 06	Section 06	Section 06	Section 06	Section 06	Section 06
Element Group	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord

Member Factored Load Effects:

C_f (kN)	165	162	160	61	59	57	48	46	44	456	451	447	447	445	443	377	374	371
$M_{fx\ (comp)}$ (kNm)	3	1	7	7	1	2	2	3	1	15	10	10	8	5	8	8	6	16
$M_{fy\ (comp)}$ (kNm)	3	3	7	7	3	4	4	4	0	740	496	252	427	169	88	88	39	12
T_f (kN)	578	582	586	132	136	140	145	149	153	1423	1431	1439	1440	1443	1446	1393	1398	1403
$M_{fx\ (tension)}$ (kNm)	3	1	7	7	1	2	2	3	1	15	10	10	8	5	8	8	6	16
$M_{fy\ (tension)}$ (kNm)	3	3	7	7	3	4	4	4	0	740	496	252	427	169	88	88	39	12
V_{fx} (kN)	3	1	3	4	2	4	3	1	3	321	321	321	135	135	135	17	17	18
V_{fy} (kN)	2	2	4	4	1	2	3	0	2	9	4	2	2	4	6	3	2	5

Gross Section Properties:

Ag (mm^2)	12774	12774	12774	12774	12774	12774	12774	12774	12774	70701	70701	70701	15097	15097	15097	15097	15097	15097
I_x (mm^4)	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.48E+09	2.48E+09	2.48E+09	2.89E+08	2.89E+08	2.89E+08	2.89E+08	2.89E+08	2.89E+08
I_y (mm^4)	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	1.02E+10	1.02E+10	1.02E+10	1.05E+09	1.05E+09	1.05E+09	1.05E+09	1.05E+09	1.05E+09
J (mm^4)	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	1.47E+09	1.47E+09	1.47E+09	1.05E+06	1.05E+06	1.05E+06	1.05E+06	1.05E+06	1.05E+06
r_x (mm)	143	143	143	143	143	143	143	143	143	187	187	187	138	138	138	138	138	138
r_y (mm)	265	265	265	265	265	265	265	265	265	381	381	381	264	264	264	264	264	264
S_x (mm^3)	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	8.62E+06	8.62E+06	8.62E+06	1.52E+06	1.52E+06	1.52E+06	1.52E+06	1.52E+06	1.52E+06
S_y (mm^3)	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	1.67E+07	1.67E+07	1.67E+07	3.18E+06	3.18E+06	3.18E+06	3.18E+06	3.18E+06	3.18E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	5799	5799	5799	5799	5799	5799	5799	5799	5799	1979	1979	1979	3821	3821	3821	5799	5799	5799

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	421	421	421	422	422	422	423	423	423	486	486	486	487	487	487	488	488	488
Member Label	7N-5N	7N-5N	7N-5N	5N-3N	5N-3N	5N-3N	3N-1N	3N-1N	3N-1N	13S-48S	13S-48S	13S-48S	48S-11S	48S-11S	48S-11S	11S-9S	11S-9S	11S-9S
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	1.0	2.0	0.0	1.9	3.8	0.0	2.9	5.8
Node Label at Station	7N	---	5N	5N	---	3N	3N	---	1N	13S	---	48S	48S	---	11S	11S	---	9S
Section #	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	S 13-48	S 13-48	S 13-48	Section 06	Section 06	Section 06	Section 06	Section 06	Section 06
Element Group	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8
Webs in flexural compression	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8
Webs in combined flexural and axial compression	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	421	421	421	422	422	422	423	423	423	486	486	486	487	487	487	488	488	488
Member Label	7N-5N	7N-5N	7N-5N	5N-3N	5N-3N	5N-3N	3N-1N	3N-1N	3N-1N	13S-48S	13S-48S	13S-48S	48S-11S	48S-11S	48S-11S	11S-9S	11S-9S	11S-9S
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	1.0	2.0	0.0	1.9	3.8	0.0	2.9	5.8
Node Label at Station	7N	---	5N	5N	---	3N	3N	---	1N	13S	---	48S	48S	---	11S	11S	---	9S
Section #	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	S 13-48	S 13-48	S 13-48	Section 06	Section 06	Section 06	Section 06	Section 06	Section 06
Element Group	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799
L_y (mm)	5799	5799	5799	5799	5799	5799	5799	5799	5799	1979	1979	1979	3821	3821	3821	5799	5799	5799
λ_{max}	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.320	0.320	0.320	0.433	0.433	0.433	0.433	0.433	0.433
C_r (kN)	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	12265.5	12265.5	12265.5	2513.6	2513.6	2513.6	2513.6	2513.6	2513.6
$(kL/r)_{max}$	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	31.0	31.0	31.0	42.0	42.0	42.0	42.0	42.0	42.0
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	15313	15313	15313	15313	15313	15313	15313	15313	15313	145617	145617	145617	16962	16962	16962	16962	16962	16962

Shear Flexibility Factor:

1. Lacing:

a (mm)	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670
b (mm)	580	580	580	580	580	580	580	580	580	580	580	580	580	580	580	580	580	580
ε_aa (mm)	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670
ε_bb (mm)	580	580	580	580	580	580	580	580	580	580	580	580	580	580	580	580	580	580
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	5219	5219	5219	5219	5219	5219	5219	5219	5219	1781	1781	1781	3439	3439	3439	5219	5219	5219
A_c (mm^2)	6387	6387	6387	6387	6387	6387	6387	6387	6387	35351	35351	35351	7549	7549	7549	7549	7549	7549
A_d (mm^2)	845	845	845	845	845	845	845	845	845	845	845	845	845	845	845	845	845	845
A_b (mm^2)	845	845	845	845	845	845	845	845	845	845	845	845	845	845	845	845	845	845
μ	0.1844	0.1844	0.1844	0.1844	0.1844	0.1844	0.1844	0.1844	0.1844	8.7695	8.7695	8.7695	0.5022	0.5022	0.5022	0.2180	0.2180	0.2180
P_{cr}/P_e (Fig.3.51)	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.50	0.50	0.50	0.50	0.50	0.50	0.65	0.65	0.65
k'(sqrt(P_e/P_{cr}))	1.216	1.216	1.216	1.216	1.216	1.216	1.216	1.216	1.216	1.414	1.414	1.414	1.414	1.414	1.414	1.236	1.236	1.236
λ_v	0.274	0.274	0.274	0.274	0.274	0.274	0.274	0.274	0.274	0.076	0.076	0.076	0.211	0.211	0.211	0.280	0.280	0.280
Cr' (kN)	2241.5	2241.5	2241.5	2241.5	2241.5	2241.5	2241.5	2241.5	2241.5	12685.0	12685.0	12685.0	2679.8	2679.8	2679.8	2645.8	2645.8	2645.8
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	421	421	421	422	422	422	423	423	423	486	486	486	487	487	487	488	488	488
Member Label	7N-5N	7N-5N	7N-5N	5N-3N	5N-3N	5N-3N	3N-1N	3N-1N	3N-1N	13S-48S	13S-48S	13S-48S	48S-11S	48S-11S	48S-11S	11S-9S	11S-9S	11S-9S
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	1.0	2.0	0.0	1.9	3.8	0.0	2.9	5.8
Node Label at Station	7N	---	5N	5N	---	3N	3N	---	1N	13S	---	48S	48S	---	11S	11S	---	9S
Section #	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	S 13-48	S 13-48	S 13-48	Section 06	Section 06	Section 06	Section 06	Section 06	Section 06
Element Group	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	6387	6387	6387	6387	6387	6387	6387	6387	6387	35351	35351	35351	7549	7549	7549	7549	7549	7549
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	12265.5	12265.5	12265.5	2513.6	2513.6	2513.6	2513.6	2513.6	2513.6

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	12135	12135	12135	12135	12135	12135	12135	12135	12135	67166	67166	67166	14342	14342	14342	14342	14342	14342
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	2421	2421	2421	2421	2421	2421	2421	2421	2421	13400	13400	13400	2861	2861	2861	2861	2861	2861
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	8019	8019	8019	8019	8019	8019	8019	8019	8019	65946	65946	65946	10342	10342	10342	10342	10342	10342
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	8019	8019	8019	8019	8019	8019	8019	8019	8019	65946	65946	65946	10342	10342	10342	10342	10342	10342
$A_{n(corrosion)}$ (mm^2)	7618	7618	7618	7618	7618	7618	7618	7618	7618	62649	62649	62649	9825	9825	9825	9825	9825	9825
$T_{r(b)}$ (kN)	2560	2560	2560	2560	2560	2560	2560	2560	2560	21050	21050	21050	3301	3301	3301	3301	3301	3301
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	7618	7618	7618	7618	7618	7618	7618	7618	7618	62649	62649	62649	9825	9825	9825	9825	9825	9825
$T_{r(c)}$ (kN)	2560	2560	2560	2560	2560	2560	2560	2560	2560	21050	21050	21050	3301	3301	3301	3301	3301	3301
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	421	421	421	422	422	422	423	423	423	486	486	486	487	487	487	488	488	488
Member Label	7N-5N	7N-5N	7N-5N	5N-3N	5N-3N	5N-3N	3N-1N	3N-1N	3N-1N	13S-48S	13S-48S	13S-48S	48S-11S	48S-11S	48S-11S	11S-9S	11S-9S	11S-9S
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	1.0	2.0	0.0	1.9	3.8	0.0	2.9	5.8
Node Label at Station	7N	---	5N	5N	---	3N	3N	---	1N	13S	---	48S	48S	---	11S	11S	---	9S
Section #	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	S 13-48	S 13-48	S 13-48	Section 06	Section 06	Section 06	Section 06	Section 06	Section 06
Element Group	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	2560	2560	2560	2560	2560	2560	2560	2560	2560	21050	21050	21050	3301	3301	3301	3301	3301	3301
$(kL/r)_{max}$	41	41	41	41	41	41	41	41	41	31	31	31	42	42	42	42	42	42
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	2421	2421	2421	2421	2421	2421	2421	2421	2421	13400	13400	13400	2861	2861	2861	2861	2861	2861
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	260	260	260	260	260	260	260	260	260	1634	1634	1634	288	288	288	288	288	288
$M_{ry(Laterally\ Supported)}$ (kNm)	517	517	517	517	517	517	517	517	517	3159	3159	3159	603	603	603	603	603	603
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799
L_{uy} (mm)	5799	5799	5799	5799	5799	5799	5799	5799	5799	1979	1979	1979	3821	3821	3821	5799	5799	5799
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	921	921	921	921	921	921	921	921	921	128522	128522	128522	1168	1168	1168	1168	1168	1168
M_{rx} (kNm)	259.6	259.6	259.6	259.6	259.6	259.6	259.6	259.6	259.6	1633.9	1633.9	1633.9	287.5	287.5	287.5	287.5	287.5	287.5
M_{ry} (kNm)	491.2	491.2	491.2	491.2	491.2	491.2	491.2	491.2	491.2	3605.2	3605.2	3605.2	582.3	582.3	582.3	582.3	582.3	582.3

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.077	0.076	0.075	0.028	0.028	0.027	0.022	0.021	0.021	0.037	0.037	0.036	0.178	0.177	0.176	0.150	0.149	0.148
(T_f/T_r)<=1	0.239	0.240	0.242	0.055	0.056	0.058	0.060	0.062	0.063	0.106	0.107	0.107	0.503	0.504	0.505	0.487	0.489	0.490

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.239	0.240	0.242	0.055	0.056	0.058	0.060	0.062	0.063	0.106	0.107	0.107	0.503	0.504	0.505	0.487	0.489	0.490
M_{fx}/M_{rx}<=1	0.012	0.004	0.027	0.027	0.004	0.008	0.008	0.012	0.004	0.009	0.006	0.006	0.028	0.017	0.028	0.028	0.021	0.056
M_{fy}/M_{ry}<=1	0.006	0.006	0.014	0.014	0.006	0.008	0.008	0.008	0.000	0.205	0.138	0.070	0.733	0.290	0.151	0.151	0.067	0.021
$T_f/T_r+M_f/M_r$<=1	0.256	0.250	0.283	0.096	0.066	0.074	0.076	0.081	0.067	0.321	0.250	0.183	1.264	0.812	0.684	0.666	0.576	0.567
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	421	421	421	422	422	422	423	423	423	486	486	486	487	487	487	488	488	488
Member Label	7N-5N	7N-5N	7N-5N	5N-3N	5N-3N	5N-3N	3N-1N	3N-1N	3N-1N	13S-48S	13S-48S	13S-48S	48S-11S	48S-11S	48S-11S	11S-9S	11S-9S	11S-9S
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	1.0	2.0	0.0	1.9	3.8	0.0	2.9	5.8
Node Label at Station	7N	---	5N	5N	---	3N	3N	---	1N	13S	---	48S	48S	---	11S	11S	---	9S
Section #	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	S 13-48	S 13-48	S 13-48	Section 06	Section 06	Section 06	Section 06	Section 06	Section 06
Element Group	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	2294	2294	2294	2294	2294	2294	2294	2294	2294	12694	12694	12694	2711	2711	2711	2711	2711	2711
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.53E+04	1.53E+04	1.53E+04	1.53E+04	1.53E+04	1.53E+04	1.53E+04	1.53E+04	1.53E+04	1.46E+05	1.46E+05	1.46E+05	1.70E+04	1.70E+04	1.70E+04	1.70E+04	1.70E+04	1.70E+04
U_{1x}	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.03	1.03	1.03	1.02	1.02	1.02
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	52495	52495	52495	52495	52495	52495	52495	52495	52495	5163085	5163085	5163085	142255	142255	142255	61744	61744	61744
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01
C_f/C_r	**0.072**	**0.071**	**0.070**	**0.027**	**0.026**	**0.025**	**0.021**	**0.020**	**0.019**	**0.036**	**0.036**	**0.035**	**0.165**	**0.164**	**0.163**	**0.139**	**0.138**	**0.137**
$U_{1x}M_{fx}/M_{rx}$	**0.012**	**0.004**	**0.027**	**0.027**	**0.004**	**0.008**	**0.008**	**0.012**	**0.004**	**0.009**	**0.006**	**0.006**	**0.029**	**0.018**	**0.029**	**0.028**	**0.021**	**0.057**
$U_{1y}M_{fy}/M_{ry}$	**0.006**	**0.006**	**0.014**	**0.014**	**0.006**	**0.008**	**0.008**	**0.008**	**0.000**	**0.234**	**0.157**	**0.080**	**0.711**	**0.281**	**0.146**	**0.147**	**0.065**	**0.020**
Interaction	**0.089**	**0.080**	**0.111**	**0.067**	**0.035**	**0.040**	**0.036**	**0.039**	**0.023**	**0.279**	**0.199**	**0.121**	**0.904**	**0.463**	**0.338**	**0.314**	**0.224**	**0.214**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.320	0.320	0.320	0.433	0.433	0.433	0.433	0.433	0.433
$C_{r\ (K=1)}$ (kN)	2141	2141	2141	2141	2141	2141	2141	2141	2141	12265	12265	12265	2514	2514	2514	2514	2514	2514
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.03	1.03	1.03	1.02	1.02	1.02
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01
C_f/C_r	**0.077**	**0.076**	**0.075**	**0.028**	**0.028**	**0.027**	**0.022**	**0.021**	**0.021**	**0.037**	**0.037**	**0.036**	**0.178**	**0.177**	**0.176**	**0.150**	**0.149**	**0.148**
$U_{1x}M_{fx}/M_{rx}$	**0.012**	**0.004**	**0.027**	**0.027**	**0.004**	**0.008**	**0.008**	**0.012**	**0.004**	**0.009**	**0.006**	**0.006**	**0.029**	**0.018**	**0.029**	**0.028**	**0.021**	**0.057**
$U_{1y}M_{fy}/M_{ry}$	**0.006**	**0.006**	**0.014**	**0.014**	**0.006**	**0.008**	**0.008**	**0.008**	**0.000**	**0.234**	**0.157**	**0.080**	**0.711**	**0.281**	**0.146**	**0.147**	**0.065**	**0.020**
Interaction	**0.095**	**0.085**	**0.116**	**0.069**	**0.037**	**0.042**	**0.038**	**0.041**	**0.024**	**0.281**	**0.200**	**0.122**	**0.917**	**0.476**	**0.351**	**0.325**	**0.235**	**0.225**

3.3. Lateral Torsional Buckling:

λ_{max}	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.320	0.320	0.320	0.433	0.433	0.433	0.433	0.433	0.433
C_r (kN)	2141	2141	2141	2141	2141	2141	2141	2141	2141	12265	12265	12265	2514	2514	2514	2514	2514	2514
U_{1x}	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.03	1.03	1.03	1.02	1.02	1.02
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01
M_{rx} (kNm)	260	260	260	260	260	260	260	260	260	1634	1634	1634	288	288	288	288	288	288
M_{ry} (kNm)	491	491	491	491	491	491	491	491	491	3605	3605	3605	582	582	582	582	582	582
C_f/C_r	**0.077**	**0.076**	**0.075**	**0.028**	**0.028**	**0.027**	**0.022**	**0.021**	**0.021**	**0.037**	**0.037**	**0.036**	**0.178**	**0.177**	**0.176**	**0.150**	**0.149**	**0.148**
$U_{1x}M_{fx}/M_{rx}$	**0.012**	**0.004**	**0.027**	**0.027**	**0.004**	**0.008**	**0.008**	**0.012**	**0.004**	**0.009**	**0.006**	**0.006**	**0.029**	**0.018**	**0.029**	**0.028**	**0.021**	**0.057**
$U_{1y}M_{fy}/M_{ry}$	**0.006**	**0.006**	**0.014**	**0.014**	**0.006**	**0.008**	**0.008**	**0.008**	**0.000**	**0.205**	**0.138**	**0.070**	**0.736**	**0.291**	**0.152**	**0.152**	**0.067**	**0.021**
Interaction	**0.095**	**0.086**	**0.116**	**0.070**	**0.038**	**0.043**	**0.038**	**0.041**	**0.024**	**0.252**	**0.180**	**0.112**	**0.942**	**0.486**	**0.356**	**0.330**	**0.238**	**0.225**
Demand/Capacity ≤ 1	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**NOT OK**	**OK**	**OK**	**OK**	**OK**	**OK**
Highest Ratio	**0.256**	**0.250**	**0.283**	**0.096**	**0.066**	**0.074**	**0.076**	**0.081**	**0.067**	**0.321**	**0.250**	**0.183**	**1.264**	**0.812**	**0.684**	**0.666**	**0.576**	**0.567**

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	489	489	489	490	490	490	491	491	491	492	492	492	431	431	431	432	432	432
Member Label	9S-7S	9S-7S	9S-7S	7S-5S	7S-5S	7S-5S	5S-3S	5S-3S	5S-3S	3S-1S	3S-1S	3S-1S	22N-33N	22N-33N	22N-33N	33N-32N	33N-32N	33N-32N
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	1.5	3.0	0.0	3.1	6.2
Node Label at Station	9S	---	7S	7S	---	5S	5S	---	3S	3S	---	1S	22N	---	33N	33N	---	32N
Section #	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10
Element Group	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link

Member Factored Load Effects:

C_f (kN)	232	230	227	222	220	218	86	84	81	75	73	70	0	0	0	0	0	0
$M_{fx\ (comp)}$ (kNm)	16	4	3	3	1	8	8	1	2	2	3	1	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	12	5	3	3	3	4	4	4	4	4	4	0	0	0	0	0	0	0
T_f (kN)	672	677	681	699	703	707	181	186	190	197	201	206	1791	1788	1784	1771	1763	1755
$M_{fx\ (tension)}$ (kNm)	16	4	3	3	1	8	8	1	2	2	3	1	0	45	84	84	126	138
$M_{fy\ (tension)}$ (kNm)	12	5	3	3	3	4	4	4	4	4	4	0	84	21	38	38	22	14
V_{fx} (kN)	4	2	3	3	1	3	3	0	3	3	1	3	42	40	38	3	8	13
V_{fy} (kN)	5	3	2	2	2	4	4	1	2	3	0	3	32	28	23	18	9	1

Gross Section Properties:

Ag (mm^2)	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	29435	29435	29435	29435	29435	29435
I_x (mm^4)	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09
I_y (mm^4)	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	8.94E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08
J (mm^4)	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06
r_x (mm)	143	143	143	143	143	143	143	143	143	143	143	143	335	335	335	335	335	335
r_y (mm)	265	265	265	265	265	265	265	265	265	265	265	265	61	61	61	61	61	61
S_x (mm^3)	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06
S_y (mm^3)	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	2.73E+06	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	3038	3038	3038	6248	6248	6248

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	489	489	489	490	490	490	491	491	491	492	492	492	431	431	431	432	432	432
Member Label	9S-7S	9S-7S	9S-7S	7S-5S	7S-5S	7S-5S	5S-3S	5S-3S	5S-3S	3S-1S	3S-1S	3S-1S	22N-33N	22N-33N	22N-33N	33N-32N	33N-32N	33N-32N
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	1.5	3.0	0.0	3.1	6.2
Node Label at Station	9S	---	7S	7S	---	5S	5S	---	3S	3S	---	1S	22N	---	33N	33N	---	32N
Section #	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10
Element Group	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge													8.0	8.0	8.0	8.0	8.0	8.0
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4						
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8						
Webs in flexural compression	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8						
Webs in combined flexural and axial compression	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8						
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	489	489	489	490	490	490	491	491	491	492	492	492	431	431	431	432	432	432
Member Label	9S-7S	9S-7S	9S-7S	7S-5S	7S-5S	7S-5S	5S-3S	5S-3S	5S-3S	3S-1S	3S-1S	3S-1S	22N-33N	22N-33N	22N-33N	33N-32N	33N-32N	33N-32N
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	1.5	3.0	0.0	3.1	6.2
Node Label at Station	9S	---	7S	7S	---	5S	5S	---	3S	3S	---	1S	22N	---	33N	33N	---	32N
Section #	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10
Element Group	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	16861	16861	16861	16861	16861	16861
L_y (mm)	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	3038	3038	3038	6248	6248	6248
λ_{max}	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.519	0.519	0.519	1.057	1.057	1.057
C_r (kN)	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	4693.1	4693.1	4693.1	2976.0	2976.0	2976.0
$(kL/r)_{max}$	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	50.3	50.3	50.3	102.4	102.4	102.4
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	15313	15313	15313	15313	15313	15313	15313	15313	15313	15313	15313	15313	22924	22924	22924	5495	5495	5495

Shear Flexibility Factor:

1. Lacing:

a (mm)	670	670	670	670	670	670	670	670	670	670	670	670	733	733	733	733	733	733
b (mm)	580	580	580	580	580	580	580	580	580	580	580	580	635	635	635	635	635	635
ε_aa (mm)	670	670	670	670	670	670	670	670	670	670	670	670	733	733	733	733	733	733
ε_bb (mm)	580	580	580	580	580	580	580	580	580	580	580	580	635	635	635	635	635	635
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	5219	5219	5219	5219	5219	5219	5219	5219	5219	5219	5219	5219	6477	6477	6477	6477	6477	6477
A_c (mm^2)	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	14718	14718	14718	14718	14718	14718
A_d (mm^2)	845	845	845	845	845	845	845	845	845	845	845	845	1148	1148	1148	1148	1148	1148
A_b (mm^2)	845	845	845	845	845	845	845	845	845	845	845	845	1148	1148	1148	1148	1148	1148
μ	0.1844	0.1844	0.1844	0.1844	0.1844	0.1844	0.1844	0.1844	0.1844	0.1844	0.1844	0.1844	0.2435	0.2435	0.2435	0.2435	0.2435	0.2435
P_{cr}/P_e (Fig.3.51)	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.64	0.64	0.64	0.64	0.64	0.64
k'(sqrt(P_e/P_{cr}))	1.216	1.216	1.216	1.216	1.216	1.216	1.216	1.216	1.216	1.216	1.216	1.216	1.250	1.250	1.250	1.250	1.250	1.250
λ_v	0.274	0.274	0.274	0.274	0.274	0.274	0.274	0.274	0.274	0.274	0.274	0.274	0.642	0.642	0.642	1.321	1.321	1.321
Cr' (kN)	2241.5	2241.5	2241.5	2241.5	2241.5	2241.5	2241.5	2241.5	2241.5	2241.5	2241.5	2241.5	4332.2	4332.2	4332.2	2267.5	2267.5	2267.5
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	489	489	489	490	490	490	491	491	491	492	492	492	431	431	431	432	432	432
Member Label	9S-7S	9S-7S	9S-7S	7S-5S	7S-5S	7S-5S	5S-3S	5S-3S	5S-3S	3S-1S	3S-1S	3S-1S	22N-33N	22N-33N	22N-33N	33N-32N	33N-32N	33N-32N
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	1.5	3.0	0.0	3.1	6.2
Node Label at Station	9S	---	7S	7S	---	5S	5S	---	3S	3S	---	1S	22N	---	33N	33N	---	32N
Section #	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10
Element Group	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	14718	14718	14718	14718	14718	14718
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	2140.9	4693.1	4693.1	4693.1	2976.0	2976.0	2976.0

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	12135	12135	12135	12135	12135	12135	12135	12135	12135	12135	12135	12135	27963	27963	27963	27963	27963	27963
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	2421	2421	2421	2421	2421	2421	2421	2421	2421	2421	2421	2421	5579	5579	5579	5579	5579	5579
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	8019	8019	8019	8019	8019	8019	8019	8019	8019	8019	8019	8019	20596	20596	20596	20596	20596	20596
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	8019	8019	8019	8019	8019	8019	8019	8019	8019	8019	8019	8019	20596	20596	20596	20596	20596	20596
$A_{n(corrosion)}$ (mm^2)	7618	7618	7618	7618	7618	7618	7618	7618	7618	7618	7618	7618	19566	19566	19566	19566	19566	19566
$T_{r(b)}$ (kN)	2560	2560	2560	2560	2560	2560	2560	2560	2560	2560	2560	2560	6574	6574	6574	6574	6574	6574
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	7618	7618	7618	7618	7618	7618	7618	7618	7618	7618	7618	7618	19566	19566	19566	19566	19566	19566
$T_{r(c)}$ (kN)	2560	2560	2560	2560	2560	2560	2560	2560	2560	2560	2560	2560	6574	6574	6574	6574	6574	6574
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	489	489	489	490	490	490	491	491	491	492	492	492	431	431	431	432	432	432
Member Label	9S-7S	9S-7S	9S-7S	7S-5S	7S-5S	7S-5S	5S-3S	5S-3S	5S-3S	3S-1S	3S-1S	3S-1S	22N-33N	22N-33N	22N-33N	33N-32N	33N-32N	33N-32N
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	1.5	3.0	0.0	3.1	6.2
Node Label at Station	9S	---	7S	7S	---	5S	5S	---	3S	3S	---	1S	22N	---	33N	33N	---	32N
Section #	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10
Element Group	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	2560	2560	2560	2560	2560	2560	2560	2560	2560	2560	2560	2560	6574	6574	6574	6574	6574	6574
$(kL/r)_{max}$	41	41	41	41	41	41	41	41	41	41	41	41	50	50	50	102	102	102
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	2421	2421	2421	2421	2421	2421	2421	2421	2421	2421	2421	2421	5579	5579	5579	5579	5579	5579
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	260	260	260	260	260	260	260	260	260	260	260	260	1589	1589	1589	1589	1589	1589
$M_{ry(Laterally\ Supported)}$ (kNm)	517	517	517	517	517	517	517	517	517	517	517	517	128	128	128	128	128	128
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	16861	16861	16861	16861	16861	16861
L_{uy} (mm)	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	5799	3038	3038	3038	6248	6248	6248
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	432	432	432	432	432	432
M_{uy} (kNm) (x weak)	921	921	921	921	921	921	921	921	921	921	921	921	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	259.6	259.6	259.6	259.6	259.6	259.6	259.6	259.6	259.6	259.6	259.6	259.6	389.8	389.8	389.8	389.8	389.8	389.8
M_{ry} (kNm)	491.2	491.2	491.2	491.2	491.2	491.2	491.2	491.2	491.2	491.2	491.2	491.2	128.3	128.3	128.3	128.3	128.3	128.3

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.108	0.107	0.106	0.104	0.103	0.102	0.040	0.039	0.038	0.035	0.034	0.033	0.000	0.000	0.000	0.000	0.000	0.000
(T_f/T_r)<=1	0.278	0.280	0.281	0.289	0.290	0.292	0.075	0.077	0.078	0.081	0.083	0.085	0.321	0.321	0.320	0.317	0.316	0.315

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.278	0.280	0.281	0.289	0.290	0.292	0.075	0.077	0.078	0.081	0.083	0.085	0.321	0.321	0.320	0.317	0.316	0.315
M_{fx}/M_{rx}<=1	0.062	0.015	0.012	0.012	0.004	0.031	0.031	0.004	0.008	0.008	0.012	0.004	0.000	0.115	0.215	0.215	0.323	0.354
M_{fy}/M_{ry}<=1	0.024	0.010	0.006	0.006	0.006	0.008	0.008	0.008	0.008	0.008	0.008	0.000	0.655	0.164	0.296	0.296	0.171	0.109
$T_f/T_r+M_f/M_r$<=1	0.364	0.305	0.299	0.306	0.300	0.331	0.114	0.089	0.094	0.097	0.103	0.089	0.976	0.600	0.831	0.829	0.811	0.778
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	489	489	489	490	490	490	491	491	491	492	492	492	431	431	431	432	432	432
Member Label	9S-7S	9S-7S	9S-7S	7S-5S	7S-5S	7S-5S	5S-3S	5S-3S	5S-3S	3S-1S	3S-1S	3S-1S	22N-33N	22N-33N	22N-33N	33N-32N	33N-32N	33N-32N
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	1.5	3.0	0.0	3.1	6.2
Node Label at Station	9S	---	7S	7S	---	5S	5S	---	3S	3S	---	1S	22N	---	33N	33N	---	32N
Section #	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 01	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10
Element Group	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	04 TT Top Chord	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	2294	2294	2294	2294	2294	2294	2294	2294	2294	2294	2294	2294	5285	5285	5285	5285	5285	5285
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.53E+04	1.53E+04	1.53E+04	1.53E+04	1.53E+04	1.53E+04	1.53E+04	1.53E+04	1.53E+04	1.53E+04	1.53E+04	1.53E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04
U_{1x}	1.02	1.02	1.02	1.01	1.01	1.01	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	52495	52495	52495	52495	52495	52495	52495	52495	52495	52495	52495	52495	23240	23240	23240	5495	5495	5495
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.101**	**0.100**	**0.099**	**0.097**	**0.096**	**0.095**	**0.037**	**0.037**	**0.035**	**0.033**	**0.032**	**0.031**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1x}M_{fx}/M_{rx}$	**0.063**	**0.016**	**0.012**	**0.012**	**0.004**	**0.031**	**0.031**	**0.004**	**0.008**	**0.008**	**0.012**	**0.004**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.023**	**0.010**	**0.006**	**0.006**	**0.006**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.187**	**0.126**	**0.117**	**0.114**	**0.106**	**0.134**	**0.076**	**0.048**	**0.051**	**0.048**	**0.051**	**0.034**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.519	0.519	0.519	1.057	1.057	1.057
$C_{r\ (K=1)}$ (kN)	2141	2141	2141	2141	2141	2141	2141	2141	2141	2141	2141	2141	4693	4693	4693	2976	2976	2976
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.02	1.02	1.02	1.01	1.01	1.01	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.108**	**0.107**	**0.106**	**0.104**	**0.103**	**0.102**	**0.040**	**0.039**	**0.038**	**0.035**	**0.034**	**0.033**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1x}M_{fx}/M_{rx}$	**0.063**	**0.016**	**0.012**	**0.012**	**0.004**	**0.031**	**0.031**	**0.004**	**0.008**	**0.008**	**0.012**	**0.004**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.023**	**0.010**	**0.006**	**0.006**	**0.006**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.194**	**0.133**	**0.124**	**0.121**	**0.112**	**0.141**	**0.079**	**0.051**	**0.053**	**0.051**	**0.053**	**0.037**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

3.3. Lateral Torsional Buckling:

λ_{max}	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.519	0.519	0.519	1.057	1.057	1.057
C_r (kN)	2141	2141	2141	2141	2141	2141	2141	2141	2141	2141	2141	2141	4693	4693	4693	2976	2976	2976
U_{1x}	1.02	1.02	1.02	1.01	1.01	1.01	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	260	260	260	260	260	260	260	260	260	260	260	260	390	390	390	390	390	390
M_{ry} (kNm)	491	491	491	491	491	491	491	491	491	491	491	491	128	128	128	128	128	128
C_f/C_r	**0.108**	**0.107**	**0.106**	**0.104**	**0.103**	**0.102**	**0.040**	**0.039**	**0.038**	**0.035**	**0.034**	**0.033**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1x}M_{fx}/M_{rx}$	**0.063**	**0.016**	**0.012**	**0.012**	**0.004**	**0.031**	**0.031**	**0.004**	**0.008**	**0.008**	**0.012**	**0.004**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.025**	**0.010**	**0.006**	**0.006**	**0.006**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.195**	**0.133**	**0.124**	**0.122**	**0.113**	**0.141**	**0.079**	**0.051**	**0.054**	**0.051**	**0.054**	**0.037**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Demand/Capacity ≤ 1	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
Highest Ratio	**0.364**	**0.305**	**0.299**	**0.306**	**0.300**	**0.331**	**0.114**	**0.089**	**0.094**	**0.097**	**0.103**	**0.089**	**0.976**	**0.600**	**0.831**	**0.829**	**0.811**	**0.778**

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	433	433	433	434	434	434	435	435	435	436	436	436	437	437	437	438	438	438
Member Label	32N-45N	32N-45N	32N-45N	45N-13N	45N-13N	45N-13N	22S-33S	22S-33S	22S-33S	33S-32S	33S-32S	33S-32S	32S-45S	32S-45S	32S-45S	45S-13S	45S-13S	45S-13S
Station (m)	0.0	3.1	6.2	0.0	0.7	1.3	0.0	1.5	3.0	0.0	3.1	6.2	0.0	3.1	6.2	0.0	0.7	1.3
Node Label at Station	32N	---	45N	45N	---	13N	22S	---	33S	33S	---	32S	32S	---	45S	45S	---	13S
Section #	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10
Element Group	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link

Member Factored Load Effects:

C_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	1774	1766	1759	1787	1786	1784	1874	1870	1866	1865	1856	1848	1891	1883	1876	1915	1914	1912
$M_{fx\ (tension)}$ (kNm)	138	104	40	40	21	0	0	44	80	80	124	137	137	104	42	42	22	0
$M_{fy\ (tension)}$ (kNm)	14	15	36	36	18	0	72	16	37	37	20	13	13	7	18	18	8	0
V_{fx} (kN)	9	6	8	28	27	27	38	36	33	3	8	13	7	2	6	14	13	12
V_{fy} (kN)	6	16	25	28	30	32	31	26	22	19	9	0	6	15	25	30	32	34

Gross Section Properties:

Ag (mm^2)	29435	29435	29435	29435	29435	29435	29435	29435	29435	29435	29435	29435	29435	29435	29435	29435	29435	29435
I_x (mm^4)	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09	3.30E+09
I_y (mm^4)	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08	1.09E+08
J (mm^4)	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06	3.21E+06
r_x (mm)	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335
r_y (mm)	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
S_x (mm^3)	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06	8.39E+06
S_y (mm^3)	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05	6.77E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	6248	6248	6248	1325	1325	1325	3038	3038	3038	6248	6248	6248	6248	6248	6248	1325	1325	1325

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	433	433	433	434	434	434	435	435	435	436	436	436	437	437	437	438	438	438
Member Label	32N-45N	32N-45N	32N-45N	45N-13N	45N-13N	45N-13N	22S-33S	22S-33S	22S-33S	33S-32S	33S-32S	33S-32S	32S-45S	32S-45S	32S-45S	45S-13S	45S-13S	45S-13S
Station (m)	0.0	3.1	6.2	0.0	0.7	1.3	0.0	1.5	3.0	0.0	3.1	6.2	0.0	3.1	6.2	0.0	0.7	1.3
Node Label at Station	32N	---	45N	45N	---	13N	22S	---	33S	33S	---	32S	32S	---	45S	45S	---	13S
Section #	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10
Element Group	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression																		
Webs in combined flexural and axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	433	433	433	434	434	434	435	435	435	436	436	436	437	437	437	438	438	438
Member Label	32N-45N	32N-45N	32N-45N	45N-13N	45N-13N	45N-13N	22S-33S	22S-33S	22S-33S	33S-32S	33S-32S	33S-32S	32S-45S	32S-45S	32S-45S	45S-13S	45S-13S	45S-13S
Station (m)	0.0	3.1	6.2	0.0	0.7	1.3	0.0	1.5	3.0	0.0	3.1	6.2	0.0	3.1	6.2	0.0	0.7	1.3
Node Label at Station	32N	---	45N	45N	---	13N	22S	---	33S	33S	---	32S	32S	---	45S	45S	---	13S
Section #	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10
Element Group	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861
L_y (mm)	6248	6248	6248	1325	1325	1325	3038	3038	3038	6248	6248	6248	6248	6248	6248	1325	1325	1325
λ_{max}	1.057	1.057	1.057	0.519	0.519	0.519	0.519	0.519	0.519	1.057	1.057	1.057	1.057	1.057	1.057	0.519	0.519	0.519
C_r (kN)	2976.0	2976.0	2976.0	4693.1	4693.1	4693.1	4693.1	4693.1	4693.1	2976.0	2976.0	2976.0	2976.0	2976.0	2976.0	4693.1	4693.1	4693.1
$(kL/r)_{max}$	102.4	102.4	102.4	50.3	50.3	50.3	50.3	50.3	50.3	102.4	102.4	102.4	102.4	102.4	102.4	50.3	50.3	50.3
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	5495	5495	5495	22924	22924	22924	22924	22924	22924	5495	5495	5495	5495	5495	5495	22924	22924	22924

Shear Flexibility Factor:

1. Lacing:

a (mm)	733	733	733	733	733	733	733	733	733	733	733	733	733	733	733	733	733	733
b (mm)	635	635	635	635	635	635	635	635	635	635	635	635	635	635	635	635	635	635
ε_aa (mm)	733	733	733	733	733	733	733	733	733	733	733	733	733	733	733	733	733	733
ε_bb (mm)	635	635	635	635	635	635	635	635	635	635	635	635	635	635	635	635	635	635
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477
A_c (mm^2)	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718
A_d (mm^2)	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148
A_b (mm^2)	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148
μ	0.2435	0.2435	0.2435	0.2435	0.2435	0.2435	0.2435	0.2435	0.2435	0.2435	0.2435	0.2435	0.2435	0.2435	0.2435	0.2435	0.2435	0.2435
P_{cr}/P_e (Fig.3.51)	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64
k'(sqrt(P_e/P_{cr}))	1.250	1.250	1.250	1.250	1.250	1.250	1.250	1.250	1.250	1.250	1.250	1.250	1.250	1.250	1.250	1.250	1.250	1.250
λ_v	1.321	1.321	1.321	0.280	0.280	0.280	0.642	0.642	0.642	1.321	1.321	1.321	1.321	1.321	1.321	0.280	0.280	0.280
Cr' (kN)	2267.5	2267.5	2267.5	5158.4	5158.4	5158.4	4332.2	4332.2	4332.2	2267.5	2267.5	2267.5	2267.5	2267.5	2267.5	5158.4	5158.4	5158.4
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	433	433	433	434	434	434	435	435	435	436	436	436	437	437	437	438	438	438
Member Label	32N-45N	32N-45N	32N-45N	45N-13N	45N-13N	45N-13N	22S-33S	22S-33S	22S-33S	33S-32S	33S-32S	33S-32S	32S-45S	32S-45S	32S-45S	45S-13S	45S-13S	45S-13S
Station (m)	0.0	3.1	6.2	0.0	0.7	1.3	0.0	1.5	3.0	0.0	3.1	6.2	0.0	3.1	6.2	0.0	0.7	1.3
Node Label at Station	32N	---	45N	45N	---	13N	22S	---	33S	33S	---	32S	32S	---	45S	45S	---	13S
Section #	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10
Element Group	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718	14718
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	2976.0	2976.0	2976.0	4693.1	4693.1	4693.1	4693.1	4693.1	4693.1	2976.0	2976.0	2976.0	2976.0	2976.0	2976.0	4693.1	4693.1	4693.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27963	27963	27963	27963	27963	27963	27963	27963	27963	27963	27963	27963	27963	27963	27963	27963	27963	27963
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596	20596
$A_{n(corrosion)}$ (mm^2)	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566
$T_{r(b)}$ (kN)	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566	19566
$T_{r(c)}$ (kN)	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	433	433	433	434	434	434	435	435	435	436	436	436	437	437	437	438	438	438
Member Label	32N-45N	32N-45N	32N-45N	45N-13N	45N-13N	45N-13N	22S-33S	22S-33S	22S-33S	33S-32S	33S-32S	33S-32S	32S-45S	32S-45S	32S-45S	45S-13S	45S-13S	45S-13S
Station (m)	0.0	3.1	6.2	0.0	0.7	1.3	0.0	1.5	3.0	0.0	3.1	6.2	0.0	3.1	6.2	0.0	0.7	1.3
Node Label at Station	32N	---	45N	45N	---	13N	22S	---	33S	33S	---	32S	32S	---	45S	45S	---	13S
Section #	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10
Element Group	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574	6574
$(kL/r)_{max}$	102	102	102	50	50	50	50	50	50	102	102	102	102	102	102	50	50	50
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579	5579
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1589	1589	1589	1589	1589	1589	1589	1589	1589	1589	1589	1589	1589	1589	1589	1589	1589	1589
$M_{ry(Laterally\ Supported)}$ (kNm)	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861	16861
L_{uy} (mm)	6248	6248	6248	1325	1325	1325	3038	3038	3038	6248	6248	6248	6248	6248	6248	1325	1325	1325
M_{ux} (kNm) (y weak)	432	432	432	432	432	432	432	432	432	432	432	432	432	432	432	432	432	432
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	389.8	389.8	389.8	389.8	389.8	389.8	389.8	389.8	389.8	389.8	389.8	389.8	389.8	389.8	389.8	389.8	389.8	389.8
M_{ry} (kNm)	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
$(V_f/V_r)<=1$																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$(T_f/T_r)<=1$	0.318	0.317	0.315	0.320	0.320	0.320	0.336	0.335	0.334	0.334	0.333	0.331	0.339	0.338	0.336	0.343	0.343	0.343

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.318	0.317	0.315	0.320	0.320	0.320	0.336	0.335	0.334	0.334	0.333	0.331	0.339	0.338	0.336	0.343	0.343	0.343
$M_{fx}/M_{rx}<=1$	0.354	0.267	0.103	0.103	0.054	0.000	0.000	0.113	0.205	0.205	0.318	0.351	0.351	0.267	0.108	0.108	0.056	0.000
$M_{fy}/M_{ry}<=1$	0.109	0.117	0.281	0.281	0.140	0.000	0.561	0.125	0.288	0.288	0.156	0.101	0.101	0.055	0.140	0.140	0.062	0.000
$T_f/T_r+M_f/M_r<=1$	0.781	0.700	0.698	0.703	0.514	0.320	0.897	0.573	0.828	0.828	0.807	0.784	0.792	0.659	0.584	0.591	0.462	0.343
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Member ID in CSiBridge	433	433	433	434	434	434	435	435	435	436	436	436	437	437	437	438	438	438
Member Label	32N-45N	32N-45N	32N-45N	45N-13N	45N-13N	45N-13N	22S-33S	22S-33S	22S-33S	33S-32S	33S-32S	33S-32S	32S-45S	32S-45S	32S-45S	45S-13S	45S-13S	45S-13S
Station (m)	0.0	3.1	6.2	0.0	0.7	1.3	0.0	1.5	3.0	0.0	3.1	6.2	0.0	3.1	6.2	0.0	0.7	1.3
Node Label at Station	32N	---	45N	45N	---	13N	22S	---	33S	33S	---	32S	32S	---	45S	45S	---	13S
Section #	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10	Section 10
Element Group	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link	05 CTWT Link

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5285	5285	5285	5285	5285	5285	5285	5285	5285	5285	5285	5285	5285	5285	5285	5285	5285	5285
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04	2.29E+04
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	5495	5495	5495	122119	122119	122119	23240	23240	23240	5495	5495	5495	5495	5495	5495	122119	122119	122119
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.057	1.057	1.057	0.519	0.519	0.519	0.519	0.519	0.519	1.057	1.057	1.057	1.057	1.057	1.057	0.519	0.519	0.519
$C_{r\ (K=1)}$ (kN)	2976	2976	2976	4693	4693	4693	4693	4693	4693	2976	2976	2976	2976	2976	2976	4693	4693	4693
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.3. Lateral Torsional Buckling:

λ_{max}	1.057	1.057	1.057	0.519	0.519	0.519	0.519	0.519	0.519	1.057	1.057	1.057	1.057	1.057	1.057	0.519	0.519	0.519
C_r (kN)	2976	2976	2976	4693	4693	4693	4693	4693	4693	2976	2976	2976	2976	2976	2976	4693	4693	4693
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	390	390	390	390	390	390	390	390	390	390	390	390	390	390	390	390	390	390
M_{ry} (kNm)	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.781	0.700	0.698	0.703	0.514	0.320	0.897	0.573	0.828	0.828	0.807	0.784	0.792	0.659	0.584	0.591	0.462	0.343

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	27	27	27	138	138	138	142	142	142	203	203	203	14	14	14	189	189	189
Member Label	13N-54N	13N-54N	13N-54N	54N-55N	54N-55N	54N-55N	54S-55S	54S-55S	54S-55S	13S-54S	13S-54S	13S-54S	15N-16N	15N-16N	15N-16N	15S-16S	15S-16S	15S-16S
Station (m)	0.0	7.8	15.6	0.0	0.5	1.0	0.0	0.5	1.0	0.0	7.8	15.6	0.0	0.7	1.5	0.0	0.7	1.5
Node Label at Station	13N	---	54N	54N	---	55N	54S	---	55S	13S	---	54S	15N	---	16N	15S	---	16S
Section #	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 09	Section 09	Section 09	Section 09	Section 09	Section 09
Element Group	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay

Member Factored Load Effects:

C_f (kN)	988	992	996	0	0	0	0	0	0	1009	1013	1018	1300	1301	1302	1357	1358	1359
$M_{fx\ (comp)}$ (kNm)	0	100	242	0	0	0	0	0	0	0	100	242	0	80	155	0	127	247
$M_{fy\ (comp)}$ (kNm)	0	37	89	0	0	0	0	0	0	0	37	89	122	17	92	109	18	73
T_f (kN)	1238	1232	1226	23	11	0	23	11	0	1271	1265	1259	0	0	0	0	0	0
$M_{fx\ (tension)}$ (kNm)	0	100	242	242	61	0	242	61	0	0	100	242	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	37	89	89	22	0	89	22	0	0	37	89	0	0	0	0	0	0
V_{fx} (kN)	9	14	19	17	9	0	17	9	0	9	14	19	148	147	145	125	124	123
V_{fy} (kN)	26	40	53	47	23	0	47	23	0	26	40	53	114	106	98	177	169	161

Gross Section Properties:

Ag (mm^2)	37576	37576	37576	37576	37576	37576	37576	37576	37576	37576	37576	37576	109680	109680	109680	109680	109680	109680
I_x (mm^4)	2.02E+09	2.02E+09	2.02E+09	2.02E+09	2.02E+09	2.02E+09	2.02E+09	2.02E+09	2.02E+09	2.02E+09	2.02E+09	2.02E+09	3.13E+09	3.13E+09	3.13E+09	3.13E+09	3.13E+09	3.13E+09
I_y (mm^4)	1.18E+09	1.18E+09	1.18E+09	1.18E+09	1.18E+09	1.18E+09	1.18E+09	1.18E+09	1.18E+09	1.18E+09	1.18E+09	1.18E+09	7.74E+07	7.74E+07	7.74E+07	7.74E+07	7.74E+07	7.74E+07
J (mm^4)	7.12E+06	7.12E+06	7.12E+06	7.12E+06	7.12E+06	7.12E+06	7.12E+06	7.12E+06	7.12E+06	7.12E+06	7.12E+06	7.12E+06	1.67E+07	1.67E+07	1.67E+07	1.67E+07	1.67E+07	1.67E+07
r_x (mm)	232	232	232	232	232	232	232	232	232	232	232	232	169	169	169	169	169	169
r_y (mm)	177	177	177	177	177	177	177	177	177	177	177	177	27	27	27	27	27	27
S_x (mm^3)	5.51E+06	5.51E+06	5.51E+06	5.51E+06	5.51E+06	5.51E+06	5.51E+06	5.51E+06	5.51E+06	5.51E+06	5.51E+06	5.51E+06	8.72E+06	8.72E+06	8.72E+06	8.72E+06	8.72E+06	8.72E+06
S_y (mm^3)	4.41E+06	4.41E+06	4.41E+06	4.41E+06	4.41E+06	4.41E+06	4.41E+06	4.41E+06	4.41E+06	4.41E+06	4.41E+06	4.41E+06	8.13E+05	8.13E+05	8.13E+05	8.13E+05	8.13E+05	8.13E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	20	20	20	20	20	20
L (mm)	15582	15582	15582	955	955	955	955	955	955	15582	15582	15582	1463	1463	1463	1463	1463	1463

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	27	27	27	138	138	138	142	142	142	203	203	203	14	14	14	189	189	189
Member Label	13N-54N	13N-54N	13N-54N	54N-55N	54N-55N	54N-55N	54S-55S	54S-55S	54S-55S	13S-54S	13S-54S	13S-54S	15N-16N	15N-16N	15N-16N	15S-16S	15S-16S	15S-16S
Station (m)	0.0	7.8	15.6	0.0	0.5	1.0	0.0	0.5	1.0	0.0	7.8	15.6	0.0	0.7	1.5	0.0	0.7	1.5
Node Label at Station	13N	---	54N	54N	---	55N	54S	---	55S	13S	---	54S	15N	---	16N	15S	---	16S
Section #	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 09	Section 09	Section 09	Section 09	Section 09	Section 09
Element Group	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	16.0	16.0	16.0	16.0	16.0	16.0
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3						
Webs in flexural compression	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3						
Webs in combined flexural and axial compression	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	16.0	16.0	16.0	16.0	16.0	16.0
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	27	27	27	138	138	138	142	142	142	203	203	203	14	14	14	189	189	189
Member Label	13N-54N	13N-54N	13N-54N	54N-55N	54N-55N	54N-55N	54S-55S	54S-55S	54S-55S	13S-54S	13S-54S	13S-54S	15N-16N	15N-16N	15N-16N	15S-16S	15S-16S	15S-16S
Station (m)	0.0	7.8	15.6	0.0	0.5	1.0	0.0	0.5	1.0	0.0	7.8	15.6	0.0	0.7	1.5	0.0	0.7	1.5
Node Label at Station	13N	---	54N	54N	---	55N	54S	---	55S	13S	---	54S	15N	---	16N	15S	---	16S
Section #	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 09	Section 09	Section 09	Section 09	Section 09	Section 09
Element Group	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	15582	15582	15582	955	955	955	955	955	955	15582	15582	15582	1463	1463	1463	1463	1463	1463
L_y (mm)	15582	15582	15582	955	955	955	955	955	955	15582	15582	15582	1463	1463	1463	1463	1463	1463
λ_{max}	0.908	0.908	0.908	0.056	0.056	0.056	0.056	0.056	0.056	0.908	0.908	0.908	0.559	0.559	0.559	0.559	0.559	0.559
C_r (kN)	4402.0	4402.0	4402.0	6744.6	6744.6	6744.6	6744.6	6744.6	6744.6	4402.0	4402.0	4402.0	14383.2	14383.2	14383.2	14383.2	14383.2	14383.2
$(kL/r)_{max}$	88.0	88.0	88.0	5.4	5.4	5.4	5.4	5.4	5.4	88.0	88.0	88.0	54.2	54.2	54.2	54.2	54.2	54.2
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1						
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	9621	9621	9621	2560940	2560940	2560940	2560940	2560940	2560940	9621	9621	9621	71449	71449	71449	71449	71449	71449

Shear Flexibility Factor:

1. Lacing:

a (mm)	675	675	675	675	675	675	675	675	675	675	675	675	425	425	425	425	425	425
b (mm)	584	584	584	584	584	584	584	584	584	584	584	584	368	368	368	368	368	368
ε_aa (mm)	675	675	675	675	675	675	675	675	675	675	675	675	425	425	425	425	425	425
ε_bb (mm)	584	584	584	584	584	584	584	584	584	584	584	584	368	368	368	368	368	368
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477	6477
A_c (mm^2)	18788	18788	18788	18788	18788	18788	18788	18788	18788	18788	18788	18788	54840	54840	54840	54840	54840	54840
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	0.3330	0.3330	0.3330	0.3330	0.3330	0.3330	0.3330	0.3330	0.3330	0.3330	0.3330	0.3330	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	1.324	1.324	1.324	1.324	1.324	1.324	1.324	1.324	1.324	1.324	1.324	1.324	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	1.203	1.203	1.203	0.074	0.074	0.074	0.074	0.074	0.074	1.203	1.203	1.203	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	3270.0	3270.0	3270.0	6742.1	6742.1	6742.1	6742.1	6742.1	6742.1	3270.0	3270.0	3270.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	Yes	Yes	Yes	No	No	No	No	No	No	Yes	Yes	Yes	No	No	No	No	No	No

Member ID in CSiBridge	27	27	27	138	138	138	142	142	142	203	203	203	14	14	14	189	189	189
Member Label	13N-54N	13N-54N	13N-54N	54N-55N	54N-55N	54N-55N	54S-55S	54S-55S	54S-55S	13S-54S	13S-54S	13S-54S	15N-16N	15N-16N	15N-16N	15S-16S	15S-16S	15S-16S
Station (m)	0.0	7.8	15.6	0.0	0.5	1.0	0.0	0.5	1.0	0.0	7.8	15.6	0.0	0.7	1.5	0.0	0.7	1.5
Node Label at Station	13N	---	54N	54N	---	55N	54S	---	55S	13S	---	54S	15N	---	16N	15S	---	16S
Section #	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 09	Section 09	Section 09	Section 09	Section 09	Section 09
Element Group	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	18788	18788	18788	18788	18788	18788	18788	18788	18788	18788	18788	18788	54840	54840	54840	54840	54840	54840
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	3270.0	3270.0	3270.0	6744.6	6744.6	6744.6	6744.6	6744.6	6744.6	3270.0	3270.0	3270.0	14383.2	14383.2	14383.2	14383.2	14383.2	14383.2

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	35697	35697	35697	35697	35697	35697	35697	35697	35697	35697	35697	35697	87744	87744	87744	87744	87744	87744
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	7122	7122	7122	7122	7122	7122	7122	7122	7122	7122	7122	7122	17505	17505	17505	17505	17505	17505
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	25994	25994	25994	25994	25994	25994	25994	25994	25994	25994	25994	25994	108918	108918	108918	108918	108918	108918
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	25994	25994	25994	25994	25994	25994	25994	25994	25994	25994	25994	25994	108918	108918	108918	108918	108918	108918
$A_{n(corrosion)}$ (mm^2)	24694	24694	24694	24694	24694	24694	24694	24694	24694	24694	24694	24694	87134	87134	87134	87134	87134	87134
$T_{r(b)}$ (kN)	8297	8297	8297	8297	8297	8297	8297	8297	8297	8297	8297	8297	29277	29277	29277	29277	29277	29277
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	24694	24694	24694	24694	24694	24694	24694	24694	24694	24694	24694	24694	87134	87134	87134	87134	87134	87134
$T_{r(c)}$ (kN)	8297	8297	8297	8297	8297	8297	8297	8297	8297	8297	8297	8297	29277	29277	29277	29277	29277	29277
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	27	27	27	138	138	138	142	142	142	203	203	203	14	14	14	189	189	189
Member Label	13N-54N	13N-54N	13N-54N	54N-55N	54N-55N	54N-55N	54S-55S	54S-55S	54S-55S	13S-54S	13S-54S	13S-54S	15N-16N	15N-16N	15N-16N	15S-16S	15S-16S	15S-16S
Station (m)	0.0	7.8	15.6	0.0	0.5	1.0	0.0	0.5	1.0	0.0	7.8	15.6	0.0	0.7	1.5	0.0	0.7	1.5
Node Label at Station	13N	---	54N	54N	---	55N	54S	---	55S	13S	---	54S	15N	---	16N	15S	---	16S
Section #	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 09	Section 09	Section 09	Section 09	Section 09	Section 09
Element Group	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	8297	8297	8297	8297	8297	8297	8297	8297	8297	8297	8297	8297	29277	29277	29277	29277	29277	29277
$(kL/r)_{max}$	88	88	88	5	5	5	5	5	5	88	88	88	54	54	54	54	54	54
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	7122	7122	7122	7122	7122	7122	7122	7122	7122	7122	7122	7122	17505	17505	17505	17505	17505	17505
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1044	1044	1044	1044	1044	1044	1044	1044	1044	1044	1044	1044	1392	1392	1392	1392	1392	1392
$M_{ry(Laterally\ Supported)}$ (kNm)	836	836	836	836	836	836	836	836	836	836	836	836	130	130	130	130	130	130
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	15582	15582	15582	955	955	955	955	955	955	15582	15582	15582	1463	1463	1463	1463	1463	1463
L_{uy} (mm)	15582	15582	15582	955	955	955	955	955	955	15582	15582	15582	1463	1463	1463	1463	1463	1463
M_{ux} (kNm) (y weak)	2297	2297	2297	37470	37470	37470	37470	37470	37470	2297	2297	2297	9573	9573	9573	9573	9573	9573
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1031.4	1031.4	1031.4	1190.3	1190.3	1190.3	1190.3	1190.3	1190.3	1031.4	1031.4	1031.4	1515.2	1515.2	1515.2	1515.2	1515.2	1515.2
M_{ry} (kNm)	836.1	836.1	836.1	836.1	836.1	836.1	836.1	836.1	836.1	836.1	836.1	836.1	129.8	129.8	129.8	129.8	129.8	129.8

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y/w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.302	0.303	0.305	0.000	0.000	0.000	0.000	0.000	0.000	0.309	0.310	0.311	0.090	0.090	0.091	0.094	0.094	0.094
(T_f/T_r)<=1	0.174	0.173	0.172	0.003	0.002	0.000	0.003	0.002	0.000	0.178	0.178	0.177	0.000	0.000	0.000	0.000	0.000	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.174	0.173	0.172	0.003	0.002	0.000	0.003	0.002	0.000	0.178	0.178	0.177	0.000	0.000	0.000	0.000	0.000	0.000
M_{fx}/M_{rx}<=1	0.000	0.097	0.235	0.203	0.051	0.000	0.203	0.051	0.000	0.000	0.097	0.235	0.000	0.000	0.000	0.000	0.000	0.000
M_{fy}/M_{ry}<=1	0.000	0.044	0.106	0.106	0.026	0.000	0.106	0.026	0.000	0.000	0.044	0.106	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r$<=1	0.174	0.314	0.513	0.313	0.079	0.000	0.313	0.079	0.000	0.178	0.319	0.518	0.000	0.000	0.000	0.000	0.000	0.000
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.304	0.075	0.000	0.304	0.075	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	27	27	27	138	138	138	142	142	142	203	203	203	14	14	14	189	189	189
Member Label	13N-54N	13N-54N	13N-54N	54N-55N	54N-55N	54N-55N	54S-55S	54S-55S	54S-55S	13S-54S	13S-54S	13S-54S	15N-16N	15N-16N	15N-16N	15S-16S	15S-16S	15S-16S
Station (m)	0.0	7.8	15.6	0.0	0.5	1.0	0.0	0.5	1.0	0.0	7.8	15.6	0.0	0.7	1.5	0.0	0.7	1.5
Node Label at Station	13N	---	54N	54N	---	55N	54S	---	55S	13S	---	54S	15N	---	16N	15S	---	16S
Section #	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 28	Section 09	Section 09	Section 09	Section 09	Section 09	Section 09
Element Group	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	06 Oper Strut	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	6747	6747	6747	6747	6747	6747	6747	6747	6747	6747	6747	6747	16584	16584	16584	16584	16584	16584
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.64E+04	1.64E+04	1.64E+04	4.38E+06	4.38E+06	4.38E+06	4.38E+06	4.38E+06	4.38E+06	1.64E+04	1.64E+04	1.64E+04	2.88E+06	2.88E+06	2.88E+06	2.88E+06	2.88E+06	2.88E+06
U_{1x}	1.06	1.06	1.06	1.00	1.00	1.00	1.00	1.00	1.00	1.07	1.07	1.07	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	9621	9621	9621	2560940	2560940	2560940	2560940	2560940	2560940	9621	9621	9621	71449	71449	71449	71449	71449	71449
U_{1y}	1.11	1.11	1.12	1.00	1.00	1.00	1.00	1.00	1.00	1.12	1.12	1.12	1.02	1.02	1.02	1.02	1.02	1.02
C_f/C_r	0.146	0.147	0.148	0.000	0.000	0.000	0.000	0.000	0.000	0.150	0.150	0.151	0.078	0.078	0.079	0.082	0.082	0.082
$U_{1x}M_{fx}/M_{rx}$	0.000	0.102	0.247	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.102	0.247	0.000	0.057	0.111	0.000	0.091	0.178
$U_{1y}M_{fy}/M_{ry}$	0.000	0.049	0.119	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.049	0.119	0.958	0.133	0.722	0.856	0.141	0.574
Interaction	0.146	0.298	0.513	0.000	0.000	0.000	0.000	0.000	0.000	0.150	0.302	0.517	1.036	0.269	0.912	0.938	0.315	0.833

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.908	0.908	0.908	0.056	0.056	0.056	0.056	0.056	0.056	0.908	0.908	0.908	0.559	0.559	0.559	0.559	0.559	0.559
$C_{r\ (K=1)}$ (kN)	4402	4402	4402	6745	6745	6745	6745	6745	6745	4402	4402	4402	14383	14383	14383	14383	14383	14383
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.06	1.06	1.06	1.00	1.00	1.00	1.00	1.00	1.00	1.07	1.07	1.07	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.11	1.11	1.12	1.00	1.00	1.00	1.00	1.00	1.00	1.12	1.12	1.12	1.02	1.02	1.02	1.02	1.02	1.02
C_f/C_r	0.224	0.225	0.226	0.000	0.000	0.000	0.000	0.000	0.000	0.229	0.230	0.231	0.090	0.090	0.091	0.094	0.094	0.094
$U_{1x}M_{fx}/M_{rx}$	0.000	0.102	0.247	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.102	0.247	0.000	0.057	0.111	0.000	0.091	0.178
$U_{1y}M_{fy}/M_{ry}$	0.000	0.049	0.119	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.049	0.119	0.958	0.133	0.722	0.856	0.141	0.574
Interaction	0.224	0.377	0.592	0.000	0.000	0.000	0.000	0.000	0.000	0.229	0.382	0.597	1.048	0.281	0.924	0.951	0.327	0.846

3.3. Lateral Torsional Buckling:

λ_{max}	0.908	0.908	0.908	0.056	0.056	0.056	0.056	0.056	0.056	0.908	0.908	0.908	0.559	0.559	0.559	0.559	0.559	0.559
C_r (kN)	4402	4402	4402	6745	6745	6745	6745	6745	6745	4402	4402	4402	14383	14383	14383	14383	14383	14383
U_{1x}	1.06	1.06	1.06	1.00	1.00	1.00	1.00	1.00	1.00	1.07	1.07	1.07	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.11	1.11	1.12	1.00	1.00	1.00	1.00	1.00	1.00	1.12	1.12	1.12	1.02	1.02	1.02	1.02	1.02	1.02
M_{rx} (kNm)	1031	1031	1031	1190	1190	1190	1190	1190	1190	1031	1031	1031	1515	1515	1515	1515	1515	1515
M_{ry} (kNm)	836	836	836	836	836	836	836	836	836	836	836	836	130	130	130	130	130	130
C_f/C_r	0.224	0.225	0.226	0.000	0.000	0.000	0.000	0.000	0.000	0.229	0.230	0.231	0.090	0.090	0.091	0.094	0.094	0.094
$U_{1x}M_{fx}/M_{rx}$	0.000	0.103	0.250	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.103	0.250	0.000	0.053	0.102	0.000	0.084	0.163
$U_{1y}M_{fy}/M_{ry}$	0.000	0.049	0.119	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.049	0.119	0.958	0.133	0.722	0.856	0.141	0.574
Interaction	0.224	0.378	0.595	0.000	0.000	0.000	0.000	0.000	0.000	0.229	0.383	0.600	1.048	0.277	0.915	0.951	0.320	0.831
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	NOT OK	OK	OK	OK	OK	OK
Highest Ratio	0.302	0.378	0.595	0.313	0.079	0.000	0.313	0.079	0.000	0.309	0.383	0.600	1.048	0.281	0.924	0.951	0.327	0.846

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	248	248	248	251	251	251	252	252	252	399	399	399	579	579	579	580	580	580
Member Label	16N-56N	16N-56N	16N-56N	15N-56N	15N-56N	15N-56N	56N-14N	56N-14N	56N-14N	16S-56S	16S-56S	16S-56S	15S-56S	15S-56S	15S-56S	56S-14S	56S-14S	56S-14S
Station (m)	0.0	0.8	1.6	0.0	0.8	1.6	0.0	3.4	6.7	0.0	0.8	1.6	0.0	0.8	1.6	0.0	3.4	6.7
Node Label at Station	16N	---	56N	15N	---	56N	56N	---	14N	16S	---	56S	15S	---	56S	56S	---	14S
Section #	Section 01	Section 01	Section 01	Section 08	Section 08	Section 08	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01	Section 08	Section 08	Section 08	Section 08	Section 08	Section 08
Element Group	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay

Member Factored Load Effects:

C_f (kN)	0	0	0	2055	2054	2052	2100	2093	2085	0	0	0	2086	2084	2082	2124	2116	2108
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	14	28	0	9	0	0	0	0	0	13	26	0	9	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	297	148	0	0	11	0	0	0	0	295	147	0	0	11	0
T_f (kN)	1840	1841	1842	1495	1496	1497	1534	1538	1542	1932	1933	1934	1369	1370	1371	1403	1407	1411
$M_{fx\ (tension)}$ (kNm)	78	34	28	0	14	28	0	9	0	72	32	26	0	13	26	0	9	0
$M_{fy\ (tension)}$ (kNm)	215	108	1	297	148	0	0	11	0	222	112	1	295	147	0	0	11	0
V_{fx} (kN)	137	138	140	184	183	181	6	0	6	142	143	145	183	181	180	6	0	6
V_{fy} (kN)	61	60	60	16	17	18	6	0	6	55	55	55	15	16	17	6	0	6

Gross Section Properties:

Ag (mm^2)	12774	12774	12774	20903	20903	20903	20903	20903	20903	12774	12774	12774	20903	20903	20903	20903	20903	20903
I_x (mm^4)	2.61E+08	2.61E+08	2.61E+08	3.34E+08	3.34E+08	3.34E+08	3.34E+08	3.34E+08	3.34E+08	2.61E+08	2.61E+08	2.61E+08	3.34E+08	3.34E+08	3.34E+08	3.34E+08	3.34E+08	3.34E+08
I_y (mm^4)	8.94E+08	8.94E+08	8.94E+08	9.14E+08	9.14E+08	9.14E+08	9.14E+08	9.14E+08	9.14E+08	8.94E+08	8.94E+08	8.94E+08	9.14E+08	9.14E+08	9.14E+08	9.14E+08	9.14E+08	9.14E+08
J (mm^4)	7.19E+05	7.19E+05	7.19E+05	2.92E+06	2.92E+06	2.92E+06	2.92E+06	2.92E+06	2.92E+06	7.19E+05	7.19E+05	7.19E+05	2.92E+06	2.92E+06	2.92E+06	2.92E+06	2.92E+06	2.92E+06
r_x (mm)	143	143	143	126	126	126	126	126	126	143	143	143	126	126	126	126	126	126
r_y (mm)	265	265	265	209	209	209	209	209	209	265	265	265	209	209	209	209	209	209
S_x (mm^3)	1.37E+06	1.37E+06	1.37E+06	1.75E+06	1.75E+06	1.75E+06	1.75E+06	1.75E+06	1.75E+06	1.37E+06	1.37E+06	1.37E+06	1.75E+06	1.75E+06	1.75E+06	1.75E+06	1.75E+06	1.75E+06
S_y (mm^3)	2.73E+06	2.73E+06	2.73E+06	4.00E+06	4.00E+06	4.00E+06	4.00E+06	4.00E+06	4.00E+06	2.73E+06	2.73E+06	2.73E+06	4.00E+06	4.00E+06	4.00E+06	4.00E+06	4.00E+06	4.00E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
L (mm)	1557	1557	1557	1628	1628	1628	6715	6715	6715	1557	1557	1557	1628	1628	1628	6715	6715	6715

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	248	248	248	251	251	251	252	252	252	399	399	399	579	579	579	580	580	580
Member Label	16N-56N	16N-56N	16N-56N	15N-56N	15N-56N	15N-56N	56N-14N	56N-14N	56N-14N	16S-56S	16S-56S	16S-56S	15S-56S	15S-56S	15S-56S	56S-14S	56S-14S	56S-14S
Station (m)	0.0	0.8	1.6	0.0	0.8	1.6	0.0	3.4	6.7	0.0	0.8	1.6	0.0	0.8	1.6	0.0	3.4	6.7
Node Label at Station	16N	---	56N	15N	---	56N	56N	---	14N	16S	---	56S	15S	---	56S	56S	---	14S
Section #	Section 01	Section 01	Section 01	Section 08	Section 08	Section 08	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01	Section 08	Section 08	Section 08	Section 08	Section 08	Section 08
Element Group	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels	5.2	5.2	5.2	5.4	5.4	5.4	5.4	5.4	5.4	5.2	5.2	5.2	5.4	5.4	5.4	5.4	5.4	5.4
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	37.5	37.5	37.5	28.8	28.8	28.8	28.8	28.8	28.8	37.5	37.5	37.5	28.8	28.8	28.8	28.8	28.8	28.8
Webs in flexural compression	37.5	37.5	37.5	28.8	28.8	28.8	28.8	28.8	28.8	37.5	37.5	37.5	28.8	28.8	28.8	28.8	28.8	28.8
Webs in combined flexural and axial compression	37.5	37.5	37.5	28.8	28.8	28.8	28.8	28.8	28.8	37.5	37.5	37.5	28.8	28.8	28.8	28.8	28.8	28.8
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	248	248	248	251	251	251	252	252	252	399	399	399	579	579	579	580	580	580
Member Label	16N-56N	16N-56N	16N-56N	15N-56N	15N-56N	15N-56N	56N-14N	56N-14N	56N-14N	16S-56S	16S-56S	16S-56S	15S-56S	15S-56S	15S-56S	56S-14S	56S-14S	56S-14S
Station (m)	0.0	0.8	1.6	0.0	0.8	1.6	0.0	3.4	6.7	0.0	0.8	1.6	0.0	0.8	1.6	0.0	3.4	6.7
Node Label at Station	16N	---	56N	15N	---	56N	56N	---	14N	16S	---	56S	15S	---	56S	56S	---	14S
Section #	Section 01	Section 01	Section 01	Section 08	Section 08	Section 08	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01	Section 08	Section 08	Section 08	Section 08	Section 08	Section 08
Element Group	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	1557	1557	1557	1628	1628	1628	6715	6715	6715	1557	1557	1557	1628	1628	1628	6715	6715	6715
L_y (mm)	1557	1557	1557	1628	1628	1628	6715	6715	6715	1557	1557	1557	1628	1628	1628	6715	6715	6715
λ_{max}	0.112	0.112	0.112	0.133	0.133	0.133	0.550	0.550	0.550	0.112	0.112	0.112	0.133	0.133	0.133	0.550	0.550	0.550
C_r (kN)	1927.3	1927.3	1927.3	3149.9	3149.9	3149.9	2756.5	2756.5	2756.5	1927.3	1927.3	1927.3	3149.9	3149.9	3149.9	2756.5	2756.5	2756.5
$(kL/r)_{max}$	10.9	10.9	10.9	12.9	12.9	12.9	53.3	53.3	53.3	10.9	10.9	10.9	12.9	12.9	12.9	53.3	53.3	53.3
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens							1	1	1							1	1	1
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	212506	212506	212506	248806	248806	248806	14617	14617	14617	212506	212506	212506	248806	248806	248806	14617	14617	14617

Shear Flexibility Factor:

1. Lacing:

a (mm)	657	657	657	425	425	425	425	425	425	657	657	657	425	425	425	425	425	425
b (mm)	569	569	569	368	368	368	368	368	368	569	569	569	368	368	368	368	368	368
ε_aa (mm)	657	657	657	425	425	425	425	425	425	657	657	657	425	425	425	425	425	425
ε_bb (mm)	569	569	569	368	368	368	368	368	368	569	569	569	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	1401	1401	1401	6477	6477	6477	6477	6477	6477	1401	1401	1401	6477	6477	6477	6477	6477	6477
A_c (mm^2)	6387	6387	6387	10452	10452	10452	10452	10452	10452	6387	6387	6387	10452	10452	10452	10452	10452	10452
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	248	248	248	251	251	251	252	252	252	399	399	399	579	579	579	580	580	580
Member Label	16N-56N	16N-56N	16N-56N	15N-56N	15N-56N	15N-56N	56N-14N	56N-14N	56N-14N	16S-56S	16S-56S	16S-56S	15S-56S	15S-56S	15S-56S	56S-14S	56S-14S	56S-14S
Station (m)	0.0	0.8	1.6	0.0	0.8	1.6	0.0	3.4	6.7	0.0	0.8	1.6	0.0	0.8	1.6	0.0	3.4	6.7
Node Label at Station	16N	---	56N	15N	---	56N	56N	---	14N	16S	---	56S	15S	---	56S	56S	---	14S
Section #	Section 01	Section 01	Section 01	Section 08	Section 08	Section 08	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01	Section 08	Section 08	Section 08	Section 08	Section 08	Section 08
Element Group	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	0.79	0.79	0.79	N/A	N/A	N/A	N/A	N/A	N/A	0.79	0.79	0.79
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	0.76	0.76	0.76	N/A	N/A	N/A	N/A	N/A	N/A	0.76	0.76	0.76
l (mm)	3343	3343	3343	3343	3343	3343	6044	6044	6044	3343	3343	3343	3343	3343	3343	6044	6044	6044
A_c (mm^2)	6387	6387	6387	10452	10452	10452	10452	10452	10452	6387	6387	6387	10452	10452	10452	10452	10452	10452
A_b (mm^2)	800	800	800	800	800	800	1000	1000	1000	800	800	800	800	800	800	1000	1000	1000
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	0.50	0.50	0.50	N/A	N/A	N/A	N/A	N/A	N/A	0.50	0.50	0.50
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	1.41	1.41	1.41	N/A	N/A	N/A	N/A	N/A	N/A	1.41	1.41	1.41
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	0.47	0.47	0.47	N/A	N/A	N/A	N/A	N/A	N/A	0.47	0.47	0.47
Cr' (kN)	999999	999999	999999	999999	999999	999999	2883	2883	2883	999999	999999	999999	999999	999999	999999	2883	2883	2883
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	1927.3	1927.3	1927.3	3149.9	3149.9	3149.9	2756.5	2756.5	2756.5	1927.3	1927.3	1927.3	3149.9	3149.9	3149.9	2756.5	2756.5	2756.5

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	10219	10219	10219	16722	16722	16722	16722	16722	16722	10219	10219	10219	16722	16722	16722	16722	16722	16722
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	2039	2039	2039	3336	3336	3336	3336	3336	3336	2039	2039	2039	3336	3336	3336	3336	3336	3336
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	9238	9238	9238	14953	14953	14953	14953	14953	14953	9238	9238	9238	14953	14953	14953	14953	14953	14953
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	9238	9238	9238	14953	14953	14953	14953	14953	14953	9238	9238	9238	14953	14953	14953	14953	14953	14953
$A_{n(corrosion)}$ (mm^2)	7391	7391	7391	11963	11963	11963	11963	11963	11963	7391	7391	7391	11963	11963	11963	11963	11963	11963
$T_{r(b)}$ (kN)	2483	2483	2483	4019	4019	4019	4019	4019	4019	2483	2483	2483	4019	4019	4019	4019	4019	4019
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	7391	7391	7391	11963	11963	11963	11963	11963	11963	7391	7391	7391	11963	11963	11963	11963	11963	11963
$T_{r(c)}$ (kN)	2483	2483	2483	4019	4019	4019	4019	4019	4019	2483	2483	2483	4019	4019	4019	4019	4019	4019
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	248	248	248	251	251	251	252	252	252	399	399	399	579	579	579	580	580	580
Member Label	16N-56N	16N-56N	16N-56N	15N-56N	15N-56N	15N-56N	56N-14N	56N-14N	56N-14N	16S-56S	16S-56S	16S-56S	15S-56S	15S-56S	15S-56S	56S-14S	56S-14S	56S-14S
Station (m)	0.0	0.8	1.6	0.0	0.8	1.6	0.0	3.4	6.7	0.0	0.8	1.6	0.0	0.8	1.6	0.0	3.4	6.7
Node Label at Station	16N	---	56N	15N	---	56N	56N	---	14N	16S	---	56S	15S	---	56S	56S	---	14S
Section #	Section 01	Section 01	Section 01	Section 08	Section 08	Section 08	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01	Section 08	Section 08	Section 08	Section 08	Section 08	Section 08
Element Group	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	2483	2483	2483	4019	4019	4019	4019	4019	4019	2483	2483	2483	4019	4019	4019	4019	4019	4019
$(kL/r)_{max}$	11	11	11	13	13	13	53	53	53	11	11	11	13	13	13	53	53	53
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	2039	2039	2039	3336	3336	3336	3336	3336	3336	2039	2039	2039	3336	3336	3336	3336	3336	3336
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	219	219	219	280	280	280	280	280	280	219	219	219	280	280	280	280	280	280
$M_{ry(Laterally\ Supported)}$ (kNm)	436	436	436	638	638	638	638	638	638	436	436	436	638	638	638	638	638	638
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	1557	1557	1557	1628	1628	1628	6715	6715	6715	1557	1557	1557	1628	1628	1628	6715	6715	6715
L_{uy} (mm)	1557	1557	1557	1628	1628	1628	6715	6715	6715	1557	1557	1557	1628	1628	1628	6715	6715	6715
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	3430	3430	3430	7477	7477	7477	1812	1812	1812	3430	3430	3430	7477	7477	7477	1812	1812	1812
M_{rx} (kNm)	218.6	218.6	218.6	279.8	279.8	279.8	279.8	279.8	279.8	218.6	218.6	218.6	279.8	279.8	279.8	279.8	279.8	279.8
M_{ry} (kNm)	477.6	477.6	477.6	711.0	711.0	711.0	638.8	638.8	638.8	477.6	477.6	477.6	711.0	711.0	711.0	638.8	638.8	638.8

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.000	0.000	0.000	0.652	0.652	0.651	0.762	0.759	0.756	0.000	0.000	0.000	0.662	0.662	0.661	0.771	0.768	0.765
(T_f/T_r)<=1	0.903	0.903	0.904	0.448	0.448	0.449	0.460	0.461	0.462	0.948	0.948	0.949	0.410	0.411	0.411	0.421	0.422	0.423

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.903	0.903	0.904	0.448	0.448	0.449	0.460	0.461	0.462	0.948	0.948	0.949	0.410	0.411	0.411	0.421	0.422	0.423
M_{fx}/M_{rx}<=1	0.357	0.156	0.128	0.000	0.050	0.100	0.000	0.032	0.000	0.329	0.146	0.119	0.000	0.046	0.093	0.000	0.032	0.000
M_{fy}/M_{ry}<=1	0.450	0.226	0.002	0.418	0.208	0.000	0.000	0.017	0.000	0.465	0.235	0.002	0.415	0.207	0.000	0.000	0.017	0.000
$T_f/T_r+M_f/M_r$<=1	1.710	1.285	1.034	0.866	0.707	0.549	0.460	0.510	0.462	1.742	1.329	1.070	0.825	0.664	0.504	0.421	0.471	0.423
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	248	248	248	251	251	251	252	252	252	399	399	399	579	579	579	580	580	580
Member Label	16N-56N	16N-56N	16N-56N	15N-56N	15N-56N	15N-56N	56N-14N	56N-14N	56N-14N	16S-56S	16S-56S	16S-56S	15S-56S	15S-56S	15S-56S	56S-14S	56S-14S	56S-14S
Station (m)	0.0	0.8	1.6	0.0	0.8	1.6	0.0	3.4	6.7	0.0	0.8	1.6	0.0	0.8	1.6	0.0	3.4	6.7
Node Label at Station	16N	---	56N	15N	---	56N	56N	---	14N	16S	---	56S	15S	---	56S	56S	---	14S
Section #	Section 01	Section 01	Section 01	Section 08	Section 08	Section 08	Section 08	Section 08	Section 08	Section 01	Section 01	Section 01	Section 08	Section 08	Section 08	Section 08	Section 08	Section 08
Element Group	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay	07 TT Trunnion Bay

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1931	1931	1931	3161	3161	3161	3161	3161	3161	1931	1931	1931	3161	3161	3161	3161	3161	3161
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	2.13E+05	2.13E+05	2.13E+05	2.49E+05	2.49E+05	2.49E+05	1.46E+04	1.46E+04	1.46E+04	2.13E+05	2.13E+05	2.13E+05	2.49E+05	2.49E+05	2.49E+05	1.46E+04	1.46E+04	1.46E+04
U_{1x}	1.00	1.00	1.00	1.01	1.01	1.01	1.17	1.17	1.17	1.00	1.00	1.00	1.01	1.01	1.01	1.17	1.17	1.17
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	728481	728481	728481	681145	681145	681145	40017	40017	40017	728481	728481	728481	681145	681145	681145	40017	40017	40017
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.06	1.06	1.05	1.00	1.00	1.00	1.00	1.00	1.00	1.06	1.06	1.06
C_f/C_r	0.000	0.000	0.000	0.650	0.650	0.649	0.664	0.662	0.660	0.000	0.000	0.000	0.660	0.659	0.659	0.672	0.670	0.667
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.050	0.101	0.000	0.038	0.000	0.000	0.000	0.000	0.000	0.047	0.094	0.000	0.038	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.467	0.233	0.000	0.000	0.018	0.000	0.000	0.000	0.000	0.464	0.231	0.000	0.000	0.018	0.000
Interaction	0.000	0.000	0.000	1.117	0.933	0.750	0.664	0.718	0.660	0.000	0.000	0.000	1.124	0.937	0.752	0.672	0.725	0.667

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.112	0.112	0.112	0.133	0.133	0.133	0.550	0.550	0.550	0.112	0.112	0.112	0.133	0.133	0.133	0.550	0.550	0.550
$C_{r\ (K=1)}$ (kN)	1927	1927	1927	3150	3150	3150	2756	2756	2756	1927	1927	1927	3150	3150	3150	2756	2756	2756
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.01	1.01	1.01	1.17	1.17	1.17	1.00	1.00	1.00	1.01	1.01	1.01	1.17	1.17	1.17
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.06	1.06	1.05	1.00	1.00	1.00	1.00	1.00	1.00	1.06	1.06	1.06
C_f/C_r	0.000	0.000	0.000	0.652	0.652	0.651	0.762	0.759	0.756	0.000	0.000	0.000	0.662	0.662	0.661	0.771	0.768	0.765
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.050	0.101	0.000	0.038	0.000	0.000	0.000	0.000	0.000	0.047	0.094	0.000	0.038	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.467	0.233	0.000	0.000	0.018	0.000	0.000	0.000	0.000	0.464	0.231	0.000	0.000	0.018	0.000
Interaction	0.000	0.000	0.000	1.119	0.935	0.752	0.762	0.815	0.756	0.000	0.000	0.000	1.126	0.939	0.755	0.771	0.823	0.765

3.3. Lateral Torsional Buckling:

λ_{max}	0.112	0.112	0.112	0.133	0.133	0.133	0.550	0.550	0.550	0.112	0.112	0.112	0.133	0.133	0.133	0.550	0.550	0.550
C_r (kN)	1927	1927	1927	3150	3150	3150	2756	2756	2756	1927	1927	1927	3150	3150	3150	2756	2756	2756
U_{1x}	1.00	1.00	1.00	1.01	1.01	1.01	1.17	1.17	1.17	1.00	1.00	1.00	1.01	1.01	1.01	1.17	1.17	1.17
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.06	1.06	1.05	1.00	1.00	1.00	1.00	1.00	1.00	1.06	1.06	1.06
M_{rx} (kNm)	219	219	219	280	280	280	280	280	280	219	219	219	280	280	280	280	280	280
M_{ry} (kNm)	478	478	478	711	711	711	639	639	639	478	478	478	711	711	711	639	639	639
C_f/C_r	0.000	0.000	0.000	0.652	0.652	0.651	0.762	0.759	0.756	0.000	0.000	0.000	0.662	0.662	0.661	0.771	0.768	0.765
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.050	0.101	0.000	0.038	0.000	0.000	0.000	0.000	0.000	0.047	0.094	0.000	0.038	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.419	0.209	0.000	0.000	0.018	0.000	0.000	0.000	0.000	0.416	0.207	0.000	0.000	0.018	0.000
Interaction	0.000	0.000	0.000	1.071	0.911	0.752	0.762	0.815	0.756	0.000	0.000	0.000	1.078	0.916	0.755	0.771	0.823	0.765
Demand/Capacity ≤ 1	NOT OK	NOT OK	NOT OK	NOT OK	OK	OK	OK	OK	OK	NOT OK	NOT OK	NOT OK	NOT OK	OK	OK	OK	OK	OK
Highest Ratio	1.710	1.285	1.034	1.119	0.935	0.752	0.762	0.815	0.756	1.742	1.329	1.070	1.126	0.939	0.755	0.771	0.823	0.765

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	29	29	29	33	33	33	157	157	157	160	160	160	164	164	164	206	206	206
Member Label	23N-24N	23N-24N	23N-24N	26N-25N	26N-25N	26N-25N	23S-24S	23S-24S	23S-24S	24N-25N	24N-25N	24N-25N	26S-25S	26S-25S	26S-25S	24S-25S	24S-25S	24S-25S
Station (m)	0.0	1.6	3.1	0.0	2.4	4.8	0.0	1.6	3.1	0.0	1.8	3.5	0.0	2.4	4.8	0.0	1.8	3.5
Node Label at Station	23N	---	24N	26N	---	25N	23S	---	24S	24N	---	25N	26S	---	25S	24S	---	25S
Section #	Section 23	Section 23	Section 23	Section 25	Section 25	Section 25	Section 23	Section 23	Section 23	Section 24	Section 24	Section 24	Section 25	Section 25	Section 25	Section 24	Section 24	Section 24
Element Group	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord

Member Factored Load Effects:

C_f (kN)	0	0	0	1354	1348	1342	0	0	0	0	0	0	1343	1337	1331	0	0	0
$M_{fx\ (comp)}$ (kNm)	0	0	0	90	286	485	0	0	0	0	0	0	89	284	483	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	99	42	12	0	0	0	0	0	0	90	37	12	0	0	0
T_f (kN)	1550	1543	1536	0	0	0	1606	1599	1591	1396	1388	1380	0	0	0	1444	1436	1428
$M_{fx\ (tension)}$ (kNm)	295	235	213	0	0	0	304	239	211	259	125	509	0	0	0	257	125	506
$M_{fy\ (tension)}$ (kNm)	39	6	32	0	0	0	33	7	33	31	10	13	0	0	0	31	10	14
V_{fx} (kN)	20	23	26	26	21	17	18	21	24	13	10	7	24	20	15	14	11	7
V_{fy} (kN)	40	37	34	81	82	83	43	41	38	217	217	217	80	81	82	216	215	215

Gross Section Properties:

Ag (mm^2)	36774	36774	36774	20927	20927	20927	36774	36774	36774	33871	33871	33871	20927	20927	20927	33871	33871	33871
I_x (mm^4)	3.53E+09	3.53E+09	3.53E+09	2.00E+09	2.00E+09	2.00E+09	3.53E+09	3.53E+09	3.53E+09	3.31E+09	3.31E+09	3.31E+09	2.00E+09	2.00E+09	2.00E+09	3.31E+09	3.31E+09	3.31E+09
I_y (mm^4)	7.35E+09	7.35E+09	7.35E+09	4.02E+09	4.02E+09	4.02E+09	7.35E+09	7.35E+09	7.35E+09	6.75E+09	6.75E+09	6.75E+09	4.02E+09	4.02E+09	4.02E+09	6.75E+09	6.75E+09	6.75E+09
J (mm^4)	1.28E+07	1.28E+07	1.28E+07	8.86E+05	8.86E+05	8.86E+05	1.28E+07	1.28E+07	1.28E+07	3.68E+06	3.68E+06	3.68E+06	8.86E+05	8.86E+05	8.86E+05	3.68E+06	3.68E+06	3.68E+06
r_x (mm)	310	310	310	309	309	309	310	310	310	312	312	312	309	309	309	312	312	312
r_y (mm)	447	447	447	438	438	438	447	447	447	446	446	446	438	438	438	446	446	446
S_x (mm^3)	9.12E+06	9.12E+06	9.12E+06	5.17E+06	5.17E+06	5.17E+06	9.12E+06	9.12E+06	9.12E+06	8.53E+06	8.53E+06	8.53E+06	5.17E+06	5.17E+06	5.17E+06	8.53E+06	8.53E+06	8.53E+06
S_y (mm^3)	1.36E+07	1.36E+07	1.36E+07	7.55E+06	7.55E+06	7.55E+06	1.36E+07	1.36E+07	1.36E+07	1.26E+07	1.26E+07	1.26E+07	7.55E+06	7.55E+06	7.55E+06	1.26E+07	1.26E+07	1.26E+07
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	3127	3127	3127	4847	4847	4847	3127	3127	3127	3539	3539	3539	4847	4847	4847	3539	3539	3539

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	29	29	29	33	33	33	157	157	157	160	160	160	164	164	164	206	206	206
Member Label	23N-24N	23N-24N	23N-24N	26N-25N	26N-25N	26N-25N	23S-24S	23S-24S	23S-24S	24N-25N	24N-25N	24N-25N	26S-25S	26S-25S	26S-25S	24S-25S	24S-25S	24S-25S
Station (m)	0.0	1.6	3.1	0.0	2.4	4.8	0.0	1.6	3.1	0.0	1.8	3.5	0.0	2.4	4.8	0.0	1.8	3.5
Node Label at Station	23N	---	24N	26N	---	25N	23S	---	24S	24N	---	25N	26S	---	25S	24S	---	25S
Section #	Section 23	Section 23	Section 23	Section 25	Section 25	Section 25	Section 23	Section 23	Section 23	Section 24	Section 24	Section 24	Section 25	Section 25	Section 25	Section 24	Section 24	Section 24
Element Group	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	8.0	8.0	8.0	16.0	16.0	16.0	8.0	8.0	8.0	8.0	8.0	8.0	16.0	16.0	16.0	8.0	8.0	8.0
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression																		
Webs in combined flexural and axial compression	11.1	11.1	11.1	18.0	18.0	18.0	11.1	11.1	11.1	13.0	13.0	13.0	18.0	18.0	18.0	13.0	13.0	13.0
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	29	29	29	33	33	33	157	157	157	160	160	160	164	164	164	206	206	206
Member Label	23N-24N	23N-24N	23N-24N	26N-25N	26N-25N	26N-25N	23S-24S	23S-24S	23S-24S	24N-25N	24N-25N	24N-25N	26S-25S	26S-25S	26S-25S	24S-25S	24S-25S	24S-25S
Station (m)	0.0	1.6	3.1	0.0	2.4	4.8	0.0	1.6	3.1	0.0	1.8	3.5	0.0	2.4	4.8	0.0	1.8	3.5
Node Label at Station	23N	---	24N	26N	---	25N	23S	---	24S	24N	---	25N	26S	---	25S	24S	---	25S
Section #	Section 23	Section 23	Section 23	Section 25	Section 25	Section 25	Section 23	Section 23	Section 23	Section 24	Section 24	Section 24	Section 25	Section 25	Section 25	Section 24	Section 24	Section 24
Element Group	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	3127	3127	3127	4847	4847	4847	3127	3127	3127	3539	3539	3539	4847	4847	4847	3539	3539	3539
L_y (mm)	3127	3127	3127	4847	4847	4847	3127	3127	3127	3539	3539	3539	4847	4847	4847	3539	3539	3539
λ_{max}	0.104	0.104	0.104	0.162	0.162	0.162	0.104	0.104	0.104	0.117	0.117	0.117	0.162	0.162	0.162	0.117	0.117	0.117
C_r (kN)	6591.4	6591.4	6591.4	3736.3	3736.3	3736.3	6591.4	6591.4	6591.4	6067.1	6067.1	6067.1	3736.3	3736.3	3736.3	6067.1	6067.1	6067.1
$(kL/r)_{max}$	10.1	10.1	10.1	15.7	15.7	15.7	10.1	10.1	10.1	11.3	11.3	11.3	15.7	15.7	15.7	11.3	11.3	11.3
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	713692	713692	713692	168307	168307	168307	713692	713692	713692	520848	520848	520848	168307	168307	168307	520848	520848	520848

Shear Flexibility Factor:

1. Lacing:

a (mm)	1129	1129	1129	1112	1112	1112	1129	1129	1129	1122	1122	1122	1112	1112	1112	1122	1122	1122
b (mm)	978	978	978	963	963	963	978	978	978	972	972	972	963	963	963	972	972	972
ε_aa (mm)	1129	1129	1129	1112	1112	1112	1129	1129	1129	1122	1122	1122	1112	1112	1112	1122	1122	1122
ε_bb (mm)	978	978	978	963	963	963	978	978	978	972	972	972	963	963	963	972	972	972
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	6477	6477	6477	4363	4363	4363	6477	6477	6477	3185	3185	3185	4363	4363	4363	3185	3185	3185
A_c (mm^2)	18387	18387	18387	10464	10464	10464	18387	18387	18387	16936	16936	16936	10464	10464	10464	16936	16936	16936
A_d (mm^2)	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206
A_b (mm^2)	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206	2206
μ	0.3754	0.3754	0.3754	0.4563	0.4563	0.4563	0.3754	0.3754	0.3754	1.4119	1.4119	1.4119	0.4563	0.4563	0.4563	1.4119	1.4119	1.4119
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414
λ_v	0.102	0.102	0.102	0.161	0.161	0.161	0.102	0.102	0.102	0.116	0.116	0.116	0.161	0.161	0.161	0.116	0.116	0.116
Cr' (kN)	6591.9	6591.9	6591.9	3736.4	3736.4	3736.4	6591.9	6591.9	6591.9	6067.5	6067.5	6067.5	3736.4	3736.4	3736.4	6067.5	6067.5	6067.5
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	29	29	29	33	33	33	157	157	157	160	160	160	164	164	164	206	206	206
Member Label	23N-24N	23N-24N	23N-24N	26N-25N	26N-25N	26N-25N	23S-24S	23S-24S	23S-24S	24N-25N	24N-25N	24N-25N	26S-25S	26S-25S	26S-25S	24S-25S	24S-25S	24S-25S
Station (m)	0.0	1.6	3.1	0.0	2.4	4.8	0.0	1.6	3.1	0.0	1.8	3.5	0.0	2.4	4.8	0.0	1.8	3.5
Node Label at Station	23N	---	24N	26N	---	25N	23S	---	24S	24N	---	25N	26S	---	25S	24S	---	25S
Section #	Section 23	Section 23	Section 23	Section 25	Section 25	Section 25	Section 23	Section 23	Section 23	Section 24	Section 24	Section 24	Section 25	Section 25	Section 25	Section 24	Section 24	Section 24
Element Group	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	18387	18387	18387	10464	10464	10464	18387	18387	18387	16936	16936	16936	10464	10464	10464	16936	16936	16936
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	6591.4	6591.4	6591.4	3736.3	3736.3	3736.3	6591.4	6591.4	6591.4	6067.1	6067.1	6067.1	3736.3	3736.3	3736.3	6067.1	6067.1	6067.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	34935	34935	34935	19881	19881	19881	34935	34935	34935	32177	32177	32177	19881	19881	19881	32177	32177	32177
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	6970	6970	6970	3966	3966	3966	6970	6970	6970	6419	6419	6419	3966	3966	3966	6419	6419	6419
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	25289	25289	25289	20165	20165	20165	25289	25289	25289	23337	23337	23337	20165	20165	20165	23337	23337	21069
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	25289	25289	25289	20165	20165	20165	25289	25289	25289	23337	23337	23337	20165	20165	20165	23337	23337	21069
$A_{n(corrosion)}$ (mm^2)	24025	24025	24025	19157	19157	19157	24025	24025	24025	22170	22170	22170	19157	19157	19157	22170	22170	20016
$T_{r(b)}$ (kN)	8072	8072	8072	6437	6437	6437	8072	8072	8072	7449	7449	7449	6437	6437	6437	7449	7449	6725
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	24025	24025	24025	19157	19157	19157	24025	24025	24025	22170	22170	22170	19157	19157	19157	22170	22170	20016
$T_{r(c)}$ (kN)	8072	8072	8072	6437	6437	6437	8072	8072	8072	7449	7449	7449	6437	6437	6437	7449	7449	6725
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	29	29	29	33	33	33	157	157	157	160	160	160	164	164	164	206	206	206
Member Label	23N-24N	23N-24N	23N-24N	26N-25N	26N-25N	26N-25N	23S-24S	23S-24S	23S-24S	24N-25N	24N-25N	24N-25N	26S-25S	26S-25S	26S-25S	24S-25S	24S-25S	24S-25S
Station (m)	0.0	1.6	3.1	0.0	2.4	4.8	0.0	1.6	3.1	0.0	1.8	3.5	0.0	2.4	4.8	0.0	1.8	3.5
Node Label at Station	23N	---	24N	26N	---	25N	23S	---	24S	24N	---	25N	26S	---	25S	24S	---	25S
Section #	Section 23	Section 23	Section 23	Section 25	Section 25	Section 25	Section 23	Section 23	Section 23	Section 24	Section 24	Section 24	Section 25	Section 25	Section 25	Section 24	Section 24	Section 24
Element Group	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	8072	8072	8072	6437	6437	6437	8072	8072	8072	7449	7449	7449	6437	6437	6437	7449	7449	6725
$(kL/r)_{max}$	10	10	10	16	16	16	10	10	10	11	11	11	16	16	16	11	11	11
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Minimum Factored Tensile Resistance:																		
T_r (min) (kN)	6970	6970	6970	3966	3966	3966	6970	6970	6970	6419	6419	6419	3966	3966	3966	6419	6419	6419
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Factored Moment Resistances:																		
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1729	1729	1729	980	980	980	1729	1729	1729	1617	1617	1617	980	980	980	1617	1617	1617
$M_{ry(Laterally\ Supported)}$ (kNm)	2580	2580	2580	1432	1432	1432	2580	2580	2580	2382	2382	2382	1432	1432	1432	2382	2382	2382
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	3127	3127	3127	4847	4847	4847	3127	3127	3127	3539	3539	3539	4847	4847	4847	3539	3539	3539
L_{uy} (mm)	3127	3127	3127	4847	4847	4847	3127	3127	3127	3539	3539	3539	4847	4847	4847	3539	3539	3539
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	26518	26518	26518	3389	3389	3389	26518	26518	26518	12144	12144	12144	3389	3389	3389	12144	12144	12144
M_{rx} (kNm)	1729.2	1729.2	1729.2	980.2	980.2	980.2	1729.2	1729.2	1729.2	1617.1	1617.1	1617.1	980.2	980.2	980.2	1617.1	1617.1	1617.1
M_{ry} (kNm)	2877.6	2877.6	2877.6	1430.6	1430.6	1430.6	2877.6	2877.6	2877.6	2572.5	2572.5	2572.5	1430.6	1430.6	1430.6	2572.5	2572.5	2572.5
Shear resistance:																		
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		
Beam Column Checks:																		
1. Axial Force To Resistance Ratios:																		
(C_f/C_r)<=1	0.000	0.000	0.000	0.362	0.361	0.359	0.000	0.000	0.000	0.000	0.000	0.000	0.359	0.358	0.356	0.000	0.000	0.000
(T_f/T_r)<=1	0.222	0.221	0.220	0.000	0.000	0.000	0.230	0.229	0.228	0.217	0.216	0.215	0.000	0.000	0.000	0.225	0.224	0.222
2. Axial Tension and Bending:																		
(T_f/T_r)<=1	0.222	0.221	0.220	0.000	0.000	0.000	0.230	0.229	0.228	0.217	0.216	0.215	0.000	0.000	0.000	0.225	0.224	0.222
M_{fx}/M_{rx}<=1	0.171	0.136	0.123	0.000	0.000	0.000	0.176	0.138	0.122	0.160	0.077	0.315	0.000	0.000	0.000	0.159	0.077	0.313
M_{fy}/M_{ry}<=1	0.014	0.002	0.011	0.000	0.000	0.000	0.011	0.002	0.011	0.012	0.004	0.005	0.000	0.000	0.000	0.012	0.004	0.005
$T_f/T_r+M_f/M_r$<=1	0.407	0.359	0.355	0.000	0.000	0.000	0.418	0.370	0.362	0.390	0.297	0.535	0.000	0.000	0.000	0.396	0.305	0.541
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	29	29	29	33	33	33	157	157	157	160	160	160	164	164	164	206	206	206
Member Label	23N-24N	23N-24N	23N-24N	26N-25N	26N-25N	26N-25N	23S-24S	23S-24S	23S-24S	24N-25N	24N-25N	24N-25N	26S-25S	26S-25S	26S-25S	24S-25S	24S-25S	24S-25S
Station (m)	0.0	1.6	3.1	0.0	2.4	4.8	0.0	1.6	3.1	0.0	1.8	3.5	0.0	2.4	4.8	0.0	1.8	3.5
Node Label at Station	23N	---	24N	26N	---	25N	23S	---	24S	24N	---	25N	26S	---	25S	24S	---	25S
Section #	Section 23	Section 23	Section 23	Section 25	Section 25	Section 25	Section 23	Section 23	Section 23	Section 24	Section 24	Section 24	Section 25	Section 25	Section 25	Section 24	Section 24	Section 24
Element Group	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	6603	6603	6603	3757	3757	3757	6603	6603	6603	6082	6082	6082	3757	3757	3757	6082	6082	6082
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	7.14E+05	7.14E+05	7.14E+05	1.68E+05	1.68E+05	1.68E+05	7.14E+05	7.14E+05	7.14E+05	5.21E+05	5.21E+05	5.21E+05	1.68E+05	1.68E+05	1.68E+05	5.21E+05	5.21E+05	5.21E+05
U_{1x}	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	1483764	1483764	1483764	337684	337684	337684	1483764	1483764	1483764	1062886	1062886	1062886	337684	337684	337684	1062886	1062886	1062886
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.360	0.359	0.357	0.000	0.000	0.000	0.000	0.000	0.000	0.357	0.356	0.354	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.093	0.294	0.499	0.000	0.000	0.000	0.000	0.000	0.000	0.092	0.292	0.497	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.069	0.029	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.063	0.026	0.008	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.522	0.682	0.864	0.000	0.000	0.000	0.000	0.000	0.000	0.512	0.674	0.859	0.000	0.000	0.000

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.104	0.104	0.104	0.162	0.162	0.162	0.104	0.104	0.104	0.117	0.117	0.117	0.162	0.162	0.162	0.117	0.117	0.117
$C_{r\ (K=1)}$ (kN)	6591	6591	6591	3736	3736	3736	6591	6591	6591	6067	6067	6067	3736	3736	3736	6067	6067	6067
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.362	0.361	0.359	0.000	0.000	0.000	0.000	0.000	0.000	0.359	0.358	0.356	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.093	0.294	0.499	0.000	0.000	0.000	0.000	0.000	0.000	0.092	0.292	0.497	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.069	0.029	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.063	0.026	0.008	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.524	0.684	0.866	0.000	0.000	0.000	0.000	0.000	0.000	0.514	0.676	0.861	0.000	0.000	0.000

3.3. Lateral Torsional Buckling:

λ_{max}	0.104	0.104	0.104	0.162	0.162	0.162	0.104	0.104	0.104	0.117	0.117	0.117	0.162	0.162	0.162	0.117	0.117	0.117
C_r (kN)	6591	6591	6591	3736	3736	3736	6591	6591	6591	6067	6067	6067	3736	3736	3736	6067	6067	6067
U_{1x}	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1729	1729	1729	980	980	980	1729	1729	1729	1617	1617	1617	980	980	980	1617	1617	1617
M_{ry} (kNm)	2878	2878	2878	1431	1431	1431	2878	2878	2878	2573	2573	2573	1431	1431	1431	2573	2573	2573
C_f/C_r	0.000	0.000	0.000	0.362	0.361	0.359	0.000	0.000	0.000	0.000	0.000	0.000	0.359	0.358	0.356	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.093	0.294	0.499	0.000	0.000	0.000	0.000	0.000	0.000	0.092	0.292	0.497	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.069	0.029	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.063	0.026	0.008	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.524	0.684	0.866	0.000	0.000	0.000	0.000	0.000	0.000	0.514	0.676	0.861	0.000	0.000	0.000
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.407	0.359	0.355	0.524	0.684	0.866	0.418	0.370	0.362	0.390	0.297	0.535	0.514	0.676	0.861	0.396	0.305	0.541

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	528	528	528	529	529	529	530	530	530	531	531	531	30	30	30	205	205	205
Member Label	23N-46N	23N-46N	23N-46N	46N-22N	46N-22N	46N-22N	23S-46S	23S-46S	23S-46S	46S-22S	46S-22S	46S-22S	21N-25N	21N-25N	21N-25N	21S-25S	21S-25S	21S-25S
Station (m)	0.0	3.8	7.6	0.0	0.3	0.6	0.0	3.8	7.6	0.0	0.3	0.6	0.0	3.9	7.9	0.0	3.9	7.9
Node Label at Station	23N	---	46N	46N	---	22N	23S	---	46S	46S	---	22S	21N	---	25N	21S	---	25S
Section #	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 18	Section 18	Section 18	Section 18	Section 18	Section 18
Element Group	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal

Member Factored Load Effects:

C_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	2528	2535	2541	2518	2525	2531
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	25	25	24	25	25	23
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	40	30	3	38	29	3
T_f (kN)	1561	1580	1599	1662	1664	1666	1631	1650	1668	1742	1744	1745	0	0	0	0	0	0
$M_{fx\ (tension)}$ (kNm)	274	140	45	45	42	39	284	145	45	45	41	38	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	38	19	81	81	81	82	33	29	100	100	85	71	0	0	0	0	0	0
V_{fx} (kN)	9	16	23	40	39	39	9	16	23	48	47	47	8	5	11	8	5	11
V_{fy} (kN)	40	30	22	19	18	18	41	32	23	21	20	20	8	6	19	8	6	19

Gross Section Properties:

Ag (mm^2)	41129	41129	41129	41129	41129	41129	41129	41129	41129	41129	41129	41129	27097	27097	27097	27097	27097	27097
I_x (mm^4)	3.88E+09	3.88E+09	3.88E+09	3.88E+09	3.88E+09	3.88E+09	3.88E+09	3.88E+09	3.88E+09	3.88E+09	3.88E+09	3.88E+09	6.94E+08	6.94E+08	6.94E+08	6.94E+08	6.94E+08	6.94E+08
I_y (mm^4)	8.28E+09	8.28E+09	8.28E+09	8.28E+09	8.28E+09	8.28E+09	8.28E+09	8.28E+09	8.28E+09	8.28E+09	8.28E+09	8.28E+09	3.83E+09	3.83E+09	3.83E+09	3.83E+09	3.83E+09	3.83E+09
J (mm^4)	7.46E+06	7.46E+06	7.46E+06	7.46E+06	7.46E+06	7.46E+06	7.46E+06	7.46E+06	7.46E+06	7.46E+06	7.46E+06	7.46E+06	5.16E+06	5.16E+06	5.16E+06	5.16E+06	5.16E+06	5.16E+06
r_x (mm)	307	307	307	307	307	307	307	307	307	307	307	307	160	160	160	160	160	160
r_y (mm)	449	449	449	449	449	449	449	449	449	449	449	449	376	376	376	376	376	376
S_x (mm^3)	1.00E+07	1.00E+07	1.00E+07	1.00E+07	1.00E+07	1.00E+07	1.00E+07	1.00E+07	1.00E+07	1.00E+07	1.00E+07	1.00E+07	3.04E+06	3.04E+06	3.04E+06	3.04E+06	3.04E+06	3.04E+06
S_y (mm^3)	1.52E+07	1.52E+07	1.52E+07	1.52E+07	1.52E+07	1.52E+07	1.52E+07	1.52E+07	1.52E+07	1.52E+07	1.52E+07	1.52E+07	9.60E+06	9.60E+06	9.60E+06	9.60E+06	9.60E+06	9.60E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	7594	7594	7594	636	636	636	7594	7594	7594	636	636	636	7895	7895	7895	7895	7895	7895

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	528	528	528	529	529	529	530	530	530	531	531	531	30	30	30	205	205	205
Member Label	23N-46N	23N-46N	23N-46N	46N-22N	46N-22N	46N-22N	23S-46S	23S-46S	23S-46S	46S-22S	46S-22S	46S-22S	21N-25N	21N-25N	21N-25N	21S-25S	21S-25S	21S-25S
Station (m)	0.0	3.8	7.6	0.0	0.3	0.6	0.0	3.8	7.6	0.0	0.3	0.6	0.0	3.9	7.9	0.0	3.9	7.9
Node Label at Station	23N	---	46N	46N	---	22N	23S	---	46S	46S	---	22S	21N	---	25N	21S	---	25S
Section #	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 18	Section 18	Section 18	Section 18	Section 18	Section 18
Element Group	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression																		
Webs in combined flexural and axial compression	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	24.0	24.0	24.0	24.0	24.0	24.0
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	528	528	528	529	529	529	530	530	530	531	531	531	30	30	30	205	205	205
Member Label	23N-46N	23N-46N	23N-46N	46N-22N	46N-22N	46N-22N	23S-46S	23S-46S	23S-46S	46S-22S	46S-22S	46S-22S	21N-25N	21N-25N	21N-25N	21S-25S	21S-25S	21S-25S
Station (m)	0.0	3.8	7.6	0.0	0.3	0.6	0.0	3.8	7.6	0.0	0.3	0.6	0.0	3.9	7.9	0.0	3.9	7.9
Node Label at Station	23N	---	46N	46N	---	22N	23S	---	46S	46S	---	22S	21N	---	25N	21S	---	25S
Section #	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 18	Section 18	Section 18	Section 18	Section 18	Section 18
Element Group	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	8230	8230	8230	8230	8230	8230	8230	8230	8230	8230	8230	8230	7895	7895	7895	7895	7895	7895
L_y (mm)	7594	7594	7594	636	636	636	7594	7594	7594	636	636	636	7895	7895	7895	7895	7895	7895
λ_{max}	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.509	0.509	0.509	0.509	0.509	0.509
C_r (kN)	7213.7	7213.7	7213.7	7213.7	7213.7	7213.7	7213.7	7213.7	7213.7	7213.7	7213.7	7213.7	4344.9	4344.9	4344.9	4344.9	4344.9	4344.9
$(kL/r)_{max}$	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	49.3	49.3	49.3	49.3	49.3	49.3
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1				1	1	1				1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	113029	113029	113029	113029	113029	113029	113029	113029	113029	113029	113029	113029	21981	21981	21981	21981	21981	21981

Shear Flexibility Factor:

1. Lacing:

a (mm)	1141	1141	1141	719	719	719	1141	1141	1141	719	719	719	759	759	759	759	759	759
b (mm)	988	988	988	622	622	622	988	988	988	622	622	622	657	657	657	657	657	657
ε_aa (mm)	1141	1141	1141	719	719	719	1141	1141	1141	719	719	719	759	759	759	759	759	759
ε_bb (mm)	988	988	988	622	622	622	988	988	988	622	622	622	657	657	657	657	657	657
ε_a	1.00	1.00	1.00	N/A	N/A	N/A	1.00	1.00	1.00	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	N/A	N/A	N/A	1.00	1.00	1.00	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	6834	6834	6834	572	572	572	6834	6834	6834	572	572	572	7106	7106	7106	7106	7106	7106
A_c (mm^2)	20565	20565	20565	20565	20565	20565	20565	20565	20565	20565	20565	20565	13549	13549	13549	13549	13549	13549
A_d (mm^2)	2206	2206	2206	1045	1045	1045	2206	2206	2206	1045	1045	1045	1008	1008	1008	1008	1008	1008
A_b (mm^2)	2206	2206	2206	1045	1045	1045	2206	2206	2206	1045	1045	1045	1008	1008	1008	1008	1008	1008
μ	0.3850	0.3850	0.3850	NA	NA	NA	0.3850	0.3850	0.3850	NA	NA	NA	0.2273	0.2273	0.2273	0.2273	0.2273	0.2273
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.65	0.65	0.65	0.65	0.65	0.65
k'(sqrt(P_e/P_{cr}))	1.414	1.414	1.414	N/A	N/A	N/A	1.414	1.414	1.414	N/A	N/A	N/A	1.241	1.241	1.241	1.241	1.241	1.241
λ_v	0.247	0.247	0.247	N/A	N/A	N/A	0.247	0.247	0.247	N/A	N/A	N/A	0.269	0.269	0.269	0.269	0.269	0.269
Cr' (kN)	7257.8	7257.8	7257.8	999999.0	999999.0	999999.0	7257.8	7257.8	7257.8	999999.0	999999.0	999999.0	4760.6	4760.6	4760.6	4760.6	4760.6	4760.6
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	528	528	528	529	529	529	530	530	530	531	531	531	30	30	30	205	205	205
Member Label	23N-46N	23N-46N	23N-46N	46N-22N	46N-22N	46N-22N	23S-46S	23S-46S	23S-46S	46S-22S	46S-22S	46S-22S	21N-25N	21N-25N	21N-25N	21S-25S	21S-25S	21S-25S
Station (m)	0.0	3.8	7.6	0.0	0.3	0.6	0.0	3.8	7.6	0.0	0.3	0.6	0.0	3.9	7.9	0.0	3.9	7.9
Node Label at Station	23N	---	46N	46N	---	22N	23S	---	46S	46S	---	22S	21N	---	25N	21S	---	25S
Section #	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 18	Section 18	Section 18	Section 18	Section 18	Section 18
Element Group	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	20565	20565	20565	20565	20565	20565	20565	20565	20565	20565	20565	20565	13549	13549	13549	13549	13549	13549
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	7213.7	7213.7	7213.7	7213.7	7213.7	7213.7	7213.7	7213.7	7213.7	7213.7	7213.7	7213.7	4344.9	4344.9	4344.9	4344.9	4344.9	4344.9

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	39073	39073	39073	39073	39073	39073	39073	39073	39073	39073	39073	39073	25742	25742	25742	25742	25742	25742
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	7795	7795	7795	7795	7795	7795	7795	7795	7795	7795	7795	7795	5136	5136	5136	5136	5136	5136
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	28327	28327	28327	28327	28327	28327	28327	28327	28327	28327	28327	28327	21001	21001	21001	21001	21001	21001
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	28327	28327	28327	28327	28327	28327	28327	28327	28327	28327	28327	28327	21001	21001	21001	21001	21001	21001
$A_{n(corrosion)}$ (mm^2)	26911	26911	26911	26911	26911	26911	26911	26911	26911	26911	26911	26911	19951	19951	19951	19951	19951	19951
$T_{r(b)}$ (kN)	9042	9042	9042	9042	9042	9042	9042	9042	9042	9042	9042	9042	6704	6704	6704	6704	6704	6704
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26911	26911	26911	26911	26911	26911	26911	26911	26911	26911	26911	26911	19951	19951	19951	19951	19951	19951
$T_{r(c)}$ (kN)	9042	9042	9042	9042	9042	9042	9042	9042	9042	9042	9042	9042	6704	6704	6704	6704	6704	6704
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	528	528	528	529	529	529	530	530	530	531	531	531	30	30	30	205	205	205
Member Label	23N-46N	23N-46N	23N-46N	46N-22N	46N-22N	46N-22N	23S-46S	23S-46S	23S-46S	46S-22S	46S-22S	46S-22S	21N-25N	21N-25N	21N-25N	21S-25S	21S-25S	21S-25S
Station (m)	0.0	3.8	7.6	0.0	0.3	0.6	0.0	3.8	7.6	0.0	0.3	0.6	0.0	3.9	7.9	0.0	3.9	7.9
Node Label at Station	23N	---	46N	46N	---	22N	23S	---	46S	46S	---	22S	21N	---	25N	21S	---	25S
Section #	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 18	Section 18	Section 18	Section 18	Section 18	Section 18
Element Group	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	9042	9042	9042	9042	9042	9042	9042	9042	9042	9042	9042	9042	6704	6704	6704	6704	6704	6704
$(kL/r)_{max}$	27	27	27	27	27	27	27	27	27	27	27	27	49	49	49	49	49	49
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	7795	7795	7795	7795	7795	7795	7795	7795	7795	7795	7795	7795	5136	5136	5136	5136	5136	5136
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1897	1897	1897	1897	1897	1897	1897	1897	1897	1897	1897	1897	576	576	576	576	576	576
$M_{ry(Laterally\ Supported)}$ (kNm)	2882	2882	2882	2882	2882	2882	2882	2882	2882	2882	2882	2882	1820	1820	1820	1820	1820	1820
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	8230	8230	8230	8230	8230	8230	8230	8230	8230	8230	8230	8230	7895	7895	7895	7895	7895	7895
L_{uy} (mm)	7594	7594	7594	636	636	636	7594	7594	7594	636	636	636	7895	7895	7895	7895	7895	7895
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	8059	8059	8059	8059	8059	8059	8059	8059	8059	8059	8059	8059	2957	2957	2957	2957	2957	2957
M_{rx} (kNm)	1897.3	1897.3	1897.3	1897.3	1897.3	1897.3	1897.3	1897.3	1897.3	1897.3	1897.3	1897.3	575.5	575.5	575.5	575.5	575.5	575.5
M_{ry} (kNm)	2946.3	2946.3	2946.3	2946.3	2946.3	2946.3	2946.3	2946.3	2946.3	2946.3	2946.3	2946.3	1693.4	1693.4	1693.4	1693.4	1693.4	1693.4

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.582	0.583	0.585	0.580	0.581	0.583
(T_f/T_r)<=1	0.200	0.203	0.205	0.213	0.213	0.214	0.209	0.212	0.214	0.223	0.224	0.224	0.000	0.000	0.000	0.000	0.000	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.200	0.203	0.205	0.213	0.213	0.214	0.209	0.212	0.214	0.223	0.224	0.224	0.000	0.000	0.000	0.000	0.000	0.000
M_{fx}/M_{rx}<=1	0.144	0.074	0.024	0.024	0.022	0.021	0.150	0.076	0.024	0.024	0.022	0.020	0.000	0.000	0.000	0.000	0.000	0.000
M_{fy}/M_{ry}<=1	0.013	0.006	0.027	0.027	0.027	0.028	0.011	0.010	0.034	0.034	0.029	0.024	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r$<=1	0.358	0.283	0.256	0.264	0.263	0.262	0.370	0.298	0.272	0.281	0.274	0.268	0.000	0.000	0.000	0.000	0.000	0.000
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	528	528	528	529	529	529	530	530	530	531	531	531	30	30	30	205	205	205
Member Label	23N-46N	23N-46N	23N-46N	46N-22N	46N-22N	46N-22N	23S-46S	23S-46S	23S-46S	46S-22S	46S-22S	46S-22S	21N-25N	21N-25N	21N-25N	21S-25S	21S-25S	21S-25S
Station (m)	0.0	3.8	7.6	0.0	0.3	0.6	0.0	3.8	7.6	0.0	0.3	0.6	0.0	3.9	7.9	0.0	3.9	7.9
Node Label at Station	23N	---	46N	46N	---	22N	23S	---	46S	46S	---	22S	21N	---	25N	21S	---	25S
Section #	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 22	Section 18	Section 18	Section 18	Section 18	Section 18	Section 18
Element Group	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	08 CTWT Top Chord	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	7385	7385	7385	7385	7385	7385	7385	7385	7385	7385	7385	7385	4865	4865	4865	4865	4865	4865
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	2.20E+04	2.20E+04	2.20E+04	2.20E+04	2.20E+04	2.20E+04
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.13	1.13	1.13	1.13	1.13	1.13
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	283591	283591	283591	40416161	40416161	40416161	283591	283591	283591	40416161	40416161	40416161	121219	121219	121219	121219	121219	121219
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.02	1.02	1.02	1.02	1.02	1.02
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.520	0.521	0.522	0.518	0.519	0.520
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.049	0.049	0.047	0.049	0.049	0.045
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.022	0.017	0.002	0.021	0.016	0.002
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.591	0.587	0.571	0.588	0.584	0.567

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.509	0.509	0.509	0.509	0.509	0.509
$C_{r\ (K=1)}$ (kN)	7214	7214	7214	7214	7214	7214	7214	7214	7214	7214	7214	7214	4345	4345	4345	4345	4345	4345
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.13	1.13	1.13	1.13	1.13	1.13
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.02	1.02	1.02	1.02	1.02	1.02
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.582	0.583	0.585	0.580	0.581	0.583
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.049	0.049	0.047	0.049	0.049	0.045
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.022	0.017	0.002	0.021	0.016	0.002
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.653	0.649	0.634	0.650	0.646	0.629

3.3. Lateral Torsional Buckling:

λ_{max}	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.509	0.509	0.509	0.509	0.509	0.509
C_r (kN)	7214	7214	7214	7214	7214	7214	7214	7214	7214	7214	7214	7214	4345	4345	4345	4345	4345	4345
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.13	1.13	1.13	1.13	1.13	1.13
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.02	1.02	1.02	1.02	1.02	1.02
M_{rx} (kNm)	1897	1897	1897	1897	1897	1897	1897	1897	1897	1897	1897	1897	576	576	576	576	576	576
M_{ry} (kNm)	2946	2946	2946	2946	2946	2946	2946	2946	2946	2946	2946	2946	1693	1693	1693	1693	1693	1693
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.582	0.583	0.585	0.580	0.581	0.583
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.049	0.049	0.047	0.049	0.049	0.045
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.024	0.018	0.002	0.023	0.017	0.002
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.655	0.651	0.634	0.652	0.648	0.629
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.358	0.283	0.256	0.264	0.263	0.262	0.370	0.298	0.272	0.281	0.274	0.268	0.655	0.651	0.634	0.652	0.648	0.629

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	255	255	255	273	273	273	274	274	274	275	275	275	424	424	424	425	425	425
Member Label	23N-21N	23N-21N	23N-21N	21N-43N	21N-43N	21N-43N	43N-44N	43N-44N	43N-44N	44N-24N	44N-24N	44N-24N	22N-42N	22N-42N	22N-42N	42N-41N	42N-41N	42N-41N
Station (m)	0.0	3.3	6.6	0.0	0.6	1.2	0.0	2.6	5.2	0.0	0.3	0.5	0.0	0.6	1.3	0.0	4.2	8.3
Node Label at Station	23N	---	21N	21N	---	43N	43N	---	44N	44N	---	24N	22N	---	42N	42N	---	41N
Section #	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal

Member Factored Load Effects:

C_f (kN)	254	256	259	672	672	672	629	629	629	633	633	633	2671	2673	2676	2628	2644	2661
$M_{fx\ (comp)}$ (kNm)	22	13	32	32	30	29	29	3	35	35	41	46	38	23	8	8	80	146
$M_{fy\ (comp)}$ (kNm)	4	37	61	29	39	51	51	28	19	19	5	10	130	101	91	91	92	70
T_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	14	9	5	49	49	48	10	13	17	54	54	53	46	47	48	6	7	13
V_{fy} (kN)	13	8	4	2	3	4	8	12	17	20	20	20	24	23	23	21	18	15

Gross Section Properties:

Ag (mm^2)	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	12774	30968	30968	30968	30968	30968	30968
I_x (mm^4)	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	1.40E+09	1.40E+09	1.40E+09	1.40E+09	1.40E+09	1.40E+09
I_y (mm^4)	1.82E+09	1.82E+09	1.82E+09	1.82E+09	1.82E+09	1.82E+09	1.82E+09	1.82E+09	1.82E+09	1.82E+09	1.82E+09	1.82E+09	4.44E+09	4.44E+09	4.44E+09	4.44E+09	4.44E+09	4.44E+09
J (mm^4)	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	4.90E+06	4.90E+06	4.90E+06	4.90E+06	4.90E+06	4.90E+06
r_x (mm)	143	143	143	143	143	143	143	143	143	143	143	143	213	213	213	213	213	213
r_y (mm)	377	377	377	377	377	377	377	377	377	377	377	377	378	378	378	378	378	378
S_x (mm^3)	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	4.59E+06	4.59E+06	4.59E+06	4.59E+06	4.59E+06	4.59E+06
S_y (mm^3)	4.56E+06	4.56E+06	4.56E+06	4.56E+06	4.56E+06	4.56E+06	4.56E+06	4.56E+06	4.56E+06	4.56E+06	4.56E+06	4.56E+06	1.11E+07	1.11E+07	1.11E+07	1.11E+07	1.11E+07	1.11E+07
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	6553	6553	6553	1191	1191	1191	5202	5202	5202	542	542	542	1299	1299	1299	8300	8300	8300

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	255	255	255	273	273	273	274	274	274	275	275	275	424	424	424	425	425	425
Member Label	23N-21N	23N-21N	23N-21N	21N-43N	21N-43N	21N-43N	43N-44N	43N-44N	43N-44N	44N-24N	44N-24N	44N-24N	22N-42N	22N-42N	22N-42N	42N-41N	42N-41N	42N-41N
Station (m)	0.0	3.3	6.6	0.0	0.6	1.2	0.0	2.6	5.2	0.0	0.3	0.5	0.0	0.6	1.3	0.0	4.2	8.3
Node Label at Station	23N	---	21N	21N	---	43N	43N	---	44N	44N	---	24N	22N	---	42N	42N	---	41N
Section #	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge													8.0	8.0	8.0	8.0	8.0	8.0
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2						
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	34.8	34.8	34.8	34.8	34.8	34.8
Webs in flexural compression	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	34.8	34.8	34.8	34.8	34.8	34.8
Webs in combined flexural and axial compression	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	34.8	34.8	34.8	34.8	34.8	34.8
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	255	255	255	273	273	273	274	274	274	275	275	275	424	424	424	425	425	425
Member Label	23N-21N	23N-21N	23N-21N	21N-43N	21N-43N	21N-43N	43N-44N	43N-44N	43N-44N	44N-24N	44N-24N	44N-24N	22N-42N	22N-42N	22N-42N	42N-41N	42N-41N	42N-41N
Station (m)	0.0	3.3	6.6	0.0	0.6	1.2	0.0	2.6	5.2	0.0	0.3	0.5	0.0	0.6	1.3	0.0	4.2	8.3
Node Label at Station	23N	---	21N	21N	---	43N	43N	---	44N	44N	---	24N	22N	---	42N	42N	---	41N
Section #	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	6553	6553	6553	6934	6934	6934	6934	6934	6934	6934	6934	6934	10520	10520	10520	10520	10520	10520
L_y (mm)	6553	6553	6553	1191	1191	1191	5202	5202	5202	542	542	542	1299	1299	1299	8300	8300	8300
λ_{max}	0.473	0.473	0.473	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.509	0.509	0.509	0.509	0.509	0.509
C_r (kN)	2087.8	2087.8	2087.8	2058.2	2058.2	2058.2	2058.2	2058.2	2058.2	2058.2	2058.2	2058.2	4964.4	4964.4	4964.4	4964.4	4964.4	4964.4
$(kL/r)_{max}$	45.8	45.8	45.8	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	49.4	49.4	49.4	49.4	49.4	49.4
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	11992	11992	11992	10711	10711	10711	10711	10711	10711	10711	10711	10711	24954	24954	24954	24954	24954	24954

Shear Flexibility Factor:

1. Lacing:

a (mm)	821	821	821	821	821	821	821	821	821	821	821	821	763	763	763	763	763	763
b (mm)	711	711	711	711	711	711	711	711	711	711	711	711	660	660	660	660	660	660
ε_aa (mm)	821	821	821	821	821	821	821	821	821	821	821	821	763	763	763	763	763	763
ε_bb (mm)	711	711	711	711	711	711	711	711	711	711	711	711	660	660	660	660	660	660
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	5898	5898	5898	1072	1072	1072	4682	4682	4682	487	487	487	1170	1170	1170	7470	7470	7470
A_c (mm^2)	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	15484	15484	15484	15484	15484	15484
A_d (mm^2)	1008	1008	1008	1008	1008	1008	1008	1008	1008	1008	1008	1008	2206	2206	2206	2206	2206	2206
A_b (mm^2)	1008	1008	1008	1008	1008	1008	1008	1008	1008	1008	1008	1008	2206	2206	2206	2206	2206	2206
μ	0.1821	0.1821	0.1821	5.5125	5.5125	5.5125	0.2890	0.2890	0.2890	26.6643	26.6643	26.6643	4.4224	4.4224	4.4224	0.1084	0.1084	0.1084
P_{cr}/P_e (Fig.3.51)	0.68	0.68	0.68	0.50	0.50	0.50	0.61	0.61	0.61	0.50	0.50	0.50	0.50	0.50	0.50	0.75	0.75	0.75
k'(sqrt(P_e/P_{cr}))	1.215	1.215	1.215	1.414	1.414	1.414	1.280	1.280	1.280	1.414	1.414	1.414	1.414	1.414	1.414	1.153	1.153	1.153
λ_v	0.218	0.218	0.218	0.046	0.046	0.046	0.182	0.182	0.182	0.021	0.021	0.021	0.050	0.050	0.050	0.261	0.261	0.261
Cr' (kN)	2265.2	2265.2	2265.2	2293.1	2293.1	2293.1	2275.9	2275.9	2275.9	2293.5	2293.5	2293.5	5558.9	5558.9	5558.9	5449.3	5449.3	5449.3
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	255	255	255	273	273	273	274	274	274	275	275	275	424	424	424	425	425	425
Member Label	23N-21N	23N-21N	23N-21N	21N-43N	21N-43N	21N-43N	43N-44N	43N-44N	43N-44N	44N-24N	44N-24N	44N-24N	22N-42N	22N-42N	22N-42N	42N-41N	42N-41N	42N-41N
Station (m)	0.0	3.3	6.6	0.0	0.6	1.2	0.0	2.6	5.2	0.0	0.3	0.5	0.0	0.6	1.3	0.0	4.2	8.3
Node Label at Station	23N	---	21N	21N	---	43N	43N	---	44N	44N	---	24N	22N	---	42N	42N	---	41N
Section #	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	6387	15484	15484	15484	15484	15484	15484
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	2087.8	2087.8	2087.8	2058.2	2058.2	2058.2	2058.2	2058.2	2058.2	2058.2	2058.2	2058.2	4964.4	4964.4	4964.4	4964.4	4964.4	4964.4

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	12135	12135	12135	12135	12135	12135	12135	12135	12135	12135	12135	12135	29420	29420	29420	29420	29420	29420
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	2421	2421	2421	2421	2421	2421	2421	2421	2421	2421	2421	2421	5869	5869	5869	5869	5869	5869
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	9238	9238	9238	9238	9238	9238	9238	9238	9238	9238	9238	9238	23482	23482	23482	23482	23482	23482
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	9238	9238	9238	9238	9238	9238	9238	9238	9238	9238	9238	9238	23482	23482	23482	23482	23482	23482
$A_{n(corrosion)}$ (mm^2)	8776	8776	8776	8776	8776	8776	8776	8776	8776	8776	8776	8776	22308	22308	22308	22308	22308	22308
$T_{r(b)}$ (kN)	2949	2949	2949	2949	2949	2949	2949	2949	2949	2949	2949	2949	7495	7495	7495	7495	7495	7495
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	8776	8776	8776	8776	8776	8776	8776	8776	8776	8776	8776	8776	22308	22308	22308	22308	22308	22308
$T_{r(c)}$ (kN)	2949	2949	2949	2949	2949	2949	2949	2949	2949	2949	2949	2949	7495	7495	7495	7495	7495	7495
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	255	255	255	273	273	273	274	274	274	275	275	275	424	424	424	425	425	425
Member Label	23N-21N	23N-21N	23N-21N	21N-43N	21N-43N	21N-43N	43N-44N	43N-44N	43N-44N	44N-24N	44N-24N	44N-24N	22N-42N	22N-42N	22N-42N	42N-41N	42N-41N	42N-41N
Station (m)	0.0	3.3	6.6	0.0	0.6	1.2	0.0	2.6	5.2	0.0	0.3	0.5	0.0	0.6	1.3	0.0	4.2	8.3
Node Label at Station	23N	---	21N	21N	---	43N	43N	---	44N	44N	---	24N	22N	---	42N	42N	---	41N
Section #	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	2949	2949	2949	2949	2949	2949	2949	2949	2949	2949	2949	2949	7495	7495	7495	7495	7495	7495
$(kL/r)_{max}$	46	46	46	48	48	48	48	48	48	48	48	48	49	49	49	49	49	49
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	2421	2421	2421	2421	2421	2421	2421	2421	2421	2421	2421	2421	5869	5869	5869	5869	5869	5869
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	260	260	260	260	260	260	260	260	260	260	260	260	870	870	870	870	870	870
$M_{ry(Laterally\ Supported)}$ (kNm)	865	865	865	865	865	865	865	865	865	865	865	865	2110	2110	2110	2110	2110	2110
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	6553	6553	6553	6934	6934	6934	6934	6934	6934	6934	6934	6934	10520	10520	10520	10520	10520	10520
L_{uy} (mm)	6553	6553	6553	1191	1191	1191	5202	5202	5202	542	542	542	1299	1299	1299	8300	8300	8300
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	815	815	815	770	770	770	770	770	770	770	770	770	3070	3070	3070	3070	3070	3070
M_{rx} (kNm)	259.6	259.6	259.6	259.6	259.6	259.6	259.6	259.6	259.6	259.6	259.6	259.6	869.9	869.9	869.9	869.9	869.9	869.9
M_{ry} (kNm)	667.0	667.0	667.0	648.0	648.0	648.0	648.0	648.0	648.0	648.0	648.0	648.0	1908.9	1908.9	1908.9	1908.9	1908.9	1908.9

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y/w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
(V_f/V_r)<=1																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.122	0.123	0.124	0.327	0.327	0.327	0.306	0.306	0.306	0.308	0.308	0.308	0.538	0.538	0.539	0.529	0.533	0.536
(T_f/T_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
M_{fx}/M_{rx}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
M_{fy}/M_{ry}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	255	255	255	273	273	273	274	274	274	275	275	275	424	424	424	425	425	425
Member Label	23N-21N	23N-21N	23N-21N	21N-43N	21N-43N	21N-43N	43N-44N	43N-44N	43N-44N	44N-24N	44N-24N	44N-24N	22N-42N	22N-42N	22N-42N	42N-41N	42N-41N	42N-41N
Station (m)	0.0	3.3	6.6	0.0	0.6	1.2	0.0	2.6	5.2	0.0	0.3	0.5	0.0	0.6	1.3	0.0	4.2	8.3
Node Label at Station	23N	---	21N	21N	---	43N	43N	---	44N	44N	---	24N	22N	---	42N	42N	---	41N
Section #	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	2294	2294	2294	2294	2294	2294	2294	2294	2294	2294	2294	2294	5560	5560	5560	5560	5560	5560
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.20E+04	1.20E+04	1.20E+04	1.07E+04	1.07E+04	1.07E+04	1.07E+04	1.07E+04	1.07E+04	1.07E+04	1.07E+04	1.07E+04	2.50E+04	2.50E+04	2.50E+04	2.50E+04	2.50E+04	2.50E+04
U_{1x}	1.02	1.02	1.02	1.07	1.07	1.07	1.06	1.06	1.06	1.06	1.06	1.06	1.12	1.12	1.12	1.12	1.12	1.12
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	83551	83551	83551	2529457	2529457	2529457	132609	132609	132609	12235257	12235257	12235257	5184951	5184951	5184951	127089	127089	127089
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.02	1.02	1.02
C_f/C_r	**0.111**	**0.112**	**0.113**	**0.293**	**0.293**	**0.293**	**0.274**	**0.274**	**0.274**	**0.276**	**0.276**	**0.276**	**0.480**	**0.481**	**0.481**	**0.473**	**0.476**	**0.479**
$U_{1x}M_{fx}/M_{rx}$	**0.087**	**0.051**	**0.126**	**0.132**	**0.123**	**0.119**	**0.119**	**0.012**	**0.143**	**0.143**	**0.168**	**0.188**	**0.049**	**0.030**	**0.010**	**0.010**	**0.103**	**0.188**
$U_{1y}M_{fy}/M_{ry}$	**0.005**	**0.043**	**0.071**	**0.034**	**0.045**	**0.059**	**0.059**	**0.033**	**0.022**	**0.022**	**0.006**	**0.012**	**0.062**	**0.048**	**0.043**	**0.044**	**0.045**	**0.034**
Interaction	**0.202**	**0.206**	**0.310**	**0.458**	**0.461**	**0.471**	**0.452**	**0.319**	**0.440**	**0.441**	**0.450**	**0.476**	**0.591**	**0.558**	**0.535**	**0.527**	**0.623**	**0.700**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.473	0.473	0.473	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.509	0.509	0.509	0.509	0.509	0.509
$C_{r\ (K=1)}$ (kN)	2088	2088	2088	2058	2058	2058	2058	2058	2058	2058	2058	2058	4964	4964	4964	4964	4964	4964
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.02	1.02	1.02	1.07	1.07	1.07	1.06	1.06	1.06	1.06	1.06	1.06	1.12	1.12	1.12	1.12	1.12	1.12
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.02	1.02	1.02
C_f/C_r	**0.122**	**0.123**	**0.124**	**0.327**	**0.327**	**0.327**	**0.306**	**0.306**	**0.306**	**0.308**	**0.308**	**0.308**	**0.538**	**0.538**	**0.539**	**0.529**	**0.533**	**0.536**
$U_{1x}M_{fx}/M_{rx}$	**0.087**	**0.051**	**0.126**	**0.132**	**0.123**	**0.119**	**0.119**	**0.012**	**0.143**	**0.143**	**0.168**	**0.188**	**0.049**	**0.030**	**0.010**	**0.010**	**0.103**	**0.188**
$U_{1y}M_{fy}/M_{ry}$	**0.005**	**0.043**	**0.071**	**0.034**	**0.045**	**0.059**	**0.059**	**0.033**	**0.022**	**0.022**	**0.006**	**0.012**	**0.062**	**0.048**	**0.043**	**0.044**	**0.045**	**0.034**
Interaction	**0.213**	**0.217**	**0.321**	**0.492**	**0.495**	**0.505**	**0.484**	**0.350**	**0.471**	**0.473**	**0.481**	**0.507**	**0.649**	**0.616**	**0.592**	**0.584**	**0.680**	**0.758**

3.3. Lateral Torsional Buckling:

λ_{max}	0.473	0.473	0.473	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.509	0.509	0.509	0.509	0.509	0.509
C_r (kN)	2088	2088	2088	2058	2058	2058	2058	2058	2058	2058	2058	2058	4964	4964	4964	4964	4964	4964
U_{1x}	1.02	1.02	1.02	1.07	1.07	1.07	1.06	1.06	1.06	1.06	1.06	1.06	1.12	1.12	1.12	1.12	1.12	1.12
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.02	1.02	1.02
M_{rx} (kNm)	260	260	260	260	260	260	260	260	260	260	260	260	870	870	870	870	870	870
M_{ry} (kNm)	667	667	667	648	648	648	648	648	648	648	648	648	1909	1909	1909	1909	1909	1909
C_f/C_r	**0.122**	**0.123**	**0.124**	**0.327**	**0.327**	**0.327**	**0.306**	**0.306**	**0.306**	**0.308**	**0.308**	**0.308**	**0.538**	**0.538**	**0.539**	**0.529**	**0.533**	**0.536**
$U_{1x}M_{fx}/M_{rx}$	**0.087**	**0.051**	**0.126**	**0.132**	**0.123**	**0.119**	**0.119**	**0.012**	**0.143**	**0.143**	**0.168**	**0.188**	**0.049**	**0.030**	**0.010**	**0.010**	**0.103**	**0.188**
$U_{1y}M_{fy}/M_{ry}$	**0.006**	**0.056**	**0.092**	**0.045**	**0.060**	**0.079**	**0.079**	**0.043**	**0.029**	**0.029**	**0.008**	**0.015**	**0.068**	**0.053**	**0.048**	**0.049**	**0.049**	**0.037**
Interaction	**0.214**	**0.229**	**0.342**	**0.503**	**0.510**	**0.524**	**0.503**	**0.361**	**0.478**	**0.480**	**0.483**	**0.511**	**0.655**	**0.621**	**0.597**	**0.588**	**0.685**	**0.761**
Demand/Capacity ≤ 1	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
Highest Ratio	**0.214**	**0.229**	**0.342**	**0.503**	**0.510**	**0.524**	**0.503**	**0.361**	**0.478**	**0.480**	**0.483**	**0.511**	**0.655**	**0.621**	**0.597**	**0.588**	**0.685**	**0.761**

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	426	426	426	583	583	583	601	601	601	602	602	602	603	603	603	604	604	604
Member Label	41N-21N	41N-21N	41N-21N	23S-21S	23S-21S	23S-21S	22S-42S	22S-42S	22S-42S	42S-41S	42S-41S	42S-41S	41S-21S	41S-21S	41S-21S	21S-43S	21S-43S	21S-43S
Station (m)	0.0	0.5	0.9	0.0	3.3	6.6	0.0	0.6	1.3	0.0	4.2	8.3	0.0	0.5	0.9	0.0	0.6	1.2
Node Label at Station	41N	---	21N	23S	---	21S	22S	---	42S	42S	---	41S	41S	---	21S	21S	---	43S
Section #	Section 16	Section 16	Section 16	Section 17	Section 17	Section 17	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 17	Section 17	Section 17
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal

Member Factored Load Effects:

C_f (kN)	2762	2764	2766	265	268	270	2794	2797	2799	2745	2761	2778	2878	2880	2882	680	680	680
$M_{fx\ (comp)}$ (kNm)	146	153	159	22	13	32	37	22	8	8	81	149	149	155	160	31	30	29
$M_{fy\ (comp)}$ (kNm)	70	47	29	4	40	67	112	115	120	120	104	65	65	39	18	29	36	47
T_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	59	59	60	15	11	6	43	44	45	6	7	13	59	60	60	49	49	48
V_{fy} (kN)	14	14	13	13	8	4	23	23	22	21	18	15	14	13	13	2	2	3

Gross Section Properties:

Ag (mm^2)	30968	30968	30968	12774	12774	12774	30968	30968	30968	30968	30968	30968	30968	30968	30968	12774	12774	12774
I_x (mm^4)	1.40E+09	1.40E+09	1.40E+09	2.61E+08	2.61E+08	2.61E+08	1.40E+09	1.40E+09	1.40E+09	1.40E+09	1.40E+09	1.40E+09	1.40E+09	1.40E+09	1.40E+09	2.61E+08	2.61E+08	2.61E+08
I_y (mm^4)	4.44E+09	4.44E+09	4.44E+09	1.82E+09	1.82E+09	1.82E+09	4.44E+09	4.44E+09	4.44E+09	4.44E+09	4.44E+09	4.44E+09	4.44E+09	4.44E+09	4.44E+09	1.82E+09	1.82E+09	1.82E+09
J (mm^4)	4.90E+06	4.90E+06	4.90E+06	7.19E+05	7.19E+05	7.19E+05	4.90E+06	4.90E+06	4.90E+06	4.90E+06	4.90E+06	4.90E+06	4.90E+06	4.90E+06	4.90E+06	7.19E+05	7.19E+05	7.19E+05
r_x (mm)	213	213	213	143	143	143	213	213	213	213	213	213	213	213	213	143	143	143
r_y (mm)	378	378	378	377	377	377	378	378	378	378	378	378	378	378	378	377	377	377
S_x (mm^3)	4.59E+06	4.59E+06	4.59E+06	1.37E+06	1.37E+06	1.37E+06	4.59E+06	4.59E+06	4.59E+06	4.59E+06	4.59E+06	4.59E+06	4.59E+06	4.59E+06	4.59E+06	1.37E+06	1.37E+06	1.37E+06
S_y (mm^3)	1.11E+07	1.11E+07	1.11E+07	4.56E+06	4.56E+06	4.56E+06	1.11E+07	1.11E+07	1.11E+07	1.11E+07	1.11E+07	1.11E+07	1.11E+07	1.11E+07	1.11E+07	4.56E+06	4.56E+06	4.56E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	921	921	921	6553	6553	6553	1299	1299	1299	8300	8300	8300	921	921	921	1191	1191	1191

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	426	426	426	583	583	583	601	601	601	602	602	602	603	603	603	604	604	604
Member Label	41N-21N	41N-21N	41N-21N	23S-21S	23S-21S	23S-21S	22S-42S	22S-42S	22S-42S	42S-41S	42S-41S	42S-41S	41S-21S	41S-21S	41S-21S	21S-43S	21S-43S	21S-43S
Station (m)	0.0	0.5	0.9	0.0	3.3	6.6	0.0	0.6	1.3	0.0	4.2	8.3	0.0	0.5	0.9	0.0	0.6	1.2
Node Label at Station	41N	---	21N	23S	---	21S	22S	---	42S	42S	---	41S	41S	---	21S	21S	---	43S
Section #	Section 16	Section 16	Section 16	Section 17	Section 17	Section 17	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 17	Section 17	Section 17
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	8.0	8.0	8.0				8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0			
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels				5.2	5.2	5.2										5.2	5.2	5.2
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	34.8	34.8	34.8	37.5	37.5	37.5	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	37.5	37.5	37.5
Webs in flexural compression	34.8	34.8	34.8	37.5	37.5	37.5	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	37.5	37.5	37.5
Webs in combined flexural and axial compression	34.8	34.8	34.8	37.5	37.5	37.5	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	37.5	37.5	37.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	426	426	426	583	583	583	601	601	601	602	602	602	603	603	603	604	604	604
Member Label	41N-21N	41N-21N	41N-21N	23S-21S	23S-21S	23S-21S	22S-42S	22S-42S	22S-42S	42S-41S	42S-41S	42S-41S	41S-21S	41S-21S	41S-21S	21S-43S	21S-43S	21S-43S
Station (m)	0.0	0.5	0.9	0.0	3.3	6.6	0.0	0.6	1.3	0.0	4.2	8.3	0.0	0.5	0.9	0.0	0.6	1.2
Node Label at Station	41N	---	21N	23S	---	21S	22S	---	42S	42S	---	41S	41S	---	21S	21S	---	43S
Section #	Section 16	Section 16	Section 16	Section 17	Section 17	Section 17	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 17	Section 17	Section 17
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	10520	10520	10520	6553	6553	6553	10520	10520	10520	10520	10520	10520	10520	10520	10520	6934	6934	6934
L_y (mm)	921	921	921	6553	6553	6553	1299	1299	1299	8300	8300	8300	921	921	921	1191	1191	1191
λ_{max}	0.509	0.509	0.509	0.473	0.473	0.473	0.509	0.509	0.509	0.509	0.509	0.509	0.509	0.509	0.509	0.500	0.500	0.500
C_r (kN)	4964.4	4964.4	4964.4	2087.8	2087.8	2087.8	4964.4	4964.4	4964.4	4964.4	4964.4	4964.4	4964.4	4964.4	4964.4	2058.2	2058.2	2058.2
$(kL/r)_{max}$	49.4	49.4	49.4	45.8	45.8	45.8	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	48.5	48.5	48.5
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	24954	24954	24954	11992	11992	11992	24954	24954	24954	24954	24954	24954	24954	24954	24954	10711	10711	10711

Shear Flexibility Factor:

1. Lacing:

a (mm)	763	763	763	821	821	821	763	763	763	763	763	763	763	763	763	821	821	821
b (mm)	660	660	660	711	711	711	660	660	660	660	660	660	660	660	660	711	711	711
ε_aa (mm)	763	763	763	821	821	821	763	763	763	763	763	763	763	763	763	821	821	821
ε_bb (mm)	660	660	660	711	711	711	660	660	660	660	660	660	660	660	660	711	711	711
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	828	828	828	5898	5898	5898	1170	1170	1170	7470	7470	7470	828	828	828	1072	1072	1072
A_c (mm^2)	15484	15484	15484	6387	6387	6387	15484	15484	15484	15484	15484	15484	15484	15484	15484	6387	6387	6387
A_d (mm^2)	2206	2206	2206	1008	1008	1008	2206	2206	2206	2206	2206	2206	2206	2206	2206	1008	1008	1008
A_b (mm^2)	2206	2206	2206	1008	1008	1008	2206	2206	2206	2206	2206	2206	2206	2206	2206	1008	1008	1008
μ	8.8133	8.8133	8.8133	0.1821	0.1821	0.1821	4.4224	4.4224	4.4224	0.1084	0.1084	0.1084	8.8133	8.8133	8.8133	5.5125	5.5125	5.5125
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.68	0.68	0.68	0.50	0.50	0.50	0.75	0.75	0.75	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	1.414	1.414	1.414	1.215	1.215	1.215	1.414	1.414	1.414	1.153	1.153	1.153	1.414	1.414	1.414	1.414	1.414	1.414
λ_v	0.036	0.036	0.036	0.218	0.218	0.218	0.050	0.050	0.050	0.261	0.261	0.261	0.036	0.036	0.036	0.046	0.046	0.046
Cr' (kN)	5559.8	5559.8	5559.8	2265.2	2265.2	2265.2	5558.9	5558.9	5558.9	5449.3	5449.3	5449.3	5559.8	5559.8	5559.8	2293.1	2293.1	2293.1
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	426	426	426	583	583	583	601	601	601	602	602	602	603	603	603	604	604	604
Member Label	41N-21N	41N-21N	41N-21N	23S-21S	23S-21S	23S-21S	22S-42S	22S-42S	22S-42S	42S-41S	42S-41S	42S-41S	41S-21S	41S-21S	41S-21S	21S-43S	21S-43S	21S-43S
Station (m)	0.0	0.5	0.9	0.0	3.3	6.6	0.0	0.6	1.3	0.0	4.2	8.3	0.0	0.5	0.9	0.0	0.6	1.2
Node Label at Station	41N	---	21N	23S	---	21S	22S	---	42S	42S	---	41S	41S	---	21S	21S	---	43S
Section #	Section 16	Section 16	Section 16	Section 17	Section 17	Section 17	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 17	Section 17	Section 17
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	15484	15484	15484	6387	6387	6387	15484	15484	15484	15484	15484	15484	15484	15484	15484	6387	6387	6387
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	4964.4	4964.4	4964.4	2087.8	2087.8	2087.8	4964.4	4964.4	4964.4	4964.4	4964.4	4964.4	4964.4	4964.4	4964.4	2058.2	2058.2	2058.2

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	29420	29420	29420	12135	12135	12135	29420	29420	29420	29420	29420	29420	29420	29420	29420	12135	12135	12135
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5869	5869	5869	2421	2421	2421	5869	5869	5869	5869	5869	5869	5869	5869	5869	2421	2421	2421
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	23482	23482	23482	9238	9238	9238	23482	23482	23482	23482	23482	23482	23482	23482	23482	9238	9238	9238
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	23482	23482	23482	9238	9238	9238	23482	23482	23482	23482	23482	23482	23482	23482	23482	9238	9238	9238
$A_{n(corrosion)}$ (mm^2)	22308	22308	22308	8776	8776	8776	22308	22308	22308	22308	22308	22308	22308	22308	22308	8776	8776	8776
$T_{r(b)}$ (kN)	7495	7495	7495	2949	2949	2949	7495	7495	7495	7495	7495	7495	7495	7495	7495	2949	2949	2949
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	22308	22308	22308	8776	8776	8776	22308	22308	22308	22308	22308	22308	22308	22308	22308	8776	8776	8776
$T_{r(c)}$ (kN)	7495	7495	7495	2949	2949	2949	7495	7495	7495	7495	7495	7495	7495	7495	7495	2949	2949	2949
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	426	426	426	583	583	583	601	601	601	602	602	602	603	603	603	604	604	604
Member Label	41N-21N	41N-21N	41N-21N	23S-21S	23S-21S	23S-21S	22S-42S	22S-42S	22S-42S	42S-41S	42S-41S	42S-41S	41S-21S	41S-21S	41S-21S	21S-43S	21S-43S	21S-43S
Station (m)	0.0	0.5	0.9	0.0	3.3	6.6	0.0	0.6	1.3	0.0	4.2	8.3	0.0	0.5	0.9	0.0	0.6	1.2
Node Label at Station	41N	---	21N	23S	---	21S	22S	---	42S	42S	---	41S	41S	---	21S	21S	---	43S
Section #	Section 16	Section 16	Section 16	Section 17	Section 17	Section 17	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 17	Section 17	Section 17
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	7495	7495	7495	2949	2949	2949	7495	7495	7495	7495	7495	7495	7495	7495	7495	2949	2949	2949
$(kL/r)_{max}$	49	49	49	46	46	46	49	49	49	49	49	49	49	49	49	48	48	48
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Minimum Factored Tensile Resistance:																		
T_r (min) (kN)	5869	5869	5869	2421	2421	2421	5869	5869	5869	5869	5869	5869	5869	5869	5869	2421	2421	2421
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Factored Moment Resistances:																		
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	870	870	870	260	260	260	870	870	870	870	870	870	870	870	870	260	260	260
$M_{ry(Laterally\ Supported)}$ (kNm)	2110	2110	2110	865	865	865	2110	2110	2110	2110	2110	2110	2110	2110	2110	865	865	865
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	10520	10520	10520	6553	6553	6553	10520	10520	10520	10520	10520	10520	10520	10520	10520	6934	6934	6934
L_{uy} (mm)	921	921	921	6553	6553	6553	1299	1299	1299	8300	8300	8300	921	921	921	1191	1191	1191
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	3070	3070	3070	815	815	815	3070	3070	3070	3070	3070	3070	3070	3070	3070	770	770	770
M_{rx} (kNm)	869.9	869.9	869.9	259.6	259.6	259.6	869.9	869.9	869.9	869.9	869.9	869.9	869.9	869.9	869.9	259.6	259.6	259.6
M_{ry} (kNm)	1908.9	1908.9	1908.9	667.0	667.0	667.0	1908.9	1908.9	1908.9	1908.9	1908.9	1908.9	1908.9	1908.9	1908.9	648.0	648.0	648.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y/w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
$(V_f/V_r)<=1$																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.556	0.557	0.557	0.127	0.128	0.129	0.563	0.563	0.564	0.553	0.556	0.560	0.580	0.580	0.581	0.330	0.330	0.330
$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fx}/M_{rx}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fy}/M_{ry}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	426	426	426	583	583	583	601	601	601	602	602	602	603	603	603	604	604	604
Member Label	41N-21N	41N-21N	41N-21N	23S-21S	23S-21S	23S-21S	22S-42S	22S-42S	22S-42S	42S-41S	42S-41S	42S-41S	41S-21S	41S-21S	41S-21S	21S-43S	21S-43S	21S-43S
Station (m)	0.0	0.5	0.9	0.0	3.3	6.6	0.0	0.6	1.3	0.0	4.2	8.3	0.0	0.5	0.9	0.0	0.6	1.2
Node Label at Station	41N	---	21N	23S	---	21S	22S	---	42S	42S	---	41S	41S	---	21S	21S	---	43S
Section #	Section 16	Section 16	Section 16	Section 17	Section 17	Section 17	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 16	Section 17	Section 17	Section 17
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5560	5560	5560	2294	2294	2294	5560	5560	5560	5560	5560	5560	5560	5560	5560	2294	2294	2294
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	2.50E+04	2.50E+04	2.50E+04	1.20E+04	1.20E+04	1.20E+04	2.50E+04	2.50E+04	2.50E+04	2.50E+04	2.50E+04	2.50E+04	2.50E+04	2.50E+04	2.50E+04	1.07E+04	1.07E+04	1.07E+04
U_{1x}	1.12	1.12	1.12	1.02	1.02	1.02	1.13	1.13	1.13	1.12	1.12	1.13	1.13	1.13	1.13	1.07	1.07	1.07
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	10332917	10332917	10332917	83551	83551	83551	5184951	5184951	5184951	127089	127089	127089	10332917	10332917	10332917	2529457	2529457	2529457
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.02	1.02	1.02	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.497**	**0.497**	**0.497**	**0.116**	**0.117**	**0.118**	**0.502**	**0.503**	**0.503**	**0.494**	**0.497**	**0.500**	**0.518**	**0.518**	**0.518**	**0.296**	**0.296**	**0.296**
$U_{1x}M_{fx}/M_{rx}$	**0.189**	**0.198**	**0.206**	**0.087**	**0.051**	**0.126**	**0.048**	**0.028**	**0.010**	**0.010**	**0.105**	**0.193**	**0.194**	**0.201**	**0.208**	**0.128**	**0.123**	**0.119**
$U_{1y}M_{fy}/M_{ry}$	**0.033**	**0.022**	**0.014**	**0.005**	**0.046**	**0.078**	**0.053**	**0.055**	**0.057**	**0.058**	**0.050**	**0.031**	**0.031**	**0.018**	**0.009**	**0.034**	**0.042**	**0.054**
Interaction	**0.719**	**0.717**	**0.717**	**0.207**	**0.214**	**0.322**	**0.604**	**0.586**	**0.571**	**0.562**	**0.652**	**0.724**	**0.742**	**0.738**	**0.735**	**0.458**	**0.462**	**0.470**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.509	0.509	0.509	0.473	0.473	0.473	0.509	0.509	0.509	0.509	0.509	0.509	0.509	0.509	0.509	0.500	0.500	0.500
$C_{r\ (K=1)}$ (kN)	4964	4964	4964	2088	2088	2088	4964	4964	4964	4964	4964	4964	4964	4964	4964	2058	2058	2058
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.12	1.12	1.12	1.02	1.02	1.02	1.13	1.13	1.13	1.12	1.12	1.13	1.13	1.13	1.13	1.07	1.07	1.07
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.02	1.02	1.02	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.556**	**0.557**	**0.557**	**0.127**	**0.128**	**0.129**	**0.563**	**0.563**	**0.564**	**0.553**	**0.556**	**0.560**	**0.580**	**0.580**	**0.581**	**0.330**	**0.330**	**0.330**
$U_{1x}M_{fx}/M_{rx}$	**0.189**	**0.198**	**0.206**	**0.087**	**0.051**	**0.126**	**0.048**	**0.028**	**0.010**	**0.010**	**0.105**	**0.193**	**0.194**	**0.201**	**0.208**	**0.128**	**0.123**	**0.119**
$U_{1y}M_{fy}/M_{ry}$	**0.033**	**0.022**	**0.014**	**0.005**	**0.046**	**0.078**	**0.053**	**0.055**	**0.057**	**0.058**	**0.050**	**0.031**	**0.031**	**0.018**	**0.009**	**0.034**	**0.042**	**0.054**
Interaction	**0.778**	**0.777**	**0.776**	**0.218**	**0.226**	**0.333**	**0.664**	**0.646**	**0.631**	**0.621**	**0.711**	**0.784**	**0.804**	**0.800**	**0.797**	**0.491**	**0.495**	**0.504**

3.3. Lateral Torsional Buckling:

λ_{max}	0.509	0.509	0.509	0.473	0.473	0.473	0.509	0.509	0.509	0.509	0.509	0.509	0.509	0.509	0.509	0.500	0.500	0.500
C_r (kN)	4964	4964	4964	2088	2088	2088	4964	4964	4964	4964	4964	4964	4964	4964	4964	2058	2058	2058
U_{1x}	1.12	1.12	1.12	1.02	1.02	1.02	1.13	1.13	1.13	1.12	1.12	1.13	1.13	1.13	1.13	1.07	1.07	1.07
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.02	1.02	1.02	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	870	870	870	260	260	260	870	870	870	870	870	870	870	870	870	260	260	260
M_{ry} (kNm)	1909	1909	1909	667	667	667	1909	1909	1909	1909	1909	1909	1909	1909	1909	648	648	648
C_f/C_r	**0.556**	**0.557**	**0.557**	**0.127**	**0.128**	**0.129**	**0.563**	**0.563**	**0.564**	**0.553**	**0.556**	**0.560**	**0.580**	**0.580**	**0.581**	**0.330**	**0.330**	**0.330**
$U_{1x}M_{fx}/M_{rx}$	**0.189**	**0.198**	**0.206**	**0.087**	**0.051**	**0.126**	**0.048**	**0.028**	**0.010**	**0.010**	**0.105**	**0.193**	**0.194**	**0.201**	**0.208**	**0.128**	**0.123**	**0.119**
$U_{1y}M_{fy}/M_{ry}$	**0.037**	**0.025**	**0.015**	**0.006**	**0.060**	**0.101**	**0.059**	**0.060**	**0.063**	**0.064**	**0.056**	**0.035**	**0.034**	**0.020**	**0.009**	**0.045**	**0.056**	**0.073**
Interaction	**0.782**	**0.779**	**0.778**	**0.220**	**0.240**	**0.356**	**0.669**	**0.652**	**0.637**	**0.628**	**0.717**	**0.787**	**0.807**	**0.802**	**0.798**	**0.503**	**0.509**	**0.522**
Demand/Capacity ≤ 1	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
Highest Ratio	**0.782**	**0.779**	**0.778**	**0.220**	**0.240**	**0.356**	**0.669**	**0.652**	**0.637**	**0.628**	**0.717**	**0.787**	**0.807**	**0.802**	**0.798**	**0.503**	**0.509**	**0.522**

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	605	605	605	606	606	606	31	31	31	207	207	207	276	276	276	277	277	277
Member Label	43S-44S	43S-44S	43S-44S	44S-24S	44S-24S	44S-24S	27N-25N	27N-25N	27N-25N	27S-25S	27S-25S	27S-25S	26N-27N	26N-27N	26N-27N	27N-50N	27N-50N	27N-50N
Station (m)	0.0	2.6	5.2	0.0	0.3	0.5	0.0	1.8	3.6	0.0	1.8	3.6	0.0	2.0	3.9	0.0	2.7	5.5
Node Label at Station	43S	---	44S	44S	---	24S	27N	---	25N	27S	---	25S	26N	---	27N	27N	---	50N
Section #	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 19	Section 19	Section 19	Section 19	Section 19	Section 19	Section 26	Section 26	Section 26	Section 21	Section 21	Section 21
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal

Member Factored Load Effects:

C_f (kN)	638	638	638	642	642	642	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (comp)}$ (kNm)	29	3	36	36	40	45	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	47	30	19	19	5	10	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	0	0	0	0	0	0	3129	3132	3135	3111	3114	3117	1820	1827	1834	4366	4379	4393
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	1	0	0	1	0	78	198	461	461	179	131
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	6	0	0	6	0	138	79	244	250	95	171
V_{fx} (kN)	9	13	16	54	53	53	6	0	6	6	0	6	88	86	83	73	77	81
V_{fy} (kN)	8	12	17	18	18	19	1	0	1	1	0	1	140	136	131	99	108	118

Gross Section Properties:

Ag (mm^2)	12774	12774	12774	12774	12774	12774	28589	28589	28589	28589	28589	28589	33185	33185	33185	44798	44798	44798
I_x (mm^4)	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.61E+08	2.57E+09	2.57E+09	2.57E+09	2.57E+09	2.57E+09	2.57E+09	1.56E+09	1.56E+09	1.56E+09	1.92E+09	1.92E+09	1.92E+09
I_y (mm^4)	1.82E+09	1.82E+09	1.82E+09	1.82E+09	1.82E+09	1.82E+09	7.29E+07	7.29E+07	7.29E+07	7.29E+07	7.29E+07	7.29E+07	6.47E+09	6.47E+09	6.47E+09	8.82E+09	8.82E+09	8.82E+09
J (mm^4)	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	7.19E+05	8.08E+06	8.08E+06	8.08E+06	8.08E+06	8.08E+06	8.08E+06	6.16E+06	6.16E+06	6.16E+06	8.85E+06	8.85E+06	8.85E+06
r_x (mm)	143	143	143	143	143	143	300	300	300	300	300	300	217	217	217	207	207	207
r_y (mm)	377	377	377	377	377	377	50	50	50	50	50	50	441	441	441	444	444	444
S_x (mm^3)	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	6.53E+06	6.53E+06	6.53E+06	6.53E+06	6.53E+06	6.53E+06	5.12E+06	5.12E+06	5.12E+06	6.30E+06	6.30E+06	6.30E+06
S_y (mm^3)	4.56E+06	4.56E+06	4.56E+06	4.56E+06	4.56E+06	4.56E+06	4.52E+05	4.52E+05	4.52E+05	4.52E+05	4.52E+05	4.52E+05	1.20E+07	1.20E+07	1.20E+07	1.61E+07	1.61E+07	1.61E+07
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	5202	5202	5202	542	542	542	3593	3593	3593	3593	3593	3593	3948	3948	3948	5451	5451	5451

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	605	605	605	606	606	606	31	31	31	207	207	207	276	276	276	277	277	277
Member Label	43S-44S	43S-44S	43S-44S	44S-24S	44S-24S	44S-24S	27N-25N	27N-25N	27N-25N	27S-25S	27S-25S	27S-25S	26N-27N	26N-27N	26N-27N	27N-50N	27N-50N	27N-50N
Station (m)	0.0	2.6	5.2	0.0	0.3	0.5	0.0	1.8	3.6	0.0	1.8	3.6	0.0	2.0	3.9	0.0	2.7	5.5
Node Label at Station	43S	---	44S	44S	---	24S	27N	---	25N	27S	---	25S	26N	---	27N	27N	---	50N
Section #	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 19	Section 19	Section 19	Section 19	Section 19	Section 19	Section 26	Section 26	Section 26	Section 21	Section 21	Section 21
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge							12.0	12.0	12.0	12.0	12.0	12.0	6.4	6.4	6.4	6.4	6.4	6.4
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels	5.2	5.2	5.2	5.2	5.2	5.2												
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	37.5	37.5	37.5	37.5	37.5	37.5	44.9	44.9	44.9	44.9	44.9	44.9	34.8	34.8	34.8	34.8	34.8	34.8
Webs in flexural compression	37.5	37.5	37.5	37.5	37.5	37.5	44.9	44.9	44.9	44.9	44.9	44.9	34.8	34.8	34.8	34.8	34.8	34.8
Webs in combined flexural and axial compression	37.5	37.5	37.5	37.5	37.5	37.5	44.9	44.9	44.9	44.9	44.9	44.9	34.8	34.8	34.8	34.8	34.8	34.8
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	605	605	605	606	606	606	31	31	31	207	207	207	276	276	276	277	277	277
Member Label	43S-44S	43S-44S	43S-44S	44S-24S	44S-24S	44S-24S	27N-25N	27N-25N	27N-25N	27S-25S	27S-25S	27S-25S	26N-27N	26N-27N	26N-27N	27N-50N	27N-50N	27N-50N
Station (m)	0.0	2.6	5.2	0.0	0.3	0.5	0.0	1.8	3.6	0.0	1.8	3.6	0.0	2.0	3.9	0.0	2.7	5.5
Node Label at Station	43S	---	44S	44S	---	24S	27N	---	25N	27S	---	25S	26N	---	27N	27N	---	50N
Section #	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 19	Section 19	Section 19	Section 19	Section 19	Section 19	Section 26	Section 26	Section 26	Section 21	Section 21	Section 21
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	6934	6934	6934	6934	6934	6934	3593	3593	3593	3593	3593	3593	3948	3948	3948	6425	6425	6425
L_y (mm)	5202	5202	5202	542	542	542	3593	3593	3593	3593	3593	3593	3948	3948	3948	5451	5451	5451
λ_{max}	0.500	0.500	0.500	0.500	0.500	0.500	0.741	0.741	0.741	0.741	0.741	0.741	0.188	0.188	0.188	0.320	0.320	0.320
C_r (kN)	2058.2	2058.2	2058.2	2058.2	2058.2	2058.2	3893.6	3893.6	3893.6	3893.6	3893.6	3893.6	5908.7	5908.7	5908.7	7771.1	7771.1	7771.1
$(kL/r)_{max}$	48.5	48.5	48.5	48.5	48.5	48.5	71.9	71.9	71.9	71.9	71.9	71.9	18.2	18.2	18.2	31.0	31.0	31.0
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1							1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	10711	10711	10711	10711	10711	10711	11143	11143	11143	11143	11143	11143	197674	197674	197674	91829	91829	91829

Shear Flexibility Factor:

1. Lacing:

a (mm)	821	821	821	821	821	821	425	425	425	425	425	425	1122	1122	1122	1122	1122	1122
b (mm)	711	711	711	711	711	711	368	368	368	368	368	368	972	972	972	972	972	972
ε_aa (mm)	821	821	821	821	821	821	425	425	425	425	425	425	1122	1122	1122	1122	1122	1122
ε_bb (mm)	711	711	711	711	711	711	368	368	368	368	368	368	972	972	972	972	972	972
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	N/A	N/A	N/A	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	N/A	N/A	N/A	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	4682	4682	4682	487	487	487	3234	3234	3234	3234	3234	3234	3553	3553	3553	4906	4906	4906
A_c (mm^2)	6387	6387	6387	6387	6387	6387	14295	14295	14295	14295	14295	14295	16593	16593	16593	22399	22399	22399
A_d (mm^2)	1008	1008	1008	1008	1008	1008	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	1008	1008	1008	1008	1008	1008	907	907	907	907	907	907	907	907	907	907	907	907
μ	0.2890	0.2890	0.2890	26.6643	26.6643	26.6643	NA	NA	NA	NA	NA	NA	2.7037	2.7037	2.7037	1.9149	1.9149	1.9149
P_{cr}/P_e (Fig.3.51)	0.61	0.61	0.61	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	1.280	1.280	1.280	1.414	1.414	1.414	N/A	N/A	N/A	N/A	N/A	N/A	1.414	1.414	1.414	1.414	1.414	1.414
λ_v	0.182	0.182	0.182	0.021	0.021	0.021	N/A	N/A	N/A	N/A	N/A	N/A	0.131	0.131	0.131	0.179	0.179	0.179
Cr' (kN)	2275.9	2275.9	2275.9	2293.5	2293.5	2293.5	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	5939.4	5939.4	5939.4	7984.2	7984.2	7984.2
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	605	605	605	606	606	606	31	31	31	207	207	207	276	276	276	277	277	277
Member Label	43S-44S	43S-44S	43S-44S	44S-24S	44S-24S	44S-24S	27N-25N	27N-25N	27N-25N	27S-25S	27S-25S	27S-25S	26N-27N	26N-27N	26N-27N	27N-50N	27N-50N	27N-50N
Station (m)	0.0	2.6	5.2	0.0	0.3	0.5	0.0	1.8	3.6	0.0	1.8	3.6	0.0	2.0	3.9	0.0	2.7	5.5
Node Label at Station	43S	---	44S	44S	---	24S	27N	---	25N	27S	---	25S	26N	---	27N	27N	---	50N
Section #	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 19	Section 19	Section 19	Section 19	Section 19	Section 19	Section 26	Section 26	Section 26	Section 21	Section 21	Section 21
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	6387	6387	6387	6387	6387	6387	14295	14295	14295	14295	14295	14295	16593	16593	16593	22399	22399	22399
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	2058.2	2058.2	2058.2	2058.2	2058.2	2058.2	3893.6	3893.6	3893.6	3893.6	3893.6	3893.6	5908.7	5908.7	5908.7	7771.1	7771.1	7771.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	12135	12135	12135	12135	12135	12135	27160	27160	27160	27160	27160	27160	31526	31526	31526	42558	42558	42558
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	2421	2421	2421	2421	2421	2421	5418	5418	5418	5418	5418	5418	6289	6289	6289	8490	8490	8490
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	9238	9238	9238	9238	9238	9238	19927	19927	19927	19927	19927	19927	25108	25108	25108	33978	33978	33978
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	9238	9238	9238	9238	9238	9238	19927	19927	19927	19927	19927	19927	25108	25108	25108	33978	33978	33978
$A_{n(corrosion)}$ (mm^2)	8776	8776	8776	8776	8776	8776	18930	18930	18930	18930	18930	18930	23852	23852	23852	32279	32279	32279
$T_{r(b)}$ (kN)	2949	2949	2949	2949	2949	2949	6361	6361	6361	6361	6361	6361	8014	8014	8014	10846	10846	10846
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	8776	8776	8776	8776	8776	8776	18930	18930	18930	18930	18930	18930	23852	23852	23852	32279	32279	32279
$T_{r(c)}$ (kN)	2949	2949	2949	2949	2949	2949	6361	6361	6361	6361	6361	6361	8014	8014	8014	10846	10846	10846
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	605	605	605	606	606	606	31	31	31	207	207	207	276	276	276	277	277	277
Member Label	43S-44S	43S-44S	43S-44S	44S-24S	44S-24S	44S-24S	27N-25N	27N-25N	27N-25N	27S-25S	27S-25S	27S-25S	26N-27N	26N-27N	26N-27N	27N-50N	27N-50N	27N-50N
Station (m)	0.0	2.6	5.2	0.0	0.3	0.5	0.0	1.8	3.6	0.0	1.8	3.6	0.0	2.0	3.9	0.0	2.7	5.5
Node Label at Station	43S	---	44S	44S	---	24S	27N	---	25N	27S	---	25S	26N	---	27N	27N	---	50N
Section #	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 19	Section 19	Section 19	Section 19	Section 19	Section 19	Section 26	Section 26	Section 26	Section 21	Section 21	Section 21
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	2949	2949	2949	2949	2949	2949	6361	6361	6361	6361	6361	6361	8014	8014	8014	10846	10846	10846
$(kL/r)_{max}$	48	48	48	48	48	48	72	72	72	72	72	72	18	18	18	31	31	31
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	2421	2421	2421	2421	2421	2421	5418	5418	5418	5418	5418	5418	6289	6289	6289	8490	8490	8490
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	260	260	260	260	260	260	1238	1238	1238	1238	1238	1238	971	971	971	1194	1194	1194
$M_{ry(Laterally\ Supported)}$ (kNm)	865	865	865	865	865	865	86	86	86	86	86	86	2284	2284	2284	3060	3060	3060
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	6934	6934	6934	6934	6934	6934	3593	3593	3593	3593	3593	3593	3948	3948	3948	6425	6425	6425
L_{uy} (mm)	5202	5202	5202	542	542	542	3593	3593	3593	3593	3593	3593	3948	3948	3948	5451	5451	5451
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	2633	2633	2633	2633	2633	2633	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	770	770	770	770	770	770	NA	NA	NA	NA	NA	NA	9683	9683	9683	7912	7912	7912
M_{rx} (kNm)	259.6	259.6	259.6	259.6	259.6	259.6	1215.6	1215.6	1215.6	1215.6	1215.6	1215.6	970.6	970.6	970.6	1194.2	1194.2	1194.2
M_{ry} (kNm)	648.0	648.0	648.0	648.0	648.0	648.0	85.7	85.7	85.7	85.7	85.7	85.7	2434.1	2434.1	2434.1	3096.9	3096.9	3096.9

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
$(V_f/V_r)<=1$																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.310	0.310	0.310	0.312	0.312	0.312	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.577	0.578	0.579	0.574	0.575	0.575	0.289	0.290	0.292	0.514	0.516	0.517

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.577	0.578	0.579	0.574	0.575	0.575	0.289	0.290	0.292	0.514	0.516	0.517
$M_{fx}/M_{rx}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.080	0.204	0.475	0.386	0.150	0.110
$M_{fy}/M_{ry}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.070	0.000	0.000	0.070	0.000	0.057	0.032	0.100	0.081	0.031	0.055
$T_f/T_r+M_f/M_r<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.577	0.649	0.579	0.574	0.646	0.575	0.426	0.527	0.867	0.981	0.696	0.682
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.000	0.000	0.000

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	605	605	605	606	606	606	31	31	31	207	207	207	276	276	276	277	277	277
Member Label	43S-44S	43S-44S	43S-44S	44S-24S	44S-24S	44S-24S	27N-25N	27N-25N	27N-25N	27S-25S	27S-25S	27S-25S	26N-27N	26N-27N	26N-27N	27N-50N	27N-50N	27N-50N
Station (m)	0.0	2.6	5.2	0.0	0.3	0.5	0.0	1.8	3.6	0.0	1.8	3.6	0.0	2.0	3.9	0.0	2.7	5.5
Node Label at Station	43S	---	44S	44S	---	24S	27N	---	25N	27S	---	25S	26N	---	27N	27N	---	50N
Section #	Section 17	Section 17	Section 17	Section 17	Section 17	Section 17	Section 19	Section 19	Section 19	Section 19	Section 19	Section 19	Section 26	Section 26	Section 26	Section 21	Section 21	Section 21
Element Group	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	09 CTWT Diagonal	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	10 CTWT Vertical	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	2294	2294	2294	2294	2294	2294	5133	5133	5133	5133	5133	5133	5958	5958	5958	8043	8043	8043
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.07E+04	1.07E+04	1.07E+04	1.07E+04	1.07E+04	1.07E+04	3.93E+05	3.93E+05	3.93E+05	3.93E+05	3.93E+05	3.93E+05	1.98E+05	1.98E+05	1.98E+05	9.18E+04	9.18E+04	9.18E+04
U_{1x}	1.06	1.06	1.06	1.06	1.06	1.06	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	132609	132609	132609	12235257	12235257	12235257	11143	11143	11143	11143	11143	11143	818907	818907	818907	586115	586115	586115
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.278	0.278	0.278	0.280	0.280	0.280	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.119	0.012	0.147	0.148	0.164	0.184	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.055	0.035	0.022	0.022	0.006	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.452	0.325	0.448	0.449	0.450	0.476	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.500	0.500	0.500	0.500	0.500	0.500	0.741	0.741	0.741	0.741	0.741	0.741	0.188	0.188	0.188	0.320	0.320	0.320
$C_{r\ (K=1)}$ (kN)	2058	2058	2058	2058	2058	2058	3894	3894	3894	3894	3894	3894	5909	5909	5909	7771	7771	7771
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.06	1.06	1.06	1.06	1.06	1.06	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.310	0.310	0.310	0.312	0.312	0.312	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.119	0.012	0.147	0.148	0.164	0.184	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.055	0.035	0.022	0.022	0.006	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.483	0.357	0.480	0.481	0.482	0.508	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.3. Lateral Torsional Buckling:

λ_{max}	0.500	0.500	0.500	0.500	0.500	0.500	0.741	0.741	0.741	0.741	0.741	0.741	0.188	0.188	0.188	0.320	0.320	0.320
C_r (kN)	2058	2058	2058	2058	2058	2058	3894	3894	3894	3894	3894	3894	5909	5909	5909	7771	7771	7771
U_{1x}	1.06	1.06	1.06	1.06	1.06	1.06	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	260	260	260	260	260	260	1216	1216	1216	1216	1216	1216	971	971	971	1194	1194	1194
M_{ry} (kNm)	648	648	648	648	648	648	86	86	86	86	86	86	2434	2434	2434	3097	3097	3097
C_f/C_r	0.310	0.310	0.310	0.312	0.312	0.312	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.119	0.012	0.147	0.148	0.164	0.184	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.073	0.047	0.029	0.029	0.008	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.502	0.369	0.487	0.489	0.484	0.512	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.502	0.369	0.487	0.489	0.484	0.512	0.577	0.649	0.579	0.574	0.646	0.575	0.426	0.527	0.867	0.981	0.696	0.682

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	278	278	278	607	607	607	608	608	608	609	609	609	256	256	256	257	257	257
Member Label	50N-21N	50N-21N	50N-21N	26S-27S	26S-27S	26S-27S	27S-50S	27S-50S	27S-50S	50S-21S	50S-21S	50S-21S	21N-38N	21N-38N	21N-38N	38N-31N	38N-31N	38N-31N
Station (m)	0.0	0.5	1.0	0.0	2.0	3.9	0.0	2.7	5.5	0.0	0.5	1.0	0.0	1.2	2.4	0.0	0.8	1.6
Node Label at Station	50N	---	21N	26S	---	27S	27S	---	50S	50S	---	21S	21N	---	38N	38N	---	31N
Section #	Section 21	Section 21	Section 21	Section 26	Section 26	Section 26	Section 21	Section 21	Section 21	Section 21	Section 21	Section 21	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20
Element Group	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical

Member Factored Load Effects:

C_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	3886	3892	3898	3980	3984	3988
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	345	104	185	185	80	292
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	5	11	11	15	18
T_f (kN)	4461	4463	4466	1812	1819	1826	4347	4360	4374	4436	4439	4441	0	0	0	0	0	0
$M_{fx\ (tension)}$ (kNm)	131	189	248	78	196	458	458	178	131	131	188	247	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	171	249	327	143	72	237	244	100	166	166	230	303	0	0	0	0	0	0
V_{fx} (kN)	159	160	161	88	86	83	70	74	78	149	150	151	5	5	5	5	5	5
V_{fy} (kN)	121	123	125	140	135	130	99	108	117	120	121	123	202	203	205	282	281	279

Gross Section Properties:

Ag (mm^2)	44798	44798	44798	33185	33185	33185	44798	44798	44798	44798	44798	44798	46572	46572	46572	46572	46572	46572
I_x (mm^4)	1.92E+09	1.92E+09	1.92E+09	1.56E+09	1.56E+09	1.56E+09	1.92E+09	1.92E+09	1.92E+09	1.92E+09	1.92E+09	1.92E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09
I_y (mm^4)	8.82E+09	8.82E+09	8.82E+09	6.47E+09	6.47E+09	6.47E+09	8.82E+09	8.82E+09	8.82E+09	8.82E+09	8.82E+09	8.82E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09
J (mm^4)	8.85E+06	8.85E+06	8.85E+06	6.16E+06	6.16E+06	6.16E+06	8.85E+06	8.85E+06	8.85E+06	8.85E+06	8.85E+06	8.85E+06	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07
r_x (mm)	207	207	207	217	217	217	207	207	207	207	207	207	194	194	194	194	194	194
r_y (mm)	444	444	444	441	441	441	444	444	444	444	444	444	155	155	155	155	155	155
S_x (mm^3)	6.30E+06	6.30E+06	6.30E+06	5.12E+06	5.12E+06	5.12E+06	6.30E+06	6.30E+06	6.30E+06	6.30E+06	6.30E+06	6.30E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06
S_y (mm^3)	1.61E+07	1.61E+07	1.61E+07	1.20E+07	1.20E+07	1.20E+07	1.61E+07	1.61E+07	1.61E+07	1.61E+07	1.61E+07	1.61E+07	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	975	975	975	3948	3948	3948	5451	5451	5451	975	975	975	2394	2394	2394	1644	1644	1644

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	278	278	278	607	607	607	608	608	608	609	609	609	256	256	256	257	257	257
Member Label	50N-21N	50N-21N	50N-21N	26S-27S	26S-27S	26S-27S	27S-50S	27S-50S	27S-50S	50S-21S	50S-21S	50S-21S	21N-38N	21N-38N	21N-38N	38N-31N	38N-31N	38N-31N
Station (m)	0.0	0.5	1.0	0.0	2.0	3.9	0.0	2.7	5.5	0.0	0.5	1.0	0.0	1.2	2.4	0.0	0.8	1.6
Node Label at Station	50N	---	21N	26S	---	27S	27S	---	50S	50S	---	21S	21N	---	38N	38N	---	31N
Section #	Section 21	Section 21	Section 21	Section 26	Section 26	Section 26	Section 21	Section 21	Section 21	Section 21	Section 21	Section 21	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20
Element Group	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	8.0	8.0	8.0	8.0	8.0	8.0
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	28.0	28.0	28.0	28.0	28.0	28.0
Webs in flexural compression	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	28.0	28.0	28.0	28.0	28.0	28.0
Webs in combined flexural and axial compression	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	28.0	28.0	28.0	28.0	28.0	28.0
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	278	278	278	607	607	607	608	608	608	609	609	609	256	256	256	257	257	257
Member Label	50N-21N	50N-21N	50N-21N	26S-27S	26S-27S	26S-27S	27S-50S	27S-50S	27S-50S	50S-21S	50S-21S	50S-21S	21N-38N	21N-38N	21N-38N	38N-31N	38N-31N	38N-31N
Station (m)	0.0	0.5	1.0	0.0	2.0	3.9	0.0	2.7	5.5	0.0	0.5	1.0	0.0	1.2	2.4	0.0	0.8	1.6
Node Label at Station	50N	---	21N	26S	---	27S	27S	---	50S	50S	---	21S	21N	---	38N	38N	---	31N
Section #	Section 21	Section 21	Section 21	Section 26	Section 26	Section 26	Section 21	Section 21	Section 21	Section 21	Section 21	Section 21	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20
Element Group	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	6425	6425	6425	3948	3948	3948	6425	6425	6425	6425	6425	6425	2394	2394	2394	2805	2805	2805
L_y (mm)	975	975	975	3948	3948	3948	5451	5451	5451	975	975	975	4039	4039	4039	4039	4039	4039
λ_{max}	0.320	0.320	0.320	0.188	0.188	0.188	0.320	0.320	0.320	0.320	0.320	0.320	0.269	0.269	0.269	0.269	0.269	0.269
C_r (kN)	7771.1	7771.1	7771.1	5908.7	5908.7	5908.7	7771.1	7771.1	7771.1	7771.1	7771.1	7771.1	8182.2	8182.2	8182.2	8182.2	8182.2	8182.2
$(kL/r)_{max}$	31.0	31.0	31.0	18.2	18.2	18.2	31.0	31.0	31.0	31.0	31.0	31.0	26.1	26.1	26.1	26.1	26.1	26.1
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1						
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	91829	91829	91829	197674	197674	197674	91829	91829	91829	91829	91829	91829	135694	135694	135694	135694	135694	135694

Shear Flexibility Factor:

1. Lacing:

a (mm)	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	425	425	425	425	425	425
b (mm)	972	972	972	972	972	972	972	972	972	972	972	972	368	368	368	368	368	368
ε_aa (mm)	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	425	425	425	425	425	425
ε_bb (mm)	972	972	972	972	972	972	972	972	972	972	972	972	368	368	368	368	368	368
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	877	877	877	3553	3553	3553	4906	4906	4906	877	877	877	2155	2155	2155	1480	1480	1480
A_c (mm^2)	22399	22399	22399	16593	16593	16593	22399	22399	22399	22399	22399	22399	23286	23286	23286	23286	23286	23286
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	59.8944	59.8944	59.8944	2.7037	2.7037	2.7037	1.9149	1.9149	1.9149	59.8944	59.8944	59.8944	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	0.032	0.032	0.032	0.131	0.131	0.131	0.179	0.179	0.179	0.032	0.032	0.032	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	8042.9	8042.9	8042.9	5939.4	5939.4	5939.4	7984.2	7984.2	7984.2	8042.9	8042.9	8042.9	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	278	278	278	607	607	607	608	608	608	609	609	609	256	256	256	257	257	257
Member Label	50N-21N	50N-21N	50N-21N	26S-27S	26S-27S	26S-27S	27S-50S	27S-50S	27S-50S	50S-21S	50S-21S	50S-21S	21N-38N	21N-38N	21N-38N	38N-31N	38N-31N	38N-31N
Station (m)	0.0	0.5	1.0	0.0	2.0	3.9	0.0	2.7	5.5	0.0	0.5	1.0	0.0	1.2	2.4	0.0	0.8	1.6
Node Label at Station	50N	---	21N	26S	---	27S	27S	---	50S	50S	---	21S	21N	---	38N	38N	---	31N
Section #	Section 21	Section 21	Section 21	Section 26	Section 26	Section 26	Section 21	Section 21	Section 21	Section 21	Section 21	Section 21	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20
Element Group	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	22399	22399	22399	16593	16593	16593	22399	22399	22399	22399	22399	22399	23286	23286	23286	23286	23286	23286
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	7771.1	7771.1	7771.1	5908.7	5908.7	5908.7	7771.1	7771.1	7771.1	7771.1	7771.1	7771.1	8182.2	8182.2	8182.2	8182.2	8182.2	8182.2

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	42558	42558	42558	31526	31526	31526	42558	42558	42558	42558	42558	42558	44243	44243	44243	44243	44243	44243
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	8490	8490	8490	6289	6289	6289	8490	8490	8490	8490	8490	8490	8827	8827	8827	8827	8827	8827
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	44036	44036	44036	25108	25108	25108	33978	33978	33978	44036	44036	44036	37428	37428	37428	37428	37428	37428
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	44036	44036	44036	25108	25108	25108	33978	33978	33978	44036	44036	44036	37428	37428	37428	37428	37428	37428
$A_{n(corrosion)}$ (mm^2)	41834	41834	41834	23852	23852	23852	32279	32279	32279	41834	41834	41834	35557	35557	35557	35557	35557	35557
$T_{r(b)}$ (kN)	14056	14056	14056	8014	8014	8014	10846	10846	10846	14056	14056	14056	11947	11947	11947	11947	11947	11947
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	41834	41834	41834	23852	23852	23852	32279	32279	32279	41834	41834	41834	35557	35557	35557	35557	35557	35557
$T_{r(c)}$ (kN)	14056	14056	14056	8014	8014	8014	10846	10846	10846	14056	14056	14056	11947	11947	11947	11947	11947	11947
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	278	278	278	607	607	607	608	608	608	609	609	609	256	256	256	257	257	257
Member Label	50N-21N	50N-21N	50N-21N	26S-27S	26S-27S	26S-27S	27S-50S	27S-50S	27S-50S	50S-21S	50S-21S	50S-21S	21N-38N	21N-38N	21N-38N	38N-31N	38N-31N	38N-31N
Station (m)	0.0	0.5	1.0	0.0	2.0	3.9	0.0	2.7	5.5	0.0	0.5	1.0	0.0	1.2	2.4	0.0	0.8	1.6
Node Label at Station	50N	---	21N	26S	---	27S	27S	---	50S	50S	---	21S	21N	---	38N	38N	---	31N
Section #	Section 21	Section 21	Section 21	Section 26	Section 26	Section 26	Section 21	Section 21	Section 21	Section 21	Section 21	Section 21	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20
Element Group	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	14056	14056	14056	8014	8014	8014	10846	10846	10846	14056	14056	14056	11947	11947	11947	11947	11947	11947
$(kL/r)_{max}$	31	31	31	18	18	18	31	31	31	31	31	31	26	26	26	26	26	26
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	8490	8490	8490	6289	6289	6289	8490	8490	8490	8490	8490	8490	8827	8827	8827	8827	8827	8827
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1194	1194	1194	971	971	971	1194	1194	1194	1194	1194	1194	1069	1069	1069	1069	1069	1069
$M_{ry(Laterally\ Supported)}$ (kNm)	3060	3060	3060	2284	2284	2284	3060	3060	3060	3060	3060	3060	760	760	760	760	760	760
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	6425	6425	6425	3948	3948	3948	6425	6425	6425	6425	6425	6425	2394	2394	2394	2805	2805	2805
L_{uy} (mm)	975	975	975	3948	3948	3948	5451	5451	5451	975	975	975	4039	4039	4039	4039	4039	4039
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	20367	20367	20367	17384	17384	17384
M_{uy} (kNm) (x weak)	7912	7912	7912	9683	9683	9683	7912	7912	7912	7912	7912	7912	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1194.2	1194.2	1194.2	970.6	970.6	970.6	1194.2	1194.2	1194.2	1194.2	1194.2	1194.2	1209.8	1209.8	1209.8	1206.4	1206.4	1206.4
M_{ry} (kNm)	3096.9	3096.9	3096.9	2434.1	2434.1	2434.1	3096.9	3096.9	3096.9	3096.9	3096.9	3096.9	760.3	760.3	760.3	760.3	760.3	760.3

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
$(V_f/V_r)<=1$																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.475	0.476	0.476	0.486	0.487	0.487
$(T_f/T_r)<=1$	0.525	0.526	0.526	0.288	0.289	0.290	0.512	0.514	0.515	0.522	0.523	0.523	0.000	0.000	0.000	0.000	0.000	0.000

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.525	0.526	0.526	0.288	0.289	0.290	0.512	0.514	0.515	0.522	0.523	0.523	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fx}/M_{rx}<=1$	0.110	0.158	0.208	0.080	0.202	0.472	0.384	0.149	0.110	0.110	0.157	0.207	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fy}/M_{ry}<=1$	0.055	0.080	0.106	0.059	0.030	0.097	0.079	0.032	0.054	0.054	0.074	0.098	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r<=1$	0.690	0.764	0.839	0.427	0.521	0.860	0.974	0.695	0.678	0.686	0.755	0.828	0.000	0.000	0.000	0.000	0.000	0.000
$M_f/M_r-T_fS/M_tA<=1$	0.000	0.000	0.000	0.000	0.000	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	278	278	278	607	607	607	608	608	608	609	609	609	256	256	256	257	257	257
Member Label	50N-21N	50N-21N	50N-21N	26S-27S	26S-27S	26S-27S	27S-50S	27S-50S	27S-50S	50S-21S	50S-21S	50S-21S	21N-38N	21N-38N	21N-38N	38N-31N	38N-31N	38N-31N
Station (m)	0.0	0.5	1.0	0.0	2.0	3.9	0.0	2.7	5.5	0.0	0.5	1.0	0.0	1.2	2.4	0.0	0.8	1.6
Node Label at Station	50N	---	21N	26S	---	27S	27S	---	50S	50S	---	21S	21N	---	38N	38N	---	31N
Section #	Section 21	Section 21	Section 21	Section 26	Section 26	Section 26	Section 21	Section 21	Section 21	Section 21	Section 21	Section 21	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20
Element Group	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	11 CTWT Horizontal	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	8043	8043	8043	5958	5958	5958	8043	8043	8043	8043	8043	8043	8362	8362	8362	8362	8362	8362
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	9.18E+04	9.18E+04	9.18E+04	1.98E+05	1.98E+05	1.98E+05	9.18E+04	9.18E+04	9.18E+04	9.18E+04	9.18E+04	9.18E+04	6.05E+05	6.05E+05	6.05E+05	4.41E+05	4.41E+05	4.41E+05
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	18332642	18332642	18332642	818907	818907	818907	586115	586115	586115	18332642	18332642	18332642	135694	135694	135694	135694	135694	135694
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.03	1.03	1.03	1.03	1.03	1.03
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.465	0.465	0.466	0.476	0.476	0.477
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.325	0.098	0.174	0.175	0.075	0.276
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.015	0.015	0.020	0.024
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.789	0.570	0.655	0.665	0.572	0.777

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.320	0.320	0.320	0.188	0.188	0.188	0.320	0.320	0.320	0.320	0.320	0.320	0.269	0.269	0.269	0.269	0.269	0.269
$C_{r\ (K=1)}$ (kN)	7771	7771	7771	5909	5909	5909	7771	7771	7771	7771	7771	7771	8182	8182	8182	8182	8182	8182
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.03	1.03	1.03	1.03	1.03	1.03
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.475	0.476	0.476	0.486	0.487	0.487
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.325	0.098	0.174	0.175	0.075	0.276
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.015	0.015	0.020	0.024
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.800	0.580	0.665	0.676	0.583	0.787

3.3. Lateral Torsional Buckling:

λ_{max}	0.320	0.320	0.320	0.188	0.188	0.188	0.320	0.320	0.320	0.320	0.320	0.320	0.269	0.269	0.269	0.269	0.269	0.269
C_r (kN)	7771	7771	7771	5909	5909	5909	7771	7771	7771	7771	7771	7771	8182	8182	8182	8182	8182	8182
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.03	1.03	1.03	1.03	1.03	1.03
M_{rx} (kNm)	1194	1194	1194	971	971	971	1194	1194	1194	1194	1194	1194	1210	1210	1210	1206	1206	1206
M_{ry} (kNm)	3097	3097	3097	2434	2434	2434	3097	3097	3097	3097	3097	3097	760	760	760	760	760	760
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.475	0.476	0.476	0.486	0.487	0.487
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.287	0.087	0.154	0.155	0.067	0.244
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.015	0.015	0.020	0.024
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.762	0.569	0.645	0.656	0.574	0.756
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.690	0.764	0.839	0.427	0.521	0.860	0.974	0.695	0.678	0.686	0.755	0.828	0.800	0.580	0.665	0.676	0.583	0.787

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	258	258	258	259	259	259	260	260	260	584	584	584	585	585	585	586	586	586
Member Label	31N-51N	31N-51N	31N-51N	51N-20N	51N-20N	51N-20N	20N-19N	20N-19N	20N-19N	21S-38S	21S-38S	21S-38S	38S-31S	38S-31S	38S-31S	31S-51S	31S-51S	31S-51S
Station (m)	0.0	0.6	1.2	0.0	0.1	0.3	0.0	2.7	5.5	0.0	1.2	2.4	0.0	0.8	1.6	0.0	0.6	1.2
Node Label at Station	31N	---	51N	51N	---	20N	20N	---	19N	21S	---	38S	38S	---	31S	31S	---	51S
Section #	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20
Element Group	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical

Member Factored Load Effects:

C_f (kN)	3987	3990	3993	4258	4259	4259	4406	4420	4434	3877	3883	3889	3986	3990	3994	3993	3996	3999
$M_{fx\ (comp)}$ (kNm)	292	443	599	599	566	533	533	115	765	330	100	190	190	77	288	288	454	620
$M_{fy\ (comp)}$ (kNm)	16	69	139	139	156	173	177	18	173	0	6	12	12	16	20	17	69	142
T_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	120	120	120	121	121	121	64	64	64	5	5	5	5	5	5	126	126	126
V_{fy} (kN)	278	277	276	230	231	231	232	236	239	207	209	211	292	290	289	288	287	286

Gross Section Properties:

Ag (mm^2)	46572	46572	46572	46572	46572	46572	46572	46572	46572	46572	46572	46572	46572	46572	46572	46572	46572	46572
I_x (mm^4)	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09
I_y (mm^4)	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09
J (mm^4)	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07
r_x (mm)	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194
r_y (mm)	155	155	155	155	155	155	155	155	155	155	155	155	155	155	155	155	155	155
S_x (mm^3)	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06
S_y (mm^3)	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	20	20	20	5	5	5	5	5	5	5	5	5
L (mm)	1161	1161	1161	287	287	287	5486	5486	5486	2394	2394	2394	1644	1644	1644	1161	1161	1161

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	258	258	258	259	259	259	260	260	260	584	584	584	585	585	585	586	586	586
Member Label	31N-51N	31N-51N	31N-51N	51N-20N	51N-20N	51N-20N	20N-19N	20N-19N	20N-19N	21S-38S	21S-38S	21S-38S	38S-31S	38S-31S	38S-31S	31S-51S	31S-51S	31S-51S
Station (m)	0.0	0.6	1.2	0.0	0.1	0.3	0.0	2.7	5.5	0.0	1.2	2.4	0.0	0.8	1.6	0.0	0.6	1.2
Node Label at Station	31N	---	51N	51N	---	20N	20N	---	19N	21S	---	38S	38S	---	31S	31S	---	51S
Section #	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20
Element Group	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0
Webs in flexural compression	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0
Webs in combined flexural and axial compression	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	258	258	258	259	259	259	260	260	260	584	584	584	585	585	585	586	586	586
Member Label	31N-51N	31N-51N	31N-51N	51N-20N	51N-20N	51N-20N	20N-19N	20N-19N	20N-19N	21S-38S	21S-38S	21S-38S	38S-31S	38S-31S	38S-31S	31S-51S	31S-51S	31S-51S
Station (m)	0.0	0.6	1.2	0.0	0.1	0.3	0.0	2.7	5.5	0.0	1.2	2.4	0.0	0.8	1.6	0.0	0.6	1.2
Node Label at Station	31N	---	51N	51N	---	20N	20N	---	19N	21S	---	38S	38S	---	31S	31S	---	51S
Section #	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20
Element Group	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	2805	2805	2805	5773	5773	5773	5773	5773	5773	2394	2394	2394	2805	2805	2805	2805	2805	2805
L_y (mm)	1448	1448	1448	1448	1448	1448	5486	5486	5486	4039	4039	4039	4039	4039	4039	1448	1448	1448
λ_{max}	0.149	0.149	0.149	0.307	0.307	0.307	0.365	0.365	0.365	0.269	0.269	0.269	0.269	0.269	0.269	0.149	0.149	0.149
C_r (kN)	8324.1	8324.1	8324.1	8108.0	8108.0	8108.0	6708.2	6708.2	6708.2	8182.2	8182.2	8182.2	8182.2	8182.2	8182.2	8324.1	8324.1	8324.1
$(kL/r)_{max}$	14.5	14.5	14.5	29.8	29.8	29.8	35.4	35.4	35.4	26.1	26.1	26.1	26.1	26.1	26.1	14.5	14.5	14.5
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	440698	440698	440698	104076	104076	104076	73527	73527	73527	135694	135694	135694	135694	135694	135694	440698	440698	440698

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	1045	1045	1045	258	258	258	4938	4938	4938	2155	2155	2155	1480	1480	1480	1045	1045	1045
A_c (mm^2)	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	258	258	258	259	259	259	260	260	260	584	584	584	585	585	585	586	586	586
Member Label	31N-51N	31N-51N	31N-51N	51N-20N	51N-20N	51N-20N	20N-19N	20N-19N	20N-19N	21S-38S	21S-38S	21S-38S	38S-31S	38S-31S	38S-31S	31S-51S	31S-51S	31S-51S
Station (m)	0.0	0.6	1.2	0.0	0.1	0.3	0.0	2.7	5.5	0.0	1.2	2.4	0.0	0.8	1.6	0.0	0.6	1.2
Node Label at Station	31N	---	51N	51N	---	20N	20N	---	19N	21S	---	38S	38S	---	31S	31S	---	51S
Section #	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20
Element Group	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286	23286
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	8324.1	8324.1	8324.1	8108.0	8108.0	8108.0	6708.2	6708.2	6708.2	8182.2	8182.2	8182.2	8182.2	8182.2	8182.2	8324.1	8324.1	8324.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	44243	44243	44243	44243	44243	44243	37258	37258	37258	44243	44243	44243	44243	44243	44243	44243	44243	44243
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	8827	8827	8827	8827	8827	8827	7433	7433	7433	8827	8827	8827	8827	8827	8827	8827	8827	8827
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428	37428
$A_{n(corrosion)}$ (mm^2)	35557	35557	35557	35557	35557	35557	29942	29942	29942	35557	35557	35557	35557	35557	35557	35557	35557	35557
$T_{r(b)}$ (kN)	11947	11947	11947	11947	11947	11947	10061	10061	10061	11947	11947	11947	11947	11947	11947	11947	11947	11947
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	35557	35557	35557	35557	35557	35557	29942	29942	29942	35557	35557	35557	35557	35557	35557	35557	35557	35557
$T_{r(c)}$ (kN)	11947	11947	11947	11947	11947	11947	10061	10061	10061	11947	11947	11947	11947	11947	11947	11947	11947	11947
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	258	258	258	259	259	259	260	260	260	584	584	584	585	585	585	586	586	586
Member Label	31N-51N	31N-51N	31N-51N	51N-20N	51N-20N	51N-20N	20N-19N	20N-19N	20N-19N	21S-38S	21S-38S	21S-38S	38S-31S	38S-31S	38S-31S	31S-51S	31S-51S	31S-51S
Station (m)	0.0	0.6	1.2	0.0	0.1	0.3	0.0	2.7	5.5	0.0	1.2	2.4	0.0	0.8	1.6	0.0	0.6	1.2
Node Label at Station	31N	---	51N	51N	---	20N	20N	---	19N	21S	---	38S	38S	---	31S	31S	---	51S
Section #	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20
Element Group	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	11947	11947	11947	11947	11947	11947	10061	10061	10061	11947	11947	11947	11947	11947	11947	11947	11947	11947
$(kL/r)_{max}$	14	14	14	30	30	30	35	35	35	26	26	26	26	26	26	14	14	14
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	8827	8827	8827	8827	8827	8827	7433	7433	7433	8827	8827	8827	8827	8827	8827	8827	8827	8827
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1069	1069	1069	1069	1069	1069	901	901	901	1069	1069	1069	1069	1069	1069	1069	1069	1069
$M_{ry(Laterally\ Supported)}$ (kNm)	760	760	760	760	760	760	640	640	640	760	760	760	760	760	760	760	760	760
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	2805	2805	2805	5773	5773	5773	5773	5773	5773	2394	2394	2394	2805	2805	2805	2805	2805	2805
L_{uy} (mm)	1448	1448	1448	1448	1448	1448	5486	5486	5486	4039	4039	4039	4039	4039	4039	1448	1448	1448
M_{ux} (kNm) (y weak)	17384	17384	17384	8448	8448	8448	8448	8448	8448	20367	20367	20367	17384	17384	17384	17384	17384	17384
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1206.4	1206.4	1206.4	1181.5	1181.5	1181.5	995.0	995.0	995.0	1209.8	1209.8	1209.8	1206.4	1206.4	1206.4	1206.4	1206.4	1206.4
M_{ry} (kNm)	760.3	760.3	760.3	760.3	760.3	760.3	640.2	640.2	640.2	760.3	760.3	760.3	760.3	760.3	760.3	760.3	760.3	760.3

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
$(V_f/V_r)<=1$																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.479	0.479	0.480	0.525	0.525	0.525	0.657	0.659	0.661	0.474	0.475	0.475	0.487	0.488	0.488	0.480	0.480	0.480
$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fx}/M_{rx}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fy}/M_{ry}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Member ID in CSiBridge	258	258	258	259	259	259	260	260	260	584	584	584	585	585	585	586	586	586
Member Label	31N-51N	31N-51N	31N-51N	51N-20N	51N-20N	51N-20N	20N-19N	20N-19N	20N-19N	21S-38S	21S-38S	21S-38S	38S-31S	38S-31S	38S-31S	31S-51S	31S-51S	31S-51S
Station (m)	0.0	0.6	1.2	0.0	0.1	0.3	0.0	2.7	5.5	0.0	1.2	2.4	0.0	0.8	1.6	0.0	0.6	1.2
Node Label at Station	31N	---	51N	51N	---	20N	20N	---	19N	21S	---	38S	38S	---	31S	31S	---	51S
Section #	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20
Element Group	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	8362	8362	8362	8362	8362	8362	7042	7042	7042	8362	8362	8362	8362	8362	8362	8362	8362	8362
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	4.41E+05	4.41E+05	4.41E+05	1.04E+05	1.04E+05	1.04E+05	1.04E+05	1.04E+05	1.04E+05	6.05E+05	6.05E+05	6.05E+05	4.41E+05	4.41E+05	4.41E+05	4.41E+05	4.41E+05	4.41E+05
U_{1x}	1.01	1.01	1.01	1.04	1.04	1.04	1.04	1.04	1.04	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	1055855	1055855	1055855	1055855	1055855	1055855	73527	73527	73527	135694	135694	135694	135694	135694	135694	1055855	1055855	1055855
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.06	1.06	1.06	1.03	1.03	1.03	1.03	1.03	1.03	1.00	1.00	1.00
C_f/C_r	0.477	0.477	0.478	0.509	0.509	0.509	0.626	0.628	0.630	0.464	0.464	0.465	0.477	0.477	0.478	0.478	0.478	0.478
$U_{1x}M_{fx}/M_{rx}$	0.276	0.418	0.565	0.584	0.552	0.520	0.618	0.133	0.887	0.311	0.094	0.179	0.179	0.073	0.272	0.272	0.428	0.585
$U_{1y}M_{fy}/M_{ry}$	0.021	0.091	0.184	0.184	0.206	0.228	0.294	0.030	0.288	0.000	0.008	0.016	0.016	0.022	0.027	0.022	0.091	0.187
Interaction	0.773	0.986	1.226	1.277	1.267	1.257	1.538	0.791	1.804	0.774	0.567	0.660	0.672	0.572	0.777	0.772	0.997	1.251

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.149	0.149	0.149	0.307	0.307	0.307	0.365	0.365	0.365	0.269	0.269	0.269	0.269	0.269	0.269	0.149	0.149	0.149
$C_{r\ (K=1)}$ (kN)	8324	8324	8324	8108	8108	8108	6708	6708	6708	8182	8182	8182	8182	8182	8182	8324	8324	8324
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.01	1.01	1.01	1.04	1.04	1.04	1.04	1.04	1.04	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.06	1.06	1.06	1.03	1.03	1.03	1.03	1.03	1.03	1.00	1.00	1.00
C_f/C_r	0.479	0.479	0.480	0.525	0.525	0.525	0.657	0.659	0.661	0.474	0.475	0.475	0.487	0.488	0.488	0.480	0.480	0.480
$U_{1x}M_{fx}/M_{rx}$	0.276	0.418	0.565	0.584	0.552	0.520	0.618	0.133	0.887	0.311	0.094	0.179	0.179	0.073	0.272	0.272	0.428	0.585
$U_{1y}M_{fy}/M_{ry}$	0.021	0.091	0.184	0.184	0.206	0.228	0.294	0.030	0.288	0.000	0.008	0.016	0.016	0.022	0.027	0.022	0.091	0.187
Interaction	0.776	0.988	1.228	1.293	1.283	1.273	1.569	0.822	1.836	0.784	0.577	0.670	0.683	0.582	0.787	0.774	1.000	1.253

3.3. Lateral Torsional Buckling:

λ_{max}	0.149	0.149	0.149	0.307	0.307	0.307	0.365	0.365	0.365	0.269	0.269	0.269	0.269	0.269	0.269	0.149	0.149	0.149
C_r (kN)	8324	8324	8324	8108	8108	8108	6708	6708	6708	8182	8182	8182	8182	8182	8182	8324	8324	8324
U_{1x}	1.01	1.01	1.01	1.04	1.04	1.04	1.04	1.04	1.04	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.06	1.06	1.06	1.03	1.03	1.03	1.03	1.03	1.03	1.00	1.00	1.00
M_{rx} (kNm)	1206	1206	1206	1182	1182	1182	995	995	995	1210	1210	1210	1206	1206	1206	1206	1206	1206
M_{ry} (kNm)	760	760	760	760	760	760	640	640	640	760	760	760	760	760	760	760	760	760
C_f/C_r	0.479	0.479	0.480	0.525	0.525	0.525	0.657	0.659	0.661	0.474	0.475	0.475	0.487	0.488	0.488	0.480	0.480	0.480
$U_{1x}M_{fx}/M_{rx}$	0.244	0.371	0.501	0.529	0.499	0.470	0.559	0.121	0.803	0.275	0.083	0.158	0.159	0.064	0.241	0.241	0.380	0.519
$U_{1y}M_{fy}/M_{ry}$	0.021	0.091	0.184	0.184	0.206	0.228	0.294	0.030	0.288	0.000	0.008	0.016	0.016	0.022	0.027	0.022	0.091	0.187
Interaction	0.744	0.941	1.164	1.237	1.231	1.224	1.510	0.810	1.752	0.748	0.566	0.650	0.662	0.574	0.756	0.743	0.951	1.187
Demand/Capacity ≤ 1	OK	OK	NOT OK	NOT OK	NOT OK	NOT OK	NOT OK	OK	NOT OK	OK	OK	OK	OK	OK	OK	OK	OK	NOT OK
Highest Ratio	0.776	0.988	1.228	1.293	1.283	1.273	1.569	0.822	1.836	0.784	0.577	0.670	0.683	0.582	0.787	0.774	1.000	1.253

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	587	587	587	588	588	588	262	262	262	263	263	263	264	264	264	265	265	265
Member Label	51S-20S	51S-20S	51S-20S	20S-19S	20S-19S	20S-19S	21N-39N	21N-39N	21N-39N	39N-37N	39N-37N	39N-37N	37N-40N	37N-40N	37N-40N	40N-28N	40N-28N	40N-28N
Station (m)	0.0	0.1	0.3	0.0	2.7	5.5	0.0	0.5	0.9	0.0	0.8	1.7	0.0	1.1	2.2	0.0	0.7	1.4
Node Label at Station	51S	---	20S	20S	---	19S	21N	---	39N	39N	---	37N	37N	---	40N	40N	---	28N
Section #	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11
Element Group	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal

Member Factored Load Effects:

C_f (kN)	4265	4265	4266	4393	4407	4420	1884	1885	1886	1874	1876	1878	1863	1865	1867	1911	1912	1913
$M_{fx\ (comp)}$ (kNm)	620	586	552	552	110	778	0	11	21	21	33	45	42	55	73	73	90	107
$M_{fy\ (comp)}$ (kNm)	142	160	178	181	17	181	126	118	117	108	76	53	54	42	106	108	177	256
T_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	126	126	126	66	66	66	48	48	47	63	62	60	73	72	71	116	116	116
V_{fy} (kN)	237	237	237	239	242	246	24	23	22	17	15	13	18	20	23	24	26	27

Gross Section Properties:

Ag (mm^2)	46572	46572	46572	46572	46572	46572	26734	26734	26734	26734	26734	26734	26734	26734	26734	26734	26734	26734
I_x (mm^4)	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.76E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09
I_y (mm^4)	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.12E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09
J (mm^4)	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	1.40E+07	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06
r_x (mm)	194	194	194	194	194	194	197	197	197	197	197	197	197	197	197	197	197	197
r_y (mm)	155	155	155	155	155	155	221	221	221	221	221	221	221	221	221	221	221	221
S_x (mm^3)	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	5.64E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06
S_y (mm^3)	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.01E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	20	20	20	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	287	287	287	5486	5486	5486	918	918	918	1675	1675	1675	2236	2236	2236	1377	1377	1377

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	587	587	587	588	588	588	262	262	262	263	263	263	264	264	264	265	265	265
Member Label	51S-20S	51S-20S	51S-20S	20S-19S	20S-19S	20S-19S	21N-39N	21N-39N	21N-39N	39N-37N	39N-37N	39N-37N	37N-40N	37N-40N	37N-40N	40N-28N	40N-28N	40N-28N
Station (m)	0.0	0.1	0.3	0.0	2.7	5.5	0.0	0.5	0.9	0.0	0.8	1.7	0.0	1.1	2.2	0.0	0.7	1.4
Node Label at Station	51S	---	20S	20S	---	19S	21N	---	39N	39N	---	37N	37N	---	40N	40N	---	28N
Section #	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11
Element Group	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	8.0	8.0	8.0	8.0	8.0	8.0	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	28.0	28.0	28.0	28.0	28.0	28.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0
Webs in flexural compression	28.0	28.0	28.0	28.0	28.0	28.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0
Webs in combined flexural and axial compression	28.0	28.0	28.0	28.0	28.0	28.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	587	587	587	588	588	588	262	262	262	263	263	263	264	264	264	265	265	265
Member Label	51S-20S	51S-20S	51S-20S	20S-19S	20S-19S	20S-19S	21N-39N	21N-39N	21N-39N	39N-37N	39N-37N	39N-37N	37N-40N	37N-40N	37N-40N	40N-28N	40N-28N	40N-28N
Station (m)	0.0	0.1	0.3	0.0	2.7	5.5	0.0	0.5	0.9	0.0	0.8	1.7	0.0	1.1	2.2	0.0	0.7	1.4
Node Label at Station	51S	---	20S	20S	---	19S	21N	---	39N	39N	---	37N	37N	---	40N	40N	---	28N
Section #	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11
Element Group	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5773	5773	5773	5773	5773	5773	6206	6206	6206	6206	6206	6206	6206	6206	6206	6206	6206	6206
L_y (mm)	1448	1448	1448	5486	5486	5486	918	918	918	1675	1675	1675	2236	2236	2236	1377	1377	1377
λ_{max}	0.307	0.307	0.307	0.365	0.365	0.365	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325
C_r (kN)	8108.0	8108.0	8108.0	6708.2	6708.2	6708.2	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3
$(kL/r)_{max}$	29.8	29.8	29.8	35.4	35.4	35.4	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing							1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	104076	104076	104076	73527	73527	73527	53055	53055	53055	53055	53055	53055	53055	53055	53055	53055	53055	53055

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	609	609	609	609	609	609	609	609	609	609	609	609
b (mm)	368	368	368	368	368	368	527	527	527	527	527	527	527	527	527	527	527	527
ε_aa (mm)	425	425	425	425	425	425	609	609	609	609	609	609	609	609	609	609	609	609
ε_bb (mm)	368	368	368	368	368	368	527	527	527	527	527	527	527	527	527	527	527	527
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	258	258	258	4938	4938	4938	826	826	826	1507	1507	1507	2012	2012	2012	1239	1239	1239
A_c (mm^2)	23286	23286	23286	23286	23286	23286	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	11.8556	11.8556	11.8556	3.5643	3.5643	3.5643	1.9998	1.9998	1.9998	5.2705	5.2705	5.2705
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	0.061	0.061	0.061	0.111	0.111	0.111	0.148	0.148	0.148	0.091	0.091	0.091
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	4798.1	4798.1	4798.1	4790.3	4790.3	4790.3	4779.0	4779.0	4779.0	4794.3	4794.3	4794.3
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	587	587	587	588	588	588	262	262	262	263	263	263	264	264	264	265	265	265
Member Label	51S-20S	51S-20S	51S-20S	20S-19S	20S-19S	20S-19S	21N-39N	21N-39N	21N-39N	39N-37N	39N-37N	39N-37N	37N-40N	37N-40N	37N-40N	40N-28N	40N-28N	40N-28N
Station (m)	0.0	0.1	0.3	0.0	2.7	5.5	0.0	0.5	0.9	0.0	0.8	1.7	0.0	1.1	2.2	0.0	0.7	1.4
Node Label at Station	51S	---	20S	20S	---	19S	21N	---	39N	39N	---	37N	37N	---	40N	40N	---	28N
Section #	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11
Element Group	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	23286	23286	23286	23286	23286	23286	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	8108.0	8108.0	8108.0	6708.2	6708.2	6708.2	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	44243	44243	44243	37258	37258	37258	25397	25397	25397	25397	25397	25397	25397	25397	25397	25397	25397	25397
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	8827	8827	8827	7433	7433	7433	5067	5067	5067	5067	5067	5067	5067	5067	5067	5067	5067	5067
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	37428	37428	37428	37428	37428	37428	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	37428	37428	37428	37428	37428	37428	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333
$A_{n(corrosion)}$ (mm^2)	35557	35557	35557	29942	29942	29942	19317	19317	19317	19317	19317	19317	19317	19317	19317	19317	19317	19317
$T_{r(b)}$ (kN)	11947	11947	11947	10061	10061	10061	6490	6490	6490	6490	6490	6490	6490	6490	6490	6490	6490	6490
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	35557	35557	35557	29942	29942	29942	19317	19317	19317	19317	19317	19317	19317	19317	19317	19317	19317	19317
$T_{r(c)}$ (kN)	11947	11947	11947	10061	10061	10061	6490	6490	6490	6490	6490	6490	6490	6490	6490	6490	6490	6490
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	587	587	587	588	588	588	262	262	262	263	263	263	264	264	264	265	265	265
Member Label	51S-20S	51S-20S	51S-20S	20S-19S	20S-19S	20S-19S	21N-39N	21N-39N	21N-39N	39N-37N	39N-37N	39N-37N	37N-40N	37N-40N	37N-40N	40N-28N	40N-28N	40N-28N
Station (m)	0.0	0.1	0.3	0.0	2.7	5.5	0.0	0.5	0.9	0.0	0.8	1.7	0.0	1.1	2.2	0.0	0.7	1.4
Node Label at Station	51S	---	20S	20S	---	19S	21N	---	39N	39N	---	37N	37N	---	40N	40N	---	28N
Section #	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11
Element Group	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	11947	11947	11947	10061	10061	10061	6490	6490	6490	6490	6490	6490	6490	6490	6490	6490	6490	6490
$(kL/r)_{max}$	30	30	30	35	35	35	32	32	32	32	32	32	32	32	32	32	32	32
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	8827	8827	8827	7433	7433	7433	5067	5067	5067	5067	5067	5067	5067	5067	5067	5067	5067	5067
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1069	1069	1069	901	901	901	644	644	644	644	644	644	644	644	644	644	644	644
$M_{ry(Laterally\ Supported)}$ (kNm)	760	760	760	640	640	640	788	788	788	788	788	788	788	788	788	788	788	788
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	5773	5773	5773	5773	5773	5773	6206	6206	6206	6206	6206	6206	6206	6206	6206	6206	6206	6206
L_{uy} (mm)	1448	1448	1448	5486	5486	5486	918	918	918	1675	1675	1675	2236	2236	2236	1377	1377	1377
M_{ux} (kNm) (y weak)	8448	8448	8448	8448	8448	8448	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	3444	3444	3444	3444	3444	3444	3444	3444	3444	3444	3444	3444
M_{rx} (kNm)	1181.5	1181.5	1181.5	995.0	995.0	995.0	643.6	643.6	643.6	643.6	643.6	643.6	643.6	643.6	643.6	643.6	643.6	643.6
M_{ry} (kNm)	760.3	760.3	760.3	640.2	640.2	640.2	841.7	841.7	841.7	841.7	841.7	841.7	841.7	841.7	841.7	841.7	841.7	841.7

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y/w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
$(V_f/V_r)<=1$																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.526	0.526	0.526	0.655	0.657	0.659	0.407	0.407	0.407	0.405	0.405	0.406	0.402	0.403	0.403	0.413	0.413	0.413
$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fx}/M_{rx}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fy}/M_{ry}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_f/M_r-T_fS/M_tA<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	587	587	587	588	588	588	262	262	262	263	263	263	264	264	264	265	265	265
Member Label	51S-20S	51S-20S	51S-20S	20S-19S	20S-19S	20S-19S	21N-39N	21N-39N	21N-39N	39N-37N	39N-37N	39N-37N	37N-40N	37N-40N	37N-40N	40N-28N	40N-28N	40N-28N
Station (m)	0.0	0.1	0.3	0.0	2.7	5.5	0.0	0.5	0.9	0.0	0.8	1.7	0.0	1.1	2.2	0.0	0.7	1.4
Node Label at Station	51S	---	20S	20S	---	19S	21N	---	39N	39N	---	37N	37N	---	40N	40N	---	28N
Section #	Section 20	Section 20	Section 20	Section 20	Section 20	Section 20	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11
Element Group	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	12 TowerT Vertical	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	8362	8362	8362	7042	7042	7042	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.04E+05	1.04E+05	1.04E+05	1.04E+05	1.04E+05	1.04E+05	5.31E+04	5.31E+04	5.31E+04	5.31E+04	5.31E+04	5.31E+04	5.31E+04	5.31E+04	5.31E+04	5.31E+04	5.31E+04	5.31E+04
U_{1x}	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	1055855	1055855	1055855	73527	73527	73527	3059815	3059815	3059815	919913	919913	919913	516117	516117	516117	1360263	1360263	1360263
U_{1y}	1.00	1.00	1.00	1.06	1.06	1.06	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.510	0.510	0.510	0.624	0.626	0.628	0.392	0.393	0.393	0.390	0.391	0.391	0.388	0.389	0.389	0.398	0.398	0.399
$U_{1x}M_{fx}/M_{rx}$	0.605	0.571	0.538	0.640	0.128	0.902	0.000	0.018	0.034	0.034	0.053	0.072	0.068	0.089	0.118	0.118	0.145	0.172
$U_{1y}M_{fy}/M_{ry}$	0.188	0.211	0.235	0.301	0.028	0.301	0.160	0.150	0.149	0.137	0.097	0.067	0.069	0.054	0.135	0.137	0.225	0.325
Interaction	1.302	1.293	1.283	1.564	0.782	1.831	0.553	0.560	0.575	0.562	0.541	0.531	0.525	0.531	0.642	0.653	0.768	0.896

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.307	0.307	0.307	0.365	0.365	0.365	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325
$C_{r\ (K=1)}$ (kN)	8108	8108	8108	6708	6708	6708	4631	4631	4631	4631	4631	4631	4631	4631	4631	4631	4631	4631
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.06	1.06	1.06	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.526	0.526	0.526	0.655	0.657	0.659	0.407	0.407	0.407	0.405	0.405	0.406	0.402	0.403	0.403	0.413	0.413	0.413
$U_{1x}M_{fx}/M_{rx}$	0.605	0.571	0.538	0.640	0.128	0.902	0.000	0.018	0.034	0.034	0.053	0.072	0.068	0.089	0.118	0.118	0.145	0.172
$U_{1y}M_{fy}/M_{ry}$	0.188	0.211	0.235	0.301	0.028	0.301	0.160	0.150	0.149	0.137	0.097	0.067	0.069	0.054	0.135	0.137	0.225	0.325
Interaction	1.318	1.309	1.299	1.596	0.813	1.862	0.567	0.575	0.590	0.576	0.555	0.545	0.539	0.545	0.656	0.668	0.783	0.911

3.3. Lateral Torsional Buckling:

λ_{max}	0.307	0.307	0.307	0.365	0.365	0.365	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325
C_r (kN)	8108	8108	8108	6708	6708	6708	4631	4631	4631	4631	4631	4631	4631	4631	4631	4631	4631	4631
U_{1x}	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
U_{1y}	1.00	1.00	1.00	1.06	1.06	1.06	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1182	1182	1182	995	995	995	644	644	644	644	644	644	644	644	644	644	644	644
M_{ry} (kNm)	760	760	760	640	640	640	842	842	842	842	842	842	842	842	842	842	842	842
C_f/C_r	0.526	0.526	0.526	0.655	0.657	0.659	0.407	0.407	0.407	0.405	0.405	0.406	0.402	0.403	0.403	0.413	0.413	0.413
$U_{1x}M_{fx}/M_{rx}$	0.547	0.517	0.487	0.579	0.115	0.817	0.000	0.018	0.034	0.034	0.053	0.072	0.068	0.089	0.118	0.118	0.145	0.172
$U_{1y}M_{fy}/M_{ry}$	0.188	0.211	0.235	0.301	0.028	0.301	0.150	0.140	0.139	0.129	0.090	0.063	0.064	0.050	0.126	0.128	0.211	0.305
Interaction	1.261	1.254	1.248	1.535	0.801	1.776	0.557	0.565	0.580	0.567	0.549	0.541	0.534	0.541	0.647	0.659	0.768	0.890
Demand/Capacity ≤ 1	NOT OK	NOT OK	NOT OK	NOT OK	OK	NOT OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	1.318	1.309	1.299	1.596	0.813	1.862	0.567	0.575	0.590	0.576	0.555	0.545	0.539	0.545	0.656	0.668	0.783	0.911

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	266	266	266	267	267	267	268	268	268	590	590	590	591	591	591	592	592	592
Member Label	28N-52N	28N-52N	28N-52N	52N-17N	52N-17N	52N-17N	17N-15N	17N-15N	17N-15N	21S-39S	21S-39S	21S-39S	39S-37S	39S-37S	39S-37S	37S-40S	37S-40S	37S-40S
Station (m)	0.0	0.2	0.4	0.0	0.9	1.8	0.0	4.2	8.4	0.0	0.5	0.9	0.0	0.8	1.7	0.0	1.1	2.2
Node Label at Station	28N	---	52N	52N	---	17N	17N	---	15N	21S	---	39S	39S	---	37S	37S	---	40S
Section #	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11
Element Group	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal

Member Factored Load Effects:

C_f (kN)	2492	2492	2493	2241	2243	2244	2496	2504	2512	1975	1976	1977	1964	1965	1967	1948	1950	1952
$M_{fx\ (comp)}$ (kNm)	108	169	231	550	198	163	126	57	122	0	11	21	21	33	45	41	55	72
$M_{fy\ (comp)}$ (kNm)	256	174	531	300	254	247	249	26	323	130	116	107	107	77	52	53	45	110
T_f (kN)	90	90	90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (tension)}$ (kNm)	108	169	231	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	256	174	531	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	1717	1717	1717	128	128	128	62	68	74	48	47	47	59	58	57	74	73	72
V_{fy} (kN)	277	278	278	396	398	400	27	23	32	24	23	22	17	15	13	18	20	22

Gross Section Properties:

Ag (mm^2)	26734	26734	26734	26734	26734	26734	26734	26734	26734	26734	26734	26734	26734	26734	26734	26734	26734	26734
I_x (mm^4)	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09
I_y (mm^4)	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09
J (mm^4)	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06
r_x (mm)	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197
r_y (mm)	221	221	221	221	221	221	221	221	221	221	221	221	221	221	221	221	221	221
S_x (mm^3)	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06
S_y (mm^3)	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	20	20	20	5	5	5	5	5	5	5	5	5
L (mm)	444	444	444	1781	1781	1781	8430	8430	8430	918	918	918	1675	1675	1675	2236	2236	2236

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	266	266	266	267	267	267	268	268	268	590	590	590	591	591	591	592	592	592
Member Label	28N-52N	28N-52N	28N-52N	52N-17N	52N-17N	52N-17N	17N-15N	17N-15N	17N-15N	21S-39S	21S-39S	21S-39S	39S-37S	39S-37S	39S-37S	37S-40S	37S-40S	37S-40S
Station (m)	0.0	0.2	0.4	0.0	0.9	1.8	0.0	4.2	8.4	0.0	0.5	0.9	0.0	0.8	1.7	0.0	1.1	2.2
Node Label at Station	28N	---	52N	52N	---	17N	17N	---	15N	21S	---	39S	39S	---	37S	37S	---	40S
Section #	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11
Element Group	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0
Webs in flexural compression	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0
Webs in combined flexural and axial compression	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	266	266	266	267	267	267	268	268	268	590	590	590	591	591	591	592	592	592
Member Label	28N-52N	28N-52N	28N-52N	52N-17N	52N-17N	52N-17N	17N-15N	17N-15N	17N-15N	21S-39S	21S-39S	21S-39S	39S-37S	39S-37S	39S-37S	37S-40S	37S-40S	37S-40S
Station (m)	0.0	0.2	0.4	0.0	0.9	1.8	0.0	4.2	8.4	0.0	0.5	0.9	0.0	0.8	1.7	0.0	1.1	2.2
Node Label at Station	28N	---	52N	52N	---	17N	17N	---	15N	21S	---	39S	39S	---	37S	37S	---	40S
Section #	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11
Element Group	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	444	444	444	1781	1781	1781	8430	8430	8430	6206	6206	6206	6206	6206	6206	6206	6206	6206
L_y (mm)	444	444	444	1781	1781	1781	8430	8430	8430	918	918	918	1675	1675	1675	2236	2236	2236
λ_{max}	0.023	0.023	0.023	0.093	0.093	0.093	0.441	0.441	0.441	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325
C_r (kN)	4799.9	4799.9	4799.9	4793.9	4793.9	4793.9	3735.0	3735.0	3735.0	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3
$(kL/r)_{max}$	2.3	2.3	2.3	9.0	9.0	9.0	42.8	42.8	42.8	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	10384804	10384804	10384804	644046	644046	644046	28748	28748	28748	53055	53055	53055	53055	53055	53055	53055	53055	53055

Shear Flexibility Factor:

1. Lacing:

a (mm)	609	609	609	609	609	609	609	609	609	609	609	609	609	609	609	609	609	609
b (mm)	527	527	527	527	527	527	527	527	527	527	527	527	527	527	527	527	527	527
ε_aa (mm)	609	609	609	609	609	609	609	609	609	609	609	609	609	609	609	609	609	609
ε_bb (mm)	527	527	527	527	527	527	527	527	527	527	527	527	527	527	527	527	527	527
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	399	399	399	1603	1603	1603	7587	7587	7587	826	826	826	1507	1507	1507	2012	2012	2012
A_c (mm^2)	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	50.8047	50.8047	50.8047	3.1508	3.1508	3.1508	0.1406	0.1406	0.1406	11.8556	11.8556	11.8556	3.5643	3.5643	3.5643	1.9998	1.9998	1.9998
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.71	0.71	0.71	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	1.414	1.414	1.414	1.414	1.414	1.414	1.184	1.184	1.184	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414
λ_v	0.029	0.029	0.029	0.118	0.118	0.118	0.466	0.466	0.466	0.061	0.061	0.061	0.111	0.111	0.111	0.148	0.148	0.148
Cr' (kN)	4799.8	4799.8	4799.8	4788.6	4788.6	4788.6	3692.0	3692.0	3692.0	4798.1	4798.1	4798.1	4790.3	4790.3	4790.3	4779.0	4779.0	4779.0
Lacing Governs?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	266	266	266	267	267	267	268	268	268	590	590	590	591	591	591	592	592	592
Member Label	28N-52N	28N-52N	28N-52N	52N-17N	52N-17N	52N-17N	17N-15N	17N-15N	17N-15N	21S-39S	21S-39S	21S-39S	39S-37S	39S-37S	39S-37S	37S-40S	37S-40S	37S-40S
Station (m)	0.0	0.2	0.4	0.0	0.9	1.8	0.0	4.2	8.4	0.0	0.5	0.9	0.0	0.8	1.7	0.0	1.1	2.2
Node Label at Station	28N	---	52N	52N	---	17N	17N	---	15N	21S	---	39S	39S	---	37S	37S	---	40S
Section #	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11
Element Group	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	4799.8	4799.8	4799.8	4788.6	4788.6	4788.6	3692.0	3692.0	3692.0	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3	4631.3

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	25397	25397	25397	25397	25397	25397	21387	21387	21387	25397	25397	25397	25397	25397	25397	25397	25397	25397
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5067	5067	5067	5067	5067	5067	4267	4267	4267	5067	5067	5067	5067	5067	5067	5067	5067	5067
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333
$A_{n(corrosion)}$ (mm^2)	19317	19317	19317	19317	19317	19317	16267	16267	16267	19317	19317	19317	19317	19317	19317	19317	19317	19317
$T_{r(b)}$ (kN)	6490	6490	6490	6490	6490	6490	5466	5466	5466	6490	6490	6490	6490	6490	6490	6490	6490	6490
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	19317	19317	19317	19317	19317	19317	16267	16267	16267	19317	19317	19317	19317	19317	19317	19317	19317	19317
$T_{r(c)}$ (kN)	6490	6490	6490	6490	6490	6490	5466	5466	5466	6490	6490	6490	6490	6490	6490	6490	6490	6490
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	266	266	266	267	267	267	268	268	268	590	590	590	591	591	591	592	592	592
Member Label	28N-52N	28N-52N	28N-52N	52N-17N	52N-17N	52N-17N	17N-15N	17N-15N	17N-15N	21S-39S	21S-39S	21S-39S	39S-37S	39S-37S	39S-37S	37S-40S	37S-40S	37S-40S
Station (m)	0.0	0.2	0.4	0.0	0.9	1.8	0.0	4.2	8.4	0.0	0.5	0.9	0.0	0.8	1.7	0.0	1.1	2.2
Node Label at Station	28N	---	52N	52N	---	17N	17N	---	15N	21S	---	39S	39S	---	37S	37S	---	40S
Section #	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11
Element Group	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	6490	6490	6490	6490	6490	6490	5466	5466	5466	6490	6490	6490	6490	6490	6490	6490	6490	6490
$(kL/r)_{max}$	2	2	2	9	9	9	43	43	43	32	32	32	32	32	32	32	32	32
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5067	5067	5067	5067	5067	5067	4267	4267	4267	5067	5067	5067	5067	5067	5067	5067	5067	5067
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	644	644	644	644	644	644	542	542	542	644	644	644	644	644	644	644	644	644
$M_{ry(Laterally\ Supported)}$ (kNm)	788	788	788	788	788	788	663	663	663	788	788	788	788	788	788	788	788	788
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	444	444	444	1781	1781	1781	8430	8430	8430	6206	6206	6206	6206	6206	6206	6206	6206	6206
L_{uy} (mm)	444	444	444	1781	1781	1781	8430	8430	8430	918	918	918	1675	1675	1675	2236	2236	2236
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	48177	48177	48177	11998	11998	11998	2535	2535	2535	3444	3444	3444	3444	3444	3444	3444	3444	3444
M_{rx} (kNm)	643.6	643.6	643.6	643.6	643.6	643.6	542.0	542.0	542.0	643.6	643.6	643.6	643.6	643.6	643.6	643.6	643.6	643.6
M_{ry} (kNm)	901.4	901.4	901.4	887.6	887.6	887.6	689.4	689.4	689.4	841.7	841.7	841.7	841.7	841.7	841.7	841.7	841.7	841.7

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
$(V_f/V_r)<=1$																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.519	0.519	0.519	0.468	0.468	0.469	0.676	0.678	0.680	0.426	0.427	0.427	0.424	0.424	0.425	0.421	0.421	0.421
$(T_f/T_r)<=1$	0.018	0.018	0.018	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.018	0.018	0.018	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fx}/M_{rx}<=1$	0.168	0.263	0.359	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fy}/M_{ry}<=1$	0.284	0.193	0.589	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r<=1$	0.470	0.473	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_f/M_r-T_fS/M_rA<=1$	0.419	0.422	0.915	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	266	266	266	267	267	267	268	268	268	590	590	590	591	591	591	592	592	592
Member Label	28N-52N	28N-52N	28N-52N	52N-17N	52N-17N	52N-17N	17N-15N	17N-15N	17N-15N	21S-39S	21S-39S	21S-39S	39S-37S	39S-37S	39S-37S	37S-40S	37S-40S	37S-40S
Station (m)	0.0	0.2	0.4	0.0	0.9	1.8	0.0	4.2	8.4	0.0	0.5	0.9	0.0	0.8	1.7	0.0	1.1	2.2
Node Label at Station	28N	---	52N	52N	---	17N	17N	---	15N	21S	---	39S	39S	---	37S	37S	---	40S
Section #	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11
Element Group	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	4800	4800	4800	4800	4800	4800	4042	4042	4042	4800	4800	4800	4800	4800	4800	4800	4800	4800
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.04E+07	1.04E+07	1.04E+07	6.44E+05	6.44E+05	6.44E+05	2.87E+04	2.87E+04	2.87E+04	5.31E+04	5.31E+04	5.31E+04	5.31E+04	5.31E+04	5.31E+04	5.31E+04	5.31E+04	5.31E+04
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.10	1.10	1.10	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	13112165	13112165	13112165	813191	813191	813191	36298	36298	36298	3059815	3059815	3059815	919913	919913	919913	516117	516117	516117
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.07	1.07	1.07	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.519**	**0.519**	**0.519**	**0.467**	**0.467**	**0.467**	**0.617**	**0.619**	**0.621**	**0.411**	**0.412**	**0.412**	**0.409**	**0.409**	**0.410**	**0.406**	**0.406**	**0.407**
$U_{1x}M_{fx}/M_{rx}$	**0.168**	**0.263**	**0.359**	**0.858**	**0.309**	**0.254**	**0.255**	**0.115**	**0.247**	**0.000**	**0.018**	**0.034**	**0.034**	**0.053**	**0.073**	**0.066**	**0.089**	**0.116**
$U_{1y}M_{fy}/M_{ry}$	**0.325**	**0.221**	**0.674**	**0.382**	**0.323**	**0.314**	**0.403**	**0.042**	**0.523**	**0.165**	**0.147**	**0.136**	**0.136**	**0.098**	**0.066**	**0.068**	**0.057**	**0.140**
Interaction	**1.012**	**1.003**	**1.552**	**1.706**	**1.099**	**1.036**	**1.275**	**0.777**	**1.391**	**0.577**	**0.577**	**0.582**	**0.579**	**0.561**	**0.549**	**0.539**	**0.552**	**0.663**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.023	0.023	0.023	0.093	0.093	0.093	0.441	0.441	0.441	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325
$C_{r\ (K=1)}$ (kN)	4800	4800	4800	4794	4794	4794	3735	3735	3735	4631	4631	4631	4631	4631	4631	4631	4631	4631
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.10	1.10	1.10	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.07	1.07	1.07	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.519**	**0.519**	**0.519**	**0.467**	**0.468**	**0.468**	**0.668**	**0.670**	**0.673**	**0.426**	**0.427**	**0.427**	**0.424**	**0.424**	**0.425**	**0.421**	**0.421**	**0.421**
$U_{1x}M_{fx}/M_{rx}$	**0.168**	**0.263**	**0.359**	**0.858**	**0.309**	**0.254**	**0.255**	**0.115**	**0.247**	**0.000**	**0.018**	**0.034**	**0.034**	**0.053**	**0.073**	**0.066**	**0.089**	**0.116**
$U_{1y}M_{fy}/M_{ry}$	**0.325**	**0.221**	**0.674**	**0.382**	**0.323**	**0.314**	**0.403**	**0.042**	**0.523**	**0.165**	**0.147**	**0.136**	**0.136**	**0.098**	**0.066**	**0.068**	**0.057**	**0.140**
Interaction	**1.012**	**1.003**	**1.552**	**1.707**	**1.100**	**1.037**	**1.326**	**0.828**	**1.442**	**0.592**	**0.592**	**0.597**	**0.594**	**0.575**	**0.563**	**0.554**	**0.567**	**0.678**

3.3. Lateral Torsional Buckling:

λ_{max}	0.023	0.023	0.023	0.093	0.093	0.093	0.441	0.441	0.441	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325
C_r (kN)	4800	4800	4800	4794	4794	4794	3735	3735	3735	4631	4631	4631	4631	4631	4631	4631	4631	4631
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.10	1.10	1.10	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.07	1.07	1.07	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	644	644	644	644	644	644	542	542	542	644	644	644	644	644	644	644	644	644
M_{ry} (kNm)	901	901	901	888	888	888	689	689	689	842	842	842	842	842	842	842	842	842
C_f/C_r	**0.519**	**0.519**	**0.519**	**0.467**	**0.468**	**0.468**	**0.668**	**0.670**	**0.673**	**0.426**	**0.427**	**0.427**	**0.424**	**0.424**	**0.425**	**0.421**	**0.421**	**0.421**
$U_{1x}M_{fx}/M_{rx}$	**0.168**	**0.263**	**0.359**	**0.858**	**0.309**	**0.254**	**0.255**	**0.115**	**0.247**	**0.000**	**0.018**	**0.034**	**0.034**	**0.053**	**0.073**	**0.066**	**0.089**	**0.116**
$U_{1y}M_{fy}/M_{ry}$	**0.284**	**0.193**	**0.589**	**0.339**	**0.287**	**0.279**	**0.388**	**0.041**	**0.503**	**0.155**	**0.138**	**0.127**	**0.127**	**0.092**	**0.062**	**0.063**	**0.054**	**0.131**
Interaction	**0.971**	**0.975**	**1.468**	**1.664**	**1.064**	**1.001**	**1.311**	**0.826**	**1.423**	**0.581**	**0.582**	**0.588**	**0.585**	**0.569**	**0.559**	**0.550**	**0.563**	**0.669**
Demand/Capacity ≤ 1	**NOT OK**	**NOT OK**	**NOT OK**	**NOT OK**	**NOT OK**	**NOT OK**	**NOT OK**	**OK**	**NOT OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
Highest Ratio	**1.012**	**1.003**	**1.552**	**1.707**	**1.100**	**1.037**	**1.326**	**0.828**	**1.442**	**0.592**	**0.592**	**0.597**	**0.594**	**0.575**	**0.563**	**0.554**	**0.567**	**0.678**

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	593	593	593	594	594	594	595	595	595	596	596	596	253	253	253	254	254	254
Member Label	40S-28S	40S-28S	40S-28S	28S-52S	28S-52S	28S-52S	52S-17S	52S-17S	52S-17S	17S-15S	17S-15S	17S-15S	15N-18N	15N-18N	15N-18N	18N-19N	18N-19N	18N-19N
Station (m)	0.0	0.7	1.4	0.0	0.2	0.4	0.0	0.9	1.8	0.0	4.2	8.4	0.0	3.2	6.4	0.0	3.2	6.4
Node Label at Station	40S	---	28S	28S	---	52S	52S	---	17S	17S	---	15S	15N	---	18N	18N	---	19N
Section #	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 12	Section 12	Section 12	Section 12	Section 12	Section 12
Element Group	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont

Member Factored Load Effects:

C_f (kN)	2004	2005	2007	2653	2653	2653	2367	2369	2370	2637	2645	2653	140	140	140	140	140	140
$M_{fx\ (comp)}$ (kNm)	72	88	105	106	172	239	560	197	174	138	55	122	18	3	10	5	2	11
$M_{fy\ (comp)}$ (kNm)	112	181	261	261	180	551	310	263	249	253	29	326	12	8	18	18	19	15
T_f (kN)	0	0	0	152	151	151	0	0	0	0	0	0	173	173	173	175	175	175
$M_{fx\ (tension)}$ (kNm)	0	0	0	106	172	239	0	0	0	0	0	0	18	3	10	5	2	11
$M_{fy\ (tension)}$ (kNm)	0	0	0	261	180	551	0	0	0	0	0	0	12	8	18	18	19	15
V_{fx} (kN)	117	117	117	1772	1772	1772	128	128	128	61	68	74	6	5	3	2	1	3
V_{fy} (kN)	24	25	27	301	301	302	408	410	412	30	25	34	7	4	3	3	2	5

Gross Section Properties:

Ag (mm^2)	26734	26734	26734	26734	26734	26734	26734	26734	26734	26734	26734	26734	7547	7547	7547	7547	7547	7547
I_x (mm^4)	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	1.04E+09	6.55E+07	6.55E+07	6.55E+07	6.55E+07	6.55E+07	6.55E+07
I_y (mm^4)	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	1.31E+09	2.22E+08	2.22E+08	2.22E+08	2.22E+08	2.22E+08	2.22E+08
J (mm^4)	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.90E+06	2.60E+05	2.60E+05	2.60E+05	2.60E+05	2.60E+05	2.60E+05
r_x (mm)	197	197	197	197	197	197	197	197	197	197	197	197	93	93	93	93	93	93
r_y (mm)	221	221	221	221	221	221	221	221	221	221	221	221	171	171	171	171	171	171
S_x (mm^3)	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	3.40E+06	5.16E+05	5.16E+05	5.16E+05	5.16E+05	5.16E+05	5.16E+05
S_y (mm^3)	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	4.16E+06	1.18E+06	1.18E+06	1.18E+06	1.18E+06	1.18E+06	1.18E+06
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	20	20	20	20	20	20	20	20	20
L (mm)	1377	1377	1377	444	444	444	1781	1781	1781	8430	8430	8430	6401	6401	6401	6401	6401	6401

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	593	593	593	594	594	594	595	595	595	596	596	596	253	253	253	254	254	254
Member Label	40S-28S	40S-28S	40S-28S	28S-52S	28S-52S	28S-52S	52S-17S	52S-17S	52S-17S	17S-15S	17S-15S	17S-15S	15N-18N	15N-18N	15N-18N	18N-19N	18N-19N	18N-19N
Station (m)	0.0	0.7	1.4	0.0	0.2	0.4	0.0	0.9	1.8	0.0	4.2	8.4	0.0	3.2	6.4	0.0	3.2	6.4
Node Label at Station	40S	---	28S	28S	---	52S	52S	---	17S	17S	---	15S	15N	---	18N	18N	---	19N
Section #	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 12	Section 12	Section 12	Section 12	Section 12	Section 12
Element Group	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7						
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels													6.3	6.3	6.3	6.3	6.3	6.3
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	26.4	26.4	26.4	26.4	26.4	26.4
Webs in flexural compression	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	26.4	26.4	26.4	26.4	26.4	26.4
Webs in combined flexural and axial compression	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	26.4	26.4	26.4	26.4	26.4	26.4
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	593	593	593	594	594	594	595	595	595	596	596	596	253	253	253	254	254	254
Member Label	40S-28S	40S-28S	40S-28S	28S-52S	28S-52S	28S-52S	52S-17S	52S-17S	52S-17S	17S-15S	17S-15S	17S-15S	15N-18N	15N-18N	15N-18N	18N-19N	18N-19N	18N-19N
Station (m)	0.0	0.7	1.4	0.0	0.2	0.4	0.0	0.9	1.8	0.0	4.2	8.4	0.0	3.2	6.4	0.0	3.2	6.4
Node Label at Station	40S	---	28S	28S	---	52S	52S	---	17S	17S	---	15S	15N	---	18N	18N	---	19N
Section #	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 12	Section 12	Section 12	Section 12	Section 12	Section 12
Element Group	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	6206	6206	6206	444	444	444	1781	1781	1781	8430	8430	8430	6401	6401	6401	6401	6401	6401
L_y (mm)	1377	1377	1377	444	444	444	1781	1781	1781	8430	8430	8430	12802	12802	12802	12802	12802	12802
λ_{max}	0.325	0.325	0.325	0.023	0.023	0.023	0.093	0.093	0.093	0.441	0.441	0.441	0.772	0.772	0.772	0.772	0.772	0.772
C_r (kN)	4631.3	4631.3	4631.3	4799.9	4799.9	4799.9	4793.9	4793.9	4793.9	3735.0	3735.0	3735.0	843.1	843.1	843.1	843.1	843.1	843.1
$(kL/r)_{max}$	31.5	31.5	31.5	2.3	2.3	2.3	9.0	9.0	9.0	42.8	42.8	42.8	74.9	74.9	74.9	74.9	74.9	74.9
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	53055	53055	53055	10384804	10384804	10384804	644046	644046	644046	28748	28748	28748	2670	2670	2670	2670	2670	2670

Shear Flexibility Factor:

1. Lacing:

a (mm)	609	609	609	609	609	609	609	609	609	609	609	609	352	352	352	352	352	352
b (mm)	527	527	527	527	527	527	527	527	527	527	527	527	305	305	305	305	305	305
ε_aa (mm)	609	609	609	609	609	609	609	609	609	609	609	609	352	352	352	352	352	352
ε_bb (mm)	527	527	527	527	527	527	527	527	527	527	527	527	305	305	305	305	305	305
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	1239	1239	1239	399	399	399	1603	1603	1603	7587	7587	7587	5761	5761	5761	5761	5761	5761
A_c (mm^2)	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	3774	3774	3774	3774	3774	3774
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	544	544	544	544	544	544
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	544	544	544	544	544	544
μ	5.2705	5.2705	5.2705	50.8047	50.8047	50.8047	3.1508	3.1508	3.1508	0.1406	0.1406	0.1406	0.0384	0.0384	0.0384	0.0384	0.0384	0.0384
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.71	0.71	0.71	0.89	0.89	0.89	0.89	0.89	0.89
k'(sqrt(P_e/P_{cr}))	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.184	1.184	1.184	1.062	1.062	1.062	1.062	1.062	1.062
λ_v	0.091	0.091	0.091	0.029	0.029	0.029	0.118	0.118	0.118	0.466	0.466	0.466	0.820	0.820	0.820	0.820	0.820	0.820
Cr' (kN)	4794.3	4794.3	4794.3	4799.8	4799.8	4799.8	4788.6	4788.6	4788.6	3692.0	3692.0	3692.0	808.2	808.2	808.2	808.2	808.2	808.2
Lacing Governs?	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Member ID in CSiBridge	593	593	593	594	594	594	595	595	595	596	596	596	253	253	253	254	254	254
Member Label	40S-28S	40S-28S	40S-28S	28S-52S	28S-52S	28S-52S	52S-17S	52S-17S	52S-17S	17S-15S	17S-15S	17S-15S	15N-18N	15N-18N	15N-18N	18N-19N	18N-19N	18N-19N
Station (m)	0.0	0.7	1.4	0.0	0.2	0.4	0.0	0.9	1.8	0.0	4.2	8.4	0.0	3.2	6.4	0.0	3.2	6.4
Node Label at Station	40S	---	28S	28S	---	52S	52S	---	17S	17S	---	15S	15N	---	18N	18N	---	19N
Section #	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 12	Section 12	Section 12	Section 12	Section 12	Section 12
Element Group	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	13367	3774	3774	3774	3774	3774	3774
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	4631.3	4631.3	4631.3	4799.8	4799.8	4799.8	4788.6	4788.6	4788.6	3692.0	3692.0	3692.0	808.2	808.2	808.2	808.2	808.2	808.2

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	25397	25397	25397	25397	25397	25397	25397	25397	25397	21387	21387	21387	6038	6038	6038	6038	6038	6038
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5067	5067	5067	5067	5067	5067	5067	5067	5067	4267	4267	4267	1205	1205	1205	1205	1205	1205
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	4636	4636	4636	4636	4636	4636
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	20333	4636	4636	4636	4636	4636	4636
$A_{n(corrosion)}$ (mm^2)	19317	19317	19317	19317	19317	19317	19317	19317	19317	16267	16267	16267	3708	3708	3708	3708	3708	3708
$T_{r(b)}$ (kN)	6490	6490	6490	6490	6490	6490	6490	6490	6490	5466	5466	5466	1246	1246	1246	1246	1246	1246
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	19317	19317	19317	19317	19317	19317	19317	19317	19317	16267	16267	16267	3708	3708	3708	3708	3708	3708
$T_{r(c)}$ (kN)	6490	6490	6490	6490	6490	6490	6490	6490	6490	5466	5466	5466	1246	1246	1246	1246	1246	1246
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	593	593	593	594	594	594	595	595	595	596	596	596	253	253	253	254	254	254
Member Label	40S-28S	40S-28S	40S-28S	28S-52S	28S-52S	28S-52S	52S-17S	52S-17S	52S-17S	17S-15S	17S-15S	17S-15S	15N-18N	15N-18N	15N-18N	18N-19N	18N-19N	18N-19N
Station (m)	0.0	0.7	1.4	0.0	0.2	0.4	0.0	0.9	1.8	0.0	4.2	8.4	0.0	3.2	6.4	0.0	3.2	6.4
Node Label at Station	40S	---	28S	28S	---	52S	52S	---	17S	17S	---	15S	15N	---	18N	18N	---	19N
Section #	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 12	Section 12	Section 12	Section 12	Section 12	Section 12
Element Group	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	6490	6490	6490	6490	6490	6490	6490	6490	6490	5466	5466	5466	1246	1246	1246	1246	1246	1246
$(kL/r)_{max}$	32	32	32	2	2	2	9	9	9	43	43	43	75	75	75	75	75	75
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5067	5067	5067	5067	5067	5067	5067	5067	5067	4267	4267	4267	1205	1205	1205	1205	1205	1205
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	644	644	644	644	644	644	644	644	644	542	542	542	82	82	82	82	82	82
$M_{ry(Laterally\ Supported)}$ (kNm)	788	788	788	788	788	788	788	788	788	663	663	663	189	189	189	189	189	189
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.70	1.70	1.70	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	6206	6206	6206	444	444	444	1781	1781	1781	8430	8430	8430	6401	6401	6401	6401	6401	6401
L_{uy} (mm)	1377	1377	1377	444	444	444	1781	1781	1781	8430	8430	8430	12802	12802	12802	12802	12802	12802
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	3444	3444	3444	48177	48177	48177	20396	20396	20396	2535	2535	2535	252	252	252	252	252	252
M_{rx} (kNm)	643.6	643.6	643.6	643.6	643.6	643.6	643.6	643.6	643.6	542.0	542.0	542.0	82.3	82.3	82.3	82.3	82.3	82.3
M_{ry} (kNm)	841.7	841.7	841.7	901.4	901.4	901.4	895.2	895.2	895.2	689.4	689.4	689.4	157.1	157.1	157.1	157.1	157.1	157.1

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
$(V_f/V_r)<=1$																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.433	0.433	0.433	0.553	0.553	0.553	0.494	0.495	0.495	0.714	0.716	0.719	0.173	0.173	0.173	0.173	0.173	0.173
$(T_f/T_r)<=1$	0.000	0.000	0.000	0.030	0.030	0.030	0.000	0.000	0.000	0.000	0.000	0.000	0.144	0.144	0.144	0.145	0.145	0.145

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.000	0.000	0.000	0.030	0.030	0.030	0.000	0.000	0.000	0.000	0.000	0.000	0.144	0.144	0.144	0.145	0.145	0.145
$M_{fx}/M_{rx}<=1$	0.000	0.000	0.000	0.165	0.267	0.371	0.000	0.000	0.000	0.000	0.000	0.000	0.219	0.036	0.121	0.061	0.024	0.134
$M_{fy}/M_{ry}<=1$	0.000	0.000	0.000	0.290	0.200	0.611	0.000	0.000	0.000	0.000	0.000	0.000	0.076	0.051	0.115	0.115	0.121	0.095
$T_f/T_r+M_f/M_r<=1$	0.000	0.000	0.000	0.484	0.497	1.012	0.000	0.000	0.000	0.000	0.000	0.000	0.439	0.231	0.380	0.321	0.290	0.374
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.000	0.000	0.398	0.411	0.927	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	593	593	593	594	594	594	595	595	595	596	596	596	253	253	253	254	254	254
Member Label	40S-28S	40S-28S	40S-28S	28S-52S	28S-52S	28S-52S	52S-17S	52S-17S	52S-17S	17S-15S	17S-15S	17S-15S	15N-18N	15N-18N	15N-18N	18N-19N	18N-19N	18N-19N
Station (m)	0.0	0.7	1.4	0.0	0.2	0.4	0.0	0.9	1.8	0.0	4.2	8.4	0.0	3.2	6.4	0.0	3.2	6.4
Node Label at Station	40S	---	28S	28S	---	52S	52S	---	17S	17S	---	15S	15N	---	18N	18N	---	19N
Section #	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 11	Section 12	Section 12	Section 12	Section 12	Section 12	Section 12
Element Group	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	13 TowerT Diagonal	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	4800	4800	4800	4800	4800	4800	4800	4800	4800	4042	4042	4042	1141	1141	1141	1141	1141	1141
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	5.31E+04	5.31E+04	5.31E+04	1.04E+07	1.04E+07	1.04E+07	6.44E+05	6.44E+05	6.44E+05	2.87E+04	2.87E+04	2.87E+04	3.16E+03	3.16E+03	3.16E+03	3.16E+03	3.16E+03	3.16E+03
U_{1x}	1.04	1.04	1.04	1.00	1.00	1.00	1.00	1.00	1.00	1.10	1.10	1.10	1.05	1.05	1.05	1.05	1.05	1.05
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	1360263	1360263	1360263	13112165	13112165	13112165	813191	813191	813191	36298	36298	36298	2670	2670	2670	2670	2670	2670
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.08	1.08	1.08	1.06	1.06	1.06	1.06	1.06	1.06
C_f/C_r	**0.417**	**0.418**	**0.418**	**0.553**	**0.553**	**0.553**	**0.493**	**0.494**	**0.494**	**0.652**	**0.654**	**0.656**	**0.123**	**0.123**	**0.123**	**0.123**	**0.123**	**0.123**
$U_{1x}M_{fx}/M_{rx}$	**0.116**	**0.142**	**0.170**	**0.165**	**0.267**	**0.371**	**0.873**	**0.307**	**0.271**	**0.280**	**0.112**	**0.248**	**0.229**	**0.038**	**0.127**	**0.064**	**0.025**	**0.140**
$U_{1y}M_{fy}/M_{ry}$	**0.142**	**0.230**	**0.332**	**0.331**	**0.229**	**0.700**	**0.395**	**0.335**	**0.317**	**0.411**	**0.047**	**0.530**	**0.067**	**0.045**	**0.101**	**0.101**	**0.106**	**0.084**
Interaction	**0.676**	**0.790**	**0.919**	**1.049**	**1.049**	**1.624**	**1.761**	**1.136**	**1.082**	**1.344**	**0.813**	**1.434**	**0.419**	**0.206**	**0.350**	**0.287**	**0.254**	**0.346**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.325	0.325	0.325	0.023	0.023	0.023	0.093	0.093	0.093	0.441	0.441	0.441	0.772	0.772	0.772	0.772	0.772	0.772
$C_{r\ (K=1)}$ (kN)	4631	4631	4631	4800	4800	4800	4794	4794	4794	3735	3735	3735	843	843	843	843	843	843
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.04	1.04	1.04	1.00	1.00	1.00	1.00	1.00	1.00	1.10	1.10	1.10	1.05	1.05	1.05	1.05	1.05	1.05
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.08	1.08	1.08	1.06	1.06	1.06	1.06	1.06	1.06
C_f/C_r	**0.433**	**0.433**	**0.433**	**0.553**	**0.553**	**0.553**	**0.494**	**0.494**	**0.494**	**0.706**	**0.708**	**0.710**	**0.166**	**0.166**	**0.166**	**0.166**	**0.166**	**0.166**
$U_{1x}M_{fx}/M_{rx}$	**0.116**	**0.142**	**0.170**	**0.165**	**0.267**	**0.371**	**0.873**	**0.307**	**0.271**	**0.280**	**0.112**	**0.248**	**0.229**	**0.038**	**0.127**	**0.064**	**0.025**	**0.140**
$U_{1y}M_{fy}/M_{ry}$	**0.142**	**0.230**	**0.332**	**0.331**	**0.229**	**0.700**	**0.395**	**0.335**	**0.317**	**0.411**	**0.047**	**0.530**	**0.067**	**0.045**	**0.101**	**0.101**	**0.106**	**0.084**
Interaction	**0.691**	**0.805**	**0.935**	**1.049**	**1.049**	**1.624**	**1.762**	**1.136**	**1.083**	**1.398**	**0.867**	**1.488**	**0.462**	**0.249**	**0.394**	**0.330**	**0.298**	**0.390**

3.3. Lateral Torsional Buckling:

λ_{max}	0.325	0.325	0.325	0.023	0.023	0.023	0.093	0.093	0.093	0.441	0.441	0.441	0.772	0.772	0.772	0.772	0.772	0.772
C_r (kN)	4631	4631	4631	4800	4800	4800	4794	4794	4794	3735	3735	3735	843	843	843	843	843	843
U_{1x}	1.04	1.04	1.04	1.00	1.00	1.00	1.00	1.00	1.00	1.10	1.10	1.10	1.05	1.05	1.05	1.05	1.05	1.05
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.08	1.08	1.08	1.06	1.06	1.06	1.06	1.06	1.06
M_{rx} (kNm)	644	644	644	644	644	644	644	644	644	542	542	542	82	82	82	82	82	82
M_{ry} (kNm)	842	842	842	901	901	901	895	895	895	689	689	689	157	157	157	157	157	157
C_f/C_r	**0.433**	**0.433**	**0.433**	**0.553**	**0.553**	**0.553**	**0.494**	**0.494**	**0.494**	**0.706**	**0.708**	**0.710**	**0.166**	**0.166**	**0.166**	**0.166**	**0.166**	**0.166**
$U_{1x}M_{fx}/M_{rx}$	**0.116**	**0.142**	**0.170**	**0.165**	**0.267**	**0.371**	**0.873**	**0.307**	**0.271**	**0.280**	**0.112**	**0.248**	**0.229**	**0.038**	**0.127**	**0.064**	**0.025**	**0.140**
$U_{1y}M_{fy}/M_{ry}$	**0.133**	**0.215**	**0.311**	**0.290**	**0.200**	**0.611**	**0.347**	**0.295**	**0.279**	**0.396**	**0.045**	**0.510**	**0.081**	**0.054**	**0.121**	**0.121**	**0.128**	**0.101**
Interaction	**0.682**	**0.790**	**0.913**	**1.007**	**1.020**	**1.536**	**1.714**	**1.096**	**1.045**	**1.382**	**0.865**	**1.468**	**0.475**	**0.258**	**0.414**	**0.350**	**0.319**	**0.407**
Demand/Capacity ≤ 1	**OK**	**OK**	**OK**	**NOT OK**	**NOT OK**	**NOT OK**	**NOT OK**	**NOT OK**	**NOT OK**	**NOT OK**	**OK**	**NOT OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
Highest Ratio	**0.691**	**0.805**	**0.935**	**1.049**	**1.049**	**1.624**	**1.762**	**1.136**	**1.083**	**1.398**	**0.867**	**1.488**	**0.475**	**0.258**	**0.414**	**0.350**	**0.319**	**0.407**

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	581	581	581	582	582	582	19	19	19	194	194	194	20	20	20	195	195	195
Member Label	15S-18S	15S-18S	15S-18S	18S-19S	18S-19S	18S-19S	18N-17N	18N-17N	18N-17N	18S-17S	18S-17S	18S-17S	17N-19N	17N-19N	17N-19N	17S-19S	17S-19S	17S-19S
Station (m)	0.0	3.2	6.4	0.0	3.2	6.4	0.0	2.7	5.5	0.0	2.7	5.5	0.0	4.2	8.4	0.0	4.2	8.4
Node Label at Station	15S	---	18S	18S	---	19S	18N	---	17N	18S	---	17S	17N	---	19N	17S	---	19S
Section #	Section 12	Section 12	Section 12	Section 12	Section 12	Section 12	Section 13	Section 13	Section 13	Section 13	Section 13	Section 13	Section 14	Section 14	Section 14	Section 14	Section 14	Section 14
Element Group	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal

Member Factored Load Effects:

C_f (kN)	144	144	144	144	144	144	2	0	0	1	0	0	865	869	872	885	888	891
$M_{fx\ (comp)}$ (kNm)	17	4	9	4	2	11	0	0	0	0	0	0	10	1	24	10	1	23
$M_{fy\ (comp)}$ (kNm)	15	9	19	19	20	15	5	0	0	5	0	0	18	7	19	18	7	19
T_f (kN)	162	162	162	164	164	164	6	9	12	6	9	12	673	670	667	697	694	691
$M_{fx\ (tension)}$ (kNm)	17	4	9	4	2	11	0	1	9	0	2	9	10	1	24	10	1	23
$M_{fy\ (tension)}$ (kNm)	15	9	19	19	20	15	5	5	15	5	5	14	18	7	19	18	7	19
V_{fx} (kN)	7	5	3	2	1	3	4	4	4	3	3	3	6	4	8	6	4	8
V_{fy} (kN)	6	4	3	3	2	5	1	2	4	1	2	4	0	4	8	0	4	8

Gross Section Properties:

Ag (mm^2)	7547	7547	7547	7547	7547	7547	9315	9315	9315	9315	9315	9315	11361	11361	11361	11361	11361	11361
I_x (mm^4)	6.55E+07	6.55E+07	6.55E+07	6.55E+07	6.55E+07	6.55E+07	2.69E+08	2.69E+08	2.69E+08	2.69E+08	2.69E+08	2.69E+08	3.28E+08	3.28E+08	3.28E+08	3.28E+08	3.28E+08	3.28E+08
I_y (mm^4)	2.22E+08	2.22E+08	2.22E+08	2.22E+08	2.22E+08	2.22E+08	6.25E+07	6.25E+07	6.25E+07	6.25E+07	6.25E+07	6.25E+07	9.07E+07	9.07E+07	9.07E+07	9.07E+07	9.07E+07	9.07E+07
J (mm^4)	2.60E+05	2.60E+05	2.60E+05	2.60E+05	2.60E+05	2.60E+05	2.80E+05	2.80E+05	2.80E+05	2.80E+05	2.80E+05	2.80E+05	4.63E+05	4.63E+05	4.63E+05	4.63E+05	4.63E+05	4.63E+05
r_x (mm)	93	93	93	93	93	93	170	170	170	170	170	170	170	170	170	170	170	170
r_y (mm)	171	171	171	171	171	171	82	82	82	82	82	82	89	89	89	89	89	89
S_x (mm^3)	5.16E+05	5.16E+05	5.16E+05	5.16E+05	5.16E+05	5.16E+05	1.44E+06	1.44E+06	1.44E+06	1.44E+06	1.44E+06	1.44E+06	1.75E+06	1.75E+06	1.75E+06	1.75E+06	1.75E+06	1.75E+06
S_y (mm^3)	1.18E+06	1.18E+06	1.18E+06	1.18E+06	1.18E+06	1.18E+06	3.68E+05	3.68E+05	3.68E+05	3.68E+05	3.68E+05	3.68E+05	4.96E+05	4.96E+05	4.96E+05	4.96E+05	4.96E+05	4.96E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
L (mm)	6401	6401	6401	6401	6401	6401	5486	5486	5486	5486	5486	5486	8430	8430	8430	8430	8430	8430

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	581	581	581	582	582	582	19	19	19	194	194	194	20	20	20	195	195	195
Member Label	15S-18S	15S-18S	15S-18S	18S-19S	18S-19S	18S-19S	18N-17N	18N-17N	18N-17N	18S-17S	18S-17S	18S-17S	17N-19N	17N-19N	17N-19N	17S-19S	17S-19S	17S-19S
Station (m)	0.0	3.2	6.4	0.0	3.2	6.4	0.0	2.7	5.5	0.0	2.7	5.5	0.0	4.2	8.4	0.0	4.2	8.4
Node Label at Station	15S	---	18S	18S	---	19S	18N	---	17N	18S	---	17S	17N	---	19N	17S	---	19S
Section #	Section 12	Section 12	Section 12	Section 12	Section 12	Section 12	Section 13	Section 13	Section 13	Section 13	Section 13	Section 13	Section 14	Section 14	Section 14	Section 14	Section 14	Section 14
Element Group	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge							16.3	16.3	16.3	16.3	16.3	16.3	16.0	16.0	16.0	16.0	16.0	16.0
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels	6.3	6.3	6.3	6.3	6.3	6.3												
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	26.4	26.4	26.4	26.4	26.4	26.4	16.3	16.3	16.3	16.3	16.3	16.3	16.0	16.0	16.0	16.0	16.0	16.0
Webs in flexural compression	26.4	26.4	26.4	26.4	26.4	26.4	16.3	16.3	16.3	16.3	16.3	16.3	16.0	16.0	16.0	16.0	16.0	16.0
Webs in combined flexural and axial compression	26.4	26.4	26.4	26.4	26.4	26.4	16.3	16.3	16.3	16.3	16.3	16.3	16.0	16.0	16.0	16.0	16.0	16.0
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	581	581	581	582	582	582	19	19	19	194	194	194	20	20	20	195	195	195
Member Label	15S-18S	15S-18S	15S-18S	18S-19S	18S-19S	18S-19S	18N-17N	18N-17N	18N-17N	18S-17S	18S-17S	18S-17S	17N-19N	17N-19N	17N-19N	17S-19S	17S-19S	17S-19S
Station (m)	0.0	3.2	6.4	0.0	3.2	6.4	0.0	2.7	5.5	0.0	2.7	5.5	0.0	4.2	8.4	0.0	4.2	8.4
Node Label at Station	15S	---	18S	18S	---	19S	18N	---	17N	18S	---	17S	17N	---	19N	17S	---	19S
Section #	Section 12	Section 12	Section 12	Section 12	Section 12	Section 12	Section 13	Section 13	Section 13	Section 13	Section 13	Section 13	Section 14	Section 14	Section 14	Section 14	Section 14	Section 14
Element Group	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	6401	6401	6401	6401	6401	6401	5486	5486	5486	5486	5486	5486	8430	8430	8430	8430	8430	8430
L_y (mm)	12802	12802	12802	12802	12802	12802	5486	5486	5486	5486	5486	5486	8430	8430	8430	8430	8430	8430
λ_{max}	0.772	0.772	0.772	0.772	0.772	0.772	0.690	0.690	0.690	0.690	0.690	0.690	0.977	0.977	0.977	0.977	0.977	0.977
C_r (kN)	843.1	843.1	843.1	843.1	843.1	843.1	1113.5	1113.5	1113.5	1113.5	1113.5	1113.5	1047.8	1047.8	1047.8	1047.8	1047.8	1047.8
$(kL/r)_{max}$	74.9	74.9	74.9	74.9	74.9	74.9	66.9	66.9	66.9	66.9	66.9	66.9	94.7	94.7	94.7	94.7	94.7	94.7
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	2670	2670	2670	2670	2670	2670	4096	4096	4096	4096	4096	4096	2518	2518	2518	2518	2518	2518

Shear Flexibility Factor:

1. Lacing:

a (mm)	352	352	352	352	352	352	330	330	330	330	330	330	330	330	330	330	330	330
b (mm)	305	305	305	305	305	305	286	286	286	286	286	286	286	286	286	286	286	286
ε_aa (mm)	352	352	352	352	352	352	330	330	330	330	330	330	330	330	330	330	330	330
ε_bb (mm)	305	305	305	305	305	305	286	286	286	286	286	286	286	286	286	286	286	286
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	5761	5761	5761	5761	5761	5761	4938	4938	4938	4938	4938	4938	7587	7587	7587	7587	7587	7587
A_c (mm^2)	3774	3774	3774	3774	3774	3774	4658	4658	4658	4658	4658	4658	5681	5681	5681	5681	5681	5681
A_d (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
A_b (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
μ	0.0384	0.0384	0.0384	0.0384	0.0384	0.0384	0.0567	0.0567	0.0567	0.0567	0.0567	0.0567	0.0293	0.0293	0.0293	0.0293	0.0293	0.0293
P_{cr}/P_e (Fig.3.51)	0.89	0.89	0.89	0.89	0.89	0.89	0.84	0.84	0.84	0.84	0.84	0.84	0.91	0.91	0.91	0.91	0.91	0.91
k'(sqrt(P_e/P_{cr}))	1.062	1.062	1.062	1.062	1.062	1.062	1.089	1.089	1.089	1.089	1.089	1.089	1.048	1.048	1.048	1.048	1.048	1.048
λ_v	0.820	0.820	0.820	0.820	0.820	0.820	0.752	0.752	0.752	0.752	0.752	0.752	1.024	1.024	1.024	1.024	1.024	1.024
Cr' (kN)	808.2	808.2	808.2	808.2	808.2	808.2	1059.1	1059.1	1059.1	1059.1	1059.1	1059.1	999.7	999.7	999.7	999.7	999.7	999.7
Lacing Governs?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes

Member ID in CSiBridge	581	581	581	582	582	582	19	19	19	194	194	194	20	20	20	195	195	195
Member Label	15S-18S	15S-18S	15S-18S	18S-19S	18S-19S	18S-19S	18N-17N	18N-17N	18N-17N	18S-17S	18S-17S	18S-17S	17N-19N	17N-19N	17N-19N	17S-19S	17S-19S	17S-19S
Station (m)	0.0	3.2	6.4	0.0	3.2	6.4	0.0	2.7	5.5	0.0	2.7	5.5	0.0	4.2	8.4	0.0	4.2	8.4
Node Label at Station	15S	---	18S	18S	---	19S	18N	---	17N	18S	---	17S	17N	---	19N	17S	---	19S
Section #	Section 12	Section 12	Section 12	Section 12	Section 12	Section 12	Section 13	Section 13	Section 13	Section 13	Section 13	Section 13	Section 14	Section 14	Section 14	Section 14	Section 14	Section 14
Element Group	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	3774	3774	3774	3774	3774	3774	4658	4658	4658	4658	4658	4658	5681	5681	5681	5681	5681	5681
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	808.2	808.2	808.2	808.2	808.2	808.2	1059.1	1113.5	1113.5	1059.1	1113.5	1113.5	999.7	999.7	999.7	999.7	999.7	999.7

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6038	6038	6038	6038	6038	6038	7452	7452	7452	7452	7452	7452	9089	9089	9089	9089	9089	9089
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1205	1205	1205	1205	1205	1205	1487	1487	1487	1487	1487	1487	1813	1813	1813	1813	1813	1813
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	4636	4636	4636	4636	4636	4636	6572	6572	6572	6572	6572	6572	8161	8161	8161	8161	8161	8161
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	4636	4636	4636	4636	4636	4636	6572	6572	6572	6572	6572	6572	8161	8161	8161	8161	8161	8161
$A_{n(corrosion)}$ (mm^2)	3708	3708	3708	3708	3708	3708	5257	5257	5257	5257	5257	5257	6528	6528	6528	6528	6528	6528
$T_{r(b)}$ (kN)	1246	1246	1246	1246	1246	1246	1766	1766	1766	1766	1766	1766	2194	2194	2194	2194	2194	2194
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	3708	3708	3708	3708	3708	3708	5257	5257	5257	5257	5257	5257	6528	6528	6528	6528	6528	6528
$T_{r(c)}$ (kN)	1246	1246	1246	1246	1246	1246	1766	1766	1766	1766	1766	1766	2194	2194	2194	2194	2194	2194
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	581	581	581	582	582	582	19	19	19	194	194	194	20	20	20	195	195	195
Member Label	15S-18S	15S-18S	15S-18S	18S-19S	18S-19S	18S-19S	18N-17N	18N-17N	18N-17N	18S-17S	18S-17S	18S-17S	17N-19N	17N-19N	17N-19N	17S-19S	17S-19S	17S-19S
Station (m)	0.0	3.2	6.4	0.0	3.2	6.4	0.0	2.7	5.5	0.0	2.7	5.5	0.0	4.2	8.4	0.0	4.2	8.4
Node Label at Station	15S	---	18S	18S	---	19S	18N	---	17N	18S	---	17S	17N	---	19N	17S	---	19S
Section #	Section 12	Section 12	Section 12	Section 12	Section 12	Section 12	Section 13	Section 13	Section 13	Section 13	Section 13	Section 13	Section 14	Section 14	Section 14	Section 14	Section 14	Section 14
Element Group	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	1246	1246	1246	1246	1246	1246	1766	1766	1766	1766	1766	1766	2194	2194	2194	2194	2194	2194
$(kL/r)_{max}$	75	75	75	75	75	75	67	67	67	67	67	67	95	95	95	95	95	95
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1205	1205	1205	1205	1205	1205	1487	1487	1487	1487	1487	1487	1813	1813	1813	1813	1813	1813
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	82	82	82	82	82	82	229	229	229	229	229	229	280	280	280	280	280	280
$M_{ry(Laterally\ Supported)}$ (kNm)	189	189	189	189	189	189	59	59	59	59	59	59	79	79	79	79	79	79
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	6401	6401	6401	6401	6401	6401	5486	5486	5486	5486	5486	5486	8430	8430	8430	8430	8430	8430
L_{uy} (mm)	12802	12802	12802	12802	12802	12802	5486	5486	5486	5486	5486	5486	8430	8430	8430	8430	8430	8430
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	297	297	297	297	297	297	299	299	299	299	299	299
M_{uy} (kNm) (x weak)	252	252	252	252	252	252	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	82.3	82.3	82.3	82.3	82.3	82.3	188.6	188.6	188.6	188.6	188.6	188.6	210.9	210.9	210.9	210.9	210.9	210.9
M_{ry} (kNm)	157.1	157.1	157.1	157.1	157.1	157.1	58.7	58.7	58.7	58.7	58.7	58.7	79.2	79.2	79.2	79.2	79.2	79.2

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
$(V_f/V_r)<=1$																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.178	0.178	0.178	0.178	0.178	0.178	0.002	0.000	0.000	0.001	0.000	0.000	0.865	0.869	0.872	0.885	0.888	0.891
$(T_f/T_r)<=1$	0.134	0.134	0.134	0.136	0.136	0.136	0.004	0.006	0.008	0.004	0.006	0.008	0.371	0.370	0.368	0.384	0.383	0.381

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.134	0.134	0.134	0.136	0.136	0.136	0.004	0.006	0.008	0.004	0.006	0.008	0.371	0.370	0.368	0.384	0.383	0.381
$M_{fx}/M_{rx}<=1$	0.206	0.049	0.109	0.049	0.024	0.134	0.000	0.005	0.048	0.000	0.011	0.048	0.047	0.005	0.114	0.047	0.005	0.109
$M_{fy}/M_{ry}<=1$	0.095	0.057	0.121	0.121	0.127	0.095	0.085	0.085	0.255	0.085	0.085	0.238	0.227	0.088	0.240	0.227	0.088	0.240
$T_f/T_r+M_f/M_r<=1$	0.436	0.240	0.365	0.306	0.288	0.365	0.089	0.097	0.311	0.089	0.102	0.294	0.646	0.463	0.721	0.659	0.476	0.730
$M_f/M_r-T_fS/M_rA<=1$	0.006	0.000	0.000	0.000	0.000	0.000	0.076	0.077	0.285	0.076	0.082	0.268	0.000	0.000	0.000	0.000	0.000	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	581	581	581	582	582	582	19	19	19	194	194	194	20	20	20	195	195	195
Member Label	15S-18S	15S-18S	15S-18S	18S-19S	18S-19S	18S-19S	18N-17N	18N-17N	18N-17N	18S-17S	18S-17S	18S-17S	17N-19N	17N-19N	17N-19N	17S-19S	17S-19S	17S-19S
Station (m)	0.0	3.2	6.4	0.0	3.2	6.4	0.0	2.7	5.5	0.0	2.7	5.5	0.0	4.2	8.4	0.0	4.2	8.4
Node Label at Station	15S	---	18S	18S	---	19S	18N	---	17N	18S	---	17S	17N	---	19N	17S	---	19S
Section #	Section 12	Section 12	Section 12	Section 12	Section 12	Section 12	Section 13	Section 13	Section 13	Section 13	Section 13	Section 13	Section 14	Section 14	Section 14	Section 14	Section 14	Section 14
Element Group	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	14 TowerT Horizont	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	15 TowerT Vertical	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal	16 TowerT Diagonal

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1141	1141	1141	1141	1141	1141	1408	1408	1408	1408	1408	1408	1718	1718	1718	1718	1718	1718
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	3.16E+03	3.16E+03	3.16E+03	3.16E+03	3.16E+03	3.16E+03	1.76E+04	1.76E+04	1.76E+04	1.76E+04	1.76E+04	1.76E+04	9.11E+03	9.11E+03	9.11E+03	9.11E+03	9.11E+03	9.11E+03
U_{1x}	1.05	1.05	1.05	1.05	1.05	1.05	1.00	1.00	1.00	1.00	1.00	1.00	1.10	1.11	1.11	1.11	1.11	1.11
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	2670	2670	2670	2670	2670	2670	4096	4096	4096	4096	4096	4096	2518	2518	2518	2518	2518	2518
U_{1y}	1.06	1.06	1.06	1.06	1.06	1.06	1.00	1.00	1.00	1.00	1.00	1.00	1.52	1.53	1.53	1.54	1.54	1.55
C_f/C_r	0.126	0.126	0.126	0.126	0.126	0.126	0.001	0.000	0.000	0.001	0.000	0.000	0.504	0.506	0.508	0.515	0.517	0.519
$U_{1x}M_{fx}/M_{rx}$	0.216	0.051	0.115	0.051	0.025	0.140	0.000	0.000	0.000	0.000	0.000	0.000	0.040	0.004	0.095	0.040	0.004	0.091
$U_{1y}M_{fy}/M_{ry}$	0.084	0.050	0.106	0.106	0.112	0.084	0.085	0.000	0.000	0.085	0.000	0.000	0.346	0.135	0.367	0.350	0.136	0.371
Interaction	0.426	0.227	0.347	0.283	0.264	0.350	0.087	0.000	0.000	0.086	0.000	0.000	0.889	0.645	0.969	0.905	0.657	0.981

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.772	0.772	0.772	0.772	0.772	0.772	0.690	0.690	0.690	0.690	0.690	0.690	0.977	0.977	0.977	0.977	0.977	0.977
$C_{r\ (K=1)}$ (kN)	843	843	843	843	843	843	1113	1113	1113	1113	1113	1113	1048	1048	1048	1048	1048	1048
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.05	1.05	1.05	1.05	1.05	1.05	1.00	1.00	1.00	1.00	1.00	1.00	1.10	1.11	1.11	1.11	1.11	1.11
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.06	1.06	1.06	1.06	1.06	1.06	1.00	1.00	1.00	1.00	1.00	1.00	1.52	1.53	1.53	1.54	1.54	1.55
C_f/C_r	0.171	0.171	0.171	0.171	0.171	0.171	0.002	0.000	0.000	0.001	0.000	0.000	0.826	0.829	0.832	0.845	0.848	0.850
$U_{1x}M_{fx}/M_{rx}$	0.216	0.051	0.115	0.051	0.025	0.140	0.000	0.000	0.000	0.000	0.000	0.000	0.040	0.004	0.095	0.040	0.004	0.091
$U_{1y}M_{fy}/M_{ry}$	0.084	0.050	0.106	0.106	0.112	0.084	0.085	0.000	0.000	0.085	0.000	0.000	0.346	0.135	0.367	0.350	0.136	0.371
Interaction	0.471	0.272	0.392	0.328	0.308	0.395	0.087	0.000	0.000	0.086	0.000	0.000	1.211	0.968	1.294	1.235	0.988	1.313

3.3. Lateral Torsional Buckling:

λ_{max}	0.772	0.772	0.772	0.772	0.772	0.772	0.690	0.690	0.690	0.690	0.690	0.690	0.977	0.977	0.977	0.977	0.977	0.977
C_r (kN)	843	843	843	843	843	843	1113	1113	1113	1113	1113	1113	1048	1048	1048	1048	1048	1048
U_{1x}	1.05	1.05	1.05	1.05	1.05	1.05	1.00	1.00	1.00	1.00	1.00	1.00	1.10	1.11	1.11	1.11	1.11	1.11
U_{1y}	1.06	1.06	1.06	1.06	1.06	1.06	1.00	1.00	1.00	1.00	1.00	1.00	1.52	1.53	1.53	1.54	1.54	1.55
M_{rx} (kNm)	82	82	82	82	82	82	189	189	189	189	189	189	211	211	211	211	211	211
M_{ry} (kNm)	157	157	157	157	157	157	59	59	59	59	59	59	79	79	79	79	79	79
C_f/C_r	0.171	0.171	0.171	0.171	0.171	0.171	0.002	0.000	0.000	0.001	0.000	0.000	0.826	0.829	0.832	0.845	0.848	0.850
$U_{1x}M_{fx}/M_{rx}$	0.216	0.051	0.115	0.051	0.025	0.140	0.000	0.000	0.000	0.000	0.000	0.000	0.052	0.005	0.126	0.053	0.005	0.121
$U_{1y}M_{fy}/M_{ry}$	0.101	0.061	0.128	0.128	0.135	0.101	0.085	0.000	0.000	0.085	0.000	0.000	0.346	0.135	0.367	0.350	0.136	0.371
Interaction	0.488	0.282	0.413	0.350	0.331	0.412	0.087	0.000	0.000	0.086	0.000	0.000	1.224	0.970	1.325	1.248	0.989	1.342
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK
Highest Ratio	0.488	0.282	0.413	0.350	0.331	0.412	0.089	0.097	0.311	0.089	0.102	0.294	1.224	0.970	1.325	1.248	0.989	1.342

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	24	24	24	25	25	25	26	26	26	199	199	199	200	200	200	201	201	201
Member Label	20N-30N	20N-30N	20N-30N	30N-29N	30N-29N	30N-29N	28N-29N	28N-29N	28N-29N	20S-30S	20S-30S	20S-30S	30S-29S	30S-29S	30S-29S	28S-29S	28S-29S	28S-29S
Station (m)	0.0	1.0	2.0	0.0	1.1	2.2	0.0	1.1	2.2	0.0	1.0	2.0	0.0	1.1	2.2	0.0	1.1	2.2
Node Label at Station	20N	---	30N	30N	---	29N	28N	---	29N	20S	---	30S	30S	---	29S	28S	---	29S
Section #	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T

Member Factored Load Effects:

C_f (kN)	292	291	291	329	329	330	307	308	308	295	295	294	338	338	339	311	311	312
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	300	301	301	304	304	303	342	342	341	309	309	309	308	307	307	351	351	350
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fy} (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Gross Section Properties:

Ag (mm^2)	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116
I_x (mm^4)	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07
I_y (mm^4)	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08
J (mm^4)	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05
r_x (mm)	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49
r_y (mm)	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175
S_x (mm^3)	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05
S_y (mm^3)	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	2048	2048	2048	2164	2164	2164	2200	2200	2200	2048	2048	2048	2164	2164	2164	2200	2200	2200

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	24	24	24	25	25	25	26	26	26	199	199	199	200	200	200	201	201	201
Member Label	20N-30N	20N-30N	20N-30N	30N-29N	30N-29N	30N-29N	28N-29N	28N-29N	28N-29N	20S-30S	20S-30S	20S-30S	30S-29S	30S-29S	30S-29S	28S-29S	28S-29S	28S-29S
Station (m)	0.0	1.0	2.0	0.0	1.1	2.2	0.0	1.1	2.2	0.0	1.0	2.0	0.0	1.1	2.2	0.0	1.1	2.2
Node Label at Station	20N	---	30N	30N	---	29N	28N	---	29N	20S	---	30S	30S	---	29S	28S	---	29S
Section #	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7
Webs in flexural compression	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7
Webs in combined flexural and axial compression	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	24	24	24	25	25	25	26	26	26	199	199	199	200	200	200	201	201	201
Member Label	20N-30N	20N-30N	20N-30N	30N-29N	30N-29N	30N-29N	28N-29N	28N-29N	28N-29N	20S-30S	20S-30S	20S-30S	30S-29S	30S-29S	30S-29S	28S-29S	28S-29S	28S-29S
Station (m)	0.0	1.0	2.0	0.0	1.1	2.2	0.0	1.1	2.2	0.0	1.0	2.0	0.0	1.1	2.2	0.0	1.1	2.2
Node Label at Station	20N	---	30N	30N	---	29N	28N	---	29N	20S	---	30S	30S	---	29S	28S	---	29S
Section #	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	2048	2048	2048	2164	2164	2164	2200	2200	2200	2048	2048	2048	2164	2164	2164	2200	2200	2200
L_y (mm)	2048	2048	2048	2164	2164	2164	2200	2200	2200	2048	2048	2048	2164	2164	2164	2200	2200	2200
λ_{max}	0.431	0.431	0.431	0.455	0.455	0.455	0.463	0.463	0.463	0.431	0.431	0.431	0.455	0.455	0.455	0.463	0.463	0.463
C_r (kN)	852.7	852.7	852.7	843.2	843.2	843.2	840.2	840.2	840.2	852.7	852.7	852.7	843.2	843.2	843.2	840.2	840.2	840.2
$(kL/r)_{max}$	41.8	41.8	41.8	44.2	44.2	44.2	44.9	44.9	44.9	41.8	41.8	41.8	44.2	44.2	44.2	44.9	44.9	44.9
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	5785	5785	5785	5180	5180	5180	5012	5012	5012	5785	5785	5785	5180	5180	5180	5012	5012	5012

Shear Flexibility Factor:

1. Lacing:

a (mm)	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344
b (mm)	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298
ε_aa (mm)	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344
ε_bb (mm)	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	1843	1843	1843	1947	1947	1947	1980	1980	1980	1843	1843	1843	1947	1947	1947	1980	1980	1980
A_c (mm^2)	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558
A_d (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
A_b (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
μ	0.2432	0.2432	0.2432	0.2178	0.2178	0.2178	0.2107	0.2107	0.2107	0.2432	0.2432	0.2432	0.2178	0.2178	0.2178	0.2107	0.2107	0.2107
P_{cr}/P_e (Fig.3.51)	0.64	0.64	0.64	0.65	0.65	0.65	0.66	0.66	0.66	0.64	0.64	0.64	0.65	0.65	0.65	0.66	0.66	0.66
k'(sqrt(P_e/P_{cr}))	1.250	1.250	1.250	1.236	1.236	1.236	1.232	1.232	1.232	1.250	1.250	1.250	1.236	1.236	1.236	1.232	1.232	1.232
λ_v	0.151	0.151	0.151	0.158	0.158	0.158	0.160	0.160	0.160	0.151	0.151	0.151	0.158	0.158	0.158	0.160	0.160	0.160
Cr' (kN)	914.3	914.3	914.3	913.8	913.8	913.8	913.6	913.6	913.6	914.3	914.3	914.3	913.8	913.8	913.8	913.6	913.6	913.6
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	24	24	24	25	25	25	26	26	26	199	199	199	200	200	200	201	201	201
Member Label	20N-30N	20N-30N	20N-30N	30N-29N	30N-29N	30N-29N	28N-29N	28N-29N	28N-29N	20S-30S	20S-30S	20S-30S	30S-29S	30S-29S	30S-29S	28S-29S	28S-29S	28S-29S
Station (m)	0.0	1.0	2.0	0.0	1.1	2.2	0.0	1.1	2.2	0.0	1.0	2.0	0.0	1.1	2.2	0.0	1.1	2.2
Node Label at Station	20N	---	30N	30N	---	29N	28N	---	29N	20S	---	30S	30S	---	29S	28S	---	29S
Section #	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	852.7	852.7	852.7	843.2	843.2	843.2	840.2	840.2	840.2	852.7	852.7	852.7	843.2	843.2	843.2	840.2	840.2	840.2

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516
$A_{n(corrosion)}$ (mm^2)	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340
$T_{r(b)}$ (kN)	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340
$T_{r(c)}$ (kN)	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	24	24	24	25	25	25	26	26	26	199	199	199	200	200	200	201	201	201
Member Label	20N-30N	20N-30N	20N-30N	30N-29N	30N-29N	30N-29N	28N-29N	28N-29N	28N-29N	20S-30S	20S-30S	20S-30S	30S-29S	30S-29S	30S-29S	28S-29S	28S-29S	28S-29S
Station (m)	0.0	1.0	2.0	0.0	1.1	2.2	0.0	1.1	2.2	0.0	1.0	2.0	0.0	1.1	2.2	0.0	1.1	2.2
Node Label at Station	20N	---	30N	30N	---	29N	28N	---	29N	20S	---	30S	30S	---	29S	28S	---	29S
Section #	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122
$(kL/r)_{max}$	42	42	42	44	44	44	45	45	45	42	42	42	44	44	44	45	45	45
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23
$M_{ry(Laterally\ Supported)}$ (kNm)	153	153	153	153	153	153	153	153	153	153	153	153	153	153	153	153	153	153
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	2048	2048	2048	2164	2164	2164	2200	2200	2200	2048	2048	2048	2164	2164	2164	2200	2200	2200
L_{uy} (mm)	2048	2048	2048	2164	2164	2164	2200	2200	2200	2048	2048	2048	2164	2164	2164	2200	2200	2200
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	304	304	304	288	288	288	283	283	283	304	304	304	288	288	288	283	283	283
M_{rx} (kNm)	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3
M_{ry} (kNm)	148.5	148.5	148.5	146.9	146.9	146.9	146.4	146.4	146.4	148.5	148.5	148.5	146.9	146.9	146.9	146.4	146.4	146.4

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
$(V_f/V_r)<=1$																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.342	0.341	0.341	0.390	0.390	0.391	0.365	0.367	0.367	0.346	0.346	0.345	0.401	0.401	0.402	0.370	0.370	0.371
$(T_f/T_r)<=1$	0.309	0.310	0.310	0.314	0.314	0.312	0.353	0.353	0.352	0.319	0.319	0.319	0.318	0.317	0.317	0.362	0.362	0.361

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.309	0.310	0.310	0.314	0.314	0.312	0.353	0.353	0.352	0.319	0.319	0.319	0.318	0.317	0.317	0.362	0.362	0.361
$M_{fx}/M_{rx}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fy}/M_{ry}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r<=1$	0.309	0.310	0.310	0.314	0.314	0.312	0.353	0.353	0.352	0.319	0.319	0.319	0.318	0.317	0.317	0.362	0.362	0.361
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	24	24	24	25	25	25	26	26	26	199	199	199	200	200	200	201	201	201
Member Label	20N-30N	20N-30N	20N-30N	30N-29N	30N-29N	30N-29N	28N-29N	28N-29N	28N-29N	20S-30S	20S-30S	20S-30S	30S-29S	30S-29S	30S-29S	28S-29S	28S-29S	28S-29S
Station (m)	0.0	1.0	2.0	0.0	1.1	2.2	0.0	1.1	2.2	0.0	1.0	2.0	0.0	1.1	2.2	0.0	1.1	2.2
Node Label at Station	20N	---	30N	30N	---	29N	28N	---	29N	20S	---	30S	30S	---	29S	28S	---	29S
Section #	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	919	919	919	919	919	919	919	919	919	919	919	919	919	919	919	919	919	919
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	5.78E+03	5.78E+03	5.78E+03	5.18E+03	5.18E+03	5.18E+03	5.01E+03	5.01E+03	5.01E+03	5.78E+03	5.78E+03	5.78E+03	5.18E+03	5.18E+03	5.18E+03	5.01E+03	5.01E+03	5.01E+03
U_{1x}	1.05	1.05	1.05	1.07	1.07	1.07	1.07	1.07	1.07	1.05	1.05	1.05	1.07	1.07	1.07	1.07	1.07	1.07
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	73561	73561	73561	65872	65872	65872	63738	63738	63738	73561	73561	73561	65872	65872	65872	63738	63738	63738
U_{1y}	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00
C_f/C_r	**0.318**	**0.317**	**0.317**	**0.358**	**0.358**	**0.359**	**0.334**	**0.335**	**0.335**	**0.321**	**0.321**	**0.320**	**0.368**	**0.368**	**0.369**	**0.339**	**0.339**	**0.340**
$U_{1x}M_{fx}/M_{rx}$	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.318**	**0.317**	**0.317**	**0.358**	**0.358**	**0.359**	**0.334**	**0.335**	**0.335**	**0.321**	**0.321**	**0.320**	**0.368**	**0.368**	**0.369**	**0.339**	**0.339**	**0.340**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.431	0.431	0.431	0.455	0.455	0.455	0.463	0.463	0.463	0.431	0.431	0.431	0.455	0.455	0.455	0.463	0.463	0.463
$C_{r\ (K=1)}$ (kN)	853	853	853	843	843	843	840	840	840	853	853	853	843	843	843	840	840	840
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.05	1.05	1.05	1.07	1.07	1.07	1.07	1.07	1.07	1.05	1.05	1.05	1.07	1.07	1.07	1.07	1.07	1.07
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00
C_f/C_r	**0.342**	**0.341**	**0.341**	**0.390**	**0.390**	**0.391**	**0.365**	**0.367**	**0.367**	**0.346**	**0.346**	**0.345**	**0.401**	**0.401**	**0.402**	**0.370**	**0.370**	**0.371**
$U_{1x}M_{fx}/M_{rx}$	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.342**	**0.341**	**0.341**	**0.390**	**0.390**	**0.391**	**0.365**	**0.367**	**0.367**	**0.346**	**0.346**	**0.345**	**0.401**	**0.401**	**0.402**	**0.370**	**0.370**	**0.371**

3.3. Lateral Torsional Buckling:

λ_{max}	0.431	0.431	0.431	0.455	0.455	0.455	0.463	0.463	0.463	0.431	0.431	0.431	0.455	0.455	0.455	0.463	0.463	0.463
C_r (kN)	853	853	853	843	843	843	840	840	840	853	853	853	843	843	843	840	840	840
U_{1x}	1.05	1.05	1.05	1.07	1.07	1.07	1.07	1.07	1.07	1.05	1.05	1.05	1.07	1.07	1.07	1.07	1.07	1.07
U_{1y}	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00
M_{rx} (kNm)	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23
M_{ry} (kNm)	148	148	148	147	147	147	146	146	146	148	148	148	147	147	147	146	146	146
C_f/C_r	**0.342**	**0.341**	**0.341**	**0.390**	**0.390**	**0.391**	**0.365**	**0.367**	**0.367**	**0.346**	**0.346**	**0.345**	**0.401**	**0.401**	**0.402**	**0.370**	**0.370**	**0.371**
$U_{1x}M_{fx}/M_{rx}$	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.342**	**0.341**	**0.341**	**0.390**	**0.390**	**0.391**	**0.365**	**0.367**	**0.367**	**0.346**	**0.346**	**0.345**	**0.401**	**0.401**	**0.402**	**0.370**	**0.370**	**0.371**
Demand/Capacity ≤ 1	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
Highest Ratio	**0.342**	**0.341**	**0.341**	**0.390**	**0.390**	**0.391**	**0.365**	**0.367**	**0.367**	**0.346**	**0.346**	**0.345**	**0.401**	**0.401**	**0.402**	**0.370**	**0.370**	**0.371**

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	269	269	269	270	270	270	271	271	271	272	272	272	597	597	597	598	598	598
Member Label	17N-29N	17N-29N	17N-29N	29N-20N	29N-20N	29N-20N	28N-30N	28N-30N	28N-30N	30N-31N	30N-31N	30N-31N	17S-29S	17S-29S	17S-29S	29S-20S	29S-20S	29S-20S
Station (m)	0.0	1.7	3.3	0.0	1.5	3.1	0.0	1.6	3.3	0.0	0.7	1.4	0.0	1.7	3.3	0.0	1.5	3.1
Node Label at Station	17N	---	29N	29N	---	20N	28N	---	30N	30N	---	31N	17S	---	29S	29S	---	20S
Section #	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 27	Section 27	Section 27	Section 27	Section 27	Section 27	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T

Member Factored Load Effects:

C_f (kN)	533	533	533	36	36	36	332	332	332	120	120	120	545	545	545	34	34	34
$M_{fx\ (comp)}$ (kNm)	2	2	2	2	1	4	2	1	2	2	2	6	2	2	2	2	1	4
$M_{fy\ (comp)}$ (kNm)	5	2	2	2	2	0	1	2	2	2	1	0	5	1	2	2	1	0
T_f (kN)	513	513	513	60	60	60	337	337	337	100	100	100	516	516	516	58	58	58
$M_{fx\ (tension)}$ (kNm)	2	2	2	2	1	4	2	1	2	2	2	6	2	2	2	2	1	4
$M_{fy\ (tension)}$ (kNm)	5	2	2	2	2	0	1	2	2	2	1	0	5	1	2	2	1	0
V_{fx} (kN)	2	2	1	0	0	1	1	0	0	1	2	2	2	2	1	0	0	1
V_{fy} (kN)	1	0	1	3	2	3	1	1	2	6	5	5	1	0	1	3	2	3

Gross Section Properties:

Ag (mm^2)	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116	5116
I_x (mm^4)	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07
I_y (mm^4)	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08
J (mm^4)	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05
r_x (mm)	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49
r_y (mm)	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175
S_x (mm^3)	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05
S_y (mm^3)	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	3345	3345	3345	3056	3056	3056	3264	3264	3264	1448	1448	1448	3345	3345	3345	3056	3056	3056

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	269	269	269	270	270	270	271	271	271	272	272	272	597	597	597	598	598	598
Member Label	17N-29N	17N-29N	17N-29N	29N-20N	29N-20N	29N-20N	28N-30N	28N-30N	28N-30N	30N-31N	30N-31N	30N-31N	17S-29S	17S-29S	17S-29S	29S-20S	29S-20S	29S-20S
Station (m)	0.0	1.7	3.3	0.0	1.5	3.1	0.0	1.6	3.3	0.0	0.7	1.4	0.0	1.7	3.3	0.0	1.5	3.1
Node Label at Station	17N	---	29N	29N	---	20N	28N	---	30N	30N	---	31N	17S	---	29S	29S	---	20S
Section #	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 27	Section 27	Section 27	Section 27	Section 27	Section 27	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T

Width-to-thickness ratio of elements in compression

Legs of angles and elements supported along one edge	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections																		
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7
Webs in flexural compression	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7
Webs in combined flexural and axial compression	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	269	269	269	270	270	270	271	271	271	272	272	272	597	597	597	598	598	598
Member Label	17N-29N	17N-29N	17N-29N	29N-20N	29N-20N	29N-20N	28N-30N	28N-30N	28N-30N	30N-31N	30N-31N	30N-31N	17S-29S	17S-29S	17S-29S	29S-20S	29S-20S	29S-20S
Station (m)	0.0	1.7	3.3	0.0	1.5	3.1	0.0	1.6	3.3	0.0	0.7	1.4	0.0	1.7	3.3	0.0	1.5	3.1
Node Label at Station	17N	---	29N	29N	---	20N	28N	---	30N	30N	---	31N	17S	---	29S	29S	---	20S
Section #	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 27	Section 27	Section 27	Section 27	Section 27	Section 27	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	3345	3345	3345	3056	3056	3056	3264	3264	3264	1448	1448	1448	3345	3345	3345	3056	3056	3056
L_y (mm)	6401	6401	6401	6401	6401	6401	4712	4712	4712	4712	4712	4712	6401	6401	6401	6401	6401	6401
λ_{max}	0.704	0.704	0.704	0.643	0.643	0.643	0.687	0.687	0.687	0.305	0.305	0.305	0.704	0.704	0.704	0.643	0.643	0.643
C_r (kN)	718.2	718.2	718.2	752.4	752.4	752.4	728.0	728.0	728.0	891.2	891.2	891.2	718.2	718.2	718.2	752.4	752.4	752.4
$(kL/r)_{max}$	68.3	68.3	68.3	62.4	62.4	62.4	66.6	66.6	66.6	29.5	29.5	29.5	68.3	68.3	68.3	62.4	62.4	62.4
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	2167	2167	2167	2597	2597	2597	2276	2276	2276	11569	11569	11569	2167	2167	2167	2597	2597	2597

Shear Flexibility Factor:

1. Lacing:

a (mm)	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344
b (mm)	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298
ε_aa (mm)	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344
ε_bb (mm)	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298
ε_a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	3011	3011	3011	2750	2750	2750	2938	2938	2938	1303	1303	1303	3011	3011	3011	2750	2750	2750
A_c (mm^2)	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558
A_d (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
A_b (mm^2)	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544	544
μ	0.0911	0.0911	0.0911	0.1092	0.1092	0.1092	0.0957	0.0957	0.0957	0.4864	0.4864	0.4864	0.0911	0.0911	0.0911	0.1092	0.1092	0.1092
P_{cr}/P_e (Fig.3.51)	0.78	0.78	0.78	0.75	0.75	0.75	0.77	0.77	0.77	0.50	0.50	0.50	0.78	0.78	0.78	0.75	0.75	0.75
k'(sqrt(P_e/P_{cr}))	1.134	1.134	1.134	1.154	1.154	1.154	1.139	1.139	1.139	1.414	1.414	1.414	1.134	1.134	1.134	1.154	1.154	1.154
λ_v	0.428	0.428	0.428	0.435	0.435	0.435	0.316	0.316	0.316	0.393	0.393	0.393	0.428	0.428	0.428	0.435	0.435	0.435
Cr' (kN)	853.9	853.9	853.9	851.1	851.1	851.1	888.4	888.4	888.4	866.3	866.3	866.3	853.9	853.9	853.9	851.1	851.1	851.1
Lacing Governs?	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	No	No	No	No	No	No

Member ID in CSiBridge	269	269	269	270	270	270	271	271	271	272	272	272	597	597	597	598	598	598
Member Label	17N-29N	17N-29N	17N-29N	29N-20N	29N-20N	29N-20N	28N-30N	28N-30N	28N-30N	30N-31N	30N-31N	30N-31N	17S-29S	17S-29S	17S-29S	29S-20S	29S-20S	29S-20S
Station (m)	0.0	1.7	3.3	0.0	1.5	3.1	0.0	1.6	3.3	0.0	0.7	1.4	0.0	1.7	3.3	0.0	1.5	3.1
Node Label at Station	17N	---	29N	29N	---	20N	28N	---	30N	30N	---	31N	17S	---	29S	29S	---	20S
Section #	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 27	Section 27	Section 27	Section 27	Section 27	Section 27	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558	2558
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	718.2	718.2	718.2	752.4	752.4	752.4	728.0	728.0	728.0	866.3	866.3	866.3	718.2	718.2	718.2	752.4	752.4	752.4

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516	3516
$A_{n(corrosion)}$ (mm^2)	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340
$T_{r(b)}$ (kN)	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340	3340
$T_{r(c)}$ (kN)	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	269	269	269	270	270	270	271	271	271	272	272	272	597	597	597	598	598	598
Member Label	17N-29N	17N-29N	17N-29N	29N-20N	29N-20N	29N-20N	28N-30N	28N-30N	28N-30N	30N-31N	30N-31N	30N-31N	17S-29S	17S-29S	17S-29S	29S-20S	29S-20S	29S-20S
Station (m)	0.0	1.7	3.3	0.0	1.5	3.1	0.0	1.6	3.3	0.0	0.7	1.4	0.0	1.7	3.3	0.0	1.5	3.1
Node Label at Station	17N	---	29N	29N	---	20N	28N	---	30N	30N	---	31N	17S	---	29S	29S	---	20S
Section #	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 27	Section 27	Section 27	Section 27	Section 27	Section 27	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122	1122
$(kL/r)_{max}$	68	68	68	62	62	62	67	67	67	30	30	30	68	68	68	62	62	62
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23
$M_{ry(Laterally\ Supported)}$ (kNm)	153	153	153	153	153	153	153	153	153	153	153	153	153	153	153	153	153	153
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	3345	3345	3345	3056	3056	3056	3264	3264	3264	1448	1448	1448	3345	3345	3345	3056	3056	3056
L_{uy} (mm)	6401	6401	6401	6401	6401	6401	4712	4712	4712	4712	4712	4712	6401	6401	6401	6401	6401	6401
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	186	186	186	204	204	204	191	191	191	430	430	430	186	186	186	204	204	204
M_{rx} (kNm)	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3
M_{ry} (kNm)	131.0	131.0	131.0	134.9	134.9	134.9	132.1	132.1	132.1	156.5	156.5	156.5	131.0	131.0	131.0	134.9	134.9	134.9

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)																		
w_y (mm)																		
A_{wy} (mm^2)																		
h_y / w_y																		
F_{cr} (N/mm^2)																		
F_t (N/mm^2)																		
V_{ry} (kN)																		
$(V_f/V_r)<=1$																		

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.742	0.742	0.742	0.048	0.048	0.048	0.456	0.456	0.456	0.139	0.139	0.139	0.759	0.759	0.759	0.045	0.045	0.045
$(T_f/T_r)<=1$	0.529	0.529	0.529	0.062	0.062	0.062	0.348	0.348	0.348	0.103	0.103	0.103	0.532	0.532	0.532	0.060	0.060	0.060

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.529	0.529	0.529	0.062	0.062	0.062	0.348	0.348	0.348	0.103	0.103	0.103	0.532	0.532	0.532	0.060	0.060	0.060
$M_{fx}/M_{rx}<=1$	0.086	0.086	0.086	0.086	0.043	0.172	0.086	0.043	0.086	0.086	0.086	0.258	0.086	0.086	0.086	0.086	0.043	0.172
$M_{fy}/M_{ry}<=1$	0.038	0.015	0.015	0.015	0.015	0.000	0.008	0.015	0.015	0.013	0.006	0.000	0.038	0.008	0.015	0.015	0.007	0.000
$T_f/T_r+M_f/M_r<=1$	0.653	0.630	0.630	0.163	0.120	0.234	0.441	0.406	0.449	0.202	0.195	0.361	0.656	0.626	0.633	0.161	0.110	0.232
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.000	0.000	0.000	0.000	0.040	0.000	0.000	0.000	0.000	0.000	0.054	0.000	0.000	0.000	0.000	0.000	0.044

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	269	269	269	270	270	270	271	271	271	272	272	272	597	597	597	598	598	598
Member Label	17N-29N	17N-29N	17N-29N	29N-20N	29N-20N	29N-20N	28N-30N	28N-30N	28N-30N	30N-31N	30N-31N	30N-31N	17S-29S	17S-29S	17S-29S	29S-20S	29S-20S	29S-20S
Station (m)	0.0	1.7	3.3	0.0	1.5	3.1	0.0	1.6	3.3	0.0	0.7	1.4	0.0	1.7	3.3	0.0	1.5	3.1
Node Label at Station	17N	---	29N	29N	---	20N	28N	---	30N	30N	---	31N	17S	---	29S	29S	---	20S
Section #	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15	Section 27	Section 27	Section 27	Section 27	Section 27	Section 27	Section 15	Section 15	Section 15	Section 15	Section 15	Section 15
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	919	919	919	919	919	919	919	919	919	919	919	919	919	919	919	919	919	919
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	2.17E+03	2.17E+03	2.17E+03	2.60E+03	2.60E+03	2.60E+03	2.28E+03	2.28E+03	2.28E+03	1.16E+04	1.16E+04	1.16E+04	2.17E+03	2.17E+03	2.17E+03	2.60E+03	2.60E+03	2.60E+03
U_{1x}	1.33	1.33	1.33	1.01	1.01	1.01	1.17	1.17	1.17	1.01	1.01	1.01	1.34	1.34	1.34	1.01	1.01	1.01
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	7527	7527	7527	7527	7527	7527	13891	13891	13891	13891	13891	13891	7527	7527	7527	7527	7527	7527
U_{1y}	1.08	1.08	1.08	1.00	1.00	1.00	1.02	1.02	1.02	1.01	1.01	1.01	1.08	1.08	1.08	1.00	1.00	1.00
C_f/C_r	**0.580**	**0.580**	**0.580**	**0.039**	**0.039**	**0.039**	**0.361**	**0.361**	**0.361**	**0.131**	**0.131**	**0.131**	**0.593**	**0.593**	**0.593**	**0.037**	**0.037**	**0.037**
$U_{1x}M_{fx}/M_{rx}$	**0.114**	**0.114**	**0.114**	**0.087**	**0.044**	**0.174**	**0.101**	**0.050**	**0.101**	**0.087**	**0.087**	**0.261**	**0.115**	**0.115**	**0.115**	**0.087**	**0.044**	**0.174**
$U_{1y}M_{fy}/M_{ry}$	**0.035**	**0.014**	**0.014**	**0.013**	**0.013**	**0.000**	**0.007**	**0.013**	**0.013**	**0.013**	**0.007**	**0.000**	**0.035**	**0.007**	**0.014**	**0.013**	**0.007**	**0.000**
Interaction	**0.729**	**0.708**	**0.708**	**0.139**	**0.096**	**0.214**	**0.469**	**0.425**	**0.475**	**0.231**	**0.224**	**0.391**	**0.743**	**0.715**	**0.722**	**0.137**	**0.087**	**0.211**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.704	0.704	0.704	0.643	0.643	0.643	0.687	0.687	0.687	0.305	0.305	0.305	0.704	0.704	0.704	0.643	0.643	0.643
$C_{r\ (K=1)}$ (kN)	718	718	718	752	752	752	728	728	728	891	891	891	718	718	718	752	752	752
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.33	1.33	1.33	1.01	1.01	1.01	1.17	1.17	1.17	1.01	1.01	1.01	1.34	1.34	1.34	1.01	1.01	1.01
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.08	1.08	1.08	1.00	1.00	1.00	1.02	1.02	1.02	1.01	1.01	1.01	1.08	1.08	1.08	1.00	1.00	1.00
C_f/C_r	**0.742**	**0.742**	**0.742**	**0.048**	**0.048**	**0.048**	**0.456**	**0.456**	**0.456**	**0.135**	**0.135**	**0.135**	**0.759**	**0.759**	**0.759**	**0.045**	**0.045**	**0.045**
$U_{1x}M_{fx}/M_{rx}$	**0.114**	**0.114**	**0.114**	**0.087**	**0.044**	**0.174**	**0.101**	**0.050**	**0.101**	**0.087**	**0.087**	**0.261**	**0.115**	**0.115**	**0.115**	**0.087**	**0.044**	**0.174**
$U_{1y}M_{fy}/M_{ry}$	**0.035**	**0.014**	**0.014**	**0.013**	**0.013**	**0.000**	**0.007**	**0.013**	**0.013**	**0.013**	**0.007**	**0.000**	**0.035**	**0.007**	**0.014**	**0.013**	**0.007**	**0.000**
Interaction	**0.891**	**0.870**	**0.870**	**0.148**	**0.105**	**0.222**	**0.563**	**0.520**	**0.570**	**0.235**	**0.228**	**0.395**	**0.909**	**0.881**	**0.888**	**0.145**	**0.095**	**0.219**

3.3. Lateral Torsional Buckling:

λ_{max}	0.704	0.704	0.704	0.643	0.643	0.643	0.687	0.687	0.687	0.305	0.305	0.305	0.704	0.704	0.704	0.643	0.643	0.643
C_r (kN)	718	718	718	752	752	752	728	728	728	891	891	891	718	718	718	752	752	752
U_{1x}	1.33	1.33	1.33	1.01	1.01	1.01	1.17	1.17	1.17	1.01	1.01	1.01	1.34	1.34	1.34	1.01	1.01	1.01
U_{1y}	1.08	1.08	1.08	1.00	1.00	1.00	1.02	1.02	1.02	1.01	1.01	1.01	1.08	1.08	1.08	1.00	1.00	1.00
M_{rx} (kNm)	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23
M_{ry} (kNm)	131	131	131	135	135	135	132	132	132	157	157	157	131	131	131	135	135	135
C_f/C_r	**0.742**	**0.742**	**0.742**	**0.048**	**0.048**	**0.048**	**0.456**	**0.456**	**0.456**	**0.135**	**0.135**	**0.135**	**0.759**	**0.759**	**0.759**	**0.045**	**0.045**	**0.045**
$U_{1x}M_{fx}/M_{rx}$	**0.114**	**0.114**	**0.114**	**0.087**	**0.044**	**0.174**	**0.101**	**0.050**	**0.101**	**0.087**	**0.087**	**0.261**	**0.115**	**0.115**	**0.115**	**0.087**	**0.044**	**0.174**
$U_{1y}M_{fy}/M_{ry}$	**0.041**	**0.016**	**0.016**	**0.015**	**0.015**	**0.000**	**0.008**	**0.016**	**0.016**	**0.013**	**0.006**	**0.000**	**0.041**	**0.008**	**0.016**	**0.015**	**0.007**	**0.000**
Interaction	**0.897**	**0.873**	**0.873**	**0.150**	**0.106**	**0.222**	**0.564**	**0.522**	**0.572**	**0.234**	**0.228**	**0.395**	**0.915**	**0.882**	**0.890**	**0.147**	**0.096**	**0.219**
Demand/Capacity ≤ 1	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
Highest Ratio	**0.897**	**0.873**	**0.873**	**0.163**	**0.120**	**0.234**	**0.564**	**0.522**	**0.572**	**0.235**	**0.228**	**0.395**	**0.915**	**0.882**	**0.890**	**0.161**	**0.110**	**0.232**

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	599	599	599	600	600	600
Member Label	28S-30S	28S-30S	28S-30S	30S-31S	30S-31S	30S-31S
Station (m)	0.0	1.6	3.3	0.0	0.7	1.4
Node Label at Station	28S	---	30S	30S	---	31S
Section #	Section 27	Section 27	Section 27	Section 27	Section 27	Section 27
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T

Member Factored Load Effects:

C_f (kN)	334	334	334	127	127	127
$M_{fx\ (comp)}$ (kNm)	2	1	2	2	2	6
$M_{fy\ (comp)}$ (kNm)	1	2	2	2	1	0
T_f (kN)	343	343	343	102	102	102
$M_{fx\ (tension)}$ (kNm)	2	1	2	2	2	6
$M_{fy\ (tension)}$ (kNm)	1	2	2	2	1	0
V_{fx} (kN)	1	0	0	1	2	2
V_{fy} (kN)	1	1	2	6	5	5

Gross Section Properties:

Ag (mm^2)	5116	5116	5116	5116	5116	5116
I_x (mm^4)	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07	1.23E+07
I_y (mm^4)	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08
J (mm^4)	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05	2.07E+05
r_x (mm)	49	49	49	49	49	49
r_y (mm)	175	175	175	175	175	175
S_x (mm^3)	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05
S_y (mm^3)	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5
L (mm)	3264	3264	3264	1448	1448	1448

Material Properties:

F_Y (MPa)	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	599	599	599	600	600	600
Member Label	28S-30S	28S-30S	28S-30S	30S-31S	30S-31S	30S-31S
Station (m)	0.0	1.6	3.3	0.0	0.7	1.4
Node Label at Station	28S	---	30S	30S	---	31S
Section #	Section 27	Section 27	Section 27	Section 27	Section 27	Section 27
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T

Width-to-thickness ratio of elements in compression

Legs of angles and elements supported along one edge	13.7	13.7	13.7	13.7	13.7	13.7
angles in continuous contact with other elements						
Plate girder stiffeners						
Stems of T-sections						
Flanges of I- or T-sections						
plates projecting from compression elements						
outstanding legs of pairs of angles in continuous contact						
Flanges of channels						
Flanges of rectangular hollow structural shapes						
Flanges of box girder sections						
flange cover plates and diaphragm plates between lines of fasteners or welds						
Perforated cover plates						
Webs in axial compression	13.7	13.7	13.7	13.7	13.7	13.7
Webs in flexural compression	13.7	13.7	13.7	13.7	13.7	13.7
Webs in combined flexural and axial compression	13.7	13.7	13.7	13.7	13.7	13.7
Circular and multi-sided hollow sections in axial compression						
Circular and multi-sided hollow sections in axial compression						
Member Class	**3**	**3**	**3**	**3**	**3**	**3**
Member Class = 3	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**

Member ID in CSiBridge	599	599	599	600	600	600
Member Label	28S-30S	28S-30S	28S-30S	30S-31S	30S-31S	30S-31S
Station (m)	0.0	1.6	3.3	0.0	0.7	1.4
Node Label at Station	28S	---	30S	30S	---	31S
Section #	Section 27	Section 27	Section 27	Section 27	Section 27	Section 27
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	3264	3264	3264	1448	1448	1448
L_y (mm)	4712	4712	4712	4712	4712	4712
λ_{max}	0.687	0.687	0.687	0.305	0.305	0.305
C_r (kN)	728.0	728.0	728.0	891.2	891.2	891.2
$(kL/r)_{max}$	66.6	66.6	66.6	29.5	29.5	29.5
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing	1	1	1	1	1	1
Battens						
Perforated Plate						
Cover Plate						

P_e^{min} (Euler, kN)	2276	2276	2276	11569	11569	11569

Shear Flexibility Factor:

1. Lacing:

a (mm)	344	344	344	344	344	344
b (mm)	298	298	298	298	298	298
ε_aa (mm)	344	344	344	344	344	344
ε_bb (mm)	298	298	298	298	298	298
ε_a	1.00	1.00	1.00	1.00	1.00	1.00
ε_b	1.00	1.00	1.00	1.00	1.00	1.00
l (mm)	2938	2938	2938	1303	1303	1303
A_c (mm^2)	2558	2558	2558	2558	2558	2558
A_d (mm^2)	544	544	544	544	544	544
A_b (mm^2)	544	544	544	544	544	544
μ	0.0957	0.0957	0.0957	0.4864	0.4864	0.4864
P_{cr}/P_e (Fig.3.51)	0.77	0.77	0.77	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	1.139	1.139	1.139	1.414	1.414	1.414
λ_v	0.316	0.316	0.316	0.393	0.393	0.393
Cr' (kN)	888.4	888.4	888.4	866.3	866.3	866.3
Lacing Governs?	No	No	No	Yes	Yes	Yes

Member ID in CSiBridge	599	599	599	600	600	600
Member Label	28S-30S	28S-30S	28S-30S	30S-31S	30S-31S	30S-31S
Station (m)	0.0	1.6	3.3	0.0	0.7	1.4
Node Label at Station	28S	---	30S	30S	---	31S
Section #	Section 27	Section 27	Section 27	Section 27	Section 27	Section 27
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T

2. Battens:

a (mm)	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343
A_c (mm^2)	2558	2558	2558	2558	2558	2558
A_b (mm^2)	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	728.0	728.0	728.0	866.3	866.3	866.3

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	4860	4860	4860	4860	4860	4860
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	970	970	970	970	970	970
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24
ΣW_n t (mm^2)	3516	3516	3516	3516	3516	3516
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0
A_n (mm^2)	3516	3516	3516	3516	3516	3516
$A_{n(corrosion)}$ (mm^2)	3340	3340	3340	3340	3340	3340
$T_{r(b)}$ (kN)	1122	1122	1122	1122	1122	1122
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	3340	3340	3340	3340	3340	3340
$T_{r(c)}$ (kN)	1122	1122	1122	1122	1122	1122
U_t	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	599	599	599	600	600	600
Member Label	28S-30S	28S-30S	28S-30S	30S-31S	30S-31S	30S-31S
Station (m)	0.0	1.6	3.3	0.0	0.7	1.4
Node Label at Station	28S	---	30S	30S	---	31S
Section #	Section 27	Section 27	Section 27	Section 27	Section 27	Section 27
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T

F_m	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	1122	1122	1122	1122	1122	1122
$(kL/r)_{max}$	67	67	67	30	30	30
kL/r<200	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	970	970	970	970	970	970
Ductile	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	23	23	23	23	23	23
$M_{ry(Laterally\ Supported)}$ (kNm)	153	153	153	153	153	153
ω_2	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	3264	3264	3264	1448	1448	1448
L_{uy} (mm)	4712	4712	4712	4712	4712	4712
M_{ux} (kNm) (y weak)	NA	NA	NA	NA	NA	NA
M_{uy} (kNm) (x weak)	191	191	191	430	430	430
M_{rx} (kNm)	23.3	23.3	23.3	23.3	23.3	23.3
M_{ry} (kNm)	132.1	132.1	132.1	156.5	156.5	156.5

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)						
w_y (mm)						
A_{wy} (mm^2)						
h_y/w_y						
F_{cr} (N/mm^2)						
F_t (N/mm^2)						
V_{ry} (kN)						
$(V_f/V_r)<=1$						

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.459	0.459	0.459	0.147	0.147	0.147
$(T_f/T_r)<=1$	0.354	0.354	0.354	0.105	0.105	0.105

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.354	0.354	0.354	0.105	0.105	0.105
$M_{fx}/M_{rx}<=1$	0.086	0.043	0.086	0.086	0.086	0.258
$M_{fy}/M_{ry}<=1$	0.008	0.015	0.015	0.013	0.006	0.000
$T_f/T_r+M_f/M_r<=1$	0.447	0.412	0.455	0.204	0.198	0.363
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.000	0.000	0.000	0.000	0.050

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	599	599	599	600	600	600
Member Label	28S-30S	28S-30S	28S-30S	30S-31S	30S-31S	30S-31S
Station (m)	0.0	1.6	3.3	0.0	0.7	1.4
Node Label at Station	28S	---	30S	30S	---	31S
Section #	Section 27	Section 27	Section 27	Section 27	Section 27	Section 27
Element Group	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T	17 TowerT Second T

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	919	919	919	919	919	919
ω_{1x}	1	1	1	1	1	1
C_{ex} (kN)	2.28E+03	2.28E+03	2.28E+03	1.16E+04	1.16E+04	1.16E+04
U_{1x}	1.17	1.17	1.17	1.01	1.01	1.01
ω_{1y}	1	1	1	1	1	1
C_{ey} (kN)	13891	13891	13891	13891	13891	13891
U_{1y}	1.02	1.02	1.02	1.01	1.01	1.01
C_f/C_r	**0.364**	**0.364**	**0.364**	**0.138**	**0.138**	**0.138**
$U_{1x}M_{fx}/M_{rx}$	**0.101**	**0.050**	**0.101**	**0.087**	**0.087**	**0.261**
$U_{1y}M_{fy}/M_{ry}$	**0.007**	**0.013**	**0.013**	**0.013**	**0.007**	**0.000**
Interaction	**0.471**	**0.427**	**0.478**	**0.238**	**0.232**	**0.399**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.687	0.687	0.687	0.305	0.305	0.305
$C_{r\ (K=1)}$ (kN)	728	728	728	891	891	891
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.17	1.17	1.17	1.01	1.01	1.01
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.02	1.02	1.02	1.01	1.01	1.01
C_f/C_r	**0.459**	**0.459**	**0.459**	**0.143**	**0.143**	**0.143**
$U_{1x}M_{fx}/M_{rx}$	**0.101**	**0.050**	**0.101**	**0.087**	**0.087**	**0.261**
$U_{1y}M_{fy}/M_{ry}$	**0.007**	**0.013**	**0.013**	**0.013**	**0.007**	**0.000**
Interaction	**0.566**	**0.523**	**0.573**	**0.243**	**0.236**	**0.403**

3.3. Lateral Torsional Buckling:

λ_{max}	0.687	0.687	0.687	0.305	0.305	0.305
C_r (kN)	728	728	728	891	891	891
U_{1x}	1.17	1.17	1.17	1.01	1.01	1.01
U_{1y}	1.02	1.02	1.02	1.01	1.01	1.01
M_{rx} (kNm)	23	23	23	23	23	23
M_{ry} (kNm)	132	132	132	157	157	157
C_f/C_r	**0.459**	**0.459**	**0.459**	**0.143**	**0.143**	**0.143**
$U_{1x}M_{fx}/M_{rx}$	**0.101**	**0.050**	**0.101**	**0.087**	**0.087**	**0.261**
$U_{1y}M_{fy}/M_{ry}$	**0.008**	**0.016**	**0.016**	**0.013**	**0.006**	**0.000**
Interaction	**0.567**	**0.525**	**0.575**	**0.242**	**0.236**	**0.403**
Demand/Capacity ≤ 1	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
Highest Ratio	**0.567**	**0.525**	**0.575**	**0.243**	**0.236**	**0.403**

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	81	81	81	82	82	82	83	83	83	84	84	84	85	85	85	86	86	86
Member Label	2N-	2N-	2N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	2N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Member Factored Load Effects:

C_f (kN)	13	13	13	8	8	8	1	1	1	0	0	0	0	0	0	0	0	0
$M_{fx\ (comp)}$ (kNm)	6	21	43	41	65	89	86	95	104	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	28	19	11	11	5	1	1	3	5	0	0	0	0	0	0	0	0	0
T_f (kN)	26	26	26	26	26	26	25	25	25	24	24	24	24	24	24	24	24	24
$M_{fx\ (tension)}$ (kNm)	6	21	43	41	65	89	86	95	104	102	113	123	122	124	127	126	125	123
$M_{fy\ (tension)}$ (kNm)	28	19	11	11	5	1	1	3	5	5	7	8	8	9	9	9	9	9
V_{fx} (kN)	27	26	25	14	12	10	8	7	6	6	4	3	3	2	1	2	0	2
V_{fy} (kN)	70	69	69	49	48	48	34	34	33	24	23	22	10	10	9	3	4	5

Gross Section Properties:

Ag (mm^2)	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429
I_x (mm^4)	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09
I_y (mm^4)	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
J (mm^4)	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06
r_x (mm)	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383
r_y (mm)	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
S_x (mm^3)	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06
S_y (mm^3)	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	648	648	648	991	991	991	533	533	533	914	914	914	533	533	533	991	991	991

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	81	81	81	82	82	82	83	83	83	84	84	84	85	85	85	86	86	86
Member Label	2N-	2N-	2N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	2N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Webs in combined flexural and axial compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	81	81	81	82	82	82	83	83	83	84	84	84	85	85	85	86	86	86
Member Label	2N-	2N-	2N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	2N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	648	648	648	991	991	991	533	533	533	914	914	914	533	533	533	991	991	991
L_y (mm)	648	648	648	991	991	991	533	533	533	914	914	914	533	533	533	991	991	991
λ_{max}	0.108	0.108	0.108	0.165	0.165	0.165	0.089	0.089	0.089	0.152	0.152	0.152	0.089	0.089	0.089	0.165	0.165	0.165
C_r (kN)	5094.7	5094.7	5094.7	5074.3	5074.3	5074.3	5098.7	5098.7	5098.7	5080.1	5080.1	5080.1	5098.7	5098.7	5098.7	5074.3	5074.3	5074.3
$(kL/r)_{max}$	10.4	10.4	10.4	16.0	16.0	16.0	8.6	8.6	8.6	14.7	14.7	14.7	8.6	8.6	8.6	16.0	16.0	16.0
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	507435	507435	507435	216936	216936	216936	748208	748208	748208	254599	254599	254599	748208	748208	748208	216936	216936	216936

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	583	583	583	892	892	892	480	480	480	823	823	823	480	480	480	892	892	892
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	81	81	81	82	82	82	83	83	83	84	84	84	85	85	85	86	86	86
Member Label	2N-	2N-	2N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	2N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	5094.7	5094.7	5094.7	5074.3	5074.3	5074.3	5098.7	5098.7	5098.7	5080.1	5080.1	5080.1	5098.7	5098.7	5098.7	5074.3	5074.3	5074.3

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$A_{n(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(b)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(c)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	81	81	81	82	82	82	83	83	83	84	84	84	85	85	85	86	86	86
Member Label	2N-	2N-	2N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	2N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
$(kL/r)_{max}$	10	10	10	16	16	16	9	9	9	15	15	15	9	9	9	16	16	16
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619
$M_{ry(Laterally\ Supported)}$ (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	648	648	648	991	991	991	533	533	533	914	914	914	533	533	533	991	991	991
L_{uy} (mm)	648	648	648	991	991	991	533	533	533	914	914	914	533	533	533	991	991	991
M_{ux} (kNm) (y weak)	11689	11689	11689	7643	7643	7643	14194	14194	14194	8280	8280	8280	14194	14194	14194	7643	7643	7643
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1782.3	1782.3	1782.3	1740.0	1740.0	1740.0	1796.5	1796.5	1796.5	1749.4	1749.4	1749.4	1796.5	1796.5	1796.5	1740.0	1740.0	1740.0
M_{ry} (kNm)	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3
w_y (mm)	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
A_{wy} (mm^2)	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792
h_y/w_y	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
F_{cr} (N/mm^2)	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703
(V_f/V_r)<=1	0.041	0.041	0.041	0.029	0.028	0.028	0.020	0.020	0.019	0.014	0.014	0.013	0.006	0.006	0.005	0.002	0.002	0.003

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.003	0.003	0.003	0.002	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
(T_f/T_r)<=1	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
M_{fx}/M_{rx}<=1	0.003	0.012	0.024	0.024	0.037	0.051	0.048	0.053	0.058	0.058	0.065	0.070	0.068	0.069	0.071	0.072	0.072	0.071
M_{fy}/M_{ry}<=1	0.211	0.143	0.083	0.083	0.038	0.008	0.008	0.023	0.038	0.038	0.053	0.060	0.060	0.068	0.068	0.068	0.068	0.068
$T_f/T_r+M_f/M_r$<=1	0.219	0.159	0.112	0.111	0.080	0.063	0.060	0.080	0.100	0.100	0.122	0.135	0.133	0.141	0.143	0.145	0.144	0.143
$M_f/M_r-T_fS/M_rA$<=1	0.205	0.145	0.098	0.097	0.066	0.049	0.047	0.067	0.087	0.087	0.109	0.122	0.120	0.128	0.130	0.131	0.131	0.130

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	81	81	81	82	82	82	83	83	83	84	84	84	85	85	85	86	86	86
Member Label	2N-	2N-	2N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	2N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.96E+07	1.96E+07	1.96E+07	8.38E+06	8.38E+06	8.38E+06	2.89E+07	2.89E+07	2.89E+07	9.83E+06	9.83E+06	9.83E+06	2.89E+07	2.89E+07	2.89E+07	8.38E+06	8.38E+06	8.38E+06
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	507435	507435	507435	216936	216936	216936	748208	748208	748208	254599	254599	254599	748208	748208	748208	216936	216936	216936
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.003	0.003	0.003	0.002	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.004	0.013	0.027	0.025	0.040	0.055	0.053	0.059	0.064	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.211	0.143	0.083	0.083	0.038	0.008	0.008	0.023	0.038	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.217	0.158	0.112	0.110	0.079	0.064	0.061	0.081	0.102	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.108	0.108	0.108	0.165	0.165	0.165	0.089	0.089	0.089	0.152	0.152	0.152	0.089	0.089	0.089	0.165	0.165	0.165
$C_{r\ (K=1)}$ (kN)	5095	5095	5095	5074	5074	5074	5099	5099	5099	5080	5080	5080	5099	5099	5099	5074	5074	5074
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.003	0.003	0.003	0.002	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.004	0.013	0.027	0.025	0.040	0.055	0.053	0.059	0.064	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.211	0.143	0.083	0.083	0.038	0.008	0.008	0.023	0.038	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.217	0.158	0.112	0.110	0.079	0.064	0.061	0.081	0.102	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.3. Lateral Torsional Buckling:

λ_{max}	0.108	0.108	0.108	0.165	0.165	0.165	0.089	0.089	0.089	0.152	0.152	0.152	0.089	0.089	0.089	0.165	0.165	0.165
C_r (kN)	5095	5095	5095	5074	5074	5074	5099	5099	5099	5080	5080	5080	5099	5099	5099	5074	5074	5074
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1782	1782	1782	1740	1740	1740	1796	1796	1796	1749	1749	1749	1796	1796	1796	1740	1740	1740
M_{ry} (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
C_f/C_r	0.003	0.003	0.003	0.002	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.003	0.012	0.024	0.024	0.037	0.051	0.048	0.053	0.058	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.211	0.143	0.083	0.083	0.038	0.008	0.008	0.023	0.038	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.216	0.157	0.109	0.108	0.077	0.060	0.056	0.076	0.096	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.219	0.159	0.112	0.111	0.080	0.064	0.061	0.081	0.102	0.100	0.122	0.135	0.133	0.141	0.143	0.145	0.144	0.143

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	87	87	87	88	88	88	89	89	89	90	90	90	91	91	91	92	92	92
Member Label	-	-	-	-	-	-	-	-	-	-2S	-2S	-2S	4N-	4N-	4N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	2S	4N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Member Factored Load Effects:

C_f (kN)	0	0	0	0	0	0	6	6	6	12	12	12	4	4	4	3	3	3
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	73	47	21	23	5	27	3	26	48	46	70	94
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	1	6	12	12	20	28	29	20	12	12	6	2
T_f (kN)	25	25	25	26	26	26	27	27	27	28	28	28	19	19	19	23	23	23
$M_{fx\ (tension)}$ (kNm)	124	114	104	106	89	70	73	47	21	23	5	27	3	26	48	46	70	94
$M_{fy\ (tension)}$ (kNm)	9	8	6	6	4	1	1	6	12	12	20	28	29	20	12	12	6	2
V_{fx} (kN)	1	3	4	4	6	8	10	12	14	25	26	27	28	27	26	14	12	11
V_{fy} (kN)	19	20	21	36	37	37	52	53	54	74	75	75	71	70	70	50	49	48

Gross Section Properties:

Ag (mm^2)	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429
I_x (mm^4)	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09
I_y (mm^4)	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
J (mm^4)	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06
r_x (mm)	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383
r_y (mm)	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
S_x (mm^3)	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06
S_y (mm^3)	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	991	991	991	991	991	991	991	991	991	648	648	648	648	648	648	991	991	991

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	87	87	87	88	88	88	89	89	89	90	90	90	91	91	91	92	92	92
Member Label	-	-	-	-	-	-	-	-	-	-2S	-2S	-2S	4N-	4N-	4N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	2S	4N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Webs in combined flexural and axial compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	87	87	87	88	88	88	89	89	89	90	90	90	91	91	91	92	92	92
Member Label	-	-	-	-	-	-	-	-	-	-2S	-2S	-2S	4N-	4N-	4N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	2S	4N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	991	991	991	991	991	991	991	991	991	648	648	648	648	648	648	991	991	991
L_y (mm)	991	991	991	991	991	991	991	991	991	648	648	648	648	648	648	991	991	991
λ_{max}	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.108	0.108	0.108	0.108	0.108	0.108	0.165	0.165	0.165
C_r (kN)	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5094.7	5094.7	5094.7	5094.7	5094.7	5094.7	5074.3	5074.3	5074.3
$(kL/r)_{max}$	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	10.4	10.4	10.4	10.4	10.4	10.4	16.0	16.0	16.0
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	216936	216936	216936	216936	216936	216936	216936	216936	216936	507435	507435	507435	507435	507435	507435	216936	216936	216936

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	892	892	892	892	892	892	892	892	892	583	583	583	583	583	583	892	892	892
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	87	87	87	88	88	88	89	89	89	90	90	90	91	91	91	92	92	92
Member Label	-	-	-	-	-	-	-	-	-	-2S	-2S	-2S	4N-	4N-	4N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	2S	4N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5094.7	5094.7	5094.7	5094.7	5094.7	5094.7	5074.3	5074.3	5074.3

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$A_{n(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(b)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(c)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	87	87	87	88	88	88	89	89	89	90	90	90	91	91	91	92	92	92
Member Label	-	-	-	-	-	-	-	-	-	-2S	-2S	-2S	4N-	4N-	4N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	2S	4N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
$(kL/r)_{max}$	16	16	16	16	16	16	16	16	16	10	10	10	10	10	10	16	16	16
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619
$M_{ry(Laterally\ Supported)}$ (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	991	991	991	991	991	991	991	991	991	648	648	648	648	648	648	991	991	991
L_{uy} (mm)	991	991	991	991	991	991	991	991	991	648	648	648	648	648	648	991	991	991
M_{ux} (kNm) (y weak)	7643	7643	7643	7643	7643	7643	7643	7643	7643	11689	11689	11689	11689	11689	11689	7643	7643	7643
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1782.3	1782.3	1782.3	1782.3	1782.3	1782.3	1740.0	1740.0	1740.0
M_{ry} (kNm)	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3
w_y (mm)	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
A_{wy} (mm^2)	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792
h_y/w_y	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
F_{cr} (N/mm^2)	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703
$(V_f/V_r)<=1$	0.011	0.012	0.012	0.021	0.022	0.022	0.031	0.031	0.032	0.043	0.044	0.044	0.042	0.041	0.041	0.029	0.029	0.028

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001
$(T_f/T_r)<=1$	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.004	0.004	0.004	0.004	0.004	0.004

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.004	0.004	0.004	0.004	0.004	0.004
$M_{fx}/M_{rx}<=1$	0.071	0.066	0.060	0.061	0.051	0.040	0.042	0.027	0.012	0.013	0.003	0.015	0.002	0.015	0.027	0.026	0.040	0.054
$M_{fy}/M_{ry}<=1$	0.068	0.060	0.045	0.045	0.030	0.008	0.008	0.045	0.090	0.090	0.150	0.211	0.218	0.150	0.090	0.090	0.045	0.015
$T_f/T_r+M_f/M_r<=1$	0.144	0.130	0.110	0.111	0.086	0.053	0.054	0.077	0.107	0.108	0.158	0.231	0.223	0.168	0.121	0.121	0.090	0.073
$M_f/M_r-T_fS/M_rA<=1$	0.130	0.117	0.096	0.097	0.072	0.038	0.040	0.062	0.093	0.093	0.143	0.216	0.213	0.158	0.110	0.108	0.077	0.061

Member ID in CSiBridge	87	87	87	88	88	88	89	89	89	90	90	90	91	91	91	92	92	92
Member Label	-	-	-	-	-	-	-	-	-	-2S	-2S	-2S	4N-	4N-	4N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	2S	4N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	1.96E+07	1.96E+07	1.96E+07	1.96E+07	1.96E+07	1.96E+07	8.38E+06	8.38E+06	8.38E+06
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	216936	216936	216936	216936	216936	216936	216936	216936	216936	507435	507435	507435	507435	507435	507435	216936	216936	216936
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.045	0.029	0.013	0.014	0.003	0.017	0.002	0.016	0.030	0.028	0.043	0.058
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.045	0.090	0.090	0.150	0.211	0.218	0.150	0.090	0.090	0.045	0.015
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.054	0.075	0.104	0.107	0.156	0.230	0.221	0.167	0.121	0.119	0.089	0.074

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.108	0.108	0.108	0.108	0.108	0.108	0.165	0.165	0.165
$C_{r\ (K=1)}$ (kN)	5074	5074	5074	5074	5074	5074	5074	5074	5074	5095	5095	5095	5095	5095	5095	5074	5074	5074
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.045	0.029	0.013	0.014	0.003	0.017	0.002	0.016	0.030	0.028	0.043	0.058
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.045	0.090	0.090	0.150	0.211	0.218	0.150	0.090	0.090	0.045	0.015
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.054	0.075	0.104	0.107	0.156	0.230	0.221	0.167	0.121	0.119	0.089	0.074

3.3. Lateral Torsional Buckling:

λ_{max}	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.108	0.108	0.108	0.108	0.108	0.108	0.165	0.165	0.165
C_r (kN)	5074	5074	5074	5074	5074	5074	5074	5074	5074	5095	5095	5095	5095	5095	5095	5074	5074	5074
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1740	1740	1740	1740	1740	1740	1740	1740	1740	1782	1782	1782	1782	1782	1782	1740	1740	1740
M_{ry} (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.042	0.027	0.012	0.013	0.003	0.015	0.002	0.015	0.027	0.026	0.040	0.054
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.045	0.090	0.090	0.150	0.211	0.218	0.150	0.090	0.090	0.045	0.015
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.051	0.073	0.103	0.105	0.156	0.228	0.221	0.166	0.118	0.117	0.086	0.070
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.144	0.130	0.110	0.111	0.086	0.053	0.054	0.077	0.107	0.108	0.158	0.231	0.223	0.168	0.121	0.121	0.090	0.074

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	93	93	93	94	94	94	96	96	96	98	98	98	99	99	99	100	100	100
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Member Factored Load Effects:

C_f (kN)	3	3	3	5	5	5	6	6	6	7	7	7	7	7	7	6	6	6
$M_{fx\ (comp)}$ (kNm)	91	100	109	107	118	128	127	129	132	131	129	127	128	119	108	111	93	74
$M_{fy\ (comp)}$ (kNm)	2	4	5	5	7	8	8	9	9	9	10	9	9	8	7	7	5	2
T_f (kN)	31	31	31	37	37	37	42	42	42	44	44	44	41	41	41	34	34	34
$M_{fx\ (tension)}$ (kNm)	91	100	109	107	118	128	127	129	132	131	129	127	128	119	108	111	93	74
$M_{fy\ (tension)}$ (kNm)	2	4	5	5	7	8	8	9	9	9	10	9	9	8	7	7	5	2
V_{fx} (kN)	8	7	6	6	4	3	3	2	1	2	0	2	1	3	5	5	6	8
V_{fy} (kN)	34	34	33	24	23	22	10	10	9	3	4	5	19	20	21	36	37	38

Gross Section Properties:

Ag (mm^2)	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429
I_x (mm^4)	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09
I_y (mm^4)	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
J (mm^4)	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06
r_x (mm)	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383
r_y (mm)	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
S_x (mm^3)	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06
S_y (mm^3)	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	533	533	533	914	914	914	533	533	533	991	991	991	991	991	991	991	991	991

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	93	93	93	94	94	94	96	96	96	98	98	98	99	99	99	100	100	100
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Width-to-thickness ratio of elements in compression

Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Webs in combined flexural and axial compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	93	93	93	94	94	94	96	96	96	98	98	98	99	99	99	100	100	100
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	533	533	533	914	914	914	533	533	533	991	991	991	991	991	991	991	991	991
L_y (mm)	533	533	533	914	914	914	533	533	533	991	991	991	991	991	991	991	991	991
λ_{max}	0.089	0.089	0.089	0.152	0.152	0.152	0.089	0.089	0.089	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165
C_r (kN)	5098.7	5098.7	5098.7	5080.1	5080.1	5080.1	5098.7	5098.7	5098.7	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3
$(kL/r)_{max}$	8.6	8.6	8.6	14.7	14.7	14.7	8.6	8.6	8.6	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	748208	748208	748208	254599	254599	254599	748208	748208	748208	216936	216936	216936	216936	216936	216936	216936	216936	216936

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	480	480	480	823	823	823	480	480	480	892	892	892	892	892	892	892	892	892
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	93	93	93	94	94	94	96	96	96	98	98	98	99	99	99	100	100	100
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	5098.7	5098.7	5098.7	5080.1	5080.1	5080.1	5098.7	5098.7	5098.7	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$A_{n(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(b)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(c)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	93	93	93	94	94	94	96	96	96	98	98	98	99	99	99	100	100	100
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
$(kL/r)_{max}$	9	9	9	15	15	15	9	9	9	16	16	16	16	16	16	16	16	16
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619
$M_{ry(Laterally\ Supported)}$ (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	533	533	533	914	914	914	533	533	533	991	991	991	991	991	991	991	991	991
L_{uy} (mm)	533	533	533	914	914	914	533	533	533	991	991	991	991	991	991	991	991	991
M_{ux} (kNm) (y weak)	14194	14194	14194	8280	8280	8280	14194	14194	14194	7643	7643	7643	7643	7643	7643	7643	7643	7643
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1796.5	1796.5	1796.5	1749.4	1749.4	1749.4	1796.5	1796.5	1796.5	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0
M_{ry} (kNm)	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3
w_y (mm)	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
A_{wy} (mm^2)	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792
h_y/w_y	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
F_{cr} (N/mm^2)	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703
$(V_f/V_r)<=1$	0.020	0.020	0.019	0.014	0.014	0.013	0.006	0.006	0.005	0.002	0.002	0.003	0.011	0.012	0.012	0.021	0.022	0.022

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
$(T_f/T_r)<=1$	0.006	0.006	0.006	0.007	0.007	0.007	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.006	0.006	0.006

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.006	0.006	0.006	0.007	0.007	0.007	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.006	0.006	0.006
$M_{fx}/M_{rx}<=1$	0.051	0.056	0.061	0.061	0.067	0.073	0.071	0.072	0.073	0.075	0.074	0.073	0.074	0.068	0.062	0.064	0.053	0.043
$M_{fy}/M_{ry}<=1$	0.015	0.030	0.038	0.038	0.053	0.060	0.060	0.068	0.068	0.068	0.075	0.068	0.068	0.060	0.053	0.053	0.038	0.015
$T_f/T_r+M_f/M_r<=1$	0.071	0.091	0.104	0.106	0.127	0.140	0.139	0.147	0.149	0.151	0.157	0.149	0.149	0.136	0.122	0.123	0.097	0.064
$M_f/M_r-T_fS/M_rA<=1$	0.055	0.075	0.087	0.086	0.107	0.120	0.116	0.125	0.126	0.127	0.134	0.125	0.127	0.114	0.100	0.104	0.079	0.045

PARSONS

Member ID in CSiBridge	93	93	93	94	94	94	96	96	96	98	98	98	99	99	99	100	100	100
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	2.89E+07	2.89E+07	2.89E+07	9.83E+06	9.83E+06	9.83E+06	2.89E+07	2.89E+07	2.89E+07	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	748208	748208	748208	254599	254599	254599	748208	748208	748208	216936	216936	216936	216936	216936	216936	216936	216936	216936
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
$U_{1x}M_{fx}/M_{rx}$	0.056	0.062	0.067	0.066	0.073	0.079	0.078	0.080	0.082	0.081	0.080	0.078	0.079	0.073	0.067	0.069	0.057	0.046
$U_{1y}M_{fy}/M_{ry}$	0.015	0.030	0.038	0.038	0.053	0.060	0.060	0.068	0.068	0.068	0.075	0.068	0.068	0.060	0.053	0.053	0.038	0.015
Interaction	0.072	0.092	0.105	0.105	0.126	0.140	0.140	0.148	0.150	0.150	0.156	0.147	0.148	0.135	0.121	0.122	0.096	0.062

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.089	0.089	0.089	0.152	0.152	0.152	0.089	0.089	0.089	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165
$C_{r\ (K=1)}$ (kN)	5099	5099	5099	5080	5080	5080	5099	5099	5099	5074	5074	5074	5074	5074	5074	5074	5074	5074
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
$U_{1x}M_{fx}/M_{rx}$	0.056	0.062	0.067	0.066	0.073	0.079	0.078	0.080	0.082	0.081	0.080	0.078	0.079	0.073	0.067	0.069	0.057	0.046
$U_{1y}M_{fy}/M_{ry}$	0.015	0.030	0.038	0.038	0.053	0.060	0.060	0.068	0.068	0.068	0.075	0.068	0.068	0.060	0.053	0.053	0.038	0.015
Interaction	0.072	0.092	0.105	0.105	0.126	0.140	0.140	0.148	0.150	0.150	0.156	0.147	0.148	0.135	0.121	0.122	0.096	0.062

3.3. Lateral Torsional Buckling:

λ_{max}	0.089	0.089	0.089	0.152	0.152	0.152	0.089	0.089	0.089	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165
C_r (kN)	5099	5099	5099	5080	5080	5080	5099	5099	5099	5074	5074	5074	5074	5074	5074	5074	5074	5074
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1796	1796	1796	1749	1749	1749	1796	1796	1796	1740	1740	1740	1740	1740	1740	1740	1740	1740
M_{ry} (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
C_f/C_r	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
$U_{1x}M_{fx}/M_{rx}$	0.051	0.056	0.061	0.061	0.067	0.073	0.071	0.072	0.073	0.075	0.074	0.073	0.074	0.068	0.062	0.064	0.053	0.043
$U_{1y}M_{fy}/M_{ry}$	0.015	0.030	0.038	0.038	0.053	0.060	0.060	0.068	0.068	0.068	0.075	0.068	0.068	0.060	0.053	0.053	0.038	0.015
Interaction	0.066	0.086	0.099	0.100	0.121	0.134	0.132	0.141	0.142	0.144	0.151	0.142	0.143	0.130	0.116	0.118	0.092	0.059
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.072	0.092	0.105	0.106	0.127	0.140	0.140	0.148	0.150	0.151	0.157	0.149	0.149	0.136	0.122	0.123	0.097	0.064

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	101	101	101	103	103	103	105	105	105	107	107	107	108	108	108	109	109	109
Member Label	-	-	-	-4S	-4S	-4S	6N-	6N-	6N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	4S	6N	---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Member Factored Load Effects:

C_f (kN)	4	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (comp)}$ (kNm)	78	52	25	28	5	22	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	2	6	12	12	21	29	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	25	25	25	18	18	18	41	48	48	62	62	62	76	76	76	85	85	85
$M_{fx\ (tension)}$ (kNm)	78	52	25	28	5	22	12	16	37	30	56	83	75	85	96	90	102	114
$M_{fy\ (tension)}$ (kNm)	2	6	12	12	21	29	87	46	7	32	4	38	10	19	28	9	16	23
V_{fx} (kN)	11	12	14	26	27	28	151	122	121	72	71	69	35	34	33	17	15	14
V_{fy} (kN)	52	53	54	74	75	75	74	68	68	55	54	53	40	39	39	27	26	26

Gross Section Properties:

Ag (mm^2)	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429
I_x (mm^4)	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09
I_y (mm^4)	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
J (mm^4)	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06
r_x (mm)	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383
r_y (mm)	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
S_x (mm^3)	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06
S_y (mm^3)	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	991	991	991	648	648	648	648	648	648	991	991	991	533	533	533	914	914	914

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	101	101	101	103	103	103	105	105	105	107	107	107	108	108	108	109	109	109
Member Label	-	-	-	-4S	-4S	-4S	6N-	6N-	6N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	4S	6N	---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Webs in combined flexural and axial compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	101	101	101	103	103	103	105	105	105	107	107	107	108	108	108	109	109	109
Member Label	-	-	-	-4S	-4S	-4S	6N-	6N-	6N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	4S	6N	---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	991	991	991	648	648	648	648	648	648	991	991	991	533	533	533	914	914	914
L_y (mm)	991	991	991	648	648	648	648	648	648	991	991	991	533	533	533	914	914	914
λ_{max}	0.165	0.165	0.165	0.108	0.108	0.108	0.108	0.108	0.108	0.165	0.165	0.165	0.089	0.089	0.089	0.152	0.152	0.152
C_r (kN)	5074.3	5074.3	5074.3	5094.7	5094.7	5094.7	5094.7	5094.7	5094.7	5074.3	5074.3	5074.3	5098.7	5098.7	5098.7	5080.1	5080.1	5080.1
$(kL/r)_{max}$	16.0	16.0	16.0	10.4	10.4	10.4	10.4	10.4	10.4	16.0	16.0	16.0	8.6	8.6	8.6	14.7	14.7	14.7
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	216936	216936	216936	507435	507435	507435	507435	507435	507435	216936	216936	216936	748208	748208	748208	254599	254599	254599

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	892	892	892	583	583	583	583	583	583	892	892	892	480	480	480	823	823	823
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	101	101	101	103	103	103	105	105	105	107	107	107	108	108	108	109	109	109
Member Label	-	-	-	-4S	-4S	-4S	6N-	6N-	6N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	4S	6N	---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	5074.3	5074.3	5074.3	5094.7	5094.7	5094.7	5094.7	5094.7	5094.7	5074.3	5074.3	5074.3	5098.7	5098.7	5098.7	5080.1	5080.1	5080.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$A_{n(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(b)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(c)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	101	101	101	103	103	103	105	105	105	107	107	107	108	108	108	109	109	109
Member Label	-	-	-	-4S	-4S	-4S	6N-	6N-	6N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	4S	6N	---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
$(kL/r)_{max}$	16	16	16	10	10	10	10	10	10	16	16	16	9	9	9	15	15	15
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619
$M_{ry(Laterally\ Supported)}$ (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	991	991	991	648	648	648	648	648	648	991	991	991	533	533	533	914	914	914
L_{uy} (mm)	991	991	991	648	648	648	648	648	648	991	991	991	533	533	533	914	914	914
M_{ux} (kNm) (y weak)	7643	7643	7643	11689	11689	11689	11689	11689	11689	7643	7643	7643	14194	14194	14194	8280	8280	8280
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1740.0	1740.0	1740.0	1782.3	1782.3	1782.3	1782.3	1782.3	1782.3	1740.0	1740.0	1740.0	1796.5	1796.5	1796.5	1749.4	1749.4	1749.4
M_{ry} (kNm)	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3
w_y (mm)	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
A_{wy} (mm^2)	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792
h_y/w_y	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
F_{cr} (N/mm^2)	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703
$(V_f/V_r)<=1$	0.031	0.031	0.032	0.043	0.044	0.044	0.043	0.040	0.040	0.032	0.032	0.031	0.023	0.023	0.023	0.016	0.015	0.015

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$(T_f/T_r)<=1$	0.005	0.005	0.005	0.003	0.003	0.003	0.008	0.009	0.009	0.012	0.012	0.012	0.014	0.014	0.014	0.016	0.016	0.016

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.005	0.005	0.005	0.003	0.003	0.003	0.008	0.009	0.009	0.012	0.012	0.012	0.014	0.014	0.014	0.016	0.016	0.016
$M_{fx}/M_{rx}<=1$	0.045	0.030	0.014	0.016	0.003	0.012	0.007	0.009	0.021	0.017	0.032	0.048	0.042	0.047	0.053	0.051	0.058	0.065
$M_{fy}/M_{ry}<=1$	0.015	0.045	0.090	0.090	0.158	0.218	0.654	0.346	0.053	0.241	0.030	0.286	0.075	0.143	0.211	0.068	0.120	0.173
$T_f/T_r+M_f/M_r<=1$	0.065	0.080	0.109	0.109	0.164	0.234	0.668	0.364	0.082	0.269	0.074	0.345	0.131	0.204	0.278	0.135	0.194	0.254
$M_f/M_r-T_fS/M_rA<=1$	0.051	0.066	0.096	0.100	0.154	0.224	0.646	0.338	0.056	0.236	0.040	0.311	0.090	0.163	0.237	0.089	0.148	0.208

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	101	101	101	103	103	103	105	105	105	107	107	107	108	108	108	109	109	109
Member Label	-	-	-	-4S	-4S	-4S	6N-	6N-	6N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	4S	6N	---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.38E+06	8.38E+06	8.38E+06	1.96E+07	1.96E+07	1.96E+07	1.96E+07	1.96E+07	1.96E+07	8.38E+06	8.38E+06	8.38E+06	2.89E+07	2.89E+07	2.89E+07	9.83E+06	9.83E+06	9.83E+06
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	216936	216936	216936	507435	507435	507435	507435	507435	507435	216936	216936	216936	748208	748208	748208	254599	254599	254599
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.048	0.032	0.015	0.017	0.003	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.015	0.045	0.090	0.090	0.158	0.218	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.064	0.078	0.106	0.108	0.162	0.232	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.165	0.165	0.165	0.108	0.108	0.108	0.108	0.108	0.108	0.165	0.165	0.165	0.089	0.089	0.089	0.152	0.152	0.152
$C_{r\ (K=1)}$ (kN)	5074	5074	5074	5095	5095	5095	5095	5095	5095	5074	5074	5074	5099	5099	5099	5080	5080	5080
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.048	0.032	0.015	0.017	0.003	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.015	0.045	0.090	0.090	0.158	0.218	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.064	0.078	0.106	0.108	0.162	0.232	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.3. Lateral Torsional Buckling:

λ_{max}	0.165	0.165	0.165	0.108	0.108	0.108	0.108	0.108	0.108	0.165	0.165	0.165	0.089	0.089	0.089	0.152	0.152	0.152
C_r (kN)	5074	5074	5074	5095	5095	5095	5095	5095	5095	5074	5074	5074	5099	5099	5099	5080	5080	5080
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1740	1740	1740	1782	1782	1782	1782	1782	1782	1740	1740	1740	1796	1796	1796	1749	1749	1749
M_{ry} (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
C_f/C_r	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.045	0.030	0.014	0.016	0.003	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.015	0.045	0.090	0.090	0.158	0.218	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.061	0.076	0.105	0.107	0.161	0.231	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.065	0.080	0.109	0.109	0.164	0.234	0.668	0.364	0.082	0.269	0.074	0.345	0.131	0.204	0.278	0.135	0.194	0.254

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	110	110	110	111	111	111	112	112	112	118	118	118	119	119	119	120	120	120
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-6S	-6S	-6S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	6S
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Member Factored Load Effects:

C_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	92	92	92	93	93	92	86	86	86	72	72	72	51	51	51	35	35	31
$M_{fx\ (tension)}$ (kNm)	111	114	117	117	117	115	118	109	98	107	88	69	81	54	26	35	14	10
$M_{fy\ (tension)}$ (kNm)	12	13	14	11	12	11	18	14	10	30	17	4	37	3	32	8	46	87
V_{fx} (kN)	6	5	4	2	1	2	6	8	9	25	26	28	68	70	71	119	120	150
V_{fy} (kN)	13	12	12	1	1	6	19	20	21	37	38	39	55	56	57	70	71	76

Gross Section Properties:

Ag (mm^2)	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429
I_x (mm^4)	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09
I_y (mm^4)	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
J (mm^4)	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06
r_x (mm)	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383
r_y (mm)	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
S_x (mm^3)	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06
S_y (mm^3)	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	533	533	533	991	991	991	991	991	991	991	991	991	991	991	991	648	648	648

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	110	110	110	111	111	111	112	112	112	118	118	118	119	119	119	120	120	120
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-6S	-6S	-6S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	6S
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Webs in combined flexural and axial compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	110	110	110	111	111	111	112	112	112	118	118	118	119	119	119	120	120	120
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-6S	-6S	-6S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	6S
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	533	533	533	991	991	991	991	991	991	991	991	991	991	991	991	648	648	648
L_y (mm)	533	533	533	991	991	991	991	991	991	991	991	991	991	991	991	648	648	648
λ_{max}	0.089	0.089	0.089	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.108	0.108	0.108
C_r (kN)	5098.7	5098.7	5098.7	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5094.7	5094.7	5094.7
$(kL/r)_{max}$	8.6	8.6	8.6	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	10.4	10.4	10.4
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	748208	748208	748208	216936	216936	216936	216936	216936	216936	216936	216936	216936	216936	216936	216936	507435	507435	507435

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	480	480	480	892	892	892	892	892	892	892	892	892	892	892	892	583	583	583
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	110	110	110	111	111	111	112	112	112	118	118	118	119	119	119	120	120	120
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-6S	-6S	-6S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	6S
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	5098.7	5098.7	5098.7	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5094.7	5094.7	5094.7

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$A_{n(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(b)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(c)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	110	110	110	111	111	111	112	112	112	118	118	118	119	119	119	120	120	120
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-6S	-6S	-6S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	6S
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
$(kL/r)_{max}$	9	9	9	16	16	16	16	16	16	16	16	16	16	16	16	10	10	10
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619
$M_{ry(Laterally\ Supported)}$ (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	533	533	533	991	991	991	991	991	991	991	991	991	991	991	991	648	648	648
L_{uy} (mm)	533	533	533	991	991	991	991	991	991	991	991	991	991	991	991	648	648	648
M_{ux} (kNm) (y weak)	14194	14194	14194	7643	7643	7643	7643	7643	7643	7643	7643	7643	7643	7643	7643	11689	11689	11689
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1796.5	1796.5	1796.5	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1782.3	1782.3	1782.3
M_{ry} (kNm)	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3
w_y (mm)	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
A_{wy} (mm^2)	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792
h_y/w_y	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
F_{cr} (N/mm^2)	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703
$(V_f/V_r)<=1$	0.008	0.007	0.007	0.001	0.001	0.004	0.011	0.012	0.012	0.022	0.022	0.023	0.032	0.033	0.033	0.041	0.042	0.045

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$(T_f/T_r)<=1$	0.017	0.017	0.017	0.017	0.017	0.017	0.016	0.016	0.016	0.013	0.013	0.013	0.009	0.009	0.009	0.006	0.006	0.006

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.017	0.017	0.017	0.017	0.017	0.017	0.016	0.016	0.016	0.013	0.013	0.013	0.009	0.009	0.009	0.006	0.006	0.006
$M_{fx}/M_{rx}<=1$	0.062	0.063	0.065	0.067	0.067	0.066	0.068	0.063	0.056	0.061	0.051	0.040	0.047	0.031	0.015	0.020	0.008	0.006
$M_{fy}/M_{ry}<=1$	0.090	0.098	0.105	0.083	0.090	0.083	0.135	0.105	0.075	0.226	0.128	0.030	0.278	0.023	0.241	0.060	0.346	0.654
$T_f/T_r+M_f/M_r<=1$	0.169	0.178	0.187	0.167	0.175	0.166	0.219	0.184	0.147	0.300	0.192	0.083	0.334	0.063	0.265	0.086	0.360	0.665
$M_f/M_r-T_fS/M_rA<=1$	0.120	0.129	0.138	0.117	0.124	0.116	0.172	0.137	0.101	0.261	0.153	0.044	0.306	0.035	0.237	0.067	0.341	0.649

PARSONS

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	110	110	110	111	111	111	112	112	112	118	118	118	119	119	119	120	120	120
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-6S	-6S	-6S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	6S
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	2.89E+07	2.89E+07	2.89E+07	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	1.96E+07	1.96E+07	1.96E+07
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	748208	748208	748208	216936	216936	216936	216936	216936	216936	216936	216936	216936	216936	216936	216936	507435	507435	507435
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.089	0.089	0.089	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.108	0.108	0.108
$C_{r\ (K=1)}$ (kN)	5099	5099	5099	5074	5074	5074	5074	5074	5074	5074	5074	5074	5074	5074	5074	5095	5095	5095
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.3. Lateral Torsional Buckling:

λ_{max}	0.089	0.089	0.089	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.108	0.108	0.108
C_r (kN)	5099	5099	5099	5074	5074	5074	5074	5074	5074	5074	5074	5074	5074	5074	5074	5095	5095	5095
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1796	1796	1796	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740	1782	1782	1782
M_{ry} (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.169	0.178	0.187	0.167	0.175	0.166	0.219	0.184	0.147	0.300	0.192	0.083	0.334	0.063	0.265	0.086	0.360	0.665

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	121	121	121	122	122	122	123	123	123	124	124	124	125	125	125	126	126	126
Member Label	10N-	10N-	10N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	10N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Member Factored Load Effects:

C_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	2	2	2
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	131	134	136	136	134	133
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	9	10	10	10	10	10
T_f (kN)	98	98	98	106	106	106	116	116	116	124	124	124	129	129	129	131	131	131
$M_{fx\ (tension)}$ (kNm)	26	42	61	59	80	102	99	107	115	113	123	133	131	134	136	136	134	133
$M_{fy\ (tension)}$ (kNm)	39	28	18	18	10	5	5	6	7	7	9	9	9	10	10	10	10	10
V_{fx} (kN)	35	34	32	17	15	13	10	9	8	7	5	4	4	3	2	3	1	3
V_{fy} (kN)	65	65	64	46	46	45	32	32	32	23	23	22	11	11	10	5	6	7

Gross Section Properties:

Ag (mm^2)	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429
I_x (mm^4)	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09
I_y (mm^4)	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
J (mm^4)	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06
r_x (mm)	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383
r_y (mm)	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
S_x (mm^3)	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06
S_y (mm^3)	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	648	648	648	991	991	991	533	533	533	914	914	914	533	533	533	991	991	991

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	121	121	121	122	122	122	123	123	123	124	124	124	125	125	125	126	126	126
Member Label	10N-	10N-	10N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	10N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Webs in combined flexural and axial compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	121	121	121	122	122	122	123	123	123	124	124	124	125	125	125	126	126	126
Member Label	10N-	10N-	10N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	10N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	648	648	648	991	991	991	533	533	533	914	914	914	533	533	533	991	991	991
L_y (mm)	648	648	648	991	991	991	533	533	533	914	914	914	533	533	533	991	991	991
λ_{max}	0.108	0.108	0.108	0.165	0.165	0.165	0.089	0.089	0.089	0.152	0.152	0.152	0.089	0.089	0.089	0.165	0.165	0.165
C_r (kN)	5094.7	5094.7	5094.7	5074.3	5074.3	5074.3	5098.7	5098.7	5098.7	5080.1	5080.1	5080.1	5098.7	5098.7	5098.7	5074.3	5074.3	5074.3
$(kL/r)_{max}$	10.4	10.4	10.4	16.0	16.0	16.0	8.6	8.6	8.6	14.7	14.7	14.7	8.6	8.6	8.6	16.0	16.0	16.0
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	507435	507435	507435	216936	216936	216936	748208	748208	748208	254599	254599	254599	748208	748208	748208	216936	216936	216936

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	583	583	583	892	892	892	480	480	480	823	823	823	480	480	480	892	892	892
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	121	121	121	122	122	122	123	123	123	124	124	124	125	125	125	126	126	126
Member Label	10N-	10N-	10N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	10N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	5094.7	5094.7	5094.7	5074.3	5074.3	5074.3	5098.7	5098.7	5098.7	5080.1	5080.1	5080.1	5098.7	5098.7	5098.7	5074.3	5074.3	5074.3

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$A_{n(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(b)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(c)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Member ID in CSiBridge	121	121	121	122	122	122	123	123	123	124	124	124	125	125	125	126	126	126
Member Label	10N-	10N-	10N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	10N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
$(kL/r)_{max}$	10	10	10	16	16	16	9	9	9	15	15	15	9	9	9	16	16	16
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619
$M_{ry(Laterally\ Supported)}$ (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	648	648	648	991	991	991	533	533	533	914	914	914	533	533	533	991	991	991
L_{uy} (mm)	648	648	648	991	991	991	533	533	533	914	914	914	533	533	533	991	991	991
M_{ux} (kNm) (y weak)	11689	11689	11689	7643	7643	7643	14194	14194	14194	8280	8280	8280	14194	14194	14194	7643	7643	7643
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1782.3	1782.3	1782.3	1740.0	1740.0	1740.0	1796.5	1796.5	1796.5	1749.4	1749.4	1749.4	1796.5	1796.5	1796.5	1740.0	1740.0	1740.0
M_{ry} (kNm)	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3
w_y (mm)	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
A_{wy} (mm^2)	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792
h_y/w_y	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
F_{cr} (N/mm^2)	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703
$(V_f/V_r)<=1$	0.038	0.038	0.038	0.027	0.027	0.026	0.019	0.019	0.019	0.014	0.014	0.013	0.006	0.006	0.006	0.003	0.004	0.004

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$(T_f/T_r)<=1$	0.018	0.018	0.018	0.020	0.020	0.020	0.022	0.022	0.022	0.023	0.023	0.023	0.024	0.024	0.024	0.024	0.024	0.024

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.018	0.018	0.018	0.020	0.020	0.020	0.022	0.022	0.022	0.023	0.023	0.023	0.024	0.024	0.024	0.024	0.024	0.024
$M_{fx}/M_{rx}<=1$	0.015	0.024	0.034	0.034	0.046	0.059	0.055	0.060	0.064	0.065	0.070	0.076	0.073	0.075	0.076	0.078	0.077	0.076
$M_{fy}/M_{ry}<=1$	0.293	0.211	0.135	0.135	0.075	0.038	0.038	0.045	0.053	0.053	0.068	0.068	0.068	0.075	0.075	0.075	0.075	0.075
$T_f/T_r+M_f/M_r<=1$	0.326	0.252	0.188	0.189	0.141	0.116	0.114	0.126	0.138	0.140	0.161	0.167	0.165	0.174	0.175	0.178	0.177	0.176
$M_f/M_r-T_fS/M_rA<=1$	0.273	0.199	0.135	0.131	0.083	0.058	0.052	0.064	0.076	0.073	0.094	0.099	0.095	0.104	0.105	0.106	0.105	0.105

Member ID in CSiBridge	121	121	121	122	122	122	123	123	123	124	124	124	125	125	125	126	126	126
Member Label	10N-	10N-	10N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	10N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.96E+07	1.96E+07	1.96E+07	8.38E+06	8.38E+06	8.38E+06	2.89E+07	2.89E+07	2.89E+07	9.83E+06	9.83E+06	9.83E+06	2.89E+07	2.89E+07	2.89E+07	8.38E+06	8.38E+06	8.38E+06
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	507435	507435	507435	216936	216936	216936	748208	748208	748208	254599	254599	254599	748208	748208	748208	216936	216936	216936
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.081	0.083	0.084	0.084	0.083	0.082
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.068	0.075	0.075	0.075	0.075	0.075
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.149	0.158	0.159	0.160	0.158	0.158

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.108	0.108	0.108	0.165	0.165	0.165	0.089	0.089	0.089	0.152	0.152	0.152	0.089	0.089	0.089	0.165	0.165	0.165
$C_{r\ (K=1)}$ (kN)	5095	5095	5095	5074	5074	5074	5099	5099	5099	5080	5080	5080	5099	5099	5099	5074	5074	5074
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.081	0.083	0.084	0.084	0.083	0.082
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.068	0.075	0.075	0.075	0.075	0.075
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.149	0.158	0.159	0.160	0.158	0.158

3.3. Lateral Torsional Buckling:

λ_{max}	0.108	0.108	0.108	0.165	0.165	0.165	0.089	0.089	0.089	0.152	0.152	0.152	0.089	0.089	0.089	0.165	0.165	0.165
C_r (kN)	5095	5095	5095	5074	5074	5074	5099	5099	5099	5080	5080	5080	5099	5099	5099	5074	5074	5074
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1782	1782	1782	1740	1740	1740	1796	1796	1796	1749	1749	1749	1796	1796	1796	1740	1740	1740
M_{ry} (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.073	0.075	0.076	0.078	0.077	0.076
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.068	0.075	0.075	0.075	0.075	0.075
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.141	0.150	0.151	0.154	0.153	0.152
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.326	0.252	0.188	0.189	0.141	0.116	0.114	0.126	0.138	0.140	0.161	0.167	0.165	0.174	0.175	0.178	0.177	0.176

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	127	127	127	128	128	128	129	129	129	130	130	130	610	610	610	611	611	611
Member Label	-	-	-	-	-	-	-	-	-	-10S	-10S	-10S	0N-	0N-	0N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	10S	0N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Member Factored Load Effects:

C_f (kN)	1	1	1	0	0	0	0	0	0	0	0	0	10	21	21	29	29	29
$M_{fx\ (comp)}$ (kNm)	134	125	116	0	0	0	0	0	0	0	0	0	2	10	23	20	36	51
$M_{fy\ (comp)}$ (kNm)	10	9	8	0	0	0	0	0	0	0	0	0	53	30	9	19	2	20
T_f (kN)	127	127	127	119	119	119	107	107	107	99	99	99	0	2	2	7	7	7
$M_{fx\ (tension)}$ (kNm)	134	125	116	118	102	85	89	66	44	47	30	23	0	10	23	20	36	51
$M_{fy\ (tension)}$ (kNm)	10	9	8	8	7	5	5	10	18	18	28	39	0	30	9	19	2	20
V_{fx} (kN)	2	4	5	6	8	9	13	15	17	33	34	35	84	65	64	42	40	38
V_{fy} (kN)	19	20	20	34	35	36	48	49	50	69	69	70	42	39	38	31	31	30

Gross Section Properties:

Ag (mm^2)	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429
I_x (mm^4)	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09
I_y (mm^4)	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
J (mm^4)	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06
r_x (mm)	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383
r_y (mm)	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
S_x (mm^3)	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06
S_y (mm^3)	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	991	991	991	991	991	991	991	991	991	648	648	648	648	648	648	991	991	991

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	127	127	127	128	128	128	129	129	129	130	130	130	610	610	610	611	611	611
Member Label	-	-	-	-	-	-	-	-	-	-10S	-10S	-10S	0N-	0N-	0N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	10S	0N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Webs in combined flexural and axial compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	127	127	127	128	128	128	129	129	129	130	130	130	610	610	610	611	611	611
Member Label	-	-	-	-	-	-	-	-	-	-10S	-10S	-10S	0N-	0N-	0N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	10S	0N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	991	991	991	991	991	991	991	991	991	648	648	648	648	648	648	991	991	991
L_y (mm)	991	991	991	991	991	991	991	991	991	648	648	648	648	648	648	991	991	991
λ_{max}	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.108	0.108	0.108	0.108	0.108	0.108	0.165	0.165	0.165
C_r (kN)	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5094.7	5094.7	5094.7	5094.7	5094.7	5094.7	5074.3	5074.3	5074.3
$(kL/r)_{max}$	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	10.4	10.4	10.4	10.4	10.4	10.4	16.0	16.0	16.0
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	216936	216936	216936	216936	216936	216936	216936	216936	216936	507435	507435	507435	507435	507435	507435	216936	216936	216936

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	892	892	892	892	892	892	892	892	892	583	583	583	583	583	583	892	892	892
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	127	127	127	128	128	128	129	129	129	130	130	130	610	610	610	611	611	611
Member Label	-	-	-	-	-	-	-	-	-	-10S	-10S	-10S	0N-	0N-	0N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	10S	0N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5094.7	5094.7	5094.7	5094.7	5094.7	5094.7	5074.3	5074.3	5074.3

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$A_{n(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(b)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(c)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	127	127	127	128	128	128	129	129	129	130	130	130	610	610	610	611	611	611
Member Label	-	-	-	-	-	-	-	-	-	-10S	-10S	-10S	0N-	0N-	0N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	10S	0N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
$(kL/r)_{max}$	16	16	16	16	16	16	16	16	16	10	10	10	10	10	10	16	16	16
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619
$M_{ry(Laterally\ Supported)}$ (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	991	991	991	991	991	991	991	991	991	648	648	648	648	648	648	991	991	991
L_{uy} (mm)	991	991	991	991	991	991	991	991	991	648	648	648	648	648	648	991	991	991
M_{ux} (kNm) (y weak)	7643	7643	7643	7643	7643	7643	7643	7643	7643	11689	11689	11689	11689	11689	11689	7643	7643	7643
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1782.3	1782.3	1782.3	1782.3	1782.3	1782.3	1740.0	1740.0	1740.0
M_{ry} (kNm)	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3
w_y (mm)	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
A_{wy} (mm^2)	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792
h_y/w_y	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
F_{cr} (N/mm^2)	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703
(V_f/V_r)<=1	0.011	0.012	0.012	0.020	0.021	0.021	0.028	0.029	0.029	0.041	0.041	0.041	0.025	0.023	0.022	0.018	0.018	0.018

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.004	0.004	0.006	0.006	0.006
(T_f/T_r)<=1	0.024	0.024	0.024	0.022	0.022	0.022	0.020	0.020	0.020	0.018	0.018	0.018	0.000	0.000	0.000	0.001	0.001	0.001

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.024	0.024	0.024	0.022	0.022	0.022	0.020	0.020	0.020	0.018	0.018	0.018	0.000	0.000	0.000	0.001	0.001	0.001
M_{fx}/M_{rx}<=1	0.077	0.072	0.067	0.068	0.059	0.049	0.051	0.038	0.025	0.026	0.017	0.013	0.000	0.006	0.013	0.011	0.021	0.029
M_{fy}/M_{ry}<=1	0.075	0.068	0.060	0.060	0.053	0.038	0.038	0.075	0.135	0.135	0.211	0.293	0.000	0.226	0.068	0.143	0.015	0.150
$T_f/T_r+M_f/M_r$<=1	0.176	0.163	0.150	0.150	0.133	0.109	0.109	0.133	0.180	0.180	0.246	0.324	0.000	0.232	0.081	0.156	0.037	0.181
$M_f/M_r-T_fS/M_rA$<=1	0.107	0.094	0.081	0.085	0.069	0.044	0.050	0.075	0.122	0.127	0.192	0.271	0.000	0.230	0.080	0.152	0.033	0.177

Member ID in CSiBridge	127	127	127	128	128	128	129	129	129	130	130	130	610	610	610	611	611	611
Member Label	-	-	-	-	-	-	-	-	-	-10S	-10S	-10S	0N-	0N-	0N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	10S	0N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	1.96E+07	1.96E+07	1.96E+07	1.96E+07	1.96E+07	1.96E+07	8.38E+06	8.38E+06	8.38E+06
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	216936	216936	216936	216936	216936	216936	216936	216936	216936	507435	507435	507435	507435	507435	507435	216936	216936	216936
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.004	0.004	0.006	0.006	0.006
$U_{1x}M_{fx}/M_{rx}$	0.083	0.077	0.072	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.006	0.014	0.012	0.022	0.031
$U_{1y}M_{fy}/M_{ry}$	0.075	0.068	0.060	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.398	0.226	0.068	0.143	0.015	0.150
Interaction	0.158	0.145	0.132	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.402	0.236	0.086	0.161	0.043	0.188

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.108	0.108	0.108	0.108	0.108	0.108	0.165	0.165	0.165
$C_{r\ (K=1)}$ (kN)	5074	5074	5074	5074	5074	5074	5074	5074	5074	5095	5095	5095	5095	5095	5095	5074	5074	5074
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.004	0.004	0.006	0.006	0.006
$U_{1x}M_{fx}/M_{rx}$	0.083	0.077	0.072	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.006	0.014	0.012	0.022	0.031
$U_{1y}M_{fy}/M_{ry}$	0.075	0.068	0.060	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.398	0.226	0.068	0.143	0.015	0.150
Interaction	0.158	0.145	0.132	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.402	0.236	0.086	0.161	0.043	0.188

3.3. Lateral Torsional Buckling:

λ_{max}	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.108	0.108	0.108	0.108	0.108	0.108	0.165	0.165	0.165
C_r (kN)	5074	5074	5074	5074	5074	5074	5074	5074	5074	5095	5095	5095	5095	5095	5095	5074	5074	5074
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1740	1740	1740	1740	1740	1740	1740	1740	1740	1782	1782	1782	1782	1782	1782	1740	1740	1740
M_{ry} (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.004	0.004	0.006	0.006	0.006
$U_{1x}M_{fx}/M_{rx}$	0.077	0.072	0.067	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.006	0.013	0.011	0.021	0.029
$U_{1y}M_{fy}/M_{ry}$	0.075	0.068	0.060	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.398	0.226	0.068	0.143	0.015	0.150
Interaction	0.152	0.140	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.402	0.235	0.085	0.160	0.041	0.185
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.176	0.163	0.150	0.150	0.133	0.109	0.109	0.133	0.180	0.180	0.246	0.324	0.402	0.236	0.086	0.161	0.043	0.188

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	612	612	612	613	613	613	614	614	614	615	615	615	616	616	616	617	617	617
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Member Factored Load Effects:

C_f (kN)	38	38	38	44	44	44	48	48	48	49	49	49	47	47	47	40	40	40
$M_{fx\ (comp)}$ (kNm)	48	54	60	58	65	71	70	72	74	73	73	71	72	67	61	63	52	41
$M_{fy\ (comp)}$ (kNm)	8	13	19	10	15	19	13	14	15	14	14	14	17	14	11	21	13	4
T_f (kN)	13	13	13	17	17	17	20	20	20	21	21	21	20	20	20	16	16	16
$M_{fx\ (tension)}$ (kNm)	48	54	60	58	65	71	70	72	74	73	73	71	72	67	61	63	52	41
$M_{fy\ (tension)}$ (kNm)	8	13	19	10	15	19	13	14	15	14	14	14	17	14	11	21	13	4
V_{fx} (kN)	22	21	20	12	10	9	5	4	3	2	1	2	4	6	7	15	17	19
V_{fy} (kN)	23	22	22	15	15	14	7	7	6	1	1	3	11	12	12	21	22	22

Gross Section Properties:

Ag (mm^2)	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429
I_x (mm^4)	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09
I_y (mm^4)	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
J (mm^4)	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06
r_x (mm)	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383
r_y (mm)	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
S_x (mm^3)	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06
S_y (mm^3)	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	533	533	533	914	914	914	533	533	533	991	991	991	991	991	991	991	991	991

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	612	612	612	613	613	613	614	614	614	615	615	615	616	616	616	617	617	617
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Webs in combined flexural and axial compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	612	612	612	613	613	613	614	614	614	615	615	615	616	616	616	617	617	617
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	533	533	533	914	914	914	533	533	533	991	991	991	991	991	991	991	991	991
L_y (mm)	533	533	533	914	914	914	533	533	533	991	991	991	991	991	991	991	991	991
λ_{max}	0.089	0.089	0.089	0.152	0.152	0.152	0.089	0.089	0.089	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165
C_r (kN)	5098.7	5098.7	5098.7	5080.1	5080.1	5080.1	5098.7	5098.7	5098.7	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3
$(kL/r)_{max}$	8.6	8.6	8.6	14.7	14.7	14.7	8.6	8.6	8.6	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	748208	748208	748208	254599	254599	254599	748208	748208	748208	216936	216936	216936	216936	216936	216936	216936	216936	216936

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	480	480	480	823	823	823	480	480	480	892	892	892	892	892	892	892	892	892
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	612	612	612	613	613	613	614	614	614	615	615	615	616	616	616	617	617	617
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	5098.7	5098.7	5098.7	5080.1	5080.1	5080.1	5098.7	5098.7	5098.7	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$A_{n(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(b)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(c)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Member ID in CSiBridge	612	612	612	613	613	613	614	614	614	615	615	615	616	616	616	617	617	617
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
$(kL/r)_{max}$	9	9	9	15	15	15	9	9	9	16	16	16	16	16	16	16	16	16
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619
$M_{ry(Laterally\ Supported)}$ (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	533	533	533	914	914	914	533	533	533	991	991	991	991	991	991	991	991	991
L_{uy} (mm)	533	533	533	914	914	914	533	533	533	991	991	991	991	991	991	991	991	991
M_{ux} (kNm) (y weak)	14194	14194	14194	8280	8280	8280	14194	14194	14194	7643	7643	7643	7643	7643	7643	7643	7643	7643
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1796.5	1796.5	1796.5	1749.4	1749.4	1749.4	1796.5	1796.5	1796.5	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0
M_{ry} (kNm)	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3
w_y (mm)	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
A_{wy} (mm^2)	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792
h_y/w_y	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
F_{cr} (N/mm^2)	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703
(V_f/V_r)<=1	0.014	0.013	0.013	0.009	0.009	0.008	0.004	0.004	0.004	0.001	0.001	0.002	0.006	0.007	0.007	0.012	0.013	0.013

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.007	0.007	0.007	0.009	0.009	0.009	0.009	0.009	0.009	0.010	0.010	0.010	0.009	0.009	0.009	0.008	0.008	0.008
(T_f/T_r)<=1	0.002	0.002	0.002	0.003	0.003	0.003	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.003	0.003	0.003

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.002	0.002	0.002	0.003	0.003	0.003	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.003	0.003	0.003
M_{fx}/M_{rx}<=1	0.027	0.030	0.033	0.033	0.037	0.041	0.039	0.040	0.041	0.042	0.042	0.041	0.041	0.039	0.035	0.036	0.030	0.024
M_{fy}/M_{ry}<=1	0.060	0.098	0.143	0.075	0.113	0.143	0.098	0.105	0.113	0.105	0.105	0.105	0.128	0.105	0.083	0.158	0.098	0.030
$T_f/T_r+M_f/M_r$<=1	0.089	0.130	0.179	0.111	0.153	0.187	0.140	0.149	0.158	0.151	0.151	0.150	0.173	0.147	0.121	0.197	0.131	0.057
$M_f/M_r-T_fS/M_rA$<=1	0.082	0.123	0.172	0.102	0.144	0.177	0.130	0.138	0.147	0.140	0.140	0.139	0.162	0.137	0.111	0.188	0.122	0.048

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	612	612	612	613	613	613	614	614	614	615	615	615	616	616	616	617	617	617
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	2.89E+07	2.89E+07	2.89E+07	9.83E+06	9.83E+06	9.83E+06	2.89E+07	2.89E+07	2.89E+07	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	748208	748208	748208	254599	254599	254599	748208	748208	748208	216936	216936	216936	216936	216936	216936	216936	216936	216936
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.007	0.007	0.007	0.009	0.009	0.009	0.009	0.009	0.009	0.010	0.010	0.010	0.009	0.009	0.009	0.008	0.008	0.008
$U_{1x}M_{fx}/M_{rx}$	0.030	0.033	0.037	0.036	0.040	0.044	0.043	0.044	0.046	0.045	0.045	0.044	0.044	0.041	0.038	0.039	0.032	0.025
$U_{1y}M_{fy}/M_{ry}$	0.060	0.098	0.143	0.075	0.113	0.143	0.098	0.105	0.113	0.105	0.105	0.105	0.128	0.105	0.083	0.158	0.098	0.030
Interaction	0.097	0.139	0.187	0.120	0.162	0.195	0.150	0.159	0.168	0.160	0.160	0.159	0.182	0.156	0.130	0.205	0.138	0.063

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.089	0.089	0.089	0.152	0.152	0.152	0.089	0.089	0.089	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165
$C_{r\ (K=1)}$ (kN)	5099	5099	5099	5080	5080	5080	5099	5099	5099	5074	5074	5074	5074	5074	5074	5074	5074	5074
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.007	0.007	0.007	0.009	0.009	0.009	0.009	0.009	0.009	0.010	0.010	0.010	0.009	0.009	0.009	0.008	0.008	0.008
$U_{1x}M_{fx}/M_{rx}$	0.030	0.033	0.037	0.036	0.040	0.044	0.043	0.044	0.046	0.045	0.045	0.044	0.044	0.041	0.038	0.039	0.032	0.025
$U_{1y}M_{fy}/M_{ry}$	0.060	0.098	0.143	0.075	0.113	0.143	0.098	0.105	0.113	0.105	0.105	0.105	0.128	0.105	0.083	0.158	0.098	0.030
Interaction	0.097	0.139	0.187	0.120	0.162	0.195	0.150	0.159	0.168	0.160	0.160	0.159	0.182	0.156	0.130	0.205	0.138	0.063

3.3. Lateral Torsional Buckling:

λ_{max}	0.089	0.089	0.089	0.152	0.152	0.152	0.089	0.089	0.089	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165
C_r (kN)	5099	5099	5099	5080	5080	5080	5099	5099	5099	5074	5074	5074	5074	5074	5074	5074	5074	5074
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1796	1796	1796	1749	1749	1749	1796	1796	1796	1740	1740	1740	1740	1740	1740	1740	1740	1740
M_{ry} (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
C_f/C_r	0.007	0.007	0.007	0.009	0.009	0.009	0.009	0.009	0.009	0.010	0.010	0.010	0.009	0.009	0.009	0.008	0.008	0.008
$U_{1x}M_{fx}/M_{rx}$	0.027	0.030	0.033	0.033	0.037	0.041	0.039	0.040	0.041	0.042	0.042	0.041	0.041	0.039	0.035	0.036	0.030	0.024
$U_{1y}M_{fy}/M_{ry}$	0.060	0.098	0.143	0.075	0.113	0.143	0.098	0.105	0.113	0.105	0.105	0.105	0.128	0.105	0.083	0.158	0.098	0.030
Interaction	0.094	0.135	0.184	0.117	0.159	0.192	0.146	0.155	0.163	0.157	0.157	0.156	0.178	0.153	0.127	0.202	0.136	0.062
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.097	0.139	0.187	0.120	0.162	0.195	0.150	0.159	0.168	0.160	0.160	0.159	0.182	0.156	0.130	0.205	0.138	0.063

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	618	618	618	619	619	619	656	656	656	657	657	657	658	658	658	659	659	659
Member Label	-	-	-	-0S	-0S	-0S	8N-	8N-	8N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	0S	8N	---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Member Factored Load Effects:

C_f (kN)	29	29	29	22	22	11	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (comp)}$ (kNm)	44	28	13	14	4	13	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	19	1	20	10	30	53	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	10	10	10	6	6	3	62	62	62	70	70	70	81	81	81	89	89	89
$M_{fx\ (tension)}$ (kNm)	44	28	13	14	4	13	15	37	60	57	81	104	101	110	118	116	126	136
$M_{fy\ (tension)}$ (kNm)	19	1	20	10	30	53	34	24	15	15	8	4	4	5	6	6	8	9
V_{fx} (kN)	37	39	41	62	63	82	31	30	29	15	14	12	9	8	7	6	5	3
V_{fy} (kN)	31	31	32	39	40	42	70	70	69	49	48	47	33	33	32	23	23	22

Gross Section Properties:

Ag (mm^2)	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429
I_x (mm^4)	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09
I_y (mm^4)	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
J (mm^4)	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06
r_x (mm)	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383
r_y (mm)	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
S_x (mm^3)	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06
S_y (mm^3)	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	991	991	991	648	648	648	648	648	648	991	991	991	533	533	533	914	914	914

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	618	618	618	619	619	619	656	656	656	657	657	657	658	658	658	659	659	659
Member Label	-	-	-	-0S	-0S	-0S	8N-	8N-	8N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	0S	8N	---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Webs in combined flexural and axial compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	618	618	618	619	619	619	656	656	656	657	657	657	658	658	658	659	659	659
Member Label	-	-	-	-0S	-0S	-0S	8N-	8N-	8N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	0S	8N	---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	991	991	991	648	648	648	648	648	648	991	991	991	533	533	533	914	914	914
L_y (mm)	991	991	991	648	648	648	648	648	648	991	991	991	533	533	533	914	914	914
λ_{max}	0.165	0.165	0.165	0.108	0.108	0.108	0.108	0.108	0.108	0.165	0.165	0.165	0.089	0.089	0.089	0.152	0.152	0.152
C_r (kN)	5074.3	5074.3	5074.3	5094.7	5094.7	5094.7	5094.7	5094.7	5094.7	5074.3	5074.3	5074.3	5098.7	5098.7	5098.7	5080.1	5080.1	5080.1
$(kL/r)_{max}$	16.0	16.0	16.0	10.4	10.4	10.4	10.4	10.4	10.4	16.0	16.0	16.0	8.6	8.6	8.6	14.7	14.7	14.7
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	216936	216936	216936	507435	507435	507435	507435	507435	507435	216936	216936	216936	748208	748208	748208	254599	254599	254599

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	892	892	892	583	583	583	583	583	583	892	892	892	480	480	480	823	823	823
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	618	618	618	619	619	619	656	656	656	657	657	657	658	658	658	659	659	659
Member Label	-	-	-	-0S	-0S	-0S	8N-	8N-	8N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	0S	8N	---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	5074.3	5074.3	5074.3	5094.7	5094.7	5094.7	5094.7	5094.7	5094.7	5074.3	5074.3	5074.3	5098.7	5098.7	5098.7	5080.1	5080.1	5080.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$A_{n(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(b)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(c)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	618	618	618	619	619	619	656	656	656	657	657	657	658	658	658	659	659	659
Member Label	-	-	-	-0S	-0S	-0S	8N-	8N-	8N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	0S	8N	---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
$(kL/r)_{max}$	16	16	16	10	10	10	10	10	10	16	16	16	9	9	9	15	15	15
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619
$M_{ry(Laterally\ Supported)}$ (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	991	991	991	648	648	648	648	648	648	991	991	991	533	533	533	914	914	914
L_{uy} (mm)	991	991	991	648	648	648	648	648	648	991	991	991	533	533	533	914	914	914
M_{ux} (kNm) (y weak)	7643	7643	7643	11689	11689	11689	11689	11689	11689	7643	7643	7643	14194	14194	14194	8280	8280	8280
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1740.0	1740.0	1740.0	1782.3	1782.3	1782.3	1782.3	1782.3	1782.3	1740.0	1740.0	1740.0	1796.5	1796.5	1796.5	1749.4	1749.4	1749.4
M_{ry} (kNm)	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3
w_y (mm)	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
A_{wy} (mm^2)	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792
h_y/w_y	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
F_{cr} (N/mm^2)	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703
(V_f/V_r)<=1	0.018	0.018	0.019	0.023	0.023	0.025	0.041	0.041	0.041	0.029	0.028	0.028	0.019	0.019	0.019	0.014	0.014	0.013

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.006	0.006	0.006	0.004	0.004	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
(T_f/T_r)<=1	0.002	0.002	0.002	0.001	0.001	0.001	0.012	0.012	0.012	0.013	0.013	0.013	0.015	0.015	0.015	0.017	0.017	0.017

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.002	0.002	0.002	0.001	0.001	0.001	0.012	0.012	0.012	0.013	0.013	0.013	0.015	0.015	0.015	0.017	0.017	0.017
M_{fx}/M_{rx}<=1	0.025	0.016	0.007	0.008	0.002	0.007	0.008	0.021	0.034	0.033	0.047	0.060	0.056	0.061	0.066	0.066	0.072	0.078
M_{fy}/M_{ry}<=1	0.143	0.008	0.150	0.075	0.226	0.398	0.256	0.180	0.113	0.113	0.060	0.030	0.030	0.038	0.045	0.045	0.060	0.068
$T_f/T_r+M_f/M_r$<=1	0.170	0.025	0.160	0.084	0.229	0.406	0.276	0.213	0.158	0.159	0.120	0.103	0.101	0.114	0.126	0.128	0.149	0.162
$M_f/M_r-T_fS/M_rA$<=1	0.165	0.020	0.154	0.081	0.226	0.405	0.242	0.179	0.124	0.120	0.082	0.065	0.058	0.070	0.082	0.080	0.100	0.114

PARSONS

Member ID in CSiBridge	618	618	618	619	619	619	656	656	656	657	657	657	658	658	658	659	659	659
Member Label	-	-	-	-0S	-0S	-0S	8N-	8N-	8N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	0S	8N	---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.38E+06	8.38E+06	8.38E+06	1.96E+07	1.96E+07	1.96E+07	1.96E+07	1.96E+07	1.96E+07	8.38E+06	8.38E+06	8.38E+06	2.89E+07	2.89E+07	2.89E+07	9.83E+06	9.83E+06	9.83E+06
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	216936	216936	216936	507435	507435	507435	507435	507435	507435	216936	216936	216936	748208	748208	748208	254599	254599	254599
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.006**	**0.006**	**0.006**	**0.004**	**0.004**	**0.002**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1x}M_{fx}/M_{rx}$	**0.027**	**0.017**	**0.008**	**0.009**	**0.002**	**0.008**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.143**	**0.008**	**0.150**	**0.075**	**0.226**	**0.398**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.176**	**0.030**	**0.164**	**0.088**	**0.232**	**0.409**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.165	0.165	0.165	0.108	0.108	0.108	0.108	0.108	0.108	0.165	0.165	0.165	0.089	0.089	0.089	0.152	0.152	0.152
$C_{r\ (K=1)}$ (kN)	5074	5074	5074	5095	5095	5095	5095	5095	5095	5074	5074	5074	5099	5099	5099	5080	5080	5080
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.006**	**0.006**	**0.006**	**0.004**	**0.004**	**0.002**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1x}M_{fx}/M_{rx}$	**0.027**	**0.017**	**0.008**	**0.009**	**0.002**	**0.008**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.143**	**0.008**	**0.150**	**0.075**	**0.226**	**0.398**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.176**	**0.031**	**0.164**	**0.088**	**0.232**	**0.409**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

3.3. Lateral Torsional Buckling:

λ_{max}	0.165	0.165	0.165	0.108	0.108	0.108	0.108	0.108	0.108	0.165	0.165	0.165	0.089	0.089	0.089	0.152	0.152	0.152
C_r (kN)	5074	5074	5074	5095	5095	5095	5095	5095	5095	5074	5074	5074	5099	5099	5099	5080	5080	5080
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1740	1740	1740	1782	1782	1782	1782	1782	1782	1740	1740	1740	1796	1796	1796	1749	1749	1749
M_{ry} (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
C_f/C_r	**0.006**	**0.006**	**0.006**	**0.004**	**0.004**	**0.002**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1x}M_{fx}/M_{rx}$	**0.025**	**0.016**	**0.007**	**0.008**	**0.002**	**0.007**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.143**	**0.008**	**0.150**	**0.075**	**0.226**	**0.398**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.174**	**0.029**	**0.164**	**0.087**	**0.232**	**0.408**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Demand/Capacity ≤ 1	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
Highest Ratio	**0.176**	**0.031**	**0.164**	**0.088**	**0.232**	**0.409**	**0.276**	**0.213**	**0.158**	**0.159**	**0.120**	**0.103**	**0.101**	**0.114**	**0.126**	**0.128**	**0.149**	**0.162**

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	660	660	660	661	661	661	662	662	662	663	663	663	664	664	664	665	665	665
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-8S	-8S	-8S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	8S
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Member Factored Load Effects:

C_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	95	95	95	97	97	97	94	94	94	86	86	86	75	75	75	66	66	66
$M_{fx\ (tension)}$ (kNm)	135	137	140	139	137	135	136	127	117	119	102	84	87	62	36	38	14	15
$M_{fy\ (tension)}$ (kNm)	9	9	10	10	10	9	9	9	8	8	6	4	4	8	15	15	24	34
V_{fx} (kN)	4	3	2	3	1	2	2	3	5	5	7	8	12	14	15	29	30	31
V_{fy} (kN)	10	9	9	3	4	5	19	20	21	35	36	37	52	52	53	74	75	76

Gross Section Properties:

Ag (mm^2)	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429
I_x (mm^4)	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09
I_y (mm^4)	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
J (mm^4)	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06
r_x (mm)	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383
r_y (mm)	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
S_x (mm^3)	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06
S_y (mm^3)	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	533	533	533	991	991	991	991	991	991	991	991	991	991	991	991	648	648	648

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	660	660	660	661	661	661	662	662	662	663	663	663	664	664	664	665	665	665
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-8S	-8S	-8S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	8S
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Webs in combined flexural and axial compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	660	660	660	661	661	661	662	662	662	663	663	663	664	664	664	665	665	665
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-8S	-8S	-8S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	8S
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	533	533	533	991	991	991	991	991	991	991	991	991	991	991	991	648	648	648
L_y (mm)	533	533	533	991	991	991	991	991	991	991	991	991	991	991	991	648	648	648
λ_{max}	0.089	0.089	0.089	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.108	0.108	0.108
C_r (kN)	5098.7	5098.7	5098.7	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5094.7	5094.7	5094.7
$(kL/r)_{max}$	8.6	8.6	8.6	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	10.4	10.4	10.4
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	748208	748208	748208	216936	216936	216936	216936	216936	216936	216936	216936	216936	216936	216936	216936	507435	507435	507435

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	480	480	480	892	892	892	892	892	892	892	892	892	892	892	892	583	583	583
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	660	660	660	661	661	661	662	662	662	663	663	663	664	664	664	665	665	665
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-8S	-8S	-8S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	8S
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	5098.7	5098.7	5098.7	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5094.7	5094.7	5094.7

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$A_{n(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(b)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(c)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	660	660	660	661	661	661	662	662	662	663	663	663	664	664	664	665	665	665
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-8S	-8S	-8S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	8S
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
$(kL/r)_{max}$	9	9	9	16	16	16	16	16	16	16	16	16	16	16	16	10	10	10
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619
$M_{ry(Laterally\ Supported)}$ (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	533	533	533	991	991	991	991	991	991	991	991	991	991	991	991	648	648	648
L_{uy} (mm)	533	533	533	991	991	991	991	991	991	991	991	991	991	991	991	648	648	648
M_{ux} (kNm) (y weak)	14194	14194	14194	7643	7643	7643	7643	7643	7643	7643	7643	7643	7643	7643	7643	11689	11689	11689
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1796.5	1796.5	1796.5	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1782.3	1782.3	1782.3
M_{ry} (kNm)	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3
w_y (mm)	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
A_{wy} (mm^2)	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792
h_y/w_y	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
F_{cr} (N/mm^2)	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703
$(V_f/V_r)<=1$	0.006	0.005	0.005	0.002	0.002	0.003	0.011	0.012	0.012	0.021	0.021	0.022	0.031	0.031	0.031	0.043	0.044	0.045

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$(T_f/T_r)<=1$	0.018	0.018	0.018	0.018	0.018	0.018	0.017	0.017	0.017	0.016	0.016	0.016	0.014	0.014	0.014	0.012	0.012	0.012

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.018	0.018	0.018	0.018	0.018	0.018	0.017	0.017	0.017	0.016	0.016	0.016	0.014	0.014	0.014	0.012	0.012	0.012
$M_{fx}/M_{rx}<=1$	0.075	0.076	0.078	0.080	0.079	0.078	0.078	0.073	0.067	0.068	0.059	0.048	0.050	0.036	0.021	0.021	0.008	0.008
$M_{fy}/M_{ry}<=1$	0.068	0.068	0.075	0.075	0.075	0.068	0.068	0.068	0.060	0.060	0.045	0.030	0.030	0.060	0.113	0.113	0.180	0.256
$T_f/T_r+M_f/M_r<=1$	0.160	0.162	0.171	0.173	0.172	0.163	0.163	0.158	0.145	0.145	0.120	0.094	0.094	0.110	0.147	0.146	0.201	0.276
$M_f/M_r-T_fS/M_rA<=1$	0.109	0.110	0.120	0.120	0.119	0.110	0.112	0.107	0.094	0.098	0.073	0.048	0.053	0.069	0.107	0.111	0.165	0.241

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	660	660	660	661	661	661	662	662	662	663	663	663	664	664	664	665	665	665
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-8S	-8S	-8S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	8S
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	2.89E+07	2.89E+07	2.89E+07	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	1.96E+07	1.96E+07	1.96E+07
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	748208	748208	748208	216936	216936	216936	216936	216936	216936	216936	216936	216936	216936	216936	216936	507435	507435	507435
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.089	0.089	0.089	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.108	0.108	0.108
$C_{r\ (K=1)}$ (kN)	5099	5099	5099	5074	5074	5074	5074	5074	5074	5074	5074	5074	5074	5074	5074	5095	5095	5095
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.3. Lateral Torsional Buckling:

λ_{max}	0.089	0.089	0.089	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.108	0.108	0.108
C_r (kN)	5099	5099	5099	5074	5074	5074	5074	5074	5074	5074	5074	5074	5074	5074	5074	5095	5095	5095
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1796	1796	1796	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740	1782	1782	1782
M_{ry} (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.160	0.162	0.171	0.173	0.172	0.163	0.163	0.158	0.145	0.145	0.120	0.094	0.094	0.110	0.147	0.146	0.201	0.276

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	666	666	666	667	667	667	668	668	668	669	669	669	670	670	670	671	671	671
Member Label	12N-	12N-	12N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	12N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Member Factored Load Effects:

C_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	146	147	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	17	0
T_f (kN)	97	110	110	127	127	127	145	145	145	156	156	156	163	163	163	164	164	163
$M_{fx\ (tension)}$ (kNm)	23	42	65	55	85	113	103	115	126	120	132	145	141	144	147	146	147	143
$M_{fy\ (tension)}$ (kNm)	134	72	13	50	4	56	14	28	42	12	23	34	16	19	21	16	17	16
V_{fx} (kN)	227	183	182	109	107	106	53	52	51	25	24	22	10	9	8	5	3	4
V_{fy} (kN)	79	72	72	60	59	58	42	42	42	28	28	27	12	12	11	3	3	10

Gross Section Properties:

Ag (mm^2)	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429
I_x (mm^4)	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09
I_y (mm^4)	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
J (mm^4)	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06
r_x (mm)	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383
r_y (mm)	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
S_x (mm^3)	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06
S_y (mm^3)	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	648	648	648	991	991	991	533	533	533	914	914	914	533	533	533	991	991	991

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	666	666	666	667	667	667	668	668	668	669	669	669	670	670	670	671	671	671
Member Label	12N-	12N-	12N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	12N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Webs in combined flexural and axial compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	666	666	666	667	667	667	668	668	668	669	669	669	670	670	670	671	671	671
Member Label	12N-	12N-	12N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	12N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	648	648	648	991	991	991	533	533	533	914	914	914	533	533	533	991	991	991
L_y (mm)	648	648	648	991	991	991	533	533	533	914	914	914	533	533	533	991	991	991
λ_{max}	0.108	0.108	0.108	0.165	0.165	0.165	0.089	0.089	0.089	0.152	0.152	0.152	0.089	0.089	0.089	0.165	0.165	0.165
C_r (kN)	5094.7	5094.7	5094.7	5074.3	5074.3	5074.3	5098.7	5098.7	5098.7	5080.1	5080.1	5080.1	5098.7	5098.7	5098.7	5074.3	5074.3	5074.3
$(kL/r)_{max}$	10.4	10.4	10.4	16.0	16.0	16.0	8.6	8.6	8.6	14.7	14.7	14.7	8.6	8.6	8.6	16.0	16.0	16.0
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	507435	507435	507435	216936	216936	216936	748208	748208	748208	254599	254599	254599	748208	748208	748208	216936	216936	216936

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	583	583	583	892	892	892	480	480	480	823	823	823	480	480	480	892	892	892
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	666	666	666	667	667	667	668	668	668	669	669	669	670	670	670	671	671	671
Member Label	12N-	12N-	12N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	12N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	5094.7	5094.7	5094.7	5074.3	5074.3	5074.3	5098.7	5098.7	5098.7	5080.1	5080.1	5080.1	5098.7	5098.7	5098.7	5074.3	5074.3	5074.3

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667
$A_{n(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(b)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284
$T_{r(c)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	666	666	666	667	667	667	668	668	668	669	669	669	670	670	670	671	671	671
Member Label	12N-	12N-	12N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	12N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831
$(kL/r)_{max}$	10	10	10	16	16	16	9	9	9	15	15	15	9	9	9	16	16	16
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619
$M_{ry(Laterally\ Supported)}$ (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	648	648	648	991	991	991	533	533	533	914	914	914	533	533	533	991	991	991
L_{uy} (mm)	648	648	648	991	991	991	533	533	533	914	914	914	533	533	533	991	991	991
M_{ux} (kNm) (y weak)	11689	11689	11689	7643	7643	7643	14194	14194	14194	8280	8280	8280	14194	14194	14194	7643	7643	7643
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1782.3	1782.3	1782.3	1740.0	1740.0	1740.0	1796.5	1796.5	1796.5	1749.4	1749.4	1749.4	1796.5	1796.5	1796.5	1740.0	1740.0	1740.0
M_{ry} (kNm)	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3
w_y (mm)	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
A_{wy} (mm^2)	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792
h_y/w_y	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
F_{cr} (N/mm^2)	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703
(V_f/V_r)<=1	0.046	0.042	0.042	0.035	0.035	0.034	0.025	0.025	0.025	0.016	0.016	0.016	0.007	0.007	0.006	0.002	0.002	0.006

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
(T_f/T_r)<=1	0.018	0.020	0.020	0.024	0.024	0.024	0.027	0.027	0.027	0.029	0.029	0.029	0.030	0.030	0.030	0.030	0.030	0.030

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.018	0.020	0.020	0.024	0.024	0.024	0.027	0.027	0.027	0.029	0.029	0.029	0.030	0.030	0.030	0.030	0.030	0.030
M_{fx}/M_{rx}<=1	0.013	0.024	0.036	0.032	0.049	0.065	0.057	0.064	0.070	0.069	0.075	0.083	0.078	0.080	0.082	0.084	0.084	0.082
M_{fy}/M_{ry}<=1	1.007	0.541	0.098	0.376	0.030	0.421	0.105	0.211	0.316	0.090	0.173	0.256	0.120	0.143	0.158	0.120	0.128	0.120
$T_f/T_r+M_f/M_r$<=1	1.038	0.585	0.155	0.431	0.102	0.510	0.190	0.301	0.413	0.188	0.277	0.367	0.229	0.253	0.270	0.235	0.243	0.233
$M_f/M_r-T_fS/M_rA$<=1	0.986	0.526	0.095	0.362	0.033	0.440	0.111	0.223	0.335	0.103	0.193	0.283	0.141	0.165	0.182	0.145	0.154	0.144

Member ID in CSiBridge	666	666	666	667	667	667	668	668	668	669	669	669	670	670	670	671	671	671
Member Label	12N-	12N-	12N-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0
Node Label at Station	12N	---			---			---			---			---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	1.96E+07	1.96E+07	1.96E+07	8.38E+06	8.38E+06	8.38E+06	2.89E+07	2.89E+07	2.89E+07	9.83E+06	9.83E+06	9.83E+06	2.89E+07	2.89E+07	2.89E+07	8.38E+06	8.38E+06	8.38E+06
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	507435	507435	507435	216936	216936	216936	748208	748208	748208	254599	254599	254599	748208	748208	748208	216936	216936	216936
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.090	0.091	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.120	0.128	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.211	0.219	0.000

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.108	0.108	0.108	0.165	0.165	0.165	0.089	0.089	0.089	0.152	0.152	0.152	0.089	0.089	0.089	0.165	0.165	0.165
$C_{r\ (K=1)}$ (kN)	5095	5095	5095	5074	5074	5074	5099	5099	5099	5080	5080	5080	5099	5099	5099	5074	5074	5074
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.090	0.091	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.120	0.128	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.211	0.219	0.000

3.3. Lateral Torsional Buckling:

λ_{max}	0.108	0.108	0.108	0.165	0.165	0.165	0.089	0.089	0.089	0.152	0.152	0.152	0.089	0.089	0.089	0.165	0.165	0.165
C_r (kN)	5095	5095	5095	5074	5074	5074	5099	5099	5099	5080	5080	5080	5099	5099	5099	5074	5074	5074
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1782	1782	1782	1740	1740	1740	1796	1796	1796	1749	1749	1749	1796	1796	1796	1740	1740	1740
M_{ry} (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.084	0.084	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.120	0.128	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.204	0.212	0.000
Demand/Capacity ≤ 1	NOT OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	1.038	0.585	0.155	0.431	0.102	0.510	0.190	0.301	0.413	0.188	0.277	0.367	0.229	0.253	0.270	0.235	0.243	0.233

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	672	672	672	673	673	673	674	674	674	675	675	675	676	676	676	677	677	677
Member Label	-	-	-	-	-	-	-	-	-	-12S	-12S	-12S	14N-	14N-	14N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	12S	14N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Member Factored Load Effects:

C_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	156	156	156	140	140	140	117	117	117	100	100	90	190	190	190	199	199	199
$M_{fx\ (tension)}$ (kNm)	147	136	125	134	113	92	106	75	43	54	29	14	38	57	79	76	100	124
$M_{fy\ (tension)}$ (kNm)	26	20	14	45	25	5	55	3	50	14	73	134	53	39	26	26	16	8
V_{fx} (kN)	11	12	14	39	41	42	105	106	108	181	182	227	44	43	42	20	19	17
V_{fy} (kN)	22	23	24	42	43	44	63	64	65	77	77	85	71	71	70	50	49	48

Gross Section Properties:

Ag (mm^2)	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	28429	29034	29034	29034	29034	29034	29034
I_x (mm^4)	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09
I_y (mm^4)	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
J (mm^4)	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.50E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06
r_x (mm)	383	383	383	383	383	383	383	383	383	383	383	383	396	396	396	396	396	396
r_y (mm)	62	62	62	62	62	62	62	62	62	62	62	62	61	61	61	61	61	61
S_x (mm^3)	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.54E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06
S_y (mm^3)	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	991	991	991	991	991	991	991	991	991	648	648	648	648	648	648	991	991	991

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	672	672	672	673	673	673	674	674	674	675	675	675	676	676	676	677	677	677
Member Label	-	-	-	-	-	-	-	-	-	-12S	-12S	-12S	14N-	14N-	14N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	12S	14N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	60.9	60.9	60.9	60.9	60.9	60.9
Webs in combined flexural and axial compression	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	60.9	60.9	60.9	60.9	60.9	60.9
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	672	672	672	673	673	673	674	674	674	675	675	675	676	676	676	677	677	677
Member Label	-	-	-	-	-	-	-	-	-	-12S	-12S	-12S	14N-	14N-	14N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	12S	14N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	991	991	991	991	991	991	991	991	991	648	648	648	648	648	648	991	991	991
L_y (mm)	991	991	991	991	991	991	991	991	991	648	648	648	648	648	648	991	991	991
λ_{max}	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.108	0.108	0.108	0.110	0.110	0.110	0.167	0.167	0.167
C_r (kN)	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5094.7	5094.7	5094.7	5202.7	5202.7	5202.7	5180.9	5180.9	5180.9
$(kL/r)_{max}$	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	10.4	10.4	10.4	10.6	10.6	10.6	16.2	16.2	16.2
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	216936	216936	216936	216936	216936	216936	216936	216936	216936	507435	507435	507435	507495	507495	507495	216962	216962	216962

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	892	892	892	892	892	892	892	892	892	583	583	583	583	583	583	892	892	892
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14517	14517	14517	14517	14517	14517
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	672	672	672	673	673	673	674	674	674	675	675	675	676	676	676	677	677	677
Member Label	-	-	-	-	-	-	-	-	-	-12S	-12S	-12S	14N-	14N-	14N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	12S	14N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14215	14517	14517	14517	14517	14517	14517
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5074.3	5094.7	5094.7	5094.7	5202.7	5202.7	5202.7	5180.9	5180.9	5180.9

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27008	27582	27582	27582	27582	27582	27582
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5503	5503	5503	5503	5503	5503
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	28272	28272	28272	28272	28272	28272
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	27667	28272	28272	28272	28272	28272	28272
$A_{n(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26858	26858	26858	26858	26858	26858
$T_{r(b)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	9024	9024	9024	9024	9024	9024
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26284	26858	26858	26858	26858	26858	26858
$T_{r(c)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	9024	9024	9024	9024	9024	9024
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	672	672	672	673	673	673	674	674	674	675	675	675	676	676	676	677	677	677
Member Label	-	-	-	-	-	-	-	-	-	-12S	-12S	-12S	14N-	14N-	14N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	12S	14N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	8831	9024	9024	9024	9024	9024	9024
$(kL/r)_{max}$	16	16	16	16	16	16	16	16	16	10	10	10	11	11	11	16	16	16
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5388	5503	5503	5503	5503	5503	5503
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619	1704	1704	1704	1704	1704	1704
$M_{ry(Laterally\ Supported)}$ (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	991	991	991	991	991	991	991	991	991	648	648	648	648	648	648	991	991	991
L_{uy} (mm)	991	991	991	991	991	991	991	991	991	648	648	648	648	648	648	991	991	991
M_{ux} (kNm) (y weak)	7643	7643	7643	7643	7643	7643	7643	7643	7643	11689	11689	11689	11774	11774	11774	7699	7699	7699
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1740.0	1782.3	1782.3	1782.3	1871.8	1871.8	1871.8	1825.2	1825.2	1825.2
M_{ry} (kNm)	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	930.3	968.4	968.4	968.4	968.4	968.4	968.4
w_y (mm)	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
A_{wy} (mm^2)	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	14792	15398	15398	15398	15398	15398	15398
h_y/w_y	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	60.9	60.9	60.9	60.9	60.9	60.9
F_{cr} (N/mm^2)	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703	1772	1772	1772	1772	1772	1772
(V_f/V_r)<=1	0.013	0.014	0.014	0.025	0.025	0.026	0.037	0.038	0.038	0.045	0.045	0.050	0.040	0.040	0.039	0.028	0.028	0.027

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
(T_f/T_r)<=1	0.029	0.029	0.029	0.026	0.026	0.026	0.022	0.022	0.022	0.019	0.019	0.017	0.035	0.035	0.035	0.036	0.036	0.036

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.029	0.029	0.029	0.026	0.026	0.026	0.022	0.022	0.022	0.019	0.019	0.017	0.035	0.035	0.035	0.036	0.036	0.036
M_{fx}/M_{rx}<=1	0.084	0.078	0.072	0.077	0.065	0.053	0.061	0.043	0.025	0.030	0.016	0.008	0.020	0.030	0.042	0.042	0.055	0.068
M_{fy}/M_{ry}<=1	0.195	0.150	0.105	0.338	0.188	0.038	0.414	0.023	0.376	0.105	0.549	1.007	0.398	0.293	0.195	0.195	0.120	0.060
$T_f/T_r+M_f/M_r$<=1	0.309	0.257	0.206	0.441	0.279	0.116	0.496	0.087	0.422	0.154	0.584	1.032	0.453	0.358	0.272	0.273	0.211	0.164
$M_f/M_r-T_fS/M_rA$<=1	0.224	0.173	0.121	0.365	0.203	0.040	0.433	0.024	0.359	0.100	0.530	0.983	0.353	0.258	0.172	0.167	0.105	0.058

Member ID in CSiBridge	672	672	672	673	673	673	674	674	674	675	675	675	676	676	676	677	677	677
Member Label	-	-	-	-	-	-	-	-	-	-12S	-12S	-12S	14N-	14N-	14N-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0
Node Label at Station		---			---			---			---	12S	14N	---			---	
Section #	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 57	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5104	5213	5213	5213	5213	5213	5213
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	8.38E+06	1.96E+07	1.96E+07	1.96E+07	2.14E+07	2.14E+07	2.14E+07	9.16E+06	9.16E+06	9.16E+06
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	216936	216936	216936	216936	216936	216936	216936	216936	216936	507435	507435	507435	507495	507495	507495	216962	216962	216962
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.108	0.108	0.108	0.110	0.110	0.110	0.167	0.167	0.167
$C_{r\ (K=1)}$ (kN)	5074	5074	5074	5074	5074	5074	5074	5074	5074	5095	5095	5095	5203	5203	5203	5181	5181	5181
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.3. Lateral Torsional Buckling:

λ_{max}	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.108	0.108	0.108	0.110	0.110	0.110	0.167	0.167	0.167
C_r (kN)	5074	5074	5074	5074	5074	5074	5074	5074	5074	5095	5095	5095	5203	5203	5203	5181	5181	5181
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1740	1740	1740	1740	1740	1740	1740	1740	1740	1782	1782	1782	1872	1872	1872	1825	1825	1825
M_{ry} (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	NOT OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.309	0.257	0.206	0.441	0.279	0.116	0.496	0.087	0.422	0.154	0.584	1.032	0.453	0.358	0.272	0.273	0.211	0.164

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	678	678	678	679	679	679	680	680	680	681	681	681	682	682	682	683	683	683
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Member Factored Load Effects:

C_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	211	211	211	221	221	221	229	229	229	233	233	233	232	232	232	228	228	228
$M_{fx\ (tension)}$ (kNm)	119	128	137	134	144	155	152	154	157	155	152	149	150	138	126	128	108	88
$M_{fy\ (tension)}$ (kNm)	8	9	10	10	10	10	10	10	10	10	10	10	10	11	10	10	9	8
V_{fx} (kN)	12	11	10	8	7	5	5	5	4	4	3	4	4	5	7	8	10	11
V_{fy} (kN)	34	34	33	24	23	22	9	9	8	6	7	8	23	24	25	41	42	43

Gross Section Properties:

Ag (mm^2)	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034
I_x (mm^4)	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09
I_y (mm^4)	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
J (mm^4)	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06
r_x (mm)	396	396	396	396	396	396	396	396	396	396	396	396	396	396	396	396	396	396
r_y (mm)	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
S_x (mm^3)	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06
S_y (mm^3)	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	533	533	533	914	914	914	533	533	533	991	991	991	991	991	991	991	991	991

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	678	678	678	679	679	679	680	680	680	681	681	681	682	682	682	683	683	683
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9
Webs in combined flexural and axial compression	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	678	678	678	679	679	679	680	680	680	681	681	681	682	682	682	683	683	683
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	533	533	533	914	914	914	533	533	533	991	991	991	991	991	991	991	991	991
L_y (mm)	533	533	533	914	914	914	533	533	533	991	991	991	991	991	991	991	991	991
λ_{max}	0.090	0.090	0.090	0.155	0.155	0.155	0.090	0.090	0.090	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167
C_r (kN)	5206.9	5206.9	5206.9	5187.1	5187.1	5187.1	5206.9	5206.9	5206.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9
$(kL/r)_{max}$	8.7	8.7	8.7	15.0	15.0	15.0	8.7	8.7	8.7	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	748296	748296	748296	254629	254629	254629	748296	748296	748296	216962	216962	216962	216962	216962	216962	216962	216962	216962

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	480	480	480	823	823	823	480	480	480	892	892	892	892	892	892	892	892	892
A_c (mm^2)	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	678	678	678	679	679	679	680	680	680	681	681	681	682	682	682	683	683	683
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	5206.9	5206.9	5206.9	5187.1	5187.1	5187.1	5206.9	5206.9	5206.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272
$A_{n(corrosion)}$ (mm^2)	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858
$T_{r(b)}$ (kN)	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858
$T_{r(c)}$ (kN)	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	678	678	678	679	679	679	680	680	680	681	681	681	682	682	682	683	683	683
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024
$(kL/r)_{max}$	9	9	9	15	15	15	9	9	9	16	16	16	16	16	16	16	16	16
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704
$M_{ry(Laterally\ Supported)}$ (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	533	533	533	914	914	914	533	533	533	991	991	991	991	991	991	991	991	991
L_{uy} (mm)	533	533	533	914	914	914	533	533	533	991	991	991	991	991	991	991	991	991
M_{ux} (kNm) (y weak)	14298	14298	14298	8340	8340	8340	14298	14298	14298	7699	7699	7699	7699	7699	7699	7699	7699	7699
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1887.3	1887.3	1887.3	1835.6	1835.6	1835.6	1887.3	1887.3	1887.3	1825.2	1825.2	1825.2	1825.2	1825.2	1825.2	1825.2	1825.2	1825.2
M_{ry} (kNm)	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4
w_y (mm)	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
A_{wy} (mm^2)	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398
h_y/w_y	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9
F_{cr} (N/mm^2)	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772
$(V_f/V_r)<=1$	0.019	0.019	0.019	0.014	0.013	0.012	0.005	0.005	0.005	0.003	0.004	0.005	0.013	0.014	0.014	0.023	0.024	0.024

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$(T_f/T_r)<=1$	0.038	0.038	0.038	0.040	0.040	0.040	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.041	0.041	0.041

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.038	0.038	0.038	0.040	0.040	0.040	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.041	0.041	0.041
$M_{fx}/M_{rx}<=1$	0.063	0.068	0.073	0.073	0.078	0.084	0.081	0.082	0.083	0.085	0.083	0.082	0.082	0.076	0.069	0.070	0.059	0.048
$M_{fy}/M_{ry}<=1$	0.060	0.068	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.083	0.075	0.075	0.068	0.060
$T_f/T_r+M_f/M_r<=1$	0.162	0.174	0.186	0.188	0.194	0.200	0.197	0.198	0.200	0.202	0.201	0.199	0.200	0.200	0.186	0.187	0.168	0.150
$M_f/M_r-T_fS/M_rA<=1$	0.050	0.063	0.075	0.071	0.076	0.082	0.077	0.078	0.079	0.078	0.077	0.075	0.076	0.077	0.063	0.065	0.047	0.028

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	678	678	678	679	679	679	680	680	680	681	681	681	682	682	682	683	683	683
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.3	0.5	0.0	0.5	0.9	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0
Node Label at Station		---			---			---			---			---			---	
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	3.16E+07	3.16E+07	3.16E+07	1.08E+07	1.08E+07	1.08E+07	3.16E+07	3.16E+07	3.16E+07	9.16E+06	9.16E+06	9.16E+06	9.16E+06	9.16E+06	9.16E+06	9.16E+06	9.16E+06	9.16E+06
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	748296	748296	748296	254629	254629	254629	748296	748296	748296	216962	216962	216962	216962	216962	216962	216962	216962	216962
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.090	0.090	0.090	0.155	0.155	0.155	0.090	0.090	0.090	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167
$C_{r\ (K=1)}$ (kN)	5207	5207	5207	5187	5187	5187	5207	5207	5207	5181	5181	5181	5181	5181	5181	5181	5181	5181
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.3. Lateral Torsional Buckling:

λ_{max}	0.090	0.090	0.090	0.155	0.155	0.155	0.090	0.090	0.090	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167
C_r (kN)	5207	5207	5207	5187	5187	5187	5207	5207	5207	5181	5181	5181	5181	5181	5181	5181	5181	5181
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1887	1887	1887	1836	1836	1836	1887	1887	1887	1825	1825	1825	1825	1825	1825	1825	1825	1825
M_{ry} (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.162	0.174	0.186	0.188	0.194	0.200	0.197	0.198	0.200	0.202	0.201	0.199	0.200	0.200	0.186	0.187	0.168	0.150

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	684	684	684	685	685	685	686	686	686	687	687	687	688	688	688	689	689	689
Member Label	-	-	-	-14S	-14S	-14S	16N-	16N-	16N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	14S	16N	---			---			---			---	
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Member Factored Load Effects:

C_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	221	221	221	216	216	216	148	159	159	177	177	177	196	196	196	209	209	209
$M_{fx\ (tension)}$ (kNm)	91	64	45	47	43	44	199	179	172	160	152	145	132	126	121	113	102	93
$M_{fy\ (tension)}$ (kNm)	8	16	25	25	39	52	116	66	33	40	12	43	22	32	41	26	32	38
V_{fx} (kN)	17	18	20	41	42	43	187	141	140	82	80	79	37	36	36	17	16	14
V_{fy} (kN)	57	58	59	78	78	79	76	69	69	66	65	64	55	55	54	50	49	48

Gross Section Properties:

Ag (mm^2)	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034
I_x (mm^4)	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09
I_y (mm^4)	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
J (mm^4)	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06
r_x (mm)	396	396	396	396	396	396	396	396	396	396	396	396	396	396	396	396	396	396
r_y (mm)	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
S_x (mm^3)	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06
S_y (mm^3)	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	991	991	991	648	648	648	648	648	648	991	991	991	533	533	533	914	914	914

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	684	684	684	685	685	685	686	686	686	687	687	687	688	688	688	689	689	689
Member Label	-	-	-	-14S	-14S	-14S	16N-	16N-	16N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	14S	16N	---			---			---			---	
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9
Webs in combined flexural and axial compression	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	684	684	684	685	685	685	686	686	686	687	687	687	688	688	688	689	689	689
Member Label	-	-	-	-14S	-14S	-14S	16N-	16N-	16N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	14S	16N	---			---			---			---	
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	991	991	991	648	648	648	648	648	648	991	991	991	533	533	533	914	914	914
L_y (mm)	991	991	991	648	648	648	648	648	648	991	991	991	533	533	533	914	914	914
λ_{max}	0.167	0.167	0.167	0.110	0.110	0.110	0.110	0.110	0.110	0.167	0.167	0.167	0.090	0.090	0.090	0.155	0.155	0.155
C_r (kN)	5180.9	5180.9	5180.9	5202.7	5202.7	5202.7	5202.7	5202.7	5202.7	5180.9	5180.9	5180.9	5206.9	5206.9	5206.9	5187.1	5187.1	5187.1
$(kL/r)_{max}$	16.2	16.2	16.2	10.6	10.6	10.6	10.6	10.6	10.6	16.2	16.2	16.2	8.7	8.7	8.7	15.0	15.0	15.0
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	216962	216962	216962	507495	507495	507495	507495	507495	507495	216962	216962	216962	748296	748296	748296	254629	254629	254629

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	892	892	892	583	583	583	583	583	583	892	892	892	480	480	480	823	823	823
A_c (mm^2)	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	684	684	684	685	685	685	686	686	686	687	687	687	688	688	688	689	689	689
Member Label	-	-	-	-14S	-14S	-14S	16N-	16N-	16N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	14S	16N	---			---			---			---	
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	5180.9	5180.9	5180.9	5202.7	5202.7	5202.7	5202.7	5202.7	5202.7	5180.9	5180.9	5180.9	5206.9	5206.9	5206.9	5187.1	5187.1	5187.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272
$A_{n(corrosion)}$ (mm^2)	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858
$T_{r(b)}$ (kN)	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858
$T_{r(c)}$ (kN)	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	684	684	684	685	685	685	686	686	686	687	687	687	688	688	688	689	689	689
Member Label	-	-	-	-14S	-14S	-14S	16N-	16N-	16N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	14S	16N	---			---			---			---	
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024
$(kL/r)_{max}$	16	16	16	11	11	11	11	11	11	16	16	16	9	9	9	15	15	15
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704
$M_{ry(Laterally\ Supported)}$ (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	991	991	991	648	648	648	648	648	648	991	991	991	533	533	533	914	914	914
L_{uy} (mm)	991	991	991	648	648	648	648	648	648	991	991	991	533	533	533	914	914	914
M_{ux} (kNm) (y weak)	7699	7699	7699	11774	11774	11774	11774	11774	11774	7699	7699	7699	14298	14298	14298	8340	8340	8340
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1825.2	1825.2	1825.2	1871.8	1871.8	1871.8	1871.8	1871.8	1871.8	1825.2	1825.2	1825.2	1887.3	1887.3	1887.3	1835.6	1835.6	1835.6
M_{ry} (kNm)	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4
w_y (mm)	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
A_{wy} (mm^2)	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398
h_y/w_y	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9
F_{cr} (N/mm^2)	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772
$(V_f/V_r)<=1$	0.032	0.033	0.033	0.044	0.044	0.045	0.043	0.039	0.039	0.037	0.037	0.036	0.031	0.031	0.030	0.028	0.028	0.027

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$(T_f/T_r)<=1$	0.040	0.040	0.040	0.039	0.039	0.039	0.027	0.029	0.029	0.032	0.032	0.032	0.036	0.036	0.036	0.038	0.038	0.038

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.040	0.040	0.040	0.039	0.039	0.039	0.027	0.029	0.029	0.032	0.032	0.032	0.036	0.036	0.036	0.038	0.038	0.038
$M_{fx}/M_{rx}<=1$	0.050	0.035	0.025	0.025	0.023	0.024	0.106	0.096	0.092	0.088	0.083	0.079	0.070	0.067	0.064	0.062	0.056	0.051
$M_{fy}/M_{ry}<=1$	0.060	0.120	0.188	0.188	0.293	0.391	0.872	0.496	0.248	0.301	0.090	0.323	0.165	0.241	0.308	0.195	0.241	0.286
$T_f/T_r+M_f/M_r<=1$	0.150	0.196	0.253	0.252	0.355	0.454	1.005	0.621	0.369	0.421	0.206	0.435	0.271	0.343	0.408	0.295	0.334	0.374
$M_f/M_r-T_fS/M_rA<=1$	0.032	0.078	0.135	0.138	0.241	0.339	0.927	0.537	0.285	0.326	0.111	0.340	0.168	0.240	0.305	0.184	0.223	0.263

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	684	684	684	685	685	685	686	686	686	687	687	687	688	688	688	689	689	689
Member Label	-	-	-	-14S	-14S	-14S	16N-	16N-	16N-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	0.5	1.0	0.0	0.3	0.6	0.0	0.3	0.6	0.0	0.5	1.0	0.0	0.3	0.5	0.0	0.5	0.9
Node Label at Station		---			---	14S	16N	---			---			---			---	
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	9.16E+06	9.16E+06	9.16E+06	2.14E+07	2.14E+07	2.14E+07	2.14E+07	2.14E+07	2.14E+07	9.16E+06	9.16E+06	9.16E+06	3.16E+07	3.16E+07	3.16E+07	1.08E+07	1.08E+07	1.08E+07
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	216962	216962	216962	507495	507495	507495	507495	507495	507495	216962	216962	216962	748296	748296	748296	254629	254629	254629
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.167	0.167	0.167	0.110	0.110	0.110	0.110	0.110	0.110	0.167	0.167	0.167	0.090	0.090	0.090	0.155	0.155	0.155
$C_{r\ (K=1)}$ (kN)	5181	5181	5181	5203	5203	5203	5203	5203	5203	5181	5181	5181	5207	5207	5207	5187	5187	5187
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.3. Lateral Torsional Buckling:

λ_{max}	0.167	0.167	0.167	0.110	0.110	0.110	0.110	0.110	0.110	0.167	0.167	0.167	0.090	0.090	0.090	0.155	0.155	0.155
C_r (kN)	5181	5181	5181	5203	5203	5203	5203	5203	5203	5181	5181	5181	5207	5207	5207	5187	5187	5187
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1825	1825	1825	1872	1872	1872	1872	1872	1872	1825	1825	1825	1887	1887	1887	1836	1836	1836
M_{ry} (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	NOT OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.150	0.196	0.253	0.252	0.355	0.454	1.005	0.621	0.369	0.421	0.206	0.435	0.271	0.343	0.408	0.295	0.334	0.374

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	690	690	690	691	691	691	692	692	692	693	693	693	694	694	694	695	695	695
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-16S	-16S	-16S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	16S
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Member Factored Load Effects:

C_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	215	215	215	216	216	214	208	208	208	190	190	190	165	165	165	151	151	149
$M_{fx\ (tension)}$ (kNm)	90	85	81	81	75	77	80	83	93	102	111	122	139	145	153	165	172	192
$M_{fy\ (tension)}$ (kNm)	29	29	30	27	27	27	33	31	28	44	30	16	41	12	44	34	72	123
V_{fx} (kN)	9	8	7	6	4	6	8	10	11	27	29	30	80	82	83	142	143	189
V_{fy} (kN)	44	43	43	43	43	45	50	51	51	58	59	60	72	73	74	77	77	85

Gross Section Properties:

Ag (mm^2)	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034	29034
I_x (mm^4)	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09	4.55E+09
I_y (mm^4)	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
J (mm^4)	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06	3.55E+06
r_x (mm)	396	396	396	396	396	396	396	396	396	396	396	396	396	396	396	396	396	396
r_y (mm)	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
S_x (mm^3)	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06	8.99E+06
S_y (mm^3)	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05	7.02E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	533	533	533	991	991	991	991	991	991	991	991	991	991	991	991	648	648	648

Material Properties:

F_Y (MPa)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	690	690	690	691	691	691	692	692	692	693	693	693	694	694	694	695	695	695
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-16S	-16S	-16S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	16S
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9
Webs in combined flexural and axial compression	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	690	690	690	691	691	691	692	692	692	693	693	693	694	694	694	695	695	695
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-16S	-16S	-16S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	16S
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	533	533	533	991	991	991	991	991	991	991	991	991	991	991	991	648	648	648
L_y (mm)	533	533	533	991	991	991	991	991	991	991	991	991	991	991	991	648	648	648
λ_{max}	0.090	0.090	0.090	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.110	0.110	0.110
C_r (kN)	5206.9	5206.9	5206.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5202.7	5202.7	5202.7
$(kL/r)_{max}$	8.7	8.7	8.7	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	10.6	10.6	10.6
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	748296	748296	748296	216962	216962	216962	216962	216962	216962	216962	216962	216962	216962	216962	216962	507495	507495	507495

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	480	480	480	892	892	892	892	892	892	892	892	892	892	892	892	583	583	583
A_c (mm^2)	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	690	690	690	691	691	691	692	692	692	693	693	693	694	694	694	695	695	695
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-16S	-16S	-16S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	16S
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517	14517
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	5206.9	5206.9	5206.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5180.9	5202.7	5202.7	5202.7

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582	27582
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272	28272
$A_{n(corrosion)}$ (mm^2)	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858
$T_{r(b)}$ (kN)	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858	26858
$T_{r(c)}$ (kN)	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	690	690	690	691	691	691	692	692	692	693	693	693	694	694	694	695	695	695
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-16S	-16S	-16S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	16S
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams
F_m	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
$T_{r(Block\ Shear)}$ (kN)	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024	9024
$(kL/r)_{max}$	9	9	9	16	16	16	16	16	16	16	16	16	16	16	16	11	11	11
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503	5503
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704
$M_{ry(Laterally\ Supported)}$ (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	533	533	533	991	991	991	991	991	991	991	991	991	991	991	991	648	648	648
L_{uy} (mm)	533	533	533	991	991	991	991	991	991	991	991	991	991	991	991	648	648	648
M_{ux} (kNm) (y weak)	14298	14298	14298	7699	7699	7699	7699	7699	7699	7699	7699	7699	7699	7699	7699	11774	11774	11774
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	1887.3	1887.3	1887.3	1825.2	1825.2	1825.2	1825.2	1825.2	1825.2	1825.2	1825.2	1825.2	1825.2	1825.2	1825.2	1871.8	1871.8	1871.8
M_{ry} (kNm)	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0	133.0

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4	968.4
w_y (mm)	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
A_{wy} (mm^2)	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398	15398
h_y/w_y	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9	60.9
F_{cr} (N/mm^2)	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772	1772
$(V_f/V_r)<=1$	0.025	0.024	0.024	0.024	0.024	0.025	0.028	0.029	0.029	0.033	0.033	0.034	0.041	0.041	0.042	0.043	0.043	0.048

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$(T_f/T_r)<=1$	0.039	0.039	0.039	0.039	0.039	0.039	0.038	0.038	0.038	0.035	0.035	0.035	0.030	0.030	0.030	0.027	0.027	0.027

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.039	0.039	0.039	0.039	0.039	0.039	0.038	0.038	0.038	0.035	0.035	0.035	0.030	0.030	0.030	0.027	0.027	0.027
$M_{fx}/M_{rx}<=1$	0.048	0.045	0.043	0.044	0.041	0.042	0.044	0.045	0.051	0.056	0.061	0.067	0.076	0.079	0.084	0.088	0.092	0.103
$M_{fy}/M_{ry}<=1$	0.218	0.218	0.226	0.203	0.203	0.203	0.248	0.233	0.210	0.331	0.226	0.120	0.308	0.090	0.331	0.256	0.541	0.925
$T_f/T_r+M_f/M_r<=1$	0.305	0.302	0.308	0.287	0.283	0.284	0.330	0.316	0.299	0.421	0.321	0.222	0.414	0.200	0.445	0.371	0.661	1.054
$M_f/M_r-T_fS/M_rA<=1$	0.191	0.189	0.194	0.171	0.168	0.170	0.219	0.205	0.188	0.320	0.220	0.120	0.326	0.112	0.357	0.291	0.581	0.975

Member ID in CSiBridge	690	690	690	691	691	691	692	692	692	693	693	693	694	694	694	695	695	695
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-16S	-16S	-16S
Station (m)	0.0	0.3	0.5	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.5	1.0	0.0	0.3	0.6
Node Label at Station		---			---			---			---			---			---	16S
Section #	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62	Section 62
Element Group	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams	20 Floor Beams

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213	5213
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	3.16E+07	3.16E+07	3.16E+07	9.16E+06	9.16E+06	9.16E+06	9.16E+06	9.16E+06	9.16E+06	9.16E+06	9.16E+06	9.16E+06	9.16E+06	9.16E+06	9.16E+06	2.14E+07	2.14E+07	2.14E+07
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	748296	748296	748296	216962	216962	216962	216962	216962	216962	216962	216962	216962	216962	216962	216962	507495	507495	507495
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	0.090	0.090	0.090	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.110	0.110	0.110
$C_{r\ (K=1)}$ (kN)	5207	5207	5207	5181	5181	5181	5181	5181	5181	5181	5181	5181	5181	5181	5181	5203	5203	5203
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.3. Lateral Torsional Buckling:

λ_{max}	0.090	0.090	0.090	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.110	0.110	0.110
C_r (kN)	5207	5207	5207	5181	5181	5181	5181	5181	5181	5181	5181	5181	5181	5181	5181	5203	5203	5203
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	1887	1887	1887	1825	1825	1825	1825	1825	1825	1825	1825	1825	1825	1825	1825	1872	1872	1872
M_{ry} (kNm)	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	NOT OK
Highest Ratio	0.305	0.302	0.308	0.287	0.283	0.284	0.330	0.316	0.299	0.421	0.321	0.222	0.414	0.200	0.445	0.371	0.661	1.054

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	12	12	12	13	13	13	16	16	16	17	17	17	18	18	18	21	21	21
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Member Factored Load Effects:

C_f (kN)	1	0	8	1	0	4	3	0	3	1	0	9	0	0	2	0	0	1
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	3	0	2	4	0	1	8	0	0	3	0	1	2	0	0	1	0	0
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	0	0	5	1	0	2	5	0	0	0	0	6	1	0	7	2	0	3
V_{fy} (kN)	20	3	12	7	0	7	13	4	24	22	3	14	11	1	9	5	0	4

Gross Section Properties:

Ag (mm^2)	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354
I_x (mm^4)	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08
I_y (mm^4)	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06
J (mm^4)	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05
r_x (mm)	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
r_y (mm)	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
S_x (mm^3)	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05
S_y (mm^3)	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791

Material Properties:

F_Y (MPa)	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	12	12	12	13	13	13	16	16	16	17	17	17	18	18	18	21	21	21
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Webs in combined flexural and axial compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	12	12	12	13	13	13	16	16	16	17	17	17	18	18	18	21	21	21
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
L_y (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1
$(kL/r)_{max}$	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5
(comp. only) kL/r<120	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	OK	OK	NOT OK	OK	OK	NOT OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	12	12	12	13	13	13	16	16	16	17	17	17	18	18	18	21	21	21
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$A_{n(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(b)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(c)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Member ID in CSiBridge	12	12	12	13	13	13	16	16	16	17	17	17	18	18	18	21	21	21
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
F_m	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335
$T_{r(Block\ Shear)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
$(kL/r)_{max}$	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177
$M_{ry(Laterally\ Supported)}$ (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
L_{uy} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
M_{ux} (kNm) (y weak)	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0
M_{ry} (kNm)	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1
w_y (mm)	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188
A_{wy} (mm^2)	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552
h_y/w_y	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
F_{cr} (N/mm^2)	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
(V_f/V_r)<=1	0.057	0.009	0.034	0.020	0.000	0.020	0.037	0.011	0.069	0.063	0.009	0.040	0.031	0.003	0.026	0.014	0.000	0.011

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.002	0.000	0.019	0.002	0.000	0.010	0.007	0.000	0.007	0.002	0.000	0.022	0.000	0.000	0.005	0.000	0.000	0.002
(T_f/T_r)<=1	0.002	0.000	0.001	0.003	0.000	0.001	0.006	0.000	0.000	0.002	0.000	0.001	0.001	0.000	0.000	0.001	0.000	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.002	0.000	0.001	0.003	0.000	0.001	0.006	0.000	0.000	0.002	0.000	0.001	0.001	0.000	0.000	0.001	0.000	0.000
M_{fx}/M_{rx}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
M_{fy}/M_{ry}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r$<=1	0.002	0.000	0.001	0.003	0.000	0.001	0.006	0.000	0.000	0.002	0.000	0.001	0.001	0.000	0.000	0.001	0.000	0.000
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	12	12	12	13	13	13	16	16	16	17	17	17	18	18	18	21	21	21
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569
U_{1y}	1.00	1.00	1.01	1.00	1.00	1.01	1.01	1.00	1.01	1.00	1.00	1.02	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.001**	**0.000**	**0.006**	**0.001**	**0.000**	**0.003**	**0.002**	**0.000**	**0.002**	**0.001**	**0.000**	**0.007**	**0.000**	**0.000**	**0.001**	**0.000**	**0.000**	**0.001**
$U_{1x}M_{fx}/M_{rx}$	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.001**	**0.000**	**0.006**	**0.001**	**0.000**	**0.003**	**0.002**	**0.000**	**0.002**	**0.001**	**0.000**	**0.007**	**0.000**	**0.000**	**0.001**	**0.000**	**0.000**	**0.001**

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
$C_{r\ (K=1)}$ (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.01	1.00	1.00	1.01	1.01	1.00	1.01	1.00	1.00	1.02	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	**0.002**	**0.000**	**0.019**	**0.002**	**0.000**	**0.010**	**0.007**	**0.000**	**0.007**	**0.002**	**0.000**	**0.022**	**0.000**	**0.000**	**0.005**	**0.000**	**0.000**	**0.002**
$U_{1x}M_{fx}/M_{rx}$	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.002**	**0.000**	**0.019**	**0.002**	**0.000**	**0.010**	**0.007**	**0.000**	**0.007**	**0.002**	**0.000**	**0.022**	**0.000**	**0.000**	**0.005**	**0.000**	**0.000**	**0.002**

3.3. Lateral Torsional Buckling:

λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.01	1.00	1.00	1.01	1.01	1.00	1.01	1.00	1.00	1.02	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194
M_{ry} (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
C_f/C_r	**0.002**	**0.000**	**0.019**	**0.002**	**0.000**	**0.010**	**0.007**	**0.000**	**0.007**	**0.002**	**0.000**	**0.022**	**0.000**	**0.000**	**0.005**	**0.000**	**0.000**	**0.002**
$U_{1x}M_{fx}/M_{rx}$	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
$U_{1y}M_{fy}/M_{ry}$	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Interaction	**0.002**	**0.000**	**0.019**	**0.002**	**0.000**	**0.010**	**0.007**	**0.000**	**0.007**	**0.002**	**0.000**	**0.022**	**0.000**	**0.000**	**0.005**	**0.000**	**0.000**	**0.002**
Demand/Capacity ≤ 1	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
Highest Ratio	**0.057**	**0.009**	**0.034**	**0.020**	**0.000**	**0.020**	**0.037**	**0.011**	**0.069**	**0.063**	**0.009**	**0.040**	**0.031**	**0.003**	**0.026**	**0.014**	**0.000**	**0.011**

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	22	22	22	28	28	28	32	32	32	36	36	36	37	37	37	38	38	38
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Member Factored Load Effects:

C_f (kN)	1	0	2	0	0	2	0	0	0	0	0	0	1	0	1	0	0	1
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	2	0	0	1	0	0	1	0	0	0	0	0	1	0	0	1	0	0
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	8	0	1	1	0	9	1	0	6	1	0	2	6	0	1	1	0	7
V_{fy} (kN)	10	2	14	12	1	10	6	1	5	4	0	4	6	1	8	7	1	6

Gross Section Properties:

Ag (mm^2)	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354
I_x (mm^4)	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08
I_y (mm^4)	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06
J (mm^4)	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05
r_x (mm)	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
r_y (mm)	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
S_x (mm^3)	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05
S_y (mm^3)	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791

Material Properties:

F_Y (MPa)	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	22	22	22	28	28	28	32	32	32	36	36	36	37	37	37	38	38	38
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Webs in combined flexural and axial compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	22	22	22	28	28	28	32	32	32	36	36	36	37	37	37	38	38	38
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
L_y (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1
$(kL/r)_{max}$	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5
(comp. only) kL/r<120	NOT OK	OK	NOT OK	OK	OK	NOT OK	OK	OK	OK	OK	OK	OK	NOT OK	OK	NOT OK	OK	OK	NOT OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	22	22	22	28	28	28	32	32	32	36	36	36	37	37	37	38	38	38
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$A_{n(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(b)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(c)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Member ID in CSiBridge	22	22	22	28	28	28	32	32	32	36	36	36	37	37	37	38	38	38
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
F_m	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335
$T_{r(Block\ Shear)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
$(kL/r)_{max}$	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177
$M_{ry(Laterally\ Supported)}$ (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
L_{uy} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
M_{ux} (kNm) (y weak)	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0
M_{ry} (kNm)	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1
w_y (mm)	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188
A_{wy} (mm^2)	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552
h_y/w_y	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
F_{cr} (N/mm^2)	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
(V_f/V_r)<=1	0.029	0.006	0.040	0.034	0.003	0.029	0.017	0.003	0.014	0.011	0.000	0.011	0.017	0.003	0.023	0.020	0.003	0.017

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.002	0.000	0.005	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.002	0.000	0.000	0.002
(T_f/T_r)<=1	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000
M_{fx}/M_{rx}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
M_{fy}/M_{ry}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r$<=1	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	22	22	22	28	28	28	32	32	32	36	36	36	37	37	37	38	38	38
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.001	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.001
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.001	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.001

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
$C_{r\ (K=1)}$ (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.002	0.000	0.005	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.002	0.000	0.000	0.002
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.002	0.000	0.005	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.002	0.000	0.000	0.002

3.3. Lateral Torsional Buckling:

λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194
M_{ry} (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
C_f/C_r	0.002	0.000	0.005	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.002	0.000	0.000	0.002
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.002	0.000	0.005	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.002	0.000	0.000	0.002
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.029	0.006	0.040	0.034	0.003	0.029	0.017	0.003	0.014	0.011	0.000	0.011	0.017	0.003	0.023	0.020	0.003	0.017

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	39	39	39	40	40	40	41	41	41	42	42	42	43	43	43	44	44	44
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Member Factored Load Effects:

C_f (kN)	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	0	0	3	1	0	1	4	0	0	0	1	4	0	0	2	0	0	1
V_{fy} (kN)	3	0	7	5	0	4	8	1	4	3	0	8	4	0	7	5	0	5

Gross Section Properties:

Ag (mm^2)	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354
I_x (mm^4)	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08
I_y (mm^4)	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06
J (mm^4)	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05
r_x (mm)	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
r_y (mm)	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
S_x (mm^3)	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05
S_y (mm^3)	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791

Material Properties:

F_Y (MPa)	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	39	39	39	40	40	40	41	41	41	42	42	42	43	43	43	44	44	44
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Webs in combined flexural and axial compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	39	39	39	40	40	40	41	41	41	42	42	42	43	43	43	44	44	44
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
L_y (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1
$(kL/r)_{max}$	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	NOT OK	OK	NOT OK	OK	OK	OK	OK	OK	OK	NOT OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	39	39	39	40	40	40	41	41	41	42	42	42	43	43	43	44	44	44
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$A_{n(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(b)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(c)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Member ID in CSiBridge	39	39	39	40	40	40	41	41	41	42	42	42	43	43	43	44	44	44
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
F_m	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335
$T_{r(Block\ Shear)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
$(kL/r)_{max}$	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177
$M_{ry(Laterally\ Supported)}$ (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
L_{uy} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
M_{ux} (kNm) (y weak)	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0
M_{ry} (kNm)	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1
w_y (mm)	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188
A_{wy} (mm^2)	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552
h_y/w_y	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
F_{cr} (N/mm^2)	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
(V_f/V_r)<=1	0.009	0.000	0.020	0.014	0.000	0.011	0.023	0.003	0.011	0.009	0.000	0.023	0.011	0.000	0.020	0.014	0.000	0.014

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000
(T_f/T_r)<=1	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000
M_{fx}/M_{rx}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
M_{fy}/M_{ry}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r$<=1	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	39	39	39	40	40	40	41	41	41	42	42	42	43	43	43	44	44	44
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
$C_{r\ (K=1)}$ (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000

3.3. Lateral Torsional Buckling:

λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194
M_{ry} (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.009	0.000	0.020	0.014	0.000	0.011	0.023	0.003	0.011	0.009	0.000	0.023	0.011	0.000	0.020	0.014	0.000	0.014

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	45	45	45	46	46	46	47	47	47	48	48	48	49	49	49	50	50	50
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Member Factored Load Effects:

C_f (kN)	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	2	0	0	0	0	2	0	0	2	1	0	1	3	0	0	0	0	2
V_{fy} (kN)	7	1	4	3	0	7	4	0	9	6	0	5	10	1	4	3	0	9

Gross Section Properties:

Ag (mm^2)	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354
I_x (mm^4)	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08
I_y (mm^4)	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06
J (mm^4)	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05
r_x (mm)	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
r_y (mm)	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
S_x (mm^3)	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05
S_y (mm^3)	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791

Material Properties:

F_Y (MPa)	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	45	45	45	46	46	46	47	47	47	48	48	48	49	49	49	50	50	50
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Webs in combined flexural and axial compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	45	45	45	46	46	46	47	47	47	48	48	48	49	49	49	50	50	50
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
L_y (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1
$(kL/r)_{max}$	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5
(comp. only) kL/r<120	NOT OK	OK	OK	OK	OK	OK	OK	OK	OK	NOT OK	OK	OK	NOT OK	OK	OK	OK	OK	OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	45	45	45	46	46	46	47	47	47	48	48	48	49	49	49	50	50	50
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$A_{n(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(b)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(c)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	45	45	45	46	46	46	47	47	47	48	48	48	49	49	49	50	50	50
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
F_m	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335
$T_{r(Block\ Shear)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
$(kL/r)_{max}$	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177
$M_{ry(Laterally\ Supported)}$ (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
L_{uy} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
M_{ux} (kNm) (y weak)	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0
M_{ry} (kNm)	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1
w_y (mm)	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188
A_{wy} (mm^2)	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552
h_y/w_y	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
F_{cr} (N/mm^2)	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
$(V_f/V_r)<=1$	0.020	0.003	0.011	0.009	0.000	0.020	0.011	0.000	0.026	0.017	0.000	0.014	0.029	0.003	0.011	0.009	0.000	0.026

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000
$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
$M_{fx}/M_{rx}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fy}/M_{ry}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r<=1$	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	45	45	45	46	46	46	47	47	47	48	48	48	49	49	49	50	50	50
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
$C_{r\ (K=1)}$ (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000

3.3. Lateral Torsional Buckling:

λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194
M_{ry} (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
C_f/C_r	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.020	0.003	0.011	0.009	0.000	0.020	0.011	0.000	0.026	0.017	0.000	0.014	0.029	0.003	0.011	0.009	0.000	0.026

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	51	51	51	52	52	52	53	53	53	54	54	54	55	55	55	56	56	56
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Member Factored Load Effects:

C_f (kN)	0	0	0	0	0	0	1	0	1	0	0	0	0	0	2	0	0	1
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	1	0	0	0	0	0	0	0	0	1	0	0	2	0	0	1	0	0
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	0	0	5	2	0	2	6	0	0	0	0	5	1	0	7	3	0	3
V_{fy} (kN)	5	1	10	5	0	5	10	1	8	6	1	10	12	1	10	5	0	4

Gross Section Properties:

Ag (mm^2)	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354
I_x (mm^4)	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08
I_y (mm^4)	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06
J (mm^4)	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05
r_x (mm)	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
r_y (mm)	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
S_x (mm^3)	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05
S_y (mm^3)	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791

Material Properties:

F_Y (MPa)	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	51	51	51	52	52	52	53	53	53	54	54	54	55	55	55	56	56	56
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Webs in combined flexural and axial compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	51	51	51	52	52	52	53	53	53	54	54	54	55	55	55	56	56	56
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
L_y (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1
$(kL/r)_{max}$	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5
(comp. only) kL/r<120	OK	OK	OK	OK	OK	OK	NOT OK	OK	NOT OK	OK	OK	OK	OK	OK	NOT OK	OK	OK	NOT OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	51	51	51	52	52	52	53	53	53	54	54	54	55	55	55	56	56	56
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$A_{n(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(b)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(c)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Member ID in CSiBridge	51	51	51	52	52	52	53	53	53	54	54	54	55	55	55	56	56	56
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
F_m	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335
$T_{r(Block\ Shear)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
$(kL/r)_{max}$	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177
$M_{ry(Laterally\ Supported)}$ (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
L_{uy} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
M_{ux} (kNm) (y weak)	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0
M_{ry} (kNm)	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1
w_y (mm)	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188
A_{wy} (mm^2)	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552
h_y/w_y	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
F_{cr} (N/mm^2)	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
(V_f/V_r)<=1	0.014	0.003	0.029	0.014	0.000	0.014	0.029	0.003	0.023	0.017	0.003	0.029	0.034	0.003	0.029	0.014	0.000	0.011

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.002
(T_f/T_r)<=1	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000
M_{fx}/M_{rx}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
M_{fy}/M_{ry}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r$<=1	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Member ID in CSiBridge	51	51	51	52	52	52	53	53	53	54	54	54	55	55	55	56	56	56
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.001
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.001

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
$C_{r\ (K=1)}$ (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.002
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.002

3.3. Lateral Torsional Buckling:

λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194
M_{ry} (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
C_f/C_r	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.002
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.002
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.014	0.003	0.029	0.014	0.000	0.014	0.029	0.003	0.023	0.017	0.003	0.029	0.034	0.003	0.029	0.014	0.000	0.011

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	57	57	57	58	58	58	59	59	59	60	60	60	61	61	61	62	62	62
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Member Factored Load Effects:

C_f (kN)	1	0	2	0	0	2	0	0	7	1	0	4	2	0	3	1	0	9
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	2	0	0	2	0	0	2	0	1	4	0	0	8	0	0	3	0	1
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	8	0	1	1	0	8	0	0	5	2	0	2	6	0	0	0	0	6
V_{fy} (kN)	10	2	16	14	1	11	19	3	13	7	0	7	13	4	25	23	3	15

Gross Section Properties:

Ag (mm^2)	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354
I_x (mm^4)	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08
I_y (mm^4)	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06
J (mm^4)	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05
r_x (mm)	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
r_y (mm)	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
S_x (mm^3)	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05
S_y (mm^3)	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791

Material Properties:

F_Y (MPa)	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	57	57	57	58	58	58	59	59	59	60	60	60	61	61	61	62	62	62
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Webs in combined flexural and axial compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	57	57	57	58	58	58	59	59	59	60	60	60	61	61	61	62	62	62
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
L_y (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1
$(kL/r)_{max}$	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5
(comp. only) kL/r<120	NOT OK	OK	NOT OK	OK	OK	NOT OK	OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	57	57	57	58	58	58	59	59	59	60	60	60	61	61	61	62	62	62
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$A_{n(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(b)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(c)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Member ID in CSiBridge	57	57	57	58	58	58	59	59	59	60	60	60	61	61	61	62	62	62
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
F_m	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335
$T_{r(Block\ Shear)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
$(kL/r)_{max}$	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177
$M_{ry(Laterally\ Supported)}$ (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
L_{uy} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
M_{ux} (kNm) (y weak)	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0
M_{ry} (kNm)	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1
w_y (mm)	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188
A_{wy} (mm^2)	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552
h_y/w_y	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
F_{cr} (N/mm^2)	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
(V_f/V_r)<=1	0.029	0.006	0.046	0.040	0.003	0.031	0.054	0.009	0.037	0.020	0.000	0.020	0.037	0.011	0.071	0.066	0.009	0.043

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.002	0.000	0.005	0.000	0.000	0.005	0.000	0.000	0.017	0.002	0.000	0.010	0.005	0.000	0.007	0.002	0.000	0.022
(T_f/T_r)<=1	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.001	0.003	0.000	0.000	0.006	0.000	0.000	0.002	0.000	0.001

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.001	0.003	0.000	0.000	0.006	0.000	0.000	0.002	0.000	0.001
M_{fx}/M_{rx}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
M_{fy}/M_{ry}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r$<=1	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.001	0.003	0.000	0.000	0.006	0.000	0.000	0.002	0.000	0.001
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Member ID in CSiBridge	57	57	57	58	58	58	59	59	59	60	60	60	61	61	61	62	62	62
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.01	1.00	1.00	1.01	1.00	1.00	1.02
C_f/C_r	0.001	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.005	0.001	0.000	0.003	0.001	0.000	0.002	0.001	0.000	0.007
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.001	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.005	0.001	0.000	0.003	0.001	0.000	0.002	0.001	0.000	0.007

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
$C_{r\ (K=1)}$ (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.01	1.00	1.00	1.01	1.00	1.00	1.02
C_f/C_r	0.002	0.000	0.005	0.000	0.000	0.005	0.000	0.000	0.017	0.002	0.000	0.010	0.005	0.000	0.007	0.002	0.000	0.022
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.002	0.000	0.005	0.000	0.000	0.005	0.000	0.000	0.017	0.002	0.000	0.010	0.005	0.000	0.007	0.002	0.000	0.022

3.3. Lateral Torsional Buckling:

λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.01	1.00	1.00	1.01	1.00	1.00	1.02
M_{rx} (kNm)	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194
M_{ry} (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
C_f/C_r	0.002	0.000	0.005	0.000	0.000	0.005	0.000	0.000	0.017	0.002	0.000	0.010	0.005	0.000	0.007	0.002	0.000	0.022
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.002	0.000	0.005	0.000	0.000	0.005	0.000	0.000	0.017	0.002	0.000	0.010	0.005	0.000	0.007	0.002	0.000	0.022
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.029	0.006	0.046	0.040	0.003	0.031	0.054	0.009	0.037	0.020	0.000	0.020	0.037	0.011	0.071	0.066	0.009	0.043

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	63	63	63	64	64	64	65	65	65	66	66	66	67	67	67	68	68	68
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Member Factored Load Effects:

C_f (kN)	1	0	6	1	1	4	1	0	2	1	1	3	1	0	1	1	0	2
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	12	0	0	0	0	0	7	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	5	0	0	10	0	0	1	0	0	2	0	0	0	0	0	1	0	0
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	2	0	2	6	0	0	2	0	3	8	0	1	2	0	2	6	1	1
V_{fy} (kN)	7	0	6	12	5	35	4	0	4	9	2	19	3	0	3	5	1	11

Gross Section Properties:

Ag (mm^2)	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354
I_x (mm^4)	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08
I_y (mm^4)	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06
J (mm^4)	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05
r_x (mm)	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
r_y (mm)	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
S_x (mm^3)	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05
S_y (mm^3)	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791

Material Properties:

F_Y (MPa)	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	63	63	63	64	64	64	65	65	65	66	66	66	67	67	67	68	68	68
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Webs in combined flexural and axial compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	63	63	63	64	64	64	65	65	65	66	66	66	67	67	67	68	68	68
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
L_y (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1
$(kL/r)_{max}$	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5
(comp. only) kL/r<120	NOT OK	OK	NOT OK	NOT OK	NOT OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	NOT OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	63	63	63	64	64	64	65	65	65	66	66	66	67	67	67	68	68	68
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$A_{n(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(b)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(c)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Member ID in CSiBridge	63	63	63	64	64	64	65	65	65	66	66	66	67	67	67	68	68	68
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
F_m	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335
$T_{r(Block\ Shear)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
$(kL/r)_{max}$	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177
$M_{ry(Laterally\ Supported)}$ (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
L_{uy} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
M_{ux} (kNm) (y weak)	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0
M_{ry} (kNm)	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1
w_y (mm)	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188
A_{wy} (mm^2)	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552
h_y/w_y	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
F_{cr} (N/mm^2)	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
(V_f/V_r)<=1	0.020	0.000	0.017	0.034	0.014	0.100	0.011	0.000	0.011	0.026	0.006	0.054	0.009	0.000	0.009	0.014	0.003	0.031

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.002	0.000	0.015	0.002	0.002	0.010	0.002	0.000	0.005	0.002	0.002	0.007	0.002	0.000	0.002	0.002	0.000	0.005
(T_f/T_r)<=1	0.003	0.000	0.000	0.007	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.003	0.000	0.000	0.007	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
M_{fx}/M_{rx}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
M_{fy}/M_{ry}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r$<=1	0.003	0.000	0.000	0.007	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	63	63	63	64	64	64	65	65	65	66	66	66	67	67	67	68	68	68
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569
U_{1y}	1.00	1.00	1.01	1.00	1.00	1.01	1.00	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.001	0.000	0.004	0.001	0.001	0.003	0.001	0.000	0.001	0.001	0.001	0.002	0.001	0.000	0.001	0.001	0.000	0.001
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.068	0.000	0.000	0.000	0.000	0.000	0.040	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.001	0.000	0.004	0.001	0.069	0.003	0.001	0.000	0.001	0.001	0.040	0.002	0.001	0.000	0.001	0.001	0.000	0.001

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
$C_{r\ (K=1)}$ (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.01	1.00	1.00	1.01	1.00	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.002	0.000	0.015	0.002	0.002	0.010	0.002	0.000	0.005	0.002	0.002	0.007	0.002	0.000	0.002	0.002	0.000	0.005
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.068	0.000	0.000	0.000	0.000	0.000	0.040	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.002	0.000	0.015	0.002	0.070	0.010	0.002	0.000	0.005	0.002	0.042	0.007	0.002	0.000	0.002	0.002	0.000	0.005

3.3. Lateral Torsional Buckling:

λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.01	1.00	1.00	1.01	1.00	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194
M_{ry} (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
C_f/C_r	0.002	0.000	0.015	0.002	0.002	0.010	0.002	0.000	0.005	0.002	0.002	0.007	0.002	0.000	0.002	0.002	0.000	0.005
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.062	0.000	0.000	0.000	0.000	0.000	0.036	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.002	0.000	0.015	0.002	0.064	0.010	0.002	0.000	0.005	0.002	0.039	0.007	0.002	0.000	0.002	0.002	0.000	0.005
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.020	0.000	0.017	0.034	0.070	0.100	0.011	0.000	0.011	0.026	0.042	0.054	0.009	0.000	0.009	0.014	0.003	0.031

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	69	69	69	70	70	70	71	71	71	72	72	72	73	73	73	74	74	74
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Member Factored Load Effects:

C_f (kN)	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	1	0	1	4	1	0	1	0	1	2	1	0	1	0	1	4	1	0
V_{fy} (kN)	4	0	3	8	0	5	5	0	4	7	0	2	5	0	4	10	0	4

Gross Section Properties:

Ag (mm^2)	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354
I_x (mm^4)	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08
I_y (mm^4)	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06
J (mm^4)	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05
r_x (mm)	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
r_y (mm)	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
S_x (mm^3)	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05
S_y (mm^3)	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791

Material Properties:

F_Y (MPa)	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	69	69	69	70	70	70	71	71	71	72	72	72	73	73	73	74	74	74
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Webs in combined flexural and axial compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Member ID in CSiBridge	69	69	69	70	70	70	71	71	71	72	72	72	73	73	73	74	74	74
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
L_y (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1
$(kL/r)_{max}$	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5
(comp. only) kL/r<120	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	69	69	69	70	70	70	71	71	71	72	72	72	73	73	73	74	74	74
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$A_{n(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(b)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(c)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	69	69	69	70	70	70	71	71	71	72	72	72	73	73	73	74	74	74
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
F_m	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335
$T_{r(Block\ Shear)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
$(kL/r)_{max}$	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177
$M_{ry(Laterally\ Supported)}$ (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
L_{uy} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
M_{ux} (kNm) (y weak)	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0
M_{ry} (kNm)	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1
w_y (mm)	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188
A_{wy} (mm^2)	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552
h_y/w_y	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
F_{cr} (N/mm^2)	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
(V_f/V_r)<=1	0.011	0.000	0.009	0.023	0.000	0.014	0.014	0.000	0.011	0.020	0.000	0.006	0.014	0.000	0.011	0.029	0.000	0.011

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.002	0.000	0.002	0.002	0.000	0.002	0.002	0.000	0.002	0.002	0.000	0.002	0.002	0.000	0.002	0.002	0.000	0.002
(T_f/T_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
M_{fx}/M_{rx}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
M_{fy}/M_{ry}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Member ID in CSiBridge	69	69	69	70	70	70	71	71	71	72	72	72	73	73	73	74	74	74
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.001	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.001
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.001	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.001

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
$C_{r\ (K=1)}$ (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.002	0.000	0.002	0.002	0.000	0.002	0.002	0.000	0.002	0.002	0.000	0.002	0.002	0.000	0.002	0.002	0.000	0.002
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.002	0.000	0.002	0.002	0.000	0.002	0.002	0.000	0.002	0.002	0.000	0.002	0.002	0.000	0.002	0.002	0.000	0.002

3.3. Lateral Torsional Buckling:

λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194
M_{ry} (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
C_f/C_r	0.002	0.000	0.002	0.002	0.000	0.002	0.002	0.000	0.002	0.002	0.000	0.002	0.002	0.000	0.002	0.002	0.000	0.002
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.002	0.000	0.002	0.002	0.000	0.002	0.002	0.000	0.002	0.002	0.000	0.002	0.002	0.000	0.002	0.002	0.000	0.002
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.011	0.000	0.009	0.023	0.000	0.014	0.014	0.000	0.011	0.020	0.000	0.006	0.014	0.000	0.011	0.029	0.000	0.011

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	75	75	75	76	76	76	77	77	77	78	78	78	79	79	79	80	80	80
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Member Factored Load Effects:

C_f (kN)	1	0	1	1	0	1	1	0	2	1	1	3	1	0	6	2	1	4
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	13	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	0	0	0	0	0	0	1	0	0	3	0	0	5	0	0	11	0	0
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	2	0	2	7	1	0	3	0	3	10	0	1	2	0	2	7	0	0
V_{fy} (kN)	4	0	4	10	1	11	4	0	4	9	3	23	7	0	7	12	5	36

Gross Section Properties:

Ag (mm^2)	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354	6354
I_x (mm^4)	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08	1.39E+08
I_y (mm^4)	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06	9.67E+06
J (mm^4)	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05	2.11E+05
r_x (mm)	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
r_y (mm)	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
S_x (mm^3)	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05	7.83E+05
S_y (mm^3)	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05	1.13E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791

Material Properties:

F_Y (MPa)	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	75	75	75	76	76	76	77	77	77	78	78	78	79	79	79	80	80	80
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Webs in combined flexural and axial compression	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

PARSONS

Member ID in CSiBridge	75	75	75	76	76	76	77	77	77	78	78	78	79	79	79	80	80	80
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
L_y (mm)	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791	5791
λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1
$(kL/r)_{max}$	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5
(comp. only) kL/r<120	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	NOT OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	NOT OK	NOT OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212	5212
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	75	75	75	76	76	76	77	77	77	78	78	78	79	79	79	80	80	80
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177	3177
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1	411.1

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036	6036
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592	5592
$A_{n(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(b)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312	5312
$T_{r(c)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Member ID in CSiBridge	75	75	75	76	76	76	77	77	77	78	78	78	79	79	79	80	80	80
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
F_m	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335
$T_{r(Block\ Shear)}$ (kN)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
$(kL/r)_{max}$	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434	1434
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177
$M_{ry(Laterally\ Supported)}$ (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
L_{uy} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
M_{ux} (kNm) (y weak)	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0
M_{ry} (kNm)	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1	355.1
w_y (mm)	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188	7.188
A_{wy} (mm^2)	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552
h_y/w_y	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
F_{cr} (N/mm^2)	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
(V_f/V_r)<=1	0.011	0.000	0.011	0.029	0.003	0.031	0.011	0.000	0.011	0.026	0.009	0.066	0.020	0.000	0.020	0.034	0.014	0.103

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.002	0.000	0.002	0.002	0.000	0.002	0.002	0.000	0.005	0.002	0.002	0.007	0.002	0.000	0.015	0.005	0.002	0.010
(T_f/T_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.002	0.000	0.000	0.003	0.000	0.000	0.008	0.000	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.002	0.000	0.000	0.003	0.000	0.000	0.008	0.000	0.000
M_{fx}/M_{rx}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
M_{fy}/M_{ry}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.002	0.000	0.000	0.003	0.000	0.000	0.008	0.000	0.000
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	75	75	75	76	76	76	77	77	77	78	78	78	79	79	79	80	80	80
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8	0.0	2.9	5.8
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34	W14x34
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03	8.18E+03
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.01	1.00	1.00	1.01
C_f/C_r	0.001	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.001	0.001	0.002	0.001	0.000	0.004	0.001	0.001	0.003
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.051	0.000	0.000	0.000	0.000	0.000	0.074	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.001	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.001	0.052	0.002	0.001	0.000	0.004	0.001	0.074	0.003

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
$C_{r\ (K=1)}$ (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.01	1.00	1.00	1.01
C_f/C_r	0.002	0.000	0.002	0.002	0.000	0.002	0.002	0.000	0.005	0.002	0.002	0.007	0.002	0.000	0.015	0.005	0.002	0.010
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.051	0.000	0.000	0.000	0.000	0.000	0.074	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.002	0.000	0.002	0.002	0.000	0.002	0.002	0.000	0.005	0.002	0.053	0.007	0.002	0.000	0.015	0.005	0.076	0.010

3.3. Lateral Torsional Buckling:

λ_{max}	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671
C_r (kN)	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411	411
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.01	1.00	1.00	1.01
M_{rx} (kNm)	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194
M_{ry} (kNm)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
C_f/C_r	0.002	0.000	0.002	0.002	0.000	0.002	0.002	0.000	0.005	0.002	0.002	0.007	0.002	0.000	0.015	0.005	0.002	0.010
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.046	0.000	0.000	0.000	0.000	0.000	0.067	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.002	0.000	0.002	0.002	0.000	0.002	0.002	0.000	0.005	0.002	0.049	0.007	0.002	0.000	0.015	0.005	0.069	0.010
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.011	0.000	0.011	0.029	0.003	0.031	0.011	0.000	0.011	0.026	0.053	0.066	0.020	0.000	0.020	0.034	0.076	0.103

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	622	622	622	623	623	623	626	626	626	627	627	627	630	630	630	631	631	631
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Member Factored Load Effects:

C_f (kN)	1	0	14	1	0	8	1	0	3	1	0	4	1	0	1	1	0	3
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	4	0	0	8	0	0	2	0	0	2	0	0	2	0	0	1	0	0
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	0	1	6	3	1	2	1	1	9	4	0	2	1	1	7	3	0	2
V_{fy} (kN)	36	5	13	10	6	71	20	2	8	8	3	41	12	2	5	7	2	22

Gross Section Properties:

Ag (mm^2)	6354	6354	6354	7419	7419	7419	6354	6354	6354	7419	7419	7419	6354	6354	6354	7419	7419	7419
I_x (mm^4)	1.39E+08	1.39E+08	1.39E+08	2.10E+08	2.10E+08	2.10E+08	1.39E+08	1.39E+08	1.39E+08	2.10E+08	2.10E+08	2.10E+08	1.39E+08	1.39E+08	1.39E+08	2.10E+08	2.10E+08	2.10E+08
I_y (mm^4)	9.67E+06	9.67E+06	9.67E+06	1.19E+07	1.19E+07	1.19E+07	9.67E+06	9.67E+06	9.67E+06	1.19E+07	1.19E+07	1.19E+07	9.67E+06	9.67E+06	9.67E+06	1.19E+07	1.19E+07	1.19E+07
J (mm^4)	2.11E+05	2.11E+05	2.11E+05	2.87E+05	2.87E+05	2.87E+05	2.11E+05	2.11E+05	2.11E+05	2.87E+05	2.87E+05	2.87E+05	2.11E+05	2.11E+05	2.11E+05	2.87E+05	2.87E+05	2.87E+05
r_x (mm)	148	148	148	168	168	168	148	148	148	168	168	168	148	148	148	168	168	168
r_y (mm)	39	39	39	40	40	40	39	39	39	40	40	40	39	39	39	40	40	40
S_x (mm^3)	7.83E+05	7.83E+05	7.83E+05	1.03E+06	1.03E+06	1.03E+06	7.83E+05	7.83E+05	7.83E+05	1.03E+06	1.03E+06	1.03E+06	7.83E+05	7.83E+05	7.83E+05	1.03E+06	1.03E+06	1.03E+06
S_y (mm^3)	1.13E+05	1.13E+05	1.13E+05	1.34E+05	1.34E+05	1.34E+05	1.13E+05	1.13E+05	1.13E+05	1.34E+05	1.34E+05	1.34E+05	1.13E+05	1.13E+05	1.13E+05	1.34E+05	1.34E+05	1.34E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722

Material Properties:

F_Y (MPa)	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	622	622	622	623	623	623	626	626	626	627	627	627	630	630	630	631	631	631
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	7.4	7.4	7.4	7.0	7.0	7.0	7.4	7.4	7.4	7.0	7.0	7.0	7.4	7.4	7.4	7.0	7.0	7.0
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	49.4	49.4	49.4	56.5	56.5	56.5	49.4	49.4	49.4	56.5	56.5	56.5	49.4	49.4	49.4	56.5	56.5	56.5
Webs in combined flexural and axial compression	49.4	49.4	49.4	56.5	56.5	56.5	49.4	49.4	49.4	56.5	56.5	56.5	49.4	49.4	49.4	56.5	56.5	56.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	622	622	622	623	623	623	626	626	626	627	627	627	630	630	630	631	631	631
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722
L_y (mm)	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722
λ_{max}	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172
C_r (kN)	411.1	411.1	411.1	307.7	307.7	307.7	411.1	411.1	411.1	307.7	307.7	307.7	411.1	411.1	411.1	307.7	307.7	307.7
$(kL/r)_{max}$	148.5	148.5	148.5	193.0	193.0	193.0	148.5	148.5	148.5	193.0	193.0	193.0	148.5	148.5	148.5	193.0	193.0	193.0
(comp. only) kL/r<120	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		
P_e^{min} (Euler, kN)	569	569	569	394	394	394	569	569	569	394	394	394	569	569	569	394	394	394

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	5212	5212	5212	6949	6949	6949	5212	5212	5212	6949	6949	6949	5212	5212	5212	6949	6949	6949
A_c (mm^2)	3177	3177	3177	3710	3710	3710	3177	3177	3177	3710	3710	3710	3177	3177	3177	3710	3710	3710
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	622	622	622	623	623	623	626	626	626	627	627	627	630	630	630	631	631	631
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	3177	3177	3177	3710	3710	3710	3177	3177	3177	3710	3710	3710	3177	3177	3177	3710	3710	3710
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	411.1	411.1	411.1	307.7	307.7	307.7	411.1	411.1	411.1	307.7	307.7	307.7	411.1	411.1	411.1	307.7	307.7	307.7

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6036	6036	6036	7048	7048	7048	6036	6036	6036	7048	7048	7048	6036	6036	6036	7048	7048	7048
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1434	1434	1434	1674	1674	1674	1434	1434	1434	1674	1674	1674	1434	1434	1434	1674	1674	1674
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	5592	5592	5592	6657	6657	6657	5592	5592	5592	6657	6657	6657	5592	5592	5592	6657	6657	6657
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	5592	5592	5592	6657	6657	6657	5592	5592	5592	6657	6657	6657	5592	5592	5592	6657	6657	6657
$A_{n(corrosion)}$ (mm^2)	5312	5312	5312	6324	6324	6324	5312	5312	5312	6324	6324	6324	5312	5312	5312	6324	6324	6324
$T_{r(b)}$ (kN)	1785	1785	1785	2125	2125	2125	1785	1785	1785	2125	2125	2125	1785	1785	1785	2125	2125	2125
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	5312	5312	5312	6324	6324	6324	5312	5312	5312	6324	6324	6324	5312	5312	5312	6324	6324	6324
$T_{r(c)}$ (kN)	1785	1785	1785	2125	2125	2125	1785	1785	1785	2125	2125	2125	1785	1785	1785	2125	2125	2125
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	622	622	622	623	623	623	626	626	626	627	627	627	630	630	630	631	631	631
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
F_m	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335
$T_{r(Block\ Shear)}$ (kN)	1785	1785	1785	2125	2125	2125	1785	1785	1785	2125	2125	2125	1785	1785	1785	2125	2125	2125
$(kL/r)_{max}$	148	148	148	193	193	193	148	148	148	193	193	193	148	148	148	193	193	193
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1434	1434	1434	1674	1674	1674	1434	1434	1434	1674	1674	1674	1434	1434	1434	1674	1674	1674
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	177	177	177	233	233	233	177	177	177	233	233	233	177	177	177	233	233	233
$M_{ry(Laterally\ Supported)}$ (kNm)	26	26	26	30	30	30	26	26	26	30	30	30	26	26	26	30	30	30
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
L_{uy} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
M_{ux} (kNm) (y weak)	1219	1219	1219	1578	1578	1578	1219	1219	1219	1578	1578	1578	1219	1219	1219	1578	1578	1578
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	194.0	194.0	194.0	256.1	256.1	256.1	194.0	194.0	194.0	256.1	256.1	256.1	194.0	194.0	194.0	256.1	256.1	256.1
M_{ry} (kNm)	25.5	25.5	25.5	30.2	30.2	30.2	25.5	25.5	25.5	30.2	30.2	30.2	25.5	25.5	25.5	30.2	30.2	30.2

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	355.1	355.1	355.1	406.4	406.4	406.4	355.1	355.1	355.1	406.4	406.4	406.4	355.1	355.1	355.1	406.4	406.4	406.4
w_y (mm)	7.188	7.188	7.188	7.62	7.62	7.62	7.188	7.188	7.188	7.62	7.62	7.62	7.188	7.188	7.188	7.62	7.62	7.62
A_{wy} (mm^2)	2552	2552	2552	3097	3097	3097	2552	2552	2552	3097	3097	3097	2552	2552	2552	3097	3097	3097
h_y/w_y	49.4	49.4	49.4	53.3	53.3	53.3	49.4	49.4	49.4	53.3	53.3	53.3	49.4	49.4	49.4	53.3	53.3	53.3
F_{cr} (N/mm^2)	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	350	350	350	424	424	424	350	350	350	424	424	424	350	350	350	424	424	424
(V_f/V_r)<=1	0.103	0.014	0.037	0.024	0.014	0.167	0.057	0.006	0.023	0.019	0.007	0.097	0.034	0.006	0.014	0.016	0.005	0.052

Beam Column Checks:

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1	0.002	0.000	0.034	0.003	0.000	0.026	0.002	0.000	0.007	0.003	0.000	0.013	0.002	0.000	0.002	0.003	0.000	0.010
(T_f/T_r)<=1	0.003	0.000	0.000	0.005	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000

2. Axial Tension and Bending:

(T_f/T_r)<=1	0.003	0.000	0.000	0.005	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000
M_{fx}/M_{rx}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
M_{fy}/M_{ry}<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r$<=1	0.003	0.000	0.000	0.005	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000
$M_f/M_r-T_fS/M_rA$<=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Member ID in CSiBridge	622	622	622	623	623	623	626	626	626	627	627	627	630	630	630	631	631	631
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1358	1358	1358	1586	1586	1586	1358	1358	1358	1586	1586	1586	1358	1358	1358	1586	1586	1586
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.18E+03	8.18E+03	8.18E+03	6.96E+03	6.96E+03	6.96E+03	8.18E+03	8.18E+03	8.18E+03	6.96E+03	6.96E+03	6.96E+03	8.18E+03	8.18E+03	8.18E+03	6.96E+03	6.96E+03	6.96E+03
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	569	569	569	394	394	394	569	569	569	394	394	394	569	569	569	394	394	394
U_{1y}	1.00	1.00	1.03	1.00	1.00	1.02	1.00	1.00	1.01	1.00	1.00	1.01	1.00	1.00	1.00	1.00	1.00	1.01
C_f/C_r	0.001	0.000	0.010	0.001	0.000	0.005	0.001	0.000	0.002	0.001	0.000	0.003	0.001	0.000	0.001	0.001	0.000	0.002
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.001	0.000	0.010	0.001	0.000	0.005	0.001	0.000	0.002	0.001	0.000	0.003	0.001	0.000	0.001	0.001	0.000	0.002

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172
$C_{r\ (K=1)}$ (kN)	411	411	411	308	308	308	411	411	411	308	308	308	411	411	411	308	308	308
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.03	1.00	1.00	1.02	1.00	1.00	1.01	1.00	1.00	1.01	1.00	1.00	1.00	1.00	1.00	1.01
C_f/C_r	0.002	0.000	0.034	0.003	0.000	0.026	0.002	0.000	0.007	0.003	0.000	0.013	0.002	0.000	0.002	0.003	0.000	0.010
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.002	0.000	0.034	0.003	0.000	0.026	0.002	0.000	0.007	0.003	0.000	0.013	0.002	0.000	0.002	0.003	0.000	0.010

3.3. Lateral Torsional Buckling:

λ_{max}	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172
C_r (kN)	411	411	411	308	308	308	411	411	411	308	308	308	411	411	411	308	308	308
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.03	1.00	1.00	1.02	1.00	1.00	1.01	1.00	1.00	1.01	1.00	1.00	1.00	1.00	1.00	1.01
M_{rx} (kNm)	194	194	194	256	256	256	194	194	194	256	256	256	194	194	194	256	256	256
M_{ry} (kNm)	26	26	26	30	30	30	26	26	26	30	30	30	26	26	26	30	30	30
C_f/C_r	0.002	0.000	0.034	0.003	0.000	0.026	0.002	0.000	0.007	0.003	0.000	0.013	0.002	0.000	0.002	0.003	0.000	0.010
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.002	0.000	0.034	0.003	0.000	0.026	0.002	0.000	0.007	0.003	0.000	0.013	0.002	0.000	0.002	0.003	0.000	0.010
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.103	0.014	0.037	0.024	0.014	0.167	0.057	0.006	0.023	0.019	0.007	0.097	0.034	0.006	0.014	0.016	0.005	0.052

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	634	634	634	635	635	635	638	638	638	639	639	639	642	642	642	643	643	643
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Member Factored Load Effects:

C_f (kN)	1	0	0	1	0	1	1	0	0	1	0	1	1	0	0	1	0	1
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	1	0	1	1	0	0	1	0	1	0	0	0	1	0	1	0	0	0
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	0	1	5	2	0	1	0	1	3	1	0	1	0	1	2	1	0	1
V_{fy} (kN)	6	1	7	8	0	11	3	1	6	8	0	6	5	1	8	9	0	7

Gross Section Properties:

Ag (mm^2)	6354	6354	6354	7419	7419	7419	6354	6354	6354	7419	7419	7419	6354	6354	6354	7419	7419	7419
I_x (mm^4)	1.39E+08	1.39E+08	1.39E+08	2.10E+08	2.10E+08	2.10E+08	1.39E+08	1.39E+08	1.39E+08	2.10E+08	2.10E+08	2.10E+08	1.39E+08	1.39E+08	1.39E+08	2.10E+08	2.10E+08	2.10E+08
I_y (mm^4)	9.67E+06	9.67E+06	9.67E+06	1.19E+07	1.19E+07	1.19E+07	9.67E+06	9.67E+06	9.67E+06	1.19E+07	1.19E+07	1.19E+07	9.67E+06	9.67E+06	9.67E+06	1.19E+07	1.19E+07	1.19E+07
J (mm^4)	2.11E+05	2.11E+05	2.11E+05	2.87E+05	2.87E+05	2.87E+05	2.11E+05	2.11E+05	2.11E+05	2.87E+05	2.87E+05	2.87E+05	2.11E+05	2.11E+05	2.11E+05	2.87E+05	2.87E+05	2.87E+05
r_x (mm)	148	148	148	168	168	168	148	148	148	168	168	168	148	148	148	168	168	168
r_y (mm)	39	39	39	40	40	40	39	39	39	40	40	40	39	39	39	40	40	40
S_x (mm^3)	7.83E+05	7.83E+05	7.83E+05	1.03E+06	1.03E+06	1.03E+06	7.83E+05	7.83E+05	7.83E+05	1.03E+06	1.03E+06	1.03E+06	7.83E+05	7.83E+05	7.83E+05	1.03E+06	1.03E+06	1.03E+06
S_y (mm^3)	1.13E+05	1.13E+05	1.13E+05	1.34E+05	1.34E+05	1.34E+05	1.13E+05	1.13E+05	1.13E+05	1.34E+05	1.34E+05	1.34E+05	1.13E+05	1.13E+05	1.13E+05	1.34E+05	1.34E+05	1.34E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L (mm)	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722

Material Properties:

F_Y (MPa)	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	634	634	634	635	635	635	638	638	638	639	639	639	642	642	642	643	643	643
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	7.4	7.4	7.4	7.0	7.0	7.0	7.4	7.4	7.4	7.0	7.0	7.0	7.4	7.4	7.4	7.0	7.0	7.0
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	49.4	49.4	49.4	56.5	56.5	56.5	49.4	49.4	49.4	56.5	56.5	56.5	49.4	49.4	49.4	56.5	56.5	56.5
Webs in combined flexural and axial compression	49.4	49.4	49.4	56.5	56.5	56.5	49.4	49.4	49.4	56.5	56.5	56.5	49.4	49.4	49.4	56.5	56.5	56.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	634	634	634	635	635	635	638	638	638	639	639	639	642	642	642	643	643	643
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722
L_y (mm)	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722
λ_{max}	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172
C_r (kN)	411.1	411.1	411.1	307.7	307.7	307.7	411.1	411.1	411.1	307.7	307.7	307.7	411.1	411.1	411.1	307.7	307.7	307.7
$(kL/r)_{max}$	148.5	148.5	148.5	193.0	193.0	193.0	148.5	148.5	148.5	193.0	193.0	193.0	148.5	148.5	148.5	193.0	193.0	193.0
(comp. only) kL/r<120	NOT OK	OK	OK	NOT OK	OK	NOT OK	NOT OK	OK	OK	NOT OK	OK	NOT OK	NOT OK	OK	OK	NOT OK	OK	NOT OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	569	569	569	394	394	394	569	569	569	394	394	394	569	569	569	394	394	394

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	5212	5212	5212	6949	6949	6949	5212	5212	5212	6949	6949	6949	5212	5212	5212	6949	6949	6949
A_c (mm^2)	3177	3177	3177	3710	3710	3710	3177	3177	3177	3710	3710	3710	3177	3177	3177	3710	3710	3710
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	634	634	634	635	635	635	638	638	638	639	639	639	642	642	642	643	643	643
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	3177	3177	3177	3710	3710	3710	3177	3177	3177	3710	3710	3710	3177	3177	3177	3710	3710	3710
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	411.1	411.1	411.1	307.7	307.7	307.7	411.1	411.1	411.1	307.7	307.7	307.7	411.1	411.1	411.1	307.7	307.7	307.7

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6036	6036	6036	7048	7048	7048	6036	6036	6036	7048	7048	7048	6036	6036	6036	7048	7048	7048
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1434	1434	1434	1674	1674	1674	1434	1434	1434	1674	1674	1674	1434	1434	1434	1674	1674	1674
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	5592	5592	5592	6657	6657	6657	5592	5592	5592	6657	6657	6657	5592	5592	5592	6657	6657	6657
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	5592	5592	5592	6657	6657	6657	5592	5592	5592	6657	6657	6657	5592	5592	5592	6657	6657	6657
$A_{n(corrosion)}$ (mm^2)	5312	5312	5312	6324	6324	6324	5312	5312	5312	6324	6324	6324	5312	5312	5312	6324	6324	6324
$T_{r(b)}$ (kN)	1785	1785	1785	2125	2125	2125	1785	1785	1785	2125	2125	2125	1785	1785	1785	2125	2125	2125
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	5312	5312	5312	6324	6324	6324	5312	5312	5312	6324	6324	6324	5312	5312	5312	6324	6324	6324
$T_{r(c)}$ (kN)	1785	1785	1785	2125	2125	2125	1785	1785	1785	2125	2125	2125	1785	1785	1785	2125	2125	2125
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	634	634	634	635	635	635	638	638	638	639	639	639	642	642	642	643	643	643
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
F_m	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335
$T_{r(Block\ Shear)}$ (kN)	1785	1785	1785	2125	2125	2125	1785	1785	1785	2125	2125	2125	1785	1785	1785	2125	2125	2125
$(kL/r)_{max}$	148	148	148	193	193	193	148	148	148	193	193	193	148	148	148	193	193	193
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1434	1434	1434	1674	1674	1674	1434	1434	1434	1674	1674	1674	1434	1434	1434	1674	1674	1674
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	177	177	177	233	233	233	177	177	177	233	233	233	177	177	177	233	233	233
$M_{ry(Laterally\ Supported)}$ (kNm)	26	26	26	30	30	30	26	26	26	30	30	30	26	26	26	30	30	30
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
L_{uy} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
M_{ux} (kNm) (y weak)	1219	1219	1219	1578	1578	1578	1219	1219	1219	1578	1578	1578	1219	1219	1219	1578	1578	1578
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	194.0	194.0	194.0	256.1	256.1	256.1	194.0	194.0	194.0	256.1	256.1	256.1	194.0	194.0	194.0	256.1	256.1	256.1
M_{ry} (kNm)	25.5	25.5	25.5	30.2	30.2	30.2	25.5	25.5	25.5	30.2	30.2	30.2	25.5	25.5	25.5	30.2	30.2	30.2

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	355.1	355.1	355.1	406.4	406.4	406.4	355.1	355.1	355.1	406.4	406.4	406.4	355.1	355.1	355.1	406.4	406.4	406.4
w_y (mm)	7.188	7.188	7.188	7.62	7.62	7.62	7.188	7.188	7.188	7.62	7.62	7.62	7.188	7.188	7.188	7.62	7.62	7.62
A_{wy} (mm^2)	2552	2552	2552	3097	3097	3097	2552	2552	2552	3097	3097	3097	2552	2552	2552	3097	3097	3097
h_y/w_y	49.4	49.4	49.4	53.3	53.3	53.3	49.4	49.4	49.4	53.3	53.3	53.3	49.4	49.4	49.4	53.3	53.3	53.3
F_{cr} (N/mm^2)	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	350	350	350	424	424	424	350	350	350	424	424	424	350	350	350	424	424	424
$(V_f/V_r)<=1$	0.017	0.003	0.020	0.019	0.000	0.026	0.009	0.003	0.017	0.019	0.000	0.014	0.014	0.003	0.023	0.021	0.000	0.016

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.002	0.000	0.000	0.003	0.000	0.003	0.002	0.000	0.000	0.003	0.000	0.003	0.002	0.000	0.000	0.003	0.000	0.003
$(T_f/T_r)<=1$	0.001	0.000	0.001	0.001	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.001	0.000	0.001	0.001	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000
$M_{fx}/M_{rx}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fy}/M_{ry}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r<=1$	0.001	0.000	0.001	0.001	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PARSONS

Member ID in CSiBridge	634	634	634	635	635	635	638	638	638	639	639	639	642	642	642	643	643	643
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1358	1358	1358	1586	1586	1586	1358	1358	1358	1586	1586	1586	1358	1358	1358	1586	1586	1586
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.18E+03	8.18E+03	8.18E+03	6.96E+03	6.96E+03	6.96E+03	8.18E+03	8.18E+03	8.18E+03	6.96E+03	6.96E+03	6.96E+03	8.18E+03	8.18E+03	8.18E+03	6.96E+03	6.96E+03	6.96E+03
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	569	569	569	394	394	394	569	569	569	394	394	394	569	569	569	394	394	394
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.001	0.000	0.000	0.001	0.000	0.001	0.001	0.000	0.000	0.001	0.000	0.001	0.001	0.000	0.000	0.001	0.000	0.001
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.001	0.000	0.000	0.001	0.000	0.001	0.001	0.000	0.000	0.001	0.000	0.001	0.001	0.000	0.000	0.001	0.000	0.001

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172
$C_{r\ (K=1)}$ (kN)	411	411	411	308	308	308	411	411	411	308	308	308	411	411	411	308	308	308
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C_f/C_r	0.002	0.000	0.000	0.003	0.000	0.003	0.002	0.000	0.000	0.003	0.000	0.003	0.002	0.000	0.000	0.003	0.000	0.003
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.002	0.000	0.000	0.003	0.000	0.003	0.002	0.000	0.000	0.003	0.000	0.003	0.002	0.000	0.000	0.003	0.000	0.003

3.3. Lateral Torsional Buckling:

λ_{max}	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172
C_r (kN)	411	411	411	308	308	308	411	411	411	308	308	308	411	411	411	308	308	308
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M_{rx} (kNm)	194	194	194	256	256	256	194	194	194	256	256	256	194	194	194	256	256	256
M_{ry} (kNm)	26	26	26	30	30	30	26	26	26	30	30	30	26	26	26	30	30	30
C_f/C_r	0.002	0.000	0.000	0.003	0.000	0.003	0.002	0.000	0.000	0.003	0.000	0.003	0.002	0.000	0.000	0.003	0.000	0.003
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.002	0.000	0.000	0.003	0.000	0.003	0.002	0.000	0.000	0.003	0.000	0.003	0.002	0.000	0.000	0.003	0.000	0.003
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.017	0.003	0.020	0.019	0.000	0.026	0.009	0.003	0.017	0.019	0.000	0.014	0.014	0.003	0.023	0.021	0.000	0.016

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	646	646	646	647	647	647	650	650	650	651	651	651	654	654	654	655	655	655
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Member Factored Load Effects:

C_f (kN)	1	0	1	1	0	2	1	0	3	1	0	4	1	0	13	1	0	8
$M_{fx\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (comp)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_f (kN)	1	0	1	1	0	0	2	0	0	3	0	0	4	0	0	8	0	0
$M_{fx\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$M_{fy\ (tension)}$ (kNm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{fx} (kN)	0	1	3	2	0	1	1	1	6	3	0	3	0	1	4	2	1	2
V_{fy} (kN)	12	2	9	9	1	22	24	3	8	10	3	49	36	6	12	10	6	73

Gross Section Properties:

Ag (mm^2)	6354	6354	6354	7419	7419	7419	6354	6354	6354	7419	7419	7419	6354	6354	6354	7419	7419	7419
I_x (mm^4)	1.39E+08	1.39E+08	1.39E+08	2.10E+08	2.10E+08	2.10E+08	1.39E+08	1.39E+08	1.39E+08	2.10E+08	2.10E+08	2.10E+08	1.39E+08	1.39E+08	1.39E+08	2.10E+08	2.10E+08	2.10E+08
I_y (mm^4)	9.67E+06	9.67E+06	9.67E+06	1.19E+07	1.19E+07	1.19E+07	9.67E+06	9.67E+06	9.67E+06	1.19E+07	1.19E+07	1.19E+07	9.67E+06	9.67E+06	9.67E+06	1.19E+07	1.19E+07	1.19E+07
J (mm^4)	2.11E+05	2.11E+05	2.11E+05	2.87E+05	2.87E+05	2.87E+05	2.11E+05	2.11E+05	2.11E+05	2.87E+05	2.87E+05	2.87E+05	2.11E+05	2.11E+05	2.11E+05	2.87E+05	2.87E+05	2.87E+05
r_x (mm)	148	148	148	168	168	168	148	148	148	168	168	168	148	148	148	168	168	168
r_y (mm)	39	39	39	40	40	40	39	39	39	40	40	40	39	39	39	40	40	40
S_x (mm^3)	7.83E+05	7.83E+05	7.83E+05	1.03E+06	1.03E+06	1.03E+06	7.83E+05	7.83E+05	7.83E+05	1.03E+06	1.03E+06	1.03E+06	7.83E+05	7.83E+05	7.83E+05	1.03E+06	1.03E+06	1.03E+06
S_y (mm^3)	1.13E+05	1.13E+05	1.13E+05	1.34E+05	1.34E+05	1.34E+05	1.13E+05	1.13E+05	1.13E+05	1.34E+05	1.34E+05	1.34E+05	1.13E+05	1.13E+05	1.13E+05	1.34E+05	1.34E+05	1.34E+05
C_w (mm^6)	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
% Corrosion Loss	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	1	1	1
L (mm)	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722

Material Properties:

F_Y (MPa)	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
F_u (MPa)	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420

E (MPa)	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
G (MPa)	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000	77000

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	646	646	646	647	647	647	650	650	650	651	651	651	654	654	654	655	655	655
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
Width-to-thickness ratio of elements in compression																		
Legs of angles and elements supported along one edge																		
angles in continuous contact with other elements																		
Plate girder stiffeners																		
Stems of T-sections																		
Flanges of I- or T-sections	7.4	7.4	7.4	7.0	7.0	7.0	7.4	7.4	7.4	7.0	7.0	7.0	7.4	7.4	7.4	7.0	7.0	7.0
plates projecting from compression elements																		
outstanding legs of pairs of angles in continuous contact																		
Flanges of channels																		
Flanges of rectangular hollow structural shapes																		
Flanges of box girder sections																		
flange cover plates and diaphragm plates between lines of fasteners or welds																		
Perforated cover plates																		
Webs in axial compression																		
Webs in flexural compression	49.4	49.4	49.4	56.5	56.5	56.5	49.4	49.4	49.4	56.5	56.5	56.5	49.4	49.4	49.4	56.5	56.5	56.5
Webs in combined flexural and axial compression	49.4	49.4	49.4	56.5	56.5	56.5	49.4	49.4	49.4	56.5	56.5	56.5	49.4	49.4	49.4	56.5	56.5	56.5
Circular and multi-sided hollow sections in axial compression																		
Circular and multi-sided hollow sections in axial compression																		
Member Class	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Member Class = 3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	646	646	646	647	647	647	650	650	650	651	651	651	654	654	654	655	655	655
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

Factored Axial Compression Resistance:

1. based on fully composite section and flexural buckling:

ϕ_s	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
k_x	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_y	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L_x (mm)	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722
L_y (mm)	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722	5791	5791	5791	7722	7722	7722
λ_{max}	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172
C_r (kN)	411.1	411.1	411.1	307.7	307.7	307.7	411.1	411.1	411.1	307.7	307.7	307.7	411.1	411.1	411.1	320.7	320.7	320.7
$(kL/r)_{max}$	148.5	148.5	148.5	193.0	193.0	193.0	148.5	148.5	148.5	193.0	193.0	193.0	148.5	148.5	148.5	193.0	193.0	193.0
(comp. only) kL/r<120	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK	NOT OK	OK	NOT OK

2. based on shear flexibility in interconnections:

Lacing																		
Battens																		
Perforated Plate																		
Cover Plate																		

P_e^{min} (Euler, kN)	569	569	569	394	394	394	569	569	569	394	394	394	569	569	569	394	394	394

Shear Flexibility Factor:

1. Lacing:

a (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
b (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_aa (mm)	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
ε_bb (mm)	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	5212	5212	5212	6949	6949	6949	5212	5212	5212	6949	6949	6949	5212	5212	5212	6949	6949	6949
A_c (mm^2)	3177	3177	3177	3710	3710	3710	3177	3177	3177	3710	3710	3710	3177	3177	3177	3710	3710	3710
A_d (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
A_b (mm^2)	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
μ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
k'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_v	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0	999999.0
Lacing Governs?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Member ID in CSiBridge	646	646	646	647	647	647	650	650	650	651	651	651	654	654	654	655	655	655
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

2. Battens:

a (mm)	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
b (mm)	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3	368.3
ε_aa (mm)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ε_bb (mm)	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4	279.4
ε_a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ε_b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
l (mm)	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343	3343
A_c (mm^2)	3177	3177	3177	3710	3710	3710	3177	3177	3177	3710	3710	3710	3177	3177	3177	3710	3710	3710
A_b (mm^2)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
r_c (mm)	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18	26.18
r_b (mm)	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09	23.09
η_c	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
η_b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
μ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P_{cr}/P_e (Fig.3.51)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
K'(sqrt(P_e/P_{cr}))	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
λ_y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cr' (kN)	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999
Battens Govern?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Minimum Factored Compressive Resistance:

C_r^{min} (kN)	411.1	411.1	411.1	307.7	307.7	307.7	411.1	411.1	411.1	307.7	307.7	307.7	411.1	411.1	411.1	320.7	320.7	320.7

Factored Axial Tensile Resistance:

$A_{g(corrosion)}$ (mm^2)	6036	6036	6036	7048	7048	7048	6036	6036	6036	7048	7048	7048	6036	6036	6036	7345	7345	7345
ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$T_{r(a)}$ (kN)	1434	1434	1434	1674	1674	1674	1434	1434	1434	1674	1674	1674	1434	1434	1434	1744	1744	1744
ϕ_u	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
D_{Hole} (mm)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
ΣW_n t (mm^2)	5592	5592	5592	6657	6657	6657	5592	5592	5592	6657	6657	6657	5592	5592	5592	6657	6657	6657
$\Sigma(s^2t/4g)$ (mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_n (mm^2)	5592	5592	5592	6657	6657	6657	5592	5592	5592	6657	6657	6657	5592	5592	5592	6657	6657	6657
$A_{n(corrosion)}$ (mm^2)	5312	5312	5312	6324	6324	6324	5312	5312	5312	6324	6324	6324	5312	5312	5312	6590	6590	6590
$T_{r(b)}$ (kN)	1785	1785	1785	2125	2125	2125	1785	1785	1785	2125	2125	2125	1785	1785	1785	2214	2214	2214
Shear Lag Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$A_{ne(corrosion)}$ (mm^2)	5312	5312	5312	6324	6324	6324	5312	5312	5312	6324	6324	6324	5312	5312	5312	6590	6590	6590
$T_{r(c)}$ (kN)	1785	1785	1785	2125	2125	2125	1785	1785	1785	2125	2125	2125	1785	1785	1785	2214	2214	2214
U_t	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_{gv} (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$A_{gv(corrosion)}$ (mm^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge	646	646	646	647	647	647	650	650	650	651	651	651	654	654	654	655	655	655
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer
F_m	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335
$T_{r(Block\ Shear)}$ (kN)	1785	1785	1785	2125	2125	2125	1785	1785	1785	2125	2125	2125	1785	1785	1785	2214	2214	2214
$(kL/r)_{max}$	148	148	148	193	193	193	148	148	148	193	193	193	148	148	148	193	193	193
kL/r<200	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Minimum Factored Tensile Resistance:

T_r (min) (kN)	1434	1434	1434	1674	1674	1674	1434	1434	1434	1674	1674	1674	1434	1434	1434	1744	1744	1744
Ductile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Factored Moment Resistances:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
$M_{rx(Laterally\ Supported)}$ (kNm)	177	177	177	233	233	233	177	177	177	233	233	233	177	177	177	243	243	243
$M_{ry(Laterally\ Supported)}$ (kNm)	26	26	26	30	30	30	26	26	26	30	30	30	26	26	26	32	32	32
ω_2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_{ux} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
L_{uy} (mm)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
M_{ux} (kNm) (y weak)	1219	1219	1219	1578	1578	1578	1219	1219	1219	1578	1578	1578	1219	1219	1219	1578	1578	1578
M_{uy} (kNm) (x weak)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M_{rx} (kNm)	194.0	194.0	194.0	256.1	256.1	256.1	194.0	194.0	194.0	256.1	256.1	256.1	194.0	194.0	194.0	266.8	266.8	266.8
M_{ry} (kNm)	25.5	25.5	25.5	30.2	30.2	30.2	25.5	25.5	25.5	30.2	30.2	30.2	25.5	25.5	25.5	31.5	31.5	31.5

Shear resistance:

ϕ_s	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
h_y (mm)	355.1	355.1	355.1	406.4	406.4	406.4	355.1	355.1	355.1	406.4	406.4	406.4	355.1	355.1	355.1	406.4	406.4	406.4
w_y (mm)	7.188	7.188	7.188	7.62	7.62	7.62	7.188	7.188	7.188	7.62	7.62	7.62	7.188	7.188	7.188	7.62	7.62	7.62
A_{wy} (mm^2)	2552	2552	2552	3097	3097	3097	2552	2552	2552	3097	3097	3097	2552	2552	2552	3097	3097	3097
h_y/w_y	49.4	49.4	49.4	53.3	53.3	53.3	49.4	49.4	49.4	53.3	53.3	53.3	49.4	49.4	49.4	53.3	53.3	53.3
F_{cr} (N/mm^2)	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
F_t (N/mm^2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{ry} (kN)	350	350	350	424	424	424	350	350	350	424	424	424	350	350	350	424	424	424
$(V_f/V_r)<=1$	0.034	0.006	0.026	0.021	0.002	0.052	0.069	0.009	0.023	0.024	0.007	0.115	0.103	0.017	0.034	0.024	0.014	0.172

Beam Column Checks:

1. Axial Force To Resistance Ratios:

$(C_f/C_r)<=1$	0.002	0.000	0.002	0.003	0.000	0.006	0.002	0.000	0.007	0.003	0.000	0.013	0.002	0.000	0.032	0.003	0.000	0.025
$(T_f/T_r)<=1$	0.001	0.000	0.001	0.001	0.000	0.000	0.001	0.000	0.000	0.002	0.000	0.000	0.003	0.000	0.000	0.005	0.000	0.000

2. Axial Tension and Bending:

$(T_f/T_r)<=1$	0.001	0.000	0.001	0.001	0.000	0.000	0.001	0.000	0.000	0.002	0.000	0.000	0.003	0.000	0.000	0.005	0.000	0.000
$M_{fx}/M_{rx}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_{fy}/M_{ry}<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_f/T_r+M_f/M_r<=1$	0.001	0.000	0.001	0.001	0.000	0.000	0.001	0.000	0.000	0.002	0.000	0.000	0.003	0.000	0.000	0.005	0.000	0.000
$M_f/M_r-T_fS/M_rA<=1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Member ID in CSiBridge	646	646	646	647	647	647	650	650	650	651	651	651	654	654	654	655	655	655
Member Label	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station (m)	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7	0.0	2.9	5.8	0.0	3.9	7.7
Node Label at Station		---			---			---			---			---			---	
Section #	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40	W14x34	W14x34	W14x34	W16x40	W16x40	W16x40
Element Group	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer	21 Stringer

3. Axial Compression and Bending:

3.1. Cross-Sectional Strength
(members in braced frames only):

C_{r0} (kN)	1358	1358	1358	1586	1586	1586	1358	1358	1358	1586	1586	1586	1358	1358	1358	1653	1653	1653
ω_{1x}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ex} (kN)	8.18E+03	8.18E+03	8.18E+03	6.96E+03	6.96E+03	6.96E+03	8.18E+03	8.18E+03	8.18E+03	6.96E+03	6.96E+03	6.96E+03	8.18E+03	8.18E+03	8.18E+03	6.96E+03	6.96E+03	6.96E+03
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_{ey} (kN)	569	569	569	394	394	394	569	569	569	394	394	394	569	569	569	394	394	394
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.01	1.00	1.00	1.01	1.00	1.00	1.02	1.00	1.00	1.02
C_f/C_r	0.001	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.002	0.001	0.000	0.003	0.001	0.000	0.010	0.001	0.000	0.005
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.001	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.002	0.001	0.000	0.003	0.001	0.000	0.010	0.001	0.000	0.005

3.2. Overall Member Strength:

$\lambda_{max\ (K=1)}$	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172
$C_{r\ (K=1)}$ (kN)	411	411	411	308	308	308	411	411	411	308	308	308	411	411	411	321	321	321
ω_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ω_{1y}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.01	1.00	1.00	1.01	1.00	1.00	1.02	1.00	1.00	1.02
C_f/C_r	0.002	0.000	0.002	0.003	0.000	0.006	0.002	0.000	0.007	0.003	0.000	0.013	0.002	0.000	0.032	0.003	0.000	0.025
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.002	0.000	0.002	0.003	0.000	0.006	0.002	0.000	0.007	0.003	0.000	0.013	0.002	0.000	0.032	0.003	0.000	0.025

3.3. Lateral Torsional Buckling:

λ_{max}	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172	1.671	1.671	1.671	2.172	2.172	2.172
C_r (kN)	411	411	411	308	308	308	411	411	411	308	308	308	411	411	411	321	321	321
U_{1x}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
U_{1y}	1.00	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.01	1.00	1.00	1.01	1.00	1.00	1.02	1.00	1.00	1.02
M_{rx} (kNm)	194	194	194	256	256	256	194	194	194	256	256	256	194	194	194	267	267	267
M_{ry} (kNm)	26	26	26	30	30	30	26	26	26	30	30	30	26	26	26	32	32	32
C_f/C_r	0.002	0.000	0.002	0.003	0.000	0.006	0.002	0.000	0.007	0.003	0.000	0.013	0.002	0.000	0.032	0.003	0.000	0.025
$U_{1x}M_{fx}/M_{rx}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$U_{1y}M_{fy}/M_{ry}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction	0.002	0.000	0.002	0.003	0.000	0.006	0.002	0.000	0.007	0.003	0.000	0.013	0.002	0.000	0.032	0.003	0.000	0.025
Demand/Capacity ≤ 1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Highest Ratio	0.034	0.006	0.026	0.021	0.002	0.052	0.069	0.009	0.023	0.024	0.007	0.115	0.103	0.017	0.034	0.024	0.014	0.172

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge													
Member Label													
Station (m)													
Node Label at Station													
Section #													
Element Group													

Member Factored Load Effects:

C_f (kN)													
$M_{fx\ (comp)}$ (kNm)													
$M_{fy\ (comp)}$ (kNm)													
T_f (kN)													
$M_{fx\ (tension)}$ (kNm)													
$M_{fy\ (tension)}$ (kNm)													
V_{fx} (kN)													
V_{fy} (kN)													

Gross Section Properties:

Ag (mm^2)													
I_x (mm^4)													
I_y (mm^4)													
J (mm^4)													
r_x (mm)													
r_y (mm)													
S_x (mm^3)													
S_y (mm^3)													
C_w (mm^6)													
% Corrosion Loss													
L (mm)													

Material Properties:

F_Y (MPa)													
F_u (MPa)													

E (MPa)													
G (MPa)													

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge													
Member Label													
Station (m)													
Node Label at Station													
Section #													
Element Group													

Width-to-thickness ratio of elements in compression Ref: Cl. 10.9.2 S6-14

Legs of angles and elements supported along one edge													
angles in continuous contact with other elements													
Plate girder stiffeners													
Stems of T-sections													
Flanges of I- or T-sections													
plates projecting from compression elements													
outstanding legs of pairs of angles in continuous contact													
Flanges of channels													
Flanges of rectangular hollow structural shapes													
Flanges of box girder sections													
flange cover plates and diaphragm plates between lines of fasteners or welds													
Perforated cover plates													
Webs in axial compression													
Webs in flexural compression													
Webs in combined flexural and axial compression													
Circular and multi-sided hollow sections in axial compression													
Circular and multi-sided hollow sections in axial compression													
Member Class													
Member Class = 3													

Member ID in CSiBridge													
Member Label													
Station (m)													
Node Label at Station													
Section #													
Element Group													

Factored Axial Compression Resistance: Ref: Cl. 10.9.3 S6-14

1. based on fully composite section and flexural buckling:

ϕ_s													
k_x													
k_y													
L_x (mm)													
L_y (mm)													
λ_{max}													
C_r (kN)													
$(kL/r)_{max}$													
(comp. only) kL/r<120													

2. based on shear flexibility in interconnections: Interconnections (1 = YES, Interconnection Type is Present):

Lacing													
Battens													
Perforated Plate													
Cover Plate													

P_e^{min} (Euler, kN)													

Shear Flexibility Factor: Ref: Sections 3.4.3 and 3.4.4 of the Guide to Stability Design Criteria to Metal Structures (GSDCMS), 5th Edition

1. Lacing:

a (mm)													
b (mm)													
ε_aa (mm)													
ε_bb (mm)													
ε_a													
ε_b													
l (mm)													
A_c (mm^2)													
A_d (mm^2)													
A_b (mm^2)													
μ													
P_{cr}/P_e (Fig.3.51)													
k'(sqrt(P_e/P_{cr}))													
λ_v													
Cr' (kN)													
Lacing Governs?													

$\mu = \varepsilon_b/(1+\varepsilon_a)*(b/l)^2*A_c/A_d*((b/\varepsilon_a a)*(1+(\varepsilon_a a/b)^2)^{3/2} + b/(\varepsilon_a a)*A_d/A_b)$

where:

- μ is the shear flexibility factor
- ε_bb is the clear distance between interconnected member components
- ε_aa is the longitudinal distance measured between lacing end WP's
- b is the c/c distance between interconnected member components
- *l* is the member length between tie plates
- A_c is the area of one of the two long. elements
- A_d is the total area of diagonal components (lacing members) in an individual panel
- Ab is the strut member area of strut element in one panel
- a is the longitudinal panel length

Member ID in CSiBridge													
Member Label													
Station (m)													
Node Label at Station													
Section #													
Element Group													

2. Battens:

a (mm)													
b (mm)													
ε_aa (mm)													
ε_bb (mm)													
ε_a													
ε_b													
l (mm)													
A_c (mm^2)													
A_b (mm^2)													
r_c (mm)													
r_b (mm)													
η_c													
η_b													
μ													
P_{cr}/P_e (Fig.3.51)													
K'(sqrt(P_e/P_{cr}))													
λ_γ													
Cr' (kN)													
Battens Govern?													

$$\mu = (1/(l/r_c)^2+(b/2l)^2)(A_c/A_b*(ab/6r_b^2 + 5.2a/b*\eta_b) + 2.6\varepsilon_a\eta_c+\varepsilon_a^3/12*(a/r_c)^2)$$

where:

A_c,A_b is the area of a single longitudinal and all battens within length a, respectively

r_c,r_b is the radius of gyration of longitudinal (single) and batten elements in plane of buckling, respectively

η_c,η_b is the shear shape factors of the longitudinal and batten elements, respectively

$$\eta_i = A_{gi}/A_{vi}$$

Minimum Factored Compressive Resistance:

C_r^{min} (kN)													

Factored Axial Tensile Resistance: Ref: Cl. 10.8 S6-14

$A_{g(corrosion)}$ (mm^2)													
ϕ_s													
$T_{r(a)}$ (kN)													
ϕ_u													
D_{Hole} (mm)													
ΣW_n t (mm^2)													
$\Sigma(s^2t/4g)$ (mm^2)													
A_n (mm^2)													
$A_{n(corrosion)}$ (mm^2)													
$T_{r(b)}$ (kN)													
Shear Lag Factor													
$A_{ne(corrosion)}$ (mm^2)													
$T_{r(c)}$ (kN)													
U_t													
A_{gv} (mm^2)													
$A_{gv(corrosion)}$ (mm^2)													

- $Tr_{(a)}$ accounts for yielding of the gross section with reduction in section due to corrosion being accounted for.

- $Tr_{(b)}$ accounts for rupture at the critical net section with reduction in section due to corrosion being accounted for.

- $Tr_{(C)}$ accounts for rupture at the critical net section with both corrosion reduction and shear lag effects being accounted for.

- $T_{r(Block\ Shear)}$ accounts for a potential failure involving the simultaneous development of tensile and shear component areas including corrosion.

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge													
Member Label													
Station (m)													
Node Label at Station													
Section #													
Element Group													

F_m													
$T_{r(Block\ Shear)}$ (kN)													
$(kL/r)_{max}$													
kL/r<200													

Minimum Factored Tensile Resistance:

T_r (min) (kN)													
Ductile													

Factored Moment Resistances: Ref: Cl. 10.10 S6-14

ϕ_s													
$M_{rx(Laterally\ Supported)}$ (kNm)													
$M_{ry(Laterally\ Supported)}$ (kNm)													
ω_2													
L_{ux} (mm)													
L_{uy} (mm)													
M_{ux} (kNm) (y weak)													
M_{uy} (kNm) (x weak)													
M_{rx} (kNm)													
M_{ry} (kNm)													

Shear resistance: Ref: Cl. 10.10.5 S6-14

ϕ_s													
h_y (mm)													
w_y (mm)													
A_{wy} (mm^2)													
h_y/w_y													
F_{cr} (N/mm^2)													
F_t (N/mm^2)													
V_{ry} (kN)													
(V_f/V_r)<=1													

Beam Column Checks: Ref: Cl. 10.9.4 & Cl. 10.8.3 S6-14

1. Axial Force To Resistance Ratios:

(C_f/C_r)<=1													
(T_f/T_r)<=1													

2. Axial Tension and Bending:

(T_f/T_r)<=1													
M_{fx}/M_{rx}<=1													
M_{fy}/M_{ry}<=1													
$T_f/T_r+M_f/M_r$<=1													
$M_f/M_r-T_fS/M_rA$<=1													

Bascule Bridge Structural Evaluation - Frame Members (Detailed Strength Calculations For All Primary Members Under ULS B3 @ 63°)

Member ID in CSiBridge													
Member Label													
Station (m)													
Node Label at Station													
Section #													
Element Group													

3. Axial Compression and Bending:

$C_f/C_r + U_{1x}M_{fx}/M_{rx} + U_{1y}M_{fy}/M_{ry} <= 1$

3.1. Cross-Sectional Strength (members in braced frames only):

C_{r0} (kN)													
ω_{1x}													
C_{ex} (kN)													
U_{1x}													
ω_{1y}													
C_{ey} (kN)													
U_{1y}													
C_f/C_r													
$U_{1x}M_{fx}/M_{rx}$													
$U_{1y}M_{fy}/M_{ry}$													
Interaction													

3.2. Overall Member Strength:

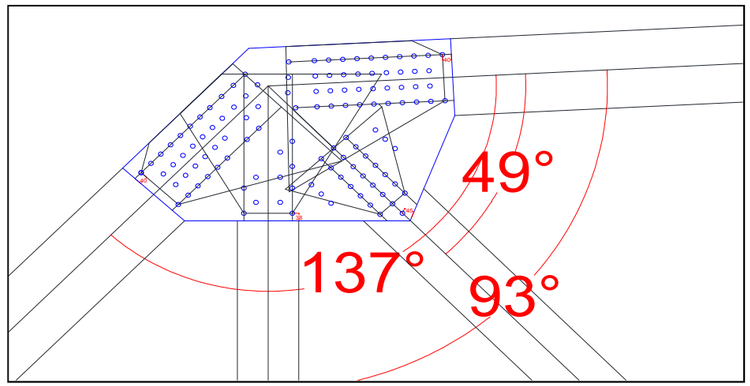
$\lambda_{max\ (K=1)}$													
$C_{r\ (K=1)}$ (kN)													
ω_{1x}													
U_{1x}													
ω_{1y}													
U_{1y}													
C_f/C_r													
$U_{1x}M_{fx}/M_{rx}$													
$U_{1y}M_{fy}/M_{ry}$													
Interaction													

3.3. Lateral Torsional Buckling:

λ_{max}													
C_r (kN)													
U_{1x}													
U_{1y}													
M_{rx} (kNm)													
M_{ry} (kNm)													
C_f/C_r													
$U_{1x}M_{fx}/M_{rx}$													
$U_{1y}M_{fy}/M_{ry}$													
Interaction													
Demand/Capacity ≤ 1													
Highest Ratio													

Span: Bascule Bridge - Leaf Span
Node: 1N

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.47 in	12 mm	6% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units		
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa		

MEMBER FORCES

Load Combination: D1, D2, CL1-625 Max

1N-A	P_{Max} =	0.0 kip	0 kN
1N-A	P_{Min} =	0.0 kip	0 kN
1N-B	P_{Max} =	26.0 kip	116 kN
1N-B	P_{Min} =	-261.6 kip	-1163 kN
1N-C	P_{Max} =	138.5 kip	615 kN
1N-C	P_{Min} =	14.1 kip	63 kN
1N-D	P_{Max} =	162.5 kip	722 kN
1N-D	P_{Min} =	-73.0 kip	-325 kN
1N-E	P_{Max} =	50.5 kip	225 kN
1N-E	P_{Min} =	-271.9 kip	-1208 kN

Note: Tension is positive.

Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
1N-A	0	#N/A	#N/A	#N/A	#N/A
1N-A	0	#N/A	#N/A	#N/A	#N/A
1N-B	2	116	111	107	116
1N-B	2	-1154	-1158	-1163	-1163
1N-C	241	610	613	615	615
1N-C	241	63	65	67	63
1N-D	3	716	719	722	722
1N-D	3	-325	-321	-318	-325
1N-E	423	225	224	224	225
1N-E	423	-1208	-1208	-1208	-1208

Span: Bascule Bridge - Leaf Span
Node: 1N

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		137	deg	B
	φ_C =		93	deg	C
	φ_D =		49	deg	D
	$\cos(\varphi_B)$ =		-0.731		
	$\cos(\varphi_C)$ =		-0.052		
	$\cos(\varphi_D)$ =		0.656		
	$V_{A'-A',max}$ =	297.2 kip	1321	kN	*
	$V_{A'-A',min}$ =	-74.2 kip	-330	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	297.2 kip	1321	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	178.4 kip	793	kN	

*using absolute maximum sums, conservative

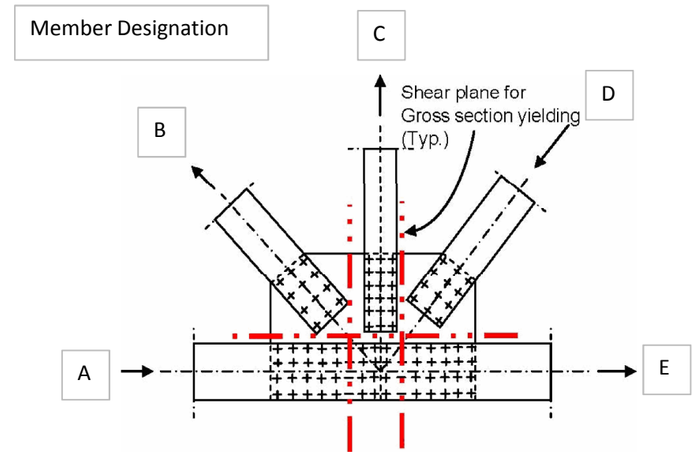


Figure 4 – Examples of gross section shear yielding planes

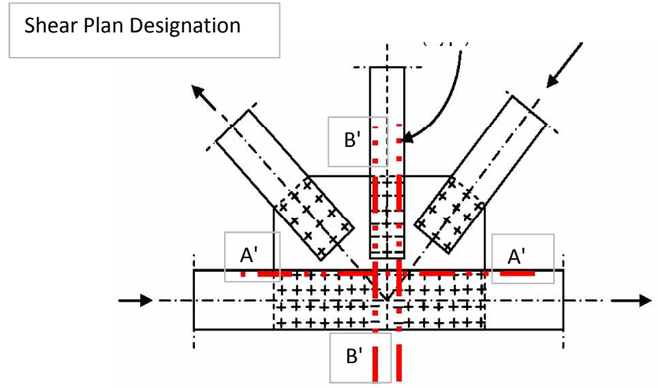


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Possible Scenario?			No		
Length of Shear Plane	L =	49.02 in	1245	mm	
No of holes in shear plane	N =	12.00 ea	12	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00 ea	2	ea	
Gross Shear Area	A_g =		29880	mm^2	
Net Shear Area	A_n =		23947	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =		$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =		2981	kN	
Shear Resistance (Net Section)	V_{Rn} =		$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =		4023	kN	
Shear Resistance (Governing)	V_R =		**2981**	**kN**	
Demand/Capacity	D/C =		**0.000**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Possible Scenario?			Yes		
Length of Shear Plane	L =	34.06 in	865	mm	
No of holes in shear plane	N =	11.00 ea	11	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2 ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 1N

Members A and E continuous through the gusset plate?				No	
Outside height of member A	H_A=	15	in	381 mm	
Thickness of the web of member A	w_A=	0.40	in	10 mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4 ea	
Gross Shear Area	A_g =			20760 mm^2	
Net Shear Area	A_n =			15322 mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$	Cl 10.18.5.2
	V_{Rg} =			2071 kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$ *	Cl 10.18.5.2
	V_{Rn} =			2574 kN	
Shear Resistance (Governing)	V_R =			**2071 kN**	
Demand/Capacity	D/C =			**0.383**	

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E

Members A and E continuous through the gusset plate? No

General

Whitmore Width	W_w =	28.31	in	719 mm	Number of Rivet/bolt diameters Intsecting Plane	
Shear Length 1	L_{V1} =	28.54	in	725 mm	4	
Shear Length 2	L_{V2} =	27.80	in	706 mm	10.5	
Tension Length	L_T =	8.98	in	228 mm	10.5	
Number of Gusset Plates	m =	2.00	ea	2 ea	3	Typ, 1 less than Whitemore Width
Diameter of holes in plane	d_b =	0.81	in	21 mm	($^{13}/_{16}$")	

Axile Tensile Resistance

CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	
		3443 kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	
For gusset plates, U=1.0, FHWA 3.1.2		5134 kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =	2736	mm^2
Gross Shear Area	A_{vg} =	17172	mm^2
Net Tension Area	A_{tn} =	1994	mm^2
Net Shear Area	A_{vn} =	11981	mm^2
$A_{tn} > 0.58*A_{vn}$?		No	

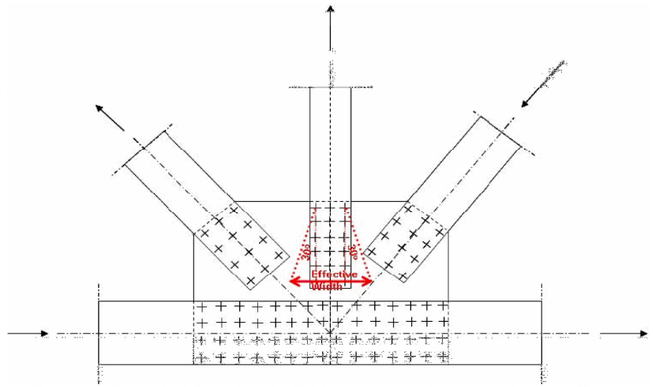


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

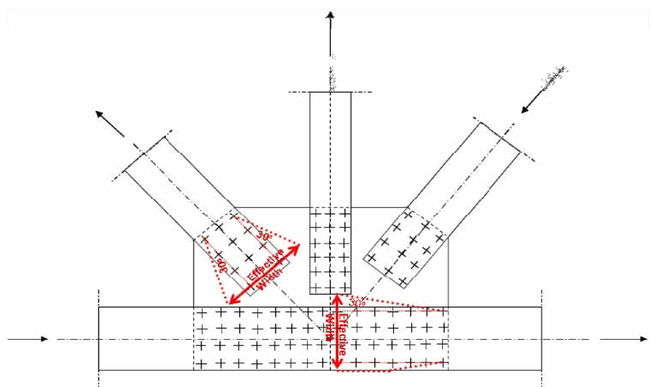


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 1N

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		5589 kN		FHWA 3.1.3
Tension Resistance (Governing)			3443 kN		
Demand/Capacity	D/C =		**0.065**		

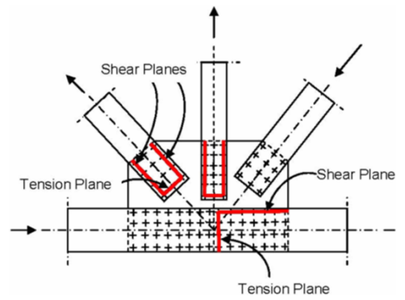


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E

General FHWA 3.3

Whitmore Width	W_w =	28.31 in	719 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.14 in	3.46 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			3261 kN		
Demand/Capacity	D/C =		**0.371**		

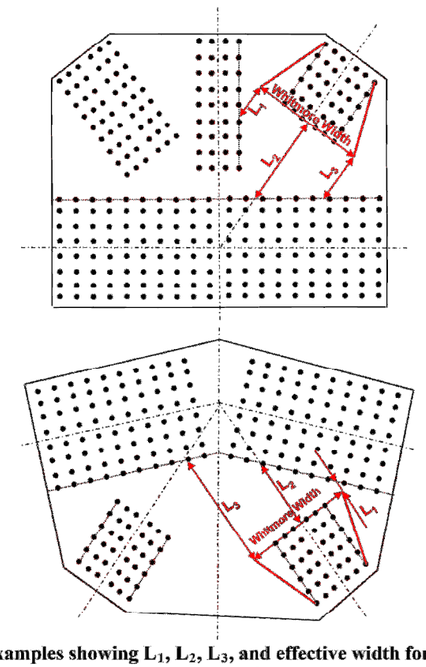


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	42 ea	42 ea			
Longest Length of connection	L=	28.58 in	726 mm			
Edge distance	e =	1.57 in	40 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$			CSA S6 CL14.14.1.4.2
	B_{r1} =	1276 kip	5673 kN			
	B_{r2} =	1824 kip	8105 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$			CSA S6 CL14.14.1.4.2
		433 kip	1925 kN			
Governing Resistance			3850 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span

Node: 1N

Demand/Capacity	D/C =	**0.314**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? Yes

General

					Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	26.97 in	685	mm	4
Shear Length 1	L_{V1} =	27.83 in	707	mm	10.5
Shear Length 2	L_{V2} =	28.07 in	713	mm	10.5
Tension Length	L_T =	9.02 in	229	mm	2
Number of Gusset Plates	m =	2 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$	3280	kN	U=1.0 FHWA 3.1.2
Net Section Resistance For gusset plates, U=1.0, FHWA 3.1.2	P_{RN} =	$U*\varphi_u*A_n*F_u$	4859	kN	U=1.0 FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =	2748	mm^2	
Gross Shear Area	A_{vg} =	17040	mm^2	
Net Tension Area	A_{tn} =	2254	mm^2	
Net Shear Area	A_{vn} =	11849	mm^2	
$A_{tn} \geq 0.58*A_{vn}$?		No		

		$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$			U=1.0
Block Shear Resistance	P_{Rbs} =		5542	kN	FHWA 3.1.3
Tension Resistance (Governing)			3280	kN	
Demand/Capacity	D/C =		**0.035**		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? Yes

General — FHWA 3.3

Whitmore Width	W_w =	26.97 in	685	mm

Span: Bascule Bridge - Leaf Span

Node: 1N

L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	0.00 in	0	mm	
L3	L_3 =	0.00 in	0	mm	
Unsupported Column Length	L_u =	0.00 in	0	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.00		
Compressive Resistance	C_r =		$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			3107	kN	
Demand/Capacity	D/C =		**0.374**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	37 ea	37	ea		
Longest Length of connection	L=	28.07 in	713	mm		
Edge distance	e =	1.57 in	40	mm		
Diameter of Rivet	d =	0.75 in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1	ea		
Number of Gusset Plates		2.00 ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	1124 kip	4998	kN		
	B_{r2} =	1607 kip	7140	kN		
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		691 kip	3069	kN		
Governing Resistance			6139	kN	for 2 plate(s)	
Demand/Capacity	D/C =		**0.189**			

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

					Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	28.07 in	713	mm	4	
Shear Length 1	L_{V1} =	28.62 in	727	mm	9.5	
Shear Length 2	L_{V2} =	28.62 in	727	mm	10.5	
Tension Length	L_T =	8.50 in	216	mm	3	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 1N

Number of Gusset Plates	m =	2.00 ea	2 ea		
Diameter of holes in plane	d_b =	0.81 in	21 mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			3414	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			5085	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		2592	mm^2	
Gross Shear Area	A_{vg} =		17448	mm^2	
Net Tension Area	A_{tn} =		1850	mm^2	
Net Shear Area	A_{vn} =		12504	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		5744	kN	FHWA 3.1.3
Tension Resistance (Governing)			3414	kN	
Demand/Capacity	D/C =		**0.180**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	28.07 in	713	mm	
L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	0.00 in	0	mm	
L3	L_3 =	0.00 in	0	mm	
Unsupported Column Length	L_u =	0.00 in	0	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			3234	kN	

Span: Bascule Bridge - Leaf Span
Node: 1N

Demand/Capacity	D/C =			**0.000**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	22	ea	22	ea		
Longest Length of connection	L=	28.62	in	727	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	635	kip	2823	kN		
	B_{r2} =	955	kip	4246	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		411	kip	1825	kN		
Governing Resistance				3650	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.169**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	23.31	in	592	mm	3	
Shear Length 1	L_{V1} =	18.07	in	459	mm	6.5	
Shear Length 2	L_{V2} =	16.73	in	425	mm	6.5	
Tension Length	L_T =	5.98	in	152	mm	2	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		2834	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		4276	kN		

Block Shear

Gross Tension Area	A_{tg} =	1824	mm^2

Span: Bascule Bridge - Leaf Span

Node: 1N

Gross Shear Area	A_{vg} =		10608	mm^2	
Net Tension Area	A_{tn} =		1330	mm^2	
Net Shear Area	A_{vn} =		7394	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0		
Block Shear Resistance	P_{Rbs} =		3495	kN	FHWA 3.1.3
Tension Resistance (Governing)			2834	kN	
Demand/Capacity	D/C =		**0.255**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?			Yes		
General					FHWA 3.3
Whitmore Width	W_w =	23.31 in	592	mm	
L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	10.51 in	267	mm	
L3	L_3 =	0.83 in	21	mm	
Unsupported Column Length	L_u =	3.78 in	96	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.34		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			2577	kN	
Demand/Capacity	D/C =		**0.126**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	22 ea	22	ea		
Longest Length of connection	L=	18.07 in	459	mm		
Edge distance	e =	1.77 in	45	mm		
Diameter of Rivet	d =	0.75 in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1	ea		
Number of Gusset Plates		2.00 ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	752 kip	3343	kN		
	B_{r2} =	955 kip	4246	kN		

Span: Bascule Bridge - Leaf Span
Node: 1N

Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$ U=1.81	CSA S6 CL14.14.1.4.2
		411 kip	1825 kN	
Governing Resistance			3650 kN for 2 plate(s)	
Demand/Capacity	D/C =		**0.198**	
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	671	2981
Shear Resistance (Net Section)	905	4023
Shear Resistance (Governing)	671	2981
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	466	2071
Shear Resistance (Net Section)	579	2574
Shear Resistance (Governing)	466	2071
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	775	3443
Net Section Resistance	1155	5134
Block Shear Resistance	1258	5589
Tension Resistance (Governing)	775	3443
At Member B:		
Gross Section Resistance	738	3280
Net Section Resistance	1093	4859
Block Shear Resistance	1247	5542
Tension Resistance (Governing)	738	3280
At Member C:		
Gross Section Resistance	768	3414
Net Section Resistance	1144	5085
Block Shear Resistance	1293	5744
Tension Resistance (Governing)	768	3414
At Member D:		
Gross Section Resistance	638	2834
Net Section Resistance	962	4276
Block Shear Resistance	786	3495
Tension Resistance (Governing)	638	2834
At Member E:		
Gross Section Resistance	775	3443

Span: Bascule Bridge - Leaf Span
Node: 1N

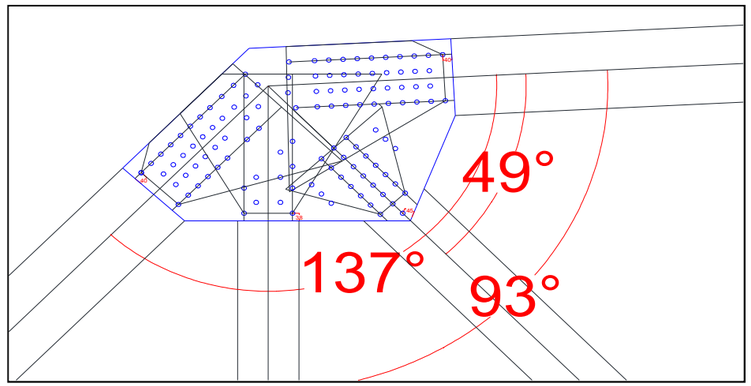
Net Section Resistance	1155	5134
Block Shear Resistance	1258	5589
Tension Resistance (Governing)	775	3443
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	734	3261
Compressive Resistance at Member B	699	3107
Compressive Resistance at Member C	728	3234
Compressive Resistance at Member D	580	2577
Compressive Resistance at Member E	734	3261
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	866	3850
Governing Resistance at Member B	1381	6139
Governing Resistance at Member C	821	3650
Governing Resistance at Member D	821	3650
Governing Resistance at Member E	866	3850

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
	SHEAR PLANE A'-A'	671	2981	**0.000**	
	SHEAR PLANE B'-B'	466	2071	**0.383**	<--- Governing
GUSSET PLATE TENSION					
	Member A	775	3443	**0.065**	
	Member B	738	3280	**0.035**	
	Member C	768	3414	**0.180**	
	Member D	638	2834	**0.255**	
	Member E	775	3443	**0.065**	
GUSSET PLATE COMPRESSION					
	Member A	734	3261	**0.371**	
	Member B	699	3107	**0.374**	
	Member C	728	3234	**0.000**	
	Member D	580	2577	**0.126**	
	Member E	734	3261	**0.371**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	866	3850	**0.314**	
	Member B	1381	6139	**0.189**	
	Member C	821	3650	**0.169**	
	Member D	821	3650	**0.198**	
	Member E	866	3850	**0.314**	
	Highest Demand/Capacity Ratio			**0.383**	

Span: Bascule Bridge - Leaf Span
Node: 1S

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.47 in	12 mm	6% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units			
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6	
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa			

MEMBER FORCES

Load Combination:		D1, D2, CL1-625 Max	
1S-A	P_{Max} =	0.0 kip	0 kN
1S-A	P_{Min} =	0.0 kip	0 kN
1S-B	P_{Max} =	10.6 kip	47 kN
1S-B	P_{Min} =	-277.0 kip	-1231 kN
1S-C	P_{Max} =	142.8 kip	635 kN
1S-C	P_{Min} =	18.4 kip	82 kN
1S-D	P_{Max} =	170.0 kip	756 kN
1S-D	P_{Min} =	-65.4 kip	-291 kN
1S-E	P_{Max} =	34.7 kip	154 kN
1S-E	P_{Min} =	-287.7 kip	-1279 kN

Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
1S-A	0	#N/A	#N/A	#N/A	#N/A
1S-A	0	#N/A	#N/A	#N/A	#N/A
1S-B	178	47	43	38	47
1S-B	178	-1222	-1227	-1231	-1231
1S-C	569	630	632	635	635
1S-C	569	82	84	87	82
1S-D	179	749	753	756	756
1S-D	179	-291	-287	-284	-291
1S-E	492	154	154	154	154
1S-E	492	-1278	-1278	-1279	-1279

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 1S

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		137	deg	B
	φ_C =		93	deg	C
	φ_D =		49	deg	D
	$\cos(\varphi_B)$ =		-0.731		
	$\cos(\varphi_C)$ =		-0.052		
	$\cos(\varphi_D)$ =		0.656		
	$V_{A'-A',max}$ =	313.2 kip	1392	kN	*
	$V_{A'-A',min}$ =	-58.1 kip	-258	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	313.2 kip	1392	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	188.9 kip	840	kN	

*using absolute maximum sums, conservative

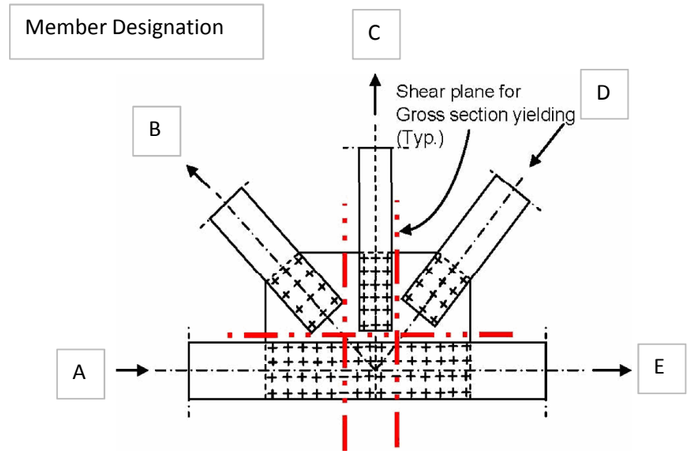


Figure 4 – Examples of gross section shear yielding planes

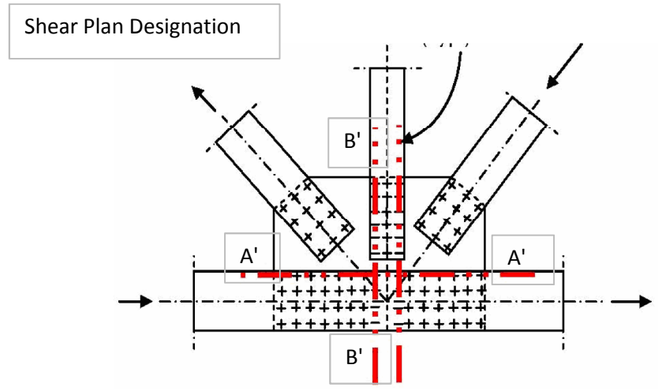


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Possible Scenario?			No		
Length of Shear Plane	L =	49.02 in	1245	mm	
No of holes in shear plane	N =	12.00 ea	12	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00 ea	2	ea	
Gross Shear Area	A_g =		29880	mm^2	
Net Shear Area	A_n =		23947	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =		$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =		2981	kN	
Shear Resistance (Net Section)	V_{Rn} =		$0.5*\varphi_u*A_n*F_U$ *		Cl 10.18.5.2
	V_{Rn} =		4023	kN	
Shear Resistance (Governing)	V_R =		**2981**	**kN**	
Demand/Capacity	D/C =		**0.000**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Possible Scenario?			Yes		
Length of Shear Plane	L =	34.06 in	865	mm	
No of holes in shear plane	N =	11.00 ea	11	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2 ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 1S

Members A and E continuous through the gusset plate?				No	
Outside height of member A	H_A=	15	in	381 mm	
Thickness of the web of member A	w_A=	0.40	in	10 mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4 ea	
Gross Shear Area	A_g =			20760 mm^2	
Net Shear Area	A_n =			15322 mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$	Cl 10.18.5.2
	V_{Rg} =			2071 kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$ *	Cl 10.18.5.2
	V_{Rn} =			2574 kN	
Shear Resistance (Governing)	V_R =			**2071 kN**	
Demand/Capacity	D/C =			**0.405**	

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E

Members A and E continuous through the gusset plate? No

General

Whitmore Width	W_w =	28.31	in	719 mm	Number of Rivet/bolt diameters Intsecting Plane	
Shear Length 1	L_{V1} =	28.54	in	725 mm	4	
Shear Length 2	L_{V2} =	27.80	in	706 mm	10.5	
Tension Length	L_T =	8.98	in	228 mm	10.5	
Number of Gusset Plates	m =	2.00	ea	2 ea	3	Typ, 1 less than Whitemore Width
Diameter of holes in plane	d_b =	0.81	in	21 mm	($^{13}/_{16}$")	

Axile Tensile Resistance CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	
		3443 kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	
For gusset plates, U=1.0, FHWA 3.1.2		5134 kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =	2736	mm^2
Gross Shear Area	A_{vg} =	17172	mm^2
Net Tension Area	A_{tn} =	1994	mm^2
Net Shear Area	A_{vn} =	11981	mm^2
$A_{tn} > 0.58*A_{vn}$?		No	

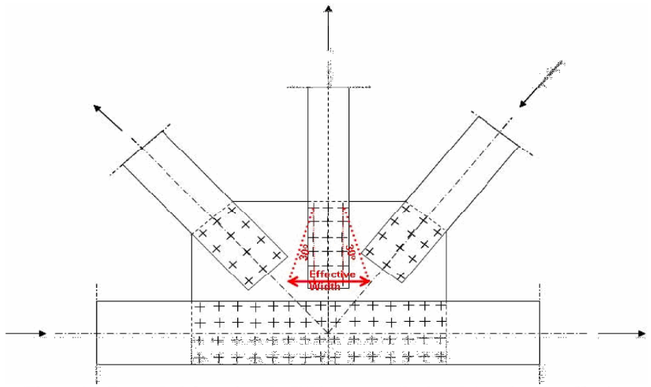


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

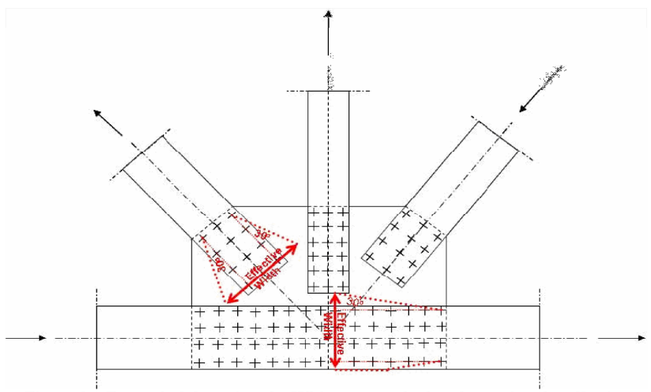


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 1S

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		5589 kN		FHWA 3.1.3
Tension Resistance (Governing)			3443 kN		
Demand/Capacity	D/C =		**0.045**		

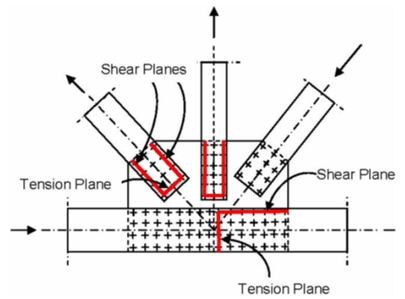


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E

General — FHWA 3.3

Whitmore Width	W_w =	28.31 in	719 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.14 in	3.46 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			3261 kN		
Demand/Capacity	D/C =		**0.392**		

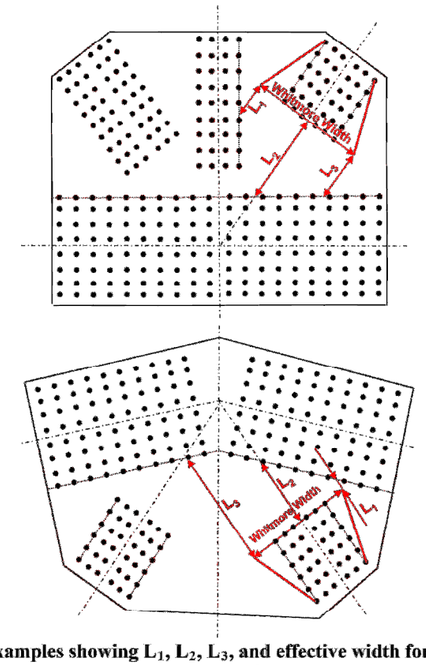


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	42 ea	42 ea			
Longest Length of connection	L=	28.58 in	726 mm			
Edge distance	e =	1.57 in	40 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$			CSA S6 CL14.14.1.4.2
	B_{r1} =	1276 kip	5673 kN			
	B_{r2} =	1824 kip	8105 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$			CSA S6 CL14.14.1.4.2
		433 kip	1925 kN			
Governing Resistance			3850 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span

Node: 1S

Demand/Capacity	D/C =	**0.332**	
For Connections greater than 50in (1270mm), shear resistance taken as 80%.			FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? Yes

General

					Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	26.97 in	685	mm	4
Shear Length 1	L_{V1} =	27.83 in	707	mm	10.5
Shear Length 2	L_{V2} =	28.07 in	713	mm	10.5
Tension Length	L_T =	9.02 in	229	mm	2
Number of Gusset Plates	m =	2 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$	3280	kN	U=1.0 FHWA 3.1.2
Net Section Resistance For gusset plates, U=1.0, FHWA 3.1.2	P_{RN} =	$U*\varphi_u*A_n*F_u$	4859	kN	U=1.0 FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =	2748	mm^2	
Gross Shear Area	A_{vg} =	17040	mm^2	
Net Tension Area	A_{tn} =	2254	mm^2	
Net Shear Area	A_{vn} =	11849	mm^2	
$A_{tn} \geq 0.58*A_{vn}$?		No		

		$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$			U=1.0
Block Shear Resistance	P_{Rbs} =		5542	kN	FHWA 3.1.3
Tension Resistance (Governing)			3280	kN	
Demand/Capacity	D/C =		**0.014**		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? Yes

General — FHWA 3.3

Whitmore Width	W_w =	26.97 in	685	mm

Span: Bascule Bridge - Leaf Span

Node: 1S

L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	0.00 in	0	mm	
L3	L_3 =	0.00 in	0	mm	
Unsupported Column Length	L_u =	0.00 in	0	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.00		
Compressive Resistance	C_r =		$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			3107	kN	
Demand/Capacity	D/C =		**0.396**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	37 ea	37	ea		
Longest Length of connection	L=	28.07 in	713	mm		
Edge distance	e =	1.57 in	40	mm		
Diameter of Rivet	d =	0.75 in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1	ea		
Number of Gusset Plates		2.00 ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	1124 kip	4998	kN		
	B_{r2} =	1607 kip	7140	kN		
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		691 kip	3069	kN		
Governing Resistance			6139	kN	for 2 plate(s)	
Demand/Capacity	D/C =		**0.201**			

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

					Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	28.07 in	713	mm	4	
Shear Length 1	L_{V1} =	28.62 in	727	mm	9.5	
Shear Length 2	L_{V2} =	28.62 in	727	mm	10.5	
Tension Length	L_T =	8.50 in	216	mm	3	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 1S

Number of Gusset Plates	m =	2.00 ea	2 ea		
Diameter of holes in plane	d_b =	0.81 in	21 mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			3414	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			5085	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		2592	mm^2	
Gross Shear Area	A_{vg} =		17448	mm^2	
Net Tension Area	A_{tn} =		1850	mm^2	
Net Shear Area	A_{vn} =		12504	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		5744	kN	FHWA 3.1.3
Tension Resistance (Governing)			3414	kN	
Demand/Capacity	D/C =		**0.186**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	28.07 in	713	mm	
L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	0.00 in	0	mm	
L3	L_3 =	0.00 in	0	mm	
Unsupported Column Length	L_u =	0.00 in	0	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			3234	kN	

Span: Bascule Bridge - Leaf Span
Node: 1S

Demand/Capacity	D/C =			**0.000**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	22	ea	22	ea		
Longest Length of connection	L=	28.62	in	727	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	635	kip	2823	kN		
	B_{r2} =	955	kip	4246	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		411	kip	1825	kN		
Governing Resistance				3650	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.174**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	23.31	in	592	mm	3	
Shear Length 1	L_{V1} =	18.07	in	459	mm	6.5	
Shear Length 2	L_{V2} =	16.73	in	425	mm	6.5	
Tension Length	L_T =	5.98	in	152	mm	2	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		2834	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		4276	kN		

Block Shear

Gross Tension Area	A_{tg} =	1824	mm^2

Span: Bascule Bridge - Leaf Span

Node: 1S

Gross Shear Area	A_{vg} =			10608	mm^2	
Net Tension Area	A_{tn} =			1330	mm^2	
Net Shear Area	A_{vn} =			7394	mm^2	
$A_{tn} > 0.58*A_{vn}$?				No		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		U=1.0		
Block Shear Resistance	P_{Rbs} =			3495	kN	FHWA 3.1.3
Tension Resistance (Governing)				2834	kN	
Demand/Capacity	D/C =			**0.267**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?				Yes		
General						FHWA 3.3
Whitmore Width	W_w =	23.31	in	592	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	10.51	in	267	mm	
L3	L_3 =	0.83	in	21	mm	
Unsupported Column Length	L_u =	3.78	in	96	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.34		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2577	kN	
Demand/Capacity	D/C =			**0.113**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	22	ea	22	ea		
Longest Length of connection	L=	18.07	in	459	mm		
Edge distance	e =	1.77	in	45	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0			CSA S6 CL14.14.1.4.2
	B_{r1} =	752	kip	3343	kN		
	B_{r2} =	955	kip	4246	kN		

Span: Bascule Bridge - Leaf Span
Node: 1S

Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$ U=1.81	CSA S6 CL14.14.1.4.2
		411 kip	1825 kN	
Governing Resistance			3650 kN for 2 plate(s)	
Demand/Capacity	D/C =		**0.207**	
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	671	2981
Shear Resistance (Net Section)	905	4023
Shear Resistance (Governing)	671	2981
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	466	2071
Shear Resistance (Net Section)	579	2574
Shear Resistance (Governing)	466	2071
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	775	3443
Net Section Resistance	1155	5134
Block Shear Resistance	1258	5589
Tension Resistance (Governing)	775	3443
At Member B:		
Gross Section Resistance	738	3280
Net Section Resistance	1093	4859
Block Shear Resistance	1247	5542
Tension Resistance (Governing)	738	3280
At Member C:		
Gross Section Resistance	768	3414
Net Section Resistance	1144	5085
Block Shear Resistance	1293	5744
Tension Resistance (Governing)	768	3414
At Member D:		
Gross Section Resistance	638	2834
Net Section Resistance	962	4276
Block Shear Resistance	786	3495
Tension Resistance (Governing)	638	2834
At Member E:		
Gross Section Resistance	775	3443

Span: Bascule Bridge - Leaf Span
Node: 1S

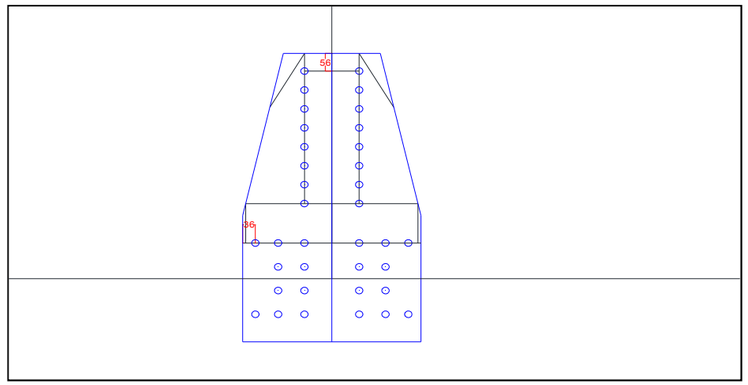
Net Section Resistance	1155	5134
Block Shear Resistance	1258	5589
Tension Resistance (Governing)	775	3443
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	734	3261
Compressive Resistance at Member B	699	3107
Compressive Resistance at Member C	728	3234
Compressive Resistance at Member D	580	2577
Compressive Resistance at Member E	734	3261
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	866	3850
Governing Resistance at Member B	1381	6139
Governing Resistance at Member C	821	3650
Governing Resistance at Member D	821	3650
Governing Resistance at Member E	866	3850

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
	SHEAR PLANE A'-A'	671	2981	**0.000**	
	SHEAR PLANE B'-B'	466	2071	**0.405**	<--- Governing
GUSSET PLATE TENSION					
	Member A	775	3443	**0.045**	
	Member B	738	3280	**0.014**	
	Member C	768	3414	**0.186**	
	Member D	638	2834	**0.267**	
	Member E	775	3443	**0.045**	
GUSSET PLATE COMPRESSION					
	Member A	734	3261	**0.392**	
	Member B	699	3107	**0.396**	
	Member C	728	3234	**0.000**	
	Member D	580	2577	**0.113**	
	Member E	734	3261	**0.392**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	866	3850	**0.332**	
	Member B	1381	6139	**0.201**	
	Member C	821	3650	**0.174**	
	Member D	821	3650	**0.207**	
	Member E	866	3850	**0.332**	
	Highest Demand/Capacity Ratio			**0.405**	

Span: Bascule Bridge - Leaf Span
Node: 2N

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.28 in	7 mm	45% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units		
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa		

MEMBER FORCES

Load Combination: D1, D2, CL1-625 Max

2N-A	P_{Max} =	171.0 kip	760 kN	
2N-A	P_{Min} =	-9.2 kip	-41 kN	
2N-B	P_{Max} =	0.0 kip	0 kN	
2N-B	P_{Min} =	0.0 kip	0 kN	
2N-C	P_{Max} =	138.5 kip	615 kN	
2N-C	P_{Min} =	14.1 kip	63 kN	
2N-D	P_{Max} =	0.0 kip	0 kN	
2N-D	P_{Min} =	0.0 kip	0 kN	
2N-E	P_{Max} =	167.9 kip	746 kN	
2N-E	P_{Min} =	-8.4 kip	-37 kN	

Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
2N-A	279	760	760	760	760
2N-A	279	-41	-41	-41	-41
2N-B	0	#N/A	#N/A	#N/A	#N/A
2N-B	0	#N/A	#N/A	#N/A	#N/A
2N-C	241	610	613	615	615
2N-C	241	63	65	67	63
2N-D	0	#N/A	#N/A	#N/A	#N/A
2N-D	0	#N/A	#N/A	#N/A	#N/A
2N-E	280	746	746	746	746
2N-E	280	-37	-37	-37	-37

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 2N

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		128	deg	B
	φ_C =		90	deg	C
	φ_D =		54	deg	D
	$\cos(\varphi_B)$ =		-0.616		
	$\cos(\varphi_C)$ =		0.000		
	$\cos(\varphi_D)$ =		0.588		
	$V_{A'-A',max}$ =	0.0 kip	0	kN	*
	$V_{A'-A',min}$ =	0.0 kip	0	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	0.0 kip	0	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	0.0 kip	0	kN	

*using absolute maximum sums, conservative

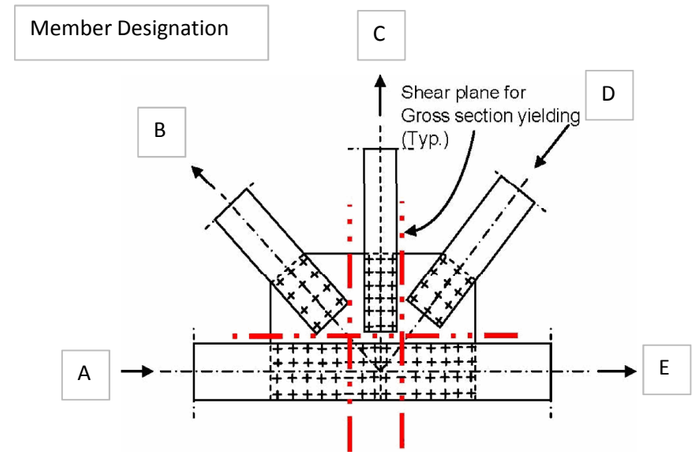


Figure 4 – Examples of gross section shear yielding planes

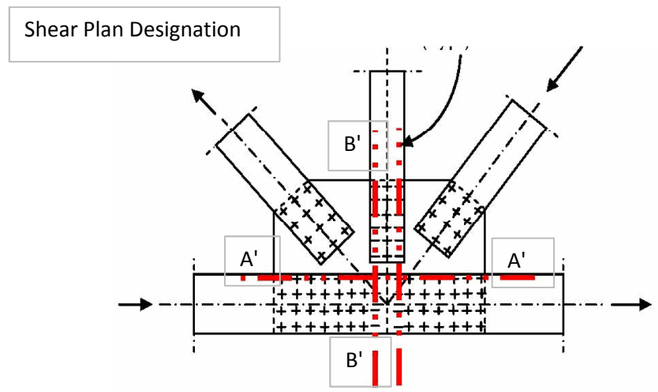


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	20.00	in	508	mm	
No of holes in shear plane	N =	6.00	ea	6	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			7112	mm^2	
Net Shear Area	A_n =			5382	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			709	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =			904	kN	
Shear Resistance (Governing)	V_R =			**709**	**kN**	
Demand/Capacity	D/C =			**0.000**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	35.98	in	914	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 2N

Members A and E continuous through the gusset plate?			Yes		
Outside height of member A	H_A=	15 in	381	mm	
Thickness of the web of member A	w_A=	0.40 in	10	mm	
No of holes in member A/E in shear plane	N_A=	4 ea	4	ea	
Gross Shear Area	A_g =		20538	mm^2	
Net Shear Area	A_n =		15403	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =		$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =		2049	kN	
Shear Resistance (Net Section)	V_{Rn} =		$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =		2588	kN	
Shear Resistance (Governing)	V_R =		**2049**	**kN**	
Demand/Capacity	D/C =		**0.000**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E — N/A

Members A and E continuous through the gusset plate? Yes

General

					Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	0.00 in	0	mm	0	
Shear Length 1	L_{V1} =	0.00 in	0	mm	0	
Shear Length 2	L_{V2} =	0.00 in	0	mm	0	
Tension Length	L_T =	0.00 in	0	mm	0	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00 ea	2	ea		
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance

CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$		
		0	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		0	kN	

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

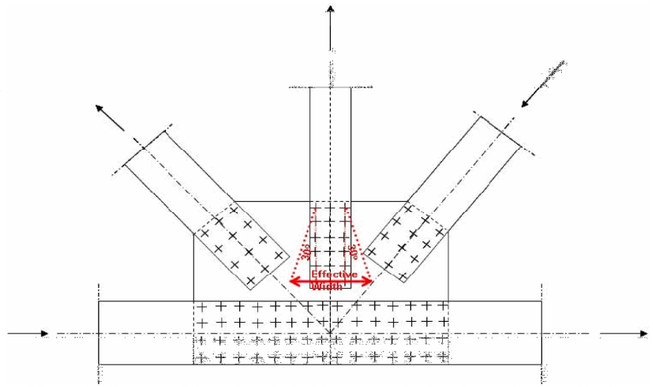


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

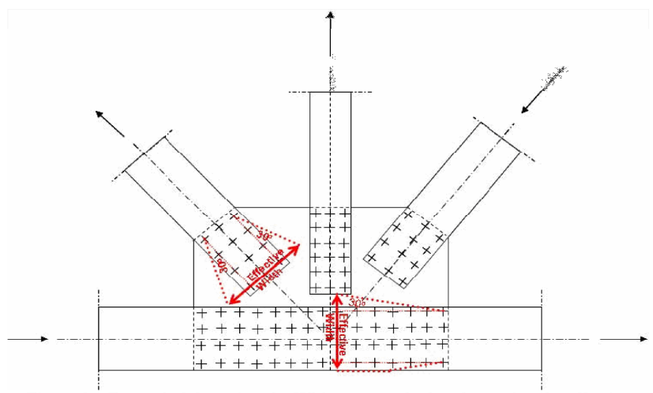


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 2N

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

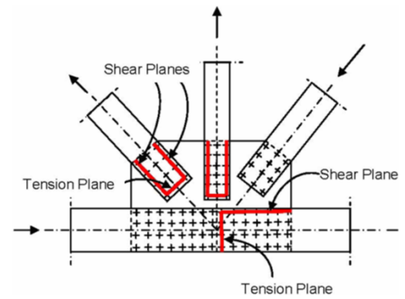


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.08 in	2.02 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

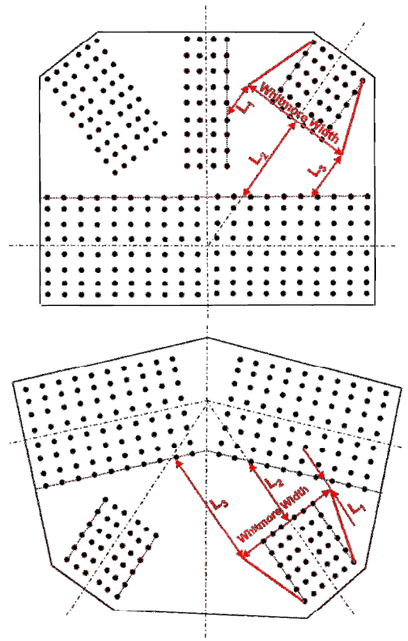


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	20 ea	20 ea			
Longest Length of connection	L=	20.00 in	508 mm			
Edge distance	e =	1.42 in	36 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$			CSA S6 CL14.14.1.4.2
	B_{r1} =	319 kip	1418 kN			
	B_{r2} =	507 kip	2251 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$			CSA S6 CL14.14.1.4.2
		206 kip	917 kN			
Governing Resistance			1833 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span

Node: 2N

Demand/Capacity	D/C =		**0.414**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.					FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored?			Yes		
General					Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	21.81 in	554 mm		3
Shear Length 1	L_{V1} =	13.11 in	333 mm		4.5
Shear Length 2	L_{V2} =	11.38 in	289 mm		4.5
Tension Length	L_T =	14.33 in	364 mm		4
Number of Gusset Plates	m =	2 ea	2 ea		
Diameter of holes in plane	d_b =	0.81 in	21 mm		($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$U*\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
			1547	kN	
Net Section Resistance	P_{RN} =		$U*\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2			2315	kN	

Block Shear

Gross Tension Area	A_{tg} =		2548	mm^2
Gross Shear Area	A_{vg} =		4354	mm^2
Net Tension Area	A_{tn} =		1971	mm^2
Net Shear Area	A_{vn} =		3056	mm^2
$A_{tn} \geq 0.58*A_{vn}$?			Yes	

			$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		2173	kN	FHWA 3.1.3
Tension Resistance (Governing)			1547	kN	
Demand/Capacity	D/C =		**0.000**		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored?			Yes		
General					FHWA 3.3
Whitmore Width	W_w =	21.81 in	554 mm		

Span: Bascule Bridge - Leaf Span

Node: 2N

L1	L_1 =	0.79	in	20	mm	
L2 - along centreline of action	L_2 =	13.54	in	344	mm	
L3	L_3 =	4.88	in	124	mm	
Unsupported Column Length	L_u =	6.40	in	163	mm	
Effective Length Factor	K =	1.20		1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)		for rectangular plate
		0.08	in	2.02	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				1.00		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				877	kN	
Demand/Capacity	D/C =			**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22	ea	22	ea	
Longest Length of connection	L=	18.94	in	481	mm	
Edge distance	e =	1.50	in	38	mm	
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")
Shear Planes per gusset plate	m =	1	ea	1	ea	
Number of Gusset Plates		2.00	ea	2	ea	
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0	CSA S6 CL14.14.1.4.2
	B_{r1} =	371	kip	1647	kN	
	B_{r2} =	557	kip	2477	kN	
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81	CSA S6 CL14.14.1.4.2
		411	kip	1825	kN	
Governing Resistance				3294	kN	for 2 plate(s)
Demand/Capacity	D/C =			**0.000**		

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	19.29	in	490	mm	2	
Shear Length 1	L_{V1} =	18.74	in	476	mm	7.5	
Shear Length 2	L_{V2} =	18.74	in	476	mm	7.5	
Tension Length	L_T =	6.14	in	156	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 2N

Number of Gusset Plates	m =	2.00	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =			$\varphi_s*A_g*F_y$	U=1.0	
				1369	kN	
Net Section Resistance	P_{RN} =			$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2				2111	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =			1092	mm^2	
Gross Shear Area	A_{vg} =			6664	mm^2	
Net Tension Area	A_{tn} =			948	mm^2	
Net Shear Area	A_{vn} =			4501	mm^2	
$A_{tn} > 0.58*A_{vn}$?				No		
				$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =			2121	kN	FHWA 3.1.3
Tension Resistance (Governing)				1369	kN	
Demand/Capacity	D/C =			**0.450**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	19.29	in	490	mm	
L1	L_1 =	4.92	in	125	mm	
L2 - along centreline of action	L_2 =	4.92	in	125	mm	
L3	L_3 =	4.92	in	125	mm	
Unsupported Column Length	L_u =	4.92	in	125	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			$t/\sqrt{(12)}$	for rectangular plate	
		0.08	in	2.02	mm	
	λ =			$(K*L_u/r)*\mathrm{sqrt}[F_y/(\pi^2*E_s)]$		
				0.77		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				963	kN	

Span: Bascule Bridge - Leaf Span
Node: 2N

Demand/Capacity	D/C =			**0.000**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea		
Longest Length of connection	L=	18.74	in	476	mm		
Edge distance	e =	2.20	in	56	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	397	kip	1765	kN		
	B_{r2} =	405	kip	1801	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		299	kip	1327	kN		
Governing Resistance				2655	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.232**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	24.41	in	620	mm	5	
Shear Length 1	L_{V1} =	10.87	in	276	mm	3.5	
Shear Length 2	L_{V2} =	14.25	in	362	mm	4.5	
Tension Length	L_T =	15.55	in	395	mm	5	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		1732	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		2432	kN		

Block Shear

Gross Tension Area	A_{tg} =	2765	mm^2

Span: Bascule Bridge - Leaf Span

Node: 2N

Gross Shear Area	A_{vg} =	4466	mm^2	
Net Tension Area	A_{tn} =	2044	mm^2	
Net Shear Area	A_{vn} =	3312	mm^2	
$A_{tn} > 0.58*A_{vn}$?		Yes		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =	2244	kN	FHWA 3.1.3
Tension Resistance (Governing)		1732	kN	
Demand/Capacity	D/C =	**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?				Yes		
General						FHWA 3.3
Whitmore Width	W_w =	24.41	in	620	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	13.15	in	334	mm	
L3	L_3 =	4.21	in	107	mm	
Unsupported Column Length	L_u =	5.79	in	147	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.08	in	2.02	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.90		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				1078	kN	
Demand/Capacity	D/C =			**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	25	ea	25	ea		
Longest Length of connection	L=	19.37	in	492	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	421	kip	1871	kN		
	B_{r2} =	633	kip	2814	kN		

Span: Bascule Bridge - Leaf Span
Node: 2N

Shear Resistance of Rivets V_r = $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 CSA S6 CL14.14.1.4.2

467 kip 2074 kN

Governing Resistance 3743 kN for 2 plate(s)

Demand/Capacity D/C = **0.000**

For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	160	709
Shear Resistance (Net Section)	203	904
Shear Resistance (Governing)	160	709
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	461	2049
Shear Resistance (Net Section)	582	2588
Shear Resistance (Governing)	461	2049
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	348	1547
Net Section Resistance	521	2315
Block Shear Resistance	489	2173
Tension Resistance (Governing)	348	1547
At Member C:		
Gross Section Resistance	308	1369
Net Section Resistance	475	2111
Block Shear Resistance	477	2121
Tension Resistance (Governing)	308	1369
At Member D:		
Gross Section Resistance	390	1732
Net Section Resistance	547	2432
Block Shear Resistance	505	2244
Tension Resistance (Governing)	390	1732
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 2N

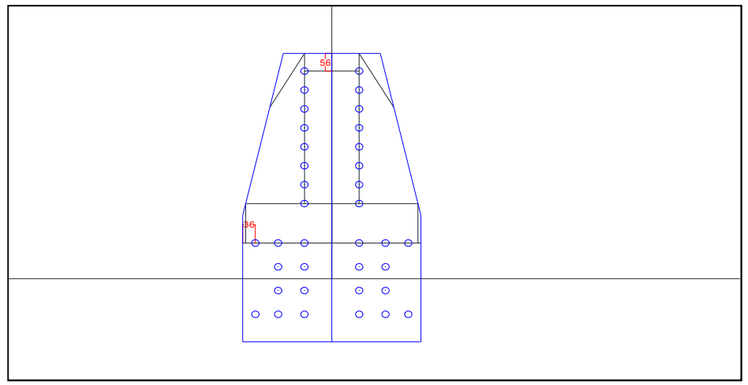
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	197	877
Compressive Resistance at Member C	217	963
Compressive Resistance at Member D	243	1078
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	412	1833
Governing Resistance at Member B	741	3294
Governing Resistance at Member C	597	2655
Governing Resistance at Member D	842	3743
Governing Resistance at Member E	412	1833

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
SHEAR PLANE A'-A'		160	709	**0.000**	
SHEAR PLANE B'-B'		461	2049	**0.000**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	348	1547	**0.000**	
	Member C	308	1369	**0.450**	<--- Governing
	Member D	390	1732	**0.000**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	197	877	**0.000**	
	Member C	217	963	**0.000**	
	Member D	243	1078	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	412	1833	**0.414**	
	Member B	741	3294	**0.000**	
	Member C	597	2655	**0.232**	
	Member D	842	3743	**0.000**	
	Member E	412	1833	**0.414**	
	Highest Demand/Capacity Ratio			**0.450**	

Span: Bascule Bridge - Leaf Span
Node: 2S

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.28 in	7 mm	45% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units		
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa		

MEMBER FORCES

Load Combination: D1, D2, CL1-625 Max

2S-A	P_{Max} =	181.5 kip	806 kN	
2S-A	P_{Min} =	1.1 kip	5 kN	
2S-B	P_{Max} =	0.0 kip	0 kN	
2S-B	P_{Min} =	0.0 kip	0 kN	
2S-C	P_{Max} =	142.8 kip	635 kN	
2S-C	P_{Min} =	18.4 kip	82 kN	
2S-D	P_{Max} =	0.0 kip	0 kN	
2S-D	P_{Min} =	0.0 kip	0 kN	
2S-E	P_{Max} =	177.4 kip	789 kN	
2S-E	P_{Min} =	1.2 kip	5 kN	

Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
2S-A	559	806	806	806	806
2S-A	559	5	5	5	5
2S-B	0	#N/A	#N/A	#N/A	#N/A
2S-B	0	#N/A	#N/A	#N/A	#N/A
2S-C	569	630	632	635	635
2S-C	569	82	84	87	82
2S-D	0	#N/A	#N/A	#N/A	#N/A
2S-D	0	#N/A	#N/A	#N/A	#N/A
2S-E	560	789	789	789	789
2S-E	560	5	5	5	5

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 2S

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		128	deg	B
	φ_C =		90	deg	C
	φ_D =		54	deg	D
	$\cos(\varphi_B)$ =		-0.616		
	$\cos(\varphi_C)$ =		0.000		
	$\cos(\varphi_D)$ =		0.588		
	$V_{A'-A',max}$ =	0.0 kip	0	kN	*
	$V_{A'-A',min}$ =	0.0 kip	0	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	0.0 kip	0	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	0.0 kip	0	kN	

*using absolute maximum sums, conservative

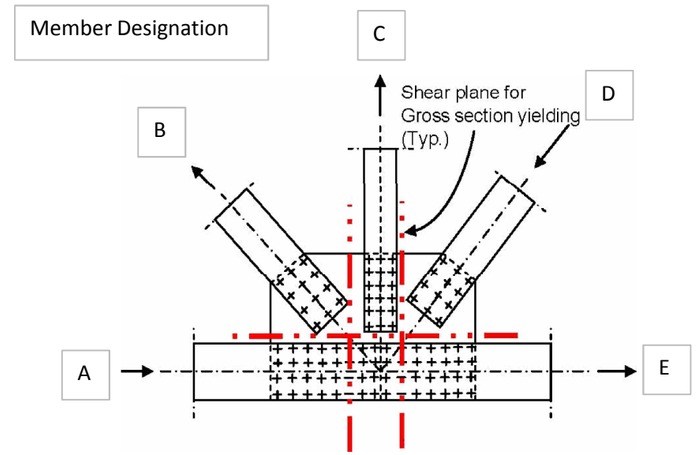


Figure 4 – Examples of gross section shear yielding planes

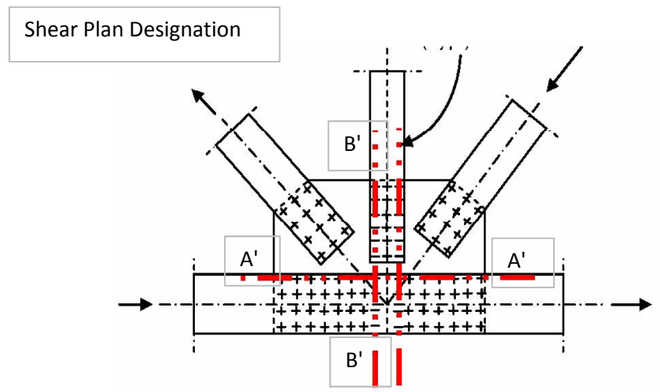


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	20.00	in	508	mm	
No of holes in shear plane	N =	6.00	ea	6	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			7112	mm^2	
Net Shear Area	A_n =			5382	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			709	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =			904	kN	
Shear Resistance (Governing)	V_R =			**709**	**kN**	
Demand/Capacity	D/C =			**0.000**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	35.98	in	914	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 2S

Members A and E continuous through the gusset plate?				Yes		
Outside height of member A	H_A=	15	in	381	mm	
Thickness of the web of member A	w_A=	0.40	in	10	mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4	ea	
Gross Shear Area	A_g =			20538	mm^2	
Net Shear Area	A_n =			15403	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2049	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =			2588	kN	
Shear Resistance (Governing)	V_R =			**2049**	**kN**	
Demand/Capacity	D/C =			**0.000**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E

N/A

Members A and E continuous through the gusset plate? Yes

General

Whitmore Width	W_w =	0.00	in	0	mm	
Shear Length 1	L_{V1} =	0.00	in	0	mm	
Shear Length 2	L_{V2} =	0.00	in	0	mm	
Tension Length	L_T =	0.00	in	0	mm	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Number of Rivet/bolt diameters Intsecting Plane

0	
0	
0	
0	Typ, 1 less than Whitemore Width

Axile Tensile Resistance

CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	
		0	kN
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	
For gusset plates, U=1.0, FHWA 3.1.2		0	kN

FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =	0 mm^2
Gross Shear Area	A_{vg} =	0 mm^2
Net Tension Area	A_{tn} =	0 mm^2
Net Shear Area	A_{vn} =	0 mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes

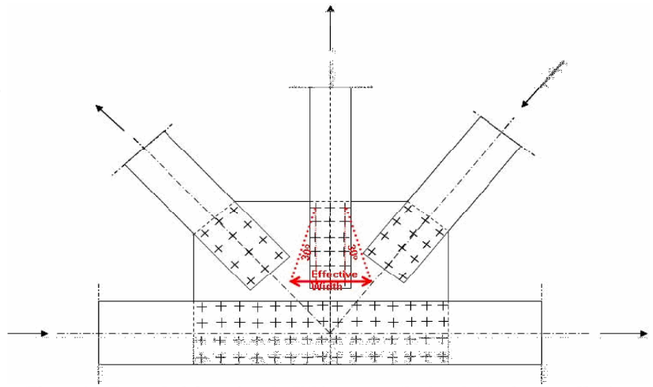


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

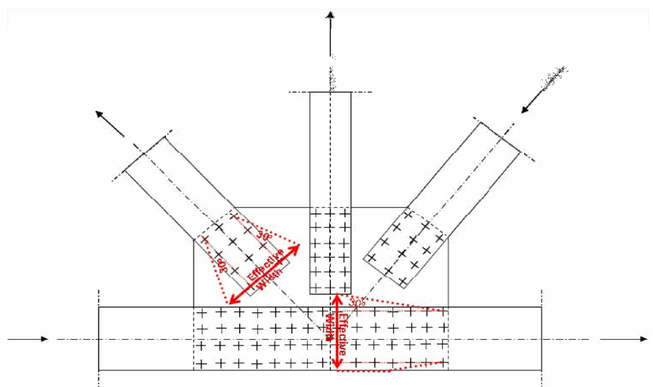


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 2S

				$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =			0 kN		FHWA 3.1.3
Tension Resistance (Governing)				0 kN		
Demand/Capacity	D/C =			**0.000**		

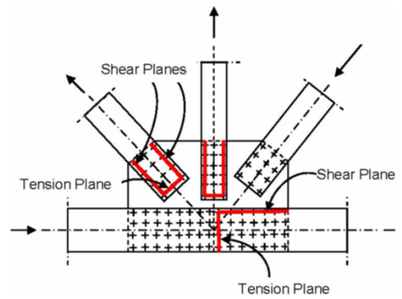


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00	in	0	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	0.00	in	0	mm	
L3	L_3 =	0.00	in	0	mm	
Unsupported Column Length	L_u =	0.00	in	0	mm	
Effective Length Factor	K =	0.00		0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			$t/\sqrt{(12)}$	for rectangular plate	
		0.08	in	2.02	mm	
	λ =			$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
				0.00		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
				0 kN		
Demand/Capacity	D/C =			**0.000**		

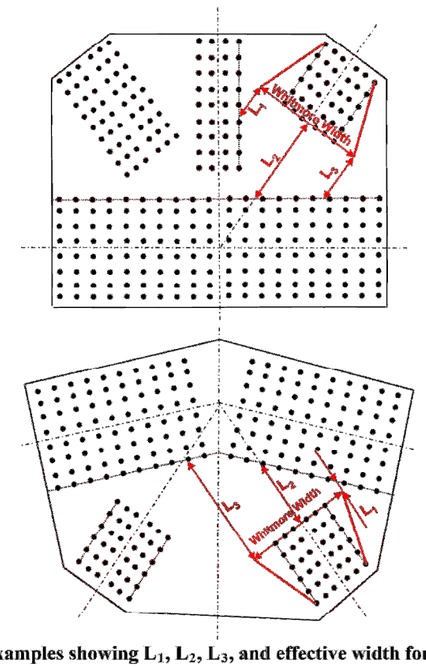


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	20	ea	20	ea		
Longest Length of connection	L=	20.00	in	508	mm		
Edge distance	e =	1.42	in	36	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$			CSA S6 CL14.14.1.4.2
	B_{r1} =	319	kip	1418	kN		
	B_{r2} =	507	kip	2251	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$			CSA S6 CL14.14.1.4.2
		206	kip	917	kN		
Governing Resistance				1833	kN	for 2 plate(s)	

Span: Bascule Bridge - Leaf Span
Node: 2S

Demand/Capacity	D/C =	**0.440**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? Yes

General

					Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	21.81 in	554	mm	3
Shear Length 1	L_{V1} =	13.11 in	333	mm	4.5
Shear Length 2	L_{V2} =	11.38 in	289	mm	4.5
Tension Length	L_T =	14.33 in	364	mm	4
Number of Gusset Plates	m =	2 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$	1547	kN	U=1.0 FHWA 3.1.2
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$	2315	kN	U=1.0 FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2					

Block Shear

Gross Tension Area	A_{tg} =	2548	mm^2
Gross Shear Area	A_{vg} =	4354	mm^2
Net Tension Area	A_{tn} =	1971	mm^2
Net Shear Area	A_{vn} =	3056	mm^2
$A_{tn} \geq 0.58*A_{vn}$?		Yes	

		$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$			U=1.0
Block Shear Resistance	P_{Rbs} =		2173	kN	FHWA 3.1.3
Tension Resistance (Governing)			1547	kN	
Demand/Capacity	D/C =		**0.000**		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? Yes

General — FHWA 3.3

Whitmore Width	W_w =	21.81 in	554	mm

Span: Bascule Bridge - Leaf Span
Node: 2S

L1	L_1 =	0.79	in	20	mm	
L2 - along centreline of action	L_2 =	13.54	in	344	mm	
L3	L_3 =	4.88	in	124	mm	
Unsupported Column Length	L_u =	6.40	in	163	mm	
Effective Length Factor	K =	1.20		1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)		for rectangular plate
		0.08	in	2.02	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				1.00		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				877	kN	
Demand/Capacity	D/C =			**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22	ea	22	ea	
Longest Length of connection	L=	18.94	in	481	mm	
Edge distance	e =	1.50	in	38	mm	
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")
Shear Planes per gusset plate	m =	1	ea	1	ea	
Number of Gusset Plates		2.00	ea	2	ea	
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0	CSA S6 CL14.14.1.4.2
	B_{r1} =	371	kip	1647	kN	
	B_{r2} =	557	kip	2477	kN	
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81	CSA S6 CL14.14.1.4.2
		411	kip	1825	kN	
Governing Resistance				3294	kN	for 2 plate(s)
Demand/Capacity	D/C =			**0.000**		

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	19.29	in	490	mm	2	
Shear Length 1	L_{V1} =	18.74	in	476	mm	7.5	
Shear Length 2	L_{V2} =	18.74	in	476	mm	7.5	
Tension Length	L_T =	6.14	in	156	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 2S

Number of Gusset Plates	m =	2.00 ea	2 ea		
Diameter of holes in plane	d_b =	0.81 in	21 mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			1369	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			2111	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		1092	mm^2	
Gross Shear Area	A_{vg} =		6664	mm^2	
Net Tension Area	A_{tn} =		948	mm^2	
Net Shear Area	A_{vn} =		4501	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		2121	kN	FHWA 3.1.3
Tension Resistance (Governing)			1369	kN	
Demand/Capacity	D/C =		**0.464**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored?			N/A		
General					FHWA 3.3
Whitmore Width	W_w =	19.29 in	490	mm	
L1	L_1 =	4.92 in	125	mm	
L2 - along centreline of action	L_2 =	4.92 in	125	mm	
L3	L_3 =	4.92 in	125	mm	
Unsupported Column Length	L_u =	4.92 in	125	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.08 in	2.02	mm	
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.77		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			963	kN	

Span: Bascule Bridge - Leaf Span
Node: 2S

Demand/Capacity	D/C =			**0.000**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea		
Longest Length of connection	L=	18.74	in	476	mm		
Edge distance	e =	2.20	in	56	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	397	kip	1765	kN		
	B_{r2} =	405	kip	1801	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		299	kip	1327	kN		
Governing Resistance				2655	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.239**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	24.41	in	620	mm	5	
Shear Length 1	L_{V1} =	10.87	in	276	mm	3.5	
Shear Length 2	L_{V2} =	14.25	in	362	mm	4.5	
Tension Length	L_T =	15.55	in	395	mm	5	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
		1732	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		2432	kN	

Block Shear

Gross Tension Area	A_{tg} =	2765	mm^2

Span: Bascule Bridge - Leaf Span

Node: 2S

Gross Shear Area	A_{vg} =		4466	mm^2	
Net Tension Area	A_{tn} =		2044	mm^2	
Net Shear Area	A_{vn} =		3312	mm^2	
$A_{tn} > 0.58*A_{vn}$?			Yes		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0		
Block Shear Resistance	P_{Rbs} =		2244	kN	FHWA 3.1.3
Tension Resistance (Governing)			1732	kN	
Demand/Capacity	D/C =		**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?			Yes		
General					FHWA 3.3
Whitmore Width	W_w =	24.41 in	620	mm	
L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	13.15 in	334	mm	
L3	L_3 =	4.21 in	107	mm	
Unsupported Column Length	L_u =	5.79 in	147	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.08 in	2.02	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.90		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			1078	kN	
Demand/Capacity	D/C =		**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	25 ea	25	ea		
Longest Length of connection	L=	19.37 in	492	mm		
Edge distance	e =	1.50 in	38	mm		
Diameter of Rivet	d =	0.75 in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1	ea		
Number of Gusset Plates		2.00 ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	421 kip	1871	kN		
	B_{r2} =	633 kip	2814	kN		

Span: Bascule Bridge - Leaf Span
Node: 2S

Shear Resistance of Rivets V_r = $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 CSA S6 CL14.14.1.4.2

467 kip 2074 kN

Governing Resistance 3743 kN for 2 plate(s)

Demand/Capacity D/C = **0.000**

For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	160	709
Shear Resistance (Net Section)	203	904
Shear Resistance (Governing)	160	709
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	461	2049
Shear Resistance (Net Section)	582	2588
Shear Resistance (Governing)	461	2049
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	348	1547
Net Section Resistance	521	2315
Block Shear Resistance	489	2173
Tension Resistance (Governing)	348	1547
At Member C:		
Gross Section Resistance	308	1369
Net Section Resistance	475	2111
Block Shear Resistance	477	2121
Tension Resistance (Governing)	308	1369
At Member D:		
Gross Section Resistance	390	1732
Net Section Resistance	547	2432
Block Shear Resistance	505	2244
Tension Resistance (Governing)	390	1732
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 2S

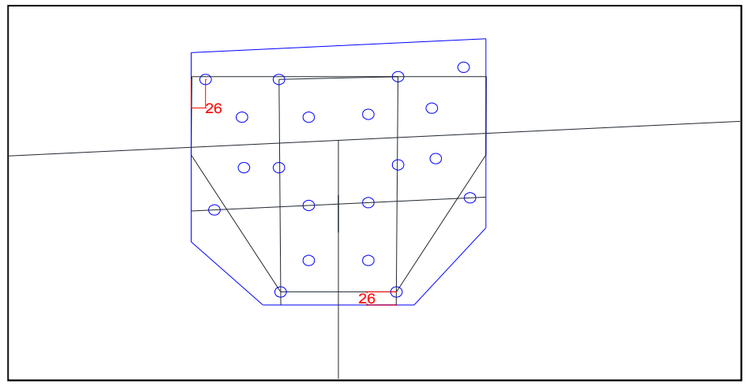
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	197	877
Compressive Resistance at Member C	217	963
Compressive Resistance at Member D	243	1078
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	412	1833
Governing Resistance at Member B	741	3294
Governing Resistance at Member C	597	2655
Governing Resistance at Member D	842	3743
Governing Resistance at Member E	412	1833

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
	SHEAR PLANE A'-A'	160	709	**0.000**	
	SHEAR PLANE B'-B'	461	2049	**0.000**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	348	1547	**0.000**	
	Member C	308	1369	**0.464**	<--- Governing
	Member D	390	1732	**0.000**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	197	877	**0.000**	
	Member C	217	963	**0.000**	
	Member D	243	1078	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	412	1833	**0.440**	
	Member B	741	3294	**0.000**	
	Member C	597	2655	**0.239**	
	Member D	842	3743	**0.000**	
	Member E	412	1833	**0.440**	
	Highest Demand/Capacity Ratio			**0.464**	

Span: Bascule Bridge - Leaf Span
Node: 3N

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units		S.I. Units		
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50	in	12.7	mm	
Limiting Thickness of Gusset Plate	t =	0.47	in	12	mm	6% Corrosion
Structural Steel - Tension	φ_s =			0.95		
	φ_u =			0.8		
Structural Steel - Compression	φ_s =			0.9		
Resistance Factor for Riveted Connections	φ_{mc} =			0.67		CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =			0.67		CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units		S.I. Units			
Yield Strength of Steel:	F_y =	30	ksi	210	MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61	ksi	420	MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46	ksi	320	MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000	ksi	200000	MPa		

MEMBER FORCES

Load Combination:		D1, D2, CL1-625 Max			
3N-A	P_{Max} =	50.5	kip	225	kN
3N-A	P_{Min} =	-271.9	kip	-1208	kN
3N-B	P_{Max} =	0.0	kip	0	kN
3N-B	P_{Min} =	0.0	kip	0	kN
3N-C	P_{Max} =	-1.7	kip	-7	kN
3N-C	P_{Min} =	-4.5	kip	-20	kN
3N-D	P_{Max} =	0.0	kip	0	kN
3N-D	P_{Min} =	0.0	kip	0	kN
3N-E	P_{Max} =	49.9	kip	222	kN
3N-E	P_{Min} =	-264.6	kip	-1176	kN

Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
3N-A	423	225	224	224	225
3N-A	423	-1208	-1208	-1208	-1208
3N-B	0	#N/A	#N/A	#N/A	#N/A
3N-B	0	#N/A	#N/A	#N/A	#N/A
3N-C	243	-12	-9	-7	-7
3N-C	243	-20	-18	-16	-20
3N-D	0	#N/A	#N/A	#N/A	#N/A
3N-D	0	#N/A	#N/A	#N/A	#N/A
3N-E	422	222	222	221	222
3N-E	422	-1176	-1176	-1176	-1176

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 3N

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		0	deg	B
	φ_C =		93	deg	C
	φ_D =		0	deg	D
	$\cos(\varphi_B)$ =		1.000		
	$\cos(\varphi_C)$ =		-0.052		
	$\cos(\varphi_D)$ =		1.000		
	$V_{A'-A',max}$ =	0.2 kip	1	kN	*
	$V_{A'-A',min}$ =	0.1 kip	0	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	0.2 kip	1	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	0.0 kip	0	kN	

*using absolute maximum sums, conservative

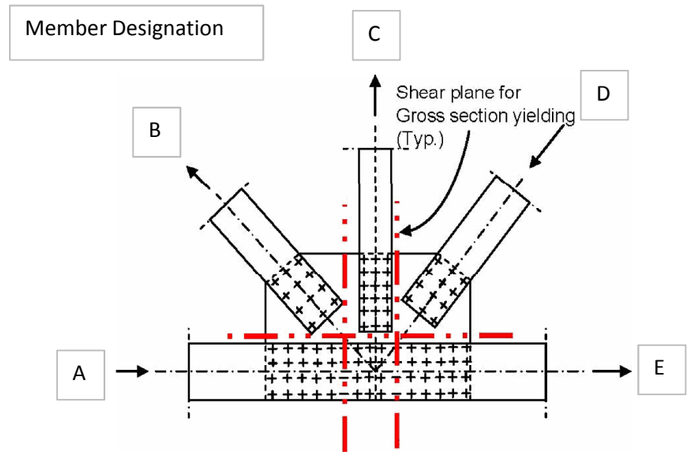


Figure 4 – Examples of gross section shear yielding planes

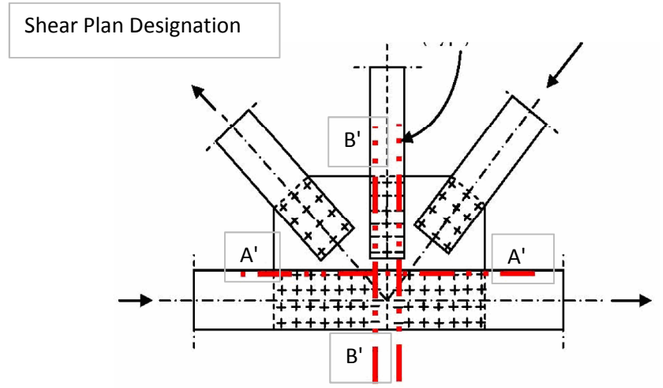


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	21.06	in	535	mm	
No of holes in shear plane	N =	4.00	ea	4	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			12840	mm^2	
Net Shear Area	A_n =			10862	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			1281	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =			1825	kN	
Shear Resistance (Governing)	V_R =			**1281**	**kN**	
Demand/Capacity	D/C =			**0.001**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	20.35	in	517	mm	
No of holes in shear plane	N =	6.00	ea	6	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 3N

Members A and E continuous through the gusset plate?				Yes		
Outside height of member A	H_A=	15	in	381	mm	
Thickness of the web of member A	w_A=	0.40	in	10	mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4	ea	
Gross Shear Area	A_g =			20150	mm^2	
Net Shear Area	A_n =			15509	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2010	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =			2606	kN	
Shear Resistance (Governing)	V_R =			**2010**	**kN**	
Demand/Capacity	D/C =			**0.000**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E — N/A

Members A and E continuous through the gusset plate? Yes

General

Whitmore Width	W_w =	0.00	in	0	mm	Number of Rivet/bolt diameters Intsecting Plane
Shear Length 1	L_{V1} =	0.00	in	0	mm	0
Shear Length 2	L_{V2} =	0.00	in	0	mm	0
Tension Length	L_T =	0.00	in	0	mm	0
Number of Gusset Plates	m =	2.00	ea	2	ea	0 Typ, 1 less than Whitemore Width
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance

CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$		
		0	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		0	kN	

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

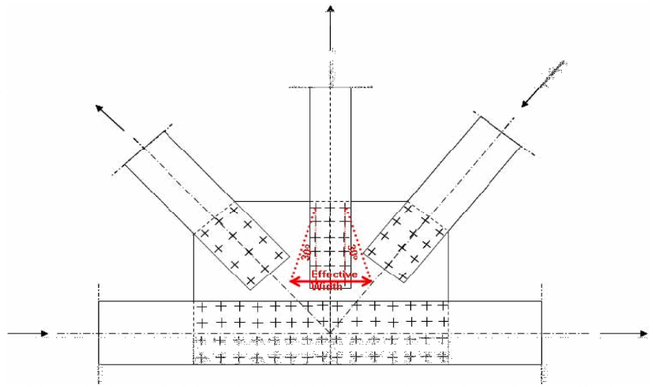


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

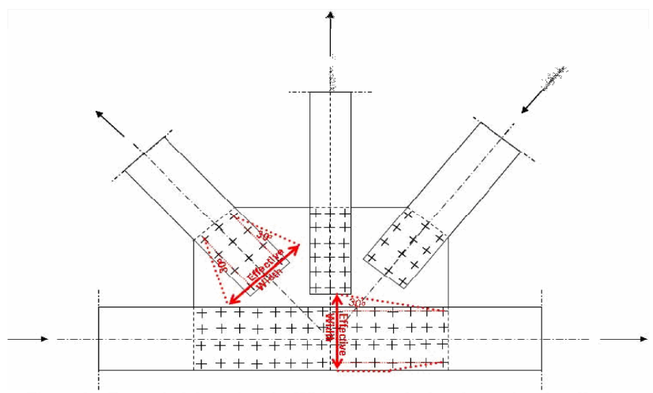


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 3N

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

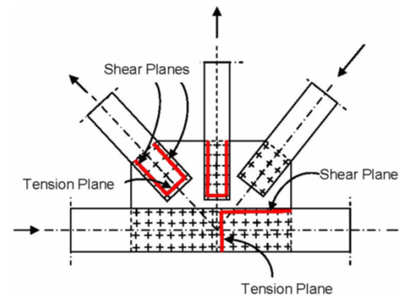


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46 mm		
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

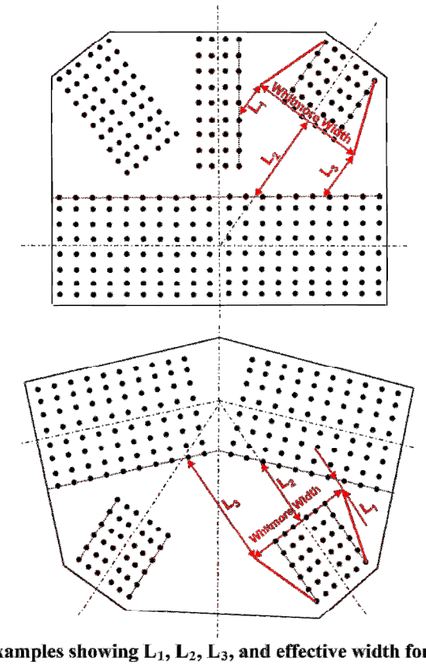


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Possible Scenario?			No		
Number of Rivets/Bolts	n =	16 ea	16 ea		
Longest Length of connection	L=	21.02 in	534 mm		
Edge distance	e =	1.02 in	26 mm		
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1 ea		
Number of Gusset Plates		2 ea	2 ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$		CSA S6 CL14.14.1.4.2
	B_{r1} =	316 kip	1405 kN		
	B_{r2} =	695 kip	3088 kN		
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$		CSA S6 CL14.14.1.4.2
		165 kip	733 kN		
Governing Resistance			1467 kN	for 2 plate(s)	

Span: Bascule Bridge - Leaf Span

Node: 3N

Demand/Capacity	D/C =		**0.000**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.					FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored?			Yes		
General					Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	21.81 in	554 mm		3
Shear Length 1	L_{V1} =	13.11 in	333 mm		4.5
Shear Length 2	L_{V2} =	11.38 in	289 mm		4.5
Tension Length	L_T =	14.33 in	364 mm		4
Number of Gusset Plates	m =	2 ea	2 ea		
Diameter of holes in plane	d_b =	0.81 in	21 mm		($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$U*\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
			2653	kN	
Net Section Resistance	P_{RN} =		$U*\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2			3969	kN	

Block Shear

Gross Tension Area	A_{tg} =	4368	mm^2	
Gross Shear Area	A_{vg} =	7464	mm^2	
Net Tension Area	A_{tn} =	3379	mm^2	
Net Shear Area	A_{vn} =	5239	mm^2	
$A_{tn} \geq 0.58*A_{vn}$?		Yes		

	$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$			U=1.0
Block Shear Resistance	P_{Rbs} =	3725	kN	FHWA 3.1.3
Tension Resistance (Governing)		2653	kN	
Demand/Capacity	D/C =	**0.000**		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored?			Yes		
General					FHWA 3.3
Whitmore Width	W_w =	21.81 in	554 mm		

Span: Bascule Bridge - Leaf Span

Node: 3N

L1	L_1 =	0.79	in	20	mm	
L2 - along centreline of action	L_2 =	13.54	in	344	mm	
L3	L_3 =	4.88	in	124	mm	
Unsupported Column Length	L_u =	6.40	in	163	mm	
Effective Length Factor	K =	1.20		1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)		for rectangular plate
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.58		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2149	kN	
Demand/Capacity	D/C =			**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22	ea	22	ea	
Longest Length of connection	L=	18.94	in	481	mm	
Edge distance	e =	1.50	in	38	mm	
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")
Shear Planes per gusset plate	m =	1	ea	1	ea	
Number of Gusset Plates		2.00	ea	2	ea	
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0	CSA S6 CL14.14.1.4.2
	B_{r1} =	635	kip	2823	kN	
	B_{r2} =	955	kip	4246	kN	
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81	CSA S6 CL14.14.1.4.2
		411	kip	1825	kN	
Governing Resistance				3650	kN	for 2 plate(s)
Demand/Capacity	D/C =			**0.000**		

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	21.02	in	534	mm	2	
Shear Length 1	L_{V1} =	18.11	in	460	mm	5.5	
Shear Length 2	L_{V2} =	18.11	in	460	mm	5.5	
Tension Length	L_T =	8.27	in	210	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 3N

Number of Gusset Plates	m =	2.00 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			2557	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			3974	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		2520	mm^2	
Gross Shear Area	A_{vg} =		11040	mm^2	
Net Tension Area	A_{tn} =		2273	mm^2	
Net Shear Area	A_{vn} =		8321	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		4090	kN	FHWA 3.1.3
Tension Resistance (Governing)			2557	kN	
Demand/Capacity	D/C =		**0.000**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored?			N/A		
General					FHWA 3.3
Whitmore Width	W_w =	21.02 in	534	mm	
L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	0.00 in	0	mm	
L3	L_3 =	0.00 in	0	mm	
Unsupported Column Length	L_u =	0.00 in	0	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			2422	kN	

Span: Bascule Bridge - Leaf Span
Node: 3N

Demand/Capacity	D/C =			**0.008**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	12	ea	12	ea		
Longest Length of connection	L=	18.11	in	460	mm		
Edge distance	e =	1.02	in	26	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	237	kip	1054	kN		
	B_{r2} =	521	kip	2316	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		224	kip	995	kN		
Governing Resistance				1991	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.010**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	24.41	in	620	mm	5	
Shear Length 1	L_{V1} =	10.87	in	276	mm	3.5	
Shear Length 2	L_{V2} =	14.25	in	362	mm	4.5	
Tension Length	L_T =	15.55	in	395	mm	5	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		2969	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		4169	kN		

Block Shear

Gross Tension Area	A_{tg} =	4740	mm^2

Span: Bascule Bridge - Leaf Span

Node: 3N

Gross Shear Area	A_{vg} =		7656	mm^2	
Net Tension Area	A_{tn} =		3504	mm^2	
Net Shear Area	A_{vn} =		5678	mm^2	
$A_{tn} > 0.58*A_{vn}$?			Yes		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0		
Block Shear Resistance	P_{Rbs} =		3847	kN	FHWA 3.1.3
Tension Resistance (Governing)			2969	kN	
Demand/Capacity	D/C =		**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?			Yes		
General					FHWA 3.3
Whitmore Width	W_w =	24.41 in	620	mm	
L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	13.15 in	334	mm	
L3	L_3 =	4.21 in	107	mm	
Unsupported Column Length	L_u =	5.79 in	147	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.53		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			2489	kN	
Demand/Capacity	D/C =		**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	25 ea	25	ea		
Longest Length of connection	L=	19.37 in	492	mm		
Edge distance	e =	1.50 in	38	mm		
Diameter of Rivet	d =	0.75 in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1	ea		
Number of Gusset Plates		2.00 ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	722 kip	3208	kN		
	B_{r2} =	1086 kip	4825	kN		

Span: Bascule Bridge - Leaf Span
Node: 3N

Shear Resistance of Rivets V_r = 467 kip $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 2074 kN CSA S6 CL14.14.1.4.2

Governing Resistance 4148 kN for 2 plate(s)
Demand/Capacity D/C = **0.000**
For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	288	1281
Shear Resistance (Net Section)	411	1825
Shear Resistance (Governing)	288	1281
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	452	2010
Shear Resistance (Net Section)	586	2606
Shear Resistance (Governing)	452	2010
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	597	2653
Net Section Resistance	893	3969
Block Shear Resistance	838	3725
Tension Resistance (Governing)	597	2653
At Member C:		
Gross Section Resistance	575	2557
Net Section Resistance	894	3974
Block Shear Resistance	920	4090
Tension Resistance (Governing)	575	2557
At Member D:		
Gross Section Resistance	668	2969
Net Section Resistance	938	4169
Block Shear Resistance	866	3847
Tension Resistance (Governing)	668	2969
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 3N

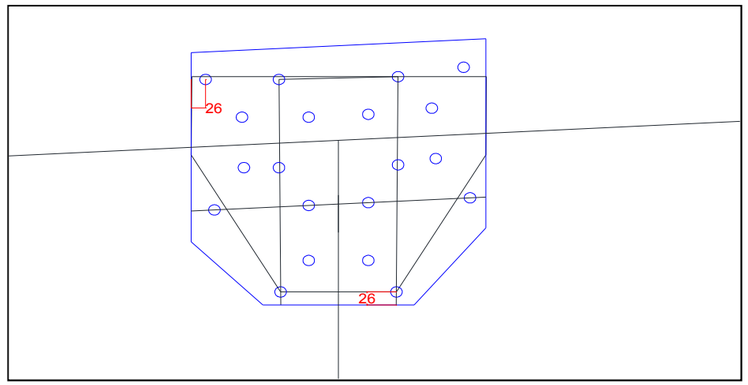
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	483	2149
Compressive Resistance at Member C	545	2422
Compressive Resistance at Member D	560	2489
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	330	1467
Governing Resistance at Member B	821	3650
Governing Resistance at Member C	448	1991
Governing Resistance at Member D	933	4148
Governing Resistance at Member E	330	1467

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
	SHEAR PLANE A'-A'	288	1281	**0.001**	
	SHEAR PLANE B'-B'	452	2010	**0.000**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	597	2653	**0.000**	
	Member C	575	2557	**0.000**	
	Member D	668	2969	**0.000**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	483	2149	**0.000**	
	Member C	545	2422	**0.008**	
	Member D	560	2489	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	330	1467	**0.000**	
	Member B	821	3650	**0.000**	
	Member C	448	1991	**0.010**	<--- Governing
	Member D	933	4148	**0.000**	
	Member E	330	1467	**0.000**	
	Highest Demand/Capacity Ratio			**0.010**	

Span: Bascule Bridge - Leaf Span
Node: 3S

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units		S.I. Units		
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50	in	12.7	mm	
Limiting Thickness of Gusset Plate	t =	0.47	in	12	mm	6% Corrosion
Structural Steel - Tension	φ_s =			0.95		
	φ_u =			0.8		
Structural Steel - Compression	φ_s =			0.9		
Resistance Factor for Riveted Connections	φ_{mc} =			0.67		CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =			0.67		CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units		S.I. Units			
Yield Strength of Steel:	F_y =	30	ksi	210	MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61	ksi	420	MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46	ksi	320	MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000	ksi	200000	MPa		

MEMBER FORCES

Load Combination: D1, D2, CL1-625 Max

						Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
3S-A	P_{Max} =	34.7	kip	154	kN	3S-A	492	154	154	154	154
3S-A	P_{Min} =	-287.7	kip	-1279	kN	3S-A	492	-1278	-1278	-1279	-1279
3S-B	P_{Max} =	0.0	kip	0	kN	3S-B	0	#N/A	#N/A	#N/A	#N/A
3S-B	P_{Min} =	0.0	kip	0	kN	3S-B	0	#N/A	#N/A	#N/A	#N/A
3S-C	P_{Max} =	-1.6	kip	-7	kN	3S-C	572	-11	-9	-7	-7
3S-C	P_{Min} =	-4.4	kip	-20	kN	3S-C	572	-20	-18	-16	-20
3S-D	P_{Max} =	0.0	kip	0	kN	3S-D	0	#N/A	#N/A	#N/A	#N/A
3S-D	P_{Min} =	0.0	kip	0	kN	3S-D	0	#N/A	#N/A	#N/A	#N/A
3S-E	P_{Max} =	34.1	kip	151	kN	3S-E	491	151	151	151	151
3S-E	P_{Min} =	-280.4	kip	-1246	kN	3S-E	491	-1246	-1246	-1246	-1246

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 3S

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		0	deg	B
	φ_C =		93	deg	C
	φ_D =		0	deg	D
	$\cos(\varphi_B)$ =		1.000		
	$\cos(\varphi_C)$ =		-0.052		
	$\cos(\varphi_D)$ =		1.000		
	$V_{A'\text{-}A',max}$ =	0.2 kip	1	kN	*
	$V_{A'\text{-}A',min}$ =	0.1 kip	0	kN	*
Shear Force at A'-A' (Governing)	$V_{A'\text{-}A'}$ =	0.2 kip	1	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'\text{-}B'}$ =	0.0 kip	0	kN	

*using absolute maximum sums, conservative

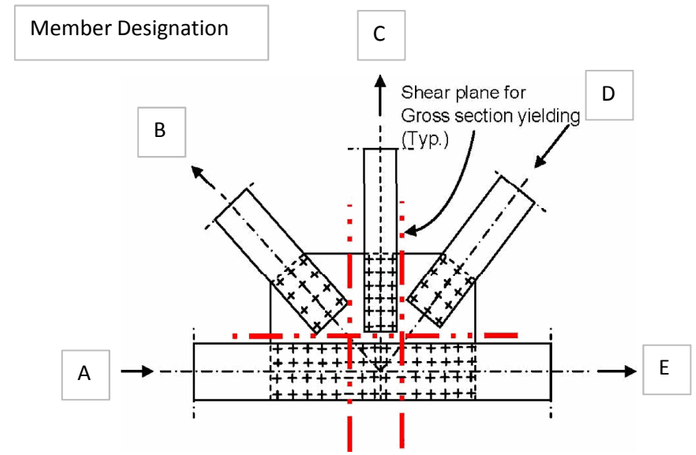


Figure 4 – Examples of gross section shear yielding planes

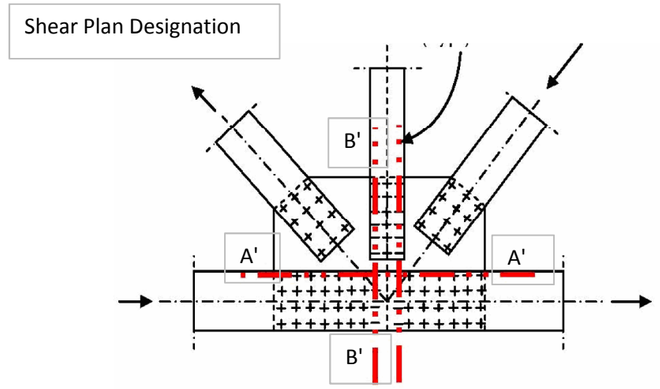


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	21.06	in	535	mm	
No of holes in shear plane	N =	4.00	ea	4	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			12840	mm^2	
Net Shear Area	A_n =			10862	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			1281	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =			1825	kN	
Shear Resistance (Governing)	V_R =			**1281**	**kN**	
Demand/Capacity	D/C =			**0.001**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	20.35	in	517	mm	
No of holes in shear plane	N =	6.00	ea	6	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 3S

Members A and E continuous through the gusset plate?				Yes		
Outside height of member A	H_A=	15	in	381	mm	
Thickness of the web of member A	w_A=	0.40	in	10	mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4	ea	
Gross Shear Area	A_g =			20150	mm^2	
Net Shear Area	A_n =			15509	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2010	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =			2606	kN	
Shear Resistance (Governing)	V_R =			**2010**	**kN**	
Demand/Capacity	D/C =			**0.000**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E — N/A

Members A and E continuous through the gusset plate? Yes

General

Whitmore Width	W_w =	0.00	in	0	mm	Number of Rivet/bolt diameters Intsecting Plane
Shear Length 1	L_{V1} =	0.00	in	0	mm	0
Shear Length 2	L_{V2} =	0.00	in	0	mm	0
Tension Length	L_T =	0.00	in	0	mm	0
Number of Gusset Plates	m =	2.00	ea	2	ea	0 Typ, 1 less than Whitemore Width
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance

CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$		
		0	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		0	kN	

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

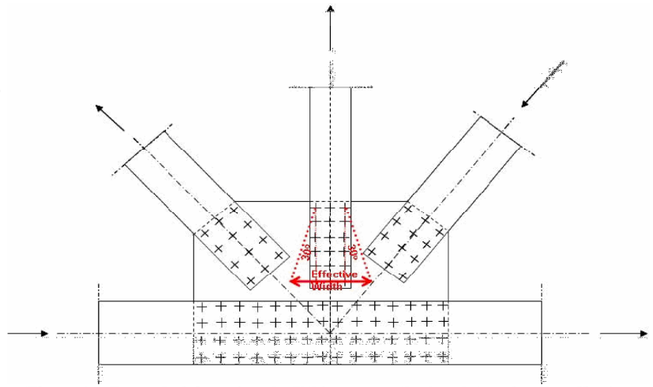


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

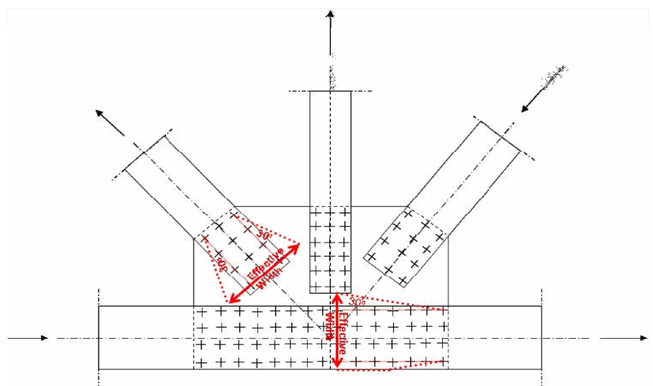


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 3S

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

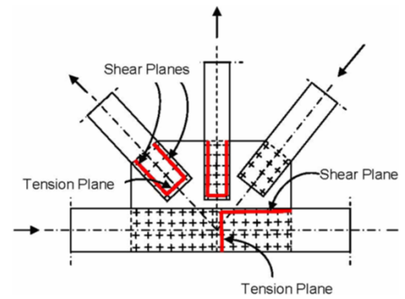


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.14 in	3.46 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

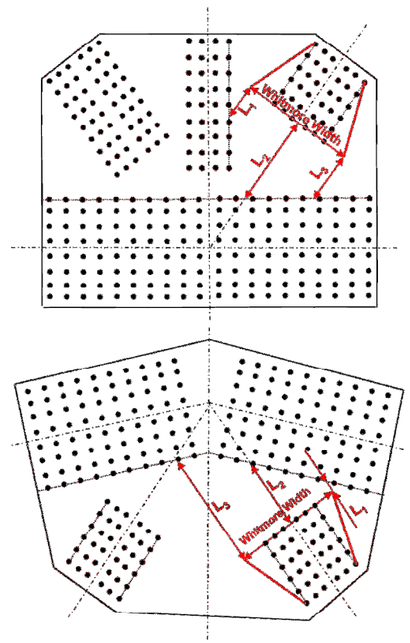


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Possible Scenario?			No			
Number of Rivets/Bolts	n =	16 ea	16 ea			
Longest Length of connection	L=	21.02 in	534 mm			
Edge distance	e =	1.02 in	26 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$			CSA S6 CL14.14.1.4.2
	B_{r1} =	316 kip	1405 kN			
	B_{r2} =	695 kip	3088 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$			CSA S6 CL14.14.1.4.2
		165 kip	733 kN			
Governing Resistance			1467 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span
Node: 3S

Demand/Capacity	D/C =		**0.000**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.					FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored?			Yes		
General					Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	21.81 in	554	mm	3
Shear Length 1	L_{V1} =	13.11 in	333	mm	4.5
Shear Length 2	L_{V2} =	11.38 in	289	mm	4.5
Tension Length	L_T =	14.33 in	364	mm	4
Number of Gusset Plates	m =	2 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$U*\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
			2653	kN	
Net Section Resistance	P_{RN} =		$U*\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2			3969	kN	

Block Shear

Gross Tension Area	A_{tg} =		4368	mm^2
Gross Shear Area	A_{vg} =		7464	mm^2
Net Tension Area	A_{tn} =		3379	mm^2
Net Shear Area	A_{vn} =		5239	mm^2
$A_{tn} \geq 0.58*A_{vn}$?			Yes	

		$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		U=1.0	
Block Shear Resistance	P_{Rbs} =		3725	kN	FHWA 3.1.3
Tension Resistance (Governing)			2653	kN	
Demand/Capacity	D/C =		**0.000**		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored?			Yes		
General					FHWA 3.3
Whitmore Width	W_w =	21.81 in	554	mm	

Span: Bascule Bridge - Leaf Span
Node: 3S

L1	L_1 =	0.79	in	20	mm	
L2 - along centreline of action	L_2 =	13.54	in	344	mm	
L3	L_3 =	4.88	in	124	mm	
Unsupported Column Length	L_u =	6.40	in	163	mm	
Effective Length Factor	K =	1.20		1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)		for rectangular plate
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.58		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2149	kN	
Demand/Capacity	D/C =			**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22	ea	22	ea	
Longest Length of connection	L=	18.94	in	481	mm	
Edge distance	e =	1.50	in	38	mm	
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")
Shear Planes per gusset plate	m =	1	ea	1	ea	
Number of Gusset Plates		2.00	ea	2	ea	
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0	CSA S6 CL14.14.1.4.2
	B_{r1} =	635	kip	2823	kN	
	B_{r2} =	955	kip	4246	kN	
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81	CSA S6 CL14.14.1.4.2
		411	kip	1825	kN	
Governing Resistance				3650	kN	for 2 plate(s)
Demand/Capacity	D/C =			**0.000**		

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	21.02	in	534	mm	2	
Shear Length 1	L_{V1} =	18.11	in	460	mm	5.5	
Shear Length 2	L_{V2} =	18.11	in	460	mm	5.5	
Tension Length	L_T =	8.27	in	210	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 3S

Number of Gusset Plates	m =	2.00 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			2557	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			3974	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		2520	mm^2	
Gross Shear Area	A_{vg} =		11040	mm^2	
Net Tension Area	A_{tn} =		2273	mm^2	
Net Shear Area	A_{vn} =		8321	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		4090	kN	FHWA 3.1.3
Tension Resistance (Governing)			2557	kN	
Demand/Capacity	D/C =		**0.000**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	21.02 in	534	mm	
L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	0.00 in	0	mm	
L3	L_3 =	0.00 in	0	mm	
Unsupported Column Length	L_u =	0.00 in	0	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			2422	kN	

Span: Bascule Bridge - Leaf Span
Node: 3S

Demand/Capacity	D/C =			**0.008**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	12	ea	12	ea		
Longest Length of connection	L=	18.11	in	460	mm		
Edge distance	e =	1.02	in	26	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	237	kip	1054	kN		
	B_{r2} =	521	kip	2316	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		224	kip	995	kN		
Governing Resistance				1991	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.010**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	24.41	in	620	mm	5	
Shear Length 1	L_{V1} =	10.87	in	276	mm	3.5	
Shear Length 2	L_{V2} =	14.25	in	362	mm	4.5	
Tension Length	L_T =	15.55	in	395	mm	5	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		2969	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		4169	kN		

Block Shear

Gross Tension Area	A_{tg} =	4740	mm^2

Span: Bascule Bridge - Leaf Span

Node: 3S

Gross Shear Area	A_{vg} =		7656	mm^2	
Net Tension Area	A_{tn} =		3504	mm^2	
Net Shear Area	A_{vn} =		5678	mm^2	
$A_{tn} > 0.58*A_{vn}$?			Yes		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0		
Block Shear Resistance	P_{Rbs} =		3847	kN	FHWA 3.1.3
Tension Resistance (Governing)			2969	kN	
Demand/Capacity	D/C =		**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?			Yes		
General					FHWA 3.3
Whitmore Width	W_w =	24.41 in	620	mm	
L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	13.15 in	334	mm	
L3	L_3 =	4.21 in	107	mm	
Unsupported Column Length	L_u =	5.79 in	147	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.53		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			2489	kN	
Demand/Capacity	D/C =		**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	25 ea	25	ea		
Longest Length of connection	L=	19.37 in	492	mm		
Edge distance	e =	1.50 in	38	mm		
Diameter of Rivet	d =	0.75 in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1	ea		
Number of Gusset Plates		2.00 ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	722 kip	3208	kN		
	B_{r2} =	1086 kip	4825	kN		

Span: Bascule Bridge - Leaf Span
Node: 3S

Shear Resistance of Rivets V_r = 467 kip $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 2074 kN CSA S6 CL14.14.1.4.2

Governing Resistance 4148 kN for 2 plate(s)
Demand/Capacity D/C = **0.000**
For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	288	1281
Shear Resistance (Net Section)	411	1825
Shear Resistance (Governing)	288	1281
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	452	2010
Shear Resistance (Net Section)	586	2606
Shear Resistance (Governing)	452	2010
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	597	2653
Net Section Resistance	893	3969
Block Shear Resistance	838	3725
Tension Resistance (Governing)	597	2653
At Member C:		
Gross Section Resistance	575	2557
Net Section Resistance	894	3974
Block Shear Resistance	920	4090
Tension Resistance (Governing)	575	2557
At Member D:		
Gross Section Resistance	668	2969
Net Section Resistance	938	4169
Block Shear Resistance	866	3847
Tension Resistance (Governing)	668	2969
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 3S

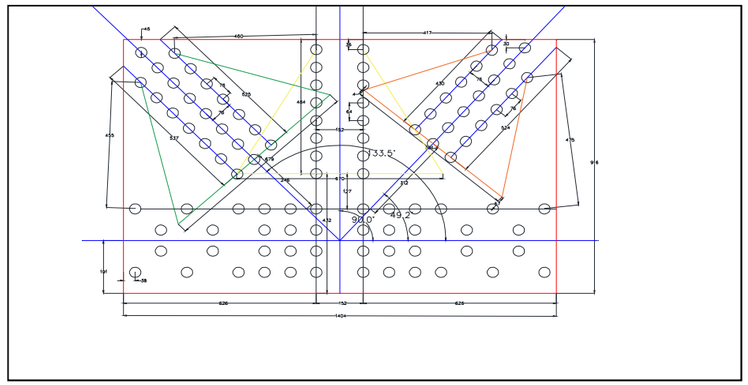
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	483	2149
Compressive Resistance at Member C	545	2422
Compressive Resistance at Member D	560	2489
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	330	1467
Governing Resistance at Member B	821	3650
Governing Resistance at Member C	448	1991
Governing Resistance at Member D	933	4148
Governing Resistance at Member E	330	1467

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
SHEAR PLANE A'-A'		288	1281	**0.001**	
SHEAR PLANE B'-B'		452	2010	**0.000**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	597	2653	**0.000**	
	Member C	575	2557	**0.000**	
	Member D	668	2969	**0.000**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	483	2149	**0.000**	
	Member C	545	2422	**0.008**	
	Member D	560	2489	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	330	1467	**0.000**	
	Member B	821	3650	**0.000**	
	Member C	448	1991	**0.010**	<--- Governing
	Member D	933	4148	**0.000**	
	Member E	330	1467	**0.000**	
Highest Demand/Capacity Ratio				**0.010**	

Span: Bascule Bridge - Leaf Span
Node: 4N

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units		S.I. Units		
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50	in	12.7	mm	
Limiting Thickness of Gusset Plate	t =	0.31	in	8	mm	37% Corrosion
Structural Steel - Tension	φ_s =			0.95		
	φ_u =			0.8		
Structural Steel - Compression	φ_s =			0.9		
Resistance Factor for Riveted Connections	φ_{mc} =			0.67		CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =			0.67		CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units		S.I. Units			
Yield Strength of Steel:	F_y =	30	ksi	210	MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61	ksi	420	MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46	ksi	320	MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000	ksi	200000	MPa		

MEMBER FORCES

Load Combination:		D1, D2, CL1-625 Max		
4N-A	P_{Max} =	167.9	kip	746 kN
4N-A	P_{Min} =	-8.4	kip	-37 kN
4N-B	P_{Max} =	162.5	kip	722 kN
4N-B	P_{Min} =	-73.0	kip	-325 kN
4N-C	P_{Max} =	-1.7	kip	-7 kN
4N-C	P_{Min} =	-4.5	kip	-20 kN
4N-D	P_{Max} =	137.5	kip	611 kN
4N-D	P_{Min} =	-83.5	kip	-371 kN
4N-E	P_{Max} =	260.3	kip	1157 kN
4N-E	P_{Min} =	-87.7	kip	-390 kN

Note: Tension is positive.

Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
4N-A	280	746	746	746	746
4N-A	280	-37	-37	-37	-37
4N-B	3	716	719	722	722
4N-B	3	-325	-321	-318	-325
4N-C	243	-12	-9	-7	-7
4N-C	243	-20	-18	-16	-20
4N-D	7	611	608	604	611
4N-D	7	-364	-367	-371	-371
4N-E	281	1157	1157	1157	1157
4N-E	281	-390	-390	-390	-390

Span: Bascule Bridge - Leaf Span
Node: 4N

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		133.5	deg	B
	φ_C =		90	deg	C
	φ_D =		49.2	deg	D
	$\cos(\varphi_B)$ =		-0.688		
	$\cos(\varphi_C)$ =		0.000		
	$\cos(\varphi_D)$ =		0.653		
	$V_{A'-A',max}$ =	140.1 kip	623	kN	*
	$V_{A'-A',min}$ =	-166.4 kip	-740	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	166.4 kip	740	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	117.9 kip	524	kN	

*using absolute maximum sums, conservative

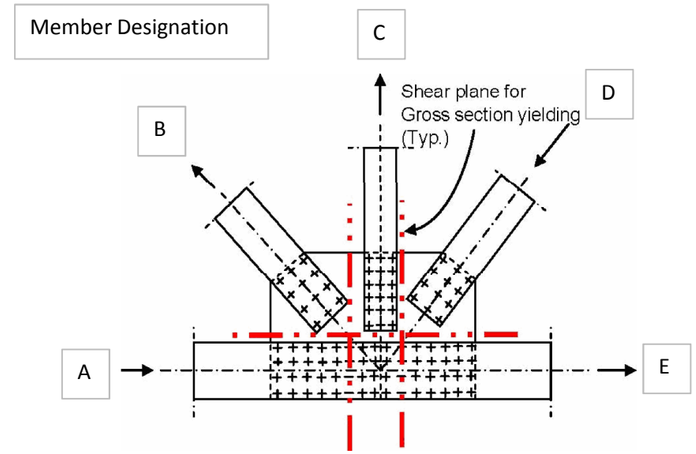


Figure 4 – Examples of gross section shear yielding planes

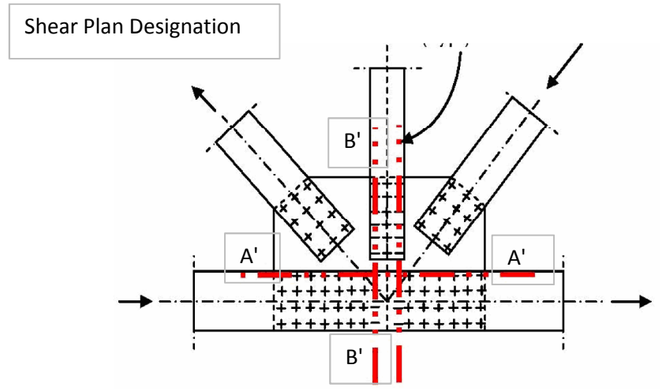


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	55.28	in	1404	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			22464	mm^2	
Net Shear Area	A_n =			18509	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2241	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$ *		Cl 10.18.5.2
	V_{Rn} =			3109	kN	
Shear Resistance (Governing)	V_R =			**2241**	**kN**	
Demand/Capacity	D/C =			**0.330**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	36.06	in	916	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 4N

Members A and E continuous through the gusset plate?				Yes		
Outside height of member A	H_A=	15	in	381	mm	
Thickness of the web of member A	w_A=	0.40	in	10	mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4	ea	
Gross Shear Area	A_g =			22398	mm^2	
Net Shear Area	A_n =			16768	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2234	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =			2817	kN	
Shear Resistance (Governing)	V_R =			**2234**	**kN**	
Demand/Capacity	D/C =			**0.235**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E

N/A

Members A and E continuous through the gusset plate? Yes

General

Whitmore Width	W_w =	0.00	in	0	mm	
Shear Length 1	L_{V1} =	0.00	in	0	mm	
Shear Length 2	L_{V2} =	0.00	in	0	mm	
Tension Length	L_T =	0.00	in	0	mm	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	

Number of Rivet/bolt diameters Intsecting Plane

0
0
0
0 Typ, 1 less than Whitemore Width

($^{13}/_{16}$")

Axile Tensile Resistance

CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	
		0	kN
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	
For gusset plates, U=1.0, FHWA 3.1.2		0	kN

FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

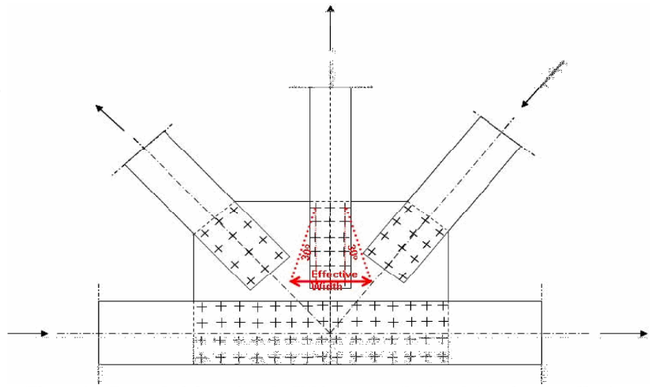


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

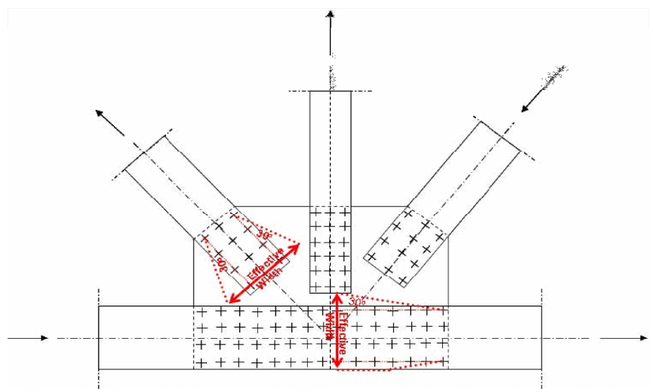


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 4N

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

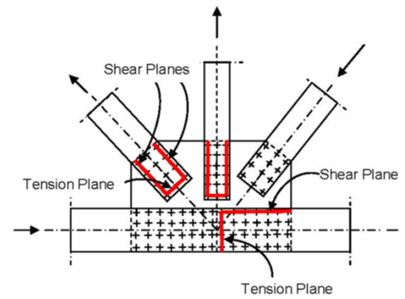


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.09 in	2.31 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

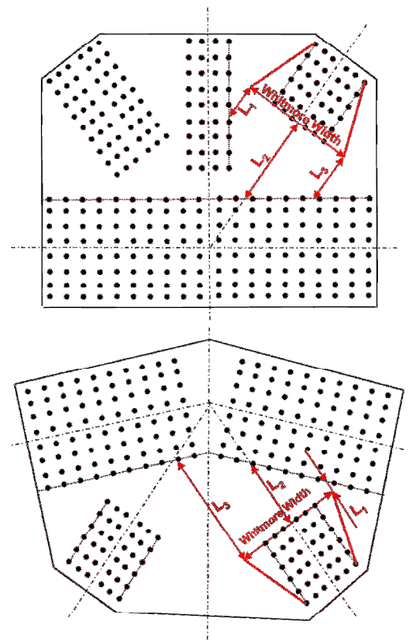


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	44 ea	44 ea			
Longest Length of connection	L=	55.28 in	1404 mm			
Edge distance	e =	1.50 in	38 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$			CSA S6 CL14.14.1.4.2
	B_{r1} =	847 kip	3764 kN			
	B_{r2} =	1274 kip	5661 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$			CSA S6 CL14.14.1.4.2
		454 kip	2017 kN			
Governing Resistance			3227 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span

Node: 4N

Demand/Capacity	D/C =			**0.359**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.						FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored?				Yes		
General						Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	26.77	in	680	mm	3
Shear Length 1	L_{V1} =	20.67	in	525	mm	6.5
Shear Length 2	L_{V2} =	21.14	in	537	mm	6.5
Tension Length	L_T =	5.98	in	152	mm	2
Number of Gusset Plates	m =	2	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =			$U*\varphi_s*A_g*F_y$ 2171	U=1.0 kN	FHWA 3.1.2
Net Section Resistance	P_{RN} =			$U*\varphi_u*A_n*F_u$ 3323	U=1.0 kN	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2						

Block Shear

Gross Tension Area	A_{tg} =			1216	mm^2	
Gross Shear Area	A_{vg} =			8496	mm^2	
Net Tension Area	A_{tn} =			886	mm^2	
Net Shear Area	A_{vn} =			6354	mm^2	
$A_{tn} \geq 0.58*A_{vn}$?				No		
	$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$				U=1.0	
Block Shear Resistance	P_{Rbs} =			2885	kN	FHWA 3.1.3
Tension Resistance (Governing)				2171	kN	
Demand/Capacity	D/C =			**0.333**		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored?				Yes		
General						FHWA 3.3
Whitmore Width	W_w =	26.77	in	680	mm	

Span: Bascule Bridge - Leaf Span

Node: 4N

L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	9.69 in	246	mm	
L3	L_3 =	0.00 in	0	mm	
Unsupported Column Length	L_u =	3.23 in	82	mm	
Effective Length Factor	K =	1.20	1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)		for rectangular plate
		0.09 in	2.31	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.44		
Compressive Resistance	C_r =		$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		U=1.0
			1902	kN	
Demand/Capacity	D/C =		**0.171**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22 ea	22	ea		
Longest Length of connection	L=	21.14 in	537	mm		
Edge distance	e =	1.77 in	45	mm		
Diameter of Rivet	d =	0.75 in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1	ea		
Number of Gusset Plates		2.00 ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$		U=1.0	CSA S6 CL14.14.1.4.2
	B_{r1} =	501 kip	2229	kN		
	B_{r2} =	637 kip	2830	kN		
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$		U=1.81	CSA S6 CL14.14.1.4.2
		411 kip	1825	kN		
Governing Resistance			3650	kN	for 2 plate(s)	
Demand/Capacity	D/C =		**0.198**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.						FHWA Section 2

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

					Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	26.38 in	670	mm	2	
Shear Length 1	L_{V1} =	19.06 in	484	mm	7.5	
Shear Length 2	L_{V2} =	19.06 in	484	mm	7.5	
Tension Length	L_T =	5.98 in	152	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 4N

Number of Gusset Plates	m =	2.00 ea	2 ea		
Diameter of holes in plane	d_b =	0.81 in	21 mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
			2139 kN		
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2			3380 kN		

Block Shear

Gross Tension Area	A_{tg} =		1216	mm^2	
Gross Shear Area	A_{vg} =		7744	mm^2	
Net Tension Area	A_{tn} =		1051	mm^2	
Net Shear Area	A_{vn} =		5272	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		2463 kN		FHWA 3.1.3
Tension Resistance (Governing)			2139 kN		
Demand/Capacity	D/C =		**0.000**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	26.38 in	670	mm	
L1	L_1 =	5.00 in	127	mm	
L2 - along centreline of action	L_2 =	5.00 in	127	mm	
L3	L_3 =	5.00 in	127	mm	
Unsupported Column Length	L_u =	5.00 in	127	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.09 in	2.31	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.68		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			1614 kN		

Span: Bascule Bridge - Leaf Span
Node: 4N

Demand/Capacity	D/C =			**0.012**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea		
Longest Length of connection	L=	19.06	in	484	mm		
Edge distance	e =	1.42	in	36	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	292	kip	1297	kN		
	B_{r2} =	463	kip	2058	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		299	kip	1327	kN		
Governing Resistance				2593	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.008**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	23.23	in	590	mm	3	
Shear Length 1	L_{V1} =	20.63	in	524	mm	5.5	
Shear Length 2	L_{V2} =	16.93	in	430	mm	5.5	
Tension Length	L_T =	5.98	in	152	mm	2	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		1883	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		2840	kN		

Block Shear

Gross Tension Area	A_{tg} =	1216	mm^2

Span: Bascule Bridge - Leaf Span

Node: 4N

Gross Shear Area	A_{vg} =	7632	mm^2	
Net Tension Area	A_{tn} =	886	mm^2	
Net Shear Area	A_{vn} =	5819	mm^2	
$A_{tn} > 0.58*A_{vn}$?		No		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =	2677	kN	FHWA 3.1.3
Tension Resistance (Governing)		1883	kN	
Demand/Capacity	D/C =	**0.325**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?				Yes		
General						FHWA 3.3
Whitmore Width	W_w =	23.23	in	590	mm	
L1	L_1 =	0.16	in	4	mm	
L2 - along centreline of action	L_2 =	12.28	in	312	mm	
L3	L_3 =	2.24	in	57	mm	
Unsupported Column Length	L_u =	4.90	in	124	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.09	in	2.31	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.67		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				1437	kN	
Demand/Capacity	D/C =			**0.258**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	19	ea	19	ea		
Longest Length of connection	L=	20.63	in	524	mm		
Edge distance	e =	1.18	in	30	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	289	kip	1283	kN		
	B_{r2} =	550	kip	2444	kN		

Span: Bascule Bridge - Leaf Span
Node: 4N

Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$ U=1.81	CSA S6 CL14.14.1.4.2
		355 kip	1576 kN	
Governing Resistance			2566 kN for 2 plate(s)	
Demand/Capacity	D/C =		**0.238**	
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	504	2241
Shear Resistance (Net Section)	700	3109
Shear Resistance (Governing)	504	2241
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	503	2234
Shear Resistance (Net Section)	634	2817
Shear Resistance (Governing)	503	2234
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	488	2171
Net Section Resistance	748	3323
Block Shear Resistance	649	2885
Tension Resistance (Governing)	488	2171
At Member C:		
Gross Section Resistance	481	2139
Net Section Resistance	761	3380
Block Shear Resistance	554	2463
Tension Resistance (Governing)	481	2139
At Member D:		
Gross Section Resistance	424	1883
Net Section Resistance	639	2840
Block Shear Resistance	602	2677
Tension Resistance (Governing)	424	1883
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 4N

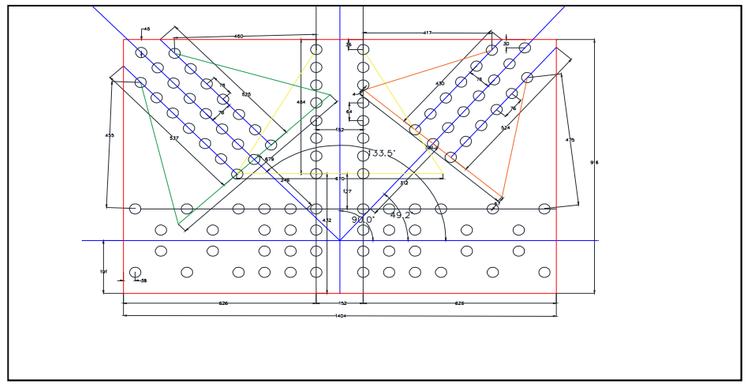
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	428	1902
Compressive Resistance at Member C	363	1614
Compressive Resistance at Member D	323	1437
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	726	3227
Governing Resistance at Member B	821	3650
Governing Resistance at Member C	584	2593
Governing Resistance at Member D	577	2566
Governing Resistance at Member E	726	3227

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
	SHEAR PLANE A'-A'	504	2241	**0.330**	
	SHEAR PLANE B'-B'	503	2234	**0.235**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	488	2171	**0.333**	
	Member C	481	2139	**0.000**	
	Member D	424	1883	**0.325**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	428	1902	**0.171**	
	Member C	363	1614	**0.012**	
	Member D	323	1437	**0.258**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	726	3227	**0.359**	<--- Governing
	Member B	821	3650	**0.198**	
	Member C	584	2593	**0.008**	
	Member D	577	2566	**0.238**	
	Member E	726	3227	**0.359**	<--- Governing
	Highest Demand/Capacity Ratio			**0.359**	

Span: Bascule Bridge - Leaf Span
Node: 4S

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units		S.I. Units		
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50	in	12.7	mm	
Limiting Thickness of Gusset Plate	t =	0.31	in	8	mm	37% Corrosion
Structural Steel - Tension	φ_s =			0.95		
	φ_u =			0.8		
Structural Steel - Compression	φ_s =			0.9		
Resistance Factor for Riveted Connections	φ_{mc} =			0.67		CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =			0.67		CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units		S.I. Units			
Yield Strength of Steel:	F_y =	30	ksi	210	MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61	ksi	420	MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46	ksi	320	MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000	ksi	200000	MPa		

MEMBER FORCES

Load Combination: D1, D2, CL1-625 Max

4S-A	P_{Max} =	177.4	kip	789	kN
4S-A	P_{Min} =	1.2	kip	5	kN
4S-B	P_{Max} =	170.0	kip	756	kN
4S-B	P_{Min} =	-65.4	kip	-291	kN
4S-C	P_{Max} =	-1.6	kip	-7	kN
4S-C	P_{Min} =	-4.4	kip	-20	kN
4S-D	P_{Max} =	136.4	kip	606	kN
4S-D	P_{Min} =	-84.5	kip	-376	kN
4S-E	P_{Max} =	276.1	kip	1227	kN
4S-E	P_{Min} =	-72.3	kip	-321	kN

Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
4S-A	560	789	789	789	789
4S-A	560	5	5	5	5
4S-B	179	749	753	756	756
4S-B	179	-291	-287	-284	-291
4S-C	572	-11	-9	-7	-7
4S-C	572	-20	-18	-16	-20
4S-D	183	606	603	599	606
4S-D	183	-369	-372	-376	-376
4S-E	561	1227	1227	1227	1227
4S-E	561	-321	-321	-321	-321

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 4S

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		133.5	deg	B
	φ_C =		90	deg	C
	φ_D =		49.2	deg	D
	$\cos(\varphi_B)$ =		-0.688		
	$\cos(\varphi_C)$ =		0.000		
	$\cos(\varphi_D)$ =		0.653		
	$V_{A'-A',max}$ =	134.1 kip	596	kN	*
	$V_{A'-A',min}$ =	-172.3 kip	-766	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	172.3 kip	766	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	123.3 kip	548	kN	

*using absolute maximum sums, conservative

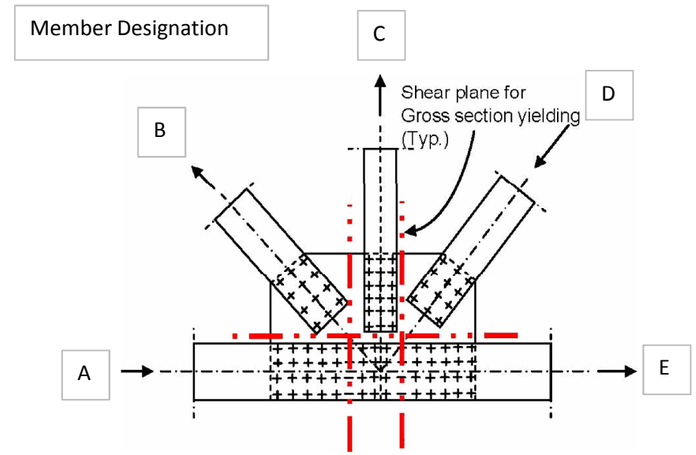


Figure 4 – Examples of gross section shear yielding planes

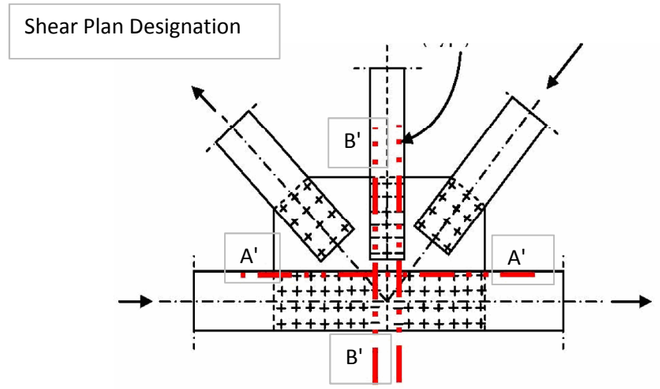


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	55.12	in	1400	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			22400	mm^2	
Net Shear Area	A_n =			18445	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2234	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$ *		Cl 10.18.5.2
	V_{Rn} =			3099	kN	
Shear Resistance (Governing)	V_R =			**2234**	**kN**	
Demand/Capacity	D/C =			**0.343**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	36.02	in	915	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 4S

Members A and E continuous through the gusset plate?				Yes		
Outside height of member A	H_A=	15	in	381	mm	
Thickness of the web of member A	w_A=	0.40	in	10	mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4	ea	
Gross Shear Area	A_g =			22382	mm^2	
Net Shear Area	A_n =			16752	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2233	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =			2814	kN	
Shear Resistance (Governing)	V_R =			**2233**	**kN**	
Demand/Capacity	D/C =			**0.246**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E

N/A

Members A and E continuous through the gusset plate? Yes

General

Whitmore Width	W_w =	0.00	in	0	mm	
Shear Length 1	L_{V1} =	0.00	in	0	mm	
Shear Length 2	L_{V2} =	0.00	in	0	mm	
Tension Length	L_T =	0.00	in	0	mm	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Number of Rivet/bolt diameters Intsecting Plane

0	
0	
0	
0	Typ, 1 less than Whitemore Width

Axile Tensile Resistance

CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	
		0	kN
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	
For gusset plates, U=1.0, FHWA 3.1.2		0	kN

FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =	0 mm^2
Gross Shear Area	A_{vg} =	0 mm^2
Net Tension Area	A_{tn} =	0 mm^2
Net Shear Area	A_{vn} =	0 mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes

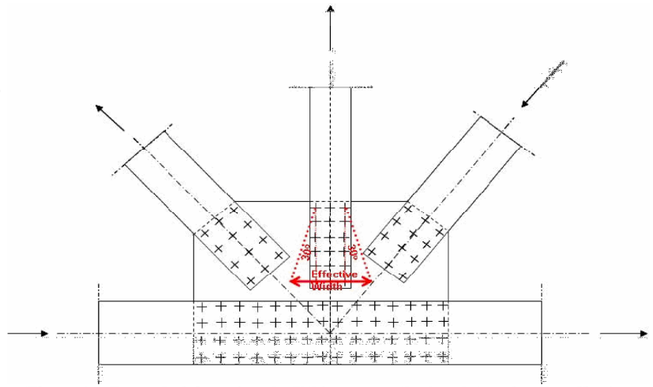


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

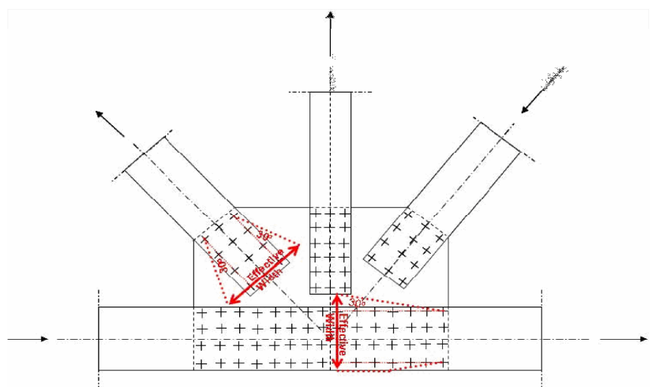


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 4S

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

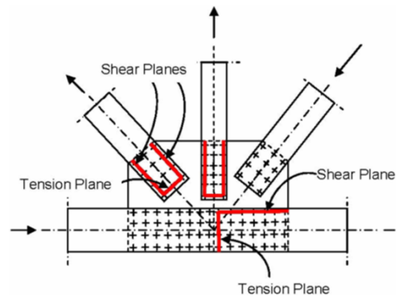


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.09 in	2.31 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

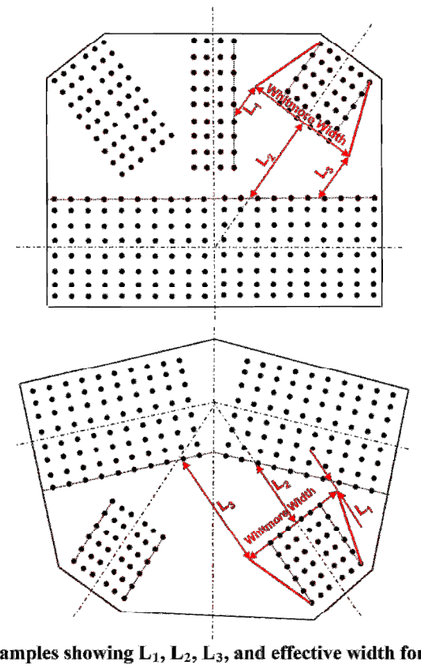


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	44 ea	44 ea			
Longest Length of connection	L=	53.78 in	1366 mm			
Edge distance	e =	1.50 in	38 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$		CSA S6 CL14.14.1.4.2	
	B_{r1} =	847 kip	3764 kN			
	B_{r2} =	1274 kip	5661 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$		CSA S6 CL14.14.1.4.2	
		454 kip	2017 kN			
Governing Resistance			3227 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span
Node: 4S

Demand/Capacity	D/C =	**0.380**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored?				Yes		
General						Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	26.77	in	680	mm	3
Shear Length 1	L_{V1} =	20.67	in	525	mm	6.5
Shear Length 2	L_{V2} =	21.06	in	535	mm	6.5
Tension Length	L_T =	5.98	in	152	mm	2
Number of Gusset Plates	m =	2	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		2171	kN		
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		3323	kN		

Block Shear

Gross Tension Area	A_{tg} =	1216	mm^2	
Gross Shear Area	A_{vg} =	8480	mm^2	
Net Tension Area	A_{tn} =	886	mm^2	
Net Shear Area	A_{vn} =	6338	mm^2	
$A_{tn} \geq 0.58*A_{vn}$?		No		
	$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		U=1.0	
Block Shear Resistance	P_{Rbs} =	2879	kN	FHWA 3.1.3
Tension Resistance (Governing)		2171	kN	
Demand/Capacity	D/C =	**0.348**		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored?			Yes		
General					FHWA 3.3
Whitmore Width	W_w =	26.77 in	680	mm	

Span: Bascule Bridge - Leaf Span

Node: 4S

L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	9.84 in	250	mm	
L3	L_3 =	0.00 in	0	mm	
Unsupported Column Length	L_u =	3.28 in	83	mm	
Effective Length Factor	K =	1.20	1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)		for rectangular plate
		0.09 in	2.31	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.45		
Compressive Resistance	C_r =		$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		U=1.0
			1895	kN	
Demand/Capacity	D/C =		**0.153**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22 ea	22	ea		
Longest Length of connection	L=	20.98 in	533	mm		
Edge distance	e =	1.50 in	38	mm		
Diameter of Rivet	d =	0.75 in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1	ea		
Number of Gusset Plates		2.00 ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$		U=1.0	CSA S6 CL14.14.1.4.2
	B_{r1} =	423 kip	1882	kN		
	B_{r2} =	637 kip	2830	kN		
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$		U=1.81	CSA S6 CL14.14.1.4.2
		411 kip	1825	kN		
Governing Resistance			3650	kN	for 2 plate(s)	
Demand/Capacity	D/C =		**0.207**			

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

					Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	26.38 in	670	mm	2	
Shear Length 1	L_{V1} =	19.06 in	484	mm	7.5	
Shear Length 2	L_{V2} =	19.06 in	484	mm	7.5	
Tension Length	L_T =	5.98 in	152	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 4S

Number of Gusset Plates	m =	2.00 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			2139	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			3380	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		1216	mm^2	
Gross Shear Area	A_{vg} =		7744	mm^2	
Net Tension Area	A_{tn} =		1051	mm^2	
Net Shear Area	A_{vn} =		5272	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		2463	kN	FHWA 3.1.3
Tension Resistance (Governing)			2139	kN	
Demand/Capacity	D/C =		**0.000**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored?			N/A		
General					FHWA 3.3
Whitmore Width	W_w =	26.38 in	670	mm	
L1	L_1 =	5.00 in	127	mm	
L2 - along centreline of action	L_2 =	5.00 in	127	mm	
L3	L_3 =	5.00 in	127	mm	
Unsupported Column Length	L_u =	5.00 in	127	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.09 in	2.31	mm	
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.68		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			1614	kN	

Span: Bascule Bridge - Leaf Span
Node: 4S

Demand/Capacity	D/C =			**0.012**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea		
Longest Length of connection	L=	19.06	in	484	mm		
Edge distance	e =	1.42	in	36	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	292	kip	1297	kN		
	B_{r2} =	463	kip	2058	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		299	kip	1327	kN		
Governing Resistance				2593	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.008**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	23.23	in	590	mm	3	
Shear Length 1	L_{V1} =	20.63	in	524	mm	5.5	
Shear Length 2	L_{V2} =	16.93	in	430	mm	5.5	
Tension Length	L_T =	5.98	in	152	mm	2	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		1883	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		2840	kN		

Block Shear

Gross Tension Area	A_{tg} =	1216	mm^2

Span: Bascule Bridge - Leaf Span

Node: 4S

Gross Shear Area	A_{vg} =		7632	mm^2	
Net Tension Area	A_{tn} =		886	mm^2	
Net Shear Area	A_{vn} =		5819	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0		
Block Shear Resistance	P_{Rbs} =		2677	kN	FHWA 3.1.3
Tension Resistance (Governing)			1883	kN	
Demand/Capacity	D/C =		**0.322**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?			Yes		
General					FHWA 3.3
Whitmore Width	W_w =	23.23 in	590	mm	
L1	L_1 =	0.16 in	4	mm	
L2 - along centreline of action	L_2 =	12.28 in	312	mm	
L3	L_3 =	2.24 in	57	mm	
Unsupported Column Length	L_u =	4.90 in	124	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.09 in	2.31	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.67		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			1437	kN	
Demand/Capacity	D/C =		**0.262**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	19 ea	19	ea		
Longest Length of connection	L=	20.63 in	524	mm		
Edge distance	e =	1.18 in	30	mm		
Diameter of Rivet	d =	0.75 in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1	ea		
Number of Gusset Plates		2.00 ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	289 kip	1283	kN		
	B_{r2} =	550 kip	2444	kN		

Span: Bascule Bridge - Leaf Span
Node: 4S

Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$ U=1.81	CSA S6 CL14.14.1.4.2
		355 kip	1576 kN	
Governing Resistance			2566 kN for 2 plate(s)	
Demand/Capacity	D/C =		**0.236**	
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	503	2234
Shear Resistance (Net Section)	697	3099
Shear Resistance (Governing)	503	2234
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	502	2233
Shear Resistance (Net Section)	633	2814
Shear Resistance (Governing)	502	2233
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	488	2171
Net Section Resistance	748	3323
Block Shear Resistance	648	2879
Tension Resistance (Governing)	488	2171
At Member C:		
Gross Section Resistance	481	2139
Net Section Resistance	761	3380
Block Shear Resistance	554	2463
Tension Resistance (Governing)	481	2139
At Member D:		
Gross Section Resistance	424	1883
Net Section Resistance	639	2840
Block Shear Resistance	602	2677
Tension Resistance (Governing)	424	1883
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 4S

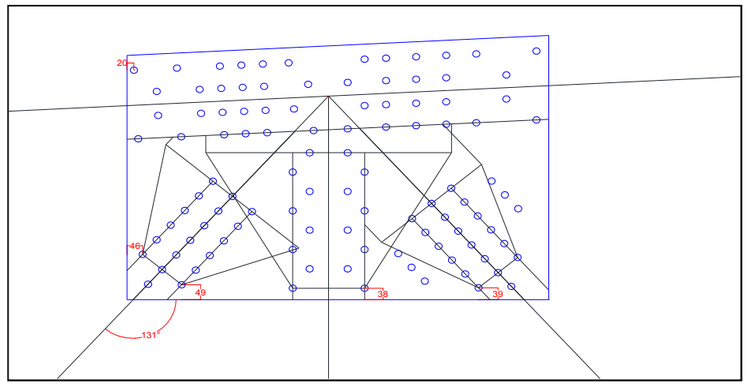
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	426	1895
Compressive Resistance at Member C	363	1614
Compressive Resistance at Member D	323	1437
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	726	3227
Governing Resistance at Member B	821	3650
Governing Resistance at Member C	584	2593
Governing Resistance at Member D	577	2566
Governing Resistance at Member E	726	3227

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
SHEAR PLANE A'-A'		503	2234	**0.343**	
SHEAR PLANE B'-B'		502	2233	**0.246**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	488	2171	**0.348**	
	Member C	481	2139	**0.000**	
	Member D	424	1883	**0.322**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	426	1895	**0.153**	
	Member C	363	1614	**0.012**	
	Member D	323	1437	**0.262**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	726	3227	**0.380**	<--- Governing
	Member B	821	3650	**0.207**	
	Member C	584	2593	**0.008**	
	Member D	577	2566	**0.236**	
	Member E	726	3227	**0.380**	<--- Governing
Highest Demand/Capacity Ratio				**0.380**	

Span: Bascule Bridge - Leaf Span
Node: 5N

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.47 in	12 mm	6% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units		
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa		

MEMBER FORCES

Load Combination: D1, D2, CL1-625 Max

5N-A	P_{Max} =	49.9 kip	222 kN	
5N-A	P_{Min} =	-264.6 kip	-1176 kN	
5N-B	P_{Max} =	137.5 kip	611 kN	
5N-B	P_{Min} =	-83.5 kip	-371 kN	
5N-C	P_{Max} =	139.4 kip	620 kN	
5N-C	P_{Min} =	15.3 kip	68 kN	
5N-D	P_{Max} =	11.8 kip	53 kN	
5N-D	P_{Min} =	-202.0 kip	-898 kN	
5N-E	P_{Max} =	161.7 kip	719 kN	
5N-E	P_{Min} =	-210.6 kip	-936 kN	

Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
5N-A	422	222	222	221	222
5N-A	422	-1176	-1176	-1176	-1176
5N-B	7	611	608	604	611
5N-B	7	-364	-367	-371	-371
5N-C	321	618	619	620	620
5N-C	321	68	69	69	68
5N-D	8	53	49	46	53
5N-D	8	-891	-894	-898	-898
5N-E	421	719	718	718	719
5N-E	421	-936	-936	-936	-936

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 5N

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		134	deg	B
	φ_C =		93	deg	C
	φ_D =		52	deg	D
	$\cos(\varphi_B)$ =		-0.695		
	$\cos(\varphi_C)$ =		-0.052		
	$\cos(\varphi_D)$ =		0.616		
	$V_{A'-A',max}$ =	64.5 kip	287	kN	*
	$V_{A'-A',min}$ =	-227.2 kip	-1010	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	227.2 kip	1010	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	159.2 kip	707	kN	

*using absolute maximum sums, conservative

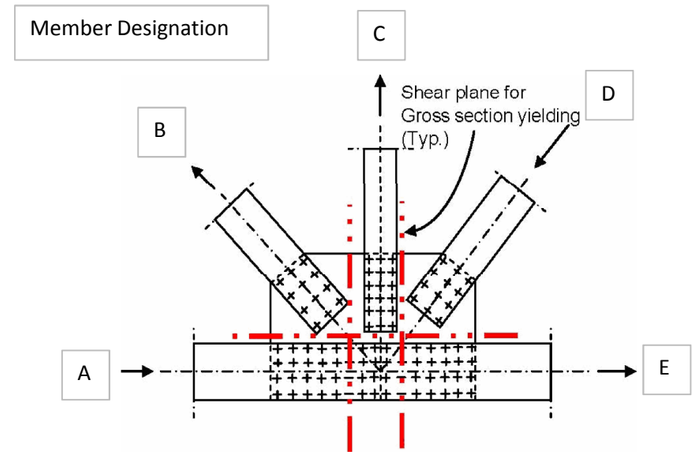


Figure 4 – Examples of gross section shear yielding planes

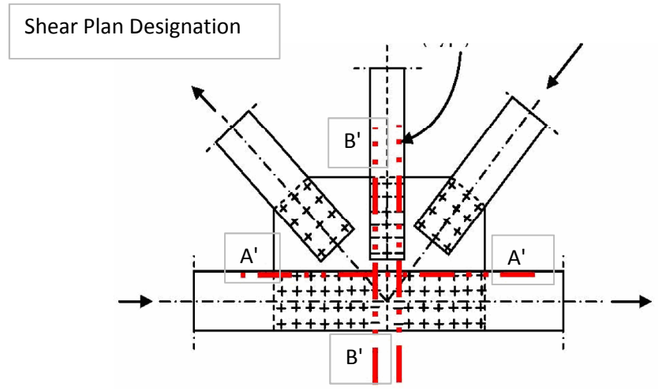


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	49.09	in	1247	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			29928	mm^2	
Net Shear Area	A_n =			23995	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2985	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =			4031	kN	
Shear Resistance (Governing)	V_R =			**2985**	**kN**	
Demand/Capacity	D/C =			**0.338**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	32.68	in	830	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 5N

Members A and E continuous through the gusset plate?				Yes		
Outside height of member A	H_A=	15	in	381	mm	
Thickness of the web of member A	w_A=	0.40	in	10	mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4	ea	
Gross Shear Area	A_g =			27662	mm^2	
Net Shear Area	A_n =			20055	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2759	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =			3369	kN	
Shear Resistance (Governing)	V_R =			**2759**	**kN**	
Demand/Capacity	D/C =			**0.256**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E — N/A

Members A and E continuous through the gusset plate?				Yes		

General

Whitmore Width	W_w =	0.00	in	0	mm	
Shear Length 1	L_{V1} =	0.00	in	0	mm	
Shear Length 2	L_{V2} =	0.00	in	0	mm	
Tension Length	L_T =	0.00	in	0	mm	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	

Number of Rivet/bolt diameters Intsecting Plane

0	
0	
0	
0	Typ, 1 less than Whitemore Width

($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	
		0	kN
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	
For gusset plates, U=1.0, FHWA 3.1.2		0	kN

FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

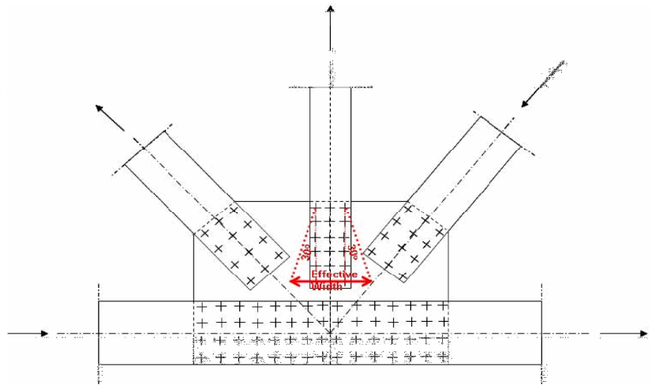


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

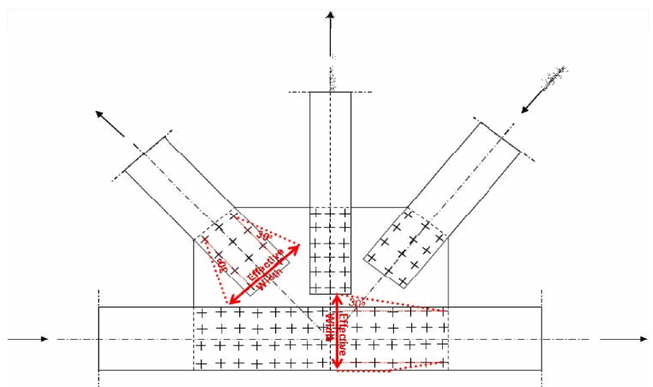


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 5N

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

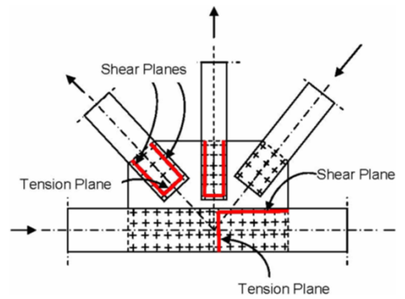


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.14 in	3.46 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

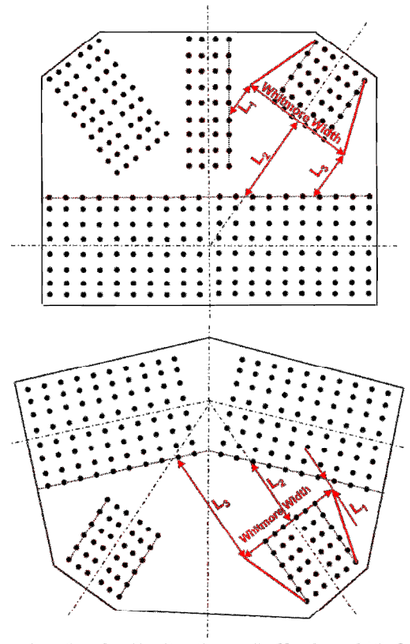


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	48 ea	48 ea			
Longest Length of connection	L=	49.09 in	1247 mm			
Edge distance	e =	0.79 in	20 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$			CSA S6 CL14.14.1.4.2
	B_{r1} =	729 kip	3242 kN			
	B_{r2} =	2084 kip	9263 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$			CSA S6 CL14.14.1.4.2
		495 kip	2200 kN			
Governing Resistance			4400 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span
Node: 5N

Demand/Capacity	D/C =		**0.267**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.					FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored?			Yes		
General					Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	20.43 in	519 mm		3
Shear Length 1	L_{V1} =	15.04 in	382 mm		5.5
Shear Length 2	L_{V2} =	15.28 in	388 mm		5.5
Tension Length	L_T =	5.98 in	152 mm		2
Number of Gusset Plates	m =	2 ea	2 ea		
Diameter of holes in plane	d_b =	0.81 in	21 mm		($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$U*\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
			2485	kN	
Net Section Resistance	P_{RN} =		$U*\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2			3687	kN	

Block Shear

Gross Tension Area	A_{tg} =		1824	mm^2
Gross Shear Area	A_{vg} =		9240	mm^2
Net Tension Area	A_{tn} =		1330	mm^2
Net Shear Area	A_{vn} =		6521	mm^2
$A_{tn} \geq 0.58*A_{vn}$?			No	

		$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		U=1.0	
Block Shear Resistance	P_{Rbs} =		3154	kN	FHWA 3.1.3
Tension Resistance (Governing)			2485	kN	
Demand/Capacity	D/C =		**0.246**		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored?			Yes		
General					FHWA 3.3
Whitmore Width	W_w =	20.43 in	519 mm		

Span: Bascule Bridge - Leaf Span

Node: 5N

L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	11.10	in	282	mm	
L3	L_3 =	1.30	in	33	mm	
Unsupported Column Length	L_u =	4.13	in	105	mm	
Effective Length Factor	K =	1.20		1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			$t/\sqrt{(12)}$		for rectangular plate
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.38		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		U=1.0
				2235	kN	
Demand/Capacity	D/C =			**0.166**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	19	ea	19	ea	
Longest Length of connection	L=	17.64	in	448	mm	
Edge distance	e =	1.81	in	46	mm	
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")
Shear Planes per gusset plate	m =	1	ea	1	ea	
Number of Gusset Plates		2.00	ea	2	ea	
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$		U=1.0 CSA S6 CL14.14.1.4.2
	B_{r1} =	664	kip	2951	kN	
	B_{r2} =	825	kip	3667	kN	
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$		U=1.81 CSA S6 CL14.14.1.4.2
		355	kip	1576	kN	
Governing Resistance				3152	kN	for 2 plate(s)
Demand/Capacity	D/C =			**0.194**		

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	28.54	in	725	mm	2	
Shear Length 1	L_{V1} =	19.02	in	483	mm	7.5	
Shear Length 2	L_{V2} =	19.02	in	483	mm	7.5	
Tension Length	L_T =	8.35	in	212	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 5N

Number of Gusset Plates	m =	2.00 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			3471	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			5514	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		2544	mm^2	
Gross Shear Area	A_{vg} =		11592	mm^2	
Net Tension Area	A_{tn} =		2297	mm^2	
Net Shear Area	A_{vn} =		7884	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		3928	kN	FHWA 3.1.3
Tension Resistance (Governing)			3471	kN	
Demand/Capacity	D/C =		**0.179**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	28.54 in	725	mm	
L1	L_1 =	2.20 in	56	mm	
L2 - along centreline of action	L_2 =	2.95 in	75	mm	
L3	L_3 =	3.74 in	95	mm	
Unsupported Column Length	L_u =	2.97 in	75	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.27		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			3218	kN	

Span: Bascule Bridge - Leaf Span
Node: 5N

Demand/Capacity	D/C =			**0.000**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea		
Longest Length of connection	L=	19.02	in	483	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	462	kip	2053	kN		
	B_{r2} =	695	kip	3088	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		299	kip	1327	kN		
Governing Resistance				2655	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.233**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	15.35	in	390	mm	3	
Shear Length 1	L_{V1} =	17.36	in	441	mm	5.5	
Shear Length 2	L_{V2} =	13.86	in	352	mm	5.5	
Tension Length	L_T =	5.98	in	152	mm	2	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		1867	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		2647	kN		

Block Shear

Gross Tension Area	A_{tg} =	1824	mm^2

Span: Bascule Bridge - Leaf Span

Node: 5N

Gross Shear Area	A_{vg} =		9516	mm^2	
Net Tension Area	A_{tn} =		1330	mm^2	
Net Shear Area	A_{vn} =		6797	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0		
Block Shear Resistance	P_{Rbs} =		3262	kN	FHWA 3.1.3
Tension Resistance (Governing)			1867	kN	
Demand/Capacity	D/C =		**0.028**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?			Yes		
General					FHWA 3.3
Whitmore Width	W_w =	15.35 in	390	mm	
L1	L_1 =	3.03 in	77	mm	
L2 - along centreline of action	L_2 =	12.83 in	326	mm	
L3	L_3 =	6.89 in	175	mm	
Unsupported Column Length	L_u =	7.59 in	193	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.69		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			1400	kN	
Demand/Capacity	D/C =		**0.641**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	18 ea	18	ea		
Longest Length of connection	L=	16.46 in	418	mm		
Edge distance	e =	1.54 in	39	mm		
Diameter of Rivet	d =	0.75 in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1	ea		
Number of Gusset Plates		2.00 ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	533 kip	2371	kN		
	B_{r2} =	782 kip	3474	kN		

Span: Bascule Bridge - Leaf Span
Node: 5N

Shear Resistance of Rivets V_r = $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 CSA S6 CL14.14.1.4.2

336 kip 1493 kN

Governing Resistance 2986 kN for 2 plate(s)

Demand/Capacity D/C = **0.301**

For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	672	2985
Shear Resistance (Net Section)	907	4031
Shear Resistance (Governing)	672	2985
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	621	2759
Shear Resistance (Net Section)	758	3369
Shear Resistance (Governing)	621	2759
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	559	2485
Net Section Resistance	830	3687
Block Shear Resistance	710	3154
Tension Resistance (Governing)	559	2485
At Member C:		
Gross Section Resistance	781	3471
Net Section Resistance	1241	5514
Block Shear Resistance	884	3928
Tension Resistance (Governing)	781	3471
At Member D:		
Gross Section Resistance	420	1867
Net Section Resistance	595	2647
Block Shear Resistance	734	3262
Tension Resistance (Governing)	420	1867
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 5N

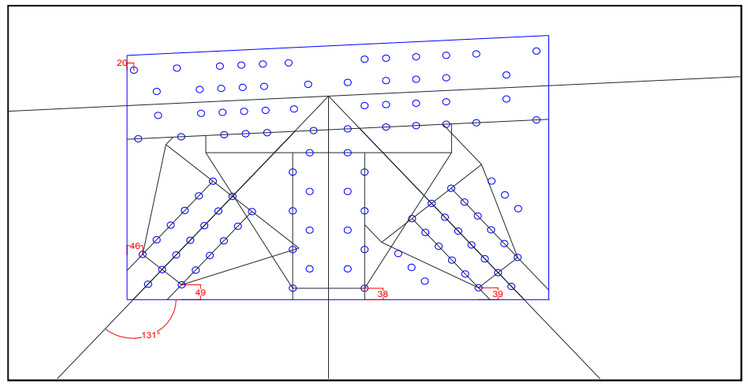
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	503	2235
Compressive Resistance at Member C	724	3218
Compressive Resistance at Member D	315	1400
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	990	4400
Governing Resistance at Member B	709	3152
Governing Resistance at Member C	597	2655
Governing Resistance at Member D	672	2986
Governing Resistance at Member E	990	4400

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
	SHEAR PLANE A'-A'	672	2985	**0.338**	
	SHEAR PLANE B'-B'	621	2759	**0.256**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	559	2485	**0.246**	
	Member C	781	3471	**0.179**	
	Member D	420	1867	**0.028**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	503	2235	**0.166**	
	Member C	724	3218	**0.000**	
	Member D	315	1400	**0.641**	<--- Governing
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	990	4400	**0.267**	
	Member B	709	3152	**0.194**	
	Member C	597	2655	**0.233**	
	Member D	672	2986	**0.301**	
	Member E	990	4400	**0.267**	
	Highest Demand/Capacity Ratio			**0.641**	

Span: Bascule Bridge - Leaf Span
Node: 5S

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.47 in	12 mm	6% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units			
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6	
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa			

MEMBER FORCES

Load Combination: D1, D2, CL1-625 Max

				Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
5S-A	P_{Max} =	34.1 kip	151 kN	5S-A	491	151	151	151	151
5S-A	P_{Min} =	-280.4 kip	-1246 kN	5S-A	491	-1246	-1246	-1246	-1246
5S-B	P_{Max} =	136.4 kip	606 kN	5S-B	183	606	603	599	606
5S-B	P_{Min} =	-84.5 kip	-376 kN	5S-B	183	-369	-372	-376	-376
5S-C	P_{Max} =	143.5 kip	638 kN	5S-C	325	637	637	638	638
5S-C	P_{Min} =	19.1 kip	85 kN	5S-C	325	85	86	86	85
5S-D	P_{Max} =	8.5 kip	38 kN	5S-D	184	38	34	31	38
5S-D	P_{Min} =	-205.3 kip	-912 kN	5S-D	184	-905	-909	-912	-912
5S-E	P_{Max} =	146.8 kip	652 kN	5S-E	490	652	652	652	652
5S-E	P_{Min} =	-225.3 kip	-1001 kN	5S-E	490	-1001	-1001	-1001	-1001

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 5S

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		134	deg	B
	φ_C =		93	deg	C
	φ_D =		52	deg	D
	$\cos(\varphi_B)$ =		-0.695		
	$\cos(\varphi_C)$ =		-0.052		
	$\cos(\varphi_D)$ =		0.616		
	$V_{A'-A',max}$ =	63.0 kip	280	kN	*
	$V_{A'-A',min}$ =	-228.6 kip	-1016	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	228.6 kip	1016	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	161.8 kip	719	kN	

*using absolute maximum sums, conservative

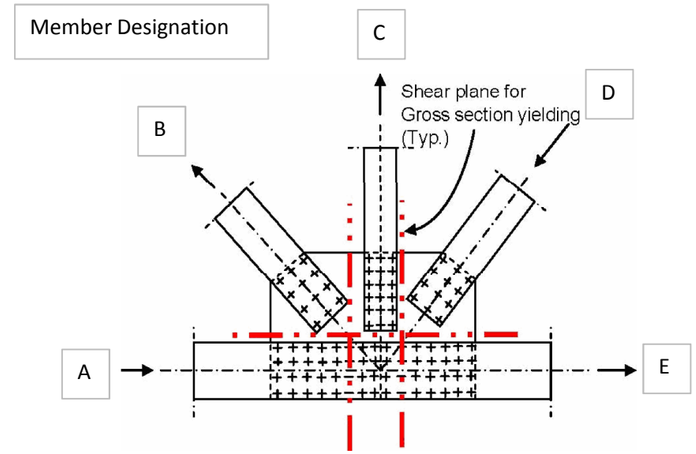


Figure 4 – Examples of gross section shear yielding planes

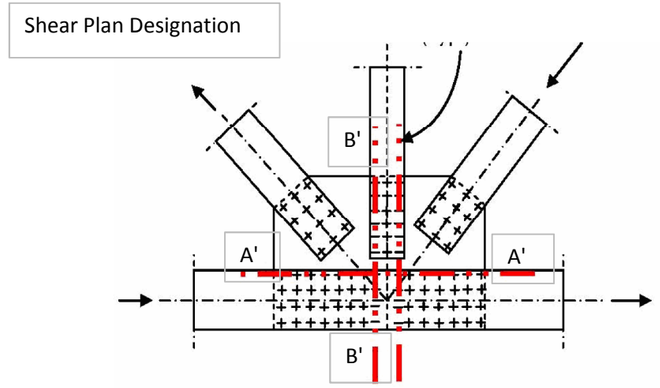


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	49.09	in	1247	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			29928	mm^2	
Net Shear Area	A_n =			23995	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2985	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =			4031	kN	
Shear Resistance (Governing)	V_R =			**2985**	**kN**	
Demand/Capacity	D/C =			**0.340**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	32.68	in	830	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 5S

Members A and E continuous through the gusset plate?				Yes		
Outside height of member A	H_A=	15	in	381	mm	
Thickness of the web of member A	w_A=	0.40	in	10	mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4	ea	
Gross Shear Area	A_g =			27662	mm^2	
Net Shear Area	A_n =			20055	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2759	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =			3369	kN	
Shear Resistance (Governing)	V_R =			**2759**	**kN**	
Demand/Capacity	D/C =			**0.261**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E — N/A

Members A and E continuous through the gusset plate? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	0.00	in	0	mm	0	
Shear Length 1	L_{V1} =	0.00	in	0	mm	0	
Shear Length 2	L_{V2} =	0.00	in	0	mm	0	
Tension Length	L_T =	0.00	in	0	mm	0	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =			$\varphi_s*A_g*F_y$		
				0	kN	
Net Section Resistance	P_{RN} =			$\varphi_u*A_n*F_u$		
For gusset plates, U=1.0, FHWA 3.1.2				0	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =			0	mm^2
Gross Shear Area	A_{vg} =			0	mm^2
Net Tension Area	A_{tn} =			0	mm^2
Net Shear Area	A_{vn} =			0	mm^2
$A_{tn} > 0.58*A_{vn}$?				Yes	

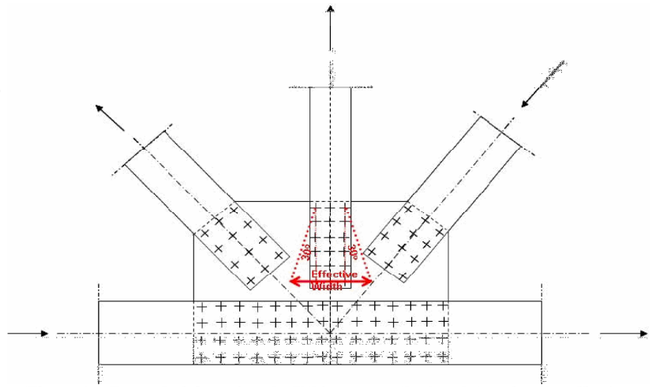


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

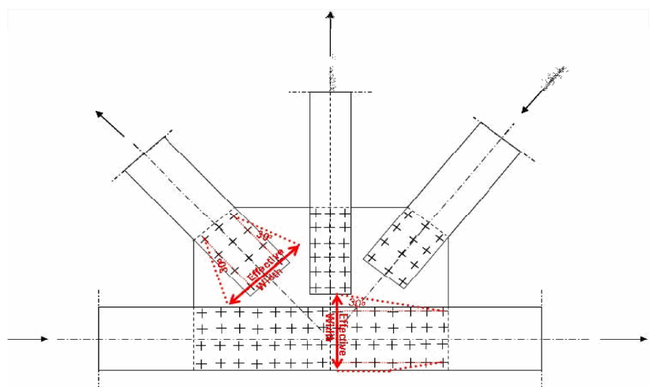


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 5S

				$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =			0 kN		FHWA 3.1.3
Tension Resistance (Governing)				0 kN		
Demand/Capacity	D/C =			**0.000**		

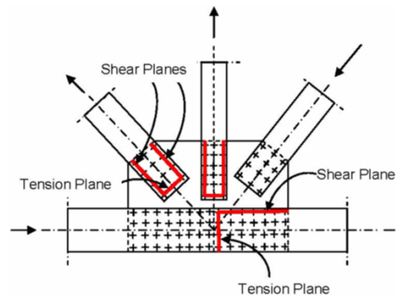


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00	in	0	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	0.00	in	0	mm	
L3	L_3 =	0.00	in	0	mm	
Unsupported Column Length	L_u =	0.00	in	0	mm	
Effective Length Factor	K =	0.00		0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
				0.00		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
				0 kN		
Demand/Capacity	D/C =			**0.000**		

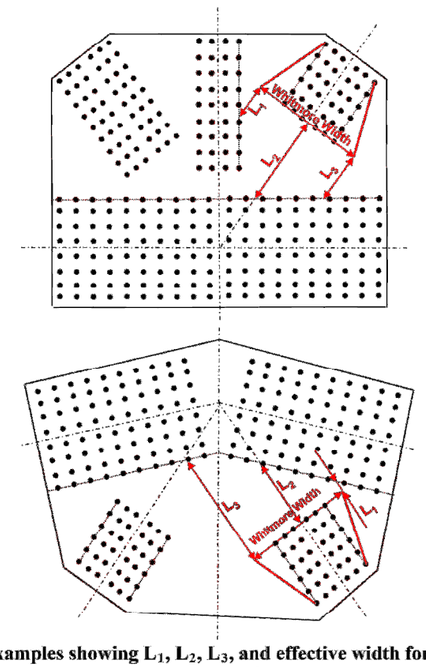


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	48	ea	48	ea		
Longest Length of connection	L=	49.09	in	1247	mm		
Edge distance	e =	0.79	in	20	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$			CSA S6 CL14.14.1.4.2
	B_{r1} =	729	kip	3242	kN		
	B_{r2} =	2084	kip	9263	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$			CSA S6 CL14.14.1.4.2
		495	kip	2200	kN		
Governing Resistance				4400	kN	for 2 plate(s)	

Span: Bascule Bridge - Leaf Span
Node: 5S

Demand/Capacity	D/C =		**0.283**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.					FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored?			Yes		
General					Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	20.43 in	519 mm		3
Shear Length 1	L_{V1} =	15.04 in	382 mm		5.5
Shear Length 2	L_{V2} =	15.28 in	388 mm		5.5
Tension Length	L_T =	5.98 in	152 mm		2
Number of Gusset Plates	m =	2 ea	2 ea		
Diameter of holes in plane	d_b =	0.81 in	21 mm		($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$U*\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
			2485	kN	
Net Section Resistance	P_{RN} =		$U*\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2			3687	kN	

Block Shear

Gross Tension Area	A_{tg} =		1824	mm^2
Gross Shear Area	A_{vg} =		9240	mm^2
Net Tension Area	A_{tn} =		1330	mm^2
Net Shear Area	A_{vn} =		6521	mm^2
$A_{tn} \geq 0.58*A_{vn}$?			No	

			$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		3154	kN	FHWA 3.1.3
Tension Resistance (Governing)			2485	kN	
Demand/Capacity	D/C =		**0.244**		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored?			Yes		
General					FHWA 3.3
Whitmore Width	W_w =	20.43 in	519 mm		

Span: Bascule Bridge - Leaf Span
Node: 5S

L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	11.10	in	282	mm	
L3	L_3 =	1.30	in	33	mm	
Unsupported Column Length	L_u =	4.13	in	105	mm	
Effective Length Factor	K =	1.20		1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			$t/\sqrt{(12)}$		for rectangular plate
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.38		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		U=1.0
				2235	kN	
Demand/Capacity	D/C =			**0.168**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	19	ea	19	ea	
Longest Length of connection	L=	17.64	in	448	mm	
Edge distance	e =	1.81	in	46	mm	
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")
Shear Planes per gusset plate	m =	1	ea	1	ea	
Number of Gusset Plates		2.00	ea	2	ea	
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$		U=1.0 CSA S6 CL14.14.1.4.2
	B_{r1} =	664	kip	2951	kN	
	B_{r2} =	825	kip	3667	kN	
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$		U=1.81 CSA S6 CL14.14.1.4.2
		355	kip	1576	kN	
Governing Resistance				3152	kN	for 2 plate(s)
Demand/Capacity	D/C =			**0.192**		

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	28.54	in	725	mm	2	
Shear Length 1	L_{V1} =	19.02	in	483	mm	7.5	
Shear Length 2	L_{V2} =	19.02	in	483	mm	7.5	
Tension Length	L_T =	8.35	in	212	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 5S

Number of Gusset Plates	m =	2.00 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			3471	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			5514	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		2544	mm^2	
Gross Shear Area	A_{vg} =		11592	mm^2	
Net Tension Area	A_{tn} =		2297	mm^2	
Net Shear Area	A_{vn} =		7884	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		3928	kN	FHWA 3.1.3
Tension Resistance (Governing)			3471	kN	
Demand/Capacity	D/C =		**0.184**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	28.54 in	725	mm	
L1	L_1 =	2.20 in	56	mm	
L2 - along centreline of action	L_2 =	2.95 in	75	mm	
L3	L_3 =	3.74 in	95	mm	
Unsupported Column Length	L_u =	2.97 in	75	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.27		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			3218	kN	

Span: Bascule Bridge - Leaf Span
Node: 5S

Demand/Capacity	D/C =			**0.000**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea		
Longest Length of connection	L=	19.02	in	483	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	462	kip	2053	kN		
	B_{r2} =	695	kip	3088	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		299	kip	1327	kN		
Governing Resistance				2655	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.240**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	15.35	in	390	mm	3	
Shear Length 1	L_{V1} =	17.36	in	441	mm	5.5	
Shear Length 2	L_{V2} =	13.86	in	352	mm	5.5	
Tension Length	L_T =	5.98	in	152	mm	2	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		1867	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		2647	kN		

Block Shear

Gross Tension Area	A_{tg} =	1824	mm^2

Span: Bascule Bridge - Leaf Span

Node: 5S

Gross Shear Area	A_{vg} =		9516	mm^2	
Net Tension Area	A_{tn} =		1330	mm^2	
Net Shear Area	A_{vn} =		6797	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0		
Block Shear Resistance	P_{Rbs} =		3262	kN	FHWA 3.1.3
Tension Resistance (Governing)			1867	kN	
Demand/Capacity	D/C =		**0.020**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?			Yes		
General					FHWA 3.3
Whitmore Width	W_w =	15.35 in	390	mm	
L1	L_1 =	3.03 in	77	mm	
L2 - along centreline of action	L_2 =	12.83 in	326	mm	
L3	L_3 =	6.89 in	175	mm	
Unsupported Column Length	L_u =	7.59 in	193	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.69		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			1400	kN	
Demand/Capacity	D/C =		**0.652**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	18 ea	18	ea		
Longest Length of connection	L=	16.46 in	418	mm		
Edge distance	e =	1.54 in	39	mm		
Diameter of Rivet	d =	0.75 in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1	ea		
Number of Gusset Plates		2.00 ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	533 kip	2371	kN		
	B_{r2} =	782 kip	3474	kN		

Span: Bascule Bridge - Leaf Span
Node: 5S

Shear Resistance of Rivets V_r = $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 CSA S6 CL14.14.1.4.2

336 kip 1493 kN

Governing Resistance 2986 kN for 2 plate(s)

Demand/Capacity D/C = **0.306**

For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	672	2985
Shear Resistance (Net Section)	907	4031
Shear Resistance (Governing)	672	2985
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	621	2759
Shear Resistance (Net Section)	758	3369
Shear Resistance (Governing)	621	2759
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	559	2485
Net Section Resistance	830	3687
Block Shear Resistance	710	3154
Tension Resistance (Governing)	559	2485
At Member C:		
Gross Section Resistance	781	3471
Net Section Resistance	1241	5514
Block Shear Resistance	884	3928
Tension Resistance (Governing)	781	3471
At Member D:		
Gross Section Resistance	420	1867
Net Section Resistance	595	2647
Block Shear Resistance	734	3262
Tension Resistance (Governing)	420	1867
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 5S

Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A

GUSSET PLATE COMPRESSION

Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	503	2235
Compressive Resistance at Member C	724	3218
Compressive Resistance at Member D	315	1400
Compressive Resistance at Member E	N/A	N/A

RIVETS SHEAR AND GUSSET PLATE BEARING

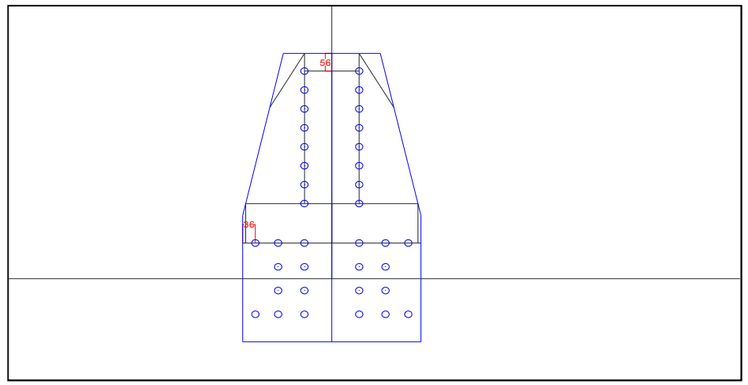
Governing Resistance at Member A	990	4400
Governing Resistance at Member B	709	3152
Governing Resistance at Member C	597	2655
Governing Resistance at Member D	672	2986
Governing Resistance at Member E	990	4400

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
	SHEAR PLANE A'-A'	672	2985	**0.340**	
	SHEAR PLANE B'-B'	621	2759	**0.261**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	559	2485	**0.244**	
	Member C	781	3471	**0.184**	
	Member D	420	1867	**0.020**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	503	2235	**0.168**	
	Member C	724	3218	**0.000**	
	Member D	315	1400	**0.652**	<--- Governing
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	990	4400	**0.283**	
	Member B	709	3152	**0.192**	
	Member C	597	2655	**0.240**	
	Member D	672	2986	**0.306**	
	Member E	990	4400	**0.283**	
	Highest Demand/Capacity Ratio			**0.652**	

Span: Bascule Bridge - Leaf Span
Node: 6N

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.28 in	7 mm	45% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units			
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6	
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa			

MEMBER FORCES

Load Combination:		D1, D2, CL1-625 Max		Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
6N-A	P_{Max} =	260.3 kip	1157 kN	6N-A	281	1157	1157	1157	1157
6N-A	P_{Min} =	-87.7 kip	-390 kN	6N-A	281	-390	-390	-390	-390
6N-B	P_{Max} =	0.0 kip	0 kN	6N-B	0	#N/A	#N/A	#N/A	#N/A
6N-B	P_{Min} =	0.0 kip	0 kN	6N-B	0	#N/A	#N/A	#N/A	#N/A
6N-C	P_{Max} =	139.1 kip	618 kN	6N-C	320	614	616	618	618
6N-C	P_{Min} =	14.4 kip	64 kN	6N-C	320	64	66	68	64
6N-D	P_{Max} =	0.0 kip	0 kN	6N-D	0	#N/A	#N/A	#N/A	#N/A
6N-D	P_{Min} =	0.0 kip	0 kN	6N-D	0	#N/A	#N/A	#N/A	#N/A
6N-E	P_{Max} =	258.8 kip	1150 kN	6N-E	282	1150	1150	1150	1150
6N-E	P_{Min} =	-80.5 kip	-358 kN	6N-E	282	-358	-358	-358	-358

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 6N

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		128	deg	B
	φ_C =		90	deg	C
	φ_D =		54	deg	D
	$\cos(\varphi_B)$ =		-0.616		
	$\cos(\varphi_C)$ =		0.000		
	$\cos(\varphi_D)$ =		0.588		
	$V_{A'-A',max}$ =	0.0 kip	0	kN	*
	$V_{A'-A',min}$ =	0.0 kip	0	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	0.0 kip	0	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	0.0 kip	0	kN	

*using absolute maximum sums, conservative

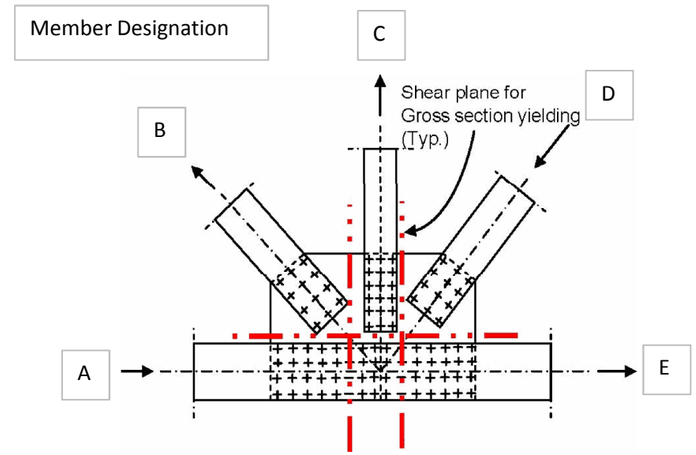


Figure 4 – Examples of gross section shear yielding planes

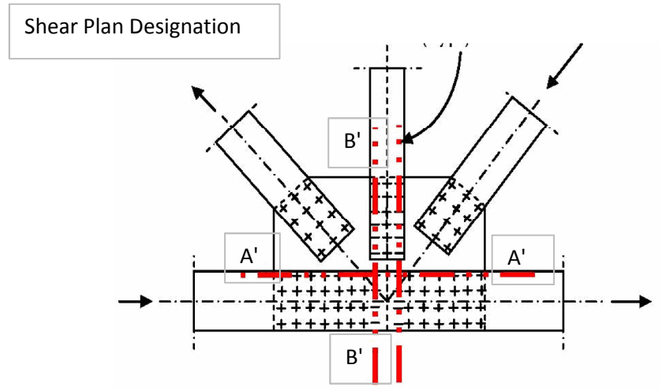


Figure 5 – Examples of net section shear fracture planes

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	20.00	in	508	mm	
No of holes in shear plane	N =	6.00	ea	6	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			7112	mm^2	
Net Shear Area	A_n =			5382	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			709	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =			904	kN	
Shear Resistance (Governing)	V_R =			**709**	**kN**	
Demand/Capacity	D/C =			**0.000**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

FHWA, Figures 4 and 5

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	35.98	in	914	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 6N

Members A and E continuous through the gusset plate?				Yes		
Outside height of member A	H_A=	15	in	381	mm	
Thickness of the web of member A	w_A=	0.40	in	10	mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4	ea	
Gross Shear Area	A_g =			20538	mm^2	
Net Shear Area	A_n =			15403	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2049	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =			2588	kN	
Shear Resistance (Governing)	V_R =			**2049**	**kN**	
Demand/Capacity	D/C =			**0.000**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E

N/A

Members A and E continuous through the gusset plate? Yes

General

Whitmore Width	W_w =	0.00	in	0	mm	
Shear Length 1	L_{V1} =	0.00	in	0	mm	
Shear Length 2	L_{V2} =	0.00	in	0	mm	
Tension Length	L_T =	0.00	in	0	mm	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Number of Rivet/bolt diameters Intsecting Plane

0	
0	
0	
0	Typ, 1 less than Whitemore Width

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	
		0	kN
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	
For gusset plates, U=1.0, FHWA 3.1.2		0	kN

FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

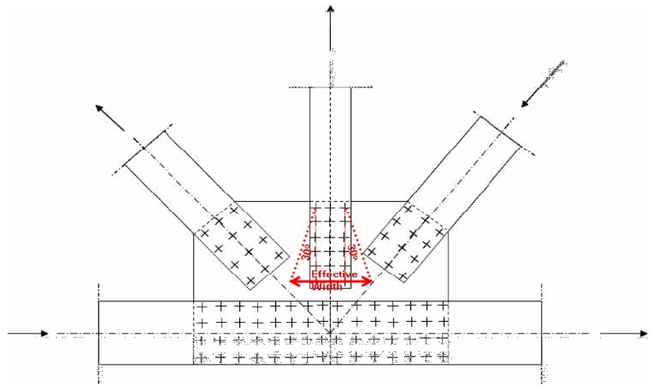


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

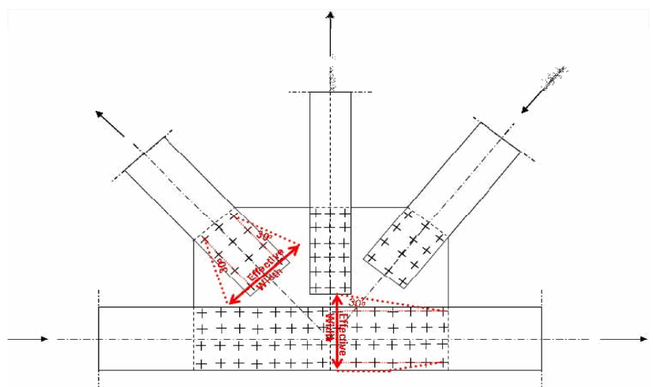


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 6N

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

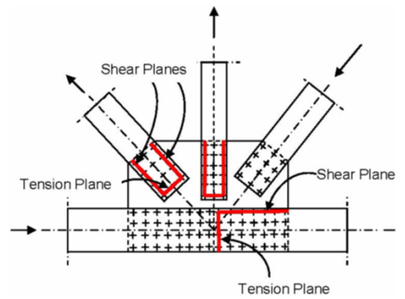


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.08 in	2.02 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

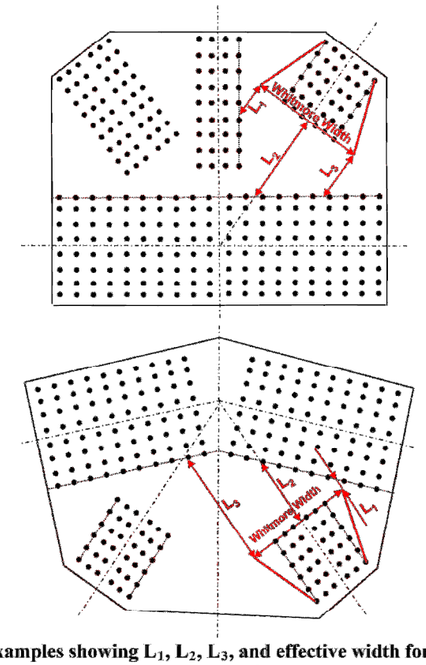


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	20 ea	20 ea			
Longest Length of connection	L=	20.00 in	508 mm			
Edge distance	e =	1.42 in	36 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$			CSA S6 CL14.14.1.4.2
	B_{r1} =	319 kip	1418 kN			
	B_{r2} =	507 kip	2251 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$			CSA S6 CL14.14.1.4.2
		206 kip	917 kN			
Governing Resistance			1833 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span
Node: 6N

Demand/Capacity	D/C =	**0.631**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored?				Yes		
General						Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	21.81	in	554	mm	3
Shear Length 1	L_{V1} =	13.11	in	333	mm	4.5
Shear Length 2	L_{V2} =	11.38	in	289	mm	4.5
Tension Length	L_T =	14.33	in	364	mm	4
Number of Gusset Plates	m =	2	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		1547	kN		
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		2315	kN		

Block Shear

Gross Tension Area	A_{tg} =	2548	mm^2	
Gross Shear Area	A_{vg} =	4354	mm^2	
Net Tension Area	A_{tn} =	1971	mm^2	
Net Shear Area	A_{vn} =	3056	mm^2	
$A_{tn} \geq 0.58*A_{vn}$?		Yes		
	$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		U=1.0	
Block Shear Resistance	P_{Rbs} =	2173	kN	FHWA 3.1.3
Tension Resistance (Governing)		1547	kN	
Demand/Capacity	D/C =	**0.000**		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored?				Yes		
General						FHWA 3.3
Whitmore Width	W_w =	21.81	in	554	mm	

Span: Bascule Bridge - Leaf Span

Node: 6N

L1	L_1 =	0.79	in	20	mm	
L2 - along centreline of action	L_2 =	13.54	in	344	mm	
L3	L_3 =	4.88	in	124	mm	
Unsupported Column Length	L_u =	6.40	in	163	mm	
Effective Length Factor	K =	1.20		1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)		for rectangular plate
		0.08	in	2.02	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				1.00		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				877	kN	
Demand/Capacity	D/C =			**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22	ea	22	ea	
Longest Length of connection	L=	18.94	in	481	mm	
Edge distance	e =	1.50	in	38	mm	
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")
Shear Planes per gusset plate	m =	1	ea	1	ea	
Number of Gusset Plates		2.00	ea	2	ea	
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0	CSA S6 CL14.14.1.4.2
	B_{r1} =	371	kip	1647	kN	
	B_{r2} =	557	kip	2477	kN	
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81	CSA S6 CL14.14.1.4.2
		411	kip	1825	kN	
Governing Resistance				3294	kN	for 2 plate(s)
Demand/Capacity	D/C =			**0.000**		

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	19.29	in	490	mm	2	
Shear Length 1	L_{V1} =	18.74	in	476	mm	7.5	
Shear Length 2	L_{V2} =	18.74	in	476	mm	7.5	
Tension Length	L_T =	6.14	in	156	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 6N

Number of Gusset Plates	m =	2.00	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =			$\varphi_s*A_g*F_y$	U=1.0	
				1369	kN	
Net Section Resistance	P_{RN} =			$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2				2111	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =			1092	mm^2	
Gross Shear Area	A_{vg} =			6664	mm^2	
Net Tension Area	A_{tn} =			948	mm^2	
Net Shear Area	A_{vn} =			4501	mm^2	
$A_{tn} > 0.58*A_{vn}$?				No		
				$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =			2121	kN	FHWA 3.1.3
Tension Resistance (Governing)				1369	kN	
Demand/Capacity	D/C =			**0.452**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	19.29	in	490	mm	
L1	L_1 =	4.92	in	125	mm	
L2 - along centreline of action	L_2 =	4.92	in	125	mm	
L3	L_3 =	4.92	in	125	mm	
Unsupported Column Length	L_u =	4.92	in	125	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			$t/\sqrt{(12)}$	for rectangular plate	
		0.08	in	2.02	mm	
	λ =			$(K*L_u/r)*\mathrm{sqrt}[F_y/(\pi^2*E_s)]$		
				0.77		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				963	kN	

Span: Bascule Bridge - Leaf Span
Node: 6N

Demand/Capacity	D/C =			**0.000**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea		
Longest Length of connection	L=	18.74	in	476	mm		
Edge distance	e =	2.20	in	56	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	397	kip	1765	kN		
	B_{r2} =	405	kip	1801	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		299	kip	1327	kN		
Governing Resistance				2655	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.233**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	24.41	in	620	mm	5	
Shear Length 1	L_{V1} =	10.87	in	276	mm	3.5	
Shear Length 2	L_{V2} =	14.25	in	362	mm	4.5	
Tension Length	L_T =	15.55	in	395	mm	5	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
		1732	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		2432	kN	

Block Shear

Gross Tension Area	A_{tg} =	2765	mm^2

Span: Bascule Bridge - Leaf Span

Node: 6N

Gross Shear Area	A_{vg} =	4466	mm^2	
Net Tension Area	A_{tn} =	2044	mm^2	
Net Shear Area	A_{vn} =	3312	mm^2	
$A_{tn} > 0.58*A_{vn}$?		Yes		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =	2244	kN	FHWA 3.1.3
Tension Resistance (Governing)		1732	kN	
Demand/Capacity	D/C =	**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?				Yes		
General						FHWA 3.3
Whitmore Width	W_w =	24.41	in	620	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	13.15	in	334	mm	
L3	L_3 =	4.21	in	107	mm	
Unsupported Column Length	L_u =	5.79	in	147	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.08	in	2.02	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.90		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				1078	kN	
Demand/Capacity	D/C =			**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	25	ea	25	ea		
Longest Length of connection	L=	19.37	in	492	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	421	kip	1871	kN		
	B_{r2} =	633	kip	2814	kN		

Span: Bascule Bridge - Leaf Span
Node: 6N

Shear Resistance of Rivets V_r = $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 CSA S6 CL14.14.1.4.2

467 kip 2074 kN

Governing Resistance 3743 kN for 2 plate(s)

Demand/Capacity D/C = **0.000**

For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	160	709
Shear Resistance (Net Section)	203	904
Shear Resistance (Governing)	160	709
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	461	2049
Shear Resistance (Net Section)	582	2588
Shear Resistance (Governing)	461	2049
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	348	1547
Net Section Resistance	521	2315
Block Shear Resistance	489	2173
Tension Resistance (Governing)	348	1547
At Member C:		
Gross Section Resistance	308	1369
Net Section Resistance	475	2111
Block Shear Resistance	477	2121
Tension Resistance (Governing)	308	1369
At Member D:		
Gross Section Resistance	390	1732
Net Section Resistance	547	2432
Block Shear Resistance	505	2244
Tension Resistance (Governing)	390	1732
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 6N

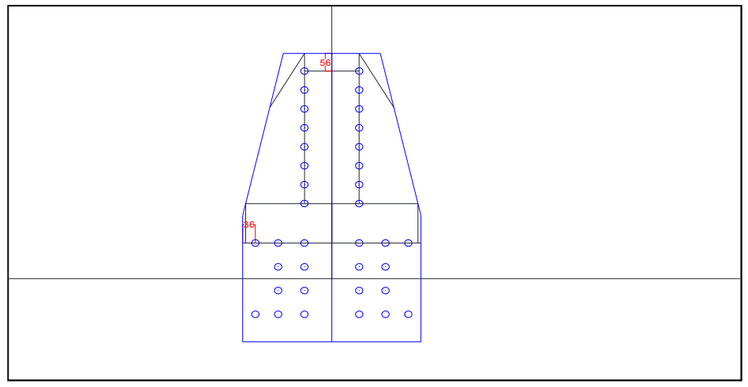
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	197	877
Compressive Resistance at Member C	217	963
Compressive Resistance at Member D	243	1078
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	412	1833
Governing Resistance at Member B	741	3294
Governing Resistance at Member C	597	2655
Governing Resistance at Member D	842	3743
Governing Resistance at Member E	412	1833

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
SHEAR PLANE A'-A'		160	709	**0.000**	
SHEAR PLANE B'-B'		461	2049	**0.000**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	348	1547	**0.000**	
	Member C	308	1369	**0.452**	
	Member D	390	1732	**0.000**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	197	877	**0.000**	
	Member C	217	963	**0.000**	
	Member D	243	1078	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	412	1833	**0.631**	<--- Governing
	Member B	741	3294	**0.000**	
	Member C	597	2655	**0.233**	
	Member D	842	3743	**0.000**	
	Member E	412	1833	**0.631**	<--- Governing
Highest Demand/Capacity Ratio				**0.631**	

Span: Bascule Bridge - Leaf Span
Node: 6S

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.28 in	7 mm	45% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units			
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6	
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa			

MEMBER FORCES

Load Combination: D1, D2, CL1-625 Max

				Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
6S-A	P_{Max} =	276.1 kip	1227 kN	6S-A	561	1227	1227	1227	1227
6S-A	P_{Min} =	-72.3 kip	-321 kN	6S-A	561	-321	-321	-321	-321
6S-B	P_{Max} =	0.0 kip	0 kN	6S-B	0	#N/A	#N/A	#N/A	#N/A
6S-B	P_{Min} =	0.0 kip	0 kN	6S-B	0	#N/A	#N/A	#N/A	#N/A
6S-C	P_{Max} =	143.8 kip	639 kN	6S-C	324	635	637	639	639
6S-C	P_{Min} =	18.7 kip	83 kN	6S-C	324	83	85	88	83
6S-D	P_{Max} =	0.0 kip	0 kN	6S-D	0	#N/A	#N/A	#N/A	#N/A
6S-D	P_{Min} =	0.0 kip	0 kN	6S-D	0	#N/A	#N/A	#N/A	#N/A
6S-E	P_{Max} =	275.6 kip	1225 kN	6S-E	562	1225	1225	1225	1225
6S-E	P_{Min} =	-63.9 kip	-284 kN	6S-E	562	-284	-284	-284	-284

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 6S

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		128	deg	B
	φ_C =		90	deg	C
	φ_D =		54	deg	D
	$\cos(\varphi_B)$ =		-0.616		
	$\cos(\varphi_C)$ =		0.000		
	$\cos(\varphi_D)$ =		0.588		
	$V_{A'-A',max}$ =	0.0 kip	0	kN	*
	$V_{A'-A',min}$ =	0.0 kip	0	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	0.0 kip	0	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	0.0 kip	0	kN

*using absolute maximum sums, conservative

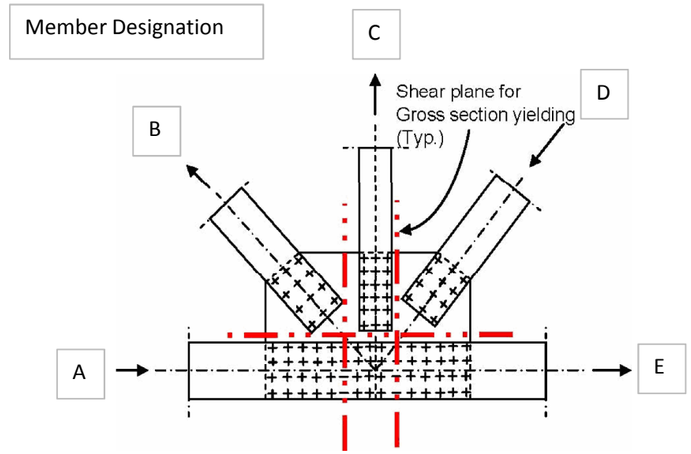


Figure 4 – Examples of gross section shear yielding planes

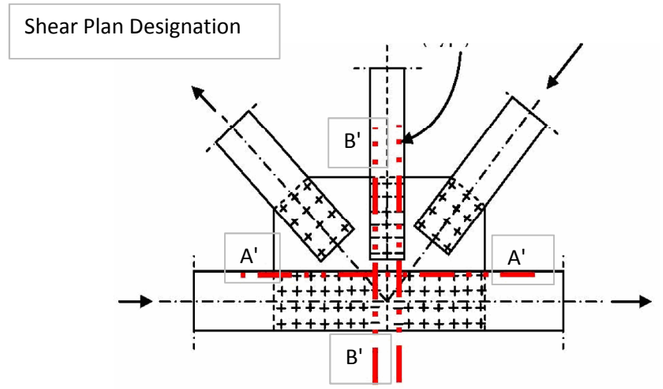


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	20.00	in	508	mm	
No of holes in shear plane	N =	6.00	ea	6	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			7112	mm^2	
Net Shear Area	A_n =			5382	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			709	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =			904	kN	
Shear Resistance (Governing)	V_R =			**709**	**kN**	
Demand/Capacity	D/C =			**0.000**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	35.98	in	914	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 6S

Members A and E continuous through the gusset plate?				Yes		
Outside height of member A	H_A=	15	in	381	mm	
Thickness of the web of member A	w_A=	0.40	in	10	mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4	ea	
Gross Shear Area	A_g =			20538	mm^2	
Net Shear Area	A_n =			15403	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2049	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =			2588	kN	
Shear Resistance (Governing)	V_R =			**2049**	**kN**	
Demand/Capacity	D/C =			**0.000**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E

N/A

Members A and E continuous through the gusset plate? Yes

General

Whitmore Width	W_w =	0.00	in	0	mm	Number of Rivet/bolt diameters Intsecting Plane
Shear Length 1	L_{V1} =	0.00	in	0	mm	0
Shear Length 2	L_{V2} =	0.00	in	0	mm	0
Tension Length	L_T =	0.00	in	0	mm	0
Number of Gusset Plates	m =	2.00	ea	2	ea	0 Typ, 1 less than Whitemore Width
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance

CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	
			0	kN
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	
For gusset plates, U=1.0, FHWA 3.1.2			0	kN

FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

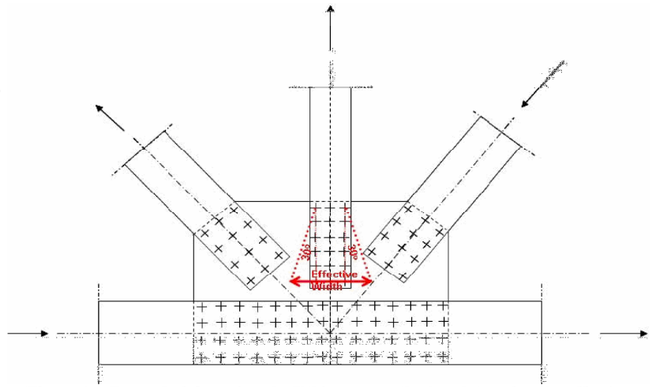


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

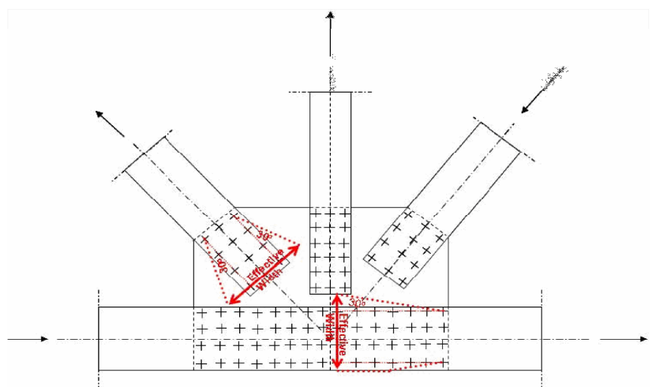


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 6S

				$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =			0 kN		FHWA 3.1.3
Tension Resistance (Governing)				0 kN		
Demand/Capacity	D/C =			**0.000**		

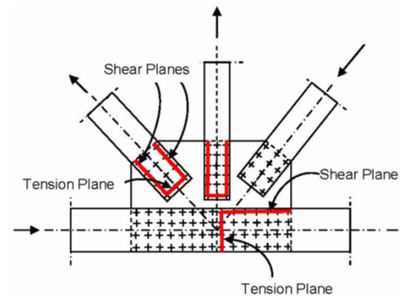


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00	in	0	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	0.00	in	0	mm	
L3	L_3 =	0.00	in	0	mm	
Unsupported Column Length	L_u =	0.00	in	0	mm	
Effective Length Factor	K =	0.00		0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.08	in	2.02	mm	
	λ =			$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
				0.00		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
				0 kN		
Demand/Capacity	D/C =			**0.000**		

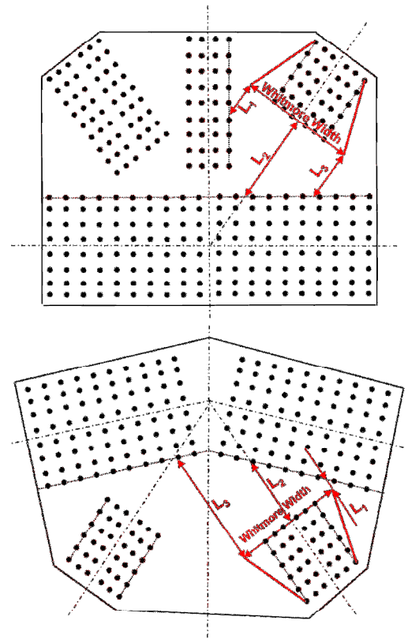


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	20	ea	20	ea		
Longest Length of connection	L=	20.00	in	508	mm		
Edge distance	e =	1.42	in	36	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$			CSA S6 CL14.14.1.4.2
	B_{r1} =	319	kip	1418	kN		
	B_{r2} =	507	kip	2251	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$			CSA S6 CL14.14.1.4.2
		206	kip	917	kN		
Governing Resistance				1833	kN	for 2 plate(s)	

Span: Bascule Bridge - Leaf Span
Node: 6S

Demand/Capacity	D/C =	**0.669**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored?				Yes		
General						Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	21.81	in	554 mm		3
Shear Length 1	L_{V1} =	13.11	in	333 mm		4.5
Shear Length 2	L_{V2} =	11.38	in	289 mm		4.5
Tension Length	L_T =	14.33	in	364 mm		4
Number of Gusset Plates	m =	2	ea	2 ea		
Diameter of holes in plane	d_b =	0.81	in	21 mm		($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$ U=1.0	1547 kN	FHWA 3.1.2
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$ U=1.0	2315 kN	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2				

Block Shear

Gross Tension Area	A_{tg} =	2548	mm^2
Gross Shear Area	A_{vg} =	4354	mm^2
Net Tension Area	A_{tn} =	1971	mm^2
Net Shear Area	A_{vn} =	3056	mm^2
$A_{tn} \geq 0.58*A_{vn}$?		Yes	

		$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$ U=1.0		
Block Shear Resistance	P_{Rbs} =		2173 kN	FHWA 3.1.3
Tension Resistance (Governing)			1547 kN	
Demand/Capacity	D/C =		**0.000**	

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored?			Yes		
General					FHWA 3.3
Whitmore Width	W_w =	21.81	in	554 mm	

Span: Bascule Bridge - Leaf Span
Node: 6S

L1	L_1 =	0.79 in	20 mm		
L2 - along centreline of action	L_2 =	13.54 in	344 mm		
L3	L_3 =	4.88 in	124 mm		
Unsupported Column Length	L_u =	6.40 in	163 mm		
Effective Length Factor	K =	1.20	1.2 "fixed-free condition"		
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		t/√(12) for rectangular plate		
		0.08 in	2.02 mm		
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			1.00		
Compressive Resistance	C_r =		$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$ U=1.0		
			877 kN		
Demand/Capacity	D/C =		**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22 ea	22 ea		
Longest Length of connection	L=	18.94 in	481 mm		
Edge distance	e =	1.50 in	38 mm		
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1 ea		
Number of Gusset Plates		2.00 ea	2 ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$ U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	371 kip	1647 kN		
	B_{r2} =	557 kip	2477 kN		
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$ U=1.81		CSA S6 CL14.14.1.4.2
		411 kip	1825 kN		
Governing Resistance			3294 kN	for 2 plate(s)	
Demand/Capacity	D/C =		**0.000**		

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

					Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	19.29 in	490 mm		2	
Shear Length 1	L_{V1} =	18.74 in	476 mm		7.5	
Shear Length 2	L_{V2} =	18.74 in	476 mm		7.5	
Tension Length	L_T =	6.14 in	156 mm		1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 6S

Number of Gusset Plates	m =	2.00 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			1369	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			2111	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		1092	mm^2	
Gross Shear Area	A_{vg} =		6664	mm^2	
Net Tension Area	A_{tn} =		948	mm^2	
Net Shear Area	A_{vn} =		4501	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		2121	kN	FHWA 3.1.3
Tension Resistance (Governing)			1369	kN	
Demand/Capacity	D/C =		**0.467**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored?			N/A		
General					FHWA 3.3
Whitmore Width	W_w =	19.29 in	490	mm	
L1	L_1 =	4.92 in	125	mm	
L2 - along centreline of action	L_2 =	4.92 in	125	mm	
L3	L_3 =	4.92 in	125	mm	
Unsupported Column Length	L_u =	4.92 in	125	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.08 in	2.02	mm	
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.77		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			963	kN	

Span: Bascule Bridge - Leaf Span
Node: 6S

Demand/Capacity	D/C =			**0.000**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea		
Longest Length of connection	L=	18.74	in	476	mm		
Edge distance	e =	2.20	in	56	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	397	kip	1765	kN		
	B_{r2} =	405	kip	1801	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		299	kip	1327	kN		
Governing Resistance				2655	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.241**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	24.41	in	620	mm	5	
Shear Length 1	L_{V1} =	10.87	in	276	mm	3.5	
Shear Length 2	L_{V2} =	14.25	in	362	mm	4.5	
Tension Length	L_T =	15.55	in	395	mm	5	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
		1732	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		2432	kN	

Block Shear

Gross Tension Area	A_{tg} =	2765	mm^2

Span: Bascule Bridge - Leaf Span

Node: 6S

Gross Shear Area	A_{vg} =	4466	mm^2	
Net Tension Area	A_{tn} =	2044	mm^2	
Net Shear Area	A_{vn} =	3312	mm^2	
$A_{tn} > 0.58*A_{vn}$?		Yes		
	$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0		
Block Shear Resistance	P_{Rbs} =	2244	kN	FHWA 3.1.3
Tension Resistance (Governing)		1732	kN	
Demand/Capacity	D/C =	**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?				Yes		
General						FHWA 3.3
Whitmore Width	W_w =	24.41	in	620	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	13.15	in	334	mm	
L3	L_3 =	4.21	in	107	mm	
Unsupported Column Length	L_u =	5.79	in	147	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.08	in	2.02	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.90		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				1078	kN	
Demand/Capacity	D/C =			**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	25	ea	25	ea		
Longest Length of connection	L=	19.37	in	492	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	421	kip	1871	kN		
	B_{r2} =	633	kip	2814	kN		

Span: Bascule Bridge - Leaf Span
Node: 6S

Shear Resistance of Rivets V_r = $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 CSA S6 CL14.14.1.4.2

467 kip 2074 kN

Governing Resistance 3743 kN for 2 plate(s)

Demand/Capacity D/C = **0.000**

For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	160	709
Shear Resistance (Net Section)	203	904
Shear Resistance (Governing)	160	709
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	461	2049
Shear Resistance (Net Section)	582	2588
Shear Resistance (Governing)	461	2049
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	348	1547
Net Section Resistance	521	2315
Block Shear Resistance	489	2173
Tension Resistance (Governing)	348	1547
At Member C:		
Gross Section Resistance	308	1369
Net Section Resistance	475	2111
Block Shear Resistance	477	2121
Tension Resistance (Governing)	308	1369
At Member D:		
Gross Section Resistance	390	1732
Net Section Resistance	547	2432
Block Shear Resistance	505	2244
Tension Resistance (Governing)	390	1732
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 6S

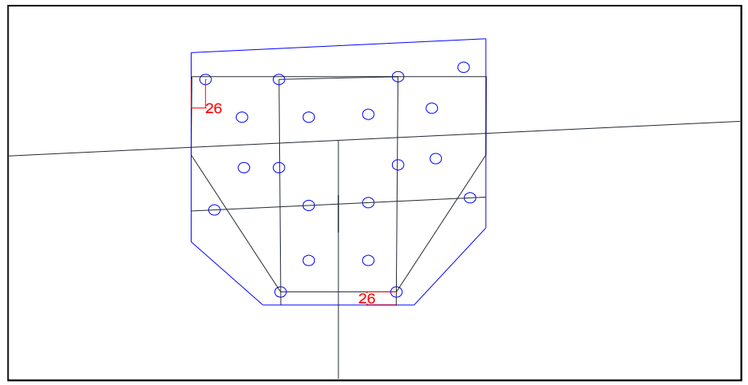
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	197	877
Compressive Resistance at Member C	217	963
Compressive Resistance at Member D	243	1078
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	412	1833
Governing Resistance at Member B	741	3294
Governing Resistance at Member C	597	2655
Governing Resistance at Member D	842	3743
Governing Resistance at Member E	412	1833

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
	SHEAR PLANE A'-A'	160	709	**0.000**	
	SHEAR PLANE B'-B'	461	2049	**0.000**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	348	1547	**0.000**	
	Member C	308	1369	**0.467**	
	Member D	390	1732	**0.000**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	197	877	**0.000**	
	Member C	217	963	**0.000**	
	Member D	243	1078	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	412	1833	**0.669**	<--- Governing
	Member B	741	3294	**0.000**	
	Member C	597	2655	**0.241**	
	Member D	842	3743	**0.000**	
	Member E	412	1833	**0.669**	<--- Governing
	Highest Demand/Capacity Ratio			**0.669**	

Span: Bascule Bridge - Leaf Span
Node: 7N

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.47 in	12 mm	6% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units		
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa		

MEMBER FORCES

Load Combination:		D1, D2, CL1-625 Max	
7N-A	P_{Max} =	161.7 kip	719 kN
7N-A	P_{Min} =	-210.6 kip	-936 kN
7N-B	P_{Max} =	0.0 kip	0 kN
7N-B	P_{Min} =	0.0 kip	0 kN
7N-C	P_{Max} =	-1.4 kip	-6 kN
7N-C	P_{Min} =	-4.5 kip	-20 kN
7N-D	P_{Max} =	0.0 kip	0 kN
7N-D	P_{Min} =	0.0 kip	0 kN
7N-E	P_{Max} =	163.2 kip	725 kN
7N-E	P_{Min} =	-210.0 kip	-933 kN

Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
7N-A	421	719	718	718	719
7N-A	421	-936	-936	-936	-936
7N-B	0	#N/A	#N/A	#N/A	#N/A
7N-B	0	#N/A	#N/A	#N/A	#N/A
7N-C	245	-11	-9	-6	-6
7N-C	245	-20	-18	-15	-20
7N-D	0	#N/A	#N/A	#N/A	#N/A
7N-D	0	#N/A	#N/A	#N/A	#N/A
7N-E	420	725	725	725	725
7N-E	420	-933	-933	-933	-933

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 7N

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		0	deg	B
	φ_C =		93	deg	C
	φ_D =		0	deg	D
	$\cos(\varphi_B)$ =		1.000		
	$\cos(\varphi_C)$ =		-0.052		
	$\cos(\varphi_D)$ =		1.000		
	$V_{A'\text{-}A',max}$ =	0.2 kip	1	kN	*
	$V_{A'\text{-}A',min}$ =	0.1 kip	0	kN	*
Shear Force at A'-A' (Governing)	$V_{A'\text{-}A'}$ =	0.2 kip	1	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'\text{-}B'}$ =	0.0 kip	0	kN	

*using absolute maximum sums, conservative

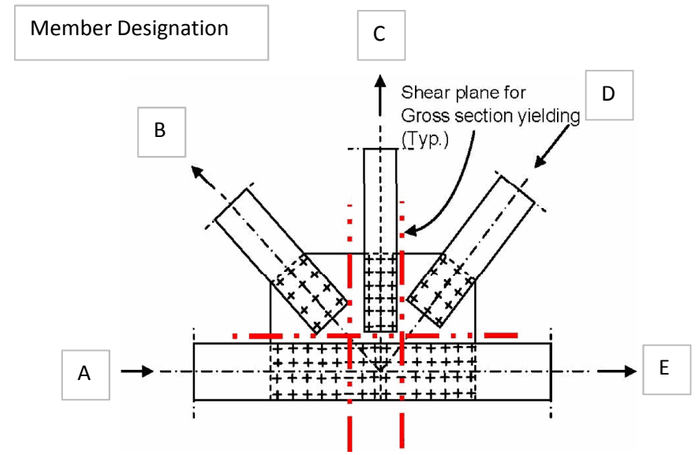


Figure 4 – Examples of gross section shear yielding planes

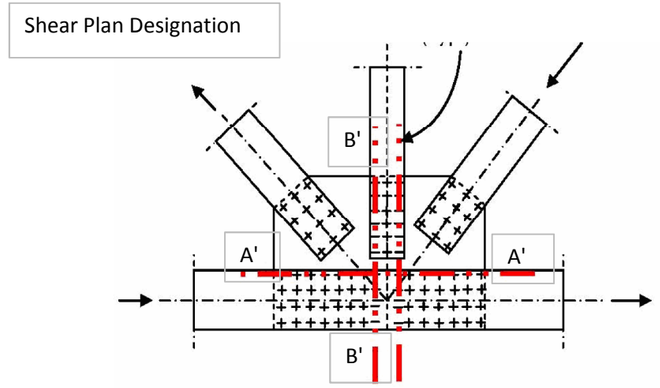


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	21.06	in	535	mm	
No of holes in shear plane	N =	4.00	ea	4	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			12840	mm^2	
Net Shear Area	A_n =			10862	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			1281	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =			1825	kN	
Shear Resistance (Governing)	V_R =			**1281**	**kN**	
Demand/Capacity	D/C =			**0.001**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	20.35	in	517	mm	
No of holes in shear plane	N =	6.00	ea	6	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 7N

Members A and E continuous through the gusset plate?				Yes		
Outside height of member A	H_A=	15	in	381	mm	
Thickness of the web of member A	w_A=	0.40	in	10	mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4	ea	
Gross Shear Area	A_g =			20150	mm^2	
Net Shear Area	A_n =			15509	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2010	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =			2606	kN	
Shear Resistance (Governing)	V_R =			**2010**	**kN**	
Demand/Capacity	D/C =			**0.000**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E — N/A

Members A and E continuous through the gusset plate? Yes

General

Whitmore Width	W_w =	0.00	in	0	mm	Number of Rivet/bolt diameters Intsecting Plane
Shear Length 1	L_{V1} =	0.00	in	0	mm	0
Shear Length 2	L_{V2} =	0.00	in	0	mm	0
Tension Length	L_T =	0.00	in	0	mm	0
Number of Gusset Plates	m =	2.00	ea	2	ea	0 Typ, 1 less than Whitemore Width
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance

CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$		
		0	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		0	kN	

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

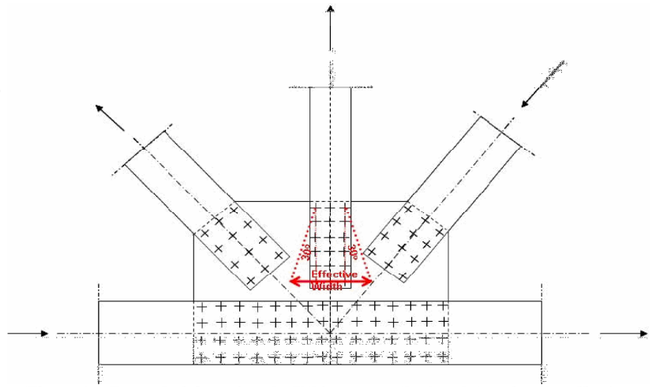


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

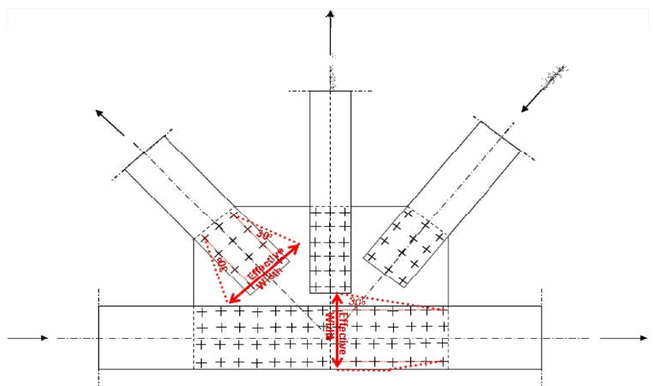


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 7N

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

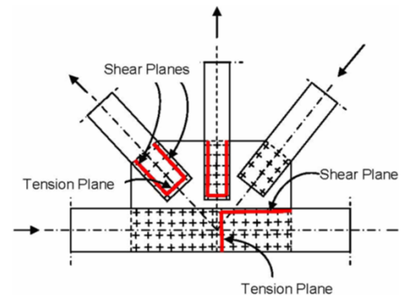


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0 "fixed-free condition"		
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		t/√(12) for rectangular plate		
		0.14 in	3.46 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

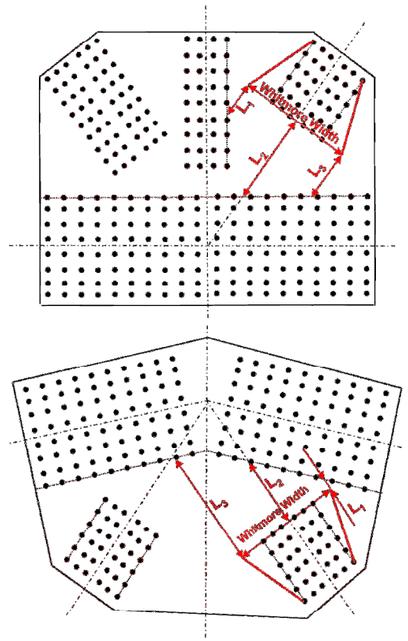


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Possible Scenario?			No			
Number of Rivets/Bolts	n =	16 ea	16 ea			
Longest Length of connection	L=	21.02 in	534 mm			
Edge distance	e =	1.02 in	26 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$		CSA S6 CL14.14.1.4.2	
	B_{r1} =	316 kip	1405 kN			
	B_{r2} =	695 kip	3088 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$		CSA S6 CL14.14.1.4.2	
		165 kip	733 kN			
Governing Resistance			1467 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span
Node: 7N

Demand/Capacity	D/C =	0.000		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? Yes

General

					Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	21.81 in	554	mm	3
Shear Length 1	L_{V1} =	13.11 in	333	mm	4.5
Shear Length 2	L_{V2} =	11.38 in	289	mm	4.5
Tension Length	L_T =	14.33 in	364	mm	4
Number of Gusset Plates	m =	2 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$	2653	kN	U=1.0 FHWA 3.1.2
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$	3969	kN	U=1.0 FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2					

Block Shear

Gross Tension Area	A_{tg} =	4368	mm^2
Gross Shear Area	A_{vg} =	7464	mm^2
Net Tension Area	A_{tn} =	3379	mm^2
Net Shear Area	A_{vn} =	5239	mm^2
$A_{tn} \geq 0.58*A_{vn}$?		Yes	

		$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$			U=1.0
Block Shear Resistance	P_{Rbs} =		3725	kN	FHWA 3.1.3
Tension Resistance (Governing)			2653	kN	
Demand/Capacity	D/C =		0.000		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? Yes

General — FHWA 3.3

Whitmore Width	W_w =	21.81 in	554	mm

Span: Bascule Bridge - Leaf Span
Node: 7N

L1	L_1 =	0.79	in	20	mm	
L2 - along centreline of action	L_2 =	13.54	in	344	mm	
L3	L_3 =	4.88	in	124	mm	
Unsupported Column Length	L_u =	6.40	in	163	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			$t/\sqrt{(12)}$	for rectangular plate	
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.58		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2149	kN	
Demand/Capacity	D/C =			**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22	ea	22	ea		
Longest Length of connection	L=	18.94	in	481	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	635	kip	2823	kN		
	B_{r2} =	955	kip	4246	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		411	kip	1825	kN		
Governing Resistance				3650	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.000**			

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	21.02	in	534	mm	2	
Shear Length 1	L_{V1} =	18.11	in	460	mm	5.5	
Shear Length 2	L_{V2} =	18.11	in	460	mm	5.5	
Tension Length	L_T =	8.27	in	210	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 7N

Number of Gusset Plates	m =	2.00 ea	2 ea		
Diameter of holes in plane	d_b =	0.81 in	21 mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			2557	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			3974	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		2520	mm^2	
Gross Shear Area	A_{vg} =		11040	mm^2	
Net Tension Area	A_{tn} =		2273	mm^2	
Net Shear Area	A_{vn} =		8321	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		4090	kN	FHWA 3.1.3
Tension Resistance (Governing)			2557	kN	
Demand/Capacity	D/C =		**0.000**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	21.02 in	534	mm	
L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	0.00 in	0	mm	
L3	L_3 =	0.00 in	0	mm	
Unsupported Column Length	L_u =	0.00 in	0	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			2422	kN	

Span: Bascule Bridge - Leaf Span
Node: 7N

Demand/Capacity	D/C =			**0.008**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	12	ea	12	ea		
Longest Length of connection	L=	18.11	in	460	mm		
Edge distance	e =	1.02	in	26	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	237	kip	1054	kN		
	B_{r2} =	521	kip	2316	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		224	kip	995	kN		
Governing Resistance				1991	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.010**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	24.41	in	620	mm	5	
Shear Length 1	L_{V1} =	10.87	in	276	mm	3.5	
Shear Length 2	L_{V2} =	14.25	in	362	mm	4.5	
Tension Length	L_T =	15.55	in	395	mm	5	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
		2969	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		4169	kN	

Block Shear

Gross Tension Area	A_{tg} =	4740	mm^2

Span: Bascule Bridge - Leaf Span

Node: 7N

Gross Shear Area	A_{vg} =		7656	mm^2	
Net Tension Area	A_{tn} =		3504	mm^2	
Net Shear Area	A_{vn} =		5678	mm^2	
$A_{tn} > 0.58*A_{vn}$?			Yes		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0		
Block Shear Resistance	P_{Rbs} =		3847	kN	FHWA 3.1.3
Tension Resistance (Governing)			2969	kN	
Demand/Capacity	D/C =		**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?			Yes		
General					FHWA 3.3
Whitmore Width	W_w =	24.41 in	620	mm	
L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	13.15 in	334	mm	
L3	L_3 =	4.21 in	107	mm	
Unsupported Column Length	L_u =	5.79 in	147	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.53		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			2489	kN	
Demand/Capacity	D/C =		**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	25 ea	25	ea		
Longest Length of connection	L=	19.37 in	492	mm		
Edge distance	e =	1.50 in	38	mm		
Diameter of Rivet	d =	0.75 in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1	ea		
Number of Gusset Plates		2.00 ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	722 kip	3208	kN		
	B_{r2} =	1086 kip	4825	kN		

Span: Bascule Bridge - Leaf Span
Node: 7N

Shear Resistance of Rivets V_r = 467 kip $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 2074 kN CSA S6 CL14.14.1.4.2

Governing Resistance 4148 kN for 2 plate(s)
Demand/Capacity D/C = **0.000**
For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	288	1281
Shear Resistance (Net Section)	411	1825
Shear Resistance (Governing)	288	1281
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	452	2010
Shear Resistance (Net Section)	586	2606
Shear Resistance (Governing)	452	2010
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	597	2653
Net Section Resistance	893	3969
Block Shear Resistance	838	3725
Tension Resistance (Governing)	597	2653
At Member C:		
Gross Section Resistance	575	2557
Net Section Resistance	894	3974
Block Shear Resistance	920	4090
Tension Resistance (Governing)	575	2557
At Member D:		
Gross Section Resistance	668	2969
Net Section Resistance	938	4169
Block Shear Resistance	866	3847
Tension Resistance (Governing)	668	2969
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 7N

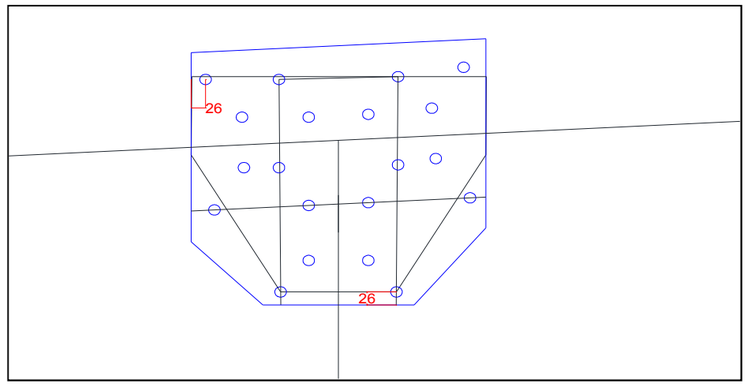
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	483	2149
Compressive Resistance at Member C	545	2422
Compressive Resistance at Member D	560	2489
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	330	1467
Governing Resistance at Member B	821	3650
Governing Resistance at Member C	448	1991
Governing Resistance at Member D	933	4148
Governing Resistance at Member E	330	1467

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
	SHEAR PLANE A'-A'	288	1281	**0.001**	
	SHEAR PLANE B'-B'	452	2010	**0.000**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	597	2653	**0.000**	
	Member C	575	2557	**0.000**	
	Member D	668	2969	**0.000**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	483	2149	**0.000**	
	Member C	545	2422	**0.008**	
	Member D	560	2489	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	330	1467	**0.000**	
	Member B	821	3650	**0.000**	
	Member C	448	1991	**0.010**	<--- Governing
	Member D	933	4148	**0.000**	
	Member E	330	1467	**0.000**	
	Highest Demand/Capacity Ratio			**0.010**	

Span: Bascule Bridge - Leaf Span
Node: 7S

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.47 in	12 mm	6% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units		
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa		

MEMBER FORCES

Load Combination:		D1, D2, CL1-625 Max	
7S-A	P_{Max} =	146.8 kip	652 kN
7S-A	P_{Min} =	-225.3 kip	-1001 kN
7S-B	P_{Max} =	0.0 kip	0 kN
7S-B	P_{Min} =	0.0 kip	0 kN
7S-C	P_{Max} =	-1.4 kip	-6 kN
7S-C	P_{Min} =	-4.5 kip	-20 kN
7S-D	P_{Max} =	0.0 kip	0 kN
7S-D	P_{Min} =	0.0 kip	0 kN
7S-E	P_{Max} =	147.2 kip	654 kN
7S-E	P_{Min} =	-225.9 kip	-1004 kN

Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
7S-A	490	652	652	652	652
7S-A	490	-1001	-1001	-1001	-1001
7S-B	0	#N/A	#N/A	#N/A	#N/A
7S-B	0	#N/A	#N/A	#N/A	#N/A
7S-C	575	-11	-8	-6	-6
7S-C	575	-20	-18	-15	-20
7S-D	0	#N/A	#N/A	#N/A	#N/A
7S-D	0	#N/A	#N/A	#N/A	#N/A
7S-E	489	654	654	654	654
7S-E	489	-1003	-1004	-1004	-1004

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 7S

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		0	deg	B
	φ_C =		93	deg	C
	φ_D =		0	deg	D
	$\cos(\varphi_B)$ =		1.000		
	$\cos(\varphi_C)$ =		-0.052		
	$\cos(\varphi_D)$ =		1.000		
	$V_{A'-A',max}$ =	0.2 kip	1	kN	*
	$V_{A'-A',min}$ =	0.1 kip	0	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	0.2 kip	1	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	0.0 kip	0	kN	

*using absolute maximum sums, conservative

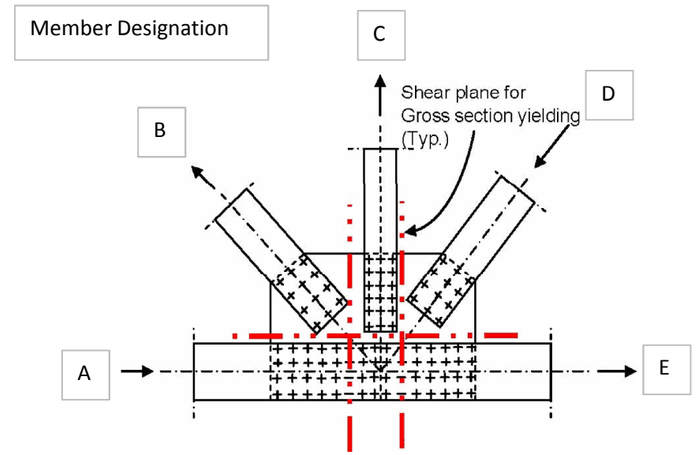


Figure 4 – Examples of gross section shear yielding planes

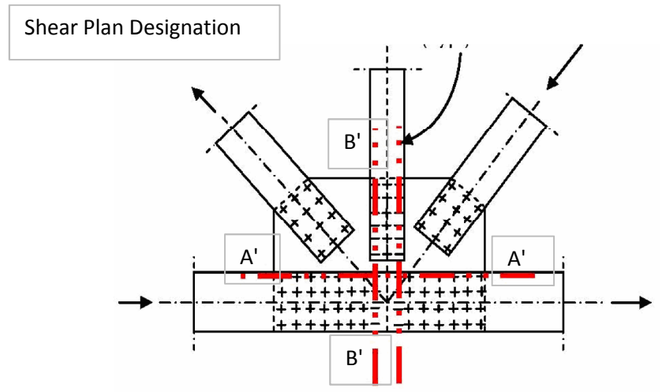


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	21.06	in	535	mm	
No of holes in shear plane	N =	4.00	ea	4	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			12840	mm^2	
Net Shear Area	A_n =			10862	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			1281	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =			1825	kN	
Shear Resistance (Governing)	V_R =			**1281**	**kN**	
Demand/Capacity	D/C =			**0.001**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	20.35	in	517	mm	
No of holes in shear plane	N =	6.00	ea	6	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 7S

Members A and E continuous through the gusset plate?			Yes		
Outside height of member A	H_A=	15 in	381	mm	
Thickness of the web of member A	w_A=	0.40 in	10	mm	
No of holes in member A/E in shear plane	N_A=	4 ea	4	ea	
Gross Shear Area	A_g =		20150	mm^2	
Net Shear Area	A_n =		15509	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =		$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =		2010	kN	
Shear Resistance (Net Section)	V_{Rn} =		$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =		2606	kN	
Shear Resistance (Governing)	V_R =		**2010**	**kN**	
Demand/Capacity	D/C =		**0.000**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E — N/A

Members A and E continuous through the gusset plate?			Yes		

General

Whitmore Width	W_w =	0.00 in	0	mm	
Shear Length 1	L_{V1} =	0.00 in	0	mm	
Shear Length 2	L_{V2} =	0.00 in	0	mm	
Tension Length	L_T =	0.00 in	0	mm	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	

Number of Rivet/bolt diameters Intsecting Plane

0	
0	
0	
0	Typ, 1 less than Whitemore Width

($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	
			0	kN
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	
For gusset plates, U=1.0, FHWA 3.1.2			0	kN

FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

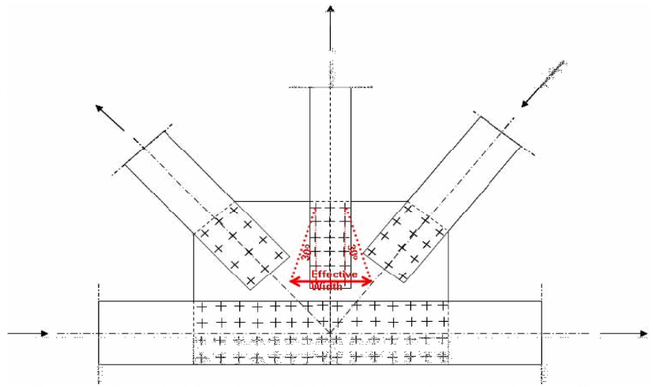


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

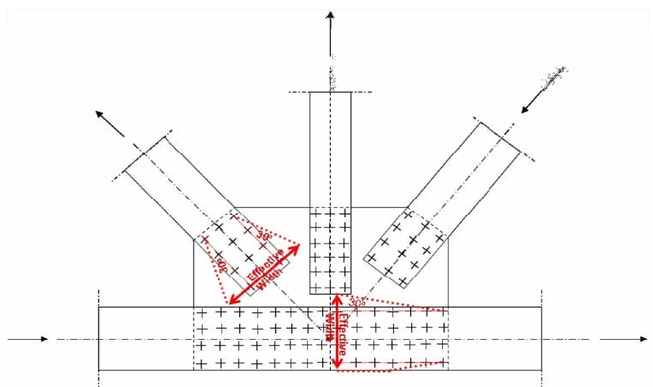


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 7S

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

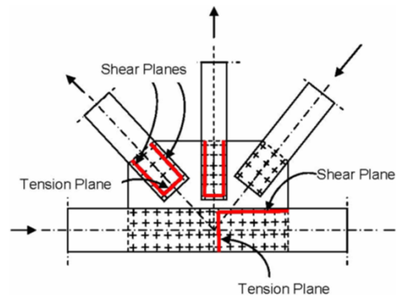


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.14 in	3.46 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

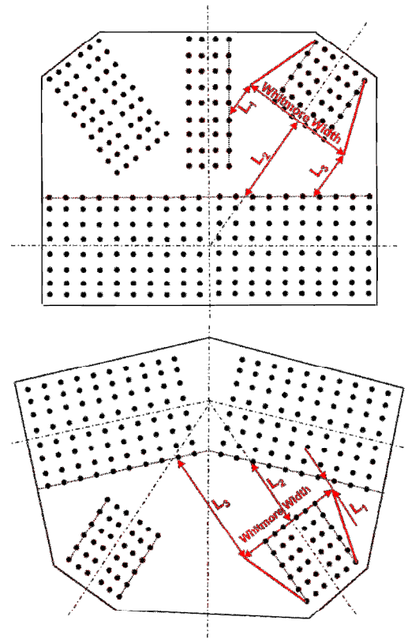


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Possible Scenario?			No		
Number of Rivets/Bolts	n =	16 ea	16 ea		
Longest Length of connection	L=	21.02 in	534 mm		
Edge distance	e =	1.02 in	26 mm		
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1 ea		
Number of Gusset Plates		2 ea	2 ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$		CSA S6 CL14.14.1.4.2
	B_{r1} =	316 kip	1405 kN		
	B_{r2} =	695 kip	3088 kN		
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$		CSA S6 CL14.14.1.4.2
		165 kip	733 kN		
Governing Resistance			1467 kN	for 2 plate(s)	

Span: Bascule Bridge - Leaf Span
Node: 7S

Demand/Capacity	D/C =	0.000		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	21.81	in	554	mm	3
Shear Length 1	L_{V1} =	13.11	in	333	mm	4.5
Shear Length 2	L_{V2} =	11.38	in	289	mm	4.5
Tension Length	L_T =	14.33	in	364	mm	4
Number of Gusset Plates	m =	2	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$ U=1.0		FHWA 3.1.2
		2653	kN	
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$ U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		3969	kN	

Block Shear

Gross Tension Area	A_{tg} =	4368	mm^2
Gross Shear Area	A_{vg} =	7464	mm^2
Net Tension Area	A_{tn} =	3379	mm^2
Net Shear Area	A_{vn} =	5239	mm^2
$A_{tn} \geq 0.58*A_{vn}$?		Yes	

		$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$ U=1.0		
Block Shear Resistance	P_{Rbs} =	3725	kN	FHWA 3.1.3
Tension Resistance (Governing)		2653	kN	
Demand/Capacity	D/C =	0.000		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? Yes

General — FHWA 3.3

Whitmore Width	W_w =	21.81	in	554	mm

Span: Bascule Bridge - Leaf Span
Node: 7S

L1	L_1 =	0.79	in	20	mm	
L2 - along centreline of action	L_2 =	13.54	in	344	mm	
L3	L_3 =	4.88	in	124	mm	
Unsupported Column Length	L_u =	6.40	in	163	mm	
Effective Length Factor	K =	1.20		1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)		for rectangular plate
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.58		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2149	kN	
Demand/Capacity	D/C =			**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22	ea	22	ea		
Longest Length of connection	L=	18.94	in	481	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	635	kip	2823	kN		
	B_{r2} =	955	kip	4246	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		411	kip	1825	kN		
Governing Resistance				3650	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.000**			

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	21.02	in	534	mm	2	
Shear Length 1	L_{V1} =	18.11	in	460	mm	5.5	
Shear Length 2	L_{V2} =	18.11	in	460	mm	5.5	
Tension Length	L_T =	8.27	in	210	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 7S

Number of Gusset Plates	m =	2.00 ea	2 ea		
Diameter of holes in plane	d_b =	0.81 in	21 mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			2557	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			3974	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		2520	mm^2	
Gross Shear Area	A_{vg} =		11040	mm^2	
Net Tension Area	A_{tn} =		2273	mm^2	
Net Shear Area	A_{vn} =		8321	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		4090	kN	FHWA 3.1.3
Tension Resistance (Governing)			2557	kN	
Demand/Capacity	D/C =		**0.000**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	21.02 in	534	mm	
L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	0.00 in	0	mm	
L3	L_3 =	0.00 in	0	mm	
Unsupported Column Length	L_u =	0.00 in	0	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			2422	kN	

Span: Bascule Bridge - Leaf Span
Node: 7S

Demand/Capacity	D/C =			**0.008**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	12	ea	12	ea		
Longest Length of connection	L=	18.11	in	460	mm		
Edge distance	e =	1.02	in	26	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	237	kip	1054	kN		
	B_{r2} =	521	kip	2316	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		224	kip	995	kN		
Governing Resistance				1991	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.010**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	24.41	in	620	mm	5	
Shear Length 1	L_{V1} =	10.87	in	276	mm	3.5	
Shear Length 2	L_{V2} =	14.25	in	362	mm	4.5	
Tension Length	L_T =	15.55	in	395	mm	5	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
		2969	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		4169	kN	

Block Shear

Gross Tension Area	A_{tg} =	4740	mm^2

Span: Bascule Bridge - Leaf Span
Node: 7S

Gross Shear Area	A_{vg} =			7656	mm^2	
Net Tension Area	A_{tn} =			3504	mm^2	
Net Shear Area	A_{vn} =			5678	mm^2	
$A_{tn} > 0.58*A_{vn}$?				Yes		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		U=1.0	
Block Shear Resistance	P_{Rbs} =			3847	kN	FHWA 3.1.3
Tension Resistance (Governing)				2969	kN	
Demand/Capacity	D/C =			**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?				Yes		
General						FHWA 3.3
Whitmore Width	W_w =	24.41	in	620	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	13.15	in	334	mm	
L3	L_3 =	4.21	in	107	mm	
Unsupported Column Length	L_u =	5.79	in	147	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			$t/\sqrt{(12)}$	for rectangular plate	
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.53		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2489	kN	
Demand/Capacity	D/C =			**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	25	ea	25	ea		
Longest Length of connection	L=	19.37	in	492	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	722	kip	3208	kN		
	B_{r2} =	1086	kip	4825	kN		

Span: Bascule Bridge - Leaf Span
Node: 7S

Shear Resistance of Rivets V_r = 467 kip $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 2074 kN CSA S6 CL14.14.1.4.2

Governing Resistance 4148 kN for 2 plate(s)
Demand/Capacity D/C = **0.000**
For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	288	1281
Shear Resistance (Net Section)	411	1825
Shear Resistance (Governing)	288	1281
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	452	2010
Shear Resistance (Net Section)	586	2606
Shear Resistance (Governing)	452	2010
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	597	2653
Net Section Resistance	893	3969
Block Shear Resistance	838	3725
Tension Resistance (Governing)	597	2653
At Member C:		
Gross Section Resistance	575	2557
Net Section Resistance	894	3974
Block Shear Resistance	920	4090
Tension Resistance (Governing)	575	2557
At Member D:		
Gross Section Resistance	668	2969
Net Section Resistance	938	4169
Block Shear Resistance	866	3847
Tension Resistance (Governing)	668	2969
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 7S

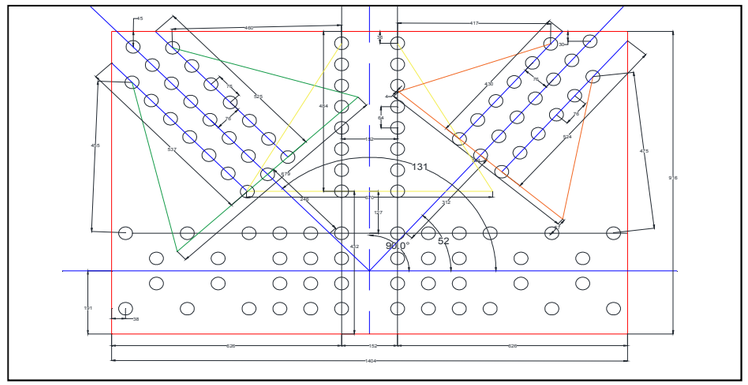
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	483	2149
Compressive Resistance at Member C	545	2422
Compressive Resistance at Member D	560	2489
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	330	1467
Governing Resistance at Member B	821	3650
Governing Resistance at Member C	448	1991
Governing Resistance at Member D	933	4148
Governing Resistance at Member E	330	1467

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
	SHEAR PLANE A'-A'	288	1281	**0.001**	
	SHEAR PLANE B'-B'	452	2010	**0.000**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	597	2653	**0.000**	
	Member C	575	2557	**0.000**	
	Member D	668	2969	**0.000**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	483	2149	**0.000**	
	Member C	545	2422	**0.008**	
	Member D	560	2489	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	330	1467	**0.000**	
	Member B	821	3650	**0.000**	
	Member C	448	1991	**0.010**	<--- Governing
	Member D	933	4148	**0.000**	
	Member E	330	1467	**0.000**	
	Highest Demand/Capacity Ratio			**0.010**	

Span: Bascule Bridge - Leaf Span
Node: 8N

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units		S.I. Units		
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50	in	12.7	mm	
Limiting Thickness of Gusset Plate	t =	0.31	in	8	mm	37% Corrosion
Structural Steel - Tension	φ_s =			0.95		
	φ_u =			0.8		
Structural Steel - Compression	φ_s =			0.9		
Resistance Factor for Riveted Connections	φ_{mc} =			0.67		CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =			0.67		CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units		S.I. Units			
Yield Strength of Steel:	F_y =	30	ksi	210	MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61	ksi	420	MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46	ksi	320	MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000	ksi	200000	MPa		

MEMBER FORCES

Load Combination: D1, D2, CL1-625 Max

						Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
8N-A	P_{Max} =	258.8	kip	1150	kN	8N-A	282	1150	1150	1150	1150
8N-A	P_{Min} =	-80.5	kip	-358	kN	8N-A	282	-358	-358	-358	-358
8N-B	P_{Max} =	11.8	kip	53	kN	8N-B	8	53	49	46	53
8N-B	P_{Min} =	-202.0	kip	-898	kN	8N-B	8	-891	-894	-898	-898
8N-C	P_{Max} =	-1.4	kip	-6	kN	8N-C	245	-11	-9	-6	-6
8N-C	P_{Min} =	-4.5	kip	-20	kN	8N-C	245	-20	-18	-15	-20
8N-D	P_{Max} =	273.6	kip	1216	kN	8N-D	9	1208	1212	1216	1216
8N-D	P_{Min} =	49.4	kip	220	kN	8N-D	9	220	223	227	220
8N-E	P_{Max} =	97.3	kip	432	kN	8N-E	283	432	432	432	432
8N-E	P_{Min} =	-217.1	kip	-965	kN	8N-E	283	-965	-965	-965	-965

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 8N

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		131	deg	B
	φ_C =		90	deg	C
	φ_D =		52	deg	D
	$\cos(\varphi_B)$ =		-0.656		
	$\cos(\varphi_C)$ =		0.000		
	$\cos(\varphi_D)$ =		0.616		
	$V_{A'-A',max}$ =	301.0 kip	1338	kN	*
	$V_{A'-A',min}$ =	22.7 kip	101	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	301.0 kip	1338	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	215.6 kip	958	kN	

*using absolute maximum sums, conservative

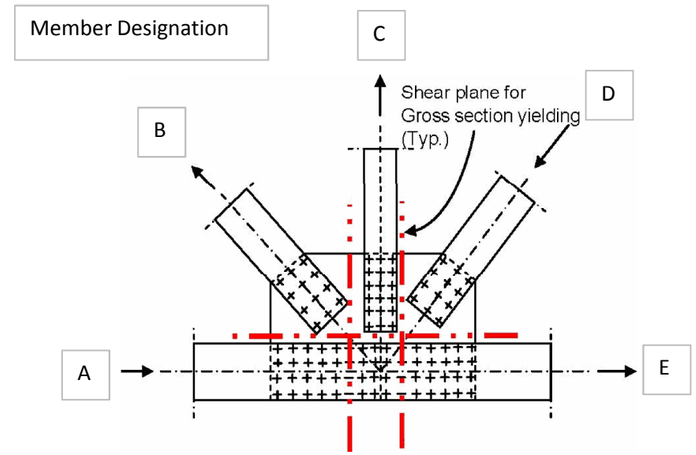


Figure 4 – Examples of gross section shear yielding planes

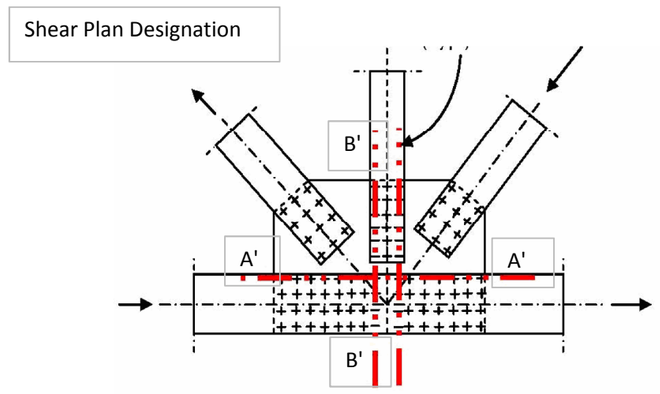


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	55.12	in	1400	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			22400	mm^2	
Net Shear Area	A_n =			18445	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2234	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =			3099	kN	
Shear Resistance (Governing)	V_R =			**2234**	**kN**	
Demand/Capacity	D/C =			**0.599**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	36.02	in	915	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 8N

Members A and E continuous through the gusset plate?			Yes		
Outside height of member A	H_A=	15 in	381	mm	
Thickness of the web of member A	w_A=	0.40 in	10	mm	
No of holes in member A/E in shear plane	N_A=	4 ea	4	ea	
Gross Shear Area	A_g =		22382	mm^2	
Net Shear Area	A_n =		16752	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =		$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =		2233	kN	
Shear Resistance (Net Section)	V_{Rn} =		$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =		2814	kN	
Shear Resistance (Governing)	V_R =		**2233**	**kN**	
Demand/Capacity	D/C =		**0.429**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E — N/A

Members A and E continuous through the gusset plate?			Yes		

General

Whitmore Width	W_w =	0.00 in	0	mm	
Shear Length 1	L_{V1} =	0.00 in	0	mm	
Shear Length 2	L_{V2} =	0.00 in	0	mm	
Tension Length	L_T =	0.00 in	0	mm	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	

Number of Rivet/bolt diameters Intsecting Plane

0	
0	
0	
0	Typ, 1 less than Whitemore Width

($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	
			0	kN
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	
For gusset plates, U=1.0, FHWA 3.1.2			0	kN

FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

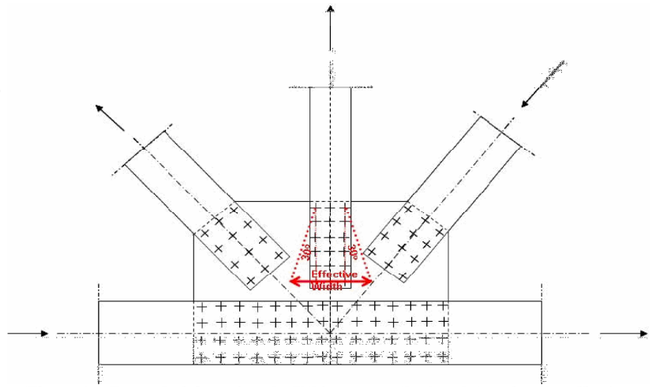


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

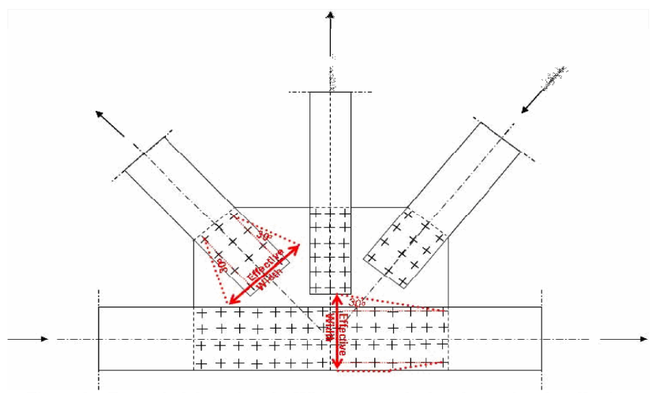


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 8N

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

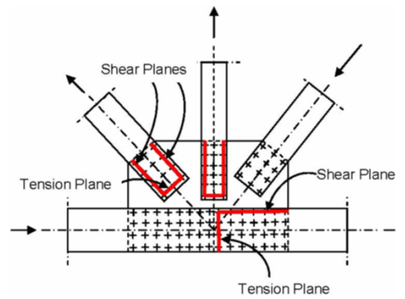


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.09 in	2.31 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

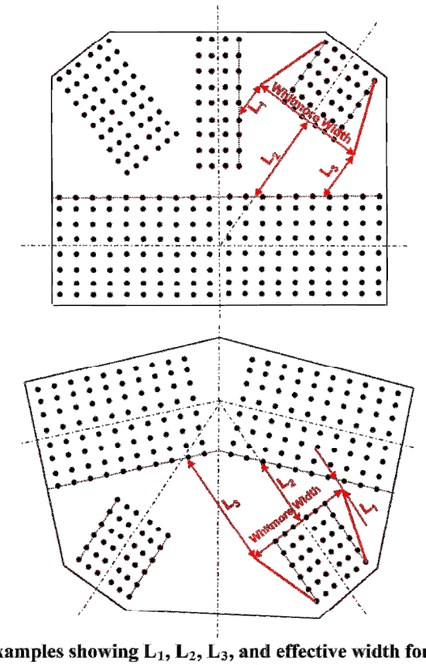


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	44 ea	44 ea			
Longest Length of connection	L=	53.78 in	1366 mm			
Edge distance	e =	1.50 in	38 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$			CSA S6 CL14.14.1.4.2
	B_{r1} =	847 kip	3764 kN			
	B_{r2} =	1274 kip	5661 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$			CSA S6 CL14.14.1.4.2
		454 kip	2017 kN			
Governing Resistance			3227 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span

Node: 8N

Demand/Capacity	D/C =		**0.356**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.					FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored?			Yes		
General					Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	26.77 in	680 mm		3
Shear Length 1	L_{V1} =	20.67 in	525 mm		6.5
Shear Length 2	L_{V2} =	21.06 in	535 mm		6.5
Tension Length	L_T =	5.98 in	152 mm		2
Number of Gusset Plates	m =	2 ea	2 ea		
Diameter of holes in plane	d_b =	0.81 in	21 mm		($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$U*\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
			2171	kN	
Net Section Resistance	P_{RN} =		$U*\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2			3323	kN	

Block Shear

Gross Tension Area	A_{tg} =		1216	mm^2
Gross Shear Area	A_{vg} =		8480	mm^2
Net Tension Area	A_{tn} =		886	mm^2
Net Shear Area	A_{vn} =		6338	mm^2
$A_{tn} \geq 0.58*A_{vn}$?			No	

		$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		U=1.0	
Block Shear Resistance	P_{Rbs} =		2879	kN	FHWA 3.1.3
Tension Resistance (Governing)			2171	kN	
Demand/Capacity	D/C =		**0.024**		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored?			Yes		
General					FHWA 3.3
Whitmore Width	W_w =	26.77 in	680 mm		

Span: Bascule Bridge - Leaf Span

Node: 8N

L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	9.84 in	250	mm	
L3	L_3 =	0.00 in	0	mm	
Unsupported Column Length	L_u =	3.28 in	83	mm	
Effective Length Factor	K =	1.20	1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)		for rectangular plate
		0.09 in	2.31	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.45		
Compressive Resistance	C_r =		$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		U=1.0
			1895	kN	
Demand/Capacity	D/C =		**0.474**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22 ea	22	ea		
Longest Length of connection	L=	20.98 in	533	mm		
Edge distance	e =	1.50 in	38	mm		
Diameter of Rivet	d =	0.75 in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1	ea		
Number of Gusset Plates		2.00 ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$		U=1.0	CSA S6 CL14.14.1.4.2
	B_{r1} =	423 kip	1882	kN		
	B_{r2} =	637 kip	2830	kN		
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$		U=1.81	CSA S6 CL14.14.1.4.2
		411 kip	1825	kN		
Governing Resistance			3650	kN	for 2 plate(s)	
Demand/Capacity	D/C =		**0.246**			

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

					Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	26.38 in	670	mm	2	
Shear Length 1	L_{V1} =	19.06 in	484	mm	7.5	
Shear Length 2	L_{V2} =	19.06 in	484	mm	7.5	
Tension Length	L_T =	5.98 in	152	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 8N

Number of Gusset Plates	m =	2.00 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			2139	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			3380	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		1216	mm^2	
Gross Shear Area	A_{vg} =		7744	mm^2	
Net Tension Area	A_{tn} =		1051	mm^2	
Net Shear Area	A_{vn} =		5272	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		2463	kN	FHWA 3.1.3
Tension Resistance (Governing)			2139	kN	
Demand/Capacity	D/C =		**0.000**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	26.38 in	670	mm	
L1	L_1 =	5.00 in	127	mm	
L2 - along centreline of action	L_2 =	5.00 in	127	mm	
L3	L_3 =	5.00 in	127	mm	
Unsupported Column Length	L_u =	5.00 in	127	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.09 in	2.31	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.68		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			1614	kN	

Span: Bascule Bridge - Leaf Span
Node: 8N

Demand/Capacity	D/C =			**0.012**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea		
Longest Length of connection	L=	19.06	in	484	mm		
Edge distance	e =	1.42	in	36	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	292	kip	1297	kN		
	B_{r2} =	463	kip	2058	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		299	kip	1327	kN		
Governing Resistance				2593	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.008**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	23.23	in	590	mm	3	
Shear Length 1	L_{V1} =	20.63	in	524	mm	5.5	
Shear Length 2	L_{V2} =	16.93	in	430	mm	5.5	
Tension Length	L_T =	5.98	in	152	mm	2	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
		1883	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		2840	kN	

Block Shear

Gross Tension Area	A_{tg} =	1216	mm^2

Span: Bascule Bridge - Leaf Span

Node: 8N

Gross Shear Area	A_{vg} =	7632	mm^2	
Net Tension Area	A_{tn} =	886	mm^2	
Net Shear Area	A_{vn} =	5819	mm^2	
$A_{tn} > 0.58*A_{vn}$?		No		
	$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0		
Block Shear Resistance	P_{Rbs} =	2677	kN	FHWA 3.1.3
Tension Resistance (Governing)		1883	kN	
Demand/Capacity	D/C =	**0.646**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?				Yes		
General						FHWA 3.3
Whitmore Width	W_w =	23.23	in	590	mm	
L1	L_1 =	0.16	in	4	mm	
L2 - along centreline of action	L_2 =	12.28	in	312	mm	
L3	L_3 =	2.24	in	57	mm	
Unsupported Column Length	L_u =	4.90	in	124	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.09	in	2.31	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.67		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				1437	kN	
Demand/Capacity	D/C =			**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	19	ea	19	ea		
Longest Length of connection	L=	20.63	in	524	mm		
Edge distance	e =	1.18	in	30	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	289	kip	1283	kN		
	B_{r2} =	550	kip	2444	kN		

Span: Bascule Bridge - Leaf Span
Node: 8N

Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$ U=1.81	CSA S6 CL14.14.1.4.2
		355 kip	1576 kN	
Governing Resistance			2566 kN for 2 plate(s)	
Demand/Capacity	D/C =		**0.474**	
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	503	2234
Shear Resistance (Net Section)	697	3099
Shear Resistance (Governing)	503	2234
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	502	2233
Shear Resistance (Net Section)	633	2814
Shear Resistance (Governing)	502	2233
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	488	2171
Net Section Resistance	748	3323
Block Shear Resistance	648	2879
Tension Resistance (Governing)	488	2171
At Member C:		
Gross Section Resistance	481	2139
Net Section Resistance	761	3380
Block Shear Resistance	554	2463
Tension Resistance (Governing)	481	2139
At Member D:		
Gross Section Resistance	424	1883
Net Section Resistance	639	2840
Block Shear Resistance	602	2677
Tension Resistance (Governing)	424	1883
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 8N

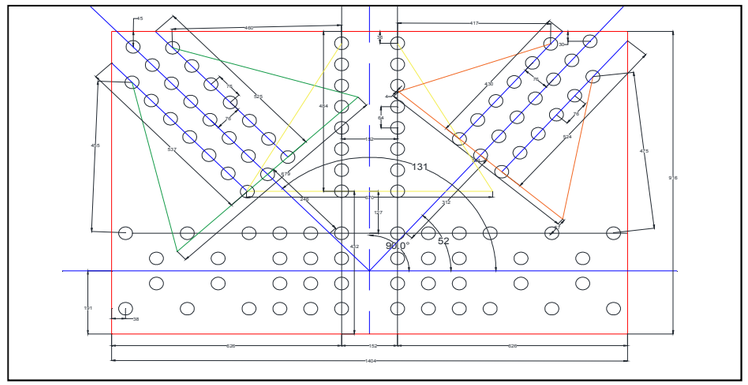
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	426	1895
Compressive Resistance at Member C	363	1614
Compressive Resistance at Member D	323	1437
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	726	3227
Governing Resistance at Member B	821	3650
Governing Resistance at Member C	584	2593
Governing Resistance at Member D	577	2566
Governing Resistance at Member E	726	3227

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
		kip	kN		
GUSSET PLATE SHEAR					
	SHEAR PLANE A'-A'	503	2234	**0.599**	
	SHEAR PLANE B'-B'	502	2233	**0.429**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	488	2171	**0.024**	
	Member C	481	2139	**0.000**	
	Member D	424	1883	**0.646**	<--- Governing
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	426	1895	**0.474**	
	Member C	363	1614	**0.012**	
	Member D	323	1437	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	726	3227	**0.356**	
	Member B	821	3650	**0.246**	
	Member C	584	2593	**0.008**	
	Member D	577	2566	**0.474**	
	Member E	726	3227	**0.356**	
	Highest Demand/Capacity Ratio			**0.646**	

Span: Bascule Bridge - Leaf Span
Node: 8S

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units		
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm		
Limiting Thickness of Gusset Plate	t =	0.31 in	8 mm	37% Corrosion	
Structural Steel - Tension	φ_s =		0.95		
	φ_u =		0.8		
Structural Steel - Compression	φ_s =		0.9		
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2	
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2	

MATERIAL PROPERTIES

		U.S. Units	S.I. Units			
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6	
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa			

MEMBER FORCES

Load Combination:		D1, D2, CL1-625 Max	
8S-A	P_{Max} =	275.6 kip	1225 kN
8S-A	P_{Min} =	-63.9 kip	-284 kN
8S-B	P_{Max} =	8.5 kip	38 kN
8S-B	P_{Min} =	-205.3 kip	-912 kN
8S-C	P_{Max} =	-1.4 kip	-6 kN
8S-C	P_{Min} =	-4.5 kip	-20 kN
8S-D	P_{Max} =	282.7 kip	1257 kN
8S-D	P_{Min} =	58.6 kip	260 kN
8S-E	P_{Max} =	107.3 kip	477 kN
8S-E	P_{Min} =	-206.9 kip	-919 kN

Note: Tension is positive.

Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
8S-A	562	1225	1225	1225	1225
8S-A	562	-284	-284	-284	-284
8S-B	184	38	34	31	38
8S-B	184	-905	-909	-912	-912
8S-C	575	-11	-8	-6	-6
8S-C	575	-20	-18	-15	-20
8S-D	185	1249	1253	1257	1257
8S-D	185	260	264	268	260
8S-E	563	477	477	477	477
8S-E	563	-919	-919	-919	-919

Span: Bascule Bridge - Leaf Span
Node: 8S

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		131	deg	B
	φ_C =		90	deg	C
	φ_D =		52	deg	D
	$\cos(\varphi_B)$ =		-0.656		
	$\cos(\varphi_C)$ =		0.000		
	$\cos(\varphi_D)$ =		0.616		
	$V_{A'-A',max}$ =	308.8 kip	1372	kN	*
	$V_{A'-A',min}$ =	30.5 kip	136	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	308.8 kip	1372	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	222.8 kip	990	kN

*using absolute maximum sums, conservative

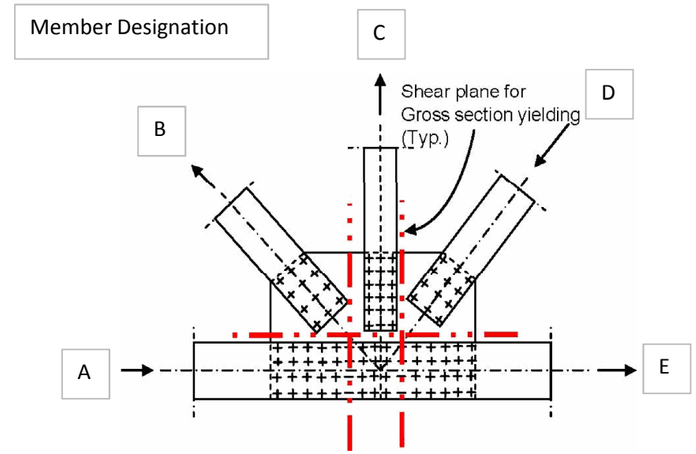


Figure 4 – Examples of gross section shear yielding planes

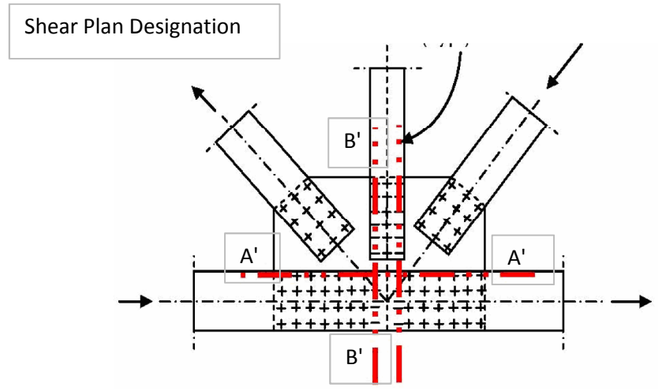


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	55.12	in	1400	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			22400	mm^2	
Net Shear Area	A_n =			18445	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2234	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$ *		Cl 10.18.5.2
	V_{Rn} =			3099	kN	
Shear Resistance (Governing)	V_R =			**2234**	**kN**	
Demand/Capacity	D/C =			**0.614**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	36.02	in	915	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 8S

Members A and E continuous through the gusset plate?			Yes		
Outside height of member A	H_A=	15 in	381	mm	
Thickness of the web of member A	w_A=	0.40 in	10	mm	
No of holes in member A/E in shear plane	N_A=	4 ea	4	ea	
Gross Shear Area	A_g =		22382	mm^2	
Net Shear Area	A_n =		16752	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =		$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =		2233	kN	
Shear Resistance (Net Section)	V_{Rn} =		$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =		2814	kN	
Shear Resistance (Governing)	V_R =		**2233**	**kN**	
Demand/Capacity	D/C =		**0.444**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E — N/A

Members A and E continuous through the gusset plate?			Yes		

General

Whitmore Width	W_w =	0.00 in	0	mm	
Shear Length 1	L_{V1} =	0.00 in	0	mm	
Shear Length 2	L_{V2} =	0.00 in	0	mm	
Tension Length	L_T =	0.00 in	0	mm	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	

Number of Rivet/bolt diameters Intsecting Plane

0	
0	
0	
0	Typ, 1 less than Whitemore Width

($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	
			0	kN
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	
For gusset plates, U=1.0, FHWA 3.1.2			0	kN

FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		0	mm^2
Gross Shear Area	A_{vg} =		0	mm^2
Net Tension Area	A_{tn} =		0	mm^2
Net Shear Area	A_{vn} =		0	mm^2
$A_{tn} > 0.58*A_{vn}$?			Yes	

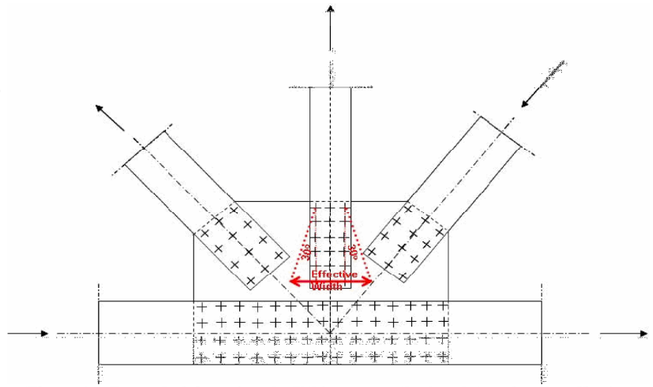


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

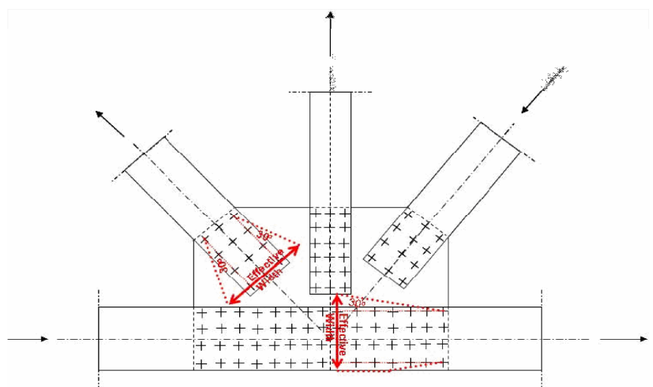


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 8S

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

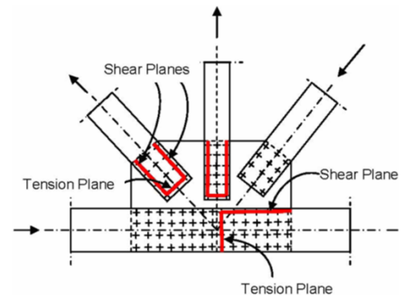


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.09 in	2.31 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

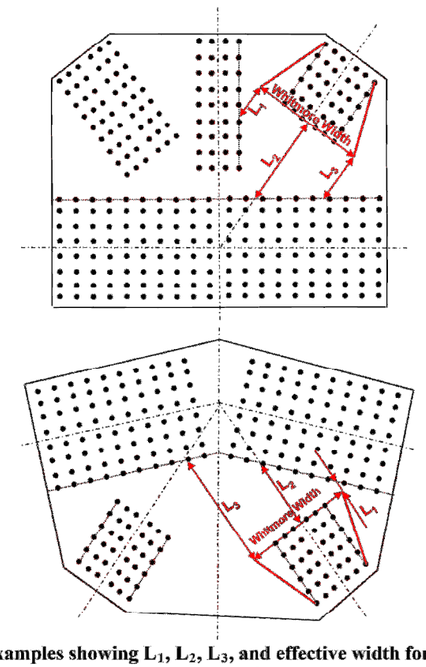


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	44 ea	44 ea			
Longest Length of connection	L=	53.78 in	1366 mm			
Edge distance	e =	1.50 in	38 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$			CSA S6 CL14.14.1.4.2
	B_{r1} =	847 kip	3764 kN			
	B_{r2} =	1274 kip	5661 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$			CSA S6 CL14.14.1.4.2
		454 kip	2017 kN			
Governing Resistance			3227 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span

Node: 8S

Demand/Capacity	D/C =		**0.380**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.					FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored?			Yes		
General					Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	26.77 in	680 mm		3
Shear Length 1	L_{V1} =	20.67 in	525 mm		6.5
Shear Length 2	L_{V2} =	21.06 in	535 mm		6.5
Tension Length	L_T =	5.98 in	152 mm		2
Number of Gusset Plates	m =	2 ea	2 ea		
Diameter of holes in plane	d_b =	0.81 in	21 mm		($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$U*\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
			2171	kN	
Net Section Resistance	P_{RN} =		$U*\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2			3323	kN	

Block Shear

Gross Tension Area	A_{tg} =		1216	mm^2
Gross Shear Area	A_{vg} =		8480	mm^2
Net Tension Area	A_{tn} =		886	mm^2
Net Shear Area	A_{vn} =		6338	mm^2
$A_{tn} \geq 0.58*A_{vn}$?			No	

			$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		2879	kN	FHWA 3.1.3
Tension Resistance (Governing)			2171	kN	
Demand/Capacity	D/C =		**0.017**		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored?			Yes		
General					FHWA 3.3
Whitmore Width	W_w =	26.77 in	680 mm		

Span: Bascule Bridge - Leaf Span
Node: 8S

L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	9.84 in	250	mm	
L3	L_3 =	0.00 in	0	mm	
Unsupported Column Length	L_u =	3.28 in	83	mm	
Effective Length Factor	K =	1.20	1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)		for rectangular plate
		0.09 in	2.31	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.45		
Compressive Resistance	C_r =		$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		U=1.0
			1895	kN	
Demand/Capacity	D/C =		**0.481**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22 ea	22	ea		
Longest Length of connection	L=	20.98 in	533	mm		
Edge distance	e =	1.50 in	38	mm		
Diameter of Rivet	d =	0.75 in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1	ea		
Number of Gusset Plates		2.00 ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$		U=1.0	CSA S6 CL14.14.1.4.2
	B_{r1} =	423 kip	1882	kN		
	B_{r2} =	637 kip	2830	kN		
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$		U=1.81	CSA S6 CL14.14.1.4.2
		411 kip	1825	kN		
Governing Resistance			3650	kN	for 2 plate(s)	
Demand/Capacity	D/C =		**0.250**			

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

					Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	26.38 in	670	mm	2	
Shear Length 1	L_{V1} =	19.06 in	484	mm	7.5	
Shear Length 2	L_{V2} =	19.06 in	484	mm	7.5	
Tension Length	L_T =	5.98 in	152	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 8S

Number of Gusset Plates	m =	2.00	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =			$\varphi_s*A_g*F_y$	U=1.0	
				2139	kN	
Net Section Resistance	P_{RN} =			$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2				3380	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =			1216	mm^2	
Gross Shear Area	A_{vg} =			7744	mm^2	
Net Tension Area	A_{tn} =			1051	mm^2	
Net Shear Area	A_{vn} =			5272	mm^2	
$A_{tn} > 0.58*A_{vn}$?				No		
				$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =			2463	kN	FHWA 3.1.3
Tension Resistance (Governing)				2139	kN	
Demand/Capacity	D/C =			**0.000**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	26.38	in	670	mm	
L1	L_1 =	5.00	in	127	mm	
L2 - along centreline of action	L_2 =	5.00	in	127	mm	
L3	L_3 =	5.00	in	127	mm	
Unsupported Column Length	L_u =	5.00	in	127	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			$t/\sqrt{(12)}$	for rectangular plate	
		0.09	in	2.31	mm	
	λ =			$(K*L_u/r)*\mathrm{sqrt}[F_y/(\pi^2*E_s)]$		
				0.68		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				1614	kN	

Span: Bascule Bridge - Leaf Span
Node: 8S

Demand/Capacity	D/C =			**0.012**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea		
Longest Length of connection	L=	19.06	in	484	mm		
Edge distance	e =	1.42	in	36	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	292	kip	1297	kN		
	B_{r2} =	463	kip	2058	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		299	kip	1327	kN		
Governing Resistance				2593	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.008**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	23.23	in	590	mm	3	
Shear Length 1	L_{V1} =	20.63	in	524	mm	5.5	
Shear Length 2	L_{V2} =	16.93	in	430	mm	5.5	
Tension Length	L_T =	5.98	in	152	mm	2	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
		1883	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		2840	kN	

Block Shear

Gross Tension Area	A_{tg} =	1216	mm^2

Span: Bascule Bridge - Leaf Span

Node: 8S

Gross Shear Area	A_{vg} =		7632	mm^2	
Net Tension Area	A_{tn} =		886	mm^2	
Net Shear Area	A_{vn} =		5819	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0		
Block Shear Resistance	P_{Rbs} =		2677	kN	FHWA 3.1.3
Tension Resistance (Governing)			1883	kN	
Demand/Capacity	D/C =		**0.667**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?			Yes		
General					FHWA 3.3
Whitmore Width	W_w =	23.23 in	590	mm	
L1	L_1 =	0.16 in	4	mm	
L2 - along centreline of action	L_2 =	12.28 in	312	mm	
L3	L_3 =	2.24 in	57	mm	
Unsupported Column Length	L_u =	4.90 in	124	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.09 in	2.31	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.67		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			1437	kN	
Demand/Capacity	D/C =		**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	19 ea	19	ea		
Longest Length of connection	L=	20.63 in	524	mm		
Edge distance	e =	1.18 in	30	mm		
Diameter of Rivet	d =	0.75 in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1	ea		
Number of Gusset Plates		2.00 ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	289 kip	1283	kN		
	B_{r2} =	550 kip	2444	kN		

Span: Bascule Bridge - Leaf Span
Node: 8S

Shear Resistance of Rivets V_r = $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 CSA S6 CL14.14.1.4.2

355 kip 1576 kN

Governing Resistance 2566 kN for 2 plate(s)

Demand/Capacity D/C = **0.490**

For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	503	2234
Shear Resistance (Net Section)	697	3099
Shear Resistance (Governing)	503	2234
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	502	2233
Shear Resistance (Net Section)	633	2814
Shear Resistance (Governing)	502	2233
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	488	2171
Net Section Resistance	748	3323
Block Shear Resistance	648	2879
Tension Resistance (Governing)	488	2171
At Member C:		
Gross Section Resistance	481	2139
Net Section Resistance	761	3380
Block Shear Resistance	554	2463
Tension Resistance (Governing)	481	2139
At Member D:		
Gross Section Resistance	424	1883
Net Section Resistance	639	2840
Block Shear Resistance	602	2677
Tension Resistance (Governing)	424	1883
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 8S

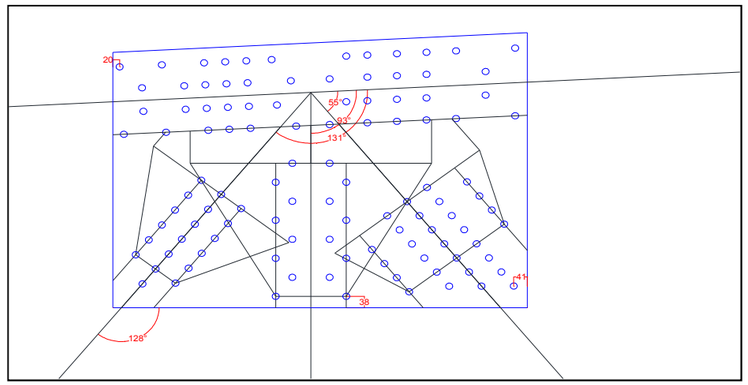
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	426	1895
Compressive Resistance at Member C	363	1614
Compressive Resistance at Member D	323	1437
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	726	3227
Governing Resistance at Member B	821	3650
Governing Resistance at Member C	584	2593
Governing Resistance at Member D	577	2566
Governing Resistance at Member E	726	3227

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
SHEAR PLANE A'-A'		503	2234	**0.614**	
SHEAR PLANE B'-B'		502	2233	**0.444**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	488	2171	**0.017**	
	Member C	481	2139	**0.000**	
	Member D	424	1883	**0.667**	<--- Governing
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	426	1895	**0.481**	
	Member C	363	1614	**0.012**	
	Member D	323	1437	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	726	3227	**0.380**	
	Member B	821	3650	**0.250**	
	Member C	584	2593	**0.008**	
	Member D	577	2566	**0.490**	
	Member E	726	3227	**0.380**	
Highest Demand/Capacity Ratio				**0.667**	

Span: Bascule Bridge - Leaf Span
Node: 9N

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.47 in	12 mm	6% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units			
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6	
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa			

MEMBER FORCES

Load Combination:		D1, D2, CL1-625 Max	
9N-A	P_{Max} =	163.2 kip	725 kN
9N-A	P_{Min} =	-210.0 kip	-933 kN
9N-B	P_{Max} =	273.6 kip	1216 kN
9N-B	P_{Min} =	49.4 kip	220 kN
9N-C	P_{Max} =	137.2 kip	610 kN
9N-C	P_{Min} =	15.1 kip	67 kN
9N-D	P_{Max} =	-100.2 kip	-446 kN
9N-D	P_{Min} =	-326.7 kip	-1452 kN
9N-E	P_{Max} =	325.1 kip	1445 kN
9N-E	P_{Min} =	39.5 kip	176 kN

Note: Tension is positive.

Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
9N-A	420	725	725	725	725
9N-A	420	-933	-933	-933	-933
9N-B	9	1208	1212	1216	1216
9N-B	9	220	223	227	220
9N-C	328	608	609	610	610
9N-C	328	67	68	69	67
9N-D	10	-446	-450	-455	-446
9N-D	10	-1443	-1447	-1452	-1452
9N-E	419	1445	1444	1444	1445
9N-E	419	176	176	176	176

Span: Bascule Bridge - Leaf Span
Node: 9N

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		131	deg	B
	φ_C =		93	deg	C
	φ_D =		55	deg	D
	$\cos(\varphi_B)$ =		-0.656		
	$\cos(\varphi_C)$ =		-0.052		
	$\cos(\varphi_D)$ =		0.574		
	$V_{A'-A',max}$ =	-90.7 kip	-403	kN	*
	$V_{A'-A',min}$ =	-374.1 kip	-1663	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	374.1 kip	1663	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	267.6 kip	1189	kN	

*using absolute maximum sums, conservative

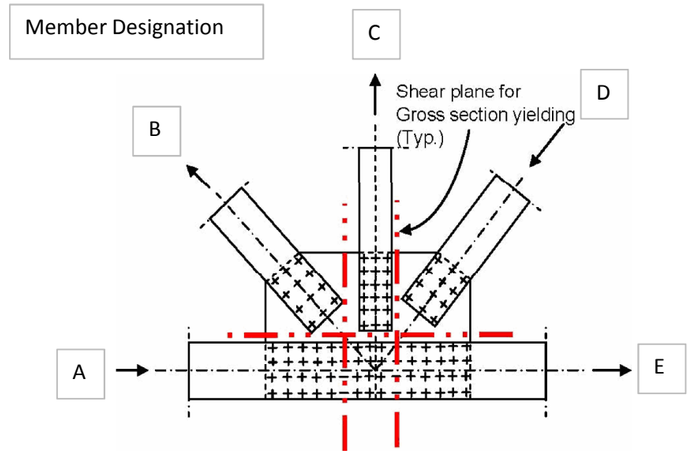


Figure 4 – Examples of gross section shear yielding planes

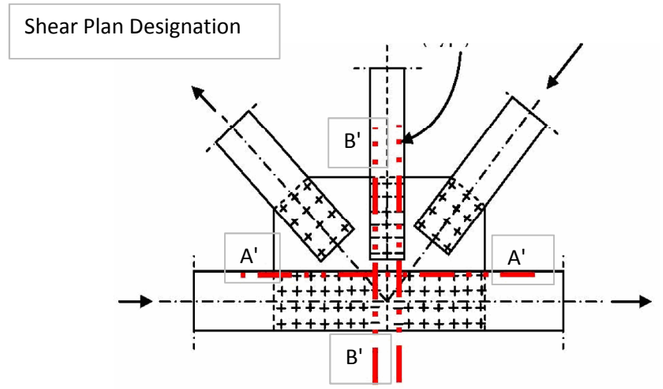


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	49.02	in	1245	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			29880	mm^2	
Net Shear Area	A_n =			23947	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2981	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =			4023	kN	
Shear Resistance (Governing)	V_R =			**2981**	**kN**	
Demand/Capacity	D/C =			**0.558**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	34.84	in	885	mm	
No of holes in shear plane	N =	14.00	ea	14	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 9N

Members A and E continuous through the gusset plate?			Yes		
Outside height of member A	H_A=	15 in	381	mm	
Thickness of the web of member A	w_A=	0.40 in	10	mm	
No of holes in member A/E in shear plane	N_A=	4 ea	4	ea	
Gross Shear Area	A_g =		28982	mm^2	
Net Shear Area	A_n =		20386	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =		$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =		2891	kN	
Shear Resistance (Net Section)	V_{Rn} =		$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =		3425	kN	
Shear Resistance (Governing)	V_R =		**2891**	**kN**	
Demand/Capacity	D/C =		**0.411**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E

N/A

Members A and E continuous through the gusset plate? Yes

General

					Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	0.00 in	0	mm	0	
Shear Length 1	L_{V1} =	0.00 in	0	mm	0	
Shear Length 2	L_{V2} =	0.00 in	0	mm	0	
Tension Length	L_T =	0.00 in	0	mm	0	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00 ea	2	ea		
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$		
		0	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		0	kN	

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

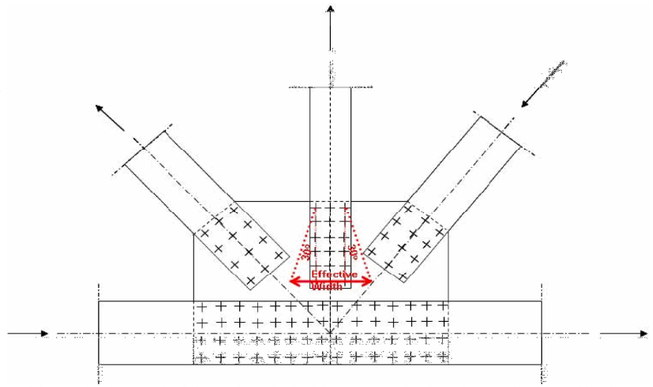


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

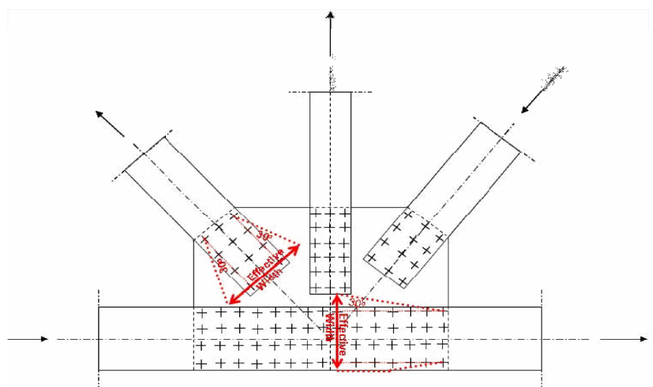


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 9N

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

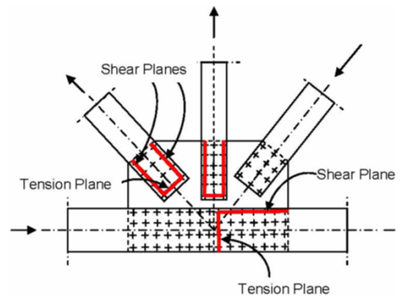


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46 mm		
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

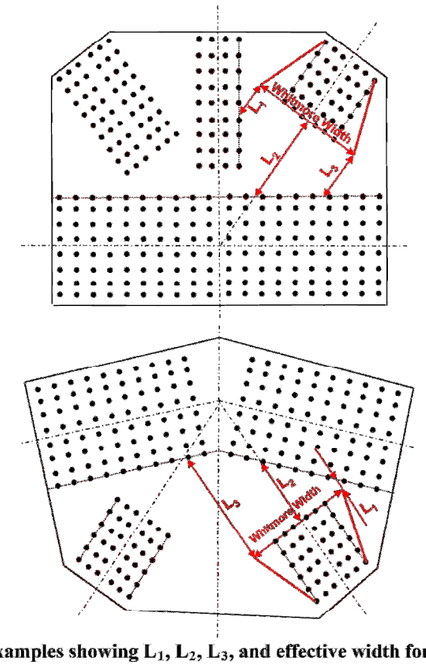


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	48 ea	48 ea			
Longest Length of connection	L=	49.02 in	1245 mm			
Edge distance	e =	0.79 in	20 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$			CSA S6 CL14.14.1.4.2
	B_{r1} =	729 kip	3242 kN			
	B_{r2} =	2084 kip	9263 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$			CSA S6 CL14.14.1.4.2
		495 kip	2200 kN			
Governing Resistance			4400 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span
Node: 9N

Demand/Capacity	D/C =	**0.328**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored?				Yes		
General						Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	20.43	in	519	mm	3
Shear Length 1	L_{V1} =	16.85	in	428	mm	5.5
Shear Length 2	L_{V2} =	16.61	in	422	mm	5.5
Tension Length	L_T =	5.98	in	152	mm	2
Number of Gusset Plates	m =	2	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =			$U*\varphi_s*A_g*F_y$ U=1.0		FHWA 3.1.2
				2485	kN	
Net Section Resistance	P_{RN} =			$U*\varphi_u*A_n*F_u$ U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2				3687	kN	

Block Shear

Gross Tension Area	A_{tg} =			1824	mm^2
Gross Shear Area	A_{vg} =			10200	mm^2
Net Tension Area	A_{tn} =			1330	mm^2
Net Shear Area	A_{vn} =			7481	mm^2
$A_{tn} \geq 0.58*A_{vn}$?				No	
	$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$ U=1.0				
Block Shear Resistance	P_{Rbs} =			3529	kN — FHWA 3.1.3
Tension Resistance (Governing)				2485	kN
Demand/Capacity	D/C =			**0.489**	

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored?				Yes		
General						FHWA 3.3
Whitmore Width	W_w =	20.43	in	519	mm	

Span: Bascule Bridge - Leaf Span
Node: 9N

L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	11.34	in	288	mm	
L3	L_3 =	2.32	in	59	mm	
Unsupported Column Length	L_u =	4.55	in	116	mm	
Effective Length Factor	K =	1.20		1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)		for rectangular plate
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.41		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2202	kN	
Demand/Capacity	D/C =			**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	19	ea	19	ea	
Longest Length of connection	L=	19.02	in	483	mm	
Edge distance	e =	1.50	in	38	mm	
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")
Shear Planes per gusset plate	m =	1	ea	1	ea	
Number of Gusset Plates		2.00	ea	2	ea	
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0	CSA S6 CL14.14.1.4.2
	B_{r1} =	549	kip	2438	kN	
	B_{r2} =	825	kip	3667	kN	
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81	CSA S6 CL14.14.1.4.2
		355	kip	1576	kN	
Governing Resistance				3152	kN	for 2 plate(s)
Demand/Capacity	D/C =			**0.386**		

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	28.54	in	725	mm	2	
Shear Length 1	L_{V1} =	19.02	in	483	mm	7.5	
Shear Length 2	L_{V2} =	19.02	in	483	mm	7.5	
Tension Length	L_T =	8.35	in	212	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 9N

Number of Gusset Plates	m =	2.00 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			3471	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			5514	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		2544	mm^2	
Gross Shear Area	A_{vg} =		11592	mm^2	
Net Tension Area	A_{tn} =		2297	mm^2	
Net Shear Area	A_{vn} =		7884	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		3928	kN	FHWA 3.1.3
Tension Resistance (Governing)			3471	kN	
Demand/Capacity	D/C =		**0.176**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	28.54 in	725	mm	
L1	L_1 =	4.21 in	107	mm	
L2 - along centreline of action	L_2 =	4.96 in	126	mm	
L3	L_3 =	5.71 in	145	mm	
Unsupported Column Length	L_u =	4.96 in	126	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.45		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			3026	kN	

Span: Bascule Bridge - Leaf Span
Node: 9N

Demand/Capacity	D/C =			**0.000**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea		
Longest Length of connection	L=	19.02	in	483	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	462	kip	2053	kN		
	B_{r2} =	695	kip	3088	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		299	kip	1327	kN		
Governing Resistance				2655	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.230**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? No

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	21.81	in	554	mm	3	
Shear Length 1	L_{V1} =	12.13	in	308	mm	4	
Shear Length 2	L_{V2} =	13.86	in	352	mm	4	
Tension Length	L_T =	14.33	in	364	mm	4	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		2653	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		3969	kN		

Block Shear

Gross Tension Area	A_{tg} =	4368	mm^2

Span: Bascule Bridge - Leaf Span

Node: 9N

Gross Shear Area	A_{vg} =		7920	mm^2	
Net Tension Area	A_{tn} =		3379	mm^2	
Net Shear Area	A_{vn} =		5942	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0		
Block Shear Resistance	P_{Rbs} =		3784	kN	FHWA 3.1.3
Tension Resistance (Governing)			2653	kN	
Demand/Capacity	D/C =		**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?			No		
General					FHWA 3.3
Whitmore Width	W_w =	21.81 in	554	mm	
L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	12.99 in	330	mm	
L3	L_3 =	5.28 in	134	mm	
Unsupported Column Length	L_u =	6.09 in	155	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.55		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			2188	kN	
Demand/Capacity	D/C =		**0.664**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	29 ea	29	ea		
Longest Length of connection	L=	17.80 in	452	mm		
Edge distance	e =	1.50 in	38	mm		
Diameter of Rivet	d =	0.75 in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1	ea		
Number of Gusset Plates		2.00 ea	2	ea		
Bearing Resistance of Riveted Connection		$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0			CSA S6 CL14.14.1.4.2
	B_{r1} =	837 kip	3721	kN		
	B_{r2} =	1259 kip	5597	kN		

Span: Bascule Bridge - Leaf Span
Node: 9N

Shear Resistance of Rivets V_r = 541 kip $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 2406 kN CSA S6 CL14.14.1.4.2

Governing Resistance 4811 kN for 2 plate(s)
Demand/Capacity D/C = **0.302**
For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	671	2981
Shear Resistance (Net Section)	905	4023
Shear Resistance (Governing)	671	2981
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	650	2891
Shear Resistance (Net Section)	771	3425
Shear Resistance (Governing)	650	2891
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	559	2485
Net Section Resistance	830	3687
Block Shear Resistance	794	3529
Tension Resistance (Governing)	559	2485
At Member C:		
Gross Section Resistance	781	3471
Net Section Resistance	1241	5514
Block Shear Resistance	884	3928
Tension Resistance (Governing)	781	3471
At Member D:		
Gross Section Resistance	597	2653
Net Section Resistance	893	3969
Block Shear Resistance	851	3784
Tension Resistance (Governing)	597	2653
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 9N

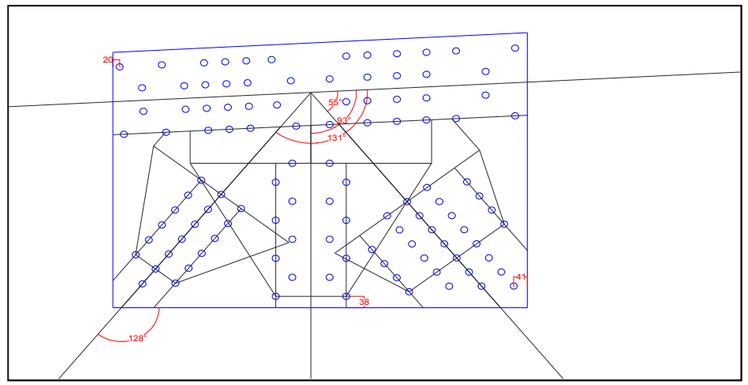
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	495	2202
Compressive Resistance at Member C	681	3026
Compressive Resistance at Member D	492	2188
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	990	4400
Governing Resistance at Member B	709	3152
Governing Resistance at Member C	597	2655
Governing Resistance at Member D	1083	4811
Governing Resistance at Member E	990	4400

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
	SHEAR PLANE A'-A'	671	2981	**0.558**	
	SHEAR PLANE B'-B'	650	2891	**0.411**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	559	2485	**0.489**	
	Member C	781	3471	**0.176**	
	Member D	597	2653	**0.000**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	495	2202	**0.000**	
	Member C	681	3026	**0.000**	
	Member D	492	2188	**0.664**	<--- Governing
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	990	4400	**0.328**	
	Member B	709	3152	**0.386**	
	Member C	597	2655	**0.230**	
	Member D	1083	4811	**0.302**	
	Member E	990	4400	**0.328**	
	Highest Demand/Capacity Ratio			**0.664**	

Span: Bascule Bridge - Leaf Span
Node: 9S

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.47 in	12 mm	6% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units			
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6	
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa			

MEMBER FORCES

Load Combination:		D1, D2, CL1-625 Max	
9S-A	P_{Max} =	147.2 kip	654 kN
9S-A	P_{Min} =	-225.9 kip	-1004 kN
9S-B	P_{Max} =	282.7 kip	1257 kN
9S-B	P_{Min} =	58.6 kip	260 kN
9S-C	P_{Max} =	140.9 kip	626 kN
9S-C	P_{Min} =	18.8 kip	84 kN
9S-D	P_{Max} =	-112.6 kip	-500 kN
9S-D	P_{Min} =	-339.0 kip	-1506 kN
9S-E	P_{Max} =	320.6 kip	1425 kN
9S-E	P_{Min} =	35.1 kip	156 kN

Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
9S-A	489	654	654	654	654
9S-A	489	-1003	-1004	-1004	-1004
9S-B	185	1249	1253	1257	1257
9S-B	185	260	264	268	260
9S-C	332	624	625	626	626
9S-C	332	84	85	85	84
9S-D	186	-500	-505	-509	-500
9S-D	186	-1497	-1502	-1506	-1506
9S-E	488	1425	1425	1425	1425
9S-E	488	157	156	156	156

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 9S

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		131	deg	B
	φ_C =		93	deg	C
	φ_D =		55	deg	D
	$\cos(\varphi_B)$ =		-0.656		
	$\cos(\varphi_C)$ =		-0.052		
	$\cos(\varphi_D)$ =		0.574		
	$V_{A'-A',max}$ =	-104.0 kip	-462	kN	*
	$V_{A'-A',min}$ =	-387.3 kip	-1721	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	387.3 kip	1721	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	277.7 kip	1234	kN	

*using absolute maximum sums, conservative

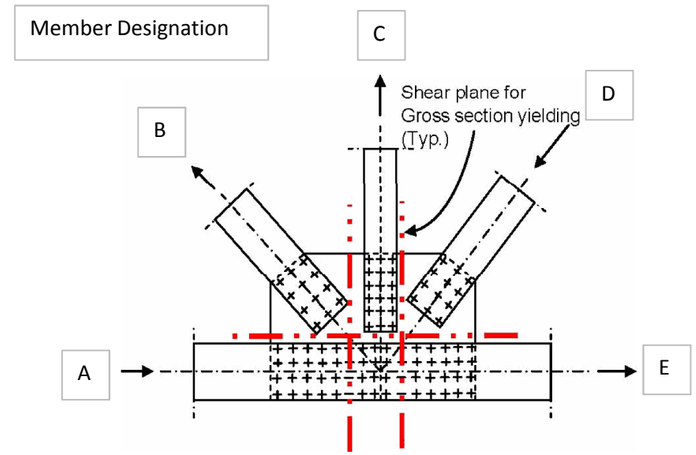


Figure 4 – Examples of gross section shear yielding planes

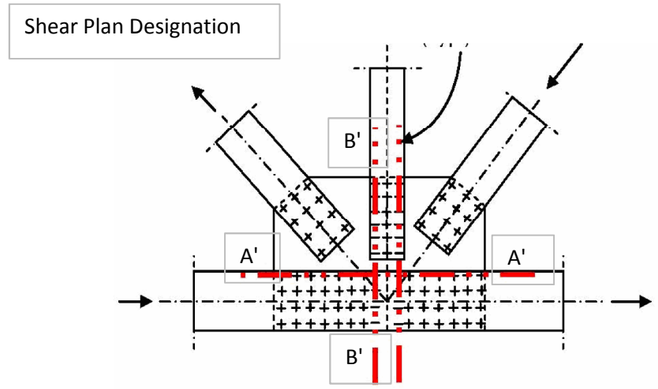


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	49.02	in	1245	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			29880	mm^2	
Net Shear Area	A_n =			23947	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2981	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =			4023	kN	
Shear Resistance (Governing)	V_R =			**2981**	**kN**	
Demand/Capacity	D/C =			**0.577**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	34.84	in	885	mm	
No of holes in shear plane	N =	14.00	ea	14	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 9S

Members A and E continuous through the gusset plate?			Yes		
Outside height of member A	H_A=	15 in	381	mm	
Thickness of the web of member A	w_A=	0.40 in	10	mm	
No of holes in member A/E in shear plane	N_A=	4 ea	4	ea	
Gross Shear Area	A_g =		28982	mm^2	
Net Shear Area	A_n =		20386	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =		$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =		2891	kN	
Shear Resistance (Net Section)	V_{Rn} =		$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =		3425	kN	
Shear Resistance (Governing)	V_R =		**2891**	**kN**	
Demand/Capacity	D/C =		**0.427**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E

N/A

Members A and E continuous through the gusset plate? Yes

General

					Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	0.00 in	0	mm	0	
Shear Length 1	L_{V1} =	0.00 in	0	mm	0	
Shear Length 2	L_{V2} =	0.00 in	0	mm	0	
Tension Length	L_T =	0.00 in	0	mm	0	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00 ea	2	ea		
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$		
		0	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$		
For gusset plates, U=1.0, FHWA 3.1.2		0	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

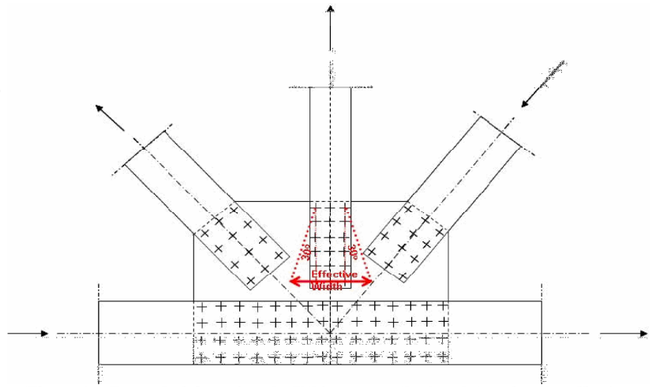


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

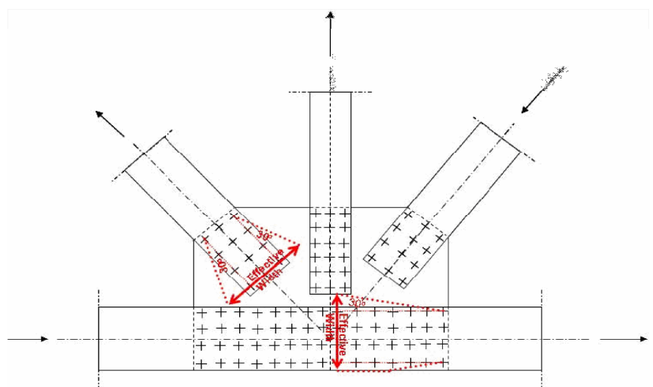


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 9S

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

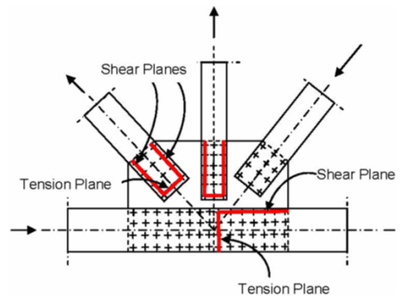


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.14 in	3.46 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

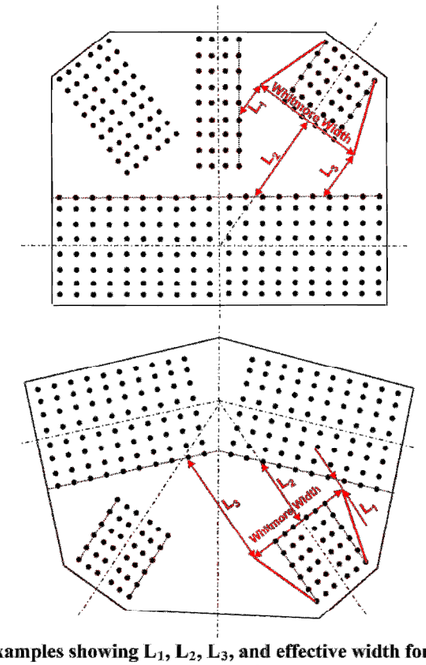


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	48 ea	48 ea			
Longest Length of connection	L=	49.02 in	1245 mm			
Edge distance	e =	0.79 in	20 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$			CSA S6 CL14.14.1.4.2
	B_{r1} =	729 kip	3242 kN			
	B_{r2} =	2084 kip	9263 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$			CSA S6 CL14.14.1.4.2
		495 kip	2200 kN			
Governing Resistance			4400 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span
Node: 9S

Demand/Capacity	D/C =	**0.324**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? Yes

General

					Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	20.43 in	519	mm	3
Shear Length 1	L_{V1} =	16.85 in	428	mm	5.5
Shear Length 2	L_{V2} =	16.61 in	422	mm	5.5
Tension Length	L_T =	5.98 in	152	mm	2
Number of Gusset Plates	m =	2 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$	2485	kN	U=1.0 FHWA 3.1.2
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$	3687	kN	U=1.0 FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2					

Block Shear

Gross Tension Area	A_{tg} =	1824	mm^2	
Gross Shear Area	A_{vg} =	10200	mm^2	
Net Tension Area	A_{tn} =	1330	mm^2	
Net Shear Area	A_{vn} =	7481	mm^2	
$A_{tn} \geq 0.58*A_{vn}$?		No		

$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$ U=1.0

Block Shear Resistance	P_{Rbs} =	3529	kN	FHWA 3.1.3
Tension Resistance (Governing)		2485	kN	
Demand/Capacity	D/C =	**0.506**		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? Yes

General — FHWA 3.3

Whitmore Width	W_w =	20.43 in	519	mm

Span: Bascule Bridge - Leaf Span
Node: 9S

L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	11.34	in	288	mm	
L3	L_3 =	2.32	in	59	mm	
Unsupported Column Length	L_u =	4.55	in	116	mm	
Effective Length Factor	K =	1.20		1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)		for rectangular plate
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.41		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2202	kN	
Demand/Capacity	D/C =			**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	19	ea	19	ea	
Longest Length of connection	L=	19.02	in	483	mm	
Edge distance	e =	1.50	in	38	mm	
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")
Shear Planes per gusset plate	m =	1	ea	1	ea	
Number of Gusset Plates		2.00	ea	2	ea	
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0	CSA S6 CL14.14.1.4.2
	B_{r1} =	549	kip	2438	kN	
	B_{r2} =	825	kip	3667	kN	
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81	CSA S6 CL14.14.1.4.2
		355	kip	1576	kN	
Governing Resistance				3152	kN	for 2 plate(s)
Demand/Capacity	D/C =			**0.399**		

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	28.54	in	725	mm	2	
Shear Length 1	L_{V1} =	19.02	in	483	mm	7.5	
Shear Length 2	L_{V2} =	19.02	in	483	mm	7.5	
Tension Length	L_T =	8.35	in	212	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 9S

Number of Gusset Plates	m =	2.00 ea	2 ea		
Diameter of holes in plane	d_b =	0.81 in	21 mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			3471	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			5514	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		2544	mm^2	
Gross Shear Area	A_{vg} =		11592	mm^2	
Net Tension Area	A_{tn} =		2297	mm^2	
Net Shear Area	A_{vn} =		7884	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		3928	kN	FHWA 3.1.3
Tension Resistance (Governing)			3471	kN	
Demand/Capacity	D/C =		**0.180**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored?			N/A		
General					FHWA 3.3
Whitmore Width	W_w =	28.54 in	725	mm	
L1	L_1 =	4.21 in	107	mm	
L2 - along centreline of action	L_2 =	4.96 in	126	mm	
L3	L_3 =	5.71 in	145	mm	
Unsupported Column Length	L_u =	4.96 in	126	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*\mathrm{sqrt}[F_y/(\pi^2*E_s)]$		
			0.45		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			3026	kN	

Span: Bascule Bridge - Leaf Span
Node: 9S

Demand/Capacity	D/C =			**0.000**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea		
Longest Length of connection	L=	19.02	in	483	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	462	kip	2053	kN		
	B_{r2} =	695	kip	3088	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		299	kip	1327	kN		
Governing Resistance				2655	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.236**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? No

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	21.81	in	554	mm	3	
Shear Length 1	L_{V1} =	12.13	in	308	mm	4	
Shear Length 2	L_{V2} =	13.86	in	352	mm	4	
Tension Length	L_T =	14.33	in	364	mm	4	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		2653	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		3969	kN		

Block Shear

Gross Tension Area	A_{tg} =	4368	mm^2

Span: Bascule Bridge - Leaf Span

Node: 9S

Gross Shear Area	A_{vg} =			7920	mm^2	
Net Tension Area	A_{tn} =			3379	mm^2	
Net Shear Area	A_{vn} =			5942	mm^2	
$A_{tn} > 0.58*A_{vn}$?				No		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		U=1.0		
Block Shear Resistance	P_{Rbs} =			3784	kN	FHWA 3.1.3
Tension Resistance (Governing)				2653	kN	
Demand/Capacity	D/C =			**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?				No		
General						FHWA 3.3
Whitmore Width	W_w =	21.81	in	554	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	12.99	in	330	mm	
L3	L_3 =	5.28	in	134	mm	
Unsupported Column Length	L_u =	6.09	in	155	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.55		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2188	kN	
Demand/Capacity	D/C =			**0.689**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	29	ea	29	ea		
Longest Length of connection	L=	17.80	in	452	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0			CSA S6 CL14.14.1.4.2
	B_{r1} =	837	kip	3721	kN		
	B_{r2} =	1259	kip	5597	kN		

Span: Bascule Bridge - Leaf Span
Node: 9S

Shear Resistance of Rivets	V_r =	541 kip	$0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 2406 kN	CSA S6 CL14.14.1.4.2
Governing Resistance			4811 kN for 2 plate(s)	
Demand/Capacity	D/C =		**0.313**	
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	671	2981
Shear Resistance (Net Section)	905	4023
Shear Resistance (Governing)	671	2981
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	650	2891
Shear Resistance (Net Section)	771	3425
Shear Resistance (Governing)	650	2891
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	559	2485
Net Section Resistance	830	3687
Block Shear Resistance	794	3529
Tension Resistance (Governing)	559	2485
At Member C:		
Gross Section Resistance	781	3471
Net Section Resistance	1241	5514
Block Shear Resistance	884	3928
Tension Resistance (Governing)	781	3471
At Member D:		
Gross Section Resistance	597	2653
Net Section Resistance	893	3969
Block Shear Resistance	851	3784
Tension Resistance (Governing)	597	2653
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 9S

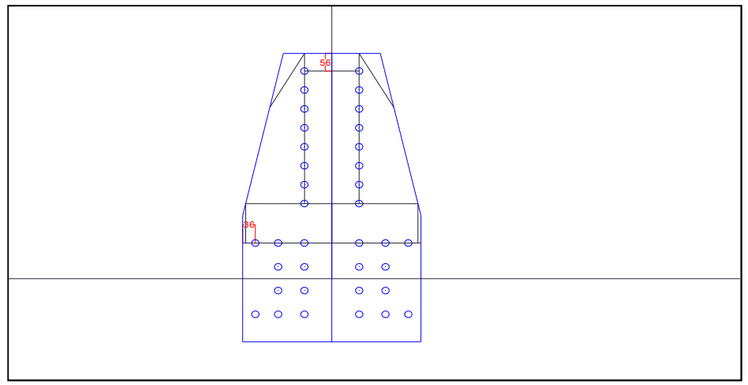
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	495	2202
Compressive Resistance at Member C	681	3026
Compressive Resistance at Member D	492	2188
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	990	4400
Governing Resistance at Member B	709	3152
Governing Resistance at Member C	597	2655
Governing Resistance at Member D	1083	4811
Governing Resistance at Member E	990	4400

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
SHEAR PLANE A'-A'		671	2981	**0.577**	
SHEAR PLANE B'-B'		650	2891	**0.427**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	559	2485	**0.506**	
	Member C	781	3471	**0.180**	
	Member D	597	2653	**0.000**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	495	2202	**0.000**	
	Member C	681	3026	**0.000**	
	Member D	492	2188	**0.689**	<--- Governing
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	990	4400	**0.324**	
	Member B	709	3152	**0.399**	
	Member C	597	2655	**0.236**	
	Member D	1083	4811	**0.313**	
	Member E	990	4400	**0.324**	
Highest Demand/Capacity Ratio				**0.689**	

Span: Bascule Bridge - Leaf Span
Node: 10N

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.35 in	9 mm	29% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units		
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa		

MEMBER FORCES

Load Combination:		D1, D2, CL1-625 Max	
10N-A	P_{Max} =	97.3 kip	432 kN
10N-A	P_{Min} =	-217.1 kip	-965 kN
10N-B	P_{Max} =	0.0 kip	0 kN
10N-B	P_{Min} =	0.0 kip	0 kN
10N-C	P_{Max} =	136.9 kip	608 kN
10N-C	P_{Min} =	13.6 kip	60 kN
10N-D	P_{Max} =	0.0 kip	0 kN
10N-D	P_{Min} =	0.0 kip	0 kN
10N-E	P_{Max} =	99.9 kip	444 kN
10N-E	P_{Min} =	-218.5 kip	-971 kN

Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
10N-A	283	432	432	432	432
10N-A	283	-965	-965	-965	-965
10N-B	0	#N/A	#N/A	#N/A	#N/A
10N-B	0	#N/A	#N/A	#N/A	#N/A
10N-C	327	604	606	608	608
10N-C	327	60	63	65	60
10N-D	0	#N/A	#N/A	#N/A	#N/A
10N-D	0	#N/A	#N/A	#N/A	#N/A
10N-E	284	444	444	444	444
10N-E	284	-971	-971	-971	-971

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 10N

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		128	deg	B
	φ_C =		90	deg	C
	φ_D =		54	deg	D
	$\cos(\varphi_B)$ =		-0.616		
	$\cos(\varphi_C)$ =		0.000		
	$\cos(\varphi_D)$ =		0.588		
	$V_{A'-A',max}$ =	0.0 kip	0	kN	*
	$V_{A'-A',min}$ =	0.0 kip	0	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	0.0 kip	0	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	0.0 kip	0	kN	

*using absolute maximum sums, conservative

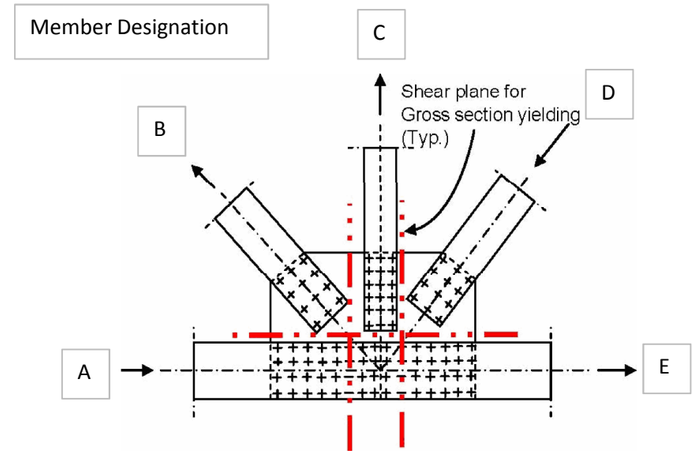


Figure 4 – Examples of gross section shear yielding planes

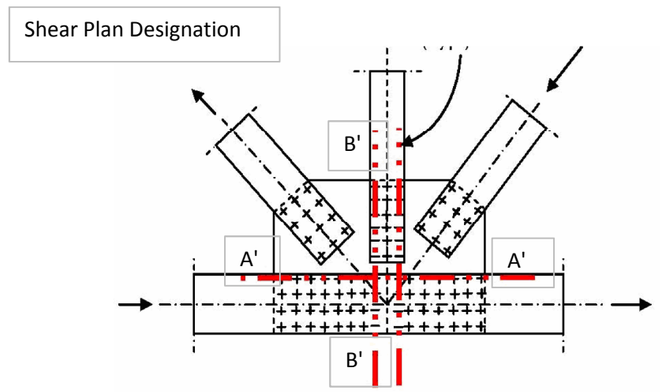


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	20.00	in	508	mm	
No of holes in shear plane	N =	6.00	ea	6	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			9144	mm^2	
Net Shear Area	A_n =			6919	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			912	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$ *		Cl 10.18.5.2
	V_{Rn} =			1162	kN	
Shear Resistance (Governing)	V_R =			**912**	**kN**	
Demand/Capacity	D/C =			**0.000**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	35.98	in	914	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 10N

Members A and E continuous through the gusset plate?			Yes		
Outside height of member A	H_A=	15 in	381	mm	
Thickness of the web of member A	w_A=	0.40 in	10	mm	
No of holes in member A/E in shear plane	N_A=	4 ea	4	ea	
Gross Shear Area	A_g =		24194	mm^2	
Net Shear Area	A_n =		18070	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =		$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =		2413	kN	
Shear Resistance (Net Section)	V_{Rn} =		$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =		3036	kN	
Shear Resistance (Governing)	V_R =		**2413**	**kN**	
Demand/Capacity	D/C =		**0.000**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E — N/A

Members A and E continuous through the gusset plate?			Yes		
Members A and E continuous through the gusset plate?			Yes		

General

					Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	0.00 in	0	mm	0	
Shear Length 1	L_{V1} =	0.00 in	0	mm	0	
Shear Length 2	L_{V2} =	0.00 in	0	mm	0	
Tension Length	L_T =	0.00 in	0	mm	0	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00 ea	2	ea		
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$		
			0	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_y$		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2			0	kN	

Block Shear

Gross Tension Area	A_{tg} =		0	mm^2
Gross Shear Area	A_{vg} =		0	mm^2
Net Tension Area	A_{tn} =		0	mm^2
Net Shear Area	A_{vn} =		0	mm^2
$A_{tn} > 0.58*A_{vn}$?			Yes	

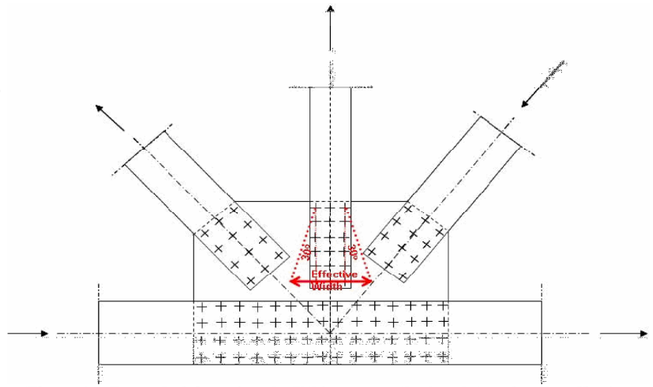


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

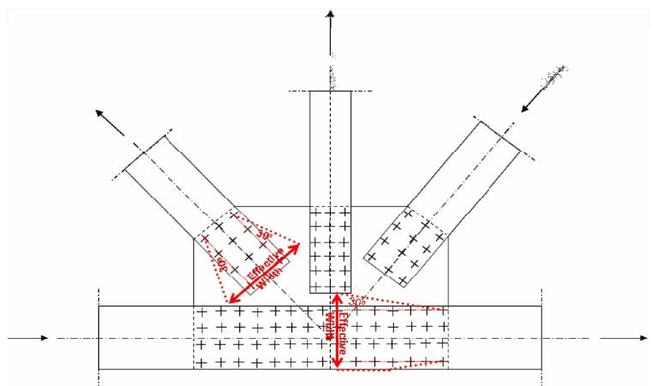


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 10N

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

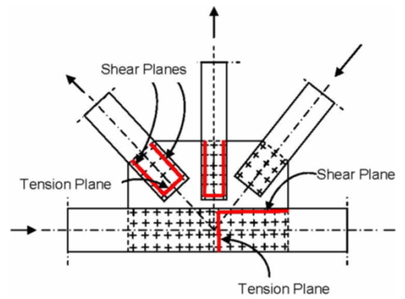


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.10 in	2.60 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

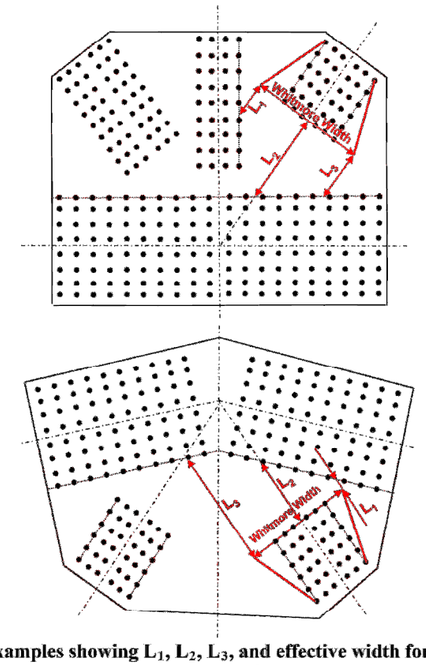


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	20 ea	20 ea			
Longest Length of connection	L=	20.00 in	508 mm			
Edge distance	e =	1.42 in	36 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$		CSA S6 CL14.14.1.4.2	
	B_{r1} =	410 kip	1823 kN			
	B_{r2} =	651 kip	2895 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$		CSA S6 CL14.14.1.4.2	
		206 kip	917 kN			
Governing Resistance			1833 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span

Node: 10N

Demand/Capacity	D/C =		**0.530**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.					FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored?			Yes		
General					Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	21.81 in	554	mm	3
Shear Length 1	L_{V1} =	13.11 in	333	mm	4.5
Shear Length 2	L_{V2} =	11.38 in	289	mm	4.5
Tension Length	L_T =	14.33 in	364	mm	4
Number of Gusset Plates	m =	2 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$U*\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
			1989	kN	
Net Section Resistance	P_{RN} =		$U*\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2			2977	kN	

Block Shear

Gross Tension Area	A_{tg} =		3276	mm^2
Gross Shear Area	A_{vg} =		5598	mm^2
Net Tension Area	A_{tn} =		2534	mm^2
Net Shear Area	A_{vn} =		3929	mm^2
$A_{tn} \geq 0.58*A_{vn}$?			Yes	

		$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		U=1.0	
Block Shear Resistance	P_{Rbs} =		2794	kN	FHWA 3.1.3
Tension Resistance (Governing)			1989	kN	
Demand/Capacity	D/C =		**0.000**		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored?			Yes		
General					FHWA 3.3
Whitmore Width	W_w =	21.81 in	554	mm	

Span: Bascule Bridge - Leaf Span

Node: 10N

L1	L_1 =	0.79	in	20	mm	
L2 - along centreline of action	L_2 =	13.54	in	344	mm	
L3	L_3 =	4.88	in	124	mm	
Unsupported Column Length	L_u =	6.40	in	163	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.10	in	2.60	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.77		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				1389	kN	
Demand/Capacity	D/C =			**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22	ea	22	ea		
Longest Length of connection	L=	18.94	in	481	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	476	kip	2117	kN		
	B_{r2} =	716	kip	3184	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		411	kip	1825	kN		
Governing Resistance				3650	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.000**			

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	19.29	in	490	mm	2	
Shear Length 1	L_{V1} =	18.74	in	476	mm	7.5	
Shear Length 2	L_{V2} =	18.74	in	476	mm	7.5	
Tension Length	L_T =	6.14	in	156	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 10N

Number of Gusset Plates	m =	2.00 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			1760	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			2714	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		1404	mm^2	
Gross Shear Area	A_{vg} =		8568	mm^2	
Net Tension Area	A_{tn} =		1219	mm^2	
Net Shear Area	A_{vn} =		5787	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		2727	kN	FHWA 3.1.3
Tension Resistance (Governing)			1760	kN	
Demand/Capacity	D/C =		**0.346**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored?			N/A		
General					FHWA 3.3
Whitmore Width	W_w =	19.29 in	490	mm	
L1	L_1 =	4.92 in	125	mm	
L2 - along centreline of action	L_2 =	4.92 in	125	mm	
L3	L_3 =	4.92 in	125	mm	
Unsupported Column Length	L_u =	4.92 in	125	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.10 in	2.60	mm	
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.60		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			1412	kN	

Span: Bascule Bridge - Leaf Span
Node: 10N

Demand/Capacity	D/C =			**0.000**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea		
Longest Length of connection	L=	18.74	in	476	mm		
Edge distance	e =	2.20	in	56	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	511	kip	2269	kN		
	B_{r2} =	521	kip	2316	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		299	kip	1327	kN		
Governing Resistance				2655	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.229**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	24.41	in	620	mm	5	
Shear Length 1	L_{V1} =	10.87	in	276	mm	3.5	
Shear Length 2	L_{V2} =	14.25	in	362	mm	4.5	
Tension Length	L_T =	15.55	in	395	mm	5	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		2226	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		3127	kN		

Block Shear

Gross Tension Area	A_{tg} =	3555	mm^2

Span: Bascule Bridge - Leaf Span

Node: 10N

Gross Shear Area	A_{vg} =			5742	mm^2	
Net Tension Area	A_{tn} =			2628	mm^2	
Net Shear Area	A_{vn} =			4259	mm^2	
$A_{tn} > 0.58*A_{vn}$?				Yes		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		U=1.0		
Block Shear Resistance	P_{Rbs} =			2885	kN	FHWA 3.1.3
Tension Resistance (Governing)				2226	kN	
Demand/Capacity	D/C =			**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?				Yes		
General						FHWA 3.3
Whitmore Width	W_w =	24.41	in	620	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	13.15	in	334	mm	
L3	L_3 =	4.21	in	107	mm	
Unsupported Column Length	L_u =	5.79	in	147	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.10	in	2.60	mm	
	λ =			$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
				0.70		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				1654	kN	
Demand/Capacity	D/C =			**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	25	ea	25	ea		
Longest Length of connection	L=	19.37	in	492	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	541	kip	2406	kN		
	B_{r2} =	814	kip	3618	kN		

Span: Bascule Bridge - Leaf Span
Node: 10N

Shear Resistance of Rivets V_r = $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 CSA S6 CL14.14.1.4.2

467 kip — 2074 kN

Governing Resistance 4148 kN for 2 plate(s)

Demand/Capacity D/C = **0.000**

For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	205	912
Shear Resistance (Net Section)	262	1162
Shear Resistance (Governing)	205	912
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	543	2413
Shear Resistance (Net Section)	683	3036
Shear Resistance (Governing)	543	2413
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	448	1989
Net Section Resistance	670	2977
Block Shear Resistance	629	2794
Tension Resistance (Governing)	448	1989
At Member C:		
Gross Section Resistance	396	1760
Net Section Resistance	611	2714
Block Shear Resistance	614	2727
Tension Resistance (Governing)	396	1760
At Member D:		
Gross Section Resistance	501	2226
Net Section Resistance	704	3127
Block Shear Resistance	649	2885
Tension Resistance (Governing)	501	2226
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 10N

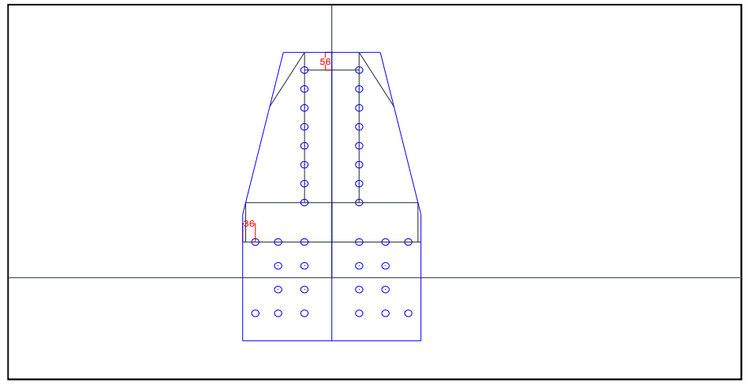
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	313	1389
Compressive Resistance at Member C	318	1412
Compressive Resistance at Member D	372	1654
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	412	1833
Governing Resistance at Member B	821	3650
Governing Resistance at Member C	597	2655
Governing Resistance at Member D	933	4148
Governing Resistance at Member E	412	1833

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
		kip	kN		
GUSSET PLATE SHEAR					
	SHEAR PLANE A'-A'	205	912	**0.000**	
	SHEAR PLANE B'-B'	543	2413	**0.000**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	448	1989	**0.000**	
	Member C	396	1760	**0.346**	
	Member D	501	2226	**0.000**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	313	1389	**0.000**	
	Member C	318	1412	**0.000**	
	Member D	372	1654	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	412	1833	**0.530**	<--- Governing
	Member B	821	3650	**0.000**	
	Member C	597	2655	**0.229**	
	Member D	933	4148	**0.000**	
	Member E	412	1833	**0.530**	<--- Governing
	Highest Demand/Capacity Ratio			**0.530**	

Span: Bascule Bridge - Leaf Span
Node: 10S

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.24 in	6 mm	53% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units		
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa		

MEMBER FORCES

Load Combination:		D1, D2, CL1-625 Max	
10S-A	P_{Max} =	107.3 kip	477 kN
10S-A	P_{Min} =	-206.9 kip	-919 kN
10S-B	P_{Max} =	0.0 kip	0 kN
10S-B	P_{Min} =	0.0 kip	0 kN
10S-C	P_{Max} =	141.3 kip	628 kN
10S-C	P_{Min} =	18.2 kip	81 kN
10S-D	P_{Max} =	0.0 kip	0 kN
10S-D	P_{Min} =	0.0 kip	0 kN
10S-E	P_{Max} =	112.5 kip	500 kN
10S-E	P_{Min} =	-206.1 kip	-916 kN

Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
10S-A	563	477	477	477	477
10S-A	563	-919	-919	-919	-919
10S-B	0	#N/A	#N/A	#N/A	#N/A
10S-B	0	#N/A	#N/A	#N/A	#N/A
10S-C	331	624	626	628	628
10S-C	331	81	83	85	81
10S-D	0	#N/A	#N/A	#N/A	#N/A
10S-D	0	#N/A	#N/A	#N/A	#N/A
10S-E	564	500	500	500	500
10S-E	564	-916	-916	-916	-916

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 10S

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		128	deg	B
	φ_C =		90	deg	C
	φ_D =		54	deg	D
	$\cos(\varphi_B)$ =		-0.616		
	$\cos(\varphi_C)$ =		0.000		
	$\cos(\varphi_D)$ =		0.588		
	$V_{A'-A',max}$ =	0.0 kip	0	kN	*
	$V_{A'-A',min}$ =	0.0 kip	0	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	0.0 kip	0	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	0.0 kip	0	kN	

*using absolute maximum sums, conservative

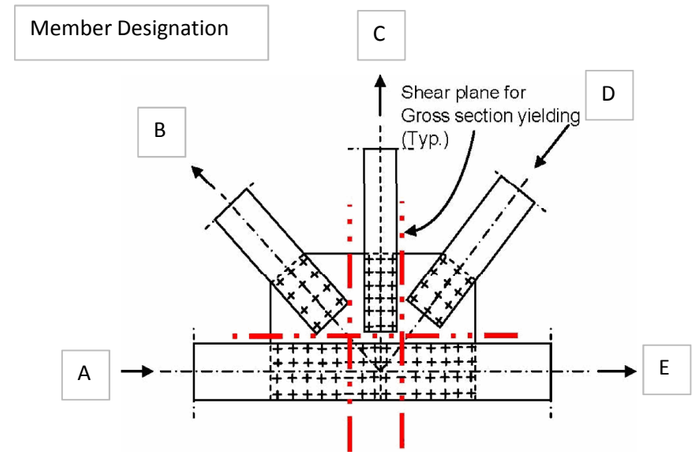


Figure 4 – Examples of gross section shear yielding planes

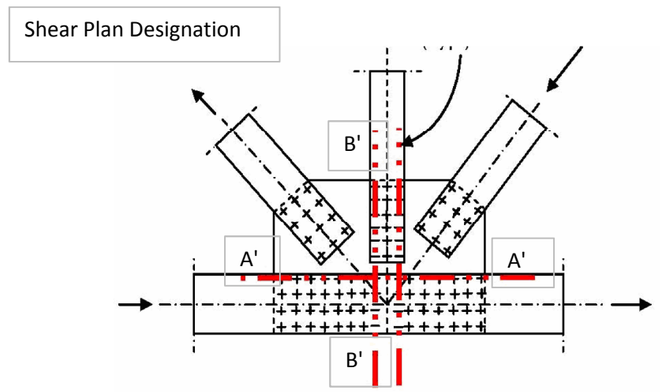


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	20.00	in	508	mm	
No of holes in shear plane	N =	6.00	ea	6	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			6096	mm^2	
Net Shear Area	A_n =			4613	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			608	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =			775	kN	
Shear Resistance (Governing)	V_R =			**608**	**kN**	
Demand/Capacity	D/C =			**0.000**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	35.98	in	914	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 10S

Members A and E continuous through the gusset plate?				Yes		
Outside height of member A	H_A=	15	in	381	mm	
Thickness of the web of member A	w_A=	0.40	in	10	mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4	ea	
Gross Shear Area	A_g =			18710	mm^2	
Net Shear Area	A_n =			14069	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			1866	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =			2364	kN	
Shear Resistance (Governing)	V_R =			**1866**	**kN**	
Demand/Capacity	D/C =			**0.000**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E — N/A

Members A and E continuous through the gusset plate? Yes

General

Whitmore Width	W_w =	0.00	in	0	mm	
Shear Length 1	L_{V1} =	0.00	in	0	mm	
Shear Length 2	L_{V2} =	0.00	in	0	mm	
Tension Length	L_T =	0.00	in	0	mm	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Number of Rivet/bolt diameters Intsecting Plane

0	
0	
0	
0	Typ, 1 less than Whitemore Width

Axile Tensile Resistance

CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	
		0	kN
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	
For gusset plates, U=1.0, FHWA 3.1.2		0	kN

FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =	0 mm^2
Gross Shear Area	A_{vg} =	0 mm^2
Net Tension Area	A_{tn} =	0 mm^2
Net Shear Area	A_{vn} =	0 mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes

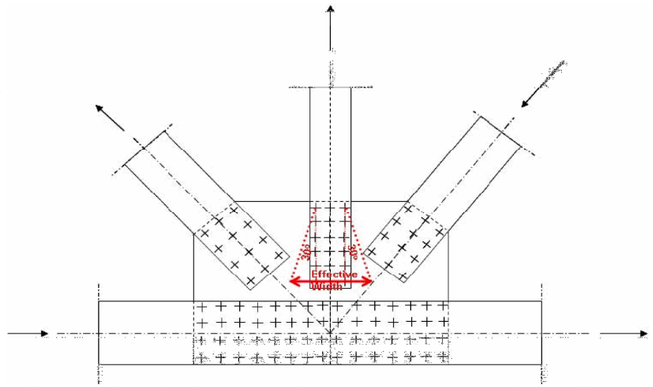


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

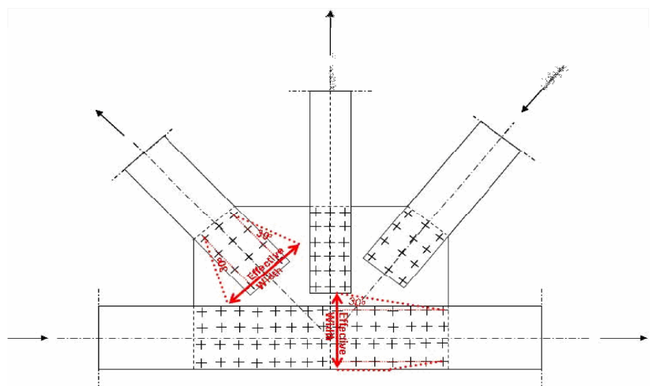


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 10S

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

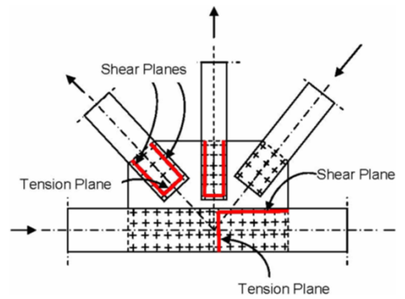


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0 "fixed-free condition"		
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		t/√(12) for rectangular plate		
		0.07 in	1.73 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

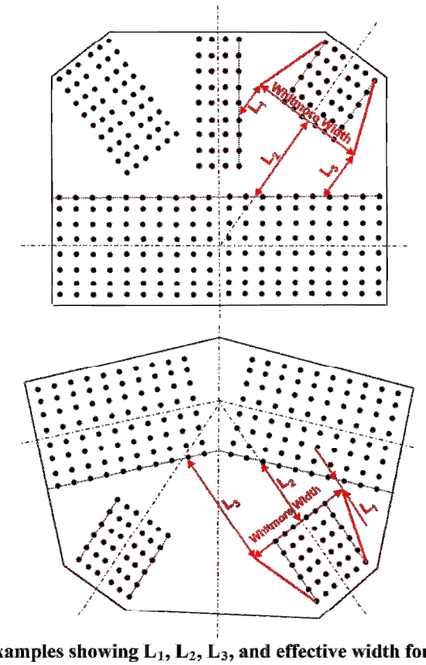


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	20 ea	20 ea		
Longest Length of connection	L=	20.00 in	508 mm		
Edge distance	e =	1.42 in	36 mm		
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1 ea		
Number of Gusset Plates		2 ea	2 ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$		CSA S6 CL14.14.1.4.2
	B_{r1} =	274 kip	1216 kN		
	B_{r2} =	434 kip	1930 kN		
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$		CSA S6 CL14.14.1.4.2
		206 kip	917 kN		
Governing Resistance			1833 kN	for 2 plate(s)	

Span: Bascule Bridge - Leaf Span

Node: 10S

Demand/Capacity	D/C =	**0.502**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored?				Yes		
General						Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	21.81	in	554 mm		3
Shear Length 1	L_{V1} =	13.11	in	333 mm		4.5
Shear Length 2	L_{V2} =	11.38	in	289 mm		4.5
Tension Length	L_T =	14.33	in	364 mm		4
Number of Gusset Plates	m =	2	ea	2 ea		
Diameter of holes in plane	d_b =	0.81	in	21 mm		($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$ U=1.0	1326 kN	FHWA 3.1.2
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$ U=1.0	1985 kN	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2				

Block Shear

Gross Tension Area	A_{tg} =	2184	mm^2
Gross Shear Area	A_{vg} =	3732	mm^2
Net Tension Area	A_{tn} =	1690	mm^2
Net Shear Area	A_{vn} =	2620	mm^2
$A_{tn} \geq 0.58*A_{vn}$?		Yes	

		$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$ U=1.0		
Block Shear Resistance	P_{Rbs} =		1863 kN	FHWA 3.1.3
Tension Resistance (Governing)			1326 kN	
Demand/Capacity	D/C =		**0.000**	

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored?			Yes		
General					FHWA 3.3
Whitmore Width	W_w =	21.81	in	554 mm	

Span: Bascule Bridge - Leaf Span

Node: 10S

L1	L_1 =	0.79	in	20	mm	
L2 - along centreline of action	L_2 =	13.54	in	344	mm	
L3	L_3 =	4.88	in	124	mm	
Unsupported Column Length	L_u =	6.40	in	163	mm	
Effective Length Factor	K =	1.20		1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)		for rectangular plate
		0.07	in	1.73	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				1.16		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				635	kN	
Demand/Capacity	D/C =			**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22	ea	22	ea		
Longest Length of connection	L=	18.94	in	481	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	318	kip	1412	kN		
	B_{r2} =	478	kip	2123	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		411	kip	1825	kN		
Governing Resistance				2823	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.000**			

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	19.29	in	490	mm	2	
Shear Length 1	L_{V1} =	18.74	in	476	mm	7.5	
Shear Length 2	L_{V2} =	18.74	in	476	mm	7.5	
Tension Length	L_T =	6.14	in	156	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 10S

Number of Gusset Plates	m =	2.00 ea	2 ea		
Diameter of holes in plane	d_b =	0.81 in	21 mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			1173	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			1810	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		936	mm^2	
Gross Shear Area	A_{vg} =		5712	mm^2	
Net Tension Area	A_{tn} =		812	mm^2	
Net Shear Area	A_{vn} =		3858	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		1818	kN	FHWA 3.1.3
Tension Resistance (Governing)			1173	kN	
Demand/Capacity	D/C =		**0.535**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored?			N/A		
General					FHWA 3.3
Whitmore Width	W_w =	19.29 in	490	mm	
L1	L_1 =	4.92 in	125	mm	
L2 - along centreline of action	L_2 =	4.92 in	125	mm	
L3	L_3 =	4.92 in	125	mm	
Unsupported Column Length	L_u =	4.92 in	125	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.07 in	1.73	mm	
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.89		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			735	kN	

Span: Bascule Bridge - Leaf Span
Node: 10S

Demand/Capacity	D/C =			**0.000**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea		
Longest Length of connection	L=	18.74	in	476	mm		
Edge distance	e =	2.20	in	56	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	340	kip	1513	kN		
	B_{r2} =	347	kip	1544	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		299	kip	1327	kN		
Governing Resistance				2655	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.237**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	24.41	in	620	mm	5	
Shear Length 1	L_{V1} =	10.87	in	276	mm	3.5	
Shear Length 2	L_{V2} =	14.25	in	362	mm	4.5	
Tension Length	L_T =	15.55	in	395	mm	5	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
		1484	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		2085	kN	

Block Shear

Gross Tension Area	A_{tg} =	2370	mm^2

Span: Bascule Bridge - Leaf Span

Node: 10S

Gross Shear Area	A_{vg} =	3828	mm^2	
Net Tension Area	A_{tn} =	1752	mm^2	
Net Shear Area	A_{vn} =	2839	mm^2	
$A_{tn} > 0.58*A_{vn}$?		Yes		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =	1923	kN	FHWA 3.1.3
Tension Resistance (Governing)		1484	kN	
Demand/Capacity	D/C =	**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?				Yes		
General						FHWA 3.3
Whitmore Width	W_w =	24.41	in	620	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	13.15	in	334	mm	
L3	L_3 =	4.21	in	107	mm	
Unsupported Column Length	L_u =	5.79	in	147	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.07	in	1.73	mm	
	λ =			$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
				1.05		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				797	kN	
Demand/Capacity	D/C =			**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	25	ea	25	ea		
Longest Length of connection	L=	19.37	in	492	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	361	kip	1604	kN		
	B_{r2} =	543	kip	2412	kN		

Span: Bascule Bridge - Leaf Span
Node: 10S

Shear Resistance of Rivets V_r = $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 CSA S6 CL14.14.1.4.2

467 kip 2074 kN

Governing Resistance 3208 kN for 2 plate(s)

Demand/Capacity D/C = **0.000**

For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	137	608
Shear Resistance (Net Section)	174	775
Shear Resistance (Governing)	137	608
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	420	1866
Shear Resistance (Net Section)	532	2364
Shear Resistance (Governing)	420	1866
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	298	1326
Net Section Resistance	447	1985
Block Shear Resistance	419	1863
Tension Resistance (Governing)	298	1326
At Member C:		
Gross Section Resistance	264	1173
Net Section Resistance	407	1810
Block Shear Resistance	409	1818
Tension Resistance (Governing)	264	1173
At Member D:		
Gross Section Resistance	334	1484
Net Section Resistance	469	2085
Block Shear Resistance	433	1923
Tension Resistance (Governing)	334	1484
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 10S

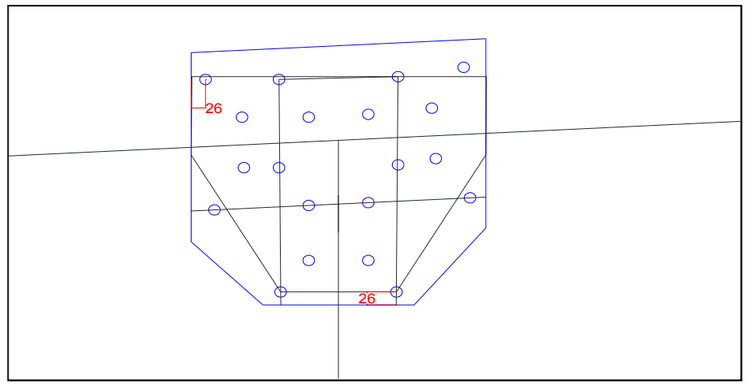
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	143	635
Compressive Resistance at Member C	165	735
Compressive Resistance at Member D	179	797
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	412	1833
Governing Resistance at Member B	635	2823
Governing Resistance at Member C	597	2655
Governing Resistance at Member D	722	3208
Governing Resistance at Member E	412	1833

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
SHEAR PLANE A'-A'		137	608	**0.000**	
SHEAR PLANE B'-B'		420	1866	**0.000**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	298	1326	**0.000**	
	Member C	264	1173	**0.535**	<--- Governing
	Member D	334	1484	**0.000**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	143	635	**0.000**	
	Member C	165	735	**0.000**	
	Member D	179	797	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	412	1833	**0.502**	
	Member B	635	2823	**0.000**	
	Member C	597	2655	**0.237**	
	Member D	722	3208	**0.000**	
	Member E	412	1833	**0.502**	
	Highest Demand/Capacity Ratio			**0.535**	

Span: Bascule Bridge - Leaf Span
Node: 11N

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.47 in	12 mm	6% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units		
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa		

MEMBER FORCES

Load Combination:		D1, D2, CL1-625 Max	
11N-A	P_{Max} =	325.1 kip	1445 kN
11N-A	P_{Min} =	39.5 kip	176 kN
11N-B	P_{Max} =	0.0 kip	0 kN
11N-B	P_{Min} =	0.0 kip	0 kN
11N-C	P_{Max} =	-3.3 kip	-15 kN
11N-C	P_{Min} =	-6.0 kip	-27 kN
11N-D	P_{Max} =	0.0 kip	0 kN
11N-D	P_{Min} =	0.0 kip	0 kN
11N-E	P_{Max} =	327.3 kip	1454 kN
11N-E	P_{Min} =	41.7 kip	185 kN

Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
11N-A	419	1445	1444	1444	1445
11N-A	419	176	176	176	176
11N-B	0	#N/A	#N/A	#N/A	#N/A
11N-B	0	#N/A	#N/A	#N/A	#N/A
11N-C	247	-20	-17	-15	-15
11N-C	247	-27	-24	-22	-27
11N-D	0	#N/A	#N/A	#N/A	#N/A
11N-D	0	#N/A	#N/A	#N/A	#N/A
11N-E	418	1454	1454	1454	1454
11N-E	418	186	185	185	185

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 11N

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		0	deg	B
	φ_C =		93	deg	C
	φ_D =		0	deg	D
	$\cos(\varphi_B)$ =		1.000		
	$\cos(\varphi_C)$ =		-0.052		
	$\cos(\varphi_D)$ =		1.000		
	$V_{A'-A',max}$ =	0.3 kip	1	kN	*
	$V_{A'-A',min}$ =	0.2 kip	1	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	0.3 kip	1	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	0.0 kip	0	kN	

*using absolute maximum sums, conservative

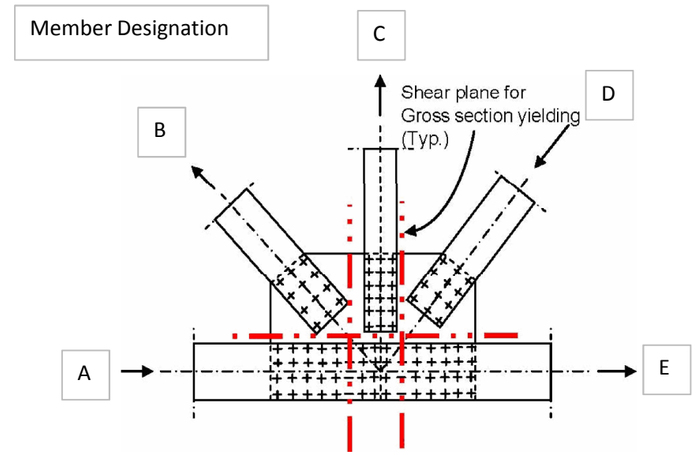


Figure 4 – Examples of gross section shear yielding planes

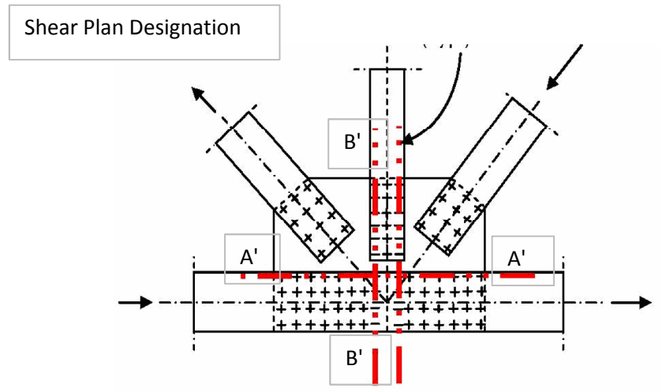


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	21.06	535	mm	
No of holes in shear plane	N =	4.00 ea	4	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00 ea	2	ea	
Gross Shear Area	A_g =		12840	mm^2	
Net Shear Area	A_n =		10862	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =		$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =		1281	kN	
Shear Resistance (Net Section)	V_{Rn} =		$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =		1825	kN	
Shear Resistance (Governing)	V_R =		**1281**	**kN**	
Demand/Capacity	D/C =		**0.001**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	20.35 in	517	mm	
No of holes in shear plane	N =	6.00 ea	6	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2 ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 11N

Members A and E continuous through the gusset plate?			Yes		
Outside height of member A	H_A=	15 in	381	mm	
Thickness of the web of member A	w_A=	0.40 in	10	mm	
No of holes in member A/E in shear plane	N_A=	4 ea	4	ea	
Gross Shear Area	A_g =		20150	mm^2	
Net Shear Area	A_n =		15509	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =		$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =		2010	kN	
Shear Resistance (Net Section)	V_{Rn} =		$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =		2606	kN	
Shear Resistance (Governing)	V_R =		**2010**	**kN**	
Demand/Capacity	D/C =		**0.000**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E — N/A

Members A and E continuous through the gusset plate?			Yes		

General

Whitmore Width	W_w =	0.00 in	0	mm	
Shear Length 1	L_{V1} =	0.00 in	0	mm	
Shear Length 2	L_{V2} =	0.00 in	0	mm	
Tension Length	L_T =	0.00 in	0	mm	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	

Number of Rivet/bolt diameters Intsecting Plane

0	
0	
0	
0	Typ, 1 less than Whitemore Width

($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$		
		0	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$		
For gusset plates, U=1.0, FHWA 3.1.2		0	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

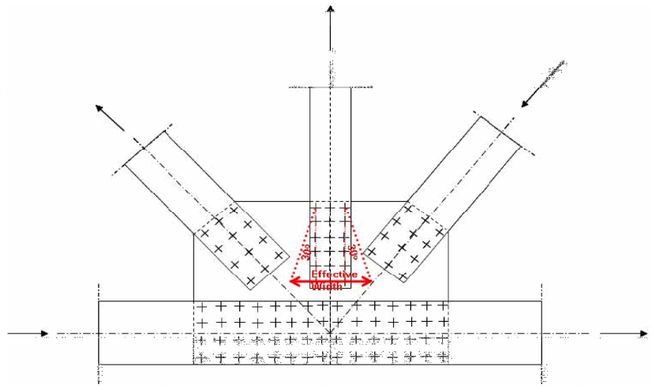


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

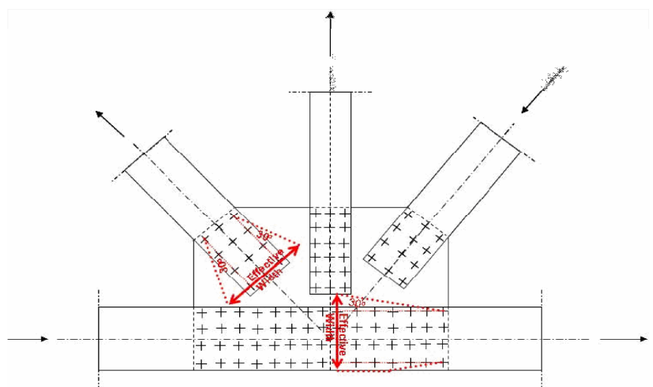


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 11N

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

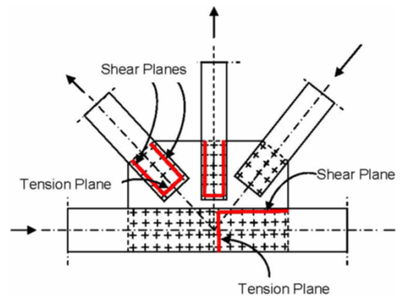


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.14 in	3.46 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

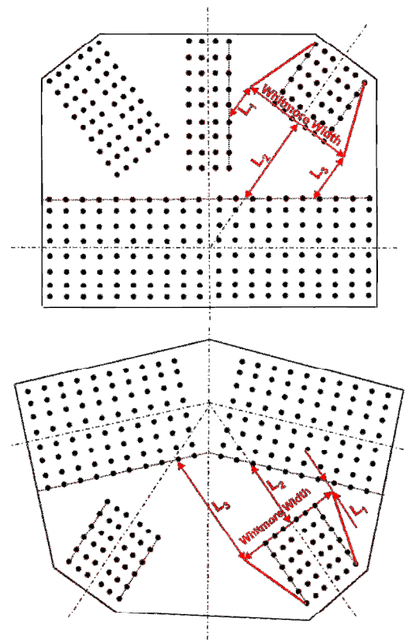


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Possible Scenario?			No		
Number of Rivets/Bolts	n =	16 ea	16 ea		
Longest Length of connection	L=	21.02 in	534 mm		
Edge distance	e =	1.02 in	26 mm		
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1 ea		
Number of Gusset Plates		2 ea	2 ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$		CSA S6 CL14.14.1.4.2
	B_{r1} =	316 kip	1405 kN		
	B_{r2} =	695 kip	3088 kN		
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$		CSA S6 CL14.14.1.4.2
		165 kip	733 kN		
Governing Resistance			1467 kN	for 2 plate(s)	

Span: Bascule Bridge - Leaf Span
Node: 11N

Demand/Capacity	D/C =	**0.000**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	21.81	in	554	mm	3
Shear Length 1	L_{V1} =	13.11	in	333	mm	4.5
Shear Length 2	L_{V2} =	11.38	in	289	mm	4.5
Tension Length	L_T =	14.33	in	364	mm	4
Number of Gusset Plates	m =	2	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$ U=1.0	2653 kN	FHWA 3.1.2
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$ U=1.0	3969 kN	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2				

Block Shear

Gross Tension Area	A_{tg} =	4368	mm^2
Gross Shear Area	A_{vg} =	7464	mm^2
Net Tension Area	A_{tn} =	3379	mm^2
Net Shear Area	A_{vn} =	5239	mm^2
$A_{tn} \geq 0.58*A_{vn}$?		Yes	

		$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$ U=1.0		
Block Shear Resistance	P_{Rbs} =		3725 kN	FHWA 3.1.3
Tension Resistance (Governing)			2653 kN	
Demand/Capacity	D/C =		**0.000**	

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? Yes

General — FHWA 3.3

Whitmore Width	W_w =	21.81	in	554 mm

Span: Bascule Bridge - Leaf Span

Node: 11N

L1	L_1 =	0.79	in	20	mm	
L2 - along centreline of action	L_2 =	13.54	in	344	mm	
L3	L_3 =	4.88	in	124	mm	
Unsupported Column Length	L_u =	6.40	in	163	mm	
Effective Length Factor	K =	1.20		1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)		for rectangular plate
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.58		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2149	kN	
Demand/Capacity	D/C =			**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22	ea	22	ea	
Longest Length of connection	L=	18.94	in	481	mm	
Edge distance	e =	1.50	in	38	mm	
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")
Shear Planes per gusset plate	m =	1	ea	1	ea	
Number of Gusset Plates		2.00	ea	2	ea	
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0	CSA S6 CL14.14.1.4.2
	B_{r1} =	635	kip	2823	kN	
	B_{r2} =	955	kip	4246	kN	
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81	CSA S6 CL14.14.1.4.2
		411	kip	1825	kN	
Governing Resistance				3650	kN	for 2 plate(s)
Demand/Capacity	D/C =			**0.000**		

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	21.02	in	534	mm	2	
Shear Length 1	L_{V1} =	18.11	in	460	mm	5.5	
Shear Length 2	L_{V2} =	18.11	in	460	mm	5.5	
Tension Length	L_T =	8.27	in	210	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 11N

Number of Gusset Plates	m =	2.00	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =			$\varphi_s*A_g*F_y$	U=1.0	
				2557	kN	
Net Section Resistance	P_{RN} =			$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2				3974	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =			2520	mm^2	
Gross Shear Area	A_{vg} =			11040	mm^2	
Net Tension Area	A_{tn} =			2273	mm^2	
Net Shear Area	A_{vn} =			8321	mm^2	
$A_{tn} > 0.58*A_{vn}$?				No		
				$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =			4090	kN	FHWA 3.1.3
Tension Resistance (Governing)				2557	kN	
Demand/Capacity	D/C =			**0.000**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	21.02	in	534	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	0.00	in	0	mm	
L3	L_3 =	0.00	in	0	mm	
Unsupported Column Length	L_u =	0.00	in	0	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			$t/\sqrt{(12)}$	for rectangular plate	
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\mathrm{sqrt}[F_y/(\pi^2*E_s)]$		
				0.00		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2422	kN	

Span: Bascule Bridge - Leaf Span
Node: 11N

Demand/Capacity	D/C =			**0.011**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	12	ea	12	ea		
Longest Length of connection	L=	18.11	in	460	mm		
Edge distance	e =	1.02	in	26	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	237	kip	1054	kN		
	B_{r2} =	521	kip	2316	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		224	kip	995	kN		
Governing Resistance				1991	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.013**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	24.41	in	620	mm	5	
Shear Length 1	L_{V1} =	10.87	in	276	mm	3.5	
Shear Length 2	L_{V2} =	14.25	in	362	mm	4.5	
Tension Length	L_T =	15.55	in	395	mm	5	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
		2969	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		4169	kN	

Block Shear

Gross Tension Area	A_{tg} =	4740	mm^2

Span: Bascule Bridge - Leaf Span

Node: 11N

Gross Shear Area	A_{vg} =		7656	mm^2	
Net Tension Area	A_{tn} =		3504	mm^2	
Net Shear Area	A_{vn} =		5678	mm^2	
$A_{tn} > 0.58*A_{vn}$?			Yes		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0		
Block Shear Resistance	P_{Rbs} =		3847	kN	FHWA 3.1.3
Tension Resistance (Governing)			2969	kN	
Demand/Capacity	D/C =		**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?			Yes		
General					FHWA 3.3
Whitmore Width	W_w =	24.41 in	620	mm	
L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	13.15 in	334	mm	
L3	L_3 =	4.21 in	107	mm	
Unsupported Column Length	L_u =	5.79 in	147	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.53		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			2489	kN	
Demand/Capacity	D/C =		**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	25 ea	25	ea		
Longest Length of connection	L=	19.37 in	492	mm		
Edge distance	e =	1.50 in	38	mm		
Diameter of Rivet	d =	0.75 in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1	ea		
Number of Gusset Plates		2.00 ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	722 kip	3208	kN		
	B_{r2} =	1086 kip	4825	kN		

Span: Bascule Bridge - Leaf Span
Node: 11N

Shear Resistance of Rivets V_r = 467 kip $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 2074 kN CSA S6 CL14.14.1.4.2

Governing Resistance 4148 kN for 2 plate(s)
Demand/Capacity D/C = **0.000**
For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	288	1281
Shear Resistance (Net Section)	411	1825
Shear Resistance (Governing)	288	1281
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	452	2010
Shear Resistance (Net Section)	586	2606
Shear Resistance (Governing)	452	2010
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	597	2653
Net Section Resistance	893	3969
Block Shear Resistance	838	3725
Tension Resistance (Governing)	597	2653
At Member C:		
Gross Section Resistance	575	2557
Net Section Resistance	894	3974
Block Shear Resistance	920	4090
Tension Resistance (Governing)	575	2557
At Member D:		
Gross Section Resistance	668	2969
Net Section Resistance	938	4169
Block Shear Resistance	866	3847
Tension Resistance (Governing)	668	2969
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 11N

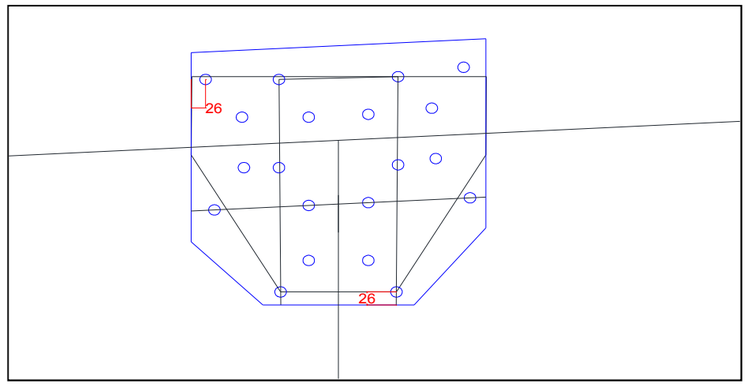
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	483	2149
Compressive Resistance at Member C	545	2422
Compressive Resistance at Member D	560	2489
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	330	1467
Governing Resistance at Member B	821	3650
Governing Resistance at Member C	448	1991
Governing Resistance at Member D	933	4148
Governing Resistance at Member E	330	1467

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
SHEAR PLANE A'-A'		288	1281	**0.001**	
SHEAR PLANE B'-B'		452	2010	**0.000**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	597	2653	**0.000**	
	Member C	575	2557	**0.000**	
	Member D	668	2969	**0.000**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	483	2149	**0.000**	
	Member C	545	2422	**0.011**	
	Member D	560	2489	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	330	1467	**0.000**	
	Member B	821	3650	**0.000**	
	Member C	448	1991	**0.013**	<--- Governing
	Member D	933	4148	**0.000**	
	Member E	330	1467	**0.000**	
Highest Demand/Capacity Ratio				**0.013**	

Span: Bascule Bridge - Leaf Span
Node: 11S

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.47 in	12 mm	6% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units		
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa		

MEMBER FORCES

Load Combination:		D1, D2, CL1-625 Max	
11S-A	P_{Max} =	320.6 kip	1425 kN
11S-A	P_{Min} =	35.1 kip	156 kN
11S-B	P_{Max} =	0.0 kip	0 kN
11S-B	P_{Min} =	0.0 kip	0 kN
11S-C	P_{Max} =	-3.4 kip	-15 kN
11S-C	P_{Min} =	-6.1 kip	-27 kN
11S-D	P_{Max} =	0.0 kip	0 kN
11S-D	P_{Min} =	0.0 kip	0 kN
11S-E	P_{Max} =	320.6 kip	1425 kN
11S-E	P_{Min} =	35.0 kip	156 kN

Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
11S-A	488	1425	1425	1425	1425
11S-A	488	157	156	156	156
11S-B	0	#N/A	#N/A	#N/A	#N/A
11S-B	0	#N/A	#N/A	#N/A	#N/A
11S-C	578	-20	-18	-15	-15
11S-C	578	-27	-25	-22	-27
11S-D	0	#N/A	#N/A	#N/A	#N/A
11S-D	0	#N/A	#N/A	#N/A	#N/A
11S-E	487	1425	1425	1425	1425
11S-E	487	156	156	156	156

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 11S

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		0	deg	B
	φ_C =		93	deg	C
	φ_D =		0	deg	D
	$\cos(\varphi_B)$ =		1.000		
	$\cos(\varphi_C)$ =		-0.052		
	$\cos(\varphi_D)$ =		1.000		
	$V_{A'-A',max}$ =	0.3 kip	1	kN	*
	$V_{A'-A',min}$ =	0.2 kip	1	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	0.3 kip	1	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	0.0 kip	0	kN	

*using absolute maximum sums, conservative

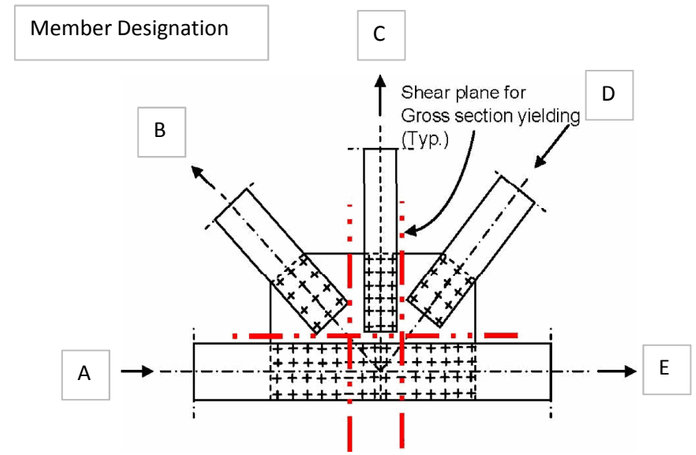


Figure 4 – Examples of gross section shear yielding planes

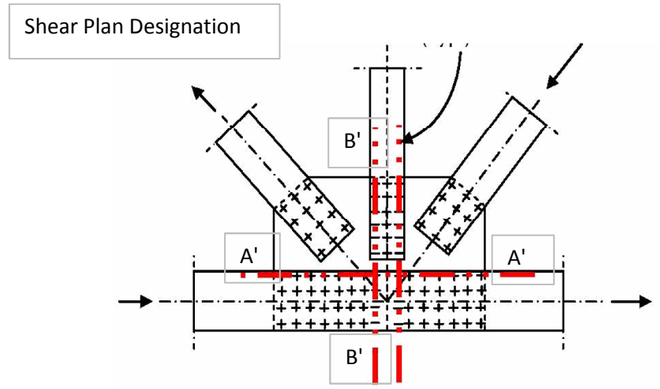


Figure 5 – Examples of net section shear fracture planes

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	21.06	in	535	mm	
No of holes in shear plane	N =	4.00	ea	4	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			12840	mm^2	
Net Shear Area	A_n =			10862	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			1281	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =			1825	kN	
Shear Resistance (Governing)	V_R =			**1281**	**kN**	
Demand/Capacity	D/C =			**0.001**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	20.35	in	517	mm	
No of holes in shear plane	N =	6.00	ea	6	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

FHWA, Figures 4 and 5

Span: Bascule Bridge - Leaf Span

Node: 11S

Members A and E continuous through the gusset plate?				Yes		
Outside height of member A	H_A=	15	in	381	mm	
Thickness of the web of member A	w_A=	0.40	in	10	mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4	ea	
Gross Shear Area	A_g =			20150	mm^2	
Net Shear Area	A_n =			15509	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2010	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =			2606	kN	
Shear Resistance (Governing)	V_R =			**2010**	**kN**	
Demand/Capacity	D/C =			**0.000**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E

N/A

Members A and E continuous through the gusset plate? Yes

General

Whitmore Width	W_w =	0.00	in	0	mm	Number of Rivet/bolt diameters Intsecting Plane
Shear Length 1	L_{V1} =	0.00	in	0	mm	0
Shear Length 2	L_{V2} =	0.00	in	0	mm	0
Tension Length	L_T =	0.00	in	0	mm	0
Number of Gusset Plates	m =	2.00	ea	2	ea	0 Typ, 1 less than Whitemore Width
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance

CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$		
		0	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		0	kN	

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

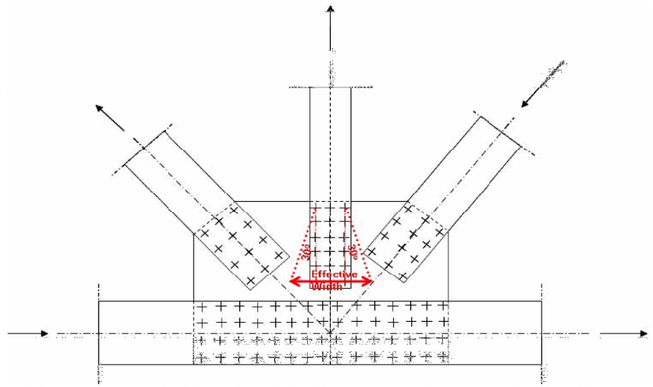


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

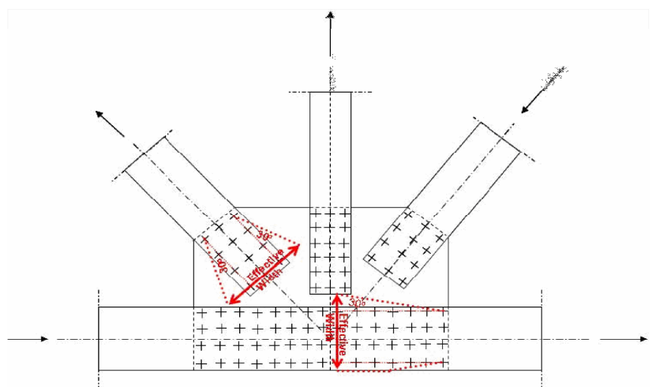


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 11S

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

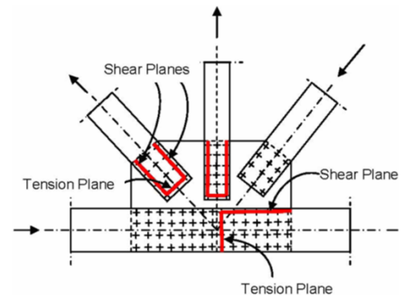


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.14 in	3.46 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

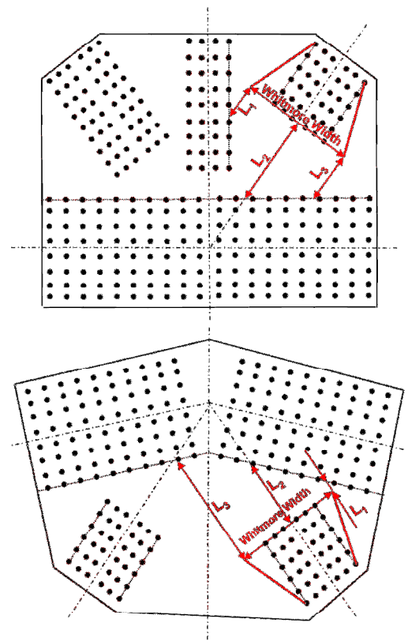


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Possible Scenario?			No		
Number of Rivets/Bolts	n =	16 ea	16 ea		
Longest Length of connection	L=	21.02 in	534 mm		
Edge distance	e =	1.02 in	26 mm		
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1 ea		
Number of Gusset Plates		2 ea	2 ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$		CSA S6 CL14.14.1.4.2
	B_{r1} =	316 kip	1405 kN		
	B_{r2} =	695 kip	3088 kN		
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$		CSA S6 CL14.14.1.4.2
		165 kip	733 kN		
Governing Resistance			1467 kN	for 2 plate(s)	

Span: Bascule Bridge - Leaf Span
Node: 11S

Demand/Capacity	D/C =	**0.000**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	21.81	in	554	mm	3
Shear Length 1	L_{V1} =	13.11	in	333	mm	4.5
Shear Length 2	L_{V2} =	11.38	in	289	mm	4.5
Tension Length	L_T =	14.33	in	364	mm	4
Number of Gusset Plates	m =	2	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$ U=1.0	2653 kN	FHWA 3.1.2
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$ U=1.0	3969 kN	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2				

Block Shear

Gross Tension Area	A_{tg} =	4368	mm^2
Gross Shear Area	A_{vg} =	7464	mm^2
Net Tension Area	A_{tn} =	3379	mm^2
Net Shear Area	A_{vn} =	5239	mm^2
$A_{tn} \geq 0.58*A_{vn}$?		Yes	

		$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$ U=1.0		
Block Shear Resistance	P_{Rbs} =		3725 kN	FHWA 3.1.3
Tension Resistance (Governing)			2653 kN	
Demand/Capacity	D/C =		**0.000**	

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? Yes

General — FHWA 3.3

Whitmore Width	W_w =	21.81	in	554 mm

Span: Bascule Bridge - Leaf Span

Node: 11S

L1	L_1 =	0.79	in	20	mm	
L2 - along centreline of action	L_2 =	13.54	in	344	mm	
L3	L_3 =	4.88	in	124	mm	
Unsupported Column Length	L_u =	6.40	in	163	mm	
Effective Length Factor	K =	1.20		1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)		for rectangular plate
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.58		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2149	kN	
Demand/Capacity	D/C =			**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22	ea	22	ea	
Longest Length of connection	L=	18.94	in	481	mm	
Edge distance	e =	1.50	in	38	mm	
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")
Shear Planes per gusset plate	m =	1	ea	1	ea	
Number of Gusset Plates		2.00	ea	2	ea	
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0	CSA S6 CL14.14.1.4.2
	B_{r1} =	635	kip	2823	kN	
	B_{r2} =	955	kip	4246	kN	
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81	CSA S6 CL14.14.1.4.2
		411	kip	1825	kN	
Governing Resistance				3650	kN	for 2 plate(s)
Demand/Capacity	D/C =			**0.000**		

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	21.02	in	534	mm	2	
Shear Length 1	L_{V1} =	18.11	in	460	mm	5.5	
Shear Length 2	L_{V2} =	18.11	in	460	mm	5.5	
Tension Length	L_T =	8.27	in	210	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 11S

Number of Gusset Plates	m =	2.00 ea	2 ea		
Diameter of holes in plane	d_b =	0.81 in	21 mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			2557	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			3974	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		2520	mm^2	
Gross Shear Area	A_{vg} =		11040	mm^2	
Net Tension Area	A_{tn} =		2273	mm^2	
Net Shear Area	A_{vn} =		8321	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		4090	kN	FHWA 3.1.3
Tension Resistance (Governing)			2557	kN	
Demand/Capacity	D/C =		**0.000**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	21.02 in	534	mm	
L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	0.00 in	0	mm	
L3	L_3 =	0.00 in	0	mm	
Unsupported Column Length	L_u =	0.00 in	0	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			2422	kN	

Span: Bascule Bridge - Leaf Span
Node: 11S

Demand/Capacity	D/C =			**0.011**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	12	ea	12	ea		
Longest Length of connection	L=	18.11	in	460	mm		
Edge distance	e =	1.02	in	26	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	237	kip	1054	kN		
	B_{r2} =	521	kip	2316	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		224	kip	995	kN		
Governing Resistance				1991	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.014**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	24.41	in	620	mm	5	
Shear Length 1	L_{V1} =	10.87	in	276	mm	3.5	
Shear Length 2	L_{V2} =	14.25	in	362	mm	4.5	
Tension Length	L_T =	15.55	in	395	mm	5	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
		2969	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		4169	kN	

Block Shear

Gross Tension Area	A_{tg} =	4740	mm^2

Span: Bascule Bridge - Leaf Span

Node: 11S

Gross Shear Area	A_{vg} =		7656	mm^2	
Net Tension Area	A_{tn} =		3504	mm^2	
Net Shear Area	A_{vn} =		5678	mm^2	
$A_{tn} > 0.58*A_{vn}$?			Yes		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0		
Block Shear Resistance	P_{Rbs} =		3847	kN	FHWA 3.1.3
Tension Resistance (Governing)			2969	kN	
Demand/Capacity	D/C =		**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?			Yes		
General					FHWA 3.3
Whitmore Width	W_w =	24.41 in	620	mm	
L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	13.15 in	334	mm	
L3	L_3 =	4.21 in	107	mm	
Unsupported Column Length	L_u =	5.79 in	147	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.53		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			2489	kN	
Demand/Capacity	D/C =		**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	25 ea	25	ea		
Longest Length of connection	L=	19.37 in	492	mm		
Edge distance	e =	1.50 in	38	mm		
Diameter of Rivet	d =	0.75 in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1	ea		
Number of Gusset Plates		2.00 ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	722 kip	3208	kN		
	B_{r2} =	1086 kip	4825	kN		

Span: Bascule Bridge - Leaf Span
Node: 11S

Shear Resistance of Rivets V_r = 467 kip $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 2074 kN CSA S6 CL14.14.1.4.2

Governing Resistance 4148 kN for 2 plate(s)
Demand/Capacity D/C = **0.000**
For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	288	1281
Shear Resistance (Net Section)	411	1825
Shear Resistance (Governing)	288	1281
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	452	2010
Shear Resistance (Net Section)	586	2606
Shear Resistance (Governing)	452	2010
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	597	2653
Net Section Resistance	893	3969
Block Shear Resistance	838	3725
Tension Resistance (Governing)	597	2653
At Member C:		
Gross Section Resistance	575	2557
Net Section Resistance	894	3974
Block Shear Resistance	920	4090
Tension Resistance (Governing)	575	2557
At Member D:		
Gross Section Resistance	668	2969
Net Section Resistance	938	4169
Block Shear Resistance	866	3847
Tension Resistance (Governing)	668	2969
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 11S

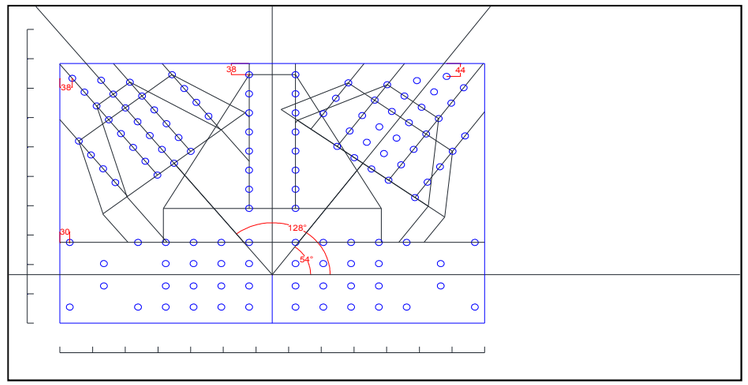
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	483	2149
Compressive Resistance at Member C	545	2422
Compressive Resistance at Member D	560	2489
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	330	1467
Governing Resistance at Member B	821	3650
Governing Resistance at Member C	448	1991
Governing Resistance at Member D	933	4148
Governing Resistance at Member E	330	1467

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
	SHEAR PLANE A'-A'	288	1281	**0.001**	
	SHEAR PLANE B'-B'	452	2010	**0.000**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	597	2653	**0.000**	
	Member C	575	2557	**0.000**	
	Member D	668	2969	**0.000**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	483	2149	**0.000**	
	Member C	545	2422	**0.011**	
	Member D	560	2489	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	330	1467	**0.000**	
	Member B	821	3650	**0.000**	
	Member C	448	1991	**0.014**	<--- Governing
	Member D	933	4148	**0.000**	
	Member E	330	1467	**0.000**	
	Highest Demand/Capacity Ratio			**0.014**	

Span: Bascule Bridge - Leaf Span
Node: 12N

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.39 in	10 mm	21% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units		
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa		

MEMBER FORCES

Load Combination:		D1, D2, CL1-625 Max	
12N-A	P_{Max} =	99.9 kip	444 kN
12N-A	P_{Min} =	-218.5 kip	-971 kN
12N-B	P_{Max} =	-100.2 kip	-446 kN
12N-B	P_{Min} =	-326.7 kip	-1452 kN
12N-C	P_{Max} =	-3.3 kip	-15 kN
12N-C	P_{Min} =	-6.0 kip	-27 kN
12N-D	P_{Max} =	396.2 kip	1761 kN
12N-D	P_{Min} =	152.3 kip	677 kN
12N-E	P_{Max} =	-233.1 kip	-1036 kN
12N-E	P_{Min} =	-411.9 kip	-1831 kN

Note: Tension is positive.

Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
12N-A	284	444	444	444	444
12N-A	284	-971	-971	-971	-971
12N-B	10	-446	-450	-455	-446
12N-B	10	-1443	-1447	-1452	-1452
12N-C	247	-20	-17	-15	-15
12N-C	247	-27	-24	-22	-27
12N-D	11	1751	1756	1761	1761
12N-D	11	677	682	687	677
12N-E	285	-1036	-1036	-1036	-1036
12N-E	285	-1831	-1831	-1831	-1831

Span: Bascule Bridge - Leaf Span
Node: 12N

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		128	deg	B
	φ_C =		90	deg	C
	φ_D =		54	deg	D
	$\cos(\varphi_B)$ =		-0.616		
	$\cos(\varphi_C)$ =		0.000		
	$\cos(\varphi_D)$ =		0.588		
	$V_{A'\text{-}A',max}$ =	434.0 kip	1929	kN	*
	$V_{A'\text{-}A',min}$ =	151.2 kip	672	kN	*
Shear Force at A'-A' (Governing)	$V_{A'\text{-}A'}$ =	434.0 kip	1929	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'\text{-}B'}$ =	320.6 kip	1425	kN	

*using absolute maximum sums, conservative

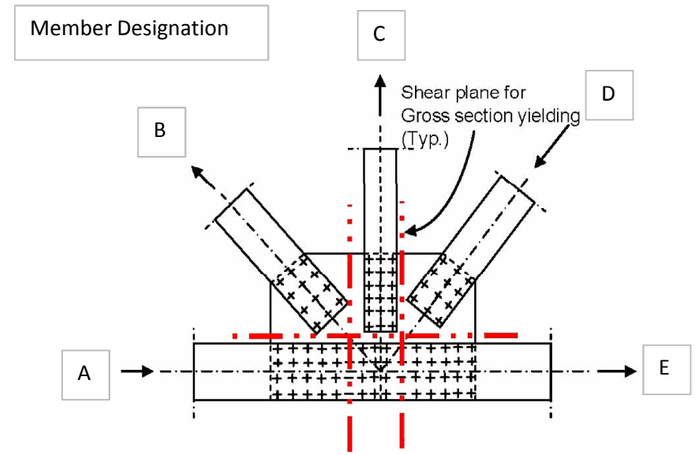


Figure 4 – Examples of gross section shear yielding planes

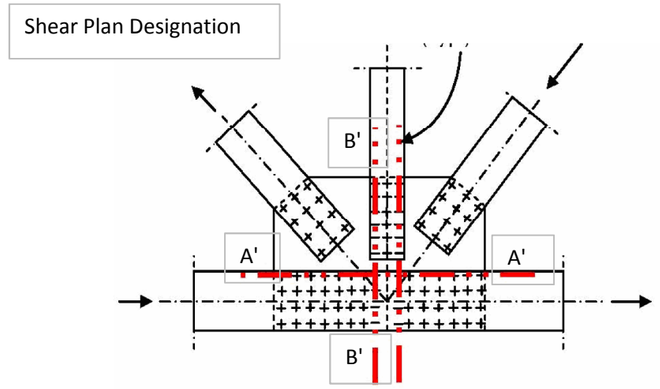


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	51.18	in	1300	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			26000	mm^2	
Net Shear Area	A_n =			21056	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2594	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$ *		Cl 10.18.5.2
	V_{Rn} =			3537	kN	
Shear Resistance (Governing)	V_R =			**2594**	**kN**	
Demand/Capacity	D/C =			**0.744**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	34.80	in	884	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 12N

Members A and E continuous through the gusset plate?			Yes		
Outside height of member A	H_A=	15 in	381	mm	
Thickness of the web of member A	w_A=	0.40 in	10	mm	
No of holes in member A/E in shear plane	N_A=	4 ea	4	ea	
Gross Shear Area	A_g =		25422	mm^2	
Net Shear Area	A_n =		18804	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =		$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =		2536	kN	
Shear Resistance (Net Section)	V_{Rn} =		$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =		3159	kN	
Shear Resistance (Governing)	V_R =		**2536**	**kN**	
Demand/Capacity	D/C =		**0.562**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E — N/A

Members A and E continuous through the gusset plate? Yes

General

					Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	0.00 in	0	mm	0	
Shear Length 1	L_{V1} =	0.00 in	0	mm	0	
Shear Length 2	L_{V2} =	0.00 in	0	mm	0	
Tension Length	L_T =	0.00 in	0	mm	0	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00 ea	2	ea		
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$		
		0	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		0	kN	

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

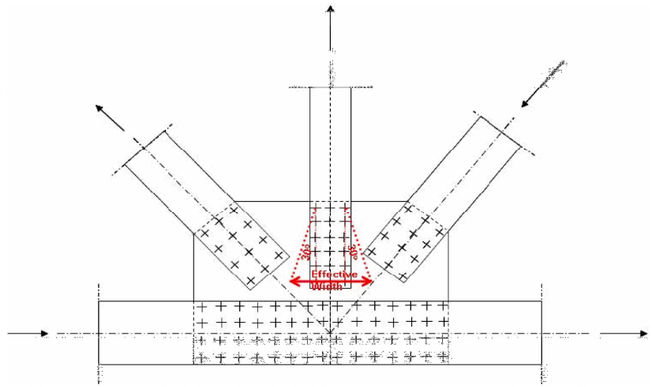


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

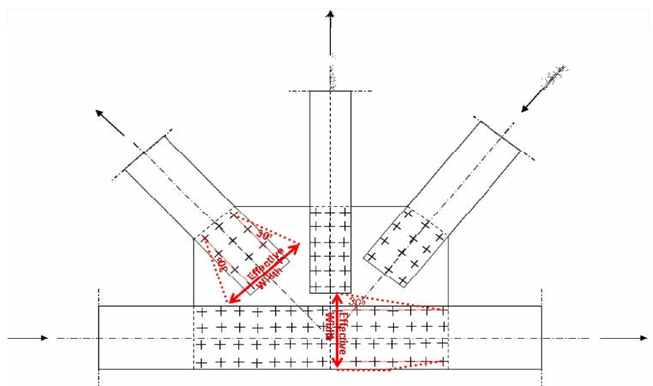


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 12N

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

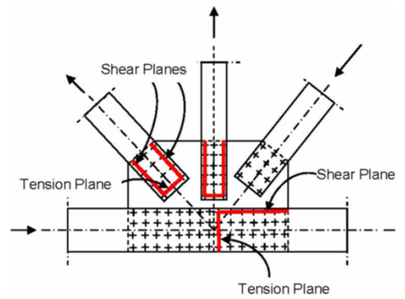


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.11 in	2.89 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

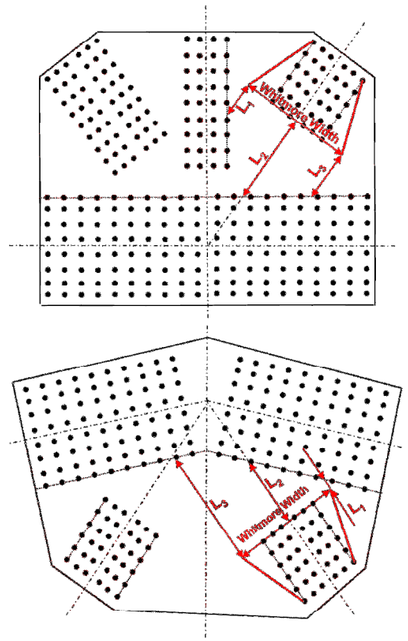


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	44 ea	44 ea		
Longest Length of connection	L=	51.18 in	1300 mm		
Edge distance	e =	1.18 in	30 mm		
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1 ea		
Number of Gusset Plates		2 ea	2 ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$		CSA S6 CL14.14.1.4.2
	B_{r1} =	836 kip	3714 kN		
	B_{r2} =	1592 kip	7076 kN		
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$		CSA S6 CL14.14.1.4.2
		454 kip	2017 kN		
Governing Resistance			3227 kN	for 2 plate(s)	

Span: Bascule Bridge - Leaf Span

Node: 12N

Demand/Capacity	D/C =	**0.567**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? No

General

						Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	21.81	in	554	mm	3
Shear Length 1	L_{V1} =	13.11	in	333	mm	4.5
Shear Length 2	L_{V2} =	11.38	in	289	mm	4.5
Tension Length	L_T =	14.33	in	364	mm	4
Number of Gusset Plates	m =	2	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$ U=1.0	2210 kN	FHWA 3.1.2
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$ U=1.0	3308 kN	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2				

Block Shear

Gross Tension Area	A_{tg} =	3640	mm^2
Gross Shear Area	A_{vg} =	6220	mm^2
Net Tension Area	A_{tn} =	2816	mm^2
Net Shear Area	A_{vn} =	4366	mm^2
$A_{tn} \geq 0.58*A_{vn}$?		Yes	

		$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$ U=1.0		
Block Shear Resistance	P_{Rbs} =		3105 kN	FHWA 3.1.3
Tension Resistance (Governing)			2210 kN	
Demand/Capacity	D/C =		**0.000**	

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? No

General — FHWA 3.3

Whitmore Width	W_w =	21.81	in	554 mm

Span: Bascule Bridge - Leaf Span

Node: 12N

L1	L_1 =	0.79	in	20	mm	
L2 - along centreline of action	L_2 =	13.54	in	344	mm	
L3	L_3 =	4.88	in	124	mm	
Unsupported Column Length	L_u =	6.40	in	163	mm	
Effective Length Factor	K =	1.20		1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)		for rectangular plate
		0.11	in	2.89	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.70		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				1646	kN	
Demand/Capacity	D/C =			**0.882**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22	ea	22	ea		
Longest Length of connection	L=	18.94	in	481	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	529	kip	2353	kN		
	B_{r2} =	796	kip	3538	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		411	kip	1825	kN		
Governing Resistance				3650	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.398**			

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	26.38	in	670	mm	2	
Shear Length 1	L_{V1} =	19.41	in	493	mm	7.5	
Shear Length 2	L_{V2} =	19.41	in	493	mm	7.5	
Tension Length	L_T =	5.59	in	142	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 12N

Number of Gusset Plates	m =	2.00 ea	2 ea		
Diameter of holes in plane	d_b =	0.81 in	21 mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			2673	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			4226	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		1420	mm^2	
Gross Shear Area	A_{vg} =		9860	mm^2	
Net Tension Area	A_{tn} =		1214	mm^2	
Net Shear Area	A_{vn} =		6770	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		3116	kN	FHWA 3.1.3
Tension Resistance (Governing)			2673	kN	
Demand/Capacity	D/C =		**0.000**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	26.38 in	670	mm	
L1	L_1 =	4.57 in	116	mm	
L2 - along centreline of action	L_2 =	4.57 in	116	mm	
L3	L_3 =	4.57 in	116	mm	
Unsupported Column Length	L_u =	4.57 in	116	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.11 in	2.89	mm	
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.50		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			2276	kN	

Span: Bascule Bridge - Leaf Span
Node: 12N

Demand/Capacity	D/C =			**0.012**				

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea			
Longest Length of connection	L=	19.41	in	493	mm			
Edge distance	e =	1.50	in	38	mm			
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")		
Shear Planes per gusset plate	m =	1	ea	1	ea			
Number of Gusset Plates		2.00	ea	2	ea			
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$	U=1.0			CSA S6 CL14.14.1.4.2
	B_{r1} =	385	kip	1711	kN			
	B_{r2} =	579	kip	2573	kN			
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81			CSA S6 CL14.14.1.4.2
		299	kip	1327	kN			
Governing Resistance				2655	kN	for	2 plate(s)	
Demand/Capacity	D/C =			**0.010**				
For Connections greater than 50in (1270mm), shear resistance taken as 80%.								FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? No

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	24.41	in	620	mm	5	
Shear Length 1	L_{V1} =	10.87	in	276	mm	3.5	
Shear Length 2	L_{V2} =	14.25	in	362	mm	4.5	
Tension Length	L_T =	15.55	in	395	mm	5	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		2474	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		3474	kN		

Block Shear

Gross Tension Area	A_{tg} =	3950	mm^2

Span: Bascule Bridge - Leaf Span

Node: 12N

Gross Shear Area	A_{vg} =	6380	mm^2	
Net Tension Area	A_{tn} =	2920	mm^2	
Net Shear Area	A_{vn} =	4732	mm^2	
$A_{tn} > 0.58*A_{vn}$?		Yes		
	$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0		
Block Shear Resistance	P_{Rbs} =	3206	kN	FHWA 3.1.3
Tension Resistance (Governing)		2474	kN	
Demand/Capacity	D/C =	**0.712**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored? No

General FHWA 3.3

Whitmore Width	W_w =	24.41	in	620	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	13.15	in	334	mm	
L3	L_3 =	4.21	in	107	mm	
Unsupported Column Length	L_u =	5.79	in	147	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.11	in	2.89	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.63		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				1938	kN	
Demand/Capacity	D/C =			**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	25	ea	25	ea		
Longest Length of connection	L=	19.37	in	492	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	601	kip	2673	kN		
	B_{r2} =	905	kip	4021	kN		

Span: Bascule Bridge - Leaf Span
Node: 12N

Shear Resistance of Rivets V_r = 467 kip $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 2074 kN CSA S6 CL14.14.1.4.2

Governing Resistance 4148 kN for 2 plate(s)
Demand/Capacity D/C = **0.425**
For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	584	2594
Shear Resistance (Net Section)	796	3537
Shear Resistance (Governing)	584	2594
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	571	2536
Shear Resistance (Net Section)	711	3159
Shear Resistance (Governing)	571	2536
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	497	2210
Net Section Resistance	744	3308
Block Shear Resistance	699	3105
Tension Resistance (Governing)	497	2210
At Member C:		
Gross Section Resistance	601	2673
Net Section Resistance	951	4226
Block Shear Resistance	701	3116
Tension Resistance (Governing)	601	2673
At Member D:		
Gross Section Resistance	557	2474
Net Section Resistance	782	3474
Block Shear Resistance	721	3206
Tension Resistance (Governing)	557	2474
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 12N

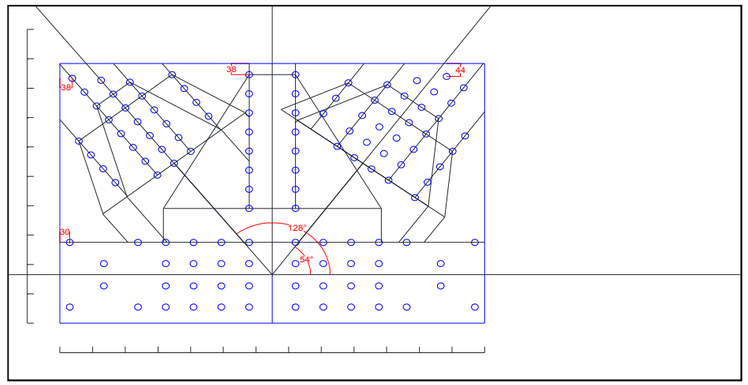
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	370	1646
Compressive Resistance at Member C	512	2276
Compressive Resistance at Member D	436	1938
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	726	3227
Governing Resistance at Member B	821	3650
Governing Resistance at Member C	597	2655
Governing Resistance at Member D	933	4148
Governing Resistance at Member E	726	3227

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
SHEAR PLANE A'-A'		584	2594	**0.744**	
SHEAR PLANE B'-B'		571	2536	**0.562**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	497	2210	**0.000**	
	Member C	601	2673	**0.000**	
	Member D	557	2474	**0.712**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	370	1646	**0.882**	<--- Governing
	Member C	512	2276	**0.012**	
	Member D	436	1938	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	726	3227	**0.567**	
	Member B	821	3650	**0.398**	
	Member C	597	2655	**0.010**	
	Member D	933	4148	**0.425**	
	Member E	726	3227	**0.567**	
Highest Demand/Capacity Ratio				**0.882**	

Span: Bascule Bridge - Leaf Span
Node: 12S

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.39 in	10 mm	21% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units		
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa		

MEMBER FORCES

Load Combination:		D1, D2, CL1-625 Max		Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
12S-A	P_{Max} =	112.5 kip	500 kN	12S-A	564	500	500	500	500
12S-A	P_{Min} =	-206.1 kip	-916 kN	12S-A	564	-916	-916	-916	-916
12S-B	P_{Max} =	-112.6 kip	-500 kN	12S-B	186	-500	-505	-509	-500
12S-B	P_{Min} =	-339.0 kip	-1506 kN	12S-B	186	-1497	-1502	-1506	-1506
12S-C	P_{Max} =	-3.4 kip	-15 kN	12S-C	578	-20	-18	-15	-15
12S-C	P_{Min} =	-6.1 kip	-27 kN	12S-C	578	-27	-25	-22	-27
12S-D	P_{Max} =	414.4 kip	1842 kN	12S-D	187	1832	1837	1842	1842
12S-D	P_{Min} =	170.4 kip	757 kN	12S-D	187	757	762	767	757
12S-E	P_{Max} =	-236.3 kip	-1050 kN	12S-E	565	-1050	-1050	-1050	-1050
12S-E	P_{Min} =	-415.0 kip	-1844 kN	12S-E	565	-1844	-1844	-1844	-1844

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 12S

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		128	deg	B
	φ_C =		90	deg	C
	φ_D =		54	deg	D
	$\cos(\varphi_B)$ =		-0.616		
	$\cos(\varphi_C)$ =		0.000		
	$\cos(\varphi_D)$ =		0.588		
	$V_{A'-A',max}$ =	452.3 kip	2010	kN	*
	$V_{A'-A',min}$ =	169.5 kip	753	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	452.3 kip	2010	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	335.3 kip	1490	kN	

*using absolute maximum sums, conservative

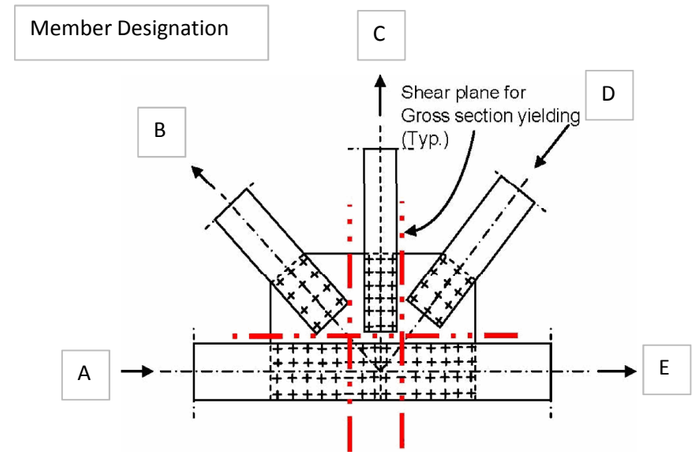


Figure 4 – Examples of gross section shear yielding planes

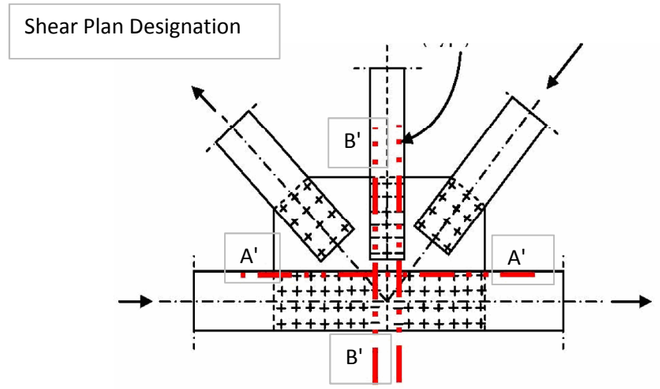


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	51.18	in	1300	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			26000	mm^2	
Net Shear Area	A_n =			21056	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2594	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =			3537	kN	
Shear Resistance (Governing)	V_R =			**2594**	**kN**	
Demand/Capacity	D/C =			**0.775**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	34.80	in	884	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 12S

Members A and E continuous through the gusset plate?			Yes		
Outside height of member A	H_A=	15 in	381	mm	
Thickness of the web of member A	w_A=	0.40 in	10	mm	
No of holes in member A/E in shear plane	N_A=	4 ea	4	ea	
Gross Shear Area	A_g =		25422	mm^2	
Net Shear Area	A_n =		18804	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =		$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =		2536	kN	
Shear Resistance (Net Section)	V_{Rn} =		$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =		3159	kN	
Shear Resistance (Governing)	V_R =		**2536**	**kN**	
Demand/Capacity	D/C =		**0.588**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E — N/A

Members A and E continuous through the gusset plate? Yes

General

					Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	0.00 in	0	mm	0	
Shear Length 1	L_{V1} =	0.00 in	0	mm	0	
Shear Length 2	L_{V2} =	0.00 in	0	mm	0	
Tension Length	L_T =	0.00 in	0	mm	0	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00 ea	2	ea		
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$		
		0	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$		
For gusset plates, U=1.0, FHWA 3.1.2		0	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

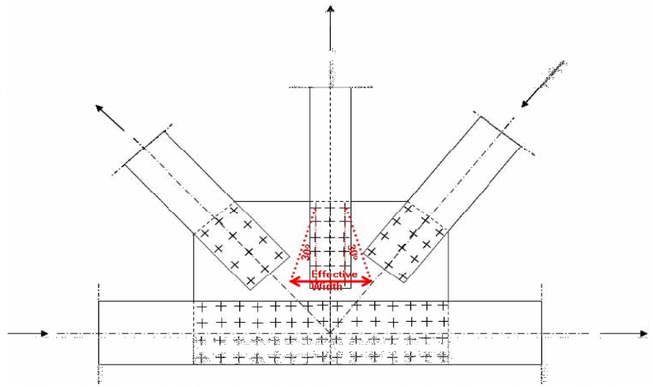


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

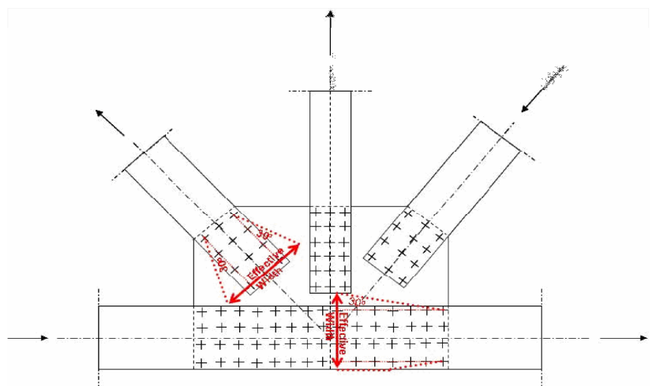


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 12S

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

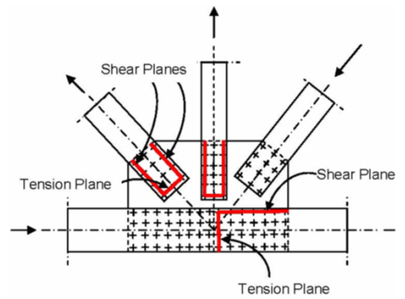


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.11 in	2.89 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

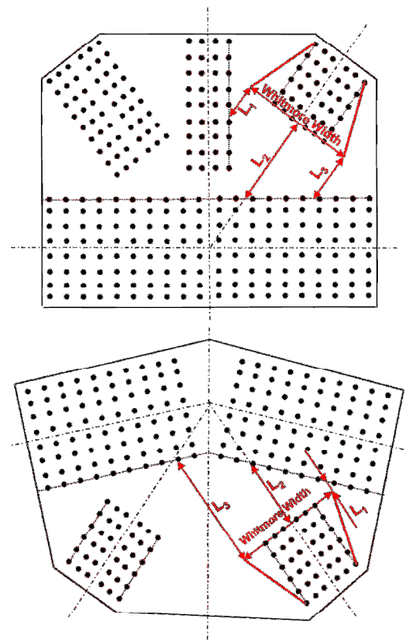


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	44 ea	44 ea			
Longest Length of connection	L=	51.18 in	1300 mm			
Edge distance	e =	1.18 in	30 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$			CSA S6 CL14.14.1.4.2
	B_{r1} =	836 kip	3714 kN			
	B_{r2} =	1592 kip	7076 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$			CSA S6 CL14.14.1.4.2
		454 kip	2017 kN			
Governing Resistance			3227 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span
Node: 12S

Demand/Capacity	D/C =	**0.572**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored?				No		
General						Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	21.81	in	554	mm	3
Shear Length 1	L_{V1} =	13.11	in	333	mm	4.5
Shear Length 2	L_{V2} =	11.38	in	289	mm	4.5
Tension Length	L_T =	14.33	in	364	mm	4
Number of Gusset Plates	m =	2	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		2210	kN		
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		3308	kN		

Block Shear

Gross Tension Area	A_{tg} =	3640	mm^2	
Gross Shear Area	A_{vg} =	6220	mm^2	
Net Tension Area	A_{tn} =	2816	mm^2	
Net Shear Area	A_{vn} =	4366	mm^2	
$A_{tn} \geq 0.58*A_{vn}$?		Yes		
	$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		U=1.0	
Block Shear Resistance	P_{Rbs} =	3105	kN	FHWA 3.1.3
Tension Resistance (Governing)		2210	kN	
Demand/Capacity	D/C =	**0.000**		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored?			No		
General					FHWA 3.3
Whitmore Width	W_w =	21.81	in	554	mm

Span: Bascule Bridge - Leaf Span

Node: 12S

L1	L_1 =	0.79 in	20	mm	
L2 - along centreline of action	L_2 =	13.54 in	344	mm	
L3	L_3 =	4.88 in	124	mm	
Unsupported Column Length	L_u =	6.40 in	163	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.11 in	2.89	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.70		
Compressive Resistance	C_r =		$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			1646	kN	
Demand/Capacity	D/C =		**0.915**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22 ea	22	ea		
Longest Length of connection	L=	18.94 in	481	mm		
Edge distance	e =	1.50 in	38	mm		
Diameter of Rivet	d =	0.75 in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1	ea		
Number of Gusset Plates		2.00 ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	529 kip	2353	kN		
	B_{r2} =	796 kip	3538	kN		
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		411 kip	1825	kN		
Governing Resistance			3650	kN	for 2 plate(s)	
Demand/Capacity	D/C =		**0.413**			

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

					Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	26.38 in	670	mm	2	
Shear Length 1	L_{V1} =	19.41 in	493	mm	7.5	
Shear Length 2	L_{V2} =	19.41 in	493	mm	7.5	
Tension Length	L_T =	5.59 in	142	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 12S

Number of Gusset Plates	m =	2.00 ea	2 ea		
Diameter of holes in plane	d_b =	0.81 in	21 mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			2673	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			4226	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		1420	mm^2	
Gross Shear Area	A_{vg} =		9860	mm^2	
Net Tension Area	A_{tn} =		1214	mm^2	
Net Shear Area	A_{vn} =		6770	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		3116	kN	FHWA 3.1.3
Tension Resistance (Governing)			2673	kN	
Demand/Capacity	D/C =		**0.000**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	26.38 in	670	mm	
L1	L_1 =	4.57 in	116	mm	
L2 - along centreline of action	L_2 =	4.57 in	116	mm	
L3	L_3 =	4.57 in	116	mm	
Unsupported Column Length	L_u =	4.57 in	116	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.11 in	2.89	mm	
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.50		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			2276	kN	

Span: Bascule Bridge - Leaf Span
Node: 12S

Demand/Capacity	D/C =			**0.012**				

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea			
Longest Length of connection	L=	19.41	in	493	mm			
Edge distance	e =	1.50	in	38	mm			
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")		
Shear Planes per gusset plate	m =	1	ea	1	ea			
Number of Gusset Plates		2.00	ea	2	ea			
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2	
	B_{r1} =	385	kip	1711	kN			
	B_{r2} =	579	kip	2573	kN			
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2	
		299	kip	1327	kN			
Governing Resistance				2655	kN	for 2 plate(s)		
Demand/Capacity	D/C =			**0.010**				
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2	

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? No

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	24.41	in	620	mm	5	
Shear Length 1	L_{V1} =	10.87	in	276	mm	3.5	
Shear Length 2	L_{V2} =	14.25	in	362	mm	4.5	
Tension Length	L_T =	15.55	in	395	mm	5	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		2474	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		3474	kN		

Block Shear

Gross Tension Area	A_{tg} =	3950	mm^2

Span: Bascule Bridge - Leaf Span

Node: 12S

Gross Shear Area	A_{vg} =		6380	mm^2	
Net Tension Area	A_{tn} =		2920	mm^2	
Net Shear Area	A_{vn} =		4732	mm^2	
$A_{tn} > 0.58*A_{vn}$?			Yes		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0		
Block Shear Resistance	P_{Rbs} =		3206	kN	FHWA 3.1.3
Tension Resistance (Governing)			2474	kN	
Demand/Capacity	D/C =		**0.745**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?			No		
General					FHWA 3.3
Whitmore Width	W_w =	24.41 in	620	mm	
L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	13.15 in	334	mm	
L3	L_3 =	4.21 in	107	mm	
Unsupported Column Length	L_u =	5.79 in	147	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.11 in	2.89	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.63		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			1938	kN	
Demand/Capacity	D/C =		**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	25 ea	25	ea		
Longest Length of connection	L=	19.37 in	492	mm		
Edge distance	e =	1.50 in	38	mm		
Diameter of Rivet	d =	0.75 in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1	ea		
Number of Gusset Plates		2.00 ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	601 kip	2673	kN		
	B_{r2} =	905 kip	4021	kN		

Span: Bascule Bridge - Leaf Span
Node: 12S

Shear Resistance of Rivets V_r = 467 kip $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 2074 kN CSA S6 CL14.14.1.4.2

Governing Resistance 4148 kN for 2 plate(s)
Demand/Capacity D/C = **0.444**
For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	584	2594
Shear Resistance (Net Section)	796	3537
Shear Resistance (Governing)	584	2594
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	571	2536
Shear Resistance (Net Section)	711	3159
Shear Resistance (Governing)	571	2536
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	497	2210
Net Section Resistance	744	3308
Block Shear Resistance	699	3105
Tension Resistance (Governing)	497	2210
At Member C:		
Gross Section Resistance	601	2673
Net Section Resistance	951	4226
Block Shear Resistance	701	3116
Tension Resistance (Governing)	601	2673
At Member D:		
Gross Section Resistance	557	2474
Net Section Resistance	782	3474
Block Shear Resistance	721	3206
Tension Resistance (Governing)	557	2474
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 12S

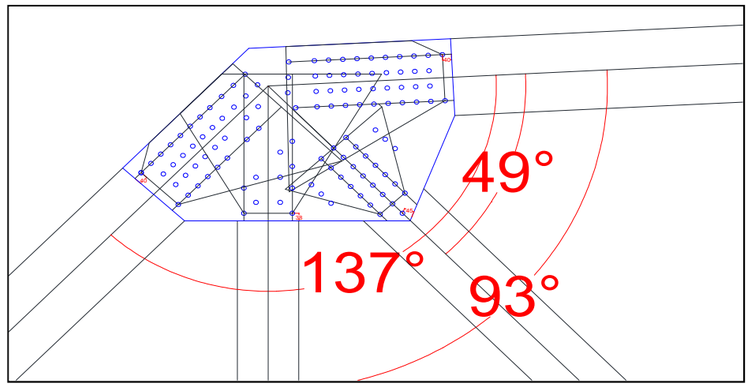
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	370	1646
Compressive Resistance at Member C	512	2276
Compressive Resistance at Member D	436	1938
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	726	3227
Governing Resistance at Member B	821	3650
Governing Resistance at Member C	597	2655
Governing Resistance at Member D	933	4148
Governing Resistance at Member E	726	3227

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
SHEAR PLANE A'-A'		584	2594	**0.775**	
SHEAR PLANE B'-B'		571	2536	**0.588**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	497	2210	**0.000**	
	Member C	601	2673	**0.000**	
	Member D	557	2474	**0.745**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	370	1646	**0.915**	<--- Governing
	Member C	512	2276	**0.012**	
	Member D	436	1938	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	726	3227	**0.572**	
	Member B	821	3650	**0.413**	
	Member C	597	2655	**0.010**	
	Member D	933	4148	**0.444**	
	Member E	726	3227	**0.572**	
Highest Demand/Capacity Ratio				**0.915**	

Span: Bascule Bridge - Leaf Span
Node: 1N

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.47 in	12 mm	6% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units			
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6	
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa			

MEMBER FORCES

Load Combination:		ULSB3 Max 0		Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
1N-A	P_{Max} =	0.0 kip	0 kN	1N-A	0	#N/A	#N/A	#N/A	#N/A
1N-A	P_{Min} =	0.0 kip	0 kN	1N-A	0	#N/A	#N/A	#N/A	#N/A
1N-B	P_{Max} =	21.7 kip	97 kN	1N-B	2	97	91	86	97
1N-B	P_{Min} =	9.5 kip	42 kN	1N-B	2	48	45	42	42
1N-C	P_{Max} =	19.2 kip	85 kN	1N-C	241	79	82	85	85
1N-C	P_{Min} =	9.1 kip	40 kN	1N-C	241	40	42	44	40
1N-D	P_{Max} =	-25.4 kip	-113 kN	1N-D	3	-117	-115	-113	-113
1N-D	P_{Min} =	-50.2 kip	-223 kN	1N-D	3	-223	-219	-216	-223
1N-E	P_{Max} =	50.0 kip	222 kN	1N-E	423	222	222	222	222
1N-E	P_{Min} =	22.9 kip	102 kN	1N-E	423	102	102	102	102

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 1N

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		137	deg	B
	φ_C =		93	deg	C
	φ_D =		49	deg	D
	$\cos(\varphi_B)$ =		-0.731		
	$\cos(\varphi_C)$ =		-0.052		
	$\cos(\varphi_D)$ =		0.656		
	$V_{A'-A',max}$ =	-24.1 kip	-107	kN	*
	$V_{A'-A',min}$ =	-49.9 kip	-222	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	49.9 kip	222	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	37.9 kip	168	kN	

*using absolute maximum sums, conservative

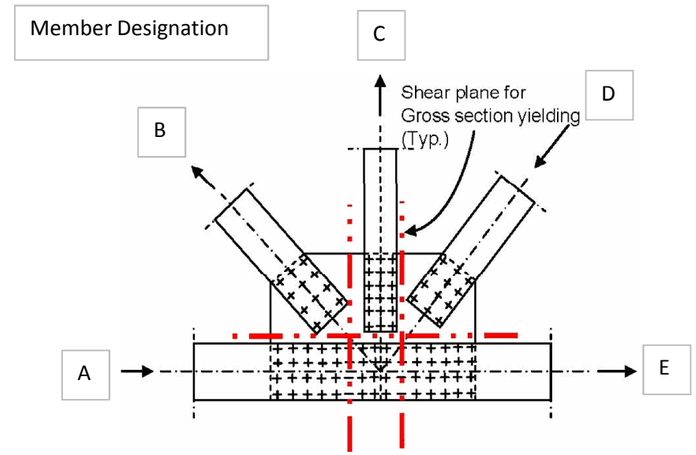


Figure 4 – Examples of gross section shear yielding planes

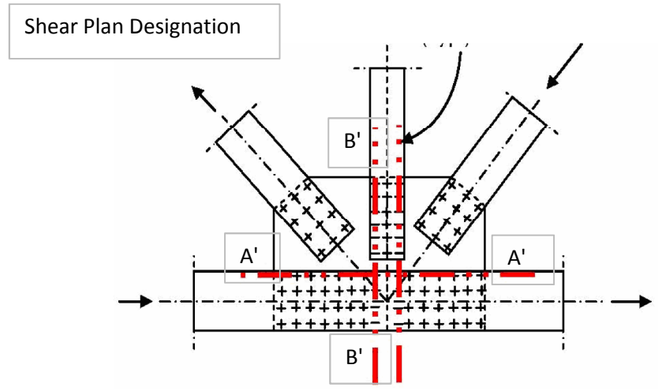


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Possible Scenario?			No		
Length of Shear Plane	L =	49.02 in	1245	mm	
No of holes in shear plane	N =	12.00 ea	12	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00 ea	2	ea	
Gross Shear Area	A_g =		29880	mm^2	
Net Shear Area	A_n =		23947	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =		$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =		2981	kN	
Shear Resistance (Net Section)	V_{Rn} =		$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =		4023	kN	
Shear Resistance (Governing)	V_R =		**2981**	**kN**	
Demand/Capacity	D/C =		**0.000**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Possible Scenario?			Yes		
Length of Shear Plane	L =	34.06 in	865	mm	
No of holes in shear plane	N =	11.00 ea	11	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2 ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 1N

Members A and E continuous through the gusset plate?				No		
Outside height of member A	H_A=	15	in	381	mm	
Thickness of the web of member A	w_A=	0.40	in	10	mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4	ea	
Gross Shear Area	A_g =			20760	mm^2	
Net Shear Area	A_n =			15322	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2071	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =			2574	kN	
Shear Resistance (Governing)	V_R =			**2071**	**kN**	
Demand/Capacity	D/C =			**0.081**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E

Members A and E continuous through the gusset plate? No

General

Whitmore Width	W_w =	28.31	in	719	mm	Number of Rivet/bolt diameters Intsecting Plane
Shear Length 1	L_{V1} =	28.54	in	725	mm	4
Shear Length 2	L_{V2} =	27.80	in	706	mm	10.5
Tension Length	L_T =	8.98	in	228	mm	10.5
Number of Gusset Plates	m =	2.00	ea	2	ea	3 Typ, 1 less than Whitemore Width
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	
			3443	kN
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	
For gusset plates, U=1.0, FHWA 3.1.2			5134	kN

FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		2736	mm^2
Gross Shear Area	A_{vg} =		17172	mm^2
Net Tension Area	A_{tn} =		1994	mm^2
Net Shear Area	A_{vn} =		11981	mm^2
$A_{tn} > 0.58*A_{vn}$?			No	

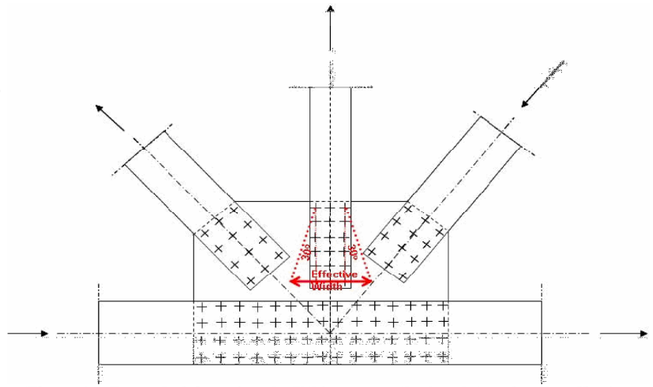


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

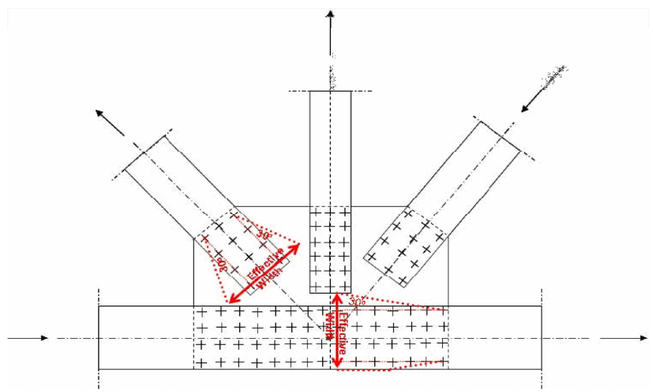


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 1N

				$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	
Block Shear Resistance	P_{Rbs} =			5589 kN	FHWA 3.1.3
Tension Resistance (Governing)				3443 kN	
Demand/Capacity	D/C =			**0.065**	

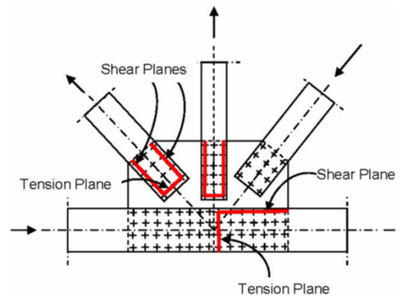


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E

General FHWA 3.3

Whitmore Width	W_w =	28.31	in	719	mm
L1	L_1 =	0.00	in	0	mm
L2 - along centreline of action	L_2 =	0.00	in	0	mm
L3	L_3 =	0.00	in	0	mm
Unsupported Column Length	L_u =	0.00	in	0	mm
Effective Length Factor	K =	0.00		0.0	"fixed-free condition"
Number of Gusset Plates	m =	2.00	ea	2	ea
Minimum radius of gyration of column plate	r =			$t/\sqrt{(12)}$	for rectangular plate
		0.14	in	3.46	mm
	λ =			$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$	
				0.00	
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	
				3261 kN	
Demand/Capacity	D/C =			**0.000**	

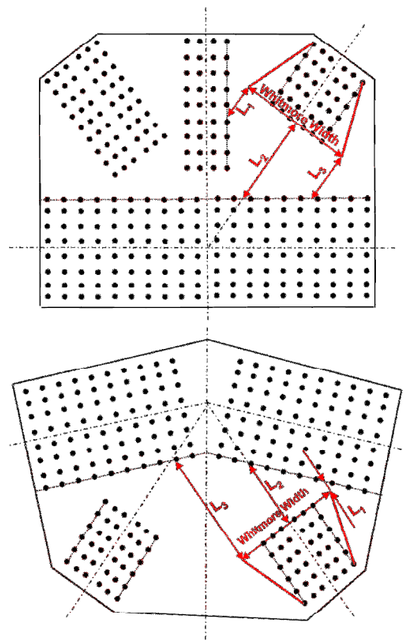


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	42	ea	42	ea	
Longest Length of connection	L=	28.58	in	726	mm	
Edge distance	e =	1.57	in	40	mm	
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")
Shear Planes per gusset plate	m =	1	ea	1	ea	
Number of Gusset Plates		2	ea	2	ea	
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$		CSA S6 CL14.14.1.4.2
	B_{r1} =	1276	kip	5673	kN	
	B_{r2} =	1824	kip	8105	kN	
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$		CSA S6 CL14.14.1.4.2
		433	kip	1925	kN	
Governing Resistance				3850	kN	for 2 plate(s)

Span: Bascule Bridge - Leaf Span

Node: 1N

Demand/Capacity	D/C =			**0.058**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.						FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored?				Yes		
General						Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	26.97	in	685	mm	4
Shear Length 1	L_{V1} =	27.83	in	707	mm	10.5
Shear Length 2	L_{V2} =	28.07	in	713	mm	10.5
Tension Length	L_T =	9.02	in	229	mm	2
Number of Gusset Plates	m =	2	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =			$U*\varphi_s*A_g*F_y$ 3280	U=1.0 kN	FHWA 3.1.2
Net Section Resistance For gusset plates, U=1.0, FHWA 3.1.2	P_{RN} =			$U*\varphi_u*A_n*F_u$ 4859	U=1.0 kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =			2748	mm^2	
Gross Shear Area	A_{vg} =			17040	mm^2	
Net Tension Area	A_{tn} =			2254	mm^2	
Net Shear Area	A_{vn} =			11849	mm^2	
$A_{tn} \geq 0.58*A_{vn}$?				No		
	$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$				U=1.0	
Block Shear Resistance	P_{Rbs} =			5542	kN	FHWA 3.1.3
Tension Resistance (Governing)				3280	kN	
Demand/Capacity	D/C =			**0.029**		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored?				Yes		
General						FHWA 3.3
Whitmore Width	W_w =	26.97	in	685	mm	

Span: Bascule Bridge - Leaf Span

Node: 1N

L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	0.00	in	0	mm	
L3	L_3 =	0.00	in	0	mm	
Unsupported Column Length	L_u =	0.00	in	0	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.00		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				3107	kN	
Demand/Capacity	D/C =			**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	37	ea	37	ea		
Longest Length of connection	L=	28.07	in	713	mm		
Edge distance	e =	1.57	in	40	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	1124	kip	4998	kN		
	B_{r2} =	1607	kip	7140	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		691	kip	3069	kN		
Governing Resistance				6139	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.016**			

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	28.07	in	713	mm	4	
Shear Length 1	L_{V1} =	28.62	in	727	mm	9.5	
Shear Length 2	L_{V2} =	28.62	in	727	mm	10.5	
Tension Length	L_T =	8.50	in	216	mm	3	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 1N

Number of Gusset Plates	m =	2.00 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			3414	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			5085	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		2592	mm^2	
Gross Shear Area	A_{vg} =		17448	mm^2	
Net Tension Area	A_{tn} =		1850	mm^2	
Net Shear Area	A_{vn} =		12504	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		5744	kN	FHWA 3.1.3
Tension Resistance (Governing)			3414	kN	
Demand/Capacity	D/C =		**0.025**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored?			N/A		
General					FHWA 3.3
Whitmore Width	W_w =	28.07 in	713	mm	
L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	0.00 in	0	mm	
L3	L_3 =	0.00 in	0	mm	
Unsupported Column Length	L_u =	0.00 in	0	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			3234	kN	

Span: Bascule Bridge - Leaf Span

Node: 1N

Demand/Capacity	D/C =			**0.000**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	22	ea	22	ea		
Longest Length of connection	L=	28.62	in	727	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	635	kip	2823	kN		
	B_{r2} =	955	kip	4246	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		411	kip	1825	kN		
Governing Resistance				3650	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.023**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	23.31	in	592	mm	3	
Shear Length 1	L_{V1} =	18.07	in	459	mm	6.5	
Shear Length 2	L_{V2} =	16.73	in	425	mm	6.5	
Tension Length	L_T =	5.98	in	152	mm	2	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
		2834	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		4276	kN	

Block Shear

Gross Tension Area	A_{tg} =	1824	mm^2

Span: Bascule Bridge - Leaf Span

Node: 1N

Gross Shear Area	A_{vg} =	10608	mm^2	
Net Tension Area	A_{tn} =	1330	mm^2	
Net Shear Area	A_{vn} =	7394	mm^2	
$A_{tn} > 0.58*A_{vn}$?		No		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =	3495	kN	FHWA 3.1.3
Tension Resistance (Governing)		2834	kN	
Demand/Capacity	D/C =	**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?				Yes		
General						FHWA 3.3
Whitmore Width	W_w =	23.31	in	592	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	10.51	in	267	mm	
L3	L_3 =	0.83	in	21	mm	
Unsupported Column Length	L_u =	3.78	in	96	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.34		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2577	kN	
Demand/Capacity	D/C =			**0.087**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	22	ea	22	ea		
Longest Length of connection	L=	18.07	in	459	mm		
Edge distance	e =	1.77	in	45	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	752	kip	3343	kN		
	B_{r2} =	955	kip	4246	kN		

Span: Bascule Bridge - Leaf Span
Node: 1N

Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$ U=1.81	CSA S6 CL14.14.1.4.2
		411 kip	1825 kN	
Governing Resistance			3650 kN for 2 plate(s)	
Demand/Capacity	D/C =		**0.061**	
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	671	2981
Shear Resistance (Net Section)	905	4023
Shear Resistance (Governing)	671	2981
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	466	2071
Shear Resistance (Net Section)	579	2574
Shear Resistance (Governing)	466	2071
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	775	3443
Net Section Resistance	1155	5134
Block Shear Resistance	1258	5589
Tension Resistance (Governing)	775	3443
At Member B:		
Gross Section Resistance	738	3280
Net Section Resistance	1093	4859
Block Shear Resistance	1247	5542
Tension Resistance (Governing)	738	3280
At Member C:		
Gross Section Resistance	768	3414
Net Section Resistance	1144	5085
Block Shear Resistance	1293	5744
Tension Resistance (Governing)	768	3414
At Member D:		
Gross Section Resistance	638	2834
Net Section Resistance	962	4276
Block Shear Resistance	786	3495
Tension Resistance (Governing)	638	2834
At Member E:		
Gross Section Resistance	775	3443

Span: Bascule Bridge - Leaf Span
Node: 1N

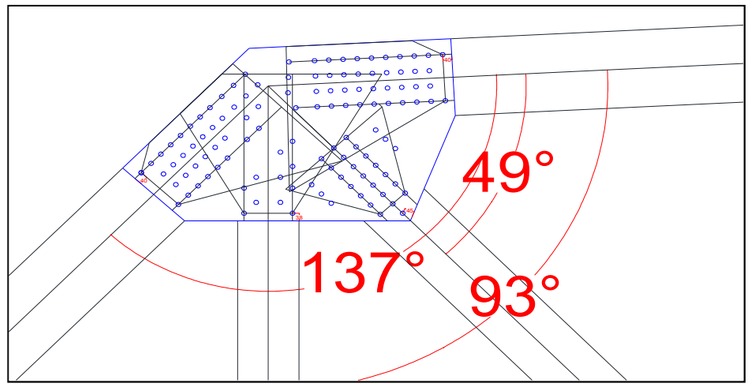
Net Section Resistance	1155	5134
Block Shear Resistance	1258	5589
Tension Resistance (Governing)	775	3443
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	734	3261
Compressive Resistance at Member B	699	3107
Compressive Resistance at Member C	728	3234
Compressive Resistance at Member D	580	2577
Compressive Resistance at Member E	734	3261
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	866	3850
Governing Resistance at Member B	1381	6139
Governing Resistance at Member C	821	3650
Governing Resistance at Member D	821	3650
Governing Resistance at Member E	866	3850

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
	SHEAR PLANE A'-A'	671	2981	**0.000**	
	SHEAR PLANE B'-B'	466	2071	**0.081**	
GUSSET PLATE TENSION					
	Member A	775	3443	**0.065**	
	Member B	738	3280	**0.029**	
	Member C	768	3414	**0.025**	
	Member D	638	2834	**0.000**	
	Member E	775	3443	**0.065**	
GUSSET PLATE COMPRESSION					
	Member A	734	3261	**0.000**	
	Member B	699	3107	**0.000**	
	Member C	728	3234	**0.000**	
	Member D	580	2577	**0.087**	<--- Governing
	Member E	734	3261	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	866	3850	**0.058**	
	Member B	1381	6139	**0.016**	
	Member C	821	3650	**0.023**	
	Member D	821	3650	**0.061**	
	Member E	866	3850	**0.058**	
	Highest Demand/Capacity Ratio			**0.087**	

Span: Bascule Bridge - Leaf Span
Node: 1S

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.47 in	12 mm	6% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units		
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa		

MEMBER FORCES

Load Combination:		ULSB3 Max 0		Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
1S-A	P_{Max} =	0.0 kip	0 kN	1S-A	0	#N/A	#N/A	#N/A	#N/A
1S-A	P_{Min} =	0.0 kip	0 kN	1S-A	0	#N/A	#N/A	#N/A	#N/A
1S-B	P_{Max} =	25.3 kip	112 kN	1S-B	178	112	107	102	112
1S-B	P_{Min} =	11.1 kip	50 kN	1S-B	178	55	52	50	50
1S-C	P_{Max} =	24.9 kip	111 kN	1S-C	569	105	108	111	111
1S-C	P_{Min} =	11.7 kip	52 kN	1S-C	569	52	54	55	52
1S-D	P_{Max} =	-30.7 kip	-136 kN	1S-D	179	-140	-138	-136	-136
1S-D	P_{Min} =	-61.5 kip	-273 kN	1S-D	179	-273	-269	-266	-273
1S-E	P_{Max} =	60.2 kip	268 kN	1S-E	492	268	267	267	268
1S-E	P_{Min} =	27.7 kip	123 kN	1S-E	492	123	123	123	123

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 1S

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		137	deg	B
	φ_C =		93	deg	C
	φ_D =		49	deg	D
	$\cos(\varphi_B)$ =		-0.731		
	$\cos(\varphi_C)$ =		-0.052		
	$\cos(\varphi_D)$ =		0.656		
	$V_{A'-A',max}$ =	-28.9 kip	-128	kN	*
	$V_{A'-A',min}$ =	-60.1 kip	-267	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	60.1 kip	267	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	46.4 kip	206	kN	

*using absolute maximum sums, conservative

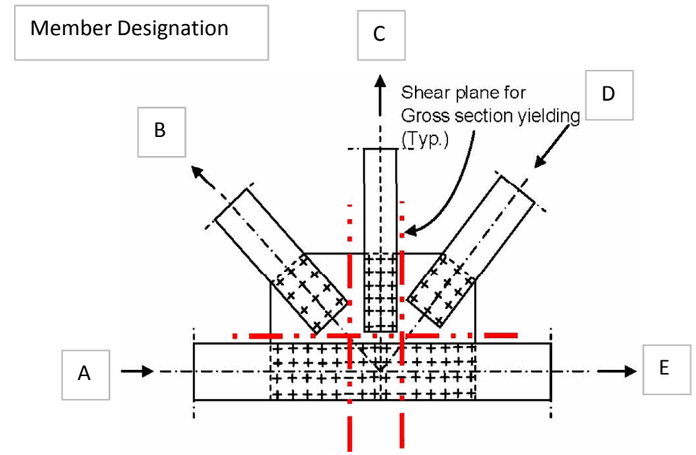


Figure 4 – Examples of gross section shear yielding planes

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

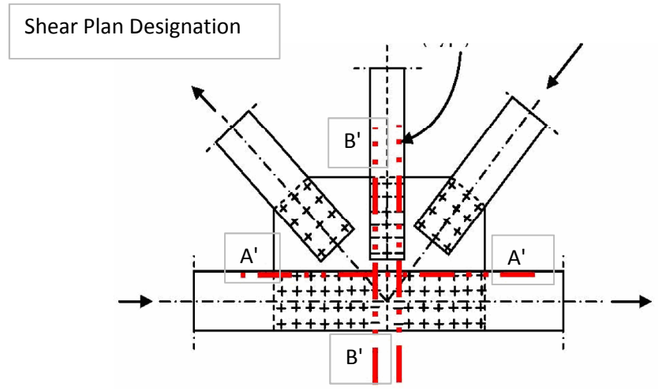


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Possible Scenario?			No		
Length of Shear Plane	L =	49.02 in	1245	mm	
No of holes in shear plane	N =	12.00 ea	12	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00 ea	2	ea	
Gross Shear Area	A_g =		29880	mm^2	
Net Shear Area	A_n =		23947	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =		$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =		2981	kN	
Shear Resistance (Net Section)	V_{Rn} =		$0.5*\varphi_u*A_n*F_U$ *		Cl 10.18.5.2
	V_{Rn} =		4023	kN	
Shear Resistance (Governing)	V_R =		**2981**	**kN**	
Demand/Capacity	D/C =		**0.000**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Possible Scenario?			Yes		
Length of Shear Plane	L =	34.06 in	865	mm	
No of holes in shear plane	N =	11.00 ea	11	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2 ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 1S

Members A and E continuous through the gusset plate?				No		
Outside height of member A	H_A=	15	in	381	mm	
Thickness of the web of member A	w_A=	0.40	in	10	mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4	ea	
Gross Shear Area	A_g =			20760	mm^2	
Net Shear Area	A_n =			15322	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2071	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =			2574	kN	
Shear Resistance (Governing)	V_R =			**2071**	**kN**	
Demand/Capacity	D/C =			**0.100**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E

Members A and E continuous through the gusset plate? No

General

Whitmore Width	W_w =	28.31	in	719	mm	Number of Rivet/bolt diameters Intsecting Plane
Shear Length 1	L_{V1} =	28.54	in	725	mm	4
Shear Length 2	L_{V2} =	27.80	in	706	mm	10.5
Tension Length	L_T =	8.98	in	228	mm	10.5
Number of Gusset Plates	m =	2.00	ea	2	ea	3 Typ, 1 less than Whitemore Width
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$		
		3443	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		5134	kN	

Block Shear

Gross Tension Area	A_{tg} =	2736	mm^2
Gross Shear Area	A_{vg} =	17172	mm^2
Net Tension Area	A_{tn} =	1994	mm^2
Net Shear Area	A_{vn} =	11981	mm^2
$A_{tn} > 0.58*A_{vn}$?		No	

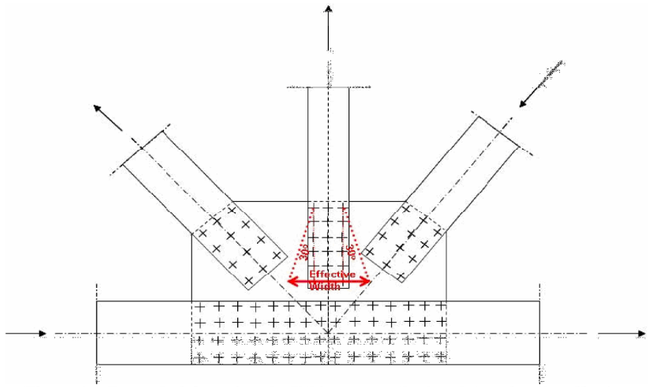


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

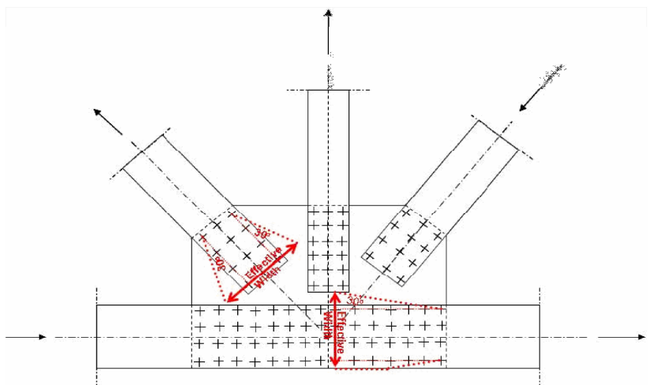


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 1S

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		5589 kN		FHWA 3.1.3
Tension Resistance (Governing)			3443 kN		
Demand/Capacity	D/C =		**0.078**		

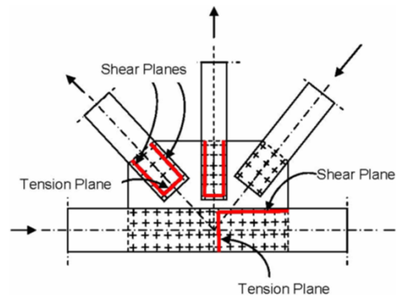


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E

General FHWA 3.3

Whitmore Width	W_w =	28.31 in	719 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.14 in	3.46 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			3261 kN		
Demand/Capacity	D/C =		**0.000**		

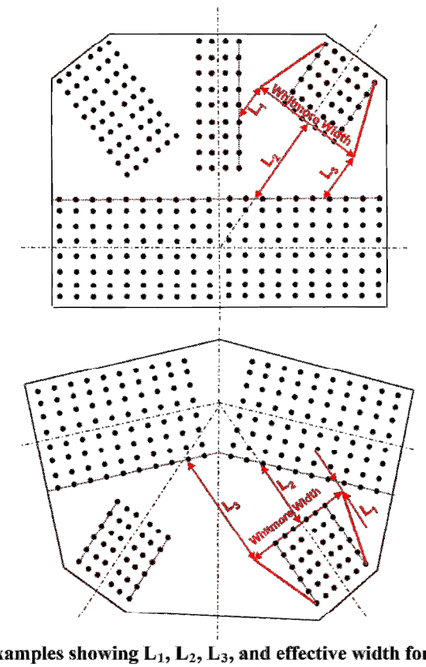


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	42 ea	42 ea			
Longest Length of connection	L=	28.58 in	726 mm			
Edge distance	e =	1.57 in	40 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$			CSA S6 CL14.14.1.4.2
	B_{r1} =	1276 kip	5673 kN			
	B_{r2} =	1824 kip	8105 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$			CSA S6 CL14.14.1.4.2
		433 kip	1925 kN			
Governing Resistance			3850 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span

Node: 1S

Demand/Capacity	D/C =	**0.070**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? Yes

General

					Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	26.97 in	685	mm	4
Shear Length 1	L_{V1} =	27.83 in	707	mm	10.5
Shear Length 2	L_{V2} =	28.07 in	713	mm	10.5
Tension Length	L_T =	9.02 in	229	mm	2
Number of Gusset Plates	m =	2 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$U*\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
			3280	kN	
Net Section Resistance	P_{RN} =		$U*\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2			4859	kN	

Block Shear

Gross Tension Area	A_{tg} =	2748	mm^2	
Gross Shear Area	A_{vg} =	17040	mm^2	
Net Tension Area	A_{tn} =	2254	mm^2	
Net Shear Area	A_{vn} =	11849	mm^2	
$A_{tn} \geq 0.58*A_{vn}$?		No		

$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$ U=1.0

Block Shear Resistance	P_{Rbs} =	5542	kN	FHWA 3.1.3
Tension Resistance (Governing)		3280	kN	
Demand/Capacity	D/C =	**0.034**		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? Yes

General — FHWA 3.3

Whitmore Width	W_w =	26.97 in	685	mm

Span: Bascule Bridge - Leaf Span

Node: 1S

L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	0.00	in	0	mm	
L3	L_3 =	0.00	in	0	mm	
Unsupported Column Length	L_u =	0.00	in	0	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.00		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				3107	kN	
Demand/Capacity	D/C =			**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	37	ea	37	ea		
Longest Length of connection	L=	28.07	in	713	mm		
Edge distance	e =	1.57	in	40	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	1124	kip	4998	kN		
	B_{r2} =	1607	kip	7140	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		691	kip	3069	kN		
Governing Resistance				6139	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.018**			

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	28.07	in	713	mm	4	
Shear Length 1	L_{V1} =	28.62	in	727	mm	9.5	
Shear Length 2	L_{V2} =	28.62	in	727	mm	10.5	
Tension Length	L_T =	8.50	in	216	mm	3	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 1S

Number of Gusset Plates	m =	2.00 ea	2 ea		
Diameter of holes in plane	d_b =	0.81 in	21 mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			3414	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			5085	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		2592	mm^2	
Gross Shear Area	A_{vg} =		17448	mm^2	
Net Tension Area	A_{tn} =		1850	mm^2	
Net Shear Area	A_{vn} =		12504	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		5744	kN	FHWA 3.1.3
Tension Resistance (Governing)			3414	kN	
Demand/Capacity	D/C =		**0.032**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	28.07 in	713	mm	
L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	0.00 in	0	mm	
L3	L_3 =	0.00 in	0	mm	
Unsupported Column Length	L_u =	0.00 in	0	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			3234	kN	

Span: Bascule Bridge - Leaf Span
Node: 1S

Demand/Capacity	D/C =			**0.000**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	22	ea	22	ea		
Longest Length of connection	L=	28.62	in	727	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	635	kip	2823	kN		
	B_{r2} =	955	kip	4246	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		411	kip	1825	kN		
Governing Resistance				3650	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.030**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	23.31	in	592	mm	3	
Shear Length 1	L_{V1} =	18.07	in	459	mm	6.5	
Shear Length 2	L_{V2} =	16.73	in	425	mm	6.5	
Tension Length	L_T =	5.98	in	152	mm	2	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		2834	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		4276	kN		

Block Shear

Gross Tension Area	A_{tg} =	1824	mm^2

Span: Bascule Bridge - Leaf Span

Node: 1S

Gross Shear Area	A_{vg} =		10608	mm^2	
Net Tension Area	A_{tn} =		1330	mm^2	
Net Shear Area	A_{vn} =		7394	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0		
Block Shear Resistance	P_{Rbs} =		3495	kN	FHWA 3.1.3
Tension Resistance (Governing)			2834	kN	
Demand/Capacity	D/C =		**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?			Yes		
General					FHWA 3.3
Whitmore Width	W_w =	23.31 in	592	mm	
L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	10.51 in	267	mm	
L3	L_3 =	0.83 in	21	mm	
Unsupported Column Length	L_u =	3.78 in	96	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.34		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			2577	kN	
Demand/Capacity	D/C =		**0.106**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	22 ea	22	ea		
Longest Length of connection	L=	18.07 in	459	mm		
Edge distance	e =	1.77 in	45	mm		
Diameter of Rivet	d =	0.75 in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1	ea		
Number of Gusset Plates		2.00 ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	752 kip	3343	kN		
	B_{r2} =	955 kip	4246	kN		

Span: Bascule Bridge - Leaf Span

Node: 1S

Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$ U=1.81	CSA S6 CL14.14.1.4.2
		411 kip	1825 kN	
Governing Resistance			3650 kN for 2 plate(s)	
Demand/Capacity	D/C =		**0.075**	
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	671	2981
Shear Resistance (Net Section)	905	4023
Shear Resistance (Governing)	671	2981
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	466	2071
Shear Resistance (Net Section)	579	2574
Shear Resistance (Governing)	466	2071
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	775	3443
Net Section Resistance	1155	5134
Block Shear Resistance	1258	5589
Tension Resistance (Governing)	775	3443
At Member B:		
Gross Section Resistance	738	3280
Net Section Resistance	1093	4859
Block Shear Resistance	1247	5542
Tension Resistance (Governing)	738	3280
At Member C:		
Gross Section Resistance	768	3414
Net Section Resistance	1144	5085
Block Shear Resistance	1293	5744
Tension Resistance (Governing)	768	3414
At Member D:		
Gross Section Resistance	638	2834
Net Section Resistance	962	4276
Block Shear Resistance	786	3495
Tension Resistance (Governing)	638	2834
At Member E:		
Gross Section Resistance	775	3443

Span: Bascule Bridge - Leaf Span
Node: 1S

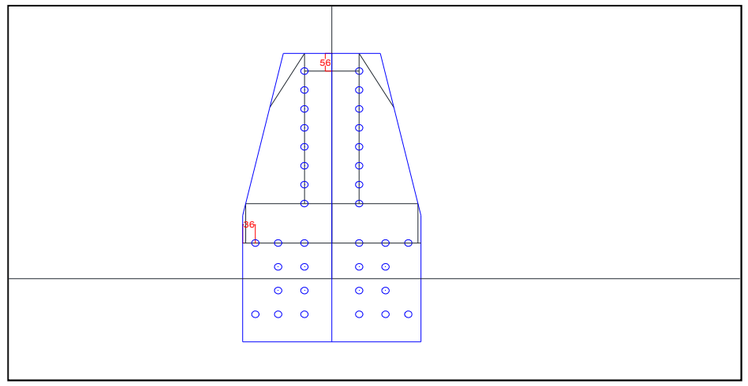
Net Section Resistance	1155	5134
Block Shear Resistance	1258	5589
Tension Resistance (Governing)	775	3443
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	734	3261
Compressive Resistance at Member B	699	3107
Compressive Resistance at Member C	728	3234
Compressive Resistance at Member D	580	2577
Compressive Resistance at Member E	734	3261
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	866	3850
Governing Resistance at Member B	1381	6139
Governing Resistance at Member C	821	3650
Governing Resistance at Member D	821	3650
Governing Resistance at Member E	866	3850

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
	SHEAR PLANE A'-A'	671	2981	**0.000**	
	SHEAR PLANE B'-B'	466	2071	**0.100**	
GUSSET PLATE TENSION					
	Member A	775	3443	**0.078**	
	Member B	738	3280	**0.034**	
	Member C	768	3414	**0.032**	
	Member D	638	2834	**0.000**	
	Member E	775	3443	**0.078**	
GUSSET PLATE COMPRESSION					
	Member A	734	3261	**0.000**	
	Member B	699	3107	**0.000**	
	Member C	728	3234	**0.000**	
	Member D	580	2577	**0.106**	<--- Governing
	Member E	734	3261	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	866	3850	**0.070**	
	Member B	1381	6139	**0.018**	
	Member C	821	3650	**0.030**	
	Member D	821	3650	**0.075**	
	Member E	866	3850	**0.070**	
	Highest Demand/Capacity Ratio			**0.106**	

Span: Bascule Bridge - Leaf Span
Node: 2N

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.28 in	7 mm	45% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units			
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6	
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa			

MEMBER FORCES

Load Combination:		ULSB3 Max 0		Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
2N-A	P_{Max} =	0.7 kip	3 kN	2N-A	279	3	3	3	3
2N-A	P_{Min} =	-8.1 kip	-36 kN	2N-A	279	-36	-36	-36	-36
2N-B	P_{Max} =	0.0 kip	0 kN	2N-B	0	#N/A	#N/A	#N/A	#N/A
2N-B	P_{Min} =	0.0 kip	0 kN	2N-B	0	#N/A	#N/A	#N/A	#N/A
2N-C	P_{Max} =	19.2 kip	85 kN	2N-C	241	79	82	85	85
2N-C	P_{Min} =	9.1 kip	40 kN	2N-C	241	40	42	44	40
2N-D	P_{Max} =	0.0 kip	0 kN	2N-D	0	#N/A	#N/A	#N/A	#N/A
2N-D	P_{Min} =	0.0 kip	0 kN	2N-D	0	#N/A	#N/A	#N/A	#N/A
2N-E	P_{Max} =	7.2 kip	32 kN	2N-E	280	32	32	32	32
2N-E	P_{Min} =	-14.0 kip	-62 kN	2N-E	280	-62	-62	-62	-62

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 2N

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		128	deg	B
	φ_C =		90	deg	C
	φ_D =		54	deg	D
	$\cos(\varphi_B)$ =		-0.616		
	$\cos(\varphi_C)$ =		0.000		
	$\cos(\varphi_D)$ =		0.588		
	$V_{A'-A',max}$ =	0.0 kip	0	kN	*
	$V_{A'-A',min}$ =	0.0 kip	0	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	0.0 kip	0	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	0.0 kip	0	kN	

*using absolute maximum sums, conservative

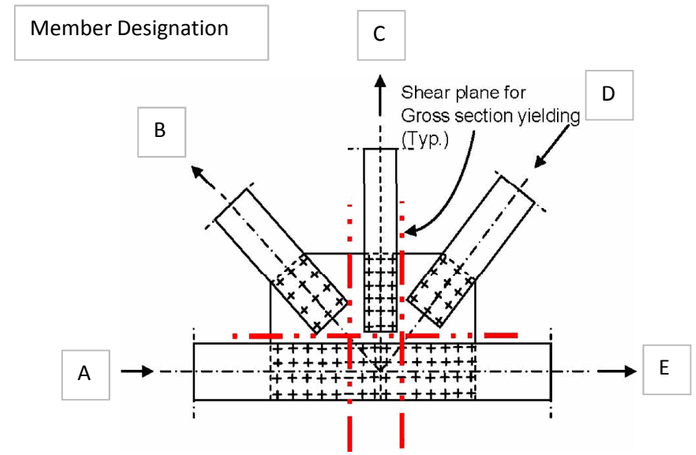


Figure 4 – Examples of gross section shear yielding planes

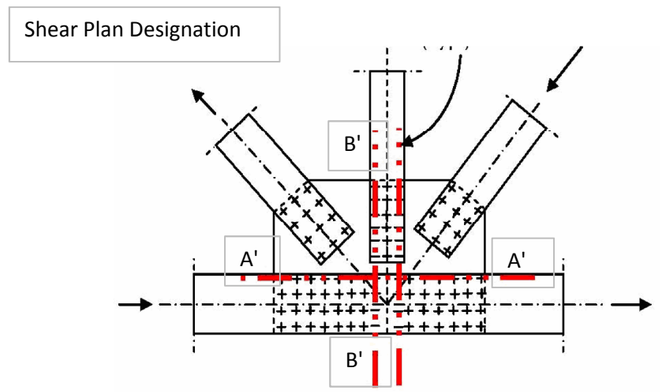


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	20.00	in	508	mm	
No of holes in shear plane	N =	6.00	ea	6	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			7112	mm^2	
Net Shear Area	A_n =			5382	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			709	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =			904	kN	
Shear Resistance (Governing)	V_R =			**709**	**kN**	
Demand/Capacity	D/C =			**0.000**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	35.98	in	914	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 2N

Members A and E continuous through the gusset plate?				Yes		
Outside height of member A	H_A=	15	in	381	mm	
Thickness of the web of member A	w_A=	0.40	in	10	mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4	ea	
Gross Shear Area	A_g =			20538	mm^2	
Net Shear Area	A_n =			15403	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2049	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =			2588	kN	
Shear Resistance (Governing)	V_R =			**2049**	**kN**	
Demand/Capacity	D/C =			**0.000**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E — N/A

Members A and E continuous through the gusset plate? Yes

General

Whitmore Width	W_w =	0.00	in	0	mm	Number of Rivet/bolt diameters Intsecting Plane
Shear Length 1	L_{V1} =	0.00	in	0	mm	0
Shear Length 2	L_{V2} =	0.00	in	0	mm	0
Tension Length	L_T =	0.00	in	0	mm	0
Number of Gusset Plates	m =	2.00	ea	2	ea	0 Typ, 1 less than Whitemore Width
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance

CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	
			0	kN
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	
For gusset plates, U=1.0, FHWA 3.1.2			0	kN

FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

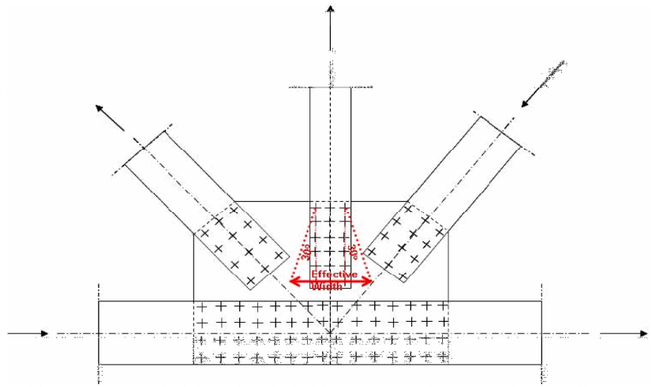


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

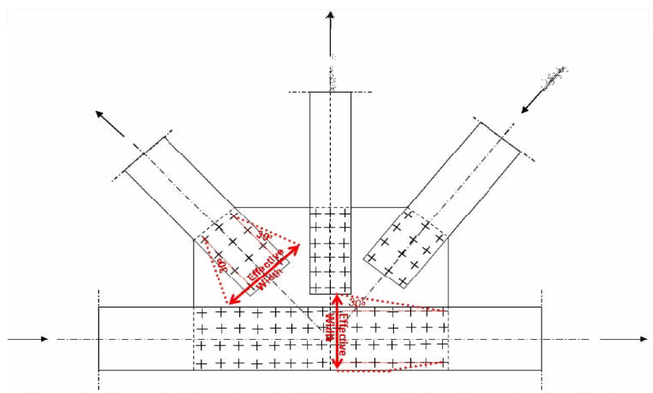


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 2N

				$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =			0 kN		FHWA 3.1.3
Tension Resistance (Governing)				0 kN		
Demand/Capacity	D/C =			0.000		

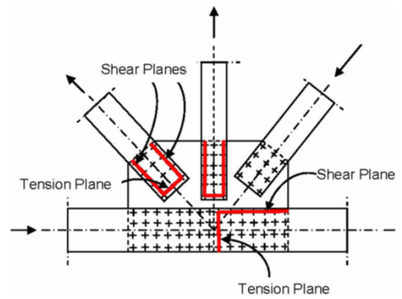


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00	in	0	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	0.00	in	0	mm	
L3	L_3 =	0.00	in	0	mm	
Unsupported Column Length	L_u =	0.00	in	0	mm	
Effective Length Factor	K =	0.00		0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.08	in	2.02	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.00		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
				0 kN		
Demand/Capacity	D/C =			0.000		

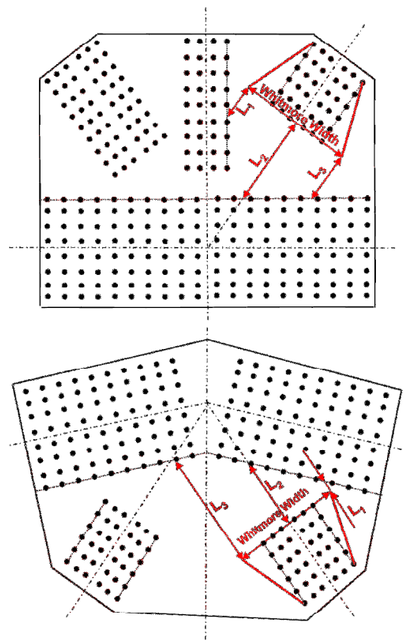


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	20	ea	20	ea		
Longest Length of connection	L=	20.00	in	508	mm		
Edge distance	e =	1.42	in	36	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$			CSA S6 CL14.14.1.4.2
	B_{r1} =	319	kip	1418	kN		
	B_{r2} =	507	kip	2251	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$			CSA S6 CL14.14.1.4.2
		206	kip	917	kN		
Governing Resistance				1833	kN	for 2 plate(s)	

Span: Bascule Bridge - Leaf Span

Node: 2N

Demand/Capacity	D/C =	**0.034**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	21.81	in	554	mm	3
Shear Length 1	L_{V1} =	13.11	in	333	mm	4.5
Shear Length 2	L_{V2} =	11.38	in	289	mm	4.5
Tension Length	L_T =	14.33	in	364	mm	4
Number of Gusset Plates	m =	2	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$ U=1.0	1547 kN	FHWA 3.1.2
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$ U=1.0	2315 kN	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2				

Block Shear

Gross Tension Area	A_{tg} =	2548	mm^2
Gross Shear Area	A_{vg} =	4354	mm^2
Net Tension Area	A_{tn} =	1971	mm^2
Net Shear Area	A_{vn} =	3056	mm^2
$A_{tn} \geq 0.58*A_{vn}$?		Yes	

		$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$ U=1.0		
Block Shear Resistance	P_{Rbs} =		2173 kN	FHWA 3.1.3
Tension Resistance (Governing)			1547 kN	
Demand/Capacity	D/C =		**0.000**	

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? Yes

General — FHWA 3.3

Whitmore Width	W_w =	21.81	in	554 mm

Span: Bascule Bridge - Leaf Span

Node: 2N

L1	L_1 =	0.79	in	20	mm	
L2 - along centreline of action	L_2 =	13.54	in	344	mm	
L3	L_3 =	4.88	in	124	mm	
Unsupported Column Length	L_u =	6.40	in	163	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.08	in	2.02	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				1.00		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				877	kN	
Demand/Capacity	D/C =			**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22	ea	22	ea	
Longest Length of connection	L=	18.94	in	481	mm	
Edge distance	e =	1.50	in	38	mm	
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")
Shear Planes per gusset plate	m =	1	ea	1	ea	
Number of Gusset Plates		2.00	ea	2	ea	
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0	CSA S6 CL14.14.1.4.2
	B_{r1} =	371	kip	1647	kN	
	B_{r2} =	557	kip	2477	kN	
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81	CSA S6 CL14.14.1.4.2
		411	kip	1825	kN	
Governing Resistance				3294	kN	for 2 plate(s)
Demand/Capacity	D/C =			**0.000**		

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	19.29	in	490	mm	2	
Shear Length 1	L_{V1} =	18.74	in	476	mm	7.5	
Shear Length 2	L_{V2} =	18.74	in	476	mm	7.5	
Tension Length	L_T =	6.14	in	156	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 2N

Number of Gusset Plates	m =	2.00 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			1369	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			2111	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		1092	mm^2	
Gross Shear Area	A_{vg} =		6664	mm^2	
Net Tension Area	A_{tn} =		948	mm^2	
Net Shear Area	A_{vn} =		4501	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		2121	kN	FHWA 3.1.3
Tension Resistance (Governing)			1369	kN	
Demand/Capacity	D/C =		**0.062**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	19.29 in	490	mm	
L1	L_1 =	4.92 in	125	mm	
L2 - along centreline of action	L_2 =	4.92 in	125	mm	
L3	L_3 =	4.92 in	125	mm	
Unsupported Column Length	L_u =	4.92 in	125	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.08 in	2.02	mm	
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.77		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			963	kN	

Span: Bascule Bridge - Leaf Span
Node: 2N

Demand/Capacity	D/C =			**0.000**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea		
Longest Length of connection	L=	18.74	in	476	mm		
Edge distance	e =	2.20	in	56	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	397	kip	1765	kN		
	B_{r2} =	405	kip	1801	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		299	kip	1327	kN		
Governing Resistance				2655	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.032**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	24.41	in	620	mm	5	
Shear Length 1	L_{V1} =	10.87	in	276	mm	3.5	
Shear Length 2	L_{V2} =	14.25	in	362	mm	4.5	
Tension Length	L_T =	15.55	in	395	mm	5	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		1732	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		2432	kN		

Block Shear

Gross Tension Area	A_{tg} =	2765	mm^2

Span: Bascule Bridge - Leaf Span

Node: 2N

Gross Shear Area	A_{vg} =		4466	mm^2	
Net Tension Area	A_{tn} =		2044	mm^2	
Net Shear Area	A_{vn} =		3312	mm^2	
$A_{tn} > 0.58*A_{vn}$?			Yes		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0		
Block Shear Resistance	P_{Rbs} =		2244	kN	FHWA 3.1.3
Tension Resistance (Governing)			1732	kN	
Demand/Capacity	D/C =		**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?			Yes		
General					FHWA 3.3
Whitmore Width	W_w =	24.41 in	620	mm	
L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	13.15 in	334	mm	
L3	L_3 =	4.21 in	107	mm	
Unsupported Column Length	L_u =	5.79 in	147	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.08 in	2.02	mm	
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.90		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			1078	kN	
Demand/Capacity	D/C =		**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	25 ea	25	ea		
Longest Length of connection	L=	19.37 in	492	mm		
Edge distance	e =	1.50 in	38	mm		
Diameter of Rivet	d =	0.75 in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1	ea		
Number of Gusset Plates		2.00 ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	421 kip	1871	kN		
	B_{r2} =	633 kip	2814	kN		

Span: Bascule Bridge - Leaf Span

Node: 2N

Shear Resistance of Rivets V_r = $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 CSA S6 CL14.14.1.4.2

467 kip 2074 kN

Governing Resistance 3743 kN for 2 plate(s)

Demand/Capacity D/C = **0.000**

For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	160	709
Shear Resistance (Net Section)	203	904
Shear Resistance (Governing)	160	709
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	461	2049
Shear Resistance (Net Section)	582	2588
Shear Resistance (Governing)	461	2049
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	348	1547
Net Section Resistance	521	2315
Block Shear Resistance	489	2173
Tension Resistance (Governing)	348	1547
At Member C:		
Gross Section Resistance	308	1369
Net Section Resistance	475	2111
Block Shear Resistance	477	2121
Tension Resistance (Governing)	308	1369
At Member D:		
Gross Section Resistance	390	1732
Net Section Resistance	547	2432
Block Shear Resistance	505	2244
Tension Resistance (Governing)	390	1732
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 2N

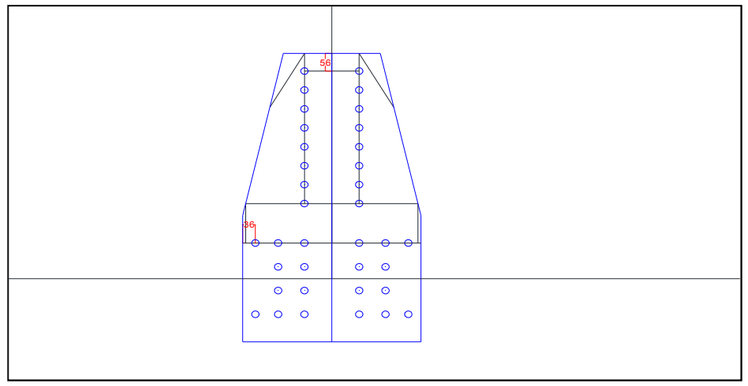
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	197	877
Compressive Resistance at Member C	217	963
Compressive Resistance at Member D	243	1078
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	412	1833
Governing Resistance at Member B	741	3294
Governing Resistance at Member C	597	2655
Governing Resistance at Member D	842	3743
Governing Resistance at Member E	412	1833

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
SHEAR PLANE A'-A'		160	709	**0.000**	
SHEAR PLANE B'-B'		461	2049	**0.000**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	348	1547	**0.000**	
	Member C	308	1369	**0.062**	<--- Governing
	Member D	390	1732	**0.000**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	197	877	**0.000**	
	Member C	217	963	**0.000**	
	Member D	243	1078	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	412	1833	**0.034**	
	Member B	741	3294	**0.000**	
	Member C	597	2655	**0.032**	
	Member D	842	3743	**0.000**	
	Member E	412	1833	**0.034**	
	Highest Demand/Capacity Ratio			**0.062**	

Span: Bascule Bridge - Leaf Span
Node: 2S

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.28 in	7 mm	45% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units		
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa		

MEMBER FORCES

Load Combination:		ULSB3 Max 0	
2S-A	P_{Max} =	-0.8 kip	-4 kN
2S-A	P_{Min} =	-11.1 kip	-49 kN
2S-B	P_{Max} =	0.0 kip	0 kN
2S-B	P_{Min} =	0.0 kip	0 kN
2S-C	P_{Max} =	24.9 kip	111 kN
2S-C	P_{Min} =	11.7 kip	52 kN
2S-D	P_{Max} =	0.0 kip	0 kN
2S-D	P_{Min} =	0.0 kip	0 kN
2S-E	P_{Max} =	6.5 kip	29 kN
2S-E	P_{Min} =	-15.6 kip	-69 kN

Note: Tension is positive.

Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
2S-A	559	-4	-4	-4	-4
2S-A	559	-49	-49	-49	-49
2S-B	0	#N/A	#N/A	#N/A	#N/A
2S-B	0	#N/A	#N/A	#N/A	#N/A
2S-C	569	105	108	111	111
2S-C	569	52	54	55	52
2S-D	0	#N/A	#N/A	#N/A	#N/A
2S-D	0	#N/A	#N/A	#N/A	#N/A
2S-E	560	29	29	29	29
2S-E	560	-69	-69	-69	-69

Span: Bascule Bridge - Leaf Span
Node: 2S

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		128	deg	B
	φ_C =		90	deg	C
	φ_D =		54	deg	D
	$\cos(\varphi_B)$ =		-0.616		
	$\cos(\varphi_C)$ =		0.000		
	$\cos(\varphi_D)$ =		0.588		
	$V_{A'-A',max}$ =	0.0 kip	0	kN	*
	$V_{A'-A',min}$ =	0.0 kip	0	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	0.0 kip	0	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	0.0 kip	0	kN	

*using absolute maximum sums, conservative

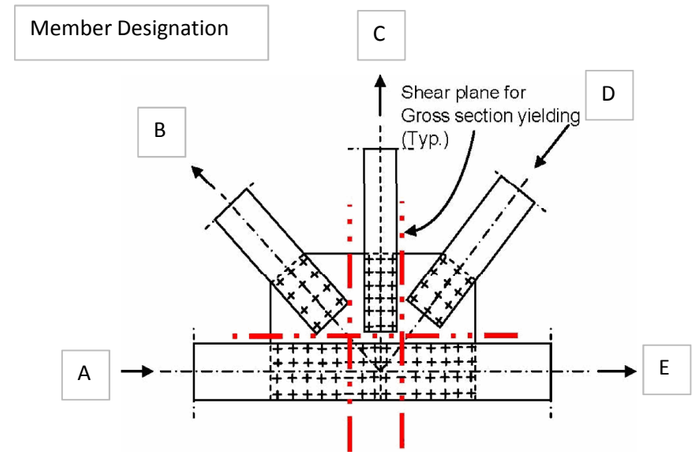


Figure 4 – Examples of gross section shear yielding planes

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

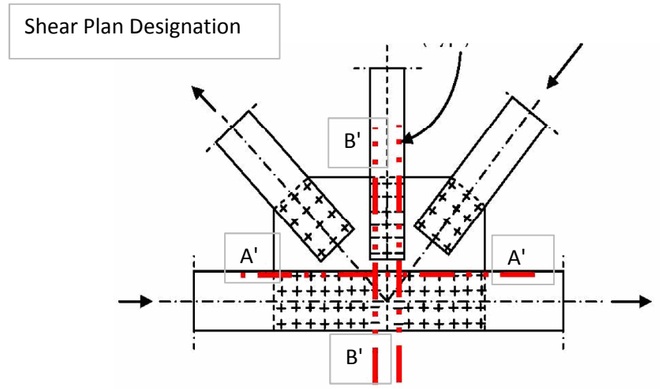


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	20.00	in	508	mm	
No of holes in shear plane	N =	6.00	ea	6	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			7112	mm^2	
Net Shear Area	A_n =			5382	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			709	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =			904	kN	
Shear Resistance (Governing)	V_R =			**709**	**kN**	
Demand/Capacity	D/C =			**0.000**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	35.98	in	914	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 2S

Members A and E continuous through the gusset plate?				Yes		
Outside height of member A	H_A=	15	in	381	mm	
Thickness of the web of member A	w_A=	0.40	in	10	mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4	ea	
Gross Shear Area	A_g =			20538	mm^2	
Net Shear Area	A_n =			15403	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2049	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =			2588	kN	
Shear Resistance (Governing)	V_R =			**2049**	**kN**	
Demand/Capacity	D/C =			**0.000**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E — N/A

Members A and E continuous through the gusset plate?				Yes		

General

Whitmore Width	W_w =	0.00	in	0	mm	
Shear Length 1	L_{V1} =	0.00	in	0	mm	
Shear Length 2	L_{V2} =	0.00	in	0	mm	
Tension Length	L_T =	0.00	in	0	mm	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	

Number of Rivet/bolt diameters Intsecting Plane

0	
0	
0	
0	Typ, 1 less than Whitemore Width

($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	
		0	kN
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	
For gusset plates, U=1.0, FHWA 3.1.2		0	kN

FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

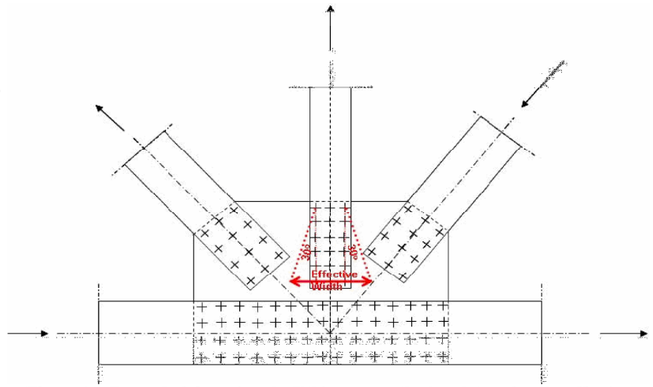


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

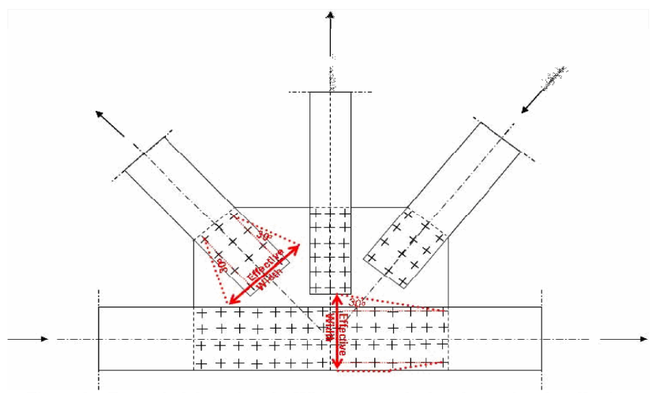


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 2S

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

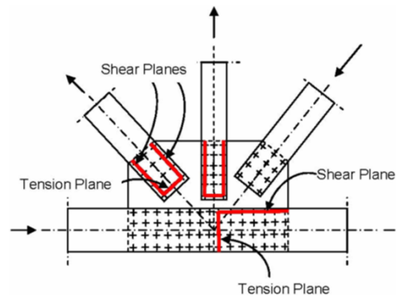


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.08 in	2.02 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

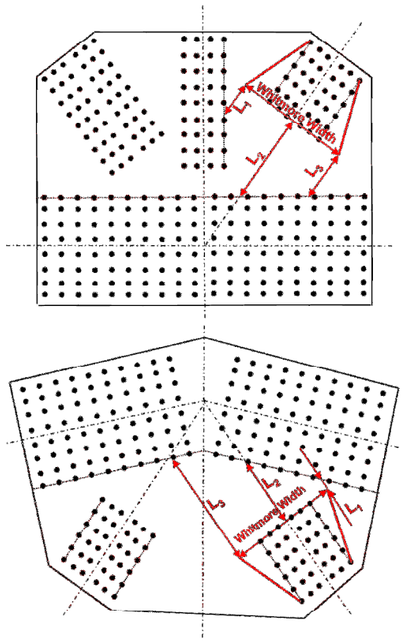


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	20 ea	20 ea			
Longest Length of connection	L=	20.00 in	508 mm			
Edge distance	e =	1.42 in	36 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$			CSA S6 CL14.14.1.4.2
	B_{r1} =	319 kip	1418 kN			
	B_{r2} =	507 kip	2251 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$			CSA S6 CL14.14.1.4.2
		206 kip	917 kN			
Governing Resistance			1833 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span

Node: 2S

Demand/Capacity	D/C =	**0.038**

For Connections greater than 50in (1270mm), shear resistance taken as 80%.

FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	21.81	in	554	mm	3
Shear Length 1	L_{V1} =	13.11	in	333	mm	4.5
Shear Length 2	L_{V2} =	11.38	in	289	mm	4.5
Tension Length	L_T =	14.33	in	364	mm	4
Number of Gusset Plates	m =	2	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance

CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$ U=1.0	1547 kN	FHWA 3.1.2
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$ U=1.0	2315 kN	FHWA 3.1.2

For gusset plates, U=1.0, FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =	2548	mm^2
Gross Shear Area	A_{vg} =	4354	mm^2
Net Tension Area	A_{tn} =	1971	mm^2
Net Shear Area	A_{vn} =	3056	mm^2

$A_{tn} \geq 0.58*A_{vn}$? Yes

		$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$ U=1.0		
Block Shear Resistance	P_{Rbs} =		2173 kN	FHWA 3.1.3
Tension Resistance (Governing)			1547 kN	
Demand/Capacity	D/C =		**0.000**	

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? Yes

General FHWA 3.3

Whitmore Width	W_w =	21.81	in	554	mm

Span: Bascule Bridge - Leaf Span
Node: 2S

L1	L_1 =	0.79	in	20	mm	
L2 - along centreline of action	L_2 =	13.54	in	344	mm	
L3	L_3 =	4.88	in	124	mm	
Unsupported Column Length	L_u =	6.40	in	163	mm	
Effective Length Factor	K =	1.20		1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)		for rectangular plate
		0.08	in	2.02	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				1.00		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				877	kN	
Demand/Capacity	D/C =			**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22	ea	22	ea	
Longest Length of connection	L=	18.94	in	481	mm	
Edge distance	e =	1.50	in	38	mm	
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")
Shear Planes per gusset plate	m =	1	ea	1	ea	
Number of Gusset Plates		2.00	ea	2	ea	
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0	CSA S6 CL14.14.1.4.2
	B_{r1} =	371	kip	1647	kN	
	B_{r2} =	557	kip	2477	kN	
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81	CSA S6 CL14.14.1.4.2
		411	kip	1825	kN	
Governing Resistance				3294	kN	for 2 plate(s)
Demand/Capacity	D/C =			**0.000**		

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	19.29	in	490	mm	2	
Shear Length 1	L_{V1} =	18.74	in	476	mm	7.5	
Shear Length 2	L_{V2} =	18.74	in	476	mm	7.5	
Tension Length	L_T =	6.14	in	156	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 2S

Number of Gusset Plates	m =	2.00 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			1369	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			2111	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		1092	mm^2	
Gross Shear Area	A_{vg} =		6664	mm^2	
Net Tension Area	A_{tn} =		948	mm^2	
Net Shear Area	A_{vn} =		4501	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		2121	kN	FHWA 3.1.3
Tension Resistance (Governing)			1369	kN	
Demand/Capacity	D/C =		**0.081**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	19.29 in	490	mm	
L1	L_1 =	4.92 in	125	mm	
L2 - along centreline of action	L_2 =	4.92 in	125	mm	
L3	L_3 =	4.92 in	125	mm	
Unsupported Column Length	L_u =	4.92 in	125	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.08 in	2.02	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.77		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			963	kN	

Span: Bascule Bridge - Leaf Span
Node: 2S

Demand/Capacity	D/C =			**0.000**				

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea			
Longest Length of connection	L=	18.74	in	476	mm			
Edge distance	e =	2.20	in	56	mm			
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")		
Shear Planes per gusset plate	m =	1	ea	1	ea			
Number of Gusset Plates		2.00	ea	2	ea			
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2	
	B_{r1} =	397	kip	1765	kN			
	B_{r2} =	405	kip	1801	kN			
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2	
		299	kip	1327	kN			
Governing Resistance				2655	kN	for 2 plate(s)		
Demand/Capacity	D/C =			**0.042**				
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2	

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	24.41	in	620	mm	5	
Shear Length 1	L_{V1} =	10.87	in	276	mm	3.5	
Shear Length 2	L_{V2} =	14.25	in	362	mm	4.5	
Tension Length	L_T =	15.55	in	395	mm	5	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		1732	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		2432	kN		

Block Shear

Gross Tension Area	A_{tg} =	2765	mm^2

Span: Bascule Bridge - Leaf Span

Node: 2S

Gross Shear Area	A_{vg} =			4466	mm^2	
Net Tension Area	A_{tn} =			2044	mm^2	
Net Shear Area	A_{vn} =			3312	mm^2	
$A_{tn} > 0.58*A_{vn}$?				Yes		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		U=1.0	
Block Shear Resistance	P_{Rbs} =			2244	kN	FHWA 3.1.3
Tension Resistance (Governing)				1732	kN	
Demand/Capacity	D/C =			**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?				Yes		
General						FHWA 3.3
Whitmore Width	W_w =	24.41	in	620	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	13.15	in	334	mm	
L3	L_3 =	4.21	in	107	mm	
Unsupported Column Length	L_u =	5.79	in	147	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.08	in	2.02	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.90		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				1078	kN	
Demand/Capacity	D/C =			**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	25	ea	25	ea		
Longest Length of connection	L=	19.37	in	492	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	421	kip	1871	kN		
	B_{r2} =	633	kip	2814	kN		

Span: Bascule Bridge - Leaf Span
Node: 2S

Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$ U=1.81	CSA S6 CL14.14.1.4.2
		467 kip	2074 kN	
Governing Resistance			3743 kN for 2 plate(s)	
Demand/Capacity	D/C =		**0.000**	
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	160	709
Shear Resistance (Net Section)	203	904
Shear Resistance (Governing)	160	709
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	461	2049
Shear Resistance (Net Section)	582	2588
Shear Resistance (Governing)	461	2049
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	348	1547
Net Section Resistance	521	2315
Block Shear Resistance	489	2173
Tension Resistance (Governing)	348	1547
At Member C:		
Gross Section Resistance	308	1369
Net Section Resistance	475	2111
Block Shear Resistance	477	2121
Tension Resistance (Governing)	308	1369
At Member D:		
Gross Section Resistance	390	1732
Net Section Resistance	547	2432
Block Shear Resistance	505	2244
Tension Resistance (Governing)	390	1732
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 2S

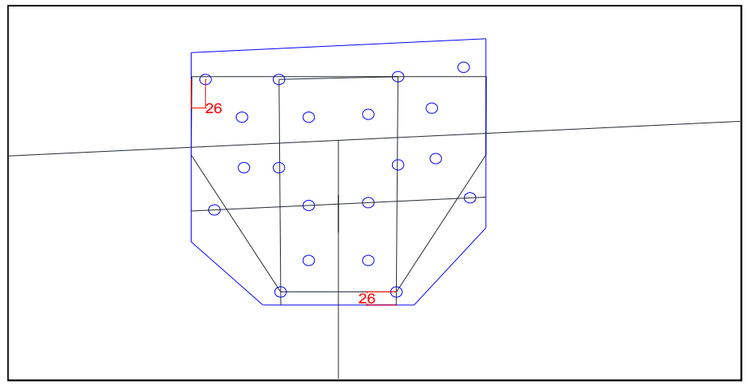
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	197	877
Compressive Resistance at Member C	217	963
Compressive Resistance at Member D	243	1078
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	412	1833
Governing Resistance at Member B	741	3294
Governing Resistance at Member C	597	2655
Governing Resistance at Member D	842	3743
Governing Resistance at Member E	412	1833

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
	SHEAR PLANE A'-A'	160	709	**0.000**	
	SHEAR PLANE B'-B'	461	2049	**0.000**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	348	1547	**0.000**	
	Member C	308	1369	**0.081**	<--- Governing
	Member D	390	1732	**0.000**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	197	877	**0.000**	
	Member C	217	963	**0.000**	
	Member D	243	1078	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	412	1833	**0.038**	
	Member B	741	3294	**0.000**	
	Member C	597	2655	**0.042**	
	Member D	842	3743	**0.000**	
	Member E	412	1833	**0.038**	
	Highest Demand/Capacity Ratio			**0.081**	

Span: Bascule Bridge - Leaf Span
Node: 3N

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.47 in	12 mm	6% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units			
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6	
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa			

MEMBER FORCES

Load Combination:		ULSB3 Max 0		Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
3N-A	P_{Max} =	50.0 kip	222 kN	3N-A	423	222	222	222	222
3N-A	P_{Min} =	22.9 kip	102 kN	3N-A	423	102	102	102	102
3N-B	P_{Max} =	0.0 kip	0 kN	3N-B	0	#N/A	#N/A	#N/A	#N/A
3N-B	P_{Min} =	0.0 kip	0 kN	3N-B	0	#N/A	#N/A	#N/A	#N/A
3N-C	P_{Max} =	-1.9 kip	-8 kN	3N-C	243	-11	-10	-8	-8
3N-C	P_{Min} =	-5.0 kip	-22 kN	3N-C	243	-22	-20	-17	-22
3N-D	P_{Max} =	0.0 kip	0 kN	3N-D	0	#N/A	#N/A	#N/A	#N/A
3N-D	P_{Min} =	0.0 kip	0 kN	3N-D	0	#N/A	#N/A	#N/A	#N/A
3N-E	P_{Max} =	54.3 kip	241 kN	3N-E	422	241	241	241	241
3N-E	P_{Min} =	17.7 kip	79 kN	3N-E	422	79	79	79	79

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 3N

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		0	deg	B
	φ_C =		93	deg	C
	φ_D =		0	deg	D
	$\cos(\varphi_B)$ =		1.000		
	$\cos(\varphi_C)$ =		-0.052		
	$\cos(\varphi_D)$ =		1.000		
	$V_{A'-A',max}$ =	0.3 kip	1	kN	*
	$V_{A'-A',min}$ =	0.1 kip	0	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	0.3 kip	1	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	0.0 kip	0	kN	

*using absolute maximum sums, conservative

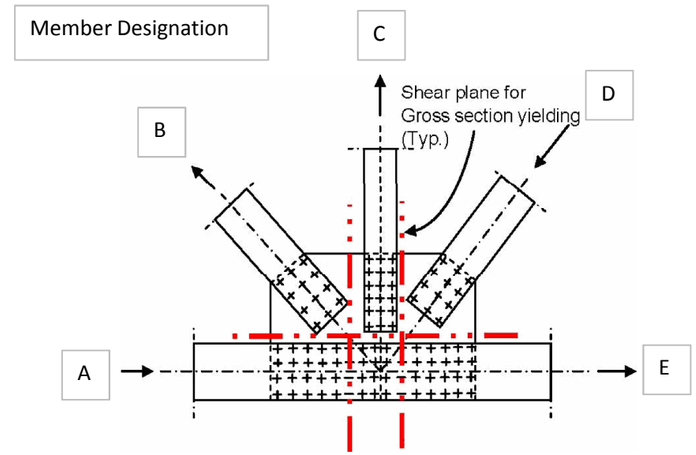


Figure 4 – Examples of gross section shear yielding planes

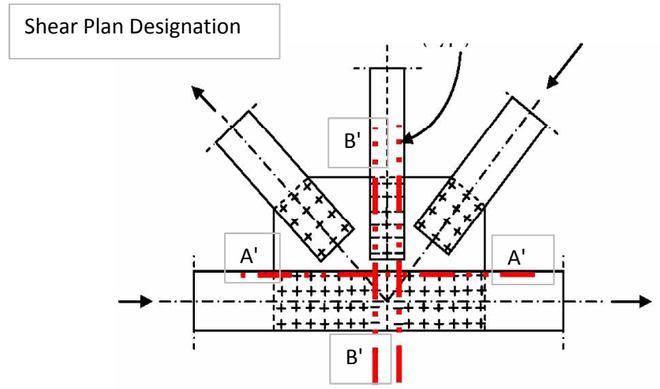


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	21.06	in	535	mm	
No of holes in shear plane	N =	4.00	ea	4	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			12840	mm^2	
Net Shear Area	A_n =			10862	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			1281	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =			1825	kN	
Shear Resistance (Governing)	V_R =			**1281**	**kN**	
Demand/Capacity	D/C =			**0.001**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	20.35	in	517	mm	
No of holes in shear plane	N =	6.00	ea	6	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 3N

Members A and E continuous through the gusset plate?			Yes		
Outside height of member A	H_A=	15 in	381	mm	
Thickness of the web of member A	w_A=	0.40 in	10	mm	
No of holes in member A/E in shear plane	N_A=	4 ea	4	ea	
Gross Shear Area	A_g =		20150	mm^2	
Net Shear Area	A_n =		15509	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =		$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =		2010	kN	
Shear Resistance (Net Section)	V_{Rn} =		$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =		2606	kN	
Shear Resistance (Governing)	V_R =		**2010**	**kN**	
Demand/Capacity	D/C =		**0.000**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E — N/A

Members A and E continuous through the gusset plate?			Yes		

General

Whitmore Width	W_w =	0.00 in	0	mm	
Shear Length 1	L_{V1} =	0.00 in	0	mm	
Shear Length 2	L_{V2} =	0.00 in	0	mm	
Tension Length	L_T =	0.00 in	0	mm	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	

Number of Rivet/bolt diameters Intsecting Plane

0	
0	
0	
0	Typ, 1 less than Whitemore Width

($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	
			0	kN
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	
For gusset plates, U=1.0, FHWA 3.1.2			0	kN

FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

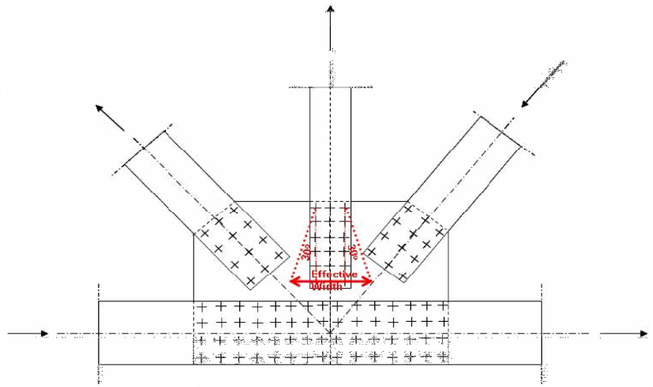


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

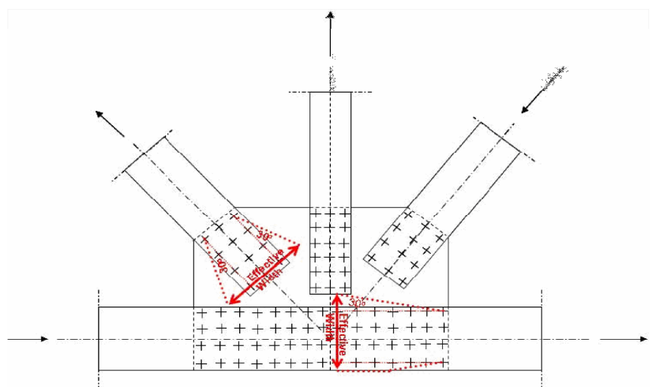


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 3N

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

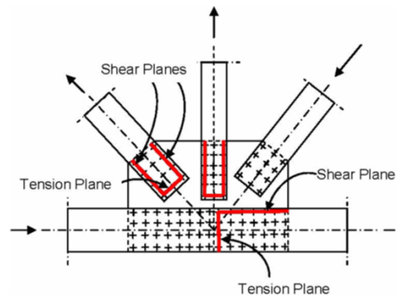


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0 "fixed-free condition"		
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		t/√(12) for rectangular plate		
		0.14 in	3.46 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

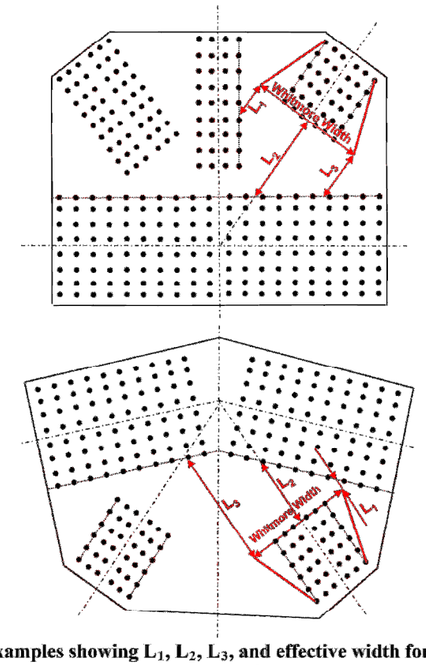


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Possible Scenario?			No		
Number of Rivets/Bolts	n =	16 ea	16 ea		
Longest Length of connection	L=	21.02 in	534 mm		
Edge distance	e =	1.02 in	26 mm		
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1 ea		
Number of Gusset Plates		2 ea	2 ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$		CSA S6 CL14.14.1.4.2
	B_{r1} =	316 kip	1405 kN		
	B_{r2} =	695 kip	3088 kN		
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$		CSA S6 CL14.14.1.4.2
		165 kip	733 kN		
Governing Resistance			1467 kN	for 2 plate(s)	

Span: Bascule Bridge - Leaf Span

Node: 3N

Demand/Capacity	D/C =		**0.000**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.					FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored?			Yes		
General					Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	21.81 in	554	mm	3
Shear Length 1	L_{V1} =	13.11 in	333	mm	4.5
Shear Length 2	L_{V2} =	11.38 in	289	mm	4.5
Tension Length	L_T =	14.33 in	364	mm	4
Number of Gusset Plates	m =	2 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$U*\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
			2653	kN	
Net Section Resistance	P_{RN} =		$U*\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2			3969	kN	

Block Shear

Gross Tension Area	A_{tg} =	4368	mm^2	
Gross Shear Area	A_{vg} =	7464	mm^2	
Net Tension Area	A_{tn} =	3379	mm^2	
Net Shear Area	A_{vn} =	5239	mm^2	
$A_{tn} \geq 0.58*A_{vn}$?		Yes		

	$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$			U=1.0
Block Shear Resistance	P_{Rbs} =	3725	kN	FHWA 3.1.3
Tension Resistance (Governing)		2653	kN	
Demand/Capacity	D/C =	**0.000**		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored?			Yes		
General					FHWA 3.3
Whitmore Width	W_w =	21.81 in	554	mm	

Span: Bascule Bridge - Leaf Span

Node: 3N

L1	L_1 =	0.79	in	20	mm	
L2 - along centreline of action	L_2 =	13.54	in	344	mm	
L3	L_3 =	4.88	in	124	mm	
Unsupported Column Length	L_u =	6.40	in	163	mm	
Effective Length Factor	K =	1.20		1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)		for rectangular plate
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.58		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2149	kN	
Demand/Capacity	D/C =			**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22	ea	22	ea	
Longest Length of connection	L=	18.94	in	481	mm	
Edge distance	e =	1.50	in	38	mm	
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")
Shear Planes per gusset plate	m =	1	ea	1	ea	
Number of Gusset Plates		2.00	ea	2	ea	
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0	CSA S6 CL14.14.1.4.2
	B_{r1} =	635	kip	2823	kN	
	B_{r2} =	955	kip	4246	kN	
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81	CSA S6 CL14.14.1.4.2
		411	kip	1825	kN	
Governing Resistance				3650	kN	for 2 plate(s)
Demand/Capacity	D/C =			**0.000**		

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	21.02	in	534	mm	2	
Shear Length 1	L_{V1} =	18.11	in	460	mm	5.5	
Shear Length 2	L_{V2} =	18.11	in	460	mm	5.5	
Tension Length	L_T =	8.27	in	210	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 3N

Number of Gusset Plates	m =	2.00 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			2557	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			3974	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		2520	mm^2	
Gross Shear Area	A_{vg} =		11040	mm^2	
Net Tension Area	A_{tn} =		2273	mm^2	
Net Shear Area	A_{vn} =		8321	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		4090	kN	FHWA 3.1.3
Tension Resistance (Governing)			2557	kN	
Demand/Capacity	D/C =		**0.000**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored?			N/A		
General					FHWA 3.3
Whitmore Width	W_w =	21.02 in	534	mm	
L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	0.00 in	0	mm	
L3	L_3 =	0.00 in	0	mm	
Unsupported Column Length	L_u =	0.00 in	0	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			2422	kN	

Span: Bascule Bridge - Leaf Span
Node: 3N

Demand/Capacity	D/C =			**0.009**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	12	ea	12	ea		
Longest Length of connection	L=	18.11	in	460	mm		
Edge distance	e =	1.02	in	26	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	237	kip	1054	kN		
	B_{r2} =	521	kip	2316	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		224	kip	995	kN		
Governing Resistance				1991	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.011**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	24.41	in	620	mm	5	
Shear Length 1	L_{V1} =	10.87	in	276	mm	3.5	
Shear Length 2	L_{V2} =	14.25	in	362	mm	4.5	
Tension Length	L_T =	15.55	in	395	mm	5	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		2969	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		4169	kN		

Block Shear

Gross Tension Area	A_{tg} =	4740	mm^2

Span: Bascule Bridge - Leaf Span

Node: 3N

Gross Shear Area	A_{vg} =			7656	mm^2	
Net Tension Area	A_{tn} =			3504	mm^2	
Net Shear Area	A_{vn} =			5678	mm^2	
$A_{tn} > 0.58*A_{vn}$?				Yes		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		U=1.0	
Block Shear Resistance	P_{Rbs} =			3847	kN	FHWA 3.1.3
Tension Resistance (Governing)				2969	kN	
Demand/Capacity	D/C =			**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?				Yes		
General						FHWA 3.3
Whitmore Width	W_w =	24.41	in	620	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	13.15	in	334	mm	
L3	L_3 =	4.21	in	107	mm	
Unsupported Column Length	L_u =	5.79	in	147	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.53		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2489	kN	
Demand/Capacity	D/C =			**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	25	ea	25	ea		
Longest Length of connection	L=	19.37	in	492	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$		U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	722	kip	3208	kN		
	B_{r2} =	1086	kip	4825	kN		

Span: Bascule Bridge - Leaf Span

Node: 3N

Shear Resistance of Rivets V_r = 467 kip $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 2074 kN CSA S6 CL14.14.1.4.2

Governing Resistance 4148 kN for 2 plates(s)

Demand/Capacity D/C = **0.000**

For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	288	1281
Shear Resistance (Net Section)	411	1825
Shear Resistance (Governing)	288	1281
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	452	2010
Shear Resistance (Net Section)	586	2606
Shear Resistance (Governing)	452	2010
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	597	2653
Net Section Resistance	893	3969
Block Shear Resistance	838	3725
Tension Resistance (Governing)	597	2653
At Member C:		
Gross Section Resistance	575	2557
Net Section Resistance	894	3974
Block Shear Resistance	920	4090
Tension Resistance (Governing)	575	2557
At Member D:		
Gross Section Resistance	668	2969
Net Section Resistance	938	4169
Block Shear Resistance	866	3847
Tension Resistance (Governing)	668	2969
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 3N

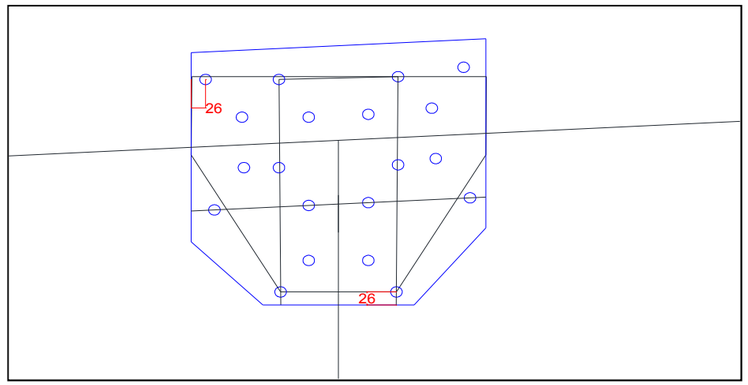
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	483	2149
Compressive Resistance at Member C	545	2422
Compressive Resistance at Member D	560	2489
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	330	1467
Governing Resistance at Member B	821	3650
Governing Resistance at Member C	448	1991
Governing Resistance at Member D	933	4148
Governing Resistance at Member E	330	1467

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
	SHEAR PLANE A'-A'	288	1281	**0.001**	
	SHEAR PLANE B'-B'	452	2010	**0.000**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	597	2653	**0.000**	
	Member C	575	2557	**0.000**	
	Member D	668	2969	**0.000**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	483	2149	**0.000**	
	Member C	545	2422	**0.009**	
	Member D	560	2489	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	330	1467	**0.000**	
	Member B	821	3650	**0.000**	
	Member C	448	1991	**0.011**	<--- Governing
	Member D	933	4148	**0.000**	
	Member E	330	1467	**0.000**	
	Highest Demand/Capacity Ratio			**0.011**	

Span: Bascule Bridge - Leaf Span
Node: 3S

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.47 in	12 mm	6% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units			
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6	
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa			

MEMBER FORCES

Load Combination:		ULSB3 Max 0		Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
3S-A	P_{Max} =	60.2 kip	268 kN	3S-A	492	268	267	267	268
3S-A	P_{Min} =	27.7 kip	123 kN	3S-A	492	123	123	123	123
3S-B	P_{Max} =	0.0 kip	0 kN	3S-B	0	#N/A	#N/A	#N/A	#N/A
3S-B	P_{Min} =	0.0 kip	0 kN	3S-B	0	#N/A	#N/A	#N/A	#N/A
3S-C	P_{Max} =	-1.9 kip	-8 kN	3S-C	572	-11	-10	-8	-8
3S-C	P_{Min} =	-5.0 kip	-22 kN	3S-C	572	-22	-20	-17	-22
3S-D	P_{Max} =	0.0 kip	0 kN	3S-D	0	#N/A	#N/A	#N/A	#N/A
3S-D	P_{Min} =	0.0 kip	0 kN	3S-D	0	#N/A	#N/A	#N/A	#N/A
3S-E	P_{Max} =	64.3 kip	286 kN	3S-E	491	286	285	285	286
3S-E	P_{Min} =	22.3 kip	99 kN	3S-E	491	100	99	99	99

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 3S

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		0	deg	B
	φ_C =		93	deg	C
	φ_D =		0	deg	D
	$\cos(\varphi_B)$ =		1.000		
	$\cos(\varphi_C)$ =		-0.052		
	$\cos(\varphi_D)$ =		1.000		
	$V_{A'-A',max}$ =	0.3 kip	1	kN	*
	$V_{A'-A',min}$ =	0.1 kip	0	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	0.3 kip	1	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	0.0 kip	0	kN	

*using absolute maximum sums, conservative

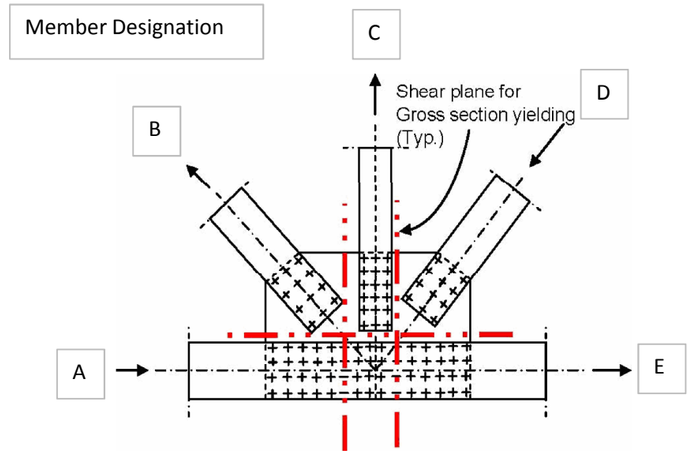


Figure 4 – Examples of gross section shear yielding planes

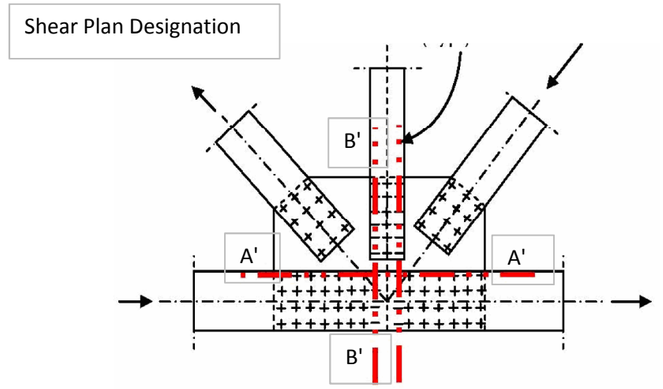


Figure 5 – Examples of net section shear fracture planes

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	21.06	in	535	mm	
No of holes in shear plane	N =	4.00	ea	4	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			12840	mm^2	
Net Shear Area	A_n =			10862	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			1281	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =			1825	kN	
Shear Resistance (Governing)	V_R =			**1281**	**kN**	
Demand/Capacity	D/C =			**0.001**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

FHWA, Figures 4 and 5

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	20.35	in	517	mm	
No of holes in shear plane	N =	6.00	ea	6	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 3S

Members A and E continuous through the gusset plate?				Yes	
Outside height of member A	H_A=	15	in	381 mm	
Thickness of the web of member A	w_A=	0.40	in	10 mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4 ea	
Gross Shear Area	A_g =			20150 mm^2	
Net Shear Area	A_n =			15509 mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$	Cl 10.18.5.2
	V_{Rg} =			2010 kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$ *	Cl 10.18.5.2
	V_{Rn} =			2606 kN	
Shear Resistance (Governing)	V_R =			**2010 kN**	
Demand/Capacity	D/C =			**0.000**	

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E — N/A

Members A and E continuous through the gusset plate?				Yes	

General

Whitmore Width	W_w =	0.00	in	0 mm	
Shear Length 1	L_{V1} =	0.00	in	0 mm	
Shear Length 2	L_{V2} =	0.00	in	0 mm	
Tension Length	L_T =	0.00	in	0 mm	
Number of Gusset Plates	m =	2.00	ea	2 ea	
Diameter of holes in plane	d_b =	0.81	in	21 mm	

Number of Rivet/bolt diameters Intsecting Plane

0	
0	
0	
0	Typ, 1 less than Whitemore Width

($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	
		0 kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		0 kN	

Block Shear

Gross Tension Area	A_{tg} =	0 mm^2
Gross Shear Area	A_{vg} =	0 mm^2
Net Tension Area	A_{tn} =	0 mm^2
Net Shear Area	A_{vn} =	0 mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes

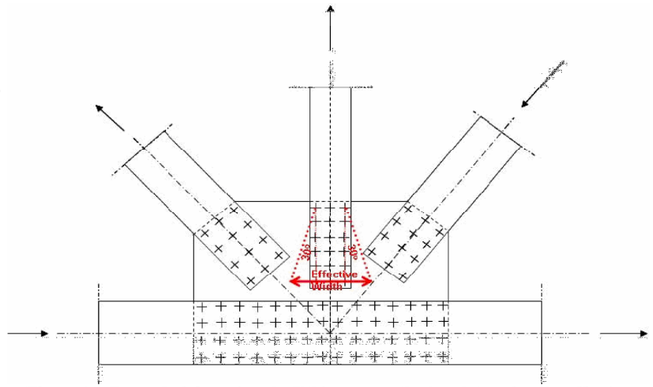


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

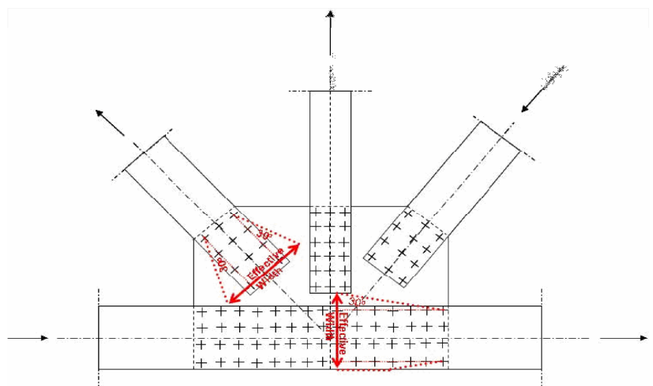


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 3S

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

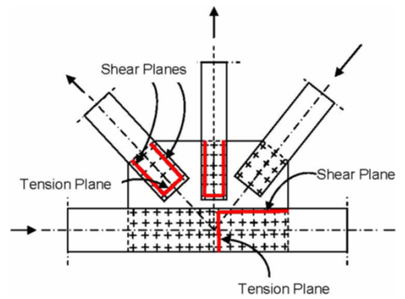


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0 "fixed-free condition"		
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		t/√(12) for rectangular plate		
		0.14 in	3.46 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

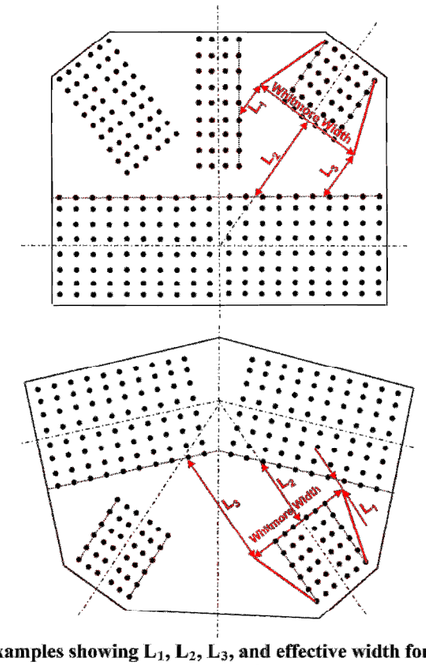


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Possible Scenario?			No		
Number of Rivets/Bolts	n =	16 ea	16 ea		
Longest Length of connection	L=	21.02 in	534 mm		
Edge distance	e =	1.02 in	26 mm		
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1 ea		
Number of Gusset Plates		2 ea	2 ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$		CSA S6 CL14.14.1.4.2
	B_{r1} =	316 kip	1405 kN		
	B_{r2} =	695 kip	3088 kN		
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$		CSA S6 CL14.14.1.4.2
		165 kip	733 kN		
Governing Resistance			1467 kN	for 2 plate(s)	

Span: Bascule Bridge - Leaf Span

Node: 3S

Demand/Capacity	D/C =	**0.000**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? Yes

General

					Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	21.81 in	554	mm	3
Shear Length 1	L_{V1} =	13.11 in	333	mm	4.5
Shear Length 2	L_{V2} =	11.38 in	289	mm	4.5
Tension Length	L_T =	14.33 in	364	mm	4
Number of Gusset Plates	m =	2 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$U*\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
			2653	kN	
Net Section Resistance	P_{RN} =		$U*\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2			3969	kN	

Block Shear

Gross Tension Area	A_{tg} =	4368	mm^2	
Gross Shear Area	A_{vg} =	7464	mm^2	
Net Tension Area	A_{tn} =	3379	mm^2	
Net Shear Area	A_{vn} =	5239	mm^2	
$A_{tn} \geq 0.58*A_{vn}$?		Yes		

	$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$			U=1.0
Block Shear Resistance	P_{Rbs} =	3725	kN	FHWA 3.1.3
Tension Resistance (Governing)		2653	kN	
Demand/Capacity	D/C =	**0.000**		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? Yes

General — FHWA 3.3

Whitmore Width	W_w =	21.81 in	554	mm

Span: Bascule Bridge - Leaf Span

Node: 3S

L1	L_1 =	0.79	in	20	mm	
L2 - along centreline of action	L_2 =	13.54	in	344	mm	
L3	L_3 =	4.88	in	124	mm	
Unsupported Column Length	L_u =	6.40	in	163	mm	
Effective Length Factor	K =	1.20		1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)		for rectangular plate
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.58		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2149	kN	
Demand/Capacity	D/C =			**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22	ea	22	ea	
Longest Length of connection	L=	18.94	in	481	mm	
Edge distance	e =	1.50	in	38	mm	
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")
Shear Planes per gusset plate	m =	1	ea	1	ea	
Number of Gusset Plates		2.00	ea	2	ea	
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0	CSA S6 CL14.14.1.4.2
	B_{r1} =	635	kip	2823	kN	
	B_{r2} =	955	kip	4246	kN	
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81	CSA S6 CL14.14.1.4.2
		411	kip	1825	kN	
Governing Resistance				3650	kN	for 2 plate(s)
Demand/Capacity	D/C =			**0.000**		

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	21.02	in	534	mm	2	
Shear Length 1	L_{V1} =	18.11	in	460	mm	5.5	
Shear Length 2	L_{V2} =	18.11	in	460	mm	5.5	
Tension Length	L_T =	8.27	in	210	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 3S

Number of Gusset Plates	m =	2.00 ea	2 ea		
Diameter of holes in plane	d_b =	0.81 in	21 mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			2557	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			3974	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		2520	mm^2	
Gross Shear Area	A_{vg} =		11040	mm^2	
Net Tension Area	A_{tn} =		2273	mm^2	
Net Shear Area	A_{vn} =		8321	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		4090	kN	FHWA 3.1.3
Tension Resistance (Governing)			2557	kN	
Demand/Capacity	D/C =		**0.000**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	21.02 in	534	mm	
L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	0.00 in	0	mm	
L3	L_3 =	0.00 in	0	mm	
Unsupported Column Length	L_u =	0.00 in	0	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			2422	kN	

Span: Bascule Bridge - Leaf Span
Node: 3S

Demand/Capacity	D/C =			**0.009**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	12	ea	12	ea		
Longest Length of connection	L=	18.11	in	460	mm		
Edge distance	e =	1.02	in	26	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	237	kip	1054	kN		
	B_{r2} =	521	kip	2316	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		224	kip	995	kN		
Governing Resistance				1991	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.011**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	24.41	in	620	mm	5	
Shear Length 1	L_{V1} =	10.87	in	276	mm	3.5	
Shear Length 2	L_{V2} =	14.25	in	362	mm	4.5	
Tension Length	L_T =	15.55	in	395	mm	5	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
		2969	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		4169	kN	

Block Shear

Gross Tension Area	A_{tg} =	4740	mm^2

Span: Bascule Bridge - Leaf Span

Node: 3S

Gross Shear Area	A_{vg} =			7656	mm^2	
Net Tension Area	A_{tn} =			3504	mm^2	
Net Shear Area	A_{vn} =			5678	mm^2	
$A_{tn} > 0.58*A_{vn}$?				Yes		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		U=1.0	
Block Shear Resistance	P_{Rbs} =			3847	kN	FHWA 3.1.3
Tension Resistance (Governing)				2969	kN	
Demand/Capacity	D/C =			**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?				Yes		
General						FHWA 3.3
Whitmore Width	W_w =	24.41	in	620	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	13.15	in	334	mm	
L3	L_3 =	4.21	in	107	mm	
Unsupported Column Length	L_u =	5.79	in	147	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.53		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2489	kN	
Demand/Capacity	D/C =			**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	25	ea	25	ea		
Longest Length of connection	L=	19.37	in	492	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$		U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	722	kip	3208	kN		
	B_{r2} =	1086	kip	4825	kN		

Span: Bascule Bridge - Leaf Span
Node: 3S

Shear Resistance of Rivets V_r = $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 CSA S6 CL14.14.1.4.2

467 kip 2074 kN

Governing Resistance 4148 kN for 2 plate(s)

Demand/Capacity D/C = **0.000**

For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	288	1281
Shear Resistance (Net Section)	411	1825
Shear Resistance (Governing)	288	1281
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	452	2010
Shear Resistance (Net Section)	586	2606
Shear Resistance (Governing)	452	2010
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	597	2653
Net Section Resistance	893	3969
Block Shear Resistance	838	3725
Tension Resistance (Governing)	597	2653
At Member C:		
Gross Section Resistance	575	2557
Net Section Resistance	894	3974
Block Shear Resistance	920	4090
Tension Resistance (Governing)	575	2557
At Member D:		
Gross Section Resistance	668	2969
Net Section Resistance	938	4169
Block Shear Resistance	866	3847
Tension Resistance (Governing)	668	2969
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 3S

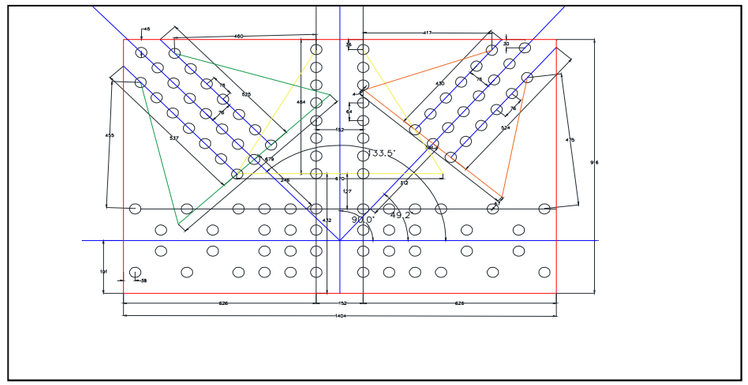
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	483	2149
Compressive Resistance at Member C	545	2422
Compressive Resistance at Member D	560	2489
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	330	1467
Governing Resistance at Member B	821	3650
Governing Resistance at Member C	448	1991
Governing Resistance at Member D	933	4148
Governing Resistance at Member E	330	1467

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
SHEAR PLANE A'-A'		288	1281	**0.001**	
SHEAR PLANE B'-B'		452	2010	**0.000**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	597	2653	**0.000**	
	Member C	575	2557	**0.000**	
	Member D	668	2969	**0.000**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	483	2149	**0.000**	
	Member C	545	2422	**0.009**	
	Member D	560	2489	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	330	1467	**0.000**	
	Member B	821	3650	**0.000**	
	Member C	448	1991	**0.011**	<--- Governing
	Member D	933	4148	**0.000**	
	Member E	330	1467	**0.000**	
Highest Demand/Capacity Ratio				**0.011**	

Span: Bascule Bridge - Leaf Span
Node: 4N

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.31 in	8 mm	37% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units		
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa		

MEMBER FORCES

Load Combination:		ULSB3 Max 0	
4N-A	P_{Max} =	7.2 kip	32 kN
4N-A	P_{Min} =	-14.0 kip	-62 kN
4N-B	P_{Max} =	-25.4 kip	-113 kN
4N-B	P_{Min} =	-50.2 kip	-223 kN
4N-C	P_{Max} =	-1.9 kip	-8 kN
4N-C	P_{Min} =	-5.0 kip	-22 kN
4N-D	P_{Max} =	86.8 kip	386 kN
4N-D	P_{Min} =	42.5 kip	189 kN
4N-E	P_{Max} =	-27.5 kip	-122 kN
4N-E	P_{Min} =	-110.2 kip	-490 kN

Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
4N-A	280	32	32	32	32
4N-A	280	-62	-62	-62	-62
4N-B	3	-117	-115	-113	-113
4N-B	3	-223	-219	-216	-223
4N-C	243	-11	-10	-8	-8
4N-C	243	-22	-20	-17	-22
4N-D	7	386	381	377	386
4N-D	7	193	191	189	189
4N-E	281	-122	-122	-122	-122
4N-E	281	-490	-490	-490	-490

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 4N

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		133.5	deg	B
	φ_C =		90	deg	C
	φ_D =		49.2	deg	D
	$\cos(\varphi_B)$ =		-0.688		
	$\cos(\varphi_C)$ =		0.000		
	$\cos(\varphi_D)$ =		0.653		
	$V_{A'-A',max}$ =	91.3 kip	406	kN	*
	$V_{A'-A',min}$ =	45.3 kip	201	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	91.3 kip	406	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	65.7 kip	292	kN	

*using absolute maximum sums, conservative

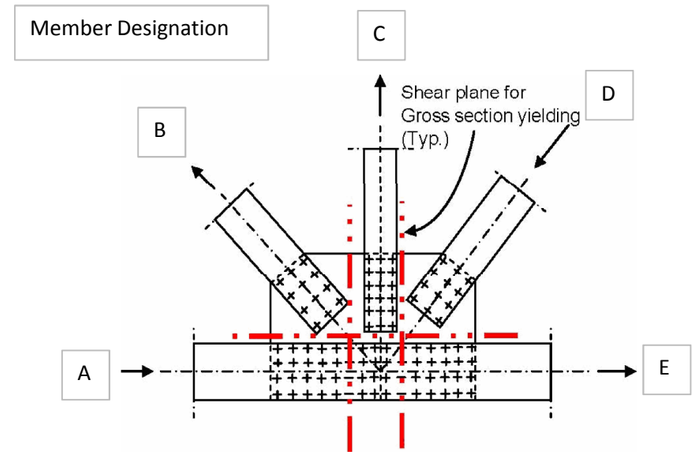


Figure 4 – Examples of gross section shear yielding planes

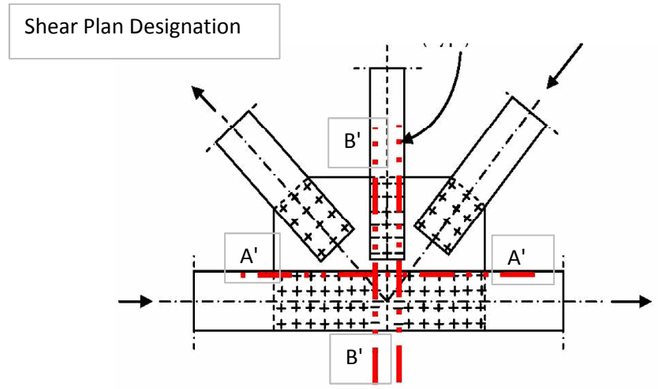


Figure 5 – Examples of net section shear fracture planes

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	55.28	in	1404	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			22464	mm^2	
Net Shear Area	A_n =			18509	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2241	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$ *		Cl 10.18.5.2
	V_{Rn} =			3109	kN	
Shear Resistance (Governing)	V_R =			**2241**	**kN**	
Demand/Capacity	D/C =			**0.181**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

FHWA, Figures 4 and 5

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	36.06	in	916	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 4N

Members A and E continuous through the gusset plate?				Yes		
Outside height of member A	H_A=	15	in	381	mm	
Thickness of the web of member A	w_A=	0.40	in	10	mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4	ea	
Gross Shear Area	A_g =			22398	mm^2	
Net Shear Area	A_n =			16768	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2234	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =			2817	kN	
Shear Resistance (Governing)	V_R =			**2234**	**kN**	
Demand/Capacity	D/C =			**0.131**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E

N/A

Members A and E continuous through the gusset plate? Yes

General

Whitmore Width	W_w =	0.00	in	0	mm	
Shear Length 1	L_{V1} =	0.00	in	0	mm	
Shear Length 2	L_{V2} =	0.00	in	0	mm	
Tension Length	L_T =	0.00	in	0	mm	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	

Number of Rivet/bolt diameters Intsecting Plane

0
0
0
0 Typ, 1 less than Whitemore Width

($^{13}/_{16}$")

Axile Tensile Resistance

CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	
		0	kN
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	
For gusset plates, U=1.0, FHWA 3.1.2		0	kN

FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

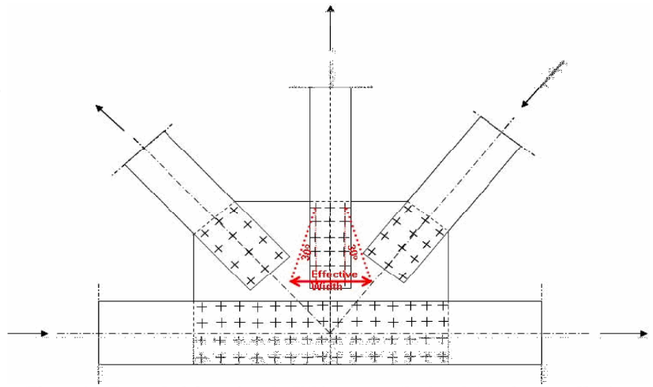


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

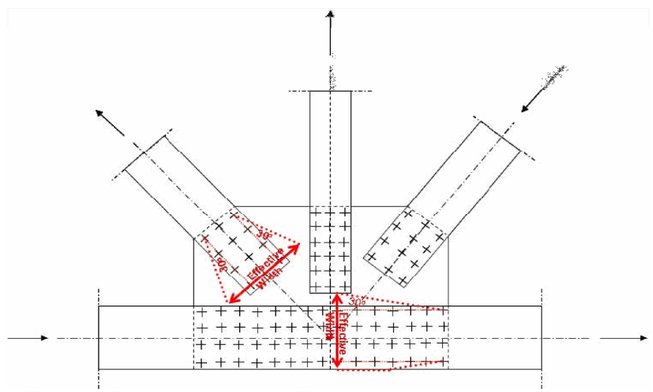


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 4N

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

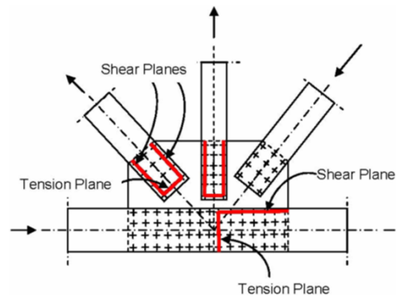


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0 "fixed-free condition"		
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		t/√(12) for rectangular plate		
		0.09 in	2.31 mm		
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

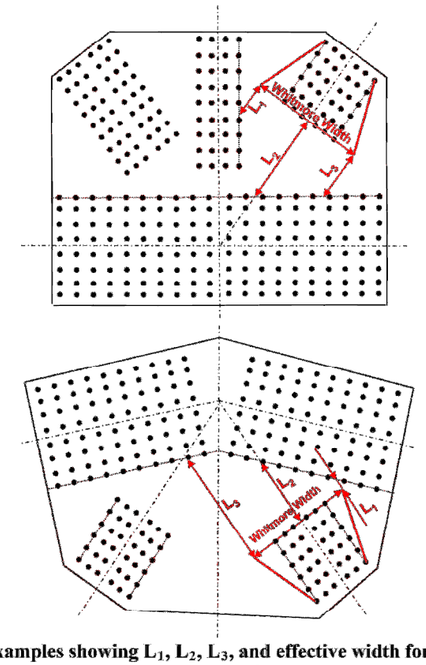


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	44 ea	44 ea		
Longest Length of connection	L=	55.28 in	1404 mm		
Edge distance	e =	1.50 in	38 mm		
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1 ea		
Number of Gusset Plates		2 ea	2 ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$		CSA S6 CL14.14.1.4.2
	B_{r1} =	847 kip	3764 kN		
	B_{r2} =	1274 kip	5661 kN		
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$		CSA S6 CL14.14.1.4.2
		454 kip	2017 kN		
Governing Resistance			3227 kN	for 2 plate(s)	

Span: Bascule Bridge - Leaf Span

Node: 4N

Demand/Capacity	D/C =	**0.152**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? Yes

General

					Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	26.77 in	680	mm	3
Shear Length 1	L_{V1} =	20.67 in	525	mm	6.5
Shear Length 2	L_{V2} =	21.14 in	537	mm	6.5
Tension Length	L_T =	5.98 in	152	mm	2
Number of Gusset Plates	m =	2 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$	2171	kN	U=1.0 FHWA 3.1.2
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$	3323	kN	U=1.0 FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2					

Block Shear

Gross Tension Area	A_{tg} =	1216	mm^2
Gross Shear Area	A_{vg} =	8496	mm^2
Net Tension Area	A_{tn} =	886	mm^2
Net Shear Area	A_{vn} =	6354	mm^2
$A_{tn} \geq 0.58*A_{vn}$?		No	

		$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$			U=1.0
Block Shear Resistance	P_{Rbs} =		2885	kN	FHWA 3.1.3
Tension Resistance (Governing)			2171	kN	
Demand/Capacity	D/C =		**0.000**		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? Yes

General — FHWA 3.3

Whitmore Width	W_w =	26.77 in	680	mm

Span: Bascule Bridge - Leaf Span

Node: 4N

L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	9.69	in	246	mm	
L3	L_3 =	0.00	in	0	mm	
Unsupported Column Length	L_u =	3.23	in	82	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.09	in	2.31	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.44		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				1902	kN	
Demand/Capacity	D/C =			**0.117**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22	ea	22	ea		
Longest Length of connection	L=	21.14	in	537	mm		
Edge distance	e =	1.77	in	45	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	501	kip	2229	kN		
	B_{r2} =	637	kip	2830	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		411	kip	1825	kN		
Governing Resistance				3650	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.061**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	26.38	in	670	mm	2	
Shear Length 1	L_{V1} =	19.06	in	484	mm	7.5	
Shear Length 2	L_{V2} =	19.06	in	484	mm	7.5	
Tension Length	L_T =	5.98	in	152	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 4N

Number of Gusset Plates	m =	2.00	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =			$\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
				2139	kN	
Net Section Resistance	P_{RN} =			$\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2				3380	kN	

Block Shear

Gross Tension Area	A_{tg} =			1216	mm^2	
Gross Shear Area	A_{vg} =			7744	mm^2	
Net Tension Area	A_{tn} =			1051	mm^2	
Net Shear Area	A_{vn} =			5272	mm^2	
$A_{tn} > 0.58*A_{vn}$?				No		
				$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =			2463	kN	FHWA 3.1.3
Tension Resistance (Governing)				2139	kN	
Demand/Capacity	D/C =			**0.000**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	26.38	in	670	mm	
L1	L_1 =	5.00	in	127	mm	
L2 - along centreline of action	L_2 =	5.00	in	127	mm	
L3	L_3 =	5.00	in	127	mm	
Unsupported Column Length	L_u =	5.00	in	127	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			$t/\sqrt{(12)}$	for rectangular plate	
		0.09	in	2.31	mm	
	λ =			$(K*L_u/r)*\mathrm{sqrt}[F_y/(\pi^2*E_s)]$		
				0.68		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				1614	kN	

Span: Bascule Bridge - Leaf Span
Node: 4N

Demand/Capacity	D/C =			**0.014**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea		
Longest Length of connection	L=	19.06	in	484	mm		
Edge distance	e =	1.42	in	36	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	292	kip	1297	kN		
	B_{r2} =	463	kip	2058	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		299	kip	1327	kN		
Governing Resistance				2593	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.009**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	23.23	in	590	mm	3	
Shear Length 1	L_{V1} =	20.63	in	524	mm	5.5	
Shear Length 2	L_{V2} =	16.93	in	430	mm	5.5	
Tension Length	L_T =	5.98	in	152	mm	2	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		1883	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		2840	kN		

Block Shear

Gross Tension Area	A_{tg} =	1216	mm^2

Span: Bascule Bridge - Leaf Span

Node: 4N

Gross Shear Area	A_{vg} =		7632	mm^2	
Net Tension Area	A_{tn} =		886	mm^2	
Net Shear Area	A_{vn} =		5819	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0		
Block Shear Resistance	P_{Rbs} =		2677	kN	FHWA 3.1.3
Tension Resistance (Governing)			1883	kN	
Demand/Capacity	D/C =		**0.205**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?			Yes		
General					FHWA 3.3
Whitmore Width	W_w =	23.23 in	590	mm	
L1	L_1 =	0.16 in	4	mm	
L2 - along centreline of action	L_2 =	12.28 in	312	mm	
L3	L_3 =	2.24 in	57	mm	
Unsupported Column Length	L_u =	4.90 in	124	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.09 in	2.31	mm	
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.67		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			1437	kN	
Demand/Capacity	D/C =		**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	19 ea	19	ea		
Longest Length of connection	L=	20.63 in	524	mm		
Edge distance	e =	1.18 in	30	mm		
Diameter of Rivet	d =	0.75 in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1	ea		
Number of Gusset Plates		2.00 ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	289 kip	1283	kN		
	B_{r2} =	550 kip	2444	kN		

Span: Bascule Bridge - Leaf Span
Node: 4N

Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$ U=1.81	CSA S6 CL14.14.1.4.2
		355 kip	1576 kN	
Governing Resistance			2566 kN for 2 plate(s)	
Demand/Capacity	D/C =		**0.150**	
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	504	2241
Shear Resistance (Net Section)	700	3109
Shear Resistance (Governing)	504	2241
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	503	2234
Shear Resistance (Net Section)	634	2817
Shear Resistance (Governing)	503	2234
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	488	2171
Net Section Resistance	748	3323
Block Shear Resistance	649	2885
Tension Resistance (Governing)	488	2171
At Member C:		
Gross Section Resistance	481	2139
Net Section Resistance	761	3380
Block Shear Resistance	554	2463
Tension Resistance (Governing)	481	2139
At Member D:		
Gross Section Resistance	424	1883
Net Section Resistance	639	2840
Block Shear Resistance	602	2677
Tension Resistance (Governing)	424	1883
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 4N

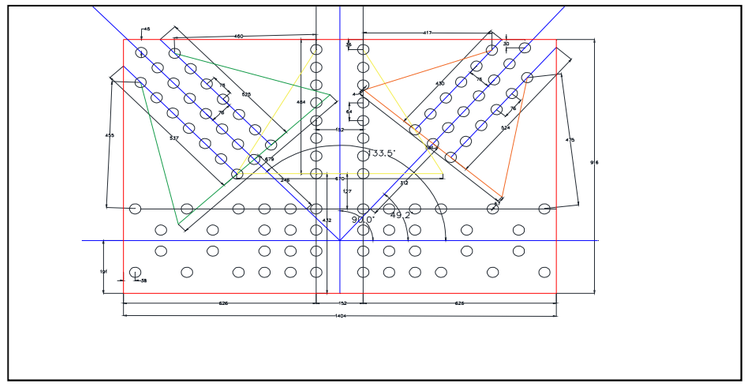
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	428	1902
Compressive Resistance at Member C	363	1614
Compressive Resistance at Member D	323	1437
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	726	3227
Governing Resistance at Member B	821	3650
Governing Resistance at Member C	584	2593
Governing Resistance at Member D	577	2566
Governing Resistance at Member E	726	3227

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
	SHEAR PLANE A'-A'	504	2241	**0.181**	
	SHEAR PLANE B'-B'	503	2234	**0.131**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	488	2171	**0.000**	
	Member C	481	2139	**0.000**	
	Member D	424	1883	**0.205**	<--- Governing
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	428	1902	**0.117**	
	Member C	363	1614	**0.014**	
	Member D	323	1437	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	726	3227	**0.152**	
	Member B	821	3650	**0.061**	
	Member C	584	2593	**0.009**	
	Member D	577	2566	**0.150**	
	Member E	726	3227	**0.152**	
	Highest Demand/Capacity Ratio			**0.205**	

Span: Bascule Bridge - Leaf Span
Node: 4S

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units		S.I. Units			
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50	in	12.7	mm		
Limiting Thickness of Gusset Plate	t =	0.31	in	8	mm	37% Corrosion	
Structural Steel - Tension	φ_s =			0.95			
	φ_u =			0.8			
Structural Steel - Compression	φ_s =			0.9			
Resistance Factor for Riveted Connections	φ_{mc} =			0.67		CSA S6 CL 14.14.1.4.2	
Resistance Factor for Rivet	φr =			0.67		CSA S6 CL 14.14.1.4.2	

MATERIAL PROPERTIES

		U.S. Units		S.I. Units			
Yield Strength of Steel:	F_y =	30	ksi	210	MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61	ksi	420	MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46	ksi	320	MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000	ksi	200000	MPa		

MEMBER FORCES

Load Combination:		ULSB3 Max 0				Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
4S-A	P_{Max} =	6.5	kip	29	kN	4S-A	560	29	29	29	29
4S-A	P_{Min} =	-15.6	kip	-69	kN	4S-A	560	-69	-69	-69	-69
4S-B	P_{Max} =	-30.7	kip	-136	kN	4S-B	179	-140	-138	-136	-136
4S-B	P_{Min} =	-61.5	kip	-273	kN	4S-B	179	-273	-269	-266	-273
4S-C	P_{Max} =	-1.9	kip	-8	kN	4S-C	572	-11	-10	-8	-8
4S-C	P_{Min} =	-5.0	kip	-22	kN	4S-C	572	-22	-20	-17	-22
4S-D	P_{Max} =	104.7	kip	465	kN	4S-D	183	465	461	457	465
4S-D	P_{Min} =	50.8	kip	226	kN	4S-D	183	230	228	226	226
4S-E	P_{Max} =	-36.1	kip	-160	kN	4S-E	561	-160	-160	-160	-160
4S-E	P_{Min} =	-128.7	kip	-572	kN	4S-E	561	-572	-572	-572	-572

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 4S

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		133.5	deg	B
	φ_C =		90	deg	C
	φ_D =		49.2	deg	D
	$\cos(\varphi_B)$ =		-0.688		
	$\cos(\varphi_C)$ =		0.000		
	$\cos(\varphi_D)$ =		0.653		
	$V_{A'-A',max}$ =	110.7 kip	492	kN	*
	$V_{A'-A',min}$ =	54.3 kip	241	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	110.7 kip	492	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	79.3 kip	352	kN

*using absolute maximum sums, conservative

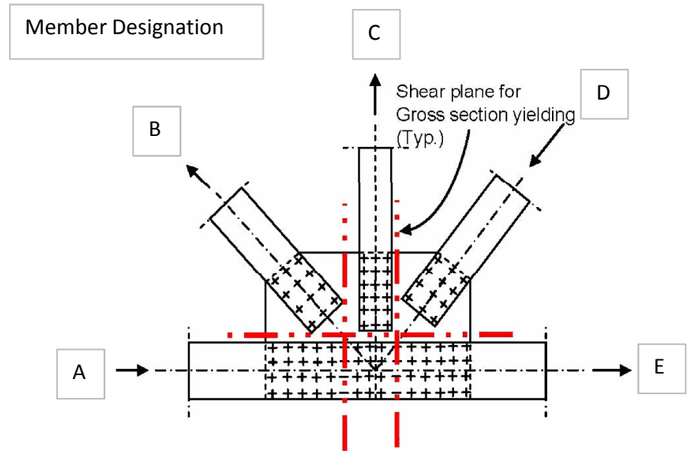


Figure 4 – Examples of gross section shear yielding planes

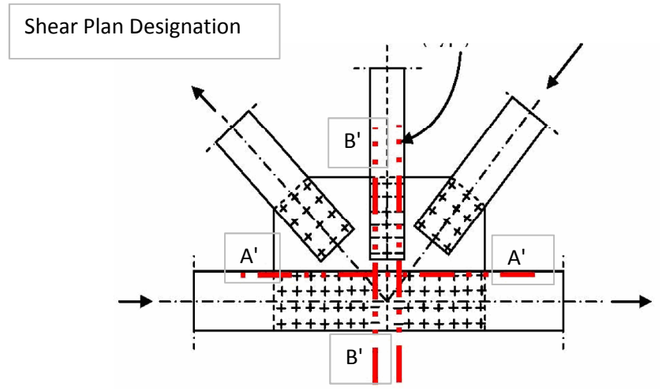


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	55.12	in	1400	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			22400	mm^2	
Net Shear Area	A_n =			18445	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2234	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$ *		Cl 10.18.5.2
	V_{Rn} =			3099	kN	
Shear Resistance (Governing)	V_R =			**2234**	**kN**	
Demand/Capacity	D/C =			**0.220**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	36.02	in	915	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 4S

Members A and E continuous through the gusset plate?				Yes		
Outside height of member A	H_A=	15	in	381	mm	
Thickness of the web of member A	w_A=	0.40	in	10	mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4	ea	
Gross Shear Area	A_g =			22382	mm^2	
Net Shear Area	A_n =			16752	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2233	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =			2814	kN	
Shear Resistance (Governing)	V_R =			**2233**	**kN**	
Demand/Capacity	D/C =			**0.158**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E

N/A

Members A and E continuous through the gusset plate? Yes

General

Whitmore Width	W_w =	0.00	in	0	mm	
Shear Length 1	L_{V1} =	0.00	in	0	mm	
Shear Length 2	L_{V2} =	0.00	in	0	mm	
Tension Length	L_T =	0.00	in	0	mm	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Number of Rivet/bolt diameters Intsecting Plane

0	
0	
0	
0	Typ, 1 less than Whitemore Width

Axile Tensile Resistance

CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	
		0	kN
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	
For gusset plates, U=1.0, FHWA 3.1.2		0	kN

FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =	0 mm^2
Gross Shear Area	A_{vg} =	0 mm^2
Net Tension Area	A_{tn} =	0 mm^2
Net Shear Area	A_{vn} =	0 mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes

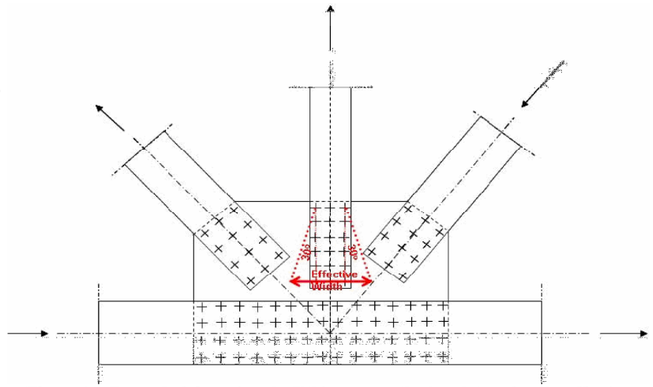


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

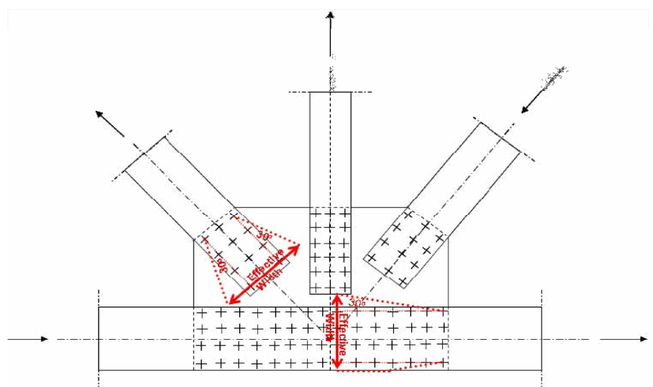


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 4S

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

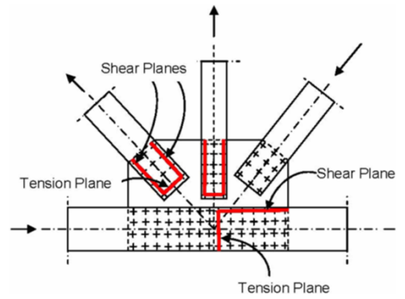


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.09 in	2.31 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

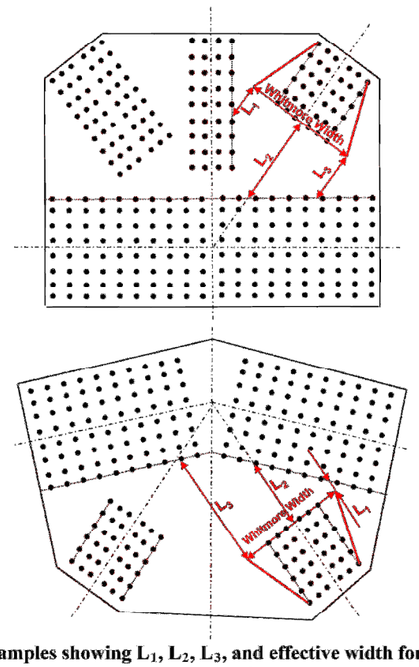


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	44 ea	44 ea			
Longest Length of connection	L=	53.78 in	1366 mm			
Edge distance	e =	1.50 in	38 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$		CSA S6 CL14.14.1.4.2	
	B_{r1} =	847 kip	3764 kN			
	B_{r2} =	1274 kip	5661 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$		CSA S6 CL14.14.1.4.2	
		454 kip	2017 kN			
Governing Resistance			3227 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span

Node: 4S

Demand/Capacity	D/C =	**0.177**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	26.77	in	680	mm	3
Shear Length 1	L_{V1} =	20.67	in	525	mm	6.5
Shear Length 2	L_{V2} =	21.06	in	535	mm	6.5
Tension Length	L_T =	5.98	in	152	mm	2
Number of Gusset Plates	m =	2	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$ U=1.0	2171 kN	FHWA 3.1.2
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$ U=1.0	3323 kN	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2				

Block Shear

Gross Tension Area	A_{tg} =	1216	mm^2
Gross Shear Area	A_{vg} =	8480	mm^2
Net Tension Area	A_{tn} =	886	mm^2
Net Shear Area	A_{vn} =	6338	mm^2
$A_{tn} \geq 0.58*A_{vn}$?		No	

		$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$ U=1.0		
Block Shear Resistance	P_{Rbs} =	2879	kN	FHWA 3.1.3
Tension Resistance (Governing)		2171	kN	
Demand/Capacity	D/C =	**0.000**		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? Yes

General — FHWA 3.3

Whitmore Width	W_w =	26.77	in	680	mm

Span: Bascule Bridge - Leaf Span

Node: 4S

L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	9.84	in	250	mm	
L3	L_3 =	0.00	in	0	mm	
Unsupported Column Length	L_u =	3.28	in	83	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.09	in	2.31	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.45		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				1895	kN	
Demand/Capacity	D/C =			**0.144**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22	ea	22	ea	
Longest Length of connection	L=	20.98	in	533	mm	
Edge distance	e =	1.50	in	38	mm	
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")
Shear Planes per gusset plate	m =	1	ea	1	ea	
Number of Gusset Plates		2.00	ea	2	ea	
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0	CSA S6 CL14.14.1.4.2
	B_{r1} =	423	kip	1882	kN	
	B_{r2} =	637	kip	2830	kN	
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81	CSA S6 CL14.14.1.4.2
		411	kip	1825	kN	
Governing Resistance				3650	kN	for 2 plate(s)
Demand/Capacity	D/C =			**0.075**		

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	26.38	in	670	mm	2	
Shear Length 1	L_{V1} =	19.06	in	484	mm	7.5	
Shear Length 2	L_{V2} =	19.06	in	484	mm	7.5	
Tension Length	L_T =	5.98	in	152	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 4S

Number of Gusset Plates	m =	2.00 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			2139	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			3380	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		1216	mm^2	
Gross Shear Area	A_{vg} =		7744	mm^2	
Net Tension Area	A_{tn} =		1051	mm^2	
Net Shear Area	A_{vn} =		5272	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		2463	kN	FHWA 3.1.3
Tension Resistance (Governing)			2139	kN	
Demand/Capacity	D/C =		**0.000**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored?			N/A		
General					FHWA 3.3
Whitmore Width	W_w =	26.38 in	670	mm	
L1	L_1 =	5.00 in	127	mm	
L2 - along centreline of action	L_2 =	5.00 in	127	mm	
L3	L_3 =	5.00 in	127	mm	
Unsupported Column Length	L_u =	5.00 in	127	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.09 in	2.31	mm	
	λ =		$(K*L_u/r)*\mathrm{sqrt}[F_y/(\pi^2*E_s)]$		
			0.68		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			1614	kN	

Span: Bascule Bridge - Leaf Span
Node: 4S

Demand/Capacity	D/C =			**0.014**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea		
Longest Length of connection	L=	19.06	in	484	mm		
Edge distance	e =	1.42	in	36	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	292	kip	1297	kN		
	B_{r2} =	463	kip	2058	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		299	kip	1327	kN		
Governing Resistance				2593	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.009**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	23.23	in	590	mm	3	
Shear Length 1	L_{V1} =	20.63	in	524	mm	5.5	
Shear Length 2	L_{V2} =	16.93	in	430	mm	5.5	
Tension Length	L_T =	5.98	in	152	mm	2	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		1883	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		2840	kN		

Block Shear

Gross Tension Area	A_{tg} =	1216	mm^2

Span: Bascule Bridge - Leaf Span

Node: 4S

Gross Shear Area	A_{vg} =			7632	mm^2	
Net Tension Area	A_{tn} =			886	mm^2	
Net Shear Area	A_{vn} =			5819	mm^2	
$A_{tn} > 0.58*A_{vn}$?				No		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		U=1.0		
Block Shear Resistance	P_{Rbs} =			2677	kN	FHWA 3.1.3
Tension Resistance (Governing)				1883	kN	
Demand/Capacity	D/C =			**0.247**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?				Yes		
General						FHWA 3.3
Whitmore Width	W_w =	23.23	in	590	mm	
L1	L_1 =	0.16	in	4	mm	
L2 - along centreline of action	L_2 =	12.28	in	312	mm	
L3	L_3 =	2.24	in	57	mm	
Unsupported Column Length	L_u =	4.90	in	124	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.09	in	2.31	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.67		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				1437	kN	
Demand/Capacity	D/C =			**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	19	ea	19	ea		
Longest Length of connection	L=	20.63	in	524	mm		
Edge distance	e =	1.18	in	30	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0			CSA S6 CL14.14.1.4.2
	B_{r1} =	289	kip	1283	kN		
	B_{r2} =	550	kip	2444	kN		

Span: Bascule Bridge - Leaf Span
Node: 4S

Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$ U=1.81	CSA S6 CL14.14.1.4.2
		355 kip	1576 kN	
Governing Resistance			2566 kN for 2 plate(s)	
Demand/Capacity	D/C =		**0.181**	
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	503	2234
Shear Resistance (Net Section)	697	3099
Shear Resistance (Governing)	503	2234
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	502	2233
Shear Resistance (Net Section)	633	2814
Shear Resistance (Governing)	502	2233
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	488	2171
Net Section Resistance	748	3323
Block Shear Resistance	648	2879
Tension Resistance (Governing)	488	2171
At Member C:		
Gross Section Resistance	481	2139
Net Section Resistance	761	3380
Block Shear Resistance	554	2463
Tension Resistance (Governing)	481	2139
At Member D:		
Gross Section Resistance	424	1883
Net Section Resistance	639	2840
Block Shear Resistance	602	2677
Tension Resistance (Governing)	424	1883
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 4S

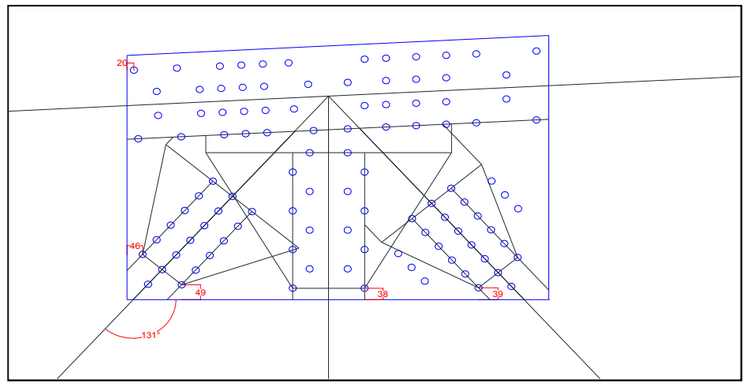
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	426	1895
Compressive Resistance at Member C	363	1614
Compressive Resistance at Member D	323	1437
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	726	3227
Governing Resistance at Member B	821	3650
Governing Resistance at Member C	584	2593
Governing Resistance at Member D	577	2566
Governing Resistance at Member E	726	3227

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
SHEAR PLANE A'-A'		503	2234	**0.220**	
SHEAR PLANE B'-B'		502	2233	**0.158**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	488	2171	**0.000**	
	Member C	481	2139	**0.000**	
	Member D	424	1883	**0.247**	<--- Governing
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	426	1895	**0.144**	
	Member C	363	1614	**0.014**	
	Member D	323	1437	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	726	3227	**0.177**	
	Member B	821	3650	**0.075**	
	Member C	584	2593	**0.009**	
	Member D	577	2566	**0.181**	
	Member E	726	3227	**0.177**	
Highest Demand/Capacity Ratio				**0.247**	

Span: Bascule Bridge - Leaf Span
Node: 5N

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.47 in	12 mm	6% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units			
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6	
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa			

MEMBER FORCES

Load Combination:		ULSB3 Max 0		Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
5N-A	P_{Max} =	54.3 kip	241 kN	5N-A	422	241	241	241	241
5N-A	P_{Min} =	17.7 kip	79 kN	5N-A	422	79	79	79	79
5N-B	P_{Max} =	86.8 kip	386 kN	5N-B	7	386	381	377	386
5N-B	P_{Min} =	42.5 kip	189 kN	5N-B	7	193	191	189	189
5N-C	P_{Max} =	24.2 kip	107 kN	5N-C	321	106	107	107	107
5N-C	P_{Min} =	11.4 kip	51 kN	5N-C	321	51	51	52	51
5N-D	P_{Max} =	-61.1 kip	-271 kN	5N-D	8	-271	-274	-276	-271
5N-D	P_{Min} =	-118.8 kip	-528 kN	5N-D	8	-520	-524	-528	-528
5N-E	P_{Max} =	193.2 kip	858 kN	5N-E	421	858	858	858	858
5N-E	P_{Min} =	76.9 kip	342 kN	5N-E	421	342	342	342	342

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 5N

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		134	deg	B
	φ_C =		93	deg	C
	φ_D =		52	deg	D
	$\cos(\varphi_B)$ =		-0.695		
	$\cos(\varphi_C)$ =		-0.052		
	$\cos(\varphi_D)$ =		0.616		
	$V_{A'-A',max}$ =	-67.7 kip	-301	kN	*
	$V_{A'-A',min}$ =	-134.7 kip	-599	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	134.7 kip	599	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	93.6 kip	416	kN

*using absolute maximum sums, conservative

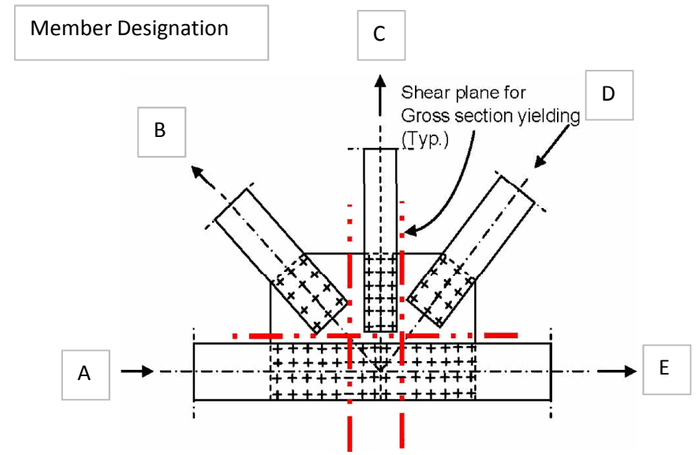


Figure 4 – Examples of gross section shear yielding planes

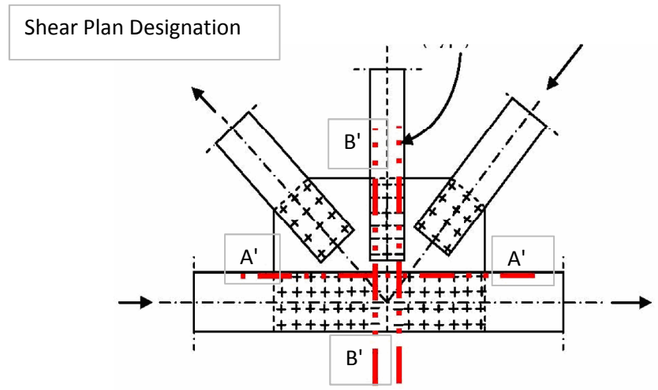


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	49.09	in	1247	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			29928	mm^2	
Net Shear Area	A_n =			23995	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2985	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$ *		Cl 10.18.5.2
	V_{Rn} =			4031	kN	
Shear Resistance (Governing)	V_R =			**2985**	**kN**	
Demand/Capacity	D/C =			**0.201**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	32.68	in	830	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 5N

Members A and E continuous through the gusset plate?				Yes		
Outside height of member A	H_A=	15	in	381	mm	
Thickness of the web of member A	w_A=	0.40	in	10	mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4	ea	
Gross Shear Area	A_g =			27662	mm^2	
Net Shear Area	A_n =			20055	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2759	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =			3369	kN	
Shear Resistance (Governing)	V_R =			**2759**	**kN**	
Demand/Capacity	D/C =			**0.151**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E

N/A

Members A and E continuous through the gusset plate? Yes

General

Whitmore Width	W_w =	0.00	in	0	mm	Number of Rivet/bolt diameters Intsecting Plane	
Shear Length 1	L_{V1} =	0.00	in	0	mm	0	
Shear Length 2	L_{V2} =	0.00	in	0	mm	0	
Tension Length	L_T =	0.00	in	0	mm	0	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$		
		0	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		0	kN	

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

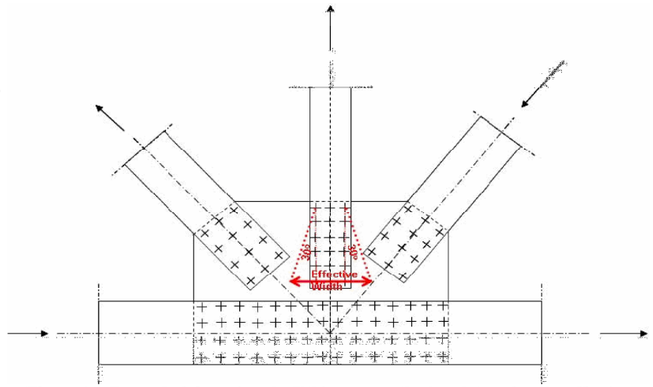


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

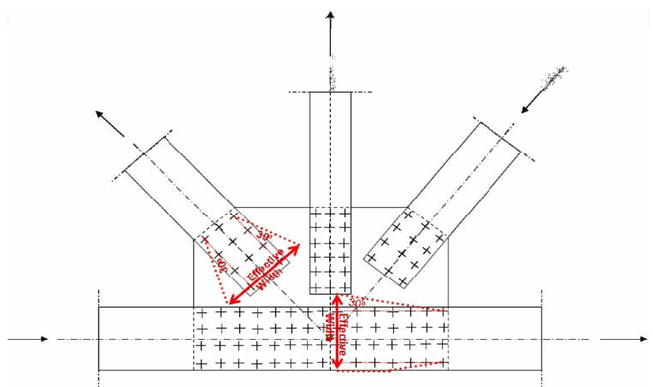


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 5N

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

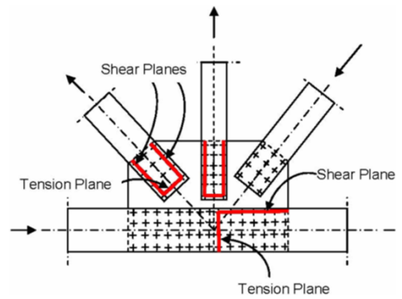


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.14 in	3.46 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

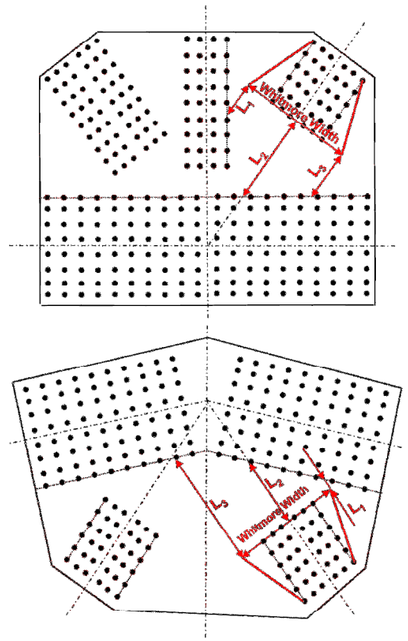


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	48 ea	48 ea			
Longest Length of connection	L=	49.09 in	1247 mm			
Edge distance	e =	0.79 in	20 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$			CSA S6 CL14.14.1.4.2
	B_{r1} =	729 kip	3242 kN			
	B_{r2} =	2084 kip	9263 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$			CSA S6 CL14.14.1.4.2
		495 kip	2200 kN			
Governing Resistance			4400 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span
Node: 5N

Demand/Capacity	D/C =	**0.195**	
For Connections greater than 50in (1270mm), shear resistance taken as 80%.			FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? Yes

General

					Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	20.43 in	519	mm	3
Shear Length 1	L_{V1} =	15.04 in	382	mm	5.5
Shear Length 2	L_{V2} =	15.28 in	388	mm	5.5
Tension Length	L_T =	5.98 in	152	mm	2
Number of Gusset Plates	m =	2 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$	2485	kN	U=1.0 FHWA 3.1.2
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$	3687	kN	U=1.0 FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2					

Block Shear

Gross Tension Area	A_{tg} =	1824	mm^2
Gross Shear Area	A_{vg} =	9240	mm^2
Net Tension Area	A_{tn} =	1330	mm^2
Net Shear Area	A_{vn} =	6521	mm^2
$A_{tn} \geq 0.58*A_{vn}$?		No	

		$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$			U=1.0
Block Shear Resistance	P_{Rbs} =		3154	kN	FHWA 3.1.3
Tension Resistance (Governing)			2485	kN	
Demand/Capacity	D/C =		**0.155**		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? Yes

General — FHWA 3.3

Whitmore Width	W_w =	20.43 in	519	mm

Span: Bascule Bridge - Leaf Span

Node: 5N

L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	11.10 in	282 mm		
L3	L_3 =	1.30 in	33 mm		
Unsupported Column Length	L_u =	4.13 in	105 mm		
Effective Length Factor	K =	1.20	1.2 "fixed-free condition"		
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		t/√(12) for rectangular plate		
		0.14 in	3.46 mm		
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.38		
Compressive Resistance	C_r =		$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$ U=1.0		
			2235 kN		
Demand/Capacity	D/C =		**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	19 ea	19 ea		
Longest Length of connection	L=	17.64 in	448 mm		
Edge distance	e =	1.81 in	46 mm		
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1 ea		
Number of Gusset Plates		2.00 ea	2 ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$ U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	664 kip	2951 kN		
	B_{r2} =	825 kip	3667 kN		
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$ U=1.81		CSA S6 CL14.14.1.4.2
		355 kip	1576 kN		
Governing Resistance			3152 kN	for 2 plate(s)	
Demand/Capacity	D/C =		**0.122**		

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

				Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	28.54 in	725 mm	2	
Shear Length 1	L_{V1} =	19.02 in	483 mm	7.5	
Shear Length 2	L_{V2} =	19.02 in	483 mm	7.5	
Tension Length	L_T =	8.35 in	212 mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 5N

Number of Gusset Plates	m =	2.00 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			3471	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			5514	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		2544	mm^2	
Gross Shear Area	A_{vg} =		11592	mm^2	
Net Tension Area	A_{tn} =		2297	mm^2	
Net Shear Area	A_{vn} =		7884	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		3928	kN	FHWA 3.1.3
Tension Resistance (Governing)			3471	kN	
Demand/Capacity	D/C =		**0.031**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	28.54 in	725	mm	
L1	L_1 =	2.20 in	56	mm	
L2 - along centreline of action	L_2 =	2.95 in	75	mm	
L3	L_3 =	3.74 in	95	mm	
Unsupported Column Length	L_u =	2.97 in	75	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.27		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			3218	kN	

Span: Bascule Bridge - Leaf Span
Node: 5N

Demand/Capacity	D/C =			**0.000**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea		
Longest Length of connection	L=	19.02	in	483	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	462	kip	2053	kN		
	B_{r2} =	695	kip	3088	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		299	kip	1327	kN		
Governing Resistance				2655	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.040**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	15.35	in	390	mm	3	
Shear Length 1	L_{V1} =	17.36	in	441	mm	5.5	
Shear Length 2	L_{V2} =	13.86	in	352	mm	5.5	
Tension Length	L_T =	5.98	in	152	mm	2	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		1867	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		2647	kN		

Block Shear

Gross Tension Area	A_{tg} =	1824	mm^2

Span: Bascule Bridge - Leaf Span

Node: 5N

Gross Shear Area	A_{vg} =		9516	mm^2	
Net Tension Area	A_{tn} =		1330	mm^2	
Net Shear Area	A_{vn} =		6797	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0		
Block Shear Resistance	P_{Rbs} =		3262	kN	FHWA 3.1.3
Tension Resistance (Governing)			1867	kN	
Demand/Capacity	D/C =		**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?			Yes		
General					FHWA 3.3
Whitmore Width	W_w =	15.35 in	390	mm	
L1	L_1 =	3.03 in	77	mm	
L2 - along centreline of action	L_2 =	12.83 in	326	mm	
L3	L_3 =	6.89 in	175	mm	
Unsupported Column Length	L_u =	7.59 in	193	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.69		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			1400	kN	
Demand/Capacity	D/C =		**0.377**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	18 ea	18	ea		
Longest Length of connection	L=	16.46 in	418	mm		
Edge distance	e =	1.54 in	39	mm		
Diameter of Rivet	d =	0.75 in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1	ea		
Number of Gusset Plates		2.00 ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	533 kip	2371	kN		
	B_{r2} =	782 kip	3474	kN		

Span: Bascule Bridge - Leaf Span
Node: 5N

Shear Resistance of Rivets V_r = $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 CSA S6 CL14.14.1.4.2

336 kip 1493 kN

Governing Resistance 2986 kN for 2 plate(s)

Demand/Capacity D/C = **0.177**

For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	672	2985
Shear Resistance (Net Section)	907	4031
Shear Resistance (Governing)	672	2985
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	621	2759
Shear Resistance (Net Section)	758	3369
Shear Resistance (Governing)	621	2759
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	559	2485
Net Section Resistance	830	3687
Block Shear Resistance	710	3154
Tension Resistance (Governing)	559	2485
At Member C:		
Gross Section Resistance	781	3471
Net Section Resistance	1241	5514
Block Shear Resistance	884	3928
Tension Resistance (Governing)	781	3471
At Member D:		
Gross Section Resistance	420	1867
Net Section Resistance	595	2647
Block Shear Resistance	734	3262
Tension Resistance (Governing)	420	1867
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 5N

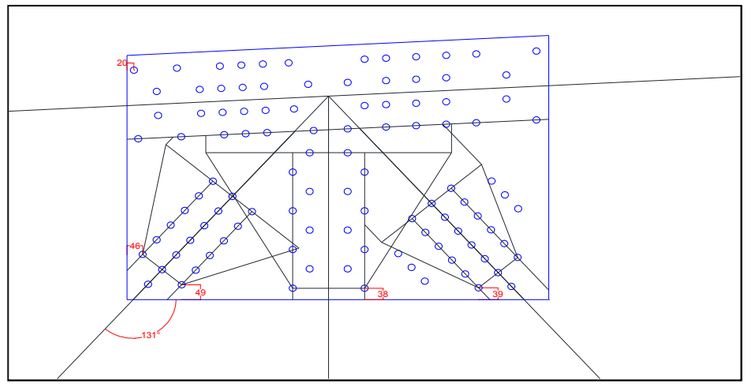
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	503	2235
Compressive Resistance at Member C	724	3218
Compressive Resistance at Member D	315	1400
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	990	4400
Governing Resistance at Member B	709	3152
Governing Resistance at Member C	597	2655
Governing Resistance at Member D	672	2986
Governing Resistance at Member E	990	4400

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
SHEAR PLANE A'-A'		672	2985	**0.201**	
SHEAR PLANE B'-B'		621	2759	**0.151**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	559	2485	**0.155**	
	Member C	781	3471	**0.031**	
	Member D	420	1867	**0.000**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	503	2235	**0.000**	
	Member C	724	3218	**0.000**	
	Member D	315	1400	**0.377**	<--- Governing
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	990	4400	**0.195**	
	Member B	709	3152	**0.122**	
	Member C	597	2655	**0.040**	
	Member D	672	2986	**0.177**	
	Member E	990	4400	**0.195**	
Highest Demand/Capacity Ratio				**0.377**	

Span: Bascule Bridge - Leaf Span
Node: 5S

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.47 in	12 mm	6% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units			
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6	
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa			

MEMBER FORCES

Load Combination:		ULSB3 Max 0		Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
5S-A	P_{Max} =	64.3 kip	286 kN	5S-A	491	286	285	285	286
5S-A	P_{Min} =	22.3 kip	99 kN	5S-A	491	100	99	99	99
5S-B	P_{Max} =	104.7 kip	465 kN	5S-B	183	465	461	457	465
5S-B	P_{Min} =	50.8 kip	226 kN	5S-B	183	230	228	226	226
5S-C	P_{Max} =	25.1 kip	111 kN	5S-C	325	110	111	111	111
5S-C	P_{Min} =	11.8 kip	53 kN	5S-C	325	53	53	53	53
5S-D	P_{Max} =	-66.7 kip	-296 kN	5S-D	184	-296	-299	-301	-296
5S-D	P_{Min} =	-131.0 kip	-582 kN	5S-D	184	-574	-578	-582	-582
5S-E	P_{Max} =	218.7 kip	972 kN	5S-E	490	972	972	971	972
5S-E	P_{Min} =	88.7 kip	394 kN	5S-E	490	394	394	394	394

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 5S

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		134	deg	B
	φ_C =		93	deg	C
	φ_D =		52	deg	D
	$\cos(\varphi_B)$ =		-0.695		
	$\cos(\varphi_C)$ =		-0.052		
	$\cos(\varphi_D)$ =		0.616		
	$V_{A'-A',max}$ =	-76.9 kip	-342	kN	*
	$V_{A'-A',min}$ =	-154.7 kip	-687	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	154.7 kip	687	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	103.2 kip	459	kN	

*using absolute maximum sums, conservative

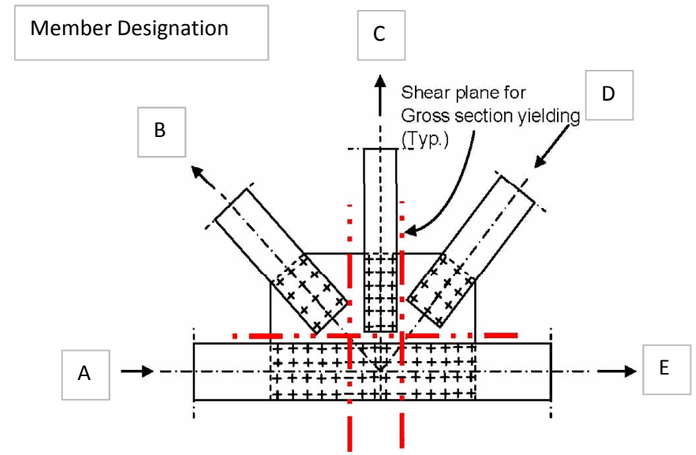


Figure 4 – Examples of gross section shear yielding planes

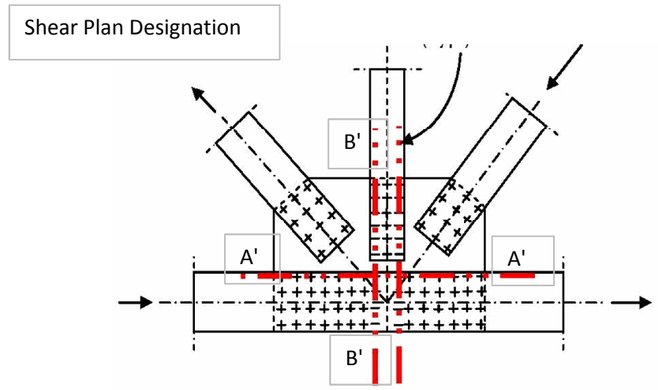


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	49.09	in	1247	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			29928	mm^2	
Net Shear Area	A_n =			23995	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2985	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =			4031	kN	
Shear Resistance (Governing)	V_R =			**2985**	**kN**	
Demand/Capacity	D/C =			**0.230**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	32.68	in	830	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 5S

Members A and E continuous through the gusset plate?				Yes		
Outside height of member A	H_A=	15	in	381	mm	
Thickness of the web of member A	w_A=	0.40	in	10	mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4	ea	
Gross Shear Area	A_g =			27662	mm^2	
Net Shear Area	A_n =			20055	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2759	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =			3369	kN	
Shear Resistance (Governing)	V_R =			**2759**	**kN**	
Demand/Capacity	D/C =			**0.166**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E — N/A

Members A and E continuous through the gusset plate? Yes

General

Whitmore Width	W_w =	0.00	in	0	mm	Number of Rivet/bolt diameters Intsecting Plane	
Shear Length 1	L_{V1} =	0.00	in	0	mm	0	
Shear Length 2	L_{V2} =	0.00	in	0	mm	0	
Tension Length	L_T =	0.00	in	0	mm	0	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance

CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$		
		0	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		0	kN	

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

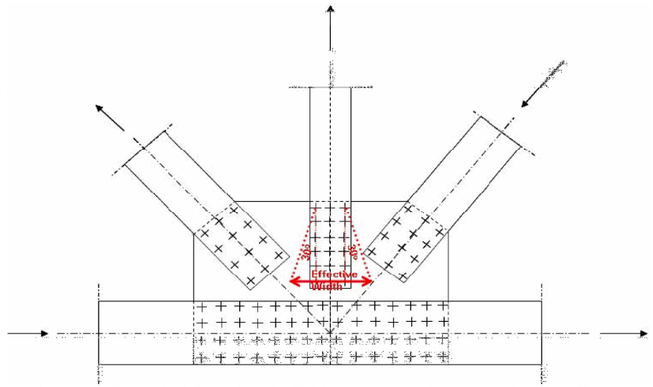


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

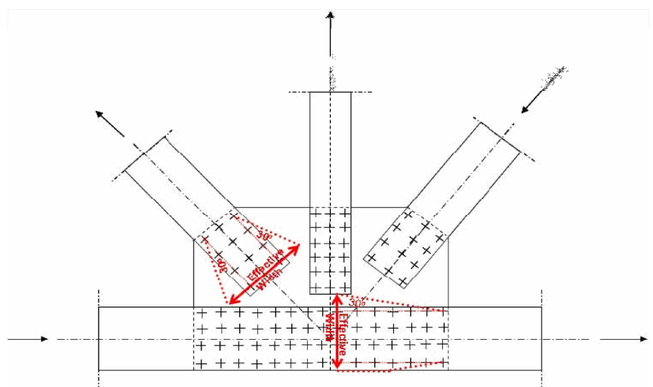


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 5S

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

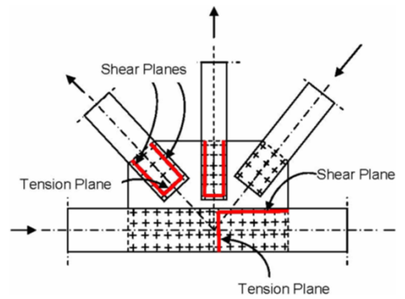


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.14 in	3.46 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

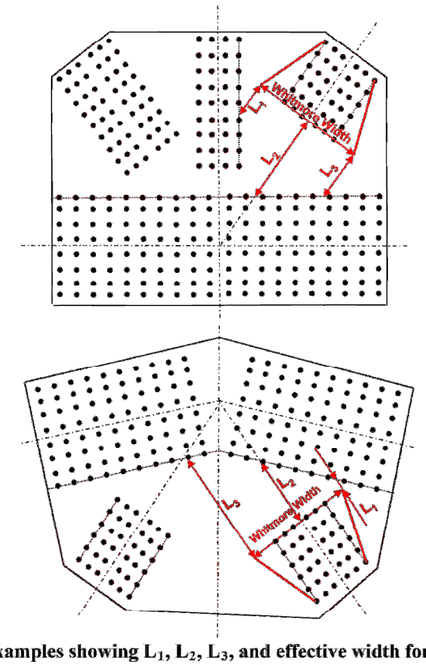


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	48 ea	48 ea			
Longest Length of connection	L=	49.09 in	1247 mm			
Edge distance	e =	0.79 in	20 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$			CSA S6 CL14.14.1.4.2
	B_{r1} =	729 kip	3242 kN			
	B_{r2} =	2084 kip	9263 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$			CSA S6 CL14.14.1.4.2
		495 kip	2200 kN			
Governing Resistance			4400 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span
Node: 5S

Demand/Capacity	D/C =	**0.221**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	20.43	in	519	mm	3
Shear Length 1	L_{V1} =	15.04	in	382	mm	5.5
Shear Length 2	L_{V2} =	15.28	in	388	mm	5.5
Tension Length	L_T =	5.98	in	152	mm	2
Number of Gusset Plates	m =	2	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$ U=1.0		FHWA 3.1.2
		2485	kN	
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$ U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		3687	kN	

Block Shear

Gross Tension Area	A_{tg} =	1824	mm^2
Gross Shear Area	A_{vg} =	9240	mm^2
Net Tension Area	A_{tn} =	1330	mm^2
Net Shear Area	A_{vn} =	6521	mm^2
$A_{tn} \geq 0.58*A_{vn}$?		No	

$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$ U=1.0

Block Shear Resistance	P_{Rbs} =	3154	kN	FHWA 3.1.3
Tension Resistance (Governing)		2485	kN	
Demand/Capacity	D/C =	**0.187**		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? Yes

General — FHWA 3.3

Whitmore Width	W_w =	20.43	in	519	mm

Span: Bascule Bridge - Leaf Span

Node: 5S

L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	11.10 in	282	mm	
L3	L_3 =	1.30 in	33	mm	
Unsupported Column Length	L_u =	4.13 in	105	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.38		
Compressive Resistance	C_r =		$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			2235	kN	
Demand/Capacity	D/C =		**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	19 ea	19	ea		
Longest Length of connection	L=	17.64 in	448	mm		
Edge distance	e =	1.81 in	46	mm		
Diameter of Rivet	d =	0.75 in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1	ea		
Number of Gusset Plates		2.00 ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	664 kip	2951	kN		
	B_{r2} =	825 kip	3667	kN		
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		355 kip	1576	kN		
Governing Resistance			3152	kN	for 2 plate(s)	
Demand/Capacity	D/C =		**0.148**			

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

					Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	28.54 in	725	mm	2	
Shear Length 1	L_{V1} =	19.02 in	483	mm	7.5	
Shear Length 2	L_{V2} =	19.02 in	483	mm	7.5	
Tension Length	L_T =	8.35 in	212	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 5S

Number of Gusset Plates	m =	2.00 ea	2 ea		
Diameter of holes in plane	d_b =	0.81 in	21 mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			3471	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			5514	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		2544	mm^2	
Gross Shear Area	A_{vg} =		11592	mm^2	
Net Tension Area	A_{tn} =		2297	mm^2	
Net Shear Area	A_{vn} =		7884	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		3928	kN	FHWA 3.1.3
Tension Resistance (Governing)			3471	kN	
Demand/Capacity	D/C =		**0.032**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored?			N/A		
General					FHWA 3.3
Whitmore Width	W_w =	28.54 in	725	mm	
L1	L_1 =	2.20 in	56	mm	
L2 - along centreline of action	L_2 =	2.95 in	75	mm	
L3	L_3 =	3.74 in	95	mm	
Unsupported Column Length	L_u =	2.97 in	75	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.27		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			3218	kN	

Span: Bascule Bridge - Leaf Span
Node: 5S

Demand/Capacity	D/C =			**0.000**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea		
Longest Length of connection	L=	19.02	in	483	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	462	kip	2053	kN		
	B_{r2} =	695	kip	3088	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		299	kip	1327	kN		
Governing Resistance				2655	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.042**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	15.35	in	390	mm	3	
Shear Length 1	L_{V1} =	17.36	in	441	mm	5.5	
Shear Length 2	L_{V2} =	13.86	in	352	mm	5.5	
Tension Length	L_T =	5.98	in	152	mm	2	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		1867	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		2647	kN		

Block Shear

Gross Tension Area	A_{tg} =	1824	mm^2

Span: Bascule Bridge - Leaf Span

Node: 5S

Gross Shear Area	A_{vg} =			9516	mm^2	
Net Tension Area	A_{tn} =			1330	mm^2	
Net Shear Area	A_{vn} =			6797	mm^2	
$A_{tn} > 0.58*A_{vn}$?				No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		U=1.0	
Block Shear Resistance	P_{Rbs} =			3262	kN	FHWA 3.1.3
Tension Resistance (Governing)				1867	kN	
Demand/Capacity	D/C =			**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?				Yes		
General						FHWA 3.3
Whitmore Width	W_w =	15.35	in	390	mm	
L1	L_1 =	3.03	in	77	mm	
L2 - along centreline of action	L_2 =	12.83	in	326	mm	
L3	L_3 =	6.89	in	175	mm	
Unsupported Column Length	L_u =	7.59	in	193	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.69		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				1400	kN	
Demand/Capacity	D/C =			**0.416**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	18	ea	18	ea		
Longest Length of connection	L=	16.46	in	418	mm		
Edge distance	e =	1.54	in	39	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$		U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	533	kip	2371	kN		
	B_{r2} =	782	kip	3474	kN		

Span: Bascule Bridge - Leaf Span
Node: 5S

Shear Resistance of Rivets	V_r =	336 kip	$0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 1493 kN	CSA S6 CL14.14.1.4.2
Governing Resistance			2986 kN for 2 plate(s)	
Demand/Capacity	D/C =		**0.195**	
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	672	2985
Shear Resistance (Net Section)	907	4031
Shear Resistance (Governing)	672	2985
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	621	2759
Shear Resistance (Net Section)	758	3369
Shear Resistance (Governing)	621	2759
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	559	2485
Net Section Resistance	830	3687
Block Shear Resistance	710	3154
Tension Resistance (Governing)	559	2485
At Member C:		
Gross Section Resistance	781	3471
Net Section Resistance	1241	5514
Block Shear Resistance	884	3928
Tension Resistance (Governing)	781	3471
At Member D:		
Gross Section Resistance	420	1867
Net Section Resistance	595	2647
Block Shear Resistance	734	3262
Tension Resistance (Governing)	420	1867
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 5S

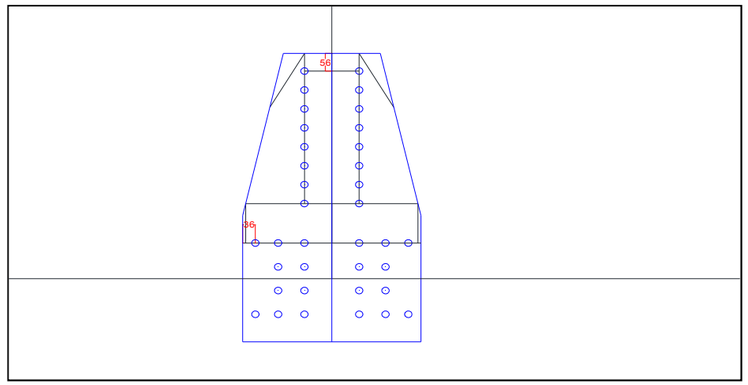
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	503	2235
Compressive Resistance at Member C	724	3218
Compressive Resistance at Member D	315	1400
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	990	4400
Governing Resistance at Member B	709	3152
Governing Resistance at Member C	597	2655
Governing Resistance at Member D	672	2986
Governing Resistance at Member E	990	4400

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
SHEAR PLANE A'-A'		672	2985	**0.230**	
SHEAR PLANE B'-B'		621	2759	**0.166**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	559	2485	**0.187**	
	Member C	781	3471	**0.032**	
	Member D	420	1867	**0.000**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	503	2235	**0.000**	
	Member C	724	3218	**0.000**	
	Member D	315	1400	**0.416**	<--- Governing
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	990	4400	**0.221**	
	Member B	709	3152	**0.148**	
	Member C	597	2655	**0.042**	
	Member D	672	2986	**0.195**	
	Member E	990	4400	**0.221**	
Highest Demand/Capacity Ratio				**0.416**	

Span: Bascule Bridge - Leaf Span
Node: 6N

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.28 in	7 mm	45% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units		
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa		

MEMBER FORCES

Load Combination:		ULSB3 Max 0	
6N-A	P_{Max} =	-27.5 kip	-122 kN
6N-A	P_{Min} =	-110.2 kip	-490 kN
6N-B	P_{Max} =	0.0 kip	0 kN
6N-B	P_{Min} =	0.0 kip	0 kN
6N-C	P_{Max} =	20.7 kip	92 kN
6N-C	P_{Min} =	9.8 kip	44 kN
6N-D	P_{Max} =	0.0 kip	0 kN
6N-D	P_{Min} =	0.0 kip	0 kN
6N-E	P_{Max} =	0.8 kip	4 kN
6N-E	P_{Min} =	-126.0 kip	-560 kN

Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
6N-A	281	-122	-122	-122	-122
6N-A	281	-490	-490	-490	-490
6N-B	0	#N/A	#N/A	#N/A	#N/A
6N-B	0	#N/A	#N/A	#N/A	#N/A
6N-C	320	87	89	92	92
6N-C	320	44	45	46	44
6N-D	0	#N/A	#N/A	#N/A	#N/A
6N-D	0	#N/A	#N/A	#N/A	#N/A
6N-E	282	4	4	4	4
6N-E	282	-560	-560	-560	-560

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 6N

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		128	deg	B
	φ_C =		90	deg	C
	φ_D =		54	deg	D
	$\cos(\varphi_B)$ =		-0.616		
	$\cos(\varphi_C)$ =		0.000		
	$\cos(\varphi_D)$ =		0.588		
	$V_{A'-A',max}$ =	0.0 kip	0	kN	*
	$V_{A'-A',min}$ =	0.0 kip	0	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	0.0 kip	0	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	0.0 kip	0	kN	

*using absolute maximum sums, conservative

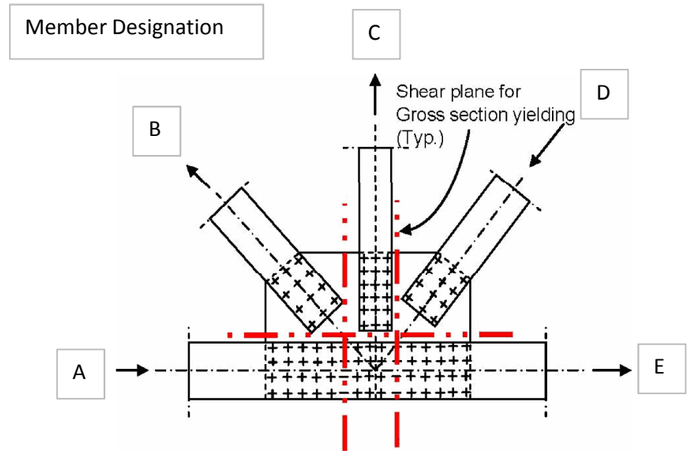


Figure 4 – Examples of gross section shear yielding planes

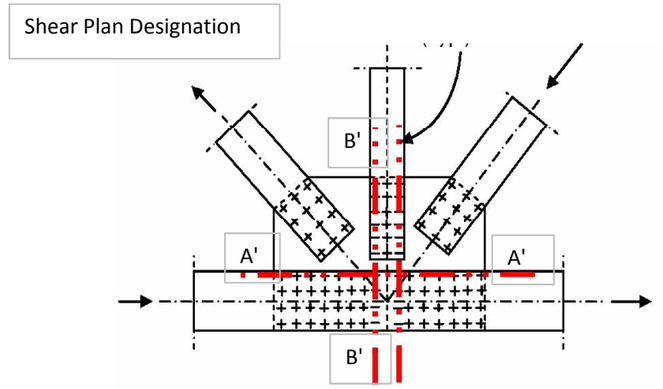


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	20.00	in	508	mm	
No of holes in shear plane	N =	6.00	ea	6	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			7112	mm^2	
Net Shear Area	A_n =			5382	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			709	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =			904	kN	
Shear Resistance (Governing)	V_R =			**709**	**kN**	
Demand/Capacity	D/C =			**0.000**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	35.98	in	914	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 6N

Members A and E continuous through the gusset plate?				Yes		
Outside height of member A	H_A=	15	in	381	mm	
Thickness of the web of member A	w_A=	0.40	in	10	mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4	ea	
Gross Shear Area	A_g =			20538	mm^2	
Net Shear Area	A_n =			15403	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2049	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =			2588	kN	
Shear Resistance (Governing)	V_R =			**2049**	**kN**	
Demand/Capacity	D/C =			**0.000**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E

N/A

Members A and E continuous through the gusset plate? Yes

General

Whitmore Width	W_w =	0.00	in	0	mm	
Shear Length 1	L_{V1} =	0.00	in	0	mm	
Shear Length 2	L_{V2} =	0.00	in	0	mm	
Tension Length	L_T =	0.00	in	0	mm	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Number of Rivet/bolt diameters Intsecting Plane

0	
0	
0	
0	Typ, 1 less than Whitemore Width

Axile Tensile Resistance

CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	
		0	kN
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	
For gusset plates, U=1.0, FHWA 3.1.2		0	kN

FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

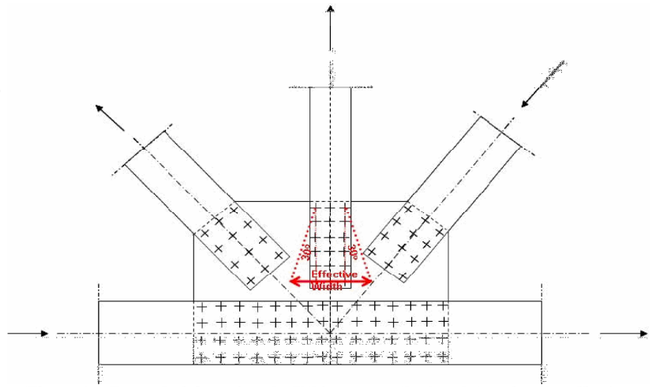


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

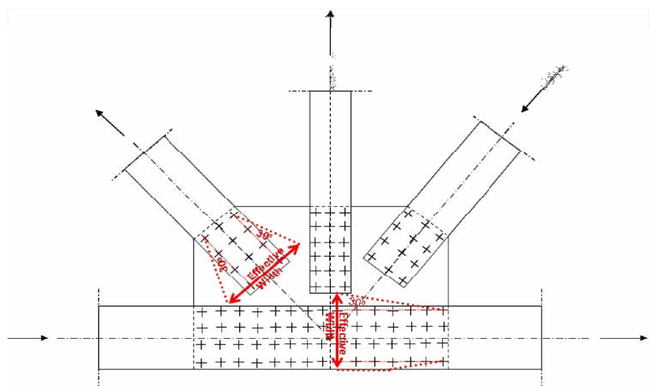


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 6N

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

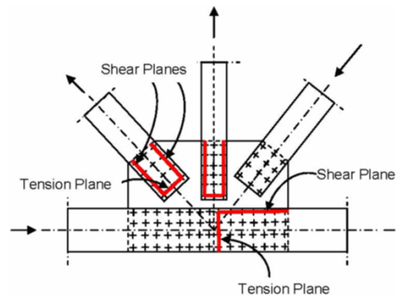


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0 "fixed-free condition"		
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		t/√(12) for rectangular plate		
		0.08 in	2.02 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

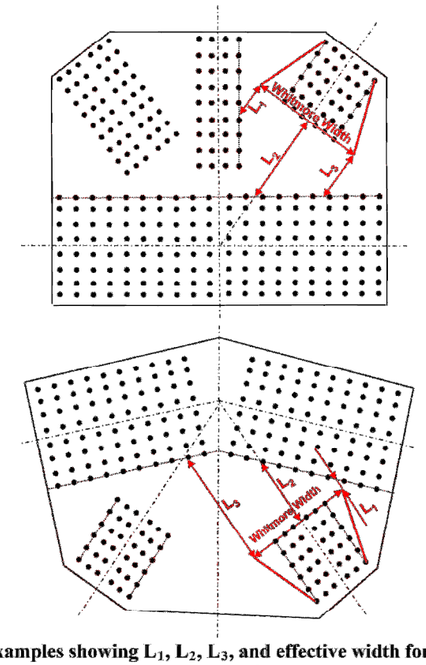


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	20 ea	20 ea			
Longest Length of connection	L=	20.00 in	508 mm			
Edge distance	e =	1.42 in	36 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$		CSA S6 CL14.14.1.4.2	
	B_{r1} =	319 kip	1418 kN			
	B_{r2} =	507 kip	2251 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$		CSA S6 CL14.14.1.4.2	
		206 kip	917 kN			
Governing Resistance			1833 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span

Node: 6N

Demand/Capacity	D/C =	**0.306**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	21.81	in	554	mm	3
Shear Length 1	L_{V1} =	13.11	in	333	mm	4.5
Shear Length 2	L_{V2} =	11.38	in	289	mm	4.5
Tension Length	L_T =	14.33	in	364	mm	4
Number of Gusset Plates	m =	2	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$ U=1.0	1547 kN	FHWA 3.1.2
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$ U=1.0	2315 kN	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2				

Block Shear

Gross Tension Area	A_{tg} =	2548	mm^2
Gross Shear Area	A_{vg} =	4354	mm^2
Net Tension Area	A_{tn} =	1971	mm^2
Net Shear Area	A_{vn} =	3056	mm^2
$A_{tn} \geq 0.58*A_{vn}$?		Yes	

		$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$ U=1.0		
Block Shear Resistance	P_{Rbs} =		2173 kN	FHWA 3.1.3
Tension Resistance (Governing)			1547 kN	
Demand/Capacity	D/C =		**0.000**	

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? Yes

General — FHWA 3.3

Whitmore Width	W_w =	21.81	in	554 mm

Span: Bascule Bridge - Leaf Span

Node: 6N

L1	L_1 =	0.79	in	20	mm	
L2 - along centreline of action	L_2 =	13.54	in	344	mm	
L3	L_3 =	4.88	in	124	mm	
Unsupported Column Length	L_u =	6.40	in	163	mm	
Effective Length Factor	K =	1.20		1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)		for rectangular plate
		0.08	in	2.02	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				1.00		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				877	kN	
Demand/Capacity	D/C =			**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22	ea	22	ea	
Longest Length of connection	L=	18.94	in	481	mm	
Edge distance	e =	1.50	in	38	mm	
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")
Shear Planes per gusset plate	m =	1	ea	1	ea	
Number of Gusset Plates		2.00	ea	2	ea	
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0	CSA S6 CL14.14.1.4.2
	B_{r1} =	371	kip	1647	kN	
	B_{r2} =	557	kip	2477	kN	
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81	CSA S6 CL14.14.1.4.2
		411	kip	1825	kN	
Governing Resistance				3294	kN	for 2 plate(s)
Demand/Capacity	D/C =			**0.000**		

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	19.29	in	490	mm	2	
Shear Length 1	L_{V1} =	18.74	in	476	mm	7.5	
Shear Length 2	L_{V2} =	18.74	in	476	mm	7.5	
Tension Length	L_T =	6.14	in	156	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 6N

Number of Gusset Plates	m =	2.00 ea	2 ea		
Diameter of holes in plane	d_b =	0.81 in	21 mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			1369	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			2111	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		1092	mm^2	
Gross Shear Area	A_{vg} =		6664	mm^2	
Net Tension Area	A_{tn} =		948	mm^2	
Net Shear Area	A_{vn} =		4501	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		2121	kN	FHWA 3.1.3
Tension Resistance (Governing)			1369	kN	
Demand/Capacity	D/C =		**0.067**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	19.29 in	490	mm	
L1	L_1 =	4.92 in	125	mm	
L2 - along centreline of action	L_2 =	4.92 in	125	mm	
L3	L_3 =	4.92 in	125	mm	
Unsupported Column Length	L_u =	4.92 in	125	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.08 in	2.02	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.77		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			963	kN	

Span: Bascule Bridge - Leaf Span
Node: 6N

Demand/Capacity	D/C =			**0.000**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea		
Longest Length of connection	L=	18.74	in	476	mm		
Edge distance	e =	2.20	in	56	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	397	kip	1765	kN		
	B_{r2} =	405	kip	1801	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		299	kip	1327	kN		
Governing Resistance				2655	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.035**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	24.41	in	620	mm	5	
Shear Length 1	L_{V1} =	10.87	in	276	mm	3.5	
Shear Length 2	L_{V2} =	14.25	in	362	mm	4.5	
Tension Length	L_T =	15.55	in	395	mm	5	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
		1732	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		2432	kN	

Block Shear

Gross Tension Area	A_{tg} =	2765	mm^2

Span: Bascule Bridge - Leaf Span

Node: 6N

Gross Shear Area	A_{vg} =			4466	mm^2	
Net Tension Area	A_{tn} =			2044	mm^2	
Net Shear Area	A_{vn} =			3312	mm^2	
$A_{tn} > 0.58*A_{vn}$?				Yes		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$			U=1.0	
Block Shear Resistance	P_{Rbs} =			2244	kN	FHWA 3.1.3
Tension Resistance (Governing)				1732	kN	
Demand/Capacity	D/C =			**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?				Yes		
General						FHWA 3.3
Whitmore Width	W_w =	24.41	in	620	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	13.15	in	334	mm	
L3	L_3 =	4.21	in	107	mm	
Unsupported Column Length	L_u =	5.79	in	147	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.08	in	2.02	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.90		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				1078	kN	
Demand/Capacity	D/C =			**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	25	ea	25	ea		
Longest Length of connection	L=	19.37	in	492	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	421	kip	1871	kN		
	B_{r2} =	633	kip	2814	kN		

Span: Bascule Bridge - Leaf Span
Node: 6N

Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$ U=1.81	CSA S6 CL14.14.1.4.2
		467 kip	2074 kN	
Governing Resistance			3743 kN for 2 plate(s)	
Demand/Capacity	D/C =		**0.000**	
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	160	709
Shear Resistance (Net Section)	203	904
Shear Resistance (Governing)	160	709
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	461	2049
Shear Resistance (Net Section)	582	2588
Shear Resistance (Governing)	461	2049
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	348	1547
Net Section Resistance	521	2315
Block Shear Resistance	489	2173
Tension Resistance (Governing)	348	1547
At Member C:		
Gross Section Resistance	308	1369
Net Section Resistance	475	2111
Block Shear Resistance	477	2121
Tension Resistance (Governing)	308	1369
At Member D:		
Gross Section Resistance	390	1732
Net Section Resistance	547	2432
Block Shear Resistance	505	2244
Tension Resistance (Governing)	390	1732
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 6N

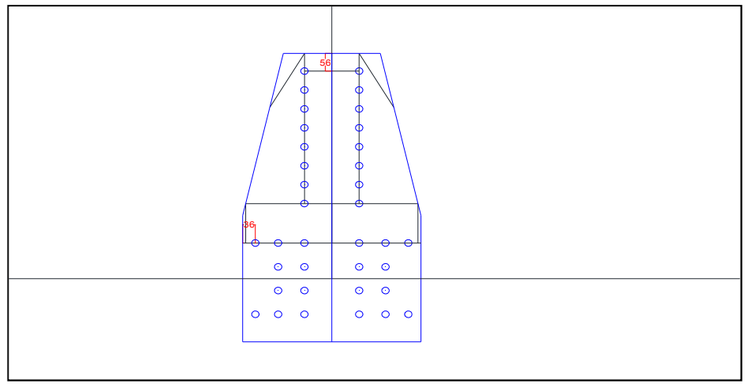
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	197	877
Compressive Resistance at Member C	217	963
Compressive Resistance at Member D	243	1078
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	412	1833
Governing Resistance at Member B	741	3294
Governing Resistance at Member C	597	2655
Governing Resistance at Member D	842	3743
Governing Resistance at Member E	412	1833

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
SHEAR PLANE A'-A'		160	709	**0.000**	
SHEAR PLANE B'-B'		461	2049	**0.000**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	348	1547	**0.000**	
	Member C	308	1369	**0.067**	
	Member D	390	1732	**0.000**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	197	877	**0.000**	
	Member C	217	963	**0.000**	
	Member D	243	1078	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	412	1833	**0.306**	<--- Governing
	Member B	741	3294	**0.000**	
	Member C	597	2655	**0.035**	
	Member D	842	3743	**0.000**	
	Member E	412	1833	**0.306**	<--- Governing
Highest Demand/Capacity Ratio				**0.306**	

Span: Bascule Bridge - Leaf Span
Node: 6S

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.28 in	7 mm	45% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units		
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa		

MEMBER FORCES

Load Combination: ULSB3 Max 0

				Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
6S-A	P_{Max} =	-36.1 kip	-160 kN	6S-A	561	-160	-160	-160	-160
6S-A	P_{Min} =	-128.7 kip	-572 kN	6S-A	561	-572	-572	-572	-572
6S-B	P_{Max} =	0.0 kip	0 kN	6S-B	0	#N/A	#N/A	#N/A	#N/A
6S-B	P_{Min} =	0.0 kip	0 kN	6S-B	0	#N/A	#N/A	#N/A	#N/A
6S-C	P_{Max} =	25.9 kip	115 kN	6S-C	324	110	112	115	115
6S-C	P_{Min} =	12.2 kip	54 kN	6S-C	324	54	56	57	54
6S-D	P_{Max} =	0.0 kip	0 kN	6S-D	0	#N/A	#N/A	#N/A	#N/A
6S-D	P_{Min} =	0.0 kip	0 kN	6S-D	0	#N/A	#N/A	#N/A	#N/A
6S-E	P_{Max} =	-5.9 kip	-26 kN	6S-E	562	-26	-26	-26	-26
6S-E	P_{Min} =	-140.7 kip	-625 kN	6S-E	562	-625	-625	-625	-625

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 6S

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		128	deg	B
	φ_C =		90	deg	C
	φ_D =		54	deg	D
	$\cos(\varphi_B)$ =		-0.616		
	$\cos(\varphi_C)$ =		0.000		
	$\cos(\varphi_D)$ =		0.588		
	$V_{A'-A',max}$ =	0.0 kip	0	kN	*
	$V_{A'-A',min}$ =	0.0 kip	0	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	0.0 kip	0	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	0.0 kip	0	kN	

*using absolute maximum sums, conservative

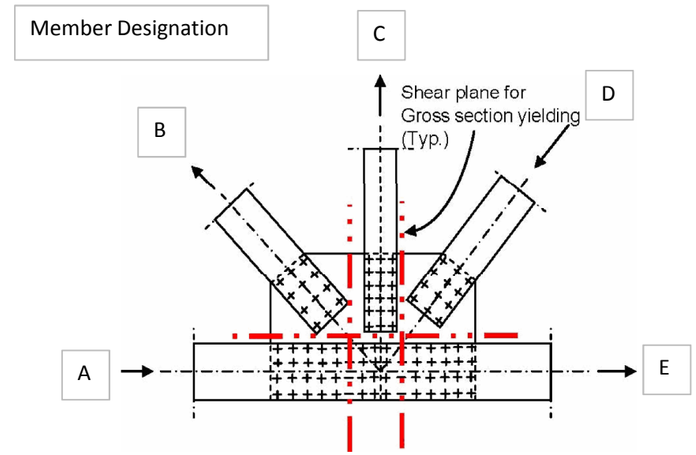


Figure 4 – Examples of gross section shear yielding planes

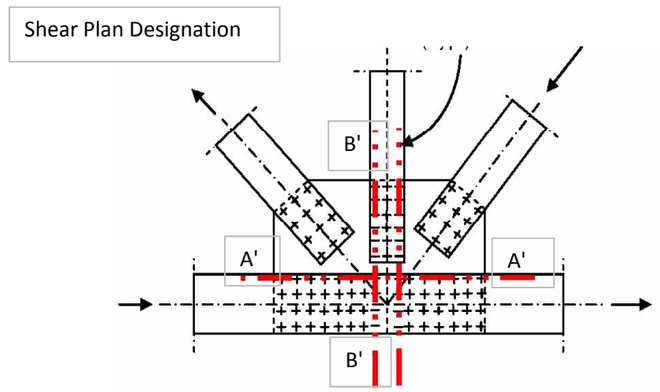


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	20.00	in	508	mm	
No of holes in shear plane	N =	6.00	ea	6	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			7112	mm^2	
Net Shear Area	A_n =			5382	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			709	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =			904	kN	
Shear Resistance (Governing)	V_R =			**709**	**kN**	
Demand/Capacity	D/C =			**0.000**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	35.98	in	914	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 6S

Members A and E continuous through the gusset plate?				Yes	
Outside height of member A	H_A=	15	in	381 mm	
Thickness of the web of member A	w_A=	0.40	in	10 mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4 ea	
Gross Shear Area	A_g =			20538 mm^2	
Net Shear Area	A_n =			15403 mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$	Cl 10.18.5.2
	V_{Rg} =			2049 kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$ *	Cl 10.18.5.2
	V_{Rn} =			2588 kN	
Shear Resistance (Governing)	V_R =			**2049 kN**	
Demand/Capacity	D/C =			**0.000**	

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E — N/A

Members A and E continuous through the gusset plate? Yes

General

					Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	0.00	in	0 mm	0	
Shear Length 1	L_{V1} =	0.00	in	0 mm	0	
Shear Length 2	L_{V2} =	0.00	in	0 mm	0	
Tension Length	L_T =	0.00	in	0 mm	0	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2 ea		
Diameter of holes in plane	d_b =	0.81	in	21 mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	
		0 kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		0 kN	

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

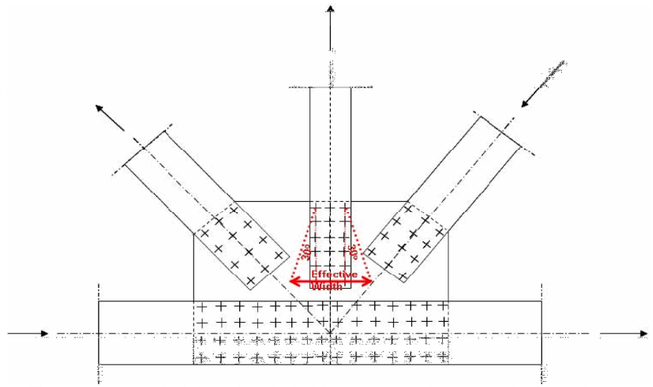


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

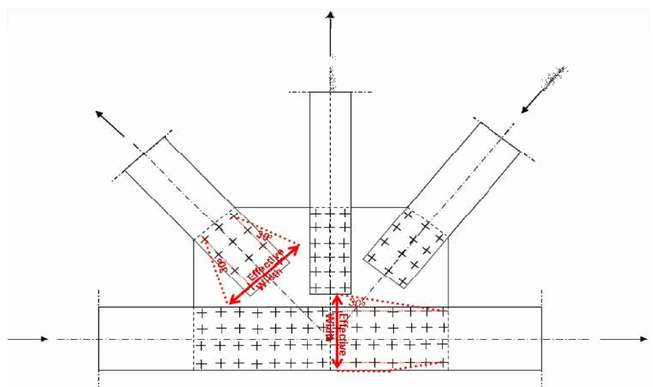


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 6S

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

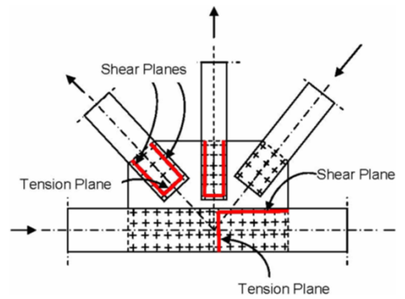


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.08 in	2.02 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

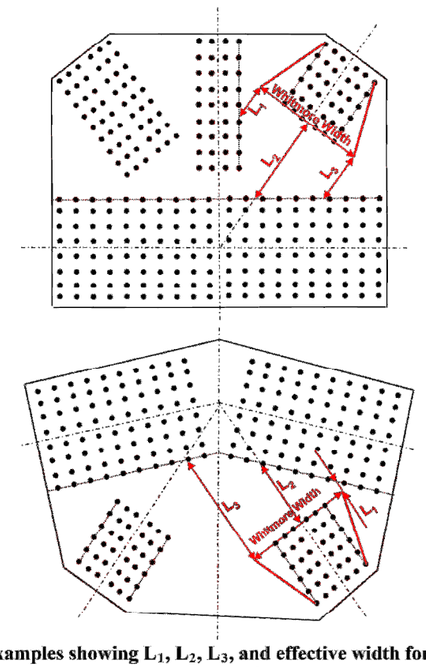


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	20 ea	20 ea			
Longest Length of connection	L=	20.00 in	508 mm			
Edge distance	e =	1.42 in	36 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$		CSA S6 CL14.14.1.4.2	
	B_{r1} =	319 kip	1418 kN			
	B_{r2} =	507 kip	2251 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$		CSA S6 CL14.14.1.4.2	
		206 kip	917 kN			
Governing Resistance			1833 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span
Node: 6S

Demand/Capacity	D/C =	**0.341**	
For Connections greater than 50in (1270mm), shear resistance taken as 80%.			FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	21.81	in	554	mm	3
Shear Length 1	L_{V1} =	13.11	in	333	mm	4.5
Shear Length 2	L_{V2} =	11.38	in	289	mm	4.5
Tension Length	L_T =	14.33	in	364	mm	4
Number of Gusset Plates	m =	2	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$ U=1.0	1547 kN	FHWA 3.1.2
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$ U=1.0	2315 kN	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2				

Block Shear

Gross Tension Area	A_{tg} =	2548	mm^2
Gross Shear Area	A_{vg} =	4354	mm^2
Net Tension Area	A_{tn} =	1971	mm^2
Net Shear Area	A_{vn} =	3056	mm^2
$A_{tn} \geq 0.58*A_{vn}$?		Yes	

		$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$ U=1.0		
Block Shear Resistance	P_{Rbs} =		2173 kN	FHWA 3.1.3
Tension Resistance (Governing)			1547 kN	
Demand/Capacity	D/C =		**0.000**	

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? Yes

General — FHWA 3.3

Whitmore Width	W_w =	21.81	in	554 mm

Span: Bascule Bridge - Leaf Span
Node: 6S

L1	L_1 =	0.79	in	20	mm	
L2 - along centreline of action	L_2 =	13.54	in	344	mm	
L3	L_3 =	4.88	in	124	mm	
Unsupported Column Length	L_u =	6.40	in	163	mm	
Effective Length Factor	K =	1.20		1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)		for rectangular plate
		0.08	in	2.02	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				1.00		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				877	kN	
Demand/Capacity	D/C =			**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22	ea	22	ea	
Longest Length of connection	L=	18.94	in	481	mm	
Edge distance	e =	1.50	in	38	mm	
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")
Shear Planes per gusset plate	m =	1	ea	1	ea	
Number of Gusset Plates		2.00	ea	2	ea	
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0	CSA S6 CL14.14.1.4.2
	B_{r1} =	371	kip	1647	kN	
	B_{r2} =	557	kip	2477	kN	
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81	CSA S6 CL14.14.1.4.2
		411	kip	1825	kN	
Governing Resistance				3294	kN	for 2 plate(s)
Demand/Capacity	D/C =			**0.000**		

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	19.29	in	490	mm	2	
Shear Length 1	L_{V1} =	18.74	in	476	mm	7.5	
Shear Length 2	L_{V2} =	18.74	in	476	mm	7.5	
Tension Length	L_T =	6.14	in	156	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 6S

Number of Gusset Plates	m =	2.00 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			1369	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			2111	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		1092	mm^2	
Gross Shear Area	A_{vg} =		6664	mm^2	
Net Tension Area	A_{tn} =		948	mm^2	
Net Shear Area	A_{vn} =		4501	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		2121	kN	FHWA 3.1.3
Tension Resistance (Governing)			1369	kN	
Demand/Capacity	D/C =		**0.084**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	19.29 in	490	mm	
L1	L_1 =	4.92 in	125	mm	
L2 - along centreline of action	L_2 =	4.92 in	125	mm	
L3	L_3 =	4.92 in	125	mm	
Unsupported Column Length	L_u =	4.92 in	125	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.08 in	2.02	mm	
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.77		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			963	kN	

Span: Bascule Bridge - Leaf Span
Node: 6S

Demand/Capacity	D/C =			**0.000**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea		
Longest Length of connection	L=	18.74	in	476	mm		
Edge distance	e =	2.20	in	56	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	397	kip	1765	kN		
	B_{r2} =	405	kip	1801	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		299	kip	1327	kN		
Governing Resistance				2655	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.043**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	24.41	in	620	mm	5	
Shear Length 1	L_{V1} =	10.87	in	276	mm	3.5	
Shear Length 2	L_{V2} =	14.25	in	362	mm	4.5	
Tension Length	L_T =	15.55	in	395	mm	5	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
		1732	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		2432	kN	

Block Shear

Gross Tension Area	A_{tg} =	2765	mm^2

Span: Bascule Bridge - Leaf Span

Node: 6S

Gross Shear Area	A_{vg} =		4466	mm^2	
Net Tension Area	A_{tn} =		2044	mm^2	
Net Shear Area	A_{vn} =		3312	mm^2	
$A_{tn} > 0.58*A_{vn}$?			Yes		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0		
Block Shear Resistance	P_{Rbs} =		2244	kN	FHWA 3.1.3
Tension Resistance (Governing)			1732	kN	
Demand/Capacity	D/C =		**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?				Yes		
General						FHWA 3.3
Whitmore Width	W_w =	24.41	in	620	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	13.15	in	334	mm	
L3	L_3 =	4.21	in	107	mm	
Unsupported Column Length	L_u =	5.79	in	147	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.08	in	2.02	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.90		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				1078	kN	
Demand/Capacity	D/C =			**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	25	ea	25	ea		
Longest Length of connection	L=	19.37	in	492	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	421	kip	1871	kN		
	B_{r2} =	633	kip	2814	kN		

Span: Bascule Bridge - Leaf Span
Node: 6S

Shear Resistance of Rivets V_r = $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 CSA S6 CL14.14.1.4.2

467 kip 2074 kN

Governing Resistance 3743 kN for 2 plate(s)

Demand/Capacity D/C = **0.000**

For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	160	709
Shear Resistance (Net Section)	203	904
Shear Resistance (Governing)	160	709
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	461	2049
Shear Resistance (Net Section)	582	2588
Shear Resistance (Governing)	461	2049
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	348	1547
Net Section Resistance	521	2315
Block Shear Resistance	489	2173
Tension Resistance (Governing)	348	1547
At Member C:		
Gross Section Resistance	308	1369
Net Section Resistance	475	2111
Block Shear Resistance	477	2121
Tension Resistance (Governing)	308	1369
At Member D:		
Gross Section Resistance	390	1732
Net Section Resistance	547	2432
Block Shear Resistance	505	2244
Tension Resistance (Governing)	390	1732
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 6S

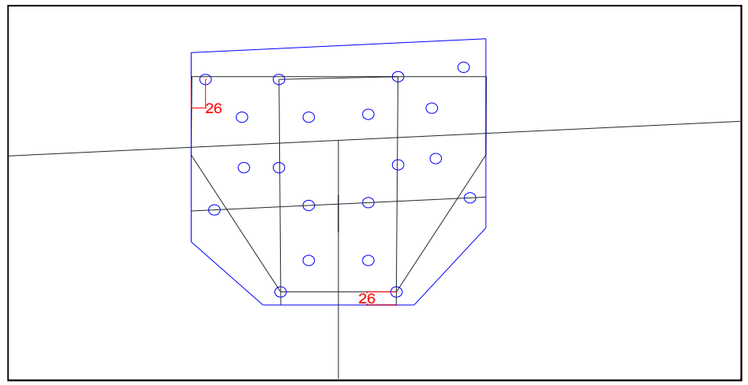
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	197	877
Compressive Resistance at Member C	217	963
Compressive Resistance at Member D	243	1078
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	412	1833
Governing Resistance at Member B	741	3294
Governing Resistance at Member C	597	2655
Governing Resistance at Member D	842	3743
Governing Resistance at Member E	412	1833

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
	SHEAR PLANE A'-A'	160	709	**0.000**	
	SHEAR PLANE B'-B'	461	2049	**0.000**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	348	1547	**0.000**	
	Member C	308	1369	**0.084**	
	Member D	390	1732	**0.000**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	197	877	**0.000**	
	Member C	217	963	**0.000**	
	Member D	243	1078	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	412	1833	**0.341**	<--- Governing
	Member B	741	3294	**0.000**	
	Member C	597	2655	**0.043**	
	Member D	842	3743	**0.000**	
	Member E	412	1833	**0.341**	<--- Governing
	Highest Demand/Capacity Ratio			**0.341**	

Span: Bascule Bridge - Leaf Span
Node: 7N

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.47 in	12 mm	6% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units			
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6	
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa			

MEMBER FORCES

Load Combination:		ULSB3 Max 0		Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
7N-A	P_{Max} =	193.2 kip	858 kN	7N-A	421	858	858	858	858
7N-A	P_{Min} =	76.9 kip	342 kN	7N-A	421	342	342	342	342
7N-B	P_{Max} =	0.0 kip	0 kN	7N-B	0	#N/A	#N/A	#N/A	#N/A
7N-B	P_{Min} =	0.0 kip	0 kN	7N-B	0	#N/A	#N/A	#N/A	#N/A
7N-C	P_{Max} =	-1.4 kip	-6 kN	7N-C	245	-9	-8	-6	-6
7N-C	P_{Min} =	-5.1 kip	-23 kN	7N-C	245	-23	-20	-17	-23
7N-D	P_{Max} =	0.0 kip	0 kN	7N-D	0	#N/A	#N/A	#N/A	#N/A
7N-D	P_{Min} =	0.0 kip	0 kN	7N-D	0	#N/A	#N/A	#N/A	#N/A
7N-E	P_{Max} =	209.9 kip	933 kN	7N-E	420	933	933	932	933
7N-E	P_{Min} =	68.0 kip	302 kN	7N-E	420	302	302	302	302

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 7N

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		0	deg	B
	φ_C =		93	deg	C
	φ_D =		0	deg	D
	$\cos(\varphi_B)$ =		1.000		
	$\cos(\varphi_C)$ =		-0.052		
	$\cos(\varphi_D)$ =		1.000		
	$V_{A'-A',max}$ =	0.3 kip	1	kN	*
	$V_{A'-A',min}$ =	0.1 kip	0	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	0.3 kip	1	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	0.0 kip	0	kN	

*using absolute maximum sums, conservative

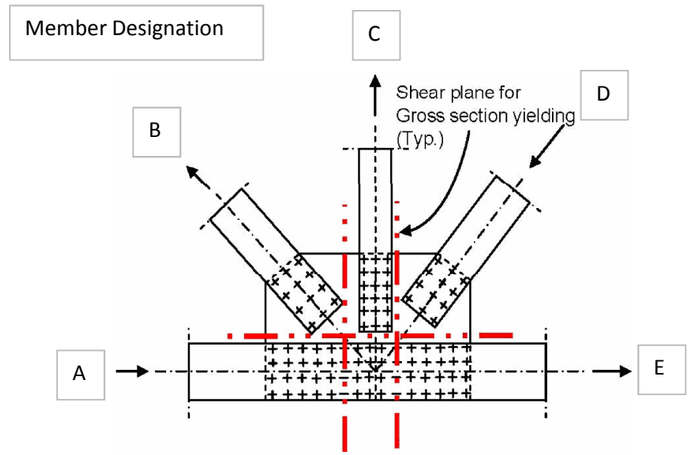


Figure 4 – Examples of gross section shear yielding planes

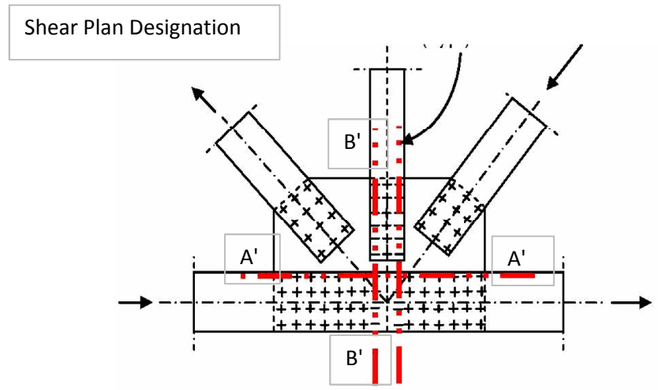


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	21.06	in	535	mm	
No of holes in shear plane	N =	4.00	ea	4	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			12840	mm^2	
Net Shear Area	A_n =			10862	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			1281	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =			1825	kN	
Shear Resistance (Governing)	V_R =			**1281**	**kN**	
Demand/Capacity	D/C =			**0.001**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	20.35	in	517	mm	
No of holes in shear plane	N =	6.00	ea	6	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 7N

Members A and E continuous through the gusset plate?				Yes		
Outside height of member A	H_A=	15	in	381	mm	
Thickness of the web of member A	w_A=	0.40	in	10	mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4	ea	
Gross Shear Area	A_g =			20150	mm^2	
Net Shear Area	A_n =			15509	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2010	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =			2606	kN	
Shear Resistance (Governing)	V_R =			**2010**	**kN**	
Demand/Capacity	D/C =			**0.000**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E

N/A

Members A and E continuous through the gusset plate? Yes

General

Whitmore Width	W_w =	0.00	in	0	mm	Number of Rivet/bolt diameters Intsecting Plane
Shear Length 1	L_{V1} =	0.00	in	0	mm	0
Shear Length 2	L_{V2} =	0.00	in	0	mm	0
Tension Length	L_T =	0.00	in	0	mm	0
Number of Gusset Plates	m =	2.00	ea	2	ea	0 Typ, 1 less than Whitemore Width
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance

CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	
			0	kN
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	
For gusset plates, U=1.0, FHWA 3.1.2			0	kN

FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

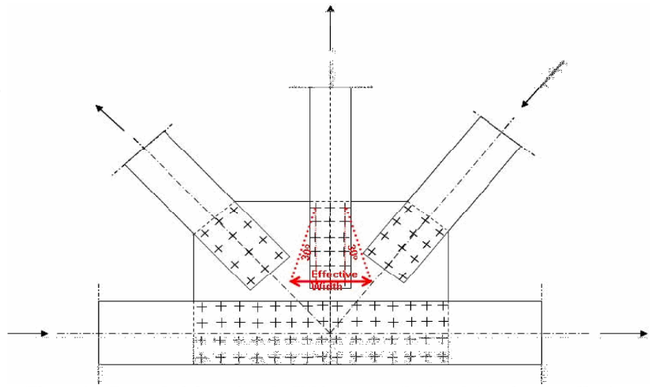


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

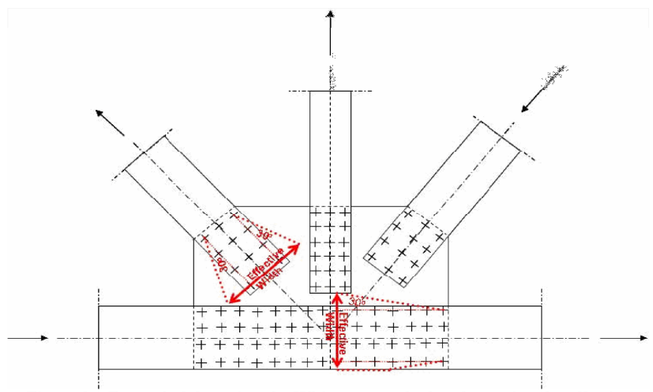


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 7N

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

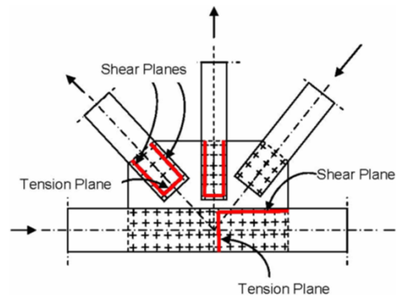


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0 "fixed-free condition"		
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		t/√(12) for rectangular plate		
		0.14 in	3.46 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

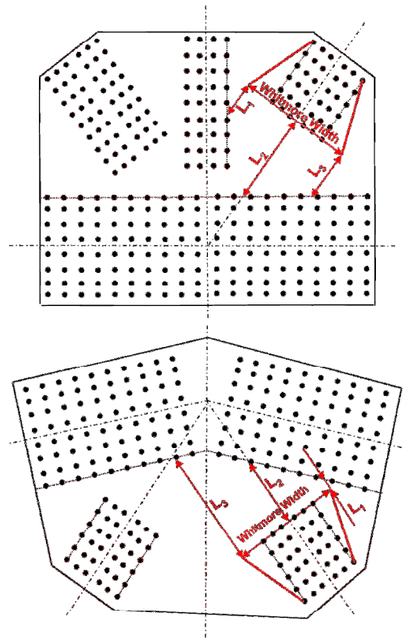


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Possible Scenario?			No			
Number of Rivets/Bolts	n =	16 ea	16 ea			
Longest Length of connection	L=	21.02 in	534 mm			
Edge distance	e =	1.02 in	26 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$			CSA S6 CL14.14.1.4.2
	B_{r1} =	316 kip	1405 kN			
	B_{r2} =	695 kip	3088 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$			CSA S6 CL14.14.1.4.2
		165 kip	733 kN			
Governing Resistance			1467 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span

Node: 7N

Demand/Capacity	D/C =	**0.000**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	21.81	in	554	mm	3
Shear Length 1	L_{V1} =	13.11	in	333	mm	4.5
Shear Length 2	L_{V2} =	11.38	in	289	mm	4.5
Tension Length	L_T =	14.33	in	364	mm	4
Number of Gusset Plates	m =	2	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$ U=1.0		FHWA 3.1.2
		2653	kN	
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$ U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		3969	kN	

Block Shear

Gross Tension Area	A_{tg} =	4368	mm^2
Gross Shear Area	A_{vg} =	7464	mm^2
Net Tension Area	A_{tn} =	3379	mm^2
Net Shear Area	A_{vn} =	5239	mm^2
$A_{tn} \geq 0.58*A_{vn}$?		Yes	

		$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$ U=1.0			
Block Shear Resistance	P_{Rbs} =	3725	kN		FHWA 3.1.3
Tension Resistance (Governing)		2653	kN		
Demand/Capacity	D/C =	**0.000**			

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? Yes

General — FHWA 3.3

Whitmore Width	W_w =	21.81	in	554	mm

Span: Bascule Bridge - Leaf Span

Node: 7N

L1	L_1 =	0.79	in	20	mm	
L2 - along centreline of action	L_2 =	13.54	in	344	mm	
L3	L_3 =	4.88	in	124	mm	
Unsupported Column Length	L_u =	6.40	in	163	mm	
Effective Length Factor	K =	1.20		1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)		for rectangular plate
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.58		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2149	kN	
Demand/Capacity	D/C =			**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22	ea	22	ea	
Longest Length of connection	L=	18.94	in	481	mm	
Edge distance	e =	1.50	in	38	mm	
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")
Shear Planes per gusset plate	m =	1	ea	1	ea	
Number of Gusset Plates		2.00	ea	2	ea	
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0	CSA S6 CL14.14.1.4.2
	B_{r1} =	635	kip	2823	kN	
	B_{r2} =	955	kip	4246	kN	
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81	CSA S6 CL14.14.1.4.2
		411	kip	1825	kN	
Governing Resistance				3650	kN	for 2 plate(s)
Demand/Capacity	D/C =			**0.000**		

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	21.02	in	534	mm	2	
Shear Length 1	L_{V1} =	18.11	in	460	mm	5.5	
Shear Length 2	L_{V2} =	18.11	in	460	mm	5.5	
Tension Length	L_T =	8.27	in	210	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 7N

Number of Gusset Plates	m =	2.00	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =			$\varphi_s*A_g*F_y$	U=1.0	
				2557	kN	
Net Section Resistance	P_{RN} =			$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2				3974	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =			2520	mm^2	
Gross Shear Area	A_{vg} =			11040	mm^2	
Net Tension Area	A_{tn} =			2273	mm^2	
Net Shear Area	A_{vn} =			8321	mm^2	
$A_{tn} > 0.58*A_{vn}$?				No		
				$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =			4090	kN	FHWA 3.1.3
Tension Resistance (Governing)				2557	kN	
Demand/Capacity	D/C =			**0.000**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	21.02	in	534	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	0.00	in	0	mm	
L3	L_3 =	0.00	in	0	mm	
Unsupported Column Length	L_u =	0.00	in	0	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			$t/\sqrt{(12)}$	for rectangular plate	
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\mathrm{sqrt}[F_y/(\pi^2*E_s)]$		
				0.00		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2422	kN	

Span: Bascule Bridge - Leaf Span
Node: 7N

Demand/Capacity	D/C =			**0.009**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	12	ea	12	ea		
Longest Length of connection	L=	18.11	in	460	mm		
Edge distance	e =	1.02	in	26	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	237	kip	1054	kN		
	B_{r2} =	521	kip	2316	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		224	kip	995	kN		
Governing Resistance				1991	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.011**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	24.41	in	620	mm	5	
Shear Length 1	L_{V1} =	10.87	in	276	mm	3.5	
Shear Length 2	L_{V2} =	14.25	in	362	mm	4.5	
Tension Length	L_T =	15.55	in	395	mm	5	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		2969	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		4169	kN		

Block Shear

Gross Tension Area	A_{tg} =	4740	mm^2

Span: Bascule Bridge - Leaf Span

Node: 7N

Gross Shear Area	A_{vg} =			7656	mm^2	
Net Tension Area	A_{tn} =			3504	mm^2	
Net Shear Area	A_{vn} =			5678	mm^2	
$A_{tn} > 0.58*A_{vn}$?				Yes		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$			U=1.0	
Block Shear Resistance	P_{Rbs} =			3847	kN	FHWA 3.1.3
Tension Resistance (Governing)				2969	kN	
Demand/Capacity	D/C =			**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?				Yes		
General						FHWA 3.3
Whitmore Width	W_w =	24.41	in	620	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	13.15	in	334	mm	
L3	L_3 =	4.21	in	107	mm	
Unsupported Column Length	L_u =	5.79	in	147	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.53		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2489	kN	
Demand/Capacity	D/C =			**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	25	ea	25	ea		
Longest Length of connection	L=	19.37	in	492	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	722	kip	3208	kN		
	B_{r2} =	1086	kip	4825	kN		

Span: Bascule Bridge - Leaf Span
Node: 7N

Shear Resistance of Rivets	V_r =	467 kip	$0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 2074 kN	CSA S6 CL14.14.1.4.2
Governing Resistance			4148 kN for 2 plate(s)	
Demand/Capacity	D/C =		**0.000**	
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	288	1281
Shear Resistance (Net Section)	411	1825
Shear Resistance (Governing)	288	1281
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	452	2010
Shear Resistance (Net Section)	586	2606
Shear Resistance (Governing)	452	2010
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	597	2653
Net Section Resistance	893	3969
Block Shear Resistance	838	3725
Tension Resistance (Governing)	597	2653
At Member C:		
Gross Section Resistance	575	2557
Net Section Resistance	894	3974
Block Shear Resistance	920	4090
Tension Resistance (Governing)	575	2557
At Member D:		
Gross Section Resistance	668	2969
Net Section Resistance	938	4169
Block Shear Resistance	866	3847
Tension Resistance (Governing)	668	2969
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 7N

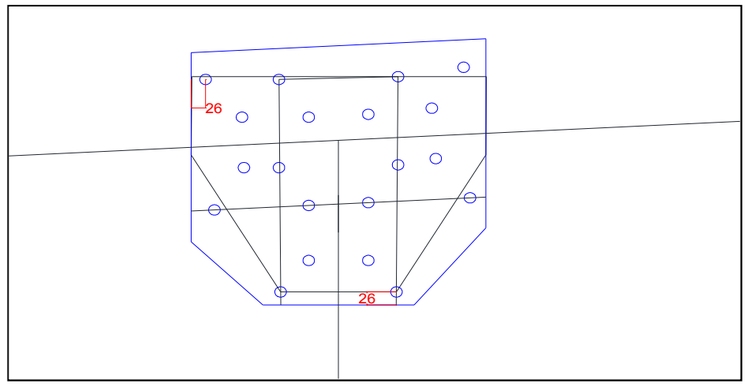
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	483	2149
Compressive Resistance at Member C	545	2422
Compressive Resistance at Member D	560	2489
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	330	1467
Governing Resistance at Member B	821	3650
Governing Resistance at Member C	448	1991
Governing Resistance at Member D	933	4148
Governing Resistance at Member E	330	1467

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
	SHEAR PLANE A'-A'	288	1281	**0.001**	
	SHEAR PLANE B'-B'	452	2010	**0.000**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	597	2653	**0.000**	
	Member C	575	2557	**0.000**	
	Member D	668	2969	**0.000**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	483	2149	**0.000**	
	Member C	545	2422	**0.009**	
	Member D	560	2489	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	330	1467	**0.000**	
	Member B	821	3650	**0.000**	
	Member C	448	1991	**0.011**	<--- Governing
	Member D	933	4148	**0.000**	
	Member E	330	1467	**0.000**	
	Highest Demand/Capacity Ratio			**0.011**	

Span: Bascule Bridge - Leaf Span
Node: 7S

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.47 in	12 mm	6% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units			
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6	
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa			

MEMBER FORCES

Load Combination:		ULSB3 Max 0		Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
7S-A	P_{Max} =	218.7 kip	972 kN	7S-A	490	972	972	971	972
7S-A	P_{Min} =	88.7 kip	394 kN	7S-A	490	394	394	394	394
7S-B	P_{Max} =	0.0 kip	0 kN	7S-B	0	#N/A	#N/A	#N/A	#N/A
7S-B	P_{Min} =	0.0 kip	0 kN	7S-B	0	#N/A	#N/A	#N/A	#N/A
7S-C	P_{Max} =	-1.4 kip	-6 kN	7S-C	575	-9	-7	-6	-6
7S-C	P_{Min} =	-5.0 kip	-22 kN	7S-C	575	-22	-19	-17	-22
7S-D	P_{Max} =	0.0 kip	0 kN	7S-D	0	#N/A	#N/A	#N/A	#N/A
7S-D	P_{Min} =	0.0 kip	0 kN	7S-D	0	#N/A	#N/A	#N/A	#N/A
7S-E	P_{Max} =	227.1 kip	1009 kN	7S-E	489	1009	1009	1009	1009
7S-E	P_{Min} =	76.0 kip	338 kN	7S-E	489	338	338	338	338

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 7S

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		0	deg	B
	φ_C =		93	deg	C
	φ_D =		0	deg	D
	$\cos(\varphi_B)$ =		1.000		
	$\cos(\varphi_C)$ =		-0.052		
	$\cos(\varphi_D)$ =		1.000		
	$V_{A'-A',max}$ =	0.3 kip	1	kN	*
	$V_{A'-A',min}$ =	0.1 kip	0	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	0.3 kip	1	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	0.0 kip	0	kN	

*using absolute maximum sums, conservative

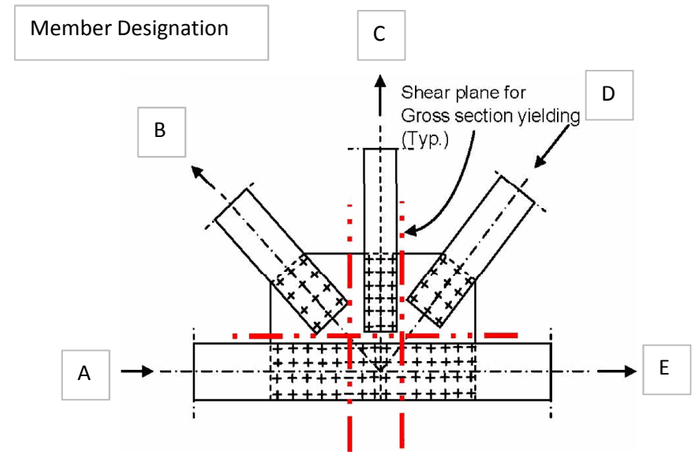


Figure 4 – Examples of gross section shear yielding planes

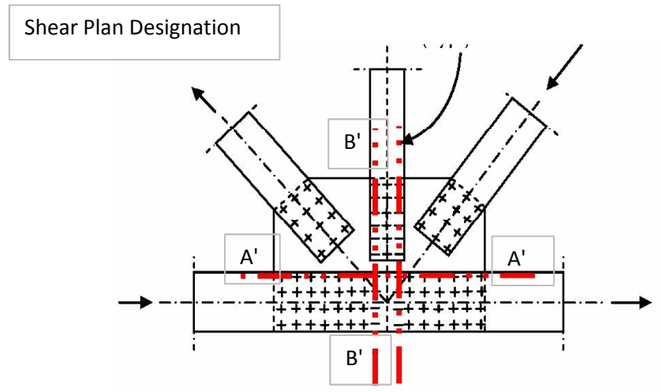


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	21.06 in	535	mm	
No of holes in shear plane	N =	4.00 ea	4	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00 ea	2	ea	
Gross Shear Area	A_g =		12840	mm^2	
Net Shear Area	A_n =		10862	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =		$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =		1281	kN	
Shear Resistance (Net Section)	V_{Rn} =		$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =		1825	kN	
Shear Resistance (Governing)	V_R =		**1281**	**kN**	
Demand/Capacity	D/C =		**0.001**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	20.35 in	517	mm	
No of holes in shear plane	N =	6.00 ea	6	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2 ea	2	ea	

Span: Bascule Bridge - Leaf Span
Node: 7S

Members A and E continuous through the gusset plate?				Yes		
Outside height of member A	H_A=	15	in	381	mm	
Thickness of the web of member A	w_A=	0.40	in	10	mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4	ea	
Gross Shear Area	A_g =			20150	mm^2	
Net Shear Area	A_n =			15509	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2010	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =			2606	kN	
Shear Resistance (Governing)	V_R =			**2010**	**kN**	
Demand/Capacity	D/C =			**0.000**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E — N/A

Members A and E continuous through the gusset plate?				Yes		

General

Whitmore Width	W_w =	0.00	in	0	mm	
Shear Length 1	L_{V1} =	0.00	in	0	mm	
Shear Length 2	L_{V2} =	0.00	in	0	mm	
Tension Length	L_T =	0.00	in	0	mm	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	

Number of Rivet/bolt diameters Intsecting Plane

0	
0	
0	
0	Typ, 1 less than Whitemore Width

($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	
		0	kN
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	
For gusset plates, U=1.0, FHWA 3.1.2		0	kN

FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

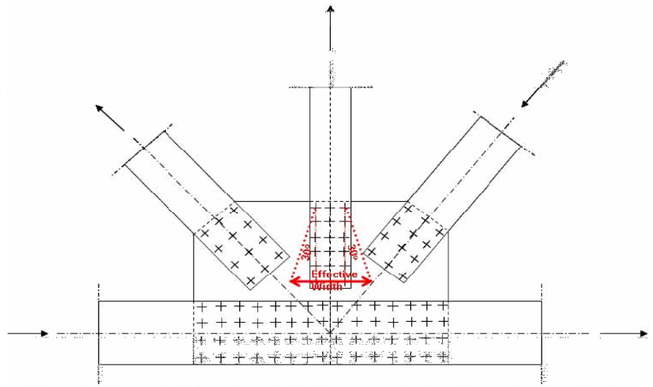


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

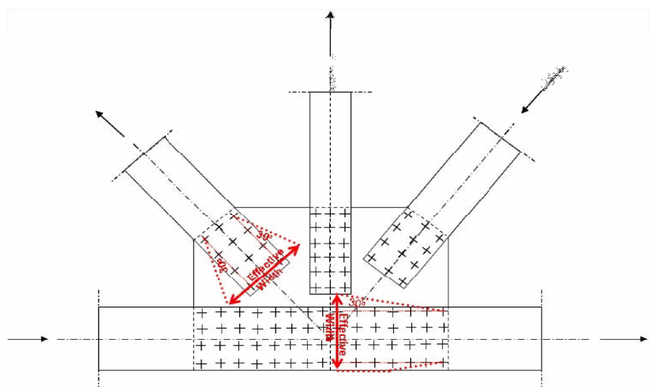


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 7S

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

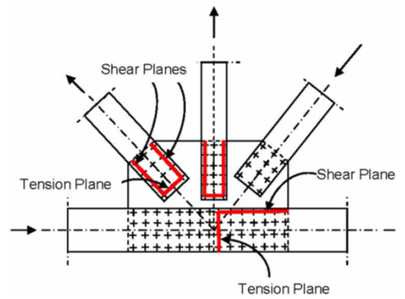


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46 mm		
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

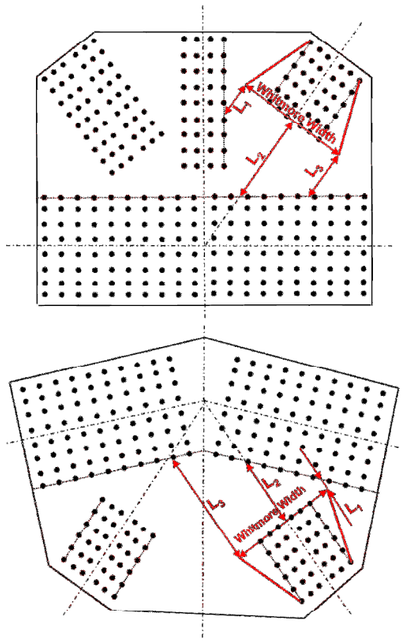


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Possible Scenario?			No			
Number of Rivets/Bolts	n =	16 ea	16 ea			
Longest Length of connection	L=	21.02 in	534 mm			
Edge distance	e =	1.02 in	26 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$			CSA S6 CL14.14.1.4.2
	B_{r1} =	316 kip	1405 kN			
	B_{r2} =	695 kip	3088 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$			CSA S6 CL14.14.1.4.2
		165 kip	733 kN			
Governing Resistance			1467 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span
Node: 7S

Demand/Capacity	D/C =	0.000	
For Connections greater than 50in (1270mm), shear resistance taken as 80%.			FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	21.81	in	554	mm	3
Shear Length 1	L_{V1} =	13.11	in	333	mm	4.5
Shear Length 2	L_{V2} =	11.38	in	289	mm	4.5
Tension Length	L_T =	14.33	in	364	mm	4
Number of Gusset Plates	m =	2	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$ U=1.0	2653 kN	FHWA 3.1.2
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$ U=1.0	3969 kN	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2				

Block Shear

Gross Tension Area	A_{tg} =	4368	mm^2
Gross Shear Area	A_{vg} =	7464	mm^2
Net Tension Area	A_{tn} =	3379	mm^2
Net Shear Area	A_{vn} =	5239	mm^2
$A_{tn} \geq 0.58*A_{vn}$?		Yes	

		$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$ U=1.0		
Block Shear Resistance	P_{Rbs} =		3725 kN	FHWA 3.1.3
Tension Resistance (Governing)			2653 kN	
Demand/Capacity	D/C =		0.000	

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? Yes

General — FHWA 3.3

Whitmore Width	W_w =	21.81	in	554 mm

Span: Bascule Bridge - Leaf Span

Node: 7S

L1	L_1 =	0.79	in	20	mm	
L2 - along centreline of action	L_2 =	13.54	in	344	mm	
L3	L_3 =	4.88	in	124	mm	
Unsupported Column Length	L_u =	6.40	in	163	mm	
Effective Length Factor	K =	1.20		1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)		for rectangular plate
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.58		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2149	kN	
Demand/Capacity	D/C =			**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22	ea	22	ea	
Longest Length of connection	L=	18.94	in	481	mm	
Edge distance	e =	1.50	in	38	mm	
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")
Shear Planes per gusset plate	m =	1	ea	1	ea	
Number of Gusset Plates		2.00	ea	2	ea	
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0	CSA S6 CL14.14.1.4.2
	B_{r1} =	635	kip	2823	kN	
	B_{r2} =	955	kip	4246	kN	
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81	CSA S6 CL14.14.1.4.2
		411	kip	1825	kN	
Governing Resistance				3650	kN	for 2 plate(s)
Demand/Capacity	D/C =			**0.000**		

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	21.02	in	534	mm	2	
Shear Length 1	L_{V1} =	18.11	in	460	mm	5.5	
Shear Length 2	L_{V2} =	18.11	in	460	mm	5.5	
Tension Length	L_T =	8.27	in	210	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 7S

Number of Gusset Plates	m =	2.00	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =			$\varphi_s*A_g*F_y$	U=1.0	
				2557	kN	
Net Section Resistance	P_{RN} =			$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2				3974	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =			2520	mm^2	
Gross Shear Area	A_{vg} =			11040	mm^2	
Net Tension Area	A_{tn} =			2273	mm^2	
Net Shear Area	A_{vn} =			8321	mm^2	
$A_{tn} > 0.58*A_{vn}$?				No		
				$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =			4090	kN	FHWA 3.1.3
Tension Resistance (Governing)				2557	kN	
Demand/Capacity	D/C =			**0.000**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	21.02	in	534	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	0.00	in	0	mm	
L3	L_3 =	0.00	in	0	mm	
Unsupported Column Length	L_u =	0.00	in	0	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			$t/\sqrt{(12)}$	for rectangular plate	
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\mathrm{sqrt}[F_y/(\pi^2*E_s)]$		
				0.00		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2422	kN	

Span: Bascule Bridge - Leaf Span
Node: 7S

Demand/Capacity	D/C =			**0.009**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	12	ea	12	ea		
Longest Length of connection	L=	18.11	in	460	mm		
Edge distance	e =	1.02	in	26	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	237	kip	1054	kN		
	B_{r2} =	521	kip	2316	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		224	kip	995	kN		
Governing Resistance				1991	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.011**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	24.41	in	620	mm	5	
Shear Length 1	L_{V1} =	10.87	in	276	mm	3.5	
Shear Length 2	L_{V2} =	14.25	in	362	mm	4.5	
Tension Length	L_T =	15.55	in	395	mm	5	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		2969	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		4169	kN		

Block Shear

Gross Tension Area	A_{tg} =	4740	mm^2

Span: Bascule Bridge - Leaf Span

Node: 7S

Gross Shear Area	A_{vg} =			7656	mm^2	
Net Tension Area	A_{tn} =			3504	mm^2	
Net Shear Area	A_{vn} =			5678	mm^2	
$A_{tn} > 0.58*A_{vn}$?				Yes		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		U=1.0	
Block Shear Resistance	P_{Rbs} =			3847	kN	FHWA 3.1.3
Tension Resistance (Governing)				2969	kN	
Demand/Capacity	D/C =			**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?				Yes		
General						FHWA 3.3
Whitmore Width	W_w =	24.41	in	620	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	13.15	in	334	mm	
L3	L_3 =	4.21	in	107	mm	
Unsupported Column Length	L_u =	5.79	in	147	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.53		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2489	kN	
Demand/Capacity	D/C =			**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	25	ea	25	ea		
Longest Length of connection	L=	19.37	in	492	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	722	kip	3208	kN		
	B_{r2} =	1086	kip	4825	kN		

Span: Bascule Bridge - Leaf Span

Node: 7S

Shear Resistance of Rivets V_r = $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 CSA S6 CL14.14.1.4.2

467 kip 2074 kN

Governing Resistance 4148 kN for 2 plate(s)

Demand/Capacity D/C = **0.000**

For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	288	1281
Shear Resistance (Net Section)	411	1825
Shear Resistance (Governing)	288	1281
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	452	2010
Shear Resistance (Net Section)	586	2606
Shear Resistance (Governing)	452	2010
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	597	2653
Net Section Resistance	893	3969
Block Shear Resistance	838	3725
Tension Resistance (Governing)	597	2653
At Member C:		
Gross Section Resistance	575	2557
Net Section Resistance	894	3974
Block Shear Resistance	920	4090
Tension Resistance (Governing)	575	2557
At Member D:		
Gross Section Resistance	668	2969
Net Section Resistance	938	4169
Block Shear Resistance	866	3847
Tension Resistance (Governing)	668	2969
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 7S

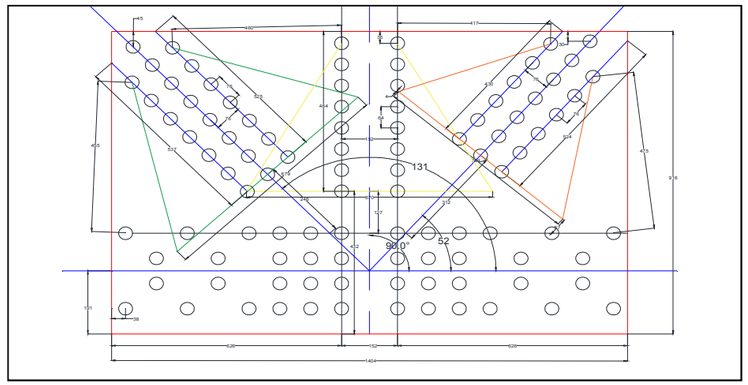
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	483	2149
Compressive Resistance at Member C	545	2422
Compressive Resistance at Member D	560	2489
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	330	1467
Governing Resistance at Member B	821	3650
Governing Resistance at Member C	448	1991
Governing Resistance at Member D	933	4148
Governing Resistance at Member E	330	1467

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
	SHEAR PLANE A'-A'	288	1281	**0.001**	
	SHEAR PLANE B'-B'	452	2010	**0.000**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	597	2653	**0.000**	
	Member C	575	2557	**0.000**	
	Member D	668	2969	**0.000**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	483	2149	**0.000**	
	Member C	545	2422	**0.009**	
	Member D	560	2489	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	330	1467	**0.000**	
	Member B	821	3650	**0.000**	
	Member C	448	1991	**0.011**	<--- Governing
	Member D	933	4148	**0.000**	
	Member E	330	1467	**0.000**	
	Highest Demand/Capacity Ratio			**0.011**	

Span: Bascule Bridge - Leaf Span
Node: 8N

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.31 in	8 mm	37% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units		
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa		

MEMBER FORCES

Load Combination:		ULSB3 Max 0	
8N-A	P_{Max} =	0.8 kip	4 kN
8N-A	P_{Min} =	-126.0 kip	-560 kN
8N-B	P_{Max} =	-61.1 kip	-271 kN
8N-B	P_{Min} =	-118.8 kip	-528 kN
8N-C	P_{Max} =	-1.4 kip	-6 kN
8N-C	P_{Min} =	-5.1 kip	-23 kN
8N-D	P_{Max} =	147.8 kip	657 kN
8N-D	P_{Min} =	76.5 kip	340 kN
8N-E	P_{Max} =	-60.8 kip	-270 kN
8N-E	P_{Min} =	-316.3 kip	-1406 kN

Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
8N-A	282	4	4	4	4
8N-A	282	-560	-560	-560	-560
8N-B	8	-271	-274	-276	-271
8N-B	8	-520	-524	-528	-528
8N-C	245	-9	-8	-6	-6
8N-C	245	-23	-20	-17	-23
8N-D	9	648	652	657	657
8N-D	9	340	342	345	340
8N-E	283	-270	-270	-270	-270
8N-E	283	-1406	-1406	-1406	-1406

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 8N

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		131	deg	B
	φ_C =		90	deg	C
	φ_D =		52	deg	D
	$\cos(\varphi_B)$ =		-0.656		
	$\cos(\varphi_C)$ =		0.000		
	$\cos(\varphi_D)$ =		0.616		
	$V_{A'-A',max}$ =	169.0 kip	751	kN	*
	$V_{A'-A',min}$ =	87.2 kip	387	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	169.0 kip	751	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	116.5 kip	518	kN	

*using absolute maximum sums, conservative

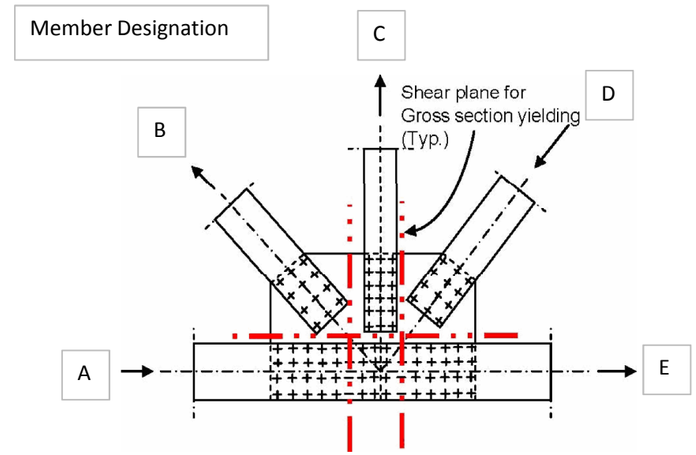


Figure 4 – Examples of gross section shear yielding planes

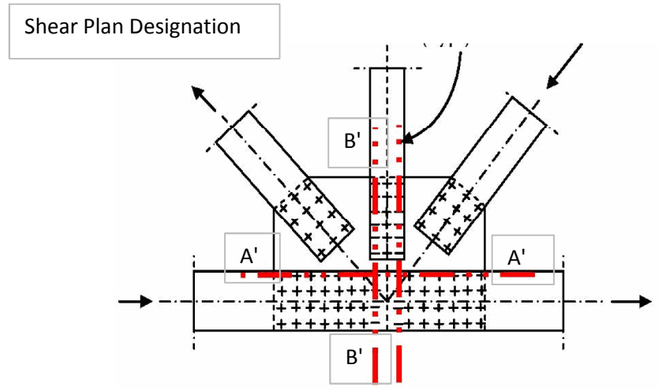


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	55.12	in	1400	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			22400	mm^2	
Net Shear Area	A_n =			18445	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2234	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$ *		Cl 10.18.5.2
	V_{Rn} =			3099	kN	
Shear Resistance (Governing)	V_R =			**2234**	**kN**	
Demand/Capacity	D/C =			**0.336**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	36.02	in	915	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 8N

Members A and E continuous through the gusset plate?			Yes		
Outside height of member A	H_A=	15 in	381	mm	
Thickness of the web of member A	w_A=	0.40 in	10	mm	
No of holes in member A/E in shear plane	N_A=	4 ea	4	ea	
Gross Shear Area	A_g =		22382	mm^2	
Net Shear Area	A_n =		16752	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =		$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =		2233	kN	
Shear Resistance (Net Section)	V_{Rn} =		$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =		2814	kN	
Shear Resistance (Governing)	V_R =		**2233**	**kN**	
Demand/Capacity	D/C =		**0.232**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E — N/A

Members A and E continuous through the gusset plate? Yes

General

					Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	0.00 in	0	mm	0	
Shear Length 1	L_{V1} =	0.00 in	0	mm	0	
Shear Length 2	L_{V2} =	0.00 in	0	mm	0	
Tension Length	L_T =	0.00 in	0	mm	0	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00 ea	2	ea		
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$		
		0	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$		
For gusset plates, U=1.0, FHWA 3.1.2		0	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

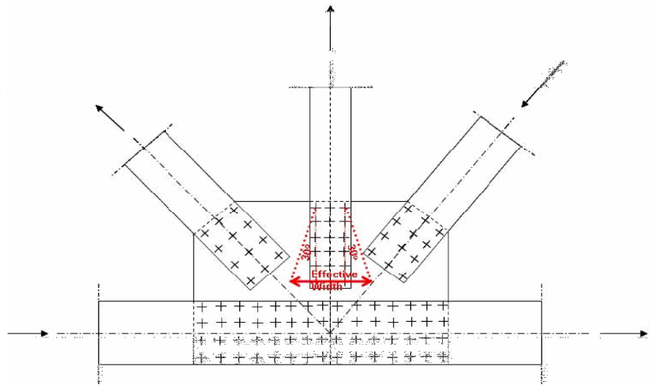


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

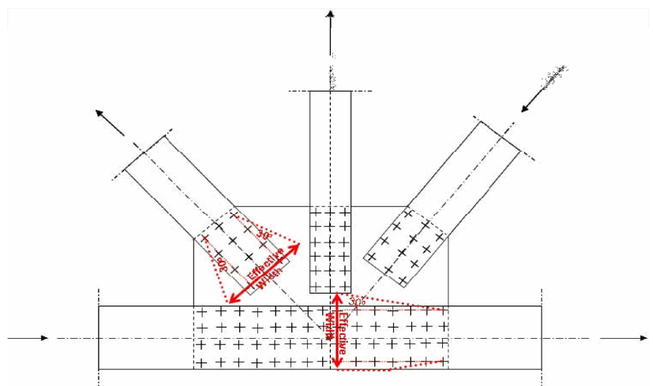


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 8N

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		0.000		

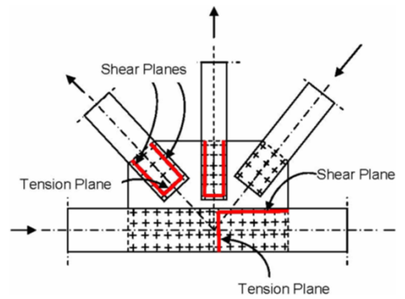


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.09 in	2.31 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		0.000		

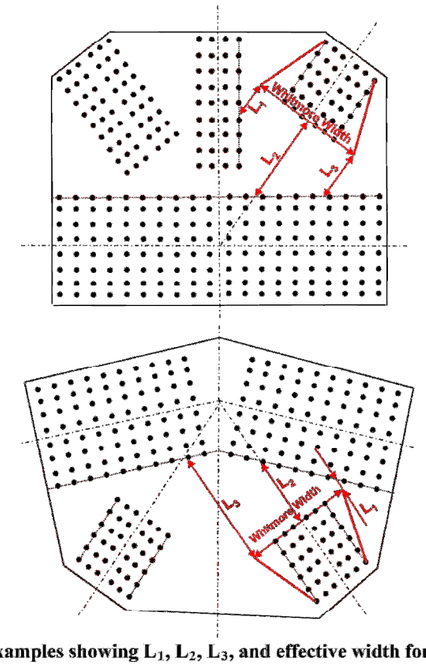


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	44 ea	44 ea			
Longest Length of connection	L=	53.78 in	1366 mm			
Edge distance	e =	1.50 in	38 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$			CSA S6 CL14.14.1.4.2
	B_{r1} =	847 kip	3764 kN			
	B_{r2} =	1274 kip	5661 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$			CSA S6 CL14.14.1.4.2
		454 kip	2017 kN			
Governing Resistance			3227 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span

Node: 8N

Demand/Capacity	D/C =	**0.436**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? Yes

General

					Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	26.77 in	680	mm	3
Shear Length 1	L_{V1} =	20.67 in	525	mm	6.5
Shear Length 2	L_{V2} =	21.06 in	535	mm	6.5
Tension Length	L_T =	5.98 in	152	mm	2
Number of Gusset Plates	m =	2 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$	2171	kN	U=1.0 FHWA 3.1.2
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$	3323	kN	U=1.0 FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2					

Block Shear

Gross Tension Area	A_{tg} =	1216	mm^2
Gross Shear Area	A_{vg} =	8480	mm^2
Net Tension Area	A_{tn} =	886	mm^2
Net Shear Area	A_{vn} =	6338	mm^2
$A_{tn} \geq 0.58*A_{vn}$?		No	

		$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$			U=1.0
Block Shear Resistance	P_{Rbs} =		2879	kN	FHWA 3.1.3
Tension Resistance (Governing)			2171	kN	
Demand/Capacity	D/C =		**0.000**		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? Yes

General — FHWA 3.3

Whitmore Width	W_w =	26.77 in	680	mm

Span: Bascule Bridge - Leaf Span

Node: 8N

L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	9.84 in	250	mm	
L3	L_3 =	0.00 in	0	mm	
Unsupported Column Length	L_u =	3.28 in	83	mm	
Effective Length Factor	K =	1.20	1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)		for rectangular plate
		0.09 in	2.31	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.45		
Compressive Resistance	C_r =		$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		U=1.0
			1895	kN	
Demand/Capacity	D/C =		**0.279**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22 ea	22	ea		
Longest Length of connection	L=	20.98 in	533	mm		
Edge distance	e =	1.50 in	38	mm		
Diameter of Rivet	d =	0.75 in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1	ea		
Number of Gusset Plates		2.00 ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$		U=1.0	CSA S6 CL14.14.1.4.2
	B_{r1} =	423 kip	1882	kN		
	B_{r2} =	637 kip	2830	kN		
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$		U=1.81	CSA S6 CL14.14.1.4.2
		411 kip	1825	kN		
Governing Resistance			3650	kN	for 2 plate(s)	
Demand/Capacity	D/C =		**0.145**			

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

					Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	26.38 in	670	mm	2	
Shear Length 1	L_{V1} =	19.06 in	484	mm	7.5	
Shear Length 2	L_{V2} =	19.06 in	484	mm	7.5	
Tension Length	L_T =	5.98 in	152	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 8N

Number of Gusset Plates	m =	2.00	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =			$\varphi_s*A_g*F_y$	U=1.0	
				2139	kN	
Net Section Resistance	P_{RN} =			$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2				3380	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =			1216	mm^2	
Gross Shear Area	A_{vg} =			7744	mm^2	
Net Tension Area	A_{tn} =			1051	mm^2	
Net Shear Area	A_{vn} =			5272	mm^2	
$A_{tn} > 0.58*A_{vn}$?				No		
				$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =			2463	kN	FHWA 3.1.3
Tension Resistance (Governing)				2139	kN	
Demand/Capacity	D/C =			**0.000**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	26.38	in	670	mm	
L1	L_1 =	5.00	in	127	mm	
L2 - along centreline of action	L_2 =	5.00	in	127	mm	
L3	L_3 =	5.00	in	127	mm	
Unsupported Column Length	L_u =	5.00	in	127	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.09	in	2.31	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.68		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				1614	kN	

Span: Bascule Bridge - Leaf Span
Node: 8N

Demand/Capacity	D/C =			**0.014**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea		
Longest Length of connection	L=	19.06	in	484	mm		
Edge distance	e =	1.42	in	36	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	292	kip	1297	kN		
	B_{r2} =	463	kip	2058	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		299	kip	1327	kN		
Governing Resistance				2593	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.009**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	23.23	in	590	mm	3	
Shear Length 1	L_{V1} =	20.63	in	524	mm	5.5	
Shear Length 2	L_{V2} =	16.93	in	430	mm	5.5	
Tension Length	L_T =	5.98	in	152	mm	2	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		1883	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		2840	kN		

Block Shear

Gross Tension Area	A_{tg} =	1216	mm^2

Span: Bascule Bridge - Leaf Span

Node: 8N

Gross Shear Area	A_{vg} =	7632	mm^2	
Net Tension Area	A_{tn} =	886	mm^2	
Net Shear Area	A_{vn} =	5819	mm^2	
$A_{tn} > 0.58*A_{vn}$?		No		
	$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0		
Block Shear Resistance	P_{Rbs} =	2677	kN	FHWA 3.1.3
Tension Resistance (Governing)		1883	kN	
Demand/Capacity	D/C =	**0.349**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?				Yes		
General						FHWA 3.3
Whitmore Width	W_w =	23.23	in	590	mm	
L1	L_1 =	0.16	in	4	mm	
L2 - along centreline of action	L_2 =	12.28	in	312	mm	
L3	L_3 =	2.24	in	57	mm	
Unsupported Column Length	L_u =	4.90	in	124	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.09	in	2.31	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.67		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				1437	kN	
Demand/Capacity	D/C =			**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	19	ea	19	ea		
Longest Length of connection	L=	20.63	in	524	mm		
Edge distance	e =	1.18	in	30	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	289	kip	1283	kN		
	B_{r2} =	550	kip	2444	kN		

Span: Bascule Bridge - Leaf Span

Node: 8N

Shear Resistance of Rivets V_r = $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 CSA S6 CL14.14.1.4.2

355 kip 1576 kN

Governing Resistance 2566 kN for 2 plate(s)

Demand/Capacity D/C = **0.256**

For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	503	2234
Shear Resistance (Net Section)	697	3099
Shear Resistance (Governing)	503	2234
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	502	2233
Shear Resistance (Net Section)	633	2814
Shear Resistance (Governing)	502	2233
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	488	2171
Net Section Resistance	748	3323
Block Shear Resistance	648	2879
Tension Resistance (Governing)	488	2171
At Member C:		
Gross Section Resistance	481	2139
Net Section Resistance	761	3380
Block Shear Resistance	554	2463
Tension Resistance (Governing)	481	2139
At Member D:		
Gross Section Resistance	424	1883
Net Section Resistance	639	2840
Block Shear Resistance	602	2677
Tension Resistance (Governing)	424	1883
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 8N

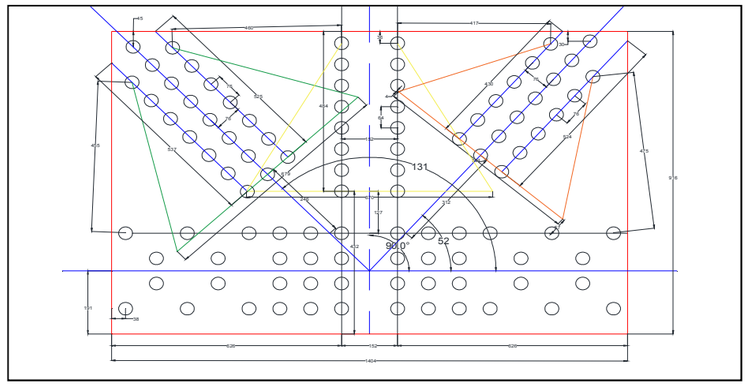
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	426	1895
Compressive Resistance at Member C	363	1614
Compressive Resistance at Member D	323	1437
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	726	3227
Governing Resistance at Member B	821	3650
Governing Resistance at Member C	584	2593
Governing Resistance at Member D	577	2566
Governing Resistance at Member E	726	3227

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
SHEAR PLANE A'-A'		503	2234	**0.336**	
SHEAR PLANE B'-B'		502	2233	**0.232**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	488	2171	**0.000**	
	Member C	481	2139	**0.000**	
	Member D	424	1883	**0.349**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	426	1895	**0.279**	
	Member C	363	1614	**0.014**	
	Member D	323	1437	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	726	3227	**0.436**	<--- Governing
	Member B	821	3650	**0.145**	
	Member C	584	2593	**0.009**	
	Member D	577	2566	**0.256**	
	Member E	726	3227	**0.436**	<--- Governing
Highest Demand/Capacity Ratio				**0.436**	

Span: Bascule Bridge - Leaf Span
Node: 8S

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.31 in	8 mm	37% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units		
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa		

MEMBER FORCES

Load Combination:		ULSB3 Max 0	
8S-A	P_{Max} =	-5.9 kip	-26 kN
8S-A	P_{Min} =	-140.7 kip	-625 kN
8S-B	P_{Max} =	-66.7 kip	-296 kN
8S-B	P_{Min} =	-131.0 kip	-582 kN
8S-C	P_{Max} =	-1.4 kip	-6 kN
8S-C	P_{Min} =	-5.0 kip	-22 kN
8S-D	P_{Max} =	166.7 kip	741 kN
8S-D	P_{Min} =	85.2 kip	379 kN
8S-E	P_{Max} =	-73.0 kip	-324 kN
8S-E	P_{Min} =	-342.6 kip	-1523 kN

Note: Tension is positive.

Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
8S-A	562	-26	-26	-26	-26
8S-A	562	-625	-625	-625	-625
8S-B	184	-296	-299	-301	-296
8S-B	184	-574	-578	-582	-582
8S-C	575	-9	-7	-6	-6
8S-C	575	-22	-19	-17	-22
8S-D	185	732	736	741	741
8S-D	185	379	381	384	379
8S-E	563	-324	-324	-324	-324
8S-E	563	-1523	-1523	-1523	-1523

Span: Bascule Bridge - Leaf Span
Node: 8S

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		131	deg	B
	φ_C =		90	deg	C
	φ_D =		52	deg	D
	$\cos(\varphi_B)$ =		-0.656		
	$\cos(\varphi_C)$ =		0.000		
	$\cos(\varphi_D)$ =		0.616		
	$V_{A'-A',max}$ =	188.6 kip	838	kN	*
	$V_{A'-A',min}$ =	96.2 kip	428	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	188.6 kip	838	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	131.4 kip	584	kN

*using absolute maximum sums, conservative

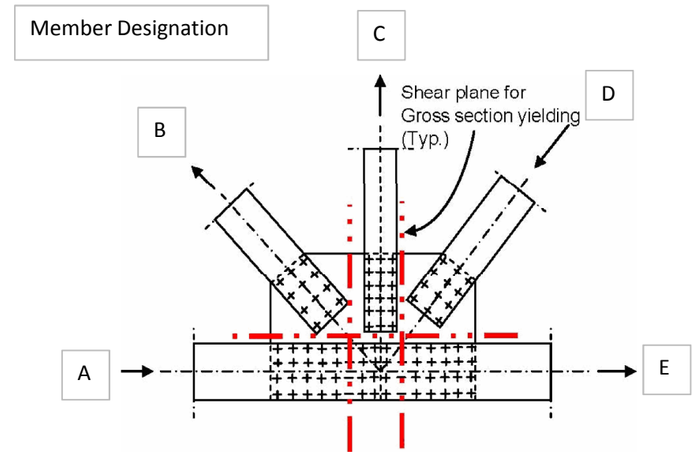


Figure 4 – Examples of gross section shear yielding planes

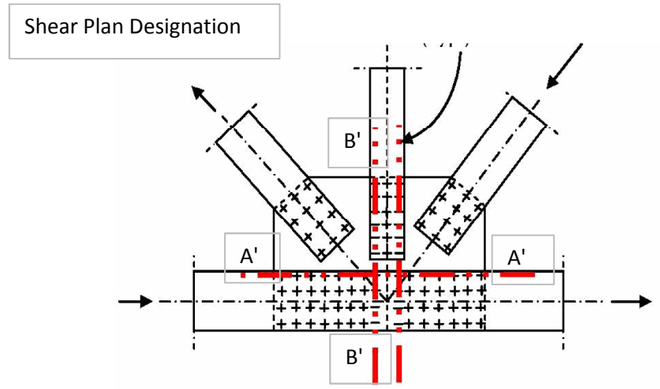


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	55.12	in	1400	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			22400	mm^2	
Net Shear Area	A_n =			18445	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2234	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =			3099	kN	
Shear Resistance (Governing)	V_R =			**2234**	**kN**	
Demand/Capacity	D/C =			**0.375**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	36.02	in	915	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 8S

Members A and E continuous through the gusset plate?				Yes	
Outside height of member A	H_A=	15	in	381 mm	
Thickness of the web of member A	w_A=	0.40	in	10 mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4 ea	
Gross Shear Area	A_g =			22382 mm^2	
Net Shear Area	A_n =			16752 mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$	Cl 10.18.5.2
	V_{Rg} =			2233 kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$ *	Cl 10.18.5.2
	V_{Rn} =			2814 kN	
Shear Resistance (Governing)	V_R =			**2233 kN**	
Demand/Capacity	D/C =			**0.262**	

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E — N/A

Members A and E continuous through the gusset plate?				Yes	

General

					Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	0.00	in	0 mm	0	
Shear Length 1	L_{V1} =	0.00	in	0 mm	0	
Shear Length 2	L_{V2} =	0.00	in	0 mm	0	
Tension Length	L_T =	0.00	in	0 mm	0	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2 ea		
Diameter of holes in plane	d_b =	0.81	in	21 mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	
		0 kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		0 kN	

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

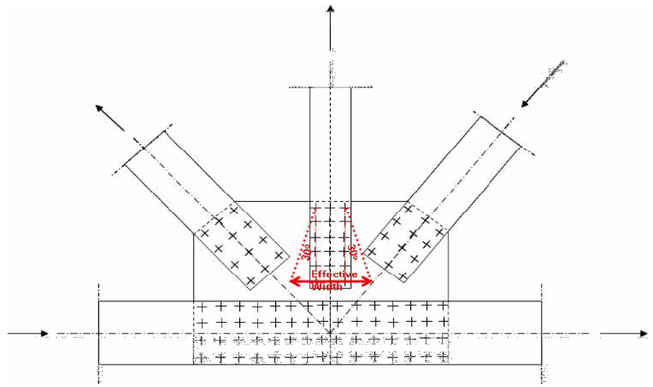


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

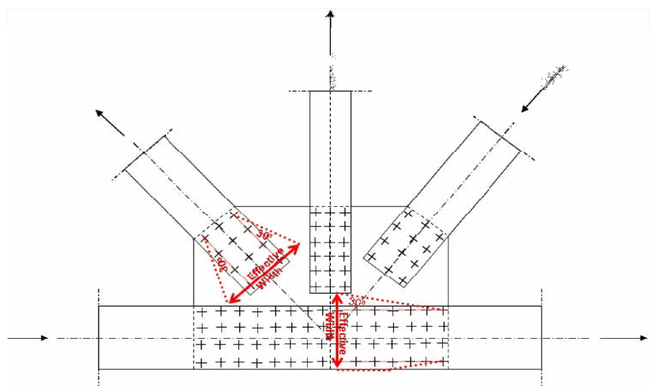


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 8S

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

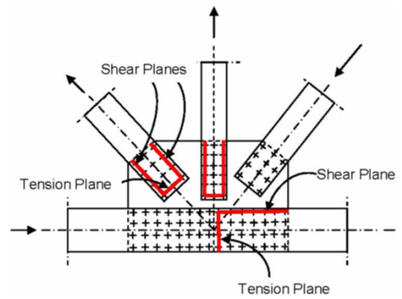


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.09 in	2.31 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

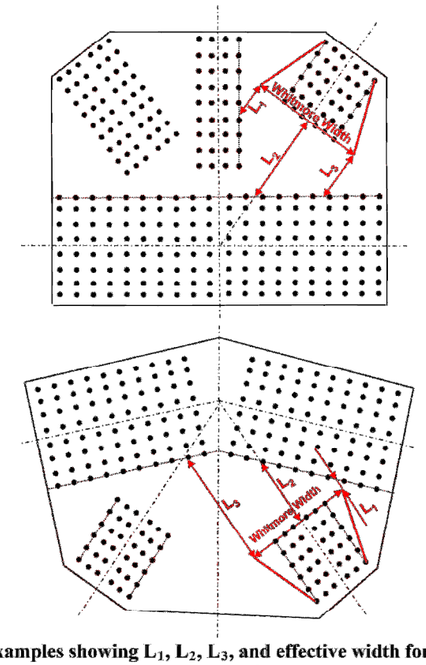


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	44 ea	44 ea			
Longest Length of connection	L=	53.78 in	1366 mm			
Edge distance	e =	1.50 in	38 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$			CSA S6 CL14.14.1.4.2
	B_{r1} =	847 kip	3764 kN			
	B_{r2} =	1274 kip	5661 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$			CSA S6 CL14.14.1.4.2
		454 kip	2017 kN			
Governing Resistance			3227 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span

Node: 8S

Demand/Capacity	D/C =	**0.472**	
For Connections greater than 50in (1270mm), shear resistance taken as 80%.			FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	26.77	in	680	mm	3
Shear Length 1	L_{V1} =	20.67	in	525	mm	6.5
Shear Length 2	L_{V2} =	21.06	in	535	mm	6.5
Tension Length	L_T =	5.98	in	152	mm	2
Number of Gusset Plates	m =	2	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$ U=1.0	2171 kN	FHWA 3.1.2
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$ U=1.0	3323 kN	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2				

Block Shear

Gross Tension Area	A_{tg} =	1216	mm^2
Gross Shear Area	A_{vg} =	8480	mm^2
Net Tension Area	A_{tn} =	886	mm^2
Net Shear Area	A_{vn} =	6338	mm^2
$A_{tn} \geq 0.58*A_{vn}$?		No	

		$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$ U=1.0		
Block Shear Resistance	P_{Rbs} =		2879 kN	FHWA 3.1.3
Tension Resistance (Governing)			2171 kN	
Demand/Capacity	D/C =		**0.000**	

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? Yes

General — FHWA 3.3

Whitmore Width	W_w =	26.77	in	680 mm

Span: Bascule Bridge - Leaf Span

Node: 8S

L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	9.84	in	250	mm	
L3	L_3 =	0.00	in	0	mm	
Unsupported Column Length	L_u =	3.28	in	83	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.09	in	2.31	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.45		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				1895	kN	
Demand/Capacity	D/C =			**0.307**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22	ea	22	ea	
Longest Length of connection	L=	20.98	in	533	mm	
Edge distance	e =	1.50	in	38	mm	
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")
Shear Planes per gusset plate	m =	1	ea	1	ea	
Number of Gusset Plates		2.00	ea	2	ea	
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0	CSA S6 CL14.14.1.4.2
	B_{r1} =	423	kip	1882	kN	
	B_{r2} =	637	kip	2830	kN	
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81	CSA S6 CL14.14.1.4.2
		411	kip	1825	kN	
Governing Resistance				3650	kN	for 2 plate(s)
Demand/Capacity	D/C =			**0.159**		

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	26.38	in	670	mm	2	
Shear Length 1	L_{V1} =	19.06	in	484	mm	7.5	
Shear Length 2	L_{V2} =	19.06	in	484	mm	7.5	
Tension Length	L_T =	5.98	in	152	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 8S

Number of Gusset Plates	m =	2.00	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =			$\varphi_s*A_g*F_y$	U=1.0	
				2139	kN	
Net Section Resistance	P_{RN} =			$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2				3380	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =			1216	mm^2	
Gross Shear Area	A_{vg} =			7744	mm^2	
Net Tension Area	A_{tn} =			1051	mm^2	
Net Shear Area	A_{vn} =			5272	mm^2	
$A_{tn} > 0.58*A_{vn}$?				No		
				$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =			2463	kN	FHWA 3.1.3
Tension Resistance (Governing)				2139	kN	
Demand/Capacity	D/C =			**0.000**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	26.38	in	670	mm	
L1	L_1 =	5.00	in	127	mm	
L2 - along centreline of action	L_2 =	5.00	in	127	mm	
L3	L_3 =	5.00	in	127	mm	
Unsupported Column Length	L_u =	5.00	in	127	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			$t/\sqrt{(12)}$	for rectangular plate	
		0.09	in	2.31	mm	
	λ =			$(K*L_u/r)*\mathrm{sqrt}[F_y/(\pi^2*E_s)]$		
				0.68		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				1614	kN	

Span: Bascule Bridge - Leaf Span
Node: 8S

Demand/Capacity	D/C =			**0.014**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea		
Longest Length of connection	L=	19.06	in	484	mm		
Edge distance	e =	1.42	in	36	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	292	kip	1297	kN		
	B_{r2} =	463	kip	2058	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		299	kip	1327	kN		
Governing Resistance				2593	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.009**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	23.23	in	590	mm	3	
Shear Length 1	L_{V1} =	20.63	in	524	mm	5.5	
Shear Length 2	L_{V2} =	16.93	in	430	mm	5.5	
Tension Length	L_T =	5.98	in	152	mm	2	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		1883	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		2840	kN		

Block Shear

Gross Tension Area	A_{tg} =	1216	mm^2

Span: Bascule Bridge - Leaf Span

Node: 8S

Gross Shear Area	A_{vg} =	7632	mm^2	
Net Tension Area	A_{tn} =	886	mm^2	
Net Shear Area	A_{vn} =	5819	mm^2	
$A_{tn} > 0.58*A_{vn}$?		No		
	$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0		
Block Shear Resistance	P_{Rbs} =	2677	kN	FHWA 3.1.3
Tension Resistance (Governing)		1883	kN	
Demand/Capacity	D/C =	**0.393**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?				Yes		
General						FHWA 3.3
Whitmore Width	W_w =	23.23	in	590	mm	
L1	L_1 =	0.16	in	4	mm	
L2 - along centreline of action	L_2 =	12.28	in	312	mm	
L3	L_3 =	2.24	in	57	mm	
Unsupported Column Length	L_u =	4.90	in	124	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.09	in	2.31	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.67		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				1437	kN	
Demand/Capacity	D/C =			**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	19	ea	19	ea		
Longest Length of connection	L=	20.63	in	524	mm		
Edge distance	e =	1.18	in	30	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	289	kip	1283	kN		
	B_{r2} =	550	kip	2444	kN		

Span: Bascule Bridge - Leaf Span
Node: 8S

Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$ U=1.81	CSA S6 CL14.14.1.4.2
		355 kip	1576 kN	
Governing Resistance			2566 kN for 2 plate(s)	
Demand/Capacity	D/C =		**0.289**	
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	503	2234
Shear Resistance (Net Section)	697	3099
Shear Resistance (Governing)	503	2234
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	502	2233
Shear Resistance (Net Section)	633	2814
Shear Resistance (Governing)	502	2233
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	488	2171
Net Section Resistance	748	3323
Block Shear Resistance	648	2879
Tension Resistance (Governing)	488	2171
At Member C:		
Gross Section Resistance	481	2139
Net Section Resistance	761	3380
Block Shear Resistance	554	2463
Tension Resistance (Governing)	481	2139
At Member D:		
Gross Section Resistance	424	1883
Net Section Resistance	639	2840
Block Shear Resistance	602	2677
Tension Resistance (Governing)	424	1883
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 8S

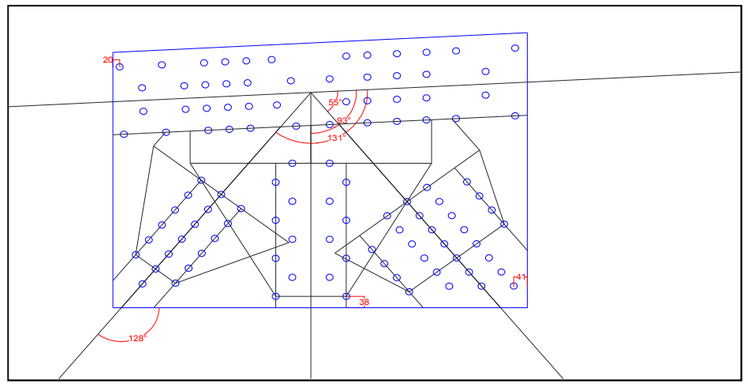
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	426	1895
Compressive Resistance at Member C	363	1614
Compressive Resistance at Member D	323	1437
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	726	3227
Governing Resistance at Member B	821	3650
Governing Resistance at Member C	584	2593
Governing Resistance at Member D	577	2566
Governing Resistance at Member E	726	3227

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
	SHEAR PLANE A'-A'	503	2234	**0.375**	
	SHEAR PLANE B'-B'	502	2233	**0.262**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	488	2171	**0.000**	
	Member C	481	2139	**0.000**	
	Member D	424	1883	**0.393**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	426	1895	**0.307**	
	Member C	363	1614	**0.014**	
	Member D	323	1437	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	726	3227	**0.472**	<--- Governing
	Member B	821	3650	**0.159**	
	Member C	584	2593	**0.009**	
	Member D	577	2566	**0.289**	
	Member E	726	3227	**0.472**	<--- Governing
	Highest Demand/Capacity Ratio			**0.472**	

Span: Bascule Bridge - Leaf Span
Node: 9N

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.47 in	12 mm	6% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units			
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6	
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa			

MEMBER FORCES

Load Combination:		ULSB3 Max 0	
9N-A	P_{Max} =	209.9 kip	933 kN
9N-A	P_{Min} =	68.0 kip	302 kN
9N-B	P_{Max} =	147.8 kip	657 kN
9N-B	P_{Min} =	76.5 kip	340 kN
9N-C	P_{Max} =	23.9 kip	106 kN
9N-C	P_{Min} =	8.2 kip	36 kN
9N-D	P_{Max} =	-81.6 kip	-363 kN
9N-D	P_{Min} =	-179.4 kip	-797 kN
9N-E	P_{Max} =	415.1 kip	1845 kN
9N-E	P_{Min} =	163.2 kip	726 kN

Note: Tension is positive.

Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
9N-A	420	933	933	932	933
9N-A	420	302	302	302	302
9N-B	9	648	652	657	657
9N-B	9	340	342	345	340
9N-C	328	104	105	106	106
9N-C	328	36	37	38	36
9N-D	10	-363	-366	-369	-363
9N-D	10	-786	-792	-797	-797
9N-E	419	1845	1845	1844	1845
9N-E	419	726	726	726	726

Span: Bascule Bridge - Leaf Span
Node: 9N

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		131	deg	B
	φ_C =		93	deg	C
	φ_D =		55	deg	D
	$\cos(\varphi_B)$ =		-0.656		
	$\cos(\varphi_C)$ =		-0.052		
	$\cos(\varphi_D)$ =		0.574		
	$V_{A'-A',max}$ =	-97.4 kip	-433	kN	*
	$V_{A'-A',min}$ =	-201.1 kip	-894	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	201.1 kip	894	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	147.0 kip	653	kN	

*using absolute maximum sums, conservative

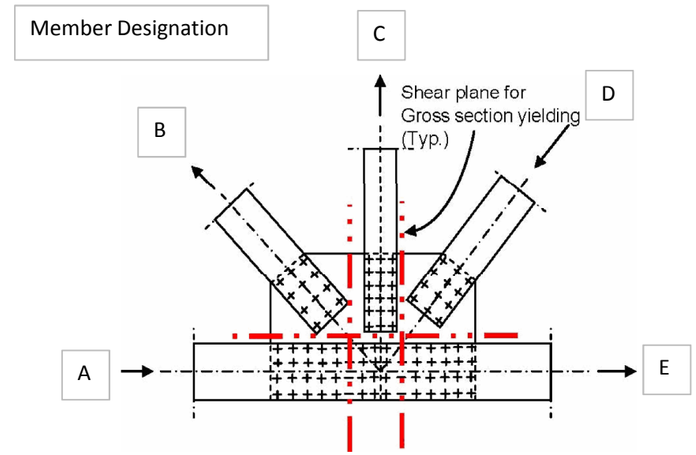


Figure 4 – Examples of gross section shear yielding planes

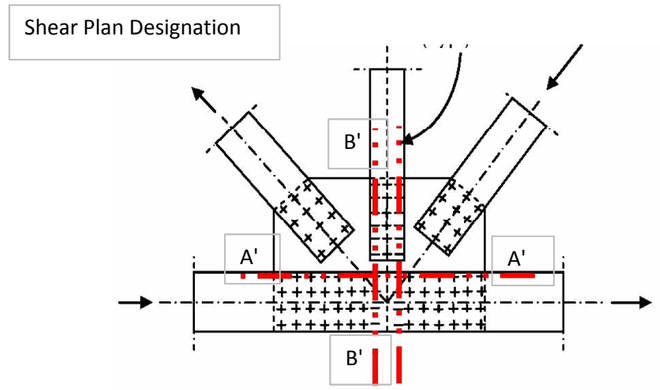


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	49.02	in	1245	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			29880	mm^2	
Net Shear Area	A_n =			23947	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2981	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =			4023	kN	
Shear Resistance (Governing)	V_R =			**2981**	**kN**	
Demand/Capacity	D/C =			**0.300**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	34.84	in	885	mm	
No of holes in shear plane	N =	14.00	ea	14	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 9N

Members A and E continuous through the gusset plate?				Yes		
Outside height of member A	H_A=	15	in	381	mm	
Thickness of the web of member A	w_A=	0.40	in	10	mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4	ea	
Gross Shear Area	A_g =			28982	mm^2	
Net Shear Area	A_n =			20386	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2891	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =			3425	kN	
Shear Resistance (Governing)	V_R =			**2891**	**kN**	
Demand/Capacity	D/C =			**0.226**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E — N/A

Members A and E continuous through the gusset plate? Yes

General

Whitmore Width	W_w =	0.00	in	0	mm	Number of Rivet/bolt diameters Intsecting Plane
Shear Length 1	L_{V1} =	0.00	in	0	mm	0
Shear Length 2	L_{V2} =	0.00	in	0	mm	0
Tension Length	L_T =	0.00	in	0	mm	0
Number of Gusset Plates	m =	2.00	ea	2	ea	0 Typ, 1 less than Whitemore Width
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance

CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	
			0	kN
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	
For gusset plates, U=1.0, FHWA 3.1.2			0	kN

FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

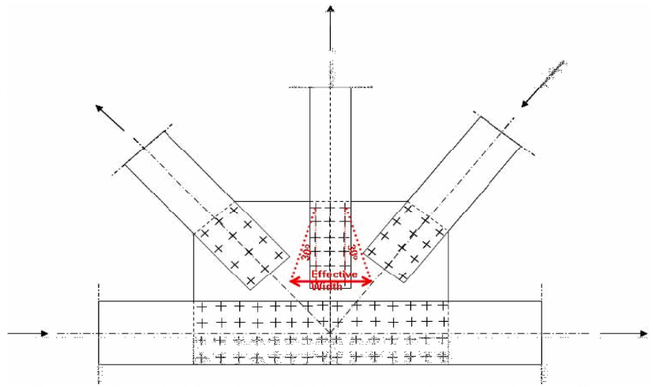


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

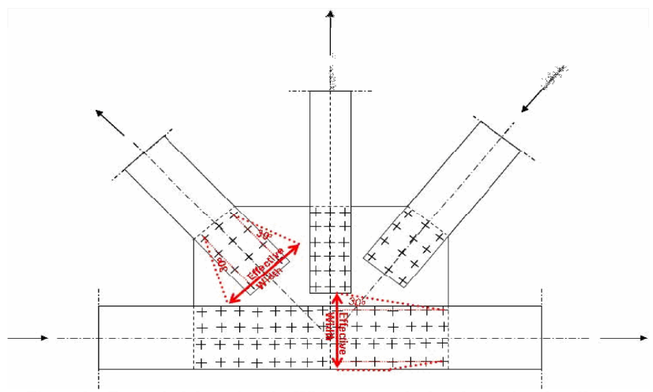


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 9N

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

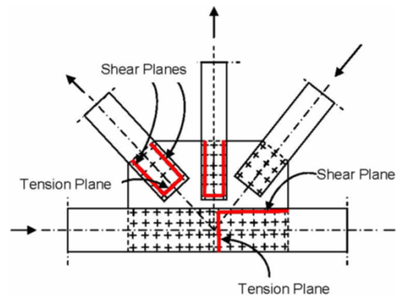


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.14 in	3.46 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

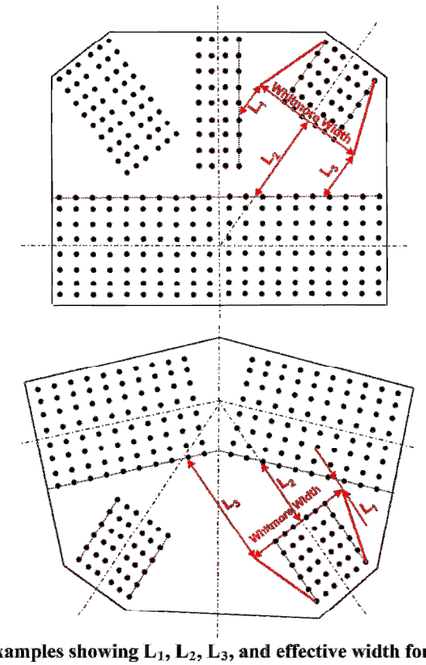


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	48 ea	48 ea			
Longest Length of connection	L=	49.02 in	1245 mm			
Edge distance	e =	0.79 in	20 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$			CSA S6 CL14.14.1.4.2
	B_{r1} =	729 kip	3242 kN			
	B_{r2} =	2084 kip	9263 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$			CSA S6 CL14.14.1.4.2
		495 kip	2200 kN			
Governing Resistance			4400 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span

Node: 9N

Demand/Capacity	D/C =	**0.419**	
For Connections greater than 50in (1270mm), shear resistance taken as 80%.			FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	20.43	in	519	mm	3
Shear Length 1	L_{V1} =	16.85	in	428	mm	5.5
Shear Length 2	L_{V2} =	16.61	in	422	mm	5.5
Tension Length	L_T =	5.98	in	152	mm	2
Number of Gusset Plates	m =	2	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$ U=1.0		FHWA 3.1.2
		2485	kN	
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$ U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		3687	kN	

Block Shear

Gross Tension Area	A_{tg} =	1824	mm^2
Gross Shear Area	A_{vg} =	10200	mm^2
Net Tension Area	A_{tn} =	1330	mm^2
Net Shear Area	A_{vn} =	7481	mm^2
$A_{tn} \geq 0.58*A_{vn}$?		No	

$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$ U=1.0

Block Shear Resistance	P_{Rbs} =	3529	kN	FHWA 3.1.3
Tension Resistance (Governing)		2485	kN	
Demand/Capacity	D/C =	**0.264**		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? Yes

General — FHWA 3.3

Whitmore Width	W_w =	20.43	in	519	mm

Span: Bascule Bridge - Leaf Span

Node: 9N

L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	11.34	in	288	mm	
L3	L_3 =	2.32	in	59	mm	
Unsupported Column Length	L_u =	4.55	in	116	mm	
Effective Length Factor	K =	1.20		1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)		for rectangular plate
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.41		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2202	kN	
Demand/Capacity	D/C =			**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	19	ea	19	ea		
Longest Length of connection	L=	19.02	in	483	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	549	kip	2438	kN		
	B_{r2} =	825	kip	3667	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		355	kip	1576	kN		
Governing Resistance				3152	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.208**			

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	28.54	in	725	mm	2	
Shear Length 1	L_{V1} =	19.02	in	483	mm	7.5	
Shear Length 2	L_{V2} =	19.02	in	483	mm	7.5	
Tension Length	L_T =	8.35	in	212	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 9N

Number of Gusset Plates	m =	2.00 ea	2 ea		
Diameter of holes in plane	d_b =	0.81 in	21 mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			3471	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			5514	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		2544	mm^2	
Gross Shear Area	A_{vg} =		11592	mm^2	
Net Tension Area	A_{tn} =		2297	mm^2	
Net Shear Area	A_{vn} =		7884	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		3928	kN	FHWA 3.1.3
Tension Resistance (Governing)			3471	kN	
Demand/Capacity	D/C =		**0.031**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored?			N/A		
General					FHWA 3.3
Whitmore Width	W_w =	28.54 in	725	mm	
L1	L_1 =	4.21 in	107	mm	
L2 - along centreline of action	L_2 =	4.96 in	126	mm	
L3	L_3 =	5.71 in	145	mm	
Unsupported Column Length	L_u =	4.96 in	126	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.45		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			3026	kN	

Span: Bascule Bridge - Leaf Span
Node: 9N

Demand/Capacity	D/C =			**0.000**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea		
Longest Length of connection	L=	19.02	in	483	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	462	kip	2053	kN		
	B_{r2} =	695	kip	3088	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		299	kip	1327	kN		
Governing Resistance				2655	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.040**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? No

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	21.81	in	554	mm	3	
Shear Length 1	L_{V1} =	12.13	in	308	mm	4	
Shear Length 2	L_{V2} =	13.86	in	352	mm	4	
Tension Length	L_T =	14.33	in	364	mm	4	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		2653	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		3969	kN		

Block Shear

Gross Tension Area	A_{tg} =	4368	mm^2

Span: Bascule Bridge - Leaf Span

Node: 9N

Gross Shear Area	A_{vg} =			7920	mm^2	
Net Tension Area	A_{tn} =			3379	mm^2	
Net Shear Area	A_{vn} =			5942	mm^2	
$A_{tn} > 0.58*A_{vn}$?				No		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		U=1.0		
Block Shear Resistance	P_{Rbs} =			3784	kN	FHWA 3.1.3
Tension Resistance (Governing)				2653	kN	
Demand/Capacity	D/C =			**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?				No		
General						FHWA 3.3
Whitmore Width	W_w =	21.81	in	554	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	12.99	in	330	mm	
L3	L_3 =	5.28	in	134	mm	
Unsupported Column Length	L_u =	6.09	in	155	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.55		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2188	kN	
Demand/Capacity	D/C =			**0.365**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	29	ea	29	ea		
Longest Length of connection	L=	17.80	in	452	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0			CSA S6 CL14.14.1.4.2
	B_{r1} =	837	kip	3721	kN		
	B_{r2} =	1259	kip	5597	kN		

Span: Bascule Bridge - Leaf Span
Node: 9N

Shear Resistance of Rivets V_r = $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 CSA S6 CL14.14.1.4.2

541 kip 2406 kN

Governing Resistance 4811 kN for 2 plate(s)

Demand/Capacity D/C = **0.166**

For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	671	2981
Shear Resistance (Net Section)	905	4023
Shear Resistance (Governing)	671	2981
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	650	2891
Shear Resistance (Net Section)	771	3425
Shear Resistance (Governing)	650	2891
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	559	2485
Net Section Resistance	830	3687
Block Shear Resistance	794	3529
Tension Resistance (Governing)	559	2485
At Member C:		
Gross Section Resistance	781	3471
Net Section Resistance	1241	5514
Block Shear Resistance	884	3928
Tension Resistance (Governing)	781	3471
At Member D:		
Gross Section Resistance	597	2653
Net Section Resistance	893	3969
Block Shear Resistance	851	3784
Tension Resistance (Governing)	597	2653
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 9N

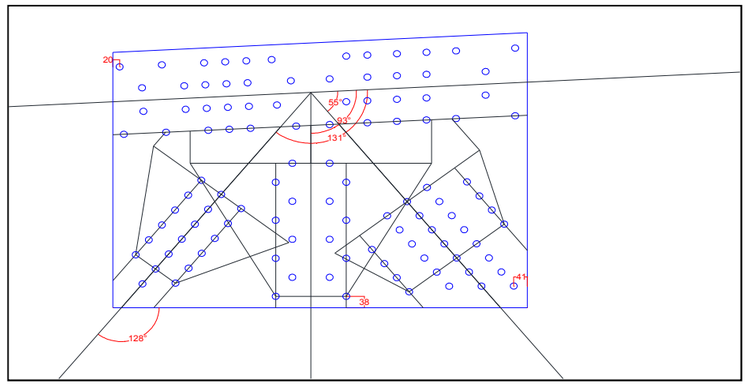
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	495	2202
Compressive Resistance at Member C	681	3026
Compressive Resistance at Member D	492	2188
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	990	4400
Governing Resistance at Member B	709	3152
Governing Resistance at Member C	597	2655
Governing Resistance at Member D	1083	4811
Governing Resistance at Member E	990	4400

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
SHEAR PLANE A'-A'		671	2981	**0.300**	
SHEAR PLANE B'-B'		650	2891	**0.226**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	559	2485	**0.264**	
	Member C	781	3471	**0.031**	
	Member D	597	2653	**0.000**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	495	2202	**0.000**	
	Member C	681	3026	**0.000**	
	Member D	492	2188	**0.365**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	990	4400	**0.419**	<--- Governing
	Member B	709	3152	**0.208**	
	Member C	597	2655	**0.040**	
	Member D	1083	4811	**0.166**	
	Member E	990	4400	**0.419**	<--- Governing
Highest Demand/Capacity Ratio				**0.419**	

Span: Bascule Bridge - Leaf Span
Node: 9S

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.47 in	12 mm	6% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units			
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2	
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6	
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa			

MEMBER FORCES

Load Combination:		ULSB3 Max 0		Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
9S-A	P_{Max} =	227.1 kip	1009 kN	9S-A	489	1009	1009	1009	1009
9S-A	P_{Min} =	76.0 kip	338 kN	9S-A	489	338	338	338	338
9S-B	P_{Max} =	166.7 kip	741 kN	9S-B	185	732	736	741	741
9S-B	P_{Min} =	85.2 kip	379 kN	9S-B	185	379	381	384	379
9S-C	P_{Max} =	27.8 kip	124 kN	9S-C	332	121	122	124	124
9S-C	P_{Min} =	10.0 kip	44 kN	9S-C	332	44	45	46	44
9S-D	P_{Max} =	-91.2 kip	-405 kN	9S-D	186	-405	-408	-411	-405
9S-D	P_{Min} =	-200.1 kip	-889 kN	9S-D	186	-878	-884	-889	-889
9S-E	P_{Max} =	447.1 kip	1987 kN	9S-E	488	1987	1987	1987	1987
9S-E	P_{Min} =	178.1 kip	791 kN	9S-E	488	792	792	791	791

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 9S

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		131	deg	B
	φ_C =		93	deg	C
	φ_D =		55	deg	D
	$\cos(\varphi_B)$ =		-0.656		
	$\cos(\varphi_C)$ =		-0.052		
	$\cos(\varphi_D)$ =		0.574		
	$V_{A'-A',max}$ =	-108.7 kip	-483	kN	*
	$V_{A'-A',min}$ =	-225.6 kip	-1003	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	225.6 kip	1003	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	163.9 kip	728	kN

*using absolute maximum sums, conservative

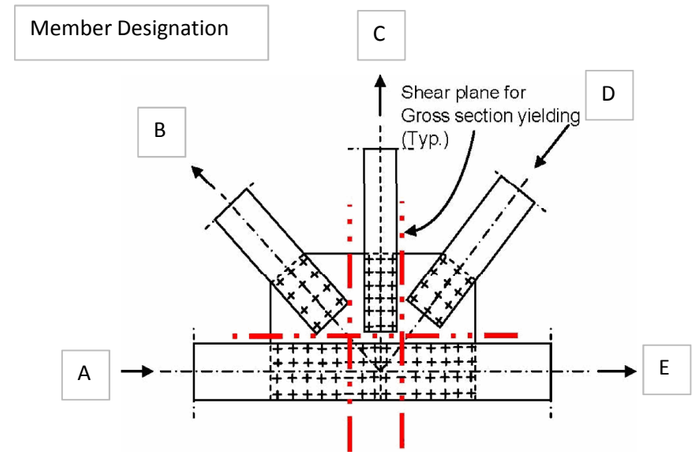


Figure 4 – Examples of gross section shear yielding planes

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

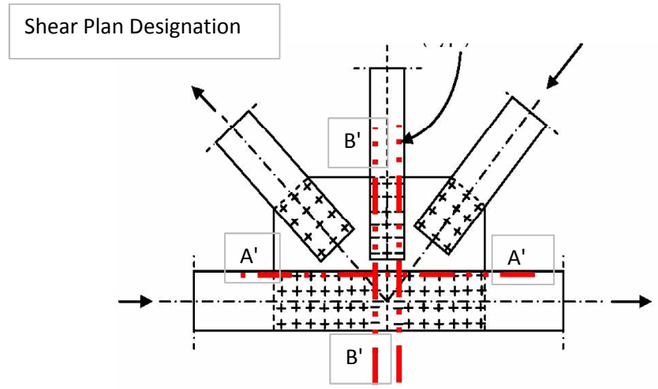


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	49.02	in	1245	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			29880	mm^2	
Net Shear Area	A_n =			23947	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2981	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =			4023	kN	
Shear Resistance (Governing)	V_R =			**2981**	**kN**	
Demand/Capacity	D/C =			**0.336**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	34.84	in	885	mm	
No of holes in shear plane	N =	14.00	ea	14	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 9S

Members A and E continuous through the gusset plate?				Yes		
Outside height of member A	H_A=	15	in	381	mm	
Thickness of the web of member A	w_A=	0.40	in	10	mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4	ea	
Gross Shear Area	A_g =			28982	mm^2	
Net Shear Area	A_n =			20386	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2891	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =			3425	kN	
Shear Resistance (Governing)	V_R =			**2891**	**kN**	
Demand/Capacity	D/C =			**0.252**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E — N/A

Members A and E continuous through the gusset plate? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	0.00	in	0	mm	0	
Shear Length 1	L_{V1} =	0.00	in	0	mm	0	
Shear Length 2	L_{V2} =	0.00	in	0	mm	0	
Tension Length	L_T =	0.00	in	0	mm	0	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$		
		0	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		0	kN	

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

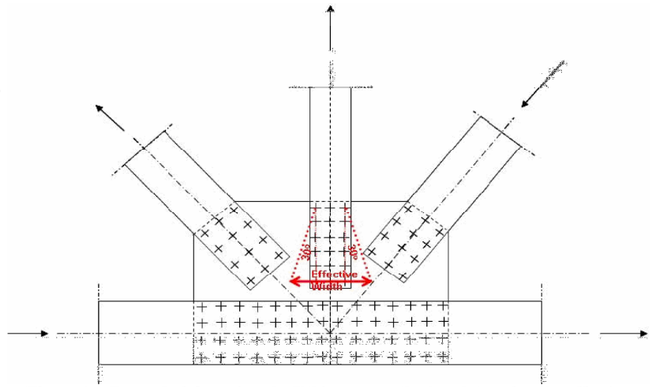


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

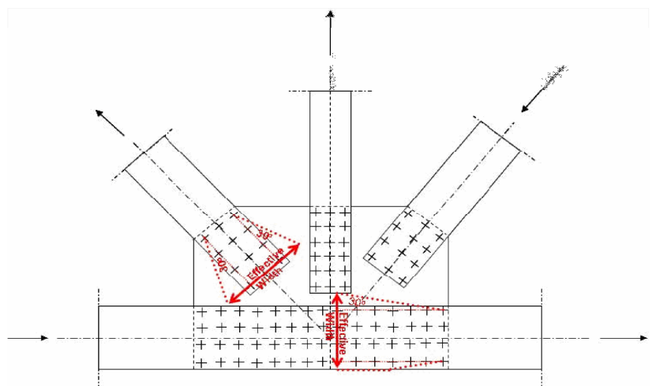


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 9S

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

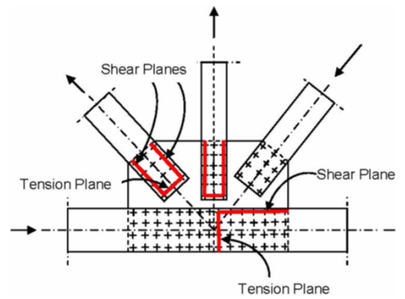


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.14 in	3.46 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

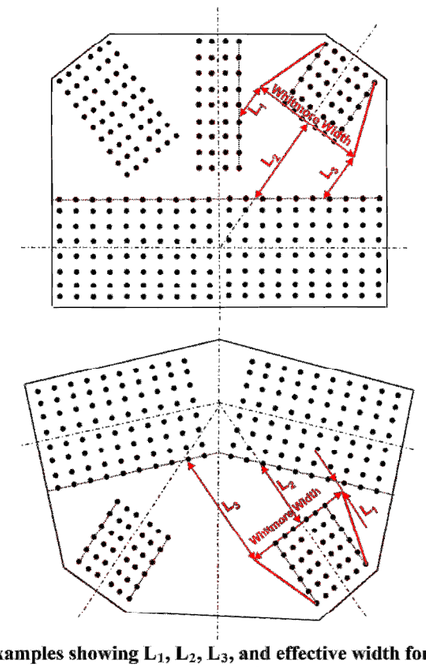


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	48 ea	48 ea			
Longest Length of connection	L=	49.02 in	1245 mm			
Edge distance	e =	0.79 in	20 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$			CSA S6 CL14.14.1.4.2
	B_{r1} =	729 kip	3242 kN			
	B_{r2} =	2084 kip	9263 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$			CSA S6 CL14.14.1.4.2
		495 kip	2200 kN			
Governing Resistance			4400 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span
Node: 9S

Demand/Capacity	D/C =	**0.452**	
For Connections greater than 50in (1270mm), shear resistance taken as 80%.			FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? Yes

General

					Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	20.43 in	519	mm	3
Shear Length 1	L_{V1} =	16.85 in	428	mm	5.5
Shear Length 2	L_{V2} =	16.61 in	422	mm	5.5
Tension Length	L_T =	5.98 in	152	mm	2
Number of Gusset Plates	m =	2 ea	2	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$U*\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
			2485	kN	
Net Section Resistance	P_{RN} =		$U*\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2			3687	kN	

Block Shear

Gross Tension Area	A_{tg} =	1824	mm^2	
Gross Shear Area	A_{vg} =	10200	mm^2	
Net Tension Area	A_{tn} =	1330	mm^2	
Net Shear Area	A_{vn} =	7481	mm^2	
$A_{tn} \geq 0.58*A_{vn}$?		No		

$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$ U=1.0

Block Shear Resistance	P_{Rbs} =	3529	kN	FHWA 3.1.3
Tension Resistance (Governing)		2485	kN	
Demand/Capacity	D/C =	**0.298**		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? Yes

General — FHWA 3.3

Whitmore Width	W_w =	20.43 in	519	mm

Span: Bascule Bridge - Leaf Span

Node: 9S

L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	11.34	in	288	mm	
L3	L_3 =	2.32	in	59	mm	
Unsupported Column Length	L_u =	4.55	in	116	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.41		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2202	kN	
Demand/Capacity	D/C =			**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	19	ea	19	ea	
Longest Length of connection	L=	19.02	in	483	mm	
Edge distance	e =	1.50	in	38	mm	
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")
Shear Planes per gusset plate	m =	1	ea	1	ea	
Number of Gusset Plates		2.00	ea	2	ea	
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0	CSA S6 CL14.14.1.4.2
	B_{r1} =	549	kip	2438	kN	
	B_{r2} =	825	kip	3667	kN	
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81	CSA S6 CL14.14.1.4.2
		355	kip	1576	kN	
Governing Resistance				3152	kN	for 2 plate(s)
Demand/Capacity	D/C =			**0.235**		

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	28.54	in	725	mm	2	
Shear Length 1	L_{V1} =	19.02	in	483	mm	7.5	
Shear Length 2	L_{V2} =	19.02	in	483	mm	7.5	
Tension Length	L_T =	8.35	in	212	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 9S

Number of Gusset Plates	m =	2.00 ea	2 ea		
Diameter of holes in plane	d_b =	0.81 in	21 mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			3471	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			5514	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		2544	mm^2	
Gross Shear Area	A_{vg} =		11592	mm^2	
Net Tension Area	A_{tn} =		2297	mm^2	
Net Shear Area	A_{vn} =		7884	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		3928	kN	FHWA 3.1.3
Tension Resistance (Governing)			3471	kN	
Demand/Capacity	D/C =		**0.036**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored?			N/A		
General					FHWA 3.3
Whitmore Width	W_w =	28.54 in	725	mm	
L1	L_1 =	4.21 in	107	mm	
L2 - along centreline of action	L_2 =	4.96 in	126	mm	
L3	L_3 =	5.71 in	145	mm	
Unsupported Column Length	L_u =	4.96 in	126	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.45		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			3026	kN	

Span: Bascule Bridge - Leaf Span
Node: 9S

Demand/Capacity	D/C =			**0.000**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea		
Longest Length of connection	L=	19.02	in	483	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	462	kip	2053	kN		
	B_{r2} =	695	kip	3088	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		299	kip	1327	kN		
Governing Resistance				2655	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.047**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? No

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	21.81	in	554	mm	3	
Shear Length 1	L_{V1} =	12.13	in	308	mm	4	
Shear Length 2	L_{V2} =	13.86	in	352	mm	4	
Tension Length	L_T =	14.33	in	364	mm	4	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		2653	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		3969	kN		

Block Shear

Gross Tension Area	A_{tg} =	4368	mm^2

Span: Bascule Bridge - Leaf Span

Node: 9S

Gross Shear Area	A_{vg} =			7920	mm^2	
Net Tension Area	A_{tn} =			3379	mm^2	
Net Shear Area	A_{vn} =			5942	mm^2	
$A_{tn} > 0.58*A_{vn}$?				No		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		U=1.0		
Block Shear Resistance	P_{Rbs} =			3784	kN	FHWA 3.1.3
Tension Resistance (Governing)				2653	kN	
Demand/Capacity	D/C =			**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?				No		
General						FHWA 3.3
Whitmore Width	W_w =	21.81	in	554	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	12.99	in	330	mm	
L3	L_3 =	5.28	in	134	mm	
Unsupported Column Length	L_u =	6.09	in	155	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.55		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2188	kN	
Demand/Capacity	D/C =			**0.406**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	29	ea	29	ea		
Longest Length of connection	L=	17.80	in	452	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0			CSA S6 CL14.14.1.4.2
	B_{r1} =	837	kip	3721	kN		
	B_{r2} =	1259	kip	5597	kN		

Span: Bascule Bridge - Leaf Span
Node: 9S

Shear Resistance of Rivets V_r = $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 CSA S6 CL14.14.1.4.2

541 kip 2406 kN

Governing Resistance 4811 kN for 2 plate(s)

Demand/Capacity D/C = **0.185**

For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	671	2981
Shear Resistance (Net Section)	905	4023
Shear Resistance (Governing)	671	2981
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	650	2891
Shear Resistance (Net Section)	771	3425
Shear Resistance (Governing)	650	2891
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	559	2485
Net Section Resistance	830	3687
Block Shear Resistance	794	3529
Tension Resistance (Governing)	559	2485
At Member C:		
Gross Section Resistance	781	3471
Net Section Resistance	1241	5514
Block Shear Resistance	884	3928
Tension Resistance (Governing)	781	3471
At Member D:		
Gross Section Resistance	597	2653
Net Section Resistance	893	3969
Block Shear Resistance	851	3784
Tension Resistance (Governing)	597	2653
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 9S

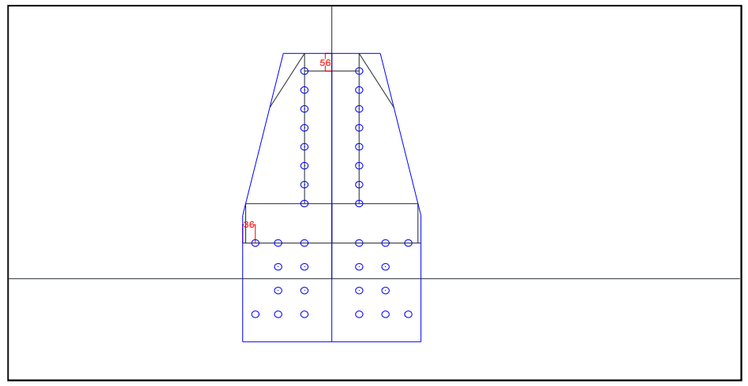
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	495	2202
Compressive Resistance at Member C	681	3026
Compressive Resistance at Member D	492	2188
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	990	4400
Governing Resistance at Member B	709	3152
Governing Resistance at Member C	597	2655
Governing Resistance at Member D	1083	4811
Governing Resistance at Member E	990	4400

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
		kip	kN		
GUSSET PLATE SHEAR					
	SHEAR PLANE A'-A'	671	2981	**0.336**	
	SHEAR PLANE B'-B'	650	2891	**0.252**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	559	2485	**0.298**	
	Member C	781	3471	**0.036**	
	Member D	597	2653	**0.000**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	495	2202	**0.000**	
	Member C	681	3026	**0.000**	
	Member D	492	2188	**0.406**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	990	4400	**0.452**	<--- Governing
	Member B	709	3152	**0.235**	
	Member C	597	2655	**0.047**	
	Member D	1083	4811	**0.185**	
	Member E	990	4400	**0.452**	<--- Governing
	Highest Demand/Capacity Ratio			**0.452**	

Span: Bascule Bridge - Leaf Span
Node: 10N

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.35 in	9 mm	29% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units		
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa		

MEMBER FORCES

Load Combination:		ULSB3 Max 0		Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
10N-A	P_{Max} =	-60.8 kip	-270 kN	10N-A	283	-270	-270	-270	-270
10N-A	P_{Min} =	-316.3 kip	-1406 kN	10N-A	283	-1406	-1406	-1406	-1406
10N-B	P_{Max} =	0.0 kip	0 kN	10N-B	0	#N/A	#N/A	#N/A	#N/A
10N-B	P_{Min} =	0.0 kip	0 kN	10N-B	0	#N/A	#N/A	#N/A	#N/A
10N-C	P_{Max} =	19.5 kip	87 kN	10N-C	327	82	84	87	87
10N-C	P_{Min} =	9.3 kip	41 kN	10N-C	327	41	43	44	41
10N-D	P_{Max} =	0.0 kip	0 kN	10N-D	0	#N/A	#N/A	#N/A	#N/A
10N-D	P_{Min} =	0.0 kip	0 kN	10N-D	0	#N/A	#N/A	#N/A	#N/A
10N-E	P_{Max} =	-29.2 kip	-130 kN	10N-E	284	-130	-130	-130	-130
10N-E	P_{Min} =	-354.7 kip	-1576 kN	10N-E	284	-1576	-1576	-1576	-1576

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 10N

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		128	deg	B
	φ_C =		90	deg	C
	φ_D =		54	deg	D
	$\cos(\varphi_B)$ =		-0.616		
	$\cos(\varphi_C)$ =		0.000		
	$\cos(\varphi_D)$ =		0.588		
	$V_{A'-A',max}$ =	0.0 kip	0	kN	*
	$V_{A'-A',min}$ =	0.0 kip	0	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	0.0 kip	0	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	0.0 kip	0	kN	

*using absolute maximum sums, conservative

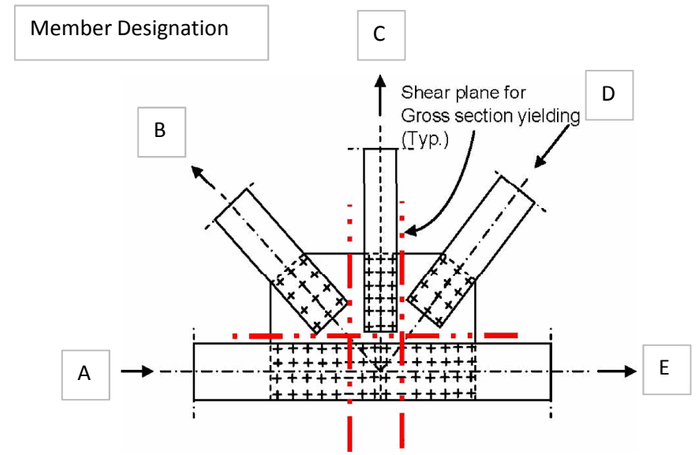


Figure 4 – Examples of gross section shear yielding planes

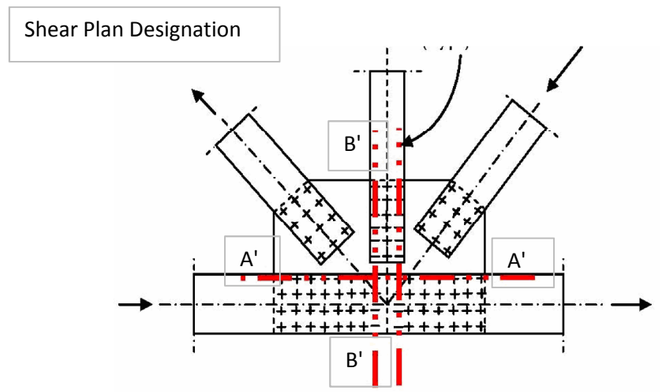


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	20.00	in	508	mm	
No of holes in shear plane	N =	6.00	ea	6	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			9144	mm^2	
Net Shear Area	A_n =			6919	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			912	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$ *		Cl 10.18.5.2
	V_{Rn} =			1162	kN	
Shear Resistance (Governing)	V_R =			**912**	**kN**	
Demand/Capacity	D/C =			**0.000**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	35.98	in	914	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 10N

Members A and E continuous through the gusset plate?				Yes	
Outside height of member A	H_A=	15	in	381 mm	
Thickness of the web of member A	w_A=	0.40	in	10 mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4 ea	
Gross Shear Area	A_g =			24194 mm^2	
Net Shear Area	A_n =			18070 mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$	Cl 10.18.5.2
	V_{Rg} =			2413 kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$ *	Cl 10.18.5.2
	V_{Rn} =			3036 kN	
Shear Resistance (Governing)	V_R =			**2413 kN**	
Demand/Capacity	D/C =			**0.000**	

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E — N/A

Members A and E continuous through the gusset plate?				Yes	

General

Whitmore Width	W_w =	0.00	in	0 mm	
Shear Length 1	L_{V1} =	0.00	in	0 mm	
Shear Length 2	L_{V2} =	0.00	in	0 mm	
Tension Length	L_T =	0.00	in	0 mm	
Number of Gusset Plates	m =	2.00	ea	2 ea	
Diameter of holes in plane	d_b =	0.81	in	21 mm	

Number of Rivet/bolt diameters Intsecting Plane

0
0
0
0 Typ, 1 less than Whitemore Width

($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	
		0 kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	
For gusset plates, U=1.0, FHWA 3.1.2		0 kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		0 mm^2
Gross Shear Area	A_{vg} =		0 mm^2
Net Tension Area	A_{tn} =		0 mm^2
Net Shear Area	A_{vn} =		0 mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

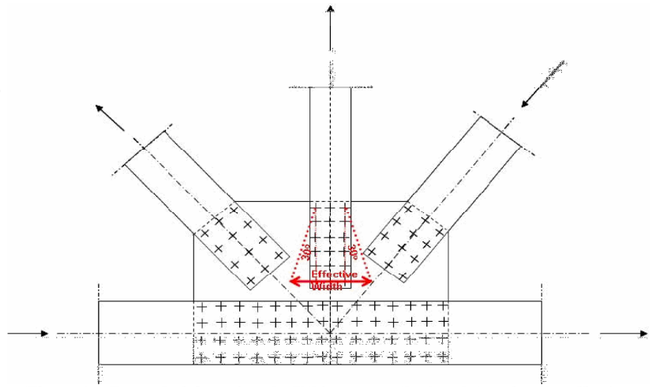


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

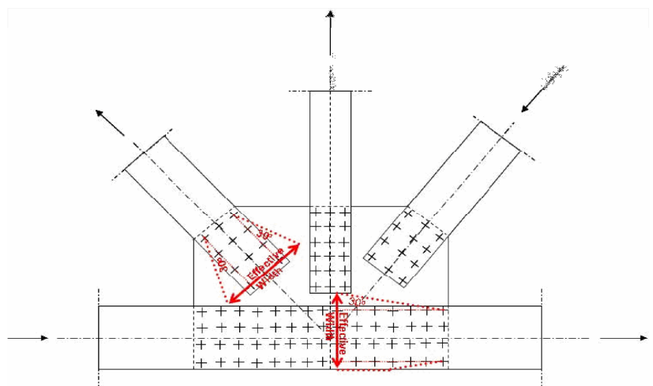


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 10N

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

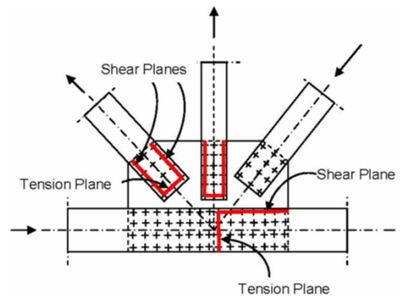


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.10 in	2.60 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

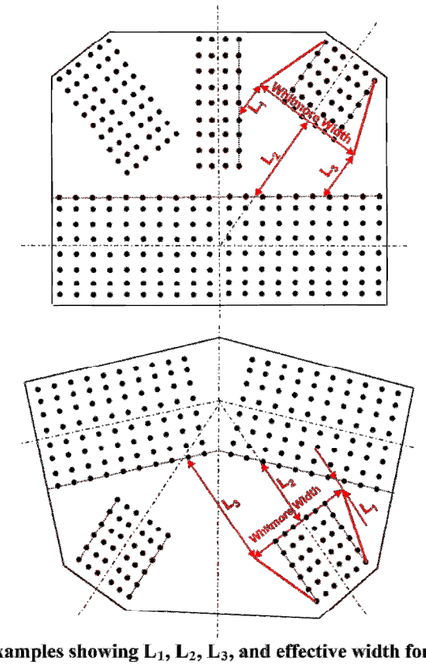


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	20 ea	20 ea			
Longest Length of connection	L=	20.00 in	508 mm			
Edge distance	e =	1.42 in	36 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$			CSA S6 CL14.14.1.4.2
	B_{r1} =	410 kip	1823 kN			
	B_{r2} =	651 kip	2895 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$			CSA S6 CL14.14.1.4.2
		206 kip	917 kN			
Governing Resistance			1833 kN		for 2 plate(s)	

Span: Bascule Bridge - Leaf Span

Node: 10N

Demand/Capacity	D/C =	**0.860**	
For Connections greater than 50in (1270mm), shear resistance taken as 80%.			FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	21.81	in	554	mm	3
Shear Length 1	L_{V1} =	13.11	in	333	mm	4.5
Shear Length 2	L_{V2} =	11.38	in	289	mm	4.5
Tension Length	L_T =	14.33	in	364	mm	4
Number of Gusset Plates	m =	2	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$ U=1.0	1989 kN	FHWA 3.1.2
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$ U=1.0	2977 kN	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2				

Block Shear

Gross Tension Area	A_{tg} =	3276	mm^2
Gross Shear Area	A_{vg} =	5598	mm^2
Net Tension Area	A_{tn} =	2534	mm^2
Net Shear Area	A_{vn} =	3929	mm^2
$A_{tn} \geq 0.58*A_{vn}$?		Yes	

		$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$ U=1.0		
Block Shear Resistance	P_{Rbs} =		2794 kN	FHWA 3.1.3
Tension Resistance (Governing)			1989 kN	
Demand/Capacity	D/C =		**0.000**	

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? Yes

General — FHWA 3.3

Whitmore Width	W_w =	21.81	in	554	mm

Span: Bascule Bridge - Leaf Span

Node: 10N

L1	L_1 =	0.79	in	20	mm	
L2 - along centreline of action	L_2 =	13.54	in	344	mm	
L3	L_3 =	4.88	in	124	mm	
Unsupported Column Length	L_u =	6.40	in	163	mm	
Effective Length Factor	K =	1.20		1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)		for rectangular plate
		0.10	in	2.60	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.77		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				1389	kN	
Demand/Capacity	D/C =			**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22	ea	22	ea	
Longest Length of connection	L=	18.94	in	481	mm	
Edge distance	e =	1.50	in	38	mm	
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")
Shear Planes per gusset plate	m =	1	ea	1	ea	
Number of Gusset Plates		2.00	ea	2	ea	
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0	CSA S6 CL14.14.1.4.2
	B_{r1} =	476	kip	2117	kN	
	B_{r2} =	716	kip	3184	kN	
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81	CSA S6 CL14.14.1.4.2
		411	kip	1825	kN	
Governing Resistance				3650	kN	for 2 plate(s)
Demand/Capacity	D/C =			**0.000**		

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	19.29	in	490	mm	2	
Shear Length 1	L_{V1} =	18.74	in	476	mm	7.5	
Shear Length 2	L_{V2} =	18.74	in	476	mm	7.5	
Tension Length	L_T =	6.14	in	156	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 10N

Number of Gusset Plates	m =	2.00	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =			$\varphi_s*A_g*F_y$	U=1.0	
				1760	kN	
Net Section Resistance	P_{RN} =			$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2				2714	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =			1404	mm^2	
Gross Shear Area	A_{vg} =			8568	mm^2	
Net Tension Area	A_{tn} =			1219	mm^2	
Net Shear Area	A_{vn} =			5787	mm^2	
$A_{tn} > 0.58*A_{vn}$?				No		
				$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =			2727	kN	FHWA 3.1.3
Tension Resistance (Governing)				1760	kN	
Demand/Capacity	D/C =			**0.049**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored?				N/A		
General						FHWA 3.3
Whitmore Width	W_w =	19.29	in	490	mm	
L1	L_1 =	4.92	in	125	mm	
L2 - along centreline of action	L_2 =	4.92	in	125	mm	
L3	L_3 =	4.92	in	125	mm	
Unsupported Column Length	L_u =	4.92	in	125	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.10	in	2.60	mm	
	λ =			$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
				0.60		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				1412	kN	

Span: Bascule Bridge - Leaf Span

Node: 10N

Demand/Capacity	D/C =			**0.000**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea		
Longest Length of connection	L=	18.74	in	476	mm		
Edge distance	e =	2.20	in	56	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	511	kip	2269	kN		
	B_{r2} =	521	kip	2316	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		299	kip	1327	kN		
Governing Resistance				2655	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.033**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

					Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	24.41	in	620 mm	5	
Shear Length 1	L_{V1} =	10.87	in	276 mm	3.5	
Shear Length 2	L_{V2} =	14.25	in	362 mm	4.5	
Tension Length	L_T =	15.55	in	395 mm	5	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2 ea		
Diameter of holes in plane	d_b =	0.81	in	21 mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
		2226 kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		3127 kN		

Block Shear

Gross Tension Area	A_{tg} =	3555	mm^2

Span: Bascule Bridge - Leaf Span

Node: 10N

Gross Shear Area	A_{vg} =			5742	mm^2	
Net Tension Area	A_{tn} =			2628	mm^2	
Net Shear Area	A_{vn} =			4259	mm^2	
$A_{tn} > 0.58*A_{vn}$?				Yes		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		U=1.0		
Block Shear Resistance	P_{Rbs} =			2885	kN	FHWA 3.1.3
Tension Resistance (Governing)				2226	kN	
Demand/Capacity	D/C =			**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?				Yes		
General						FHWA 3.3
Whitmore Width	W_w =	24.41	in	620	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	13.15	in	334	mm	
L3	L_3 =	4.21	in	107	mm	
Unsupported Column Length	L_u =	5.79	in	147	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			$t/\sqrt{(12)}$	for rectangular plate	
		0.10	in	2.60	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.70		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				1654	kN	
Demand/Capacity	D/C =			**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	25	ea	25	ea		
Longest Length of connection	L=	19.37	in	492	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	541	kip	2406	kN		
	B_{r2} =	814	kip	3618	kN		

Span: Bascule Bridge - Leaf Span

Node: 10N

Shear Resistance of Rivets V_r = $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 CSA S6 CL14.14.1.4.2

467 kip 2074 kN

Governing Resistance 4148 kN for 2 plate(s)

Demand/Capacity D/C = **0.000**

For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	205	912
Shear Resistance (Net Section)	262	1162
Shear Resistance (Governing)	205	912
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	543	2413
Shear Resistance (Net Section)	683	3036
Shear Resistance (Governing)	543	2413
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	448	1989
Net Section Resistance	670	2977
Block Shear Resistance	629	2794
Tension Resistance (Governing)	448	1989
At Member C:		
Gross Section Resistance	396	1760
Net Section Resistance	611	2714
Block Shear Resistance	614	2727
Tension Resistance (Governing)	396	1760
At Member D:		
Gross Section Resistance	501	2226
Net Section Resistance	704	3127
Block Shear Resistance	649	2885
Tension Resistance (Governing)	501	2226
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 10N

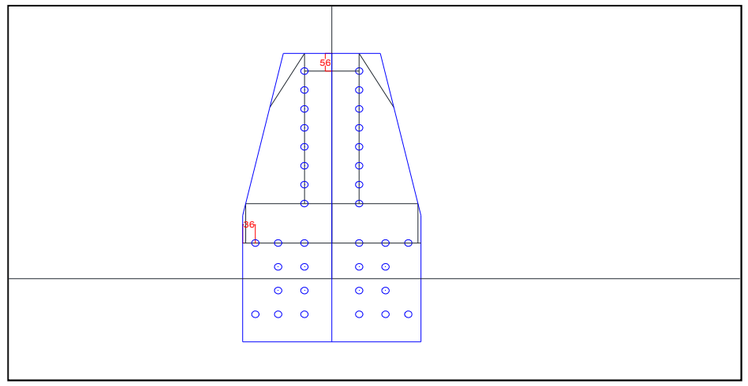
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	313	1389
Compressive Resistance at Member C	318	1412
Compressive Resistance at Member D	372	1654
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	412	1833
Governing Resistance at Member B	821	3650
Governing Resistance at Member C	597	2655
Governing Resistance at Member D	933	4148
Governing Resistance at Member E	412	1833

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
		kip	kN		
GUSSET PLATE SHEAR					
	SHEAR PLANE A'-A'	205	912	**0.000**	
	SHEAR PLANE B'-B'	543	2413	**0.000**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	448	1989	**0.000**	
	Member C	396	1760	**0.049**	
	Member D	501	2226	**0.000**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	313	1389	**0.000**	
	Member C	318	1412	**0.000**	
	Member D	372	1654	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	412	1833	**0.860**	<--- Governing
	Member B	821	3650	**0.000**	
	Member C	597	2655	**0.033**	
	Member D	933	4148	**0.000**	
	Member E	412	1833	**0.860**	<--- Governing
	Highest Demand/Capacity Ratio			**0.860**	

Span: Bascule Bridge - Leaf Span
Node: 10S

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.24 in	6 mm	53% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units		
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa		

MEMBER FORCES

Load Combination:		ULSB3 Max 0		Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
10S-A	P_{Max} =	-73.0 kip	-324 kN	10S-A	563	-324	-324	-324	-324
10S-A	P_{Min} =	-342.6 kip	-1523 kN	10S-A	563	-1523	-1523	-1523	-1523
10S-B	P_{Max} =	0.0 kip	0 kN	10S-B	0	#N/A	#N/A	#N/A	#N/A
10S-B	P_{Min} =	0.0 kip	0 kN	10S-B	0	#N/A	#N/A	#N/A	#N/A
10S-C	P_{Max} =	25.0 kip	111 kN	10S-C	331	106	109	111	111
10S-C	P_{Min} =	11.8 kip	52 kN	10S-C	331	52	54	55	52
10S-D	P_{Max} =	0.0 kip	0 kN	10S-D	0	#N/A	#N/A	#N/A	#N/A
10S-D	P_{Min} =	0.0 kip	0 kN	10S-D	0	#N/A	#N/A	#N/A	#N/A
10S-E	P_{Max} =	-37.2 kip	-165 kN	10S-E	564	-165	-165	-165	-165
10S-E	P_{Min} =	-372.1 kip	-1654 kN	10S-E	564	-1654	-1654	-1654	-1654

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 10S

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		128	deg	B
	φ_C =		90	deg	C
	φ_D =		54	deg	D
	$\cos(\varphi_B)$ =		-0.616		
	$\cos(\varphi_C)$ =		0.000		
	$\cos(\varphi_D)$ =		0.588		
	$V_{A'-A',max}$ =	0.0 kip	0	kN	*
	$V_{A'-A',min}$ =	0.0 kip	0	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	0.0 kip	0	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	0.0 kip	0	kN	

*using absolute maximum sums, conservative

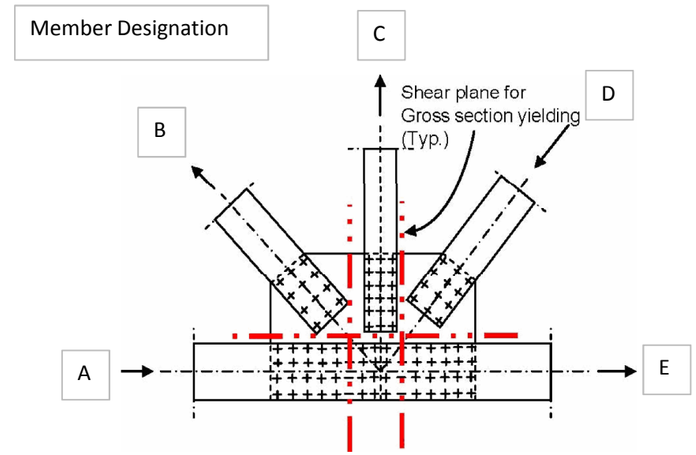


Figure 4 – Examples of gross section shear yielding planes

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

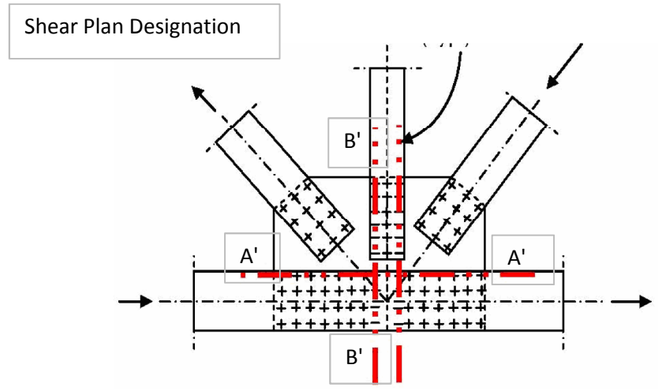


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	20.00	in	508	mm	
No of holes in shear plane	N =	6.00	ea	6	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			6096	mm^2	
Net Shear Area	A_n =			4613	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			608	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =			775	kN	
Shear Resistance (Governing)	V_R =			**608**	**kN**	
Demand/Capacity	D/C =			**0.000**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	35.98	in	914	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 10S

Members A and E continuous through the gusset plate?				Yes	
Outside height of member A	H_A=	15	in	381 mm	
Thickness of the web of member A	w_A=	0.40	in	10 mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4 ea	
Gross Shear Area	A_g =			18710 mm^2	
Net Shear Area	A_n =			14069 mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$	Cl 10.18.5.2
	V_{Rg} =			1866 kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$ *	Cl 10.18.5.2
	V_{Rn} =			2364 kN	
Shear Resistance (Governing)	V_R =			**1866 kN**	
Demand/Capacity	D/C =			**0.000**	

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E

N/A

Members A and E continuous through the gusset plate? Yes

General

					Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	0.00	in	0 mm	0	
Shear Length 1	L_{V1} =	0.00	in	0 mm	0	
Shear Length 2	L_{V2} =	0.00	in	0 mm	0	
Tension Length	L_T =	0.00	in	0 mm	0	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2 ea		
Diameter of holes in plane	d_b =	0.81	in	21 mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	
		0 kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		0 kN	

Block Shear

Gross Tension Area	A_{tg} =	0 mm^2
Gross Shear Area	A_{vg} =	0 mm^2
Net Tension Area	A_{tn} =	0 mm^2
Net Shear Area	A_{vn} =	0 mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes

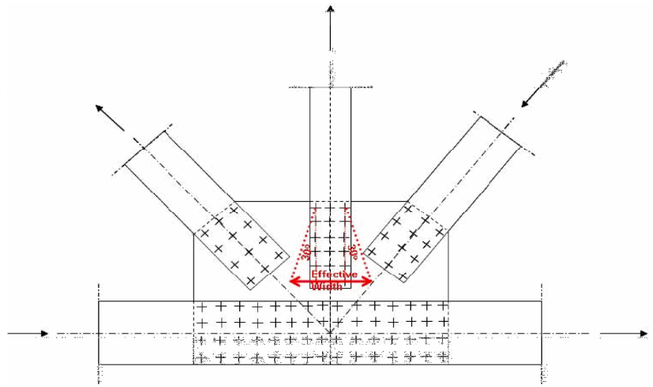


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

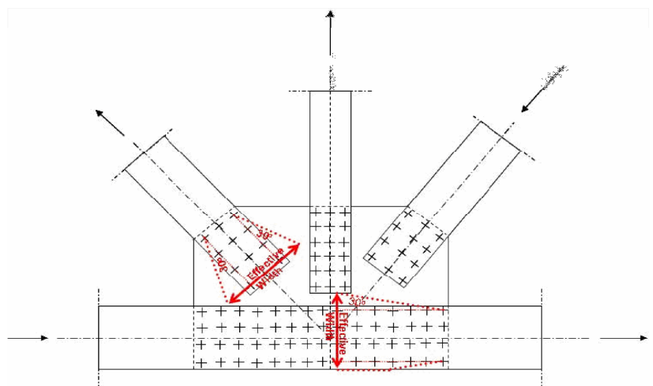


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 10S

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

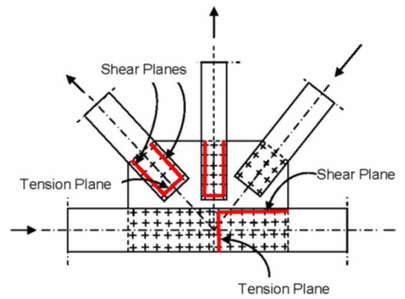


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.07 in	1.73 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

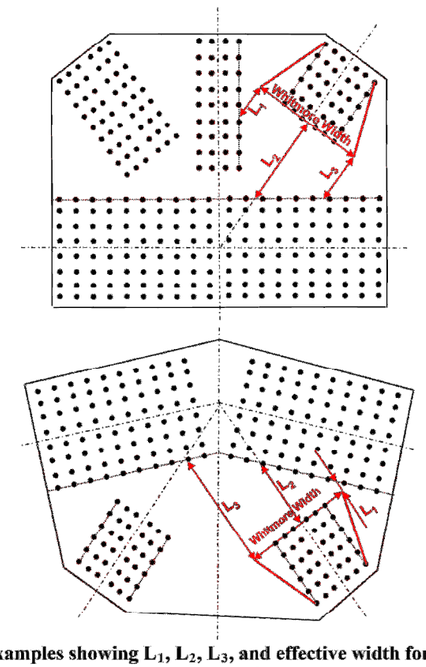


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	20 ea	20 ea			
Longest Length of connection	L=	20.00 in	508 mm			
Edge distance	e =	1.42 in	36 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$			CSA S6 CL14.14.1.4.2
	B_{r1} =	274 kip	1216 kN			
	B_{r2} =	434 kip	1930 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$			CSA S6 CL14.14.1.4.2
		206 kip	917 kN			
Governing Resistance			1833 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span

Node: 10S

Demand/Capacity	D/C =	**0.902**	
For Connections greater than 50in (1270mm), shear resistance taken as 80%.			FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	21.81	in	554	mm	3
Shear Length 1	L_{V1} =	13.11	in	333	mm	4.5
Shear Length 2	L_{V2} =	11.38	in	289	mm	4.5
Tension Length	L_T =	14.33	in	364	mm	4
Number of Gusset Plates	m =	2	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$ U=1.0	1326 kN	FHWA 3.1.2
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$ U=1.0	1985 kN	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2				

Block Shear

Gross Tension Area	A_{tg} =	2184	mm^2
Gross Shear Area	A_{vg} =	3732	mm^2
Net Tension Area	A_{tn} =	1690	mm^2
Net Shear Area	A_{vn} =	2620	mm^2
$A_{tn} \geq 0.58*A_{vn}$?		Yes	

		$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$ U=1.0		
Block Shear Resistance	P_{Rbs} =		1863 kN	FHWA 3.1.3
Tension Resistance (Governing)			1326 kN	
Demand/Capacity	D/C =		**0.000**	

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? Yes

General — FHWA 3.3

Whitmore Width	W_w =	21.81	in	554	mm

Span: Bascule Bridge - Leaf Span

Node: 10S

L1	L_1 =	0.79	in	20	mm	
L2 - along centreline of action	L_2 =	13.54	in	344	mm	
L3	L_3 =	4.88	in	124	mm	
Unsupported Column Length	L_u =	6.40	in	163	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.07	in	1.73	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				1.16		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				635	kN	
Demand/Capacity	D/C =			**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22	ea	22	ea		
Longest Length of connection	L=	18.94	in	481	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	318	kip	1412	kN		
	B_{r2} =	478	kip	2123	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		411	kip	1825	kN		
Governing Resistance				2823	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.000**			

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	19.29	in	490	mm	2	
Shear Length 1	L_{V1} =	18.74	in	476	mm	7.5	
Shear Length 2	L_{V2} =	18.74	in	476	mm	7.5	
Tension Length	L_T =	6.14	in	156	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 10S

Number of Gusset Plates	m =	2.00	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =			$\varphi_s*A_g*F_y$	U=1.0	
				1173	kN	
Net Section Resistance	P_{RN} =			$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2				1810	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =			936	mm^2	
Gross Shear Area	A_{vg} =			5712	mm^2	
Net Tension Area	A_{tn} =			812	mm^2	
Net Shear Area	A_{vn} =			3858	mm^2	
$A_{tn} > 0.58*A_{vn}$?				No		
				$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =			1818	kN	FHWA 3.1.3
Tension Resistance (Governing)				1173	kN	
Demand/Capacity	D/C =			**0.095**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	19.29	in	490	mm	
L1	L_1 =	4.92	in	125	mm	
L2 - along centreline of action	L_2 =	4.92	in	125	mm	
L3	L_3 =	4.92	in	125	mm	
Unsupported Column Length	L_u =	4.92	in	125	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			$t/\sqrt{(12)}$	for rectangular plate	
		0.07	in	1.73	mm	
	λ =			$(K*L_u/r)*\mathrm{sqrt}[F_y/(\pi^2*E_s)]$		
				0.89		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				735	kN	

Span: Bascule Bridge - Leaf Span
Node: 10S

Demand/Capacity	D/C =			**0.000**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea		
Longest Length of connection	L=	18.74	in	476	mm		
Edge distance	e =	2.20	in	56	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	340	kip	1513	kN		
	B_{r2} =	347	kip	1544	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		299	kip	1327	kN		
Governing Resistance				2655	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.042**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	24.41	in	620	mm	5	
Shear Length 1	L_{V1} =	10.87	in	276	mm	3.5	
Shear Length 2	L_{V2} =	14.25	in	362	mm	4.5	
Tension Length	L_T =	15.55	in	395	mm	5	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
		1484	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		2085	kN	

Block Shear

Gross Tension Area	A_{tg} =	2370	mm^2

Span: Bascule Bridge - Leaf Span

Node: 10S

Gross Shear Area	A_{vg} =	3828	mm^2	
Net Tension Area	A_{tn} =	1752	mm^2	
Net Shear Area	A_{vn} =	2839	mm^2	
$A_{tn} > 0.58*A_{vn}$?		Yes		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =	1923	kN	FHWA 3.1.3
Tension Resistance (Governing)		1484	kN	
Demand/Capacity	D/C =	**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?				Yes		
General						FHWA 3.3
Whitmore Width	W_w =	24.41	in	620	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	13.15	in	334	mm	
L3	L_3 =	4.21	in	107	mm	
Unsupported Column Length	L_u =	5.79	in	147	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.07	in	1.73	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				1.05		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				797	kN	
Demand/Capacity	D/C =			**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	25	ea	25	ea		
Longest Length of connection	L=	19.37	in	492	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	361	kip	1604	kN		
	B_{r2} =	543	kip	2412	kN		

Span: Bascule Bridge - Leaf Span

Node: 10S

Shear Resistance of Rivets V_r = $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 CSA S6 CL14.14.1.4.2

467 kip 2074 kN

Governing Resistance 3208 kN for 2 plate(s)

Demand/Capacity D/C = **0.000**

For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	137	608
Shear Resistance (Net Section)	174	775
Shear Resistance (Governing)	137	608
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	420	1866
Shear Resistance (Net Section)	532	2364
Shear Resistance (Governing)	420	1866
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	298	1326
Net Section Resistance	447	1985
Block Shear Resistance	419	1863
Tension Resistance (Governing)	298	1326
At Member C:		
Gross Section Resistance	264	1173
Net Section Resistance	407	1810
Block Shear Resistance	409	1818
Tension Resistance (Governing)	264	1173
At Member D:		
Gross Section Resistance	334	1484
Net Section Resistance	469	2085
Block Shear Resistance	433	1923
Tension Resistance (Governing)	334	1484
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 10S

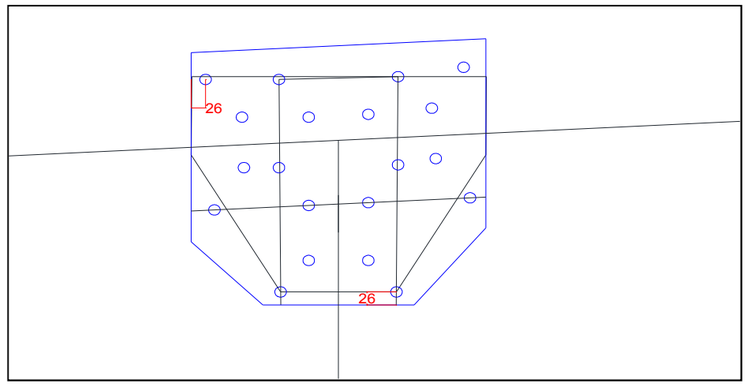
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	143	635
Compressive Resistance at Member C	165	735
Compressive Resistance at Member D	179	797
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	412	1833
Governing Resistance at Member B	635	2823
Governing Resistance at Member C	597	2655
Governing Resistance at Member D	722	3208
Governing Resistance at Member E	412	1833

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
	SHEAR PLANE A'-A'	137	608	**0.000**	
	SHEAR PLANE B'-B'	420	1866	**0.000**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	298	1326	**0.000**	
	Member C	264	1173	**0.095**	
	Member D	334	1484	**0.000**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	143	635	**0.000**	
	Member C	165	735	**0.000**	
	Member D	179	797	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	412	1833	**0.902**	<--- Governing
	Member B	635	2823	**0.000**	
	Member C	597	2655	**0.042**	
	Member D	722	3208	**0.000**	
	Member E	412	1833	**0.902**	<--- Governing
	Highest Demand/Capacity Ratio			**0.902**	

Span: Bascule Bridge - Leaf Span
Node: 11N

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.47 in	12 mm	6% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units		
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa		

MEMBER FORCES

Load Combination:		ULSB3 Max 0		Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
11N-A	P_{Max} =	415.1 kip	1845 kN	11N-A	419	1845	1845	1844	1845
11N-A	P_{Min} =	163.2 kip	726 kN	11N-A	419	726	726	726	726
11N-B	P_{Max} =	0.0 kip	0 kN	11N-B	0	#N/A	#N/A	#N/A	#N/A
11N-B	P_{Min} =	0.0 kip	0 kN	11N-B	0	#N/A	#N/A	#N/A	#N/A
11N-C	P_{Max} =	-2.5 kip	-11 kN	11N-C	247	-15	-13	-11	-11
11N-C	P_{Min} =	-7.1 kip	-32 kN	11N-C	247	-32	-28	-25	-32
11N-D	P_{Max} =	0.0 kip	0 kN	11N-D	0	#N/A	#N/A	#N/A	#N/A
11N-D	P_{Min} =	0.0 kip	0 kN	11N-D	0	#N/A	#N/A	#N/A	#N/A
11N-E	P_{Max} =	436.6 kip	1940 kN	11N-E	418	1940	1940	1940	1940
11N-E	P_{Min} =	152.6 kip	678 kN	11N-E	418	678	678	678	678

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 11N

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		0	deg	B
	φ_C =		93	deg	C
	φ_D =		0	deg	D
	$\cos(\varphi_B)$ =		1.000		
	$\cos(\varphi_C)$ =		-0.052		
	$\cos(\varphi_D)$ =		1.000		
	$V_{A'-A',max}$ =	0.4 kip	2	kN	*
	$V_{A'-A',min}$ =	0.1 kip	1	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	0.4 kip	2	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	0.0 kip	0	kN	

*using absolute maximum sums, conservative

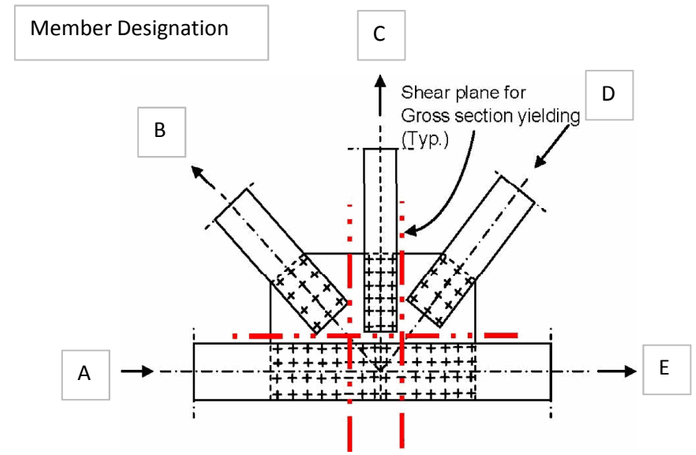


Figure 4 – Examples of gross section shear yielding planes

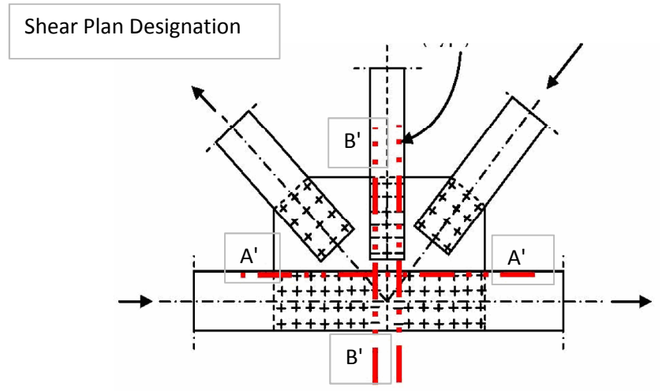


Figure 5 – Examples of net section shear fracture planes

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	21.06 in	535	mm	
No of holes in shear plane	N =	4.00 ea	4	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00 ea	2	ea	
Gross Shear Area	A_g =		12840	mm^2	
Net Shear Area	A_n =		10862	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =		$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =		1281	kN	
Shear Resistance (Net Section)	V_{Rn} =		$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =		1825	kN	
Shear Resistance (Governing)	V_R =		**1281**	**kN**	
Demand/Capacity	D/C =		**0.001**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	20.35 in	517	mm	
No of holes in shear plane	N =	6.00 ea	6	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2 ea	2	ea	

FHWA, Figures 4 and 5

Span: Bascule Bridge - Leaf Span

Node: 11N

Members A and E continuous through the gusset plate?				Yes		
Outside height of member A	H_A=	15	in	381	mm	
Thickness of the web of member A	w_A=	0.40	in	10	mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4	ea	
Gross Shear Area	A_g =			20150	mm^2	
Net Shear Area	A_n =			15509	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2010	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =			2606	kN	
Shear Resistance (Governing)	V_R =			**2010**	**kN**	
Demand/Capacity	D/C =			**0.000**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E — N/A

Members A and E continuous through the gusset plate?				Yes		

General

Whitmore Width	W_w =	0.00	in	0	mm	
Shear Length 1	L_{V1} =	0.00	in	0	mm	
Shear Length 2	L_{V2} =	0.00	in	0	mm	
Tension Length	L_T =	0.00	in	0	mm	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	

Number of Rivet/bolt diameters Intsecting Plane

0	
0	
0	
0	Typ, 1 less than Whitemore Width

($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	
		0	kN
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	
For gusset plates, U=1.0, FHWA 3.1.2		0	kN

FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

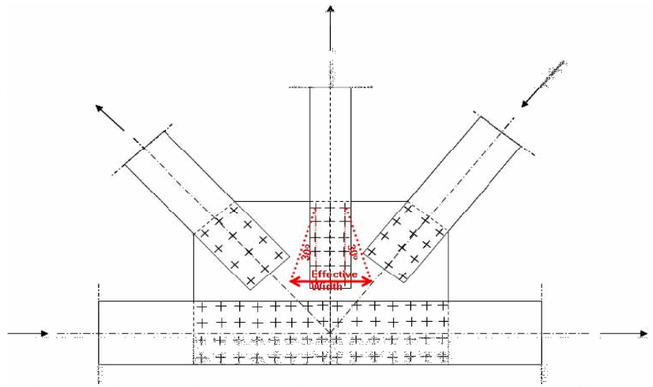


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

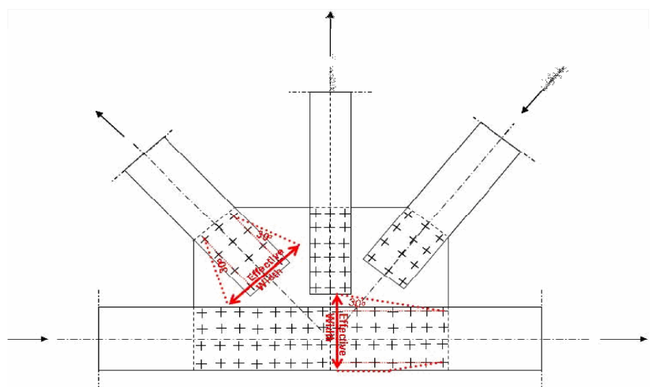


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 11N

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

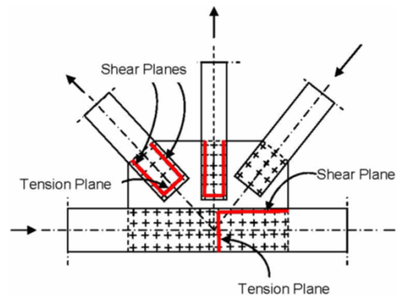


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0 "fixed-free condition"		
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		t/√(12) for rectangular plate		
		0.14 in	3.46 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

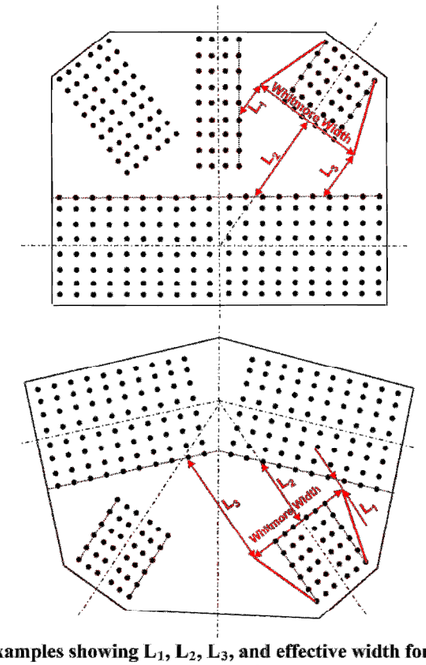


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Possible Scenario?			No		
Number of Rivets/Bolts	n =	16 ea	16 ea		
Longest Length of connection	L=	21.02 in	534 mm		
Edge distance	e =	1.02 in	26 mm		
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1 ea		
Number of Gusset Plates		2 ea	2 ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$		CSA S6 CL14.14.1.4.2
	B_{r1} =	316 kip	1405 kN		
	B_{r2} =	695 kip	3088 kN		
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$		CSA S6 CL14.14.1.4.2
		165 kip	733 kN		
Governing Resistance			1467 kN	for 2 plate(s)	

Span: Bascule Bridge - Leaf Span

Node: 11N

Demand/Capacity	D/C =	**0.000**		
For Connections greater than 50in (1270mm), shear resistance taken as 80%.				FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	21.81	in	554	mm	3
Shear Length 1	L_{V1} =	13.11	in	333	mm	4.5
Shear Length 2	L_{V2} =	11.38	in	289	mm	4.5
Tension Length	L_T =	14.33	in	364	mm	4
Number of Gusset Plates	m =	2	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$ U=1.0		FHWA 3.1.2
		2653	kN	
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$ U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		3969	kN	

Block Shear

Gross Tension Area	A_{tg} =	4368	mm^2
Gross Shear Area	A_{vg} =	7464	mm^2
Net Tension Area	A_{tn} =	3379	mm^2
Net Shear Area	A_{vn} =	5239	mm^2
$A_{tn} \geq 0.58*A_{vn}$?		Yes	

		$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$ U=1.0		
Block Shear Resistance	P_{Rbs} =	3725	kN	FHWA 3.1.3
Tension Resistance (Governing)		2653	kN	
Demand/Capacity	D/C =	**0.000**		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? Yes

General — FHWA 3.3

Whitmore Width	W_w =	21.81	in	554	mm

Span: Bascule Bridge - Leaf Span

Node: 11N

L1	L_1 =	0.79	in	20	mm	
L2 - along centreline of action	L_2 =	13.54	in	344	mm	
L3	L_3 =	4.88	in	124	mm	
Unsupported Column Length	L_u =	6.40	in	163	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.58		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2149	kN	
Demand/Capacity	D/C =			**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22	ea	22	ea	
Longest Length of connection	L=	18.94	in	481	mm	
Edge distance	e =	1.50	in	38	mm	
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")
Shear Planes per gusset plate	m =	1	ea	1	ea	
Number of Gusset Plates		2.00	ea	2	ea	
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0	CSA S6 CL14.14.1.4.2
	B_{r1} =	635	kip	2823	kN	
	B_{r2} =	955	kip	4246	kN	
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81	CSA S6 CL14.14.1.4.2
		411	kip	1825	kN	
Governing Resistance				3650	kN	for 2 plate(s)
Demand/Capacity	D/C =			**0.000**		

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	21.02	in	534	mm	2	
Shear Length 1	L_{V1} =	18.11	in	460	mm	5.5	
Shear Length 2	L_{V2} =	18.11	in	460	mm	5.5	
Tension Length	L_T =	8.27	in	210	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 11N

Number of Gusset Plates	m =	2.00	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =			$\varphi_s*A_g*F_y$	U=1.0	
				2557	kN	
Net Section Resistance	P_{RN} =			$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2				3974	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =			2520	mm^2	
Gross Shear Area	A_{vg} =			11040	mm^2	
Net Tension Area	A_{tn} =			2273	mm^2	
Net Shear Area	A_{vn} =			8321	mm^2	
$A_{tn} > 0.58*A_{vn}$?				No		
				$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =			4090	kN	FHWA 3.1.3
Tension Resistance (Governing)				2557	kN	
Demand/Capacity	D/C =			**0.000**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	21.02	in	534	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	0.00	in	0	mm	
L3	L_3 =	0.00	in	0	mm	
Unsupported Column Length	L_u =	0.00	in	0	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			$t/\sqrt{(12)}$	for rectangular plate	
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\mathrm{sqrt}[F_y/(\pi^2*E_s)]$		
				0.00		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2422	kN	

Span: Bascule Bridge - Leaf Span
Node: 11N

Demand/Capacity	D/C =			**0.013**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	12	ea	12	ea		
Longest Length of connection	L=	18.11	in	460	mm		
Edge distance	e =	1.02	in	26	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	237	kip	1054	kN		
	B_{r2} =	521	kip	2316	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		224	kip	995	kN		
Governing Resistance				1991	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.016**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	24.41	in	620	mm	5	
Shear Length 1	L_{V1} =	10.87	in	276	mm	3.5	
Shear Length 2	L_{V2} =	14.25	in	362	mm	4.5	
Tension Length	L_T =	15.55	in	395	mm	5	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		2969	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		4169	kN		

Block Shear

Gross Tension Area	A_{tg} =	4740	mm^2

Span: Bascule Bridge - Leaf Span

Node: 11N

Gross Shear Area	A_{vg} =			7656	mm^2	
Net Tension Area	A_{tn} =			3504	mm^2	
Net Shear Area	A_{vn} =			5678	mm^2	
$A_{tn} > 0.58*A_{vn}$?				Yes		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		U=1.0		
Block Shear Resistance	P_{Rbs} =			3847	kN	FHWA 3.1.3
Tension Resistance (Governing)				2969	kN	
Demand/Capacity	D/C =			**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?				Yes		
General						FHWA 3.3
Whitmore Width	W_w =	24.41	in	620	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	13.15	in	334	mm	
L3	L_3 =	4.21	in	107	mm	
Unsupported Column Length	L_u =	5.79	in	147	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			$t/\sqrt{(12)}$	for rectangular plate	
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.53		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2489	kN	
Demand/Capacity	D/C =			**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	25	ea	25	ea		
Longest Length of connection	L=	19.37	in	492	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0			CSA S6 CL14.14.1.4.2
	B_{r1} =	722	kip	3208	kN		
	B_{r2} =	1086	kip	4825	kN		

Span: Bascule Bridge - Leaf Span

Node: 11N

Shear Resistance of Rivets V_r = 467 kip $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 2074 kN CSA S6 CL14.14.1.4.2

Governing Resistance 4148 kN for 2 plate(s)

Demand/Capacity D/C = **0.000**

For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	288	1281
Shear Resistance (Net Section)	411	1825
Shear Resistance (Governing)	288	1281
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	452	2010
Shear Resistance (Net Section)	586	2606
Shear Resistance (Governing)	452	2010
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	597	2653
Net Section Resistance	893	3969
Block Shear Resistance	838	3725
Tension Resistance (Governing)	597	2653
At Member C:		
Gross Section Resistance	575	2557
Net Section Resistance	894	3974
Block Shear Resistance	920	4090
Tension Resistance (Governing)	575	2557
At Member D:		
Gross Section Resistance	668	2969
Net Section Resistance	938	4169
Block Shear Resistance	866	3847
Tension Resistance (Governing)	668	2969
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 11N

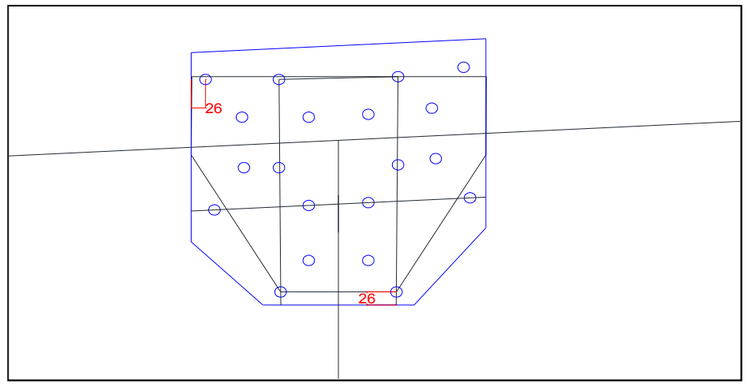
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	483	2149
Compressive Resistance at Member C	545	2422
Compressive Resistance at Member D	560	2489
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	330	1467
Governing Resistance at Member B	821	3650
Governing Resistance at Member C	448	1991
Governing Resistance at Member D	933	4148
Governing Resistance at Member E	330	1467

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
	SHEAR PLANE A'-A'	288	1281	**0.001**	
	SHEAR PLANE B'-B'	452	2010	**0.000**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	597	2653	**0.000**	
	Member C	575	2557	**0.000**	
	Member D	668	2969	**0.000**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	483	2149	**0.000**	
	Member C	545	2422	**0.013**	
	Member D	560	2489	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	330	1467	**0.000**	
	Member B	821	3650	**0.000**	
	Member C	448	1991	**0.016**	<--- Governing
	Member D	933	4148	**0.000**	
	Member E	330	1467	**0.000**	
	Highest Demand/Capacity Ratio			**0.016**	

Span: Bascule Bridge - Leaf Span
Node: 11S

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.47 in	12 mm	6% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units		
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa		

MEMBER FORCES

Load Combination:		ULSB3 Max 0	
11S-A	P_{Max} =	447.1 kip	1987 kN
11S-A	P_{Min} =	178.1 kip	791 kN
11S-B	P_{Max} =	0.0 kip	0 kN
11S-B	P_{Min} =	0.0 kip	0 kN
11S-C	P_{Max} =	-2.6 kip	-12 kN
11S-C	P_{Min} =	-7.3 kip	-32 kN
11S-D	P_{Max} =	0.0 kip	0 kN
11S-D	P_{Min} =	0.0 kip	0 kN
11S-E	P_{Max} =	457.9 kip	2035 kN
11S-E	P_{Min} =	162.5 kip	722 kN

Note: Tension is positive.

Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
11S-A	488	1987	1987	1987	1987
11S-A	488	792	792	791	791
11S-B	0	#N/A	#N/A	#N/A	#N/A
11S-B	0	#N/A	#N/A	#N/A	#N/A
11S-C	578	-15	-13	-12	-12
11S-C	578	-32	-29	-26	-32
11S-D	0	#N/A	#N/A	#N/A	#N/A
11S-D	0	#N/A	#N/A	#N/A	#N/A
11S-E	487	2035	2035	2035	2035
11S-E	487	722	722	722	722

Span: Bascule Bridge - Leaf Span
Node: 11S

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		0	deg	B
	φ_C =		93	deg	C
	φ_D =		0	deg	D
	$\cos(\varphi_B)$ =		1.000		
	$\cos(\varphi_C)$ =		-0.052		
	$\cos(\varphi_D)$ =		1.000		
	$V_{A'-A',max}$ =	0.4 kip	2	kN	*
	$V_{A'-A',min}$ =	0.1 kip	1	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	0.4 kip	2	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	0.0 kip	0	kN	

*using absolute maximum sums, conservative

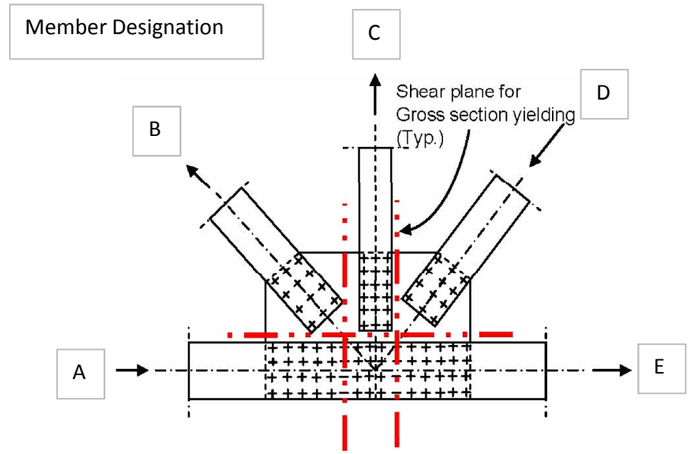


Figure 4 – Examples of gross section shear yielding planes

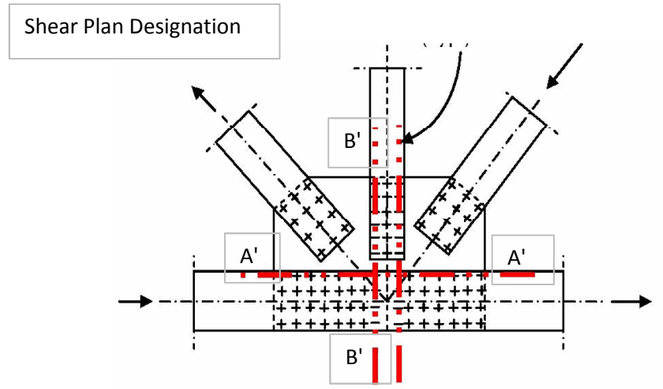


Figure 5 – Examples of net section shear fracture planes

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	21.06	in	535	mm	
No of holes in shear plane	N =	4.00	ea	4	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			12840	mm^2	
Net Shear Area	A_n =			10862	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			1281	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =			1825	kN	
Shear Resistance (Governing)	V_R =			**1281**	**kN**	
Demand/Capacity	D/C =			**0.001**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	20.35	in	517	mm	
No of holes in shear plane	N =	6.00	ea	6	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

FHWA, Figures 4 and 5

Span: Bascule Bridge - Leaf Span

Node: 11S

Members A and E continuous through the gusset plate?				Yes		
Outside height of member A	H_A=	15	in	381	mm	
Thickness of the web of member A	w_A=	0.40	in	10	mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4	ea	
Gross Shear Area	A_g =			20150	mm^2	
Net Shear Area	A_n =			15509	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2010	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =			2606	kN	
Shear Resistance (Governing)	V_R =			**2010**	**kN**	
Demand/Capacity	D/C =			**0.000**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E — N/A

Members A and E continuous through the gusset plate?				Yes		

General

Whitmore Width	W_w =	0.00	in	0	mm	
Shear Length 1	L_{V1} =	0.00	in	0	mm	
Shear Length 2	L_{V2} =	0.00	in	0	mm	
Tension Length	L_T =	0.00	in	0	mm	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	

Number of Rivet/bolt diameters Intsecting Plane

0	
0	
0	
0	Typ, 1 less than Whitemore Width

($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	
		0	kN
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	
For gusset plates, U=1.0, FHWA 3.1.2		0	kN

FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

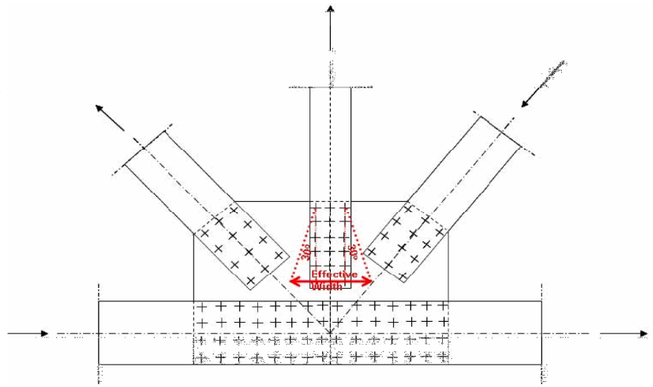


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

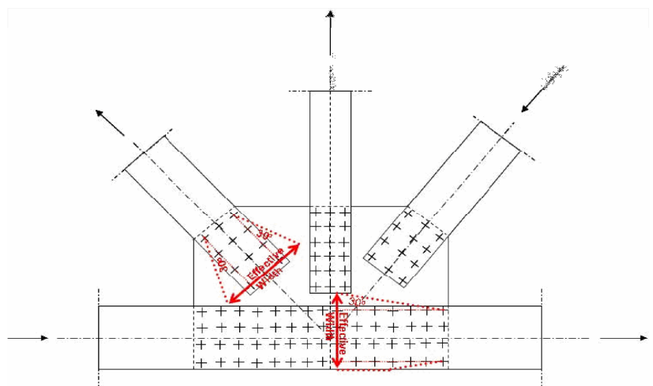


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 11S

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

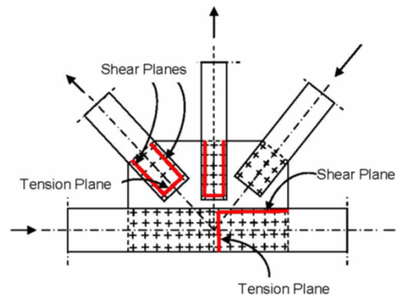


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46 mm		
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

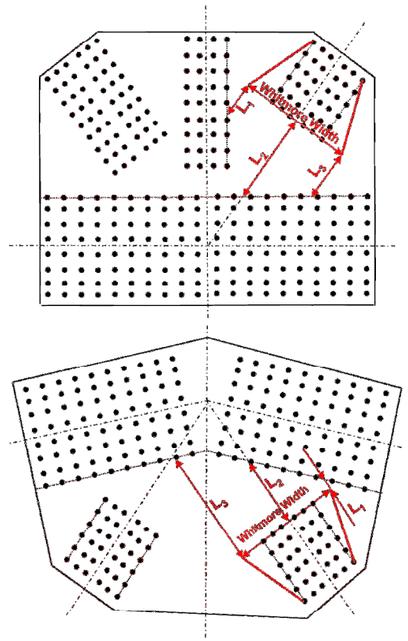


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Possible Scenario?			No			
Number of Rivets/Bolts	n =	16 ea	16 ea			
Longest Length of connection	L=	21.02 in	534 mm			
Edge distance	e =	1.02 in	26 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$			CSA S6 CL14.14.1.4.2
	B_{r1} =	316 kip	1405 kN			
	B_{r2} =	695 kip	3088 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$			CSA S6 CL14.14.1.4.2
		165 kip	733 kN			
Governing Resistance			1467 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span
Node: 11S

Demand/Capacity	D/C =	0.000	
For Connections greater than 50in (1270mm), shear resistance taken as 80%.			FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	21.81	in	554	mm	3
Shear Length 1	L_{V1} =	13.11	in	333	mm	4.5
Shear Length 2	L_{V2} =	11.38	in	289	mm	4.5
Tension Length	L_T =	14.33	in	364	mm	4
Number of Gusset Plates	m =	2	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$ U=1.0	2653 kN	FHWA 3.1.2
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$ U=1.0	3969 kN	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2				

Block Shear

Gross Tension Area	A_{tg} =	4368	mm^2
Gross Shear Area	A_{vg} =	7464	mm^2
Net Tension Area	A_{tn} =	3379	mm^2
Net Shear Area	A_{vn} =	5239	mm^2
$A_{tn} \geq 0.58*A_{vn}$?		Yes	

		$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$ U=1.0		
Block Shear Resistance	P_{Rbs} =		3725 kN	FHWA 3.1.3
Tension Resistance (Governing)			2653 kN	
Demand/Capacity	D/C =		0.000	

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? Yes

General — FHWA 3.3

Whitmore Width	W_w =	21.81	in	554 mm

Span: Bascule Bridge - Leaf Span

Node: 11S

L1	L_1 =	0.79	in	20	mm	
L2 - along centreline of action	L_2 =	13.54	in	344	mm	
L3	L_3 =	4.88	in	124	mm	
Unsupported Column Length	L_u =	6.40	in	163	mm	
Effective Length Factor	K =	1.20		1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)		for rectangular plate
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.58		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2149	kN	
Demand/Capacity	D/C =			**0.000**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22	ea	22	ea	
Longest Length of connection	L=	18.94	in	481	mm	
Edge distance	e =	1.50	in	38	mm	
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")
Shear Planes per gusset plate	m =	1	ea	1	ea	
Number of Gusset Plates		2.00	ea	2	ea	
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0	CSA S6 CL14.14.1.4.2
	B_{r1} =	635	kip	2823	kN	
	B_{r2} =	955	kip	4246	kN	
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81	CSA S6 CL14.14.1.4.2
		411	kip	1825	kN	
Governing Resistance				3650	kN	for 2 plate(s)
Demand/Capacity	D/C =			**0.000**		

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	21.02	in	534	mm	2	
Shear Length 1	L_{V1} =	18.11	in	460	mm	5.5	
Shear Length 2	L_{V2} =	18.11	in	460	mm	5.5	
Tension Length	L_T =	8.27	in	210	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 11S

Number of Gusset Plates	m =	2.00 ea	2 ea		
Diameter of holes in plane	d_b =	0.81 in	21 mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			2557	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			3974	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		2520	mm^2	
Gross Shear Area	A_{vg} =		11040	mm^2	
Net Tension Area	A_{tn} =		2273	mm^2	
Net Shear Area	A_{vn} =		8321	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		4090	kN	FHWA 3.1.3
Tension Resistance (Governing)			2557	kN	
Demand/Capacity	D/C =		**0.000**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored?			N/A		
General					FHWA 3.3
Whitmore Width	W_w =	21.02 in	534	mm	
L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	0.00 in	0	mm	
L3	L_3 =	0.00 in	0	mm	
Unsupported Column Length	L_u =	0.00 in	0	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.14 in	3.46	mm	
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			2422	kN	

Span: Bascule Bridge - Leaf Span
Node: 11S

Demand/Capacity	D/C =			**0.013**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	12	ea	12	ea		
Longest Length of connection	L=	18.11	in	460	mm		
Edge distance	e =	1.02	in	26	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	237	kip	1054	kN		
	B_{r2} =	521	kip	2316	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		224	kip	995	kN		
Governing Resistance				1991	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.016**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? Yes

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	24.41	in	620	mm	5	
Shear Length 1	L_{V1} =	10.87	in	276	mm	3.5	
Shear Length 2	L_{V2} =	14.25	in	362	mm	4.5	
Tension Length	L_T =	15.55	in	395	mm	5	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0	FHWA 3.1.2
		2969	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0	FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		4169	kN	

Block Shear

Gross Tension Area	A_{tg} =	4740	mm^2

Span: Bascule Bridge - Leaf Span

Node: 11S

Gross Shear Area	A_{vg} =			7656	mm^2	
Net Tension Area	A_{tn} =			3504	mm^2	
Net Shear Area	A_{vn} =			5678	mm^2	
$A_{tn} > 0.58*A_{vn}$?				Yes		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		U=1.0	
Block Shear Resistance	P_{Rbs} =			3847	kN	FHWA 3.1.3
Tension Resistance (Governing)				2969	kN	
Demand/Capacity	D/C =			**0.000**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?				Yes		
General						FHWA 3.3
Whitmore Width	W_w =	24.41	in	620	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	13.15	in	334	mm	
L3	L_3 =	4.21	in	107	mm	
Unsupported Column Length	L_u =	5.79	in	147	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.14	in	3.46	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.53		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2489	kN	
Demand/Capacity	D/C =			**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	25	ea	25	ea		
Longest Length of connection	L=	19.37	in	492	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$		U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	722	kip	3208	kN		
	B_{r2} =	1086	kip	4825	kN		

Span: Bascule Bridge - Leaf Span
Node: 11S

Shear Resistance of Rivets V_r = $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 CSA S6 CL14.14.1.4.2

467 kip 2074 kN

Governing Resistance 4148 kN for 2 plate(s)

Demand/Capacity D/C = **0.000**

For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	288	1281
Shear Resistance (Net Section)	411	1825
Shear Resistance (Governing)	288	1281
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	452	2010
Shear Resistance (Net Section)	586	2606
Shear Resistance (Governing)	452	2010
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	597	2653
Net Section Resistance	893	3969
Block Shear Resistance	838	3725
Tension Resistance (Governing)	597	2653
At Member C:		
Gross Section Resistance	575	2557
Net Section Resistance	894	3974
Block Shear Resistance	920	4090
Tension Resistance (Governing)	575	2557
At Member D:		
Gross Section Resistance	668	2969
Net Section Resistance	938	4169
Block Shear Resistance	866	3847
Tension Resistance (Governing)	668	2969
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 11S

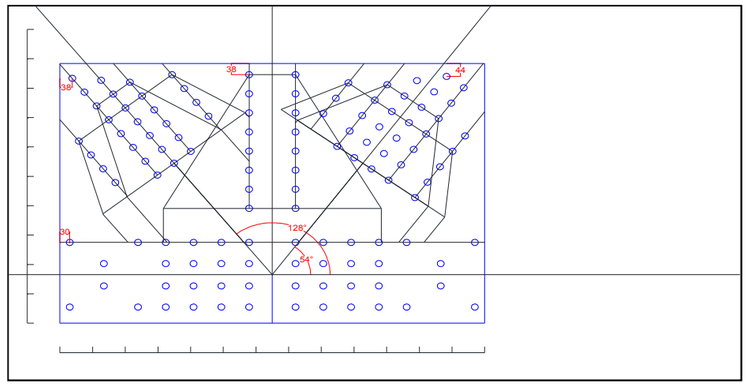
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	483	2149
Compressive Resistance at Member C	545	2422
Compressive Resistance at Member D	560	2489
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	330	1467
Governing Resistance at Member B	821	3650
Governing Resistance at Member C	448	1991
Governing Resistance at Member D	933	4148
Governing Resistance at Member E	330	1467

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
GUSSET PLATE SHEAR		kip	kN		
	SHEAR PLANE A'-A'	288	1281	**0.001**	
	SHEAR PLANE B'-B'	452	2010	**0.000**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	597	2653	**0.000**	
	Member C	575	2557	**0.000**	
	Member D	668	2969	**0.000**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	483	2149	**0.000**	
	Member C	545	2422	**0.013**	
	Member D	560	2489	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	330	1467	**0.000**	
	Member B	821	3650	**0.000**	
	Member C	448	1991	**0.016**	<--- Governing
	Member D	933	4148	**0.000**	
	Member E	330	1467	**0.000**	
	Highest Demand/Capacity Ratio			**0.016**	

Span: Bascule Bridge - Leaf Span
Node: 12N

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units	S.I. Units	
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50 in	12.7 mm	
Limiting Thickness of Gusset Plate	t =	0.39 in	10 mm	21% Corrosion
Structural Steel - Tension	φ_s =		0.95	
	φ_u =		0.8	
Structural Steel - Compression	φ_s =		0.9	
Resistance Factor for Riveted Connections	φ_{mc} =		0.67	CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =		0.67	CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units	S.I. Units		
Yield Strength of Steel:	F_y =	30 ksi	210 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61 ksi	420 MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46 ksi	320 MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000 ksi	200000 MPa		

MEMBER FORCES

Load Combination:		ULSB3 Max 0		Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
12N-A	P_{Max} =	-29.2 kip	-130 kN	12N-A	284	-130	-130	-130	-130
12N-A	P_{Min} =	-354.7 kip	-1576 kN	12N-A	284	-1576	-1576	-1576	-1576
12N-B	P_{Max} =	-81.6 kip	-363 kN	12N-B	10	-363	-366	-369	-363
12N-B	P_{Min} =	-179.4 kip	-797 kN	12N-B	10	-786	-792	-797	-797
12N-C	P_{Max} =	-2.5 kip	-11 kN	12N-C	247	-15	-13	-11	-11
12N-C	P_{Min} =	-7.1 kip	-32 kN	12N-C	247	-32	-28	-25	-32
12N-D	P_{Max} =	211.8 kip	942 kN	12N-D	11	929	935	942	942
12N-D	P_{Min} =	99.4 kip	442 kN	12N-D	11	442	445	448	442
12N-E	P_{Max} =	-85.5 kip	-380 kN	12N-E	285	-380	-380	-380	-380
12N-E	P_{Min} =	-656.5 kip	-2918 kN	12N-E	285	-2918	-2918	-2918	-2918

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 12N

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		128	deg	B
	φ_C =		90	deg	C
	φ_D =		54	deg	D
	$\cos(\varphi_B)$ =		-0.616		
	$\cos(\varphi_C)$ =		0.000		
	$\cos(\varphi_D)$ =		0.588		
	$V_{A'-A',max}$ =	235.0 kip	1044	kN	*
	$V_{A'-A',min}$ =	108.7 kip	483	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	235.0 kip	1044	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	171.4 kip	762	kN	

*using absolute maximum sums, conservative

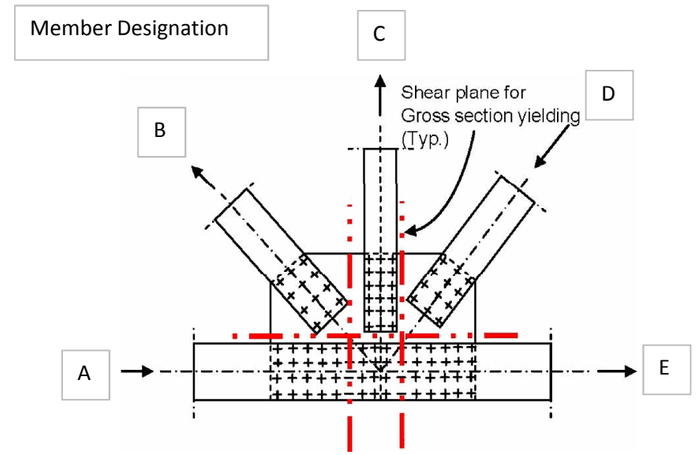


Figure 4 – Examples of gross section shear yielding planes

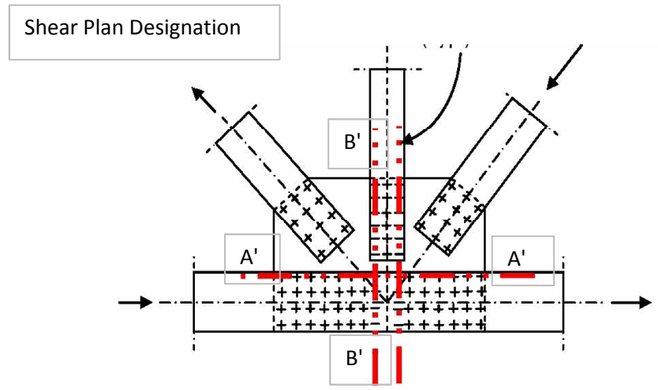


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	51.18 in	1300	mm	
No of holes in shear plane	N =	12.00 ea	12	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00 ea	2	ea	
Gross Shear Area	A_g =		26000	mm^2	
Net Shear Area	A_n =		21056	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =		$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =		2594	kN	
Shear Resistance (Net Section)	V_{Rn} =		$0.5*\varphi_u*A_n*F_U$ *		Cl 10.18.5.2
	V_{Rn} =		3537	kN	
Shear Resistance (Governing)	V_R =		**2594**	**kN**	
Demand/Capacity	D/C =		**0.403**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	34.80 in	884	mm	
No of holes in shear plane	N =	12.00 ea	12	ea	
Diameter of holes in plane	d_b =	0.81 in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2 ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 12N

Members A and E continuous through the gusset plate?				Yes		
Outside height of member A	H_A=	15	in	381	mm	
Thickness of the web of member A	w_A=	0.40	in	10	mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4	ea	
Gross Shear Area	A_g =			25422	mm^2	
Net Shear Area	A_n =			18804	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2536	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =			3159	kN	
Shear Resistance (Governing)	V_R =			**2536**	**kN**	
Demand/Capacity	D/C =			**0.300**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E — N/A

Members A and E continuous through the gusset plate? Yes

General

Whitmore Width	W_w =	0.00	in	0	mm	Number of Rivet/bolt diameters Intsecting Plane
Shear Length 1	L_{V1} =	0.00	in	0	mm	0
Shear Length 2	L_{V2} =	0.00	in	0	mm	0
Tension Length	L_T =	0.00	in	0	mm	0
Number of Gusset Plates	m =	2.00	ea	2	ea	0 Typ, 1 less than Whitemore Width
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$		
		0	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		0	kN	

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

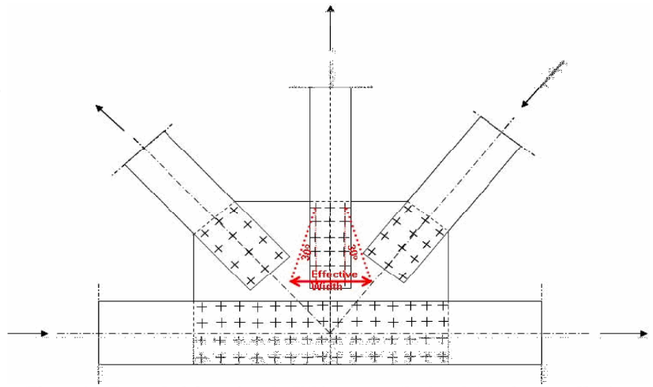


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

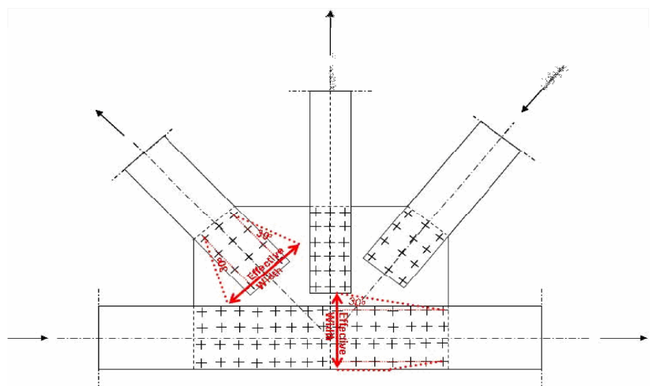


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 12N

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

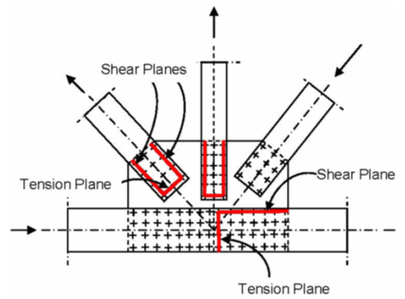


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.11 in	2.89 mm		
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

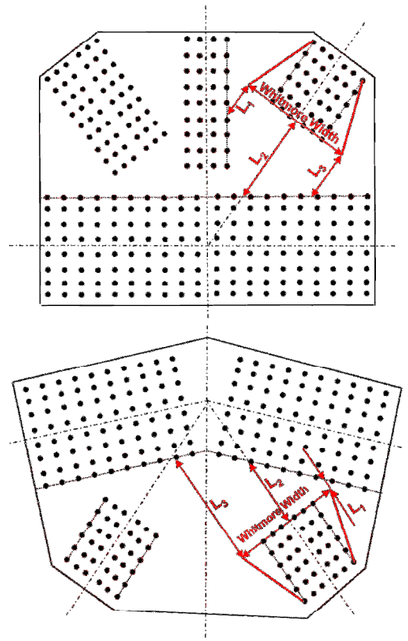


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	44 ea	44 ea			
Longest Length of connection	L=	51.18 in	1300 mm			
Edge distance	e =	1.18 in	30 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$		CSA S6 CL14.14.1.4.2	
	B_{r1} =	836 kip	3714 kN			
	B_{r2} =	1592 kip	7076 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$		CSA S6 CL14.14.1.4.2	
		454 kip	2017 kN			
Governing Resistance			3227 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span

Node: 12N

Demand/Capacity	D/C =	**0.904**	
For Connections greater than 50in (1270mm), shear resistance taken as 80%.			FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? No

General

						Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	21.81	in	554	mm	3
Shear Length 1	L_{V1} =	13.11	in	333	mm	4.5
Shear Length 2	L_{V2} =	11.38	in	289	mm	4.5
Tension Length	L_T =	14.33	in	364	mm	4
Number of Gusset Plates	m =	2	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$ U=1.0		FHWA 3.1.2
		2210	kN	
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$ U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		3308	kN	

Block Shear

Gross Tension Area	A_{tg} =	3640	mm^2
Gross Shear Area	A_{vg} =	6220	mm^2
Net Tension Area	A_{tn} =	2816	mm^2
Net Shear Area	A_{vn} =	4366	mm^2
$A_{tn} \geq 0.58*A_{vn}$?		Yes	

$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$ U=1.0

Block Shear Resistance	P_{Rbs} =	3105	kN	FHWA 3.1.3
Tension Resistance (Governing)		2210	kN	
Demand/Capacity	D/C =	**0.000**		

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? No

General — FHWA 3.3

Whitmore Width	W_w =	21.81	in	554	mm

Span: Bascule Bridge - Leaf Span

Node: 12N

L1	L_1 =	0.79	in	20	mm	
L2 - along centreline of action	L_2 =	13.54	in	344	mm	
L3	L_3 =	4.88	in	124	mm	
Unsupported Column Length	L_u =	6.40	in	163	mm	
Effective Length Factor	K =	1.20		1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)		for rectangular plate
		0.11	in	2.89	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.70		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				1646	kN	
Demand/Capacity	D/C =			**0.484**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22	ea	22	ea		
Longest Length of connection	L=	18.94	in	481	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	529	kip	2353	kN		
	B_{r2} =	796	kip	3538	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		411	kip	1825	kN		
Governing Resistance				3650	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.218**			

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	26.38	in	670	mm	2	
Shear Length 1	L_{V1} =	19.41	in	493	mm	7.5	
Shear Length 2	L_{V2} =	19.41	in	493	mm	7.5	
Tension Length	L_T =	5.59	in	142	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 12N

Number of Gusset Plates	m =	2.00	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =			$\varphi_s*A_g*F_y$	U=1.0	
				2673	kN	
Net Section Resistance	P_{RN} =			$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2				4226	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =			1420	mm^2	
Gross Shear Area	A_{vg} =			9860	mm^2	
Net Tension Area	A_{tn} =			1214	mm^2	
Net Shear Area	A_{vn} =			6770	mm^2	
$A_{tn} > 0.58*A_{vn}$?				No		
				$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =			3116	kN	FHWA 3.1.3
Tension Resistance (Governing)				2673	kN	
Demand/Capacity	D/C =			**0.000**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored? N/A

General — FHWA 3.3

Whitmore Width	W_w =	26.38	in	670	mm	
L1	L_1 =	4.57	in	116	mm	
L2 - along centreline of action	L_2 =	4.57	in	116	mm	
L3	L_3 =	4.57	in	116	mm	
Unsupported Column Length	L_u =	4.57	in	116	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			$t/\sqrt{(12)}$	for rectangular plate	
		0.11	in	2.89	mm	
	λ =			$(K*L_u/r)*\mathrm{sqrt}[F_y/(\pi^2*E_s)]$		
				0.50		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				2276	kN	

Span: Bascule Bridge - Leaf Span
Node: 12N

Demand/Capacity	D/C =			**0.014**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea		
Longest Length of connection	L=	19.41	in	493	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	385	kip	1711	kN		
	B_{r2} =	579	kip	2573	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		299	kip	1327	kN		
Governing Resistance				2655	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.012**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? No

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	24.41	in	620	mm	5	
Shear Length 1	L_{V1} =	10.87	in	276	mm	3.5	
Shear Length 2	L_{V2} =	14.25	in	362	mm	4.5	
Tension Length	L_T =	15.55	in	395	mm	5	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		2474	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		3474	kN		

Block Shear

Gross Tension Area	A_{tg} =	3950	mm^2

Span: Bascule Bridge - Leaf Span

Node: 12N

Gross Shear Area	A_{vg} =	6380	mm^2	
Net Tension Area	A_{tn} =	2920	mm^2	
Net Shear Area	A_{vn} =	4732	mm^2	
$A_{tn} > 0.58*A_{vn}$?		Yes		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =	3206	kN	FHWA 3.1.3
Tension Resistance (Governing)		2474	kN	
Demand/Capacity	D/C =	**0.381**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored? No

General FHWA 3.3

Whitmore Width	W_w =	24.41	in	620	mm	
L1	L_1 =	0.00	in	0	mm	
L2 - along centreline of action	L_2 =	13.15	in	334	mm	
L3	L_3 =	4.21	in	107	mm	
Unsupported Column Length	L_u =	5.79	in	147	mm	
Effective Length Factor	K =	1.20		1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)	for rectangular plate	
		0.11	in	2.89	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.63		
Compressive Resistance	C_r =			$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				1938	kN	
Demand/Capacity	D/C =			**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	25	ea	25	ea		
Longest Length of connection	L=	19.37	in	492	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	601	kip	2673	kN		
	B_{r2} =	905	kip	4021	kN		

Span: Bascule Bridge - Leaf Span

Node: 12N

Shear Resistance of Rivets V_r = $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 CSA S6 CL14.14.1.4.2

467 kip 2074 kN

Governing Resistance 4148 kN for 2 plate(s)

Demand/Capacity D/C = **0.227**

For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	584	2594
Shear Resistance (Net Section)	796	3537
Shear Resistance (Governing)	584	2594
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	571	2536
Shear Resistance (Net Section)	711	3159
Shear Resistance (Governing)	571	2536
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	497	2210
Net Section Resistance	744	3308
Block Shear Resistance	699	3105
Tension Resistance (Governing)	497	2210
At Member C:		
Gross Section Resistance	601	2673
Net Section Resistance	951	4226
Block Shear Resistance	701	3116
Tension Resistance (Governing)	601	2673
At Member D:		
Gross Section Resistance	557	2474
Net Section Resistance	782	3474
Block Shear Resistance	721	3206
Tension Resistance (Governing)	557	2474
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 12N

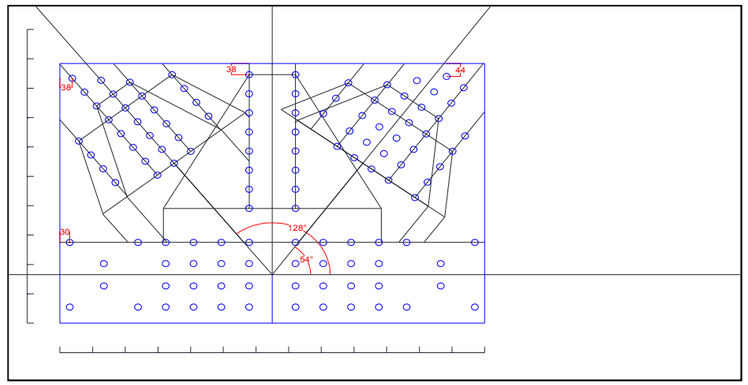
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	370	1646
Compressive Resistance at Member C	512	2276
Compressive Resistance at Member D	436	1938
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	726	3227
Governing Resistance at Member B	821	3650
Governing Resistance at Member C	597	2655
Governing Resistance at Member D	933	4148
Governing Resistance at Member E	726	3227

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
		kip	kN		
GUSSET PLATE SHEAR					
	SHEAR PLANE A'-A'	584	2594	**0.403**	
	SHEAR PLANE B'-B'	571	2536	**0.300**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	497	2210	**0.000**	
	Member C	601	2673	**0.000**	
	Member D	557	2474	**0.381**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	370	1646	**0.484**	
	Member C	512	2276	**0.014**	
	Member D	436	1938	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	726	3227	**0.904**	<--- Governing
	Member B	821	3650	**0.218**	
	Member C	597	2655	**0.012**	
	Member D	933	4148	**0.227**	
	Member E	726	3227	**0.904**	<--- Governing
	Highest Demand/Capacity Ratio			**0.904**	

Span: Bascule Bridge - Leaf Span
Node: 12S

1.0 GENERAL INFORMATION



REFERENCES

1. CSA S6-14
2. FHWA-IF-09-014 Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges - Part A
3. Gusset plate under combined flexural and axial loads and slenderness ratio of unsupported free edges of the gusset plate not checked in accordance with guidance provided within the above mentioned document, sections 3.4 and 3.5

ANALYSIS ASSUMPTIONS & INITIAL DIMENSIONS

		U.S. Units		S.I. Units		
Nominal Thickness of Gusset Plate	$t_{Nominal}$ =	0.50	in	12.7	mm	
Limiting Thickness of Gusset Plate	t =	0.39	in	10	mm	21% Corrosion
Structural Steel - Tension	φ_s =			0.95		
	φ_u =			0.8		
Structural Steel - Compression	φ_s =			0.9		
Resistance Factor for Riveted Connections	φ_{mc} =			0.67		CSA S6 CL 14.14.1.4.2
Resistance Factor for Rivet	φr =			0.67		CSA S6 CL 14.14.1.4.2

MATERIAL PROPERTIES

		U.S. Units		S.I. Units			
Yield Strength of Steel:	F_y =	30	ksi	210	MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Steel:	F_u =	61	ksi	420	MPa	1905-1932	CSA S6 CL14.7.4.2
Ultimate Tensile Strength of Rivets:	F_u =	46	ksi	320	MPa	1905-1932	CSA S6-14 CL14.7.4.6
Modulus of Elasticity of Steel:	E =	29000	ksi	200000	MPa		

MEMBER FORCES

Load Combination:		ULSB3 Max 0				Frame Member	Frame ID	P @ 0 kN	P @ L/2 kN	P @ L kN	P_{max} or P_{min} kN
12S-A	P_{Max} =	-37.2	kip	-165	kN	12S-A	564	-165	-165	-165	-165
12S-A	P_{Min} =	-372.1	kip	-1654	kN	12S-A	564	-1654	-1654	-1654	-1654
12S-B	P_{Max} =	-91.2	kip	-405	kN	12S-B	186	-405	-408	-411	-405
12S-B	P_{Min} =	-200.1	kip	-889	kN	12S-B	186	-878	-884	-889	-889
12S-C	P_{Max} =	-2.6	kip	-12	kN	12S-C	578	-15	-13	-12	-12
12S-C	P_{Min} =	-7.3	kip	-32	kN	12S-C	578	-32	-29	-26	-32
12S-D	P_{Max} =	239.4	kip	1064	kN	12S-D	187	1052	1058	1064	1064
12S-D	P_{Min} =	112.2	kip	499	kN	12S-D	187	499	502	505	499
12S-E	P_{Max} =	-102.4	kip	-455	kN	12S-E	565	-455	-455	-455	-455
12S-E	P_{Min} =	-693.0	kip	-3080	kN	12S-E	565	-3080	-3080	-3080	-3080

Note: Tension is positive.

Span: Bascule Bridge - Leaf Span
Node: 12S

Section A'-A'

Member Angle (clockwise from Line of Action to Shear Plane (A'-A')	φ_B =		128	deg	B
	φ_C =		90	deg	C
	φ_D =		54	deg	D
	$\cos(\varphi_B)$ =		-0.616		
	$\cos(\varphi_C)$ =		0.000		
	$\cos(\varphi_D)$ =		0.588		
	$V_{A'-A',max}$ =	263.9 kip	1173	kN	*
	$V_{A'-A',min}$ =	122.1 kip	543	kN	*
Shear Force at A'-A' (Governing)	$V_{A'-A'}$ =	263.9 kip	1173	kN	*

Section B'-B'

Shear Force at B'-B' (Governing)	$V_{B'-B'}$ =	193.7 kip	861	kN	

*using absolute maximum sums, conservative

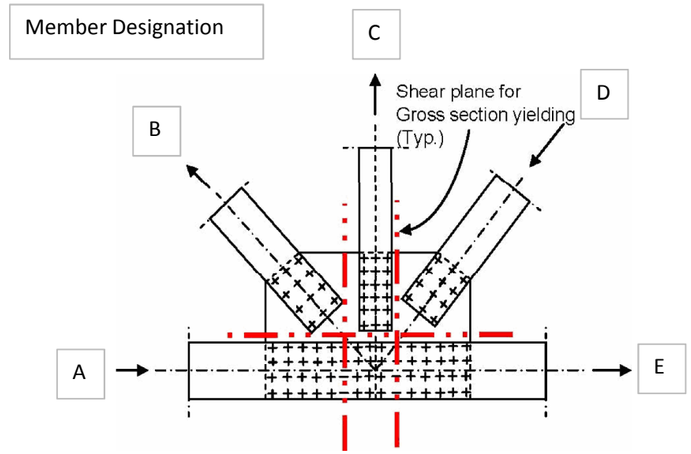


Figure 4 – Examples of gross section shear yielding planes

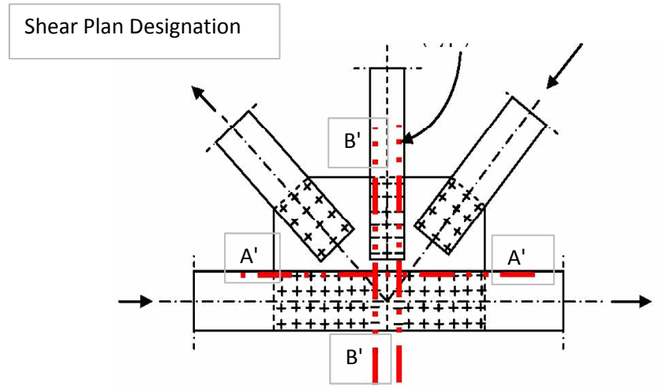


Figure 5 – Examples of net section shear fracture planes

FHWA, Figures 4 and 5

2.0 GUSSET PLATE SHEAR

Take shear sections as required to capture shear of the plate.

SHEAR PLANE **A'-A'** Horizontal in plane of member A and/or E

Length of Shear Plane	L =	51.18	in	1300	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2.00	ea	2	ea	
Gross Shear Area	A_g =			26000	mm^2	
Net Shear Area	A_n =			21056	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2594	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_U$	*	Cl 10.18.5.2
	V_{Rn} =			3537	kN	
Shear Resistance (Governing)	V_R =			**2594**	**kN**	
Demand/Capacity	D/C =			**0.452**		

For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

SHEAR PLANE **B'-B'** Vertical in plane of member C

Length of Shear Plane	L =	34.80	in	884	mm	
No of holes in shear plane	N =	12.00	ea	12	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")
Number of Gusset Plates	m =	2	ea	2	ea	

Span: Bascule Bridge - Leaf Span

Node: 12S

Members A and E continuous through the gusset plate?				Yes		
Outside height of member A	H_A=	15	in	381	mm	
Thickness of the web of member A	w_A=	0.40	in	10	mm	
No of holes in member A/E in shear plane	N_A=	4	ea	4	ea	
Gross Shear Area	A_g =			25422	mm^2	
Net Shear Area	A_n =			18804	mm^2	
Shear Resistance (Gross Section)	V_{Rg} =			$0.5*\varphi_s*A_g*F_y$		Cl 10.18.5.2
	V_{Rg} =			2536	kN	
Shear Resistance (Net Section)	V_{Rn} =			$0.5*\varphi_u*A_n*F_u$	*	Cl 10.18.5.2
	V_{Rn} =			3159	kN	
Shear Resistance (Governing)	V_R =			**2536**	**kN**	
Demand/Capacity	D/C =			**0.339**		

* For shear fracture at net section, φ_u was applied instead of φ_s. (conservative)

3.0 GUSSET PLATE TENSION FOR MEMBER(S) A AND/OR E — N/A

Members A and E continuous through the gusset plate? Yes

General

Whitmore Width	W_w =	0.00	in	0	mm	Number of Rivet/bolt diameters Intsecting Plane
Shear Length 1	L_{V1} =	0.00	in	0	mm	0
Shear Length 2	L_{V2} =	0.00	in	0	mm	0
Tension Length	L_T =	0.00	in	0	mm	0
Number of Gusset Plates	m =	2.00	ea	2	ea	0 Typ, 1 less than Whitemore Width
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$		
		0	kN	
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		0	kN	

Block Shear

Gross Tension Area	A_{tg} =	0	mm^2
Gross Shear Area	A_{vg} =	0	mm^2
Net Tension Area	A_{tn} =	0	mm^2
Net Shear Area	A_{vn} =	0	mm^2
$A_{tn} > 0.58*A_{vn}$?		Yes	

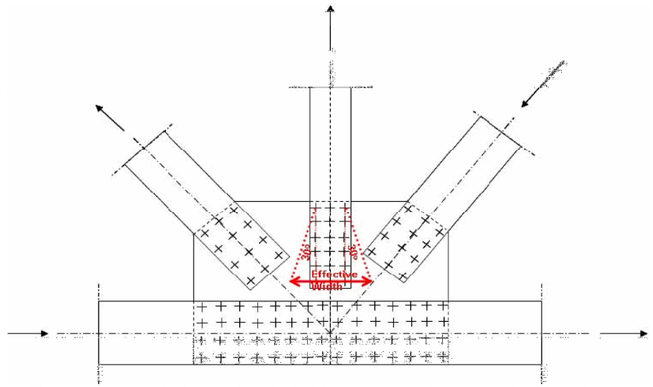


Figure 1 – Example 1 for using the Whitmore method to determine the effective width in tension

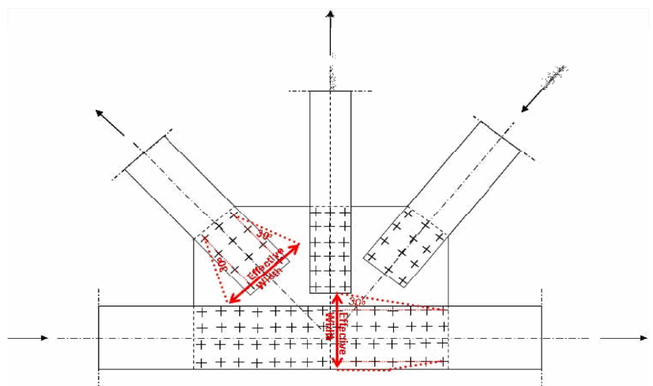


Figure 2 Example 2 for using the Whitmore method to determine the effective width in tension

FHWA, Figures 1 and 2

Span: Bascule Bridge - Leaf Span
Node: 12S

			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$		
Block Shear Resistance	P_{Rbs} =		0 kN		FHWA 3.1.3
Tension Resistance (Governing)			0 kN		
Demand/Capacity	D/C =		**0.000**		

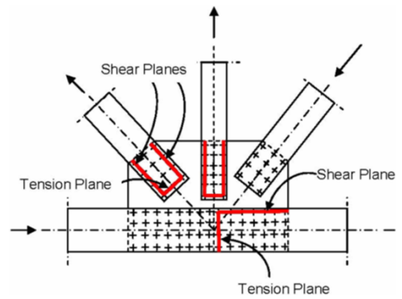


Figure 3 – Examples of potential block shear rupture planes for gusset plates in tension

FHWA, Figure 3

4.0 GUSSET PLATE COMPRESSION FOR MEMBER(S) A AND/OR E — N/A

General — FHWA 3.3

Whitmore Width	W_w =	0.00 in	0 mm		
L1	L_1 =	0.00 in	0 mm		
L2 - along centreline of action	L_2 =	0.00 in	0 mm		
L3	L_3 =	0.00 in	0 mm		
Unsupported Column Length	L_u =	0.00 in	0 mm		
Effective Length Factor	K =	0.00	0.0	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2 ea		
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.11 in	2.89 mm		
	λ =		$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
			0.00		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$		
			0 kN		
Demand/Capacity	D/C =		**0.000**		

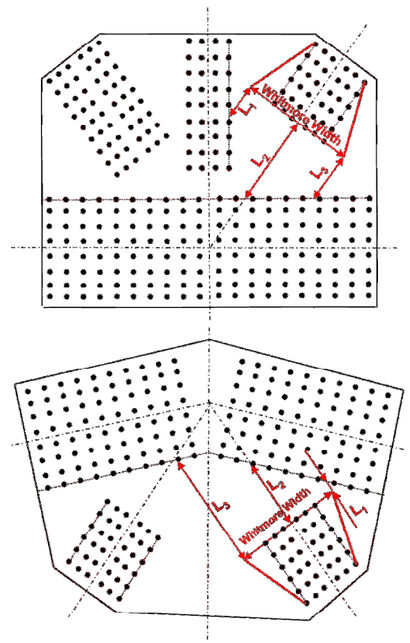


Figure 6 – Examples showing L_1, L_2, L_3, and effective width for a gusset plate in compression.

FHWA, Figure 6

5.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER(S) A AND/OR E

Number of Rivets/Bolts	n =	44 ea	44 ea			
Longest Length of connection	L=	51.18 in	1300 mm			
Edge distance	e =	1.18 in	30 mm			
Diameter of Rivet	d =	0.75 in	19.1 mm	(3/4")		
Shear Planes per gusset plate	m =	1 ea	1 ea			
Number of Gusset Plates		2 ea	2 ea			
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u$ <= $3*\varphi_{mc}*t*n*d*F_u$			CSA S6 CL14.14.1.4.2
	B_{r1} =	836 kip	3714 kN			
	B_{r2} =	1592 kip	7076 kN			
Shear Resistance of Rivets	V_r =		$0.75*\varphi_r*n*m*Ar*F_u$			CSA S6 CL14.14.1.4.2
		454 kip	2017 kN			
Governing Resistance			3227 kN	for	2 plate(s)	

Span: Bascule Bridge - Leaf Span
Node: 12S

Demand/Capacity	D/C =	**0.955**

For Connections greater than 50in (1270mm), shear resistance taken as 80%.

FHWA Part A Section 2

6.0 GUSSET PLATE TENSION FOR MEMBER B

Are lug angles ignored? No

General

						Number of Rivet/bolt diameters Intersecting Plane
Whitmore Width	W_w =	21.81	in	554	mm	3
Shear Length 1	L_{V1} =	13.11	in	333	mm	4.5
Shear Length 2	L_{V2} =	11.38	in	289	mm	4.5
Tension Length	L_T =	14.33	in	364	mm	4
Number of Gusset Plates	m =	2	ea	2	ea	
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")

Axile Tensile Resistance

CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$U*\varphi_s*A_g*F_y$ U=1.0	2210 kN	FHWA 3.1.2
Net Section Resistance	P_{RN} =	$U*\varphi_u*A_n*F_u$ U=1.0	3308 kN	FHWA 3.1.2

For gusset plates, U=1.0, FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =	3640	mm^2
Gross Shear Area	A_{vg} =	6220	mm^2
Net Tension Area	A_{tn} =	2816	mm^2
Net Shear Area	A_{vn} =	4366	mm^2

$A_{tn} \geq 0.58*A_{vn}$? Yes

		$U*\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $U*\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$ U=1.0		
Block Shear Resistance	P_{Rbs} =		3105 kN	FHWA 3.1.3
Tension Resistance (Governing)			2210 kN	
Demand/Capacity	D/C =		**0.000**	

7.0 GUSSET PLATE COMPRESSION FOR MEMBER B

Are lug angles ignored? No

General FHWA 3.3

Whitmore Width	W_w =	21.81	in	554 mm

Span: Bascule Bridge - Leaf Span

Node: 12S

L1	L_1 =	0.79	in	20	mm	
L2 - along centreline of action	L_2 =	13.54	in	344	mm	
L3	L_3 =	4.88	in	124	mm	
Unsupported Column Length	L_u =	6.40	in	163	mm	
Effective Length Factor	K =	1.20		1.2		"fixed-free condition"
Number of Gusset Plates	m =	2.00	ea	2	ea	
Minimum radius of gyration of column plate	r =			t/√(12)		for rectangular plate
		0.11	in	2.89	mm	
	λ =			$(K*L_u/r)*\sqrt{[F_y/(\pi^2*E_s)]}$		
				0.70		
Compressive Resistance	C_r =			$U*\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
				1646	kN	
Demand/Capacity	D/C =			**0.540**		

8.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER B

Number of Rivets/Bolts	n =	22	ea	22	ea	
Longest Length of connection	L=	18.94	in	481	mm	
Edge distance	e =	1.50	in	38	mm	
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")
Shear Planes per gusset plate	m =	1	ea	1	ea	
Number of Gusset Plates		2.00	ea	2	ea	
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0	CSA S6 CL14.14.1.4.2
	B_{r1} =	529	kip	2353	kN	
	B_{r2} =	796	kip	3538	kN	
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81	CSA S6 CL14.14.1.4.2
		411	kip	1825	kN	
Governing Resistance				3650	kN	for 2 plate(s)
Demand/Capacity	D/C =			**0.244**		

For Connections greater than 50in (1270mm), shear resistance taken as 80% (FHWA Section 2)

9.0 GUSSET PLATE TENSION FOR MEMBER C

Are lug angles ignored? N/A

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	26.38	in	670	mm	2	
Shear Length 1	L_{V1} =	19.41	in	493	mm	7.5	
Shear Length 2	L_{V2} =	19.41	in	493	mm	7.5	
Tension Length	L_T =	5.59	in	142	mm	1	Typ, 1 less than Whitemore Width

Span: Bascule Bridge - Leaf Span
Node: 12S

Number of Gusset Plates	m =	2.00 ea	2 ea		
Diameter of holes in plane	d_b =	0.81 in	21 mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =		$\varphi_s*A_g*F_y$	U=1.0	
			2673	kN	
Net Section Resistance	P_{RN} =		$\varphi_u*A_n*F_u$	U=1.0	
For gusset plates, U=1.0, FHWA 3.1.2			4226	kN	FHWA 3.1.2

Block Shear

Gross Tension Area	A_{tg} =		1420	mm^2	
Gross Shear Area	A_{vg} =		9860	mm^2	
Net Tension Area	A_{tn} =		1214	mm^2	
Net Shear Area	A_{vn} =		6770	mm^2	
$A_{tn} > 0.58*A_{vn}$?			No		
			$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0	
Block Shear Resistance	P_{Rbs} =		3116	kN	FHWA 3.1.3
Tension Resistance (Governing)			2673	kN	
Demand/Capacity	D/C =		**0.000**		

10.0 GUSSET PLATE COMPRESSION FOR MEMBER C

Are lug angles ignored?			N/A		
General					FHWA 3.3
Whitmore Width	W_w =	26.38 in	670	mm	
L1	L_1 =	4.57 in	116	mm	
L2 - along centreline of action	L_2 =	4.57 in	116	mm	
L3	L_3 =	4.57 in	116	mm	
Unsupported Column Length	L_u =	4.57 in	116	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		$t/\sqrt{(12)}$	for rectangular plate	
		0.11 in	2.89	mm	
	λ =		$(K*L_u/r)*\mathrm{sqrt}[F_y/(\pi^2*E_s)]$		
			0.50		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			2276	kN	

Span: Bascule Bridge - Leaf Span
Node: 12S

Demand/Capacity	D/C =			**0.014**			

11.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER C

Number of Rivets/Bolts	n =	16	ea	16	ea		
Longest Length of connection	L=	19.41	in	493	mm		
Edge distance	e =	1.50	in	38	mm		
Diameter of Rivet	d =	0.75	in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1	ea	1	ea		
Number of Gusset Plates		2.00	ea	2	ea		
Bearing Resistance of Riveted Connection				$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	385	kip	1711	kN		
	B_{r2} =	579	kip	2573	kN		
Shear Resistance of Rivets	V_r =			$0.75*\varphi_r*n*m*Ar*F_u$	U=1.81		CSA S6 CL14.14.1.4.2
		299	kip	1327	kN		
Governing Resistance				2655	kN	for 2 plate(s)	
Demand/Capacity	D/C =			**0.012**			
For Connections greater than 50in (1270mm), shear resistance taken as 80%.							FHWA Section 2

12.0 GUSSET PLATE TENSION FOR MEMBER D

Are lug angles ignored? No

General

						Number of Rivet/bolt diameters Intsecting Plane	
Whitmore Width	W_w =	24.41	in	620	mm	5	
Shear Length 1	L_{V1} =	10.87	in	276	mm	3.5	
Shear Length 2	L_{V2} =	14.25	in	362	mm	4.5	
Tension Length	L_T =	15.55	in	395	mm	5	Typ, 1 less than Whitemore Width
Number of Gusset Plates	m =	2.00	ea	2	ea		
Diameter of holes in plane	d_b =	0.81	in	21	mm	($^{13}/_{16}$")	

Axile Tensile Resistance — CL 10.8.2 & FHWA 3.1.2

Gross Section Resistance	P_{RG} =	$\varphi_s*A_g*F_y$	U=1.0		FHWA 3.1.2
		2474	kN		
Net Section Resistance	P_{RN} =	$\varphi_u*A_n*F_u$	U=1.0		FHWA 3.1.2
For gusset plates, U=1.0, FHWA 3.1.2		3474	kN		

Block Shear

Gross Tension Area	A_{tg} =	3950	mm^2

Span: Bascule Bridge - Leaf Span

Node: 12S

Gross Shear Area	A_{vg} =		6380	mm^2	
Net Tension Area	A_{tn} =		2920	mm^2	
Net Shear Area	A_{vn} =		4732	mm^2	
$A_{tn} > 0.58*A_{vn}$?			Yes		
		$\varphi_u(0.58F_yA_{vg} + F_uA_{tn})$ or $\varphi_u(0.58F_uA_{vn} + F_yA_{tg})$	U=1.0		
Block Shear Resistance	P_{Rbs} =		3206	kN	FHWA 3.1.3
Tension Resistance (Governing)			2474	kN	
Demand/Capacity	D/C =		**0.430**		

13.0 GUSSET PLATE COMPRESSION FOR MEMBER D

Are lug angles ignored?			No		
General					FHWA 3.3
Whitmore Width	W_w =	24.41 in	620	mm	
L1	L_1 =	0.00 in	0	mm	
L2 - along centreline of action	L_2 =	13.15 in	334	mm	
L3	L_3 =	4.21 in	107	mm	
Unsupported Column Length	L_u =	5.79 in	147	mm	
Effective Length Factor	K =	1.20	1.2	"fixed-free condition"	
Number of Gusset Plates	m =	2.00 ea	2	ea	
Minimum radius of gyration of column plate	r =		t/√(12)	for rectangular plate	
		0.11 in	2.89	mm	
	λ =		$(K*L_u/r)*sqrt[F_y/(\pi^2*E_s)]$		
			0.63		
Compressive Resistance	C_r =		$\varphi_s*A*F_y*(1+\lambda^{2n})^{-1/n}$	U=1.0	
			1938	kN	
Demand/Capacity	D/C =		**0.000**		

14.0 RIVETS SHEAR AND GUSSET PLATE BEARING FOR MEMBER D

Number of Rivets/Bolts	n =	25 ea	25	ea		
Longest Length of connection	L=	19.37 in	492	mm		
Edge distance	e =	1.50 in	38	mm		
Diameter of Rivet	d =	0.75 in	19.1	mm	(3/4")	
Shear Planes per gusset plate	m =	1 ea	1	ea		
Number of Gusset Plates		2.00 ea	2	ea		
Bearing Resistance of Riveted Connection			$\varphi_{mc}*t*n*e*F_u <= 3*\varphi_{mc}*t*n*d*F_u$	U=1.0		CSA S6 CL14.14.1.4.2
	B_{r1} =	601 kip	2673	kN		
	B_{r2} =	905 kip	4021	kN		

Span: Bascule Bridge - Leaf Span

Node: 12S

Shear Resistance of Rivets V_r = $0.75*\varphi_r*n*m*Ar*F_u$ U=1.81 CSA S6 CL14.14.1.4.2

467 kip 2074 kN

Governing Resistance 4148 kN for 2 plate(s)

Demand/Capacity D/C = **0.256**

For Connections greater than 50in (1270mm), shear resistance taken as 80%. FHWA Section 2

15.0 Summary of Resistance Forces

	Resistance Force	
	kip	kN
GUSSET PLATE SHEAR		
SHEAR PLANE A'-A'		
Shear Resistance (Gross Section)	584	2594
Shear Resistance (Net Section)	796	3537
Shear Resistance (Governing)	584	2594
SHEAR PLANE B'-B'		
Shear Resistance (Gross Section)	571	2536
Shear Resistance (Net Section)	711	3159
Shear Resistance (Governing)	571	2536
GUSSET PLATE TENSION		
At Member A:		
Gross Section Resistance	N/A	N/A
Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
At Member B:		
Gross Section Resistance	497	2210
Net Section Resistance	744	3308
Block Shear Resistance	699	3105
Tension Resistance (Governing)	497	2210
At Member C:		
Gross Section Resistance	601	2673
Net Section Resistance	951	4226
Block Shear Resistance	701	3116
Tension Resistance (Governing)	601	2673
At Member D:		
Gross Section Resistance	557	2474
Net Section Resistance	782	3474
Block Shear Resistance	721	3206
Tension Resistance (Governing)	557	2474
At Member E:		
Gross Section Resistance	N/A	N/A

Span: Bascule Bridge - Leaf Span
Node: 12S

Net Section Resistance	N/A	N/A
Block Shear Resistance	N/A	N/A
Tension Resistance (Governing)	N/A	N/A
GUSSET PLATE COMPRESSION		
Compressive Resistance at Member A	N/A	N/A
Compressive Resistance at Member B	370	1646
Compressive Resistance at Member C	512	2276
Compressive Resistance at Member D	436	1938
Compressive Resistance at Member E	N/A	N/A
RIVETS SHEAR AND GUSSET PLATE BEARING		
Governing Resistance at Member A	726	3227
Governing Resistance at Member B	821	3650
Governing Resistance at Member C	597	2655
Governing Resistance at Member D	933	4148
Governing Resistance at Member E	726	3227

16.0 Summary of Resistance Forces and Demand/Capacity Ratios

		Resistance Force		D/C Ratio	
		kip	kN		
GUSSET PLATE SHEAR					
	SHEAR PLANE A'-A'	584	2594	**0.452**	
	SHEAR PLANE B'-B'	571	2536	**0.339**	
GUSSET PLATE TENSION					
	Member A	N/A	N/A	**0.000**	
	Member B	497	2210	**0.000**	
	Member C	601	2673	**0.000**	
	Member D	557	2474	**0.430**	
	Member E	N/A	N/A	**0.000**	
GUSSET PLATE COMPRESSION					
	Member A	N/A	N/A	**0.000**	
	Member B	370	1646	**0.540**	
	Member C	512	2276	**0.014**	
	Member D	436	1938	**0.000**	
	Member E	N/A	N/A	**0.000**	
RIVETS SHEAR AND GUSSET PLATE BEARING					
	Member A	726	3227	**0.955**	<--- Governing
	Member B	821	3650	**0.244**	
	Member C	597	2655	**0.012**	
	Member D	933	4148	**0.256**	
	Member E	726	3227	**0.955**	<--- Governing
	Highest Demand/Capacity Ratio			**0.955**	