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Burlington Canal Lift Bridge

Deck Replacement and Rehabilitation Options Technical Memorandum - Final

Prepared by:

AECOM Canada Ltd.
50 Sportsworld Crossing Road, Suite 290
Kitchener, ON N2P 0A4
Canada

T: 519.650.5313
F: 519.650.3424
www.aecom.com

Prepared for:

Public Works and Government Services Canada
4900 Yonge St, Toronto ON M2N 6A6

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AECOM Canada Ltd.
50 Sportsworld Crossing Road, Suite 290
Kitchener, ON N2P 0A4
Canada

T: 519.650.5313
F: 519.650.3424
www.aecom.com

Ranya El Sadawy P.Eng
Project Manager
Public Works and Government Services Canada
4900 Yonge St, Toronto ON M2N 6A6

April 14, 2021

Project #
60637587
R.090216.002

Dear Ms. Ranya El Sadawy:

Subject: Burlington Canal Lift Bridge
Deck Replacement and Rehabilitation Options Technical Memorandum - Final

Please find attached a copy of the Final Memo Summary Report for the Deck Rehabilitation Feasibility Study.

Sincerely,
AECOM Canada Ltd.

Christine Beard Laaber, P.Eng CAHP
Manager Structural Engineering, Transportation
Christine.laaber@aecom.com

CBL:cbl
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AECOM: 2015-04-13

Authors

Report Prepared By:

Ryan Arends P.Eng
Intermediate Structural Engineer, Transportation

LICENSED PROFESSIONAL ENGINEER
R. G. ARENDS
100163934
April 14, 2021
PROVINCE OF ONTARIO

Eugenie Bergeron
Junior Mechanical Engineer

Report Reviewed By:

Christine Beard Laaber P.Eng
Senior Structural Engineer, Transportation

LICENSED PROFESSIONAL ENGINEER
C.A. BEARD LAABER
100079495
April 14, 2021
PROVINCE OF ONTARIO

Simon Bonin, P.Eng, eng
Engineer, Heavy Mechanical

LICENSED PROFESSIONAL ENGINEER
S BONIN
100542654
2021-04-14
PROVINCE OF ONTARIO

Brad Kopping
Senior Mechanical Engineer (USA)

Executive Summary

This report summarizes the inspection, structural evaluation and the structural evaluation of rehabilitation options for the Burlington Canal Lift Bridge. The report further considers the rapid construction, construction staging options, and life cycle cost analysis for the lift and approach span rehabilitation options. A comparison of the options and their attributes is provided.

The bridge was inspected in August 2020 to review potential issues for future rehabilitation. The tower and approach spans are in fair to good condition. The expansion joints between the tower and lift span are in fair to poor condition, it is recommended they be replaced or converted to a link slab to reduce leakage and the resulting damage to the structure below. It is recommended the sidewalk be widened to meet minimum standards at constraint locations in the sidewalk approach and towers spans.

The structural evaluation of the existing conditions was done in accordance with Canadian Highway Bridge Design Code (CHBDC). The tower, approach and lift span were modelled using a software Midas Civil 2020. The models illustrate the loads effects on the structure using finite element analysis. The capacity of the bridge is generally acceptable. The front facing column adjacent to the road level on the tower requires further detailed evaluation to assess rehabilitation and strengthening needs.

The rehabilitation evaluation was completed with a consideration to high-volume traffic with full CL-625 ONT loading in accordance with the current CHBDC for the lift span, towers, and counterweight main mechanical components. Total of eight deck replacement options were evaluated and modelled on Midas Civil 2020.

Rapid deck replacement options were considered evaluated for the lift span. It is recommended the deck and stringers be fabricated off-site and connected to the floor beams on site to improve durability. The deck/stringers can be delivered by a truck and craned or launched into their designated position. The bridge has an overhead clearance restriction due to the truss and tower, therefore launching the bridge may be preferable. Due to the horizontal curve in the approach road, the launching process may need to consist of staging from both ends of the bridge.

The construction for the replacement of the lift span bridge deck included consideration of three traffic staging options. All waterway closures are restricted to 2 months and therefore all lift span construction needs to take 2 months or less. The options for deck replacement include full closure, two lanes open at all times, and nightly fully closure. Each option includes a preliminary construction schedule considering that the operational shutdown for the lift bridge is in January and February. The approach and tower span rehabilitation are anticipated to proceed with traditional construction techniques outside of the waterway shutdown period in January and February. The contractors overall planning for construction should begin no later than September.

A Life cycle cost analysis was completed using sensitivity analysis with an inflation rate of 2% and 4% for the approach span with two alternatives and the lift span deck considering five alternatives. The final results show the replacement of the deck with semi-integral conversion and link slab is the most cost-effective alternative over the 50-year time frame for the approach and tower spans. The replacement of the deck with a crimped I Bar Heavy Duty Open Steel Grid Deck is the most cost-effective option over the 50-year time frame.

Furthermore, the lift span deck systems were ranked using nine evaluation criteria. The criteria include capital cost, lift cycle cost, historical use, implication of deck weight, durability, constructability/ contractor experience, user experience, traffic/staging/schedule, environmental effects, and procurement risks. Each criterion was assigned with specific weighting according to departmental priorities. Overall, the Rivetted Open Grid Steel Deck option is the top ranking for a open-deck system; and the Partially filled with lightweight concrete Steel Grid Deck option with Matacryl (or equivalent) wearing surface ranked highest for the closed-deck system.

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1. Introduction

AECOM Canada Ltd. (AECOM) was retained by the Public Works and Government Services Canada (PWGSC) to review and complete a structural evaluation of rehabilitation options for the Burlington Canal Lift Bridge (BCLB) including the lift span, towers and counterweight main mechanical components to determine the load carrying capacity of the bridge.

1.1 Background

The BCLB is a tower driven vertical steel truss style lift bridge located between the cities of Hamilton and Burlington in Ontario. It is in a north-to-south orientation and spans the Burlington Bay Canal. The BCLB was constructed between 1959 and 1960 and has been operating since 1962 as a rail/highway bridge, replacing the original CN swing bridge nearby. In 1982, the BCLB underwent a major rehabilitation to convert it for roadway traffic use only. It currently carries four (4) lanes of Eastport Drive, two (2) lanes in each northbound (NB) and southbound (SB) direction, with an approximate AADT of 25,000 per day. When it is lifted, it accommodates commercial and recreational boat passage between Lake Ontario and Burlington Harbour. The BCLB typically operates from late March to late December with approximately 3400 openings per year, corresponding with an “average usage”.

The entire bridge consists of five (5) spans and has a roadway width of 13.6 m. There are two reinforced concrete deck on steel I-girder approach spans at each end of the bridge. The exterior approach spans (referred to as the “approach spans”) are 12.6 m long and cross over an access road/trail. The interior approach spans (referred to as the “tower spans”) are 10.6 m long (including 0.9 m long cantilevered portions at the lift span ends) and pass under the towers at each.

The steel truss lift span is 115.8 m long with open steel deck grating welded to steel stringers over floor beams. The tower lift span and tower span foundations are comprised of reinforced concrete on piles with 2 pits between the steel columns. The back encased steel columns extend to the top of the pier cap. The tower foundation is enclosed inside of a galvanized chain link fence with a reinforced concrete wall along under the approach span access road. The approach span is supported on one end by a reinforced concrete abutment.

The lift span is connected to the counterweights by 80 counterweight ropes that are held in place by 8 counterweight sheaves, with 10 ropes per sheave. Each sheave is carried by a trunnion shaft that is supported by two spherical roller bearing assemblies. The counterweight ropes are 57mm (2.25”) in diameter and the counterweight sheaves have a 4,572mm (180”) diameter at the rope groves.

1.2 Scope

This memorandum summary will review previous memorandums completed and consider the various shortlisted options for the lift span deck replacement, potential sidewalk widening, and approach span deck replacement. The construction staging requirements for the implementation of the bridge improvements will be considered along with potential options for staging. The constructability and potential for fast tracking the deck replacement options for the lift span will be considered along with their durability.

Life Cycle Cost Analysis (LCCA) will be performed for the short listed lift span deck replacement options and will consider the approach span deck replacement life cycle costs with and without expansion joints. The LCCA will consider typical MTO and supplier maintenance recommendations and cycles. Estimated costs will be based on MTO data where available, recent projects and supplier budget estimates. A review of estimates from previous reports has also been considered. Based on the Rehabilitation Evaluation Memorandum (Appendix C) the summary of options carried forward are included in **Table 1**.

Table 1: Summary of Options for Consideration

Deck Type	
Open Steel Grid Deck	Crimped I Bar
Open Steel Grid Deck	Rivetted
Aluminum Deck	
Half Filled Grid Deck	No Overlay
Orthotropic Steel Deck	

2. Inspection

The bridge was generally inspected in August 2020 to consider potential issues for a future rehabilitation. The full inspection memorandum is included in Appendix A with photographs and a summary of the inspection follows:

The steel truss lift span is comprised of steel grating with transverse bearing bars welded to longitudinal stringers. The weld connections are small and are susceptible to local fatigue. The localized weld failures continue to arise in the southbound lanes and where wheel paths of the vehicular traffic are located. The west lanes show greater localized weld failure compared to the east lanes. The current railings in the approach, tower and lift spans are substandard; thus, replacement during a rehabilitation is recommended with crash tested CSA S6-19 Canadian Highway Bridge Design Code (CHBDC) compliant railings including anchorage system. The deck grating is welded to stringers which may not have suitable carbon content for welding. Several welds between the deck grating and stringers have cracked. The rail girders below the deck span are oversized and may be part of a lateral balancing system. The sidewalk on the approach, tower and lift spans was found to be in good condition however maintenance and widening of the sidewalk to minimum standards in the approach and tower span is recommended to improve flow to pedestrians and cyclists. The lift span sidewalk meets minimum standards.

The diaphragms and girders away from the deck joints were in good condition in the tower and approach spans. Diaphragms and girders adjacent to joints were generally in poor condition with severe corrosion. Perforations in the girders were observed at the approach ends adjacent to the ballast walls. All severely corroded sections should be abrasively blast cleaned and repaired. Diaphragms may require replacement.

In the span lock room on the north end of the bridge, the 4th girder from the east side on the north tower span showed coating failure and moderate to severe corrosion along the top flange to web. The girder has excess capacity regardless of the section loss at this time. However, to protect their capacity going forward the girders should be abrasive blast cleaned, repaired and painted where section loss is excessive and ongoing. It is recommended to install screened vents in the north span lock room to improve air flow. Sealing asphalt above the girder will decrease leakage in the interim prior to deck replacement.

The concrete soffit in the approach and tower span was observed to be in fair to poor condition with delamination and light scaling. The concrete soffit in the widened side of the bridge show has narrow patterned cracking likely as a result of concrete pour conditions.

The approach span deck is in fair to poor condition, recent condition reports indicate high chlorides, the existing soffit is leaking in several locations with delamination and spalling observed. There is a paved over sealed joint at the abutment end and a standard expansion joint at the joint with the tower. It is recommended that the implementation of a semi-integral deck be considered to prevent water infiltration at the abutment.

The expansion joint between the tower and lift span consists of concrete end dams, armoring angles and rubber seal. They were found to be in a fair to poor condition. It is highly recommended they be replaced in order to protect the overall condition of the members below, including girders, diaphragms and the rear tower beams. A deck replacement should include the installation of link slab across the tower/approach span joint to reduce infiltration of moisture and salts below. The south end lift span joint consists of steel deck grating and a vertical plate. They were found to be in good condition. However, adjacent asphalt has light potholes. It is recommended to use armoring angles and an end dam to improve durability of the joint. The north end finger joints were in a good condition with some wearing on checker plate and light plow damage to the fingers.

3. Structural Evaluation

The structural evaluation for the existing conditions considers the capacity and weight for the structural and mechanical components of the lift bridge and approach spans. The complete memorandum is included in Appendix B. Details of the model and calculations are included in Appendix F. A summary of the memorandum follows:

Midas Civil (2020) was used to evaluate the load effects on the lift bridge, towers, tower spans and approach spans. The structural evaluation was completed in accordance with CHBDC. Structure dimensions, and material properties were taken from the original construction drawings (1959) and rehabilitation drawings (1982).

The approach span is 12.6 m long and the tower span is 10.6 m long. Both the approach and tower spans have a superstructure containing 8 steel I-girders (stringers) supporting a reinforced concrete deck covered with asphalt. The tower span stringers are supported at both ends on the tower floor beams and the approach span stringers are connected to the tower span stringers. Between the approach and tower span there is a deck joint. At the abutment end of the approach span there is a paved over sealed expansion joint. The approach spans and tower spans were evaluated by considering the capacity of the stringers and floor beams. The approach span and tower span were modeled together with the tower floor beams. The model results and section calculations can be found in Exhibit B.5 and B.8 as part of Appendix F. Under existing conditions, the evaluation of the approach and tower spans have adequate structural capacities.

The lift span is 115.8 m long with the primary structural elements being two steel trusses connected with floor beams, lifting girders, and sway frames. The lift span was originally constructed for both vehicular traffic and railway traffic, with a pedestrian walkway on the vehicular side. The lift span has been rehabilitated several times, with one rehabilitation circa 1980 including the removal of the railway and conversion of the full lift span to four lanes of vehicular traffic. Since the weight of the lift span is difficult to accurately calculate, the precise weight of the span should be verified through testing prior to rehabilitation or during the next counterweight rope replacement. The east-west balance can be verified at the same time. For analysis, the bridge was assumed to be balanced correctly. Based on the model results and completed calculations in Exhibit B.3 and B.6, the lift span members have adequate structural capacities under the existing conditions.

The tower at each end of the lift span support the tower and approach spans, the counterweights, the auxiliary counterweights, mechanical components to operate the bridge, tower control rooms, the messenger cables that span across the canal between the two towers and the lift bridge weight. Even when the bridge is lowered, the tower supports most of the dead weight from the bridge expect to maintain contact transfer from transitory (live) loads to the bearings The tower has four columns, each column is braced with horizontal struts and diagonal bracing on all 4 tower faces. The existing structural evaluation of the tower indicates that there is excessive stress at the front columns at the horizontal struct above the road level when the bridge is lifted based on lateral 80 km/h wind loads. The deck weight or type is not the primary contributor to the overstress. The model results and completed calculations are shown in Exhibit B.4 and B.7.

Main mechanical components (motors, counterweight ropes, trunnion bearings and shafts) were evaluated for each type of deck in an effort to select viable options. The approximative weight of each deck option were used for the evaluation. Calculation were made as per CHBDC and AASHTO requirements and guidelines.

4. Rehabilitation Evaluation

The rehabilitation evaluation was completed for the lift span, towers and counterweight main mechanical components. A memorandum summarizing the rehabilitation evaluation is included in Appendix C.

The recommended options consider the need to minimize adjustments to the mechanical system, no option that results in their replacement were considered further.

The retained and shortlisted options for further consideration are as follows:

1. Open Steel Grid Deck – Crimped I Bar
2. Open Steel Grid Deck – Rivetted
3. Aluminum Deck
4. Half Filled Lightweight Concrete Grid Deck with No overlay
5. Orthotropic Steel Deck

The rehabilitation evaluation considers that only options for high volume traffic with a preferred full CL-625 ONT loading in accordance with the current CHBDC will be suitable. Any substandard options including decks planned to exceed their design spans have been rejected due to the excessive liability and risk associated with those options. AECOM has considered a total of 8 different deck replacement options, which were reviewed and compared in 2 groups by lighter and heavier deck replacement options. The options considered are all transverse oriented except for one of the open steel grid deck options which was longitudinal. The options are: open steel grid deck crimped I bar, open steel grid deck rivetted, aluminum deck, fibre-reinforced polymer deck, half filled grid deck no overlay, half filled concrete grid deck with 50 mm overlay, exodermic deck, orthotropic steel deck, and precast concrete deck. The fibre reinforced polymer was not recommended due to insufficient consistency in available products and lack of testing on medium to high bridge traffic volume. The exodermic deck, half filled grid deck with overlay and precast concrete deck were also not recommended due to the overall span weight increase and subsequent effects to mechanical service life.

Midas Civil 2020 was used to evaluate the load effects of the rehabilitation options to the lift bridge, towers, tower spans and approach spans. They were evaluated considering the demand and capacity for the limited primary members for their worst-case forces. All the options relating to the change in deck show a demand over capacity (D/C) ratio of less than 1 indicating they satisfy the CHBDC for capacity. The overall calculations and evaluations are shown Appendix F Exhibit B.3 and C.1.

The rehabilitation of the approach spans includes for a deck replacement, structural steel repairs, concrete foundation repairs. For the deck replacement two alternatives were considered: deck replacement with expansion joints and elimination of expansion joints. The 1st alternative assumes the existing deck layout with expansion joints between the tower and approach span and at the end of the approach span. The 2nd alternative considers the elimination of the expansion joints through a link or integral slab and a semi-integral overhang. The existing bridge deck is 190mm thick with 64mm of asphalt. With consideration for the Alternatives rehabilitation options, AECOM has reviewed deck replacement options with consideration to MTO and CHBDC Requirements. The 225mm thick concrete deck with premium stainless steel reinforcing in top layer and a 20mm exposed concrete wearing surface is considered the most suitable deck replacement option for the approach and tower spans. The calculations and evaluations are shown in Appendix F Exhibit B.5 and C.3.

The south tower was also modelled and analyzed according based on the shortlisted lift span deck replacement options noted previously. The tower capacity was not affected by the evaluated deck replacement options. The overall calculations and evaluations are shown in Appendix F Exhibit B.4 and C.2. The north tower is the same design as the south tower and in similar condition so it was not modelled separately. The tower evaluation indicates that under existing conditions the front columns on the south and north towers are overstressed when the bridge is lifted during a 80kph wind speed. This does not relate to the deck type or weight. A detailed evaluation of all north and south tower columns including detailed plate and connection information is required to further verify the capacity of the columns during detailed design prior to any major rehabilitation at the bridge. Strengthening of the columns may be required based on the results of a more detailed analysis.

The main counterweight ropes were analyzed according to each replacement option. The counterweight ropes are over stressed by maximum of 8% for the lighter deck options and do not require replacement, and the trunnion shaft fatigue life exceeds 100 years. Where the overstress in the ropes is less than 10% replacement of the ropes is not considered necessary (counterweight ropes are designed with a 4.5 safety factor, because the ropes are in good condition a 10% overload is acceptable for continued operation with sustained inspection and maintenance). The remaining trunnion shaft fatigue life exceeds100 years for the shortlisted options. The heavier weight deck options (exodermic deck, precast concrete deck and half-filled grid deck with overlay) are not recommended and were not shortlisted because they reduce the trunnion shaft fatigue life and increase the risk of failure. Calculations are included in Appendix F Exhibit B.9 and C.5. Detailed analysis of results for all mechanical components are included in appendix C.

In all cases, the bridge should not be opened during winter or if there are high winds.

5. Construction Options

Construction at the BCLB site over the waterway has several constraints including:

1. No in water works between July 15 and September 1;
2. Pedestrian traffic to be maintained at all times;
3. Marine traffic cannot be interrupted. Marine traffic runs from March 1 to December 31.

All construction options assume that sidewalk repairs or replacement and the replacement of the deck need to occur over an 8 week period from January 1 to March 1.

In a November 20, 2020 conference call with the Ontario Ministry of Transportation (MTO) AECOM discussed three possible traffic staging options for the construction of the lift span deck. Communication is ongoing at this stage to assess what is acceptable. The following options are being considered at this time:

1. Full Closure for 2 months;
2. Two lanes open at all times;
3. Nightly Full Closure for 2 months.

The deck replacement options will be considered based on the traffic staging discussed with MTO. This road is considered a vital link for access to the QEW Highway during emergencies and MTO may not be willing to consider options 1 and 3. The full closure option is considered the most efficient as it allows the detailed design to proceed with the lightest version of the deck system without consideration to transitions or additional stringer weight which may be required to accommodate traffic barriers. Further the full closure allows the contractor to be the most efficient and will reduce construction costs.

For the options being considered stringers need to be replaced on the lift span bridge deck. No suitable option for deck replacement exists that is able to utilize the existing stringers without an increase to risk and liability to PWGSC. Reusing the existing stringers would increase the weight of all deck options as additional stringers would be needed between the existing to adequately support a new deck. Using new stringers allows for the optimization of the stringer placement and sizing to maximize efficiency for each deck option. In order to ensure the durability and high quality of the system it is recommended that the stringers be connected off site to the decking panels either through welds or bolts and shipped to site in segments. By fabricating the stringers to fit the deck, the primary site connection to the existing structure would be by bolting to the floor beams. Any inconsistency in the stringer to floor beam connection would need to be accommodated without affecting the deck elevation. Connecting the stringer/deck system to the floor beams by bolting will improve the stiffness of the deck/stringer system and reduce fatigue and improve durability in the deck by eliminating the stress that is often caused as a result of field connections between the deck and stringer.

5.1 Rapid Replacement Options

The approach and tower span deck replacement could be fast-tracked. However, while technically feasible the timing of the approach and tower span deck replacement and rehabilitation is not crucial to the success of the overall bridge rehabilitation. For a significant increase in cost – precast panels with cast in place closure strips could be used to expedite construction in the approach spans, although on site structural steel repairs cannot be fast tracked. Therefore, rapid deck replacement for the approach and tower span is not either technically or financially advantageous. As a result, rapid replacement options are only evaluated for the lift span.

The deck replacement options that are better suited for rapid replacement consist of premade panels that are larger with simple connections between panels and supporting structure. Pre-made panel rapid replacement is a widely used method of replacement for lift span decks in urban locations. All the lift span deck options in consideration can be fabricated off site with their stringers and connected on site. Installation of the deck panels will be limited by the overhead truss and tower. The weight of each panel and their dimensions will control how the panelized sections are delivered and lifted into place on site. **Figure 1** depicts a deck on stringers being delivered by truck to site, although a boat delivery may be possible for this site and allow for heavier sections. Construction in the winter means that over-water shipping is potentially problematic depending on ice levels and proximity of manufacturing to Lake Ontario. Ideally, the panels will be fabricated off site to minimize site work in January/February during the limited canal shutdown period. The deck/stringer panels need to arrive, placed into position and bolted to the floor beams and then connected together at the deck level. **Figure 2** includes pictures of an aluminum and an orthotropic steel deck being craned into place.

Figure 1: Deck on stringer shipping

Figure 2: Craning of Deck on Stringers [2]

An alternative method of replacing the deck rapidly given the overhead clearance restriction from the truss and towers is launching of the bridge. For this method the deck and stringers are delivered and assembled on site. The deck system on stringers is pushed using hydraulic jacks and dropped into place and bolted as a system onto the floor beams (**Figure 3**). Precast culverts are often installed in Canada using this method where rail tracks can only be closed for short periods.[1] MTO often uses this method of construction to install bridges constructed adjacent to the installation location over a short term weekend closure. The horizontal curve in the approach road may limit how a bridge is launched at the BCLB. An approach topographic survey would confirm the available space to fabricate the deck and whether the launching would need to be done in stages or from both ends of the bridge.

Another approach that may be feasible is the use of a site fabricated overhead hoist gantry on rails. The overhead hoist could be supported by the vertical members of the truss. The specific design for the overhead hoist on rails would need to be completed by the contractor's hoist design team to ensure compatibility with the bridge. The bridge would need to be fully closed for this option to be viable.

Finishing work should be limited to connections and protective coatings for connections. Work on the approach spans should be limited during deliveries, crane and launching events for the lift span. Removal of the existing steel that is no longer needed and preparations for connections including any lead remediation required are to be completed in advance of the deck/stringer delivery.

Figure 3: Launch of Bridge Deck[3]

Typically truck shipments are limited to 18m x 3m without special permit. The design of the prefabricated panels will need to take shipping into consideration as well as truck and highway loading limitations. For a full closure transverse panels can be installed for the full width of the bridge. For a partial road closure – 2 lanes, stringers will need to be aligned along both sides of the temporary work zone to support temporary and permanent traffic barriers in the next stage. The installation panel width will be limited to the work zone width (**Figure 4**, **Figure 5**). The 2nd stage work zone will include for a longitudinal connection between stages. Lastly, night closures would allow for full width installation of the deck panels by replacing sections of deck between floor beams but will require temporary connections between the new and old decks. The temporary connections will need to ensure the elevation differential between deck systems is accommodated each night. It will be key to ensure that each night the panels are installed between the existing floor beams to allow traffic to flow in the morning. All of the short listed options are suitable for rapid replacement. A brief summary of connections is provided in **Table 2**.

Table 2: Deck Options for Rapid Replacement

Deck Type		Connection
Open Steel Grid Deck	Crimped I Bar	Panels welded, bolted or rivetted together
Open Steel Grid Deck	Rivetted	
Aluminum Deck		Sealant joining the panels, touch up to wearing surface at joints
Half Filled Grid Deck	No Overlay	Panels welded together, touch up to wearing surface and seals at joints.
Orthotropic Steel Deck		Panels welded together, touch up to wearing surface and seals at joints.

5.2 Preliminary Construction Staging

Per the introduction to Section 5 three (3) possible traffic staging options for the construction of the lift span deck. Communication is ongoing at this stage to assess what staging scenarios are acceptable to stakeholders at this location. The following options are being considered at this time:

1. Full Closure for 2 months;
2. Two lanes open at all times;
3. Nightly Full Closure for 2 months.

A detailed traffic study is to be prepared at the concept design stage. A full closure is considered the most efficient, likely to succeed and cost effective staging option.

5.2.1 Full 2 month closure

Where there is a full road closure for 2 months, it is considered essential that the contract be awarded well in advance such that the contractor is able to prepare all of the materials they require in advance. The approach and tower span work can also be advanced ahead of the January and February full closure or in the following spring. Work that does not affect boat or vehicle traffic should be done in advance where possible. The contractor will need to be extremely organized to complete both the lift span, approach span and tower span work within 2 months. It is recommended that if PWGSC intends to proceed with a standard tender under this option that the work be limited to the lift span during the January to February operational closure to reduce work area conflicts and prioritize the lift span deck replacement.

5.2.2 Two Lane Traffic Staging

Where only two lanes can be closed at any given time through construction the focus should again be on completing the lift span deck as a priority during January and February. The approach and tower span rehabilitations may progress during this period but should not be the priority in order to avoid construction conflicts. Traffic staging for traffic and pedestrians over the lift bridge (approach spans similar) are included as 3 stages in **Figure 4**, **Figure 5** and **Figure 6**. Key to the staging is ensuring that the traffic barrier between the stages is properly supported at the edge of a stringer. This may result in an extra stringer depending on the deck system selected and is key for ensuring both worker and traffic safety. Detailed design of the deck layout should include consideration of the stringer layout as it compares to the traffic staging needs.

5.2.3 Nightly Road Closure

A nightly closure for 12 hours over 8-12 weeks will be similar to a two lane traffic staging and rapid replacement techniques will continue to be key to the lift span deck replacement. Temporary panels will be required to ensure lead remediation and preparation for new permanent panels proceeds smoothly with traffic being allowed back on the bridge every morning. A staged approach with a single temporary panel the first morning and a gradually larger impact each night to ensure contractor efficiency increases throughout the project. A well organized and coordinated construction and engineering team will solve problems as they occur to minimize delays. The approach and tower span replacements should be done during a different phase of construction as road closures required will be longer for the approach than for a panelized deck in the lift span and may impact lift span deck replacement efficiency.

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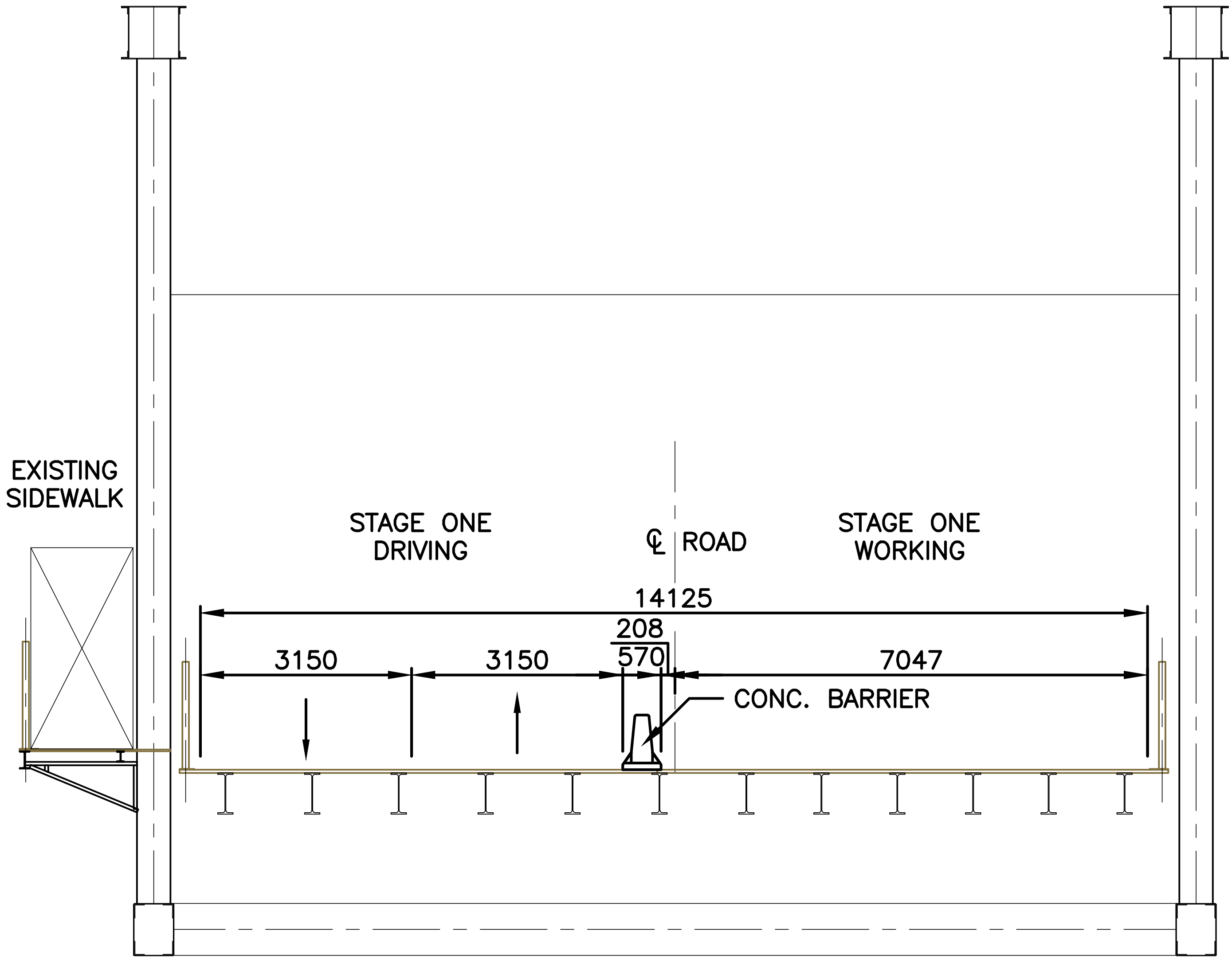

AECOM

PWGSC BURLINGTON CANAL LIFT BRIDGE TRAFFIC STAGING SECTIONS - STAGE ONE

DRN:	DSN:	CHK:	APP:
BJS	XX	CBL	XX

PROJECT NUMBER: 60637587

SCALE: NTS

FIGURE NUMBER:

04

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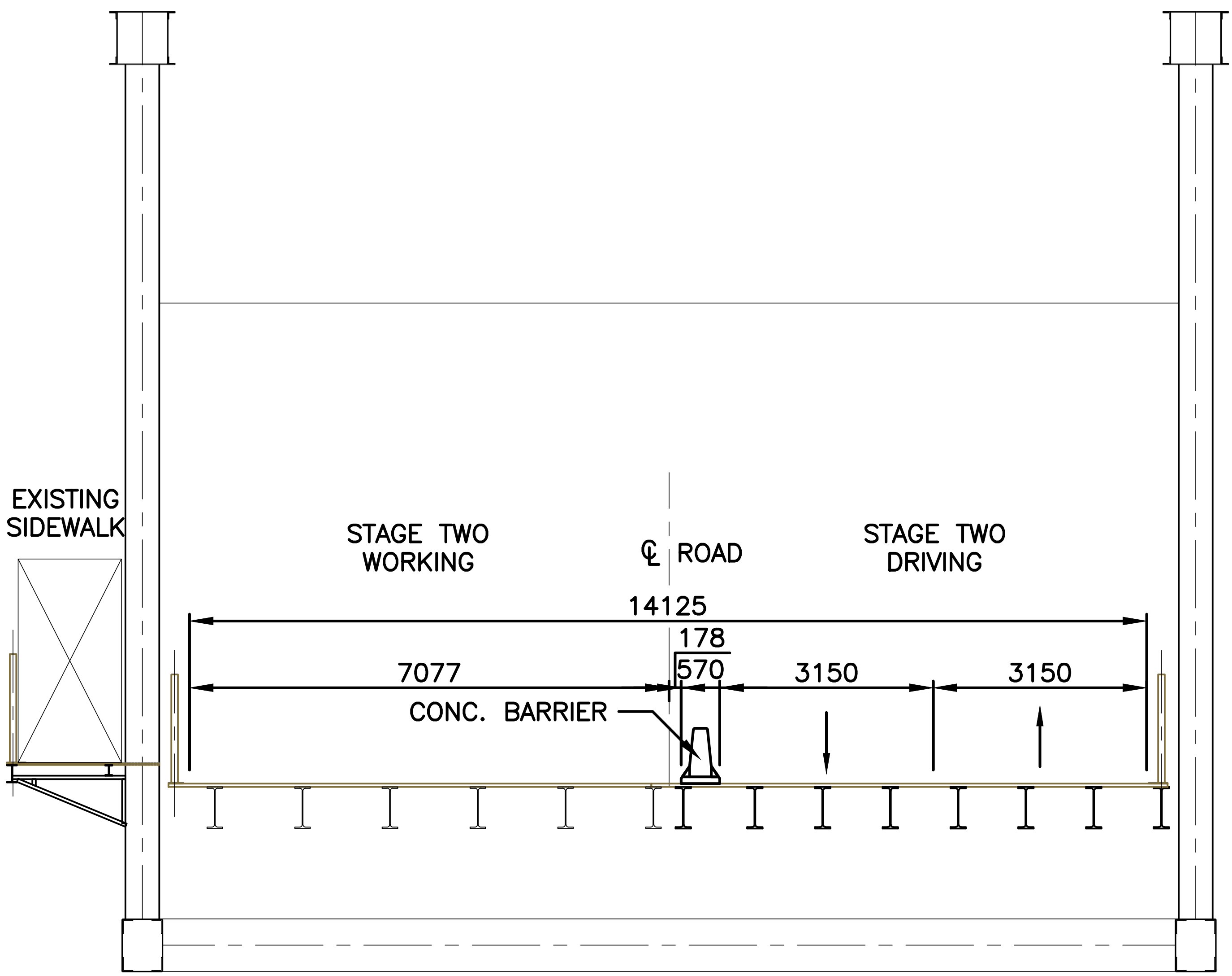

AECOM

PWGSC BURLINGTON CANAL LIFT BRIDGE TRAFFIC STAGING SECTIONS - STAGE TWO

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BJS	XX	CBL	XX

PROJECT NUMBER: 60637587

SCALE: NTS

FIGURE NUMBER:

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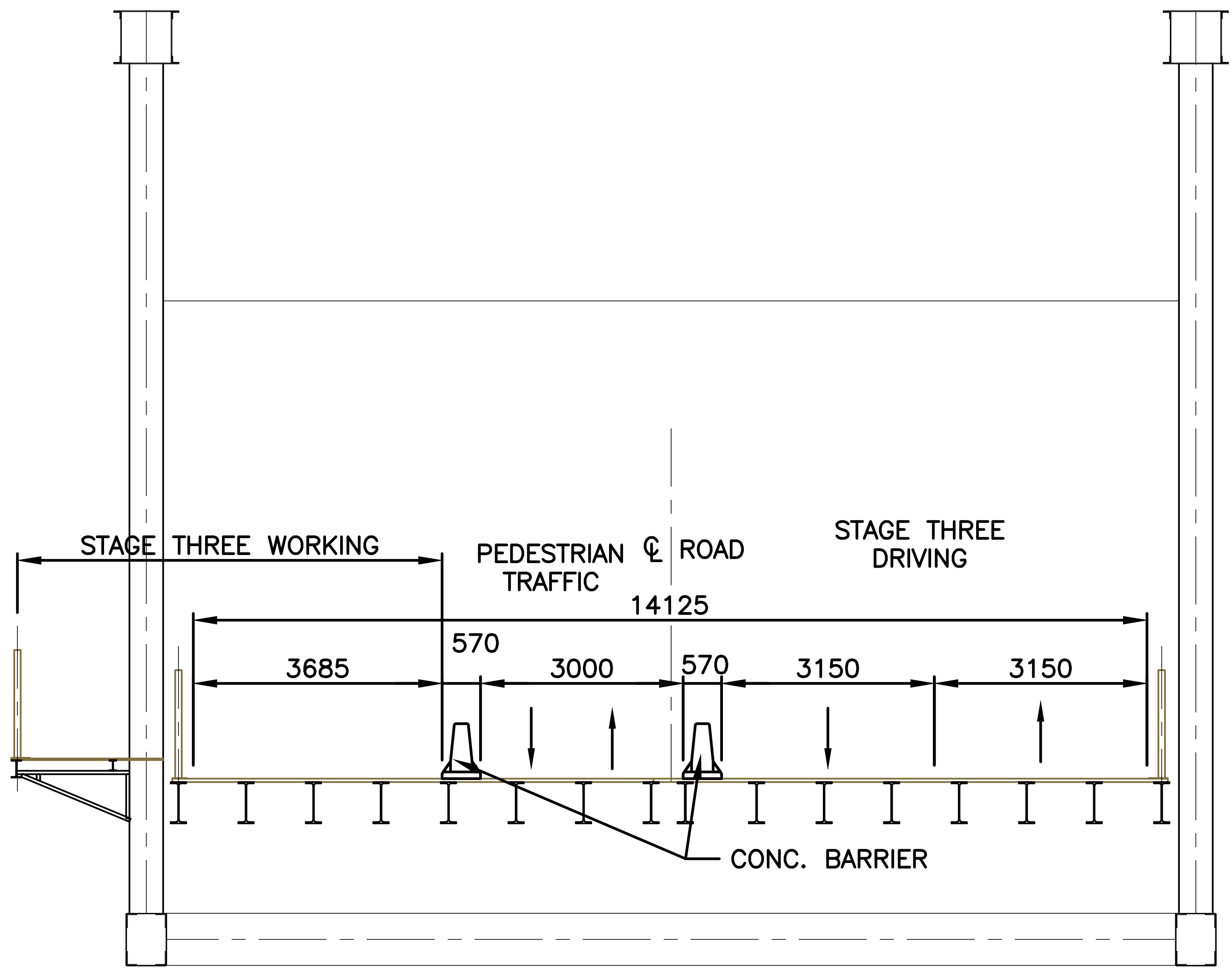

AECOM

PWGSC BURLINGTON
CANAL LIFT BRIDGE
TRAFFIC STAGING
SECTIONS - STAGE THREE

DRN:	DSN:	CHK:	APP:
BJS	XX	CBL	XX

PROJECT NUMBER: 60637587

SCALE: NTS

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06

5.3 Preliminary Construction Schedules

Depending on the construction staging selected and the level of assembly performed off site the schedule will vary. The project should be tendered and awarded up to six months in advance to allow for factory pre-construction of the bridge deck including the stringers. On site work during the lift span replacement should focus on replacing the lift span deck system, sidewalk maintenance and re-balancing the bridge. Work on the approach spans including sidewalk widening can be delayed or done in advance of the lift span work. Any height difference between the final deck and the approach deck will need to be accommodated through temporary risers, but the finger joint at the north end of the lift span will require additional consideration and protection. Winter construction further needs to consider allowance for temperature and weather fluctuations in both the design and construction timing.

5.3.1 Lift Span Construction

All lift span construction for a deck replacement is required to take place over January and February. As this is not the traditional construction season and some finishes are temperature sensitive, prefabrication off site of deck panels with stringers is preferred. Finish durability can vary widely when installed during cold temperatures. It is recommended that deck on stringer fabrication and wearing surface installation be completed as much as possible off site and that panels be connected to the floor beams and locally finished on site. The final deck product will be better fitted to the stringers and result in an overall stiffer deck system when assembled in panels off site by the fabricator. All shimming between the stringer/deck system should be between the stringer and floor beam on site. The timing to do the installation will vary depending on contractor experience, timing of tender, required finishing and connections. The schedule for all 3 of the staging options are considered aggressive. Key to the planning of an installation over 8 weeks is a vigorous and detailed schedule with a competent experienced contractor. Pay items should be tied to the review and acceptance of the schedule and meeting the schedule targets to encourage contractor compliance and planning prior to the beginning of construction.

5.3.1.1 Full Closure for 2 months

- September– Contractor to survey and measure bridge
- September to December - Prefabricate bridge deck in panels including stringers and wearing surface
- January 1 – Close bridge to traffic (marine and vehicle)
- January – 5 to 10 days – Setup scaffold for environmental protection
- January – 10 days - remove existing stringers, redundant members for deck, perform lead remediation: seal floor beams.
- January to February - 40 days – deliver and install deck panels, connect to floor beams, touch up coatings to steel, connect panels and touch up wearing surfaces. Rehabilitate sidewalk, connect and touch up wearing surfaces. Install all railing systems and temporary approach modifications
- February – 5 days – rebalance and test bridge
- March 1 – Open bridge to traffic

5.3.1.2 Two lanes of traffic open

- September– Contractor to survey and measure bridge
- September to December - Prefabricate bridge deck in panels including stringers and wearing surface
- January – 1 to 2 days Close bridge to traffic (marine and vehicle). Install temporary barriers for stage 1 work on east lanes.
- January – 5 to 10 days – Setup scaffold for environmental protection under entire bridge
- January – 8 days - remove existing stringers under east lanes, perform lead remediation on east side: seal floor beams.

- January - 5 days – deliver and install deck panels, connect to floor beams, touch up coatings to steel, connect panels and touch up wearing surfaces install traffic railings
- February – 3 days – Transfer traffic to new deck, move all launching equipment off road temporarily, remobilize on west side.
- February – 8 days - remove existing stringers under west lanes, perform outstanding lead remediation and floor beam coating and sealing.
- February - 5 days – deliver and install deck panels, connect to floor beams, touch up coatings to steel, connect panels and touch up wearing surfaces install traffic railings.
- February– 3 days – Remove all equipment from road, transfer pedestrian traffic to deck
- March - 5 days – Rehabilitate sidewalk on lift span, connect and touch up wearing surfaces.
- March – 5 days – rebalance and test bridge
- March 15 – Open bridge to traffic

5.3.1.3 Nightly Full Road Closure for 2 months

- September– Contractor to survey and measure bridge
- September to December - Prefabricate bridge deck in panels including stringers and wearing surface
- January 1 – Close bridge to traffic (marine and vehicle)
- January – 5 to 10 days – Setup access and environmental protection
- January to February – 30 days - perform lead remediation concurrently with deck/stringer removal: seal floor beams. remove existing stringers between one section of floor beams at a time, deliver and install deck panels in floor beam sections, connect to adjacent section, install temporary panels each morning where section incomplete.
- February – 3 days –touch up coatings to steel, touch up wearing surfaces. Install deck railing systems
- March – 3 days – divert pedestrians to deck
- March – 8 days – rehabilitate sidewalk structure, deliver and install sidewalk panels, connect and touch up wearing surfaces. Reinstall all railing systems.
- March – 5 days – rebalance and test bridge
- March 20 – Open bridge to traffic

All of the above schedules for the lift span rehabilitation have limited float time. The staged construction and nightly closure options have no float, as mid-March is typically when the bridge is tested for the next season. Risk could be reduced significantly by completing the deck improvements during a full road closure. A full road closure and fast tracked construction are recommended for the lift span deck replacement.

5.3.2 Approach and Tower Span Rehabilitation

It is expected the approach span and tower span rehabilitation will use traditional construction techniques. It is assumed staged construction will be used for improvements to the cantilevered sidewalk and the concrete bridge decks. Spring construction has been considered as the bridge is not over water and not subject to the constraints of work over water. Further this is a slower construction season and may be a competitive time to perform construction.

- September – Contractor to survey and measure approach bridges
- March 1 – Close approach bridge east lanes to traffic. Install temporary barriers for stage 1 work on east lanes;
- March – 5 days - Install environmental enclosures
- March – 15 days – Remove bridge deck in work zone. Perform lead remediation, repair and recoat structural steel within 3 metres of joints, seal all other lead paint, install shear studs, formwork and place concrete deck.
- March to April – 28 days - cure bridge deck

- April – Install railings (pave bridge if needed)
- April 15 – Close approach bridge west lanes to traffic. Adjust temporary barriers for stage 2 work on west lanes;
- April to May – 15 days – Remove bridge deck in work zone. Perform lead remediation, repair and recoat structural steel within 3 metres of joints, seal all other lead paint, install shear studs, formwork and place concrete deck.
- May – 28 days - cure bridge deck
- May – Install railings (pave bridge if needed)
- May 20 – Close sidewalk and transfer pedestrian traffic to west lanes. Adjust temporary barriers for stage 3 work on sidewalk;
- May to June - 10 days – Modify sidewalk structure as needed to accommodate widened sidewalk, deliver and install sidewalk panels, connect and touch up wearing surfaces. Install all railing systems.

6. Life Cycle Cost Analysis

Where there are a variety of options for rehabilitation at a site a life cycle cost analysis (LCCA) is performed. The LCCA is a means of analyzing the expenses relating to a structure over its lifetime. These costs may include capital costs, rehabilitation costs, maintenance costs, and disposal costs for a structure. LCCA considers more than initial construction costs; the goal of LCCA is to choose the most cost effective approach to infrastructure management over the lifespan of the structure.

In order to perform an LCCA, rehabilitation and maintenance alternatives are developed, and the timing of improvements is considered. Costs for construction, rehabilitation and maintenance including engineering and administrative costs are estimated. Costs for structure users have not been considered as part of the analyses. Alternatives are considered over a 50 year period of time, and the present value of each alternative is calculated and the results of the present value costs are analyzed. The analysis period considered for the purpose of this memo is 50 years because required maintenance costs beyond 50 years generally have little effect on the LCCA. **Table 3** includes a list of typical structural elements and potential deck types at the BCLB, their repairs and anticipated service life before additional maintenance is required.

Table 3: Rehabilitation and Element Life Spans

Element	Maintenance Life (years)	Current Age - Approach Spans	Current Age - Lift Span
		Built (Last Rehab)	
Asphalt Pavement	10-15	Unknown	-
Steel Truss	50	-	62 (38)
Steel Bridge	45	62 (38)	-
Pedestrian Steel Bridge	30	62 (38)	62 (38)
Deck Replacement (generic)	50	62	21
Rehabilitation (Overlay, Waterproof and Pave)	30	38	-
Elastomeric Bearings	25-30	38	-
Expansion Joint Seals/ Seals	5-15	38	-
Expansion Joint Assembly	15-30	38	-
Coating Systems	10-20	38-62	38-62
Wire Ropes	50+/-5	19 (last rehab 2002)	
Bearings	40-50	62	
Main Counterweight Sheave Trunnion Shafts	> 100 years (depends on fatigue life)	62	

Element	Maintenance Life (years)	Current Age - Approach Spans	Current Age - Lift Span
		Built (Last Rehab)	
Open Grid Steel Grating Deck (Heavy Duty)	75	NA	
Partially Filled Grating	75	NA	
Aluminum Deck	75	NA	
Orthotropic Steel Deck	75	NA	

6.1 Present Value Analysis

Present value analysis involves calculating the cost of alternative designs in present day dollars. For future years the current estimate "C" is increased to account for inflation "i", which is as follows:

$$C_n = C(1+i)^n$$

Variations in costs may occur due to inflation or deflation. To consider this a sensitivity analysis is performed using discount rates are considered from 2% to 6%. The present value "PV" of a capital expenditure "C'" in year "n" at a discount rate "r" can be calculated as follows:

$$PV = C / (1+r)^n$$

The discount rate "r" (2%-6%) sensitivity is compared for each alternative. The residual salvage value of the structure is considered as a reduction to the life cycle costs at the end of the analysis, and is calculated as a percentage of the life remaining in the most recent work scheme proposed for the structure.

6.2 Approach Spans

Two alternative schemes were considered using Life Cycle Cost Analysis (LCCA) for rehabilitation of the approach spans.

Alternative 1: Replacement of Expansion Joints

For this alternative in year 1 a major rehabilitation would include the replacement of the concrete deck with a 225mm deck with integral 20mm concrete wearing surface. Lead paint removal and remediation would be completed within 3 metres of all joints to facilitate steel repairs in those areas. All areas with lead paint in good condition would be sealed. Steel repairs near the joints would be performed, bearing replacements at the approach abutments are included.

Year 1 – Treatment 1: Deck Replacement with Expansion Joint Replacement;
Year 10 – Treatment 3: Replace Expansion Joint Seals;
Year 20 – Treatment 4: Replace Expansion Joint Seals, recoat/ seal coatings as needed;
Year 30 – Treatment 5: Replace Expansion Joint Assembly including seals, Scarify deck and place overlay
Year 40 – Treatment 4: Replace Expansion Joint Seals, recoat/ seal coatings as needed;
Year 50 – Treatment 3: Replace Expansion Joint Seals;

Alternative 2: Semi-Integral Conversion

For this alternative in year 1 a major rehabilitation would include the replacement of the concrete deck with a 225mm deck and integral 20mm wearing surface including conversion of joint between the tower and approach span to a link or integral connection, at the approach abutment a semi-integral conversion would be completed with an approach span expansion joint. Lead paint removal and remediation would be completed within 3 metres of all joints to facilitate steel repairs in those areas. All areas with lead paint in good condition would be sealed and re-coated. Steel repairs near the joints would be performed, bearing replacements at the approach abutments are included. Subsequent

Year 1 – Treatment 2: Rehabilitation with Semi-integral/Link slab deck conversion;
Year 20 – Treatment 6: Recoat/ seal steel coatings as needed;
Year 30 – Treatment 7: Scarify deck and place overlay
Year 40 – Treatment 6: Recoat/ seal steel coatings as needed;

Consideration of the two alternatives over a 50 year life cycle cost analysis was completed using sensitivity analysis **(Figure 7)** and a consideration of discount rates from 2% to 6%. Based on the present value and the sensitivity analysis, Alternative 2 the replacement of the deck with a semi-integral conversion and link slab is the least expensive option over the 50 year time frame. Details relating to the estimates are included in **Appendix D.**

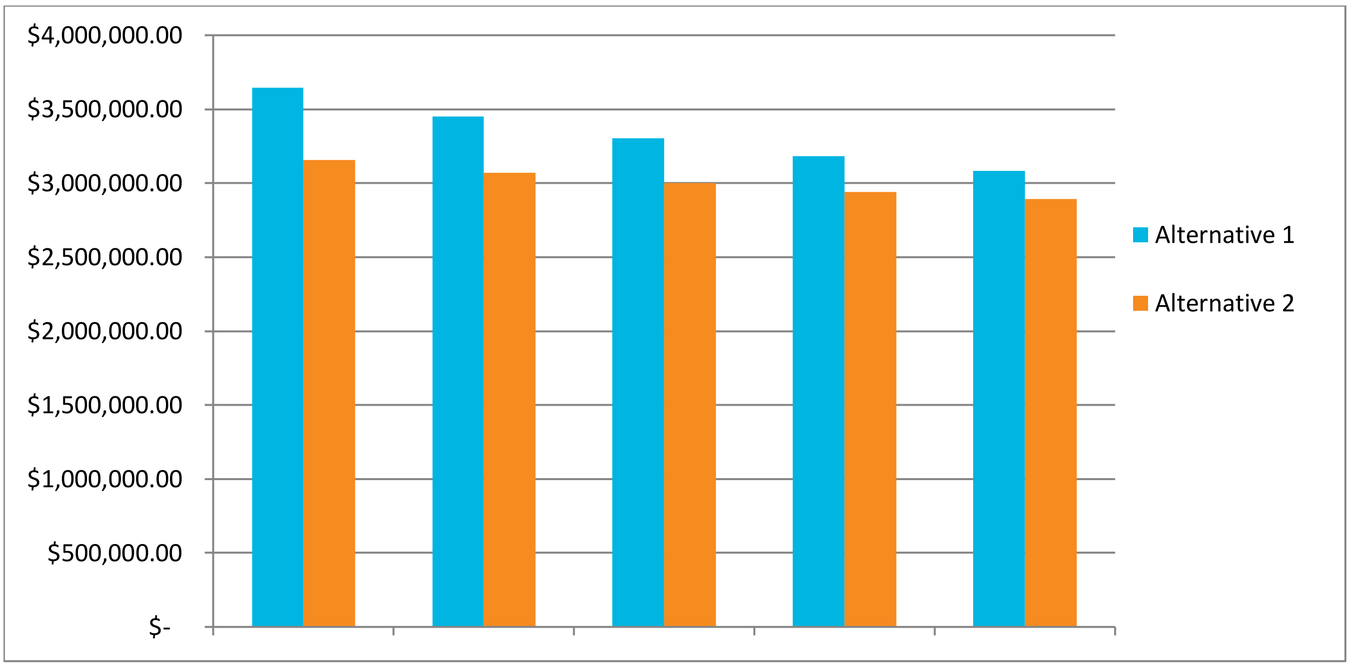

Figure 7: Sensitivity Analysis – Approach and Tower Span Rehabilitation costs

6.3 Lift Span

Five alternative deck replacement schemes were considered using Life Cycle Cost Analysis (LCCA) for rehabilitation of the lift span. Maintenance considerations that exist in each alternative such as bridge cleaning and plowing and existing typical mechanical maintenance are not considered. Maintenance specific to each option and where the costs for the maintenance will differ are considered.

Table 4: Summary of Deck Options Considered

Deck Type	
Open Steel Grid Deck	Crimped I Bar
Open Steel Grid Deck	Rivetted
Aluminum Deck	
Half Filled Grid Deck	No Overlay
Orthotropic Steel Deck	

Alternative 1 and 2: Open Steel Grid Deck

Alternative 1 and 2 will have similar maintenance considerations. It is assumed that the installation will include new stringers installed and fitted off site to the deck to ensure higher quality control and improved durability and stiffness in the new system. Interim repair costs are expected to increase if all of the connections to the stringers are done on site and have not been considered in the LCCA evaluation. The estimated costs for recoating/sealing structural steel under this option are higher due to increased exposure to debris from road.

Year 1 – Treatment 1 & 2: Deck Replacement with Open Grid Decking
Year 20 – Treatment 6: Recoat/ seal structural steel coatings as needed;
Year 30 – Treatment 7: Miscellaneous Open Grid Repairs
Year 40 – Treatment 6: Recoat/ seal structural steel coatings as needed;

Alternative 3: Aluminum Deck

Alternative 3 the Aluminum decking will have new maintenance considerations in comparison to the existing bridge. The wearing surface will require maintenance, the new deck drainage system will require annual maintenance and regular replacement of seals between panels.

Year 1 – Treatment 3: Deck Replacement with Aluminum Deck Panels
Year 2 to 50 – Treatment 8: Clean Deck Drains;
Year 10 – Treatment 9: Replace Deck Panel Seals;
Year 15 – Treatment 10: Maintain deck wearing surface;
Year 20 – Treatment 11: Replace Deck Panel Seals, Recoat/ seal structural steel coatings as needed;
Year 30 – Treatment 12: Replace Deck Panel Seals, Maintain deck wearing surface;
Year 40 – Treatment 11: Replace Deck Panel Seals, Recoat/ seal structural steel coatings as needed;
Year 50 – Treatment 9: Replace Deck Panel Seals

Alternative 4: Half Filled Grid Deck

For Alternative 4 a half filled grid deck system with Matacryl (or equivalent) wearing surface will have new maintenance considerations in comparison to the existing bridge. The wearing surface will require maintenance, the new deck drainage system will require annual maintenance.

Year 1 – Treatment 4: Deck Replacement with Half Filled Grid Deck Panels
Year 2 to 50 – Treatment 8: Clean Deck Drains;
Year 15 – Treatment 12: Maintain Deck wearing surface;
Year 20 – Treatment 13: Recoat/ seal structural steel coatings as needed;
Year 30 – Treatment 12: Maintain Deck wearing surface;
Year 40 – Treatment 13: Recoat/ seal structural steel coatings as needed
Year 45 – Treatment 12: Maintain Deck wearing surface;

Alternative 5: Orthotropic Steel Deck

For Alternative 5 an orthotropic steel deck with Bimagrip LS (or equivalent) wearing surface will have new maintenance considerations in comparison to the existing bridge. The wearing surface will require maintenance, and the new deck drainage system will require annual maintenance.

Year 1 – Treatment 5: Deck Replacement with Orthotropic Steel Deck
Year 2 to 50 – Treatment 8: Clean Deck Drains;
Year 15 – Treatment 12: Maintain Deck wearing surface;
Year 20 – Treatment 13: Recoat/ seal steel coatings as needed;
Year 30 – Treatment 12: Maintain Deck wearing surface;
Year 40 – Treatment 13: Recoat/ seal steel coatings as needed;
Year 45 – Treatment 12: Maintain Deck wearing surface;

Consideration of the five alternatives over a 50 year life cycle cost analysis was completed using sensitivity analysis **(Figure 8)** with consideration to discount rates from 2% to 6%. Based on the present value and the sensitivity analysis, Alternative 1 the replacement of the deck with a crimped I Bar Heavy Duty Open Steel Grid Deck is the least expensive option over the 50 year time frame. Details relating to the estimates are included in **Appendix E.**

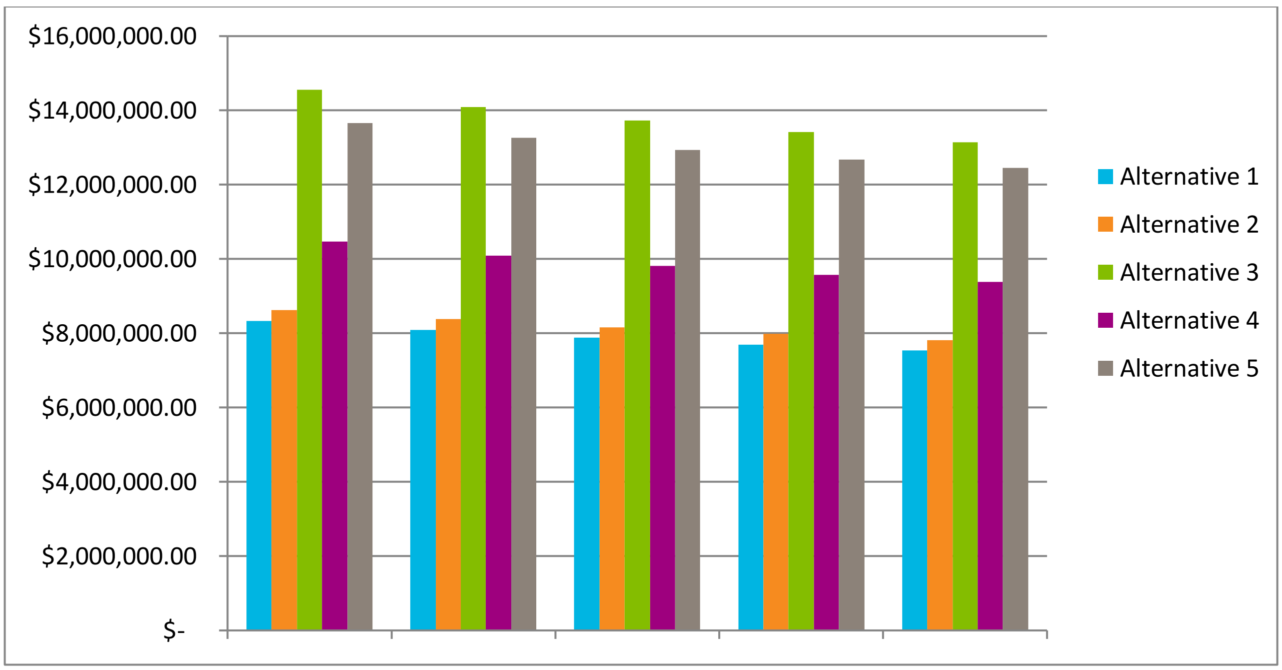

Figure 8: Sensitivity Analysis – Lift Span Rehabilitation Options

7. Conclusion

7.1 Lift Span Deck System Ranking

The proposed lift span bridge deck system options have been evaluated and ranked based on the information presented in this report. These findings have been presented as an evaluation matrix in **Table 5**. Each deck system was ranked against the ten (10) evaluation criteria with a score between 1 and 10, with a ranking of 1 representing a deck system that best meets the criteria and 10 representing a deck system that poorly meets the criteria per the graphic below. Each of the evaluation criteria were given a weighting which when multiplied by the ranking number add up to determine the final ranking for each deck system. The deck system with the lowest value represents the preferred option.

1.0	3.0	5.0	8.0	10.0

Preferred Widely used	Better than Average Moderate	Average Occasional	Worse than Average Limited (In testing)	Least Preferred Not Typical

Descriptions of the evaluation ranking criteria follow:

Capital Cost
Capital cost ranking is based on the estimated capital cost with the highest value getting a rank of 10.0 and the lowest value getting a rank of 1.0. All of the options between are prorated for their score based on the highest and lowest capital costs.

Life Cycle Cost
Life Cycle Costs (LCC) include capital costs, rehabilitation costs, maintenance costs, and disposal costs for a structure over a 50 year period. The highest LCC ranking is the most expensive over 50 years with 10.0 points and the least expensive over 50 years has 1.0 point. The remaining options are prorated based on the highest and lowest LCC.

Implications of Deck Weight
The potential impacts to the structure resulting from an increase to weight such as mechanical and operational considerations are included in this ranking. A lighter weight deck option is considered as the most desirable as their will be fewer changes to the way the bridge operates and less addition of stress to the counterweight ropes, trunnion and motors. The lightest option is scored as 1.0 points with the heaviest at 10.0 points. The remaining options are prorated between the highest and lowest option.

Durability
The durability of the deck will relate to previous experience with similar deck systems. Some systems may include more fatigue prone details and result in more moisture and debris accumulation than others. This is a qualitative evaluation based on AECOM's experience at other moveable bridge sites. A bridge deck system with lower potential for local steel or welds under tension, and lower potential for corrosion in the structural elements is considered desirable. The higher the score the more durability issues have been encountered at other sites. For

example, the existing bridge deck is a Crimped I Bar type and the small welds at the connections have a high failure rate – this type of detail is considered least preferred as a result and this deck ranks as 10 under the category accordingly.

Historic Use on Lift Bridges

This item is being considered to take into account the historic use of some bridge deck types and their continued use on lift bridges. Deck systems with less history will be ranked with a higher number. Deck systems which have been in use for over 50 years for lift bridges will receive the lowest score of 1.0. Remaining systems will be ranked according to the approximate number of years they have been in use on lift bridges. More recent deck system usage is considered to carry a greater number of risks and unknowns. Open grating systems have been in use for more than 50 years on lift bridges and are therefore considered “widely used” under this category. The other deck systems have been in use for less than 50 years and less frequently and are therefore considered accordingly.

Constructability /Contractor Experience

The constructability and in particular Canadian contractor experience for each deck replacement option is considered this criterion. Contractor familiarity and experience with the selected system will improve the quality of the installation. As a qualitative criterion, how common the bridge deck is will be considered and the success of the installations. Lower scored deck types are considered to be more commonly constructed successfully.

Road User Experience

Road user experience relates to the noise and impact to drivers. Steel grating is louder than a paved deck and the orientation of the bearing bars can impose increase side to side pull on tires. Drivers are more familiar with an asphalt or concrete driving surface and as such this would be considered as preferred (1.0). Lane markings can further improve the user experience. A better user experience is associated with a lower score. The existing Crimped I bar deck is loud and has a tendency to pull the vehicle laterally, lane markings are less visible and therefore this deck type is considered least preferred (score of 10).

Traffic/Staging/Schedule

Staging of traffic and construction and the ease with which the system can be panelized and delivered to site account for the score in this criterion. Where the system lends itself to staged panelized construction the score will be lower. Lighter systems and those easier to adjust on site will be preferred. Grating type decks are considered the easiest to adjust on site and score as preferred, whereas orthotropic decks and aluminum decks are harder to adjust on site and are considered worse than average as a result for the schedule.

Sustainable Materials/ Greenhouse Gas Reduction

Steel and aluminum are recyclable materials whereas concrete (and aggregate) are consider non-renewable. Where the bridge will use less material and be easier to recycle or could include recycled material the bridge is more sustainable and is considered to reduce overall greenhouse gas emissions and the score is lower. The partially filled concrete deck option is considered to be the most challenging to recycle and includes non-renewable materials and is therefore least preferred and scores 10.0 under this criteria. Low carbon concrete or cement is an option to improve the sustainability of the partially filled concrete deck, but has only recently become available in some parts of Canada. The steel grating is considered easier to recycle, uses less material and no non-renewable material.

Procurement Risk

The procurement risk considers the availability of the materials for each deck system, potential cost increases due to fluctuating material availability and exchange rates. Lastly where Canadian suppliers have expressed interest in bidding for the project this is considered to reduce risk as exchange rate impacts will be lower. A lower score indicates lower fluctuation in values and high supplier interest. The aluminum and orthotropic options are considered higher risk because both have only one supplier who has expressed interest and there are exchange rate and material risks as well.

The solid deck system with the highest ranking is the Lightweight concrete half filled Grid deck with no overlay and a Matacryl (or equivalent) wearing surface. The open deck system with the highest ranking is the Rivetted Open Grid Steel Deck. Both options will include railing upgrades, structural steel repairs, new stringers, and sidewalk maintenance.

Table 5: Lift Span Bridge Deck System Ranking Evaluation

Deck Alternative		1	2	3	4	5
Ranking Criteria	**Weight**	**Crimped I Bar**	**Rivetted**	**Aluminum**	**Half Filled Grid - No Overlay**	**Orthotropic**
Capital Cost	**5%**	$ 7,534,772	$ 7,833,319	$ 13,197,817	$ 9,499,947	$ 12,756,836
		1.0	1.5	10.0	4.1	9.3
Life Cycle Cost (50 Years)	**15%**	$ 8,337,461	$ 8,630,267	$ 14,534,928	$ 10,436,167	$ 13,630,423
		1.0	1.4	10.0	4.0	8.7
Implications of Deck Weight (kN/m^2)	**10%**	2.08	2.24	1.65	2.65	2.9
		4.1	5.2	1.0	8.2	10.0
Durability	**10%**	Least Preferred	Worse than Average	Average	Better than Average	Better than Average
		10	8	5	3	3
Historic Use on Lift Bridges	**5%**	Widely Used	Widely Used	Limited Use	Widely Used	Moderate Use
		1	1	8	1	5
Constructability/ Contractor Experience	**20%**	Better than Average	Better than Average	Average	Average	Average
		3	3	6	5	5
Road User Experience	**10%**	Least Preferred	Worse than Average	Better than Average	Preferred	Preferred
		10	8	3	1	1
Traffic/ Staging/ Schedule	**10%**	Preferred	Preferred	Worse than Average	Average	Worse than Average
		1	1	8	5	8
Sustainable Materials/ Greenhouse Gas Reduction	**10%**	Better than Average	Better than Average	Average	Least Preferred	Average
		3	3	5	10	5
Procurement Risk	**5%**	Better than Average	Better than Average	Worse than Average	Average	Worse than Average
		3	3	8	5	8
	100%	**Weighted Score (Lowest Best Meets Criteria)**				
		3.81	3.61	6.20	4.84	6.12
Final Ranking		2	1	5	3	4

7.2 Recommendations

Construction at the BCLB site over the waterway has several constraints including:

1. No in water works between July 15 and September 1;
2. Pedestrian traffic to be maintained at all times;
3. Marine traffic cannot be interrupted. Marine traffic runs from March 1 to December 31.

All construction options need to consider that work on the lift span needs to occur during the 8 week period from January 1 to March 1. A general consideration in the rehabilitation is the sealing of lead paint and lead paint remediation where construction is impacting a deteriorated area of the structure. A summary of the specific recommendations as they relate to the rehabilitation and staging are including in the following sections.

7.2.1 Tower

The tower evaluation indicates that under existing conditions the front columns on the south and north towers are overstressed when the bridge is lifted during a 80kph wind speed. This does not relate to the deck type or weight. A detailed evaluation of all north and south tower columns including detailed plate and connection information is required to further verify the capacity of the columns during detailed design prior to any major rehabilitation at the bridge. Strengthening of the columns may be required based on the results of a more detailed analysis.

7.2.2 Approach and Tower Spans

The approach and tower spans require a deck replacement and repairs to the steel superstructure near the deck joints. The deck should be replaced in accordance with current standards including a 225mm deck and 20mm wearing surface using premium steel in the top reinforcing layers of the deck. The life cycle cost analysis confirmed that by converting the joints to link between the tower and approach spans and semi-integral at the abutment that the overall life cycle costs are reduced. It is recommended that the implementation of a semi-integral and link slab deck be considered to prevent water infiltration at the abutment to reduce deterioration in the superstructure and reduce maintenance costs.

The sidewalk in the approach and tower spans do not meet the minimum standard for Ontario sidewalks at 1.5m clear. The sidewalks should be widened during the next rehabilitation. The highway railings do not meet current standards and should be improved to meet CHBDC standards during the deck replacement.

The corroded structural members near joints and within the north span lock room should be abrasive blast cleaned and repaired where section loss is excessive and recoated/painted with remediation of the lead paint hazard. It is recommended to install screened vents in the north span lock room to improve air flow and reduce moisture accumulation and rust to the structural steel within the room.

7.2.3 Lift Span

Since the weight of the lift span is difficult to accurately calculate, the precise weight of the lift span should be verified through testing prior to rehabilitation or during the next counterweight rope replacement. The east-west balance can be verified at the same time by measuring the differential in weights between all four corners. There is currently no lateral balancing system. The abandoned rail stringers act to laterally balance the bridge. Implementation of a lateral balancing system on the lift span would improve operations and potentially allow for the reduction of overall span weight. The bridge cannot be operated during balance testing or re-balancing. Balancing has been considered in the project schedule. The recommended options consider the need to minimize adjustments to the mechanical system, the ranked deck replacement options considered are included in **Table 6**.

Table 6: Ranked Summary of Deck Replacement Options

Ranking	Deck Type	
1	Open Steel Grid Deck	Rivetted
2	Open Steel Grid Deck	Crimped I Bar
3	Half Filled Grid Deck	No Overlay
4	Orthotropic Steel Deck	
5	Aluminum Deck	

The current railings and anchorage in the lift span are likely substandard; thus replacement during a rehabilitation is recommended with crash tested CHBDC compliant railings including their anchorage to a primary structural member consistent with CHBDC requirements.

All lift span construction for a deck replacement is required to take place over January and February. As this is not the traditional construction season and some finishes are temperature sensitive, prefabrication off site of deck panels with stringers is preferred. It is recommended that deck on stringer fabrication and wearing surface installation be completed as much as possible off site and that panels be connected to the floor beams and locally finished and connected on site. The timing to do the installation will vary depending on contractor experience, timing of tender, required finishing and connections. Key to the planning of an installation over 8 weeks is a vigorous and detailed schedule. The only option which currently meets this schedule is the full closure of the road and bridge to vehicle and pedestrian traffic.

Based on the evaluated criteria of the deck replacement options it is recommended that the concept design proceed with the rivetted open grating and the partially filled lightweight concrete steel deck grating with no overlay and a matacryl (or equivalent) wearing surface.

7.2.4 Construction Staging and Approach

In general, the deck replacement in the lift span should be performed using rapid construction techniques including off site fabrication where possible with assembly and final connections on site minimized. A full road closure is optimal to ensure the bridge is operating on time for marine traffic in March. A full road closure is preferred to maximize construction efficiency and optimize scheduling during construction however the night closures and dual lane closures can also be performed with and addition 2-3 weeks and no float time. Traffic staging and impacts are to be considered further at the concept design phase.

The approach and tower span rehabilitations should be done either prior to the lift span deck replacement or after to avoid any conflicts with priorities on the construction site. Traditional construction techniques are appropriate for the approach and tower spans.

8. References

1. Project Vendome: Pub June 20, 2019 https://www.youtube.com/watch?v=17rl1p4B_Sk link viewed Dec 9, 2020
2. Aluma Bridge Rapid Deployment: http://www.alumabridge.com/alumabridge_video.htm link viewed Dec 9, 2020
3. Project New Wear Crossing: Pub Mar 30, 2017 https://www.youtube.com/watch?v=66uzWSgfhD8 link viewed Dec 9, 2020

Appendix A

Inspection Memorandum

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AECOM Canada Ltd.
50 Sportsworld Crossing Road, Suite 290
Kitchener, ON N2P 0A4
Canada

T: 519.650.5313
F: 519.650.3424
www.aecom.com

To: Ranya El Sadawy P.Eng
Senior Bridge Engineer

cc: Nang Quach P.Eng

Date: April 14, 2021

Project #: 60637587
EQ754-192679/002/PWL

From: Christine Beard Laaber
Karol Chorostecki

Memorandum

Subject: **Burlington Canal Lift Bridge Inspection Memorandum – Draft 2**

1. Introduction

AECOM Canada Ltd. (AECOM) was retained by the Public Works and Government Services Canada (PWGSC) to review and complete a site reconnaissance to support a structural analysis and evaluation of the Burlington Canal Lift Bridge (BCLB) including the lift span, towers and mechanical counterweight components to determine the load carrying capacity of the bridge.

This memorandum summarizes the results of a ground level inspection and site reconnaissance of the deck and superstructure including the lift, tower and approach spans of the bridge completed between August 10-13, 2020. A comprehensive detailed inspection is underway as well. This focus of this inspection was on elements which could affect a deck replacement on the lift span and approaches.

1.1 Background

The BCLB has been operating since 1962 as a rail/highway bridge and replaced the original CN swing bridge nearby. The BCLB is a tower driven vertical steel truss style lift bridge and was converted for roadway traffic only in 1982. Currently Eastport Drive at the bridge between the border of the City of Hamilton and the City of Burlington in Ontario has an approximate average annual daily traffic (AADT) of 25,000 per day. The road carries four lanes of vehicle traffic over the bridge when it is lowered and accommodates commercial vessel passage between Lake Ontario and the Burlington Harbour when the bridge is lifted. It is assumed the bridge is lifted with “average usage” (with 400 to 4000 openings per year). Through the summer there is a high volume of pedestrians and cyclists on the sidewalk and additional cyclists on the road over the bridge deck. When lifted to maximum height, the bridge spans the canal approximately 36.5m above the water course during normal water levels to allow passage of larger private and commercial vessels. When lowered the bridge sits approximately 5m above the canal allowing smaller private watercrafts to pass. The BCLB typically operates from late March through to late December.

2. Inspection

Purpose: The purpose of this inspection was to review potential issues in considering a future deck replacement with particular focus on the condition of members and detailing affecting the deck and sidewalks.

Methodology: The entire bridge consists of 5 spans including the lift span, two tower spans and two approach spans. Each span was inspected from the ground level with the use of hand tools and without the use of specialized access equipment. The following subsections summarize the inspection and potential issues.

2.1 Lift Span

The steel truss lift span is 115.8m long with open steel deck grating welded to steel stringers over floor beams. The bridge deck is comprised of 98 panels (2 transverse x 49 panels longitudinally) of steel grating with transverse bearing bars welded to the longitudinal stringers. Transverse bearing bars alternate with wear bars. The wear bars are slotted to fit together with the other wear bars and the bearing bars with a thin weld at the traffic level. As these welds are small they have proven to be susceptible to fatigue. Many of these localized weld failures have been repaired though significantly more are still present across the deck, typically located in the wheel paths of the vehicular traffic. It was noted during the inspection that the localized weld failures were more common on the southbound lanes (sidewalk side) (**Figure 1**). The higher localized weld failure on the west side of the bridge may be caused by increased vibration/fatigue adjacent to the lighter (non rail) west truss. Localized wear bar failures were noted in several locations. Bearing bar to stringer welds were observed to be cracked in a few locations, with many weld locations repaired. A repair/test panel, where each transverse bar is a bearing bar (no wear bars), at the north end of the southbound lane was observed to be in good condition with no defects observed. Line painting over the bridge was difficult to see and may be a safety hazard.

The deck grating bearing bars are cantilevered at the east and west sides of the road and support traffic railing posts. On the west side the intermediate cantilevers for the sidewalk are partially supported on the grating edge beam (**Figure 2**). The railings are not a crash tested type and the east railing at 1.2m high is a substandard height for cyclists. Future deck replacements should include for replacing the railing to meet crash testing standards and will need to consider how to improve the anchorage for the railings to ensure it is sufficient to sustain CHBDC crash loading.

The stringers supporting the deck grating are overall in good condition, but section loss has occurred previous to the last painting and it is unknown if the stringers have suitable carbon content for welding based on their date of fabrication. Previous experience when removing a welded deck grating is that some stringers may be damaged at the weld points. When inspecting the deck stringers from below it was observed that several of the rail stringers were not removed from the deck span. It is expected that these stringers are part of a lateral balancing system to offset the sidewalk weight. These stringers are oversized for the structural system and could be removed and replaced with a lateral counterweight system during a rehabilitation to improve the lateral balance of the lift span and potentially reduce the weight of the lift span (**Figure 3**).

A review of the sidewalk condition indicated that it is in overall good condition with a width of 1.89m between vertical truss members and the pedestrian railing on the lift span. At expansion joints the width narrows where at the tower access ladder/stair to as little as 1.34m on the south end (**Figure 4**). There was a high volume of pedestrians and cyclists at the time of the inspection and cyclists did not dismount consistently which makes the narrow width a potential hazard. A future deck replacement should consider a widening of the sidewalk to improve the flow of pedestrians across the bridge.

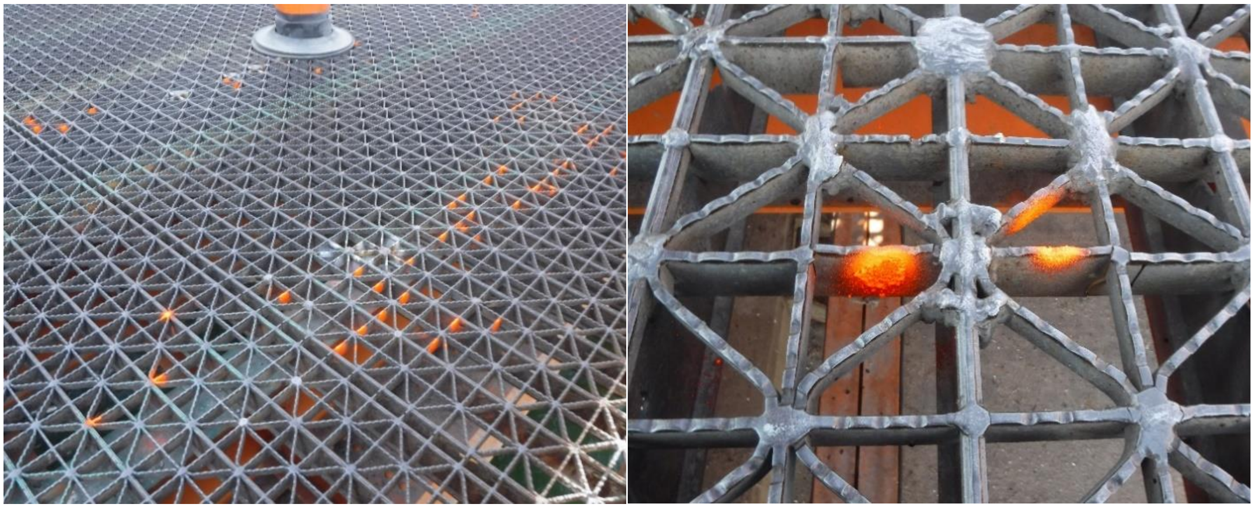
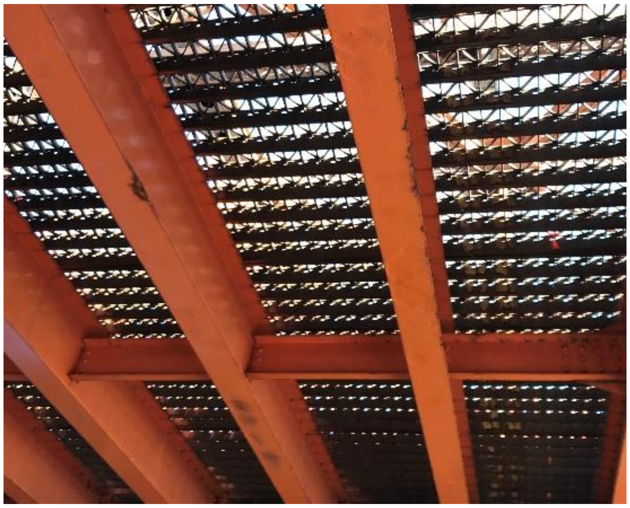
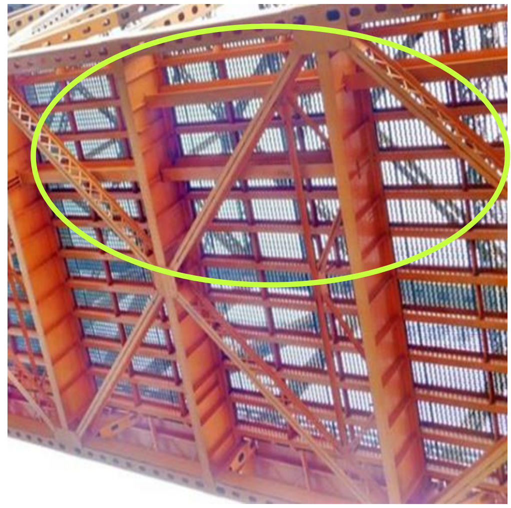


Figure 1. Typical Condition of Steel Deck Grating
(Orange paint markings note the locations of localized weld failures)

Figure 2. Grating Edge Post Support and intermediate Cantilever Support



Typical Stringer Condition



Typical Soffit (Rail Stringers Circled)

Figure 3. Lift Span Soffit

Figure 4. Sidewalk Expansion Joints

2.2 Tower Spans

The north and south tower span 9.8m over the tower foundations and span lock equipment under the towers. The deck is concrete reinforced supported by steel stringers bearing on transverse tower beams which are connected to the vertical tower posts. The west side of the deck is original to the bridge and the east side of the deck was installed over new stringers in the early 1980’s when the railway tracks were removed. The condition of the diaphragms and stringers supporting the tower spans varied. With increasing distance from the expansion joints, the diaphragms and stringers are in good condition (**Figure 5**), with the exception of the 4th stringer from the east side on the north tower span, described in further detail in Section 2.2.1. Adjacent to the expansion joints at both the approach span and tower span the sections are in fair condition with loss of coating on stringers and diaphragms. The concrete in the widened side of the bridge has narrow crazing type cracks. Light scaling in the concrete was observed on the original concrete soffit. The concrete soffits were in good condition overall but it is expected the construction joint in the deck is leaking at the north end. It was noted that the backer rod had fallen through the expansion joint at the north end.

Stringers adjacent to Approach Span

Figure 5. Typical Condition of Steel and Concrete Soffit under Tower Span

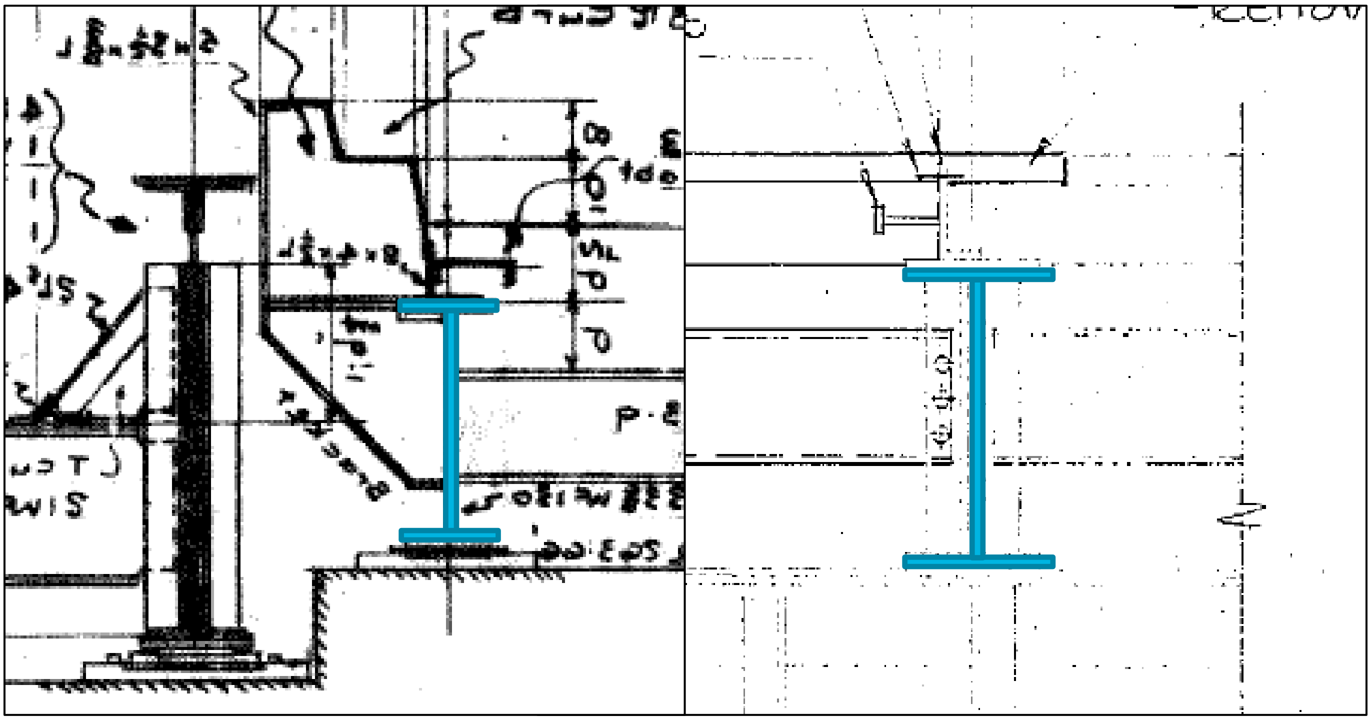
2.2.1 Tower Span Stringer through Span Lock Room

During the 1982 widening of the deck the approach span was widened to accommodate 4 lanes of traffic. The 4th stringer from the east side of the bridge in the tower span was likely exposed to more road salts by this time than the interior stringers as the outside stringer. After the deck was widened a construction joint in the concrete was added over the stringer and another joint in the asphalt adjacent to the joint in the concrete. The fourth tower stringer also currently goes through the span lock room at the base of the north and south towers (**Figure 7**, **Figure 8**). At the time of the inspection humidity levels in the north span lock room seemed high. This may be representative of typical conditions resulting in an accelerated rate of corrosion in the stringer flange.

Based on our site investigation the tower spans have asphalt drains adjacent to the stringer at each end at the 1982 construction joint (**Figure 9**). The joint in the asphalt in that area is unsealed above the stringer with alligator cracking of asphalt pavement at the lift span expansion joint on the north end. While similar conditions exist at the south span it is suspected that the waterproofing under the asphalt over the construction joint in the north tower span has failed which is resulting in increased moisture through that construction joint. The condition of the stringer is noticeably worse under the north tower when compared to the south tower. In general, the stringer (fourth from the east side of the bridge) under the north tower has coating failure and moderate to severe corrosion along the top flange. The corrosion reaction is accelerated where chlorides (salt) are present and extends into the web of the stringer in the humid span lock room.

2.2.2 Recommendations

In the short term, it is recommended that screened vents be installed in the north span lock room to improve air flow. The asphalt drains should be extended below the stringer to reduce any potential leakage from the deck surface onto steel. It is recommended that the stringer be abrasive blast cleaned and repaired where section loss is excessive and recoated/painted during the next rehabilitation within 1 to 5 years.



Before 1982 Rehabilitation **After 1982 Rehabilitation**

Figure 6. Position of the 4th Stringer Before and After 1982 Rehabilitation


Inside the Span Lock Room **Outside the Span Lock Room**

Figure 7. North Tower Span 4th Stringer

Inside the Span Lock Room

Figure 8. South Tower Span 4th Stringer

Asphalt Drain **Unsealed Asphalt Joint Over Stringer**

Figure 9. Detailing near 1982 Construction Joint

2.3 Approach Spans

The approach bridge spans 12.6m over the Waterfront Trail (North) and the Breezeway Trail (South) adjacent to the north and south towers and a protection wall adjacent to the tower. The approach span consists of a reinforced concrete deck on steel stringers and is supported on one end by a reinforced concrete abutment (with a spread footing) and on the other by the tower beam and tower foundation. A deck drain penetrates the soffit on the west side of the road and empties onto the access road/trail. The typical condition of the approach span deck is assumed to be good to fair. A previous inspection by others using a wax crayon has marked areas of delamination in the soffit (**Figure 10**). Adjacent to the expansion joints at both ends the sections are in fair condition with loss of coating on stringers and diaphragms, otherwise the steel condition is good (**Figure 11**). There is a paved over sealed joint at the abutment end and a standard expansion joint (end dam/armouring angle seal) at the joint with the tower. Consideration should be given to adding a semi-integral deck modification detail to prevent water infiltration at the abutment as part of a future deck replacement as well as painting and repairs to the end stringers and diaphragms. Diaphragms may require replacement to allow for jacking of the bridge to replace bearings if needed at that time. Bearings were not inspected due to their height above ground.

Figure 10. Typical Condition of Approach Span

Typical Paved over Joint **Typical Condition of Stringers at Abutment**

Figure 11. Typical Condition of Approach Span

2.4 Expansion Joints

The expansion joint between the tower and lift spans consist of concrete end dams, armouring angles and rubber seals. The expansion joints are in fair to poor condition with punctured seals, concrete spalling on end dams and damaged/deformed armouring angles (**Figure 13**). Expansion joint seal replacement should be considered as key maintenance at the site to protect the overall condition of the members below. In particular, the members affected by leaking joints consist of the approach and tower span stringers, diaphragms and the rear tower beam. Further, deck replacement should consider the opportunity to install a link slab across the tower/approach span joint to reduce infiltration of moisture and salts below.

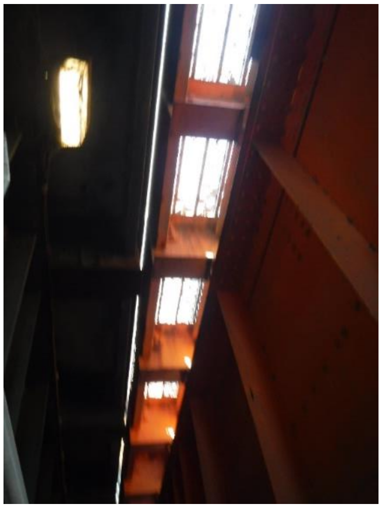
South Expansion Joint **North Expansion Joint**

Figure 12. Tower and Approach Span Expansion Joints

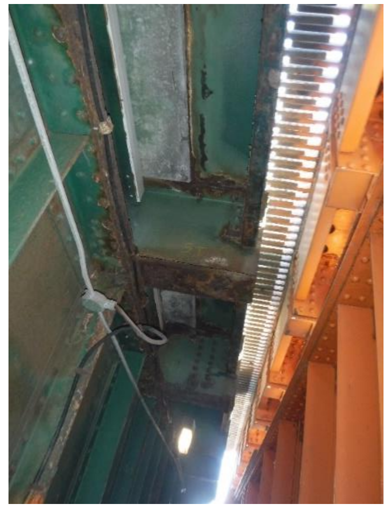
The south end lift span joint consists of steel deck grating (lift span) and a vertical plate (tower span). Both are in good condition but the adjacent asphalt has light potholes. An armouring angle and end dam on the tower span side will improve the durability of the joint. The north end finger joint is in good condition with typical wear in the adjacent checker plate and light plow damage to the “fingers”. The base curb steel is slightly higher than the finger joint making it prone to potential plow damage but with none observed (**Figure 13**). The condition of the steel below the finger joint is poor in areas and consideration to reducing the potential for dripping onto the steel structure during a deck replacement will improve the durability of the bridge (**Figure 14**).

South End Joint with Lift Span **North End Finger Joint with Lift Span**

Figure 13. Lift Span Joints



Underside of South End Joint with Lift Span



Underside of Finger Joint with Lift Span

Figure 14. Lift Span Joints – Underside

3. Conclusion and Recommendations

Overall the structure is in fair to good condition with some poor condition elements in localized areas particularly around joints. Short term repairs should consider the following:

1. The addition of screened vents to the north and south span lock rooms;
2. Replacement of expansion joint seals;
3. Extension of asphalt drains below stringers in tower spans; and
4. Line painting on the lift span deck.

During the next bridge/deck rehabilitation the following should be considered:

1. Widening (or local widening) of the sidewalk to improve safety for pedestrians and cyclists;
2. Improved connection of intermediate cantilever supports for the sidewalk to the lift span structure;
3. Traffic barrier upgrades across the bridge and anchorage railing upgrades in the lift span;
4. Raising of the height of railings in lift and approach spans for cyclists;
5. Cleaning, painting and repair of structural steel members near joints;
6. Consider removal of the rail stringers and the addition of a lateral counterweight system to improve lateral balance and reduce overall weight of lift span; and
7. Modifications to expansion/lift joints as follows:
   a. South lift joint – add armouring to the tower span side;
   b. Tower-Approach joints – consider installing a link slab at next deck replacement; and
   c. Approach paved over joints – consider detailing for semi-integral abutment.

4. References

1. *Public Works and Government Services Canada, Bridge Inspection Manual 2010, Structures Marine and Transportation*

2. *Canadian Standards Association*. November 2006. *Canadian Highway Bridge Design Code*.

Appendix B

Structural Evaluation Memorandum

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AECOM Canada Ltd.
50 Sportsworld Crossing Road, Suite 290
Kitchener, ON N2P 0A4
Canada

T: 519.650.5313
F: 519.650.3424
www.aecom.com

To:	Ranya El Sadawy P.Eng Senior Bridge Engineer	Date:	April 14, 2021
		Project #:	60637587 EQ754-192679/002/PWL
		From:	Christine Beard Laaber Brad Kopping
cc:	Nang Quach P.Eng		

Memorandum

Subject: ***Structural Evaluation Technical Memorandum – Final***

1. Introduction

AECOM Canada Ltd. (AECOM) was retained by the Public Works and Government Services Canada (PWGSC) to review and complete a structural analysis and evaluation of the Burlington Canal Lift Bridge (BCLB) including the lift span, towers and counterweight main mechanical components to determine the load carrying capacity of the bridge.

1.1 Background

The BCLB is a tower driven vertical steel truss style lift bridge located between the cities of Hamilton and Burlington in Ontario. It is in a north-to-south orientation and spans the Burlington Bay Canal. The BCLB was constructed between 1959 and 1960 and has been operating since 1962 as a rail/highway bridge, replacing the original CN swing bridge nearby. In 1982, the BCLB underwent a major rehabilitation to convert it for roadway traffic use only. It currently carries four (4) lanes of Eastport Drive, two (2) lanes in each northbound (NB) and southbound (SB) direction, with an approximate AADT of 25,000 per day when it is lowered. When the bridge is lifted, it accommodates commercial passage between Lake Ontario and Hamilton Harbour. It is assumed the bridge is lifted with “average usage” (400-4000 openings per year). The BCLB typically operates from late March through to late December.

The entire bridge consists of five (5) spans and has a roadway width of 13.6 m (**Figure 1**). There are two reinforced concrete deck on steel I-girder approach spans at each end of the bridge. The exterior approach spans (referred to as the “approach spans”) are 12.6 m long and cross over an access road/trail. The interior approach spans (referred to as the “tower spans”) are 10.6 m long (including 0.9 m long cantilevered portions at the lift span ends) and pass under the towers at each side.

Figure 1 Elevation of Burlington Lift Bridge

The steel truss lift span is 115.8m long with open steel deck grating welded to steel stringers over floor beams. The tower, lift span, and tower span foundations are comprised of steel piles encased in reinforced concrete at the back (away from the lift span) and with steel anchors to the reinforced concrete foundation at the front (beside the lift span). There are 2 pits between the front and back supports for the tower. The back steel anchors extend below the pit base to the pile cap. The tower foundation is enclosed inside of a galvanized chain link fence with a reinforced concrete wall under the approach span beside the access road. The approach span is supported on one end by a reinforced concrete abutment and on the back tower foundations on the other side.

The lift span is connected to the counterweights by 80 counterweight ropes that are held in place by 8 counterweight sheaves. Each sheave is carried by a shaft that is supported by two spherical roller bearing assemblies. The counterweight ropes are 2.25" diameter and the counterweight sheaves have a 180" diameter at the rope grooves.

1.2 Scope

This memorandum is the second in a series of memorandums to review and consider rehabilitation options at the BCLB. The scope of the memorandum addresses the review of the previous capacity and weight calculations for the structural and mechanical components of the lift bridge and the approach spans. The approach spans and lift span were modeled to evaluate structural capacities. The tower will be evaluated in a later memorandum. Available life for existing mechanical components are considered and their capacity are considered.

2. Existing Structure

2.1 Approach Span

The approach span is 12.6 m long, measured between the centreline of bearings at the abutment and the centreline of the rear tower column (which supports the rear floor beam) (**Figure 2**). The superstructure of the approach span consists of eight (8) steel **I**-girders (stringers) supporting a 190 mm reinforced concrete deck originally covered with 64 mm thick asphalt. The centre-to-centre spacing of the five (5) stringers from original construction is 1.9 m (Stringer Nos. 4 – 8, numbered from the east) and the centre-to-centre spacing of the three (3) stringers added during the 1982 rehabilitation (Stringer Nos. 1 – 3, numbered from the east) is 2.0 m. According to the original construction drawings, Stringer Nos. 4 – 8 are standard size W33x130 (or W840x193 metric designation). According to the 1982 rehabilitation drawings, Stringer Nos. 1 – 3 are also sized W840x193. Field measurements taken during the recent AECOM inspection found that the newer Stringer Nos. 1 – 3 are approximately 880mm – 890mm deep, which is deeper than the W840x193 girders listed on the rehabilitation drawings. The web was measured on site to be approximately 15 mm thick and the bottom flange was measured 27 – 30 mm thick.

There is an expansion joint on the deck between the approach span and tower span, and a paved over sealed joint at the abutment end. The original construction drawings do not show that the flanges of the approach and tower span stringers are connected, but on site they are connected through rivets and angles to the transverse diaphragms. The detailing suggests that the rivet connections at the tower floor beam behave like pinned connections and that there is no continuity in the stringers. Drawings from the 1982 rehabilitation show that the newer stringers are supported on 203 mm x 305 mm x 61 mm thick laminated elastomeric bearings at the abutments and on the rear floor beam steelwork at the opposite end. According to the original construction drawings, the original stringers were supported on sliding plates on expansion shoes at the abutments and on the rear floor beam steelwork at the opposite end. However, the original bearings have been replaced with laminated elastomeric bearings at the abutments. Original construction drawings indicate that the reinforced concrete abutments are supported on spread footings.

The approach roadway is bordered by steel plate curbs and a mix of steel post with guiderail and box beam barriers. Along the east edge of the approach span, a concrete fascia was constructed as part of the 1982 rehabilitation. Along the west edge, there are steel diaphragm plates cantilevered off the stringers which support the steel curb. There is a sidewalk along the west side of the bridge, which has a width of approximately 2.1 m at location of the abutment. There is a metal pedestrian handrail along the west side of the sidewalk. The sidewalk is classified as a “50mm Tee Type” comprised of 50mm deep Tee Beams inverted with steel plates between the Tee’s and filled with concrete (**Figure 3**). The sidewalk is partly supported by the exterior roadway stringer and a sidewalk stringer running along the west edge of the sidewalk. The sidewalk stinger is supported by the abutment and by cantilevers from the tower verticals.

Figure 2 Approach Span Elevation

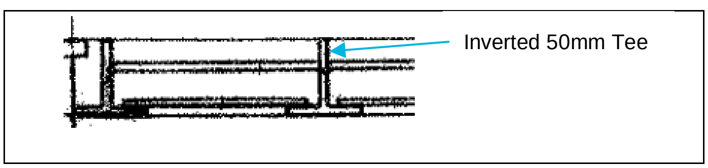


Figure 3 Tee Type Bridge Sidewalk Cross-Section

2.2 Tower Span

The tower span is 10.6 m long, measured from the centreline of the rear tower columns to the cantilevered end of the tower span at the lift span side (**Figure 4).** The tower span consists of a 9.7 m span between centrelines of tower columns, and a 0.9 m cantilevered portion on the lift span end. The superstructure of the tower span consists of eight (8) steel I-girders (stringers) supporting a 190 mm thick reinforced concrete slab originally covered with 64 mm thick asphalt. The centre-to-centre spacing of the five (5) stringers from original construction is 1.93 m

(Stringer Nos. 4 – 8, numbered from the east) and the centre-to-centre spacing of the three (3) stringers from the 1982 rehabilitation is 2.0 m (Stringer Nos. 1 – 3, numbered from the east), with the exception of the 1.52 m space between the east exterior stringer (Stringer No. 1) and the adjacent interior stringer (Stringer No. 2). According to the original construction drawings, Stringer Nos. 4 – 8 are standard size W27x102 (or W690x152 with metric designation). According to the 1982 rehabilitation drawings, Stringer Nos. 1 – 3 are also sized W690x152.

There is an expansion joint on the deck between the approach span and tower span. The tower span stringers are supported at both ends on the steelwork of the tower floor beams, on the rear floor beam at the approach side and on the front floor beam at the lift span side. The stringers are continuous over the front floor beam at the lift span end. The floor beams are supported by the tower columns at each end, and an interior support at the location of the former railway centreline.

The roadway is bordered by steel plate curbs and steel post with guiderail and box beam barriers. Along both east and west sides of the roadway, there are steel diaphragm plates cantilevered off the stringers which support the steel curbs. There is a 3 m wide sidewalk along the west side of the bridge for pedestrian use which narrows to as little as 1.34m at the tower legs. There is a metal pedestrian railing along the west side of the sidewalk. The sidewalk is classified as a “50mm Tee Type” comprised of 50mm deep Tee Beams inverted with steel plates between the Tee’s and filled with concrete. The edge beam is supported on both ends by the tower columns and cantilevered to facilitate the finger joint to connect to the lift span (**Figure 5**).

Figure 4 Tower Span Elevation

Figure 5 Finger Joint Connection

2.3 Lift Span

The Lift Span is 112.8m long from centre to centre of bearings. The lift span's primary structural elements include two steel trusses connected with floor beams, lifting girders, and sway frames (**Figure 6**). The span was originally constructed to support vehicular traffic and railway traffic. The road vehicular side of the bridge has a pedestrian walkway on the exterior side of the harbour side truss. The roadway and railway side truss members have different section composition and fabricated out of different steel materials. The lift span is connected to the counterweights through the lifting girders. The counterweight load is permanently acting on the lift span. Ideally the bridge is heavier than the counterweight to maintain constant downward force/contact on the bearings.

Figure 6 Lift Span Elevation

The lift span bridge has gone through a couple of rehabilitations since construction. Around 1980 a design for rehabilitation of the railway tracks was proposed to remove the timber ties and raise the existing railway stringers which spanned between the floor beams to support the railway directly and to allow the installation of open steel grating around the rail to allow for an additional lane of roadway vehicles. However, this design does not appear to have been fully implemented. Original railway stringers are still present beneath the current road stringers. If the railway stringers had been raised, then they wouldn't be in their original position presently. In 1982, another lift span re-design was implemented to remove the railway entirely from the lift span and establish 4 lanes of roadway traffic including the transition of the barrier to the inside of the existing railway truss some railway stringers were left in place for lateral balance.

In 2000, the grating on the bridge was removed and replaced. The roadway barriers at that time were also removed and replaced with the current barriers.

2.4 Tower

On the north and south side of the lift span are two tower structures (**Figure 7**). These structures support the tower spans, the counterweights, the auxiliary counterweights, the mechanical components to operate the bridge, tower control rooms, the messenger cables that span across the canal between the north and south tower and the lift bridge weight. The tower supports almost the entire dead weight of the bridge even in the lowered position. When the lift span is lowered the bearings only have enough load to maintain contact to transfer the additional weight from transitory (live) loads.

Figure 7 South Tower Elevations

The towers were pre-cambered away from the lift span to provide for a vertical tower after being loaded. The front legs of the towers are designed to be in compression only, while the rear columns are design for compression and tension due to wind loading on the lift span during raising of the lift span. The front steel columns bear on top of the pier while the rear steel columns are embedded in concrete to anchor the towers below the pits to the pile cap.

The mechanical/controls room at the top of the tower houses electrical, controls and mechanical equipment required to facilitate the raising and lowering of the bridge.

The towers are comprised of four columns, two front columns and two rear columns. The towers extend a total of 54.5m from the top of the pier and support a mechanical room for an additional 4.7m to the roof. The towers are columns are spaced 15.9m transverse to the road and 9.7m along the road. The columns are braced with horizontal struts and diagonal bracing on all 4 faces of the towers. On the inside of the towers there is an elevator and an access stair for emergency use.

3. Structure Evaluation

3.1 Methodology

The existing bridges and towers were evaluated in accordance with CAN/CSA S6-19 Canadian Highway Bridge Design Code (CHBDC). Existing structure dimensions were taken from original construction drawings (1959) and rehabilitation drawings (1982). The existing drawings and CHBDC were referenced to determine material strengths and properties.

3.1.1 Dead Loads

Dead loads are considered to include the self-weight of the structure (such as girders, deck, trusses, etc.), as well as superimposed dead loads including asphalt wearing surface, sidewalks, barriers and handrails. In accordance with CL. 3.6 – Table 3.4 in the CHBDC, **Table 1** includes the unit material weights used for evaluation purposes:

Table 1 Unit Material Weights

Material	Unit Weight, kN/m^3
Asphalt Wearing Surface	23.5
Reinforced Concrete	24.0
Steel	77.0

3.1.2 Material Properties

The original construction drawings list the grade of the structural steel in the original lift bridge and towers as CSA-G40-4 or ASTM A7 for carbon steel members and ASTM 242-55 for low alloy steel members. The carbon and low alloy steel based on the standards referenced would have a yield strength of 230 MPa and 350 MPa respectively. in accordance with the CISC Handbook of Steel Construction (11th edition).[2]

Structural steel members added as part of the 1982 rehabilitation were analyzed with a yield strength of 350 MPa in accordance with the rehabilitation drawings. **Table 2** summarizes the material properties utilized for the evaluation.

Table 2 Material Strengths of Structural Members

Material	Strength (MPa)	Description	Reference
1959 Original Structural Steel - Carbon	230	Yield Strength	Original Drawings & CISC
1959 Original Structural Steel – Low Allow	350	Yield Strength	ASTM (Reference)
1982 Rehab Structural Steel	350	Yield Strength	1982 Rehab Drawings

3.1.3 Live Loads

CHBDC defines the live load in Ontario for design of new bridges as the CL-625-ONT Truck, which consists of a series of axle loads which total 625 kN (63 Tonnes), and the CL-625-ONT Lane Load which is made up of the CL-625-ONT Truck reduced to 80% superimposed with a uniformly distributed load of 9 kN/m. Under serviceability limit state (SLS) and ultimate limit state (ULS), the CL-625-ONT Truck load effect is increased by the addition of a dynamic load amplification (DLA) factor to account for impact, which varies depending on how many axles are loading the component under consideration, as shown in **Figure 8**. When all axles are acting on the bridge, the DLA is 25%. The contact area of each of the wheels is 0.25 x 0.60 metres, except for the front wheels which have a contact area of 0.25 x 0.25 metres. The number of design lanes for each structure is determined in accordance with CHBDC Cl. 3.8.2 (Table 3.5). Since the roadway width of Eastport Drive on the bridge is 13.6 m, as shown on the 1982 rehabilitation drawing, four (4) design lanes are required in the analysis. Where multiple lanes are loaded, the load in each lane is reduced by the multi-lane loading factors, R_L, shown in in accordance with CHBDC T14.3. These reduction factors take into account the reduced probability of more than one lane being loaded simultaneously, due to traffic distribution, volume, speed, and decrease of dynamic loads.

Evaluation Level 1, CL1-625-ONT, is identical to the live load diagram for new bridges. For live traffic loads there are several levels of evaluation in order to determine the load posting required. If evaluation at level 1 indicates that a posting is required, the bridge must be evaluated for levels 2 and 3, to provide appropriate load ratings for two-unit vehicles (**Figure 9**) and single unit vehicles (**Figure 10**).

The highway class affects the application of lane loads to each of the evaluation levels. All new bridges are designed to comply with Class A highway requirements. For evaluation purposes, the highway class for each bridge is based on the Average Annual Daily Traffic (AADT) in accordance with CHBDC §1. For the purposes of evaluation the recorded AADT for Eastport Drive was estimated at approximately 25,000 vehicles per day, and as a result, Eastport Drive is considered a Class A Highway. The required lane loading for a Class A highway is 9 kN/m.

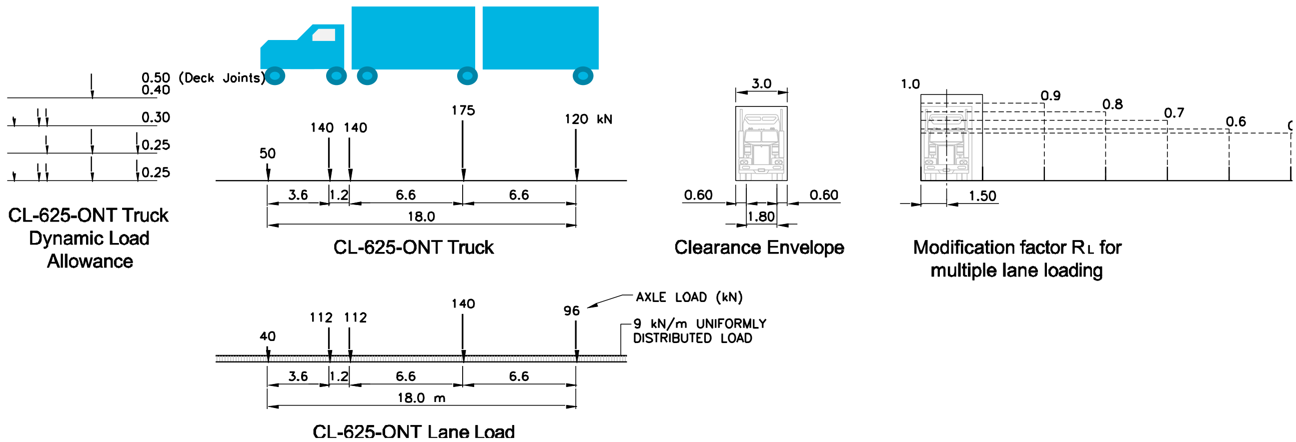


Figure 8 Live Loading: Maximum of CL-625-ONT Truck or CL-625-ONT Lane Load.

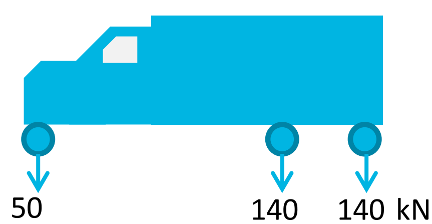


Figure 9 Live Loading: Evaluation Level 2 CL2-625-ONT Truck, Axle Loads

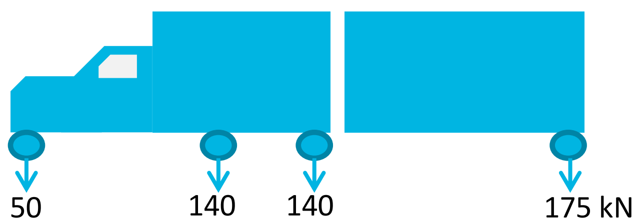


Figure 10 Live Loading: Evaluation Level 3 CL3-625-ONT Truck, Axle Load

In addition to vehicular live load, pedestrian live load acting on the west sidewalk was also considered in accordance with CHBDC §3.8.9. As per the code, traffic loads in design lanes were considered together with pedestrian load only at ULS, with the pedestrian load reduced by 20%.

In additional to vehicular traffic, wind and pedestrian loads are considered and tabulated in **Table 3**.

Table 3 Live Wind and Pedestrian Loads

Load	Pressure (kPa)
Wind (Bridge Closed) (50 Year Burlington)	0.530
Wind (Bridge Open)	0.450
Pedestrians	= 5-Span/30 <4

The values from **Table 3** are taken from CHBDC §3.5 based on the location and span of the bridge.

3.1.4 Load Combinations and Load Factors

According to Section 15 - Rehabilitation and Repair in the CHBDC (§15.3.2), rehabilitated members shall satisfy ULS and SLS requirements of Section 1 to 13, 16 and 17, unless the purpose of the rehabilitation is to allow passage of a controlled vehicle. Therefore, load combinations and load factors as specified in Section 3 of the CHBDC were used for the structural evaluation as this information will be used for rehabilitation purposes.

Load Combinations Considered for Structure Analysis as required by the CHBDC

The following load combinations were utilized with reference to Cl. 3.5 (Tables 3.1, 3.2 and 3.3) of the CHBDC:

1. **SLS Combination 1:** Permanent loads consisting of dead loads and superimposed dead loads. Transitory loads consisting of live load (0.9 x CL 625-ONT truck).
2. **ULS Combination 1:** Permanent loads consisting of dead and superimposed dead loads. Transitory loads consisting of vehicular live load (1.70 x CL 625-ONT) and pedestrian live load (0.2 x 1.70 x P).
3. **ULS Combination 2:** Permanent loads consisting of dead and superimposed dead loads. Transitory loads consisting of vehicular live load (1.60 x CL 625-ONT), pedestrian live load (0.2 x 1.60 x P) and temperature effects (1.15 x K).
4. **ULS Combination 3:** Permanent loads consisting of dead and superimposed dead loads. Transitory loads consisting of vehicular live load (1.40 x CL 625-ONT), pedestrian live load (0.8 x 1.40 x P), temperature effects (1.15 x K) and wind (0.45 x W).
5. **ULS Combination 4:** Permanent loads consisting of dead and superimposed dead loads. Transitory loads consisting of temperature effects (1.25 x K) and wind (0.45 x W).
6. **ULS Combination 9:** Permanent loads consisting of dead load and superimposed dead loads. (Not considered for Lift Span as per Cl13.6.11.2)

The following load combination with reference to Cl. 3.5 (Tables 3.1, 3.2 and 3.3) of the CHBDC could be evaluated in detailed design however is not part of this project scope:

7. **ULS Combination 8:** Permanent loads consisting of dead and superimposed dead loads. Exceptional Loads consisting of Collisions loads arising from highway vehicles and collisions.

The following load combinations were utilized with reference to Cl. 13.6.11.2 (Tables 13.3, 13.4) of the CHBDC:

Category 1 – Bridge Lifted

1. **ULS Combination V1:** Permanent loads consisting of dead loads and superimposed dead loads. Operating Impact of 120% applied to the maximum dead load effect in all members that are in motion and to the load effect on a stationary member caused by the moving dead load. Operation of machinery loads of 155% caused by the moving and stopping of the lift span.

2. **ULS Combination V2:** Permanent loads consisting of dead loads and superimposed dead loads. Wind Load of 120% with the bridge open in any position. Operating Impact of 120% applied to the maximum dead load effect in all members that are in motion and to the load effect on a stationary member caused by the moving dead load. Operation of machinery loads of 125% caused by moving of stopping the lift span.
3. **ULS Combination V3:** Permanent loads consisting of dead loads and superimposed dead loads. Wind Load of 150% with the bridge open in any position. Operating Impact of 120% applied to the maximum dead load effect in all members that are in motion and to the load effect on a stationary member caused by the moving dead load.

Category 2 – Bridge Closed, Counterweights Supported

1. **ULS Combination V4:** Permanent loads consisting of dead loads and superimposed dead loads with counterweights supported. Transitory loads consisting of vehicular live load (1.70 x CL 625-ONT) and pedestrian live load (0.2 x 1.70 x P).

3.1.5 Mechanical Evaluation

Main Counterweights Ropes

The ropes will be analyzed in accordance with the latest AASHTO specifications to determine if they are properly rated under the current loading conditions. Information regarding the ropes has been taken directly from the 2002 rope replacement specification. The counterweight ropes and sheave trunnion bearings were spot inspected in March 2020 along with the other machinery components. The counterweight ropes were found to be in good condition with no strand breakage, so they will be evaluated at 100% of capacity.

3.1.6 Counterweights Sheave Trunnion Shafts

The counterweight sheave shafts will be analysed for fatigue life under current loading and any additional loading that is being proposed. The shafts bearing capacity will also be verified. The trunnion shafts and bearing assemblies were found to be in good condition in the March 2020 inspection.

4. Evaluation Results

The focus of the evaluation is on the critical components of the 3 separate bridge spans and towers as follows:

Mechanical	**Approach and Tower Spans**	**Lift Span**	**Towers**
• Main Counterweight Ropes • Counterweight Sheave Shafts	• Girders/Stringers • Floor beams • Bearings	• Top and Bottom Chords • Verticals • Diagonals • Floor Beams • Girders	• Towers • Floor Beams • Horizontal Struts • Diagonal Bracing • Verticals

The connections between members have not been evaluated in detail at this time.

4.1 Approach and Tower Spans

The evaluation of the approach spans (12.6 m) and tower spans (10.6 m) consisted of assessing the capacity of the structural steel stringers and the structural steel floor beams supporting the stringers. Connections and diaphragms were not evaluated.

To evaluate the approach and tower spans, a grillage model was established in Midas Civil (2020) to evaluate load effects, related structural impacts and structural capacity. The superstructure was modeled using frame elements, with section properties (e.g. cross-sectional area, moment of inertia) simulating the reinforced concrete deck and steel I-girders. The model consists of both adjacent approach and tower spans, with stringer connections between the two spans considered as pins and not moment connections. At the floor beams, stringers were considered pin-connected to the floor beams. At the lift span end, the tower span stringers were considered continuous over the front floor beam, modeled with the 0.9 m long cantilevered end. The bearings at the abutment of the approach span were modeled considering the existing laminated elastomeric bearings.

The approach span stringers from the 1982 rehabilitation (Stringer Nos. 1 – 3) were measured in the field to be deeper and have different web and flange dimensions than the W840x193 girders shown in the 1982 rehabilitation drawings. Although no standard W girders have been found that exactly match the dimensions measured on site for these stringers, W920x238 girders have been chosen as the closest match.

The dead load resulting from the concrete deck slab and steel girders were calculated and applied in the model. Superimposed dead loads for the steel post barriers, concrete curb (on the east side of the approach spans) and asphalt were applied. Loading from the sidewalk, including the weight of the concrete deck and steel bracing, the metal railings and pedestrian load, were calculated and applied to the roadway stringers at the stringer-diaphragm connection nodes of the west exterior roadway stringer.

The floor beams were modeled as two-span beams, pin-connected to the towers at each end, with an interior support at the location of the past railway centreline. The concrete deck is not composite with the steel stringers.

The following table presents the maximum demand/capacity ratios for the stringers and floor beams:

Table 4 Approach and Tower Spans: Member Critical Moment and Shear Evaluation

		Demand/Capacity	
Location	**Member**	**Mf/Mr**	**Vf/Vr**
Approach Span	Original Stringer (W840x193)	0.79	0.44
	1982 Rehab. Stringer (W920x238)	0.42	0.29
Tower Span	Original Stringer (W690x152)	0.81	0.46
	1982 Rehab. Stringer (W690x152)	0.53	0.31
	Rear Floor Beam	0.50	0.41
	Front Floor Beam	0.38	0.47

The evaluation of the approach and tower spans indicate that structural capacities are adequate under existing conditions. For the stringers, the maximum moments occurred at midspan and the maximum shears occurred at the supports. The approach span stringers are cut to a shallower depth at the location of the rear floor beam (from 840 mm to 690 mm) and reinforced with and angle rivetted/bolted to the web. This shallower girder depth was used to evaluate the shear resistance of the approach slab stringers. Impacts of section loss due to corrosion were not considered in the moment capacity calculations for the stringers since in general, measurements from recent AECOM site inspections and past inspections on record indicate that corrosion in the stringers is most severe at the supports, where moment does not govern. At the supports, severe/very severe corrosion was observed in flanges, as well as localized areas of severe/very severe corrosion in the web. To account for the effect of corrosion on shear capacity, 20% section loss of the web was considered in the shear capacity calculations for both approach and tower span stringers, to account for the effect of corrosion on shear capacity. This is expected to yield conservative results, since the areas of severe corrosion on the web were generally observed to be localized and not spread uniformly over the web surface as considered in the shear capacity calculation.

To conservatively account for the impact of corrosion on the rear floor beams, 50% section loss of the top and bottom flange plates was considered, translating to just over 6mm of section loss. At the front floor beams, the areas of corrosion were significantly lighter, and only 10% section loss was considered for the top and bottom flange plate.

The capacities of the existing laminated elastomeric bearings at the abutments were also evaluated. The 1982 rehabilitation drawings specify that the existing laminated elastomeric bearings have the following dimensions: 203 x 305 x 61 mm. Bearing details are not provided for the original portion of the bridge in the drawings, so it is assumed that the bearings supporting the original stringers at the abutments have the same dimensions. Although bearing design loads were not provided on the existing drawings, calculated pressures were compared with pressure limits specified in CAN/CSA S6-14. It was deemed reasonable to reference the maximum bearing pressure limits from the previous version of the CHBDC because information about the structure of the existing bearings, such as thickness and number of elastomeric internal layers and thickness of laminates, is not known. The new approach presented in §11.6.6.3.2 of the 2019 version of the CHBDC relies on such bearing data to calculate the total strain from combined axial load, rotation and shear and compare with the maximum permissible strain limits at SLS. In this case, carrying out this calculation would require wide-ranging assumptions of the structure and material properties of the existing laminated elastomeric bearings, which may lead to misleading estimates of bearing capacity. The commentary to the 2019 version of the CHBDC also mentions that although the maximum pressure limits from previous versions of the code have been superseded by the total strain approach, the previous pressure limits can still be used for reasonable estimates of bearing plan dimensions.

The following table compares the CHBDC pressure limits to the maximum bearing pressures found from the evaluation:

Table 5 Abutment Bearing Evaluation

	CHBDC Pressure Limit (MPa)	Calculated Bearing Pressure (MPa)	Demand/Capacity
SLS Permanent Load	4.5	1.8	0.40
SLS Total Load	7.0	5.1	0.73
ULS Permanent Load	7.0	2.3	0.33
ULS Total Load	10.0	8.4	0.84

The results of the evaluation indicated that the existing bearings are within the CHBDC code pressure limits; therefore, the bearings are not considered to be overstressed from existing loading.

4.2 Approach Span Support Conditions

There are laminated elastomeric bearings supporting the approach span stringers at the abutment. They are listed in the 1982 rehabilitation drawings as being 60 mm thick and no anchor rods or other methods are providing fixity. Longitudinal and transverse expansion/contraction at the abutment bearings is permitted. In the original design, the approach span stringers were supported on sliding plates on expansion shoes. The bearings were replaced with elastomeric bearings in the 1982 rehabilitation. The current expansion joint at the abutment is limited to a paved over sealed joint (**Figure 11**).

The non-composite deck expansion joint is located between approach and tower spans, at the location of the rear floor beam support. The stringers are pin connected to each other and the floor beam, but the deck is free to expand and contract above them. **Figure 12** shows the connection of the girders at the expansion joint (taken from the 1982 rehabilitation drawings).

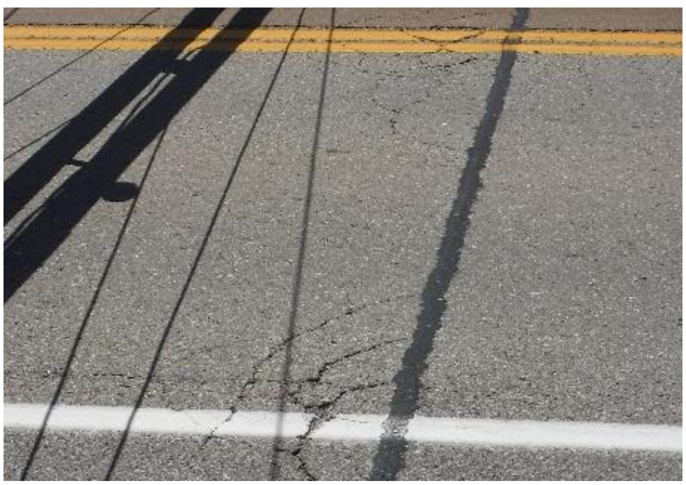


Figure 11 Typical Paved over Joint at Abutment

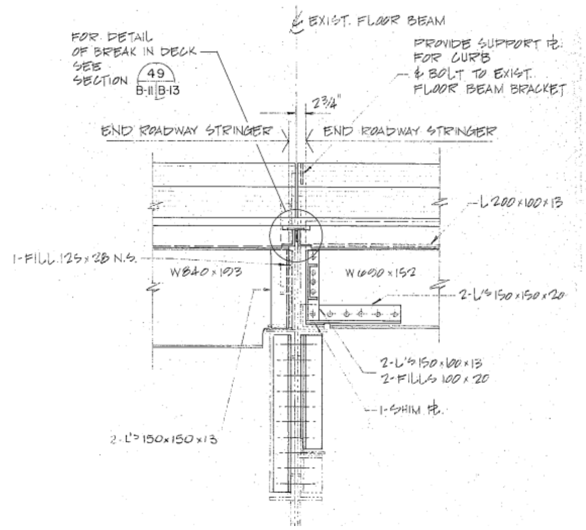


Figure 12 Detail of Stringers and Deck Expansion Joint at Rear Floor Beam

4.3 Lift Span

PWGSC provided a detailed breakdown of a previously calculated total weight of the lift span. The result of the calculation estimated the weight of the bridge at 1877 Tonnes. For the purpose of the structural analysis, the previous calculations have been reviewed as similar to those calculated by AECOM with the exception that the concrete sidewalk is 150mm thick in the provided calculations. However based on the drawings and field measurements the sidewalk is only 50mm thick. **Table 6** summarizes the changes to the previously calculated bridge weight.

Table 6 Lift Span Weight Calculations Modifications

Item	Past Weight (Tonne)	Aecom Weight (Tonne)	Difference (Tonne)
Sidewalk – Steel + Concrete	140+2.4 = 142.4	39	-103.4
Total Bridge Weight	1877	**1774**	-103.4

The precise weight of the span is extremely challenging to accurately calculate and therefore it should be verified through testing prior to rehabilitation or during the next counterweight rope replacement.

The lift span has been modeled and analyzed in Midas Civil 2020 to identify the forces in each member (**Figure 13**). The bridge is assumed to be balanced correctly for the purposes of the analysis. The 4 corner bearings in a balanced bridge are to be loaded with 6.7kN (1500lbs) when the bridge has no transitory/live loads. Based on the assumption the bridge is properly balanced the counterweight of each tower were anticipated to be proportional to provide the appropriate bearing reactions in all 4 corners. **Table 7** and **Table 8** summarize the results of the analysis of Demand/Capacity for the primary Truss Members and Beam member respectively based on the above information. The member labelling is based on the system used in the original drawings.

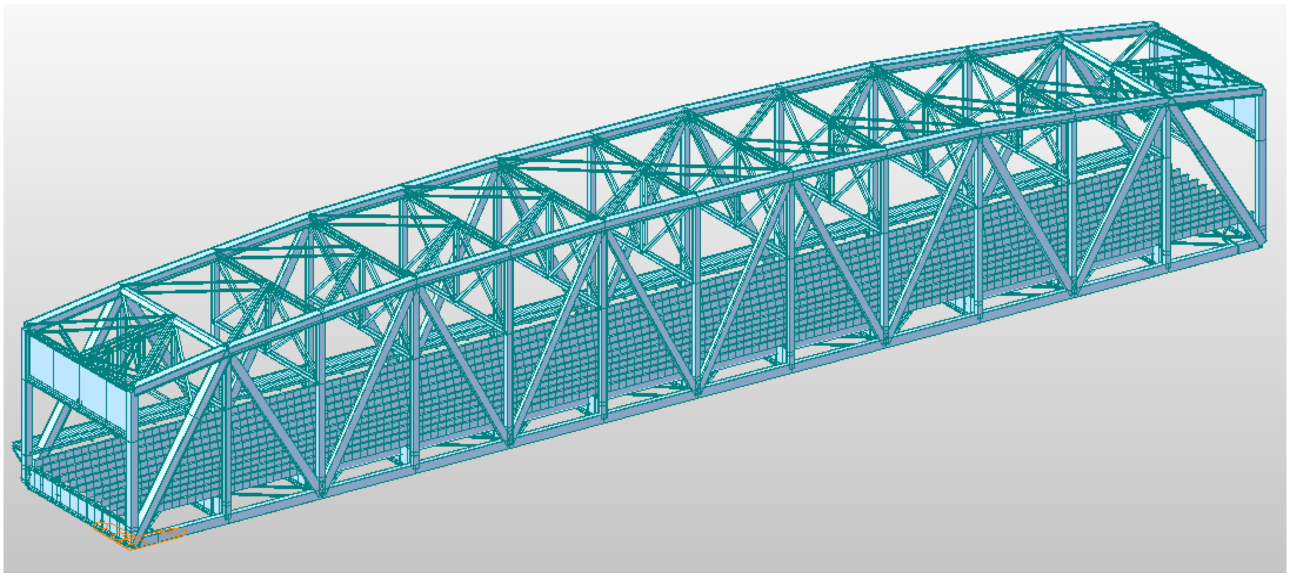


Figure 13 Lift Span Model

Table 7 Lift Span Truss Members Demand/Capacity

Member	Railway Truss		Highway Truss	
	Tension	Compression	Tension	Compression
L0-L2	0.36	NA	0.36	NA
L2-L4	0.36	NA	0.44	NA
L4-L6	0.36	NA	0.44	NA
U0-U1	NA	0.01	NA	0.01
U1-U3	NA	0.43	NA	0.56
U3-U5	NA	0.41	NA	0.58
U5-U6	NA	0.41	NA	0.59
L0-U1	NA	0.19	NA	0.27
U1-L2	0.30	NA	0.47	NA
L2-U3	NA	0.29	NA	0.48
U3-L4	0.27	NA	0.45	NA
L4-U5 (Min)	NA	0.27	NA	0.30
L4-U5 (Max)	NA	0.27	NA	0.29
U5-L6 (Min)	0.20	0.05	0.19	0.07
U5-L6 (Max)	0.20	0.05	0.20	0.05
U0-L0	0.17	NA	0.15	NA
U1-L1 (Top)	0.23	NA	0.24	NA
U1-L1 (Bot)	0.12	NA	0.13	NA
U2-L2 (Top)	NA	0.03	NA	0.03
U2-L2 (Bot)	NA	0.03	NA	0.04
U3-L3 (Top)	0.24	NA	0.24	NA
U3-L3 (Bot)	0.13	NA	0.13	NA
U4-L4 (Top)	NA	0.03	NA	0.03
U4-L4 (Bot)	NA	0.04	NA	0.04
U5-L5 (Top)	0.23	NA	0.23	NA
U5-L5 (Bot)	0.13	NA	0.13	NA
U6-L6 (Top)	NA	0.03	NA	0.03
U6-L6 (Bot)	NA	0.04	NA	0.04

Table 8 Lift Span Beam Members Demand/Capacity

Member	Positive Bending	Shear
Lifting Girder	0.32	0.37
End Floor Beam	0.17	0.32
Intermediate Floor Beam	0.21	0.32
1959 Stringer	0.56	0.36
1982 Stringer	0.35	0.23

4.4 Tower Analysis

The evaluation of the tower consisted of assessing the capacity of the columns, horizontal struts, bracing and the longitudinal and transverse sheave girders. The members at the machine house and penthouse floors were not evaluated. They were included in the model to get their contribution to the self weight of the structure.

The tower was modeled and analyzed using Midas Civil (2020) to evaluate the forces in each member (**Figure 14**). Each element was modeled using frame elements, with equivalent section properties (i.e. cross-sectional area, moment of inertia) as the sections shown on the original drawings. The weight of the lattice which is present in the horizontal struts and braces was accounted for by increasing the weight of the material defined in the program. Moment releases were applied at the connections between the columns and the horizontal struts and bracing.

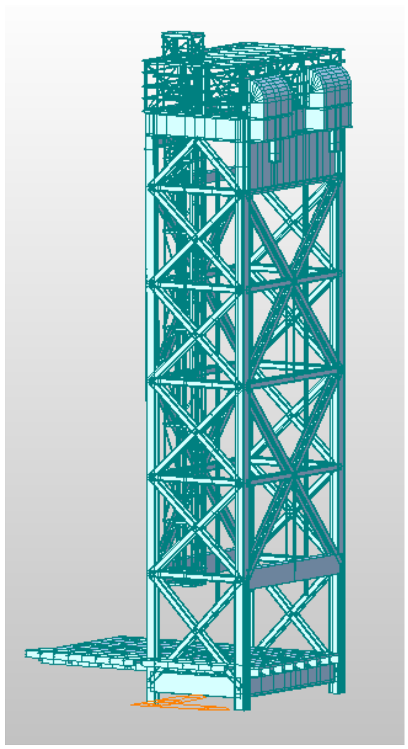


Figure 14 Overall View of Tower Model

The self weight of the structure was automatically calculated by the program, given that each element was modelled with the appropriate section properties. The dead loads from the concrete floor, checkered plate floor and wall and roof panels were calculated and applied to the model as uniformly distributed loads. The weight of the sheave motor and gear was applied as a combination of uniformly distributed loads and point loads. Collateral loads, which include loads from sprinklers (0.24 kPa), ductwork (0.15 kPa) and acoustic ceiling tiles (0.1 kPa) per the National Building Code of Canada (NBCC), were applied to the roof members of the machine house and penthouse. An occupancy live load of 3.6 kPa for equipment areas and service rooms, per the NBCC, was applied to the area covered by the concrete floor in the machine house. An equal load was used for the dead load of the equipment in the machine house. A roof live load of 7.4 kPa was applied to the roof of the machine house and penthouse. This value was used since it resulted in a similar reaction at the base of the columns as what is shown on the original drawings.

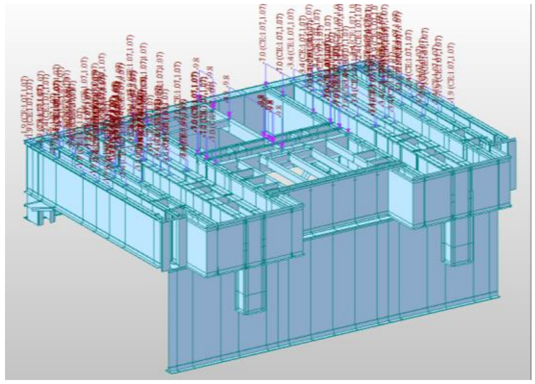


Figure 15 Concrete Floor Load Applied to Sheave Girders

Wind loads were applied as trapezoidal pressure loads, which increased as the elevation increased, in accordance with the CHBDC. Wind load cases were established for wind acting on all four directions as well as for wind acting at a 45° angle to the main axes of the tower. The wind loads were applied on the windward and on the leeward planes of the tower. The wind loads on the leeward planes were reduced by the shielding factor, in accordance with Table C3.6 of the CHBDC.

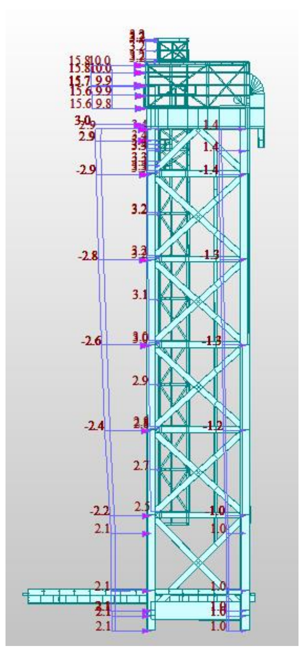


Figure 16 Wind Load in N-S Direction

The tower was evaluated in the raised and lowered position considering the demand and capacity for the limiting primary members for the worst case forces. The wind load for the lifted bridge was reduced from CHBDC loading in the models as the lift span is only lifted when wind speeds are 80km/h or less. The unfactored wind load for the tower when the existing bridge is lifted was reduced to match the lifting wind limit. Calculations are included in Appendix F Exhibit B.4 for reference and summarized in **Table 9**. The front face columns are overloaded according to this analysis as a result of horizontal and lateral wind loads being applied to the bridge superstructure. While no evidence of structural concerns were observed during site inspections for these column, additional consideration and modeling will need to be completed on the tower columns prior to a future rehabilitation for the bridge, and future inspections should pay special attention to this area.

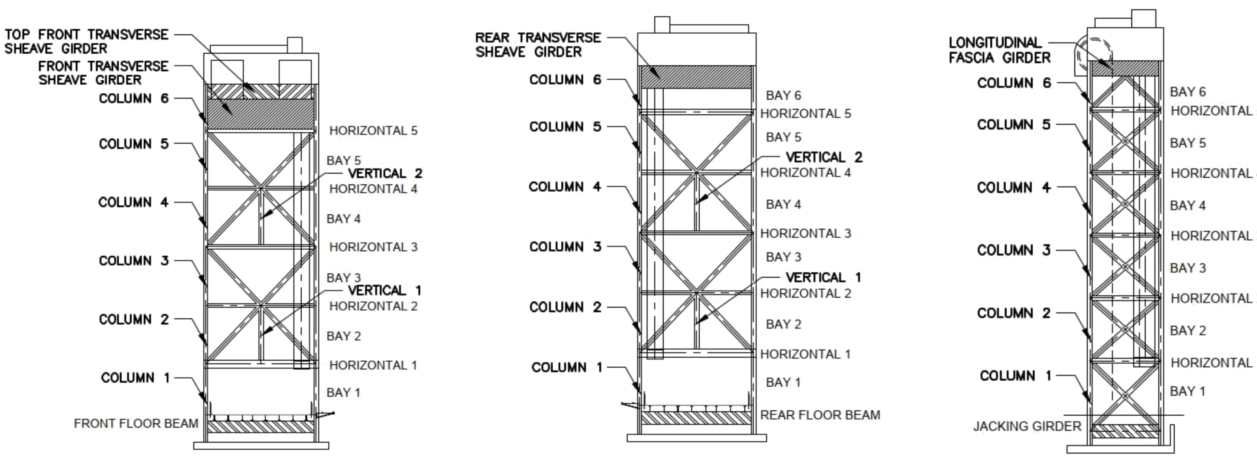


Figure 17 Tower Members

Table 9 Tower Demand/Capacity

Member	D/C Governing Case						Governing Location
	Lift Span Raised				Lift Span Lowered		
	Wind		No Wind				
	Tension	Compression	Tension	Compression	Tension	Compression	
Column 1	0.92	**1.67**	0.00	0.31	0.87	**1.52**	Front Panel
Column 2	0.19	0.70	NA	0.20	0.20	0.63	Front Panel
Column 3	0.01	0.51	NA	0.19	0.04	0.44	Front Panel
Column 4	NA	0.68	NA	0.20	0.00	0.60	Front Panel
Column 5	NA	0.68	NA	0.21	0.02	0.60	Front Panel
Column 6	0.07	0.53	0.01	0.32	0.07	0.45	Front Panel
Horizontal 1	0.44	0.52	0.07	0.01	0.40	0.48	West Panel
Horizontal 2	0.24	0.32	0.10	0.06	0.22	0.30	Rear Panel
Horizontal 3	0.30	0.10	0.11	0.02	0.25	0.12	Front Panel
Horizontal 4	0.27	0.29	0.14	0.04	0.24	0.27	Front Panel
Horizontal 5	0.16	0.10	0.08	0.11	0.12	0.13	Front Panel
Vertical 1	0.03	0.67	NA	0.23	0.04	0.57	Front Panel
Vertical 2	0.03	NA	0.02	NA	0.03	NA	Rear Panel
Jacking Girder	0.02	0.01	0.01	0.00	0.02	0.01	West Panel
Diagonals	0.43	0.83	0.02	0.33	0.41	0.76	West Panel
	Moment	**Shear**	**Moment**	**Shear**	**Moment**	**Shear**	
Transverse Sheave Girder	0.73	0.62	0.26	0.36	0.61	0.52	Front Panel
Fascia Girder	0.20	0.69	0.34	0.65	0.17	0.58	West/East Panel

4.5 Mechanical Analysis

The mechanical systems, Counterweight Rope and Counterweight Rope Sheave Trunnions specifically were analyzed using CHBDC and AASHTO to determine the limits of the existing ropes and trunnions. The ropes were analyzed to determine the total allowable loading. The trunnions were analyzed to determine if they have infinite fatigue life at the existing loading. The analysis is done with MathCad 15 and uses the latest weights from AECOM structural analysis. Calculations are included in Appendix F Exhibit B.9

4.6 Summary

The evaluation of the approach and tower spans indicates that the stringer and floor beam support members have adequate moment and shear resistance at existing conditions. Bearing loads on the existing abutment bearings were found to be compliant with the CHBDC pressure limits. The lift span was found to have sufficient capacity in the truss and beam members.

The counterweight ropes are over stressed but in good condition. The counterweight trunnion shafts are loaded such that they have a finite life.

5. Recommendations and Conclusions

5.1 Structural Components

The approach span, tower span, and lift span all have adequate and significant reserve capacity to facilitate the current demand on 4 lanes of vehicular traffic and the pedestrian sidewalk. The bridge span components satisfy the capacity requirements of the CHBDC with reserve capacity in the order of 10% to 30% depending on the element.

The tower evaluation indicates that under existing conditions the front columns on the south and north towers are overstressed when the bridge is lifted during a 80kph wind speed. This does not relate to the deck type or weight. A detailed evaluation of all north and south tower columns including detailed plate and connection information is required to further verify the capacity of the columns during detailed design prior to any major rehabilitation at the bridge. Strengthening of the columns may be required based on the results of a more detailed analysis.

The weight of the existing bridge and current lateral balance should be verified prior to any rehabilitations.

5.2 Mechanical Components

The counterweight ropes are acceptable to use if the lift span load remains the same or if it is reduced. Yearly in-depth inspection of the counterweight ropes is recommended where no change or a reduction to the lift load is maintained. If the loading is increased, then replacement with higher strength ropes will be necessary. When the ropes are replaced, regardless if the loading is increased or not, higher strength ropes should be installed.

Based on calculations taking into consideration the new weight calculated by AECOM, the counterweight ropes are currently overstressed by about 6%. Due to the good inspection results and the fact that the ropes are designed with a 4.5 safety factor (as per CHBDC), there is no reason to change the ropes if current conditions remain.

Calculations with the AECOM span weight shows that the trunnion shafts have a finite fatigue life under current loading conditions. The calculations show that the trunnions have more than 100 years of operation left.

Table 9 Counterweight Sheave Trunnion and Rope Calculation Summary Table

	Stress in Rope (MPa)	**Trunnion Shaft Capacity (lb)**	**Trunnion Bearing (fatigue life)**
Original weight (1877 tonne)	345	636254	> 100 years
Aecom Weight (1776 tonne)	337	673512	> 100 years
Allowable	317	917225	2018 is the maximum allowable weight for a 60 years expectancy
Assessment	OK, ropes were designed with a SF of	OK	OK

	4.5 for combined stresses		

5.3 Conclusion

Any new proposed deck system for the lift span on the bridge needs to consider that counterweight ropes are currently overstressed by 6% under allowable conditions. A replacement lift span deck that results in overstress exceeding 10% will result in the counterweight ropes needing to be replaced. The lift span and approach spans have excess capacity. The tower capacity is limited by wind loads but is suitable for the weight of the lift span.

6. References

1. *Canadian Standards Association*. November 2019. *Canadian Highway Bridge Design Code*.

2. CISC Handbook of Steel Construction (11th edition).

3. AASHTO Moveable Bridge Design Specifications (2nd Edition 2007)

4. Roebling Wire Rope Charts (1932)

5. National Building Code of Canada (2015)

Appendix C

Rehabilitation Evaluation Memorandum

AECOM Canada Ltd.
50 Sportsworld Crossing Road, Suite 290
Kitchener, ON N2P 0A4
Canada

T: 519.650.5313
F: 519.650.3424
www.aecom.com

To: Ranya El Sadawy P.Eng
Senior Bridge Engineer

Date: April 14, 2021

Project #: 60637587
EQ754-192679/002/PWL

From: Christine Beard Laaber
Brad Kopping

cc: Jack To, Robert Jacques

Memorandum

Subject: **Structural Rehabilitation Evaluation Technical Memorandum – Final**

1. Introduction

AECOM Canada Ltd. (AECOM) was retained by the Public Works and Government Services Canada (PWGSC) to review and complete a structural evaluation of rehabilitation options for the Burlington Canal Lift Bridge (BCLB) including the lift span, towers and counterweight main mechanical components to determine the load carrying capacity of the bridge.

1.1 Background

The BCLB is a tower driven vertical steel truss style lift bridge located between the cities of Hamilton and Burlington in Ontario. It is in a north-to-south orientation and spans the Burlington Bay Canal. The BCLB was constructed between 1959 and 1960 and has been operating since 1962 as a rail/highway bridge, replacing the original CN swing bridge nearby. In 1982, the BCLB underwent a major rehabilitation to convert it for roadway traffic use only. It currently carries four (4) lanes of Eastport Drive, two (2) lanes in each northbound (NB) and southbound (SB) direction, with an approximate AADT of 25,000 per day. When it is lifted, it accommodates commercial and recreational boat passage between Lake Ontario and Burlington Harbour. It is assumed the bridge is lifted with “average usage” (400-4000 openings per year). The BCLB typically operates from late March through to late December with approximately 3400 openings per year.

The entire bridge consists of five (5) spans and has a roadway width of 13.6 m. There are two reinforced concrete deck on steel I-girder approach spans at each end of the bridge. The exterior approach spans (referred to as the “approach spans”) are 12.6 m long and cross over an access road/trail. The interior approach spans (referred to as the “tower spans”) are 10.6 m long (including 0.9 m long cantilevered portions at the lift span ends) and pass under the towers at each.

The steel truss lift span is 115.8m long with open steel deck grating welded to steel stringers over floor beams. The tower, lift span and tower span foundations are comprised of reinforced concrete on piles with 2 pits between the concrete supporting the piles. The back piles extend deeper into the concrete than the front piles and below the pit base. The tower foundation is enclosed inside of a galvanized chain link fence with a reinforced concrete wall along under the approach span access road. The approach span is supported on one end by a reinforced concrete abutment.

The lift span is connected to the counterweights by 80 counterweight ropes that are held in place by 8 counterweight sheaves, with 10 ropes per sheave. Each sheave is carried by a trunnion shaft that is supported by two spherical roller bearing assemblies. The counterweight ropes are 57mm (2.25") diameter and the counterweight sheaves have a 4,572mm (180") diameter at the rope groves.

1.2 Scope

This memorandum will review various options for rehabilitation for the approach, tower and lift spans structurally and mechanically. The evaluation of rehabilitation options will consider constructability, long term durability, environment, available structural capacity, required modifications to the bridge for each option. The aim of the rehabilitation will be to improve the bridge to meet an Overall Bridge Rating: Functional of 5, in accordance with the Bridge Inspection Manual as summarized in **Table 1**.[27] Vehicle traffic related improvements such as lane widenings and additional lanes were not considered. The rehabilitation evaluation assumes that only options for high volume traffic with a preferred full CL-625 ONT loading in accordance with the current Canadian Highway Bridge Design Code (CHBDC) will be suitable. Consideration to the risks associated with posting the bridge are included.

Table 1: Overall Bridge Rating – Functional Target of Rehabilitation Evaluation

Rating	Condition	Observations
4	Fair	▪ Structure meets current CHBDC live loading requirements ▪ Approach or bridge barriers do not meet current standards ▪ Repairs required at multiple locations <20% ▪ Riding Quality Fair
5	Good	▪ Structure Meets current CHBDC live loading requirements ▪ Crash tested barriers at bridge and approaches – meet current requirements ▪ Riding Quality – good

The memorandum will review available deck replacement options for the lift span including open and closed deck replacements such as open steel grating, partially filled deck grating, exodermic, aluminum and orthotropic steel deck systems. The suitability of each deck system to utilize existing bridge components such as counterweight ropes, trunnions and lift span stringers are assessed. Where deck replacement systems exceed the capacity of existing bridge elements, the scope of structural and mechanical rehabilitation/replacement will be reviewed. A description of recommended rehabilitation for the structural and mechanical components for the shortlisted options is provided.

The approach spans (approach and tower) will be discussed including the rehabilitation options for improving durability and extending service life. A qualitative evaluation of deck replacement options and durability improvements is included.

As discussed in the structural evaluation memorandum (Appendix B) the primary and secondary lift and approach spans have sufficient capacity for current traffic loading. The approach decks and the lift span deck grating have exceeded their service life. The lift span deck grating in particular has an excessive span based on similar products available on the market today. The span may be as much as double what a newer deck grating would be rated for. The scope includes for a discussion of the capacity of the existing grating and the risks around load posting options.

2. Rehabilitation

The information presented in this memorandum is based on visual inspection and can be used for high level planning purposes. This memorandum aims to identify the condition of the structure and assess the available rehabilitation alternatives. Several factors are considered in determining the timing and recommendations for the structure's lifecycle. For new structures, geometry standards are in accordance with the Canadian Highway Bridge Design Code, CSA S6-19 (CHBDC)[29]and the Ontario Ministry of Transportation's (MTO) Structural Manual (OSM) where applicable.[36] Roadway geometric standards considered are based on the MTO's Design Supplement where the Transportation Association of Canada's (TAC) manual provides insufficient guidance.

In 2018 the Public Services and Procurement Canada performed a Lead Assessment survey at the BCLB.[28] Lead paint exceeding acceptable levels has been noted on the bridge structure. In addition, asbestos has been identified in numerous locations such as in drywall jointing, caulking and mechanical room siding which may be encountered during a rehabilitation. The 2018 report recommends that all loose lead paint in poor condition be encapsulated. Lead paint is a health hazard especially where chips can be inhaled. While encapsulating paint is an effective way to protect people it works best on clean dry surfaces and does not bond properly where surfaces are badly deteriorated such as below the joints on the approach span. Where significant work is occurring at the bridge encapsulation may not be possible and the lead paint may require removal to safely complete work. As such it is assumed wherever elements require strengthening, replacement or modification that the lead paint and or asbestos will be removed in accordance with current guidelines as set out by the Ontario Ministry of Labour.

In consideration of rehabilitation requirements **Table 2** is provided to assess typical life cycles for elements and the current age of the elements at the Burlington Canal Lift Bridge site. The maintenance life assumed are based on Ontario Ministry of Transportation (MTO) experience in Ontario. The actual life expectancy can vary greatly depending on traffic, annual maintenance and salt and moisture exposure.

Table 2: Rehabilitation and Element Life Spans

Element	Maintenance Life (years) [33,34]	Current Age - Approach Spans	Current Age - Lift Span
		Built (Last Rehab)	
Asphalt Pavement	10-15	Unknown	-
Steel Truss	50	-	62 (38)
Steel Bridge	45	62 (38)	-
Pedestrian Steel Bridge	30	62 (38)	62 (38)
Deck Replacement (generic)	50	62	-
Deck Replacement (existing grating*)	25	-	21
Rehabilitation (Overlay, Waterproof and Pave)	30	38	-
Elastomeric Bearings	25-30	38	-
Expansion Joint Seals	5-15	38	-
Expansion Joint Assembly	15-30	38	-
Coating Systems	10-20	38-62	38-62
Wire Ropes	50 ± 5	19 (last rehab 2002)	
Bearings	40-50	62	
Main Counterweight Sheave Trunnion Shafts	> 100 years (depends on fatigue life)	62	

*In accordance with LB Foster for a similar grating they supply

2.1 Sidewalk

The existing sidewalk over the bridge is used by pedestrians and cyclists. Signage exists at each end of the bridge instructing cyclists to dismount. The MTO bridge sidewalk standard is 1.5m clear. The existing bridge sidewalk typically meets or exceeds this standard for clear width. Unfortunately, the bridge sidewalk narrows in a few locations in the approach and approach spans as little as:

- 1.34m in the tower spans adjacent to the stair cage; and
- 1.2m in the approach due to gate encroachment.

Figure 1 shows the existing encroachments on the south approach and the proposed widening of the sidewalk to improve the sidewalk to meet MTO Bridge standards for sidewalks. The south approach can be widened to 1.5m. In the north end a maintenance building is opposite a gate and the 1.5m wide sidewalk would require re-location of the building. The sidewalk should be surveyed end to end during the detailed design phase to ensure details are correct and that no other overhead, lateral or equipment impacts exist to widen the sidewalk. Widening the sidewalk will require an extension of the cantilever supports in the tower and approach spans. The stairwell may be impacted and require modification. The retaining walls may require modification to allow for either lateral railing anchors or a small curb to widen the sidewalk.

The existing cantilevered sidewalk in the lift span is counterbalanced by the heavier truss on the east side and the railway stringers left in place between the truss floor beams. Any consideration to increase or decrease the deck weight in the sidewalk will require a detailed analysis of the lateral balancing system on the bridge. The analysis may recommend removal or addition of weight. The removal of the railway stringers and the addition of a counterweight system would simplify balancing in the long term. The bridge should be weighed at each bearing with the counterweights jacked to evaluate the current lateral balance of the bridge during the detailed design phase.

The existing sidewalk is in fair condition and a rehabilitation is warranted at this time In order to level the scaling and improve slip resistance a Matacryl (or equivalent) wearing surface for pedestrians should be added to increase the service level and protect the sidewalk. This will add approximately 0.2kPa to the weight of the sidewalk and has been included in the structure evaluation. Regardless modification to the intermediate transverse supports on the existing deck are required for a lift span deck replacement. If a sidewalk deck replacement is selected for the lift span, this will require structural changes and modifications to anchor to the existing structure and verification of the lateral balancing system.

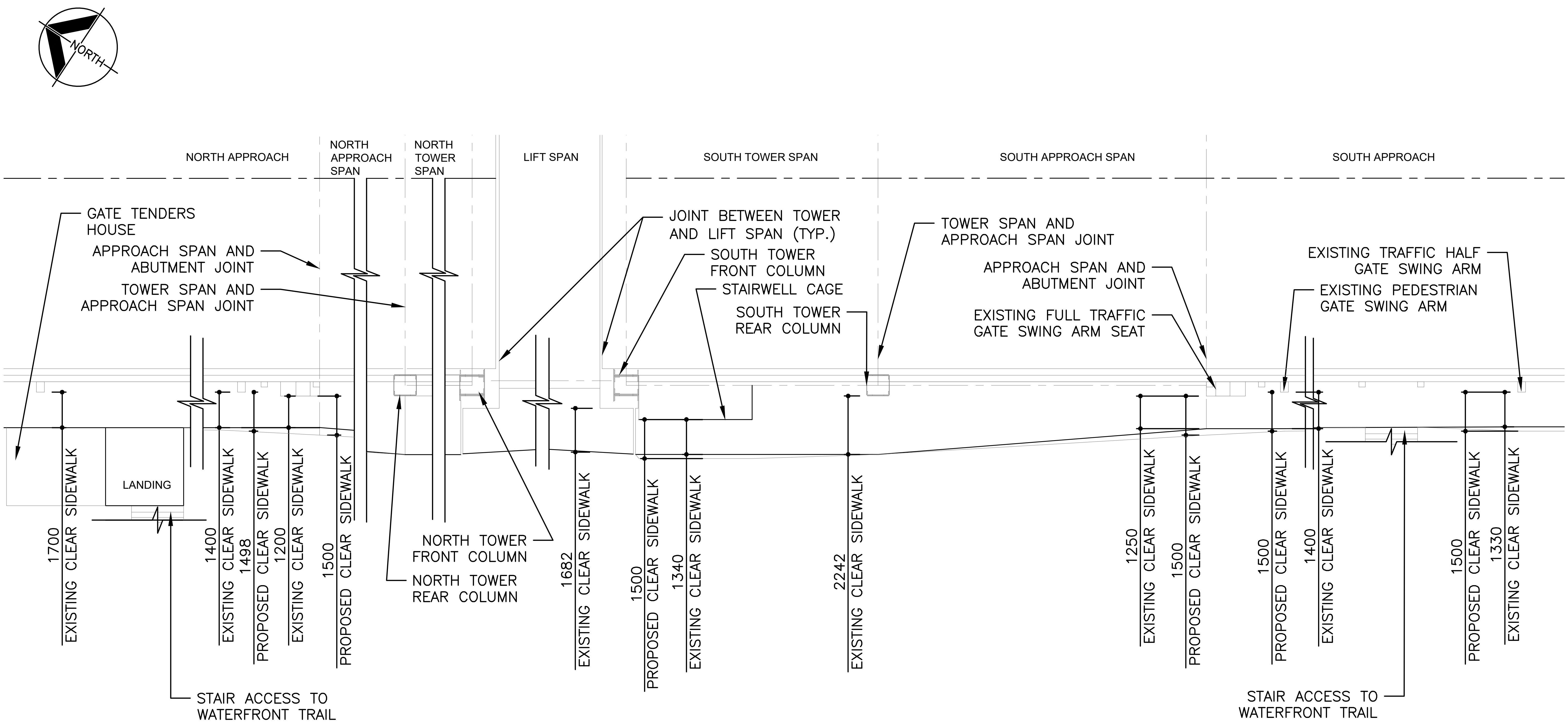
For the approach and tower spans where widening is being considered the sidewalk deck will require replacement in order to widen. Sidewalk deck replacement options considered for the sidewalk are included in **Table 3**, including the required stringer spacing for each one based on manufacturer provided information. The half-filled grid deck option is heavier than existing and should be eliminated from the options. The best option for a sidewalk deck replacement on the approach and tower span is the aluminum deck with a wearing surface such as Matacryl (or equivalent). Modifications will be required on the approach span due to the sidewalk widening proposed.

Table 3: Sidewalk Replacement Alternatives

Deck Type	Exist Double Tee Sidewalk	Half Filled Grid Deck [1]	Aluminum Deck[10,12]	Fiber-reinforced Polymer Deck[15]
Unit Weight (kN/m^2)	1.55	2.12 - 2.41	1.00	0.96
Required Stringer spacing (metre)	Existing = 1.59m Max	1.7	1.8	1.5

More information on the sidewalk replacement types, including descriptions is included in Section 2.4.1.

FILE NAME: C:\USERS\BRIAN.SANDERS1\AECOM DIRECTORY\BCLB DECK PRE-DESIGN AND CONCEPT DESIGN PROP - GENERAL\900_CAD_GI



AECOM

PWGSC BURLINGTON CANAL LIFT BRIDGE DECK PRE-DESIGN SIDEWALK PLAN

DRN:	DSN:	CHK:	APP:
BS	XX	CBL	XX

PROJECT NUMBER: 60617790

SCALE: AS NOTED

FIGURE NUMBER: 01

2.2 Traffic and Pedestrian Barriers

In accordance with CHBDC, traffic barriers shall be provided to reduce the consequence of a vehicle leaving the roadway. Traffic barriers shall meet the crash test requirements of NCHRP Report 350 or the AASHTO Manual for Assessing Safety Hardware (MASH). Details may be changed that do not affect the geometry or strength of the system. The suitability of the anchorage shall be based on performance during crash testing. If crash testing results are not available, the deck or other supporting members shall be designed to resist the maximum load effects that can be transmitted to them. Posts in a steel railing system can transmit large concentrated loads to the edge of a deck or curb and many proprietary deck systems do not have the available design data to address if they are suitable for TL-2 or TL-4 concentrated loads. AASHTO requires that decks have minimum thickness of 200mm for deck mounted barriers and 300mm for side mounted barriers, many of the lift span deck options reviewed don’t meet this requirement. Further the CHBDC suggests that it is preferable to connect the barrier system to primary load carrying members and that the primary member be designed to carry the full load from the barrier system for bridges without the deck. For the BCLB this means that most deck systems require additional structural members at the edge of the deck to ensure the barrier is adequately supported for crashes.

There are a variety of traffic barriers over the BCLB and approaches, they are summarized in **Table 4**. The existing lift span steel road barriers are not a suitable height for cyclists on the east side and the anchorage for the barrier on the lift span consists of two plates sandwiching the deck grating (**Figure 2**). All lift span deck replacement options are to consider detailing to ensure sufficient anchorage of the crash railings for a TL-2 at a minimum. While the existing anchorage may be designed for crash loading no information addressing this was found in existing drawings.

Table 4: Existing Barriers Characteristics

Barrier	Height (m)	Max Gaps (m)	Type	Crash Tested for Bridge
Sidewalk	1.37	0.15	Cyclist	NA
Approach Span	0.7	-	Roadside Safety	No
Tower Span	0.7	-	Roadside Safety	No
Lift Span (East)	1.22	0.3	Traffic/Pedestrian	Unknown
Lift Span (West)	1.37	0.3	Traffic/Cyclist	Unknown

On the approach and tower spans the railings consist of guiderail and guiderail hybrids. The guiderail on the approach span east side is flexible and the 4 m height difference to the trail below would be hazardous for an errant vehicle. The sidewalk barrier is acceptable but will need to be replaced if the sidewalk is widened as proposed.

Figure 2: Existing Connection of Traffic Railing to Lift Span Deck

Where the deck is replaced or modified in a rehabilitation the barriers and support system need to be updated to meet the current CHBDC. All of the highway traffic barriers should meet the CHBDC for crash testing and cyclist height based on observed cyclist traffic. In consideration of the type of barriers that should be located adjacent to traffic at the BCLB the crash test level was calculated in accordance with CHBDC. As the bridge is not on a curve TL-2 barriers are sufficient over the bridge. The radii of the horizontal curve on the approach is less than 300m, therefore TL-4 barriers are recommended on the approach spans of the bridge. TL-2 barriers can be curb mounted or side mounted. TL-4 barriers are typically mounted on a reinforced curb. The barriers will require some modification to meet cyclist height and gap requirements. The combined sidewalk/road barrier should be cyclist height adjacent to traffic and pedestrian height on the sidewalk have vertical pickets be added similar to MTO standard to make the railing system less climbable. Example Steel Box Beam railing for TL-2 barriers is included in **Figure 3** and of a TL-4 barrier is in **Figure 4**. It is recommended that box beam style barriers be selected for the length of the bridge to maintain a similar aesthetic with the approach barrier on curb and the lift span barrier anchored to the structural system for the deck.

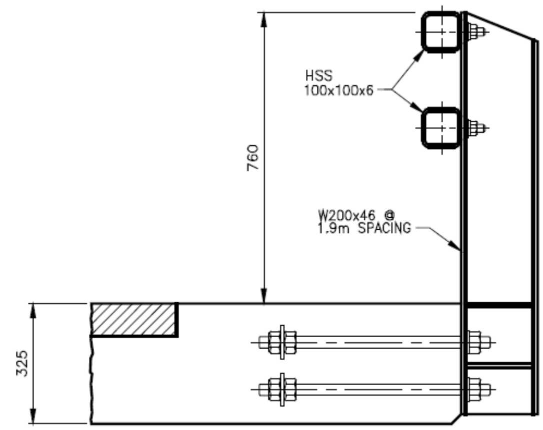


Figure 3: Typical TL-2 Steel Box Beam Barrier

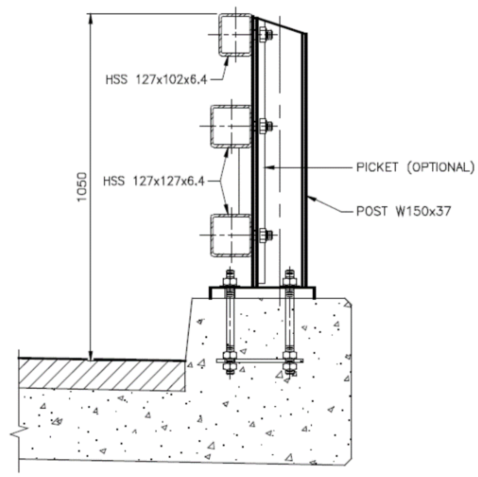


Figure 4: Typical Steel TL-4 Steel Box Beam Barrier

2.3 Approach Spans

In accordance with the 2018 Comprehensive Detailed Inspection, a 2004 deck condition survey indicated that the concrete decks on the approach spans were saturated with chlorides. High chlorides accelerate the corrosion chemical reaction in steel reinforcing within the concrete deck. As 16 years have passed since the deck condition survey was completed – the deck condition will be worse than in 2004. The deck should be replaced in the approach spans during the next rehabilitation. The steel superstructure is in good condition except at the leaking joints. The elements of the approach bridges are nearing or have exceeded their service life and require maintenance or replacement.

Under existing conditions, longitudinal and transverse contraction/expansion of the roadway stringers is accommodated by the laminated elastomeric bearings at the abutments. No anchor rods or other methods are providing fixity to the abutment bearings. The expansion joint at the abutment is limited to a paved over sealed joint. There is also a non-composite expansion joint in the deck between approach and tower spans, at the location of the rear floor beam support, at which the deck is free to expand and contract separately from the stringers below. The stringers are rivetted to the tower structure.

The existing bridge deck is 190mm thick with 64mm of asphalt. With consideration for the Alternative rehabilitation options, AECOM has reviewed deck replacement options with consideration to MTO and CHBDC Requirements. The MTO steel reinforcing cover requirements from the 2016 Structural Manual supersede the CHBDC cover requirement, a summary of the requirements is included in **Table 5**.

Table 5: Concrete Cover Requirements

<table>
<tr><th>Deck Type</th><th>Reinforcing Steel</th><th>GFRP Reinforcing</th><th>References</th></tr>
<tr><td>Soffit (mm)</td><td>40+/- 10</td><td>30+10</td><td rowspan="2">16.4.4; T2.4.1
2.5.7; 8.11.2.2[36]</td></tr>
<tr><td>Deck top (mm)</td><td>70+/-20</td><td>60+/-20</td></tr>
<tr><td>Clear Distance Between Layers (mm)</td><td colspan="2">Max 150, Min 40</td><td>8.14.2.1.3[29]</td></tr>
<tr><td>Min thickness of Deck Slab (MTO)</td><td colspan="2">225mm</td><td>9.3.2[36]</td></tr>
<tr><td rowspan="2">Min thickness based on CHBDC requirements</td><td colspan="2">175mm</td><td rowspan="2">8.18.2.2[29]</td></tr>
<tr><td>225mm</td><td>190mm</td></tr>
</table>

Option 1: 225mm thick concrete deck with premium reinforcing in top layer and a 20mm exposed concrete wearing surface. (Premium Stainless Steel Reinforcing)
Option 2: 225mm concrete steel reinforced deck with 90mm asphalt and waterproofing including the replacement of the steel superstructure.
Option 3: 190mm thick concrete deck with four layers of premium 15M reinforcing and 64mm of High Performance Asphalt with waterproofing.

The minimum standard for overhead clearance is 5.3m. It is anticipated that the overhead clearance for the lift and approach spans are approximately 7.1m considering the light fixtures, security cameras and counterweight ropes anchors this will be closer to 6.7m. In general it is not recommended to reduce the overhead clearance from existing. However if a thicker deck (Option 2) is selected the overhead clearance would be reduced and still within provincial standards. In order to accommodate a thicker deck on the approach spans the lift span deck would also need to be raised and the approach road would require a vertical alignment modification extending onto the MTO owned portion of the road. Construction staging for the lift span and approaches would need to consider temporary ramps at either end of the bridge. The finger joint at the north end may require replacement or a temporary plate to allow for a mis-alignment during construction of the approach spans.

Reducing the overhead clearance will increase the risk that the tower bracing and equipment is impacted by an over height vehicle. While this would occur as an accident, it may result in a shutdown of lifting operations to allow for a structural inspection and capacity review. This is not considered desirable and modifying the overhead clearance is not recommended as there have been no prior issues at this site.

The first two options proposed meet current MTO standard approaches to deck design. The third option has been provided as it is acceptable based on CHBDC but only considers 15M reinforcing. If the joint is made integral between the tower and lift span this option is no longer considered viable. Longitudinal reinforcing required to allow for moment transfer across the joint will likely be larger than 15M.

Two alternatives have been considered for the approach spans with Option 1 deck replacement considered the least problematic deck configuration for this site. The 1st alternative assumes the existing deck layout with expansion joints between the tower and approach span and at the end of the approach span. Expansion joints are high maintenance and seals can be easily punctured which results in leaking and corrosion in the steel superstructure. The 2nd alternative considers the elimination of the expansion joints through a link or integral slab and a semi-integral overhang (**Figure 5**). The elimination of joints results in less maintenance and reduces the ingress of moisture and road salts through failed expansion joint seals. Descriptions of the alternatives follow:

Alternative 1 – Deck Replacement with Expansion Joints
This alternative considers the replacement of the deck with Option 1. Under this rehabilitation the following work will be required:

1. Removal of the existing deteriorated deck and replacement;
2. Removal and replacement of deteriorated steel end diaphragms and connections at the ends of the approach spans to allow for jacking and replacement of bearings;
3. Replacement of the Expansion Joint Assembly between the approach and tower span including the seal;
4. Removal of paved over joint and installation of a new expansion joint assembly between the approach road and approach span.
5. Lead paint abatement and removal within 3 metres of expansion joints to accommodate abrasive blast cleaning and repairs to steel in those areas;
6. Sealing of Lead Paint in the approach and tower spans; and
7. Installation of new TL4 box beam railings to cyclist height.

Alternative 2 – Elimination of Expansion Joints
This alternative considers a low maintenance rehabilitation of the structure based on age and condition. Under this rehabilitation the following work will be required:

1. Removal of deck concrete and integration of a new composite Option 1 concrete deck;
2. Removal and replacement of deteriorated steel end diaphragms and connections at the ends of the approach spans to allow for jacking and replacement of bearings;
3. Removal of Expansion joint between approach and tower span and replace with integral deck or link slab;
4. Removal of paved over joint at approach span and replace with semi-integral overhang
5. Lead paint abatement and removal within 3 metres of expansion joints to accommodate abrasive blast cleaning and repairs/strengthening to steel in those areas;
6. Sealing of Lead Paint in the approach and tower spans; and
7. Installation of new TL4 box beam railings to cyclist height.

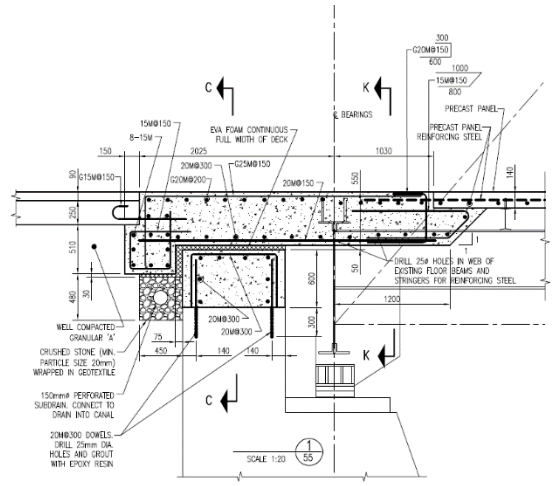


Figure 5: Sample Semi-Integral Detail at Abutment

In general elimination of joints should be considered in conjunction with a life cycle cost analysis where a bridge is more than 40 years old. Therefore the comparison of maintenance and capital rehabilitation costs is warranted to assess the most cost effective option for a site. Considering that the deck will be made continuous with the elimination of the deck expansion joint, and that the new deck will be constructed composite with the stingers as part of the proposed rehabilitation, the semi-integral joint and replacement bearing at the abutment design will need to accommodate the combined movement from the composite superstructure in approach and tower spans.

2.4 Lift Span

The existing lift span deck was replaced in 1999. The design load used for the grating was CAN/CSA S6, CS-600. The type of grating included for bearing bars on 190mm increments and factory welds at cross bars and diagonal bars. (**Figure 6**). The 1999 grating manufacturer is unknown but LB Foster a US Manufacturer of this type of grating recommends it be used for lower traffic volumes with a 25 year service life.[28] The current loading for Ontario Highways is a CL-625-ONT truck which is a total of 625kN. The CS600 design truck is a 600kN truck. Please refer to **Figure 7** for each truck's axle configuration and loading. When evaluating the steel deck grating, the analysis would only consider the length of each individual grating panel which based on the axle spacing of both design trucks, could only be loaded by a single axle. Therefore, since any axle load on the CS600 truck is greater than any axle load on the CL625-ONT truck (i.e. 180kN on the CS600 is greater than 175kN on the CL625-ONT), no load posting is required based on original design loads.

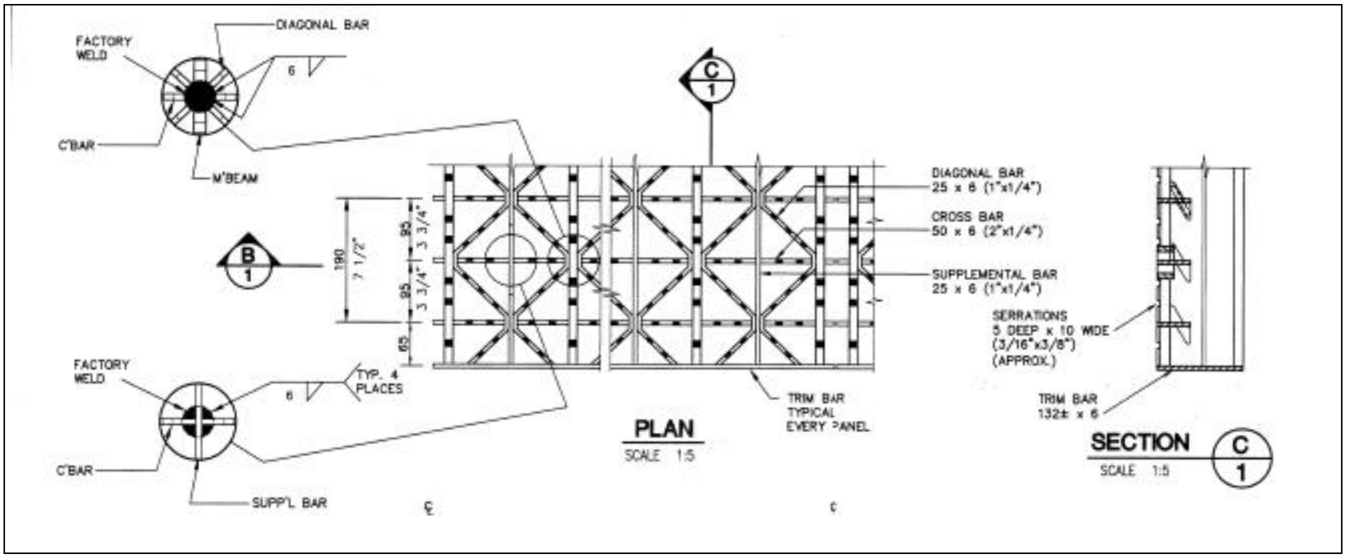


Figure 6: 1999 Open Steel Deck Grating

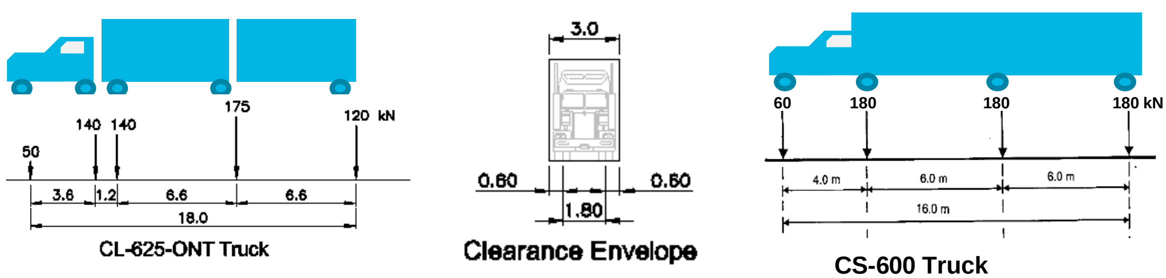


Figure 7: Truck Comparison

A load posting could be considered for the deck based on the current performance of the deck grating. A load posting would need to be implemented on a trial and error basis by installing a posting and then reviewing the deck for fatigue cracks. When a road is posted, compliance from trucks is difficult to achieve without regular MTO monitoring of the site.

Lastly, in reviewing the original deck to current design standards – the deck appears to be spanning almost twice the distance that fabricators such as Borden Gratings recommend for a similar weight panel designed for the CL625 CHBDC loading. Borden grating carries a similar product to what is installed at the site R/W-L-I that spans 818 mm when placed perpendicular traffic. LB foster's comparable product is rated for light traffic with a 25 year life cycle. In order to consider LB Foster's product further for appropriateness it would need to be reviewed and designed under CHBDC. Borden grating has indicated that all of their grating designs require further information to assess their suitability to meet the CHBDC fatigue requirements. As fatigue appears to be the primary problem with the existing grating replacing the deck in kind is not recommended. While a load posting may be able to be added to the bridge to accommodate a similar replacement deck, it is unlikely a reputable proprietary deck designer and fabricator will be willing to provide a substandard deck as the liability risk is high.

2.4.1 Potential Deck Replacement Types

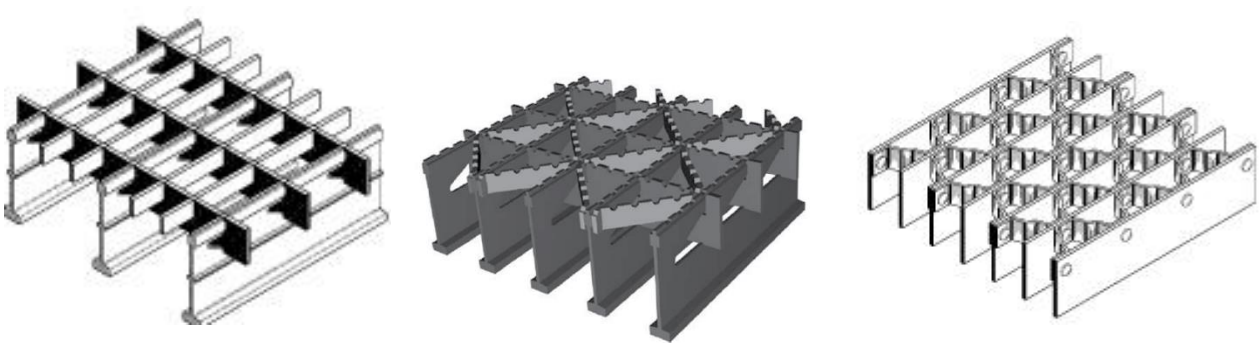
Several deck types were considered in the analysis. In considering the different deck types we have reviewed each for weight increase/decrease potential, safety (friction), durability and noise potential. A summary of the defining characteristics is summarized for all options and included in **Table 7**, and **Table 8**. Not considered through the evaluation of the different deck types is that the Canadian Highway Bridge Design Code (CHBDC) recommends against using open grating systems because they allow road salts onto the structural members and reduce their service life, have environmental implications and reduce safety and ride quality. §C13.5.2. At this stage of the study open systems have not been eliminated as deck options. The open deck grating option is acceptable for this site as it is a pre-existing condition. All closed deck options will require the addition of cross-falls and/or an adjusted longitudinal alignment along with a drainage system.

<u>*Open Steel Deck Grating*</u>

The current deck on the Burlington Lift Bridge is a crimped open steel grid deck. The existing deck type (similar to Borden R/W-L-I) is welded to the stringers and lightweight and suitable for higher volume traffic. The existing system however has been fatigue prone which indicates a stiffer system is desirable for this site to improve load distribution and reduce localized stresses by vibrations and fatigue. This could be achieved through the addition of stringers or by installing a stiffer deck. There is also an existing repair to one panel in the bridge deck at the BCLB which is very similar to the R/W-I from Borden Gratings, this panel has performed well thus far. The R/W-I type of open deck is much stiffer as indicated by its higher moment of inertia and according to LB Foster is for the heaviest and most intense loading conditions even on longer spans. [2] A square bar road grating is lighter than the crimped system but is only suitable for low speed, low span moderate traffic volumes and is not considered for the BCLB.

Rivetted gratings have purportedly higher resistance to impact and fatigue. The rivetted gratings are more flexible at their internal connections than welded gratings and that additional flexibility has led to early rivet failures at other sites where adjacent stringers were not well levelled and welded to the stringers. Welded connections are prone to fatigue and where possible, the grating should be bolted to the stringers and well shimmed if there are inconsistencies between supports. Contractor experience is key to a successful installation.

All of the reviewed options require adjustments to stringer spacing in order to meet maximum span constraints and accommodate anchorage for the railing system as part of the primary load carrying structure. It is proposed that the existing stringers be removed as newer stringers will have a higher yield capacity and a lighter section can be chosen for replacement. The lighter weight steel stringers allow for a heavier grating section while minimizing any increase in total weight to the lift span. An estimate of the overall increase due to stringer weight and a list of several open steel grating types and a comparison of their weight and stiffness is included in **Table 6**. Consideration was also given to steel grating parallel to vehicular traffic in order to take advantage of the stronger orientation of the bearing bars. This would require the installation of new steel cross-beams (perpendicular to traffic) that span between stringers. Based on our evaluation, the overall weight of the system with grating parallel to traffic is similar to that of a system with steel grating perpendicular to traffic thus is not considered further due to the additional effort/costs involved due to the installation of steel cross-beams to accommodate the new orientation.



Bar Roadway Grating Crimped I-Bar Roadway Grating Rivetted Roadway Grating

Figure 8: Open steel deck grating panel by Borden Gratings[1]

Table 6: Summary of Steel Open Grating Options[1]

Deck Type	Deck Weight (kN/m²)	Change in Weight with New Stringers (kN/m²)	Grating Depth (mm)	Moment of Inertia (mm⁴/m)	Max Span (mm) (Transverse to Traffic)	Current Stringer Max spacing (c/c)
R/W-L-I Crimped I-Bar Grating (Similar to existing)	0.93	0.04	132	1.22e+07	818	1295 mm
R/W-I Crimped I-Bar Grating (Repair Location)	**1.26**	**-0.18**	**132**	**1.88e+07**	**1064**	
R/W-20-4 Rivetted Roadway Grating	1.17	0.14	114	1.21e+07	747	
R/W-22-4 Rivetted Roadway Grating	1.26	0	127	1.66e+07	856	
R/W-24-4 Rivetted Roadway Grating	**1.36**	**-0.12**	**140**	**2.22e+07**	**980**	
R/W-26-4 Rivetted Roadway Grating	1.46	-0.21	152	2.88e+07	1118	
R/WL-26 Rivetted Roadway Grating	1.04	+0.20	152	1.35e+07	709	

Open grid deck panels can be bolted or welded together and to the bridge structure.[3] Open steel grid decks provide less skid resistance compared to solid decks, have high noise levels, and poor riding comfort.[4] All open grating system will need to consider height variations. The deck elevation should not be increased overall so as to maintain the existing vertical clearance. The first preferred grating to be considered further is the R/W – I Crimped I Bar Grating due to the weight of the overall system and the spacing between stringers and low grating depth. The second grating to be considered further is the R/W-24-4 Rivetted Grating due to the second largest stringer spacing and grating depth.

Half Filled Deck Grating

Concrete filled deck gratings are similar to open steel deck grating however the deck is cast partially with concrete. Some variations to concrete filled grid decks including overfilling the grid with concrete, and partially filling the grid with concrete. A half-filled grid deck is depicted in **Figure 9**, the system requires less concrete and is lighter than a fully filled grid deck. Borden Gratings provides a half-filled deck 132 mm thick that works with the existing stringer spacing R/R-L 10-5x4 at 2.12 kN/ m^2 and with double the stringer spacing R/R-L 6-2x4 at 2.41 kN/ m^2.[1] Panels can be made at various sizes an example size is 5.72 m long by 4.67 m wide.[26] A raked concrete wearing surface of at least 25mm is recommended for the system which adds 0.6kN/m^2 to the systems weight. The concrete wearing system protects the grating and improves durability and rideability of the roadway.

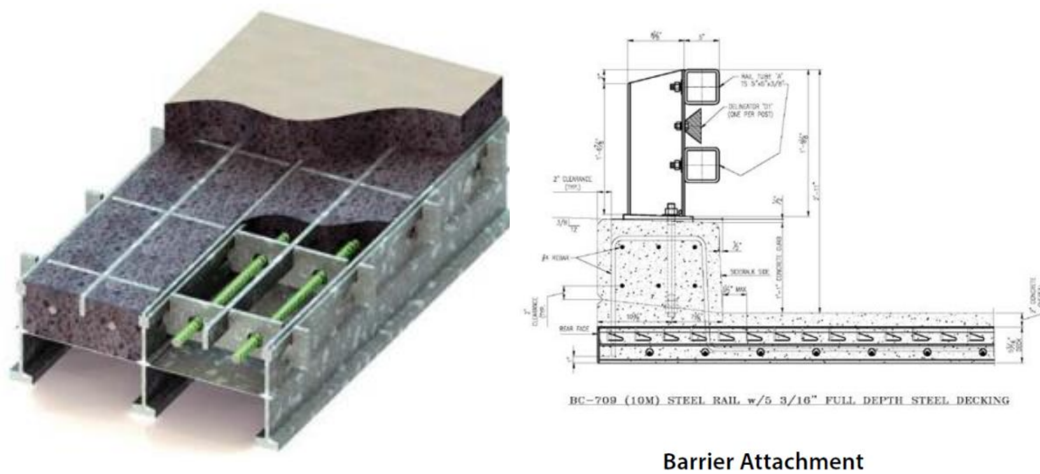


Figure 9: Concrete half-filled grid with concrete overfill [5]

Figure 10: Concrete half-filled grid installation[7]

When the half-filled grid deck is not overfilled, a wearing surface is typically applied, although at the Thousand Island Bridge over the St Lawrence river the top edges of the grid is left exposed.[5] The concrete can be cast in the steel grid in premade panels before being brought to site. The premade panels can then be welded or bolted together onsite. Once onsite additional concrete is placed to fill the space between the panels as expressed in **Figure 10**.[7] The connection of the half-filled grid deck to the steel framing superstructure typically consists of welded stud shear connectors that are placed in a pocket filled with grout.[3] The concrete in the half-filled grid helps to reduce traffic noise.[2] The not overfilled - half filled deck provides a better riding surface than open grating but is not as good as a concrete riding surface.

Exodermic Deck System

An exodermic deck system consists of a reinforced concrete slab on top of an unfilled steel grid depicted in **Figure 11**. A portion of the steel grid extends into the concrete slab making the section composite. In an exodermic deck the steel grid is in tension while the concrete slab is in compression. The concrete slab can be either cast-in-place or precast for quicker installation.[2]

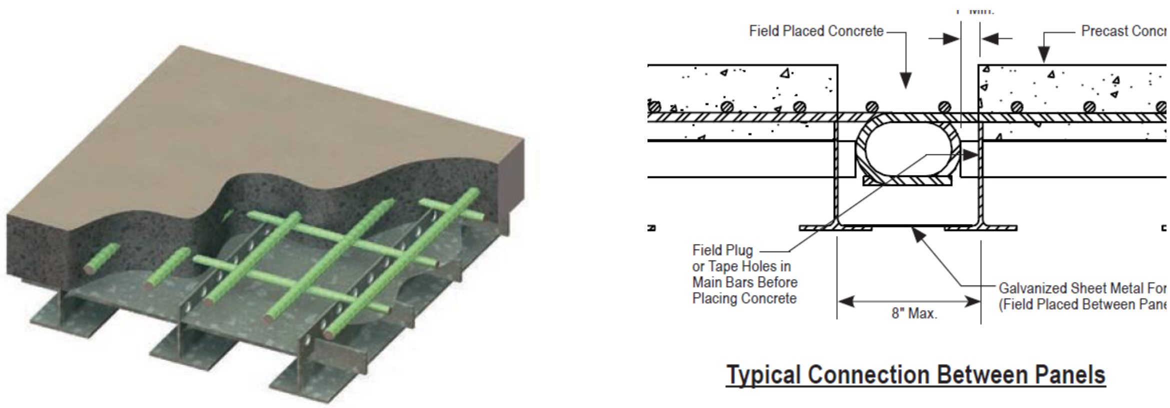


Figure 11: Exodermic bridge deck system[8]

The exodermic deck system can be made composite with stringers. Connections between panels and to steel structure are similar to half-filled grating decks. The steel grid sections are either bolted or welded together and the steel grid is typically connected to the steel framing through welded stud shear connectors.[3] Similar to the half-filled grating deck when the concrete slab for an exodermic deck is precast additional concrete needs to be placed onsite between the precast concrete panels to create a uniform surface.[7] LB Fosters exodermic deck system was considered, the overall thickness of the deck ranges from 150 mm to 250 mm with the deck weight ranging from 1.92 kN/m^2 to 3.83 kN/m^2.[9] Panels can be made at various sizes an example size is 5.72 m long by 4.67 m wide.[26] Closure pours are used to connect the panels.

The concrete wearing surface in the exodermic concrete slab helps to reduce traffic noise.[2] This type of decking is suitable for prefabricated rapid construction and is low maintenance. An exodermic deck was used in a new lift bridge in 2014 linking Portsmouth New Hampshire and Kittery Maine.

Aluminum Deck System

The aluminum deck system considered is a prefabricated orthotropic deck system produced by Aluma Bridge and distributed by LB Foster **Figure 12**. The 125 mm deep orthotropic section with a flat plate surface along the top and bottom was chosen as it is the aluminum deck system that is suitable for use on moveable bridges and can be prefabricated for fast-track construction. Friction stir welding is used to weld extruded sections together to create the aluminum deck panels.[10] Friction stir welding uses a rotating tool to create frictional heat along the surface between the two aluminum sections.[11] Friction stir welding has high cycle fatigue resistance. The weight of the system varies due to the wearing surface and deck depth. The maximum panel size is 4.27 m wide by 12.19 m long made of extruded section that are 0.46 m wide. Panels can be joined using a sealant or left open. The sealant between panels will increase maintenance on the system, but reduces ingress of salts and moisture onto the structure below. The deck is connected to the steel framing along longitudinal beams spaced at approximately 1.83 m using bolts.[12] For this system stringers are assumed to be removed and optimized for the deck system.

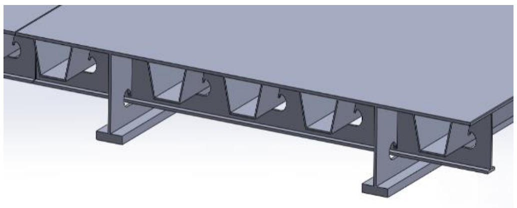
Figure 12: Aluminum decking with wearing surface[2,12]

Aluma Bridge provides a skid resistant epoxy and aggregate bonded wearing surface. The wearing surface is an aluminium oxide aggregate blend with an average unit weight of 0.08 kN/m^2 and a service life of 10-20 years[12] The average weight of the aluminum deck system is about 1.00 kN/m^2. The aluminum deck system has a longer life and is stronger than fiber-reinforced decking.[10] Compared to open grid decks, aluminum bridge decks have less road surface noise.[2] The Aluma Bridge panels are chemical and UV resistant.[25] The panels including the wearing surface have been used in the USA purportedly under high traffic volume and in snowy conditions where ploughs are used.

Aluminum decks have been used on the St. Ambroise River Bridge in Quebec, test areas on the ED Koch Queensboro Bridge in New York, and tested on the Marine Parkway Bridge.[25] AECOM is currently discussing the use of this deck type with the NYSDOT and MTA Bridges & Tunnels for further information on its performance.

Orthotropic Steel Deck System

The steel orthotropic deck system supplied by Canam Bridges consists of prefabricated panels, **Figure 13**. The panel consists of a steel plate reinforced with steel ribs. The prefabricated panels allow for quick installation and a wearing surface is applied during fabrication.[13] The weight of the steel orthotropic deck system is approximately 2.50 kN/m^2. Orthotropic steel deck depth varies depending on the application with an approximate depth of 240 mm. The steel orthotropic deck panels are welded or bolted in place and can be integrated with the floor beams.[5]



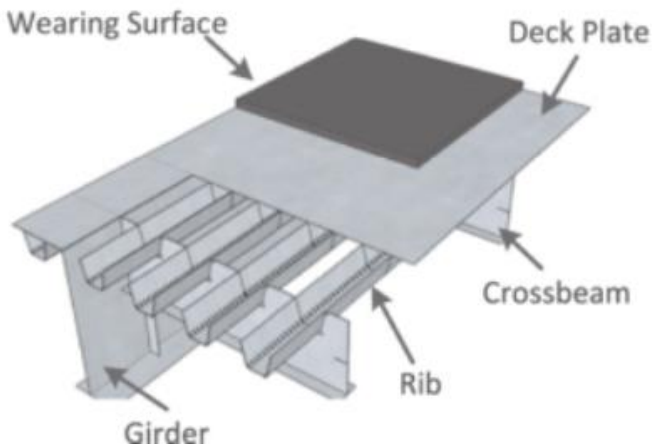


Figure 13: Orthotropic steel deck system[7]

A thin waterproof polyurethane-based wearing surface is typically applied to the orthotropic steel deck with resurfacing expected after approximately 25 years of service.[5] A durability concern with steel orthotropic decks is debonding of some wearing surfaces. Research has been conducted to show that the wearing surface can last for decades using an epoxy concrete and thermoset resin-extended asphalt.[14]

Orthotropic steel deck systems have been widely used in the United States and currently used on bridges across Canada including the Hastings Swing Bridge, Baseline Bridge and Kingston Mills Bridge.[13]

Fiber-reinforced Polymer Deck System

The fiber-reinforced polymer deck system being considered is FiberSPAN supplied by Composite Advantage, **Figure 14**. The FiberSPAN system consists of prefabricated fiberglass panels with a composite sandwich construction.[15] The FiberSPAN system is suitable for use on movable bridges and quick installation. The system includes a non-slip overlay, crowns, curbs and drains. The panels are high strength as well as corrosion resistant to chemicals and water.[16] The average weight of the fiber-reinforced polymer system is approximately 0.96 kN/m^2.[17]

Figure 14: Fiber-reinforced polymer bridge decks supplied by Composite Advantage[15]

Panels are designed to connect through interlocking with male-female shear keys or a high-quality epoxy adhesive. Panels are connected to the framing typical through welded stud shear connectors with non-shrink grout.[3] Each panel is custom made and the size varies by project. The restoration of the Blackfriars Pedestrian Bridge in London, Ontario used panels approximately 203 mm thick, 5.33 m long and 2.09 m wide.[15] The fiber-reinforced deck panels have a maximum support spacing of 1.5 m.[19]

The main durability concern for fiber-reinforced polymer decks is the debonding of the wearing surface from the bridge deck.[24] The wearing surface is typically either polymer concrete or asphalt.[17] Fiber-reinforced deck panels are quieter compared to steel grating.[18] Some examples of highway traffic bridges that have incorporated fiber-reinforced polymer into the bridge deck included the Rocks Village Bridge in Haverhill, Massachusetts and the Minto East Bridge in Ottawa, Ontario.[16] This system does not have a long history for high volume traffic and Manufacturers are claiming 100 years for this product but recent investigations into long term performance are not consistent with manufacturer statements.

Precast Concrete Deck System

Precast concrete deck slabs are fabricated in a precasting plant and shipped to site and connected on site. The slabs are connected by placing a cast in place closure pour between the panels. The precast concrete deck slabs are connected to the steel framing using shear connectors.[3] The supporting steel structure is a site specific design. Precast concrete deck panel size varies with the typical length being between 2.4 m and 3.6 m and often depend on manufacturer crane carrying capacity, highway loading and shipment limitations. Unit weights vary depending on site specific design. A range of depths and weights is included in **Table 8**.

Figure 15: Precast concrete deck system[7]

The wearing surface for a precast concrete deck may be a raked exposed concrete wearing surface, a waterproof membrane with asphalt or a proprietary system such as Matacryl.[21] Precast concrete panels are a very durable option. However, care must be taken in manufacturing to ensure proper curing and lifting of the panels before they are fully cured. Similar to the half-filled concrete deck and the exodermic deck the concrete surface helps to mitigate the traffic noise.[2]

2.4.2 Potential Deck Replacement Types Comparison

AECOM reviewed and compared nine different deck options which are summarized in tables as lighter deck options (**Table 7**) and heavier deck options (**Table 8**). The lift span was further evaluated with consideration to the heavier range of each option and the results are summarized in **Table 9**. Given that some systems span further than others and that stringer replacement can be done to maximize weight efficiency for some systems the Unit Weights used consider an estimate of new stringer weights where applicable.

Table 7: Summary of Lighter Weight Deck Options

Deck Type	Open Steel Grid Deck[1,2]		Aluminum Deck[10,12]	Fiber-reinforced Polymer Deck[15]
	Crimped I Bar	Rivetted		
Unit Weight (kN/m^2)	2.08	2.24	1.65	1.69
Depth (mm)	132	140	125	178 – 250
Required minimum Stringer Spacing (mm)	1064	980	1830	1500
Max Panel Size	The width of the open steel deck grating is 2.34 m		4.27 m wide by 12.19 m long	Panel size varies with previous size of 5.33 m long by 2.09 m wide
Connection -panel/panel -panel/stringer	Open grid deck panels can be bolted or welded together and to the steel frame. [3]		Panels can be joined using a sealant. The deck is connected to the stringers using bolts.	Panels are interlocked together with male-female shear keys. Panels are connected to the framing through welded stud shear connectors and sometimes bolts. [3]
Wearing Surface	Serrated bars		The wearing surface is an aluminium oxide aggregate blend.	Polymer concrete or asphalt [17]
Durability	Poor skid resistance compared to solid decks and poor riding comfort. [4]		Panels are chemical and UV resistant. [25]	Issues with the wearing surface debonding from the bridge deck [24]
Noise Potential	High noise levels [4]		Low [2]	Low [18]
Crash Tested Railing Connection Details	None provided, modification likely required.		Fabricator indicated that standard anchorage details not available.	No information

Table 8: Summary of Heavier Weight Deck Options

Deck Type	Half Filled Grid Deck [1]		Exodermic Deck	Orthotropic Steel Deck [5]	Precast Concrete Deck [20]
	No Overlay	With 50mm Overlay			
Unit Weight (kN/m^2)	2.79	3.8	3.6	2.82	6.0
Product Reviewed	Borden R/R-L 10-3.33X4	BRFMA 5+3/16 -10-1	BRFMA WT4x5 – 12	NA	NA
Depth (mm)	130	183	180	Varies 240	210
Required Support Spacing (mm)	1713	2164	2255	Varies	Varies (2900-3300)
Max Panel Size	Approximately 4.5 m wide[26]		Example size is 5.72 m long by 4.67 m wide[26]		Typical length 2.4 m to 3.6 m and a max width of 15 m[21]
Connection -panel/panel -panel/stringer	Panels are welded or bolted together. Welded stud shear connectors are used to connect panels to steel framing.[3]		Panels are welded or bolted together. Welded stud shear connectors connect panels to steel framing.[3]	Welded or bolted in place	Panels are connected with closure pour and grouted shear keys. Panels are connected to stringers shear studs.[3]
Wearing Surface	Exposed bar and concrete wearing surface	Exposed tined concrete	Exposed tined concrete	Thin waterproof polyurethane asphalt-based wearing surface	Exposed tined concrete surface
Durability		Potential cracking due to concrete shrinking	Potential cracking due to concrete shrinking[9]		Improvements could be made to the joint design and construction of the precast panels.[22]
Noise Potential	Moderate	Moderate	Moderate	Low	Moderate
Crash Tested Railing Connection Details	None Provided	Barrier anchored laterally through full depth concrete section	Barrier anchored laterally through full depth concrete section	Unknown	Standard

The lift span structure was evaluated considering the weight of each deck option. Calculations are included in Appendix F Exhibit B.3 for reference. The stringers were adjusted to for the analysis and require replacement based on the selected system and to accommodate crash loading from barriers to meet minimum standards. The lift span is suitable for any of the proposed deck options considering structural capacity. The lift span was evaluated for each option considering the demand and capacity for the limiting primary members for their worst case forces. A summary of that evaluation consider the limiting member for primary structural members (floor beams, verticals, top and bottom chord) is provided in **Table 9**. Where the Demand to Capacity ratio (D/C) is less than one the limiting member has available capacity. Note stringer replacement is recommended for all options to optimize their load carrying capacity.

Table 9: Evaluation of Deck Options for Lift Span

Deck Type		Overall Span Weight Increase (kN)	Primary Members D/C (limiting)	Limiting Member	Lift Span Structural Upgrades Required (Y/N)
Open Steel Grid Deck[1,2]	Crimped I Bar	140	0.71	L2-U3 HWY	N
	Rivetted	400	0.72	L2-U3 HWY	N
Aluminum Deck[10,12]		-570	0.69	L2-U3 HWY	N
Fiber-reinforced Polymer Deck[15]		-510	0.70	L2-U3 HWY	N
Half Filled Grid Deck [1]	No Overlay	1310	0.73	L2-U3 HWY	N
	With 50mm Overlay	2960	0.77	L2-U3 HWY	N
Exodermic Deck		2580	0.75	L2-U3 HWY	N
Orthotropic Steel Deck [5]		1400	0.76	L2-U3 HWY	N
Precast Concrete Deck [20]		6600	0.85	L2-U3 HWY	N

The tower was evaluated in the raised and lowered position considering the demand and capacity for the limiting primary members and their worst case forces. Calculations are included in Appendix F Exhibit B.4 for reference. A summary of that evaluation consider the limiting member for primary structural members (columns/diagonals/horizontals) is provided in **Table 10**.

Table 10: Evaluation of Tower for Deck Options

Deck Type		Primary Members Wind ULS D/C	Primary Members Non Wind D/C	Primary Members wind D/C (limiting)
Open Steel Grid Deck	Existing	1.67	0.65	**Columns at Horizontal # 1**
Open Steel Grid Deck	Crimped I Bar	1.68	0.65	**Columns at Horizontal # 1**
	Rivetted	1.68	0.66	**Columns at Horizontal # 1**
Aluminum Deck		1.67	0.64	**Columns at Horizontal # 1**
Fiber-reinforced Polymer Deck		1.67	0.64	**Columns at Horizontal # 1**
Half Filled Grid Deck	No Overlay	1.70	0.68	**Columns at Horizontal # 1**
Exodermic Deck		1.72	0.71	**Columns at Horizontal # 1**
Orthotropic Steel Deck		1.72	0.71	**Columns at Horizontal # 1**

2.5 Mechanical Components

2.5.1 Ropes assessment

During the official detailed annual inspection in March 2020, the main counterweight ropes were visually inspected and found in overall good condition. The maintenance is appropriate.

The ropes show wear over the running length of rope due to contact with the sheaves during operations. The wear is apparent in the form of elliptical flats on the crowns of the wires. Typically ropes show the greatest wear on the portion of rope which is in contact with the span side tangent point of the sheave when the span is seated. The largest wear flats observed along the running length of the ropes were approximately 5/8 inches which indicate a remaining strength of 95%. The rope capacity has not changed since the last inspection.

In October 2020, the ropes and other mechanical components were inspected during operation. No mechanical issues were detected during the inspection.

Results following evaluation of rope capacity for each deck type are shown below. Calculations were made as per CHBDC and AASHTO requirements.

2.5.2 Trunnion shaft assessment and bearings

The trunnion shafts were found to have more than 100 years of service life left for the current lift weight and number of operations per year (around 3350 lifts in 2019 as per the Bridgemasters log). If the life span weight is significantly increased, then the trunnion shaft life will need to be re-evaluated.

All deck options do not exceed bearing capacities.

Results following evaluation of trunnion shaft and bearing are shown below. Calculations were made as per CHBDC and AASHTO requirements.

2.5.3 Motor assessment

The motors were replaced in 2013 following as part of the complete refurbishment of the span machinery. During the detailed annual inspection performed in 2020, the motors were found in good condition. No mechanical issues were detected.

Results following evaluation of motor capacity are shown below. Calculations were made as per CHBDC recommendations and take into consideration bearing friction, bending losses in counterweight ropes, inertial of main mechanical components, imbalance and ice and wind loads.

2.5.4 Need and timeline for replacement

The tables below summarize the performance of the main mechanical components for each type of deck options based on the recommendation by CHBDC. The ropes should be replaced for options where the allowable stress exceeds 10%.

Table 11: Summary of Lighter Weight Deck Options

	Open Steel Grid Deck		Aluminum Deck	Fiber-Reinforced Polymer Deck
	Crimped I Bar	Rivetted		
Estimated Weight of Span (tonne)	1799	1826	1727	1733
Stress in ropes (MPa) (max 317 MPa)	339 MPa, 6,9% higher than allowable stress	341 MPa, 7.4% higher than allowable stress	332,1 MPa, 4,5% higher than allowable stress	332.2 MPa, 4.6% higher than allowable stress
Trunnion Bearing Capacity (lb) (max 917225 lb)	644494 lb, OK	654167, OK	618700 lb, OK	620849 lb, OK
Trunnion Fatigue Life	> 100 years	> 100 years	> 100 years	> 100 years
Motor Capacity (hp) (rated capacity of 150 hp)	145 hp	146 hp	154 hp, 2,6 % higher than rated capacity	154 hp, 2,6 % higher than rated capacity

Table 12: Summary of Heavier Weight Deck Options

	Half Filled Grid Deck		Exodermic Deck	Orthotropic Steel Deck	Precast Concrete Deck
	No Overlay	50mm Overlay			
Estimated Weight of Span (tonne)	1919	2087	2048	1924.6	2458
Stress in ropes (MPa) (max 317 MPa)	349,9 MPa, 10% higher than allowable stress	365,8 MPa, 15% higher than allowable stress	362 MPa, 14% higher than allowable stress	350,4 MPa, 10% higher than allowable stress	401 MPa, 26% higher than allowable stress
Trunnion Bearing Capacity (lb) (max 917225 lb)	687484, OK	747670, OK	733698, OK	689490 lb, OK	880581lb, OK
Trunnion Fatigue Life	> 100 years	Less than 10 years	Less than 70 years	> 100 years	failure
Motor Capacity (hp) (rated capacity of 150 hp)	159 hp, 6% higher than rated capacity	163 hp, 9% higher than rated capacity	162 hp, 9% higher than rated capacity	159 hp, 6% higher than rated capacity	172 hp, 15% higher than rated capacity

Based on the calculations, the counterweight ropes are over stressed (max 8%) for all lighter deck options. Calculations are included in Appendix F Exhibit C.5 for reference. Counterweight ropes are designed with a 4.5 safety factor, because the ropes are in good condition a 10% overload is acceptable for continued operation with sustained inspection and maintenance. There is no reason to change the ropes if one of the lighter deck options (overstress is less than 10%) is selected. However, the ropes should be replaced for all heavier deck options when overstress is greater than 10%. In all cases, ropes should be changed every 50+/-5 years.

Following this assessment, it appears the trunnion shaft fatigue life is greatly impacted by the rehabilitation for heavier weight deck options. The fatigue life is low for heavier weight deck options (half filled grid deck with overlay, exodermic deck and precast concrete deck) and there is a risk of failure. This should be further investigated if those options are selected.

For closed deck option, motors are slightly undersized. This is due to the ice and wind load applied on the deck. In the calculations, for closed deck options, those loads were applied on the decks total surfaces which generate a significant difference in loading between open and closed decks. This approach is considered conservative because having both maximum ice and wind loads applied on the entire deck is very unlikely. Furthermore, results for motor capacities were compared to their nominal rated capacity of 150 hp. Since motors can develop overload capacity of 300%, a change for a heavier deck option would not significantly affect bridge operation nor service life of the motors. Also, the control systems should cut out at about 185% of full load torque. In all cases, the bridge should not be opened during winter or when there is high winds. Rope replacement requirements
If the ropes are to be replaced, provision shall be made for the independent support of the counterweights for rope replacement as per CHBDC section 13.6.21.14. Dogging devices are already installed on the bridge towers for support.

3. Conclusions and Recommendations

The lift span primary member analysis identified no overloading when evaluated for each deck replacement option. A preliminary review of the stringers and their optimal layout was considered as part of this analysis, as many of the potential deck replacement options would require stringers at closer than existing spacing. The existing spacing is not considered suitable for any available deck grating option. As a result where the spacing could be increased this was also considered when looking at the true weight of a deck option. The sidewalk width was not modified for this evaluation.

The tower structural element capacities are acceptable based on the evaluated deck replacement options. The overstress observed in the columns is a result of wind loading is primarily driven by transverse and longitudinal wind with minor implications from deck type for vertical wind unrelated to the deck type. The recommended options are primarily driven by the required mechanical system rehabilitation and potential tower modifications. No option that results in the replacement of mechanical components will be considered further.

3.1 Recommendations

Based on the durability and maintenance requirements five of the lift span deck options should be reviewed in further detail considering the capital, maintenance and life cycle costs for each system over 50 years. Crash tested barriers are required for each option and their connection to the superstructure requires evaluation at detailed design. All of the closed deck options will require drainage modifications over the lift bridge. The open steel grid deck options are similar to what is currently on the bridge. There are durability and environmental concerns with this option due to the ingress of salts into the river and onto the support structure, however it is an acceptable option as a pre-existing condition on the bridge.

Table 13: Summary of Options Considered

Deck Type		Recommended for Further Consideration	Comment
Open Steel Grid Deck	Crimped I Bar	Yes	
Open Steel Grid Deck	Rivetted	Yes	
Aluminum Deck		Yes	
Fibre Reinforced Polymer		No	Insufficient use on medium - higher volume traffic bridge
Half Filled Grid Deck	No Overlay	Yes	
Half Filled Grid Deck	50mm Overlay	No	Too heavy
Exodermic Deck		No	Too heavy
Orthotropic Steel Deck		Yes	
Precast Steel Deck		No	Too heavy

Widening of the approach sidewalk deck needs to be evaluated in further detail and concurrently with the deck replacement options. A site survey needs to be completed at detailed design to verify overhead clearance, sidewalk layout in comparison with adjacent site features. The sidewalk requires either replacement or a maintenance rehabilitation in the lift span. Further, the weight of the bridge should be verified prior to detailed design for the lift span sidewalk to verify and assess the lateral balance. The addition of a lateral counterweight system in the lift span may be warranted to adjust for current and future changes to the bridge.

The approach and tower span decks require replacement. A 225 deck with 20 mm exposed concrete overlay is the recommended deck replacement. A life cycle cost analysis is required to assess whether expansion joint replacements or semi-integral detailing is the preferred configuration for the deck. Deteriorated steel requires replacement or repair and lead remediation sealing will be required to perform the steel repairs.

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Statement of Qualifications and Limitations

The attached Report (the "Report") has been prepared by AECOM Canada Ltd. ("AECOM") for the benefit of the Client ("Client") in accordance with the agreement between AECOM and Client, including the scope of work detailed therein (the "Agreement").

The information, data, recommendations and conclusions contained in the Report (collectively, the "Information"):

- is subject to the scope, schedule, and other constraints and limitations in the Agreement and the qualifications contained in the Report (the "Limitations");
- represents AECOM's professional judgement in light of the Limitations and industry standards for the preparation of similar reports;
- may be based on information provided to AECOM which has not been independently verified;
- has not been updated since the date of issuance of the Report and its accuracy is limited to the time period and circumstances in which it was collected, processed, made or issued;
- must be read as a whole and sections thereof should not be read out of such context;
- was prepared for the specific purposes described in the Report and the Agreement; and
- in the case of subsurface, environmental or geotechnical conditions, may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time.

AECOM shall be entitled to rely upon the accuracy and completeness of information that was provided to it and has no obligation to update such information. AECOM accepts no responsibility for any events or circumstances that may have occurred since the date on which the Report was prepared and, in the case of subsurface, environmental or geotechnical conditions, is not responsible for any variability in such conditions, geographically or over time.

AECOM agrees that the Report represents its professional judgement as described above and that the Information has been prepared for the specific purpose and use described in the Report and the Agreement, but AECOM makes no other representations, or any guarantees or warranties whatsoever, whether express or implied, with respect to the Report, the Information or any part thereof.

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This Statement of Qualifications and Limitations is attached to and forms part of the Report and any use of the Report is subject to the terms hereof.

AECOM: 2015-04-13

Appendix D

Approach Span Estimates

Life Cycle Cost Analysis Approach Spans

P =		*Estimated Capital Cost*
Ci =	P * (1+i)^n	*Future Capital Cost Based on Present Construction Estimate*
Pr =	P/(1+r)^n	*Present Capital Cost*
i =	2.00% %	*Inflation*
r =	4.00% %	*Discount Rate*

Alternative 1 - Deck Replacement with Expansion Joints

Year	Number of Years	Estimated Capital Cost, P	Future Capital Cost, Ci	Present Capital Cost, Pr	Treatment
2021	1	$ 2,956,876	$ 3,016,014	$ 2,900,013	Treatment 1- Deck Replacement with Expansion Joint Replacement
2031	10	$ 154,700	$ 188,578	$ 127,397	Treatment 3 - Replace Expansion Joint Seals
2041	20	$ 265,200	$ 394,073	$ 179,850	Treatment 4 - Replace Expansion Joint Seals, recoat/seal paint as needed
2051	30	$ 577,200	$ 1,045,518	$ 322,353	Treatment 5- Replace Expansion Joint Assembly, Scarify Deck and Place Overlay
2061	40	$ 265,200	$ 585,572	$ 121,968	Treatment 4 - Replace Expansion Joint Seals, recoat/seal paint as needed
2071	50	$ -	$ -	$ -	Salvage value at 50 years
			Total	$ 3,651,581	

Alternative 2 - Deck Replacement with Semi-Integral detailing

Year	Number of Years	Estimated Capital Cost, P	Future Capital Cost, Ci	Present Capital Cost, Pr	Treatment
2021	1	$ 2,981,160	$ 3,040,783	$ 2,923,830	Treatment 2- Semi-Integral Conversion
2041	20	$ 65,000	$ 96,587	$ 44,081	Treatment 6 - Recoat/seal paint as needed
2051	30	$ 312,000	$ 565,145	$ 174,245	Treatment 7- Scarify Deck and Place Overlay
2061	40	$ 65,000	$ 143,523	$ 29,894	Treatment 6 - Recoat/seal paint as needed
2071	50	$ (32,500)	$ (87,477)	$ (12,309)	Salvage value at 50 years
			Total	$ 3,159,741	

Sensitivity Analysis

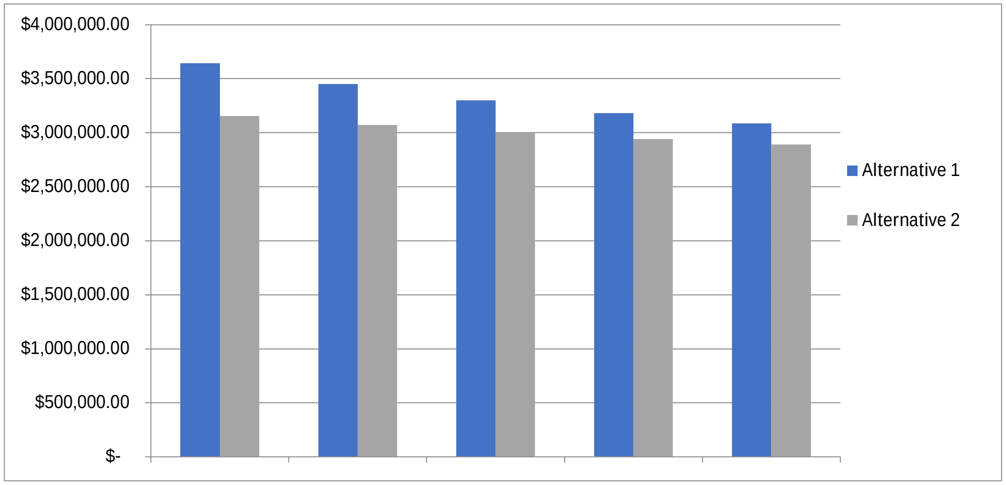
Alternative 1 - Deck Replacement with Expansion Joints

Activity	n	Capital Cost	PV (For Discount Rates) 2%	3%	4%	5%	6%
Treatment 1- Deck Replacement with Expansion Joint Replacement	1	$ 2,956,876.00	$ 2,898,898.04	$ 2,870,753.40	$ 2,843,150.00	$ 2,816,072.38	$ 2,789,505.66
Treatment 3 - Replace Expansion Joint Seals	10	$ 154,700.00	$ 126,907.88	$ 115,111.33	$ 104,509.78	$ 94,972.38	$ 86,383.67
Treatment 4 - Replace Expansion Joint Seals, recoat/seal paint as needed	20	$ 265,200.00	$ 178,472.00	$ 146,834.81	$ 121,033.82	$ 99,951.09	$ 82,690.61
Treatment 5- Replace Expansion Joint Assembly, Scarify Deck and Place Overlay	30	$ 577,200.00	$ 318,655.32	$ 237,798.76	$ 177,961.54	$ 133,551.06	$ 100,496.37
Treatment 4 - Replace Expansion Joint Seals, recoat/seal paint as needed	40	$ 265,200.00	$ 120,106.54	$ 81,298.87	$ 55,238.25	$ 37,670.51	$ 25,783.32
Salvage value at 50 years	50	$ -	$ -	$ -	$ -	$ -	$ -
			$ 3,643,039.77	$ 3,451,797.17	$ 3,301,893.38	$ 3,182,217.43	$ 3,084,859.64

Alternative 2 - Deck Replacement with Semi-Integral detailing

Activity	n	Capital Cost	PV (For Discount Rates) 2%	3%	4%	5%	6%
Treatment 2- Semi-Integral Conversion	1	$ 2,981,160.00	$ 2,922,705.88	$ 2,894,330.10	$ 2,866,500.00	$ 2,839,200.00	$ 2,812,415.09
Treatment 6 - Recoat/seal paint as needed	20	$ 65,000.00	$ 43,743.14	$ 35,988.92	$ 29,665.15	$ 24,497.82	$ 20,267.31
Treatment 7- Scarify Deck and Place Overlay	30	$ 312,000.00	$ 172,246.12	$ 128,539.87	$ 96,195.42	$ 72,189.76	$ 54,322.36
Treatment 6 - Recoat/seal paint as needed	40	$ 65,000.00	$ 29,437.88	$ 19,926.19	$ 13,538.79	$ 9,232.97	$ 6,319.44
Salvage value at 50 years	50	-$ 32,500.00	-$ 12,074.66	-$ 7,413.48	-$ 4,573.16	-$ 2,834.12	-$ 1,764.37
			$ 3,156,058.36	$ 3,071,371.60	$ 3,001,326.20	$ 2,942,286.43	$ 2,891,559.83

Sensitivity Analysis



Treatment 1- Deck Replacement with Expansion Joint Replacement					
Item	Description	Unit	Est Qty	Unit Price	Total Cost
1	Mobilization/Demobilization	LS	1.0	$100,000	$100,000
2	Traffic Control	LS	1.0	$85,000	$85,000
3	Erosion and Sediment Control	LS	1.0	$30,000	$30,000
4	Sealing Joints in Asphalt	m	30.0	$250	$7,500
5	Concrete in Deck - Deck	LS/m^3	180.0	$3,199	$575,820
6	Concrete in Deck - New Curbs	LS/m^3	5.0	$3,200	$16,000
7	Concrete in Deck - New Expansion Joints	LS/m^3	7.0	$3,850	$26,950
8	Concrete in Deck - Approach Slabs	LS/m^3	45.0	$1,500	$67,500
9	Reinforcing Steel Bar	LS/T	16	$ 2,500	$ 40,000
10	Stainless Steel Reinforcing Bar	LS/T	8	$ 12,000	$ 96,000
11	Mechanical Connectors	LS/T	158	$ 50	$ 7,900
12	Stainless Steel Mechanical Connectors	each	158	$ 100	$ 15,800
13	Fabrication of Steel - New TL-4 Barriers	LS/T	10.0	$5,000	$50,000
14	Delivery of Steel - New TL-4 Barriers	LS/T	10.0	$250	$2,500
15	Erection of Steel - New TL-4 Barriers	LS/T	10.0	$2,000	$20,000
16	Fabrication of Steel - New Diaphragms and Stiffeners	LS/T	2.0	$5,000	$10,000
17	Delivery of Steel - New Diaphragms and Stiffeners	LS/T	2.0	$250	$500
18	Erection of Steel - New Diaphragms and Stiffeners	LS/T	2.0	$2,000	$4,000
19	Coating Existing Structural Steel - Girders, Intermediate Diaphragms and Floor Beams	LS/m^2	730.0	$200	$146,000
20	Coating New Structural Steel	LS/m^2	37.0	$200	$7,400
21	Environmental Protection During Coating of Structural Steel and Railing System(s)	LS/m^2	800.0	$150	$120,000
22	Lead Abatement and Removals	LS/m^2	225.0	$200	$45,000
23	Embedded Work in Structure (Utility)	LS/m	56.0	$100	$5,600
24	Form and Fill Grooves	m	29.0	$50	$1,450
25	Deck Joint Assemblies, Installation	LS/m	60.0	$3,000	$180,000
26	Bearings	Each	18.0	$3,000	$54,000
27	Access to Work Area, Work Platform and Scaffolding	LS	1.0	$60,000	$60,000
28	Concrete Removal - Partial Depth - Type A	m^3	6.0	$4,000	$24,000
29	Concrete Removal - Partial Depth - Type B	m^3	1.0	$14,000	$14,000
30	Concrete Removal - Partial Depth - Type C	m^3	4.0	$9,000	$36,000
31	Concrete Removal (Full Depth) - Removal of Existing Concrete Deck	LS/cum	126	$ 1,500	$ 189,000
32	Concrete Removal (Full Depth) - Removal of Existing Concrete Curbs on Approach Slab	LS/cum	9	$ 1,500	$ 13,500
33	Concrete Removal (Full Depth) - Removal of Existing Approach Slabs	LS/cum	43	$ 1,500	$ 64,500
34	Concrete Removal (Full Depth) - Removal of Existing Approach Span	LS/cum	4	$ 1,500	$ 6,000
35	Concrete Removal - Deck Joint Assemblies	LS/m^3	7.0	$4,500	$31,500
36	Abrasive Blast Cleaning of Reinforcing Steel	m^2	35.0	$100	$3,500
37	Concrete Patches, Form and Pump	m^3	5.0	$14,000	$70,000
38	Crack Injection	m	36.0	$250	$9,000
39	Dowels into Concrete	each	80.0	$50	$4,000
40	Jacking of Superstructure	LS	1.0	$80,000	$80,000
41	Shear Connectors - Type A	each	1430	$ 30	$ 42,900
42	Structural Steel Removals - Removal of Existing Diaphragms	LS/t	1.2	$1,000	$1,200
43	Structural Steel Removals - Removal of Existing Stiffeners	LS/t	0.7	$1,000	$700
44	Structural Steel Removals - Removal of Existing Metal Barriers	LS/t	0.8	$1,000	$800
45	Structural Steel Removals - Removal of Existing Steel Curb Plates	LS/t	9	1000	$9,000
				Subtotal	$2,274,520
			Contingency	30%	$682,356
				Total	$2,956,876

Treatment 2- Semi-Integral Conversion					
Item	**Description**	**Unit**	**Est Qty**	**Unit Price**	**Total Cost**
1	Mobilization/Demobilization	LS	1.0	$ 100,000	$100,000
2	Traffic Control	LS	1.0	$ 85,000	$85,000
3	Traffic Protection System	LS	1	$ 30,000	$30,000
4	Erosion and Sediment Control	LS	1.0	$ 30,000	$30,000
5	Sealing Joints in Asphalt	m	30.0	$ 250	$7,500
6	Granular A	t	26	$ 80	$2,080
7	Earth Excavation for Structure	m^3	37	$ 50	$1,850
8	Concrete in Deck - Deck	LS/m^3	180.0	$ 3,199	$575,820
9	Concrete in Deck - New Curbs	LS/m^3	5.0	$ 3,200	$16,000
10	Concrete in Deck - Approach Slabs	LS/m^3	45.0	$ 1,500	$67,500
11	Concrete in Deck - Semi-Integral Deck Extension	LS/m^3	32	$ 3,850	$123,200
12	Concrete in Approach Slabs - Sleeper Slabs	LS/m^3	17	$ 2,500	$42,500
13	Concrete in Approach Slabs - Expansion Joints	LS/m^3	9	$ 2,500	$22,500
14	New Subdrains for Sleeper Slabs	m	100	$ 35	$3,500
15	Reinforcing Steel Bar	LS/T	16	$ 2,500	$ 40,000
16	Stainless Steel Reinforcing Bar	LS/T	8	$ 12,000	$ 96,000
17	Mechanical Connectors	LS/T	158	$ 50	$ 7,900
18	Stainless Steel Mechanical Connectors	each	158	$ 100	$ 15,800
19	Fabrication of Steel - New TL-4 Barriers	LS/T	10.0	$ 5,000	$50,000
20	Delivery of Steel - New TL-4 Barriers	LS/T	10.0	$ 250	$2,500
21	Erection of Steel - New TL-4 Barriers	LS/T	10.0	$ 2,000	$20,000
22	Fabrication of Steel - New Diaphragms and Stiffeners	LS/T	2.0	$ 5,000	$10,000
23	Delivery of Steel - New Diaphragms and Stiffeners	LS/T	2.0	$ 250	$500
24	Erection of Steel - New Diaphragms and Stiffeners	LS/T	2.0	$ 2,000	$4,000
25	Coating Existing Structural Steel - Girders, Intermediate Diaphragms and Floor Beams	LS/m^2	730.0	$ 200	$146,000
26	Coating New Structural Steel	LS/m^2	37.0	$ 200	$7,400
27	Environmental Protection During Coating of Structural Steel and Railing System(s)	LS/m^2	800.0	$ 150	$120,000
28	Lead Abatement and Removals	LS/m^2	225.0	$ 200	$45,000
29	Embedded Work in Structure (Utility)	LS/m	56.0	$ 100	$5,600
30	Form and Fill Grooves	m	29.0	$ 50	$1,450
32	Bearings	Each	18.0	$ 3,000	$54,000
33	Access to Work Area, Work Platform and Scaffolding	LS	1.0	$ 60,000	$60,000
34	Concrete Removal - Partial Depth - Type A	m^3	6.0	$ 4,000	$24,000
35	Concrete Removal - Partial Depth - Type B	m^3	1.0	$ 14,000	$14,000
36	Concrete Removal - Partial Depth - Type C	m^3	4.0	$ 9,000	$36,000
37	Concrete Removal (Full Depth) - Removal of Existing Concrete Deck	LS/cum	126	$ 1,500	$ 189,000
38	Concrete Removal (Full Depth) - Removal of Existing Concrete Curbs on Approach Slab	LS/cum	9	$ 1,500	$ 13,500
39	Concrete Removal (Full Depth) - Removal of Existing Approach Slabs	LS/cum	43	$ 1,500	$ 64,500
40	Concrete Removal (Full Depth) - Removal of Existing Approach Span	LS/cum	4	$ 1,500	$ 6,000
41	Concrete Removal - Deck Joint Assemblies	LS/m^3	7.0	$ 4,500	$31,500
42	Abrasive Blast Cleaning of Reinforcing Steel	m^2	35.0	$ 100	$3,500
43	Concrete Patches, Form and Pump	m^3	5.0	$ 14,000	$70,000
44	Crack Injection	m	36.0	$ 250	$9,000
45	Dowels into Concrete	each	80.0	$ 50	$4,000
46	Jacking of Superstructure	LS	1.0	$ 80,000	$80,000
47	Shear Connectors - Type A	each	1430	$ 30	$ 42,900
48	Structural Steel Removals - Removal of Existing Diaphragms	LS/t	1.2	$ 1,000	$1,200
49	Structural Steel Removals - Removal of Existing Stiffeners	LS/t	0.7	$ 1,000	$700
50	Structural Steel Removals - Removal of Existing Metal Barriers	LS/t	0.8	$ 1,000	$800
51	Structural Steel Removals - Removal of Existing Steel Curb Plates	LS/t	9	$ 1,000	$9,000
				Subtotal	**$2,293,200**
			Contingency	**30%**	**$687,960**
				Total	**$2,981,160**

Treatment 3 - Replace Expansion Joint Seals					
Item	Description	Unit	Est Qty	Unit Price	Total Cost
1	Traffic Control	LS	1.0	$10,000.00	$10,000.00
2	Mobilization/Demobilization	LS	1.0	$5,000.00	$5,000.00
3	Removal of Expansion Joint Seals	LS	1.0	$2,000.00	$2,000.00
4	Replacement of Expansion Joint Seals	m	60.0	$1,700.00	$102,000.00
				Subtotal	$119,000.00
			Contingency	30%	$35,700
				Total	$154,700

Treatment 4 - Replace Expansion Joint Seals, recoat/seal paint as needed					
Item	**Description**	**Unit**	**Est Qty**	**Unit Price**	**Total Cost**
1	Traffic Control	LS	1.0	$10,000.00	$10,000.00
2	Mobilization/Demobilization	LS	1.0	$5,000.00	$5,000.00
3	Removal of Expansion Joint Seals	LS	1.0	$2,000.00	$2,000.00
4	Replacement of Expansion Joint Seals	m	60.0	$1,700.00	$102,000.00
5	Coating Structural Steel	LS	1.0	$15,000.00	$15,000.00
6	Environmental Protection During Coating of Structural Steel	LS	1.0	$ 50,000.00	$ 50,000.00
7	Access to Work Area, Work Platform and Scaffolding	LS	1.0	$ 20,000.00	$ 20,000.00
				Subtotal	**$ 204,000.00**
		Contingency		**30%**	**$ 61,200.00**
				Total	**$ 265,200.00**

Treatment 5- Replace Expansion Joint Assembly, Scarify Deck and Place Overlay					
Item	Description	Unit	Est Qty	Unit Price	Total Cost
1	Mobilization/Demobilization	LS	1.0	$50,000.00	$50,000.00
2	Traffic Control	LS	1.0	$85,000.00	$85,000.00
3	Erosion and Sediment Control	LS	1.0	$30,000.00	$30,000.00
4	Concrete in Deck - Overlay	LS/m^3	40.0	$2,500.00	$100,000.00
5	Deck Joint Assemblies, Removal and Re-Installation	LS/m	60.0	$3,400.00	$204,000.00
6	Scarify Concrete Deck	LS/sqm	50.0	$500.00	$25,000.00
				Subtotal	$444,000
		Contingency		30%	$133,200
				Total	$577,200

Treatment 6 - Recoat/seal paint as needed					
Item	**Description**	**Unit**	**Est Qty**	**Unit Price**	**Total Cost**
1	Mobilization/Demobilization	LS	1.0	$5,000.00	$5,000.00
2	Coating Structural Steel	LS	1.0	$5,000.00	$5,000.00
3	Environmental Protection During Coating of Structural Steel	LS	1.0	$20,000.00	$20,000.00
4	Access to Work Area, Work Platform and Scaffolding	LS	1.0	$20,000.00	$20,000.00
				Subtotal	**$50,000.00**
		Contingency		**30%**	**$ 15,000.00**
				Total	**$ 65,000.00**

Treatment 7- Scarify Deck and Place Overlay					
Item	Description	Unit	Est Qty	Unit Price	Total Cost
1	Mobilization/Demobilization	LS	1.0	$50,000.00	$50,000.00
2	Traffic Control	LS	1.0	$85,000.00	$85,000.00
3	Erosion and Sediment Control	LS	1.0	$30,000.00	$30,000.00
4	Concrete in Deck - Overlay	LS/m^3	40.0	$2,500.00	$100,000.00
6	Scarify Concrete Deck	LS/sqm	50.0	$500.00	$25,000.00
				Subtotal	$240,000
		Contingency		30%	$72,000
				Total	$312,000

Appendix E

Lift Span Estimates

Life Cycle Cost Analysis Lift Span

P =		*Estimated Capital Cost*
Ci = P * (1+i)^n		*Future Capital Cost Based on Present Construction Estimate*
Pr = P/(1+r)^n		*Present Capital Cost*
i =	2.00% %	*Inflation*
r =	4.00% %	*Discount Rate*

Alternative 1 - Crimped I Bar Open Steel Grid Deck

Year	Number of Years	Estimated Capital Cost, P	Future Capital Cost, Ci	Present Capital Cost, Pr	Treatment
2021	1	$ 7,534,772	$ 7,685,467	$ 7,389,872	Treatment 1- Crimped I Bar Open Steel Grid Deck
2041	20	$ 1,341,600	$ 1,993,547	$ 909,829	Treatment 6- Recoat/Seal Coating As needed
2051	30	$ 87,360	$ 158,241	$ 48,789	Treatment 7- Misc Deck Repairs
2071	50	$ (29,120)	$ (78,379)	$ (11,029)	Salvage value at 50 years
			Total	$ 8,337,461	

Alternative 2 - Rivetted Deck Grating

Year	Number of Years	Estimated Capital Cost, P	Future Capital Cost, Ci	Present Capital Cost, Pr	Treatment
2021	1	$ 7,833,319	$ 7,989,985	$ 7,682,678	Treatment 2- Rivetted Open Steel Grid Deck
2041	20	$ 1,341,600	$ 1,993,547	$ 909,829	Treatment 6- Recoat/Seal Coating As needed
2051	30	$ 87,360	$ 158,241	$ 48,789	Treatment 7- Misc Deck Repairs
2071	50	$ (29,120)	$ (78,379)	$ (11,029)	Salvage value at 50 years
			Total	$ 8,630,267	

Alternative 3 - Aluminum Deck System

Year	Number of Years	Estimated Capital Cost, P	Future Capital Cost, Ci	Present Capital Cost, Pr	Treatment
2021	1	$ 13,197,817	$ 13,461,773	$ 12,944,012	Treatment 3- Aluminum Deck System
NA	2-49	$ 312,000	$ 536,636	$ 78,532	Treatment 8- Clean Deck, Clear Drains
2031	10	$ 340,600	$ 415,189	$ 280,487	Treatment 9 - Replace Seals
2036	15	$ 283,894	$ 382,084	$ 212,158	Treatment 10 - Maintain Wearing Surface
2041	20	$ 665,600	$ 989,047	$ 451,388	Treatment 11 - Replace Seals, Recoat Steel Coatings
2051	30	$ 611,494	$ 1,107,637	$ 341,505	Treatment 12 - Maintain Wearing Surface/ Replace Seals
2061	40	$ 665,600	$ 1,469,671	$ 306,116	Treatment 11 - Replace Seals, Recoat Steel Coatings
2071	50	$ (209,300)	$ (563,349)	$ (79,270)	Salvage value at 50 years
			Total	$ 14,534,928	

Life Cycle Cost Analysis Lift Span

Alternative 4 - Half Filled Grid Deck

	Year	Number of Years	Estimated Capital Cost, P	Future Capital Cost, Ci	Present Capital Cost, Pr	Treatment
	2021	1	$ 9,516,691	$ 9,707,025	$ 9,333,678	Treatment 4- Half Filled Grating System
NA		2-49	$ 312,000	$ 536,636	$ 78,532	Treatment 8- Clean Deck, Clear Drains
	2036	15	$ 283,894	$ 382,084	$ 212,158	Treatment 10 - Maintain Wearing Surface
	2041	20	$ 547,300	$ 813,259	$ 371,161	Treatment 13- Recoat/Seal Coating As needed under solid dec
	2051	30	$ 283,894	$ 514,235	$ 158,548	Treatment 10 - Maintain Wearing Surface
	2061	40	$ 547,300	$ 1,208,460	$ 251,709	Treatment 13- Recoat/Seal Coating As needed under solid dec
	2066	45	$ 283,894	$ 692,092	$ 118,485	Treatment 10 - Maintain Wearing Surface
	2071	50	$ (189,263)	$ (509,417)	$ (71,681)	Salvage value at 50 years
				Total	$ 10,452,589	

Alternative 5 -Orthotropic Steel Deck

	Year	Number of Years	Estimated Capital Cost, P	Future Capital Cost, Ci	Present Capital Cost, Pr	Treatment
	2021	1	$ 12,756,836	$ 13,011,973	$ 12,511,512	Treatment 5 - Orthotropic Steel Deck
NA		2-49	$ 312,000	$ 536,636	$ 78,532	Treatment 8- Clean Deck, Clear Drains
	2036	15	$ 283,894	$ 382,084	$ 212,158	Treatment 10 - Maintain Wearing Surface
	2041	20	$ 547,300	$ 813,259	$ 371,161	Treatment 13- Recoat/Seal Coating As needed under solid dec
	2051	30	$ 283,894	$ 514,235	$ 158,548	Treatment 10 - Maintain Wearing Surface
	2061	40	$ 547,300	$ 1,208,460	$ 251,709	Treatment 13- Recoat/Seal Coating As needed under solid dec
	2066	45	$ 283,894	$ 692,092	$ 118,485	Treatment 10 - Maintain Wearing Surface
	2071	50	$ (189,263)	$ (509,417)	$ (71,681)	Salvage value at 50 years
				Total	$ 13,630,423	

Sensitivity Analysis

Alternative 1 - Crimped I Bar Open Steel Grid Deck

			PV (For Discount Rates)				
Activity	n	Capital Cost	2%	3%	4%	5%	6%
Treatment 1- Crimped I Bar Open Steel Grid Deck	1	$ 7,534,771.72	$ 7,387,031.10	$ 7,315,312.35	$ 7,244,972.81	$ 7,175,973.06	$ 7,108,275.21
Treatment 6- Recoat/Seal Coating As needed	20	$ 1,341,600.00	$ 902,858.34	$ 742,811.39	$ 612,288.73	$ 505,634.93	$ 418,317.22
Treatment 7- Misc Deck Repairs	30	$ 87,360.00	$ 48,228.91	$ 35,991.16	$ 26,934.72	$ 20,213.13	$ 15,210.26
Salvage value at 50 years	50	-$ 29,120.00	-$ 10,818.89	-$ 6,642.48	-$ 4,097.55	-$ 2,539.37	-$ 1,580.88
		Total PV	$ 8,327,299.46	$ 8,087,472.42	$ 7,880,098.70	$ 7,699,281.76	$ 7,540,221.81

Alternative 2 - Rivetted Deck Grating

			PV (For Discount Rates)				
Activity	n	Capital Cost	2%	3%	4%	5%	6%
Treatment 2- Rivetted Open Steel Grid Deck	1	$ 7,833,319.00	$ 7,679,724.51	$ 7,605,164.08	$ 7,532,037.50	$ 7,460,303.81	$ 7,389,923.58
Treatment 6- Recoat/Seal Coating As needed	20	$ 1,341,600.00	$ 902,858.34	$ 742,811.39	$ 612,288.73	$ 505,634.93	$ 418,317.22
Treatment 7- Misc Deck Repairs	30	$ 87,360.00	$ 48,228.91	$ 35,991.16	$ 26,934.72	$ 20,213.13	$ 15,210.26
Salvage value at 50 years	50	-$ 29,120.00	-$ 10,818.89	-$ 6,642.48	-$ 4,097.55	-$ 2,539.37	-$ 1,580.88
		Total PV	$ 8,619,992.87	$ 8,377,324.15	$ 8,167,163.39	$ 7,983,612.50	$ 7,821,870.19

Alternative 3 - Aluminum Deck System

			PV (For Discount Rates)				
Activity	n	Capital Cost	2%	3%	4%	5%	6%
Treatment 3- Aluminum Deck System	1	$ 13,197,816.58	$ 12,939,035.87	$ 12,813,414.16	$ 12,690,208.25	$ 12,569,349.13	$ 12,450,770.36
Treatment 8- Clean Deck, Clear Drains	2-49	$ 312,000.00	$ 118,235	$ 73,304	$ 45,658	$ 28,568	$ 17,954
Treatment 9 - Replace Seals	10	$ 340,600.00	$ 279,410.63	$ 253,438.39	$ 230,097.16	$ 209,098.85	$ 190,189.26
Treatment 10 - Maintain Wearing Surface	15	$ 283,894.00	$ 210,937.42	$ 182,220.76	$ 157,636.26	$ 136,557.87	$ 118,459.05
Treatment 11 - Replace Seals, Recoat Steel Coatings	20	$ 665,600.00	$ 447,929.72	$ 368,526.58	$ 303,771.15	$ 250,857.64	$ 207,537.23
Treatment 12 - Maintain Wearing Surface/ Replace Seals	30	$ 611,494.00	$ 337,588.04	$ 251,927.43	$ 188,535.02	$ 141,485.92	$ 106,467.30
Treatment 11 - Replace Seals, Recoat Steel Coatings	40	$ 665,600.00	$ 301,443.86	$ 204,044.23	$ 138,637.19	$ 94,545.61	$ 64,711.09
Salvage value at 50 years	50	-$ 209,300.00	-$ 77,760.79	-$ 47,742.81	-$ 29,451.15	-$ 18,251.74	-$ 11,362.55
		Total PV	$ 14,556,819.78	$ 14,099,133.23	$ 13,725,092.30	$ 13,412,211.22	$ 13,144,725.98

Sensitivity Analysis

Alternative 4 - Half Filled Grid Deck

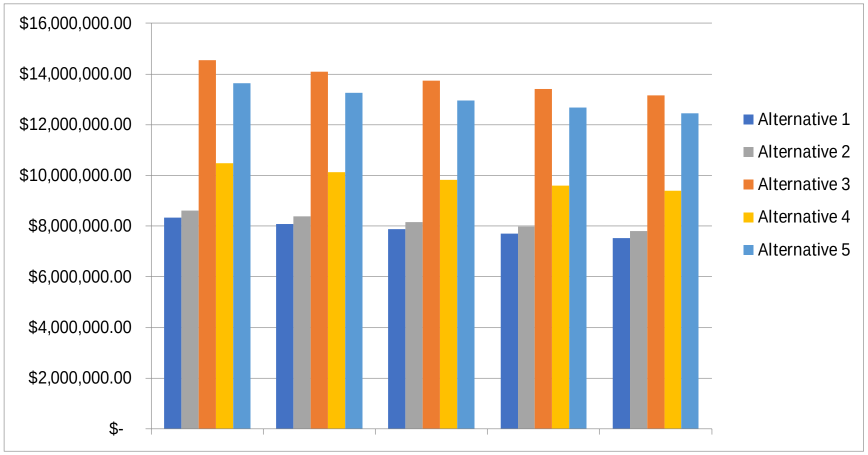
Activity	n	Capital Cost	PV (For Discount Rates) 2%	3%	4%	5%	6%
Treatment 4- Half Filled Grating System	1	$ 9,516,690.86	$ 9,330,089.08	$ 9,239,505.69	$ 9,150,664.29	$ 9,063,515.11	$ 8,978,010.25
Treatment 8- Clean Deck, Clear Drains	2-49	$ 312,000.00	$ 118,235	$ 73,304	$ 45,658	$ 28,568	$ 17,954
Treatment 10 - Maintain Wearing Surface	15	$ 283,894.00	$ 210,937.42	$ 182,220.76	$ 157,636.26	$ 136,557.87	$ 118,459.05
Treatment 13- Recoat/Seal Coating As needed under solid deck	20	$ 547,300.00	$ 368,317.21	$ 303,026.74	$ 249,780.58	$ 206,271.61	$ 170,650.73
Treatment 10 - Maintain Wearing Surface	30	$ 283,894.00	$ 156,729.61	$ 116,960.57	$ 87,529.82	$ 65,686.67	$ 49,428.82
Treatment 13- Recoat/Seal Coating As needed under solid deck	40	$ 547,300.00	$ 247,866.92	$ 167,778.56	$ 113,996.59	$ 77,741.60	$ 53,209.70
Treatment 10 - Maintain Wearing Surface	45	$ 283,894.00	$ 116,452.41	$ 75,072.54	$ 48,602.20	$ 31,596.41	$ 20,624.92
Salvage value at 50 years	50	-$ 189,262.67	-$ 70,316.36	-$ 43,172.15	-$ 26,631.64	-$ 16,504.41	-$ 10,274.76
		Total PV	$ 10,478,311.34	$ 10,114,697.19	$ 9,827,236.53	$ 9,593,432.80	$ 9,398,062.95

Alternative 5 -Orthotropic Steel Deck

Inflation Rate = 2%

Activity	n	Capital Cost	PV (For Discount Rates) 2%	3%	4%	5%	6%
Treatment 5 - Orthotropic Steel Deck	1	$ 12,756,835.87	$ 12,506,701.83	$ 12,385,277.54	$ 12,266,188.33	$ 12,149,367.49	$ 12,034,750.82
Treatment 8- Clean Deck, Clear Drains	2-49	$ 312,000.00	$ 118,235	$ 73,304	$ 45,658	$ 28,568	$ 17,954
Treatment 10 - Maintain Wearing Surface	15	$ 283,894.00	$ 210,937.42	$ 182,220.76	$ 157,636.26	$ 136,557.87	$ 118,459.05
Treatment 13- Recoat/Seal Coating As needed under solid deck	20	$ 547,300.00	$ 368,317.21	$ 303,026.74	$ 249,780.58	$ 206,271.61	$ 170,650.73
Treatment 10 - Maintain Wearing Surface	30	$ 283,894.00	$ 156,729.61	$ 116,960.57	$ 87,529.82	$ 65,686.67	$ 49,428.82
Treatment 13- Recoat/Seal Coating As needed under solid deck	40	$ 547,300.00	$ 247,866.92	$ 167,778.56	$ 113,996.59	$ 77,741.60	$ 53,209.70
Treatment 10 - Maintain Wearing Surface	45	$ 283,894.00	$ 116,452.41	$ 75,072.54	$ 48,602.20	$ 31,596.41	$ 20,624.92
Salvage value at 50 years	50	-$ 189,262.67	-$ 70,316.36	-$ 43,172.15	-$ 26,631.64	-$ 16,504.41	-$ 10,274.76
		Total PV	$ 13,654,924.09	$ 13,260,469.04	$ 12,942,760.57	$ 12,679,285.19	$ 12,454,803.52

Sensitivity Analysis



Treatment 1- Crimped I Bar Open Steel Grid Deck					
Item	Description	Unit	Est Qty	Unit Price	Total Cost
1	Mobilization/Demobilization	LS	1.0	$200,000	$200,000
2	Traffic Control	LS	1.0	$100,000	$100,000
3	Environmental Protection/ Temporary Access	LS	1.0	$700,000	$700,000
4	Lead Abatement and Stringer Removals	LS	1.0	$250,000	$250,000
5	Remove Existing Grating and Stringers	m^2	1610	$ 75	$120,750
6	Seal Existing Steel affected by upgrades for lead remediation	LS	1	$ 200,000	$200,000
7	Prepare Floor Beams	LS	1	$ 51,500	$51,500
8	Supply New Stringers	t	140	$ 5,670	$793,800
9	Deliver New Stringers	t	140	$ 260	$36,400
10	Install New Stringers	t	140	$ 2,060	$288,400
11	Supply Deck System	m^2	1610	$ 1,008	$1,622,078
12	Install New Grating	m^2	1610	$ 130	$209,300
13	Coating New Structural Steel	m^2	1610	$ 500	$805,000
14	Line Painting	m	575	$ 50	$28,750
15	Fabrication of Steel - New TL-2 Barriers	LS/T	40.0	$5,000	$200,000
16	Delivery of Steel - New TL-2 Barriers	LS/T	40.0	$250	$10,000
17	Erection of Steel - New TL-2 Barriers	LS/T	40.0	$2,000	$80,000
18	Counterweight Adjustment	LS	1.0	$100,000	$100,000
				Subtotal	$5,795,978
			Contingency	30%	$1,738,793
				Total	$7,534,772

Treatment 2- Rivetted Open Steel Grid Deck					
Item	Description	Unit	Est Qty	Unit Price	Total Cost
1	Mobilization/Demobilization	LS	1.0	$200,000	$200,000
2	Traffic Control	LS	1.0	$100,000	$100,000
3	Environmental Protection/ Temporary Access	LS	1.0	$700,000	$700,000
4	Lead Abatement and Stringer Removals	LS	1.0	$250,000	$250,000
5	Remove Existing Grating and Stringers	m^2	1610	$ 75	$120,750
6	Seal Existing Steel affected by upgrades for lead remediation	LS	1	$ 200,000	$200,000
7	Prepare Floor Beams	LS	1	$ 51,500	$51,500
8	Supply New Stringers	t	160	$ 5,670	$907,200
9	Deliver New Stringers	t	160	$ 260	$41,600
10	Install New Stringers	t	160	$ 2,060	$329,600
11	Supply Deck System	m^2	1610	$ 1,113	$1,791,930
12	Install New Grating	m^2	1610	$ 130	$209,300
13	Coating New Structural Steel	m^2	1610	$ 500	$805,000
14	Line Painting	m	575	$ 50	$28,750
15	Fabrication of Steel - New TL-2 Barriers	LS/T	40.0	$5,000	$200,000
16	Delivery of Steel - New TL-2 Barriers	LS/T	40.0	$250	$10,000
17	Erection of Steel - New TL-2 Barriers	LS/T	40.0	$2,000	$80,000
18	Counterweight Adjustment	LS	1.0	$100,000	$100,000
				Subtotal	$6,025,630
		Contingency		30%	$1,807,689
				Total	$7,833,319

Treatment 3- Aluminum Deck System					
Item	Description	Unit	Est Qty	Unit Price	Total Cost
1	Mobilization/Demobilization	LS	1.0	$200,000	$200,000
2	Traffic Control	LS	1.0	$100,000	$100,000
3	Environmental Protection/ Temporary Access	LS	1.0	$700,000	$700,000
4	Lead Abatement and Stringer Removals	LS	1.0	$250,000	$250,000
5	Remove Existing Grating and Stringers	m^2	1610	$ 75	$120,750
6	Seal Existing Steel affected by upgrades for lead remediation	LS	1	$ 200,000	$200,000
7	Prepare Floor Beams	LS	1	$ 51,500	$51,500
8	Supply New Stringers	t	110	$ 5,670	$623,700
9	Deliver New Stringers	t	110	$ 260	$28,600
10	Install New Stringers	t	110	$ 2,060	$226,600
11	Supply Deck System C/W Wearing Surface	m^2	1610	$ 3,862	$6,217,967
12	Install New Aluminum Deck	m^2	1610	$ 130	$209,300
13	Coating New Structural Steel	m^2	1610	$ 500	$805,000
14	Drainage System	LS	1	$ 100,000	$100,000
15	Line Painting	m	575	$ 50	$28,750
16	Fabrication of Steel - New TL-2 Barriers	LS/T	40.0	$5,000	$200,000
17	Delivery of Steel - New TL-2 Barriers	LS/T	40.0	$250	$10,000
18	Erection of Steel - New TL-2 Barriers	LS/T	40.0	$2,000	$80,000
19	Counterweight Adjustment	LS	1.0	$100,000	$100,000
				Subtotal	$10,152,167
			Contingency	30%	$3,045,650
				Total	$13,197,817

Treatment 4- Half Filled Grating System					
Item	Description	Unit	Est Qty	Unit Price	Total Cost
1	Mobilization/Demobilization	LS	1.0	$200,000	$200,000
2	Traffic Control	LS	1.0	$100,000	$100,000
3	Environmental Protection/ Temporary Access	LS	1.0	$700,000	$700,000
4	Lead Abatement and Stringer Removals	LS	1.0	$250,000	$250,000
5	Remove Existing Grating and Stringers	m^2	1610	$ 75	$120,750
6	Seal Existing Steel affected by upgrades for lead remediation	LS	1	$ 200,000	$200,000
7	Prepare Floor Beams	LS	1	$ 51,500	$51,500
8	Supply New Stringers	t	120	$ 5,670	$680,400
9	Deliver New Stringers	t	120	$ 260	$31,200
10	Install New Stringers	t	120	$ 2,060	$247,200
11	Supply Deck System C/W part depth semi-lightweight Concrete infill	m^2	1610	$ 1,174	$1,890,881
12	Install New Part Filled Concrete Grid Deck	m^2	1610	$ 130	$209,300
13	Install Wearing Surface	m^2	1610	$ 755	$1,215,550
14	Coating New Structural Steel	m^2	1610	$ 500	$805,000
15	Drainage System	LS	1	$ 100,000	$100,000
16	Line Painting	m	575	$ 50	$28,750
17	Fabrication of Steel - New TL-2 Barriers	LS/T	40.0	$5,000	$200,000
18	Delivery of Steel - New TL-2 Barriers	LS/T	40.0	$250	$10,000
19	Erection of Steel - New TL-2 Barriers	LS/T	40.0	$2,000	$80,000
18	Counterweight Adjustment	LS	1.0	$200,000	$200,000
				Subtotal	$7,320,531
			Contingency	30%	$2,196,159
				Total	$9,516,691

Treatment 5 - Orthotropic Steel Deck					
Item	Description	Unit	Est Qty	Unit Price	Total Cost
1	Mobilization/Demobilization	LS	1.0	$200,000	$200,000
2	Traffic Control	LS	1.0	$100,000	$100,000
3	Environmental Protection/ Temporary Access	LS	1.0	$700,000	$700,000
4	Lead Abatement and Stringer Removals	LS	1.0	$250,000	$250,000
5	Remove Existing Grating and Stringers	m^2	1610	$ 75	$120,750
6	Seal Existing Steel affected by upgrades for lead remediation	LS	1	$ 200,000	$200,000
7	Prepare Floor Beams	LS	1	$ 51,500	$51,500
11	Supply Deck System C/W stringers and wearing surface	m^2	1610	$ 3,442	$5,542,101
12	Install New Part Filled Concrete Grid Deck	m^2	1610	$ 130	$209,300
13	Install Wearing Surface	m^2	1610	$ 755	$1,215,550
14	Coating New Structural Steel	m^2	1610	$ 500	$805,000
15	Drainage System	LS	1	$ 100,000	$100,000
16	Line Painting	m	575	$ 50	$28,750
17	Fabrication of Steel - New TL-2 Barriers	LS/T	40.0	$5,000	$200,000
18	Delivery of Steel - New TL-2 Barriers	LS/T	40.0	$250	$10,000
19	Erection of Steel - New TL-2 Barriers	LS/T	40.0	$2,000	$80,000
18	Counterweight Adjustment	LS	1.0	$200,000	$200,000
				Subtotal	$9,812,951
			Contingency	30%	$2,943,885
				Total	$12,756,836

Treatment 6- Recoat/Seal Coating As needed					
Item	**Description**	**Unit**	**Est Qty**	**Unit Price**	**Total Cost**
1	Mobilization/Demobilization	LS	1.0	$ 10,000	$10,000
2	Environmental Protection/ Temporary Access	LS	1.0	$700,000	$700,000
3	Clean, Seal, Paint Structural Steel	m^2	1610	$ 200	$322,000
				Subtotal	**$1,032,000**
		Contingency		**30%**	**$309,600**
				Total	**$1,341,600**

Treatment 7- Misc Deck Repairs					
Item	**Description**	**Unit**	**Est Qty**	**Unit Price**	**Total Cost**
1	Mobilization/Demobilization	LS	1.0	$ 5,000	$5,000
2	Traffic Control	LS	1.0	$30,000	$30,000
3	Deck Repairs	m^2	1610	$ 20	$32,200
				Subtotal	**$67,200**
			Contingency	**30%**	**$20,160**
				Total	**$87,360**

Treatment 8- Clean Deck, Clear Drains					
Item	**Description**	**Unit**	**Est Qty**	**Unit Price**	**Total Cost**
1	Clear Drains, Clean Deck	LS	1	$ 5,000	$5,000
				Subtotal	**$5,000**
			Contingency	**30%**	**$1,500**
				Total	**$6,500**

Treatment 9 - Replace Seals

Item	Description	Unit	Est Qty	Unit Price	Total Cost
1	Traffic Control	LS	1	$ 10,000.00	$ 10,000.00
2	Mobilization/Demobilization	LS	1	$ 5,000.00	$ 5,000.00
3	Removal of Joint Seals	LS	1	$ 2,000.00	$ 2,000.00
4	Replacement of Joint Seals	m	490	$ 500.00	$ 245,000.00
				Subtotal	$262,000
			Contingency	30%	$78,600
				Total	$340,600

Treatment 10 - Maintain Wearing Surface

Item	Description	Unit	Est Qty	Unit Price	Total Cost
1	Traffic Control	LS	1	$ 5,000.00	$ 5,000.00
2	Mobilization/Demobilization	LS	1	$ 5,000.00	$ 5,000.00
3	Reapply Wearing Surface as Needed	m^2	276	$ 755	$ 208,380.00
				Subtotal	$218,380
			Contingency	30%	$65,514
				Total	$283,894

Treatment 11 - Replace Seals, Recoat Steel Coatings

Item	Description	Unit	Est Qty	Unit Price	Total Cost
1	Traffic Control	LS	1	$ 10,000.00	$ 10,000.00
2	Mobilization/Demobilization	LS	1	$ 5,000.00	$ 5,000.00
3	Environmental Protection/ Temporary Access *	LS	1.0	$250,000	$250,000
4	Removal of Joint Seals	LS	1	$ 2,000.00	$ 2,000.00
5	Replacement of Joint Seals	m	490	$ 500.00	$ 245,000.00
6	Clean, Seal, Paint Structural Steel	m^2	1610	$ 100	$161,000
				Subtotal	$512,000
			Contingency	30%	$153,600
				Total	$665,600

* Assumed work required is limited to joints and deck edges

Treatment 12 - Maintain Wearing Surface/ Replace Seals

Item	Description	Unit	Est Qty	Unit Price	Total Cost
1	Traffic Control	LS	1	$ 10,000.00	$ 10,000.00
2	Mobilization/Demobilization	LS	1	$ 5,000.00	$ 5,000.00
3	Removal of Joint Seals	LS	1	$ 2,000.00	$ 2,000.00
4	Replacement of Joint Seals	m	490	$ 500.00	$ 245,000.00
5	Reapply Wearing Surface as Needed	m^2	276	$ 755	$ 208,380.00
				Subtotal	$470,380
			Contingency	30%	$141,114
				Total	$611,494

Treatment 13- Recoat/Seal Coating As needed under solid deck					
Item	**Description**	**Unit**	**Est Qty**	**Unit Price**	**Total Cost**
1	Mobilization/Demobilization	LS	1.0	$ 10,000	$10,000
2	Environmental Protection/ Temporary Access*	LS	1.0	$250,000	$250,000
3	Clean, Seal, Paint Structural Steel	m^2	1610	$ 100	$161,000
				Subtotal	**$421,000**
		Contingency		**30%**	**$126,300**
				Total	**$547,300**

* Assumed work is limited to joints and deck edges

Appendix F

Calculations and Models

Exhibit B.1

Loads

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	JC	DATE	30-Nov-20
CHECKED BY	JQ	DATE	18-Dec-20

1.0 Tower Loads

1.1 Dead Loads

			Bridge Weight						
		#	**DIA**	**Length**	**γ_s (kN/m3)**	**P (kN)**	**w (kN/m)**		
Counterweight cables		10			77				
			Motor						
		Width (m)	**Length (m)**	**Height (m)**	**γ_s (kN/m3)**	**P (kN)**	**w (kN/m)**		
Gearbox Pedestal						25.11			
Gearbox		0.90	1.87	1.04	77.00	134.28	71.88		
Brake		0.21		0.48	77.00	2.96			
Motor Pedestal			1.50			9.79	6.53	1.63	(divided over 4 channel sections)
Motor		0.61	1.07	0.66	77.00	33.11	31.00	7.75	(divided over 4 channel sections)
Motor Brake		0.21		0.38	77.00	1.84			
			Wall Panels						
		Height (m)	**Thickness (m)**		**γ (kN/m3)**	**P (kPa)**	**w (kN/m)**		
22ga. Liner Panels						0.09			
22ga. HF Siding Panels						0.09			
2" Mineral Wool Insulation			0.05		0.69	0.03			
Panels around elevator		4.38				0.09	0.39		
			Trib Height (m)	**Area**	**γ (kN/m3)**	**P (kPa)**	**w (kN/m)**		
Machine Room Horizontal Frames	**Bottom**		0.66			0.21	0.14		
	A		1.18			0.21	0.25		
	B		1.16			0.21	0.25		
	C		1.17			0.21	0.25		
	Top		0.53			0.21	0.11		
Penthouse Horizontal Frames	**Bottom**		0.74			0.21	0.16		
	Middle		1.07			0.21	0.23		
	Top		0.61			0.21	0.13		

		5" Concrete Slab				1/2" Chkd Plate Floor				Occupancy Live Load	
	Width (m)	Height (m)	Area (m2)	γ_c (kN/m3)	w (kN/m)	Height (m)	Area (m2)	γ_s (kN/m3)	w (kN/m)	P (kPa)	w (kN/m)
A64	0.61	0.13	0.08	24.00	1.86	0.01	0.01	77.00	0.60	3.60	2.19
A65	0.77	0.13	0.10	24.00	2.36	0.01	0.01	77.00	0.76	3.60	2.79
A30	1.06	0.13	0.13	24.00	3.23	0.01	0.01	77.00	1.04	3.60	3.82
A36	1.11	0.13	0.14	24.00	3.39	0.01	0.01	77.00	1.09	3.60	4.00
B36	1.11	0.13	0.14	24.00	3.39	0.01	0.01	77.00	1.09	3.60	4.00
A41 (Slab)	2.29	0.13	0.29	24.00	6.97					3.60	8.23
A41, B41 (Chkd Pl)	1.21					0.01	0.02	77.00	1.19		
G82, H82	1.07					0.01	0.01	77.00	1.05		
F53, G53, F53	1.07					0.01	0.01	77.00	1.05		
A82	3.21	0.13	0.41	24.00	9.79					3.60	11.57
A82 (beside hatch)	1.61	0.13	0.20	24.00	4.90					3.60	5.78
B41	2.29	0.13	0.29	24.00	6.97					3.60	8.23
B41 (beside hatch)	0.68	0.13	0.09	24.00	2.07					3.60	2.45
D36	1.11	0.13	0.14	24.00	3.39	0.01	0.01	77.00	1.09	3.60	4.00
C36	1.11	0.13	0.14	24.00	3.39	0.01	0.01	77.00	1.09	3.60	4.00
C36 (beside access)	0.43	0.13	0.05	24.00	1.32					3.60	1.55
B30	1.06	0.13	0.13	24.00	3.23	0.01	0.01	77.00	1.04	3.60	3.82
B30 (beside access)	0.38	0.13	0.05	24.00	1.16					3.60	1.37
B65	0.77	0.13	0.10	24.00	2.36	0.01	0.01	77.00	0.76	3.60	2.79
B64	0.61	0.13	0.08	24.00	1.86	0.01	0.01	77.00	0.60	3.60	2.19
Penthouse (per beam)	1.07					0.01	0.01	77.00	1.04	3.60	3.84
Access Platform around Sheave not											

Note: detailed calculations for tower control room around sheaves not considered at this stage

Wind Load - Vertical

q_{50} (Pa)	530.00
C_g	2.00
C_e	1.42
C_v	1.00
F_v (Pa)	1508.67

Wind Loads on Truss in N-S/S-N Direction

h (m)	46.89
X (m)	9.69
X/h	0.21
A_s (m2)	270.26
Columns (m2)	*75.05*
Bracing (m2)	*57.73*
Struts (m2)	*72.70*
Elevator Shaft (m2)	*64.79*
A (m2)	783.12
A_s/A	0.35
K_x	0.48

Wind Load on Windward Truss						**Wind Load on Elevator Shaft Vertical Members**		**Wind Load on Leeward Truss**		
Height (m)	**q_{50} (Pa)**	**C_g**	**C_e**	**C_h**	**$F_{h,\ windward}$ (Pa)**	**Trib Width (m)**	**$F_{h,\ elevator\ shaft}$ (kN/m)**	**K_x**	**$F_{h,\ leeward}$ (Pa)**	
10.00	530.00	2.00	1.00	2.00	2120.00	1.14	2.42	0.48	1015.08	U/S A61
11.81	530.00	2.00	1.03	2.00	2191.88	1.14	2.51	0.48	1049.50	A61
20.58	530.00	2.00	1.16	2.00	2449.29	1.14	2.80	0.48	1172.75	D47
29.35	530.00	2.00	1.24	2.00	2629.46	1.14	3.01	0.48	1259.01	B54
38.12	530.00	2.00	1.31	2.00	2770.59	1.14	3.17	0.48	1326.59	C47
46.89	530.00	2.00	1.36	2.00	2887.72	1.14	3.30	0.48	1382.67	B50
51.57	530.00	2.00	1.39	2.00	2943.19	1.14	3.36	0.48	1409.23	U/S of Sheave Girders
52.64	530.00	2.00	1.39	2.00	2955.26	1.14	3.38	0.48	1415.01	CL of Sheave Girders
53.71	530.00	2.00	1.40	2.00	2967.15	1.14	3.39	0.48	1420.70	Top of Sheave Girders
Wind Load on Counterweight Girder										
Height (m)	**q_{50} (Pa)**	**C_g**	**C_e**	**C_h**	**F_h (Pa)**	**Width (m)**	**Height (m)**	**Load (kN)**	**Per Node (kN)**	
45.26	530.00	2.00	1.35	2.00	2867.33	14.15	6.46	262.23	131.12	

Wind Loads on Truss in E-W/W-E Direction

h (m)	51.57
X (m)	15.90
X/h	0.31
A_s (m2)	256.64
Columns (m2)	83.83
Bracing (m2)	88.56
Struts (m2)	29.54
Elevator Shaft (m2)	54.70
A (m2)	541.65
A_s/A	0.47
K_x	0.24

Wind Load on Windward Truss						Wind Load on Elevator Shaft Vertical Members		Wind Load on Leeward Truss	
Height (m)	q_{50} (Pa)	C_g	C_e	C_h	$F_{h,\ windward}$ (Pa)	Trib Width (m)	$F_{h,\ elevator\ shaft}$ (kN/m)	K_x	$F_{h,\ leeward}$ (Pa)
10.00	530.00	2.00	1.00	2.00	2120.00	1.49	3.15	0.24	508.31
11.81	530.00	2.00	1.03	2.00	2191.88	1.49	3.26	0.24	525.55
20.58	530.00	2.00	1.16	2.00	2449.29	1.49	3.64	0.24	587.26
29.35	530.00	2.00	1.24	2.00	2629.46	1.49	3.91	0.24	630.46
38.12	530.00	2.00	1.31	2.00	2770.59	1.49	4.12	0.24	664.30
46.89	530.00	2.00	1.36	2.00	2887.72	1.49	4.29	0.24	692.39
48.96	530.00	2.00	1.37	2.00	2912.72	1.49	4.33	0.24	698.38
50.34	530.00	2.00	1.38	2.00	2928.99	1.49	4.35	0.24	702.28
51.57	530.00	2.00	1.39	2.00	2943.19	1.49	4.37	0.24	705.69
52.64	530.00	2.00	1.39	2.00	2955.26	1.49	4.39	0.24	708.58
53.71	530.00	2.00	1.40	2.00	2967.15	1.49	4.41	0.24	711.43
Wind Load on Counterweight Girder									
Height (m)	q_{50} (Pa)	C_g	C_e	C_h	F_h (Pa)	Width (m)	Height (m)	Load (kN)	
45.26	530.00	2.00	1.35	2.00	2867.33	4.29	6.46	79.56	

Wind Loads on Machine House and Penthouse

N-S/S-N Direction									
Wind Pressure						Wind Load on Columns			
Height (m)	q_{50} (Pa)	C_g	C_e	C_h	$F_{h, windward}$ (Pa)	Trib Width (kN/m)	$F_{h, exterior}$ (kN/m)	Trib Width (m)	$F_{h, interior}$ (kN/m)
53.71	530.00	2.00	1.40	2.00	2967.15	3.31	9.84	5.25	15.56
55.02	530.00	2.00	1.41	2.00	2981.50	3.31	9.88	5.25	15.64
56.07	530.00	2.00	1.41	2.00	2992.80	3.31	9.92	5.25	15.70
57.34	530.00	2.00	1.42	2.00	3006.24	3.31	9.96	5.25	15.77
58.40	530.00	2.00	1.42	2.00	3017.34	3.31	10.00	5.25	15.83
58.40	530.00	2.00	1.42	2.00	3017.34	1.07	3.22		
58.68	530.00	2.00	1.42	2.00	3020.16	1.07	3.22		
59.60	530.00	2.00	1.43	2.00	3029.64	1.07	3.23		
60.82	530.00	2.00	1.43	2.00	3041.90	1.07	3.25		

E-W Direction											
Wind Pressure						Wind Load on Columns					
Height (m)	q_{50} (Pa)	C_g	C_e	C_h	$F_{h, windward}$ (Pa)	Trib Width (m)	$F_{h, rear\ exterior}$ (kN/m)	Trib Width (m)	$F_{h, interior}$ (kN/m)	Trib Width (m)	$F_{h, front\ exterior}$ (kN/m)
53.71	530.00	2.00	1.40	2.00	2967.15	3.34	9.91	5.09	15.11	2.39	7.09
55.02	530.00	2.00	1.41	2.00	2981.50	3.34	9.96	5.09	15.18	2.39	7.13
56.07	530.00	2.00	1.41	2.00	2992.80	3.34	10.00	5.09	15.24	2.39	7.16
57.34	530.00	2.00	1.42	2.00	3006.24	3.34	10.04	5.09	15.31	2.39	7.19
58.40	530.00	2.00	1.42	2.00	3017.34	3.34	10.08	5.09	15.37	2.39	7.21
58.40	530.00	2.00	1.42	2.00	3017.34	0.86	2.61	1.59	4.79	0.90	2.72
58.68	530.00	2.00	1.42	2.00	3020.16	0.86	2.61	1.59	4.79	0.90	2.72
59.60	530.00	2.00	1.43	2.00	3029.64	0.86	2.62	1.59	4.81	0.90	2.73
60.82	530.00	2.00	1.43	2.00	3041.90	0.86	2.63	1.59	4.83	0.90	2.74

W-E Direction											
Wind Pressure						Wind Load on Columns					
Height (m)	q_{50} (Pa)	C_g	C_e	C_h	$F_{h, windward}$ (Pa)	Trib Width (m)	$F_{h, rear\ exterior}$ (kN/m)	Trib Width (m)	$F_{h, interior}$ (kN/m)	Trib Width (m)	$F_{h, front\ exterior}$ (kN/m)
53.71	530.00	2.00	1.40	2.00	2967.15	3.34	9.91	5.09	15.11	2.39	7.09
55.02	530.00	2.00	1.41	2.00	2981.50	3.34	9.96	5.09	15.18	2.39	7.13
56.07	530.00	2.00	1.41	2.00	2992.80	3.34	10.00	5.09	15.24	2.39	7.16
57.34	530.00	2.00	1.42	2.00	3006.24	3.34	10.04	5.09	15.31	2.39	7.19
58.40	530.00	2.00	1.42	2.00	3017.34	3.34	10.08	5.09	15.37	2.39	7.21
58.40	530.00	2.00	1.42	2.00	3017.34	1.68	5.06			1.68	5.06
58.68	530.00	2.00	1.42	2.00	3020.16	1.68	5.06			1.68	5.06
59.60	530.00	2.00	1.43	2.00	3029.64	1.68	5.08			1.68	5.08
60.82	530.00	2.00	1.43	2.00	3041.90	1.68	5.10			1.68	5.10

Exhibit **B.2**

Self-Weight of Members with Lattice

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	JC	DATE	30-Nov-20
CHECKED BY	SA	DATE	16-Dec-20

Base Weight = **77.09** kN/m^3

Member	Lattice Tie Bars										Plates					Member			Material Weight	
	L (in)	W (in)	H (in)	Spacing (in)	L (mm)	W (mm)	H (mm)	Spacing (mm)	#	Total Lattice Volume in Member (mm^3)	L (mm)	W (mm)	t (mm)	#	Total Plate Volume in Member (mm^3)	L (mm)	Area in Model (mm^2)	Total Member Volume (mm^3)	Lattice + Plate Volume/ Member Volume (%)	Modified Weight (kN/m^3)
Bracing Long (A43 B43 C43 D43)	43.13	2.75	0.63	28.00	1,095.38	69.85	15.88	711.20	44	53,443,593	977.90	787.40	15.88	4	48,894,902	9,855	23,871	235,253,479	43.5%	110.63
Bracing Long (A37 B37 C37)	39.75	2.75	0.63	25.63	1,009.65	69.85	15.88	650.88	48	53,739,328	1,041.40	727.08	15.88	4	48,080,670	10,198	20,927	213,419,718	47.7%	113.87
Bracing Short (A45 B45 C45 A54)	40.50	2.75	0.63	26.13	1,028.70	69.85	15.88	663.58	16	18,251,093	1,187.45	739.78	15.88	4	55,781,310	5,180	18,992	98,378,279	75.3%	135.10
Bracing Short (ABC79)	40.50	2.75	0.63		1,028.70	69.85	15.88	0.00	56	63,878,824	835.03	739.78	15.88	4	39,225,894	11,925	21,331	254,377,382	40.5%	108.34
Bracing Short (B94 D81)	40.50	2.75	0.63		1,028.70	69.85	15.88	0.00	20	22,813,866	889.00	739.78	15.88	4	41,761,408	5,477	21,331	116,826,673	55.3%	119.70
Bracing Short (ABCD68)	40.50	2.75	0.63		1,028.70	69.85	15.88	0.00	56	63,878,824	911.23	739.78	15.88	4	42,805,444	11,481	18,992	218,042,206	48.9%	114.81
Struts Long (B54 C47)	43.13	2.75	0.63	28.00	1,095.38	69.85	15.88	711.20	72	87,453,152	1,035.05	787.40	15.88	4	51,752,396	14,973	20,927	313,352,238	44.4%	111.34
Struts Long (AA47 B47 A47)	43.25	2.75	0.63		1,098.55	69.85	15.88	0.00	72	87,706,639	1,012.83	790.58	15.88	4	50,845,347	15,037	18,992	285,577,402	48.5%	114.49
Struts Long (D47)	43.13	2.75	0.63		1,095.38	69.85	15.88	0.00	72	87,453,152	1,022.35	787.40	15.88	4	51,117,398	14,999	23,876	358,114,961	38.7%	106.92
Struts Short (C54 AC54 AD54 D54 A81 B81)	36.88	2.75	0.63	23.63	936.63	69.85	15.88	600.08	44	45,698,144	977.90	676.28	15.88	4	41,994,412	8,709	20,927	182,257,250	48.1%	114.18
B61	45.50	2.75	0.50		1,155.70	69.85	12.70	0.00	14	14,353,020	1,003.30	971.55	12.70	2	24,758,805	7,449	6,411	47,754,740	81.9%	140.23
C94	49.00	2.75	0.50		1,244.60	69.85	12.70	0.00	14	15,457,098	561.98	952.50	12.70	2	13,596,142	7,449	6,411	47,754,740	60.8%	123.99
D45	45.50	2.75	0.50		1,155.70	69.85	12.70	0.00	16	16,403,451	917.58	971.55	12.70	2	22,643,338	8,033	6,411	51,500,209	75.8%	135.54
E45	49.00	2.75	0.50		1,244.60	69.85	12.70	0.00	14	15,457,098	1,085.85	1,031.88	12.70	2	28,459,721	8,033	6,411	51,500,209	85.3%	142.83

Exhibit B.3

Lift Span Existing and Rehabilitation Calculation Summary

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	RA	DATE	30-Nov-20
CHECKED BY	KG	DATE	16-Dec-20

General Information

Material Specifications

Structural Steel (CSA G40-4 or ASTM A7) - Original Steel

F_u =	410	MPa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	MPa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***
Unit Weight =	77	kN/m^3	***[CSA S6-19 cl. 3.6, Table 3.4]***
G_s =	77000	MPa	

Material Properties: A-242-55 Steel

F_u =	480	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	350	Mpa	***[CISC 6-7, 11TH Edition, 2016]***

Structural Steel - 1982 Rehabilitation - Strength not listed on rehabilitation drawings

F_y =	300	MPa	***[CSA S6-19 cl. 14.7.4.2, Table 14.1]***
F_u =	450	MPa	***[CSA S6-19 cl. 14.7.4.2, Table 14.1]***

1.0 Load Combination for Lift Bridge - Bridge Open ***CSA S6-19 Table 3.1***

1. SLS Combination 1: Permanent loads consisting of dead loads and superimposed dead loads. Transitory loads consisting of live load (0.9 x CL 625-ONT truck).
2. ULS Combination 1: Permanent loads consisting of dead and superimposed dead loads. Transitory loads consisting of vehicular live load (1.70 x CL 625-ONT) and pedestrian live load (0.2 x 1.70 x P）.
3. ULS Combination 2: Permanent loads consisting of dead and superimposed dead loads. Transitory loads consisting of vehicular live load (1.60 x CL 625-ONT), pedestrian live load (0.2 x 1.60 x P) and temperature effects (1.15 x K).
4. ULS Combination 3: Permanent loads consisting of dead and superimposed dead loads. Transitory loads consisting of vehicular live load (1.40 x CL 625-ONT), pedestrian live load (0.8 x 1.40 x P), temperature effects (1.15 x K) and wind (0.45 x
5. ULS Combination 4: Permanent loads consisting of dead and superimposed dead loads. Transitory loads consisting of temperature effects (1.25 x K) and wind (0.45 x W).

1.1 Load Combination for Lift Bridge - Bridge Closed Counter Weight Supported ***CSA S6-19 Table 13.3, 13.4***

6. ULS Combination V4: Permanent loads consisting of dead loads and superimposed dead loads with counterweights supported. Transitory loads consisting of vehicular live load (1.70 x CL 625-ONT) and pedestrian live load (0.2 x 1.70 x P).

2.0 Bridge Weight

Steel Density = 77 kN/m3 Individual Member Weights based on Model

2.1 Existing Roadway Grating

Drawings specify exact Weight of Panels are unavaible: therefore weight of Grating Calculated by individual components

Steel Density =	77	kN/m3
Panel Width =	2330	mm
Per 95 mm		
M - Beams		
Hieght =	132	mm
Area =	1303.2	mm2
Spacing =	179.2307692	mm
Area / Metre =	7270.9	mm2
Number =	13	Bars
Pannel	2330	mm
Volume	1609414.95	mm3
C - Beam		
Hieght =	50	mm
Width =	6.35	mm
Area =	317.5	mm2
Spacing =	95	mm
Area / Metre =	3342.1	mm2
Pannel	2330	mm
Volume	739775	mm3
Supplemental Bar		
Hieght =	25	mm
Width =	6.35	mm
Area =	158.8	mm2
Spacing =	194.1666667	mm
Area / Metre =	817.6	mm2
Inter spacing =	95	mm
Number =	12	Bars
Volume =	180975	mm3
Diagonal Bar		
Hieght =	25	mm
Width =	6.35	mm
Area =	158.8	mm2
Spacing =	95	mm
Area / Metre =	1671	mm2
Number =	24	Bars
Volume =	361950	mm3
Combined Volume =	2892114.95	mm3/95mm
Combined Volume =	30443315	mm3/m
Total Weight =	1.006	KN/m

Grating Weight Per Girder

Location	Spacing (mm)	Girder #	Tributary Width (mm)	Unit Weight
Sidewalk Overhang	690			
Girder 1 - 2	1295	1	1337.5	1.346
Girder 2 - 3	1295	2	1295.0	1.303
Girder 3 - 4	1295	3	1295.0	1.303
Girder 4 - 5	1295	4	1295.0	1.303
Girder 5 - 6	1295	5	1295.0	1.303
Girder 6 - 7	1295	6	1295.0	1.303
Girder 7 - 8	1120	7	1207.5	1.215
Girder 8 - 9	1130	8	1125.0	1.132
Girder 10 - 11	1130	9	1130.0	1.137
Girder 11 - 12	1130	10	1130.0	1.137
Girder 12 - 13	1130	11	1130.0	1.137
Curb Side Overhang	685	12	1250.0	1.258

2.2 Existing Sidewalk Weight

Steel T's

Hieght =	2	in
Width =	2	in
Thickness =	0.25	in
Area =	604.84	mm2

Steel Plates Between T's

Area =	1130.3	mm2

Combined Steel Per 203 mm

Total Steel Area =	1735.138	mm2/(203.2mm)
Steel	0.66	kn/m2

Concrete

Concrete Thickness =	38.1	mm
Width =	203.2	mm
Area =	7741.92	mm2
Concrete Unit Weight =	23.5	kN/m3
Concrete =	0.90	kn/m2

Sidewalk Total Weight	1.55	kn/m2	Load Applied in Model
Area =	317	m2	
Weight =	492.8	kN	
Weight =			

Total Bridge Weight

Item	Past Weight (Tonne)	Aecom Weight (Tonne)	Difference (Tonne)
Sidewalk – Steel + Concrete	140+2.4 = 142.4	50	92.4
Total Bridge Weight	1877	**1784.6**	92.4

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	RA	DATE	30-Nov-20
CHECKED BY	KG	DATE	16-Dec-20

Grating Alternative Weights			Current		
Length of Deck =	112776	mm	Stringer	0.999	kn/m2
Width Grating =	14785	mm	Grating and Stringer	1.999	kn/m2

Option Number	Deck System	Grating and Stringer: Unit Weights	Total Deck Weight kN	Total Change kN	Total Change kg	Total Change	Total Bridge weight (tonne)
0	Existing Grating	2.00	3332	0	0	0	1785
1	Crimped I Bar	2.08	3465	133	13527	14	1798
2	Rivetted Grating	2.24	3734	401	40935	41	1826
3	Aluminum Deck	1.65	2758	-575	-58602	-59	1726
4	Fiber-Reinforced Polymer	1.69	2821	-511	-52107	-52	1733
5	Half Filled Grid	2.79	4645	1313	133856	134	1919
6	Half Filled Grid W Overlay	3.77	6289	2957	301537	302	2086
7	Exodermic	3.55	5911	2579	262996	263	2048
8	Orthotropic Steel	**2.82**	4702	1370	139666	140	1925
9	Precast Concrete	**5.96**	9935	6603	673306	673	2458

Decking Weight in Additon to the Current Stringer Loads (kN/m)

	Option #	0	1	2	3	4	5	6	7	8	9
	Tributary Width (mm)	Existing	Crimped I Bar	Rivetted Grating	Aluminum Deck	Fiber-Reinforced	Half Filled Grid	Half Filled Grid W	Exodermic	Orthotropic Steel	Precast Concrete
Girder 1	1337.5	1.34	1.44	1.66	0.88	0.93	2.39	3.71	3.41	2.44	6.63
Girder 2	1295.0	1.30	1.40	1.61	0.85	0.90	2.31	3.59	3.30	2.36	6.42
Girder 3	1295.0	1.30	1.40	1.61	0.85	0.90	2.31	3.59	3.30	2.36	6.42
Girder 4	1295.0	1.30	1.40	1.61	0.85	0.90	2.31	3.59	3.30	2.36	6.42
Girder 5	1295.0	1.30	1.40	1.61	0.85	0.90	2.31	3.59	3.30	2.36	6.42
Girder 6	1295.0	1.30	1.40	1.61	0.85	0.90	2.31	3.59	3.30	2.36	6.42
Girder 7	1207.5	1.21	1.30	1.50	0.79	0.84	2.16	3.35	3.08	2.20	5.99
Girder 8	1125.0	1.13	1.21	1.40	0.74	0.78	2.01	3.12	2.87	2.05	5.58
Girder 9	1130.0	1.13	1.22	1.40	0.74	0.78	2.02	3.13	2.88	2.06	5.60
Girder 10	1130.0	1.13	1.22	1.40	0.74	0.78	2.02	3.13	2.88	2.06	5.60
Girder 11	1130.0	1.13	1.22	1.40	0.74	0.78	2.02	3.13	2.88	2.06	5.60
Girder 12	1250.0	1.25	1.35	1.55	0.82	0.87	2.23	3.47	3.18	2.28	6.20

3.0 Applied Load

3.1 Pedestrian Load

CSA S6-19 3.8.9

Length of Bridge = 112.78 m

Pedestrian Pressure Load over Entire Span = 1.6 Kpa

3.2 Vehicular Live Load

CSA S6-19 3.8

Figure A3.4.1
CL-625-ONT truck
(See Clause A3.4.1.)

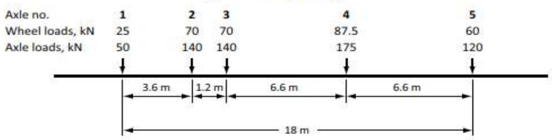
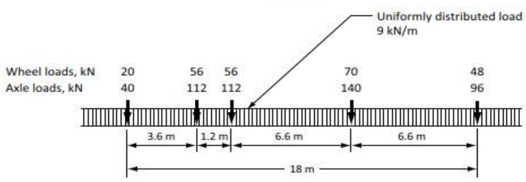


Figure A3.4.2
CL-625-ONT lane load
(See Clause A3.4.1.)



Roadway Vehicle Loads

Live Load:	CL-625-ONT (CHBDC)	DLA in accordance with CHBDC 3.8.4.5.3
	ONT Lane Load (CHBDC)	DLA in accordance with CHBDC 3.8.4.5.3

Dynamic Load Allowance

For components other than buried structures, the dynamic load allowance shall be
(a) 0.50 for deck joints;
(b) 0.40 where only one axle of the CL-W Truck is used (except for deck joints);
(c) 0.30 where any two axles of the CL-W Truck, or axles nos. 1 to 3, are used; or
(d) 0.25 where three axles of the CL-W Truck, except for axles nos. 1 to 3, or more than three axles, are used.

- Number of lanes 4

- Multi-Lane Factor

1 Lane	:	1.0
2 Lanes	:	1.0 on Track 1, 0.9 on Track 2
3 Lanes	:	1.0 on Track 1, 0.9 on Track 2, 0.8 on Track 3
4 Lanes		1.0 on Track 1, 0.9 on Track 2, 0.8 on Track 3, 0.7 on Track 4

Longitudinal Forces due to Braking Traction (LF) CHBDC Trucks

CSA S6-19 3.8.6

3.8.6 Braking force

Braking force shall be considered only at the ultimate limit states.

Braking force shall be an equivalent static force of 180 kN plus 10% of the uniformly distributed load portion of the lane load from one design lane, irrespective of the number of design lanes, but not greater than 700 kN in total.

The braking force shall be applied at the deck surface.

Breaking Force (CHBDC 3.8.6)

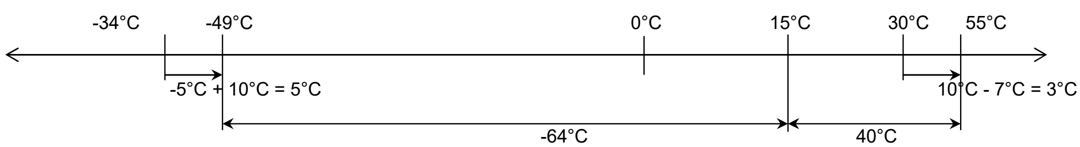
180KN +10%	Lane Load = 9 Kn/m			
10% =	36.9 kn	180+10% =	216.9 KN	5.29 kn/m

3.3 Temperature Effect (K)

CSA S6-19 3.9.4

3.3.1 Temperature Change

- Location : Burlington, ON
- Superstructure Type : A
- Construction Temperature : 15 °C
- Thermal Coefficient of Concrete : 10 x 10^{-6} / °C
- Max Effective Temperature : 25 °C above maximum mean daily temperature
  Min Effective Temperature : 15 °C below minimum mean daily temperature
- Reduction in Max Effective Temperature : 0.0 °C
  Increase in Min Effective Temperature : 0.0 °C
- Max Mean Daily Temperature : 30 °C
  Min Mean Daily Temperature : -34 °C
- Applied Max Temperature : 40 °C
  Applied Min Temperature : -64 °C
- Temperature range



3.3.2 Thermal Differential

- Height : Depth of Structure 0.7m Minimum

- Summer	Top	:	15.000 °C	For Top Chord
	Bottom	:	0.000 °C	
- Winter	Top	:	0.000 °C	
	Bottom	:	-8.000 °C	Bottom Chord

3.4 Wind Load

Pressure (Bridge Closed)	530	Pa	***n/m2***	50 Year Return Period	S6-19 Table A3.1.1
Pressure (Bridge Open)	450	Pa	***n/m2***		S6-19 CL 13.6.4
Pressure limited by windspeed	80	km/h		Reference Report Provided	

CHBDC- Commentary Annex - Design and Reference Wind Pressures Page 162

Design and reference wind pressures

Table A3.1.1 provides design hourly mean reference wind pressures associated with return periods of 10, 25, 50, and 100 years for some 600 locations across Canada. These reference pressures are hourly mean velocity pressures at the standard anemometer height of 10 m and are computed using the mean hourly wind speed estimated for that return period and a constant air density. The relationship between the reference pressure, q (in Pa), and the corresponding mean hourly wind speed, v (in km/h) is

$q = 0.05\,v^2$, Pa

Most of the reference pressures for the return period of 10 years have been taken from Chapter 1 of the *Supplement to the National Building Code of Canada* (NBC, 1990). Reference pressures for return periods of 25 and 50 years were obtained from the same source using the following interpolation procedure:

$q_{(25)} = 0.166\,q_{(10)} + 0.834\,q_{(30)}$

and

q = 320 Pa

Bridge Closed

Wind Horizontal Drag

Ce =	1.2	Hieght =	20	m	Table 3.9
Cg =	2	3.10.1.3			
Ch =	2	3.10.1.5			
q =	530	pa			
Fh =	2544	pa	Horizontal Wind Pressure Applied in the Model		

* Longitudinal Wind Force Shall Be 50% of Transverse Wind Force

Wind Vertical Pressure

Ce =	1.2	Hieght =	20	m	Table 3.9
Cg =	2	3.10.1.3			
Cv =	1	3.10.1.5			
q =	530	pa			
Fv =	1272	pa			

Bridge Raised

Wind Horizontal Drag

Ce =	1.5	Hieght =	61	m	Table 3.9
Cg =	2	3.10.1.3			
Ch =	2	3.10.1.5			
q =	320	pa			
Fh =	1920	pa	Horizontal Wind Pressure Applied in the Model		

* Longitudinal Wind Force Shall Be 50% of Transverse Wind Force S6-19 CL 13.6.4.4

Wind Vertical Pressure

Ce =	1.5	Hieght =	61	m	Table 3.9
Cg =	2	3.10.1.3			
Cv =	1	3.10.1.5			
q =	320	pa			
Fv =	960	pa			

The Following Table Summarizes the factors for Winds at Skew angles of the Structure

S6-19 CL 3.10.3.2

Table 3.10
Modification of wind loads on superstructure with skew angle
(See Clause 3.10.3.2.)

Skew angle (measured from a line normal to the longitudinal axis), degrees	Modification coefficients — Truss spans: Transverse horizontal or vertical load	Truss spans: Longitudinal horizontal load	Other spans: Transverse horizontal or vertical load	Other spans: Longitudinal horizontal load
0	1.00	0.00	1.00	0.00
15	0.93	0.16	0.88	0.12
30	0.87	0.37	0.82	0.24
45	0.63	0.55	0.66	0.32
60	0.33	0.67	0.34	0.38

Roadway Stringer Wind Vertical Force (kN/m)			
Member	Tributary Width (mm) =	Closed Bridge	Open Bridge
Stringer 1 (Highway Side)	1337.5	1.701	1.284
Stringer 2	1295.0	1.647	1.243
Stringer 3	1295.0	1.647	1.243
Stringer 4	1295.0	1.647	1.243
Stringer 5	1295.0	1.647	1.243
Stringer 6	1295.0	1.647	1.243
Stringer 7	1207.5	1.536	1.159
Stringer 8	1125.0	1.431	1.080
Stringer 9	1130.0	1.437	1.085
Stringer 10	1130.0	1.437	1.085
Stringer 11	1130.0	1.437	1.085
Stringer 12 (Railway Side)	1250.0	1.590	1.200

Wind Load to be taken as 85% on Grating
100% applied to model - to be factored when considering open grating

Sidewalk Stringer Wind Vertical Force (kN/m)			
Member	Tributary Width (mm) =	Closed Bridge	Open Bridge
Exterior W Section	865.2	1.101	0.831
Middle S Beam	1398.6	1.779	1.343
Interior C Beam	533.4	0.678	0.512

Analysis Method for Stress and Force: Truss Section Result for L0-L2

	L0-L2	
Axial	ULS Max	4483
	ULS Min	1548
IY Bending	ULS Max	63
	ULS Min	0
IZ Bending	ULS Max	82
	ULS Min	-115

Section Calculations

	Angle	Web	T&B Plate	
Designation	8x6x1/2	30x7/16	23x3/8	
Qty=	4	2	2	
Iy =	73.6	819.5	0.1	$x10^6mm^4$
Iz =	35.84	0.2	21.9	$x10^6mm^4$
A =	17400.0	16935.5	7258.1	mm^2
dz =	318.2	0	385.0	mm^2
dy =	254.8	297.7	196.9	mm
Iyy =	1835.4	819.5	1075.7	$x10^6mm^4$
Izz =	1165.5	1500.6	303.2	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	41594	mm^2
A_{RHM*}=	7096.8	mm2
A_{net} =	34497	mm^2
∑Iyy =	3730.5	$x10^6mm^4$
∑Izz =	2969.3	$x10^6mm^4$
ybar=	391	mm
xbar=	303	mm

Applied Stresses & Forces			
	Formula	Value	Unit
Stress Y =	Iy bending |ULS| * ybar / Iyy	7	MPa
Stress Z =	Iz bending |ULS| * xbar / Izz	12	MPa
Force =	(Stress Y + Stress Z) * A_{net}	634	kN
Tension Combined Force =	Axial ULS Max + Force	5138	kN
Compression Combined Force =	Axial ULS Min - Force	934	kN

***Calculation process applies to all other members**

Case 0 (Existing)		Railway Truss																											
		Bottom Chord			Top Chord				Diagonals								Verticals												
		L0-L2	L2-L4	L4-L6	U0-U1	U1-U3	U3-U5	U5-U6	L0-U1	U1-L2	L2-U3	U3-L4	L4-U5 (Min)	L4-U5 (Max)	U5-L6 (Min)	U5-L6 (Max)	U0-L0	U1-L1 (Top)	U1-L1 (Bot)	U2-L2 (Top)	U2-L2 (Bot)	U3-L3 (Top)	U3-L3 (Bot)	U4-L4 (Top)	U4-L4 (Bot)	U5-L5 (Top)	U5-L5 (Bot)	U6-L6 (Top)	U6-L6 (Bot)
Axial	ULS Max	4483	9212	11592	472	-4623	-7235	-7235	-4836	5736	-2245	3531	-394	-394	1487	1487	4642	1487	1467	-92	-170	1598	1566	-135	-196	1565	1560	-153	-210
	ULS Min	1548	5418	6819	-777	-7641	-11278	-12059	-7801	3453	-4423	1511	-2341	-2341	-361	-361	-349	361	303	-186	-262	484	410	-197	-307	467	415	-200	-326
IY Bending	ULS Max	63	111	126	62	121	142	154	334	128	128	98	109	109	83	83	751	11	366	6	357	0	532	2	419	12	563	0	428
	ULS Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-413	-97	-101	-135	-136	-186	-205	-158	-180	-202	-224	-168	-192
IZ Bending	ULS Max	82	31	31	32	32	32	32	465	104	122	106	112	112	103	103	128	56	56	80	80	83	83	125	125	104	104	94	94
	ULS Min	-115	-31	-31	-32	-32	-32	-32	-446	-104	-122	-106	-112	-112	-103	-103	-132	-44	-44	-110	-110	-110	-110	-101	-101	-94	-94	-85	-85
Section Properties	Area =	34497	71432	87722	44286	90245	107019	117180	126009	48045	43852	31835	35142	35142	25303	25303	61838	21494	37944	17319	31817	21494	37944	17319	31817	21494	37944	17319	31817
	Iy =	3731	5442	6307	5165	10317	11253	11454	11932	4040	3805	2380	2506	2506	1805	1805	4558	2080	3296	1635	2647	2080	3296	1635	2647	2080	3296	1635	2647
	Iz =	2969	6066	7217	6054	12393	14755	16273	18155	4494	4040	2973	3214	3214	2383	2383	3198	1127	1179	955	999	1127	1179	955	999	1127	1179	955	999
	Y	391	391	391	419	403	403	407	420	391	391	340	340	340	314	314	305	305	305	302	302	305	305	302	302	305	305	302	302
	Z	303	302	302	483	533	533	533	533	308	305	305	302	302	306	306	356	257	257	257	257	257	257	257	257	257	257	257	257
	Stress Y	7	8	8	5	5	5	5	12	12	13	14	15	15	14	14	50	14	34	25	41	27	49	29	48	30	52	31	49
	Stress Z	12	2	1	3	1	1	1	14	7	9	11	10	10	13	13	15	13	12	30	28	25	24	34	32	24	23	25	24
Force (kn) =		634	677	796	336	551	669	763	3202	937	978	790	890	890	701	701	4012	579	1747	941	2196	1128	2780	1090	2545	1147	2836	972	2317
Tension Combined Force (kN) =		5118	9889	12388	808	-4073	-6566	-6472	-1634	6673	-1267	4322	495	495	2189	2189	8654	2066	3215	849	2026	2726	4346	955	2349	2713	4397	819	2107
Compression Combined Force (kN) =		913	4741	6023	-1112	-8192	-11947	-12822	-11003	2516	-5402	721	-3230	-3230	-1063	-1063	-4360	-217	-1444	-1127	-2458	-644	-2370	-1286	-2852	-680	-2422	-1172	-2643
ULS Capacity	Tension (kN)	11260	23315	28633	10751				41129	15682	14313	10391	9511	9511	7009	7009	20184	5993	10579	4829	8871	5993	10579	4829	8871	5993	10579	4829	8871
	Compression (kN)	10107	20676	25228	8905	15748	24908	26604	37336	14106	12911	9248	6918	6918	4982	4982	14340	4383	6697	3510	5626.58	4307	6698	3466	5625.87	4274	6698	3452	5632
	Capacity/Need	0.45	0.42	0.43	0.08	NA	NA	NA	NA	0.43	NA	0.42	0.05	0.05	0.31	0.31	0.43	0.34	0.30	0.18	0.23	0.45	0.41	0.20	0.26	0.45	0.42	0.17	0.24
		NA	NA	NA	0.124922	0.520171	0.47964	0.481967	0.294702	NA	0.4183781	NA	0.4669002	0.4669	0.21331	0.21331	0.30408	0.04962	0.21564	0.32118	0.43684	0.14948	0.35383	0.37115	0.50703	0.15915	0.36153	0.33968	0.46928

Case 0 (Existing)		Highway Truss																											
		Bottom Chord			Top Chord				Diagonals								Verticals												
		L0-L2	L2-L4	L4-L6	U0-U1	U1-U3	U3-U5	U5-U6	L0-U1	U1-L2	L2-U3	U3-L4	L4-U5 (Min)	L4-U5 (Max)	U5-L6 (Min)	U5-L6 (Max)	U0-L0	U1-L1 (Top)	U1-L1 (Bot)	U2-L2 (Top)	U2-L2 (Bot)	U3-L3 (Top)	U3-L3 (Bot)	U4-L4 (Top)	U4-L4 (Bot)	U5-L5 (Top)	U5-L5 (Bot)	U6-L6 (Top)	U6-L6 (Bot)
Axial	ULS Max	3963	7901	9799	675	-3929	-6177	-6177	-4652	5434	-2037	3302	-283	-283	1434	1434	4629	1573	1552	-74	-129	1574	1581	-127	-163	1489	1508	-127	-165
	ULS Min	893	4314	5397	-584	-6823	-9973	-10605	-7587	3206	-4146	1326	-2194	-2194	-402	-402	-372	437	323	-169	-307	458	351	-170	-321	409	331	-157	-322
IY Bending	ULS Max	64	91	91	62	87	120	126	334	118	106	84	95	95	83	83	420	97	97	70	70	82	101	0	99	0	128	0	128
	ULS Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-800	-4	-432	-51	-328	-92	-419	-97	-300	-149	-375	-110	-288
IZ Bending	ULS Max	101	31	31	32	32	32	32	415	104	122	106	112	112	103	103	272	66	233	86	172	94	161	0	124	0	72	0	18
	ULS Min	-88	-31	-31	-32	-32	-32	-32	-458	-104	-122	-106	-112	-112	-103	-103	-384	-163	-326	-179	-255	-172	-207	-144	-144	-120	-120	-86	-86
	Area =	34497	63045	62561	44286	64282	90245	94439	126009	43852	35464	26513	29820	29820	25303	25303	61838	21494	37944	17319	31817	21494	37944	17319	31817	21494	37944	17319	31817
	Iy =	3731	4974	4902	5165	7358	10317	10551	11932	3805	3337	2152	2277	2277	1805	1805	4558	2080	3296	1635	2647	2080	3296	1635	2647	2080	3296	1635	2647
	Iz =	2969	5204	4739	6054	9040	12393	13000	18155	4040	3159	2397	2650	2650	2383	2383	3198	1127	1179	955	999	1127	1179	955	999	1127	1179	955	999
	Y	391	391	391	419	396	403	403	420	391	391	340	340	340	314	314	305	305	305	302	302	305	305	302	302	305	305	302	302
	Z	303	295	283	483	533	533	533	533	305	298	300	297	297	306	306	356	257	257	257	257	257	257	257	257	257	257	257	257
	Stress Y	7	7	7	5	5	5	5	12	12	12	13	14	14	14	14	53	14	40	13	37	13	39	18	34	22	35	20	33
	Stress Z	10	2	2	3	2	1	1	13	8	12	13	13	13	13	13	43	37	71	48	66	39	45	39	37	27	26	23	22
	Force (kn) =	586	558	567	336	421	548	578	3174	875	848	702	795	795	701	701	5949	1106	4212	1058	3281	1134	3182	983	2273	1058	2309	749	1746
Tension Combined Force (kN) =		4549	8460	10366	1011	-3508	-5629	-5600	-1478	6309	-1189	4004	512	512	2135	2135	10577	2679	5764	985	3152	2708	4763	856	2109	2546	3817	622	1581
Compression Combined Force (kN) =		306	3756	4830	-920	-7244	-10522	-11182	-10761	2331	-4994	624	-2989	-2989	-1104	-1104	-6321	-670	-3889	-1227	-3588	-676	-2831	-1153	-2594	-648	-1978	-906	-2068
ULS Capacity	Tension	9088	16665	20420	10751				30141	11555	9441	7273	8137	8137	7009	7009	20184	5993	10579	4829	8871	5993	10579	4829	8871	5993	10579	4829	8871
	Compression				8905	11220	15771	16429	25174	8728	7068	5260	5896	5896	4982	4982	14340	4383	6697	3510	5627	4307	6698	3466	5625.87	4274	6698	3452	5632
	Capacity/Need	0.50	0.51	0.51	0.09	NA	NA	NA	NA	0.55	NA	0.55	0.06	0.06	0.30	0.30	0.52	0.45	0.54	0.20	0.36	0.45	0.45	0.18	0.24	0.42	0.36	0.13	0.18
		NA	NA	NA	0.103257	0.645613	0.667175	0.680667	0.427466	NA	0.7066378	NA	0.5069941	0.50699	0.22158	0.22158	0.4408	0.15278	0.58072	0.34958	0.63763	0.15689	0.42271	0.3327	0.46106	0.15169	0.29532	0.26262	0.36717

Case 1		Railway Truss																											
		Bottom Chord			Top Chord				Diagonals								Verticals												
		L0-L2	L2-L4	L4-L6	U0-U1	U1-U3	U3-U5	U5-U6	L0-U1	U1-L2	L2-U3	U3-L4	L4-U5 (Min)	L4-U5 (Max)	U5-L6 (Min)	U5-L6 (Max)	U0-L0	U1-L1 (Top)	U1-L1 (Bot)	U2-L2 (Top)	U2-L2 (Bot)	U3-L3 (Top)	U3-L3 (Bot)	U4-L4 (Top)	U4-L4 (Bot)	U5-L5 (Top)	U5-L5 (Bot)	U6-L6 (Top)	U6-L6 (Bot)
Axial	ULS Max	4504	9260	11652	472	-4663	-7295	-7295	-4876	5765	-2267	3548	-403	-403	1491	1491	4678	1493	1473	-92	-170	1604	1572	-135	-196	1572	1567	-153	-210
	ULS Min	1568	5465	6879	-777	-7681	-11337	-12123	-7842	3483	-4445	1528	-2350	-2350	-358	-358	-349	367	309	-186	-262	491	417	-197	-307	473	421	-201	-326
IY Bending	ULS Max	63	111	126	62	121	142	154	334	128	128	98	109	109	83	83	751	11	368	6	359	0	534	2	421	12	565	0	430
	ULS Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-412	-97	-101	-135	-136	-187	-206	-159	-181	-203	-225	-168	-192
IZ Bending	ULS Max	82	31	31	32	32	32	32	465	104	122	106	112	112	103	103	128	56	56	80	80	83	83	126	126	104	104	94	94
	ULS Min	-115	-31	-31	-32	-32	-32	-32	-446	-104	-122	-106	-112	-112	-103	-103	-132	-44	-44	-110	-110	-111	-111	-101	-101	-94	-94	-85	-85
Section Properties	Area =	34497	71432	87722	44286	90245	107019	117180	126009	48045	43852	31835	35142	35142	25303	25303	61838	21494	37944	17319	31817	21494	37944	17319	31817	21494	37944	17319	31817
	Iy =	3731	5442	6307	5165	10317	11253	11454	11932	4040	3805	2380	2506	2506	1805	1805	4558	2080	3296	1635	2647	2080	3296	1635	2647	2080	3296	1635	2647
	Iz =	2969	6066	7217	6054	12393	14755	16273	18155	4494	4040	2973	3214	3214	2383	2383	3198	1127	1179	955	999	1127	1179	955	999	1127	1179	955	999
	Y	391	391	391	419	403	403	407	420	391	391	340	340	340	314	314	305	305	305	302	302	305	305	302	302	305	305	302	302
	Z	303	302	302	483	533	533	533	533	308	305	305	302	302	306	306	356	257	257	257	257	257	257	257	257	257	257	257	257
	Stress Y	7	8	8	5	5	5	5	12	12	13	14	15	15	14	14	50	14	34	25	41	27	49	29	48	30	52	31	49
	Stress Z	12	2	1	3	1	1	1	14	7	9	11	10	10	13	13	15	13	12	30	28	25	24	34	32	24	23	25	24
Force (kn) =		634	677	796	336	551	669	763	3202	937	978	790	890	890	701	701	4015	581	1754	944	2203	1131	2790	1093	2554	1150	2846	974	2324
Tension Combined Force (kN) =		5138	9936	12448	807	-4113	-6626	-6531	-1674	6702	-1288	4338	486	486	2192	2192	8694	2074	3228	852	2033	2735	4362	958	2358	2721	4413	821	2114
Compression Combined Force (kN) =		934	4789	6083	-1113	-8231	-12006	-12886	-11044	2546	-5423	737	-3239	-3239	-1059	-1059	-4364	-213	-1445	-1130	-2465	-641	-2373	-1289	-2861	-677	-2425	-1175	-2650
ULS Capacity	Tension (kN)	11260	23315	28633	10751				41129	15682	14313	10391	9511	9511	7009	7009	20184	5993	10579	4829	8871	5993	10579	4829	8871	5993	10579	4829	8871
	Compression (kN)				8905	15748	24908	26604	37336	14106	12911	9248	6918	6918	4982	4982	14340	4383	6697	3510	5626.58	4307	6698	3466	5625.87	4274	6698	3452	5632
	Capacity/Need	0.46	0.43	0.43	0.08	NA	NA	NA	NA	0.43	NA	0.42	0.05	0.05	0.31	0.31	0.43	0.35	0.31	0.18	0.23	0.46	0.41	0.20	0.27	0.45	0.42	0.17	0.24
		NA	NA	NA	0.124991	0.522708	0.482028	0.484359	0.295791	NA	0.4200418	NA	0.4681996	0.4682	0.21258	0.21258	0.30431	0.0487	0.2158	0.32189	0.43813	0.14874	0.35429	0.37205	0.5086	0.15838	0.36205	0.34033	0.47059

Case 1		Highway Truss																											
		Bottom Chord			Top Chord				Diagonals								Verticals												
		L0-L2	L2-L4	L4-L6	U0-U1	U1-U3	U3-U5	U5-U6	L0-U1	U1-L2	L2-U3	U3-L4	L4-U5 (Min)	L4-U5 (Max)	U5-L6 (Min)	U5-L6 (Max)	U0-L0	U1-L1 (Top)	U1-L1 (Bot)	U2-L2 (Top)	U2-L2 (Bot)	U3-L3 (Top)	U3-L3 (Bot)	U4-L4 (Top)	U4-L4 (Bot)	U5-L5 (Top)	U5-L5 (Bot)	U6-L6 (Top)	U6-L6 (Bot)
Axial	ULS Max	3980	7941	9848	676	-3964	-6229	-6229	-4691	5461	-2057	3317	-291	-291	1437	1437	4665	1579	1559	-74	-129	1580	1587	-127	-163	1494	1514	-127	-164
	ULS Min	910	4353	5446	-584	-6858	-10025	-10660	-7626	3234	-4166	1341	-2202	-2202	-399	-399	-372	443	329	-169	-307	464	357	-170	-321	415	336	-157	-322
IY Bending	ULS Max	64	91	91	62	87	120	126	334	118	106	84	95	95	83	83	419	98	98	70	70	82	101	0	98	0	128	0	127
	ULS Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-800	-3	-434	-50	-330	-92	-420	-97	-301	-149	-376	-110	-289
IZ Bending	ULS Max	101	31	31	32	32	32	32	415	104	122	106	112	112	103	103	272	66	233	86	172	93	161	0	124	0	72	0	18
	ULS Min	-88	-31	-31	-32	-32	-32	-32	-458	-104	-122	-106	-112	-112	-103	-103	-385	-164	-327	-179	-256	-173	-208	-145	-145	-120	-120	-86	-86
	Area =	34497	63045	62561	44286	64282	90245	94439	126009	43852	35464	26513	29820	29820	25303	25303	61838	21494	37944	17319	31817	21494	37944	17319	31817	21494	37944	17319	31817
	Iy =	3731	4974	4902	5165	7358	10317	10551	11932	3805	3337	2152	2277	2277	1805	1805	4558	2080	3296	1635	2647	2080	3296	1635	2647	2080	3296	1635	2647
	Iz =	2969	5204	4739	6054	9040	12393	13000	18155	4040	3159	2397	2650	2650	2383	2383	3198	1127	1179	955	999	1127	1179	955	999	1127	1179	955	999
	Y	391	391	391	419	396	403	403	420	391	391	340	340	340	314	314	305	305	305	302	302	305	305	302	302	305	305	302	302
	Z	303	295	283	483	533	533	533	533	305	298	300	297	297	306	306	356	257	257	257	257	257	257	257	257	257	257	257	257
	Stress Y	7	7	7	5	5	5	5	12	12	12	13	14	14	14	14	54	14	40	13	38	13	39	18	34	22	35	20	33
	Stress Z	10	2	2	3	2	1	1	13	8	12	13	13	13	13	13	43	37	71	48	66	39	45	39	37	27	26	23	22
	Force (kn) =	586	558	567	336	421	548	578	3174	875	848	702	795	795	701	701	5958	1110	4227	1061	3292	1135	3192	984	2277	1059	2313	750	1748
Tension Combined Force (kN) =		4566	8499	10415	1011	-3543	-5681	-5651	-1517	6336	-1209	4019	504	504	2139	2139	10623	2689	5785	987	3163	2715	4779	857	2114	2553	3827	623	1584
Compression Combined Force (kN) =		323	3795	4879	-919	-7279	-10574	-11238	-10801	2359	-5014	639	-2997	-2997	-1101	-1101	-6331	-667	-3898	-1229	-3599	-671	-2835	-1154	-2599	-644	-1976	-907	-2070
ULS Capacity	Tension	9088	16665	20420	10751				30141	11555	9441	7273	8137	8137	7009	7009	20184	5993	10579	4829	8871	5993	10579	4829	8871	5993	10579	4829	8871
	Compression				8905	11220	15771	16429	25174	8728	7068	5260	5896	5896	4982	4982	14340	4383	6697	3510	5627	4307	6698	3466	5625.87	4274	6698	3452	5632
	Capacity/Need	0.50	0.51	0.51	0.09	NA	NA	NA	NA	0.55	NA	0.55	0.06	0.06	0.31	0.31	0.53	0.45	0.55	0.20	0.36	0.45	0.45	0.18	0.24	0.43	0.36	0.13	0.18
		NA	NA	NA	0.103215	0.648737	0.670468	0.68404	0.429034	NA	0.7094717	NA	0.5083781	0.50838	0.22091	0.22091	0.44146	0.15219	0.58207	0.35032	0.6396	0.15581	0.42334	0.33299	0.4619	0.15064	0.29507	0.26265	0.36757

Case 2		Railway Truss																											
		Bottom Chord			**Top Chord**				**Diagonals**								**Verticals**												
		L0-L2	**L2-L4**	**L4-L6**	**U0-U1**	**U1-U3**	**U3-U5**	**U5-U6**	**L0-U1**	**U1-L2**	**L2-U3**	**U3-L4**	**L4-U5 (Min)**	**L4-U5 (Max)**	**U5-L6 (Min)**	**U5-L6 (Max)**	**U0-L0**	**U1-L1 (Top)**	**U1-L1 (Bot)**	**U2-L2 (Top)**	**U2-L2 (Bot)**	**U3-L3 (Top)**	**U3-L3 (Bot)**	**U4-L4 (Top)**	**U4-L4 (Bot)**	**U5-L5 (Top)**	**U5-L5 (Bot)**	**U6-L6 (Top)**	**U6-L6 (Bot)**
Axial	ULS Max	4546	9356	11774	470	-4744	-7415	-7415	-4958	5825	-2310	3581	-421	-421	1498	1498	4753	1506	1486	-92	-171	1616	1585	-135	-197	1584	1579	-153	-210
	ULS Min	1610	5562	7000	-779	-7762	-11458	-12252	-7924	3543	-4488	1561	-2368	-2368	-350	-350	-349	380	322	-186	-262	503	429	-197	-308	485	434	-201	-326
IY Bending	ULS Max	63	111	126	62	121	142	154	334	128	128	98	109	109	83	83	752	10	372	5	362	0	539	0	425	10	571	0	434
	ULS Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-411	-98	-101	-136	-137	-189	-207	-160	-182	-204	-226	-170	-194
IZ Bending	ULS Max	82	31	31	32	32	32	32	465	104	122	106	112	112	103	103	129	56	56	80	81	83	83	126	126	104	104	94	94
	ULS Min	-115	-31	-31	-32	-32	-32	-32	-446	-104	-122	-106	-112	-112	-103	-103	-133	-44	-44	-110	-111	-111	-111	-101	-101	-95	-95	-85	-85
Section Properties	Area =	34497	71432	87722	44286	90245	107019	117180	126009	48045	43852	31835	35142	35142	25303	25303	61838	21494	37944	17319	31817	21494	37944	17319	31817	21494	37944	17319	31817
	Iy =	3731	5442	6307	5165	10317	11253	11454	11932	4040	3805	2380	2506	2506	1805	1805	4558	2080	3296	1635	2647	2080	3296	1635	2647	2080	3296	1635	2647
	Iz =	2969	6066	7217	6054	12393	14755	16273	18155	4494	4040	2973	3214	3214	2383	2383	3198	1127	1179	955	999	1127	1179	955	999	1127	1179	955	999
	Y	391	391	391	419	403	403	407	420	391	391	340	340	340	314	314	305	305	305	302	302	305	305	302	302	305	305	302	302
	Z	303	302	302	483	533	533	533	533	308	305	305	302	302	306	306	356	257	257	257	257	257	257	257	257	257	257	257	257
	Stress Y	7	8	8	5	5	5	5	12	12	13	14	15	15	14	14	50	14	34	25	41	28	50	30	48	30	53	31	49
	Stress Z	12	2	1	3	1	1	1	14	7	9	11	10	10	13	13	15	13	12	30	28	25	24	34	32	24	23	25	24
Force (kn) =		634	677	796	336	551	669	763	3202	937	978	790	890	890	701	701	4022	585	1769	949	2218	1137	2808	1099	2572	1155	2866	979	2339
Tension Combined Force (kN) =		5180	10033	12570	806	-4194	-6746	-6652	-1757	6762	-1332	4371	468	468	2200	2200	8775	2090	3255	857	2048	2754	4393	964	2375	2739	4445	826	2129
Compression Combined Force (kN) =		976	4885	6204	-1114	-8312	-12127	-13015	-11126	2606	-5467	770	-3257	-3257	-1052	-1052	-4371	-205	-1448	-1135	-2480	-634	-2379	-1296	-2879	-670	-2432	-1179	-2665
ULS Capacity	Tension (kN)	11260	23315	28633	10751				41129	15682	14313	10391	9511	9511	7009	7009	20184	5993	10579	4829	8871	5993	10579	4829	8871	5993	10579	4829	8871
	Compression (kN)				8905	15748	24908	26604	37336	14106	12911	9248	6918	6918	4982	4982	14340	4383	6697	3510	5626.58	4307	6698	3466	5625.87	4274	6698	3452	5632
	Capacity/Need	0.46	0.43	0.44	0.07	NA	NA	NA	NA	0.43	NA	0.42	0.05	0.05	0.31	0.31	0.43	0.35	0.31	0.18	0.23	0.46	0.42	0.20	0.27	0.46	0.42	0.17	0.24
		NA	NA	NA	0.12513	0.527849	0.486867	0.489208	0.298	NA	0.4234134	NA	0.4708331	0.47083	0.21111	0.21111	0.30478	0.04683	0.21614	0.32332	0.44078	0.14723	0.35523	0.37387	0.5118	0.15681	0.36307	0.34168	0.47327

Case 2		Highway Truss																											
		Bottom Chord			**Top Chord**				**Diagonals**								**Verticals**												
		L0-L2	**L2-L4**	**L4-L6**	**U0-U1**	**U1-U3**	**U3-U5**	**U5-U6**	**L0-U1**	**U1-L2**	**L2-U3**	**U3-L4**	**L4-U5 (Min)**	**L4-U5 (Max)**	**U5-L6 (Min)**	**U5-L6 (Max)**	**U0-L0**	**U1-L1 (Top)**	**U1-L1 (Bot)**	**U2-L2 (Top)**	**U2-L2 (Bot)**	**U3-L3 (Top)**	**U3-L3 (Bot)**	**U4-L4 (Top)**	**U4-L4 (Bot)**	**U5-L5 (Top)**	**U5-L5 (Bot)**	**U6-L6 (Top)**	**U6-L6 (Bot)**
Axial	ULS Max	4015	8022	9949	676	-4035	-6334	-6334	-4769	5518	-2097	3348	-308	-308	1444	1444	4738	1591	1571	-74	-129	1592	1599	-127	-163	1505	1526	-127	-164
	ULS Min	945	4433	5546	-583	-6929	-10130	-10773	-7705	3290	-4207	1371	-2219	-2219	-392	-392	-372	455	341	-169	-307	476	369	-170	-321	426	348	-157	-322
IY Bending	ULS Max	64	91	91	62	87	120	126	334	118	106	84	95	95	83	83	418	99	99	71	71	82	101	0	97	0	126	0	126
	ULS Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-801	-3	-437	-50	-332	-91	-423	-97	-303	-150	-378	-110	-290
IZ Bending	ULS Max	101	31	31	32	32	32	32	415	104	122	106	112	112	103	103	274	65	235	85	174	93	162	0	125	0	73	0	18
	ULS Min	-88	-31	-31	-32	-32	-32	-32	-458	-104	-122	-106	-112	-112	-103	-103	-387	-164	-329	-180	-258	-173	-209	-145	-145	-120	-120	-86	-86
	Area =	34497	63045	62561	44286	64282	90245	94439	126009	43852	35464	26513	29820	29820	25303	25303	61838	21494	37944	17319	31817	21494	37944	17319	31817	21494	37944	17319	31817
	Iy =	3731	4974	4902	5165	7358	10317	10551	11932	3805	3337	2152	2277	2277	1805	1805	4558	2080	3296	1635	2647	2080	3296	1635	2647	2080	3296	1635	2647
	Iz =	2969	5204	4739	6054	9040	12393	13000	18155	4040	3159	2397	2650	2650	2383	2383	3198	1127	1179	955	999	1127	1179	955	999	1127	1179	955	999
	Y	391	391	391	419	396	403	403	420	391	391	340	340	340	314	314	305	305	305	302	302	305	305	302	302	305	305	302	302
	Z	303	295	283	483	533	533	533	533	305	298	300	297	297	306	306	356	257	257	257	257	257	257	257	257	257	257	257	257
	Stress Y	7	7	7	5	5	5	5	12	12	12	13	14	14	14	14	54	14	40	13	38	13	39	18	35	22	35	20	33
	Stress Z	10	2	2	3	2	1	1	13	8	12	13	13	13	13	13	43	38	72	48	66	40	46	39	37	27	26	23	22
Force (kn) =		586	558	567	336	421	548	578	3175	875	848	702	795	795	701	701	5978	1117	4257	1066	3314	1137	3213	986	2287	1061	2321	750	1753
Tension Combined Force (kN) =		4601	8580	10515	1012	-3614	-5786	-5757	-1594	6393	-1249	4049	487	487	2145	2145	10716	2708	5828	992	3185	2729	4812	859	2124	2566	3848	623	1589
Compression Combined Force (kN) =		359	3875	4979	-918	-7350	-10679	-11350	-10881	2415	-5055	669	-3014	-3014	-1094	-1094	-6350	-662	-3917	-1235	-3621	-662	-2844	-1156	-2608	-635	-1973	-907	-2075
ULS Capacity	Tension	9088	16665	20420	10751				30141	11555	9441	7273	8137	8137	7009	7009	20184	5993	10579	4829	8871	5993	10579	4829	8871	5993	10579	4829	8871
	Compression				8905	11220	15771	16429	25174	8728	7068	5260	5896	5896	4982	4982	14340	4383	6697	3510	5627	4307	6698	3466	5625.87	4274	6698	3452	5632
	Capacity/Need	0.51	0.51	0.51	0.09	NA	NA	NA	NA	0.55	NA	0.56	0.06	0.06	0.31	0.31	0.53	0.45	0.55	0.21	0.36	0.46	0.45	0.18	0.24	0.43	0.36	0.13	0.18
		NA	NA	NA	0.103132	0.655068	0.677142	0.690874	0.432213	NA	0.7152132	NA	0.5111852	0.51119	0.21956	0.21956	0.44281	0.15098	0.58481	0.35178	0.64362	0.15363	0.42462	0.33358	0.4636	0.14852	0.29458	0.2627	0.36841

Case 3		Railway Truss																											
		Bottom Chord			**Top Chord**				**Diagonals**								**Verticals**												
		L0-L2	**L2-L4**	**L4-L6**	**U0-U1**	**U1-U3**	**U3-U5**	**U5-U6**	**L0-U1**	**U1-L2**	**L2-U3**	**U3-L4**	**L4-U5 (Min)**	**L4-U5 (Max)**	**U5-L6 (Min)**	**U5-L6 (Max)**	**U0-L0**	**U1-L1 (Top)**	**U1-L1 (Bot)**	**U2-L2 (Top)**	**U2-L2 (Bot)**	**U3-L3 (Top)**	**U3-L3 (Bot)**	**U4-L4 (Top)**	**U4-L4 (Bot)**	**U5-L5 (Top)**	**U5-L5 (Bot)**	**U6-L6 (Top)**	**U6-L6 (Bot)**
Axial	ULS Max	4457	9052	11391	473	-4572	-7075	-7110	-4660	5608	-2152	3461	-355	-355	1471	1471	4483	1461	1441	-92	-170	1571	1539	-135	-196	1539	1533	-153	-209
	ULS Min	1521	5357	6742	-776	-7507	-11078	-11846	-7625	3325	-4330	1440	-2302	-2302	-377	-377	-349	335	277	-186	-261	458	384	-197	-307	441	388	-200	-325
IY Bending	ULS Max	63	111	126	62	121	142	154	334	128	128	98	109	109	83	83	747	12	359	9	350	3	522	5	411	15	552	3	419
	ULS Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-411	-95	-100	-132	-134	-183	-202	-155	-177	-199	-220	-165	-188
IZ Bending	ULS Max	82	31	31	32	32	32	32	465	104	122	106	112	112	103	103	127	56	56	80	80	83	83	125	125	104	104	93	93
	ULS Min	-115	-31	-31	-32	-32	-32	-32	-446	-104	-122	-106	-112	-112	-103	-103	-132	-44	-44	-109	-110	-110	-110	-101	-101	-94	-94	-85	-85
Section Properties	Area =	34497	71432	87722	44286	90245	107019	117180	126009	48045	43852	31835	35142	35142	25303	25303	61838	21494	37944	17319	31817	21494	37944	17319	31817	21494	37944	17319	31817
	Iy =	3731	5442	6307	5165	10317	11253	11454	11932	4040	3805	2380	2506	2506	1805	1805	4558	2080	3296	1635	2647	2080	3296	1635	2647	2080	3296	1635	2647
	Iz =	2969	6066	7217	6054	12393	14755	16273	18155	4494	4040	2973	3214	3214	2383	2383	3198	1127	1179	955	999	1127	1179	955	999	1127	1179	955	999
	Y	391	391	391	419	403	403	407	420	391	391	340	340	340	314	314	305	305	305	302	302	305	305	302	302	305	305	302	302
	Z	303	302	302	483	533	533	533	533	308	305	305	302	302	306	306	356	257	257	257	257	257	257	257	257	257	257	257	257
	Stress Y	7	8	8	5	5	5	5	12	12	13	14	15	15	14	14	50	14	33	24	40	27	48	29	47	29	51	30	48
	Stress Z	12	2	1	3	1	1	1	14	7	9	11	10	10	13	13	15	13	12	29	28	25	24	34	32	24	23	25	24
Force (kn) =		634	677	796	336	551	669	763	3202	937	978	790	890	890	701	701	3994	572	1719	933	2170	1118	2744	1080	2514	1136	2797	963	2286
Tension Combined Force (kN) =		5091	9729	12187	809	-4021	-6406	-6347	-1458	6545	-1173	4251	534	534	2173	2173	8477	2032	3160	841	2000	2689	4283	945	2318	2676	4331	810	2077
Compression Combined Force (kN) =		887	4680	5946	-1112	-8058	-11747	-12609	-10827	2389	-5309	650	-3191	-3191	-1078	-1078	-4343	-237	-1442	-1119	-2431	-660	-2360	-1276	-2820	-696	-2409	-1163	-2611
ULS Capacity	Tension (kN)	11260	23315	28633	10751				41129	15682	14313	10391	9511	9511	7009	7009	20184	5993	10579	4829	8871	5993	10579	4829	8871	5993	10579	4829	8871
	Compression (kN)				8905	15748	24908	26604	37336	14106	12911	9248	6918	6918	4982	4982	14340	4383	6697	3510	5626.58	4307	6698	3466	5625.87	4274	6698	3452	5632
	Capacity/Need	0.45	0.42	0.43	0.08	NA	NA	NA	NA	0.42	NA	0.41	0.06	0.06	0.31	0.31	0.42	0.34	0.30	0.17	0.23	0.45	0.40	0.20	0.26	0.45	0.41	0.17	0.23
		NA	NA	NA	0.124837	0.51167	0.471636	0.47395	0.289987	NA	0.4111694	NA	0.4612704	0.46127	0.21646	0.21646	0.30283	0.05398	0.2153	0.31887	0.43211	0.15325	0.3524	0.36827	0.50133	0.16282	0.35969	0.33694	0.46371

Case 3		Highway Truss																											
		Bottom Chord			**Top Chord**				**Diagonals**								**Verticals**												
		L0-L2	**L2-L4**	**L4-L6**	**U0-U1**	**U1-U3**	**U3-U5**	**U5-U6**	**L0-U1**	**U1-L2**	**L2-U3**	**U3-L4**	**L4-U5 (Min)**	**L4-U5 (Max)**	**U5-L6 (Min)**	**U5-L6 (Max)**	**U0-L0**	**U1-L1 (Top)**	**U1-L1 (Bot)**	**U2-L2 (Top)**	**U2-L2 (Bot)**	**U3-L3 (Top)**	**U3-L3 (Bot)**	**U4-L4 (Top)**	**U4-L4 (Bot)**	**U5-L5 (Top)**	**U5-L5 (Bot)**	**U6-L6 (Top)**	**U6-L6 (Bot)**
Axial	ULS Max	3941	7768	9633	675	-3884	-6111	-6111	-4484	5314	-1950	3237	-248	-248	1419	1419	4472	1546	1526	-73	-129	1549	1555	-127	-164	1465	1482	-128	-165
	ULS Min	870	4263	5334	-584	-6706	-9799	-10419	-7447	3086	-4059	1261	-2159	-2159	-417	-417	-373	410	296	-169	-307	433	325	-170	-321	385	305	-157	-322
IY Bending	ULS Max	64	91	91	62	87	120	126	334	118	106	84	95	95	83	83	418	95	97	69	69	81	100	0	103	0	133	0	131
	ULS Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-796	-4	-424	-51	-324	-92	-413	-97	-297	-149	-371	-109	-285
IZ Bending	ULS Max	101	31	31	32	32	32	32	416	104	122	106	112	112	103	103	271	67	231	87	171	94	160	0	122	0	71	0	18
	ULS Min	-88	-31	-31	-32	-32	-32	-32	-458	-104	-122	-106	-112	-112	-103	-103	-383	-163	-324	-178	-254	-172	-206	-144	-144	-120	-120	-86	-86
	Area =	34497	63045	62561	44286	64282	90245	94439	126009	43852	35464	26513	29820	29820	25303	25303	61838	21494	37944	17319	31817	21494	37944	17319	31817	21494	37944	17319	31817
	Iy =	3731	4974	4902	5165	7358	10317	10551	11932	3805	3337	2152	2277	2277	1805	1805	4558	2080	3296	1635	2647	2080	3296	1635	2647	2080	3296	1635	2647
	Iz =	2969	5204	4739	6054	9040	12393	13000	18155	4040	3159	2397	2650	2650	2383	2383	3198	1127	1179	955	999	1127	1179	955	999	1127	1179	955	999
	Y	391	391	391	419	396	403	403	420	391	391	340	340	340	314	314	305	305	305	302	302	305	305	302	302	305	305	302	302
	Z	303	295	283	483	533	533	533	533	305	298	300	297	297	306	306	356	257	257	257	257	257	257	257	257	257	257	257	257
	Stress Y	7	7	7	5	5	5	5	12	12	12	13	14	14	14	14	53	14	39	13	37	14	38	18	34	22	34	20	32
	Stress Z	10	2	2	3	2	1	1	13	8	12	13	13	13	13	13	43	37	71	48	65	39	45	39	37	27	26	23	22
	Force (kn) =	587	558	567	336	421	548	578	3174	875	848	702	795	795	701	701	5924	1098	4173	1053	3254	1133	3155	981	2258	1055	2293	749	1735
Tension Combined Force (kN) =		4527	8326	10200	1010	-3463	-5562	-5533	-1311	6189	-1102	3939	547	547	2121	2121	10396	2644	5699	979	3125	2682	4710	854	2094	2519	3776	621	1570
Compression Combined Force (kN) =		284	3705	4767	-920	-7126	-10348	-10997	-10621	2211	-4908	559	-2954	-2954	-1118	-1118	-6297	-687	-3877	-1221	-3561	-700	-2830	-1152	-2579	-669	-1988	-906	-2057
ULS Capacity	Tension	9088	16665	20420	10751				30141	11555	9441	7273	8137	8137	7009	7009	20184	5993	10579	4829	8871	5993	10579	4829	8871	5993	10579	4829	8871
	Compression				8905	11220	15771	16429	25174	8728	7068	5260	5896	5896	4982	4982	14340	4383	6697	3510	5627	4307	6698	3466	5625.87	4274	6698	3452	5632
	Capacity/Need	0.50	0.50	0.50	0.09	NA	NA	NA	NA	0.54	NA	0.54	0.07	0.07	0.30	0.30	0.52	0.44	0.54	0.20	0.35	0.45	0.45	0.18	0.24	0.42	0.36	0.13	0.18
		NA	NA	NA	0.103312	0.635145	0.65614	0.669365	0.421881	NA	0.694364	NA	0.5009932	0.50099	0.22447	0.22447	0.43912	0.15681	0.57884	0.34804	0.63292	0.16257	0.42252	0.33234	0.45846	0.15664	0.29683	0.2625	0.36534

Case 4		Railway Truss																											
		Bottom Chord			Top Chord				Diagonals									Verticals											
		L0-L2	L2-L4	L4-L6	U0-U1	U1-U3	U3-U5	U5-U6	L0-U1	U1-L2	L2-U3	U3-L4	L4-U5 (Min)	L4-U5 (Max)	U5-L6 (Min)	U5-L6 (Max)	U0-L0	U1-L1 (Top)	U1-L1 (Bot)	U2-L2 (Top)	U2-L2 (Bot)	U3-L3 (Top)	U3-L3 (Bot)	U4-L4 (Top)	U4-L4 (Bot)	U5-L5 (Top)	U5-L5 (Bot)	U6-L6 (Top)	U6-L6 (Bot)
Axial	ULS Max	4467	9075	11420	473	-4591	-7103	-7138	-4679	5622	-2162	3468	-360	-360	1473	1473	4501	1464	1444	-92	-170	1574	1542	-135	-196	1542	1536	-153	-209
	ULS Min	1531	5380	6771	-776	-7526	-11107	-11876	-7644	3340	-4340	1448	-2306	-2306	-375	-375	-349	338	280	-186	-262	461	387	-197	-307	444	391	-200	-325
IY Bending	ULS Max	63	111	126	62	121	142	154	334	128	128	98	109	109	83	83	748	12	359	8	351	3	523	5	412	15	553	3	420
	ULS Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-411	-95	-100	-133	-134	-184	-202	-156	-177	-199	-221	-165	-189
IZ Bending	ULS Max	82	31	31	32	32	32	32	465	104	122	106	112	112	103	103	128	56	56	80	80	83	83	125	125	104	104	93	93
	ULS Min	-115	-31	-31	-32	-32	-32	-32	-446	-104	-122	-106	-112	-112	-103	-103	-132	-44	-44	-109	-110	-110	-110	-101	-101	-94	-94	-85	-85
Section Properties	Area =	34497	71432	87722	44286	90245	107019	117180	126009	48045	43852	31835	35142	35142	25303	25303	61838	21494	37944	17319	31817	21494	37944	17319	31817	21494	37944	17319	31817
	Iy =	3731	5442	6307	5165	10317	11253	11454	11932	4040	3805	2380	2506	2506	1805	1805	4558	2080	3296	1635	2647	2080	3296	1635	2647	2080	3296	1635	2647
	Iz =	2969	6066	7217	6054	12393	14755	16273	18155	4494	4040	2973	3214	3214	2383	2383	3198	1127	1179	955	999	1127	1179	955	999	1127	1179	955	999
	Y	391	391	391	419	403	403	407	420	391	391	340	340	340	314	314	305	305	305	302	302	305	305	302	302	305	305	302	302
	Z	303	302	302	483	533	533	533	533	308	305	305	302	302	306	306	356	257	257	257	257	257	257	257	257	257	257	257	257
	Stress Y	7	8	8	5	5	5	5	12	12	13	14	15	15	14	14	50	14	33	24	40	27	48	29	47	29	51	30	48
	Stress Z	12	2	1	3	1	1	1	14	7	9	11	10	10	13	13	15	13	12	29	28	25	24	34	32	24	23	25	24
Force (kn) =		634	677	796	336	551	669	763	3202	937	978	790	890	890	701	701	3996	572	1722	934	2173	1119	2748	1081	2518	1138	2802	964	2290
Tension Combined Force (kN) =		5101	9752	12216	808	-4041	-6434	-6375	-1477	6559	-1184	4259	530	530	2174	2174	8497	2036	3166	842	2003	2693	4291	947	2322	2680	4338	811	2081
Compression Combined Force (kN) =		897	4703	5975	-1112	-8077	-11776	-12639	-10846	2403	-5319	658	-3196	-3196	-1077	-1077	-4345	-235	-1442	-1120	-2435	-658	-2362	-1278	-2825	-694	-2411	-1164	-2615
ULS Capacity	Tension (kN)	11260	23315	28633	10751				41129	15682	14313	10391	9511	9511	7009	7009	20184	5993	10579	4829	8871	5993	10579	4829	8871	5993	10579	4829	8871
	Compression (kN)				8905	15748	24908	26604	37336	14106	12911	9248	6918	6918	4982	4982	14340	4383	6697	3510	5626.58	4307	6698	3466	5625.87	4274	6698	3452	5632
	Capacity/Need	0.45	0.42	0.43	0.08	NA	NA	NA	NA	0.42	NA	0.41	0.06	0.06	0.31	0.31	0.42	0.34	0.30	0.17	0.23	0.45	0.41	0.20	0.26	0.45	0.41	0.17	0.23
		NA	NA	NA	0.124869	0.512887	0.472783	0.475098	0.290509	NA	0.4119679	NA	0.4618933	0.46189	0.21611	0.21611	0.30298	0.05354	0.21538	0.31922	0.43272	0.15288	0.35262	0.3687	0.50209	0.16245	0.35994	0.33725	0.46435

Case 4		Highway Truss																											
		Bottom Chord			Top Chord				Diagonals									Verticals											
		L0-L2	L2-L4	L4-L6	U0-U1	U1-U3	U3-U5	U5-U6	L0-U1	U1-L2	L2-U3	U3-L4	L4-U5 (Min)	L4-U5 (Max)	U5-L6 (Min)	U5-L6 (Max)	U0-L0	U1-L1 (Top)	U1-L1 (Bot)	U2-L2 (Top)	U2-L2 (Bot)	U3-L3 (Top)	U3-L3 (Bot)	U4-L4 (Top)	U4-L4 (Bot)	U5-L5 (Top)	U5-L5 (Bot)	U6-L6 (Top)	U6-L6 (Bot)
Axial	ULS Max	3949	7787	9657	675	-3901	-6136	-6136	-4503	5327	-1960	3244	-252	-252	1421	1421	4489	1549	1529	-74	-129	1552	1557	-127	-164	1467	1485	-127	-165
	ULS Min	879	4282	5358	-584	-6723	-9824	-10446	-7466	3099	-4069	1268	-2163	-2163	-415	-415	-373	413	299	-169	-307	436	328	-170	-321	388	308	-157	-322
IY Bending	ULS Max	64	91	91	62	87	120	126	334	118	106	84	95	95	83	83	418	96	97	69	69	81	100	0	102	0	132	0	130
	ULS Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-797	-4	-425	-51	-324	-92	-414	-97	-297	-149	-372	-109	-285
IZ Bending	ULS Max	101	31	31	32	32	32	32	415	104	122	106	112	112	103	103	271	66	232	87	171	94	160	0	122	0	71	0	18
	ULS Min	-88	-31	-31	-32	-32	-32	-32	-458	-104	-122	-106	-112	-112	-103	-103	-383	-163	-325	-179	-254	-172	-206	-144	-144	-120	-120	-86	-86
	Area =	34497	63045	62561	44286	64282	90245	94439	126009	43852	35464	26513	29820	29820	25303	25303	61838	21494	37944	17319	31817	21494	37944	17319	31817	21494	37944	17319	31817
	Iy =	3731	4974	4902	5165	7358	10317	10551	11932	3805	3337	2152	2277	2277	1805	1805	4558	2080	3296	1635	2647	2080	3296	1635	2647	2080	3296	1635	2647
	Iz =	2969	5204	4739	6054	9040	12393	13000	18155	4040	3159	2397	2650	2650	2383	2383	3198	1127	1179	955	999	1127	1179	955	999	1127	1179	955	999
	Y	391	391	391	419	396	403	403	420	391	391	340	340	340	314	314	305	305	305	302	302	305	305	302	302	305	305	302	302
	Z	303	295	283	483	533	533	533	533	305	298	300	297	297	306	306	356	257	257	257	257	257	257	257	257	257	257	257	257
	Stress Y	7	7	7	5	5	5	5	12	12	12	13	14	14	14	14	53	14	39	13	37	13	38	18	34	22	34	20	33
	Stress Z	10	2	2	3	2	1	1	13	8	12	13	13	13	13	13	43	37	71	48	66	39	45	39	37	27	26	23	22
Force (kn) =		587	558	567	336	421	548	578	3174	875	848	702	795	795	701	701	5930	1099	4180	1054	3260	1134	3160	982	2260	1055	2295	749	1736
Tension Combined Force (kN) =		4536	8345	10224	1011	-3480	-5587	-5558	-1329	6202	-1112	3946	543	543	2122	2122	10419	2649	5709	980	3130	2686	4718	855	2096	2523	3781	621	1571
Compression Combined Force (kN) =		292	3724	4791	-920	-7143	-10373	-11023	-10640	2224	-4917	566	-2958	-2958	-1117	-1117	-6302	-686	-3881	-1223	-3567	-698	-2832	-1152	-2581	-667	-1987	-906	-2059
ULS Capacity	Tension	9088	16665	20420	10751				30141	11555	9441	7273	8137	8137	7009	7009	20184	5993	10579	4829	8871	5993	10579	4829	8871	5993	10579	4829	8871
	Compression				8905	11220	15771	16429	25174	8728	7068	5260	5896	5896	4982	4982	14340	4383	6697	3510	5627	4307	6698	3466	5625.87	4274	6698	3452	5632
	Capacity/Need	0.50	0.50	0.50	0.09	NA	NA	NA	NA	0.54	NA	0.54	0.07	0.07	0.30	0.30	0.52	0.44	0.54	0.20	0.35	0.45	0.45	0.18	0.24	0.42	0.36	0.13	0.18
		NA	NA	NA	0.103289	0.636644	0.657721	0.670983	0.422634	NA	0.6957223	NA	0.5016581	0.50166	0.22415	0.22415	0.43949	0.15652	0.57949	0.34838	0.63387	0.16206	0.42284	0.33248	0.45886	0.15613	0.29671	0.26251	0.36554

Case 5		Railway Truss																											
		Bottom Chord			Top Chord				Diagonals								Verticals												
		L0-L2	L2-L4	L4-L6	U0-U1	U1-U3	U3-U5	U5-U6	L0-U1	U1-L2	L2-U3	U3-L4	L4-U5 (Min)	L4-U5 (Max)	U5-L6 (Min)	U5-L6 (Max)	U0-L0	U1-L1 (Top)	U1-L1 (Bot)	U2-L2 (Top)	U2-L2 (Bot)	U3-L3 (Top)	U3-L3 (Bot)	U4-L4 (Top)	U4-L4 (Bot)	U5-L5 (Top)	U5-L5 (Bot)	U6-L6 (Top)	U6-L6 (Bot)
Axial	ULS Max	4752	9730	12245	465	-5141	-7917	-7956	-5237	6027	-2458	3693	-483	-483	1523	1523	5005	1547	1527	-91	-171	1659	1627	-135	-198	1626	1622	-153	-211
	ULS Min	1816	6033	7593	-785	-8075	-11925	-12751	-8204	3746	-4636	1673	-2430	-2430	-325	-325	-349	421	363	-185	-262	545	471	-197	-309	527	477	-201	-328
IY Bending	ULS Max	63	111	126	62	121	142	154	334	128	128	98	109	109	83	83	754	7	384	3	373	0	554	0	437	5	588	0	447
	ULS Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-404	-102	-103	-140	-141	-193	-212	-164	-187	-209	-232	-174	-199
IZ Bending	ULS Max	82	31	31	32	32	32	32	466	104	122	106	112	112	103	103	131	57	57	80	81	83	83	129	129	105	105	94	94
	ULS Min	-115	-31	-31	-32	-32	-32	-32	-446	-104	-122	-106	-112	-112	-103	-103	-135	-44	-44	-112	-113	-112	-112	-102	-102	-95	-95	-85	-85
Section Properties	Area =	34497	71432	87722	44286	90245	107019	117180	126009	48045	43852	31835	35142	35142	25303	25303	61838	21494	37944	17319	31817	21494	37944	17319	31817	21494	37944	17319	31817
	Iy =	3731	5442	6307	5165	10317	11253	11454	11932	4040	3805	2380	2506	2506	1805	1805	4558	2080	3296	1635	2647	2080	3296	1635	2647	2080	3296	1635	2647
	Iz =	2969	6066	7217	6054	12393	14755	16273	18155	4494	4040	2973	3214	3214	2383	2383	3198	1127	1179	955	999	1127	1179	955	999	1127	1179	955	999
	Y	391	391	391	419	403	403	407	420	391	391	340	340	340	314	314	305	305	305	302	302	305	305	302	302	305	305	302	302
	Z	303	302	302	483	533	533	533	533	308	305	305	302	302	306	306	356	257	257	257	257	257	257	257	257	257	257	257	257
	Stress Y	7	8	8	5	5	5	5	12	12	13	14	15	15	14	14	50	15	36	26	42	28	51	30	50	31	54	32	51
	Stress Z	12	2	1	3	1	1	1	14	7	9	11	10	10	13	13	15	13	13	30	29	26	25	35	33	24	23	25	24
Force (kn) =		634	677	796	336	551	669	763	3202	937	978	790	890	890	701	701	4046	600	1824	969	2273	1160	2876	1124	2638	1176	2934	995	2389
Tension Combined Force (kN) =		5386	10407	13041	800	-4590	-7248	-7193	-2035	6964	-1480	4483	407	407	2225	2225	9051	2148	3351	878	2102	2818	4503	989	2440	2802	4556	841	2178
Compression Combined Force (kN) =		1182	5357	6797	-1120	-8626	-12594	-13514	-11406	2809	-5614	883	-3319	-3319	-1027	-1027	-4395	-179	-1460	-1154	-2535	-614	-2404	-1321	-2947	-649	-2458	-1196	-2717
ULS Capacity	Tension (kN)	11260	23315	28633	10751				41129	15682	14313	10391	9511	9511	7009	7009	20184	5993	10579	4829	8871	5993	10579	4829	8871	5993	10579	4829	8871
	Compression (kN)				8905	15748	24908	26604	37336	14106	12911	9248	6918	6918	4982	4982	14340	4383	6697	3510	5626.58	4307	6698	3466	5625.87	4274	6698	3452	5632
	Capacity/Need	0.48	0.45	0.46	0.07	NA	NA	NA	NA	0.44	NA	0.43	0.04	0.04	0.32	0.32	0.45	0.36	0.32	0.18	0.24	0.47	0.43	0.20	0.28	0.47	0.43	0.17	0.25
		NA	NA	NA	0.125795	0.547763	0.505614	0.507988	0.305489	NA	0.4348433	NA	0.4797614	0.47976	0.20611	0.20611	0.30647	0.04087	0.21806	0.32895	0.45061	0.14262	0.35897	0.38111	0.52376	0.15186	0.36691	0.34637	0.48247

Case 5		Highway Truss																											
		Bottom Chord			Top Chord				Diagonals								Verticals												
		L0-L2	L2-L4	L4-L6	U0-U1	U1-U3	U3-U5	U5-U6	L0-U1	U1-L2	L2-U3	U3-L4	L4-U5 (Min)	L4-U5 (Max)	U5-L6 (Min)	U5-L6 (Max)	U0-L0	U1-L1 (Top)	U1-L1 (Bot)	U2-L2 (Top)	U2-L2 (Bot)	U3-L3 (Top)	U3-L3 (Bot)	U4-L4 (Top)	U4-L4 (Bot)	U5-L5 (Top)	U5-L5 (Bot)	U6-L6 (Top)	U6-L6 (Bot)
Axial	ULS Max	4186	8335	10337	680	-4383	-6850	-6850	-5035	5709	-2235	3451	-364	-364	1467	1467	4987	1634	1613	-74	-129	1632	1640	-126	-162	1544	1567	-126	-163
	ULS Min	1116	4824	6036	-579	-7204	-10539	-11207	-8001	3480	-4344	1474	-2275	-2275	-370	-370	-372	497	382	-169	-307	516	410	-170	-321	464	389	-156	-321
IY Bending	ULS Max	64	91	91	62	87	120	126	334	118	106	84	95	95	83	83	410	102	102	72	72	83	102	0	91	0	119	0	121
	ULS Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-804	-2	-450	-48	-339	-90	-432	-97	-308	-151	-384	-110	-295
IZ Bending	ULS Max	100	31	31	32	32	32	32	413	104	122	106	112	112	103	103	282	61	243	82	180	90	165	0	129	0	75	0	18
	ULS Min	-89	-31	-31	-32	-32	-32	-32	-460	-104	-122	-106	-112	-112	-103	-103	-399	-169	-339	-184	-266	-176	-216	-147	-147	-121	-121	-86	-86
	Area =	34497	63045	62561	44286	64282	90245	94439	126009	43852	35464	26513	29820	29820	25303	25303	61838	21494	37944	17319	31817	21494	37944	17319	31817	21494	37944	17319	31817
	Iy =	3731	4974	4902	5165	7358	10317	10551	11932	3805	3337	2152	2277	2277	1805	1805	4558	2080	3296	1635	2647	2080	3296	1635	2647	2080	3296	1635	2647
	Iz =	2969	5204	4739	6054	9040	12393	13000	18155	4040	3159	2397	2650	2650	2383	2383	3198	1127	1179	955	999	1127	1179	955	999	1127	1179	955	999
	Y	391	391	391	419	396	403	403	420	391	391	340	340	340	314	314	305	305	305	302	302	305	305	302	302	305	305	302	302
	Z	303	295	283	483	533	533	533	533	305	298	300	297	297	306	306	356	257	257	257	257	257	257	257	257	257	257	257	257
	Stress Y	7	7	7	5	5	5	5	12	12	12	13	14	14	14	14	54	15	42	13	39	13	40	18	35	22	36	20	34
	Stress Z	10	2	2	3	2	1	1	14	8	12	13	13	13	13	13	44	38	74	50	69	40	47	40	38	28	26	23	22
	Force (kn) =	585	558	567	336	421	548	578	3181	875	848	702	795	795	701	701	6067	1147	4387	1088	3412	1150	3300	997	2325	1070	2354	751	1770
Tension Combined Force (kN) =		4771	8893	10904	1016	-3962	-6301	-6272	-1855	6584	-1386	4152	431	431	2168	2168	11054	2781	6000	1015	3283	2782	4940	870	2163	2614	3921	625	1607
Compression Combined Force (kN) =		531	4266	5469	-915	-7625	-11087	-11785	-11182	2605	-5193	772	-3070	-3070	-1071	-1071	-6439	-650	-4005	-1258	-3720	-634	-2890	-1166	-2646	-606	-1965	-907	-2091
ULS Capacity	Tension	9088	16665	20420	10751				30141	11555	9441	7273	8137	8137	7009	7009	20184	5993	10579	4829	8871	5993	10579	4829	8871	5993	10579	4829	8871
	Compression				8905	11220	15771	16429	25174	8728	7068	5260	5896	5896	4982	4982	14340	4383	6697	3510	5627	4307	6698	3466	5625.87	4274	6698	3452	5632
	Capacity/Need	0.52	0.53	0.53	0.09	NA	NA	NA	NA	0.57	NA	0.57	0.05	0.05	0.31	0.31	0.55	0.46	0.57	0.21	0.37	0.46	0.47	0.18	0.24	0.44	0.37	0.13	0.18
		NA	NA	NA	0.102702	0.679592	0.70302	0.71735	0.444167	NA	0.7346758	NA	0.5207006	0.5207	0.21498	0.21498	0.44904	0.14832	0.59805	0.35831	0.66109	0.14729	0.43154	0.33651	0.47031	0.14176	0.29338	0.26285	0.37126

Case 6		Railway Truss																											
		Bottom Chord			**Top Chord**				**Diagonals**								**Verticals**												
		L0-L2	**L2-L4**	**L4-L6**	**U0-U1**	**U1-U3**	**U3-U5**	**U5-U6**	**L0-U1**	**U1-L2**	**L2-U3**	**U3-L4**	**L4-U5 (Min)**	**L4-U5 (Max)**	**U5-L6 (Min)**	**U5-L6 (Max)**	**U0-L0**	**U1-L1 (Top)**	**U1-L1 (Bot)**	**U2-L2 (Top)**	**U2-L2 (Bot)**	**U3-L3 (Top)**	**U3-L3 (Bot)**	**U4-L4 (Top)**	**U4-L4 (Bot)**	**U5-L5 (Top)**	**U5-L5 (Bot)**	**U6-L6 (Top)**	**U6-L6 (Bot)**
Axial	ULS Max	5009	10321	12988	457	-5636	-8651	-8693	-5739	6393	-2725	3895	-594	-594	1569	1569	5459	1623	1603	-91	-172	1735	1703	-135	-199	1701	1699	-154	-213
	ULS Min	2073	6623	8334	-792	-8570	-12662	-13540	-8709	4112	-4902	1876	-2541	-2541	-280	-280	-349	496	438	-185	-263	622	548	-197	-310	602	554	-202	-330
IY Bending	ULS Max	63	111	126	62	121	142	154	333	128	128	98	109	109	83	83	759	4	407	2	392	0	583	0	460	0	619	0	471
	ULS Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-399	-108	-109	-146	-148	-202	-222	-172	-195	-219	-241	-182	-208
IZ Bending	ULS Max	82	31	31	32	32	32	32	466	104	122	106	112	112	103	103	134	58	61	81	81	83	83	132	132	106	106	94	94
	ULS Min	-115	-31	-31	-32	-32	-32	-32	-446	-104	-122	-106	-112	-112	-103	-103	-138	-44	-44	-115	-115	-114	-114	-103	-103	-95	-95	-84	-84
Section Properties	Area =	34497	71432	87722	44286	90245	107019	117180	126009	48045	43852	31835	35142	35142	25303	25303	61838	21494	37944	17319	31817	21494	37944	17319	31817	21494	37944	17319	31817
	Iy =	3731	5442	6307	5165	10317	11253	11454	11932	4040	3805	2380	2506	2506	1805	1805	4558	2080	3296	1635	2647	2080	3296	1635	2647	2080	3296	1635	2647
	Iz =	2969	6066	7217	6054	12393	14755	16273	18155	4494	4040	2973	3214	3214	2383	2383	3198	1127	1179	955	999	1127	1179	955	999	1127	1179	955	999
	Y	391	391	391	419	403	403	407	420	391	391	340	340	340	314	314	305	305	305	302	302	305	305	302	302	305	305	302	302
	Z	303	302	302	483	533	533	533	533	308	305	305	302	302	306	306	356	257	257	257	257	257	257	257	257	257	257	257	257
	Stress Y	7	8	8	5	5	5	5	12	12	13	14	15	15	14	14	51	16	38	27	45	30	54	32	52	32	57	34	54
	Stress Z	12	2	1	3	1	1	1	14	7	9	11	10	10	13	13	15	13	13	31	30	26	25	35	34	24	23	25	24
Force (kn) =		635	677	796	336	551	669	763	3201	937	978	790	890	890	701	701	4087	625	1930	1000	2363	1196	2990	1163	2746	1210	3053	1022	2479
Tension Combined Force (kN) =		5643	10998	13784	793	-5085	-7982	-7930	-2538	7330	-1747	4685	296	296	2270	2270	9546	2248	3533	910	2192	2931	4694	1028	2547	2911	4752	868	2266
Compression Combined Force (kN) =		1439	5946	7538	-1128	-9121	-13331	-14303	-11910	3175	-5880	1085	-3431	-3431	-982	-982	-4436	-129	-1492	-1185	-2626	-574	-2443	-1360	-3057	-608	-2500	-1224	-2809
ULS Capacity	Tension (kN)	11260	23315	28633	10751				41129	15682	14313	10391	9511	9511	7009	7009	20184	5993	10579	4829	8871	5993	10579	4829	8871	5993	10579	4829	8871
	Compression (kN)				8905	15748	24908	26604	37336	14106	12911	9248	6918	6918	4982	4982	14340	4383	6697	3510	5626.58	4307	6698	3466	5625.87	4274	6698	3452	5632
	Capacity/Need	0.50	0.47	0.48	0.07	NA	NA	NA	NA	0.47	NA	0.45	0.03	0.03	0.32	0.32	0.47	0.38	0.33	0.19	0.25	0.49	0.44	0.21	0.29	0.49	0.45	0.18	0.26
		NA	NA	NA	0.126647	0.579209	0.535217	0.537644	0.318997	NA	0.4554687	NA	0.4958718	0.49587	0.19709	0.19709	0.30935	0.02945	0.22277	0.33774	0.46672	0.13337	0.3647	0.39232	0.5433	0.14229	0.3732	0.35457	0.49883

Case 6		Highway Truss																											
		Bottom Chord			**Top Chord**				**Diagonals**								**Verticals**												
		L0-L2	**L2-L4**	**L4-L6**	**U0-U1**	**U1-U3**	**U3-U5**	**U5-U6**	**L0-U1**	**U1-L2**	**L2-U3**	**U3-L4**	**L4-U5 (Min)**	**L4-U5 (Max)**	**U5-L6 (Min)**	**U5-L6 (Max)**	**U0-L0**	**U1-L1 (Top)**	**U1-L1 (Bot)**	**U2-L2 (Top)**	**U2-L2 (Bot)**	**U3-L3 (Top)**	**U3-L3 (Bot)**	**U4-L4 (Top)**	**U4-L4 (Bot)**	**U5-L5 (Top)**	**U5-L5 (Bot)**	**U6-L6 (Top)**	**U6-L6 (Bot)**
Axial	ULS Max	4400	8828	10950	685	-4817	-7493	-7493	-5516	6054	-2482	3637	-464	-464	1509	1509	5435	1710	1689	-74	-128	1704	1715	-126	-160	1612	1641	-125	-161
	ULS Min	1330	5313	6648	-574	-7639	-11185	-11894	-8484	3824	-4593	1659	-2376	-2376	-328	-328	-371	573	457	-169	-308	588	484	-169	-320	533	461	-155	-320
IY Bending	ULS Max	64	91	91	62	87	120	126	333	118	106	84	95	95	83	83	405	108	108	75	75	85	103	0	82	0	108	0	113
	ULS Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-810	0	-472	-46	-353	-89	-448	-97	-318	-153	-396	-111	-303
IZ Bending	ULS Max	100	31	31	32	32	32	32	411	104	122	106	112	112	103	103	292	56	253	77	188	85	169	0	134	0	78	0	18
	ULS Min	-89	-31	-31	-32	-32	-32	-32	-462	-104	-122	-106	-112	-112	-103	-103	-412	-174	-352	-189	-277	-181	-224	-150	-151	-123	-123	-86	-86
	Area =	34497	63045	62561	44286	64282	90245	94439	126009	43852	35464	26513	29820	29820	25303	25303	61838	21494	37944	17319	31817	21494	37944	17319	31817	21494	37944	17319	31817
	Iy =	3731	4974	4902	5165	7358	10317	10551	11932	3805	3337	2152	2277	2277	1805	1805	4558	2080	3296	1635	2647	2080	3296	1635	2647	2080	3296	1635	2647
	Iz =	2969	5204	4739	6054	9040	12393	13000	18155	4040	3159	2397	2650	2650	2383	2383	3198	1127	1179	955	999	1127	1179	955	999	1127	1179	955	999
	Y	391	391	391	419	396	403	403	420	391	391	340	340	340	314	314	305	305	305	302	302	305	305	302	302	305	305	302	302
	Z	303	295	283	483	533	533	533	533	305	298	300	297	297	306	306	356	257	257	257	257	257	257	257	257	257	257	257	257
	Stress Y	7	7	7	5	5	5	5	12	12	12	13	14	14	14	14	54	16	44	14	40	13	41	18	36	22	37	20	35
	Stress Z	10	2	2	3	2	1	1	14	8	12	13	13	13	13	13	46	40	77	51	71	41	49	40	39	28	27	23	22
	Force (kn) =	583	558	567	336	421	548	578	3187	875	848	702	795	795	701	701	6186	1191	4574	1120	3550	1165	3426	1010	2394	1084	2406	753	1800
Tension Combined Force (kN) =		4983	9387	11517	1020	-4397	-6945	-6916	-2329	6929	-1634	4338	331	331	2210	2210	11621	2900	6263	1046	3422	2868	5141	884	2234	2696	4047	628	1639
Compression Combined Force (kN) =		747	4755	6081	-910	-8060	-11733	-12472	-11670	2949	-5441	958	-3171	-3171	-1030	-1030	-6557	-618	-4117	-1289	-3858	-577	-2943	-1179	-2713	-550	-1945	-908	-2120
ULS Capacity	Tension	9088	16665	20420	10751				30141	11555	9441	7273	8137	8137	7009	7009	20184	5993	10579	4829	8871	5993	10579	4829	8871	5993	10579	4829	8871
	Compression				8905	11220	15771	16429	25174	8728	7068	5260	5896	5896	4982	4982	14340	4383	6697	3510	5627	4307	6698	3466	5625.87	4274	6698	3452	5632
	Capacity/Need	0.55	0.56	0.56	0.09	NA	NA	NA	NA	0.60	NA	0.60	0.04	0.04	0.32	0.32	0.58	0.48	0.59	0.22	0.39	0.48	0.49	0.18	0.25	0.45	0.38	0.13	0.18
		NA	NA	NA	0.10219	0.718318	0.744005	0.759158	0.463584	NA	0.7697993	NA	0.5378705	0.53787	0.20671	0.20671	0.45727	0.14093	0.61476	0.36728	0.68563	0.13399	0.4394	0.34015	0.48229	0.1288	0.29036	0.26317	0.37642

Case 7		Railway Truss																											
		Bottom Chord			**Top Chord**				**Diagonals**								**Verticals**												
		L0-L2	**L2-L4**	**L4-L6**	**U0-U1**	**U1-U3**	**U3-U5**	**U5-U6**	**L0-U1**	**U1-L2**	**L2-U3**	**U3-L4**	**L4-U5 (Min)**	**L4-U5 (Max)**	**U5-L6 (Min)**	**U5-L6 (Max)**	**U0-L0**	**U1-L1 (Top)**	**U1-L1 (Bot)**	**U2-L2 (Top)**	**U2-L2 (Bot)**	**U3-L3 (Top)**	**U3-L3 (Bot)**	**U4-L4 (Top)**	**U4-L4 (Bot)**	**U5-L5 (Top)**	**U5-L5 (Bot)**	**U6-L6 (Top)**	**U6-L6 (Bot)**
Axial	ULS Max	4736	10185	12817	295	-5569	-8482	-8524	-5624	6309	-2664	3848	-569	-569	1558	1558	5340	1605	1585	-102	-171	1718	1686	-140	-199	1684	1681	-154	-213
	ULS Min	2272	6571	8268	-603	-8457	-12493	-13359	-8593	4028	-4841	1829	-2516	-2516	-291	-291	-349	479	421	-175	-263	604	530	-191	-310	585	536	-201	-329
IY Bending	ULS Max	62	111	126	62	121	142	154	329	128	128	98	109	109	83	83	758	1	401	0	387	0	576	0	455	0	612	0	465
	ULS Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-400	-106	-107	-144	-146	-200	-219	-170	-193	-216	-239	-180	-206
IZ Bending	ULS Max	76	22	22	23	23	23	23	378	74	87	76	80	80	74	74	109	46	60	59	60	59	59	104	116	80	80	69	69
	ULS Min	-108	-22	-22	-23	-23	-23	-23	-359	-74	-87	-76	-80	-80	-74	-74	-112	-33	-33	-90	-103	-88	-88	-77	-77	-69	-69	-59	-59
Section Properties	Area =	34497	71432	87722	44286	90245	107019	117180	126009	48045	43852	31835	35142	35142	25303	25303	61838	21494	37944	17319	31817	21494	37944	17319	31817	21494	37944	17319	31817
	Iy =	3731	5442	6307	5165	10317	11253	11454	11932	4040	3805	2380	2506	2506	1805	1805	4558	2080	3296	1635	2647	2080	3296	1635	2647	2080	3296	1635	2647
	Iz =	2969	6066	7217	6054	12393	14755	16273	18155	4494	4040	2973	3214	3214	2383	2383	3198	1127	1179	955	999	1127	1179	955	999	1127	1179	955	999
	Y	391	391	391	419	403	403	407	420	391	391	340	340	340	314	314	305	305	305	302	302	305	305	302	302	305	305	302	302
	Z	303	302	302	483	533	533	533	533	308	305	305	302	302	306	306	356	257	257	257	257	257	257	257	257	257	257	257	257
	Stress Y	6	8	8	5	5	5	5	12	12	13	14	15	15	14	14	51	16	37	27	44	29	53	31	52	32	57	33	53
	Stress Z	11	1	1	2	1	1	1	11	5	7	8	7	7	9	9	12	11	13	24	26	20	19	28	30	18	17	18	18
Force (kn) =		604	645	764	304	515	634	728	2854	839	863	691	784	784	605	605	3903	560	1906	880	2246	1060	2747	1028	2597	1073	2808	897	2249
Tension Combined Force (kN) =		5340	10831	13581	598	-5053	-7848	-7795	-2769	7148	-1801	4540	216	216	2164	2164	9244	2166	3491	778	2074	2777	4433	888	2398	2757	4489	743	2036
Compression Combined Force (kN) =		1668	5926	7504	-906	-8972	-13126	-14087	-11447	3188	-5704	1138	-3300	-3300	-896	-896	-4252	-81	-1485	-1055	-2508	-455	-2217	-1218	-2907	-488	-2272	-1098	-2578
ULS Capacity	Tension (kN)	11260	23315	28633	10751				41129	15682	14313	10391	9511	9511	7009	7009	20184	5993	10579	4829	8871	5993	10579	4829	8871	5993	10579	4829	8871
	Compression (kN)				8905	15748	24908	26604	37336	14106	12911	9248	6918	6918	4982	4982	14340	4383	6697	3510	5626.58	4307	6698	3466	5625.87	4274	6698	3452	5632
	Capacity/Need	0.47	0.46	0.47	0.06	NA	NA	NA	NA	0.46	NA	0.44	0.02	0.02	0.31	0.31	0.46	0.36	0.33	0.16	0.23	0.46	0.42	0.18	0.27	0.46	0.42	0.15	0.23
		NA	NA	NA	0.10179	0.56972	0.527	0.529514	0.306596	NA	0.4417948	NA	0.4769495	0.47695	0.17988	0.17988	0.29653	0.01851	0.2217	0.30055	0.44583	0.10568	0.33103	0.35157	0.51663	0.11422	0.33917	0.31811	0.45785

Case 7		Highway Truss																											
		Bottom Chord			**Top Chord**				**Diagonals**								**Verticals**												
		L0-L2	**L2-L4**	**L4-L6**	**U0-U1**	**U1-U3**	**U3-U5**	**U5-U6**	**L0-U1**	**U1-L2**	**L2-U3**	**U3-L4**	**L4-U5 (Min)**	**L4-U5 (Max)**	**U5-L6 (Min)**	**U5-L6 (Max)**	**U0-L0**	**U1-L1 (Top)**	**U1-L1 (Bot)**	**U2-L2 (Top)**	**U2-L2 (Bot)**	**U3-L3 (Top)**	**U3-L3 (Bot)**	**U4-L4 (Top)**	**U4-L4 (Bot)**	**U5-L5 (Top)**	**U5-L5 (Bot)**	**U6-L6 (Top)**	**U6-L6 (Bot)**
Axial	ULS Max	4092	8715	10809	498	-4771	-7331	-7331	-5405	5975	-2425	3594	-441	-441	1499	1499	5317	1692	1672	-85	-128	1687	1697	-132	-160	1597	1624	-126	-161
	ULS Min	1562	5280	6613	-410	-7539	-11036	-11736	-8373	3745	-4536	1617	-2353	-2353	-338	-338	-371	556	440	-158	-301	571	467	-164	-318	517	445	-155	-320
IY Bending	ULS Max	63	91	91	62	87	120	126	329	118	106	84	95	95	83	83	407	106	106	74	74	84	102	0	84	0	110	0	115
	ULS Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-809	0	-467	-46	-350	-89	-444	-97	-316	-152	-393	-111	-301
IZ Bending	ULS Max	94	22	22	23	23	23	23	327	74	87	76	80	80	74	74	270	42	239	55	184	61	147	0	114	0	74	0	18
	ULS Min	-82	-22	-22	-23	-23	-23	-23	-375	-74	-87	-76	-80	-80	-74	-74	-379	-152	-323	-159	-253	-149	-203	-121	-140	-95	-95	-61	-61
	Area =	34497	63045	62561	44286	64282	90245	94439	126009	43852	35464	26513	29820	29820	25303	25303	61838	21494	37944	17319	31817	21494	37944	17319	31817	21494	37944	17319	31817
	Iy =	3731	4974	4902	5165	7358	10317	10551	11932	3805	3337	2152	2277	2277	1805	1805	4558	2080	3296	1635	2647	2080	3296	1635	2647	2080	3296	1635	2647
	Iz =	2969	5204	4739	6054	9040	12393	13000	18155	4040	3159	2397	2650	2650	2383	2383	3198	1127	1179	955	999	1127	1179	955	999	1127	1179	955	999
	Y	391	391	391	419	396	403	403	420	391	391	340	340	340	314	314	305	305	305	302	302	305	305	302	302	305	305	302	302
	Z	303	295	283	483	533	533	533	533	305	298	300	297	297	306	306	356	257	257	257	257	257	257	257	257	257	257	257	257
	Stress Y	7	7	7	5	5	5	5	12	12	12	13	14	14	14	14	54	16	43	14	40	13	41	18	36	22	36	20	34
	Stress Z	10	1	1	2	1	1	1	11	6	8	9	9	9	9	9	42	35	70	43	65	34	44	33	36	22	21	16	16
	Force (kn) =	556	527	534	304	387	513	542	2844	777	731	601	688	688	605	605	5950	1081	4311	979	3345	1013	3239	874	2295	946	2167	639	1592
Tension Combined Force (kN) =		4648	9242	11344	802	-4384	-6818	-6789	-2561	6751	-1694	4195	247	247	2104	2104	11267	2774	5982	895	3217	2700	4937	742	2135	2543	3790	513	1431
Compression Combined Force (kN) =		1006	4754	6079	-714	-7926	-11549	-12279	-11217	2968	-5267	1016	-3041	-3041	-943	-943	-6321	-526	-3871	-1137	-3646	-442	-2773	-1038	-2613	-428	-1722	-794	-1913
ULS Capacity	Tension	9088	16665	20420	10751				30141	11555	9441	7273	8137	8137	7009	7009	20184	5993	10579	4829	8871	5993	10579	4829	8871	5993	10579	4829	8871
	Compression				8905	11220	15771	16429	25174	8728	7068	5260	5896	5896	4982	4982	14340	4383	6697	3510	5627	4307	6698	3466	5625.87	4274	6698	3452	5632
	Capacity/Need	0.51	0.55	0.56	0.07	NA	NA	NA	NA	0.58	NA	0.58	0.03	0.03	0.30	0.30	0.56	0.46	0.57	0.19	0.36	0.45	0.47	0.15	0.24	0.42	0.36	0.11	0.16
		NA	NA	NA	0.080195	0.706375	0.732344	0.747403	0.445579	NA	0.745201	NA	0.5158323	0.51583	0.18932	0.18932	0.44079	0.11997	0.57799	0.32392	0.64792	0.10262	0.41398	0.29952	0.46452	0.10025	0.2571	0.23003	0.33964

Case 8		Railway Truss																											
		Bottom Chord			Top Chord				Diagonals								Verticals												
		L0-L2	L2-L4	L4-L6	U0-U1	U1-U3	U3-U5	U5-U6	L0-U1	U1-L2	L2-U3	U3-L4	L4-U5 (Min)	L4-U5 (Max)	U5-L6 (Min)	U5-L6 (Max)	U0-L0	U1-L1 (Top)	U1-L1 (Bot)	U2-L2 (Top)	U2-L2 (Bot)	U3-L3 (Top)	U3-L3 (Bot)	U4-L4 (Top)	U4-L4 (Bot)	U5-L5 (Top)	U5-L5 (Bot)	U6-L6 (Top)	U6-L6 (Bot)
Axial	ULS Max	4938	10157	12782	459	-5499	-8447	-8489	-5600	6291	-2651	3839	-563	-563	1556	1556	5333	1602	1582	-91	-171	1714	1682	-135	-199	1680	1678	-154	-213
	ULS Min	2002	6459	8129	-790	-8433	-12458	-13321	-8569	4010	-4828	1820	-2510	-2510	-293	-293	-349	476	418	-185	-263	601	527	-197	-310	581	532	-201	-329
IY Bending	ULS Max	63	111	126	62	121	142	154	333	128	128	98	109	109	83	83	758	5	400	2	386	0	575	0	454	0	610	0	464
	ULS Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-401	-106	-107	-144	-146	-200	-219	-170	-193	-216	-239	-180	-205
IZ Bending	ULS Max	82	31	31	32	32	32	32	466	104	122	106	112	112	103	103	133	58	60	81	81	83	83	131	131	106	106	94	94
	ULS Min	-115	-31	-31	-32	-32	-32	-32	-446	-104	-122	-106	-112	-112	-103	-103	-137	-44	-44	-114	-114	-114	-114	-103	-103	-95	-95	-84	-84
Section Properties	Area =	34497	71432	87722	44286	90245	107019	117180	126009	48045	43852	31835	35142	35142	25303	25303	61838	21494	37944	17319	31817	21494	37944	17319	31817	21494	37944	17319	31817
	Iy =	3731	5442	6307	5165	10317	11253	11454	11932	4040	3805	2380	2506	2506	1805	1805	4558	2080	3296	1635	2647	2080	3296	1635	2647	2080	3296	1635	2647
	Iz =	2969	6066	7217	6054	12393	14755	16273	18155	4494	4040	2973	3214	3214	2383	2383	3198	1127	1179	955	999	1127	1179	955	999	1127	1179	955	999
	Y	391	391	391	419	403	403	407	420	391	391	340	340	340	314	314	305	305	305	302	302	305	305	302	302	305	305	302	302
	Z	303	302	302	483	533	533	533	533	308	305	305	302	302	306	306	356	257	257	257	257	257	257	257	257	257	257	257	257
	Stress Y	7	8	8	5	5	5	5	12	12	13	14	15	15	14	14	51	16	37	27	44	29	53	31	52	32	56	33	53
	Stress Z	12	2	1	3	1	1	1	14	7	9	11	10	10	13	13	15	13	13	31	29	26	25	35	34	24	23	25	24
Force (kn) =		634	677	796	336	551	669	763	3201	937	978	790	890	890	701	701	4076	618	1901	992	2338	1186	2959	1152	2716	1201	3020	1015	2455
Tension Combined Force (kN) =		5572	10834	13578	795	-4948	-7778	-7726	-2398	7228	-1673	4629	326	326	2257	2257	9409	2220	3483	901	2167	2900	4641	1018	2518	2881	4698	861	2242
Compression Combined Force (kN) =		1367	5783	7333	-1126	-8984	-13127	-14085	-11770	3073	-5807	1029	-3400	-3400	-994	-994	-4425	-143	-1483	-1177	-2601	-585	-2432	-1349	-3026	-619	-2488	-1216	-2784
ULS Capacity	Tension (kN)	11260	23315	28633	10751				41129	15682	14313	10391	9511	9511	7009	7009	20184	5993	10579	4829	8871	5993	10579	4829	8871	5993	10579	4829	8871
	Compression (kN)				8905	15748	24908	26604	37336	14106	12911	9248	6918	6918	4982	4982	14340	4383	6697	3510	5626.58	4307	6698	3466	5625.87	4274	6698	3452	5632
	Capacity/Need	0.49	0.46	0.47	0.07	NA	NA	NA	NA	0.46	NA	0.45	0.03	0.03	0.32	0.32	0.47	0.37	0.33	0.19	0.24	0.48	0.44	0.21	0.28	0.48	0.44	0.18	0.25
		NA	NA	NA	0.126411	0.57049	0.527009	0.529421	0.315251	NA	0.4497494	NA	0.4914055	0.49141	0.19959	0.19959	0.30855	0.03261	0.22147	0.3353	0.46226	0.13592	0.36312	0.38922	0.53788	0.14494	0.37147	0.3523	0.49429

Case 8		Highway Truss																											
		Bottom Chord			Top Chord				Diagonals								Verticals												
		L0-L2	L2-L4	L4-L6	U0-U1	U1-U3	U3-U5	U5-U6	L0-U1	U1-L2	L2-U3	U3-L4	L4-U5 (Min)	L4-U5 (Max)	U5-L6 (Min)	U5-L6 (Max)	U0-L0	U1-L1 (Top)	U1-L1 (Bot)	U2-L2 (Top)	U2-L2 (Bot)	U3-L3 (Top)	U3-L3 (Bot)	U4-L4 (Top)	U4-L4 (Bot)	U5-L5 (Top)	U5-L5 (Bot)	U6-L6 (Top)	U6-L6 (Bot)
Axial	ULS Max	4341	8692	10780	683	-4697	-7315	-7315	-5383	5958	-2414	3585	-437	-437	1497	1497	5311	1688	1668	-74	-128	1684	1694	-126	-161	1593	1620	-126	-161
	ULS Min	1271	5178	6478	-576	-7519	-11006	-11704	-8350	3729	-4524	1608	-2348	-2348	-340	-340	-371	552	436	-169	-308	568	463	-169	-320	514	441	-155	-320
IY Bending	ULS Max	64	91	91	62	87	120	126	333	118	106	84	95	95	83	83	406	106	106	74	74	84	102	0	84	0	111	0	115
	ULS Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-809	-1	-466	-46	-349	-89	-443	-97	-315	-152	-393	-111	-301
IZ Bending	ULS Max	100	31	31	32	32	32	32	412	104	122	106	112	112	103	103	289	57	250	78	186	87	168	0	133	0	77	0	18
	ULS Min	-89	-31	-31	-32	-32	-32	-32	-461	-104	-122	-106	-112	-112	-103	-103	-409	-172	-349	-187	-274	-179	-222	-150	-150	-122	-122	-86	-86
	Area =	34497	63045	62561	44286	64282	90245	94439	126009	43852	35464	26513	29820	29820	25303	25303	61838	21494	37944	17319	31817	21494	37944	17319	31817	21494	37944	17319	31817
	Iy =	3731	4974	4902	5165	7358	10317	10551	11932	3805	3337	2152	2277	2277	1805	1805	4558	2080	3296	1635	2647	2080	3296	1635	2647	2080	3296	1635	2647
	Iz =	2969	5204	4739	6054	9040	12393	13000	18155	4040	3159	2397	2650	2650	2383	2383	3198	1127	1179	955	999	1127	1179	955	999	1127	1179	955	999
	Y	391	391	391	419	396	403	403	420	391	391	340	340	340	314	314	305	305	305	302	302	305	305	302	302	305	305	302	302
	Z	303	295	283	483	533	533	533	533	305	298	300	297	297	306	306	356	257	257	257	257	257	257	257	257	257	257	257	257
	Stress Y	7	7	7	5	5	5	5	12	12	12	13	14	14	14	14	54	16	43	14	40	13	41	18	36	22	36	20	34
	Stress Z	10	2	2	3	2	1	1	14	8	12	13	13	13	13	13	45	39	76	50	71	41	48	40	39	28	27	23	22
Force (kn) =		583	558	567	336	421	548	578	3185	875	848	702	795	795	701	701	6153	1179	4522	1111	3512	1161	3391	1006	2370	1080	2392	753	1791
Tension Combined Force (kN) =		4924	9250	11347	1019	-4276	-6766	-6737	-2198	6833	-1565	4287	359	359	2198	2198	11464	2867	6190	1037	3383	2844	5085	880	2210	2673	4012	627	1630
Compression Combined Force (kN) =		687	4620	5911	-911	-7939	-11554	-12281	-11535	2854	-5372	906	-3143	-3143	-1041	-1041	-6525	-627	-4086	-1280	-3819	-593	-2928	-1175	-2690	-566	-1950	-908	-2112
ULS Capacity	Tension	9088	16665	20420	10751				30141	11555	9441	7273	8137	8137	7009	7009	20184	5993	10579	4829	8871	5993	10579	4829	8871	5993	10579	4829	8871
	Compression				8905	11220	15771	16429	25174	8728	7068	5260	5896	5896	4982	4982	14340	4383	6697	3510	5627	4307	6698	3466	5625.87	4274	6698	3452	5632
	Capacity/Need	0.54	0.56	0.56	0.09	NA	NA	NA	NA	0.59	NA	0.59	0.04	0.04	0.31	0.31	0.57	0.48	0.59	0.21	0.38	0.47	0.48	0.18	0.25	0.45	0.38	0.13	0.18
		NA	NA	NA	0.102333	0.707581	0.732641	0.747566	0.4582	NA	0.7600595	NA	0.5331095	0.53311	0.209	0.209	0.45498	0.14298	0.61013	0.36479	0.67882	0.13767	0.43721	0.33914	0.47822	0.13238	0.2912	0.26309	0.37498

Case 9		Railway Truss																													
		Bottom Chord			Top Chord				Diagonals								Verticals														
		L0-L2	L2-L4	L4-L6	U0-U1	U1-U3	U3-U5	U5-U6	L0-U1	U1-L2	L2-U3	U3-L4	L4-U5 (Min)	L4-U5 (Max)	U5-L6 (Min)	U5-L6 (Max)	U0-L0	U1-L1 (Top)	U1-L1 (Bot)	U2-L2 (Top)	U2-L2 (Bot)	U3-L3 (Top)	U3-L3 (Bot)	U4-L4 (Top)	U4-L4 (Bot)	U5-L5 (Top)	U5-L5 (Bot)	U6-L6 (Top)	U6-L6 (Bot)
Axial	ULS Max	5579	11631	14637	440	-6734	-10278	-10328	-6853	7203	-3317	4343	-840	-840	1669	1669	6467	1790	1770	-90	-173	1905	1873	-135	-203	1868	1870	-155	-218
	ULS Min	2643	7930	9977	-809	-9668	-14297	-15289	-9828	4923	-5492	2325	-2788	-2788	-181	-181	-349	663	605	-184	-264	791	717	-197	-314	769	725	-203	-334
IY Bending	ULS Max	63	111	126	62	121	142	154	332	128	128	98	109	109	83	83	770	0	456	0	435	0	645	0	511	0	688	0	524
	ULS Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-388	-121	-122	-159	-161	-221	-242	-189	-214	-239	-263	-200	-228
IZ Bending	ULS Max	82	31	31	32	32	32	32	466	104	122	106	112	112	103	103	141	61	68	82	82	82	82	138	138	109	109	95	95
	ULS Min	-115	-31	-31	-32	-32	-32	-32	-445	-104	-122	-106	-112	-112	-103	-103	-144	-44	-45	-120	-121	-118	-118	-105	-105	-96	-96	-83	-83
Section Properties	Area =	34497	71432	87722	44286	90245	107019	117180	126009	48045	43852	31835	35142	35142	25303	25303	61838	21494	37944	17319	31817	21494	37944	17319	31817	21494	37944	17319	31817
	Iy =	3731	5442	6307	5165	10317	11253	11454	11932	4040	3805	2380	2506	2506	1805	1805	4558	2080	3296	1635	2647	2080	3296	1635	2647	2080	3296	1635	2647
	Iz =	2969	6066	7217	6054	12393	14755	16273	18155	4494	4040	2973	3214	3214	2383	2383	3198	1127	1179	955	999	1127	1179	955	999	1127	1179	955	999
	Y	391	391	391	419	403	403	407	420	391	391	340	340	340	314	314	305	305	305	302	302	305	305	302	302	305	305	302	302
	Z	303	302	302	483	533	533	533	533	308	305	305	302	302	306	306	356	257	257	257	257	257	257	257	257	257	257	257	257
	Stress Y	7	8	8	5	5	5	5	12	12	13	14	15	15	14	14	52	18	42	29	50	32	60	35	58	35	64	37	60
	Stress Z	12	2	1	3	1	1	1	14	7	9	11	10	10	13	13	16	14	15	32	31	27	26	37	36	25	24	26	25
Force (kn) =		635	677	796	336	551	669	763	3200	937	978	790	890	890	701	701	4179	681	2167	1070	2563	1277	3245	1249	2987	1287	3318	1084	2679
Tension Combined Force (kN) =		6213	12308	15433	776	-6183	-9608	-9564	-3652	8140	-2338	5134	49	49	2371	2371	10646	2471	3937	980	2390	3182	5118	1114	2784	3154	5188	929	2461
Compression Combined Force (kN) =		2009	7253	9181	-1145	-10219	-14966	-16053	-13028	3986	-6471	1535	-3678	-3678	-882	-882	-4528	-18	-1562	-1254	-2827	-486	-2528	-1446	-3300	-518	-2593	-1287	-3013
ULS Capacity	Tension (kN)	11260	23315	28633	10751				41129	15682	14313	10391	9511	9511	7009	7009	20184	5993	10579	4829	8871	5993	10579	4829	8871	5993	10579	4829	8871
	Compression (kN)				8905	15748	24908	26604	37336	14106	12911	9248	6918	6918	4982	4982	14340	4383	6697	3510	5626.58	4307	6698	3466	5625.87	4274	6698	3452	5632
	Capacity/Need	0.55	0.53	0.54	0.07	NA	NA	NA	NA	0.52	NA	0.49	0.01	0.01	0.34	0.34	0.53	0.41	0.37	0.20	0.27	0.53	0.48	0.23	0.31	0.53	0.49	0.19	0.28
		NA	NA	NA	0.128535	0.64893	0.600852	0.603396	0.348946	NA	0.5011986	NA	0.5315934	0.53159	0.17709	0.17709	0.31575	0.00414	0.23323	0.35722	0.50247	0.11283	0.3774	0.41716	0.58661	0.1211	0.38716	0.37277	0.53507

Case 9		Highway Truss																													
		Bottom Chord			Top Chord				Diagonals								Verticals														
		L0-L2	L2-L4	L4-L6	U0-U1	U1-U3	U3-U5	U5-U6	L0-U1	U1-L2	L2-U3	U3-L4	L4-U5 (Min)	L4-U5 (Max)	U5-L6 (Min)	U5-L6 (Max)	U0-L0	U1-L1 (Top)	U1-L1 (Bot)	U2-L2 (Top)	U2-L2 (Bot)	U3-L3 (Top)	U3-L3 (Bot)	U4-L4 (Top)	U4-L4 (Bot)	U5-L5 (Top)	U5-L5 (Bot)	U6-L6 (Top)	U6-L6 (Bot)
Axial	ULS Max	4874	9923	12311	695	-5781	-8921	-8921	-6581	6817	-3031	4049	-688	-688	1601	1601	6429	1878	1857	-74	-127	1864	1880	-124	-156	1765	1804	-123	-156
	ULS Min	1796	6397	8004	-564	-8602	-12618	-13417	-9554	4586	-5143	2071	-2601	-2601	-237	-237	-369	741	623	-170	-309	747	647	-168	-318	686	623	-153	-318
IY Bending	ULS Max	64	91	91	62	87	120	126	332	118	106	84	95	95	83	83	392	120	120	81	81	89	105	0	60	0	82	0	94
	ULS Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-823	0	-522	-40	-384	-85	-483	-96	-340	-157	-421	-112	-321
IZ Bending	ULS Max	99	31	31	32	32	32	32	407	104	122	106	112	112	103	103	314	44	275	66	206	77	177	0	145	0	85	0	18
	ULS Min	-91	-31	-31	-32	-32	-32	-32	-466	-104	-122	-106	-112	-112	-103	-103	-443	-185	-381	-199	-301	-189	-243	-157	-164	-126	-126	-86	-86
	Area =	34497	63045	62561	44286	64282	90245	94439	126009	43852	35464	26513	29820	29820	25303	25303	61838	21494	37944	17319	31817	21494	37944	17319	31817	21494	37944	17319	31817
	Iy =	3731	4974	4902	5165	7358	10317	10551	11932	3805	3337	2152	2277	2277	1805	1805	4558	2080	3296	1635	2647	2080	3296	1635	2647	2080	3296	1635	2647
	Iz =	2969	5204	4739	6054	9040	12393	13000	18155	4040	3159	2397	2650	2650	2383	2383	3198	1127	1179	955	999	1127	1179	955	999	1127	1179	955	999
	Y	391	391	391	419	396	403	403	420	391	391	340	340	340	314	314	305	305	305	302	302	305	305	302	302	305	305	302	302
	Z	303	295	283	483	533	533	533	533	305	298	300	297	297	306	306	356	257	257	257	257	257	257	257	257	257	257	257	257
	Stress Y	7	7	7	5	5	5	5	12	12	12	13	14	14	14	14	55	18	48	15	44	13	45	18	39	23	39	21	37
	Stress Z	10	2	2	3	2	1	1	14	8	12	13	13	13	13	13	49	42	83	54	77	43	53	42	42	29	28	23	22
	Force (kn) =	579	558	567	336	421	548	578	3200	875	848	702	795	795	701	701	6450	1287	4988	1189	3855	1208	3706	1039	2579	1114	2523	758	1866
Tension Combined Force (kN) =		5454	10482	12877	1030	-5360	-8372	-8343	-3380	7692	-2183	4751	107	107	2302	2302	12879	3165	6845	1114	3728	3072	5586	915	2423	2879	4327	635	1710
Compression Combined Force (kN) =		1217	5839	7437	-900	-9023	-13166	-13995	-12754	3711	-5991	1369	-3396	-3396	-938	-938	-6819	-546	-4365	-1359	-4164	-461	-3059	-1207	-2897	-428	-1900	-911	-2184
ULS Capacity	Tension	9088	16665	20420	10751				30141	11555	9441	7273	8137	8137	7009	7009	20184	5993	10579	4829	8871	5993	10579	4829	8871	5993	10579	4829	8871
	Compression				8905	11220	15771	16429	25174	8728	7068	5260	5896	5896	4982	4982	14340	4383	6697	3510	5627	4307	6698	3466	5625.87	4274	6698	3452	5632
	Capacity/Need	0.60	0.63	0.63	0.10	NA	NA	NA	NA	0.67	NA	0.65	0.01	0.01	0.33	0.33	0.64	0.53	0.65	0.23	0.42	0.51	0.53	0.19	0.27	0.48	0.41	0.13	0.19
		NA	NA	NA	0.101056	0.80418	0.834876	0.851854	0.506634	NA	0.8476724	NA	0.5759403	0.57594	0.18838	0.18838	0.4755	0.12455	0.65182	0.38713	0.74006	0.10709	0.45679	0.34821	0.51488	0.10006	0.28369	0.26386	0.38784

Primary Truss	
Summary	D/C Max
Case 0	0.71
Case 1	0.71
Case 2	0.72
Case 3	0.69
Case 4	0.70
Case 5	0.73
Case 6	0.77
Case 7	0.75
Case 8	0.76
Case 9	0.85

Lift Girder	
Summary	D/C Max
Case 0	0.61
Case 1	0.62
Case 2	0.62
Case 3	0.61
Case 4	0.61
Case 5	0.64
Case 6	0.67
Case 7	0.66
Case 8	0.66
Case 9	0.74

End Floor Beam	
Summary	D/C Max
Case 0	0.43
Case 1	0.43
Case 2	0.43
Case 3	0.43
Case 4	0.43
Case 5	0.44
Case 6	0.45
Case 7	0.45
Case 8	0.45
Case 9	0.47

Int Floor Beam	
Summary	D/C Max
Case 0	0.39
Case 1	0.40
Case 2	0.40
Case 3	0.39
Case 4	0.39
Case 5	0.41
Case 6	0.43
Case 7	0.43
Case 8	0.43
Case 9	0.48

1959 Stringer	
Summary	D/C Max
Case 0	0.79

1982 Stringers	
Summary	D/C Max
Case 0	0.48

Case 0 (Existing)

Member	Railway Truss		Highway Truss	
	Tension	Compression	Tension	Compression
L0-L2	0.45	NA	0.50	NA
L2-L4	0.42	NA	0.51	NA
L4-L6	0.43	NA	0.51	NA
U0-U1	0.08	0.12	0.09	0.10
U1-U3	NA	0.52	NA	0.65
U3-U5	NA	0.48	NA	0.67
U5-U6	NA	0.48	NA	0.68
L0-U1	NA	0.29	NA	0.43
U1-L2	0.43	NA	0.55	NA
L2-U3	NA	0.42	NA	0.71
U3-L4	0.42	NA	0.55	NA
L4-U5 (Min)	0.05	0.47	0.06	0.51
L4-U5 (Max)	0.05	0.47	0.06	0.51
U5-L6 (Min)	0.31	0.21	0.30	0.22
U5-L6 (Max)	0.31	0.21	0.30	0.22
U0-L0	0.43	0.30	0.52	0.44
U1-L1 (Top)	0.34	0.05	0.45	0.15
U1-L1 (Bot)	0.30	0.22	0.54	0.58
U2-L2 (Top)	0.18	0.32	0.20	0.35
U2-L2 (Bot)	0.23	0.44	0.36	0.64
U3-L3 (Top)	0.45	0.15	0.45	0.16
U3-L3 (Bot)	0.41	0.35	0.45	0.42
U4-L4 (Top)	0.20	0.37	0.18	0.33
U4-L4 (Bot)	0.26	0.51	0.24	0.46
U5-L5 (Top)	0.45	0.16	0.42	0.15
U5-L5 (Bot)	0.42	0.36	0.36	0.30
U6-L6 (Top)	0.17	0.34	0.13	0.26
U6-L6 (Bot)	0.24	0.47	0.18	0.37

Case 1

Member	Railway Truss		Highway Truss	
	Tension	Compression	Tension	Compression
L0-L2	0.46	NA	0.50	NA
L2-L4	0.43	NA	0.51	NA
L4-L6	0.43	NA	0.51	NA
U0-U1	0.08	0.12	0.09	0.10
U1-U3	NA	0.52	NA	0.65
U3-U5	NA	0.48	NA	0.67
U5-U6	NA	0.48	NA	0.68
L0-U1	NA	0.30	NA	0.43
U1-L2	0.43	NA	0.55	NA
L2-U3	NA	0.42	NA	0.71
U3-L4	0.42	NA	0.55	NA
L4-U5 (Min)	0.05	0.47	0.06	0.51
L4-U5 (Max)	0.05	0.47	0.06	0.51
U5-L6 (Min)	0.31	0.21	0.31	0.22
U5-L6 (Max)	0.31	0.21	0.31	0.22
U0-L0	0.43	0.30	0.53	0.44
U1-L1 (Top)	0.35	0.05	0.45	0.15
U1-L1 (Bot)	0.31	0.22	0.55	0.58
U2-L2 (Top)	0.18	0.32	0.20	0.35
U2-L2 (Bot)	0.23	0.44	0.36	0.64
U3-L3 (Top)	0.46	0.15	0.45	0.16
U3-L3 (Bot)	0.41	0.35	0.45	0.42
U4-L4 (Top)	0.20	0.37	0.18	0.33
U4-L4 (Bot)	0.27	0.51	0.24	0.46
U5-L5 (Top)	0.45	0.16	0.43	0.15
U5-L5 (Bot)	0.42	0.36	0.36	0.30
U6-L6 (Top)	0.17	0.34	0.13	0.26
U6-L6 (Bot)	0.24	0.47	0.18	0.37

Case 2

Member	Railway Truss		Highway Truss	
	Tension	Compression	Tension	Compression
L0-L2	0.46	NA	0.51	NA
L2-L4	0.43	NA	0.51	NA
L4-L6	0.44	NA	0.51	NA
U0-U1	0.07	0.13	0.09	0.10
U1-U3	NA	0.53	NA	0.66
U3-U5	NA	0.49	NA	0.68
U5-U6	NA	0.49	NA	0.69
L0-U1	NA	0.30	NA	0.43
U1-L2	0.43	NA	0.55	NA
L2-U3	NA	0.42	NA	0.72
U3-L4	0.42	NA	0.56	NA
L4-U5 (Min)	0.05	0.47	0.06	0.51
L4-U5 (Max)	0.05	0.47	0.06	0.51
U5-L6 (Min)	0.31	0.21	0.31	0.22
U5-L6 (Max)	0.31	0.21	0.31	0.22
U0-L0	0.43	0.30	0.53	0.44
U1-L1 (Top)	0.35	0.05	0.45	0.15
U1-L1 (Bot)	0.31	0.22	0.55	0.58
U2-L2 (Top)	0.18	0.32	0.21	0.35
U2-L2 (Bot)	0.23	0.44	0.36	0.64
U3-L3 (Top)	0.46	0.15	0.46	0.15
U3-L3 (Bot)	0.42	0.36	0.45	0.42
U4-L4 (Top)	0.20	0.37	0.18	0.33
U4-L4 (Bot)	0.27	0.51	0.24	0.46
U5-L5 (Top)	0.46	0.16	0.43	0.15
U5-L5 (Bot)	0.42	0.36	0.36	0.29
U6-L6 (Top)	0.17	0.34	0.13	0.26
U6-L6 (Bot)	0.24	0.47	0.18	0.37

Case 3

Member	Railway Truss		Highway Truss	
	Tension	Compression	Tension	Compression
L0-L2	0.45	NA	0.50	NA
L2-L4	0.42	NA	0.50	NA
L4-L6	0.43	NA	0.50	NA
U0-U1	0.08	0.12	0.09	0.10
U1-U3	NA	0.51	NA	0.64
U3-U5	NA	0.47	NA	0.66
U5-U6	NA	0.47	NA	0.67
L0-U1	NA	0.29	NA	0.42
U1-L2	0.42	NA	0.54	NA
L2-U3	NA	0.41	NA	0.69
U3-L4	0.41	NA	0.54	NA
L4-U5 (Min)	0.06	0.46	0.07	0.50
L4-U5 (Max)	0.06	0.46	0.07	0.50
U5-L6 (Min)	0.31	0.22	0.30	0.22
U5-L6 (Max)	0.31	0.22	0.30	0.22
U0-L0	0.42	0.30	0.52	0.44
U1-L1 (Top)	0.34	0.05	0.44	0.16
U1-L1 (Bot)	0.30	0.22	0.54	0.58
U2-L2 (Top)	0.17	0.32	0.20	0.35
U2-L2 (Bot)	0.23	0.43	0.35	0.63
U3-L3 (Top)	0.45	0.15	0.45	0.16
U3-L3 (Bot)	0.40	0.35	0.45	0.42
U4-L4 (Top)	0.20	0.37	0.18	0.33
U4-L4 (Bot)	0.26	0.50	0.24	0.46
U5-L5 (Top)	0.45	0.16	0.42	0.16
U5-L5 (Bot)	0.41	0.36	0.36	0.30
U6-L6 (Top)	0.17	0.34	0.13	0.26
U6-L6 (Bot)	0.23	0.46	0.18	0.37

Case 4

Member	Railway Truss		Highway Truss	
	Tension	Compression	Tension	Compression
L0-L2	0.45	NA	0.50	NA
L2-L4	0.42	NA	0.50	NA
L4-L6	0.43	NA	0.50	NA
U0-U1	0.08	0.12	0.09	0.10
U1-U3	NA	0.51	NA	0.64
U3-U5	NA	0.47	NA	0.66
U5-U6	NA	0.48	NA	0.67
L0-U1	NA	0.29	NA	0.42
U1-L2	0.42	NA	0.54	NA
L2-U3	NA	0.41	NA	0.70
U3-L4	0.41	NA	0.54	NA
L4-U5 (Min)	0.06	0.46	0.07	0.50
L4-U5 (Max)	0.06	0.46	0.07	0.50
U5-L6 (Min)	0.31	0.22	0.30	0.22
U5-L6 (Max)	0.31	0.22	0.30	0.22
U0-L0	0.42	0.30	0.52	0.44
U1-L1 (Top)	0.34	0.05	0.44	0.16
U1-L1 (Bot)	0.30	0.22	0.54	0.58
U2-L2 (Top)	0.17	0.32	0.20	0.35
U2-L2 (Bot)	0.23	0.43	0.35	0.63
U3-L3 (Top)	0.45	0.15	0.45	0.16
U3-L3 (Bot)	0.41	0.35	0.45	0.42
U4-L4 (Top)	0.20	0.37	0.18	0.33
U4-L4 (Bot)	0.26	0.50	0.24	0.46
U5-L5 (Top)	0.45	0.16	0.42	0.16
U5-L5 (Bot)	0.41	0.36	0.36	0.30
U6-L6 (Top)	0.17	0.34	0.13	0.26
U6-L6 (Bot)	0.23	0.46	0.18	0.37

Case 5

Member	Railway Truss		Highway Truss	
	Tension	Compression	Tension	Compression
L0-L2	0.48	NA	0.52	NA
L2-L4	0.45	NA	0.53	NA
L4-L6	0.46	NA	0.53	NA
U0-U1	0.07	0.13	0.09	0.10
U1-U3	NA	0.55	NA	0.68
U3-U5	NA	0.51	NA	0.70
U5-U6	NA	0.51	NA	0.72
L0-U1	NA	0.31	NA	0.44
U1-L2	0.44	NA	0.57	NA
L2-U3	NA	0.43	NA	0.73
U3-L4	0.43	NA	0.57	NA
L4-U5 (Min)	0.04	0.48	0.05	0.52
L4-U5 (Max)	0.04	0.48	0.05	0.52
U5-L6 (Min)	0.32	0.21	0.31	0.21
U5-L6 (Max)	0.32	0.21	0.31	0.21
U0-L0	0.45	0.31	0.55	0.45
U1-L1 (Top)	0.36	0.04	0.46	0.15
U1-L1 (Bot)	0.32	0.22	0.57	0.60
U2-L2 (Top)	0.18	0.33	0.21	0.36
U2-L2 (Bot)	0.24	0.45	0.37	0.66
U3-L3 (Top)	0.47	0.14	0.46	0.15
U3-L3 (Bot)	0.43	0.36	0.47	0.43
U4-L4 (Top)	0.20	0.38	0.18	0.34
U4-L4 (Bot)	0.28	0.52	0.24	0.47
U5-L5 (Top)	0.47	0.15	0.44	0.14
U5-L5 (Bot)	0.43	0.37	0.37	0.29
U6-L6 (Top)	0.17	0.35	0.13	0.26
U6-L6 (Bot)	0.25	0.48	0.18	0.37

Case 6

Member	Railway Truss		Highway Truss	
	Tension	Compression	Tension	Compression
L0-L2	0.50	NA	0.55	NA
L2-L4	0.47	NA	0.56	NA
L4-L6	0.48	NA	0.56	NA
U0-U1	0.07	0.13	0.09	0.10
U1-U3	NA	0.58	NA	0.72
U3-U5	NA	0.54	NA	0.74
U5-U6	NA	0.54	NA	0.76
L0-U1	NA	0.32	NA	0.46
U1-L2	0.47	NA	0.60	NA
L2-U3	NA	0.46	NA	0.77
U3-L4	0.45	NA	0.60	NA
L4-U5 (Min)	0.03	0.50	0.04	0.54
L4-U5 (Max)	0.03	0.50	0.04	0.54
U5-L6 (Min)	0.32	0.20	0.32	0.21
U5-L6 (Max)	0.32	0.20	0.32	0.21
U0-L0	0.47	0.31	0.58	0.46
U1-L1 (Top)	0.38	0.03	0.48	0.14
U1-L1 (Bot)	0.33	0.22	0.59	0.61
U2-L2 (Top)	0.19	0.34	0.22	0.37
U2-L2 (Bot)	0.25	0.47	0.39	0.69
U3-L3 (Top)	0.49	0.13	0.48	0.13
U3-L3 (Bot)	0.44	0.36	0.49	0.44
U4-L4 (Top)	0.21	0.39	0.18	0.34
U4-L4 (Bot)	0.29	0.54	0.25	0.48
U5-L5 (Top)	0.49	0.14	0.45	0.13
U5-L5 (Bot)	0.45	0.37	0.38	0.29
U6-L6 (Top)	0.18	0.35	0.13	0.26
U6-L6 (Bot)	0.26	0.50	0.18	0.38

Case 7

Member	Railway Truss		Highway Truss	
	Tension	Compression	Tension	Compression
L0-L2	0.47	NA	0.51	NA
L2-L4	0.46	NA	0.55	NA
L4-L6	0.47	NA	0.56	NA
U0-U1	0.06	0.10	0.07	0.08
U1-U3	NA	0.57	NA	0.71
U3-U5	NA	0.53	NA	0.73
U5-U6	NA	0.53	NA	0.75
L0-U1	NA	0.31	NA	0.45
U1-L2	0.46	NA	0.58	NA
L2-U3	NA	0.44	NA	0.75
U3-L4	0.44	NA	0.58	NA
L4-U5 (Min)	0.02	0.48	0.03	0.52
L4-U5 (Max)	0.02	0.48	0.03	0.52
U5-L6 (Min)	0.31	0.18	0.30	0.19
U5-L6 (Max)	0.31	0.18	0.30	0.19
U0-L0	0.46	0.30	0.56	0.44
U1-L1 (Top)	0.36	0.02	0.46	0.12
U1-L1 (Bot)	0.33	0.22	0.57	0.58
U2-L2 (Top)	0.16	0.30	0.19	0.32
U2-L2 (Bot)	0.23	0.45	0.36	0.65
U3-L3 (Top)	0.46	0.11	0.45	0.10
U3-L3 (Bot)	0.42	0.33	0.47	0.41
U4-L4 (Top)	0.18	0.35	0.15	0.30
U4-L4 (Bot)	0.27	0.52	0.24	0.46
U5-L5 (Top)	0.46	0.11	0.42	0.10
U5-L5 (Bot)	0.42	0.34	0.36	0.26
U6-L6 (Top)	0.15	0.32	0.11	0.23
U6-L6 (Bot)	0.23	0.46	0.16	0.34

Case 8

Member	Railway Truss		Highway Truss	
	Tension	Compression	Tension	Compression
L0-L2	0.49	NA	0.54	NA
L2-L4	0.46	NA	0.56	NA
L4-L6	0.47	NA	0.56	NA
U0-U1	0.07	0.13	0.09	0.10
U1-U3	NA	0.57	NA	0.71
U3-U5	NA	0.53	NA	0.73
U5-U6	NA	0.53	NA	0.75
L0-U1	NA	0.32	NA	0.46
U1-L2	0.46	NA	0.59	NA
L2-U3	NA	0.45	NA	0.76
U3-L4	0.45	NA	0.59	NA
L4-U5 (Min)	0.03	0.49	0.04	0.53
L4-U5 (Max)	0.03	0.49	0.04	0.53
U5-L6 (Min)	0.32	0.20	0.31	0.21
U5-L6 (Max)	0.32	0.20	0.31	0.21
U0-L0	0.47	0.31	0.57	0.45
U1-L1 (Top)	0.37	0.03	0.48	0.14
U1-L1 (Bot)	0.33	0.22	0.59	0.61
U2-L2 (Top)	0.19	0.34	0.21	0.36
U2-L2 (Bot)	0.24	0.46	0.38	0.68
U3-L3 (Top)	0.48	0.14	0.47	0.14
U3-L3 (Bot)	0.44	0.36	0.48	0.44
U4-L4 (Top)	0.21	0.39	0.18	0.34
U4-L4 (Bot)	0.28	0.54	0.25	0.48
U5-L5 (Top)	0.48	0.14	0.45	0.13
U5-L5 (Bot)	0.44	0.37	0.38	0.29
U6-L6 (Top)	0.18	0.35	0.13	0.26
U6-L6 (Bot)	0.25	0.49	0.18	0.37

Case 9

Member	Railway Truss		Highway Truss	
	Tension	Compression	Tension	Compression
L0-L2	0.55	NA	0.60	NA
L2-L4	0.53	NA	0.63	NA
L4-L6	0.54	NA	0.63	NA
U0-U1	0.07	0.13	0.10	0.10
U1-U3	NA	0.65	NA	0.80
U3-U5	NA	0.60	NA	0.83
U5-U6	NA	0.60	NA	0.85
L0-U1	NA	0.35	NA	0.51
U1-L2	0.52	NA	0.67	NA
L2-U3	NA	0.50	NA	0.85
U3-L4	0.49	NA	0.65	NA
L4-U5 (Min)	0.01	0.53	0.01	0.58
L4-U5 (Max)	0.01	0.53	0.01	0.58
U5-L6 (Min)	0.34	0.18	0.33	0.19
U5-L6 (Max)	0.34	0.18	0.33	0.19
U0-L0	0.53	0.32	0.64	0.48
U1-L1 (Top)	0.41	0.00	0.53	0.12
U1-L1 (Bot)	0.37	0.23	0.65	0.65
U2-L2 (Top)	0.20	0.36	0.23	0.39
U2-L2 (Bot)	0.27	0.50	0.42	0.74
U3-L3 (Top)	0.53	0.11	0.51	0.11
U3-L3 (Bot)	0.48	0.38	0.53	0.46
U4-L4 (Top)	0.23	0.42	0.19	0.35
U4-L4 (Bot)	0.31	0.59	0.27	0.51
U5-L5 (Top)	0.53	0.12	0.48	0.10
U5-L5 (Bot)	0.49	0.39	0.41	0.28
U6-L6 (Top)	0.19	0.37	0.13	0.26
U6-L6 (Bot)	0.28	0.54	0.19	0.39

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	JOB TITLE	BCLB DECK PRE-DESIGN		
	JOB NO.	60637587	CALCULATION NO.	
	DESIGNED BY		DATE	
	ORIGINATOR BY	KG	DATE	30-Nov-20
	CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

L_0-L_2 East (R) Tension member Drawing Location (1959)

E56 Bottom Chord Plan

Material Properties: A-242-55 Steel Reference

F_u =	480	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	350	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

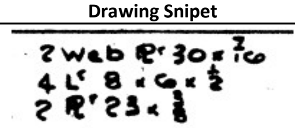
Member	**Angle**	**Web**	**Top Plate**	**Bottom Plate**
Quantity	**4**	**2**	**1**	**1**
Dimensions (in)	8x6x1/2	30x7/16	23x3/8	23x3/8

Flange Perfortion Width	8	in
Rivet dia.	1	in

Member Dimensions

Length =	9398	mm
Width =	606	mm
Depth =	781	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Web			Top & Bottom Plate			Angle		
Designation	30x7/16		Designation	23x3/8		Designation	8x6x1/2	
Qty =	2		Qty =	2		Qty =	4	
w =	11.1125	mm	t =	9.525	mm	b =	203.2	mm
h =	762	mm	b =	584.2	mm	d =	152.4	mm
A =	16935.45	mm^2	b_{eff} =	381	mm	t =	12.7	mm
y Bar =	303.2125	mm	A =	11129.01	mm^2	A =	4350	mm^2
z Bar =	0	mm	A_{eff} =	7258.05	mm^2	y =	62.8	mm
RHM*	4		y Bar =	0	mm	x =	37.3	mm
RHM Area =	2258.1	mm	z Bar =	390.525	mm	I_y =	18.4	$x10^6 mm^4$
			RHM*	2		I_z =	8.96	$x10^6 mm^4$
			RHM Area =	967.7	mm	A_{angle} =	17400	mm^2
						RHM*	3	
						RHM Area =	3871.0	mm

RHM* = Rivet Holes/Member

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Section Calculations

	Angle	Web	T&B Plate	
Designation	8x6x1/2	30x7/16	23x3/8	
Qty=	4	2	2	
Iy =	73.6	819.5	0.1	$x10^6mm^4$
Iz =	35.84	0.2	21.9	$x10^6mm^4$
A =	17400.0	16935.5	7258.1	mm^2
dz =	318.2	0	385.0	mm^2
dy =	254.8	297.7	196.9	mm
Iyy =	1835.4	819.5	1075.7	$x10^6mm^4$
Izz =	1165.5	1500.6	303.2	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	41594	mm^2
A_{RHM*}=	7096.8	mm2
A_{net} =	34497	mm^2
∑Iyy =	3730.5	$x10^6mm^4$
∑Izz =	2969.3	$x10^6mm^4$
ybar=	391	mm
xbar=	303	mm

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9398	mm	kyLy/ry =	28.6	< 120 therefore OK
Lz =	9398	mm	kzLz/rz =	32.0	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	35.8
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	35.8
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	44.9

Webs	h =	355.6	w =	11.1	h/w =	32.0	OK
Flange	b =	279.4	t =	9.5	b/t =	29.3	OK
Flange Perforated	b =	76.2	t =	9.5	b/t =	8.0	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	34497	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	328.8	mm
rz =	293.4	mm
λy =	0.381	
λz =	0.427	
Cry =	10295	kN
Crz =	10107	kN
Cr Min =	10107	kN

10.8.2 Axial Tensile Resistance ***[CSA S6-19 cl. 10.8.2]***

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	13830	kN
b)	Tr =	$\phi_u A_n F_u$	13247	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	11260	kN
		Tr Min =	11260	kN

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JOB NO.	60637587	CALCULATION NO.	
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CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

Bottom Chord L_2-L_4 East (R) Tension member

Drawing Location (1959)
E56 Bottom Chord Plan

Material Properties: A-242-55 Steel Reference

F_u =	480	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
F_y =	350	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
ϕ_s =	0.95		*[CSA S6-19 cl. 10.5.7]*
E =	200000	Mpa	*[CSA S6-19 cl. 10.4.2]*

Built up Section Components

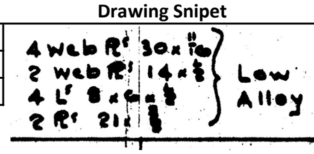
Member	Angle	Web	Web	Top Plate	Bottom Plate
Quantity	**4**	**4**	**2**	**1**	**1**
Dimensions (in)	8x6x1/2	30x11/16	14x1/2	21x3/8	21x3/8

Flange Perfortion Width	8	in
Rivet dia.	1	in

Member Dimensions

Length =	9398	mm
Width =	603	mm
Depth =	781	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Web				
Positioning	**Outside**	**Middle**	**Inside**	
Designation	30x11/16	30x11/16	14x1/2	
Qty =	2	2	2	
w =	17.4625	17.4625	12.7	mm
h =	762	762	355.6	mm
A =	26612.85	26612.85	9032.24	mm^2
y Bar =	292.89375	275.43125	260.35	mm
z Bar =	0	0	0	mm
RHM*	4	4	4	
RHM Area =	3548.4	3548.4	2580.6	mm

Angle		
Designation	8x6x1/2	
Qty =	4	
b =	203.2	mm
d =	152.4	mm
t =	12.7	mm
A =	4350	mm^2
z =	62.8	mm
y =	37.3	mm
I_y =	18.4	$x10^6mm^4$
I_z =	8.96	$x10^6mm^4$
A_{angle} =	17400	mm^2
RHM*	3	
RHM Area =	3871.0	mm

Top & Bottom Plate		
Designation	21x3/8	
Qty =	2	
t =	9.525	mm
b =	533.4	mm
b_{eff} =	330.2	mm
A =	10161.27	mm^2
A_{eff} =	6290.31	mm^2
RHM*	2	
RHM Area =	967.7	mm

RHM* = Rivet Holes/Member

JOB TITLE	BCLB DECK PRE-DESIGN		
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CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

	Angle	Web	Web	Web	T&B Plate	
Designation	8x6x1/2	30x11/16	30x11/16	14x1/2	21x3/8	
Qty=	4	2	2	2	2	
Iy =	73.6	1287.7	1287.7	95.2	0.0	$x10^6mm^4$
Iz =	35.84	0.7	0.7	0.1	14.3	$x10^6mm^4$
A =	17400.0	26612.9	26612.9	9032.2	6290.3	mm^2
dz =	318.2	0	0	0	385.8	mm^2
dy =	229	292.9	275.4	260.4	171.5	mm
Iyy =	1835.4	1287.7	1287.7	95.2	936.1	$x10^6mm^4$
Izz =	951.5	2283.7	2019.6	612.3	199.2	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	85948.0	mm^2
A_{RHM*}=	14516.1	mm2
A_{net} =	71432	mm^2
∑Iyy =	5442.0	$x10^6mm^4$
∑Izz =	6066.0	$x10^6mm^4$
ybar=	391	mm
xbar=	302	mm

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JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9398	mm	kyLy/ry =	34.0	< 120 therefore OK
Lz =	9398	mm	kzLz/rz =	32.3	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	35.8
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	35.8
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	44.9

Webs	h =	355.6	w =	17.5	h/w =	20.4	OK
Flange	b =	228.6	t =	9.5	b/t =	24.0	OK
Flange Perforated	b =	25.4	t =	9.5	b/t =	2.7	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	71432	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	276.0	mm
rz =	291.4	mm
λy =	0.453	
λz =	0.429	
Cry =	20676	kN
Crz =	20902	kN
Cr Min =	20676	kN

10.8.2 Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	28578	kN
b)	Tr =	$\phi_u A_n F_u$	27430	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	23315	kN
		Tr Min =	23315	kN

JOB TITLE	BCLB DECK PRE-DESIGN		
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DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

Bottom Chord L_2-L_4 East (R) Tension member

Drawing Location (1959)

E56 Bottom Chord Plan

Material Properties: A-242-55 Steel Reference

F_u =	480	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
F_y =	350	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
ϕ_s =	0.95		*[CSA S6-19 cl. 10.5.7]*
E =	200000	Mpa	*[CSA S6-19 cl. 10.4.2]*

Built up Section Components

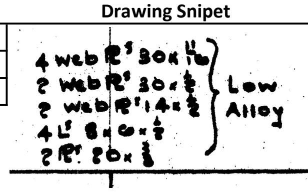
Member	Angle	Web	Web	Web	Top Plate	Bottom Plate
Quantity	**4**	**4**	**2**	**2**	**1**	**1**
Dimensions (in)	8x6x1/2	30x11/16	30x1/2	14x1/2	20x3/8	20x3/8

Flange Perfortion Width	8	in
Rivet dia.	1	in

Member Dimensions

Length =	9398	mm
Width =	603	mm
Depth =	781	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Web					
Positioning	Outside 2	Outside 1	Middle	Inside	
Designation	30x11/16	30x11/16	30x1/2	14x1/2	
Qty =	2	2	2	2	
w =	17.4625	17.4625	12.7	12.7	mm
h =	762	762	762	355.6	mm
A =	26612.85	26612.85	19354.8	9032.24	mm^2
y Bar =	292.89375	275.43125	260.35	247.65	mm
z Bar =	0	0	0	0	mm
RHM*	4	4	4	4	
RHM Area =	3548.4	3548.4	2580.6	2580.6	mm

Angle		
Designation	8x6x1/2	
Qty =	4	
b =	203.2	mm
d =	152.4	mm
t =	12.7	mm
A =	4350	mm^2
z =	62.8	mm
y =	37.3	mm
I_y =	18.4	$x10^6mm^4$
I_z =	8.96	$x10^6mm^4$
A_{angle} =	17400	mm^2
RHM*	3	
RHM Area =	3871.0	mm

Top & Bottom Plate		
Designation	20x3/8	
Qty =	2	
t =	9.525	mm
b =	508.0	mm
b_{eff} =	304.8	mm
A =	9677.4	mm^2
A_{eff} =	5806.44	mm^2
RHM*	2	
RHM Area =	967.7	mm

RHM* = Rivet Holes/Member

JOB TITLE	BCLB DECK PRE-DESIGN		
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DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
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Section Calculations

	Angle	Web	Web	Web	Web	T&B Plate	
Designation	8x6x1/2	30x11/16	30x11/16	30x1/2	14x1/2	20x3/8	
Qty=	4	2	2	2	2	2	
Iy =	73.6	1287.7	1287.7	936.5	95.2	0.0	$x10^6mm^4$
Iz =	35.84	0.7	0.7	0.3	0.1	11.2	$x10^6mm^4$
A =	17400.0	26612.9	26612.9	19354.8	9032.2	5806.4	mm^2
dz =	318.2	0	0	0	0	385.8	mm^2
dy =	217	292.9	275.4	260.4	247.7	177.8	mm
Iyy =	1835.4	1287.7	1287.7	936.5	95.2	864.1	$x10^6mm^4$
Izz =	852.9	2283.7	2019.6	1312.2	554.1	194.8	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	104819.0	mm^2
A_{RHM*}=	17096.7	mm2
A_{net} =	87722	mm^2
∑Iyy =	6307.0	$x10^6mm^4$
∑Izz =	7217.0	$x10^6mm^4$
zbar=	391	mm
ybar=	302	mm

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9398	mm	kyLy/ry =	35.0	< 120 therefore OK
Lz =	9398	mm	kzLz/rz =	32.8	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	35.8
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	35.8
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	44.9

Webs	h =	355.6	w =	17.5	h/w =	20.4	OK
Flange	b =	203.2	t =	9.5	b/t =	21.3	OK
Flange Perforated	b =	0.0	t =	9.5	b/t =	0.0	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	87722	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	268.1	mm
rz =	286.8	mm
λy =	0.467	
λz =	0.436	
Cry =	25228	kN
Crz =	25591	kN
Cr Min =	25228	kN

10.8.2 Axial Tensile Resistance ***[CSA S6-19 cl. 10.8.2]***

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	34852	kN
b)	Tr =	$\phi_u A_n F_u$	33685	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	28633	kN
		Tr Min =	28633	kN

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LIFT SPAN

Bottom Chord L_0-L_2 West (H)

Tension member

Drawing Location (1959)

E56 Bottom Chord Plan

Material Properties: A-7 Steel

Reference

F_u =	410	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

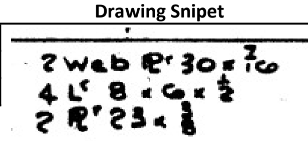
Member	**Angle**	**Web**	**Top Plate**	**Bottom Plate**
Quantity	**4**	**2**	**1**	**1**
Dimensions (in)	8x6x1/2	30x7/16	23x3/8	23x3/8

Flange Perfortion Width	8	in
Rivet dia.	1	in

Member Dimensions

Length =	9398	mm
Width =	606	mm
Depth =	781	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Web			**Top & Bottom Plate**			**Angle**		
Designation	30x7/16		Designation	23x3/8		Designation	8x6x1/2	
Qty =	2		Qty =	2		Qty =	4	
w =	11.1125	mm	t =	9.525	mm	b =	203.2	mm
h =	762	mm	b =	584.2	mm	d =	152.4	mm
A =	16935.45	mm^2	b_{eff} =	381	mm	t =	12.7	mm
y Bar =	303.2125	mm	A =	11129.01	mm^2	A =	4350	mm^2
z Bar =	0	mm	A_{eff} =	7258.05	mm^2	y =	62.8	mm
RHM*	4		y Bar =	0	mm	x =	37.3	mm
RHM Area =	2258.1	mm	z Bar =	390.525	mm	I_y =	18.4	$x10^6 mm^4$
			RHM*	2		I_z =	8.96	$x10^6 mm^4$
			RHM Area =	967.7	mm	A_{angle} =	17400	mm^2

RHM*	3	
RHM Area =	3871.0	mm

RHM* = Rivet Holes/Member

JOB TITLE	BCLB DECK PRE-DESIGN		
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Section Calculations

	Angle	Web	T&B Plate	
Designation	8x6x1/2	30x7/16	23x3/8	
Qty=	4	2	2	
Iy =	73.6	819.5	0.1	$x10^6mm^4$
Iz =	35.84	0.2	21.9	$x10^6mm^4$
A =	17400.0	16935.5	7258.1	mm^2
dz =	318.2	0	385.0	mm^2
dy =	254.8	297.7	196.9	mm
Iyy =	1835.4	819.5	1075.7	$x10^6mm^4$
Izz =	1165.5	1500.6	303.2	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	41594	mm^2
A_{RHM*}=	7096.8	mm2
A_{net} =	34497	mm^2
∑Iyy =	3730.5	$x10^6mm^4$
∑Izz =	2969.3	$x10^6mm^4$
ybar=	391	mm
xbar=	303	mm

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9398	mm	kyLy/ry =	28.6	< 120 therefore OK
Lz =	9398	mm	kzLz/rz =	32.0	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	355.6	w =	11.1	h/w =	32.0	OK
Flange	b =	279.4	t =	9.5	b/t =	29.3	OK
Flange Perforated	b =	76.2	t =	9.5	b/t =	8.0	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	34497	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	328.8	mm
rz =	293.4	mm
λy =	0.308	
λz =	0.346	
Cry =	6921	kN
Crz =	6846	kN
Cr Min =	6846	kN

10.8.2 Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	9088	kN
b)	Tr =	$\phi_u A_n F_u$	11315	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	9618	kN
		Tr Min =	9088	kN

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LIFT SPAN

Bottom Chord L_2-L_4 West (H) Tension member

Drawing Location (1959)

E56 Bottom Chord Plan

Material Properties: A-7 Steel Reference

F_u =	410	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

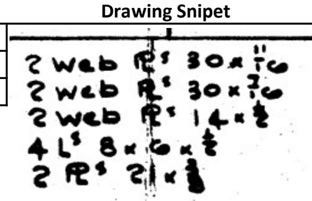
Member	**Angle**	**Web**	**Web**	**Web**	**Top Plate**	**Bottom Plate**
Quantity	**4**	**2**	**2**	**2**	**1**	**1**
Dimensions (in)	8x6x1/2	30x11/16	30x7/16	14x1/2	21x3/8	21x3/8

Flange Perfortion Width	8	in
Rivet dia.	1	in

Member Dimensions

Length =	9398	mm
Width =	591	mm
Depth =	781	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Web				
Positioning	**Outside**	**Middle**	**Inside**	
Designation	30x11/16	30x7/16	14x1/2	
Qty =	2	2	2	
w =	17.4625	11.1125	12.7	mm
h =	762	762	355.6	mm
A =	26612.85	16935.45	9032.24	mm^2
y Bar =	286.54375	272.25625	260.35	mm
z Bar =	0	0	0	mm
RHM*	4	4	4	
RHM Area =	3548.4	2258.1	2580.6	mm

Angle		
Designation	8x6x1/2	
Qty =	4	
b =	203.2	mm
d =	152.4	mm
t =	12.7	mm
A =	4350	mm^2
z =	62.8	mm
y =	37.3	mm
I_y =	18.4	$x10^6mm^4$
I_z =	8.96	$x10^6mm^4$
A_{angle} =	17400	mm^2
RHM*	3	
RHM Area =	3871.0	mm

Top & Bottom Plate		
Designation	21x3/8	
Qty =	2	
t =	9.525	mm
b =	533.4	mm
b_{eff} =	330.2	mm
A =	10161.27	mm^2
A_{eff} =	6290.31	mm^2
RHM*	2	
RHM Area =	967.7	mm

RHM* = Rivet Holes/Member

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Section Calculations

	Angle	Web	Web	Web	T&B Plate	
Designation	8x6x1/2	30x11/16	30x7/16	14x1/2	21x3/8	
Qty=	4	2	2	2	2	
Iy =	73.6	1287.7	819.5	95.2	0.0	$x10^6mm^4$
Iz =	35.84	0.7	0.2	0.1	14.3	$x10^6mm^4$
A =	17400.0	26612.9	16935.5	9032.2	6290.3	mm^2
dz =	318.2	0	0	0	385.8	mm^2
dy =	229	286.5	272.3	260.4	171.5	mm
Iyy =	1835.4	1287.7	819.5	95.2	936.1	$x10^6mm^4$
Izz =	951.5	2185.8	1255.5	612.3	199.2	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	76271.0	mm^2
A_{RHM*}=	13225.8	mm2
A_{net} =	63045	mm^2
∑Iyy =	4974.0	$x10^6mm^4$
∑Izz =	5204.0	$x10^6mm^4$
ybar=	391	mm
xbar=	295	mm

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9398	mm	kyLy/ry =	33.5	< 120 therefore OK
Lz =	9398	mm	kzLz/rz =	32.7	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	355.6	w =	17.5	h/w =	20.4	OK
Flange	b =	228.6	t =	9.5	b/t =	24.0	OK
Flange Perforated	b =	25.4	t =	9.5	b/t =	2.7	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	63045	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	280.9	mm
rz =	287.3	mm
λy =	0.361	
λz =	0.353	
Cry =	12449	kN
Crz =	12483	kN
Cr Min =	12449	kN

10.8.2 Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	16665	kN
b)	Tr =	$\phi_u A_n F_u$	20679	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	17577	kN
		Tr Min =	16665	kN

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LIFT SPAN

Bottom Chord L_4-L_6 West (H) Tension member Drawing Location (1959)

E56 Bottom Chord Plan

Material Properties: A-242-55 Steel Reference

F_u =	480	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	350	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

Member	**Angle**	**Web**	**Web**	**Web**	**Top Plate**	**Bottom Plate**
Quantity	**4**	**2**	**2**	**2**	**1**	**1**
Dimensions (in)	8x6x1/2	30x11/16	30x7/16	14x1/2	20x3/8	20x3/8
Flange Perfortion Width		8	in			
Rivet dia.	1		in			

Member Dimensions **Drawing Snipet** **Member Cross-Section**

Length =	9398	mm
Width =	565	mm
Depth =	781	mm

pl

2 web Pl 30x11/16
2 web Pl 30x7/16
2 web Pl 14x1/2
4 Ls 8x6x1/2
2 Pl 20x3/8
Low Alloy

Individual Member Properties

Web				
Positioning	**Outside 2**	**Middle**	**Inside**	
Designation	30x11/16	30x7/16	14x1/2	
Qty =	2	2	2	
w =	17.4625	11.1125	12.7	mm
h =	762	762	355.6	mm
A =	26612.85	16935.45	9032.24	mm^2
y Bar =	273.84375	259.55625	247.65	mm
z Bar =	0	0	0	mm
RHM*	4	4	4	
RHM Area =	3548.4	2258.1	2580.6	mm

Angle		
Designation	8x6x1/2	
Qty =	4	
b =	203.2	mm
d =	152.4	mm
t =	12.7	mm
A =	4350	mm^2
z =	62.8	mm
y =	37.3	mm
I_y =	18.4	$x10^6mm^4$
I_z =	8.96	$x10^6mm^4$
A_{angle} =	17400	mm^2
RHM*	3	
RHM Area =	3871.0	mm

Top & Bottom Plate		
Designation	20x3/8	
Qty =	2	
t =	9.525	mm
b =	508.0	mm
b_{eff} =	304.8	mm
A =	9677.4	mm^2
A_{eff} =	5806.44	mm^2
RHM*	2	
RHM Area =	967.7	mm

RHM* = Rivet Holes/Member

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Section Calculations

	Angle	Web	Web	Web	T&B Plate	
Designation	8x6x1/2	30x11/16	30x7/16	14x1/2	20x3/8	
Qty=	4	2	2	2	2	
Iy =	73.6	1287.7	819.5	95.2	0.0	$x10^6mm^4$
Iz =	35.84	0.7	0.2	0.1	11.2	$x10^6mm^4$
A =	17400.0	26612.9	16935.5	9032.2	5806.4	mm^2
dz =	318.2	0	0	0	385.8	mm^2
dy =	217	273.8	259.6	247.7	177.8	mm
Iyy =	1835.4	1287.7	819.5	95.2	864.1	$x10^6mm^4$
Izz =	852.9	1996.4	1141.1	554.1	194.8	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	75787.0	mm^2
A_{RHM*}=	13225.8	mm2
A_{net} =	62561	mm^2
∑Iyy =	4902.0	$x10^6mm^4$
∑Izz =	4739.0	$x10^6mm^4$
zbar=	391	mm
ybar=	283	mm

JOB TITLE	BCLB DECK PRE-DESIGN		
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Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9398	mm	kyLy/ry =	33.6	< 120 therefore OK
Lz =	9398	mm	kzLz/rz =	34.1	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	35.8
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	35.8
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	44.9

Webs	h =	355.6	w =	17.5	h/w =	20.4	OK
Flange	b =	203.2	t =	9.5	b/t =	21.3	OK
Flange Perforated	b =	0.0	t =	9.5	b/t =	0.0	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	62561	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	279.9	mm
rz =	275.2	mm
λy =	0.447	
λz =	0.455	
Cry =	18162	kN
Crz =	18097	kN
Cr Min =	18097	kN

10.8.2 Axial Tensile Resistance ***[CSA S6-19 cl. 10.8.2]***

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	25199	kN
b)	Tr =	$\phi_u A_n F_u$	24024	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	20420	kN
		Tr Min =	20420	kN

	JOB TITLE	BCLB DECK PRE-DESIGN		
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LIFT SPAN

Top Chord U_0-U_1 East (R) Compression Member Drawing Location (1959)

E56 Top Chord Plan

Material Properties: A-7 Steel Reference

F_u =	410	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

Member	**Angle**	**Web**	**Top Plate**	**Bottom Plate**
Quantity	**4**	**2**	**1**	**1**
Dimensions (in)	4x4x7/16	30x1/2	38x1/2	38x1/2

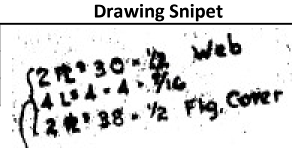
Flange Perfortion Width 10 in

Rivet dia. 1 in

Member Dimensions

Length =	9482	mm
Width =	965	mm
Depth =	787	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Web		
Designation	30x1/2	
Qty =	2	
w =	12.7	mm
h =	762	mm
A =	19354.8	mm^2
z Bar =	394	mm
RHM*	4	
RHM Area =	2580.6	mm^2

	Top Plate	**Bottom Plate**	
Designation	38x1/2	38x1/2	
Qty =	1	1	
t =	12.7	12.7	mm
b =	965.2	965.2	mm
b_{eff} =	965.2	711.2	mm
z Bar =	781.05	6.35	mm
A =	12258.04	12258.04	mm^2
A_{eff} =	12258.04	9032.24	mm^2
RHM*	2	2	
RHM Area =	645.2	645.2	mm^2

Angle			
Location	Top	Bottom	
Designation	4x4x7/16	4x4x7/16	
Qty =	2	2	mm
b =	101.6	101.6	mm
d =	101.6	101.6	mm
t =	11.1	11.1	mm^2
A =	2140	2140	mm
y =	29.6	29.6	mm
x =	29.6	29.6	mm
Z bar	745.1	42.3	mm
I_y =	2.09	2.09	$x10^6mm^4$
I_z =	2.09	2.09	$x10^6mm^4$
A_{angle} =	4280	4280	mm^2
RHM*	3	3	mm
RHM Area =	1693.5	1693.5	mm^2

RHM* = Rivet Holes/Member

JOB TITLE	BCLB DECK PRE-DESIGN		
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Section Calculations

	Angle Top	Angle Bottom	Web	Top Plate	Bot Plate	
Designation	4x4x7/16	4x4x7/16	30x1/2	38x1/2	38x1/2	
Qty=	2	2	2	1	1	
Iy =	4.2	4.2	936.5	0.2	0.1	$x10^6mm^4$
Iz =	4.18	4.18	0.3	951.6	95.2	$x10^6mm^4$
A =	4280.0	4280.0	19354.8	12258.0	9032.2	mm^2
dz =	326.0	376.8	25.4	362.0	412.7	mm^2
dy =	411	411	374.7	0.0	304.8	mm
Iyy =	459.1	611.8	949.0	1606.1	1538.8	$x10^6mm^4$
Izz =	725.8	725.8	2717.0	951.6	934.3	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	49205.1	mm^2
A_{RHM*}=	4919.3	mm2
A_{net} =	44286	mm^2
∑Iyy =	5164.8	$x10^6mm^4$
∑Izz =	6054.4	$x10^6mm^4$
Zbar=	419	mm
ybar=	483	mm

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9482.3629	mm	kyLy/ry =	27.8	< 120 therefore OK
Lz =	9482.3629	mm	kzLz/rz =	25.6	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	558.8	w =	12.7	h/w =	44.0	OK
Flange	b =	762.0	t =	12.7	b/t =	60.0	NG
Flange Perforated	b =	762.0	t =	12.7	b/t =	60.0	NG

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	44286	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	341.5	mm
rz =	369.7	mm
λy =	0.300	
λz =	0.277	
Cry =	8905	kN
Crz =	8954	kN
Cr Min =	8905	kN

10.8.2 Axial Tensile Resistance ***[CSA S6-19 cl. 10.8.2]***

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	10751	kN
b)	Tr =	$\phi_u A_n F_u$	14526	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	12347	kN
		Tr Min =	10751	kN

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ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

Top Chord U_1-U_3 East (R) Compression Member Drawing Location (1959)

E56 Top Chord Plan

Material Properties: A-7 Steel Reference

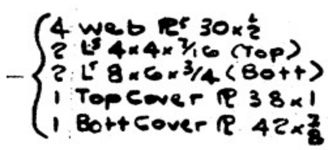
F_u =	410	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

Member	**Top Angle**	**Bottom Angle**	**Web**	**Top Plate**	**Bottom Plate**
Quantity	**2**	**2**	**2**	**1**	**1**
Dimensions (in)	4x4x7/16	8x6x3/4	30x1	38x1	42x7/8
Flange Perfortion Width		10	in		
Rivet dia.		1	in		

Member Dimensions **Drawing Snipet** **Member Cross-Section**

Length =	18871	mm
Width =	1067	mm
Depth =	810	mm



Individual Member Properties

Web		
Designation	30x1	
Qty =	2	
w =	25.4	mm
h =	762	mm
A =	38709.6	mm^2
z Bar =	403	mm
RHM*	4	
RHM Area =	5161.3	mm^2

	Top Plate	**Bottom Plate**	
Designation	38x1	42x7/8	
Qty =	1	1	
t =	25.4	22.225	mm
b =	965.2	1066.8	mm
b_{eff} =	965.2	812.8	mm
z Bar =	796.925	11.1125	mm
A =	24516.08	23709.63	mm^2
A_{eff} =	24516.08	18064.48	mm^2
RHM*	2	2	
RHM Area =	1290.3	1129.0	mm^2

Angle			
Location	Top	Bottom	
Designatio	4x4x7/16	8x6x3/4	
Qty =	2	2	mm
b =	101.6	152.4	mm
d =	101.6	203.2	mm
t =	11.1	19.1	mm^2
A =	2140	6410	mm
z =	29.6	65.1	mm
y =	29.6	39.6	mm
Z bar	754.625	87.325	mm
I_y =	2.09	26.2	$x10^6mm^4$
I_z =	2.09	12.7	$x10^6mm^4$
A_{angle} =	4280	12820	mm^2
RHM*	3	3	mm
RHM Area =	2903.2	1693.5	mm^2

RHM* = Rivet Holes/Member

JOB TITLE	BCLB DECK PRE-DESIGN		
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DESIGNED BY		DATE	
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Section Calculations

	Angle Top	Angle Bottom	Web	Top Plate	Bot Plate	
Designation	4x4x7/16	8x6x3/4	30x1	38x1	42x7/8	
Qty=	2	2	2	1	1	
Iy =	4.2	52.4	1873.0	1.3	0.7	$x10^6mm^4$
Iz =	4.18	25.4	2.1	1903.3	248.6	$x10^6mm^4$
A =	4280.0	12820.0	38709.6	24516.1	18064.5	mm^2
dz =	351.2	316.1	0.2	393.5	392.3	mm^2
dy =	411	421	368.3	0.0	330.2	mm
Iyy =	532.0	1333.6	1873.0	3796.8	2781.5	$x10^6mm^4$
Izz =	725.8	2293.3	5252.8	1903.3	2218.2	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	98390.2	mm^2
A_{RHM*}=	8145.1	mm2
A_{net} =	90245	mm^2
∑Iyy =	10317.0	$x10^6mm^4$
∑Izz =	12393.4	$x10^6mm^4$
Zbar=	403	mm
ybar=	533	mm

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	18871.175	mm	kyLy/ry =	55.8	< 120 therefore OK
Lz =	18871.175	mm	kzLz/rz =	50.9	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	558.8	w =	25.4	h/w =	22.0	OK
Flange	b =	762.0	t =	25.4	b/t =	30.0	OK
Flange Perforated	b =	762.0	t =	25.4	b/t =	30.0	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	90245	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	338.1	mm
rz =	370.6	mm
λy =	0.602	
λz =	0.550	
Cry =	15748	kN
Crz =	16293	kN
Cr Min =	15748	kN

10.8.2 Axial Tensile Resistance ***[CSA S6-19 cl. 10.8.2]***

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	21498	kN
b)	Tr =	$\phi_u A_n F_u$	29600	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	25160	kN
		Tr Min =	21498	kN

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LIFT SPAN

Top Chord U_3-U_5 East (R) Compression Member Drawing Location (1959)

E56 Top Chord Plan

Material Properties: A-242-55 Steel Reference

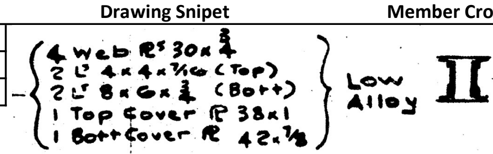
F_u =	480	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
F_y =	350	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
ϕ_s =	0.95		*[CSA S6-19 cl. 10.5.7]*
E =	200000	Mpa	*[CSA S6-19 cl. 10.4.2]*

Built up Section Components

Member	Top Angle	Bottom Angle	Web	Top Plate	Bottom Plate
Quantity	**2**	**2**	**2**	**1**	**1**
Dimensions (in)	4x4x7/16	8x6x3/4	30x1.5	38x1	42x7/8
Flange Perfortion Width	10	in			
Rivet dia.	1	in			

Member Dimensions **Drawing Snipet** **Member Cross-Section**

Length =	18804	mm
Width =	1067	mm
Depth =	810	mm



Individual Member Properties

Web		
Designation	30x1.5	
Qty =	2	
w =	38.1	mm
h =	762	mm
A =	58064.4	mm^2
z Bar =	403	mm
RHM*	4	
RHM Area =	7741.9	mm^2

	Top Plate	Bottom Plate	
Designation	38x1	42x7/8	
Qty =	1	1	
t =	25.4	22.225	mm
b =	965.2	1066.8	mm
b_{eff} =	965.2	812.8	mm
z Bar =	796.925	11.1125	mm
A =	24516.08	23709.63	mm^2
A_{eff} =	24516.08	18064.48	mm^2
RHM*	2	2	
RHM Area =	1290.3	1129.0	mm^2

Angle			
Location	Top	Bottom	
Designatio	4x4x7/16	8x6x3/4	
Qty =	2	2	mm
b =	101.6	152.4	mm
d =	101.6	203.2	mm
t =	11.1	19.1	mm^2
A =	2140	6410	mm
z =	29.6	65.1	mm
y =	29.6	39.6	mm
Z bar	754.625	87.325	mm
I_y =	2.09	26.2	$x10^6 mm^4$
I_z =	2.09	12.7	$x10^6 mm^4$
A_{angle} =	4280	12820	mm^2
RHM*	3	3	mm
RHM Area =	2903.2	1693.5	mm^2

RHM* = Rivet Holes/Member

Section Calculations

	Angle Top	Angle Bottom	Web	Top Plate	Bot Plate	
Designation	4x4x7/16	8x6x3/4	30x1.5	38x1	42x7/8	
Qty=	2	2	2	1	1	
Iy =	4.2	52.4	2809.6	1.3	0.7	$x10^6mm^4$
Iz =	4.18	25.4	7.0	1903.3	248.6	$x10^6mm^4$
A =	4280.0	12820.0	58064.4	24516.1	18064.5	mm^2
dz =	351.2	316.1	0.2	393.5	392.3	mm^2
dy =	411	421	362.0	0.0	330.2	mm
Iyy =	532.1	1333.3	2809.6	3797.6	2780.9	$x10^6mm^4$
Izz =	725.8	2293.3	7613.9	1903.3	2218.2	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	117745.0	mm^2
A_{RHM*}=	10725.8	mm2
A_{net} =	107019	mm^2
∑Iyy =	11253.5	$x10^6mm^4$
∑Izz =	14754.5	$x10^6mm^4$
Zbar=	403	mm
ybar=	533	mm

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	ORIGINATOR BY	KG	DATE	30-Nov-20
	CHECKED BY	RA	DATE	16-Dec-20

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	18804.352	mm	kyLy/ry =	58.0	< 120 therefore OK
Lz =	18804.352	mm	kzLz/rz =	50.6	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	35.8
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	35.8
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	44.9

Webs	h =	558.8	w =	38.1	h/w =	14.7	OK
Flange	b =	762.0	t =	25.4	b/t =	30.0	OK
Flange Perforated	b =	762.0	t =	25.4	b/t =	30.0	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	107019	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	324.3	mm
rz =	371.3	mm
λy =	0.772	
λz =	0.674	
Cry =	24908	kN
Crz =	26978	kN
Cr Min =	24908	kN

10.8.2 Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	39150	kN
b)	Tr =	$\phi_u A_n F_u$	41095	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	34931	kN
		Tr Min =	34931	kN

JOB TITLE	BCLB DECK PRE-DESIGN		
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LIFT SPAN

Top Chord U_5-U_5 East (R) Compression Member Drawing Location (1959)

E56 Top Chord Plan

Material Properties: A-242-55 Steel Reference

F_u =	480	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	350	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

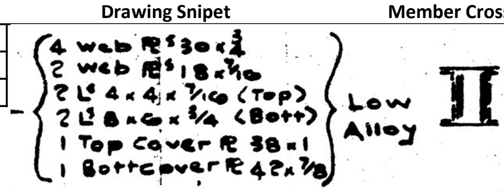
Member	Top Angle	Bottom Angle	Web	Web	Top Plate	Bottom Plate
Quantity	**2**	**2**	**2**	**2**	**1**	**1**
Dimensions (in)	4x4x7/16	8x6x3/4	18x7/16	30x1.5	38x1	42x7/8

Flange Perfortion Width	10	in
Rivet dia.	1	in

Member Dimensions

Length =	18796	mm
Width =	1067	mm
Depth =	810	mm

Drawing Snipet **Member Cross-Section**



Individual Member Properties

Web	Outside	Inside	
Designation	18x7/16	30x1.5	
Qty =	2	2	
w =	11.1125	38.1	mm
h =	457.2	762	mm
A =	10161.27	58064.4	mm^2
z Bar =	454	403	mm
RHM*	4	4	
RHM Area =	2258.1	7741.9	mm^2

	Top Plate	Bottom Plate	
Designation	38x1	42x7/8	
Qty =	1	1	
t =	25.4	22.225	mm
b =	965.2	1066.8	mm
b_{eff} =	965.2	812.8	mm
z Bar =	796.925	11.1125	mm
A =	24516.08	23709.63	mm^2
A_{eff} =	24516.08	18064.48	mm^2
RHM*	2	2	
RHM Area =	1290.3	1129.0	mm^2

Angle			
Location	Top	Bottom	
Designatio	4x4x7/16	8x6x3/4	
Qty =	2	2	mm
b =	101.6	152.4	mm
d =	101.6	203.2	mm
t =	11.1	19.1	mm^2
A =	2140	6410	mm
z =	29.6	65.1	mm
y =	29.6	39.6	mm
Z bar	754.625	87.325	mm
I_y =	2.09	26.2	$x10^6mm^4$
I_z =	2.09	12.7	$x10^6mm^4$
A_{angle} =	4280	12820	mm^2
RHM*	3	3	mm
RHM Area =	2903	1694	mm^2

RHM* = Rivet Holes/Member

Section Calculations

	Angle Top	Angle Bottom	Web	Web	Top Plate	Bot Plate	
Designation	4x4x7/16	8x6x3/4	18x7/16	30x1.5	38x1	42x7/8	
Qty=	2	2	2	2	1	1	
Iy =	4.2	52.4	177.0	2809.6	1.3	0.7	$x10^6mm^4$
Iz =	4.18	25.4	0.1	7.0	1903.3	248.6	$x10^6mm^4$
A =	4280.0	12820.0	10161.3	58064.4	24516.1	18064.5	mm^2
dz =	347.2	320.1	46.6	4.2	389.5	396.3	mm^2
dy =	411	421	386.6	362.0	0.0	330.2	mm
Iyy =	520.1	1366.1	199.1	2810.6	3720.4	2838.2	$x10^6mm^4$
Izz =	725.8	2293.3	1518.5	7613.9	1903.3	2218.2	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	127906.2	mm^2
A_{RHM*}=	10725.8	mm2
A_{net} =	117180	mm^2
∑Iyy =	11454.4	$x10^6mm^4$
∑Izz =	16273.0	$x10^6mm^4$
Zbar=	407	mm
ybar=	533	mm

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	JOB NO.	60637587	CALCULATION NO.	
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	ORIGINATOR BY	KG	DATE	30-Nov-20
	CHECKED BY	RA	DATE	16-Dec-20

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	18796	mm	kyLy/ry =	60.1	< 120 therefore OK
Lz =	18796	mm	kzLz/rz =	50.4	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	35.8
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	35.8
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	44.9

Webs	h =	558.8	w =	38.1	h/w =	14.7	OK
Flange	b =	762.0	t =	25.4	b/t =	30.0	OK
Flange Perforated	b =	762.0	t =	25.4	b/t =	30.0	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	117180	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	312.7	mm
rz =	372.7	mm
λy =	0.801	
λz =	0.672	
Cry =	26604	kN
Crz =	29602	kN
Cr Min =	26604	kN

10.8.2 Axial Tensile Resistance ***[CSA S6-19 cl. 10.8.2]***

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	42529	kN
b)	Tr =	$\phi_u A_n F_u$	44997	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	38248	kN
		Tr Min =	38248	kN

JOB TITLE	BCLB DECK PRE-DESIGN
JOB NO.	60637587
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DESIGNED BY	
DATE	
ORIGINATOR BY	KG
DATE	30-Nov-20
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DATE	16-Dec-20

LIFT SPAN

Top Chord U_0-U_1 West (H) — Compression Member — Drawing Location (1959)

E56 Top Chord Plan

Material Properties: A-7 Steel — Reference

F_u =	410	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
F_y =	230	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
ϕ_s =	0.95		*[CSA S6-19 cl. 10.5.7]*
E =	200000	Mpa	*[CSA S6-19 cl. 10.4.2]*

Built up Section Components

Member	Angle	Web	Top Plate	Bottom Plate
Quantity	**4**	**2**	**1**	**1**
Dimensions (in)	4x4x7/16	30x1/2	38x1/2	38x1/2

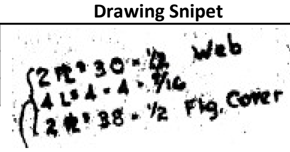
Flange Perfortion Width 10 in

Rivet dia. 1 in

Member Dimensions

Length =	9482	mm
Width =	965	mm
Depth =	787	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Web		
Designation	30x1/2	
Qty =	2	
w =	12.7	mm
h =	762	mm
A =	19354.8	mm^2
z Bar =	394	mm
RHM*	4	
RHM Area =	2580.6	mm^2

Angle			
Location	Top	Bottom	
Designation	4x4x7/16	4x4x7/16	
Qty =	2	2	mm
b =	101.6	101.6	mm
d =	101.6	101.6	mm
t =	11.1	11.1	mm^2
A =	2140	2140	mm
y =	29.6	29.6	mm
x =	29.6	29.6	mm
Z bar	745.1	42.3	mm
I_y =	2.09	2.09	$x10^6 mm^4$
I_z =	2.09	2.09	$x10^6 mm^4$
A_{angle} =	4280	4280	mm^2
RHM*	3	3	mm
RHM Area =	1693.5	1693.5	mm^2

	Top Plate	Bottom Plate	
Designation	38x1/2	38x1/2	
Qty =	1	1	
t =	12.7	12.7	mm
b =	965.2	965.2	mm
b_{eff} =	965.2	711.2	mm
z Bar =	781.05	6.35	mm
A =	12258.04	12258.04	mm^2
A_{eff} =	12258.04	9032.24	mm^2
RHM*	2	2	
RHM Area =	645.2	645.2	mm^2

RHM* = Rivet Holes/Member

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JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

	Angle Top	Angle Bottom	Web	Top Plate	Bot Plate	
Designation	4x4x7/16	4x4x7/16	30x1/2	38x1/2	38x1/2	
Qty=	2	2	2	1	1	
Iy =	4.2	4.2	936.5	0.2	0.1	$x10^6mm^4$
Iz =	4.18	4.18	0.3	951.6	95.2	$x10^6mm^4$
A =	4280.0	4280.0	19354.8	12258.0	9032.2	mm^2
dz =	326.0	376.8	25.4	362.0	412.7	mm^2
dy =	411	411	374.7	0.0	304.8	mm
Iyy =	459.1	611.8	949.0	1606.1	1538.8	$x10^6mm^4$
Izz =	725.8	725.8	2717.0	951.6	934.3	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	49205.1	mm^2
A_{RHM*}=	4919.3	mm2
A_{net} =	44286	mm^2
∑Iyy =	5164.8	$x10^6mm^4$
∑Izz =	6054.4	$x10^6mm^4$
Zbar=	419	mm
ybar=	483	mm

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9482.3629	mm	kyLy/ry =	27.8	< 120 therefore OK
Lz =	9482.3629	mm	kzLz/rz =	25.6	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	558.8	w =	12.7	h/w =	44.0	OK
Flange	b =	762.0	t =	12.7	b/t =	60.0	NG
Flange Perforated	b =	762.0	t =	12.7	b/t =	60.0	NG

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	44286	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	341.5	mm
rz =	369.7	mm
λy =	0.300	
λz =	0.277	
Cry =	8905	kN
Crz =	8954	kN
Cr Min =	8905	kN

10.8.2 Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	10751	kN
b)	Tr =	$\phi_u A_n F_u$	14526	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	12347	kN
		Tr Min =	10751	kN

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

Top Chord U_1-U_3 West Compression Member Drawing Location (1959)

E56 Top Chord Plan

Material Properties: A-7 Steel Reference

F_u =	410	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

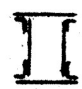
Built up Section Components

Member	**Top Angle**	**Bottom Angle**	**Web**	**Top Plate**	**Bottom Plate**
Quantity	**2**	**2**	**2**	**1**	**1**
Dimensions (in)	4x4x7/16	8x6x9/16	30x11/16	38x11/16	42x5/8
Flange Perfortion Width		10	in		
Rivet dia.	1		in		

Member Dimensions **Drawing Snipet** **Member Cross-Section**

Length =	18871	mm
Width =	1067	mm
Depth =	795	mm

2 Web PLs 30 x 11/16
2 Ls 4 x 4 x 7/16 (Top)
2 Ls 8 x 6 x 9/16 (Bott)
1 Top Cover PL 38 x 11/16
1 Bott Cover PL 42 x 5/8



Individual Member Properties

Web		
Designation	30x11/16	
Qty =	2	
w =	17.4625	mm
h =	762	mm
A =	26612.85	mm^2
z Bar =	397	mm
RHM*	4	
RHM Area =	3548.4	mm^2

	Top Plate	**Bottom Plate**	
Designation	38x11/16	42x5/8	
Qty =	1	1	
t =	17.4625	15.875	mm
b =	965.2	1066.8	mm
b_{eff} =	965.2	812.8	mm
z Bar =	786.60625	7.9375	mm
A =	16854.805	16935.45	mm^2
A_{eff} =	16854.805	12903.2	mm^2
RHM*	2	2	
RHM Area =	887.1	806.5	mm^2

Angle			
Location	Top	Bottom	
Designation	4x4x7/16	8x6x9/16	
Qty =	2	2	mm
b =	101.6	152.4	mm
d =	101.6	203.2	mm
t =	11.1	14.3	mm^2
A =	2140	4880	mm
z =	29.6	63.4	mm
y =	29.6	37.9	mm
Z bar	748.275	79.275	mm
I_y =	2.09	20.4	$x10^6 mm^4$
I_z =	2.09	9.94	$x10^6 mm^4$
A_{angle} =	4280	9760	mm^2
RHM*	3	3	mm
RHM Area =	2177.8	1693.5	mm^2

RHM* = Rivet Holes/Member

Section Calculations

	Angle Top	Angle Bottom	Web	Top Plate	Bot Plate	
Designation	4x4x7/16	8x6x9/16	30x11/16	38x11/16	42x5/8	
Qty=	2	2	2	1	1	
Iy =	4.2	40.8	1287.7	0.4	0.3	$x10^6mm^4$
Iz =	4.18	19.88	0.7	1308.5	177.6	$x10^6mm^4$
A =	4280.0	9760.0	26612.9	16854.8	12903.2	mm^2
dz =	352.0	317.0	0.6	390.4	388.3	mm^2
dy =	411	419	372.3	0.0	330.2	mm
Iyy =	534.6	1021.3	1287.7	2569.0	1945.7	$x10^6mm^4$
Izz =	725.8	1732.5	3688.8	1308.5	1584.5	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	70410.9	mm^2
A_{RHM*}=	6129.0	mm2
A_{net} =	64282	mm^2
∑Iyy =	7358.3	$x10^6mm^4$
∑Izz =	9040.0	$x10^6mm^4$
Zbar=	396	mm
ybar=	533	mm

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	18871.175	mm	kyLy/ry =	55.8	< 120 therefore OK
Lz =	18871.175	mm	kzLz/rz =	50.3	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	558.8	w =	17.5	h/w =	32.0	OK
Flange	b =	762.0	t =	17.5	b/t =	43.6	OK
Flange Perforated	b =	762.0	t =	17.5	b/t =	43.6	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	64282	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	338.3	mm
rz =	375.0	mm
λy =	0.602	
λz =	0.543	
Cry =	11220	kN
Crz =	11651	kN
Cr Min =	11220	kN

10.8.2 Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	15385	kN
b)	Tr =	$\phi_u A_n F_u$	21084	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	17922	kN
		Tr Min =	15385	kN

AECOM Imagine it. Delivered.	JOB TITLE	BCLB DECK PRE-DESIGN		
	JOB NO.	60637587	CALCULATION NO.	
	DESIGNED BY		DATE	
	ORIGINATOR BY	KG	DATE	30-Nov-20
	CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

U3-U5 West Compression Member Drawing Location (1959)

E56 Top Chord Plan

Material Properties: A-7 Steel Reference

F_u =	410	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

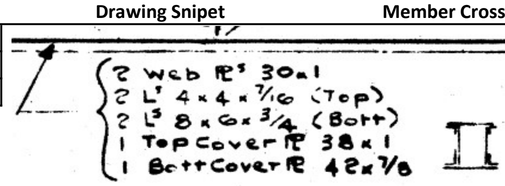
Built up Section Components

Member	**Top Angle**	**Bottom Angle**	**Web**	**Top Plate**	**Bottom Plate**
Quantity	**2**	**2**	**2**	**1**	**1**
Dimensions (in)	4x4x7/16	8x6x3/4	30x1	38x1	42x7/8

Flange Perfortion Width	10	in
Rivet dia.	1	in

Member Dimensions **Drawing Snipet** **Member Cross-Section**

Length =	18804	mm
Width =	1067	mm
Depth =	810	mm



Individual Member Properties

Web		
Designation	30x1	
Qty =	2	
w =	25.4	mm
h =	762	mm
A =	38709.6	mm^2
z Bar =	403	mm
RHM*	4	
RHM Area =	5161.3	mm^2

	Top Plate	**Bottom Plate**	
Designation	38x1	42x7/8	
Qty =	1	1	
t =	25.4	22.225	mm
b =	965.2	1066.8	mm
b_{eff} =	965.2	812.8	mm
z Bar =	796.925	11.1125	mm
A =	24516.08	23709.63	mm^2
A_{eff} =	24516.08	18064.48	mm^2
RHM*	2	2	
RHM Area =	1290.3	1129.0	mm^2

Angle			
Location	Top	Bottom	
Designatio	4x4x7/16	8x6x3/4	
Qty =	2	2	mm
b =	101.6	152.4	mm
d =	101.6	203.2	mm
t =	11.1	19.1	mm^2
A =	2140	6410	mm
z =	29.6	65.1	mm
y =	29.6	39.6	mm
Z bar	754.625	87.325	mm
I_y =	2.09	26.2	$x10^6mm^4$
I_z =	2.09	12.7	$x10^6mm^4$
A_{angle} =	4280	12820	mm^2
RHM*	3	3	mm
RHM Area =	2903.2	1693.5	mm^2

RHM* = Rivet Holes/Member

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JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

	Angle Top	Angle Bottom	Web	Top Plate	Bot Plate	
Designation	4x4x7/16	8x6x3/4	30x1	38x1	42x7/8	
Qty=	2	2	2	1	1	
Iy =	4.2	52.4	1873.0	1.3	0.7	$x10^6mm^4$
Iz =	4.18	25.4	2.1	1903.3	248.6	$x10^6mm^4$
A =	4280.0	12820.0	38709.6	24516.1	18064.5	mm^2
dz =	351.2	316.1	0.2	393.5	392.3	mm^2
dy =	411	421	368.3	0.0	330.2	mm
Iyy =	532.0	1333.6	1873.0	3796.8	2781.5	$x10^6mm^4$
Izz =	725.8	2293.3	5252.8	1903.3	2218.2	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	98390.2	mm^2
A_{RHM*}=	8145.1	mm2
A_{net} =	90245	mm^2
∑Iyy =	10317.0	$x10^6mm^4$
∑Izz =	12393.4	$x10^6mm^4$
Zbar=	403	mm
ybar=	533	mm

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	18804.352	mm	kyLy/ry =	55.6	< 120 therefore OK
Lz =	18804.352	mm	kzLz/rz =	50.7	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	558.8	w =	25.4	h/w =	22.0	OK
Flange	b =	762.0	t =	25.4	b/t =	30.0	OK
Flange Perforated	b =	762.0	t =	25.4	b/t =	30.0	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	90245	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	338.1	mm
rz =	370.6	mm
λy =	0.600	
λz =	0.548	
Cry =	15771	kN
Crz =	16312	kN
Cr Min =	15771	kN

10.8.2 Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	21498	kN
b)	Tr =	$\phi_u A_n F_u$	29600	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	25160	kN
		Tr Min =	21498	kN

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

U_5-U_5 West Compression Member Drawing Location (1959)

E56 Top Chord Plan

Material Properties: A-7 Steel Reference

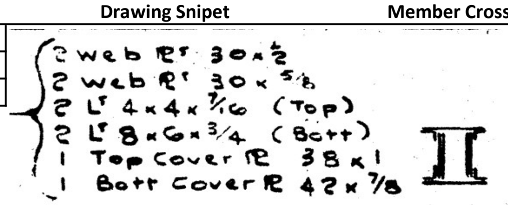
F_u =	410	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

Member	Top Angle	Bottom Angle	Web	Top Plate	Bottom Plate
Quantity	**2**	**2**	**2**	**1**	**1**
Dimensions (in)	4x4x7/16	8x6x3/4	30x1.125	38x1	42x7/8
Flange Perfortion Width		10	in		
Rivet dia.	1		in		

Member Dimensions **Drawing Snipet** **Member Cross-Section**

Length =	18796	mm
Width =	1067	mm
Depth =	810	mm



Individual Member Properties

Web		
Designation	30x1.125	
Qty =	2	
w =	28.575	mm
h =	762	mm
A =	43548.3	mm^2
z Bar =	403	mm
RHM*	4	
RHM Area =	5806.4	mm^2

Angle			
Location	Top	Bottom	
Designation	4x4x7/16	8x6x3/4	
Qty =	2	2	mm
b =	101.6	152.4	mm
d =	101.6	203.2	mm
t =	11.1	19.1	mm^2
A =	2140	6410	mm
z =	29.6	65.1	mm
y =	29.6	39.6	mm
Z bar	754.625	87.325	mm
I_y =	2.09	26.2	$x10^6mm^4$
I_z =	2.09	12.7	$x10^6mm^4$
A_{angle} =	4280	12820	mm^2
RHM*	3	3	mm
RHM Area =	2903.2	1693.5	mm^2

	Top Plate	Bottom Plate	
Designation	38x1	42x7/8	
Qty =	1	1	
t =	25.4	22.225	mm
b =	965.2	1066.8	mm
b_{eff} =	965.2	812.8	mm
z Bar =	796.925	11.1125	mm
A =	24516.08	23709.63	mm^2
A_{eff} =	24516.08	18064.48	mm^2
RHM*	2	2	
RHM Area =	1290.3	1129.0	mm^2

RHM* = Rivet Holes/Member

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

	Angle Top	Angle Bottom	Web	Top Plate	Bot Plate	
Designation	4x4x7/16	8x6x3/4	30x1.125	38x1	42x7/8	
Qty=	2	2	2	1	1	
Iy =	4.2	52.4	2107.2	1.3	0.7	$x10^6mm^4$
Iz =	4.18	25.4	3.0	1903.3	248.6	$x10^6mm^4$
A =	4280.0	12820.0	43548.3	24516.1	18064.5	mm^2
dz =	351.2	316.1	0.2	393.5	392.3	mm^2
dy =	411	421	366.7	0.0	330.2	mm
Iyy =	532.0	1333.5	2107.2	3797.0	2781.3	$x10^6mm^4$
Izz =	725.8	2293.3	5859.3	1903.3	2218.2	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	103228.9	mm^2
A_{RHM*}=	8790.3	mm2
A_{net} =	94439	mm^2
∑Iyy =	10551.1	$x10^6mm^4$
∑Izz =	12999.8	$x10^6mm^4$
Zbar=	403	mm
ybar=	533	mm

JOB TITLE	BCLB DECK PRE-DESIGN			
JOB NO.	60637587	CALCULATION NO.		
DESIGNED BY		DATE		
ORIGINATOR BY	KG	DATE	30-Nov-20	
CHECKED BY	RA	DATE	16-Dec-20	

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	18796	mm	kyLy/ry =	56.2	< 120 therefore OK
Lz =	18796	mm	kzLz/rz =	50.7	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	558.8	w =	28.6	h/w =	19.6	OK
Flange	b =	762.0	t =	25.4	b/t =	30.0	OK
Flange Perforated	b =	762.0	t =	25.4	b/t =	30.0	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	94439	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	334.3	mm
rz =	371.0	mm
λy =	0.607	
λz =	0.547	
Cry =	16429	kN
Crz =	17079	kN
Cr Min =	16429	kN

10.8.2 Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	22556	kN
b)	Tr =	$\phi_u A_n F_u$	30976	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	26329	kN
		Tr Min =	22556	kN

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

Vertical Member L_0-U_0 East — Tension & Compression Member — Drawing Location (1959)

E54 Sections of Lift Span
E59 Lift Span Top Chord

Material Properties: A-242-55 Steel — Reference

F_u =	480	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
F_y =	350	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
ϕ_s =	0.95		*[CSA S6-19 cl. 10.5.7]*
E =	200000	Mpa	*[CSA S6-19 cl. 10.4.2]*

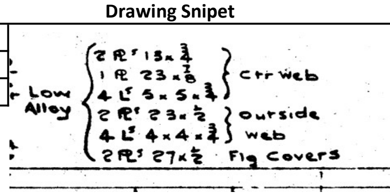
Built up Section Components

Member	Exterior Angle	Web Angles	Centre Web	Centre Web	Exterior Web	Top Plate	Bottom Plate
Quantity	**4**	**4**	**2**	**1**	**2**	**1**	**1**
Dimensions (in)	4x4x3/4	5x5x3/4	13x3/4	23x7/8	23x1/2	27x1/2	27x1/2

Ext. Web Perfortion Width 10 in
Rivet dia. 1 in

Member Dimensions — **Drawing Snipet** — **Member Cross-Section**

Length =	13259	mm
Width =	711	mm
Depth =	610	mm



Individual Member Properties

Angles					
Location	Exterior Top	Exterior Bottom	Web Top	Web Bot.	
Designation	4x4x3/4	4x4x3/4	5x5x3/4	5x5x3/4	
Qty =	2	2	2	2	mm
b =	101.6	101.6	127	127	mm (Hori)
d =	101.6	101.6	127	127	mm (Vert)
t =	19.1	19.1	19.1	19.1	mm^2
A =	3530	3530	4490	4490	mm
z =	32.4	32.4	38.7	38.7	mm (Vert)
y =	32.4	32.4	38.7	38.7	mm (Hori)
Z bar	565	45.1	558	51.4	mm
I_y =	3.24	3.24	6.57	6.57	$x10^6 mm^4$
I_z =	3.24	3.24	6.57	6.57	$x10^6 mm^4$
A_{angle} =	7060	7060	8980	8980	mm^2
RHM*	3	3	3	3	mm
RHM Area =	2903	2903	2903	2903	mm^2

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

	Top Plate	**Bottom Plate**	
Designation	27x1/2	27x1/2	
Qty =	1	1	
t =	12.7	12.7	mm
b =	685.8	685.8	mm
z Bar =	603.25	6.35	mm
A =	8709.66	8709.66	mm^2
RHM*	2	2	
RHM Area =	645.2	645.2	mm^2

RHM* = Rivet Holes/Member

Web				
Location	**Outside**	**Inside**	**Exterior**	
Designation =	13x3/4	23x7/8	23x1/2	
Qty =	2	1	2	
w =	19.05	22.225	12.7	mm
h =	330.2	584.2	584.2	mm
h_{eff} =	330.2	584.2	330.2	mm
A =	12580.62	12983.845	14838.68	mm^2
A_{eff} =	12580.62	12983.845	8387.08	mm^2
z Bar =	305	305	305	mm
RHM*	4	4	4	
RHM Area =	3871.0	2258.1	2580.6	mm^2

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JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

Angle

Location	Exterior Top	Exterior Bottom	Web Top	Web Bot.	
Designation	4x4x3/4	4x4x3/4	5x5x3/4	5x5x3/4	
Qty=	2	2	2	2	
Iy =	6.5	6.5	13.1	13.1	$x10^6mm^4$
Iz =	6.48	6.48	13.14	13.14	$x10^6mm^4$
A =	7060	7060	8980	8980	mm^2
dz =	259.7	259.7	253.4	253.4	mm^2
dy =	311	311	68.9	68.9	mm
Iyy =	482.6	482.6	589.8	589.8	$x10^6mm^4$
Izz =	687.1	687.1	55.7	55.7	$x10^6mm^4$

	Outside	**Inside**	**Exterior**			
	Web	Web	Web	Top Plate	Bot Plate	
Designation	13x3/4	23x7/8	23x1/2	27x1/2	27x1/2	
Qty=	2	1	2	1	1	
Iy =	114.3	369.3	9.5	0.1	0.1	$x10^6mm^4$
Iz =	0.4	0.5	0.2	341.4	341.4	$x10^6mm^4$
A =	12580.6	12983.8	8387.1	8709.7	8709.7	mm^2
dz =	0.0	0.0	209.6	298.5	298.5	mm^2
dy =	20.6	0.0	349.3	0.0	0.0	mm
Iyy =	114.3	369.3	377.8	775.9	775.9	$x10^6mm^4$
Izz =	5.7	0.5	1023.2	341.4	341.4	$x10^6mm^4$

Composite Member Properties

A_{gross} =	83451	mm^2
A_{RHM*}=	21613	mm2
A_{net} =	61838	mm^2
∑Iyy =	4558.0	$x10^6mm^4$
∑Izz =	3197.9	$x10^6mm^4$
Zbar=	305	mm
ybar=	356	mm

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Geometry Comformance Checks

10.9.1.3 **Slenderness Ratio**

Member Classification = Primary Compression Member

Ly =	13258.8	mm	kyLy/ry =	48.8	< 120 therefore OK
Lz =	13258.8	mm	kzLz/rz =	58.3	< 120 therefore OK

10.9.2 **Width to Thickness Ratio**

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	35.8
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	35.8
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	44.9

Webs	h =	381	w =	22.2	h/w =	17.1	OK
Flange	b =	482.6	t =	12.7	b/t =	38.0	NG
Flange Perforated	b =	482.6	t =	12.7	b/t =	38.0	OK

10.9.3 **Axial Compression Resistance**

Φs =	0.9	
A =	61838	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	271.5	mm
rz =	227.4	mm
λy =	0.650	
λz =	0.776	
Cry =	15873	kN
Crz =	14340	kN
Cr Min =	14340	kN

10.8.2 **Axial Tensile Resistance** *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	27747	kN
b)	Tr =	$\phi_u A_n F_u$	23746	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	20184	kN
		Tr Min =	20184	kN

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

Vertical Member L_1-U_1 East (Bottom) Tension & Compression Member

Drawing Location (1959)
E54 Sections of Lift Span
E59 Lift Span Top Chord

Material Properties: A-7 Steel Reference

F_u =	410	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

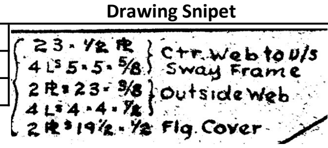
Member	**Exterior Angle**	**Web Angles**	**Centre Web**	**Exterior Web**	**Top Plate**	**Bottom Plate**
Quantity	**4**	**4**	**1**	**2**	**1**	**1**
Dimensions (in)	4x4x1/2	5x5x5/8	23x1/2	23x3/8	19.5x1/2	19.5x1/2

Ext. Web Perfortion Width	10	in
Rivet dia.	1	in

Member Dimensions

Length =	9560	mm
Width =	514	mm
Depth =	610	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Angles						
Location	Exterior Top	Exterior Bottom	Web Top	Web Bot.		
Designation	4x4x1/2	4x4x1/2	5x5x5/8	5x5x5/8		
Qty =	2	2	2	2	mm	
b =	101.6	101.6	127	127	mm	Hori
d =	101.6	101.6	127	127	mm	Vert
t =	12.7	12.7	15.9	15.9	mm^2	
A =	2430	2430	3790	3790	mm	
z =	30.2	30.2	37.6	37.6	mm	Vert
y =	30.2	30.2	37.6	37.6	mm	Hori
Z bar	567	42.9	559	50.3	mm	
I_y =	2.34	2.34	5.66	5.66	$x10^6mm^4$	
I_z =	2.34	2.34	5.66	5.66	$x10^6mm^4$	
A_{angle} =	4860	4860	7580	7580	mm^2	
RHM*	3	3	3	3	mm	
RHM Area =	1935	1935	2419	2419	mm^2	

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
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	Top Plate	**Bottom Plate**	
Designation	19.5x1/2	19.5x1/2	
Qty =	1	1	
t =	12.7	12.7	mm
b =	495.3	495.3	mm
z Bar =	603.25	6.35	mm
A =	6290.31	6290.31	mm^2
RHM*	2	2	
RHM Area =	645.2	645.2	mm^2

RHM* = Rivet Holes/Member

Web			
Location	**Inside**	**Exterior**	
Designation =	23x1/2	23x3/8	
Qty =	1	2	
w =	12.7	9.525	mm
h =	584.2	584.2	mm
h_{eff} =	584.2	330.2	mm
A =	7419.34	11129.01	mm^2
A_{eff} =	7419.34	6290.31	mm^2
z Bar =	305	305	mm
RHM*	4	4	
RHM Area =	1290.3	1935.5	mm^2

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

Angle

Location	Exterior Top	Exterior Bottom	Web Top	Web Bot.	
Designation	4x4x1/2	4x4x1/2	5x5x5/8	5x5x5/8	
Qty=	2	2	2	2	
Iy =	4.7	4.7	11.3	11.3	$x10^6mm^4$
Iz =	4.68	4.68	11.32	11.32	$x10^6mm^4$
A =	4860	4860	7580	7580	mm^2
dz =	261.9	261.9	254.5	254.5	mm^2
dy =	217	217	44.0	44.0	mm
Iyy =	338.0	338.0	502.3	502.3	$x10^6mm^4$
Izz =	234.5	234.5	26.0	26.0	$x10^6mm^4$

	Inside	**Exterior**			
	Web	Web	Top Plate	Bot Plate	
Designation	23x1/2	23x3/8	19.5x1/2	19.5x1/2	
Qty=	1	2	1	1	
Iy =	211.0	7.1	0.1	0.1	$x10^6mm^4$
Iz =	0.1	0.1	128.6	128.6	$x10^6mm^4$
A =	7419.3	6290.3	6290.3	6290.3	mm^2
dz =	0.0	209.6	298.5	298.5	mm^2
dy =	0.0	252.4	0.0	0.0	mm
Iyy =	211.0	283.4	560.4	560.4	$x10^6mm^4$
Izz =	0.1	400.9	128.6	128.6	$x10^6mm^4$

Composite Member Properties

A_{gross} =	51170	mm^2
A_{RHM*}=	13226	mm2
A_{net} =	37944	mm^2
∑Iyy =	3295.8	$x10^6mm^4$
∑Izz =	1179.0	$x10^6mm^4$
Zbar=	305	mm
ybar=	257	mm

Geometry Comformance Checks

10.9.1.3 **Slenderness Ratio**

Member Classification = Primary Compression Member

Ly =	9559.925	mm	kyLy/ry =	32.4	< 120 therefore OK
Lz =	9559.925	mm	kzLz/rz =	54.2	< 120 therefore OK

10.9.2 **Width to Thickness Ratio**

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	381	w =	12.7	h/w =	30.0	OK
Flange	b =	292.1	t =	12.7	b/t =	23.0	OK
Flange Perforated	b =	292.1	t =	12.7	b/t =	23.0	OK

10.9.3 **Axial Compression Resistance**

Φs =	0.9	
A =	37944	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	294.7	mm
rz =	176.3	mm
λy =	0.350	
λz =	0.585	
Cry =	7520	kN
Crz =	6697	kN
Cr Min =	6697	kN

10.8.2 **Axial Tensile Resistance** ***[CSA S6-19 cl. 10.8.2]***

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	11181	kN
b)	Tr =	$\phi_u A_n F_u$	12446	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	10579	kN
		Tr Min =	10579	kN

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

Vertical Member L_1-U_1 East (Top) — Tension & Compression Member

Drawing Location (1959)

E54	Sections of Lift Span
E59	Lift Span Top Chord

Material Properties: A-7 Steel

			Reference
F_u =	410	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

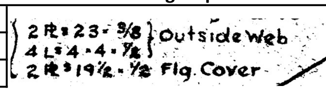
Built up Section Components

Member	**Exterior Angle**	**Exterior Web**	**Top Plate**	**Bottom Plate**
Quantity	**4**	**2**	**1**	**1**
Dimensions (in)	4x4x1/2	23x3/8	19.5x1/2	19.5x1/2
Ext. Web Perfortion Width		10	in	
Rivet dia.		1	in	

Member Dimensions

Length =	4961	mm
Width =	514	mm
Depth =	610	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Angles				
Location	Exterior Top	Exterior Bottom		
Designation	4x4x1/2	4x4x1/2		
Qty =	2	2	mm	
b =	101.6	101.6	mm	Hori
d =	101.6	101.6	mm	Vert
t =	12.7	12.7	mm^2	
A =	2430	2430	mm	
z =	30.2	30.2	mm	Vert
y =	30.2	30.2	mm	Hori
Z bar	567	42.9	mm	
I_y =	2.34	2.34	$x10^6mm^4$	
I_z =	2.34	2.34	$x10^6mm^4$	
A_{angle} =	4860	4860	mm^2	
RHM*	3	3	mm	
RHM Area =	1935	1935	mm^2	

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

	Top Plate	**Bottom Plate**	
Designation	19.5x1/2	19.5x1/2	
Qty =	1	1	
t =	12.7	12.7	mm
b =	495.3	495.3	mm
z Bar =	603.25	6.35	mm
A =	6290.31	6290.31	mm^2
RHM*	2	2	
RHM Area =	645.2	645.2	mm^2

RHM* = Rivet Holes/Member

Web		
Location	**Exterior**	
Designation =	23x3/8	
Qty =	2	
w =	9.525	mm
h =	584.2	mm
h_{eff} =	330.2	mm
A =	11129.01	mm^2
A_{eff} =	6290.31	mm^2
z Bar =	305	mm
RHM*	4	
RHM Area =	1935.5	mm^2

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations			
Angle			
Location	Exterior Top	Exterior Bottom	
Designation	4x4x1/2	4x4x1/2	
Qty=	2	2	
Iy =	4.7	4.7	$x10^6mm^4$
Iz =	4.68	4.68	$x10^6mm^4$
A =	4860	4860	mm^2
dz =	261.9	261.9	mm^2
dy =	217	217	mm
Iyy =	338.0	338.0	$x10^6mm^4$
Izz =	234.5	234.5	$x10^6mm^4$

Location	**Exterior**			
	Web	Top Plate	Bot Plate	
Designation	23x3/8	19.5x1/2	19.5x1/2	
Qty=	2	1	1	
Iy =	7.1	0.1	0.1	$x10^6mm^4$
Iz =	0.1	128.6	128.6	$x10^6mm^4$
A =	6290.3	6290.3	6290.3	mm^2
dz =	209.6	298.5	298.5	mm^2
dy =	252.4	0.0	0.0	mm
Iyy =	283.4	560.4	560.4	$x10^6mm^4$
Izz =	400.9	128.6	128.6	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	28591	mm^2
A_{RHM*}=	7097	mm2
A_{net} =	21494	mm^2
∑Iyy =	2080.2	$x10^6mm^4$
∑Izz =	1127.0	$x10^6mm^4$
Zbar=	305	mm
ybar=	257	mm

`

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	4960.9375	mm	kyLy/ry =	15.9	< 120 therefore OK
Lz =	4960.9375	mm	kzLz/rz =	21.7	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	381	w =	9.5	h/w =	40.0	OK
Flange	b =	292.1	t =	12.7	b/t =	23.0	OK
Flange Perforated	b =	292.1	t =	12.7	b/t =	23.0	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	21494	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	311.1	mm
rz =	229.0	mm
λy =	0.172	
λz =	0.234	
Cry =	4420	kN
Crz =	4383	kN
Cr Min =	4383	kN

10.8.2 Axial Tensile Resistance ***[CSA S6-19 cl. 10.8.2]***

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	6247	kN
b)	Tr =	$\phi_u A_n F_u$	7050	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	5993	kN
		Tr Min =	5993	kN

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

Vertical Member L_2-U_2 East (Bottom) Tension & Compression Member

Drawing Location (1959)
E54 Sections of Lift Span
E59 Lift Span Top Chord

Material Properties: A-7 Steel Reference

F_u =	410	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

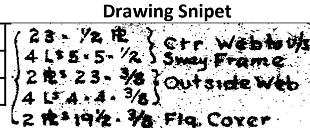
Member	**Exterior Angle**	**Web Angles**	**Centre Web**	**Exterior Web**	**Top Plate**	**Bottom Plate**
Quantity	**4**	**4**	**1**	**2**	**1**	**1**
Dimensions (in)	4x4x3/8	5x5x1/2	23x1/2	23x3/8	19.5x3/8	19.5x3/8

Ext. Web Perfortion Width	10	in
Rivet dia.	1	in

Member Dimensions

Length =	9562	mm
Width =	514	mm
Depth =	603	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Angles						
Location	Exterior Top	Exterior Bottom	Web Top	Web Bot.		
Designation	4x4x3/8	4x4x3/8	5x5x1/2	5x5x1/2		
Qty =	2	2	2	2	mm	
b =	101.6	101.6	127	127	mm	Hori
d =	101.6	101.6	127	127	mm	Vert 1844.754 3064.51
t =	9.5	9.5	12.7	12.7	mm^2	
A =	1850	1850	3060	3060	mm	
z =	29	29	39.1	39.4	mm	Vert
y =	29	29	39.1	39.1	mm	Hori
Z bar	565	38.525	555	48.925	mm	
I_y =	1.84	1.84	4.68	4.68	$x10^6mm^4$	
I_z =	1.84	1.84	4.68	4.68	$x10^6mm^4$	
A_{angle} =	3700	3700	6120	6120	mm^2	
RHM*	3	3	3	3	mm	
RHM Area =	1452	1452	1935	1935	mm^2	

	Top Plate	**Bottom Plate**	
Designation	19.5x3/8	19.5x3/8	
Qty =	1	1	
t =	9.525	9.525	mm
b =	495.3	495.3	mm
z Bar =	598.4875	4.7625	mm
A =	4717.73	4717.73	mm^2
RHM*	2	2	
RHM Area =	483.9	483.9	mm^2

RHM* = Rivet Holes/Member

Web			
Location	**Inside**	**Exterior**	
Designation =	23x1/2	23x3/8	
Qty =	1	2	
w =	12.7	9.525	mm
h =	584.2	584.2	mm
h_{eff} =	584.2	330.2	mm
A =	7419.34	11129.01	mm^2
A_{eff} =	7419.34	6290.31	mm^2
z Bar =	302	302	mm
RHM*	4	4	
RHM Area =	1290.3	1935.5	mm^2

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

Angle

Location	Exterior Top	Exterior Bottom	Web Top	Web Bot.	
Designation	4x4x3/8	4x4x3/8	5x5x1/2	5x5x1/2	
Qty=	2	2	2	2	
Iy =	3.7	3.7	9.4	9.4	$x10^6 mm^4$
Iz =	3.68	3.68	9.36	9.36	$x10^6 mm^4$
A =	3700	3700	6120	6120	mm^2
dz =	263.1	263.1	253.0	252.7	mm^2
dy =	219	219	45.5	45.5	mm
Iyy =	259.7	259.9	401.0	400.3	$x10^6 mm^4$
Izz =	180.6	180.6	22.0	22.0	$x10^6 mm^4$

	Inside	**Exterior**			
	Web	Web	Top Plate	Bot Plate	
Designation	23x1/2	23x3/8	19.5x3/8	19.5x3/8	
Qty=	1	2	1	1	
Iy =	211.0	7.1	0.0	0.0	$x10^6 mm^4$
Iz =	0.1	0.1	96.4	96.4	$x10^6 mm^4$
A =	7419.3	6290.3	4717.7	4717.7	mm^2
dz =	0.0	209.6	296.8	296.9	mm^2
dy =	0.0	252.4	0.0	0.0	mm
Iyy =	211.0	283.5	415.7	415.9	$x10^6 mm^4$
Izz =	0.1	400.9	96.4	96.4	$x10^6 mm^4$

Composite Member Properties

A_{gross} =	42785	mm^2
A_{RHM*}=	10968	mm2
A_{net} =	31817	mm^2
∑Iyy =	2646.9	$x10^6 mm^4$
∑Izz =	999.0	$x10^6 mm^4$
Zbar=	302	mm
ybar=	257	mm

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9561.5125	mm	kyLy/ry =	33.2	< 120 therefore OK
Lz =	9561.5125	mm	kzLz/rz =	54.0	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	381	w =	12.7	h/w =	30.0	OK
Flange	b =	292.1	t =	9.5	b/t =	30.7	OK
Flange Perforated	b =	292.1	t =	9.5	b/t =	30.7	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	31817	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	288.4	mm
rz =	177.2	mm
λy =	0.358	
λz =	0.582	
Cry =	6290	kN
Crz =	5627	kN
Cr Min =	5627	kN

10.8.2 Axial Tensile Resistance ***[CSA S6-19 cl. 10.8.2]***

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	9349	kN
b)	Tr =	$\phi_u A_n F_u$	10436	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	8871	kN
		Tr Min =	8871	kN

LIFT SPAN

Vertical Member L_2-U_2 East (Top)

Tension & Compression Member

Drawing Location (1959)

E54 Sections of Lift Span

E59 Lift Span Top Chord

Material Properties: A-7 Steel

Reference

F_u =	410	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
F_y =	230	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
ϕ_s =	0.95		*[CSA S6-19 cl. 10.5.7]*
E =	200000	Mpa	*[CSA S6-19 cl. 10.4.2]*

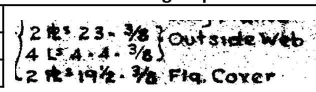
Built up Section Components

Member	Exterior Angle	Exterior Web	Top Plate	Bottom Plate
Quantity	**4**	**2**	**1**	**1**
Dimensions (in)	4x4x3/8	23x3/8	19.5x3/8	19.5x3/8
Ext. Web Perfortion Width		10	in	
Rivet dia.		1	in	

Member Dimensions

Length =	5801	mm
Width =	514	mm
Depth =	603	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Angles				
Location	Exterior Top	Exterior Bottom		
Designation	4x4x3/8	4x4x3/8		
Qty =	2	2	mm	
b =	101.6	101.6	mm	Hori
d =	101.6	101.6	mm	Vert
t =	9.5	9.5	mm^2	
A =	1850	1850	mm	
z =	29	29	mm	Vert
y =	29	29	mm	Hori
Z bar	565	38.525	mm	
I_y =	1.84	1.84	$x10^6mm^4$	
I_z =	1.84	1.84	$x10^6mm^4$	
A_{angle} =	3700	3700	mm^2	
RHM*	3	3	mm	
RHM Area =	1452	1452	mm^2	

1844.754

	Top Plate	**Bottom Plate**	
Designation =	19.5x3/8	19.5x3/8	
Qty =	1	1	
t =	9.525	9.525	mm
b =	495.3	495.3	mm
z Bar =	598.4875	4.7625	mm
A =	4717.73	4717.73	mm^2
RHM*	2	2	
RHM Area =	483.9	483.9	mm^2

RHM* = Rivet Holes/Member

Web		
Location	**Exterior**	
Designation =	23x3/8	
Qty =	2	
w =	9.525	mm
h =	584.2	mm
h_{eff} =	330.2	mm
A =	11129.01	mm^2
A_{eff} =	6290.31	mm^2
z Bar =	302	mm
RHM*	4	
RHM Area =	1935.5	mm^2

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

Angle

Location	Exterior Top	Exterior Bottom	
Designation	4x4x3/8	4x4x3/8	
Qty=	2	2	
Iy =	3.7	3.7	$x10^6mm^4$
Iz =	3.68	3.68	$x10^6mm^4$
A =	3700	3700	mm^2
dz =	263.1	263.1	mm^2
dy =	219	219	mm
Iyy =	259.8	259.8	$x10^6mm^4$
Izz =	180.6	180.6	$x10^6mm^4$

	Exterior			
	Web	Top Plate	Bot Plate	
Designation	23x3/8	19.5x3/8	19.5x3/8	
Qty=	2	1	1	
Iy =	7.1	0.0	0.0	$x10^6mm^4$
Iz =	0.1	96.4	96.4	$x10^6mm^4$
A =	6290.3	4717.7	4717.7	mm^2
dz =	209.6	296.9	296.9	mm^2
dy =	252.4	0.0	0.0	mm
Iyy =	283.4	415.8	415.8	$x10^6mm^4$
Izz =	400.9	96.4	96.4	$x10^6mm^4$

Composite Member Properties

A_{gross} =	23126	mm^2
A_{RHM*}=	5806	mm2
A_{net} =	17319	mm^2
∑Iyy =	1634.6	$x10^6mm^4$
∑Izz =	954.9	$x10^6mm^4$
Zbar=	302	mm
ybar=	257	mm

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	5800.725	mm	kyLy/ry =	18.9	< 120 therefore OK
Lz =	5800.725	mm	kzLz/rz =	24.7	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	381	w =	9.5	h/w =	40.0	OK
Flange	b =	292.1	t =	9.5	b/t =	30.7	OK
Flange Perforated	b =	292.1	t =	9.5	b/t =	30.7	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	17319	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	307.2	mm
rz =	234.8	mm
λy =	0.204	
λz =	0.267	
Cry =	3548	kN
Crz =	3510	kN
Cr Min =	3510	kN

10.8.2 Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	5053	kN
b)	Tr =	$\phi_u A_n F_u$	5681	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	4829	kN
		Tr Min =	4829	kN

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

Vertical Member L_3-U_3 East (Bottom) — Tension & Compression Member — Drawing Location (1959)

E54 Sections of Lift Span

E59 Lift Span Top Chord

Material Properties: A-7 Steel — Reference

F_u =	410	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

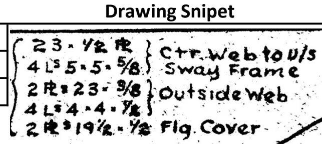
Member	**Exterior Angle**	**Web Angles**	**Centre Web**	**Exterior Web**	**Top Plate**	**Bottom Plate**
Quantity	**4**	**4**	**1**	**2**	**1**	**1**
Dimensions (in)	4x4x1/2	5x5x5/8	23x1/2	23x3/8	19.5x1/2	19.5x1/2

Ext. Web Perfortion Width	10	in
Rivet dia.	1	in

Member Dimensions

Length =	9558	mm
Width =	514	mm
Depth =	610	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Angles						
Location	Exterior Top	Exterior Bottom	Web Top	Web Bot.		
Designation	4x4x1/2	4x4x1/2	5x5x5/8	5x5x5/8		
Qty =	2	2	2	2	mm	
b =	101.6	101.6	127	127	mm	Hori
d =	101.6	101.6	127	127	mm	Vert
t =	12.7	12.7	15.9	15.9	mm^2	
A =	2430	2430	3790	3790	mm	
z =	30.2	30.2	37.6	37.6	mm	Vert
y =	30.2	30.2	37.6	37.6	mm	Hori
Z bar	567	42.9	559	50.3	mm	
I_y =	2.34	2.34	5.66	5.66	$x10^6mm^4$	
I_z =	2.34	2.34	5.66	5.66	$x10^6mm^4$	
A_{angle} =	4860	4860	7580	7580	mm^2	
RHM*	3	3	3	3	mm	
RHM Area =	1935	1935	2419	2419	mm^2	

JOB TITLE	BCLB DECK PRE-DESIGN			
JOB NO.	60637587	CALCULATION NO.		
DESIGNED BY		DATE		
ORIGINATOR BY	KG	DATE	30-Nov-20	
CHECKED BY	RA	DATE	16-Dec-20	

	Top Plate	Bottom Plate	
Designation	19.5x1/2	19.5x1/2	
Qty =	1	1	
t =	12.7	12.7	mm
b =	495.3	495.3	mm
z Bar =	603.25	6.35	mm
A =	6290.31	6290.31	mm^2
RHM*	2	2	
RHM Area =	645.2	645.2	mm^2

RHM* = Rivet Holes/Member

Web			
Location	Inside	Exterior	
Designation =	23x1/2	23x3/8	
Qty =	1	2	
w =	12.7	9.525	mm
h =	584.2	584.2	mm
h_{eff} =	584.2	330.2	mm
A =	7419.34	11129.01	mm^2
A_{eff} =	7419.34	6290.31	mm^2
z Bar =	305	305	mm
RHM*	4	4	
RHM Area =	1290.3	1935.5	mm^2

Section Calculations

Angle

Location	Exterior Top	Exterior Bottom	Web Top	Web Bot.	
Designation	4x4x1/2	4x4x1/2	5x5x5/8	5x5x5/8	
Qty=	2	2	2	2	
Iy =	4.7	4.7	11.3	11.3	$x10^6mm^4$
Iz =	4.68	4.68	11.32	11.32	$x10^6mm^4$
A =	4860	4860	7580	7580	mm^2
dz =	261.9	261.9	254.5	254.5	mm^2
dy =	217	217	44.0	44.0	mm
Iyy =	338.0	338.0	502.3	502.3	$x10^6mm^4$
Izz =	234.5	234.5	26.0	26.0	$x10^6mm^4$

	Inside	**Exterior**			
	Web	Web	Top Plate	Bot Plate	
Designation	23x1/2	23x3/8	19.5x1/2	19.5x1/2	
Qty=	1	2	1	1	
Iy =	211.0	7.1	0.1	0.1	$x10^6mm^4$
Iz =	0.1	0.1	128.6	128.6	$x10^6mm^4$
A =	7419.3	6290.3	6290.3	6290.3	mm^2
dz =	0.0	209.6	298.5	298.5	mm^2
dy =	0.0	252.4	0.0	0.0	mm
Iyy =	211.0	283.4	560.4	560.4	$x10^6mm^4$
Izz =	0.1	400.9	128.6	128.6	$x10^6mm^4$

Composite Member Properties

A_{gross} =	51170	mm^2
A_{RHM*}=	13226	mm2
A_{net} =	37944	mm^2
∑Iyy =	3295.8	$x10^6mm^4$
∑Izz =	1179.0	$x10^6mm^4$
Zbar=	305	mm
ybar=	257	mm

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9558.3375	mm	kyLy/ry =	32.4	< 120 therefore OK
Lz =	9558.3375	mm	kzLz/rz =	54.2	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	381	w =	12.7	h/w =	30.0	OK
Flange	b =	292.1	t =	12.7	b/t =	23.0	OK
Flange Perforated	b =	292.1	t =	12.7	b/t =	23.0	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	37944	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	294.7	mm
rz =	176.3	mm
λy =	0.350	
λz =	0.585	
Cry =	7520	kN
Crz =	6698	kN
Cr Min =	6698	kN

10.8.2 Axial Tensile Resistance ***[CSA S6-19 cl. 10.8.2]***

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	11181	kN
b)	Tr =	$\phi_u A_n F_u$	12446	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	10579	kN
		Tr Min =	10579	kN

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

Vertical Member L_3-U_3 East (Top) — Tension & Compression Member

Drawing Location (1959)
E54 Sections of Lift Span
E59 Lift Span Top Chord

Material Properties: A-7 Steel

			Reference
F_u =	410	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
F_y =	230	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
ϕ_s =	0.95		*[CSA S6-19 cl. 10.5.7]*
E =	200000	Mpa	*[CSA S6-19 cl. 10.4.2]*

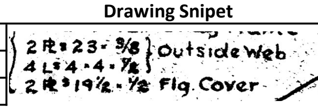
Built up Section Components

Member	Exterior Angle	Exterior Web	Top Plate	Bottom Plate
Quantity	**4**	**2**	**1**	**1**
Dimensions (in)	4x4x1/2	23x3/8	19.5x1/2	19.5x1/2
Ext. Web Perfortion Width		10	in	
Rivet dia.		1	in	

Member Dimensions

Length =	6645	mm
Width =	514	mm
Depth =	610	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Angles				
Location	Exterior Top	Exterior Bottom		
Designation	4x4x1/2	4x4x1/2		
Qty =	2	2	mm	
b =	101.6	101.6	mm	Hori
d =	101.6	101.6	mm	Vert
t =	12.7	12.7	mm^2	
A =	2430	2430	mm	
z =	30.2	30.2	mm	Vert
y =	30.2	30.2	mm	Hori
Z bar	567	42.9	mm	
I_y =	2.34	2.34	$x10^6mm^4$	
I_z =	2.34	2.34	$x10^6mm^4$	
A_{angle} =	4860	4860	mm^2	
RHM*	3	3	mm	
RHM Area =	1935	1935	mm^2	

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

	Top Plate	**Bottom Plate**	
Designation	19.5x1/2	19.5x1/2	
Qty =	1	1	
t =	12.7	12.7	mm
b =	495.3	495.3	mm
z Bar =	603.25	6.35	mm
A =	6290.31	6290.31	mm^2
RHM*	2	2	
RHM Area =	645.2	645.2	mm^2

RHM* = Rivet Holes/Member

Web		
Location	**Exterior**	
Designation =	23x3/8	
Qty =	2	
w =	9.525	mm
h =	584.2	mm
h_{eff} =	330.2	mm
A =	11129.01	mm^2
A_{eff} =	6290.31	mm^2
z Bar =	305	mm
RHM*	4	
RHM Area =	1935.5	mm^2

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations			
Angle			
Location	Exterior Top	Exterior Bottom	
Designation	4x4x1/2	4x4x1/2	
Qty=	2	2	
Iy =	4.7	4.7	$x10^6 mm^4$
Iz =	4.68	4.68	$x10^6 mm^4$
A =	4860	4860	mm^2
dz =	261.9	261.9	mm^2
dy =	217	217	mm
Iyy =	338.0	338.0	$x10^6 mm^4$
Izz =	234.5	234.5	$x10^6 mm^4$

	Exterior			
	Web	Top Plate	Bot Plate	
Designation	23x3/8	19.5x1/2	19.5x1/2	
Qty=	2	1	1	
Iy =	7.1	0.1	0.1	$x10^6 mm^4$
Iz =	0.1	128.6	128.6	$x10^6 mm^4$
A =	6290.3	6290.3	6290.3	mm^2
dz =	209.6	298.5	298.5	mm^2
dy =	252.4	0.0	0.0	mm
Iyy =	283.4	560.4	560.4	$x10^6 mm^4$
Izz =	400.9	128.6	128.6	$x10^6 mm^4$

Composite Member Properties		
A_{gross} =	28591	mm^2
A_{RHM*}=	7097	mm2
A_{net} =	21494	mm^2
∑Iyy =	2080.2	$x10^6 mm^4$
∑Izz =	1127.0	$x10^6 mm^4$
Zbar=	305	mm
ybar=	257	mm

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	6645.275	mm	kyLy/ry =	21.4	< 120 therefore OK
Lz =	6645.275	mm	kzLz/rz =	29.0	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	381	w =	9.5	h/w =	40.0	OK
Flange	b =	292.1	t =	12.7	b/t =	23.0	OK
Flange Perforated	b =	292.1	t =	12.7	b/t =	23.0	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	21494	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	311.1	mm
rz =	229.0	mm
λy =	0.231	
λz =	0.313	
Cry =	4385	kN
Crz =	4307	kN
Cr Min =	4307	kN

10.8.2 Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	6247	kN
b)	Tr =	$\phi_u A_n F_u$	7050	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	5993	kN
		Tr Min =	5993	kN

AECOM Imagine it. Delivered.	JOB TITLE	BCLB DECK PRE-DESIGN		
	JOB NO.	60637587	CALCULATION NO.	
	DESIGNED BY		DATE	
	ORIGINATOR BY	KG	DATE	30-Nov-20
	CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

Vertical Member L_4-U_4 East (Bottom) — Tension & Compression Member

Drawing Location (1959)
E54 Sections of Lift Span
E59 Lift Span Top Chord

Material Properties: A-7 Steel

			Reference
F_u =	410	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

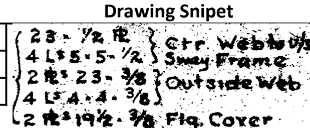
Built up Section Components

Member	**Exterior Angle**	**Web Angles**	**Centre Web**	**Exterior Web**	**Top Plate**	**Bottom Plate**
Quantity	**4**	**4**	**1**	**2**	**1**	**1**
Dimensions (in)	4x4x3/8	5x5x1/2	23x1/2	23x3/8	19.5x3/8	19.5x3/8
Ext. Web Perfortion Width		10	in			
Rivet dia.		1	in			

Member Dimensions

Length =	9565	mm
Width =	514	mm
Depth =	603	mm

Drawing Snipet


23 - 1/2 PL } Ctr. Web b/b L's
4 L's 5 x 5 - 1/2 } Sway Frame
2 PL's 23 - 3/8 } Outside Web
4 L's 4 x 4 - 3/8
2 PL's 19 1/2 - 3/8 Flg. Cover

Member Cross-Section

Individual Member Properties

Angles								
Location	Exterior Top	Exterior Bottom	Web Top	Web Bot.				
Designation	4x4x3/8	4x4x3/8	5x5x1/2	5x5x1/2				
Qty =	2	2	2	2	mm			
b =	101.6	101.6	127	127	mm	Hori		
d =	101.6	101.6	127	127	mm	Vert	1844.754	3064.51
t =	9.5	9.5	12.7	12.7	mm^2			
A =	1850	1850	3060	3060	mm			
z =	29	29	39.1	39.4	mm	Vert		
y =	29	29	39.1	39.1	mm	Hori		
Z bar	565	38.525	555	48.925	mm			
I_y =	1.84	1.84	4.68	4.68	$x10^6mm^4$			
I_z =	1.84	1.84	4.68	4.68	$x10^6mm^4$			
A_{angle} =	3700	3700	6120	6120	mm^2			
RHM*	3	3	3	3	mm			
RHM Area =	1452	1452	1935	1935	mm^2			

	Top Plate	**Bottom Plate**	
Designation	19.5x3/8	19.5x3/8	
Qty =	1	1	
t =	9.525	9.525	mm
b =	495.3	495.3	mm
z Bar =	598.4875	4.7625	mm
A =	4717.73	4717.73	mm^2
RHM*	2	2	
RHM Area =	483.9	483.9	mm^2

RHM* = Rivet Holes/Member

Web			
Location	**Inside**	**Exterior**	
Designation =	23x1/2	23x3/8	
Qty =	1	2	
w =	12.7	9.525	mm
h =	584.2	584.2	mm
h_{eff} =	584.2	330.2	mm
A =	7419.34	11129.01	mm^2
A_{eff} =	7419.34	6290.31	mm^2
z Bar =	302	302	mm
RHM*	4	4	
RHM Area =	1290.3	1935.5	mm^2

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

Angle

Location	Exterior Top	Exterior Bottom	Web Top	Web Bot.	
Designation	4x4x3/8	4x4x3/8	5x5x1/2	5x5x1/2	
Qty=	2	2	2	2	
Iy =	3.7	3.7	9.4	9.4	$x10^6 mm^4$
Iz =	3.68	3.68	9.36	9.36	$x10^6 mm^4$
A =	3700	3700	6120	6120	mm^2
dz =	263.1	263.1	253.0	252.7	mm^2
dy =	219	219	45.5	45.5	mm
Iyy =	259.7	259.9	401.0	400.3	$x10^6 mm^4$
Izz =	180.6	180.6	22.0	22.0	$x10^6 mm^4$

	Inside	**Exterior**			
	Web	Web	Top Plate	Bot Plate	
Designation	23x1/2	23x3/8	19.5x3/8	19.5x3/8	
Qty=	1	2	1	1	
Iy =	211.0	7.1	0.0	0.0	$x10^6 mm^4$
Iz =	0.1	0.1	96.4	96.4	$x10^6 mm^4$
A =	7419.3	6290.3	4717.7	4717.7	mm^2
dz =	0.0	209.6	296.8	296.9	mm^2
dy =	0.0	252.4	0.0	0.0	mm
Iyy =	211.0	283.5	415.7	415.9	$x10^6 mm^4$
Izz =	0.1	400.9	96.4	96.4	$x10^6 mm^4$

Composite Member Properties

A_{gross} =	42785	mm^2
A_{RHM*}=	10968	mm2
A_{net} =	31817	mm^2
∑Iyy =	2646.9	$x10^6 mm^4$
∑Izz =	999.0	$x10^6 mm^4$
Zbar=	302	mm
ybar=	257	mm

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9564.6875	mm	kyLy/ry =	33.2	< 120 therefore OK
Lz =	9564.6875	mm	kzLz/rz =	54.0	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	381	w =	12.7	h/w =	30.0	OK
Flange	b =	292.1	t =	9.5	b/t =	30.7	OK
Flange Perforated	b =	292.1	t =	9.5	b/t =	30.7	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	31817	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	288.4	mm
rz =	177.2	mm
λy =	0.358	
λz =	0.583	
Cry =	6289	kN
Crz =	5626	kN
Cr Min =	5626	kN

10.8.2 Axial Tensile Resistance ***[CSA S6-19 cl. 10.8.2]***

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	9349	kN
b)	Tr =	$\phi_u A_n F_u$	10436	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	8871	kN
		Tr Min =	8871	kN

JOB TITLE	BCLB DECK PRE-DESIGN			
JOB NO.	60637587	CALCULATION NO.		
DESIGNED BY		DATE		
ORIGINATOR BY	KG	DATE	30-Nov-20	
CHECKED BY	RA	DATE	16-Dec-20	

LIFT SPAN

Vertical Member L4-U4 East (Top) — Tension & Compression Member

Drawing Location (1959)
E54 Sections of Lift Span
E59 Lift Span Top Chord

Material Properties: A-7 Steel — Reference

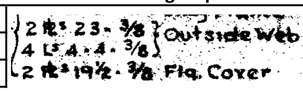
F_u =	410	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

Member	**Exterior Angle**	**Exterior Web**	**Top Plate**	**Bottom Plate**
Quantity	**4**	**2**	**1**	**1**
Dimensions (in)	4x4x3/8	23x3/8	19.5x3/8	19.5x3/8
Ext. Web Perfortion Width		10	in	
Rivet dia.		1	in	

Member Dimensions — **Drawing Snipet** — **Member Cross-Section**

Length =	6920	mm
Width =	514	mm
Depth =	603	mm



Individual Member Properties

Angles				
Location	Exterior Top	Exterior Bottom		
Designation	4x4x3/8	4x4x3/8		
Qty =	2	2	mm	
b =	101.6	101.6	mm	Hori
d =	101.6	101.6	mm	Vert
t =	9.5	9.5	mm^2	
A =	1850	1850	mm	
z =	29	29	mm	Vert
y =	29	29	mm	Hori
Z bar	565	38.525	mm	
I_y =	1.84	1.84	$x10^6mm^4$	
I_z =	1.84	1.84	$x10^6mm^4$	
A_{angle} =	3700	3700	mm^2	
RHM*	3	3	mm	
RHM Area =	1452	1452	mm^2	

1844.754 #REF!

	Top Plate	**Bottom Plate**	
Designation	19.5x3/8	19.5x3/8	
Qty =	1	1	
t =	9.525	9.525	mm
b =	495.3	495.3	mm
z Bar =	598.4875	4.7625	mm
A =	4717.73	4717.73	mm^2
RHM*	2	2	
RHM Area =	483.9	483.9	mm^2

RHM* = Rivet Holes/Member

Web		
Location	**Exterior**	
Designation =	23x3/8	
Qty =	2	
w =	9.525	mm
h =	584.2	mm
h_{eff} =	330.2	mm
A =	11129.01	mm^2
A_{eff} =	6290.31	mm^2
z Bar =	302	mm
RHM*	4	
RHM Area =	1935.5	mm^2

Section Calculations

Angle

Location	Exterior Top	Exterior Bottom	
Designation	4x4x3/8	4x4x3/8	
Qty=	2	2	
Iy =	3.7	3.7	$x10^6mm^4$
Iz =	3.68	3.68	$x10^6mm^4$
A =	3700	3700	mm^2
dz =	263.1	263.1	mm^2
dy =	219	219	mm
Iyy =	259.8	259.8	$x10^6mm^4$
Izz =	180.6	180.6	$x10^6mm^4$

	Exterior			
	Web	Top Plate	Bot Plate	
Designation	23x3/8	19.5x3/8	19.5x3/8	
Qty=	2	1	1	
Iy =	7.1	0.0	0.0	$x10^6mm^4$
Iz =	0.1	96.4	96.4	$x10^6mm^4$
A =	6290.3	4717.7	4717.7	mm^2
dz =	209.6	296.9	296.9	mm^2
dy =	252.4	0.0	0.0	mm
Iyy =	283.4	415.8	415.8	$x10^6mm^4$
Izz =	400.9	96.4	96.4	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	23126	mm^2
A_{RHM*}=	5806	mm2
A_{net} =	17319	mm^2
∑Iyy =	1634.6	$x10^6mm^4$
∑Izz =	954.9	$x10^6mm^4$
Zbar=	302	mm
ybar=	257	mm

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	6919.9125	mm	kyLy/ry =	22.5	< 120 therefore OK
Lz =	6919.9125	mm	kzLz/rz =	29.5	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	381	w =	9.5	h/w =	40.0	OK
Flange	b =	292.1	t =	9.5	b/t =	30.7	OK
Flange Perforated	b =	292.1	t =	9.5	b/t =	30.7	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	17319	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	307.2	mm
rz =	234.8	mm
λy =	0.243	
λz =	0.318	
Cry =	3526	kN
Crz =	3466	kN
Cr Min =	3466	kN

10.8.2 Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	5053	kN
b)	Tr =	$\phi_u A_n F_u$	5681	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	4829	kN
		Tr Min =	4829	kN

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

Vertical Member L_5-U_5 East (Bottom) Tension & Compression Member

Drawing Location (1959)

E54 Sections of Lift Span

E59 Lift Span Top Chord

Material Properties: A-7 Steel Reference

F_u =	410	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

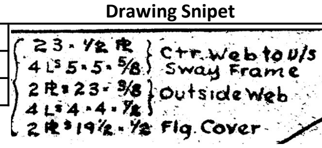
Member	Exterior Angle	Web Angles	Centre Web	Exterior Web	Top Plate	Bottom Plate
Quantity	**4**	**4**	**1**	**2**	**1**	**1**
Dimensions (in)	4x4x1/2	5x5x5/8	23x1/2	23x3/8	19.5x1/2	19.5x1/2

Ext. Web Perfortion Width	10	in
Rivet dia.	1	in

Member Dimensions

Length =	9557	mm
Width =	514	mm
Depth =	610	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Angles						
Location	Exterior Top	Exterior Bottom	Web Top	Web Bot.		
Designation	4x4x1/2	4x4x1/2	5x5x5/8	5x5x5/8		
Qty =	2	2	2	2	mm	
b =	101.6	101.6	127	127	mm	Hori
d =	101.6	101.6	127	127	mm	Vert
t =	12.7	12.7	15.9	15.9	mm^2	
A =	2430	2430	3790	3790	mm	
z =	30.2	30.2	37.6	37.6	mm	Vert
y =	30.2	30.2	37.6	37.6	mm	Hori
Z bar	567	42.9	559	50.3	mm	
I_y =	2.34	2.34	5.66	5.66	$x10^6mm^4$	
I_z =	2.34	2.34	5.66	5.66	$x10^6mm^4$	
A_{angle} =	4860	4860	7580	7580	mm^2	
RHM*	3	3	3	3	mm	
RHM Area =	1935	1935	2419	2419	mm^2	

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

	Top Plate	Bottom Plate	
Designation	19.5x1/2	19.5x1/2	
Qty =	1	1	
t =	12.7	12.7	mm
b =	495.3	495.3	mm
z Bar =	603.25	6.35	mm
A =	6290.31	6290.31	mm^2
RHM*	2	2	
RHM Area =	645.2	645.2	mm^2

RHM* = Rivet Holes/Member

Web			
Location	**Inside**	**Exterior**	
Designation =	23x1/2	23x3/8	
Qty =	1	2	
w =	12.7	9.525	mm
h =	584.2	584.2	mm
h_{eff} =	584.2	330.2	mm
A =	7419.34	11129.01	mm^2
A_{eff} =	7419.34	6290.31	mm^2
z Bar =	305	305	mm
RHM*	4	4	
RHM Area =	1290.3	1935.5	mm^2

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

Angle

Location	Exterior Top	Exterior Bottom	Web Top	Web Bot.	
Designation	4x4x1/2	4x4x1/2	5x5x5/8	5x5x5/8	
Qty=	2	2	2	2	
Iy =	4.7	4.7	11.3	11.3	$x10^6mm^4$
Iz =	4.68	4.68	11.32	11.32	$x10^6mm^4$
A =	4860	4860	7580	7580	mm^2
dz =	261.9	261.9	254.5	254.5	mm^2
dy =	217	217	44.0	44.0	mm
Iyy =	338.0	338.0	502.3	502.3	$x10^6mm^4$
Izz =	234.5	234.5	26.0	26.0	$x10^6mm^4$

	Inside Web	**Exterior** Web	Top Plate	Bot Plate	
Designation	23x1/2	23x3/8	19.5x1/2	19.5x1/2	
Qty=	1	2	1	1	
Iy =	211.0	7.1	0.1	0.1	$x10^6mm^4$
Iz =	0.1	0.1	128.6	128.6	$x10^6mm^4$
A =	7419.3	6290.3	6290.3	6290.3	mm^2
dz =	0.0	209.6	298.5	298.5	mm^2
dy =	0.0	252.4	0.0	0.0	mm
Iyy =	211.0	283.4	560.4	560.4	$x10^6mm^4$
Izz =	0.1	400.9	128.6	128.6	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	51170	mm^2
A_{RHM*}=	13226	mm2
A_{net} =	37944	mm^2
∑Iyy =	3295.8	$x10^6mm^4$
∑Izz =	1179.0	$x10^6mm^4$
Zbar=	305	mm
ybar=	257	mm

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9556.75	mm	kyLy/ry =	32.4	< 120 therefore OK
Lz =	9556.75	mm	kzLz/rz =	54.2	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	381	w =	12.7	h/w =	30.0	OK
Flange	b =	292.1	t =	12.7	b/t =	23.0	OK
Flange Perforated	b =	292.1	t =	12.7	b/t =	23.0	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	37944	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	294.7	mm
rz =	176.3	mm
λy =	0.350	
λz =	0.585	
Cry =	7520	kN
Crz =	6698	kN
Cr Min =	6698	kN

10.8.2 Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	11181	kN
b)	Tr =	$\phi_u A_n F_u$	12446	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	10579	kN
		Tr Min =	10579	kN

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

Vertical Member L_5-U_5 East (Top) — Tension & Compression Member — Drawing Location (1959)

E54 Sections of Lift Span

E59 Lift Span Top Chord

Material Properties: A-7 Steel — Reference

F_u =	410	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
F_y =	230	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
ϕ_s =	0.95		*[CSA S6-19 cl. 10.5.7]*
E =	200000	Mpa	*[CSA S6-19 cl. 10.4.2]*

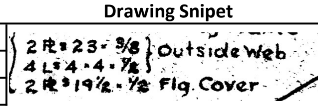
Built up Section Components

Member	Exterior Angle	Exterior Web	Top Plate	Bottom Plate
Quantity	**4**	**2**	**1**	**1**
Dimensions (in)	4x4x1/2	23x3/8	19.5x1/2	19.5x1/2
Ext. Web Perfortion Width		10	in	
Rivet dia.		1	in	

Member Dimensions

Length =	7207	mm
Width =	514	mm
Depth =	610	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Angles				
Location	Exterior Top	Exterior Bottom		
Designation	4x4x1/2	4x4x1/2		
Qty =	2	2	mm	
b =	101.6	101.6	mm	Hori
d =	101.6	101.6	mm	Vert
t =	12.7	12.7	mm^2	
A =	2430	2430	mm	
z =	30.2	30.2	mm	Vert
y =	30.2	30.2	mm	Hori
Z bar	567	42.9	mm	
I_y =	2.34	2.34	$x10^6mm^4$	
I_z =	2.34	2.34	$x10^6mm^4$	
A_{angle} =	4860	4860	mm^2	
RHM*	3	3	mm	
RHM Area =	1935	1935	mm^2	

JOB TITLE	BCLB DECK PRE-DESIGN			
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	Top Plate	**Bottom Plate**	
Designation	19.5x1/2	19.5x1/2	
Qty =	1	1	
t =	12.7	12.7	mm
b =	495.3	495.3	mm
z Bar =	603.25	6.35	mm
A =	6290.31	6290.31	mm^2
RHM*	2	2	
RHM Area =	645.2	645.2	mm^2

RHM* = Rivet Holes/Member

Web		
Location	**Exterior**	
Designation =	23x3/8	
Qty =	2	
w =	9.525	mm
h =	584.2	mm
h_{eff} =	330.2	mm
A =	11129.01	mm^2
A_{eff} =	6290.31	mm^2
z Bar =	305	mm
RHM*	4	
RHM Area =	1935.5	mm^2

Section Calculations			
Angle			
Location	Exterior Top	Exterior Bottom	
Designation	4x4x1/2	4x4x1/2	
Qty=	2	2	
Iy =	4.7	4.7	$x10^6mm^4$
Iz =	4.68	4.68	$x10^6mm^4$
A =	4860	4860	mm^2
dz =	261.9	261.9	mm^2
dy =	217	217	mm
Iyy =	338.0	338.0	$x10^6mm^4$
Izz =	234.5	234.5	$x10^6mm^4$

	Exterior			
	Web	Top Plate	Bot Plate	
Designation	23x3/8	19.5x1/2	19.5x1/2	
Qty=	2	1	1	
Iy =	7.1	0.1	0.1	$x10^6mm^4$
Iz =	0.1	128.6	128.6	$x10^6mm^4$
A =	6290.3	6290.3	6290.3	mm^2
dz =	209.6	298.5	298.5	mm^2
dy =	252.4	0.0	0.0	mm
Iyy =	283.4	560.4	560.4	$x10^6mm^4$
Izz =	400.9	128.6	128.6	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	28591	mm^2
A_{RHM*}=	7097	mm2
A_{net} =	21494	mm^2
∑Iyy =	2080.2	$x10^6mm^4$
∑Izz =	1127.0	$x10^6mm^4$
Zbar=	305	mm
ybar=	257	mm

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	7207.25	mm	kyLy/ry =	23.2	< 120 therefore OK
Lz =	7207.25	mm	kzLz/rz =	31.5	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	381	w =	9.5	h/w =	40.0	OK
Flange	b =	292.1	t =	12.7	b/t =	23.0	OK
Flange Perforated	b =	292.1	t =	12.7	b/t =	23.0	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	21494	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	311.1	mm
rz =	229.0	mm
λy =	0.250	
λz =	0.340	
Cry =	4370	kN
Crz =	4274	kN
Cr Min =	4274	kN

10.8.2 Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	6247	kN
b)	Tr =	$\phi_u A_n F_u$	7050	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	5993	kN
		Tr Min =	5993	kN

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LIFT SPAN

Vertical Member L_6-U_6 East (Bottom)

Tension & Compression Member

Drawing Location (1959)

E54 Sections of Lift Span

E59 Lift Span Top Chord

Material Properties: A-7 Steel

Reference

F_u =	410	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

Member	**Exterior Angle**	**Web Angles**	**Centre Web**	**Exterior Web**	**Top Plate**	**Bottom Plate**
Quantity	**4**	**4**	**1**	**2**	**1**	**1**
Dimensions (in)	4x4x3/8	5x5x1/2	23x1/2	23x3/8	19.5x3/8	19.5x3/8

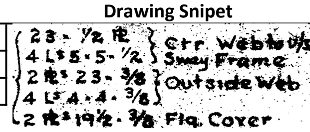
Ext. Web Perfortion Width 10 in

Rivet dia. 1 in

Member Dimensions

Length =	9539	mm
Width =	514	mm
Depth =	603	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Angles					
Location	Exterior Top	Exterior Bottom	Web Top	Web Bot.	
Designation	4x4x3/8	4x4x3/8	5x5x1/2	5x5x1/2	
Qty =	2	2	2	2	mm
b =	101.6	101.6	127	127	mm
d =	101.6	101.6	127	127	mm
t =	9.5	9.5	12.7	12.7	mm^2
A =	1850	1850	3060	3060	mm
z =	29	29	39.1	39.4	mm
y =	29	29	39.1	39.1	mm
Z bar	565	38.525	555	48.925	mm
I_y =	1.84	1.84	4.68	4.68	$x10^6mm^4$
I_z =	1.84	1.84	4.68	4.68	$x10^6mm^4$
A_{angle} =	3700	3700	6120	6120	mm^2
RHM*	3	3	3	3	mm
RHM Area =	1452	1452	1935	1935	mm^2

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
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	Top Plate	**Bottom Plate**	
Designation	19.5x3/8	19.5x3/8	
Qty =	1	1	
t =	9.525	9.525	mm
b =	495.3	495.3	mm
z Bar =	598.4875	4.7625	mm
A =	4717.73	4717.73	mm^2
RHM*	2	2	
RHM Area =	483.9	483.9	mm^2

RHM* = Rivet Holes/Member

Web			
Location	**Inside**	**Exterior**	
Designation =	23x1/2	23x3/8	
Qty =	1	2	
w =	12.7	9.525	mm
h =	584.2	584.2	mm
h_{eff} =	584.2	330.2	mm
A =	7419.34	11129.01	mm^2
A_{eff} =	7419.34	6290.31	mm^2
z Bar =	302	302	mm
RHM*	4	4	
RHM Area =	1290.3	1935.5	mm^2

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

Angle

Location	Exterior Top	Exterior Bottom	Web Top	Web Bot.	
Designation	4x4x3/8	4x4x3/8	5x5x1/2	5x5x1/2	
Qty=	2	2	2	2	
Iy =	3.7	3.7	9.4	9.4	$x10^6mm^4$
Iz =	3.68	3.68	9.36	9.36	$x10^6mm^4$
A =	3700	3700	6120	6120	mm^2
dz =	263.1	263.1	253.0	252.7	mm^2
dy =	219	219	45.5	45.5	mm
Iyy =	259.7	259.9	401.0	400.3	$x10^6mm^4$
Izz =	180.6	180.6	22.0	22.0	$x10^6mm^4$

	Inside	**Exterior**			
	Web	Web	Top Plate	Bot Plate	
Designation	23x1/2	23x3/8	19.5x3/8	19.5x3/8	
Qty=	1	2	1	1	
Iy =	211.0	7.1	0.0	0.0	$x10^6mm^4$
Iz =	0.1	0.1	96.4	96.4	$x10^6mm^4$
A =	7419.3	6290.3	4717.7	4717.7	mm^2
dz =	0.0	209.6	296.8	296.9	mm^2
dy =	0.0	252.4	0.0	0.0	mm
Iyy =	211.0	283.5	415.7	415.9	$x10^6mm^4$
Izz =	0.1	400.9	96.4	96.4	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	42785	mm^2
A_{RHM*}=	10968	mm2
A_{net} =	31817	mm^2
∑Iyy =	2646.9	$x10^6mm^4$
∑Izz =	999.0	$x10^6mm^4$
Zbar=	302	mm
ybar=	257	mm

AECOM Imagine it. Delivered.	JOB TITLE	BCLB DECK PRE-DESIGN		
	JOB NO.	60637587	CALCULATION NO.	
	DESIGNED BY		DATE	
	ORIGINATOR BY	KG	DATE	30-Nov-20
	CHECKED BY	RA	DATE	16-Dec-20

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9539.3002	mm	kyLy/ry =	33.1	< 120 therefore OK
Lz =	9539.3002	mm	kzLz/rz =	53.8	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	381	w =	12.7	h/w =	30.0	OK
Flange	b =	292.1	t =	9.5	b/t =	30.7	OK
Flange Perforated	b =	292.1	t =	9.5	b/t =	30.7	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	31817	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	288.4	mm
rz =	177.2	mm
λy =	0.357	
λz =	0.581	
Cry =	6291	kN
Crz =	5632	kN
Cr Min =	5632	kN

10.8.2 Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	9349	kN
b)	Tr =	$\phi_u A_n F_u$	10436	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	8871	kN
		Tr Min =	8871	kN

JOB TITLE	BCLB DECK PRE-DESIGN		
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DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

Vertical Member L_6-U_6 East (Top)

Tension & Compression Member

Drawing Location (1959)

E54 Sections of Lift Span
E59 Lift Span Top Chord

Material Properties: A-7 Steel

			Reference
F_u =	410	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
F_y =	230	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
ϕ_s =	0.95		*[CSA S6-19 cl. 10.5.7]*
E =	200000	Mpa	*[CSA S6-19 cl. 10.4.2]*

Built up Section Components

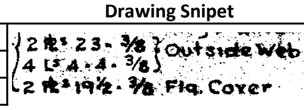
Member	Exterior Angle	Exterior Web	Top Plate	Bottom Plate
Quantity	**4**	**2**	**1**	**1**
Dimensions (in)	4x4x3/8	23x3/8	19.5x3/8	19.5x3/8

Ext. Web Perfortion Width	10	in
Rivet dia.	1	in

Member Dimensions

Length =	7225	mm
Width =	514	mm
Depth =	603	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Angles				
Location	Exterior Top	Exterior Bottom		
Designation	4x4x3/8	4x4x3/8		
Qty =	2	2	mm	
b =	101.6	101.6	mm	Hori
d =	101.6	101.6	mm	Vert
t =	9.5	9.5	mm^2	
A =	1850	1850	mm	
z =	29	29	mm	Vert
y =	29	29	mm	Hori
Z bar	565	38.525	mm	
I_y =	1.84	1.84	$x10^6mm^4$	
I_z =	1.84	1.84	$x10^6mm^4$	
A_{angle} =	3700	3700	mm^2	
RHM*	3	3	mm	
RHM Area =	1452	1452	mm^2	

	Top Plate	**Bottom Plate**	
Designation	19.5x3/8	19.5x3/8	
Qty =	1	1	
t =	9.525	9.525	mm
b =	495.3	495.3	mm
z Bar =	598.4875	4.7625	mm
A =	4717.73	4717.73	mm^2
RHM*	2	2	
RHM Area =	483.9	483.9	mm^2

RHM* = Rivet Holes/Member

Web		
Location	**Exterior**	
Designation =	23x3/8	
Qty =	2	
w =	9.525	mm
h =	584.2	mm
h_{eff} =	330.2	mm
A =	11129.01	mm^2
A_{eff} =	6290.31	mm^2
z Bar =	302	mm
RHM*	4	
RHM Area =	1935.5	mm^2

AECOM Imagine it. Delivered.			
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Section Calculations			
Angle			
Location	Exterior Top	Exterior Bottom	
Designation	4x4x3/8	4x4x3/8	
Qty=	2	2	
Iy =	3.7	3.7	$x10^6mm^4$
Iz =	3.68	3.68	$x10^6mm^4$
A =	3700	3700	mm^2
dz =	263.1	263.1	mm^2
dy =	219	219	mm
Iyy =	259.8	259.8	$x10^6mm^4$
Izz =	180.6	180.6	$x10^6mm^4$

	Exterior			
	Web	Top Plate	Bot Plate	
Designation	23x3/8	19.5x3/8	19.5x3/8	
Qty=	2	1	1	
Iy =	7.1	0.0	0.0	$x10^6mm^4$
Iz =	0.1	96.4	96.4	$x10^6mm^4$
A =	6290.3	4717.7	4717.7	mm^2
dz =	209.6	296.9	296.9	mm^2
dy =	252.4	0.0	0.0	mm
Iyy =	283.4	415.8	415.8	$x10^6mm^4$
Izz =	400.9	96.4	96.4	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	23126	mm^2
A_{RHM*}=	5806	mm2
A_{net} =	17319	mm^2
∑Iyy =	1634.6	$x10^6mm^4$
∑Izz =	954.9	$x10^6mm^4$
Zbar=	302	mm
ybar=	257	mm

JOB TITLE	BCLB DECK PRE-DESIGN			
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DESIGNED BY		DATE		
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Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	7224.6998	mm	kyLy/ry =	23.5	< 120 therefore OK
Lz =	7224.6998	mm	kzLz/rz =	30.8	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	381	w =	9.5	h/w =	40.0	OK
Flange	b =	292.1	t =	9.5	b/t =	30.7	OK
Flange Perforated	b =	292.1	t =	9.5	b/t =	30.7	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	17319	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	307.2	mm
rz =	234.8	mm
λy =	0.254	
λz =	0.332	
Cry =	3519	kN
Crz =	3452	kN
Cr Min =	3452	kN

10.8.2 Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	5053	kN
b)	Tr =	$\phi_u A_n F_u$	5681	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	4829	kN
		Tr Min =	4829	kN

AECOM Imagine it. Delivered.	JOB TITLE	BCLB DECK PRE-DESIGN		
	JOB NO.	60637587	CALCULATION NO.	
	DESIGNED BY		DATE	
	ORIGINATOR BY	KG	DATE	30-Nov-20
	CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

Vertical Member L_0-U_0 East & West — Tension & Compression Member

Drawing Location (1959)

E54 Sections of Lift Span

E59 Lift Span Top Chord

Material Properties: A-242-55 Steel — Reference

F_u =	480	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	350	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

Member	Exterior Angle	Web Angles	Centre Web	Centre Web	Exterior Web	Top Plate	Bottom Plate
Quantity	**4**	**4**	**2**	**1**	**2**	**1**	**1**
Dimensions (in)	4x4x3/4	5x5x3/4	13x3/4	23x7/8	23x1/2	27x1/2	27x1/2

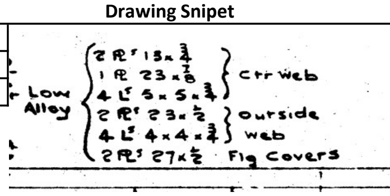
Ext. Web Perfortion Width 10 in

Rivet dia. 1 in

Member Dimensions

Length =	13259	mm
Width =	711	mm
Depth =	610	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Angles						
Location	Exterior Top	Exterior Bottom	Web Top	Web Bot.		
Designation	4x4x3/4	4x4x3/4	5x5x3/4	5x5x3/4		
Qty =	2	2	2	2	mm	
b =	101.6	101.6	127	127	mm	Hori
d =	101.6	101.6	127	127	mm	Vert
t =	19.1	19.1	19.1	19.1	mm^2	
A =	3530	3530	4490	4490	mm	
z =	32.4	32.4	38.7	38.7	mm	Vert
y =	32.4	32.4	38.7	38.7	mm	Hori
Z bar	565	45.1	558	51.4	mm	
I_y =	3.24	3.24	6.57	6.57	$x10^6mm^4$	
I_z =	3.24	3.24	6.57	6.57	$x10^6mm^4$	
A_{angle} =	7060	7060	8980	8980	mm^2	
RHM*	3	3	3	3	mm	
RHM Area =	2903	2903	2903	2903	mm^2	

JOB TITLE	BCLB DECK PRE-DESIGN		
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	Top Plate	**Bottom Plate**	
Designation	27x1/2	27x1/2	
Qty =	1	1	
t =	12.7	12.7	mm
b =	685.8	685.8	mm
z Bar =	603.25	6.35	mm
A =	8709.66	8709.66	mm^2
RHM*	2	2	
RHM Area =	645.2	645.2	mm^2

RHM* = Rivet Holes/Member

Web				
Location	**Outside**	**Inside**	**Exterior**	
Designation =	13x3/4	23x7/8	23x1/2	
Qty =	2	1	2	
w =	19.05	22.225	12.7	mm
h =	330.2	584.2	584.2	mm
h_{eff} =	330.2	584.2	330.2	mm
A =	12580.62	12983.845	14838.68	mm^2
A_{eff} =	12580.62	12983.845	8387.08	mm^2
z Bar =	305	305	305	mm
RHM*	4	4	4	
RHM Area =	3871.0	2258.1	2580.6	mm^2

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

Angle

Location	Exterior Top	Exterior Bottom	Web Top	Web Bot.	
Designation	4x4x3/4	4x4x3/4	5x5x3/4	5x5x3/4	
Qty=	2	2	2	2	
Iy =	6.5	6.5	13.1	13.1	$x10^6mm^4$
Iz =	6.48	6.48	13.14	13.14	$x10^6mm^4$
A =	7060	7060	8980	8980	mm^2
dz =	259.7	259.7	253.4	253.4	mm^2
dy =	311	311	68.9	68.9	mm
Iyy =	482.6	482.6	589.8	589.8	$x10^6mm^4$
Izz =	687.1	687.1	55.7	55.7	$x10^6mm^4$

	Outside	**Inside**	**Exterior**			
	Web	Web	Web	Top Plate	Bot Plate	
Designation	13x3/4	23x7/8	23x1/2	27x1/2	27x1/2	
Qty=	2	1	2	1	1	
Iy =	114.3	369.3	9.5	0.1	0.1	$x10^6mm^4$
Iz =	0.4	0.5	0.2	341.4	341.4	$x10^6mm^4$
A =	12580.6	12983.8	8387.1	8709.7	8709.7	mm^2
dz =	0.0	0.0	209.6	298.5	298.5	mm^2
dy =	20.6	0.0	349.3	0.0	0.0	mm
Iyy =	114.3	369.3	377.8	775.9	775.9	$x10^6mm^4$
Izz =	5.7	0.5	1023.2	341.4	341.4	$x10^6mm^4$

Composite Member Properties

A_{gross} =	83451	mm^2
A_{RHM*}=	21613	mm2
A_{net} =	61838	mm^2
∑Iyy =	4558.0	$x10^6mm^4$
∑Izz =	3197.9	$x10^6mm^4$
Zbar=	305	mm
ybar=	356	mm

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CHECKED BY	RA	DATE	16-Dec-20

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	13258.8	mm	kyLy/ry =	48.8	< 120 therefore OK
Lz =	13258.8	mm	kzLz/rz =	58.3	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	35.8
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	35.8
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	44.9

Webs	h =	381	w =	22.2	h/w =	17.1	OK
Flange	b =	482.6	t =	12.7	b/t =	38.0	NG
Flange Perforated	b =	482.6	t =	12.7	b/t =	38.0	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	61838	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	271.5	mm
rz =	227.4	mm
λy =	0.650	
λz =	0.776	
Cry =	15873	kN
Crz =	14340	kN
Cr Min =	14340	kN

10.8.2 Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	27747	kN
b)	Tr =	$\phi_u A_n F_u$	23746	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	20184	kN
		Tr Min =	20184	kN

JOB TITLE	BCLB DECK PRE-DESIGN		
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LIFT SPAN

Vertical Member L_1-U_1 West (Bottom) Tension & Compression Member

Drawing Location (1959)

E54 Sections of Lift Span

E59 Lift Span Top Chord

Material Properties: A-7 Steel

			Reference
F_u =	410	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

Member	**Exterior Angle**	**Web Angles**	**Centre Web**	**Exterior Web**	**Top Plate**	**Bottom Plate**
Quantity	**4**	**4**	**1**	**2**	**1**	**1**
Dimensions (in)	4x4x1/2	5x5x5/8	23x1/2	23x3/8	19.5x1/2	19.5x1/2

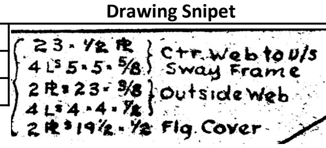
Ext. Web Perfortion Width 10 in

Rivet dia. 1 in

Member Dimensions

Length =	9560	mm
Width =	514	mm
Depth =	610	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Angles						
Location	Exterior Top	Exterior Bottom	Web Top	Web Bot.		
Designation	4x4x1/2	4x4x1/2	5x5x5/8	5x5x5/8		
Qty =	2	2	2	2	mm	
b =	101.6	101.6	127	127	mm	Hori
d =	101.6	101.6	127	127	mm	Vert
t =	12.7	12.7	15.9	15.9	mm^2	
A =	2430	2430	3790	3790	mm	
z =	30.2	30.2	37.6	37.6	mm	Vert
y =	30.2	30.2	37.6	37.6	mm	Hori
Z bar	567	42.9	559	50.3	mm	
I_y =	2.34	2.34	5.66	5.66	$x10^6mm^4$	
I_z =	2.34	2.34	5.66	5.66	$x10^6mm^4$	
A_{angle} =	4860	4860	7580	7580	mm^2	
RHM*	3	3	3	3	mm	
RHM Area =	1935	1935	2419	2419	mm^2	

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
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	Top Plate	Bottom Plate	
Designation	19.5x1/2	19.5x1/2	
Qty =	1	1	
t =	12.7	12.7	mm
b =	495.3	495.3	mm
z Bar =	603.25	6.35	mm
A =	6290.31	6290.31	mm^2
RHM*	2	2	
RHM Area =	645.2	645.2	mm^2

RHM* = Rivet Holes/Member

Web			
Location	Inside	Exterior	
Designation =	23x1/2	23x3/8	
Qty =	1	2	
w =	12.7	9.525	mm
h =	584.2	584.2	mm
h_{eff} =	584.2	330.2	mm
A =	7419.34	11129.01	mm^2
A_{eff} =	7419.34	6290.31	mm^2
z Bar =	305	305	mm
RHM*	4	4	
RHM Area =	1290.3	1935.5	mm^2

Section Calculations

Angle

Location	Exterior Top	Exterior Bottom	Web Top	Web Bot.	
Designation	4x4x1/2	4x4x1/2	5x5x5/8	5x5x5/8	
Qty=	2	2	2	2	
Iy =	4.7	4.7	11.3	11.3	$x10^6mm^4$
Iz =	4.68	4.68	11.32	11.32	$x10^6mm^4$
A =	4860	4860	7580	7580	mm^2
dz =	261.9	261.9	254.5	254.5	mm^2
dy =	217	217	44.0	44.0	mm
Iyy =	338.0	338.0	502.3	502.3	$x10^6mm^4$
Izz =	234.5	234.5	26.0	26.0	$x10^6mm^4$

	Inside	**Exterior**			
	Web	Web	Top Plate	Bot Plate	
Designation	23x1/2	23x3/8	19.5x1/2	19.5x1/2	
Qty=	1	2	1	1	
Iy =	211.0	7.1	0.1	0.1	$x10^6mm^4$
Iz =	0.1	0.1	128.6	128.6	$x10^6mm^4$
A =	7419.3	6290.3	6290.3	6290.3	mm^2
dz =	0.0	209.6	298.5	298.5	mm^2
dy =	0.0	252.4	0.0	0.0	mm
Iyy =	211.0	283.4	560.4	560.4	$x10^6mm^4$
Izz =	0.1	400.9	128.6	128.6	$x10^6mm^4$

Composite Member Properties

A_{gross} =	51170	mm^2
A_{RHM*}=	13226	mm2
A_{net} =	37944	mm^2
∑Iyy =	3295.8	$x10^6mm^4$
∑Izz =	1179.0	$x10^6mm^4$
Zbar=	305	mm
ybar=	257	mm

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9559.925	mm	kyLy/ry =	32.4	< 120 therefore OK
Lz =	9559.925	mm	kzLz/rz =	54.2	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	381	w =	12.7	h/w =	30.0	OK
Flange	b =	292.1	t =	12.7	b/t =	23.0	OK
Flange Perforated	b =	292.1	t =	12.7	b/t =	23.0	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	37944	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	294.7	mm
rz =	176.3	mm
λy =	0.350	
λz =	0.585	
Cry =	7520	kN
Crz =	6697	kN
Cr Min =	6697	kN

10.8.2 Axial Tensile Resistance ***[CSA S6-19 cl. 10.8.2]***

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	11181	kN
b)	Tr =	$\phi_u A_n F_u$	12446	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	10579	kN
		Tr Min =	10579	kN

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LIFT SPAN

Vertical Member L_1-U_1 (Top) — Tension & Compression Member — Drawing Location (1959)

E54 Sections of Lift Span

Material Properties: A-7 Steel — Reference — E59 Lift Span Top Chord

F_u =	410	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

Member	Exterior Angle	Exterior Web	Top Plate	Bottom Plate
Quantity	**4**	**2**	**1**	**1**
Dimensions (in)	4x4x1/2	23x3/8	19.5x1/2	19.5x1/2

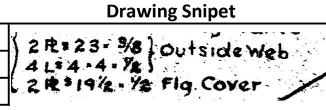
Ext. Web Perfortion Width 10 in

Rivet dia. 1 in

Member Dimensions

Length =	4961	mm
Width =	514	mm
Depth =	610	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Angles				
Location	Exterior Top	Exterior Bottom		
Designation	4x4x1/2	4x4x1/2		
Qty =	2	2	mm	
b =	101.6	101.6	mm	Hori
d =	101.6	101.6	mm	Vert
t =	12.7	12.7	mm^2	
A =	2430	2430	mm	
z =	30.2	30.2	mm	Vert
y =	30.2	30.2	mm	Hori
Z bar	567	42.9	mm	
I_y =	2.34	2.34	$x10^6mm^4$	
I_z =	2.34	2.34	$x10^6mm^4$	
A_{angle} =	4860	4860	mm^2	
RHM*	3	3	mm	
RHM Area =	1935	1935	mm^2	

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	Top Plate	Bottom Plate	
Designation	19.5x1/2	19.5x1/2	
Qty =	1	1	
t =	12.7	12.7	mm
b =	495.3	495.3	mm
z Bar =	603.25	6.35	mm
A =	6290.31	6290.31	mm^2
RHM*	2	2	
RHM Area =	645.2	645.2	mm^2

RHM* = Rivet Holes/Member

Web		
Location	**Exterior**	
Designation =	23x3/8	
Qty =	2	
w =	9.525	mm
h =	584.2	mm
h_{eff} =	330.2	mm
A =	11129.01	mm^2
A_{eff} =	6290.31	mm^2
z Bar =	305	mm
RHM*	4	
RHM Area =	1935.5	mm^2

Section Calculations

Angle

Location	Exterior Top	Exterior Bottom	
Designation	4x4x1/2	4x4x1/2	
Qty=	2	2	
Iy =	4.7	4.7	$x10^6mm^4$
Iz =	4.68	4.68	$x10^6mm^4$
A =	4860	4860	mm^2
dz =	261.9	261.9	mm^2
dy =	217	217	mm
Iyy =	338.0	338.0	$x10^6mm^4$
Izz =	234.5	234.5	$x10^6mm^4$

	Exterior			
	Web	Top Plate	Bot Plate	
Designation	23x3/8	19.5x1/2	19.5x1/2	
Qty=	2	1	1	
Iy =	7.1	0.1	0.1	$x10^6mm^4$
Iz =	0.1	128.6	128.6	$x10^6mm^4$
A =	6290.3	6290.3	6290.3	mm^2
dz =	209.6	298.5	298.5	mm^2
dy =	252.4	0.0	0.0	mm
Iyy =	283.4	560.4	560.4	$x10^6mm^4$
Izz =	400.9	128.6	128.6	$x10^6mm^4$

Composite Member Properties

A_{gross} =	28591	mm^2
A_{RHM*}=	7097	mm2
A_{net} =	21494	mm^2
∑Iyy =	2080.2	$x10^6mm^4$
∑Izz =	1127.0	$x10^6mm^4$
Zbar=	305	mm
ybar=	257	mm

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	4960.9375	mm	kyLy/ry =	15.9	< 120 therefore OK
Lz =	4960.9375	mm	kzLz/rz =	21.7	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	381	w =	9.5	h/w =	40.0	OK
Flange	b =	292.1	t =	12.7	b/t =	23.0	OK
Flange Perforated	b =	292.1	t =	12.7	b/t =	23.0	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	21494	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	311.1	mm
rz =	229.0	mm
λy =	0.172	
λz =	0.234	
Cry =	4420	kN
Crz =	4383	kN
Cr Min =	4383	kN

10.8.2 Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension Φs = 0.95

Tension Φu = 0.8

a)	Tr =	$\phi_s A_g F_y$	6247	kN
b)	Tr =	$\phi_u A_n F_u$	7050	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	5993	kN
		Tr Min =	5993	kN

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LIFT SPAN

Vertical Member L_2-U_2 (Bottom) — Tension & Compression Member

Drawing Location (1959)

E54 Sections of Lift Span
E59 Lift Span Top Chord

Material Properties: A-7 Steel — Reference

F_u =	410	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

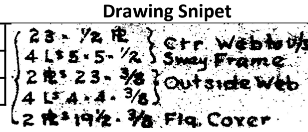
Member	**Exterior Angle**	**Web Angles**	**Centre Web**	**Exterior Web**	**Top Plate**	**Bottom Plate**
Quantity	**4**	**4**	**1**	**2**	**1**	**1**
Dimensions (in)	4x4x3/8	5x5x1/2	23x1/2	23x3/8	19.5x3/8	19.5x3/8

Ext. Web Perfortion Width	10	in
Rivet dia.	1	in

Member Dimensions

Length =	9562	mm
Width =	514	mm
Depth =	603	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Angles						
Location	Exterior Top	Exterior Bottom	Web Top	Web Bot.		
Designation	4x4x3/8	4x4x3/8	5x5x1/2	5x5x1/2		
Qty =	2	2	2	2	mm	
b =	101.6	101.6	127	127	mm	Hori
d =	101.6	101.6	127	127	mm	Vert
t =	9.5	9.5	12.7	12.7	mm^2	
A =	1850	1850	3060	3060	mm	
z =	29	29	39.1	39.4	mm	Vert
y =	29	29	39.1	39.1	mm	Hori
Z bar	565	38.525	555	48.925	mm	
I_y =	1.84	1.84	4.68	4.68	$x10^6mm^4$	
I_z =	1.84	1.84	4.68	4.68	$x10^6mm^4$	
A_{angle} =	3700	3700	6120	6120	mm^2	
RHM*	3	3	3	3	mm	
RHM Area =	1452	1452	1935	1935	mm^2	

	Top Plate	Bottom Plate	
Designation	19.5x3/8	19.5x3/8	
Qty =	1	1	
t =	9.525	9.525	mm
b =	495.3	495.3	mm
z Bar =	598.4875	4.7625	mm
A =	4717.73	4717.73	mm^2
RHM*	2	2	
RHM Area =	483.9	483.9	mm^2

RHM* = Rivet Holes/Member

Web			
Location	Inside	Exterior	
Designation =	23x1/2	23x3/8	
Qty =	1	2	
w =	12.7	9.525	mm
h =	584.2	584.2	mm
h_{eff} =	584.2	330.2	mm
A =	7419.34	11129.01	mm^2
A_{eff} =	7419.34	6290.31	mm^2
z Bar =	302	302	mm
RHM*	4	4	
RHM Area =	1290.3	1935.5	mm^2

JOB TITLE	BCLB DECK PRE-DESIGN		
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DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

Angle

Location	Exterior Top	Exterior Bottom	Web Top	Web Bot.	
Designation	4x4x3/8	4x4x3/8	5x5x1/2	5x5x1/2	
Qty=	2	2	2	2	
Iy =	3.7	3.7	9.4	9.4	$x10^6mm^4$
Iz =	3.68	3.68	9.36	9.36	$x10^6mm^4$
A =	3700	3700	6120	6120	mm^2
dz =	263.1	263.1	253.0	252.7	mm^2
dy =	219	219	45.5	45.5	mm
Iyy =	259.7	259.9	401.0	400.3	$x10^6mm^4$
Izz =	180.6	180.6	22.0	22.0	$x10^6mm^4$

	Inside	**Exterior**			
	Web	Web	Top Plate	Bot Plate	
Designation	23x1/2	23x3/8	19.5x3/8	19.5x3/8	
Qty=	1	2	1	1	
Iy =	211.0	7.1	0.0	0.0	$x10^6mm^4$
Iz =	0.1	0.1	96.4	96.4	$x10^6mm^4$
A =	7419.3	6290.3	4717.7	4717.7	mm^2
dz =	0.0	209.6	296.8	296.9	mm^2
dy =	0.0	252.4	0.0	0.0	mm
Iyy =	211.0	283.5	415.7	415.9	$x10^6mm^4$
Izz =	0.1	400.9	96.4	96.4	$x10^6mm^4$

Composite Member Properties

A_{gross} =	42785	mm^2
A_{RHM*}=	10968	mm2
A_{net} =	31817	mm^2
∑Iyy =	2646.9	$x10^6mm^4$
∑Izz =	999.0	$x10^6mm^4$
Zbar=	302	mm
ybar=	257	mm

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9561.5125	mm	kyLy/ry =	33.2	< 120 therefore OK
Lz =	9561.5125	mm	kzLz/rz =	54.0	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	381	w =	12.7	h/w =	30.0	OK
Flange	b =	292.1	t =	9.5	b/t =	30.7	OK
Flange Perforated	b =	292.1	t =	9.5	b/t =	30.7	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	31817	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	288.4	mm
rz =	177.2	mm
λy =	0.358	
λz =	0.582	
Cry =	6290	kN
Crz =	5627	kN
Cr Min =	5627	kN

10.8.2 Axial Tensile Resistance ***[CSA S6-19 cl. 10.8.2]***

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	9349	kN
b)	Tr =	$\phi_u A_n F_u$	10436	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	8871	kN
		Tr Min =	8871	kN

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

Vertical Member L_2-U_2 (Top) Tension & Compression Member

Drawing Location (1959)
E54 Sections of Lift Span
E59 Lift Span Top Chord

Material Properties: A-7 Steel Reference

F_u =	410	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
F_y =	230	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
ϕ_s =	0.95		*[CSA S6-19 cl. 10.5.7]*
E =	200000	Mpa	*[CSA S6-19 cl. 10.4.2]*

Built up Section Components

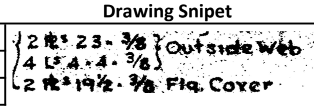
Member	**Exterior Angle**	**Exterior Web**	**Top Plate**	**Bottom Plate**
Quantity	**4**	**2**	**1**	**1**
Dimensions (in)	4x4x3/8	23x3/8	19.5x3/8	19.5x3/8

Ext. Web Perfortion Width 10 in
Rivet dia. 1 in

Member Dimensions

Length =	5801	mm
Width =	514	mm
Depth =	603	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Angles				
Location	Exterior Top	Exterior Bottom		
Designation	4x4x3/8	4x4x3/8		
Qty =	2	2	mm	
b =	101.6	101.6	mm	Hori
d =	101.6	101.6	mm	Vert
t =	9.5	9.5	mm^2	
A =	1850	1850	mm	
z =	29	29	mm	Vert
y =	29	29	mm	Hori
Z bar	565	38.525	mm	
I_y =	1.84	1.84	$x10^6 mm^4$	
I_z =	1.84	1.84	$x10^6 mm^4$	
A_{angle} =	3700	3700	mm^2	
RHM*	3	3	mm	
RHM Area =	1452	1452	mm^2	

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

	Top Plate	**Bottom Plate**	
Designation	19.5x3/8	19.5x3/8	
Qty =	1	1	
t =	9.525	9.525	mm
b =	495.3	495.3	mm
z Bar =	598.4875	4.7625	mm
A =	4717.73	4717.73	mm^2
RHM*	2	2	
RHM Area =	483.9	483.9	mm^2

RHM* = Rivet Holes/Member

Web		
Location	**Exterior**	
Designation =	23x3/8	
Qty =	2	
w =	9.525	mm
h =	584.2	mm
h_{eff} =	330.2	mm
A =	11129.01	mm^2
A_{eff} =	6290.31	mm^2
z Bar =	302	mm
RHM*	4	
RHM Area =	1935.5	mm^2

Section Calculations			
Angle			
Location	Exterior Top	Exterior Bottom	
Designation	4x4x3/8	4x4x3/8	
Qty=	2	2	
Iy =	3.7	3.7	$x10^6mm^4$
Iz =	3.68	3.68	$x10^6mm^4$
A =	3700	3700	mm^2
dz =	263.1	263.1	mm^2
dy =	219	219	mm
Iyy =	259.8	259.8	$x10^6mm^4$
Izz =	180.6	180.6	$x10^6mm^4$

	Exterior			
	Web	Top Plate	Bot Plate	
Designation	23x3/8	19.5x3/8	19.5x3/8	
Qty=	2	1	1	
Iy =	7.1	0.0	0.0	$x10^6mm^4$
Iz =	0.1	96.4	96.4	$x10^6mm^4$
A =	6290.3	4717.7	4717.7	mm^2
dz =	209.6	296.9	296.9	mm^2
dy =	252.4	0.0	0.0	mm
Iyy =	283.4	415.8	415.8	$x10^6mm^4$
Izz =	400.9	96.4	96.4	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	23126	mm^2
A_{RHM*}=	5806	mm2
A_{net} =	17319	mm^2
∑Iyy =	1634.6	$x10^6mm^4$
∑Izz =	954.9	$x10^6mm^4$
Zbar=	302	mm
ybar=	257	mm

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	5800.725	mm	kyLy/ry =	18.9	< 120 therefore OK
Lz =	5800.725	mm	kzLz/rz =	24.7	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	381	w =	9.5	h/w =	40.0	OK
Flange	b =	292.1	t =	9.5	b/t =	30.7	OK
Flange Perforated	b =	292.1	t =	9.5	b/t =	30.7	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	17319	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	307.2	mm
rz =	234.8	mm
λy =	0.204	
λz =	0.267	
Cry =	3548	kN
Crz =	3510	kN
Cr Min =	3510	kN

10.8.2 Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	5053	kN
b)	Tr =	$\phi_u A_n F_u$	5681	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	4829	kN
		Tr Min =	4829	kN

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

Vertical Member L_3-U_3 (Bottom) Tension & Compression Member

Drawing Location (1959)
E54 Sections of Lift Span
E59 Lift Span Top Chord

Material Properties: A-7 Steel

			Reference
F_u =	410	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

Member	**Exterior Angle**	**Web Angles**	**Centre Web**	**Exterior Web**	**Top Plate**	**Bottom Plate**
Quantity	**4**	**4**	**1**	**2**	**1**	**1**
Dimensions (in)	4x4x1/2	5x5x5/8	23x1/2	23x3/8	19.5x1/2	19.5x1/2

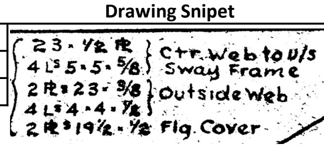
Ext. Web Perfortion Width 10 in

Rivet dia. 1 in

Member Dimensions

Length =	9558	mm
Width =	514	mm
Depth =	610	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Angles					
Location	Exterior Top	Exterior Bottom	Web Top	Web Bot.		
Designation	4x4x1/2	4x4x1/2	5x5x5/8	5x5x5/8		
Qty =	2	2	2	2	mm	
b =	101.6	101.6	127	127	mm	Hori
d =	101.6	101.6	127	127	mm	Vert
t =	12.7	12.7	15.9	15.9	mm^2	
A =	2430	2430	3790	3790	mm	
z =	30.2	30.2	37.6	37.6	mm	Vert
y =	30.2	30.2	37.6	37.6	mm	Hori
Z bar	567	42.9	559	50.3	mm	
I_y =	2.34	2.34	5.66	5.66	$x10^6mm^4$	
I_z =	2.34	2.34	5.66	5.66	$x10^6mm^4$	
A_{angle} =	4860	4860	7580	7580	mm^2	
RHM*	3	3	3	3	mm	
RHM Area =	1935	1935	2419	2419	mm^2	

AECOM Imagine it. Delivered.			
JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

	Top Plate	**Bottom Plate**	
Designation	19.5x1/2	19.5x1/2	
Qty =	1	1	
t =	12.7	12.7	mm
b =	495.3	495.3	mm
z Bar =	603.25	6.35	mm
A =	6290.31	6290.31	mm^2
RHM*	2	2	
RHM Area =	645.2	645.2	mm^2

RHM* = Rivet Holes/Member

Web			
Location	**Inside**	**Exterior**	
Designation =	23x1/2	23x3/8	
Qty =	1	2	
w =	12.7	9.525	mm
h =	584.2	584.2	mm
h_{eff} =	584.2	330.2	mm
A =	7419.34	11129.01	mm^2
A_{eff} =	7419.34	6290.31	mm^2
z Bar =	305	305	mm
RHM*	4	4	
RHM Area =	1290.3	1935.5	mm^2

AECOM Imagine it. Delivered.			
JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

Angle

Location	Exterior Top	Exterior Bottom	Web Top	Web Bot.	
Designation	4x4x1/2	4x4x1/2	5x5x5/8	5x5x5/8	
Qty=	2	2	2	2	
Iy =	4.7	4.7	11.3	11.3	$x10^6mm^4$
Iz =	4.68	4.68	11.32	11.32	$x10^6mm^4$
A =	4860	4860	7580	7580	mm^2
dz =	261.9	261.9	254.5	254.5	mm^2
dy =	217	217	44.0	44.0	mm
Iyy =	338.0	338.0	502.3	502.3	$x10^6mm^4$
Izz =	234.5	234.5	26.0	26.0	$x10^6mm^4$

	Inside	**Exterior**			
	Web	Web	Top Plate	Bot Plate	
Designation	23x1/2	23x3/8	19.5x1/2	19.5x1/2	
Qty=	1	2	1	1	
Iy =	211.0	7.1	0.1	0.1	$x10^6mm^4$
Iz =	0.1	0.1	128.6	128.6	$x10^6mm^4$
A =	7419.3	6290.3	6290.3	6290.3	mm^2
dz =	0.0	209.6	298.5	298.5	mm^2
dy =	0.0	252.4	0.0	0.0	mm
Iyy =	211.0	283.4	560.4	560.4	$x10^6mm^4$
Izz =	0.1	400.9	128.6	128.6	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	51170	mm^2
A_{RHM*}=	13226	mm2
A_{net} =	37944	mm^2
∑Iyy =	3295.8	$x10^6mm^4$
∑Izz =	1179.0	$x10^6mm^4$
Zbar=	305	mm
ybar=	257	mm

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9558.3375	mm	kyLy/ry =	32.4	< 120 therefore OK
Lz =	9558.3375	mm	kzLz/rz =	54.2	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	381	w =	12.7	h/w =	30.0	OK
Flange	b =	292.1	t =	12.7	b/t =	23.0	OK
Flange Perforated	b =	292.1	t =	12.7	b/t =	23.0	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	37944	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	294.7	mm
rz =	176.3	mm
λy =	0.350	
λz =	0.585	
Cry =	7520	kN
Crz =	6698	kN
Cr Min =	6698	kN

10.8.2 Axial Tensile Resistance ***[CSA S6-19 cl. 10.8.2]***

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	11181	kN
b)	Tr =	$\phi_u A_n F_u$	12446	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	10579	kN
		Tr Min =	10579	kN

JOB TITLE	BCLB DECK PRE-DESIGN			
JOB NO.	60637587	CALCULATION NO.		
DESIGNED BY		DATE		
ORIGINATOR BY	KG	DATE	30-Nov-20	
CHECKED BY	RA	DATE	16-Dec-20	

LIFT SPAN

Vertical Member L_3-U_3 (Top) — Tension & Compression Member

Drawing Location (1959)

E54 Sections of Lift Span

E59 Lift Span Top Chord

Material Properties: A-7 Steel

Reference

F_u =	410	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

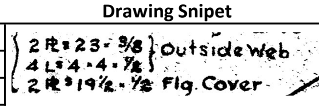
Built up Section Components

Member	**Exterior Angle**	**Exterior Web**	**Top Plate**	**Bottom Plate**
Quantity	**4**	**2**	**1**	**1**
Dimensions (in)	4x4x1/2	23x3/8	19.5x1/2	19.5x1/2
Ext. Web Perfortion Width		10	in	
Rivet dia.		1	in	

Member Dimensions

Length =	6645	mm
Width =	514	mm
Depth =	610	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Angles			
Location	Exterior Top	Exterior Bottom	
Designation	4x4x1/2	4x4x1/2	
Qty =	2	2	mm
b =	101.6	101.6	mm
d =	101.6	101.6	mm
t =	12.7	12.7	mm^2
A =	2430	2430	mm
z =	30.2	30.2	mm
y =	30.2	30.2	mm
Z bar	567	42.9	mm
I_y =	2.34	2.34	$x10^6mm^4$
I_z =	2.34	2.34	$x10^6mm^4$
A_{angle} =	4860	4860	mm^2
RHM*	3	3	mm
RHM Area =	1935	1935	mm^2

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

	Top Plate	Bottom Plate	
Designation	19.5x1/2	19.5x1/2	
Qty =	1	1	
t =	12.7	12.7	mm
b =	495.3	495.3	mm
z Bar =	603.25	6.35	mm
A =	6290.31	6290.31	mm^2
RHM*	2	2	
RHM Area =	645.2	645.2	mm^2

RHM* = Rivet Holes/Member

Web		
Location	Exterior	
Designation =	23x3/8	
Qty =	2	
w =	9.525	mm
h =	584.2	mm
h_{eff} =	330.2	mm
A =	11129.01	mm^2
A_{eff} =	6290.31	mm^2
z Bar =	305	mm
RHM*	4	
RHM Area =	1935.5	mm^2

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

Angle

Location	Exterior Top	Exterior Bottom	
Designation	4x4x1/2	4x4x1/2	
Qty=	2	2	
Iy =	4.7	4.7	$x10^6mm^4$
Iz =	4.68	4.68	$x10^6mm^4$
A =	4860	4860	mm^2
dz =	261.9	261.9	mm^2
dy =	217	217	mm
Iyy =	338.0	338.0	$x10^6mm^4$
Izz =	234.5	234.5	$x10^6mm^4$

	Exterior			
	Web	Top Plate	Bot Plate	
Designation	23x3/8	19.5x1/2	19.5x1/2	
Qty=	2	1	1	
Iy =	7.1	0.1	0.1	$x10^6mm^4$
Iz =	0.1	128.6	128.6	$x10^6mm^4$
A =	6290.3	6290.3	6290.3	mm^2
dz =	209.6	298.5	298.5	mm^2
dy =	252.4	0.0	0.0	mm
Iyy =	283.4	560.4	560.4	$x10^6mm^4$
Izz =	400.9	128.6	128.6	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	28591	mm^2
A_{RHM*}=	7097	mm2
A_{net} =	21494	mm^2
∑Iyy =	2080.2	$x10^6mm^4$
∑Izz =	1127.0	$x10^6mm^4$
Zbar=	305	mm
ybar=	257	mm

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	6645.275	mm	kyLy/ry =	21.4	< 120 therefore OK
Lz =	6645.275	mm	kzLz/rz =	29.0	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	381	w =	9.5	h/w =	40.0	OK
Flange	b =	292.1	t =	12.7	b/t =	23.0	OK
Flange Perforated	b =	292.1	t =	12.7	b/t =	23.0	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	21494	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	311.1	mm
rz =	229.0	mm
λy =	0.231	
λz =	0.313	
Cry =	4385	kN
Crz =	4307	kN
Cr Min =	4307	kN

10.8.2 Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	6247	kN
b)	Tr =	$\phi_u A_n F_u$	7050	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	5993	kN
		Tr Min =	5993	kN

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

Vertical Member L_4-U_4 (Bottom)

Tension & Compression Member

Drawing Location (1959)

E54 Sections of Lift Span
E59 Lift Span Top Chord

Material Properties: A-7 Steel

Reference

F_u =	410	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
F_y =	230	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
ϕ_s =	0.95		*[CSA S6-19 cl. 10.5.7]*
E =	200000	Mpa	*[CSA S6-19 cl. 10.4.2]*

Built up Section Components

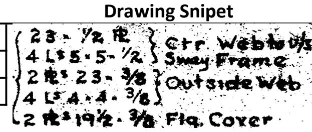
Member	Exterior Angle	Web Angles	Centre Web	Exterior Web	Top Plate	Bottom Plate
Quantity	**4**	**4**	**1**	**2**	**1**	**1**
Dimensions (in)	4x4x3/8	5x5x1/2	23x1/2	23x3/8	19.5x3/8	19.5x3/8

Ext. Web Perfortion Width	10	in
Rivet dia.	1	in

Member Dimensions

Length =	9565	mm
Width =	514	mm
Depth =	603	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Angles						
Location	Exterior Top	Exterior Bottom	Web Top	Web Bot.		
Designation	4x4x3/8	4x4x3/8	5x5x1/2	5x5x1/2		
Qty =	2	2	2	2	mm	
b =	101.6	101.6	127	127	mm	Hori
d =	101.6	101.6	127	127	mm	Vert
t =	9.5	9.5	12.7	12.7	mm^2	
A =	1850	1850	3060	3060	mm	
z =	29	29	39.1	39.4	mm	Vert
y =	29	29	39.1	39.1	mm	Hori
Z bar	565	38.525	555	48.925	mm	
I_y =	1.84	1.84	4.68	4.68	$x10^6mm^4$	
I_z =	1.84	1.84	4.68	4.68	$x10^6mm^4$	
A_{angle} =	3700	3700	6120	6120	mm^2	
RHM*	3	3	3	3	mm	
RHM Area =	1452	1452	1935	1935	mm^2	

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

	Top Plate	**Bottom Plate**	
Designation	19.5x3/8	19.5x3/8	
Qty =	1	1	
t =	9.525	9.525	mm
b =	495.3	495.3	mm
z Bar =	598.4875	4.7625	mm
A =	4717.73	4717.73	mm^2
RHM*	2	2	
RHM Area =	483.9	483.9	mm^2

RHM* = Rivet Holes/Member

Web			
Location	**Inside**	**Exterior**	
Designation =	23x1/2	23x3/8	
Qty =	1	2	
w =	12.7	9.525	mm
h =	584.2	584.2	mm
h_{eff} =	584.2	330.2	mm
A =	7419.34	11129.01	mm^2
A_{eff} =	7419.34	6290.31	mm^2
z Bar =	302	302	mm
RHM*	4	4	
RHM Area =	1290.3	1935.5	mm^2

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

Angle

Location	Exterior Top	Exterior Bottom	Web Top	Web Bot.	
Designation	4x4x3/8	4x4x3/8	5x5x1/2	5x5x1/2	
Qty=	2	2	2	2	
Iy =	3.7	3.7	9.4	9.4	$x10^6mm^4$
Iz =	3.68	3.68	9.36	9.36	$x10^6mm^4$
A =	3700	3700	6120	6120	mm^2
dz =	263.1	263.1	253.0	252.7	mm^2
dy =	219	219	45.5	45.5	mm
Iyy =	259.7	259.9	401.0	400.3	$x10^6mm^4$
Izz =	180.6	180.6	22.0	22.0	$x10^6mm^4$

	Inside	**Exterior**			
	Web	Web	Top Plate	Bot Plate	
Designation	23x1/2	23x3/8	19.5x3/8	19.5x3/8	
Qty=	1	2	1	1	
Iy =	211.0	7.1	0.0	0.0	$x10^6mm^4$
Iz =	0.1	0.1	96.4	96.4	$x10^6mm^4$
A =	7419.3	6290.3	4717.7	4717.7	mm^2
dz =	0.0	209.6	296.8	296.9	mm^2
dy =	0.0	252.4	0.0	0.0	mm
Iyy =	211.0	283.5	415.7	415.9	$x10^6mm^4$
Izz =	0.1	400.9	96.4	96.4	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	42785	mm^2
A_{RHM*}=	10968	mm2
A_{net} =	31817	mm^2
∑Iyy =	2646.9	$x10^6mm^4$
∑Izz =	999.0	$x10^6mm^4$
Zbar=	302	mm
ybar=	257	mm

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9564.6875	mm	kyLy/ry =	33.2	< 120 therefore OK
Lz =	9564.6875	mm	kzLz/rz =	54.0	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	381	w =	12.7	h/w =	30.0	OK
Flange	b =	292.1	t =	9.5	b/t =	30.7	OK
Flange Perforated	b =	292.1	t =	9.5	b/t =	30.7	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	31817	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	288.4	mm
rz =	177.2	mm
λy =	0.358	
λz =	0.583	
Cry =	6289	kN
Crz =	5626	kN
Cr Min =	5626	kN

10.8.2 Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	9349	kN
b)	Tr =	$\phi_u A_n F_u$	10436	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	8871	kN
		Tr Min =	8871	kN

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

Vertical Member L_4-U_4 (Top)

Tension & Compression Member

Drawing Location (1959)

E54 Sections of Lift Span

E59 Lift Span Top Chord

Material Properties: A-7 Steel

Reference

F_u =	410	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
F_y =	230	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
ϕ_s =	0.95		*[CSA S6-19 cl. 10.5.7]*
E =	200000	Mpa	*[CSA S6-19 cl. 10.4.2]*

Built up Section Components

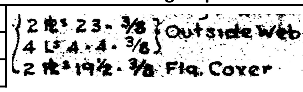
Member	**Exterior Angle**	**Exterior Web**	**Top Plate**	**Bottom Plate**
Quantity	**4**	**2**	**1**	**1**
Dimensions (in)	4x4x3/8	23x3/8	19.5x3/8	19.5x3/8

Ext. Web Perfortion Width	10	in
Rivet dia.	1	in

Member Dimensions

Length =	6920	mm
Width =	514	mm
Depth =	603	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Angles				
Location	Exterior Top	Exterior Bottom		
Designation	4x4x3/8	4x4x3/8		
Qty =	2	2	mm	
b =	101.6	101.6	mm	Hori
d =	101.6	101.6	mm	Vert
t =	9.5	9.5	mm^2	
A =	1850	1850	mm	
z =	29	29	mm	Vert
y =	29	29	mm	Hori
Z bar	565	38.525	mm	
I_y =	1.84	1.84	$x10^6mm^4$	
I_z =	1.84	1.84	$x10^6mm^4$	
A_{angle} =	3700	3700	mm^2	
RHM*	3	3	mm	
RHM Area =	1452	1452	mm^2	

	Top Plate	**Bottom Plate**	
Designation	19.5x3/8	19.5x3/8	
Qty =	1	1	
t =	9.525	9.525	mm
b =	495.3	495.3	mm
z Bar =	598.4875	4.7625	mm
A =	4717.73	4717.73	mm^2
RHM*	2	2	
RHM Area =	483.9	483.9	mm^2

RHM* = Rivet Holes/Member

Web		
Location	**Exterior**	
Designation =	23x3/8	
Qty =	2	
w =	9.525	mm
h =	584.2	mm
h_{eff} =	330.2	mm
A =	11129.01	mm^2
A_{eff} =	6290.31	mm^2
z Bar =	302	mm
RHM*	4	
RHM Area =	1935.5	mm^2

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JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

Angle

Location	Exterior Top	Exterior Bottom	
Designation	4x4x3/8	4x4x3/8	
Qty=	2	2	
Iy =	3.7	3.7	$x10^6mm^4$
Iz =	3.68	3.68	$x10^6mm^4$
A =	3700	3700	mm^2
dz =	263.1	263.1	mm^2
dy =	219	219	mm
Iyy =	259.8	259.8	$x10^6mm^4$
Izz =	180.6	180.6	$x10^6mm^4$

	Exterior			
	Web	Top Plate	Bot Plate	
Designation	23x3/8	19.5x3/8	19.5x3/8	
Qty=	2	1	1	
Iy =	7.1	0.0	0.0	$x10^6mm^4$
Iz =	0.1	96.4	96.4	$x10^6mm^4$
A =	6290.3	4717.7	4717.7	mm^2
dz =	209.6	296.9	296.9	mm^2
dy =	252.4	0.0	0.0	mm
Iyy =	283.4	415.8	415.8	$x10^6mm^4$
Izz =	400.9	96.4	96.4	$x10^6mm^4$

Composite Member Properties

A_{gross} =	23126	mm^2
A_{RHM*}=	5806	mm2
A_{net} =	17319	mm^2
∑Iyy =	1634.6	$x10^6mm^4$
∑Izz =	954.9	$x10^6mm^4$
Zbar=	302	mm
ybar=	257	mm

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	6919.9125	mm	kyLy/ry =	22.5	< 120 therefore OK
Lz =	6919.9125	mm	kzLz/rz =	29.5	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	381	w =	9.5	h/w =	40.0	OK
Flange	b =	292.1	t =	9.5	b/t =	30.7	OK
Flange Perforated	b =	292.1	t =	9.5	b/t =	30.7	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	17319	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	307.2	mm
rz =	234.8	mm
λy =	0.243	
λz =	0.318	
Cry =	3526	kN
Crz =	3466	kN
Cr Min =	3466	kN

10.8.2 Axial Tensile Resistance ***[CSA S6-19 cl. 10.8.2]***

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	5053	kN
b)	Tr =	$\phi_u A_n F_u$	5681	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	4829	kN
		Tr Min =	4829	kN

AECOM Imagine it. Delivered.	JOB TITLE	BCLB DECK PRE-DESIGN			
	JOB NO.	60637587	CALCULATION NO.		
	DESIGNED BY		DATE		
	ORIGINATOR BY	KG	DATE	30-Nov-20	
	CHECKED BY	RA	DATE	16-Dec-20	

LIFT SPAN

Vertical Member L_5-U_5 (Bottom) Tension & Compression Member

Drawing Location (1959)

E54 Sections of Lift Span

E59 Lift Span Top Chord

Material Properties: A-7 Steel

			Reference
F_u =	410	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
F_y =	230	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
ϕ_s =	0.95		*[CSA S6-19 cl. 10.5.7]*
E =	200000	Mpa	*[CSA S6-19 cl. 10.4.2]*

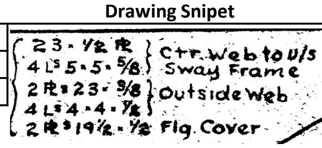
Built up Section Components

Member	Exterior Angle	Web Angles	Centre Web	Exterior Web	Top Plate	Bottom Plate
Quantity	**4**	**4**	**1**	**2**	**1**	**1**
Dimensions (in)	4x4x1/2	5x5x5/8	23x1/2	23x3/8	19.5x1/2	19.5x1/2
Ext. Web Perfortion Width		10	in			
Rivet dia.		1	in			

Member Dimensions

Length =	9557	mm
Width =	514	mm
Depth =	610	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Angles						
Location	Exterior Top	Exterior Bottom	Web Top	Web Bot.		
Designation	4x4x1/2	4x4x1/2	5x5x5/8	5x5x5/8		
Qty =	2	2	2	2	mm	
b =	101.6	101.6	127	127	mm	Hori
d =	101.6	101.6	127	127	mm	Vert
t =	12.7	12.7	15.9	15.9	mm^2	
A =	2430	2430	3790	3790	mm	
z =	30.2	30.2	37.6	37.6	mm	Vert
y =	30.2	30.2	37.6	37.6	mm	Hori
Z bar	567	42.9	559	50.3	mm	
I_y =	2.34	2.34	5.66	5.66	$x10^6mm^4$	
I_z =	2.34	2.34	5.66	5.66	$x10^6mm^4$	
A_{angle} =	4860	4860	7580	7580	mm^2	
RHM*	3	3	3	3	mm	
RHM Area =	1935	1935	2419	2419	mm^2	

	Top Plate	Bottom Plate	
Designation	19.5x1/2	19.5x1/2	
Qty =	1	1	
t =	12.7	12.7	mm
b =	495.3	495.3	mm
z Bar =	603.25	6.35	mm
A =	6290.31	6290.31	mm^2
RHM*	2	2	
RHM Area =	645.2	645.2	mm^2

RHM* = Rivet Holes/Member

Web			
Location	**Inside**	**Exterior**	
Designation =	23x1/2	23x3/8	
Qty =	1	2	
w =	12.7	9.525	mm
h =	584.2	584.2	mm
h_{eff} =	584.2	330.2	mm
A =	7419.34	11129.01	mm^2
A_{eff} =	7419.34	6290.31	mm^2
z Bar =	305	305	mm
RHM*	4	4	
RHM Area =	1290.3	1935.5	mm^2

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

Angle

Location	Exterior Top	Exterior Bottom	Web Top	Web Bot.	
Designation	4x4x1/2	4x4x1/2	5x5x5/8	5x5x5/8	
Qty=	2	2	2	2	
Iy =	4.7	4.7	11.3	11.3	$x10^6 mm^4$
Iz =	4.68	4.68	11.32	11.32	$x10^6 mm^4$
A =	4860	4860	7580	7580	mm^2
dz =	261.9	261.9	254.5	254.5	mm^2
dy =	217	217	44.0	44.0	mm
Iyy =	338.0	338.0	502.3	502.3	$x10^6 mm^4$
Izz =	234.5	234.5	26.0	26.0	$x10^6 mm^4$

	Inside Web	**Exterior** Web	Top Plate	Bot Plate	
Designation	23x1/2	23x3/8	19.5x1/2	19.5x1/2	
Qty=	1	2	1	1	
Iy =	211.0	7.1	0.1	0.1	$x10^6 mm^4$
Iz =	0.1	0.1	128.6	128.6	$x10^6 mm^4$
A =	7419.3	6290.3	6290.3	6290.3	mm^2
dz =	0.0	209.6	298.5	298.5	mm^2
dy =	0.0	252.4	0.0	0.0	mm
Iyy =	211.0	283.4	560.4	560.4	$x10^6 mm^4$
Izz =	0.1	400.9	128.6	128.6	$x10^6 mm^4$

Composite Member Properties

A_{gross} =	51170	mm^2
A_{RHM*}=	13226	mm2
A_{net} =	37944	mm^2
∑Iyy =	3295.8	$x10^6 mm^4$
∑Izz =	1179.0	$x10^6 mm^4$
Zbar=	305	mm
ybar=	257	mm

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9556.75	mm	kyLy/ry =	32.4	< 120 therefore OK
Lz =	9556.75	mm	kzLz/rz =	54.2	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	381	w =	12.7	h/w =	30.0	OK
Flange	b =	292.1	t =	12.7	b/t =	23.0	OK
Flange Perforated	b =	292.1	t =	12.7	b/t =	23.0	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	37944	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	294.7	mm
rz =	176.3	mm
λy =	0.350	
λz =	0.585	
Cry =	7520	kN
Crz =	6698	kN
Cr Min =	6698	kN

10.8.2 Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	11181	kN
b)	Tr =	$\phi_u A_n F_u$	12446	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	10579	kN
		Tr Min =	10579	kN

LIFT SPAN

Vertical Member L_5-U_5 (Top)

Tension & Compression Member

Drawing Location (1959)

E54 Sections of Lift Span
E59 Lift Span Top Chord

Material Properties: A-7 Steel

Reference

F_u =	410	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
F_y =	230	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
ϕ_s =	0.95		*[CSA S6-19 cl. 10.5.7]*
E =	200000	Mpa	*[CSA S6-19 cl. 10.4.2]*

Built up Section Components

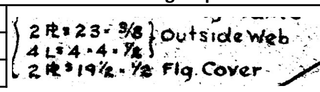
Member	Exterior Angle	Exterior Web	Top Plate	Bottom Plate
Quantity	**4**	**2**	**1**	**1**
Dimensions (in)	4x4x1/2	23x3/8	19.5x1/2	19.5x1/2

Ext. Web Perfortion Width	10	in
Rivet dia.	1	in

Member Dimensions

Length =	7207	mm
Width =	514	mm
Depth =	610	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Angles			
Location	Exterior Top	Exterior Bottom	
Designation	4x4x1/2	4x4x1/2	
Qty =	2	2	mm
b =	101.6	101.6	mm
d =	101.6	101.6	mm
t =	12.7	12.7	mm^2
A =	2430	2430	mm
z =	30.2	30.2	mm
y =	30.2	30.2	mm
Z bar	567	42.9	mm
I_y =	2.34	2.34	$x10^6 mm^4$
I_z =	2.34	2.34	$x10^6 mm^4$
A_{angle} =	4860	4860	mm^2
RHM*	3	3	mm
RHM Area =	1935	1935	mm^2

AECOM Imagine it. Delivered.			
JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

	Top Plate	**Bottom Plate**	
Designation	19.5x1/2	19.5x1/2	
Qty =	1	1	
t =	12.7	12.7	mm
b =	495.3	495.3	mm
z Bar =	603.25	6.35	mm
A =	6290.31	6290.31	mm^2
RHM*	2	2	
RHM Area =	645.2	645.2	mm^2

RHM* = Rivet Holes/Member

Web		
Location	**Exterior**	
Designation =	23x3/8	
Qty =	2	
w =	9.525	mm
h =	584.2	mm
h_{eff} =	330.2	mm
A =	11129.01	mm^2
A_{eff} =	6290.31	mm^2
z Bar =	305	mm
RHM*	4	
RHM Area =	1935.5	mm^2

Section Calculations

Angle

Location	Exterior Top	Exterior Bottom	
Designation	4x4x1/2	4x4x1/2	
Qty=	2	2	
Iy =	4.7	4.7	$x10^6mm^4$
Iz =	4.68	4.68	$x10^6mm^4$
A =	4860	4860	mm^2
dz =	261.9	261.9	mm^2
dy =	217	217	mm
Iyy =	338.0	338.0	$x10^6mm^4$
Izz =	234.5	234.5	$x10^6mm^4$

	Exterior			
	Web	Top Plate	Bot Plate	
Designation	23x3/8	19.5x1/2	19.5x1/2	
Qty=	2	1	1	
Iy =	7.1	0.1	0.1	$x10^6mm^4$
Iz =	0.1	128.6	128.6	$x10^6mm^4$
A =	6290.3	6290.3	6290.3	mm^2
dz =	209.6	298.5	298.5	mm^2
dy =	252.4	0.0	0.0	mm
Iyy =	283.4	560.4	560.4	$x10^6mm^4$
Izz =	400.9	128.6	128.6	$x10^6mm^4$

Composite Member Properties

A_{gross} =	28591	mm^2
A_{RHM*}=	7097	mm2
A_{net} =	21494	mm^2
∑Iyy =	2080.2	$x10^6mm^4$
∑Izz =	1127.0	$x10^6mm^4$
Zbar=	305	mm
ybar=	257	mm

AECOM Imagine it. Delivered.	JOB TITLE	BCLB DECK PRE-DESIGN		
	JOB NO.	60637587	CALCULATION NO.	
	DESIGNED BY		DATE	
	ORIGINATOR BY	KG	DATE	30-Nov-20
	CHECKED BY	RA	DATE	16-Dec-20

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	7207.25	mm	kyLy/ry =	23.2	< 120 therefore OK
Lz =	7207.25	mm	kzLz/rz =	31.5	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	381	w =	9.5	h/w =	40.0	OK
Flange	b =	292.1	t =	12.7	b/t =	23.0	OK
Flange Perforated	b =	292.1	t =	12.7	b/t =	23.0	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	21494	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	311.1	mm
rz =	229.0	mm
λy =	0.250	
λz =	0.340	
Cry =	4370	kN
Crz =	4274	kN
Cr Min =	4274	kN

10.8.2 Axial Tensile Resistance ***[CSA S6-19 cl. 10.8.2]***

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	6247	kN
b)	Tr =	$\phi_u A_n F_u$	7050	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	5993	kN
		Tr Min =	5993	kN

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LIFT SPAN

Vertical Member L_6-U_6 (Bottom)

Tension & Compression Member

Drawing Location (1959)

E54 Sections of Lift Span

E59 Lift Span Top Chord

Material Properties: A-7 Steel

Reference

F_u =	410	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

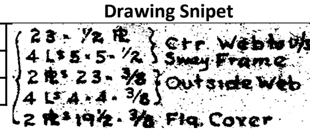
Member	**Exterior Angle**	**Web Angles**	**Centre Web**	**Exterior Web**	**Top Plate**	**Bottom Plate**
Quantity	**4**	**4**	**1**	**2**	**1**	**1**
Dimensions (in)	4x4x3/8	5x5x1/2	23x1/2	23x3/8	19.5x3/8	19.5x3/8

Ext. Web Perfortion Width	10	in
Rivet dia.	1	in

Member Dimensions

Length =	9539	mm
Width =	514	mm
Depth =	603	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Angles						
Location	Exterior Top	Exterior Bottom	Web Top	Web Bot.		
Designation	4x4x3/8	4x4x3/8	5x5x1/2	5x5x1/2		
Qty =	2	2	2	2	mm	
b =	101.6	101.6	127	127	mm	Hori
d =	101.6	101.6	127	127	mm	Vert
t =	9.5	9.5	12.7	12.7	mm^2	
A =	1850	1850	3060	3060	mm	
z =	29	29	39.1	39.4	mm	Vert
y =	29	29	39.1	39.1	mm	Hori
Z bar	565	38.525	555	48.925	mm	
I_y =	1.84	1.84	4.68	4.68	$x10^6mm^4$	
I_z =	1.84	1.84	4.68	4.68	$x10^6mm^4$	
A_{angle} =	3700	3700	6120	6120	mm^2	
RHM*	3	3	3	3	mm	
RHM Area =	1452	1452	1935	1935	mm^2	

	Top Plate	Bottom Plate	
Designation	19.5x3/8	19.5x3/8	
Qty =	1	1	
t =	9.525	9.525	mm
b =	495.3	495.3	mm
z Bar =	598.4875	4.7625	mm
A =	4717.73	4717.73	mm^2
RHM*	2	2	
RHM Area =	483.9	483.9	mm^2

RHM* = Rivet Holes/Member

Web			
Location	Inside	Exterior	
Designation =	23x1/2	23x3/8	
Qty =	1	2	
w =	12.7	9.525	mm
h =	584.2	584.2	mm
h_{eff} =	584.2	330.2	mm
A =	7419.34	11129.01	mm^2
A_{eff} =	7419.34	6290.31	mm^2
z Bar =	302	302	mm
RHM*	4	4	
RHM Area =	1290.3	1935.5	mm^2

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Section Calculations

Angle

Location	Exterior Top	Exterior Bottom	Web Top	Web Bot.	
Designation	4x4x3/8	4x4x3/8	5x5x1/2	5x5x1/2	
Qty=	2	2	2	2	
Iy =	3.7	3.7	9.4	9.4	$x10^6mm^4$
Iz =	3.68	3.68	9.36	9.36	$x10^6mm^4$
A =	3700	3700	6120	6120	mm^2
dz =	263.1	263.1	253.0	252.7	mm^2
dy =	219	219	45.5	45.5	mm
Iyy =	259.7	259.9	401.0	400.3	$x10^6mm^4$
Izz =	180.6	180.6	22.0	22.0	$x10^6mm^4$

	Inside	**Exterior**			
	Web	Web	Top Plate	Bot Plate	
Designation	23x1/2	23x3/8	19.5x3/8	19.5x3/8	
Qty=	1	2	1	1	
Iy =	211.0	7.1	0.0	0.0	$x10^6mm^4$
Iz =	0.1	0.1	96.4	96.4	$x10^6mm^4$
A =	7419.3	6290.3	4717.7	4717.7	mm^2
dz =	0.0	209.6	296.8	296.9	mm^2
dy =	0.0	252.4	0.0	0.0	mm
Iyy =	211.0	283.5	415.7	415.9	$x10^6mm^4$
Izz =	0.1	400.9	96.4	96.4	$x10^6mm^4$

Composite Member Properties

A_{gross} =	42785	mm^2
A_{RHM*}=	10968	mm2
A_{net} =	31817	mm^2
∑Iyy =	2646.9	$x10^6mm^4$
∑Izz =	999.0	$x10^6mm^4$
Zbar=	302	mm
ybar=	257	mm

JOB TITLE	BCLB DECK PRE-DESIGN		
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Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9539.2875	mm	kyLy/ry =	33.1	< 120 therefore OK
Lz =	9539.2875	mm	kzLz/rz =	53.8	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	381	w =	12.7	h/w =	30.0	OK
Flange	b =	292.1	t =	9.5	b/t =	30.7	OK
Flange Perforated	b =	292.1	t =	9.5	b/t =	30.7	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	31817	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	288.4	mm
rz =	177.2	mm
λy =	0.357	
λz =	0.581	
Cry =	6291	kN
Crz =	5632	kN
Cr Min =	5632	kN

10.8.2 Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	9349	kN
b)	Tr =	$\phi_u A_n F_u$	10436	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	8871	kN
		Tr Min =	8871	kN

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LIFT SPAN

Vertical Member L_6-U_6 (Top) — Tension & Compression Member

Drawing Location (1959)

E54 Sections of Lift Span

E59 Lift Span Top Chord

Material Properties: A-7 Steel — Reference

F_u =	410	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

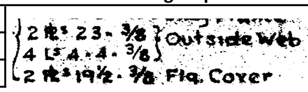
Member	**Exterior Angle**	**Exterior Web**	**Top Plate**	**Bottom Plate**
Quantity	**4**	**2**	**1**	**1**
Dimensions (in)	4x4x3/8	23x3/8	19.5x3/8	19.5x3/8

Ext. Web Perfortion Width	10	in
Rivet dia.	1	in

Member Dimensions

Length =	7225	mm
Width =	514	mm
Depth =	603	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Angles			
Location	Exterior Top	Exterior Bottom	
Designation	4x4x3/8	4x4x3/8	
Qty =	2	2	mm
b =	101.6	101.6	mm
d =	101.6	101.6	mm
t =	9.5	9.5	mm^2
A =	1850	1850	mm
z =	29	29	mm
y =	29	29	mm
Z bar	565	38.525	mm
I_y =	1.84	1.84	$x10^6 mm^4$
I_z =	1.84	1.84	$x10^6 mm^4$
A_{angle} =	3700	3700	mm^2
RHM*	3	3	mm
RHM Area =	1452	1452	mm^2

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	Top Plate	Bottom Plate	
Designation	19.5x3/8	19.5x3/8	
Qty =	1	1	
t =	9.525	9.525	mm
b =	495.3	495.3	mm
z Bar =	598.4875	4.7625	mm
A =	4717.73	4717.73	mm^2
RHM*	2	2	
RHM Area =	483.9	483.9	mm^2

RHM* = Rivet Holes/Member

Web		
Location	Exterior	
Designation =	23x3/8	
Qty =	2	
w =	9.525	mm
h =	584.2	mm
h_{eff} =	330.2	mm
A =	11129.01	mm^2
A_{eff} =	6290.31	mm^2
z Bar =	302	mm
RHM*	4	
RHM Area =	1935.5	mm^2

JOB TITLE	BCLB DECK PRE-DESIGN		
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Section Calculations			
Angle			
Location	Exterior Top	Exterior Bottom	
Designation	4x4x3/8	4x4x3/8	
Qty=	2	2	
Iy =	3.7	3.7	$x10^6mm^4$
Iz =	3.68	3.68	$x10^6mm^4$
A =	3700	3700	mm^2
dz =	263.1	263.1	mm^2
dy =	219	219	mm
Iyy =	259.8	259.8	$x10^6mm^4$
Izz =	180.6	180.6	$x10^6mm^4$

	Exterior			
	Web	Top Plate	Bot Plate	
Designation	23x3/8	19.5x3/8	19.5x3/8	
Qty=	2	1	1	
Iy =	7.1	0.0	0.0	$x10^6mm^4$
Iz =	0.1	96.4	96.4	$x10^6mm^4$
A =	6290.3	4717.7	4717.7	mm^2
dz =	209.6	296.9	296.9	mm^2
dy =	252.4	0.0	0.0	mm
Iyy =	283.4	415.8	415.8	$x10^6mm^4$
Izz =	400.9	96.4	96.4	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	23126	mm^2
A_{RHM*}=	5806	mm2
A_{net} =	17319	mm^2
∑Iyy =	1634.6	$x10^6mm^4$
∑Izz =	954.9	$x10^6mm^4$
Zbar=	302	mm
ybar=	257	mm

JOB TITLE	BCLB DECK PRE-DESIGN			
JOB NO.	60637587	CALCULATION NO.		
DESIGNED BY		DATE		
ORIGINATOR BY	KG	DATE	30-Nov-20	
CHECKED BY	RA	DATE	16-Dec-20	

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	7224.7125	mm	kyLy/ry =	23.5	< 120 therefore OK
Lz =	7224.7125	mm	kzLz/rz =	30.8	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	381	w =	9.5	h/w =	40.0	OK
Flange	b =	292.1	t =	9.5	b/t =	30.7	OK
Flange Perforated	b =	292.1	t =	9.5	b/t =	30.7	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	17319	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	307.2	mm
rz =	234.8	mm
λy =	0.254	
λz =	0.332	
Cry =	3519	kN
Crz =	3452	kN
Cr Min =	3452	kN

10.8.2 Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	5053	kN
b)	Tr =	$\phi_u A_n F_u$	5681	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	4829	kN
		Tr Min =	4829	kN

AECOM Imagine it. Delivered.	JOB TITLE	BCLB DECK PRE-DESIGN		
	JOB NO.	60637587	CALCULATION NO.	
	DESIGNED BY		DATE	
	ORIGINATOR BY	KG	DATE	30-Nov-20
	CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

Diagonal Member L_0-U_1 East (R) Compression Member

Drawing Location (1959)
E54 Sections of Lift Span Trusses

Material Properties: A-242-55 Steel Reference

F_u =	480	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
F_y =	350	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
ϕ_s =	0.95		*[CSA S6-19 cl. 10.5.7]*
E =	200000	Mpa	*[CSA S6-19 cl. 10.4.2]*

Built up Section Components

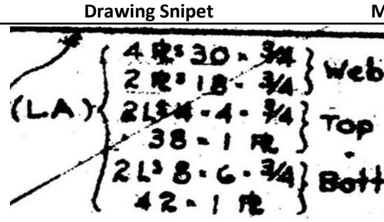
Member	Top Angle	Bottom Angle	Web	Web	Top Plate	Bottom Plate
Quantity	**2**	**2**	**2**	**2**	**1**	**1**
Dimensions (in)	4x4x3/4	8x6x3/4	18x3/4	30x1.5	38x1	42x1

Flange Perfortion Width	14	in
Rivet dia.	1	in

Member Dimensions

Length =	9231	mm
Width =	1067	mm
Depth =	813	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

	Web		
	Outside	**Inside**	
Designation	18x3/4	30x1.5	
Qty =	2	2	
w =	19.05	38.1	mm
h =	457.2	762	mm
A =	17419.32	58064.4	mm^2
z Bar =	457	406	mm
RHM*	4	4	
RHM Area =	3871.0	7741.9	mm^2

	Top Plate	Bottom Plate	
Designation	38x1	42x1	
Qty =	1	1	
t =	25.4	25.4	mm
b =	965.2	1066.8	mm
b_{eff} =	965.2	711.2	mm
z Bar =	800.1	12.7	mm
A =	24516.08	27096.72	mm^2
A_{eff} =	24516.08	18064.48	mm^2
RHM*	2	2	
RHM Area =	1290.3	1290.3	mm^2

	Angle		
Location	Top	Bottom	
Designatio	4x4x3/4	8x6x3/4	
Qty =	2	2	mm
b =	101.6	152.4	mm
d =	101.6	203.2	mm
t =	19.1	19.1	mm^2
A =	3530	6410	mm
z =	32.4	65.1	mm
y =	32.4	39.6	mm
Z bar	755	90.5	mm
I_y =	3.24	26.2	$x10^6mm^4$
I_z =	3.24	12.7	$x10^6mm^4$
A_{angle} =	7060	12820	mm^2
RHM*	3	3	mm
RHM Area =	2903	2903	mm^2

RHM* = Rivet Holes/Member

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Section Calculations

	Angle Top	Angle Bottom	Web	Web	Top Plate	Bot Plate	
Designation	4x4x3/4	8x6x3/4	18x3/4	30x1.5	38x1	42x1	
Qty=	2	2	2	2	1	1	
Iy =	6.5	52.4	303.4	2809.6	1.3	1.0	$x10^6mm^4$
Iz =	6.48	25.4	0.5	7.0	1903.3	190.4	$x10^6mm^4$
A =	7060.0	12820.0	17419.3	58064.4	24516.1	18064.5	mm^2
dz =	335.3	329.2	37.5	13.3	380.4	407.0	mm^2
dy =	413	421	390.5	362.0	0.0	355.6	mm
Iyy =	800.2	1441.8	327.9	2819.9	3548.7	2993.5	$x10^6mm^4$
Izz =	1213.0	2293.3	2657.1	7613.9	1903.3	2474.6	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	137944.3	mm^2
A_{RHM*}=	11935.5	mm2
A_{net} =	126009	mm^2
∑Iyy =	11931.9	$x10^6mm^4$
∑Izz =	18155.3	$x10^6mm^4$
Zbar=	420	mm
ybar=	533	mm

AECOM Imagine it. Delivered.				
JOB TITLE	BCLB DECK PRE-DESIGN			
JOB NO.	60637587	CALCULATION NO.		
DESIGNED BY		DATE		
ORIGINATOR BY	KG	DATE	30-Nov-20	
CHECKED BY	RA	DATE	16-Dec-20	

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9230.6846	mm	kyLy/ry =	30.0	< 120 therefore OK
Lz =	9230.6846	mm	kzLz/rz =	24.3	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	35.8
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	35.8
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	44.9

Webs	h =	558.8	w =	38.1	h/w =	14.7	OK
Flange	b =	762.0	t =	25.4	b/t =	30.0	OK
Flange Perforated	b =	762.0	t =	25.4	b/t =	30.0	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	126009	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	307.7	mm
rz =	379.6	mm
λy =	0.399	
λz =	0.324	
Cry =	37336	kN
Crz =	38309	kN
Cr Min =	37336	kN

10.8.2 Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	45866	kN
b)	Tr =	$\phi_u A_n F_u$	48387	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	41129	kN
		Tr Min =	41129	kN

	JOB TITLE	BCLB DECK PRE-DESIGN		
	JOB NO.	60637587	CALCULATION NO.	
	DESIGNED BY		DATE	
	ORIGINATOR BY	KG	DATE	30-Nov-20
	CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

Diagonal Member U_1-L_2 East (R) Tension member

Drawing Location (1959)
E54 Sections of Lift Span Trusses

Material Properties: A-242-55 Steel Reference

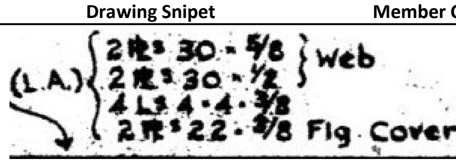
F_u =	480	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
F_y =	350	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
ϕ_s =	0.95		*[CSA S6-19 cl. 10.5.7]*
E =	200000	Mpa	*[CSA S6-19 cl. 10.4.2]*

Built up Section Components

Member	Angle	Web	Web	Top Plate	Bottom Plate
Quantity	**4**	**2**	**2**	**1**	**1**
Dimensions (in)	4x4x3/8	30x5/8	30x1/2	22x3/8	22x3/8
Flange Perfortion Width		8	in		
Rivet dia.		1	in		

Member Dimensions | **Drawing Snipet** | **Member Cross-Section**

Length =	9183	mm
Width =	616	mm
Depth =	781	mm



Individual Member Properties

Web			
Positioning	**Outside 2**	**Middle**	
Designation	30x5/8	30x1/2	
Qty =	2	2	
w =	15.875	12.7	mm
h =	762	762	mm
A =	24193.5	19354.8	mm^2
y Bar =	300.0375	285.75	mm
z Bar =	0	0	mm
RHM*	4	4	
RHM Area =	3225.8	2580.6	mm

Angle		
Designation	4x4x3/8	
Qty =	4	
b =	101.6	mm
d =	101.6	mm
t =	9.525	mm
A =	1850	mm^2
z =	29	mm
y =	29	mm
I_y =	1.84	$x10^6 mm^4$
I_z =	1.84	$x10^6 mm^4$
A_{angle} =	7400	mm^2
RHM*	3	
RHM Area =	2903.2	mm

Top & Bottom Plate		
Designation	22x3/8	
Qty =	2	
t =	9.525	mm
b =	558.8	mm
b_{eff} =	355.6	mm
A =	10645.14	mm^2
A_{eff} =	6774.18	mm^2
RHM*	2	
RHM Area =	967.7	mm

RHM* = Rivet Holes/Member

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

	Angle	Web	Web	T&B Plate	
Designation	4x4x3/8	30x5/8	30x1/2	22x3/8	
Qty=	4	2	2	2	
Iy =	7.4	1170.7	936.5	0.1	$x10^6mm^4$
Iz =	7.36	0.5	0.3	17.8	$x10^6mm^4$
A =	7400.0	24193.5	19354.8	6774.2	mm^2
dz =	352.0	0	0	385.8	mm^2
dy =	250	300.0	285.8	190.5	mm
Iyy =	924.2	1170.7	936.5	1008.1	$x10^6mm^4$
Izz =	471.3	2178.5	1580.6	263.7	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	57722.0	mm^2
A_{RHM*}=	9677.4	mm2
A_{net} =	48045	mm^2
∑Iyy =	4040.0	$x10^6mm^4$
∑Izz =	4494.0	$x10^6mm^4$
zbar=	391	mm
ybar=	308	mm

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9182.6275	mm	kyLy/ry =	31.7	< 120 therefore OK
Lz =	9182.6275	mm	kzLz/rz =	30.0	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	35.8
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	35.8
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	44.9

Webs	h =	558.8	w =	15.9	h/w =	35.2	OK
Flange	b =	355.6	t =	9.5	b/t =	37.3	NG
Flange Perforated	b =	152.4	t =	9.5	b/t =	16.0	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	48045	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	290.0	mm
rz =	305.8	mm
λy =	0.422	
λz =	0.400	
Cry =	14106	kN
Crz =	14233	kN
Cr Min =	14106	kN

10.8.2 Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	19193	kN
b)	Tr =	$\phi_u A_n F_u$	18449	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	15682	kN
		Tr Min =	15682	kN

AECOM Imagine it. Delivered.	JOB TITLE	BCLB DECK PRE-DESIGN	
	JOB NO.	60637587	CALCULATION NO.
	DESIGNED BY		DATE
	ORIGINATOR BY	KG	DATE 30-Nov-20
	CHECKED BY	RA	DATE 16-Dec-20

LIFT SPAN

Diagonal Member L_2-U_3 East (R) Tension member

Drawing Location (1959)
E54 Sections of Lift Span Trusses

Material Properties: A-242-55 Steel

			Reference
F_u =	480	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
F_y =	350	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
ϕ_s =	0.95		*[CSA S6-19 cl. 10.5.7]*
E =	200000	Mpa	*[CSA S6-19 cl. 10.4.2]*

Built up Section Components

Member	Angle	Web	Web	Top Plate	Bottom Plate
Quantity	**4**	**2**	**2**	**1**	**1**
Dimensions (in)	4x4x3/8	30x1/2	30x1/2	22x3/8	22x3/8

Flange Perfortion Width	8	in
Rivet dia.	1	in

Member Dimensions

Length =	9183	mm
Width =	610	mm
Depth =	781	mm

Drawing Snipet

Member Cross-Section

Individual Member Properties

Web			
Positioning	**Outside 2**	**Middle**	
Designation	30x1/2	30x1/2	
Qty =	2	2	
w =	12.7	12.7	mm
h =	762	762	mm
A =	19354.8	19354.8	mm^2
y Bar =	298.45	285.75	mm
z Bar =	0	0	mm
RHM*	4	4	
RHM Area =	2580.6	2580.6	mm

Angle		
Designation	4x4x3/8	
Qty =	4	
b =	101.6	mm
d =	101.6	mm
t =	9.525	mm
A =	1850	mm^2
z =	29	mm
y =	29	mm
I_y =	1.84	$x10^6 mm^4$
I_z =	1.84	$x10^6 mm^4$
A_{angle} =	7400	mm^2
RHM*	3	
RHM Area =	2903.2	mm

Top & Bottom Plate		
Designation	22x3/8	
Qty =	2	
t =	9.525	mm
b =	558.8	mm
b_{eff} =	355.6	mm
A =	10645.14	mm^2
A_{eff} =	6774.18	mm^2
RHM*	2	
RHM Area =	967.7	mm

RHM* = Rivet Holes/Member

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

	Angle	Web	Web	T&B Plate	
Designation	4x4x3/8	30x1/2	30x1/2	22x3/8	
Qty=	4	2	2	2	
Iy =	7.4	936.5	936.5	0.1	$x10^6mm^4$
Iz =	7.36	0.3	0.3	17.8	$x10^6mm^4$
A =	7400.0	19354.8	19354.8	6774.2	mm^2
dz =	352.0	0	0	385.8	mm^2
dy =	250	298.5	285.8	190.5	mm
Iyy =	924.2	936.5	936.5	1008.1	$x10^6mm^4$
Izz =	471.3	1724.2	1580.6	263.7	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	52884.0	mm^2
A_{RHM*}=	9032.2	mm2
A_{net} =	43852	mm^2
∑Iyy =	3805.0	$x10^6mm^4$
∑Izz =	4040.0	$x10^6mm^4$
zbar=	391	mm
ybar=	305	mm

AECOM Imagine it. Delivered.			
JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9182.6275	mm	kyLy/ry =	31.2	< 120 therefore OK
Lz =	9182.6275	mm	kzLz/rz =	30.3	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	35.8
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	35.8
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	44.9

Webs	h =	558.8	w =	12.7	h/w =	44.0	NG
Flange	b =	355.6	t =	9.5	b/t =	37.3	NG
Flange Perforated	b =	152.4	t =	9.5	b/t =	16.0	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	43852	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	294.6	mm
rz =	303.5	mm
λy =	0.415	
λz =	0.403	
Cry =	12911	kN
Crz =	12976	kN
Cr Min =	12911	kN

10.8.2 Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension Φs = 0.95

Tension Φu = 0.8

a)	Tr =	$\phi_s A_g F_y$	17584	kN
b)	Tr =	$\phi_u A_n F_u$	16839	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	14313	kN
		Tr Min =	14313	kN

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

Diagonal Member U_3-L_4 East (R) Tension member

Drawing Location (1959)

E54 Sections of Lift Span Trusses

Material Properties: A-242-55 Steel Reference

F_u =	480	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
F_y =	350	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
ϕ_s =	0.95		*[CSA S6-19 cl. 10.5.7]*
E =	200000	Mpa	*[CSA S6-19 cl. 10.4.2]*

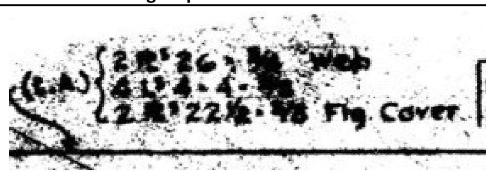
Built up Section Components

Member	Angle		Web	Top Plate	Bottom Plate
Quantity	**4**		**2**	**1**	**1**
Dimensions (in)	4x4x3/8		26x3/4	22.5x3/8	22.5x3/8

Flange Perfortion Width	8	in
Rivet dia.	1	in

Member Dimensions **Drawing Snipet** **Member Cross-Section**

Length =	9148	mm
Width =	610	mm
Depth =	679	mm



Individual Member Properties

Web		
Positioning	**Middle**	
Designation	26x3/4	
Qty =	2	
w =	19.05	mm
h =	660.4	mm
A =	25161.24	mm^2
y Bar =	295.275	mm
z Bar =	0	mm
RHM*	4	
RHM Area =	3871.0	mm

Angle		
Designation	4x4x3/8	
Qty =	4	
b =	101.6	mm
d =	101.6	mm
t =	9.525	mm
A =	1850	mm^2
z =	29	mm
y =	29	mm
I_y =	1.84	$x10^6mm^4$
I_z =	1.84	$x10^6mm^4$
A_{angle} =	7400	mm^2
RHM*	3	
RHM Area =	2903.2	mm

Top & Bottom Plate		
Designation	22.5x3/8	
Qty =	2	
t =	9.525	mm
b =	571.5	mm
b_{eff} =	368.3	mm
A =	10887.075	mm^2
A_{eff} =	7016.115	mm^2
RHM*	2	
RHM Area =	967.7	mm

RHM* = Rivet Holes/Member

AECOM Imagine it. Delivered.	JOB TITLE	BCLB DECK PRE-DESIGN	
	JOB NO.	60637587	CALCULATION NO.
	DESIGNED BY		DATE
	ORIGINATOR BY	KG	DATE 30-Nov-20
	CHECKED BY	RA	DATE 16-Dec-20

Section Calculations

	Angle	Web	T&B Plate	
Designation	4x4x3/8	26x3/4	22.5x3/8	
Qty=	4	2	2	
Iy =	7.4	914.5	0.1	$x10^6mm^4$
Iz =	7.36	0.8	19.8	$x10^6mm^4$
A =	7400.0	25161.2	7016.1	mm^2
dz =	301.2	0	335.0	mm^2
dy =	257	295.3	193.7	mm
Iyy =	678.7	914.5	787.3	$x10^6mm^4$
Izz =	495.2	2194.5	283.0	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	39577.0	mm^2
A_{RHM*}=	7741.9	mm2
A_{net} =	31835	mm^2
∑Iyy =	2380.0	$x10^6mm^4$
∑Izz =	2973.0	$x10^6mm^4$
zbar=	340	mm
ybar=	305	mm

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9148.3162	mm	kyLy/ry =	33.5	< 120 therefore OK
Lz =	9148.3162	mm	kzLz/rz =	29.9	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	35.8
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	35.8
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	44.9

Webs	h =	457.2	w =	19.1	h/w =	24.0	OK
Flange	b =	368.3	t =	9.5	b/t =	38.7	NG
Flange Perforated	b =	165.1	t =	9.5	b/t =	17.3	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	31835	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	273.4	mm
rz =	305.6	mm
λy =	0.446	
λz =	0.399	
Cry =	9248	kN
Crz =	9436	kN
Cr Min =	9248	kN

10.8.2 Axial Tensile Resistance ***[CSA S6-19 cl. 10.8.2]***

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	13159	kN
b)	Tr =	$\phi_u A_n F_u$	12225	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	10391	kN
		Tr Min =	10391	kN

LIFT SPAN

Diagonal Member L_4-U_5 East (R) Tension member

Drawing Location (1959)
E54 Sections of Lift Span Trusses

Material Properties: A-7 Steel Reference

F_u =	410	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
F_y =	230	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
ϕ_s =	0.95		*[CSA S6-19 cl. 10.5.7]*
E =	200000	Mpa	*[CSA S6-19 cl. 10.4.2]*

Built up Section Components

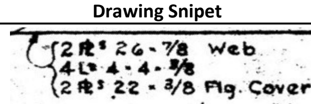
Member	Angle	Web	Top Plate	Bottom Plate
Quantity	**4**	**2**	**1**	**1**
Dimensions (in)	4x4x3/8	26x7/8	22x3/8	22x3/8

Flange Perfortion Width	8	in
Rivet dia.	1	in

Member Dimensions

Length =	9148	mm
Width =	603	mm
Depth =	679	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Web		
Positioning	**Middle**	
Designation	26x7/8	
Qty =	2	
w =	22.225	mm
h =	660.4	mm
A =	29354.78	mm^2
y Bar =	290.5125	mm
z Bar =	0	mm
RHM*	4	
RHM Area =	4516.1	mm

Angle		
Designation	4x4x3/8	
Qty =	4	
b =	101.6	mm
d =	101.6	mm
t =	9.525	mm
A =	1850	mm^2
z =	29	mm
y =	29	mm
I_y =	1.84	$x10^6mm^4$
I_z =	1.84	$x10^6mm^4$
A_{angle} =	7400	mm^2
RHM*	3	
RHM Area =	2903.2	mm

Top & Bottom Plate		
Designation	22x3/8	
Qty =	2	
t =	9.525	mm
b =	558.8	mm
b_{eff} =	355.6	mm
A =	10645.14	mm^2
A_{eff} =	6774.18	mm^2
RHM*	2	
RHM Area =	967.7	mm

RHM* = Rivet Holes/Member

AECOM Imagine it. Delivered.	JOB TITLE	BCLB DECK PRE-DESIGN	
	JOB NO.	60637587	CALCULATION NO.
	DESIGNED BY		DATE
	ORIGINATOR BY	KG	DATE 30-Nov-20
	CHECKED BY	RA	DATE 16-Dec-20

Section Calculations

	Angle	Web	T&B Plate	
Designation	4x4x3/8	26x7/8	22x3/8	
Qty=	4	2	2	
Iy =	7.4	1066.9	0.1	$x10^6mm^4$
Iz =	7.36	1.2	17.8	$x10^6mm^4$
A =	7400.0	29354.8	6774.2	mm^2
dz =	301.2	0	335.0	mm^2
dy =	250	290.5	190.5	mm
Iyy =	678.7	1066.9	760.1	$x10^6mm^4$
Izz =	471.3	2478.7	263.7	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	43529.0	mm^2
A_{RHM*}=	8387.1	mm2
A_{net} =	35142	mm^2
∑Iyy =	2506.0	$x10^6mm^4$
∑Izz =	3214.0	$x10^6mm^4$
zbar=	340	mm
ybar=	302	mm

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9148.2676	mm	kyLy/ry =	34.3	< 120 therefore OK
Lz =	9148.2676	mm	kzLz/rz =	30.3	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	457.2	w =	22.2	h/w =	20.6	OK
Flange	b =	355.6	t =	9.5	b/t =	37.3	OK
Flange Perforated	b =	152.4	t =	9.5	b/t =	16.0	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	35142	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	267.0	mm
rz =	302.4	mm
λy =	0.370	
λz =	0.327	
Cry =	6918	kN
Crz =	7015	kN
Cr Min =	6918	kN

10.8.2 Axial Tensile Resistance ***[CSA S6-19 cl. 10.8.2]***

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	9511	kN
b)	Tr =	$\phi_u A_n F_u$	11527	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	9798	kN
		Tr Min =	9511	kN

JOB TITLE	BCLB DECK PRE-DESIGN			
JOB NO.	60637587	CALCULATION NO.		
DESIGNED BY		DATE		
ORIGINATOR BY	KG	DATE	30-Nov-20	
CHECKED BY	RA	DATE	16-Dec-20	

LIFT SPAN

Diagonal Member U_5-L_6 East (R) Tension member

Drawing Location (1959)

E54 Sections of Lift Span Trusses

Material Properties: A-7 Steel Reference

F_u =	410	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
F_y =	230	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
ϕ_s =	0.95		*[CSA S6-19 cl. 10.5.7]*
E =	200000	Mpa	*[CSA S6-19 cl. 10.4.2]*

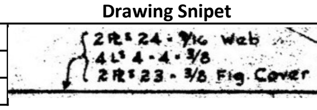
Built up Section Components

Member	Angle	Web	Top Plate	Bottom Plate
Quantity	**4**	**2**	**1**	**1**
Dimensions (in)	4x4x3/8	24x9/16	23x3/8	23x3/8
Flange Perfortion Width	8	in		
Rivet dia.	1	in		

Member Dimensions

Length =	9144	mm
Width =	613	mm
Depth =	629	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Web		
Positioning	**Middle**	
Designation	24x9/16	
Qty =	2	
w =	14.2875	mm
h =	609.6	mm
A =	17419.32	mm^2
y Bar =	299.24375	mm
z Bar =	0	mm
RHM*	4	
RHM Area =	2903.2	mm

Angle		
Designation	4x4x3/8	
Qty =	4	
b =	101.6	mm
d =	101.6	mm
t =	9.525	mm
A =	1850	mm^2
z =	29	mm
y =	29	mm
I_y =	1.84	$x10^6 mm^4$
I_z =	1.84	$x10^6 mm^4$
A_{angle} =	7400	mm^2
RHM*	3	
RHM Area =	2903.2	mm

Top & Bottom Plate		
Designation	23x3/8	
Qty =	2	
t =	9.525	mm
b =	584.2	mm
b_{eff} =	381	mm
A =	11129.01	mm^2
A_{eff} =	7258.05	mm^2
RHM*	2	
RHM Area =	967.7	mm

RHM* = Rivet Holes/Member

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

	Angle	Web	T&B Plate	
Designation	4x4x3/8	24x9/16	23x3/8	
Qty=	4	2	2	
Iy =	7.4	539.4	0.1	$x10^6mm^4$
Iz =	7.36	0.3	21.9	$x10^6mm^4$
A =	7400.0	17419.3	7258.1	mm^2
dz =	275.8	0	309.6	mm^2
dy =	263	299.2	196.9	mm
Iyy =	570.2	539.4	695.6	$x10^6mm^4$
Izz =	519.6	1560.1	303.2	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	32077.0	mm^2
A_{RHM*}=	6774.2	mm2
A_{net} =	25303	mm^2
∑Iyy =	1805.0	$x10^6mm^4$
∑Izz =	2383.0	$x10^6mm^4$
zbar=	314	mm
ybar=	306	mm

AECOM Imagine it. Delivered.	JOB TITLE	BCLB DECK PRE-DESIGN		
	JOB NO.	60637587	CALCULATION NO.	
	DESIGNED BY		DATE	
	ORIGINATOR BY	KG	DATE	30-Nov-20
	CHECKED BY	RA	DATE	16-Dec-20

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9144	mm	kyLy/ry =	34.2	< 120 therefore OK
Lz =	9144	mm	kzLz/rz =	29.8	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	406.4	w =	14.3	h/w =	28.4	OK
Flange	b =	381.0	t =	9.5	b/t =	40.0	OK
Flange Perforated	b =	177.8	t =	9.5	b/t =	18.7	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	25303	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	267.1	mm
rz =	306.9	mm
λy =	0.370	
λz =	0.322	
Cry =	4982	kN
Crz =	5058	kN
Cr Min =	4982	kN

10.8.2 Axial Tensile Resistance ***[CSA S6-19 cl. 10.8.2]***

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	7009	kN
b)	Tr =	$\phi_u A_n F_u$	8299	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	7054	kN
		Tr Min =	7009	kN

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

Diagonal Member L_0-U_1 West (H) Compression Member

Drawing Location (1959)

E54 Sections of Lift Span Trusses

Material Properties: A-7 Steel Reference

F_u =	410	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
F_y =	230	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
ϕ_s =	0.95		*[CSA S6-19 cl. 10.5.7]*
E =	200000	Mpa	*[CSA S6-19 cl. 10.4.2]*

Built up Section Components

Member	Top Angle	Bottom Angle	Web	Web	Top Plate	Bottom Plate
Quantity	**2**	**2**	**2**	**2**	**1**	**1**
Dimensions (in)	4x4x3/4	8x6x3/4	18x3/4	30x1.5	38x1	42x1

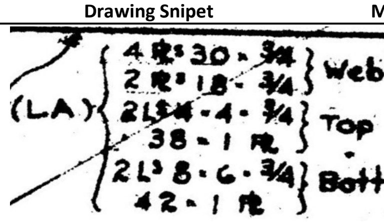
Flange Perfortion Width 14 in

Rivet dia. 1 in

Member Dimensions

Length =	9231	mm
Width =	1067	mm
Depth =	813	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

	Web		
	Outside	**Inside**	
Designation	18x3/4	30x1.5	
Qty =	2	2	
w =	19.05	38.1	mm
h =	457.2	762	mm
A =	17419.32	58064.4	mm^2
z Bar =	457	406	mm
RHM*	4	4	
RHM Area =	3871.0	7741.9	mm^2

	Angle		
Location	Top	Bottom	
Designation	4x4x3/4	8x6x3/4	
Qty =	2	2	mm
b =	101.6	152.4	mm
d =	101.6	203.2	mm
t =	19.1	19.1	mm^2
A =	3530	6410	mm
z =	32.4	65.1	mm
y =	32.4	39.6	mm
Z bar	755	90.5	mm
I_y =	3.24	26.2	$x10^6mm^4$
I_z =	3.24	12.7	$x10^6mm^4$
A_{angle} =	7060	12820	mm^2
RHM*	3	3	mm
RHM Area =	2903	2903	mm^2

	Top Plate	Bottom Plate	
Designation	38x1	42x1	
Qty =	1	1	
t =	25.4	25.4	mm
b =	965.2	1066.8	mm
b_{eff} =	965.2	711.2	mm
z Bar =	800.1	12.7	mm
A =	24516.08	27096.72	mm^2
A_{eff} =	24516.08	18064.48	mm^2
RHM*	2	2	
RHM Area =	1290.3	1290.3	mm^2

RHM* = Rivet Holes/Member

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

	Angle Top	Angle Bottom	Web	Web	Top Plate	Bot Plate	
Designation	4x4x3/4	8x6x3/4	18x3/4	30x1.5	38x1	42x1	
Qty=	2	2	2	2	1	1	
Iy =	6.5	52.4	303.4	2809.6	1.3	1.0	$x10^6mm^4$
Iz =	6.48	25.4	0.5	7.0	1903.3	190.4	$x10^6mm^4$
A =	7060.0	12820.0	17419.3	58064.4	24516.1	18064.5	mm^2
dz =	335.3	329.2	37.5	13.3	380.4	407.0	mm^2
dy =	413	421	390.5	362.0	0.0	355.6	mm
Iyy =	800.2	1441.8	327.9	2819.9	3548.7	2993.5	$x10^6mm^4$
Izz =	1213.0	2293.3	2657.1	7613.9	1903.3	2474.6	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	137944.3	mm^2
A_{RHM*}=	11935.5	mm2
A_{net} =	126009	mm^2
∑Iyy =	11931.9	$x10^6mm^4$
∑Izz =	18155.3	$x10^6mm^4$
Zbar=	420	mm
ybar=	533	mm

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9230.6846	mm	kyLy/ry =	30.0	< 120 therefore OK
Lz =	9230.6846	mm	kzLz/rz =	24.3	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	558.8	w =	38.1	h/w =	14.7	OK
Flange	b =	762.0	t =	25.4	b/t =	30.0	OK
Flange Perforated	b =	762.0	t =	25.4	b/t =	30.0	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	126009	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	307.7	mm
rz =	379.6	mm
λy =	0.324	
λz =	0.263	
Cry =	25174	kN
Crz =	25556	kN
Cr Min =	25174	kN

10.8.2 Axial Tensile Resistance ***[CSA S6-19 cl. 10.8.2]***

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	30141	kN
b)	Tr =	$\phi_u A_n F_u$	41331	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	35131	kN
		Tr Min =	30141	kN

LIFT SPAN

Diagonal Member U_1-L_2 East (H) — Tension member — Drawing Location (1959)

E54 — Sections of Lift Span Trusses

Material Properties: A-7 Steel — Reference

F_u =	410	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
F_y =	230	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
ϕ_s =	0.95		*[CSA S6-19 cl. 10.5.7]*
E =	200000	Mpa	*[CSA S6-19 cl. 10.4.2]*

Built up Section Components

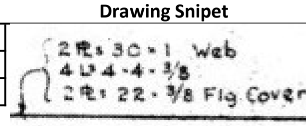
Member	Angle	Web	Top Plate	Bottom Plate
Quantity	**4**	**2**	**1**	**1**
Dimensions (in)	4x4x3/8	30x1	22x3/8	22x3/8

Flange Perfortion Width	8	in
Rivet dia.	1	in

Member Dimensions

Length =	9183	mm
Width =	610	mm
Depth =	781	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Web		
Positioning	**Middle**	
Designation	30x1	
Qty =	2	
w =	25.4	mm
h =	762	mm
A =	38709.6	mm^2
y Bar =	292.1	mm
z Bar =	0	mm
RHM*	4	
RHM Area =	5161.3	mm

Angle		
Designation	4x4x3/8	
Qty =	4	
b =	101.6	mm
d =	101.6	mm
t =	9.525	mm
A =	1850	mm^2
z =	29	mm
y =	29	mm
I_y =	1.84	$x10^6mm^4$
I_z =	1.84	$x10^6mm^4$
A_{angle} =	7400	mm^2
RHM*	3	
RHM Area =	2903.2	mm

Top & Bottom Plate		
Designation	22x3/8	
Qty =	2	
t =	9.525	mm
b =	558.8	mm
b_{eff} =	355.6	mm
A =	10645.14	mm^2
A_{eff} =	6774.18	mm^2
RHM*	2	
RHM Area =	967.7	mm

RHM* = Rivet Holes/Member

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

	Angle	Web	T&B Plate	
Designation	4x4x3/8	30x1	22x3/8	
Qty=	4	2	2	
Iy =	7.4	1873.0	0.1	$x10^6mm^4$
Iz =	7.36	2.1	17.8	$x10^6mm^4$
A =	7400.0	38709.6	6774.2	mm^2
dz =	352.0	0	385.8	mm^2
dy =	250	292.1	190.5	mm
Iyy =	924.2	1873.0	1008.1	$x10^6mm^4$
Izz =	471.3	3304.9	263.7	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	52884.0	mm^2
A_{RHM*}=	9032.2	mm2
A_{net} =	43852	mm^2
∑Iyy =	3805.0	$x10^6mm^4$
∑Izz =	4040.0	$x10^6mm^4$
zbar=	391	mm
ybar=	305	mm

AECOM Imagine it. Delivered.	JOB TITLE	BCLB DECK PRE-DESIGN		
	JOB NO.	60637587	CALCULATION NO.	
	DESIGNED BY		DATE	
	ORIGINATOR BY	KG	DATE	30-Nov-20
	CHECKED BY	RA	DATE	16-Dec-20

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9182.6275	mm	kyLy/ry =	31.2	< 120 therefore OK
Lz =	9182.6275	mm	kzLz/rz =	30.3	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	558.8	w =	25.4	h/w =	22.0	OK
Flange	b =	355.6	t =	9.5	b/t =	37.3	OK
Flange Perforated	b =	152.4	t =	9.5	b/t =	16.0	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	43852	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	294.6	mm
rz =	303.5	mm
λy =	0.336	
λz =	0.327	
Cry =	8728	kN
Crz =	8754	kN
Cr Min =	8728	kN

10.8.2 Axial Tensile Resistance ***[CSA S6-19 cl. 10.8.2]***

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	11555	kN
b)	Tr =	$\phi_u A_n F_u$	14383	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	12226	kN
		Tr Min =	11555	kN

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

Diagonal Member L_2-U_3 West (H) Tension member

Drawing Location (1959)

E54 Sections of Lift Span Trusses

Material Properties: A-7 Steel Reference

F_u =	410	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

Member	**Angle**	**Web**	**Top Plate**	**Bottom Plate**
Quantity	**4**	**2**	**1**	**1**
Dimensions (in)	4x4x3/8	30x3/4	22x3/8	22x3/8

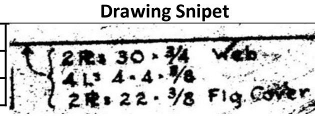
Flange Perfortion Width 8 in

Rivet dia. 1 in

Member Dimensions

Length =	9183	mm
Width =	597	mm
Depth =	781	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Web		
Positioning	**Middle**	
Designation	30x3/4	
Qty =	2	
w =	19.05	mm
h =	762	mm
A =	29032.2	mm^2
y Bar =	288.925	mm
z Bar =	0	mm
RHM*	4	
RHM Area =	3871.0	mm

Top & Bottom Plate		
Designation	22x3/8	
Qty =	2	
t =	9.525	mm
b =	558.8	mm
b_{eff} =	355.6	mm
A =	10645.14	mm^2
A_{eff} =	6774.18	mm^2
RHM*	2	
RHM Area =	967.7	mm

Angle		
Designation	4x4x3/8	
Qty =	4	
b =	101.6	mm
d =	101.6	mm
t =	9.525	mm
A =	1850	mm^2
z =	29	mm
y =	29	mm
I_y =	1.84	$x10^6mm^4$
I_z =	1.84	$x10^6mm^4$
A_{angle} =	7400	mm^2
RHM*	3	
RHM Area =	2903.2	mm

RHM* = Rivet Holes/Member

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

	Angle	Web	T&B Plate	
Designation	4x4x3/8	30x3/4	22x3/8	
Qty=	4	2	2	
Iy =	7.4	1404.8	0.1	$x10^6mm^4$
Iz =	7.36	0.9	17.8	$x10^6mm^4$
A =	7400.0	29032.2	6774.2	mm^2
dz =	352.0	0	385.8	mm^2
dy =	250	288.9	190.5	mm
Iyy =	924.2	1404.8	1008.1	$x10^6mm^4$
Izz =	471.3	2424.4	263.7	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	43206.0	mm^2
A_{RHM*}=	7741.9	mm2
A_{net} =	35464	mm^2
∑Iyy =	3337.0	$x10^6mm^4$
∑Izz =	3159.0	$x10^6mm^4$
zbar=	391	mm
ybar=	298	mm

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9182.6275	mm	kyLy/ry =	29.9	< 120 therefore OK
Lz =	9182.6275	mm	kzLz/rz =	30.8	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	558.8	w =	19.1	h/w =	29.3	OK
Flange	b =	355.6	t =	9.5	b/t =	37.3	OK
Flange Perforated	b =	152.4	t =	9.5	b/t =	16.0	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	35464	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	306.7	mm
rz =	298.5	mm
λy =	0.323	
λz =	0.332	
Cry =	7086	kN
Crz =	7068	kN
Cr Min =	7068	kN

10.8.2 Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	9441	kN
b)	Tr =	$\phi_u A_n F_u$	11632	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	9887	kN
		Tr Min =	9441	kN

LIFT SPAN

Diagonal Member U_3-L_4 West (H) Tension member

Drawing Location (1959)
E54 Sections of Lift Span Trusses

Material Properties: A-7 Steel Reference

F_u =	410	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
F_y =	230	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
ϕ_s =	0.95		*[CSA S6-19 cl. 10.5.7]*
E =	200000	Mpa	*[CSA S6-19 cl. 10.4.2]*

Built up Section Components

Member	Angle	Web	Top Plate	Bottom Plate
Quantity	**4**	**2**	**1**	**1**
Dimensions (in)	4x4x3/8	26x9/16	22.5x3/8	22.5x3/8

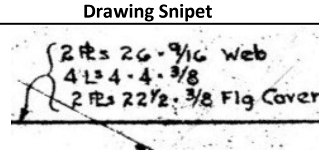
Flange Perfortion Width 8 in

Rivet dia. 1 in

Member Dimensions

Length =	9148	mm
Width =	600	mm
Depth =	679	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Web		
Positioning	**Middle**	
Designation	26x9/16	
Qty =	2	
w =	14.2875	mm
h =	660.4	mm
A =	18870.93	mm^2
y Bar =	292.89375	mm
z Bar =	0	mm
RHM*	4	
RHM Area =	2903.2	mm

Angle		
Designation	4x4x3/8	
Qty =	4	
b =	101.6	mm
d =	101.6	mm
t =	9.525	mm
A =	1850	mm^2
z =	29	mm
y =	29	mm
I_y =	1.84	$x10^6 mm^4$
I_z =	1.84	$x10^6 mm^4$
A_{angle} =	7400	mm^2
RHM*	3	
RHM Area =	2903.2	mm

Top & Bottom Plate		
Designation	22.5x3/8	
Qty =	2	
t =	9.525	mm
b =	571.5	mm
b_{eff} =	368.3	mm
A =	10887.075	mm^2
A_{eff} =	7016.115	mm^2
RHM*	2	
RHM Area =	967.7	mm

RHM* = Rivet Holes/Member

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

	Angle	Web	T&B Plate	
Designation	4x4x3/8	26x9/16	22.5x3/8	
Qty=	4	2	2	
Iy =	7.4	685.8	0.1	$x10^6mm^4$
Iz =	7.36	0.3	19.8	$x10^6mm^4$
A =	7400.0	18870.9	7016.1	mm^2
dz =	301.2	0	335.0	mm^2
dy =	257	292.9	193.7	mm
Iyy =	678.7	685.8	787.3	$x10^6mm^4$
Izz =	495.2	1619.2	283.0	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	33287.0	mm^2
A_{RHM*}=	6774.2	mm2
A_{net} =	26513	mm^2
∑Iyy =	2152.0	$x10^6mm^4$
∑Izz =	2397.0	$x10^6mm^4$
zbar=	340	mm
ybar=	300	mm

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9148.3162	mm	kyLy/ry =	32.1	< 120 therefore OK
Lz =	9148.3162	mm	kzLz/rz =	30.4	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	457.2	w =	14.3	h/w =	32.0	OK
Flange	b =	368.3	t =	9.5	b/t =	38.7	OK
Flange Perforated	b =	165.1	t =	9.5	b/t =	17.3	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	26513	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	284.9	mm
rz =	300.7	mm
λy =	0.347	
λz =	0.328	
Cry =	5260	kN
Crz =	5290	kN
Cr Min =	5260	kN

10.8.2 Axial Tensile Resistance ***[CSA S6-19 cl. 10.8.2]***

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	7273	kN
b)	Tr =	$\phi_u A_n F_u$	8696	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	7392	kN
		Tr Min =	7273	kN

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

Diagonal Member L_4-U_5 West (H) Tension member

Drawing Location (1959)
E54 Sections of Lift Span Trusses

Material Properties: A-7 Steel Reference

F_u =	410	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

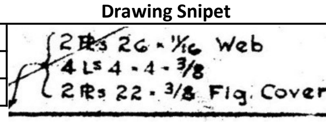
Member	Angle	Web	Top Plate	Bottom Plate
Quantity	**4**	**2**	**1**	**1**
Dimensions (in)	4x4x3/8	26x11/16	22x3/8	22x3/8

Flange Perfortion Width	8	in
Rivet dia.	1	in

Member Dimensions

Length =	9148	mm
Width =	594	mm
Depth =	679	mm

Drawing Snipet


2 PLs 26 - 11/16 Web
4 Ls 4 - 4 - 3/8
2 PLs 22 - 3/8 Flg. Cover

Member Cross-Section

Individual Member Properties

Web		
Positioning	**Middle**	
Designation	26x11/16	
Qty =	2	
w =	17.4625	mm
h =	660.4	mm
A =	23064.47	mm^2
y Bar =	288.13125	mm
z Bar =	0	mm
RHM*	4	
RHM Area =	3548.4	mm

Angle		
Designation	4x4x3/8	
Qty =	4	
b =	101.6	mm
d =	101.6	mm
t =	9.525	mm
A =	1850	mm^2
z =	29	mm
y =	29	mm
I_y =	1.84	$x10^6mm^4$
I_z =	1.84	$x10^6mm^4$
A_{angle} =	7400	mm^2
RHM*	3	
RHM Area =	2903.2	mm

Top & Bottom Plate		
Designation	22x3/8	
Qty =	2	
t =	9.525	mm
b =	558.8	mm
b_{eff} =	355.6	mm
A =	10645.14	mm^2
A_{eff} =	6774.18	mm^2
RHM*	2	
RHM Area =	967.7	mm

RHM* = Rivet Holes/Member

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

	Angle	Web	T&B Plate	
Designation	4x4x3/8	26x11/16	22x3/8	
Qty=	4	2	2	
Iy =	7.4	838.3	0.1	$x10^6mm^4$
Iz =	7.36	0.6	17.8	$x10^6mm^4$
A =	7400.0	23064.5	6774.2	mm^2
dz =	301.2	0	335.0	mm^2
dy =	250	288.1	190.5	mm
Iyy =	678.7	838.3	760.1	$x10^6mm^4$
Izz =	471.3	1915.4	263.7	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	37239.0	mm^2
A_{RHM*}=	7419.3	mm2
A_{net} =	29820	mm^2
∑Iyy =	2277.0	$x10^6mm^4$
∑Izz =	2650.0	$x10^6mm^4$
zbar=	340	mm
ybar=	297	mm

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9148.2676	mm	kyLy/ry =	33.1	< 120 therefore OK
Lz =	9148.2676	mm	kzLz/rz =	30.7	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	457.2	w =	17.5	h/w =	26.2	OK
Flange	b =	355.6	t =	9.5	b/t =	37.3	OK
Flange Perforated	b =	152.4	t =	9.5	b/t =	16.0	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	29820	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	276.3	mm
rz =	298.1	mm
λy =	0.357	
λz =	0.331	
Cry =	5896	kN
Crz =	5945	kN
Cr Min =	5896	kN

10.8.2 Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	8137	kN
b)	Tr =	$\phi_u A_n F_u$	9781	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	8314	kN
		Tr Min =	8137	kN

LIFT SPAN

Diagonal Member U_5-L_6 West (H) Tension member

Drawing Location (1959)

E54 Sections of Lift Span Trusses

Material Properties: A-7 Steel Reference

F_u =	410	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
F_y =	230	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
ϕ_s =	0.95		*[CSA S6-19 cl. 10.5.7]*
E =	200000	Mpa	*[CSA S6-19 cl. 10.4.2]*

Built up Section Components

Member	Angle	Web	Top Plate	Bottom Plate
Quantity	**4**	**2**	**1**	**1**
Dimensions (in)	4x4x3/8	24x9/16	23x3/8	23x3/8

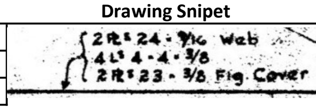
Flange Perfortion Width 8 in

Rivet dia. 1 in

Member Dimensions

Length =	9144	mm
Width =	613	mm
Depth =	629	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Web		
Positioning	**Middle**	
Designation	24x9/16	
Qty =	2	
w =	14.2875	mm
h =	609.6	mm
A =	17419.32	mm^2
y Bar =	299.24375	mm
z Bar =	0	mm
RHM*	4	
RHM Area =	2903.2	mm

Top & Bottom Plate		
Designation	23x3/8	
Qty =	2	
t =	9.525	mm
b =	584.2	mm
b_{eff} =	381	mm
A =	11129.01	mm^2
A_{eff} =	7258.05	mm^2
RHM*	2	
RHM Area =	967.7	mm

Angle		
Designation	4x4x3/8	
Qty =	4	
b =	101.6	mm
d =	101.6	mm
t =	9.525	mm
A =	1850	mm^2
z =	29	mm
y =	29	mm
I_y =	1.84	$x10^6 mm^4$
I_z =	1.84	$x10^6 mm^4$
A_{angle} =	7400	mm^2
RHM*	3	
RHM Area =	2903.2	mm

RHM* = Rivet Holes/Member

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

	Angle	Web	T&B Plate	
Designation	4x4x3/8	24x9/16	23x3/8	
Qty=	4	2	2	
Iy =	7.4	539.4	0.1	$x10^6mm^4$
Iz =	7.36	0.3	21.9	$x10^6mm^4$
A =	7400.0	17419.3	7258.1	mm^2
dz =	275.8	0	309.6	mm^2
dy =	263	299.2	196.9	mm
Iyy =	570.2	539.4	695.6	$x10^6mm^4$
Izz =	519.6	1560.1	303.2	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	32077.0	mm^2
A_{RHM*}=	6774.2	mm2
A_{net} =	25303	mm^2
∑Iyy =	1805.0	$x10^6mm^4$
∑Izz =	2383.0	$x10^6mm^4$
zbar=	314	mm
ybar=	306	mm

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Geometry Comformance Checks

10.9.1.3 Slenderness Ratio

Member Classification = Primary Compression Member

Ly =	9144	mm	kyLy/ry =	34.2	< 120 therefore OK
Lz =	9144	mm	kzLz/rz =	29.8	< 120 therefore OK

10.9.2 Width to Thickness Ratio

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4

Webs	h =	406.4	w =	14.3	h/w =	28.4	OK
Flange	b =	381.0	t =	9.5	b/t =	40.0	OK
Flange Perforated	b =	177.8	t =	9.5	b/t =	18.7	OK

10.9.3 Axial Compression Resistance

Φs =	0.9	
A =	25303	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	267.1	mm
rz =	306.9	mm
λy =	0.370	
λz =	0.322	
Cry =	4982	kN
Crz =	5058	kN
Cr Min =	4982	kN

10.8.2 Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95
Tension	Φu =	0.8

a)	Tr =	$\phi_s A_g F_y$	7009	kN
b)	Tr =	$\phi_u A_n F_u$	8299	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	7054	kN
		Tr Min =	7009	kN

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

Lifting Girder — Tension & Compression Member — Drawing Location (1959)

E59 Lift Span Top Chord

Material Properties: A-7 Steel — Reference

F_u =	410	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

Member	**Exterior Angle**	**Web Angles**	**Centre Web**	**Web Plates**	**Top Plate**	**Bottom Plate**
Quantity	**4**	**4**	**1**	**4**	**1**	**1**
Dimensions (in)	4x3x1/2	8x8x3/4	169.25x7/8	16x1/2	36x1/2	26x3/4

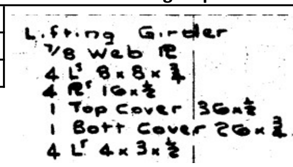
Ext. Web Perfortion Width 0 in

Rivet dia. 1 in

Member Dimensions

Length =	15545	mm
Width =	914	mm
Depth =	4375	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Angles						
Location	Exterior Top	Exterior Bottom	Web Top	Web Bot.		
Designation	4x3x1/2	4x3x1/2	8x8x3/4	8x8x3/4		
Qty =	2	2	2	2	mm	
b =	101.6	101.6	203.2	203.2	mm	Hori
d =	76.2	76.2	203.2	203.2	mm	Vert
t =	12.7	12.7	19.1	19.1	mm^2	
A =	2100	2100	7360	7360	mm	
z =	21	21	57.8	57.8	mm	Vert
y =	33.9	33.9	57.8	57.8	mm	Hori
Z bar	4341	55.2	4305	121.3	mm	
I_y =	1.01	1.01	28.9	28.9	$x10^6mm^4$	
I_z =	2.12	2.12	28.9	28.9	$x10^6mm^4$	
A_{angle} =	4200	4200	14720	14720	mm^2	
RHM*	2	2	4	4	mm	
RHM Area =	1290	1290	3871	3871	mm^2	

	Top Plate	Bottom Plate	
Designation	36x1/2	26x3/4	
Qty =	1	1	
t =	12.7	19.05	mm
b =	914.4	660.4	mm
z Bar =	4368.8	53.975	mm
A =	11612.88	12580.62	mm^2
RHM*	6	6	
RHM Area =	1935.5	2903.2	mm^2

RHM* = Rivet Holes/Member

Web				
Location	Inside	Exterior Top	Exterior Bottom	
Designation =	169.25x7/8	16x1/2	16x1/2	
Qty =	1	2	2	
w =	22.225	12.7	12.7	mm
h =	4298.95	406.4	406.4	mm
h_{eff} =	4298.95	406.4	406.4	mm
A =	95544.16	10322.56	10322.56	mm^2
A_{eff} =	95544.16	10322.56	10322.56	mm^2
z Bar =	2213	4159	267	mm
RHM*	4	4	4	
RHM Area =	2258.1	2580.6	2580.6	mm^2

Section Calculations

Angle

Location	Exterior Top	Exterior Bottom	Web Top	Web Bot.	
Designation	4x3x1/2	4x3x1/2	8x8x3/4	8x8x3/4	
Qty=	2	2	2	2	
Iy =	2.0	2.0	57.8	57.8	$x10^6mm^4$
Iz =	4.24	4.24	57.8	57.8	$x10^6mm^4$
A =	4200	4200	14720	14720	mm^2
dz =	2141.1	2145.2	2104.3	2079.1	mm^2
dy =	423	296	81.6	81.6	mm
Iyy =	19256.0	19329.1	65238.8	63684.5	$x10^6mm^4$
Izz =	756.8	373.0	155.8	155.8	$x10^6mm^4$

	Inside	**Exterior**	**Exterior**			
	Web	Top Web	Bottom Web	Top Plate	Bot Plate	
Designation	169.25x7/8	16x1/2	16x1/2	36x1/2	26x3/4	
Qty=	1	2	2	1	1	
Iy =	147145.7	17.8	17.8	0.2	0.4	$x10^6mm^4$
Iz =	3.9	0.1	0.1	809.2	457.2	$x10^6mm^4$
A =	95544.2	10322.6	10322.6	11612.9	12580.6	mm^2
dz =	12.6	1958.9	1933.7	2168.4	2146.4	mm^2
dy =	0.0	17.5	17.5	0.0	0.0	mm
Iyy =	147161.0	39628.2	38614.0	54605.7	57958.6	$x10^6mm^4$
Izz =	3.9	3.3	3.3	809.2	457.2	$x10^6mm^4$

Composite Member Properties

A_{gross} =	178223	mm^2
A_{RHM*}=	22581	mm2
A_{net} =	155642	mm^2
∑Iyy =	505476.0	$x10^6mm^4$
∑Izz =	2718.4	$x10^6mm^4$
Zbar=	2200	mm
ybar=	457	mm

JOB TITLE	BCLB DECK PRE-DESIGN			
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DESIGNED BY		DATE		
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CHECKED BY	RA	DATE	16-Dec-20	

Geometry Comformance Checks

10.9.2 **Width to Thickness Ratio**

	Class 1	Class 2	Class 3
Webs	72.53	112.09	125.28
Top Coverplate	9.56	11.21	13.19
Bottom C.P.	9.56	11.21	

Webs	h =	3486.15	w =	22.2	h/w =	156.9	Class 4
Top Coverplate	b =	254.0	t =	25.4	b/t =	10.0	Class 2
Bottom C.P.	b =	127.0	t =	19.1	b/t =	6.7	Class 1

Class 4 Web ***[CSA S6-19 cl.10.10.4.4]***

h/w 157 >150 ***Stiffened Plate Girder***

Unbraced Length, L 7772 mm

Yeild Moment

Elastic Section Modulus, Sx 229724832 mm^3

Yield Stress, F_y 230 MPa Fu = 410 MPa

Yield Moment, M_y 52837 kNm

Critical Elastic Moment, M_u - Assumed not Governing - To Be Confirmed in Preliminary Design ***[CSA S6-19 cl.10.10.2.3]***

Overall Moment Resist., M_r **50195 kNm** ***[CSA S6-19 cl.10.10.3.3]***

Reduced Mr **50195 kNm** ***Girder with no longitudinal stiffeners*** ***[CSA S6-19 cl.10.10.4.4]***

Shear Resistance ***[CSA S6-19 cl. 10.10.5.1]***

a =	2000	mm	Approximate Information unavailable for actual spacing ***[CSA S6-19 cl. 10.10.6.1]***
Web height, h	4299	mm	
a/h	0.47		
k_v	28.67		
h/w	157		
502√kv/Fy	177.24		
621√kv/Fy	219.26		
F_{cr}	**132.71**	**MPa**	
F_t	**0.00**	**MPa**	
F_s	**132.71**	**MPa**	
Area of Web, A_w	95544.16	mm^2	

Shear Resistance, V_r **12046 kN**

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

End Floor Beam — Tension & Compression Member — Drawing Location (1959)

E59 Lift Span Top Chord

Material Properties: A-7 Steel — Reference

F_u =	410	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
F_y =	230	Mpa	*[CISC 6-7, 11TH Edition, 2016]*
ϕ_s =	0.95		*[CSA S6-19 cl. 10.5.7]*
E =	200000	Mpa	*[CSA S6-19 cl. 10.4.2]*

Built up Section Components

Member	Top Angle	Bottom Angles	Centre Web	Top Plate	Bottom Plate
Quantity	**2**	**2**	**1**	**1**	**1**
Dimensions (in)	8x8x3/4	8x8x3/4	71.375x1/2	20x1/2	20x1/2

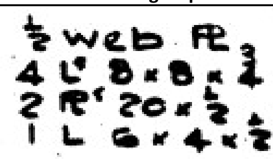
Ext. Web Perfortion Width 0 in

Rivet dia. 1 in

Member Dimensions

Length =	15545	mm
Width =	508	mm
Depth =	1838	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

Angles			
Location	Web Top	Web Bot.	
Designation	8x8x3/4	8x8x3/4	
Qty =	2	2	mm
b =	203.2	203.2	mm
d =	203.2	203.2	mm
t =	19.1	19.1	mm
A =	7360	7360	mm^2
z =	57.8	57.8	mm
y =	57.8	57.8	mm
Z bar	1768	70.5	mm
I_y =	28.9	28.9	$x10^6mm^4$
I_z =	28.9	28.9	$x10^6mm^4$
A_{angle} =	14720	14720	mm^2
RHM*	4	4	mm
RHM Area =	3871	3871	mm^2

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

	Top Plate	Bottom Plate	
Designation	20x1/2	20x1/2	
Qty =	1	1	
t =	13	13	mm
b =	508	508	mm
z Bar =	1832	6	mm
A =	6452	6452	mm^2
RHM*	6	6	
RHM Area =	1935	1935	mm^2

RHM* = Rivet Holes/Member

Web		
Location	**Inside**	
Designation =	71.375x1/2	
Qty =	1	
w =	12.7	mm
h =	1812.9	mm
h_{eff} =	1812.9	mm
A =	23024.1	mm^2
A_{eff} =	23024.1	mm^2
z Bar =	919.2	mm
RHM*	4	
RHM Area =	1290.3	mm^2

JOB TITLE	BCLB DECK PRE-DESIGN			
JOB NO.	60637587	CALCULATION NO.		
DESIGNED BY		DATE		
ORIGINATOR BY	KG	DATE	30-Nov-20	
CHECKED BY	RA	DATE	16-Dec-20	

Section Calculations

Angle

Location	Web Top	Web Bot.	
Designation	8x8x3/4	8x8x3/4	
Qty=	2	2	
Iy =	57.8	57.8	$x10^6mm^4$
Iz =	57.8	57.8	$x10^6mm^4$
A =	14720	14720	mm^2
dz =	848.7	848.7	mm^2
dy =	64.2	64.2	mm
Iyy =	10659.6	10659.6	$x10^6mm^4$
Izz =	118.4	118.4	$x10^6mm^4$

	Web	Top Plate	Bot Plate	
Designation	71.375x1/2	20x1/2	20x1/2	
Qty=	1	1	1	
Iy =	6306.1	0.1	0.1	$x10^6mm^4$
Iz =	0.3	138.7	138.7	$x10^6mm^4$
A =	23024.1	6451.6	6451.6	mm^2
dz =	0.0	912.8	912.8	mm^2
dy =	0.0	0.0	0.0	mm
Iyy =	6306.1	5375.7	5375.7	$x10^6mm^4$
Izz =	0.3	138.7	138.7	$x10^6mm^4$

Composite Member Properties

A_{gross} =	65367	mm^2
A_{RHM*}=	12903	mm2
A_{net} =	52464	mm^2
∑Iyy =	38376.7	$x10^6mm^4$
∑Izz =	514.5	$x10^6mm^4$
Zbar=	919	mm
ybar=	254	mm

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Geometry Comformance Checks

10.9.2 **Width to Thickness Ratio**

	Class 1	Class 2	Class 3
Webs	72.53	112.09	125.28
Top Coverplate	9.56	11.21	13.19
Bottom C.P.	9.56	11.21	

Webs	h =	1406.5	w =	12.7	h/w =	110.8	Class 2
Top Coverplate	b =	50.8	t =	12.7	b/t =	4.0	Class 1
Bottom C.P.	b =	50.8	t =	12.7	b/t =	4.0	Class 1

Plastic Moment

Elastic Section Modulus, Zx 46367924 mm^3

Yield Stress, F_y 230 MPa Fu = 410 MPa

Yield Moment, M_p 10665 kNm

Critical Elastic Moment, M_u - Assumed not Governing - To Be Confirmed in Preliminary Design *[CSA S6-19 cl.10.10.2.3]*

Overall Moment Resist., M_r **10131 kNm** *[CSA S6-19 cl.10.10.3.3]*

Shear Resistance *[CSA S6-19 cl. 10.10.5.1]*

a =	1300	mm	Approximate Information unavailable for actual spacing *[CSA S6-19 cl. 10.10.6.1]*
Web height, h	1813	mm	
a/h	0.72		
k_v	14.39		
h/w	111		
502√kv/Fy	125.54		
621√kv/Fy	155.30		
F_{cr}	**132.71**	**MPa**	
F_t	**0.00**	**MPa**	
F_s	**132.71**	**MPa**	
Area of Web, A_w	23024.15	mm^2	

Shear Resistance, V_r **2903 kN**

AECOM Imagine it. Delivered.	JOB TITLE	BCLB DECK PRE-DESIGN		
	JOB NO.	60637587	CALCULATION NO.	
	DESIGNED BY		DATE	
	ORIGINATOR BY	KG	DATE	30-Nov-20
	CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

Intermediate Floor Beam — Tension & Compression Member — Drawing Location (1959): E56 Lift Span Bottom Chord

Material Properties: A-7 Steel — Reference

F_u =	410	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

Member	**Top Angle**	**Bottom Angles**	**Centre Web**	**Top Plate**	**Bottom Plate**
Quantity	**2**	**2**	**1**	**1**	**1**
Dimensions (in)	8x8x7/8	8x8x7/8	78.5x9/16	20x3/4	20x3/4

Ext. Web Perfortion Width	0	in
Rivet dia.	1	in

Member Dimensions — **Drawing Snipet** — **Member Cross-Section**

Length =	15545	mm
Width =	508	mm
Depth =	2032	mm

Individual Member Properties

Angles			
Location	Web Top	Web Bot.	
Designation	8x8x7/8	8x8x7/8	
Qty =	2	2	mm
b =	203.2	203.2	mm
d =	203.2	203.2	mm
t =	22.2	22.2	mm
A =	8500	8500	mm^2
z =	58.9	58.9	mm
y =	58.9	58.9	mm
Z bar	1954	78.0	mm
I_y =	33	33	$x10^6 mm^4$
I_z =	33	33	$x10^6 mm^4$
A_{angle} =	17000	17000	mm^2
RHM*	4	4	mm
RHM Area =	4516	4516	mm^2

JOB TITLE	BCLB DECK PRE-DESIGN		
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DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
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	Top Plate	**Bottom Plate**	
Designation	20x3/4	20x3/4	
Qty =	1	1	
t =	19	19	mm
b =	508	508	mm
z Bar =	2022	10	mm
A =	9677	9677	mm^2
RHM*	6	6	
RHM Area =	2903	2903	mm^2

RHM* = Rivet Holes/Member

Web		
Location	**Inside**	
Designation =	78.5x9/16	
Qty =	1	
w =	14.3	mm
h =	1993.9	mm
h_{eff} =	1993.9	mm
A =	28487.8	mm^2
A_{eff} =	28487.8	mm^2
z Bar =	1016.0	mm
RHM*	4	
RHM Area =	1451.6	mm^2

Section Calculations			
Angle			
Location	Web Top	Web Bot.	
Designation	8x8x7/8	8x8x7/8	
Qty=	2	2	
Iy =	66.0	66.0	$x10^6mm^4$
Iz =	66	66	$x10^6mm^4$
A =	17000	17000	mm^2
dz =	938.1	938.1	mm^2
dy =	66.0	66.0	mm
Iyy =	15024.9	15024.9	$x10^6mm^4$
Izz =	140.2	140.2	$x10^6mm^4$

	Web	Top Plate	Bot Plate	
Designation	78.5x9/16	20x3/4	20x3/4	
Qty=	1	1	1	
Iy =	9438.1	0.3	0.3	$x10^6mm^4$
Iz =	0.5	208.1	208.1	$x10^6mm^4$
A =	28487.8	9677.4	9677.4	mm^2
dz =	0.0	1006.5	1006.5	mm^2
dy =	0.0	0.0	0.0	mm
Iyy =	9438.1	9803.4	9803.4	$x10^6mm^4$
Izz =	0.5	208.1	208.1	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	81843	mm^2
A_{RHM*}=	16290	mm2
A_{net} =	65552	mm^2
∑Iyy =	59094.8	$x10^6mm^4$
∑Izz =	697.0	$x10^6mm^4$
Zbar=	1016	mm
ybar=	254	mm

Geometry Comformance Checks

10.9.2 Width to Thickness Ratio

	Class 1	Class 2	Class 3
Webs	72.53	112.09	125.28
Top Coverplate	9.56	11.21	13.19
Bottom C.P.	9.56	11.21	13.19

Webs	h =	1587.5	w =	14.3	h/w =	111.1	Class 2
Top Coverplate	b =	50.8	t =	19.1	b/t =	2.7	Class 1
Bottom C.P.	b =	50.8	t =	19.1	b/t =	2.7	Class 1

Plastic Moment

Elastic Section Modulus, Zx 64015199 mm^3

Yield Stress, F_y 230 MPa Fu = 410 MPa

Yield Moment, M_p 14723 kNm

Critical Elastic Moment, M_u - Assumed not Governing - To Be Confirmed in Preliminary Design ***[CSA S6-19 cl.10.10.2.3]***

Overall Moment Resist., M_r 13987 kNm

Shear Resistance ***[CSA S6-19 cl. 10.10.5.1]***

a=	1300	mm	Approximate Information unavailable for actual spacing ***[CSA S6-19 cl. 10.10.6.1]***
Web height, h	1994	mm	
a/h	0.65		
k_v	16.56		
h/w	111		
502√kv/Fy	134.71		
621√kv/Fy	166.64		
F_{cr}	**132.71**	**MPa**	
F_t	**0.00**	**MPa**	
F_s	**132.71**	**MPa**	
Area of Web, A_w	28487.85	mm^2	

Shear Resistance, V_r 3592 kN

JOB TITLE	BCLB DECK PRE-DESIGN			
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CHECKED BY	RA	DATE	16-Dec-20	

LIFT SPAN

Stringers 610x125 Original Tension Member Drawing Location (1959)

E57 Plan of Deck Supports

Material Properties: A-7 Steel Reference

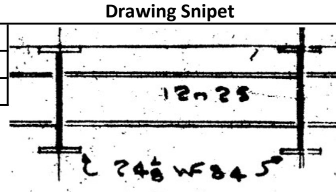
F_u =	410	Mpa	***[CSA S6-19 cl. 14.7.4.2]***
F_y =	230	Mpa	***[CSA S6-19 cl. 14.7.4.2]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

Ext. Web Perfortion Width 0 in

Rivet dia. 0 in

Member Dimensions **Drawing Snipet** **Member Cross-Section**

Length =	3133	mm
Flange Width =	229	mm
Depth =	612	mm



Member Properties		
Designation	610x125	
b =	229	mm
d =	612	mm
t =	19.6	mm
w =	11.9	mm
S_x =	3220	$x10^3mm^4$
S_y =	343	$x10^3mm^4$
I_x =	985	$x10^6mm^4$
I_Y =	39.3	$x10^6mm^4$
Z_x =	3670	$x10^3mm^3$
Z_y =	535	$x10^3mm^3$
J =	1540	$x10^3mm^4$
C_w =	3450	$x10^9mm^6$
A =	15900	mm
RHM*	0	mm
A_{RHM*}=	0	mm^2
A_{net} =	15900	mm^2

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
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CHECKED BY	RA	DATE	16-Dec-20

Geometry Comformance Checks

10.9.2 Width to Thickness Ratio

	Class 1	Class 2	Class 3
Webs	72.53	112.09	125.28
Flange	9.56	11.21	13.19

Webs	h =	572.8	w =	11.9	h/w =	48.1	Class 1
Flange	b =	114.5	t =	19.6	b/t =	5.8	Class 1

Plastic Moment ***[CSA S6-19 cl.10.10.2.3]***

ction Modulus, Zx 3670000 mm^3

Yield Stress, F_y 230 MPa Fu = 410 MPa

Yield Moment, M_p 844 kNm

Critical Elastic Moment, M_u - Assumed not Governing - To Be Confirmed in Preliminary Design

Overall Moment Resist., M_r 802 kNm

Shear Resistance ***[CSA S6-19 cl. 10.10.5.1]***

k_v	5.34	***Assumed to be unstiffened, a/h infinite***	
h/w	48	≤502√kv/Fy=	76.49
F_{cr}	**132.71**	**MPa**	
F_t	**0.00**	**MPa**	
F_s	**132.71**	**MPa**	
Area of Web, A_w	6816.32	mm^2	

Shear Resistance, V_r 859 kN

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

LIFT SPAN

Stringers 610x125 New Tension Member Drawing Location (1982 Rehab)

B-6 Framing Plan

Material Properties: A-242-55 Steel Reference

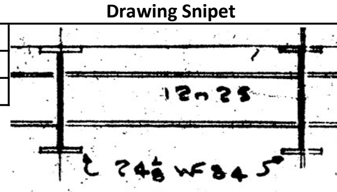
F_u =	480	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	350	Mpa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	Mpa	***[CSA S6-19 cl. 10.4.2]***

Ext. Web Perfortion Width 0 in

Rivet dia. 0 in

Member Dimensions **Drawing Snipet** **Member Cross-Section**

Length =	3133	mm
Flange Width =	229	mm
Depth =	612	mm



Member Properties		
Designation	610x125	
b =	229	mm
d =	612	mm
t =	19.6	mm
w =	11.9	mm
S_x =	3220	$x10^3mm^4$
S_y =	343	$x10^3mm^4$
I_x =	985	$x10^6mm^4$
I_Y =	39.3	$x10^6mm^4$
Z_x =	3670	$x10^3mm^3$
Z_y =	535	$x10^3mm^3$
J =	1540	$x10^3mm^4$
C_w =	3450	$x10^9mm^6$
A =	15900	mm
RHM*	0	mm
A_{RHM^*}=	0	mm^2
A_{net} =	15900	mm^2

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Geometry Comformance Checks

10.9.2 Width to Thickness Ratio

	Class 1	Class 2	Class 3
Webs	58.80	90.87	101.56
Flange	7.75	9.09	10.69

Webs	h =	572.8	w =	11.9	h/w =	48.1	Class 1
Flange	b =	114.5	t =	19.6	b/t =	5.8	Class 1

Plastic Moment ***[CSA S6-19 cl.10.10.2.3]***

ction Modulus, Zx 3670000 mm^3

Yield Stress, F_y 350 MPa Fu = 480 MPa

Yield Moment, M_p 1285 kNm

Critical Elastic Moment, M_u - Assumed not Governing - To Be Confirmed in Preliminary Design

Overall Moment Resist., M_r 1204 kNm

Shear Resistance ***[CSA S6-19 cl. 10.10.5.1]***

k_v	5.34		***Assumed to be unstiffened, a/h infinite***
h/w	48	≤502√kv/Fy=	62.01
F_{cr}	**201.95**	**MPa**	
F_t	**0.00**	**MPa**	
F_s	**201.95**	**MPa**	
Area of Web, A_w	6816.32	mm^2	

Shear Resistance, V_r 1308 kN

Exhibit B.4

Tower Existing and Rehabilitation Calculation Summary

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

General Information

Material Specifications

Structural Steel (CSA G40-4 or ASTM A7) - Original Steel

F_u =	410	MPa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	MPa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***
Unit Weight =	77	kN/m^3	***[CSA S6-19 cl. 3.6, Table 3.4]***
G_s =	77000	MPa	

Structural Steel - 1982 Rehabilitation - Strength not listed on rehabilitation drawings

F_y =	300	MPa	***[CSA S6-19 cl. 14.7.4.2, Table 14.1]***
F_u =	450	MPa	***[CSA S6-19 cl. 14.7.4.2, Table 14.1]***

Reinforced Concrete - Deck

f'_c =	20	MPa	***[CSA S6-19 cl. 14.7.4.4 - unknown concrete strength]***
f_{cr} =	1.79	MPa	***[CSA S6-19 cl. 8.4.1.8.1]***
Unit Weight =	24	kN/m^3	***[CSA S6-19 cl. 3.6, Table 3.4]***
E_c =	21656	MPa	

[Slab details not provided on original construction drawings - reinforcement unknown]

Asphalt

Unit Weight =	23.5	kN/m^3	***[CSA S6-19 cl. 3.6, Table 3.4]***

Plain Concrete - Sidewalk Deck

Unit Weight =	23.5	kN/m^3	***[CSA S6-19 cl. 3.6, Table 3.4]***

Aluminum

Unit Weight =	27.0	kN/m^3	***[CSA S6-19 cl. 3.6, Table 3.4]***

General Information

Total Length of Floor Beam	15.0014	***[Considered length from faces of tower columns]***

1.0 Load Combination for Lift Bridge - Bridge Open *CSA S6-19 Table 3.1*

1. SLS Combination 1: Permanent loads consisting of dead loads and superimposed dead loads. Transitory loads consisting of live load (0.9 x CL 625-ONT truck).

2. ULS Combination 1: Permanent loads consisting of dead and superimposed dead loads. Transitory loads consisting of vehicular live load (1.70 x CL 625-ONT) and pedestrian live load (0.2 x 1.70 x P）.

4. ULS Combination 4: Permanent loads consisting of dead and superimposed dead loads. Transitory loads consisting of temperature effects (1.25 x K) and wind (0.45 x W).

Category 1 – Bridge Lifted *CSA S6-19 Table 13.3, 13.4*

1. ULS Combination V1: Permanent loads consisting of dead loads and superimposed dead loads. Operating Impact of 120% applied to the maximum dead load effect in all members that are in motion and to the load effect on a stationary member caused by the moving dead load. Operation of machinery loads of 155% caused by moving of stopping the lift span.

2. ULS Combination V2: Permanent loads consisting of dead loads and superimposed dead loads. Wind Load of 120% with the bridge open in any position. Operating Impact of 120% applied to the maximum dead load effect in all members that are in motion and to the load effect on a stationary member caused by the moving dead load. Operation of machinery loads of 125% caused by moving of stopping the lift span.

3. ULS Combination V3: Permanent loads consisting of dead loads and superimposed dead loads. Wind Load of 150% with the bridge open in any position. Operating Impact of 120% applied to the maximum dead load effect in all members that are in motion and to the load effect on a stationary member caused by the moving dead load.

Category 2 – Bridge Closed, Counterweights Supported

8. **ULS Combination V4:** Permanent loads consisting of dead loads and superimposed dead loads with counterweights supported. Transitory loads consisting of vehicular live load (1.70 x CL 625-ONT) and pedestrian live load (0.2 x 1.70 x P).

Loads

Operation of Machinery Load

1.2 GENERAL DATA

$W_{span} := 1838tonne$ — Weigth of span

$W_{cwt} := W_{span}$ — Weigth of counterweight (hypothesis)

$W_{sheave} := 50000lb$ — Weight of sheave (hypothesis)

$W_{trunnion} := 7500lb$ — Weight of trunnion (hypothesis)

$W_{gear} := 8 \cdot 540lb$ — Weight of gear sets (per sheave) (hypothesis)

$W_{total} := W_{span} + W_{cwt} + 8 \cdot W_{sheave} + 8W_{trunnion} + 8W_{gear} = 8.599 \times 10^{6} \cdot lb$ — Weight to be lifted

		lbs	889.6444	kN
8	50000.00	lbs	133.44666	kN
8	7500.00	lbs	151.9512635	kN
8	8540.00			
		Total x 4 =	1175.042324	kN
			146.8802904	kN

Analysis Method of Stress and Force: A20R|B20L North Front Panel 1

Rail Side Columns Front Leg (100) Panel 1 A20R & B20L (ULS 4) Existing		
	ULS Max	-6582
Axial	ULS Min	-18264
	ULS Max	1829
IY Bending	ULS Min	-1703
	ULS Max	1549
IZ Bending	ULS Min	-1590

Composite Member Properties		
A_{gross} =	178155.0	mm^2
A_{RHM*}=	45483.8	mm^2
A_{net} =	132671	mm^2
∑Iyy =	20634.7	$x10^6mm^4$
∑Izz =	26281.3	$x10^6mm^4$
ybar=	610	mm
zbar=	644	mm

Applied Stresses & Forces				
	Formula		Value	Unit
Stress Y =	Iy bending |ULS| * ybar / Iyy		52	MPa
Stress Z =	Iz bending |ULS| * xbar / Izz		34	MPa
Force =	(Stress Y + Stress Z) * A_{net}		11456	kN
Tension Combined Force =		Axial ULS Max + Force	5498	kN
Compression Combined Force =		Axial ULS Min - Force	-28848	kN

***Calculation process applies to all other members**

0 - ULS 1		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-12562	-12540	-11760	-11487	-10775	-10573	-10235	-10201	-10003	-12200	-12186	-11314	-10663.01	-10489.48	-10189.01	-10155.59	-9979.45
	ULS Min	-12592	-12550	-11803	-11643	-10912	-10710	-10296	-10235	-10098	-12230	-12197	-11514	-10800.11	-10626.58	-10250.4	-10189.01	-10074.25
IY Bending	ULS Max	0	-59	-56	72	66	105	110	112	112	31	42	70	68.15	108.4	108.4	104.94	102.94
	ULS Min	-59	-85	-82	65	66	66	105	110	54	0	31	44	63.73	63.52	104.94	102.94	89.42
IZ Bending	ULS Max	0	-42	119	426	-45	267	267	-43	221	87	117	151	160.12	151.15	41.98	210.92	210.91
	ULS Min	-42	-49	-3	267	-163	-163	-43	-211	-211	0	87	12	151.13	-268.42	-268.39	41.98	-204.6
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	2	3	2	2	2	3	4	4	4	1	1	2	2	3	4	4	4
	Stress Z	1	1	3	10	3	6	9	7	7	2	3	4	3	6	9	7	7
Force (kn) =		368	491	709	1666	868	1406	1326	1145	1179	407	544	763	869	1429	1326	1116	1108
Tension Combined Force (kN) =		-12193	-12049	-11052	-9821	-9907	-9167	-8908	-9056	-8824	-11793	-11643	-10551	-9794	-9061	-8863	-9040	-8871
Compression Combined Force (kN) =		-12960	-13041	-12511	-13309	-11780	-12116	-11622	-11379	-11277	-12637	-12741	-12276	-11670	-12055	-11576	-11305	-11182
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		0.32	0.32	0.31	0.33	0.29	0.30	0.36	0.35	0.345	0.31	0.32	0.31	0.29	0.30	0.35	0.35	0.34

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	-4048	-4037	-2901	-2578	-2292	-2189	-1988	-1838	-1973	-3762.98	-3744.01	-2532.97	-2235.26	-2109.28	-1860.39	-1677.92	-1749.19
	ULS Min	-4061	-4041	-2920	-2646	-2370	-2267	-2066	-1916	-2004	-3776.21	-3748.66	-2620.32	-2313.38	-2187.4	-1938.51	-1756.04	-1779.91
IY Bending	ULS Max	2	7	9	47	44	43	43	160	156	14.25	17.28	29.17	31.6	41.24	45.22	160.81	161.33
	ULS Min	0	2	-39	-21	27	27	42	42	-166	0	8.43	9.41	30.48	31.57	41.17	45.2	-210.03
IZ Bending	ULS Max	0	-66	-38	281	-24	49	49	93	314	34.55	64.62	108.44	100.85	16.05	30.54	37.82	37.79
	ULS Min	-66	-82	-127	171	-39	-24	-41	-40	93	0	29.55	29.84	16.05	-49.97	-49.97	30.52	-499.32
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	0	0	2	2	2	2	2	8	8	1	1	1	2	2	2	8	10
	Stress Z	2	3	4	9	1	2	2	3	10	1	2	3	3	2	2	1	16
Force (kn) =		169	228	460	869	261	282	282	828	1395	139	224	377	367	278	293	695	2018
Tension Combined Force (kN) =		-3879	-3809	-2441	-1709	-2031	-1908	-1705	-1010	-579	-3624	-3520	-2156	-1868	-1832	-1568	-983	269
Compression Combined Force (kN) =		-4230	-4269	-3380	-3515	-2631	-2549	-2348	-2744	-3399	-3915	-3973	-2997	-2680	-2465	-2231	-2451	-3798
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01
		0.27	0.27	0.22	0.23	0.17	0.16	0.15	0.17	0.21	0.25	0.25	0.19	0.17	0.16	0.14	0.16	0.24

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
								Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	Horizontal 4 (AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	191.49	191.49	295.14	322.53	404.45	148.96	-302.62	-321.29	-183.08	-200.15	-149.67	-170.54	-216.94	-227.15	-243.33	-267.45	-36.36	-879.85
	ULS Min	191.49	191.49	286.11	305.42	376.41	102.46	-343.9	-366.17	-227.29	-253.97	-194.85	-221.98	-262	-280.24	-288.9	-318.45	-49.52	-890.77
IY Bending	ULS Max	0	0	39.74	41.12	40.4	39.62	3.35	0	5.4	16.24	5.34	20.72	3.25	22.91	4.48	23.79	0	28.68
	ULS Min	0	0	0	0	0	0	-19.25	0	-20.33	0	-19.82	0	-25.3	0	-21	0	0	0
IZ Bending	ULS Max	0	0	0	0.25	0	0	0	0	0.46	1.14	0	0.17	0	0.77	0	2.29	0	0
	ULS Min	0	0	-5.49	-7.78	-34.19	-38.39	-1.2	0	-0.51	0	-0.56	0	-2.92	0	-5.52	0	0	-5.55
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	14	14	14	14	8	0	8	7	8	9	11	10	9	10	0	10
	Stress Z	0	0	1	1	4	4	0	0	0	0	0	0	0	0	1	0	0	1
Force (kn) =		0	0	259	272	319	322	131	0	137	111	134	139	175	155	151	164	0	189
Tension Combined Force (kN) =		191	191	554	595	723	471	-171	-321	-46	-89	-16	-31	-42	-72	-92	-104	-36	-691
Compression Combined Force (kN) =		191	191	27	33	58	-220	-475	-366	-365	-365	-329	-361	-437	-435	-440	-482	-50	-1080
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.04	0.12	0.13	0.16	0.10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.06	0.15	0.11	0.11	0.11	0.10	0.11	0.13	0.13	0.14	0.15	0.01	0.30

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
								Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	Horizontal 4 (AD54)	Horizontal 5 (A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	234.3	367.42	291.74	316.84	397.19	92.85	-263.54	-255.59	-180.15	-202.52	-147.96	-164.84	-201.44	-232.54	-250.37	-270.2	-664.55	-28.96
	ULS Min	234.3	358.6	290.79	316.07	395.7	88.82	-310.77	-322.39	-234.42	-246.74	-199.48	-210.13	-254.94	-277.73	-301.89	-315.2	-676.77	-42.12
IY Bending	ULS Max	0	0	39.24	39.23	39.53	41.05	0	40.58	15.15	5.51	20.3	5.36	21.72	3.5	23.08	5.14	24.81	0
	ULS Min	0	-26.58	0	0	0	0	-6.32	0	0	-20.38	0	-19.82	0	-25.37	0	-21.15	0	0
IZ Bending	ULS Max	0	0	0	1.18	0	1.74	0	2.41	0.89	0	0.41	0.09	0	0.71	0.65	1.05	0.28	0
	ULS Min	0	-1.8	-1.25	0	-0.79	0	-3.29	0	0	-1.41	0	-0.16	-0.4	0	0	0	-0.53	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	8	14	14	14	14	3	17	6	8	8	8	9	11	10	9	9	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		0	145	248	247	248	260	48	277	103	139	137	133	147	172	156	144	156	0
Tension Combined Force (kN) =		234	512	539	564	646	353	-215	21	-77	-63	-11	-31	-55	-61	-94	-126	-509	-29
Compression Combined Force (kN) =		234	214	43	69	147	-171	-359	-599	-338	-386	-337	-343	-401	-449	-458	-459	-833	-42
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.10	0.12	0.12	0.14	0.08	NA	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.05	0.11	0.19	0.10	0.12	0.10	0.11	0.12	0.14	0.14	0.14	0.23	0.01

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	343.18	63.57	744.05	110.08	-518.16	-549.81	-546.2	-539.43	-690.87	-697.3	-618.7	-623.98	-130.88	23.26
	ULS Min	343.18	46.85	744.05	102.21	-543.65	-575.3	-571.69	-564.93	-713.22	-719.66	-641.05	-646.33	-138.55	14.42
IY Bending	ULS Max	519.01	0	23.71	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-471.23	-50.58	0	-15.19	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	4.79	0	0.06	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	0.41	-0.45	0	-0.95	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	5	17	9	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		438	336	169	110	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		781	400	913	220	-518	-550	-546	-539	-691	-697	-619	-624	-131	23
Compression Combined Force (kN) =		-95	-289	575	-7	-544	-575	-572	-565	-713	-720	-641	-646	-139	14
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.04	0.08	0.20	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.07	NA	0.00	0.14	0.15	0.15	0.15	0.21	0.22	0.19	0.19	0.44	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	157.17	11.29	212.62	51.43	196.13	-193.52	-197.82	-143.07	-156.93	-175.47	-156.74	-47.74	-130.37	-18.38	29.38
	ULS Min	152.18	-1.99	199.04	8.52	196.13	-216.52	-220.81	-166.06	-179.92	-198.47	-179.73	-70.74	-153.36	-27.21	21
IY Bending	ULS Max	236.86	10.44	16.95	11.76	98.64	0	0	0	0	0	0	0	0	0	0
	ULS Min	-210.37	-19.68	-7.65	-15.93	98.64	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	5.99	3.5	3.29	5.51	17.11	0	0	0	0	0	0	0	0	0	0
	ULS Min	-5.89	0	0	0	17.11	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	3	9	8	7	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Force (kn) =		222	146	126	123	303	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		379	157	339	174	499	-194	-198	-143	-157	-175	-157	-48	-130	-18	29
Compression Combined Force (kN) =		-70	-148	73	-114	-107	-217	-221	-166	-180	-198	-180	-71	-153	-27	21
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.02	0.04	0.08	0.04	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.06	NA	0.04	0.01	0.06	0.06	0.04	0.05	0.05	0.05	0.02	0.04	0.09	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder End	Front Transverse Sheave Girder Middle	Back Transverse Sheave Girder	G1	G2/3	G4	G6
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	23637.72	23637.72	3442.09	1613.48	1914.49	1619.27	812.24
	ULS Min	0	0	-1012	-10	-12	-10	-542
Shear	Fz Max	9362	9362	1360	2178	2307	2141	1151
	Fz Min	-9288	-9288	-1352	-336	-2235	-321	-361
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.434	0.576	0.171	0.155	0.155	0.155	0.155
		0.258	0.490	0.252	0.521	0.552	0.512	0.501

0 - ULS 4		**North Tower**																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-6582	-6560	-6423	-6287	-7871	-8484	-9708	-9675	-9860	-6564	-6551	-6117	-7767.34	-8235.15	-9505.58	-9472.7	-9657.81
	ULS Min	-18264	-18218	-17157	-17010	-13956	-13102	-11177	-11115	-10617	-17812	-17779	-16720	-13616.28	-12865.75	-11001.96	-10940.03	-10444.06
IY Bending	ULS Max	1829	2464	2464	1898	645	452	1227	1227	529	1731	2331	2331	577.28	483.03	1161.27	1161.27	544.93
	ULS Min	-1703	-2295	-2291	-1620	-528	-266	-848	-848	-340	-1626	-2198	-2194	-423.52	-251.34	-918.54	-918.54	-324.07
IZ Bending	ULS Max	1549	1967	3466	11261	2345	757	757	97	589	1534	2003	10631	2479.33	374.26	1107.13	1107.13	234.2
	ULS Min	-1590	-2022	-3357	-10337	-2428	-395	-1116	-1116	-244	-1372	-1796	-10701	-2207.32	-759.25	-759.37	-111.1	-545.51
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	54	73	73	56	20	14	43	43	19	51	69	69	18	15	41	41	19
	Stress Z	39	50	85	276	51	16	36	36	19	38	49	262	52	16	36	36	18
Force (kn) =		12333	16226	20918	44022	11266	4754	8411	8411	3998	11768	15642	43902	11103	4912	8135	8135	3906
Tension Combined Force (kN) =		5751	9666	14495	37735	3395	-3730	-1297	-1264	-5862	5204	9092	37785	3335	-3323	-1371	-1338	-5751
Compression Combined Force (kN) =		-30597	-34444	-38075	-61032	-25222	-17856	-19588	-19526	-14615	-29581	-33422	-60621	-24719	-17778	-19137	-19075	-14351
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	0.13	0.22	0.33	0.87	0.07	NA	NA	NA	NA	0.12	0.21	0.87	0.06	NA	NA	NA	NA
		0.76	0.86	0.95	1.52	0.63	0.44	0.60	0.60	0.448	0.73	0.83	1.51	0.61	0.44	0.59	0.58	0.44

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	2426	2436	2407	2577	1131	4	-665	-789	-1224	2394.7	2414.85	2600.36	1230.96	191.69	-491.97	-636.11	-1055.96
	ULS Min	-9345	-9324	-7080	-6965	-4822	-3339	-2103	-1591	-1401	-8677.26	-8647.82	-6495.79	-4519.71	-3176.13	-1991.26	-1433.56	-1205.65
IY Bending	ULS Max	714	956	960	510	268	69	95	159	161	577.46	782.12	786.2	256.56	71.81	94.91	162.29	163.11
	ULS Min	-632	-855	-854	-470	-189	23	24	23	-142	-543.21	-739.98	-739.66	-179.22	26.38	20.49	20.5	-266.96
IZ Bending	ULS Max	640	714	978	5172	876	116	68	278	453	488.13	586.09	4842.43	907.74	133.65	43.24	188.24	188.28
	ULS Min	-680	-783	-1036	-4854	-927	-146	-54	-96	-97	-458.56	-537.4	-4780.69	-780.15	-124.45	-68.65	-186.67	-598.73
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	34	46	46	24	13	3	5	8	8	28	38	38	12	3	5	8	13
	Stress Z	21	25	33	163	29	5	2	9	14	15	19	153	29	4	2	6	19
Force (kn) =		4349	5511	6151	14665	3288	618	523	1279	1722	3366	4374	14887	3199	598	525	1072	2476
Tension Combined Force (kN) =		6775	7947	8559	17242	4419	622	-142	490	498	5761	6789	17487	4430	790	33	436	1420
Compression Combined Force (kN) =		-13694	-14835	-13231	-21630	-8110	-3957	-2625	-2869	-3123	-12043	-13022	-21383	-7719	-3775	-2516	-2505	-3682
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	0.31	0.37	0.39	0.79	0.20	0.03	NA	0.02	0.02	0.26	0.31	0.80	0.20	0.04	0.00	0.02	0.07
		0.88	0.95	0.85	1.39	0.52	0.25	0.17	0.18	0.19	0.77	0.83	1.37	0.49	0.24	0.16	0.16	0.23

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	766.81	766.81	381.97	394.95	584.6	124.92	1237.2	1137.14	764.86	801.12	787.66	844.41	476.79	422.09	-19.71	-18.71	145.61	-683.36
	ULS Min	-327.85	-327.85	160.46	180.02	142.25	-20.72	-2003.58	-1637.51	-1281.39	-1137.97	-1241.28	-1111.37	-1037.93	-835.97	-576.24	-536.29	-19.09	-839.01
IY Bending	ULS Max	0	0	56.31	55.32	49.49	44.21	14.39	0	17.62	28.08	18.44	39.71	11.2	36.04	7.11	28.49	0	28.08
	ULS Min	0	0	0	0	0	0	-40.31	0	-32.65	-4.72	-31.12	-1.16	-33.05	0	-25.46	0	0	0
IZ Bending	ULS Max	0	0	82.74	112.09	74.42	38.94	98.35	0	91.45	31.84	72.11	4.99	76.05	8.69	77.5	9.78	0	7.35
	ULS Min	0	0	-70.53	-101.62	-109.96	-78.48	-51.66	0	-45.37	-35.35	-21.71	-8.97	-26.67	-12.2	-27.52	-10.38	0	-8.08
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	20	19	17	15	17	0	14	12	13	17	14	15	11	12	0	10
	Stress Z	0	0	9	12	12	8	11	0	10	4	8	1	9	1	9	1	0	1
Force (kn) =		0	0	513	564	523	429	449	0	385	253	340	283	360	264	311	210	0	190
Tension Combined Force (kN) =		767	767	895	959	1108	554	1686	1137	1150	1054	1127	1127	836	686	292	191	146	-494
Compression Combined Force (kN) =		-328	-328	-352	-384	-381	-450	-2452	-1638	-1666	-1391	-1581	-1394	-1398	-1100	-888	-746	-19	-1029
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.15	0.20	0.21	0.24	0.12	0.41	0.27	0.28	0.25	0.27	0.27	0.20	0.17	0.07	0.05	0.03	NA
		0.01	0.09	0.10	0.11	0.11	0.13	0.76	0.51	0.51	0.43	0.49	0.43	0.43	0.34	0.27	0.23	0.01	0.29

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	730.73	481.01	363.89	377.51	567.63	62.86	1019.97	1154.88	691.49	689.54	755.37	751.24	389.76	467.15	-10.38	-32.16	-501.92	169.48
	ULS Min	-320.48	191.48	162.23	208.04	173.88	-43.39	-1495.59	-1764.47	-1039.61	-1160.38	-1045.24	-1146.51	-794.38	-989.48	-518.16	-589.2	-615.14	-14.78
IY Bending	ULS Max	0	57.87	51.38	48.68	44.74	42.8	6.76	71.84	36.75	18.08	37.99	17.52	34.1	11.05	27.48	7.93	24.27	0
	ULS Min	0	-108.14	0	0	0	0	-16.66	-2.59	-7.92	-31.91	0	-30.81	0	-32.73	0	-25.17	0	0
IZ Bending	ULS Max	0	29.62	34.76	38.79	37.15	34.06	112.49	37.2	16.96	23.15	6.48	14.69	6.16	16.21	6.95	17.48	2.15	0
	ULS Min	0	-52.6	-12.67	-10.24	-10.36	-9.84	-65.48	-38.94	-13.04	-71.29	-1.6	-65.87	-1.96	-68.57	-1.6	-75.68	-9.96	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	31	18	17	16	15	7	30	15	13	16	13	14	14	11	10	9	0
	Stress Z	0	5	4	4	4	4	13	4	2	8	1	7	1	8	1	9	1	0
Force (kn) =		0	670	389	380	352	334	316	553	277	343	267	326	240	344	197	306	169	0
Tension Combined Force (kN) =		731	1151	752	757	919	396	1336	1708	969	1033	1022	1077	630	811	187	274	-332	169
Compression Combined Force (kN) =		-320	-479	-226	-172	-178	-377	-1811	-2317	-1317	-1504	-1312	-1473	-1034	-1333	-715	-895	-785	-15
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.22	0.16	0.17	0.20	0.09	0.32	0.41	0.23	0.25	0.25	0.26	0.15	0.20	0.04	0.07	NA	0.04
		0.01	0.13	0.06	0.05	0.05	0.11	0.56	0.72	0.41	0.46	0.40	0.45	0.32	0.41	0.22	0.28	0.22	0.00

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	411.74	412.19	846.75	171.57	1238.15	1161.92	663.27	711.12	283.96	229.87	-151.21	-117.41	-95.2	23.78
	ULS Min	254.15	-269.61	594.18	-473.4	-2327.48	-2394.38	-1908.53	-1857.86	-1726.98	-1776.51	-1229.17	-1199.84	-179.06	13.74
IY Bending	ULS Max	8154.35	0	26.42	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-8895.34	-57.31	0	-16.2	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	146.32	237.21	73.42	268.54	0	0	0	0	0	0	0	0	0	0
	ULS Min	-70.61	-113.84	-35.15	-99.3	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	90	19	10	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	7	17	6	22	0	0	0	0	0	0	0	0	0	0
Force (kn) =		7765	732	296	511	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		8177	1144	1143	682	1238	1162	663	711	284	230	-151	-117	-95	24
Compression Combined Force (kN) =		-7511	-1002	298	-984	-2327	-2394	-1909	-1858	-1727	-1777	-1229	-1200	-179	14
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.40	0.22	0.25	0.15	0.24	0.22	0.13	0.14	0.06	0.05	NA	NA	NA	0.02
		0.48	0.25	NA	0.27	0.61	0.63	0.50	0.49	0.52	0.53	0.37	0.36	0.57	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	239.8	207.36	296	109.6	136.7	649.21	614.2	408.57	426.5	301.56	283.29	323.26	286.87	47.21	32.23
	ULS Min	-16.68	-231.98	-0.33	-72.41	77.34	-958.89	-960.99	-641.28	-648.17	-564.44	-547.94	-383.05	-443.86	-75.77	19.6
IY Bending	ULS Max	3975.43	15.82	20.29	16.27	115.13	0	0	0	0	0	0	0	0	0	0
	ULS Min	-4319.25	-22.62	-13.62	-18.63	89.41	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	169.13	239.94	97.78	267.73	123.73	0	0	0	0	0	0	0	0	0	0
	ULS Min	-100.57	-120.84	-56.24	-136.93	0	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	52	10	9	8	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	13	24	10	26	7	0	0	0	0	0	0	0	0	0	0
Force (kn) =		4355	544	301	560	634	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		4595	751	597	669	770	649	614	409	427	302	283	323	287	47	32
Compression Combined Force (kN) =		-4372	-776	-301	-632	-556	-959	-961	-641	-648	-564	-548	-383	-444	-76	20
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.27	0.18	0.14	0.16	0.06	0.14	0.13	0.09	0.09	0.07	0.06	0.07	0.06	0.04	0.03
		0.34	0.30	0.12	0.24	0.06	0.25	0.25	0.17	0.17	0.15	0.14	0.10	0.12	0.24	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder End	Front Transverse Sheave Girder Middle	Back Transverse Sheave Girder	G1	G2/3	G4	G6
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	24872.61	24872.61	2280.01	1778.81	1835.11	1742.83	494.91
	ULS Min	0	0	-1093	-10	-12	-17	-481
Shear	Fz Max	9830	9830	946	2391	2405	2302	1116
	Fz Min	-9869	-9869	-988	-262	-2418	-257	-657
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.456	0.606	0.113	0.170	0.149	0.167	0.094
		0.272	0.516	0.183	0.572	0.578	0.551	0.486

0 - ULS V1		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-14380	-14358	-13548	-13275	-12499	-12298	-11940	-11906	-11713	-14029	-14015	-13115	-12395.93	-12226.15	-11904.77	-11871.36	-11700.99
	ULS Min	-14410	-14369	-13591	-13431	-12636	-12436	-12001	-11940	-11808	-14059	-14025	-13314	-12533.03	-12363.25	-11966.16	-11904.77	-11795.79
IY Bending	ULS Max	0	-60	-50	83	84	122	140	150	150	33	43	88	86.24	126.44	134.95	139.47	139.47
	ULS Min	-60	-86	-83	78	80	80	122	140	1	0	33	45	77.88	77.66	126.44	134.95	39.3
IZ Bending	ULS Max	0	-46	120	451	-52	312	312	-51	260	92	123	159	178.42	178.44	50.29	248.04	248.03
	ULS Min	-46	-55	-8	267	-190	-190	-51	-248	-248	0	92	-17	166.64	-313.06	-313.03	50.29	-243.28
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	2	3	2	2	3	4	5	5	5	1	1	3	3	4	5	5	5
	Stress Z	1	1	3	11	4	7	10	8	8	2	3	4	4	7	10	8	8
Force (kn) =		386	514	714	1787	1046	1640	1594	1411	1452	428	569	861	1020	1666	1578	1372	1372
Tension Combined Force (kN) =		-13994	-13843	-12834	-11488	-11452	-10658	-10346	-10496	-10261	-13601	-13446	-12254	-11376	-10560	-10327	-10499	-10329
Compression Combined Force (kN) =		-14795	-14883	-14305	-15218	-13682	-14076	-13595	-13350	-13260	-14486	-14594	-14175	-13553	-14030	-13544	-13277	-13168
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		0.37	0.37	0.36	0.38	0.34	0.35	0.42	0.41	0.406	0.36	0.36	0.35	0.34	0.35	0.41	0.41	0.40

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	-4249	-4237	-3074	-2751	-2463	-2364	-2157	-2007	-2134	-3963.89	-3944.92	-2708.57	-2407.54	-2283.95	-2029.35	-1843.23	-1899.68
	ULS Min	-4262	-4242	-3093	-2819	-2541	-2442	-2236	-2085	-2165	-3977.13	-3949.58	-2795.93	-2485.66	-2362.07	-2107.47	-1921.35	-1930.4
IY Bending	ULS Max	2	8	11	56	52	51	52	172	168	13.74	16.77	36.43	38	49.67	54.52	174.95	175.8
	ULS Min	0	2	-40	-22	33	33	50	51	-172	0	7.72	8.69	37.82	37.97	49.59	54.5	-228.05
IZ Bending	ULS Max	0	-67	-38	280	-27	53	53	107	330	35.41	65.81	108.25	102.82	18.32	34	37.43	37.41
	ULS Min	-67	-84	-129	177	-40	-26	-44	-43	107	0	30.41	28.99	18.32	-54.23	-54.23	33.99	-535.18
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	0	0	2	3	3	2	3	8	8	1	1	2	2	2	3	8	11
	Stress Z	2	3	4	9	1	2	2	3	10	1	2	3	3	2	2	1	17
Force (kn) =		175	235	468	899	295	324	328	908	1460	139	225	403	396	320	338	747	2174
Tension Combined Force (kN) =		-4074	-4002	-2606	-1851	-2168	-2040	-1830	-1099	-674	-3825	-3720	-2305	-2012	-1964	-1691	-1096	274
Compression Combined Force (kN) =		-4436	-4477	-3561	-3719	-2836	-2765	-2563	-2993	-3625	-4116	-4175	-3199	-2882	-2682	-2445	-2669	-4104
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01
		0.28	0.29	0.23	0.24	0.18	0.18	0.16	0.19	0.23	0.26	0.27	0.21	0.18	0.17	0.16	0.17	0.26

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	217.24	217.24	336.06	368.8	465.35	209.45	-341.9	-363.05	-211.75	-230.18	-174.46	-196.85	-252.91	-266.26	-283.03	-295.68	-93.6	-885.93
	ULS Min	217.24	217.24	325.34	348.87	432.18	155.13	-383.2	-408.43	-255.89	-284.56	-219.61	-248.74	-297.9	-320.08	-328.62	-347.36	-106.76	-896.8
IY Bending	ULS Max	0	0	39.89	41.45	40.52	39.13	2.32	0	4.92	17.04	4.9	21.75	2.47	24.36	3.85	25.12	0	29.05
	ULS Min	0	0	0	0	0	0	-20.95	0	-21.93	0	-21.35	0	-27.74	0	-23.23	0	0	0
IZ Bending	ULS Max	0	0	0	0.3	0	0	0	0	0.54	1.13	0	0.24	0	0.89	0	2.66	0	0
	ULS Min	0	0	-6.12	-8.68	-38.52	-43.75	-1.21	0	-0.44	0	-0.62	0	-3.42	0	-5.99	0	0	-5.89
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	14	14	14	14	9	0	9	7	9	9	12	10	10	10	0	10
	Stress Z	0	0	1	1	4	5	0	0	0	0	0	0	0	0	1	0	0	1
Force (kn) =		0	0	261	276	328	330	143	0	148	116	144	146	192	165	167	173	0	192
Tension Combined Force (kN) =		217	217	597	645	793	539	-199	-363	-64	-114	-30	-50	-60	-101	-116	-122	-94	-694
Compression Combined Force (kN) =		217	217	64	73	104	-174	-526	-408	-404	-401	-364	-395	-490	-485	-495	-521	-107	-1089
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.04	0.13	0.14	0.17	0.12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.05	0.16	0.13	0.12	0.12	0.11	0.12	0.15	0.15	0.15	0.16	0.03	0.30

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	260.51	416.38	332.74	363.16	458.25	145.83	-301.79	-289.4	-209.14	-233.1	-173.26	-190.61	-239.28	-269.72	-278.42	-313.91	-645.77	-87.24
	ULS Min	260.51	406.74	331.52	362.12	456.55	141.91	-349.8	-357.97	-264	-277.26	-225.22	-235.88	-293.55	-314.86	-330.67	-358.85	-658.09	-100.41
IY Bending	ULS Max	0	0	39.3	39.3	39.59	40.92	0	42.58	15.88	5.02	21.33	4.91	23.06	2.74	24.37	4.6	24.71	0
	ULS Min	0	-31.45	0	0	0	0	-5.33	0	0	-22	0	-21.36	0	-27.81	0	-23.36	0	0
IZ Bending	ULS Max	0	0	0	1.29	0	1.66	0	2.63	0.91	0	0.47	0	0	0.81	0.72	0.9	0.26	0
	ULS Min	0	-2.04	-1.49	0	-0.89	0	-3.6	0	0	-1.56	0	-0.23	-0.46	0	0	0	-0.55	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	9	14	14	14	14	2	18	7	9	9	9	10	12	10	10	9	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		0	171	248	248	249	259	42	291	108	151	144	144	156	188	165	158	155	0
Tension Combined Force (kN) =		261	588	581	611	707	405	-259	1	-101	-83	-29	-47	-84	-82	-114	-155	-491	-87
Compression Combined Force (kN) =		261	235	83	114	207	-117	-392	-649	-372	-428	-369	-380	-449	-503	-496	-517	-813	-100
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.11	0.13	0.13	0.15	0.09	NA	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.03	0.12	0.20	0.11	0.13	0.11	0.12	0.14	0.15	0.15	0.16	0.23	0.03

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	391.66	73.97	866.59	128.56	-599.63	-629.9	-642.77	-637.1	-802.94	-807.72	-729.97	-737.63	-155.88	21.59
	ULS Min	391.66	57.44	866.59	120.21	-625.12	-655.4	-668.26	-662.6	-825.3	-830.07	-752.32	-759.98	-163.55	12.75
IY Bending	ULS Max	584.25	0	30.36	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-503.18	-53.73	0	-14.69	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	4.03	0	0.05	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	0.5	-0.56	0	-1.18	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	6	18	12	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		487	357	216	106	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		879	431	1083	235	-600	-630	-643	-637	-803	-808	-730	-738	-156	22
Compression Combined Force (kN) =		-96	-300	650	14	-625	-655	-668	-663	-825	-830	-752	-760	-164	13
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.04	0.08	0.24	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.07	NA	NA	0.16	0.17	0.18	0.17	0.25	0.25	0.23	0.23	0.52	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	165.7	12.28	230.34	57.57	212.18	-205.69	-211.31	-158.85	-171.92	-188.5	-169.35	-56.95	-147.17	-22.2	29.21
	ULS Min	159.61	-1.19	215.49	9.83	212.18	-228.69	-234.3	-181.84	-194.91	-211.5	-192.35	-79.94	-170.17	-31.04	20.82
IY Bending	ULS Max	247.82	10.41	17.44	11.83	97.68	0	0	0	0	0	0	0	0	0	0
	ULS Min	-216.91	-19.85	-6.94	-15.76	97.68	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	6.31	4.1	3.61	6.04	18.09	0	0	0	0	0	0	0	0	0	0
	ULS Min	-7.59	0	0	0	18.09	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	3	9	8	7	5	0	0	0	0	0	0	0	0	0	0
	Stress Z	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Force (kn) =		239	148	130	122	303	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		405	161	361	180	515	-206	-211	-159	-172	-189	-169	-57	-147	-22	29
Compression Combined Force (kN) =		-79	-149	85	-112	-91	-229	-234	-182	-195	-212	-192	-80	-170	-31	21
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.02	0.04	0.09	0.04	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.06	NA	0.04	0.01	0.06	0.06	0.05	0.05	0.06	0.05	0.02	0.04	0.10	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder End	Front Transverse Sheave Girder Middle	Back Transverse Sheave Girder	G1	G2/3	G4	G6
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	28153.35	28153.35	3693.33	1948.72	2314.81	1937.45	814.1
	ULS Min	0	0	-1085	-10	-12	-10	-550
Shear	Fz Max	11169	11169	1468	2626	2773	2538	1275
	Fz Min	-11060	-11060	-1485	-365	-2688	-358	-400
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.517	0.686	0.183	0.187	0.188	0.186	0.155
		0.308	0.584	0.275	0.628	0.663	0.607	0.555

0 - ULS V2		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-9739	-9717	-9412	-9192	-10359	-10855	-11821	-11788	-11923	-9497	-9484	-8944	-10221.33	-10606.57	-11633.85	-11600.89	-11749.15
	ULS Min	-19756	-19712	-18619	-18405	-15594	-14833	-13089	-13027	-12586	-19143	-19110	-18061	-15254.29	-14595.23	-12925.22	-12863.38	-12436.63
IY Bending	ULS Max	1531	2058	2059	1666	563	413	1093	1093	504	1508	2032	2032	505.28	439.94	1034.15	1034.15	512.85
	ULS Min	-1497	-2021	-2017	-1349	-443	-203	-685	-685	-327	-1370	-1850	-1846	-352.55	-189.52	-748.54	-748.54	-269.64
IZ Bending	ULS Max	1316	1676	3078	9873	2026	740	740	11	579	1363	1784	9244	2202.33	370.63	963.63	963.63	273.14
	ULS Min	-1374	-1743	-2770	-8639	-2065	-397	-971	-971	-281	-1128	-1471	-9040	-1814.8	-742.23	-742.32	-22.83	-536.82
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	45	61	61	49	17	13	38	38	18	45	60	60	16	14	36	36	18
	Stress Z	34	43	75	242	43	15	31	31	19	33	44	226	46	16	31	31	17
Force (kn) =		10465	13730	18071	38607	9652	4502	7413	7413	3868	10337	13762	37997	9825	4643	7168	7168	3757
Tension Combined Force (kN) =		726	4012	8659	29415	-707	-6353	-4408	-4375	-8056	840	4278	29053	-396	-5964	-4466	-4433	-7992
Compression Combined Force (kN) =		-30221	-33441	-36690	-57012	-25246	-19335	-20502	-20440	-16453	-29480	-32871	-56058	-25080	-19238	-20093	-20031	-16194
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	0.02	0.09	0.20	0.68	NA	NA	NA	NA	NA	0.02	0.10	0.67	NA	NA	NA	NA	NA
		0.75	0.83	0.91	1.42	0.63	0.48	0.63	0.63	0.504	0.73	0.82	1.39	0.62	0.48	0.62	0.61	0.50

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	506	517	758	1085	-81	-1041	-1590	-1685	-2052	674.52	693.22	1077.98	-22.59	-895.59	-1431.5	-1529.05	-1842.64
	ULS Min	-9585	-9564	-7376	-7104	-5195	-3917	-2834	-2384	-2209	-8817.62	-8789.73	-6731.2	-4962.9	-3793.45	-2727.76	-2223.74	-1975.33
IY Bending	ULS Max	610	825	830	422	244	73	88	190	191	508.93	681.11	683.79	225.66	74.35	88.35	193.67	193.95
	ULS Min	-543	-727	-726	-418	-147	25	27	26	-189	-451.64	-623.55	-624.1	-147.86	35.41	24.55	24.56	-307.4
IZ Bending	ULS Max	501	560	833	4532	749	87	82	275	561	440.37	545.42	4272.45	828.21	123.85	52.91	184.6	184.6
	ULS Min	-631	-724	-893	-4061	-795	-139	-65	-65	-46	-371.08	-417.57	-3975.94	-618.55	-97.38	-84	-136.75	-771.29
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	29	40	40	20	12	3	4	9	9	24	33	33	11	4	4	9	15
	Stress Z	20	23	28	143	25	4	3	9	18	14	17	135	26	4	3	6	24
Force (kn) =		3841	4874	5309	12758	2877	614	534	1390	2099	2992	3895	13098	2888	584	538	1180	3053
Tension Combined Force (kN) =		4347	5391	6068	13843	2795	-427	-1056	-295	47	3666	4588	14176	2865	-312	-894	-349	1211
Compression Combined Force (kN) =		-13426	-14438	-12686	-19862	-8072	-4531	-3367	-3774	-4308	-11809	-12685	-19829	-7850	-4377	-3266	-3404	-5029
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	0.20	0.25	0.28	0.64	0.13	NA	NA	NA	0.00	0.17	0.21	0.65	0.13	NA	NA	NA	0.06
		0.86	0.93	0.81	1.27	0.51	0.29	0.21	0.24	0.27	0.76	0.81	1.27	0.50	0.28	0.21	0.22	0.31

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
								Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	Horizontal 4 (AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	711.74	711.74	437.97	456.71	640.81	253.07	943.93	850.82	585.08	606.32	614.63	653.29	323.05	267.02	-97.3	-101.19	-35.81	-834.72
	ULS Min	-226.54	-226.54	248.1	272.49	261.65	112.19	-1839.91	-1534.11	-1175.27	-1063.67	-1131.05	-1030.45	-981.87	-819.17	-581.19	-552.42	-178.86	-969.09
IY Bending	ULS Max	0	0	54.08	53.9	48.46	42.9	12.33	0	15.72	25.38	16.48	38.61	9.58	36.32	6.11	29.84	0	30.45
	ULS Min	0	0	0	0	0	0	-38.09	0	-31.77	-2.74	-30.21	0	-33.66	0	-26.67	0	0	0
IZ Bending	ULS Max	0	0	68.49	92.34	49.06	28.08	83.4	0	77.51	28.31	61.68	4.33	64.36	7.81	64	9.23	0	4.63
	ULS Min	0	0	-62.88	-90.84	-108.98	-83.46	-45.59	0	-39.76	-29.29	-18.74	-7.74	-23.71	-10.27	-26.05	-8.23	0	-9.23
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	19	19	17	15	16	0	13	11	13	16	14	15	11	12	0	11
	Stress Z	0	0	7	10	12	9	9	0	9	3	7	1	7	1	7	1	0	1
	Force (kn) =	0	0	471	516	515	430	407	0	354	223	315	273	343	262	295	217	0	207
	Tension Combined Force (kN) =	712	712	909	973	1155	683	1351	851	939	830	929	927	666	529	198	116	-36	-628
	Compression Combined Force (kN) =	-227	-227	-223	-244	-253	-318	-2247	-1534	-1529	-1287	-1446	-1304	-1324	-1082	-876	-769	-179	-1176
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.14	0.20	0.21	0.25	0.15	0.33	0.20	0.23	0.20	0.22	0.22	0.16	0.13	0.05	0.03	NA	NA
		0.01	0.06	0.06	0.07	0.07	0.09	0.69	0.47	0.47	0.40	0.45	0.40	0.41	0.33	0.27	0.24	0.05	0.33

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
								Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	Horizontal 4 (AD54)	Horizontal 5 (A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	721.4	545.82	422.42	441.99	628.24	188.08	778.37	884.16	520.56	510.02	586.88	574.24	250.26	305.32	-84.2	-121.1	-609.18	-24.71
	ULS Min	-179.65	294.87	249.57	296.73	290.75	95.56	-1385.76	-1631.08	-971.23	-1082.09	-963.86	-1059.09	-772.72	-949.86	-527.3	-605.2	-707.65	-184.53
IY Bending	ULS Max	0	38.04	48.56	47.31	44	42.46	4.8	70.43	34.68	16.19	36.91	15.77	34.15	9.6	28.6	7.14	25.82	0
	ULS Min	0	-104.26	0	0	0	0	-15.27	0	-3.61	-31.04	0	-29.83	0	-33.32	0	-26.51	0	0
IZ Bending	ULS Max	0	26.14	29.32	33.71	31.51	30.95	96.18	32.08	14.96	19.19	5.79	12.64	5.19	14.15	6.34	15.62	2.41	0
	ULS Min	0	-44.76	-11.37	-8.32	-9.35	-6.87	-56.37	-33.86	-10.76	-61.76	-1.24	-56.42	-1.89	-58.55	-1.15	-64.25	-8.01	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	30	17	16	15	15	6	29	14	13	15	12	14	14	12	11	9	0
	Stress Z	0	4	3	4	3	3	11	4	2	7	1	6	1	7	1	7	1	0
	Force (kn) =	0	635	360	361	336	325	277	534	260	320	258	302	239	330	203	294	176	0
	Tension Combined Force (kN) =	721	1181	783	803	964	514	1055	1418	780	830	845	877	489	635	119	173	-434	-25
	Compression Combined Force (kN) =	-180	-341	-111	-64	-45	-230	-1663	-2165	-1231	-1402	-1222	-1362	-1011	-1280	-731	-900	-883	-185
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.23	0.17	0.18	0.21	0.11	0.25	0.34	0.19	0.20	0.20	0.21	0.12	0.15	0.03	0.04	NA	NA
		0.01	0.09	0.03	0.02	0.01	0.07	0.51	0.67	0.38	0.43	0.38	0.42	0.31	0.39	0.23	0.28	0.25	0.05

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	468.97	379.35	978.5	184.87	901	811.48	374.21	419.94	12.88	-38.3	-353.85	-324.41	-128.38	21.7
	ULS Min	333.89	-216.8	762.01	-370.88	-2158.89	-2240.43	-1833.83	-1785.68	-1713.98	-1761.24	-1281	-1255.39	-201.35	11.83
IY Bending	ULS Max	7043.86	0	34.02	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-7828.64	-60.01	0	-15.38	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	129.75	203.15	62.93	229.81	0	0	0	0	0	0	0	0	0	0
	ULS Min	-56.19	-97.75	-30.13	-85.49	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	79	20	13	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	7	15	5	19	0	0	0	0	0	0	0	0	0	0
Force (kn) =		6838	700	335	448	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		7307	1079	1313	633	901	811	374	420	13	-38	-354	-324	-128	22
Compression Combined Force (kN) =		-6504	-916	427	-819	-2159	-2240	-1834	-1786	-1714	-1761	-1281	-1255	-201	12
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.36	0.21	0.29	0.14	0.17	0.16	0.07	0.08	0.00	NA	NA	NA	NA	0.02
		0.41	0.23	NA	0.23	0.57	0.59	0.48	0.47	0.51	0.53	0.38	0.38	0.65	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	278.06	184.76	359.07	116.74	233.7	474.46	441.39	268.71	275.7	173.52	168.39	227	157.25	24.82	31.07
	ULS Min	59.3	-191.81	100.05	-39.27	179.45	-907.19	-912.06	-634.44	-648.73	-572.05	-547.38	-381.69	-472.38	-81.86	19.05
IY Bending	ULS Max	3478.86	14.83	20.79	15.11	110.3	0	0	0	0	0	0	0	0	0	0
	ULS Min	-3803.72	-22.9	-9.69	-17.69	89.41	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	141.55	206.19	84.31	229.96	103.93	0	0	0	0	0	0	0	0	0	0
	ULS Min	-89.62	-103.06	-47.7	-116.89	0	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	46	10	9	8	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	11	20	8	23	6	0	0	0	0	0	0	0	0	0	0
Force (kn) =		3798	492	283	493	568	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		4076	677	642	610	801	474	441	269	276	174	168	227	157	25	31
Compression Combined Force (kN) =		-3738	-684	-183	-532	-388	-907	-912	-634	-649	-572	-547	-382	-472	-82	19
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.24	0.16	0.15	0.15	0.07	0.10	0.10	0.06	0.06	0.04	0.04	0.05	0.03	0.02	0.02
		0.29	0.26	0.07	0.20	0.04	0.24	0.24	0.17	0.17	0.15	0.14	0.10	0.12	0.26	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder End	Front Transverse Sheave Girder Middle	Back Transverse Sheave Girder	G1	G2/3	G4	G6
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	29663.68	29663.68	3778.06	2081.32	2183.16	2070.3	963.3
	ULS Min	0	0	-1432	-10	-12	-16	-653
Shear	Fz Max	11647	11647	1461	2799	2873	2732	1515
	Fz Min	-11680	-11680	-1479	-379	-2850	-352	-661
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.544	0.723	0.187	0.199	0.177	0.198	0.183
		0.322	0.611	0.275	0.670	0.687	0.654	0.660

0 - ULS V3		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-8486	-8464	-8287	-8080	-9736	-10406	-11705	-11672	-11889	-8272	-8258	-7810	-9590.17	-10114.01	-11479.71	-11446.87	-11674.36
	ULS Min	-20999	-20955	-19785	-19558	-16246	-15344	-13274	-13212	-12693	-20322	-20288	-19156	-15847.1	-15065.57	-13078.59	-13016.62	-12510.01
IY Bending	ULS Max	1928	2594	2595	2063	682	485	1330	1330	590	1877	2530	2529	609.12	517.44	1257.37	1257.37	604.22
	ULS Min	-1856	-2505	-2500	-1706	-575	-285	-893	-893	-406	-1720	-2323	-2319	-463.17	-269.38	-971	-971	-344.32
IZ Bending	ULS Max	1657	2110	3818	12228	2547	845	845	77	657	1680	2199	11561	2710.92	417.29	1191.68	1191.68	277.76
	ULS Min	-1706	-2164	-3493	-10913	-2567	-447	-1201	-1201	-288	-1433	-1870	-11295	-2310.49	-847.26	-847.38	-92.21	-608.8
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	57	77	77	61	21	15	47	47	21	55	75	75	19	16	44	44	21
	Stress Z	42	53	93	299	54	18	39	39	21	41	54	283	57	18	38	38	20
Force (kn) =		13102	17200	22572	47811	11912	5206	9085	9085	4458	12813	17059	47471	12031	5375	8784	8784	4345
Tension Combined Force (kN) =		4616	8736	14286	39731	2176	-5200	-2620	-2587	-7430	4541	8800	39661	2441	-4739	-2696	-2663	-7329
Compression Combined Force (kN) =		-34101	-38155	-42357	-67368	-28157	-20550	-22359	-22297	-17151	-33135	-37347	-66628	-27878	-20441	-21862	-21800	-16855
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	0.11	0.20	0.33	0.92	0.04	NA	NA	NA	NA	0.10	0.20	0.92	0.05	NA	NA	NA	NA
		0.85	0.95	1.05	1.67	0.70	0.51	0.68	0.68	0.525	0.82	0.93	1.66	0.69	0.51	0.67	0.67	0.52

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	1705	1716	1725	2053	523	-701	-1439	-1596	-2025	1844.12	1862.75	2033.37	582.26	-539.73	-1273.53	-1441.96	-1821.91
	ULS Min	-10905	-10884	-8438	-8166	-5850	-4277	-2975	-2450	-2213	-10017.74	-9989.77	-7706.27	-5573.59	-4142.52	-2874.33	-2290.79	-1980.1
IY Bending	ULS Max	762	1029	1034	533	292	77	97	194	196	632.77	849.51	852.62	272.24	80.07	96.42	197.54	197.67
	ULS Min	-680	-911	-910	-517	-197	23	20	19	-193	-567.94	-781.31	-782.23	-194.66	31.4	16.68	16.69	-326.61
IZ Bending	ULS Max	643	721	1051	5620	947	115	89	316	618	541.58	665.27	5313.52	1009.45	150.12	57.45	221.59	221.59
	ULS Min	-771	-884	-1107	-5121	-984	-167	-70	-84	-85	-472.73	-538.47	-4996.97	-799	-126.42	-91.23	-180.1	-829.32
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	37	49	50	26	14	4	5	9	9	30	41	41	13	4	5	9	16
	Stress Z	24	28	35	178	31	5	3	10	20	17	21	168	32	5	3	7	26
Force (kn) =		4757	6033	6603	15858	3520	701	583	1506	2259	3705	4821	16298	3509	670	586	1286	3268
Tension Combined Force (kN) =		6462	7749	8328	17912	4043	0	-856	-90	234	5549	6684	18331	4091	130	-688	-156	1446
Compression Combined Force (kN) =		-15662	-16917	-15041	-24024	-9370	-4978	-3558	-3956	-4472	-13723	-14811	-24004	-9083	-4813	-3460	-3577	-5248
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	0.30	0.36	0.38	0.82	0.19	NA	NA	NA	0.01	0.25	0.31	0.84	0.19	0.01	NA	NA	0.07
		1.00	1.08	0.96	1.54	0.60	0.32	0.23	0.25	0.28	0.88	0.95	1.54	0.58	0.31	0.22	0.23	0.33

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	834.03	834.03	461.53	477.71	685.41	260.18	1267.44	1156.39	785.78	816.96	813.21	867.14	468.92	402.33	-48.99	-51.34	-16.93	-820.25
	ULS Min	-338.81	-338.81	224.19	247.43	211.46	95.46	-2202.04	-1813.39	-1403.62	-1256.91	-1357.61	-1224.54	-1150.98	-941.92	-642.45	-602.42	-192.45	-985.49
IY Bending	ULS Max	0	0	57.62	56.99	50.44	43.86	14.88	0	18.45	29.08	19.4	42.77	11.4	39.23	6.71	30.96	0	30.77
	ULS Min	0	0	0	0	0	0	-42.29	0	-34.15	-6.07	-32.34	-1.02	-35.02	0	-27.4	0	0	0
IZ Bending	ULS Max	0	0	87.05	117.47	71.06	39.11	104.42	0	97	35.22	77.16	5.35	81.12	9.54	81.38	10.86	0	6.76
	ULS Min	0	0	-77.17	-111.5	-126.48	-93.32	-56.69	0	-49.6	-36.78	-23.36	-9.67	-28.95	-12.92	-31.16	-10.81	0	-10.08
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	20	20	17	15	18	0	14	12	13	18	15	16	11	13	0	11
	Stress Z	0	0	9	13	14	10	12	0	11	4	9	1	9	1	9	1	0	1
	Force (kn) =	0	0	529	584	561	455	473	0	405	262	357	305	382	287	331	228	0	210
	Tension Combined Force (kN) =	834	834	991	1062	1246	716	1741	1156	1191	1079	1170	1172	851	689	282	176	-17	-610
	Compression Combined Force (kN) =	-339	-339	-305	-337	-350	-360	-2675	-1813	-1809	-1519	-1715	-1529	-1533	-1229	-974	-830	-192	-1196
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.16	0.22	0.23	0.27	0.16	0.42	0.28	0.29	0.26	0.28	0.28	0.20	0.17	0.07	0.04	NA	NA
		0.01	0.09	0.09	0.10	0.10	0.10	0.83	0.56	0.56	0.47	0.53	0.47	0.47	0.38	0.30	0.26	0.05	0.33

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	835.31	575.71	442.76	459.64	668.22	194.79	1050.38	1179.22	704.47	697.32	778.21	766.72	374.61	450.95	-34.45	-70.99	-599.89	-4.3
	ULS Min	-291	264.47	226.7	278.06	246.36	80.12	-1642.75	-1947.6	-1146.52	-1281.78	-1147.19	-1263.62	-890.51	-1106.74	-575.23	-664.87	-719.89	-200.79
IY Bending	ULS Max	0	55.65	53.21	49.67	45.09	42.85	7.28	77.29	39.35	19.01	40.76	18.51	36.86	11.35	29.59	7.8	26.09	0
	ULS Min	0	-122.22	0	0	0	0	-17.81	-3.66	-8.52	-33.22	0	-31.87	0	-34.57	0	-27.18	0	0
IZ Bending	ULS Max	0	32.83	37	41.84	39.55	38.3	121.11	39.44	18.59	24.39	7.12	15.86	6.54	17.48	7.74	19.43	2.95	0
	ULS Min	0	-55.42	-13.82	-10.69	-11.47	-8.85	-69.57	-42.36	-13.56	-76.8	-1.62	-70.46	-2.25	-73.37	-1.52	-80.4	-9.86	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	35	18	17	16	15	7	32	16	14	17	13	15	14	12	11	9	0
	Stress Z	0	5	4	5	4	4	14	5	2	9	1	8	1	8	1	9	1	0
	Force (kn) =	0	750	404	392	359	342	339	596	298	362	287	342	259	365	213	328	181	0
	Tension Combined Force (kN) =	835	1326	847	851	1027	537	1389	1775	1002	1060	1065	1108	634	816	178	257	-419	-4
	Compression Combined Force (kN) =	-291	-486	-178	-114	-112	-262	-1982	-2543	-1444	-1644	-1434	-1605	-1150	-1472	-788	-993	-901	-201
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.26	0.19	0.19	0.22	0.12	0.33	0.43	0.24	0.26	0.26	0.27	0.15	0.20	0.04	0.06	NA	NA
		0.01	0.14	0.05	0.03	0.03	0.08	0.61	0.79	0.44	0.51	0.44	0.49	0.35	0.45	0.24	0.31	0.25	0.06

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	485.86	455.15	1000.14	198.1	1280.26	1175.87	633.32	689.13	222.68	159.86	-253.99	-215.15	-120.24	21.81
	ULS Min	317	-285.89	729.53	-494.46	-2538.23	-2632.64	-2120.36	-2061.52	-1930.3	-1988.24	-1407.35	-1373.29	-209.54	11.69
IY Bending	ULS Max	8853.7	0	34.59	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-9658.39	-61.42	0	-15.59	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	161.69	254.06	78.65	287.52	0	0	0	0	0	0	0	0	0	0
	ULS Min	-70.74	-122.04	-37.67	-106.55	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	98	20	14	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	8	19	6	23	0	0	0	0	0	0	0	0	0	0
Force (kn) =		8443	785	362	534	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		8929	1240	1362	732	1280	1176	633	689	223	160	-254	-215	-120	22
Compression Combined Force (kN) =		-8126	-1070	367	-1029	-2538	-2633	-2120	-2062	-1930	-1988	-1407	-1373	-210	12
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.44	0.24	0.30	0.16	0.25	0.23	0.12	0.13	0.05	0.03	NA	NA	NA	0.02
		0.52	0.26	NA	0.29	0.67	0.69	0.56	0.54	0.58	0.60	0.42	0.41	0.67	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	305.71	228.05	390.35	131.31	238.49	645.12	605.25	376.4	388.37	264.69	253.52	298.57	234.14	36.77	31.54
	ULS Min	32.27	-242.66	69.15	-63.7	172.09	-1076.2	-1080.82	-746.79	-761.42	-661.52	-635.45	-456.54	-547.15	-94.37	18.61
IY Bending	ULS Max	4347.65	15.96	22.13	16.39	113.78	0	0	0	0	0	0	0	0	0	0
	ULS Min	-4700.1	-23.65	-10.41	-18.18	87.9	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	178.16	257.07	104.84	287.06	133.43	0	0	0	0	0	0	0	0	0	0
	ULS Min	-110.81	-129.48	-60.17	-146.5	0	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	57	10	10	8	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	14	25	10	28	8	0	0	0	0	0	0	0	0	0	0
Force (kn) =		4709	579	325	587	656	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		5015	807	715	719	895	645	605	376	388	265	254	299	234	37	32
Compression Combined Force (kN) =		-4677	-821	-256	-651	-484	-1076	-1081	-747	-761	-662	-635	-457	-547	-94	19
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.30	0.19	0.17	0.17	0.07	0.14	0.13	0.08	0.08	0.06	0.06	0.07	0.05	0.03	0.03
		0.36	0.32	0.10	0.25	0.05	0.28	0.29	0.20	0.20	0.17	0.17	0.12	0.14	0.30	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder End	Front Transverse Sheave Girder Middle	Back Transverse Sheave Girder	G1	G2/3	G4	G6
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	29960.55	29960.55	3791.43	2096.59	2183.84	2107.49	1000.71
	ULS Min	0	0	-1516	-10	-12	-18	-676
Shear	Fz Max	11694	11694	1455	2818	2874	2781	1568
	Fz Min	-11764	-11764	-1473	-381	-2867	-350	-724
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.550	0.731	0.188	0.201	0.177	0.202	0.190
		0.324	0.615	0.273	0.674	0.688	0.665	0.683

0 - ULS V4		North Tower																	
		Rail Side Columns									HWY Side Columns								
		Front Leg (100-110)									Front Leg (200-209)								
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-7677	-7655	-6926	-6653	-6135	-5929	-5650	-5617	-5394	-7278	-7264	-6442	-5983.95	-5802.38	-5553.39	-5519.97	-5320.23
	ULS Min	-7707	-7666	-6969	-6809	-6272	-6066	-5712	-5650	-5488	-7308	-7275	-6642	-6121.05	-5939.48	-5614.78	-5553.39	-5415.04
IY Bending	ULS Max	0	-66	-85	43	10	41	41	3	246	32	43	44	7.51	44.28	44.28	-3.79	281.04
	ULS Min	-66	-93	-90	-12	-11	10	3	-19	-19	0	32	-8	-9.31	7.35	-3.79	-30.07	-30.07
IZ Bending	ULS Max	0	-29	120	346	-27	147	147	-20	112	75	100	136	139.97	77.73	19.43	110.42	110.42
	ULS Min	-29	-33	20	267	-91	-91	-20	-111	-111	0	75	76	77.72	-147.75	-147.73	19.43	-100.39
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	2	3	3	1	0	1	1	1	9	1	1	1	0	1	2	1	10
	Stress Z	1	1	3	8	2	3	5	4	4	2	2	3	3	3	5	4	4
Force (kn) =		353	472	743	1291	359	695	660	450	1303	369	492	614	512	710	672	491	1428
Tension Combined Force (kN) =		-7323	-7183	-6183	-5362	-5775	-5234	-4990	-5167	-4091	-6909	-6773	-5829	-5472	-5092	-4881	-5029	-3892
Compression Combined Force (kN) =		-8060	-8137	-7711	-8100	-6631	-6761	-6372	-6100	-6791	-7677	-7767	-7256	-6633	-6650	-6287	-6045	-6843
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		0.20	0.20	0.19	0.20	0.16	0.17	0.20	0.19	0.208	0.19	0.19	0.18	0.16	0.17	0.19	0.19	0.21

		North Tower																
		Rail Side Columns									HWY Side Columns								
		Rear Leg (300-310)									Rear Leg (400-409)								
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	-4560	-4549	-3456	-3132	-2797	-2685	-2505	-2367	-2587	-4259.74	-4240.78	-3066.58	-2728.5	-2596.92	-2371.82	-2197.65	-2361.92
	ULS Min	-4573	-4553	-3474	-3201	-2875	-2763	-2583	-2445	-2617	-4272.98	-4245.43	-3153.93	-2806.62	-2675.04	-2449.94	-2275.77	-2392.64
IY Bending	ULS Max	1	5	8	16	13	14	13	156	152	17.62	20.76	13.59	7.1	11.15	11.11	143.43	142.47
	ULS Min	0	1	-42	-26	4	3	3	2	-236	0	12.6	-0.59	0.82	7.09	7.85	7.83	-243.96
IZ Bending	ULS Max	0	-65	-40	278	-31	61	61	81	465	35.08	65.96	108.13	105.73	22.52	34.23	87.88	87.84
	ULS Min	-65	-82	-134	188	-42	-31	-45	-44	81	0	29.91	29.62	22.52	-61.77	-61.77	34.22	-714.64
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	0	0	2	1	1	1	1	7	11	1	1	1	0	1	1	7	12
	Stress Z	2	3	4	9	1	2	2	3	15	1	2	3	3	2	2	3	23
Force (kn) =		163	220	489	786	154	201	199	782	2031	152	240	318	287	194	194	754	2676
Tension Combined Force (kN) =		-4397	-4329	-2967	-2346	-2643	-2485	-2306	-1584	-556	-4107	-4000	-2749	-2441	-2403	-2178	-1444	314
Compression Combined Force (kN) =		-4736	-4773	-3963	-3987	-3029	-2964	-2782	-3227	-4649	-4425	-4486	-3472	-3094	-2869	-2644	-3030	-5069
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01
		0.30	0.31	0.25	0.26	0.19	0.19	0.18	0.21	0.29	0.28	0.29	0.22	0.20	0.18	0.17	0.19	0.32

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
								Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
Top Down Defined		Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	Horizontal 4 (AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
Element #		1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	148.46	148.46	222.29	233.29	277.71	25.35	-242.05	-252.22	-129.63	-143.37	-104.18	-122.71	-141.67	-146.1	-141.87	-231.83	68.04	-973.88
	ULS Min	148.46	148.46	214	220.94	255.66	-21.02	-283.47	-295.05	-174.4	-194.85	-149.78	-171.98	-187.4	-196.16	-187.9	-279.73	54.88	-984.31
IY Bending	ULS Max	0	0	39.18	40.66	40.09	40	7.54	0	7.47	14.32	7.34	18.57	6.13	19.75	6.72	21.29	0	29.6
	ULS Min	0	0	0	0	0	0	-12.38	0	-14.01	0	-13.61	0	-16.59	0	-12.79	0	0	0
IZ Bending	ULS Max	0	0	0	0	0	0	0	0	0.08	1.31	0	0	0	0.97	0	2.81	0	0
	ULS Min	0	0	-6.45	-14.15	-47.22	-54.05	-1.38	0	-0.9	0	-1.39	-0.07	-3.17	0	-7.04	0	0	-6.33
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	14	14	14	14	5	0	6	6	6	8	7	8	5	9	0	10
	Stress Z	0	0	1	2	5	6	0	0	0	0	0	0	0	0	1	0	0	1
Force (kn) =		0	0	257	282	342	355	86	0	96	99	94	125	117	134	99	148	0	196
Tension Combined Force (kN) =		148	148	480	515	620	380	-156	-252	-34	-45	-10	2	-25	-12	-43	-84	68	-778
Compression Combined Force (kN) =		148	148	-43	-61	-87	-376	-369	-295	-270	-293	-244	-297	-305	-331	-287	-428	55	-1180
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.00	0.03	0.10	0.11	0.14	0.08	NA	NA	NA	NA	NA	0.00	NA	NA	NA	NA	0.01	NA
		NA	NA	0.01	0.02	0.02	0.11	0.11	0.09	0.08	0.09	0.08	0.09	0.09	0.10	0.09	0.13	NA	0.33

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
								Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	Horizontal 4 (AD54)	Horizontal 5 (A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
Element #		2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	193.04	278.47	215.74	225.75	266.76	-45.81	-194.99	-205.82	-126.47	-143.84	-101.27	-117.98	-119.01	-157.31	-212.61	-173.34	-768.6	113.04
	ULS Min	193.04	270.88	214.68	224.92	264.79	-50.89	-240.88	-270.64	-178.36	-188.54	-150.61	-163.73	-169.48	-203.06	-261.03	-218.83	-780.24	99.87
IY Bending	ULS Max	0	0	39	38.94	39.32	41.44	0	37.2	13.42	7.6	18.07	7.46	18.6	6.38	20.4	7.5	25.86	0
	ULS Min	0	-18.48	0	0	0	0	-11.16	0	0	-14.05	0	-13.59	0	-16.65	0	-12.79	0	0
IZ Bending	ULS Max	0	0	0	1.2	0	2.28	0	2.04	0.87	0	0.42	0.67	0	0.34	0.69	1.7	0.42	0
	ULS Min	0	-1.44	-0.82	0	-1.04	0	-2.79	-0.02	0	-1.07	0	0	-0.41	-0.21	0	0	-0.42	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	5	14	13	14	14	5	16	6	6	8	6	8	7	9	5	9	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		0	101	245	246	248	263	80	253	92	96	122	92	126	112	138	89	162	0
Tension Combined Force (kN) =		193	380	461	471	514	218	-115	48	-35	-48	21	-26	7	-45	-74	-84	-606	113
Compression Combined Force (kN) =		193	170	-31	-21	17	-314	-321	-524	-270	-285	-273	-256	-295	-315	-399	-308	-942	100
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.07	0.10	0.10	0.11	0.05	NA	0.01	NA	NA	0.01	NA	0.00	NA	NA	NA	NA	0.02
		NA	NA	0.01	0.01	NA	0.09	0.10	0.16	0.08	0.09	0.08	0.08	0.09	0.10	0.12	0.09	0.26	NA

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	212.46	35.59	414.87	63.2	-302.4	-329.56	-281.62	-279.77	-394.57	-394.92	-311.75	-325.72	-63.37	27.77
	ULS Min	212.46	18.59	414.87	53.58	-327.89	-355.06	-307.12	-305.27	-416.92	-417.28	-334.11	-348.08	-71.04	18.93
IY Bending	ULS Max	343.03	0	5.81	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-371.99	-42.12	0	-16.49	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	6.98	0	0.07	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	0.15	-0.15	0	-0.34	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	4	14	2	7	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		328	280	41	118	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		541	315	456	181	-302	-330	-282	-280	-395	-395	-312	-326	-63	28
Compression Combined Force (kN) =		-116	-261	373	-64	-328	-355	-307	-305	-417	-417	-334	-348	-71	19
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.03	0.06	0.10	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.06	NA	0.02	0.09	0.09	0.08	0.08	0.12	0.12	0.10	0.10	0.23	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	184.32	14.77	264.36	62.14	295.82	-227.11	-237.05	-188.8	-198.89	-212.62	-192.77	-73.83	-178.65	-29.5	28.78
	ULS Min	177.77	0.26	244.55	5.07	295.82	-250.1	-260.05	-211.79	-221.88	-235.61	-215.76	-96.83	-201.64	-38.34	20.4
IY Bending	ULS Max	267.74	10.14	18.02	11.59	97.4	0	0	0	0	0	0	0	0	0	0
	ULS Min	-231.73	-20.17	-5.48	-15.47	97.4	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	5.41	1.71	2.35	6.12	23.26	0	0	0	0	0	0	0	0	0	0
	ULS Min	-0.09	0	0	-0.03	23.26	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	3	9	8	7	5	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Force (kn) =		244	147	132	120	316	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		428	162	397	182	612	-227	-237	-189	-199	-213	-193	-74	-179	-30	29
Compression Combined Force (kN) =		-66	-146	112	-115	-20	-250	-260	-212	-222	-236	-216	-97	-202	-38	20
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.03	0.04	0.10	0.04	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.06	NA	0.04	0.00	0.07	0.07	0.06	0.06	0.06	0.06	0.03	0.05	0.12	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder End	Front Transverse Sheave Girder Middle	Back Transverse Sheave Girder	G1	G2/3	G4	G6
	Members	40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	10644.97	10644.97	4388.55	1240.61	4225.34	1120.65	847.99
	ULS Min	0	0	-1417	-19	-12	-18	-654
Shear	Fz Max	4268	4268	1915	188	1930	43	1496
	Fz Min	-4245	-4245	-1932	-442	-1848	-255	-496
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.195	0.260	0.218	0.119	0.343	0.107	0.161
		0.118	0.223	0.359	0.106	0.462	0.061	0.651

1 - ULS 1		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-12621	-12599	-11819	-11545	-10831	-10629	-10290	-10257	-10059	-12260	-12247	-11374	-10720.04	-10546.64	-10245.51	-10212.09	-10036.13
	ULS Min	-12651	-12610	-11861	-11702	-10968	-10766	-10352	-10290	-10153	-12290	-12257	-11573	-10857.14	-10683.74	-10306.9	-10245.51	-10130.93
IY Bending	ULS Max	0	-59	-56	72	66	105	111	113	113	31	42	70	68.75	109	109	105.92	104.13
	ULS Min	-59	-85	-82	65	66	66	105	111	52	0	31	44	64.19	63.98	105.92	104.13	87.78
IZ Bending	ULS Max	0	-42	119	427	-45	269	269	-43	223	88	117	151	160.33	152.05	42.27	212.17	212.16
	ULS Min	-42	-49	-3	267	-164	-164	-43	-213	-213	0	88	11	152.04	-269.88	-269.86	42.27	-205.95
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	2	3	2	2	2	3	4	4	4	1	1	2	2	3	4	4	4
	Stress Z	1	1	3	10	3	6	9	7	7	2	3	4	3	6	9	7	7
Force (kn) =		369	492	709	1669	874	1414	1335	1153	1188	407	544	766	873	1436	1333	1124	1117
Tension Combined Force (kN) =		-12252	-12107	-11110	-9876	-9957	-9216	-8955	-9103	-8871	-11853	-11702	-10607	-9847	-9110	-8912	-9088	-8919
Compression Combined Force (kN) =		-13020	-13102	-12570	-13371	-11842	-12180	-11687	-11443	-11342	-12698	-12802	-12339	-11730	-12120	-11640	-11369	-11248
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		0.32	0.33	0.31	0.33	0.29	0.30	0.36	0.35	0.347	0.32	0.32	0.31	0.29	0.30	0.36	0.35	0.34

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	-4054	-4043	-2907	-2583	-2297	-2195	-1993	-1843	-1979	-3769.65	-3750.68	-2538.8	-2240.97	-2115.07	-1865.97	-1683.36	-1754.26
	ULS Min	-4068	-4048	-2925	-2652	-2376	-2273	-2071	-1921	-2009	-3782.89	-3755.33	-2626.16	-2319.09	-2193.19	-1944.09	-1761.48	-1784.98
IY Bending	ULS Max	2	7	9	47	44	43	43	160	156	14.24	17.27	29.4	31.81	41.51	45.54	161.26	161.8
	ULS Min	0	2	-39	-21	28	27	42	42	-166	0	8.41	9.39	30.72	31.78	41.44	45.51	-210.64
IZ Bending	ULS Max	0	-66	-38	281	-24	49	49	94	315	34.58	64.66	108.42	100.92	16.12	30.65	37.83	37.8
	ULS Min	-66	-82	-128	171	-39	-24	-41	-40	94	0	29.58	29.83	16.13	-50.11	-50.11	30.64	-500.58
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	0	0	2	2	2	2	2	8	8	1	1	1	2	2	2	8	10
	Stress Z	2	3	4	9	1	2	2	3	10	1	2	3	3	2	2	1	16
Force (kn) =		169	228	460	870	262	283	284	831	1397	139	224	377	368	279	294	697	2023
Tension Combined Force (kN) =		-3885	-3815	-2447	-1713	-2035	-1912	-1709	-1013	-582	-3631	-3527	-2161	-1873	-1836	-1572	-986	269
Compression Combined Force (kN) =		-4237	-4276	-3386	-3522	-2638	-2556	-2355	-2752	-3407	-3921	-3979	-3004	-2687	-2472	-2238	-2459	-3808
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01
		0.27	0.27	0.22	0.23	0.17	0.16	0.15	0.17	0.21	0.25	0.26	0.19	0.17	0.16	0.14	0.16	0.24

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
								Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	Horizontal 4 (AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	192.32	192.32	296.47	324.04	406.44	150.86	-303.89	-322.66	-184.01	-201.13	-150.47	-171.41	-218.1	-228.43	-244.64	-268.4	-38.08	-879.92
	ULS Min	192.32	192.32	287.39	306.84	378.24	104.1	-345.18	-367.55	-228.22	-254.97	-195.65	-222.86	-263.16	-281.55	-290.21	-319.41	-51.24	-890.84
IY Bending	ULS Max	0	0	39.75	41.13	40.4	39.6	3.32	0	5.38	16.26	5.32	20.76	3.23	22.95	4.46	23.83	0	28.69
	ULS Min	0	0	0	0	0	0	-19.31	0	-20.38	0	-19.87	0	-25.38	0	-21.07	0	0	0
IZ Bending	ULS Max	0	0	0	0.25	0	0	0	0	0.46	1.14	0	0.17	0	0.77	0	2.3	0	0
	ULS Min	0	0	-5.51	-7.81	-34.34	-38.57	-1.2	0	-0.5	0	-0.56	0	-2.94	0	-5.54	0	0	-5.57
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	14	14	14	14	8	0	8	7	8	9	11	10	9	10	0	10
	Stress Z	0	0	1	1	4	4	0	0	0	0	0	0	0	0	1	0	0	1
Force (kn) =		0	0	259	272	319	322	132	0	138	111	134	140	176	155	151	164	0	189
Tension Combined Force (kN) =		192	192	556	596	726	473	-172	-323	-46	-90	-16	-32	-42	-73	-93	-104	-38	-691
Compression Combined Force (kN) =		192	192	28	35	59	-218	-477	-368	-366	-366	-330	-363	-439	-437	-442	-484	-51	-1080
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.04	0.12	0.13	0.16	0.10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.06	0.15	0.11	0.11	0.11	0.10	0.11	0.14	0.13	0.14	0.15	0.01	0.30

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
								Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	Horizontal 4 (AD54)	Horizontal 5 (A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	235.17	369.03	293.09	318.36	399.22	94.48	-264.8	-256.71	-181.1	-203.53	-148.79	-165.7	-202.68	-233.77	-251.31	-271.67	-663.82	-30.7
	ULS Min	235.17	360.18	292.13	317.59	397.72	90.45	-312.05	-323.57	-235.39	-247.75	-200.32	-210.99	-256.21	-278.96	-302.86	-316.67	-676.04	-43.86
IY Bending	ULS Max	0	0	39.24	39.24	39.53	41.04	0	40.64	15.17	5.49	20.34	5.35	21.77	3.48	23.12	5.12	24.81	0
	ULS Min	0	-26.74	0	0	0	0	-6.28	0	0	-20.44	0	-19.87	0	-25.45	0	-21.22	0	0
IZ Bending	ULS Max	0	0	0	1.18	0	1.74	0	2.41	0.89	0	0.41	0.09	0	0.71	0.65	1.04	0.28	0
	ULS Min	0	-1.81	-1.26	0	-0.8	0	-3.3	0	0	-1.41	0	-0.16	-0.4	0	0	0	-0.53	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	8	14	14	14	14	3	17	6	9	8	8	9	11	10	9	9	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		0	146	248	247	249	260	48	277	103	140	137	134	147	172	156	144	156	0
Tension Combined Force (kN) =		235	515	541	566	648	354	-217	20	-78	-64	-11	-32	-56	-62	-95	-127	-508	-31
Compression Combined Force (kN) =		235	214	45	70	149	-169	-360	-601	-339	-388	-338	-345	-403	-451	-459	-461	-832	-44
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.10	0.12	0.12	0.14	0.08	NA	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.05	0.11	0.19	0.10	0.12	0.10	0.11	0.12	0.14	0.14	0.14	0.23	0.01

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	344.77	63.9	748.05	110.69	-520.83	-552.44	-549.37	-542.63	-694.52	-700.91	-622.34	-627.67	-131.7	23.21
	ULS Min	344.77	47.2	748.05	102.82	-546.32	-577.93	-574.87	-568.13	-716.88	-723.26	-644.69	-650.03	-139.37	14.37
IY Bending	ULS Max	521.15	0	23.92	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-472.29	-50.69	0	-15.17	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	4.76	0	0.06	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	0.41	-0.45	0	-0.96	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	5	17	9	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		440	337	170	109	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		784	401	918	220	-521	-552	-549	-543	-695	-701	-622	-628	-132	23
Compression Combined Force (kN) =		-95	-290	578	-7	-546	-578	-575	-568	-717	-723	-645	-650	-139	14
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.04	0.08	0.20	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.07	NA	0.00	0.14	0.15	0.15	0.15	0.21	0.22	0.19	0.19	0.45	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	157.45	11.32	213.2	51.64	196.68	-193.93	-198.25	-143.58	-157.42	-175.9	-157.14	-48.03	-130.93	-18.5	29.38
	ULS Min	152.42	-1.97	199.57	8.56	196.68	-216.92	-221.25	-166.57	-180.42	-198.9	-180.14	-71.02	-153.93	-27.34	20.99
IY Bending	ULS Max	237.22	10.44	16.97	11.76	98.6	0	0	0	0	0	0	0	0	0	0
	ULS Min	-210.57	-19.68	-7.63	-15.93	98.6	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	6	3.52	3.3	5.53	17.14	0	0	0	0	0	0	0	0	0	0
	ULS Min	-5.94	0	0	0	17.14	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	3	9	8	7	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Force (kn) =		222	146	126	123	303	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		380	157	340	174	499	-194	-198	-144	-157	-176	-157	-48	-131	-19	29
Compression Combined Force (kN) =		-70	-148	73	-114	-106	-217	-221	-167	-180	-199	-180	-71	-154	-27	21
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.02	0.04	0.08	0.04	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.06	NA	0.04	0.01	0.06	0.06	0.04	0.05	0.05	0.05	0.02	0.04	0.09	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder End	Front Transverse Sheave Girder Middle	Back Transverse Sheave Girder	G1	G2/3	G4	G6
	Members	40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	23794.44	23794.44	3450.83	1624.31	1927.54	1630.7	812.32
	ULS Min	0	0	-1015	-10	-12	-10	-542
Shear	Fz Max	9424	9424	1363	2193	2322	2156	1155
	Fz Min	-9348	-9348	-1357	-337	-2250	-323	-362
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.437	0.580	0.171	0.156	0.156	0.156	0.155
		0.260	0.493	0.253	0.525	0.556	0.516	0.503

1 - ULS 4		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-6641	-6619	-6482	-6345	-7927	-8540	-9763	-9731	-9916	-6624	-6611	-6176	-7824.36	-8292.31	-9562.09	-9529.21	-9714.49
	ULS Min	-18323	-18278	-17216	-17068	-14012	-13158	-11232	-11170	-10673	-17873	-17839	-16779	-13673.3	-12922.91	-11058.46	-10996.54	-10500.74
IY Bending	ULS Max	1829	2464	2464	1898	645	453	1228	1228	531	1731	2331	2331	577.87	483.62	1162.25	1162.25	546.12
	ULS Min	-1703	-2295	-2291	-1620	-528	-265	-847	-847	-342	-1626	-2198	-2194	-422.93	-250.74	-917.56	-917.56	-322.89
IZ Bending	ULS Max	1549	1967	3466	11262	2344	759	759	96	590	1534	2003	10630	2479.55	375.16	1107.42	1107.42	235.45
	ULS Min	-1590	-2022	-3357	-10336	-2429	-396	-1116	-1116	-245	-1372	-1796	-10702	-2207.11	-760.72	-760.84	-109.85	-546.86
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	54	73	73	56	20	14	43	43	19	51	69	69	18	15	41	41	19
	Stress Z	39	50	85	276	51	16	36	36	19	38	49	262	52	16	36	36	18
Force (kn) =		12334	16227	20918	44025	11270	4762	8416	8416	4007	11769	15643	43905	11106	4920	8139	8139	3916
Tension Combined Force (kN) =		5692	9607	14436	37680	3342	-3779	-1348	-1315	-5909	5144	9033	37729	3282	-3372	-1423	-1390	-5799
Compression Combined Force (kN) =		-30657	-34504	-38133	-61094	-25282	-17920	-19648	-19586	-14680	-29641	-33483	-60684	-24780	-17843	-19198	-19136	-14416
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	0.13	0.22	0.33	0.87	0.06	NA	NA	NA	NA	0.12	0.21	0.87	0.06	NA	NA	NA	NA
		0.76	0.86	0.95	1.52	0.63	0.45	0.60	0.60	0.450	0.74	0.83	1.51	0.62	0.44	0.59	0.59	0.44

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	2419	2430	2402	2572	1125	-2	-670	-794	-1229	2388.02	2408.17	2594.53	1225.25	185.9	-497.56	-641.54	-1061.03
	ULS Min	-9351	-9331	-7086	-6970	-4828	-3344	-2108	-1596	-1407	-8683.93	-8654.49	-6501.63	-4525.42	-3181.91	-1996.84	-1438.99	-1210.72
IY Bending	ULS Max	714	956	960	510	268	69	95	159	162	577.44	782.1	786.18	256.8	72.09	95.22	162.74	163.57
	ULS Min	-632	-855	-854	-470	-189	23	24	23	-143	-543.22	-740	-739.68	-178.98	26.65	20.8	20.81	-267.58
IZ Bending	ULS Max	640	714	978	5172	876	116	68	278	454	488.16	586.13	4842.41	907.8	133.73	43.36	188.25	188.28
	ULS Min	-680	-784	-1036	-4853	-927	-146	-54	-95	-96	-458.53	-537.35	-4780.71	-780.09	-124.38	-68.79	-186.66	-599.99
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	34	46	46	24	13	3	5	8	8	28	38	38	12	3	5	8	13
	Stress Z	21	25	33	163	29	5	2	9	14	15	19	153	29	4	2	6	19
Force (kn) =		4350	5511	6151	14665	3289	620	524	1281	1724	3366	4374	14887	3200	600	526	1074	2482
Tension Combined Force (kN) =		6769	7941	8553	17237	4414	618	-146	487	495	5754	6782	17481	4426	786	29	432	1421
Compression Combined Force (kN) =		-13701	-14842	-13237	-21636	-8117	-3964	-2632	-2877	-3131	-12050	-13028	-21389	-7726	-3782	-2523	-2513	-3692
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	0.31	0.36	0.39	0.79	0.20	0.03	NA	0.02	0.02	0.26	0.31	0.80	0.20	0.04	0.00	0.02	0.07
		0.88	0.95	0.85	1.39	0.52	0.25	0.17	0.18	0.19	0.77	0.84	1.37	0.49	0.24	0.16	0.16	0.23

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
								Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	Horizontal 4 (AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	767.64	767.64	383.29	396.44	586.52	126.81	1235.92	1135.78	763.93	800.13	786.85	843.55	475.63	420.81	-21.02	-19.66	143.89	-683.43
	ULS Min	-327.02	-327.02	161.77	181.51	144.16	-19.01	-2004.85	-1638.9	-1282.31	-1138.98	-1242.08	-1112.25	-1039.1	-837.28	-577.55	-537.26	-20.81	-839.08
IY Bending	ULS Max	0	0	56.32	55.33	49.5	44.2	14.35	0	17.61	28.08	18.43	39.75	11.18	36.09	7.09	28.54	0	28.09
	ULS Min	0	0	0	0	0	0	-40.36	0	-32.71	-4.73	-31.17	-1.13	-33.13	0	-25.54	0	0	0
IZ Bending	ULS Max	0	0	82.72	112.06	74.26	38.87	98.35	0	91.45	31.84	72.1	4.99	76.04	8.69	77.48	9.79	0	7.34
	ULS Min	0	0	-70.54	-101.65	-110.11	-78.66	-51.66	0	-45.37	-35.35	-21.71	-8.97	-26.69	-12.2	-27.54	-10.37	0	-8.09
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	20	19	17	15	17	0	14	12	13	17	14	15	11	12	0	10
	Stress Z	0	0	9	12	12	8	11	0	10	4	8	1	9	1	9	1	0	1
	Force (kn) =	0	0	513	564	523	429	449	0	385	253	340	283	360	264	312	210	0	190
	Tension Combined Force (kN) =	768	768	896	960	1110	556	1685	1136	1149	1053	1127	1127	836	685	291	191	144	-494
	Compression Combined Force (kN) =	-327	-327	-351	-382	-379	-448	-2454	-1639	-1668	-1392	-1582	-1395	-1399	-1102	-889	-748	-21	-1029
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.15	0.20	0.21	0.24	0.12	0.41	0.27	0.28	0.25	0.27	0.27	0.20	0.16	0.07	0.05	0.03	NA
		0.01	0.09	0.10	0.11	0.11	0.13	0.76	0.51	0.51	0.43	0.49	0.43	0.43	0.34	0.27	0.23	0.01	0.29

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
								Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	Horizontal 4 (AD54)	Horizontal 5 (A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	731.6	482.63	365.24	379.03	569.64	64.48	1018.72	1153.76	690.54	688.53	754.55	750.38	388.53	465.93	-11.33	-33.63	-501.19	167.74
	ULS Min	-319.62	193.07	163.58	209.56	175.9	-41.75	-1496.87	-1765.65	-1040.58	-1161.39	-1046.08	-1147.36	-795.64	-990.71	-519.13	-590.67	-614.42	-16.53
IY Bending	ULS Max	0	57.71	51.38	48.68	44.74	42.79	6.79	71.91	36.78	18.06	38.02	17.5	34.14	11.02	27.52	7.91	24.26	0
	ULS Min	0	-108.3	0	0	0	0	-16.63	-2.57	-7.89	-31.96	0	-30.86	0	-32.81	0	-25.24	0	0
IZ Bending	ULS Max	0	29.62	34.76	38.8	37.15	34.06	112.48	37.21	16.96	23.14	6.48	14.69	6.16	16.22	6.95	17.48	2.15	0
	ULS Min	0	-52.61	-12.68	-10.23	-10.37	-9.84	-65.48	-38.94	-13.04	-71.3	-1.6	-65.87	-1.96	-68.57	-1.6	-75.68	-9.96	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	31	18	17	16	15	7	30	15	13	16	13	14	14	11	11	9	0
	Stress Z	0	5	4	4	4	4	13	4	2	8	1	7	1	8	1	9	1	0
	Force (kn) =	0	671	389	380	352	334	315	553	278	344	267	327	240	345	197	307	169	0
	Tension Combined Force (kN) =	732	1154	754	759	921	398	1334	1707	968	1032	1022	1077	629	810	186	273	-332	168
	Compression Combined Force (kN) =	-320	-478	-225	-170	-176	-375	-1812	-2319	-1318	-1505	-1313	-1474	-1036	-1335	-716	-897	-784	-17
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.23	0.16	0.17	0.20	0.09	0.32	0.41	0.23	0.25	0.25	0.26	0.15	0.20	0.04	0.07	NA	0.04
		0.01	0.13	0.06	0.05	0.05	0.11	0.56	0.72	0.41	0.46	0.40	0.45	0.32	0.41	0.22	0.28	0.22	0.00

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	413.33	412.53	850.76	172.18	1235.48	1159.29	660.09	707.92	280.31	226.27	-154.85	-121.11	-96.02	23.72
	ULS Min	255.74	-269.27	598.18	-472.8	-2330.14	-2397.01	-1911.7	-1861.05	-1730.63	-1780.11	-1232.81	-1203.53	-179.88	13.69
IY Bending	ULS Max	8153.17	0	26.64	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-8896.4	-57.41	0	-16.18	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	146.31	237.21	73.42	268.54	0	0	0	0	0	0	0	0	0	0
	ULS Min	-70.62	-113.84	-35.15	-99.31	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	90	19	11	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	7	17	6	22	0	0	0	0	0	0	0	0	0	0
Force (kn) =		7766	733	298	511	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		8180	1145	1149	683	1235	1159	660	708	280	226	-155	-121	-96	24
Compression Combined Force (kN) =		-7511	-1002	300	-983	-2330	-2397	-1912	-1861	-1731	-1780	-1233	-1204	-180	14
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.40	0.22	0.25	0.15	0.24	0.22	0.13	0.14	0.06	0.05	NA	NA	NA	0.02
		0.48	0.25	NA	0.27	0.61	0.63	0.50	0.49	0.52	0.53	0.37	0.36	0.58	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	240.08	207.39	296.58	109.81	137.26	648.81	613.77	408.05	426.01	301.13	282.89	322.97	286.31	47.09	32.23
	ULS Min	-16.44	-231.94	0.22	-72.2	77.9	-959.29	-961.43	-641.79	-648.66	-564.87	-548.34	-383.33	-444.42	-75.9	19.6
IY Bending	ULS Max	3975.35	15.81	20.3	16.26	115.1	0	0	0	0	0	0	0	0	0	0
	ULS Min	-4319.44	-22.62	-13.6	-18.62	89.4	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	169.1	239.96	97.79	267.72	123.52	0	0	0	0	0	0	0	0	0	0
	ULS Min	-100.6	-120.83	-56.23	-136.94	0	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	52	10	9	8	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	13	24	10	26	7	0	0	0	0	0	0	0	0	0	0
Force (kn) =		4355	544	301	560	633	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		4595	751	597	669	770	649	614	408	426	301	283	323	286	47	32
Compression Combined Force (kN) =		-4372	-776	-301	-632	-555	-959	-961	-642	-649	-565	-548	-383	-444	-76	20
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.27	0.18	0.14	0.16	0.06	0.14	0.13	0.09	0.09	0.07	0.06	0.07	0.06	0.04	0.03
		0.34	0.30	0.12	0.24	0.06	0.25	0.25	0.17	0.17	0.15	0.14	0.10	0.12	0.24	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder End	Front Transverse Sheave Girder Middle	Back Transverse Sheave Girder	G1	G2/3	G4	G6
	Members	40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	25026.27	25026.27	2288.75	1789.65	1846.33	1754.27	495
	ULS Min	0	0	-1096	-10	-12	-17	-483
Shear	Fz Max	9892	9892	949	2405	2420	2317	1120
	Fz Min	-9928	-9928	-992	-263	-2433	-259	-658
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.459	0.610	0.114	0.171	0.150	0.168	0.094
		0.273	0.519	0.184	0.575	0.582	0.554	0.487

1 - ULS V1		North Tower																	
		Rail Side Columns									HWY Side Columns								
		Front Leg (100-110)									Front Leg (200-209)								
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-14451	-14429	-13618	-13345	-12566	-12366	-12006	-11973	-11780	-14101	-14087	-13186	-12464.37	-12294.74	-11972.57	-11939.16	-11769.01
	ULS Min	-14481	-14440	-13661	-13501	-12703	-12503	-12068	-12006	-11875	-14131	-14098	-13385	-12601.46	-12431.84	-12033.96	-11972.57	-11863.81
IY Bending	ULS Max	0	-60	-49	83	85	123	142	152	152	33	43	88	86.95	127.16	136.13	140.9	140.9
	ULS Min	-60	-86	-83	78	80	80	123	142	-1	0	33	45	78.44	78.21	127.16	136.13	37.32
IZ Bending	ULS Max	0	-47	120	451	-53	313	313	-51	261	93	123	160	179.5	179.52	50.64	249.54	249.53
	ULS Min	-47	-55	-9	267	-191	-191	-51	-249	-249	0	92	-18	166.9	-314.82	-314.79	50.64	-244.9
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	2	3	2	2	3	4	5	5	5	1	1	3	3	4	5	5	5
	Stress Z	1	1	3	11	4	7	10	8	8	2	3	4	4	7	10	8	8
Force (kn) =		386	515	714	1793	1053	1649	1604	1421	1463	428	570	865	1027	1676	1589	1383	1382
Tension Combined Force (kN) =		-14065	-13914	-12904	-11552	-11513	-10717	-10402	-10552	-10317	-13672	-13517	-12321	-11438	-10619	-10384	-10557	-10387
Compression Combined Force (kN) =		-14867	-14955	-14375	-15294	-13757	-14153	-13672	-13427	-13337	-14559	-14668	-14250	-13628	-14108	-13623	-13355	-13246
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		0.37	0.37	0.36	0.38	0.34	0.35	0.42	0.41	0.408	0.36	0.36	0.35	0.34	0.35	0.42	0.41	0.41

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	-4256	-4245	-3081	-2757	-2469	-2371	-2164	-2013	-2140	-3971.9	-3952.93	-2715.57	-2414.39	-2290.89	-2036.05	-1849.75	-1905.77
	ULS Min	-4270	-4250	-3099	-2826	-2548	-2449	-2242	-2092	-2171	-3985.14	-3957.59	-2802.93	-2492.51	-2369.01	-2114.17	-1927.87	-1936.49
IY Bending	ULS Max	2	8	11	56	53	52	53	172	168	13.72	16.75	36.72	38.25	50	54.9	175.5	176.37
	ULS Min	0	2	-40	-22	34	33	51	52	-173	0	7.69	8.66	38.1	38.22	49.92	54.88	-228.79
IZ Bending	ULS Max	0	-67	-38	280	-27	54	53	108	331	35.45	65.85	108.23	102.89	18.41	34.14	37.44	37.42
	ULS Min	-67	-84	-129	177	-40	-26	-45	-43	108	0	30.45	28.97	18.42	-54.4	-54.4	34.12	-536.7
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	0	0	2	3	3	2	3	8	8	1	1	2	2	2	3	8	11
	Stress Z	2	3	4	9	1	2	2	3	10	1	2	3	3	2	2	1	17
Force (kn) =		175	236	469	901	297	325	330	911	1463	139	225	404	397	321	340	749	2180
Tension Combined Force (kN) =		-4082	-4010	-2612	-1857	-2173	-2045	-1834	-1103	-677	-3833	-3728	-2311	-2017	-1970	-1696	-1100	275
Compression Combined Force (kN) =		-4444	-4485	-3568	-3727	-2844	-2774	-2572	-3003	-3634	-4124	-4183	-3207	-2889	-2690	-2454	-2677	-4117
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01
		0.28	0.29	0.23	0.24	0.18	0.18	0.16	0.19	0.23	0.26	0.27	0.21	0.18	0.17	0.16	0.17	0.26

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	218.24	218.24	337.66	370.61	467.75	211.73	-343.42	-364.69	-212.86	-231.36	-175.42	-197.88	-254.31	-267.8	-284.6	-296.82	-95.66	-886.01
	ULS Min	218.24	218.24	326.87	350.57	434.37	157.09	-384.73	-410.09	-257	-285.76	-220.57	-249.79	-299.3	-321.64	-330.19	-348.51	-108.83	-896.88
IY Bending	ULS Max	0	0	39.89	41.46	40.52	39.11	2.28	0	4.9	17.07	4.88	21.79	2.44	24.42	3.83	25.17	0	29.06
	ULS Min	0	0	0	0	0	0	-21.01	0	-22	0	-21.41	0	-27.84	0	-23.32	0	0	0
IZ Bending	ULS Max	0	0	0	0.3	0	0	0	0	0.54	1.13	0	0.24	0	0.89	0	2.68	0	0
	ULS Min	0	0	-6.14	-8.72	-38.7	-43.97	-1.21	0	-0.44	0	-0.63	0	-3.44	0	-6.01	0	0	-5.9
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	14	14	14	14	9	0	9	7	9	9	12	10	10	10	0	10
	Stress Z	0	0	1	1	4	5	0	0	0	0	0	0	0	0	1	0	0	1
Force (kn) =		0	0	261	276	328	330	143	0	149	117	145	147	193	166	167	174	0	192
Tension Combined Force (kN) =		218	218	599	647	796	542	-200	-365	-64	-115	-31	-51	-61	-102	-117	-123	-96	-694
Compression Combined Force (kN) =		218	218	66	75	106	-173	-528	-410	-406	-402	-365	-397	-492	-487	-498	-522	-109	-1089
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.04	0.13	0.14	0.17	0.12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.05	0.16	0.13	0.12	0.12	0.11	0.12	0.15	0.15	0.15	0.16	0.03	0.30

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	261.55	418.31	334.36	364.99	460.67	147.79	-303.3	-290.75	-210.28	-234.31	-174.25	-191.64	-240.76	-271.2	-279.56	-315.68	-644.89	-89.33
	ULS Min	261.55	408.64	333.13	363.94	458.97	143.87	-351.34	-359.38	-265.17	-278.47	-226.23	-236.91	-295.06	-316.33	-331.83	-360.61	-657.23	-102.5
IY Bending	ULS Max	0	0	39.3	39.3	39.59	40.91	0	42.66	15.91	5.01	21.37	4.89	23.11	2.71	24.43	4.58	24.7	0
	ULS Min	0	-31.64	0	0	0	0	-5.29	0	0	-22.06	0	-21.42	0	-27.91	0	-23.44	0	0
IZ Bending	ULS Max	0	0	0	1.29	0	1.66	0	2.64	0.91	0	0.47	0	0	0.81	0.72	0.9	0.26	0
	ULS Min	0	-2.05	-1.5	0	-0.89	0	-3.61	0	0	-1.57	0	-0.24	-0.46	0	0	0	-0.55	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	9	14	14	14	14	2	18	7	9	9	9	10	12	10	10	9	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		0	172	248	248	249	259	42	291	108	151	144	144	156	189	165	159	155	0
Tension Combined Force (kN) =		262	591	583	613	710	407	-261	0	-102	-83	-30	-47	-85	-82	-114	-157	-490	-89
Compression Combined Force (kN) =		262	236	85	116	210	-115	-393	-651	-374	-429	-371	-381	-451	-505	-497	-520	-812	-103
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.12	0.13	0.13	0.16	0.09	NA	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.03	0.12	0.20	0.12	0.13	0.11	0.12	0.14	0.16	0.15	0.16	0.23	0.03

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	393.57	74.38	871.4	129.29	-602.83	-633.06	-646.58	-640.94	-807.33	-812.04	-734.33	-742.06	-156.86	21.53
	ULS Min	393.57	57.86	871.4	120.94	-628.32	-658.55	-672.07	-666.44	-829.69	-834.4	-756.69	-764.42	-164.53	12.68
IY Bending	ULS Max	586.81	0	30.62	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-504.46	-53.85	0	-14.67	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	4	0	0.05	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	0.51	-0.56	0	-1.19	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	6	18	12	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		489	358	218	106	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		883	433	1089	235	-603	-633	-647	-641	-807	-812	-734	-742	-157	22
Compression Combined Force (kN) =		-96	-300	653	15	-628	-659	-672	-666	-830	-834	-757	-764	-165	13
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.04	0.08	0.24	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.07	NA	NA	0.17	0.17	0.18	0.18	0.25	0.25	0.23	0.23	0.53	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	166.04	12.32	231.04	57.82	212.83	-206.18	-211.83	-159.46	-172.51	-189.02	-169.84	-57.29	-147.85	-22.35	29.2
	ULS Min	159.9	-1.16	216.14	9.88	212.83	-229.17	-234.82	-182.45	-195.5	-212.02	-192.83	-80.28	-170.84	-31.19	20.81
IY Bending	ULS Max	248.25	10.41	17.45	11.83	97.64	0	0	0	0	0	0	0	0	0	0
	ULS Min	-217.15	-19.86	-6.91	-15.76	97.64	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	6.32	4.13	3.63	6.07	18.13	0	0	0	0	0	0	0	0	0	0
	ULS Min	-7.65	0	0	0	18.13	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	3	9	8	7	5	0	0	0	0	0	0	0	0	0	0
	Stress Z	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Force (kn) =		240	148	130	122	303	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		406	161	361	180	516	-206	-212	-159	-173	-189	-170	-57	-148	-22	29
Compression Combined Force (kN) =		-80	-150	86	-112	-90	-229	-235	-182	-196	-212	-193	-80	-171	-31	21
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.02	0.04	0.09	0.04	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.06	NA	0.04	0.01	0.06	0.06	0.05	0.05	0.06	0.05	0.02	0.05	0.10	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder End	Front Transverse Sheave Girder Middle	Back Transverse Sheave Girder	G1	G2/3	G4	G6
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	28341.42	28341.42	3703.82	1961.72	2330.47	1951.5	814.2
	ULS Min	0	0	-1088	-10	-12	-10	-552
Shear	Fz Max	11243	11243	1472	2644	2791	2556	1280
	Fz Min	-11132	-11132	-1490	-366	-2706	-360	-402
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.520	0.691	0.184	0.188	0.189	0.187	0.155
		0.310	0.588	0.276	0.632	0.668	0.612	0.557

1 - ULSE V2		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-9810	-9788	-9482	-9262	-10426	-10922	-11888	-11855	-11990	-9569	-9556	-9015	-10289.76	-10675.16	-11701.65	-11668.69	-11817.17
	ULS Min	-19827	-19783	-18689	-18475	-15662	-14900	-13156	-13094	-12653	-19215	-19182	-18132	-15322.72	-14663.82	-12993.03	-12931.18	-12504.65
IY Bending	ULS Max	1531	2058	2059	1667	564	414	1094	1094	505	1508	2032	2032	505.99	440.66	1035.33	1035.33	514.27
	ULS Min	-1497	-2021	-2017	-1348	-442	-202	-684	-684	-329	-1370	-1850	-1846	-351.84	-188.8	-747.37	-747.37	-271.62
IZ Bending	ULS Max	1316	1676	3078	9874	2026	742	742	10	581	1363	1784	9243	2202.59	371.71	963.98	963.98	274.64
	ULS Min	-1375	-1743	-2770	-8638	-2065	-398	-972	-972	-282	-1128	-1471	-9042	-1814.54	-743.99	-744.08	-21.33	-538.43
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	45	61	61	49	18	13	38	38	18	45	60	60	16	14	36	36	18
	Stress Z	34	43	75	242	43	16	31	31	19	33	44	226	46	16	31	31	17
Force (kn) =		10466	13730	18071	38611	9656	4511	7419	7419	3878	10338	13763	37994	9830	4652	7173	7173	3768
Tension Combined Force (kN) =		656	3942	8589	29349	-770	-6411	-4469	-4436	-8112	768	4207	28979	-460	-6023	-4528	-4495	-8049
Compression Combined Force (kN) =		-30292	-33513	-36760	-57087	-25318	-19412	-20574	-20513	-16531	-29553	-32945	-56126	-25152	-19316	-20166	-20104	-16272
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	0.02	0.09	0.20	0.68	NA	NA	NA	NA	NA	0.02	0.10	0.67	NA	NA	NA	NA	NA
		0.75	0.83	0.91	1.42	0.63	0.48	0.63	0.63	0.506	0.73	0.82	1.39	0.62	0.48	0.62	0.62	0.50

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	498	509	752	1078	-88	-1048	-1597	-1692	-2059	666.51	685.21	1070.98	-29.45	-902.53	-1438.2	-1535.58	-1848.72
	ULS Min	-9593	-9572	-7383	-7110	-5202	-3924	-2840	-2390	-2215	-8825.63	-8797.74	-6738.2	-4969.75	-3800.39	-2734.46	-2230.27	-1981.42
IY Bending	ULS Max	611	825	830	422	245	73	89	191	192	508.91	681.08	683.76	225.95	74.68	88.72	194.22	194.52
	ULS Min	-543	-727	-726	-418	-147	25	27	26	-189	-451.66	-623.57	-624.12	-147.57	35.74	24.93	24.94	-308.14
IZ Bending	ULS Max	501	560	833	4532	749	86	83	275	561	440.41	545.46	4272.42	828.28	123.94	53.05	184.61	184.61
	ULS Min	-631	-724	-893	-4061	-796	-139	-65	-65	-46	-371.04	-417.52	-3975.97	-618.48	-97.29	-84.17	-136.74	-772.8
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	29	40	40	20	12	3	4	9	9	24	33	33	11	4	4	9	15
	Stress Z	20	23	28	143	25	4	3	9	18	14	17	135	26	4	3	6	24
Force (kn) =		3841	4874	5309	12758	2878	615	535	1393	2102	2992	3895	13098	2889	585	540	1182	3060
Tension Combined Force (kN) =		4339	5383	6061	13837	2790	-432	-1061	-299	44	3658	4580	14169	2859	-317	-898	-353	1211
Compression Combined Force (kN) =		-13434	-14446	-12692	-19869	-8080	-4540	-3376	-3784	-4318	-11817	-12693	-19836	-7859	-4386	-3274	-3413	-5041
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	0.20	0.25	0.28	0.64	0.13	NA	NA	NA	0.00	0.17	0.21	0.65	0.13	NA	NA	NA	0.06
		0.86	0.93	0.81	1.27	0.51	0.29	0.21	0.24	0.27	0.76	0.81	1.27	0.50	0.28	0.21	0.22	0.31

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
								Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	Horizontal 4 (AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	712.74	712.74	439.55	458.5	643.1	255.43	942.4	849.18	583.96	605.14	613.67	652.25	321.65	265.48	-98.87	-102.32	-37.87	-834.81
	ULS Min	-225.53	-225.53	249.68	274.28	263.94	114.24	-1841.44	-1535.77	-1176.38	-1064.88	-1132.01	-1031.51	-983.26	-820.74	-582.76	-553.58	-180.92	-969.17
IY Bending	ULS Max	0	0	54.09	53.91	48.46	42.88	12.29	0	15.7	25.37	16.46	38.65	9.55	36.37	6.09	29.9	0	30.46
	ULS Min	0	0	0	0	0	0	-38.16	0	-31.83	-2.75	-30.27	0	-33.76	0	-26.75	0	0	0
IZ Bending	ULS Max	0	0	68.47	92.3	48.87	27.99	83.4	0	77.51	28.31	61.68	4.33	64.35	7.81	63.98	9.25	0	4.62
	ULS Min	0	0	-62.91	-90.88	-109.16	-83.68	-45.59	0	-39.76	-29.29	-18.74	-7.74	-23.72	-10.27	-26.07	-8.22	0	-9.25
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	19	19	17	15	16	0	13	11	13	16	14	15	11	12	0	11
	Stress Z	0	0	7	10	12	9	9	0	9	3	7	1	7	1	7	1	0	1
Force (kn) =		0	0	471	516	515	431	407	0	354	223	315	274	343	263	296	217	0	207
Tension Combined Force (kN) =		713	713	911	975	1158	686	1350	849	938	829	929	926	665	528	197	115	-38	-628
Compression Combined Force (kN) =		-226	-226	-221	-242	-251	-316	-2249	-1536	-1531	-1288	-1447	-1305	-1327	-1084	-878	-771	-181	-1176
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.14	0.20	0.21	0.25	0.15	0.32	0.20	0.23	0.20	0.22	0.22	0.16	0.13	0.05	0.03	NA	NA
		0.01	0.06	0.06	0.07	0.07	0.09	0.70	0.47	0.47	0.40	0.45	0.40	0.41	0.33	0.27	0.24	0.05	0.33

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
								Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	Horizontal 4 (AD54)	Horizontal 5 (A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	722.43	547.75	424.04	443.81	630.66	190.04	776.87	882.81	519.42	508.81	585.88	573.21	248.77	303.84	-85.33	-122.87	-608.31	-26.8
	ULS Min	-178.61	296.77	251.19	298.55	293.17	97.52	-1387.3	-1632.49	-972.4	-1083.3	-964.87	-1060.11	-774.24	-951.33	-528.46	-606.96	-706.78	-186.62
IY Bending	ULS Max	0	37.84	48.56	47.32	44	42.45	4.84	70.51	34.71	16.17	36.95	15.75	34.21	9.57	28.65	7.12	25.82	0
	ULS Min	0	-104.45	0	0	0	0	-15.23	0	-3.58	-31.1	0	-29.89	0	-33.41	0	-26.6	0	0
IZ Bending	ULS Max	0	26.14	29.32	33.71	31.51	30.95	96.17	32.09	14.96	19.19	5.79	12.63	5.19	14.15	6.34	15.62	2.41	0
	ULS Min	0	-44.77	-11.37	-8.31	-9.36	-6.87	-56.38	-33.86	-10.76	-61.76	-1.24	-56.42	-1.89	-58.54	-1.15	-64.26	-8.01	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	30	17	16	15	15	6	29	14	13	15	12	14	14	12	11	9	0
	Stress Z	0	4	3	4	3	3	11	4	2	7	1	6	1	7	1	7	1	0
Force (kn) =		0	636	360	361	336	325	277	535	260	321	259	303	239	330	204	295	176	0
Tension Combined Force (kN) =		722	1184	784	805	967	515	1053	1418	780	830	844	876	488	634	119	172	-433	-27
Compression Combined Force (kN) =		-179	-340	-109	-63	-43	-228	-1664	-2167	-1233	-1404	-1223	-1363	-1013	-1282	-732	-902	-882	-187
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.23	0.17	0.18	0.21	0.11	0.25	0.34	0.19	0.20	0.20	0.21	0.12	0.15	0.03	0.04	NA	NA
		0.01	0.09	0.03	0.02	0.01	0.07	0.51	0.67	0.38	0.43	0.38	0.42	0.31	0.39	0.23	0.28	0.25	0.05

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	470.88	379.75	983.3	185.6	897.8	808.32	370.4	416.1	8.49	-42.62	-358.22	-328.84	-129.36	21.63
	ULS Min	335.8	-216.38	766.81	-370.15	-2162.09	-2243.58	-1837.64	-1789.52	-1718.37	-1765.57	-1285.37	-1259.83	-202.34	11.76
IY Bending	ULS Max	7042.45	0	34.28	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-7829.92	-60.14	0	-15.37	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	129.73	203.15	62.93	229.8	0	0	0	0	0	0	0	0	0	0
	ULS Min	-56.21	-97.76	-30.13	-85.49	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	79	20	14	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	7	15	5	19	0	0	0	0	0	0	0	0	0	0
Force (kn) =		6839	701	337	448	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		7310	1080	1320	633	898	808	370	416	8	-43	-358	-329	-129	22
Compression Combined Force (kN) =		-6503	-917	430	-818	-2162	-2244	-1838	-1790	-1718	-1766	-1285	-1260	-202	12
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.36	0.21	0.29	0.14	0.17	0.16	0.07	0.08	0.00	NA	NA	NA	NA	0.02
		0.41	0.23	NA	0.23	0.57	0.59	0.48	0.47	0.51	0.53	0.39	0.38	0.65	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	278.39	184.8	359.77	116.99	234.36	473.98	440.86	268.09	275.11	173	167.91	226.66	156.57	24.67	31.06
	ULS Min	59.64	-191.77	100.7	-39.02	180.12	-907.68	-912.59	-635.06	-649.32	-572.57	-547.86	-382.03	-473.05	-82.01	19.04
IY Bending	ULS Max	3478.76	14.83	20.8	15.1	110.27	0	0	0	0	0	0	0	0	0	0
	ULS Min	-3803.96	-22.9	-9.66	-17.68	89.4	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	141.51	206.2	84.32	229.96	103.68	0	0	0	0	0	0	0	0	0	0
	ULS Min	-89.66	-103.04	-47.69	-116.9	0	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	46	10	9	8	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	11	20	8	23	6	0	0	0	0	0	0	0	0	0	0
Force (kn) =		3798	492	283	493	567	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		4076	677	643	610	801	474	441	268	275	173	168	227	157	25	31
Compression Combined Force (kN) =		-3738	-684	-182	-532	-387	-908	-913	-635	-649	-573	-548	-382	-473	-82	19
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.24	0.16	0.15	0.15	0.07	0.10	0.10	0.06	0.06	0.04	0.04	0.05	0.03	0.02	0.02
		0.29	0.26	0.07	0.20	0.04	0.24	0.24	0.17	0.17	0.15	0.14	0.10	0.12	0.26	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder	Front Transverse Sheave Girder	Back Transverse Sheave Girder	G1	G2/3	G4	G6
		End	Middle					
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	29848.08	29848.08	3788.55	2094.32	2197.23	2084.02	963.39
	ULS Min	0	0	-1435	-10	-12	-16	-655
Shear	Fz Max	11720	11720	1466	2816	2892	2750	1520
	Fz Min	-11751	-11751	-1485	-381	-2868	-353	-663
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.548	0.728	0.188	0.201	0.178	0.200	0.183
		0.324	0.615	0.276	0.674	0.692	0.658	0.662

1 - ULS V3		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-8557	-8535	-8357	-8150	-9804	-10473	-11771	-11738	-11956	-8344	-8330	-7881	-9658.6	-10182.6	-11547.52	-11514.68	-11742.38
	ULS Min	-21071	-21026	-19855	-19628	-16313	-15411	-13341	-13279	-12760	-20394	-20360	-19227	-15915.53	-15134.16	-13146.39	-13084.43	-12578.03
IY Bending	ULS Max	1928	2594	2595	2063	682	486	1331	1331	591	1877	2530	2529	609.83	518.16	1258.55	1258.55	605.64
	ULS Min	-1856	-2505	-2500	-1705	-575	-284	-892	-892	-408	-1720	-2323	-2319	-462.46	-268.66	-969.82	-969.82	-346.29
IZ Bending	ULS Max	1657	2109	3818	12229	2546	846	847	76	659	1680	2199	11560	2711.18	418.38	1192.03	1192.03	279.26
	ULS Min	-1706	-2165	-3493	-10912	-2568	-448	-1201	-1201	-289	-1433	-1870	-11296	-2310.23	-849.01	-849.14	-90.71	-610.41
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	57	77	77	61	21	15	47	47	21	55	75	75	19	16	44	44	21
	Stress Z	42	53	93	299	54	18	39	39	21	41	54	283	57	18	38	38	20
Force (kn) =		13102	17201	22572	47815	11916	5215	9091	9091	4469	12814	17060	47468	12035	5384	8789	8789	4356
Tension Combined Force (kN) =		4545	8665	14216	39665	2113	-5258	-2681	-2648	-7486	4470	8729	39587	2377	-4798	-2758	-2725	-7387
Compression Combined Force (kN) =		-34173	-38227	-42427	-67442	-28229	-20626	-22431	-22369	-17229	-33208	-37420	-66695	-27951	-20519	-21936	-21874	-16934
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	0.10	0.20	0.33	0.92	0.04	NA	NA	NA	NA	0.10	0.20	0.91	0.05	NA	NA	NA	NA
		0.85	0.95	1.05	1.68	0.70	0.51	0.69	0.69	0.528	0.83	0.93	1.66	0.69	0.51	0.67	0.67	0.52

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	1697	1708	1719	2046	516	-708	-1446	-1603	-2031	1836.11	1854.74	2026.37	575.4	-546.67	-1280.23	-1448.48	-1827.99
	ULS Min	-10913	-10892	-8445	-8172	-5857	-4284	-2981	-2456	-2219	-10025.75	-9997.78	-7713.27	-5580.45	-4149.47	-2881.03	-2297.31	-1986.18
IY Bending	ULS Max	763	1029	1034	533	292	78	97	195	197	632.75	849.49	852.59	272.53	80.4	96.8	198.09	198.24
	ULS Min	-680	-911	-910	-517	-197	23	21	20	-193	-567.96	-781.33	-782.26	-194.37	31.73	17.06	17.07	-327.35
IZ Bending	ULS Max	643	721	1051	5620	947	115	90	316	619	541.61	665.31	5313.49	1009.53	150.22	57.59	221.6	221.6
	ULS Min	-771	-884	-1107	-5121	-984	-167	-70	-83	-84	-472.7	-538.42	-4997	-798.92	-126.33	-91.4	-180.09	-830.84
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	37	49	50	26	14	4	5	9	9	30	41	41	13	4	5	9	16
	Stress Z	24	28	35	178	31	5	3	10	20	17	21	168	32	5	3	7	26
Force (kn) =		4757	6033	6603	15859	3522	703	585	1510	2262	3705	4821	16297	3510	672	588	1288	3275
Tension Combined Force (kN) =		6455	7741	8322	17905	4038	-5	-861	-93	231	5541	6676	18324	4086	125	-692	-160	1447
Compression Combined Force (kN) =		-15670	-16925	-15048	-24031	-9378	-4987	-3566	-3966	-4481	-13731	-14819	-24011	-9091	-4821	-3469	-3586	-5261
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	0.30	0.36	0.38	0.82	0.19	NA	NA	NA	0.01	0.25	0.31	0.84	0.19	0.01	NA	NA	0.07
		1.00	1.09	0.96	1.54	0.60	0.32	0.23	0.25	0.28	0.88	0.95	1.54	0.58	0.31	0.22	0.23	0.33

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	835.04	835.04	463.11	479.5	687.71	262.53	1265.91	1154.75	784.66	815.78	812.25	866.1	467.52	400.79	-50.56	-52.47	-18.99	-820.33
	ULS Min	-337.81	-337.81	225.77	249.22	213.76	97.51	-2203.56	-1815.05	-1404.74	-1258.12	-1358.57	-1225.59	-1152.37	-943.49	-644.02	-603.58	-194.52	-985.57
IY Bending	ULS Max	0	0	57.63	57.01	50.44	43.84	14.84	0	18.43	29.07	19.38	42.81	11.37	39.29	6.69	31.01	0	30.78
	ULS Min	0	0	0	0	0	0	-42.36	0	-34.21	-6.07	-32.4	-0.98	-35.11	0	-27.49	0	0	0
IZ Bending	ULS Max	0	0	87.02	117.44	70.88	39.02	104.42	0	97	35.22	77.16	5.35	81.11	9.54	81.36	10.87	0	6.74
	ULS Min	0	0	-77.19	-111.54	-126.67	-93.53	-56.69	0	-49.6	-36.78	-23.36	-9.67	-28.97	-12.92	-31.18	-10.8	0	-10.09
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	20	20	17	15	18	0	14	12	14	18	15	16	11	13	0	11
	Stress Z	0	0	9	13	14	10	12	0	11	4	9	1	9	1	9	1	0	1
Force (kn) =		0	0	529	585	561	456	474	0	405	262	357	305	383	287	332	228	0	210
Tension Combined Force (kN) =		835	835	992	1064	1249	718	1740	1155	1190	1078	1170	1171	850	688	281	175	-19	-610
Compression Combined Force (kN) =		-338	-338	-303	-335	-348	-358	-2677	-1815	-1810	-1520	-1716	-1531	-1535	-1231	-976	-831	-195	-1196
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.16	0.22	0.23	0.27	0.16	0.42	0.28	0.29	0.26	0.28	0.28	0.20	0.17	0.07	0.04	NA	NA
		0.01	0.09	0.09	0.10	0.10	0.10	0.83	0.56	0.56	0.47	0.53	0.47	0.47	0.38	0.30	0.26	0.05	0.33

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	836.34	577.64	444.38	461.46	670.64	196.74	1048.87	1177.87	703.33	696.1	777.22	765.7	373.13	449.47	-35.59	-72.75	-599.02	-6.39
	ULS Min	-289.96	266.37	228.32	279.88	248.77	82.08	-1644.29	-1949.02	-1147.69	-1283	-1148.2	-1264.65	-892.02	-1108.21	-576.38	-666.63	-719.02	-202.88
IY Bending	ULS Max	0	55.46	53.2	49.67	45.1	42.84	7.32	77.37	39.37	18.99	40.8	18.49	36.91	11.32	29.64	7.78	26.08	0
	ULS Min	0	-122.41	0	0	0	0	-17.77	-3.63	-8.49	-33.28	0	-31.93	0	-34.67	0	-27.27	0	0
IZ Bending	ULS Max	0	32.83	36.99	41.84	39.54	38.3	121.1	39.45	18.59	24.38	7.12	15.86	6.54	17.48	7.75	19.42	2.95	0
	ULS Min	0	-55.43	-13.83	-10.69	-11.47	-8.85	-69.58	-42.36	-13.56	-76.8	-1.62	-70.46	-2.25	-73.37	-1.52	-80.4	-9.86	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	36	18	17	16	15	7	32	16	14	17	13	15	14	12	11	9	0
	Stress Z	0	5	4	5	4	4	14	5	2	9	1	8	1	8	1	9	1	0
Force (kn) =		0	751	404	392	359	342	339	596	298	363	287	342	260	366	213	329	181	0
Tension Combined Force (kN) =		836	1329	849	853	1029	539	1388	1774	1001	1059	1064	1108	633	815	177	256	-418	-6
Compression Combined Force (kN) =		-290	-485	-176	-112	-110	-260	-1983	-2545	-1446	-1646	-1435	-1607	-1152	-1474	-789	-995	-900	-203
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.26	0.19	0.19	0.23	0.12	0.33	0.43	0.24	0.25	0.26	0.27	0.15	0.20	0.04	0.06	NA	NA
		0.01	0.13	0.05	0.03	0.03	0.07	0.61	0.79	0.45	0.51	0.44	0.49	0.35	0.45	0.24	0.31	0.25	0.06

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	487.77	455.56	1004.95	198.83	1277.06	1172.72	629.51	685.29	218.3	155.54	-258.36	-219.59	-121.23	21.74
	ULS Min	318.91	-285.47	734.33	-493.73	-2541.43	-2635.79	-2124.16	-2065.36	-1934.69	-1992.56	-1411.72	-1377.73	-210.53	11.62
IY Bending	ULS Max	8852.29	0	34.85	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-9659.67	-61.55	0	-15.58	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	161.68	254.05	78.65	287.51	0	0	0	0	0	0	0	0	0	0
	ULS Min	-70.75	-122.05	-37.67	-106.56	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	98	20	14	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	8	19	6	23	0	0	0	0	0	0	0	0	0	0
Force (kn) =		8444	785	364	534	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		8932	1241	1369	733	1277	1173	630	685	218	156	-258	-220	-121	22
Compression Combined Force (kN) =		-8125	-1071	370	-1028	-2541	-2636	-2124	-2065	-1935	-1993	-1412	-1378	-211	12
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.44	0.24	0.30	0.16	0.25	0.23	0.12	0.13	0.05	0.03	NA	NA	NA	0.02
		0.52	0.26	NA	0.29	0.67	0.69	0.56	0.54	0.58	0.60	0.42	0.41	0.68	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	306.04	228.1	391.04	131.56	239.15	644.64	604.72	375.79	387.78	264.17	253.03	298.23	233.46	36.62	31.54
	ULS Min	32.6	-242.62	69.81	-63.45	172.76	-1076.68	-1081.34	-747.41	-762.01	-662.04	-635.93	-456.88	-547.82	-94.52	18.61
IY Bending	ULS Max	4347.55	15.96	22.14	16.39	113.74	0	0	0	0	0	0	0	0	0	0
	ULS Min	-4700.34	-23.66	-10.38	-18.17	87.88	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	178.12	257.09	104.85	287.05	133.18	0	0	0	0	0	0	0	0	0	0
	ULS Min	-110.85	-129.46	-60.16	-146.51	0	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	57	10	10	8	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	14	25	10	28	8	0	0	0	0	0	0	0	0	0	0
Force (kn) =		4709	579	325	587	656	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		5015	807	716	719	895	645	605	376	388	264	253	298	233	37	32
Compression Combined Force (kN) =		-4677	-821	-255	-651	-483	-1077	-1081	-747	-762	-662	-636	-457	-548	-95	19
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.30	0.19	0.17	0.17	0.07	0.14	0.13	0.08	0.08	0.06	0.06	0.07	0.05	0.03	0.03
		0.36	0.32	0.10	0.25	0.05	0.28	0.29	0.20	0.20	0.17	0.17	0.12	0.14	0.30	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder End	Front Transverse Sheave Girder Middle	Back Transverse Sheave Girder	G1	G2/3	G4	G6
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	30144.95	30144.95	3801.92	2109.59	2197.91	2121.21	1000.8
	ULS Min	0	0	-1519	-10	-12	-18	-678
Shear	Fz Max	11768	11768	1459	2836	2892	2799	1573
	Fz Min	-11835	-11835	-1478	-382	-2885	-351	-725
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.553	0.735	0.189	0.202	0.178	0.203	0.190
		0.326	0.619	0.274	0.678	0.692	0.670	0.685

1 - ULS V4		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-7699	-7678	-6948	-6675	-6156	-5950	-5672	-5638	-5415	-7301	-7287	-6465	-6005.6	-5824.09	-5574.82	-5541.41	-5341.66
	ULS Min	-7729	-7688	-6991	-6831	-6293	-6087	-5733	-5672	-5510	-7331	-7298	-6664	-6142.7	-5961.19	-5636.21	-5574.82	-5436.47
IY Bending	ULS Max	0	-66	-85	43	10	41	41	3	246	32	43	44	7.55	44.4	44.39	-3.63	280.84
	ULS Min	-66	-93	-90	-12	-11	10	3	-18	-18	0	32	-8	-9.3	7.39	-3.63	-29.88	-29.89
IZ Bending	ULS Max	0	-30	120	346	-27	148	148	-20	113	75	100	136	140.04	78.08	19.55	110.91	110.91
	ULS Min	-30	-33	20	267	-91	-91	-20	-111	-111	0	75	75	78.06	-148.3	-148.29	19.55	-100.93
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	2	3	3	1	0	1	1	1	9	1	1	1	0	1	2	1	10
	Stress Z	1	1	3	8	2	3	5	4	4	2	2	3	3	3	5	4	4
Force (kn) =		354	472	743	1291	360	697	663	451	1303	369	492	615	512	713	675	492	1429
Tension Combined Force (kN) =		-7346	-7205	-6205	-5383	-5796	-5253	-5009	-5187	-4112	-6932	-6795	-5850	-5494	-5111	-4900	-5049	-3913
Compression Combined Force (kN) =		-8083	-8161	-7734	-8122	-6653	-6785	-6395	-6122	-6813	-7700	-7790	-7279	-6655	-6674	-6311	-6067	-6865
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		0.20	0.20	0.19	0.20	0.17	0.17	0.20	0.19	0.209	0.19	0.19	0.18	0.17	0.17	0.19	0.19	0.21

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	-4570	-4559	-3465	-3142	-2806	-2695	-2514	-2376	-2597	-4270.13	-4251.17	-3076.41	-2737.92	-2606.37	-2381.26	-2207.01	-2371.63
	ULS Min	-4584	-4564	-3484	-3211	-2884	-2773	-2592	-2454	-2627	-4283.37	-4255.82	-3163.77	-2816.04	-2684.49	-2459.38	-2285.13	-2402.34
IY Bending	ULS Max	1	5	8	17	13	14	13	156	153	17.63	20.77	13.6	7.12	11.2	11.16	143.75	142.8
	ULS Min	0	1	-42	-27	4	3	3	2	-237	0	12.61	-0.57	0.84	7.11	7.89	7.86	-244.84
IZ Bending	ULS Max	0	-65	-40	278	-31	61	61	81	467	35.11	66.01	108.12	105.83	22.65	34.38	88.26	88.22
	ULS Min	-65	-82	-134	188	-42	-31	-45	-44	82	0	29.94	29.59	22.65	-62	-62	34.37	-717.52
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	0	0	2	1	1	1	1	7	11	1	1	1	0	1	1	7	12
	Stress Z	2	3	4	9	1	2	2	3	15	1	2	3	3	2	2	3	23
Force (kn) =		163	220	489	786	154	202	200	785	2038	153	241	318	288	195	195	756	2686
Tension Combined Force (kN) =		-4407	-4339	-2976	-2356	-2652	-2493	-2315	-1592	-559	-4118	-4011	-2759	-2450	-2412	-2187	-1451	315
Compression Combined Force (kN) =		-4747	-4784	-3973	-3997	-3038	-2974	-2792	-3239	-4666	-4436	-4496	-3481	-3104	-2879	-2654	-3041	-5089
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01
		0.30	0.31	0.25	0.26	0.19	0.19	0.18	0.21	0.29	0.28	0.29	0.22	0.20	0.18	0.17	0.19	0.32

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
Top Down Defined		Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
Element #		1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	148.97	148.97	223.06	234.13	278.74	26.32	-242.87	-253.06	-130.16	-143.93	-104.65	-123.21	-142.28	-146.77	-142.42	-232.5	67.1	-974.65
	ULS Min	148.97	148.97	214.74	221.73	256.57	-20.29	-284.29	-295.89	-174.94	-195.41	-150.25	-172.48	-188.01	-196.83	-188.45	-280.4	53.94	-985.07
IY Bending	ULS Max	0	0	39.18	40.67	40.09	39.98	7.54	0	7.47	14.33	7.34	18.59	6.13	19.77	6.71	21.31	0	29.62
	ULS Min	0	0	0	0	0	0	-12.39	0	-14.02	0	-13.62	0	-16.61	0	-12.8	0	0	0
IZ Bending	ULS Max	0	0	0	0	0	0	0	0	0.08	1.31	0	0	0	0.98	0	2.83	0	0
	ULS Min	0	0	-6.48	-14.23	-47.47	-54.34	-1.38	0	-0.9	0	-1.4	-0.07	-3.19	0	-7.08	0	0	-6.35
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	14	14	14	14	5	0	6	6	6	8	7	8	5	9	0	10
	Stress Z	0	0	1	2	5	6	0	0	0	0	0	0	0	0	1	0	0	1
Force (kn) =		0	0	257	282	343	355	86	0	96	99	94	125	117	135	99	148	0	196
Tension Combined Force (kN) =		149	149	480	516	622	382	-157	-253	-34	-45	-11	2	-25	-12	-44	-84	67	-778
Compression Combined Force (kN) =		149	149	-43	-60	-86	-376	-370	-296	-271	-294	-244	-297	-305	-331	-287	-429	54	-1181
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.00	0.03	0.11	0.11	0.14	0.08	NA	NA	NA	NA	NA	0.00	NA	NA	NA	NA	0.01	NA
		NA	NA	0.01	0.02	0.02	0.11	0.11	0.09	0.08	0.09	0.08	0.09	0.09	0.10	0.09	0.13	NA	0.33

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
Element #		2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	193.59	279.4	216.52	226.59	267.8	-45.23	-195.73	-206.56	-127.01	-144.41	-101.75	-118.47	-119.63	-157.96	-213.27	-174.08	-768.66	112.37
	ULS Min	193.59	271.81	215.45	225.75	265.82	-50.32	-241.63	-271.43	-178.9	-189.11	-151.09	-164.23	-170.1	-203.72	-261.69	-219.56	-780.3	99.21
IY Bending	ULS Max	0	0	39	38.94	39.33	41.44	0	37.24	13.43	7.6	18.09	7.46	18.62	6.38	20.42	7.5	25.86	0
	ULS Min	0	-18.58	0	0	0	0	-11.17	0	0	-14.06	0	-13.6	0	-16.66	0	-12.8	0	0
IZ Bending	ULS Max	0	0	0	1.21	0	2.28	0	2.04	0.87	0	0.42	0.67	0	0.34	0.7	1.7	0.42	0
	ULS Min	0	-1.44	-0.82	0	-1.04	0	-2.8	-0.02	0	-1.07	0	0	-0.41	-0.21	0	0	-0.41	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	5	14	13	14	14	5	16	6	6	8	6	8	7	9	5	9	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		0	102	245	246	248	263	80	254	92	96	122	93	126	112	138	89	162	0
Tension Combined Force (kN) =		194	381	462	472	516	218	-116	47	-35	-48	20	-26	6	-45	-75	-85	-607	112
Compression Combined Force (kN) =		194	170	-30	-20	18	-314	-322	-525	-271	-285	-273	-257	-296	-316	-400	-309	-942	99
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.07	0.10	0.10	0.11	0.05	NA	0.01	NA	NA	0.00	NA	0.00	NA	NA	NA	NA	0.02
		NA	NA	0.01	0.01	NA	0.09	0.10	0.16	0.08	0.09	0.08	0.08	0.09	0.10	0.12	0.10	0.26	NA

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	213.06	35.71	416.4	63.46	-303.44	-330.53	-282.79	-281.02	-395.99	-396.24	-313.07	-327.18	-63.68	27.75
	ULS Min	213.06	18.72	416.4	53.82	-328.94	-356.02	-308.29	-306.51	-418.35	-418.6	-335.42	-349.53	-71.35	18.9
IY Bending	ULS Max	343.84	0	5.9	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-372.3	-42.16	0	-16.49	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	6.97	0	0.07	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	0.15	-0.15	0	-0.34	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	4	14	2	7	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		328	280	42	118	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		541	316	459	181	-303	-331	-283	-281	-396	-396	-313	-327	-64	28
Compression Combined Force (kN) =		-115	-261	374	-64	-329	-356	-308	-307	-418	-419	-335	-350	-71	19
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.03	0.06	0.10	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.06	NA	0.02	0.09	0.09	0.08	0.08	0.13	0.13	0.10	0.10	0.23	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	184.77	14.83	265.33	62.43	297.12	-227.76	-237.79	-189.66	-199.7	-213.32	-193.45	-74.32	-179.57	-29.71	28.77
	ULS Min	178.2	0.3	245.43	5.09	297.12	-250.75	-260.78	-212.65	-222.69	-236.32	-216.44	-97.31	-202.56	-38.55	20.39
IY Bending	ULS Max	268.33	10.14	18.05	11.59	97.36	0	0	0	0	0	0	0	0	0	0
	ULS Min	-232.11	-20.18	-5.44	-15.46	97.36	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	5.42	1.71	2.36	6.14	23.34	0	0	0	0	0	0	0	0	0	0
	ULS Min	-0.09	0	0	-0.05	23.34	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	3	9	8	7	5	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Force (kn) =		245	147	133	120	316	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		429	162	398	183	613	-228	-238	-190	-200	-213	-193	-74	-180	-30	29
Compression Combined Force (kN) =		-66	-147	113	-115	-19	-251	-261	-213	-223	-236	-216	-97	-203	-39	20
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.03	0.04	0.10	0.04	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.06	NA	0.04	0.00	0.07	0.07	0.06	0.06	0.06	0.06	0.03	0.05	0.12	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder	Front Transverse Sheave Girder	Back Transverse Sheave Girder	G1	G2/3	G4	G6
		End	Middle					
	Members	40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	10703.48	10703.48	4404.45	1245.8	4254	1127.12	848.34
	ULS Min	0	0	-1423	-19	-12	-18	-655
Shear	Fz Max	4291	4291	1922	187	1943	42	1503
	Fz Min	-4267	-4267	-1941	-443	-1859	-256	-499
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.196	0.261	0.219	0.119	0.345	0.108	0.161
		0.118	0.224	0.360	0.106	0.465	0.061	0.654

2 - ULS 1		**North Tower**																	
		Rail Side Columns									HWY Side Columns								
		Front Leg (100-110)									Front Leg (200-209)								
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-12741	-12720	-11937	-11663	-10945	-10743	-10403	-10370	-10172	-12382	-12368	-11494	-10835.6	-10662.46	-10360	-10326.59	-10150.99
	ULS Min	-12771	-12730	-11979	-11820	-11082	-10880	-10464	-10403	-10266	-12412	-12379	-11693	-10972.69	-10799.56	-10421.39	-10360	-10245.79
IY Bending	ULS Max	0	-59	-56	72	68	106	113	116	116	32	42	71	69.95	110.21	110.21	107.9	106.54
	ULS Min	-59	-85	-82	66	67	67	106	113	49	0	32	44	65.13	64.92	107.9	106.54	84.45
IZ Bending	ULS Max	0	-42	119	429	-45	272	272	-44	225	88	118	152	160.77	153.88	42.87	214.7	214.69
	ULS Min	-42	-49	-3	267	-166	-166	-44	-215	-215	0	88	9	153.86	-272.85	-272.83	42.87	-208.67
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	2	3	2	2	2	3	4	4	4	1	1	2	2	3	4	4	4
	Stress Z	1	1	3	11	3	6	9	7	7	2	3	4	3	6	9	7	7
Force (kn) =		370	493	709	1676	886	1429	1353	1171	1206	409	546	773	881	1452	1348	1140	1135
Tension Combined Force (kN) =		-12371	-12226	-11228	-9987	-10059	-9314	-9050	-9199	-8965	-11973	-11822	-10721	-9955	-9210	-9012	-9187	-9016
Compression Combined Force (kN) =		-13141	-13224	-12689	-13496	-11968	-12310	-11817	-11574	-11473	-12821	-12925	-12465	-11853	-12252	-11769	-11500	-11380
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		0.33	0.33	0.32	0.34	0.30	0.31	0.36	0.35	0.351	0.32	0.32	0.31	0.29	0.30	0.36	0.35	0.35

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	-4068	-4056	-2918	-2595	-2309	-2206	-2004	-1854	-1990	-3783.17	-3764.2	-2550.62	-2252.54	-2126.78	-1877.28	-1694.37	-1764.54
	ULS Min	-4081	-4061	-2937	-2663	-2387	-2284	-2082	-1932	-2020	-3796.41	-3768.85	-2637.98	-2330.66	-2204.9	-1955.4	-1772.49	-1795.25
IY Bending	ULS Max	2	7	10	48	45	44	44	161	157	14.21	17.23	29.89	32.24	42.07	46.17	162.19	162.75
	ULS Min	0	2	-39	-22	28	27	43	43	-166	0	8.37	9.34	31.2	32.21	42	46.15	-211.9
IZ Bending	ULS Max	0	-66	-38	281	-25	50	50	95	316	34.64	64.74	108.37	101.04	16.28	30.88	37.84	37.81
	ULS Min	-66	-82	-128	172	-39	-24	-41	-40	95	0	29.65	29.79	16.28	-50.39	-50.39	30.87	-503.14
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	0	0	2	2	2	2	2	8	8	1	1	1	2	2	2	8	10
	Stress Z	2	3	4	9	1	2	2	3	10	1	2	3	3	2	2	1	16
Force (kn) =		169	228	461	872	265	286	287	836	1402	139	224	379	370	282	297	701	2034
Tension Combined Force (kN) =		-3898	-3828	-2458	-1723	-2044	-1921	-1717	-1018	-588	-3645	-3540	-2171	-1883	-1845	-1580	-994	270
Compression Combined Force (kN) =		-4250	-4289	-3397	-3535	-2651	-2570	-2369	-2768	-3422	-3935	-3993	-3017	-2701	-2487	-2253	-2473	-3830
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01
		0.27	0.27	0.22	0.23	0.17	0.16	0.15	0.18	0.21	0.25	0.26	0.19	0.17	0.16	0.14	0.16	0.24

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
								Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	Horizontal 4 (AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	194.02	194.02	299.17	327.1	410.49	154.7	-306.47	-325.43	-185.89	-203.12	-152.1	-173.15	-220.47	-231.02	-247.29	-270.31	-41.56	-880.06
	ULS Min	194.02	194.02	289.98	309.71	381.94	107.41	-347.76	-370.36	-230.1	-257	-197.28	-224.64	-265.52	-284.19	-292.85	-321.37	-54.73	-890.98
IY Bending	ULS Max	0	0	39.76	41.15	40.41	39.57	3.25	0	5.35	16.31	5.29	20.82	3.18	23.05	4.42	23.92	0	28.71
	ULS Min	0	0	0	0	0	0	-19.42	0	-20.49	0	-19.97	0	-25.55	0	-21.22	0	0	0
IZ Bending	ULS Max	0	0	0	0.25	0	0	0	0	0.47	1.14	0	0.18	0	0.78	0	2.33	0	0
	ULS Min	0	0	-5.55	-7.88	-34.65	-38.93	-1.2	0	-0.5	0	-0.57	0	-2.97	0	-5.58	0	0	-5.59
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	14	14	14	14	8	0	9	7	8	9	11	10	9	10	0	10
	Stress Z	0	0	1	1	4	4	0	0	0	0	0	0	0	0	1	0	0	1
Force (kn) =		0	0	259	272	320	323	133	0	138	112	135	140	177	156	153	165	0	189
Tension Combined Force (kN) =		194	194	558	600	730	478	-174	-325	-47	-92	-17	-33	-44	-75	-95	-105	-42	-691
Compression Combined Force (kN) =		194	194	31	37	62	-216	-480	-370	-369	-369	-332	-365	-442	-440	-445	-486	-55	-1080
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.04	0.12	0.13	0.16	0.10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.06	0.15	0.11	0.11	0.11	0.10	0.11	0.14	0.14	0.14	0.15	0.02	0.30

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
								Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	Horizontal 4 (AD54)	Horizontal 5 (A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	236.92	372.3	295.83	321.45	403.32	97.78	-267.34	-258.99	-183.02	-205.58	-150.47	-167.43	-205.18	-236.25	-253.22	-274.65	-662.35	-34.23
	ULS Min	236.92	363.4	294.85	320.66	401.81	93.76	-314.64	-325.96	-237.35	-249.8	-202.03	-212.72	-258.76	-281.44	-304.82	-319.65	-674.58	-47.39
IY Bending	ULS Max	0	0	39.24	39.24	39.53	41.04	0	40.78	15.22	5.46	20.41	5.32	21.86	3.43	23.21	5.09	24.8	0
	ULS Min	0	-27.07	0	0	0	0	-6.22	0	0	-20.54	0	-19.98	0	-25.61	0	-21.37	0	0
IZ Bending	ULS Max	0	0	0	1.19	0	1.74	0	2.43	0.89	0	0.41	0.08	0	0.72	0.65	1.03	0.28	0
	ULS Min	0	-1.83	-1.28	0	-0.8	0	-3.32	0	0	-1.43	0	-0.16	-0.41	0	0	0	-0.53	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	8	14	14	14	14	3	17	6	9	9	8	9	11	10	9	9	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		0	148	248	247	249	260	48	278	104	140	138	134	148	173	157	145	156	0
Tension Combined Force (kN) =		237	520	543	569	652	358	-220	19	-79	-65	-13	-33	-58	-63	-96	-129	-507	-34
Compression Combined Force (kN) =		237	216	47	73	153	-166	-362	-604	-341	-390	-340	-347	-406	-455	-462	-465	-830	-47
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.10	0.12	0.12	0.14	0.08	NA	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.05	0.11	0.19	0.11	0.12	0.10	0.11	0.13	0.14	0.14	0.14	0.23	0.01

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	347.99	64.59	756.17	111.92	-526.24	-557.77	-555.8	-549.11	-701.93	-708.21	-629.71	-635.16	-133.36	23.1
	ULS Min	347.99	47.91	756.17	104.05	-551.73	-583.26	-581.3	-574.6	-724.29	-730.56	-652.07	-657.52	-141.03	14.26
IY Bending	ULS Max	525.48	0	24.36	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-474.45	-50.9	0	-15.14	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	4.71	0	0.06	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	0.42	-0.46	0	-0.97	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	5	17	10	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		443	338	173	109	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		791	403	930	221	-526	-558	-556	-549	-702	-708	-630	-635	-133	23
Compression Combined Force (kN) =		-95	-291	583	-5	-552	-583	-581	-575	-724	-731	-652	-658	-141	14
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.04	0.08	0.20	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.07	NA	0.00	0.15	0.15	0.15	0.15	0.22	0.22	0.20	0.20	0.45	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	158.01	11.39	214.37	52.06	197.79	-194.75	-199.14	-144.62	-158.43	-176.78	-157.96	-48.61	-132.07	-18.76	29.36
	ULS Min	152.9	-1.91	200.66	8.64	197.79	-217.74	-222.13	-167.61	-181.42	-199.77	-180.95	-71.6	-155.07	-27.59	20.98
IY Bending	ULS Max	237.94	10.44	17	11.76	98.54	0	0	0	0	0	0	0	0	0	0
	ULS Min	-210.98	-19.69	-7.58	-15.92	98.54	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	6.02	3.56	3.32	5.57	17.21	0	0	0	0	0	0	0	0	0	0
	ULS Min	-6.05	0	0	0	17.21	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	3	9	8	7	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Force (kn) =		223	146	127	123	303	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		381	158	341	175	501	-195	-199	-145	-158	-177	-158	-49	-132	-19	29
Compression Combined Force (kN) =		-70	-148	74	-114	-105	-218	-222	-168	-181	-200	-181	-72	-155	-28	21
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.02	0.04	0.08	0.04	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.06	NA	0.04	0.01	0.06	0.06	0.04	0.05	0.05	0.05	0.02	0.04	0.09	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder End	Front Transverse Sheave Girder Middle	Back Transverse Sheave Girder	G1	G2/3	G4	G6
	Members	40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	24112.02	24112.02	3468.53	1646.27	1954	1653.99	812.48
	ULS Min	0	0	-1020	-10	-12	-10	-542
Shear	Fz Max	9548	9548	1371	2222	2353	2186	1163
	Fz Min	-9469	-9469	-1366	-339	-2280	-325	-365
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.442	0.588	0.172	0.158	0.158	0.158	0.155
		0.263	0.499	0.254	0.532	0.563	0.523	0.506

2 - ULS 4		North Tower																	
		Rail Side Columns									HWY Side Columns								
		Front Leg (100-110)									Front Leg (200-209)								
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-6762	-6740	-6600	-6464	-8041	-8655	-9876	-9843	-10029	-6746	-6733	-6296	-7939.92	-8408.13	-9676.58	-9643.7	-9829.35
	ULS Min	-18443	-18398	-17334	-17187	-14126	-13272	-11345	-11283	-10786	-17994	-17961	-16899	-13788.86	-13038.73	-11172.95	-11111.03	-10615.6
IY Bending	ULS Max	1829	2464	2464	1898	646	454	1230	1230	533	1731	2331	2331	579.07	484.83	1164.24	1164.24	548.53
	ULS Min	-1703	-2295	-2291	-1619	-527	-264	-845	-845	-345	-1626	-2198	-2194	-421.73	-249.53	-915.57	-915.57	-320.48
IZ Bending	ULS Max	1549	1967	3466	11263	2344	762	762	93	593	1534	2003	10628	2479.99	376.99	1108.02	1108.02	237.98
	ULS Min	-1590	-2023	-3357	-10335	-2429	-398	-1117	-1117	-248	-1371	-1795	-10704	-2206.67	-763.69	-763.81	-107.32	-549.59
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	54	73	73	56	20	14	43	43	19	51	69	69	18	15	41	41	19
	Stress Z	39	50	85	276	51	16	36	36	19	38	49	262	52	16	36	36	18
Force (kn) =		12335	16228	20918	44032	11277	4777	8425	8425	4025	11770	15645	43911	11114	4936	8149	8149	3934
Tension Combined Force (kN) =		5573	9488	14318	37569	3236	-3877	-1451	-1418	-6004	5024	8912	37616	3174	-3472	-1528	-1495	-5895
Compression Combined Force (kN) =		-30778	-34626	-38252	-61219	-25403	-18050	-19770	-19708	-14811	-29765	-33606	-60810	-24903	-17975	-19322	-19260	-14549
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	0.13	0.22	0.33	0.87	0.06	NA	NA	NA	NA	0.12	0.21	0.87	0.06	NA	NA	NA	NA
		0.76	0.86	0.95	1.52	0.63	0.45	0.61	0.60	0.454	0.74	0.83	1.51	0.62	0.45	0.59	0.59	0.45

		North Tower																	
		Rail Side Columns									HWY Side Columns								
		Rear Leg (300-310)									Rear Leg (400-409)								
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	2406	2417	2390	2560	1114	-13	-681	-805	-1240	2374.5	2394.65	2582.71	1213.67	174.19	-508.87	-652.56	-1071.31
	ULS Min	-9364	-9344	-7097	-6982	-4839	-3356	-2119	-1607	-1417	-8697.45	-8668.02	-6513.45	-4537	-3193.63	-2008.15	-1450.01	-1221
IY Bending	ULS Max	714	956	961	510	269	70	96	160	162	577.41	782.06	786.14	257.29	72.64	95.86	163.67	164.52
	ULS Min	-632	-855	-854	-470	-188	23	25	24	-143	-543.26	-740.04	-739.72	-178.49	27.21	21.44	21.45	-268.83
IZ Bending	ULS Max	640	714	978	5172	875	116	68	279	455	488.22	586.21	4842.36	907.93	133.89	43.59	188.26	188.3
	ULS Min	-680	-784	-1036	-4853	-927	-147	-54	-94	-95	-458.47	-537.27	-4780.76	-779.96	-124.22	-69.07	-186.64	-602.55
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	34	46	46	24	13	3	5	8	8	28	38	38	12	3	5	8	13
	Stress Z	21	25	33	163	29	5	2	9	14	15	19	153	29	4	2	6	19
Force (kn) =		4350	5512	6152	14666	3291	622	527	1286	1730	3366	4374	14887	3203	602	529	1077	2493
Tension Combined Force (kN) =		6756	7928	8542	17227	4405	609	-154	481	490	5740	6768	17469	4416	776	20	425	1421
Compression Combined Force (kN) =		-13714	-14856	-13249	-21648	-8131	-3978	-2647	-2894	-3147	-12063	-13042	-21400	-7740	-3796	-2537	-2527	-3714
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	0.31	0.36	0.39	0.79	0.20	0.03	NA	0.02	0.02	0.26	0.31	0.80	0.20	0.04	0.00	0.02	0.07
		0.88	0.95	0.85	1.39	0.52	0.25	0.17	0.18	0.20	0.77	0.84	1.37	0.49	0.24	0.16	0.16	0.23

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	769.34	769.34	385.95	399.46	590.39	130.66	1233.35	1133.01	762.05	798.14	785.23	841.8	473.27	418.22	-23.66	-21.57	140.4	-683.57
	ULS Min	-325.32	-325.32	164.44	184.54	148.04	-15.54	-2007.43	-1641.7	-1284.19	-1141.01	-1243.71	-1114.02	-1041.45	-839.92	-580.2	-539.22	-24.3	-839.22
IY Bending	ULS Max	0	0	56.33	55.35	49.5	44.16	14.28	0	17.57	28.07	18.4	39.81	11.12	36.18	7.05	28.63	0	28.11
	ULS Min	0	0	0	0	0	0	-40.47	0	-32.81	-4.74	-31.27	-1.06	-33.29	0	-25.68	0	0	0
IZ Bending	ULS Max	0	0	82.69	112	73.96	38.72	98.35	0	91.46	31.84	72.1	5	76.02	8.7	77.44	9.82	0	7.32
	ULS Min	0	0	-70.58	-101.71	-110.42	-79.02	-51.66	0	-45.36	-35.35	-21.71	-8.97	-26.71	-12.2	-27.58	-10.36	0	-8.12
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	20	19	17	15	17	0	14	12	13	17	14	15	11	12	0	10
	Stress Z	0	0	9	12	12	9	11	0	10	4	8	1	9	1	9	1	0	1
Force (kn) =		0	0	513	564	524	430	450	0	386	253	341	284	361	265	313	211	0	190
Tension Combined Force (kN) =		769	769	899	963	1114	560	1683	1133	1148	1051	1126	1125	835	683	289	189	140	-493
Compression Combined Force (kN) =		-325	-325	-348	-379	-376	-445	-2457	-1642	-1670	-1394	-1584	-1398	-1403	-1105	-893	-750	-24	-1029
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.15	0.20	0.21	0.24	0.12	0.41	0.27	0.28	0.25	0.27	0.27	0.20	0.16	0.07	0.05	0.03	NA
		0.01	0.09	0.10	0.11	0.11	0.13	0.76	0.51	0.51	0.43	0.49	0.43	0.43	0.34	0.28	0.23	0.01	0.29

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	733.35	485.89	367.97	382.11	573.73	67.79	1016.18	1151.48	688.62	686.48	752.87	748.65	386.02	463.44	-13.24	-36.61	-499.72	164.21
	ULS Min	-317.87	196.28	166.32	212.63	179.99	-38.44	-1499.46	-1768.04	-1042.54	-1163.44	-1047.79	-1149.09	-798.2	-993.19	-521.09	-593.64	-612.96	-20.06
IY Bending	ULS Max	0	57.39	51.37	48.69	44.75	42.78	6.86	72.04	36.83	18.03	38.09	17.47	34.23	10.97	27.61	7.87	24.25	0
	ULS Min	0	-108.62	0	0	0	0	-16.56	-2.52	-7.85	-32.07	0	-30.96	0	-32.97	0	-25.39	0	0
IZ Bending	ULS Max	0	29.61	34.74	38.8	37.14	34.06	112.46	37.23	16.97	23.13	6.48	14.69	6.16	16.22	6.95	17.47	2.15	0
	ULS Min	0	-52.63	-12.69	-10.23	-10.38	-9.84	-65.51	-38.94	-13.03	-71.31	-1.6	-65.88	-1.96	-68.56	-1.6	-75.68	-9.96	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	32	18	17	16	15	7	30	15	13	16	13	14	14	12	11	9	0
	Stress Z	0	5	4	4	4	4	13	4	2	8	1	7	1	8	1	9	1	0
Force (kn) =		0	673	388	380	352	333	315	554	278	345	267	327	241	346	198	308	169	0
Tension Combined Force (kN) =		733	1159	756	762	926	401	1331	1706	967	1031	1020	1076	627	809	185	271	-330	164
Compression Combined Force (kN) =		-318	-476	-222	-167	-172	-372	-1814	-2322	-1321	-1508	-1315	-1476	-1039	-1339	-719	-901	-782	-20
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.23	0.17	0.17	0.20	0.09	0.32	0.41	0.23	0.25	0.25	0.26	0.15	0.19	0.04	0.07	NA	0.04
		0.01	0.13	0.06	0.05	0.05	0.11	0.56	0.72	0.41	0.46	0.41	0.45	0.32	0.41	0.22	0.28	0.22	0.01

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	416.56	413.21	858.87	173.41	1230.07	1153.96	653.66	701.44	272.9	218.97	-162.23	-128.6	-97.69	23.61
	ULS Min	258.96	-268.58	606.3	-471.57	-2335.55	-2402.34	-1918.14	-1867.53	-1738.04	-1787.41	-1240.19	-1211.03	-181.55	13.57
IY Bending	ULS Max	8150.79	0	27.08	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-8898.56	-57.62	0	-16.15	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	146.28	237.21	73.42	268.53	0	0	0	0	0	0	0	0	0	0
	ULS Min	-70.65	-113.85	-35.15	-99.32	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	90	19	11	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	7	17	6	22	0	0	0	0	0	0	0	0	0	0
Force (kn) =		7768	734	301	510	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		8184	1148	1160	684	1230	1154	654	701	273	219	-162	-129	-98	24
Compression Combined Force (kN) =		-7509	-1003	305	-982	-2336	-2402	-1918	-1868	-1738	-1787	-1240	-1211	-182	14
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.40	0.22	0.25	0.15	0.24	0.22	0.13	0.13	0.06	0.05	NA	NA	NA	0.02
		0.48	0.25	NA	0.27	0.62	0.63	0.51	0.49	0.52	0.54	0.37	0.36	0.58	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	240.65	207.47	297.76	110.23	138.39	647.99	612.88	407.01	425	300.26	282.07	322.4	285.17	46.83	32.22
	ULS Min	-15.96	-231.86	1.33	-71.78	79.03	-960.11	-962.31	-642.83	-649.67	-565.74	-549.16	-383.91	-445.56	-76.15	19.59
IY Bending	ULS Max	3975.18	15.81	20.31	16.25	115.04	0	0	0	0	0	0	0	0	0	0
	ULS Min	-4319.85	-22.63	-13.55	-18.61	89.38	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	169.04	239.98	97.8	267.71	123.09	0	0	0	0	0	0	0	0	0	0
	ULS Min	-100.67	-120.8	-56.21	-136.95	0	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	52	10	9	8	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	13	24	10	26	7	0	0	0	0	0	0	0	0	0	0
Force (kn) =		4355	544	301	559	632	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		4596	751	599	670	770	648	613	407	425	300	282	322	285	47	32
Compression Combined Force (kN) =		-4371	-776	-300	-631	-553	-960	-962	-643	-650	-566	-549	-384	-446	-76	20
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.27	0.18	0.14	0.16	0.06	0.14	0.13	0.09	0.09	0.07	0.06	0.07	0.06	0.04	0.03
		0.34	0.30	0.11	0.24	0.06	0.25	0.25	0.17	0.17	0.15	0.14	0.10	0.12	0.24	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder	Front Transverse Sheave Girder	Back Transverse Sheave Girder	G1	G2/3	G4	G6
		End	Middle					
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	25337.71	25337.71	2306.45	1811.61	1869.07	1777.44	495.16
	ULS Min	0	0	-1101	-10	-12	-17	-486
Shear	Fz Max	10016	10016	957	2435	2451	2347	1128
	Fz Min	-10049	-10049	-1001	-265	-2462	-261	-661
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.465	0.618	0.114	0.174	0.152	0.170	0.094
		0.277	0.526	0.186	0.582	0.589	0.562	0.491

2 - ULS V1		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-14595	-14574	-13760	-13487	-12703	-12503	-12142	-12108	-11915	-14247	-14233	-13330	-12603.03	-12433.73	-12109.96	-12076.55	-11906.84
	ULS Min	-14625	-14584	-13803	-13643	-12840	-12640	-12203	-12142	-12010	-14277	-14244	-13529	-12740.13	-12570.83	-12171.35	-12109.96	-12001.64
IY Bending	ULS Max	0	-60	-49	85	86	124	144	155	155	33	43	90	88.39	128.61	138.51	143.79	143.79
	ULS Min	-60	-86	-83	79	81	82	124	144	-5	0	33	45	79.57	79.34	128.61	138.51	33.32
IZ Bending	ULS Max	0	-47	120	453	-53	317	317	-51	264	93	124	160	181.69	181.71	51.35	252.58	252.57
	ULS Min	-47	-56	-9	268	-193	-193	-51	-252	-252	0	93	-21	167.43	-318.38	-318.35	51.35	-248.17
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	2	3	2	3	3	4	5	5	5	1	1	3	3	4	5	5	5
	Stress Z	1	1	3	11	4	7	10	8	9	2	3	4	4	7	10	8	8
Force (kn) =		388	517	715	1805	1067	1668	1625	1442	1484	430	572	872	1041	1695	1610	1404	1404
Tension Combined Force (kN) =		-14208	-14056	-13045	-11682	-11636	-10835	-10517	-10666	-10431	-13817	-13661	-12458	-11562	-10739	-10500	-10673	-10503
Compression Combined Force (kN) =		-15013	-15101	-14518	-15448	-13908	-14308	-13828	-13584	-13494	-14707	-14816	-14401	-13781	-14266	-13781	-13514	-13405
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		0.37	0.38	0.36	0.38	0.35	0.36	0.42	0.42	0.413	0.37	0.37	0.36	0.34	0.35	0.42	0.41	0.41

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	-4272	-4261	-3094	-2771	-2483	-2384	-2177	-2027	-2153	-3988.12	-3969.16	-2729.76	-2428.28	-2304.96	-2049.63	-1862.97	-1918.1
	ULS Min	-4285	-4266	-3113	-2840	-2561	-2462	-2256	-2105	-2184	-4001.36	-3973.81	-2817.11	-2506.4	-2383.08	-2127.75	-1941.09	-1948.81
IY Bending	ULS Max	2	8	11	57	53	52	54	173	169	13.68	16.71	37.29	38.77	50.66	55.66	176.6	177.5
	ULS Min	0	2	-40	-22	34	33	51	53	-173	0	7.64	8.61	38.69	38.74	50.59	55.65	-230.29
IZ Bending	ULS Max	0	-67	-38	280	-27	54	54	109	333	35.52	65.95	108.17	103.04	18.6	34.41	37.46	37.44
	ULS Min	-67	-84	-130	177	-40	-26	-45	-44	109	0	30.52	28.92	18.61	-54.74	-54.74	34.4	-539.77
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	0	0	2	3	3	3	3	8	8	1	1	2	2	2	3	8	11
	Stress Z	2	3	4	9	1	2	2	3	11	1	2	3	3	2	2	1	17
Force (kn) =		175	236	469	903	299	328	333	917	1469	139	225	406	399	325	343	754	2194
Tension Combined Force (kN) =		-4097	-4025	-2625	-1868	-2184	-2056	-1844	-1110	-685	-3849	-3744	-2323	-2029	-1980	-1706	-1109	275
Compression Combined Force (kN) =		-4461	-4502	-3582	-3743	-2860	-2791	-2589	-3022	-3653	-4140	-4199	-3224	-2906	-2708	-2471	-2695	-4142
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01
		0.29	0.29	0.23	0.24	0.18	0.18	0.16	0.19	0.23	0.27	0.27	0.21	0.18	0.17	0.16	0.17	0.26

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	220.28	220.28	340.9	374.28	472.6	216.34	-346.52	-368.02	-215.12	-233.75	-177.37	-199.98	-257.15	-270.91	-287.77	-299.11	-99.84	-886.17
	ULS Min	220.28	220.28	329.98	354.01	438.81	161.06	-387.82	-413.46	-259.26	-288.2	-222.52	-251.93	-302.13	-324.81	-333.37	-350.86	-113.01	-897.05
IY Bending	ULS Max	0	0	39.91	41.49	40.53	39.07	2.2	0	4.86	17.13	4.85	21.87	2.37	24.53	3.78	25.28	0	29.08
	ULS Min	0	0	0	0	0	0	-21.15	0	-22.12	0	-21.53	0	-28.03	0	-23.49	0	0	0
IZ Bending	ULS Max	0	0	0	0.3	0	0	0	0	0.55	1.13	0	0.25	0	0.9	0	2.71	0	0
	ULS Min	0	0	-6.19	-8.81	-39.07	-44.43	-1.21	0	-0.43	0	-0.63	0	-3.48	0	-6.06	0	0	-5.94
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	14	14	14	14	9	0	9	7	9	9	12	10	10	11	0	10
	Stress Z	0	0	1	1	4	5	0	0	0	0	0	0	0	0	1	0	0	1
	Force (kn) =	0	0	261	276	329	330	144	0	150	117	146	147	194	166	169	175	0	192
	Tension Combined Force (kN) =	220	220	602	651	802	547	-202	-368	-66	-117	-32	-53	-63	-105	-119	-124	-100	-694
	Compression Combined Force (kN) =	220	220	69	78	110	-169	-532	-413	-409	-405	-368	-399	-497	-491	-502	-525	-113	-1089
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.04	0.13	0.14	0.18	0.12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.05	0.16	0.13	0.13	0.12	0.11	0.12	0.15	0.15	0.15	0.16	0.03	0.30

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	263.66	422.24	337.64	368.7	465.59	151.75	-306.35	-293.47	-212.59	-236.78	-176.26	-193.72	-243.77	-274.19	-281.85	-319.25	-643.13	-93.57
	ULS Min	263.66	412.5	336.4	367.63	463.87	147.84	-354.45	-362.25	-267.52	-280.93	-228.28	-238.98	-298.13	-319.32	-334.18	-364.18	-655.47	-106.73
IY Bending	ULS Max	0	0	39.3	39.31	39.6	40.9	0	42.82	15.97	4.97	21.45	4.85	23.22	2.65	24.53	4.54	24.69	0
	ULS Min	0	-32.03	0	0	0	0	-5.21	0	0	-22.19	0	-21.54	0	-28.11	0	-23.61	0	0
IZ Bending	ULS Max	0	0	0	1.3	0	1.66	0	2.66	0.91	0	0.48	0	0	0.82	0.73	0.89	0.26	0
	ULS Min	0	-2.07	-1.52	0	-0.9	0	-3.63	0	0	-1.58	0	-0.24	-0.47	0	0	0	-0.55	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	9	14	14	14	14	2	18	7	9	9	9	10	12	10	10	9	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Force (kn) =	0	175	248	248	249	259	42	292	109	152	145	145	157	190	166	160	155	0
	Tension Combined Force (kN) =	264	597	586	617	715	410	-265	-1	-104	-85	-31	-49	-87	-84	-116	-159	-488	-94
	Compression Combined Force (kN) =	264	238	88	120	215	-111	-396	-655	-376	-433	-373	-384	-455	-510	-500	-524	-811	-107
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.12	0.13	0.13	0.16	0.09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.03	0.12	0.20	0.12	0.13	0.11	0.12	0.14	0.16	0.15	0.16	0.23	0.03

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	397.44	75.2	881.14	130.77	-609.32	-639.45	-654.29	-648.72	-816.22	-820.8	-743.19	-751.05	-158.86	21.39
	ULS Min	397.44	58.71	881.14	122.41	-634.81	-664.95	-679.79	-674.21	-838.57	-843.16	-765.54	-773.41	-166.53	12.55
IY Bending	ULS Max	592.02	0	31.15	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-507.05	-54.1	0	-14.63	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	3.94	0	0.05	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	0.51	-0.57	0	-1.2	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	6	18	12	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		493	360	222	106	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		891	435	1103	237	-609	-639	-654	-649	-816	-821	-743	-751	-159	21
Compression Combined Force (kN) =		-96	-301	659	16	-635	-665	-680	-674	-839	-843	-766	-773	-167	13
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.04	0.08	0.24	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.07	NA	NA	0.17	0.18	0.18	0.18	0.25	0.25	0.23	0.23	0.53	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	166.72	12.4	232.45	58.33	214.17	-207.16	-212.89	-160.71	-173.71	-190.07	-170.82	-57.98	-149.21	-22.66	29.18
	ULS Min	160.48	-1.09	217.44	9.98	214.17	-230.15	-235.88	-183.7	-196.71	-213.06	-193.81	-80.98	-172.21	-31.5	20.8
IY Bending	ULS Max	249.12	10.4	17.49	11.84	97.56	0	0	0	0	0	0	0	0	0	0
	ULS Min	-217.63	-19.87	-6.85	-15.74	97.56	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	6.35	4.18	3.66	6.11	18.21	0	0	0	0	0	0	0	0	0	0
	ULS Min	-7.78	0	0	0	18.21	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	3	9	8	7	5	0	0	0	0	0	0	0	0	0	0
	Stress Z	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Force (kn) =		241	149	131	122	303	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		408	161	363	180	517	-207	-213	-161	-174	-190	-171	-58	-149	-23	29
Compression Combined Force (kN) =		-81	-150	87	-112	-89	-230	-236	-184	-197	-213	-194	-81	-172	-32	21
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.02	0.04	0.09	0.04	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.06	NA	0.04	0.01	0.06	0.06	0.05	0.05	0.06	0.05	0.02	0.05	0.10	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
Members		Front Transverse Sheave Girder End	Front Transverse Sheave Girder Middle	Back Transverse Sheave Girder	G1	G2/3	G4	G6
		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	28722.52	28722.52	3725.07	1988.07	2362.22	1979.95	814.4
	ULS Min	0	0	-1094	-10	-12	-10	-556
Shear	Fz Max	11392	11392	1480	2679	2829	2593	1290
	Fz Min	-11277	-11277	-1501	-368	-2742	-363	-405
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.527	0.700	0.185	0.190	0.192	0.190	0.155
		0.314	0.596	0.279	0.641	0.677	0.620	0.561

2 - ULS V2		North Tower																	
		Rail Side Columns									HWY Side Columns								
		Front Leg (100-110)									Front Leg (200-209)								
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207	
Axial	ULS Max	-9954	-9933	-9624	-9404	-10563	-11059	-12023	-11990	-12126	-9716	-9702	-9159	-10428.43	-10814.14	-11839.04	-11806.08	-11955	
	ULS Min	-19971	-19927	-18831	-18617	-15798	-15037	-13291	-13229	-12788	-19361	-19328	-18276	-15461.39	-14802.81	-13130.42	-13068.57	-12642.48	
IY Bending	ULS Max	1531	2058	2059	1667	565	415	1097	1097	508	1508	2032	2033	507.43	442.11	1037.72	1037.72	517.17	
	ULS Min	-1497	-2021	-2017	-1348	-441	-200	-682	-682	-333	-1370	-1849	-1846	-350.4	-187.35	-744.98	-744.98	-275.61	
IZ Bending	ULS Max	1315	1676	3078	9876	2026	745	745	7	584	1363	1785	9241	2203.12	373.9	964.69	964.69	277.68	
	ULS Min	-1375	-1744	-2770	-8636	-2066	-400	-972	-972	-285	-1127	-1471	-9044	-1814.02	-747.55	-747.65	-18.29	-541.71	
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805	
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647	
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025	
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6	
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259	
	Stress Y	45	61	61	49	18	13	38	38	18	45	60	60	16	14	36	36	18	
	Stress Z	34	43	75	242	43	16	31	31	19	33	44	226	46	16	31	31	17	
Force (kn) =		10467	13732	18070	38620	9665	4530	7430	7430	3900	10339	13765	37987	9839	4671	7185	7185	3790	
Tension Combined Force (kN) =		512	3799	8446	29216	-898	-6529	-4593	-4560	-8226	624	4063	28828	-590	-6143	-4654	-4621	-8165	
Compression Combined Force (kN) =		-30438	-33659	-36901	-57237	-25463	-19567	-20721	-20659	-16688	-29701	-33093	-56263	-25300	-19474	-20315	-20253	-16432	
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749	
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651	
	Demand/Capacity	0.01	0.09	0.20	0.67	NA	NA	NA	NA	NA	0.01	0.09	0.67	NA	NA	NA	NA	NA	
		0.76	0.84	0.92	1.42	0.63	0.49	0.63	0.63	0.511	0.74	0.82	1.40	0.63	0.48	0.62	0.62	0.50	

		North Tower																	
		Rail Side Columns									HWY Side Columns								
		Rear Leg (300-310)									Rear Leg (400-409)								
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407	
Axial	ULS Max	482	493	738	1065	-101	-1062	-1610	-1705	-2072	650.29	668.99	1056.8	-43.34	-916.59	-1451.77	-1548.79	-1861.05	
	ULS Min	-9608	-9588	-7397	-7124	-5215	-3938	-2854	-2404	-2228	-8841.85	-8813.97	-6752.39	-4983.64	-3814.45	-2748.03	-2243.48	-1993.74	
IY Bending	ULS Max	611	825	830	422	245	74	89	192	193	508.88	681.03	683.71	226.53	75.35	89.49	195.32	195.65	
	ULS Min	-543	-727	-726	-418	-146	26	28	27	-190	-451.69	-623.62	-624.17	-146.99	36.41	25.7	25.7	-309.65	
IZ Bending	ULS Max	501	560	833	4532	749	86	83	276	563	440.48	545.56	4272.37	828.43	124.13	53.32	184.63	184.63	
	ULS Min	-631	-724	-893	-4061	-796	-139	-65	-65	-44	-370.96	-417.43	-3976.03	-618.33	-97.1	-84.51	-136.72	-775.88	
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	
	Stress Y	29	40	40	20	12	4	4	9	9	24	33	33	11	4	4	9	15	
	Stress Z	20	23	28	143	25	4	3	9	18	14	17	135	26	4	3	6	25	
Force (kn) =		3841	4875	5310	12759	2881	618	539	1400	2109	2992	3895	13097	2891	588	543	1187	3073	
Tension Combined Force (kN) =		4324	5368	6048	13824	2779	-443	-1071	-306	38	3642	4564	14154	2848	-328	-908	-362	1212	
Compression Combined Force (kN) =		-13450	-14463	-12706	-19883	-8096	-4556	-3393	-3803	-4337	-11833	-12709	-19850	-7875	-4403	-3292	-3430	-5067	
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081	
	Demand/Capacity	0.20	0.25	0.28	0.64	0.13	NA	NA	NA	0.00	0.17	0.21	0.65	0.13	NA	NA	NA	0.06	
		0.86	0.93	0.81	1.27	0.51	0.29	0.22	0.24	0.27	0.76	0.81	1.27	0.50	0.28	0.21	0.22	0.32	

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	714.78	714.78	442.75	462.13	647.75	260.19	939.31	845.85	581.7	602.75	611.72	650.15	318.81	262.37	-102.05	-104.62	-42.05	-834.97
	ULS Min	-223.5	-223.5	252.88	277.9	268.59	118.4	-1844.53	-1539.13	-1178.64	-1067.32	-1133.96	-1033.64	-986.09	-823.91	-585.93	-555.93	-185.11	-969.33
IY Bending	ULS Max	0	0	54.1	53.94	48.47	42.84	12.21	0	15.67	25.36	16.43	38.73	9.49	36.49	6.04	30	0	30.49
	ULS Min	0	0	0	0	0	0	-38.29	0	-31.96	-2.76	-30.39	0	-33.95	0	-26.93	0	0	0
IZ Bending	ULS Max	0	0	68.42	92.23	48.51	27.81	83.4	0	77.52	28.31	61.67	4.34	64.32	7.82	63.93	9.28	0	4.59
	ULS Min	0	0	-62.95	-90.95	-109.53	-84.11	-45.59	0	-39.76	-29.29	-18.75	-7.74	-23.75	-10.27	-26.12	-8.2	0	-9.28
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	19	19	17	15	16	0	13	11	13	16	14	15	11	13	0	11
	Stress Z	0	0	7	10	12	9	9	0	9	3	7	1	7	1	7	1	0	1
	Force (kn) =	0	0	471	516	516	431	408	0	355	223	316	274	344	264	297	218	0	207
	Tension Combined Force (kN) =	715	715	914	978	1164	691	1347	846	937	826	927	924	663	526	195	114	-42	-628
	Compression Combined Force (kN) =	-224	-224	-218	-238	-247	-313	-2253	-1539	-1534	-1291	-1450	-1308	-1331	-1087	-883	-774	-185	-1176
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.14	0.20	0.21	0.25	0.15	0.32	0.20	0.23	0.20	0.22	0.22	0.16	0.13	0.05	0.03	NA	NA
		0.01	0.06	0.06	0.07	0.07	0.09	0.70	0.48	0.47	0.40	0.45	0.40	0.41	0.33	0.27	0.24	0.05	0.33

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	724.54	551.68	427.32	447.5	635.56	194	773.82	880.09	517.11	506.34	583.87	571.13	245.76	300.85	-87.63	-126.44	-606.55	-31.04
	ULS Min	-176.51	300.63	254.47	302.24	298.07	101.49	-1390.41	-1635.36	-974.75	-1085.76	-966.92	-1062.19	-777.31	-954.31	-530.81	-610.53	-705.03	-190.86
IY Bending	ULS Max	0	37.45	48.56	47.32	44	42.44	4.92	70.67	34.77	16.13	37.04	15.72	34.31	9.51	28.75	7.07	25.8	0
	ULS Min	0	-104.84	0	0	0	0	-15.15	0	-3.52	-31.23	0	-30.01	0	-33.61	0	-26.77	0	0
IZ Bending	ULS Max	0	26.13	29.3	33.72	31.5	30.95	96.14	32.11	14.96	19.18	5.8	12.63	5.19	14.16	6.35	15.61	2.41	0
	ULS Min	0	-44.79	-11.39	-8.31	-9.37	-6.87	-56.4	-33.85	-10.75	-61.77	-1.24	-56.43	-1.9	-58.54	-1.15	-64.26	-8.01	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	30	17	16	15	15	6	29	14	13	15	13	14	14	12	11	9	0
	Stress Z	0	4	3	4	3	3	11	4	2	7	1	6	1	7	1	7	1	0
	Force (kn) =	0	639	360	361	336	325	276	536	261	322	259	304	240	332	205	296	175	0
	Tension Combined Force (kN) =	725	1190	788	809	972	519	1050	1416	778	828	843	875	486	633	117	170	-431	-31
	Compression Combined Force (kN) =	-177	-338	-106	-59	-38	-224	-1666	-2171	-1235	-1407	-1226	-1366	-1017	-1286	-735	-907	-881	-191
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.23	0.17	0.18	0.21	0.11	0.25	0.34	0.19	0.20	0.20	0.21	0.12	0.15	0.03	0.04	NA	NA
		0.01	0.09	0.03	0.02	0.01	0.06	0.52	0.67	0.38	0.43	0.38	0.42	0.31	0.40	0.23	0.28	0.25	0.05

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	474.75	380.57	993.04	187.08	891.31	801.93	362.68	408.33	-0.4	-51.38	-367.07	-337.83	-131.36	21.5
	ULS Min	339.67	-215.53	776.55	-368.68	-2168.58	-2249.98	-1845.36	-1797.29	-1727.26	-1774.33	-1294.22	-1268.82	-204.33	11.63
IY Bending	ULS Max	7039.59	0	34.81	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-7832.51	-60.39	0	-15.33	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	129.7	203.14	62.93	229.78	0	0	0	0	0	0	0	0	0	0
	ULS Min	-56.24	-97.76	-30.13	-85.51	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	79	20	14	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	7	15	5	19	0	0	0	0	0	0	0	0	0	0
Force (kn) =		6841	702	340	448	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		7316	1083	1334	635	891	802	363	408	0	-51	-367	-338	-131	22
Compression Combined Force (kN) =		-6501	-918	436	-816	-2169	-2250	-1845	-1797	-1727	-1774	-1294	-1269	-204	12
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.36	0.21	0.29	0.14	0.17	0.15	0.07	0.08	NA	NA	NA	NA	NA	0.02
		0.41	0.23	NA	0.23	0.57	0.59	0.49	0.47	0.52	0.53	0.39	0.38	0.66	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	279.07	184.89	361.18	117.5	235.69	472.99	439.8	266.85	273.9	171.95	166.93	225.96	155.21	24.36	31.05
	ULS Min	60.32	-191.68	102.03	-38.51	181.48	-908.66	-913.65	-636.31	-650.52	-573.62	-548.84	-382.73	-474.42	-82.32	19.03
IY Bending	ULS Max	3478.56	14.82	20.82	15.09	110.19	0	0	0	0	0	0	0	0	0	0
	ULS Min	-3804.45	-22.92	-9.6	-17.67	89.37	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	141.44	206.23	84.34	229.94	103.16	0	0	0	0	0	0	0	0	0	0
	ULS Min	-89.74	-103.01	-47.68	-116.91	0	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	46	10	9	8	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	11	20	8	23	6	0	0	0	0	0	0	0	0	0	0
Force (kn) =		3798	492	283	493	565	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		4077	677	644	610	801	473	440	267	274	172	167	226	155	24	31
Compression Combined Force (kN) =		-3737	-684	-181	-531	-384	-909	-914	-636	-651	-574	-549	-383	-474	-82	19
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.24	0.16	0.16	0.15	0.07	0.10	0.10	0.06	0.06	0.04	0.04	0.05	0.03	0.02	0.02
		0.29	0.26	0.07	0.20	0.04	0.24	0.24	0.17	0.17	0.15	0.14	0.10	0.13	0.26	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder End	Front Transverse Sheave Girder Middle	Back Transverse Sheave Girder	G1	G2/3	G4	G6
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	30221.8	30221.8	3809.79	2120.67	2225.73	2111.83	963.59
	ULS Min	0	0	-1441	-10	-12	-16	-660
Shear	Fz Max	11870	11870	1474	2851	2929	2786	1530
	Fz Min	-11897	-11897	-1496	-383	-2904	-357	-666
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.555	0.737	0.189	0.203	0.181	0.202	0.183
		0.328	0.622	0.278	0.682	0.701	0.667	0.666

2 - ULS V3		North Tower																	
		Rail Side Columns									HWY Side Columns								
		Front Leg (100-110)									Front Leg (200-209)								
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-8701	-8680	-8499	-8292	-9940	-10610	-11907	-11874	-12091	-8490	-8477	-8025	-9797.26	-10321.58	-11684.91	-11652.07	-11880.21
	ULS Min	-21215	-21170	-19997	-19770	-16450	-15548	-13476	-13414	-12896	-20540	-20507	-19371	-16054.19	-15273.14	-13283.78	-13221.82	-12715.85
IY Bending	ULS Max	1928	2594	2595	2064	684	487	1333	1333	594	1877	2530	2529	611.27	519.61	1260.93	1260.93	608.54
	ULS Min	-1856	-2505	-2500	-1705	-573	-282	-890	-890	-412	-1720	-2323	-2319	-461.02	-267.21	-967.44	-967.44	-350.29
IZ Bending	ULS Max	1656	2109	3818	12231	2546	850	850	73	662	1681	2200	11558	2711.71	420.57	1192.74	1192.74	282.29
	ULS Min	-1707	-2165	-3493	-10910	-2568	-450	-1202	-1202	-292	-1432	-1870	-11298	-2309.71	-852.58	-852.71	-87.67	-613.68
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	57	77	77	61	21	15	47	47	21	55	75	75	19	16	44	44	21
	Stress Z	42	53	93	299	54	18	39	39	21	41	54	283	57	18	38	38	20
Force (kn) =		13103	17202	22572	47823	11925	5234	9102	9102	4491	12816	17062	47461	12044	5403	8801	8801	4378
Tension Combined Force (kN) =		4402	8522	14073	39532	1985	-5376	-2805	-2772	-7600	4325	8585	39436	2247	-4918	-2884	-2852	-7502
Compression Combined Force (kN) =		-34318	-38372	-42569	-67593	-28375	-20782	-22578	-22516	-17386	-33356	-37569	-66832	-28098	-20677	-22084	-22022	-17094
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	0.10	0.20	0.32	0.91	0.04	NA	NA	NA	NA	0.10	0.20	0.91	0.04	NA	NA	NA	NA
		0.85	0.95	1.06	1.68	0.70	0.52	0.69	0.69	0.532	0.83	0.93	1.66	0.70	0.51	0.68	0.67	0.52

		North Tower																	
		Rail Side Columns									HWY Side Columns								
		Rear Leg (300-310)									Rear Leg (400-409)								
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	1682	1692	1705	2033	503	-722	-1460	-1616	-2044	1819.89	1838.52	2012.18	561.51	-560.73	-1293.81	-1461.69	-1840.32
	ULS Min	-10929	-10908	-8458	-8186	-5870	-4298	-2995	-2470	-2232	-10041.98	-10014.01	-7727.46	-5594.34	-4163.53	-2894.6	-2310.53	-1998.51
IY Bending	ULS Max	763	1029	1035	533	293	79	98	196	198	632.72	849.43	852.54	273.12	81.07	97.56	199.19	199.38
	ULS Min	-680	-911	-910	-517	-196	24	21	20	-194	-568	-781.38	-782.31	-193.79	32.39	17.82	17.83	-328.85
IZ Bending	ULS Max	643	721	1051	5621	947	115	90	318	620	541.69	665.41	5313.43	1009.68	150.4	57.87	221.62	221.62
	ULS Min	-771	-884	-1107	-5120	-984	-167	-70	-82	-83	-472.62	-538.32	-4997.06	-798.77	-126.14	-91.74	-180.07	-833.91
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	37	49	50	26	14	4	5	9	9	30	41	41	13	4	5	10	16
	Stress Z	24	28	35	178	31	5	3	10	20	17	21	168	32	5	3	7	26
Force (kn) =		4758	6034	6603	15860	3525	706	589	1516	2269	3705	4821	16297	3513	674	592	1292	3288
Tension Combined Force (kN) =		6439	7726	8308	17893	4027	-16	-871	-100	225	5525	6660	18309	4074	114	-702	-169	1448
Compression Combined Force (kN) =		-15686	-16942	-15062	-24046	-9395	-5003	-3583	-3986	-4501	-13747	-14835	-24025	-9107	-4838	-3486	-3603	-5286
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	0.30	0.35	0.38	0.82	0.19	NA	NA	NA	0.01	0.25	0.31	0.84	0.19	0.01	NA	NA	0.07
		1.01	1.09	0.97	1.54	0.60	0.32	0.23	0.25	0.28	0.88	0.95	1.54	0.58	0.31	0.22	0.23	0.33

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
								Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	Horizontal 4 (AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	837.08	837.08	466.3	483.13	692.35	267.3	1262.82	1151.42	782.41	813.38	810.3	864	464.69	397.68	-53.74	-54.77	-23.17	-820.49
	ULS Min	-335.77	-335.77	228.97	252.85	218.41	101.67	-2206.66	-1818.42	-1406.99	-1260.56	-1360.52	-1227.73	-1155.2	-946.65	-647.2	-605.93	-198.7	-985.73
IY Bending	ULS Max	0	0	57.64	57.03	50.45	43.8	14.76	0	18.39	29.06	19.35	42.89	11.31	39.41	6.64	31.12	0	30.8
	ULS Min	0	0	0	0	0	0	-42.49	0	-34.34	-6.09	-32.53	-0.9	-35.31	0	-27.66	0	0	0
IZ Bending	ULS Max	0	0	86.98	117.36	70.51	38.84	104.42	0	97	35.22	77.16	5.35	81.08	9.55	81.31	10.91	0	6.72
	ULS Min	0	0	-77.24	-111.61	-127.03	-93.97	-56.69	0	-49.59	-36.78	-23.36	-9.67	-29	-12.92	-31.23	-10.78	0	-10.13
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	20	20	17	15	18	0	14	12	14	18	15	16	12	13	0	11
	Stress Z	0	0	9	13	14	10	12	0	11	4	9	1	9	1	9	1	0	1
	Force (kn) =	0	0	529	585	562	456	474	0	406	262	358	305	384	288	333	229	0	211
	Tension Combined Force (kN) =	837	837	996	1068	1255	724	1737	1151	1189	1075	1169	1169	849	686	279	174	-23	-610
	Compression Combined Force (kN) =	-336	-336	-300	-332	-344	-355	-2681	-1818	-1813	-1522	-1719	-1533	-1539	-1235	-980	-835	-199	-1196
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.16	0.22	0.23	0.27	0.16	0.42	0.28	0.29	0.26	0.28	0.28	0.20	0.17	0.07	0.04	NA	NA
		0.01	0.09	0.09	0.10	0.10	0.10	0.83	0.56	0.56	0.47	0.53	0.47	0.47	0.38	0.30	0.26	0.06	0.33

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
								Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	Horizontal 4 (AD54)	Horizontal 5 (A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	838.45	581.57	447.67	465.15	675.54	200.7	1045.83	1175.15	701.02	693.64	775.21	763.62	370.12	446.48	-37.88	-76.32	-597.25	-10.63
	ULS Min	-287.86	270.23	231.61	283.57	253.68	86.05	-1647.4	-1951.88	-1150.04	-1285.46	-1150.25	-1266.72	-895.09	-1111.2	-578.73	-670.2	-717.27	-207.11
IY Bending	ULS Max	0	55.07	53.19	49.66	45.1	42.83	7.4	77.53	39.43	18.95	40.88	18.46	37.02	11.26	29.75	7.74	26.07	0
	ULS Min	0	-122.8	0	0	0	0	-17.69	-3.58	-8.43	-33.41	0	-32.05	0	-34.86	0	-27.44	0	0
IZ Bending	ULS Max	0	32.82	36.97	41.85	39.54	38.29	121.08	39.46	18.59	24.37	7.12	15.85	6.54	17.49	7.75	19.42	2.95	0
	ULS Min	0	-55.45	-13.85	-10.68	-11.48	-8.85	-69.6	-42.35	-13.55	-76.81	-1.62	-70.47	-2.25	-73.36	-1.52	-80.4	-9.86	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	36	18	17	16	15	7	32	16	14	17	13	15	15	12	11	9	0
	Stress Z	0	5	4	5	4	4	14	5	2	9	1	8	1	8	1	9	1	0
	Force (kn) =	0	753	404	392	359	342	338	597	298	363	287	343	260	367	214	330	181	0
	Tension Combined Force (kN) =	838	1335	852	857	1034	543	1384	1772	999	1057	1063	1106	631	813	176	254	-417	-11
	Compression Combined Force (kN) =	-288	-483	-173	-108	-105	-256	-1986	-2549	-1448	-1649	-1438	-1610	-1155	-1478	-793	-1000	-898	-207
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.26	0.19	0.19	0.23	0.12	0.33	0.43	0.24	0.25	0.26	0.27	0.15	0.20	0.04	0.06	NA	NA
		0.01	0.13	0.05	0.03	0.03	0.07	0.61	0.79	0.45	0.51	0.44	0.50	0.36	0.46	0.24	0.31	0.25	0.06

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	491.63	456.38	1014.69	200.31	1270.57	1166.32	621.79	677.52	209.41	146.77	-267.21	-228.58	-123.22	21.61
	ULS Min	322.78	-284.63	744.07	-492.25	-2547.92	-2642.19	-2131.88	-2073.13	-1943.58	-2001.32	-1420.57	-1386.72	-212.52	11.49
IY Bending	ULS Max	8849.43	0	35.37	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-9662.26	-61.8	0	-15.54	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	161.65	254.05	78.65	287.5	0	0	0	0	0	0	0	0	0	0
	ULS Min	-70.78	-122.06	-37.67	-106.58	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	98	20	14	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	8	19	6	23	0	0	0	0	0	0	0	0	0	0
Force (kn) =		8446	787	368	534	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		8938	1243	1382	734	1271	1166	622	678	209	147	-267	-229	-123	22
Compression Combined Force (kN) =		-8123	-1072	376	-1026	-2548	-2642	-2132	-2073	-1944	-2001	-1421	-1387	-213	11
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.44	0.24	0.30	0.16	0.24	0.22	0.12	0.13	0.05	0.03	NA	NA	NA	0.02
		0.52	0.26	NA	0.29	0.67	0.70	0.56	0.55	0.58	0.60	0.43	0.42	0.68	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	306.72	228.19	392.45	132.07	240.49	643.66	603.66	374.54	386.58	263.12	252.05	297.54	232.09	36.31	31.52
	ULS Min	33.28	-242.53	71.14	-62.95	174.12	-1077.67	-1082.4	-748.65	-763.21	-663.09	-636.92	-457.58	-549.19	-94.83	18.59
IY Bending	ULS Max	4347.35	15.95	22.16	16.37	113.66	0	0	0	0	0	0	0	0	0	0
	ULS Min	-4700.83	-23.67	-10.33	-18.16	87.85	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	178.04	257.12	104.87	287.04	132.66	0	0	0	0	0	0	0	0	0	0
	ULS Min	-110.93	-129.43	-60.15	-146.52	0	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	57	10	10	8	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	14	25	10	28	8	0	0	0	0	0	0	0	0	0	0
Force (kn) =		4709	579	325	587	654	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		5016	807	718	719	895	644	604	375	387	263	252	298	232	36	32
Compression Combined Force (kN) =		-4676	-821	-254	-650	-480	-1078	-1082	-749	-763	-663	-637	-458	-549	-95	19
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.30	0.19	0.17	0.17	0.07	0.14	0.13	0.08	0.08	0.06	0.06	0.07	0.05	0.03	0.03
		0.36	0.32	0.10	0.25	0.05	0.28	0.29	0.20	0.20	0.17	0.17	0.12	0.14	0.30	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder	Front Transverse Sheave Girder	Back Transverse Sheave Girder	G1	G2/3	G4	G6
		End	Middle					
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	30518.67	30518.67	3823.16	2135.95	2226.41	2149.01	1001
	ULS Min	0	0	-1525	-10	-12	-18	-682
Shear	Fz Max	11917	11917	1468	2871	2930	2835	1583
	Fz Min	-11980	-11980	-1489	-385	-2920	-354	-728
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.560	0.744	0.190	0.205	0.181	0.206	0.191
		0.330	0.627	0.276	0.687	0.701	0.678	0.689

2 - ULS V4		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-7745	-7723	-6993	-6719	-6199	-5994	-5714	-5681	-5458	-7347	-7334	-6510	-6049.46	-5868.09	-5618.25	-5584.84	-5385.09
	ULS Min	-7775	-7734	-7035	-6876	-6336	-6131	-5776	-5714	-5552	-7378	-7344	-6709	-6186.55	-6005.18	-5679.64	-5618.25	-5479.9
IY Bending	ULS Max	0	-66	-85	43	10	42	42	3	245	32	43	44	7.63	44.62	44.62	-3.31	280.44
	ULS Min	-66	-93	-91	-12	-11	10	3	-18	-18	0	32	-8	-9.28	7.47	-3.31	-29.51	-29.52
IZ Bending	ULS Max	0	-30	120	346	-27	149	149	-20	114	75	100	136	140.16	78.78	19.79	111.89	111.89
	ULS Min	-30	-33	20	268	-92	-92	-20	-112	-112	0	75	74	78.76	-149.42	-149.41	19.79	-102.04
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	2	3	3	1	0	1	1	1	9	1	1	1	0	1	2	1	10
	Stress Z	1	1	3	8	2	3	5	4	4	2	2	3	3	3	5	4	4
Force (kn) =		355	474	744	1292	362	702	667	452	1304	370	493	616	512	718	679	494	1431
Tension Combined Force (kN) =		-7390	-7250	-6249	-5427	-5837	-5292	-5047	-5229	-4153	-6977	-6841	-5894	-5537	-5150	-4939	-5091	-3954
Compression Combined Force (kN) =		-8130	-8208	-7779	-8168	-6699	-6833	-6443	-6166	-6857	-7748	-7837	-7326	-6699	-6723	-6359	-6112	-6911
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		0.20	0.20	0.19	0.20	0.17	0.17	0.20	0.19	0.210	0.19	0.19	0.18	0.17	0.17	0.19	0.19	0.21

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	-4591	-4580	-3485	-3162	-2825	-2714	-2533	-2395	-2617	-4291.19	-4272.23	-3096.35	-2757.01	-2625.53	-2400.39	-2225.98	-2391.29
	ULS Min	-4605	-4585	-3504	-3231	-2903	-2792	-2611	-2474	-2648	-4304.43	-4276.89	-3183.7	-2835.13	-2703.64	-2478.51	-2304.1	-2422.01
IY Bending	ULS Max	1	5	8	17	13	14	13	157	154	17.65	20.79	13.62	7.18	11.3	11.25	144.41	143.46
	ULS Min	0	1	-42	-27	4	3	3	2	-239	0	12.63	-0.54	0.87	7.17	7.95	7.93	-246.61
IZ Bending	ULS Max	0	-65	-40	278	-31	61	61	82	470	35.18	66.11	108.11	106.03	22.9	34.67	89.03	88.99
	ULS Min	-65	-82	-135	189	-42	-31	-46	-44	83	0	30	29.53	22.9	-62.47	-62.47	34.66	-723.36
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	0	0	2	1	1	1	1	8	11	1	1	1	0	1	1	7	12
	Stress Z	2	3	4	9	1	2	2	3	15	1	2	3	3	2	2	3	23
Force (kn) =		163	220	490	786	155	203	201	789	2053	153	241	318	288	196	196	760	2707
Tension Combined Force (kN) =		-4428	-4360	-2995	-2375	-2670	-2511	-2332	-1606	-564	-4138	-4031	-2779	-2469	-2429	-2204	-1466	316
Compression Combined Force (kN) =		-4768	-4805	-3994	-4017	-3058	-2995	-2812	-3263	-4700	-4457	-4518	-3501	-3124	-2900	-2675	-3064	-5129
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01
		0.31	0.31	0.26	0.26	0.19	0.19	0.18	0.21	0.29	0.29	0.29	0.22	0.20	0.18	0.17	0.19	0.32

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	150.02	150.02	224.61	235.83	280.82	28.28	-244.53	-254.78	-131.23	-145.06	-105.59	-124.23	-143.5	-148.12	-143.53	-233.87	65.2	-976.22
	ULS Min	150.02	150.02	216.23	223.31	258.44	-18.81	-285.96	-297.61	-176.02	-196.54	-151.19	-173.49	-189.24	-198.18	-189.57	-281.76	52.04	-986.63
IY Bending	ULS Max	0	0	39.18	40.68	40.09	39.95	7.53	0	7.47	14.35	7.34	18.62	6.12	19.82	6.71	21.36	0	29.66
	ULS Min	0	0	0	0	0	0	-12.39	0	-14.03	0	-13.62	0	-16.64	0	-12.82	0	0	0
IZ Bending	ULS Max	0	0	0	0	0	0	0	0	0.08	1.31	0	0	0	0.99	0	2.87	0	0
	ULS Min	0	0	-6.53	-14.4	-47.97	-54.94	-1.39	0	-0.91	0	-1.42	-0.07	-3.23	0	-7.14	0	0	-6.39
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	14	14	14	14	5	0	6	6	6	8	7	8	5	9	0	10
	Stress Z	0	0	1	2	5	6	0	0	0	0	0	0	0	0	1	0	0	1
	Force (kn) =	0	0	257	282	344	356	86	0	96	99	94	125	118	135	99	149	0	197
	Tension Combined Force (kN) =	150	150	482	518	625	385	-159	-255	-35	-46	-12	1	-26	-13	-45	-85	65	-780
	Compression Combined Force (kN) =	150	150	-41	-59	-85	-375	-372	-298	-272	-295	-245	-299	-307	-333	-289	-430	52	-1183
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.00	0.03	0.11	0.11	0.14	0.08	NA	NA	NA	NA	NA	0.00	NA	NA	NA	NA	0.01	NA
		NA	NA	0.01	0.02	0.02	0.11	0.11	0.09	0.08	0.09	0.08	0.09	0.09	0.10	0.09	0.13	NA	0.33

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	194.71	281.31	218.09	228.28	269.9	-44.06	-197.23	-208.06	-128.12	-145.56	-102.72	-119.48	-120.87	-159.29	-214.61	-175.57	-768.79	111.02
	ULS Min	194.71	273.67	217	227.42	267.9	-49.15	-243.16	-273.02	-180.01	-190.26	-152.05	-165.24	-171.36	-205.05	-263.02	-221.06	-780.43	97.86
IY Bending	ULS Max	0	0	39	38.94	39.33	41.44	0	37.33	13.45	7.6	18.12	7.46	18.66	6.38	20.47	7.5	25.86	0
	ULS Min	0	-18.78	0	0	0	0	-11.18	0	0	-14.07	0	-13.6	0	-16.69	0	-12.81	0	0
IZ Bending	ULS Max	0	0	0	1.21	0	2.29	0	2.05	0.88	0	0.42	0.68	0	0.34	0.7	1.7	0.43	0
	ULS Min	0	-1.45	-0.83	0	-1.05	0	-2.81	-0.02	0	-1.08	0	0	-0.41	-0.21	0	0	-0.41	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	5	14	13	14	14	5	16	6	6	8	6	8	7	9	5	9	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Force (kn) =	0	103	245	246	248	263	80	254	92	96	122	93	126	113	139	89	162	0
	Tension Combined Force (kN) =	195	384	463	474	518	219	-117	46	-36	-49	20	-27	5	-47	-76	-86	-607	111
	Compression Combined Force (kN) =	195	171	-28	-18	20	-312	-323	-527	-272	-287	-274	-258	-297	-318	-402	-310	-943	98
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.07	0.10	0.10	0.11	0.05	NA	0.01	NA	NA	0.00	NA	0.00	NA	NA	NA	NA	0.02
		NA	NA	0.01	0.01	NA	0.09	0.10	0.16	0.08	0.09	0.08	0.08	0.09	0.10	0.12	0.10	0.26	NA

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	214.29	35.97	419.48	63.99	-305.57	-332.49	-285.17	-283.54	-398.88	-398.92	-315.74	-330.13	-64.31	27.7
	ULS Min	214.29	18.99	419.48	54.3	-331.06	-357.98	-310.67	-309.03	-421.23	-421.27	-338.1	-352.48	-71.98	18.86
IY Bending	ULS Max	345.49	0	6.06	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-372.91	-42.24	0	-16.48	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	6.95	0	0.07	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	0.15	-0.15	0	-0.35	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	4	14	2	7	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		329	281	43	118	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		543	316	463	182	-306	-332	-285	-284	-399	-399	-316	-330	-64	28
Compression Combined Force (kN) =		-115	-262	376	-64	-331	-358	-311	-309	-421	-421	-338	-352	-72	19
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.03	0.06	0.10	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.06	NA	0.02	0.09	0.09	0.08	0.08	0.13	0.13	0.10	0.11	0.23	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	185.7	14.95	267.3	63.01	299.76	-229.08	-239.28	-191.4	-201.33	-214.76	-194.83	-75.31	-181.43	-30.13	28.75
	ULS Min	179.09	0.39	247.21	5.12	299.76	-252.07	-262.28	-214.4	-224.33	-237.75	-217.82	-98.3	-204.42	-38.97	20.37
IY Bending	ULS Max	269.53	10.13	18.09	11.59	97.27	0	0	0	0	0	0	0	0	0	0
	ULS Min	-232.87	-20.2	-5.36	-15.44	97.27	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	5.43	1.72	2.38	6.19	23.5	0	0	0	0	0	0	0	0	0	0
	ULS Min	-0.09	0	0	-0.11	23.5	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	3	9	8	7	5	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Force (kn) =		246	147	133	120	316	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		431	162	400	183	616	-229	-239	-191	-201	-215	-195	-75	-181	-30	29
Compression Combined Force (kN) =		-66	-147	114	-115	-17	-252	-262	-214	-224	-238	-218	-98	-204	-39	20
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.03	0.04	0.10	0.04	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.06	NA	0.04	0.00	0.07	0.07	0.06	0.06	0.06	0.06	0.03	0.05	0.13	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder	Front Transverse Sheave Girder	Back Transverse Sheave Girder	G1	G2/3	G4	G6
		End	Middle					
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	10822.04	10822.04	4436.66	1256.3	4312.08	1143.2	849.05
	ULS Min	0	0	-1434	-21	-12	-19	-656
Shear	Fz Max	4337	4337	1938	187	1968	41	1516
	Fz Min	-4312	-4312	-1959	-447	-1883	-258	-503
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.199	0.264	0.220	0.120	0.350	0.109	0.162
		0.119	0.227	0.364	0.107	0.471	0.062	0.660

3 - ULS 1		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-12304	-12283	-11507	-11234	-10531	-10329	-9994	-9960	-9761	-11940	-11926	-11058	-10415.97	-10241.87	-9944.23	-9910.82	-9733.89
	ULS Min	-12335	-12293	-11550	-11391	-10668	-10466	-10055	-9994	-9856	-11970	-11936	-11257	-10553.06	-10378.97	-10005.62	-9944.23	-9828.69
IY Bending	ULS Max	0	-59	-57	71	64	102	105	107	107	31	42	67	65.59	105.81	105.81	100.69	97.79
	ULS Min	-59	-85	-82	62	63	64	102	105	62	0	31	43	61.71	61.51	100.69	97.79	96.55
IZ Bending	ULS Max	0	-41	119	423	-44	261	261	-42	216	87	116	150	159.18	147.24	40.71	205.5	205.49
	ULS Min	-41	-48	-2	267	-159	-159	-42	-206	-206	0	87	16	147.23	-262.07	-262.05	40.71	-198.77
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	2	3	2	2	2	3	4	4	4	1	1	2	2	3	4	4	3
	Stress Z	1	1	3	10	3	5	8	7	7	2	3	4	3	5	8	7	7
Force (kn) =		366	487	708	1651	844	1373	1289	1107	1141	404	540	749	854	1395	1294	1081	1070
Tension Combined Force (kN) =		-11939	-11795	-10800	-9583	-9687	-8956	-8705	-8853	-8621	-11536	-11386	-10309	-9562	-8847	-8650	-8830	-8663
Compression Combined Force (kN) =		-12700	-12781	-12258	-13041	-11513	-11839	-11344	-11101	-10997	-12373	-12476	-12006	-11407	-11774	-11300	-11025	-10899
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		0.32	0.32	0.30	0.32	0.29	0.29	0.35	0.34	0.337	0.31	0.31	0.30	0.28	0.29	0.35	0.34	0.33

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	-4020	-4009	-2877	-2554	-2268	-2165	-1964	-1814	-1950	-3734.07	-3715.1	-2507.69	-2210.51	-2084.23	-1836.2	-1654.38	-1727.23
	ULS Min	-4033	-4013	-2896	-2622	-2346	-2243	-2042	-1892	-1981	-3747.3	-3719.75	-2595.05	-2288.63	-2162.35	-1914.32	-1732.5	-1757.94
IY Bending	ULS Max	2	6	9	46	43	42	42	158	154	14.32	17.35	28.13	30.68	40.05	43.86	158.84	159.3
	ULS Min	0	2	-39	-21	27	26	41	41	-164	0	8.52	9.5	29.44	30.66	39.98	43.84	-207.35
IZ Bending	ULS Max	0	-66	-38	281	-24	49	49	91	312	34.42	64.44	108.54	100.59	15.71	30.04	37.79	37.76
	ULS Min	-66	-82	-127	171	-39	-24	-40	-39	91	0	29.42	29.92	15.71	-49.36	-49.36	30.03	-493.84
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	0	0	2	2	2	2	2	8	8	1	1	1	1	2	2	8	10
	Stress Z	2	3	4	9	1	2	2	3	10	1	2	3	3	2	2	1	16
Force (kn) =		168	227	459	865	256	276	276	817	1385	139	224	373	363	272	286	688	1994
Tension Combined Force (kN) =		-3852	-3782	-2418	-1689	-2012	-1889	-1688	-997	-565	-3596	-3491	-2135	-1848	-1813	-1550	-966	267
Compression Combined Force (kN) =		-4201	-4240	-3354	-3487	-2602	-2518	-2318	-2709	-3366	-3886	-3944	-2968	-2652	-2434	-2200	-2420	-3752
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01
		0.27	0.27	0.22	0.22	0.17	0.16	0.15	0.17	0.21	0.25	0.25	0.19	0.17	0.15	0.14	0.15	0.23

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	187.86	187.86	289.39	315.99	395.81	140.75	-297.11	-315.37	-179.06	-195.88	-146.2	-166.8	-211.89	-221.61	-237.67	-263.36	-28.91	-879.56
	ULS Min	187.86	187.86	280.57	299.28	368.51	95.38	-338.39	-360.17	-223.28	-249.62	-191.38	-218.18	-256.96	-274.6	-283.24	-314.26	-42.07	-890.48
IY Bending	ULS Max	0	0	39.72	41.07	40.38	39.69	3.5	0	5.47	16.12	5.4	20.58	3.37	22.7	4.57	23.6	0	28.63
	ULS Min	0	0	0	0	0	0	-19.01	0	-20.1	0	-19.6	0	-24.96	0	-20.69	0	0	0
IZ Bending	ULS Max	0	0	0	0.25	0	0	0	0	0.45	1.15	0	0.16	0	0.75	0	2.23	0	0
	ULS Min	0	0	-5.4	-7.63	-33.53	-37.61	-1.2	0	-0.52	0	-0.55	0	-2.85	0	-5.44	0	0	-5.49
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	14	14	14	14	8	0	8	7	8	9	10	9	9	10	0	10
	Stress Z	0	0	1	1	4	4	0	0	0	0	0	0	0	0	1	0	0	1
	Force (kn) =	0	0	259	271	317	321	130	0	136	110	133	138	173	154	149	162	0	189
	Tension Combined Force (kN) =	188	188	548	587	713	462	-167	-315	-43	-86	-14	-28	-39	-68	-89	-101	-29	-691
	Compression Combined Force (kN) =	188	188	22	28	51	-226	-468	-360	-359	-360	-324	-357	-430	-428	-432	-477	-42	-1079
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.04	0.12	0.13	0.16	0.10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.06	0.14	0.11	0.11	0.11	0.10	0.11	0.13	0.13	0.13	0.15	0.01	0.30

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	230.56	360.43	285.89	310.23	388.43	85.79	-258.11	-250.74	-176.03	-198.13	-144.38	-161.14	-196.08	-227.22	-246.28	-263.83	-667.7	-21.41
	ULS Min	230.56	351.72	284.97	309.5	386.97	81.75	-305.22	-317.28	-230.22	-242.36	-195.83	-206.43	-249.48	-272.42	-297.71	-308.84	-679.89	-34.57
IY Bending	ULS Max	0	0	39.23	39.22	39.52	41.07	0	40.29	15.04	5.58	20.16	5.43	21.53	3.61	22.89	5.21	24.83	0
	ULS Min	0	-25.89	0	0	0	0	-6.46	0	0	-20.15	0	-19.61	0	-25.02	0	-20.84	0	0
IZ Bending	ULS Max	0	0	0	1.17	0	1.74	0	2.37	0.89	0	0.4	0.11	0	0.7	0.63	1.06	0.28	0
	ULS Min	0	-1.77	-1.22	0	-0.78	0	-3.25	0	0	-1.39	0	-0.14	-0.39	0	0	0	-0.53	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	8	14	14	14	14	3	17	6	8	8	8	9	10	10	9	9	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Force (kn) =	0	141	247	247	248	260	49	275	103	138	136	132	145	169	155	142	156	0
	Tension Combined Force (kN) =	231	502	533	558	637	346	-209	24	-73	-60	-8	-29	-51	-58	-91	-122	-512	-21
	Compression Combined Force (kN) =	231	210	38	62	139	-178	-354	-592	-333	-380	-332	-338	-395	-442	-453	-451	-836	-35
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.10	0.12	0.12	0.14	0.08	NA	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.05	0.11	0.18	0.10	0.12	0.10	0.10	0.12	0.14	0.14	0.14	0.23	0.01

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	336.29	62.1	726.7	107.44	-506.6	-538.41	-532.45	-525.58	-675.03	-681.7	-602.93	-607.96	-127.32	23.5
	ULS Min	336.29	45.34	726.7	99.59	-532.09	-563.91	-557.94	-551.08	-697.39	-704.05	-625.28	-630.32	-134.99	14.66
IY Bending	ULS Max	509.74	0	22.77	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-466.61	-50.14	0	-15.25	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	4.9	0	0.06	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	0.4	-0.44	0	-0.92	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	5	16	9	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		431	333	162	110	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		767	395	889	217	-507	-538	-532	-526	-675	-682	-603	-608	-127	24
Compression Combined Force (kN) =		-95	-288	565	-10	-532	-564	-558	-551	-697	-704	-625	-630	-135	15
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.04	0.08	0.19	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.07	NA	0.00	0.14	0.15	0.15	0.15	0.21	0.21	0.19	0.19	0.43	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	156.04	11.16	210.1	50.53	193.75	-191.77	-195.93	-140.85	-154.79	-173.6	-154.99	-46.51	-127.94	-17.83	29.41
	ULS Min	151.14	-2.11	196.71	8.34	193.75	-214.77	-218.92	-163.84	-177.78	-196.6	-177.98	-69.5	-150.93	-26.67	21.02
IY Bending	ULS Max	235.3	10.45	16.88	11.75	98.78	0	0	0	0	0	0	0	0	0	0
	ULS Min	-209.51	-19.65	-7.75	-15.96	98.78	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	5.93	3.41	3.23	5.43	16.97	0	0	0	0	0	0	0	0	0	0
	ULS Min	-5.67	0	0	0	16.97	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	3	9	7	7	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Force (kn) =		220	146	126	123	303	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		376	157	336	173	496	-192	-196	-141	-155	-174	-155	-47	-128	-18	29
Compression Combined Force (kN) =		-69	-148	71	-114	-109	-215	-219	-164	-178	-197	-178	-70	-151	-27	21
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.02	0.04	0.08	0.04	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.06	NA	0.04	0.01	0.06	0.06	0.04	0.05	0.05	0.05	0.02	0.04	0.09	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder	Front Transverse Sheave Girder	Back Transverse Sheave Girder	G1	G2/3	G4	G6
		End	Middle					
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	22958.77	22958.77	3404.24	1566.54	1857.93	1569.74	811.89
	ULS Min	0	0	-1001	-10	-12	-11	-542
Shear	Fz Max	9096	9096	1344	2115	2240	2077	1133
	Fz Min	-9029	-9029	-1333	-332	-2172	-315	-355
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.421	0.560	0.169	0.150	0.151	0.150	0.155
		0.251	0.476	0.249	0.506	0.536	0.497	0.493

3 - ULS 4		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-6438	-6416	-6287	-6151	-7741	-8361	-9586	-9553	-9741	-6388	-6375	-5944	-7606.15	-8073	-9350.57	-9317.69	-9501.92
	ULS Min	-18120	-18075	-17021	-16874	-13826	-12979	-11055	-10993	-10498	-17637	-17603	-16547	-13455.09	-12703.6	-10846.95	-10785.02	-10288.18
IY Bending	ULS Max	1838	2476	2476	1906	641	448	1236	1236	523	1730	2330	2330	576.62	481.72	1159.2	1159.2	542.45
	ULS Min	-1694	-2283	-2279	-1612	-532	-270	-838	-838	-336	-1627	-2199	-2195	-424.18	-252.65	-920.61	-920.61	-326.56
IZ Bending	ULS Max	1554	1974	3475	11291	2352	754	754	99	590	1538	2008	10665	2485.64	370.82	1105.68	1105.68	229.98
	ULS Min	-1585	-2015	-3348	-10307	-2421	-394	-1116	-1116	-242	-1368	-1790	-10667	-2201.02	-755.62	-755.74	-115.32	-539.04
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	54	73	73	56	20	14	43	43	18	51	69	69	18	15	41	41	19
	Stress Z	39	49	85	276	51	16	36	36	19	38	49	261	52	16	36	36	17
Force (kn) =		12351	16251	20992	44151	11223	4720	8446	8446	3977	11778	15655	43786	11121	4894	8122	8122	3875
Tension Combined Force (kN) =		5912	9835	14705	38000	3482	-3641	-1140	-1107	-5763	5390	9281	37843	3514	-3179	-1229	-1196	-5627
Compression Combined Force (kN) =		-30471	-34326	-38014	-61024	-25049	-17699	-19501	-19439	-14475	-29415	-33259	-60333	-24576	-17597	-18969	-18907	-14163
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	0.14	0.23	0.34	0.88	0.07	NA	NA	NA	NA	0.12	0.21	0.87	0.07	NA	NA	NA	NA
		0.76	0.85	0.94	1.52	0.62	0.44	0.60	0.60	0.443	0.73	0.83	1.50	0.61	0.44	0.58	0.58	0.43

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	2433	2444	2418	2588	1150	31	-630	-751	-1185	2442.37	2462.53	2644.33	1271.22	231.58	-454.97	-600.18	-1021.05
	ULS Min	-9337	-9317	-7070	-6954	-4803	-3312	-2068	-1553	-1363	-8629.59	-8600.14	-6451.83	-4479.45	-3136.24	-1954.26	-1397.64	-1170.74
IY Bending	ULS Max	717	960	964	513	266	68	95	157	160	577.18	781.86	785.95	256.31	71.23	94.3	160.58	161.33
	ULS Min	-629	-851	-850	-467	-191	22	24	23	-140	-543.49	-740.24	-739.91	-179.47	25.8	19.88	19.89	-263.44
IZ Bending	ULS Max	641	715	981	5181	878	116	67	275	448	488.61	586.54	4852.09	909.2	132.67	42.75	186.59	186.63
	ULS Min	-679	-782	-1033	-4845	-925	-147	-53	-98	-99	-458.08	-536.95	-4771.03	-778.69	-125.44	-67.78	-188.32	-587.61
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	34	46	46	25	13	3	5	8	8	28	37	38	12	3	5	8	13
	Stress Z	21	25	33	164	29	5	2	9	14	15	19	153	29	4	2	6	19
Force (kn) =		4357	5522	6158	14698	3276	617	521	1267	1704	3366	4374	14910	3202	594	520	1066	2436
Tension Combined Force (kN) =		6791	7966	8575	17286	4427	648	-109	516	519	5808	6836	17554	4473	825	65	465	1415
Compression Combined Force (kN) =		-13694	-14839	-13227	-21652	-8079	-3929	-2589	-2820	-3066	-11996	-12974	-21362	-7682	-3730	-2474	-2463	-3606
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	0.31	0.37	0.39	0.79	0.20	0.03	NA	0.02	0.02	0.27	0.31	0.81	0.21	0.04	0.00	0.02	0.06
		0.88	0.95	0.85	1.39	0.51	0.25	0.16	0.18	0.19	0.77	0.83	1.37	0.49	0.24	0.16	0.16	0.22

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	767.73	767.73	379.08	390.24	577.94	120	1233.05	1147.26	762.24	808.61	783.94	852.19	475.57	428.41	-17.23	-16.1	151.06	-680.04
	ULS Min	-326.92	-326.92	157.56	175.31	135.59	-24.83	-2007.74	-1627.35	-1284.06	-1130.44	-1245.03	-1103.59	-1039.18	-829.64	-573.75	-533.67	-13.64	-835.71
IY Bending	ULS Max	0	0	56.24	55.23	49.47	44.27	14.48	0	17.7	28.18	18.53	39.51	11.28	35.84	7.13	28.37	0	28.01
	ULS Min	0	0	0	0	0	0	-40.15	0	-32.54	-4.63	-31.01	-1.36	-32.9	0	-25.39	0	0	0
IZ Bending	ULS Max	0	0	82.84	112.27	75.05	39.2	98.31	0	91.41	31.89	72.13	4.98	76.11	8.67	77.6	9.74	0	7.41
	ULS Min	0	0	-70.43	-101.45	-109.33	-77.78	-51.72	0	-45.41	-35.3	-21.68	-8.97	-26.61	-12.21	-27.41	-10.42	0	-8.01
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	19	19	17	15	17	0	14	12	13	16	14	15	11	12	0	10
	Stress Z	0	0	9	12	12	8	11	0	10	4	8	1	9	1	9	1	0	1
Force (kn) =		0	0	512	563	522	428	448	0	384	253	339	282	359	263	311	209	0	189
Tension Combined Force (kN) =		768	768	892	954	1100	548	1681	1147	1146	1062	1123	1134	834	691	294	193	151	-491
Compression Combined Force (kN) =		-327	-327	-355	-388	-386	-453	-2455	-1627	-1668	-1384	-1584	-1385	-1398	-1092	-885	-743	-14	-1025
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.15	0.19	0.21	0.24	0.12	0.40	0.28	0.28	0.26	0.27	0.27	0.20	0.17	0.07	0.05	0.03	NA
		0.01	0.09	0.10	0.11	0.11	0.13	0.76	0.50	0.51	0.43	0.49	0.43	0.43	0.34	0.27	0.23	0.00	0.29

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	727.11	475.29	359.19	372.51	561.35	58.46	1024.02	1159.77	694.39	693.38	757.83	754.69	393.13	471.51	-7.34	-27.17	-503.24	174.79
	ULS Min	-324.11	185.87	157.53	203.04	167.6	-47.77	-1491.42	-1759.26	-1036.67	-1156.53	-1042.76	-1143.05	-790.96	-985.12	-515.09	-584.21	-616.46	-9.47
IY Bending	ULS Max	0	58.65	51.38	48.68	44.74	42.81	6.72	71.52	36.7	18.1	37.89	17.54	33.98	11.09	27.35	7.95	24.27	0
	ULS Min	0	-107.36	0	0	0	0	-16.7	-2.72	-7.97	-31.81	0	-30.72	0	-32.55	0	-25.03	0	0
IZ Bending	ULS Max	0	29.8	34.81	38.8	37.19	34.07	112.66	37.08	16.99	23.14	6.48	14.71	6.16	16.22	6.94	17.5	2.15	0
	ULS Min	0	-52.41	-12.63	-10.23	-10.32	-9.82	-65.31	-39.05	-13.01	-71.3	-1.61	-65.85	-1.95	-68.56	-1.6	-75.65	-9.95	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	31	18	17	16	15	7	30	15	13	16	13	14	14	11	10	9	0
	Stress Z	0	5	4	4	4	4	13	4	2	8	1	7	1	8	1	9	1	0
Force (kn) =		0	666	389	380	352	334	316	551	277	343	266	326	239	343	196	305	169	0
Tension Combined Force (kN) =		727	1141	748	752	913	392	1340	1711	972	1036	1024	1080	632	814	189	278	-334	175
Compression Combined Force (kN) =		-324	-480	-231	-177	-184	-381	-1808	-2310	-1314	-1499	-1309	-1469	-1030	-1328	-711	-889	-786	-9
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.22	0.16	0.16	0.20	0.09	0.32	0.41	0.23	0.25	0.25	0.26	0.15	0.20	0.05	0.07	NA	0.04
		0.01	0.13	0.07	0.05	0.05	0.11	0.56	0.71	0.40	0.46	0.40	0.45	0.32	0.41	0.22	0.27	0.22	0.00

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	407.59	412.42	836.78	170.69	1250.75	1162.87	667.18	723.48	297.45	234.02	-146.04	-104.76	-93.12	23.91
	ULS Min	249.99	-269.98	584.2	-475.52	-2314.88	-2393.44	-1904.62	-1845.5	-1713.49	-1772.36	-1224	-1187.18	-176.98	13.87
IY Bending	ULS Max	8182.22	0	25.89	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-8917.62	-57.04	0	-16.23	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	146.33	237.22	73.42	268.56	0	0	0	0	0	0	0	0	0	0
	ULS Min	-70.6	-113.83	-35.15	-99.28	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	90	19	10	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	7	17	6	22	0	0	0	0	0	0	0	0	0	0
Force (kn) =		7783	731	292	511	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		8191	1143	1129	682	1251	1163	667	723	297	234	-146	-105	-93	24
Compression Combined Force (kN) =		-7533	-1000	292	-987	-2315	-2393	-1905	-1846	-1713	-1772	-1224	-1187	-177	14
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.40	0.22	0.25	0.15	0.24	0.22	0.13	0.14	0.07	0.05	NA	NA	NA	0.02
		0.48	0.25	NA	0.28	0.61	0.63	0.50	0.49	0.51	0.53	0.37	0.36	0.57	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	238.1	207.51	292.54	108.54	132.28	652.97	615.04	410.33	430.22	305.5	284.89	324.12	291.62	47.87	32.27
	ULS Min	-18.61	-231.82	-3.63	-73.47	72.92	-955.13	-960.15	-639.52	-644.45	-560.49	-546.34	-382.18	-439.12	-75.11	19.64
IY Bending	ULS Max	3983.79	15.82	20.23	16.29	115.23	0	0	0	0	0	0	0	0	0	0
	ULS Min	-4326.23	-22.59	-13.77	-18.66	89.45	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	169.33	239.92	97.78	267.76	124.16	0	0	0	0	0	0	0	0	0	0
	ULS Min	-100.37	-120.86	-56.23	-136.9	0	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	52	10	9	8	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	13	24	10	26	7	0	0	0	0	0	0	0	0	0	0
Force (kn) =		4362	544	300	560	635	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		4600	751	593	668	767	653	615	410	430	306	285	324	292	48	32
Compression Combined Force (kN) =		-4381	-775	-304	-633	-562	-955	-960	-640	-644	-560	-546	-382	-439	-75	20
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.27	0.18	0.14	0.16	0.06	0.14	0.13	0.09	0.09	0.07	0.06	0.07	0.06	0.04	0.03
		0.34	0.30	0.12	0.24	0.06	0.25	0.25	0.17	0.17	0.15	0.14	0.10	0.12	0.24	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder	Front Transverse Sheave Girder	Back Transverse Sheave Girder	G1	G2/3	G4	G6
		End	Middle					
	Members	40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	24528.02	24528.02	2220.3	1759.28	1813.43	1719.51	494.75
	ULS Min	0	0	-1072	-10	-12	-17	-469
Shear	Fz Max	9666	9666	916	2364	2361	2271	1087
	Fz Min	-9741	-9741	-957	-255	-2390	-249	-646
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.450	0.598	0.110	0.168	0.147	0.165	0.094
		0.268	0.510	0.178	0.566	0.572	0.543	0.473

3 - ULS V1		North Tower																	
		Rail Side Columns									HWY Side Columns								
		Front Leg (100-110)									Front Leg (200-209)								
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-14071	-14049	-13245	-12971	-12206	-12006	-11650	-11617	-11423	-13716	-13702	-12807	-12099.48	-11929.02	-11611.04	-11577.63	-11406.32
	ULS Min	-14101	-14060	-13287	-13128	-12343	-12143	-11712	-11650	-11518	-13746	-13713	-13006	-12236.57	-12066.11	-11672.43	-11611.04	-11501.13
IY Bending	ULS Max	0	-60	-51	79	81	119	135	144	144	32	43	85	83.16	123.34	129.85	133.29	133.29
	ULS Min	-60	-86	-83	77	77	77	119	135	10	0	32	45	75.47	75.25	123.33	129.85	47.85
IZ Bending	ULS Max	0	-46	119	446	-51	304	304	-49	253	91	122	158	173.73	173.75	48.77	241.55	241.53
	ULS Min	-46	-54	-7	267	-185	-185	-49	-241	-241	0	91	-12	165.51	-305.44	-305.41	48.77	-236.29
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	2	3	2	2	3	4	5	5	5	1	1	2	3	4	5	5	5
	Stress Z	1	1	3	11	4	6	10	8	8	2	3	4	4	6	10	8	8
Force (kn) =		382	510	713	1761	1016	1600	1548	1366	1405	424	564	844	989	1626	1533	1327	1327
Tension Combined Force (kN) =		-13689	-13539	-12532	-11210	-11190	-10405	-10102	-10251	-10017	-13292	-13138	-11963	-11111	-10303	-10078	-10251	-10080
Compression Combined Force (kN) =		-14484	-14570	-14000	-14889	-13360	-13743	-13260	-13016	-12923	-14170	-14277	-13850	-13225	-13692	-13205	-12938	-12828
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		0.36	0.36	0.35	0.37	0.33	0.34	0.41	0.40	0.396	0.35	0.35	0.34	0.33	0.34	0.40	0.40	0.39

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	-4215	-4204	-3045	-2722	-2434	-2334	-2129	-1978	-2106	-3929.2	-3910.23	-2678.24	-2377.84	-2253.89	-2000.33	-1814.98	-1873.33
	ULS Min	-4228	-4208	-3064	-2790	-2512	-2412	-2207	-2056	-2137	-3942.44	-3914.89	-2765.6	-2455.96	-2332.01	-2078.45	-1893.1	-1904.04
IY Bending	ULS Max	2	8	10	54	51	50	51	170	166	13.82	16.85	35.19	36.9	48.24	52.88	172.59	173.37
	ULS Min	0	2	-40	-22	32	32	49	50	-171	0	7.83	8.8	36.57	36.87	48.16	52.87	-224.83
IZ Bending	ULS Max	0	-67	-38	280	-26	53	53	105	328	35.25	65.59	108.37	102.5	17.92	33.41	37.4	37.37
	ULS Min	-67	-83	-129	176	-40	-26	-44	-43	105	0	30.25	29.09	17.92	-53.5	-53.5	33.39	-528.62
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	0	0	2	3	2	2	2	8	8	1	1	2	2	2	3	8	11
	Stress Z	2	3	4	9	1	2	2	3	10	1	2	3	3	2	2	1	17
Force (kn) =		174	234	467	894	289	316	320	894	1448	139	225	399	391	313	330	738	2146
Tension Combined Force (kN) =		-4041	-3970	-2578	-1827	-2145	-2018	-1809	-1084	-658	-3791	-3685	-2279	-1987	-1941	-1670	-1077	272
Compression Combined Force (kN) =		-4402	-4442	-3531	-3685	-2802	-2729	-2527	-2951	-3585	-4081	-4140	-3165	-2847	-2645	-2408	-2632	-4050
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01
		0.28	0.28	0.23	0.24	0.18	0.17	0.16	0.19	0.22	0.26	0.27	0.20	0.18	0.17	0.15	0.17	0.25

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	212.88	212.88	329.13	360.95	454.99	199.59	-335.28	-355.94	-206.92	-225.06	-170.29	-192.36	-246.85	-259.61	-276.24	-290.77	-84.66	-885.57
	ULS Min	212.88	212.88	318.7	341.51	422.7	146.63	-376.58	-401.24	-251.08	-279.34	-215.45	-244.17	-291.86	-313.3	-321.83	-342.33	-97.83	-896.45
IY Bending	ULS Max	0	0	39.86	41.39	40.5	39.22	2.5	0	5	16.9	4.97	21.57	2.6	24.11	3.96	24.89	0	28.99
	ULS Min	0	0	0	0	0	0	-20.66	0	-21.66	0	-21.09	0	-27.33	0	-22.86	0	0	0
IZ Bending	ULS Max	0	0	0	0.29	0	0	0	0	0.52	1.13	0	0.23	0	0.87	0	2.6	0	0
	ULS Min	0	0	-6.01	-8.51	-37.73	-42.77	-1.21	0	-0.45	0	-0.61	0	-3.33	0	-5.89	0	0	-5.82
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	14	14	14	14	9	0	9	7	9	9	11	10	10	10	0	10
	Stress Z	0	0	1	1	4	5	0	0	0	0	0	0	0	0	1	0	0	1
	Force (kn) =	0	0	261	275	326	328	141	0	146	116	143	145	190	163	164	172	0	191
	Tension Combined Force (kN) =	213	213	590	636	781	528	-194	-356	-61	-110	-28	-47	-57	-96	-112	-119	-85	-694
	Compression Combined Force (kN) =	213	213	58	66	96	-182	-517	-401	-397	-395	-358	-389	-481	-477	-486	-514	-98	-1088
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.04	0.13	0.14	0.17	0.12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.05	0.16	0.12	0.12	0.12	0.11	0.12	0.15	0.15	0.15	0.16	0.03	0.30

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	256.02	407.99	325.72	355.23	447.73	137.36	-295.28	-283.57	-204.2	-227.83	-168.95	-186.17	-232.85	-263.34	-273.52	-306.27	-649.54	-78.19
	ULS Min	256.02	398.5	324.55	354.23	446.07	133.42	-343.15	-351.84	-258.97	-272	-220.84	-231.44	-286.98	-308.48	-325.64	-351.22	-661.85	-91.35
IY Bending	ULS Max	0	0	39.29	39.29	39.58	40.94	0	42.23	15.76	5.11	21.15	4.98	22.83	2.87	24.15	4.69	24.74	0
	ULS Min	0	-30.61	0	0	0	0	-5.5	0	0	-21.72	0	-21.1	0	-27.39	0	-22.99	0	0
IZ Bending	ULS Max	0	0	0	1.27	0	1.66	0	2.59	0.91	0	0.46	0.01	0	0.79	0.71	0.92	0.26	0
	ULS Min	0	-2	-1.45	0	-0.87	0	-3.55	0	0	-1.54	0	-0.22	-0.45	0	0	0	-0.55	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	9	14	14	14	14	2	18	7	9	9	9	10	11	10	10	9	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Force (kn) =	0	167	248	248	249	259	43	288	107	149	143	142	154	185	163	156	155	0
	Tension Combined Force (kN) =	256	575	574	603	697	396	-252	5	-97	-79	-26	-44	-79	-78	-110	-150	-494	-78
	Compression Combined Force (kN) =	256	232	76	106	197	-126	-387	-640	-366	-421	-364	-373	-441	-494	-489	-507	-817	-91
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.11	0.13	0.13	0.15	0.09	NA	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.04	0.12	0.20	0.11	0.13	0.11	0.12	0.14	0.15	0.15	0.16	0.23	0.03

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	383.4	72.21	845.77	125.4	-585.75	-616.23	-626.26	-620.48	-783.94	-788.99	-711.04	-718.41	-151.61	21.88
	ULS Min	383.4	55.63	845.77	117.06	-611.25	-641.72	-651.76	-645.98	-806.3	-811.35	-733.4	-740.77	-159.28	13.03
IY Bending	ULS Max	573.12	0	29.23	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-497.64	-53.19	0	-14.77	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	4.16	0	0.05	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	0.49	-0.54	0	-1.14	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	6	17	12	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		479	354	208	107	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		862	426	1054	232	-586	-616	-626	-620	-784	-789	-711	-718	-152	22
Compression Combined Force (kN) =		-96	-298	638	10	-611	-642	-652	-646	-806	-811	-733	-741	-159	13
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.04	0.08	0.23	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.07	NA	NA	0.16	0.17	0.17	0.17	0.24	0.24	0.22	0.22	0.51	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	164.25	12.12	227.32	56.49	209.33	-203.59	-209.04	-156.18	-169.34	-186.26	-167.25	-55.46	-144.25	-21.55	29.24
	ULS Min	158.36	-1.34	212.7	9.62	209.33	-226.59	-232.03	-179.17	-192.34	-209.26	-190.25	-78.46	-167.24	-30.39	20.85
IY Bending	ULS Max	245.95	10.41	17.35	11.82	97.85	0	0	0	0	0	0	0	0	0	0
	ULS Min	-215.87	-19.82	-7.06	-15.79	97.85	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	6.24	4	3.55	5.95	17.93	0	0	0	0	0	0	0	0	0	0
	ULS Min	-7.32	0	0	0	17.93	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	3	9	8	7	5	0	0	0	0	0	0	0	0	0	0
	Stress Z	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Force (kn) =		236	148	130	122	303	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		400	160	357	179	512	-204	-209	-156	-169	-186	-167	-55	-144	-22	29
Compression Combined Force (kN) =		-78	-149	83	-113	-94	-227	-232	-179	-192	-209	-190	-78	-167	-30	21
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.02	0.04	0.09	0.04	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.06	NA	0.04	0.01	0.06	0.06	0.05	0.05	0.06	0.05	0.02	0.04	0.10	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder	Front Transverse Sheave Girder	Back Transverse Sheave Girder	G1	G2/3	G4	G6
		End	Middle					
	Members	40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	27338.62	27338.62	3647.91	1892.39	2246.94	1876.61	813.69
	ULS Min	0	0	-1072	-10	-12	-10	-541
Shear	Fz Max	10850	10850	1449	2551	2693	2461	1254
	Fz Min	-10750	-10750	-1461	-360	-2612	-351	-394
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.502	0.667	0.181	0.181	0.182	0.180	0.155
		0.299	0.568	0.271	0.610	0.644	0.589	0.546

3 - ULS V2		North Tower																	
		Rail Side Columns									HWY Side Columns								
		Front Leg (100-110)									Front Leg (200-209)								
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-9527	-9506	-9209	-8988	-10164	-10666	-11634	-11601	-11738	-9257	-9243	-8708	-9998.47	-10382.68	-11417.06	-11384.1	-11531.35
	ULS Min	-19544	-19500	-18415	-18202	-15399	-14644	-12902	-12840	-12401	-18903	-18869	-17824	-15031.43	-14371.35	-12708.43	-12646.59	-12218.83
IY Bending	ULS Max	1538	2069	2069	1673	559	408	1100	1100	497	1507	2031	2031	503.84	437.93	1030.93	1030.93	508.95
	ULS Min	-1489	-2011	-2006	-1342	-447	-207	-679	-679	-320	-1370	-1851	-1847	-353.99	-191.53	-751.77	-751.77	-264.48
IZ Bending	ULS Max	1321	1682	3086	9898	2033	735	735	14	578	1366	1788	9275	2207.41	366.34	961.95	961.95	267.67
	ULS Min	-1370	-1737	-2763	-8615	-2058	-395	-971	-971	-278	-1124	-1467	-9010	-1809.72	-736.93	-737.03	-28.3	-529.27
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	45	61	61	49	17	13	39	39	17	45	60	60	16	14	36	36	18
	Stress Z	34	43	76	242	43	15	31	31	19	33	44	227	46	15	31	31	17
Force (kn) =		10479	13750	18135	38712	9609	4462	7437	7437	3837	10345	13771	38093	9835	4615	7150	7150	3716
Tension Combined Force (kN) =		952	4244	8926	29724	-555	-6204	-4197	-4165	-7902	1087	4528	29385	-163	-5768	-4267	-4234	-7815
Compression Combined Force (kN) =		-30023	-33250	-36550	-56914	-25008	-19105	-20338	-20276	-16238	-29247	-32641	-55917	-24867	-18987	-19858	-19796	-15935
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	0.02	0.10	0.21	0.69	NA	NA	NA	NA	NA	0.03	0.10	0.68	NA	NA	NA	NA	NA
		0.75	0.83	0.91	1.41	0.62	0.47	0.62	0.62	0.497	0.73	0.81	1.39	0.62	0.47	0.61	0.61	0.49

		North Tower																	
		Rail Side Columns									HWY Side Columns								
		Rear Leg (300-310)									Rear Leg (400-409)								
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	522	533	775	1102	-56	-1010	-1552	-1645	-2011	725.3	744	1124.33	20.4	-852.8	-1391.49	-1490.19	-1805.18
	ULS Min	-9569	-9548	-7359	-7086	-5170	-3886	-2796	-2344	-2168	-8766.84	-8738.95	-6684.85	-4919.9	-3750.67	-2687.75	-2184.88	-1937.87
IY Bending	ULS Max	613	828	833	425	243	72	88	189	190	508.72	680.91	683.6	225.09	73.45	87.36	191.53	191.73
	ULS Min	-541	-724	-723	-415	-149	25	27	26	-187	-451.86	-623.74	-624.28	-148.43	34.51	23.57	23.57	-303.47
IZ Bending	ULS Max	502	561	836	4539	751	87	82	272	556	440.74	545.74	4280.76	829.37	122.89	52.32	183.17	183.17
	ULS Min	-629	-723	-891	-4054	-794	-139	-64	-64	-49	-370.71	-417.25	-3967.63	-617.39	-98.34	-83.05	-138.18	-759.88
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	29	40	40	20	12	3	4	9	9	24	33	33	11	4	4	9	15
	Stress Z	20	23	28	143	25	4	3	9	18	14	17	135	26	4	3	6	24
Force (kn) =		3847	4883	5315	12786	2865	611	530	1376	2080	2992	3895	13118	2888	578	532	1169	3010
Tension Combined Force (kN) =		4369	5416	6090	13888	2809	-398	-1022	-269	69	3717	4639	14242	2909	-275	-860	-321	1205
Compression Combined Force (kN) =		-13416	-14431	-12674	-19872	-8036	-4497	-3326	-3720	-4247	-11759	-12634	-19802	-7808	-4329	-3220	-3354	-4948
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	0.20	0.25	0.28	0.64	0.13	NA	NA	NA	0.00	0.17	0.21	0.65	0.13	NA	NA	NA	0.06
		0.86	0.93	0.81	1.27	0.51	0.29	0.21	0.24	0.26	0.75	0.81	1.27	0.50	0.28	0.20	0.21	0.31

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	711.29	711.29	433.54	450.46	632.26	245.78	942.27	861.52	584.21	614.21	612.64	661.23	323.73	274.33	-93.24	-97.55	-28.58	-831.78
	ULS Min	-226.99	-226.99	243.67	266.23	253.1	106.12	-1841.58	-1523.34	-1176.19	-1055.72	-1133.07	-1022.48	-981.21	-811.81	-577.11	-548.74	-171.63	-966.16
IY Bending	ULS Max	0	0	54.01	53.81	48.43	42.97	12.46	0	15.82	25.47	16.58	38.39	9.69	36.08	6.16	29.67	0	30.38
	ULS Min	0	0	0	0	0	0	-37.87	0	-31.59	-2.65	-30.04	0	-33.41	0	-26.5	0	0	0
IZ Bending	ULS Max	0	0	68.6	92.53	49.82	28.41	83.37	0	77.47	28.35	61.7	4.31	64.43	7.79	64.12	9.17	0	4.7
	ULS Min	0	0	-62.77	-90.65	-108.21	-82.6	-45.65	0	-39.8	-29.25	-18.72	-7.74	-23.64	-10.28	-25.93	-8.27	0	-9.15
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	19	19	17	15	16	0	13	11	13	16	14	15	11	12	0	11
	Stress Z	0	0	7	10	12	9	9	0	9	3	7	1	7	1	7	1	0	1
Force (kn) =		0	0	471	516	513	429	405	0	352	224	313	272	341	261	294	216	0	206
Tension Combined Force (kN) =		711	711	904	967	1145	675	1348	862	937	838	926	933	665	535	201	118	-29	-626
Compression Combined Force (kN) =		-227	-227	-227	-250	-260	-323	-2247	-1523	-1529	-1280	-1447	-1294	-1322	-1073	-871	-765	-172	-1172
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.14	0.20	0.21	0.25	0.15	0.32	0.21	0.23	0.20	0.22	0.22	0.16	0.13	0.05	0.03	NA	NA
		0.01	0.06	0.07	0.07	0.07	0.09	0.69	0.47	0.47	0.39	0.45	0.40	0.41	0.33	0.27	0.24	0.05	0.33

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	717	538.51	416.38	435.45	619.86	181.9	783.7	890.02	524.45	514.82	590.21	578.46	254.98	310.87	-80.2	-114.65	-611.4	-17.57
	ULS Min	-184.04	287.7	243.53	290.19	282.37	89.37	-1380.29	-1624.86	-967.28	-1077.29	-960.48	-1054.86	-767.92	-944.3	-523.23	-598.74	-709.85	-177.39
IY Bending	ULS Max	0	38.94	48.56	47.31	43.99	42.48	4.72	70.06	34.6	16.23	36.78	15.81	33.98	9.68	28.42	7.18	25.83	0
	ULS Min	0	-103.35	0	0	0	0	-15.35	0	-3.69	-30.88	0	-29.68	0	-33.05	0	-26.29	0	0
IZ Bending	ULS Max	0	26.3	29.36	33.71	31.54	30.96	96.34	31.97	14.98	19.19	5.78	12.66	5.19	14.15	6.33	15.65	2.41	0
	ULS Min	0	-44.58	-11.32	-8.32	-9.31	-6.86	-56.21	-33.95	-10.74	-61.76	-1.24	-56.4	-1.88	-58.54	-1.15	-64.23	-8.01	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	30	17	16	15	15	6	29	14	13	15	12	14	14	12	11	9	0
	Stress Z	0	4	3	4	3	3	11	4	2	7	1	6	1	7	1	7	1	0
Force (kn) =		0	630	360	361	336	326	278	532	259	319	257	301	238	328	202	293	176	0
Tension Combined Force (kN) =		717	1169	777	797	956	507	1061	1422	784	834	848	880	493	639	122	178	-436	-18
Compression Combined Force (kN) =		-184	-343	-117	-71	-54	-236	-1658	-2157	-1227	-1397	-1218	-1356	-1005	-1272	-725	-892	-886	-177
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.23	0.17	0.17	0.21	0.11	0.26	0.34	0.19	0.20	0.20	0.21	0.12	0.15	0.03	0.04	NA	NA
		0.01	0.10	0.03	0.02	0.02	0.07	0.51	0.67	0.38	0.43	0.38	0.42	0.31	0.39	0.22	0.27	0.25	0.05

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	463.05	379.04	964	183.21	915.76	816.2	382.27	435.28	29.87	-29.39	-344.01	-308.06	-125.37	21.89
	ULS Min	327.97	-218.96	747.5	-373.6	-2144.13	-2235.71	-1825.77	-1770.34	-1696.99	-1752.34	-1271.17	-1239.05	-198.35	12.03
IY Bending	ULS Max	7069.5	0	33.24	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-7846.16	-59.63	0	-15.44	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	129.78	203.16	62.93	229.83	0	0	0	0	0	0	0	0	0	0
	ULS Min	-56.16	-97.74	-30.13	-85.46	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	79	19	13	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	7	15	5	19	0	0	0	0	0	0	0	0	0	0
Force (kn) =		6852	697	329	448	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		7316	1076	1293	632	916	816	382	435	30	-29	-344	-308	-125	22
Compression Combined Force (kN) =		-6524	-916	418	-822	-2144	-2236	-1826	-1770	-1697	-1752	-1271	-1239	-198	12
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.36	0.21	0.28	0.14	0.18	0.16	0.07	0.08	0.01	NA	NA	NA	NA	0.02
		0.42	0.23	NA	0.23	0.56	0.59	0.48	0.47	0.51	0.52	0.38	0.37	0.64	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	276.18	184.84	355.24	115.53	229.1	478.29	442.76	270.98	279.63	177.54	170.37	228.16	162.15	25.57	31.11
	ULS Min	57.43	-191.74	96.4	-40.48	174.83	-903.37	-910.7	-632.17	-644.8	-568.03	-545.41	-380.53	-467.48	-81.11	19.09
IY Bending	ULS Max	3486.15	14.84	20.72	15.14	110.44	0	0	0	0	0	0	0	0	0	0
	ULS Min	-3809.42	-22.86	-9.85	-17.72	89.46	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	141.77	206.15	84.3	230	104.62	0	0	0	0	0	0	0	0	0	0
	ULS Min	-89.41	-103.09	-47.71	-116.85	0	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	46	10	9	8	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	11	20	8	23	6	0	0	0	0	0	0	0	0	0	0
Force (kn) =		3803	492	282	493	570	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		4080	677	638	609	799	478	443	271	280	178	170	228	162	26	31
Compression Combined Force (kN) =		-3746	-683	-186	-534	-395	-903	-911	-632	-645	-568	-545	-381	-467	-81	19
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.24	0.16	0.15	0.15	0.07	0.10	0.10	0.06	0.06	0.04	0.04	0.05	0.04	0.02	0.02
		0.29	0.26	0.07	0.20	0.04	0.24	0.24	0.17	0.17	0.15	0.14	0.10	0.12	0.26	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
Members		Front Transverse Sheave Girder End	Front Transverse Sheave Girder Middle	Back Transverse Sheave Girder	G1	G2/3	G4	G6
		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	29140.05	29140.05	3713.91	2048.48	2137.13	2033.32	963.03
	ULS Min	0	0	-1410	-10	-12	-17	-640
Shear	Fz Max	11414	11414	1431	2754	2813	2684	1485
	Fz Min	-11482	-11482	-1446	-372	-2804	-343	-650
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.535	0.711	0.184	0.196	0.173	0.195	0.183
		0.316	0.601	0.268	0.659	0.673	0.642	0.646

3 - ULS V3		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-8299	-8277	-8108	-7901	-9566	-10243	-11543	-11510	-11730	-8050	-8036	-7592	-9385.7	-9908.44	-11282.16	-11249.32	-11475.77
	ULS Min	-20812	-20768	-19606	-19379	-16075	-15181	-13112	-13050	-12534	-20100	-20066	-18938	-15642.63	-14860	-12881.03	-12819.07	-12311.42
IY Bending	ULS Max	1938	2607	2607	2072	678	480	1339	1339	583	1876	2528	2528	608.08	515.71	1254.61	1254.61	600.9
	ULS Min	-1847	-2492	-2487	-1697	-579	-290	-884	-884	-400	-1721	-2324	-2320	-464.2	-271.11	-973.76	-973.76	-340.01
IZ Bending	ULS Max	1662	2117	3827	12260	2555	840	840	80	657	1684	2205	11598	2717.56	413.1	1189.97	1189.97	272.54
	ULS Min	-1701	-2157	-3483	-10881	-2559	-446	-1201	-1201	-285	-1429	-1865	-11258	-2303.86	-842.54	-842.67	-97.43	-601.11
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	57	77	77	61	21	15	47	47	20	55	75	75	19	16	44	44	21
	Stress Z	42	53	94	300	54	18	39	39	21	41	54	284	57	18	38	38	19
Force (kn) =		13120	17227	22652	47947	11864	5165	9120	9120	4432	12824	17072	47587	12048	5351	8767	8767	4306
Tension Combined Force (kN) =		4821	8949	14544	40046	2298	-5077	-2423	-2390	-7298	4774	9036	39995	2662	-4558	-2515	-2482	-7170
Compression Combined Force (kN) =		-33932	-37994	-42259	-67326	-27939	-20346	-22232	-22170	-16966	-32923	-37138	-66525	-27690	-20211	-21648	-21587	-16618
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	0.11	0.21	0.34	0.92	0.04	NA	NA	NA	NA	0.11	0.21	0.92	0.05	NA	NA	NA	NA
		0.84	0.94	1.05	1.67	0.69	0.51	0.68	0.68	0.520	0.82	0.92	1.65	0.69	0.50	0.66	0.66	0.51

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	1717	1728	1740	2068	547	-669	-1399	-1553	-1980	1898.92	1917.55	2083.72	628.58	-493.76	-1230.78	-1400.44	-1781.67
	ULS Min	-10893	-10873	-8424	-8151	-5826	-4245	-2934	-2407	-2168	-9962.95	-9934.97	-7655.92	-5527.28	-4096.56	-2831.58	-2249.27	-1939.86
IY Bending	ULS Max	766	1033	1038	536	290	77	97	192	195	632.48	849.24	852.36	271.85	79.3	95.6	195.46	195.51
	ULS Min	-677	-907	-906	-514	-199	23	20	19	-190	-568.23	-781.58	-782.49	-195.06	30.62	15.86	15.87	-322.49
IZ Bending	ULS Max	644	722	1054	5630	949	115	89	313	612	542.07	665.72	5323.88	1010.99	149.03	56.87	219.82	219.82
	ULS Min	-770	-882	-1104	-5111	-982	-167	-69	-87	-88	-472.24	-538.01	-4986.61	-797.46	-127.52	-90.21	-181.87	-816.7
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	37	50	50	26	14	4	5	9	9	30	41	41	13	4	5	9	15
	Stress Z	24	28	35	178	31	5	3	10	19	17	21	168	32	5	3	7	26
Force (kn) =		4765	6044	6610	15894	3508	700	580	1493	2238	3705	4821	16322	3511	664	580	1274	3222
Tension Combined Force (kN) =		6482	7772	8349	17961	4054	30	-819	-61	258	5604	6739	18406	4140	171	-650	-126	1440
Compression Combined Force (kN) =		-15659	-16917	-15034	-24045	-9334	-4945	-3515	-3899	-4407	-13668	-14756	-23978	-9039	-4761	-3412	-3523	-5162
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	0.30	0.36	0.38	0.83	0.19	0.00	NA	NA	0.01	0.26	0.31	0.85	0.19	0.01	NA	NA	0.07
		1.00	1.08	0.96	1.54	0.59	0.31	0.22	0.25	0.27	0.88	0.95	1.54	0.57	0.30	0.22	0.22	0.32

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	834.56	834.56	457.69	471.83	677.21	253.62	1263.7	1167.99	783.49	825.54	809.68	875.95	468.26	409.81	-45.61	-48.02	-10.12	-816.65
	ULS Min	-338.28	-338.28	220.36	241.55	203.26	90.1	-2205.78	-1801.74	-1405.97	-1248.28	-1361.18	-1215.72	-1151.67	-934.41	-639.05	-599.08	-185.65	-981.91
IY Bending	ULS Max	0	0	57.54	56.89	50.41	43.93	15	0	18.54	29.19	19.5	42.54	11.5	39	6.74	30.8	0	30.69
	ULS Min	0	0	0	0	0	0	-42.09	0	-34	-5.96	-32.2	-1.26	-34.81	0	-27.28	0	0	0
IZ Bending	ULS Max	0	0	87.16	117.68	71.83	39.43	104.37	0	96.95	35.27	77.19	5.33	81.2	9.51	81.5	10.8	0	6.82
	ULS Min	0	0	-77.05	-111.3	-125.72	-92.47	-56.76	0	-49.64	-36.73	-23.33	-9.68	-28.88	-12.93	-31.04	-10.85	0	-10
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	20	20	17	15	18	0	14	12	13	18	15	16	11	13	0	11
	Stress Z	0	0	9	13	14	10	12	0	11	4	9	1	9	1	9	1	0	1
	Force (kn) =	0	0	529	584	559	454	472	0	404	263	356	303	381	285	331	226	0	210
	Tension Combined Force (kN) =	835	835	987	1056	1237	708	1735	1168	1187	1088	1166	1179	849	695	285	178	-10	-607
	Compression Combined Force (kN) =	-338	-338	-309	-343	-356	-364	-2677	-1802	-1810	-1511	-1717	-1519	-1533	-1220	-970	-826	-186	-1191
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.16	0.22	0.23	0.27	0.15	0.42	0.28	0.29	0.26	0.28	0.28	0.20	0.17	0.07	0.04	NA	NA
		0.01	0.09	0.09	0.10	0.10	0.10	0.83	0.56	0.56	0.47	0.53	0.47	0.47	0.38	0.30	0.25	0.05	0.33

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	830.94	568.67	436.98	453.43	660.37	189.18	1055.41	1185.09	708.1	702	781.3	770.89	378.91	456.29	-30.68	-64.83	-601.72	2.36
	ULS Min	-295.37	257.57	220.92	271.85	238.5	74.51	-1637.57	-1941.36	-1142.84	-1277.1	-1144.07	-1259.44	-886.14	-1101.39	-571.39	-658.71	-721.7	-194.12
IY Bending	ULS Max	0	56.58	53.21	49.67	45.09	42.87	7.23	76.91	39.27	19.04	40.63	18.54	36.7	11.42	29.43	7.84	26.1	0
	ULS Min	0	-121.29	0	0	0	0	-17.86	-3.81	-8.59	-33.08	0	-31.75	0	-34.34	0	-26.99	0	0
IZ Bending	ULS Max	0	33.02	37.05	41.84	39.58	38.31	121.3	39.3	18.61	24.38	7.1	15.88	6.54	17.49	7.73	19.45	2.95	0
	ULS Min	0	-55.22	-13.77	-10.69	-11.42	-8.83	-69.38	-42.47	-13.53	-76.8	-1.63	-70.44	-2.24	-73.36	-1.52	-80.37	-9.86	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	35	18	17	16	15	7	32	16	14	17	13	15	14	12	11	9	0
	Stress Z	0	5	4	5	4	4	14	5	2	9	1	8	1	8	1	9	1	0
	Force (kn) =	0	745	404	392	359	342	340	593	297	361	286	341	258	363	212	327	181	0
	Tension Combined Force (kN) =	831	1314	841	845	1019	532	1395	1778	1005	1063	1067	1112	637	820	181	262	-421	2
	Compression Combined Force (kN) =	-295	-487	-184	-120	-120	-268	-1977	-2535	-1440	-1638	-1430	-1600	-1144	-1465	-783	-986	-902	-194
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.26	0.18	0.18	0.22	0.12	0.34	0.43	0.24	0.26	0.26	0.27	0.15	0.20	0.04	0.06	NA	0.00
		0.01	0.14	0.05	0.03	0.03	0.08	0.61	0.78	0.44	0.50	0.44	0.49	0.35	0.45	0.24	0.30	0.25	0.05

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	480.52	455.21	987.22	196.82	1295.25	1178.35	639.28	704.15	239.17	166.31	-246.42	-199.53	-117.55	21.98
	ULS Min	311.67	-288.15	716.6	-497.06	-2523.24	-2630.16	-2114.4	-2046.5	-1913.81	-1981.79	-1399.78	-1357.67	-206.85	11.86
IY Bending	ULS Max	8884.22	0	33.89	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-9681.67	-61.08	0	-15.64	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	161.71	254.07	78.66	287.54	0	0	0	0	0	0	0	0	0	0
	ULS Min	-70.72	-122.03	-37.67	-106.53	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	98	20	13	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	8	19	6	23	0	0	0	0	0	0	0	0	0	0
Force (kn) =		8462	782	357	535	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		8942	1238	1344	732	1295	1178	639	704	239	166	-246	-200	-118	22
Compression Combined Force (kN) =		-8150	-1070	360	-1032	-2523	-2630	-2114	-2047	-1914	-1982	-1400	-1358	-207	12
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.44	0.24	0.29	0.16	0.25	0.23	0.12	0.14	0.05	0.04	NA	NA	NA	0.02
		0.52	0.26	NA	0.29	0.66	0.69	0.56	0.54	0.57	0.59	0.42	0.41	0.66	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	303.72	228.2	386.32	130.06	233.46	649.38	606.39	378.57	392.64	269.15	255.46	299.66	239.53	37.55	31.59
	ULS Min	30.28	-242.52	65.31	-64.95	167.04	-1071.94	-1079.68	-744.62	-757.15	-657.06	-633.51	-455.46	-541.75	-93.59	18.65
IY Bending	ULS Max	4356.65	15.96	22.06	16.42	113.9	0	0	0	0	0	0	0	0	0	0
	ULS Min	-4707.48	-23.61	-10.58	-18.21	87.95	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	178.39	257.04	104.84	287.1	134.01	0	0	0	0	0	0	0	0	0	0
	ULS Min	-110.58	-129.51	-60.17	-146.47	0	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	57	10	10	8	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	14	25	10	28	8	0	0	0	0	0	0	0	0	0	0
Force (kn) =		4716	578	325	588	658	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		5020	806	711	718	892	649	606	379	393	269	255	300	240	38	32
Compression Combined Force (kN) =		-4686	-821	-259	-652	-491	-1072	-1080	-745	-757	-657	-634	-455	-542	-94	19
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.30	0.19	0.17	0.17	0.07	0.14	0.13	0.08	0.09	0.06	0.06	0.07	0.05	0.03	0.03
		0.36	0.31	0.10	0.25	0.06	0.28	0.28	0.20	0.20	0.17	0.17	0.12	0.14	0.30	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder	Front Transverse Sheave Girder	Back Transverse Sheave Girder	G1	G2/3	G4	G6
		End	Middle					
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	29505.75	29505.75	3722.59	2069.63	2149.06	2076.13	1000.48
	ULS Min	0	0	-1492	-10	-12	-19	-662
Shear	Fz Max	11484	11484	1421	2781	2819	2740	1535
	Fz Min	-11594	-11594	-1437	-373	-2829	-340	-711
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.541	0.719	0.185	0.198	0.174	0.199	0.190
		0.319	0.606	0.267	0.665	0.677	0.656	0.668

3 - ULS V4		North Tower																	
		Rail Side Columns									HWY Side Columns								
		Front Leg (100-110)									Front Leg (200-209)								
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-7579	-7557	-6831	-6557	-6042	-5836	-5558	-5525	-5302	-7179	-7165	-6345	-5890.19	-5708.33	-5460.53	-5427.12	-5227.39
	ULS Min	-7609	-7568	-6873	-6714	-6179	-5973	-5620	-5558	-5397	-7209	-7176	-6545	-6027.28	-5845.43	-5521.92	-5460.53	-5322.19
IY Bending	ULS Max	0	-65	-85	43	10	41	41	2	247	32	42	44	7.34	43.79	43.79	-4.48	281.9
	ULS Min	-65	-93	-90	-12	-11	10	2	-20	-20	0	32	-8	-9.34	7.18	-4.48	-30.86	-30.87
IZ Bending	ULS Max	0	-29	119	345	-27	145	145	-20	110	75	100	135	139.7	76.24	18.92	108.32	108.32
	ULS Min	-29	-33	20	267	-90	-90	-20	-109	-109	0	75	78	76.23	-145.34	-145.33	18.92	-98.02
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	2	3	3	1	0	1	1	1	9	1	1	1	0	1	2	1	10
	Stress Z	1	1	3	8	2	3	5	4	4	2	2	3	3	3	5	3	3
Force (kn) =		351	469	741	1288	355	685	651	448	1300	367	490	611	511	700	662	487	1424
Tension Combined Force (kN) =		-7227	-7088	-6090	-5269	-5687	-5151	-4908	-5077	-4002	-6812	-6675	-5735	-5379	-5008	-4798	-4940	-3803
Compression Combined Force (kN) =		-7960	-8036	-7614	-8002	-6534	-6658	-6270	-6006	-6697	-7576	-7665	-7155	-6538	-6545	-6184	-5948	-6746
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		0.20	0.20	0.19	0.20	0.16	0.17	0.19	0.18	0.205	0.19	0.19	0.18	0.16	0.16	0.19	0.18	0.21

		North Tower																	
		Rail Side Columns									HWY Side Columns								
		Rear Leg (300-310)									Rear Leg (400-409)								
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	-4515	-4504	-3413	-3090	-2756	-2645	-2464	-2326	-2544	-4214.71	-4195.75	-3023.97	-2687.7	-2555.98	-2330.92	-2157.11	-2319.88
	ULS Min	-4528	-4509	-3432	-3159	-2834	-2723	-2542	-2404	-2574	-4227.95	-4200.4	-3111.32	-2765.82	-2634.1	-2409.04	-2235.23	-2350.59
IY Bending	ULS Max	1	5	8	16	13	13	13	154	151	17.58	20.71	13.55	6.98	10.95	10.91	142.02	141.06
	ULS Min	0	0	-42	-26	4	3	3	2	-233	0	12.55	-0.64	0.75	6.98	7.72	7.69	-240.16
IZ Bending	ULS Max	0	-65	-40	279	-30	60	60	80	457	34.94	65.74	108.17	105.29	21.98	33.62	86.24	86.2
	ULS Min	-65	-82	-134	186	-42	-30	-44	-43	80	0	29.77	29.74	21.98	-60.78	-60.78	33.61	-702.16
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	0	0	2	1	1	1	1	7	11	1	1	1	0	1	1	7	12
	Stress Z	2	3	4	9	1	2	2	3	14	1	2	3	3	2	2	3	22
Force (kn) =		162	219	487	785	152	198	196	773	2000	152	240	318	286	191	191	744	2631
Tension Combined Force (kN) =		-4353	-4285	-2926	-2305	-2604	-2447	-2268	-1553	-543	-4063	-3956	-2706	-2402	-2365	-2140	-1413	311
Compression Combined Force (kN) =		-4691	-4728	-3919	-3944	-2987	-2920	-2738	-3177	-4575	-4380	-4440	-3429	-3052	-2825	-2600	-2980	-4982
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01
		0.30	0.30	0.25	0.25	0.19	0.19	0.17	0.20	0.28	0.28	0.28	0.22	0.19	0.18	0.17	0.19	0.31

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
Top Down Defined		Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
Element #		1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	146.23	146.23	218.96	229.66	273.25	21.16	-238.49	-248.55	-127.33	-140.97	-102.18	-120.54	-139.06	-143.21	-139.5	-228.91	72.1	-970.54
	ULS Min	146.23	146.23	210.81	217.55	251.68	-24.2	-279.9	-291.38	-172.1	-192.44	-147.77	-169.81	-184.78	-193.26	-185.51	-276.82	58.94	-980.98
IY Bending	ULS Max	0	0	39.17	40.63	40.08	40.06	7.55	0	7.47	14.27	7.34	18.5	6.15	19.65	6.73	21.18	0	29.53
	ULS Min	0	0	0	0	0	0	-12.37	0	-13.99	0	-13.6	0	-16.53	0	-12.74	0	0	0
IZ Bending	ULS Max	0	0	0	0	0	0	0	0	0.08	1.31	0	0	0	0.95	0	2.74	0	0
	ULS Min	0	0	-6.33	-13.8	-46.14	-52.77	-1.37	0	-0.9	0	-1.36	-0.07	-3.09	0	-6.91	0	0	-6.25
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	14	14	14	14	5	0	6	6	6	8	7	8	5	9	0	10
	Stress Z	0	0	1	1	5	6	0	0	0	0	0	0	0	0	1	0	0	1
Force (kn) =		0	0	257	281	340	353	86	0	96	98	94	124	117	134	98	147	0	196
Tension Combined Force (kN) =		146	146	476	510	613	374	-153	-249	-32	-43	-8	4	-22	-10	-41	-82	72	-775
Compression Combined Force (kN) =		146	146	-46	-63	-88	-377	-365	-291	-268	-291	-242	-294	-301	-327	-284	-424	59	-1177
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.00	0.03	0.10	0.11	0.13	0.08	NA	NA	NA	NA	NA	0.00	NA	NA	NA	NA	0.02	NA
		NA	NA	0.01	0.02	0.03	0.11	0.11	0.09	0.08	0.09	0.07	0.09	0.09	0.10	0.09	0.13	NA	0.33

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
Element #		2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	190.65	274.4	212.38	222.13	262.27	-48.33	-191.8	-202.61	-124.1	-141.39	-99.21	-115.82	-116.34	-154.46	-209.75	-170.16	-768.33	115.92
	ULS Min	190.65	266.89	211.37	221.34	260.35	-53.39	-237.62	-267.25	-175.98	-186.08	-148.56	-161.57	-166.8	-200.21	-258.17	-215.64	-779.97	102.76
IY Bending	ULS Max	0	0	39	38.94	39.32	41.45	0	37.03	13.37	7.6	18	7.46	18.51	6.4	20.3	7.5	25.84	0
	ULS Min	0	-18.05	0	0	0	0	-11.15	0	0	-14.03	0	-13.58	0	-16.58	0	-12.75	0	0
IZ Bending	ULS Max	0	0	0	1.19	0	2.26	0	2.02	0.87	0	0.41	0.67	0	0.34	0.68	1.69	0.42	0
	ULS Min	0	-1.42	-0.8	0	-1.01	0	-2.77	-0.03	0	-1.06	0	0	-0.4	-0.2	0	0	-0.42	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	5	14	13	14	14	5	15	6	6	8	6	8	7	8	5	9	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		0	99	245	246	248	263	80	252	91	96	122	92	125	112	138	89	162	0
Tension Combined Force (kN) =		191	373	458	468	510	215	-112	50	-33	-45	22	-23	9	-43	-72	-81	-606	116
Compression Combined Force (kN) =		191	168	-34	-24	13	-317	-317	-520	-267	-282	-270	-254	-292	-312	-396	-304	-942	103
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.07	0.10	0.10	0.11	0.05	NA	0.01	NA	NA	0.01	NA	0.00	NA	NA	NA	NA	0.02
		NA	NA	0.01	0.01	NA	0.09	0.10	0.16	0.08	0.09	0.08	0.08	0.09	0.10	0.12	0.09	0.26	NA

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	209.84	35.03	408.27	62.08	-297.87	-325.38	-276.53	-274.38	-388.4	-389.21	-306.04	-319.42	-62.02	27.86
	ULS Min	209.84	18	408.27	52.56	-323.36	-350.87	-302.03	-299.87	-410.75	-411.56	-328.39	-341.77	-69.69	19.02
IY Bending	ULS Max	339.51	0	5.46	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-370.69	-41.95	0	-16.52	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	7.01	0	0.07	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	0.15	-0.14	0	-0.33	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	4	14	2	7	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		327	279	39	118	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		537	314	447	180	-298	-325	-277	-274	-388	-389	-306	-319	-62	28
Compression Combined Force (kN) =		-117	-261	369	-66	-323	-351	-302	-300	-411	-412	-328	-342	-70	19
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.03	0.06	0.10	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.06	NA	0.02	0.09	0.09	0.08	0.08	0.12	0.12	0.10	0.10	0.22	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	182.34	14.52	260.16	60.89	290.19	-224.28	-233.86	-185.06	-195.4	-209.55	-189.82	-71.72	-174.66	-28.6	28.83
	ULS Min	175.87	0.07	240.73	5	290.19	-247.27	-256.85	-208.06	-218.39	-232.55	-212.81	-94.71	-197.65	-37.43	20.44
IY Bending	ULS Max	265.18	10.16	17.92	11.58	97.58	0	0	0	0	0	0	0	0	0	0
	ULS Min	-230.11	-20.13	-5.66	-15.51	97.58	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	5.39	1.69	2.32	6.02	22.92	0	0	0	0	0	0	0	0	0	0
	ULS Min	-0.09	0	0	0	22.92	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	3	9	8	7	5	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Force (kn) =		242	146	132	120	316	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		424	161	392	181	606	-224	-234	-185	-195	-210	-190	-72	-175	-29	29
Compression Combined Force (kN) =		-66	-146	109	-115	-25	-247	-257	-208	-218	-233	-213	-95	-198	-37	20
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.03	0.04	0.09	0.04	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.06	NA	0.04	0.00	0.07	0.07	0.05	0.06	0.06	0.06	0.02	0.05	0.12	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder End	Front Transverse Sheave Girder Middle	Back Transverse Sheave Girder	G1	G2/3	G4	G6
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	10391.49	10391.49	4319.68	1218.15	4101.16	1095.5	846.48
	ULS Min	0	0	-1393	-16	-12	-17	-650
Shear	Fz Max	4169	4169	1881	190	1876	46	1467
	Fz Min	-4151	-4151	-1894	-434	-1797	-252	-487
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.191	0.253	0.214	0.117	0.333	0.105	0.161
		0.115	0.218	0.351	0.104	0.449	0.060	0.639

4 - ULS 1		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-12333	-12311	-11535	-11262	-10558	-10356	-10020	-9987	-9788	-11968	-11955	-11086	-10443.33	-10269.3	-9971.35	-9937.93	-9761.09
	ULS Min	-12363	-12322	-11578	-11419	-10695	-10493	-10082	-10020	-9883	-11999	-11965	-11285	-10580.43	-10406.4	-10032.74	-9971.35	-9855.9
IY Bending	ULS Max	0	-59	-57	71	64	102	106	108	108	31	42	67	65.87	106.1	106.1	101.16	98.36
	ULS Min	-59	-85	-82	62	64	64	102	106	61	0	31	43	61.94	61.73	101.16	98.36	95.76
IZ Bending	ULS Max	0	-41	119	423	-44	262	262	-42	217	87	116	150	159.28	147.68	40.85	206.1	206.09
	ULS Min	-41	-48	-2	267	-160	-160	-42	-207	-207	0	87	16	147.66	-262.77	-262.75	40.85	-199.42
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	2	3	2	2	2	3	4	4	4	1	1	2	2	3	4	4	3
	Stress Z	1	1	3	10	3	5	8	7	7	2	3	4	3	6	8	7	7
Force (kn) =		366	488	708	1652	847	1376	1293	1111	1145	404	540	751	855	1399	1298	1085	1075
Tension Combined Force (kN) =		-11967	-11823	-10827	-9609	-9711	-8980	-8727	-8875	-8643	-11564	-11414	-10335	-9588	-8871	-8673	-8853	-8687
Compression Combined Force (kN) =		-12729	-12810	-12286	-13071	-11542	-11869	-11374	-11132	-11028	-12403	-12506	-12036	-11436	-11805	-11331	-11056	-10930
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		0.32	0.32	0.31	0.32	0.29	0.29	0.35	0.34	0.338	0.31	0.31	0.30	0.28	0.29	0.35	0.34	0.33

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	-4023	-4012	-2880	-2556	-2271	-2167	-1966	-1816	-1953	-3737.27	-3718.3	-2510.49	-2213.25	-2087	-1838.88	-1656.99	-1729.66
	ULS Min	-4036	-4016	-2898	-2625	-2349	-2245	-2045	-1895	-1984	-3750.51	-3722.95	-2597.85	-2291.37	-2165.12	-1917	-1735.11	-1760.38
IY Bending	ULS Max	2	6	9	46	43	42	42	158	155	14.32	17.34	28.25	30.78	40.18	44.01	159.05	159.53
	ULS Min	0	2	-39	-21	27	26	41	41	-165	0	8.51	9.49	29.55	30.76	40.11	43.99	-207.64
IZ Bending	ULS Max	0	-66	-38	281	-24	49	49	92	312	34.43	64.46	108.53	100.62	15.75	30.1	37.79	37.76
	ULS Min	-66	-82	-127	171	-39	-24	-40	-39	92	0	29.43	29.91	15.75	-49.43	-49.43	30.08	-494.45
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	0	0	2	2	2	2	2	8	8	1	1	1	1	2	2	8	10
	Stress Z	2	3	4	9	1	2	2	3	10	1	2	3	3	2	2	1	16
Force (kn) =		168	227	459	865	257	276	277	818	1386	139	224	373	363	272	287	689	1997
Tension Combined Force (kN) =		-3855	-3785	-2421	-1691	-2014	-1891	-1690	-999	-567	-3599	-3494	-2137	-1850	-1815	-1552	-968	267
Compression Combined Force (kN) =		-4204	-4243	-3357	-3490	-2606	-2522	-2321	-2712	-3370	-3889	-3947	-2971	-2655	-2437	-2204	-2424	-3757
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01
		0.27	0.27	0.22	0.22	0.17	0.16	0.15	0.17	0.21	0.25	0.25	0.19	0.17	0.15	0.14	0.15	0.23

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
								Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	Horizontal 4 (AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	188.26	188.26	290.02	316.72	396.77	141.66	-297.72	-316.03	-179.5	-196.35	-146.58	-167.22	-212.45	-222.22	-238.3	-263.82	-29.74	-879.59
	ULS Min	188.26	188.26	281.19	299.96	369.38	96.17	-339	-360.84	-223.72	-250.1	-191.77	-218.6	-257.52	-275.22	-283.86	-314.73	-42.9	-890.51
IY Bending	ULS Max	0	0	39.73	41.08	40.38	39.69	3.48	0	5.46	16.13	5.39	20.59	3.35	22.72	4.56	23.62	0	28.64
	ULS Min	0	0	0	0	0	0	-19.04	0	-20.13	0	-19.63	0	-25	0	-20.73	0	0	0
IZ Bending	ULS Max	0	0	0	0.25	0	0	0	0	0.45	1.15	0	0.16	0	0.75	0	2.24	0	0
	ULS Min	0	0	-5.41	-7.65	-33.61	-37.7	-1.2	0	-0.51	0	-0.55	0	-2.85	0	-5.45	0	0	-5.5
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	14	14	14	14	8	0	8	7	8	9	10	9	9	10	0	10
	Stress Z	0	0	1	1	4	4	0	0	0	0	0	0	0	0	1	0	0	1
Force (kn) =		0	0	259	272	318	321	130	0	136	110	133	139	173	154	149	163	0	189
Tension Combined Force (kN) =		188	188	549	588	714	463	-168	-316	-43	-86	-14	-29	-39	-68	-89	-101	-30	-691
Compression Combined Force (kN) =		188	188	22	28	52	-225	-469	-361	-360	-360	-325	-357	-431	-429	-433	-477	-43	-1079
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.04	0.12	0.13	0.16	0.10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.06	0.15	0.11	0.11	0.11	0.10	0.11	0.13	0.13	0.13	0.15	0.01	0.30

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
								Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	Horizontal 4 (AD54)	Horizontal 5 (A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	230.97	361.2	286.54	310.96	389.4	86.57	-258.71	-251.27	-176.49	-198.61	-144.77	-161.55	-196.67	-227.8	-246.74	-264.54	-667.35	-22.25
	ULS Min	230.97	352.49	285.62	310.23	387.94	82.53	-305.84	-317.85	-230.69	-242.84	-196.23	-206.84	-250.08	-273	-298.17	-309.55	-679.55	-35.41
IY Bending	ULS Max	0	0	39.23	39.23	39.52	41.07	0	40.32	15.05	5.57	20.17	5.42	21.56	3.6	22.91	5.21	24.83	0
	ULS Min	0	-25.96	0	0	0	0	-6.44	0	0	-20.18	0	-19.63	0	-25.06	0	-20.88	0	0
IZ Bending	ULS Max	0	0	0	1.17	0	1.74	0	2.38	0.89	0	0.4	0.11	0	0.7	0.64	1.06	0.28	0
	ULS Min	0	-1.77	-1.22	0	-0.78	0	-3.25	0	0	-1.39	0	-0.15	-0.39	0	0	0	-0.53	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	8	14	14	14	14	3	17	6	8	8	8	9	10	10	9	9	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		0	142	247	247	248	260	49	275	103	138	136	132	145	170	155	142	156	0
Tension Combined Force (kN) =		231	503	534	558	638	347	-210	24	-74	-61	-9	-29	-51	-58	-92	-122	-511	-22
Compression Combined Force (kN) =		231	211	38	63	140	-177	-355	-593	-333	-381	-332	-339	-396	-443	-453	-452	-835	-35
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.10	0.12	0.12	0.14	0.08	NA	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.05	0.11	0.18	0.10	0.12	0.10	0.10	0.12	0.14	0.14	0.14	0.23	0.01

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	337.05	62.26	728.62	107.74	-507.88	-539.67	-533.97	-527.12	-676.79	-683.43	-604.67	-609.74	-127.72	23.48
	ULS Min	337.05	45.51	728.62	99.88	-533.37	-565.17	-559.47	-552.61	-699.14	-705.78	-627.03	-632.09	-135.39	14.63
IY Bending	ULS Max	510.77	0	22.87	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-467.13	-50.19	0	-15.25	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	4.89	0	0.06	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	0.4	-0.44	0	-0.92	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	5	16	9	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		432	334	163	110	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		769	396	892	218	-508	-540	-534	-527	-677	-683	-605	-610	-128	23
Compression Combined Force (kN) =		-95	-288	566	-10	-533	-565	-559	-553	-699	-706	-627	-632	-135	15
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.04	0.08	0.19	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.07	NA	0.00	0.14	0.15	0.15	0.15	0.21	0.21	0.19	0.19	0.43	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	156.16	11.17	210.38	50.63	194.02	-191.97	-196.14	-141.09	-155.02	-173.81	-155.18	-46.64	-128.21	-17.89	29.4
	ULS Min	151.25	-2.1	196.97	8.36	194.02	-214.96	-219.13	-164.09	-178.02	-196.8	-178.17	-69.64	-151.2	-26.73	21.02
IY Bending	ULS Max	235.48	10.45	16.89	11.75	98.77	0	0	0	0	0	0	0	0	0	0
	ULS Min	-209.6	-19.65	-7.74	-15.95	98.77	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	5.94	3.42	3.24	5.44	16.98	0	0	0	0	0	0	0	0	0	0
	ULS Min	-5.69	0	0	0	16.98	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	3	9	7	7	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Force (kn) =		221	146	126	123	303	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		377	157	336	173	497	-192	-196	-141	-155	-174	-155	-47	-128	-18	29
Compression Combined Force (kN) =		-69	-148	71	-114	-109	-215	-219	-164	-178	-197	-178	-70	-151	-27	21
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.02	0.04	0.08	0.04	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.06	NA	0.04	0.01	0.06	0.06	0.04	0.05	0.05	0.05	0.02	0.04	0.09	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder End	Front Transverse Sheave Girder Middle	Back Transverse Sheave Girder	G1	G2/3	G4	G6
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	23033.98	23033.98	3408.43	1571.73	1864.19	1575.22	811.93
	ULS Min	0	0	-1003	-10	-12	-11	-542
Shear	Fz Max	9126	9126	1346	2122	2248	2084	1135
	Fz Min	-9058	-9058	-1335	-332	-2179	-316	-356
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.423	0.562	0.169	0.151	0.151	0.151	0.155
		0.251	0.477	0.250	0.508	0.538	0.499	0.494

4 - ULS 4		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-6467	-6445	-6315	-6179	-7768	-8388	-9613	-9580	-9767	-6417	-6403	-5972	-7633.52	-8100.43	-9377.69	-9344.81	-9529.13
	ULS Min	-18149	-18103	-17049	-16902	-13853	-13006	-11081	-11019	-10524	-17665	-17632	-16575	-13482.46	-12731.03	-10874.06	-10812.14	-10315.38
IY Bending	ULS Max	1838	2476	2476	1906	641	448	1237	1237	524	1730	2330	2330	576.91	482.01	1159.68	1159.68	543.02
	ULS Min	-1695	-2283	-2279	-1612	-532	-270	-838	-838	-336	-1627	-2199	-2195	-423.89	-252.36	-920.14	-920.14	-325.99
IZ Bending	ULS Max	1554	1974	3475	11291	2352	754	755	98	590	1538	2008	10664	2485.74	371.26	1105.82	1105.82	230.58
	ULS Min	-1585	-2015	-3348	-10307	-2421	-395	-1116	-1116	-243	-1368	-1790	-10668	-2200.91	-756.32	-756.44	-114.72	-539.69
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	54	73	73	56	20	14	43	43	18	51	69	69	18	15	41	41	19
	Stress Z	39	49	85	276	51	16	36	36	19	38	49	261	52	16	36	36	17
Force (kn) =		12351	16251	20992	44152	11225	4724	8448	8448	3982	11779	15656	43788	11122	4897	8124	8124	3879
Tension Combined Force (kN) =		5884	9806	14677	37974	3456	-3665	-1164	-1131	-5786	5361	9252	37816	3489	-3203	-1253	-1221	-5650
Compression Combined Force (kN) =		-30499	-34354	-38042	-61054	-25078	-17730	-19530	-19468	-14506	-29444	-33288	-60363	-24605	-17628	-18998	-18936	-14195
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	0.14	0.23	0.34	0.88	0.07	NA	NA	NA	NA	0.12	0.21	0.87	0.07	NA	NA	NA	NA
		0.76	0.85	0.95	1.52	0.62	0.44	0.60	0.60	0.444	0.73	0.83	1.50	0.61	0.44	0.58	0.58	0.43

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	2430	2441	2415	2585	1148	28	-633	-754	-1188	2439.17	2459.32	2641.53	1268.48	228.81	-457.65	-602.79	-1023.48
	ULS Min	-9340	-9320	-7072	-6957	-4806	-3314	-2071	-1556	-1365	-8632.79	-8603.34	-6454.63	-4482.19	-3139.01	-1956.94	-1400.24	-1173.17
IY Bending	ULS Max	717	960	964	513	266	69	95	157	160	577.17	781.85	785.94	256.43	71.37	94.46	160.8	161.55
	ULS Min	-629	-851	-850	-467	-191	22	24	23	-140	-543.5	-740.25	-739.92	-179.35	25.93	20.03	20.04	-263.74
IZ Bending	ULS Max	641	715	981	5181	878	116	67	275	449	488.62	586.56	4852.08	909.23	132.71	42.81	186.6	186.63
	ULS Min	-679	-782	-1033	-4844	-925	-147	-53	-98	-99	-458.07	-536.93	-4771.04	-778.66	-125.4	-67.84	-188.31	-588.22
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	34	46	46	25	13	3	5	8	8	28	37	38	12	3	5	8	13
	Stress Z	21	25	33	164	29	5	2	9	14	15	19	153	29	4	2	6	19
Force (kn) =		4358	5522	6158	14698	3277	618	522	1268	1705	3366	4374	14910	3203	595	521	1066	2438
Tension Combined Force (kN) =		6788	7963	8573	17283	4425	646	-111	514	518	5805	6833	17551	4471	823	63	464	1415
Compression Combined Force (kN) =		-13698	-14842	-13230	-21655	-8083	-3932	-2592	-2824	-3070	-11999	-12977	-21365	-7685	-3734	-2478	-2467	-3611
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	0.31	0.37	0.39	0.79	0.20	0.03	NA	0.02	0.02	0.27	0.31	0.81	0.21	0.04	0.00	0.02	0.06
		0.88	0.95	0.85	1.39	0.51	0.25	0.16	0.18	0.19	0.77	0.83	1.37	0.49	0.24	0.16	0.16	0.22

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
								Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	Horizontal 4 (AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	768.14	768.14	379.71	390.95	578.86	120.91	1232.44	1146.6	761.79	808.14	783.56	851.77	475.01	427.79	-17.86	-16.55	150.24	-680.07
	ULS Min	-326.52	-326.52	158.19	176.02	136.51	-24.01	-2008.35	-1628.01	-1284.5	-1130.92	-1245.41	-1104.01	-1039.74	-830.26	-574.38	-534.14	-14.46	-835.74
IY Bending	ULS Max	0	0	56.24	55.24	49.47	44.26	14.46	0	17.69	28.18	18.53	39.53	11.27	35.87	7.12	28.39	0	28.02
	ULS Min	0	0	0	0	0	0	-40.18	0	-32.56	-4.63	-31.03	-1.35	-32.94	0	-25.43	0	0	0
IZ Bending	ULS Max	0	0	82.83	112.25	74.98	39.17	98.31	0	91.41	31.89	72.13	4.98	76.11	8.67	77.6	9.74	0	7.4
	ULS Min	0	0	-70.44	-101.46	-109.4	-77.87	-51.72	0	-45.41	-35.3	-21.68	-8.97	-26.62	-12.21	-27.42	-10.41	0	-8.02
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	19	19	17	15	17	0	14	12	13	16	14	15	11	12	0	10
	Stress Z	0	0	9	12	12	8	11	0	10	4	8	1	9	1	9	1	0	1
Force (kn) =		0	0	512	563	522	428	448	0	384	253	339	282	359	263	311	209	0	189
Tension Combined Force (kN) =		768	768	892	954	1101	549	1680	1147	1146	1061	1123	1133	834	691	293	193	150	-491
Compression Combined Force (kN) =		-327	-327	-354	-387	-385	-452	-2456	-1628	-1669	-1384	-1584	-1386	-1399	-1093	-886	-744	-14	-1025
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.15	0.20	0.21	0.24	0.12	0.40	0.28	0.28	0.26	0.27	0.27	0.20	0.17	0.07	0.05	0.03	NA
		0.01	0.09	0.10	0.11	0.11	0.13	0.76	0.50	0.51	0.43	0.49	0.43	0.43	0.34	0.27	0.23	0.00	0.29

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
								Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	Horizontal 4 (AD54)	Horizontal 5 (A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	727.53	476.06	359.84	373.24	562.31	59.25	1023.41	1159.24	693.93	692.9	757.43	754.28	392.54	470.92	-7.8	-27.88	-502.89	173.96
	ULS Min	-323.69	186.63	158.18	203.77	168.57	-46.99	-1492.04	-1759.82	-1037.14	-1157.02	-1043.17	-1143.46	-791.57	-985.71	-515.55	-584.92	-616.12	-10.31
IY Bending	ULS Max	0	58.58	51.38	48.68	44.74	42.81	6.74	71.55	36.71	18.09	37.9	17.53	34	11.08	27.37	7.94	24.27	0
	ULS Min	0	-107.43	0	0	0	0	-16.68	-2.71	-7.96	-31.84	0	-30.74	0	-32.59	0	-25.06	0	0
IZ Bending	ULS Max	0	29.8	34.8	38.8	37.18	34.07	112.65	37.09	16.99	23.13	6.48	14.71	6.16	16.23	6.94	17.5	2.15	0
	ULS Min	0	-52.42	-12.63	-10.23	-10.33	-9.82	-65.31	-39.05	-13.01	-71.3	-1.61	-65.85	-1.95	-68.55	-1.61	-75.65	-9.95	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	31	18	17	16	15	7	30	15	13	16	13	14	14	11	10	9	0
	Stress Z	0	5	4	4	4	4	13	4	2	8	1	7	1	8	1	9	1	0
Force (kn) =		0	666	389	380	352	334	316	551	277	343	266	326	239	343	196	305	169	0
Tension Combined Force (kN) =		728	1142	749	753	914	393	1340	1710	971	1036	1024	1080	632	814	189	277	-333	174
Compression Combined Force (kN) =		-324	-479	-230	-176	-183	-381	-1808	-2311	-1314	-1500	-1309	-1469	-1031	-1329	-712	-890	-786	-10
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.22	0.16	0.16	0.20	0.09	0.32	0.41	0.23	0.25	0.25	0.26	0.15	0.20	0.05	0.07	NA	0.04
		0.01	0.13	0.07	0.05	0.05	0.11	0.56	0.71	0.40	0.46	0.40	0.45	0.32	0.41	0.22	0.27	0.22	0.00

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	408.35	412.58	838.7	170.99	1249.46	1161.61	665.66	721.94	295.7	232.29	-147.79	-106.53	-93.51	23.89
	ULS Min	250.76	-269.81	586.12	-475.23	-2316.16	-2394.7	-1906.14	-1847.03	-1715.25	-1774.09	-1225.75	-1188.95	-177.37	13.85
IY Bending	ULS Max	8181.66	0	25.99	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-8918.13	-57.09	0	-16.22	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	146.32	237.22	73.42	268.56	0	0	0	0	0	0	0	0	0	0
	ULS Min	-70.61	-113.83	-35.15	-99.28	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	90	19	10	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	7	17	6	22	0	0	0	0	0	0	0	0	0	0
Force (kn) =		7784	731	293	511	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		8192	1143	1132	682	1249	1162	666	722	296	232	-148	-107	-94	24
Compression Combined Force (kN) =		-7533	-1001	293	-986	-2316	-2395	-1906	-1847	-1715	-1774	-1226	-1189	-177	14
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.40	0.22	0.25	0.15	0.24	0.22	0.13	0.14	0.06	0.05	NA	NA	NA	0.02
		0.48	0.25	NA	0.28	0.61	0.63	0.50	0.49	0.51	0.53	0.37	0.36	0.57	NA

		4020	4026	4032	4038	4044									
		Tower - Rear Panel													
		Horizontals					Bracing								
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	238.23	207.53	292.82	108.64	132.55	652.78	614.83	410.08	429.99	305.3	284.7	323.99	291.35	47.81	32.27
	ULS Min	-18.5	-231.81	-3.37	-73.37	73.19	-955.32	-960.36	-639.77	-644.68	-560.7	-546.54	-382.32	-439.39	-75.17	19.64
IY Bending	ULS Max	3983.75	15.82	20.23	16.29	115.22	0	0	0	0	0	0	0	0	0	0
	ULS Min	-4326.33	-22.59	-13.76	-18.66	89.45	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	169.32	239.93	97.78	267.76	124.06	0	0	0	0	0	0	0	0	0	0
	ULS Min	-100.39	-120.85	-56.23	-136.9	0	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	52	10	9	8	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	13	24	10	26	7	0	0	0	0	0	0	0	0	0	0
Force (kn) =		4362	544	300	560	635	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		4600	751	593	669	767	653	615	410	430	305	285	324	291	48	32
Compression Combined Force (kN) =		-4381	-775	-304	-633	-562	-955	-960	-640	-645	-561	-547	-382	-439	-75	20
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.27	0.18	0.14	0.16	0.06	0.14	0.13	0.09	0.09	0.07	0.06	0.07	0.06	0.04	0.03
		0.34	0.30	0.12	0.24	0.06	0.25	0.25	0.17	0.17	0.15	0.14	0.10	0.12	0.24	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder	Front Transverse Sheave Girder	Back Transverse Sheave Girder	G1	G2/3	G4	G6
		End	Middle					
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	24601.75	24601.75	2224.5	1764.48	1818.81	1725	494.78
	ULS Min	0	0	-1073	-10	-12	-17	-470
Shear	Fz Max	9695	9695	918	2371	2369	2279	1089
	Fz Min	-9770	-9770	-959	-255	-2397	-250	-646
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.451	0.600	0.110	0.169	0.148	0.165	0.094
		0.269	0.511	0.178	0.567	0.573	0.545	0.474

4 - ULS V1		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-14105	-14084	-13278	-13005	-12239	-12038	-11682	-11649	-11455	-13750	-13737	-12841	-12132.32	-11961.93	-11643.58	-11610.17	-11438.96
	ULS Min	-14135	-14094	-13321	-13162	-12376	-12175	-11744	-11682	-11550	-13781	-13747	-13040	-12269.41	-12099.03	-11704.97	-11643.58	-11533.77
IY Bending	ULS Max	0	-60	-51	80	81	119	136	145	145	32	43	85	83.5	123.68	130.42	133.97	133.97
	ULS Min	-60	-86	-83	77	78	78	120	136	9	0	32	45	75.73	75.51	123.68	130.42	46.9
IZ Bending	ULS Max	0	-46	119	447	-51	305	305	-49	254	92	122	158	174.25	174.27	48.94	242.27	242.25
	ULS Min	-46	-54	-7	267	-186	-186	-49	-242	-242	0	92	-13	165.64	-306.28	-306.26	48.94	-237.06
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	2	3	2	2	3	4	5	5	5	1	1	3	3	4	5	5	5
	Stress Z	1	1	3	11	4	6	10	8	8	2	3	4	4	6	10	8	8
Force (kn) =		383	511	713	1764	1020	1605	1553	1371	1411	424	565	846	992	1630	1538	1332	1332
Tension Combined Force (kN) =		-13722	-13573	-12565	-11241	-11219	-10433	-10129	-10278	-10044	-13326	-13172	-11995	-11140	-10332	-10105	-10278	-10107
Compression Combined Force (kN) =		-14518	-14605	-14034	-14926	-13395	-13780	-13297	-13053	-12960	-14205	-14312	-13886	-13262	-13729	-13243	-12975	-12865
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		0.36	0.36	0.35	0.37	0.33	0.34	0.41	0.40	0.397	0.35	0.36	0.35	0.33	0.34	0.41	0.40	0.39

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	-4219	-4207	-3048	-2725	-2437	-2338	-2132	-1982	-2109	-3933.04	-3914.08	-2681.6	-2381.13	-2257.22	-2003.55	-1818.11	-1876.25
	ULS Min	-4232	-4212	-3067	-2794	-2515	-2416	-2210	-2060	-2140	-3946.28	-3918.73	-2768.96	-2459.25	-2335.34	-2081.67	-1896.23	-1906.96
IY Bending	ULS Max	2	8	10	54	51	50	51	170	166	13.81	16.84	35.33	37.02	48.4	53.07	172.85	173.64
	ULS Min	0	2	-40	-22	33	32	49	50	-171	0	7.81	8.79	36.71	37	48.32	53.05	-225.19
IZ Bending	ULS Max	0	-67	-38	280	-26	53	53	105	328	35.27	65.62	108.36	102.53	17.96	33.47	37.4	37.37
	ULS Min	-67	-84	-129	176	-40	-26	-44	-43	105	0	30.27	29.08	17.97	-53.58	-53.58	33.46	-529.34
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	0	0	2	3	2	2	2	8	8	1	1	2	2	2	3	8	11
	Stress Z	2	3	4	9	1	2	2	3	10	1	2	3	3	2	2	1	17
Force (kn) =		174	234	467	895	290	317	321	896	1450	139	225	400	391	313	331	739	2149
Tension Combined Force (kN) =		-4045	-3973	-2581	-1830	-2147	-2020	-1811	-1086	-659	-3794	-3689	-2282	-1990	-1944	-1673	-1079	272
Compression Combined Force (kN) =		-4406	-4446	-3534	-3688	-2805	-2733	-2531	-2955	-3590	-4085	-4144	-3168	-2851	-2649	-2413	-2636	-4056
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01
		0.28	0.29	0.23	0.24	0.18	0.17	0.16	0.19	0.22	0.26	0.27	0.20	0.18	0.17	0.15	0.17	0.25

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
								Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	Horizontal 4 (AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	213.36	213.36	329.9	361.82	456.13	200.69	-336.01	-356.73	-207.45	-225.63	-170.75	-192.86	-247.53	-260.35	-276.99	-291.32	-85.65	-885.61
	ULS Min	213.36	213.36	319.43	342.32	423.75	147.57	-377.31	-402.03	-251.61	-279.92	-215.91	-244.68	-292.52	-314.05	-322.58	-342.89	-98.82	-896.49
IY Bending	ULS Max	0	0	39.87	41.4	40.5	39.21	2.48	0	4.99	16.92	4.97	21.59	2.59	24.14	3.95	24.91	0	29
	ULS Min	0	0	0	0	0	0	-20.69	0	-21.69	0	-21.12	0	-27.37	0	-22.9	0	0	0
IZ Bending	ULS Max	0	0	0	0.3	0	0	0	0	0.52	1.13	0	0.23	0	0.87	0	2.6	0	0
	ULS Min	0	0	-6.02	-8.53	-37.82	-42.87	-1.21	0	-0.45	0	-0.61	0	-3.34	0	-5.9	0	0	-5.83
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	14	14	14	14	9	0	9	7	9	9	11	10	10	10	0	10
	Stress Z	0	0	1	1	4	5	0	0	0	0	0	0	0	0	1	0	0	1
Force (kn) =		0	0	261	275	327	328	141	0	147	116	143	145	190	164	164	172	0	192
Tension Combined Force (kN) =		213	213	591	637	783	529	-195	-357	-61	-110	-28	-47	-58	-97	-113	-119	-86	-694
Compression Combined Force (kN) =		213	213	59	67	97	-181	-518	-402	-398	-396	-359	-390	-482	-478	-487	-515	-99	-1088
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.04	0.13	0.14	0.17	0.12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.05	0.16	0.12	0.12	0.12	0.11	0.12	0.15	0.15	0.15	0.16	0.03	0.30

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
								Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	Horizontal 4 (AD54)	Horizontal 5 (A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	256.52	408.92	326.5	356.11	448.89	138.3	-296	-284.22	-204.75	-228.41	-169.43	-186.66	-233.56	-264.05	-274.06	-307.11	-649.12	-79.19
	ULS Min	256.52	399.41	325.32	355.11	447.23	134.36	-343.89	-352.52	-259.52	-272.59	-221.33	-231.93	-287.71	-309.19	-326.2	-352.06	-661.43	-92.35
IY Bending	ULS Max	0	0	39.29	39.29	39.58	40.94	0	42.27	15.77	5.1	21.17	4.97	22.86	2.86	24.18	4.68	24.73	0
	ULS Min	0	-30.71	0	0	0	0	-5.48	0	0	-21.75	0	-21.13	0	-27.44	0	-23.03	0	0
IZ Bending	ULS Max	0	0	0	1.27	0	1.66	0	2.6	0.91	0	0.46	0.01	0	0.8	0.71	0.92	0.26	0
	ULS Min	0	-2.01	-1.45	0	-0.87	0	-3.55	0	0	-1.54	0	-0.22	-0.45	0	0	0	-0.55	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	9	14	14	14	14	2	18	7	9	9	9	10	11	10	10	9	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		0	167	248	248	249	259	43	288	108	149	143	142	154	186	164	156	155	0
Tension Combined Force (kN) =		257	576	575	604	698	397	-253	4	-97	-80	-26	-44	-79	-78	-110	-151	-494	-79
Compression Combined Force (kN) =		257	232	77	107	198	-125	-387	-641	-367	-421	-364	-374	-442	-495	-490	-508	-817	-92
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.11	0.13	0.13	0.15	0.09	NA	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.04	0.12	0.20	0.11	0.13	0.11	0.12	0.14	0.15	0.15	0.16	0.23	0.03

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	384.31	72.41	848.08	125.75	-587.29	-617.74	-628.09	-622.32	-786.05	-791.07	-713.14	-720.54	-152.09	21.84
	ULS Min	384.31	55.83	848.08	117.41	-612.78	-643.24	-653.59	-647.82	-808.4	-813.42	-735.49	-742.89	-159.76	13
IY Bending	ULS Max	574.35	0	29.36	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-498.26	-53.25	0	-14.76	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	4.14	0	0.05	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	0.49	-0.54	0	-1.14	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	6	17	12	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		480	354	209	107	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		864	427	1057	232	-587	-618	-628	-622	-786	-791	-713	-721	-152	22
Compression Combined Force (kN) =		-96	-298	639	11	-613	-643	-654	-648	-808	-813	-735	-743	-160	13
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.04	0.08	0.23	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.07	NA	NA	0.16	0.17	0.17	0.17	0.24	0.24	0.22	0.22	0.51	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	164.41	12.14	227.66	56.61	209.64	-203.83	-209.29	-156.48	-169.63	-186.51	-167.49	-55.63	-144.57	-21.62	29.23
	ULS Min	158.5	-1.32	213.01	9.64	209.64	-226.82	-232.28	-179.47	-192.62	-209.5	-190.48	-78.62	-167.57	-30.46	20.85
IY Bending	ULS Max	246.16	10.41	17.36	11.82	97.83	0	0	0	0	0	0	0	0	0	0
	ULS Min	-215.99	-19.83	-7.05	-15.79	97.83	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	6.25	4.01	3.56	5.96	17.94	0	0	0	0	0	0	0	0	0	0
	ULS Min	-7.35	0	0	0	17.94	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	3	9	8	7	5	0	0	0	0	0	0	0	0	0	0
	Stress Z	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Force (kn) =		237	148	130	122	303	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		401	160	357	179	513	-204	-209	-156	-170	-187	-167	-56	-145	-22	29
Compression Combined Force (kN) =		-78	-149	83	-113	-93	-227	-232	-179	-193	-210	-190	-79	-168	-30	21
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.02	0.04	0.09	0.04	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.06	NA	0.04	0.01	0.06	0.06	0.05	0.05	0.06	0.05	0.02	0.04	0.10	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder	Front Transverse Sheave Girder	Back Transverse Sheave Girder	G1	G2/3	G4	G6
		End	Middle					
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	27428.87	27428.87	3652.94	1898.63	2254.45	1883.35	813.73
	ULS Min	0	0	-1073	-10	-12	-10	-542
Shear	Fz Max	10885	10885	1451	2559	2702	2469	1256
	Fz Min	-10784	-10784	-1464	-361	-2620	-352	-394
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.503	0.669	0.181	0.182	0.183	0.180	0.155
		0.300	0.569	0.272	0.612	0.647	0.591	0.547

4 - ULS V2		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-9561	-9540	-9242	-9022	-10197	-10698	-11666	-11633	-11770	-9292	-9278	-8742	-10031.31	-10415.6	-11449.59	-11416.64	-11563.99
	ULS Min	-19579	-19535	-18449	-18235	-15432	-14676	-12934	-12872	-12433	-18937	-18904	-17859	-15064.27	-14404.27	-12740.97	-12679.12	-12251.47
IY Bending	ULS Max	1538	2069	2069	1673	559	409	1100	1100	497	1507	2031	2031	504.18	438.28	1031.49	1031.49	509.64
	ULS Min	-1489	-2011	-2006	-1342	-446	-207	-678	-678	-321	-1370	-1851	-1847	-353.65	-191.18	-751.21	-751.21	-265.43
IZ Bending	ULS Max	1321	1682	3086	9898	2033	735	736	14	578	1366	1789	9274	2207.54	366.86	962.12	962.12	268.39
	ULS Min	-1370	-1737	-2763	-8614	-2058	-395	-971	-971	-278	-1124	-1467	-9010	-1809.59	-737.78	-737.87	-27.58	-530.05
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	45	61	61	49	17	13	39	39	17	45	60	60	16	14	36	36	18
	Stress Z	34	43	76	242	43	15	31	31	19	33	44	227	46	15	31	31	17
Force (kn) =		10479	13750	18135	38714	9611	4466	7439	7439	3842	10345	13772	38091	9837	4620	7153	7153	3722
Tension Combined Force (kN) =		918	4210	8893	29693	-585	-6232	-4227	-4194	-7928	1053	4494	29350	-194	-5796	-4297	-4264	-7842
Compression Combined Force (kN) =		-30058	-33285	-36584	-56950	-25043	-19142	-20373	-20311	-16275	-29282	-32676	-55950	-24901	-19024	-19894	-19832	-15973
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	0.02	0.10	0.21	0.69	NA	NA	NA	NA	NA	0.02	0.10	0.68	NA	NA	NA	NA	NA
		0.75	0.83	0.91	1.41	0.62	0.48	0.62	0.62	0.498	0.73	0.81	1.39	0.62	0.47	0.61	0.61	0.49

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	518	529	772	1099	-60	-1013	-1555	-1648	-2014	721.45	740.16	1120.97	17.11	-856.14	-1394.71	-1493.32	-1808.1
	ULS Min	-9572	-9552	-7362	-7090	-5174	-3889	-2799	-2347	-2171	-8770.69	-8742.79	-6688.21	-4923.2	-3754	-2690.97	-2188.01	-1940.79
IY Bending	ULS Max	613	828	833	425	243	72	88	189	190	508.71	680.9	683.59	225.23	73.61	87.54	191.8	192
	ULS Min	-541	-724	-722	-415	-149	25	27	26	-187	-451.86	-623.75	-624.29	-148.29	34.67	23.75	23.75	-303.82
IZ Bending	ULS Max	502	561	836	4539	751	86	82	272	556	440.76	545.76	4280.75	829.4	122.94	52.39	183.18	183.18
	ULS Min	-629	-723	-891	-4054	-794	-139	-64	-64	-49	-370.69	-417.23	-3967.64	-617.36	-98.3	-83.13	-138.17	-760.61
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	29	40	40	20	12	3	4	9	9	24	33	33	11	4	4	9	15
	Stress Z	20	23	28	143	25	4	3	9	18	14	17	135	26	4	3	6	24
Force (kn) =		3847	4883	5315	12786	2866	612	531	1378	2081	2992	3895	13118	2889	579	533	1170	3013
Tension Combined Force (kN) =		4366	5412	6087	13885	2806	-401	-1024	-271	67	3713	4635	14239	2906	-277	-862	-323	1205
Compression Combined Force (kN) =		-13420	-14435	-12677	-19876	-8039	-4501	-3330	-3725	-4252	-11762	-12638	-19806	-7812	-4333	-3224	-3358	-4954
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	0.20	0.25	0.28	0.64	0.13	NA	NA	NA	0.00	0.17	0.21	0.65	0.13	NA	NA	NA	0.06
		0.86	0.93	0.81	1.27	0.51	0.29	0.21	0.24	0.26	0.75	0.81	1.27	0.50	0.28	0.20	0.21	0.31

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	711.77	711.77	434.3	451.32	633.36	246.91	941.53	860.73	583.68	613.64	612.18	660.74	323.05	273.6	-93.99	-98.09	-29.57	-831.82
	ULS Min	-226.5	-226.5	244.43	267.09	254.2	107.11	-1842.32	-1524.14	-1176.72	-1056.3	-1133.53	-1022.99	-981.88	-812.56	-577.87	-549.3	-172.62	-966.2
IY Bending	ULS Max	0	0	54.01	53.81	48.43	42.96	12.44	0	15.81	25.46	16.57	38.41	9.67	36.11	6.14	29.69	0	30.38
	ULS Min	0	0	0	0	0	0	-37.91	0	-31.62	-2.65	-30.07	0	-33.46	0	-26.54	0	0	0
IZ Bending	ULS Max	0	0	68.59	92.52	49.74	28.37	83.37	0	77.47	28.35	61.7	4.32	64.43	7.79	64.11	9.18	0	4.69
	ULS Min	0	0	-62.78	-90.67	-108.3	-82.7	-45.65	0	-39.8	-29.25	-18.72	-7.74	-23.64	-10.28	-25.94	-8.27	0	-9.16
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	19	19	17	15	16	0	13	11	13	16	14	15	11	12	0	11
	Stress Z	0	0	7	10	12	9	9	0	9	3	7	1	7	1	7	1	0	1
Force (kn) =		0	0	471	516	513	429	406	0	353	224	314	272	341	261	294	216	0	206
Tension Combined Force (kN) =		712	712	905	967	1147	676	1347	861	936	838	926	933	664	535	200	118	-30	-626
Compression Combined Force (kN) =		-227	-227	-226	-249	-259	-322	-2248	-1524	-1529	-1280	-1447	-1295	-1323	-1074	-872	-765	-173	-1172
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.14	0.20	0.21	0.25	0.15	0.32	0.21	0.23	0.20	0.22	0.22	0.16	0.13	0.05	0.03	NA	NA
		0.01	0.06	0.06	0.07	0.07	0.09	0.70	0.47	0.47	0.39	0.45	0.40	0.41	0.33	0.27	0.24	0.05	0.33

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	717.5	539.44	417.16	436.32	621.03	182.84	782.98	889.38	523.9	514.24	589.73	577.97	254.27	310.17	-80.74	-115.49	-610.98	-18.57
	ULS Min	-183.54	288.61	244.31	291.06	283.53	90.31	-1381.03	-1625.54	-967.83	-1077.87	-960.97	-1055.35	-768.64	-945	-523.78	-599.59	-709.44	-178.39
IY Bending	ULS Max	0	38.85	48.56	47.31	43.99	42.47	4.74	70.1	34.61	16.22	36.8	15.8	34.01	9.66	28.45	7.17	25.83	0
	ULS Min	0	-103.44	0	0	0	0	-15.33	0	-3.68	-30.91	0	-29.71	0	-33.1	0	-26.33	0	0
IZ Bending	ULS Max	0	26.3	29.36	33.71	31.54	30.96	96.33	31.97	14.98	19.19	5.78	12.65	5.19	14.16	6.33	15.64	2.41	0
	ULS Min	0	-44.59	-11.32	-8.32	-9.31	-6.86	-56.21	-33.95	-10.74	-61.76	-1.24	-56.4	-1.88	-58.54	-1.15	-64.23	-8.01	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	30	17	16	15	15	6	29	14	13	15	12	14	14	12	11	9	0
	Stress Z	0	4	3	4	3	3	11	4	2	7	1	6	1	7	1	7	1	0
Force (kn) =		0	631	360	361	336	326	277	532	260	319	258	302	238	328	202	293	176	0
Tension Combined Force (kN) =		718	1170	778	797	957	508	1060	1422	783	834	847	880	492	638	122	178	-435	-19
Compression Combined Force (kN) =		-184	-342	-116	-70	-53	-235	-1658	-2158	-1227	-1397	-1219	-1357	-1006	-1273	-726	-893	-885	-178
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.23	0.17	0.17	0.21	0.11	0.26	0.34	0.19	0.20	0.20	0.21	0.12	0.15	0.03	0.04	NA	NA
		0.01	0.10	0.03	0.02	0.02	0.07	0.51	0.67	0.38	0.43	0.38	0.42	0.31	0.39	0.22	0.27	0.25	0.05

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	463.96	379.23	966.3	183.56	914.23	814.68	380.44	433.44	27.76	-31.46	-346.11	-310.19	-125.85	21.86
	ULS Min	328.88	-218.76	749.81	-373.25	-2145.66	-2237.22	-1827.6	-1772.18	-1699.1	-1754.41	-1273.26	-1241.18	-198.82	11.99
IY Bending	ULS Max	7068.82	0	33.36	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-7846.77	-59.69	0	-15.43	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	129.77	203.16	62.93	229.82	0	0	0	0	0	0	0	0	0	0
	ULS Min	-56.17	-97.74	-30.13	-85.46	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	79	20	13	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	7	15	5	19	0	0	0	0	0	0	0	0	0	0
Force (kn) =		6853	698	330	448	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		7317	1077	1296	632	914	815	380	433	28	-31	-346	-310	-126	22
Compression Combined Force (kN) =		-6524	-916	420	-822	-2146	-2237	-1828	-1772	-1699	-1754	-1273	-1241	-199	12
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.36	0.21	0.28	0.14	0.18	0.16	0.07	0.08	0.01	NA	NA	NA	NA	0.02
		0.41	0.23	NA	0.23	0.57	0.59	0.48	0.47	0.51	0.53	0.38	0.37	0.64	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	276.34	184.86	355.58	115.65	229.41	478.05	442.5	270.69	279.34	177.29	170.13	228	161.83	25.5	31.11
	ULS Min	57.59	-191.72	96.71	-40.36	175.16	-903.6	-910.95	-632.47	-645.09	-568.28	-545.64	-380.69	-467.8	-81.18	19.08
IY Bending	ULS Max	3486.1	14.84	20.73	15.14	110.42	0	0	0	0	0	0	0	0	0	0
	ULS Min	-3809.53	-22.87	-9.84	-17.72	89.46	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	141.75	206.16	84.3	230	104.49	0	0	0	0	0	0	0	0	0	0
	ULS Min	-89.42	-103.09	-47.71	-116.86	0	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	46	10	9	8	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	11	20	8	23	6	0	0	0	0	0	0	0	0	0	0
Force (kn) =		3803	492	282	493	570	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		4080	677	638	609	799	478	443	271	279	177	170	228	162	26	31
Compression Combined Force (kN) =		-3746	-684	-186	-533	-394	-904	-911	-632	-645	-568	-546	-381	-468	-81	19
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.24	0.16	0.15	0.15	0.07	0.10	0.10	0.06	0.06	0.04	0.04	0.05	0.04	0.02	0.02
		0.29	0.26	0.07	0.20	0.04	0.24	0.24	0.17	0.17	0.15	0.14	0.10	0.12	0.26	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder End	Front Transverse Sheave Girder Middle	Back Transverse Sheave Girder	G1	G2/3	G4	G6
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	29228.53	29228.53	3718.94	2054.72	2143.88	2039.91	963.08
	ULS Min	0	0	-1412	-10	-12	-17	-641
Shear	Fz Max	11450	11450	1433	2762	2822	2692	1487
	Fz Min	-11516	-11516	-1449	-373	-2813	-344	-650
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.536	0.713	0.185	0.197	0.174	0.195	0.183
		0.317	0.602	0.269	0.661	0.675	0.644	0.647

4 - ULS V3		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-8333	-8311	-8142	-7935	-9598	-10275	-11575	-11542	-11762	-8085	-8071	-7626	-9418.54	-9941.35	-11314.7	-11281.86	-11508.42
	ULS Min	-20847	-20802	-19640	-19412	-16108	-15213	-13144	-13082	-12566	-20134	-20101	-18972	-15675.47	-14892.91	-12913.57	-12851.61	-12344.06
IY Bending	ULS Max	1938	2607	2607	2072	678	480	1340	1340	584	1876	2528	2528	608.43	516.06	1255.17	1255.17	601.58
	ULS Min	-1847	-2492	-2487	-1697	-579	-289	-883	-883	-401	-1721	-2324	-2320	-463.86	-270.77	-973.2	-973.2	-340.96
IZ Bending	ULS Max	1662	2117	3827	12260	2555	841	841	79	658	1684	2205	11598	2717.68	413.62	1190.13	1190.13	273.26
	ULS Min	-1701	-2157	-3483	-10881	-2559	-446	-1201	-1201	-286	-1429	-1865	-11258	-2303.73	-843.39	-843.52	-96.71	-601.88
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	57	77	77	61	21	15	47	47	20	55	75	75	19	16	44	44	21
	Stress Z	42	53	94	300	54	18	39	39	21	41	54	284	57	18	38	38	19
Force (kn) =		13120	17227	22652	47949	11866	5170	9123	9123	4437	12824	17073	47586	12050	5355	8770	8770	4311
Tension Combined Force (kN) =		4787	8915	14511	40014	2268	-5105	-2452	-2419	-7325	4740	9002	39960	2631	-4586	-2545	-2512	-7197
Compression Combined Force (kN) =		-33966	-38029	-42292	-67362	-27973	-20383	-22267	-22205	-17003	-32958	-37174	-66558	-27725	-20248	-21684	-21622	-16655
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	0.11	0.21	0.34	0.92	0.04	NA	NA	NA	NA	0.11	0.21	0.92	0.05	NA	NA	NA	NA
		0.84	0.94	1.05	1.67	0.70	0.51	0.68	0.68	0.521	0.82	0.92	1.65	0.69	0.50	0.66	0.66	0.51

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	1713	1724	1736	2064	544	-672	-1402	-1556	-1983	1895.07	1913.71	2080.36	625.29	-497.09	-1234	-1403.57	-1784.59
	ULS Min	-10897	-10876	-8427	-8155	-5829	-4248	-2938	-2410	-2171	-9966.79	-9938.81	-7659.28	-5530.57	-4099.89	-2834.79	-2252.4	-1942.78
IY Bending	ULS Max	766	1033	1038	536	290	77	97	193	195	632.47	849.23	852.35	271.98	79.46	95.78	195.72	195.78
	ULS Min	-677	-907	-906	-514	-199	23	20	19	-190	-568.24	-781.59	-782.5	-194.92	30.78	16.04	16.05	-322.85
IZ Bending	ULS Max	644	722	1054	5630	949	115	89	313	612	542.09	665.75	5323.87	1011.02	149.07	56.93	219.82	219.83
	ULS Min	-770	-882	-1104	-5111	-982	-167	-69	-86	-88	-472.22	-537.99	-4986.63	-797.43	-127.47	-90.29	-181.87	-817.43
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	37	50	50	26	14	4	5	9	9	30	41	41	13	4	5	9	15
	Stress Z	24	28	35	178	31	5	3	10	19	17	21	168	32	5	3	7	26
Force (kn) =		4766	6045	6610	15894	3508	700	581	1494	2240	3705	4821	16322	3512	665	581	1275	3225
Tension Combined Force (kN) =		6479	7768	8346	17958	4052	28	-821	-62	257	5600	6735	18403	4137	168	-653	-129	1440
Compression Combined Force (kN) =		-15663	-16921	-15037	-24048	-9337	-4948	-3519	-3904	-4411	-13672	-14760	-23981	-9042	-4765	-3416	-3527	-5168
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	0.30	0.36	0.38	0.82	0.19	0.00	NA	NA	0.01	0.26	0.31	0.85	0.19	0.01	NA	NA	0.07
		1.00	1.08	0.96	1.54	0.59	0.31	0.22	0.25	0.27	0.88	0.95	1.54	0.57	0.30	0.22	0.22	0.32

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	835.04	835.04	458.45	472.69	678.31	254.74	1262.97	1167.2	782.95	824.97	809.22	875.45	467.59	409.07	-46.36	-48.56	-11.11	-816.69
	ULS Min	-337.8	-337.8	221.11	242.41	204.36	91.09	-2206.52	-1802.53	-1406.5	-1248.86	-1361.64	-1216.22	-1152.34	-935.16	-639.81	-599.64	-186.64	-981.95
IY Bending	ULS Max	0	0	57.54	56.9	50.41	43.92	14.98	0	18.53	29.18	19.49	42.56	11.49	39.02	6.73	30.82	0	30.69
	ULS Min	0	0	0	0	0	0	-42.12	0	-34.03	-5.96	-32.23	-1.24	-34.86	0	-27.32	0	0	0
IZ Bending	ULS Max	0	0	87.15	117.66	71.74	39.38	104.37	0	96.95	35.27	77.19	5.33	81.19	9.52	81.49	10.81	0	6.81
	ULS Min	0	0	-77.07	-111.32	-125.81	-92.58	-56.76	0	-49.64	-36.73	-23.33	-9.68	-28.89	-12.93	-31.05	-10.85	0	-10
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	20	20	17	15	18	0	14	12	13	18	15	16	11	13	0	11
	Stress Z	0	0	9	13	14	10	12	0	11	4	9	1	9	1	9	1	0	1
Force (kn) =		0	0	529	584	560	454	472	0	404	262	356	303	381	285	331	227	0	210
Tension Combined Force (kN) =		835	835	987	1057	1238	709	1735	1167	1187	1087	1165	1179	849	694	285	178	-11	-607
Compression Combined Force (kN) =		-338	-338	-308	-342	-355	-363	-2678	-1803	-1811	-1511	-1718	-1519	-1533	-1221	-971	-826	-187	-1192
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.16	0.22	0.23	0.27	0.16	0.42	0.28	0.29	0.26	0.28	0.28	0.20	0.17	0.07	0.04	NA	NA
		0.01	0.09	0.09	0.10	0.10	0.10	0.83	0.56	0.56	0.47	0.53	0.47	0.47	0.38	0.30	0.25	0.05	0.33

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	831.44	569.6	437.75	454.31	661.53	190.11	1054.69	1184.44	707.56	701.41	780.82	770.4	378.2	455.59	-31.22	-65.67	-601.3	1.36
	ULS Min	-294.87	258.48	221.69	272.73	239.66	75.45	-1638.31	-1942.04	-1143.39	-1277.68	-1144.56	-1259.93	-886.87	-1102.09	-571.95	-659.55	-721.29	-195.13
IY Bending	ULS Max	0	56.48	53.21	49.67	45.09	42.86	7.24	76.95	39.29	19.03	40.65	18.53	36.73	11.4	29.45	7.83	26.09	0
	ULS Min	0	-121.38	0	0	0	0	-17.85	-3.79	-8.58	-33.11	0	-31.78	0	-34.39	0	-27.03	0	0
IZ Bending	ULS Max	0	33.02	37.04	41.84	39.58	38.31	121.29	39.3	18.62	24.38	7.1	15.88	6.54	17.49	7.73	19.45	2.95	0
	ULS Min	0	-55.22	-13.78	-10.69	-11.42	-8.83	-69.39	-42.47	-13.53	-76.81	-1.63	-70.44	-2.24	-73.36	-1.52	-80.37	-9.86	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	35	18	17	16	15	7	32	16	14	17	13	15	14	12	11	9	0
	Stress Z	0	5	4	5	4	4	14	5	2	9	1	8	1	8	1	9	1	0
Force (kn) =		0	745	404	392	359	342	340	594	298	361	286	341	258	364	212	327	181	0
Tension Combined Force (kN) =		831	1315	842	846	1020	532	1394	1778	1005	1063	1067	1111	637	819	181	261	-421	1
Compression Combined Force (kN) =		-295	-487	-183	-119	-119	-267	-1978	-2536	-1441	-1639	-1430	-1601	-1145	-1466	-784	-987	-902	-195
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.26	0.18	0.18	0.22	0.12	0.34	0.43	0.24	0.26	0.26	0.27	0.15	0.20	0.04	0.06	NA	0.00
		0.01	0.14	0.05	0.03	0.03	0.08	0.61	0.78	0.44	0.50	0.44	0.49	0.35	0.45	0.24	0.30	0.25	0.05

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	481.43	455.4	989.52	197.17	1293.71	1176.84	637.45	702.31	237.06	164.23	-248.52	-201.66	-118.02	21.95
	ULS Min	312.58	-287.95	718.91	-496.71	-2524.78	-2631.67	-2116.23	-2048.34	-1915.92	-1983.86	-1401.88	-1359.8	-207.33	11.83
IY Bending	ULS Max	8883.54	0	34.02	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-9682.29	-61.14	0	-15.63	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	161.7	254.06	78.66	287.53	0	0	0	0	0	0	0	0	0	0
	ULS Min	-70.72	-122.03	-37.67	-106.53	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	98	20	13	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	8	19	6	23	0	0	0	0	0	0	0	0	0	0
Force (kn) =		8462	783	358	535	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		8944	1238	1348	732	1294	1177	637	702	237	164	-249	-202	-118	22
Compression Combined Force (kN) =		-8150	-1071	361	-1031	-2525	-2632	-2116	-2048	-1916	-1984	-1402	-1360	-207	12
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.44	0.24	0.29	0.16	0.25	0.23	0.12	0.13	0.05	0.04	NA	NA	NA	0.02
		0.52	0.26	NA	0.29	0.67	0.69	0.56	0.54	0.57	0.59	0.42	0.41	0.67	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	303.88	228.22	386.65	130.18	233.77	649.15	606.14	378.28	392.35	268.9	255.22	299.49	239.21	37.47	31.58
	ULS Min	30.44	-242.5	65.62	-64.83	167.36	-1072.17	-1079.93	-744.92	-757.44	-657.31	-633.74	-455.62	-542.08	-93.67	18.65
IY Bending	ULS Max	4356.61	15.96	22.06	16.42	113.89	0	0	0	0	0	0	0	0	0	0
	ULS Min	-4707.59	-23.62	-10.57	-18.21	87.94	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	178.37	257.05	104.84	287.09	133.89	0	0	0	0	0	0	0	0	0	0
	ULS Min	-110.6	-129.5	-60.17	-146.47	0	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	57	10	10	8	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	14	25	10	28	8	0	0	0	0	0	0	0	0	0	0
Force (kn) =		4716	578	325	588	658	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		5020	807	711	718	892	649	606	378	392	269	255	299	239	37	32
Compression Combined Force (kN) =		-4686	-821	-259	-652	-491	-1072	-1080	-745	-757	-657	-634	-456	-542	-94	19
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.30	0.19	0.17	0.17	0.07	0.14	0.13	0.08	0.09	0.06	0.06	0.07	0.05	0.03	0.03
		0.36	0.31	0.10	0.25	0.05	0.28	0.28	0.20	0.20	0.17	0.17	0.12	0.14	0.30	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder End	Front Transverse Sheave Girder Middle	Back Transverse Sheave Girder	G1	G2/3	G4	G6
	Members	40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	29594.23	29594.23	3727.63	2075.87	2155.52	2082.71	1000.53
	ULS Min	0	0	-1494	-10	-12	-18	-663
Shear	Fz Max	11519	11519	1424	2790	2828	2749	1538
	Fz Min	-11628	-11628	-1439	-374	-2837	-341	-712
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.543	0.722	0.185	0.199	0.175	0.199	0.190
		0.320	0.608	0.267	0.667	0.679	0.658	0.669

4 - ULS V4		North Tower																	
		Rail Side Columns									HWY Side Columns								
		Front Leg (100-110)									Front Leg (200-209)								
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-7589	-7568	-6841	-6568	-6052	-5846	-5569	-5535	-5312	-7190	-7176	-6356	-5900.58	-5718.75	-5470.82	-5437.41	-5237.67
	ULS Min	-7620	-7578	-6884	-6724	-6189	-5984	-5630	-5569	-5407	-7220	-7187	-6555	-6037.67	-5855.84	-5532.21	-5470.82	-5332.48
IY Bending	ULS Max	0	-65	-85	43	10	41	41	2	247	32	42	44	7.36	43.85	43.85	-4.4	281.8
	ULS Min	-65	-93	-90	-12	-11	10	2	-20	-20	0	32	-8	-9.34	7.2	-4.4	-30.77	-30.78
IZ Bending	ULS Max	0	-29	119	345	-27	145	145	-20	110	75	100	135	139.73	76.41	18.98	108.55	108.55
	ULS Min	-29	-33	20	267	-90	-90	-20	-109	-109	0	75	77	76.39	-145.61	-145.6	18.98	-98.28
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	2	3	3	1	0	1	1	1	9	1	1	1	0	1	2	1	10
	Stress Z	1	1	3	8	2	3	5	4	4	2	2	3	3	3	5	4	4
Force (kn) =		351	469	741	1288	355	686	652	448	1300	367	490	611	511	701	663	487	1424
Tension Combined Force (kN) =		-7238	-7098	-6100	-5279	-5697	-5161	-4917	-5087	-4012	-6823	-6686	-5745	-5389	-5018	-4807	-4950	-3813
Compression Combined Force (kN) =		-7971	-8048	-7625	-8013	-6545	-6669	-6282	-6016	-6707	-7587	-7677	-7167	-6549	-6557	-6196	-5958	-6757
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		0.20	0.20	0.19	0.20	0.16	0.17	0.19	0.18	0.205	0.19	0.19	0.18	0.16	0.16	0.19	0.18	0.21

		North Tower																	
		Rail Side Columns									HWY Side Columns								
		Rear Leg (300-310)									Rear Leg (400-409)								
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	-4520	-4509	-3418	-3095	-2761	-2649	-2468	-2330	-2548	-4219.7	-4200.74	-3028.69	-2692.22	-2560.51	-2335.45	-2161.6	-2324.54
	ULS Min	-4533	-4514	-3437	-3163	-2839	-2727	-2547	-2408	-2579	-4232.94	-4205.39	-3116.04	-2770.34	-2638.63	-2413.57	-2239.72	-2355.25
IY Bending	ULS Max	1	5	8	16	13	13	13	154	151	17.58	20.72	13.56	7	10.97	10.93	142.18	141.22
	ULS Min	0	0	-42	-26	4	3	3	2	-233	0	12.56	-0.64	0.76	6.99	7.73	7.71	-240.58
IZ Bending	ULS Max	0	-65	-40	279	-31	60	60	80	458	34.95	65.77	108.17	105.34	22.04	33.68	86.42	86.38
	ULS Min	-65	-82	-134	187	-42	-30	-44	-43	80	0	29.78	29.73	22.04	-60.89	-60.89	33.68	-703.54
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	0	0	2	1	1	1	1	7	11	1	1	1	0	1	1	7	12
	Stress Z	2	3	4	9	1	2	2	3	14	1	2	3	3	2	2	3	22
Force (kn) =		162	219	487	785	153	198	196	774	2004	152	240	318	286	191	191	745	2636
Tension Combined Force (kN) =		-4358	-4290	-2931	-2309	-2608	-2451	-2273	-1556	-545	-4068	-3961	-2711	-2406	-2369	-2144	-1416	311
Compression Combined Force (kN) =		-4696	-4733	-3924	-3949	-2992	-2925	-2743	-3182	-4583	-4385	-4445	-3434	-3056	-2830	-2605	-2985	-4991
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01
		0.30	0.30	0.25	0.25	0.19	0.19	0.17	0.20	0.28	0.28	0.28	0.22	0.19	0.18	0.17	0.19	0.31

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	146.47	146.47	219.32	230.06	273.75	21.63	-238.88	-248.96	-127.58	-141.23	-102.4	-120.78	-139.35	-143.53	-139.76	-229.23	71.65	-970.91
	ULS Min	146.47	146.47	211.16	217.93	252.12	-23.85	-280.3	-291.78	-172.35	-192.71	-147.99	-170.05	-185.07	-193.58	-185.77	-277.14	58.49	-981.35
IY Bending	ULS Max	0	0	39.17	40.63	40.08	40.05	7.55	0	7.47	14.27	7.34	18.51	6.15	19.66	6.73	21.19	0	29.54
	ULS Min	0	0	0	0	0	0	-12.37	0	-13.99	0	-13.6	0	-16.54	0	-12.75	0	0	0
IZ Bending	ULS Max	0	0	0	0	0	0	0	0	0.08	1.31	0	0	0	0.95	0	2.75	0	0
	ULS Min	0	0	-6.34	-13.84	-46.26	-52.91	-1.37	0	-0.9	0	-1.36	-0.07	-3.1	0	-6.93	0	0	-6.26
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	14	14	14	14	5	0	6	6	6	8	7	8	5	9	0	10
	Stress Z	0	0	1	1	5	6	0	0	0	0	0	0	0	0	1	0	0	1
Force (kn) =		0	0	257	281	340	353	86	0	96	98	94	124	117	134	98	147	0	196
Tension Combined Force (kN) =		146	146	476	511	614	375	-153	-249	-32	-43	-9	4	-23	-10	-42	-82	72	-775
Compression Combined Force (kN) =		146	146	-46	-63	-88	-377	-366	-292	-268	-291	-242	-294	-302	-327	-284	-424	58	-1177
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.00	0.03	0.10	0.11	0.13	0.08	NA	NA	NA	NA	NA	0.00	NA	NA	NA	NA	0.02	NA
		NA	NA	0.01	0.02	0.03	0.11	0.11	0.09	0.08	0.09	0.07	0.09	0.09	0.10	0.09	0.13	NA	0.33

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	190.91	274.85	212.76	222.53	262.77	-48.05	-192.15	-202.97	-124.36	-141.66	-99.44	-116.06	-116.64	-154.78	-210.07	-170.51	-768.36	115.6
	ULS Min	190.91	267.33	211.73	221.73	260.84	-53.11	-237.98	-267.62	-176.25	-186.35	-148.78	-161.81	-167.1	-200.52	-258.49	-215.99	-780	102.44
IY Bending	ULS Max	0	0	39	38.94	39.32	41.45	0	37.05	13.37	7.6	18	7.46	18.52	6.4	20.31	7.5	25.84	0
	ULS Min	0	-18.1	0	0	0	0	-11.15	0	0	-14.03	0	-13.58	0	-16.59	0	-12.76	0	0
IZ Bending	ULS Max	0	0	0	1.19	0	2.26	0	2.02	0.87	0	0.41	0.67	0	0.34	0.68	1.69	0.42	0
	ULS Min	0	-1.42	-0.8	0	-1.02	0	-2.77	-0.03	0	-1.06	0	0	-0.4	-0.2	0	0	-0.42	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	5	14	13	14	14	5	15	6	6	8	6	8	7	8	5	9	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		0	99	245	246	248	263	80	252	91	96	122	92	125	112	138	89	162	0
Tension Combined Force (kN) =		191	374	458	468	510	215	-112	49	-33	-46	22	-24	8	-43	-72	-82	-606	116
Compression Combined Force (kN) =		191	168	-33	-24	13	-316	-318	-520	-268	-282	-270	-254	-292	-313	-396	-305	-942	102
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.07	0.10	0.10	0.11	0.05	NA	0.01	NA	NA	0.01	NA	0.00	NA	NA	NA	NA	0.02
		NA	NA	0.01	0.01	NA	0.09	0.10	0.16	0.08	0.09	0.08	0.08	0.09	0.10	0.12	0.09	0.26	NA

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	210.13	35.09	409	62.21	-298.37	-325.84	-277.1	-274.98	-389.08	-389.84	-306.67	-320.11	-62.17	27.85
	ULS Min	210.13	18.07	409	52.67	-323.86	-351.34	-302.59	-300.47	-411.44	-412.19	-329.03	-342.47	-69.84	19.01
IY Bending	ULS Max	339.9	0	5.5	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-370.83	-41.97	0	-16.52	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	7.01	0	0.07	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	0.15	-0.14	0	-0.33	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	4	14	2	7	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		327	279	39	118	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		538	314	448	180	-298	-326	-277	-275	-389	-390	-307	-320	-62	28
Compression Combined Force (kN) =		-117	-261	370	-65	-324	-351	-303	-300	-411	-412	-329	-342	-70	19
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.03	0.06	0.10	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.06	NA	0.02	0.09	0.09	0.08	0.08	0.12	0.12	0.10	0.10	0.22	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	182.56	14.55	260.63	61.03	290.82	-224.59	-234.21	-185.48	-195.78	-209.89	-190.15	-71.95	-175.1	-28.7	28.82
	ULS Min	176.08	0.09	241.15	5.01	290.82	-247.59	-257.21	-208.47	-218.78	-232.89	-213.14	-94.95	-198.09	-37.53	20.44
IY Bending	ULS Max	265.46	10.16	17.93	11.59	97.56	0	0	0	0	0	0	0	0	0	0
	ULS Min	-230.29	-20.14	-5.64	-15.5	97.56	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	5.39	1.69	2.32	6.03	22.96	0	0	0	0	0	0	0	0	0	0
	ULS Min	-0.09	0	0	0	22.96	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	3	9	8	7	5	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Force (kn) =		242	147	132	120	316	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		425	161	392	181	607	-225	-234	-185	-196	-210	-190	-72	-175	-29	29
Compression Combined Force (kN) =		-66	-146	109	-115	-25	-248	-257	-208	-219	-233	-213	-95	-198	-38	20
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.03	0.04	0.09	0.04	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.06	NA	0.04	0.00	0.07	0.07	0.06	0.06	0.06	0.06	0.03	0.05	0.12	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder	Front Transverse Sheave Girder	Back Transverse Sheave Girder	G1	G2/3	G4	G6
		End	Middle					
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	10419.57	10419.57	4327.31	1220.64	4114.92	1098.29	846.64
	ULS Min	0	0	-1396	-16	-12	-17	-651
Shear	Fz Max	4180	4180	1885	189	1882	46	1471
	Fz Min	-4161	-4161	-1898	-435	-1802	-252	-488
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.191	0.254	0.215	0.117	0.334	0.105	0.161
		0.115	0.219	0.352	0.104	0.450	0.060	0.640

5 - ULS 1		North Tower																	
		Rail Side Columns									HWY Side Columns								
		Front Leg (100-110)									Front Leg (200-209)								
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-13149	-13127	-12338	-12064	-11332	-11130	-10785	-10752	-10555	-12795	-12782	-11900	-11227.31	-11055.08	-10748.11	-10714.7	-10540.34
	ULS Min	-13179	-13138	-12380	-12221	-11469	-11267	-10847	-10785	-10650	-12825	-12792	-12100	-11364.41	-11192.18	-10809.5	-10748.11	-10635.14
IY Bending	ULS Max	0	-60	-54	74	72	110	120	124	124	32	42	75	74.02	114.32	114.64	114.7	114.71
	ULS Min	-60	-85	-83	70	70	70	110	120	37	0	32	44	68.32	68.11	114.31	114.64	73.15
IZ Bending	ULS Max	0	-43	119	434	-47	282	282	-45	234	89	119	154	162.26	160.08	44.88	223.28	223.27
	ULS Min	-43	-51	-5	267	-172	-172	-45	-223	-223	0	89	3	160.06	-282.92	-282.89	44.88	-217.91
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	2	3	2	2	2	3	4	4	4	1	1	2	2	4	4	4	4
	Stress Z	1	1	3	11	4	6	9	7	8	2	3	4	3	6	9	7	7
Force (kn) =		374	499	711	1700	926	1482	1413	1230	1268	414	552	794	906	1506	1399	1195	1195
Tension Combined Force (kN) =		-12775	-12628	-11627	-10364	-10406	-9648	-9373	-9521	-9287	-12382	-12229	-11106	-10322	-9549	-9349	-9520	-9346
Compression Combined Force (kN) =		-13553	-13637	-13091	-13921	-12394	-12749	-12259	-12016	-11917	-13239	-13344	-12894	-12270	-12698	-12208	-11943	-11830
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		0.34	0.34	0.33	0.35	0.31	0.32	0.38	0.37	0.365	0.33	0.33	0.32	0.30	0.32	0.37	0.37	0.36

		North Tower																	
		Rail Side Columns									HWY Side Columns								
		Rear Leg (300-310)									Rear Leg (400-409)								
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	-4112	-4101	-2956	-2633	-2347	-2245	-2042	-1892	-2026	-3829.01	-3810.04	-2590.7	-2291.78	-2166.51	-1915.63	-1731.71	-1799.36
	ULS Min	-4125	-4105	-2975	-2702	-2425	-2323	-2120	-1970	-2057	-3842.25	-3814.69	-2678.05	-2369.9	-2244.63	-1993.75	-1809.83	-1830.08
IY Bending	ULS Max	2	7	10	50	47	45	46	163	160	14.1	17.12	31.52	33.69	43.95	48.34	165.31	165.97
	ULS Min	0	2	-39	-22	29	29	45	45	-168	0	8.22	9.2	32.85	33.66	43.88	48.31	-216.14
IZ Bending	ULS Max	0	-66	-38	281	-25	51	50	98	320	34.85	65.02	108.21	101.46	16.81	31.67	37.89	37.86
	ULS Min	-66	-83	-128	173	-39	-25	-42	-41	98	0	29.86	29.66	16.82	-51.35	-51.35	31.65	-511.82
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	0	0	2	2	2	2	2	8	8	1	1	2	2	2	2	8	10
	Stress Z	2	3	4	9	1	2	2	3	10	1	2	3	3	2	2	1	16
Force (kn) =		171	230	462	879	272	295	297	854	1418	139	224	385	376	291	308	712	2072
Tension Combined Force (kN) =		-3941	-3871	-2494	-1754	-2074	-1950	-1745	-1038	-609	-3690	-3586	-2206	-1915	-1875	-1608	-1019	272
Compression Combined Force (kN) =		-4296	-4336	-3437	-3581	-2697	-2618	-2418	-2824	-3474	-3981	-4039	-3063	-2746	-2536	-2301	-2522	-3902
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01
		0.28	0.28	0.22	0.23	0.17	0.17	0.15	0.18	0.22	0.26	0.26	0.20	0.17	0.16	0.15	0.16	0.24

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
								Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	Horizontal 4 (AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	199.77	199.77	308.33	337.46	424.19	167.73	-315.21	-334.82	-192.27	-209.89	-157.61	-179.08	-228.47	-239.81	-256.26	-276.8	-53.37	-880.53
	ULS Min	199.77	199.77	298.76	319.44	394.48	118.64	-356.5	-379.86	-236.46	-263.89	-202.78	-230.67	-273.51	-293.14	-301.83	-328.01	-66.53	-891.44
IY Bending	ULS Max	0	0	39.79	41.23	40.44	39.46	3.02	0	5.24	16.5	5.2	21.05	3	23.38	4.28	24.22	0	28.78
	ULS Min	0	0	0	0	0	0	-19.8	0	-20.85	0	-20.31	0	-26.09	0	-21.71	0	0	0
IZ Bending	ULS Max	0	0	0	0.26	0	0	0	0	0.48	1.14	0	0.19	0	0.81	0	2.41	0	0
	ULS Min	0	0	-5.7	-8.11	-35.69	-40.19	-1.2	0	-0.48	0	-0.58	0	-3.09	0	-5.71	0	0	-5.69
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	14	14	14	14	8	0	9	7	8	9	11	10	9	10	0	10
	Stress Z	0	0	1	1	4	4	0	0	0	0	0	0	0	0	1	0	0	1
	Force (kn) =	0	0	260	273	322	325	135	0	141	113	137	142	181	158	156	167	0	190
	Tension Combined Force (kN) =	200	200	568	611	746	492	-180	-335	-51	-97	-20	-37	-48	-81	-100	-110	-53	-691
	Compression Combined Force (kN) =	200	200	39	46	72	-206	-492	-380	-377	-377	-340	-372	-454	-452	-458	-495	-67	-1081
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.04	0.12	0.13	0.16	0.11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.06	0.15	0.12	0.12	0.12	0.10	0.11	0.14	0.14	0.14	0.15	0.02	0.30

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
								Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	Horizontal 4 (AD54)	Horizontal 5 (A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	242.86	383.38	305.1	331.94	417.21	108.97	-275.95	-266.69	-189.55	-212.54	-156.15	-173.3	-213.68	-244.69	-259.7	-284.75	-657.37	-46.19
	ULS Min	242.86	374.29	304.06	331.08	415.66	104.98	-323.43	-334.06	-244.01	-256.74	-207.81	-218.58	-267.44	-289.87	-311.45	-329.73	-669.62	-59.36
IY Bending	ULS Max	0	0	39.26	39.25	39.55	41.01	0	41.23	15.39	5.35	20.64	5.22	22.16	3.25	23.5	4.97	24.76	0
	ULS Min	0	-28.17	0	0	0	0	-6	0	0	-20.91	0	-20.32	0	-26.16	0	-21.86	0	0
IZ Bending	ULS Max	0	0	0	1.21	0	1.74	0	2.48	0.9	0	0.43	0.06	0	0.74	0.67	1.01	0.28	0
	ULS Min	0	-1.88	-1.33	0	-0.83	0	-3.39	0	0	-1.46	0	-0.18	-0.42	0	0	0	-0.52	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	8	14	14	14	14	3	17	6	9	9	8	9	11	10	9	9	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Force (kn) =	0	154	248	248	249	260	46	281	105	143	139	137	150	177	159	149	155	0
	Tension Combined Force (kN) =	243	537	553	580	666	369	-230	15	-85	-70	-17	-37	-64	-68	-101	-136	-502	-46
	Compression Combined Force (kN) =	243	221	56	84	167	-155	-370	-615	-349	-400	-347	-355	-417	-467	-470	-478	-825	-59
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.10	0.12	0.13	0.15	0.08	NA	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.04	0.11	0.19	0.11	0.12	0.11	0.11	0.13	0.14	0.14	0.15	0.23	0.02

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	358.92	66.91	783.68	116.11	-544.57	-575.84	-577.61	-571.07	-727.04	-732.95	-654.72	-660.56	-138.99	22.72
	ULS Min	358.92	50.31	783.68	108.22	-570.07	-601.33	-603.1	-596.57	-749.39	-755.31	-677.07	-682.91	-146.66	13.88
IY Bending	ULS Max	540.18	0	25.86	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-481.76	-51.6	0	-15.03	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	4.54	0	0.06	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	0.44	-0.49	0	-1.02	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	5	17	10	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		454	343	184	108	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		813	410	968	225	-545	-576	-578	-571	-727	-733	-655	-661	-139	23
Compression Combined Force (kN) =		-95	-293	600	0	-570	-601	-603	-597	-749	-755	-677	-683	-147	14
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.04	0.08	0.21	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.07	NA	0.00	0.15	0.16	0.16	0.16	0.22	0.23	0.20	0.20	0.47	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	159.93	11.6	218.36	53.5	201.55	-197.52	-202.14	-148.14	-161.82	-179.74	-160.74	-50.57	-135.93	-19.62	29.32
	ULS Min	154.55	-1.72	204.35	8.93	201.55	-220.51	-225.13	-171.13	-184.82	-202.73	-183.73	-73.56	-158.93	-28.45	20.94
IY Bending	ULS Max	240.41	10.43	17.11	11.78	98.31	0	0	0	0	0	0	0	0	0	0
	ULS Min	-212.34	-19.73	-7.42	-15.88	98.31	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	6.11	3.7	3.4	5.69	17.43	0	0	0	0	0	0	0	0	0	0
	ULS Min	-6.4	0	0	0	17.43	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	3	9	8	7	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Force (kn) =		227	147	128	122	303	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		387	158	346	176	504	-198	-202	-148	-162	-180	-161	-51	-136	-20	29
Compression Combined Force (kN) =		-72	-149	77	-114	-101	-221	-225	-171	-185	-203	-184	-74	-159	-28	21
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.02	0.04	0.08	0.04	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.06	NA	0.04	0.01	0.06	0.06	0.05	0.05	0.05	0.05	0.02	0.04	0.09	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder	Front Transverse Sheave Girder	Back Transverse Sheave Girder	G1	G2/3	G4	G6
		End	Middle					
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	25188.56	25188.56	3528.55	1720.71	2043.68	1734.83	813.03
	ULS Min	0	0	-1037	-10	-12	-10	-542
Shear	Fz Max	9970	9970	1395	2322	2458	2289	1190
	Fz Min	-9879	-9879	-1396	-345	-2380	-335	-373
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.462	0.614	0.175	0.165	0.166	0.166	0.155
		0.275	0.521	0.259	0.556	0.588	0.548	0.518

5 - ULS 4		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-7283	-7261	-7118	-6981	-8542	-9163	-10378	-10345	-10534	-7244	-7230	-6786	-8417.5	-8886.22	-10154.45	-10121.57	-10308.37
	ULS Min	-18965	-18919	-17852	-17704	-14627	-13780	-11846	-11784	-11291	-18492	-18459	-17389	-14266.44	-13516.81	-11650.83	-11588.9	-11094.63
IY Bending	ULS Max	1837	2475	2475	1909	649	456	1251	1251	541	1731	2331	2331	585.05	490.22	1173.16	1173.16	559.37
	ULS Min	-1695	-2284	-2280	-1609	-524	-262	-824	-824	-360	-1626	-2198	-2194	-415.75	-244.15	-906.66	-906.66	-310.95
IZ Bending	ULS Max	1552	1971	3475	11303	2349	774	774	82	608	1540	2011	10652	2488.72	383.66	1109.85	1109.85	247.76
	ULS Min	-1587	-2018	-3348	-10295	-2424	-407	-1120	-1120	-259	-1365	-1788	-10681	-2197.94	-776.47	-776.58	-97.54	-558.18
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	54	73	73	56	20	14	44	44	19	51	69	69	18	15	41	41	20
	Stress Z	39	49	85	277	51	16	36	36	20	38	49	262	52	16	36	36	18
Force (kn) =		12357	16259	20992	44200	11276	4829	8512	8512	4104	11788	15667	43833	11172	5005	8188	8188	4004
Tension Combined Force (kN) =		5073	8998	13874	37219	2734	-4333	-1866	-1833	-6430	4544	8437	37046	2755	-3881	-1966	-1933	-6305
Compression Combined Force (kN) =		-31321	-35178	-38844	-61904	-25903	-18610	-20358	-20296	-15396	-30280	-34126	-61222	-25439	-18522	-19839	-19777	-15098
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	0.12	0.21	0.32	0.86	0.05	NA	NA	NA	NA	0.10	0.19	0.86	0.05	NA	NA	NA	NA
		0.78	0.87	0.97	1.54	0.64	0.46	0.62	0.62	0.472	0.75	0.85	1.52	0.63	0.46	0.61	0.61	0.46

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	2341	2352	2338	2509	1072	-50	-708	-830	-1261	2347.43	2367.58	2561.32	1189.94	149.3	-534.4	-677.51	-1093.18
	ULS Min	-9429	-9409	-7149	-7034	-4882	-3392	-2146	-1632	-1438	-8724.53	-8695.08	-6534.83	-4560.73	-3218.52	-2033.68	-1474.96	-1242.88
IY Bending	ULS Max	717	960	965	513	270	72	100	163	165	576.95	781.56	785.65	259.73	75.14	98.78	167.06	167.99
	ULS Min	-629	-851	-850	-467	-187	25	28	27	-143	-543.72	-740.54	-740.21	-176.05	29.71	24.36	24.37	-272.24
IZ Bending	ULS Max	641	715	981	5183	877	115	69	282	456	489.04	587.12	4851.76	910.08	133.77	44.38	186.7	186.74
	ULS Min	-679	-783	-1033	-4842	-925	-147	-55	-91	-93	-457.65	-536.37	-4771.36	-777.81	-124.33	-69.76	-188.21	-605.59
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	34	46	46	25	13	3	5	8	8	28	37	38	12	4	5	8	13
	Stress Z	21	25	33	164	29	5	2	9	14	15	19	153	29	4	2	6	19
Force (kn) =		4360	5525	6160	14703	3292	634	542	1304	1744	3366	4374	14908	3217	611	542	1090	2513
Tension Combined Force (kN) =		6701	7877	8498	17212	4364	585	-166	475	483	5714	6742	17469	4407	761	7	412	1420
Compression Combined Force (kN) =		-13789	-14934	-13309	-21737	-8174	-4027	-2689	-2936	-3182	-12091	-13069	-21443	-7778	-3830	-2576	-2565	-3756
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	0.31	0.36	0.39	0.79	0.20	0.03	NA	0.02	0.02	0.26	0.31	0.80	0.20	0.03	0.00	0.02	0.07
		0.88	0.96	0.85	1.39	0.52	0.26	0.17	0.19	0.20	0.78	0.84	1.37	0.49	0.24	0.16	0.16	0.23

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	779.65	779.65	397.79	411.45	605.14	146.99	1214.94	1127.8	749.02	794.6	772.53	839.91	458.98	410.2	-35.82	-29.53	126.6	-681.01
	ULS Min	-315.01	-315.01	176.28	196.52	162.79	-0.5	-2025.85	-1647.04	-1297.24	-1144.7	-1256.42	-1116.08	-1055.73	-848.18	-592.35	-547.42	-38.1	-836.67
IY Bending	ULS Max	0	0	56.3	55.39	49.52	44.03	14	0	17.48	28.11	18.33	39.99	10.91	36.52	6.84	28.99	0	28.16
	ULS Min	0	0	0	0	0	0	-40.94	0	-33.28	-4.7	-31.72	-0.89	-34.03	0	-26.41	0	0	0
IZ Bending	ULS Max	0	0	82.57	111.83	72.89	38.15	98.31	0	91.44	31.9	72.12	5.01	75.94	8.73	77.33	9.91	0	7.25
	ULS Min	0	0	-70.7	-101.88	-111.48	-80.32	-51.72	0	-45.38	-35.3	-21.69	-8.98	-26.79	-12.21	-27.69	-10.3	0	-8.2
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	20	19	17	15	17	0	14	12	13	17	14	15	11	12	0	10
	Stress Z	0	0	9	12	12	9	11	0	10	4	8	1	9	1	9	1	0	1
Force (kn) =		0	0	512	564	526	431	453	0	389	253	344	285	366	267	317	213	0	191
Tension Combined Force (kN) =		780	780	910	975	1131	578	1668	1128	1138	1047	1116	1125	825	678	282	184	127	-490
Compression Combined Force (kN) =		-315	-315	-336	-367	-363	-432	-2479	-1647	-1686	-1397	-1600	-1401	-1422	-1115	-910	-761	-38	-1027
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.15	0.20	0.21	0.25	0.13	0.40	0.27	0.27	0.25	0.27	0.27	0.20	0.16	0.07	0.04	0.03	NA
		0.01	0.09	0.10	0.11	0.10	0.12	0.77	0.51	0.52	0.43	0.49	0.43	0.44	0.34	0.28	0.23	0.01	0.29

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	739.42	498.24	378.4	394.09	590.03	81.64	1006.18	1143.82	680.88	678.97	746.05	742.52	375.53	454.03	-20.76	-48.09	-492.91	150.01
	ULS Min	-311.8	208.43	176.74	224.62	196.29	-24.53	-1509.62	-1776.04	-1050.46	-1170.92	-1054.75	-1155.2	-808.92	-1002.58	-528.83	-605.1	-606.19	-34.26
IY Bending	ULS Max	0	56.37	51.32	48.71	44.77	42.75	7.18	72.46	37.04	17.87	38.37	17.32	34.6	10.74	27.96	7.71	24.2	0
	ULS Min	0	-109.64	0	0	0	0	-16.24	-2.41	-7.63	-32.57	0	-31.44	0	-33.7	0	-26.04	0	0
IZ Bending	ULS Max	0	29.74	34.69	38.83	37.15	34.07	112.52	37.19	17.02	23.07	6.49	14.67	6.16	16.27	6.97	17.47	2.16	0
	ULS Min	0	-52.53	-12.74	-10.2	-10.38	-9.82	-65.45	-39.02	-12.99	-71.37	-1.61	-65.89	-1.98	-68.52	-1.61	-75.69	-9.95	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	32	18	17	16	15	7	30	15	14	16	13	14	14	12	11	9	0
	Stress Z	0	5	4	4	4	4	13	4	2	8	1	7	1	8	1	9	1	0
Force (kn) =		0	678	388	380	352	333	313	557	280	348	269	330	243	350	200	312	169	0
Tension Combined Force (kN) =		739	1176	766	774	942	415	1319	1701	960	1027	1015	1073	619	804	180	264	-324	150
Compression Combined Force (kN) =		-312	-469	-211	-155	-156	-358	-1823	-2333	-1330	-1519	-1324	-1486	-1052	-1353	-729	-917	-775	-34
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.23	0.17	0.17	0.21	0.09	0.32	0.41	0.23	0.25	0.24	0.26	0.15	0.19	0.04	0.06	NA	0.03
		0.01	0.13	0.06	0.04	0.04	0.10	0.56	0.72	0.41	0.47	0.41	0.46	0.32	0.42	0.22	0.28	0.22	0.01

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	430.22	417.23	893.76	179.36	1212.77	1125.45	622.02	677.99	245.44	182.77	-197.84	-157.35	-104.79	23.14
	ULS Min	272.62	-265.02	641.19	-466.89	-2352.85	-2430.86	-1949.78	-1890.98	-1765.5	-1823.62	-1275.79	-1239.77	-188.65	13.1
IY Bending	ULS Max	8165.5	0	28.98	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-8932.77	-58.51	0	-16.01	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	146.16	237.18	73.42	268.47	0	0	0	0	0	0	0	0	0	0
	ULS Min	-70.77	-113.88	-35.15	-99.38	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	90	19	11	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	7	17	6	22	0	0	0	0	0	0	0	0	0	0
Force (kn) =		7795	740	314	509	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		8225	1157	1208	689	1213	1125	622	678	245	183	-198	-157	-105	23
Compression Combined Force (kN) =		-7522	-1005	327	-976	-2353	-2431	-1950	-1891	-1766	-1824	-1276	-1240	-189	13
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.40	0.22	0.26	0.15	0.23	0.22	0.12	0.13	0.05	0.04	NA	NA	NA	0.02
		0.48	0.25	NA	0.27	0.62	0.64	0.51	0.50	0.53	0.55	0.38	0.37	0.61	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	242.07	208.04	300.8	111.52	140.22	647.23	608.84	403.03	423.18	299.37	279.14	320.07	283.62	46.09	32.19
	ULS Min	-15.2	-231.3	4.15	-70.5	80.86	-960.87	-966.36	-646.81	-651.48	-566.63	-552.09	-386.24	-447.12	-76.9	19.56
IY Bending	ULS Max	3982.61	15.79	20.35	16.2	114.79	0	0	0	0	0	0	0	0	0	0
	ULS Min	-4329.07	-22.67	-13.44	-18.58	89.29	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	168.88	240.11	97.88	267.68	121.14	0	0	0	0	0	0	0	0	0	0
	ULS Min	-100.83	-120.68	-56.13	-136.98	0	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	52	10	9	8	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	13	24	10	26	7	0	0	0	0	0	0	0	0	0	0
Force (kn) =		4362	545	301	559	626	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		4604	753	602	671	766	647	609	403	423	299	279	320	284	46	32
Compression Combined Force (kN) =		-4377	-776	-297	-630	-545	-961	-966	-647	-651	-567	-552	-386	-447	-77	20
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.28	0.18	0.14	0.16	0.06	0.14	0.13	0.09	0.09	0.07	0.06	0.07	0.06	0.04	0.03
		0.34	0.30	0.11	0.24	0.06	0.25	0.25	0.17	0.17	0.15	0.15	0.10	0.12	0.25	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder End	Front Transverse Sheave Girder Middle	Back Transverse Sheave Girder	G1	G2/3	G4	G6
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	26714.54	26714.54	2344.62	1913.45	1973.07	1882.2	495.89
	ULS Min	0	0	-1107	-10	-12	-17	-493
Shear	Fz Max	10539	10539	967	2570	2579	2484	1144
	Fz Min	-10591	-10591	-1020	-268	-2598	-268	-663
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.490	0.651	0.116	0.183	0.160	0.180	0.094
		0.292	0.554	0.189	0.615	0.622	0.594	0.498

5 - ULS V1		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-15085	-15063	-14241	-13968	-13167	-12967	-12600	-12567	-12375	-14743	-14729	-13818	-13073.1	-12904.87	-12575.7	-12542.29	-12374.06
	ULS Min	-15115	-15073	-14284	-14125	-13304	-13104	-12662	-12600	-12470	-14773	-14740	-14017	-13210.19	-13041.97	-12637.09	-12575.7	-12468.86
IY Bending	ULS Max	0	-60	-47	90	91	129	152	165	165	33	44	95	93.27	133.54	146.59	153.59	153.59
	ULS Min	-60	-86	-83	81	85	85	129	152	-19	0	33	45	83.4	83.17	133.53	146.59	19.77
IZ Bending	ULS Max	0	-48	120	460	-55	329	329	-54	275	94	126	162	189.13	189.15	53.77	262.88	262.87
	ULS Min	-48	-57	-11	268	-200	-200	-54	-262	-262	0	94	-28	169.21	-330.46	-330.43	53.77	-259.26
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	2	3	2	3	3	4	5	6	6	1	1	3	3	4	5	5	5
	Stress Z	1	1	3	11	4	7	11	8	9	2	3	4	4	7	11	8	8
Force (kn) =		393	524	716	1846	1115	1731	1697	1513	1558	436	579	899	1090	1759	1681	1476	1476
Tension Combined Force (kN) =		-14692	-14539	-13525	-12122	-12052	-11236	-10903	-11054	-10817	-14307	-14150	-12920	-11983	-11146	-10894	-11067	-10898
Compression Combined Force (kN) =		-15507	-15597	-15000	-15970	-14419	-14835	-14359	-14114	-14028	-15209	-15319	-14916	-14300	-14801	-14319	-14051	-13944
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		0.39	0.39	0.37	0.40	0.36	0.37	0.44	0.43	0.430	0.38	0.38	0.37	0.36	0.37	0.44	0.43	0.43

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	-4326	-4314	-3140	-2817	-2528	-2431	-2223	-2072	-2197	-4043.13	-4024.17	-2777.85	-2475.37	-2352.63	-2095.64	-1907.77	-1959.89
	ULS Min	-4339	-4319	-3159	-2886	-2607	-2509	-2301	-2150	-2228	-4056.37	-4028.82	-2865.2	-2553.49	-2430.75	-2173.76	-1985.89	-1990.61
IY Bending	ULS Max	3	8	11	59	56	55	56	177	172	13.55	16.58	39.26	40.67	52.93	58.26	180.36	181.37
	ULS Min	0	3	-40	-22	36	35	54	55	-175	0	7.47	8.43	40.51	40.48	52.85	58.24	-235.39
IZ Bending	ULS Max	0	-68	-38	280	-27	55	55	113	337	35.78	66.29	107.98	103.55	19.24	35.36	37.52	37.5
	ULS Min	-68	-84	-130	179	-41	-27	-46	-45	112	0	30.78	28.78	19.25	-55.89	-55.89	35.34	-550.19
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	0	0	2	3	3	3	3	8	8	1	1	2	2	3	3	9	11
	Stress Z	2	3	4	9	1	2	2	4	11	1	2	3	3	2	2	1	17
Force (kn) =		177	238	471	911	309	340	346	939	1488	139	226	413	408	336	356	768	2238
Tension Combined Force (kN) =		-4149	-4076	-2669	-1905	-2220	-2091	-1877	-1133	-710	-3904	-3799	-2365	-2068	-2017	-1740	-1140	278
Compression Combined Force (kN) =		-4515	-4557	-3630	-3797	-2915	-2849	-2647	-3089	-3715	-4195	-4254	-3279	-2961	-2767	-2530	-2754	-4229
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01
		0.29	0.29	0.23	0.24	0.19	0.18	0.17	0.20	0.23	0.27	0.27	0.21	0.19	0.18	0.16	0.17	0.26

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	227.18	227.18	351.89	386.72	489.04	231.98	-357.01	-379.29	-222.77	-241.87	-183.98	-207.1	-266.75	-281.46	-298.54	-306.9	-114.02	-886.74
	ULS Min	227.18	227.18	340.51	365.69	453.86	174.53	-398.32	-424.86	-266.89	-296.46	-229.12	-259.16	-311.71	-335.55	-344.14	-358.82	-127.18	-897.6
IY Bending	ULS Max	0	0	39.95	41.58	40.57	38.93	1.92	0	4.73	17.35	4.73	22.14	2.16	24.93	3.61	25.64	0	29.17
	ULS Min	0	0	0	0	0	0	-21.6	0	-22.55	0	-21.95	0	-28.69	0	-24.08	0	0	0
IZ Bending	ULS Max	0	0	0	0.31	0	0	0	0	0.57	1.12	0	0.27	0	0.94	0	2.81	0	0
	ULS Min	0	0	-6.36	-9.08	-40.32	-45.99	-1.21	0	-0.41	0	-0.65	0	-3.62	0	-6.22	0	0	-6.05
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	14	14	14	13	9	0	9	7	9	9	12	10	10	11	0	10
	Stress Z	0	0	1	1	4	5	0	0	0	0	0	0	0	0	1	0	0	1
	Force (kn) =	0	0	262	277	332	333	147	0	152	119	149	149	199	169	173	177	0	193
	Tension Combined Force (kN) =	227	227	614	664	821	565	-210	-379	-70	-123	-35	-58	-68	-112	-126	-130	-114	-694
	Compression Combined Force (kN) =	227	227	79	88	122	-158	-546	-425	-419	-415	-378	-408	-511	-505	-517	-536	-127	-1091
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.04	0.13	0.15	0.18	0.12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.05	0.17	0.13	0.13	0.13	0.12	0.13	0.16	0.16	0.16	0.17	0.04	0.31

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	270.79	435.53	348.77	381.28	482.27	165.18	-316.68	-302.71	-220.41	-245.13	-183.08	-200.77	-253.96	-284.31	-289.62	-331.37	-637.14	-107.93
	ULS Min	270.79	425.58	347.46	380.13	480.49	161.3	-364.99	-371.98	-275.51	-289.27	-235.22	-246.02	-308.54	-329.43	-342.14	-376.28	-649.52	-121.09
IY Bending	ULS Max	0	0	39.32	39.33	39.61	40.87	0	43.36	16.17	4.84	21.73	4.73	23.58	2.45	24.88	4.4	24.65	0
	ULS Min	0	-33.36	0	0	0	0	-4.94	0	0	-22.63	0	-21.96	0	-28.77	0	-24.2	0	0
IZ Bending	ULS Max	0	0	0	1.33	0	1.65	0	2.72	0.92	0	0.5	0	0	0.85	0.75	0.87	0.26	0
	ULS Min	0	-2.14	-1.58	0	-0.93	0	-3.72	0	0	-1.62	0	-0.26	-0.48	0	0	0	-0.54	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	10	14	14	14	14	2	18	7	9	9	9	10	12	10	10	9	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Force (kn) =	0	182	249	248	249	259	40	296	110	155	147	148	159	195	168	164	155	0
	Tension Combined Force (kN) =	271	617	597	630	732	424	-277	-7	-110	-90	-36	-53	-95	-90	-121	-167	-482	-108
	Compression Combined Force (kN) =	271	244	99	132	231	-97	-405	-668	-386	-444	-382	-394	-468	-524	-511	-540	-804	-121
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.12	0.13	0.14	0.16	0.09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.03	0.13	0.21	0.12	0.14	0.12	0.12	0.14	0.16	0.16	0.17	0.23	0.03

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	410.55	77.99	914.15	135.79	-631.32	-661.14	-680.46	-675.07	-846.35	-850.5	-773.19	-781.52	-165.62	20.94
	ULS Min	410.55	61.58	914.15	127.41	-656.82	-686.63	-705.95	-700.56	-868.7	-872.85	-795.55	-803.88	-173.29	12.1
IY Bending	ULS Max	609.65	0	32.94	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-515.82	-54.95	0	-14.5	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	3.73	0	0.05	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	0.54	-0.6	0	-1.26	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	6	18	13	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		507	366	235	105	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		917	444	1149	241	-631	-661	-680	-675	-846	-851	-773	-782	-166	21
Compression Combined Force (kN) =		-96	-304	680	22	-657	-687	-706	-701	-869	-873	-796	-804	-173	12
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.05	0.09	0.25	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.08	NA	NA	0.17	0.18	0.19	0.18	0.26	0.26	0.24	0.24	0.56	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	169.01	12.65	237.23	60.05	218.69	-210.49	-216.49	-164.93	-177.79	-193.63	-174.15	-60.33	-153.85	-23.69	29.14
	ULS Min	162.46	-0.87	221.87	10.32	218.69	-233.48	-239.48	-187.93	-200.78	-216.62	-197.15	-83.33	-176.84	-32.53	20.75
IY Bending	ULS Max	252.08	10.39	17.62	11.86	97.28	0	0	0	0	0	0	0	0	0	0
	ULS Min	-219.27	-19.92	-6.66	-15.7	97.28	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	6.46	4.35	3.75	6.26	18.48	0	0	0	0	0	0	0	0	0	0
	ULS Min	-8.2	0	0	0	18.48	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	3	9	8	7	5	0	0	0	0	0	0	0	0	0	0
	Stress Z	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Force (kn) =		246	149	132	122	303	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		415	162	369	182	522	-210	-216	-165	-178	-194	-174	-60	-154	-24	29
Compression Combined Force (kN) =		-83	-150	90	-112	-84	-233	-239	-188	-201	-217	-197	-83	-177	-33	21
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.02	0.04	0.09	0.04	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.06	NA	0.04	0.01	0.06	0.06	0.05	0.05	0.06	0.05	0.02	0.05	0.10	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder	Front Transverse Sheave Girder	Back Transverse Sheave Girder	G1	G2/3	G4	G6
		End	Middle					
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	30014.37	30014.37	3797.09	2077.39	2469.84	2076.42	815.06
	ULS Min	0	0	-1114	-10	-12	-10	-570
Shear	Fz Max	11898	11898	1510	2798	2955	2719	1323
	Fz Min	-11770	-11770	-1538	-376	-2862	-375	-418
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.551	0.732	0.188	0.199	0.200	0.199	0.155
		0.328	0.622	0.285	0.670	0.707	0.651	0.576

5 - ULS V2		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-10541	-10519	-10205	-9985	-11125	-11627	-12584	-12551	-12691	-10284	-10270	-9719	-10972.08	-11358.54	-12381.71	-12348.76	-12499.09
	ULS Min	-20558	-20514	-19412	-19198	-16360	-15605	-13852	-13790	-13353	-19930	-19896	-18836	-16005.05	-15347.21	-13673.09	-13611.24	-13186.56
IY Bending	ULS Max	1538	2068	2069	1677	569	418	1117	1117	518	1508	2032	2032	513.95	448.13	1047.67	1047.67	529.26
	ULS Min	-1490	-2011	-2007	-1338	-437	-197	-662	-662	-350	-1370	-1850	-1846	-343.88	-181.33	-735.03	-735.03	-292.56
IZ Bending	ULS Max	1318	1679	3086	9912	2029	759	760	-6	599	1369	1792	9259	2211.11	381.74	966.95	966.95	289.01
	ULS Min	-1373	-1740	-2762	-8601	-2062	-410	-975	-975	-298	-1122	-1464	-9026	-1806.02	-761.95	-762.05	-6.96	-552.24
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	45	61	61	50	18	13	39	39	18	45	60	60	16	14	37	37	19
	Stress Z	34	43	76	243	43	16	31	31	19	34	44	227	46	16	31	31	18
Force (kn) =		10486	13760	18134	38772	9673	4593	7515	7515	3989	10356	13786	38044	9897	4749	7230	7230	3871
Tension Combined Force (kN) =		-55	3240	7929	28787	-1452	-7035	-5069	-5036	-8701	72	3516	28325	-1075	-6610	-5152	-5119	-8628
Compression Combined Force (kN) =		-31044	-34273	-37546	-57970	-26033	-20198	-21367	-21305	-17342	-30286	-33682	-56880	-25902	-20096	-20903	-20841	-17058
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	NA	0.07	0.18	0.66	NA	NA	NA	NA	NA	0.00	0.08	0.65	NA	NA	NA	NA	NA
		0.77	0.85	0.93	1.44	0.65	0.50	0.65	0.65	0.531	0.75	0.84	1.41	0.64	0.50	0.64	0.64	0.52

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	411	422	680	1007	-151	-1106	-1646	-1739	-2102	611.37	630.07	1024.73	-77.13	-951.54	-1486.8	-1582.98	-1891.74
	ULS Min	-9679	-9659	-7454	-7182	-5265	-3982	-2890	-2438	-2259	-8880.77	-8852.88	-6784.46	-5017.43	-3849.41	-2783.06	-2277.67	-2024.44
IY Bending	ULS Max	613	829	833	424	247	77	93	195	196	508.44	680.55	683.24	229.19	78.14	92.73	199.3	199.73
	ULS Min	-541	-723	-722	-416	-144	28	32	31	-191	-452.13	-624.1	-624.64	-144.33	39.2	28.94	28.95	-314.02
IZ Bending	ULS Max	501	560	836	4542	750	85	84	280	565	441.26	546.43	4280.37	830.42	124.22	54.27	183.3	183.3
	ULS Min	-630	-723	-891	-4051	-794	-140	-66	-66	-41	-370.19	-416.56	-3968.03	-616.34	-97.02	-85.43	-138.05	-781.45
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	29	40	40	20	12	4	4	9	9	24	33	33	11	4	4	10	15
	Stress Z	20	23	28	143	25	4	3	9	18	14	17	135	26	4	3	6	25
Force (kn) =		3850	4887	5317	12792	2884	632	556	1421	2127	2992	3896	13115	2906	599	558	1198	3103
Tension Combined Force (kN) =		4262	5309	5997	13799	2734	-474	-1091	-318	25	3603	4526	14140	2829	-353	-929	-385	1211
Compression Combined Force (kN) =		-13530	-14546	-12772	-19973	-8149	-4614	-3446	-3858	-4386	-11873	-12749	-19900	-7924	-4448	-3341	-3476	-5128
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	0.20	0.24	0.28	0.63	0.13	NA	NA	NA	0.00	0.17	0.21	0.65	0.13	NA	NA	NA	0.06
		0.87	0.93	0.82	1.28	0.52	0.29	0.22	0.25	0.27	0.76	0.82	1.28	0.50	0.28	0.21	0.22	0.32

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	725.59	725.59	456	475.92	664.89	279.25	920.54	838.17	568.35	597.4	598.95	646.5	303.83	252.49	-115.54	-113.67	-57.93	-832.94
	ULS Min	-212.69	-212.69	266.13	291.69	285.73	134.63	-1863.32	-1546.97	-1192	-1072.84	-1146.74	-1037.47	-1001.07	-834.06	-599.43	-565.23	-200.98	-967.31
IY Bending	ULS Max	0	0	54.09	53.99	48.5	42.69	11.88	0	15.55	25.38	16.33	38.96	9.25	36.89	5.81	30.42	0	30.55
	ULS Min	0	0	0	0	0	0	-38.82	0	-32.49	-2.74	-30.89	0	-34.78	0	-27.72	0	0	0
IZ Bending	ULS Max	0	0	68.28	92.01	47.24	27.15	83.36	0	77.51	28.35	61.69	4.35	64.23	7.86	63.79	9.39	0	4.51
	ULS Min	0	0	-63.1	-91.17	-110.8	-85.65	-45.65	0	-39.76	-29.24	-18.73	-7.74	-23.85	-10.28	-26.26	-8.13	0	-9.38
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	19	19	17	15	16	0	14	11	13	16	14	15	12	13	0	11
	Stress Z	0	0	7	10	12	9	9	0	9	3	7	1	7	1	7	1	0	1
	Force (kn) =	0	0	471	516	518	433	412	0	359	223	319	276	350	266	302	221	0	208
	Tension Combined Force (kN) =	726	726	927	992	1183	713	1332	838	927	821	918	922	654	519	186	108	-58	-625
	Compression Combined Force (kN) =	-213	-213	-205	-225	-233	-299	-2275	-1547	-1551	-1296	-1466	-1313	-1351	-1100	-901	-786	-201	-1175
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.14	0.20	0.22	0.26	0.16	0.32	0.20	0.22	0.20	0.22	0.22	0.16	0.12	0.04	0.03	NA	NA
		0.01	0.06	0.06	0.06	0.07	0.09	0.70	0.48	0.48	0.40	0.45	0.40	0.42	0.34	0.28	0.24	0.06	0.33

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	731.77	566.05	439.44	461.35	654.29	209.71	762.3	870.88	508.24	497.52	576.08	563.87	233.86	289.9	-96.3	-139.75	-599	-47.31
	ULS Min	-169.27	314.78	266.59	316.09	316.79	117.26	-1402.14	-1645	-983.82	-1094.56	-974.87	-1069.44	-789.47	-965.24	-539.72	-623.81	-697.53	-207.13
IY Bending	ULS Max	0	36.2	48.59	47.35	44.03	42.4	5.28	71.18	35.01	15.96	37.35	15.55	34.73	9.25	29.16	6.89	25.75	0
	ULS Min	0	-106.09	0	0	0	0	-14.8	0	-3.28	-31.78	0	-30.54	0	-34.43	0	-27.5	0	0
IZ Bending	ULS Max	0	26.23	29.25	33.75	31.5	30.95	96.17	32.09	15.01	19.11	5.81	12.61	5.2	14.21	6.37	15.61	2.41	0
	ULS Min	0	-44.72	-11.45	-8.28	-9.38	-6.85	-56.38	-33.92	-10.71	-61.84	-1.24	-56.44	-1.92	-58.49	-1.15	-64.27	-8	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	31	17	16	15	15	6	30	15	13	16	13	14	14	12	11	9	0
	Stress Z	0	4	3	4	3	3	11	4	2	7	1	6	1	7	1	7	1	0
	Force (kn) =	0	645	360	361	336	325	274	539	262	325	261	307	243	337	207	301	175	0
	Tension Combined Force (kN) =	732	1211	800	823	991	535	1036	1410	770	823	837	871	476	627	111	161	-424	-47
	Compression Combined Force (kN) =	-169	-330	-94	-45	-20	-208	-1676	-2184	-1246	-1420	-1236	-1377	-1032	-1302	-747	-925	-873	-207
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.24	0.17	0.18	0.22	0.12	0.25	0.34	0.19	0.20	0.20	0.21	0.11	0.15	0.03	0.04	NA	NA
		0.01	0.09	0.03	0.01	0.01	0.06	0.52	0.68	0.38	0.44	0.38	0.42	0.32	0.40	0.23	0.28	0.24	0.06

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	490.2	384.81	1032.38	193.61	870.19	771.29	328.08	380.69	-32.54	-90.9	-406.16	-371.18	-139.37	20.96
	ULS Min	355.12	-213.01	815.89	-363.24	-2189.7	-2280.62	-1879.96	-1824.93	-1759.4	-1813.85	-1333.32	-1302.16	-212.35	11.09
IY Bending	ULS Max	7049.43	0	36.95	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-7864.34	-61.39	0	-15.17	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	129.57	203.11	62.93	229.72	0	0	0	0	0	0	0	0	0	0
	ULS Min	-56.37	-97.8	-30.13	-85.58	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	80	20	15	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	7	15	5	19	0	0	0	0	0	0	0	0	0	0
Force (kn) =		6866	709	356	446	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		7356	1094	1388	640	870	771	328	381	-33	-91	-406	-371	-139	21
Compression Combined Force (kN) =		-6511	-922	460	-810	-2190	-2281	-1880	-1825	-1759	-1814	-1333	-1302	-212	11
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.36	0.21	0.30	0.14	0.17	0.15	0.06	0.07	NA	NA	NA	NA	NA	0.02
		0.41	0.23	NA	0.23	0.58	0.60	0.50	0.48	0.53	0.54	0.40	0.39	0.68	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	280.94	185.47	365.15	119.09	238.46	471.39	435.31	262.23	271.18	170.17	163.47	223.29	152.55	23.43	31.01
	ULS Min	62.19	-191.11	105.74	-36.92	184.36	-910.26	-918.15	-640.93	-653.25	-575.4	-552.31	-385.4	-477.07	-83.25	18.99
IY Bending	ULS Max	3484.73	14.8	20.87	15.04	109.9	0	0	0	0	0	0	0	0	0	0
	ULS Min	-3812.82	-22.96	-9.45	-17.63	89.26	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	141.22	206.37	84.42	229.9	101	0	0	0	0	0	0	0	0	0	0
	ULS Min	-89.95	-102.87	-47.59	-116.95	0	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	46	10	9	8	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	11	20	8	23	6	0	0	0	0	0	0	0	0	0	0
Force (kn) =		3803	493	284	492	559	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		4084	678	649	611	797	471	435	262	271	170	163	223	153	23	31
Compression Combined Force (kN) =		-3741	-684	-178	-529	-374	-910	-918	-641	-653	-575	-552	-385	-477	-83	19
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.24	0.16	0.16	0.15	0.07	0.10	0.10	0.06	0.06	0.04	0.04	0.05	0.03	0.02	0.02
		0.29	0.26	0.07	0.20	0.04	0.24	0.24	0.17	0.17	0.15	0.15	0.10	0.13	0.27	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder End	Front Transverse Sheave Girder Middle	Back Transverse Sheave Girder	G1	G2/3	G4	G6
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	31763.88	31763.88	3863.09	2233.49	2337.25	2228.55	964.4
	ULS Min	0	0	-1453	-10	-12	-16	-670
Shear	Fz Max	12462	12462	1492	3002	3075	2939	1553
	Fz Min	-12501	-12501	-1523	-388	-3055	-366	-671
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.583	0.775	0.192	0.214	0.190	0.213	0.184
		0.344	0.654	0.283	0.718	0.736	0.703	0.676

5 - ULS V3		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-9312	-9291	-9105	-8898	-10526	-11204	-12493	-12460	-12682	-9077	-9063	-8603	-10359.32	-10884.3	-12246.81	-12213.97	-12443.51
	ULS Min	-21826	-21781	-20603	-20376	-17036	-16142	-14062	-14000	-13486	-21126	-21093	-19949	-16616.25	-15835.86	-13845.69	-13783.73	-13279.16
IY Bending	ULS Max	1937	2607	2607	2075	688	490	1356	1356	604	1876	2529	2529	618.2	525.91	1271.35	1271.35	621.2
	ULS Min	-1847	-2493	-2488	-1693	-569	-280	-867	-867	-429	-1720	-2323	-2319	-454.09	-260.91	-957.02	-957.02	-368.09
IZ Bending	ULS Max	1660	2113	3828	12273	2551	865	865	60	679	1687	2208	11582	2721.26	428.51	1194.96	1194.96	293.87
	ULS Min	-1703	-2161	-3483	-10867	-2563	-461	-1205	-1205	-305	-1426	-1861	-11274	-2300.16	-867.56	-867.69	-76.09	-624.08
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	57	77	77	61	21	15	48	48	21	55	75	75	19	16	45	45	22
	Stress Z	42	53	94	301	54	18	39	39	22	41	54	284	57	18	39	39	20
	Force (kn) =	13127	17236	22652	48006	11927	5296	9199	9199	4584	12836	17087	47538	12110	5484	8847	8847	4461
	Tension Combined Force (kN) =	3815	7945	13547	39108	1401	-5908	-3294	-3261	-8098	3759	8024	38935	1751	-5400	-3400	-3367	-7983
	Compression Combined Force (kN) =	-34953	-39017	-43255	-68382	-28963	-21438	-23261	-23199	-18070	-33962	-38180	-67488	-28726	-21320	-22693	-22631	-17740
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	0.09	0.18	0.31	0.90	0.03	NA	NA	NA	NA	0.09	0.19	0.90	0.03	NA	NA	NA	NA
		0.87	0.97	1.07	1.70	0.72	0.53	0.71	0.71	0.553	0.84	0.95	1.68	0.71	0.53	0.70	0.69	0.54

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	1606	1617	1644	1972	453	-766	-1493	-1647	-2071	1784.98	1803.62	1984.12	531.05	-592.5	-1326.09	-1493.23	-1868.24
	ULS Min	-11004	-10983	-8519	-8247	-5920	-4341	-3029	-2501	-2259	-10076.88	-10048.9	-7755.52	-5624.8	-4195.3	-2926.89	-2342.07	-2026.43
IY Bending	ULS Max	766	1034	1039	536	295	82	102	199	201	632.21	848.88	851.99	275.94	83.99	100.97	203.23	203.5
	ULS Min	-676	-906	-905	-514	-195	26	26	25	-194	-568.51	-781.94	-782.86	-190.96	35.31	21.23	21.24	-333.05
IZ Bending	ULS Max	644	721	1054	5633	948	114	91	321	622	542.59	666.42	5323.48	1012.04	150.35	58.81	219.95	219.95
	ULS Min	-771	-883	-1104	-5108	-983	-168	-71	-79	-80	-471.72	-537.32	-4987.01	-796.41	-126.19	-92.6	-181.74	-838.28
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	37	50	50	26	14	4	5	10	10	30	41	41	13	4	5	10	16
	Stress Z	24	28	35	178	31	5	3	10	20	17	21	168	32	5	3	7	26
	Force (kn) =	4768	6049	6612	15899	3527	720	606	1537	2286	3705	4822	16320	3529	685	606	1303	3314
	Tension Combined Force (kN) =	6375	7666	8256	17872	3979	-46	-887	-110	215	5490	6625	18304	4060	93	-720	-190	1446
	Compression Combined Force (kN) =	-15772	-17032	-15131	-24146	-9447	-5062	-3635	-4038	-4545	-13782	-14871	-24075	-9154	-4881	-3533	-3645	-5341
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	0.29	0.35	0.38	0.82	0.18	NA	NA	NA	0.01	0.25	0.30	0.84	0.19	0.00	NA	NA	0.07
		1.01	1.09	0.97	1.55	0.60	0.32	0.23	0.26	0.28	0.88	0.95	1.54	0.58	0.31	0.22	0.23	0.33

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
Top Down Defined		Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
Element #		1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	848.86	848.86	480.15	497.29	709.85	287.08	1241.98	1144.64	767.63	808.73	795.99	861.21	448.36	387.96	-67.91	-64.14	-39.47	-817.81
	ULS Min	-323.99	-323.99	242.81	267.01	235.9	119.3	-2227.52	-1825.36	-1421.79	-1265.4	-1374.85	-1230.71	-1171.52	-956.66	-661.37	-615.57	-215	-983.06
IY Bending	ULS Max	0	0	57.62	57.08	50.48	43.65	14.42	0	18.27	29.1	19.25	43.11	11.06	39.81	6.39	31.55	0	30.86
	ULS Min	0	0	0	0	0	0	-43.04	0	-34.89	-6.05	-33.05	-0.68	-36.17	0	-28.51	0	0	0
IZ Bending	ULS Max	0	0	86.84	117.16	69.24	38.16	104.37	0	96.99	35.27	77.18	5.37	80.99	9.58	81.18	11.02	0	6.63
	ULS Min	0	0	-77.38	-111.82	-128.31	-95.52	-56.76	0	-49.61	-36.72	-23.35	-9.68	-29.09	-12.93	-31.37	-10.71	0	-10.23
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	20	20	17	15	18	0	15	12	14	18	15	17	12	13	0	11
	Stress Z	0	0	9	13	14	10	12	0	11	4	9	1	9	1	9	1	0	1
Force (kn) =		0	0	529	584	565	458	478	0	410	262	362	307	390	291	339	232	0	211
Tension Combined Force (kN) =		849	849	1009	1082	1275	746	1720	1145	1178	1071	1158	1168	838	679	271	168	-39	-607
Compression Combined Force (kN) =		-324	-324	-286	-317	-329	-339	-2706	-1825	-1832	-1527	-1737	-1538	-1561	-1247	-1000	-847	-215	-1194
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.17	0.22	0.24	0.28	0.16	0.41	0.28	0.28	0.26	0.28	0.28	0.20	0.16	0.07	0.04	NA	NA
		0.01	0.09	0.08	0.09	0.09	0.10	0.84	0.56	0.56	0.47	0.53	0.47	0.48	0.38	0.31	0.26	0.06	0.33

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
Element #		2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	845.71	596.21	460.03	479.33	694.79	216.99	1034	1165.95	691.89	684.7	767.17	756.3	357.79	435.32	-46.78	-89.93	-589.32	-27.38
	ULS Min	-280.6	284.65	243.97	297.75	272.92	102.39	-1659.42	-1961.5	-1159.38	-1294.37	-1158.45	-1274.02	-907.7	-1122.33	-587.89	-683.77	-709.38	-223.87
IY Bending	ULS Max	0	53.83	53.14	49.59	45.13	42.79	7.78	78.04	39.68	18.77	41.21	18.28	37.45	10.99	30.16	7.55	26.01	0
	ULS Min	0	-124.03	0	0	0	0	-17.31	-3.43	-8.18	-33.99	0	-32.61	0	-35.72	0	-28.2	0	0
IZ Bending	ULS Max	0	32.96	36.92	41.88	39.54	38.31	121.13	39.43	18.64	24.3	7.14	15.83	6.55	17.54	7.77	19.41	2.96	0
	ULS Min	0	-55.35	-13.91	-10.65	-11.48	-8.83	-69.55	-42.44	-13.5	-76.89	-1.63	-70.48	-2.27	-73.31	-1.52	-80.41	-9.85	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	36	18	17	16	15	7	33	17	14	17	14	16	15	13	12	9	0
	Stress Z	0	5	4	5	4	4	14	5	2	9	1	8	1	8	1	9	1	0
Force (kn) =		0	760	404	391	359	342	336	601	300	368	290	347	263	373	217	335	180	0
Tension Combined Force (kN) =		846	1356	864	871	1054	559	1370	1767	992	1052	1057	1103	621	808	170	245	-409	-27
Compression Combined Force (kN) =		-281	-475	-160	-93	-86	-239	-1995	-2562	-1460	-1662	-1448	-1621	-1171	-1495	-804	-1019	-889	-224
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.26	0.19	0.19	0.23	0.12	0.33	0.43	0.24	0.25	0.25	0.27	0.15	0.19	0.04	0.06	NA	NA
		0.01	0.13	0.05	0.03	0.02	0.07	0.62	0.79	0.45	0.51	0.45	0.50	0.36	0.46	0.25	0.31	0.25	0.06

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	507.67	460.98	1055.6	207.21	1249.68	1133.44	585.08	649.57	176.76	104.8	-308.58	-262.64	-131.55	21.05
	ULS Min	338.82	-282.19	784.99	-486.71	-2568.81	-2675.07	-2168.59	-2101.08	-1976.22	-2043.3	-1461.93	-1420.78	-220.86	10.93
IY Bending	ULS Max	8864.15	0	37.6	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-9699.85	-62.84	0	-15.38	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	161.5	254.02	78.65	287.43	0	0	0	0	0	0	0	0	0	0
	ULS Min	-70.92	-122.09	-37.67	-106.65	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	98	21	15	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	8	19	6	23	0	0	0	0	0	0	0	0	0	0
Force (kn) =		8476	794	383	533	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		8983	1255	1439	740	1250	1133	585	650	177	105	-309	-263	-132	21
Compression Combined Force (kN) =		-8137	-1076	402	-1019	-2569	-2675	-2169	-2101	-1976	-2043	-1462	-1421	-221	11
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.44	0.24	0.31	0.16	0.24	0.22	0.11	0.12	0.04	0.02	NA	NA	NA	0.02
		0.52	0.27	NA	0.28	0.68	0.70	0.57	0.55	0.59	0.61	0.44	0.43	0.71	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	308.48	228.83	396.22	133.62	242.82	642.48	598.94	369.82	384.19	261.79	248.56	294.79	229.93	35.41	31.49
	ULS Min	35.04	-241.89	74.64	-61.39	176.57	-1078.84	-1087.13	-753.37	-765.6	-664.42	-640.41	-460.33	-551.35	-95.73	18.56
IY Bending	ULS Max	4355.24	15.93	22.21	16.32	113.37	0	0	0	0	0	0	0	0	0	0
	ULS Min	-4710.88	-23.71	-10.18	-18.12	87.75	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	177.84	257.27	104.96	287	130.39	0	0	0	0	0	0	0	0	0	0
	ULS Min	-111.13	-129.29	-60.05	-146.56	0	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	57	11	10	8	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	14	25	10	28	8	0	0	0	0	0	0	0	0	0	0
Force (kn) =		4716	579	326	587	647	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		5025	808	722	720	890	642	599	370	384	262	249	295	230	35	31
Compression Combined Force (kN) =		-4681	-821	-251	-648	-471	-1079	-1087	-753	-766	-664	-640	-460	-551	-96	19
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.30	0.19	0.17	0.17	0.07	0.14	0.13	0.08	0.08	0.06	0.05	0.06	0.05	0.03	0.03
		0.36	0.32	0.10	0.25	0.05	0.28	0.29	0.20	0.20	0.18	0.17	0.12	0.15	0.31	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder	Front Transverse Sheave Girder	Back Transverse Sheave Girder	G1	G2/3	G4	G6
		End	Middle					
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	32129.58	32129.58	3871.77	2254.64	2341.66	2271.35	1001.85
	ULS Min	0	0	-1535	-10	-12	-18	-691
Shear	Fz Max	12532	12532	1482	3029	3080	2995	1604
	Fz Min	-12613	-12613	-1513	-389	-3079	-363	-732
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.590	0.783	0.192	0.216	0.190	0.218	0.191
		0.347	0.660	0.281	0.725	0.737	0.717	0.698

5 - ULS V4		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-7901	-7879	-7144	-6871	-6346	-6141	-5860	-5827	-5603	-7505	-7491	-6664	-6198.13	-6017.22	-5765.48	-5732.07	-5532.31
	ULS Min	-7931	-7890	-7187	-7027	-6483	-6278	-5921	-5860	-5698	-7535	-7502	-6863	-6335.23	-6154.32	-5826.87	-5765.48	-5627.11
IY Bending	ULS Max	0	-66	-85	43	11	42	42	5	243	33	43	45	7.9	45.4	45.4	-2.22	279.09
	ULS Min	-66	-94	-91	-12	-11	11	5	-16	-16	0	33	-8	-9.23	7.75	-2.22	-28.25	-28.25
IZ Bending	ULS Max	0	-30	120	348	-28	153	153	-21	117	76	101	137	140.59	81.14	20.61	115.22	115.22
	ULS Min	-30	-34	20	268	-94	-94	-21	-115	-115	0	76	71	81.13	-153.23	-153.22	20.61	-105.79
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	2	3	3	1	0	1	1	1	9	1	1	1	0	1	2	1	10
	Stress Z	1	1	3	9	2	3	5	4	4	2	2	3	3	3	5	4	4
Force (kn) =		358	478	747	1296	370	718	683	456	1308	373	496	621	514	734	695	501	1437
Tension Combined Force (kN) =		-7543	-7401	-6397	-5574	-5977	-5423	-5177	-5371	-4295	-7132	-6995	-6043	-5685	-5283	-5070	-5231	-4095
Compression Combined Force (kN) =		-8289	-8368	-7934	-8324	-6853	-6996	-6604	-6316	-7006	-7908	-7998	-7484	-6849	-6889	-6522	-6266	-7064
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		0.21	0.21	0.20	0.21	0.17	0.17	0.20	0.19	0.215	0.20	0.20	0.19	0.17	0.17	0.20	0.19	0.22

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	-4663	-4651	-3552	-3229	-2889	-2778	-2598	-2461	-2685	-4362.58	-4343.63	-3163.91	-2821.7	-2690.45	-2465.23	-2290.27	-2457.96
	ULS Min	-4676	-4656	-3571	-3298	-2967	-2856	-2676	-2539	-2716	-4375.82	-4348.28	-3251.26	-2899.82	-2768.57	-2543.35	-2368.39	-2488.67
IY Bending	ULS Max	1	5	8	17	14	14	14	159	156	17.72	20.86	13.69	7.36	11.62	11.58	146.64	145.7
	ULS Min	0	1	-43	-27	4	3	3	2	-244	0	12.7	-0.45	0.98	7.35	8.17	8.15	-252.64
IZ Bending	ULS Max	0	-66	-41	278	-32	63	63	85	482	35.41	66.45	108.05	106.72	23.77	35.65	91.64	91.6
	ULS Min	-66	-82	-135	191	-43	-32	-47	-45	85	0	30.22	29.34	23.76	-64.04	-64.04	35.64	-743.16
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	0	0	2	1	1	1	1	8	12	1	1	1	0	1	1	7	12
	Stress Z	2	3	4	9	1	2	2	3	15	1	2	3	3	2	2	3	23
Force (kn) =		164	222	494	787	157	208	206	805	2101	154	242	318	291	201	201	775	2779
Tension Combined Force (kN) =		-4498	-4430	-3058	-2442	-2732	-2570	-2392	-1656	-584	-4209	-4102	-2846	-2531	-2489	-2264	-1515	321
Compression Combined Force (kN) =		-4840	-4878	-4065	-4085	-3124	-3065	-2882	-3343	-4817	-4529	-4590	-3569	-3191	-2970	-2745	-3143	-5267
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01
		0.31	0.31	0.26	0.26	0.20	0.19	0.18	0.21	0.30	0.29	0.29	0.23	0.20	0.19	0.17	0.20	0.33

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	153.55	153.55	229.9	241.6	287.89	34.93	-250.18	-260.59	-134.88	-148.87	-108.77	-127.67	-147.64	-152.71	-147.28	-238.5	58.77	-981.52
	ULS Min	153.55	153.55	221.3	228.69	264.75	-13.77	-291.61	-303.43	-179.67	-200.36	-154.39	-176.93	-193.4	-202.78	-193.36	-286.39	45.6	-991.9
IY Bending	ULS Max	0	0	39.18	40.73	40.1	39.86	7.52	0	7.47	14.44	7.35	18.74	6.09	19.99	6.68	21.54	0	29.77
	ULS Min	0	0	0	0	0	0	-12.42	0	-14.06	0	-13.65	0	-16.73	0	-12.88	0	0	0
IZ Bending	ULS Max	0	0	0	0	0	0	0	0	0.08	1.32	0	0	0	1.03	0	2.98	0	0
	ULS Min	0	0	-6.73	-14.96	-49.69	-56.97	-1.4	0	-0.91	0	-1.48	-0.06	-3.36	0	-7.35	0	0	-6.53
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	14	14	14	14	5	0	6	6	6	8	7	8	5	9	0	10
	Stress Z	0	0	1	2	5	6	0	0	0	0	0	0	0	0	1	0	0	1
	Force (kn) =	0	0	258	284	347	360	86	0	96	99	94	126	118	136	100	150	0	198
	Tension Combined Force (kN) =	154	154	488	525	635	395	-164	-261	-39	-50	-14	-2	-29	-17	-47	-88	59	-784
	Compression Combined Force (kN) =	154	154	-37	-55	-82	-374	-378	-303	-276	-300	-249	-303	-312	-339	-293	-436	46	-1189
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.00	0.03	0.11	0.11	0.14	0.09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01	NA
		NA	NA	0.01	0.02	0.02	0.11	0.12	0.09	0.08	0.09	0.08	0.09	0.10	0.10	0.09	0.13	NA	0.33

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	198.5	287.76	223.41	234.03	277.02	-40.07	-202.29	-213.15	-131.87	-149.45	-105.99	-122.9	-125.11	-163.8	-219.14	-180.61	-769.21	106.44
	ULS Min	198.5	280.01	222.26	233.1	274.94	-45.19	-248.33	-278.4	-183.77	-194.16	-155.32	-168.68	-175.6	-209.58	-267.55	-226.11	-780.85	93.28
IY Bending	ULS Max	0	0	39	38.94	39.33	41.43	0	37.6	13.53	7.6	18.23	7.47	18.8	6.35	20.62	7.51	25.88	0
	ULS Min	0	-19.46	0	0	0	0	-11.2	0	0	-14.11	0	-13.62	0	-16.79	0	-12.87	0	0
IZ Bending	ULS Max	0	0	0	1.24	0	2.31	0	2.09	0.88	0	0.43	0.68	0	0.34	0.72	1.71	0.43	0
	ULS Min	0	-1.49	-0.86	0	-1.09	0	-2.86	-0.01	0	-1.09	0	0	-0.42	-0.23	0	0	-0.4	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	6	14	13	14	14	5	16	6	6	8	6	8	7	9	5	9	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Force (kn) =	0	106	245	246	248	263	80	256	92	97	123	93	127	113	140	90	162	0
	Tension Combined Force (kN) =	199	394	469	480	525	223	-122	43	-39	-53	17	-30	2	-50	-79	-91	-607	106
	Compression Combined Force (kN) =	199	174	-23	-13	27	-309	-329	-535	-276	-291	-278	-261	-303	-323	-407	-316	-943	93
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.08	0.10	0.10	0.11	0.05	NA	0.01	NA	NA	0.00	NA	0.00	NA	NA	NA	NA	0.02
		NA	NA	0.01	0.00	NA	0.09	0.10	0.17	0.09	0.09	0.09	0.08	0.09	0.10	0.13	0.10	0.26	NA

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	218.45	36.85	429.95	65.76	-312.75	-339.12	-293.24	-292.09	-408.66	-407.99	-324.8	-340.13	-66.45	27.56
	ULS Min	218.45	19.92	429.95	55.92	-338.25	-364.62	-318.74	-317.58	-431.02	-430.34	-347.15	-362.48	-74.12	18.72
IY Bending	ULS Max	351.08	0	6.63	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-374.98	-42.51	0	-16.44	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	6.89	0	0.07	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	0.16	-0.16	0	-0.37	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	4	14	3	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		330	282	47	118	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		549	319	477	183	-313	-339	-293	-292	-409	-408	-325	-340	-66	28
Compression Combined Force (kN) =		-112	-262	383	-62	-338	-365	-319	-318	-431	-430	-347	-362	-74	19
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.03	0.06	0.10	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.06	NA	0.02	0.09	0.10	0.08	0.08	0.13	0.13	0.10	0.11	0.24	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	188.83	15.35	273.97	64.99	308.69	-233.56	-244.34	-197.32	-206.88	-219.61	-199.5	-78.66	-187.75	-31.57	28.68
	ULS Min	182.09	0.69	253.26	5.23	308.69	-256.55	-267.34	-220.31	-229.87	-242.6	-222.49	-101.65	-210.74	-40.41	20.3
IY Bending	ULS Max	273.59	10.11	18.26	11.6	96.98	0	0	0	0	0	0	0	0	0	0
	ULS Min	-235.44	-20.27	-5.09	-15.38	96.98	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	5.48	1.75	2.44	6.34	24.05	0	0	0	0	0	0	0	0	0	0
	ULS Min	-0.1	0	0	-0.29	24.05	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	3	9	8	7	5	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Force (kn) =		249	148	134	120	317	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		438	163	408	185	626	-234	-244	-197	-207	-220	-200	-79	-188	-32	29
Compression Combined Force (kN) =		-67	-147	119	-115	-8	-257	-267	-220	-230	-243	-222	-102	-211	-40	20
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.03	0.04	0.10	0.04	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.06	NA	0.04	0.00	0.07	0.07	0.06	0.06	0.06	0.06	0.03	0.06	0.13	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder	Front Transverse Sheave Girder	Back Transverse Sheave Girder	G1	G2/3	G4	G6
		End	Middle					
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	11223.95	11223.95	4545.87	1291.92	4508.98	1197.71	851.46
	ULS Min	0	0	-1472	-26	-12	-24	-673
Shear	Fz Max	4494	4494	1991	184	2054	35	1561
	Fz Min	-4462	-4462	-2020	-459	-1964	-264	-519
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.206	0.274	0.226	0.124	0.366	0.115	0.162
		0.124	0.235	0.375	0.110	0.491	0.063	0.680

7 - ULS 1		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-13716	-13694	-12895	-12622	-11869	-11668	-11316	-11283	-11087	-13369	-13356	-12466	-11771.74	-11600.76	-11287.52	-11254.11	-11081.47
	ULS Min	-13746	-13705	-12938	-12778	-12006	-11805	-11378	-11316	-11182	-13400	-13366	-12665	-11908.83	-11737.85	-11348.91	-11287.52	-11176.28
IY Bending	ULS Max	0	-60	-52	76	77	116	129	136	136	32	43	81	79.67	120.02	124	126.06	126.06
	ULS Min	-60	-86	-83	76	75	75	116	129	21	0	32	44	72.76	72.54	120.02	124	57.45
IZ Bending	ULS Max	0	-45	119	442	-50	295	295	-48	246	90	121	156	168.67	168.69	47.67	235.21	235.2
	ULS Min	-45	-53	-6	267	-180	-180	-48	-235	-234	0	90	-6	164.33	-296.91	-296.88	47.67	-230.76
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	2	3	2	2	2	4	5	5	5	1	1	2	2	4	4	4	4
	Stress Z	1	1	3	11	4	6	10	8	8	2	3	4	4	6	10	8	8
Force (kn) =		380	506	712	1734	981	1555	1496	1313	1353	420	560	825	955	1581	1482	1278	1278
Tension Combined Force (kN) =		-13336	-13188	-12183	-10887	-10888	-10112	-9821	-9970	-9735	-12949	-12796	-11641	-10817	-10020	-9806	-9976	-9804
Compression Combined Force (kN) =		-14126	-14211	-13650	-14513	-12987	-13360	-12873	-12629	-12535	-13820	-13927	-13490	-12864	-13319	-12831	-12565	-12454
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		0.35	0.35	0.34	0.36	0.32	0.33	0.39	0.39	0.384	0.34	0.35	0.34	0.32	0.33	0.39	0.38	0.38

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	-4174	-4163	-3010	-2686	-2399	-2299	-2095	-1944	-2077	-3892.72	-3873.75	-2646.39	-2346.32	-2221.72	-1968.92	-1783.59	-1847.77
	ULS Min	-4187	-4167	-3028	-2755	-2477	-2377	-2173	-2023	-2108	-3905.95	-3878.4	-2733.75	-2424.44	-2299.84	-2047.04	-1861.71	-1878.49
IY Bending	ULS Max	2	7	10	53	49	48	49	167	163	13.94	16.97	33.79	35.71	46.57	51.34	169.66	170.44
	ULS Min	0	2	-39	-22	31	31	47	48	-170	0	8.02	8.99	35.14	35.68	46.5	51.32	-222.04
IZ Bending	ULS Max	0	-67	-38	281	-26	52	52	102	325	35.14	65.41	107.99	102.05	17.55	32.75	37.96	37.94
	ULS Min	-67	-83	-129	175	-40	-25	-43	-42	102	0	30.15	29.49	17.56	-52.68	-52.68	32.74	-523.88
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	0	0	2	3	2	2	2	8	8	1	1	2	2	2	2	8	11
	Stress Z	2	3	4	9	1	2	2	3	10	1	2	3	3	2	2	1	17
Force (kn) =		172	232	465	889	283	308	312	879	1439	139	225	393	385	304	322	729	2123
Tension Combined Force (kN) =		-4002	-3930	-2545	-1798	-2116	-1991	-1783	-1066	-638	-3754	-3649	-2254	-1961	-1917	-1647	-1055	276
Compression Combined Force (kN) =		-4359	-4400	-3493	-3644	-2760	-2685	-2485	-2901	-3547	-4045	-4103	-3127	-2810	-2604	-2369	-2591	-4002
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01
		0.28	0.28	0.22	0.23	0.18	0.17	0.16	0.18	0.22	0.26	0.26	0.20	0.18	0.17	0.15	0.16	0.25

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	207.77	207.77	321.06	351.87	443.22	185.84	-327.36	-347.88	-201.14	-219.29	-165.26	-187.33	-239.6	-252.03	-268.73	-285.81	-69.78	-881.18
	ULS Min	207.77	207.77	310.96	332.96	411.9	134.24	-368.66	-393.07	-245.3	-273.46	-210.42	-239.05	-284.61	-305.58	-314.31	-337.23	-82.95	-892.08
IY Bending	ULS Max	0	0	39.84	41.33	40.48	39.3	2.7	0	5.09	16.75	5.06	21.37	2.75	23.83	4.09	24.64	0	28.88
	ULS Min	0	0	0	0	0	0	-20.33	0	-21.35	0	-20.79	0	-26.85	0	-22.4	0	0	0
IZ Bending	ULS Max	0	0	0	0.27	0	0	0	0	0.51	1.13	0	0.21	0	0.85	0	2.53	0	0
	ULS Min	0	0	-5.89	-8.42	-37.14	-41.99	-1.2	0	-0.46	0	-0.61	0	-3.25	0	-5.9	0	0	-5.82
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	14	14	14	14	8	0	9	7	9	9	11	10	9	10	0	10
	Stress Z	0	0	1	1	4	5	0	0	0	0	0	0	0	0	1	0	0	1
	Force (kn) =	0	0	260	275	325	327	139	0	144	115	141	144	186	162	161	170	0	191
	Tension Combined Force (kN) =	208	208	581	626	768	513	-189	-348	-57	-105	-25	-43	-53	-91	-108	-116	-70	-690
	Compression Combined Force (kN) =	208	208	51	58	87	-193	-507	-393	-390	-388	-351	-383	-471	-467	-475	-507	-83	-1083
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.04	0.13	0.14	0.17	0.11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.06	0.16	0.12	0.12	0.12	0.11	0.12	0.15	0.14	0.15	0.16	0.02	0.30

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	251.12	398.78	317.99	346.51	436.53	124.52	-287.92	-277.39	-198.61	-222.22	-164.05	-181.46	-225.49	-256.42	-268.7	-298.79	-650.43	-62.83
	ULS Min	251.12	389.43	316.87	345.56	434.9	120.58	-335.64	-345.32	-253.26	-266.4	-215.85	-226.74	-279.49	-301.58	-320.68	-343.75	-662.73	-75.99
IY Bending	ULS Max	0	0	39.27	39.28	39.57	40.96	0	41.86	15.62	5.2	20.96	5.07	22.58	3.02	23.91	4.81	24.71	0
	ULS Min	0	-29.7	0	0	0	0	-5.69	0	0	-21.42	0	-20.8	0	-26.93	0	-22.54	0	0
IZ Bending	ULS Max	0	0	0	1.25	0	1.73	0	2.55	0.9	0	0.45	0.03	0	0.77	0.7	0.98	0.29	0
	ULS Min	0	-1.95	-1.4	0	-0.86	0	-3.49	0	0	-1.51	0	-0.21	-0.44	0	0	0	-0.52	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	9	14	14	14	14	2	17	7	9	9	9	9	11	10	9	9	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Force (kn) =	0	162	248	248	249	259	45	286	106	147	142	140	152	182	162	153	155	0
	Tension Combined Force (kN) =	251	561	566	594	685	384	-243	8	-92	-76	-23	-41	-73	-74	-107	-146	-495	-63
	Compression Combined Force (kN) =	251	228	69	98	186	-139	-380	-631	-360	-413	-357	-367	-432	-484	-482	-497	-818	-76
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.11	0.12	0.13	0.15	0.08	NA	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.04	0.12	0.20	0.11	0.13	0.11	0.11	0.13	0.15	0.15	0.15	0.23	0.02

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	374.1	70.14	821.92	121.92	-570.05	-600.95	-607.91	-601.59	-761.94	-767.35	-689.47	-695.85	-146.82	22.2
	ULS Min	374.1	53.64	821.92	114.01	-595.55	-626.44	-633.41	-627.09	-784.29	-789.7	-711.83	-718.2	-154.49	13.36
IY Bending	ULS Max	560.61	0	27.93	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-491.93	-52.58	0	-14.89	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	4.3	0	0.05	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	0.47	-0.52	0	-1.09	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	6	17	11	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		470	350	199	108	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		844	420	1021	230	-570	-601	-608	-602	-762	-767	-689	-696	-147	22
Compression Combined Force (kN) =		-95	-296	623	6	-596	-626	-633	-627	-784	-790	-712	-718	-154	13
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.04	0.08	0.22	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.07	NA	NA	0.16	0.17	0.17	0.17	0.23	0.24	0.21	0.22	0.50	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	162.59	11.9	223.9	55.49	206.79	-201.38	-206.3	-153.04	-166.55	-183.86	-164.59	-53.29	-141.3	-20.81	29.27
	ULS Min	156.85	-1.46	209.48	9.32	206.79	-224.37	-229.29	-176.03	-189.54	-206.85	-187.59	-76.28	-164.29	-29.65	20.88
IY Bending	ULS Max	243.83	10.42	17.26	11.8	97.99	0	0	0	0	0	0	0	0	0	0
	ULS Min	-214.25	-19.79	-7.2	-15.82	97.99	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	6.23	3.9	3.52	5.87	17.74	0	0	0	0	0	0	0	0	0	0
	ULS Min	-6.9	0	0	0	17.74	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	3	9	8	7	5	0	0	0	0	0	0	0	0	0	0
	Stress Z	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Force (kn) =		232	148	129	122	303	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		395	159	353	178	510	-201	-206	-153	-167	-184	-165	-53	-141	-21	29
Compression Combined Force (kN) =		-75	-149	81	-113	-96	-224	-229	-176	-190	-207	-188	-76	-164	-30	21
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.02	0.04	0.08	0.04	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.06	NA	0.04	0.01	0.06	0.06	0.05	0.05	0.05	0.05	0.02	0.04	0.10	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder	Front Transverse Sheave Girder	Back Transverse Sheave Girder	G1	G2/3	G4	G6
		End	Middle					
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	26684.77	26684.77	3611.97	1824.16	2168.32	1847.19	813.8
	ULS Min	0	0	-1061	-10	-12	-10	-543
Shear	Fz Max	10556	10556	1429	2460	2605	2432	1229
	Fz Min	-10449	-10449	-1439	-354	-2520	-348	-385
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.490	0.651	0.179	0.175	0.176	0.177	0.155
		0.291	0.552	0.267	0.589	0.623	0.582	0.535

7 - ULS 4		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-7850	-7828	-7675	-7538	-9079	-9700	-10909	-10876	-11067	-7818	-7804	-7352	-8961.92	-9431.89	-10693.86	-10660.98	-10849.51
	ULS Min	-19531	-19486	-18409	-18262	-15164	-14318	-12377	-12316	-11824	-19066	-19033	-17955	-14810.86	-14062.49	-12190.24	-12128.31	-11635.76
IY Bending	ULS Max	1837	2475	2475	1911	655	462	1260	1260	553	1731	2331	2331	590.71	495.92	1182.52	1182.52	570.72
	ULS Min	-1695	-2284	-2280	-1607	-518	-257	-815	-815	-376	-1626	-2198	-2194	-410.09	-238.44	-897.3	-897.3	-326.65
IZ Bending	ULS Max	1550	1969	3476	11310	2346	788	788	70	620	1542	2013	10643	2490.79	392.27	1112.64	1112.64	259.69
	ULS Min	-1588	-2020	-3347	-10288	-2427	-415	-1122	-1122	-271	-1364	-1786	-10690	-2195.87	-790.46	-790.57	-85.61	-571.03
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	54	73	73	56	20	14	44	44	19	51	69	69	18	15	41	41	20
	Stress Z	39	49	85	277	51	17	36	36	20	38	49	262	52	17	36	36	18
Force (kn) =		12361	16264	20991	44233	11312	4902	8556	8556	4190	11795	15676	43864	11207	5080	8233	8233	4090
Tension Combined Force (kN) =		4511	8437	13317	36695	2233	-4798	-2353	-2320	-6877	3977	7871	36512	2245	-4352	-2461	-2428	-6759
Compression Combined Force (kN) =		-31892	-35750	-39401	-62495	-26476	-19220	-20933	-20871	-16013	-30861	-34709	-61819	-26018	-19142	-20423	-20361	-15726
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	0.10	0.19	0.31	0.85	0.04	NA	NA	NA	NA	0.09	0.18	0.84	0.04	NA	NA	NA	NA
		0.79	0.89	0.98	1.55	0.66	0.48	0.64	0.64	0.490	0.77	0.86	1.54	0.65	0.48	0.63	0.62	0.48

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	2279	2290	2285	2455	1019	-104	-761	-882	-1312	2283.72	2303.87	2505.63	1135.41	94.09	-587.69	-729.4	-1141.59
	ULS Min	-9491	-9471	-7202	-7087	-4934	-3446	-2199	-1684	-1489	-8788.24	-8758.79	-6590.53	-4615.26	-3273.73	-2086.98	-1526.85	-1291.28
IY Bending	ULS Max	717	960	965	512	272	75	103	166	169	576.8	781.35	785.44	262.02	77.76	101.79	171.41	172.46
	ULS Min	-629	-850	-850	-467	-184	27	31	30	-146	-543.87	-740.74	-740.42	-173.76	32.33	27.36	27.37	-278.14
IZ Bending	ULS Max	640	714	981	5185	877	115	70	286	462	489.34	587.51	4851.54	910.66	134.51	45.46	186.77	186.81
	ULS Min	-680	-783	-1033	-4841	-926	-148	-56	-87	-88	-457.35	-535.98	-4771.58	-777.22	-123.59	-71.1	-188.14	-617.65
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	34	46	46	25	13	4	5	8	8	28	37	38	13	4	5	8	13
	Stress Z	21	25	33	164	29	5	2	9	15	15	19	153	29	4	2	6	20
Force (kn) =		4362	5527	6161	14706	3303	646	557	1329	1770	3366	4374	14907	3227	623	556	1106	2565
Tension Combined Force (kN) =		6641	7817	8446	17162	4322	542	-204	447	458	5650	6678	17412	4362	717	-31	376	1423
Compression Combined Force (kN) =		-13853	-14998	-13364	-21793	-8237	-4092	-2756	-3013	-3259	-12155	-13133	-21497	-7842	-3897	-2643	-2633	-3856
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	0.31	0.36	0.39	0.79	0.20	0.02	NA	0.02	0.02	0.26	0.31	0.80	0.20	0.03	NA	0.02	0.07
		0.89	0.96	0.86	1.40	0.52	0.26	0.18	0.19	0.20	0.78	0.84	1.38	0.50	0.25	0.17	0.17	0.24

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	787.64	787.64	410.35	425.69	623.39	165.09	1202.8	1114.75	740.16	785.2	764.88	831.66	447.86	397.99	-48.29	-38.55	110.19	-681.66
	ULS Min	-307.01	-307.01	188.83	210.76	181.03	15.83	-2038.01	-1660.25	-1306.08	-1154.27	-1264.07	-1124.47	-1066.83	-860.62	-604.83	-556.64	-54.51	-837.31
IY Bending	ULS Max	0	0	56.35	55.49	49.56	43.87	13.68	0	17.33	28.06	18.19	40.31	10.67	36.97	6.64	29.41	0	28.26
	ULS Min	0	0	0	0	0	0	-41.47	0	-33.78	-4.74	-32.2	-0.57	-34.79	0	-27.1	0	0	0
IZ Bending	ULS Max	0	0	82.39	111.54	71.45	37.44	98.3	0	91.47	31.9	72.11	5.03	75.83	8.77	77.15	10.04	0	7.14
	ULS Min	0	0	-70.88	-102.17	-112.93	-82.03	-51.72	0	-45.36	-35.3	-21.7	-8.98	-26.9	-12.21	-27.87	-10.22	0	-8.33
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	20	19	17	15	17	0	14	12	13	17	14	15	11	12	0	10
	Stress Z	0	0	9	12	12	9	11	0	10	4	8	1	9	1	9	1	0	1
Force (kn) =		0	0	512	564	529	434	457	0	393	252	347	287	371	270	322	216	0	191
Tension Combined Force (kN) =		788	788	923	989	1153	599	1659	1115	1133	1038	1112	1119	819	668	273	177	110	-490
Compression Combined Force (kN) =		-307	-307	-323	-353	-348	-418	-2495	-1660	-1699	-1407	-1611	-1411	-1438	-1131	-927	-773	-55	-1029
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.15	0.20	0.22	0.25	0.13	0.40	0.27	0.27	0.25	0.27	0.27	0.20	0.16	0.07	0.04	0.02	NA
		0.01	0.09	0.09	0.10	0.10	0.12	0.77	0.51	0.52	0.43	0.50	0.43	0.44	0.35	0.29	0.24	0.02	0.29

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	747.68	513.63	391.29	408.58	609.28	97.2	994.21	1133.12	671.81	669.3	738.15	734.36	363.72	442.3	-29.77	-62.13	-485.98	133.38
	ULS Min	-303.54	223.58	189.63	239.1	215.53	-8.94	-1521.84	-1787.3	-1059.71	-1180.58	-1062.79	-1163.36	-820.97	-1014.29	-538.06	-619.12	-599.3	-50.89
IY Bending	ULS Max	0	54.84	51.28	48.73	44.79	42.71	7.49	73.09	37.27	17.72	38.69	17.18	35.02	10.5	28.37	7.54	24.15	0
	ULS Min	0	-111.17	0	0	0	0	-15.93	-2.2	-7.4	-33.07	0	-31.92	0	-34.47	0	-26.72	0	0
IZ Bending	ULS Max	0	29.71	34.62	38.85	37.12	34.06	112.42	37.26	17.03	23.02	6.51	14.65	6.17	16.3	7	17.45	2.16	0
	ULS Min	0	-52.6	-12.81	-10.18	-10.41	-9.82	-65.55	-39	-12.97	-71.42	-1.61	-65.91	-2	-68.49	-1.61	-75.71	-9.94	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	32	18	17	16	15	7	30	16	14	16	13	15	14	12	11	8	0
	Stress Z	0	5	4	4	4	4	13	4	2	8	1	7	1	8	1	9	1	0
Force (kn) =		0	686	388	380	352	333	311	561	281	351	272	334	246	356	203	317	169	0
Tension Combined Force (kN) =		748	1200	779	789	961	430	1305	1694	953	1021	1010	1068	610	798	173	254	-317	133
Compression Combined Force (kN) =		-304	-463	-198	-141	-136	-342	-1832	-2349	-1341	-1532	-1334	-1497	-1067	-1370	-741	-936	-768	-51
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.23	0.17	0.17	0.21	0.09	0.31	0.41	0.23	0.25	0.24	0.26	0.15	0.19	0.04	0.06	NA	0.03
		0.01	0.13	0.06	0.04	0.04	0.10	0.57	0.73	0.41	0.47	0.41	0.46	0.33	0.42	0.23	0.29	0.21	0.01

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	445.4	420.45	932	185.17	1187.29	1100.33	591.71	647.47	210.55	148.37	-232.59	-192.64	-112.62	22.61
	ULS Min	287.81	-261.69	679.43	-461.1	-2378.33	-2455.97	-1980.09	-1921.51	-1800.39	-1858.01	-1310.55	-1275.06	-196.48	12.57
IY Bending	ULS Max	8154.28	0	31.05	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-8942.94	-59.49	0	-15.86	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	146.04	237.15	73.42	268.41	0	0	0	0	0	0	0	0	0	0
	ULS Min	-70.89	-113.92	-35.15	-99.45	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	91	19	12	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	7	17	6	22	0	0	0	0	0	0	0	0	0	0
Force (kn) =		7803	747	329	508	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		8248	1167	1261	693	1187	1100	592	647	211	148	-233	-193	-113	23
Compression Combined Force (kN) =		-7515	-1008	350	-969	-2378	-2456	-1980	-1922	-1800	-1858	-1311	-1275	-196	13
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.41	0.22	0.28	0.15	0.23	0.21	0.11	0.12	0.05	0.03	NA	NA	NA	0.02
		0.48	0.25	NA	0.27	0.63	0.65	0.52	0.51	0.54	0.56	0.39	0.38	0.63	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	244.73	208.39	306.34	113.51	145.55	643.37	604.67	398.14	418.46	295.25	275.29	317.34	278.25	44.9	32.13
	ULS Min	-12.9	-230.94	9.37	-68.5	86.19	-964.73	-970.52	-651.71	-656.21	-570.75	-555.95	-388.96	-452.48	-78.09	19.5
IY Bending	ULS Max	3981.82	15.77	20.44	16.15	114.49	0	0	0	0	0	0	0	0	0	0
	ULS Min	-4330.97	-22.72	-13.22	-18.53	89.18	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	168.57	240.23	97.95	267.63	119.12	0	0	0	0	0	0	0	0	0	0
	ULS Min	-101.14	-120.55	-56.06	-137.03	0	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	52	10	9	8	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	13	24	10	26	7	0	0	0	0	0	0	0	0	0	0
Force (kn) =		4362	545	302	559	620	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		4607	753	608	672	765	643	605	398	418	295	275	317	278	45	32
Compression Combined Force (kN) =		-4375	-776	-293	-627	-533	-965	-971	-652	-656	-571	-556	-389	-452	-78	20
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.28	0.18	0.15	0.16	0.06	0.14	0.13	0.09	0.09	0.06	0.06	0.07	0.06	0.04	0.03
		0.34	0.30	0.11	0.24	0.06	0.25	0.26	0.17	0.17	0.15	0.15	0.10	0.12	0.25	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder	Front Transverse Sheave Girder	Back Transverse Sheave Girder	G1	G2/3	G4	G6
		End	Middle					
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	28181.72	28181.72	2428.04	2016.9	2080.19	1991.36	496.66
	ULS Min	0	0	-1131	-10	-12	-16	-510
Shear	Fz Max	11125	11125	1001	2709	2726	2626	1182
	Fz Min	-11161	-11161	-1063	-277	-2738	-281	-675
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.517	0.687	0.120	0.193	0.169	0.191	0.095
		0.307	0.584	0.197	0.648	0.655	0.628	0.515

7 - ULS V1		North Tower																	
		Rail Side Columns									HWY Side Columns								
		Front Leg (100-110)									Front Leg (200-209)								
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-15765	-15743	-14910	-14637	-13811	-13612	-13238	-13204	-13014	-15432	-15418	-14497	-13726.4	-13559.68	-13222.99	-13189.58	-13023.42
	ULS Min	-15795	-15754	-14953	-14793	-13948	-13749	-13299	-13238	-13109	-15462	-15429	-14696	-13863.5	-13696.78	-13284.38	-13222.99	-13118.23
IY Bending	ULS Max	0	-60	-45	96	98	136	164	179	179	34	44	102	100.06	140.38	157.83	167.21	167.21
	ULS Min	-60	-86	-84	83	91	91	136	164	-38	0	34	46	88.72	88.48	140.38	157.83	0.93
IZ Bending	ULS Max	0	-50	120	469	-58	345	345	-57	289	96	128	165	199.47	199.49	57.12	277.2	277.18
	ULS Min	-50	-60	-13	268	-210	-210	-57	-275	-275	0	96	-39	171.69	-347.25	-347.22	57.12	-274.67
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	2	3	2	3	3	4	6	6	6	1	1	3	3	4	6	6	6
	Stress Z	1	1	3	11	4	7	11	9	9	2	3	4	4	7	11	9	9
Force (kn) =		399	533	719	1902	1182	1819	1797	1613	1660	444	589	935	1158	1849	1781	1576	1576
Tension Combined Force (kN) =		-15365	-15210	-14192	-12735	-12630	-11793	-11441	-11592	-11354	-14988	-14829	-13562	-12568	-11711	-11442	-11614	-11448
Compression Combined Force (kN) =		-16194	-16287	-15671	-16695	-15130	-15568	-15096	-14851	-14769	-15905	-16017	-15631	-15021	-15546	-15065	-14799	-14694
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		0.40	0.40	0.39	0.41	0.38	0.39	0.46	0.45	0.452	0.40	0.40	0.39	0.37	0.39	0.46	0.45	0.45

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	-4400	-4389	-3204	-2881	-2592	-2496	-2286	-2135	-2258	-4119.58	-4100.62	-2844.68	-2540.81	-2418.88	-2159.59	-1970.03	-2017.98
	ULS Min	-4413	-4393	-3223	-2949	-2670	-2574	-2364	-2213	-2289	-4132.82	-4105.27	-2932.04	-2618.93	-2497	-2237.71	-2048.15	-2048.69
IY Bending	ULS Max	3	9	11	62	59	58	60	181	177	13.36	16.39	41.98	43.42	56.07	61.86	185.57	186.73
	ULS Min	0	3	-41	-22	38	37	57	59	-178	0	7.22	8.19	42.93	42.9	55.99	61.85	-242.47
IZ Bending	ULS Max	0	-68	-39	280	-28	56	56	118	344	36.13	66.75	107.71	104.25	20.13	36.66	37.61	37.59
	ULS Min	-68	-85	-131	181	-41	-28	-47	-46	118	0	31.13	28.57	20.13	-57.49	-57.49	36.64	-564.67
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	0	0	2	3	3	3	3	9	9	1	1	2	2	3	3	9	12
	Stress Z	2	3	4	9	1	2	2	4	11	1	2	3	3	2	2	1	18
Force (kn) =		179	241	474	923	321	355	363	969	1514	139	226	423	420	352	373	788	2301
Tension Combined Force (kN) =		-4221	-4148	-2730	-1958	-2270	-2140	-1923	-1166	-745	-3980	-3875	-2422	-2121	-2067	-1786	-1183	283
Compression Combined Force (kN) =		-4592	-4634	-3697	-3872	-2991	-2929	-2727	-3182	-3803	-4272	-4331	-3355	-3039	-2849	-2611	-2836	-4349
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01
		0.29	0.30	0.24	0.25	0.19	0.19	0.17	0.20	0.24	0.27	0.28	0.22	0.19	0.18	0.17	0.18	0.27

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	236.77	236.77	367.16	404	511.88	254.21	-371.59	-394.95	-233.41	-253.15	-193.17	-216.99	-280.11	-296.11	-313.51	-317.71	-133.71	-887.52
	ULS Min	236.77	236.77	355.15	381.92	474.77	193.26	-412.9	-440.72	-277.51	-307.95	-238.3	-269.22	-325.04	-350.48	-359.12	-369.89	-146.87	-898.38
IY Bending	ULS Max	0	0	40	41.7	40.61	38.74	1.53	0	4.55	17.65	4.56	22.53	1.86	25.47	3.38	26.14	0	29.29
	ULS Min	0	0	0	0	0	0	-22.24	0	-23.16	0	-22.52	0	-29.6	0	-24.9	0	0	0
IZ Bending	ULS Max	0	0	0	0.33	0	0	0	0	0.6	1.12	0	0.3	0	0.98	0	2.96	0	0
	ULS Min	0	0	-6.6	-9.46	-42.06	-48.15	-1.21	0	-0.39	0	-0.68	0	-3.81	0	-6.44	0	0	-6.2
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	14	14	14	13	9	0	10	7	9	9	12	11	10	11	0	10
	Stress Z	0	0	1	1	5	5	0	0	0	0	0	0	0	0	1	0	0	1
	Force (kn) =	0	0	263	279	335	336	152	0	157	121	152	152	206	173	179	181	0	194
	Tension Combined Force (kN) =	237	237	630	683	847	590	-220	-395	-77	-133	-41	-65	-74	-123	-135	-137	-134	-694
	Compression Combined Force (kN) =	237	237	92	103	139	-142	-564	-441	-434	-428	-391	-421	-531	-523	-538	-551	-147	-1092
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.05	0.14	0.15	0.19	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.04	0.17	0.14	0.13	0.13	0.12	0.13	0.16	0.16	0.17	0.17	0.04	0.31

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	280.7	454.01	364.24	398.77	505.45	183.84	-331.04	-315.56	-231.29	-256.74	-192.56	-210.56	-268.14	-298.39	-300.43	-348.22	-628.83	-127.89
	ULS Min	280.7	443.75	362.83	397.51	503.59	180.02	-379.65	-385.49	-286.61	-300.86	-244.87	-255.81	-323	-343.48	-353.21	-393.1	-641.25	-141.05
IY Bending	ULS Max	0	0	39.34	39.35	39.63	40.82	0	44.11	16.44	4.66	22.11	4.55	24.09	2.16	25.37	4.21	24.59	0
	ULS Min	0	-35.19	0	0	0	0	-4.57	0	0	-23.24	0	-22.54	0	-29.69	0	-25.02	0	0
IZ Bending	ULS Max	0	0	0	1.37	0	1.65	0	2.81	0.93	0	0.52	0	0	0.88	0.78	0.84	0.27	0
	ULS Min	0	-2.22	-1.67	0	-0.97	0	-3.83	0	0	-1.68	0	-0.29	-0.51	0	0	0	-0.54	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	10	14	14	14	14	2	18	7	10	9	9	10	12	11	10	9	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Force (kn) =	0	192	249	248	249	258	38	301	112	159	149	152	163	201	172	169	154	0
	Tension Combined Force (kN) =	281	646	613	647	755	442	-293	-14	-119	-98	-43	-59	-105	-97	-129	-179	-474	-128
	Compression Combined Force (kN) =	281	252	114	149	254	-78	-417	-687	-399	-460	-394	-408	-486	-544	-525	-563	-796	-141
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.13	0.13	0.14	0.17	0.10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.02	0.13	0.21	0.12	0.14	0.12	0.13	0.15	0.17	0.16	0.17	0.22	0.04

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	428.77	81.86	960.04	142.77	-661.9	-691.27	-716.82	-711.7	-888.22	-891.77	-814.9	-823.87	-175.01	20.32
	ULS Min	428.77	65.58	960.04	134.36	-687.39	-716.77	-742.32	-737.19	-910.58	-914.13	-837.25	-846.23	-182.68	11.48
IY Bending	ULS Max	634.17	0	35.43	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-528.02	-56.13	0	-14.33	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	3.45	0	0.05	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	0.58	-0.64	0	-1.35	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	6	18	14	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		525	373	252	104	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		954	455	1212	247	-662	-691	-717	-712	-888	-892	-815	-824	-175	20
Compression Combined Force (kN) =		-97	-308	708	30	-687	-717	-742	-737	-911	-914	-837	-846	-183	11
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.05	0.09	0.27	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.08	NA	NA	0.18	0.19	0.20	0.19	0.27	0.27	0.25	0.25	0.59	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	172.21	13.01	243.88	62.45	224.97	-215.12	-221.49	-170.81	-183.46	-198.57	-178.78	-63.6	-160.29	-25.13	29.07
	ULS Min	165.21	-0.56	228.02	10.79	224.97	-238.11	-244.48	-193.8	-206.45	-221.56	-201.77	-86.59	-183.28	-33.97	20.68
IY Bending	ULS Max	256.19	10.38	17.8	11.89	96.9	0	0	0	0	0	0	0	0	0	0
	ULS Min	-221.56	-19.99	-6.39	-15.63	96.9	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	6.6	4.58	3.89	6.48	18.86	0	0	0	0	0	0	0	0	0	0
	ULS Min	-8.8	0	0	0	18.86	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	3	9	8	7	5	0	0	0	0	0	0	0	0	0	0
	Stress Z	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Force (kn) =		252	150	133	122	303	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		424	163	377	184	528	-215	-221	-171	-183	-199	-179	-64	-160	-25	29
Compression Combined Force (kN) =		-87	-151	95	-111	-78	-238	-244	-194	-206	-222	-202	-87	-183	-34	21
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.03	0.04	0.09	0.04	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.06	NA	0.04	0.01	0.06	0.06	0.05	0.05	0.06	0.05	0.02	0.05	0.11	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder	Front Transverse Sheave Girder	Back Transverse Sheave Girder	G1	G2/3	G4	G6
		End	Middle					
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	31809.82	31809.82	3897.19	2201.53	2619.41	2210.49	815.98
	ULS Min	0	0	-1143	-10	-12	-10	-590
Shear	Fz Max	12601	12601	1551	2965	3131	2895	1369
	Fz Min	-12454	-12454	-1589	-386	-3031	-390	-437
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.584	0.776	0.193	0.211	0.212	0.212	0.155
		0.347	0.659	0.295	0.709	0.749	0.693	0.596

7 - ULS V2		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-11221	-11200	-10874	-10654	-11769	-12272	-13221	-13188	-13330	-10973	-10959	-10397	-11625.39	-12013.35	-13029.01	-12996.05	-13148.45
	ULS Min	-21238	-21194	-20081	-19867	-17004	-16250	-14489	-14427	-13992	-20619	-20585	-19514	-16658.35	-16002.02	-14320.38	-14258.54	-13835.93
IY Bending	ULS Max	1538	2068	2068	1679	576	425	1128	1128	532	1508	2033	2033	520.74	454.98	1058.9	1058.9	542.88
	ULS Min	-1490	-2012	-2007	-1336	-430	-191	-650	-650	-369	-1369	-1849	-1846	-337.09	-174.48	-723.8	-723.8	-311.4
IZ Bending	ULS Max	1316	1677	3086	9921	2026	776	776	-19	614	1371	1794	9248	2213.59	392.08	970.3	970.3	303.32
	ULS Min	-1374	-1743	-2762	-8592	-2065	-420	-978	-978	-312	-1120	-1461	-9037	-1803.54	-778.74	-778.84	7.35	-567.66
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	45	61	61	50	18	13	40	40	19	45	60	60	16	14	37	37	19
	Stress Z	34	43	76	243	43	16	32	32	20	34	44	226	46	16	31	31	18
Force (kn) =		10491	13766	18133	38811	9716	4681	7568	7568	4091	10364	13796	38011	9939	4839	7283	7283	3975
Tension Combined Force (kN) =		-730	2566	7259	28158	-2053	-7592	-5653	-5620	-9238	-609	2837	27614	-1686	-7175	-5746	-5713	-9174
Compression Combined Force (kN) =		-31729	-34960	-38214	-58678	-26720	-20931	-22057	-21995	-18084	-30983	-34381	-57526	-26597	-20841	-21603	-21541	-17811
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	NA	0.06	0.17	0.65	NA	NA	NA	NA	NA	NA	0.07	0.64	NA	NA	NA	NA	NA
		0.79	0.87	0.95	1.46	0.66	0.52	0.68	0.67	0.554	0.77	0.85	1.43	0.66	0.52	0.66	0.66	0.55

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	337	348	616	943	-214	-1171	-1709	-1802	-2163	534.92	553.62	957.89	-142.57	-1017.8	-1550.76	-1645.25	-1949.83
	ULS Min	-9753	-9733	-7518	-7246	-5328	-4047	-2953	-2501	-2320	-8957.22	-8929.33	-6851.29	-5082.87	-3915.66	-2847.02	-2339.94	-2082.52
IY Bending	ULS Max	613	829	834	424	250	80	97	200	200	508.26	680.31	682.99	231.94	81.28	96.34	204.52	205.1
	ULS Min	-540	-723	-722	-416	-141	30	36	35	-193	-452.31	-624.34	-624.89	-141.58	42.34	32.55	32.55	-321.1
IZ Bending	ULS Max	501	560	836	4544	750	87	85	285	572	441.61	546.9	4280.1	831.12	125.1	55.57	183.39	183.39
	ULS Min	-631	-724	-891	-4049	-795	-141	-67	-68	-36	-369.84	-416.09	-3968.29	-615.64	-96.13	-87.03	-137.96	-795.93
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	29	40	40	20	12	4	5	10	10	24	33	33	11	4	5	10	15
	Stress Z	20	23	28	144	25	4	3	9	18	14	17	135	26	4	3	6	25
Force (kn) =		3852	4890	5319	12796	2897	646	573	1451	2159	2992	3896	13114	2918	613	575	1218	3165
Tension Combined Force (kN) =		4190	5238	5935	13739	2683	-525	-1136	-351	-4	3527	4450	14072	2776	-405	-975	-427	1215
Compression Combined Force (kN) =		-13606	-14623	-12837	-20041	-8225	-4693	-3526	-3951	-4479	-11949	-12825	-19965	-8001	-4529	-3422	-3558	-5248
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	0.19	0.24	0.27	0.63	0.12	NA	NA	NA	NA	0.16	0.20	0.65	0.13	NA	NA	NA	0.06
		0.87	0.94	0.82	1.28	0.52	0.30	0.22	0.25	0.28	0.77	0.82	1.28	0.51	0.29	0.22	0.23	0.33

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	735.18	735.18	471.06	493	686.79	301.71	905.96	822.51	557.71	586.12	589.77	636.6	290.47	237.83	-130.51	-124.49	-77.63	-833.72
	ULS Min	-203.09	-203.09	281.19	308.77	307.5	153.35	-1877.91	-1562.82	-1202.62	-1084.33	-1155.92	-1047.53	-1014.39	-848.98	-614.4	-576.3	-220.68	-968.08
IY Bending	ULS Max	0	0	54.14	54.11	48.55	42.5	11.49	0	15.37	25.62	16.17	39.34	8.95	37.44	5.57	30.92	0	30.67
	ULS Min	0	0	0	0	0	0	-39.46	0	-33.09	-2.79	-31.47	0	-35.69	0	-28.54	0	0	0
IZ Bending	ULS Max	0	0	68.06	91.67	45.5	26.3	83.36	0	77.54	28.36	61.68	4.38	64.09	7.9	63.57	9.53	0	4.38
	ULS Min	0	0	-63.31	-91.52	-112.54	-87.69	-45.65	0	-39.74	-29.24	-18.75	-7.75	-23.98	-10.28	-26.49	-8.03	0	-9.54
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	19	19	17	15	16	0	14	11	13	16	15	16	12	13	0	11
	Stress Z	0	0	7	10	12	9	9	0	9	3	7	1	7	1	7	1	0	1
	Force (kn) =	0	0	471	516	522	436	416	0	363	225	323	278	356	270	307	225	0	209
	Tension Combined Force (kN) =	735	735	942	1009	1209	738	1322	823	920	811	913	915	646	508	176	100	-78	-625
	Compression Combined Force (kN) =	-203	-203	-189	-208	-215	-283	-2294	-1563	-1565	-1309	-1479	-1326	-1370	-1119	-921	-801	-221	-1177
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.14	0.21	0.22	0.26	0.16	0.32	0.20	0.22	0.20	0.22	0.22	0.16	0.12	0.04	0.02	NA	NA
		0.01	0.06	0.05	0.06	0.06	0.08	0.71	0.48	0.48	0.40	0.46	0.41	0.42	0.34	0.28	0.25	0.06	0.33

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	741.68	584.53	454.91	478.73	677.38	228.38	747.93	858.04	497.36	485.92	566.6	554.07	219.69	275.82	-107.1	-156.6	-590.69	-67.27
	ULS Min	-159.36	332.95	282.06	333.46	339.89	135.97	-1416.79	-1658.51	-994.92	-1106.14	-984.52	-1079.22	-803.93	-979.3	-550.79	-640.63	-689.26	-227.09
IY Bending	ULS Max	0	34.36	48.61	47.37	44.05	42.35	5.65	71.94	35.29	15.78	37.74	15.38	35.23	8.96	29.65	6.69	25.69	0
	ULS Min	0	-107.93	0	0	0	0	-14.43	0	-3	-32.39	0	-31.12	0	-35.35	0	-28.32	0	0
IZ Bending	ULS Max	0	26.19	29.18	33.78	31.47	30.95	96.05	32.18	15.03	19.05	5.84	12.58	5.21	14.24	6.4	15.58	2.41	0
	ULS Min	0	-44.81	-11.54	-8.25	-9.42	-6.85	-56.49	-33.9	-10.69	-61.9	-1.24	-56.47	-1.94	-58.46	-1.15	-64.3	-7.99	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	31	17	16	15	15	6	30	15	13	16	13	15	15	12	12	9	0
	Stress Z	0	4	3	4	3	3	11	4	2	7	1	6	1	7	1	7	1	0
	Force (kn) =	0	655	360	362	336	325	271	544	264	330	264	311	246	343	211	307	175	0
	Tension Combined Force (kN) =	742	1240	815	840	1014	553	1019	1402	762	816	831	865	466	619	104	150	-416	-67
	Compression Combined Force (kN) =	-159	-322	-78	-28	3	-189	-1688	-2203	-1259	-1436	-1248	-1390	-1050	-1323	-761	-947	-864	-227
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.24	0.18	0.18	0.22	0.12	0.25	0.34	0.18	0.20	0.20	0.21	0.11	0.15	0.02	0.04	NA	NA
		0.00	0.09	0.02	0.01	NA	0.05	0.52	0.68	0.39	0.44	0.38	0.43	0.32	0.41	0.23	0.29	0.24	0.06

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	508.42	388.68	1078.27	200.58	839.61	741.15	291.71	344.07	-74.42	-132.17	-447.87	-413.53	-148.77	20.33
	ULS Min	373.34	-209.01	861.77	-356.3	-2220.28	-2310.75	-1916.33	-1861.55	-1801.27	-1855.12	-1375.02	-1344.51	-221.75	10.47
IY Bending	ULS Max	7035.96	0	39.44	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-7876.54	-62.57	0	-15	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	129.43	203.08	62.93	229.65	0	0	0	0	0	0	0	0	0	0
	ULS Min	-56.51	-97.84	-30.13	-85.67	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	80	20	16	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	7	15	5	19	0	0	0	0	0	0	0	0	0	0
Force (kn) =		6876	717	373	445	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		7384	1105	1452	646	840	741	292	344	-74	-132	-448	-414	-149	20
Compression Combined Force (kN) =		-6502	-926	488	-801	-2220	-2311	-1916	-1862	-1801	-1855	-1375	-1345	-222	10
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.36	0.21	0.32	0.14	0.16	0.14	0.06	0.07	NA	NA	NA	NA	NA	0.02
		0.41	0.23	NA	0.22	0.59	0.61	0.50	0.49	0.54	0.56	0.41	0.40	0.71	NA

		4020	4026	4032	4038	4044									
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	284.14	185.89	371.8	121.49	244.74	466.76	430.31	256.35	265.51	165.23	158.84	220.02	146.11	21.99	30.94
	ULS Min	65.25	-190.68	112	-34.52	190.76	-914.89	-923.14	-646.8	-658.92	-580.34	-556.93	-388.66	-483.52	-84.69	18.92
IY Bending	ULS Max	3483.78	14.78	20.97	14.97	109.55	0	0	0	0	0	0	0	0	0	0
	ULS Min	-3815.1	-23.03	-9.18	-17.56	89.13	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	140.85	206.52	84.51	229.84	98.57	0	0	0	0	0	0	0	0	0	0
	ULS Min	-90.32	-102.72	-47.5	-117.01	0	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	46	10	9	8	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	11	20	8	23	6	0	0	0	0	0	0	0	0	0	0
Force (kn) =		3803	494	284	492	551	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		4087	679	656	613	796	467	430	256	266	165	159	220	146	22	31
Compression Combined Force (kN) =		-3738	-684	-172	-526	-360	-915	-923	-647	-659	-580	-557	-389	-484	-85	19
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.24	0.16	0.16	0.15	0.07	0.10	0.09	0.06	0.06	0.04	0.03	0.05	0.03	0.02	0.02
		0.29	0.26	0.07	0.20	0.04	0.24	0.24	0.17	0.17	0.15	0.15	0.10	0.13	0.27	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder End	Front Transverse Sheave Girder Middle	Back Transverse Sheave Girder	G1	G2/3	G4	G6
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	33524.5	33524.5	3963.19	2357.63	2471.54	2359.55	965.33
	ULS Min	0	0	-1481	-10	-12	-15	-689
Shear	Fz Max	13165	13165	1533	3168	3250	3110	1599
	Fz Min	-13186	-13186	-1574	-398	-3223	-381	-685
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.615	0.817	0.197	0.226	0.200	0.226	0.184
		0.363	0.690	0.292	0.758	0.778	0.744	0.696

7 - ULS V3		North Tower																	
		Rail Side Columns									HWY Side Columns								
		Front Leg (100-110)									Front Leg (200-209)								
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-9992	-9971	-9774	-9567	-11171	-11849	-13130	-13097	-13321	-9766	-9752	-9282	-11012.63	-11539.1	-12894.11	-12861.27	-13092.87
	ULS Min	-22506	-22461	-21272	-21044	-17680	-16787	-14700	-14638	-14125	-21815	-21782	-20628	-17269.56	-16490.66	-14492.98	-14431.02	-13928.52
IY Bending	ULS Max	1937	2606	2606	2078	694	496	1367	1367	618	1877	2530	2529	624.99	532.76	1282.58	1282.58	634.82
	ULS Min	-1847	-2493	-2488	-1691	-563	-273	-855	-855	-449	-1720	-2323	-2319	-447.3	-254.07	-945.79	-945.79	-386.93
IZ Bending	ULS Max	1658	2111	3828	12283	2548	881	882	46	693	1689	2211	11571	2723.74	438.85	1198.32	1198.32	308.19
	ULS Min	-1705	-2163	-3483	-10858	-2566	-470	-1208	-1208	-319	-1424	-1859	-11285	-2297.68	-884.35	-884.48	-61.78	-639.49
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	57	77	77	61	22	15	48	48	22	55	75	75	19	17	45	45	22
	Stress Z	42	53	94	301	54	18	39	39	22	41	54	283	57	19	39	39	21
Force (kn) =		13132	17242	22651	48046	11970	5384	9252	9252	4686	12844	17097	47506	12152	5574	8901	8901	4565
Tension Combined Force (kN) =		3139	7272	12877	38479	800	-6465	-3879	-3846	-8635	3078	7344	38224	1139	-5965	-3994	-3961	-8528
Compression Combined Force (kN) =		-35638	-39704	-43923	-69090	-29651	-22171	-23951	-23889	-18812	-34659	-38879	-68133	-29421	-22065	-23393	-23332	-18493
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	0.07	0.17	0.30	0.89	0.02	NA	NA	NA	NA	0.07	0.17	0.88	0.02	NA	NA	NA	NA
		0.89	0.99	1.09	1.72	0.74	0.55	0.73	0.73	0.576	0.86	0.97	1.69	0.73	0.55	0.72	0.71	0.57

		North Tower																	
		Rail Side Columns									HWY Side Columns								
		Rear Leg (300-310)									Rear Leg (400-409)								
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	1532	1543	1580	1908	389	-830	-1557	-1710	-2132	1708.54	1727.17	1917.28	465.61	-658.76	-1390.05	-1555.5	-1926.32
	ULS Min	-11078	-11058	-8583	-8310	-5984	-4406	-3092	-2564	-2320	-10153.33	-10125.35	-7822.36	-5690.25	-4261.56	-2990.84	-2404.33	-2084.51
IY Bending	ULS Max	766	1034	1039	536	298	85	106	204	205	632.02	848.64	851.75	278.69	87.13	104.57	208.45	208.87
	ULS Min	-676	-906	-905	-514	-192	28	29	28	-197	-568.69	-782.18	-783.1	-188.21	38.46	24.83	24.85	-340.13
IZ Bending	ULS Max	643	721	1054	5635	948	113	92	326	628	542.95	666.88	5323.22	1012.74	151.24	60.12	220.03	220.04
	ULS Min	-771	-884	-1104	-5107	-983	-169	-72	-73	-75	-471.37	-536.85	-4987.27	-795.71	-125.31	-94.2	-181.66	-852.75
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	37	50	50	26	14	4	5	10	10	30	41	41	13	4	5	10	16
	Stress Z	24	28	35	178	31	5	3	10	20	17	21	168	32	5	3	7	27
Force (kn) =		4771	6051	6614	15903	3540	734	623	1567	2318	3705	4822	16318	3541	699	624	1323	3377
Tension Combined Force (kN) =		6303	7594	8194	17812	3929	-97	-933	-143	186	5414	6549	18236	4007	40	-766	-232	1450
Compression Combined Force (kN) =		-15849	-17109	-15197	-24214	-9523	-5140	-3715	-4130	-4638	-13859	-14947	-24141	-9232	-4961	-3615	-3727	-5461
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	0.29	0.35	0.38	0.82	0.18	NA	NA	NA	0.01	0.25	0.30	0.84	0.18	0.00	NA	NA	0.07
		1.02	1.10	0.97	1.55	0.61	0.33	0.24	0.26	0.29	0.89	0.96	1.55	0.59	0.32	0.23	0.24	0.34

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	858.46	858.46	495.22	514.37	731.74	309.54	1227.4	1128.98	756.99	797.45	786.8	851.32	435	373.3	-82.88	-74.96	-59.17	-818.6
	ULS Min	-314.39	-314.39	257.88	284.09	257.79	138.9	-2242.11	-1841.21	-1432.4	-1276.89	-1384.02	-1240.77	-1184.85	-971.58	-676.34	-626.64	-234.7	-983.83
IY Bending	ULS Max	0	0	57.67	57.2	50.52	43.46	14.04	0	18.09	29.04	19.09	43.5	10.76	40.35	6.16	32.05	0	30.98
	ULS Min	0	0	0	0	0	0	-43.68	0	-35.49	-6.1	-33.63	-0.3	-37.09	0	-29.33	0	0	0
IZ Bending	ULS Max	0	0	86.62	116.81	67.5	37.31	104.37	0	97.02	35.28	77.17	5.4	80.85	9.63	80.96	11.16	0	6.5
	ULS Min	0	0	-77.6	-112.17	-130.04	-97.57	-56.76	0	-49.58	-36.72	-23.36	-9.68	-29.23	-12.93	-31.59	-10.61	0	-10.38
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	20	20	18	15	18	0	15	12	14	18	15	17	12	13	0	11
	Stress Z	0	0	9	13	14	11	12	0	11	4	9	1	9	1	9	1	0	1
Force (kn) =		0	0	529	585	568	461	482	0	414	261	366	310	396	294	344	235	0	212
Tension Combined Force (kN) =		858	858	1024	1099	1300	771	1710	1129	1171	1059	1152	1161	831	668	261	160	-59	-607
Compression Combined Force (kN) =		-314	-314	-271	-300	-311	-322	-2724	-1841	-1846	-1538	-1750	-1550	-1580	-1266	-1020	-862	-235	-1196
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.17	0.22	0.24	0.28	0.17	0.41	0.27	0.28	0.25	0.28	0.28	0.20	0.16	0.06	0.04	NA	NA
		0.01	0.09	0.08	0.09	0.09	0.09	0.84	0.57	0.57	0.47	0.54	0.48	0.49	0.39	0.31	0.27	0.07	0.33

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	855.62	614.69	475.5	496.71	717.89	235.66	1019.64	1153.1	681.01	673.09	757.69	746.5	343.62	421.25	-57.58	-106.77	-581	-47.34
	ULS Min	-270.69	302.82	259.44	315.13	296.02	121.11	-1674.08	-1975.01	-1170.48	-1305.95	-1168.1	-1283.81	-922.16	-1136.38	-598.96	-700.59	-701.11	-243.82
IY Bending	ULS Max	0	52	53.09	49.54	45.15	42.74	8.15	78.79	39.96	18.59	41.59	18.11	37.95	10.7	30.65	7.35	25.95	0
	ULS Min	0	-125.87	0	0	0	0	-16.94	-3.18	-7.9	-34.6	0	-33.19	0	-36.64	0	-29.02	0	0
IZ Bending	ULS Max	0	32.91	36.85	41.91	39.51	38.3	121.01	39.51	18.66	24.24	7.16	15.8	6.56	17.57	7.8	19.39	2.96	0
	ULS Min	0	-55.44	-14	-10.62	-11.53	-8.82	-69.67	-42.42	-13.48	-76.95	-1.63	-70.51	-2.29	-73.28	-1.53	-80.44	-9.84	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	37	18	17	16	15	7	33	17	14	17	14	16	15	13	12	9	0
	Stress Z	0	5	4	5	4	4	14	5	2	9	1	8	1	8	1	9	1	0
Force (kn) =		0	770	403	391	359	341	333	606	302	372	292	351	267	379	220	341	180	0
Tension Combined Force (kN) =		856	1384	879	888	1077	577	1353	1759	983	1045	1050	1097	610	800	162	234	-401	-47
Compression Combined Force (kN) =		-271	-467	-144	-76	-63	-220	-2007	-2581	-1473	-1678	-1460	-1634	-1189	-1515	-819	-1041	-881	-244
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.27	0.19	0.19	0.24	0.13	0.33	0.42	0.24	0.25	0.25	0.26	0.15	0.19	0.04	0.06	NA	NA
		0.01	0.13	0.04	0.02	0.02	0.06	0.62	0.80	0.45	0.52	0.45	0.50	0.37	0.47	0.25	0.32	0.25	0.07

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	525.89	464.85	1101.49	214.19	1219.1	1103.31	548.72	612.94	134.89	63.53	-350.28	-304.99	-140.95	20.43
	ULS Min	357.04	-278.2	830.87	-479.76	-2599.39	-2705.2	-2204.96	-2137.71	-2018.1	-2084.57	-1503.64	-1463.13	-230.25	10.3
IY Bending	ULS Max	8850.68	0	40.09	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-9712.05	-64.01	0	-15.2	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	161.37	253.99	78.65	287.36	0	0	0	0	0	0	0	0	0	0
	ULS Min	-71.06	-122.13	-37.67	-106.74	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	98	21	16	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	8	19	6	23	0	0	0	0	0	0	0	0	0	0
Force (kn) =		8485	802	401	531	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		9011	1267	1503	746	1219	1103	549	613	135	64	-350	-305	-141	20
Compression Combined Force (kN) =		-8128	-1080	430	-1011	-2599	-2705	-2205	-2138	-2018	-2085	-1504	-1463	-230	10
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.44	0.24	0.33	0.16	0.23	0.21	0.11	0.12	0.03	0.01	NA	NA	NA	0.02
		0.52	0.27	NA	0.28	0.68	0.71	0.58	0.56	0.60	0.62	0.45	0.44	0.74	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	311.68	229.25	402.87	136.02	249.1	637.86	593.94	363.95	378.52	256.85	243.93	291.52	223.49	33.97	31.42
	ULS Min	38.24	-241.46	80.91	-59	182.97	-1083.46	-1092.12	-759.25	-771.27	-669.37	-645.04	-463.59	-557.79	-97.17	18.49
IY Bending	ULS Max	4354.29	15.9	22.31	16.25	113.01	0	0	0	0	0	0	0	0	0	0
	ULS Min	-4713.16	-23.78	-9.92	-18.05	87.62	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	177.47	257.42	105.05	286.94	127.97	0	0	0	0	0	0	0	0	0	0
	ULS Min	-111.5	-129.14	-59.97	-146.63	0	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	57	11	10	8	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	14	25	10	28	7	0	0	0	0	0	0	0	0	0	0
Force (kn) =		4716	580	327	586	640	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		5028	809	730	722	889	638	594	364	379	257	244	292	223	34	31
Compression Combined Force (kN) =		-4678	-821	-246	-645	-457	-1083	-1092	-759	-771	-669	-645	-464	-558	-97	18
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.30	0.19	0.18	0.17	0.07	0.14	0.13	0.08	0.08	0.06	0.05	0.06	0.05	0.03	0.03
		0.36	0.32	0.09	0.25	0.05	0.29	0.29	0.20	0.20	0.18	0.17	0.12	0.15	0.31	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder	Front Transverse Sheave Girder	Back Transverse Sheave Girder	G1	G2/3	G4	G6
		End	Middle					
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	33890.19	33890.19	3971.88	2378.78	2475.94	2402.35	1002.77
	ULS Min	0	0	-1563	-10	-12	-17	-711
Shear	Fz Max	13235	13235	1523	3195	3256	3166	1650
	Fz Min	-13297	-13297	-1565	-399	-3247	-378	-747
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.622	0.826	0.197	0.228	0.201	0.230	0.191
		0.366	0.696	0.290	0.764	0.779	0.758	0.718

7 - ULS V4		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-8117	-8095	-7354	-7081	-6550	-6345	-6062	-6029	-5805	-7724	-7710	-6878	-6404.77	-6224.49	-5970.1	-5936.69	-5736.91
	ULS Min	-8147	-8106	-7397	-7238	-6687	-6482	-6124	-6062	-5900	-7754	-7721	-7077	-6541.86	-6361.58	-6031.49	-5970.1	-5831.72
IY Bending	ULS Max	0	-67	-85	43	11	43	43	6	241	33	44	45	8.28	46.47	46.47	-0.71	277.2
	ULS Min	-67	-95	-92	-12	-11	11	6	-14	-14	0	33	-8	-9.15	8.12	-0.71	-26.5	-26.5
IZ Bending	ULS Max	0	-31	120	349	-29	158	158	-22	121	76	101	139	141.18	84.43	21.74	119.85	119.85
	ULS Min	-31	-35	20	268	-97	-97	-22	-119	-119	0	76	66	84.42	-158.52	-158.51	21.74	-111.01
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	2	3	3	1	0	1	2	0	8	1	1	1	0	1	2	1	10
	Stress Z	1	1	3	9	2	3	5	4	4	2	2	3	3	3	5	4	4
Force (kn) =		362	484	751	1302	380	740	704	462	1314	377	501	628	515	757	718	510	1446
Tension Combined Force (kN) =		-7754	-7611	-6603	-5779	-6171	-5605	-5358	-5567	-4491	-7347	-7210	-6250	-5890	-5467	-5253	-5426	-4291
Compression Combined Force (kN) =		-8509	-8590	-8148	-8539	-7067	-7222	-6828	-6524	-7213	-8131	-8222	-7705	-7057	-7119	-6749	-6480	-7278
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		0.21	0.21	0.20	0.21	0.18	0.18	0.21	0.20	0.221	0.20	0.20	0.19	0.18	0.18	0.21	0.20	0.22

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	-4761	-4750	-3646	-3322	-2978	-2868	-2688	-2551	-2780	-4461.81	-4442.85	-3257.81	-2911.62	-2780.67	-2555.36	-2379.62	-2550.61
	ULS Min	-4775	-4755	-3664	-3391	-3057	-2946	-2766	-2629	-2811	-4475.04	-4447.5	-3345.16	-2989.74	-2858.79	-2633.48	-2457.74	-2581.32
IY Bending	ULS Max	1	5	8	17	14	15	14	163	159	17.81	20.96	13.78	7.6	12.07	12.03	149.74	148.81
	ULS Min	0	1	-43	-28	4	4	3	2	-251	0	12.79	-0.32	1.14	7.59	8.47	8.45	-261.02
IZ Bending	ULS Max	0	-66	-41	278	-33	65	65	88	498	35.72	66.93	107.96	107.68	24.97	37.01	95.26	95.22
	ULS Min	-66	-83	-136	194	-43	-33	-48	-46	89	0	30.52	29.06	24.96	-66.22	-66.22	37	-770.66
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	0	0	2	1	1	1	1	8	12	1	1	1	0	1	1	7	13
	Stress Z	2	3	4	9	1	2	2	3	16	1	2	3	3	2	2	3	24
Force (kn) =		166	223	498	789	160	216	213	826	2169	155	244	318	294	209	208	796	2878
Tension Combined Force (kN) =		-4596	-4527	-3147	-2534	-2819	-2653	-2474	-1725	-611	-4307	-4199	-2940	-2618	-2572	-2347	-1584	327
Compression Combined Force (kN) =		-4940	-4978	-4163	-4180	-3216	-3162	-2979	-3455	-4980	-4630	-4691	-3663	-3284	-3067	-2842	-3253	-5459
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.32	0.32	0.27	0.27	0.20	0.20	0.19	0.22	0.31	0.30	0.30	0.23	0.21	0.19	0.18	0.21	0.34

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	158.47	158.47	237.24	249.61	297.71	44.17	-258.02	-268.67	-139.94	-154.18	-113.19	-132.46	-153.4	-159.09	-152.51	-244.94	49.82	-988.89
	ULS Min	158.47	158.47	228.33	236.16	273.51	-6.78	-299.47	-311.52	-184.75	-205.67	-158.83	-181.7	-199.18	-209.16	-198.62	-292.81	36.65	-999.22
IY Bending	ULS Max	0	0	39.18	40.8	40.12	39.73	7.49	0	7.47	14.55	7.35	18.91	6.05	20.21	6.65	21.77	0	29.94
	ULS Min	0	0	0	0	0	0	-12.46	0	-14.11	0	-13.68	0	-16.87	0	-12.98	0	0	0
IZ Bending	ULS Max	0	0	0	0	0	0	0	0	0.07	1.33	0	0	0	1.08	0	3.14	0	0
	ULS Min	0	0	-7	-15.73	-52.07	-59.8	-1.41	0	-0.92	0	-1.56	-0.06	-3.54	0	-7.64	0	0	-6.71
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	14	14	14	14	5	0	6	6	6	8	7	8	5	9	0	11
	Stress Z	0	0	1	2	6	6	0	0	0	0	0	0	0	0	1	0	0	1
	Force (kn) =	0	0	258	285	352	364	86	0	96	100	95	127	120	138	101	152	0	199
	Tension Combined Force (kN) =	158	158	496	535	650	409	-172	-269	-44	-54	-19	-5	-34	-21	-52	-93	50	-790
	Compression Combined Force (kN) =	158	158	-30	-49	-78	-371	-386	-312	-281	-306	-253	-309	-319	-347	-300	-445	37	-1198
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.00	0.03	0.11	0.12	0.14	0.09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01	NA
		NA	NA	0.01	0.01	0.02	0.11	0.12	0.10	0.09	0.09	0.08	0.10	0.10	0.11	0.09	0.14	NA	0.34

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	203.77	296.73	230.8	242.02	286.91	-34.54	-209.33	-220.22	-137.08	-154.85	-110.54	-127.64	-130.99	-170.06	-225.44	-187.62	-769.8	100.08
	ULS Min	203.77	288.81	229.56	241	284.73	-39.69	-255.52	-285.88	-189	-199.58	-159.85	-173.45	-181.51	-215.86	-273.85	-233.14	-781.44	86.92
IY Bending	ULS Max	0	0	39	38.94	39.33	41.41	0	37.99	13.63	7.6	18.39	7.47	19	6.32	20.84	7.51	25.91	0
	ULS Min	0	-20.41	0	0	0	0	-11.24	0	0	-14.16	0	-13.66	0	-16.93	0	-12.94	0	0
IZ Bending	ULS Max	0	0	0	1.27	0	2.35	0	2.13	0.89	0	0.44	0.69	0	0.35	0.75	1.73	0.45	0
	ULS Min	0	-1.54	-0.91	0	-1.14	0	-2.92	0	0	-1.12	0	0	-0.44	-0.25	0	0	-0.39	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	6	14	13	14	14	5	16	6	6	8	6	8	7	9	5	9	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Force (kn) =	0	112	245	246	248	263	81	259	93	97	124	93	128	114	141	90	162	0
	Tension Combined Force (kN) =	204	408	476	488	535	229	-129	39	-44	-58	14	-35	-3	-56	-84	-98	-607	100
	Compression Combined Force (kN) =	204	177	-16	-5	37	-303	-336	-545	-282	-297	-284	-266	-310	-330	-415	-323	-944	87
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.08	0.10	0.11	0.12	0.05	NA	0.01	NA	NA	0.00	NA	NA	NA	NA	NA	NA	0.02
		NA	NA	0.00	0.00	NA	0.09	0.10	0.17	0.09	0.09	0.09	0.08	0.10	0.10	0.13	0.10	0.26	NA

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	224.22	38.08	444.5	68.23	-322.74	-348.34	-304.45	-303.97	-422.26	-420.59	-337.38	-354.03	-69.42	27.36
	ULS Min	224.22	21.21	444.5	58.18	-348.24	-373.84	-329.95	-329.47	-444.61	-442.94	-359.74	-376.38	-77.09	18.52
IY Bending	ULS Max	358.84	0	7.41	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-377.86	-42.88	0	-16.39	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	6.81	0	0.07	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	0.17	-0.17	0	-0.39	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	4	14	3	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		332	285	53	117	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		556	323	497	185	-323	-348	-304	-304	-422	-421	-337	-354	-69	27
Compression Combined Force (kN) =		-108	-264	392	-59	-348	-374	-330	-329	-445	-443	-360	-376	-77	19
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.03	0.06	0.11	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.07	NA	0.02	0.09	0.10	0.09	0.09	0.13	0.13	0.11	0.11	0.25	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	193.19	15.9	283.23	67.74	321.09	-239.79	-251.38	-205.55	-214.58	-226.36	-205.99	-83.32	-196.54	-33.57	28.58
	ULS Min	186.26	1.11	261.67	5.38	321.09	-262.78	-274.37	-228.54	-237.57	-249.35	-228.98	-106.31	-219.53	-42.41	20.2
IY Bending	ULS Max	279.24	10.08	18.48	11.61	96.57	0	0	0	0	0	0	0	0	0	0
	ULS Min	-239.02	-20.36	-4.71	-15.29	96.57	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	5.54	1.79	2.51	6.57	24.81	0	0	0	0	0	0	0	0	0	0
	ULS Min	-0.11	0	0	-0.54	24.81	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	3	9	8	7	5	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Force (kn) =		254	148	136	120	318	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		447	164	419	187	639	-240	-251	-206	-215	-226	-206	-83	-197	-34	29
Compression Combined Force (kN) =		-68	-147	126	-114	3	-263	-274	-229	-238	-249	-229	-106	-220	-42	20
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.03	0.04	0.10	0.05	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.06	NA	0.04	NA	0.07	0.07	0.06	0.06	0.07	0.06	0.03	0.06	0.14	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder	Front Transverse Sheave Girder	Back Transverse Sheave Girder	G1	G2/3	G4	G6
		End	Middle					
	Members	40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	11782.53	11782.53	4697.64	1365.46	4782.62	1273.46	854.8
	ULS Min	0	0	-1525	-32	-12	-30	-700
Shear	Fz Max	4712	4712	2065	180	2173	28	1624
	Fz Min	-4670	-4670	-2104	-475	-2076	-272	-541
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.216	0.287	0.233	0.131	0.388	0.122	0.163
		0.130	0.246	0.391	0.114	0.520	0.065	0.707

8 - ULS 1		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-13681	-13659	-12861	-12587	-11836	-11635	-11284	-11250	-11055	-13334	-13320	-12431	-11738.2	-11567.14	-11254.3	-11220.88	-11048.14
	ULS Min	-13711	-13670	-12903	-12744	-11973	-11772	-11345	-11284	-11149	-13364	-13331	-12630	-11875.29	-11704.24	-11315.69	-11254.3	-11142.94
IY Bending	ULS Max	0	-60	-52	76	77	115	128	135	135	32	43	81	79.32	119.67	123.42	125.36	125.36
	ULS Min	-60	-86	-83	76	74	74	116	128	22	0	32	44	72.48	72.26	119.66	123.42	58.42
IZ Bending	ULS Max	0	-45	119	442	-49	295	295	-48	245	90	121	156	168.14	168.16	47.5	234.48	234.46
	ULS Min	-45	-53	-6	267	-179	-179	-48	-234	-234	0	90	-6	164.2	-296.05	-296.02	47.5	-229.97
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	2	3	2	2	2	4	5	5	5	1	1	2	2	4	4	4	4
	Stress Z	1	1	3	11	4	6	9	8	8	2	3	4	4	6	10	8	8
Force (kn) =		379	506	712	1731	978	1551	1491	1308	1348	420	560	823	951	1576	1477	1273	1273
Tension Combined Force (kN) =		-13302	-13153	-12149	-10856	-10858	-10084	-9793	-9942	-9707	-12914	-12761	-11608	-10787	-9991	-9777	-9948	-9775
Compression Combined Force (kN) =		-14090	-14176	-13616	-14475	-12950	-13322	-12836	-12592	-12497	-13784	-13891	-13453	-12827	-13281	-12793	-12527	-12416
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		0.35	0.35	0.34	0.36	0.32	0.33	0.39	0.39	0.383	0.34	0.35	0.33	0.32	0.33	0.39	0.38	0.38

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	-4170	-4159	-3006	-2683	-2396	-2296	-2092	-1941	-2074	-3888.79	-3869.82	-2642.96	-2342.96	-2218.32	-1965.64	-1780.4	-1844.79
	ULS Min	-4183	-4164	-3025	-2752	-2474	-2374	-2170	-2019	-2105	-3902.03	-3874.48	-2730.32	-2421.08	-2296.44	-2043.76	-1858.52	-1875.5
IY Bending	ULS Max	2	7	10	52	49	48	49	167	163	13.95	16.98	33.65	35.58	46.41	51.15	169.39	170.16
	ULS Min	0	2	-39	-22	31	31	47	48	-170	0	8.03	9.01	35	35.55	46.34	51.13	-221.68
IZ Bending	ULS Max	0	-67	-38	281	-26	52	52	102	325	35.13	65.38	108	102.01	17.51	32.69	37.96	37.93
	ULS Min	-67	-83	-128	174	-40	-25	-43	-42	102	0	30.13	29.5	17.51	-52.6	-52.6	32.67	-523.14
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	0	0	2	3	2	2	2	8	8	1	1	2	2	2	2	8	11
	Stress Z	2	3	4	9	1	2	2	3	10	1	2	3	3	2	2	1	17
Force (kn) =		172	232	465	888	282	307	311	877	1438	139	225	392	385	303	321	728	2120
Tension Combined Force (kN) =		-3998	-3927	-2542	-1795	-2114	-1988	-1781	-1064	-636	-3750	-3645	-2251	-1958	-1915	-1644	-1053	275
Compression Combined Force (kN) =		-4355	-4396	-3490	-3640	-2757	-2681	-2480	-2896	-3543	-4041	-4099	-3123	-2806	-2600	-2365	-2586	-3996
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01
		0.28	0.28	0.22	0.23	0.18	0.17	0.16	0.18	0.22	0.26	0.26	0.20	0.18	0.17	0.15	0.16	0.25

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	207.28	207.28	320.27	350.98	442.05	184.72	-326.61	-347.07	-200.59	-218.71	-164.79	-186.82	-238.91	-251.27	-267.96	-285.26	-68.77	-881.14
	ULS Min	207.28	207.28	310.2	332.13	410.83	133.28	-367.91	-392.26	-244.76	-272.87	-209.95	-238.53	-283.93	-304.81	-313.54	-336.66	-81.94	-892.04
IY Bending	ULS Max	0	0	39.83	41.32	40.47	39.31	2.72	0	5.1	16.73	5.07	21.35	2.77	23.8	4.1	24.61	0	28.87
	ULS Min	0	0	0	0	0	0	-20.3	0	-21.32	0	-20.76	0	-26.81	0	-22.35	0	0	0
IZ Bending	ULS Max	0	0	0	0.27	0	0	0	0	0.51	1.13	0	0.21	0	0.84	0	2.53	0	0
	ULS Min	0	0	-5.88	-8.4	-37.05	-41.88	-1.2	0	-0.46	0	-0.6	0	-3.24	0	-5.89	0	0	-5.81
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	14	14	14	14	8	0	9	7	9	9	11	10	9	10	0	10
	Stress Z	0	0	1	1	4	5	0	0	0	0	0	0	0	0	1	0	0	1
	Force (kn) =	0	0	260	274	325	327	138	0	144	114	140	144	186	161	161	170	0	191
	Tension Combined Force (kN) =	207	207	581	625	767	512	-188	-347	-57	-104	-24	-43	-53	-90	-107	-115	-69	-690
	Compression Combined Force (kN) =	207	207	50	58	86	-194	-506	-392	-389	-387	-350	-382	-470	-466	-474	-506	-82	-1083
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.04	0.13	0.14	0.17	0.11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.06	0.16	0.12	0.12	0.12	0.11	0.12	0.14	0.14	0.15	0.16	0.02	0.30

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	250.61	397.83	317.2	345.61	435.34	123.57	-287.18	-276.73	-198.05	-221.62	-163.56	-180.96	-224.76	-255.7	-268.15	-297.93	-650.86	-61.8
	ULS Min	250.61	388.5	316.08	344.67	433.72	119.62	-334.89	-344.63	-252.69	-265.8	-215.36	-226.23	-278.74	-300.86	-320.11	-342.88	-663.15	-74.96
IY Bending	ULS Max	0	0	39.27	39.27	39.56	40.97	0	41.82	15.6	5.21	20.94	5.08	22.55	3.03	23.89	4.82	24.72	0
	ULS Min	0	-29.61	0	0	0	0	-5.71	0	0	-21.38	0	-20.78	0	-26.89	0	-22.49	0	0
IZ Bending	ULS Max	0	0	0	1.25	0	1.73	0	2.55	0.9	0	0.45	0.03	0	0.77	0.69	0.98	0.29	0
	ULS Min	0	-1.95	-1.4	0	-0.86	0	-3.48	0	0	-1.5	0	-0.2	-0.44	0	0	0	-0.52	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	9	14	14	14	14	2	17	7	9	9	9	9	11	10	9	9	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Force (kn) =	0	161	248	248	249	259	45	285	106	146	141	140	152	182	162	153	155	0
	Tension Combined Force (kN) =	251	559	565	593	684	383	-243	9	-92	-75	-22	-41	-73	-74	-107	-145	-496	-62
	Compression Combined Force (kN) =	251	227	68	97	185	-140	-380	-630	-359	-412	-357	-366	-431	-483	-482	-496	-818	-75
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.11	0.12	0.13	0.15	0.08	NA	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.04	0.12	0.19	0.11	0.13	0.11	0.11	0.13	0.15	0.15	0.15	0.23	0.02

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	373.17	69.94	819.57	121.56	-568.48	-599.4	-606.05	-599.71	-759.79	-765.23	-687.33	-693.67	-146.34	22.23
	ULS Min	373.17	53.43	819.57	113.65	-593.98	-624.9	-631.54	-625.21	-782.14	-787.58	-709.69	-716.03	-154.01	13.39
IY Bending	ULS Max	559.35	0	27.8	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-491.3	-52.52	0	-14.9	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	4.32	0	0.05	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	0.47	-0.52	0	-1.09	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	6	17	11	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		469	349	198	108	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		842	419	1018	229	-568	-599	-606	-600	-760	-765	-687	-694	-146	22
Compression Combined Force (kN) =		-95	-296	622	6	-594	-625	-632	-625	-782	-788	-710	-716	-154	13
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.04	0.08	0.22	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.07	NA	NA	0.16	0.16	0.17	0.16	0.23	0.24	0.21	0.21	0.49	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	162.43	11.88	223.56	55.37	206.46	-201.14	-206.04	-152.73	-166.26	-183.61	-164.36	-53.12	-140.97	-20.74	29.27
	ULS Min	156.71	-1.48	209.16	9.29	206.46	-224.13	-229.04	-175.73	-189.25	-206.6	-187.35	-76.11	-163.96	-29.58	20.89
IY Bending	ULS Max	243.62	10.42	17.25	11.8	98.01	0	0	0	0	0	0	0	0	0	0
	ULS Min	-214.13	-19.78	-7.21	-15.83	98.01	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	6.22	3.89	3.51	5.86	17.72	0	0	0	0	0	0	0	0	0	0
	ULS Min	-6.87	0	0	0	17.72	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	3	9	8	7	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Force (kn) =		232	147	129	122	303	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		394	159	352	178	509	-201	-206	-153	-166	-184	-164	-53	-141	-21	29
Compression Combined Force (kN) =		-75	-149	80	-113	-96	-224	-229	-176	-189	-207	-187	-76	-164	-30	21
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.02	0.04	0.08	0.04	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.06	NA	0.04	0.01	0.06	0.06	0.05	0.05	0.05	0.05	0.02	0.04	0.09	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder	Front Transverse Sheave Girder	Back Transverse Sheave Girder	G1	G2/3	G4	G6
		End	Middle					
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	26592.6	26592.6	3606.83	1817.78	2160.65	1840.27	813.76
	ULS Min	0	0	-1059	-10	-12	-10	-542
Shear	Fz Max	10520	10520	1427	2452	2596	2423	1226
	Fz Min	-10414	-10414	-1437	-353	-2512	-347	-385
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.488	0.648	0.179	0.174	0.175	0.176	0.155
		0.290	0.550	0.267	0.587	0.621	0.580	0.534

8 - ULS 4		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-7815	-7793	-7641	-7504	-9046	-9667	-10876	-10843	-11034	-7783	-7769	-7317	-8928.38	-9398.28	-10660.63	-10627.75	-10816.17
	ULS Min	-19496	-19451	-18375	-18227	-15131	-14285	-12345	-12283	-11791	-19031	-18998	-17920	-14777.32	-14028.87	-12157.01	-12095.08	-11602.43
IY Bending	ULS Max	1837	2475	2475	1911	655	461	1260	1260	552	1731	2331	2331	590.36	495.57	1181.94	1181.94	570.02
	ULS Min	-1695	-2284	-2280	-1607	-518	-257	-815	-815	-375	-1626	-2198	-2194	-410.44	-238.79	-897.87	-897.87	-325.68
IZ Bending	ULS Max	1551	1969	3476	11310	2346	787	787	71	619	1542	2013	10643	2490.66	391.74	1112.47	1112.47	258.96
	ULS Min	-1588	-2020	-3347	-10288	-2427	-414	-1122	-1122	-270	-1364	-1786	-10689	-2196	-789.59	-789.71	-86.35	-570.24
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	54	73	73	56	20	14	44	44	19	51	69	69	18	15	41	41	20
	Stress Z	39	49	85	277	51	16	36	36	20	38	49	262	52	17	36	36	18
Force (kn) =		12360	16264	20991	44231	11310	4898	8553	8553	4184	11794	15675	43862	11205	5075	8230	8230	4085
Tension Combined Force (kN) =		4545	8471	13351	36727	2264	-4769	-2323	-2290	-6850	4012	7906	36545	2277	-4323	-2430	-2398	-6731
Compression Combined Force (kN) =		-31857	-35715	-39366	-62458	-26440	-19183	-20898	-20836	-15975	-30825	-34673	-61782	-25982	-19104	-20387	-20325	-15687
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	0.10	0.20	0.31	0.85	0.04	NA	NA	NA	NA	0.09	0.18	0.84	0.04	NA	NA	NA	NA
		0.79	0.89	0.98	1.55	0.66	0.48	0.64	0.64	0.489	0.77	0.86	1.53	0.65	0.47	0.62	0.62	0.48

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	2283	2294	2288	2459	1022	-100	-758	-879	-1309	2287.65	2307.8	2509.06	1138.77	97.49	-584.41	-726.2	-1138.61
	ULS Min	-9487	-9467	-7199	-7084	-4931	-3443	-2196	-1681	-1486	-8784.31	-8754.87	-6587.1	-4611.9	-3270.33	-2083.7	-1523.65	-1288.3
IY Bending	ULS Max	717	960	965	513	272	75	102	166	168	576.81	781.37	785.46	261.88	77.6	101.6	171.14	172.19
	ULS Min	-629	-850	-850	-467	-184	27	31	30	-145	-543.86	-740.73	-740.4	-173.9	32.17	27.18	27.19	-277.78
IZ Bending	ULS Max	640	714	981	5184	877	115	70	286	461	489.32	587.48	4851.56	910.63	134.47	45.4	186.77	186.81
	ULS Min	-680	-783	-1033	-4841	-926	-148	-56	-87	-89	-457.37	-536.01	-4771.57	-777.26	-123.64	-71.02	-188.14	-616.91
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	34	46	46	25	13	4	5	8	8	28	37	38	13	4	5	8	13
	Stress Z	21	25	33	164	29	5	2	9	15	15	19	153	29	4	2	6	19
Force (kn) =		4362	5527	6161	14706	3302	645	556	1327	1768	3366	4374	14907	3226	622	556	1105	2562
Tension Combined Force (kN) =		6645	7821	8450	17165	4325	545	-202	449	460	5654	6682	17416	4365	720	-29	379	1423
Compression Combined Force (kN) =		-13849	-14994	-13360	-21790	-8234	-4088	-2752	-3008	-3255	-12151	-13129	-21494	-7838	-3893	-2639	-2628	-3850
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	0.31	0.36	0.39	0.79	0.20	0.03	NA	0.02	0.02	0.26	0.31	0.80	0.20	0.03	NA	0.02	0.07
		0.89	0.96	0.86	1.40	0.52	0.26	0.17	0.19	0.20	0.78	0.84	1.38	0.50	0.25	0.17	0.17	0.24

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
								Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	Horizontal 4 (AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	787.15	787.15	409.58	424.81	622.26	163.98	1203.54	1115.56	740.7	785.78	765.35	832.17	448.54	398.74	-47.52	-37.99	111.2	-681.62
	ULS Min	-307.51	-307.51	188.06	209.88	179.91	14.82	-2037.26	-1659.44	-1305.54	-1153.69	-1263.6	-1123.95	-1066.15	-859.85	-604.06	-556.07	-53.5	-837.27
IY Bending	ULS Max	0	0	56.35	55.48	49.56	43.88	13.7	0	17.34	28.06	18.2	40.29	10.68	36.95	6.65	29.38	0	28.25
	ULS Min	0	0	0	0	0	0	-41.44	0	-33.75	-4.74	-32.17	-0.59	-34.75	0	-27.05	0	0	0
IZ Bending	ULS Max	0	0	82.4	111.56	71.54	37.49	98.3	0	91.46	31.9	72.11	5.03	75.84	8.76	77.16	10.03	0	7.15
	ULS Min	0	0	-70.87	-102.15	-112.84	-81.92	-51.72	0	-45.36	-35.3	-21.7	-8.98	-26.89	-12.21	-27.86	-10.22	0	-8.32
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	20	19	17	15	17	0	14	12	13	17	14	15	11	12	0	10
	Stress Z	0	0	9	12	12	9	11	0	10	4	8	1	9	1	9	1	0	1
Force (kn) =		0	0	512	564	529	433	456	0	392	252	347	287	371	270	321	216	0	191
Tension Combined Force (kN) =		787	787	922	988	1151	597	1660	1116	1133	1038	1112	1119	819	669	274	178	111	-490
Compression Combined Force (kN) =		-308	-308	-324	-354	-349	-419	-2494	-1659	-1698	-1406	-1610	-1411	-1437	-1130	-925	-772	-54	-1029
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.15	0.20	0.22	0.25	0.13	0.40	0.27	0.27	0.25	0.27	0.27	0.20	0.16	0.07	0.04	0.02	NA
		0.01	0.09	0.09	0.10	0.10	0.12	0.77	0.51	0.52	0.43	0.50	0.43	0.44	0.35	0.29	0.24	0.01	0.29

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
								Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	Horizontal 4 (AD54)	Horizontal 5 (A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	747.17	512.69	390.5	407.68	608.09	96.24	994.95	1133.78	672.37	669.89	738.64	734.86	364.45	443.02	-29.21	-61.26	-486.41	134.4
	ULS Min	-304.05	222.64	188.84	238.21	214.35	-9.9	-1521.09	-1786.61	-1059.14	-1179.98	-1062.29	-1162.85	-820.23	-1013.57	-537.49	-618.26	-599.73	-49.86
IY Bending	ULS Max	0	54.93	51.29	48.73	44.79	42.71	7.47	73.05	37.26	17.73	38.67	17.19	34.99	10.51	28.34	7.55	24.15	0
	ULS Min	0	-111.08	0	0	0	0	-15.95	-2.21	-7.42	-33.04	0	-31.89	0	-34.42	0	-26.68	0	0
IZ Bending	ULS Max	0	29.71	34.62	38.85	37.13	34.06	112.43	37.25	17.03	23.02	6.51	14.65	6.17	16.3	7	17.46	2.16	0
	ULS Min	0	-52.6	-12.81	-10.18	-10.41	-9.82	-65.54	-39	-12.97	-71.42	-1.61	-65.91	-1.99	-68.49	-1.61	-75.71	-9.94	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	32	18	17	16	15	7	30	16	14	16	13	15	14	12	11	8	0
	Stress Z	0	5	4	4	4	4	13	4	2	8	1	7	1	8	1	9	1	0
Force (kn) =		0	686	388	380	352	333	311	561	281	351	271	334	246	355	203	316	169	0
Tension Combined Force (kN) =		747	1198	778	788	960	429	1306	1695	953	1021	1010	1068	611	798	174	255	-318	134
Compression Combined Force (kN) =		-304	-463	-199	-142	-138	-343	-1832	-2348	-1340	-1531	-1334	-1496	-1066	-1369	-740	-935	-768	-50
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.23	0.17	0.17	0.21	0.09	0.31	0.41	0.23	0.25	0.24	0.26	0.15	0.19	0.04	0.06	NA	0.03
		0.01	0.13	0.06	0.04	0.04	0.10	0.57	0.73	0.41	0.47	0.41	0.46	0.33	0.42	0.23	0.29	0.22	0.01

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	444.47	420.26	929.65	184.81	1188.86	1101.88	593.58	649.35	212.7	150.49	-230.45	-190.47	-112.13	22.65
	ULS Min	286.87	-261.89	677.07	-461.46	-2376.76	-2454.43	-1978.22	-1919.63	-1798.25	-1855.89	-1308.41	-1272.89	-195.99	12.61
IY Bending	ULS Max	8154.97	0	30.93	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-8942.31	-59.43	0	-15.87	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	146.05	237.16	73.42	268.42	0	0	0	0	0	0	0	0	0	0
	ULS Min	-70.88	-113.92	-35.15	-99.45	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	91	19	12	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	7	17	6	22	0	0	0	0	0	0	0	0	0	0
Force (kn) =		7802	746	328	508	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		8247	1167	1258	693	1189	1102	594	649	213	150	-230	-190	-112	23
Compression Combined Force (kN) =		-7515	-1008	349	-970	-2377	-2454	-1978	-1920	-1798	-1856	-1308	-1273	-196	13
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.41	0.22	0.28	0.15	0.23	0.21	0.11	0.12	0.05	0.03	NA	NA	NA	0.02
		0.48	0.25	NA	0.27	0.63	0.65	0.52	0.51	0.54	0.56	0.39	0.38	0.63	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	244.56	208.37	305.99	113.39	145.22	643.61	604.93	398.44	418.75	295.5	275.52	317.51	278.58	44.97	32.13
	ULS Min	-13.05	-230.97	9.05	-68.62	85.86	-964.49	-970.27	-651.41	-655.92	-570.5	-555.71	-388.79	-452.15	-78.02	19.51
IY Bending	ULS Max	3981.87	15.77	20.43	16.15	114.51	0	0	0	0	0	0	0	0	0	0
	ULS Min	-4330.85	-22.72	-13.23	-18.53	89.18	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	168.59	240.22	97.95	267.63	119.24	0	0	0	0	0	0	0	0	0	0
	ULS Min	-101.12	-120.56	-56.06	-137.03	0	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	52	10	9	8	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	13	24	10	26	7	0	0	0	0	0	0	0	0	0	0
Force (kn) =		4362	545	302	559	620	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		4607	753	608	672	765	644	605	398	419	296	276	318	279	45	32
Compression Combined Force (kN) =		-4375	-776	-293	-627	-534	-964	-970	-651	-656	-571	-556	-389	-452	-78	20
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.28	0.18	0.15	0.16	0.06	0.14	0.13	0.09	0.09	0.06	0.06	0.07	0.06	0.04	0.03
		0.34	0.30	0.11	0.24	0.06	0.25	0.26	0.17	0.17	0.15	0.15	0.10	0.12	0.25	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
Members		Front Transverse Sheave Girder End	Front Transverse Sheave Girder Middle	Back Transverse Sheave Girder	G1	G2/3	G4	G6
		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	28091.35	28091.35	2422.9	2010.53	2073.59	1984.64	496.61
	ULS Min	0	0	-1130	-10	-12	-16	-509
Shear	Fz Max	11089	11089	999	2700	2717	2618	1180
	Fz Min	-11126	-11126	-1060	-276	-2730	-280	-675
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.516	0.685	0.120	0.193	0.168	0.190	0.095
		0.306	0.582	0.197	0.646	0.653	0.626	0.514

8 - ULS V1		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-15723	-15701	-14869	-14596	-13772	-13572	-13199	-13165	-12975	-15389	-15376	-14455	-13686.16	-13519.35	-13183.12	-13149.7	-12983.42
	ULS Min	-15753	-15712	-14912	-14752	-13909	-13710	-13260	-13199	-13070	-15419	-15386	-14654	-13823.25	-13656.44	-13244.51	-13183.12	-13078.22
IY Bending	ULS Max	0	-60	-45	96	97	135	163	178	178	34	44	101	99.64	139.96	157.14	166.37	166.38
	ULS Min	-60	-86	-84	83	90	90	135	163	-37	0	34	46	88.39	88.16	139.96	157.14	2.09
IZ Bending	ULS Max	0	-50	120	469	-58	344	344	-56	288	96	128	165	198.83	198.85	56.91	276.31	276.3
	ULS Min	-50	-60	-13	268	-209	-209	-56	-275	-274	0	96	-38	171.54	-346.21	-346.18	56.91	-273.72
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	2	3	2	3	3	4	6	6	6	1	1	3	3	4	6	6	6
	Stress Z	1	1	3	11	4	7	11	9	9	2	3	4	4	7	11	9	9
Force (kn) =		399	532	718	1899	1178	1814	1791	1607	1654	443	588	933	1154	1843	1775	1569	1569
Tension Combined Force (kN) =		-15324	-15169	-14151	-12697	-12594	-11759	-11408	-11559	-11321	-14946	-14787	-13522	-12532	-11676	-11408	-11580	-11414
Compression Combined Force (kN) =		-16152	-16244	-15630	-16651	-15086	-15523	-15051	-14805	-14723	-15863	-15974	-15587	-14977	-15500	-15019	-14753	-14648
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		0.40	0.40	0.39	0.41	0.37	0.39	0.46	0.45	0.451	0.39	0.40	0.39	0.37	0.39	0.46	0.45	0.45

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	-4395	-4384	-3200	-2877	-2588	-2492	-2282	-2131	-2255	-4114.87	-4095.91	-2840.57	-2536.78	-2414.8	-2155.65	-1966.2	-2014.4
	ULS Min	-4408	-4389	-3219	-2946	-2666	-2570	-2360	-2209	-2285	-4128.11	-4100.56	-2927.92	-2614.9	-2492.92	-2233.77	-2044.32	-2045.11
IY Bending	ULS Max	3	9	11	62	58	58	60	181	176	13.38	16.41	41.82	43.25	55.88	61.64	185.25	186.4
	ULS Min	0	3	-41	-22	38	37	57	58	-178	0	7.24	8.2	42.78	42.75	55.79	61.62	-242.03
IZ Bending	ULS Max	0	-68	-39	280	-28	56	56	117	343	36.1	66.72	107.73	104.21	20.08	36.58	37.6	37.58
	ULS Min	-68	-85	-131	181	-41	-28	-47	-46	117	0	31.11	28.58	20.08	-57.39	-57.39	36.56	-563.77
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	0	0	2	3	3	3	3	9	9	1	1	2	2	3	3	9	12
	Stress Z	2	3	4	9	1	2	2	4	11	1	2	3	3	2	2	1	18
Force (kn) =		179	241	474	922	321	354	362	967	1512	139	226	422	419	351	372	786	2297
Tension Combined Force (kN) =		-4217	-4143	-2726	-1955	-2267	-2137	-1920	-1164	-742	-3976	-3870	-2418	-2118	-2064	-1783	-1180	282
Compression Combined Force (kN) =		-4587	-4629	-3693	-3868	-2986	-2924	-2722	-3176	-3797	-4267	-4327	-3350	-3034	-2844	-2606	-2831	-4342
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01
		0.29	0.30	0.24	0.25	0.19	0.19	0.17	0.20	0.24	0.27	0.28	0.21	0.19	0.18	0.17	0.18	0.27

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	236.18	236.18	366.22	402.94	510.48	252.83	-370.69	-393.98	-232.76	-252.45	-192.6	-216.38	-279.28	-295.21	-312.58	-317.05	-132.5	-887.47
	ULS Min	236.18	236.18	354.25	380.92	473.48	192.1	-412.01	-439.74	-276.85	-307.24	-237.73	-268.6	-324.22	-349.56	-358.19	-369.21	-145.66	-898.33
IY Bending	ULS Max	0	0	40	41.69	40.61	38.75	1.56	0	4.56	17.63	4.57	22.51	1.88	25.44	3.39	26.11	0	29.28
	ULS Min	0	0	0	0	0	0	-22.2	0	-23.12	0	-22.48	0	-29.55	0	-24.85	0	0	0
IZ Bending	ULS Max	0	0	0	0.33	0	0	0	0	0.6	1.12	0	0.29	0	0.98	0	2.95	0	0
	ULS Min	0	0	-6.59	-9.44	-41.95	-48.01	-1.21	0	-0.39	0	-0.68	0	-3.8	0	-6.42	0	0	-6.19
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	14	14	14	13	9	0	10	7	9	9	12	11	10	11	0	10
	Stress Z	0	0	1	1	5	5	0	0	0	0	0	0	0	0	1	0	0	1
Force (kn) =		0	0	263	279	335	335	151	0	156	120	152	152	205	173	178	181	0	194
Tension Combined Force (kN) =		236	236	629	682	846	588	-219	-394	-76	-132	-40	-65	-74	-123	-134	-136	-133	-694
Compression Combined Force (kN) =		236	236	92	102	138	-143	-563	-440	-433	-428	-390	-420	-529	-522	-537	-550	-146	-1092
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.05	0.14	0.15	0.18	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.04	0.17	0.14	0.13	0.13	0.12	0.13	0.16	0.16	0.17	0.17	0.04	0.31

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	280.09	452.87	363.29	397.69	504.02	182.69	-330.16	-314.77	-230.62	-256.02	-191.98	-209.96	-267.26	-297.52	-299.76	-347.18	-629.34	-126.66
	ULS Min	280.09	442.63	361.88	396.44	502.17	178.86	-378.75	-384.66	-285.93	-300.14	-244.28	-255.2	-322.11	-342.62	-352.53	-392.07	-641.76	-139.82
IY Bending	ULS Max	0	0	39.34	39.35	39.63	40.82	0	44.07	16.43	4.67	22.09	4.57	24.05	2.18	25.34	4.22	24.6	0
	ULS Min	0	-35.08	0	0	0	0	-4.59	0	0	-23.2	0	-22.5	0	-29.64	0	-24.97	0	0
IZ Bending	ULS Max	0	0	0	1.37	0	1.65	0	2.8	0.93	0	0.52	0	0	0.88	0.78	0.84	0.27	0
	ULS Min	0	-2.22	-1.67	0	-0.97	0	-3.83	0	0	-1.68	0	-0.29	-0.51	0	0	0	-0.54	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	10	14	14	14	14	2	18	7	10	9	9	10	12	11	10	9	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		0	191	249	248	249	258	38	301	112	159	149	152	162	201	172	169	154	0
Tension Combined Force (kN) =		280	644	612	646	753	441	-292	-14	-119	-97	-43	-58	-105	-97	-128	-178	-475	-127
Compression Combined Force (kN) =		280	252	113	148	253	-79	-417	-686	-398	-459	-394	-407	-484	-543	-524	-561	-796	-140
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.13	0.13	0.14	0.16	0.10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	0.02	0.13	0.21	0.12	0.14	0.12	0.13	0.15	0.17	0.16	0.17	0.22	0.04

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	427.65	81.62	957.21	142.34	-660.02	-689.42	-714.58	-709.44	-885.65	-889.23	-812.33	-821.26	-174.43	20.35
	ULS Min	427.65	65.33	957.21	133.93	-685.51	-714.91	-740.08	-734.94	-908	-911.59	-834.68	-843.62	-182.1	11.51
IY Bending	ULS Max	632.66	0	35.27	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-527.27	-56.06	0	-14.34	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	3.46	0	0.05	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	0.57	-0.64	0	-1.34	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	6	18	14	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		524	373	251	104	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		952	455	1208	246	-660	-689	-715	-709	-886	-889	-812	-821	-174	20
Compression Combined Force (kN) =		-97	-308	706	30	-686	-715	-740	-735	-908	-912	-835	-844	-182	12
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.05	0.09	0.26	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.08	NA	NA	0.18	0.19	0.20	0.19	0.27	0.27	0.25	0.25	0.58	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	172.01	12.99	243.47	62.3	224.58	-214.83	-221.18	-170.44	-183.11	-198.26	-178.5	-63.4	-159.89	-25.04	29.07
	ULS Min	165.04	-0.58	227.65	10.77	224.58	-237.82	-244.17	-193.44	-206.1	-221.26	-201.49	-86.39	-182.88	-33.88	20.69
IY Bending	ULS Max	255.93	10.38	17.79	11.88	96.93	0	0	0	0	0	0	0	0	0	0
	ULS Min	-221.42	-19.98	-6.41	-15.64	96.93	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	6.59	4.57	3.88	6.46	18.83	0	0	0	0	0	0	0	0	0	0
	ULS Min	-8.76	0	0	0	18.83	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	3	9	8	7	5	0	0	0	0	0	0	0	0	0	0
	Stress Z	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Force (kn) =		252	150	133	122	303	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		424	163	377	184	528	-215	-221	-170	-183	-198	-179	-63	-160	-25	29
Compression Combined Force (kN) =		-87	-151	94	-111	-78	-238	-244	-193	-206	-221	-201	-86	-183	-34	21
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.03	0.04	0.09	0.04	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.06	NA	0.04	0.01	0.06	0.06	0.05	0.05	0.06	0.05	0.02	0.05	0.11	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder End	Front Transverse Sheave Girder Middle	Back Transverse Sheave Girder	G1	G2/3	G4	G6
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	31699.22	31699.22	3891.03	2193.89	2610.2	2202.23	815.92
	ULS Min	0	0	-1141	-10	-12	-10	-589
Shear	Fz Max	12558	12558	1548	2954	3120	2884	1366
	Fz Min	-12411	-12411	-1586	-386	-3020	-389	-436
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.582	0.773	0.193	0.210	0.212	0.211	0.155
		0.346	0.657	0.294	0.707	0.746	0.690	0.595

8 - ULS V2		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-11179	-11158	-10833	-10612	-11730	-12233	-13182	-13149	-13290	-10930	-10917	-10356	-11585.15	-11973.01	-12989.13	-12956.18	-13108.45
	ULS Min	-21196	-21152	-20040	-19826	-16965	-16210	-14450	-14388	-13953	-20576	-20543	-19472	-16618.11	-15961.68	-14280.51	-14218.66	-13795.92
IY Bending	ULS Max	1538	2068	2068	1679	575	424	1127	1127	531	1508	2033	2033	520.32	454.55	1058.21	1058.21	542.04
	ULS Min	-1490	-2012	-2007	-1336	-430	-191	-651	-651	-368	-1369	-1849	-1846	-337.51	-174.9	-724.49	-724.49	-310.24
IZ Bending	ULS Max	1316	1677	3086	9920	2026	775	775	-18	613	1370	1794	9249	2213.44	391.44	970.1	970.1	302.44
	ULS Min	-1374	-1743	-2762	-8592	-2065	-419	-978	-978	-311	-1120	-1462	-9036	-1803.69	-777.71	-777.8	6.47	-566.71
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	45	61	61	50	18	13	40	40	19	45	60	60	16	14	37	37	19
	Stress Z	34	43	76	243	43	16	32	32	20	34	44	226	46	16	31	31	18
Force (kn) =		10491	13766	18134	38809	9713	4675	7565	7565	4085	10364	13795	38013	9937	4833	7280	7280	3968
Tension Combined Force (kN) =		-688	2608	7301	28196	-2016	-7557	-5617	-5584	-9205	-567	2879	27658	-1649	-7140	-5709	-5677	-9140
Compression Combined Force (kN) =		-31687	-34918	-38173	-58635	-26678	-20886	-22015	-21953	-18038	-30940	-34338	-57486	-26555	-20795	-21560	-21498	-17764
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	NA	0.06	0.17	0.65	NA	NA	NA	NA	NA	NA	0.07	0.64	NA	NA	NA	NA	NA
		0.79	0.87	0.95	1.46	0.66	0.52	0.67	0.67	0.552	0.77	0.85	1.43	0.66	0.52	0.66	0.66	0.54

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	342	353	620	947	-210	-1167	-1706	-1798	-2160	539.63	558.33	962.01	-138.54	-1013.72	-1546.82	-1641.41	-1946.25
	ULS Min	-9749	-9729	-7514	-7242	-5324	-4043	-2949	-2497	-2316	-8952.51	-8924.62	-6847.17	-5078.84	-3911.58	-2843.08	-2336.1	-2078.94
IY Bending	ULS Max	613	829	834	424	250	80	97	199	200	508.27	680.33	683.01	231.77	81.09	96.12	204.2	204.77
	ULS Min	-540	-723	-722	-416	-141	30	35	34	-193	-452.3	-624.33	-624.87	-141.75	42.15	32.32	32.33	-320.67
IZ Bending	ULS Max	501	560	836	4544	750	87	85	285	571	441.59	546.87	4280.12	831.08	125.05	55.49	183.38	183.39
	ULS Min	-631	-724	-891	-4049	-795	-141	-67	-67	-36	-369.86	-416.12	-3968.27	-615.68	-96.19	-86.94	-137.97	-795.04
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	29	40	40	20	12	4	5	10	10	24	33	33	11	4	5	10	15
	Stress Z	20	23	28	144	25	4	3	9	18	14	17	135	26	4	3	6	25
Force (kn) =		3852	4889	5319	12795	2896	645	572	1449	2157	2992	3896	13114	2918	612	574	1217	3161
Tension Combined Force (kN) =		4194	5242	5939	13743	2686	-522	-1134	-349	-2	3532	4454	14076	2779	-402	-973	-425	1215
Compression Combined Force (kN) =		-13601	-14618	-12833	-20037	-8221	-4688	-3521	-3945	-4473	-11945	-12821	-19961	-7996	-4524	-3417	-3553	-5240
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	0.19	0.24	0.27	0.63	0.12	NA	NA	NA	NA	0.16	0.20	0.65	0.13	NA	NA	NA	0.06
		0.87	0.94	0.82	1.28	0.52	0.30	0.22	0.25	0.28	0.77	0.82	1.28	0.51	0.29	0.22	0.23	0.33

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	734.59	734.59	470.14	491.95	685.44	300.33	906.86	823.47	558.37	586.82	590.33	637.21	291.3	238.73	-129.58	-123.82	-76.41	-833.68
	ULS Min	-203.68	-203.68	280.27	307.72	306.21	152.2	-1877.01	-1561.84	-1201.96	-1083.62	-1155.35	-1046.91	-1013.57	-848.06	-613.48	-575.62	-219.46	-968.03
IY Bending	ULS Max	0	0	54.14	54.11	48.54	42.51	11.52	0	15.38	25.6	16.18	39.32	8.97	37.4	5.59	30.89	0	30.66
	ULS Min	0	0	0	0	0	0	-39.42	0	-33.05	-2.79	-31.43	0	-35.63	0	-28.49	0	0	0
IZ Bending	ULS Max	0	0	68.07	91.69	45.61	26.35	83.36	0	77.54	28.36	61.68	4.38	64.1	7.9	63.59	9.53	0	4.39
	ULS Min	0	0	-63.3	-91.49	-112.43	-87.57	-45.65	0	-39.74	-29.24	-18.74	-7.75	-23.98	-10.28	-26.47	-8.04	0	-9.53
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	19	19	17	15	16	0	14	11	13	16	15	16	12	13	0	11
	Stress Z	0	0	7	10	12	9	9	0	9	3	7	1	7	1	7	1	0	1
	Force (kn) =	0	0	471	516	522	436	416	0	362	225	323	278	355	270	306	225	0	209
	Tension Combined Force (kN) =	735	735	941	1008	1207	736	1323	823	921	812	913	915	647	508	177	101	-76	-625
	Compression Combined Force (kN) =	-204	-204	-190	-209	-216	-284	-2293	-1562	-1564	-1308	-1478	-1325	-1369	-1118	-920	-800	-219	-1177
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.14	0.21	0.22	0.26	0.16	0.32	0.20	0.22	0.20	0.22	0.22	0.16	0.12	0.04	0.02	NA	NA
		0.01	0.06	0.05	0.06	0.06	0.08	0.71	0.48	0.48	0.40	0.46	0.41	0.42	0.34	0.28	0.25	0.06	0.33

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	741.07	583.39	453.95	477.66	675.96	227.23	748.82	858.83	498.03	486.63	567.18	554.68	220.56	276.69	-106.44	-155.56	-591.2	-66.04
	ULS Min	-159.97	331.83	281.1	332.39	338.46	134.82	-1415.89	-1657.68	-994.24	-1105.43	-983.92	-1078.62	-803.04	-978.43	-550.11	-639.59	-689.77	-225.86
IY Bending	ULS Max	0	34.48	48.61	47.37	44.05	42.35	5.62	71.89	35.27	15.79	37.71	15.39	35.2	8.98	29.62	6.71	25.69	0
	ULS Min	0	-107.82	0	0	0	0	-14.45	0	-3.02	-32.35	0	-31.08	0	-35.29	0	-28.27	0	0
IZ Bending	ULS Max	0	26.19	29.18	33.78	31.47	30.95	96.06	32.17	15.03	19.06	5.83	12.58	5.21	14.24	6.4	15.59	2.41	0
	ULS Min	0	-44.8	-11.54	-8.25	-9.41	-6.85	-56.48	-33.9	-10.69	-61.89	-1.24	-56.47	-1.94	-58.46	-1.15	-64.3	-7.99	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	31	17	16	15	15	6	30	15	13	16	13	15	15	12	12	9	0
	Stress Z	0	4	3	4	3	3	11	4	2	7	1	6	1	7	1	7	1	0
	Force (kn) =	0	655	360	362	336	325	271	544	264	329	264	311	246	343	210	306	175	0
	Tension Combined Force (kN) =	741	1238	814	839	1012	552	1020	1403	762	816	831	866	466	620	104	151	-416	-66
	Compression Combined Force (kN) =	-160	-323	-79	-29	2	-190	-1687	-2202	-1258	-1435	-1248	-1390	-1049	-1321	-761	-946	-865	-226
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.24	0.18	0.18	0.22	0.12	0.25	0.34	0.18	0.20	0.20	0.21	0.11	0.15	0.03	0.04	NA	NA
		0.00	0.09	0.02	0.01	NA	0.05	0.52	0.68	0.39	0.44	0.38	0.43	0.32	0.41	0.23	0.29	0.24	0.06

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	507.3	388.45	1075.44	200.15	841.5	743.01	293.95	346.32	-71.84	-129.63	-445.3	-410.92	-148.19	20.37
	ULS Min	372.22	-209.26	858.95	-356.72	-2218.39	-2308.9	-1914.09	-1859.3	-1798.69	-1852.58	-1372.45	-1341.9	-221.17	10.5
IY Bending	ULS Max	7036.79	0	39.28	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-7875.79	-62.49	0	-15.01	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	129.44	203.08	62.93	229.66	0	0	0	0	0	0	0	0	0	0
	ULS Min	-56.5	-97.84	-30.13	-85.66	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	80	20	16	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	7	15	5	19	0	0	0	0	0	0	0	0	0	0
Force (kn) =		6875	716	372	445	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		7382	1104	1448	645	842	743	294	346	-72	-130	-445	-411	-148	20
Compression Combined Force (kN) =		-6503	-925	487	-802	-2218	-2309	-1914	-1859	-1799	-1853	-1372	-1342	-221	11
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.36	0.21	0.32	0.14	0.16	0.14	0.06	0.07	NA	NA	NA	NA	NA	0.02
		0.41	0.23	NA	0.22	0.58	0.61	0.50	0.49	0.54	0.55	0.41	0.40	0.71	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	283.94	185.86	371.39	121.34	244.35	467.05	430.62	256.72	265.86	165.53	159.12	220.23	146.51	22.08	30.95
	ULS Min	65.08	-190.71	111.61	-34.67	190.37	-914.61	-922.84	-646.44	-658.57	-580.04	-556.65	-388.46	-483.12	-84.6	18.92
IY Bending	ULS Max	3483.84	14.78	20.97	14.97	109.57	0	0	0	0	0	0	0	0	0	0
	ULS Min	-3814.96	-23.02	-9.2	-17.57	89.14	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	140.88	206.51	84.5	229.84	98.72	0	0	0	0	0	0	0	0	0	0
	ULS Min	-90.3	-102.73	-47.51	-117.01	0	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	46	10	9	8	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	11	20	8	23	6	0	0	0	0	0	0	0	0	0	0
Force (kn) =		3803	493	284	492	552	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		4087	679	656	613	796	467	431	257	266	166	159	220	147	22	31
Compression Combined Force (kN) =		-3738	-684	-173	-526	-361	-915	-923	-646	-659	-580	-557	-388	-483	-85	19
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.24	0.16	0.16	0.15	0.07	0.10	0.09	0.06	0.06	0.04	0.03	0.05	0.03	0.02	0.02
		0.29	0.26	0.07	0.20	0.04	0.24	0.24	0.17	0.17	0.15	0.15	0.10	0.13	0.27	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder End	Front Transverse Sheave Girder Middle	Back Transverse Sheave Girder	G1	G2/3	G4	G6
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	33416.06	33416.06	3957.02	2349.98	2463.26	2351.48	965.27
	ULS Min	0	0	-1480	-10	-12	-15	-688
Shear	Fz Max	13122	13122	1530	3158	3239	3099	1596
	Fz Min	-13143	-13143	-1571	-397	-3213	-380	-684
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.613	0.815	0.196	0.225	0.200	0.225	0.184
		0.362	0.687	0.292	0.756	0.775	0.741	0.695

8 - ULS V3		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-9950	-9929	-9733	-9525	-11131	-11810	-13091	-13058	-13282	-9723	-9710	-9240	-10972.38	-11498.77	-12854.23	-12821.39	-13052.87
	ULS Min	-22464	-22419	-21230	-21003	-17641	-16747	-14660	-14598	-14086	-21773	-21740	-20586	-17229.31	-16450.33	-14453.11	-14391.14	-13888.51
IY Bending	ULS Max	1937	2606	2606	2078	694	496	1367	1367	617	1877	2530	2529	624.57	532.33	1281.89	1281.89	633.98
	ULS Min	-1847	-2493	-2488	-1691	-563	-274	-856	-856	-448	-1720	-2323	-2319	-447.72	-254.49	-946.48	-946.48	-385.77
IZ Bending	ULS Max	1658	2111	3828	12282	2548	880	881	47	693	1689	2210	11572	2723.59	438.21	1198.11	1198.11	307.31
	ULS Min	-1705	-2163	-3483	-10859	-2566	-470	-1208	-1208	-318	-1424	-1859	-11284	-2297.83	-883.32	-883.44	-62.66	-638.54
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	57	77	77	61	22	15	48	48	22	55	75	75	19	17	45	45	22
	Stress Z	42	53	94	301	54	18	39	39	22	41	54	283	57	18	39	39	21
Force (kn) =		13131	17242	22651	48043	11968	5379	9248	9248	4680	12843	17096	47508	12149	5569	8897	8897	4558
Tension Combined Force (kN) =		3181	7313	12919	38518	837	-6431	-3843	-3810	-8602	3120	7386	38268	1177	-5930	-3957	-3924	-8495
Compression Combined Force (kN) =		-35595	-39661	-43882	-69047	-29608	-22126	-23909	-23847	-18766	-34616	-38836	-68094	-29379	-22019	-23350	-23288	-18447
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	0.07	0.17	0.30	0.89	0.02	NA	NA	NA	NA	0.07	0.17	0.88	0.02	NA	NA	NA	NA
		0.88	0.99	1.09	1.72	0.74	0.55	0.73	0.73	0.575	0.86	0.96	1.69	0.73	0.55	0.72	0.71	0.56

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	1537	1547	1584	1912	393	-827	-1553	-1706	-2129	1713.25	1731.88	1921.4	469.64	-654.68	-1386.1	-1551.66	-1922.74
	ULS Min	-11074	-11053	-8579	-8307	-5980	-4402	-3088	-2560	-2317	-10148.62	-10120.64	-7818.24	-5686.21	-4257.47	-2986.9	-2400.49	-2080.93
IY Bending	ULS Max	766	1034	1039	536	298	85	105	203	205	632.04	848.65	851.76	278.52	86.94	104.35	208.12	208.54
	ULS Min	-676	-906	-905	-514	-192	28	29	28	-197	-568.68	-782.16	-783.09	-188.38	38.26	24.61	24.62	-339.69
IZ Bending	ULS Max	643	721	1054	5635	948	113	92	326	628	542.92	666.85	5323.23	1012.7	151.18	60.04	220.03	220.04
	ULS Min	-771	-884	-1104	-5107	-983	-169	-72	-74	-75	-471.39	-536.88	-4987.26	-795.75	-125.36	-94.1	-181.66	-851.86
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	37	50	50	26	14	4	5	10	10	30	41	41	13	4	5	10	16
	Stress Z	24	28	35	178	31	5	3	10	20	17	21	168	32	5	3	7	27
Force (kn) =		4770	6051	6614	15903	3539	733	622	1565	2316	3705	4822	16318	3541	698	623	1322	3373
Tension Combined Force (kN) =		6307	7598	8198	17816	3932	-93	-930	-141	187	5419	6554	18240	4010	44	-763	-230	1450
Compression Combined Force (kN) =		-15844	-17104	-15193	-24210	-9518	-5135	-3710	-4125	-4633	-13854	-14943	-24137	-9227	-4956	-3610	-3722	-5454
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	0.29	0.35	0.38	0.82	0.18	NA	NA	NA	0.01	0.25	0.30	0.84	0.18	0.00	NA	NA	0.07
		1.02	1.10	0.97	1.55	0.60	0.33	0.24	0.26	0.29	0.89	0.96	1.55	0.59	0.31	0.23	0.24	0.34

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	857.86	857.86	494.29	513.32	730.39	308.16	1228.3	1129.94	757.65	798.15	787.37	851.93	435.83	374.21	-81.96	-74.29	-57.96	-818.55
	ULS Min	-314.98	-314.98	256.95	283.04	256.45	137.69	-2241.21	-1840.24	-1431.75	-1276.18	-1383.46	-1240.15	-1184.03	-970.66	-675.42	-625.95	-233.48	-983.79
IY Bending	ULS Max	0	0	57.67	57.19	50.52	43.47	14.06	0	18.1	29.05	19.1	43.47	10.78	40.32	6.17	32.02	0	30.97
	ULS Min	0	0	0	0	0	0	-43.64	0	-35.46	-6.1	-33.59	-0.32	-37.03	0	-29.28	0	0	0
IZ Bending	ULS Max	0	0	86.63	116.83	67.61	37.37	104.37	0	97.02	35.28	77.17	5.4	80.86	9.63	80.97	11.15	0	6.51
	ULS Min	0	0	-77.58	-112.14	-129.94	-97.44	-56.76	0	-49.58	-36.72	-23.36	-9.68	-29.22	-12.93	-31.58	-10.62	0	-10.37
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	20	20	18	15	18	0	15	12	14	18	15	17	12	13	0	11
	Stress Z	0	0	9	13	14	11	12	0	11	4	9	1	9	1	9	1	0	1
Force (kn) =		0	0	529	584	568	461	482	0	414	262	365	309	395	294	343	235	0	212
Tension Combined Force (kN) =		858	858	1023	1098	1299	769	1710	1130	1172	1060	1153	1161	831	668	261	161	-58	-607
Compression Combined Force (kN) =		-315	-315	-272	-301	-312	-323	-2723	-1840	-1846	-1538	-1749	-1550	-1579	-1265	-1019	-861	-233	-1196
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.17	0.22	0.24	0.28	0.17	0.41	0.27	0.28	0.26	0.28	0.28	0.20	0.16	0.06	0.04	NA	NA
		0.01	0.09	0.08	0.09	0.09	0.09	0.84	0.57	0.57	0.47	0.54	0.48	0.49	0.39	0.31	0.27	0.07	0.33

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	855.01	613.55	474.55	495.64	716.47	234.51	1020.53	1153.9	681.68	673.81	758.28	747.11	344.49	422.11	-56.91	-105.74	-581.51	-46.11
	ULS Min	-271.3	301.7	258.49	314.06	294.6	119.95	-1673.17	-1974.18	-1169.8	-1305.24	-1167.51	-1283.2	-921.27	-1135.52	-598.27	-699.56	-701.62	-242.59
IY Bending	ULS Max	0	52.11	53.1	49.54	45.15	42.75	8.13	78.75	39.94	18.6	41.57	18.12	37.92	10.72	30.62	7.36	25.95	0
	ULS Min	0	-125.76	0	0	0	0	-16.96	-3.2	-7.92	-34.56	0	-33.15	0	-36.59	0	-28.97	0	0
IZ Bending	ULS Max	0	32.92	36.85	41.91	39.51	38.3	121.02	39.51	18.66	24.24	7.16	15.81	6.56	17.57	7.8	19.39	2.96	0
	ULS Min	0	-55.43	-13.99	-10.63	-11.52	-8.82	-69.66	-42.42	-13.48	-76.94	-1.63	-70.51	-2.29	-73.28	-1.53	-80.44	-9.84	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	37	18	17	16	15	7	33	17	14	17	14	16	15	13	12	9	0
	Stress Z	0	5	4	5	4	4	14	5	2	9	1	8	1	8	1	9	1	0
Force (kn) =		0	769	403	391	359	342	333	606	302	371	292	350	266	378	220	340	180	0
Tension Combined Force (kN) =		855	1383	878	887	1075	576	1354	1759	984	1045	1050	1097	611	801	163	235	-402	-46
Compression Combined Force (kN) =		-271	-467	-145	-77	-64	-222	-2006	-2580	-1472	-1677	-1460	-1634	-1188	-1514	-818	-1040	-881	-243
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.02	0.27	0.19	0.19	0.24	0.13	0.33	0.42	0.24	0.25	0.25	0.26	0.15	0.19	0.04	0.06	NA	NA
		0.01	0.13	0.04	0.02	0.02	0.06	0.62	0.80	0.45	0.52	0.45	0.50	0.37	0.47	0.25	0.32	0.25	0.07

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	524.77	464.61	1098.66	213.76	1220.98	1105.16	550.96	615.2	137.47	66.07	-347.71	-302.38	-140.37	20.46
	ULS Min	355.92	-278.44	828.05	-480.19	-2597.5	-2703.35	-2202.72	-2135.45	-2015.52	-2082.03	-1501.07	-1460.53	-229.67	10.34
IY Bending	ULS Max	8851.51	0	39.94	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-9711.3	-63.94	0	-15.21	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	161.37	253.99	78.65	287.37	0	0	0	0	0	0	0	0	0	0
	ULS Min	-71.05	-122.13	-37.67	-106.73	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	98	21	16	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	8	19	6	23	0	0	0	0	0	0	0	0	0	0
Force (kn) =		8484	801	400	531	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		9009	1266	1499	745	1221	1105	551	615	137	66	-348	-302	-140	20
Compression Combined Force (kN) =		-8128	-1080	428	-1012	-2598	-2703	-2203	-2135	-2016	-2082	-1501	-1461	-230	10
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.44	0.24	0.33	0.16	0.23	0.21	0.11	0.12	0.03	0.01	NA	NA	NA	0.02
		0.52	0.27	NA	0.28	0.68	0.71	0.58	0.56	0.60	0.62	0.45	0.44	0.74	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	311.48	229.22	402.46	135.87	248.71	638.14	594.25	364.31	378.87	257.15	244.21	291.72	223.89	34.06	31.42
	ULS Min	38.04	-241.49	80.52	-59.14	182.57	-1083.18	-1091.82	-758.88	-770.92	-669.06	-644.75	-463.39	-557.4	-97.08	18.49
IY Bending	ULS Max	4354.35	15.9	22.3	16.26	113.04	0	0	0	0	0	0	0	0	0	0
	ULS Min	-4713.02	-23.77	-9.93	-18.06	87.62	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	177.5	257.41	105.04	286.94	128.12	0	0	0	0	0	0	0	0	0	0
	ULS Min	-111.47	-129.15	-59.97	-146.62	0	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	57	11	10	8	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	14	25	10	28	7	0	0	0	0	0	0	0	0	0	0
Force (kn) =		4716	580	327	586	640	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		5028	809	729	722	889	638	594	364	379	257	244	292	224	34	31
Compression Combined Force (kN) =		-4678	-821	-246	-645	-458	-1083	-1092	-759	-771	-669	-645	-463	-557	-97	18
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.30	0.19	0.18	0.17	0.07	0.14	0.13	0.08	0.08	0.06	0.05	0.06	0.05	0.03	0.03
		0.36	0.32	0.09	0.25	0.05	0.29	0.29	0.20	0.20	0.18	0.17	0.12	0.15	0.31	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
		Front Transverse Sheave Girder	Front Transverse Sheave Girder	Back Transverse Sheave Girder	G1	G2/3	G4	G6
		End	Middle					
Members		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	33781.75	33781.75	3965.71	2371.13	2467.67	2394.28	1002.72
	ULS Min	0	0	-1562	-10	-12	-17	-710
Shear	Fz Max	13192	13192	1521	3185	3245	3156	1647
	Fz Min	-13255	-13255	-1562	-399	-3237	-378	-746
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.620	0.824	0.197	0.227	0.200	0.229	0.191
		0.365	0.693	0.290	0.762	0.776	0.755	0.717

8 - ULS V4		North Tower																
		Rail Side Columns									HWY Side Columns							
		Front Leg (100-110)									Front Leg (200-209)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		A20R & B20L				A34R&L	A39R&L	A39R&L	D39R&L	C39R&L	A20R & B20L			A34R&L	A39R&L	A39R&L	D39R&L	C39R&L
		100	101	102	103	104	105	106	107	108	200	201	202	203	204	205	206	207
Axial	ULS Max	-8103	-8082	-7341	-7068	-6538	-6333	-6050	-6017	-5792	-7711	-7697	-6865	-6392.04	-6211.72	-5957.5	-5924.08	-5724.31
	ULS Min	-8134	-8092	-7384	-7225	-6675	-6470	-6111	-6050	-5887	-7741	-7707	-7064	-6529.13	-6348.82	-6018.89	-5957.5	-5819.11
IY Bending	ULS Max	0	-67	-85	43	11	43	43	6	241	33	44	45	8.26	46.41	46.41	-0.8	277.32
	ULS Min	-67	-95	-92	-12	-11	11	6	-14	-14	0	33	-8	-9.16	8.1	-0.8	-26.61	-26.61
IZ Bending	ULS Max	0	-31	120	349	-29	158	158	-22	121	76	101	138	141.14	84.23	21.67	119.56	119.56
	ULS Min	-31	-35	20	268	-97	-97	-22	-119	-119	0	76	67	84.21	-158.2	-158.19	21.67	-110.69
Section Properties	Area =	132671	132671	132671	132671	158961	158961	106462	106462	106462	132671	132671	132671	158961.34	158961.34	106461.805	106461.805	106461.805
	Iy =	20635	20635	20635	20635	19626	19626	17389	17389	17389	20635	20635	20635	19625.73448	19625.73448	17389.2647	17389.2647	17389.2647
	Iz =	26281	26281	26281	26281	26312	26312	17179	17179	17179	26281	26281	26281	26311.65019	26311.65019	17178.70025	17178.70025	17178.70025
	Y	610	610	610	610	610	610	610	610	610	610	610	610	609.6	609.6	609.6	609.6	609.6
	Z	644	644	644	644	551	551	554	554	554	644	644	644	550.9396156	550.9396156	553.9371259	553.9371259	553.9371259
	Stress Y	2	3	3	1	0	1	2	0	8	1	1	1	0	1	2	1	10
	Stress Z	1	1	3	9	2	3	5	4	4	2	2	3	3	3	5	4	4
Force (kn) =		362	484	751	1302	379	739	703	461	1313	376	500	627	515	756	716	510	1445
Tension Combined Force (kN) =		-7741	-7598	-6590	-5766	-6159	-5594	-5347	-5555	-4479	-7334	-7197	-6238	-5877	-5456	-5241	-5414	-4279
Compression Combined Force (kN) =		-8496	-8576	-8135	-8526	-7054	-7208	-6814	-6511	-7200	-8117	-8208	-7691	-7044	-7105	-6735	-6467	-7265
ULS Capacity	Tension (kN)	43304	43304	43304	43304	51885	51885	34749	34749	34749	43304	43304	43304	51885	51885	34749	34749	34749
	Compression (kN)	40249	40249	40249	40249	40249	40249	32651	32651	32651	40249	40249	40249	40249	40249	32651	32651	32651
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		0.21	0.21	0.20	0.21	0.18	0.18	0.21	0.20	0.221	0.20	0.20	0.19	0.18	0.18	0.21	0.20	0.22

		North Tower																
		Rail Side Columns									HWY Side Columns							
		Rear Leg (300-310)									Rear Leg (400-409)							
		Panel 1				Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 1			Panel 2	Panel 3	Panel 4	Panel 5	Panel 6
		300	301	302	303	304	305	306	307	308	400	401	402	403	404	405	406	407
Axial	ULS Max	-4755	-4744	-3640	-3317	-2973	-2863	-2682	-2545	-2774	-4455.7	-4436.74	-3252.03	-2906.08	-2775.12	-2549.81	-2374.12	-2544.9
	ULS Min	-4769	-4749	-3659	-3385	-3051	-2941	-2760	-2624	-2805	-4468.93	-4441.39	-3339.38	-2984.2	-2853.23	-2627.93	-2452.24	-2575.62
IY Bending	ULS Max	1	5	8	17	14	15	14	162	159	17.8	20.96	13.78	7.59	12.04	12	149.55	148.62
	ULS Min	0	1	-43	-28	4	4	3	2	-251	0	12.78	-0.33	1.13	7.58	8.45	8.43	-260.5
IZ Bending	ULS Max	0	-66	-41	278	-33	65	65	88	497	35.7	66.9	107.97	107.63	24.89	36.92	95.03	94.99
	ULS Min	-66	-83	-136	194	-43	-33	-48	-46	88	0	30.5	29.08	24.89	-66.09	-66.09	36.91	-768.97
Section Properties	Area =	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076	78076
	Iy =	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343	8343
	Iz =	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468	13468
	Y	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Z	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
	Stress Y	0	0	2	1	1	1	1	8	12	1	1	1	0	1	1	7	12
	Stress Z	2	3	4	9	1	2	2	3	16	1	2	3	3	2	2	3	24
Force (kn) =		165	223	498	789	160	215	213	825	2165	155	243	318	294	208	208	794	2872
Tension Combined Force (kN) =		-4590	-4521	-3142	-2528	-2813	-2648	-2469	-1721	-609	-4301	-4193	-2934	-2612	-2567	-2342	-1580	327
Compression Combined Force (kN) =		-4934	-4972	-4157	-4174	-3211	-3156	-2973	-3448	-4970	-4624	-4685	-3657	-3278	-3061	-2836	-3247	-5448
ULS Capacity	Tension (kN)	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768	21768
	Compression (kN)	15598	15598	15598	15598	15740	15740	15740	15740	16081	15598	15598	15598	15740	15740	15740	15740	16081
	Demand/Capacity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.32	0.32	0.27	0.27	0.20	0.20	0.19	0.22	0.31	0.30	0.30	0.23	0.21	0.19	0.18	0.21	0.34

		1000	1003	1012	1018	1024	1030	1100	1103	1105	1108	1111	1114	1117	1120	1123	1126	1129	1130
		Tower - West Panel																	
		Horizontals						Bracing											
						Horizontal 4		Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
	Top Down Defined	Jacking Girder (A15)	Horizontal 1 (A75)	Horizontal 2 (C54)	Horizontal 3 (C54)	(AC54)	Horizontal 5 (B81)	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front
	Element #	1000	1001-1006	1007-1012	1013-1018	1019-1024	1025-1030	1100-1102	1103-1104	1105-1107	1108-1110	1111-1113	1114-1116	1117-1119	1120-1122	1123-1125	1126-1128	1129	1130-1131
Axial	ULS Max	158.17	158.17	236.78	249.11	297.1	43.6	-257.54	-268.17	-139.63	-153.85	-112.92	-132.17	-153.05	-158.7	-152.19	-244.54	50.37	-988.43
	ULS Min	158.17	158.17	227.9	235.7	272.97	-7.21	-298.99	-311.02	-184.44	-205.34	-158.56	-181.4	-198.83	-208.77	-198.3	-292.41	37.21	-998.77
IY Bending	ULS Max	0	0	39.18	40.8	40.12	39.73	7.49	0	7.47	14.54	7.35	18.9	6.05	20.2	6.65	21.76	0	29.93
	ULS Min	0	0	0	0	0	0	-12.45	0	-14.11	0	-13.68	0	-16.86	0	-12.97	0	0	0
IZ Bending	ULS Max	0	0	0	0	0	0	0	0	0.07	1.33	0	0	0	1.08	0	3.13	0	0
	ULS Min	0	0	-6.98	-15.69	-51.92	-59.63	-1.41	0	-0.92	0	-1.55	-0.06	-3.52	0	-7.62	0	0	-6.7
Section Properties	Area =	110495.33	18369	18029	18029	18028.76	18028.76	16109	16109	16109	16109	16109	16109	16109	16109	16109	16109	17745	17745
	Iy =	60028.90917	1371	1150	1150	1149.89	1149.89	956	956	956	956	956	956	956	956	956	956	1133	1133
	Iz =	15720.96114	3229	2885	2885	2884.72	2884.72	2766	2766	2766	2766	2766	2766	2766	2766	2766	2766	3055	3055
	Y	400.05	398	398	398	398.47	398.47	398	398	398	398	398	398	398	398	398	398	398	398
	Z	871.9163982	311	311	311	311.15	311.15	311	311	311	311	311	311	311	311	311	311	311	311
	Stress Y	0	0	14	14	14	14	5	0	6	6	6	8	7	8	5	9	0	11
	Stress Z	0	0	1	2	6	6	0	0	0	0	0	0	0	0	1	0	0	1
Force (kn) =		0	0	258	285	352	364	86	0	96	100	95	127	120	138	101	152	0	199
Tension Combined Force (kN) =		158	158	495	535	649	408	-171	-268	-43	-54	-18	-5	-33	-21	-51	-93	50	-790
Compression Combined Force (kN) =		158	158	-30	-50	-79	-371	-385	-311	-281	-305	-253	-308	-318	-346	-299	-444	37	-1198
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4573.86	4573.86	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3485.52	3485.52	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.00	0.03	0.11	0.12	0.14	0.09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01	NA
		NA	NA	0.01	0.01	0.02	0.11	0.12	0.10	0.09	0.09	0.08	0.09	0.10	0.11	0.09	0.14	NA	0.34

		2000	2001	2003	2005	2007	2009	2100	2102	2105	2108	2111	2114	2117	2120	2123	2126	2129	2131
		Tower - East Panel																	
		Horizontals						Bracing											
						Horizontal 4	Horizontal 5	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6	
		Jacking Girder (A15)	Horizontal 1 (B57)	Horizontal 2 (D54)	Horizontal 3 (D54)	(AD54)	(A81)	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear	Rear to Front	Front to Rear
	Element #	2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2100-2101	2102-2104	2105-2107	2108-2110	2111-2113	2114-2116	2117-2119	2120-2122	2123-2125	2126-2128	2129-2130	2131
Axial	ULS Max	203.45	296.18	230.35	241.52	286.3	-34.88	-208.9	-219.79	-136.76	-154.52	-110.26	-127.35	-130.62	-169.68	-225.05	-187.19	-769.77	100.47
	ULS Min	203.45	288.27	229.11	240.51	284.13	-40.03	-255.08	-285.42	-188.68	-199.24	-159.57	-173.16	-181.14	-215.48	-273.46	-232.71	-781.41	87.31
IY Bending	ULS Max	0	0	39	38.94	39.33	41.42	0	37.96	13.62	7.6	18.38	7.47	18.99	6.32	20.82	7.51	25.91	0
	ULS Min	0	-20.35	0	0	0	0	-11.24	0	0	-14.15	0	-13.65	0	-16.92	0	-12.94	0	0
IZ Bending	ULS Max	0	0	0	1.27	0	2.34	0	2.13	0.88	0	0.44	0.69	0	0.35	0.75	1.73	0.45	0
	ULS Min	0	-1.53	-0.9	0	-1.14	0	-2.91	0	0	-1.12	0	0	-0.44	-0.25	0	0	-0.39	0
Section Properties	Area =	110495.33	18369.14	18028.764	18028.764	18028.764	18028.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	16108.764	17744.62	17744.62
	Iy =	60028.90917	1371.016958	1149.890539	1149.890539	1149.890539	1149.890539	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	956.0877582	1133.054448	1133.054448
	Iz =	15720.96114	3228.542896	2884.721681	2884.721681	2884.721681	2884.721681	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	2766.183805	3055.225131	3055.225131
	Y	400.05	398.1875	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465	398.465
	Z	871.9163982	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15	311.15
	Stress Y	0	6	14	13	14	14	5	16	6	6	8	6	8	7	9	5	9	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		0	111	245	246	248	263	81	259	93	97	124	93	128	114	141	90	162	0
Tension Combined Force (kN) =		203	407	476	487	534	228	-128	39	-44	-57	14	-34	-2	-55	-84	-97	-607	100
Compression Combined Force (kN) =		203	177	-16	-5	36	-303	-336	-544	-282	-296	-284	-266	-309	-330	-415	-323	-944	87
ULS Capacity	Tension (kN)	36066	5121	4574	4574	4574	4574	4154	4154	4154	4154	4154	4154	4154	4154	4154	4154	4653	4653
	Compression (kN)	33409	3596	3486	3486	3486	3486	3234	3234	3247	3247	3247	3247	3247	3247	3247	3247	3572	3572
	Demand/Capacity	0.01	0.08	0.10	0.11	0.12	0.05	NA	0.01	NA	NA	0.00	NA	NA	NA	NA	NA	NA	0.02
		NA	NA	0.00	0.00	NA	0.09	0.10	0.17	0.09	0.09	0.09	0.08	0.10	0.10	0.13	0.10	0.26	NA

		3014	3016	3018	3020										
		Tower - Front Panel													
		Horizontals				Bracing									
						Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1 (A61)	Horizontal 2 (D47)	Horizontal 3 (B54)	Horizontal 4 (C47)	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		3014-3015	3016-3017	3018-3019	3020-3021	3101	3100	3103	3102	3105	3104	3107	3106	3108	3109
Axial	ULS Max	223.87	38	443.6	68.08	-322.13	-347.78	-303.76	-303.24	-421.42	-419.81	-336.61	-353.17	-69.24	27.38
	ULS Min	223.87	21.13	443.6	58.04	-347.62	-373.27	-329.26	-328.74	-443.78	-442.17	-358.96	-375.52	-76.91	18.54
IY Bending	ULS Max	358.36	0	7.36	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	-377.68	-42.86	0	-16.39	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	6.82	0	0.07	0	0	0	0	0	0	0	0	0	0	0
	ULS Min	0.17	-0.17	0	-0.39	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	79622	20305	18029	18029	20305	20305	20305	20305	18029	18029	18029	18029	4464	4464
	Iy =	47799	1389	1150	1150	1389	1389	1389	1389	1150	1150	1150	1150	1201	1201
	Iz =	17961	4258	3809	3809	4258	4258	4258	4258	3809	3809	3809	3809	16	16
	Y	484	454	454	454	454	454	454	454	454	454	454	454	108	108
	Z	911	311	311	311	311	311	311	311	311	311	311	311	452	452
	Stress Y	4	14	3	6	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Force (kn) =		332	285	52	117	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		556	323	496	185	-322	-348	-304	-303	-421	-420	-337	-353	-69	27
Compression Combined Force (kN) =		-108	-264	391	-59	-348	-373	-329	-329	-444	-442	-359	-376	-77	19
ULS Capacity	Tension (kN)	20353	5212	4574	4574	5212	5212	5212	5212	4574	4574	4574	4574	1244	1244
	Compression (kN)	15721	4051	2975	3585	3795	3795	3795	3795	3338	3338	3338	3338	312	312
	Demand/Capacity	0.03	0.06	0.11	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.07	NA	0.02	0.09	0.10	0.09	0.09	0.13	0.13	0.11	0.11	0.25	NA

		4020	4026	4032	4038	4044										
		Tower - Rear Panel														
		Horizontals					Bracing									
							Panel 2		Panel 3		Panel 4		Panel 5		Panel 2	Panel 4
		Horizontal 1	Horizontal 2	Horizontal 3	Horizontal 4	Horizontal 5	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Rail to Centre	Hwy to Centre	Vertical Strut	Vertical Strut
		4020-4025	4026-4031	4032-4037	4038-4043	4044-4048	4101	4100	4103	4102	4105	4104	4107	4106	4118	4119
Axial	ULS Max	192.92	15.87	282.66	67.57	320.33	-239.4	-250.95	-205.04	-214.11	-225.95	-205.59	-83.03	-195.99	-33.45	28.59
	ULS Min	186.01	1.08	261.15	5.37	320.33	-262.4	-273.94	-228.03	-237.1	-248.94	-228.58	-106.02	-218.99	-42.28	20.2
IY Bending	ULS Max	278.89	10.08	18.47	11.61	96.6	0	0	0	0	0	0	0	0	0	0
	ULS Min	-238.8	-20.35	-4.74	-15.3	96.6	0	0	0	0	0	0	0	0	0	0
IZ Bending	ULS Max	5.54	1.79	2.51	6.55	24.76	0	0	0	0	0	0	0	0	0	0
	ULS Min	-0.11	0	0	-0.52	24.76	0	0	0	0	0	0	0	0	0	0
Section Properties	Area =	66952	16109	16109	16109	46331	20933	20933	20933	20933	20933	20933	20933	20933	4464	4464
	Iy =	35125	956	956	956	7552	1150	1150	1150	1150	1150	1150	1150	1150	1040	1040
	Iz =	11877	3145	3145	3145	7947	3291	3291	3291	3291	3291	3291	3291	3291	16	16
	Y	424	424	424	424	424	424	424	424	424	424	424	424	424	108	422
	Z	908	311	311	311	464	311	311	311	311	311	311	311	311	422	108
	Stress Y	3	9	8	7	5	0	0	0	0	0	0	0	0	0	0
	Stress Z	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Force (kn) =		254	148	136	120	318	0	0	0	0	0	0	0	0	0	0
Tension Combined Force (kN) =		447	164	419	187	638	-239	-251	-205	-214	-226	-206	-83	-196	-33	29
Compression Combined Force (kN) =		-68	-147	125	-114	2	-262	-274	-228	-237	-249	-229	-106	-219	-42	20
ULS Capacity	Tension (kN)	16740	4154	4154	4154	12235	4574	4574	4574	4574	4574	4574	4574	4574	1244	1244
	Compression (kN)	12994	2606	2606	2606	8926	3790	3790	3790	3790	3790	3790	3790	3790	312	312
	Demand/Capacity	0.03	0.04	0.10	0.05	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
		0.01	0.06	NA	0.04	NA	0.07	0.07	0.06	0.06	0.07	0.06	0.03	0.06	0.14	NA

		Sheave Transverse			Longitudinl Girders			
		40000	40004	50000	30000	32000	34000	36000
Members		Front Transverse Sheave Girder End	Front Transverse Sheave Girder Middle	Back Transverse Sheave Girder	G1	G2/3	G4	G6
		40000-40003 & 40014-40017	40004-40013	50000-50017	30000to30028	32000to32059	34000to34029	36000to36034
IY Bending	ULS Max	11748.12	11748.12	4688.29	1360.84	4765.77	1268.79	854.59
	ULS Min	0	0	-1522	-32	-12	-30	-699
Shear	Fz Max	4698	4698	2060	180	2165	28	1621
	Fz Min	-4657	-4657	-2099	-474	-2070	-271	-539
Capacity	Mry =	54493	41010	20151	10441	12329	10441	5254
	Shear	36305	19118	5389	4180	4180	4180	2297
ULS Capacity	Demand/Capacity	0.216	0.286	0.233	0.130	0.387	0.122	0.163
		0.129	0.246	0.390	0.113	0.518	0.065	0.706

Max D/C 0.58

0 - ULS 1

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compression	Tension	Compression	Tension	Compression
Panel 1 (Bottom)	0.00	0.33	0.00	0.32	0.00	0.27	0.00	0.25
Panel 2	NA	0.29	NA	0.29	NA	0.17	NA	0.17
Panel 3	NA	0.30	NA	0.30	NA	0.16	NA	0.16
Panel 4	NA	0.36	NA	0.35	NA	0.15	NA	0.14
Panel 5	NA	0.35	NA	0.35	NA	0.17	NA	0.16
Panel 6 (Top)	NA	0.35	NA	0.34	NA	0.21	0.01	0.24

			West Panel		East Panel	
			Tension	Compression	Tension	Compression
Horizontals		Jacking Girder	0.01	NA	0.01	NA
		1	0.04	NA	0.10	NA
		2	0.12	NA	0.12	NA
		3	0.13	NA	0.12	NA
		4	0.16	NA	0.14	NA
		5	0.10	0.06	0.08	0.05
Bracing	Panel 1	Front to Rear	NA	0.15	0.01	0.19
		Rear to Front	NA	0.11	NA	0.11
	Panel 2	Front to Rear	NA	0.11	NA	0.12
		Rear to Front	NA	0.11	NA	0.10
	Panel 3	Front to Rear	NA	0.10	NA	0.11
		Rear to Front	NA	0.11	NA	0.10
	Panel 4	Front to Rear	NA	0.13	NA	0.14
		Rear to Front	NA	0.13	NA	0.12
	Panel 5	Front to Rear	NA	0.14	NA	0.14
		Rear to Front	NA	0.15	NA	0.14
	Panel 6	Front to Rear	NA	0.01	NA	0.01
		Rear to Front	NA	0.30	NA	0.23

			Front Panel		Rear Panel	
			Tension	Compression	Tension	Compression
Horizontals		1	0.04	0.01	0.02	0.01
		2	0.08	0.07	0.04	0.06
		3	0.20	NA	0.08	NA
		4	0.05	0.00	0.04	0.04
		5	-	-	0.04	0.01
Bracing	Panel 2	Rail to Centre	NA	0.14	NA	0.06
		Hwy to Centre	NA	0.15	NA	0.06
	Panel 3	Rail to Centre	NA	0.15	NA	0.04
		Hwy to Centre	NA	0.15	NA	0.05
	Panel 4	Rail to Centre	NA	0.21	NA	0.05
		Hwy to Centre	NA	0.22	NA	0.05
	Panel 5	Rail to Centre	NA	0.19	NA	0.02
		Hwy to Centre	NA	0.19	NA	0.04
	Panel 2	Vertical	NA	0.44	NA	0.09
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.58	0.49
Back Transverse Sheave Girder	0.17	0.25
G1	0.15	0.52
G2/G3	0.16	0.55
G4	0.16	0.51
G6	0.15	0.50

Max D/C 1.52

0 - ULS 4

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compressio	Tension	Compressio	Tension	Compressio
Panel 1 (Bottom)	0.87	1.52	0.87	1.51	0.79	1.39	0.80	1.37
Panel 2	0.07	0.63	0.06	0.61	0.20	0.52	0.20	0.49
Panel 3	NA	0.44	NA	0.44	0.03	0.25	0.04	0.24
Panel 4	NA	0.60	NA	0.59	NA	0.17	0.00	0.16
Panel 5	NA	0.60	NA	0.58	0.02	0.18	0.02	0.16
Panel 6 (Top)	NA	0.45	NA	0.44	0.02	0.19	0.07	0.23

			West Panel		East Panel	
			Tension	Compressio	Tension	Compression
Horizontals		Jacking Girder	0.02	0.01	0.02	0.01
		1	0.15	0.09	0.22	0.13
		2	0.20	0.10	0.16	0.06
		3	0.21	0.11	0.17	0.05
		4	0.24	0.11	0.20	0.05
		5	0.12	0.13	0.09	0.11
Bracing	Panel 1	Front to Rear	0.41	0.76	0.41	0.72
		Rear to Front	0.27	0.51	0.32	0.56
	Panel 2	Front to Rear	0.28	0.51	0.25	0.46
		Rear to Front	0.25	0.43	0.23	0.41
	Panel 3	Front to Rear	0.27	0.49	0.26	0.45
		Rear to Front	0.27	0.43	0.25	0.40
	Panel 4	Front to Rear	0.20	0.43	0.20	0.41
		Rear to Front	0.17	0.34	0.15	0.32
	Panel 5	Front to Rear	0.07	0.27	0.07	0.28
		Rear to Front	0.05	0.23	0.04	0.22
	Panel 6	Front to Rear	0.03	0.01	0.04	0.00
		Rear to Front	NA	0.29	NA	0.22

			Front Panel		Rear Panel	
			Tension	Compressio	Tension	Compression
Horizontals		1	0.40	0.48	0.27	0.34
		2	0.22	0.25	0.18	0.30
		3	0.25	NA	0.14	0.12
		4	0.15	0.27	0.16	0.24
		5	-	-	0.06	0.06
Bracing	Panel 2	Rail to Centre	0.24	0.61	0.14	0.25
		Hwy to Centre	0.22	0.63	0.13	0.25
	Panel 3	Rail to Centre	0.13	0.50	0.09	0.17
		Hwy to Centre	0.14	0.49	0.09	0.17
	Panel 4	Rail to Centre	0.06	0.52	0.07	0.15
		Hwy to Centre	0.05	0.53	0.06	0.14
	Panel 5	Rail to Centre	NA	0.37	0.07	0.10
		Hwy to Centre	NA	0.36	0.06	0.12
	Panel 2	Vertical	NA	0.57	0.04	0.24
	Panel 4	Vertical	0.02	NA	0.03	NA

	Moment	Shear
Front Transverse Sheave Girder	0.61	0.52
Back Transverse Sheave Girder	0.11	0.18
G1	0.17	0.57
G2/G3	0.15	0.58
G4	0.17	0.55
G6	0.09	0.49

Max D/C 0.69

0 - ULS V1

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compressio	Tension	Compressio	Tension	Compressio
Panel 1 (Bottom)	0.00	0.38	0.00	0.36	0.00	0.29	0.00	0.27
Panel 2	NA	0.34	NA	0.34	NA	0.18	NA	0.18
Panel 3	NA	0.35	NA	0.35	NA	0.18	NA	0.17
Panel 4	NA	0.42	NA	0.41	NA	0.16	NA	0.16
Panel 5	NA	0.41	NA	0.41	NA	0.19	NA	0.17
Panel 6 (Top)	NA	0.41	NA	0.40	NA	0.23	0.01	0.26

			West Panel		East Panel	
			Tension	Compressio	Tension	Compression
Horizontals		Jacking Girder	0.01	NA	0.01	NA
		1	0.04	NA	0.11	NA
		2	0.13	NA	0.13	NA
		3	0.14	NA	0.13	NA
		4	0.17	NA	0.15	NA
		5	0.12	0.05	0.09	0.03
Bracing	Panel 1	Front to Rear	NA	0.16	0.00	0.20
		Rear to Front	NA	0.13	NA	0.12
	Panel 2	Front to Rear	NA	0.12	NA	0.13
		Rear to Front	NA	0.12	NA	0.11
	Panel 3	Front to Rear	NA	0.11	NA	0.12
		Rear to Front	NA	0.12	NA	0.11
	Panel 4	Front to Rear	NA	0.15	NA	0.15
		Rear to Front	NA	0.15	NA	0.14
	Panel 5	Front to Rear	NA	0.15	NA	0.16
		Rear to Front	NA	0.16	NA	0.15
	Panel 6	Front to Rear	NA	0.03	NA	0.03
		Rear to Front	NA	0.30	NA	0.23

			Front Panel		Rear Panel	
			Tension	Compressio	Tension	Compression
Horizontals		1	0.04	0.01	0.02	0.01
		2	0.08	0.07	0.04	0.06
		3	0.24	NA	0.09	NA
		4	0.05	NA	0.04	0.04
		5	-	-	0.04	0.01
Bracing	Panel 2	Rail to Centre	NA	0.16	NA	0.06
		Hwy to Centre	NA	0.17	NA	0.06
	Panel 3	Rail to Centre	NA	0.18	NA	0.05
		Hwy to Centre	NA	0.17	NA	0.05
	Panel 4	Rail to Centre	NA	0.25	NA	0.06
		Hwy to Centre	NA	0.25	NA	0.05
	Panel 5	Rail to Centre	NA	0.23	NA	0.02
		Hwy to Centre	NA	0.23	NA	0.04
	Panel 2	Vertical	NA	0.52	NA	0.10
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.69	0.58
Back Transverse Sheave Girder	0.18	0.28
G1	0.19	0.63
G2/G3	0.19	0.66
G4	0.19	0.61
G6	0.15	0.56

Max D/C 1.42

0 - ULS V2

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compression	Tension	Compression	Tension	Compression
Panel 1 (Bottom)	0.68	1.42	0.67	1.39	0.64	1.27	0.65	1.27
Panel 2	NA	0.63	NA	0.62	0.13	0.51	0.13	0.50
Panel 3	NA	0.48	NA	0.48	NA	0.29	NA	0.28
Panel 4	NA	0.63	NA	0.62	NA	0.21	NA	0.21
Panel 5	NA	0.63	NA	0.61	NA	0.24	NA	0.22
Panel 6 (Top)	NA	0.50	NA	0.50	0.00	0.27	0.06	0.31

			West Panel		East Panel	
			Tension	Compression	Tension	Compression
Horizontals		Jacking Girder	0.02	0.01	0.02	0.01
		1	0.14	0.06	0.23	0.09
		2	0.20	0.06	0.17	0.03
		3	0.21	0.07	0.18	0.02
		4	0.25	0.07	0.21	0.01
		5	0.15	0.09	0.11	0.07
Bracing	Panel 1	Front to Rear	0.33	0.69	0.34	0.67
		Rear to Front	0.20	0.47	0.25	0.51
	Panel 2	Front to Rear	0.23	0.47	0.20	0.43
		Rear to Front	0.20	0.40	0.19	0.38
	Panel 3	Front to Rear	0.22	0.45	0.21	0.42
		Rear to Front	0.22	0.40	0.20	0.38
	Panel 4	Front to Rear	0.16	0.41	0.15	0.39
		Rear to Front	0.13	0.33	0.12	0.31
	Panel 5	Front to Rear	0.05	0.27	0.04	0.28
		Rear to Front	0.03	0.24	0.03	0.23
	Panel 6	Front to Rear	NA	0.05	NA	0.05
		Rear to Front	NA	0.33	NA	0.25

			Front Panel		Rear Panel	
			Tension	Compression	Tension	Compression
Horizontals		1	0.36	0.41	0.24	0.29
		2	0.21	0.23	0.16	0.26
		3	0.29	NA	0.15	0.07
		4	0.14	0.23	0.15	0.20
		5	-	-	0.07	0.04
Bracing	Panel 2	Rail to Centre	0.17	0.57	0.10	0.24
		Hwy to Centre	0.16	0.59	0.10	0.24
	Panel 3	Rail to Centre	0.07	0.48	0.06	0.17
		Hwy to Centre	0.08	0.47	0.06	0.17
	Panel 4	Rail to Centre	0.00	0.51	0.04	0.15
		Hwy to Centre	NA	0.53	0.04	0.14
	Panel 5	Rail to Centre	NA	0.38	0.05	0.10
		Hwy to Centre	NA	0.38	0.03	0.12
	Panel 2	Vertical	NA	0.65	0.02	0.26
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.72	0.61
Back Transverse Sheave Girder	0.19	0.27
G1	0.20	0.67
G2/G3	0.18	0.69
G4	0.20	0.65
G6	0.18	0.66

Max D/C 1.67

0 - ULS V3

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compression	Tension	Compression	Tension	Compression
Panel 1 (Bottom)	0.92	1.67	0.92	1.66	0.82	1.54	0.84	1.54
Panel 2	0.04	0.70	0.05	0.69	0.19	0.60	0.19	0.58
Panel 3	NA	0.51	NA	0.51	NA	0.32	0.01	0.31
Panel 4	NA	0.68	NA	0.67	NA	0.23	NA	0.22
Panel 5	NA	0.68	NA	0.67	NA	0.25	NA	0.23
Panel 6 (Top)	NA	0.53	NA	0.52	0.01	0.28	0.07	0.33

			West Panel		East Panel	
			Tension	Compression	Tension	Compression
Horizontals		Jacking Girder	0.02	0.01	0.02	0.01
		1	0.16	0.09	0.26	0.14
		2	0.22	0.09	0.19	0.05
		3	0.23	0.10	0.19	0.03
		4	0.27	0.10	0.22	0.03
		5	0.16	0.10	0.12	0.08
Bracing	Panel 1	Front to Rear	0.42	0.83	0.43	0.79
		Rear to Front	0.28	0.56	0.33	0.61
	Panel 2	Front to Rear	0.29	0.56	0.26	0.51
		Rear to Front	0.26	0.47	0.24	0.44
	Panel 3	Front to Rear	0.28	0.53	0.27	0.49
		Rear to Front	0.28	0.47	0.26	0.44
	Panel 4	Front to Rear	0.20	0.47	0.20	0.45
		Rear to Front	0.17	0.38	0.15	0.35
	Panel 5	Front to Rear	0.07	0.30	0.06	0.31
		Rear to Front	0.04	0.26	0.04	0.24
	Panel 6	Front to Rear	NA	0.05	NA	0.06
		Rear to Front	NA	0.33	NA	0.25

			Front Panel		Rear Panel	
			Tension	Compression	Tension	Compression
Horizontals		1	0.44	0.52	0.30	0.36
		2	0.24	0.26	0.19	0.32
		3	0.30	NA	0.17	0.10
		4	0.16	0.29	0.17	0.25
		5	-	-	0.07	0.05
Bracing	Panel 2	Rail to Centre	0.25	0.67	0.14	0.28
		Hwy to Centre	0.23	0.69	0.13	0.29
	Panel 3	Rail to Centre	0.12	0.56	0.08	0.20
		Hwy to Centre	0.13	0.54	0.08	0.20
	Panel 4	Rail to Centre	0.05	0.58	0.06	0.17
		Hwy to Centre	0.03	0.60	0.06	0.17
	Panel 5	Rail to Centre	NA	0.42	0.07	0.12
		Hwy to Centre	NA	0.41	0.05	0.14
	Panel 2	Vertical	NA	0.67	0.03	0.30
	Panel 4	Vertical	0.02	NA	0.03	NA

	Moment	Shear
Front Transverse Sheave Girder	0.73	0.62
Back Transverse Sheave Girder	0.19	0.27
G1	0.20	0.67
G2/G3	0.18	0.69
G4	0.20	0.67
G6	0.19	0.68

						Max D/C	0.65

0 - ULS V4

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compressio	Tension	Compressio	Tension	Compression
Panel 1 (Bottom)	0.00	0.20	0.00	0.19	0.00	0.31	0.00	0.29
Panel 2	NA	0.16	NA	0.16	NA	0.19	NA	0.20
Panel 3	NA	0.17	NA	0.17	NA	0.19	NA	0.18
Panel 4	NA	0.20	NA	0.19	NA	0.18	NA	0.17
Panel 5	NA	0.19	NA	0.19	NA	0.21	NA	0.19
Panel 6 (Top)	NA	0.21	NA	0.21	NA	0.29	0.01	0.32

			West Panel		East Panel	
			Tension	Compressio	Tension	Compression
Horizontals		Jacking Girder	0.00	NA	0.01	NA
		1	0.03	NA	0.07	NA
		2	0.10	0.01	0.10	0.01
		3	0.11	0.02	0.10	0.01
		4	0.14	0.02	0.11	NA
		5	0.08	0.11	0.05	0.09
Bracing	Panel 1	Front to Rear	NA	0.11	0.01	0.16
		Rear to Front	NA	0.09	NA	0.10
	Panel 2	Front to Rear	NA	0.08	NA	0.09
		Rear to Front	NA	0.09	NA	0.08
	Panel 3	Front to Rear	NA	0.08	NA	0.08
		Rear to Front	0.00	0.09	0.01	0.08
	Panel 4	Front to Rear	NA	0.09	NA	0.10
		Rear to Front	NA	0.10	0.00	0.09
	Panel 5	Front to Rear	NA	0.09	NA	0.09
		Rear to Front	NA	0.13	NA	0.12
	Panel 6	Front to Rear	0.01	NA	0.02	NA
		Rear to Front	NA	0.33	NA	0.26

			Front Panel		Rear Panel	
			Tension	Compressio	Tension	Compression
Horizontals		1	0.03	0.01	0.03	0.01
		2	0.06	0.06	0.04	0.06
		3	0.10	NA	0.10	NA
		4	0.04	0.02	0.04	0.04
		5	-	-	0.05	0.00
Bracing	Panel 2	Rail to Centre	NA	0.09	NA	0.07
		Hwy to Centre	NA	0.09	NA	0.07
	Panel 3	Rail to Centre	NA	0.08	NA	0.06
		Hwy to Centre	NA	0.08	NA	0.06
	Panel 4	Rail to Centre	NA	0.12	NA	0.06
		Hwy to Centre	NA	0.12	NA	0.06
	Panel 5	Rail to Centre	NA	0.10	NA	0.03
		Hwy to Centre	NA	0.10	NA	0.05
	Panel 2	Vertical	NA	0.23	NA	0.12
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.26	0.22
Back Transverse Sheave Girder	0.22	0.36
G1	0.12	0.11
G2/G3	0.34	0.46
G4	0.11	0.06
G6	0.16	0.65

Max D/C 0.58

1 - ULS 1

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compression	Tension	Compression	Tension	Compression
Panel 1 (Bottom)	0.00	0.33	0.00	0.32	0.00	0.27	0.00	0.26
Panel 2	NA	0.29	NA	0.29	NA	0.17	NA	0.17
Panel 3	NA	0.30	NA	0.30	NA	0.16	NA	0.16
Panel 4	NA	0.36	NA	0.36	NA	0.15	NA	0.14
Panel 5	NA	0.35	NA	0.35	NA	0.17	NA	0.16
Panel 6 (Top)	NA	0.35	NA	0.34	NA	0.21	0.01	0.24

			West Panel		East Panel	
			Tension	Compression	Tension	Compression
Horizontals		Jacking Girder	0.01	NA	0.01	NA
		1	0.04	NA	0.10	NA
		2	0.12	NA	0.12	NA
		3	0.13	NA	0.12	NA
		4	0.16	NA	0.14	NA
		5	0.10	0.06	0.08	0.05
Bracing	Panel 1	Front to Rear	NA	0.15	0.00	0.19
		Rear to Front	NA	0.11	NA	0.11
	Panel 2	Front to Rear	NA	0.11	NA	0.12
		Rear to Front	NA	0.11	NA	0.10
	Panel 3	Front to Rear	NA	0.10	NA	0.11
		Rear to Front	NA	0.11	NA	0.10
	Panel 4	Front to Rear	NA	0.14	NA	0.14
		Rear to Front	NA	0.13	NA	0.12
	Panel 5	Front to Rear	NA	0.14	NA	0.14
		Rear to Front	NA	0.15	NA	0.14
	Panel 6	Front to Rear	NA	0.01	NA	0.01
		Rear to Front	NA	0.30	NA	0.23

			Front Panel		Rear Panel	
			Tension	Compression	Tension	Compression
Horizontals		1	0.04	0.01	0.02	0.01
		2	0.08	0.07	0.04	0.06
		3	0.20	NA	0.08	NA
		4	0.05	0.00	0.04	0.04
		5	-	-	0.04	0.01
Bracing	Panel 2	Rail to Centre	NA	0.14	NA	0.06
		Hwy to Centre	NA	0.15	NA	0.06
	Panel 3	Rail to Centre	NA	0.15	NA	0.04
		Hwy to Centre	NA	0.15	NA	0.05
	Panel 4	Rail to Centre	NA	0.21	NA	0.05
		Hwy to Centre	NA	0.22	NA	0.05
	Panel 5	Rail to Centre	NA	0.19	NA	0.02
		Hwy to Centre	NA	0.19	NA	0.04
	Panel 2	Vertical	NA	0.45	NA	0.09
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.58	0.49
Back Transverse Sheave Girder	0.17	0.25
G1	0.16	0.52
G2/G3	0.16	0.56
G4	0.16	0.52
G6	0.15	0.50

Max D/C 1.52

1 - ULS 4								
	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compressio	Tension	Compressio	Tension	Compressio
Panel 1 (Bottom)	0.87	1.52	0.87	1.51	0.79	1.39	0.80	1.37
Panel 2	0.06	0.63	0.06	0.62	0.20	0.52	0.20	0.49
Panel 3	NA	0.45	NA	0.44	0.03	0.25	0.04	0.24
Panel 4	NA	0.60	NA	0.59	NA	0.17	0.00	0.16
Panel 5	NA	0.60	NA	0.59	0.02	0.18	0.02	0.16
Panel 6 (Top)	NA	0.45	NA	0.44	0.02	0.19	0.07	0.23

			West Panel		East Panel	
			Tension	Compressio	Tension	Compression
Horizontals		Jacking Girder	0.02	0.01	0.02	0.01
		1	0.15	0.09	0.23	0.13
		2	0.20	0.10	0.16	0.06
		3	0.21	0.11	0.17	0.05
		4	0.24	0.11	0.20	0.05
		5	0.12	0.13	0.09	0.11
Bracing	Panel 1	Front to Rear	0.41	0.76	0.41	0.72
		Rear to Front	0.27	0.51	0.32	0.56
	Panel 2	Front to Rear	0.28	0.51	0.25	0.46
		Rear to Front	0.25	0.43	0.23	0.41
	Panel 3	Front to Rear	0.27	0.49	0.26	0.45
		Rear to Front	0.27	0.43	0.25	0.40
	Panel 4	Front to Rear	0.20	0.43	0.20	0.41
		Rear to Front	0.16	0.34	0.15	0.32
	Panel 5	Front to Rear	0.07	0.27	0.07	0.28
		Rear to Front	0.05	0.23	0.04	0.22
	Panel 6	Front to Rear	0.03	0.01	0.04	0.00
		Rear to Front	NA	0.29	NA	0.22

			Front Panel		Rear Panel	
			Tension	Compressio	Tension	Compression
Horizontals		1	0.40	0.48	0.27	0.34
		2	0.22	0.25	0.18	0.30
		3	0.25	NA	0.14	0.12
		4	0.15	0.27	0.16	0.24
		5	-	-	0.06	0.06
Bracing	Panel 2	Rail to Centre	0.24	0.61	0.14	0.25
		Hwy to Centre	0.22	0.63	0.13	0.25
	Panel 3	Rail to Centre	0.13	0.50	0.09	0.17
		Hwy to Centre	0.14	0.49	0.09	0.17
	Panel 4	Rail to Centre	0.06	0.52	0.07	0.15
		Hwy to Centre	0.05	0.53	0.06	0.14
	Panel 5	Rail to Centre	NA	0.37	0.07	0.10
		Hwy to Centre	NA	0.36	0.06	0.12
	Panel 2	Vertical	NA	0.58	0.04	0.24
	Panel 4	Vertical	0.02	NA	0.03	NA

	Moment	Shear
Front Transverse Sheave Girder	0.61	0.52
Back Transverse Sheave Girder	0.11	0.18
G1	0.17	0.58
G2/G3	0.15	0.58
G4	0.17	0.55
G6	0.09	0.49

Max D/C 0.69

1 - ULS V1

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compressio	Tension	Compressio	Tension	Compressio
Panel 1 (Bottom)	0.00	0.38	0.00	0.36	0.00	0.29	0.00	0.27
Panel 2	NA	0.34	NA	0.34	NA	0.18	NA	0.18
Panel 3	NA	0.35	NA	0.35	NA	0.18	NA	0.17
Panel 4	NA	0.42	NA	0.42	NA	0.16	NA	0.16
Panel 5	NA	0.41	NA	0.41	NA	0.19	NA	0.17
Panel 6 (Top)	NA	0.41	NA	0.41	NA	0.23	0.01	0.26

			West Panel		East Panel	
			Tension	Compressio	Tension	Compression
Horizontals		Jacking Girder	0.01	NA	0.01	NA
		1	0.04	NA	0.12	NA
		2	0.13	NA	0.13	NA
		3	0.14	NA	0.13	NA
		4	0.17	NA	0.16	NA
		5	0.12	0.05	0.09	0.03
Bracing	Panel 1	Front to Rear	NA	0.16	0.00	0.20
		Rear to Front	NA	0.13	NA	0.12
	Panel 2	Front to Rear	NA	0.12	NA	0.13
		Rear to Front	NA	0.12	NA	0.12
	Panel 3	Front to Rear	NA	0.11	NA	0.12
		Rear to Front	NA	0.12	NA	0.11
	Panel 4	Front to Rear	NA	0.15	NA	0.16
		Rear to Front	NA	0.15	NA	0.14
	Panel 5	Front to Rear	NA	0.15	NA	0.16
		Rear to Front	NA	0.16	NA	0.15
	Panel 6	Front to Rear	NA	0.03	NA	0.03
		Rear to Front	NA	0.30	NA	0.23

			Front Panel		Rear Panel	
			Tension	Compressio	Tension	Compression
Horizontals		1	0.04	0.01	0.02	0.01
		2	0.08	0.07	0.04	0.06
		3	0.24	NA	0.09	NA
		4	0.05	NA	0.04	0.04
		5	-	-	0.04	0.01
Bracing	Panel 2	Rail to Centre	NA	0.17	NA	0.06
		Hwy to Centre	NA	0.17	NA	0.06
	Panel 3	Rail to Centre	NA	0.18	NA	0.05
		Hwy to Centre	NA	0.18	NA	0.05
	Panel 4	Rail to Centre	NA	0.25	NA	0.06
		Hwy to Centre	NA	0.25	NA	0.05
	Panel 5	Rail to Centre	NA	0.23	NA	0.02
		Hwy to Centre	NA	0.23	NA	0.05
	Panel 2	Vertical	NA	0.53	NA	0.10
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.69	0.59
Back Transverse Sheave Girder	0.18	0.28
G1	0.19	0.63
G2/G3	0.19	0.67
G4	0.19	0.61
G6	0.15	0.56

Max D/C 1.42

1 - ULS V2

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compression	Tension	Compression	Tension	Compression
Panel 1 (Bottom)	0.68	1.42	0.67	1.39	0.64	1.27	0.65	1.27
Panel 2	NA	0.63	NA	0.62	0.13	0.51	0.13	0.50
Panel 3	NA	0.48	NA	0.48	NA	0.29	NA	0.28
Panel 4	NA	0.63	NA	0.62	NA	0.21	NA	0.21
Panel 5	NA	0.63	NA	0.62	NA	0.24	NA	0.22
Panel 6 (Top)	NA	0.51	NA	0.50	0.00	0.27	0.06	0.31

			West Panel		East Panel	
			Tension	Compression	Tension	Compression
Horizontals		Jacking Girder	0.02	0.01	0.02	0.01
		1	0.14	0.06	0.23	0.09
		2	0.20	0.06	0.17	0.03
		3	0.21	0.07	0.18	0.02
		4	0.25	0.07	0.21	0.01
		5	0.15	0.09	0.11	0.07
Bracing	Panel 1	Front to Rear	0.32	0.70	0.34	0.67
		Rear to Front	0.20	0.47	0.25	0.51
	Panel 2	Front to Rear	0.23	0.47	0.20	0.43
		Rear to Front	0.20	0.40	0.19	0.38
	Panel 3	Front to Rear	0.22	0.45	0.21	0.42
		Rear to Front	0.22	0.40	0.20	0.38
	Panel 4	Front to Rear	0.16	0.41	0.15	0.39
		Rear to Front	0.13	0.33	0.12	0.31
	Panel 5	Front to Rear	0.05	0.27	0.04	0.28
		Rear to Front	0.03	0.24	0.03	0.23
	Panel 6	Front to Rear	NA	0.05	NA	0.05
		Rear to Front	NA	0.33	NA	0.25

			Front Panel		Rear Panel	
			Tension	Compression	Tension	Compression
Horizontals		1	0.36	0.41	0.24	0.29
		2	0.21	0.23	0.16	0.26
		3	0.29	NA	0.15	0.07
		4	0.14	0.23	0.15	0.20
		5	-	-	0.07	0.04
Bracing	Panel 2	Rail to Centre	0.17	0.57	0.10	0.24
		Hwy to Centre	0.16	0.59	0.10	0.24
	Panel 3	Rail to Centre	0.07	0.48	0.06	0.17
		Hwy to Centre	0.08	0.47	0.06	0.17
	Panel 4	Rail to Centre	0.00	0.51	0.04	0.15
		Hwy to Centre	NA	0.53	0.04	0.14
	Panel 5	Rail to Centre	NA	0.39	0.05	0.10
		Hwy to Centre	NA	0.38	0.03	0.12
	Panel 2	Vertical	NA	0.65	0.02	0.26
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.73	0.61
Back Transverse Sheave Girder	0.19	0.28
G1	0.20	0.67
G2/G3	0.18	0.69
G4	0.20	0.66
G6	0.18	0.66

Max D/C 1.68

1 - ULS V3

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compression	Tension	Compression	Tension	Compression
Panel 1 (Bottom)	0.92	1.68	0.91	1.66	0.82	1.54	0.84	1.54
Panel 2	0.04	0.70	0.05	0.69	0.19	0.60	0.19	0.58
Panel 3	NA	0.51	NA	0.51	NA	0.32	0.01	0.31
Panel 4	NA	0.69	NA	0.67	NA	0.23	NA	0.22
Panel 5	NA	0.69	NA	0.67	NA	0.25	NA	0.23
Panel 6 (Top)	NA	0.53	NA	0.52	0.01	0.28	0.07	0.33

			West Panel		East Panel	
			Tension	Compression	Tension	Compression
Horizontals		Jacking Girder	0.02	0.01	0.02	0.01
		1	0.16	0.09	0.26	0.13
		2	0.22	0.09	0.19	0.05
		3	0.23	0.10	0.19	0.03
		4	0.27	0.10	0.23	0.03
		5	0.16	0.10	0.12	0.07
Bracing	Panel 1	Front to Rear	0.42	0.83	0.43	0.79
		Rear to Front	0.28	0.56	0.33	0.61
	Panel 2	Front to Rear	0.29	0.56	0.25	0.51
		Rear to Front	0.26	0.47	0.24	0.45
	Panel 3	Front to Rear	0.28	0.53	0.27	0.49
		Rear to Front	0.28	0.47	0.26	0.44
	Panel 4	Front to Rear	0.20	0.47	0.20	0.45
		Rear to Front	0.17	0.38	0.15	0.35
	Panel 5	Front to Rear	0.07	0.30	0.06	0.31
		Rear to Front	0.04	0.26	0.04	0.24
	Panel 6	Front to Rear	NA	0.05	NA	0.06
		Rear to Front	NA	0.33	NA	0.25

			Front Panel		Rear Panel	
			Tension	Compression	Tension	Compression
Horizontals		1	0.44	0.52	0.30	0.36
		2	0.24	0.26	0.19	0.32
		3	0.30	NA	0.17	0.10
		4	0.16	0.29	0.17	0.25
		5	-	-	0.07	0.05
Bracing	Panel 2	Rail to Centre	0.25	0.67	0.14	0.28
		Hwy to Centre	0.23	0.69	0.13	0.29
	Panel 3	Rail to Centre	0.12	0.56	0.08	0.20
		Hwy to Centre	0.13	0.54	0.08	0.20
	Panel 4	Rail to Centre	0.05	0.58	0.06	0.17
		Hwy to Centre	0.03	0.60	0.06	0.17
	Panel 5	Rail to Centre	NA	0.42	0.07	0.12
		Hwy to Centre	NA	0.41	0.05	0.14
	Panel 2	Vertical	NA	0.68	0.03	0.30
	Panel 4	Vertical	0.02	NA	0.03	NA

	Moment	Shear
Front Transverse Sheave Girder	0.74	0.62
Back Transverse Sheave Girder	0.19	0.27
G1	0.20	0.68
G2/G3	0.18	0.69
G4	0.20	0.67
G6	0.19	0.68

Max D/C 0.65

1 - ULS V4

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compression	Tension	Compression	Tension	Compression
Panel 1 (Bottom)	0.00	0.20	0.00	0.19	0.00	0.31	0.00	0.29
Panel 2	NA	0.17	NA	0.17	NA	0.19	NA	0.20
Panel 3	NA	0.17	NA	0.17	NA	0.19	NA	0.18
Panel 4	NA	0.20	NA	0.19	NA	0.18	NA	0.17
Panel 5	NA	0.19	NA	0.19	NA	0.21	NA	0.19
Panel 6 (Top)	NA	0.21	NA	0.21	NA	0.29	0.01	0.32

			West Panel		East Panel	
			Tension	Compression	Tension	Compression
Horizontals	Jacking Girder		0.00	NA	0.01	NA
	1		0.03	NA	0.07	NA
	2		0.11	0.01	0.10	0.01
	3		0.11	0.02	0.10	0.01
	4		0.14	0.02	0.11	NA
	5		0.08	0.11	0.05	0.09
Bracing	Panel 1	Front to Rear	NA	0.11	0.01	0.16
		Rear to Front	NA	0.09	NA	0.10
	Panel 2	Front to Rear	NA	0.08	NA	0.09
		Rear to Front	NA	0.09	NA	0.08
	Panel 3	Front to Rear	NA	0.08	NA	0.08
		Rear to Front	0.00	0.09	0.00	0.08
	Panel 4	Front to Rear	NA	0.09	NA	0.10
		Rear to Front	NA	0.10	0.00	0.09
	Panel 5	Front to Rear	NA	0.09	NA	0.10
		Rear to Front	NA	0.13	NA	0.12
	Panel 6	Front to Rear	0.01	NA	0.02	NA
		Rear to Front	NA	0.33	NA	0.26

			Front Panel		Rear Panel	
			Tension	Compression	Tension	Compression
Horizontals	1		0.03	0.01	0.03	0.01
	2		0.06	0.06	0.04	0.06
	3		0.10	NA	0.10	NA
	4		0.04	0.02	0.04	0.04
	5		-	-	0.05	0.00
Bracing	Panel 2	Rail to Centre	NA	0.09	NA	0.07
		Hwy to Centre	NA	0.09	NA	0.07
	Panel 3	Rail to Centre	NA	0.08	NA	0.06
		Hwy to Centre	NA	0.08	NA	0.06
	Panel 4	Rail to Centre	NA	0.13	NA	0.06
		Hwy to Centre	NA	0.13	NA	0.06
	Panel 5	Rail to Centre	NA	0.10	NA	0.03
		Hwy to Centre	NA	0.10	NA	0.05
	Panel 2	Vertical	NA	0.23	NA	0.12
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.26	0.22
Back Transverse Sheave Girder	0.22	0.36
G1	0.12	0.11
G2/G3	0.35	0.46
G4	0.11	0.06
G6	0.16	0.65

Max D/C 0.59

2 - ULS 1

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compression	Tension	Compression	Tension	Compression
Panel 1 (Bottom)	0.00	0.34	0.00	0.32	0.00	0.27	0.00	0.26
Panel 2	NA	0.30	NA	0.29	NA	0.17	NA	0.17
Panel 3	NA	0.31	NA	0.30	NA	0.16	NA	0.16
Panel 4	NA	0.36	NA	0.36	NA	0.15	NA	0.14
Panel 5	NA	0.35	NA	0.35	NA	0.18	NA	0.16
Panel 6 (Top)	NA	0.35	NA	0.35	NA	0.21	0.01	0.24

			West Panel		East Panel	
			Tension	Compression	Tension	Compression
Horizontals		Jacking Girder	0.01	NA	0.01	NA
		1	0.04	NA	0.10	NA
		2	0.12	NA	0.12	NA
		3	0.13	NA	0.12	NA
		4	0.16	NA	0.14	NA
		5	0.10	0.06	0.08	0.05
Bracing	Panel 1	Front to Rear	NA	0.15	0.00	0.19
		Rear to Front	NA	0.11	NA	0.11
	Panel 2	Front to Rear	NA	0.11	NA	0.12
		Rear to Front	NA	0.11	NA	0.11
	Panel 3	Front to Rear	NA	0.10	NA	0.11
		Rear to Front	NA	0.11	NA	0.10
	Panel 4	Front to Rear	NA	0.14	NA	0.14
		Rear to Front	NA	0.14	NA	0.13
	Panel 5	Front to Rear	NA	0.14	NA	0.14
		Rear to Front	NA	0.15	NA	0.14
	Panel 6	Front to Rear	NA	0.02	NA	0.01
		Rear to Front	NA	0.30	NA	0.23

			Front Panel		Rear Panel	
			Tension	Compression	Tension	Compression
Horizontals		1	0.04	0.01	0.02	0.01
		2	0.08	0.07	0.04	0.06
		3	0.20	NA	0.08	NA
		4	0.05	0.00	0.04	0.04
		5	-	-	0.04	0.01
Bracing	Panel 2	Rail to Centre	NA	0.15	NA	0.06
		Hwy to Centre	NA	0.15	NA	0.06
	Panel 3	Rail to Centre	NA	0.15	NA	0.04
		Hwy to Centre	NA	0.15	NA	0.05
	Panel 4	Rail to Centre	NA	0.22	NA	0.05
		Hwy to Centre	NA	0.22	NA	0.05
	Panel 5	Rail to Centre	NA	0.20	NA	0.02
		Hwy to Centre	NA	0.20	NA	0.04
	Panel 2	Vertical	NA	0.45	NA	0.09
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.59	0.50
Back Transverse Sheave Girder	0.17	0.25
G1	0.16	0.53
G2/G3	0.16	0.56
G4	0.16	0.52
G6	0.15	0.51

Max D/C 1.52

2 - ULS 4

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compression	Tension	Compression	Tension	Compression
Panel 1 (Bottom)	0.87	1.52	0.87	1.51	0.79	1.39	0.80	1.37
Panel 2	0.06	0.63	0.06	0.62	0.20	0.52	0.20	0.49
Panel 3	NA	0.45	NA	0.45	0.03	0.25	0.04	0.24
Panel 4	NA	0.61	NA	0.59	NA	0.17	0.00	0.16
Panel 5	NA	0.60	NA	0.59	0.02	0.18	0.02	0.16
Panel 6 (Top)	NA	0.45	NA	0.45	0.02	0.20	0.07	0.23

			West Panel		East Panel	
			Tension	Compression	Tension	Compression
Horizontals		Jacking Girder	0.02	0.01	0.02	0.01
		1	0.15	0.09	0.23	0.13
		2	0.20	0.10	0.17	0.06
		3	0.21	0.11	0.17	0.05
		4	0.24	0.11	0.20	0.05
		5	0.12	0.13	0.09	0.11
Bracing	Panel 1	Front to Rear	0.41	0.76	0.41	0.72
		Rear to Front	0.27	0.51	0.32	0.56
	Panel 2	Front to Rear	0.28	0.51	0.25	0.46
		Rear to Front	0.25	0.43	0.23	0.41
	Panel 3	Front to Rear	0.27	0.49	0.26	0.45
		Rear to Front	0.27	0.43	0.25	0.41
	Panel 4	Front to Rear	0.20	0.43	0.19	0.41
		Rear to Front	0.16	0.34	0.15	0.32
	Panel 5	Front to Rear	0.07	0.28	0.07	0.28
		Rear to Front	0.05	0.23	0.04	0.22
	Panel 6	Front to Rear	0.03	0.01	0.04	0.01
		Rear to Front	NA	0.29	NA	0.22

			Front Panel		Rear Panel	
			Tension	Compression	Tension	Compression
Horizontals		1	0.40	0.48	0.27	0.34
		2	0.22	0.25	0.18	0.30
		3	0.25	NA	0.14	0.11
		4	0.15	0.27	0.16	0.24
		5	-	-	0.06	0.06
Bracing	Panel 2	Rail to Centre	0.24	0.62	0.14	0.25
		Hwy to Centre	0.22	0.63	0.13	0.25
	Panel 3	Rail to Centre	0.13	0.51	0.09	0.17
		Hwy to Centre	0.13	0.49	0.09	0.17
	Panel 4	Rail to Centre	0.06	0.52	0.07	0.15
		Hwy to Centre	0.05	0.54	0.06	0.14
	Panel 5	Rail to Centre	NA	0.37	0.07	0.10
		Hwy to Centre	NA	0.36	0.06	0.12
	Panel 2	Vertical	NA	0.58	0.04	0.24
	Panel 4	Vertical	0.02	NA	0.03	NA

	Moment	Shear
Front Transverse Sheave Girder	0.62	0.53
Back Transverse Sheave Girder	0.11	0.19
G1	0.17	0.58
G2/G3	0.15	0.59
G4	0.17	0.56
G6	0.09	0.49

Max D/C 0.70

2 - ULS V1

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compressio	Tension	Compressio	Tension	Compressio
Panel 1 (Bottom)	0.00	0.38	0.00	0.37	0.00	0.29	0.00	0.27
Panel 2	NA	0.35	NA	0.34	NA	0.18	NA	0.18
Panel 3	NA	0.36	NA	0.35	NA	0.18	NA	0.17
Panel 4	NA	0.42	NA	0.42	NA	0.16	NA	0.16
Panel 5	NA	0.42	NA	0.41	NA	0.19	NA	0.17
Panel 6 (Top)	NA	0.41	NA	0.41	NA	0.23	0.01	0.26

			West Panel		East Panel	
			Tension	Compressio	Tension	Compression
Horizontals		Jacking Girder	0.01	NA	0.01	NA
		1	0.04	NA	0.12	NA
		2	0.13	NA	0.13	NA
		3	0.14	NA	0.13	NA
		4	0.18	NA	0.16	NA
		5	0.12	0.05	0.09	0.03
Bracing	Panel 1	Front to Rear	NA	0.16	NA	0.20
		Rear to Front	NA	0.13	NA	0.12
	Panel 2	Front to Rear	NA	0.13	NA	0.13
		Rear to Front	NA	0.12	NA	0.12
	Panel 3	Front to Rear	NA	0.11	NA	0.12
		Rear to Front	NA	0.12	NA	0.11
	Panel 4	Front to Rear	NA	0.15	NA	0.16
		Rear to Front	NA	0.15	NA	0.14
	Panel 5	Front to Rear	NA	0.15	NA	0.16
		Rear to Front	NA	0.16	NA	0.15
	Panel 6	Front to Rear	NA	0.03	NA	0.03
		Rear to Front	NA	0.30	NA	0.23

			Front Panel		Rear Panel	
			Tension	Compressio	Tension	Compression
Horizontals		1	0.04	0.01	0.02	0.01
		2	0.08	0.07	0.04	0.06
		3	0.24	NA	0.09	NA
		4	0.05	NA	0.04	0.04
		5	-	-	0.04	0.01
Bracing	Panel 2	Rail to Centre	NA	0.17	NA	0.06
		Hwy to Centre	NA	0.18	NA	0.06
	Panel 3	Rail to Centre	NA	0.18	NA	0.05
		Hwy to Centre	NA	0.18	NA	0.05
	Panel 4	Rail to Centre	NA	0.25	NA	0.06
		Hwy to Centre	NA	0.25	NA	0.05
	Panel 5	Rail to Centre	NA	0.23	NA	0.02
		Hwy to Centre	NA	0.23	NA	0.05
	Panel 2	Vertical	NA	0.53	NA	0.10
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.70	0.60
Back Transverse Sheave Girder	0.18	0.28
G1	0.19	0.64
G2/G3	0.19	0.68
G4	0.19	0.62
G6	0.15	0.56

Max D/C 1.42

2 - ULS V2

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compression	Tension	Compression	Tension	Compression
Panel 1 (Bottom)	0.67	1.42	0.67	1.40	0.64	1.27	0.65	1.27
Panel 2	NA	0.63	NA	0.63	0.13	0.51	0.13	0.50
Panel 3	NA	0.49	NA	0.48	NA	0.29	NA	0.28
Panel 4	NA	0.63	NA	0.62	NA	0.22	NA	0.21
Panel 5	NA	0.63	NA	0.62	NA	0.24	NA	0.22
Panel 6 (Top)	NA	0.51	NA	0.50	0.00	0.27	0.06	0.32

			West Panel		East Panel	
			Tension	Compression	Tension	Compression
Horizontals		Jacking Girder	0.02	0.01	0.02	0.01
		1	0.14	0.06	0.23	0.09
		2	0.20	0.06	0.17	0.03
		3	0.21	0.07	0.18	0.02
		4	0.25	0.07	0.21	0.01
		5	0.15	0.09	0.11	0.06
Bracing	Panel 1	Front to Rear	0.32	0.70	0.34	0.67
		Rear to Front	0.20	0.48	0.25	0.52
	Panel 2	Front to Rear	0.23	0.47	0.20	0.43
		Rear to Front	0.20	0.40	0.19	0.38
	Panel 3	Front to Rear	0.22	0.45	0.21	0.42
		Rear to Front	0.22	0.40	0.20	0.38
	Panel 4	Front to Rear	0.16	0.41	0.15	0.40
		Rear to Front	0.13	0.33	0.12	0.31
	Panel 5	Front to Rear	0.05	0.27	0.04	0.28
		Rear to Front	0.03	0.24	0.03	0.23
	Panel 6	Front to Rear	NA	0.05	NA	0.05
		Rear to Front	NA	0.33	NA	0.25

			Front Panel		Rear Panel	
			Tension	Compression	Tension	Compression
Horizontals		1	0.36	0.41	0.24	0.29
		2	0.21	0.23	0.16	0.26
		3	0.29	NA	0.16	0.07
		4	0.14	0.23	0.15	0.20
		5	-	-	0.07	0.04
Bracing	Panel 2	Rail to Centre	0.17	0.57	0.10	0.24
		Hwy to Centre	0.15	0.59	0.10	0.24
	Panel 3	Rail to Centre	0.07	0.49	0.06	0.17
		Hwy to Centre	0.08	0.47	0.06	0.17
	Panel 4	Rail to Centre	NA	0.52	0.04	0.15
		Hwy to Centre	NA	0.53	0.04	0.14
	Panel 5	Rail to Centre	NA	0.39	0.05	0.10
		Hwy to Centre	NA	0.38	0.03	0.13
	Panel 2	Vertical	NA	0.66	0.02	0.26
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.74	0.62
Back Transverse Sheave Girder	0.19	0.28
G1	0.20	0.68
G2/G3	0.18	0.70
G4	0.20	0.67
G6	0.18	0.67

Max D/C 1.68

2 - ULS V3								
	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compression	Tension	Compression	Tension	Compression
Panel 1 (Bottom)	0.91	1.68	0.91	1.66	0.82	1.54	0.84	1.54
Panel 2	0.04	0.70	0.04	0.70	0.19	0.60	0.19	0.58
Panel 3	NA	0.52	NA	0.51	NA	0.32	0.01	0.31
Panel 4	NA	0.69	NA	0.68	NA	0.23	NA	0.22
Panel 5	NA	0.69	NA	0.67	NA	0.25	NA	0.23
Panel 6 (Top)	NA	0.53	NA	0.52	0.01	0.28	0.07	0.33

			West Panel		East Panel	
			Tension	Compression	Tension	Compression
Horizontals		Jacking Girder	0.02	0.01	0.02	0.01
		1	0.16	0.09	0.26	0.13
		2	0.22	0.09	0.19	0.05
		3	0.23	0.10	0.19	0.03
		4	0.27	0.10	0.23	0.03
		5	0.16	0.10	0.12	0.07
Bracing	Panel 1	Front to Rear	0.42	0.83	0.43	0.79
		Rear to Front	0.28	0.56	0.33	0.61
	Panel 2	Front to Rear	0.29	0.56	0.25	0.51
		Rear to Front	0.26	0.47	0.24	0.45
	Panel 3	Front to Rear	0.28	0.53	0.27	0.50
		Rear to Front	0.28	0.47	0.26	0.44
	Panel 4	Front to Rear	0.20	0.47	0.20	0.46
		Rear to Front	0.17	0.38	0.15	0.36
	Panel 5	Front to Rear	0.07	0.30	0.06	0.31
		Rear to Front	0.04	0.26	0.04	0.24
	Panel 6	Front to Rear	NA	0.06	NA	0.06
		Rear to Front	NA	0.33	NA	0.25

			Front Panel		Rear Panel	
			Tension	Compression	Tension	Compression
Horizontals		1	0.44	0.52	0.30	0.36
		2	0.24	0.26	0.19	0.32
		3	0.30	NA	0.17	0.10
		4	0.16	0.29	0.17	0.25
		5	-	-	0.07	0.05
Bracing	Panel 2	Rail to Centre	0.24	0.67	0.14	0.28
		Hwy to Centre	0.22	0.70	0.13	0.29
	Panel 3	Rail to Centre	0.12	0.56	0.08	0.20
		Hwy to Centre	0.13	0.55	0.08	0.20
	Panel 4	Rail to Centre	0.05	0.58	0.06	0.17
		Hwy to Centre	0.03	0.60	0.06	0.17
	Panel 5	Rail to Centre	NA	0.43	0.07	0.12
		Hwy to Centre	NA	0.42	0.05	0.14
	Panel 2	Vertical	NA	0.68	0.03	0.30
	Panel 4	Vertical	0.02	NA	0.03	NA

	Moment	Shear
Front Transverse Sheave Girder	0.74	0.63
Back Transverse Sheave Girder	0.19	0.28
G1	0.20	0.69
G2/G3	0.18	0.70
G4	0.21	0.68
G6	0.19	0.69

Max D/C 0.66

2 - ULS V4								
	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compression	Tension	Compression	Tension	Compression
Panel 1 (Bottom)	0.00	0.20	0.00	0.19	0.00	0.31	0.00	0.29
Panel 2	NA	0.17	NA	0.17	NA	0.19	NA	0.20
Panel 3	NA	0.17	NA	0.17	NA	0.19	NA	0.18
Panel 4	NA	0.20	NA	0.19	NA	0.18	NA	0.17
Panel 5	NA	0.19	NA	0.19	NA	0.21	NA	0.19
Panel 6 (Top)	NA	0.21	NA	0.21	NA	0.29	0.01	0.32

			West Panel		East Panel	
			Tension	Compression	Tension	Compression
Horizontals		Jacking Girder	0.00	NA	0.01	NA
		1	0.03	NA	0.07	NA
		2	0.11	0.01	0.10	0.01
		3	0.11	0.02	0.10	0.01
		4	0.14	0.02	0.11	NA
		5	0.08	0.11	0.05	0.09
Bracing	Panel 1	Front to Rear	NA	0.11	0.01	0.16
		Rear to Front	NA	0.09	NA	0.10
	Panel 2	Front to Rear	NA	0.08	NA	0.09
		Rear to Front	NA	0.09	NA	0.08
	Panel 3	Front to Rear	NA	0.08	NA	0.08
		Rear to Front	0.00	0.09	0.00	0.08
	Panel 4	Front to Rear	NA	0.09	NA	0.10
		Rear to Front	NA	0.10	0.00	0.09
	Panel 5	Front to Rear	NA	0.09	NA	0.10
		Rear to Front	NA	0.13	NA	0.12
	Panel 6	Front to Rear	0.01	NA	0.02	NA
		Rear to Front	NA	0.33	NA	0.26

			Front Panel		Rear Panel	
			Tension	Compression	Tension	Compression
Horizontals		1	0.03	0.01	0.03	0.01
		2	0.06	0.06	0.04	0.06
		3	0.10	NA	0.10	NA
		4	0.04	0.02	0.04	0.04
		5	-	-	0.05	0.00
Bracing	Panel 2	Rail to Centre	NA	0.09	NA	0.07
		Hwy to Centre	NA	0.09	NA	0.07
	Panel 3	Rail to Centre	NA	0.08	NA	0.06
		Hwy to Centre	NA	0.08	NA	0.06
	Panel 4	Rail to Centre	NA	0.13	NA	0.06
		Hwy to Centre	NA	0.13	NA	0.06
	Panel 5	Rail to Centre	NA	0.10	NA	0.03
		Hwy to Centre	NA	0.11	NA	0.05
	Panel 2	Vertical	NA	0.23	NA	0.13
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.26	0.23
Back Transverse Sheave Girder	0.22	0.36
G1	0.12	0.11
G2/G3	0.35	0.47
G4	0.11	0.06
G6	0.16	0.66

Max D/C 0.56

3 - ULS 1

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compression	Tension	Compression	Tension	Compression
Panel 1 (Bottom)	0.00	0.32	0.00	0.31	0.00	0.27	0.00	0.25
Panel 2	NA	0.29	NA	0.28	NA	0.17	NA	0.17
Panel 3	NA	0.29	NA	0.29	NA	0.16	NA	0.15
Panel 4	NA	0.35	NA	0.35	NA	0.15	NA	0.14
Panel 5	NA	0.34	NA	0.34	NA	0.17	NA	0.15
Panel 6 (Top)	NA	0.34	NA	0.33	NA	0.21	0.01	0.23

			West Panel		East Panel	
			Tension	Compression	Tension	Compression
Horizontals		Jacking Girder	0.01	NA	0.01	NA
		1	0.04	NA	0.10	NA
		2	0.12	NA	0.12	NA
		3	0.13	NA	0.12	NA
		4	0.16	NA	0.14	NA
		5	0.10	0.06	0.08	0.05
Bracing	Panel 1	Front to Rear	NA	0.14	0.01	0.18
		Rear to Front	NA	0.11	NA	0.11
	Panel 2	Front to Rear	NA	0.11	NA	0.12
		Rear to Front	NA	0.11	NA	0.10
	Panel 3	Front to Rear	NA	0.10	NA	0.10
		Rear to Front	NA	0.11	NA	0.10
	Panel 4	Front to Rear	NA	0.13	NA	0.14
		Rear to Front	NA	0.13	NA	0.12
	Panel 5	Front to Rear	NA	0.13	NA	0.14
		Rear to Front	NA	0.15	NA	0.14
	Panel 6	Front to Rear	NA	0.01	NA	0.01
		Rear to Front	NA	0.30	NA	0.23

			Front Panel		Rear Panel	
			Tension	Compression	Tension	Compression
Horizontals		1	0.04	0.01	0.02	0.01
		2	0.08	0.07	0.04	0.06
		3	0.19	NA	0.08	NA
		4	0.05	0.00	0.04	0.04
		5	-	-	0.04	0.01
Bracing	Panel 2	Rail to Centre	NA	0.14	NA	0.06
		Hwy to Centre	NA	0.15	NA	0.06
	Panel 3	Rail to Centre	NA	0.15	NA	0.04
		Hwy to Centre	NA	0.15	NA	0.05
	Panel 4	Rail to Centre	NA	0.21	NA	0.05
		Hwy to Centre	NA	0.21	NA	0.05
	Panel 5	Rail to Centre	NA	0.19	NA	0.02
		Hwy to Centre	NA	0.19	NA	0.04
	Panel 2	Vertical	NA	0.43	NA	0.09
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.56	0.48
Back Transverse Sheave Girder	0.17	0.25
G1	0.15	0.51
G2/G3	0.15	0.54
G4	0.15	0.50
G6	0.15	0.49

Max D/C 1.52

3 - ULS 4

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compressio	Tension	Compressio	Tension	Compressio
Panel 1 (Bottom)	0.88	1.52	0.87	1.50	0.79	1.39	0.81	1.37
Panel 2	0.07	0.62	0.07	0.61	0.20	0.51	0.21	0.49
Panel 3	NA	0.44	NA	0.44	0.03	0.25	0.04	0.24
Panel 4	NA	0.60	NA	0.58	NA	0.16	0.00	0.16
Panel 5	NA	0.60	NA	0.58	0.02	0.18	0.02	0.16
Panel 6 (Top)	NA	0.44	NA	0.43	0.02	0.19	0.06	0.22

			West Panel		East Panel	
			Tension	Compressio	Tension	Compression
Horizontals		Jacking Girder	0.02	0.01	0.02	0.01
		1	0.15	0.09	0.22	0.13
		2	0.19	0.10	0.16	0.07
		3	0.21	0.11	0.16	0.05
		4	0.24	0.11	0.20	0.05
		5	0.12	0.13	0.09	0.11
Bracing	Panel 1	Front to Rear	0.40	0.76	0.41	0.71
		Rear to Front	0.28	0.50	0.32	0.56
	Panel 2	Front to Rear	0.28	0.51	0.25	0.46
		Rear to Front	0.26	0.43	0.23	0.40
	Panel 3	Front to Rear	0.27	0.49	0.26	0.45
		Rear to Front	0.27	0.43	0.25	0.40
	Panel 4	Front to Rear	0.20	0.43	0.20	0.41
		Rear to Front	0.17	0.34	0.15	0.32
	Panel 5	Front to Rear	0.07	0.27	0.07	0.27
		Rear to Front	0.05	0.23	0.05	0.22
	Panel 6	Front to Rear	0.03	0.00	0.04	0.00
		Rear to Front	NA	0.29	NA	0.22

			Front Panel		Rear Panel	
			Tension	Compressio	Tension	Compression
Horizontals		1	0.40	0.48	0.27	0.34
		2	0.22	0.25	0.18	0.30
		3	0.25	NA	0.14	0.12
		4	0.15	0.28	0.16	0.24
		5	-	-	0.06	0.06
Bracing	Panel 2	Rail to Centre	0.24	0.61	0.14	0.25
		Hwy to Centre	0.22	0.63	0.13	0.25
	Panel 3	Rail to Centre	0.13	0.50	0.09	0.17
		Hwy to Centre	0.14	0.49	0.09	0.17
	Panel 4	Rail to Centre	0.07	0.51	0.07	0.15
		Hwy to Centre	0.05	0.53	0.06	0.14
	Panel 5	Rail to Centre	NA	0.37	0.07	0.10
		Hwy to Centre	NA	0.36	0.06	0.12
	Panel 2	Vertical	NA	0.57	0.04	0.24
	Panel 4	Vertical	0.02	NA	0.03	NA

	Moment	Shear
Front Transverse Sheave Girder	0.60	0.51
Back Transverse Sheave Girder	0.11	0.18
G1	0.17	0.57
G2/G3	0.15	0.57
G4	0.16	0.54
G6	0.09	0.47

Max D/C 0.67

3 - ULS V1								
	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compression	Tension	Compression	Tension	Compression
Panel 1 (Bottom)	0.00	0.37	0.00	0.35	0.00	0.28	0.00	0.27
Panel 2	NA	0.33	NA	0.33	NA	0.18	NA	0.18
Panel 3	NA	0.34	NA	0.34	NA	0.17	NA	0.17
Panel 4	NA	0.41	NA	0.40	NA	0.16	NA	0.15
Panel 5	NA	0.40	NA	0.40	NA	0.19	NA	0.17
Panel 6 (Top)	NA	0.40	NA	0.39	NA	0.22	0.01	0.25

			West Panel		East Panel	
			Tension	Compression	Tension	Compression
Horizontals	Jacking Girder		0.01	NA	0.01	NA
	1		0.04	NA	0.11	NA
	2		0.13	NA	0.13	NA
	3		0.14	NA	0.13	NA
	4		0.17	NA	0.15	NA
	5		0.12	0.05	0.09	0.04
Bracing	Panel 1	Front to Rear	NA	0.16	0.00	0.20
		Rear to Front	NA	0.12	NA	0.12
	Panel 2	Front to Rear	NA	0.12	NA	0.13
		Rear to Front	NA	0.12	NA	0.11
	Panel 3	Front to Rear	NA	0.11	NA	0.12
		Rear to Front	NA	0.12	NA	0.11
	Panel 4	Front to Rear	NA	0.15	NA	0.15
		Rear to Front	NA	0.15	NA	0.14
	Panel 5	Front to Rear	NA	0.15	NA	0.16
		Rear to Front	NA	0.16	NA	0.15
	Panel 6	Front to Rear	NA	0.03	NA	0.03
		Rear to Front	NA	0.30	NA	0.23

			Front Panel		Rear Panel	
			Tension	Compression	Tension	Compression
Horizontals	1		0.04	0.01	0.02	0.01
	2		0.08	0.07	0.04	0.06
	3		0.23	NA	0.09	NA
	4		0.05	NA	0.04	0.04
	5		-	-	0.04	0.01
Bracing	Panel 2	Rail to Centre	NA	0.16	NA	0.06
		Hwy to Centre	NA	0.17	NA	0.06
	Panel 3	Rail to Centre	NA	0.17	NA	0.05
		Hwy to Centre	NA	0.17	NA	0.05
	Panel 4	Rail to Centre	NA	0.24	NA	0.06
		Hwy to Centre	NA	0.24	NA	0.05
	Panel 5	Rail to Centre	NA	0.22	NA	0.02
		Hwy to Centre	NA	0.22	NA	0.04
	Panel 2	Vertical	NA	0.51	NA	0.10
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.67	0.57
Back Transverse Sheave Girder	0.18	0.27
G1	0.18	0.61
G2/G3	0.18	0.64
G4	0.18	0.59
G6	0.15	0.55

Max D/C 1.41

3 - ULS V2

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compression	Tension	Compression	Tension	Compression
Panel 1 (Bottom)	0.69	1.41	0.68	1.39	0.64	1.27	0.65	1.27
Panel 2	NA	0.62	NA	0.62	0.13	0.51	0.13	0.50
Panel 3	NA	0.47	NA	0.47	NA	0.29	NA	0.28
Panel 4	NA	0.62	NA	0.61	NA	0.21	NA	0.20
Panel 5	NA	0.62	NA	0.61	NA	0.24	NA	0.21
Panel 6 (Top)	NA	0.50	NA	0.49	0.00	0.26	0.06	0.31

			West Panel		East Panel	
			Tension	Compression	Tension	Compression
Horizontals		Jacking Girder	0.02	0.01	0.02	0.01
		1	0.14	0.06	0.23	0.10
		2	0.20	0.07	0.17	0.03
		3	0.21	0.07	0.17	0.02
		4	0.25	0.07	0.21	0.02
		5	0.15	0.09	0.11	0.07
Bracing	Panel 1	Front to Rear	0.32	0.69	0.34	0.67
		Rear to Front	0.21	0.47	0.26	0.51
	Panel 2	Front to Rear	0.23	0.47	0.20	0.43
		Rear to Front	0.20	0.39	0.19	0.38
	Panel 3	Front to Rear	0.22	0.45	0.21	0.42
		Rear to Front	0.22	0.40	0.20	0.38
	Panel 4	Front to Rear	0.16	0.41	0.15	0.39
		Rear to Front	0.13	0.33	0.12	0.31
	Panel 5	Front to Rear	0.05	0.27	0.04	0.27
		Rear to Front	0.03	0.24	0.03	0.22
	Panel 6	Front to Rear	NA	0.05	NA	0.05
		Rear to Front	NA	0.33	NA	0.25

			Front Panel		Rear Panel	
			Tension	Compression	Tension	Compression
Horizontals		1	0.36	0.42	0.24	0.29
		2	0.21	0.23	0.16	0.26
		3	0.28	NA	0.15	0.07
		4	0.14	0.23	0.15	0.20
		5	-	-	0.07	0.04
Bracing	Panel 2	Rail to Centre	0.18	0.56	0.10	0.24
		Hwy to Centre	0.16	0.59	0.10	0.24
	Panel 3	Rail to Centre	0.07	0.48	0.06	0.17
		Hwy to Centre	0.08	0.47	0.06	0.17
	Panel 4	Rail to Centre	0.01	0.51	0.04	0.15
		Hwy to Centre	NA	0.52	0.04	0.14
	Panel 5	Rail to Centre	NA	0.38	0.05	0.10
		Hwy to Centre	NA	0.37	0.04	0.12
	Panel 2	Vertical	NA	0.64	0.02	0.26
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.71	0.60
Back Transverse Sheave Girder	0.18	0.27
G1	0.20	0.66
G2/G3	0.17	0.67
G4	0.19	0.64
G6	0.18	0.65

Max D/C 1.67

3 - ULS V3

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compressio	Tension	Compressio	Tension	Compressio
Panel 1 (Bottom)	0.92	1.67	0.92	1.65	0.83	1.54	0.85	1.54
Panel 2	0.04	0.69	0.05	0.69	0.19	0.59	0.19	0.57
Panel 3	NA	0.51	NA	0.50	0.00	0.31	0.01	0.30
Panel 4	NA	0.68	NA	0.66	NA	0.22	NA	0.22
Panel 5	NA	0.68	NA	0.66	NA	0.25	NA	0.22
Panel 6 (Top)	NA	0.52	NA	0.51	0.01	0.27	0.07	0.32

			West Panel		East Panel	
			Tension	Compressio	Tension	Compression
Horizontals		Jacking Girder	0.02	0.01	0.02	0.01
		1	0.16	0.09	0.26	0.14
		2	0.22	0.09	0.18	0.05
		3	0.23	0.10	0.18	0.03
		4	0.27	0.10	0.22	0.03
		5	0.15	0.10	0.12	0.08
Bracing	Panel 1	Front to Rear	0.42	0.83	0.43	0.78
		Rear to Front	0.28	0.56	0.34	0.61
	Panel 2	Front to Rear	0.29	0.56	0.26	0.50
		Rear to Front	0.26	0.47	0.24	0.44
	Panel 3	Front to Rear	0.28	0.53	0.27	0.49
		Rear to Front	0.28	0.47	0.26	0.44
	Panel 4	Front to Rear	0.20	0.47	0.20	0.45
		Rear to Front	0.17	0.38	0.15	0.35
	Panel 5	Front to Rear	0.07	0.30	0.06	0.30
		Rear to Front	0.04	0.25	0.04	0.24
	Panel 6	Front to Rear	NA	0.05	0.00	0.05
		Rear to Front	NA	0.33	NA	0.25

			Front Panel		Rear Panel	
			Tension	Compressio	Tension	Compression
Horizontals		1	0.44	0.52	0.30	0.36
		2	0.24	0.26	0.19	0.31
		3	0.29	NA	0.17	0.10
		4	0.16	0.29	0.17	0.25
		5	-	-	0.07	0.06
Bracing	Panel 2	Rail to Centre	0.25	0.66	0.14	0.28
		Hwy to Centre	0.23	0.69	0.13	0.28
	Panel 3	Rail to Centre	0.12	0.56	0.08	0.20
		Hwy to Centre	0.14	0.54	0.09	0.20
	Panel 4	Rail to Centre	0.05	0.57	0.06	0.17
		Hwy to Centre	0.04	0.59	0.06	0.17
	Panel 5	Rail to Centre	NA	0.42	0.07	0.12
		Hwy to Centre	NA	0.41	0.05	0.14
	Panel 2	Vertical	NA	0.66	0.03	0.30
	Panel 4	Vertical	0.02	NA	0.03	NA

	Moment	Shear
Front Transverse Sheave Girder	0.72	0.61
Back Transverse Sheave Girder	0.18	0.27
G1	0.20	0.67
G2/G3	0.17	0.68
G4	0.20	0.66
G6	0.19	0.67

Max D/C 0.64

3 - ULS V4

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compressio	Tension	Compressio	Tension	Compression
Panel 1 (Bottom)	0.00	0.20	0.00	0.19	0.00	0.30	0.00	0.28
Panel 2	NA	0.16	NA	0.16	NA	0.19	NA	0.19
Panel 3	NA	0.17	NA	0.16	NA	0.19	NA	0.18
Panel 4	NA	0.19	NA	0.19	NA	0.17	NA	0.17
Panel 5	NA	0.18	NA	0.18	NA	0.20	NA	0.19
Panel 6 (Top)	NA	0.21	NA	0.21	NA	0.28	0.01	0.31

			West Panel		East Panel	
			Tension	Compressio	Tension	Compression
Horizontals	Jacking Girder		0.00	NA	0.01	NA
	1		0.03	NA	0.07	NA
	2		0.10	0.01	0.10	0.01
	3		0.11	0.02	0.10	0.01
	4		0.13	0.03	0.11	NA
	5		0.08	0.11	0.05	0.09
Bracing	Panel 1	Front to Rear	NA	0.11	0.01	0.16
		Rear to Front	NA	0.09	NA	0.10
	Panel 2	Front to Rear	NA	0.08	NA	0.09
		Rear to Front	NA	0.09	NA	0.08
	Panel 3	Front to Rear	NA	0.07	NA	0.08
		Rear to Front	0.00	0.09	0.01	0.08
	Panel 4	Front to Rear	NA	0.09	NA	0.10
		Rear to Front	NA	0.10	0.00	0.09
	Panel 5	Front to Rear	NA	0.09	NA	0.09
		Rear to Front	NA	0.13	NA	0.12
	Panel 6	Front to Rear	0.02	NA	0.02	NA
		Rear to Front	NA	0.33	NA	0.26

			Front Panel		Rear Panel	
			Tension	Compressio	Tension	Compression
Horizontals	1		0.03	0.01	0.03	0.01
	2		0.06	0.06	0.04	0.06
	3		0.10	NA	0.09	NA
	4		0.04	0.02	0.04	0.04
	5		-	-	0.05	0.00
Bracing	Panel 2	Rail to Centre	NA	0.09	NA	0.07
		Hwy to Centre	NA	0.09	NA	0.07
	Panel 3	Rail to Centre	NA	0.08	NA	0.05
		Hwy to Centre	NA	0.08	NA	0.06
	Panel 4	Rail to Centre	NA	0.12	NA	0.06
		Hwy to Centre	NA	0.12	NA	0.06
	Panel 5	Rail to Centre	NA	0.10	NA	0.02
		Hwy to Centre	NA	0.10	NA	0.05
	Panel 2	Vertical	NA	0.22	NA	0.12
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.25	0.22
Back Transverse Sheave Girder	0.21	0.35
G1	0.12	0.10
G2/G3	0.33	0.45
G4	0.10	0.06
G6	0.16	0.64

Max D/C 0.56

4 - ULS 1								
	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compression	Tension	Compression	Tension	Compression
Panel 1 (Bottom)	0.00	0.32	0.00	0.31	0.00	0.27	0.00	0.25
Panel 2	NA	0.29	NA	0.28	NA	0.17	NA	0.17
Panel 3	NA	0.29	NA	0.29	NA	0.16	NA	0.15
Panel 4	NA	0.35	NA	0.35	NA	0.15	NA	0.14
Panel 5	NA	0.34	NA	0.34	NA	0.17	NA	0.15
Panel 6 (Top)	NA	0.34	NA	0.33	NA	0.21	0.01	0.23

			West Panel		East Panel	
			Tension	Compression	Tension	Compression
Horizontals		Jacking Girder	0.01	NA	0.01	NA
		1	0.04	NA	0.10	NA
		2	0.12	NA	0.12	NA
		3	0.13	NA	0.12	NA
		4	0.16	NA	0.14	NA
		5	0.10	0.06	0.08	0.05
Bracing	Panel 1	Front to Rear	NA	0.15	0.01	0.18
		Rear to Front	NA	0.11	NA	0.11
	Panel 2	Front to Rear	NA	0.11	NA	0.12
		Rear to Front	NA	0.11	NA	0.10
	Panel 3	Front to Rear	NA	0.10	NA	0.10
		Rear to Front	NA	0.11	NA	0.10
	Panel 4	Front to Rear	NA	0.13	NA	0.14
		Rear to Front	NA	0.13	NA	0.12
	Panel 5	Front to Rear	NA	0.13	NA	0.14
		Rear to Front	NA	0.15	NA	0.14
	Panel 6	Front to Rear	NA	0.01	NA	0.01
		Rear to Front	NA	0.30	NA	0.23

			Front Panel		Rear Panel	
			Tension	Compression	Tension	Compression
Horizontals		1	0.04	0.01	0.02	0.01
		2	0.08	0.07	0.04	0.06
		3	0.19	NA	0.08	NA
		4	0.05	0.00	0.04	0.04
		5	-	-	0.04	0.01
Bracing	Panel 2	Rail to Centre	NA	0.14	NA	0.06
		Hwy to Centre	NA	0.15	NA	0.06
	Panel 3	Rail to Centre	NA	0.15	NA	0.04
		Hwy to Centre	NA	0.15	NA	0.05
	Panel 4	Rail to Centre	NA	0.21	NA	0.05
		Hwy to Centre	NA	0.21	NA	0.05
	Panel 5	Rail to Centre	NA	0.19	NA	0.02
		Hwy to Centre	NA	0.19	NA	0.04
	Panel 2	Vertical	NA	0.43	NA	0.09
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.56	0.48
Back Transverse Sheave Girder	0.17	0.25
G1	0.15	0.51
G2/G3	0.15	0.54
G4	0.15	0.50
G6	0.15	0.49

Max D/C 1.52

4 - ULS 4

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compressio	Tension	Compressio	Tension	Compressio
Panel 1 (Bottom)	0.88	1.52	0.87	1.50	0.79	1.39	0.81	1.37
Panel 2	0.07	0.62	0.07	0.61	0.20	0.51	0.21	0.49
Panel 3	NA	0.44	NA	0.44	0.03	0.25	0.04	0.24
Panel 4	NA	0.60	NA	0.58	NA	0.16	0.00	0.16
Panel 5	NA	0.60	NA	0.58	0.02	0.18	0.02	0.16
Panel 6 (Top)	NA	0.44	NA	0.43	0.02	0.19	0.06	0.22

			West Panel		East Panel	
			Tension	Compressio	Tension	Compression
Horizontals		Jacking Girder	0.02	0.01	0.02	0.01
		1	0.15	0.09	0.22	0.13
		2	0.20	0.10	0.16	0.07
		3	0.21	0.11	0.16	0.05
		4	0.24	0.11	0.20	0.05
		5	0.12	0.13	0.09	0.11
Bracing	Panel 1	Front to Rear	0.40	0.76	0.41	0.71
		Rear to Front	0.28	0.50	0.32	0.56
	Panel 2	Front to Rear	0.28	0.51	0.25	0.46
		Rear to Front	0.26	0.43	0.23	0.40
	Panel 3	Front to Rear	0.27	0.49	0.26	0.45
		Rear to Front	0.27	0.43	0.25	0.40
	Panel 4	Front to Rear	0.20	0.43	0.20	0.41
		Rear to Front	0.17	0.34	0.15	0.32
	Panel 5	Front to Rear	0.07	0.27	0.07	0.27
		Rear to Front	0.05	0.23	0.05	0.22
	Panel 6	Front to Rear	0.03	0.00	0.04	0.00
		Rear to Front	NA	0.29	NA	0.22

			Front Panel		Rear Panel	
			Tension	Compressio	Tension	Compression
Horizontals		1	0.40	0.48	0.27	0.34
		2	0.22	0.25	0.18	0.30
		3	0.25	NA	0.14	0.12
		4	0.15	0.28	0.16	0.24
		5	-	-	0.06	0.06
Bracing	Panel 2	Rail to Centre	0.24	0.61	0.14	0.25
		Hwy to Centre	0.22	0.63	0.13	0.25
	Panel 3	Rail to Centre	0.13	0.50	0.09	0.17
		Hwy to Centre	0.14	0.49	0.09	0.17
	Panel 4	Rail to Centre	0.06	0.51	0.07	0.15
		Hwy to Centre	0.05	0.53	0.06	0.14
	Panel 5	Rail to Centre	NA	0.37	0.07	0.10
		Hwy to Centre	NA	0.36	0.06	0.12
	Panel 2	Vertical	NA	0.57	0.04	0.24
	Panel 4	Vertical	0.02	NA	0.03	NA

	Moment	Shear
Front Transverse Sheave Girder	0.60	0.51
Back Transverse Sheave Girder	0.11	0.18
G1	0.17	0.57
G2/G3	0.15	0.57
G4	0.17	0.55
G6	0.09	0.47

Max D/C 0.67

4 - ULS V1

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compression	Tension	Compression	Tension	Compression
Panel 1 (Bottom)	0.00	0.37	0.00	0.36	0.00	0.29	0.00	0.27
Panel 2	NA	0.33	NA	0.33	NA	0.18	NA	0.18
Panel 3	NA	0.34	NA	0.34	NA	0.17	NA	0.17
Panel 4	NA	0.41	NA	0.41	NA	0.16	NA	0.15
Panel 5	NA	0.40	NA	0.40	NA	0.19	NA	0.17
Panel 6 (Top)	NA	0.40	NA	0.39	NA	0.22	0.01	0.25

			West Panel		East Panel	
			Tension	Compression	Tension	Compression
Horizontals		Jacking Girder	0.01	NA	0.01	NA
		1	0.04	NA	0.11	NA
		2	0.13	NA	0.13	NA
		3	0.14	NA	0.13	NA
		4	0.17	NA	0.15	NA
		5	0.12	0.05	0.09	0.04
Bracing	Panel 1	Front to Rear	NA	0.16	0.00	0.20
		Rear to Front	NA	0.12	NA	0.12
	Panel 2	Front to Rear	NA	0.12	NA	0.13
		Rear to Front	NA	0.12	NA	0.11
	Panel 3	Front to Rear	NA	0.11	NA	0.12
		Rear to Front	NA	0.12	NA	0.11
	Panel 4	Front to Rear	NA	0.15	NA	0.15
		Rear to Front	NA	0.15	NA	0.14
	Panel 5	Front to Rear	NA	0.15	NA	0.16
		Rear to Front	NA	0.16	NA	0.15
	Panel 6	Front to Rear	NA	0.03	NA	0.03
		Rear to Front	NA	0.30	NA	0.23

			Front Panel		Rear Panel	
			Tension	Compression	Tension	Compression
Horizontals		1	0.04	0.01	0.02	0.01
		2	0.08	0.07	0.04	0.06
		3	0.23	NA	0.09	NA
		4	0.05	NA	0.04	0.04
		5	-	-	0.04	0.01
Bracing	Panel 2	Rail to Centre	NA	0.16	NA	0.06
		Hwy to Centre	NA	0.17	NA	0.06
	Panel 3	Rail to Centre	NA	0.17	NA	0.05
		Hwy to Centre	NA	0.17	NA	0.05
	Panel 4	Rail to Centre	NA	0.24	NA	0.06
		Hwy to Centre	NA	0.24	NA	0.05
	Panel 5	Rail to Centre	NA	0.22	NA	0.02
		Hwy to Centre	NA	0.22	NA	0.04
	Panel 2	Vertical	NA	0.51	NA	0.10
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.67	0.57
Back Transverse Sheave Girder	0.18	0.27
G1	0.18	0.61
G2/G3	0.18	0.65
G4	0.18	0.59
G6	0.15	0.55

Max D/C 1.41

4 - ULS V2

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compressio	Tension	Compression	Tension	Compressio
Panel 1 (Bottom)	0.69	1.41	0.68	1.39	0.64	1.27	0.65	1.27
Panel 2	NA	0.62	NA	0.62	0.13	0.51	0.13	0.50
Panel 3	NA	0.48	NA	0.47	NA	0.29	NA	0.28
Panel 4	NA	0.62	NA	0.61	NA	0.21	NA	0.20
Panel 5	NA	0.62	NA	0.61	NA	0.24	NA	0.21
Panel 6 (Top)	NA	0.50	NA	0.49	0.00	0.26	0.06	0.31

			West Panel		East Panel	
			Tension	Compressio	Tension	Compression
Horizontals		Jacking Girder	0.02	0.01	0.02	0.01
		1	0.14	0.06	0.23	0.10
		2	0.20	0.06	0.17	0.03
		3	0.21	0.07	0.17	0.02
		4	0.25	0.07	0.21	0.02
		5	0.15	0.09	0.11	0.07
Bracing	Panel 1	Front to Rear	0.32	0.70	0.34	0.67
		Rear to Front	0.21	0.47	0.26	0.51
	Panel 2	Front to Rear	0.23	0.47	0.20	0.43
		Rear to Front	0.20	0.39	0.19	0.38
	Panel 3	Front to Rear	0.22	0.45	0.21	0.42
		Rear to Front	0.22	0.40	0.20	0.38
	Panel 4	Front to Rear	0.16	0.41	0.15	0.39
		Rear to Front	0.13	0.33	0.12	0.31
	Panel 5	Front to Rear	0.05	0.27	0.04	0.27
		Rear to Front	0.03	0.24	0.03	0.22
	Panel 6	Front to Rear	NA	0.05	NA	0.05
		Rear to Front	NA	0.33	NA	0.25

			Front Panel		Rear Panel	
			Tension	Compressio	Tension	Compression
Horizontals		1	0.36	0.41	0.24	0.29
		2	0.21	0.23	0.16	0.26
		3	0.28	NA	0.15	0.07
		4	0.14	0.23	0.15	0.20
		5	-	-	0.07	0.04
Bracing	Panel 2	Rail to Centre	0.18	0.57	0.10	0.24
		Hwy to Centre	0.16	0.59	0.10	0.24
	Panel 3	Rail to Centre	0.07	0.48	0.06	0.17
		Hwy to Centre	0.08	0.47	0.06	0.17
	Panel 4	Rail to Centre	0.01	0.51	0.04	0.15
		Hwy to Centre	NA	0.53	0.04	0.14
	Panel 5	Rail to Centre	NA	0.38	0.05	0.10
		Hwy to Centre	NA	0.37	0.04	0.12
	Panel 2	Vertical	NA	0.64	0.02	0.26
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.71	0.60
Back Transverse Sheave Girder	0.18	0.27
G1	0.20	0.66
G2/G3	0.17	0.68
G4	0.20	0.64
G6	0.18	0.65

Max D/C 1.67

4 - ULS V3

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compressio	Tension	Compressio	Tension	Compressio
Panel 1 (Bottom)	0.92	1.67	0.92	1.65	0.82	1.54	0.85	1.54
Panel 2	0.04	0.70	0.05	0.69	0.19	0.59	0.19	0.57
Panel 3	NA	0.51	NA	0.50	0.00	0.31	0.01	0.30
Panel 4	NA	0.68	NA	0.66	NA	0.22	NA	0.22
Panel 5	NA	0.68	NA	0.66	NA	0.25	NA	0.22
Panel 6 (Top)	NA	0.52	NA	0.51	0.01	0.27	0.07	0.32

			West Panel		East Panel	
			Tension	Compressio	Tension	Compression
Horizontals		Jacking Girder	0.02	0.01	0.02	0.01
		1	0.16	0.09	0.26	0.14
		2	0.22	0.09	0.18	0.05
		3	0.23	0.10	0.18	0.03
		4	0.27	0.10	0.22	0.03
		5	0.16	0.10	0.12	0.08
Bracing	Panel 1	Front to Rear	0.42	0.83	0.43	0.78
		Rear to Front	0.28	0.56	0.34	0.61
	Panel 2	Front to Rear	0.29	0.56	0.26	0.50
		Rear to Front	0.26	0.47	0.24	0.44
	Panel 3	Front to Rear	0.28	0.53	0.27	0.49
		Rear to Front	0.28	0.47	0.26	0.44
	Panel 4	Front to Rear	0.20	0.47	0.20	0.45
		Rear to Front	0.17	0.38	0.15	0.35
	Panel 5	Front to Rear	0.07	0.30	0.06	0.30
		Rear to Front	0.04	0.25	0.04	0.24
	Panel 6	Front to Rear	NA	0.05	0.00	0.05
		Rear to Front	NA	0.33	NA	0.25

			Front Panel		Rear Panel	
			Tension	Compressio	Tension	Compression
Horizontals		1	0.44	0.52	0.30	0.36
		2	0.24	0.26	0.19	0.31
		3	0.29	NA	0.17	0.10
		4	0.16	0.29	0.17	0.25
		5	-	-	0.07	0.05
Bracing	Panel 2	Rail to Centre	0.25	0.67	0.14	0.28
		Hwy to Centre	0.23	0.69	0.13	0.28
	Panel 3	Rail to Centre	0.12	0.56	0.08	0.20
		Hwy to Centre	0.13	0.54	0.09	0.20
	Panel 4	Rail to Centre	0.05	0.57	0.06	0.17
		Hwy to Centre	0.04	0.59	0.06	0.17
	Panel 5	Rail to Centre	NA	0.42	0.07	0.12
		Hwy to Centre	NA	0.41	0.05	0.14
	Panel 2	Vertical	NA	0.67	0.03	0.30
	Panel 4	Vertical	0.02	NA	0.03	NA

	Moment	Shear
Front Transverse Sheave Girder	0.72	0.61
Back Transverse Sheave Girder	0.18	0.27
G1	0.20	0.67
G2/G3	0.17	0.68
G4	0.20	0.66
G6	0.19	0.67

Max D/C 0.64

4 - ULS V4								
	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compression	Tension	Compression	Tension	Compression
Panel 1 (Bottom)	0.00	0.20	0.00	0.19	0.00	0.30	0.00	0.28
Panel 2	NA	0.16	NA	0.16	NA	0.19	NA	0.19
Panel 3	NA	0.17	NA	0.16	NA	0.19	NA	0.18
Panel 4	NA	0.19	NA	0.19	NA	0.17	NA	0.17
Panel 5	NA	0.18	NA	0.18	NA	0.20	NA	0.19
Panel 6 (Top)	NA	0.21	NA	0.21	NA	0.28	0.01	0.31

			West Panel		East Panel	
			Tension	Compression	Tension	Compression
Horizontals		Jacking Girder	0.00	NA	0.01	NA
		1	0.03	NA	0.07	NA
		2	0.10	0.01	0.10	0.01
		3	0.11	0.02	0.10	0.01
		4	0.13	0.03	0.11	NA
		5	0.08	0.11	0.05	0.09
Bracing	Panel 1	Front to Rear	NA	0.11	0.01	0.16
		Rear to Front	NA	0.09	NA	0.10
	Panel 2	Front to Rear	NA	0.08	NA	0.09
		Rear to Front	NA	0.09	NA	0.08
	Panel 3	Front to Rear	NA	0.07	NA	0.08
		Rear to Front	0.00	0.09	0.01	0.08
	Panel 4	Front to Rear	NA	0.09	NA	0.10
		Rear to Front	NA	0.10	0.00	0.09
	Panel 5	Front to Rear	NA	0.09	NA	0.09
		Rear to Front	NA	0.13	NA	0.12
	Panel 6	Front to Rear	0.02	NA	0.02	NA
		Rear to Front	NA	0.33	NA	0.26

			Front Panel		Rear Panel	
			Tension	Compression	Tension	Compression
Horizontals		1	0.03	0.01	0.03	0.01
		2	0.06	0.06	0.04	0.06
		3	0.10	NA	0.09	NA
		4	0.04	0.02	0.04	0.04
		5	-	-	0.05	0.00
Bracing	Panel 2	Rail to Centre	NA	0.09	NA	0.07
		Hwy to Centre	NA	0.09	NA	0.07
	Panel 3	Rail to Centre	NA	0.08	NA	0.06
		Hwy to Centre	NA	0.08	NA	0.06
	Panel 4	Rail to Centre	NA	0.12	NA	0.06
		Hwy to Centre	NA	0.12	NA	0.06
	Panel 5	Rail to Centre	NA	0.10	NA	0.03
		Hwy to Centre	NA	0.10	NA	0.05
	Panel 2	Vertical	NA	0.22	NA	0.12
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.25	0.22
Back Transverse Sheave Girder	0.21	0.35
G1	0.12	0.10
G2/G3	0.33	0.45
G4	0.11	0.06
G6	0.16	0.64

Max D/C 0.61

5 - ULS 1

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compression	Tension	Compression	Tension	Compression
Panel 1 (Bottom)	0.00	0.35	0.00	0.33	0.00	0.28	0.00	0.26
Panel 2	NA	0.31	NA	0.30	NA	0.17	NA	0.17
Panel 3	NA	0.32	NA	0.32	NA	0.17	NA	0.16
Panel 4	NA	0.38	NA	0.37	NA	0.15	NA	0.15
Panel 5	NA	0.37	NA	0.37	NA	0.18	NA	0.16
Panel 6 (Top)	NA	0.36	NA	0.36	NA	0.22	0.01	0.24

			West Panel		East Panel	
			Tension	Compression	Tension	Compression
Horizontals		Jacking Girder	0.01	NA	0.01	NA
		1	0.04	NA	0.10	NA
		2	0.12	NA	0.12	NA
		3	0.13	NA	0.13	NA
		4	0.16	NA	0.15	NA
		5	0.11	0.06	0.08	0.04
Bracing	Panel 1	Front to Rear	NA	0.15	0.00	0.19
		Rear to Front	NA	0.12	NA	0.11
	Panel 2	Front to Rear	NA	0.12	NA	0.12
		Rear to Front	NA	0.12	NA	0.11
	Panel 3	Front to Rear	NA	0.10	NA	0.11
		Rear to Front	NA	0.11	NA	0.11
	Panel 4	Front to Rear	NA	0.14	NA	0.14
		Rear to Front	NA	0.14	NA	0.13
	Panel 5	Front to Rear	NA	0.14	NA	0.15
		Rear to Front	NA	0.15	NA	0.14
	Panel 6	Front to Rear	NA	0.02	NA	0.02
		Rear to Front	NA	0.30	NA	0.23

			Front Panel		Rear Panel	
			Tension	Compression	Tension	Compression
Horizontals		1	0.04	0.01	0.02	0.01
		2	0.08	0.07	0.04	0.06
		3	0.21	NA	0.08	NA
		4	0.05	0.00	0.04	0.04
		5	-	-	0.04	0.01
Bracing	Panel 2	Rail to Centre	NA	0.15	NA	0.06
		Hwy to Centre	NA	0.16	NA	0.06
	Panel 3	Rail to Centre	NA	0.16	NA	0.05
		Hwy to Centre	NA	0.16	NA	0.05
	Panel 4	Rail to Centre	NA	0.22	NA	0.05
		Hwy to Centre	NA	0.23	NA	0.05
	Panel 5	Rail to Centre	NA	0.20	NA	0.02
		Hwy to Centre	NA	0.20	NA	0.04
	Panel 2	Vertical	NA	0.47	NA	0.09
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.61	0.52
Back Transverse Sheave Girder	0.18	0.26
G1	0.16	0.56
G2/G3	0.17	0.59
G4	0.17	0.55
G6	0.15	0.52

Max D/C 1.54

5 - ULS 4

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compression	Tension	Compression	Tension	Compression
Panel 1 (Bottom)	0.86	1.54	0.86	1.52	0.79	1.39	0.80	1.37
Panel 2	0.05	0.64	0.05	0.63	0.20	0.52	0.20	0.49
Panel 3	NA	0.46	NA	0.46	0.03	0.26	0.03	0.24
Panel 4	NA	0.62	NA	0.61	NA	0.17	0.00	0.16
Panel 5	NA	0.62	NA	0.61	0.02	0.19	0.02	0.16
Panel 6 (Top)	NA	0.47	NA	0.46	0.02	0.20	0.07	0.23

			West Panel		East Panel	
			Tension	Compression	Tension	Compression
Horizontals		Jacking Girder	0.02	0.01	0.02	0.01
		1	0.15	0.09	0.23	0.13
		2	0.20	0.10	0.17	0.06
		3	0.21	0.11	0.17	0.04
		4	0.25	0.10	0.21	0.04
		5	0.13	0.12	0.09	0.10
Bracing	Panel 1	Front to Rear	0.40	0.77	0.41	0.72
		Rear to Front	0.27	0.51	0.32	0.56
	Panel 2	Front to Rear	0.27	0.52	0.25	0.47
		Rear to Front	0.25	0.43	0.23	0.41
	Panel 3	Front to Rear	0.27	0.49	0.26	0.46
		Rear to Front	0.27	0.43	0.24	0.41
	Panel 4	Front to Rear	0.20	0.44	0.19	0.42
		Rear to Front	0.16	0.34	0.15	0.32
	Panel 5	Front to Rear	0.07	0.28	0.06	0.28
		Rear to Front	0.04	0.23	0.04	0.22
	Panel 6	Front to Rear	0.03	0.01	0.03	0.01
		Rear to Front	NA	0.29	NA	0.22

			Front Panel		Rear Panel	
			Tension	Compression	Tension	Compression
Horizontals		1	0.40	0.48	0.28	0.34
		2	0.22	0.25	0.18	0.30
		3	0.26	NA	0.14	0.11
		4	0.15	0.27	0.16	0.24
		5	-	-	0.06	0.06
Bracing	Panel 2	Rail to Centre	0.23	0.62	0.14	0.25
		Hwy to Centre	0.22	0.64	0.13	0.25
	Panel 3	Rail to Centre	0.12	0.51	0.09	0.17
		Hwy to Centre	0.13	0.50	0.09	0.17
	Panel 4	Rail to Centre	0.05	0.53	0.07	0.15
		Hwy to Centre	0.04	0.55	0.06	0.15
	Panel 5	Rail to Centre	NA	0.38	0.07	0.10
		Hwy to Centre	NA	0.37	0.06	0.12
	Panel 2	Vertical	NA	0.61	0.04	0.25
	Panel 4	Vertical	0.02	NA	0.03	NA

	Moment	Shear
Front Transverse Sheave Girder	0.65	0.55
Back Transverse Sheave Girder	0.12	0.19
G1	0.18	0.61
G2/G3	0.16	0.62
G4	0.18	0.59
G6	0.09	0.50

Max D/C 0.73

5 - ULS V1

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compressio	Tension	Compressio	Tension	Compressio
Panel 1 (Bottom)	0.00	0.40	0.00	0.38	0.00	0.29	0.00	0.27
Panel 2	NA	0.36	NA	0.36	NA	0.19	NA	0.19
Panel 3	NA	0.37	NA	0.37	NA	0.18	NA	0.18
Panel 4	NA	0.44	NA	0.44	NA	0.17	NA	0.16
Panel 5	NA	0.43	NA	0.43	NA	0.20	NA	0.17
Panel 6 (Top)	NA	0.43	NA	0.43	NA	0.23	0.01	0.26

			West Panel		East Panel	
			Tension	Compressio	Tension	Compression
Horizontals	Jacking Girder		0.01	NA	0.01	NA
	1		0.04	NA	0.12	NA
	2		0.13	NA	0.13	NA
	3		0.15	NA	0.14	NA
	4		0.18	NA	0.16	NA
	5		0.12	0.05	0.09	0.03
Bracing	Panel 1	Front to Rear	NA	0.17	NA	0.21
		Rear to Front	NA	0.13	NA	0.13
	Panel 2	Front to Rear	NA	0.13	NA	0.14
		Rear to Front	NA	0.13	NA	0.12
	Panel 3	Front to Rear	NA	0.12	NA	0.12
		Rear to Front	NA	0.13	NA	0.12
	Panel 4	Front to Rear	NA	0.16	NA	0.16
		Rear to Front	NA	0.16	NA	0.14
	Panel 5	Front to Rear	NA	0.16	NA	0.17
		Rear to Front	NA	0.17	NA	0.16
	Panel 6	Front to Rear	NA	0.04	NA	0.03
		Rear to Front	NA	0.31	NA	0.23

			Front Panel		Rear Panel	
			Tension	Compressio	Tension	Compression
Horizontals	1		0.05	0.01	0.02	0.01
	2		0.09	0.08	0.04	0.06
	3		0.25	NA	0.09	NA
	4		0.05	NA	0.04	0.04
	5		-	-	0.04	0.01
Bracing	Panel 2	Rail to Centre	NA	0.17	NA	0.06
		Hwy to Centre	NA	0.18	NA	0.06
	Panel 3	Rail to Centre	NA	0.19	NA	0.05
		Hwy to Centre	NA	0.18	NA	0.05
	Panel 4	Rail to Centre	NA	0.26	NA	0.06
		Hwy to Centre	NA	0.26	NA	0.05
	Panel 5	Rail to Centre	NA	0.24	NA	0.02
		Hwy to Centre	NA	0.24	NA	0.05
	Panel 2	Vertical	NA	0.56	NA	0.10
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.73	0.62
Back Transverse Sheave Girder	0.19	0.29
G1	0.20	0.67
G2/G3	0.20	0.71
G4	0.20	0.65
G6	0.16	0.58

Max D/C 1.44

5 - ULS V2								
	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compressio	Tension	Compression	Tension	Compressio
Panel 1 (Bottom)	0.66	1.44	0.65	1.41	0.63	1.28	0.65	1.28
Panel 2	NA	0.65	NA	0.64	0.13	0.52	0.13	0.50
Panel 3	NA	0.50	NA	0.50	NA	0.29	NA	0.28
Panel 4	NA	0.65	NA	0.64	NA	0.22	NA	0.21
Panel 5	NA	0.65	NA	0.64	NA	0.25	NA	0.22
Panel 6 (Top)	NA	0.53	NA	0.52	0.00	0.27	0.06	0.32

			West Panel		East Panel	
			Tension	Compressio	Tension	Compression
Horizontals		Jacking Girder	0.02	0.01	0.02	0.01
		1	0.14	0.06	0.24	0.09
		2	0.20	0.06	0.17	0.03
		3	0.22	0.06	0.18	0.01
		4	0.26	0.07	0.22	0.01
		5	0.16	0.09	0.12	0.06
Bracing	Panel 1	Front to Rear	0.32	0.70	0.34	0.68
		Rear to Front	0.20	0.48	0.25	0.52
	Panel 2	Front to Rear	0.22	0.48	0.20	0.44
		Rear to Front	0.20	0.40	0.19	0.38
	Panel 3	Front to Rear	0.22	0.45	0.21	0.42
		Rear to Front	0.22	0.40	0.20	0.38
	Panel 4	Front to Rear	0.16	0.42	0.15	0.40
		Rear to Front	0.12	0.34	0.11	0.32
	Panel 5	Front to Rear	0.04	0.28	0.04	0.28
		Rear to Front	0.03	0.24	0.03	0.23
	Panel 6	Front to Rear	NA	0.06	NA	0.06
		Rear to Front	NA	0.33	NA	0.24

			Front Panel		Rear Panel	
			Tension	Compressio	Tension	Compression
Horizontals		1	0.36	0.41	0.24	0.29
		2	0.21	0.23	0.16	0.26
		3	0.30	NA	0.16	0.07
		4	0.14	0.23	0.15	0.20
		5	-	-	0.07	0.04
Bracing	Panel 2	Rail to Centre	0.17	0.58	0.10	0.24
		Hwy to Centre	0.15	0.60	0.10	0.24
	Panel 3	Rail to Centre	0.06	0.50	0.06	0.17
		Hwy to Centre	0.07	0.48	0.06	0.17
	Panel 4	Rail to Centre	NA	0.53	0.04	0.15
		Hwy to Centre	NA	0.54	0.04	0.15
	Panel 5	Rail to Centre	NA	0.40	0.05	0.10
		Hwy to Centre	NA	0.39	0.03	0.13
	Panel 2	Vertical	NA	0.68	0.02	0.27
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.77	0.65
Back Transverse Sheave Girder	0.19	0.28
G1	0.21	0.72
G2/G3	0.19	0.74
G4	0.21	0.70
G6	0.18	0.68

Max D/C 1.70

5 - ULS V3

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compressio	Tension	Compressio	Tension	Compressio
Panel 1 (Bottom)	0.90	1.70	0.90	1.68	0.82	1.55	0.84	1.54
Panel 2	0.03	0.72	0.03	0.71	0.18	0.60	0.19	0.58
Panel 3	NA	0.53	NA	0.53	NA	0.32	0.00	0.31
Panel 4	NA	0.71	NA	0.70	NA	0.23	NA	0.22
Panel 5	NA	0.71	NA	0.69	NA	0.26	NA	0.23
Panel 6 (Top)	NA	0.55	NA	0.54	0.01	0.28	0.07	0.33

			West Panel		East Panel	
			Tension	Compressio	Tension	Compression
Horizontals	Jacking Girder		0.02	0.01	0.02	0.01
	1		0.17	0.09	0.26	0.13
	2		0.22	0.08	0.19	0.05
	3		0.24	0.09	0.19	0.03
	4		0.28	0.09	0.23	0.02
	5		0.16	0.10	0.12	0.07
Bracing	Panel 1	Front to Rear	0.41	0.84	0.43	0.79
		Rear to Front	0.28	0.56	0.33	0.62
	Panel 2	Front to Rear	0.28	0.56	0.25	0.51
		Rear to Front	0.26	0.47	0.24	0.45
	Panel 3	Front to Rear	0.28	0.53	0.27	0.50
		Rear to Front	0.28	0.47	0.25	0.45
	Panel 4	Front to Rear	0.20	0.48	0.19	0.46
		Rear to Front	0.16	0.38	0.15	0.36
	Panel 5	Front to Rear	0.07	0.31	0.06	0.31
		Rear to Front	0.04	0.26	0.04	0.25
	Panel 6	Front to Rear	NA	0.06	NA	0.06
		Rear to Front	NA	0.33	NA	0.25

			Front Panel		Rear Panel	
			Tension	Compressio	Tension	Compression
Horizontals	1		0.44	0.52	0.30	0.36
	2		0.24	0.27	0.19	0.32
	3		0.31	NA	0.17	0.10
	4		0.16	0.28	0.17	0.25
	5		-	-	0.07	0.05
Bracing	Panel 2	Rail to Centre	0.24	0.68	0.14	0.28
		Hwy to Centre	0.22	0.70	0.13	0.29
	Panel 3	Rail to Centre	0.11	0.57	0.08	0.20
		Hwy to Centre	0.12	0.55	0.08	0.20
	Panel 4	Rail to Centre	0.04	0.59	0.06	0.18
		Hwy to Centre	0.02	0.61	0.05	0.17
	Panel 5	Rail to Centre	NA	0.44	0.06	0.12
		Hwy to Centre	NA	0.43	0.05	0.15
	Panel 2	Vertical	NA	0.71	0.03	0.31
	Panel 4	Vertical	0.02	NA	0.03	NA

	Moment	Shear
Front Transverse Sheave Girder	0.78	0.66
Back Transverse Sheave Girder	0.19	0.28
G1	0.22	0.72
G2/G3	0.19	0.74
G4	0.22	0.72
G6	0.19	0.70

Max D/C 0.68

5 - ULS V4

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compressio	Tension	Compressio	Tension	Compression
Panel 1 (Bottom)	0.00	0.21	0.00	0.20	0.00	0.31	0.00	0.29
Panel 2	NA	0.17	NA	0.17	NA	0.20	NA	0.20
Panel 3	NA	0.17	NA	0.17	NA	0.19	NA	0.19
Panel 4	NA	0.20	NA	0.20	NA	0.18	NA	0.17
Panel 5	NA	0.19	NA	0.19	NA	0.21	NA	0.20
Panel 6 (Top)	NA	0.21	NA	0.22	NA	0.30	0.01	0.33

			West Panel		East Panel	
			Tension	Compressio	Tension	Compression
Horizontals		Jacking Girder	0.00	NA	0.01	NA
		1	0.03	NA	0.08	NA
		2	0.11	0.01	0.10	0.01
		3	0.11	0.02	0.10	0.00
		4	0.14	0.02	0.11	NA
		5	0.09	0.11	0.05	0.09
Bracing	Panel 1	Front to Rear	NA	0.12	0.01	0.17
		Rear to Front	NA	0.09	NA	0.10
	Panel 2	Front to Rear	NA	0.08	NA	0.09
		Rear to Front	NA	0.09	NA	0.09
	Panel 3	Front to Rear	NA	0.08	NA	0.08
		Rear to Front	NA	0.09	0.00	0.09
	Panel 4	Front to Rear	NA	0.10	NA	0.10
		Rear to Front	NA	0.10	0.00	0.09
	Panel 5	Front to Rear	NA	0.09	NA	0.10
		Rear to Front	NA	0.13	NA	0.13
	Panel 6	Front to Rear	0.01	NA	0.02	NA
		Rear to Front	NA	0.33	NA	0.26

			Front Panel		Rear Panel	
			Tension	Compressio	Tension	Compression
Horizontals		1	0.03	0.01	0.03	0.01
		2	0.06	0.06	0.04	0.06
		3	0.10	NA	0.10	NA
		4	0.04	0.02	0.04	0.04
		5	-	-	0.05	0.00
Bracing	Panel 2	Rail to Centre	NA	0.09	NA	0.07
		Hwy to Centre	NA	0.10	NA	0.07
	Panel 3	Rail to Centre	NA	0.08	NA	0.06
		Hwy to Centre	NA	0.08	NA	0.06
	Panel 4	Rail to Centre	NA	0.13	NA	0.06
		Hwy to Centre	NA	0.13	NA	0.06
	Panel 5	Rail to Centre	NA	0.10	NA	0.03
		Hwy to Centre	NA	0.11	NA	0.06
	Panel 2	Vertical	NA	0.24	NA	0.13
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.27	0.24
Back Transverse Sheave Girder	0.23	0.37
G1	0.12	0.11
G2/G3	0.37	0.49
G4	0.11	0.06
G6	0.16	0.68

								Max D/C	0.65

7 - ULS 1

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compression	Tension	Compression	Tension	Compression
Panel 1 (Bottom)	0.00	0.36	0.00	0.35	0.00	0.28	0.00	0.26
Panel 2	NA	0.32	NA	0.32	NA	0.18	NA	0.18
Panel 3	NA	0.33	NA	0.33	NA	0.17	NA	0.17
Panel 4	NA	0.39	NA	0.39	NA	0.16	NA	0.15
Panel 5	NA	0.39	NA	0.38	NA	0.18	NA	0.16
Panel 6 (Top)	NA	0.38	NA	0.38	NA	0.22	0.01	0.25

			West Panel		East Panel	
			Tension	Compression	Tension	Compression
Horizontals		Jacking Girder	0.01	NA	0.01	NA
		1	0.04	NA	0.11	NA
		2	0.13	NA	0.12	NA
		3	0.14	NA	0.13	NA
		4	0.17	NA	0.15	NA
		5	0.11	0.06	0.08	0.04
Bracing	Panel 1	Front to Rear	NA	0.16	0.00	0.20
		Rear to Front	NA	0.12	NA	0.12
	Panel 2	Front to Rear	NA	0.12	NA	0.13
		Rear to Front	NA	0.12	NA	0.11
	Panel 3	Front to Rear	NA	0.11	NA	0.11
		Rear to Front	NA	0.12	NA	0.11
	Panel 4	Front to Rear	NA	0.15	NA	0.15
		Rear to Front	NA	0.14	NA	0.13
	Panel 5	Front to Rear	NA	0.15	NA	0.15
		Rear to Front	NA	0.16	NA	0.15
	Panel 6	Front to Rear	NA	0.02	NA	0.02
		Rear to Front	NA	0.30	NA	0.23

			Front Panel		Rear Panel	
			Tension	Compression	Tension	Compression
Horizontals		1	0.04	0.01	0.02	0.01
		2	0.08	0.07	0.04	0.06
		3	0.22	NA	0.08	NA
		4	0.05	NA	0.04	0.04
		5	-	-	0.04	0.01
Bracing	Panel 2	Rail to Centre	NA	0.16	NA	0.06
		Hwy to Centre	NA	0.17	NA	0.06
	Panel 3	Rail to Centre	NA	0.17	NA	0.05
		Hwy to Centre	NA	0.17	NA	0.05
	Panel 4	Rail to Centre	NA	0.23	NA	0.05
		Hwy to Centre	NA	0.24	NA	0.05
	Panel 5	Rail to Centre	NA	0.21	NA	0.02
		Hwy to Centre	NA	0.22	NA	0.04
	Panel 2	Vertical	NA	0.50	NA	0.10
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.65	0.55
Back Transverse Sheave Girder	0.18	0.27
G1	0.17	0.59
G2/G3	0.18	0.62
G4	0.18	0.58
G6	0.15	0.53

Max D/C 1.55

7 - ULS 4

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compressio	Tension	Compressio	Tension	Compressio
Panel 1 (Bottom)	0.85	1.55	0.84	1.54	0.79	1.40	0.80	1.38
Panel 2	0.04	0.66	0.04	0.65	0.20	0.52	0.20	0.50
Panel 3	NA	0.48	NA	0.48	0.02	0.26	0.03	0.25
Panel 4	NA	0.64	NA	0.63	NA	0.18	NA	0.17
Panel 5	NA	0.64	NA	0.62	0.02	0.19	0.02	0.17
Panel 6 (Top)	NA	0.49	NA	0.48	0.02	0.20	0.07	0.24

			West Panel		East Panel	
			Tension	Compressio	Tension	Compression
Horizontals		Jacking Girder	0.02	0.01	0.02	0.01
		1	0.15	0.09	0.23	0.13
		2	0.20	0.09	0.17	0.06
		3	0.22	0.10	0.17	0.04
		4	0.25	0.10	0.21	0.04
		5	0.13	0.12	0.09	0.10
Bracing	Panel 1	Front to Rear	0.40	0.77	0.41	0.73
		Rear to Front	0.27	0.51	0.31	0.57
	Panel 2	Front to Rear	0.27	0.52	0.25	0.47
		Rear to Front	0.25	0.43	0.23	0.41
	Panel 3	Front to Rear	0.27	0.50	0.26	0.46
		Rear to Front	0.27	0.43	0.24	0.41
	Panel 4	Front to Rear	0.20	0.44	0.19	0.42
		Rear to Front	0.16	0.35	0.15	0.33
	Panel 5	Front to Rear	0.07	0.29	0.06	0.29
		Rear to Front	0.04	0.24	0.04	0.23
	Panel 6	Front to Rear	0.02	0.02	0.03	0.01
		Rear to Front	NA	0.29	NA	0.21

			Front Panel		Rear Panel	
			Tension	Compressio	Tension	Compression
Horizontals		1	0.41	0.48	0.28	0.34
		2	0.22	0.25	0.18	0.30
		3	0.28	NA	0.15	0.11
		4	0.15	0.27	0.16	0.24
		5	-	-	0.06	0.06
Bracing	Panel 2	Rail to Centre	0.23	0.63	0.14	0.25
		Hwy to Centre	0.21	0.65	0.13	0.26
	Panel 3	Rail to Centre	0.11	0.52	0.09	0.17
		Hwy to Centre	0.12	0.51	0.09	0.17
	Panel 4	Rail to Centre	0.05	0.54	0.06	0.15
		Hwy to Centre	0.03	0.56	0.06	0.15
	Panel 5	Rail to Centre	NA	0.39	0.07	0.10
		Hwy to Centre	NA	0.38	0.06	0.12
	Panel 2	Vertical	NA	0.63	0.04	0.25
	Panel 4	Vertical	0.02	NA	0.03	NA

	Moment	Shear
Front Transverse Sheave Girder	0.69	0.58
Back Transverse Sheave Girder	0.12	0.20
G1	0.19	0.65
G2/G3	0.17	0.66
G4	0.19	0.63
G6	0.09	0.51

Max D/C 0.78

7 - ULS V1

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compression	Tension	Compression	Tension	Compression
Panel 1 (Bottom)	0.00	0.41	0.00	0.40	0.00	0.30	0.00	0.28
Panel 2	NA	0.38	NA	0.37	NA	0.19	NA	0.19
Panel 3	NA	0.39	NA	0.39	NA	0.19	NA	0.18
Panel 4	NA	0.46	NA	0.46	NA	0.17	NA	0.17
Panel 5	NA	0.45	NA	0.45	NA	0.20	NA	0.18
Panel 6 (Top)	NA	0.45	NA	0.45	NA	0.24	0.01	0.27

			West Panel		East Panel	
			Tension	Compression	Tension	Compression
Horizontals		Jacking Girder	0.01	NA	0.01	NA
		1	0.05	NA	0.13	NA
		2	0.14	NA	0.13	NA
		3	0.15	NA	0.14	NA
		4	0.19	NA	0.17	NA
		5	0.13	0.04	0.10	0.02
Bracing	Panel 1	Front to Rear	NA	0.17	NA	0.21
		Rear to Front	NA	0.14	NA	0.13
	Panel 2	Front to Rear	NA	0.13	NA	0.14
		Rear to Front	NA	0.13	NA	0.12
	Panel 3	Front to Rear	NA	0.12	NA	0.13
		Rear to Front	NA	0.13	NA	0.12
	Panel 4	Front to Rear	NA	0.16	NA	0.17
		Rear to Front	NA	0.16	NA	0.15
	Panel 5	Front to Rear	NA	0.17	NA	0.17
		Rear to Front	NA	0.17	NA	0.16
	Panel 6	Front to Rear	NA	0.04	NA	0.04
		Rear to Front	NA	0.31	NA	0.22

			Front Panel		Rear Panel	
			Tension	Compression	Tension	Compression
Horizontals		1	0.05	0.01	0.03	0.01
		2	0.09	0.08	0.04	0.06
		3	0.27	NA	0.09	NA
		4	0.05	NA	0.04	0.04
		5	-	-	0.04	0.01
Bracing	Panel 2	Rail to Centre	NA	0.18	NA	0.06
		Hwy to Centre	NA	0.19	NA	0.06
	Panel 3	Rail to Centre	NA	0.20	NA	0.05
		Hwy to Centre	NA	0.19	NA	0.05
	Panel 4	Rail to Centre	NA	0.27	NA	0.06
		Hwy to Centre	NA	0.27	NA	0.05
	Panel 5	Rail to Centre	NA	0.25	NA	0.02
		Hwy to Centre	NA	0.25	NA	0.05
	Panel 2	Vertical	NA	0.59	NA	0.11
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.78	0.66
Back Transverse Sheave Girder	0.19	0.29
G1	0.21	0.71
G2/G3	0.21	0.75
G4	0.21	0.69
G6	0.16	0.60

Max D/C 1.46

7 - ULS V2								
	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compression	Tension	Compression	Tension	Compression
Panel 1 (Bottom)	0.65	1.46	0.64	1.43	0.63	1.28	0.65	1.28
Panel 2	NA	0.66	NA	0.66	0.12	0.52	0.13	0.51
Panel 3	NA	0.52	NA	0.52	NA	0.30	NA	0.29
Panel 4	NA	0.68	NA	0.66	NA	0.22	NA	0.22
Panel 5	NA	0.67	NA	0.66	NA	0.25	NA	0.23
Panel 6 (Top)	NA	0.55	NA	0.55	NA	0.28	0.06	0.33

			West Panel		East Panel	
			Tension	Compression	Tension	Compression
Horizontals		Jacking Girder	0.02	0.01	0.02	0.00
		1	0.14	0.06	0.24	0.09
		2	0.21	0.05	0.18	0.02
		3	0.22	0.06	0.18	0.01
		4	0.26	0.06	0.22	NA
		5	0.16	0.08	0.12	0.05
Bracing	Panel 1	Front to Rear	0.32	0.71	0.34	0.68
		Rear to Front	0.20	0.48	0.25	0.52
	Panel 2	Front to Rear	0.22	0.48	0.20	0.44
		Rear to Front	0.20	0.40	0.18	0.39
	Panel 3	Front to Rear	0.22	0.46	0.21	0.43
		Rear to Front	0.22	0.41	0.20	0.38
	Panel 4	Front to Rear	0.16	0.42	0.15	0.41
		Rear to Front	0.12	0.34	0.11	0.32
	Panel 5	Front to Rear	0.04	0.28	0.04	0.29
		Rear to Front	0.02	0.25	0.02	0.23
	Panel 6	Front to Rear	NA	0.06	NA	0.06
		Rear to Front	NA	0.33	NA	0.24

			Front Panel		Rear Panel	
			Tension	Compression	Tension	Compression
Horizontals		1	0.36	0.41	0.24	0.29
		2	0.21	0.23	0.16	0.26
		3	0.32	NA	0.16	0.07
		4	0.14	0.22	0.15	0.20
		5	-	-	0.07	0.04
Bracing	Panel 2	Rail to Centre	0.16	0.59	0.10	0.24
		Hwy to Centre	0.14	0.61	0.09	0.24
	Panel 3	Rail to Centre	0.06	0.50	0.06	0.17
		Hwy to Centre	0.07	0.49	0.06	0.17
	Panel 4	Rail to Centre	NA	0.54	0.04	0.15
		Hwy to Centre	NA	0.56	0.03	0.15
	Panel 5	Rail to Centre	NA	0.41	0.05	0.10
		Hwy to Centre	NA	0.40	0.03	0.13
	Panel 2	Vertical	NA	0.71	0.02	0.27
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.82	0.69
Back Transverse Sheave Girder	0.20	0.29
G1	0.23	0.76
G2/G3	0.20	0.78
G4	0.23	0.74
G6	0.18	0.70

Max D/C 1.72

7 - ULS V3

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compression	Tension	Compression	Tension	Compression
Panel 1 (Bottom)	0.89	1.72	0.88	1.69	0.82	1.55	0.84	1.55
Panel 2	0.02	0.74	0.02	0.73	0.18	0.61	0.18	0.59
Panel 3	NA	0.55	NA	0.55	NA	0.33	0.00	0.32
Panel 4	NA	0.73	NA	0.72	NA	0.24	NA	0.23
Panel 5	NA	0.73	NA	0.71	NA	0.26	NA	0.24
Panel 6 (Top)	NA	0.58	NA	0.57	0.01	0.29	0.07	0.34

			West Panel		East Panel	
			Tension	Compression	Tension	Compression
Horizontals		Jacking Girder	0.02	0.01	0.02	0.01
		1	0.17	0.09	0.27	0.13
		2	0.22	0.08	0.19	0.04
		3	0.24	0.09	0.19	0.02
		4	0.28	0.09	0.24	0.02
		5	0.17	0.09	0.13	0.06
Bracing	Panel 1	Front to Rear	0.41	0.84	0.42	0.80
		Rear to Front	0.27	0.57	0.33	0.62
	Panel 2	Front to Rear	0.28	0.57	0.25	0.52
		Rear to Front	0.25	0.47	0.24	0.45
	Panel 3	Front to Rear	0.28	0.54	0.26	0.50
		Rear to Front	0.28	0.48	0.25	0.45
	Panel 4	Front to Rear	0.20	0.49	0.19	0.47
		Rear to Front	0.16	0.39	0.15	0.37
	Panel 5	Front to Rear	0.06	0.31	0.06	0.32
		Rear to Front	0.04	0.27	0.04	0.25
	Panel 6	Front to Rear	NA	0.07	NA	0.07
		Rear to Front	NA	0.33	NA	0.25

			Front Panel		Rear Panel	
			Tension	Compression	Tension	Compression
Horizontals		1	0.44	0.52	0.30	0.36
		2	0.24	0.27	0.19	0.32
		3	0.33	NA	0.18	0.09
		4	0.16	0.28	0.17	0.25
		5	-	-	0.07	0.05
Bracing	Panel 2	Rail to Centre	0.23	0.68	0.14	0.29
		Hwy to Centre	0.21	0.71	0.13	0.29
	Panel 3	Rail to Centre	0.11	0.58	0.08	0.20
		Hwy to Centre	0.12	0.56	0.08	0.20
	Panel 4	Rail to Centre	0.03	0.60	0.06	0.18
		Hwy to Centre	0.01	0.62	0.05	0.17
	Panel 5	Rail to Centre	NA	0.45	0.06	0.12
		Hwy to Centre	NA	0.44	0.05	0.15
	Panel 2	Vertical	NA	0.74	0.03	0.31
	Panel 4	Vertical	0.02	NA	0.03	NA

	Moment	Shear
Front Transverse Sheave Girder	0.83	0.70
Back Transverse Sheave Girder	0.20	0.29
G1	0.23	0.76
G2/G3	0.20	0.78
G4	0.23	0.76
G6	0.19	0.72

Max D/C 0.71

7 - ULS V4

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compressio	Tension	Compressio	Tension	Compression
Panel 1 (Bottom)	0.00	0.21	0.00	0.20	0.00	0.32	0.00	0.30
Panel 2	NA	0.18	NA	0.18	NA	0.20	NA	0.21
Panel 3	NA	0.18	NA	0.18	NA	0.20	NA	0.19
Panel 4	NA	0.21	NA	0.21	NA	0.19	NA	0.18
Panel 5	NA	0.20	NA	0.20	NA	0.22	NA	0.21
Panel 6 (Top)	NA	0.22	NA	0.22	NA	0.31	0.02	0.34

			West Panel		East Panel	
			Tension	Compressio	Tension	Compression
Horizontals	Jacking Girder		0.00	NA	0.01	NA
	1		0.03	NA	0.08	NA
	2		0.11	0.01	0.10	0.00
	3		0.12	0.01	0.11	0.00
	4		0.14	0.02	0.12	NA
	5		0.09	0.11	0.05	0.09
Bracing	Panel 1	Front to Rear	NA	0.12	0.01	0.17
		Rear to Front	NA	0.10	NA	0.10
	Panel 2	Front to Rear	NA	0.09	NA	0.09
		Rear to Front	NA	0.09	NA	0.09
	Panel 3	Front to Rear	NA	0.08	NA	0.08
		Rear to Front	NA	0.10	0.00	0.09
	Panel 4	Front to Rear	NA	0.10	NA	0.10
		Rear to Front	NA	0.11	NA	0.10
	Panel 5	Front to Rear	NA	0.09	NA	0.10
		Rear to Front	NA	0.14	NA	0.13
	Panel 6	Front to Rear	0.01	NA	0.02	NA
		Rear to Front	NA	0.34	NA	0.26

			Front Panel		Rear Panel	
			Tension	Compressio	Tension	Compression
Horizontals	1		0.03	0.01	0.03	0.01
	2		0.06	0.07	0.04	0.06
	3		0.11	NA	0.10	NA
	4		0.04	0.02	0.05	0.04
	5		-	-	0.05	NA
Bracing	Panel 2	Rail to Centre	NA	0.09	NA	0.07
		Hwy to Centre	NA	0.10	NA	0.07
	Panel 3	Rail to Centre	NA	0.09	NA	0.06
		Hwy to Centre	NA	0.09	NA	0.06
	Panel 4	Rail to Centre	NA	0.13	NA	0.07
		Hwy to Centre	NA	0.13	NA	0.06
	Panel 5	Rail to Centre	NA	0.11	NA	0.03
		Hwy to Centre	NA	0.11	NA	0.06
	Panel 2	Vertical	NA	0.25	NA	0.14
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.29	0.25
Back Transverse Sheave Girder	0.23	0.39
G1	0.13	0.11
G2/G3	0.39	0.52
G4	0.12	0.07
G6	0.16	0.71

Max D/C 0.65

8 - ULS 1

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compression	Tension	Compression	Tension	Compression
Panel 1 (Bottom)	0.00	0.36	0.00	0.35	0.00	0.28	0.00	0.26
Panel 2	NA	0.32	NA	0.32	NA	0.18	NA	0.18
Panel 3	NA	0.33	NA	0.33	NA	0.17	NA	0.17
Panel 4	NA	0.39	NA	0.39	NA	0.16	NA	0.15
Panel 5	NA	0.39	NA	0.38	NA	0.18	NA	0.16
Panel 6 (Top)	NA	0.38	NA	0.38	NA	0.22	0.01	0.25

			West Panel		East Panel	
			Tension	Compression	Tension	Compression
Horizontals		Jacking Girder	0.01	NA	0.01	NA
		1	0.04	NA	0.11	NA
		2	0.13	NA	0.12	NA
		3	0.14	NA	0.13	NA
		4	0.17	NA	0.15	NA
		5	0.11	0.06	0.08	0.04
Bracing	Panel 1	Front to Rear	NA	0.16	0.00	0.19
		Rear to Front	NA	0.12	NA	0.12
	Panel 2	Front to Rear	NA	0.12	NA	0.13
		Rear to Front	NA	0.12	NA	0.11
	Panel 3	Front to Rear	NA	0.11	NA	0.11
		Rear to Front	NA	0.12	NA	0.11
	Panel 4	Front to Rear	NA	0.14	NA	0.15
		Rear to Front	NA	0.14	NA	0.13
	Panel 5	Front to Rear	NA	0.15	NA	0.15
		Rear to Front	NA	0.16	NA	0.15
	Panel 6	Front to Rear	NA	0.02	NA	0.02
		Rear to Front	NA	0.30	NA	0.23

			Front Panel		Rear Panel	
			Tension	Compression	Tension	Compression
Horizontals		1	0.04	0.01	0.02	0.01
		2	0.08	0.07	0.04	0.06
		3	0.22	NA	0.08	NA
		4	0.05	NA	0.04	0.04
		5	-	-	0.04	0.01
Bracing	Panel 2	Rail to Centre	NA	0.16	NA	0.06
		Hwy to Centre	NA	0.16	NA	0.06
	Panel 3	Rail to Centre	NA	0.17	NA	0.05
		Hwy to Centre	NA	0.16	NA	0.05
	Panel 4	Rail to Centre	NA	0.23	NA	0.05
		Hwy to Centre	NA	0.24	NA	0.05
	Panel 5	Rail to Centre	NA	0.21	NA	0.02
		Hwy to Centre	NA	0.21	NA	0.04
	Panel 2	Vertical	NA	0.49	NA	0.09
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.65	0.55
Back Transverse Sheave Girder	0.18	0.27
G1	0.17	0.59
G2/G3	0.18	0.62
G4	0.18	0.58
G6	0.15	0.53

Max D/C 1.55

8 - ULS 4

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compressio	Tension	Compressio	Tension	Compressio
Panel 1 (Bottom)	0.85	1.55	0.84	1.53	0.79	1.40	0.80	1.38
Panel 2	0.04	0.66	0.04	0.65	0.20	0.52	0.20	0.50
Panel 3	NA	0.48	NA	0.47	0.03	0.26	0.03	0.25
Panel 4	NA	0.64	NA	0.62	NA	0.17	NA	0.17
Panel 5	NA	0.64	NA	0.62	0.02	0.19	0.02	0.17
Panel 6 (Top)	NA	0.49	NA	0.48	0.02	0.20	0.07	0.24

			West Panel		East Panel	
			Tension	Compressio	Tension	Compression
Horizontals		Jacking Girder	0.02	0.01	0.02	0.01
		1	0.15	0.09	0.23	0.13
		2	0.20	0.09	0.17	0.06
		3	0.22	0.10	0.17	0.04
		4	0.25	0.10	0.21	0.04
		5	0.13	0.12	0.09	0.10
Bracing	Panel 1	Front to Rear	0.40	0.77	0.41	0.73
		Rear to Front	0.27	0.51	0.31	0.57
	Panel 2	Front to Rear	0.27	0.52	0.25	0.47
		Rear to Front	0.25	0.43	0.23	0.41
	Panel 3	Front to Rear	0.27	0.50	0.26	0.46
		Rear to Front	0.27	0.43	0.24	0.41
	Panel 4	Front to Rear	0.20	0.44	0.19	0.42
		Rear to Front	0.16	0.35	0.15	0.33
	Panel 5	Front to Rear	0.07	0.29	0.06	0.29
		Rear to Front	0.04	0.24	0.04	0.23
	Panel 6	Front to Rear	0.02	0.01	0.03	0.01
		Rear to Front	NA	0.29	NA	0.22

			Front Panel		Rear Panel	
			Tension	Compressio	Tension	Compression
Horizontals		1	0.41	0.48	0.28	0.34
		2	0.22	0.25	0.18	0.30
		3	0.28	NA	0.15	0.11
		4	0.15	0.27	0.16	0.24
		5	-	-	0.06	0.06
Bracing	Panel 2	Rail to Centre	0.23	0.63	0.14	0.25
		Hwy to Centre	0.21	0.65	0.13	0.26
	Panel 3	Rail to Centre	0.11	0.52	0.09	0.17
		Hwy to Centre	0.12	0.51	0.09	0.17
	Panel 4	Rail to Centre	0.05	0.54	0.06	0.15
		Hwy to Centre	0.03	0.56	0.06	0.15
	Panel 5	Rail to Centre	NA	0.39	0.07	0.10
		Hwy to Centre	NA	0.38	0.06	0.12
	Panel 2	Vertical	NA	0.63	0.04	0.25
	Panel 4	Vertical	0.02	NA	0.03	NA

	Moment	Shear
Front Transverse Sheave Girder	0.68	0.58
Back Transverse Sheave Girder	0.12	0.20
G1	0.19	0.65
G2/G3	0.17	0.65
G4	0.19	0.63
G6	0.09	0.51

Max D/C 0.77

8 - ULS V1

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compressio	Tension	Compressio	Tension	Compressio
Panel 1 (Bottom)	0.00	0.41	0.00	0.40	0.00	0.30	0.00	0.28
Panel 2	NA	0.37	NA	0.37	NA	0.19	NA	0.19
Panel 3	NA	0.39	NA	0.39	NA	0.19	NA	0.18
Panel 4	NA	0.46	NA	0.46	NA	0.17	NA	0.17
Panel 5	NA	0.45	NA	0.45	NA	0.20	NA	0.18
Panel 6 (Top)	NA	0.45	NA	0.45	NA	0.24	0.01	0.27

			West Panel		East Panel	
			Tension	Compressio	Tension	Compression
Horizontals		Jacking Girder	0.01	NA	0.01	NA
		1	0.05	NA	0.13	NA
		2	0.14	NA	0.13	NA
		3	0.15	NA	0.14	NA
		4	0.18	NA	0.16	NA
		5	0.13	0.04	0.10	0.02
Bracing	Panel 1	Front to Rear	NA	0.17	NA	0.21
		Rear to Front	NA	0.14	NA	0.13
	Panel 2	Front to Rear	NA	0.13	NA	0.14
		Rear to Front	NA	0.13	NA	0.12
	Panel 3	Front to Rear	NA	0.12	NA	0.13
		Rear to Front	NA	0.13	NA	0.12
	Panel 4	Front to Rear	NA	0.16	NA	0.17
		Rear to Front	NA	0.16	NA	0.15
	Panel 5	Front to Rear	NA	0.17	NA	0.17
		Rear to Front	NA	0.17	NA	0.16
	Panel 6	Front to Rear	NA	0.04	NA	0.04
		Rear to Front	NA	0.31	NA	0.22

			Front Panel		Rear Panel	
			Tension	Compressio	Tension	Compression
Horizontals		1	0.05	0.01	0.03	0.01
		2	0.09	0.08	0.04	0.06
		3	0.26	NA	0.09	NA
		4	0.05	NA	0.04	0.04
		5	-	-	0.04	0.01
Bracing	Panel 2	Rail to Centre	NA	0.18	NA	0.06
		Hwy to Centre	NA	0.19	NA	0.06
	Panel 3	Rail to Centre	NA	0.20	NA	0.05
		Hwy to Centre	NA	0.19	NA	0.05
	Panel 4	Rail to Centre	NA	0.27	NA	0.06
		Hwy to Centre	NA	0.27	NA	0.05
	Panel 5	Rail to Centre	NA	0.25	NA	0.02
		Hwy to Centre	NA	0.25	NA	0.05
	Panel 2	Vertical	NA	0.58	NA	0.11
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.77	0.66
Back Transverse Sheave Girder	0.19	0.29
G1	0.21	0.71
G2/G3	0.21	0.75
G4	0.21	0.69
G6	0.16	0.59

Max D/C 1.46

8 - ULS V2

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compressio	Tension	Compression	Tension	Compressio
Panel 1 (Bottom)	0.65	1.46	0.64	1.43	0.63	1.28	0.65	1.28
Panel 2	NA	0.66	NA	0.66	0.12	0.52	0.13	0.51
Panel 3	NA	0.52	NA	0.52	NA	0.30	NA	0.29
Panel 4	NA	0.67	NA	0.66	NA	0.22	NA	0.22
Panel 5	NA	0.67	NA	0.66	NA	0.25	NA	0.23
Panel 6 (Top)	NA	0.55	NA	0.54	NA	0.28	0.06	0.33

			West Panel		East Panel	
			Tension	Compressio	Tension	Compression
Horizontals		Jacking Girder	0.02	0.01	0.02	0.00
		1	0.14	0.06	0.24	0.09
		2	0.21	0.05	0.18	0.02
		3	0.22	0.06	0.18	0.01
		4	0.26	0.06	0.22	NA
		5	0.16	0.08	0.12	0.05
Bracing	Panel 1	Front to Rear	0.32	0.71	0.34	0.68
		Rear to Front	0.20	0.48	0.25	0.52
	Panel 2	Front to Rear	0.22	0.48	0.20	0.44
		Rear to Front	0.20	0.40	0.18	0.39
	Panel 3	Front to Rear	0.22	0.46	0.21	0.43
		Rear to Front	0.22	0.41	0.20	0.38
	Panel 4	Front to Rear	0.16	0.42	0.15	0.41
		Rear to Front	0.12	0.34	0.11	0.32
	Panel 5	Front to Rear	0.04	0.28	0.04	0.29
		Rear to Front	0.02	0.25	0.03	0.23
	Panel 6	Front to Rear	NA	0.06	NA	0.06
		Rear to Front	NA	0.33	NA	0.24

			Front Panel		Rear Panel	
			Tension	Compressio	Tension	Compression
Horizontals		1	0.36	0.41	0.24	0.29
		2	0.21	0.23	0.16	0.26
		3	0.32	NA	0.16	0.07
		4	0.14	0.22	0.15	0.20
		5	-	-	0.07	0.04
Bracing	Panel 2	Rail to Centre	0.16	0.58	0.10	0.24
		Hwy to Centre	0.14	0.61	0.09	0.24
	Panel 3	Rail to Centre	0.06	0.50	0.06	0.17
		Hwy to Centre	0.07	0.49	0.06	0.17
	Panel 4	Rail to Centre	NA	0.54	0.04	0.15
		Hwy to Centre	NA	0.55	0.03	0.15
	Panel 5	Rail to Centre	NA	0.41	0.05	0.10
		Hwy to Centre	NA	0.40	0.03	0.13
	Panel 2	Vertical	NA	0.71	0.02	0.27
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.81	0.69
Back Transverse Sheave Girder	0.20	0.29
G1	0.23	0.76
G2/G3	0.20	0.78
G4	0.23	0.74
G6	0.18	0.69

Max D/C 1.72

8 - ULS V3

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compressio	Tension	Compressio	Tension	Compressio
Panel 1 (Bottom)	0.89	1.72	0.88	1.69	0.82	1.55	0.84	1.55
Panel 2	0.02	0.74	0.02	0.73	0.18	0.60	0.18	0.59
Panel 3	NA	0.55	NA	0.55	NA	0.33	0.00	0.31
Panel 4	NA	0.73	NA	0.72	NA	0.24	NA	0.23
Panel 5	NA	0.73	NA	0.71	NA	0.26	NA	0.24
Panel 6 (Top)	NA	0.57	NA	0.56	0.01	0.29	0.07	0.34

			West Panel		East Panel	
			Tension	Compressio	Tension	Compression
Horizontals		Jacking Girder	0.02	0.01	0.02	0.01
		1	0.17	0.09	0.27	0.13
		2	0.22	0.08	0.19	0.04
		3	0.24	0.09	0.19	0.02
		4	0.28	0.09	0.24	0.02
		5	0.17	0.09	0.13	0.06
Bracing	Panel 1	Front to Rear	0.41	0.84	0.42	0.80
		Rear to Front	0.27	0.57	0.33	0.62
	Panel 2	Front to Rear	0.28	0.57	0.25	0.52
		Rear to Front	0.26	0.47	0.24	0.45
	Panel 3	Front to Rear	0.28	0.54	0.26	0.50
		Rear to Front	0.28	0.48	0.25	0.45
	Panel 4	Front to Rear	0.20	0.49	0.19	0.47
		Rear to Front	0.16	0.39	0.15	0.37
	Panel 5	Front to Rear	0.06	0.31	0.06	0.32
		Rear to Front	0.04	0.27	0.04	0.25
	Panel 6	Front to Rear	NA	0.07	NA	0.07
		Rear to Front	NA	0.33	NA	0.25

			Front Panel		Rear Panel	
			Tension	Compressio	Tension	Compression
Horizontals		1	0.44	0.52	0.30	0.36
		2	0.24	0.27	0.19	0.32
		3	0.33	NA	0.18	0.09
		4	0.16	0.28	0.17	0.25
		5	-	-	0.07	0.05
Bracing	Panel 2	Rail to Centre	0.23	0.68	0.14	0.29
		Hwy to Centre	0.21	0.71	0.13	0.29
	Panel 3	Rail to Centre	0.11	0.58	0.08	0.20
		Hwy to Centre	0.12	0.56	0.08	0.20
	Panel 4	Rail to Centre	0.03	0.60	0.06	0.18
		Hwy to Centre	0.01	0.62	0.05	0.17
	Panel 5	Rail to Centre	NA	0.45	0.06	0.12
		Hwy to Centre	NA	0.44	0.05	0.15
	Panel 2	Vertical	NA	0.74	0.03	0.31
	Panel 4	Vertical	0.02	NA	0.03	NA

	Moment	Shear
Front Transverse Sheave Girder	0.82	0.69
Back Transverse Sheave Girder	0.20	0.29
G1	0.23	0.76
G2/G3	0.20	0.78
G4	0.23	0.76
G6	0.19	0.72

Max D/C 0.71

8 - ULS V4

	Front Columns				Rear Columns			
	Rail		Hwy		Rail		Hwy	
	Tension	Compression	Tension	Compressio	Tension	Compressio	Tension	Compression
Panel 1 (Bottom)	0.00	0.21	0.00	0.20	0.00	0.32	0.00	0.30
Panel 2	NA	0.18	NA	0.18	NA	0.20	NA	0.21
Panel 3	NA	0.18	NA	0.18	NA	0.20	NA	0.19
Panel 4	NA	0.21	NA	0.21	NA	0.19	NA	0.18
Panel 5	NA	0.20	NA	0.20	NA	0.22	NA	0.21
Panel 6 (Top)	NA	0.22	NA	0.22	NA	0.31	0.02	0.34

			West Panel		East Panel	
			Tension	Compressio	Tension	Compression
Horizontals		Jacking Girder	0.00	NA	0.01	NA
		1	0.03	NA	0.08	NA
		2	0.11	0.01	0.10	0.00
		3	0.12	0.01	0.11	0.00
		4	0.14	0.02	0.12	NA
		5	0.09	0.11	0.05	0.09
Bracing	Panel 1	Front to Rear	NA	0.12	0.01	0.17
		Rear to Front	NA	0.10	NA	0.10
	Panel 2	Front to Rear	NA	0.09	NA	0.09
		Rear to Front	NA	0.09	NA	0.09
	Panel 3	Front to Rear	NA	0.08	NA	0.08
		Rear to Front	NA	0.09	0.00	0.09
	Panel 4	Front to Rear	NA	0.10	NA	0.10
		Rear to Front	NA	0.11	NA	0.10
	Panel 5	Front to Rear	NA	0.09	NA	0.10
		Rear to Front	NA	0.14	NA	0.13
	Panel 6	Front to Rear	0.01	NA	0.02	NA
		Rear to Front	NA	0.34	NA	0.26

			Front Panel		Rear Panel	
			Tension	Compressio	Tension	Compression
Horizontals		1	0.03	0.01	0.03	0.01
		2	0.06	0.07	0.04	0.06
		3	0.11	NA	0.10	NA
		4	0.04	0.02	0.05	0.04
		5	-	-	0.05	NA
Bracing	Panel 2	Rail to Centre	NA	0.09	NA	0.07
		Hwy to Centre	NA	0.10	NA	0.07
	Panel 3	Rail to Centre	NA	0.09	NA	0.06
		Hwy to Centre	NA	0.09	NA	0.06
	Panel 4	Rail to Centre	NA	0.13	NA	0.07
		Hwy to Centre	NA	0.13	NA	0.06
	Panel 5	Rail to Centre	NA	0.11	NA	0.03
		Hwy to Centre	NA	0.11	NA	0.06
	Panel 2	Vertical	NA	0.25	NA	0.14
	Panel 4	Vertical	0.02	NA	0.02	NA

	Moment	Shear
Front Transverse Sheave Girder	0.29	0.25
Back Transverse Sheave Girder	0.23	0.39
G1	0.13	0.11
G2/G3	0.39	0.52
G4	0.12	0.06
G6	0.16	0.71

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

TOWER SPAN

Sheave Floor Girder - End — Tension & Compression Member — Drawing Location (1959)

E5, 50 Sheave Floor Girder - Top

Material Properties: A-242-55 Steel — Reference

F_u =	480	MPa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	350	MPa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

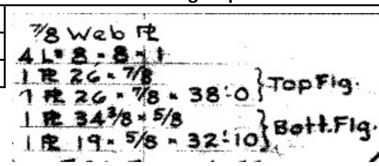
Member	Top Angle	Bottom Angles	Centre Web	Top Plate
Quantity	**2**	**2**	**1**	**1**
Dimensions (in)	8x8x1	8x8x1	180x1 5/8"	26x7/8

Ext. Web Perfortion Width	0	in
Rivet dia.	1	in

Member Dimensions

Length =	15900	mm
Width =	660	mm
Depth =	4607	mm

Drawing Snipet



Member Cross-Section

Individual Member Properties

	Angles Top	Angles Bot.			Top Plate	
Designation	8x8x1	8x8x1		Designation	26x7/8	
Qty =	2	2	mm	Qty =	1	
b =	203.2	203.2	mm	t =	22	mm
d =	203.2	203.2	mm	b =	660	mm
t =	25.4	25.4	mm	z Bar =	4596	mm
A =	9670	9670	mm^2	A =	14677	mm^2
z =	60.1	60.1	mm	RHM*	6	
y =	60.1	60.1	mm	RHM Area =	3387	mm^2
Z bar	4525	60.1	mm			
I_y =	36.9	36.9	$x10^6mm^4$			
I_z =	36.9	36.9	$x10^6mm^4$			
A_{angle} =	19340	19340	mm^2			
RHM*	4	4	mm			
RHM Area =	5161	5161	mm^2			

Web		
Designation =	180x1 5/8"	
Qty =	1	
w =	41.3	mm
h =	4584.7	mm
h_{eff} =	4584.7	mm
A =	189233.5	mm^2
A_{eff} =	189233.5	mm^2
z Bar =	2303.5	mm
RHM*	4	
RHM Area =	4193.5	mm^2

RHM* = Rivet Holes/Member

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
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Section Calculations

Location	Angles Top	Angles Bot.	Web	Top Plate	
Designation	8x8x1	8x8x1	180x1 5/8"	26x7/8	
Qty=	2	2	1	1	
Iy =	73.8	73.8	331465.7	0.6	$x10^6mm^4$
Iz =	73.8	73.8	26.9	533.4	$x10^6mm^4$
A =	19340	19340	189233.5	14677.4	mm^2
dz =	2084.2	2380.3	136.9	2155.4	mm^2
dy =	80.7	80.7	0.0	0.0	mm
Iyy =	84086	109649	335013.4	68189.9	$x10^6mm^4$
Izz =	199.9	199.9	26.9	533.4	$x10^6mm^4$

Composite Member Properties

A_{gross} =	242591	mm^2
A_{RHM*}=	17903	mm2
A_{net} =	224688	mm^2
∑Iyy =	596938.6	$x10^6mm^4$
∑Izz =	960.0	$x10^6mm^4$
Zbar=	2440	mm
ybar=	330	mm

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Geometry Comformance Checks

Width to Thickness Ratio *[CSA S6-19 cl. 10.9.2]*

Flanges Class 3 Limit = b/t<= 670/(SQRT(fy) = 35.8 *[CSA S6-19 cl. 10.9.2.1]*

Webs in Axial Compression; Class 3 Limit = h/w<= 670/(SQRT(fy) = 35.8 *[CSA S6-19 cl. 10.9.2.1]*

Webs	h =	4178.3	w =	41.3	h/w =	101.2	NG
Class 4 web	h/w<=150						
Flange	b =	660.4	t =	22.2	b/t =	29.7	OK

Moment Resistance *[CSA S6-19 cl.10.10.3.3]*

Yeilding Moment, M_y

Elastic Section Modulus, Sx	244608481	mm^3
Yield Moment, M_y	85613	kNm
0.67M_y	**57361**	**kNm**

Critical Elastic Moment, M_u - Assumed not Governing - To Be Confirmed in Preliminary Design *[CSA S6-19 cl.10.10.2.3]*

Overall Moment Resist., M_r **54493 kNm** *[Stiffened plate girder with longitudinal stiffeners]* *[CSA S6-19 cl.10.10.3.3]*

Shear Resistance *[CSA S6-19 cl. 10.10.5.1]*

Spacing of Tranverse Stiffn, a	1810	mm
Web height, h	4585	mm
a/h	0.39	
k_v	38.27	
h/w	101	
502√kv/Fy	166.00	
621√kv/Fy	205.35	
F_{cr}	**201.95**	**MPa**
F_t	**0.00**	**MPa**
F_s	**201.95**	**MPa**
Area of Web, A_w	189233	mm^2
Shear Resistance, V_r	**36305**	**kN**

AECOM Imagine it. Delivered.	JOB TITLE	BCLB DECK PRE-DESIGN		
	JOB NO.	60637587	CALCULATION NO.	
	ORIGINATOR BY	KG	DATE	30-Nov-20
	CHECKED BY	RA	DATE	16-Dec-20

TOWER SPAN

Sheave Floor Girder - Middle — Tension & Compression Member — Drawing Location (1959)

E5, 50 Sheave Floor Girder - Top

Material Properties: A-242-55 Steel — Reference

F_u =	480	MPa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	350	MPa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***

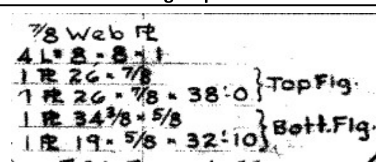
Built up Section Components

Member	**Top Angle**	**Bottom Angles**	**Centre Web**	**Top Plate**
Quantity	**2**	**2**	**1**	**2**
Dimensions (in)	8x8x1	8x8x1	180x7/8	26x7/8

Ext. Web Perfortion Width	0	in
Rivet dia.	1	in

Member Dimensions — **Drawing Snipet** — **Member Cross-Section**

Length =	15900	mm
Width =	660	mm
Depth =	4629	mm



Individual Member Properties

	Angle Top	Angle Bot.	
Designation	8x8x1	8x8x1	
Qty =	2	2	mm
b =	203.2	203.2	mm
d =	203.2	203.2	mm
t =	25.4	25.4	mm
A =	9670	9670	mm^2
z =	60.1	60.1	mm
y =	60.1	60.1	mm
Z bar	4547	82.3	mm
I_y =	36.9	36.9	$x10^6 mm^4$
I_z =	36.9	36.9	$x10^6 mm^4$
A_{angle} =	19340	19340	mm^2
RHM*	4	4	
RHM Area =	5161	5161	mm^2

	Top Plate 1	**Top Plate 2**	
Designation	26x7/8	26x7/8	
Qty =	1	1	
t =	22	22	mm
b =	660	660	mm
z Bar =	4618	4596	mm
A =	14677	14677	mm^2
RHM*	6	6	
RHM Area =	3387	3387	mm^2

	Web	
Designation =	180x7/8	
Qty =	1	
w =	22.2	mm
h =	4584.7	mm
h_{eff} =	4584.7	mm
A =	101895.0	mm^2
A_{eff} =	101895.0	mm^2
z Bar =	2314.6	mm
RHM*	4	
RHM Area =	2258.1	mm^2

RHM* = Rivet Holes/Member

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

Location	Angle Top	Angle Bot.	Web	Top Plate 1	Top Plate 2	
Designation	8x8x1	8x8x1	180x7/8	26x7/8	26x7/8	
Qty=	2	2	1	1	1	
Iy =	73.8	73.8	178481.5	0.6	0.6	$x10^6mm^4$
Iz =	73.8	73.8	4.2	533.4	533.4	$x10^6mm^4$
A =	19340	19340	101895.0	14677.4	14677.4	mm^2
dz =	1836.3	2628.2	396.0	1907.5	1885.2	mm^2
dy =	71.2	71.2	0.0	0.0	0.0	mm
Iyy =	65285	133668	194459.9	53403.3	52166.1	$x10^6mm^4$
Izz =	171.9	171.9	4.2	533.4	533.4	$x10^6mm^4$

Composite Member Properties

A_{gross} =	169930	mm^2
A_{RHM*}=	19355	mm^2
A_{net} =	150575	mm^2
∑Iyy =	498982.5	$x10^6mm^4$
∑Izz =	1414.8	$x10^6mm^4$
Zbar=	2711	mm
ybar=	330	mm

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Geometry Comformance Checks

Width to Thickness Ratio *[CSA S6-19 cl. 10.9.2]*

Flanges Class 3 Limit =	b/t<= 670/(SQRT(fy) =	35.8	*[CSA S6-19 cl. 10.9.2.1]*
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	35.8	*[CSA S6-19 cl. 10.9.2.1]*

Webs	h =	4178.3	w =	22.2	h/w =	188.0	NG
Class 4 web	h/w<=150						
Flange	b =	660.4	t =	22.2	b/t =	29.7	OK

Moment Resistance *[CSA S6-19 cl.10.10.3.3]*

Yeilding Moment, M_y

Elastic Section Modulus, Sx	184087619	mm^3
Yield Moment, M_y	64431	kNm
0.67M_y	**43169**	**kNm**

Critical Elastic Moment, M_u - Assumed not Governing - To Be Confirmed in Preliminary Design *[CSA S6-19 cl.10.10.2.3]*

Overall Moment Resist., M_r **41010 kNm** *[Stiffened plate girder with longitudinal stiffeners]* *[CSA S6-19 cl.10.10.3.3]*

Shear Resistance *[CSA S6-19 cl. 10.10.5.1]*

Spacing of Tranverse Stiffn, a	1810	mm
Web height, h	4585	mm
a/h	0.39	
k_v	38.27	
h/w	188	
502√kv/Fy	166.00	
621√kv/Fy	205.35	
F_{cr}	**178.53**	**MPa**
F_t	**18.97**	**MPa**
F_s	**197.50**	**MPa**
Area of Web, A_w	101895	mm^2

Shear Resistance, V_r **19,118 kN**

JOB TITLE	BCLB DECK PRE-DESIGN			
JOB NO.	60637587	CALCULATION NO.		
ORIGINATOR BY	KG	DATE	30-Nov-20	
CHECKED BY	RA	DATE	16-Dec-20	

TOWER SPAN

A44R/B44L N. Tower (Rear Columns Panel 1)

Drawing Location (1959)

E5	North Tower Elevations
44A	Column A44/B44
38	A38R/A38L/B38R/B38L
33A/B	A33R/A33L/B33R/B33L
29A/B	A29R/A29L/B29L/C29

Material Properties: A-7 Steel

			Reference
F_u =	410	MPa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	MPa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

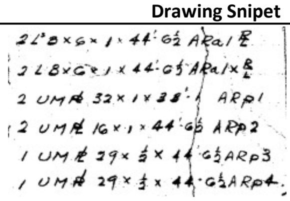
Member	**Angle**	**Web**	**Flange**	**Internal Plates**
Quantity	**4**	**2**	**2**	**2**
Dimensions (in)	8x6x1	32x1	29x1/2	16x1

Flange Perfortion Width	14	in
Rivet dia.	1	in

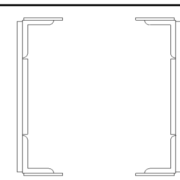
Member Dimensions

Length =	9804.4	mm
Width =	800	mm
Depth =	851	mm

Drawing Snipet



Member Cross-Section



Individual Member Properties

Web			**Top & Bottom Plate**		
Designation	32x1		Designation	29x1/2	
Qty =	2		Qty =	2	
w =	25.4	mm	t =	12.7	mm
h =	812.8	mm	b =	736.6	mm
A =	41290.24	mm^2	b_{eff} =	381	mm
y Bar =	406.4	mm	A =	18709.64	mm^2
z Bar =	0	mm	A_{eff} =	9677.4	mm^2
RHM*	7		y Bar =	0	mm
RHM Area =	9032.2	mm	z Bar =	419.1	mm
			RHM*	2	
			RHM Area =	1290.3	mm

Angle			**Extra Plate**		
Designation	8x6x1		Designation	16x1	
Qty =	4		Qty =	2	
b =	203.2	mm	w =	25.4	mm
d =	152.4	mm	h =	406.4	mm
t =	25.4	mm	A =	20645.12	mm^2
A =	8390	mm^2	y Bar =	203.2	mm
y =	67.4	mm	z Bar =	0	mm
x =	41.9	mm	RHM*	7	
I_y =	33.5	$x10^6mm^4$	RHM Area =	9032.2	mm
I_z =	16	$x10^6mm^4$			
A_{angle} =	33560	mm^2			
RHM*	3				
RHM Area =	7741.9	mm			

RHM* = Rivet Holes/Member

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

	Angle	Web	T&B Plate	Extra Plate	
Designation	8x6x1	32x1	29x1/2	16x1	
Qty=	4	2	2	2	
Iy =	134.0	2273.2	0.1	284.1	$x10^6mm^4$
Iz =	64	2.2	29.3	1.1	$x10^6mm^4$
A =	33560.0	41290.2	9677.4	20645.1	mm^2
dz =	345.4	0	412.8	0	mm^2
dy =	332.75	387.4	279.4	362.0	mm
Iyy =	4136.6	2273.2	1648.8	284.1	$x10^6mm^4$
Izz =	3779.8	6197.4	784.7	2705.8	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	105173	mm^2
A_{RHM*}=	27096.7	mm^2
A_{net} =	78076	mm^2
∑Iyy =	8342.7	$x10^6mm^4$
∑Izz =	13467.8	$x10^6mm^4$
ybar=	400	mm
zbar=	425	mm

Geometry Comformance Checks

Slenderness Ratio *[CSA S6-19 cl. 10.9.1.3]*

Member Classification = Primary Compression Member

Ly =	9804.4	mm	kyLy/ry =	30.0	< 120 therefore OK
Lz =	9804.4	mm	kzLz/rz =	23.6	< 120 therefore OK

Width to Thickness Ratio *[CSA S6-19 cl. 10.9.2]*

Flanges of box girder sections: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2	*[CSA S6-19 cl. 10.9.2.1]*
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2	*[CSA S6-19 cl. 10.9.2.1]*
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4	*[CSA S6-19 cl. 10.9.2.1]*

Webs	h =	406.4	w =	25.4	h/w =	16.0	OK
Flange	b =	431.8	t =	12.7	b/t =	34.0	OK
Flange Perforated	b =	76.2	t =	12.7	b/t =	6.0	OK

Axial Compression Resistance *[CSA S6-19 cl. 10.9.3.1]*

Φs =	0.9		*[CSA S6-19 cl. 10.5.7]*
A =	78076	mm^2	
n =	1.34		
Ky =	1.00		
Kz =	1.00		
ry =	326.9	mm	
rz =	415.3	mm	
λy =	0.324		
λz =	0.255		
Cry =	15598	kN	
Crz =	15859	kN	
Cr Min =	15598	kN	

Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95	*[CSA S6-19 cl. 10.5.7]*
Tension	Φu =	0.8	*[CSA S6-19 cl. 10.5.7]*

a)	Tr =	$\phi_s A_g F_y$	22980	kN
b)	Tr =	$\phi_u A_n F_u$	25609	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	21768	kN
		Tr Min =	21768	kN

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

TOWER SPAN

A44R/B44L N. Tower (Rear Columns Panel 2-5)

Drawing Location (1959)	
E5	North Tower Elevations
44A	Column A44/B44
38	A38R/A38L/B38R/B38L
33A/B	A33R/A33L/B33R/B33L
29A/B	A29R/A29L/B29L/C29

Material Properties: A-7 Steel

			Reference
F_u =	410	MPa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	MPa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***

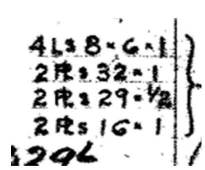
Built up Section Components

Member	**Angle**	**Web**	**Flange**	**Internal Plates**
Quantity	**4**	**2**	**2**	**2**
Dimensions (in)	8x6x1	32x1	29x1/2	16x1
Flange Perfortion Width	14	in		
Rivet dia.	1	in		

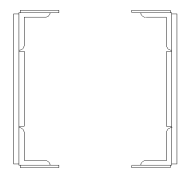
Member Dimensions

Length =	8769.35	mm
Width =	800	mm
Depth =	851	mm

Drawing Snipet



Member Cross-Section



Individual Member Properties

Web			**Top & Bottom Plate**		
Designation	32x1		Designation	29x1/2	
Qty =	2		Qty =	2	
w =	25.4	mm	t =	12.7	mm
h =	812.8	mm	b =	736.6	mm
A =	41290.24	mm^2	b_{eff} =	381	mm
y Bar =	406.4	mm	A =	18709.64	mm^2
z Bar =	0	mm	A_{eff} =	9677.4	mm^2
RHM*	7		y Bar =	0	mm
RHM Area =	9032.2	mm	z Bar =	419.1	mm
			RHM*	2	
			RHM Area =	1290.3	mm

Angle			**Extra Plate**		
Designation	8x6x1		Designation	16x1	
Qty =	4		Qty =	2	
b =	203.2	mm	w =	25.4	mm
d =	152.4	mm	h =	406.4	mm
t =	25.4	mm	A =	20645.12	mm^2
A =	8390	mm^2	y Bar =	203.2	mm
y =	67.4	mm	z Bar =	0	mm
x =	41.9	mm	RHM*	7	
I_y =	33.5	$x10^6mm^4$	RHM Area =	9032.2	mm
I_z =	16	$x10^6mm^4$			
A_{angle} =	33560	mm^2			
RHM*	3				
RHM Area =	7741.9	mm			

RHM* = Rivet Holes/Member

Section Calculations

	Angle	Web	T&B Plate	Extra Plate	
Designation	8x6x1	32x1	29x1/2	16x1	
Qty=	4	2	2	2	
Iy =	134.0	2273.2	0.1	284.1	$x10^6mm^4$
Iz =	64	2.2	29.3	1.1	$x10^6mm^4$
A =	33560.0	41290.2	9677.4	20645.1	mm^2
dz =	345.4	0	412.8	0	mm^2
dy =	332.75	387.4	279.4	362.0	mm
Iyy =	4136.6	2273.2	1648.8	284.1	$x10^6mm^4$
Izz =	3779.8	6197.4	784.7	2705.8	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	105173	mm^2
A_{RHM*}=	27096.7	mm^2
A_{net} =	78076	mm^2
∑Iyy =	8342.7	$x10^6mm^4$
∑Izz =	13467.8	$x10^6mm^4$
ybar=	400	mm
zbar=	425	mm

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Geometry Comformance Checks

Slenderness Ratio *[CSA S6-19 cl. 10.9.1.3]*

Member Classification = Primary Compression Member

Ly =	8769.35	mm	kyLy/ry =	26.8	< 120 therefore OK
Lz =	8769.35	mm	kzLz/rz =	21.1	< 120 therefore OK

Width to Thickness Ratio *[CSA S6-19 cl. 10.9.2]*

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2	*[CSA S6-19 cl. 10.9.2.1]*
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2	*[CSA S6-19 cl. 10.9.2.1]*
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4	*[CSA S6-19 cl. 10.9.2.1]*

Webs	h =	406.4	w =	25.4	h/w =	16.0	OK
Flange	b =	431.8	t =	12.7	b/t =	34.0	OK
Flange Perforated	b =	76.2	t =	12.7	b/t =	6.0	OK

Axial Compression Resistance *[CSA S6-19 cl. 10.9.3.1]*

Φs =	0.9	*[CSA S6-19 cl. 10.5.7]*
A =	78076	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	326.9	mm
rz =	415.3	mm
λy =	0.290	
λz =	0.228	
Cry =	15740	kN
Crz =	15936	kN
Cr Min =	15740	kN

Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95	*[CSA S6-19 cl. 10.5.7]*
Tension	Φu =	0.8	*[CSA S6-19 cl. 10.5.7]*

a)	Tr =	$\phi_s A_g F_y$	22980	kN
b)	Tr =	$\phi_u A_n F_u$	25609	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	21768	kN
		Tr Min =	21768	kN

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	JOB TITLE	BCLB DECK PRE-DESIGN		
	JOB NO.	60637587	CALCULATION NO.	
	ORIGINATOR BY	KG	DATE	30-Nov-20
	CHECKED BY	RA	DATE	16-Dec-20

TOWER SPAN

A44R/B44L N. Tower (Rear Columns Panel 6)

Drawing Location (1959)	
E5	North Tower Elevations
44A	Column A44/B44
38	A38R/A38L/B38R/B38L
33A/B	A33R/A33L/B33R/B33L
29A/B	A29R/A29L/B29L/C29

Material Properties: A-7 Steel

			Reference
F_u =	410	MPa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	MPa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***

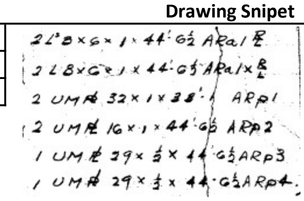
Built up Section Components

Member	**Angle**	**Web**	**Flange**	**Internal Plates**
Quantity	**4**	**2**	**2**	**2**
Dimensions (in)	8x6x1	32x1	29x1/2	16x1
Flange Perfortion Width	14	in		
Rivet dia.	1	in		

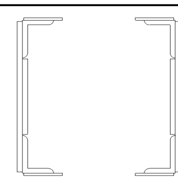
Member Dimensions

Length =	4679.95	mm
Width =	800	mm
Depth =	851	mm

Drawing Snipet



Member Cross-Section



Individual Member Properties

Web			**Top & Bottom Plate**		
Designation	32x1		Designation	29x1/2	
Qty =	2		Qty =	2	
w =	25.4	mm	t =	12.7	mm
h =	812.8	mm	b =	736.6	mm
A =	41290.24	mm^2	b_{eff} =	381	mm
y Bar =	406.4	mm	A =	18709.64	mm^2
z Bar =	0	mm	A_{eff} =	9677.4	mm^2
RHM*	7		y Bar =	0	mm
RHM Area =	9032.2	mm	z Bar =	419.1	mm
			RHM*	2	
			RHM Area =	1290.3	mm

Angle			**Extra Plate**		
Designation	8x6x1		Designation	16x1	
Qty =	4		Qty =	2	
b =	203.2	mm	w =	25.4	mm
d =	152.4	mm	h =	406.4	mm
t =	25.4	mm	A =	20645.12	mm^2
A =	8390	mm^2	y Bar =	203.2	mm
y =	67.4	mm	z Bar =	0	mm
x =	41.9	mm	RHM*	7	
I_y =	33.5	$x10^6mm^4$	RHM Area =	9032.2	mm
I_z =	16	$x10^6mm^4$			
A_{angle} =	33560	mm^2			
RHM*	3				
RHM Area =	7741.9	mm			

RHM* = Rivet Holes/Member

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JOB TITLE	BCLB DECK PRE-DESIGN		
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Section Calculations

	Angle	Web	T&B Plate	Extra Plate	
Designation	8x6x1	32x1	29x1/2	16x1	
Qty=	4	2	2	2	
Iy =	134.0	2273.2	0.1	284.1	$x10^6mm^4$
Iz =	64	2.2	29.3	1.1	$x10^6mm^4$
A =	33560.0	41290.2	9677.4	20645.1	mm^2
dz =	345.4	0	412.8	0	mm^2
dy =	332.75	387.4	279.4	362.0	mm
Iyy =	4136.6	2273.2	1648.8	284.1	$x10^6mm^4$
Izz =	3779.8	6197.4	784.7	2705.8	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	105173	mm^2
A_{RHM*}=	27097	mm^2
A_{net} =	78076	mm^2
∑Iyy =	8342.7	$x10^6mm^4$
∑Izz =	13467.8	$x10^6mm^4$
ybar=	400	mm
zbar=	425	mm

Geometry Comformance Checks

Slenderness Ratio ***[CSA S6-19 cl. 10.9.1.3]***

Member Classification = Primary Compression Member

Ly =	4679.95	mm	kyLy/ry =	14.3	< 120 therefore OK
Lz =	4679.95	mm	kzLz/rz =	11.3	< 120 therefore OK

Width to Thickness Ratio ***[CSA S6-19 cl. 10.9.2]***

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2	*[CSA S6-19 cl. 10.9.2.1]*
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2	*[CSA S6-19 cl. 10.9.2.1]*
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4	*[CSA S6-19 cl. 10.9.2.1]*

Webs	h =	406.4	w =	25.4	h/w =	16.0	OK
Flange	b =	431.8	t =	12.7	b/t =	34.0	OK
Flange Perforated	b =	76.2	t =	12.7	b/t =	6.0	OK

Axial Compression Resistance ***[CSA S6-19 cl. 10.9.3.1]***

Φs =	0.9		*[CSA S6-19 cl. 10.5.7]*
A =	78076	mm^2	
n =	1.34		
Ky =	1.00		
Kz =	1.00		
ry =	326.9	mm	
rz =	415.3	mm	
λy =	0.155		
λz =	0.122		
Cry =	16081	kN	
Crz =	16119	kN	
Cr Min =	16081	kN	

Axial Tensile Resistance ***[CSA S6-19 cl. 10.8.2]***

Tension	Φs =	0.95	*[CSA S6-19 cl. 10.5.7]*
Tension	Φu =	0.8	*[CSA S6-19 cl. 10.5.7]*

a)	Tr =	$\phi_s A_g F_y$	22980	kN
b)	Tr =	$\phi_u A_n F_u$	25609	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	21768	kN
		Tr Min =	21768	kN

JOB TITLE	BCLB DECK PRE-DESIGN		
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TOWER SPAN

A20R/B20L N. Tower (North Front - Panel 1)

Drawing Location (1959)

E5 North Tower Elevations

20A/B A20R/B20L/C20L/D20

Material Properties: A-242-55 Steel

			Reference
F_u =	480	MPa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	350	MPa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

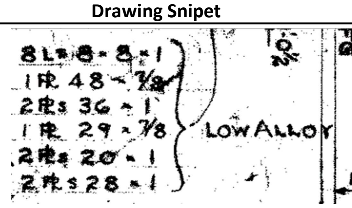
Member	**Angle**	**Web**	**Flange Top**	**Flange Bottom**	**Extra internal plate**	**Extra external**
Quantity	**8**	**2**	**1**	**1**	**2**	**2**
Dimensions (in)	8x8x1	36x1	48x7/8	29x7/8	28x1	20x1
Flange Perfortion Width			10	12	in	

Rivet dia. # ###### in

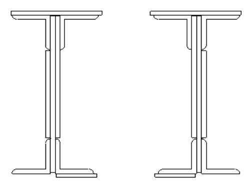
Member Dimensions

Length =	9804.4	mm
Width =	1219	mm
Depth =	972	mm

Drawing Snipet



Member Cross-Section



Individual Member Properties

Web			Top Plate			Top Angles (outer)		
Designation	36x1		Designation	48x7/8		Designation	8x8x1	
Qty =	2		Qty =	1		Qty =	2	
w =	25.4	mm	t =	22.225	mm	b =	203.2	mm
h =	914.4	mm	b =	1219.2	mm	d =	203.2	mm
A =	46451.52	mm^2	b_{eff} =	965.2	mm	t =	25.4	mm
y Bar =	387.35	mm	A =	27096.72	mm^2	A =	9680	mm^2
z Bar =	485.78	mm	A_{eff} =	21451.57	mm^2	y =	460.15	mm
RHM*	8		y Bar =	368.3	mm	z =	889.23	mm
RHM Area =	10322.6	mm	z Bar =	960.4	mm	I_y =	36.9	$x10^6mm^4$
			RHM*	8		I_z =	36.9	$x10^6mm^4$
			RHM Area =	4516.1	mm	A_{angle} =	19360	mm^2
						RHM*	4	
						RHM Area =	5161.3	mm

Bottom Angles (inner)			Bottom Plate			Extra Internal Plates		
Designation	8x8x1		Designation	29x7/8		Designation	28x1	
Qty =	2		Qty =	1		Qty =	2	
b =	203.2	mm	t =	22.225	mm	w =	25.4	mm
d =	203.2	mm	b =	736.6	mm	h =	711.2	mm
t =	25.4	mm	b_{eff} =	431.8	mm	A =	36128.96	mm^2
A =	9680	mm^2	A =	16370.935	mm^2	y Bar =	361.95	mm
y =	314.55	mm	A_{eff} =	9596.755	mm^2	z Bar =	587.38	mm
z =	82.33	mm	y Bar =	260.35	mm	RHM*	4	
I_y =	36.9	$x10^6mm^4$	z Bar =	11.11	mm	RHM Area =	5161.3	mm
I_z =	36.9	$x10^6mm^4$	RHM*	4				
A_{angle} =	19360	mm^2	RHM Area =	2258.1	mm			
RHM*	4							
RHM Area =	5161.3	mm						

Extra External Plates			Top Angles (inner)			Bottom Angles (outer)		
Designation	20x1		Designation	8x8x1		Designation	8x8x1	
Qty =	2		Qty =	2		Qty =	2	
w =	25.4	mm	b =	203.2	mm	b =	203.2	mm
h =	508	mm	d =	203.2	mm	d =	203.2	mm
A =	25806.4	mm^2	t =	25.4	mm	t =	25.4	mm
y Bar =	412.75	mm	A =	9680	mm^2	A =	9680	mm^2
z Bar =	485.78	mm	y =	289.15	mm	y =	460.15	mm
RHM*	2		z =	889.23	mm	z =	82.33	mm
RHM Area =	2580.6	mm	I_y =	36.9	$x10^6mm^4$	I_y =	36.9	$x10^6mm^4$
			I_z =	36.9	$x10^6mm^4$	I_z =	36.9	$x10^6mm^4$
			A_{angle} =	19360	mm^2	A_{angle} =	19360	mm^2
			RHM*	4		RHM*	4	
			RHM Area =	5161.3	mm	RHM Area =	5161.3	mm

RHM* = Rivet Holes/Member

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Section Calculations

	Angle (top/Out)	Angle (bottom) In	Web	Top Plate	Bottom Plate	Extra Int. Pl	Extra Ext Pl	
Designation	8x8x1	8x8x1	36x1	48x7/8	29x7/8	28x1	20x1	
Qty=	2	2	2	1	1	2	2	
Iy =	73.8	73.8	3236.6	0.9	0.4	1522.9	555.0	$x10^6mm^4$
Iz =	73.8	73.8	2.5	416.3	37.3	1.9	1.4	$x10^6mm^4$
A =	19360.0	19360.0	46451.5	21451.6	9596.8	36129.0	25806.4	mm^2
dz =	245.7	561.2	158	316.9	632.43	56.2	157.8	mm
dy =	460.2	314.6	387	368.3	260.35	362.0	412.8	mm
Iyy =	1242.4	6171.5	4392.8	2155.1	3838.8	1636.8	1197.3	$x10^6mm^4$
Izz =	4173.0	1989.3	6972.1	3326.1	687.8	4735.1	4397.8	$x10^6mm^4$

	Angle top/In	Bot Angle Out	
Designation	8x8x1	8x8x1	
Qty=	2	2	
Iy =	73.8	73.8	$x10^6mm^4$
Iz =	73.8	73.8	$x10^6mm^4$
A =	19360	19360	mm^2
dz =	245.7	561.2	mm
dy =	289.2	460.2	mm
Iyy =	1242.4	6171.5	$x10^6mm^4$
Izz =	1692.4	4173.0	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	178155.0	mm^2
A_{RHM*}=	45483.8	mm^2
A_{net} =	132671	mm^2
∑Iyy =	20634.7	$x10^6mm^4$
∑Izz =	26281.3	$x10^6mm^4$
ybar=	610	mm
zbar=	644	mm

Geometry Comformance Checks

Slenderness Ratio *[CSA S6-19 cl. 10.9.1.3]*

Member Classification = Primary Compression Member

Ly =	9804.4	mm	kyLy/ry =	24.9	< 120 therefore OK
Lz =	9804.4	mm	kzLz/rz =	22.0	< 120 therefore OK

Width to Thickness Ratio *[CSA S6-19 cl. 10.9.2]*

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	35.8	*[CSA S6-19 cl. 10.9.2.1]*
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	35.8	*[CSA S6-19 cl. 10.9.2.1]*
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	44.9	*[CSA S6-19 cl. 10.9.2.1]*

Webs	h =	508	w =	25.4	h/w =	20.0	OK
Flange	b =	406.4	t =	22.2	b/t =	18.3	OK
Flange Perforated	b =	558.8	t =	22.2	b/t =	25.1	OK

Axial Compression Resistance *[CSA S6-19 cl. 10.9.3.1]*

Φs =	0.9	*[CSA S6-19 cl. 10.5.7]*
A =	132671	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	394.4	mm
rz =	445.1	mm
λy =	0.331	
λz =	0.293	
Cry =	40249	kN
Crz =	40663	kN
Cr Min =	40249	kN

Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95	*[CSA S6-19 cl. 10.5.7]*
Tension	Φu =	0.8	*[CSA S6-19 cl. 10.5.7]*

a)	Tr =	$\phi_s A_g F_y$	59237	kN
b)	Tr =	$\phi_u A_n F_u$	50946	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	43304	kN
		Tr Min =	43304	kN

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JOB TITLE	BCLB DECK PRE-DESIGN		
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ORIGINATOR BY	KG	DATE	30-Nov-20
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TOWER SPAN

A34R/B34L N. Tower (North - Panel 2-3)

Drawing Location (1959)	
E5	North Tower Elevations
34A/B	Column A34R/L and B34R/L

Material Properties: A-242-55 Steel Reference

F_u =	480	MPa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	350	MPa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

Member	**Angle**	**Web**	**Flange Top**	**Flange Bottom**	**Extra internal plate**	**Extra external**
Quantity	**4**	**2**	**1**	**1**	**2**	**2**
mensions (in)	8x8x1	36x1	48x7/8	29x7/8	28x1	20x1

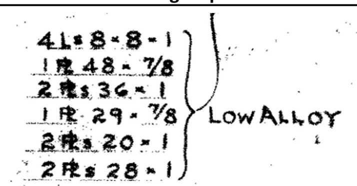
Flange Perfortion Width 0 12 in

Rivet dia. 1 in

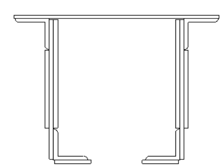
Member Dimensions

Length =	8769.35	mm
Width =	1219	mm
Depth =	972	mm

Drawing Snipet



Member Cross-Section



JOB TITLE	BCLB DECK PRE-DESIGN		
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ORIGINATOR BY	KG	DATE	30-Nov-20
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Individual Member Properties

Web			Top Plate			Top Angles		
Designation	36x1		Designation	48x7/8		Designation	8x8x1	
Qty =	2		Qty =	1		Qty =	2	
w =	25.4	mm	t =	22.23	mm	b =	203.2	mm
h =	914.4	mm	b =	1219.2	mm	d =	203.2	mm
A =	46451.52	mm^2	b_{eff} =	1219.2	mm	t =	25.4	mm
y Bar =	387	mm	A =	27097	mm^2	A =	9680	mm^2
z Bar =	486	mm	A_{eff} =	27097	mm^2	y =	460	mm
RHM*	6		y Bar =	0	mm	z =	889	mm
RHM Area =	7742	mm	z Bar =	960	mm	I_y =	36.9	$x10^6mm^4$
			RHM*	8		I_z =	36.9	$x10^6mm^4$
			RHM Area =	4516.1	mm	A_{angle} =	19360	mm^2
						RHM*	4	
						RHM Area =	5161.3	mm

Bottom Angles			Bottom Plate			Extra Internal Plates		
Designation	8x8x1		Designation	29x7/8		Designation	28x1	
Qty =	2		Qty =	1		Qty =	2	
b =	203.2	mm	t =	22.225	mm	w =	25.4	mm
d =	203.2	mm	b =	736.6	mm	h =	711.2	mm
t =	25.4	mm	b_{eff} =	431.8	mm	A =	36128.96	mm^2
A =	9680	mm^2	A =	16370.935	mm^2	y Bar =	361.95	mm
y =	314.55	mm	A_{eff} =	9596.755	mm^2	z Bar =	587.38	mm
z =	82.33	mm	y Bar =	260.35	mm	RHM*	4	
I_y =	36.9	$x10^6mm^4$	z Bar =	11.11	mm	RHM Area =	5161.3	mm
I_z =	36.9	$x10^6mm^4$	RHM*	4				
A_{angle} =	19360	mm^2	RHM Area =	2258.1	mm			
RHM*	4							
RHM Area =	5161.3	mm						

Extra External Plates		
Designation	20x1	
Qty =	2	
w =	25.4	mm
h =	508	mm
A =	25806.4	mm^2
y Bar =	412.75	mm
z Bar =	485.78	mm
RHM*	2	
RHM Area =	2580.6	mm

RHM* = Rivet Holes/Member

AECOM Imagine it. Delivered.			
JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
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CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

	Angle (top)	Angle (bottom)	Web	Top Plate	Bottom Plate	Extra Int. Pl	Extra Ext Pl	
Designation	8x8x1	8x8x1	36x1	48x7/8	29x7/8	28x1	20x1	
Qty=	2	2	2	1	1	2	2	
Iy =	73.8	73.8	3236.6	1.1	0.4	1522.9	555.0	$x10^6mm^4$
Iz =	73.8	73.8	2.5	3356.5	37.3	1.9	1.4	$x10^6mm^4$
A =	19360.0	19360.0	46451.5	27096.7	9596.8	36129.0	25806.4	mm^2
dz =	338.3	468.6	65	409.5	539.83	36.4	65.2	mm
dy =	460.2	314.6	387	0.0	260.35	362.0	412.8	mm
Iyy =	2289.3	4325.2	3433.9	4544.9	2797.0	1570.8	664.6	$x10^6mm^4$
Izz =	4173.0	1989.3	6972.1	3356.5	687.8	4735.1	4397.8	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	183800.0	mm^2
A_{RHM*}=	24838.7	mm^2
A_{net} =	158961	mm^2
∑Iyy =	19625.7	$x10^6mm^4$
∑Izz =	26311.7	$x10^6mm^4$
ybar=	610	mm
zbar=	551	mm

Geometry Comformance Checks

Slenderness Ratio *[CSA S6-19 cl. 10.9.1.3]*

Member Classification = Primary Compression Member

Ly =	8769.35	mm	kyLy/ry =	25.0	< 120 therefore OK
Lz =	8769.35	mm	kzLz/rz =	21.6	< 120 therefore OK

Width to Thickness Ratio *[CSA S6-19 cl. 10.9.2]*

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	35.8	*[CSA S6-19 cl. 10.9.2.1]*
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	35.8	*[CSA S6-19 cl. 10.9.2.1]*
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	44.9	*[CSA S6-19 cl. 10.9.2.1]*

Webs	h =	508	w =	25.4	h/w =	20.0	OK
Flange	b =	711.2	t =	22.2	b/t =	32.0	OK
Flange Perforated	b =	25.4	t =	22.2	b/t =	1.1	OK

Axial Compression Resistance *[CSA S6-19 cl. 10.9.3.1]*

Φs =	0.9		*[CSA S6-19 cl. 10.5.7]*
A =	158961	mm^2	
n =	1.34		
Ky =	1.00		
Kz =	1.00		
ry =	351.4	mm	
rz =	406.8	mm	
λy =	0.332		
λz =	0.287		
Cry =	48207	kN	
Crz =	48795	kN	
Cr Min =	48207	kN	

Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95	*[CSA S6-19 cl. 10.5.7]*
Tension	Φu =	0.8	*[CSA S6-19 cl. 10.5.7]*

a)	Tr =	$\phi_s A_g F_y$	61114	kN
b)	Tr =	$\phi_u A_n F_u$	61041	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	51885	kN
		Tr Min =	51885	kN

	JOB TITLE	BCLB DECK PRE-DESIGN		
AECOM Imagine it. Delivered.	JOB NO.	60637587	CALCULATION NO.	
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	CHECKED BY	RA	DATE	16-Dec-20

TOWER SPAN

D39RL & A39R|L N. Tower (North Front 456)

	Drawing Location (1959)
E5	North Tower Elevations
39A	Column A39R/L and B39R/L
39B	Column D39R/L

Material Properties: A-242-55 Steel Reference

F_u =	480	MPa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	350	MPa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***

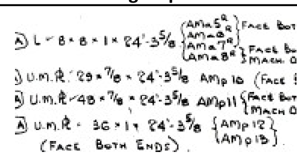
Built up Section Components

Member	**Angle**	**Web**	**Flange Top**	**Flange Bottom**
Quantity	**4**	**2**	**1**	**1**
Dimensions (in)	8x8x1	36x1	48x7/8	29x7/8
Flange Perfortion Width			0	12 in
Rivet dia.	1	in		

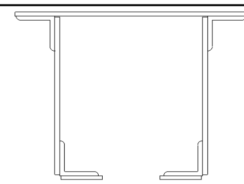
Member Dimensions

Length =	8769.35	mm
Width =	1219	mm
Depth =	972	mm

Drawing Snipet



Member Cross-Section



Individual Member Properties

Web		
Designation	36x1	
Qty =	2	
w =	25.4	mm
h =	914.4	mm
A =	46451.52	mm^2
y Bar =	387.35	mm
z Bar =	485.78	mm
RHM*	6	
RHM Area =	7741.9	mm

Top Plate		
Designation	48x7/8	
Qty =	1	
t =	22.225	mm
b =	1219.2	mm
b_{eff} =	1219.2	mm
A =	27096.72	mm^2
A_{eff} =	27096.72	mm^2
y Bar =	304.8	mm
z Bar =	960.44	mm
RHM*	5	
RHM Area =	2822.6	mm

Top Angles		
Designation	8x8x1	
Qty =	2	
b =	203.2	mm
d =	203.2	mm
t =	25.4	mm
A =	9680	mm^2
y =	460.15	mm
z =	889.23	mm
I_y =	36.9	$x10^6mm^4$
I_z =	36.9	$x10^6mm^4$
A_{angle} =	19360	mm^2
RHM*	4	
RHM Area =	5161.3	mm

Bottom Angles		
Designation	8x8x1	
Qty =	2	
b =	203.2	mm
d =	203.2	mm
t =	25.4	mm
A =	9680	mm^2
y =	314.55	mm
z =	82.33	mm
I_y =	36.9	$x10^6mm^4$
I_z =	36.9	$x10^6mm^4$
A_{angle} =	19360	mm^2
RHM*	4	
RHM Area =	5161.3	mm

Bottom Plate		
Designation	29x7/8	
Qty =	1	
t =	22.225	mm
b =	736.6	mm
b_{eff} =	431.8	mm
A =	16370.935	mm^2
A_{eff} =	9596.755	mm^2
y Bar =	260.35	mm
z Bar =	11.11	mm
RHM*	4	
RHM Area =	2258.1	mm

RHM* = Rivet Holes/Member

JOB TITLE	BCLB DECK PRE-DESIGN		
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Section Calculations

	Angle (top)	Angle (bottom)	Web	Top Plate	Bottom Plate	
Designation	8x8x1	8x8x1	36x1	48x7/8	29x7/8	
Qty=	2	2	2	1	1	
Iy =	73.8	73.8	3236.6	1.1	0.4	$x10^6mm^4$
Iz =	73.8	73.8	2.5	839.1	37.3	$x10^6mm^4$
A =	19360.0	19360.0	46451.5	27096.7	9596.8	mm^2
dz =	335.3	471.6	68	406.5	542.82	mm
dy =	460.2	314.6	387	304.8	260.35	mm
Iyy =	2250.2	4379.8	3452.4	4478.6	2828.2	$x10^6mm^4$
Izz =	4173.0	1989.3	6972.1	3356.5	687.8	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	121865.0	mm^2
A_{RHM*}=	15403.2	mm^2
A_{net} =	106462	mm^2
∑Iyy =	17389.3	$x10^6mm^4$
∑Izz =	17178.7	$x10^6mm^4$
ybar=	610	mm
zbar=	554	mm

AECOM Imagine it. Delivered.	JOB TITLE	BCLB DECK PRE-DESIGN		
	JOB NO.	60637587	CALCULATION NO.	
	ORIGINATOR BY	KG	DATE	30-Nov-20
	CHECKED BY	RA	DATE	16-Dec-20

Geometry Comformance Checks

Slenderness Ratio *[CSA S6-19 cl. 10.9.1.3]*

Member Classification = Primary Compression Member

Ly =	8769.35	mm	kyLy/ry =	21.7	< 120 therefore OK
Lz =	8769.35	mm	kzLz/rz =	21.8	< 120 therefore OK

Width to Thickness Ratio *[CSA S6-19 cl. 10.9.2]*

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	35.8	*[CSA S6-19 cl. 10.9.2.1]*
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	35.8	*[CSA S6-19 cl. 10.9.2.1]*
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	44.9	*[CSA S6-19 cl. 10.9.2.1]*

Webs	h =	508	w =	25.4	h/w =	20.0	OK
Flange	b =	762.0	t =	22.2	b/t =	34.3	OK
Flange Perforated	b =	25.4	t =	22.2	b/t =	1.1	OK

Axial Compression Resistance *[CSA S6-19 cl. 10.9.3.1]*

Φs =	0.9		*[CSA S6-19 cl. 10.5.7]*
A =	106462	mm^2	
n =	1.34		
Ky =	1.00		
Kz =	1.00		
ry =	404.2	mm	
rz =	401.7	mm	
λy =	0.289		
λz =	0.291		
Cry =	32665	kN	
Crz =	32651	kN	
Cr Min =	32651	kN	

Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95	*[CSA S6-19 cl. 10.5.7]*
Tension	Φu =	0.8	*[CSA S6-19 cl. 10.5.7]*

a)	Tr =	$\phi_s A_g F_y$	40520	kN
b)	Tr =	$\phi_u A_n F_u$	40881	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	34749	kN
		Tr Min =	34749	kN

TOWER SPAN

C39R/L N. Tower (North Panel 6)

Drawing Location (1959)

E5	North Tower Elevations
39C	Column C39R/L

Material Properties: A-242-55 Steel Reference

F_u =	480	MPa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	350	MPa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***

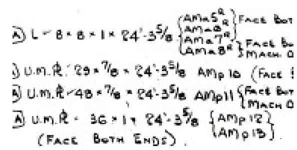
Built up Section Components

Member	Angle	Web	Flange Top	Flange Bottom	
Quantity	**4**	**2**	**1**	**1**	
Dimensions (in)	8x8x1	36x1	48x7/8	29x7/8	
Flange Perfortion Width			0	12	in
Rivet dia.	1	in			

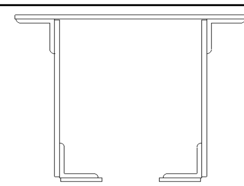
Member Dimensions

Length =	2730.5	mm
Width =	1219	mm
Depth =	972	mm

Drawing Snipet



Member Cross-Section



Individual Member Properties

Web			Top Plate			Top Angles		
Designation	36x1		Designation	48x7/8		Designation	8x8x1	
Qty =	2		Qty =	1		Qty =	2	
w =	25.4	mm	t =	22.225	mm	b =	203.2	mm
h =	914.4	mm	b =	1219.2	mm	d =	203.2	mm
A =	46451.52	mm^2	b_{eff} =	1219.2	mm	t =	25.4	mm
y Bar =	387.35	mm	A =	27096.72	mm^2	A =	9680	mm^2
z Bar =	485.78	mm	A_{eff} =	27096.72	mm^2	y =	460.15	mm
RHM*	6		y Bar =	304.8	mm	z =	889.23	mm
RHM Area =	7741.9	mm	z Bar =	960.44	mm	I_y =	36.9	$x10^6mm^4$
			RHM*	5		I_z =	36.9	$x10^6mm^4$
			RHM Area =	2822.6	mm	A_{angle} =	19360	mm^2
						RHM*	4	
						RHM Area =	5161.3	mm

Bottom Angles			Bottom Plate		
Designation	8x8x1		Designation	29x7/8	
Qty =	2		Qty =	1	
b =	203.2	mm	t =	22.225	mm
d =	203.2	mm	b =	736.6	mm
t =	25.4	mm	b_{eff} =	431.8	mm
A =	9680	mm^2	A =	16370.935	mm^2
y =	314.55	mm	A_{eff} =	9596.755	mm^2
z =	82.33	mm	y Bar =	260.35	mm
I_y =	36.9	$x10^6mm^4$	z Bar =	11.11	mm
I_z =	36.9	$x10^6mm^4$	RHM*	4	
A_{angle} =	19360	mm^2	RHM Area =	2258.1	mm
RHM*	4				
RHM Area =	5161.3	mm			

RHM* = Rivet Holes/Member

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JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

	Angle (top)	Angle (bottom)	Web	Top Plate	Bottom Plate	
Designation	8x8x1	8x8x1	36x1	48x7/8	29x7/8	
Qty=	2	2	2	1	1	
Iy =	73.8	73.8	3236.6	1.1	0.4	$x10^6mm^4$
Iz =	73.8	73.8	2.5	839.1	37.3	$x10^6mm^4$
A =	19360.0	19360.0	46451.5	27096.7	9596.8	mm^2
dz =	335.3	471.6	68	406.5	542.82	mm
dy =	460.2	314.6	387	304.8	260.35	mm
Iyy =	2250.2	4379.8	3452.4	4478.6	2828.2	$x10^6mm^4$
Izz =	4173.0	1989.3	6972.1	3356.5	687.8	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	121865.0	mm^2
A_{RHM*}=	15403.2	mm^2
A_{net} =	106462	mm^2
∑Iyy =	17389.3	$x10^6mm^4$
∑Izz =	17178.7	$x10^6mm^4$
ybar=	610	mm
zbar=	554	mm

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Geometry Comformance Checks

Slenderness Ratio *[CSA S6-19 cl. 10.9.1.3]*

Member Classification = Primary Compression Member

Ly =	2730.5	mm	kyLy/ry =	6.8	< 120 therefore OK
Lz =	2730.5	mm	kzLz/rz =	6.8	< 120 therefore OK

Width to Thickness Ratio *[CSA S6-19 cl. 10.9.2]*

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	35.8	*[CSA S6-19 cl. 10.9.2.1]*
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	35.8	*[CSA S6-19 cl. 10.9.2.1]*
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	44.9	*[CSA S6-19 cl. 10.9.2.1]*

Webs	h =	508	w =	25.4	h/w =	20.0	OK
Flange	b =	762.0	t =	22.2	b/t =	34.3	OK
Flange Perforated	b =	25.4	t =	22.2	b/t =	1.1	OK

Axial Compression Resistance *[CSA S6-19 cl. 10.9.3.1]*

Φs =	0.9		*[CSA S6-19 cl. 10.5.7]*
A =	106462	mm^2	
n =	1.34		
Ky =	1.00		
Kz =	1.00		
ry =	404.2	mm	
rz =	401.7	mm	
λy =	0.090		
λz =	0.091		
Cry =	33496	kN	
Crz =	33495	kN	
Cr Min =	33495	kN	

Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95	*[CSA S6-19 cl. 10.5.7]*
Tension	Φu =	0.8	*[CSA S6-19 cl. 10.5.7]*

a)	Tr =	$\phi_s A_g F_y$	40520	kN
b)	Tr =	$\phi_u A_n F_u$	40881	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	34749	kN
		Tr Min =	34749	kN

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

TOWER SPAN

Jacking Girder — Tension & Compression Member — Drawing Location (1959) Jacking Girder

Material Properties: A-242-55 Steel — Reference — ***E7, 15*** A15

F_u =	480	MPa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	350	MPa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

Member	**Angles**	**Exterior Web**	**Top Plate**	**Bottom Plate**
Quantity	**4**	**2**	**1**	**1**
Dimensions (in)	8x6x1	71x3/4	30x3/4	30x3/4

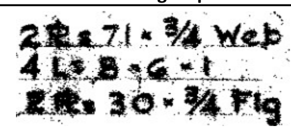
Ext. Web Perfortion Width 15 in

Rivet dia. 1 in

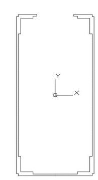
Member Dimensions

Length =	9690	mm
Width =	800	mm
Depth =	1851	mm

Drawing Snipet



Member Cross-Section



Individual Member Properties

	Top Angles	Bottom Angles			Top Plate	Bottom Plate	
Designation	8x6x1	8x6x1		Designation	30x3/4	30x3/4	
Qty =	2	2	mm	Qty =	1	1	
b =	152	152	mm	t =	19.05	19.05	mm
d =	203	203	mm	b =	762	762	mm
t =	25.4	25.4	mm^2	b_{eff} =	381	762	mm
A =	8390	8390	mm	z Bar =	1841.501	9.525	mm
z =	67.4	67.4	mm	A =	14516.10	14516.10	mm^2
y =	41.9	41.9	mm	A_{eff}=	7258.05	14516.10	mm^2
Z bar	1760	91.21	mm	RHM*	2	2	
I_y =	33.5	33.5	$x10^6 mm^4$	RHM Area =	967.7	967.7	mm^2
I_z =	16	16	$x10^6 mm^4$				
A_{angle} =	16780	16780	mm^2				
RHM*	3	3	mm				
RHM Area =	3871	3871	mm^2				

Web		
Designation =	71x3/4	
Qty =	2	
w =	19.05	mm
h =	1803.4	mm
A =	68709.54	mm^2
z Bar =	926	mm
RHM*	4	
RHM Area =	3871.0	mm^2

RHM* = Rivet Holes/Member

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
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Section Calculations

	Top Angles	Bottom Angles	Web	Top Plate	Bot Plate	
Designation	8x6x1	8x6x1	71x3/4	30x3/4	30x3/4	
Qty=	2	2	2	1	1	
Iy =	67.0	67.0	18621.7	0.2	0.4	$x10^6mm^4$
Iz =	32	32	2.1	21.9	702.4	$x10^6mm^4$
A =	16780	16780	68709.5	7258.1	14516.1	mm^2
dz =	887.9	780.7	53.6	969.6	862.4	mm^2
dy =	339	339	390.5	285.8	0.0	mm
Iyy =	13295.6	10294.4	18819.1	6823.5	10796.3	$x10^6mm^4$
Izz =	1961.5	1961.5	10481.0	614.6	702.4	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	124044	mm^2
A_{RHM*}=	13548	mm2
A_{net} =	110495	mm^2
∑Iyy =	60028.9	$x10^6mm^4$
∑Izz =	15721.0	$x10^6mm^4$
ybar=	400	mm
Zbar=	872	mm

Geometry Comformance Checks

**member designed for jacking of towers, service loading inconsequential*

Slenderness Ratio ***[CSA S6-19 cl. 10.9.1.3]***

Member Classification = Primary Compression Member

Ly =	9690.1	mm	kyLy/ry =	13.1	< 120 therefore OK
Lz =	9690.1	mm	kzLz/rz =	25.7	< 120 therefore OK

Width to Thickness Ratio ***[CSA S6-19 cl. 10.9.2]***

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	35.8	***[CSA S6-19 cl. 10.9.2.1]***
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	35.8	***[CSA S6-19 cl. 10.9.2.1]***
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	44.9	***[CSA S6-19 cl. 10.9.2.1]***

Webs	h =	1397.4	w =	19.1	h/w =	73.4	NG
Flange	b =	458.0	t =	19.1	b/t =	24.0	OK
Flange Perforated	b =	77.0	t =	19.1	b/t =	4.0	OK

Axial Compression Resistance ***[CSA S6-19 cl. 10.9.3.1]***

Φs =	0.9		***[CSA S6-19 cl. 10.5.7]***
A =	110495	mm^2	
n =	1.34		
Ky =	1.00		
Kz =	1.00		
ry =	737.1	mm	
rz =	377.2	mm	
λy =	0.175		
λz =	0.342		
Cry =	34565	kN	
Crz =	33409	kN	
Cr Min =	33409	kN	

Axial Tensile Resistance ***[CSA S6-19 cl. 10.8.2]***

Tension	Φs =	0.95	***[CSA S6-19 cl. 10.5.7]***
Tension	Φu =	0.8	***[CSA S6-19 cl. 10.5.7]***

a)	Tr =	$\phi_s A_g F_y$	41245	kN
b)	Tr =	$\phi_u A_n F_u$	42430	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	36066	kN
		Tr Min =	36066	kN

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

TOWER SPAN

Sides Hor Strut 1 Tension & Compression Member Drawing Location (1959)

Side Horizontal Struts

Material Properties: A-7 Steel			Reference		
F_u =	410	MPa	***[CISC 6-7, 11TH Edition, 2016]***	***E5 & 57***	B57
F_y =	230	MPa	***[CISC 6-7, 11TH Edition, 2016]***	***E5 & 75***	A75
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***		
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***		

Built up Section Components

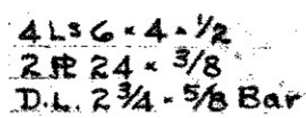
Member	**Angle**	**Web**
Quantity	**4**	**2**
Dimensions (in)	6x4x1/2	24x3/8

Flange Perfortion Width	0	in
Rivet dia.	1	in

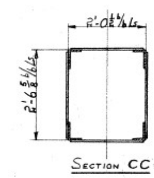
Member Dimensions

Length =	9754	mm
Width =	796	mm
Depth =	622	mm

Drawing Snipet

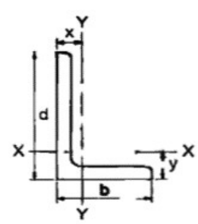


Member Cross-Section



Individual Member Properties

Web			**Angle**		
Designation	24x3/8		Designation	6x4x1/2	
Qty =	2		Qty =	4	
w =	9.525	mm	b =	102	mm
h =	609.6	mm	d =	152	mm
A =	11612.88	mm^2	t =	12.7	mm
z Bar =	311.15	mm	A =	3060	mm^2
y Bar =	4.7625	mm	z =	25.2	mm
RHM*	6		y =	50.2	mm
RHM Area =	2903.2	mm	I_y =	2.64	$x10^6 mm^4$
			I_z =	7.2	$x10^6 mm^4$
			A_{angle} =	12240	mm^2
			RHM*	2	
			RHM Area =	2580.6	mm



RHM* = Rivet Holes/Member

JOB TITLE	BCLB DECK PRE-DESIGN			
JOB NO.	60637587	CALCULATION NO.		
ORIGINATOR BY	KG	DATE	30-Nov-20	
CHECKED BY	RA	DATE	16-Dec-20	

Section Calculations

	Angle	Web	
Designation	6x4x1/2	24x3/8	
Qty=	4	2	
I_y =	10.6	359.6	$x10^6 mm^4$
I_z =	28.8	0.1	$x10^6 mm^4$
A =	12240.0	11612.9	mm^2
dy =	338.5	393.43	mm^2
dz =	286	0.0	mm
Iyy =	1011.4	359.6	$x10^6 mm^4$
Izz =	1431.0	1797.6	$x10^6 mm^4$

Composite Member Properties		
A_{gross} =	23853	mm^2
A_{RHM*}=	5484	mm2
A_{net} =	18369	mm^2
∑Iyy =	1371.0	$x10^6 mm^4$
∑Izz =	3228.5	$x10^6 mm^4$
ybar=	398	mm
zbar=	311	mm

JOB TITLE	BCLB DECK PRE-DESIGN			
JOB NO.	60637587	CALCULATION NO.		
ORIGINATOR BY	KG	DATE	30-Nov-20	
CHECKED BY	RA	DATE	16-Dec-20	

Geometry Comformance Checks

Slenderness Ratio *[CSA S6-19 cl. 10.9.1.3]*

Member Classification = Primary Compression Member

Ly =	9754	mm	kyLy/ry =	35.7	< 120 therefore OK
Lz =	9753.6	mm	kzLz/rz =	23.3	< 120 therefore OK

Width to Thickness Ratio *[CSA S6-19 cl. 10.9.2]*

Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2	*[CSA S6-19 cl. 10.9.2.1]*
Outstanging leg of pair of angles: Class 3 Limit =	b/t<= 250/(SQRT(fy) =	16.5	*[CSA S6-19 cl. 10.9.2.1]*

Webs	h =	405.6	w =	9.5	h/w =	42.6	OK
Flange angle leg	b =	152.0	t =	12.7	b/t =	12.0	OK

Axial Compression Resistance *[CSA S6-19 cl. 10.9.3.1]*

Φs =	0.9		*[CSA S6-19 cl. 10.5.7]*
A =	18369	mm^2	
n =	1.34		
Ky =	1.00		
Kz =	1.00		
ry =	273.2	mm	
rz =	419.2	mm	
λy =	0.385		
λz =	0.251		
Cry =	3596	kN	
Crz =	3734	kN	
Cr Min =	3596	kN	

Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95	*[CSA S6-19 cl. 10.5.7]*
Tension	Φu =	0.8	*[CSA S6-19 cl. 10.5.7]*

a)	Tr =	$\phi_s A_g F_y$	5212	kN
b)	Tr =	$\phi_u A_n F_u$	6025	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	5121	kN
		Tr Min =	5121	kN

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

TOWER SPAN

Sides Hor Strut 2,3,4,5 Tension & Compression Member

Drawing Location (1959)

E5, E7, 54 C54, AC54, AD54, D54

E5, E7, 81 A81, B81

Material Properties: A-7 Steel

			Reference
F_u =	410	MPa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	MPa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

Member	Angle	Web
Quantity	**4**	**2**
Dimensions (in)	6x4x3/8	24x3/8

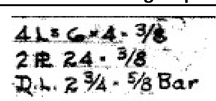
Flange Perfortion Width 0 in

Rivet dia. 1 in

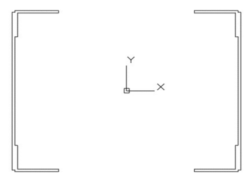
Member Dimensions

Length =	9754	mm
Width =	797	mm
Depth =	622	mm

Drawing Snipet

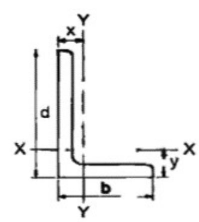


Member Cross-Section



Individual Member Properties

Web			Angle		
Designation	24x3/8		Designation	6x4x3/8	
Qty =	2		Qty =	4	
w =	9.525	mm	b =	102	mm
h =	609.6	mm	d =	152	mm
A =	11612.88	mm^2	t =	9.53	mm
z Bar =	311.15	mm	A =	2330	mm^2
y Bar =	4.76	mm	z =	24.1	mm
RHM*	2		y =	49.1	mm
RHM Area =	967.7	mm	I_y =	5.58	$x10^6mm^4$
			I_z =	2.06	$x10^6mm^4$
			A_{angle} =	9320	mm^2
			RHM*	2	
			RHM Area =	1936.5	mm



RHM* = Rivet Holes/Member

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

	Angle	Web	
Designation	6x4x3/8	24x3/8	
Qty=	4	2	
I_y =	22.3	359.6	$x10^6mm^4$
I_z =	8.24	0.1	$x10^6mm^4$
A =	9320.0	11612.9	mm^2
dy =	339.8	394	mm^2
dz =	287	0.0	mm
Iyy =	790.3	359.6	$x10^6mm^4$
Izz =	1084.6	1800.1	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	20933	mm^2
A_{RHM*}=	2904	mm2
A_{net} =	18029	mm^2
∑Iyy =	1149.9	$x10^6mm^4$
∑Izz =	2884.7	$x10^6mm^4$
ybar=	398	mm
zbar=	311	mm

Geometry Comformance Checks

Slenderness Ratio *[CSA S6-19 cl. 10.9.1.3]*

Member Classification = Primary Compression Member

Ly =	9753.6	mm	kyLy/ry =	38.6	< 120 therefore OK
Lz =	9753.6	mm	kzLz/rz =	24.4	< 120 therefore OK

Width to Thickness Ratio *[CSA S6-19 cl. 10.9.2]*

Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2	*[CSA S6-19 cl. 10.9.2.1]*
Outstanging leg of pair of angles: Class 3 Limit =	b/t<= 250/(SQRT(fy) =	16.5	*[CSA S6-19 cl. 10.9.2.1]*

Webs	h =	405.6	w =	9.5	h/w =	42.6	OK
Flange	b =	142.5	t =	9.5	b/t =	14.9	OK

Axial Compression Resistance *[CSA S6-19 cl. 10.9.3.1]*

Φs =	0.9		*[CSA S6-19 cl. 10.5.7]*
A =	18029	mm^2	
n =	1.34		
Ky =	1.00		
Kz =	1.00		
ry =	252.5	mm	
rz =	400.0	mm	
λy =	0.417		
λz =	0.263		
Cry =	3486	kN	
Crz =	3656	kN	
Cr Min =	3486	kN	

Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95	*[CSA S6-19 cl. 10.5.7]*
Tension	Φu =	0.8	*[CSA S6-19 cl. 10.5.7]*

a)	Tr =	$\phi_s A_g F_y$	4574	kN
b)	Tr =	$\phi_u A_n F_u$	5913	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	5026	kN
		Tr Min =	4574	kN

TOWER SPAN

South EW + N E Side Bracing 1

Drawing Location (1959)
Side Diagonals
Bottom Sections
E5 & 68 A68,B68,C68 & D68

Material Properties: A-7 Steel

			Reference
F_u =	410	MPa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	MPa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***

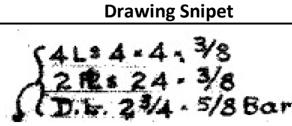
Built up Section Components

Member	Angle	Web	
Quantity	**4**	**2**	
Dimensions (in)	4x4x3/8	24x3/8	
Flange Perfortion Width		0	in
Rivet dia.		1	in

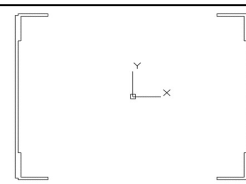
Member Dimensions

Length =	6915	mm
Width =	797	mm
Depth =	622	mm

Drawing Snipet

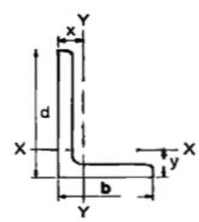


Member Cross-Section



Individual Member Properties

Web			Angle		
Designation	24x3/8		Designation	4x4x3/8	
Qty =	2		Qty =	4	
w =	9.525	mm	b =	102	mm
h =	609.6	mm	d =	102	mm
A =	11612.88	mm^2	t =	9.53	mm
z Bar =	311.15	mm	A =	1850	mm^2
y Bar =	4.8	mm	z =	29	mm
RHM*	2		y =	29	mm
RHM Area =	967.7	mm	I_y =	1.84	$x10^6mm^4$
			I_z =	1.84	$x10^6mm^4$
			A_{angle} =	7400	mm^2
			RHM*	2	
			RHM Area =	1936.5	mm



RHM* = Rivet Holes/Member

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

	Angle	Web	
Designation	4x4x3/8	24x3/8	
Qty=	4	2	
I_y =	7.4	359.6	$x10^6mm^4$
I_z =	7.36	0.1	$x10^6mm^4$
A =	7400.0	11612.9	mm^2
dy =	359.9	394	mm^2
dz =	282	0.0	mm
Iyy =	596.5	359.6	$x10^6mm^4$
Izz =	966.1	1800.1	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	19013	mm^2
A_{RHM*}=	2904	mm2
A_{net} =	16109	mm^2
∑Iyy =	956.1	$x10^6mm^4$
∑Izz =	2766.2	$x10^6mm^4$
ybar=	398	mm
zbar=	311	mm

Geometry Comformance Checks

Slenderness Ratio *[CSA S6-19 cl. 10.9.1.3]*

Member Classification = Primary Compression Member

Ly =	6915.15	mm	kyLy/ry =	28.4	< 120 therefore OK
Lz =	6915.15	mm	kzLz/rz =	16.7	< 120 therefore OK

Width to Thickness Ratio *[CSA S6-19 cl. 10.9.2]*

Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy)) =	44.2	*[CSA S6-19 cl. 10.9.2.1]*
Outstanging leg of pair of angles: Class 3 Limit =	b/t<= 250/(SQRT(fy)) =	16.5	*[CSA S6-19 cl. 10.9.2.1]*

Webs	h =	405.6	w =	9.5	h/w =	42.6	OK
Flange	b =	102.0	t =	9.5	b/t =	10.7	OK

Axial Compression Resistance *[CSA S6-19 cl. 10.9.3.1]*

Φs =	0.9		*[CSA S6-19 cl. 10.5.7]*
A =	16109	mm^2	
n =	1.34		
Ky =	1.00		
Kz =	1.00		
ry =	243.6	mm	
rz =	414.4	mm	
λy =	0.306		
λz =	0.180		
Cry =	3234	kN	
Crz =	3310	kN	
Cr Min =	3234	kN	

Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95	*[CSA S6-19 cl. 10.5.7]*
Tension	Φu =	0.8	*[CSA S6-19 cl. 10.5.7]*

a)	Tr =	$\phi_s A_g F_y$	4154	kN
b)	Tr =	$\phi_u A_n F_u$	5284	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	4491	kN
		Tr Min =	4154	kN

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

TOWER SPAN

NS Bracing 6

Drawing Location (1959)
Side Diagonals
Bottom Sections

Material Properties: A-7 Steel Reference

F_u =	410	MPa	*[CISC 6-7, 11TH Edition, 2016]*	***E5 & 79***	A79,B79 & C79
F_y =	230	MPa	*[CISC 6-7, 11TH Edition, 2016]*		Top Sections
ϕ_s =	0.95		*[CSA S6-19 cl. 10.5.7]*	***E5 & B94***	B94
E =	200000	MPa	*[CSA S6-19 cl. 10.4.2]*	***E5 & D81***	D81

Built up Section Components

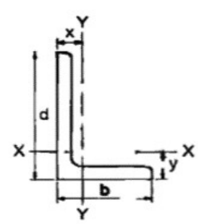
Member	**Angle**	**Web**
Quantity	**4**	**2**
Dimensions (in)	4x4x1/2	24x3/8
Flange Perfortion Width	0	in
Rivet dia.	1	in

Member Dimensions **Drawing Snipet** **Member Cross-Section**

Length =	6915	mm
Width =	797	mm
Depth =	622	mm

Individual Member Properties

Web			**Angle**		
Designation	24x3/8		Designation	4x4x1/2	
Qty =	2		Qty =	4	
w =	9.525	mm	b =	102	mm
h =	609.6	mm	d =	102	mm
A =	11612.88	mm^2	t =	12.7	mm
z Bar =	311.15	mm	A =	2420	mm^2
y Bar =	4.76	mm	z =	30.2	mm
RHM*	2		y =	30.2	mm
RHM Area =	967.7	mm	I_y =	2.34	$x10^6mm^4$
			I_z =	2.34	$x10^6mm^4$
			A_{angle} =	9680	mm^2
			RHM*	2	
			RHM Area =	2580.6	mm



RHM* = Rivet Holes/Member

Section Calculations

	Angle	Web	
Designation	4x4x1/2	24x3/8	
Qty=	4	2	
I_y =	9.36	359.6	$x10^6mm^4$
I_z =	9.36	0.1	$x10^6mm^4$
A =	9680.0	11612.9	mm^2
dy =	358.7	394	mm^2
dz =	281	0.0	mm
Iyy =	773.4	359.6	$x10^6mm^4$
Izz =	1255.1	1800.1	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	21293	mm^2
A_{RHM*}=	3548	mm2
A_{net} =	17745	mm^2
∑Iyy =	1133.1	$x10^6mm^4$
∑Izz =	3055.2	$x10^6mm^4$
ybar=	398	mm
zbar=	311	mm

Geometry Comformance Checks

Slenderness Ratio *[CSA S6-19 cl. 10.9.1.3]*

Member Classification = Primary Compression Member

Ly =	6915	mm	kyLy/ry =	27.4	< 120 therefore OK
Lz =	6915	mm	kzLz/rz =	16.7	< 120 therefore OK

Width to Thickness Ratio *[CSA S6-19 cl. 10.9.2]*

Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2	*[CSA S6-19 cl. 10.9.2.1]*
Outstanging leg of pair of angles: Class 3 Limit =	b/t<= 200/(SQRT(fy) =	13.2	*[CSA S6-19 cl. 10.9.2.1]*

Webs	h =	405.6	w =	9.5	h/w =	42.6	OK
Flange	b =	102.0	t =	12.7	b/t =	8.0	OK

Axial Compression Resistance *[CSA S6-19 cl. 10.9.3.1]*

Φs =	0.9		*[CSA S6-19 cl. 10.5.7]*
A =	17745	mm^2	
n =	1.34		
Ky =	1.00		
Kz =	1.00		
ry =	252.7	mm	
rz =	414.9	mm	
λy =	0.295		
λz =	0.180		
Cry =	3572	kN	
Crz =	3646	kN	
Cr Min =	3572	kN	

Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95	*[CSA S6-19 cl. 10.5.7]*
Tension	Φu =	0.8	*[CSA S6-19 cl. 10.5.7]*

a)	Tr =	$\phi_s A_g F_y$	4653	kN
b)	Tr =	$\phi_u A_n F_u$	5820	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	4947	kN
		Tr Min =	4653	kN

AECOM Imagine it. Delivered.	JOB TITLE	BCLB DECK PRE-DESIGN	
	JOB NO.	60637587	CALCULATION NO.
	ORIGINATOR BY	KG	DATE 30-Nov-20
	CHECKED BY	RA	DATE 16-Dec-20

TOWER SPAN

Side Diagonals Panels 2,3,4,5

Drawing Location (1959)

E5 & 45	Side Diagonals (A45, B45 & C45)
E5 & 54	(A54)

Material Properties: A-7 Steel

			Reference
F_u =	410	MPa	*[CISC 6-7, 11TH Edition, 2016]*
F_y =	230	MPa	*[CISC 6-7, 11TH Edition, 2016]*
ϕ_s =	0.95		*[CSA S6-19 cl. 10.5.7]*
E =	200000	MPa	*[CSA S6-19 cl. 10.4.2]*

Built up Section Components

Member	Angle	Web
Quantity	**4**	**2**
Dimensions (in)	4x4x3/8	24x3/8

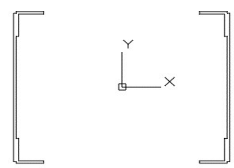
Flange Perfortion Width	0	in
Rivet dia.	1	in

Member Dimensions

Length =	6560	mm
Width =	797	mm
Depth =	622	mm

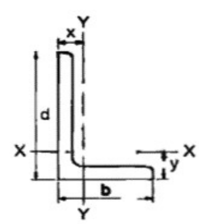
Drawing Snipet

Member Cross-Section



Individual Member Properties

Web			Angle		
Designation	24x3/8		Designation	4x4x3/8	
Qty =	2		Qty =	4	
w =	9.525	mm	b =	102	mm
h =	609.6	mm	d =	102	mm
A =	11612.88	mm^2	t =	9.53	mm
z Bar =	311.15	mm	A =	1850	mm^2
y Bar =	4.76	mm	z =	29	mm
RHM*	2		y =	29	mm
RHM Area =	967.7	mm	I_y =	1.84	$x10^6 mm^4$
			I_z =	1.84	$x10^6 mm^4$
			A_{angle} =	7400	mm^2
			RHM*	2	
			RHM Area =	1936.5	mm



RHM* = Rivet Holes/Member

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

	Angle	Web	
Designation	4x4x3/8	24x3/8	
Qty=	4	2	
I_y =	7.4	359.6	$x10^6mm^4$
I_z =	7.36	0.1	$x10^6mm^4$
A =	7400.0	11612.9	mm^2
dy =	359.9	394	mm^2
dz =	282	0.0	mm
Iyy =	596.5	359.6	$x10^6mm^4$
Izz =	966.1	1800.1	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	19013	mm^2
A_{RHM*}=	2904	mm^2
A_{net} =	16109	mm^2
∑Iyy =	956.1	$x10^6mm^4$
∑Izz =	2766.2	$x10^6mm^4$
ybar=	398	mm
zbar=	311	mm

Geometry Comformance Checks

Slenderness Ratio *[CSA S6-19 cl. 10.9.1.3]*

Member Classification = Primary Compression Member

Ly =	6559.55 mm	kyLy/ry =	26.9	< 120 therefore OK
Lz =	6559.55 mm	kzLz/rz =	15.8	< 120 therefore OK

Width to Thickness Ratio *[CSA S6-19 cl. 10.9.2]*

Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2	*[CSA S6-19 cl. 10.9.2.1]*
Outstanging leg of pair of angles: Class 3 Limit =	b/t<= 250/(SQRT(fy) =	16.5	*[CSA S6-19 cl. 10.9.2.1]*

Webs	h =	405.6	w =	9.5	h/w =	42.6	OK
Flange	b =	102.0	t =	9.5	b/t =	10.7	OK

Axial Compression Resistance *[CSA S6-19 cl. 10.9.3.1]*

Φs =	0.9	*[CSA S6-19 cl. 10.5.7]*
A =	16109 mm^2	
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	243.6 mm	
rz =	414.4 mm	
λy =	0.291	
λz =	0.171	
Cry =	3247 kN	
Crz =	3313 kN	
Cr Min =	3247 kN	

Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95	*[CSA S6-19 cl. 10.5.7]*
Tension	Φu =	0.8	*[CSA S6-19 cl. 10.5.7]*

a)	Tr =	$\phi_s A_g F_y$	4154 kN
b)	Tr =	$\phi_u A_n F_u$	5284 kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	4491 kN
		Tr Min =	4154 kN

AECOM Imagine it. Delivered.	JOB TITLE	BCLB DECK PRE-DESIGN	
	JOB NO.	60637587	CALCULATION NO.
	ORIGINATOR BY	KG	DATE 30-Nov-20
	CHECKED BY	RA	DATE 16-Dec-20

LIFT SPAN

Front Hor Strut 1 Tension & Compression Member Drawing Location (1959)

Portal Strut

Material Properties: A-7 Steel Reference ***E7, 61*** A61

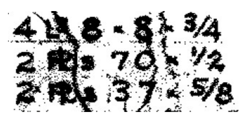
F_u =	410	MPa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	MPa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***

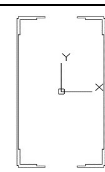
Built up Section Components

Member	Angles	Exterior Web	Top Plate	Bottom Plate
Quantity	**4**	**2**	**1**	**1**
Dimensions (in)	8x8x3/4	70x1/2	37x5/8	37x5/8
Ext. Web Perfortion Width	14	in		
Rivet dia.	1	in		

Member Dimensions **Drawing Snipet** **Member Cross-Section**

Length =	15900	mm
Width =	968	mm
Depth =	1822	mm





Individual Member Properties

	Top Angles	Bottom Angles			Top Plate	Bottom Plate	
Designation	8x8x3/4	8x8x3/4		Designation	37x5/8	37x5/8	
Qty =	2	2	mm	Qty =	1	1	
b =	203	203	mm	t =	15.88	15.88	mm
d =	203	203	mm	b =	939.8	939.8	mm
t =	19.0	19.0	mm^2	b_{eff}=	584.2	584.2	
A =	7360	7360	mm	z Bar =	1814.51	7.94	mm
z =	57.8	57.8	mm	A =	14919.33	14919.33	mm^2
y =	57.8	57.8	mm	A_{eff}=	9274.18	9274.18	mm^2
Z bar	1749	73.675	mm	RHM*	4	4	
I_y =	28.9	28.9	$x10^6 mm^4$	RHM Area =	1612.9	1612.9	mm^2
I_z =	28.9	28.9	$x10^6 mm^4$				
A_{angle} =	14720	14720	mm^2				
RHM*	4	4	mm				
RHM Area =	3861	3861	mm^2				

Web		
Location	**Exterior**	
Designation =	70x1/2	
Qty =	2	
w =	12.7	mm
h =	1778	mm
A =	45161.2	mm^2
z Bar =	911	mm
RHM*	4	
RHM Area =	2580.6	mm^2

RHM* = Rivet Holes/Member

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

	Top Angles	Bottom Angles	Web	Top Plate	Bot Plate	
Designation	8x8x3/4	8x8x3/4	70x1/2	37x5/8	37x5/8	
Qty=	2	2	2	1	1	
Iy =	57.80	57.80	11897.3	0.3	0.3	$x10^6mm^4$
Iz =	57.8	57.8	0.6	274.5	274.5	$x10^6mm^4$
A =	14720	14720	45161.2	9274.2	9274.2	mm^2
dz =	837.6	837.6	0.0	903.3	903.3	mm^2
dy =	414	414	477.8	323.9	323.9	mm
Iyy =	10383.7	10383.7	11897.3	7567.4	7567.4	$x10^6mm^4$
Izz =	2577.0	2577.0	10312.3	1247.2	1247.2	$x10^6mm^4$

Composite Member Properties

A_{gross} =	93150	mm^2
A_{RHM*}=	13528	mm2
A_{net} =	79622	mm^2
∑Iyy =	47799.5	$x10^6mm^4$
∑Izz =	17960.6	$x10^6mm^4$
ybar=	484	mm
Zbar=	911	mm

Geometry Comformance Checks

Slenderness Ratio *[CSA S6-19 cl. 10.9.1.3]*

Member Classification = Primary Compression Member

Ly =	15900.4	mm	kyLy/ry =	20.5	< 120 therefore OK
Lz =	15900.4	mm	kzLz/rz =	33.5	< 120 therefore OK

Width to Thickness Ratio *[CSA S6-19 cl. 10.9.2]*

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2	*[CSA S6-19 cl. 10.9.2.1]*
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2	*[CSA S6-19 cl. 10.9.2.1]*
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4	*[CSA S6-19 cl. 10.9.2.1]*

Webs	h =	1372	w =	12.7	h/w =	108.0	NG
Flange	b =	533.8	t =	15.9	b/t =	33.6	OK
Flange Perforated	b =	178.2	t =	15.9	b/t =	11.2	OK

Axial Compression Resistance *[CSA S6-19 cl. 10.9.3.1]*

Φs =	0.9		*[CSA S6-19 cl. 10.5.7]*
A =	79622	mm^2	
n =	1.34		
Ky =	1.00		
Kz =	1.00		
ry =	774.8	mm	
rz =	474.9	mm	
λy =	0.222		
λz =	0.361		
Cry =	16268	kN	
Crz =	15721	kN	
Cr Min =	15721	kN	

Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95	*[CSA S6-19 cl. 10.5.7]*
Tension	Φu =	0.8	*[CSA S6-19 cl. 10.5.7]*

a)	Tr =	$\phi_s A_g F_y$	20353	kN
b)	Tr =	$\phi_u A_n F_u$	26116	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	22198	kN
		Tr Min =	20353	kN

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

TOWER SPAN

Front Hor Strut 2 — Tension & Compression Member — Drawing Location (1959)

Side Horizontal Struts

Material Properties: A-7 Steel — Reference — ***E5 & 47*** D47

F_u =	410	MPa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	MPa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***

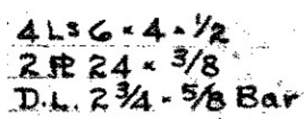
Built up Section Components

Member	**Angle**	**Web**
Quantity	**4**	**2**
Dimensions (in)	6x4x1/2	24x3/8
Flange Perfortion Width	0	in
Rivet dia.	1	in

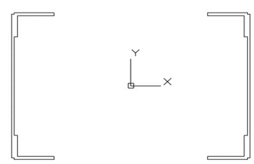
Member Dimensions

Length =	7950	mm
Width =	908	mm
Depth =	622	mm

Drawing Snipet

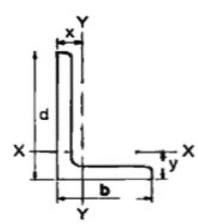


Member Cross-Section



Individual Member Properties

Web			**Angle**		
Designation	24x3/8		Designation	6x4x1/2	
Qty =	2		Qty =	4	
w =	9.525	mm	b =	102	mm
h =	609.6	mm	d =	152	mm
A =	11612.88	mm^2	t =	12.7	mm
z Bar =	311.15	mm	A =	3060	mm^2
y Bar =	4.76	mm	z =	25.2	mm
RHM*	2		y =	50.2	mm
RHM Area =	967.7	mm	I_y =	7.2	$x10^6 mm^4$
			I_z =	2.64	$x10^6 mm^4$
			A_{angle} =	12240	mm^2
			RHM*	2	
			RHM Area =	2580.6	mm



RHM* = Rivet Holes/Member

AECOM Imagine it. Delivered.	JOB TITLE	BCLB DECK PRE-DESIGN	
	JOB NO.	60637587	CALCULATION NO.
	ORIGINATOR BY	KG	DATE 30-Nov-20
	CHECKED BY	RA	DATE 16-Dec-20

Section Calculations

	Angle	Web	
Designation	6x4x1/2	24x3/8	
Qty=	4	2	
I_y =	28.8	359.6	$x10^6mm^4$
I_z =	10.56	0.1	$x10^6mm^4$
A =	12240.0	11612.9	mm^2
dy =	394.3	449	mm^2
dz =	286	0.0	mm
Iyy =	1029.6	359.6	$x10^6mm^4$
Izz =	1913.5	2344.0	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	23853	mm^2
A_{RHM*}=	3548	mm2
A_{net} =	20305	mm^2
∑Iyy =	1389.3	$x10^6mm^4$
∑Izz =	4257.5	$x10^6mm^4$
ybar=	454	mm
zbar=	311	mm

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Geometry Comformance Checks

Slenderness Ratio *[CSA S6-19 cl. 10.9.1.3]*

Member Classification = Primary Compression Member

Ly =	7950	mm	kyLy/ry =	30.4	< 120 therefore OK
Lz =	7950.2	mm	kzLz/rz =	17.4	< 120 therefore OK

Width to Thickness Ratio *[CSA S6-19 cl. 10.9.2]*

Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2	*[CSA S6-19 cl. 10.9.2.1]*
Outstanging leg of pair of angles: Class 3 Limit =	b/t<= 250/(SQRT(fy) =	16.5	*[CSA S6-19 cl. 10.9.2.1]*

Webs	h =	405.6	w =	9.5	h/w =	42.6	OK
Flange	b =	152.0	t =	12.7	b/t =	12.0	OK

Axial Compression Resistance *[CSA S6-19 cl. 10.9.3.1]*

Φs =	0.9		*[CSA S6-19 cl. 10.5.7]*
A =	20305	mm^2	
n =	1.34		
Ky =	1.00		
Kz =	1.00		
ry =	261.6	mm	
rz =	457.9	mm	
λy =	0.328		
λz =	0.187		
Cry =	4051	kN	
Crz =	4168	kN	
Cr Min =	4051	kN	

Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95	*[CSA S6-19 cl. 10.5.7]*
Tension	Φu =	0.8	*[CSA S6-19 cl. 10.5.7]*

a)	Tr =	$\phi_s A_g F_y$	5212	kN
b)	Tr =	$\phi_u A_n F_u$	6660	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	5661	kN
		Tr Min =	5212	kN

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

TOWER SPAN

Front Hor Strut 3 Tension & Compression Member Drawing Location (1959)

E5, E7, 54 B54

Material Properties: A-7 Steel Reference

F_u =	410	MPa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	MPa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

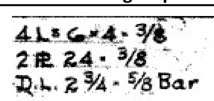
Member	**Angle**	**Web**
Quantity	**4**	**2**
Dimensions (in)	6x4x3/8	24x3/8

Flange Perfortion Width	0	in
Rivet dia.	1	in

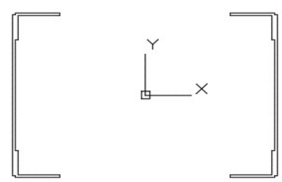
Member Dimensions

Length =	15900	mm
Width =	908	mm
Depth =	622	mm

Drawing Snipet

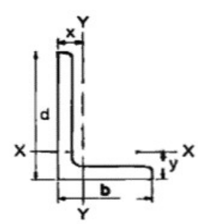


Member Cross-Section



Individual Member Properties

Web			**Angle**		
Designation	24x3/8		Designation	6x4x3/8	
Qty =	2		Qty =	4	
w =	9.525	mm	b =	102	mm
h =	609.6	mm	d =	152	mm
A =	11612.88	mm^2	t =	9.53	mm
z Bar =	311.15	mm	A =	2330	mm^2
y Bar =	4.76	mm	z =	24.1	mm
RHM*	2		y =	49.1	mm
RHM Area =	967.7	mm	I_y =	5.58	$x10^6mm^4$
			I_z =	2.06	$x10^6mm^4$
			A_{angle} =	9320	mm^2
			RHM*	2	
			RHM Area =	1936.5	mm



RHM* = Rivet Holes/Member

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

	Angle	Web	
Designation	6x4x3/8	24x3/8	
Qty=	4	2	
I_y =	22.3	359.6	$x10^6mm^4$
I_z =	8.24	0.1	$x10^6mm^4$
A =	9320.0	11612.9	mm^2
dy =	395.4	449	mm^2
dz =	287	0.0	mm
Iyy =	790.3	359.6	$x10^6mm^4$
Izz =	1465.3	2344.0	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	20933	mm^2
A_{RHM*}=	2904	mm2
A_{net} =	18029	mm^2
∑Iyy =	1149.9	$x10^6mm^4$
∑Izz =	3809.3	$x10^6mm^4$
ybar=	454	mm
zbar=	311	mm

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Geometry Comformance Checks

Slenderness Ratio *[CSA S6-19 cl. 10.9.1.3]*

Member Classification = Primary Compression Member

Ly =	15900	mm	kyLy/ry =	63.0	< 120 therefore OK
Lz =	15900.4	mm	kzLz/rz =	34.6	< 120 therefore OK

Width to Thickness Ratio *[CSA S6-19 cl. 10.9.2]*

Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2	*[CSA S6-19 cl. 10.9.2.1]*
Outstanging leg of pair of angles: Class 3 Limit =	b/t<= 250/(SQRT(fy) =	16.5	*[CSA S6-19 cl. 10.9.2.1]*

Webs	h =	405.6	w =	9.5	h/w =	42.6	OK
Flange	b =	142.5	t =	9.5	b/t =	14.9	OK

Axial Compression Resistance *[CSA S6-19 cl. 10.9.3.1]*

Φs =	0.9		*[CSA S6-19 cl. 10.5.7]*
A =	18029	mm^2	
n =	1.34		
Ky =	1.00		
Kz =	1.00		
ry =	252.5	mm	
rz =	459.7	mm	
λy =	0.680		
λz =	0.373		
Cry =	2975	kN	
Crz =	3545	kN	
Cr Min =	2975	kN	

Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95	*[CSA S6-19 cl. 10.5.7]*
Tension	Φu =	0.8	*[CSA S6-19 cl. 10.5.7]*

a)	Tr =	$\phi_s A_g F_y$	4574	kN
b)	Tr =	$\phi_u A_n F_u$	5913	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	5026	kN
		Tr Min =	4574	kN

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

TOWER SPAN

Front Hor Strut 4 Tension & Compression Member Drawing Location (1959)

E5, E7, 47 C47

Material Properties: A-7 Steel Reference

F_u =	410	MPa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	MPa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

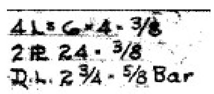
Member	**Angle**	**Web**
Quantity	**4**	**2**
Dimensions (in)	6x4x3/8	24x3/8

Flange Perfortion Width	0	in
Rivet dia.	1	in

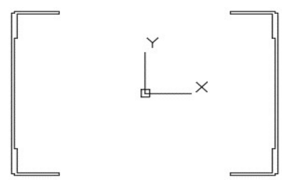
Member Dimensions

Length =	7950	mm
Width =	908	mm
Depth =	622	mm

Drawing Snipet

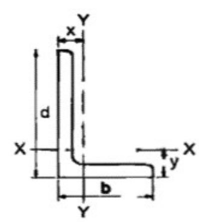


Member Cross-Section



Individual Member Properties

Web			Angle		
Designation	24x3/8		Designation	6x4x3/8	
Qty =	2		Qty =	4	
w =	9.525	mm	b =	102	mm
h =	609.6	mm	d =	152	mm
A =	11612.88	mm^2	t =	9.53	mm
z Bar =	311.15	mm	A =	2330	mm^2
y Bar =	4.76	mm	z =	24.1	mm
RHM*	2		y =	49.1	mm
RHM Area =	967.7	mm	I_y =	5.58	$x10^6mm^4$
			I_z =	2.06	$x10^6mm^4$
			A_{angle} =	9320	mm^2
			RHM*	2	
			RHM Area =	1936.5	mm



RHM* = Rivet Holes/Member

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

	Angle	Web	
Designation	6x4x3/8	24x3/8	
Qty=	4	2	
I_y =	22.3	359.6	$x10^6mm^4$
I_z =	8.24	0.1	$x10^6mm^4$
A =	9320.0	11612.9	mm^2
dy =	395.4	449	mm^2
dz =	287	0.0	mm
Iyy =	790.3	359.6	$x10^6mm^4$
Izz =	1465.3	2344.0	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	20933	mm^2
A_{RHM*}=	2904	mm2
A_{net} =	18029	mm^2
∑Iyy =	1149.9	$x10^6mm^4$
∑Izz =	3809.3	$x10^6mm^4$
ybar=	454	mm
zbar=	311	mm

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Geometry Comformance Checks

Slenderness Ratio *[CSA S6-19 cl. 10.9.1.3]*

Member Classification = Primary Compression Member

Ly =	7950	mm	kyLy/ry =	31.5	< 120 therefore OK
Lz =	7950.2	mm	kzLz/rz =	17.3	< 120 therefore OK

Width to Thickness Ratio *[CSA S6-19 cl. 10.9.2]*

Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2	*[CSA S6-19 cl. 10.9.2.1]*
Outstanging leg of pair of angles: Class 3 Limit =	b/t<= 250/(SQRT(fy) =	16.5	*[CSA S6-19 cl. 10.9.2.1]*

Webs	h =	405.6	w =	9.5	h/w =	42.6	OK
Flange	b =	142.5	t =	9.5	b/t =	14.9	OK

Axial Compression Resistance *[CSA S6-19 cl. 10.9.3.1]*

Φs =	0.9		*[CSA S6-19 cl. 10.5.7]*
A =	18029	mm^2	
n =	1.34		
Ky =	1.00		
Kz =	1.00		
ry =	252.5	mm	
rz =	459.7	mm	
λy =	0.340		
λz =	0.187		
Cry =	3585	kN	
Crz =	3701	kN	
Cr Min =	3585	kN	

Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95	*[CSA S6-19 cl. 10.5.7]*
Tension	Φu =	0.8	*[CSA S6-19 cl. 10.5.7]*

a)	Tr =	$\phi_s A_g F_y$	4574	kN
b)	Tr =	$\phi_u A_n F_u$	5913	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	5026	kN
		Tr Min =	4574	kN

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

TOWER SPAN

Front Diagonals Panel 2,3 Tension & Compression Member

Drawing Location (1959)
E5 & 43 Front Diagonals - Lower Section
(A43 & B43)

Material Properties: A-7 Steel Reference

F_u =	410	MPa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	MPa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

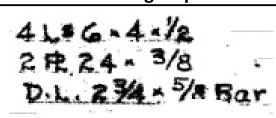
Member	**Angle**	**Web**
Quantity	**4**	**2**
Dimensions (in)	6x4x1/2	24x3/8

Flange Perfortion Width	0	in
Rivet dia.	1	in

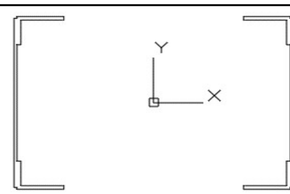
Member Dimensions

Length =	11836	mm
Width =	908	mm
Depth =	622	mm

Drawing Snipet

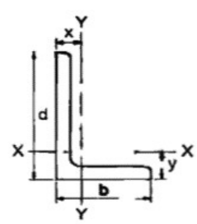


Member Cross-Section



Individual Member Properties

Web			**Angle**		
Designation	24x3/8		Designation	6x4x1/2	
Qty =	2		Qty =	4	
w =	9.525	mm	b =	102	mm
h =	609.6	mm	d =	152	mm
A =	11612.88	mm^2	t =	12.7	mm
z Bar =	311.15	mm	A =	3060	mm^2
y Bar =	4.76	mm	z =	25.2	mm
RHM*	2		y =	50.2	mm
RHM Area =	967.7	mm	I_y =	7.2	$x10^6 mm^4$
			I_z =	2.64	$x10^6 mm^4$
			A_{angle} =	12240	mm^2
			RHM*	2	
			RHM Area =	2580.6	mm



RHM* = Rivet Holes/Member

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
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Section Calculations

	Angle	Web	
Designation	6x4x1/2	24x3/8	
Qty=	4	2	
I_y =	28.8	359.6	$x10^6mm^4$
I_z =	10.56	0.1	$x10^6mm^4$
A =	12240.0	11612.9	mm^2
dy =	394.3	449	mm^2
dz =	286	0.0	mm
Iyy =	1029.6	359.6	$x10^6mm^4$
Izz =	1913.5	2344.0	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	23853	mm^2
A_{RHM*}=	3548	mm2
A_{net} =	20305	mm^2
∑Iyy =	1389.3	$x10^6mm^4$
∑Izz =	4257.5	$x10^6mm^4$
ybar=	454	mm
zbar=	311	mm

AECOM Imagine it. Delivered.	JOB TITLE	BCLB DECK PRE-DESIGN		
	JOB NO.	60637587	CALCULATION NO.	
	ORIGINATOR BY	KG	DATE	30-Nov-20
	CHECKED BY	RA	DATE	16-Dec-20

Geometry Comformance Checks

Slenderness Ratio							***[CSA S6-19 cl. 10.9.1.3]***
Member Classification =		Primary Compression Member					
Ly =	11836.4	mm	kyLy/ry =	45.3	< 120 therefore OK		
Lz =	11836.4	mm	kzLz/rz =	25.8	< 120 therefore OK		

Width to Thickness Ratio				***[CSA S6-19 cl. 10.9.2]***
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2		***[CSA S6-19 cl. 10.9.2.1]***
Outstanging leg of pair of angles: Class 3 Limit =	b/t<= 250/(SQRT(fy) =	16.5		***[CSA S6-19 cl. 10.9.2.1]***

Webs	h =	405.6	w =	9.5	h/w =	42.6	OK
Flange	b =	152.0	t =	12.7	b/t =	12.0	OK

Axial Compression Resistance			***[CSA S6-19 cl. 10.9.3.1]***
Φs =	0.9		***[CSA S6-19 cl. 10.5.7]***
A =	20305	mm^2	
n =	1.34		
Ky =	1.00		
Kz =	1.00		
ry =	261.6	mm	
rz =	457.9	mm	
λy =	0.488		
λz =	0.279		
Cry =	3795	kN	
Crz =	4103	kN	
Cr Min =	3795	kN	

Axial Tensile Resistance			***[CSA S6-19 cl. 10.8.2]***
Tension	Φs =	0.95	***[CSA S6-19 cl. 10.5.7]***
Tension	Φu =	0.8	***[CSA S6-19 cl. 10.5.7]***

a)	Tr =	$\phi_s A_g F_y$	5212	kN
b)	Tr =	$\phi_u A_n F_u$	6660	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	5661	kN
		Tr Min =	5212	kN

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
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TOWER SPAN

Front Diagonals Panel 4,5 Tension & Compression Member

Drawing Location (1959)
E5 & 43 Top Section
Front Diagonals C43 & D43

Material Properties: A-7 Steel Reference

F_u =	410	MPa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	MPa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

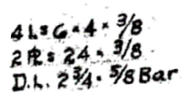
Member	Angle	Web
Quantity	**4**	**2**
Dimensions (in)	6x4x3/8	24x3/8

Flange Perfortion Width	0	in
Rivet dia.	1	in

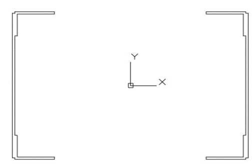
Member Dimensions

Length =	11836	mm
Width =	908	mm
Depth =	622	mm

Drawing Snipet

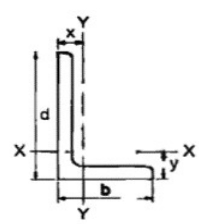


Member Cross-Section



Individual Member Properties

Web			Angle		
Designation	24x3/8		Designation	6x4x3/8	
Qty =	2		Qty =	4	
w =	9.525	mm	b =	102	mm
h =	609.6	mm	d =	152	mm
A =	11612.88	mm^2	t =	9.53	mm
z Bar =	311.15	mm	A =	2330	mm^2
y Bar =	4.7625	mm	z =	24.1	mm
RHM*	2		y =	49.1	mm
RHM Area =	967.7	mm	I_y =	5.58	$x10^6mm^4$
			I_z =	2.06	$x10^6mm^4$
			A_{angle} =	9320	mm^2
			RHM*	2	
			RHM Area =	1936.5	mm



RHM* = Rivet Holes/Member

Section Calculations

	Angle	Web	
Designation	6x4x3/8	24x3/8	
Qty=	4	2	
I_y =	22.3	359.6	$x10^6 mm^4$
I_z =	8.24	0.1	$x10^6 mm^4$
A =	9320.0	11612.9	mm^2
dy =	395.4	449	mm^2
dz =	287	0.0	mm
Iyy =	790.3	359.6	$x10^6 mm^4$
Izz =	1465.3	2344.0	$x10^6 mm^4$

Composite Member Properties		
A_{gross} =	20933	mm^2
A_{RHM*}=	2904	mm2
A_{net} =	18029	mm^2
∑Iyy =	1149.9	$x10^6 mm^4$
∑Izz =	3809.3	$x10^6 mm^4$
ybar=	454	mm
zbar=	311	mm

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
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Geometry Comformance Checks

Slenderness Ratio *[CSA S6-19 cl. 10.9.1.3]*

Member Classification = Primary Compression Member

Ly =	11836.4	mm	kyLy/ry =	46.9	< 120 therefore OK
Lz =	11836.4	mm	kzLz/rz =	25.8	< 120 therefore OK

Width to Thickness Ratio *[CSA S6-19 cl. 10.9.2]*

Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2	*[CSA S6-19 cl. 10.9.2.1]*
Outstanging leg of pair of angles: Class 3 Limit =	b/t<= 250/(SQRT(fy) =	16.5	*[CSA S6-19 cl. 10.9.2.1]*

Webs	h =	405.6	w =	9.5	h/w =	42.6	OK
Flange	b =	142.5	t =	9.5	b/t =	14.9	OK

Axial Compression Resistance *[CSA S6-19 cl. 10.9.3.1]*

Φs =	0.9		*[CSA S6-19 cl. 10.5.7]*
A =	18029	mm^2	
n =	1.34		
Ky =	1.00		
Kz =	1.00		
ry =	252.5	mm	
rz =	459.7	mm	
λy =	0.506		
λz =	0.278		
Cry =	3338	kN	
Crz =	3644	kN	
Cr Min =	3338	kN	

Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95	*[CSA S6-19 cl. 10.5.7]*
Tension	Φu =	0.8	*[CSA S6-19 cl. 10.5.7]*

a)	Tr =	$\phi_s A_g F_y$	4574	kN
b)	Tr =	$\phi_u A_n F_u$	5913	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	5026	kN
		Tr Min =	4574	kN

JOB TITLE	BCLB DECK PRE-DESIGN			
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TOWER SPAN

FrontBottom VerticalStrut(C94) — Tension & Compression Member — Drawing Location (1959)

E5, E7 & 45 Top Section
Vertical Struts
C94

Material Properties: A-7 Steel — Reference

F_u =	410	MPa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	MPa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

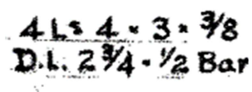
Member	**Angle**
Quantity	**4**
Dimensions (in)	4x3x3/8

Flange Perfortion Width	0	in
Rivet dia.	1	in

Member Dimensions

Length =	8769	mm
Width =	216	mm
Depth =	905	mm

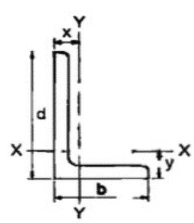
Drawing Snipet



Member Cross-Section

Individual Member Properties

Angle		
Designation	4x3x3/8	
Qty =	4	
b =	76.2	mm
d =	102	mm
t =	9.53	mm
A =	1600	mm^2
z =	19.8	mm
y =	32.7	mm
I_y =	0.8	$x10^6 mm^4$
I_z =	1.67	$x10^6 mm^4$
A_{angle} =	6400	mm^2
RHM*	2	
RHM Area =	1936.5	mm



RHM* = Rivet Holes/Member

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
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Section Calculations

	Angle	
Designation	4x3x3/8	
Qty=	4	
I_y =	3.2	$x10^6mm^4$
I_z =	6.68	$x10^6mm^4$
A =	6400.0	mm^2
dy =	39.1	mm
dz =	433	mm
Iyy =	1201.1	$x10^6mm^4$
Izz =	16.4	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	6400	mm^2
A_{RHM*}=	1936	mm2
A_{net} =	4464	mm^2
∑Iyy =	1201.1	$x10^6mm^4$
∑Izz =	16.4	$x10^6mm^4$
ybar=	108	mm
zbar=	452	mm

Geometry Comformance Checks

Slenderness Ratio *[CSA S6-19 cl. 10.9.1.3]*

Member Classification = Secondary Bracing Compression Member

Ly =	8769.35	mm	kyLy/ry =	16.9	< 160 therefore OK
Lz =	8769.35	mm	kzLz/rz =	144.5	< 160 therefore OK

Width to Thickness Ratio *[CSA S6-19 cl. 10.9.2]*

Outstanging leg of pair of angles: Class 3 Limit =	b/t<= 200/(SQRT(fy) =	13.2	*[CSA S6-19 cl. 10.9.2.1]*
Legs of angle supported; Class 3 Limit =	h/w<= 250/(SQRT(fy) =	16.5	*[CSA S6-19 cl. 10.9.2.1]*

Angle Web	h =	67	w =	9.5	h/w =	7.0	OK
Angle Flange	b =	92.5	t =	9.5	b/t =	9.7	OK

Axial Compression Resistance *[CSA S6-19 cl. 10.9.3.1]*

Φs =	0.9		*[CSA S6-19 cl. 10.5.7]*
A =	4464	mm^2	
n =	1.34		
Ky =	1.00		
Kz =	1.00		
ry =	518.7	mm	
rz =	60.7	mm	
λy =	0.182		
λz =	1.560		
Cry =	917	kN	
Crz =	312	kN	
Cr Min =	312	kN	

Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95	*[CSA S6-19 cl. 10.5.7]*
Tension	Φu =	0.8	*[CSA S6-19 cl. 10.5.7]*

a)	Tr =	$\phi_s A_g F_y$	1398	kN
b)	Tr =	$\phi_u A_n F_u$	1464	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	1244	kN
		Tr Min =	1244	kN

AECOM Imagine it. Delivered.	JOB TITLE	BCLB DECK PRE-DESIGN	
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TOWER SPAN

Front Top Vertical Struts (E45)

Tension & Compression Member

Drawing Location (1959)

E5, E7 & 45 Top Section Vertical Struts E45

Material Properties: A-7 Steel

			Reference
F_u =	410	MPa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	MPa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

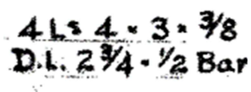
Member	**Angle**
Quantity	**4**
Dimensions (in)	4x3x3/8

Flange Perfortion Width	0	in
Rivet dia.	1	in

Member Dimensions

Length =	8769	mm
Width =	216	mm
Depth =	905	mm

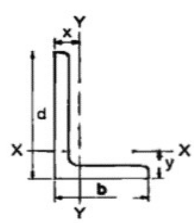
Drawing Snipet



Member Cross-Section

Individual Member Properties

Angle		
Designation	4x3x3/8	
Qty =	4	
b =	76.2	mm
d =	102	mm
t =	9.53	mm
A =	1600	mm^2
z =	19.8	mm
y =	32.7	mm
I_y =	0.8	$x10^6mm^4$
I_z =	1.67	$x10^6mm^4$
A_{angle} =	6400	mm^2
RHM*	2	
RHM Area =	1936.5	mm



RHM* = Rivet Holes/Member

Section Calculations

	Angle	
Designation	4x3x3/8	
Qty=	4	
I_y =	3.2	$x10^6mm^4$
I_z =	6.68	$x10^6mm^4$
A =	6400	mm^2
dy =	39.1	mm
dz =	433	mm
Iyy =	1201.1	$x10^6mm^4$
Izz =	16.4	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	6400	mm^2
A_{RHM*}=	1936	mm2
A_{net} =	4464	mm^2
∑Iyy =	1201.1	$x10^6mm^4$
∑Izz =	16.4	$x10^6mm^4$
ybar=	108	mm
zbar=	452	mm

JOB TITLE	BCLB DECK PRE-DESIGN		
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Geometry Comformance Checks

Slenderness Ratio *[CSA S6-19 cl. 10.9.1.3]*

Member Classification = Secondary Bracing Compression Member

Ly =	8769.35	mm	kyLy/ry =	16.9	< 160 therefore OK
Lz =	8769.35	mm	kzLz/rz =	144.5	< 160 therefore OK

Width to Thickness Ratio *[CSA S6-19 cl. 10.9.2]*

Outstanging leg of pair of angles: Class 3 Limit =	b/t<= 200/(SQRT(fy) =	13.2	*[CSA S6-19 cl. 10.9.2.1]*
Legs of angle supported; Class 3 Limit =	h/w<= 250/(SQRT(fy) =	16.5	*[CSA S6-19 cl. 10.9.2.1]*

Angle Web	h =	67	w =	9.5	h/w =	7.0	OK
Angle Flange	b =	92.5	t =	9.5	b/t =	9.7	OK

Axial Compression Resistance *[CSA S6-19 cl. 10.9.3.1]*

Φs =	0.9		*[CSA S6-19 cl. 10.5.7]*
A =	4464	mm^2	
n =	1.34		
Ky =	1.00		
Kz =	1.00		
ry =	518.7	mm	
rz =	60.7	mm	
λy =	0.182		
λz =	1.560		
Cry =	917	kN	
Crz =	312	kN	
Cr Min =	312	kN	

Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95	*[CSA S6-19 cl. 10.5.7]*
Tension	Φu =	0.8	*[CSA S6-19 cl. 10.5.7]*

a)	Tr =	$\phi_s A_g F_y$	1398	kN
b)	Tr =	$\phi_u A_n F_u$	1464	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	1244	kN
		Tr Min =	1244	kN

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

TOWER SPAN

Rear Face Horizontal 1 — Tension & Compression Member — Drawing Location (1959): Portal Strut

Material Properties: A-7 Steel — Reference — ***E7, 57*** A57

F_u =	410	MPa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	MPa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

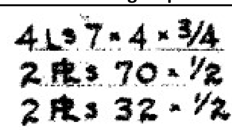
Member	Angles	Exterior Web	Top Plate	Bottom Plate
Quantity	**4**	**2**	**1**	**1**
Dimensions (in)	7x4x3/4	70x1/2	32x1/2	32x1/2

Ext. Web Perfortion Width	14	in
Rivet dia.	1	in

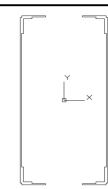
Member Dimensions

Length =	15900	mm
Width =	848	mm
Depth =	1816	mm

Drawing Snipet



Member Cross-Section



Individual Member Properties

	Top Angles	Bottom Angles	
Designation	7x4x3/4	7x4x3/4	
Qty =	2	2	
b =	102	102	mm
d =	178	178	mm
t =	19.0	19.0	mm^2
A =	4960	4960	mm
z =	63.7	63.7	mm
y =	25.7	25.7	mm
Z bar	76	76	mm
I_y =	15.8	15.8	$x10^6 mm^4$
I_z =	3.8	3.8	$x10^6 mm^4$
A_{angle} =	9920	9920	mm^2
RHM*	3	3	mm
RHM Area =	2896	2896	mm^2

	Top Plate	Bottom Plate	
Designation	32x1/2	32x1/2	
Qty =	1	1	
t =	12.7	12.7	mm
b =	812.8	812.8	mm
b_{eff}=	457.2	457.2	mm
z Bar =	1809.75	6.35	mm
A =	10322.56	10322.56	mm^2
A_{eff}=	5806.44	5806.44	mm^2
RHM*	2	2	
RHM Area =	645.2	645.2	mm^2

	Web	
Designation =	70x1/2	
Qty =	2	
w =	12.7	mm
h =	1778	mm
A =	45161.2	mm^2
z Bar =	908	mm
RHM*	4	
RHM Area =	2580.6	mm^2

RHM* = Rivet Holes/Member

JOB TITLE	BCLB DECK PRE-DESIGN		
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Section Calculations

	Top Angles	Bottom Angles	Web	Top Plate	Bot Plate	
Designation	7x4x3/4	7x4x3/4	70x1/2	32x1/2	32x1/2	
Qty=	2	2	2	1	1	
Iy =	31.6	31.6	11897.3	0.1	0.1	$x10^6mm^4$
Iz =	7.6	7.6	0.6	25.3	25.3	$x10^6mm^4$
A =	9920	9920	45161.2	5806.4	5806.4	mm^2
dz =	831.7	831.7	0.0	901.7	901.7	mm^2
dy =	385	385	417.5	292.1	292.1	mm
Iyy =	6892.7	6892.7	11897.3	4721.1	4721.1	$x10^6mm^4$
Izz =	1481.5	1481.5	7873.0	520.7	520.7	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	76614	mm^2
A_{RHM*}=	9662	mm2
A_{net} =	66952	mm^2
∑Iyy =	35124.9	$x10^6mm^4$
∑Izz =	11877.4	$x10^6mm^4$
ybar=	424	mm
Zbar=	908	mm

Geometry Comformance Checks

Slenderness Ratio *[CSA S6-19 cl. 10.9.1.3]*

Member Classification = Primary Compression Member

Ly =	15900.4	mm	kyLy/ry =	22.0	< 120 therefore OK
Lz =	15900.4	mm	kzLz/rz =	37.8	< 120 therefore OK

Width to Thickness Ratio *[CSA S6-19 cl. 10.9.2]*

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2	*[CSA S6-19 cl. 10.9.2.1]*
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2	*[CSA S6-19 cl. 10.9.2.1]*
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4	*[CSA S6-19 cl. 10.9.2.1]*

Webs	h =	1422	w =	12.7	h/w =	112.0	NG
Flange	b =	608.8	t =	12.7	b/t =	47.9	NG
Flange Perforated	b =	253.2	t =	12.7	b/t =	19.9	OK

Axial Compression Resistance *[CSA S6-19 cl. 10.9.3.1]*

Φs =	0.9	*[CSA S6-19 cl. 10.5.7]*
A =	66952	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	724.3	mm
rz =	421.2	mm
λy =	0.237	
λz =	0.407	
Cry =	13645	kN
Crz =	12994	kN
Cr Min =	12994	kN

Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95	*[CSA S6-19 cl. 10.5.7]*
Tension	Φu =	0.8	*[CSA S6-19 cl. 10.5.7]*

a)	Tr =	$\phi_s A_g F_y$	16740	kN
b)	Tr =	$\phi_u A_n F_u$	21960	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	18666	kN
		Tr Min =	16740	kN

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JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
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TOWER SPAN

Rear Face Hor Strut 2,4

Drawing Location (1959)
E5 & 47 Mid-Section Struts (AA47,A47R)

Material Properties: A-7 Steel Reference

F_u =	410	MPa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	MPa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***

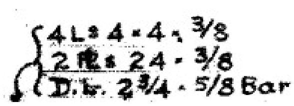
Built up Section Components

Member	**Angle**	**Web**
Quantity	**4**	**2**
Dimensions (in)	4x4x3/8	24x3/8
Flange Perfortion Width	0	in
Rivet dia.	1	in

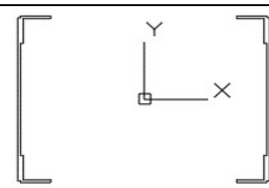
Member Dimensions

Length =	7950	mm
Width =	848	mm
Depth =	622	mm

Drawing Snipet

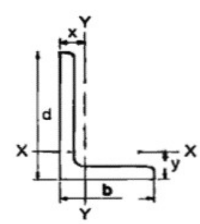


Member Cross-Section



Individual Member Properties

Web			**Angle**		
Designation	24x3/8		Designation	4x4x3/8	
Qty =	2		Qty =	4	
w =	9.525	mm	b =	102	mm
h =	609.6	mm	d =	102	mm
A =	11612.88	mm^2	t =	9.53	mm
z Bar =	311.15	mm	A =	1850	mm^2
y Bar =	4.76	mm	z =	29	mm
RHM*	2		y =	29	mm
RHM Area =	967.7	mm	I_y =	1.84	$x10^6mm^4$
			I_z =	1.84	$x10^6mm^4$
			A_{angle} =	7400	mm^2
			RHM*	2	
			RHM Area =	1936.5	mm



RHM* = Rivet Holes/Member

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
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Section Calculations

	Angle	Web	
Designation	4x4x3/8	24x3/8	
Qty=	4	2	
I_y =	7.4	359.6	$x10^6mm^4$
I_z =	7.36	0.1	$x10^6mm^4$
A =	7400.0	11612.9	mm^2
dy =	385.3	419	mm^2
dz =	282	0.0	mm
Iyy =	596.5	359.6	$x10^6mm^4$
Izz =	1105.9	2039.5	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	19013	mm^2
A_{RHM*}=	2904	mm2
A_{net} =	16109	mm^2
∑Iyy =	956.1	$x10^6mm^4$
∑Izz =	3145.4	$x10^6mm^4$
ybar=	424	mm
zbar=	311	mm

Geometry Comformance Checks

Slenderness Ratio *[CSA S6-19 cl. 10.9.1.3]*

Member Classification = Primary Compression Member

Ly =	7950.2 mm	kyLy/ry =	32.6	< 120 therefore OK	
Lz =	7950.2 mm	kzLz/rz =	18.0	< 120 therefore OK	

Width to Thickness Ratio *[CSA S6-19 cl. 10.9.2]*

Webs in Axial Compression; Class 3 Limit = h/w<= 670/(SQRT(fy) = 44.2 *[CSA S6-19 cl. 10.9.2.1]*

Outstanging leg of pair of angles: Class 3 Limit = b/t<= 250/(SQRT(fy) = 16.5 *[CSA S6-19 cl. 10.9.2.1]*

Webs	h =	405.6	w =	9.5	h/w =	42.6	OK
Flange	b =	102.0	t =	9.5	b/t =	10.7	OK

Axial Compression Resistance *[CSA S6-19 cl. 10.9.3.1]*

Φs =	0.9	*[CSA S6-19 cl. 10.5.7]*
A =	16109	mm^2
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	243.6	mm
rz =	441.9	mm
λy =	0.352	
λz =	0.194	
Cry =	3190	kN
Crz =	3304	kN
Cr Min =	3190	kN

Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95	*[CSA S6-19 cl. 10.5.7]*
Tension	Φu =	0.8	*[CSA S6-19 cl. 10.5.7]*

a)	Tr =	$\phi_s A_g F_y$	4154	kN
b)	Tr =	$\phi_u A_n F_u$	5284	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	4491	kN
		Tr Min =	4154	kN

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JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
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TOWER SPAN

Rear Face Hor Strut 3

Drawing Location (1959)
E5 & 47 Mid-Section Struts (B47)

Material Properties: A-7 Steel Reference

F_u =	410	MPa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	MPa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***

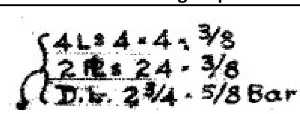
Built up Section Components

Member	**Angle**	**Web**
Quantity	**4**	**2**
Dimensions (in)	4x4x3/8	24x3/8
Flange Perfortion Width	0	in
Rivet dia.	1	in

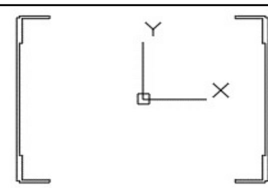
Member Dimensions

Length =	15900	mm
Width =	848	mm
Depth =	622	mm

Drawing Snipet

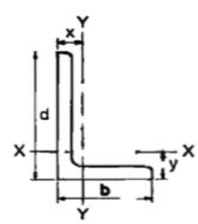


Member Cross-Section



Individual Member Properties

Web			Angle		
Designation	24x3/8		Designation	4x4x3/8	
Qty =	2		Qty =	4	
w =	9.525	mm	b =	102	mm
h =	609.6	mm	d =	102	mm
A =	11612.88	mm^2	t =	9.53	mm
z Bar =	311.15	mm	A =	1850	mm^2
y Bar =	4.76	mm	z =	29	mm
RHM*	2		y =	29	mm
RHM Area =	967.7	mm	I_y =	1.84	$x10^6mm^4$
			I_z =	1.84	$x10^6mm^4$
			A_{angle} =	7400	mm^2
			RHM*	2	
			RHM Area =	1936.5	mm



RHM* = Rivet Holes/Member

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JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

	Angle	Web	
Designation	4x4x3/8	24x3/8	
Qty=	4	2	
I_y =	7.4	359.6	$x10^6mm^4$
I_z =	7.36	0.1	$x10^6mm^4$
A =	7400.0	11612.9	mm^2
dy =	385.3	419	mm^2
dz =	282	0.0	mm
Iyy =	596.5	359.6	$x10^6mm^4$
Izz =	1105.9	2039.5	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	19013	mm^2
A_{RHM*}=	2904	mm2
A_{net} =	16109	mm^2
∑Iyy =	956.1	$x10^6mm^4$
∑Izz =	3145.4	$x10^6mm^4$
ybar=	424	mm
zbar=	311	mm

Geometry Comformance Checks

Slenderness Ratio *[CSA S6-19 cl. 10.9.1.3]*

Member Classification = Primary Compression Member

Ly =	15900.4	mm	kyLy/ry =	65.3	< 120 therefore OK
Lz =	15900.4	mm	kzLz/rz =	36.0	< 120 therefore OK

Width to Thickness Ratio *[CSA S6-19 cl. 10.9.2]*

Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2	*[CSA S6-19 cl. 10.9.2.1]*
Outstanging leg of pair of angles: Class 3 Limit =	b/t<= 250/(SQRT(fy) =	16.5	*[CSA S6-19 cl. 10.9.2.1]*

Webs	h =	405.6	w =	9.5	h/w =	42.6	OK
Flange	b =	102.0	t =	9.5	b/t =	10.7	OK

Axial Compression Resistance *[CSA S6-19 cl. 10.9.3.1]*

Φs =	0.9		*[CSA S6-19 cl. 10.5.7]*
A =	16109	mm^2	
n =	1.34		
Ky =	1.00		
Kz =	1.00		
ry =	243.6	mm	
rz =	441.9	mm	
λy =	0.705		
λz =	0.388		
Cry =	2606	kN	
Crz =	3150	kN	
Cr Min =	2606	kN	

Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95	*[CSA S6-19 cl. 10.5.7]*
Tension	Φu =	0.8	*[CSA S6-19 cl. 10.5.7]*

a)	Tr =	$\phi_s A_g F_y$	4154	kN
b)	Tr =	$\phi_u A_n F_u$	5284	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	4491	kN
		Tr Min =	4154	kN

JOB TITLE	BCLB DECK PRE-DESIGN		
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TOWER SPAN

Rear Strut 5 Tension & Compression Member Drawing Location (1959)

Portal Strut

Material Properties: A-7 Steel Reference ***E7, 81*** C81

F_u =	410	MPa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	MPa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***

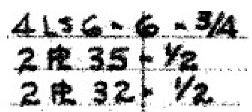
Built up Section Components

Member	**Angles**	**Exterior Web**	**Top Plate**	**Bottom Plate**
Quantity	**4**	**2**	**1**	**1**
Dimensions (in)	6x6x3/4	35x1/2	32x1/2	32x1/2
Ext. Web Perfortion Width		14	in	
Rivet dia.	1		in	

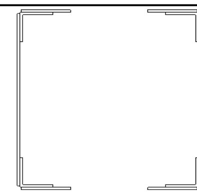
Member Dimensions

Length =	15900	mm
Width =	848	mm
Depth =	927	mm

Drawing Snipet



Member Cross-Section



Individual Member Properties

	Top Angles	Bottom Angles	
Designation	6x6x3/4	6x6x3/4	
Qty =	2	2	
b =	152	152	mm
d =	152	152	mm
t =	19.0	19.0	mm^2
A =	5450	5450	mm
z =	45	45	mm
y =	45	45	mm
Z bar	869	57.7	mm
I_y =	11.6	11.6	x10^{6}mm^4
I_z =	11.6	11.6	x10^{6}mm^4
A_{angle} =	10900	10900	mm^2
RHM*	3	3	mm
RHM Area =	2896	2896	mm^2

	Top Plate	Bottom Plate	
Designation	32x1/2	32x1/2	
Qty =	1	1	
t =	12.7	12.7	mm
b =	812.8	812.8	mm
b_{eff}=	457.2	457.2	mm
z Bar =	920.75	6.35	mm
A =	10322.56	10322.56	mm^2
A_{eff}=	5806.44	5806.44	mm^2
RHM*	2	2	
RHM Area =	645.2	645.2	mm^2

	Web	
Designation =	35x1/2	
Qty =	2	
w =	12.7	mm
h =	889	mm
A =	22580.6	mm^2
z Bar =	464	mm
RHM*	4	
RHM Area =	2580.6	mm^2

RHM* = Rivet Holes/Member

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

	Top Angles	Bottom Angles	Web	Top Plate	Bot Plate	
Designation	6x6x3/4	6x6x3/4	35x1/2	32x1/2	32x1/2	
Qty=	2	2	2	1	1	
Iy =	23.2	23.2	1487.2	0.1	0.1	$x10^6mm^4$
Iz =	23.2	23.2	0.3	25.3	25.3	$x10^6mm^4$
A =	10900	10900	22580.6	5806.4	5806.4	mm^2
dz =	405.9	405.9	0.0	457.2	457.2	mm^2
dy =	366	366	417.5	292.1	292.1	mm
Iyy =	1818.6	1818.6	1487.2	1213.8	1213.8	$x10^6mm^4$
Izz =	1484.6	1484.6	3936.5	520.7	520.7	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	55993	mm^2
A_{RHM*}=	9662	mm2
A_{net} =	46331	mm^2
∑Iyy =	7551.9	$x10^6mm^4$
∑Izz =	7947.1	$x10^6mm^4$
ybar=	424	mm
Zbar=	464	mm

Geometry Comformance Checks

Slenderness Ratio *[CSA S6-19 cl. 10.9.1.3]*

Member Classification = Primary Compression Member

Ly =	15900.4	mm	kyLy/ry =	39.4	< 120 therefore OK
Lz =	15900.4	mm	kzLz/rz =	38.4	< 120 therefore OK

Width to Thickness Ratio *[CSA S6-19 cl. 10.9.2]*

Flanges of Rectangular HSS: Class 3 Limit =	b/t<= 670/(SQRT(fy) =	44.2	*[CSA S6-19 cl. 10.9.2.1]*
Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2	*[CSA S6-19 cl. 10.9.2.1]*
Flange as Perforated Cover Plate Class 3 Limit :	h/w<= 840/SQRT(fy) =	55.4	*[CSA S6-19 cl. 10.9.2.1]*

Webs	h =	585	w =	12.7	h/w =	46.1	NG
Flange	b =	508.8	t =	12.7	b/t =	40.1	OK
Flange Perforated	b =	153.2	t =	12.7	b/t =	12.1	OK

Axial Compression Resistance *[CSA S6-19 cl. 10.9.3.1]*

Φs =	0.9		*[CSA S6-19 cl. 10.5.7]*
A =	46331	mm^2	
n =	1.34		
Ky =	1.00		
Kz =	1.00		
ry =	403.7	mm	
rz =	414.2	mm	
λy =	0.425		
λz =	0.414		
Cry =	8926	kN	
Crz =	8967	kN	
Cr Min =	8926	kN	

Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95	*[CSA S6-19 cl. 10.5.7]*
Tension	Φu =	0.8	*[CSA S6-19 cl. 10.5.7]*

a)	Tr =	$\phi_s A_g F_y$	12235	kN
b)	Tr =	$\phi_u A_n F_u$	15197	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	12917	kN
		Tr Min =	12235	kN

JOB TITLE	BCLB DECK PRE-DESIGN			
JOB NO.	60637587	CALCULATION NO.		
ORIGINATOR BY	KG	DATE	30-Nov-20	
CHECKED BY	RA	DATE	16-Dec-20	

TOWER SPAN

Rear Diagonal All 2,3,4,5 Tension & Compression Member Drawing Location (1959)

E5 & 37 Mid-Section Rear

Material Properties: A-7 Steel Reference Diagonals A37, B37 and C37

F_u =	410	MPa	*[CISC 6-7, 11TH Edition, 2016]*
F_y =	230	MPa	*[CISC 6-7, 11TH Edition, 2016]*
ϕ_s =	0.95		*[CSA S6-19 cl. 10.5.7]*
E =	200000	MPa	*[CSA S6-19 cl. 10.4.2]*

Built up Section Components

Member	Angle	Web
Quantity	**4**	**2**
Dimensions (in)	6x4x3/8	24x3/8

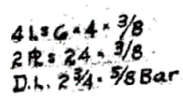
Flange Perfortion Width 0 in

Rivet dia. 1 in

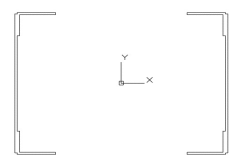
Member Dimensions

Length =	11836	mm
Width =	848	mm
Depth =	622	mm

Drawing Snipet

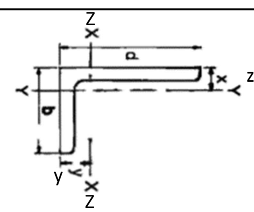


Member Cross-Section



Individual Member Properties

Web			Angle		
Designation	24x3/8		Designation	6x4x3/8	
Qty =	2		Qty =	4	
w =	9.525	mm	b =	102	mm
h =	609.6	mm	d =	152	mm
A =	11612.88	mm^2	t =	9.53	mm
z Bar =	311.15	mm	A =	2330	mm^2
y Bar =	4.76	mm	z =	24.1	mm
RHM*	0		y =	49.1	mm
RHM Area =	0.0	mm	I_y =	5.58	$x10^6 mm^4$
			I_z =	2.06	$x10^6 mm^4$
			A_{angle} =	9320	mm^2
			RHM*	0	
			RHM Area =	0.0	mm



RHM* = Rivet Holes/Member

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

	Angle	Web	
Designation	6x4x3/8	24x3/8	
Qty=	4	2	
I_y =	22.3	359.6	$x10^6mm^4$
I_z =	8.24	0.1	$x10^6mm^4$
A =	9320.0	11612.9	mm^2
dy =	365.2	419.1	mm^2
dz =	287	0.0	mm
Iyy =	790.3	359.6	$x10^6mm^4$
Izz =	1251.5	2039.8	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	20933	mm^2
A_{RHM*}=	0	mm^2
A_{net} =	20933	mm^2
∑Iyy =	1149.9	$x10^6mm^4$
∑Izz =	3291.3	$x10^6mm^4$
ybar=	424	mm
zbar=	311	mm

Geometry Comformance Checks

Slenderness Ratio *[CSA S6-19 cl. 10.9.1.3]*

Member Classification = Primary Compression Member

Ly =	11836 mm	kyLy/ry =	50.5	< 120 therefore OK	
Lz =	11836.4 mm	kzLz/rz =	29.9	< 120 therefore OK	

Width to Thickness Ratio *[CSA S6-19 cl. 10.9.2]*

Webs in Axial Compression; Class 3 Limit =	h/w<= 670/(SQRT(fy) =	44.2	*[CSA S6-19 cl. 10.9.2.1]*
Outstanging leg of pair of angles: Class 3 Limit =	b/t<= 250/(SQRT(fy) =	16.5	*[CSA S6-19 cl. 10.9.2.1]*

Webs	h =	405.6	w =	9.5	h/w =	42.6	OK
Flange	b =	152.0	t =	9.5	b/t =	15.9	OK

Axial Compression Resistance *[CSA S6-19 cl. 10.9.3.1]*

Φs =	0.9	*[CSA S6-19 cl. 10.5.7]*
A =	20933 mm^2	
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	234.4 mm	
rz =	396.5 mm	
λy =	0.545	
λz =	0.322	
Cry =	3790 kN	
Crz =	4184 kN	
Cr Min =	3790 kN	

Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs = 0.95	*[CSA S6-19 cl. 10.5.7]*
Tension	Φu = 0.8	*[CSA S6-19 cl. 10.5.7]*

a)	Tr =	$\phi_s A_g F_y$	4574 kN
b)	Tr =	$\phi_u A_n F_u$	6866 kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	5836 kN
		Tr Min =	4574 kN

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
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TOWER SPAN

Rear Bottom Vertical Strut(B61) Tension & Compression Member

Drawing Location (1959)
Bottom Section
Vertical Struts

Material Properties: A-7 Steel Reference

F_u =	410	MPa	***[CISC 6-7, 11TH Edition, 2016]***	***E5 & 61***	B61
F_y =	230	MPa	***[CISC 6-7, 11TH Edition, 2016]***		
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***		
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***		

Built up Section Components

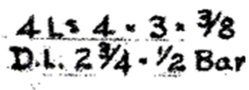
Member	**Angle**	**Web**
Quantity	**4**	**0**
Dimensions (in)	4x3x3/8	0

Flange Perfortion Width	0	in
Rivet dia.	1	in

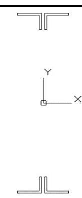
Member Dimensions

Length =	8769	mm
Width =	216	mm
Depth =	845	mm

Drawing Snipet

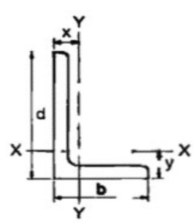


Member Cross-Section



Individual Member Properties

Angle		
Designation	4x3x3/8	
Qty =	4	
b =	76.2	mm
d =	102	mm
t =	9.53	mm
A =	1600	mm^2
z =	19.8	mm
y =	32.7	mm
I_y =	0.8	$x10^6mm^4$
I_z =	1.67	$x10^6mm^4$
A_{angle} =	6400	mm^2
RHM*	2	
RHM Area =	1936.5	mm



RHM* = Rivet Holes/Member

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

	Angle	
Designation	4x3x3/8	
Qty=	4	
I_y =	3.2	$x10^6mm^4$
I_z =	6.68	$x10^6mm^4$
A =	6400.0	mm^2
dy =	39.1	mm
dz =	402	mm
Iyy =	1039.9	$x10^6mm^4$
Izz =	16.4	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	6400	mm^2
A_{RHM*}=	1936	mm2
A_{net} =	4464	mm^2
∑Iyy =	1039.9	$x10^6mm^4$
∑Izz =	16.4	$x10^6mm^4$
ybar=	108	mm
zbar=	422	mm

Geometry Comformance Checks

Slenderness Ratio *[CSA S6-19 cl. 10.9.1.3]*

Member Classification = Secondary Bracing Compression Member

Ly =	8769.35 mm	kyLy/ry =	18.2	< 160 therefore OK	
Lz =	8769.35 mm	kzLz/rz =	144.5	< 160 therefore OK	

Width to Thickness Ratio *[CSA S6-19 cl. 10.9.2]*

Outstanging leg of pair of angles: Class 3 Limit =	b/t<= 200/(SQRT(fy) =	13.2	*[CSA S6-19 cl. 10.9.2.1]*
Legs of angle supported; Class 3 Limit =	h/w<= 250/(SQRT(fy) =	16.5	*[CSA S6-19 cl. 10.9.2.1]*

Angle Web	h =	67	w =	9.5	h/w =	7.0	OK
Angle Flange	b =	92.5	t =	9.5	b/t =	9.7	OK

10.9.3 Axial Compression Resistance *[CSA S6-19 cl. 10.9.3.1]*

Φs =	0.9	*[CSA S6-19 cl. 10.5.7]*
A =	4464 mm^2	
n =	1.34	
Ky =	1.00	
Kz =	1.00	
ry =	482.7 mm	
rz =	60.7 mm	
λy =	0.196	
λz =	1.560	
Cry =	915 kN	
Crz =	312 kN	
Cr Min =	312 kN	

Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95	*[CSA S6-19 cl. 10.5.7]*
Tension	Φu =	0.8	*[CSA S6-19 cl. 10.5.7]*

a)	Tr =	$\phi_s A_g F_y$	1398 kN
b)	Tr =	$\phi_u A_n F_u$	1464 kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	1244 kN
		Tr Min =	1244 kN

TOWER SPAN

Rear Top Vertical Struts (D45) Tension & Compression Member

Drawing Location (1959)
E5, E7 & 45 Top Section
Vertical Struts
D45

Material Properties: A-7 Steel

			Reference
F_u =	410	MPa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	MPa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***

Built up Section Components

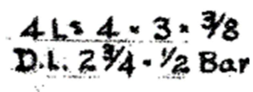
Member	**Angle**
Quantity	**4**
Dimensions (in)	4x3x3/8

Flange Perfortion Width	0	in
Rivet dia.	1	in

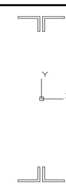
Member Dimensions

Length =	8769	mm
Width =	216	mm
Depth =	845	mm

Drawing Snipet

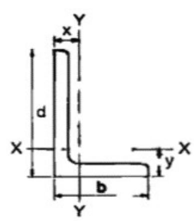


Member Cross-Section



Individual Member Properties

Angle		
Designation	4x3x3/8	
Qty =	4	
b =	76.2	mm
d =	102	mm
t =	9.53	mm
A =	1600	mm^2
z =	19.8	mm
y =	32.7	mm
I_y =	0.8	$x10^6mm^4$
I_z =	1.67	$x10^6mm^4$
A_{angle} =	6400	mm^2
RHM*	2	
RHM Area =	1936.5	mm



RHM* = Rivet Holes/Member

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JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Calculations

	Angle	
Designation	4x3x3/8	
Qty=	4	
I_y =	3.2	$x10^6mm^4$
I_z =	6.68	$x10^6mm^4$
A =	6400.0	mm^2
dy =	39.1	mm
dz =	402	mm
Iyy =	1039.9	$x10^6mm^4$
Izz =	16.4	$x10^6mm^4$

Composite Member Properties		
A_{gross} =	6400	mm^2
A_{RHM*}=	1936	mm^2
A_{net} =	4464	mm^2
∑Iyy =	1039.9	$x10^6mm^4$
∑Izz =	16.4	$x10^6mm^4$
zbar=	422	mm
ybar=	108	mm

Geometry Comformance Checks

Slenderness Ratio *[CSA S6-19 cl. 10.9.1.3]*

Member Classification = Secondary Bracing Compression Member

Ly =	8769.350 mm	kyLy/ry =	18.2	< 160 therefore OK	
Lz =	8769.350 mm	kzLz/rz =	144.5	< 160 therefore OK	

Width to Thickness Ratio *[CSA S6-19 cl. 10.9.2]*

Outstanging leg of pair of angles: Class 3 Limit =	b/t<= 200/(SQRT(fy) =	13.2	*[CSA S6-19 cl. 10.9.2.1]*
Legs of angle supported; Class 3 Limit =	h/w<= 250/(SQRT(fy) =	16.5	*[CSA S6-19 cl. 10.9.2.1]*

Angle Web	h =	67	w =	9.5	h/w =	7.0	OK
Angle Flange	b =	92.5	t =	9.5	b/t =	9.7	OK

Axial Compression Resistance *[CSA S6-19 cl. 10.9.3.1]*

Φs =	0.9		*[CSA S6-19 cl. 10.5.7]*
A =	4464	mm^2	
n =	1.34		
Ky =	1.00		
Kz =	1.00		
ry =	482.7	mm	
rz =	60.7	mm	
λy =	0.196		
λz =	1.560		
Cry =	915	kN	
Crz =	312	kN	
Cr Min =	312	kN	

Axial Tensile Resistance *[CSA S6-19 cl. 10.8.2]*

Tension	Φs =	0.95	*[CSA S6-19 cl. 10.5.7]*
Tension	Φu =	0.8	*[CSA S6-19 cl. 10.5.7]*

a)	Tr =	$\phi_s A_g F_y$	1398	kN
b)	Tr =	$\phi_u A_n F_u$	1464	kN
c)	Tr =	$0.85\phi_u A_{ne} F_u$	1244	kN
		Tr Min =	1244	kN

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Properties

TOWER SPAN

Girder G1 (A30|B30)

Material Properties: A-7 Steel — Reference — Drawing Location (1959)

F_u =	410	MPa	*[CISC 6-7, 11TH Edition, 2016]*	E5, E9 & 30 Top Section
F_y =	230	MPa	*[CISC 6-7, 11TH Edition, 2016]*	
ϕ_s =	0.95		*[CSA S6-19 cl. 10.5.7]*	
E =	200000	MPa	*[CSA S6-19 cl. 10.4.2]*	

Components	Web	Top L's	Bottom L's
Specified Size	**84 1/2x3/4**	L203x152x19	L203x152x19
No.	1	2	2
Height (mm)	2146	19	19.0
Width (mm)	19	152	152
I_x (mm^4)	15695856181	26200000	26200000
I_y (mm^4)	1236500	12700000	12700000
A_g (mm^2)	40887	12820	12820
y top or bot (mm)	1073.15	65.1	2081
x (mm)	161.525	112.4	112.4
Trans. I_x (mm^4)	15695856181	1.308E+10	13079632768
Trans. I_y (mm^4)	1236499.997	56338065.3	56338065.31

y top & bottom	1073.15	mm	
x	161.525	mm	
Total A_g	66527	mm^2	
Total I_x (mm^4)	41855121717	mm^4	*[Holes not removed when calculating I_x]*
Trans I_y (mm^4)	113912631	mm^4	*[Holes not removed when calculating I_y]*
r_x	793	mm	
r_y	41	mm	
Y_c	718	mm	
X_c	140	mm	
Z_x	47785352	mm^3	
Z_y	4645743	mm^3	
S_x	39002117	mm^3	
S_y	705232	mm^3	
J	8018000	mm^4	
d1	2146	mm	
c_w	1.20784E+14	mm^6	*[Angle leg in web not included in calculation - I-beam]*

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JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

ULS Girder Resistance

Class of Section

Width-to-Thickness Ratio Limits in Comp. ***[CSA S6-19 cl. 10.9.2]***

Flange - Angle leg			***[CSA S6-19 cl. 10.9.2.1]***
Flange Class 1	9.56	$b/t \le 145/\sqrt{(F_y)}$	
Flange Class 2	11.21	$b/t \le 170/\sqrt{(F_y)}$	
Flange Class 3	13.19	$b/t \le 200/\sqrt{(F_y)}$	
Web			***[CSA S6-19 cl. 10.9.2.1]***
Web Class 1	72.53	$h/w \le 1100/\sqrt{(F_y)}$	
Web Class 2	112.09	$h/w \le 1700/\sqrt{(F_y)}$	
Web Class 3	125.28	$h/w \le 1900/\sqrt{(F_y)}$	

Width-to-Thickness Ratios of Girder

Flange		
Angle leg flange, b	152	mm
Thickness of flange, t	19	mm
b/t	8	
Web		
Clear depth of web, h	1740	mm
Thickness of web, w	19.05	mm
h/w	91	

Class of Section

Flange Class:	1
Web Class:	2

Moment Resistance *[CSA S6-19 cl.10.10.2.2]*

Member assumed to be half length of floor slab unsupported due to concrete support on back of tower

Plastic/Yeild Moment, M_p/M_y

Elastic Section Modulus, Sx	39002117	mm^3			
Plastic Section Modulus, Zx	47785352	mm^3			
Yield Stress, F_y	230	MPa	Fu =	410	MPa
Yield Moment, M_y	8970	kNm			
Plastic Moment, M_p	10991	kNm			
Class 1/2, Mp	10991	kNm			

Critical Elastic Moment, M_u - Assumed not Governing - To Be Confirmed in Preliminary Design *[CSA S6-19 cl.10.10.2.3]*

Overall Moment Resist., M_r **10441 kNm**

Shear Resistance *[CSA S6-19 cl. 10.10.5.1]*

Spacing of Tranverse Stiffn, a	1461	mm
Web height, h	1740	mm
a/h	0.84	
k_v	11.58	
h/w	91	
502√kv/Fy	112.65	
621√kv/Fy	139.35	
F_{cr}	**132.71**	**MPa**
F_t	**0.00**	**MPa**
F_s	**132.71**	**MPa**
Area of Web, A_w	33152.72	mm^2

Shear Resistance, V_r **4180 kN**

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Properties

TOWER SPAN

Girder G2|3 (A36|B36|C36|D36)

Material Properties: A-7 Steel

			Reference	Drawing Location (1959)
F_u =	410	MPa	***[CISC 6-7, 11TH Edition, 2016]***	E5, E9 & 36 Top Section
F_y =	230	MPa	***[CISC 6-7, 11TH Edition, 2016]***	
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***	
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***	

Components	**Web**	**Top L's**	**Bottom L's**
Specified Size	**84 1/2x3/4**	L203x203x22	L203x203x22
No.	1	2	2
Height (mm)	2146	22.2	22.2
Width (mm)	19	203	203
I_x (mm^4)	15695856181	33000000	33000000
I_y (mm^4)	1236500	33000000	33000000
A_g (mm^2)	40887	17000	17000
y top or bot (mm)	1073.15	58.9	2087
x (mm)	212.525	144.1	144.1
Trans. I_x (mm^4)	15695856181	1.7554E+10	17553952063
Trans. I_y (mm^4)	1236500	145593671	145593671

y top & bottom	1073.15	mm	
x	212.53	mm	
Total A_g	74887	mm^2	
Total I_x (mm^4)	50803760306	mm^4	***[Holes not removed when calculating I_x]***
Trans I_y (mm^4)	292423841	mm^4	***[Holes not removed when calculating I_y]***
r_x	824	mm	
r_y	62	mm	
Y_c	753	mm	
X_c	179	mm	
Z_x	56423450	mm^3	
Z_y	6697094	mm^3	
S_x	47340782	mm^3	
S_y	1375950	mm^3	
J	10546000	mm^4	
d1	2146	mm	
c_w	3.20488E+14	mm^6	***[Angle leg in web not included in calculation - I-beam]***

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

ULS Girder Resistance

Class of Section

Width-to-Thickness Ratio Limits in Comp. ***[CSA S6-19 cl. 10.9.2]***

Flange - Angle leg			***[CSA S6-19 cl. 10.9.2.1]***
Flange Class 1	9.56	$b/t \le 145/\sqrt{(F_y)}$	
Flange Class 2	11.21	$b/t \le 170/\sqrt{(F_y)}$	
Flange Class 3	13.19	$b/t \le 200/\sqrt{(F_y)}$	
Web			***[CSA S6-19 cl. 10.9.2.1]***
Web Class 1	72.53	$h/w \le 1100/\sqrt{(F_y)}$	
Web Class 2	112.09	$h/w \le 1700/\sqrt{(F_y)}$	
Web Class 3	125.28	$h/w \le 1900/\sqrt{(F_y)}$	

Width-to-Thickness Ratios of Girder

Flange		
Angle leg flange, b	203	mm
Thickness of flange, t	22	mm
b/t	9	
Web		
Clear depth of web, h	1740	mm
Thickness of web, w	19.05	mm
h/w	91	

Class of Section

Flange Class:	1
Web Class:	2

Moment Resistance *[CSA S6-19 cl.10.10.2.2]*

Member assumed to be half length of floor slab unsupported due to concrete support on back of tower

Plastic/Yeild Moment, M_p/M_y

Elastic Section Modulus, Sx	47340782	mm^3			
Plastic Section Modulus, Zx	56423450	mm^3			
Yield Stress, F_y	230	MPa	Fu =	410	MPa
Yield Moment, M_y	10888	kNm			
Plastic Moment, M_p	12977	kNm			
Class 1/2, Mp	12977	kNm			

Critical Elastic Moment, M_u - Assumed not Governing - To Be Confirmed in Preliminary Design *[CSA S6-19 cl.10.10.2.3]*

Overall Moment Resist., M_r **12329** **kNm**

Shear Resistance *[CSA S6-19 cl. 10.10.5.1]*

Spacing of Tranverse Stiffn, a	1532	mm
Web height, h	1740	mm
a/h	0.88	
k_v	10.89	
h/w	91	
502√kv/Fy	109.25	
621√kv/Fy	135.15	
F_{cr}	**132.71**	**MPa**
F_t	**0.00**	**MPa**
F_s	**132.71**	**MPa**
Area of Web, A_w	33152.72	mm^2

Shear Resistance, V_r **4180** **kN**

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Properties

TOWER SPAN

Girder G4 (A41|B41)

Material Properties: A-7 Steel			Reference	Drawing Location (1959)
F_u =	410	MPa	***[CISC 6-7, 11TH Edition, 2016]***	E5, E9 & 41 Top Section
F_y =	230	MPa	***[CISC 6-7, 11TH Edition, 2016]***	
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***	
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***	

Components	**Web**	**Top L's**	**Bottom L's**
Specified Size	**84 1/2x3/4**	L203x152x19	L203x152x19
No.	1	2	2
Height (mm)	2146	19	19.0
Width (mm)	19	152	152
I_x (mm^4)	15695856181	26200000	26200000
I_y (mm^4)	1236500	12700000	12700000
A_g (mm^2)	40887	12820	12820
y top or bot (mm)	1073.15	65.1	2081
x (mm)	161.525	112.4	112.4
Trans. I_x (mm^4)	15695856181	1.308E+10	13079632768
Trans. I_y (mm^4)	1236499.997	56338065.3	56338065.31

y top & bottom	1073.15	mm	
x	161.53	mm	
Total A_g	66527	mm^2	
Total I_x (mm^4)	41855121717	mm^4	***[Holes not removed when calculating I_x]***
Trans I_y (mm^4)	113912631	mm^4	***[Holes not removed when calculating I_y]***
r_x	793	mm	
r_y	41	mm	
Y_c	718	mm	
X_c	140	mm	
Z_x	47785352	mm^3	
Z_y	4645743	mm^3	
S_x	39002117	mm^3	
S_y	705232	mm^3	
J	8018000	mm^4	
d1	2146	mm	
c_w	1.20784E+14	mm^6	***[Angle leg in web not included in calculation - I-beam]***

ULS Girder Resistance

Class of Section

Width-to-Thickness Ratio Limits in Comp. ***[CSA S6-19 cl. 10.9.2]***

Flange - Angle leg			***[CSA S6-19 cl. 10.9.2.1]***
Flange Class 1	9.56	$b/t \leq 145/\sqrt{(F_y)}$	
Flange Class 2	11.21	$b/t \leq 170/\sqrt{(F_y)}$	
Flange Class 3	13.19	$b/t \leq 200/\sqrt{(F_y)}$	
Web			***[CSA S6-19 cl. 10.9.2.1]***
Web Class 1	72.53	$h/w \leq 1100/\sqrt{(F_y)}$	
Web Class 2	112.09	$h/w \leq 1700/\sqrt{(F_y)}$	
Web Class 3	125.28	$h/w \leq 1900/\sqrt{(F_y)}$	

Width-to-Thickness Ratios of Girder

Flange		
Angle leg flange, b	152	mm
Thickness of flange, t	19	mm
b/t	8	
Web		
Clear depth of web, h	1740	mm
Thickness of web, w	19.05	mm
h/w	91	

Class of Section

Flange Class:	1
Web Class:	2

Moment Resistance *[CSA S6-19 cl.10.10.2.2]*

Member assumed to be half length of floor slab unsupported due to concrete support on back of tower

Plastic/Yeild Moment, M_p/M_y

Elastic Section Modulus, Sx	39002117	mm^3			
Plastic Section Modulus, Zx	47785352	mm^3			
Yield Stress, F_y	230	MPa	Fu =	410	MPa
Yield Moment, M_y	8970	kNm			
Plastic Moment, M_p	10991	kNm			
Class 1/2, Mp	10991	kNm			

Critical Elastic Moment, M_u - Assumed not Governing - To Be Confirmed in Preliminary Design *[CSA S6-19 cl.10.10.2.3]*

Overall Moment Resist., M_r **10441 kNm**

Shear Resistance *[CSA S6-19 cl. 10.10.5.1]*

Spacing of Tranverse Stiffn, a	1549	mm
Web height, h	1740	mm
a/h	0.89	
k_v	10.74	
h/w	91	
502√kv/Fy	108.46	
621√kv/Fy	134.17	
F_{cr}	**132.71**	**MPa**
F_t	**0.00**	**MPa**
F_s	**132.71**	**MPa**
Area of Web, A_w	33152.715	mm^2

Shear Resistance, V_r **4180 kN**

Section Properties

TOWER SPAN

Girder G6|FG6 (A64|A65|B64|B65)

Material Properties: A-7 Steel			Reference	Drawing Location (1959)
F_u =	410	MPa	***[CISC 6-7, 11TH Edition, 2016]***	E5, E9, 64 & 65 Top Section
F_y =	230	MPa	***[CISC 6-7, 11TH Edition, 2016]***	
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***	
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***	

Components	**Web**	**Top L's**	**Bottom L's**
Specified Size	83 1/2x1/2	L152x152x13	L152x152x13
No.	1	2	2
Height (mm)	2121	12.7	12.7
Width (mm)	13	152	152
I_x (mm^4)	10096783668	8220000	8220000
I_y (mm^4)	362035	8220000	8220000
A_g (mm^2)	26935	7420	7420
y top or bot (mm)	1060.45	42.7	2078
x (mm)	158.35	109.3	109.3
Trans. I_x (mm^4)	10096783668	7702187764	7702187764
Trans. I_y (mm^4)	362035	34291796.6	34291797

y top & bottom	1060.45	mm	
x	158.35	mm	
Total A_g	41775	mm^2	
Total I_x (mm^4)	25501159195	mm^4	***[Holes not removed when calculating I_x]***
Trans I_y (mm^4)	68945628	mm^4	***[Holes not removed when calculating I_y]***
r_x	781	mm	
r_y	41	mm	
Y_c	703	mm	
X_c	139	mm	
Z_x	29385248	mm^3	
Z_y	2900859	mm^3	
S_x	24047489	mm^3	
S_y	435400	mm^3	
J	2244139	mm^4	
d1	2121	mm	
c_w	7.47068E+13	mm^6	***[Angle leg in web not included in calculation - I-beam]***

ULS Girder Resistance

Class of Section

Width-to-Thickness Ratio Limits in Comp. ***[CSA S6-19 cl. 10.9.2]***

Flange - Angle leg			***[CSA S6-19 cl. 10.9.2.1]***
Flange Class 1	9.56	$b/t \le 145/\sqrt{(F_y)}$	
Flange Class 2	11.21	$b/t \le 170/\sqrt{(F_y)}$	
Flange Class 3	13.19	$b/t \le 200/\sqrt{(F_y)}$	
Web			***[CSA S6-19 cl. 10.9.2.1]***
Web Class 1	72.53	$h/w \le 1100/\sqrt{(F_y)}$	
Web Class 2	112.09	$h/w \le 1700/\sqrt{(F_y)}$	
Web Class 3	125.28	$h/w \le 1900/\sqrt{(F_y)}$	

Width-to-Thickness Ratios of Girder

Flange		
Angle leg flange, b	152	mm
Thickness of flange, t	13	mm
b/t	12	
Web		
Clear depth of web, h	1817	mm
Thickness of web, w	12.70	mm
h/w	143	

Class of Section

Flange Class:	3
Web Class:	4

Moment Resistance *[CSA S6-19 cl.10.10.3.2]*

Class 4 Web *[CSA S6-19 cl.10.10.4.4]*

h/w	143	≤150	OK	
2dc/w	141.0629921	>	1900/√(F_y)	***Moment resistance needs to be reduced***

Plastic/Yeild Moment, M_p/M_y

Elastic Section Modulus, Sx	24047489	mm^3			
Plastic Section Modulus, Zx	29385248	mm^3			
Yield Stress, F_y	230	MPa	Fu =	410	MPa
Yield Moment, M_y	5531	kNm			
Plastic Moment, M_p	6759	kNm			
Class 3/4, My	5531	kNm			

Critical Elastic Moment, M_u - Assumed not Governing - To Be Confirmed in Preliminary Design *[CSA S6-19 cl.10.10.2.3]*

Overall Moment Resist., M_r	**5254**	**kNm**		
Reduced Mr	**5254**	**kNm**	*Girder with no longitudinal stiffeners*	*[CSA S6-19 cl.10.10.4.4]*

Shear Resistance *[CSA S6-19 cl. 10.10.5.1]*

Spacing of Tranverse Stiffn, a	1803	mm
Web height, h	1715	mm
a/h	1.05	
k_v	8.96	
h/w	143	
502√kv/Fy	99.07	
621√kv/Fy	122.55	
F_{cr}	**78.77**	**MPa**
F_t	**32.24**	**MPa**
F_s	**111.01**	**MPa**
Area of Web, A_w	21779.23	mm^2
Shear Resistance, V_r	**2297**	**kN**

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	KG	DATE	30-Nov-20
CHECKED BY	RA	DATE	16-Dec-20

Section Properties

TOWER SPAN

Girder G6|FG6 (A64|A65|B64|B65)

Material Properties: A-7 Steel			Reference	Drawing Location (1959)
F_u =	410	MPa	***[CISC 6-7, 11TH Edition, 2016]***	E5, E9& 42 Top Section
F_y =	230	MPa	***[CISC 6-7, 11TH Edition, 2016]***	
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***	
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***	

Components	**Web**	**T. Plate**	**B. Plate**	**Top L's**	**Bottom L's**
Specified Size	-	-	-	L203x152x16	L203x152x16
No.	1	1	1	2	2
Height (mm)	3366	12.7	12.7	15.9	15.9
Width (mm)	13	508	508	203	203
I_x (mm^4)	40343285123	86715	86715	10900000	10900000
I_y (mm^4)	574486	138743809	138743809	22500000	22500000
A_g (mm^2)	42742	6452	6452	10780	10780
y top or bot (mm)	1695.45	6.35	3384.55	51.2	3340
x (mm)	254	254	254	183.65	183.65
Trans. I_x (mm^4)	40343285123	1.8407E+10	18406880933	2.917E+10	29166155914
Trans. I_y (mm^4)	574486	138743809	138743809	98351541	98351541

y top & bottom	1695.45	mm	
x	254	mm	
Total A_g	77205	mm^2	
Total I_x (mm^4)	1.35489E+11	mm^4	
Trans I_y (mm^4)	474765184	mm^4	
r_x	1325	mm	
r_y	78	mm	
Y_c	1195	mm	
X_c	180	mm	
Z_x	92226245	mm^3	
Z_y	6938088	mm^3	
S_x	79913509	mm^3	
S_y	1869154	mm^3	
J	2991663	mm^4	***[Angles not included in calculation - I-beam]***
d1	3378.2	mm	
c_w	7.91688E+14	mm^6	***[Angles not included in calculation - I-beam]***

ULS Girder Resistance

Class of Section

Width-to-Thickness Ratio Limits in Comp. *[CSA S6-19 cl. 10.9.2]*

Flange *[CSA S6-19 cl. 10.9.2.1]*

Flange Class 1	9.56	
Flange Class 2	11.21	
Flange Class 3	13.19	

Web *[CSA S6-19 cl. 10.9.2.1]*

Web Class 1	72.53	
Web Class 2	112.09	
Web Class 3	125.28	

Width-to-Thickness Ratios of Girder

Flange

Half width of flange, b	51	mm
Thickness of flange, t	13	mm
b/t	4	

Web

Clear depth of web, h	1289	mm
Thickness of web, w	12.70	mm
h/w	102	

Class of Section

Flange Class:	1
Web Class:	2

Moment Resistance *[CSA S6-19 cl.10.10.2.2]*

Plastic/Yeild Moment, M_p/M_y

Elastic Section Modulus, Sx	79913509	mm^3			
Plastic Section Modulus, Zx	92226245	mm^3			
Yield Stress, F_y	230	MPa	Fu =	410	Mpa
Yield Moment, M_y	18380	kNm			
Plastic Moment, M_p	21212	kNm			
Class 1/2, Mp	21212	kNm			

Critical Elastic Moment, M_u - Assumed not Governing - To Be Confirmed in Preliminary Design *[CSA S6-19 cl.10.10.2.3]*

Overall Moment Resist., M_r	**20151**	**kNm**	
Shear Resistance			***[CSA S6-19 cl. 10.10.5.1]***
Spacing of Tranverse Stiffn, a	1207	mm	***[Spacing on railway side of floor beam]***
Web height, h	3366	mm	***[Used reduced web height at south abutment per original drawings]***
a/h	0.36		
k_v	45.55		
h/w	102		
502√kv/Fy	223.40		
621√kv/Fy	276.36		
F_{cr}	**132.71**	**MPa**	
F_t	**0.00**	**MPa**	
F_s	**132.71**	**MPa**	
Area of Web, A_w	42741.9	mm^2	
Shear Resistance, V_r	**5389**	**kN**	

AECOM Imagine it. Delivered.

Exhibit B.5

Approach Span, Tower Span and Floor Beam Evaluation

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN - Approach Span (12.6m)		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	TK	DATE	30-Nov-20
CHECKED BY	KG	DATE	16-Dec-20

General Information

Material Specifications

Structural Steel (CSA G40-4 or ASTM A7) - Original Steel

F_u =	410	MPa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	MPa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***
Unit Weight =	77	kN/m^3	***[CSA S6-19 cl. 3.6, Table 3.4]***
G_s =	77000	MPa	

Structural Steel - 1982 Rehabilitation - Strength Listed on 1982 Drawings

F_y =	350	MPa	***[Per 1982 rehabilitation drawings]***
F_u =	450	MPa	***[CSA S6-19 cl. 14.7.4.2, Table 14.1]***

Reinforced Concrete - Deck

f'_c =	20	MPa	***[CSA S6-19 cl. 14.7.4.4 - unknown concrete strength]***
f_{cr} =	1.79	MPa	***[CSA S6-19 cl. 8.4.1.8.1]***
Unit Weight =	24	kN/m^3	***[CSA S6-19 cl. 3.6, Table 3.4]***
E_c =	21656	MPa	

[Slab details not provided on original construction drawings - reinforcement unknown]

Asphalt

Unit Weight =	23.5	kN/m^3	***[CSA S6-19 cl. 3.6, Table 3.4]***

Plain Concrete - Sidewalk Deck

Unit Weight =	23.5	kN/m^3	***[CSA S6-19 cl. 3.6, Table 3.4]***

Aluminum

Unit Weight =	27.0	kN/m^3	***[CSA S6-19 cl. 3.6, Table 3.4]***

Bridge Specifications

Span Length, L:	12.5984	m	***[According to Original Drawings]***
Roadway Width:	13.5636	m	***[According to 1982 Rehab Drawings]***
Tot. Deck Slab Width:	14.25	m	
West Exterior Cantilever L:	0	m	***[On west side, slab ends before girder flange edge]***
East Exterior Cantilever L:	0.2794	m	***[According to 1982 Rehab Drawings]***
No. of Design Lanes:	4		***[CSA S6-19 cl. 3.8.2, Table 3.5]***
Number of Girders:	8		
Original Girder Spacing:	1.931		***[According to Original Drawings]***
Rehabilitated Girder Spacing	2.057		***[According to 1982 Rehab Drawings]***
Orig. Girder Type (Imperial):	W33x130		***[According to Original Drawings]***
Orig. Girder Type (Metric):	W840x193		***[CISC 6-38, 11TH Edition, 2016]***
Wide. Girder Type (Imperial):	W36x160		***[According to 1982 Rehab Drawings]***
Wide. Girder Type (Metric):	W920x238		***[CISC 6-38, 11TH Edition, 2016]***
Diaphragm Spacing (m):	3.1496		

JOB TITLE	BCLB DECK PRE-DESIGN - Approach Span (12.6m)		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	TK	DATE	30-Nov-20
CHECKED BY	KG	DATE	16-Dec-20

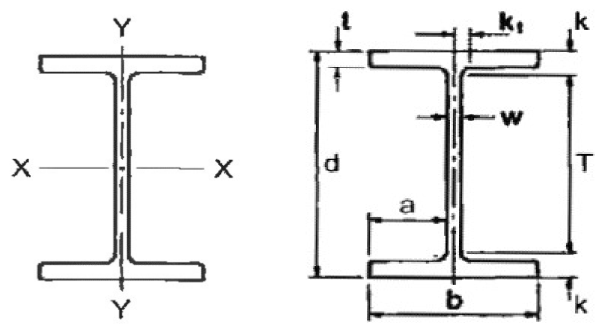
Section Properties

Non-Composite Bare Steel Girder

Longitudinal Stringer (W840 x 193) - Original Bridge

All data from CISC 11th Edition - 6-38, 3-39

Depth, d	840	mm
Flange width	292	mm
Flange thickness, t	21.7	mm
Web thickness, w	14.70	mm
Dead Load	1.9	kN/m
Area	24700	mm^2
Ix	2780000000	mm^4
Sx	6630000.00	mm^3
rx	336	mm
Zx	7620000	mm^3
Iy	90300000	mm^4
Sy	618000	mm^3
ry	60.5	mm
Zy	971000	mm^3
J	3050000	mm^4
Cw	1.51E+13	mm^6



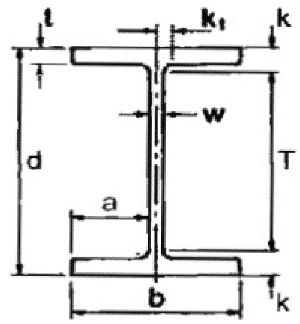
Section Properties

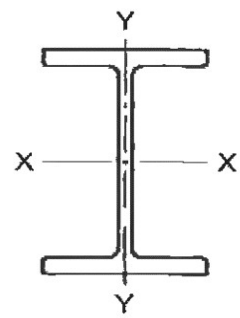
Non-Composite Bare Steel Girder

Longitudinal Stringer (W920x238) - Rehabilitated Bridge

All data from CISC 11th Edition - 6-38, 3-39

Depth, d	915	mm
Flange width	305	mm
Flange thickness, t	25.9	mm
Web thickness, w	16.50	mm
Dead Load	2.33	kN/m
Area	30300	mm^2
Ix	4060000000	mm^4
Sx	8870000.00	mm^3
rx	366	mm
Zx	10200000	mm^3
Iy	123000000	mm^4
Sy	806000	mm^3
ry	63.7	mm
Zy	1270000	mm^3
J	5100000	mm^4
Cw	2.43E+13	mm^6





Load Combinations (Original)

Load factors

Load factors from CSA S6-19 cl. 3.5, Table 3.1, 3.2 & 3.3

ULS 1 MAX		**ULS 9**	
Factory-produced component	1.10	Factory-produced component	1.35
Cast-in-place component	1.20	Cast-in-place component	1.35
Wearing surfaces	1.50	Wearing surfaces	1.35
Live Load (Vehicle)	1.70		
Load Load (Pedestrian)	1.70		

**Results taken from grillage model created in Midas Civil*

Moment

Relative Span Distance		0L	0.1L	0.2L	0.3L	0.4L	0.5L
Absolute Span Distance		0.00 m	1.26 m	2.52 m	3.78 m	5.04 m	6.30 m
SLS	**Max.**	**0 kNm**	**314 kNm**	**530 kNm**	**662 kNm**	**735 kNm**	**753 kNm**
ULS	**ULS Max Env.**	**0 kNm**	**563 kNm**	**946 kNm**	**1180 kNm**	**1312 kNm**	**1360 kNm**

**Most critical girder was west exterior girder*

Shear

Relative Span Distance		0L
Absolute Span Distance		0.00 m
SLS	**Max.**	**278 kN**
ULS	**ULS Max Env.**	**480 kN**

**Max shear occurs at support, 0L*

Maximum SLS DL Reaction:	90 kNm
Maximum SLS TL Reaction:	333 kN
Maximum ULS DL Reaction:	111 kN
Maximum ULS TL Reaction:	575 kN

JOB TITLE	BCLB DECK PRE-DESIGN - Approach Span (12.6m)		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	TK	DATE	30-Nov-20
CHECKED BY	KG	DATE	16-Dec-20

SLS Girder Resistance (Original)

*Calculated conservatively not accounting for composite properties

Control of Permanent Deflections ***[CSA S6-19 Cl. 10.11.4]***

Max. SLS Moment	753	kNm
Section Modulus, S	6630000	mm^3
Stress in Flange	**114**	**MPa**
Stress Limit ($0.9F_y$)	**207**	**MPa**
Demand/Capacity	**0.55**	

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN - Approach Span (12.6m)		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	TK	DATE	30-Nov-20
CHECKED BY	KG	DATE	16-Dec-20

Bearing Evaluation

Bearing Plan Width	203	
Bearing Plan Length	305	
Bearing Thickness	61	
Maximum SLS DL Reaction	110	kN
Maximum SLS TL Reaction	383	kN
Maximum ULS DL Reaction	136	kN
Maximum ULS TL Reaction	650	kN
Maximum SLS DL Pressure	1.78	Mpa
Maximum SLS TL Pressure	6.19	Mpa
Maximum ULS DL Pressure	2.20	Mpa
Maximum ULS TL Pressure	10.50	Mpa
Maximum SLS DL Limit	4.50	
Maximum SLS TL Limit	7.00	
Maximum ULS DL Limit	7.00	
Maximum ULS TL Limit	10.00	
SLS DL Demand/Capacity	0.39	
SLS TL Demand/Capacity	0.88	
ULS DL Demand/Capacity	0.31	
ULS TL Demand/Capacity	**1.05**	Minor exceedance

ULS Girder Resistance (Original)

*Assumed that girder section does not act compositely with the deck, shear studs are not shown in existing drawings

Original Girder Section: W840x193

Class of Section

Width-to-Thickness Ratio Limits in Comp. ***[CSA S6-19 cl. 10.9.2.1, Table 10.3]***

Flange		
Flange Class 1	9.56	
Flange Class 2	11.21	
Flange Class 3	13.19	
Web		
Web Class 1	72.53	
Web Class 2	112.09	
Web Class 3	125.28	

Width-to-Thickness Ratios of Girder

Flange		
Half width of flange, b	146	mm
Thickness of flange, t	22	mm
b/t	7	
Web		
Clear depth of web, h	796.6	mm
Thickness of web, w	14.70	mm
h/w	54	

Class of Section

Flange Class:	1
Web Class:	1

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN - Approach Span (12.6m)		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	TK	DATE	30-Nov-20
CHECKED BY	KG	DATE	16-Dec-20

Moment Resistance of Laterally Unbraced Members (Section Classes 1 & 2) - CSA S6-19 cl. 10.10.2.3

Unbraced Length, L	3149.6	mm	***[Distance between diaphragms]***

Plastic Moment, M_p

Plastic Section Modulus, Z	7620000	mm^3
Yield Stress, F_y	230	MPa
Plastic Moment, M_p	1752.6	kNm
$0.67M_p$	**1174.242**	**kNm**

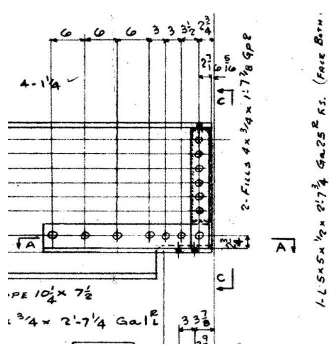
Critical Elastic Moment, M_u

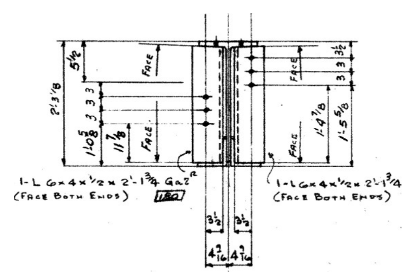
M_{max}	1360	kNm
M_a	1180	
M_b	1246	kNm
M_c	1312	
ω_2 Coefficient	1.08	
Unbraced Length, L	3149.6	mm
E_s	200000	MPa
I_y	90300000	mm^4
G_s	77000	MPa
J	3050000	mm^4
C_w	1.51E+13	mm^6
M_u	**8272**	**kNm**

Overall Moment Resist., M_r	**1665**	**kNm**
Max ULS Factored Moment	**1360**	**kNm**
Demand/Capacity	**0.82**	

Shear Resistance - CSA S6-19 cl. 10.10.5.1

Spacing of Tranverse Stiffn, a	12598	mm	***[Unstiffened web]***
Web height, h	645.575	mm	***[Used reduced web height at south abutment per original drawings]***
a/h	20		
k_v	5.35		
h/w	54		
502√kv/Fy	76.57		
621√kv/Fy	94.72		
F_{cr}	**132.71**	**MPa**	
F_t	**0.00**	**MPa**	
F_s	**132.71**	**MPa**	
Area of Web, A_w	7591.962	mm^2	





Shear Resistance, V_r	**957**	**kN**
Max ULS Factored Shear	**480**	**kN**
Demand/Capacity	**0.50**	

Bearing Resistance - Abutment End

Bearing Resistance of Web - CSA S6-19 cl. 10.10.8.1

ϕ_{be}	0.75		
w	11.76	mm	***[20% reduction due to corrosion]***
N	200	mm	***[Bearing plate width similar to flange width]***
t	21.7	mm	
Bearing Resistance, Br per b)i)	**582**	**kN**	
Bearing Resistance, Br per b)ii)	**422**	**kN**	
Bearing Resistance, Br	**422**	**kN**	
Maximum Reaction	**575**	**kN**	
Demand/Capacity (Web Alone)	**1.36**		

Bearing Resistance of Stiffener - CSA S6-19 cl. 10.10.8.2

Stiffener Type	5x5x1/2	(Angle)	***[Imperial]***
	127x127x13	(Angle)	***[Metric]***
Number of Stiffeners	2		

<u>Bearing Stiffener Dimensions</u>

Width of Stiffener (Parallel Leg)	63.5	mm	***[CISC 6-70, 11TH Edition, 2016]***	50% reduction of perpen. Leg
ıickness of Stiffener (Parallel Leg)	12.7	mm	***[CISC 6-70, 11TH Edition, 2016]***	
Width of Stiffeners (Perpen Leg)	63.5	mm	***[CISC 6-70, 11TH Edition, 2016]***	50% reduction of perpen. Leg
Thickness of Stiffener	12.7	mm	***[CISC 6-70, 11TH Edition, 2016]***	

<u>Bearing Resist. of Stiffeners</u>

Area of Stiffener	1451.61	mm^2
Bearing Resist. of Stiffeners	901	kN

Overall Bearing Resistance (Web Resistance + Stiffener Resistance)

Total Bearing Resistance	**1324**	**kN**
Maximum Reaction	**575**	**kN**
Demand/Capacity	**0.43**	

Compressive Resistance - CSA S6-19 cl. 10.10.8.3

Girder Web Thickness	11.76	mm	
Web Height	796.6	mm	
Width of Stiffener (Perpen. Leg)	63.5	mm	*(Standard Angle)*
ıickness of Stiffener (Perpen. Leg)	12.7	mm	*(Standard Angle)*
Width of Stiffener (Parallel Leg)	63.5	mm	*(Standard Angle)*
ıickness of Stiffener (Parallel Leg)	12.7	mm	*(Standard Angle)*
Column Web Width, 12 x w	141.12	mm	*(Both sides)*

Column Section Properties - X-X Axis (Parallel to Girder Longitudinal Axis)

Element	b	h	Number	A	y	Ay	$y\text{-}y_0$	$A(y\text{-}y_0)$
Stiffener 1 - Perpendicular Leg	12.7	50.8	**1**	645	25.4	1.64E+04	-44	-28374
Stiffener 1 - Parallel Leg	63.5	12.7	**1**	806	57.2	4.61E+04	-12	-9863
Web	282.2	11.8	**1**	3319	69.4	2.30E+05	0	0
Stiffener 2 - Parallel Leg	63.5	12.7	**1**	806	81.6	6.58E+04	12	9863
Stiffener 2 - Perpendicular Leg	12.7	50.8	**1**	645	113.4	7.31E+04	44	28374
				Σ = 6222		**4.32E+05**		

Element	I_0	$A(y\text{-}y_0)^2$	I_x
Stiffener 1 - Perpendicular Leg	1.39E+05	1.25E+06	1.4E+06
Stiffener 1 - Parallel Leg	1.08E+04	1.21E+05	1.3E+05
Web	3.83E+04	0.00E+00	3.8E+04
Stiffener 2 - Parallel Leg	1.08E+04	1.21E+05	1.3E+05
Stiffener 2 - Perpendicular Leg	1.39E+05	1.25E+06	1.4E+06
			Σ = 3074454

Y_0	**69.38**

Column Section Properties - Y-Y Axis (Perpendicular to Girder Longitudinal Axis)

Element	b	h	Number	A	x	Ax	$x\text{-}x_0$	$A(x\text{-}x_0)$
Stiffener 1 - Perpendicular Leg	50.8	12.7	**1**	645	134.8	8.69E+04	3	2062
Stiffener 1 - Parallel Leg	12.7	63.5	**1**	806	109.4	8.82E+04	-22	-17906
Web	11.8	282.2	**1**	3319	141.1	4.68E+05	10	31687
Stiffener 2 - Parallel Leg	12.7	63.5	**1**	806	109.4	8.82E+04	-22	-17906
Stiffener 2 - Perpendicular Leg	50.8	12.7	**1**	645	134.8	8.69E+04	3	2062
				Σ = 6222		**8.19E+05**		

X_0	**131.57**

Element	I_0	$A(x\text{-}x_0)^2$	I_y
Stiffener 1 - Perpendicular Leg	8.67E+03	6.59E+03	1.5E+04
Stiffener 1 - Parallel Leg	2.71E+05	3.98E+05	6.7E+05
Web	2.20E+07	3.03E+05	2.2E+07
Stiffener 2 - Parallel Leg	2.71E+05	3.98E+05	6.7E+05
Stiffener 2 - Perpendicular Leg	8.67E+03	6.59E+03	1.5E+04
			Σ = 23703552

FL. Buckling Resistance about X-Axis

Effective Length Factor, K	0.7	
Length of Comp. Column, 0.75L	597.45	mm
Radius of Gyration about X, r_x	22.23	mm
Specified Min. Yield Stress, F_y	230	MPa
Modulus of Elasticity, E_s	200000	MPa
λ	0.203	
Resistance Factor	0.9	
Web-Stiffener Col Area	6222	mm^2
n	1.34	
Compressive Resistance, C_r	**1275**	**kN**

FL. Buckling Resistance about Y-Axis

Effective Length Factor, K	0.7	
Length of Comp. Column, 0.75L	597.45	mm
Radius of Gyration about Y, r_y	61.72	mm
Specified Min. Yield Stress, F_y	230	MPa
Modulus of Elasticity, E_s	200000	MPa
λ	0.073	
Resistance Factor	0.9	
Web-Stiffener Col Area	6222	mm^2
n	1.34	
Compressive Resistance, C_r	**1287**	**kN**

Overall Compressive Resistance, C_r	**1275**	**kN**
Maximum Factored Reaction	**575**	**kN**
Demand/Capacity	**0.45**	

Bearing Resistance - Rear Floor Beam End

Bearing Resistance of Web - CSA S6-19 cl. 10.10.8.1

ϕ_{be}	0.75		
w	11.76	mm	***[20% reduction due to corrosion]***
N	254	mm	***[Half of top flange width of floor beam per original drawings]***
t	19	mm	***[Thickness of bottom angles per original drawings]***
Bearing Resistance, Br per b)i)	**691**	**kN**	
Bearing Resistance, Br per b)ii)	**422**	**kN**	
Bearing Resistance, Br	**422**	**kN**	
Maximum Reaction	**575**	**kN**	
Demand/Capacity (Web Alone)	**1.36**		

Bearing Resistance of Stiffener - CSA S6-19 cl. 10.10.8.2

Stiffener Type	6x4x1/2	(Angle)	***[Imperial]***
	152x102x13	(Angle)	***[Metric]***
Number of Stiffeners	2		

<u>Bearing Stiffener Dimensions</u>

Width of Stiffener (Parallel Leg)	51	mm	***[CISC 6-70, 11TH Edition, 2016]***	50% reduction of parallel leg
ıickness of Stiffener (Parallel Leg)	12.7	mm	***[CISC 6-70, 11TH Edition, 2016]***	
Width of Stiffeners (Perpen Leg)	69.325	mm	***[Smaller of Flange width minus web thicknes***	50% reduction of perpen. Leg
Thickness of Stiffener	12.7	mm	***[CISC 6-70, 11TH Edition, 2016]***	

<u>Bearing Resist. of Stiffeners</u>

Area of Stiffener	1366.8375	mm^2
Bearing Resist. of Stiffeners	849	kN

Overall Bearing Resistance (Web Resistance + Stiffener Resistance)

Total Bearing Resistance	**1271**	**kN**
Maximum Reaction	**575**	**kN**
Demand/Capacity	**0.45**	

Compressive Resistance - CSA S6-19 cl. 10.10.8.3

Girder Web Thickness	11.76	mm	
Web Height	645.575	mm	
Width of Stiffener (Perpen. Leg)	69.325	mm	*(Standard Angle)*
ıickness of Stiffener (Perpen. Leg)	12.7	mm	*(Standard Angle)*
Width of Stiffener (Parallel Leg)	51	mm	*(Standard Angle)*
ıickness of Stiffener (Parallel Leg)	12.7	mm	*(Standard Angle)*
Column Web Width, 12 x w	141.12	mm	*(Both sides)*

Column Section Properties - X-X Axis (Parallel to Girder Longitudinal Axis)

Element	b	h	Number	A	y	Ay	$y\text{-}y_0$	$A(y\text{-}y_0)$
Stiffener 1 - Perpendicular Leg	12.7	56.6	**1**	719	28.3	2.04E+04	-47	-33722
Stiffener 1 - Parallel Leg	51.0	12.7	**1**	648	63.0	4.08E+04	-12	-7921
Web	141.1	11.8	**1**	1660	75.2	1.25E+05	0	0
Stiffener 2 - Parallel Leg	51.0	12.7	**1**	648	87.4	5.66E+04	12	7921
Stiffener 2 - Perpendicular Leg	12.7	56.6	**1**	719	122.1	8.78E+04	47	33722
				Σ = 4393		**3.30E+05**		

Element	I_0	$A(y\text{-}y_0)^2$	I_x
Stiffener 1 - Perpendicular Leg	1.92E+05	1.58E+06	1.8E+06
Stiffener 1 - Parallel Leg	8.71E+03	9.69E+04	1.1E+05
Web	1.91E+04	0.00E+00	1.9E+04
Stiffener 2 - Parallel Leg	8.71E+03	9.69E+04	1.1E+05
Stiffener 2 - Perpendicular Leg	1.92E+05	1.58E+06	1.8E+06
			Σ = 3777232

Y_0	**75.21**

Column Section Properties - Y-Y Axis (Perpendicular to Girder Longitudinal Axis)

Element	b	h	Number	A	x	Ax	$x\text{-}x_0$	$A(x\text{-}x_0)$
Stiffener 1 - Perpendicular Leg	56.6	12.7	**1**	719	134.8	9.69E+04	30	21504
Stiffener 1 - Parallel Leg	12.7	51.0	**1**	648	115.6	7.49E+04	11	6964
Web	11.8	141.1	**1**	1660	70.6	1.17E+05	-34	-56936
Stiffener 2 - Parallel Leg	12.7	51.0	**1**	648	115.6	7.49E+04	11	6964
Stiffener 2 - Perpendicular Leg	56.6	12.7	**1**	719	134.8	9.69E+04	30	21504
				Σ = 4393		**4.61E+05**		

X_0	**104.87**

Element	I_0	$A(x\text{-}x_0)^2$	I_y
Stiffener 1 - Perpendicular Leg	9.67E+03	6.43E+05	6.5E+05
Stiffener 1 - Parallel Leg	1.40E+05	7.49E+04	2.2E+05
Web	2.75E+06	1.95E+06	4.7E+06
Stiffener 2 - Parallel Leg	1.40E+05	7.49E+04	2.2E+05
Stiffener 2 - Perpendicular Leg	9.67E+03	6.43E+05	6.5E+05
			Σ = 6443426

FL. Buckling Resistance about X-Axis

Effective Length Factor, K	0.7	
Length of Comp. Column, 0.75L	484.18125	mm
Radius of Gyration about X, r_x	29.32	mm
Specified Min. Yield Stress, F_y	230	MPa
Modulus of Elasticity, E_s	200000	MPa
λ	0.125	
Resistance Factor	0.9	
Web-Stiffener Col Area	4393	mm^2
n	1.34	
Compressive Resistance, C_r	**907**	**kN**

FL. Buckling Resistance about Y-Axis

Effective Length Factor, K	0.7	
Length of Comp. Column, 0.75L	484.18125	mm
Radius of Gyration about Y, r_y	38.30	mm
Specified Min. Yield Stress, F_y	230	MPa
Modulus of Elasticity, E_s	200000	MPa
λ	0.096	
Resistance Factor	0.9	
Web-Stiffener Col Area	4393	mm^2
n	1.34	
Compressive Resistance, C_r	**908**	**kN**
Overall Compressive Resistance, C_r	**907**	**kN**
Maximum Factored Reaction	**575**	**kN**
Demand/Capacity	**0.63**	

Final Bearing Resistance:	**907**	**kN**
Maximum Factored Reaction:	**575**	**kN**
Utilization (Demand/Capacity):	**0.63**	

Load Combinations (Rehabilitated)

Load factors

Load factors from CSA S6-19 cl. 3.5, Table 3.1, 3.2 & 3.3

SLS		FLS	
Factory-produced component	1.00	Factory-produced component	1.00
Cast-in-place component	1.00	Cast-in-place component	1.00
Wearing surfaces	1.00	Wearing surfaces	1.00
Live Load (Vehicle)	0.90	Live Load (Vehicle)	1.00

ULS 1 MAX		ULS 9	
Factory-produced component	1.10	Factory-produced component	1.35
Cast-in-place component	1.20	Cast-in-place component	1.35
Wearing surfaces	1.50	Wearing surfaces	1.35
Live Load (Vehicle)	1.70		
Load Load (Pedestrian)	1.70		

**Results from grillage model created in Midas Civil*

Moment

Relative Span Distance		0L	0.1L	0.2L	0.3L	0.4L	0.5L
Absolute Span Distance		0.00 m	1.26 m	2.52 m	3.78 m	5.04 m	6.30 m
SLS	**Max.**	**0 kNm**	**431 kNm**	**675 kNm**	**833 kNm**	**925 kNm**	**950 kNm**
ULS	**ULS Max Env.**	**0 kNm**	**731 kNm**	**1126 kNm**	**1376 kNm**	**1522 kNm**	**1559 kNm**

**Critical girder is 2nd interior girder from east*

Shear

Relative Span Distance		0L
Absolute Span Distance		0.00 m
SLS	**Max.**	**344 kN**
ULS	**ULS Max Env.**	**582 kN**

**Maximum shear is at location of support*

Maximum SLS DL Reaction:	110 kN
Maximum SLS TL Reaction:	383 kN
Maximum ULS DL Reaction:	136 kN
Maximum ULS TL Reaction:	650 kN

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DESIGNED BY		DATE	
ORIGINATOR BY	TK	DATE	30-Nov-20
CHECKED BY	KG	DATE	16-Dec-20

SLS Girder Resistance (Rehabilitated)

*Calculated conservatively not accounting for composite properties

Control of Permanent Deflections *[CSA S6-19 Cl. 10.11.4]*

Max. SLS Moment	950	kNm
Section Modulus, S	8870000	mm^3
Stress in Flange	**107**	**MPa**
Stress Limit (0.9F_y)	**315**	**MPa**
Demand/Capacity	**0.34**	

ULS Girder Resistance (Rehabilitated)

*Assumed that girder section does not act compositely with the deck, shear studs are not shown in existing drawings

Original Girder Section: W920x238

Class of Section

Width-to-Thickness Ratio Limits in Comp. ***[CSA S6-19 cl. 10.9.2.1, Table 10.3]***

Flange		
Flange Class 1	7.75	
Flange Class 2	9.09	
Flange Class 3	10.69	
Web		
Web Class 1	58.80	
Web Class 2	90.87	
Web Class 3	101.56	

Width-to-Thickness Ratios of Girder

Flange		
Half width of flange, b	153	mm
Thickness of flange, t	26	mm
b/t	6	
Web		
Clear depth of web, h	863.2	mm
Thickness of web, w	16.50	mm
h/w	52	
Class of Section		
Flange Class:	1	
Web Class:	1	

Moment Resistance of Laterally Unbraced Members (Section Classes 1 & 2) - CSA S6-19 cl. 10.10.2.3

Unbraced Length, L	3149.6	mm	***[Distance between diaphragms]***
Plastic Moment, M_p			
Plastic Section Modulus, Z	10200000	mm^3	
Yield Stress, F_y	350	MPa	
Plastic Moment, M_p	3570	kNm	
$0.67M_p$	**2391.9**	**kNm**	

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN - Approach Span (12.6m)		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	TK	DATE	30-Nov-20
CHECKED BY	KG	DATE	16-Dec-20

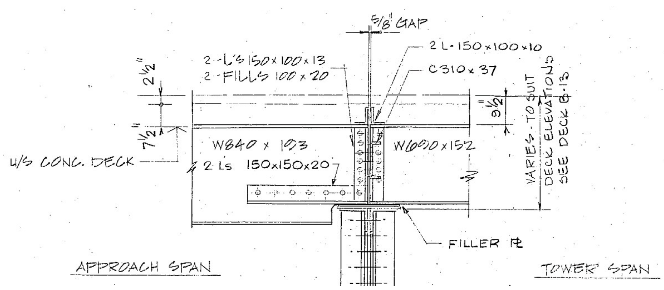
Critical Elastic Moment, M_u

M_{max}	1559.00	kNm
M_a	1376.00	
M_b	1449.00	kNm
M_c	1522.00	
ω_2 Coefficient	1.07	
Unbraced Length, L	3149.6	mm
E_s	200000	MPa
I_y	123000000	mm^4
G_s	77000	MPa
J	5100000	mm^4
C_w	2.43E+13	mm^6
M_u	**12103**	**kNm**

Overall Moment Resist., M_r	**3392**	**kNm**
Max ULS Factored Moment	**1559**	**kNm**
Demand/Capacity	**0.46**	

Shear Resistance - CSA S6-19 cl. 10.10.5.1

Spacing of Tranverse Stiffn, a	12598	mm	***[Unstiffened web]***
Web height, h	637.175	mm	***[Used reduced web height at south abutment per original drawings]***
a/h	20		
k_v	5.35		
h/w	52		
502√kv/Fy	62.07		
621√kv/Fy	76.78		
F_{cr}	**201.95**	**MPa**	
F_t	**0.00**	**MPa**	
F_s	**201.95**	**MPa**	
Area of Web, A_w	8410.71	mm^2	



Shear Resistance, V_r	**1614**	**kN**
Max ULS Factored Shear	**582**	**kN**
Demand/Capacity	**0.36**	

JOB TITLE	BCLB DECK PRE-DESIGN - Approach Span (12.6m)		
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CHECKED BY	KG	DATE	16-Dec-20

Bearing Resistance - Abutment End

Bearing Resistance of Web - CSA S6-19 cl. 10.10.8.1

ϕ_{be}	0.75		
w	13.20	mm	***[20% reduction due to corrosion]***
N	200	mm	***[Bearing plate width similar to flange width]***
t	26	mm	
Bearing Resistance, Br per b)i)	**1052**	**kN**	
Bearing Resistance, Br per b)ii)	**656**	**kN**	
Bearing Resistance, Br	**656**	**kN**	
Maximum Reaction	**650**	**kN**	
Demand/Capacity (Web Alone)	**0.99**		

Bearing Resistance of Stiffener - CSA S6-19 cl. 10.10.8.2

Stiffener Type	5x5x1/2	(Angle)	***[Imperial]***
	127x127x13	(Angle)	***[Metric]***
Number of Stiffeners	2		

Bearing Stiffener Dimensions

Width of Stiffener (Parallel Leg)	63.5	mm	***[CISC 6-70, 11TH Edition, 2016]***	50% reduction of parallel leg
ıickness of Stiffener (Parallel Leg)	12.7	mm	***[CISC 6-70, 11TH Edition, 2016]***	
Width of Stiffeners (Perpen Leg)	63.5	mm	***[CISC 6-70, 11TH Edition, 2016]***	50% reduction of perpen. Leg
Thickness of Stiffener	12.7	mm	***[CISC 6-70, 11TH Edition, 2016]***	

Bearing Resist. of Stiffeners

Area of Stiffener	1451.61	mm^2
Bearing Resist. of Stiffeners	1372	kN

Overall Bearing Resistance (Web Resistance + Stiffener Resistance)

Total Bearing Resistance	**2028**	**kN**
Maximum Reaction	**650**	**kN**
Demand/Capacity	**0.32**	

Compressive Resistance - CSA S6-19 cl. 10.10.8.3

Girder Web Thickness	13.20	mm	
Web Height	863.2	mm	
Width of Stiffener (Perpen. Leg)	63.5	mm	*(Standard Angle)*
ıickness of Stiffener (Perpen. Leg)	12.7	mm	*(Standard Angle)*
Width of Stiffener (Parallel Leg)	63.5	mm	*(Standard Angle)*
ıickness of Stiffener (Parallel Leg)	12.7	mm	*(Standard Angle)*
Column Web Width, 12 x w	158.4	mm	*(Both sides)*
Horiz. Distance to Centroid of L	36.4	mm	***[CISC 6-70, 11TH Edition, 2016 (y distance)]***

JOB TITLE	BCLB DECK PRE-DESIGN - Approach Span (12.6m)		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	TK	DATE	30-Nov-20
CHECKED BY	KG	DATE	16-Dec-20

Column Section Properties - X-X Axis (Parallel to Girder Longitudinal Axis)

Element	b	h	Number	A	y	Ay	$y\text{-}y_0$	$A(y\text{-}y_0)$
Stiffener 1 - Perpendicular Leg	12.7	50.8	1	645	25.4	1.64E+04	-45	-28839
Stiffener 1 - Parallel Leg	63.5	12.7	1	806	57.2	4.61E+04	-13	-10444
Web	316.8	13.2	1	4182	70.1	2.93E+05	0	0
Stiffener 2 - Parallel Leg	63.5	12.7	1	806	83.1	6.70E+04	13	10444
Stiffener 2 - Perpendicular Leg	12.7	50.8	1	645	114.8	7.41E+04	45	28839
				Σ = 7085		**4.97E+05**		

Element	I_0	$A(y\text{-}y_0)^2$	I_x
Stiffener 1 - Perpendicular Leg	1.39E+05	1.29E+06	1.4E+06
Stiffener 1 - Parallel Leg	1.08E+04	1.35E+05	1.5E+05
Web	6.07E+04	0.00E+00	6.1E+04
Stiffener 2 - Parallel Leg	1.08E+04	1.35E+05	1.5E+05
Stiffener 2 - Perpendicular Leg	1.39E+05	1.29E+06	1.4E+06
			Σ = 3208548

Y_0	**70.10**

Column Section Properties - Y-Y Axis (Perpendicular to Girder Longitudinal Axis)

Element	b	h	Number	A	x	Ax	$x\text{-}x_0$	$A(x\text{-}x_0)$
Stiffener 1 - Perpendicular Leg	50.8	12.7	1	645	188.5	1.22E+05	24	15173
Stiffener 1 - Parallel Leg	12.7	63.5	1	806	163.1	1.31E+05	-2	-1517
Web	13.2	316.8	1	4182	158.4	6.62E+05	-7	-27312
Stiffener 2 - Parallel Leg	12.7	63.5	1	806	163.1	1.31E+05	-2	-1517
Stiffener 2 - Perpendicular Leg	50.8	12.7	1	645	188.5	1.22E+05	24	15173
				Σ = 7085		**1.17E+06**		

X_0	**164.93**

Element	I_0	$A(x\text{-}x_0)^2$	I_y
Stiffener 1 - Perpendicular Leg	8.67E+03	3.57E+05	3.7E+05
Stiffener 1 - Parallel Leg	2.71E+05	2.85E+03	2.7E+05
Web	3.50E+07	1.78E+05	3.5E+07
Stiffener 2 - Parallel Leg	2.71E+05	2.85E+03	2.7E+05
Stiffener 2 - Perpendicular Leg	8.67E+03	3.57E+05	3.7E+05
			Σ = 36431352

FL. Buckling Resistance about X-Axis

Effective Length Factor, K	0.7	
Length of Comp. Column, 0.75L	647.4	mm
Radius of Gyration about X, r_x	21.28	mm
Specified Min. Yield Stress, F_y	350	MPa
Modulus of Elasticity, E_s	200000	MPa
λ	0.284	
Resistance Factor	0.9	
Web-Stiffener Col Area	7085	mm^2
n	1.34	
Compressive Resistance, C_r	**2177**	**kN**

FL. Buckling Resistance about Y-Axis

Effective Length Factor, K	0.7	
Length of Comp. Column, 0.75L	647.4	mm
Radius of Gyration about Y, r_y	71.71	mm
Specified Min. Yield Stress, F_y	350	MPa
Modulus of Elasticity, E_s	200000	MPa
λ	0.084	
Resistance Factor	0.9	
Web-Stiffener Col Area	7085	mm^2
n	1.34	
Compressive Resistance, C_r	**2230**	**kN**

Overall Compressive Resistance, C_r	**2177**	**kN**
Maximum Factored Reaction	**650**	**kN**
Demand/Capacity	**0.30**	

Bearing Resistance - Rear Floor Beam End

Bearing Resistance of Web - CSA S6-19 cl. 10.10.8.1

ϕ_{be}	0.75		
w	13.20	mm	***[20% reduction due to corrosion]***
N	254	mm	***[Half of top flange width of floor beam per original drawings]***
t	19	mm	***[Thickness of bottom angles per original drawings]***
Bearing Resistance, Br per b)i)	**1239**	**kN**	
Bearing Resistance, Br per b)ii)	**656**	**kN**	
Bearing Resistance, Br	**656**	**kN**	
Maximum Reaction	**650**	**kN**	
Demand/Capacity (Web Alone)	**0.99**		

Bearing Resistance of Stiffener - CSA S6-19 cl. 10.10.8.2

Stiffener Type	6x4x1/2	(Angle)	***[Imperial]***
	152x102x13	(Angle)	***[Metric]***
Number of Stiffeners	2		

<u>Bearing Stiffener Dimensions</u>

Width of Stiffener (Parallel Leg)	51	mm	***[CISC 6-70, 11TH Edition, 2016]***	50% reduction of parallel leg
ıickness of Stiffener (Parallel Leg)	12.7	mm	***[CISC 6-70, 11TH Edition, 2016]***	
Width of Stiffeners (Perpen Leg)	72.125	mm	***[Smaller of Flange width minus web thickness ar***	50% reduction of perpen. Leg
Thickness of Stiffener	12.7	mm	***[CISC 6-70, 11TH Edition, 2016]***	

<u>Bearing Resist. of Stiffeners</u>

Area of Stiffener	1402.3975	mm^2
Bearing Resist. of Stiffeners	1325	kN

Overall Bearing Resistance (Web Resistance + Stiffener Resistance)

Total Bearing Resistance	**1981**	**kN**
Maximum Reaction	**650**	**kN**
Demand/Capacity	**0.33**	

Compressive Resistance - CSA S6-19 cl. 10.10.8.3

Girder Web Thickness	13.20	mm	
Web Height	637.175	mm	
Width of Stiffener (Perpen. Leg)	72.125	mm	*(Standard Angle)*
ıickness of Stiffener (Perpen. Leg)	12.7	mm	*(Standard Angle)*
Width of Stiffener (Parallel Leg)	51	mm	*(Standard Angle)*
ıickness of Stiffener (Parallel Leg)	12.7	mm	*(Standard Angle)*
Column Web Width, 12 x w	158.4	mm	*(Both sides)*

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN - Approach Span (12.6m)		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	TK	DATE	30-Nov-20
CHECKED BY	KG	DATE	16-Dec-20

Column Section Properties - X-X Axis (Parallel to Girder Longitudinal Axis)

Element	b	h	Number	A	y	Ay	$y\text{-}y_0$	$A(y\text{-}y_0)$
Stiffener 1 - Perpendicular Leg	12.7	59.4	**1**	755	29.7	2.24E+04	-49	-36990
Stiffener 1 - Parallel Leg	51.0	12.7	**1**	648	65.8	4.26E+04	-13	-8388
Web	158.4	13.2	**1**	2091	78.7	1.65E+05	0	0
Stiffener 2 - Parallel Leg	51.0	12.7	**1**	648	91.7	5.94E+04	13	8388
Stiffener 2 - Perpendicular Leg	12.7	59.4	**1**	755	127.7	9.64E+04	49	36990
				Σ = 4896		**3.85E+05**		

Element	I_0	$A(y\text{-}y_0)^2$	I_x
Stiffener 1 - Perpendicular Leg	2.22E+05	1.81E+06	2.0E+06
Stiffener 1 - Parallel Leg	8.71E+03	1.09E+05	1.2E+05
Web	3.04E+04	0.00E+00	3.0E+04
Stiffener 2 - Parallel Leg	8.71E+03	1.09E+05	1.2E+05
Stiffener 2 - Perpendicular Leg	2.22E+05	1.81E+06	2.0E+06
			Σ = 4335100

Y_0	**78.73**

Column Section Properties - Y-Y Axis (Perpendicular to Girder Longitudinal Axis)

Element	b	h	Number	A	x	Ax	$x\text{-}x_0$	$A(x\text{-}x_0)$
Stiffener 1 - Perpendicular Leg	59.4	12.7	**1**	755	152.1	1.15E+05	36	27305
Stiffener 1 - Parallel Leg	12.7	51.0	**1**	648	132.9	8.61E+04	17	11031
Web	13.2	158.4	**1**	2091	79.2	1.66E+05	-37	-76672
Stiffener 2 - Parallel Leg	12.7	51.0	**1**	648	132.9	8.61E+04	17	11031
Stiffener 2 - Perpendicular Leg	59.4	12.7	**1**	755	152.1	1.15E+05	36	27305
				Σ = 4896		**5.67E+05**		

X_0	**115.87**

Element	I_0	$A(x\text{-}x_0)^2$	I_y
Stiffener 1 - Perpendicular Leg	1.01E+04	9.88E+05	1.0E+06
Stiffener 1 - Parallel Leg	1.40E+05	1.88E+05	3.3E+05
Web	4.37E+06	2.81E+06	7.2E+06
Stiffener 2 - Parallel Leg	1.40E+05	1.88E+05	3.3E+05
Stiffener 2 - Perpendicular Leg	1.01E+04	9.88E+05	1.0E+06
			Σ = 9835907

FL. Buckling Resistance about X-Axis

Effective Length Factor, K	0.7	
Length of Comp. Column, 0.75L	477.88125	mm
Radius of Gyration about X, r_x	29.76	mm
Specified Min. Yield Stress, F_y	350	MPa
Modulus of Elasticity, E_s	200000	MPa
λ	0.150	
Resistance Factor	0.9	
Web-Stiffener Col Area	4896	mm^2
n	1.34	
Compressive Resistance, C_r	**1535**	**kN**

FL. Buckling Resistance about Y-Axis

Effective Length Factor, K	0.7	
Length of Comp. Column, 0.75L	477.88125	mm
Radius of Gyration about Y, r_y	44.82	mm
Specified Min. Yield Stress, F_y	350	MPa
Modulus of Elasticity, E_s	200000	MPa
λ	0.099	
Resistance Factor	0.9	
Web-Stiffener Col Area	4896	mm^2
n	1.34	
Compressive Resistance, C_r	**1540**	**kN**

Overall Compressive Resistance, C_r	**1535**	**kN**
Maximum Factored Reaction	**650**	**kN**
Demand/Capacity	**0.42**	

Final Bearing Resistance:	**1535**	**kN**
Maximum Factored Reaction:	**650**	**kN**
Utilization (Demand/Capacity):	**0.42**	

JOB TITLE	BCLB DECK PRE-DESIGN - Approach Span (12.6m)		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	TK	DATE	30-Nov-20
CHECKED BY	KG	DATE	16-Dec-20

RESULT SUMMARY

**Calculated conservatively without including contribution of slab to resistance (assumed non-composite)*

Original Girder	
ULS	
M_f/M_r	**0.82**
V_f/V_r	**0.50**
B_f/B_r	**0.63**
SLS	
Demand/Stress Limit	**0.55**
Rehabilitated Girder	
ULS	
M_f/M_r	**0.46**
V_f/V_r	**0.36**
B_f/B_r	**0.42**
SLS	
Demand/Stress Limit	**0.34**

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN - Tower Span Evaluation (10.6m)		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	TK	DATE	30-Nov-20
CHECKED BY	KG	DATE	16-Dec-20

General Information

Material Specifications

Structural Steel (CSA G40-4 or ASTM A7) - Original Steel

F_u =	410	MPa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	MPa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***
Unit Weight =	77	kN/m^3	***[CSA S6-19 cl. 3.6, Table 3.4]***
G_s =	77000	MPa	

Structural Steel - 1982 Rehabilitation - Strength from 1982 Rehabiliation Drawings

F_y =	350	MPa	***[1982 Rehabilitation Drawings]***
F_u =	450	MPa	***[CSA S6-19 cl. 14.7.4.2, Table 14.1]***

Reinforced Concrete - Deck

f'_c =	20	MPa	***[CSA S6-19 cl. 14.7.4.4 - unknown concrete strength]***
f_{cr} =	1.79	MPa	***[CSA S6-19 cl. 8.4.1.8.1]***
Unit Weight =	24	kN/m^3	***[CSA S6-19 cl. 3.6, Table 3.4]***
E_c =	21656	MPa	

[Slab details not provided on original construction drawings - reinforcement unknown]

Asphalt

Unit Weight =	23.5	kN/m^3	***[CSA S6-19 cl. 3.6, Table 3.4]***

Plain Concrete - Sidewalk Deck

Unit Weight =	23.5	kN/m^3	***[CSA S6-19 cl. 3.6, Table 3.4]***

Aluminum

Unit Weight =	27.0	kN/m^3	***[CSA S6-19 cl. 3.6, Table 3.4]***

Bridge Specifications

Span Length, L:	9.7000	m	***[According to Original Drawings]***
Roadway Width:	13.5636	m	***[According to 1982 Rehab Drawings]***
Tot. Deck Slab Width:	13.6	m	
West Exterior Cantilever L:	0	m	***[On west side, slab ends before girder flange edge]***
East Exterior Cantilever L:	0.6096	m	***[According to 1982 Rehab Drawings]***
No. of Design Lanes:	4		***[CSA S6-19 cl. 3.8.2, Table 3.5]***
Number of Girders:	8		
Original Girder Spacing:	1.931	m	***[According to Original Drawings]***
Int. Rehab. Girder Spacing	2.057	m	***[According to 1982 Rehab Drawings]***
Ext. Rehab. Girder Spacing	1.524	m	***[According to 1982 Rehab Drawings]***
Orig. Girder Type (Imperial):	W27x102		***[According to Original Drawings]***
Orig. Girder Type (Metric):	W690x152		***[CISC 6-38, 11TH Edition, 2016]***
Wide. Girder Type (Imperial):	W27x102		***[According to 1982 Rehab Drawings]***
Wide. Girder Type (Metric):	W690x152		***[CISC 6-38, 11TH Edition, 2016]***
Diaphragm Spacing (m):	3.2306		

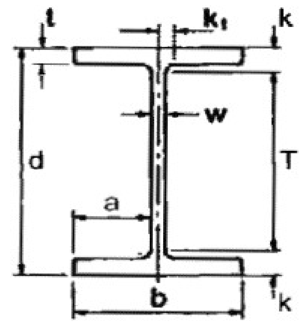
JOB TITLE	BCLB DECK PRE-DESIGN - Tower Span Evaluation (10.6m)		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	TK	DATE	30-Nov-20
CHECKED BY	KG	DATE	16-Dec-20

Section Properties

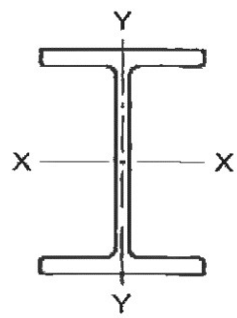
Non-Composite Bare Steel Girder

Longitudinal Stringer (W690x152) - Original Bridge

All data from CISC 11th Edition - 6-38, 3-39



Depth, d	688	mm
Flange width	254	mm
Flange thickness, t	21.1	mm
Web thickness, w	13.10	mm
Dead Load	1.49	kN/m
Area	19400	mm^2
Ix	1510000000	mm^4
Sx	4380000.00	mm^3
rx	279	mm
Zx	5000000	mm^3
Iy	57800000	mm^4
Sy	455000	mm^3
ry	54.6	mm
Zy	710000	mm^3
J	2200000	mm^4
Cw	6.42E+12	mm^6



Load Combinations (Original)

Load factors

Load factors from CSA S6-19 cl. 3.5, Table 3.1, 3.2 & 3.3

SLS	
Factory-produced component	1.00
Cast-in-place component	1.00
Wearing surfaces	1.00
Live Load (Vehicle)	0.90

FLS	
Factory-produced component	1.00
Cast-in-place component	1.00
Wearing surfaces	1.00
Live Load (Vehicle)	1.00

ULS 1 MAX	
Factory-produced component	1.10
Cast-in-place component	1.20
Wearing surfaces	1.50
Live Load (Vehicle)	1.70
Load Load (Pedestrian)	1.70

ULS 9	
Factory-produced component	1.35
Cast-in-place component	1.35
Wearing surfaces	1.35

**Results taken from grillage model created in Midas Civil*

Moment

Relative Span Distance		0L	0.1L	0.2L	0.3L	0.4L	0.5L
Absolute Span Distance		0.00 m	0.97 m	1.94 m	2.91 m	3.88 m	4.85 m
SLS	**Max.**	**0 kNm**	**233 kNm**	**388 kNm**	**476 kNm**	**523 kNm**	**543 kNm**
ULS	**ULS Max Env.**	**0 kNm**	**371 kNm**	**640 kNm**	**825 kNm**	**918 kNm**	**944 kNm**

**Taken from envelope of maximums*

Shear

Relative Span Distance		0L	
Absolute Span Distance		0.00 m	
SLS	**Max.**	**264 kN**	*At location of front floor beam*
ULS	**ULS Max Env.**	**464 kN**	*At location of front floor beam*

**Maximum shear is at location of support, 0L*

ULS Girder Resistance (Original)

*Assumed that girder section does not act compositely with the deck, shear studs are not shown in existing drawings

Original Girder Section: W690x152

Class of Section

Width-to-Thickness Ratio Limits in Comp. ***[CSA S6-19 cl. 10.9.2.1, Table 10.3]***

Flange		
Flange Class 1	9.56	
Flange Class 2	11.21	
Flange Class 3	13.19	
Web		
Web Class 1	72.53	
Web Class 2	112.09	
Web Class 3	125.28	

Width-to-Thickness Ratios of Girder

Flange		
Half width of flange, b	127	mm
Thickness of flange, t	21	mm
b/t	6	
Web		
Clear depth of web, h	645.8	mm
Thickness of web, w	13.10	mm
h/w	49	
Class of Section		
Flange Class:	1	
Web Class:	1	

Moment Resistance of Laterally Unbraced Members (Section Classes 1 & 2) - CSA S6-19 cl. 10.10.2.3

Unbraced Length, L	3149.6	mm	***[Distance between diaphragms]***
Plastic Moment, M_p			
Plastic Section Modulus, Z	5000000	mm^3	
Unbraced Length, L	3149.6	mm	
E_s	200000	MPa	
I_y	57800000	mm^4	
G_s	77000	MPa	
J	2200000	mm^4	
C_w	6.42E+12	mm^6	
M_u	**4392**	**kNm**	
Overall Moment Resist., M_r	**1093**	**kNm**	
Max ULS Factored Moment	**944**	**kNm**	
Demand/Capacity	**0.86**		

Shear Resistance - CSA S6-19 cl. 10.10.5.1

Spacing of Tranverse Stiffn, a	9700	mm	*[Unstiffened web]*
Web height, h	646.775	mm	*[Used reduced web height at south abutment per original drawings]*
a/h	15		
k_v	5.36		
h/w	49		
502√kv/Fy	76.62		
621√kv/Fy	94.78		
F_{cr}	**132.71**	**MPa**	
F_t	**0.00**	**MPa**	
F_s	**132.71**	**MPa**	
Area of Web, A_w	6778.202	mm^2	
Shear Resistance, V_r	**855**	**kN**	
Max ULS Factored Shear	**464**	**kN**	
Demand/Capacity	**0.54**		

Bearing Resistance - Front Floor Beam End

Bearing Resistance of Web - CSA S6-19 cl. 10.10.8.1

ϕ_{be}	0.75		
w	10.48	mm	***[20% reduction due to corrosion]***
N	254	mm	***[Bearing plate width similar to flange width]***
t	21	mm	
Bearing Resistance, Br per b)i)	**612**	**kN**	
Bearing Resistance, Br per b)ii)	**335**	**kN**	
Bearing Resistance, Br	**335**	**kN**	
Maximum Reaction	**802**	**kN**	
Demand/Capacity (Web Alone)	**2.39**		

Bearing Resistance of Stiffener - CSA S6-19 cl. 10.10.8.2

Stiffener Type	4x4x1/2	(Angle)	***[Imperial]***
	102x102x13	(Angle)	***[Metric]***
Number of Stiffeners	2		

Bearing Stiffener Dimensions

Width of Stiffener (Parallel Leg)	61.2	mm	***[CISC 6-70, 11TH Edition, 2016]***	40% reduction of parallel leg
ıickness of Stiffener (Parallel Leg)	12.7	mm	***[CISC 6-70, 11TH Edition, 2016]***	
Width of Stiffeners (Perpen Leg)	61.2	mm	***[CISC 6-70, 11TH Edition, 2016]***	40% reduction of perpen. leg
ıickness of Stiffener (Perpen Leg)	12.7	mm	***[CISC 6-70, 11TH Edition, 2016]***	

Bearing Resist. of Stiffeners

Area of Stiffener	1393.19	mm^2
Bearing Resist. of Stiffeners	865	kN

Overall Bearing Resistance (Web Resistance + Stiffener Resistance)

Total Bearing Resistance	**1200**	**kN**
Maximum Reaction	**802**	**kN**
Demand/Capacity	**0.67**	

Compressive Resistance - CSA S6-19 cl. 10.10.8.3

Girder Web Thickness	10.48	mm	
Web Height	645.8	mm	
Width of Stiffener (Perpen. Leg)	61.2	mm	*(Standard Angle)*
ıickness of Stiffener (Perpen. Leg)	12.7	mm	*(Standard Angle)*
Width of Stiffener (Parallel Leg)	61.2	mm	*(Standard Angle)*
ıickness of Stiffener (Parallel Leg)	12.7	mm	*(Standard Angle)*
Column Web Width, 12 x w	125.76	mm	*(Both sides)*

Column Section Properties - X-X Axis (Parallel to Girder Longitudinal Axis)

Element	*b*	*h*	*Number*	*A*	*y*	*Ay*	$y-y_0$	$A(y-y_0)$
Stiffener 1 - Perpendicular Leg	12.7	48.5	**1**	616	24.3	1.49E+04	-42	-25987
Stiffener 1 - Parallel Leg	61.2	12.7	**1**	777	54.9	4.26E+04	-12	-9008
Web	251.5	10.5	**1**	2636	66.4	1.75E+05	0	0
Stiffener 2 - Parallel Leg	61.2	12.7	**1**	777	78.0	6.06E+04	12	9008
Stiffener 2 - Perpendicular Leg	12.7	48.5	**1**	616	108.6	6.69E+04	42	25987
				Σ = 5422		**3.60E+05**		

Element	I_0	$A(y-y_0)^2$	I_x
Stiffener 1 - Perpendicular Leg	1.21E+05	1.10E+06	1.2E+06
Stiffener 1 - Parallel Leg	1.04E+04	1.04E+05	1.1E+05
Web	2.41E+04	0.00E+00	2.4E+04
Stiffener 2 - Parallel Leg	1.04E+04	1.04E+05	1.1E+05
Stiffener 2 - Perpendicular Leg	1.21E+05	1.10E+06	1.2E+06
			Σ = 2688085

Y_0	**66.44**

Column Section Properties - Y-Y Axis (Perpendicular to Girder Longitudinal Axis)

Element	*b*	*h*	*Number*	*A*	*x*	*Ax*	$x-x_0$	$A(x-x_0)$
Stiffener 1 - Perpendicular Leg	48.5	12.7	**1**	616	119.4	7.36E+04	4	2381
Stiffener 1 - Parallel Leg	12.7	61.2	**1**	777	95.2	7.40E+04	-20	-15844
Web	10.5	251.5	**1**	2636	125.8	3.31E+05	10	26926
Stiffener 2 - Parallel Leg	12.7	61.2	**1**	777	95.2	7.40E+04	-20	-15844
Stiffener 2 - Perpendicular Leg	48.5	12.7	**1**	616	119.4	7.36E+04	4	2381
				Σ = 5422		**6.27E+05**		

X_0	**115.54**

Element	I_0	$A(x-x_0)^2$	I_y
Stiffener 1 - Perpendicular Leg	8.28E+03	9.20E+03	1.7E+04
Stiffener 1 - Parallel Leg	2.43E+05	3.23E+05	5.7E+05
Web	1.39E+07	2.75E+05	1.4E+07
Stiffener 2 - Parallel Leg	2.43E+05	3.23E+05	5.7E+05
Stiffener 2 - Perpendicular Leg	8.28E+03	9.20E+03	1.7E+04
			Σ = 15337405

FL. Buckling Resistance about X-Axis

Effective Length Factor, K	0.7	
Length of Comp. Column, 0.75L	484.35	mm
Radius of Gyration about X, r_x	22.27	mm
Specified Min. Yield Stress, F_y	230	MPa
Modulus of Elasticity, E_s	200000	MPa
λ	0.164	
Resistance Factor	0.9	
Web-Stiffener Col Area	5422	mm^2
n	1.34	
Compressive Resistance, C_r	**1116**	**kN**

FL. Buckling Resistance about Y-Axis

Effective Length Factor, K	0.7	
Length of Comp. Column, 0.75L	484.35	mm
Radius of Gyration about Y, r_y	53.18	mm
Specified Min. Yield Stress, F_y	230	MPa
Modulus of Elasticity, E_s	200000	MPa
λ	0.069	
Resistance Factor	0.9	
Web-Stiffener Col Area	5422	mm^2
n	1.34	
Compressive Resistance, C_r	**1122**	**kN**

Overall Compressive Resistance, C_r	**1116**	**kN**
Maximum Factored Reaction	**802**	**kN**
Demand/Capacity	**0.72**	

Bearing Resistance - Rear Floor Beam End

Bearing Resistance of Web - CSA S6-19 cl. 10.10.8.1

ϕ_{be}	0.75		
w	10.48	mm	***[20% reduction due to corrosion]***
N	254	mm	***[Bearing plate width similar to flange width]***
t	19	mm	***[Thickness of bottom angles per original drawings]***
Bearing Resistance, Br per b)i)	**612**	**kN**	
Bearing Resistance, Br per b)ii)	**335**	**kN**	
Bearing Resistance, Br	**335**	**kN**	
Maximum Reaction	**802**	**kN**	
Demand/Capacity (Web Alone)	**2.39**		

Bearing Resistance of Stiffener - CSA S6-19 cl. 10.10.8.2

Stiffener Type	6x4x1/2	(Angle)	***[Imperial]***
	152x102x13	(Angle)	***[Metric]***
Number of Stiffeners	2		

Bearing Stiffener Dimensions

Width of Stiffener (Parallel Leg)	61.2	mm	***[CISC 6-70, 11TH Edition, 2016]***	40% reduction of parallel leg
ıickness of Stiffener (Parallel Leg)	12.7	mm	***[CISC 6-70, 11TH Edition, 2016]***	
Width of Stiffeners (Perpen Leg)	72.27	mm	***[Smaller of Flange width minus web thickness***	40% reduction of perpen. leg
Thickness of Stiffener	12.7	mm	***[CISC 6-70, 11TH Edition, 2016]***	

Bearing Resist. of Stiffeners

Area of Stiffener	1533.779	mm^2
Bearing Resist. of Stiffeners	952	kN

Overall Bearing Resistance (Web Resistance + Stiffener Resistance)

Total Bearing Resistance	**1288**	**kN**
Maximum Reaction	**802**	**kN**
Demand/Capacity	**0.62**	

JOB TITLE	BCLB DECK PRE-DESIGN - Tower Span Evaluation (10.6m)		
JOB NO.	60637587	CALCULATION NO.	
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CHECKED BY	KG	DATE	16-Dec-20

Compressive Resistance - CSA S6-19 cl. 10.10.8.3

Girder Web Thickness	10.48	mm	
Web Height	646.775	mm	
Width of Stiffener (Perpen. Leg)	72.27	mm	*(Standard Angle)*
ıickness of Stiffener (Perpen. Leg)	12.7	mm	*(Standard Angle)*
Width of Stiffener (Parallel Leg)	61.2	mm	*(Standard Angle)*
ıickness of Stiffener (Parallel Leg)	12.7	mm	*(Standard Angle)*
Column Web Width, 12 x w	125.76	mm	*(Both sides)*

Column Section Properties - X-X Axis (Parallel to Girder Longitudinal Axis)

Element	*b*	*h*	*Number*	*A*	*y*	*Ay*	*$y-y_0$*	*$A(y-y_0)$*
Stiffener 1 - Perpendicular Leg	12.7	59.6	**1**	757	29.8	2.25E+04	-48	-36106
Stiffener 1 - Parallel Leg	61.2	12.7	**1**	777	65.9	5.12E+04	-12	-9008
Web	125.8	10.5	**1**	1318	77.5	1.02E+05	0	0
Stiffener 2 - Parallel Leg	61.2	12.7	**1**	777	89.1	6.93E+04	12	9008
Stiffener 2 - Perpendicular Leg	12.7	59.6	**1**	757	125.2	9.47E+04	48	36106
				Σ = 4386		**3.40E+05**		

Element	*I_0*	*$A(y-y_0)^2$*	*I_x*
Stiffener 1 - Perpendicular Leg	2.24E+05	1.72E+06	1.9E+06
Stiffener 1 - Parallel Leg	1.04E+04	1.04E+05	1.1E+05
Web	1.21E+04	0.00E+00	1.2E+04
Stiffener 2 - Parallel Leg	1.04E+04	1.04E+05	1.1E+05
Stiffener 2 - Perpendicular Leg	2.24E+05	1.72E+06	1.9E+06
			Σ = 4135508

Y_0	**77.51**

Column Section Properties - Y-Y Axis (Perpendicular to Girder Longitudinal Axis)

Element	*b*	*h*	*Number*	*A*	*x*	*Ax*	*$x-x_0$*	*$A(x-x_0)$*
Stiffener 1 - Perpendicular Leg	59.6	12.7	**1**	757	119.4	9.03E+04	26	19356
Stiffener 1 - Parallel Leg	12.7	61.2	**1**	777	95.2	7.40E+04	1	1037
Web	10.5	125.8	**1**	1318	62.9	8.29E+04	-31	-40785
Stiffener 2 - Parallel Leg	12.7	61.2	**1**	777	95.2	7.40E+04	1	1037
Stiffener 2 - Perpendicular Leg	59.6	12.7	**1**	757	119.4	9.03E+04	26	19356
				Σ = 4386		**4.11E+05**		

X_0	**93.83**

Element	*I_0*	*$A(x-x_0)^2$*	*I_y*
Stiffener 1 - Perpendicular Leg	1.02E+04	4.95E+05	5.1E+05
Stiffener 1 - Parallel Leg	2.43E+05	1.38E+03	2.4E+05
Web	1.74E+06	1.26E+06	3.0E+06
Stiffener 2 - Parallel Leg	2.43E+05	1.38E+03	2.4E+05
Stiffener 2 - Perpendicular Leg	1.02E+04	4.95E+05	5.1E+05
			Σ = 4497846

FL. Buckling Resistance about X-Axis

Effective Length Factor, K	0.7	
Length of Comp. Column, 0.75L	485.08125	mm
Radius of Gyration about X, r_x	30.71	mm
Specified Min. Yield Stress, F_y	230	MPa
Modulus of Elasticity, E_s	200000	MPa
λ	0.119	
Resistance Factor	0.9	
Web-Stiffener Col Area	4386	mm^2
n	1.34	
Compressive Resistance, C_r	**906**	**kN**

FL. Buckling Resistance about Y-Axis

Effective Length Factor, K	0.7	
Length of Comp. Column, 0.75L	485.08125	mm
Radius of Gyration about Y, r_y	32.03	mm
Specified Min. Yield Stress, F_y	230	MPa
Modulus of Elasticity, E_s	200000	MPa
λ	0.114	
Resistance Factor	0.9	
Web-Stiffener Col Area	4386	mm^2
n	1.34	
Compressive Resistance, C_r	**906**	**kN**

Overall Compressive Resistance, C_r	**906**	**kN**
Maximum Factored Reaction	**802**	**kN**
Demand/Capacity	**0.89**	

Final Bearing Resistance:	**906**	**kN**
Maximum Factored Reaction:	**802**	**kN**
Utilization (Demand/Capacity):	**0.89**	

**Reaction taken at front floor beam location - girder continuous*

SLS Girder Resistance (Original)

*Calculated conservatively not accounting for composite properties

Control of Permanent Deflections *[CSA S6-19 Cl. 10.11.4]*

Max. SLS Moment	543	kNm
Section Modulus, S	4380000	mm^3
Stress in Flange	**124**	**MPa**
Stress Limit (0.9F_y)	**207**	**MPa**
Demand/Capacity	**0.60**	

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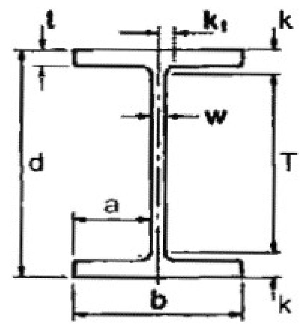
Section Properties

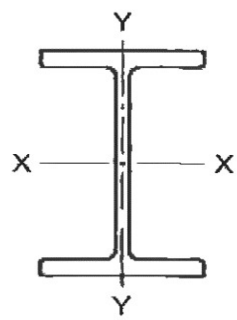
Non-Composite Bare Steel Girder

Longitudinal Stringer (W690x152) - Rehabilitation Bridge

All data from CISC 11th Edition - 6-38, 3-39



Depth, d	688	mm
Flange width	254	mm
Flange thickness, t	21.1	mm
Web thickness, w	13.10	mm
Dead Load	1.49	kN/m
Area	19400	mm^2
Ix	1510000000	mm^4
Sx	4380000.00	mm^3
rx	279	mm
Zx	5000000	mm^3
Iy	57800000	mm^4
Sy	455000	mm^3
ry	54.6	mm
Zy	710000	mm^3
J	2200000	mm^4
Cw	6.42E+12	mm^6



Load Combinations (Rehabilitated)

Load factors

Load factors from CSA S6-19 cl. 3.5, Table 3.1, 3.2 & 3.3

SLS		FLS	
Factory-produced component	1.00	Factory-produced component	1.00
Cast-in-place component	1.00	Cast-in-place component	1.00
Wearing surfaces	1.00	Wearing surfaces	1.00
Live Load (Vehicle)	0.90	Live Load (Vehicle)	1.00

ULS 1 MAX		ULS 9	
Factory-produced component	1.10	Factory-produced component	1.35
Cast-in-place component	1.20	Cast-in-place component	1.35
Wearing surfaces	1.50	Wearing surfaces	1.35
Live Load (Vehicle)	1.70		
Load Load (Pedestrian)	1.70		

**Results taken from grillage model created in Midas Civil*

Moment

Relative Span Distance		0L	0.1L	0.2L	0.3L	0.4L	0.5L
Absolute Span Distance		0.00 m	0.97 m	1.94 m	2.91 m	3.88 m	4.85 m
SLS	**Max.**	**0 kNm**	**275 kNm**	**410 kNm**	**488 kNm**	**536 kNm**	**560 kNm**
ULS	**ULS Max Env.**	**0 kNm**	**481 kNm**	**707 kNm**	**834 kNm**	**914 kNm**	**956 kNm**

**Critical girder is 2nd interior from east*

Shear

Relative Span Distance		0L
Absolute Span Distance		0.00 m
SLS	**Max.**	**294 kN**
ULS	**ULS Max Env.**	**514 kN**

**Maximum shear occurs at location of support, 0L*

ULS Girder Resistance (Rehabilitated)

*Assumed that girder section does not act compositely with the deck, shear studs are not shown in existing drawings

Original Girder Section: W690x152

Class of Section

Width-to-Thickness Ratio Limits in Comp. ***[CSA S6-19 cl. 10.9.2.1, Table 10.3]***

Flange		
Flange Class 1	7.75	
Flange Class 2	9.09	
Flange Class 3	10.69	
Web		
Web Class 1	58.80	
Web Class 2	90.87	
Web Class 3	101.56	

Width-to-Thickness Ratios of Girder

Flange		
Half width of flange, b	127	mm
Thickness of flange, t	21	mm
b/t	6	
Web		
Clear depth of web, h	645.8	mm
Thickness of web, w	13.10	mm
h/w	49	

Class of Section

Flange Class:	1
Web Class:	1

Moment Resistance of Laterally Unbraced Members (Section Classes 1 & 2) - CSA S6-19 cl. 10.10.2.3

Unbraced Length, L 3149.6 mm ***[Distance between diaphragms]***

Plastic Moment, M_p

Plastic Section Modulus, Z	5000000	mm^3
Unbraced Length, L	3149.6	mm
E_s	200000	MPa
I_y	57800000	mm^4
G_s	77000	MPa
J	2200000	mm^4
C_w	6.42E+12	mm^6
M_u	**4433**	**kNm**
Overall Moment Resist., M_r	**1663**	**kNm**
Max ULS Factored Moment	**956**	**kNm**
Demand/Capacity	**0.58**	

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Shear Resistance - CSA S6-19 cl. 10.10.5.1

Spacing of Tranverse Stiffn, a	9700	mm	***[Unstiffened web]***
Web height, h	646.775	mm	***[Used reduced web height at south abutment per original drawings]***
a/h	15		
k_v	5.36		
h/w	49		
502√kv/Fy	62.11		
621√kv/Fy	76.83		
F_{cr}	**201.95**	**MPa**	
F_t	**0.00**	**MPa**	
F_s	**201.95**	**MPa**	
Area of Web, A_w	6778.202	mm^2	
Shear Resistance, V_r	**1300**	**kN**	
Max ULS Factored Shear	**514**	**kN**	
Demand/Capacity	**0.40**		

Bearing Resistance - Front Floor Beam End

Bearing Resistance of Web - CSA S6-19 cl. 10.10.8.1

ϕ_{be}	0.75		
w	10.48	mm	***[20% reduction due to corrosion]***
N	200	mm	***[Bearing plate width similar to flange width]***
t	21	mm	
Bearing Resistance, Br per b)i)	**782**	**kN**	
Bearing Resistance, Br per b)ii)	**414**	**kN**	
Bearing Resistance, Br	**414**	**kN**	
Maximum Reaction	**889**	**kN**	
Demand/Capacity (Web Alone)	**2.15**		

Bearing Resistance of Stiffener - CSA S6-19 cl. 10.10.8.2

Stiffener Type	4x4x1/2	(Angle)	***[Imperial]***
	102x102x13	(Angle)	***[Metric]***
Number of Stiffeners	2		

Bearing Stiffener Dimensions

Width of Stiffener (Parallel Leg)	51	mm	***[CISC 6-70, 11TH Edition, 2016]***	50% reduction of parallel leg
ıickness of Stiffener (Parallel Leg)	12.7	mm	***[CISC 6-70, 11TH Edition, 2016]***	
Width of Stiffeners (Perpen Leg)	51	mm	***[CISC 6-70, 11TH Edition, 2016]***	50% reduction of perpen. leg
Thickness of Stiffener	12.7	mm	***[CISC 6-70, 11TH Edition, 2016]***	

Bearing Resist. of Stiffeners

Area of Stiffener	1134.11	mm^2
Bearing Resist. of Stiffeners	1072	kN

Overall Bearing Resistance (Web Resistance + Stiffener Resistance)

Total Bearing Resistance	**1485**	**kN**
Maximum Reaction	**889**	**kN**
Demand/Capacity	**0.60**	

Compressive Resistance - CSA S6-19 cl. 10.10.8.3

Girder Web Thickness	10.48	mm	
Web Height	645.8	mm	
Width of Stiffener (Perpen. Leg)	51	mm	*(Standard Angle)*
ıickness of Stiffener (Perpen. Leg)	12.7	mm	*(Standard Angle)*
Width of Stiffener (Parallel Leg)	51	mm	*(Standard Angle)*
ıickness of Stiffener (Parallel Leg)	12.7	mm	*(Standard Angle)*
Column Web Width, 12 x w	125.76	mm	*(Both sides)*
Horiz. Distance to Centroid of L	0	mm	***[CISC 6-70, 11TH Edition, 2016 (y distance)]***

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN - Tower Span Evaluation (10.6m)		
JOB NO.	60637587	CALCULATION NO.	
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Column Section Properties - X-X Axis (Parallel to Girder Longitudinal Axis)

Element	b	h	Number	A	y	Ay	$y-y_0$	$A(y-y_0)$
Stiffener 1 - Perpendicular Leg	12.7	38.3	1	486	19.2	9.31E+03	-37	-18041
Stiffener 1 - Parallel Leg	51.0	12.7	1	648	44.7	2.89E+04	-12	-7507
Web	251.5	10.5	1	2636	56.2	1.48E+05	0	0
Stiffener 2 - Parallel Leg	51.0	12.7	1	648	67.8	4.39E+04	12	7507
Stiffener 2 - Perpendicular Leg	12.7	38.3	1	486	93.3	4.54E+04	37	18041
				Σ = 4904		**2.76E+05**		

Element	I_0	$A(y-y_0)^2$	I_x
Stiffener 1 - Perpendicular Leg	5.95E+04	6.69E+05	7.3E+05
Stiffener 1 - Parallel Leg	8.71E+03	8.70E+04	9.6E+04
Web	2.41E+04	0.00E+00	2.4E+04
Stiffener 2 - Parallel Leg	8.71E+03	8.70E+04	9.6E+04
Stiffener 2 - Perpendicular Leg	5.95E+04	6.69E+05	7.3E+05
			Σ = 1672741

Y_0	56.24

Column Section Properties - Y-Y Axis (Perpendicular to Girder Longitudinal Axis)

Element	b	h	Number	A	x	Ax	$x-x_0$	$A(x-x_0)$
Stiffener 1 - Perpendicular Leg	38.3	12.7	1	486	119.4	5.81E+04	2	800
Stiffener 1 - Parallel Leg	12.7	51.0	1	648	100.3	6.49E+04	-18	-11338
Web	10.5	251.5	1	2636	125.8	3.31E+05	8	21075
Stiffener 2 - Parallel Leg	12.7	51.0	1	648	100.3	6.49E+04	-18	-11338
Stiffener 2 - Perpendicular Leg	38.3	12.7	1	486	119.4	5.81E+04	2	800
				Σ = 4904		**5.78E+05**		

X_0	117.76

Element	I_0	$A(x-x_0)^2$	I_y
Stiffener 1 - Perpendicular Leg	6.54E+03	1.32E+03	7.9E+03
Stiffener 1 - Parallel Leg	1.40E+05	1.98E+05	3.4E+05
Web	1.39E+07	1.69E+05	1.4E+07
Stiffener 2 - Parallel Leg	1.40E+05	1.98E+05	3.4E+05
Stiffener 2 - Perpendicular Leg	6.54E+03	1.32E+03	7.9E+03
			Σ = 14758167

FL. Buckling Resistance about X-Axis

Effective Length Factor, K	0.7	
Length of Comp. Column, 0.75L	484.35	mm
Radius of Gyration about X, r_x	18.47	mm
Specified Min. Yield Stress, F_y	350	MPa
Modulus of Elasticity, E_s	200000	MPa
λ	0.244	
Resistance Factor	0.9	
Web-Stiffener Col Area	4904	mm^2
n	1.34	
Compressive Resistance, C_r	**1519**	**kN**

FL. Buckling Resistance about Y-Axis

Effective Length Factor, K	0.7	
Length of Comp. Column, 0.75L	484.35	mm
Radius of Gyration about Y, r_y	54.86	mm
Specified Min. Yield Stress, F_y	350	MPa
Modulus of Elasticity, E_s	200000	MPa
λ	0.082	
Resistance Factor	0.9	
Web-Stiffener Col Area	4904	mm^2
n	1.34	
Compressive Resistance, C_r	**1543**	**kN**

Overall Compressive Resistance, C_r	**1519**	**kN**
Maximum Factored Reaction	**889**	**kN**
Demand/Capacity	**0.59**	

Bearing Resistance - Rear Floor Beam End

Bearing Resistance of Web - CSA S6-19 cl. 10.10.8.1

ϕ_{be}	0.75		
w	10.48	mm	***[20% reduction due to corrosion]***
N	200	mm	***[Bearing plate width similar to flange width]***
t	19	mm	***[Thickness of bottom angles per original drawings]***
Bearing Resistance, Br per b)i)	**782**	**kN**	
Bearing Resistance, Br per b)ii)	**414**	**kN**	
Bearing Resistance, Br	**414**	**kN**	
Maximum Reaction	**889**	**kN**	
Demand/Capacity (Web Alone)	**2.15**		

Bearing Resistance of Stiffener - CSA S6-19 cl. 10.10.8.2

Stiffener Type	6x4x1/2	(Angle)	***[Imperial]***
	152x102x13	(Angle)	***[Metric]***
Number of Stiffeners	2		

Bearing Stiffener Dimensions

Width of Stiffener (Parallel Leg)	51	mm	***[CISC 6-70, 11TH Edition, 2016]***	50% reduction of parallel leg
ıickness of Stiffener (Parallel Leg)	12.7	mm	***[CISC 6-70, 11TH Edition, 2016]***	
Width of Stiffeners (Perpen Leg)	60.225	mm	***[Smaller of Flange width minus web thickness a***	50% reduction of perpen. leg
Thickness of Stiffener	12.7	mm	***[CISC 6-70, 11TH Edition, 2016]***	

Bearing Resist. of Stiffeners

Area of Stiffener	1251.2675	mm^2
Bearing Resist. of Stiffeners	1182	kN

Overall Bearing Resistance (Web Resistance + Stiffener Resistance)

Total Bearing Resistance	**1596**	**kN**
Maximum Reaction	**889**	**kN**
Demand/Capacity	**0.56**	

Compressive Resistance - CSA S6-19 cl. 10.10.8.3

Girder Web Thickness	10.48	mm	
Web Height	646.775	mm	
Width of Stiffener (Perpen. Leg)	60.225	mm	*(Standard Angle)*
ıickness of Stiffener (Perpen. Leg)	12.7	mm	*(Standard Angle)*
Width of Stiffener (Parallel Leg)	51	mm	*(Standard Angle)*
ıickness of Stiffener (Parallel Leg)	12.7	mm	*(Standard Angle)*
Column Web Width, 12 x w	125.76	mm	*(Both sides)*

Column Section Properties - X-X Axis (Parallel to Girder Longitudinal Axis)

Element	b	h	Number	A	y	Ay	$y-y_0$	$A(y-y_0)$
Stiffener 1 - Perpendicular Leg	12.7	47.5	1	604	23.8	1.43E+04	-42	-25170
Stiffener 1 - Parallel Leg	51.0	12.7	1	648	53.9	3.49E+04	-12	-7507
Web	125.8	10.5	1	1318	65.5	8.63E+04	0	0
Stiffener 2 - Parallel Leg	51.0	12.7	1	648	77.1	4.99E+04	12	7507
Stiffener 2 - Perpendicular Leg	12.7	47.5	1	604	107.2	6.47E+04	42	25170
				Σ = 3820		**2.50E+05**		

Element	I_0	$A(y-y_0)^2$	I_x
Stiffener 1 - Perpendicular Leg	1.14E+05	1.05E+06	1.2E+06
Stiffener 1 - Parallel Leg	8.71E+03	8.70E+04	9.6E+04
Web	1.21E+04	0.00E+00	1.2E+04
Stiffener 2 - Parallel Leg	8.71E+03	8.70E+04	9.6E+04
Stiffener 2 - Perpendicular Leg	1.14E+05	1.05E+06	1.2E+06
			Σ = 2530015

Y_0	65.47

Column Section Properties - Y-Y Axis (Perpendicular to Girder Longitudinal Axis)

Element	b	h	Number	A	x	Ax	$x-x_0$	$A(x-x_0)$
Stiffener 1 - Perpendicular Leg	47.5	12.7	1	604	119.4	7.21E+04	26	15689
Stiffener 1 - Parallel Leg	12.7	51.0	1	648	100.3	6.49E+04	7	4433
Web	10.5	125.8	1	1318	62.9	8.29E+04	-31	-40245
Stiffener 2 - Parallel Leg	12.7	51.0	1	648	100.3	6.49E+04	7	4433
Stiffener 2 - Perpendicular Leg	47.5	12.7	1	604	119.4	7.21E+04	26	15689
				Σ = 3820		**3.57E+05**		

X_0	93.42

Element	I_0	$A(x-x_0)^2$	I_y
Stiffener 1 - Perpendicular Leg	8.11E+03	4.08E+05	4.2E+05
Stiffener 1 - Parallel Leg	1.40E+05	3.03E+04	1.7E+05
Web	1.74E+06	1.23E+06	3.0E+06
Stiffener 2 - Parallel Leg	1.40E+05	3.03E+04	1.7E+05
Stiffener 2 - Perpendicular Leg	8.11E+03	4.08E+05	4.2E+05
			Σ = 4139290

FL. Buckling Resistance about X-Axis

Effective Length Factor, K	0.7	
Length of Comp. Column, 0.75L	485.08125	mm
Radius of Gyration about X, r_x	25.73	mm
Specified Min. Yield Stress, F_y	350	MPa
Modulus of Elasticity, E_s	200000	MPa
λ	0.176	
Resistance Factor	0.9	
Web-Stiffener Col Area	3820	mm^2
n	1.34	
Compressive Resistance, C_r	**1195**	**kN**

FL. Buckling Resistance about Y-Axis

Effective Length Factor, K	0.7	
Length of Comp. Column, 0.75L	485.08125	mm
Radius of Gyration about Y, r_y	32.92	mm
Specified Min. Yield Stress, F_y	350	MPa
Modulus of Elasticity, E_s	200000	MPa
λ	0.137	
Resistance Factor	0.9	
Web-Stiffener Col Area	3820	mm^2
n	1.34	
Compressive Resistance, C_r	**1199**	**kN**
Overall Compressive Resistance, C_r	**1195**	**kN**
Maximum Factored Reaction	**889**	**kN**
Demand/Capacity	**0.74**	

Final Bearing Resistance:	**1195**	**kN**
Maximum Factored Reaction:	**889**	**kN**
Utilization (Demand/Capacity):	**0.74**	

**Reaction taken at front floor beam location - girder continuous*

SLS Girder Resistance (Rehabilitated)

*Calculated conservatively not accounting for composite properties

Control of Permanent Deflections *[CSA S6-19 Cl. 10.11.4]*

Max. SLS Moment	560	kNm
Section Modulus, S	4380000	mm^3
Stress in Flange	**128**	**MPa**
Stress Limit (0.9F_y)	**315**	**MPa**
Demand/Capacity	**0.41**	

JOB TITLE	BCLB DECK PRE-DESIGN - Tower Span Evaluation (10.6m)		
JOB NO.	60637587	CALCULATION NO.	
ORIGINATOR BY	TK	DATE	30-Nov-20
CHECKED BY	KG	DATE	16-Dec-20

RESULT SUMMARY

**Calculated conservatively without including contribution of slab to resistance (assumed non-composite)*

Original Girder

ULS

M_f/M_r	**0.86**
V_f/V_r	**0.54**
B_f/B_r	**0.89**

SLS

Demand/Stress Limit	**0.60**

Rehabilitated Girder

ULS

M_f/M_r	**0.58**
V_f/V_r	**0.40**
B_f/B_r	**0.74**

SLS

Demand/Stress Limit	**0.41**

JOB TITLE	BCLB DECK PRE-DESIGN - Floor Beam Evaluation		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	TK	DATE	30-Nov-20
CHECKED BY	KG	DATE	16-Dec-20

General Information

Material Specifications

Structural Steel (CSA G40-4 or ASTM A7) - Original Steel

F_u =	410	MPa	***[CISC 6-7, 11TH Edition, 2016]***
F_y =	230	MPa	***[CISC 6-7, 11TH Edition, 2016]***
ϕ_s =	0.95		***[CSA S6-19 cl. 10.5.7]***
E =	200000	MPa	***[CSA S6-19 cl. 10.4.2]***
Unit Weight =	77	kN/m^3	***[CSA S6-19 cl. 3.6, Table 3.4]***
G_s =	77000	MPa	

Structural Steel - 1982 Rehabilitation - Strength not listed on rehabilitation drawings

F_y =	300	MPa	***[CSA S6-19 cl. 14.7.4.2, Table 14.1]***
F_u =	450	MPa	***[CSA S6-19 cl. 14.7.4.2, Table 14.1]***

Reinforced Concrete - Deck

f'_c =	20	MPa	***[CSA S6-19 cl. 14.7.4.4 - unknown concrete strength]***
f_{cr} =	1.79	MPa	***[CSA S6-19 cl. 8.4.1.8.1]***
Unit Weight =	24	kN/m^3	***[CSA S6-19 cl. 3.6, Table 3.4]***
E_c =	21656	MPa	

[Slab details not provided on original construction drawings - reinforcement unknown]

Asphalt

Unit Weight =	23.5	kN/m^3	***[CSA S6-19 cl. 3.6, Table 3.4]***

Plain Concrete - Sidewalk Deck

Unit Weight =	23.5	kN/m^3	***[CSA S6-19 cl. 3.6, Table 3.4]***

Aluminum

Unit Weight =	27.0	kN/m^3	***[CSA S6-19 cl. 3.6, Table 3.4]***

General Information

Total Length of Floor Beam	15.0014		***[Considered length from faces of tower columns]***

JOB TITLE	BCLB DECK PRE-DESIGN - Floor Beam Evaluation		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	TK	DATE	30-Nov-20
CHECKED BY	KG	DATE	16-Dec-20

Section Properties

Non-Composite Built-Up Floor Beam

Section Properties have been reduced

Data for angles sections from CISC 11th Edition - 6-68, 6-69

Components	Web	T. Plate	B. Plate	Top L's	Bottom L's
Specified Size	-	-	-	L203x203x13	L203x203x13
No.	1	1	1	2	2
Height (mm)	1803	6.35	6.35	12.7	12.7
Width (mm)	19	508	508	203	203
I_x (mm^4)	9310862860	10839	10839	20200000	20200000
I_y (mm^4)	1038953	69371904	69371904	20200000	20200000
A_g (mm^2)	34355	3226	3226	10000	10000
y top or bot (mm)	908.05	3.175	1812.925	61.85	1755
x (mm)	254	254	254	188.975	188.975
x2 (mm)	0	0	0	319.025	319.025
Trans. I_x (mm^4)	9310862860	2641291898	2641291898	7200944400	7209408900
Trans. I_y (mm^4)	1038952.66	69371904.27	69371904.3	41341253.1	41341253.13
Trans. $I_{y\text{-}2}$ (mm^4)	0	0	0	41341253.1	41341253.13

y top & bottom	908.05	mm	
x	254	mm	
Total A_g	60806	mm^2	
Total I_x (mm^4)	29003799956	mm^4	
Trans I_y (mm^4)	305147774	mm^4	
r_x	691	mm	
r_y	71	mm	
Y_c	623	mm	
X_c	176	mm	
Z_x	37864619	mm^3	
Z_y	5341175	mm^3	
S_x	31940752	mm^3	
S_y	1201369	mm^3	
J	4242526	mm^4	***[Angles not included in calculation - I-beam]***
d1	1809.75	mm	
c_w	1.13603E+14	mm^6	***[Angles not included in calculation - I-beam]***

ULS Girder Resistance

Maximum Factored Model Response (Midas)

***Considered interior railway support**

Maximum Moment, $M_{fmax(+)}$	3745	kNm
Maximum Moment, $M_{fmax(-)}$	3362	kNm
Maximum Shear, V_{fmax}	1894	kNm

Class of Section

Width-to-Thickness Ratio Limits in Comp. ***[CSA S6-19 cl. 10.9.2.1, Table 10.3]***

Flange	
Flange Class 1	9.56
Flange Class 2	11.21
Flange Class 3	13.19
Web	
Web Class 1	72.53
Web Class 2	112.09
Web Class 3	125.28

Width-to-Thickness Ratios of Girder

Flange		
Half width of flange, b	254	mm
Thickness of flange, t	21	mm
b/t	12	
Web		
Clear depth of web, h	1803	mm
Thickness of web, w	19.05	mm
h/w	95	

Class of Section

Flange Class:	3
Web Class:	2

Moment Resistance of Laterally Unbraced Members (Section Class 3) - CSA S6-19 cl. 10.10.2.3

In positive moment region, assumed that girder spacing is unbraced length for flange

Unbraced Length, L	2000	mm
Plastic Moment, M_p		
Elastic Section Modulus, Sx	31940752	mm^3
Yield Stress, F_y	230	MPa
Yield Moment, M_y	7346.372986	kNm
$0.67M_y$	**4922.0699**	**kNm**
Critical Elastic Moment, M_u		
M_{max}	3745	Relative value
M_a	3160	Relative value
M_b	3261	Relative value
M_c	3361	Relative value
ω_2 Coefficient	1.14	
Unbraced Length, L	2000	mm
E_s	200000	MPa
I_y	305147774	mm^4
G_s	77000	MPa
J	4242526	mm^4
C_w	1.13603E+14	mm^6
M_u	**104768**	**kNm**
Overall Moment Resist., M_r	**6979**	**kNm**
Max ULS Factored Moment	**3745**	**kNm**
Demand/Capacity	**0.54**	

Shear Resistance - CSA S6-19 cl. 10.10.5.1

Spacing of Tranverse Stiffn, a	1220	mm	***[Spacing on railway side of floor beam]***
Web height, h	1803	mm	***[Used reduced web height at south abutment per original drawings]***
a/h	1		
k_v	15.67		
h/w	95		
502√kv/Fy	131.02		
621√kv/Fy	162.08		
F_{cr}	**132.71**	**MPa**	
F_t	**0.00**	**MPa**	
F_s	**132.71**	**MPa**	
Area of Web, A_w	34354.77	mm^2	
Shear Resistance, V_r	**4331**	**kN**	
Max ULS Factored Shear	**1894**	**kN**	
Demand/Capacity	**0.44**		

Bearing Resistance of Web - CSA S6-19 cl. 10.10.8

<u>Bearing Resistance of Web - CSA S6-19 cl. 10.10.8.1</u>

ϕ_{bi}	0.8		
w	19.05	mm	
N	400	mm	***[Bearing plate similar dimensions to the support]***
t	6.35	mm	
Bearing Resistance, Br per a)i)	2142	kN	*[a) equations used since support location is 2.951 from column face,*
Bearing Resistance, Br per a)ii)	2855	kN	*longer than approx 1.85 m depth of floor beam]*
Web Bearing Resistance, Br	**2142**	**kN**	

JOB TITLE	BCLB DECK PRE-DESIGN - Floor Beam Evaluation		
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CHECKED BY	KG	DATE	16-Dec-20

Section Properties

Non-Composite Built-Up Floor Beam

Section Properties have been reduced

Data for angles sections from CISC 11th Edition - 6-68, 6-69

Components	Web	T. Plate	B. Plate	Top L's	Bottom L's
Specified Size	-	-	-	L203x203x13	L203x203x13
No.	1	1	1	2	2
Height (mm)	1803	11.43	11.43	12.7	12.7
Width (mm)	13	508	508	203	203
I_x (mm^4)	6207241907	63215	63215	20200000	20200000
I_y (mm^4)	307838	124869428	124869428	20200000	20200000
A_g (mm^2)	22903	5806	5806	10000	10000
y top or bot (mm)	913.13	5.715	1820.545	66.93	1760
x (mm)	254	254	254	192.15	192.15
x2 (mm)	0	0	0	315.85	315.85
Trans. I_x (mm^4)	6207241907	4781097421	4781097421	7180744400	7189208900
Trans. I_y (mm^4)	307837.8252	124869428	124869428	39327112.5	39327112.5
Trans. I_{y-2} (mm^4)	0	0	0	39327112.5	39327112.5

y top & bottom	913.13	mm	
x	254	mm	
Total A_g	54516	mm^2	
Total I_x (mm^4)	30139390049	mm^4	
Trans I_y (mm^4)	407355143	mm^4	
r_x	744	mm	
r_y	86	mm	
Y_c	682	mm	
X_c	155	mm	
Z_x	37164482	mm^3	
Z_y	4228263	mm^3	
S_x	33006680	mm^3	
S_y	1603760	mm^3	
J	1737072	mm^4	***[Angles not included in calculation - I-beam]***
d1	1814.83	mm	
c_w	2.05635E+14	mm^6	***[Angles not included in calculation - I-beam]***

ULS Girder Resistance

Maximum Factored Model Response (Midas)

Maximum Moment, $M_{fmax(+)}$	3140	kNm
Maximum Moment, $M_{fmax(-)}$	2555	kNm
Maximum Shear, V_{fmax}	1486	kNm

Class of Section

Width-to-Thickness Ratio Limits in Comp. ***[CSA S6-19 cl. 10.9.2.1, Table 10.3]***

Flange	
Flange Class 1	9.56
Flange Class 2	11.21
Flange Class 3	13.19
Web	
Web Class 1	72.53
Web Class 2	112.09
Web Class 3	125.28

Width-to-Thickness Ratios of Girder

Flange		
Half width of flange, b	254	mm
Thickness of flange, t	21	mm
b/t	12	
Web		
Clear depth of web, h	1803	mm
Thickness of web, w	12.70	mm
h/w	142	

Class of Section

Flange Class:	3
Web Class:	3

Moment Resistance of Laterally Unbraced Members (Section Classes 3) - CSA S6-19 cl. 10.10.2.3

In negative moment region, assumed that floor beam acts as as laterally unbraced from intermediate support to column

Unbraced Length, L	2000	mm
Plastic Moment, M_p		
Elastic Section Modulus, Sx	33006680	mm^3
Yield Stress, F_y	230	MPa
Yield Moment, M_y	7591.536486	kNm
$0.67M_p$	**5086.329445**	**kNm**
Critical Elastic Moment, M_u		
M_{max}	2751	kNm
M_a	2549	kNm
M_b	2618	kNm
M_c	2685	kNm
ω_2 Coefficient	1.05	
Unbraced Length, L	2000	mm
E_s	200000	MPa
I_y	407355143	mm^4
G_s	77000	MPa
J	1737072	mm^4
C_w	2.05635E+14	mm^6
M_u	**149697**	**kNm**
Overall Moment Resist., M_r	**7212**	**kNm**
Max ULS Factored Moment	**3140**	**kNm**
Demand/Capacity	**0.44**	

Shear Resistance - CSA S6-19 cl. 10.10.5.1

Spacing of Tranverse Stiffn, a	1220	mm	***[Spacing on railway side of floor beam]***
Web height, h	1803	mm	***[Used reduced web height at south abutment per original drawings]***
a/h	1		
k_v	15.67		
h/w	142		
502√kv/Fy	131.02		
621√kv/Fy	162.08		
F_{cr}	**122.60**	**MPa**	
F_t	**7.31**	**MPa**	
F_s	**129.91**	**MPa**	
Area of Web, A_w	22903.18	mm^2	
Shear Resistance, V_r	**2827**	**kN**	
Max ULS Factored Shear	**1486**	**kN**	
Demand/Capacity	**0.53**		

Exhibit B.6

Lift Span Existing Evaluation 3D Model

Exhibit B.6.1. Bridge Lowered Structural Evaluation

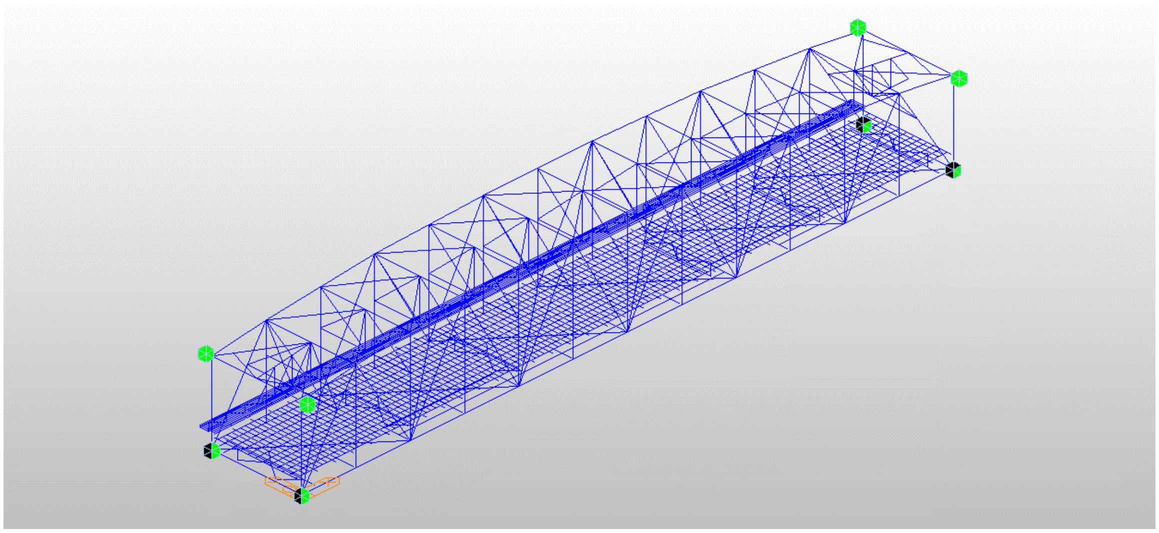


Figure 1 2D Frame Model with Supports

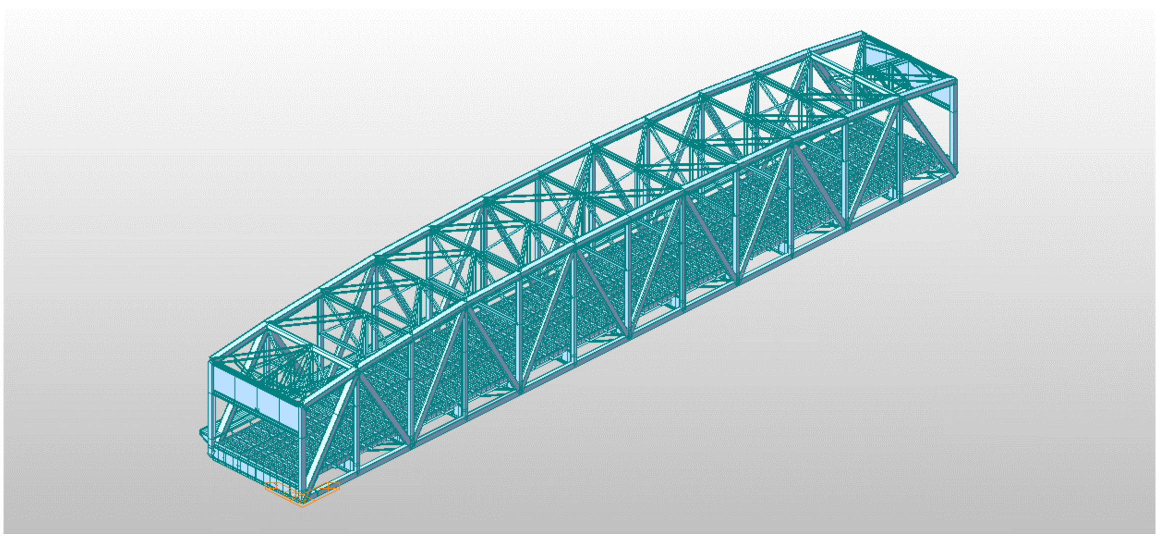


Figure 2 3D Frame Model

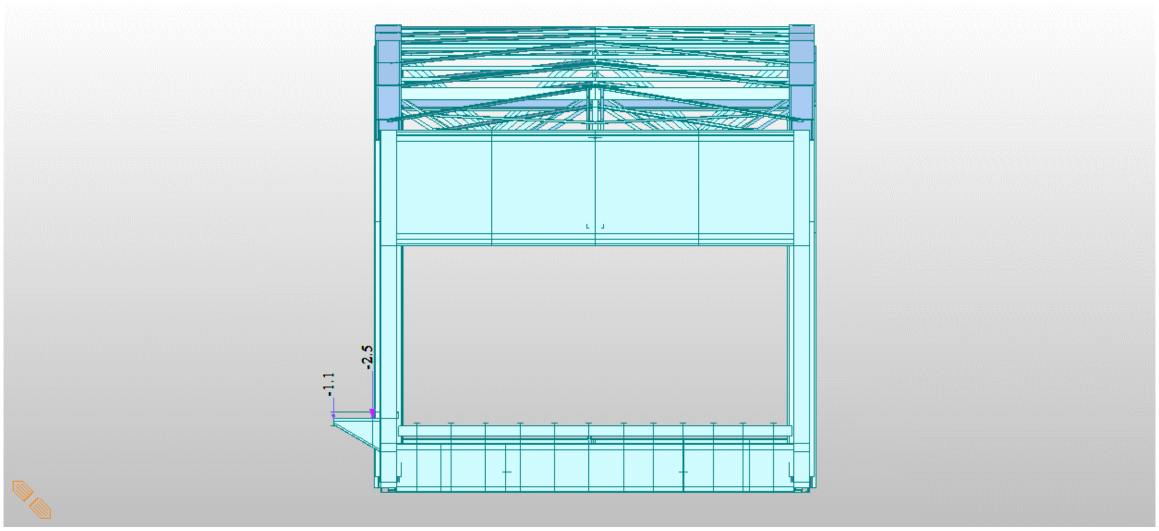


Figure 3 Wind Load Vertical Sidewalk

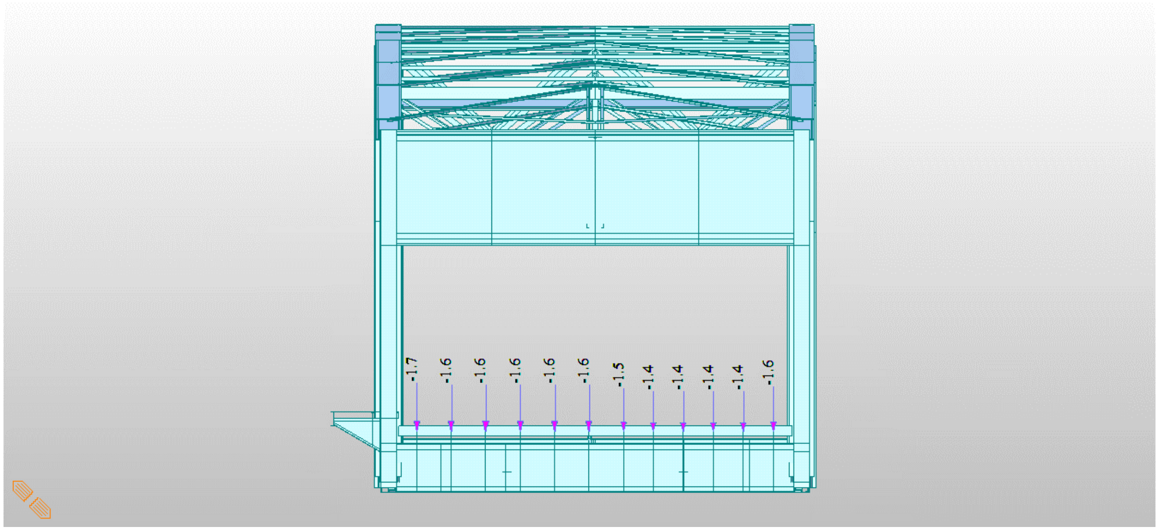


Figure 4 Wind Load Vertical Stringer

*Wind for calculations taken as 85% as per CHBDC S6-19 13.6.4.6

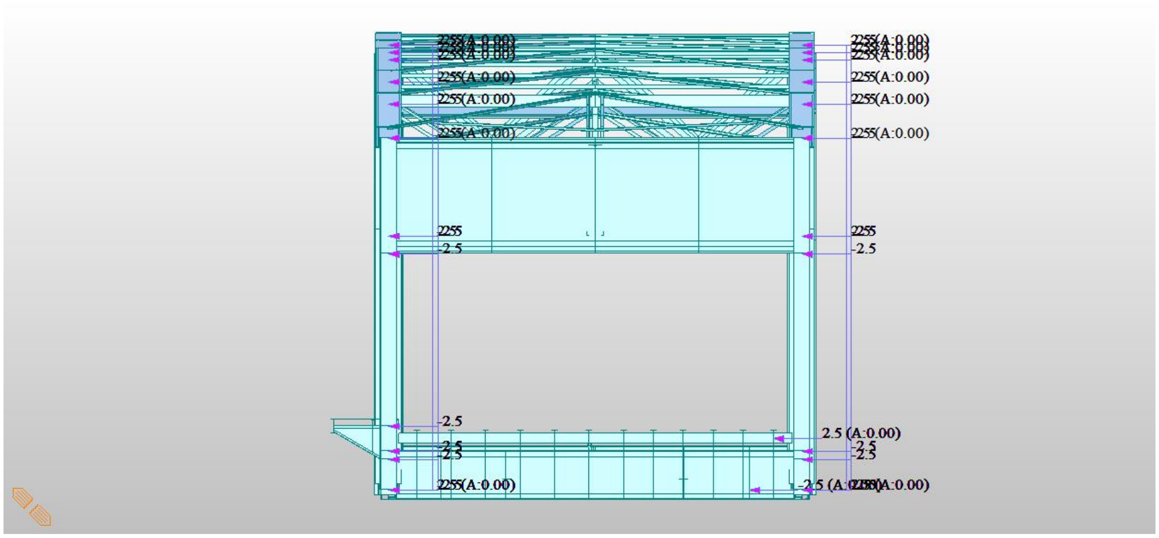


Figure 5 Wind Load Horizontal 1 (East to West)

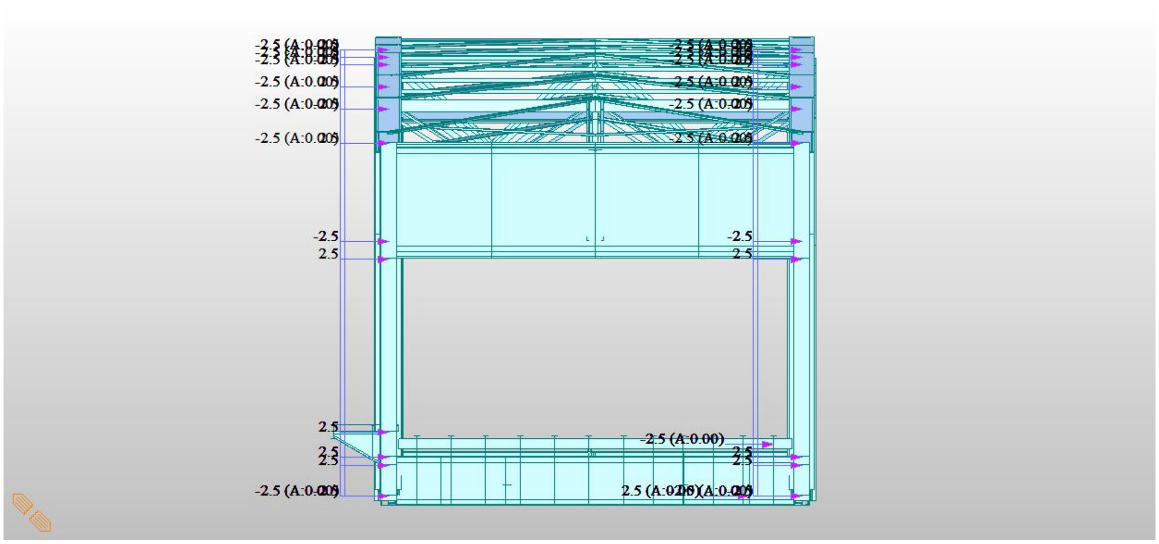


Figure 6 Wind Load Horizontal 2 (West to East)

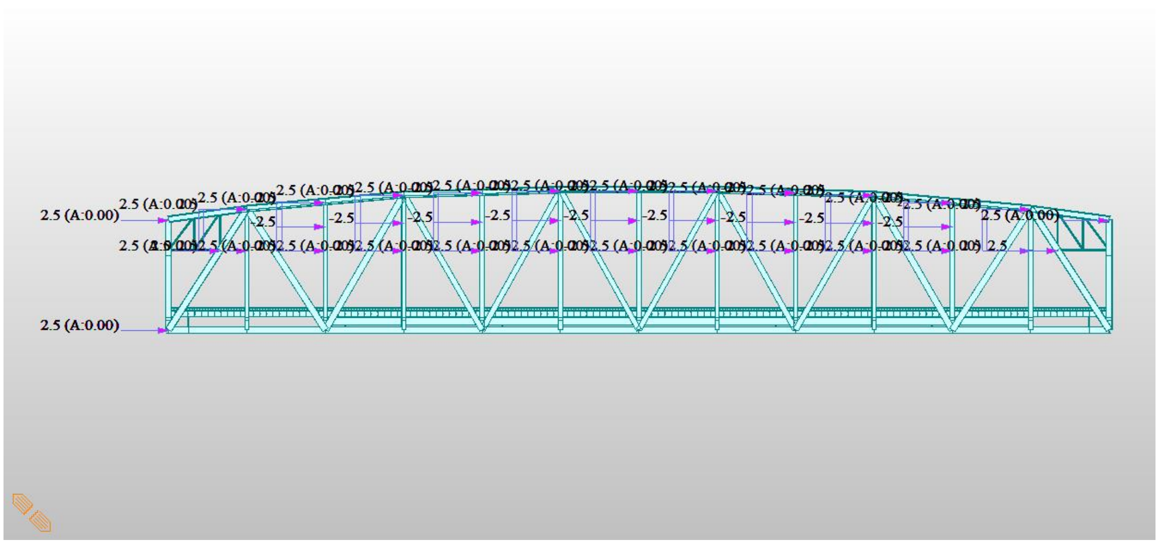


Figure 7 Wind Load Longitudinal 1 (South to North)

*Load factored up by 25% when considered to result in the longitudinal load equal to 50% of total transverse wind as per CHBDC S6-19 13.6.4.4

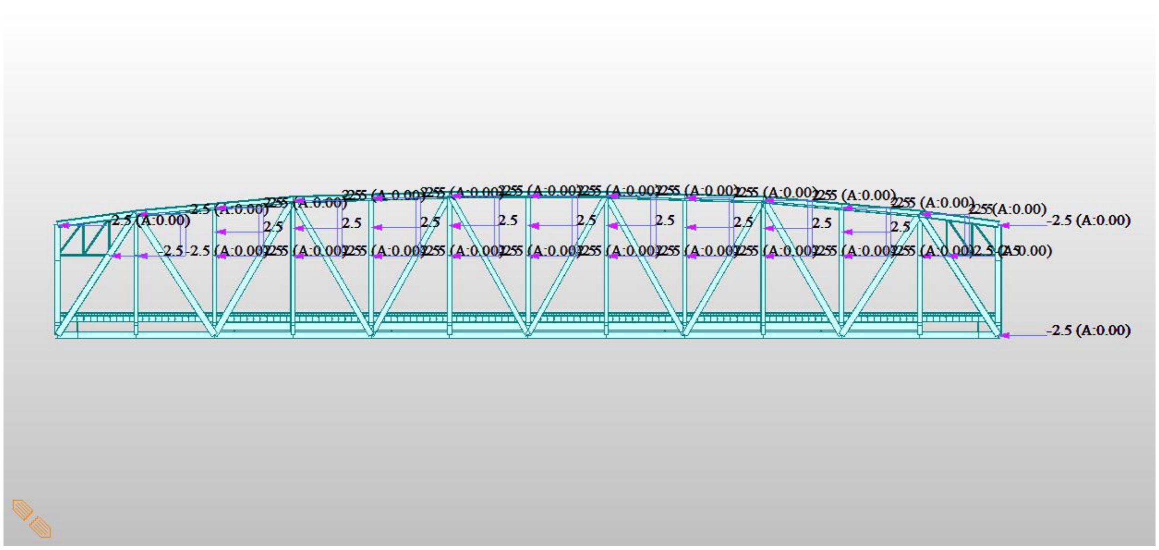


Figure 8 Wind Load Longitudinal 2 (North to South)

*Load factored up by 25% when considered to result in the longitudinal load equal to 50% of total transverse wind as per CHBDC S6-19 13.6.4.4

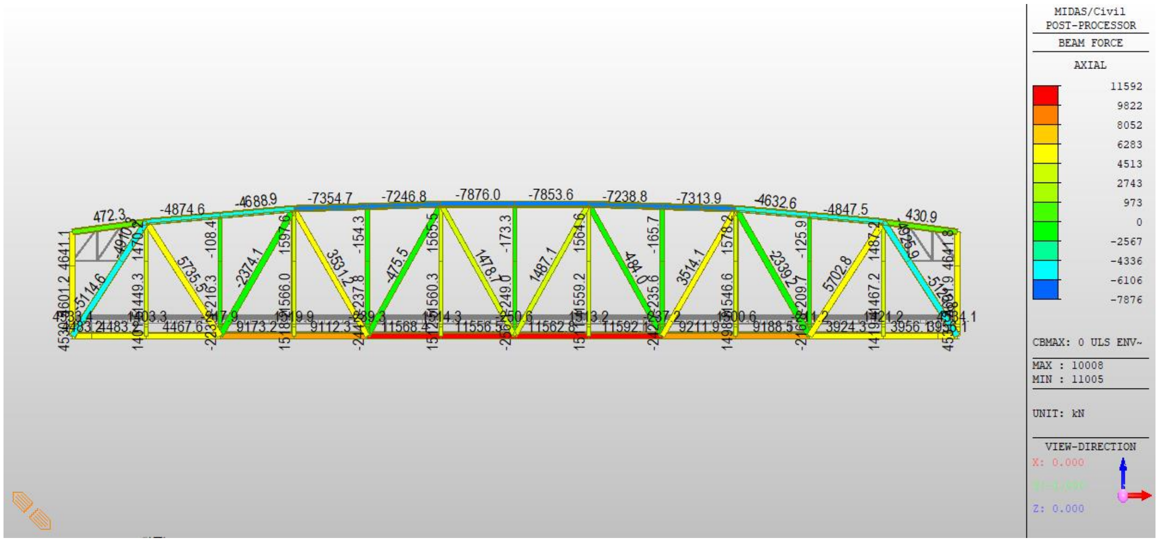


Figure 9 Railway Truss – Case 0 (Existing) Envelope Axial Max (kN)

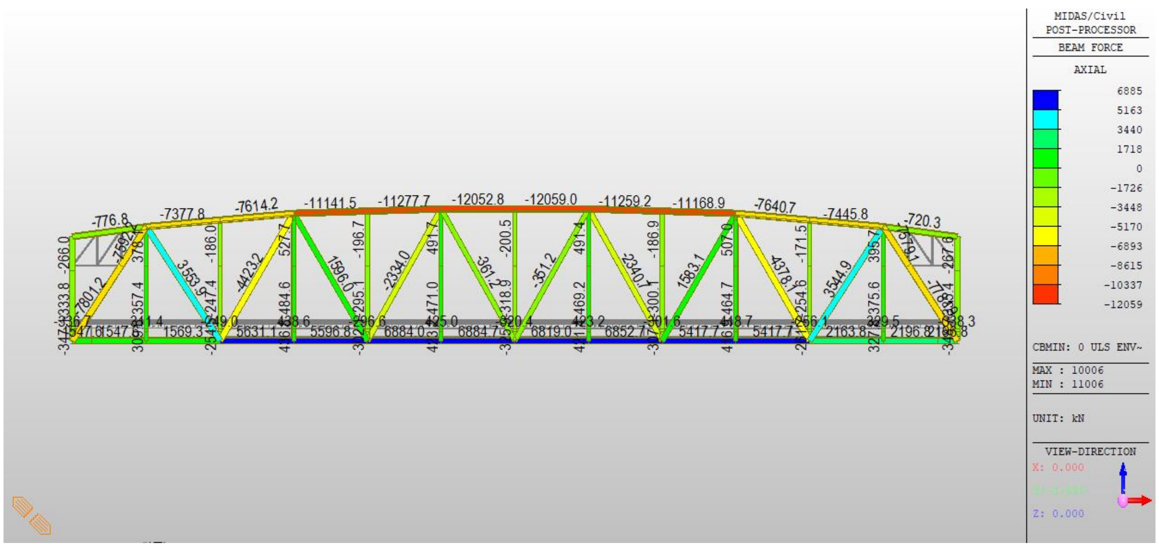


Figure 10 Railway Truss – Case 0 (Existing) Envelope Axial Min (kN)

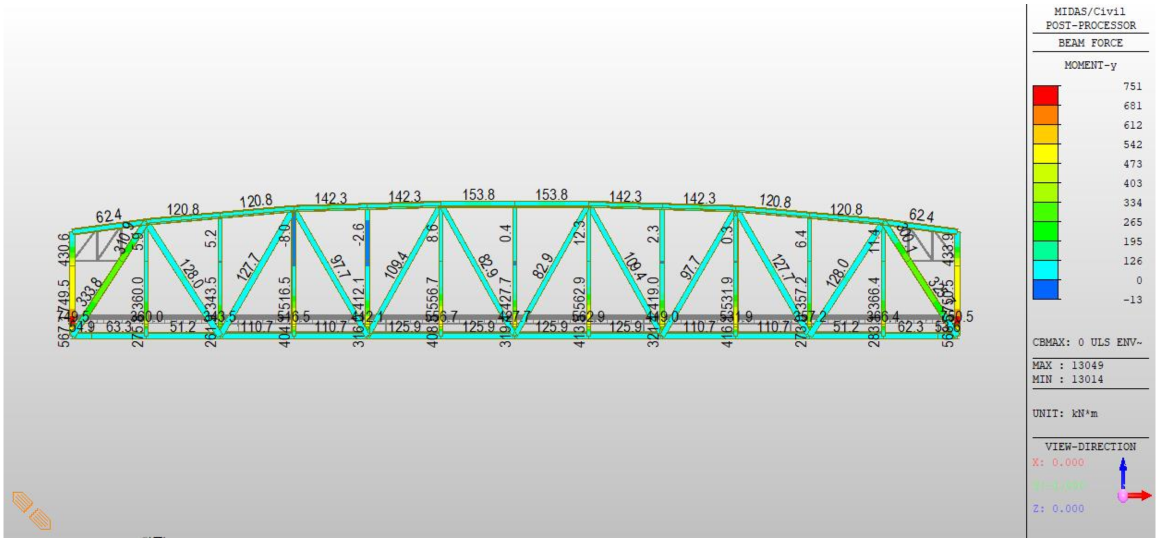


Figure 11 Railway Truss – Case 0 (Existing) Envelope M_y Max (kN/m)

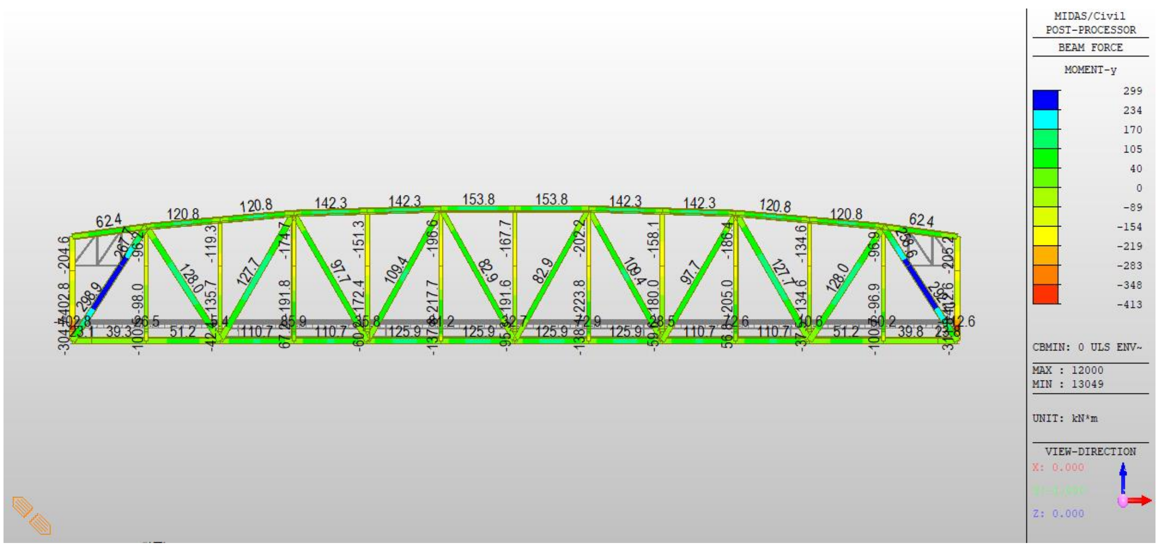


Figure 12 Railway Truss – Case 0 (Existing) Envelope M_y Min (kN/m)

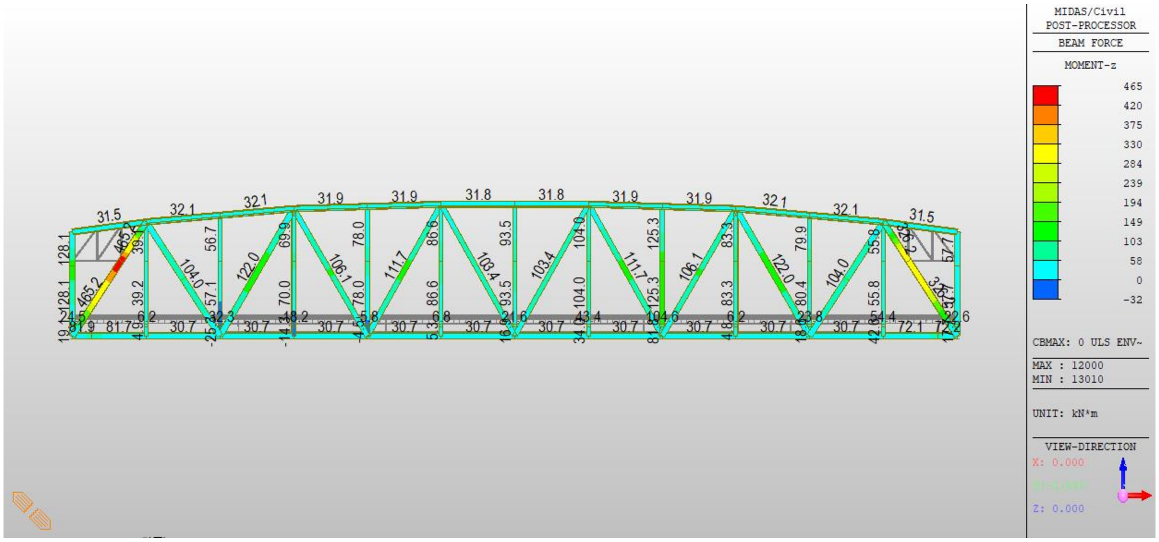


Figure 13 Railway Truss – Case 0 (Existing) Envelope M_z Max (kN/m)

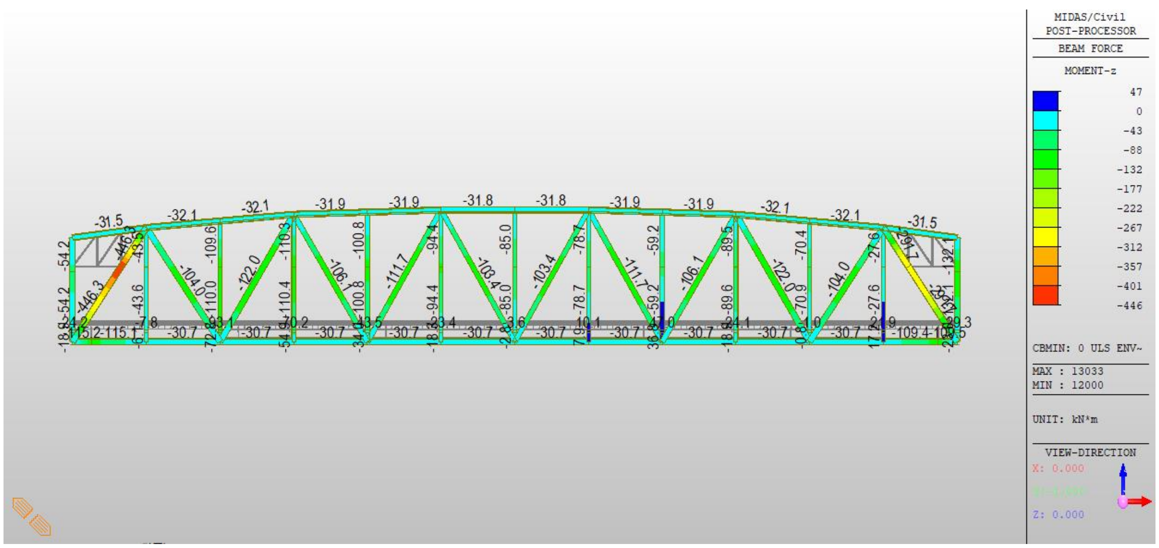


Figure 14 Railway Truss – Case 0 (Existing) Envelope M_z Min (kN/m)

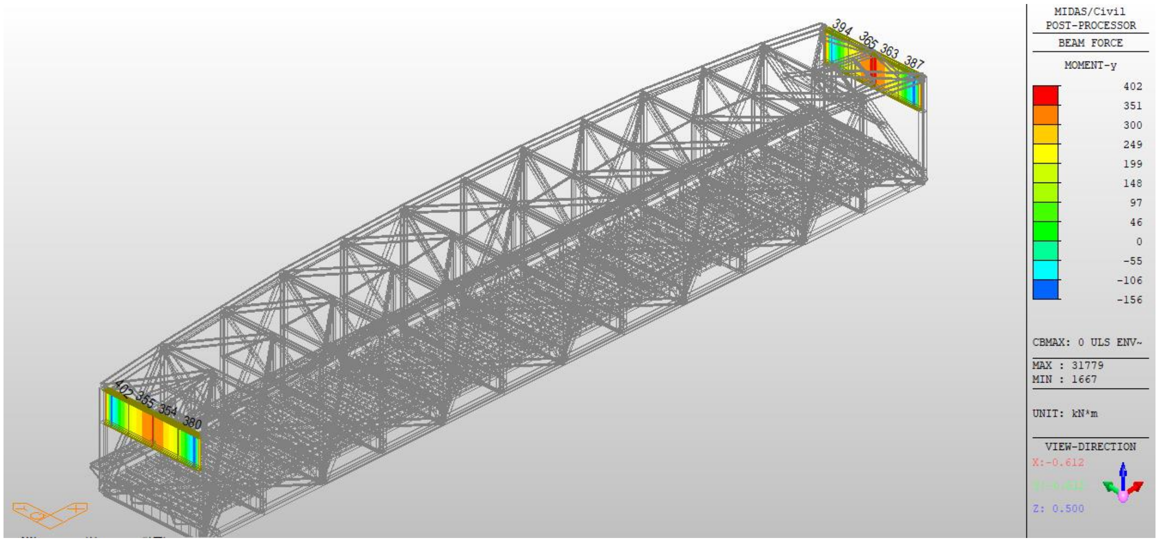


Figure 15 Lift Girder – Case 0 (Existing) Envelope M_y Max (kN/m)

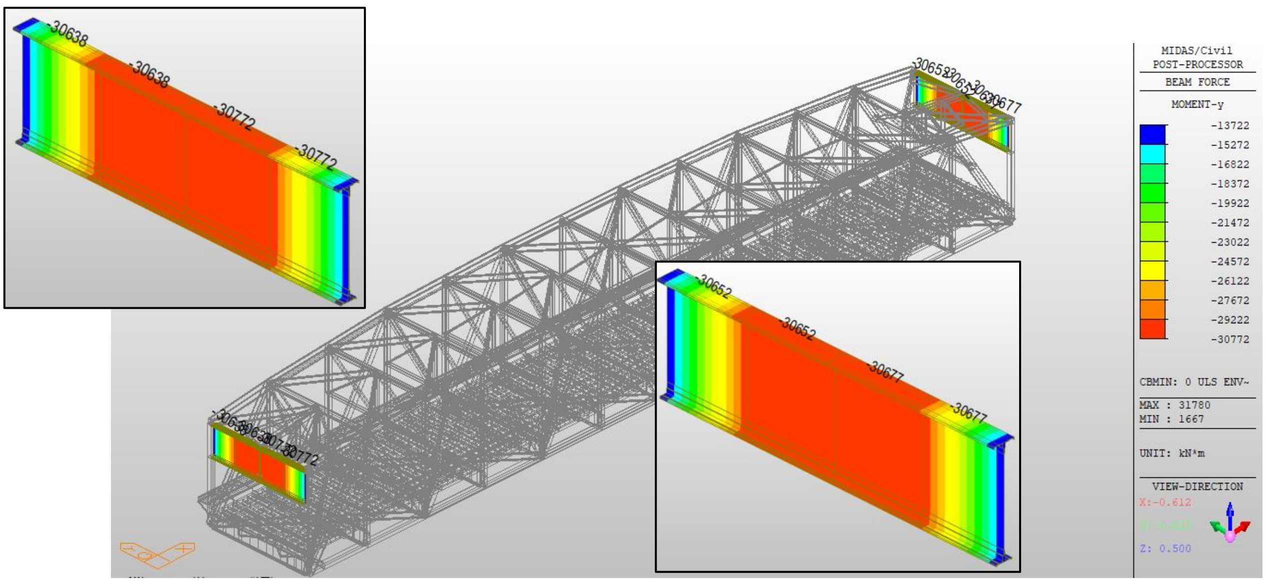


Figure 16 Lift Girder – Case 0 (Existing) Envelope M_y Min (kN/m)

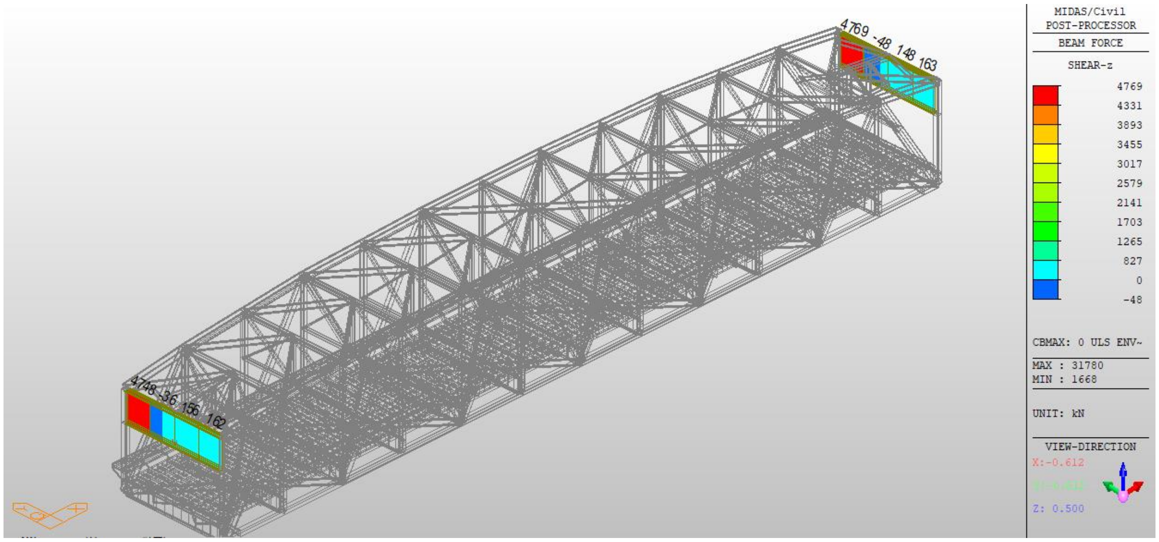


Figure 17 Lift Girder - Case 0 (Existing) Envelope F_z Max (kN)

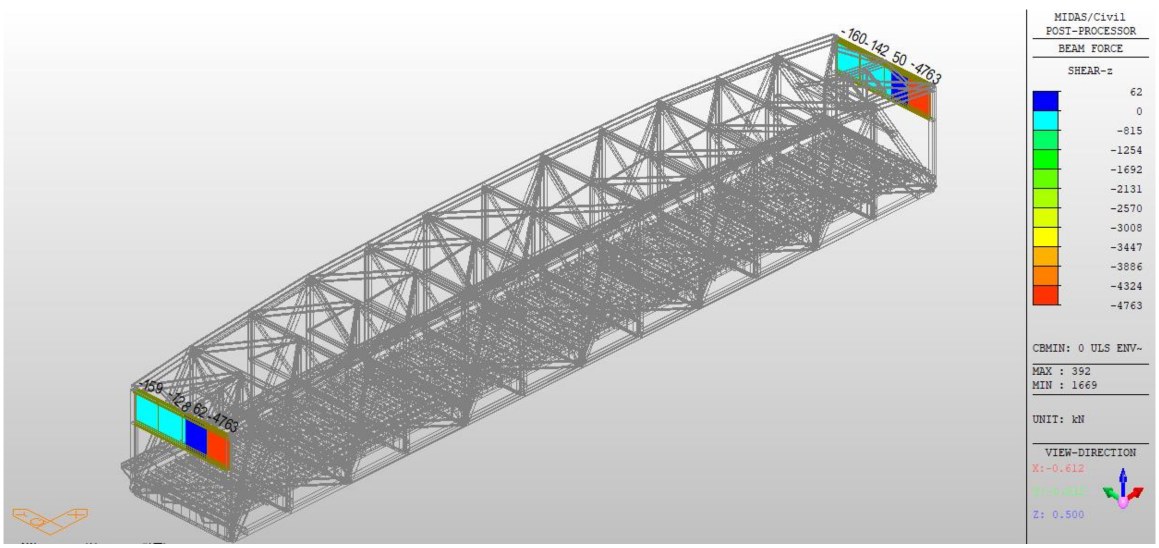


Figure 18 Lift Girder – Case 0 (Existing) Envelope F_z Min (kN)

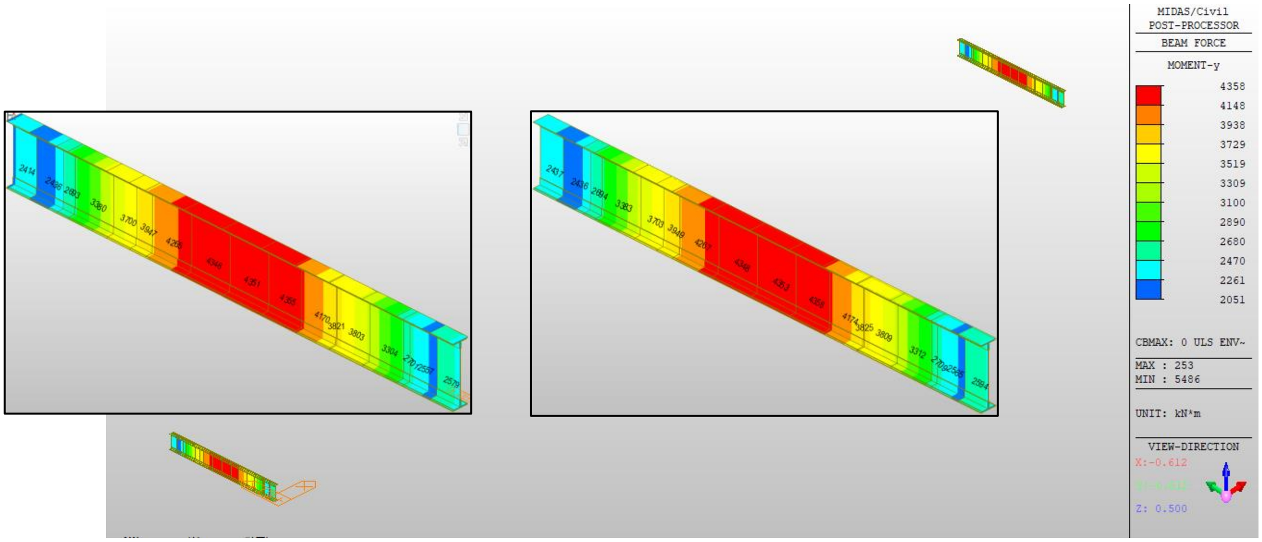


Figure 19 End Floor Beam – Case 0 (Existing) Envelope M_y Max (kN/m)

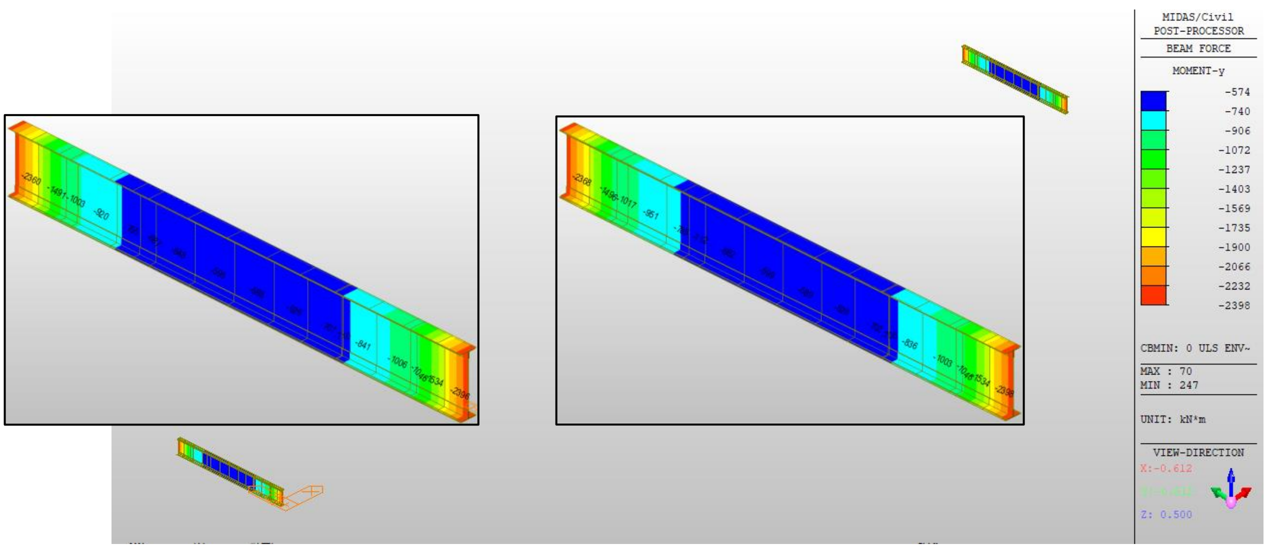


Figure 20 End Floor Beam – Case 0 (Existing) Envelope M_y Min (kN/m)

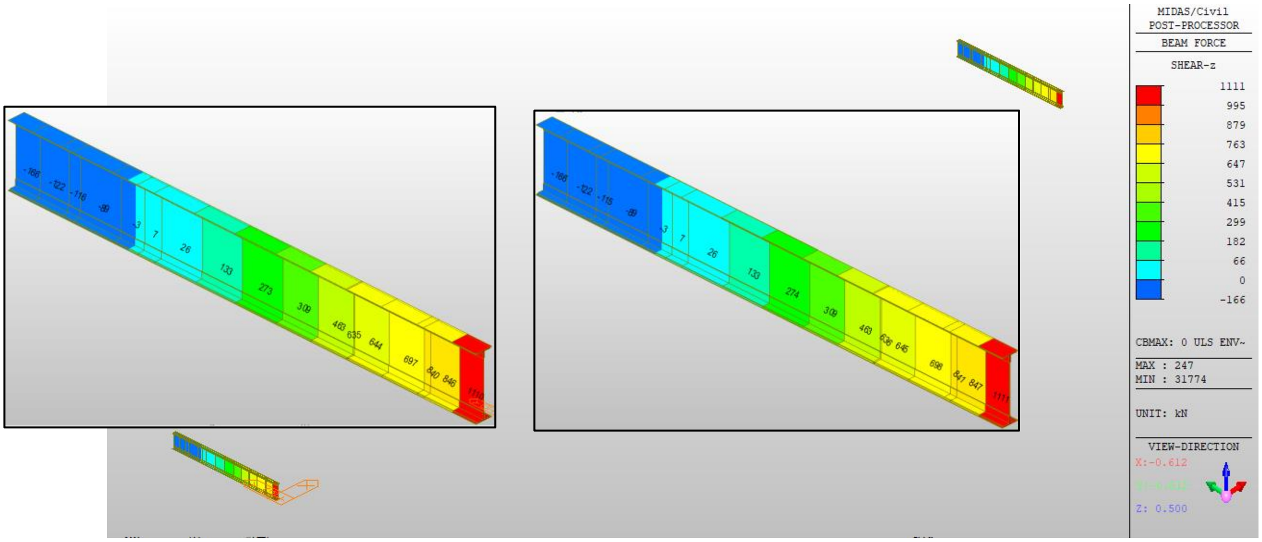


Figure 21 End Floor Beam – Case 0 (Existing) Envelope F_z Max (kN)

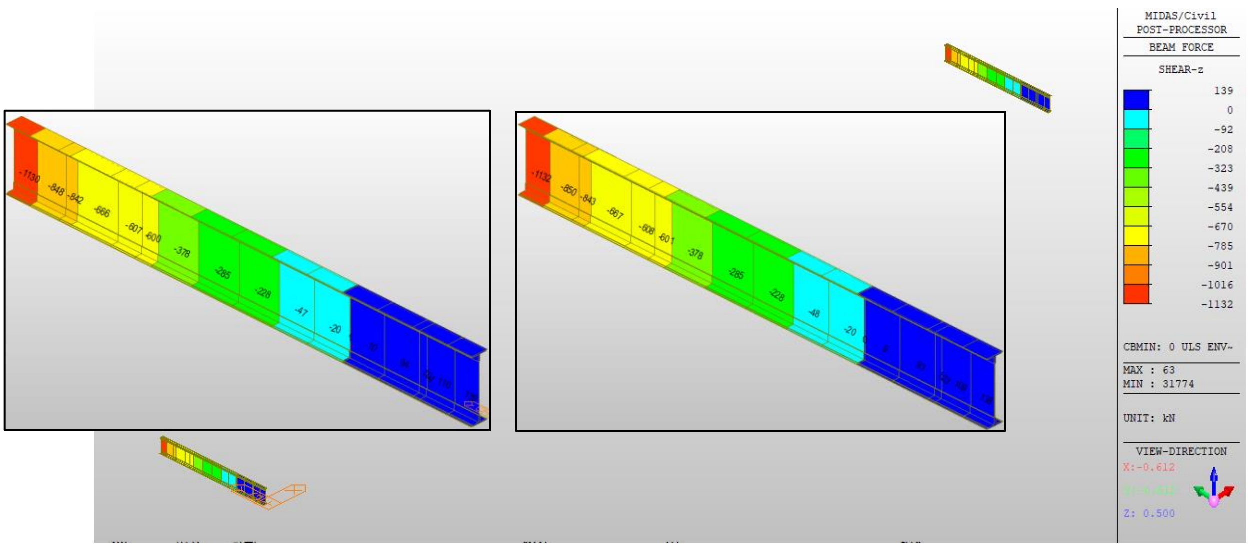


Figure 22 End Floor Beam – Case 0 (Existing) Envelope F_z Min (kN)

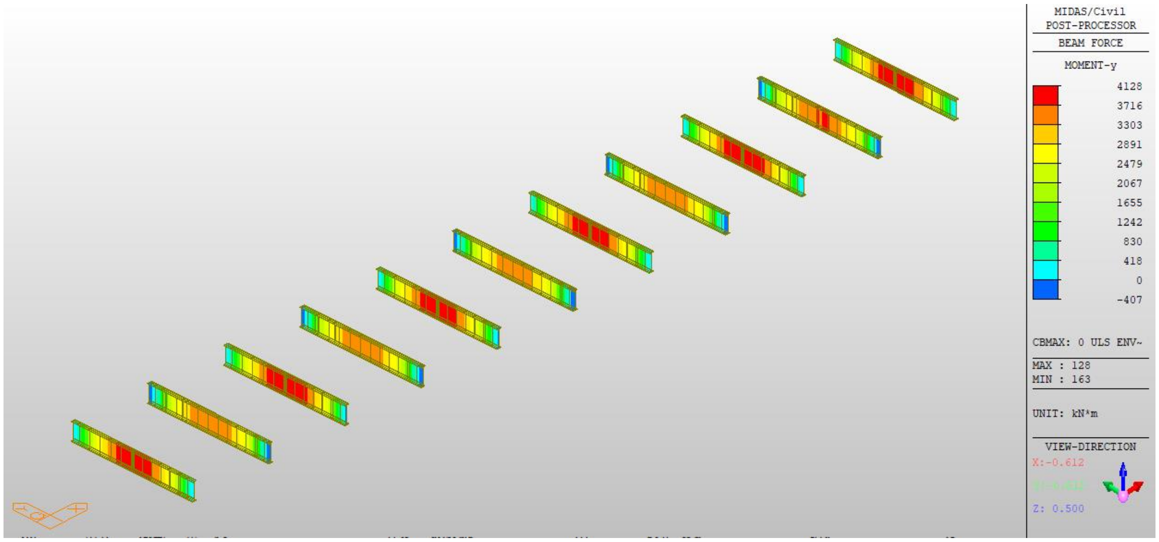


Figure 23 Intermediate Floor Beam – Case 0 (Existing) Envelope M_y Max (kN/m)

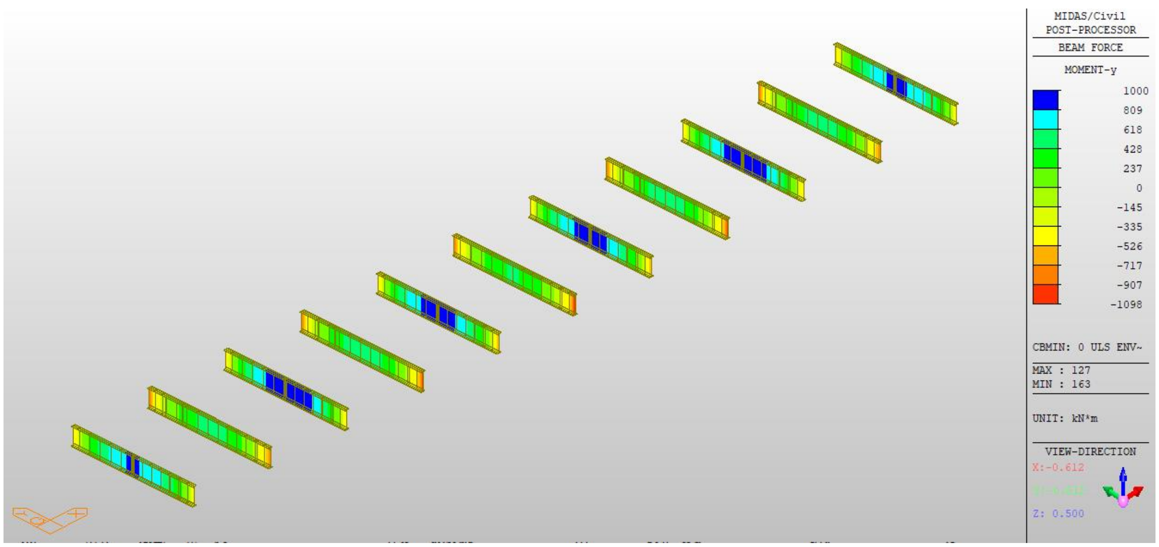


Figure 24 Intermediate Floor Beam – Case 0 (Existing) Envelope M_y Min (kN/m)

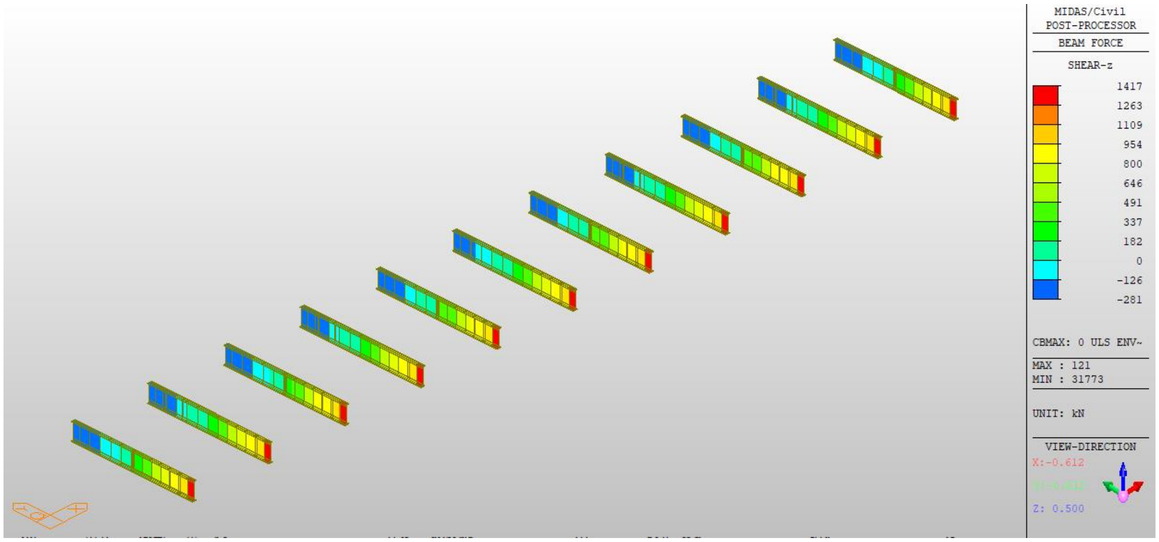


Figure 25 Intermediate Floor Beam – Case 0 (Existing) Envelope F_z Max (kN)

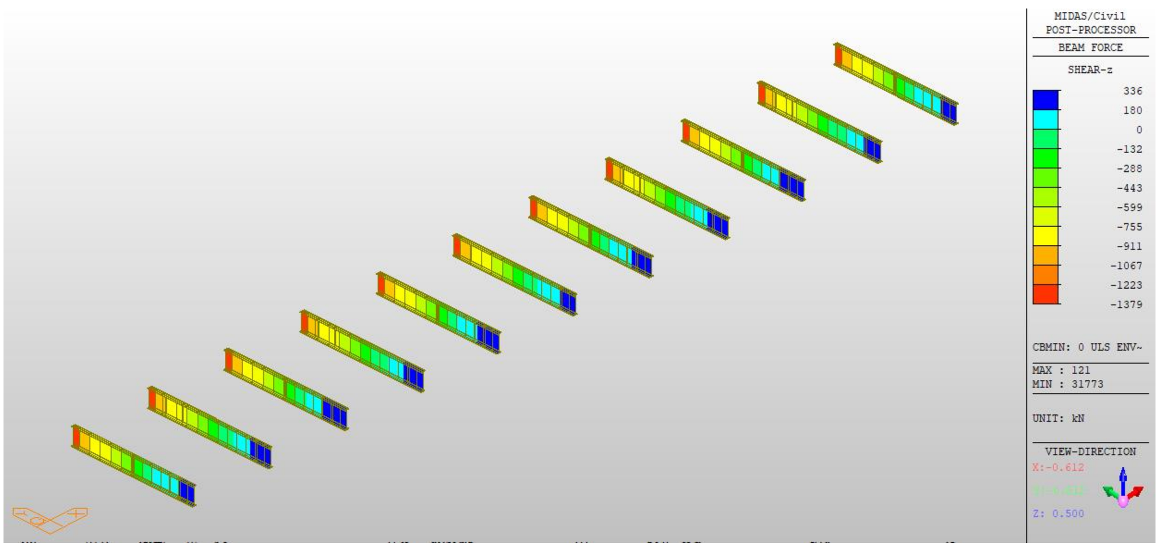


Figure 26 Intermediate Floor Beam – Case 0 (Existing) Envelope F_z Min (kN)

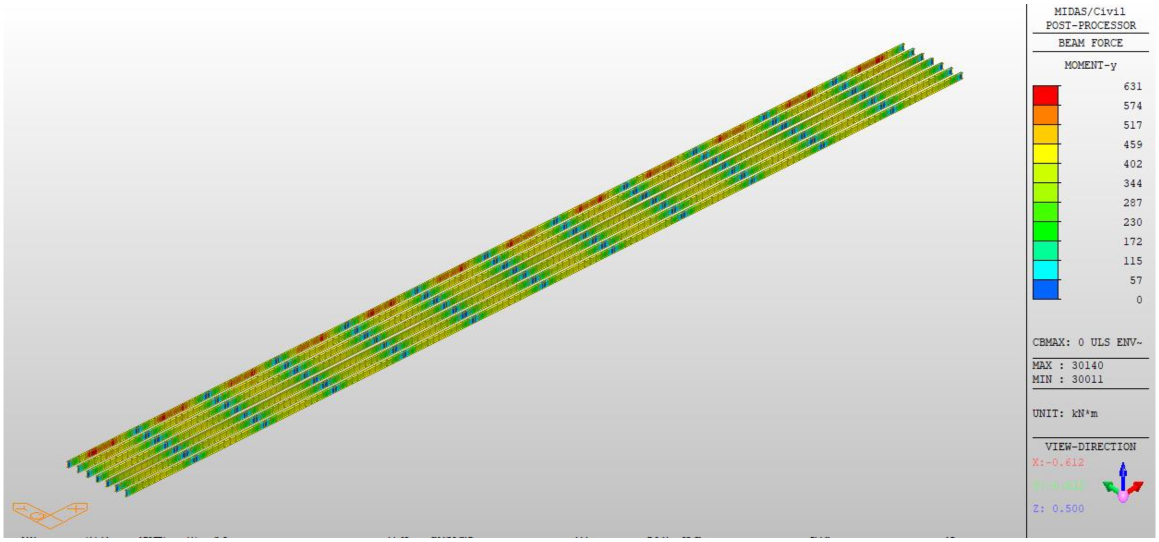


Figure 27 1959 Stringer – Case 0 (Existing) Envelope M_y Max (kN/m)

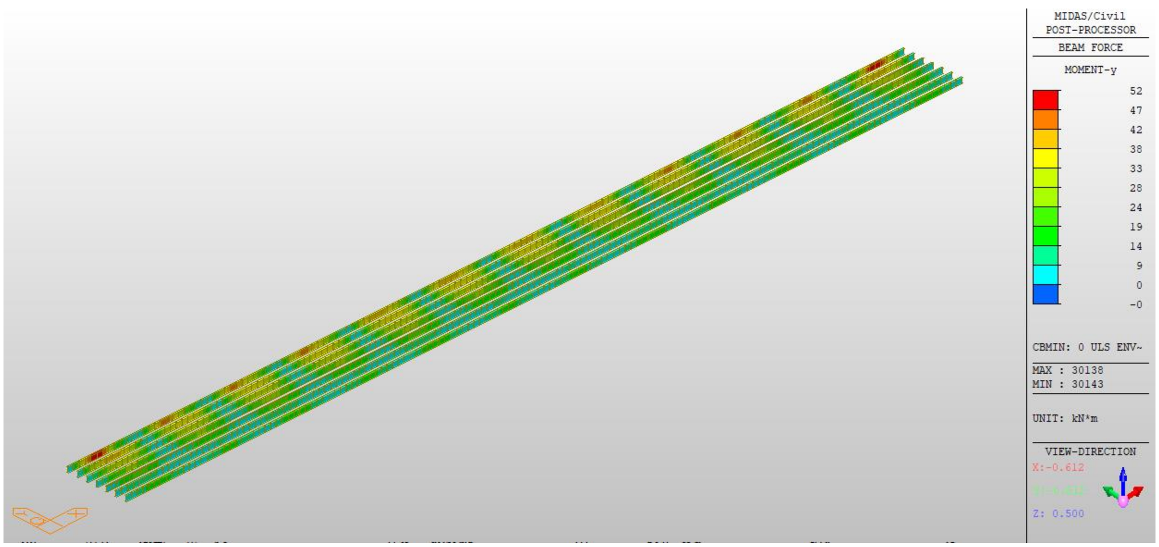


Figure 28 1959 Stringer – Case 0 (Existing) Envelope M_y Min (kN/m)

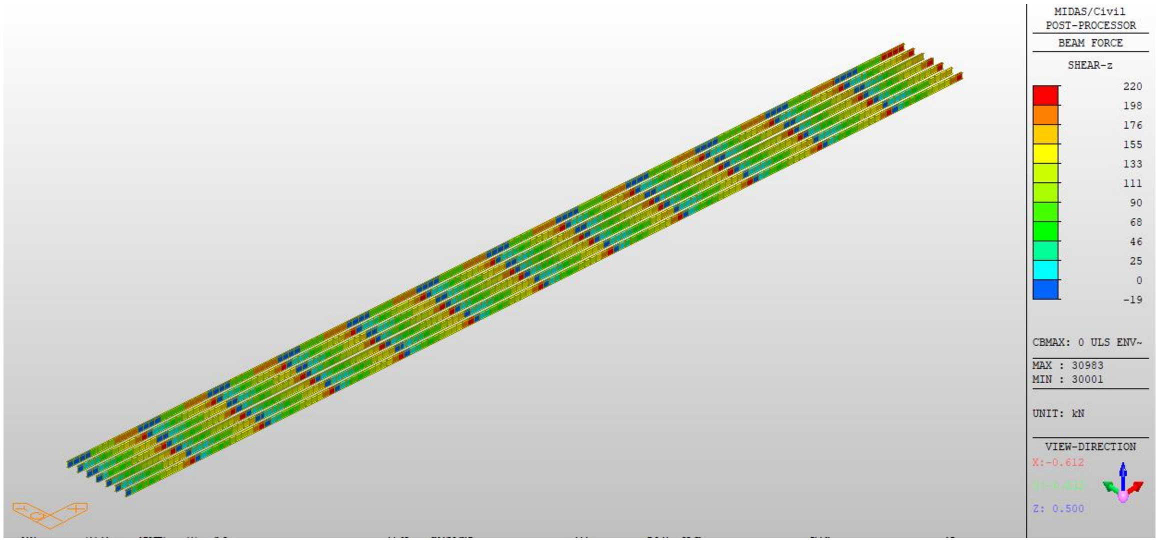


Figure 29 1959 Stringer – Case 0 (Existing) Envelope F_z Max (kN)

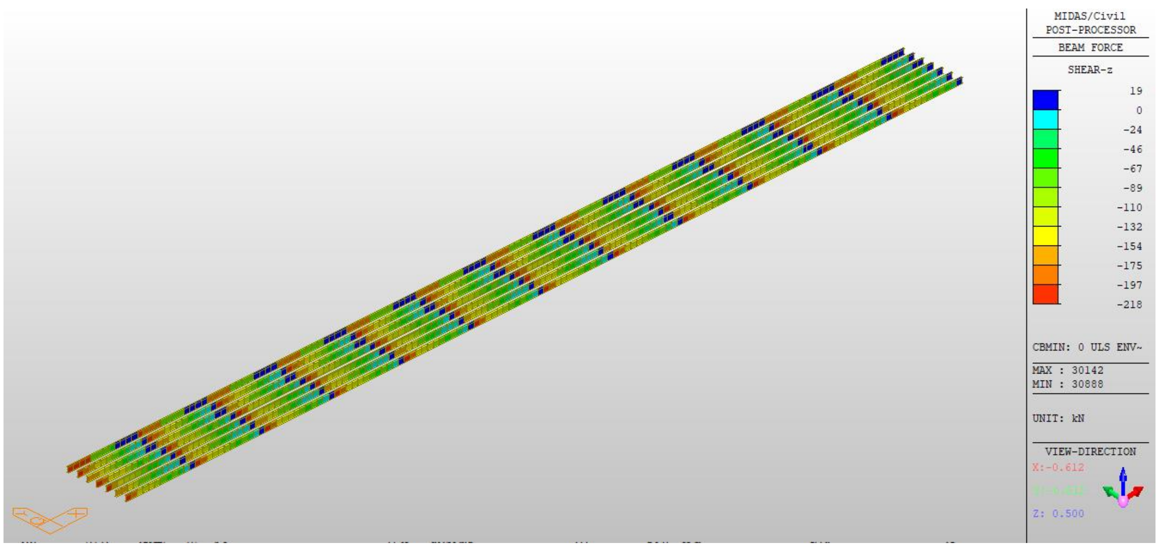


Figure 30 1959 Stringer – Case 0 (Existing) Envelope F_z Max (kN)

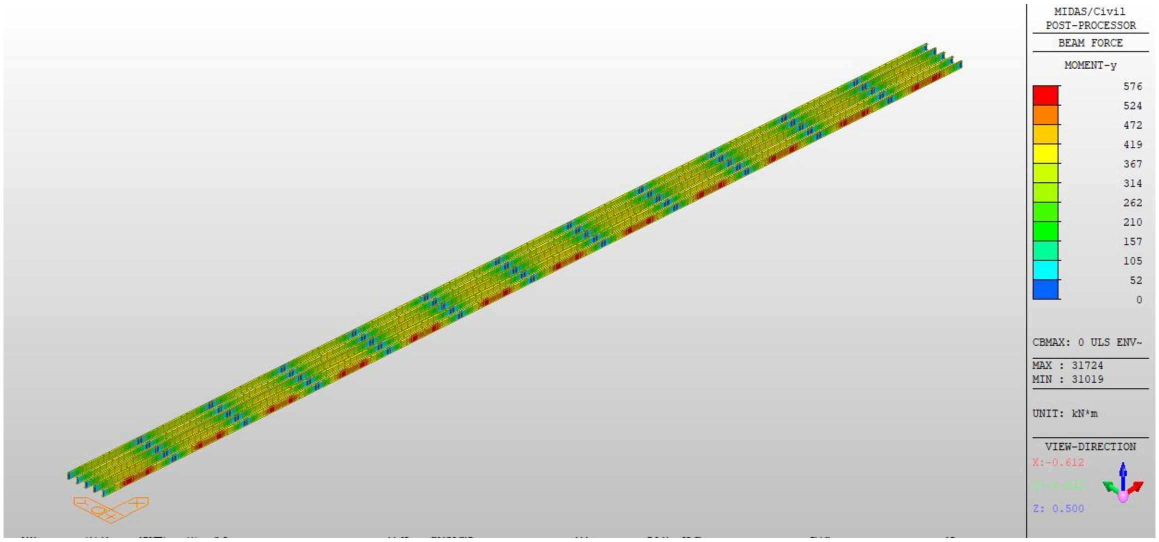


Figure 31 1982 Stringer – Case 0 (Existing) Envelope M_y Max (kN/m)

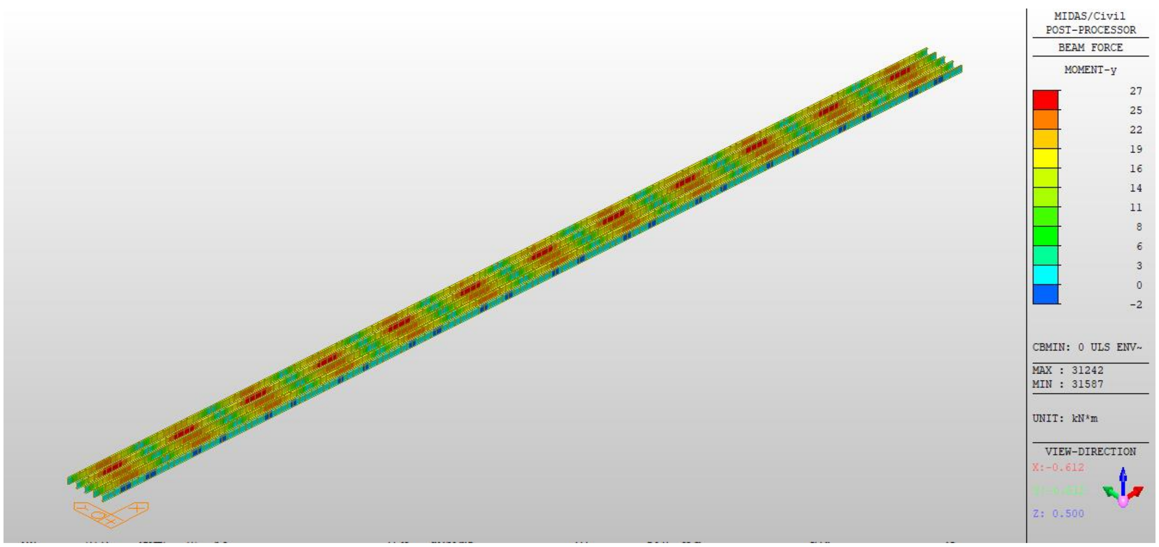


Figure 32 1982 Stringer – Case 0 (Existing) Envelope M_y Min (kN/m)

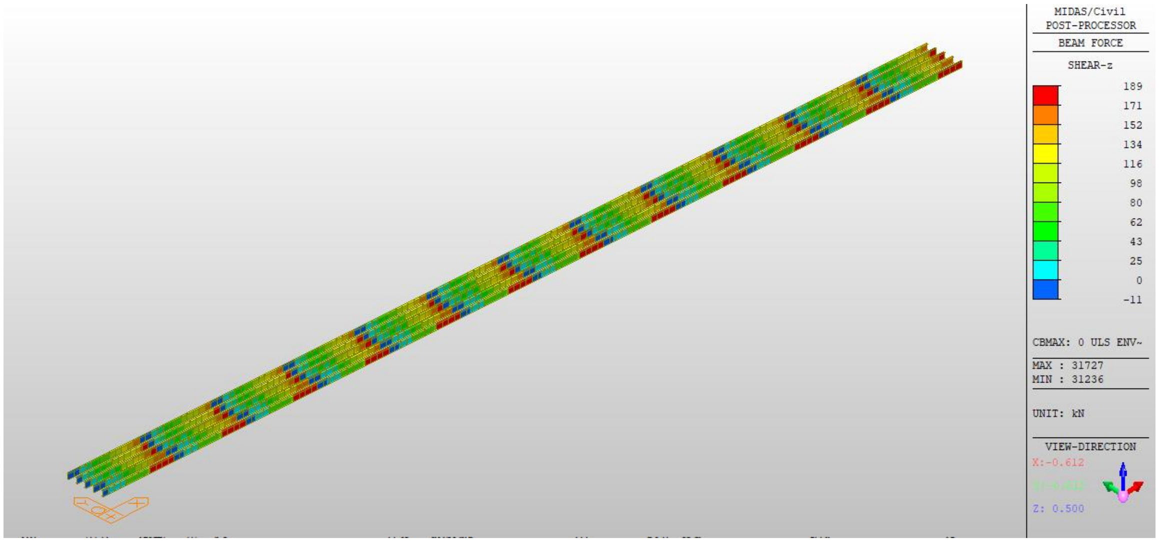


Figure 33 1982 Stringer – Case 0 (Existing) Envelope F_z Max (kN)

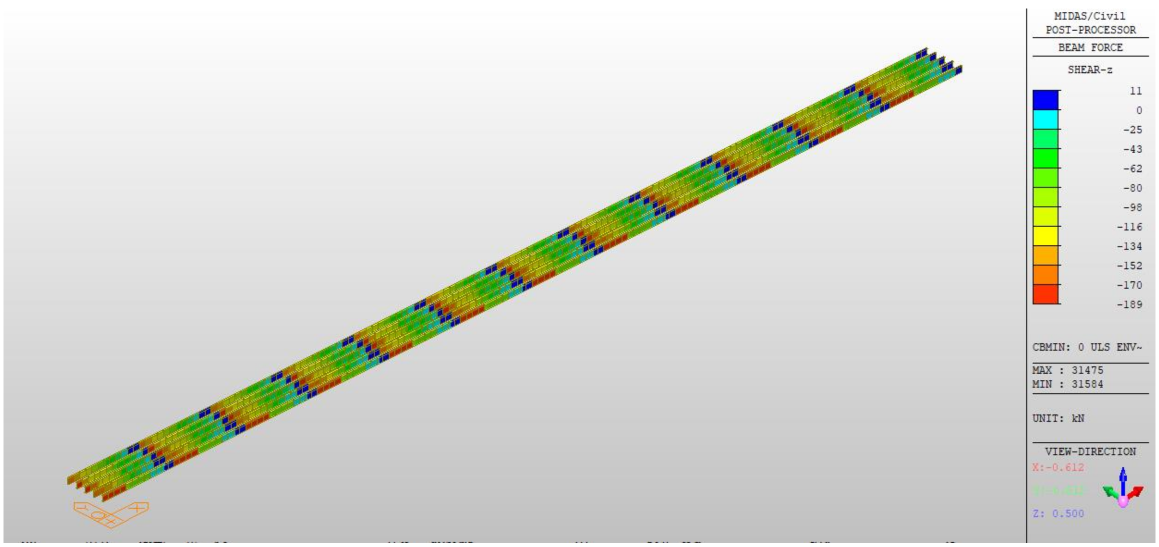


Figure 34 1982 Stringer – Case 0 (Existing) Envelope F_z Min (kN)

Exhibit B.6.2. Bridge Raised with Transverse Wind Evaluation

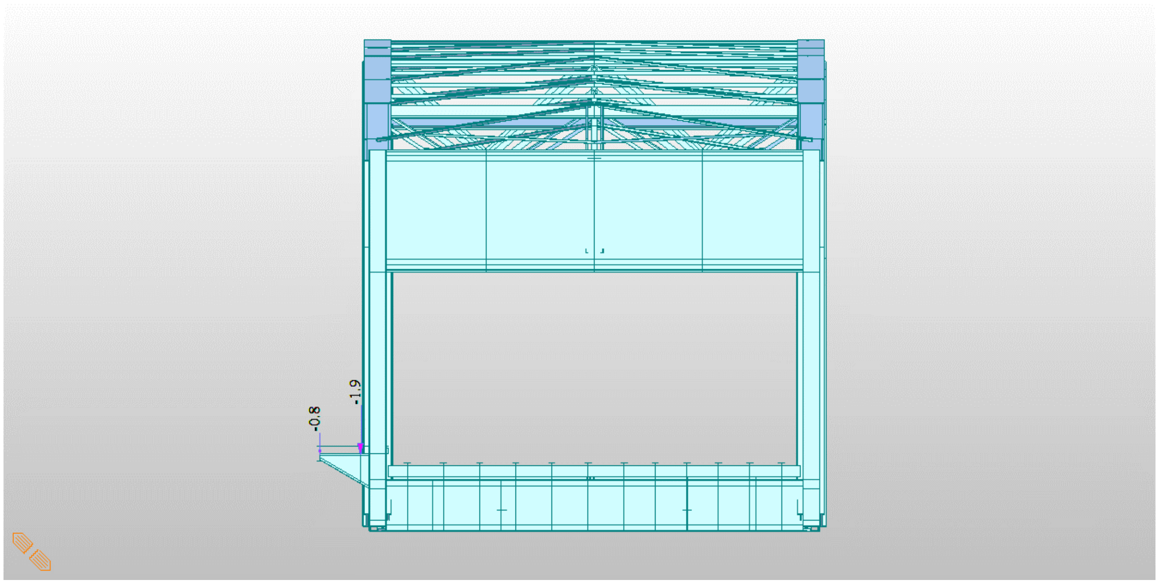


Figure 35 Wind Load Vertical Sidewalk

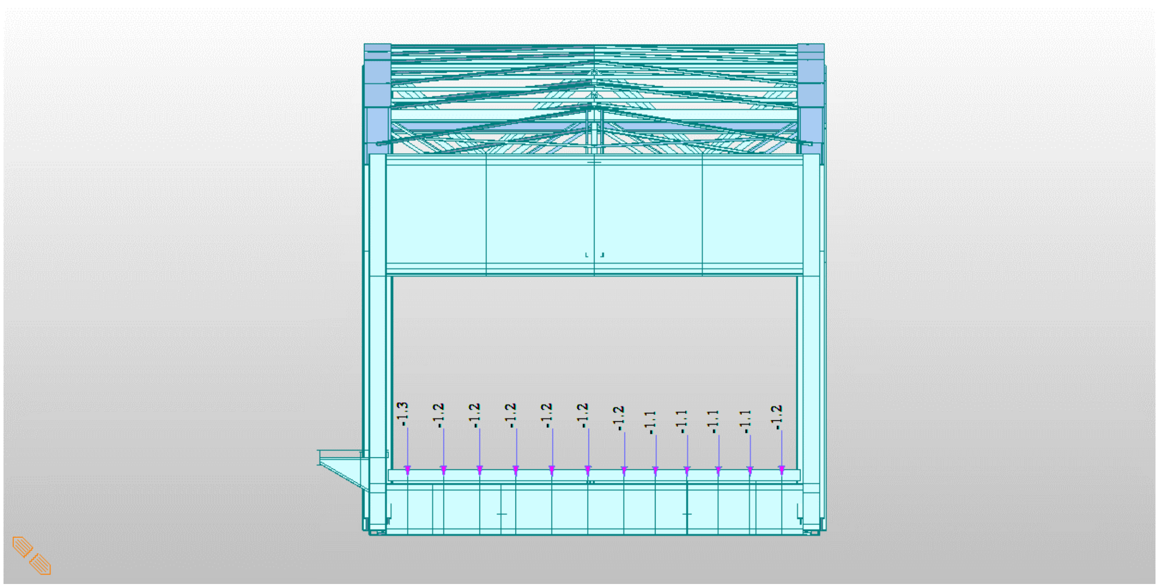


Figure 36 Wind Load Vertical Stringers

*Wind for calculations taken as 85% as per CHBDC S6-19 13.6.4.6

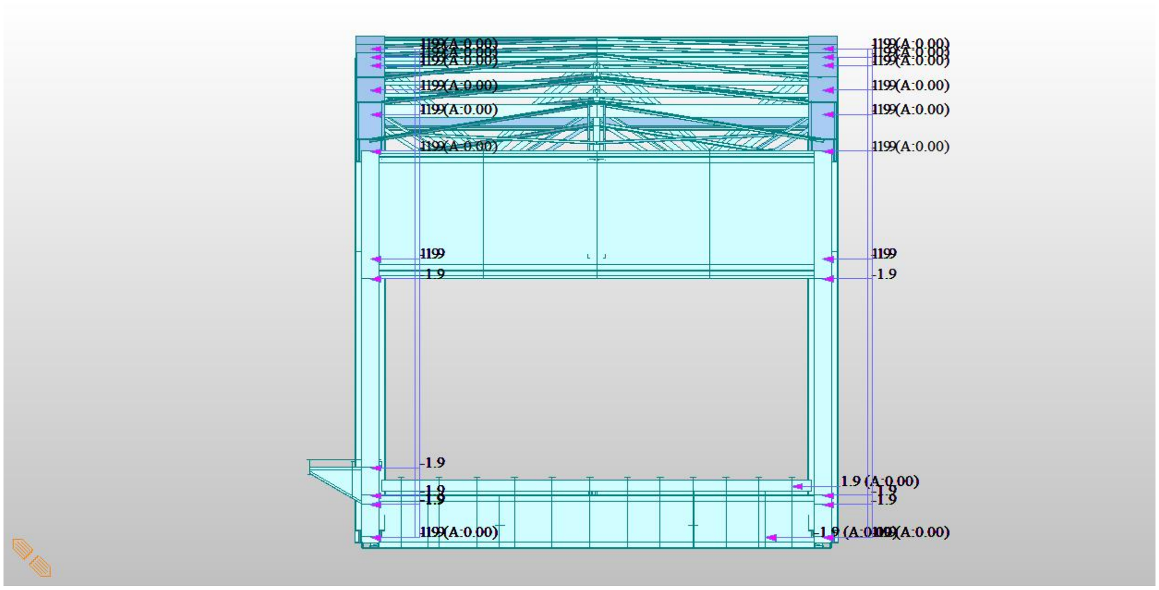


Figure 37 Wind Load Horizontal 1 (East to West)

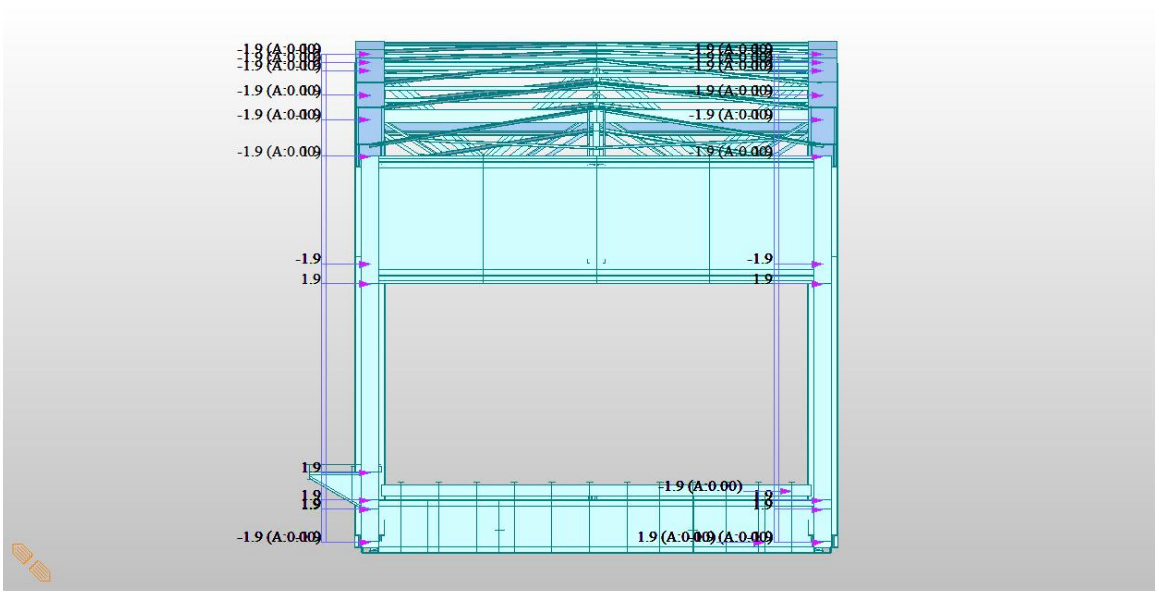


Figure 38 Wind Load Horizontal 2 (West to East)

Exhibit B.6.3. Bridge Raised with Longitudinal Wind Evaluation

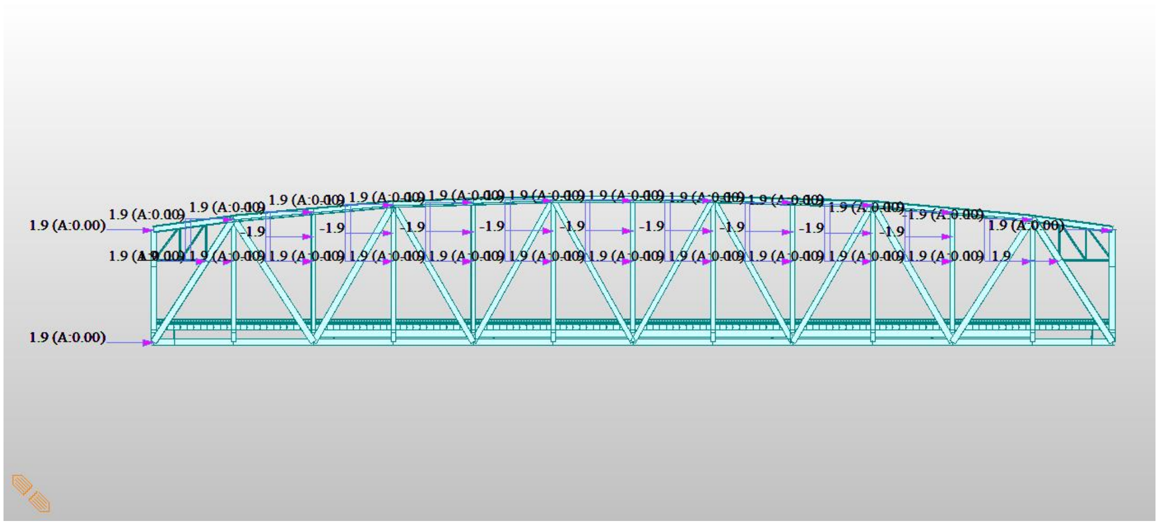


Figure 39 Wind Load Longitudinal 1 (South to North)

*Load factored up by 25% when considered to result in the longitudinal load equal to 50% of total transverse wind as per CHBDC S6-19 13.6.4.4

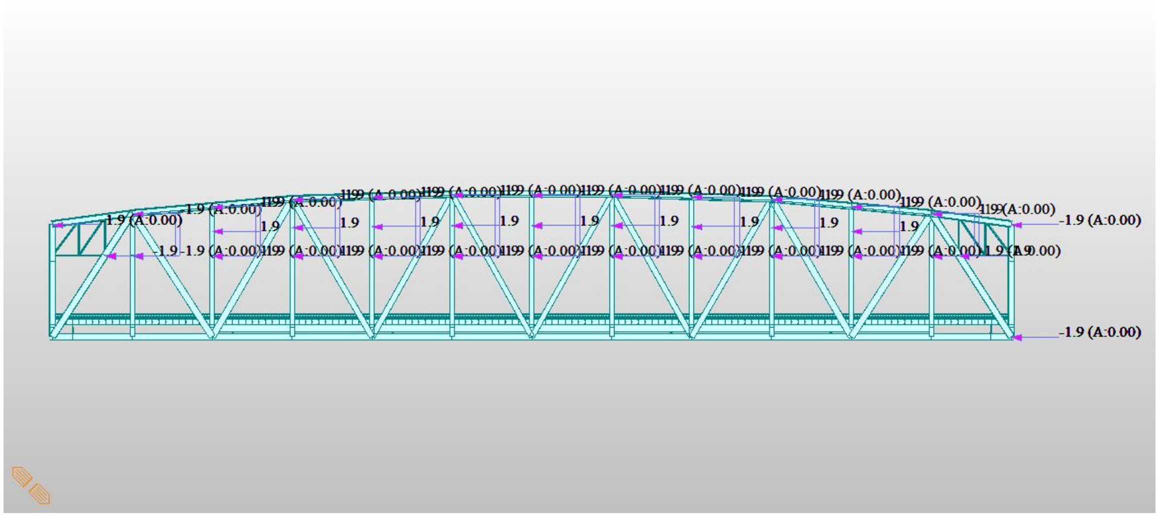


Figure 40 Wind Load Longitudinal 2 (North to South)

*Load factored up by 25% when considered to result in the longitudinal load equal to 50% of total transverse wind as per CHBDC S6-19 13.6.4.4

AECOM Imagine it. Delivered.

Exhibit B.7

South Tower Existing Evaluation 3D Model

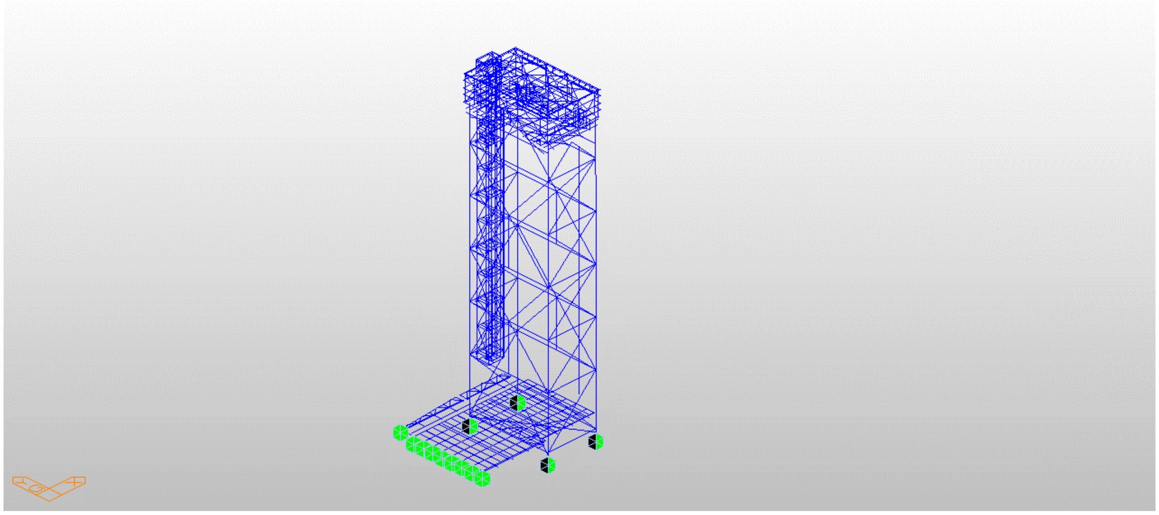


Figure 1 2D Frame Model with Supports

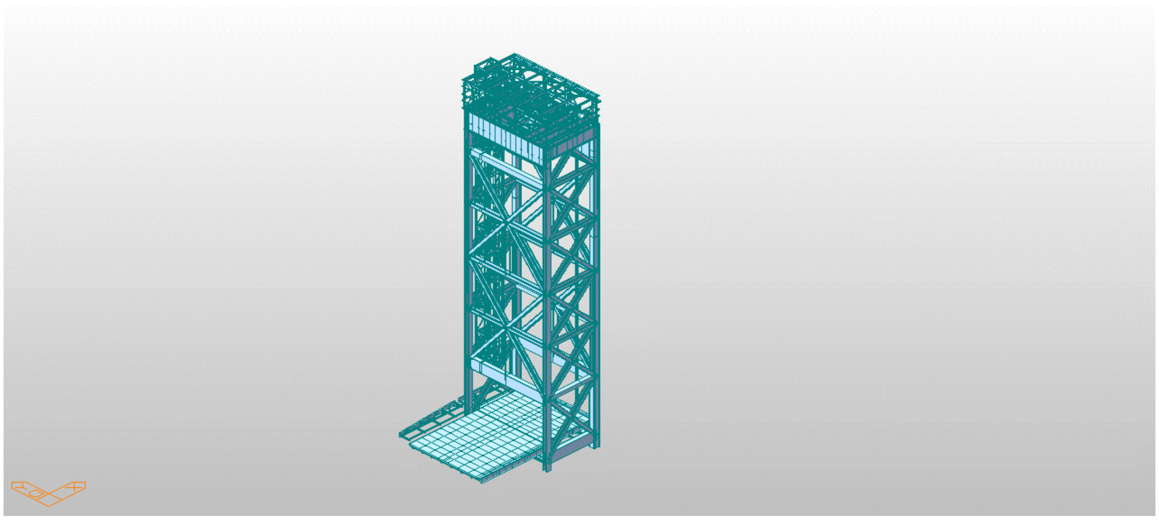


Figure 2 3D Frame Model

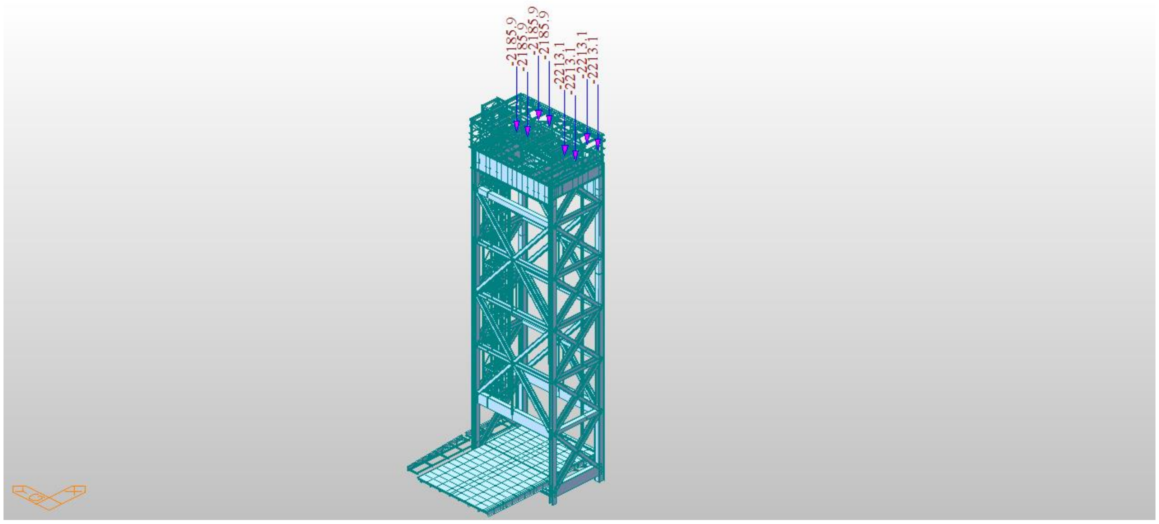


Figure 3 Bridge Weight – Case 0 (Existing) Loading

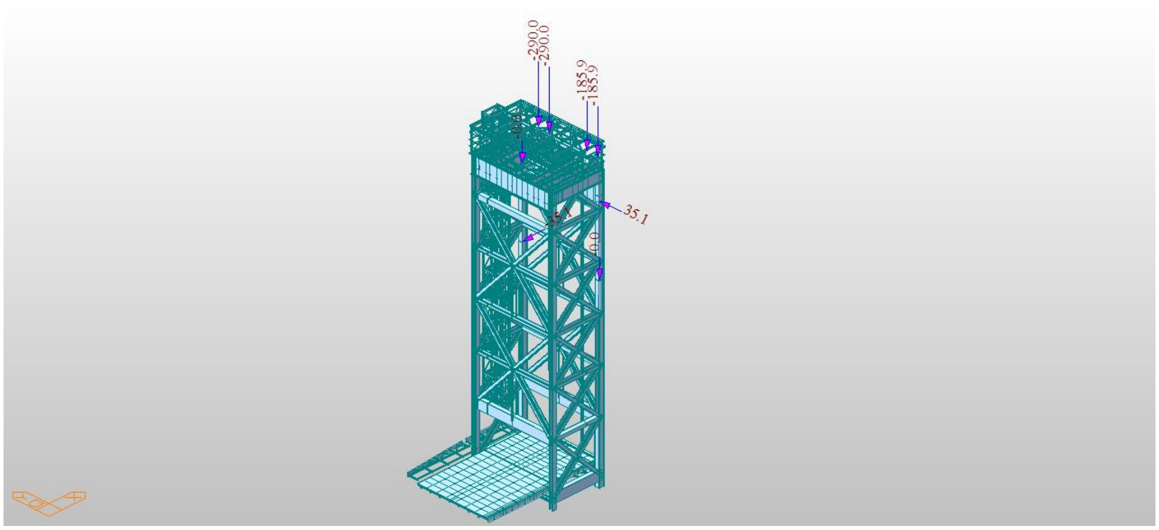


Figure 4 Wind Load Vertical – Bridge

*Wind for calculations taken as 85% as per CHBDC S6-19 13.6.4.6

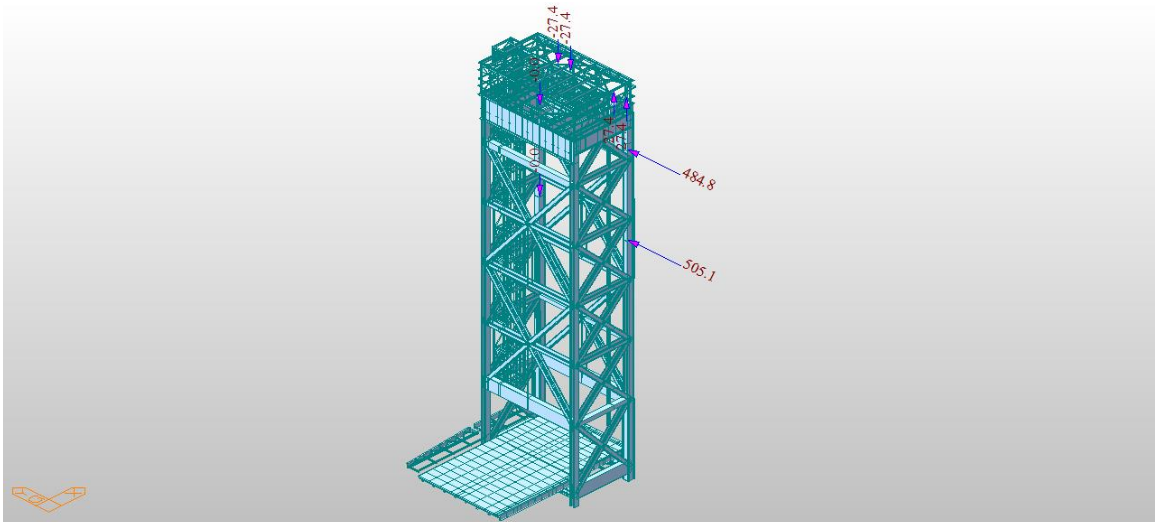


Figure 5 Wind Load Horizontal 1 (East to West) – Bridge

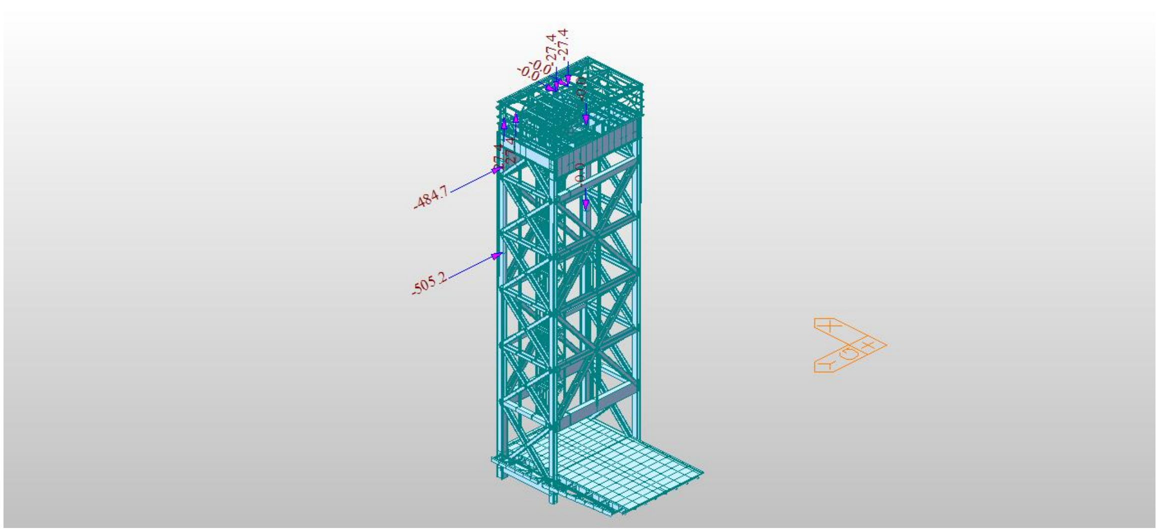


Figure 6 Wind Load Horizontal 2 (West to East) - Bridge

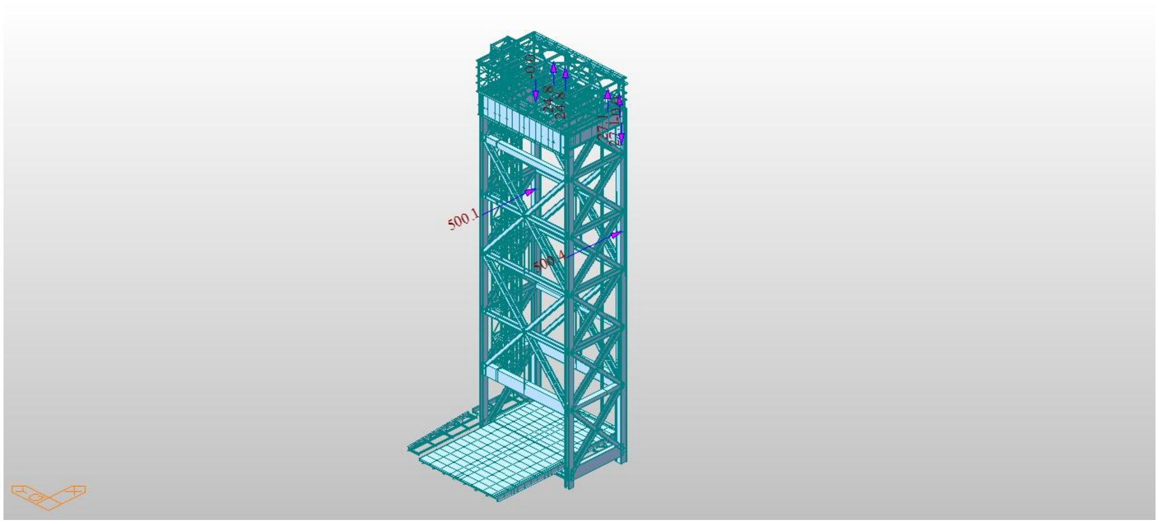


Figure 7 Wind Load Longitudinal 1 (South to North) – Bridge

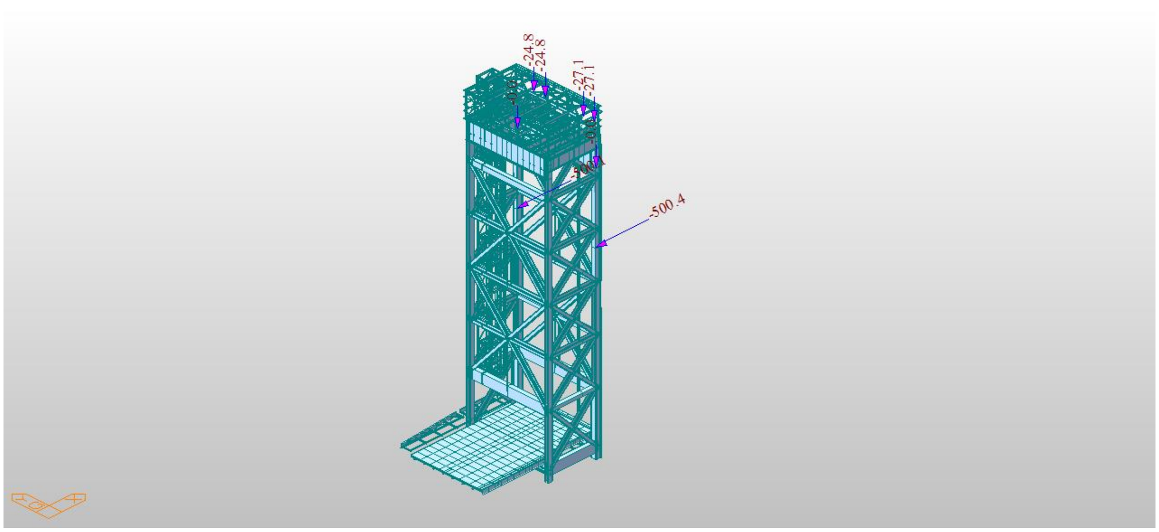


Figure 8 Wind Load Longitudinal 2 (North to South) – Bridge

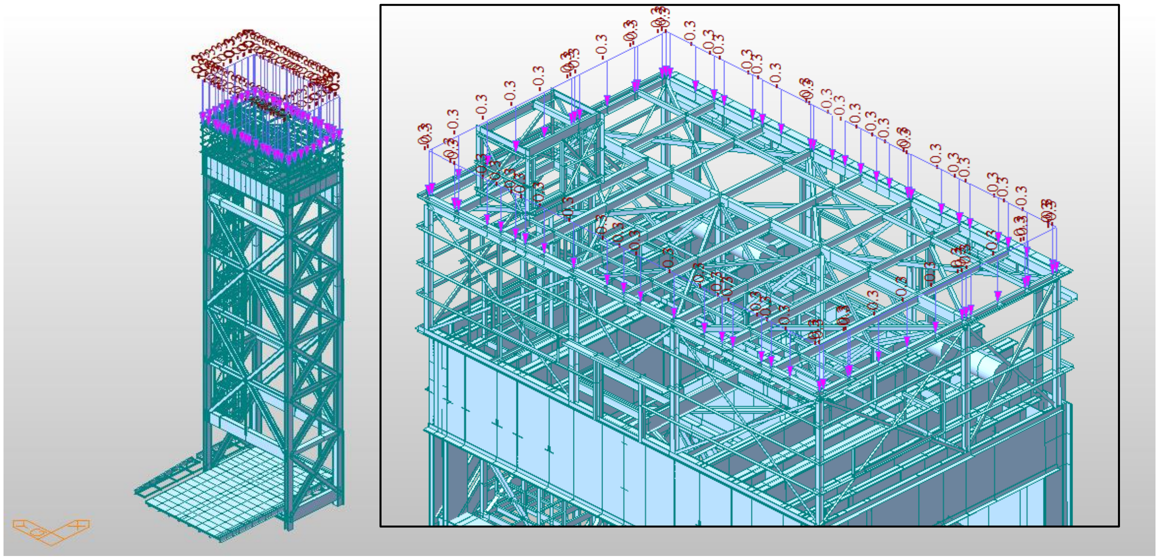


Figure 9 Wind Load Vertical Tower

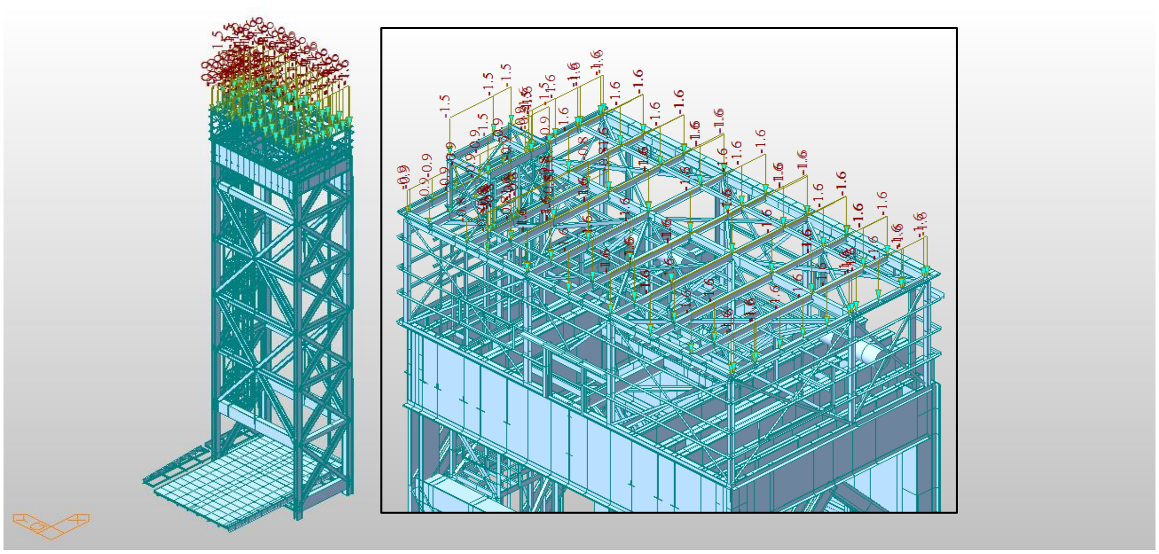


Figure 10 Wind Load Vertical Tower Floor Loads

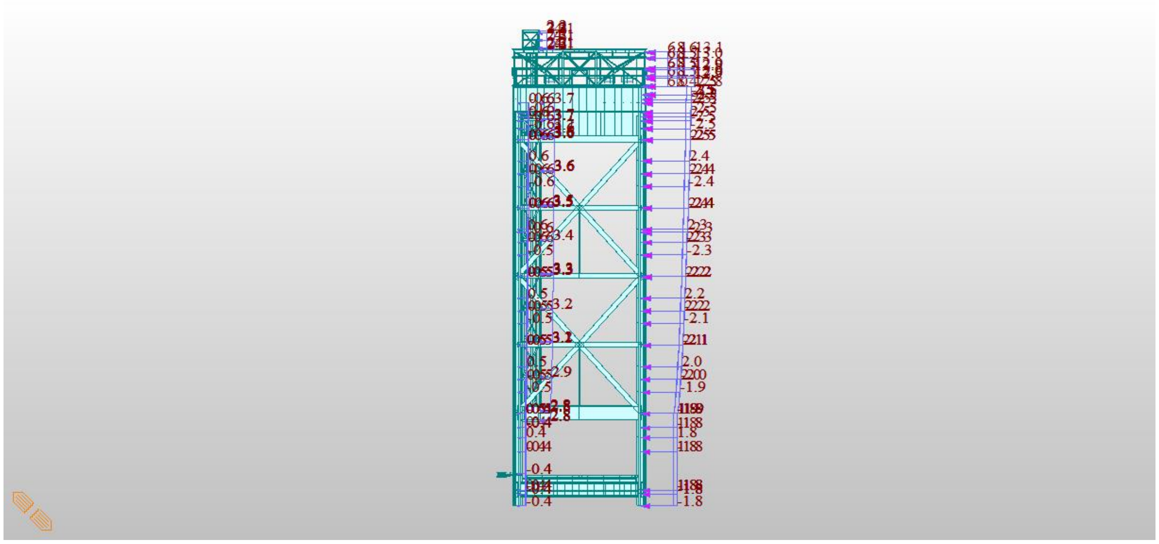


Figure 11 Wind Load Horizontal 1 (East to West) – Tower

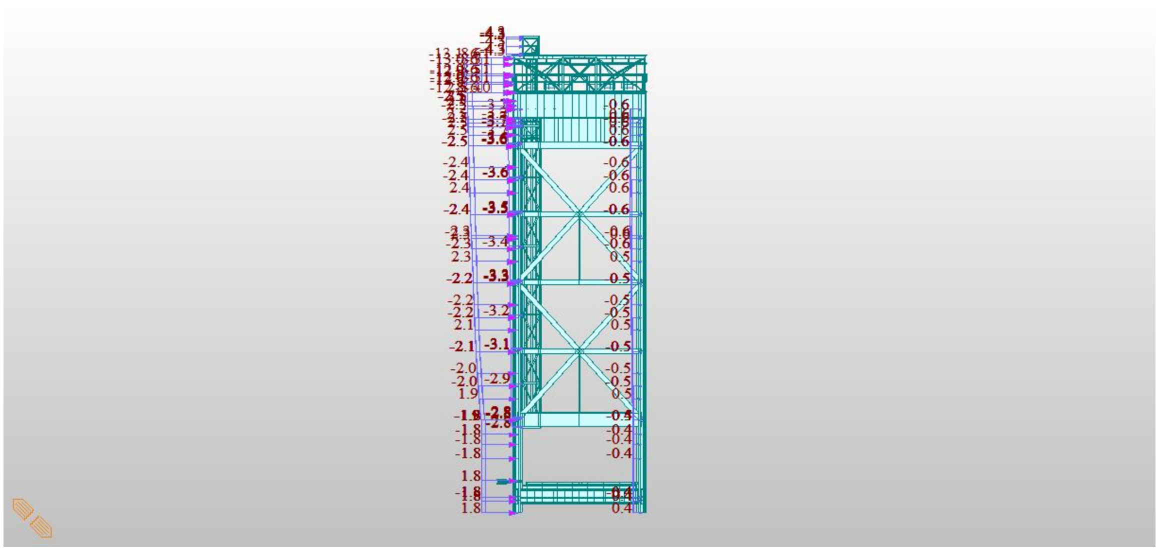


Figure 12 Wind Load Horizontal 2 (West to East) – Tower

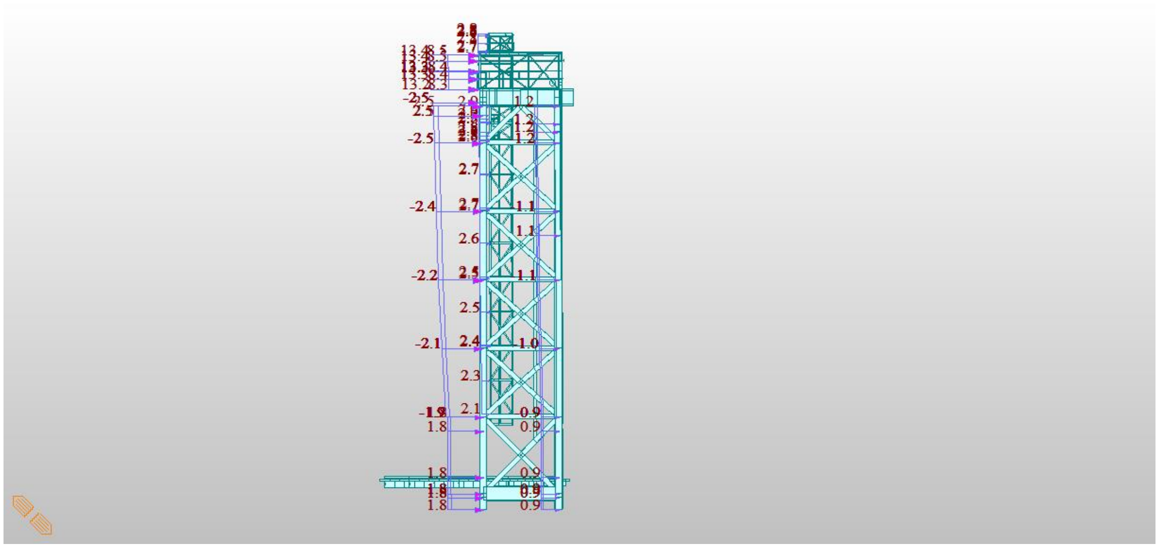


Figure 13 Wind Load Longitudinal 1 (South to North) – Tower

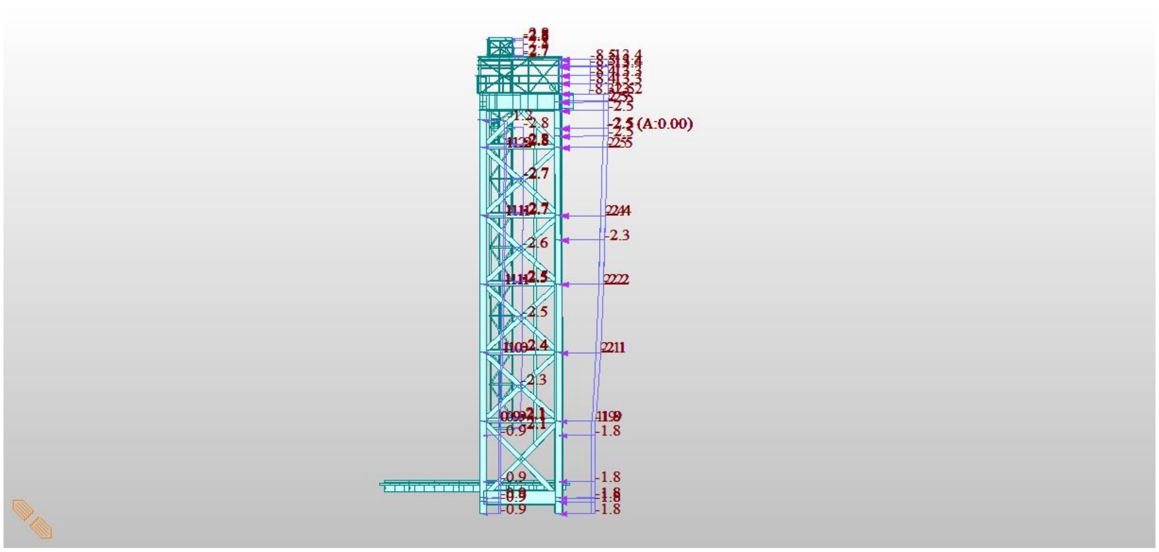


Figure 14 Wind Load Longitudinal 2 (North to South) – Tower

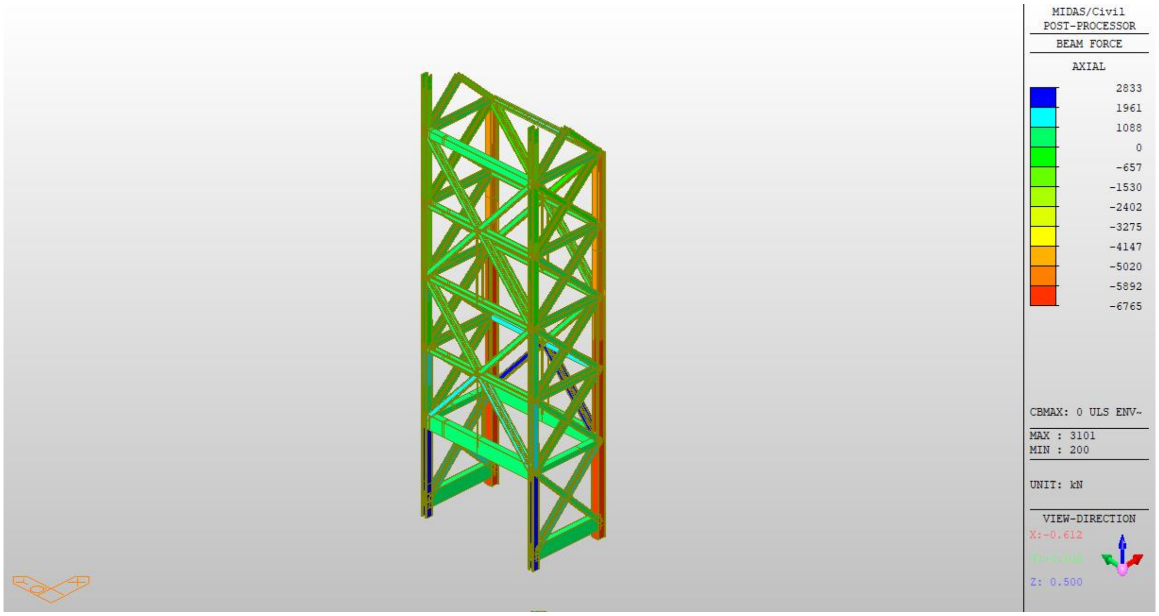


Figure 15 Truss Members – Case 0 (Existing) Envelope Axial Max (kN)

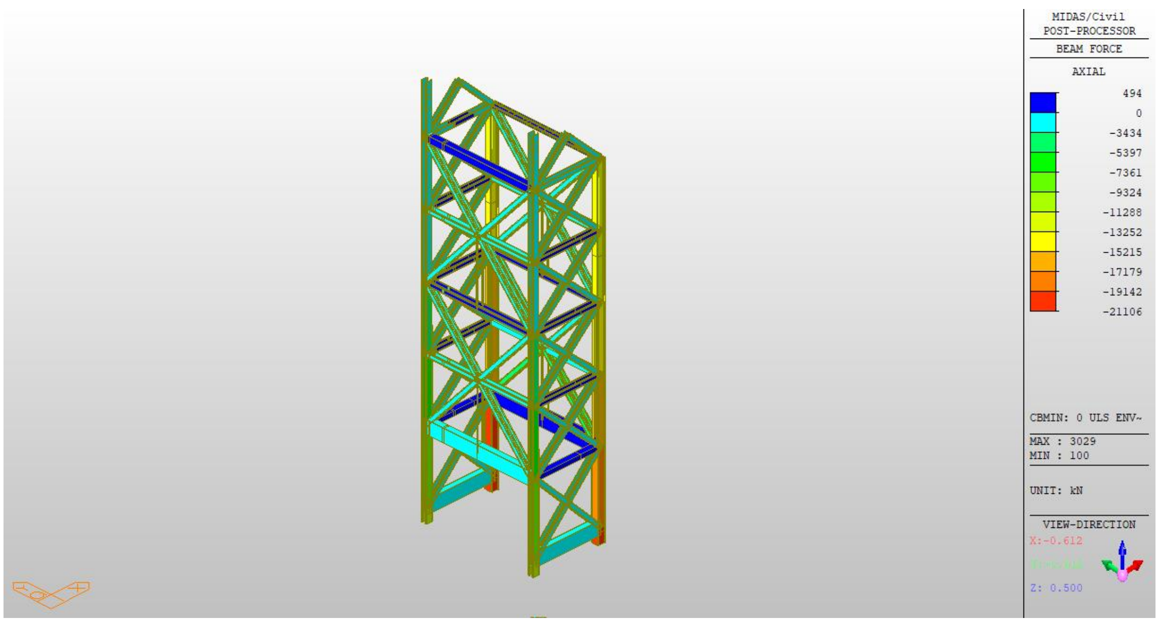


Figure 16 Truss Members - Case 0 (Existing) Envelope Axial Min (kN)

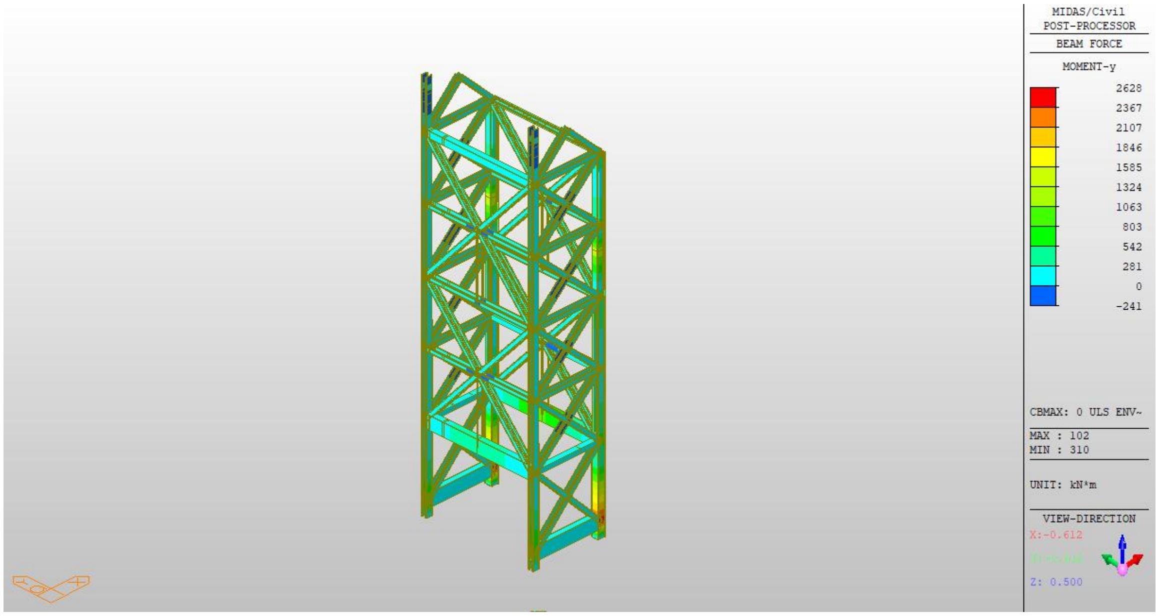


Figure 17 Truss Members - Case 0 (Existing) Envelope M_y Max (kN/m)

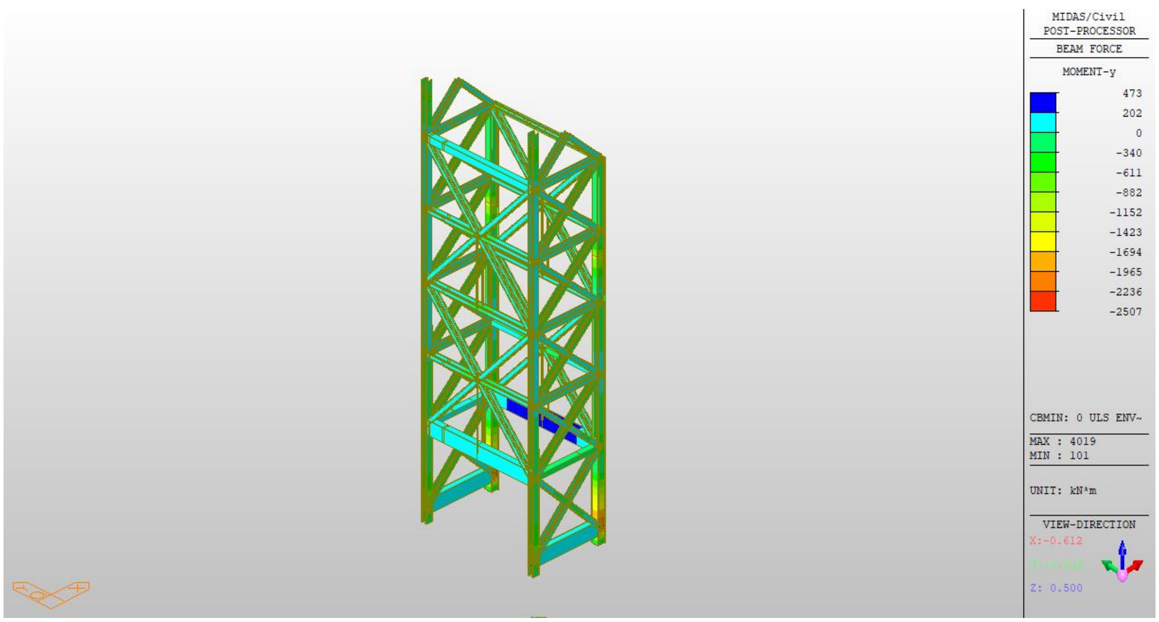


Figure 18 Truss Members - Case 0 (Existing) Envelope M_y Min (kN/m)

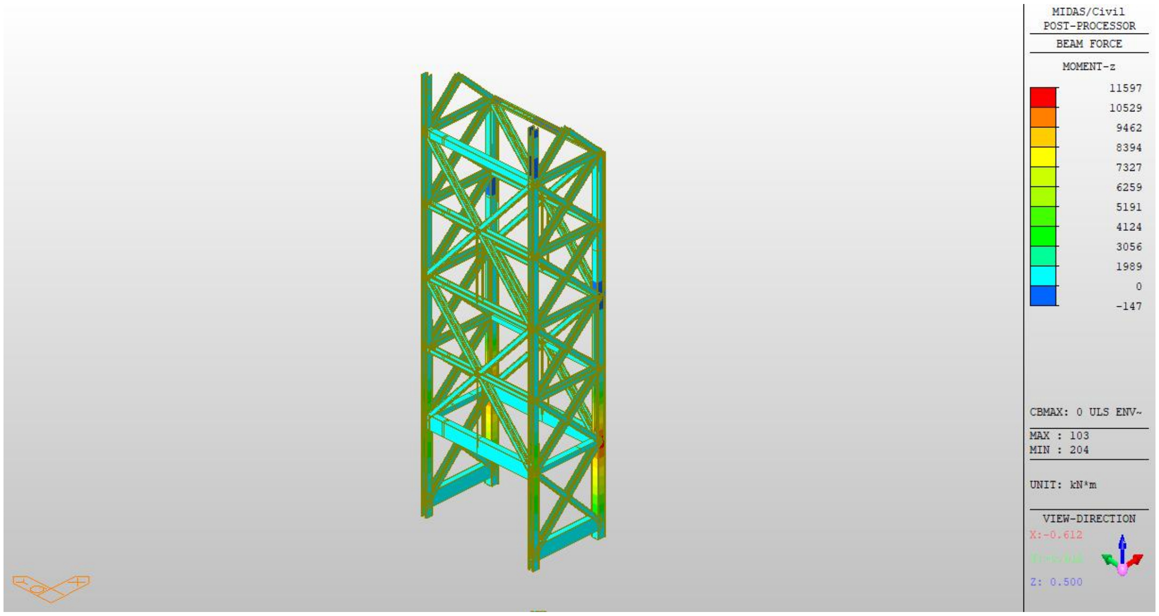


Figure 19 Truss Members - Case 0 (Existing) Envelope M_z Max (kN/m)

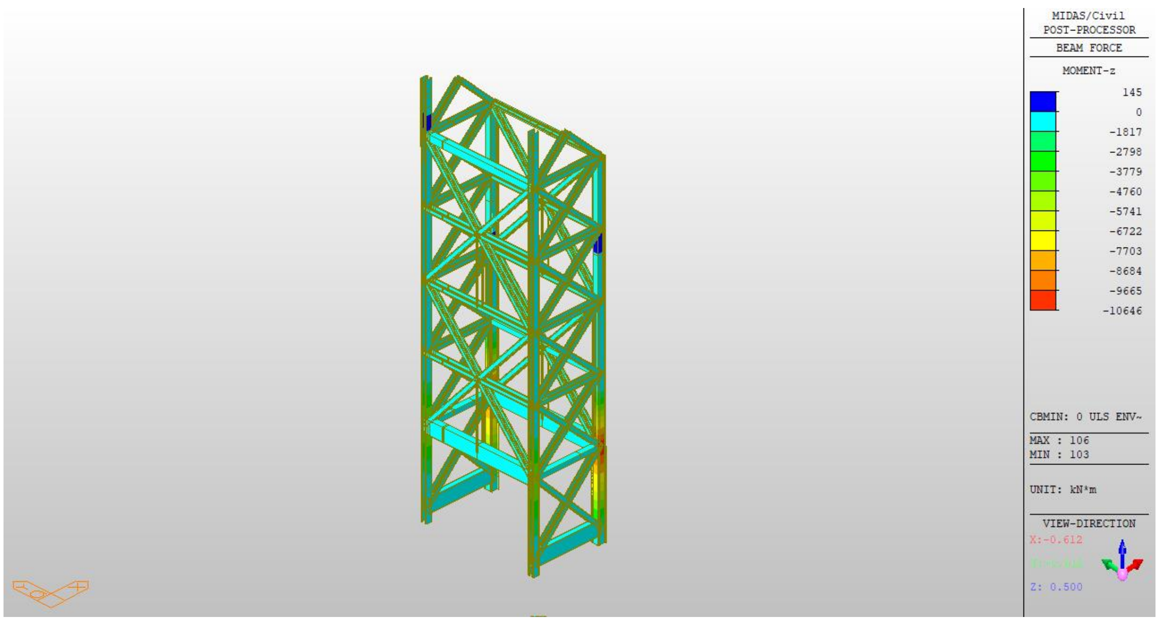


Figure 20 Truss Members - Case 0 (Existing) Envelope M_z Min (kN/m)

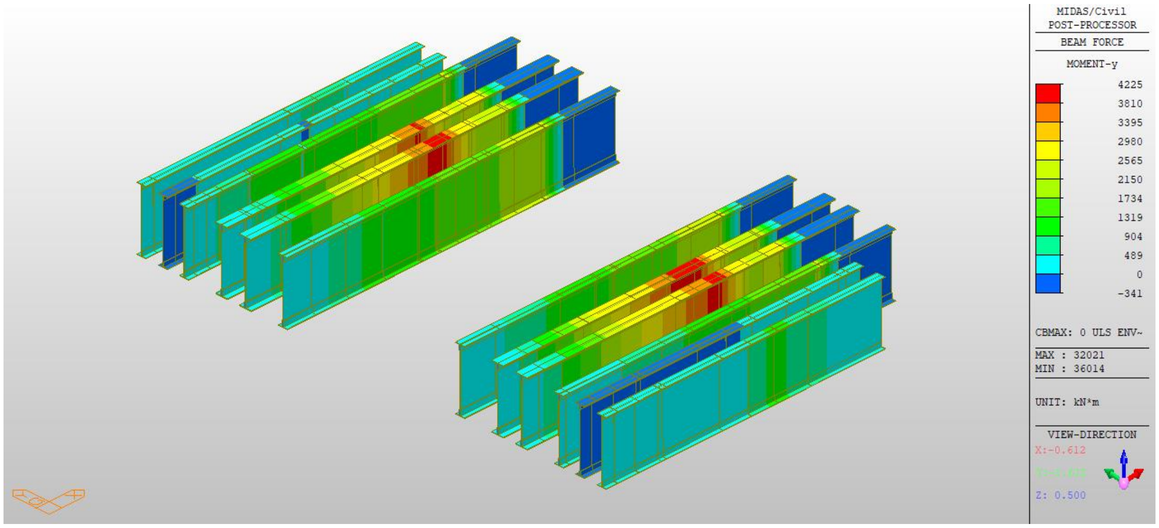


Figure 21 G1 G2 G3 G4 G6 Beam - Case 0 (Existing) M_y Max (kN/m)

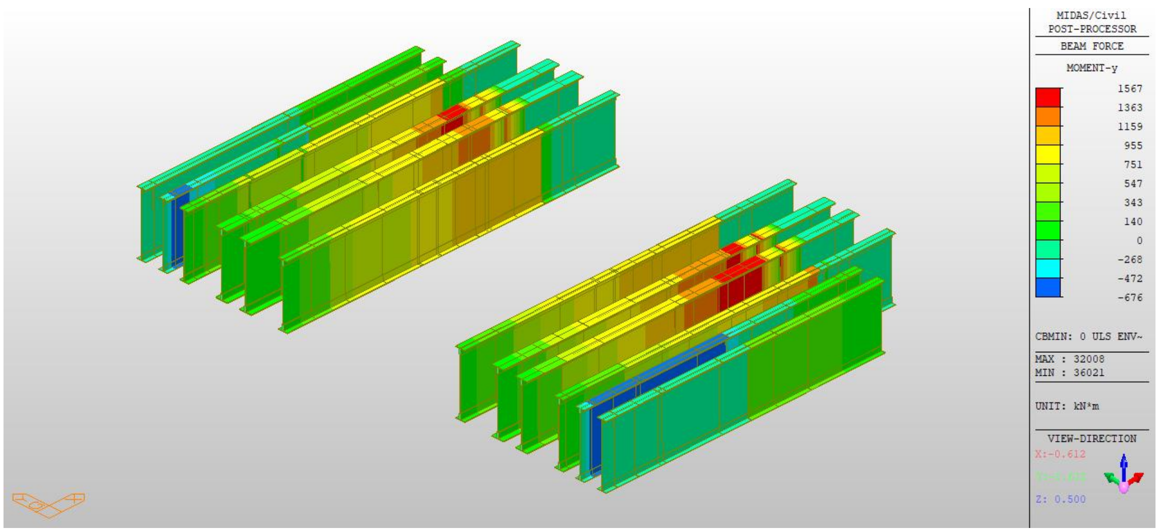


Figure 22 G1 G2 G3 G4 G6 Beam - Case 0 (Existing) M_y Min (kN/m)

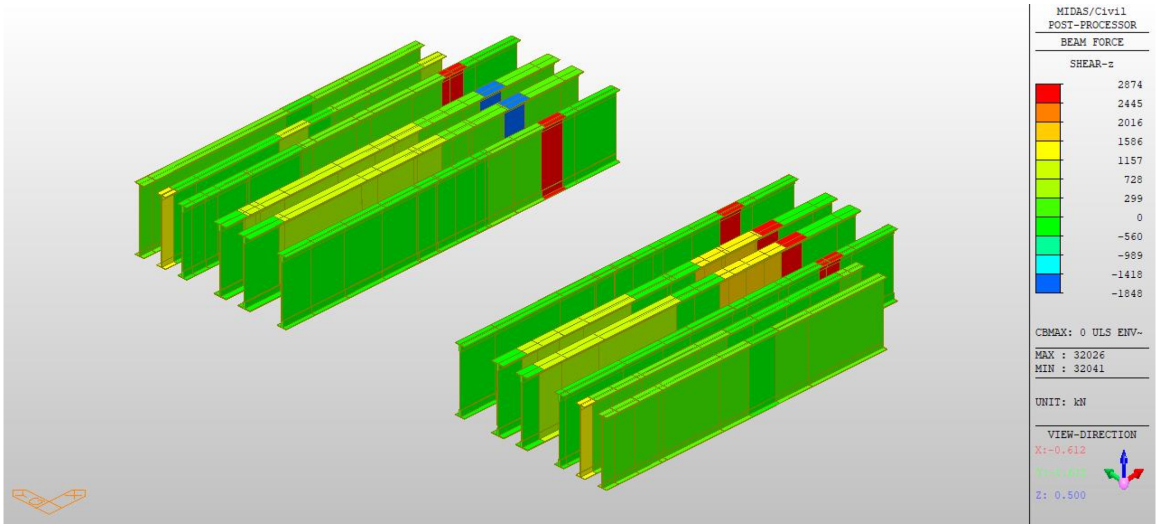


Figure 23 G1 G2 G3 G4 G6 Beam - Case 0 (Existing) F_z Max (kN)

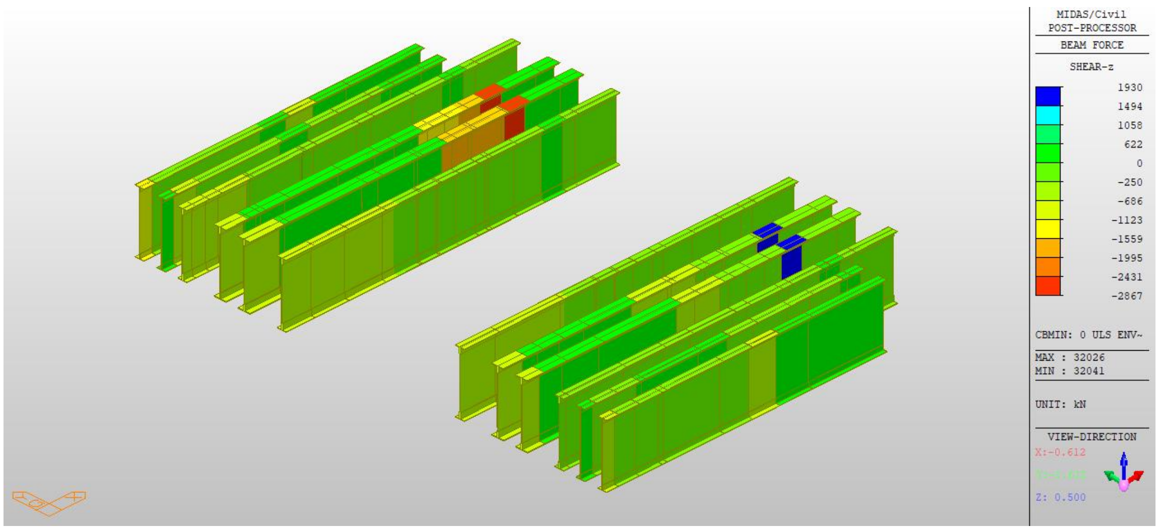


Figure 24 G1 G2 G3 G4 G6 Beam - Case 0 (Existing) F_z Min (kN)

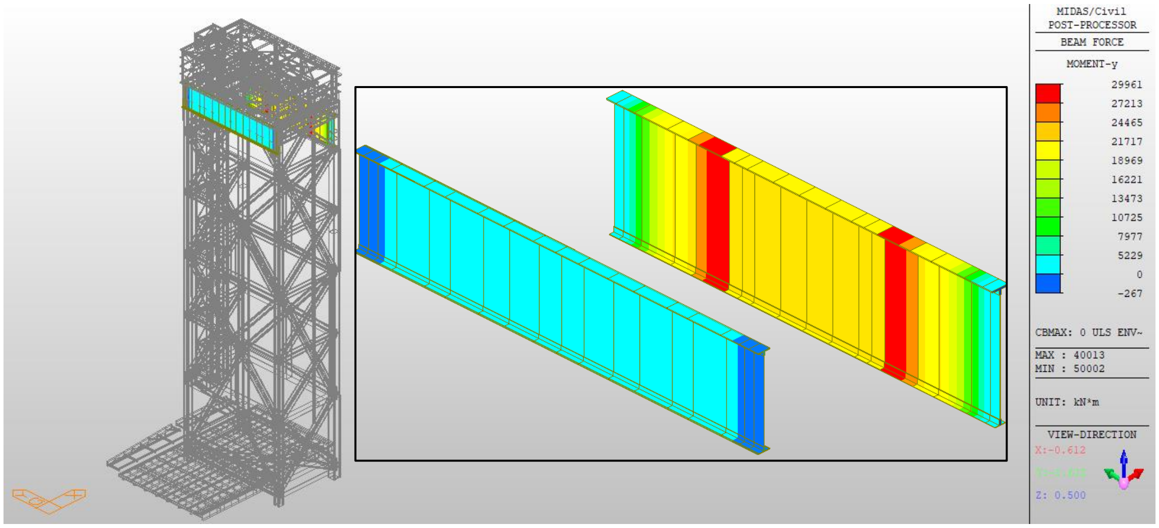


Figure 25 G7 and G8 Beam - Case 0 (Existing) M_y Max (kN/m)

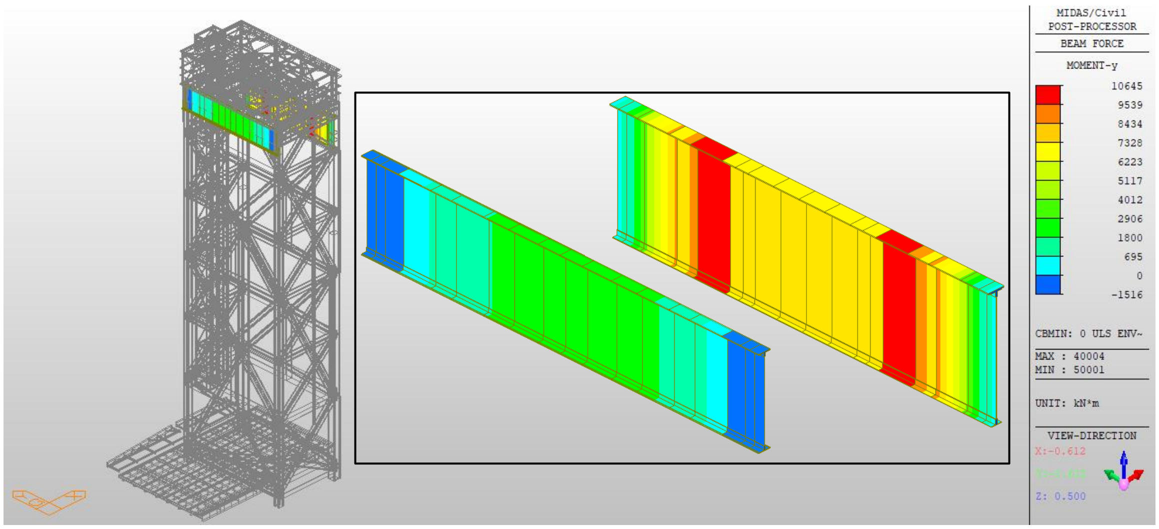


Figure 26 G7 and G8 Beam - Case 0 (Existing) M_y Min (kN/m)

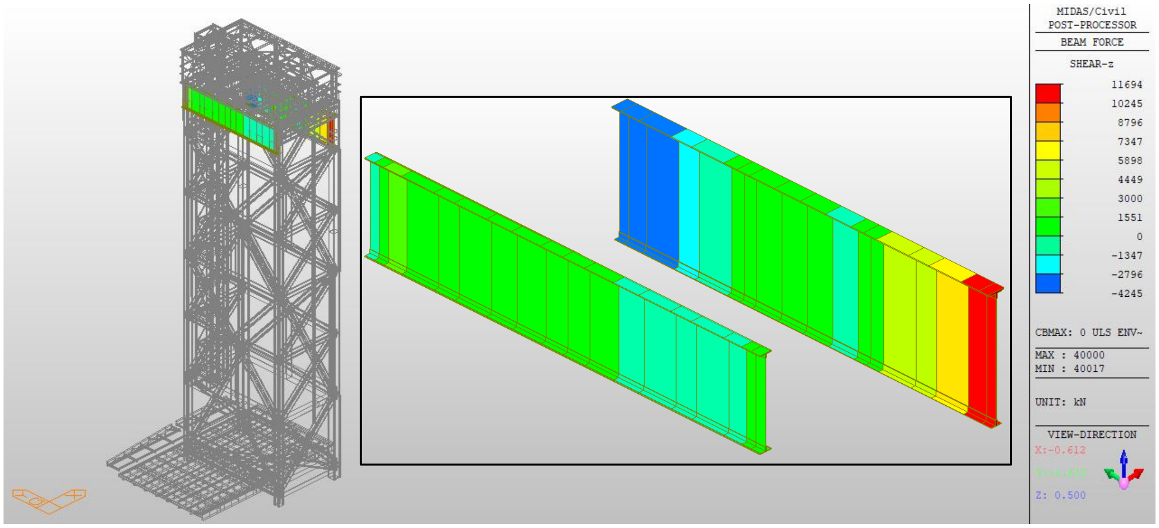


Figure 27 G7 and G8 Beam - Case 0 (Existing) F_z Max (kN)

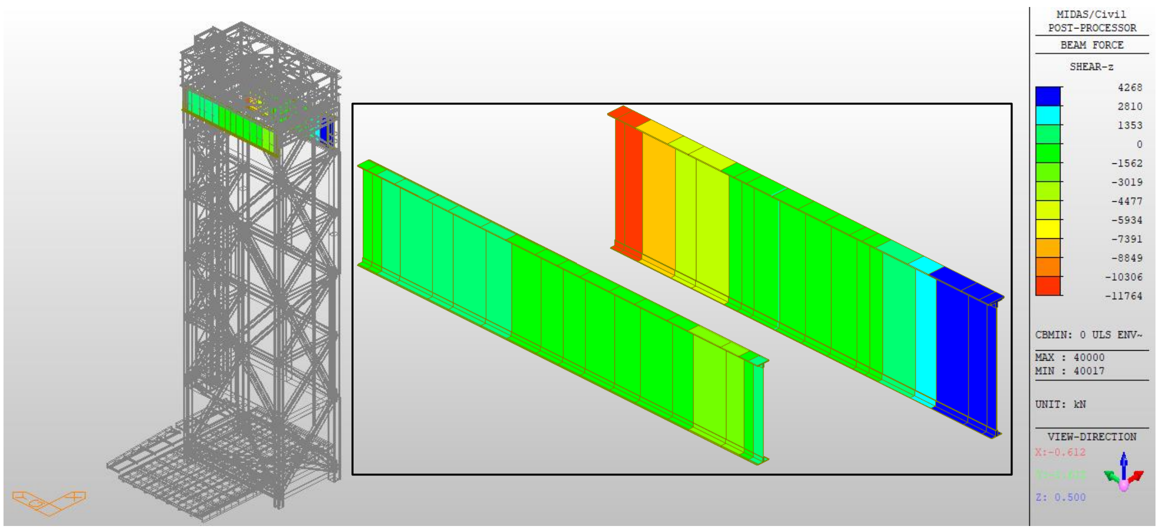


Figure 28 G7 and G8 Beam - Case 0 (Existing) F_z Min (kN)

AECOM Imagine it. Delivered.

Exhibit B.8

Approach Span and Tower Span Existing Evaluation 3D Model

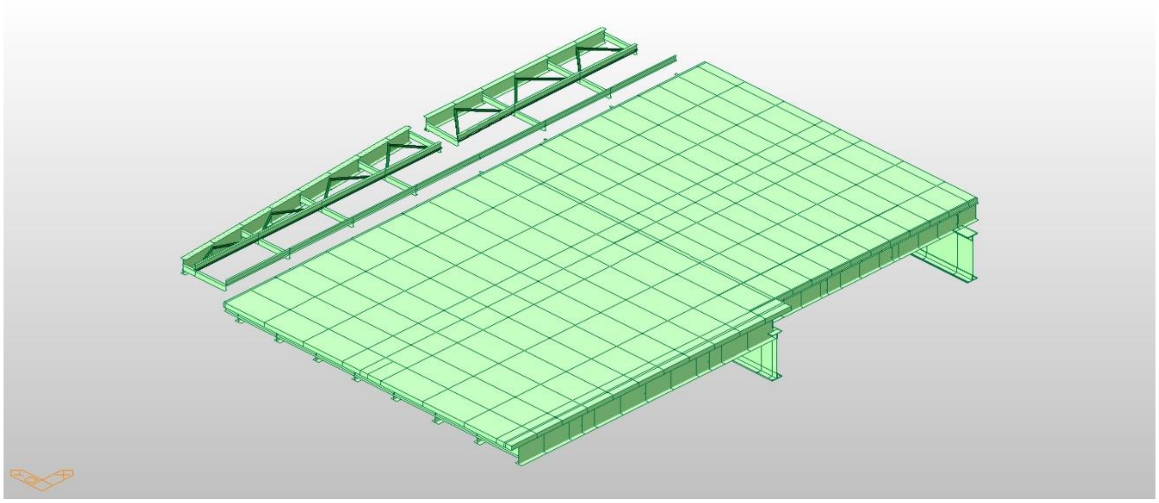


Figure 1 Approach and Tower Spans at South Tower (Similar at North Tower)

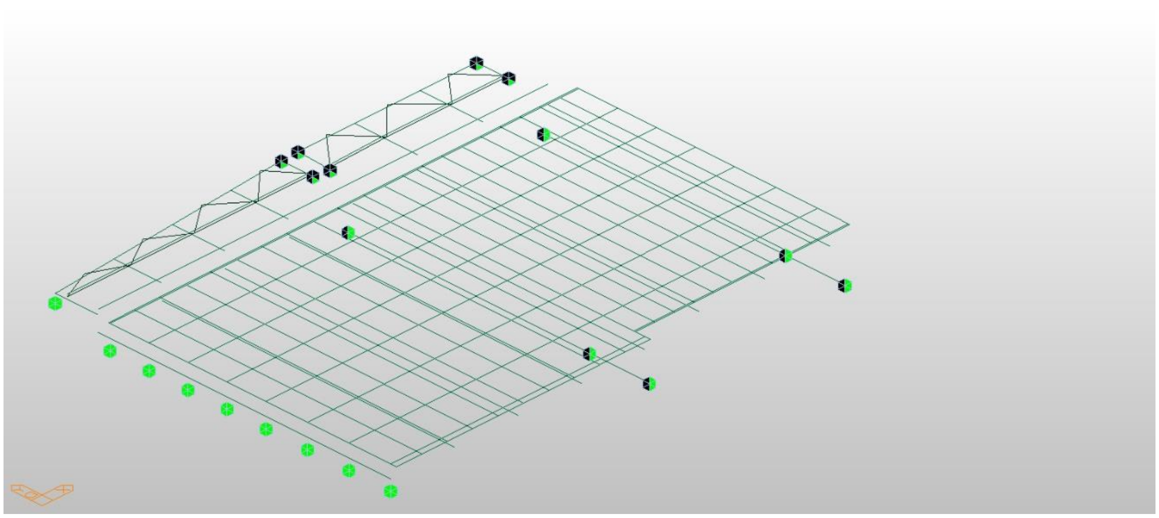


Figure 2 Approach and Tower Support Conditions (Similar at North Tower)

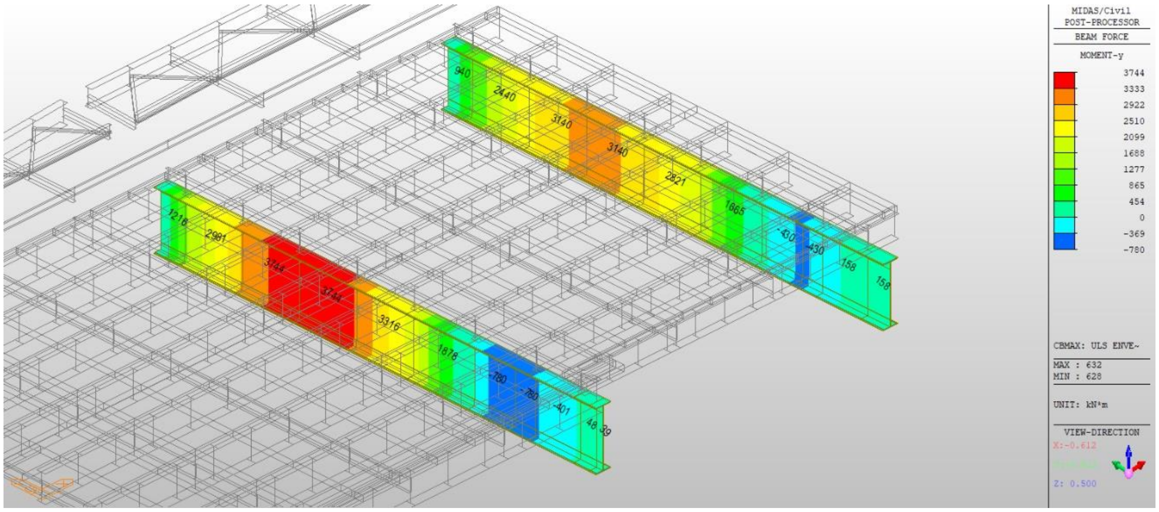


Figure 3 Maximum ULS Moment for Floor Beams

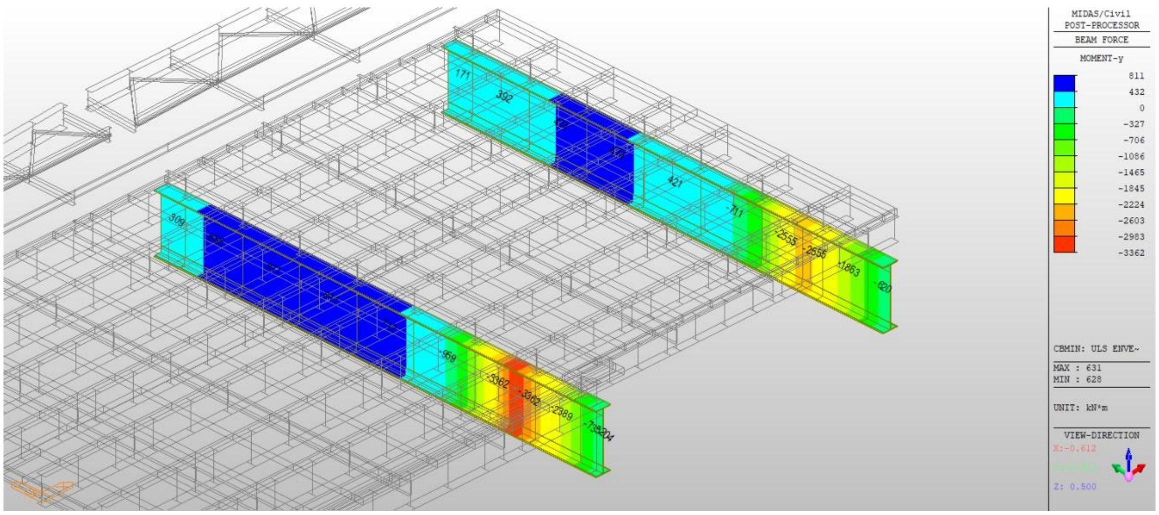


Figure 4 Minimum ULS Moment for Floor Beams

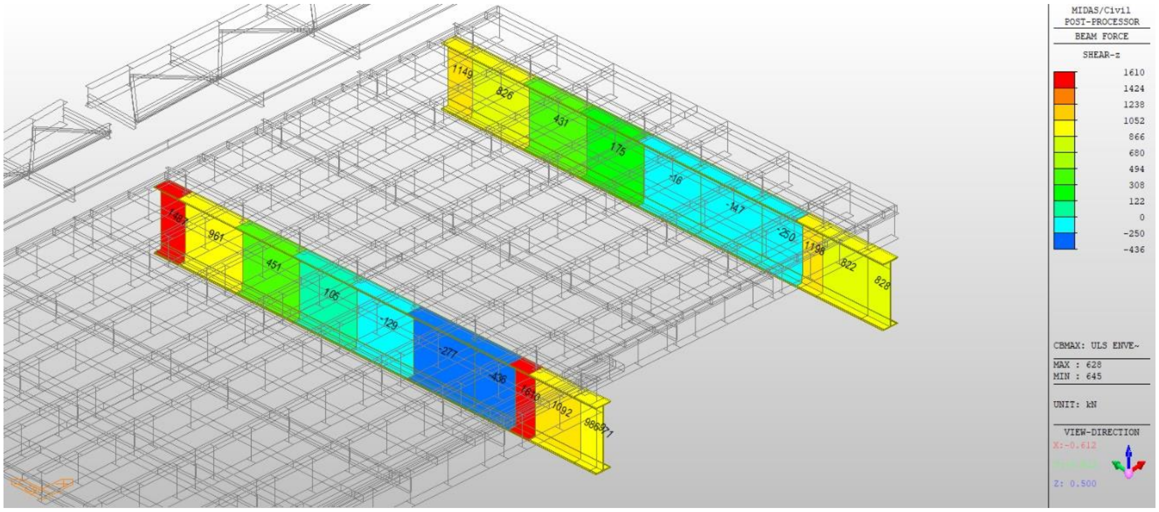


Figure 5 Maximum ULS Shear for Floor Beams

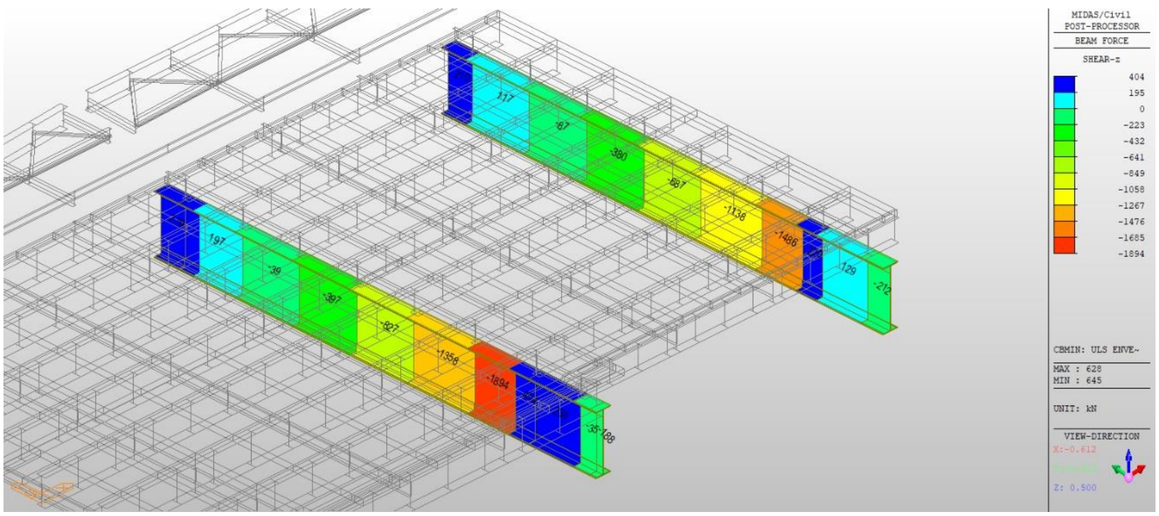


Figure 6 Minimum ULS Shear for Floor Beams

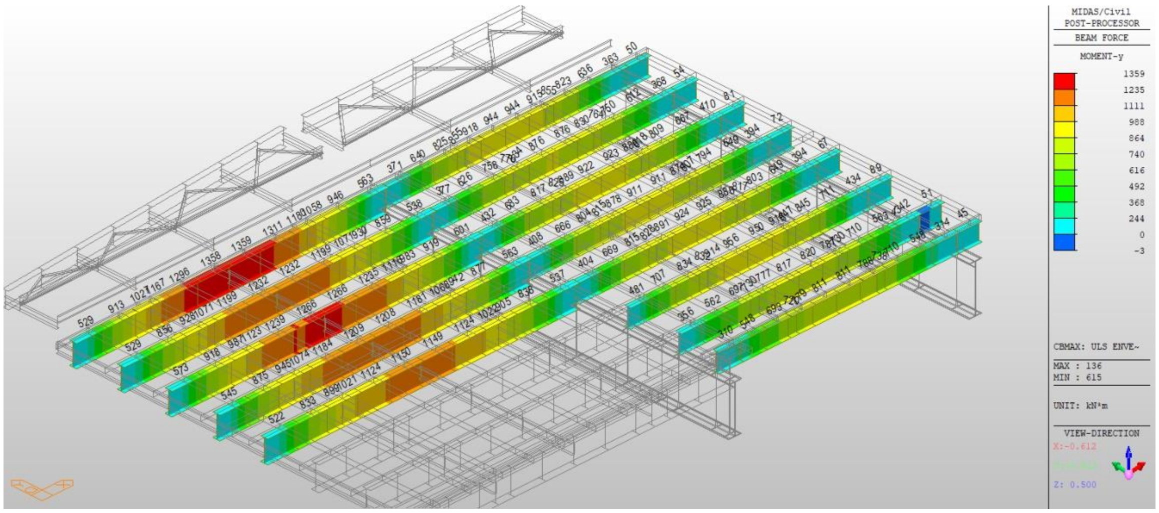


Figure 7 Maximum ULS Moment for Stringers from 1959

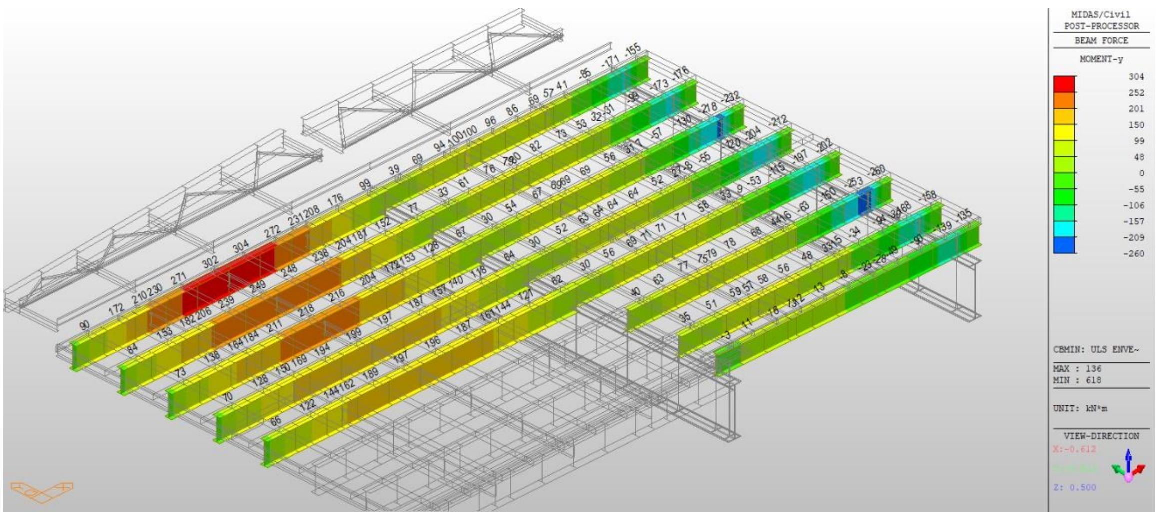


Figure 8 Minimum ULS Moment for Stringers from 1959

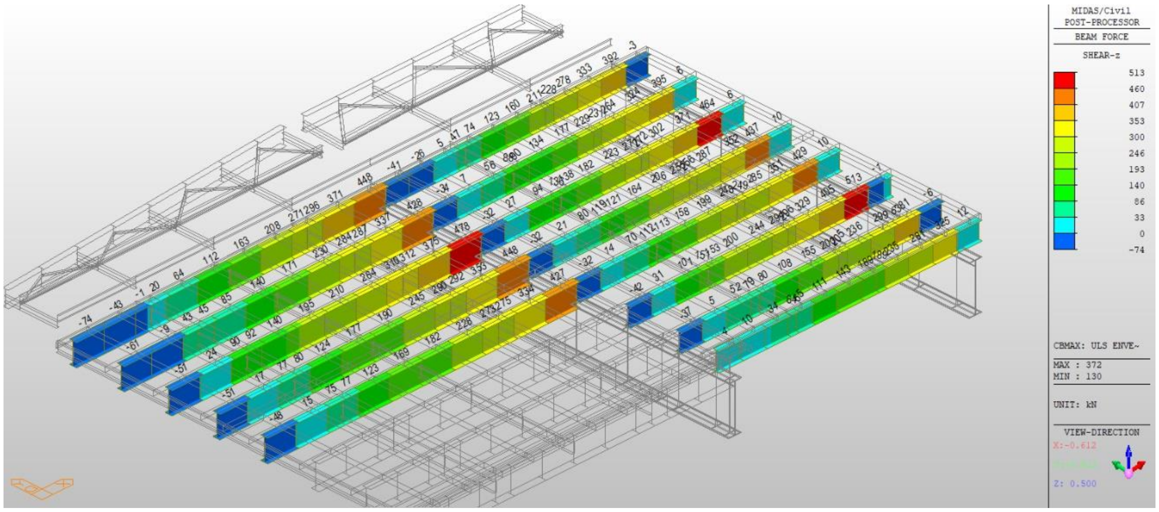


Figure 9 Maximum ULS Shear for Stringers from 1959

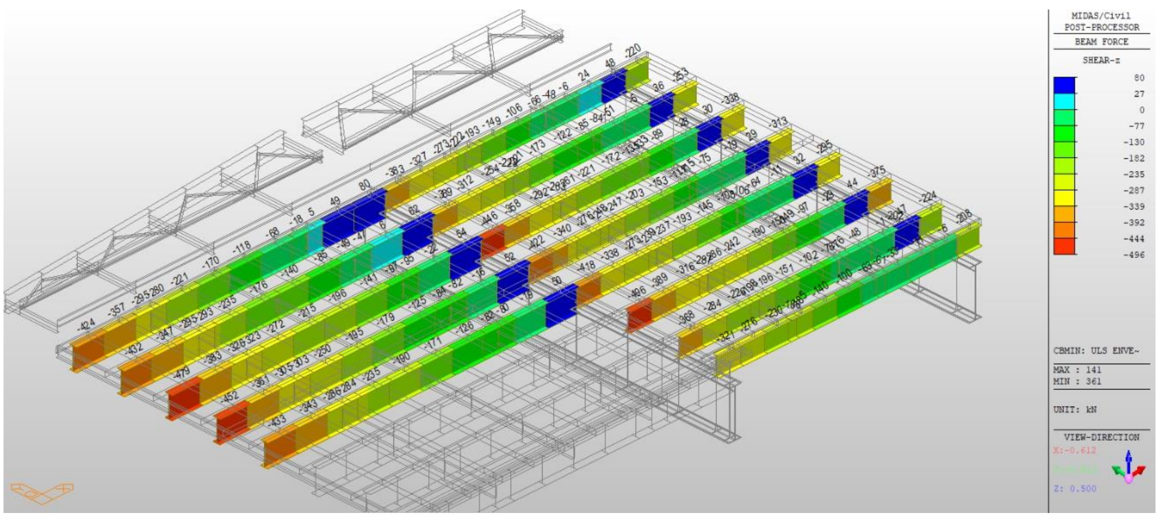


Figure 10 Minimum ULS Shear for Stringers from 1959

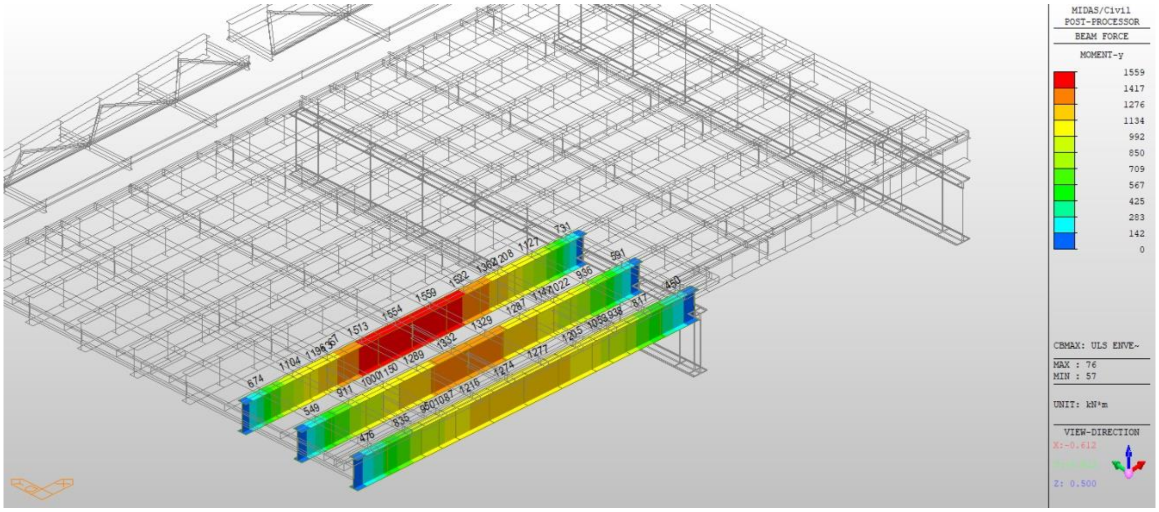


Figure 11 Maximum ULS Moment for Stringers from 1982

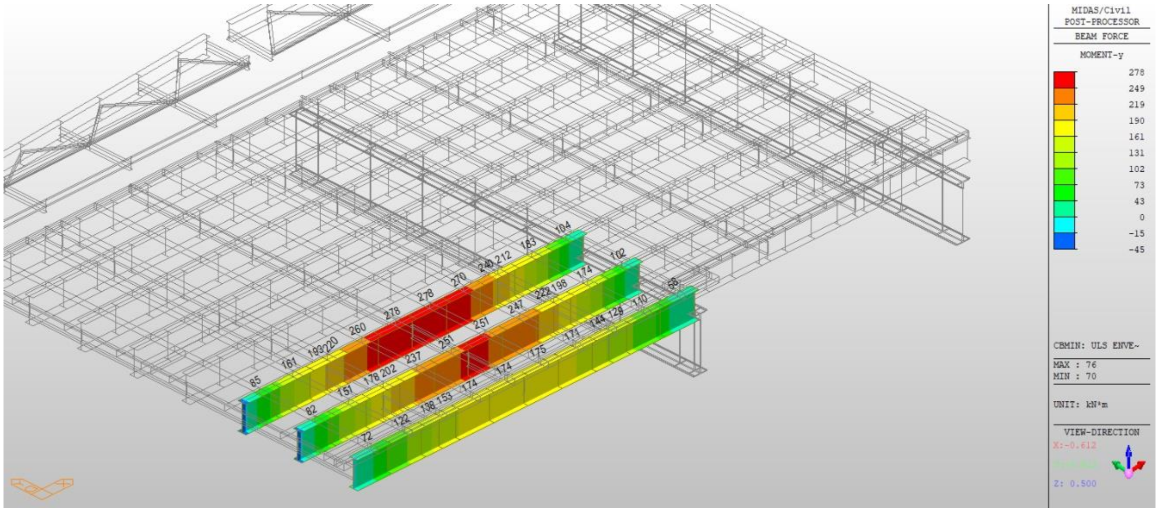


Figure 12 Minimum ULS Moment for Stringers from 1982

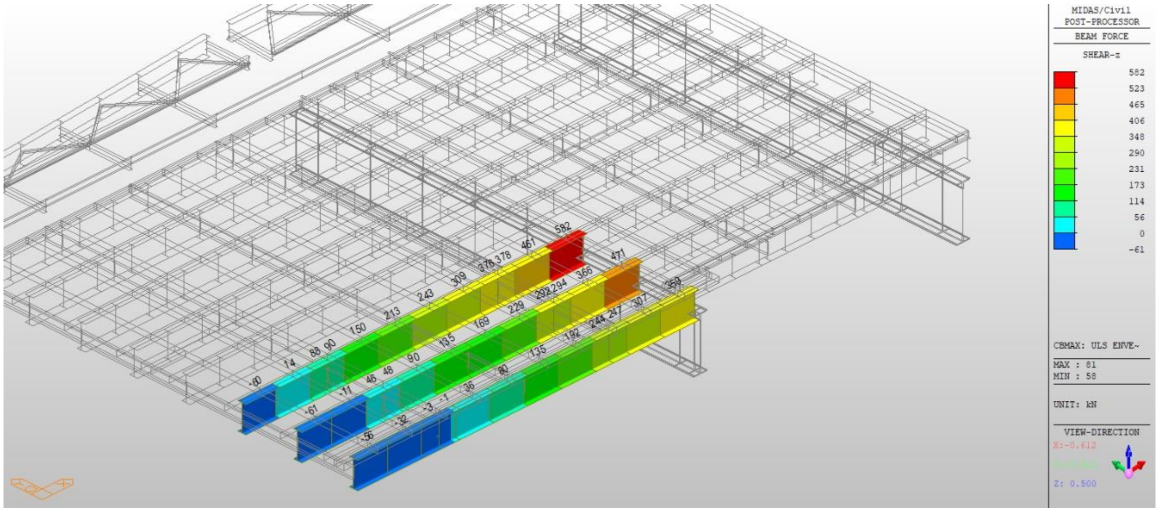


Figure 13 Maximum ULS Shear for Stringers from 1982

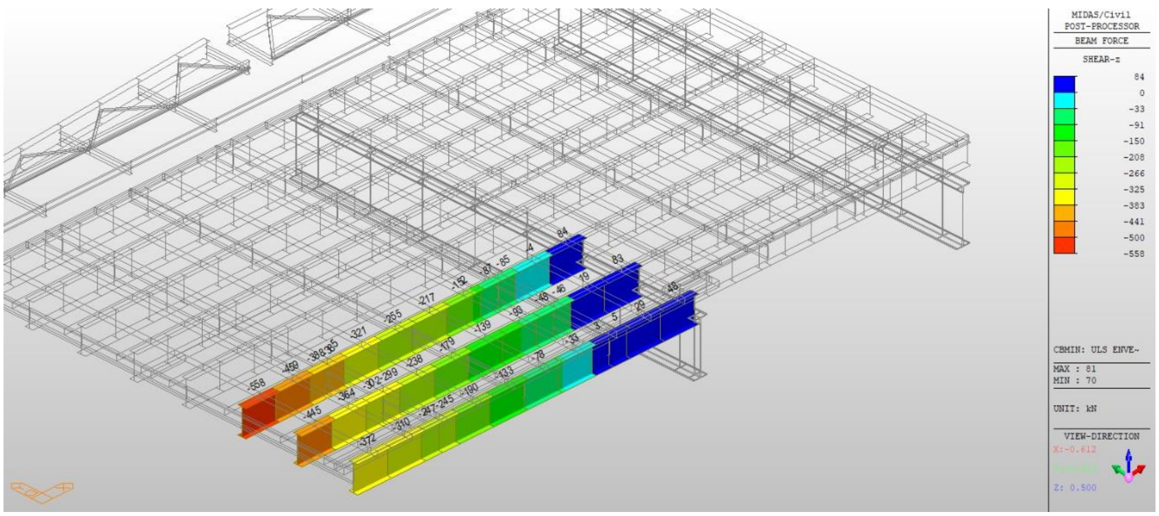


Figure 14 Minimum ULS Shear for Stringers from 1982

Exhibit B.9

Mechanical Component Existing Calculation Summary

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Motor Sizing Calculation

Original Weight

1877 tonnes

TABLE OF CONTENTS :

1.0 GENERAL INFORMATION

1.1 CONSTANTS

$\mu_{stat\_roller} := 0.004$ — Static coefficient of friction for roller bearing

Ref.: S6-14 Table 13.10

$\mu_{dyn\_roller} := 0.003$ — Static coefficient of friction for roller bearing

$Acc_{time} := 10s$ — Maximum time available to reach full lifting speed

Ref. S6-14 article 13.7.14.8.4

$Brake_{time} := 10s$ — Maximum time available to stop the bridge from the maximum speed

$P_{wind} := 0.12kPa$ — Wind pressure

Ref.: S6-14 article 13.7.14.7.4

$P_{ice} := 0.12kPa$ — Ice load per unit area

$Start_{overload} := 1.25$

$Acc_{overload} := 1.5$ — Ref.: S6-14 Table 13.14 — Allowable torque overloads

$Cons_{overload} := 1$

$\eta_{bearings} := 0.98$

$\eta_{sheaves} := \eta_{bearings}{}^{2} = 0.96$

$\eta_{gears} := 0.96^{2}$ — Ref. S6-14 (article 13.7.19.4 & 13.7.19.6.1) and Machinery Handbook — Components efficiencies

$\eta_{reducer} := 0.94$

1.2 GENERAL DATA

$W_{span} := 1877tonne$ — Weigth of span

$W_{cwt} := W_{span}$ — Weigth of counterweight (hypothesis)

$W_{sheave} := 50000lb$ — Weight of sheave (hypothesis)

$W_{trunnion} := 7500lb$ — Weight of trunnion (hypothesis)

$W_{gear} := 8 \cdot 540lb$ — Weight of gear sets (per sheave) (hypothesis)

$W_{total} := W_{span} + W_{cwt} + 8 \cdot W_{sheave} + 8W_{trunnion} + 8W_{gear} = 8.771 \times 10^{6} \cdot lb$ — Weight to be lifted

$r_{rb} := 12in$ — Radius of roller bearings

$r_{s} := \dfrac{180in}{2}$ — Radius of sheave

$S_{speed} := 1\dfrac{ft}{s}$ — Maximum lifting speed of span

$D_{rope} := 2.25in$ — Diameter of main counterweight ropes

$IMB_{South} := 7450lbf$ Seated imbalance, north tower

$IMB_{North} := 6296lbf$ Seated imbalance, south tower

$L_{open} := 370ft$ Length of span (open deck - approximative)

$W_{open} := 50ft$ Width of span (open deck - approximative)

$L_{closed} := 370ft$ Length of span (close deck - approximative)

$W_{closed} := 10ft$ Width of span (close deck - approximative)

2.0 CALCULATION OF LOADS

2.1 FRICTION LOAD - ROLLER BEARINGS OF COUNTERWEIGHT SHEAVES

$$F_{friction\_stat} := \frac{W_{total} \cdot r_{rb} \cdot \mu_{stat\_roller} \cdot g}{r_s} = 20.808 \cdot kN$$

$$F_{friction\_dyn} := \frac{W_{total} \cdot r_{rb} \cdot \mu_{dyn\_roller} \cdot g}{r_s} = 15.606 \cdot kN$$

2.2 INERTIA

$$A_{acc} := \frac{S_{speed}}{Acc_{time}} = 0.1 \cdot \frac{ft}{s^2}$$

$$A_{brake} := \frac{S_{speed}}{Brake_{time}} = 0.1 \cdot \frac{ft}{s^2}$$

$$F_{acc} := 1.25 W_{total} \cdot A_{acc} = 151.574 \cdot kN$$

$$F_{braking} := 1.25 W_{total} \cdot A_{brake} = 151.574 \cdot kN$$

2.3 ROPE BENDING

$$F_{bend} := \frac{W_{total}}{2} \cdot 0.3 \frac{D_{rope}}{2 \cdot r_s} \cdot g = 73.151 \cdot kN$$

Ref. CSA S6-14 article 13.7.20.17

2.4 UNBALANCED CONDITIONS

$$F_{balance} := IMB_{North} + IMB_{South} = 61.145 \cdot kN$$

2.5 WIND LOADING

$$F_{wind} := \left(L_{open} \cdot W_{open} \cdot 0.85 + L_{closed} \cdot W_{closed}\right) \cdot P_{wind} = 216.557 \cdot kN$$

2.6 ICE LOADING (WORST CASE SCENARIO - BRIDGE IS NOT OPENED DURING WINTER)

$$F_{ice} := \left(L_{open} \cdot W_{open} \cdot 0.85 + L_{closed} \cdot W_{closed}\right) \cdot P_{ice} = 216.557 \cdot kN$$

3.0 LOAD CASES

Case 1: Starting Load

$$F_{starting\_lc1} := F_{friction\_stat} + F_{acc} + F_{bend} + F_{balance} + F_{wind} + F_{ice} = 739.792 \cdot kN$$

Case 2: Accelerating Load

$$F_{acc\_lc2} := F_{friction\_dyn} + F_{acc} + F_{bend} + F_{balance} + F_{wind} = 518.034 \cdot kN$$

Case 3: Constant Velocity

$$F_{cons\_lc3} := F_{friction\_dyn} + F_{bend} + F_{balance} + F_{wind} = 366.459 \cdot kN$$

Case 4: Braking Load

$$F_{braking\_lc4} := F_{friction\_dyn} + F_{braking} + F_{bend} + F_{balance} + F_{wind} = 518.034 \cdot kN$$

4.0 MOTOR SELECTION

4.1 GOVERNING FORCE FOR MOTOR SELECTION

$$F_{motor.lc1} := \frac{F_{starting\_lc1}}{Start_{overload}} = 591.834 \cdot kN$$

$$F_{motor.lc2} := \frac{F_{acc\_lc2}}{Acc_{overload}} = 345.356 \cdot kN$$

$$F_{motor.lc3} := \frac{F_{cons\_lc3}}{Cons_{overload}} = 366.459 \cdot kN$$

$$F_{motor.lc4} := \frac{F_{braking\_lc4}}{Acc_{overload}} = 345.356 \cdot kN$$

$$F_{motor} := \max\left(F_{motor.lc1}, F_{motor.lc2}, F_{motor.lc3}, F_{motor.lc4}\right) = 591.834 \cdot kN$$

4.2 MOTOR POWER REQUIRED (per tower)

$$\eta_{lift} := \eta_{sheaves} \cdot \eta_{gears} \cdot \eta_{reducer} = 0.832$$

Efficiency of system

$$Hp_{motor} := \frac{F_{motor} \cdot S_{speed}}{\eta_{lift} \cdot 2} = 145 \cdot hp$$

Required power of motor in worst case scenario (wind + ice load)

Current HP of motors is 150 HP.

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Main Counterweight Rope Capacity Calculations

Original Weight

1877 tonnes

1.0 GENERAL INFORMATION

1.1 GENERAL DATA

$W_{span} := 1877\text{tonne}$ — Weigth of span and deck

$D := 177.75\text{in}$ — Tread diameter of sheave rope grooves

$d := 2.25\text{in}$ — Diameter of main counterweight ropes

$d_w := \frac{d}{16} = 0.141 \cdot \text{in}$ Ref.: AASHTO Article 6.8.3.3.4 — Diameter of the outer wires in the wire rope

$E_w := 30 \times 10^6 \text{psi}$ — Tensile modulus of elasticity of the steel wire

$A_{rope} := 0.4 \cdot d^2 = 2.025 \cdot \text{in}^2$ Ref.: S6-14 Table 13.20 — Effective cross sectional are of the ropes (approx.)

$N_{rope} := 80$ — Number of ropes

1.2 ALLOWABLE STRESSES

Ref.: AASHTO Article 6.6.5 & CHBDC article 13.7.20.18

$P_{ult} := 420000\text{lbf}$ — Minimum ultimate tensile strength of rope (ref. BLB 2002 Main CW Wire Rope Replacement)

$\sigma_{ult} := \frac{P_{ult}}{A_{rope}} = 1430 \cdot \text{MPa}$ — Allowable tensile load

$\sigma_{allowable} := 0.222 \cdot \sigma_{ult} = 317 \cdot \text{MPa}$ — Maximum allowable tensile stress (for combined effect of bending and direct load)

2.0 STRESSES CALCULATIONS

Ref.: AASHTO Article 6.8.3.3.4 & CHBDC article 13.7.20.18

$\sigma_b := E_w \cdot \frac{d_w}{D} = 163.641 \cdot \text{MPa}$ — Maximum bending stress

$P := \frac{W_{span} \cdot g}{80} = 230.089 \cdot \text{kN}$ — Direct load (per rope)

$P_{ol} := \frac{518.034\ \text{kN}}{80} = 6.475 \cdot \text{kN}$ — Operating loads (per rope) (value from motor sizing calculation)

$\sigma_r := \frac{P}{A_{rope}} + \sigma_b + \frac{P_{ol}}{A_{rope}} = 344.715 \cdot \text{MPa}$ — Maximum total stress (per rope)

$SF := \frac{\sigma_r}{\sigma_{allowable}} \cdot 100\% = 108.584 \cdot \%$ — Value of over stress

AECOM

Calculations

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Trunnion Bearing Capacity

Original Weight

1877

1.0 GENERAL INFORMATION

1.1 GENERAL DATA

$D_b := 21.625in$ — Diameter of Shaft at Section B (bore diameter)

$r_s := \frac{180in}{2} = 90 \cdot in$ — Radius of sheave

$S_{speed} := 1\frac{ft}{s}$ — Maximum lifting speed of span

$rpm_{bearing} := \frac{S_{speed} \cdot 60s}{2\pi \cdot r_s} = 1.273$ — Rotation speed of trunnion bearing (approximative)

Assume a large rolling element bearing, as per AASHTO C6.7.7.2.4

C6.7.7.2.4

Large rolling element bearings generally have a bore larger than 4 in., and a rotational speed less than 5 rpm.

It is necessary to work closely with bearing manufacturers on the large rolling element bearings. The specific operating parameters may necessitate special lubricating or other requirements, especially in applications such as a bascule trunnion bearing whose inner race operates at less than one quarter revolution each cycle.

$Span_w := 1877tonne$ — Weight of span and new deck (to be confirmed)

$Cwt := Span_w$ — Weight of Counterweights (hypothesis)

$W := \frac{(Span_w + Cwt)}{16} = 235 \cdot tonne$ — Weight on Trunnion Shaft

1.2 ALLOWABLE STRESSES

Ref.: AASHTO article 6.7.7.2.4

$C_{or} := 4586124lb$ — Basic static radial load rating of the bearing

$n_s := 5$ — Design factor

$P_{cor} := \frac{C_{or}}{5} = 917225 \cdot lb$ — Factor radial design resistance

$X_o := 1$ — Static axial load factor

$Y_o := 2$ — Static radial load factor

$F_{oxy} := X_o \cdot W + 0.15 \cdot Y_o \cdot W = 672437 \cdot lb$

$\text{Verification} := \text{if}\left(F_{oxy} \le P_{cor}, \text{"OK"}, \text{"NOT ACCEPTABLE"}\right) = \text{"OK"}$

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Fatigue Check of Trunnion Shaft

Original Weight

1877 tonnes

Critical Sections:

A - Maximum bending moment, torsional moment, and stress concentration of keyway

B - Bending moment, torsional moment, and stress concentrations of fillet

Shaft Dimensions and other Variables

Enter information in Yellow boxes:

Results are in Blue boxes

Sections AB & B Diameters — Section AB is middle of turnnion shaft Section B is at fillet

$D_{ab} := 24in$ — Diameter of Shaft at Section AB

$D_b := 22.084in$ — Diameter of Shaft at Section B

$r_f := .625$ — Fillet Radius in inches, but do not use dimension

$Span_w := 4138kip$ — Weight of Span

$Cwt := Span_w$ — Weight of Counterweights (hypothesis)

$$W_1 := \frac{(Span_w + Cwt)}{8} = 1035 \cdot kip$$ Weight on Trunnion Shaft

$\sigma ut := 75ksi$ — Ultimate Tensile Strength of Shaft Material (ASTM A235 Class E)

$\sigma y := 37.500ksi$ — Yield Strenght for material

Distance from bearings to area of concern:

$l_s := 13in + 13in + 27.5in = 53.5 \cdot in$ — Length of Shaft Between Bearing Centers

$l_a := \frac{l_s}{2}$ — Distance to Center of Shaft from center of Bearing

$l_b := 13in$ — Distance from Center of Bearing to fillet

$c_{fr} := .004$ — Coefficient of friction for Bronze on Steel (Greased)

Torque on Shaft Due to Friction

$T_{fr} := W_l \cdot D_b \cdot c_{fr}$ $\qquad T_{fr} = 635.382\,J \cdot 16.250$

Find Endurance Limit:

σe = α σut * (Cd*Cs*Ck*Ct*Cm)

$\alpha := .5$

From CSA Section 13.7.3.5.4 Endurance Limit

$Cr := 0.814$

$Cm := 1$

$Cs := 1.459 \qquad 4.51 \cdot (75)^{-0.265} = 1.436$

$Ct := 1$

Size Factor; $\qquad$ Cd = (D/7.6)$^{-0.113}$

$$Cd_{ab} := \left[\left(\frac{D_{ab}}{7.6mm}\right)^{-.113}\right] \qquad Cd_{ab} = 0.609$$

$$Cd_b := \left[\left(\frac{D_b}{7.6mm}\right)^{-.113}\right] \qquad Cd_b = 0.615$$

$$\sigma e_a := \alpha \cdot \sigma ut \cdot \left(Cd_{ab} \cdot Cr \cdot Ct \cdot Cs \cdot Cm\right) \qquad \sigma e_a = 27.135 \cdot ksi$$

$$\sigma e_b := \alpha \cdot \sigma ut \cdot \left(Cd_b \cdot Cr \cdot Ct \cdot Cs \cdot Cm\right) \qquad \sigma e_b = 27.392 \cdot ksi$$

Find - Bending Moments at each Section:

Section A -

Bending moment due to weight on Shaft

$M_a := W_l \cdot l_a$ $\qquad M_a = 2.306 \times 10^3 \cdot ft \cdot kip$

Section B -

Bending moment due to weight on Shaft

$M_b := W_l \cdot l_b$ $\qquad M_b = 1.121 \times 10^3 \cdot ft \cdot kip$

Find Stress Concentration Factors:

$\nu := .049$

$$q := \frac{1}{\left[1 + \left(\frac{\nu}{r_f^{.5}}\right)\right]} \qquad q = 0.942$$

$Kt_a := 1$ — For Sled-run keyway; Use 1 if no Keyway

$Kf_a := 1 + q \cdot (Kt_a - 1) \qquad Kf_a = 1$

$K\tau_a := 1$ — For Sled-run keyway; Use 1 if no Keyway

$Kf\tau_a := 1 + q \cdot (K\tau_a - 1) \qquad Kf\tau_a = 1$

2.22

$Kt_b := 2.02$

$Kf_b := 1 + q \cdot (Kt_b - 1) \qquad Kf_b = 1.96$ — From AASHTO Section 6.7.3.2

$K\tau_b := 1.61$

1.61

$Kf\tau_b := 1 + q \cdot (K\tau_b - 1) \qquad Kf\tau_b = 1.574$

Find Stress Concentration Factors (v.2):

From Peterson's Stress Concentration Factors, 2nd Ed. 1997, Chapter 3: Shoulder fillet in bar of circular cross section

$r_{f.} := .625$ Fillet Radius

$t := \dfrac{D_{ab} - 22.084in}{2in} = 0.958$ Fillet Height

$D := 24$ $\dfrac{t}{r_f} = 1.533$

Bending Factor

$C1b := 0.947 + 1.206\sqrt{\dfrac{t}{r_f}} - 0.131\cdot\dfrac{t}{r_f} = 2.239$

$C2b := 0.022 - 3.405\sqrt{\dfrac{t}{r_f}} + 0.915\cdot\dfrac{t}{r_f} = -2.791$

$C3b := 0.869 + 1.777\sqrt{\dfrac{t}{r_f}} - 0.555\cdot\dfrac{t}{r_f} = 2.218$

$C4b := -0.810 + 0.422\sqrt{\dfrac{t}{r_f}} - 0.260\cdot\dfrac{t}{r_f} = -0.686$

$Kt_b := C1b + C2b\cdot\left(\dfrac{2t}{D}\right) + C3b\cdot\left[\left(\dfrac{2t}{D}\right)^2\right] + C4b\cdot\left[\left(\dfrac{2t}{D}\right)^3\right]$

$Kf_b := 1 + q\cdot\left(Kt_b - 1\right)$ $Kf_b = 1.97$

Torsional Factor

$C1 := 0.905 + 0.783\sqrt{\dfrac{t}{r_f}} - 0.075\cdot\dfrac{t}{r_f} = 1.759$

$C2 := -0.437 - 1.969\sqrt{\dfrac{t}{r_f}} - 0.553\cdot\dfrac{t}{r_f} = -3.722$

$C3 := 1.557 + 1.073\sqrt{\dfrac{t}{r_f}} - 0.578\cdot\dfrac{t}{r_f} = 1.999$

$C4 := -1.061 + 0.171\sqrt{\dfrac{t}{r_f}} + 0.086\cdot\dfrac{t}{r_f} = -0.717$

$K\tau_b := C1 + C2\cdot\left(\dfrac{2t}{D}\right) + C3\cdot\left[\left(\dfrac{2t}{D}\right)^2\right] + C4\cdot\left[\left(\dfrac{2t}{D}\right)^3\right] = 1.475$

$Kf\tau_b := 1 + q\cdot\left(K\tau_b - 1\right)$ $Kf\tau_b = 1.447$

Find Number of Cycles at Each Section

Section A:

$$T_r := \frac{T_{fr}}{1ft \cdot kip} \qquad T_r = 7.615 \qquad \sigma y_a := \frac{\sigma y}{1psi} \qquad \sigma y_a = 3.75 \times 10^4$$

$$AL_{ab} := \left[\frac{32}{\left(\pi \cdot D_{ab}{}^3\right)}\right] \cdot \left[\frac{\left(Kt_a \cdot M_a\right)}{\sigma e_a}\right] + \frac{\left(\sqrt{3} \cdot Kf\tau_a \cdot T_r\right)}{\left(2 \cdot \sigma y_a\right)}$$

$$AL_{ab} = 0.752$$

$$\boxed{Check_{SectionAB} := if\left(AL_{ab} \le .8\,, \text{"Infinite"}\,, \text{"Finite"}\right) = \text{"Infinite"}}$$

$$\sigma x_a := \left[\frac{\left(32 \cdot M_a\right)}{\pi \cdot D_{ab}{}^3}\right] \cdot Kf_a \qquad \sigma x_a = 20.39 \cdot ksi$$

$$\tau y_a := \left[\frac{\left(16 \cdot T_{fr}\right)}{\left(\pi \cdot D_{ab}{}^3\right)}\right] \cdot Kf_a \qquad \tau y_a = 0.034 \cdot ksi$$

$$\tau m_a := \left[\left(\frac{\sigma x_a}{2}\right)^2 + \tau y_a{}^2\right]^{.5} \qquad \tau m_a = 10.195 \cdot ksi$$

τma = Max Torsional Stress

$$\sigma max_a := \left(\frac{\sigma x_a}{2}\right) + \tau m_a$$

$$\sigma min_a := -\left(\frac{\sigma x_a}{2}\right) - \tau m_a \qquad \sigma r_a := \frac{\left(\sigma max_a - \sigma min_a\right)}{2} \qquad \sigma r_a = 20.39 \cdot ksi \qquad \sigma e_a = 27.135 \cdot ksi$$

Find Number of Cycles:

$$A_a := \frac{(.9 \cdot \sigma y)^2}{\sigma e_a} \qquad B_a := \left(\frac{-1}{3}\right) \cdot \log\left(\frac{.9 \cdot \sigma y}{\sigma e_a}\right)$$

$$N_a := \left(\frac{\sigma r_a}{A_a}\right)^{\frac{1}{B_a}} \qquad N_a = 8.512 \times 10^9$$

Section B:

$$AL_b := \left[\frac{32}{\left(\pi \cdot D_b^{\,3}\right)}\right] \cdot \left[\frac{\left(Kt_b \cdot M_b\right)}{\sigma e_b}\right] + \frac{\left(\sqrt{3} \cdot Kf\tau_b \cdot T_r\right)}{\left(2 \cdot \sigma y_a\right)}$$

$$AL_b = 0.943$$

$$Check_{SectionB} := \mathrm{if}\left(AL_b \le .8, \text{"Infinite"}, \text{"Finite"}\right) = \text{"Finite"}$$

$$\sigma x_b := \left[\frac{\left(32 \cdot M_b\right)}{\pi \cdot D_b^{\,3}}\right] \cdot Kf_b \qquad \sigma x_b = 25.058 \cdot ksi$$

$$\tau y_b := \left[\frac{\left(16 \cdot T_{fr}\right)}{\left(\pi \cdot D_b^{\,3}\right)}\right] \cdot Kf_a \qquad \tau y_b = 0.043 \cdot ksi$$

$$\tau m_b := \left[\left(\frac{\sigma x_b}{2}\right)^2 + \tau y_b^{\,2}\right]^{.5} \qquad \tau m_b = 12.529 \cdot ksi$$

τmb = Max Torsional Stress

$$\sigma max_b := \left(\frac{\sigma x_b}{2}\right) + \tau m_b$$

$$\sigma min_b := -\left(\frac{\sigma x_b}{2}\right) - \tau m_b \qquad \sigma r_b := \frac{\left(\sigma max_b - \sigma min_b\right)}{2} \qquad \sigma r_b = 25.058 \cdot ksi \qquad \sigma e_b = 27.392 \cdot ksi$$

Find Number of Cycles:

$$A_b := \frac{(.9 \cdot \sigma y)^2}{\sigma e_b} \qquad B_b := \left(\frac{-1}{3}\right) \cdot \log\left(\frac{.9 \cdot \sigma y}{\sigma e_b}\right)$$

$$N_b := \left(\frac{\sigma r_b}{A_b}\right)^{\frac{1}{B_b}} \qquad N_b = 1.905 \times 10^7$$

Remaining Life:

$lifting := 100ft$

$r_s := \frac{180in}{2} = 90 \cdot in$

$\frac{lifting}{2r_s \cdot \pi} = 2.122$

$\frac{N_b}{2.122 \cdot 2 \cdot 3300} = 1.36 \times 10^3$

AECOM

Calculations

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Motor Sizing Calculation

Aecom Weight (Current Weight)

1776 tonnes

TABLE OF CONTENTS :

1.0 GENERAL INFORMATION

1.1 CONSTANTS

$\mu_{stat\_roller} := 0.004$ — Static coefficient of friction for roller bearing

$\mu_{dyn\_roller} := 0.003$ — Static coefficient of friction for roller bearing

Ref.: S6-14 Table 13.10

$Acc_{time} := 10s$ — Maximum time available to reach full lifting speed

$Brake_{time} := 10s$ — Maximum time available to stop the bridge from the maximum speed

Ref. S6-14 article 13.7.14.8.4

$P_{wind} := 0.12kPa$ — Wind pressure

$P_{ice} := 0.12kPa$ — Ice load per unit area

Ref.: S6-14 article 13.7.14.7.4

$Start_{overload} := 1.25$

$Acc_{overload} := 1.5$

$Cons_{overload} := 1$

Ref.: S6-14 Table 13.14 — Allowable torque overloads

$\eta_{bearings} := 0.98$

$\eta_{sheaves} := \eta_{bearings}{}^2 = 0.96$

$\eta_{gears} := 0.96^2$

$\eta_{reducer} := 0.94$

Ref. S6-14
(article 13.7.19.4 & 13.7.19.6.1) and
Machinery Handbook

Components efficiencies

1.2 GENERAL DATA

$W_{span} := 1776tonne$ — Weigth of span

$W_{cwt} := W_{span}$ — Weigth of counterweight (hypothesis)

$W_{sheave} := 50000lb$ — Weight of sheave (hypothesis)

$W_{trunnion} := 7500lb$ — Weight of trunnion (hypothesis)

$W_{gear} := 8 \cdot 540lb$ — Weight of gear sets (per sheave) (hypothesis)

$W_{total} := W_{span} + W_{cwt} + 8 \cdot W_{sheave} + 8W_{trunnion} + 8W_{gear} = 8.325 \times 10^6 \cdot lb$ — Weight to be lifted

$r_{rb} := 12in$ — Radius of roller bearings

$r_s := \frac{180in}{2}$ — Radius of sheave

$S_{speed} := 1\frac{ft}{s}$ — Maximum lifting speed of span

$D_{rope} := 2.25in$ — Diameter of main counterweight ropes

$IMB_{South} := 7450lbf$ Seated imbalance, north tower

$IMB_{North} := 6296lbf$ Seated imbalance, south tower

$L_{open} := 370ft$ Length of span (open deck - approximative)

$W_{open} := 50ft$ Width of span (open deck - approximative)

$L_{closed} := 370ft$ Length of span (close deck - approximative)

$W_{closed} := 10ft$ Width of span (close deck - approximative)

2.0 CALCULATION OF LOADS

2.1 FRICTION LOAD - ROLLER BEARINGS OF COUNTERWEIGHT SHEAVES

$$F_{friction\_stat} := \frac{W_{total} \cdot r_{rb} \cdot \mu_{stat\_roller} \cdot g}{r_s} = 19.751 \cdot kN$$

$$F_{friction\_dyn} := \frac{W_{total} \cdot r_{rb} \cdot \mu_{dyn\_roller} \cdot g}{r_s} = 14.813 \cdot kN$$

2.2 INERTIA

$$A_{acc} := \frac{S_{speed}}{Acc_{time}} = 0.1 \cdot \frac{ft}{s^2}$$

$$A_{brake} := \frac{S_{speed}}{Brake_{time}} = 0.1 \cdot \frac{ft}{s^2}$$

$$F_{acc} := 1.25 W_{total} \cdot A_{acc} = 143.878 \cdot kN$$

$$F_{braking} := 1.25 W_{total} \cdot A_{brake} = 143.878 \cdot kN$$

2.3 ROPE BENDING

$$F_{bend} := \frac{W_{total}}{2} \cdot 0.3 \frac{D_{rope}}{2 \cdot r_s} \cdot g = 69.437 \cdot kN$$

Ref. CSA S6-14 article 13.7.20.17

2.4 UNBALANCED CONDITIONS

$$F_{balance} := IMB_{North} + IMB_{South} = 61.145 \cdot kN$$

2.5 WIND LOADING

$$F_{wind} := \left(L_{open} \cdot W_{open} \cdot 0.85 + L_{closed} \cdot W_{closed}\right) \cdot P_{wind} = 216.557 \cdot kN$$

2.6 ICE LOADING (WORST CASE SCENARIO - BRIDGE IS NOT OPENED DURING WINTER)

$$F_{ice} := \left(L_{open} \cdot W_{open} \cdot 0.85 + L_{closed} \cdot W_{closed}\right) \cdot P_{ice} = 216.557 \cdot kN$$

3.0 LOAD CASES

Case 1: Starting Load

$$F_{starting\_lc1} := F_{friction\_stat} + F_{acc} + F_{bend} + F_{balance} + F_{wind} + F_{ice} = 727.325 \cdot kN$$

Case 2: Accelerating Load

$$F_{acc\_lc2} := F_{friction\_dyn} + F_{acc} + F_{bend} + F_{balance} + F_{wind} = 505.831 \cdot kN$$

Case 3: Constant Velocity

$$F_{cons\_lc3} := F_{friction\_dyn} + F_{bend} + F_{balance} + F_{wind} = 361.953 \cdot kN$$

Case 4: Braking Load

$$F_{braking\_lc4} := F_{friction\_dyn} + F_{braking} + F_{bend} + F_{balance} + F_{wind} = 505.831 \cdot kN$$

4.0 MOTOR SELECTION

4.1 GOVERNING FORCE FOR MOTOR SELECTION

$$F_{motor.lc1} := \frac{F_{starting\_lc1}}{Start_{overload}} = 581.86 \cdot kN$$

$$F_{motor.lc2} := \frac{F_{acc\_lc2}}{Acc_{overload}} = 337.22 \cdot kN$$

$$F_{motor.lc3} := \frac{F_{cons\_lc3}}{Cons_{overload}} = 361.953 \cdot kN$$

$$F_{motor.lc4} := \frac{F_{braking\_lc4}}{Acc_{overload}} = 337.22 \cdot kN$$

$$F_{motor} := \max\left(F_{motor.lc1}, F_{motor.lc2}, F_{motor.lc3}, F_{motor.lc4}\right) = 581.86 \cdot kN$$

4.2 MOTOR POWER REQUIRED (per tower)

$$\eta_{lift} := \eta_{sheaves} \cdot \eta_{gears} \cdot \eta_{reducer} = 0.832$$

Efficiency of system

$$Hp_{motor} := \frac{F_{motor} \cdot S_{speed}}{\eta_{lift} \cdot 2} = 143 \cdot hp$$

Required power of motor in worst case scenario (wind + ice load)

Current HP of motors is 150 HP.

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Main Counterweight Rope Capacity Calculations

AECOM Weigth (Current Weight)

1776 tonnes

1.0 GENERAL INFORMATION

1.1 GENERAL DATA

$W_{span} := 1776\text{tonne}$ — Weigth of span and deck

$D := 177.75\text{in}$ — Tread diameter of sheave rope grooves

$d := 2.25\text{in}$ — Diameter of main counterweight ropes

$d_w := \frac{d}{16} = 0.141 \cdot \text{in}$ Ref.: AASHTO Article 6.8.3.3.4 — Diameter of the outer wires in the wire rope

$E_w := 30 \times 10^6 \text{psi}$ — Tensile modulus of elasticity of the steel wire

$A_{rope} := 0.4 \cdot d^2 = 2.025 \cdot \text{in}^2$ Ref.: S6-14 Table 13.20 — Effective cross sectional are of the ropes (approx.)

$N_{rope} := 80$ — Number of ropes

1.2 ALLOWABLE STRESSES

Ref.: AASHTO Article 6.6.5 & CHBDC article 13.7.20.18

$P_{ult} := 420000\text{lbf}$ — Minimum ultimate tensile strength of rope (ref. BLB 2002 Main CW Wire Rope Replacement)

$\sigma_{ult} := \frac{P_{ult}}{A_{rope}} = 1430 \cdot \text{MPa}$ — Allowable tensile load

$\sigma_{allowable} := 0.222 \cdot \sigma_{ult} = 317 \cdot \text{MPa}$ — Maximum allowable tensile stress (for combined effect of bending and direct load)

2.0 STRESSES CALCULATIONS

Ref.: AASHTO Article 6.8.3.3.4 & CHBDC article 13.7.20.18

$\sigma_b := E_w \cdot \frac{d_w}{D} = 163.641 \cdot \text{MPa}$ — Maximum bending stress

$P := \frac{W_{span} \cdot g}{80} = 217.708 \cdot \text{kN}$ — Direct load (per rope)

$P_{ol} := \frac{581.86\ \text{kN}}{80} = 7.273 \cdot \text{kN}$ — Operating loads (per rope) (value from motor sizing calculation)

$\sigma_r := \frac{P}{A_{rope}} + \sigma_b + \frac{P_{ol}}{A_{rope}} = 335.849 \cdot \text{MPa}$ — Maximum total stress (per rope)

$SF := \frac{\sigma_r}{\sigma_{allowable}} \cdot 100\% = 105.791 \cdot \%$ — Value of over stress

Calculations

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Trunnion Shaft Bearing Capacity

1.0 GENERAL INFORMATION

1.1 GENERAL DATA

$D_b := 21.250in$ — Diameter of Shaft at Section B (bore diameter)

$r_s := \frac{180in}{2} = 90 \cdot in$ — Radius of sheave

$S_{speed} := 1\frac{ft}{s}$ — Maximum lifting speed of span

$rpm_{bearing} := \frac{S_{speed} \cdot 60s}{2\pi \cdot r_s} = 1.273$ — Rotation speed of trunnion bearing (approximative)

Assume a large rolling element bearing, as per AASHTO C6.7.7.2.4

> *C6.7.7.2.4*
>
> Large rolling element bearings generally have a bore larger than 4 in., and a rotational speed less than 5 rpm.
>
> It is necessary to work closely with bearing manufacturers on the large rolling element bearings. The specific operating parameters may necessitate special lubricating or other requirements, especially in applications such as a bascule trunnion bearing whose inner race operates at less than one quarter revolution each cycle.

$Span_w := 1776tonne$ — Weight of span and new deck

$Cwt := Span_w$ — Weight of Counterweights (hypothesis)

$W := \frac{(Span_w + Cwt)}{16} = 222 \cdot tonne$ — Weight on Trunnion Shaft

1.2 ALLOWABLE STRESSES

Ref.: AASHTO article 6.7.7.2.4

$C_{or} := 4586124lb$ — Basic static radial load rating of the bearing (hypothesis)

$n_s := 5$ — Design factor

$P_{cor} := \frac{C_{or}}{5} = 917225 \cdot lb$ — Factor radial design resistance

$X_o := 1$ — Static axial load factor (hypothesis)

$Y_o := 2$ — Static radial load factor (hypothesis)

$F_{oxy} := X_o \cdot W + 0.15 \cdot Y_o \cdot W = 636254 \cdot lb$

$Verification := if(F_{oxy} \le P_{cor}, \text{"OK"}, \text{"NOT ACCEPTABLE"}) = \text{"OK"}$

Calculations

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Fatigue Check of Trunnion Shaft

Critical Sections:

A - Maximum bending moment, torsional moment, and stress concentration of keyway

B - Bending moment, torsional moment, and stress concentrations of fillet

Shaft Dimensions and other Variables

Enter information in Yellow boxes:

Results are in Blue boxes

Sections AB & B Diameters — Section AB is middle of turnnion shaft Section B is at fillet

$D_{ab} := 24in$ — Diameter of Shaft at Section AB

$D_b := 22.084in$ — Diameter of Shaft at Section B

$r_f := .625$ — Fillet Radius in inches, but do not use dimension

$Span_w := 3915kip$ — Weight of Span

$Cwt := Span_w$ — Weight of Counterweights (hypothesis)

$W_l := \frac{(Span_w + Cwt)}{8} = 979 \cdot kip$ — Weight on Trunnion Shaft

$\sigma ut := 75ksi$ — Ultimate Tensile Strength of Shaft Material (ASTM A235 Class E)

$\sigma y := 37.500ksi$ — Yield Strenght for material

Distance from bearings to area of concern:

$l_s := 13in + 13in + 27.5in = 53.5 \cdot in$ — Length of Shaft Between Bearing Centers

$l_a := \frac{l_s}{2}$ — Distance to Center of Shaft from center of Bearing

$l_b := 13in$ — Distance from Center of Bearing to fillet

$c_{fr} := .004$ — Coefficient of friction for Bronze on Steel (Greased)

Torque on Shaft Due to Friction

$T_{fr} := W_l \cdot D_b \cdot c_{fr}$ $\qquad$ $T_{fr} = 601.141\,J \cdot 16.250$

Find Endurance Limit:

σe = α σut * (Cd*Cs*Ck*Ct*Cm)

$\alpha := .5$

From CSA Section 13.7.3.5.4 Endurance Limit

$Cr := 0.814$

$Cm := 1$

$Cs := 1.459$ $\qquad$ $4.51 \cdot (75)^{-0.265} = 1.436$

$Ct := 1$

Size Factor; $\qquad$ $Cd = (D/7.6)^{-0.113}$

$$Cd_{ab} := \left[\left(\frac{D_{ab}}{7.6mm}\right)^{-.113}\right] \qquad Cd_{ab} = 0.609$$

$$Cd_b := \left[\left(\frac{D_b}{7.6mm}\right)^{-.113}\right] \qquad Cd_b = 0.615$$

$\sigma e_a := \alpha \cdot \sigma ut \cdot \left(Cd_{ab} \cdot Cr \cdot Ct \cdot Cs \cdot Cm\right)$ $\qquad$ $\sigma e_a = 27.135 \cdot ksi$

$\sigma e_b := \alpha \cdot \sigma ut \cdot \left(Cd_b \cdot Cr \cdot Ct \cdot Cs \cdot Cm\right)$ $\qquad$ $\sigma e_b = 27.392 \cdot ksi$

Find - Bending Moments at each Section:

Section A -

Bending moment due to weight on Shaft

$M_a := W_l \cdot l_a$ $\quad\quad$ $M_a = 2.182 \times 10^3 \cdot ft \cdot kip$

Section B -

Bending moment due to weight on Shaft

$M_b := W_l \cdot l_b$ $\quad\quad$ $M_b = 1.06 \times 10^3 \cdot ft \cdot kip$

Find Stress Concentration Factors:

$\nu := .049$

$$q := \frac{1}{\left[1 + \left(\frac{\nu}{r_f^{.5}}\right)\right]} \quad q = 0.942$$

$Kt_a := 1$ $\quad\quad$ For Sled-run keyway; Use 1 if no Keyway

$Kf_a := 1 + q \cdot (Kt_a - 1)$ $\quad$ $Kf_a = 1$

$K\tau_a := 1$ $\quad\quad$ For Sled-run keyway; Use 1 if no Keyway

$Kf\tau_a := 1 + q \cdot (K\tau_a - 1)$ $\quad$ $Kf\tau_a = 1$

2.22

$Kt_b := 2.02$

$Kf_b := 1 + q \cdot (Kt_b - 1)$ $\quad$ $Kf_b = 1.96$ $\quad\quad$ From AASHTO Section 6.7.3.2

$K\tau_b := 1.61$

1.61

$Kf\tau_b := 1 + q \cdot (K\tau_b - 1)$ $\quad$ $Kf\tau_b = 1.574$

Find Stress Concentration Factors (v.2):

$r_{f.} := .625$ Fillet Radius

From Peterson's Stress Concentration Factors, 2nd Ed. 1997, Chapter 3: Shoulder fillet in bar of circular cross section

$$t := \frac{D_{ab} - 22.084in}{2in} = 0.958$$ Fillet Height

$D := 24$ $\quad \frac{t}{r_f} = 1.533$

Bending Factor

$$C1b := 0.947 + 1.206\sqrt{\frac{t}{r_f}} - 0.131\cdot\frac{t}{r_f} = 2.239$$

$$C2b := 0.022 - 3.405\sqrt{\frac{t}{r_f}} + 0.915\cdot\frac{t}{r_f} = -2.791$$

$$C3b := 0.869 + 1.777\sqrt{\frac{t}{r_f}} - 0.555\cdot\frac{t}{r_f} = 2.218$$

$$C4b := -0.810 + 0.422\sqrt{\frac{t}{r_f}} - 0.260\cdot\frac{t}{r_f} = -0.686$$

$$Kt_b := C1b + C2b\cdot\left(\frac{2t}{D}\right) + C3b\cdot\left[\left(\frac{2t}{D}\right)^2\right] + C4b\cdot\left[\left(\frac{2t}{D}\right)^3\right]$$

$Kf_b := 1 + q\cdot(Kt_b - 1)$ $\quad Kf_b = 1.97$

Torsional Factor

$$C1 := 0.905 + 0.783\sqrt{\frac{t}{r_f}} - 0.075\cdot\frac{t}{r_f} = 1.759$$

$$C2 := -0.437 - 1.969\sqrt{\frac{t}{r_f}} - 0.553\cdot\frac{t}{r_f} = -3.722$$

$$C3 := 1.557 + 1.073\sqrt{\frac{t}{r_f}} - 0.578\cdot\frac{t}{r_f} = 1.999$$

$$C4 := -1.061 + 0.171\sqrt{\frac{t}{r_f}} + 0.086\cdot\frac{t}{r_f} = -0.717$$

$$K\tau_b := C1 + C2\cdot\left(\frac{2t}{D}\right) + C3\cdot\left[\left(\frac{2t}{D}\right)^2\right] + C4\cdot\left[\left(\frac{2t}{D}\right)^3\right] = 1.475$$

$Kf\tau_b := 1 + q\cdot(K\tau_b - 1)$ $\quad Kf\tau_b = 1.447$

Find Number of Cycles at Each Section

Section A:

$T_r := \frac{T_{fr}}{1ft \cdot kip}$ $\quad T_r = 7.205$ $\quad \sigma y_a := \frac{\sigma y}{1psi}$ $\quad \sigma y_a = 3.75 \times 10^4$

$$AL_{ab} := \left[\frac{32}{\left(\pi \cdot D_{ab}{}^3\right)}\right] \cdot \left[\frac{\left(Kt_a \cdot M_a\right)}{\sigma e_a}\right] + \frac{\left(\sqrt{3} \cdot Kf\tau_a \cdot T_r\right)}{\left(2 \cdot \sigma y_a\right)}$$

$AL_{ab} = 0.711$

$Check_{SectionAB} := if\left(AL_{ab} \le .8, \text{"Infinite"}, \text{"Finite"}\right) = \text{"Infinite"}$

$\sigma x_a := \left[\frac{\left(32 \cdot M_a\right)}{\pi \cdot D_{ab}{}^3}\right] \cdot Kf_a$ $\quad \sigma x_a = 19.291 \cdot ksi$

$\tau y_a := \left[\frac{\left(16 \cdot T_{fr}\right)}{\left(\pi \cdot D_{ab}{}^3\right)}\right] \cdot Kf_a$ $\quad \tau y_a = 0.032 \cdot ksi$

$\tau m_a := \left[\left(\frac{\sigma x_a}{2}\right)^2 + \tau y_a{}^2\right]^{.5}$ $\quad \tau m_a = 9.646 \cdot ksi$ $\quad$ τma = Max Torsional Stress

$\sigma max_a := \left(\frac{\sigma x_a}{2}\right) + \tau m_a$

$\sigma min_a := -\left(\frac{\sigma x_a}{2}\right) - \tau m_a$ $\quad \sigma r_a := \frac{\left(\sigma max_a - \sigma min_a\right)}{2}$ $\quad \sigma r_a = 19.291 \cdot ksi$ $\quad \sigma e_a = 27.135 \cdot ksi$

Find Number of Cycles:

$A_a := \frac{(.9 \cdot \sigma y)^2}{\sigma e_a}$ $\quad B_a := \left(\frac{-1}{3}\right) \cdot \log\left(\frac{.9 \cdot \sigma y}{\sigma e_a}\right)$

$N_a := \left(\frac{\sigma r_a}{A_a}\right)^{\frac{1}{B_a}}$ $\quad N_a = 4.919 \times 10^{10}$

Section B:

$$AL_b := \left[\frac{32}{\left(\pi\cdot D_b^{\ 3}\right)}\right]\cdot\left[\frac{\left(Kt_b\cdot M_b\right)}{\sigma e_b}\right] + \frac{\left(\sqrt{3}\cdot Kf\tau_b\cdot T_r\right)}{\left(2\cdot\sigma y_a\right)}$$

$$AL_b = 0.892$$

$$Check_{SectionB} := if\left(AL_b \le .8, \text{"Infinite"}, \text{"Finite"}\right) = \text{"Finite"}$$

$$\sigma x_b := \left[\frac{\left(32\cdot M_b\right)}{\pi\cdot D_b^{\ 3}}\right]\cdot Kf_b \qquad \sigma x_b = 23.707\cdot ksi$$

$$\tau y_b := \left[\frac{\left(16\cdot T_{fr}\right)}{\left(\pi\cdot D_b^{\ 3}\right)}\right]\cdot Kf_a \qquad \tau y_b = 0.041\cdot ksi$$

$$\tau m_b := \left[\left(\frac{\sigma x_b}{2}\right)^2 + \tau y_b^{\ 2}\right]^{.5} \qquad \tau m_b = 11.854\cdot ksi$$

τmb = Max Torsional Stress

$$\sigma max_b := \left(\frac{\sigma x_b}{2}\right) + \tau m_b$$

$$\sigma min_b := -\left(\frac{\sigma x_b}{2}\right) - \tau m_b \qquad \sigma r_b := \frac{\left(\sigma max_b - \sigma min_b\right)}{2} \qquad \sigma r_b = 23.707\cdot ksi \qquad \sigma e_b = 27.392\cdot ksi$$

Find Number of Cycles:

$$A_b := \frac{(.9\cdot\sigma y)^2}{\sigma e_b} \qquad B_b := \left(\frac{-1}{3}\right)\cdot\log\left(\frac{.9\cdot\sigma y}{\sigma e_b}\right)$$

$$N_b := \left(\frac{\sigma r_b}{A_b}\right)^{\frac{1}{B_b}} \qquad N_b = 1.191\times 10^8$$

Remaining Life:

$lifting := 100ft$

$r_s := \frac{180in}{2} = 90 \cdot in$

$\frac{lifting}{2r_s \cdot \pi} = 2.122$

$\frac{N_b}{2.122 \cdot 2 \cdot 3300} = 8.505 \times 10^3$

Imagine it.
Delivered.

Exhibit C.1

Lift Span Rehabilitation Options 3D Model

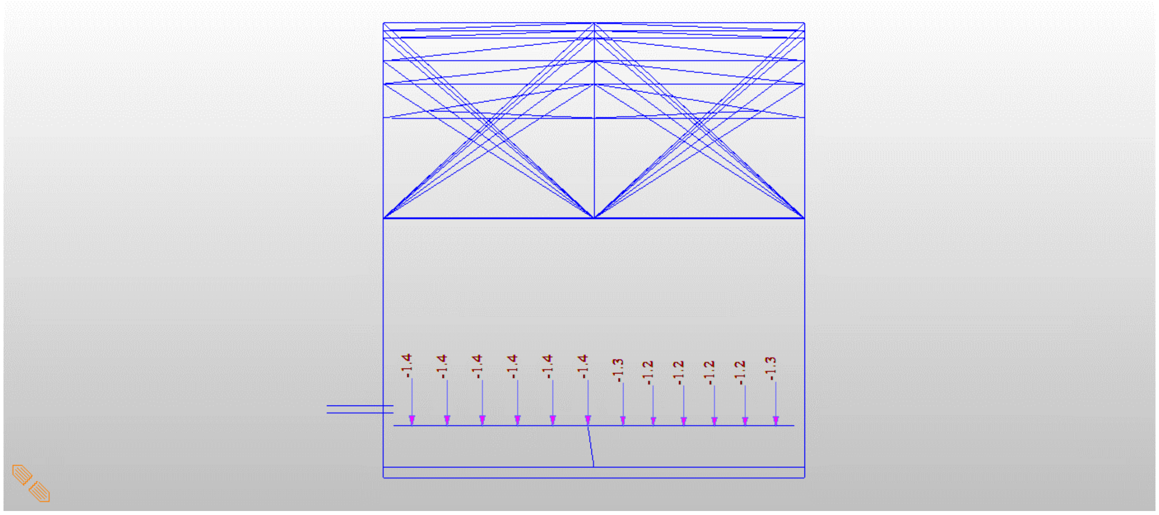


Figure 1 Wind Vert Stringer 1 ULS

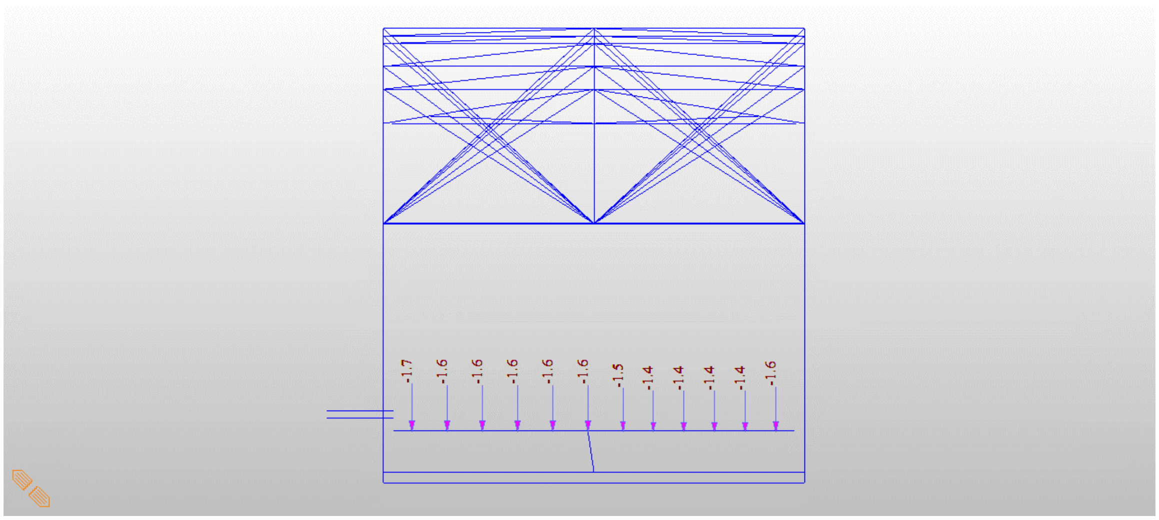


Figure 2 Wind Vert Stringer Case 2 ULS

Exhibit C.1.1. Rehabilitation Case 1 Evaluation

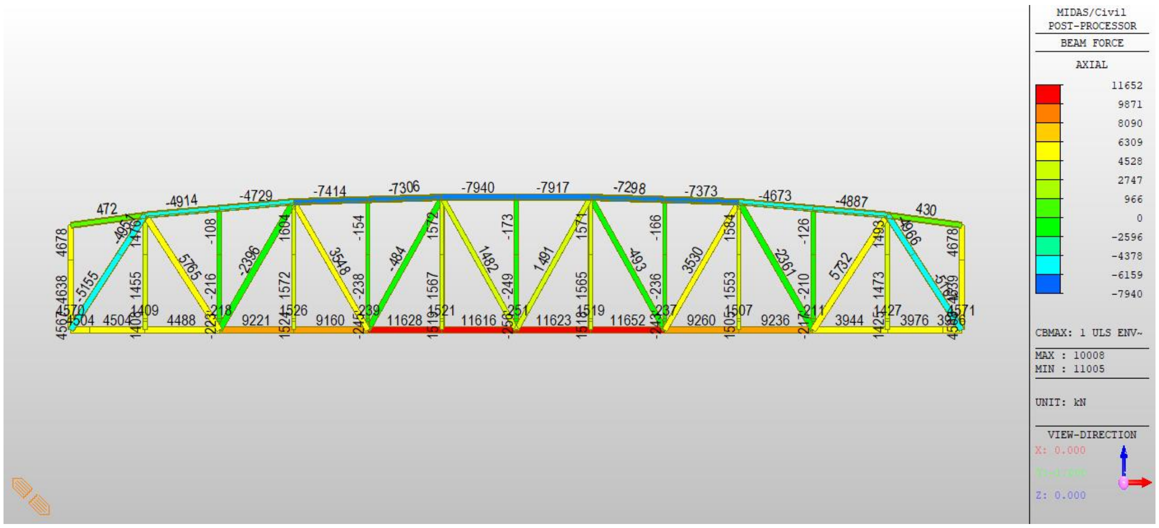


Figure 3 Railway Truss Case 1 ULS Axial Max

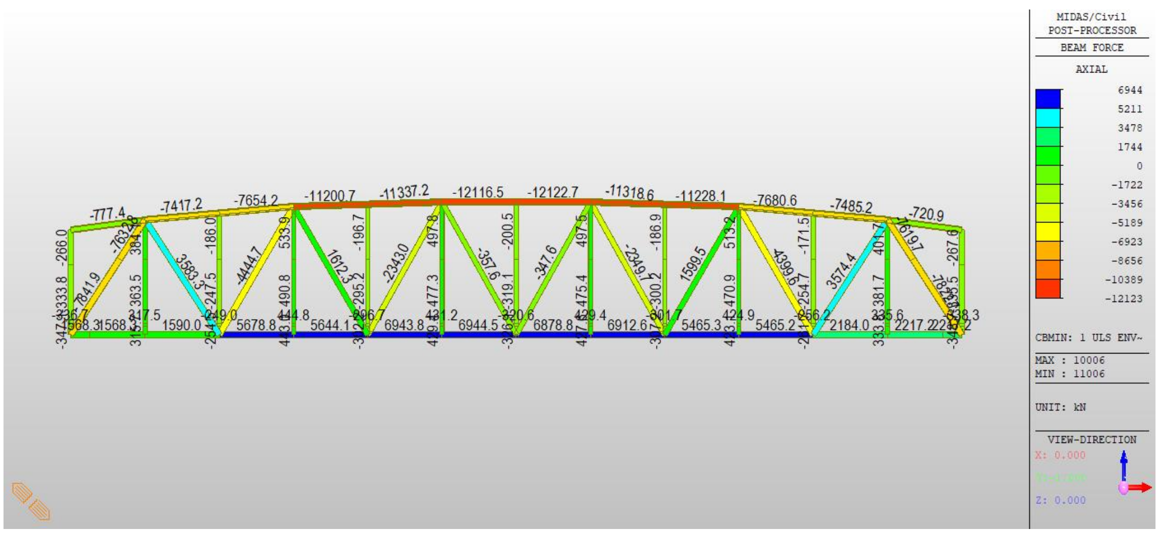


Figure 4 Railway Truss Case 1 ULS Axial Min

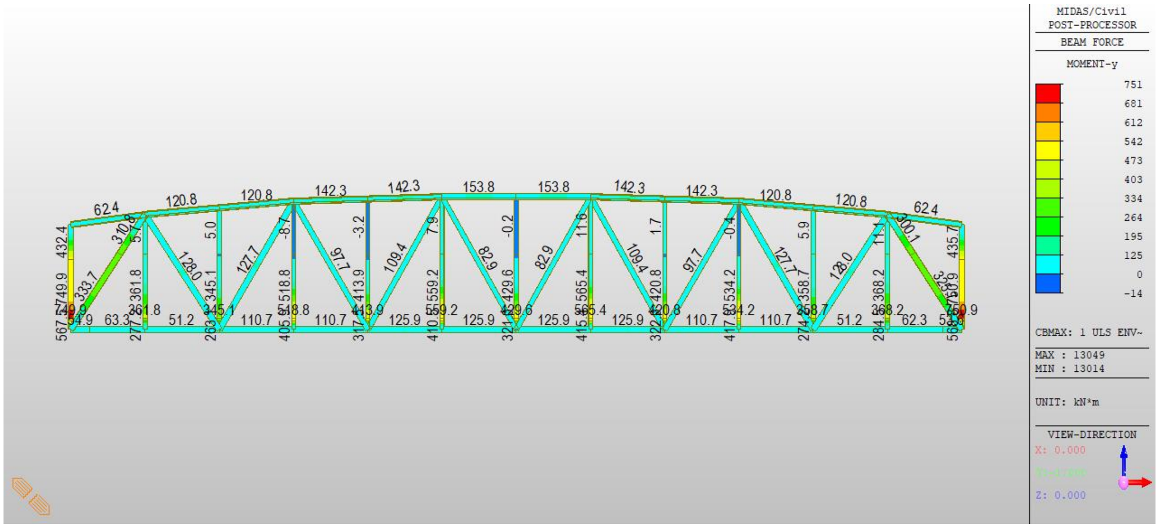


Figure 5 Railway Truss Case 1 ULS M_y Max

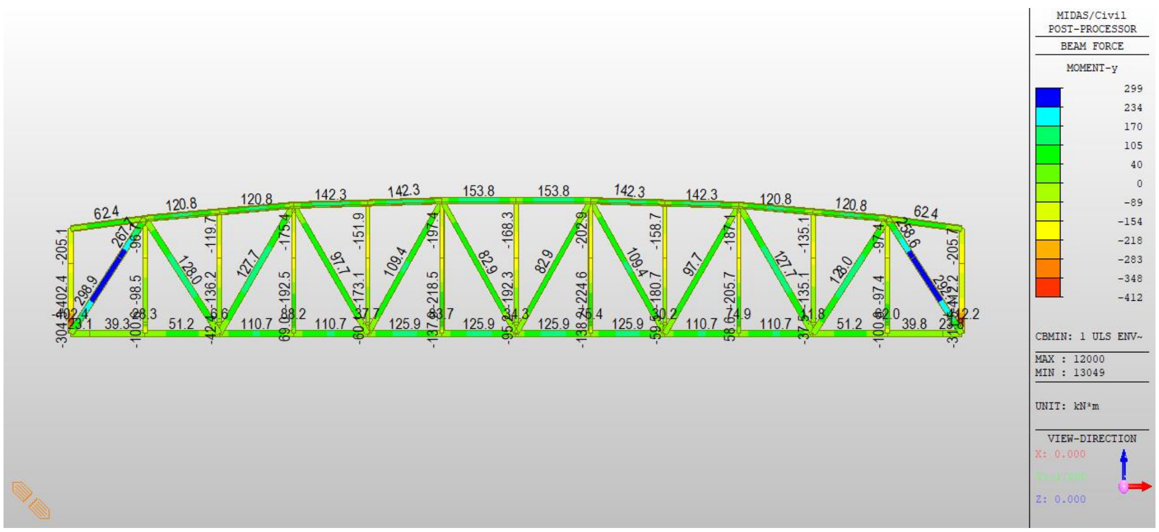


Figure 6 Railway Truss Case 1 ULS M_y Min

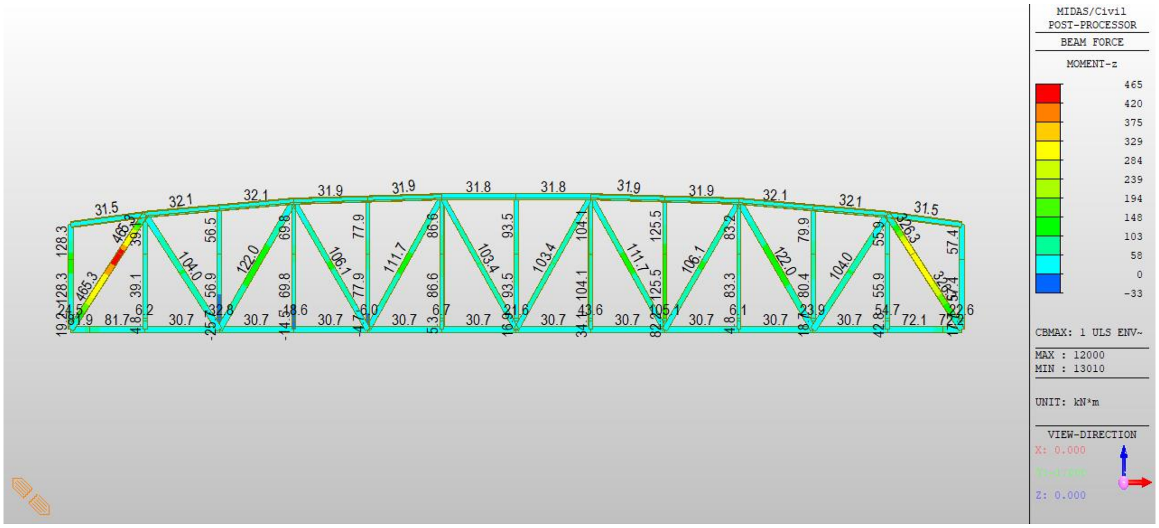


Figure 7 Railway Truss Case 1 ULS M_z Max

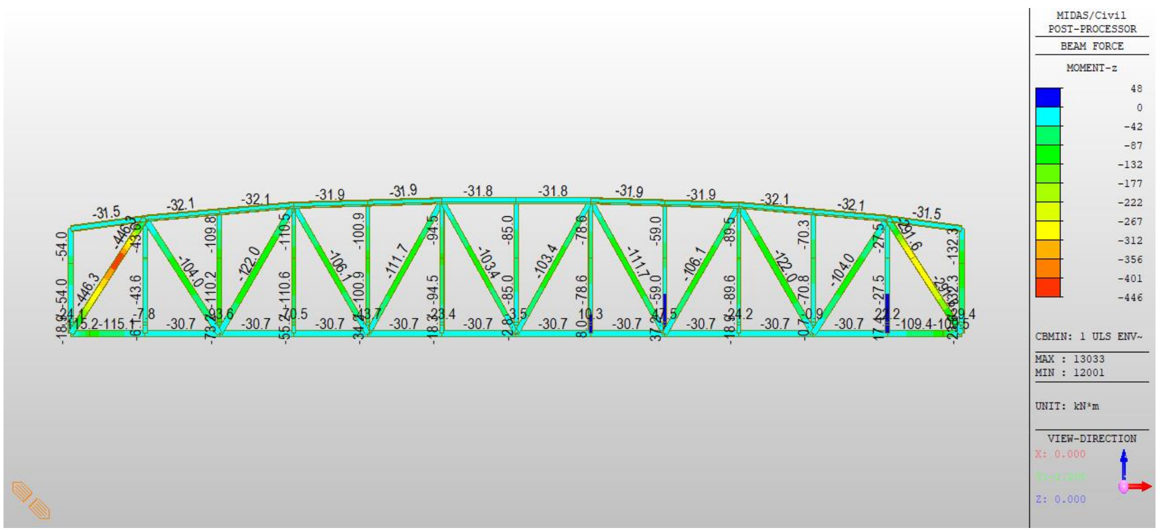


Figure 8 Railway Truss Case 1 ULS M_z Min

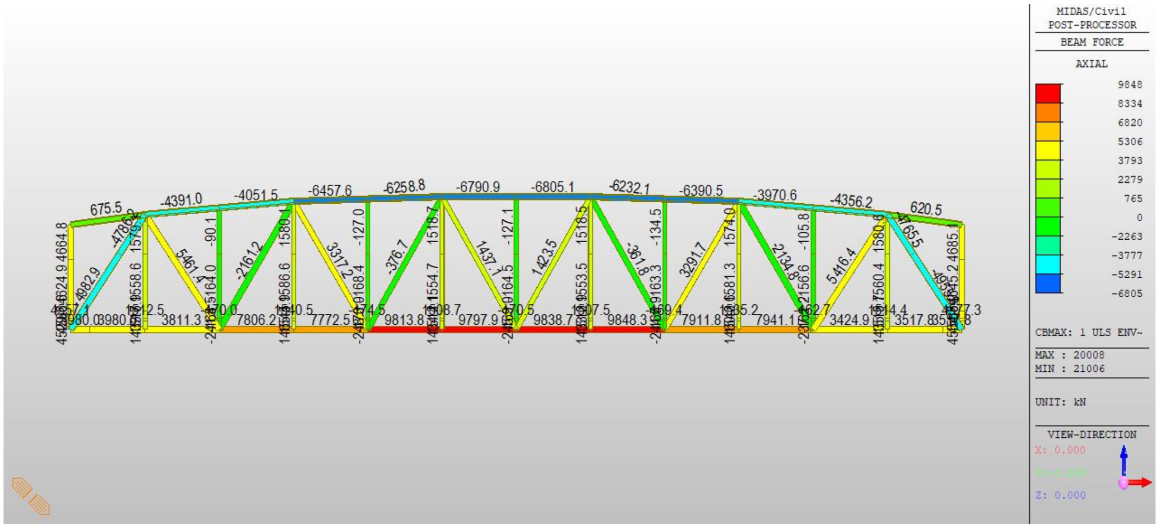


Figure 9 Highway Truss Case 1 ULS Axial Max

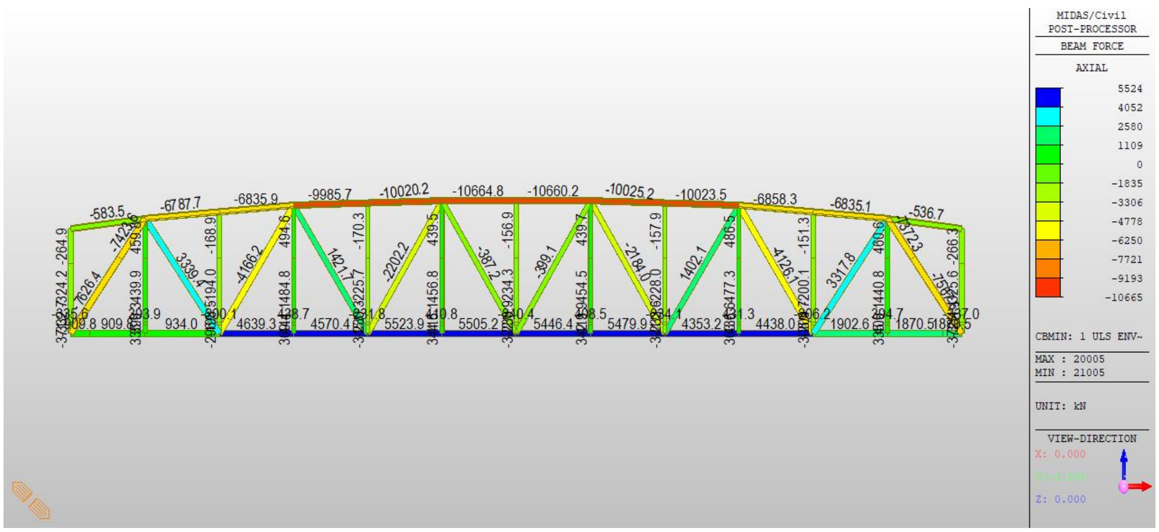


Figure 10 Highway Truss Case 1 ULS Axial Min

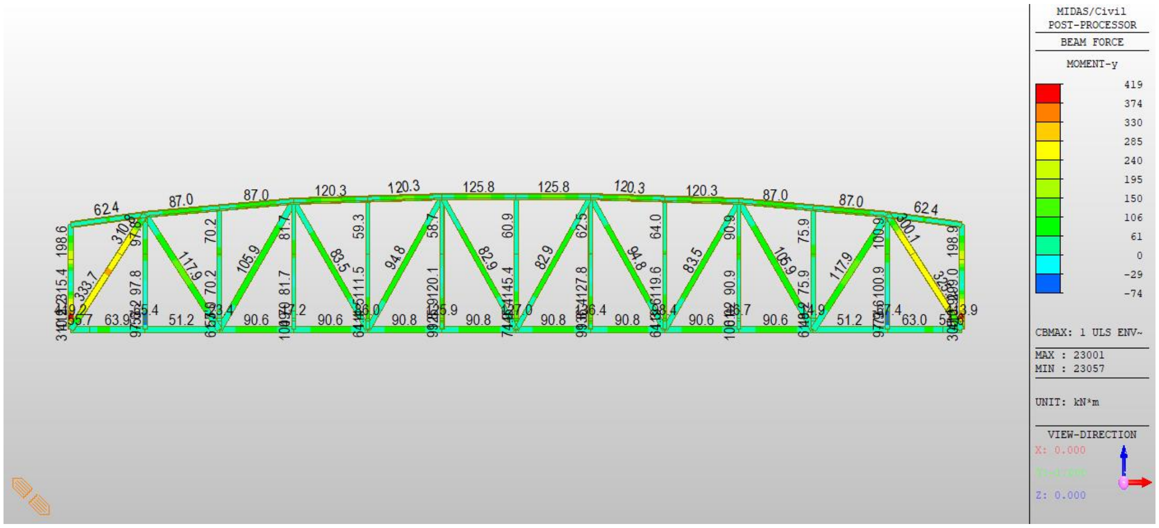


Figure 11 Highway Truss Case 1 ULS M_y Max

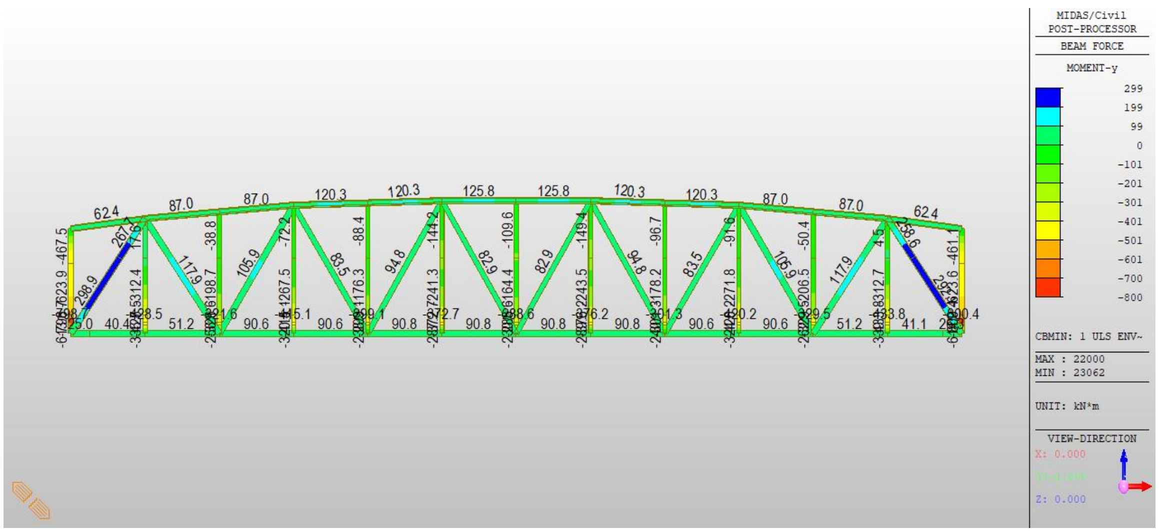


Figure 12 Highway Truss Case 1 ULS M_y Min

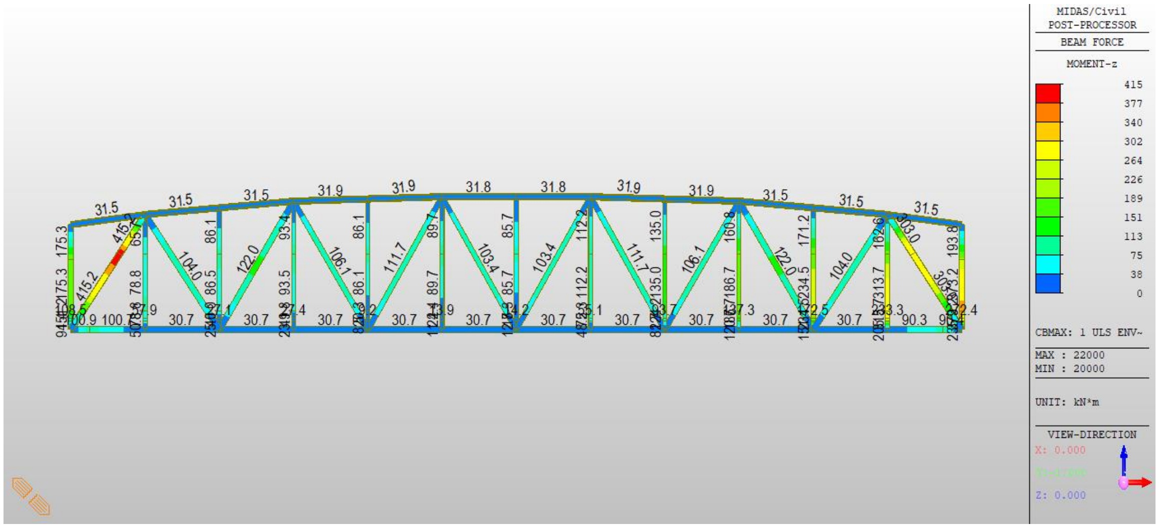


Figure 13 Highway Truss Case 1 ULS M_z Max

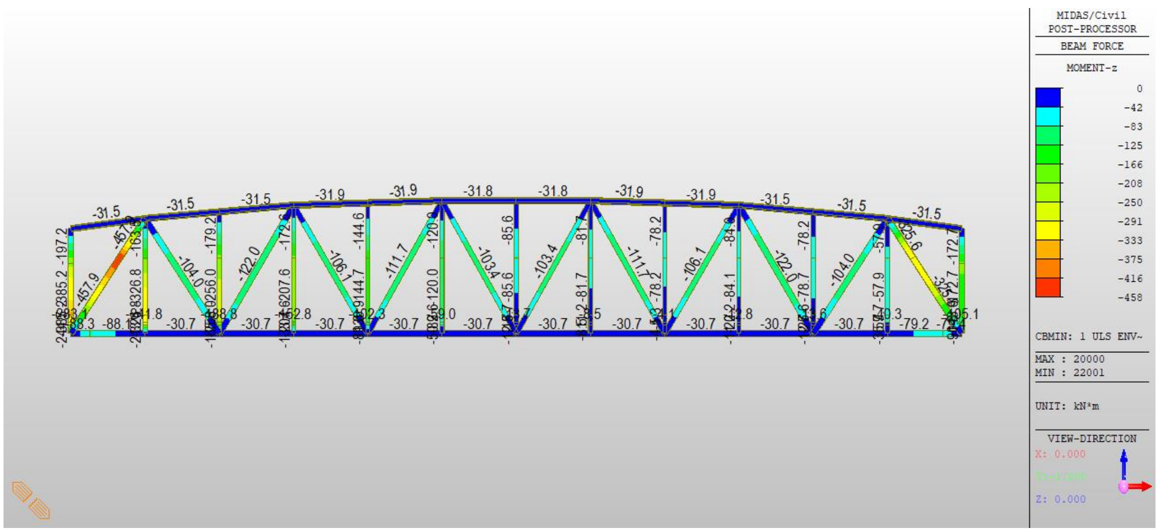


Figure 14 Highway Truss Case 1 ULS M_z Min

Figure 15 Lift Girder Case 1 ULS M_y Max

Figure 16 Lift Girder Case 1 ULS M_y Min

Figure 17 Lift Girder Case 1 ULS F_z Max

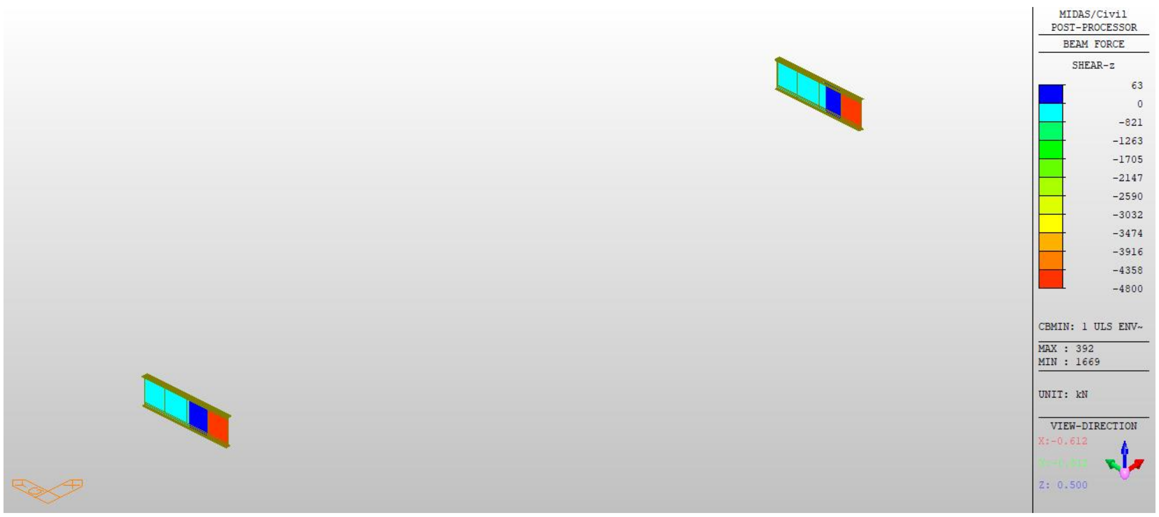


Figure 18 Lift Girder Case 1 ULS F_z Min

Figure 19 End Floor Beam Case 1 ULS M_y Max

Figure 20 End Floor Beam Case 1 ULS M_y Min

Figure 21 End Floor Beam Case 1 ULS F_z Max

Figure 22 End Floor Beam Case 1 ULS F_z Min

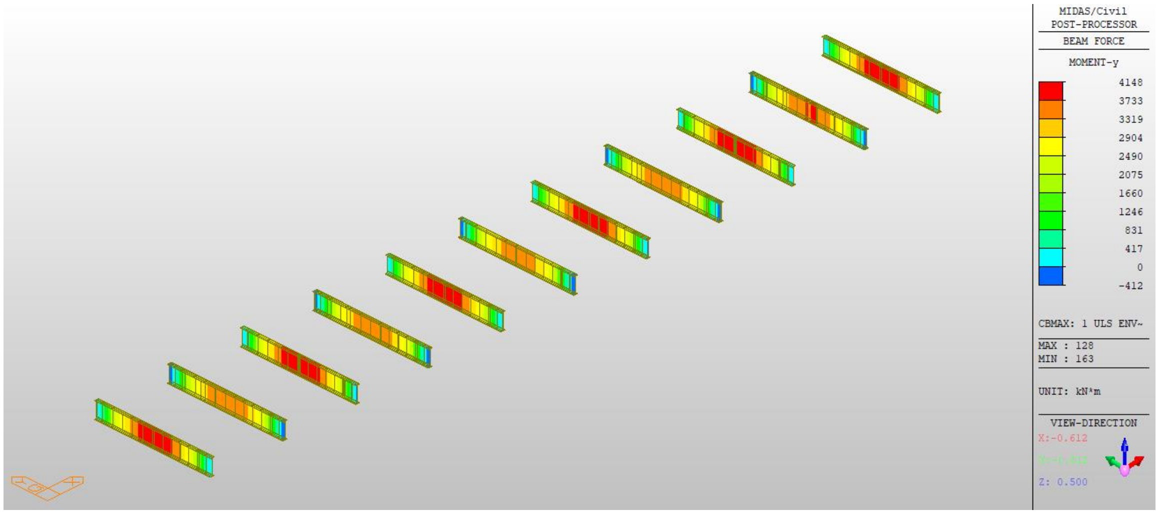


Figure 23 Interior Floor Beam Case 1 ULS M_y Max

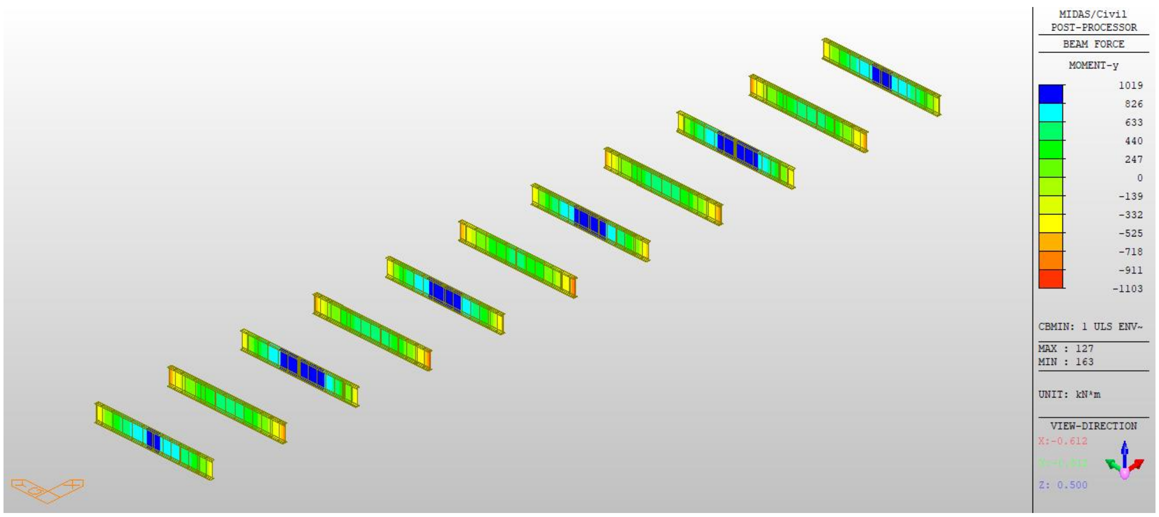


Figure 24 Interior Floor Beam Case 1 ULS M_y Min

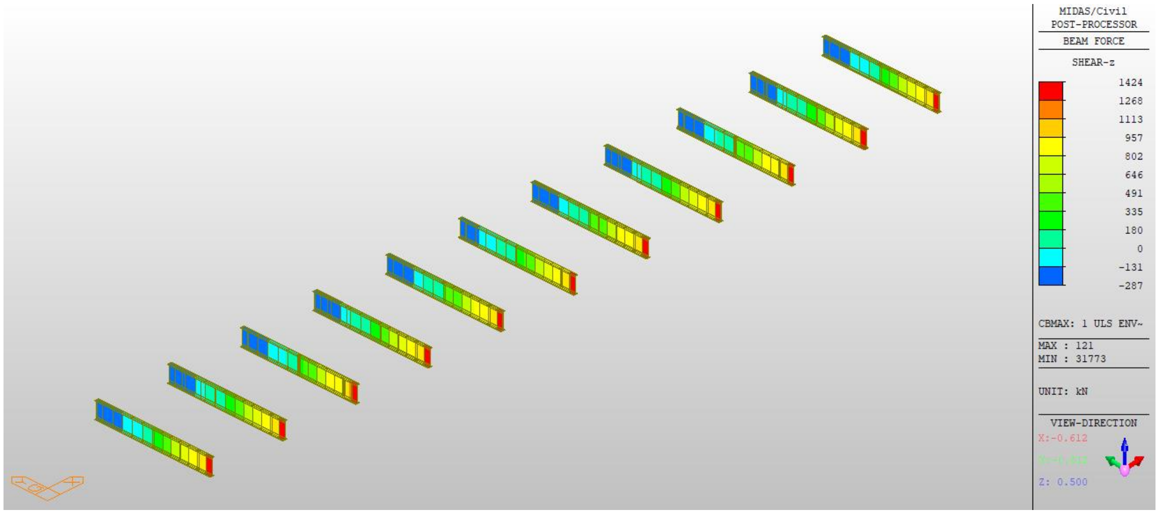


Figure 25 Interior Floor Beam Case 1 ULS F_z Max

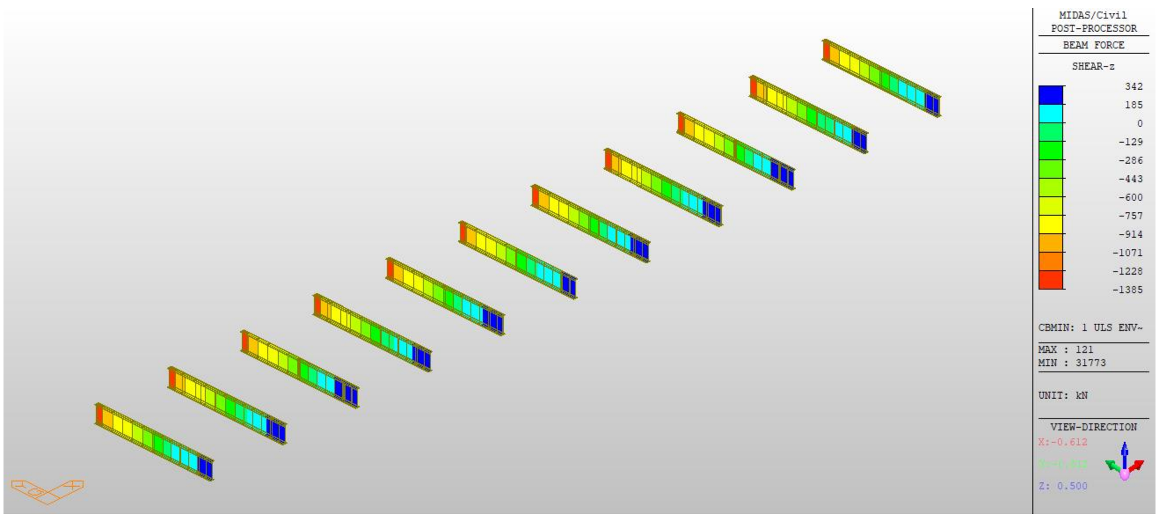


Figure 26 Interior Floor Beam Case 1 ULS F_z Min

Exhibit C.1.2. Rehabilitation Case 2 Evaluation

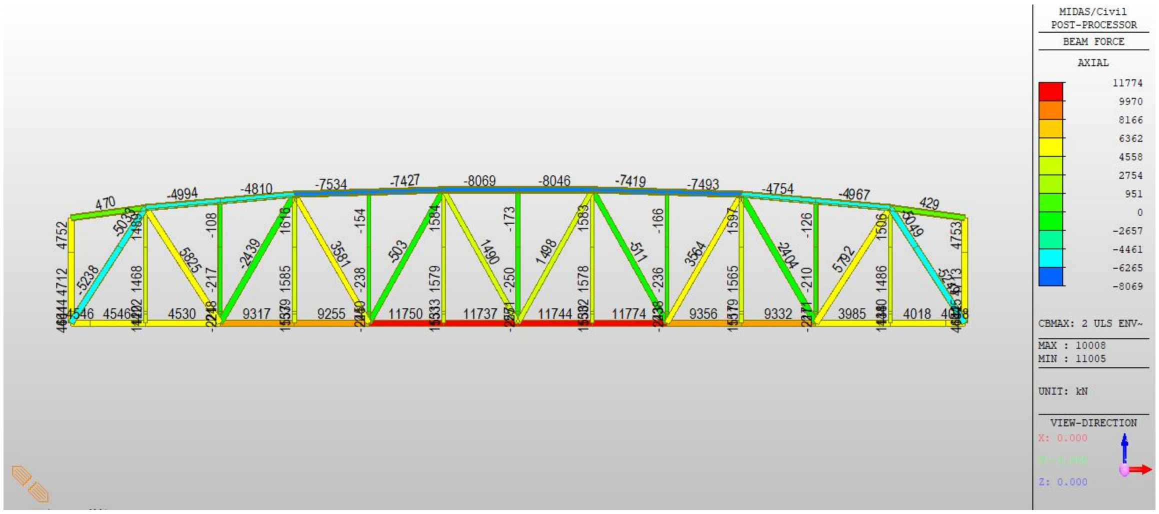


Figure 27 Railway Truss Case 2 ULS Axial Max

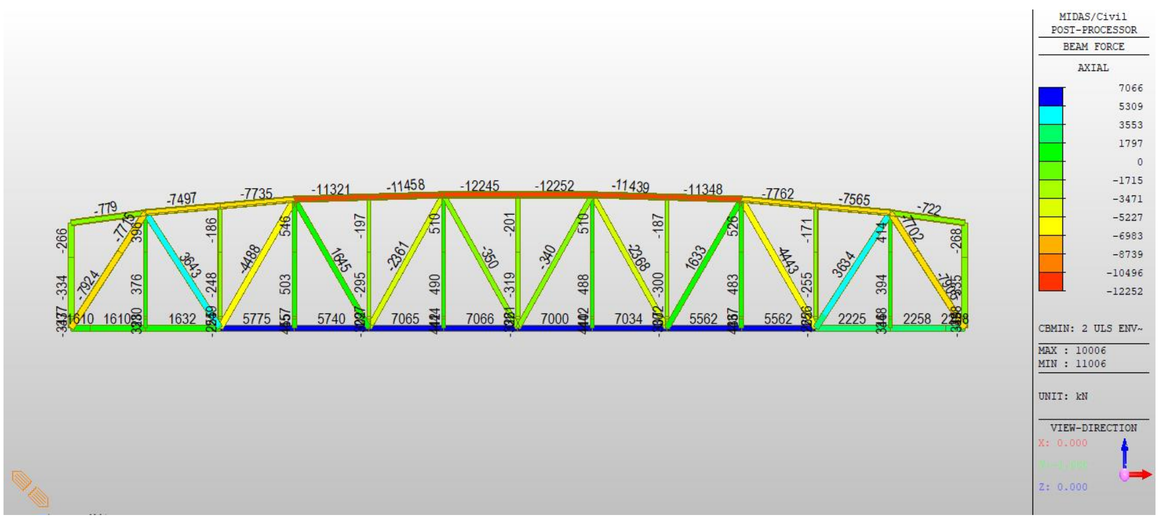


Figure 28 Railway Truss Case 2 ULS Axial Min

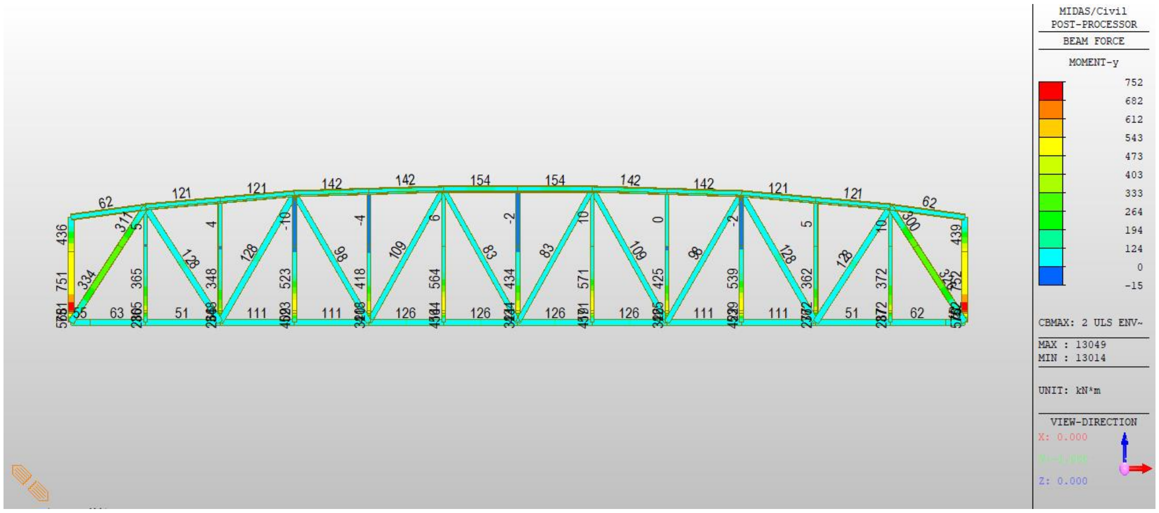


Figure 29 Railway Truss Case 2 ULS M_y Max

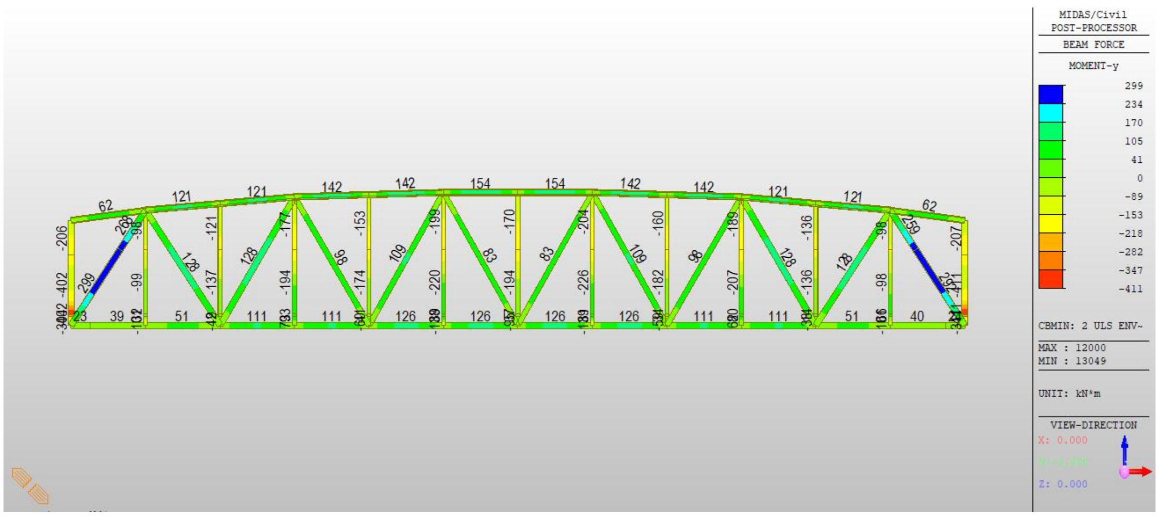


Figure 30 Railway Truss Case 2 ULS M_y Min

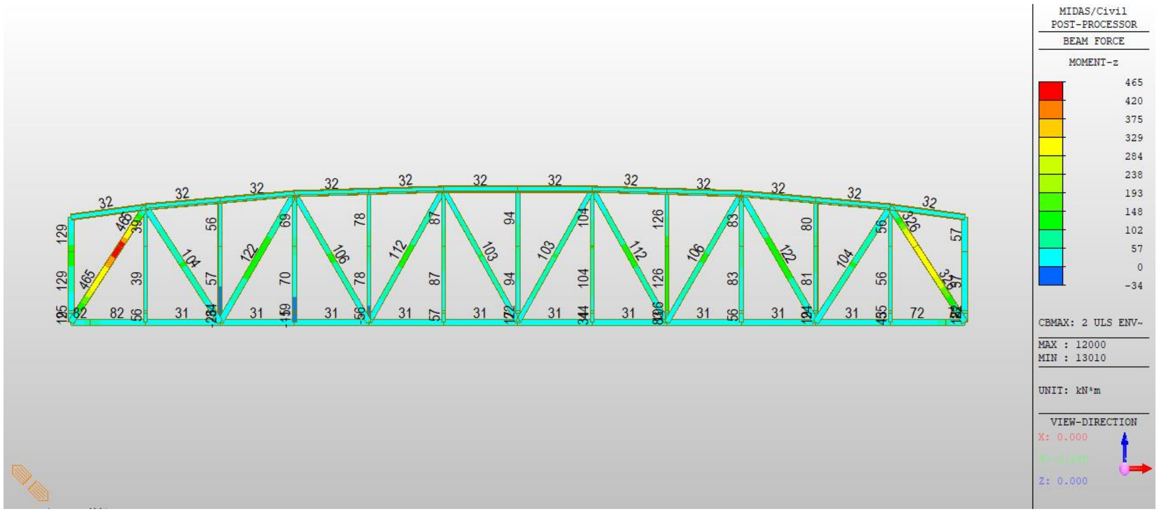


Figure 31 Railway Truss Case 2 ULS M_z Max

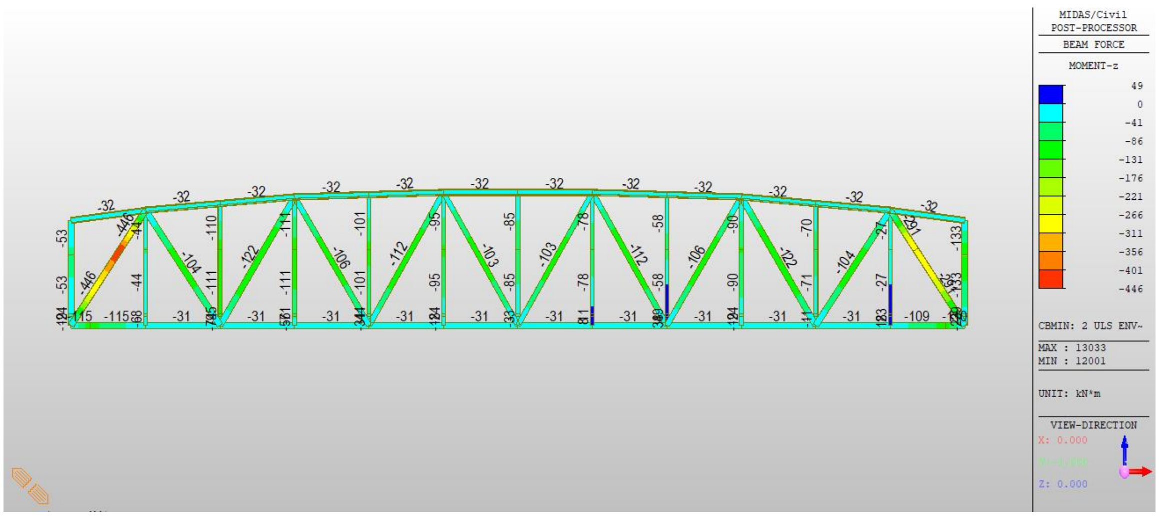


Figure 32 Railway Truss Case 2 ULS M_z Min

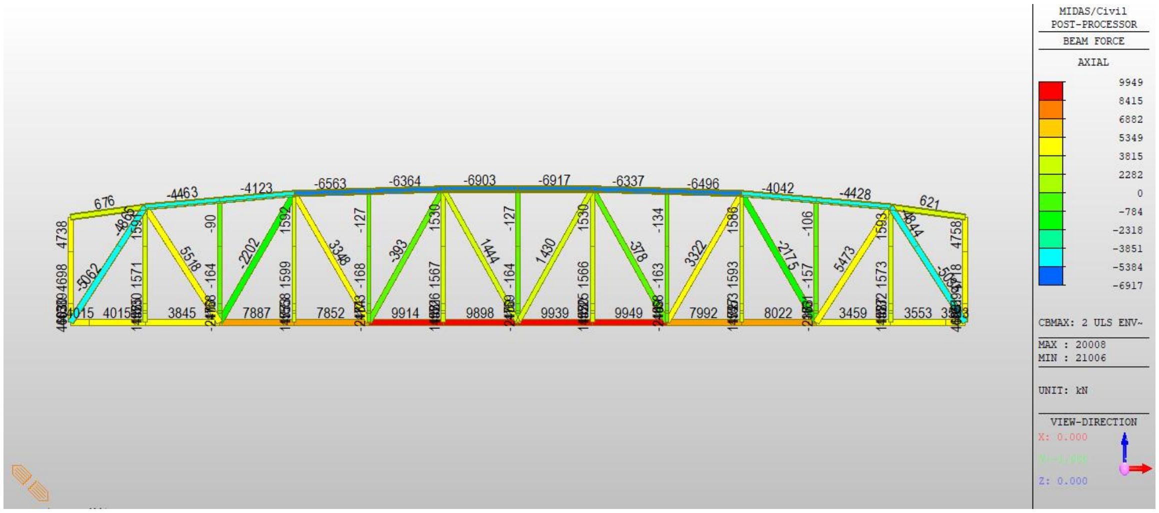


Figure 33 Highway Truss Case 2 ULS Axial Max

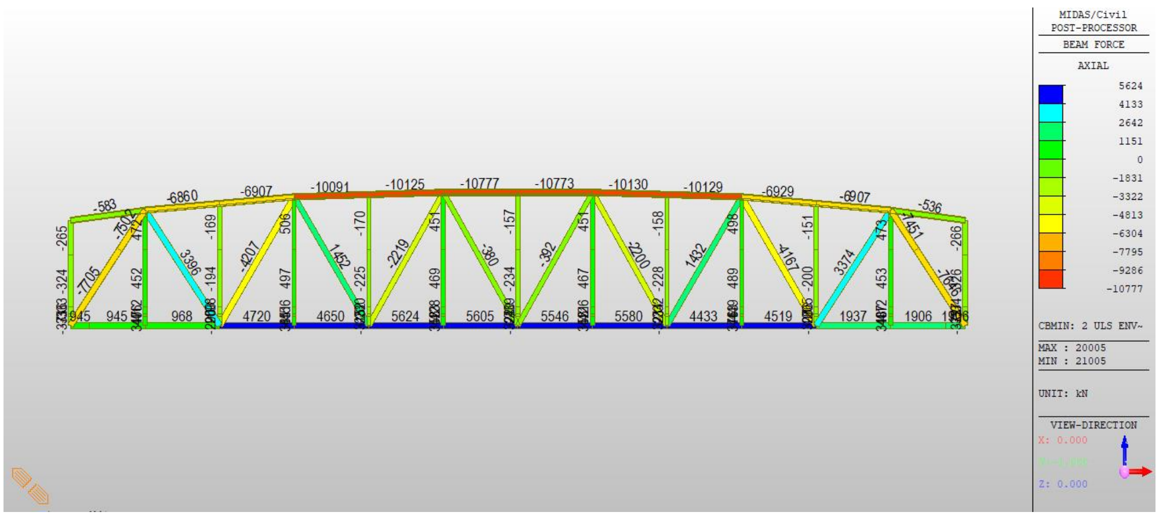


Figure 34 Highway Truss Case 2 ULS Axial Min

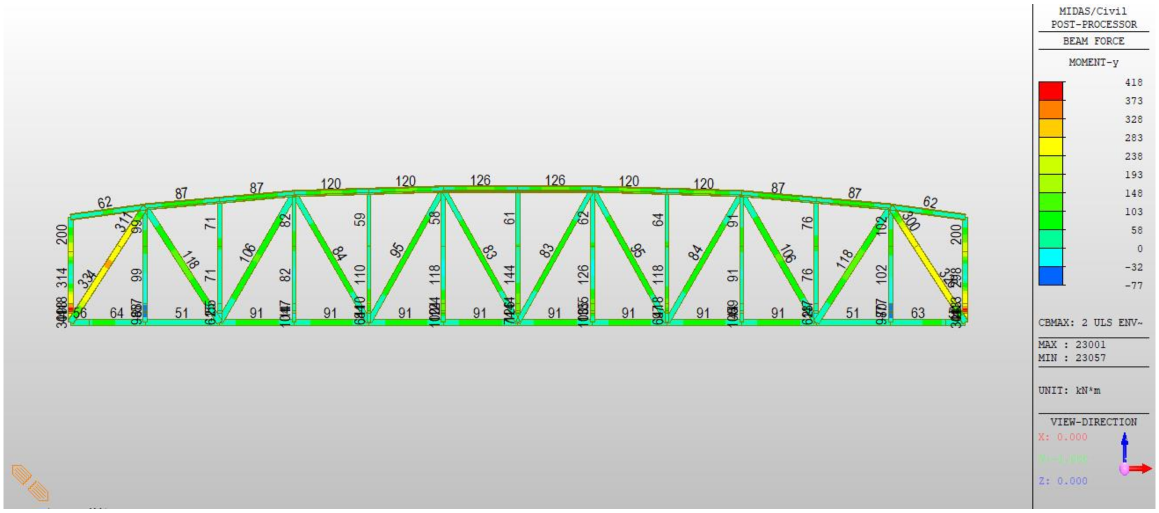


Figure 35 Highway Truss Case 2 ULS M_y Max

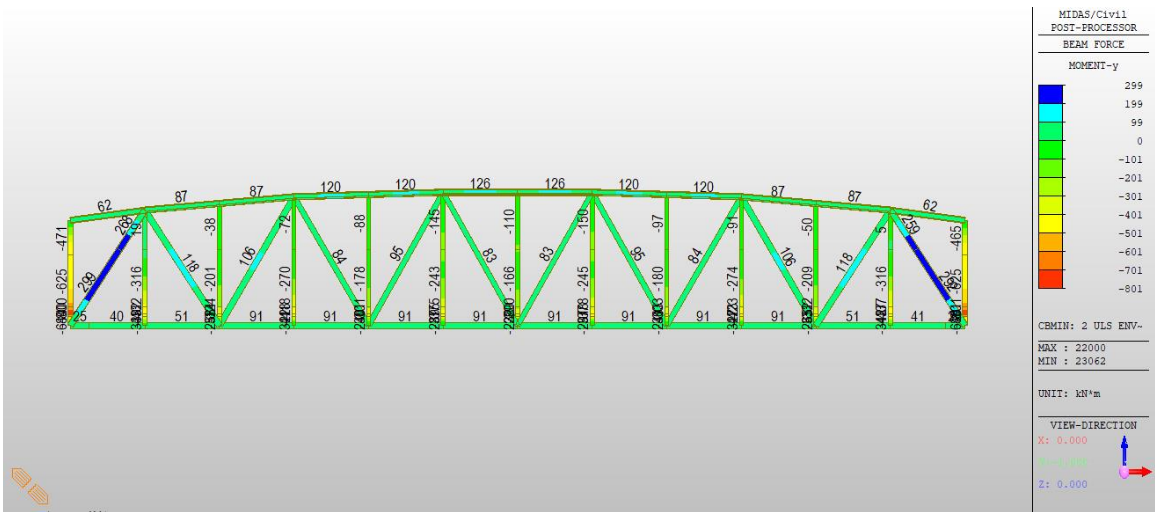


Figure 36 Highway Truss Case 2 ULS M_y Min

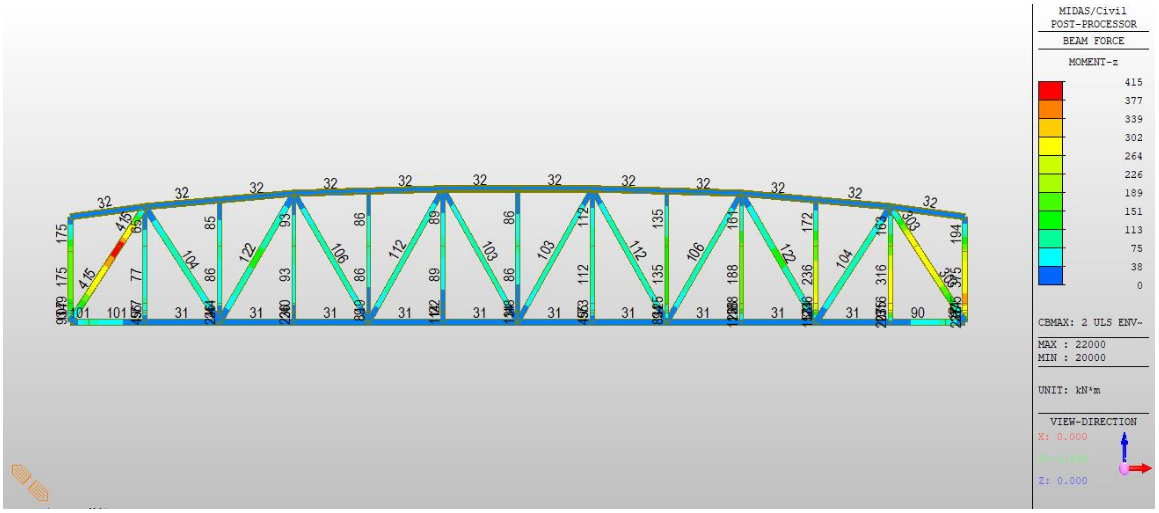


Figure 37 Highway Truss Case 2 ULS M_z Max

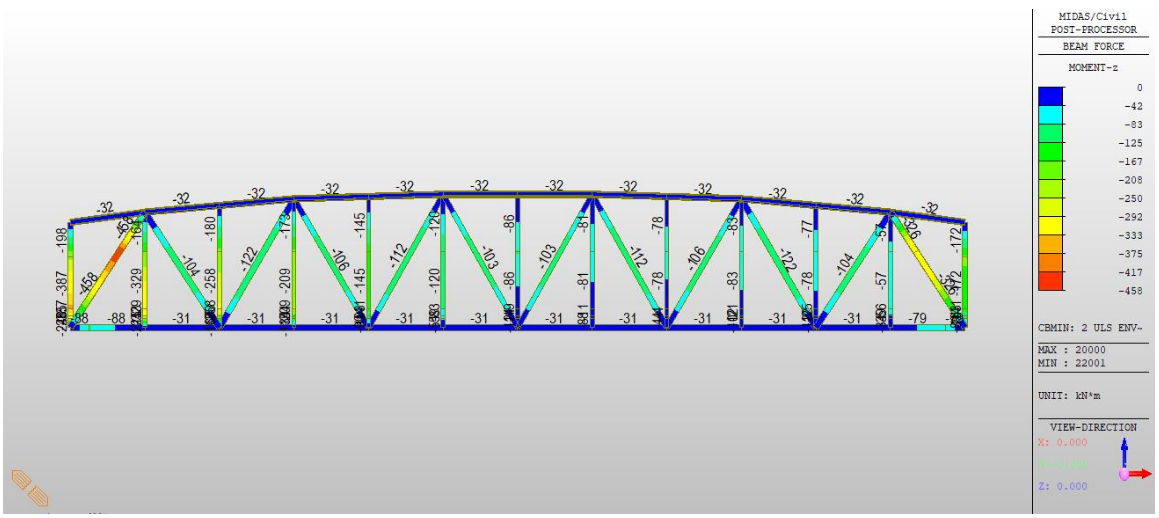


Figure 38 Highway Truss Case 2 ULS M_z Min

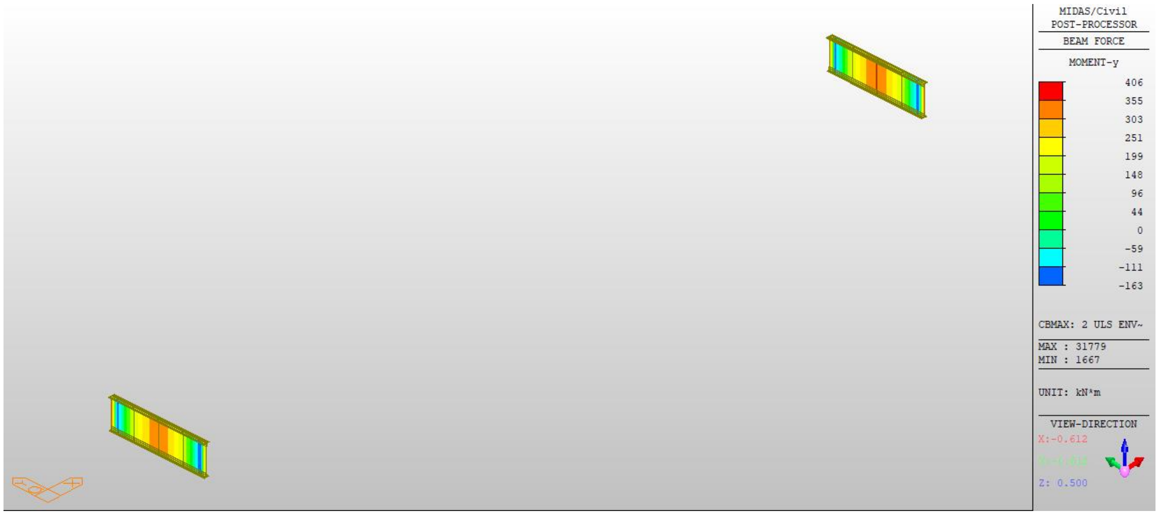


Figure 39 Lift Girder Case 2 ULS M_y Max

Figure 40 Lift Girder Case 2 ULS M_y Min

Figure 41 Lift Girder Case 2 ULS F_z Max

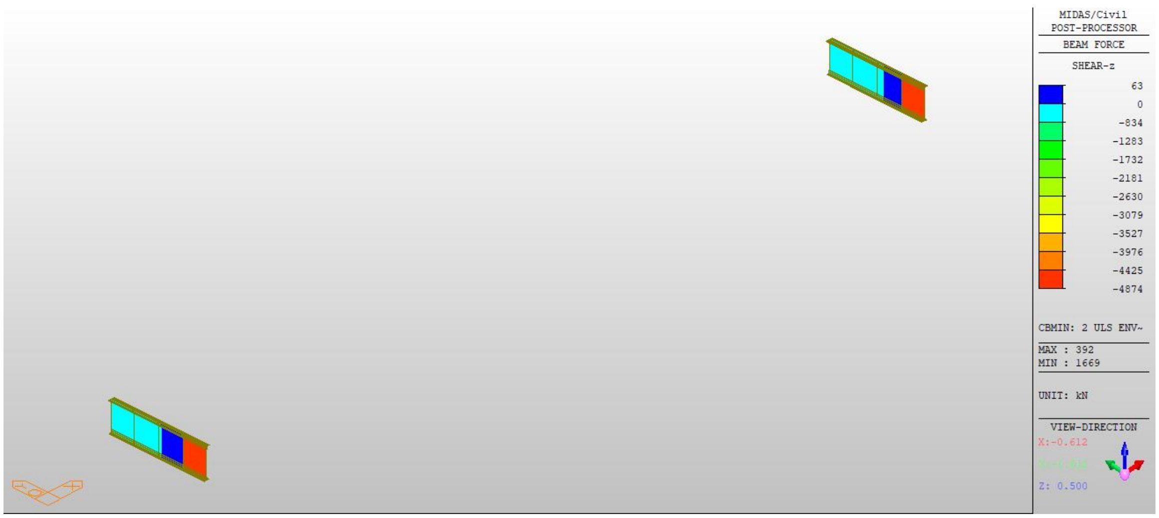


Figure 42 Lift Girder Case 2 ULS F_z Min

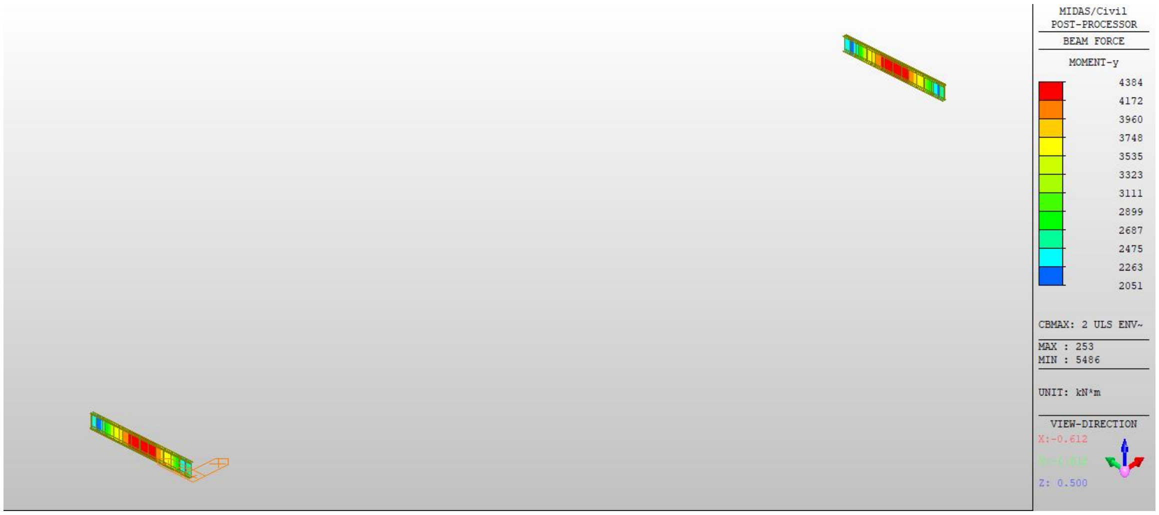


Figure 43 End Floor Beam Case 2 ULS M_y Max

Figure 44 End Floor Beam Case 2 ULS M_y Min

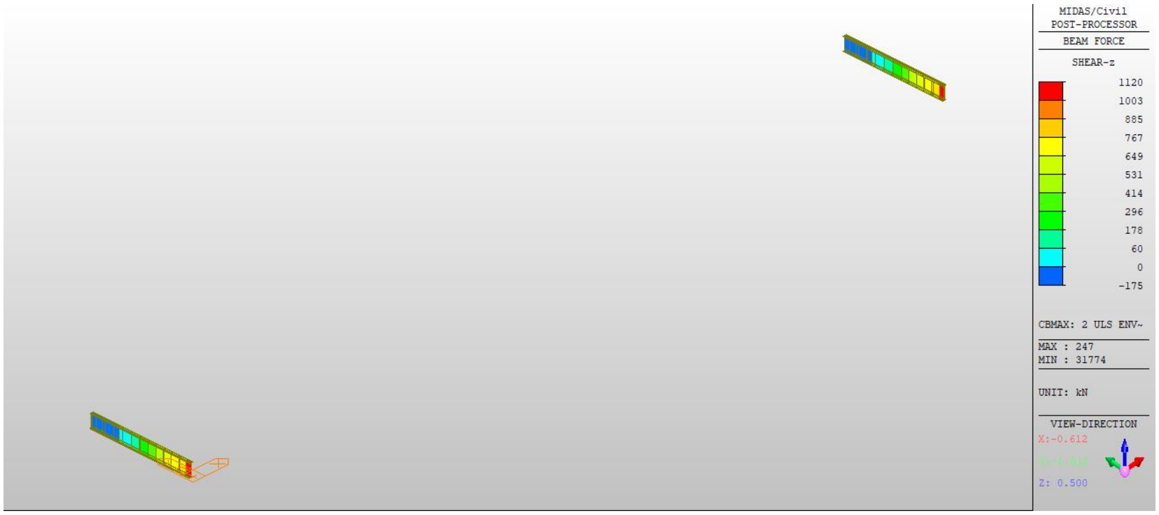


Figure 45 End Floor Beam Case 2 ULS F_z Max

Figure 46 End Floor Beam Case 2 ULS F_z Min

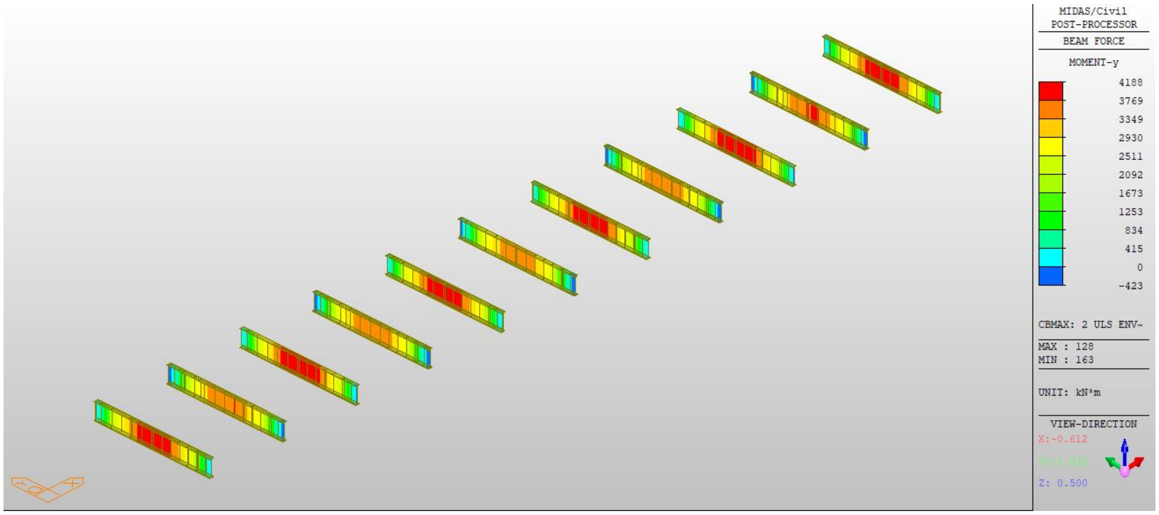


Figure 47 Interior Floor Beam Case 2 ULS M_y Max

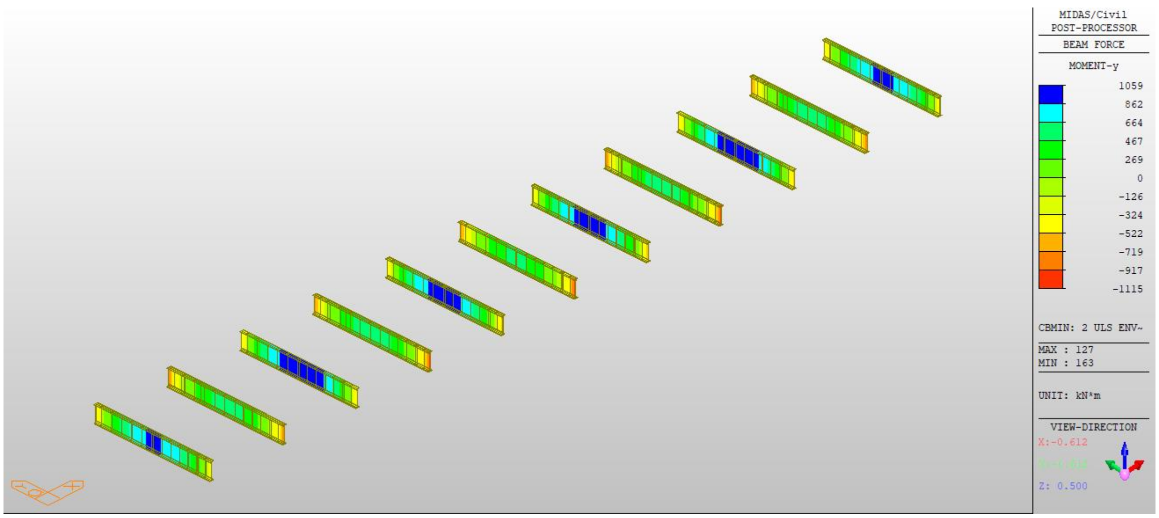


Figure 48 Interior Floor Beam Case 2 ULS M_y Min

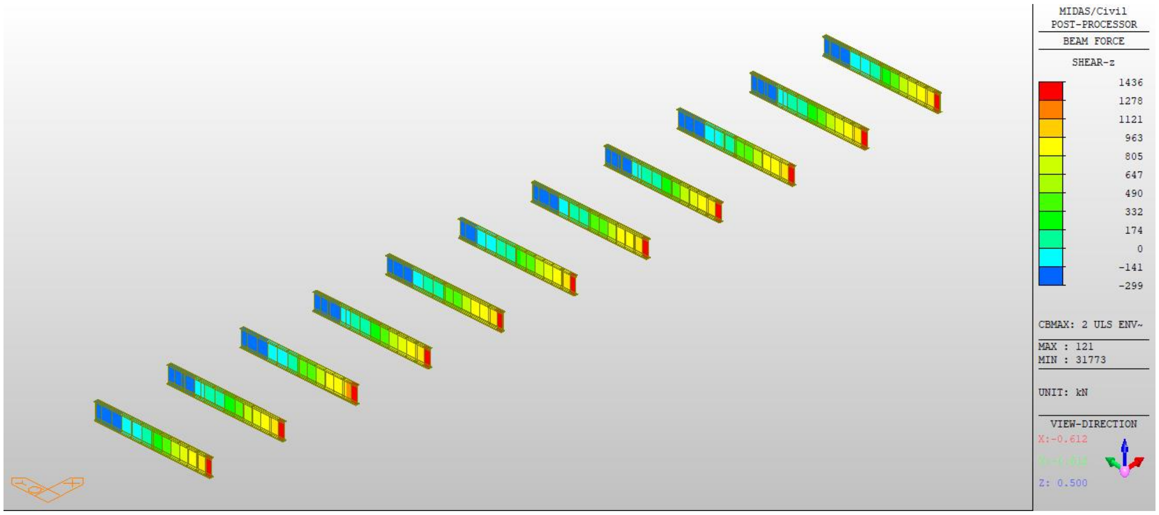


Figure 49 Interior Floor Beam Case 2 ULS F_z Max

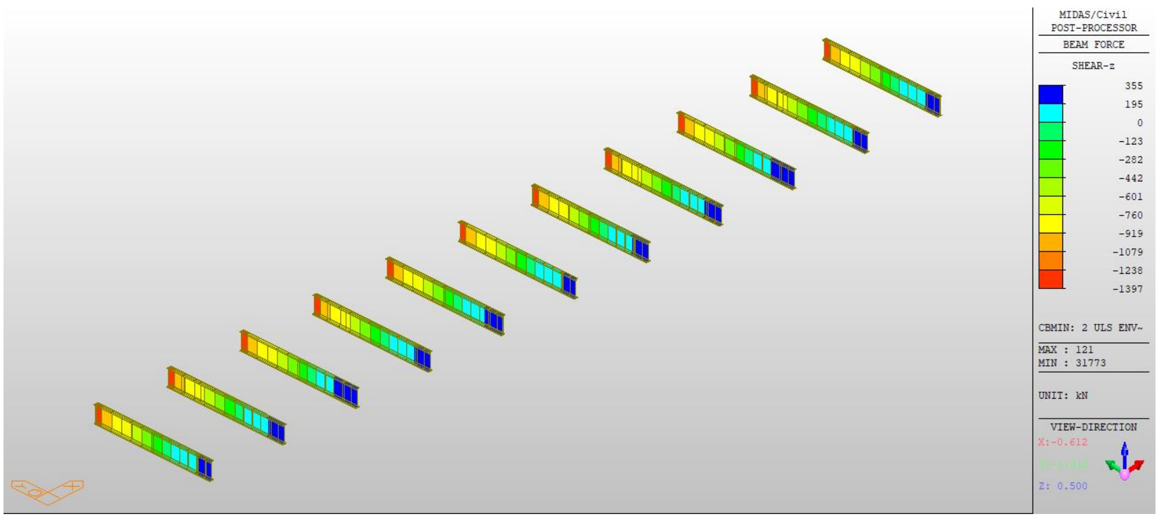


Figure 50 Interior Floor Beam Case 2 ULS F_z Min

Exhibit C.1.3. Rehabilitation Case 3 Evaluation

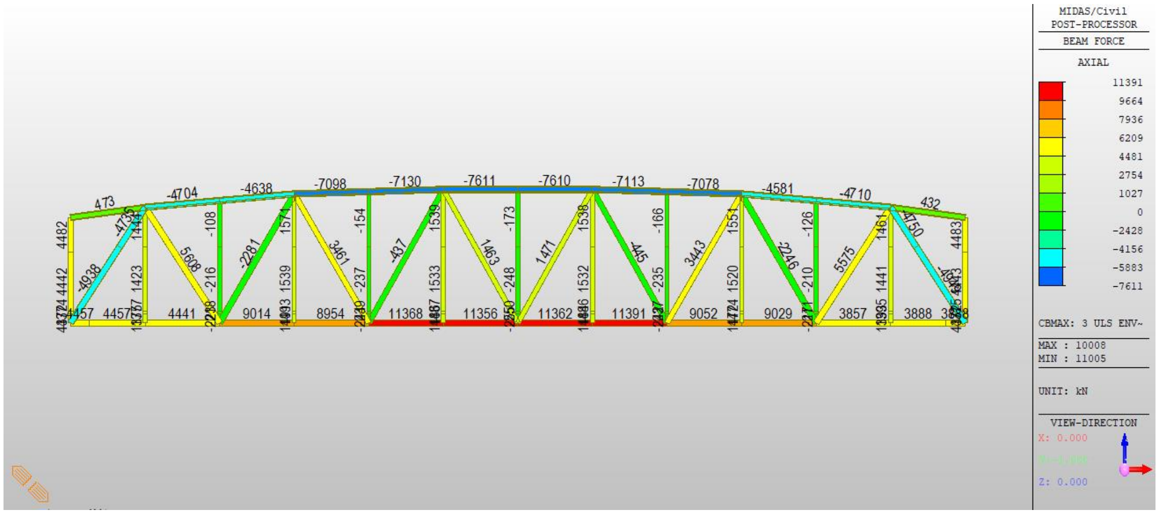


Figure 51 Railway Truss Case 3 ULS Axial Max

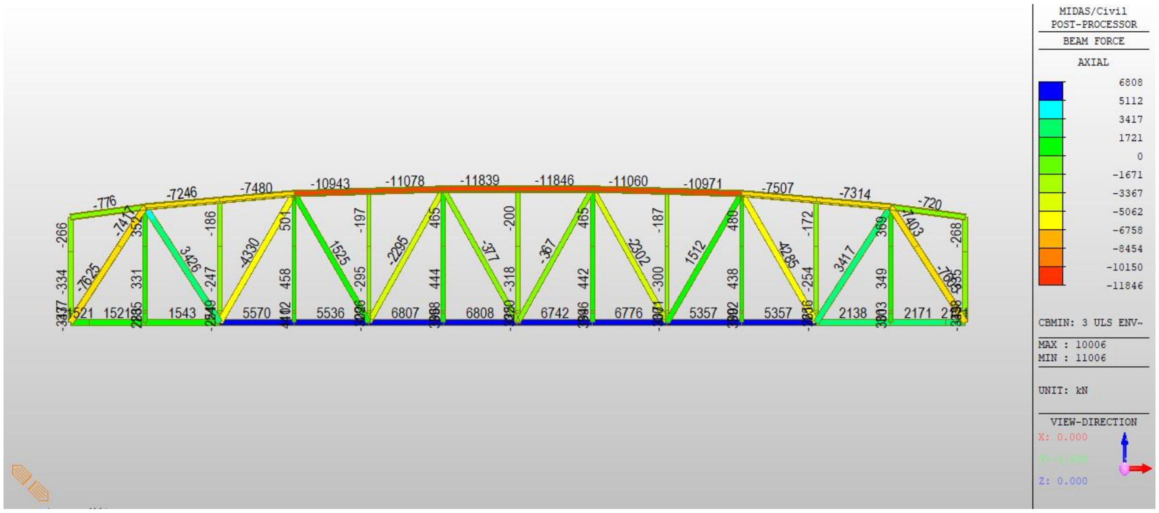


Figure 52 Railway Truss Case 3 ULS Axial Min

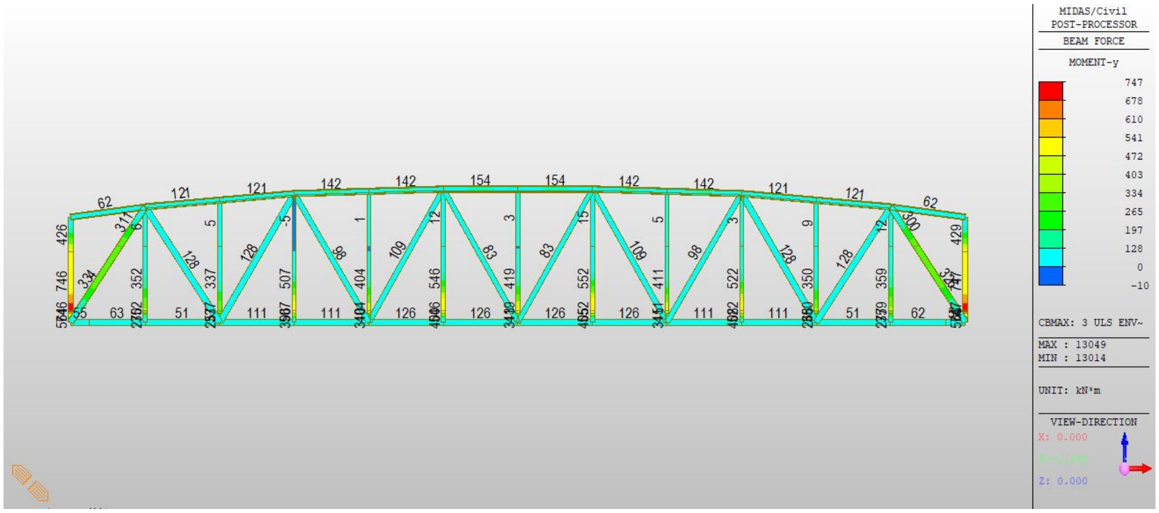


Figure 53 Railway Truss Case 3 ULS M_y Max

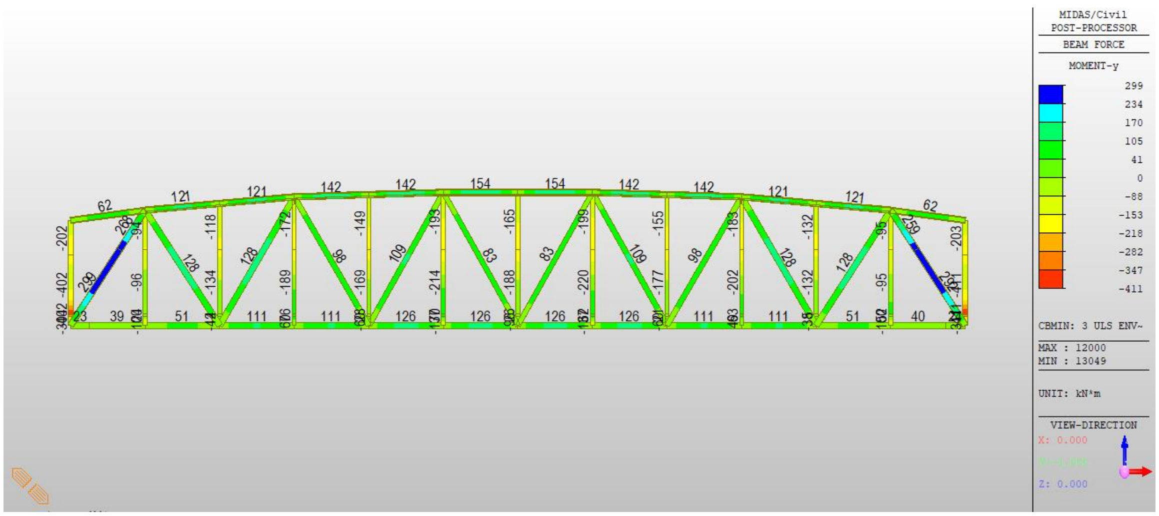


Figure 54 Railway Truss Case 3 ULS M_y Min

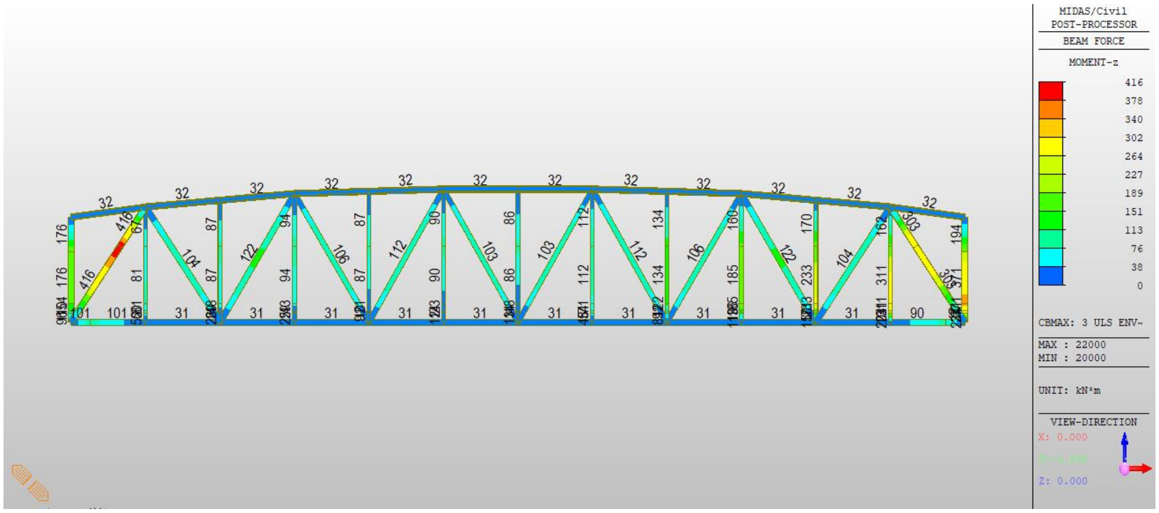


Figure 55 Railway Truss Case 3 ULS M_z Max

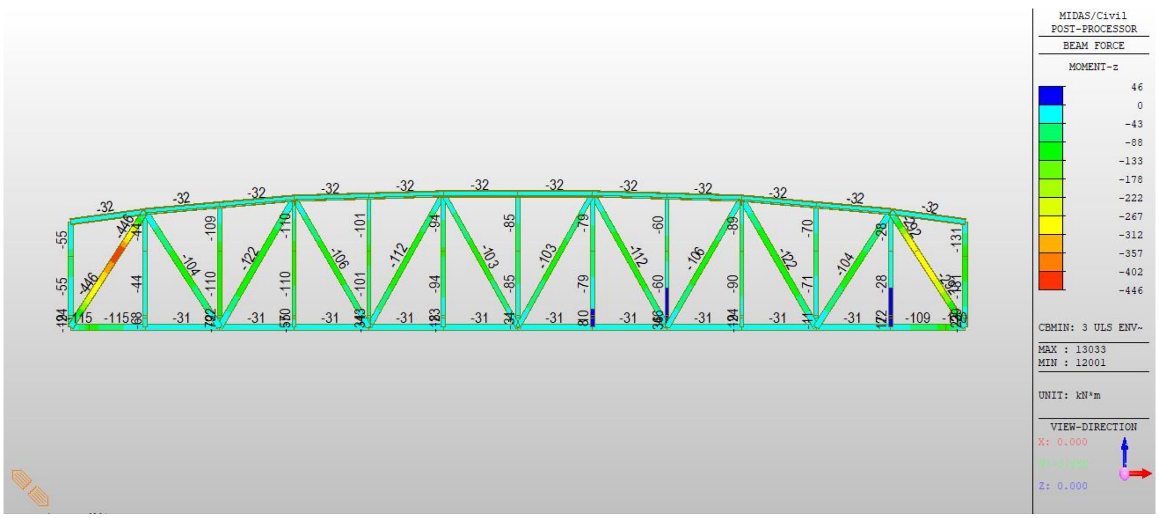


Figure 56 Railway Truss Case 3 ULS M_z Min

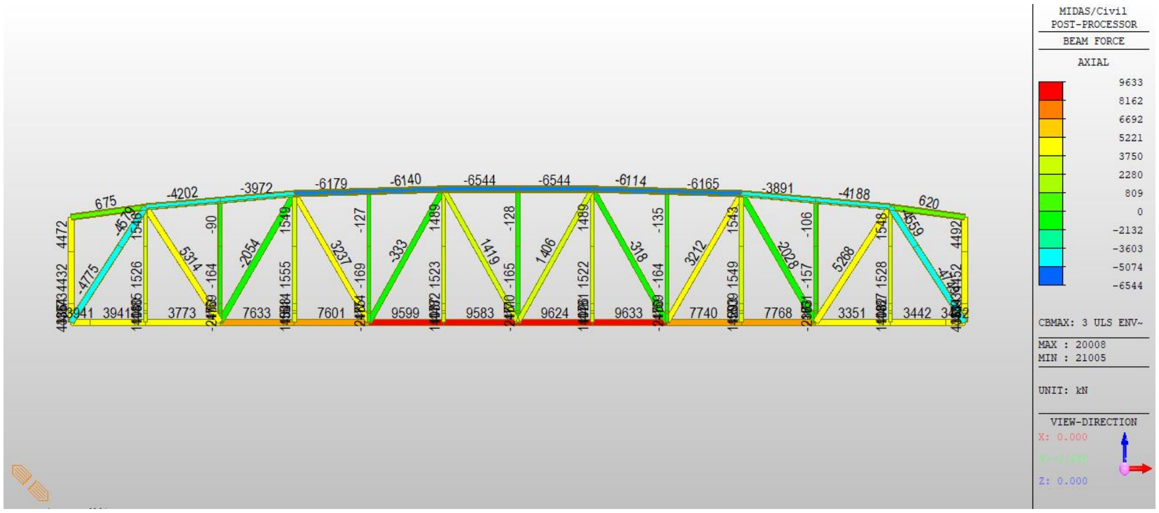


Figure 57 Highway Truss Case 3 ULS Axial Max

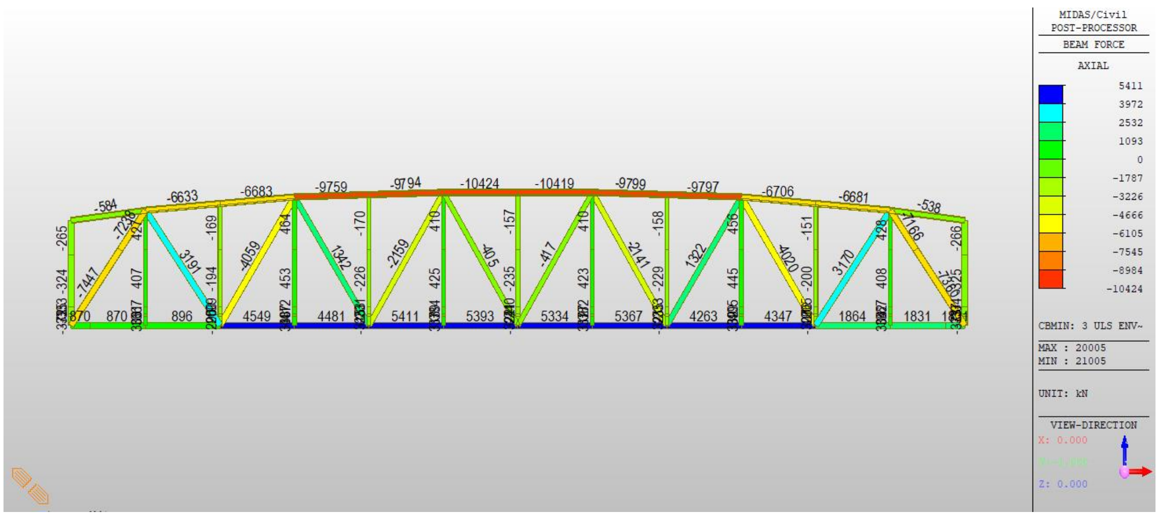


Figure 58 Highway Truss Case 3 ULS Axial Min

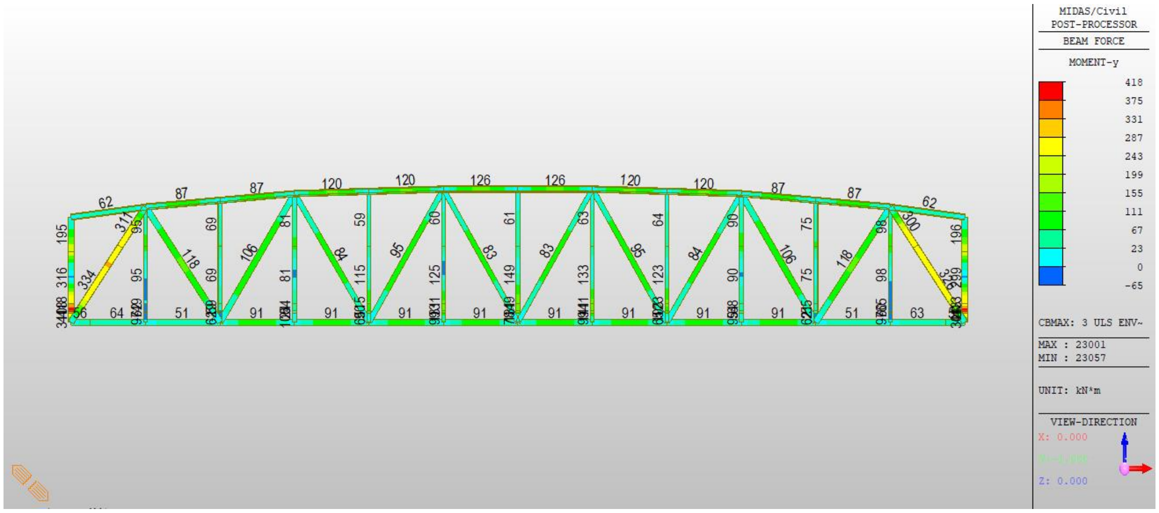


Figure 59 Highway Truss Case 3 ULS M_y Max

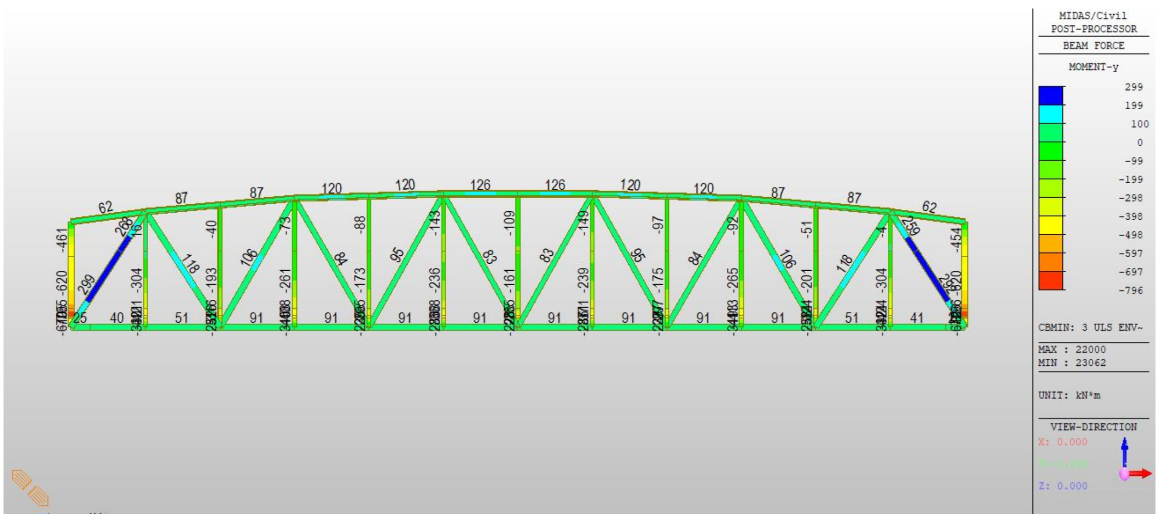


Figure 60 Highway Truss Case 3 ULS M_y Min

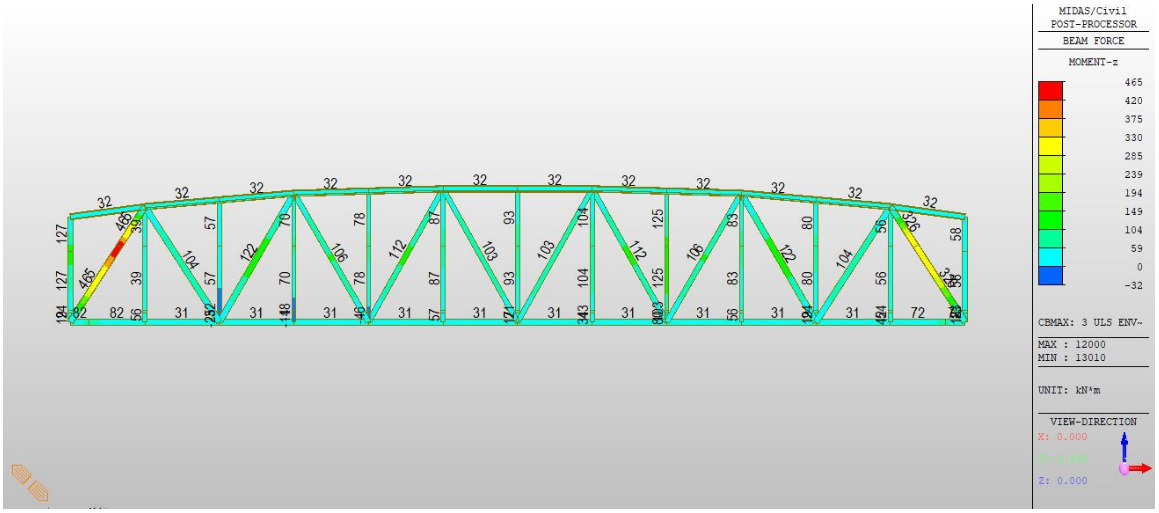


Figure 61 Highway Truss Case 3 ULS M_z Max

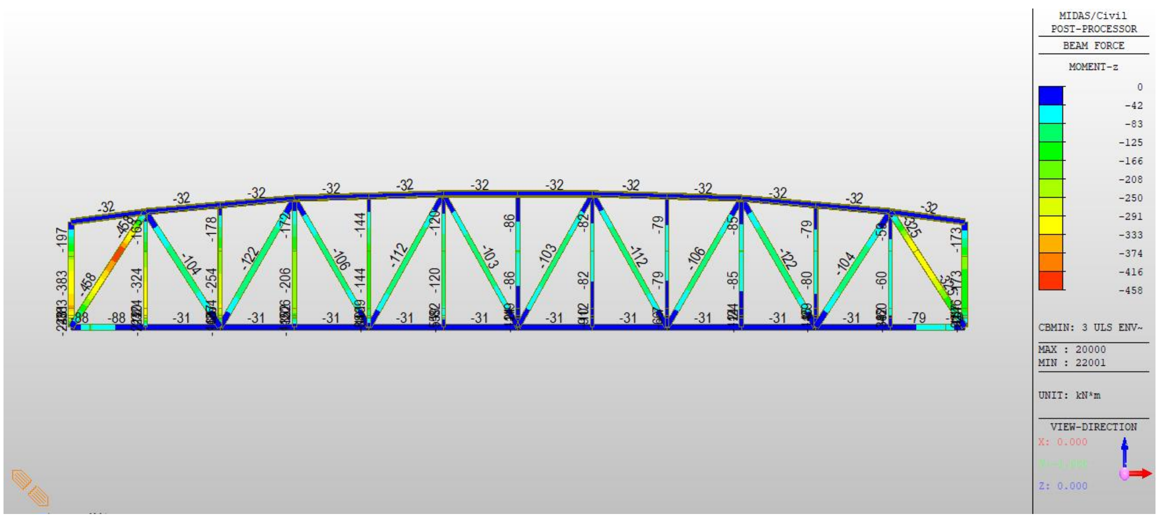


Figure 62 Highway Truss Case 3 ULS M_z Min

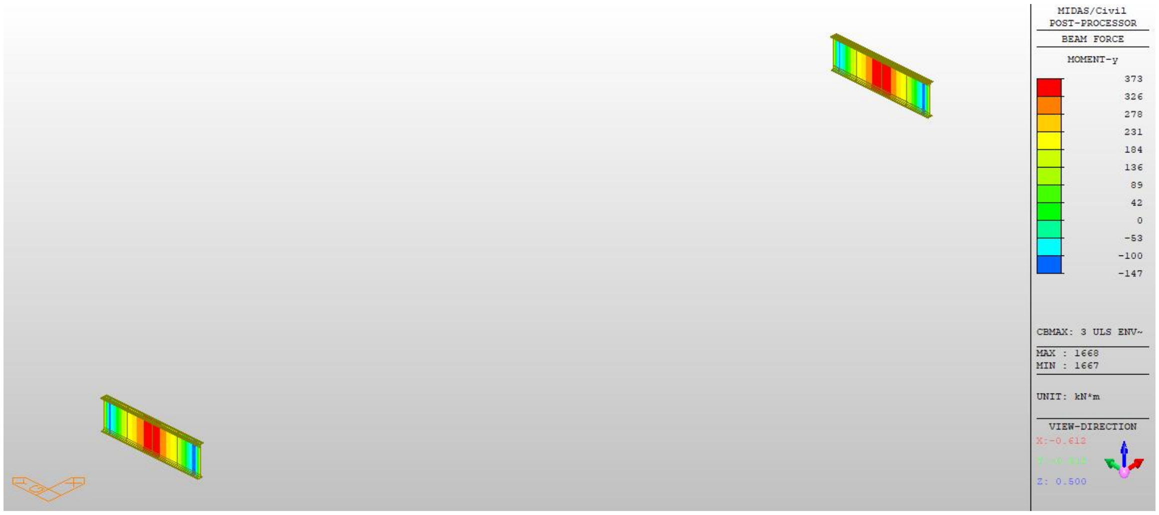


Figure 63 Lift Girder 3 ULS M_y Max

Figure 64 Lift Girder Case 3 ULS M_y Min

Figure 65 Lift Girder Case 3 ULS F_z Max

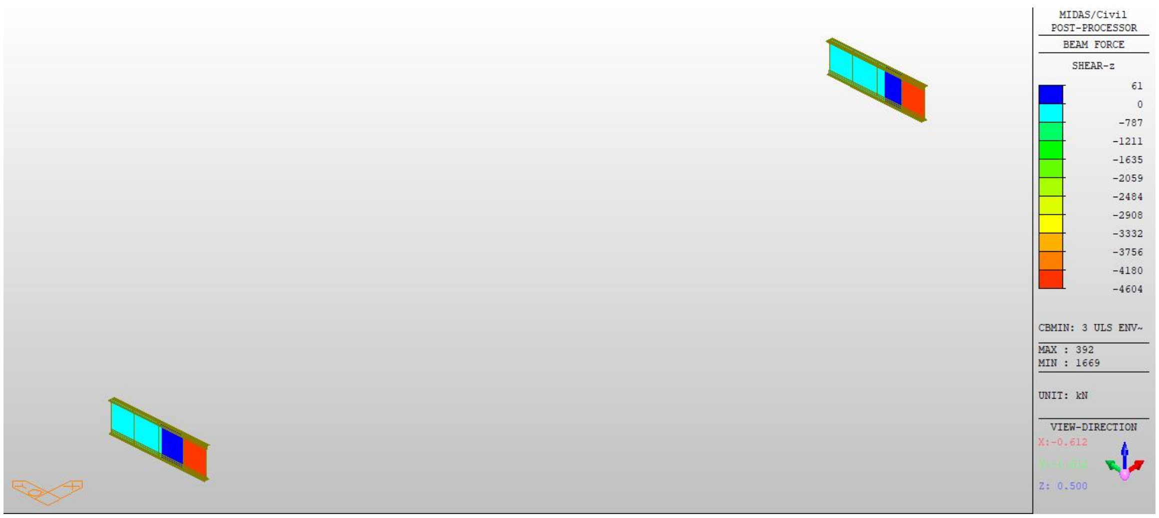


Figure 66 Lift Girder Case 3 ULS F_z Min

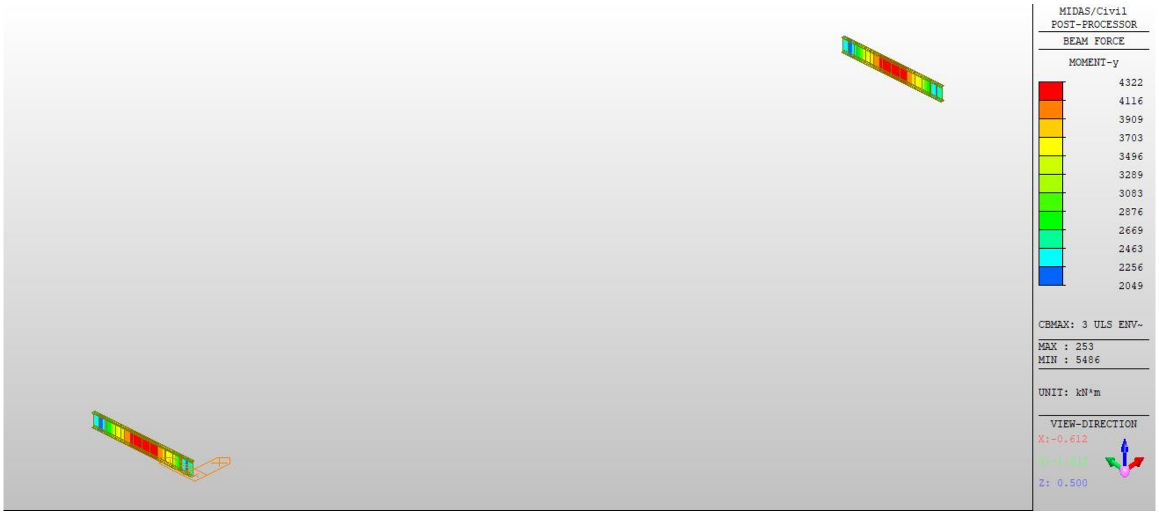


Figure 67 End Floor Beam Case 3 ULS M_y Max

Figure 68 End Floor Beam Case 3 ULS M_y Min

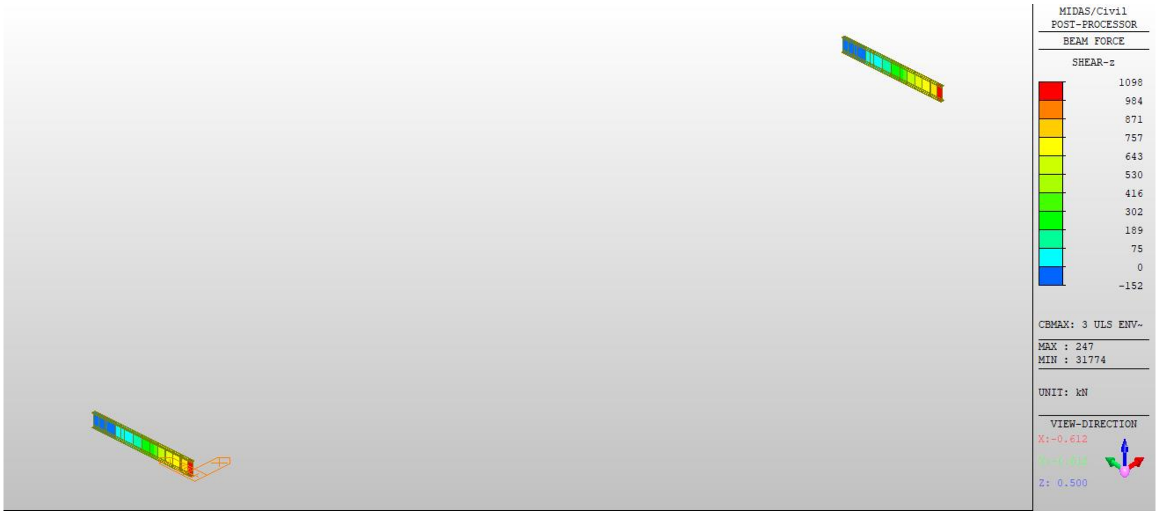


Figure 69 End Floor Beam Case 3 ULS F_z Max

Figure 70 End Floor Beam Case 3 ULS F_z Min

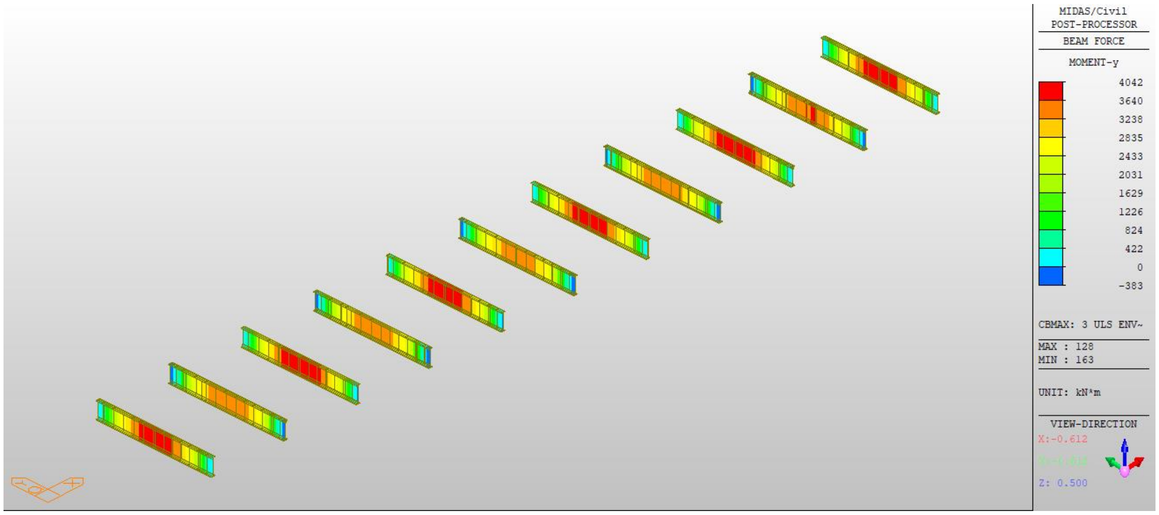


Figure 71 Interior Floor Beam Case 3 ULS M_y Max

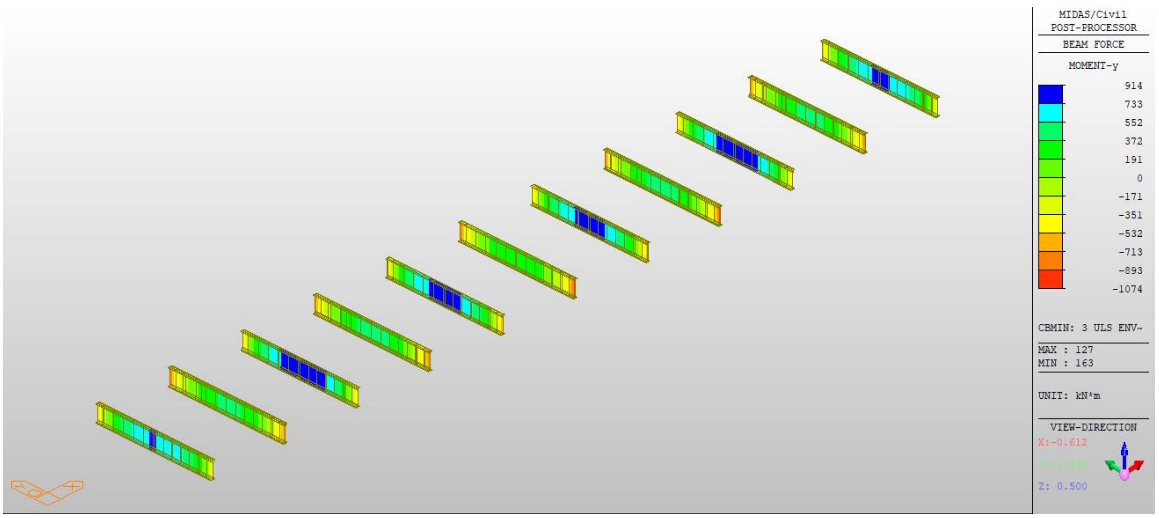


Figure 72 Interior Floor Beam Case 3 ULS M_y Min

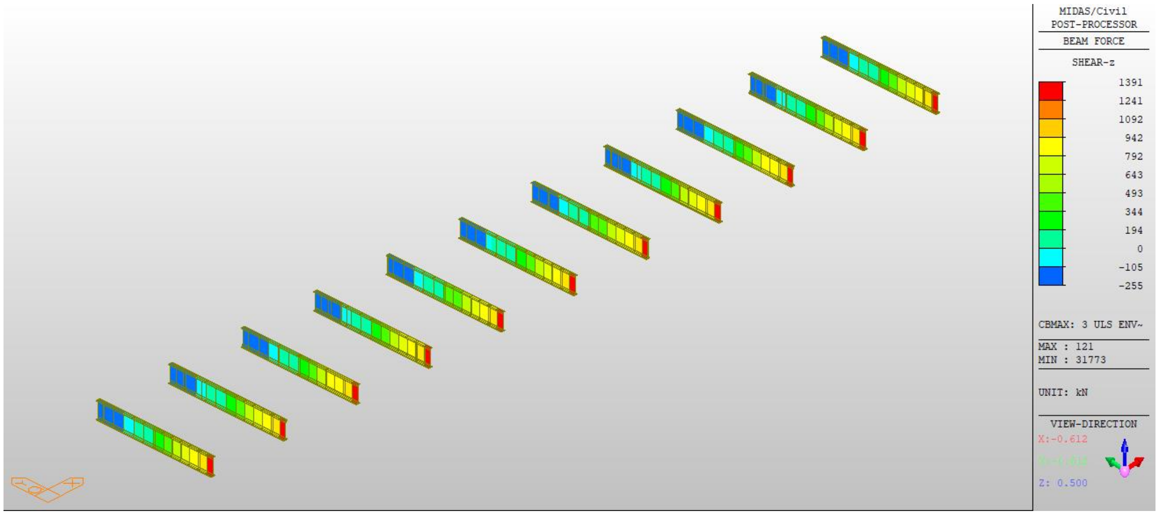


Figure 73 Interior Floor Beam Case 3 ULS F_z Max

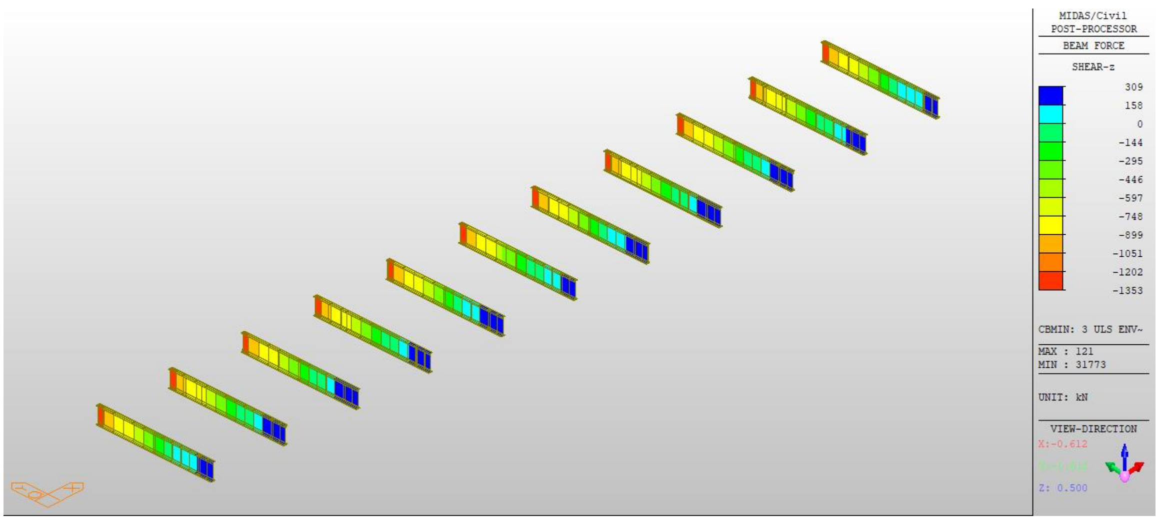


Figure 74 Interior Floor Beam Case 3 ULS F_z Min

Exhibit C.1.4. Rehabilitation Case 4 Evaluation

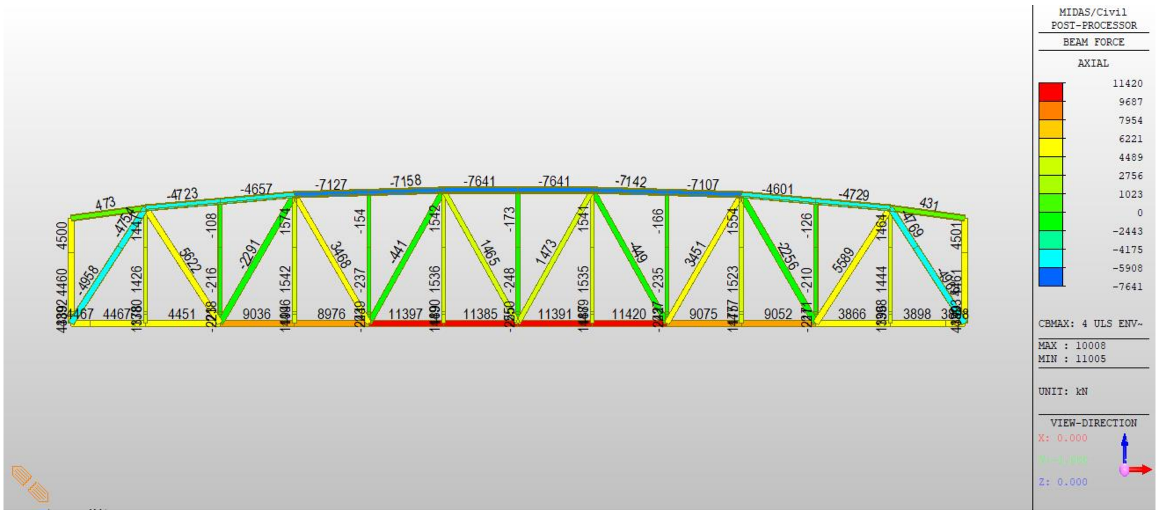


Figure 75 Railway Truss Case 4 ULS Axial Max

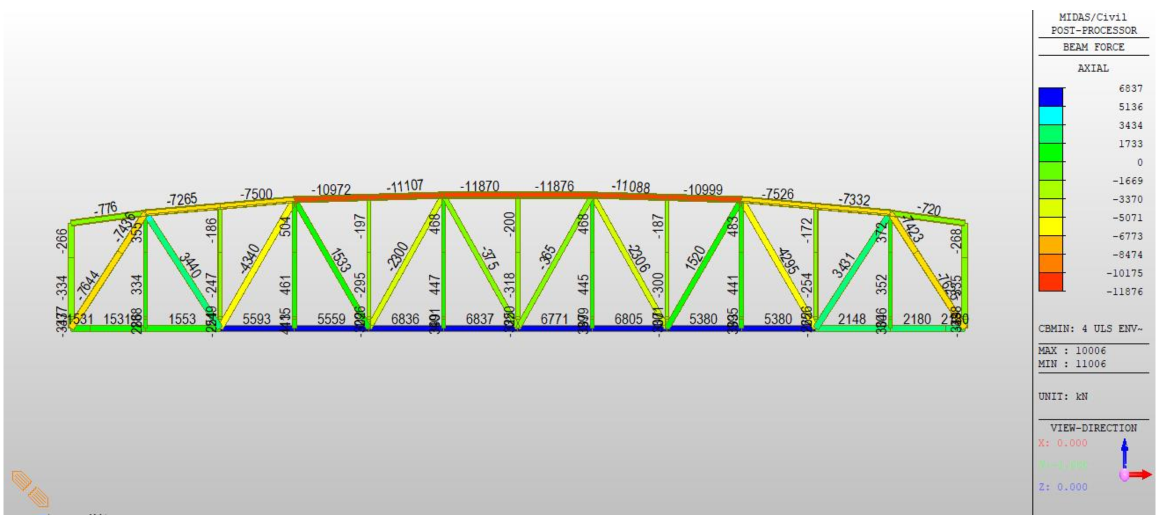


Figure 76 Railway Truss Case 4 ULS Axial Min

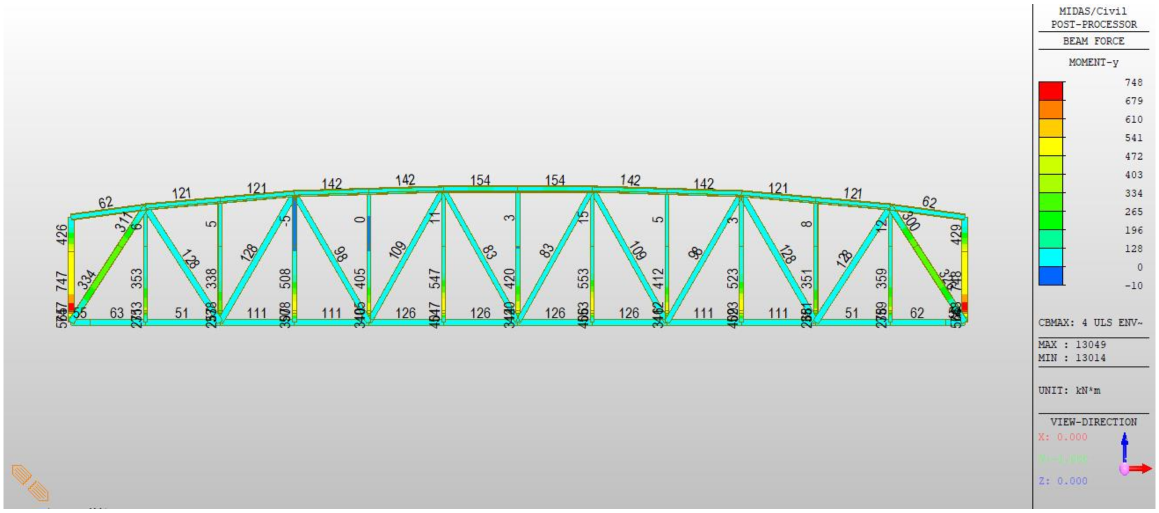


Figure 77 Railway Truss Case 4 ULS M_y Max

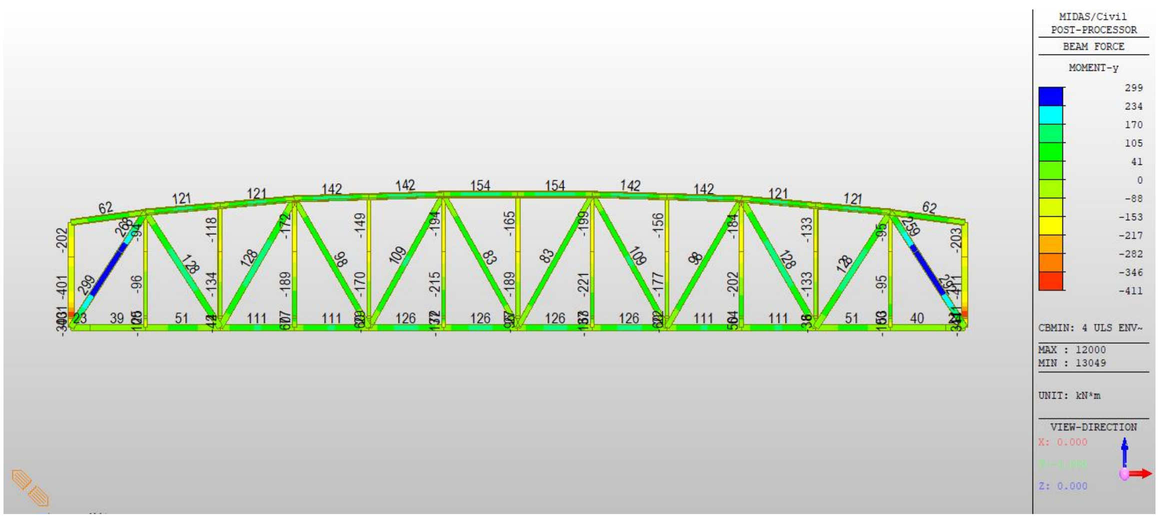


Figure 78 Railway Truss Case 4 ULS M_y Min

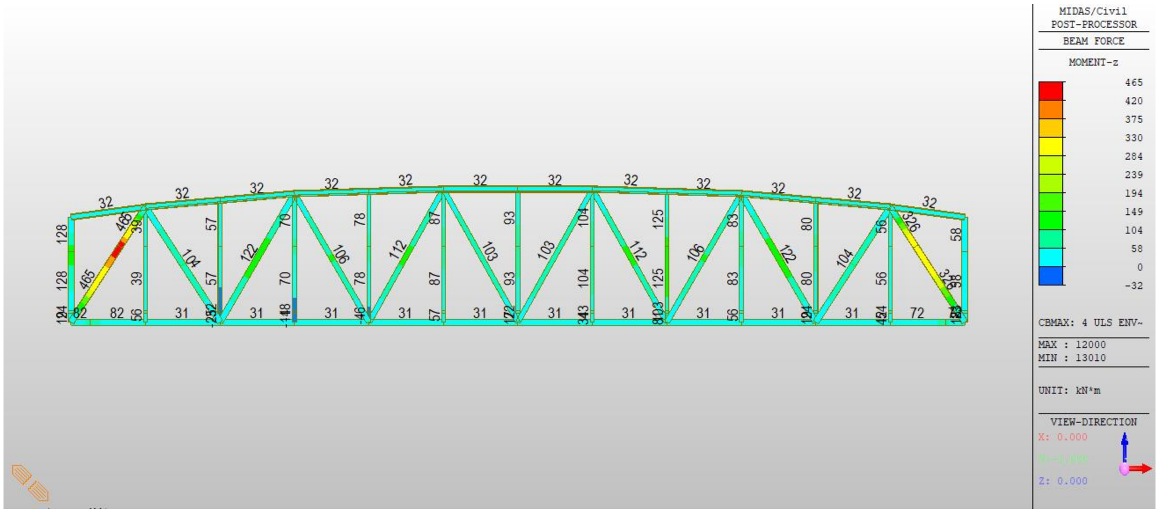


Figure 79 Railway Truss Case 4 ULS M_z Max

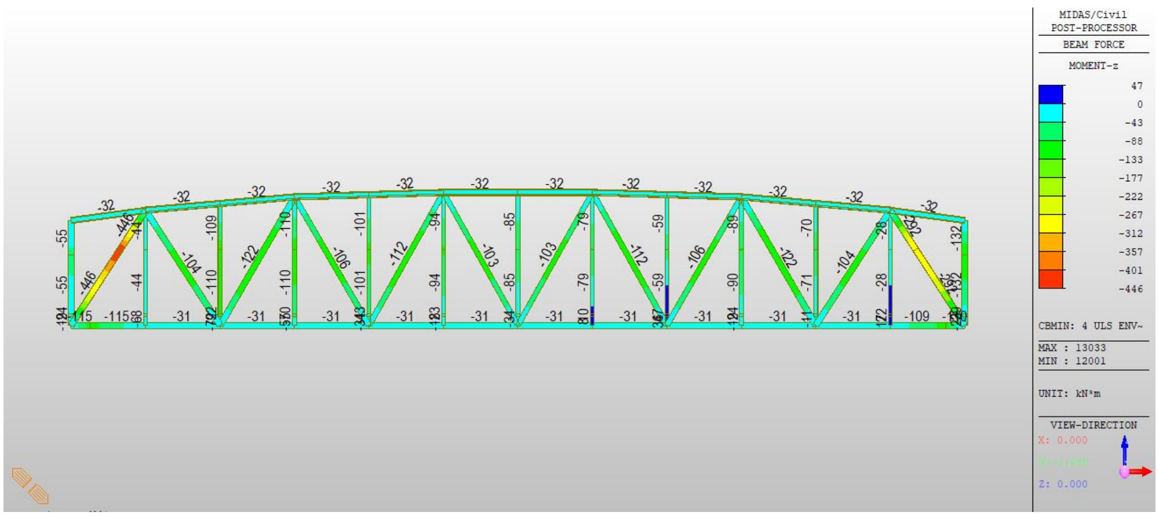


Figure 80 Railway Truss Case 4 ULS M_z Min

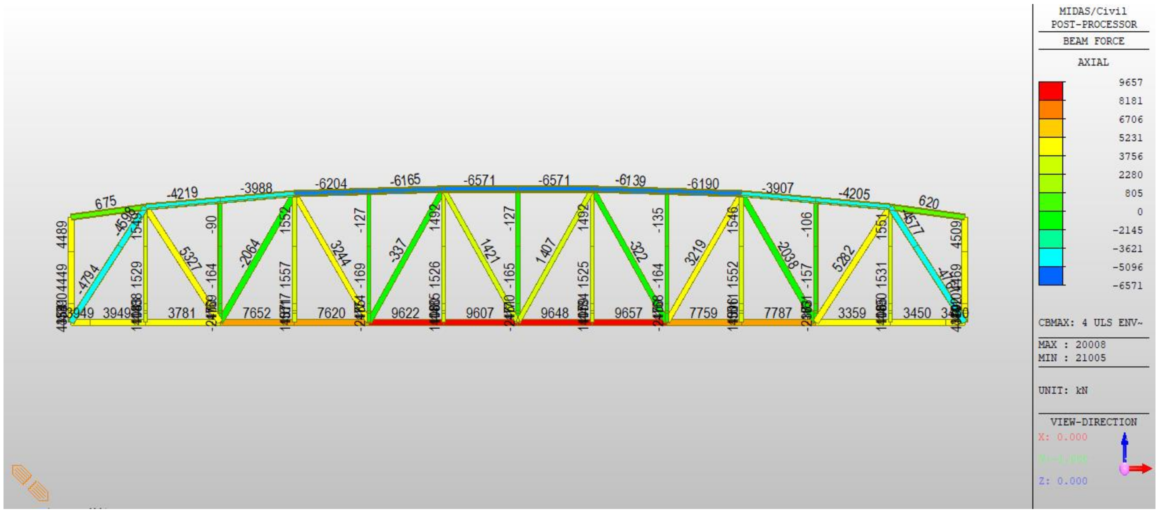


Figure 81 Highway Truss Case 4 ULS Axial Max

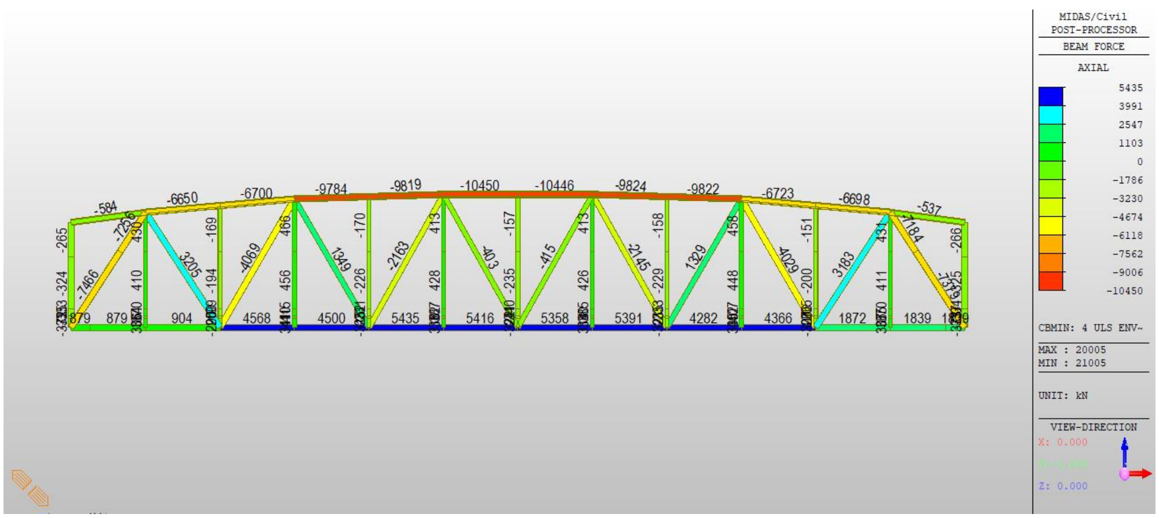


Figure 82 Highway Truss Case 4 ULS Axial Min

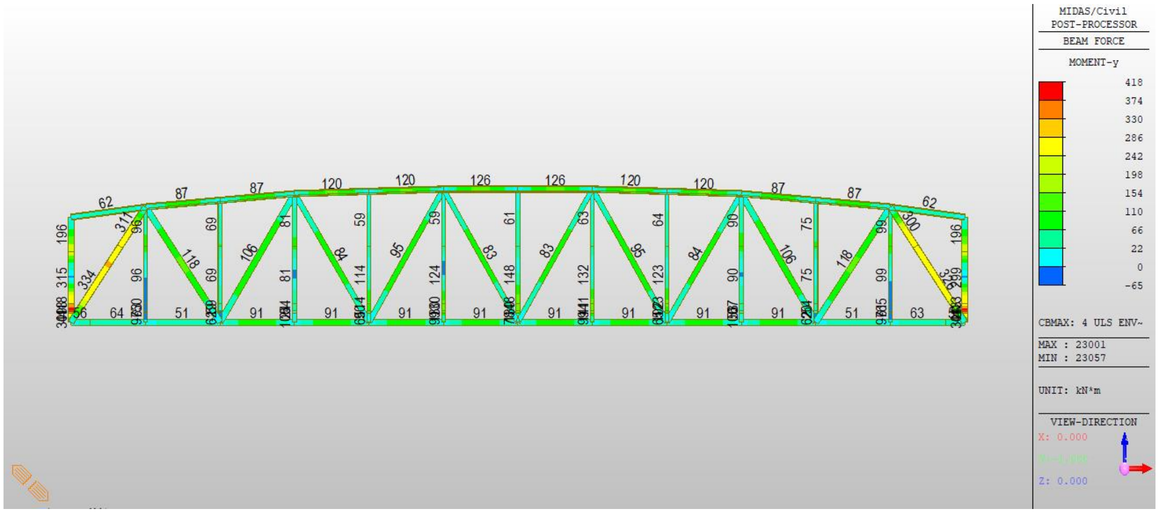


Figure 83 Highway Truss Case 4 ULS M_y Max

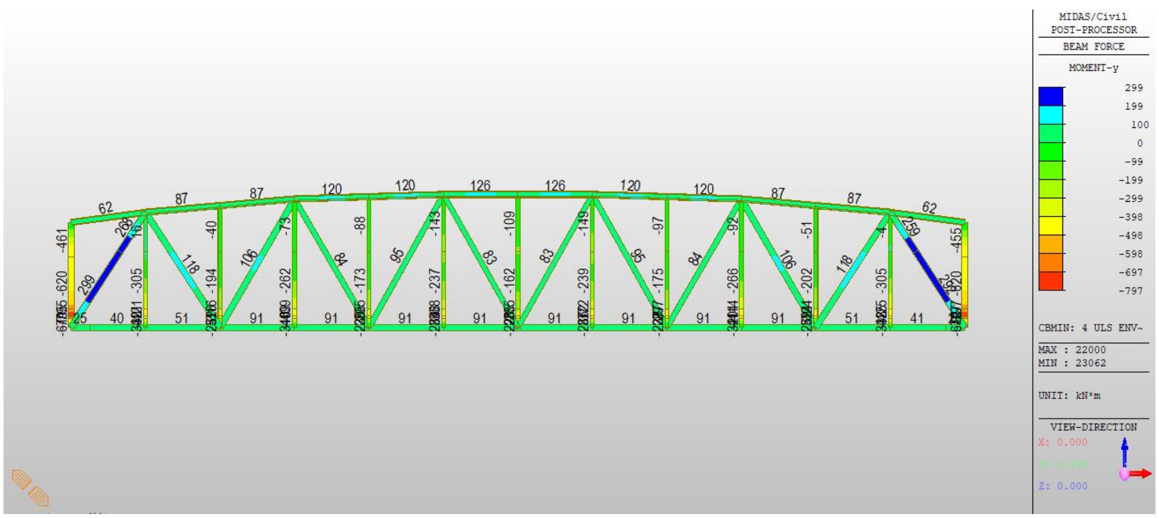


Figure 84 Highway Truss Case 4 ULS M_y Min

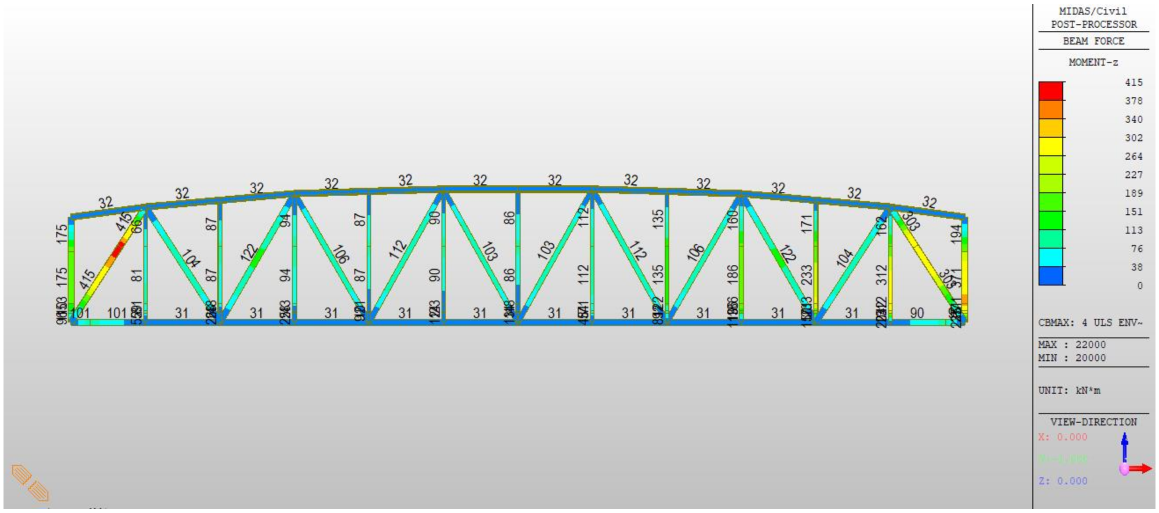


Figure 85 Highway Truss Case 4 ULS M_z Max

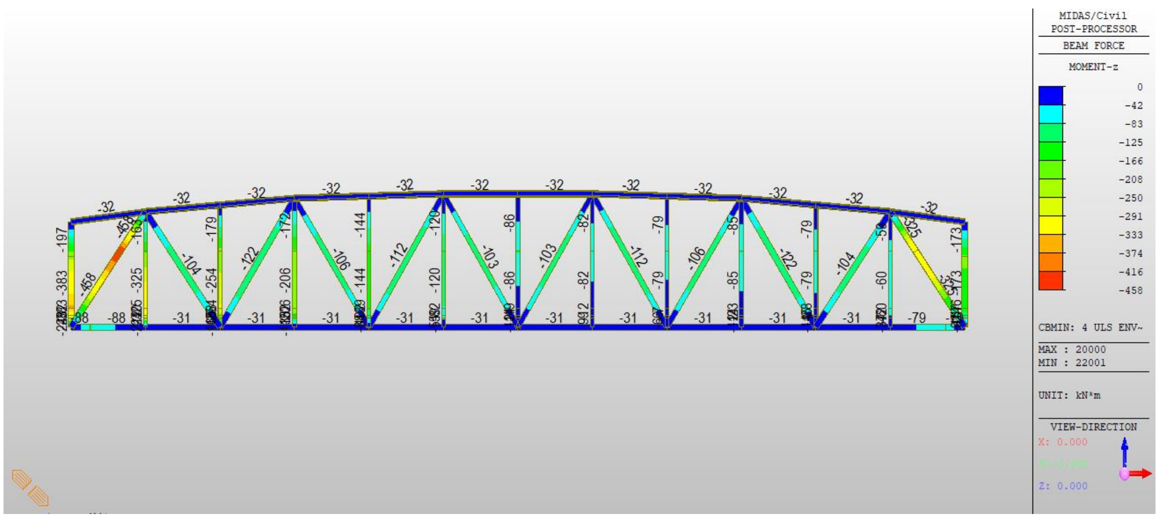


Figure 86 Highway Truss Case 4 ULS M_z Min

Figure 87 Lift Girder Case 4 ULS M_y Max

Figure 88 Lift Girder Case 4 ULS M_y Min

Figure 89 Lift Girder Case 4 ULS F_z Max

Figure 90 Lift Girder Case 4 ULS F_z Min

Figure 91 End Floor Beam Case 4 ULS M_y Max

Figure 92 End Floor Beam Case 4 ULS M_y Min

Figure 93 End Floor Beam Case 4 ULS F_z Max

Figure 94 End Floor Beam Case 4 ULS F_z Min

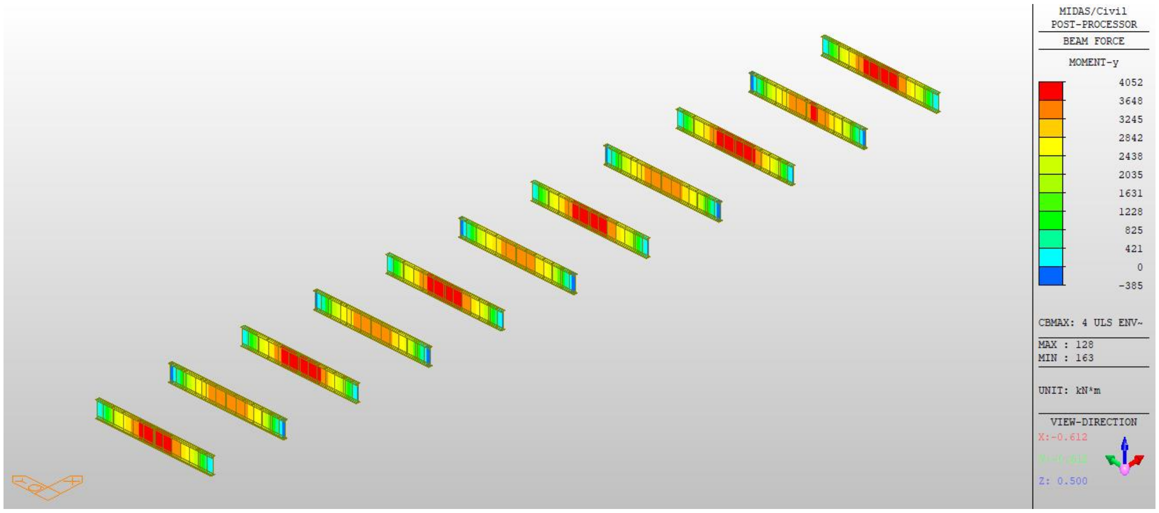


Figure 95 Interior Floor Beam Case 4 ULS M_y Max

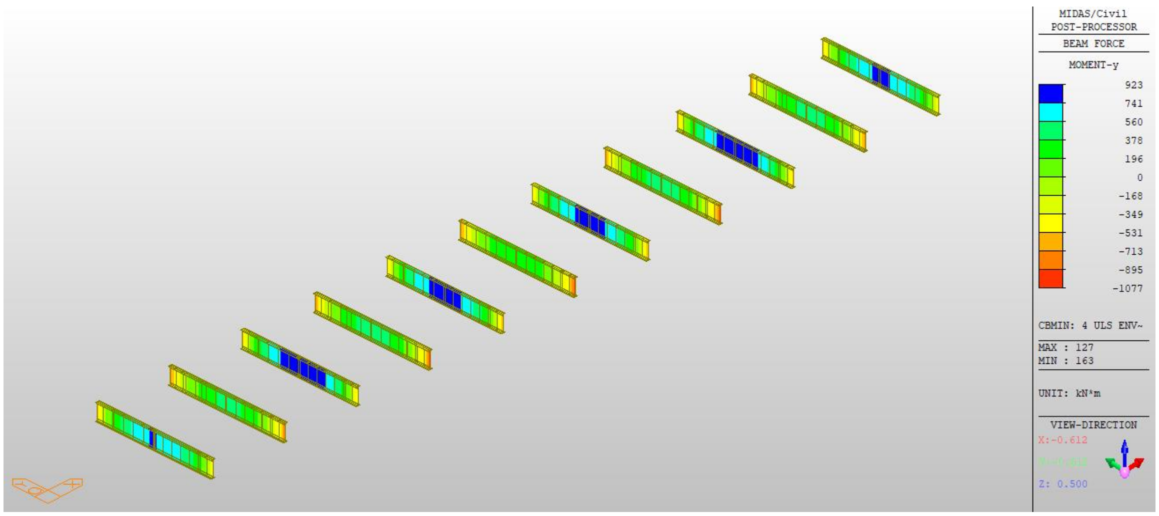


Figure 96 Interior Floor Beam Case 4 ULS M_y Min

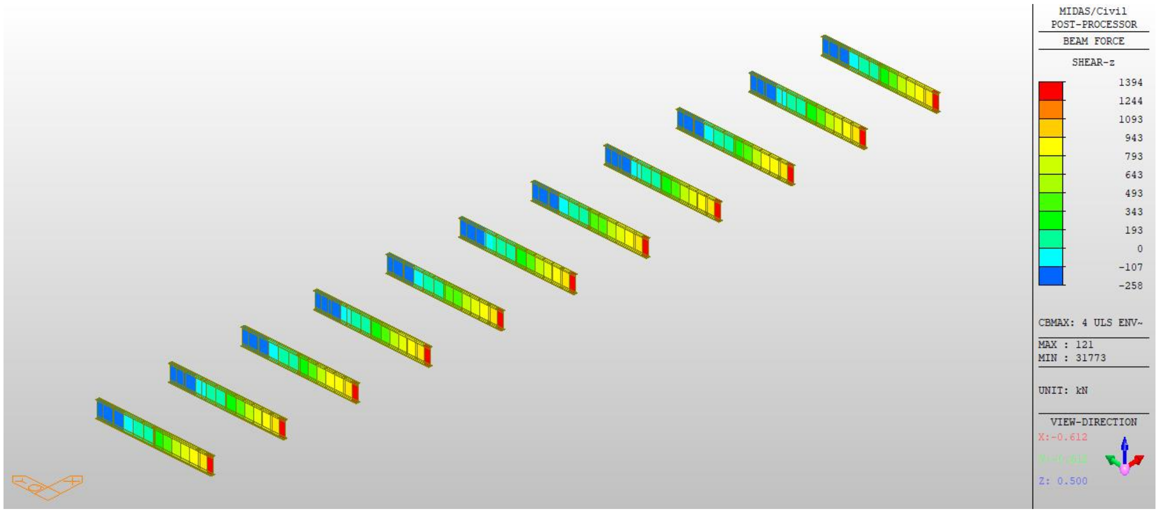


Figure 97 Interior Floor Beam Case 4 ULS F_z Max

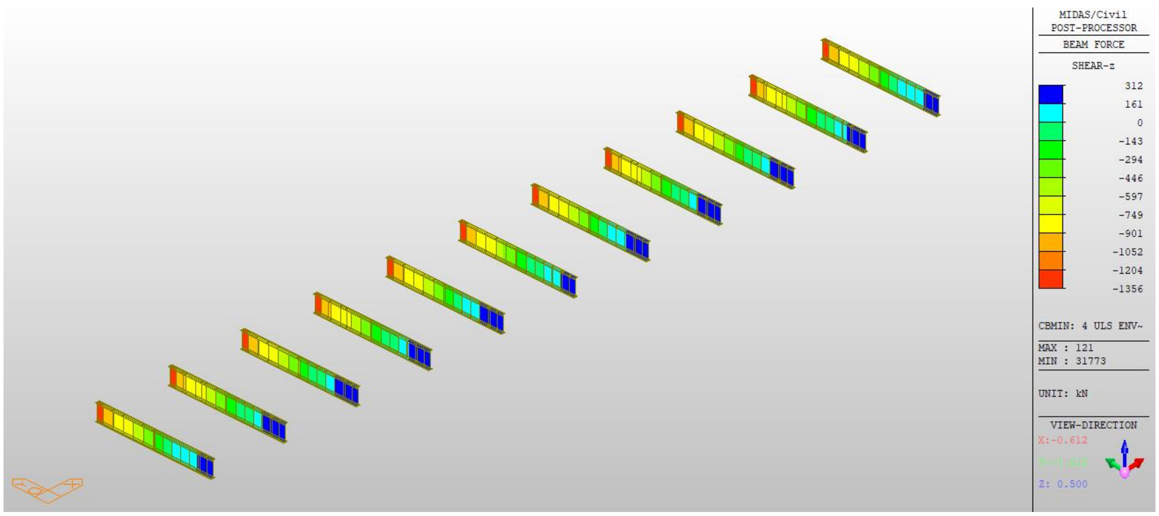


Figure 98 Interior Floor Beam Case 4 ULS F_z Min

Exhibit C.1.5. Rehabilitation Case 5 Evaluation

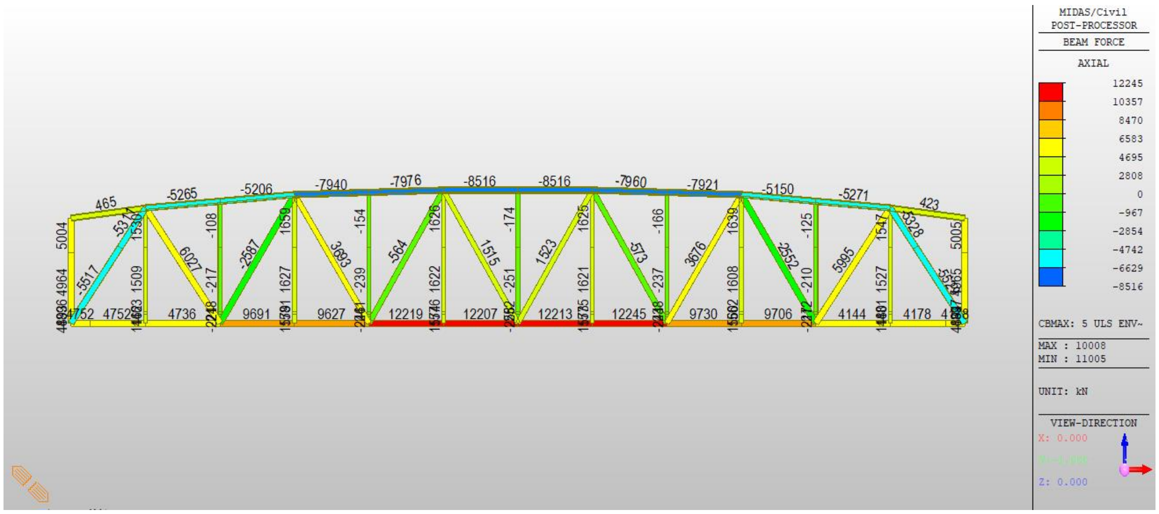


Figure 99 Railway Truss Case 5 ULS Axial Max

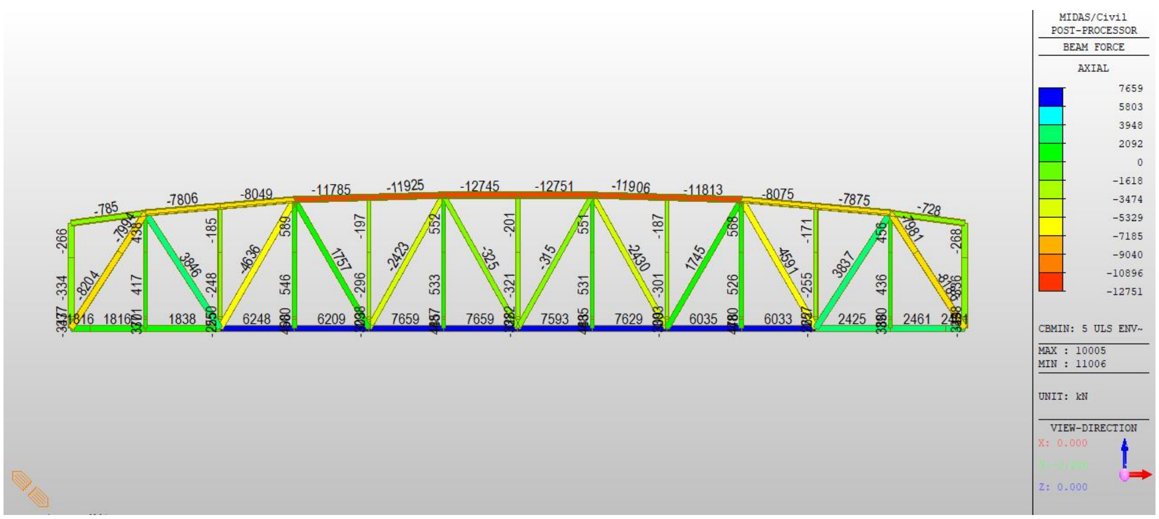


Figure 100 Railway Truss Case 5 ULS Axial Min

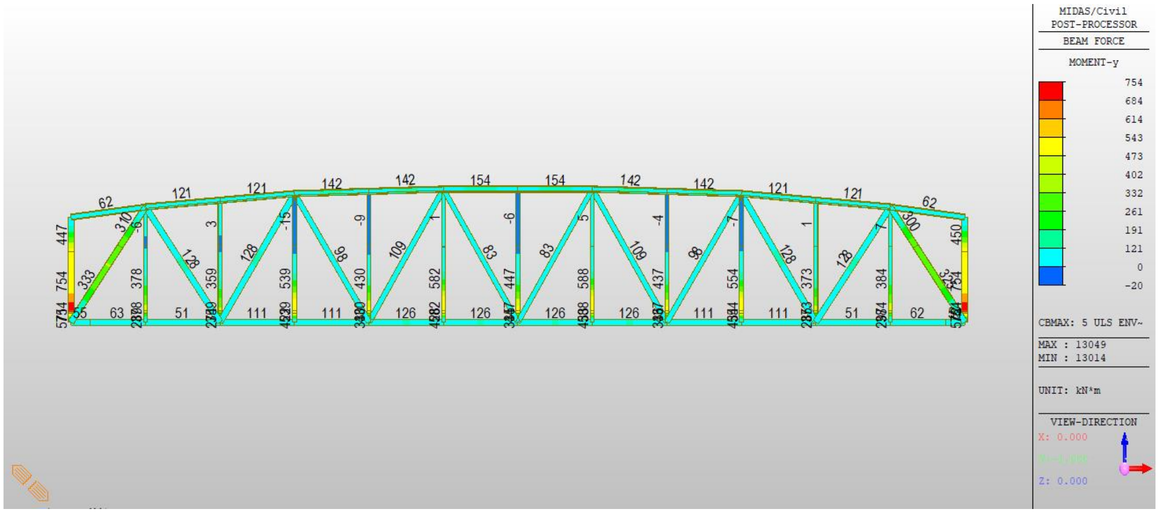


Figure 101 Railway Truss Case 5 ULS M_y Max

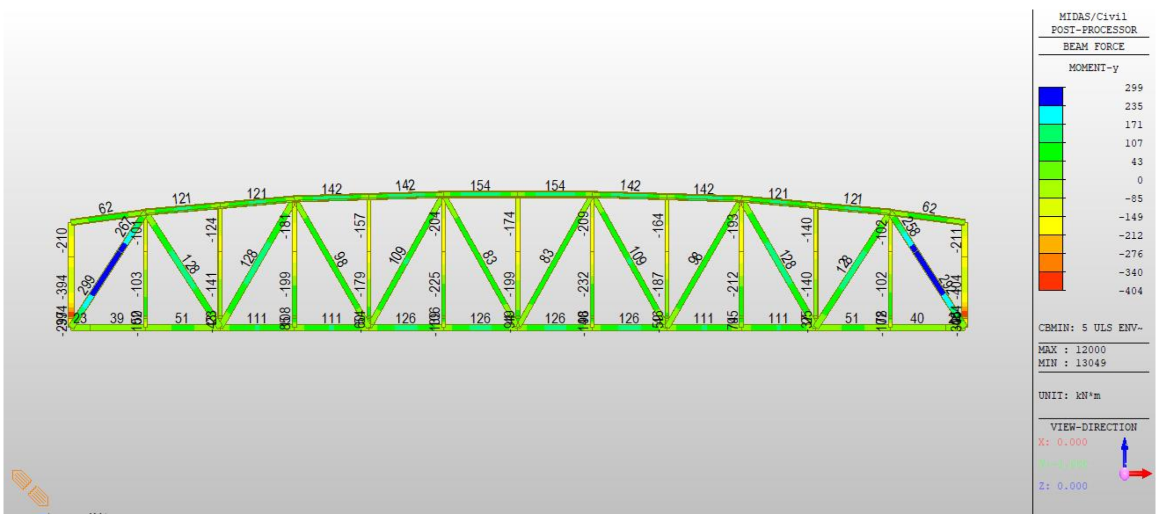


Figure 102 Railway Truss Case 5 ULS M_y Min

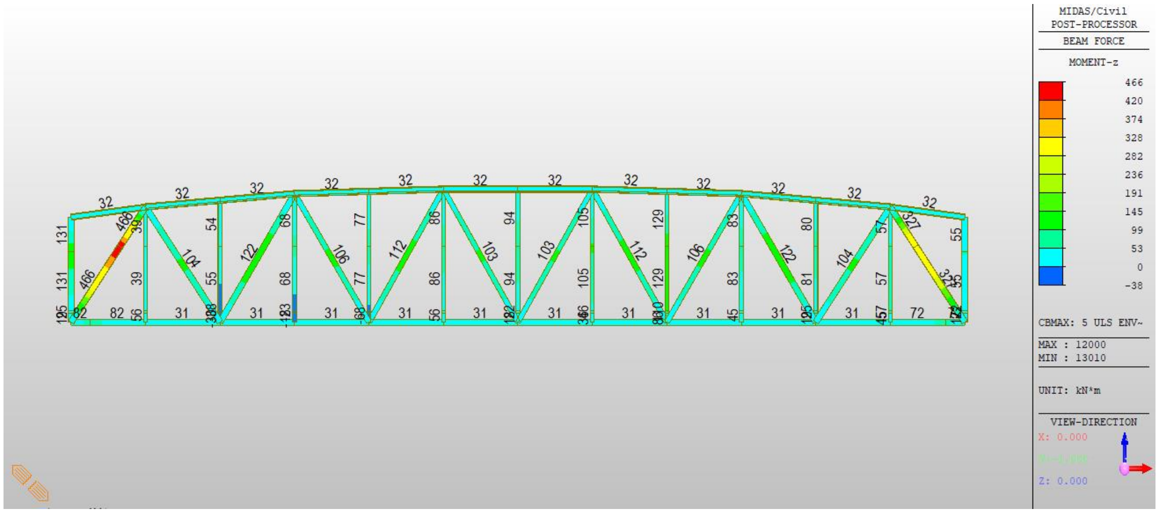


Figure 103 Railway Truss Case 5 ULS M_z Max

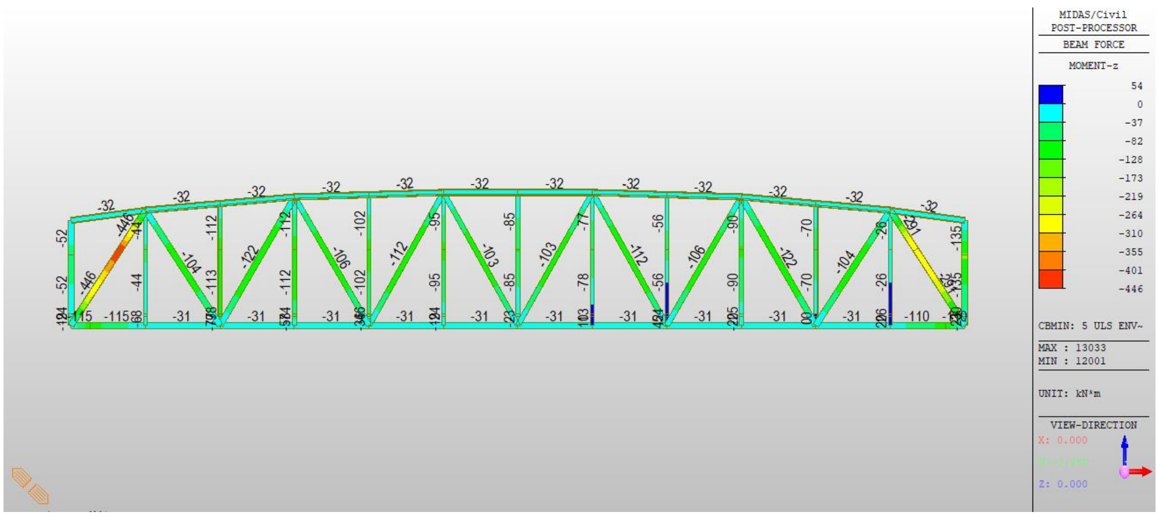


Figure 104 Railway Truss Case 5 ULS M_z Min

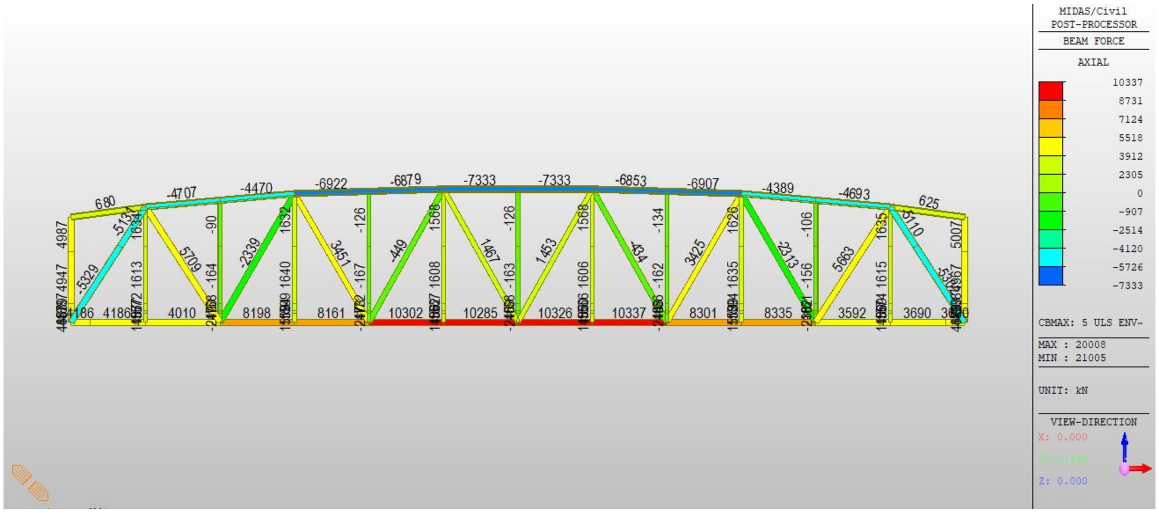


Figure 105 Highway Truss Case 5 ULS Axial Max

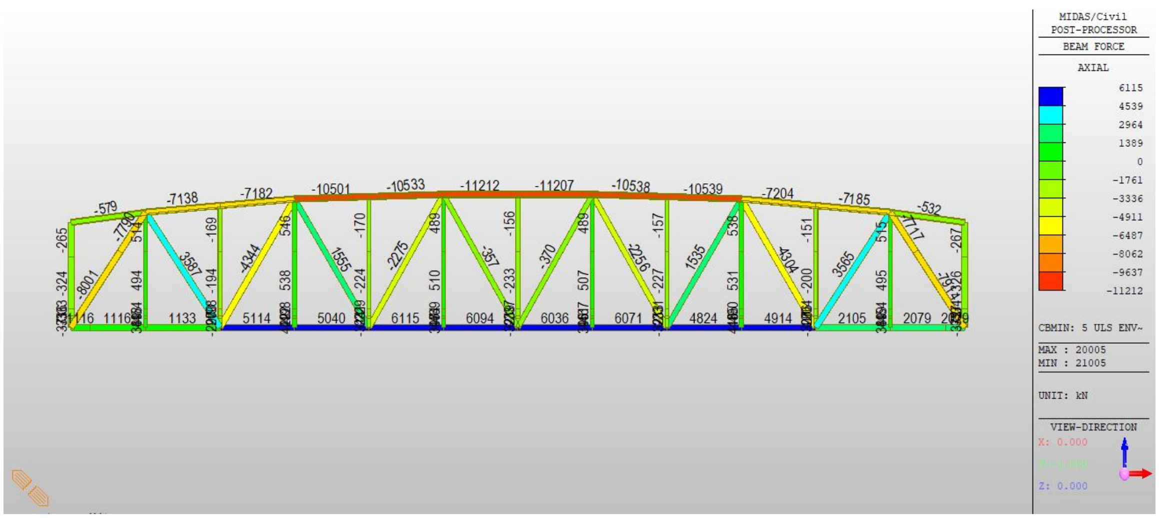


Figure 106 Highway Truss Case 5 ULS Axial Min

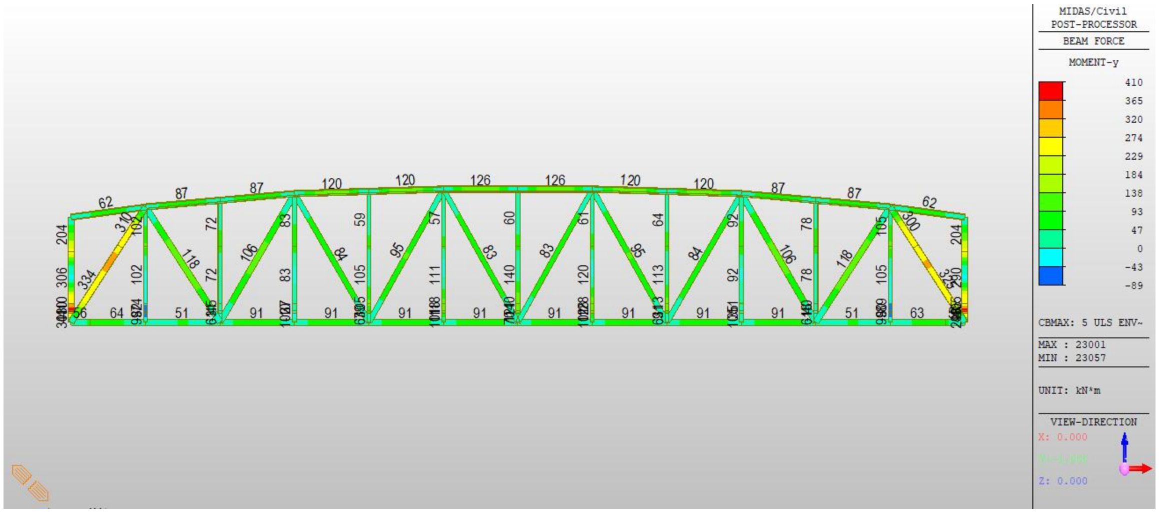


Figure 107 Highway Truss Case 5 ULS M_y Max

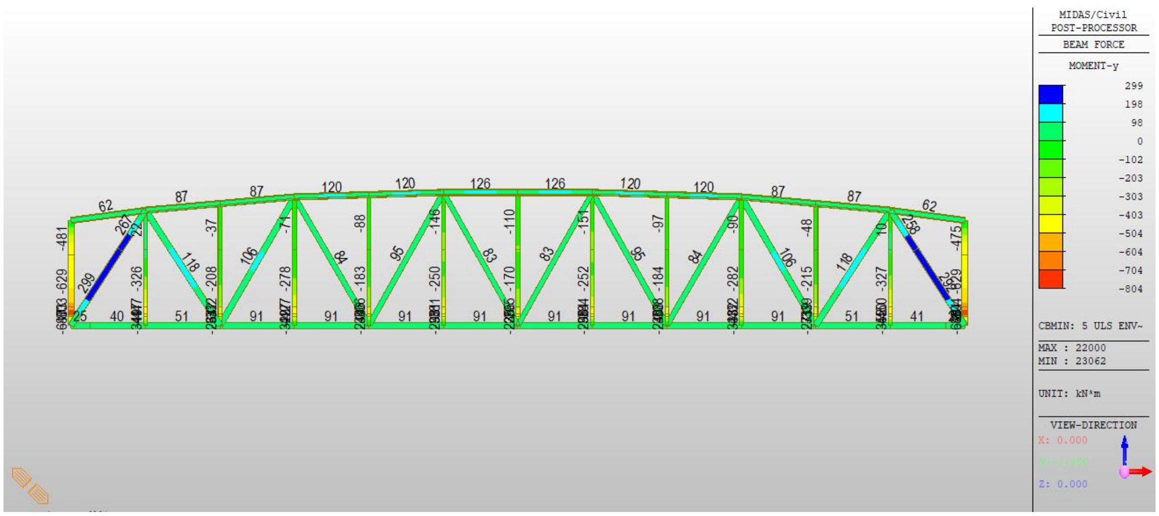


Figure 108 Highway Truss Case 5 ULS M_y Min

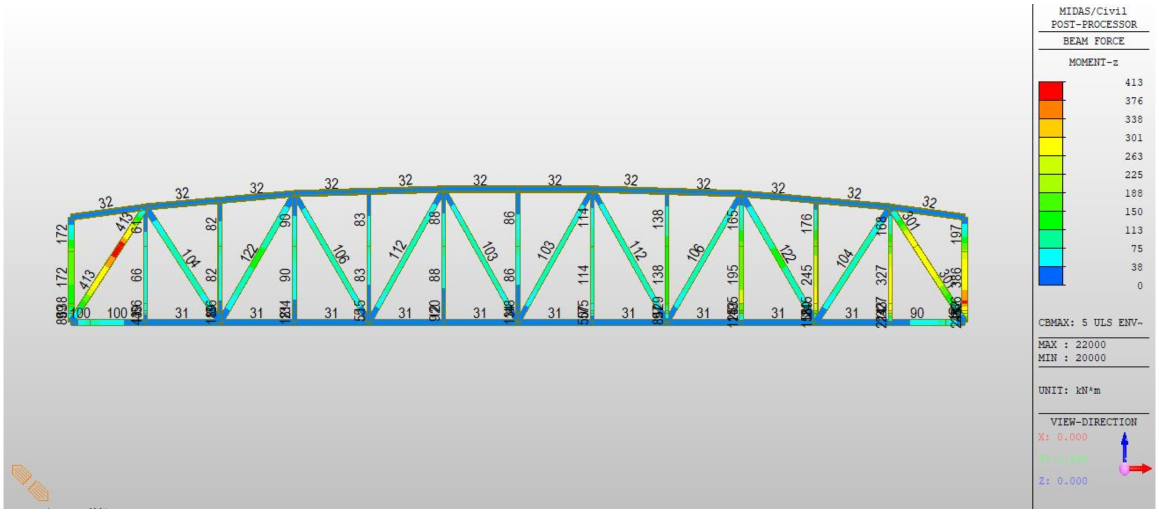


Figure 109 Highway Truss Case 5 ULS M_z Max

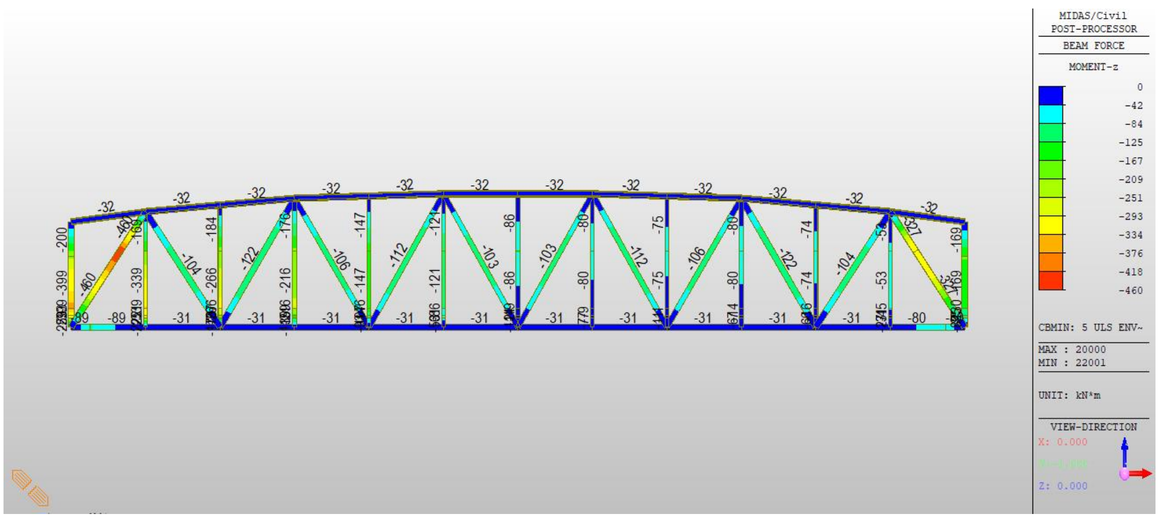


Figure 110 Highway Truss Case 5 ULS M_z Min

Figure 111 Lift Girder Case 5 ULS M_y Max

Figure 112 Lift Girder Case 5 ULS M_y Min

Figure 113 Lift Girder Case 5 ULS F_z Max

Figure 114 Lift Girder Case 5 ULS F_z Min

Figure 115 End Floor Beam Case 5 ULS M_y Max

Figure 116 End Floor Beam Case 5 ULS M_y Min

Figure 117 End Floor Beam Case 5 ULS F_z Max

Figure 118 End Floor Beam Case 5 ULS F_z Min

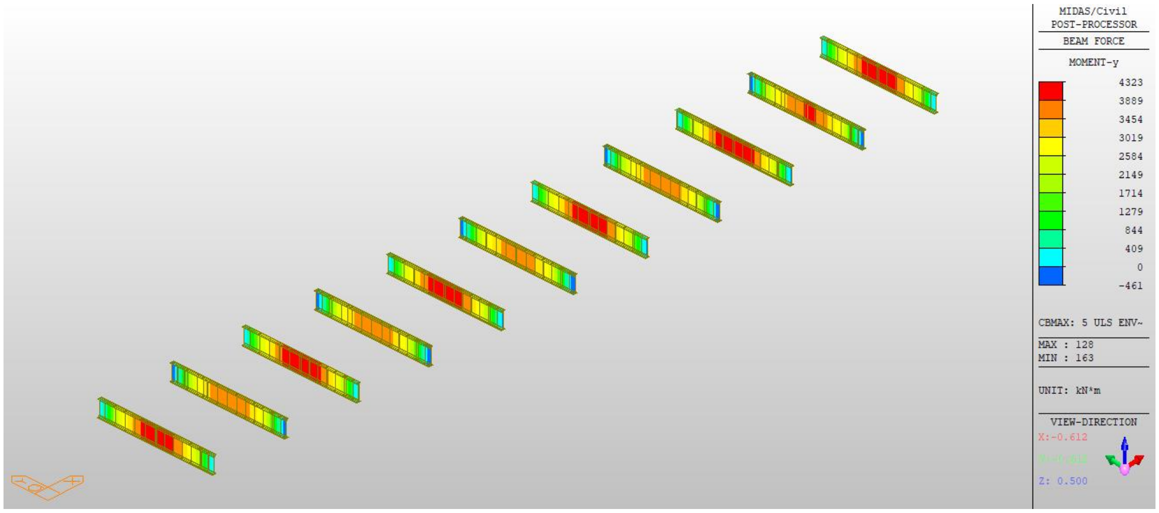


Figure 119 Interior Floor Beam Case 5 ULS M_y Max

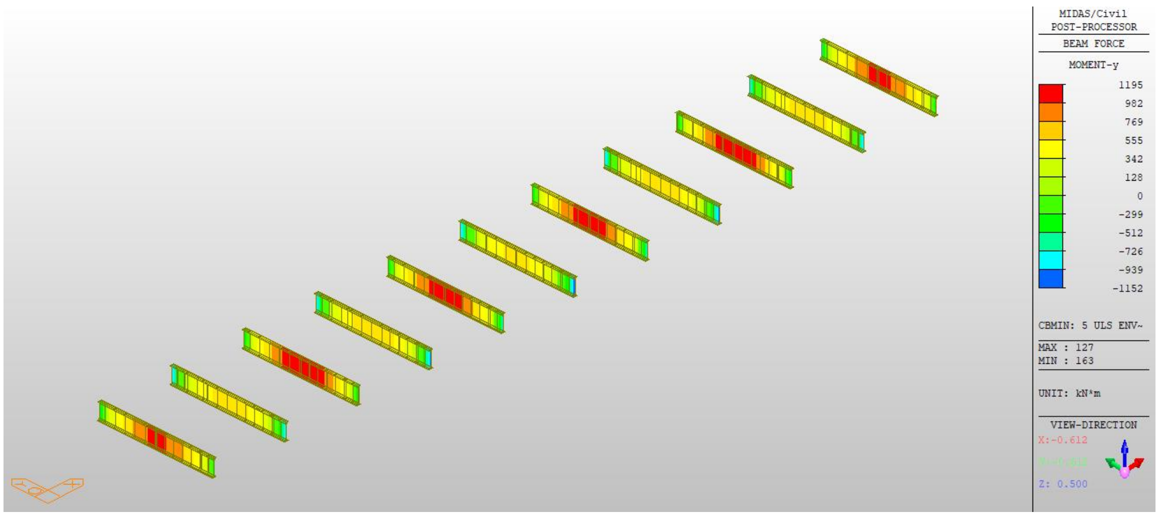


Figure 120 Interior Floor Beam Case 5 ULS M_y Min

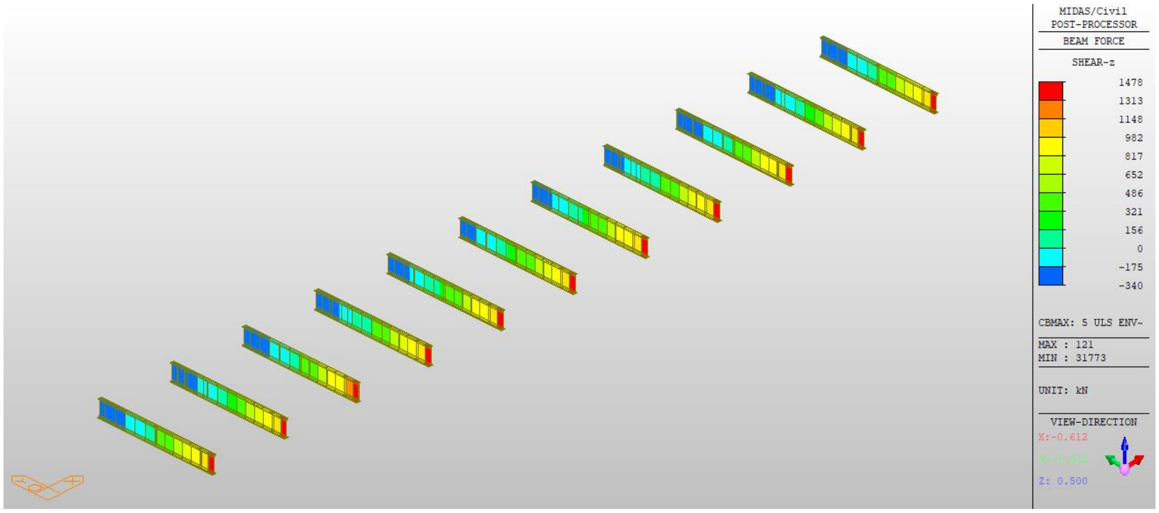


Figure 121 Interior Floor Beam Case 5 ULS F_z Max

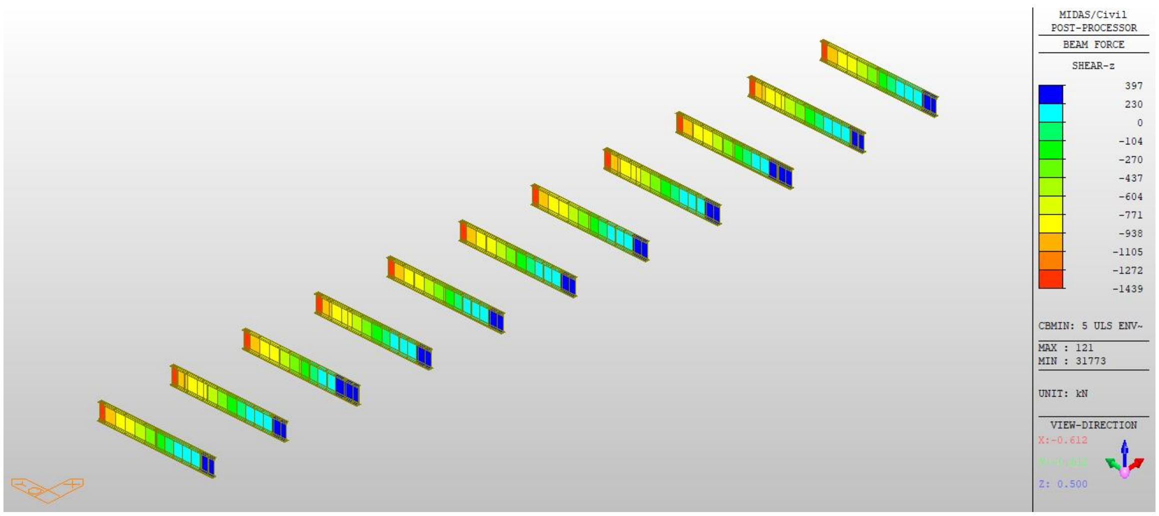


Figure 122 Interior Floor Beam Case 5 ULS F_z Min

Exhibit C.1.6. Rehabilitation Case 6 Evaluation

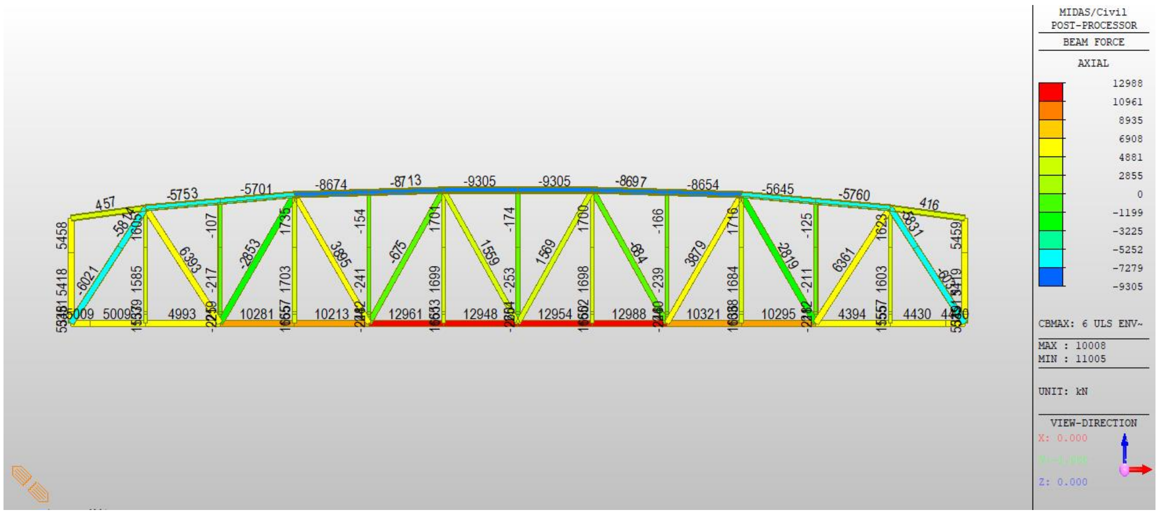


Figure 123 Railway Truss Case 6 ULS Axial Max

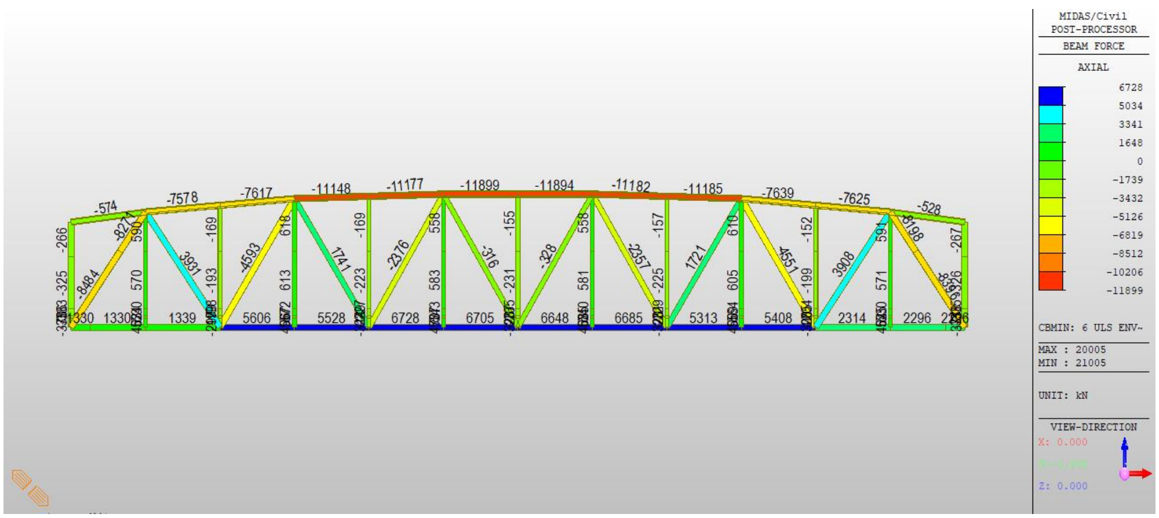


Figure 124 Railway Truss Case 6 ULS Axial Min

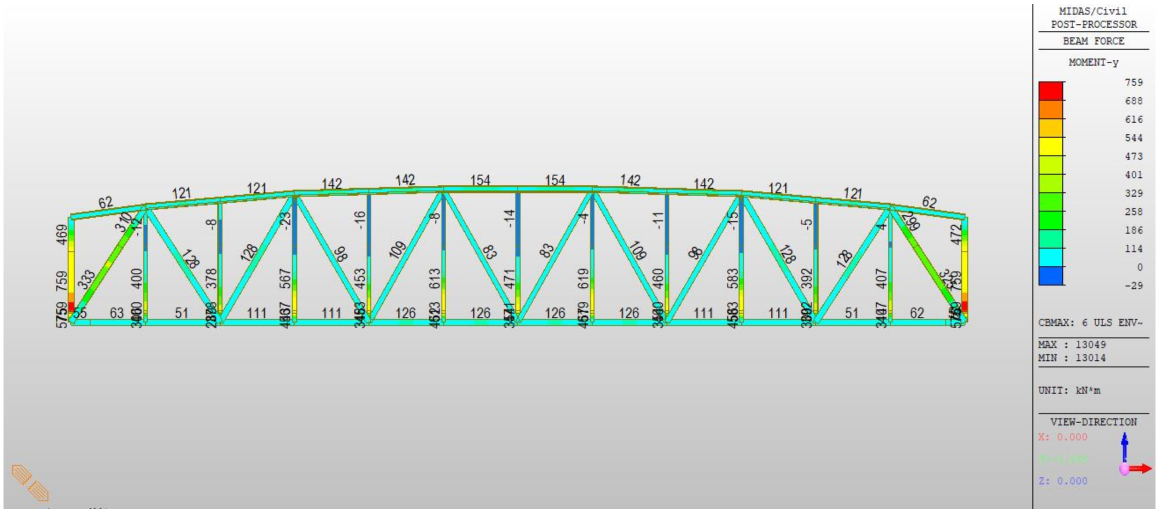


Figure 125 Railway Truss Case 6 ULS M_y Max

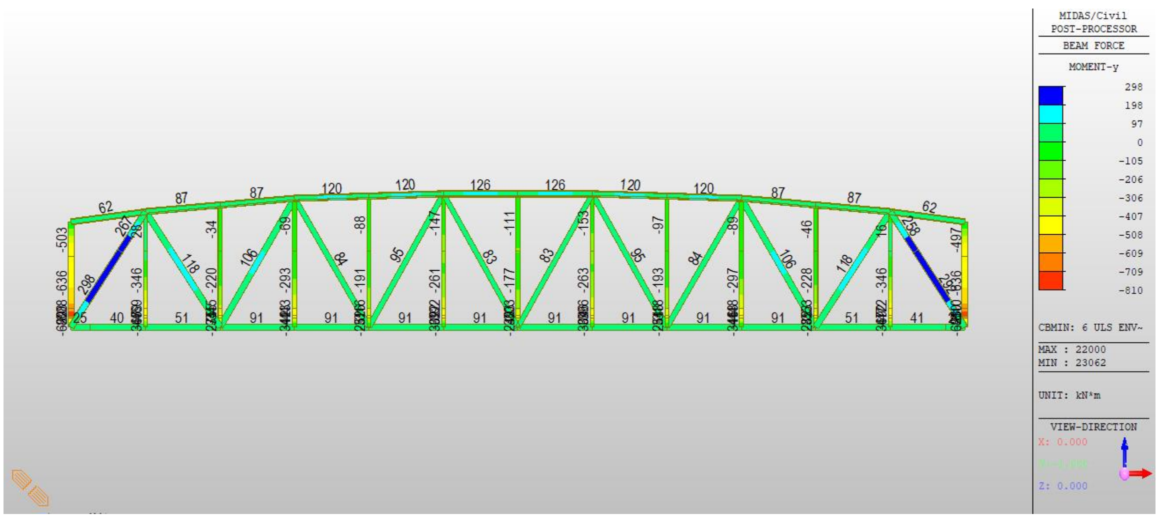


Figure 126 Railway Truss Case 6 ULS M_y Min

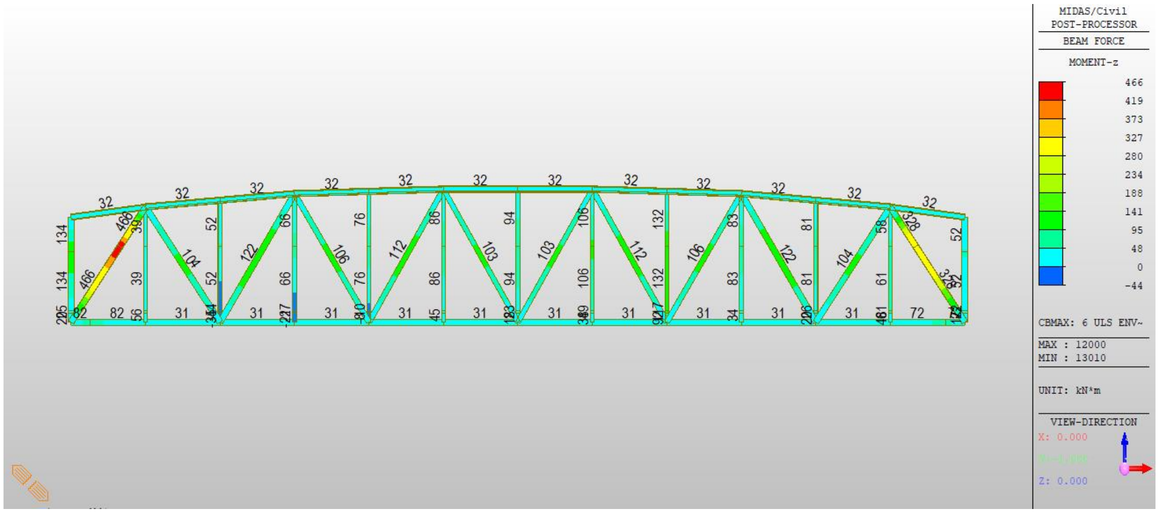


Figure 127 Railway Truss Case 6 ULS M_z Max

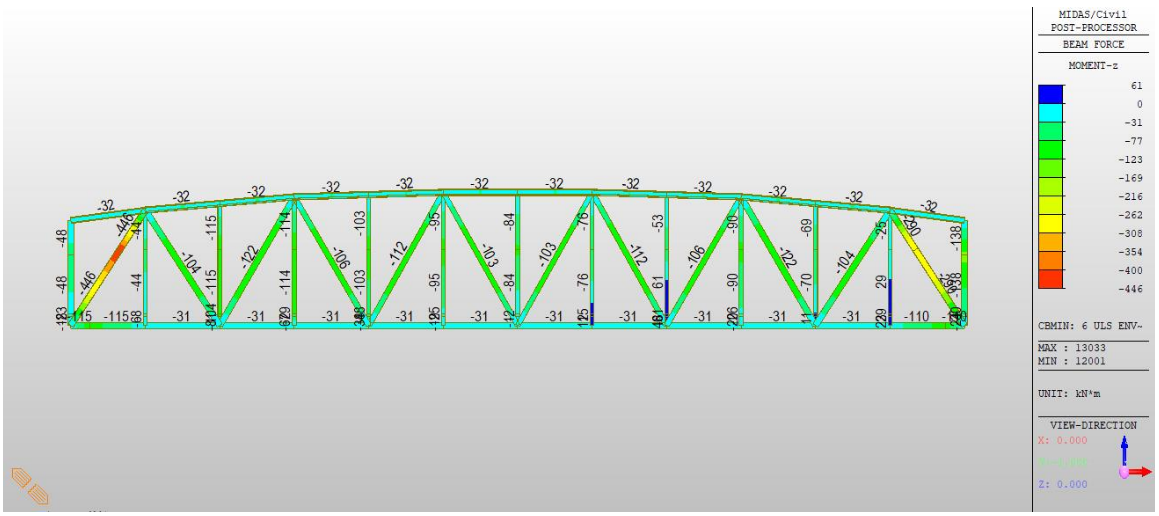


Figure 128 Railway Truss Case 6 ULS M_z Min

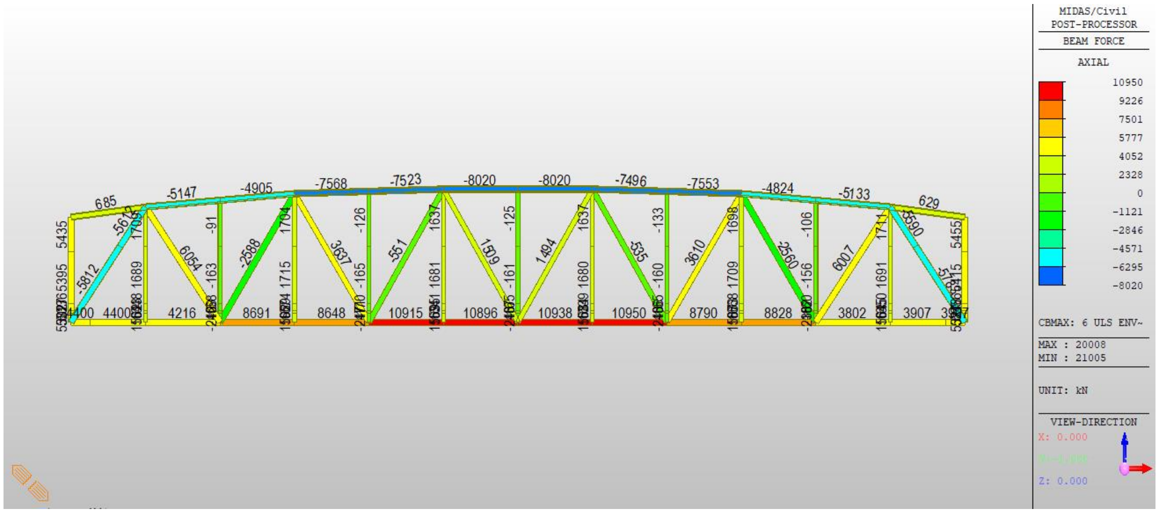


Figure 129 Highway Truss Case 6 ULS Axial Max

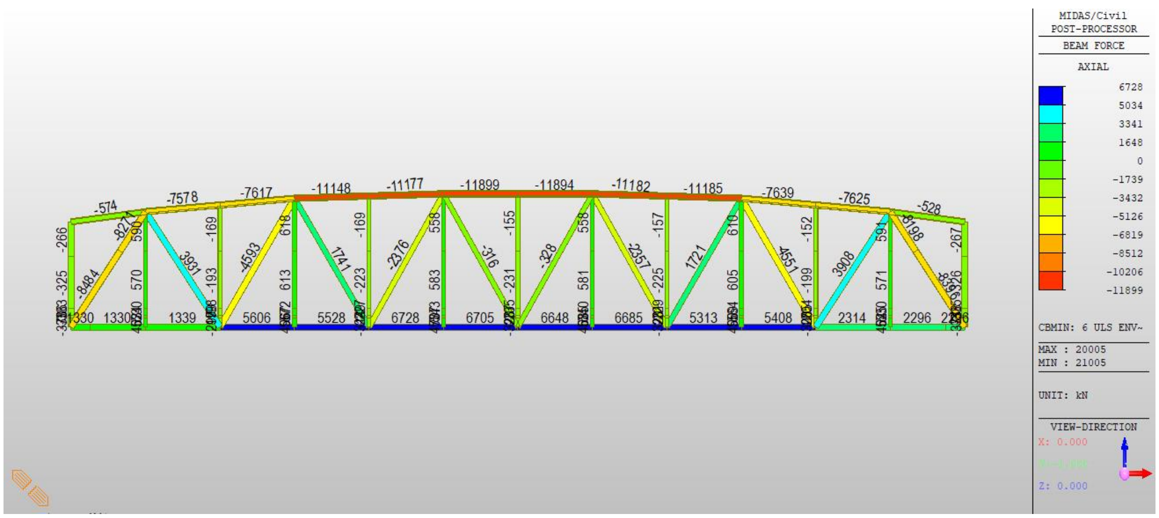


Figure 130 Highway Truss Case 6 ULS Axial Min

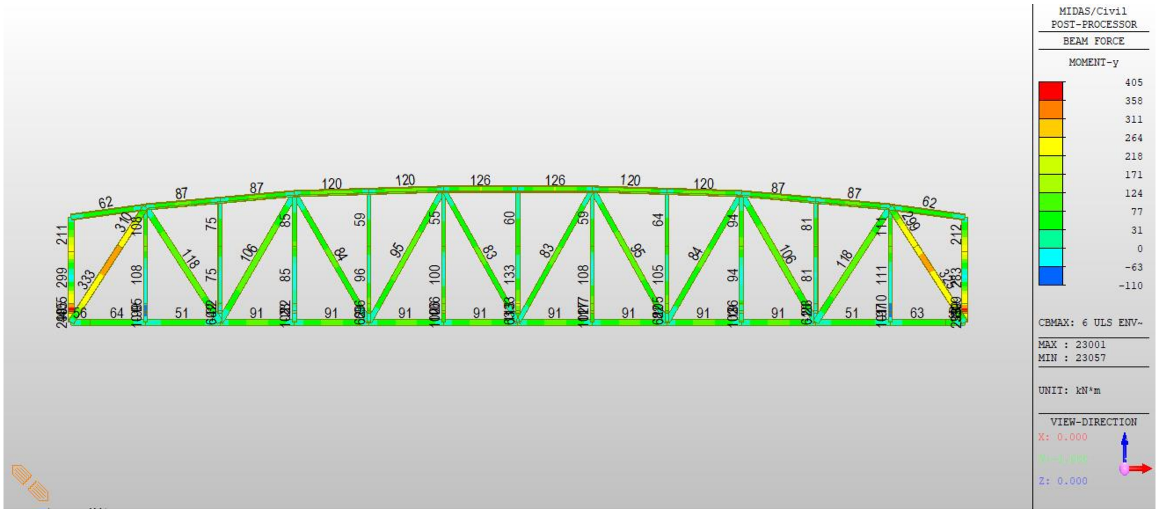


Figure 131 Highway Truss Case 6 ULS M_y Max

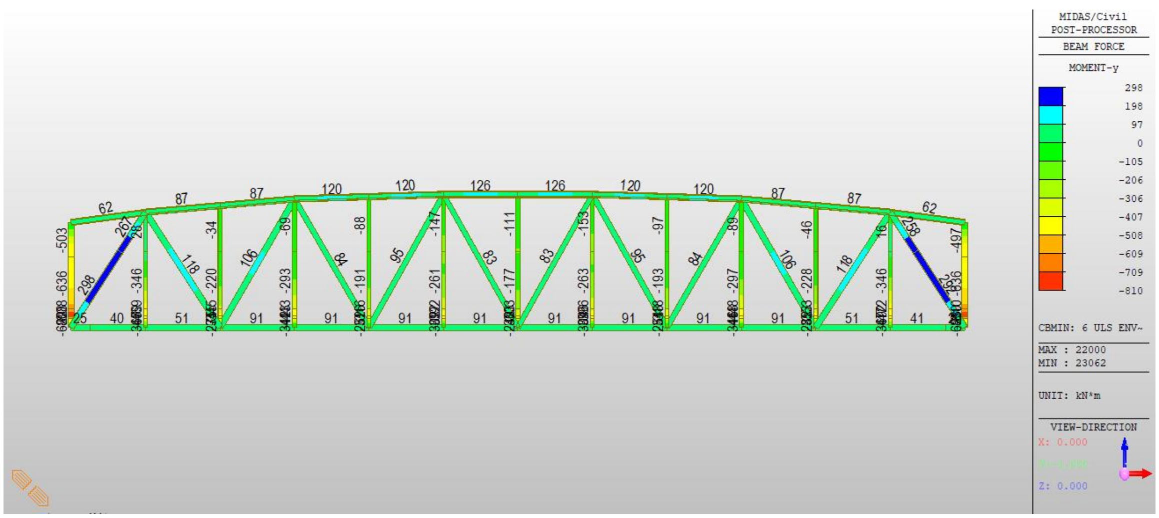


Figure 132 Highway Truss Case 6 ULS M_y Min

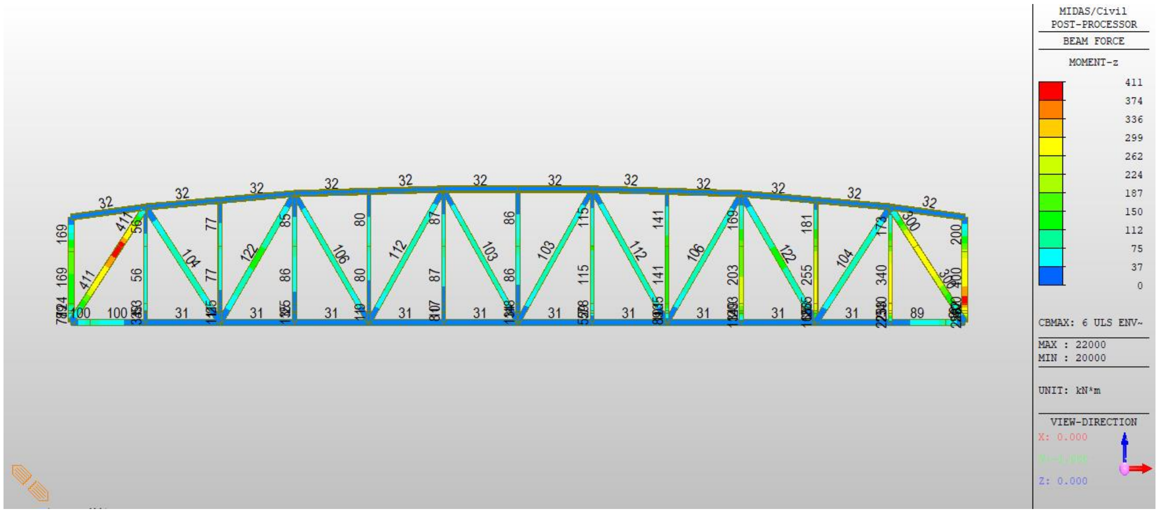


Figure 133 Highway Truss Case 6 ULS M_z Max

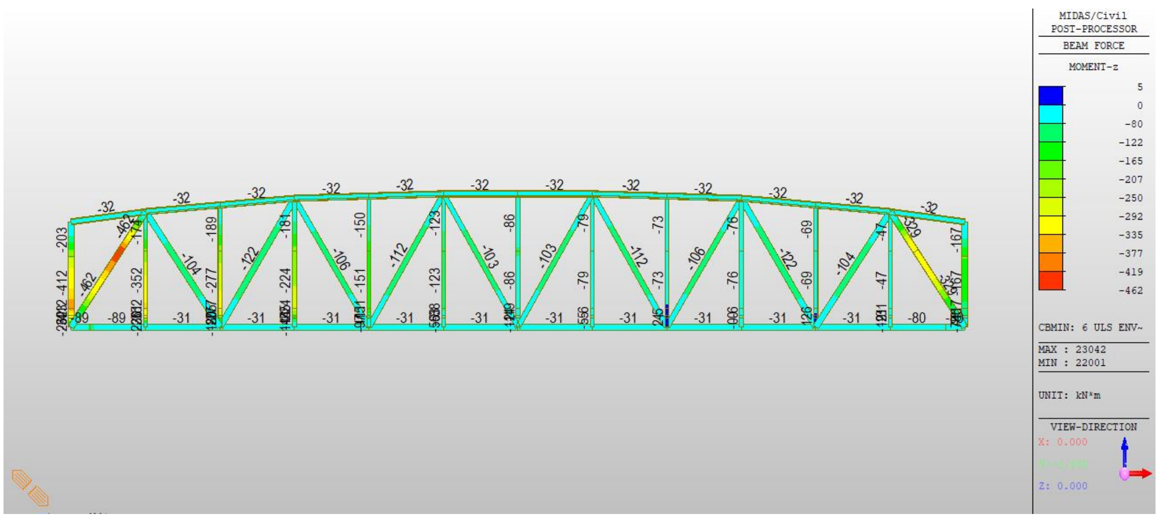


Figure 134 Highway Truss Case 6 ULS M_z Min

Figure 135 Lift Girder Case 6 ULS M_y Max

Figure 136 Lift Girder Case 6 ULS M_y Min

Figure 137 Lift Girder Case 6 ULS F_z Max

Figure 138 Lift Girder Case 6 ULS F_z Min

Figure 139 End Floor Beam Case 6 ULS M_y Max

Figure 140 End Floor Beam Case 6 ULS M_y Min

Figure 141 End Floor Beam Case 6 ULS F_z Max

Figure 142 End Floor Beam Case 6 ULS F_z Min

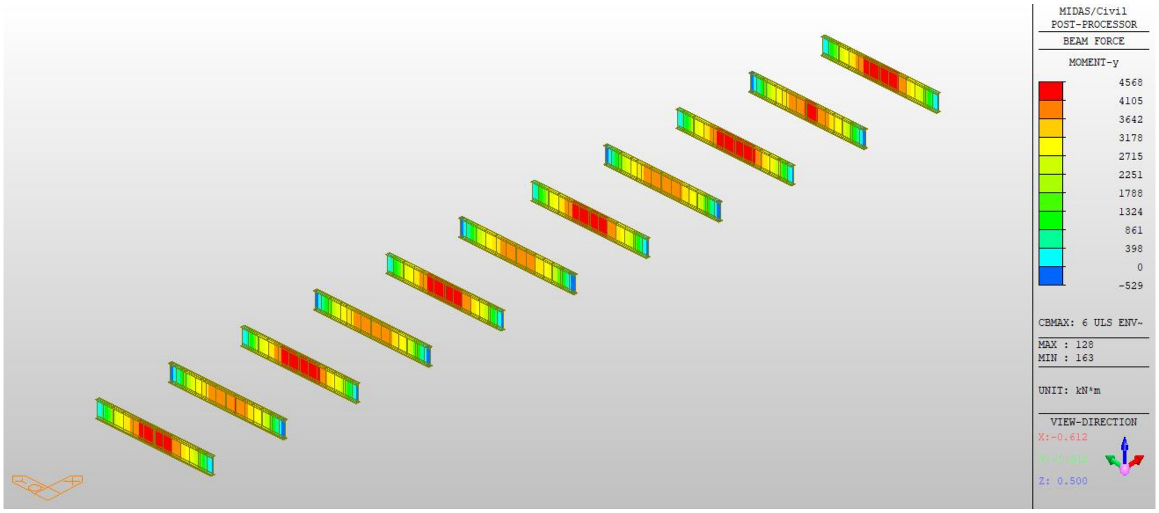


Figure 143 Interior Floor Beam Case 6 ULS M_y Max

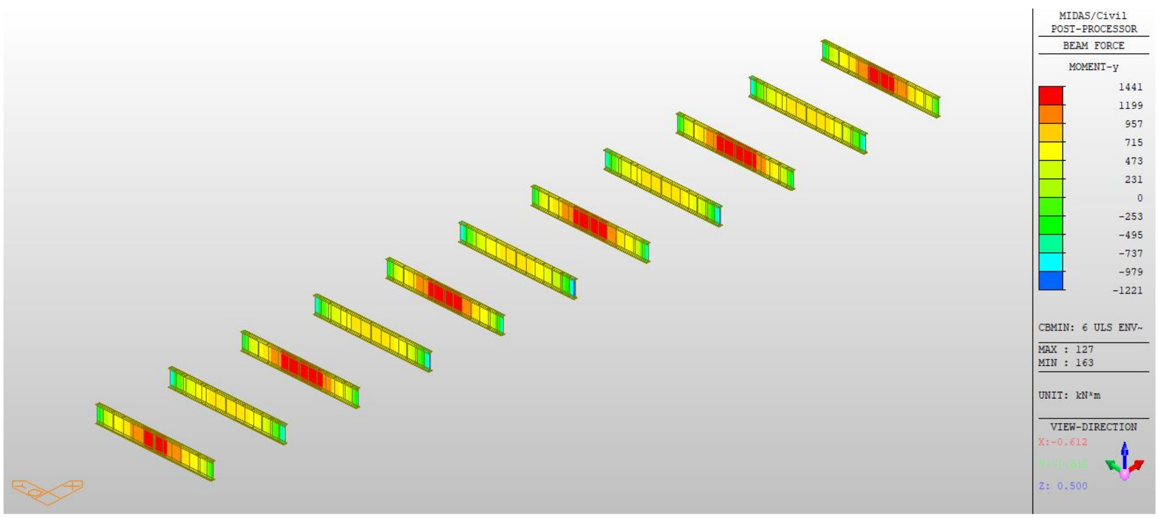


Figure 144 Interior Floor Beam Case 6 ULS M_y Min

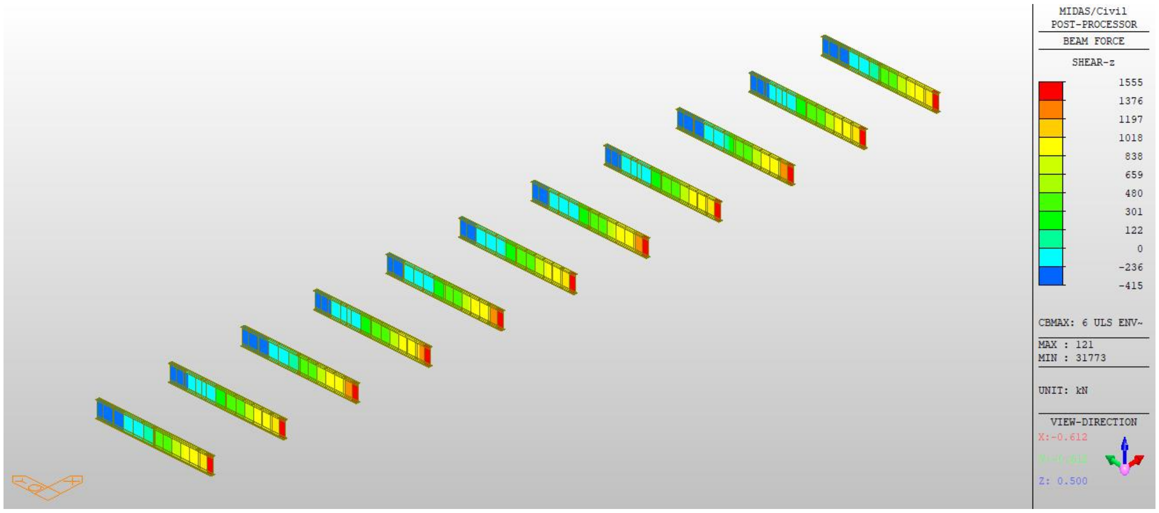


Figure 145 Interior Floor Beam Case 6 ULS F_z Max

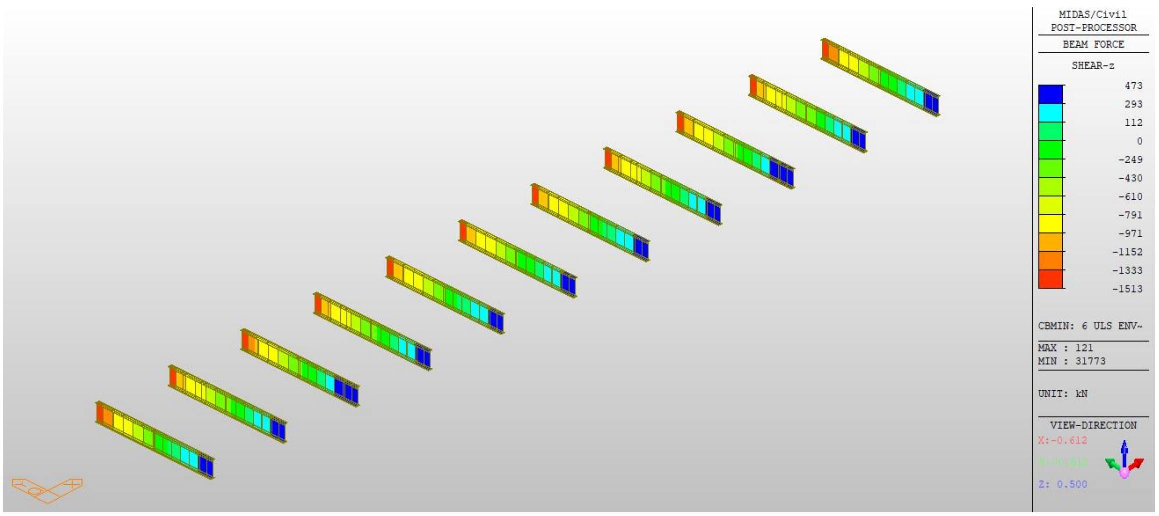


Figure 146 Interior Floor Beam Case 6 ULS F_z Min

Exhibit C.1.7. Rehabilitation Case 7 Evaluation

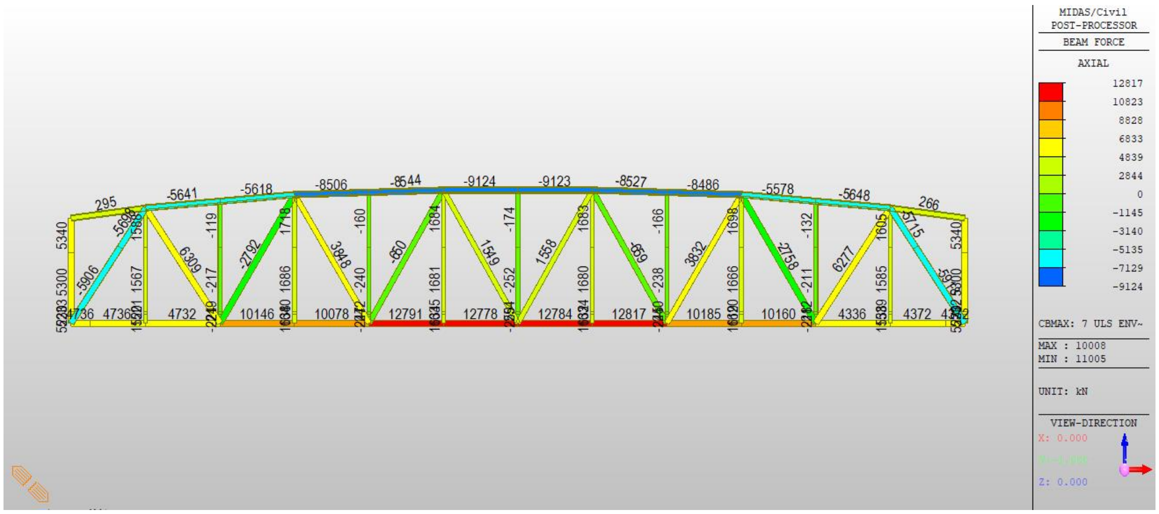


Figure 147 Railway Truss Case 7 ULS Axial Max

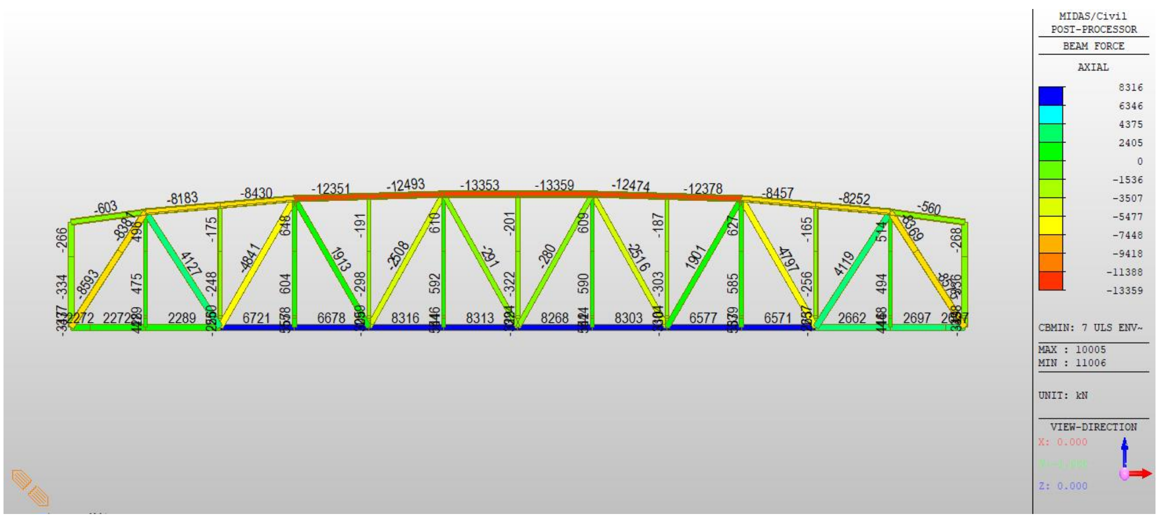


Figure 148 Railway Truss Case 7 ULS Axial Min

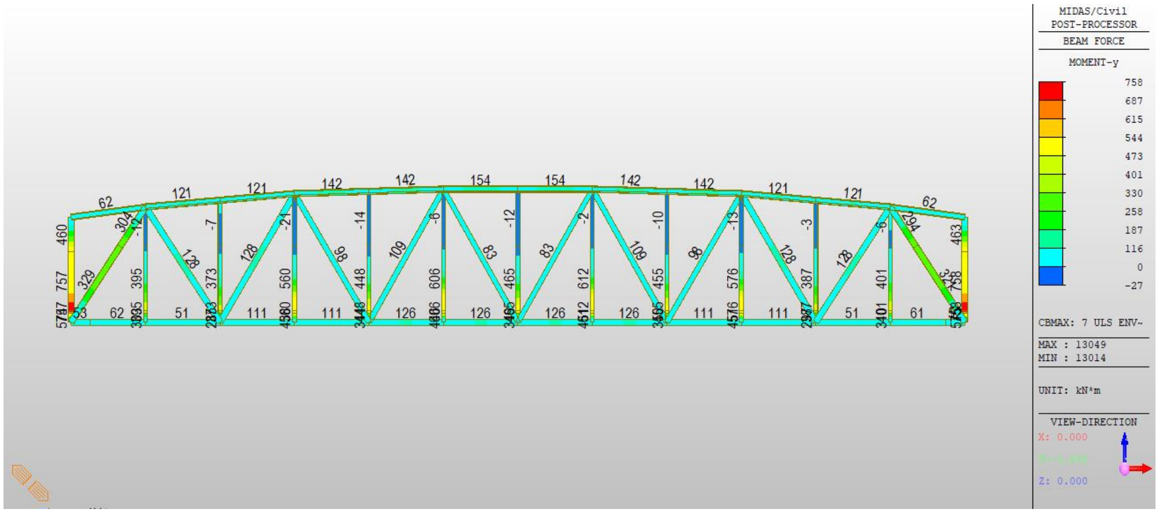


Figure 149 Railway Truss Case 7 ULS M_y Max

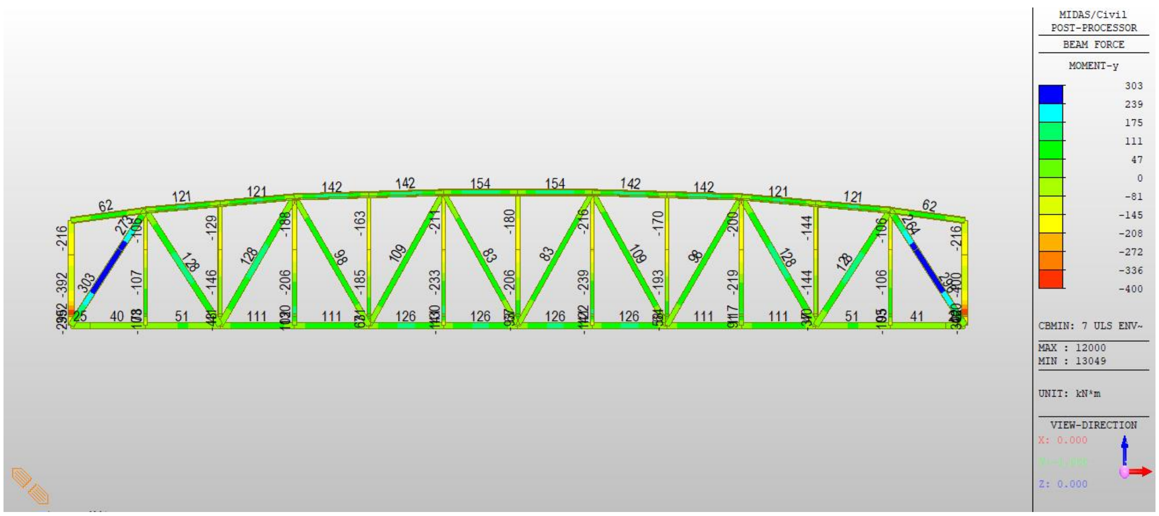


Figure 150 Railway Truss Case 7 ULS M_y Min

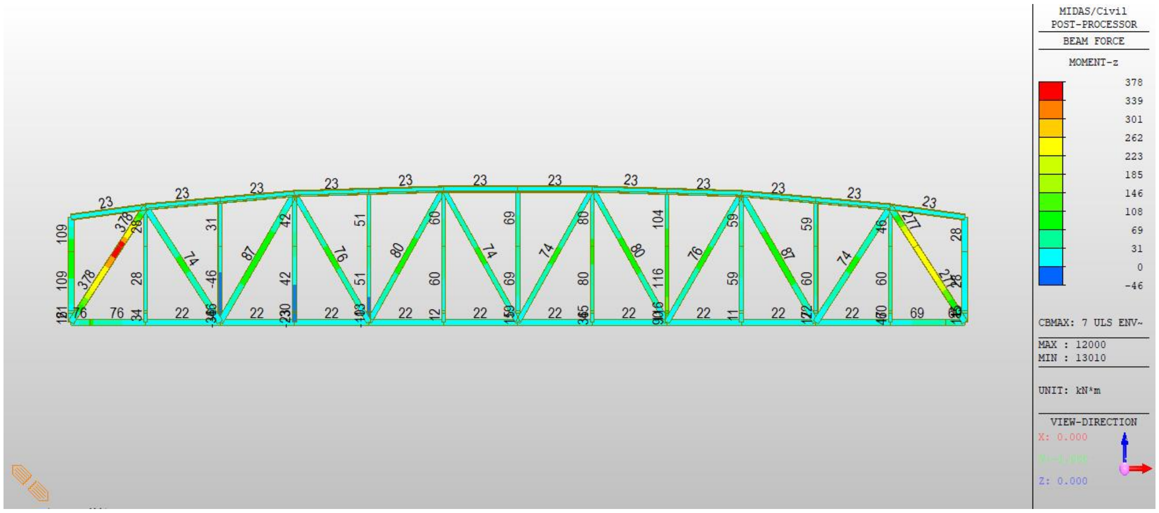


Figure 151 Railway Truss Case 7 ULS M_z Max

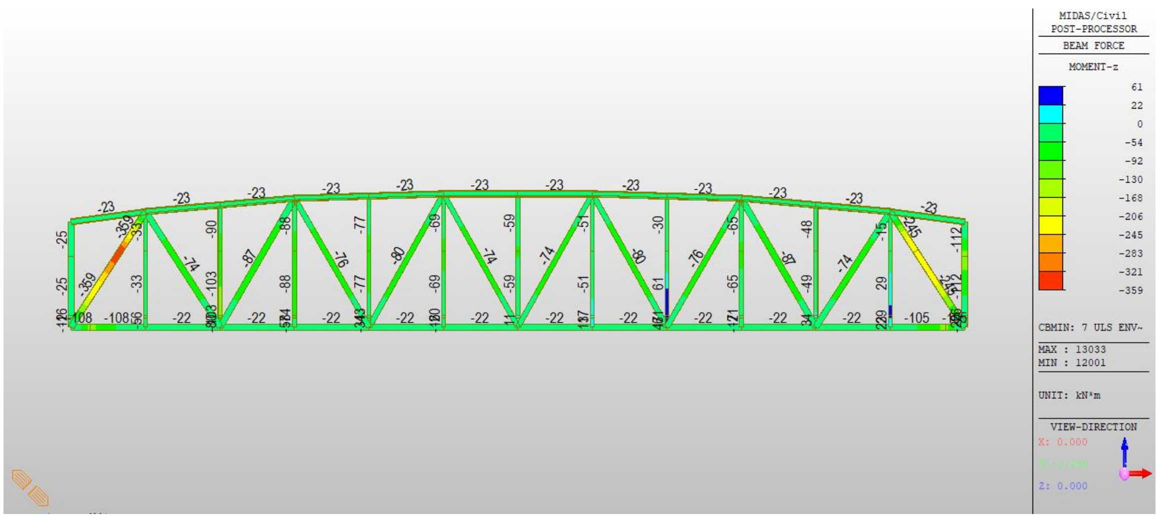


Figure 152 Railway Truss Case 7 ULS M_z Min

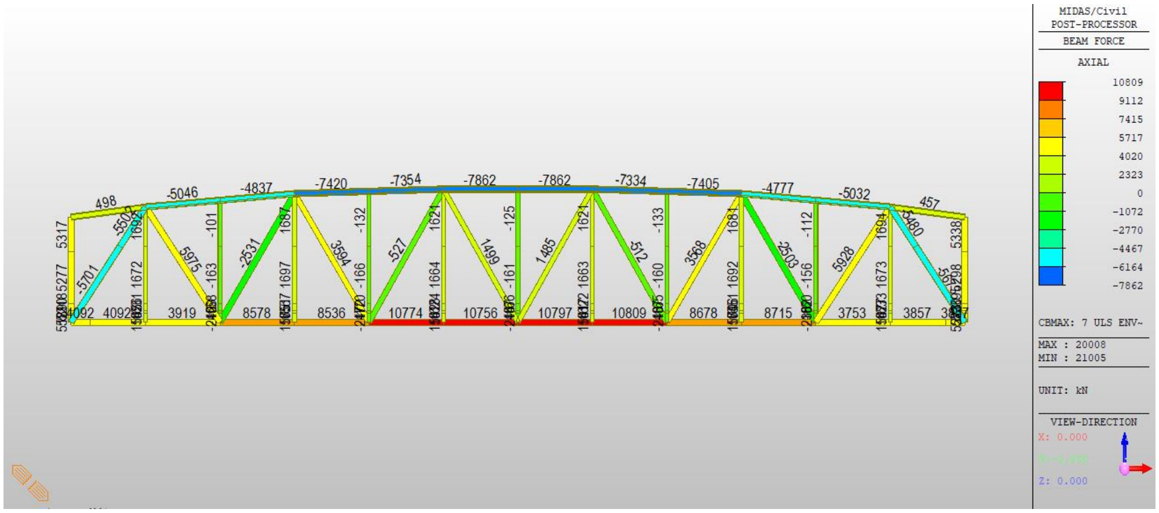


Figure 153 Highway Truss Case 7 ULS Axial Max

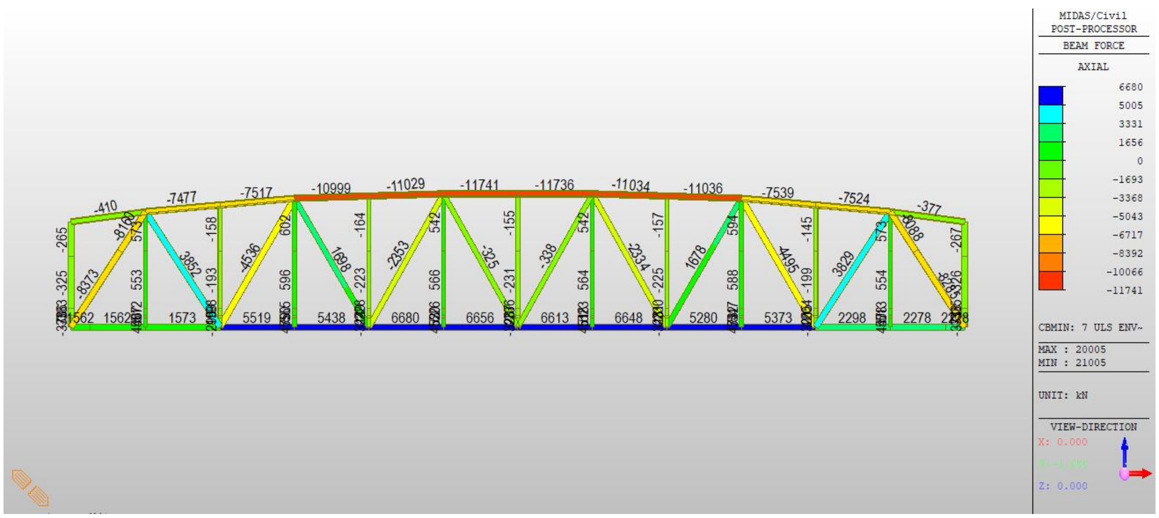


Figure 154 Highway Truss Case 7 ULS Axial Min

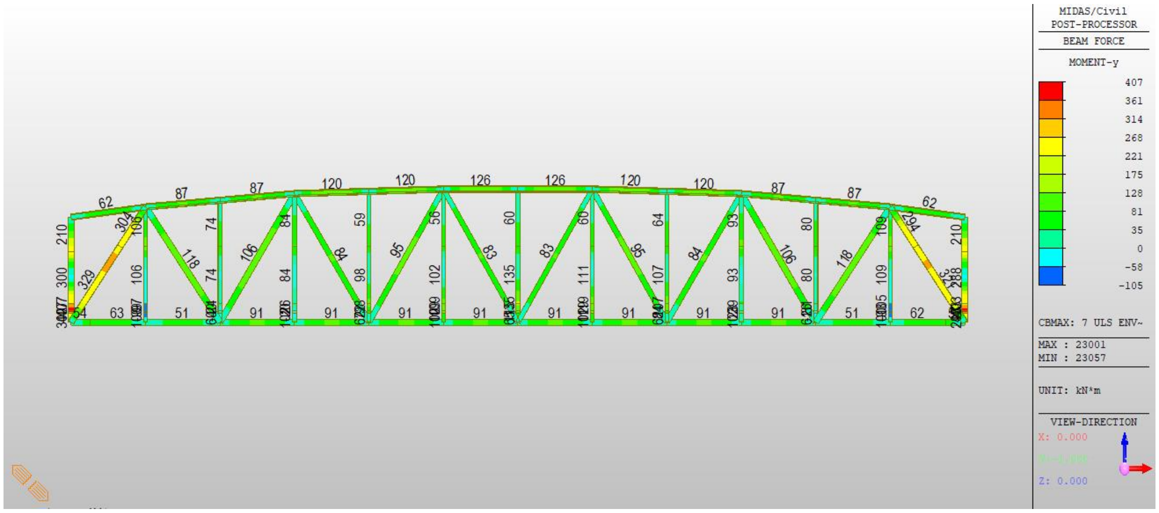


Figure 155 Highway Truss Case 7 ULS M_y Max

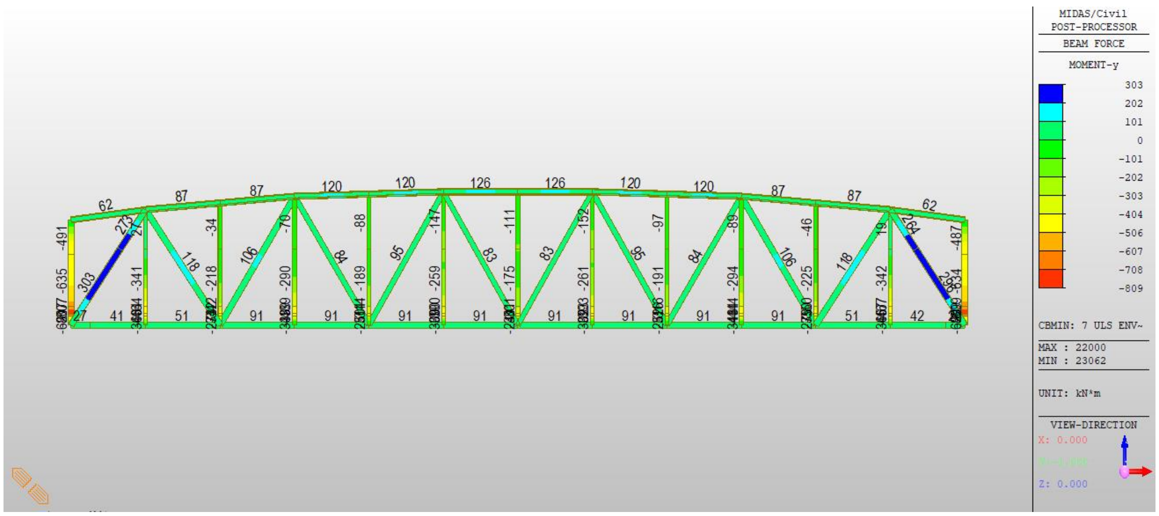


Figure 156 Highway Truss Case 7 ULS M_y Min

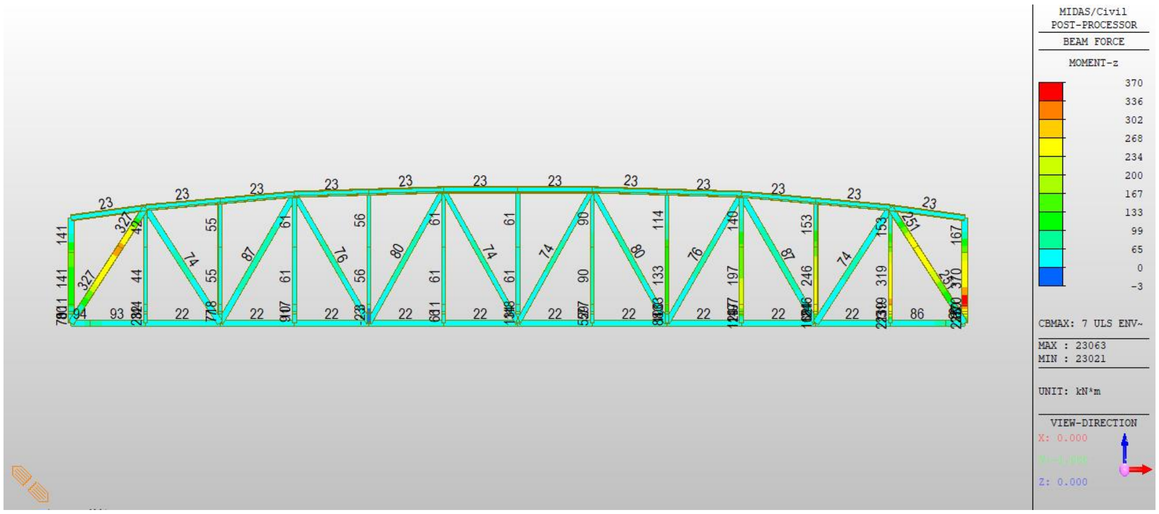


Figure 157 Highway Truss Case 7 ULS M_z Max

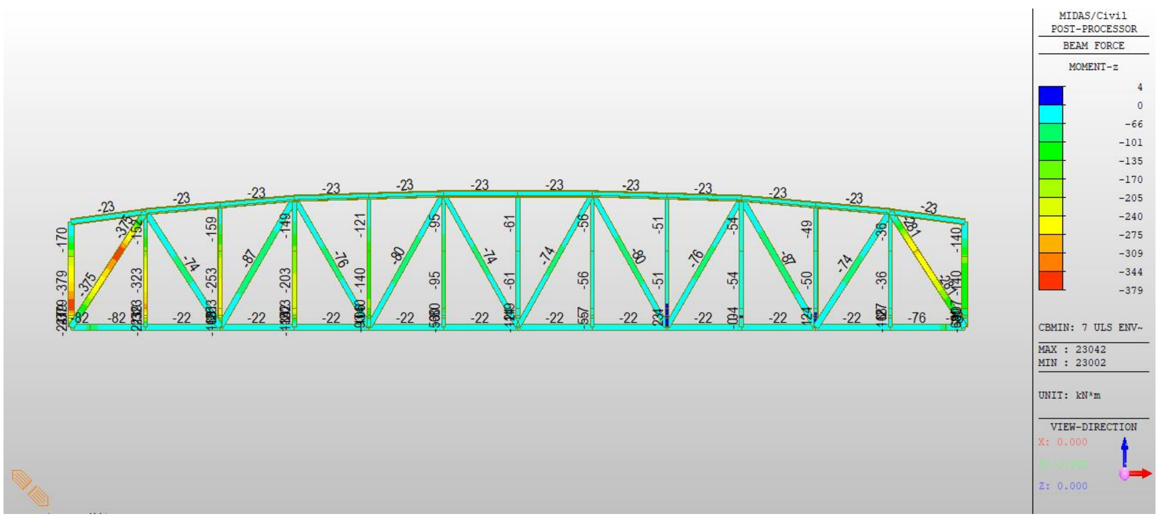


Figure 158 Highway Truss Case 7 ULS M_z Min

Figure 159 Lift Girder Case 7 ULS M_y Max

Figure 160 Lift Girder Case 7 ULS M_y Min

Figure 161 Lift Girder Case 7 ULS F_z Max

Figure 162 Lift Girder Case 7 ULS F_z Min

Figure 163 End Floor Beam Case 7 ULS M_y Max

Figure 164 End Floor Beam Case 7 ULS M_y Min

Figure 165 End Floor Beam Case 7 ULS F_z Max

Figure 166 End Floor Beam Case 7 ULS F_z Min

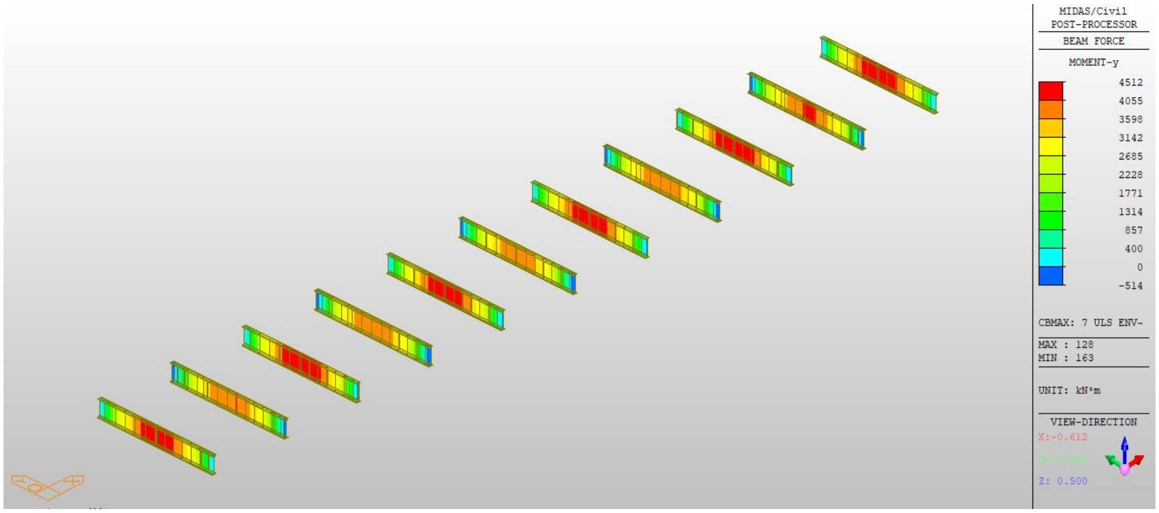


Figure 167 Interior Floor Beam Case 7 ULS M_y Max

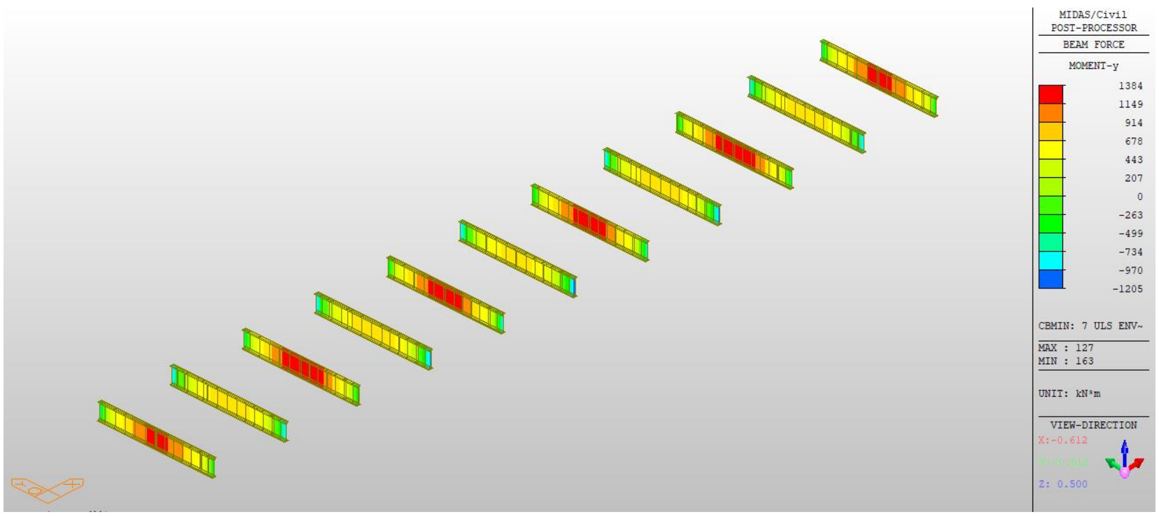


Figure 168 Interior Floor Beam Case 7 ULS M_y Min

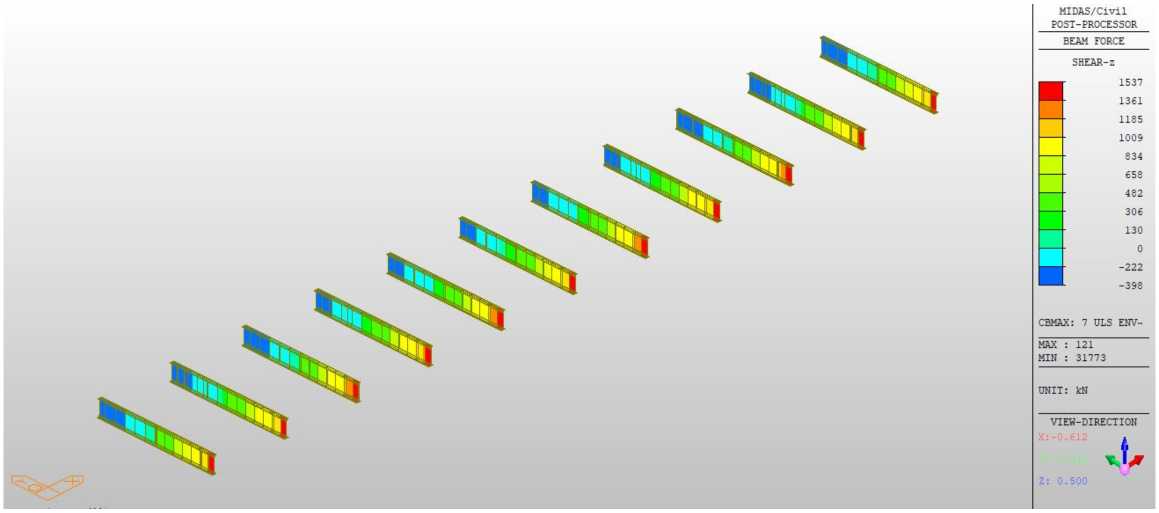


Figure 169 Interior Floor Beam Case 7 ULS F_z Max

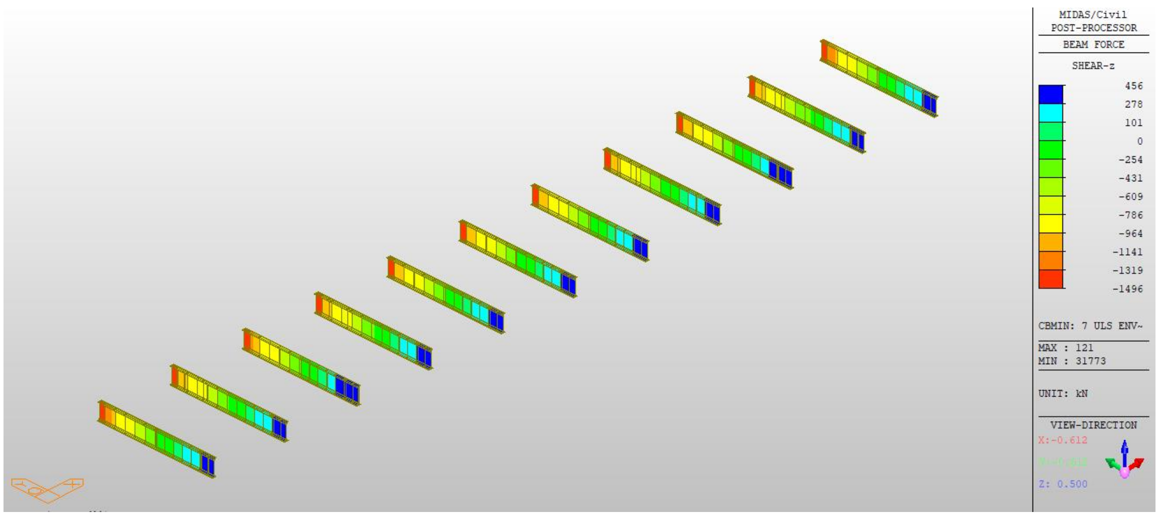


Figure 170 Interior Floor Beam Case 7 ULS F_z Min

Exhibit C.1.8. Rehabilitation Case 8 Evaluation

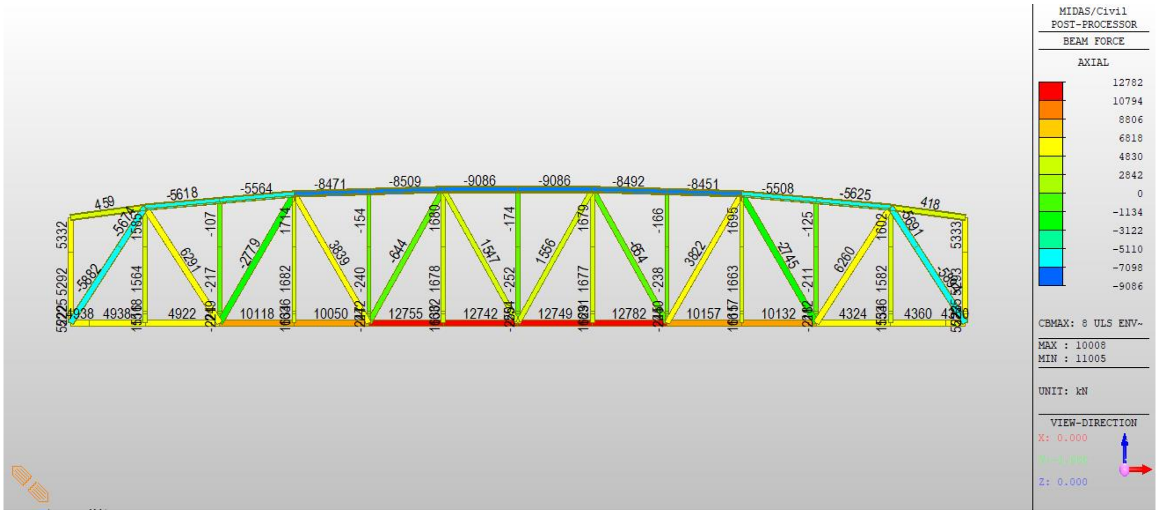


Figure 171 Railway Truss Case 8 ULS Axial Max

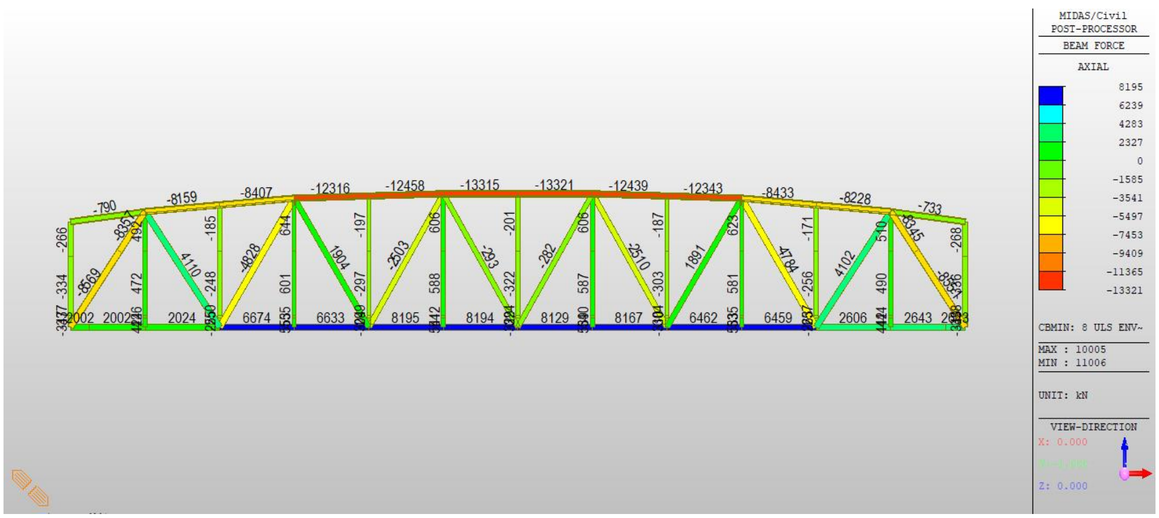


Figure 172 Railway Truss Case 8 ULS Axial Min

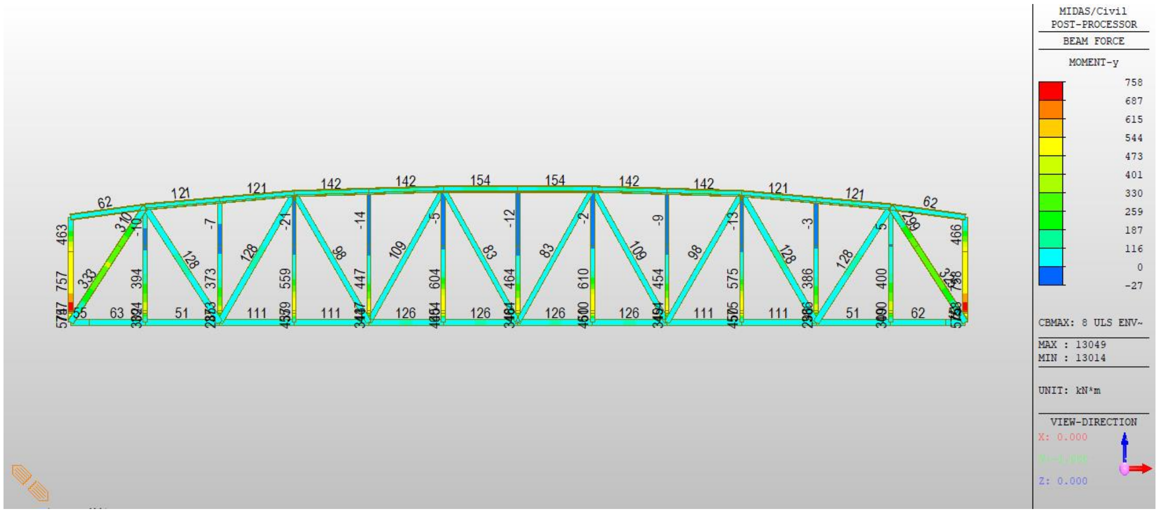


Figure 173 Railway Truss Case 8 ULS M_y Max

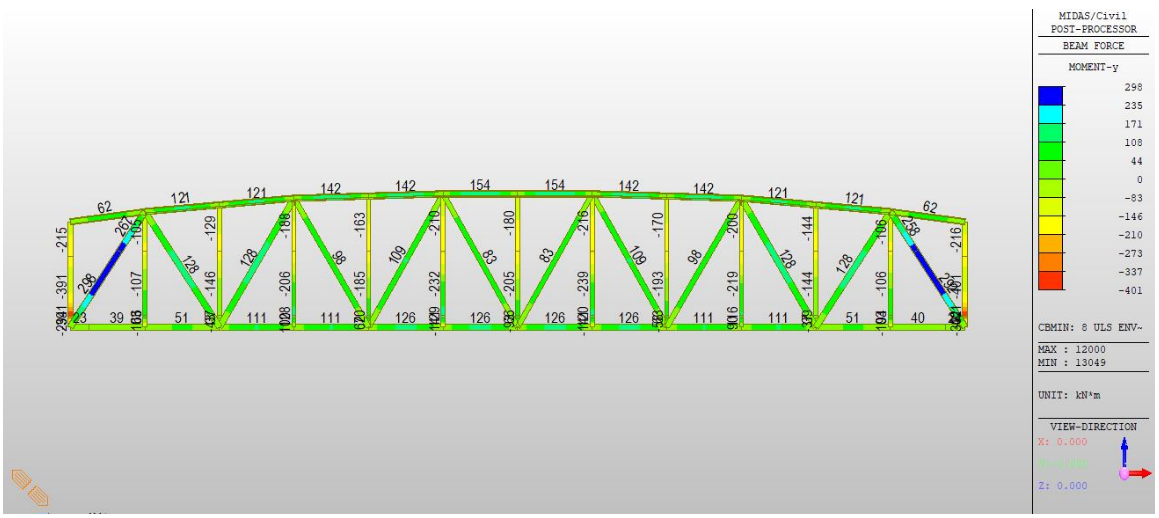


Figure 174 Railway Truss Case 8 ULS M_y Min

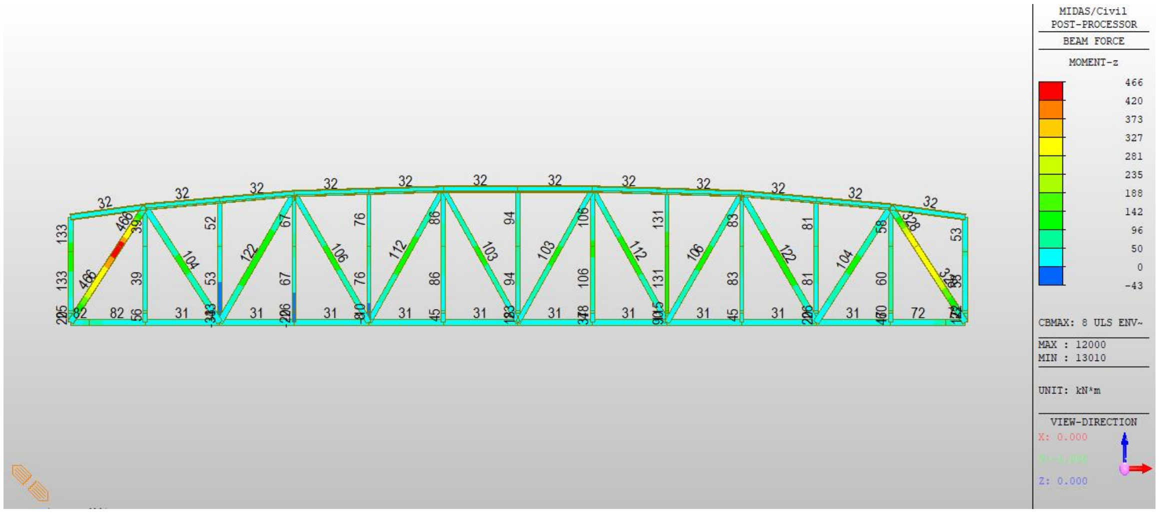


Figure 175 Railway Truss Case 8 ULS M_z Max

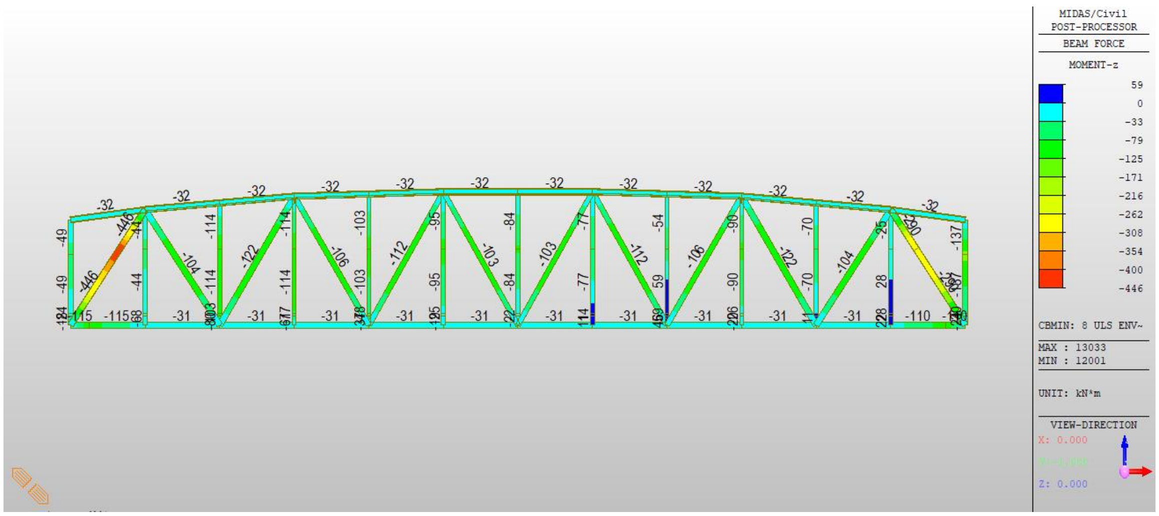


Figure 176 Railway Truss Case 8 ULS M_z Min

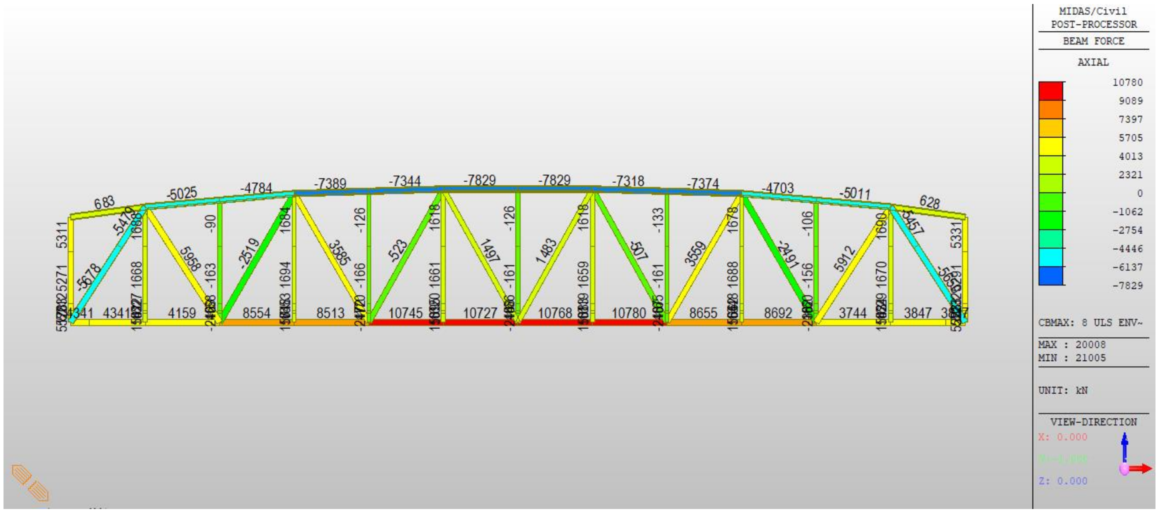


Figure 177 Highway Truss Case 8 ULS Axial Max

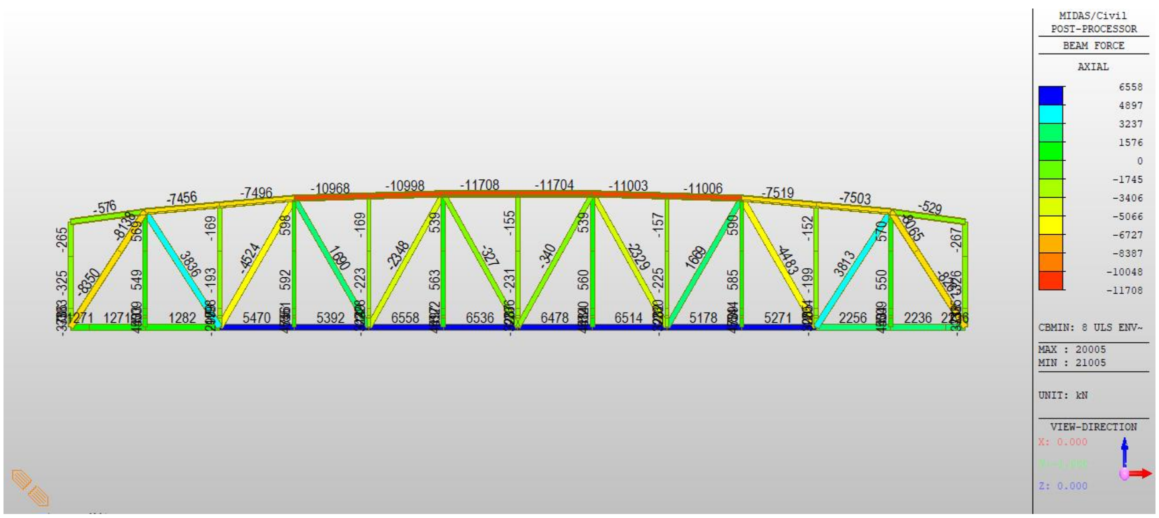


Figure 178 Highway Truss Case 8 ULS Axial Min

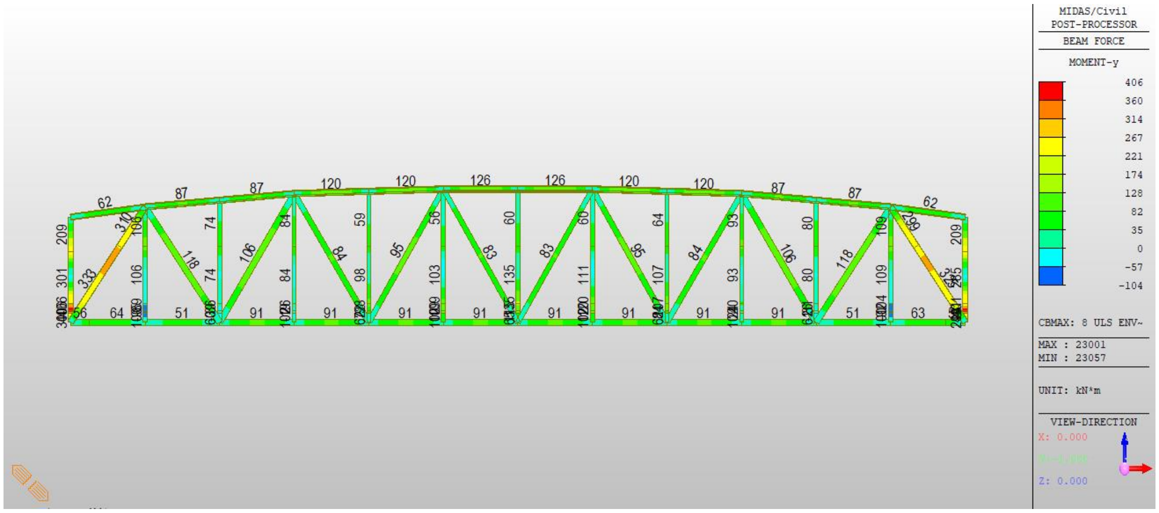


Figure 179 Highway Truss Case 8 ULS M_y Max

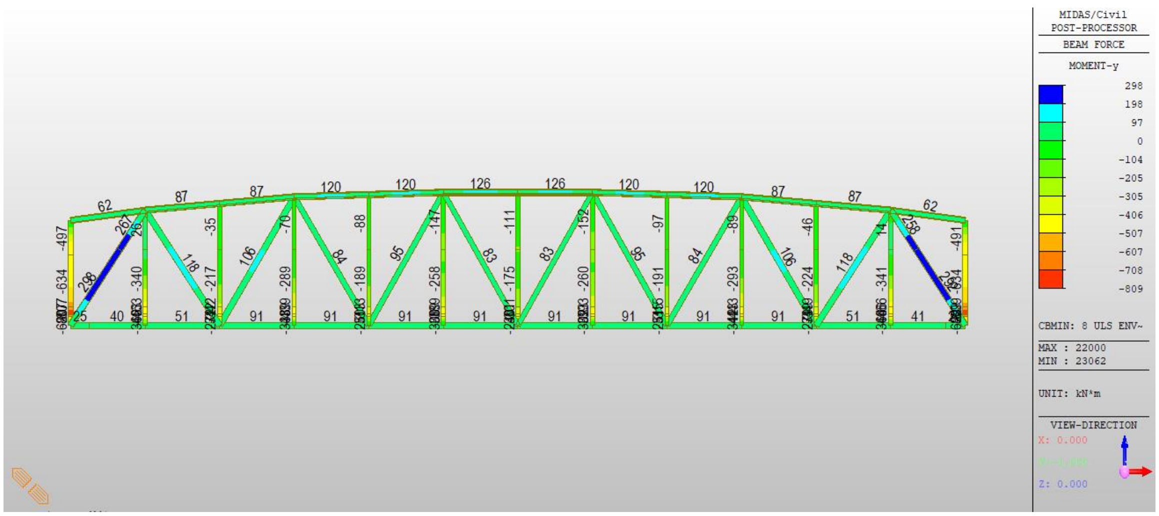


Figure 180 Highway Truss Case 8 ULS M_y Min

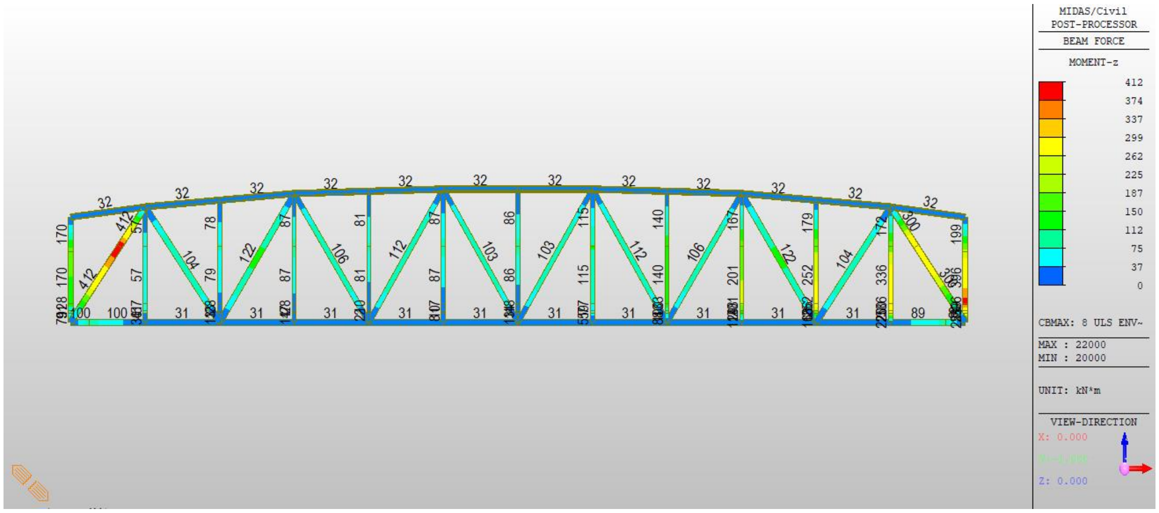


Figure 181 Highway Truss Case 8 ULS M_z Max

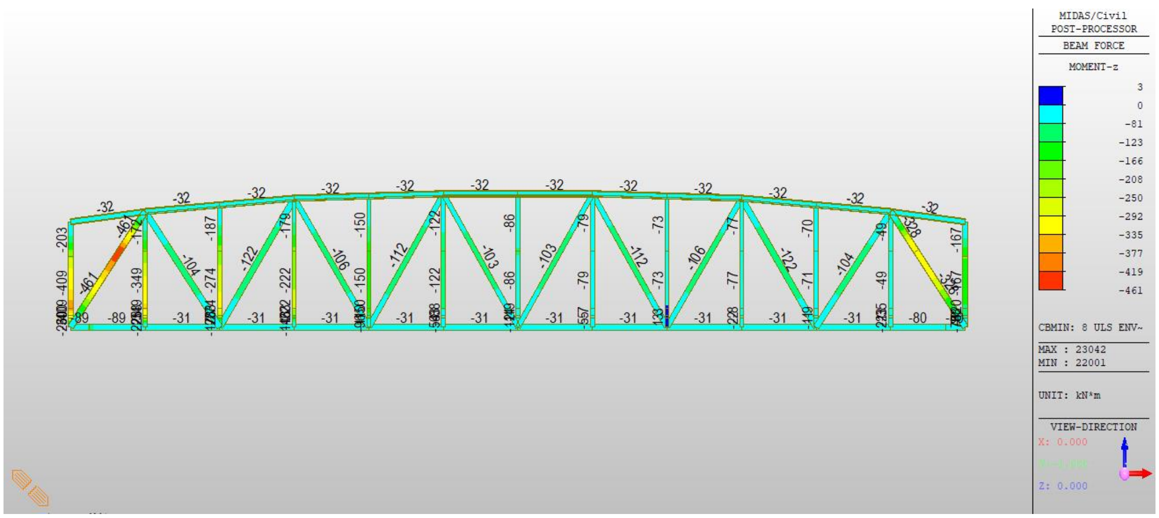


Figure 182 Highway Truss Case 8 ULS M_z Min

Figure 183 Lift Girder Case 8 ULS M_y Max

Figure 184 Lift Girder Case 8 ULS M_y Min

Figure 185 Lift Girder Case 8 ULS F_z Max

Figure 186 Lift Girder Case 8 ULS F_z Min

Figure 187 End Floor Beam Case 8 ULS M_y Max

Figure 188 End Floor Beam Case 8 ULS M_y Min

Figure 189 End Floor Beam Case 8 ULS F_z Max

Figure 190 End Floor Beam Case 8 ULS F_z Min

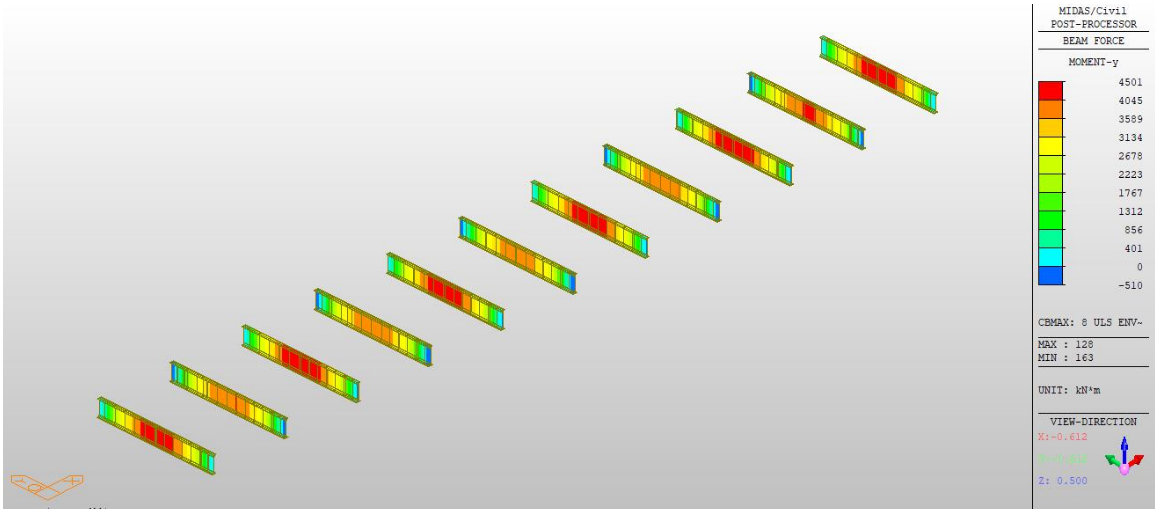
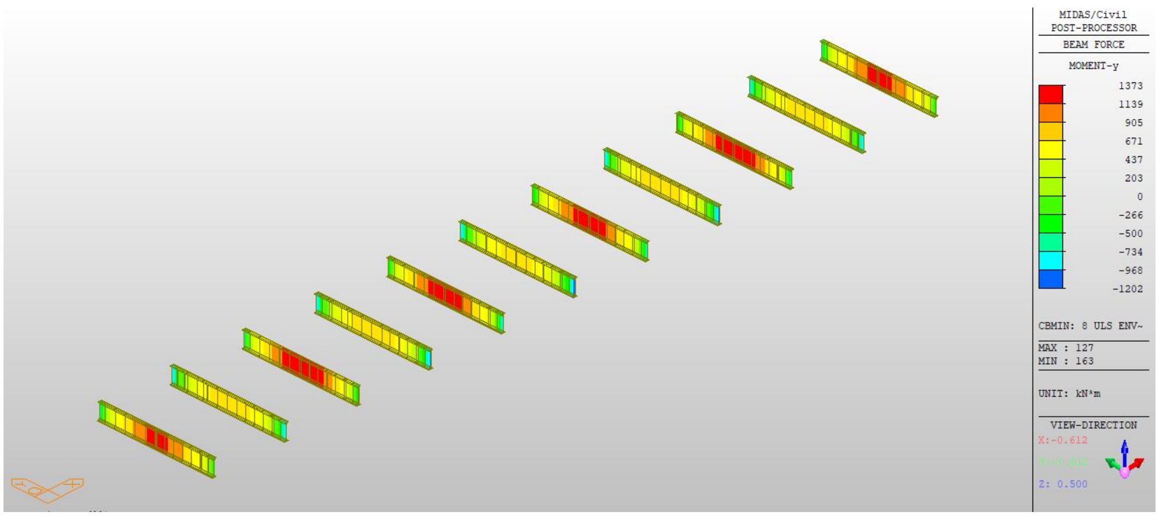


Figure 191 Interior Floor Beam Case 8 ULS M_y Max



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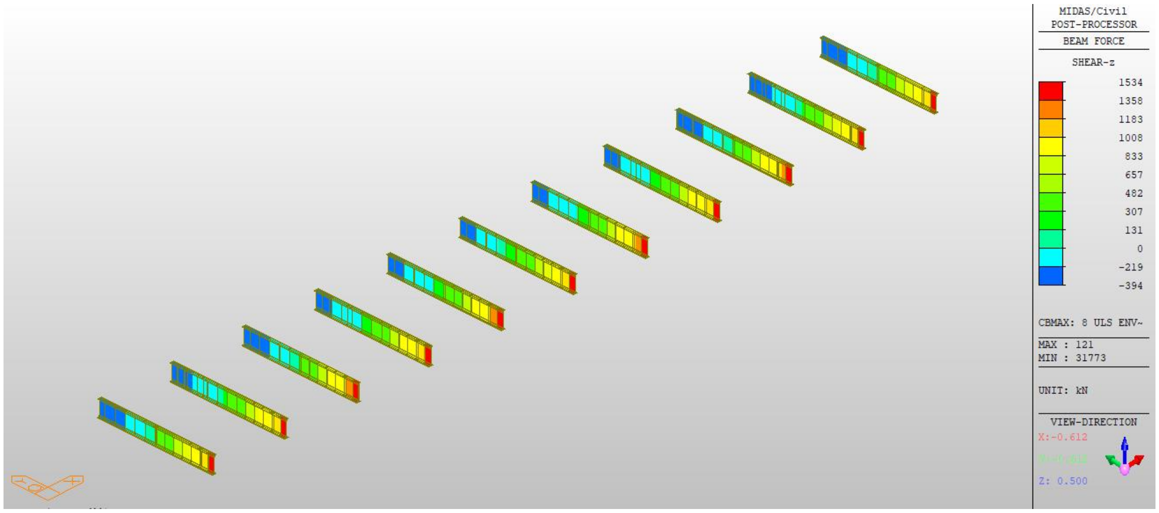

Figure 193 Interior Floor Beam Case 8 ULS F_z Max

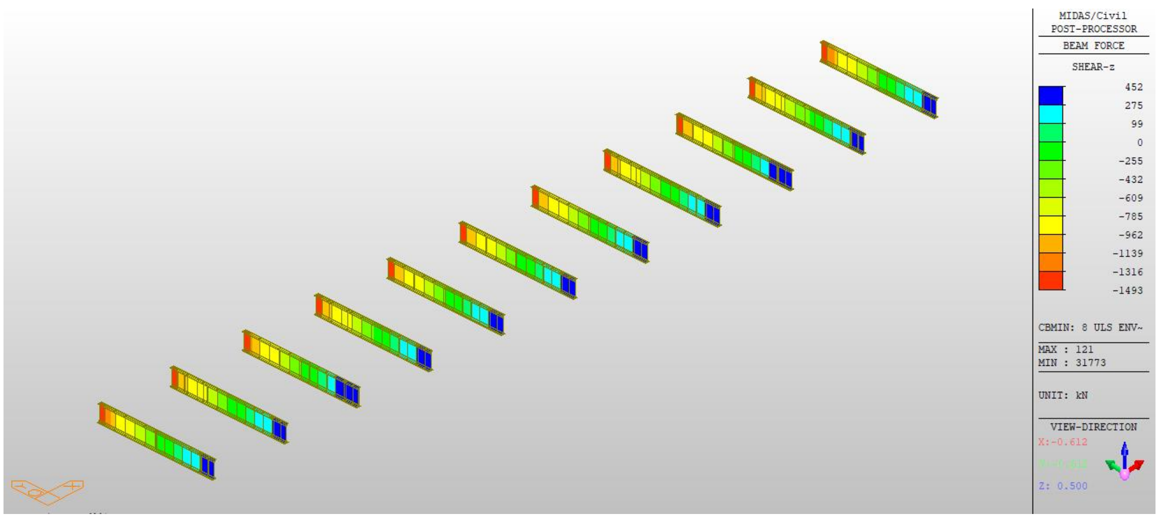

Figure 194 Interior Floor Beam Case 8 ULS F_z Min

Exhibit C.1.9 Rehabilitation Case 9 Evaluation

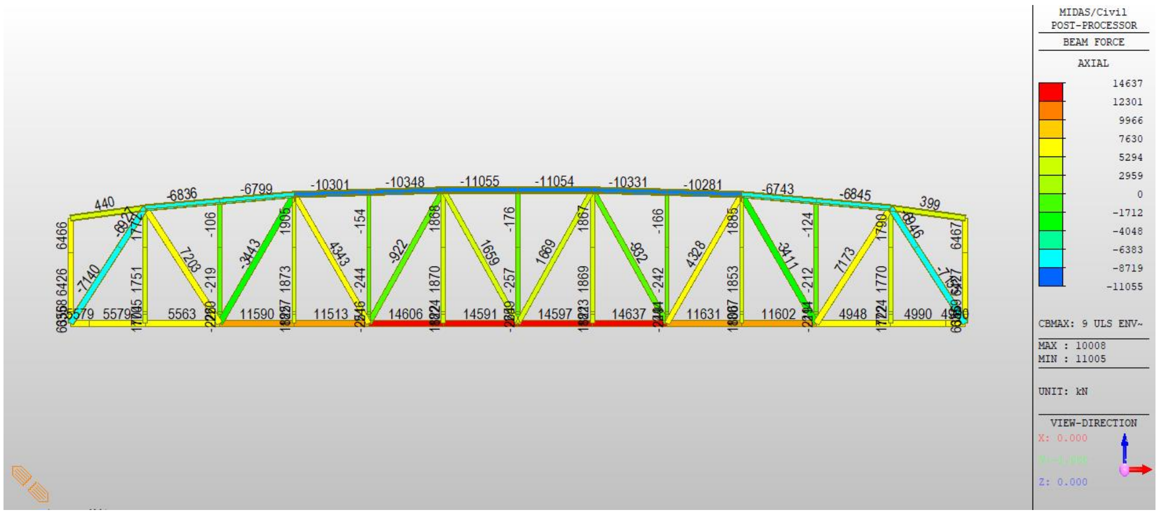

Figure 195 Railway Truss Case 9 ULS Axial Max

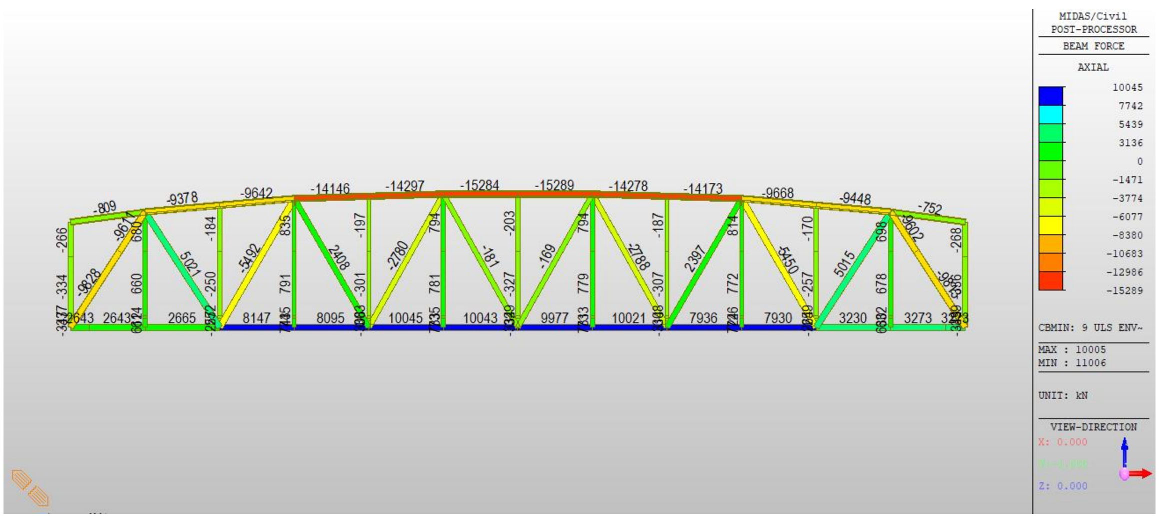

Figure 196 Railway Truss Case 9 ULS Axial Min

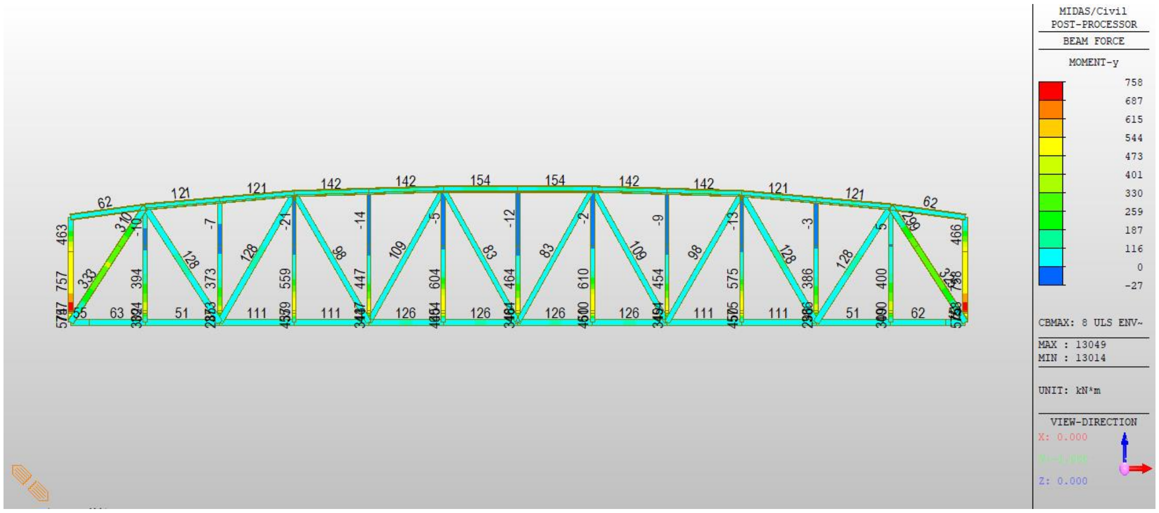

Figure 197 Railway Truss Case 9 ULS M_y Max

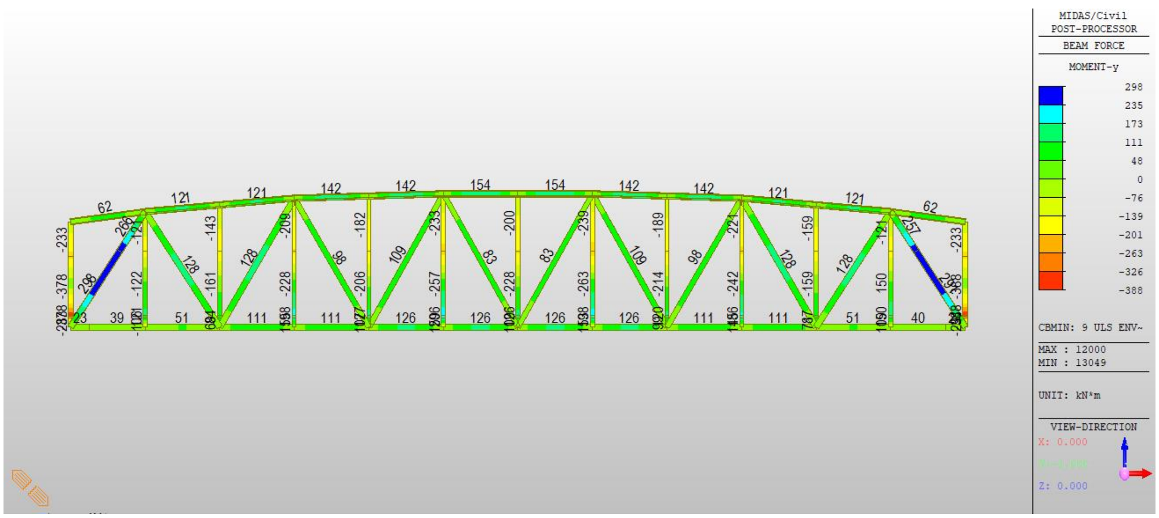

Figure 198 Railway Truss Case 9 ULS M_y Min

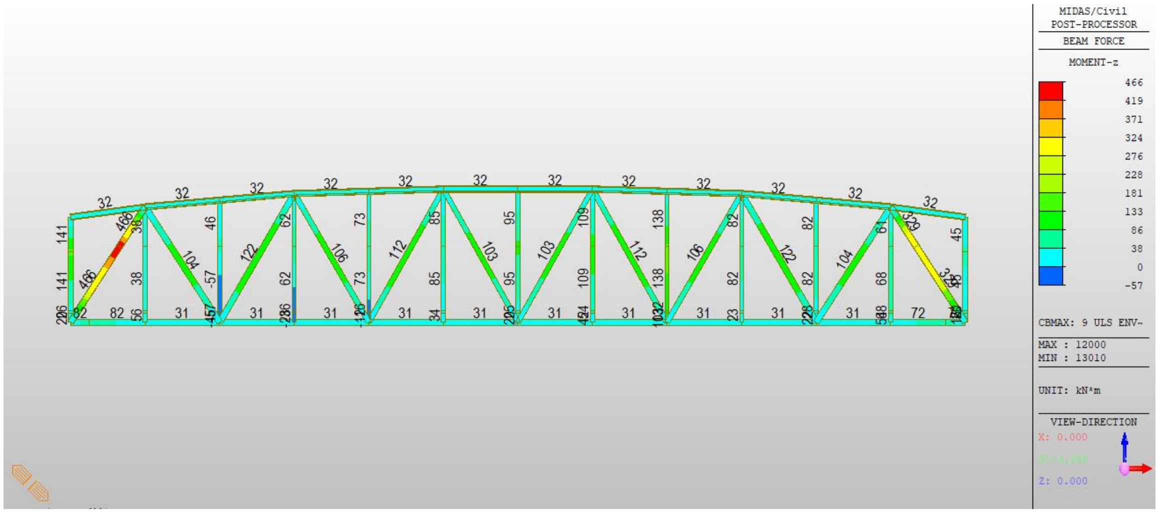

Figure 199 Railway Truss Case 9 ULS M_z Max

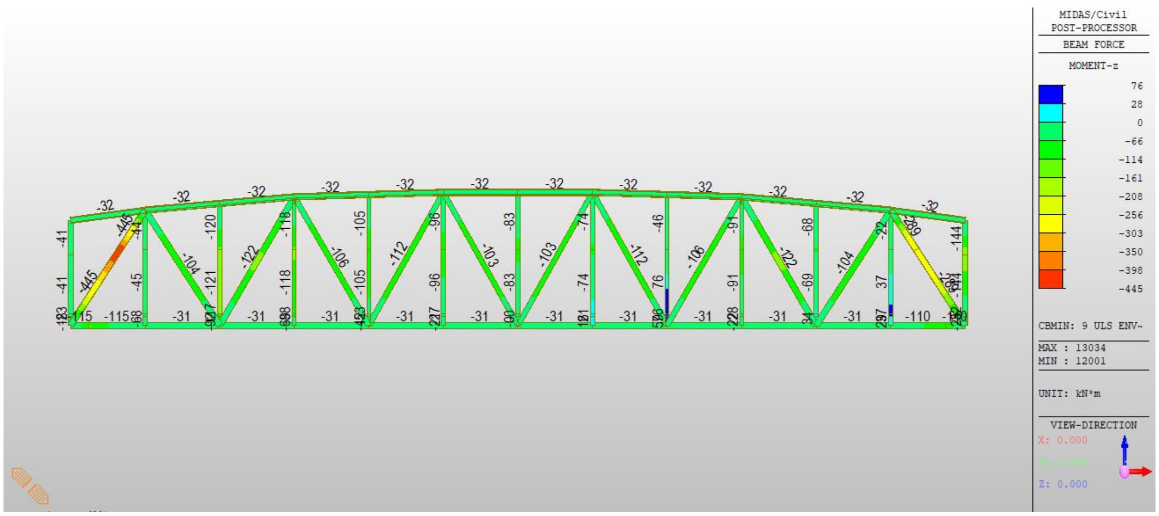

Figure 200 Railway Truss Case 9 ULS M_z Min

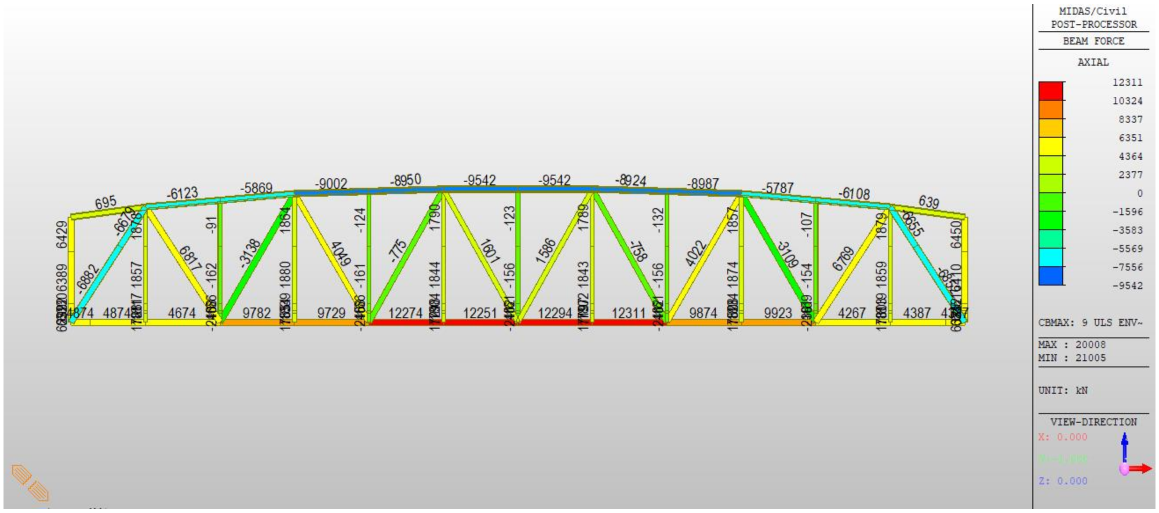

Figure 201 Highway Truss Case 9 ULS Axial Max

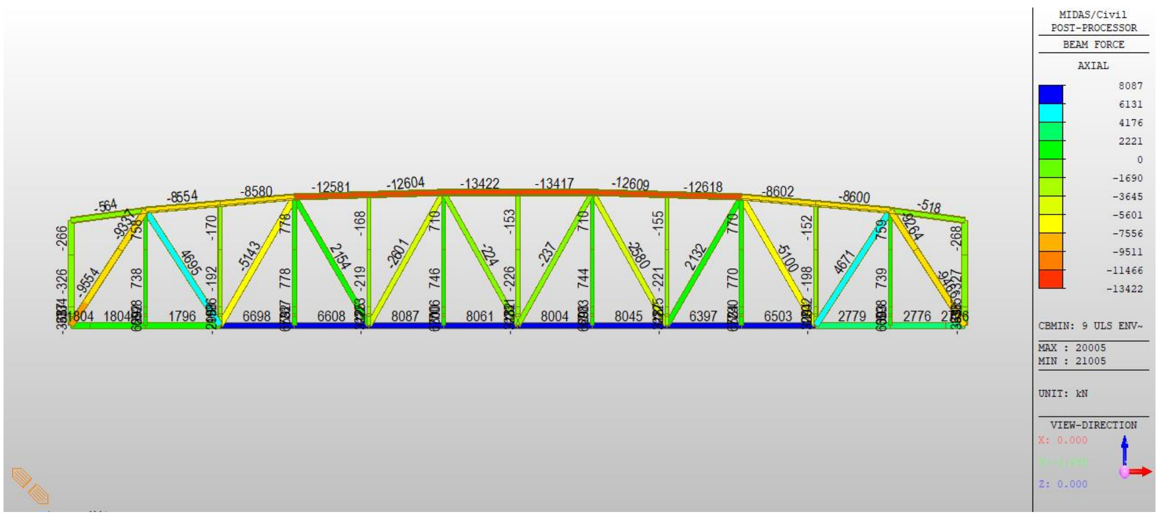

Figure 202 Highway Truss Case 9 ULS Axial Min

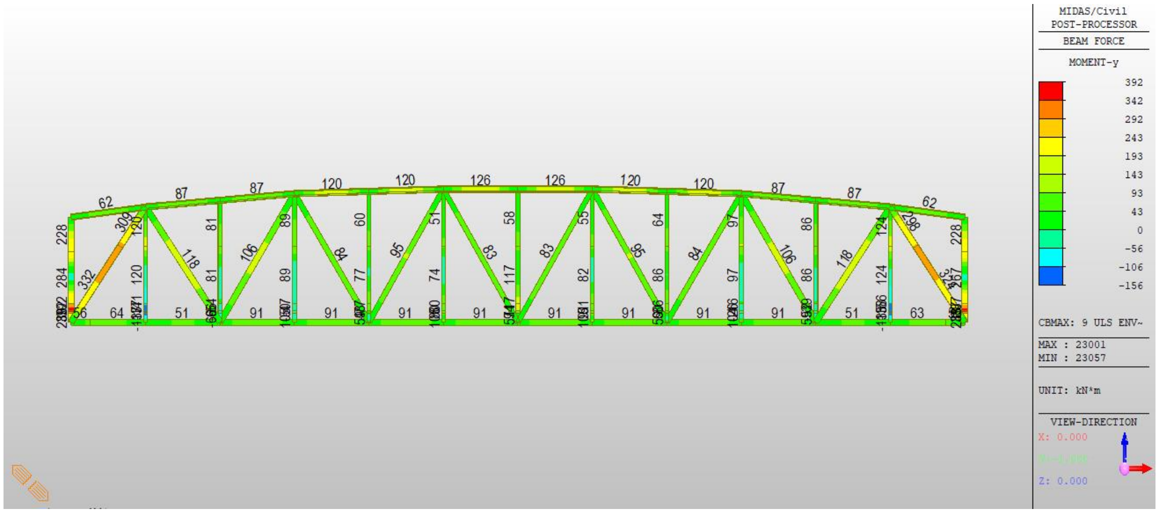

Figure 203 Highway Truss Case 9 ULS M_y Max

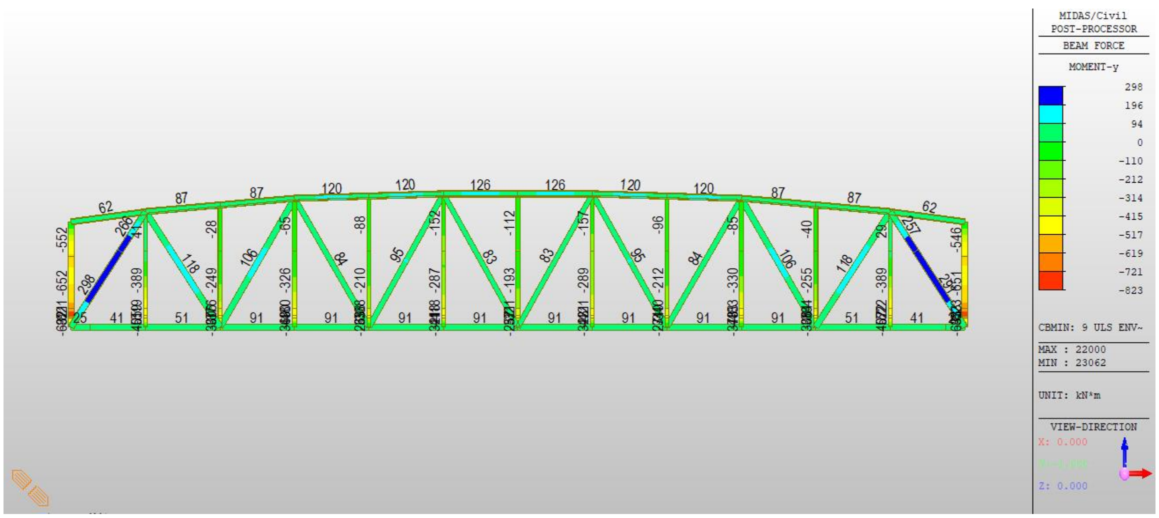

Figure 204 Highway Truss Case 9 ULS M_y Min

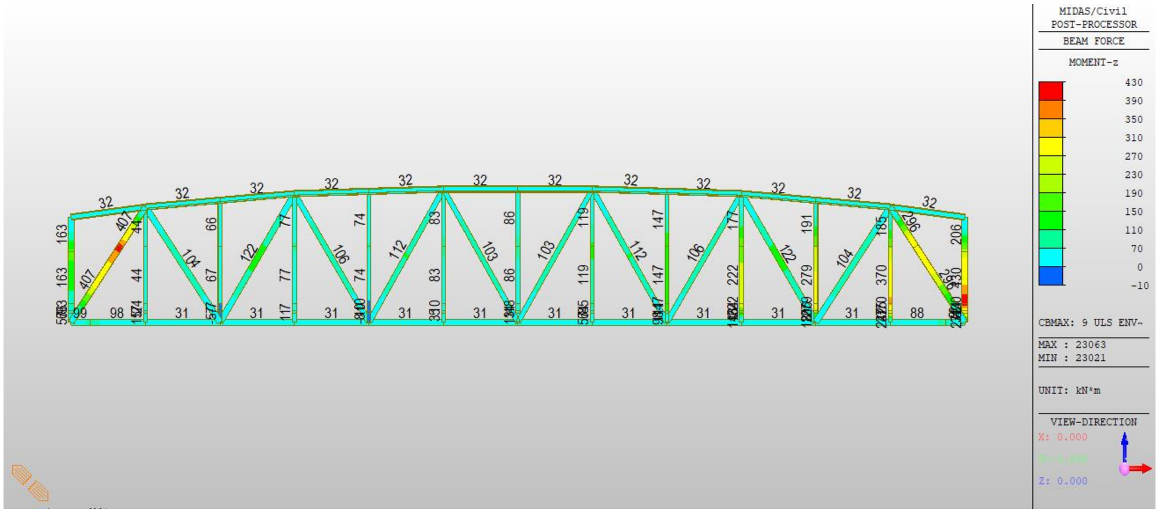

Figure 205 Highway Truss Case 9 ULS M_z Max

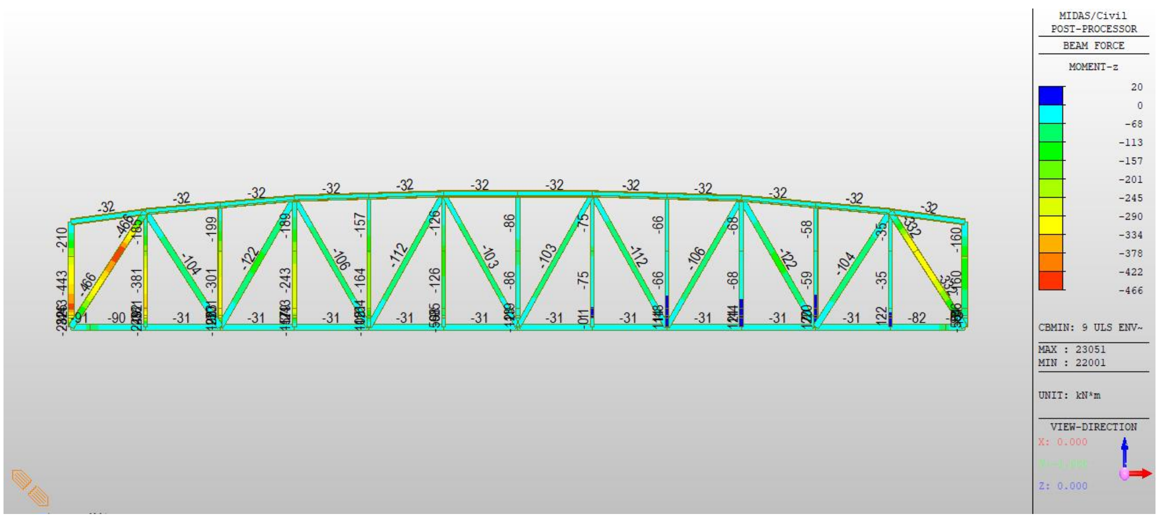

Figure 206 Highway Truss Case 9 ULS M_z Min

Figure 207 Lift Girder Case 9 ULS M_y Max

Figure 208 Lift Girder Case 9 ULS M_y Min

Figure 209 Lift Girder Case 9 ULS F_z Max

Figure 210 Lift Girder Case 9 ULS F_z Min

Figure 211 End Floor Beam Case 9 ULS M_y Max

Figure 212 End Floor Beam Case 9 ULS M_y Min

Figure 213 End Floor Beam Case 9 ULS F_z Max

Figure 214 End Floor Beam Case 9 ULS F_z Min

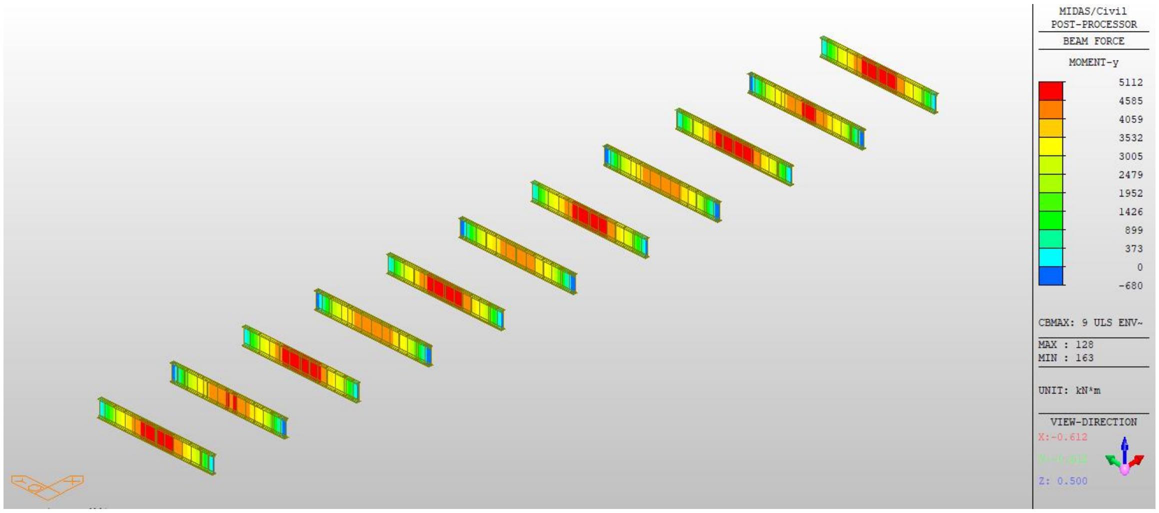

Figure 215 Interior Floor Beam Case 9 ULS M_y Max

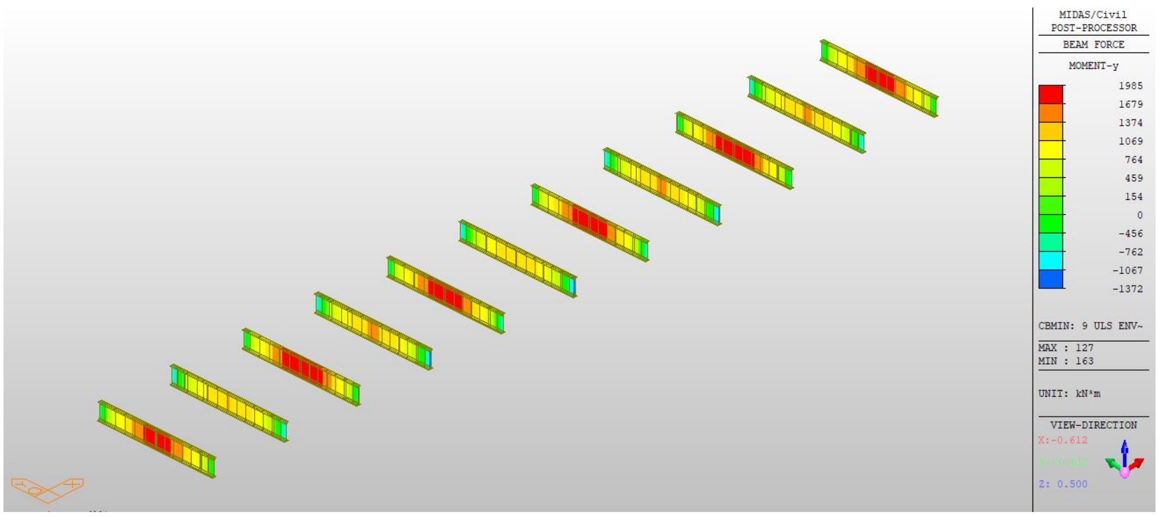

Figure 216 Interior Floor Beam Case 9 ULS M_y Min

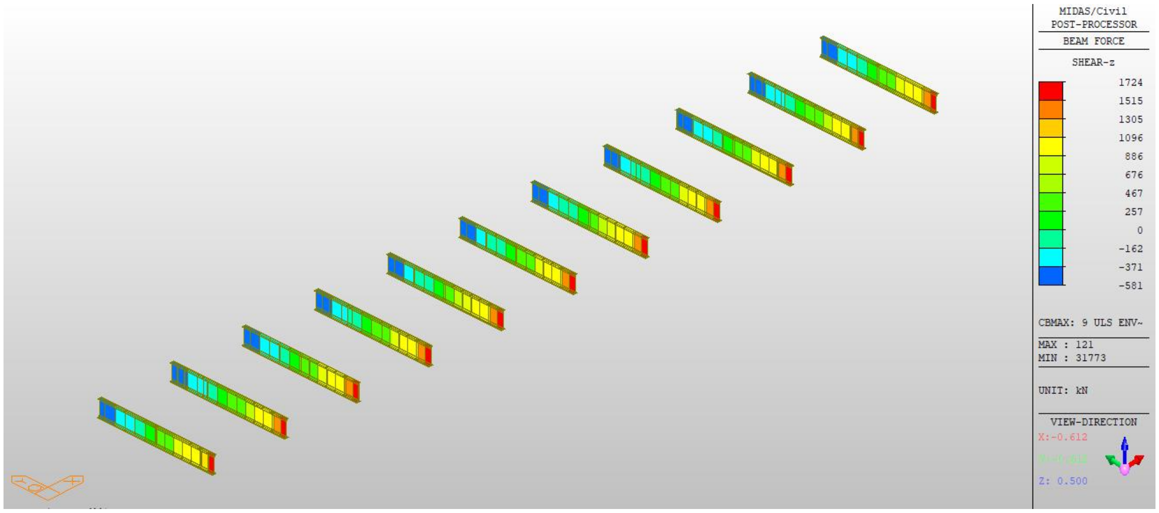

Figure 217 Interior Floor Beam Case 9 ULS F_z Max

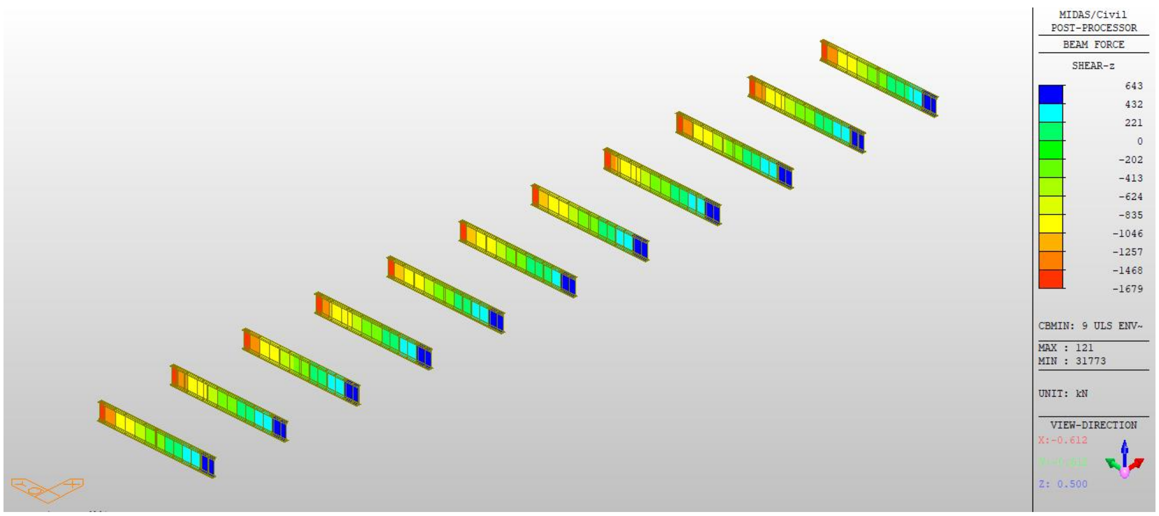

Figure 218 Interior Floor Beam Case 9 ULS F_z Min

AECOM Imagine it. Delivered.

Exhibit C.2

South Tower Rehabilitation Evaluation 3D Model

Exhibit C.2.1. Bridge Weight - Rehabilitation Case Evaluation

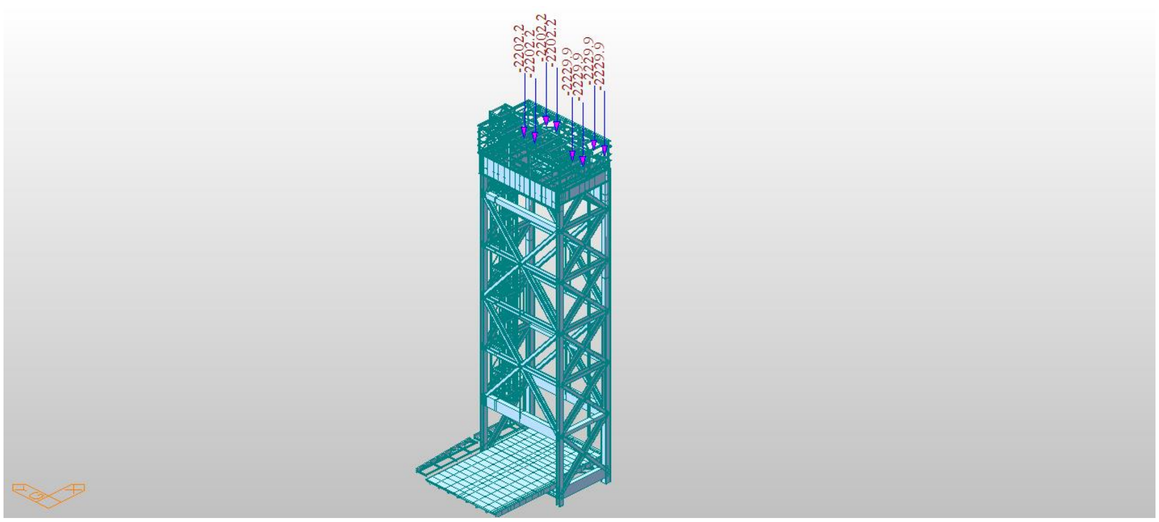

Figure 1 Bridge Weight - Case 1

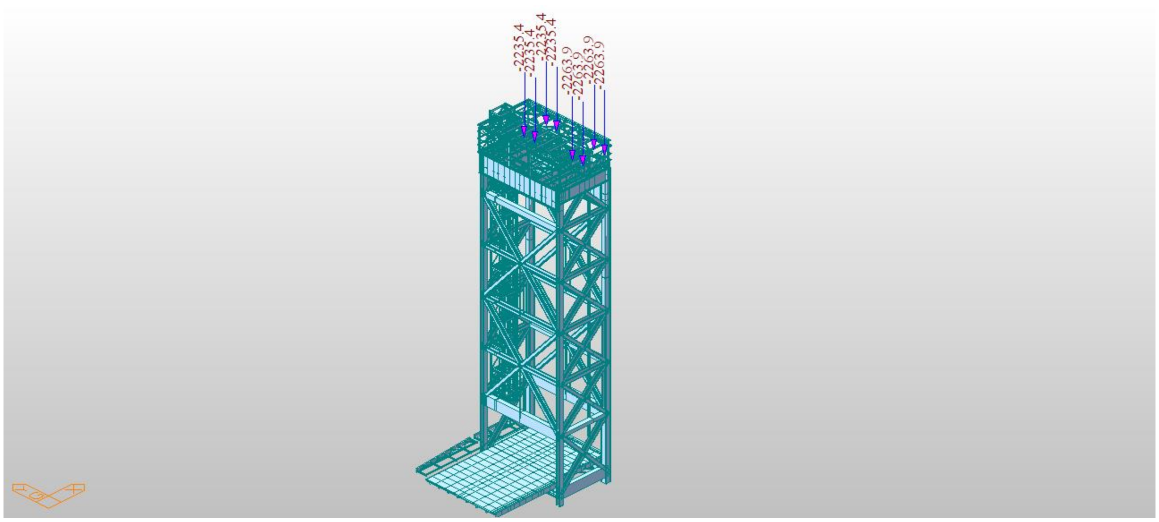

Figure 2 Bridge Weight - Case 2

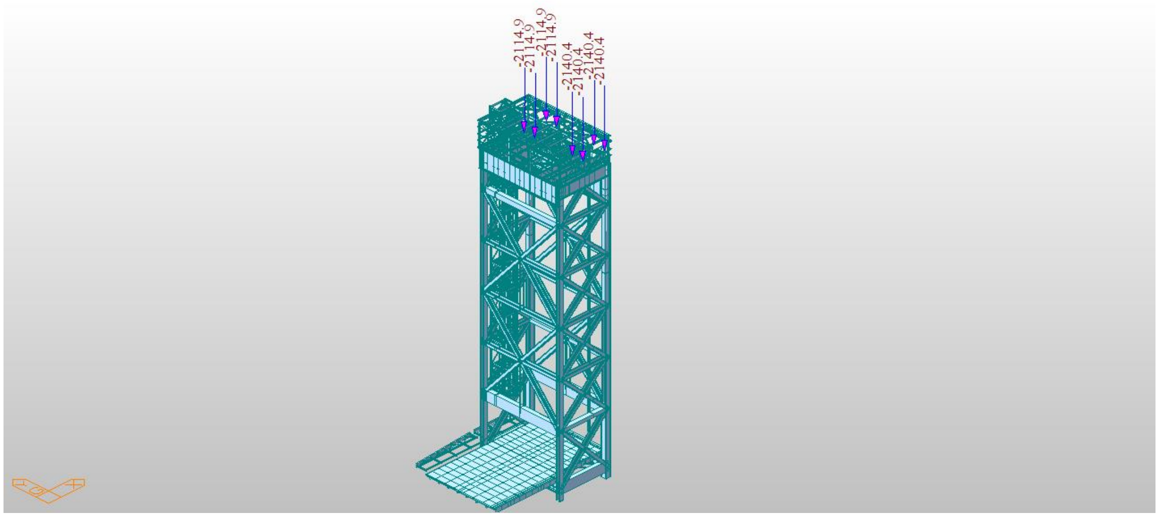

Figure 3 Bridge Weight - Case 3

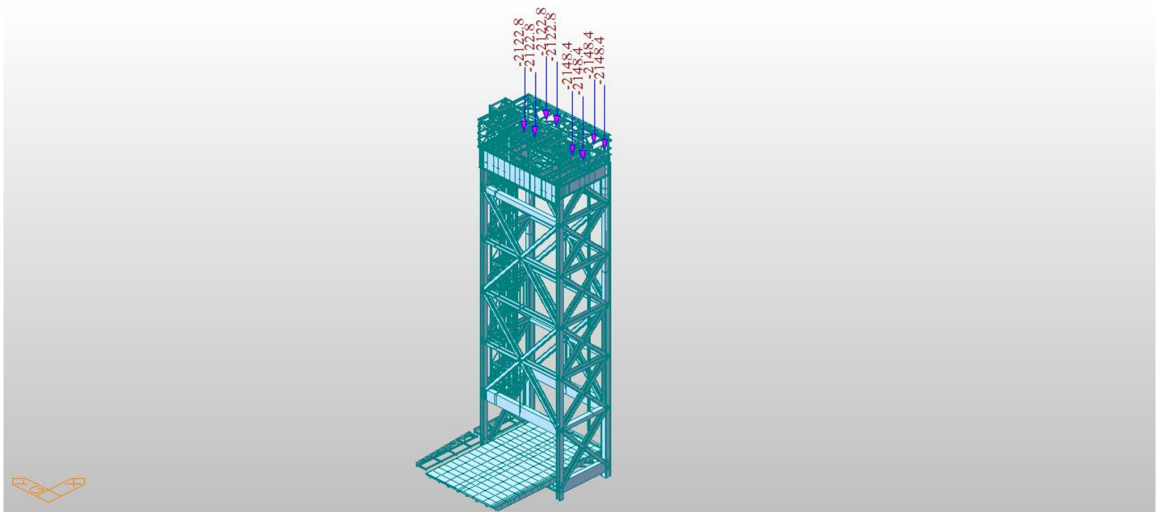

Figure 4 Bridge Weight - Case 4

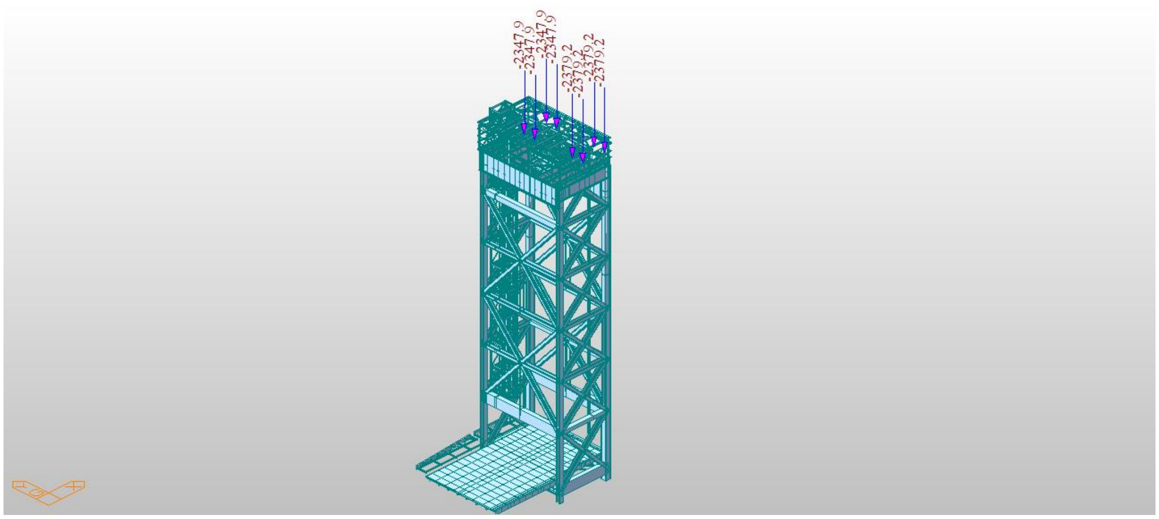

Figure 5 Bridge Weight - Case 5

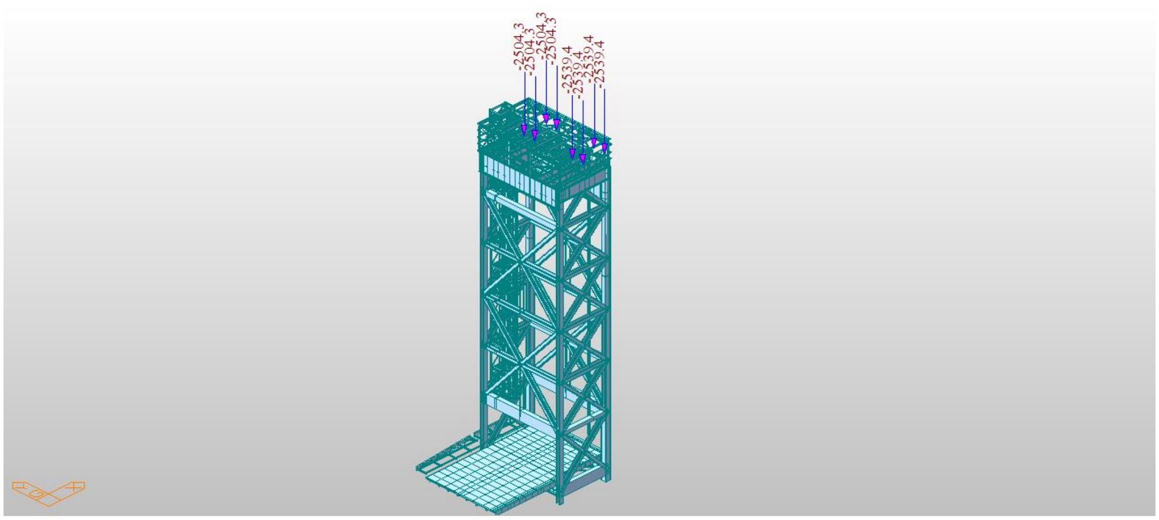

Figure 6 Bridge Weight - Case 7

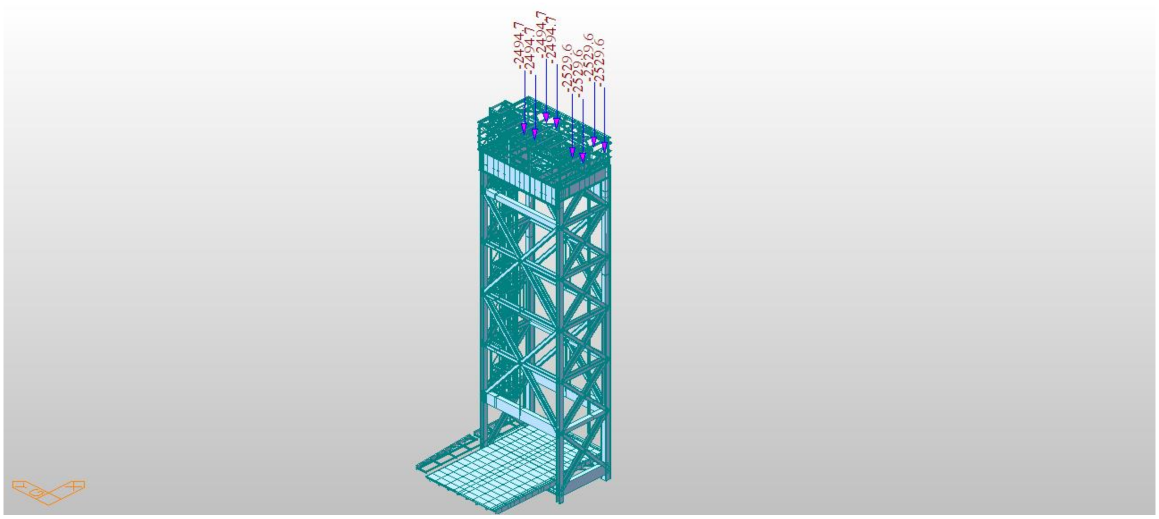

Figure 7 Bridge Weight - Case 8

Exhibit C.2.2. Rehabilitation Case 1

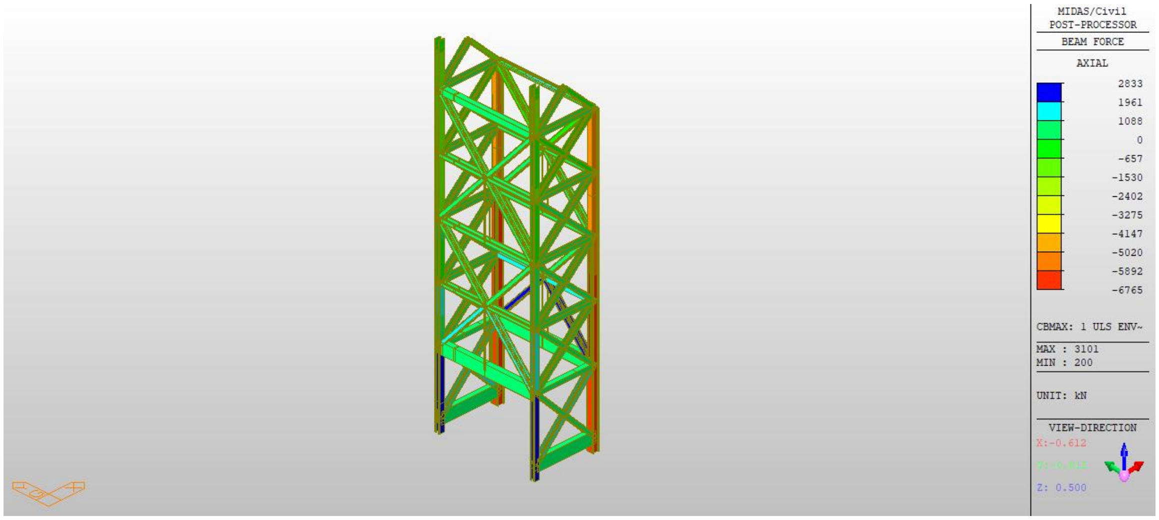

Figure 8 Truss Member - Case 1 ULS Axial Max

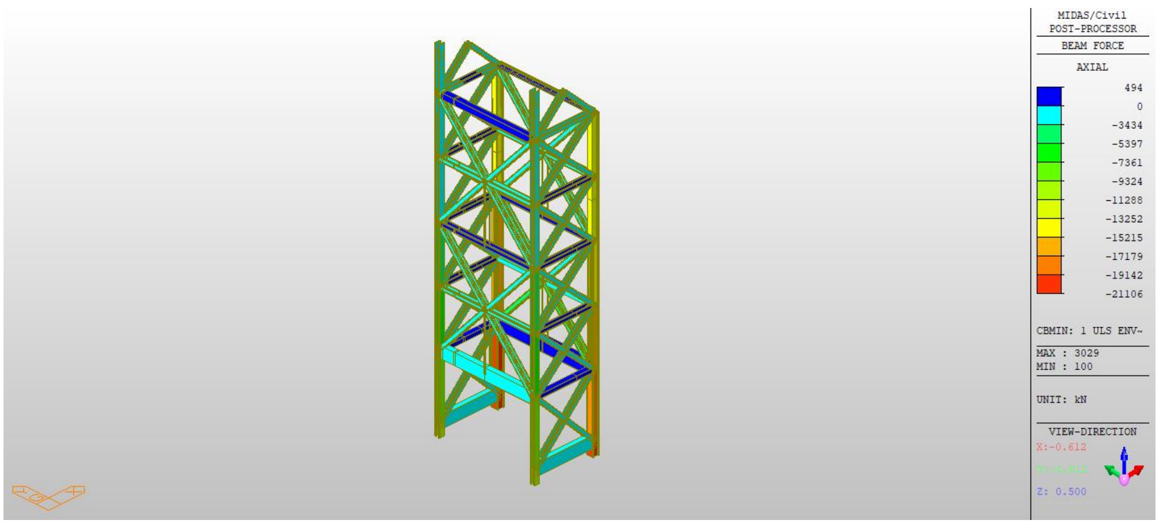

Figure 9 Truss Member - Case 1 ULS Axial Min

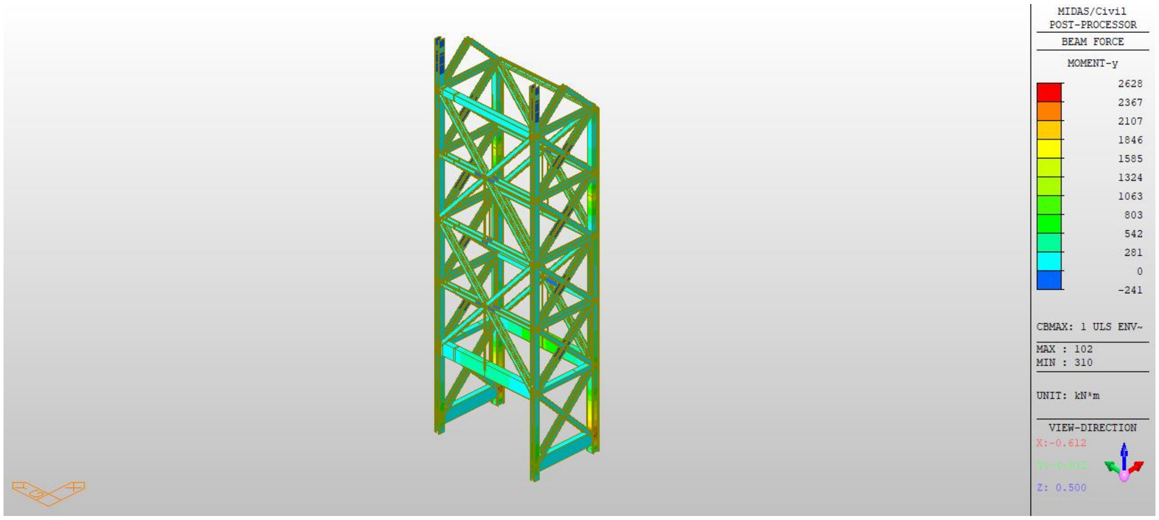

Figure 10 Truss Member - Case 1 ULS M_y Max

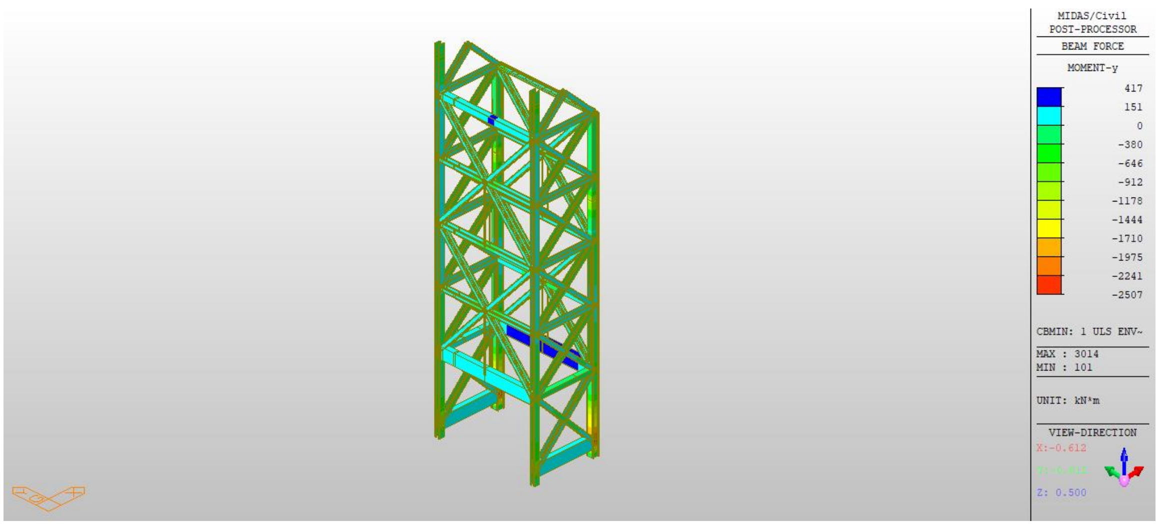

Figure 11 Truss Member - Case 1 ULS M_y Min

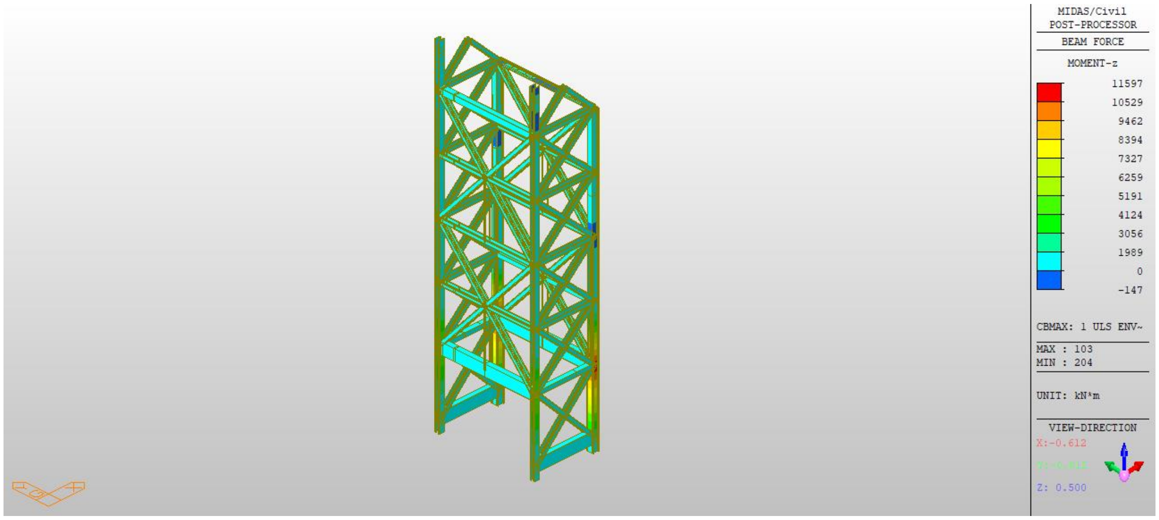

Figure 12 Truss Member - Case 1 ULS M_z Max

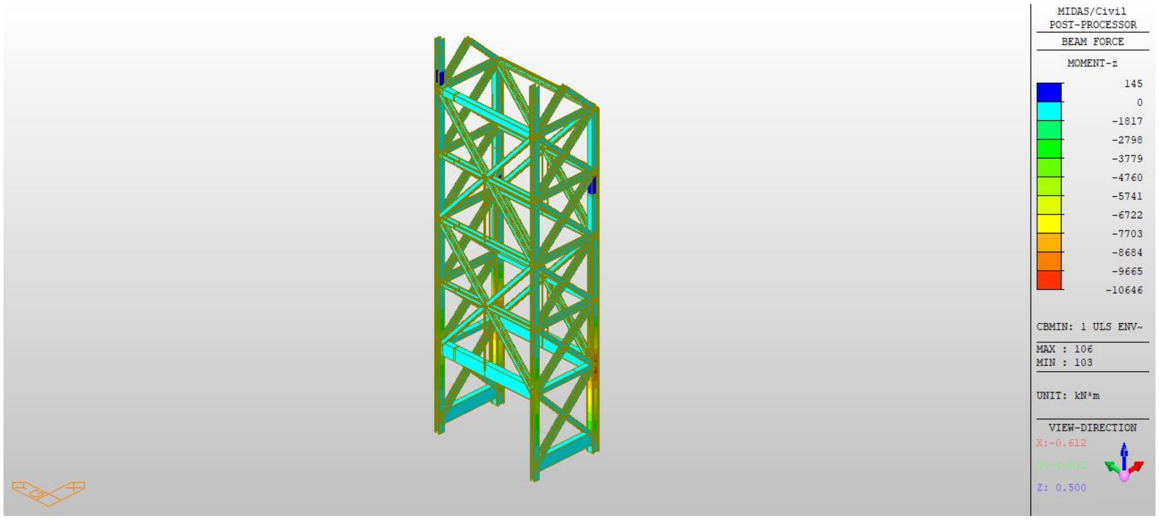

Figure 13 Truss Member - Case 1 ULS M_z Min

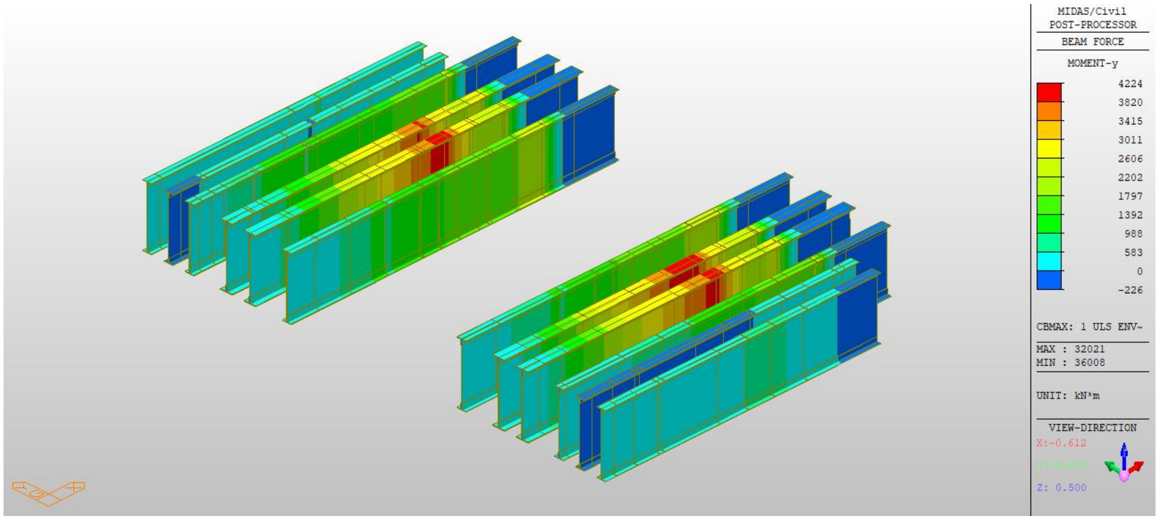

Figure 14 Girders G1 G2 G3 G4 G6 - Case 1 ULS M_y Max

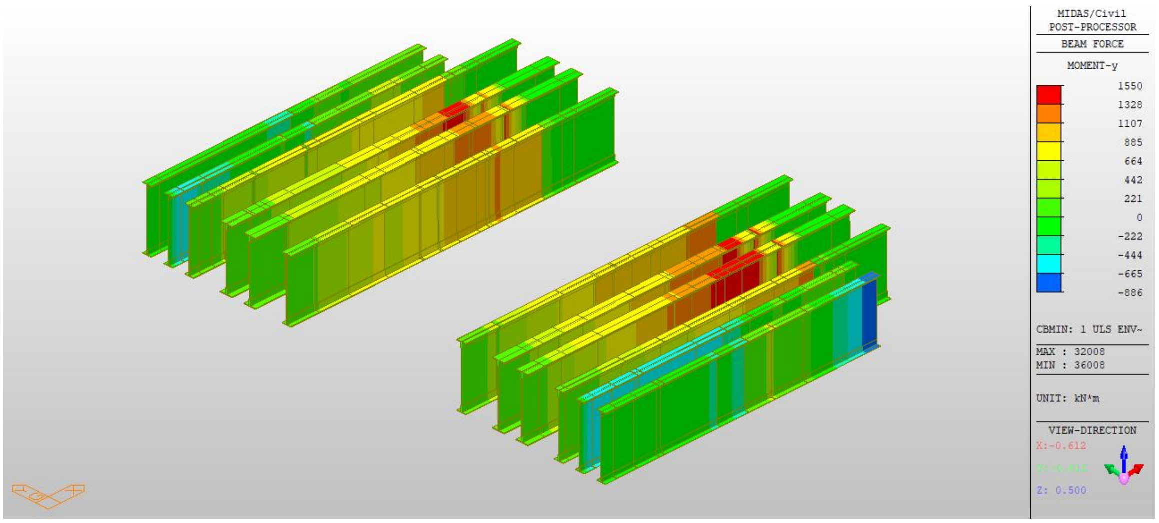

Figure 15 Girders G1 G2 G3 G4 G6 - Case 1 ULS M_y Min

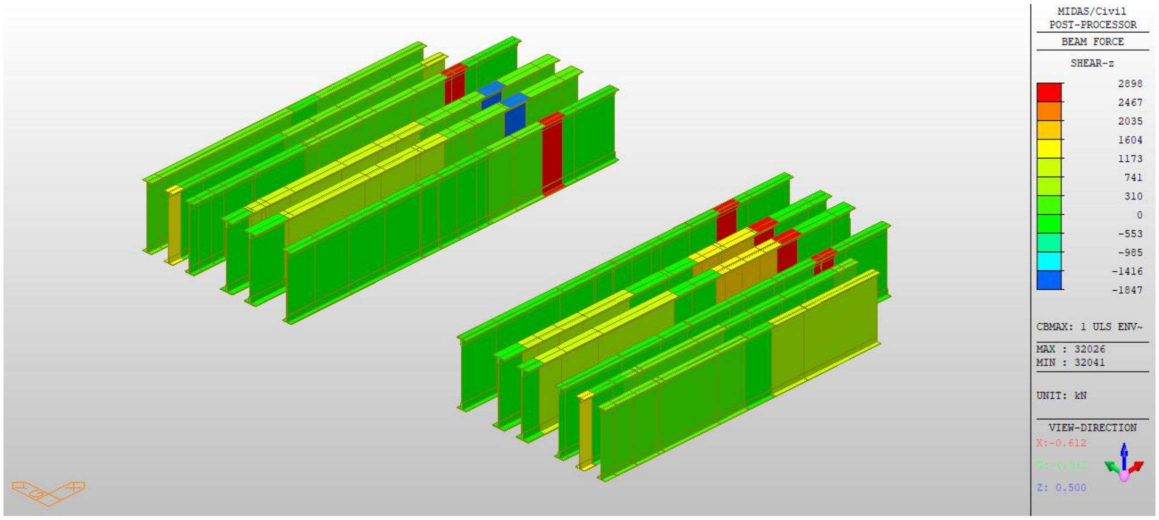

Figure 16 Girders G1 G2 G3 G4 G6 - Case 1 ULS F_z Max

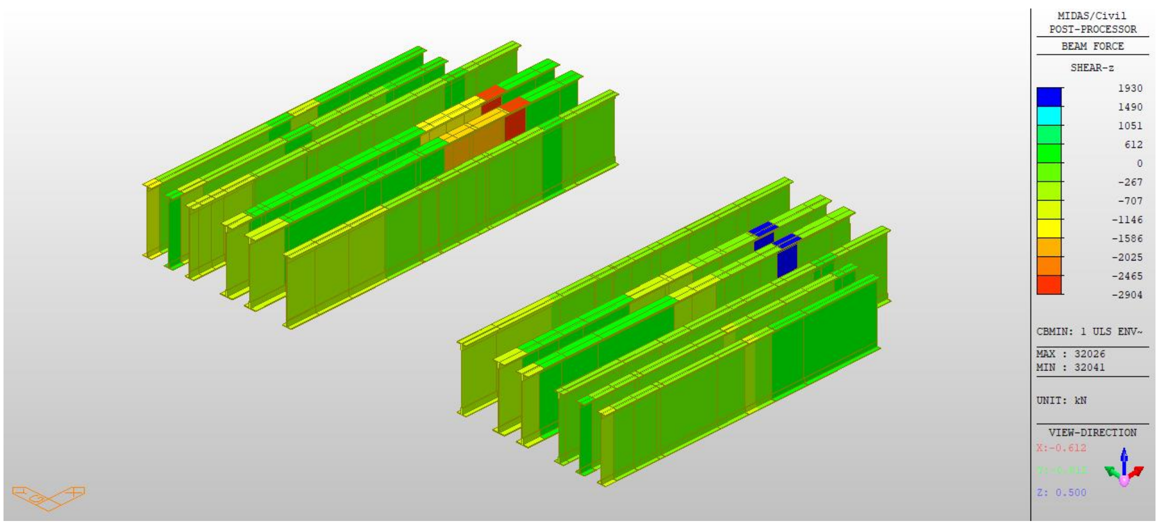

Figure 17 Girders G1 G2 G3 G4 G6 - Case 1 ULS F_z Min

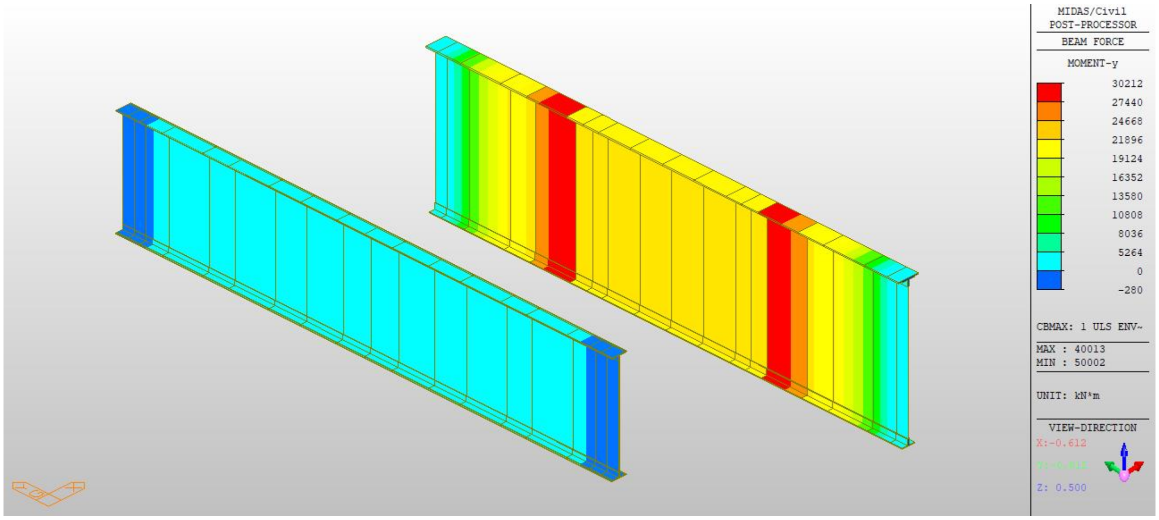

Figure 18 Girders G7 and G8 - Case 1 ULS M_y Max

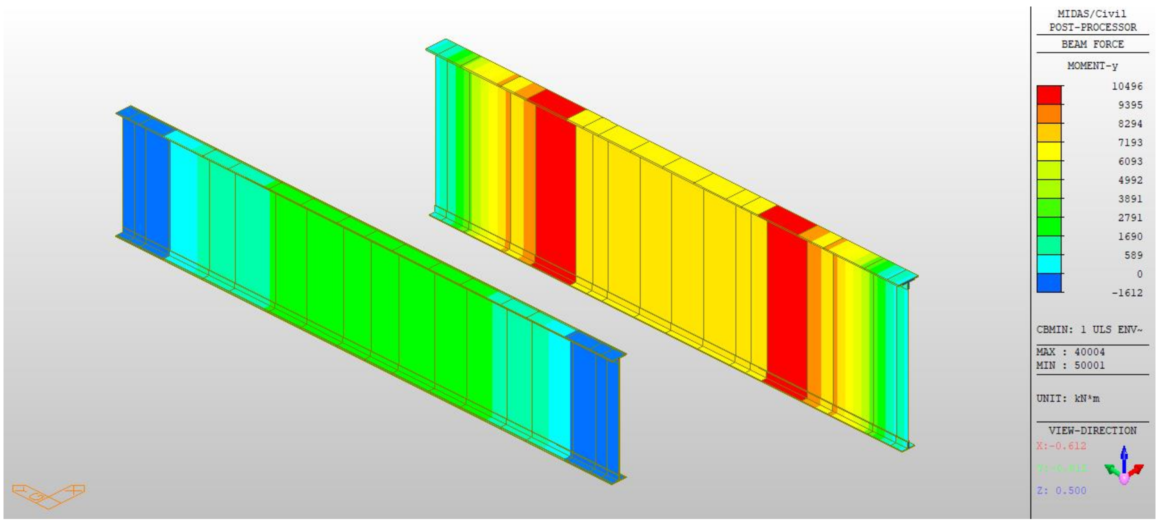

Figure 19 Girders G7 and G8 - Case 1 ULS M_y Min

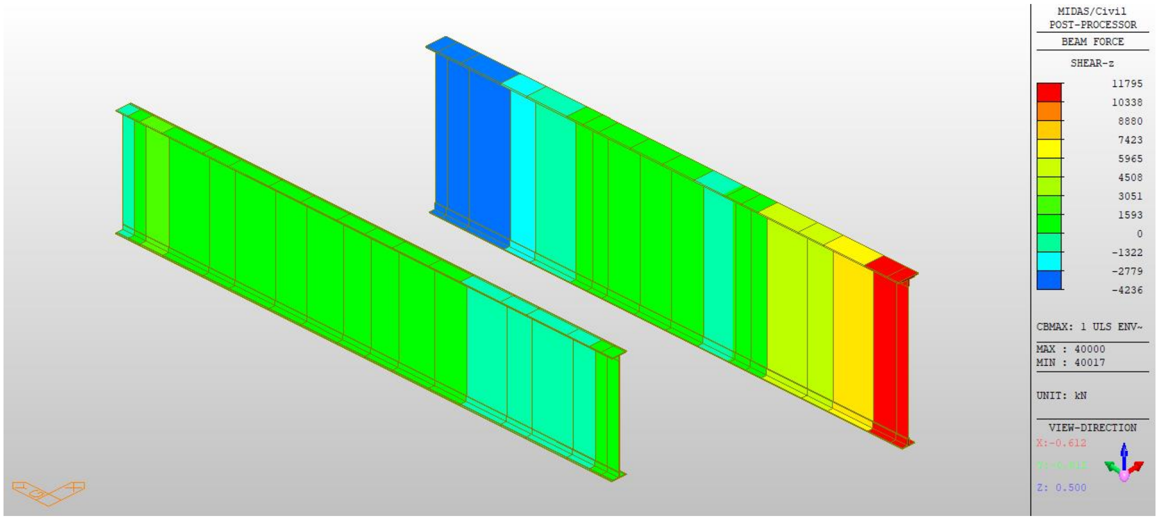

Figure 20 Girders G7 and G8 - Case 1 ULS F_z Max

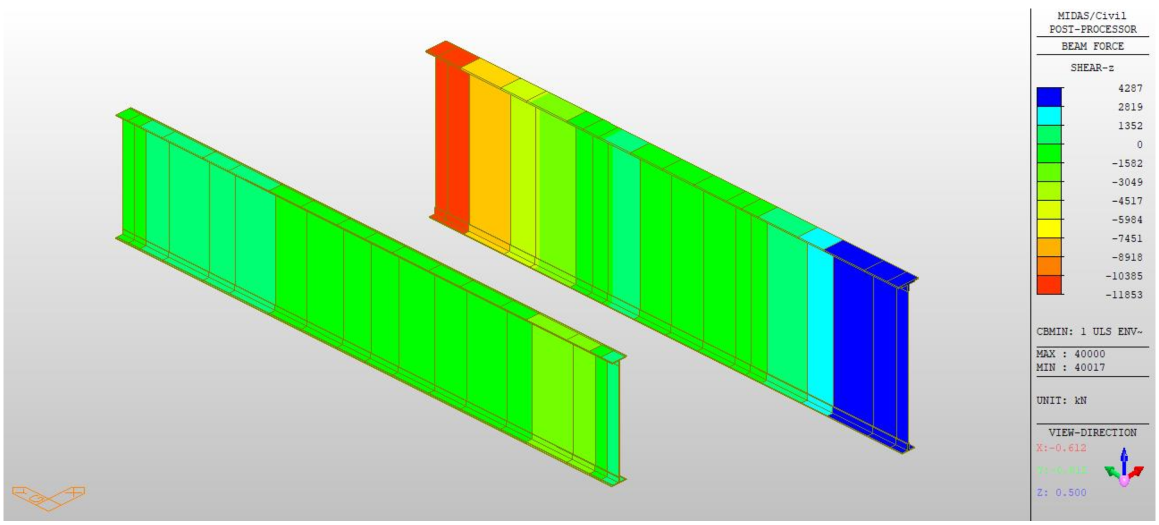

Figure 21 Girders G7 and G8 - Case 1 ULS F_z Min

Exhibit C.2.3. Rehabilitation Case 2

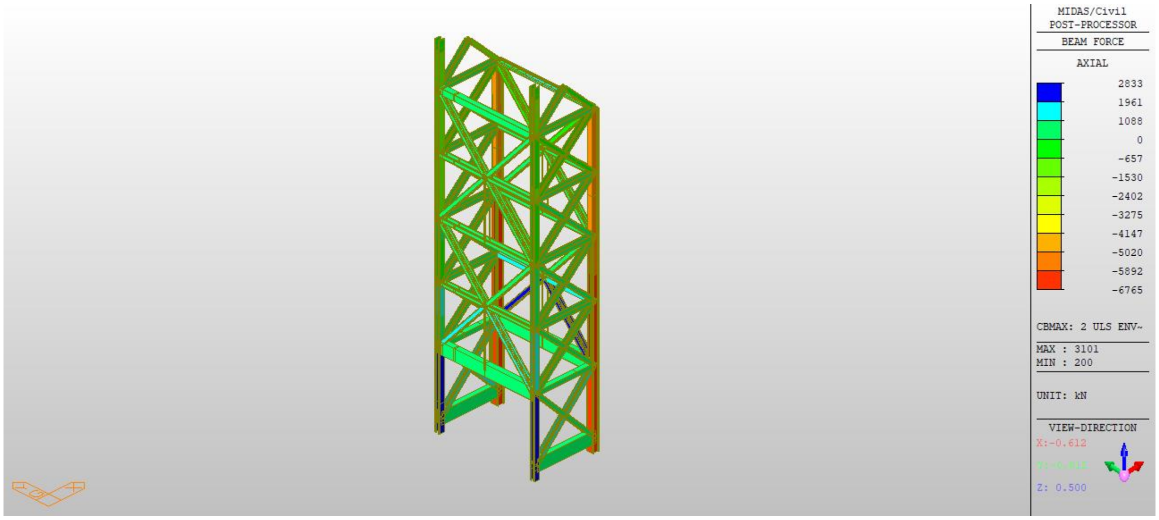

Figure 22 Truss Member - Case 2 ULS Axial Max

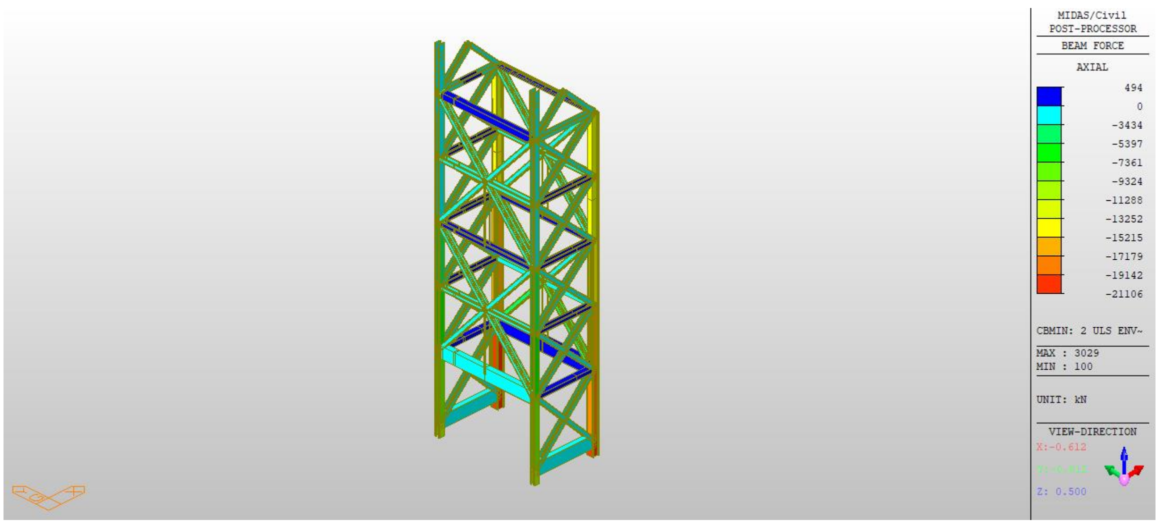

Figure 23 Truss Member - Case 2 ULS Axial Min

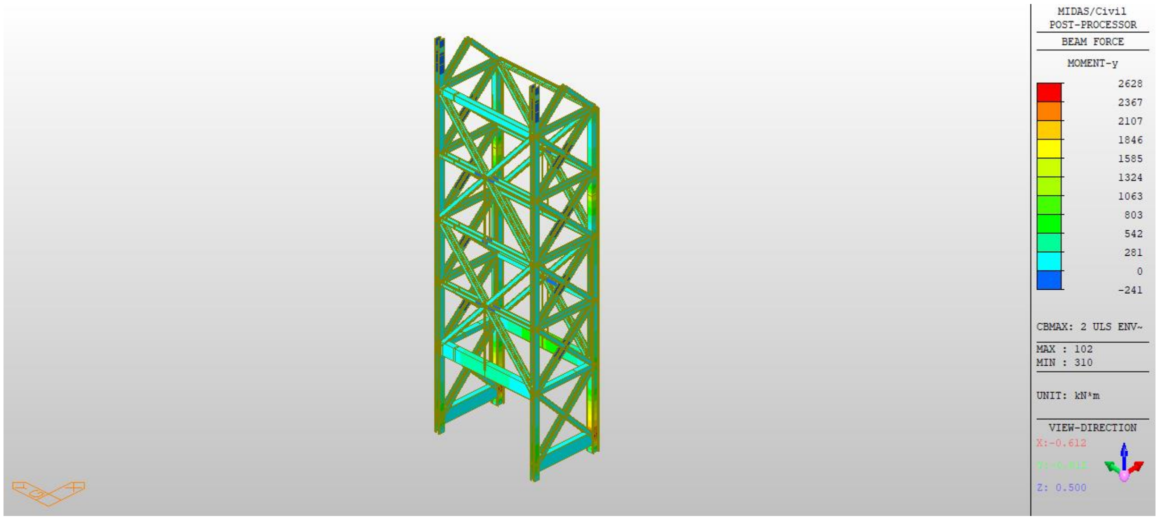

Figure 24 Truss Member - Case 2 ULS M_y Max

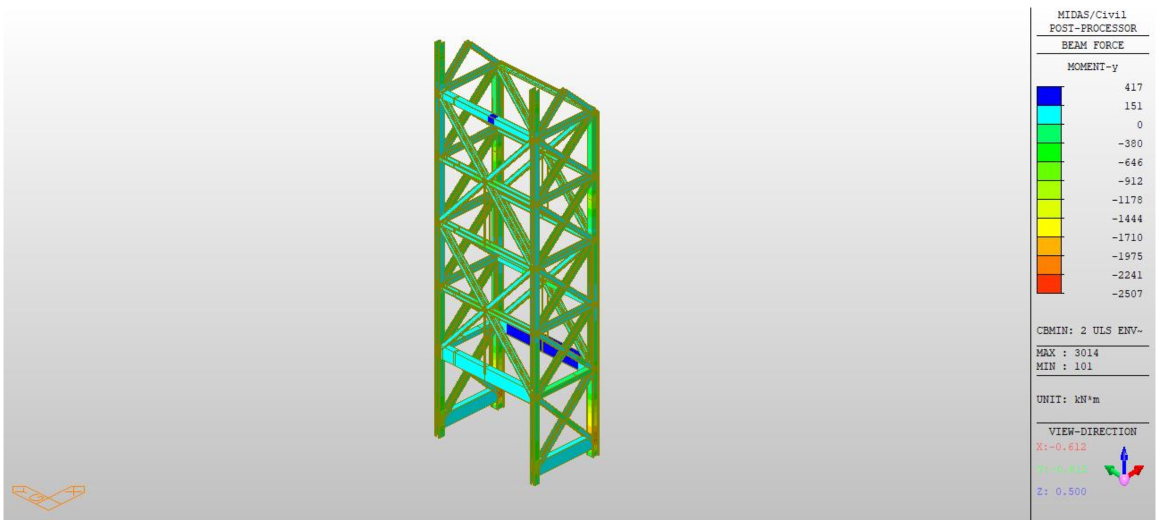

Figure 25 Truss Member - Case 2 ULS M_y Min

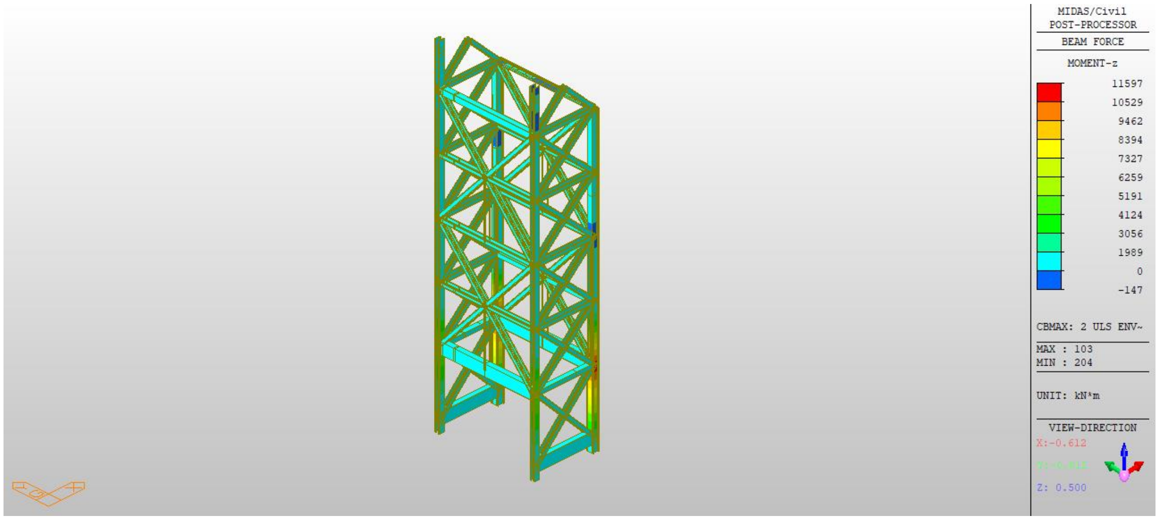

Figure 26 Truss Member - Case 2 ULS M_z Max

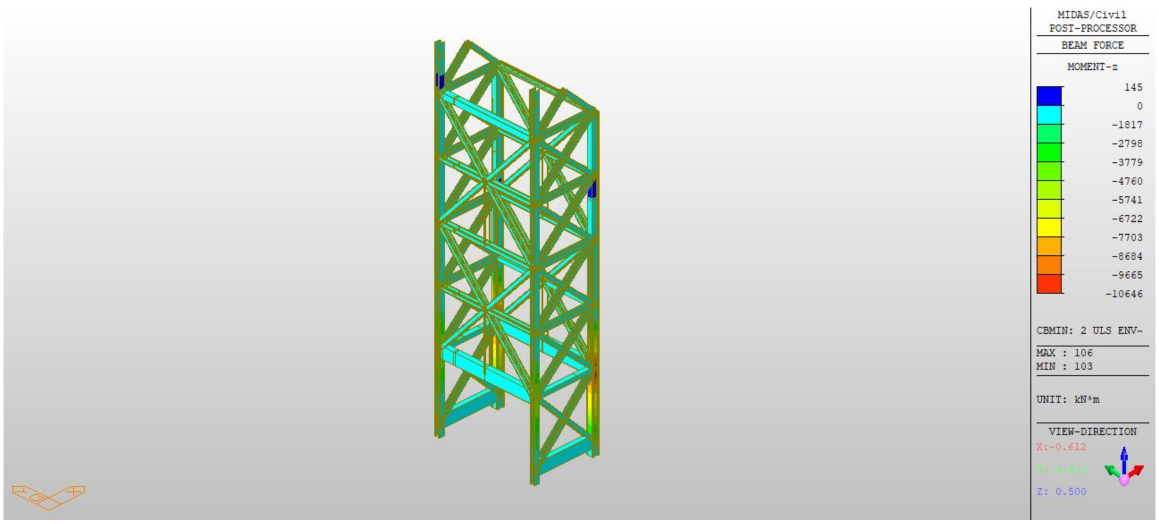

Figure 27 Truss Member - Case 2 ULS M_z Min

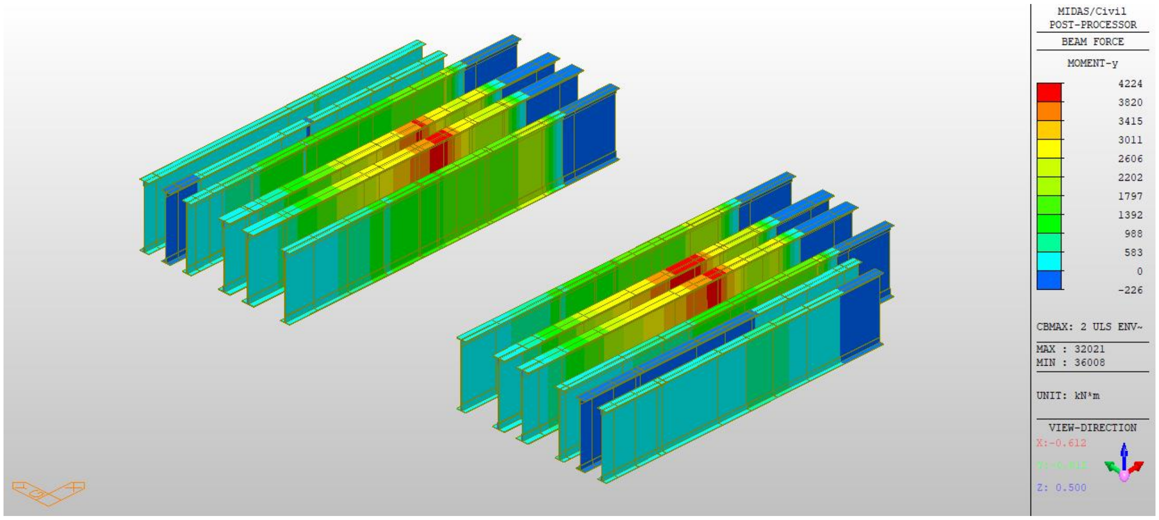

Figure 28 Girders G1 G2 G3 G4 G6 - Case 2 ULS M_y Max

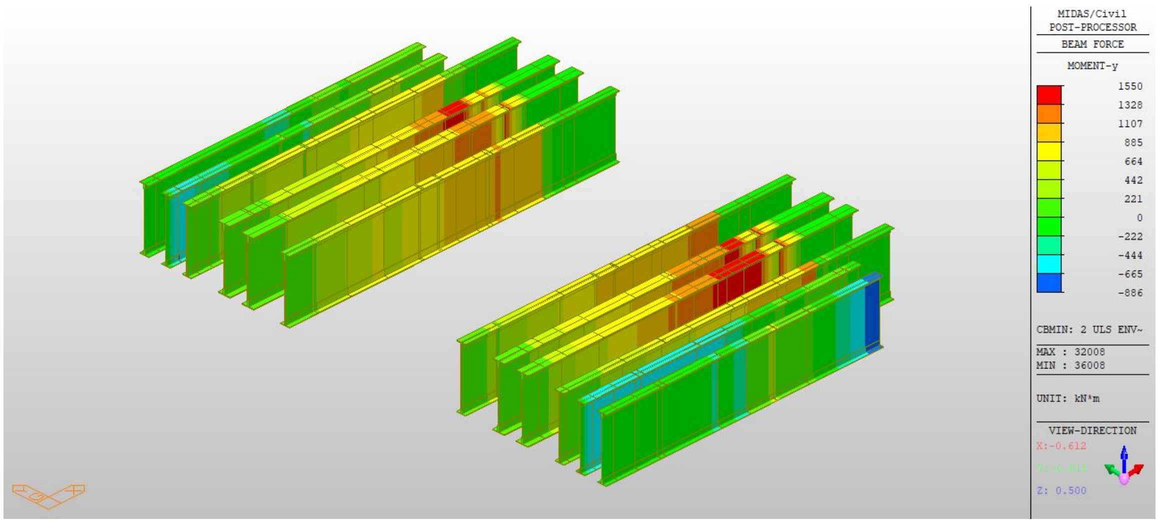

Figure 29 Girders G1 G2 G3 G4 G6 - Case 2 ULS M_y Min

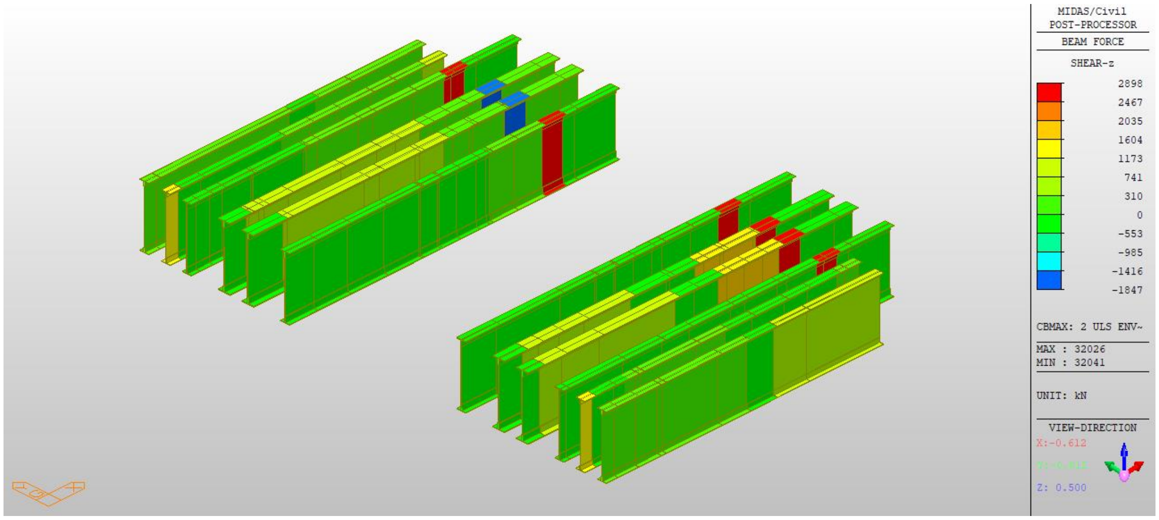

Figure 30 Girders G1 G2 G3 G4 G6 - Case 2 ULS F_z Max

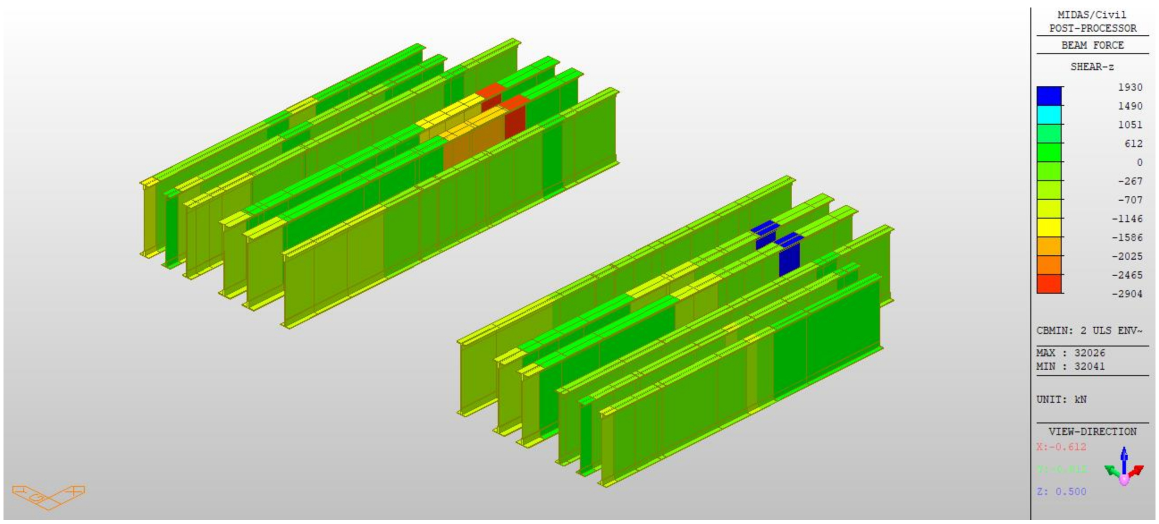

Figure 31 Girders G1 G2 G3 G4 G6 - Case 2 ULS F_z Min

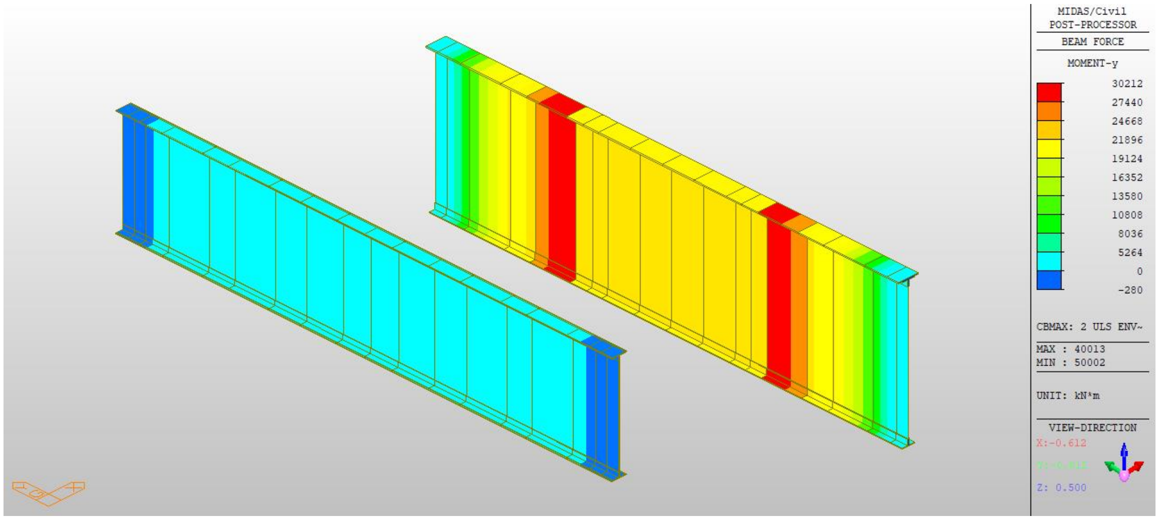

Figure 32 Girders G7 and G8 - Case 2 ULS M_y Max

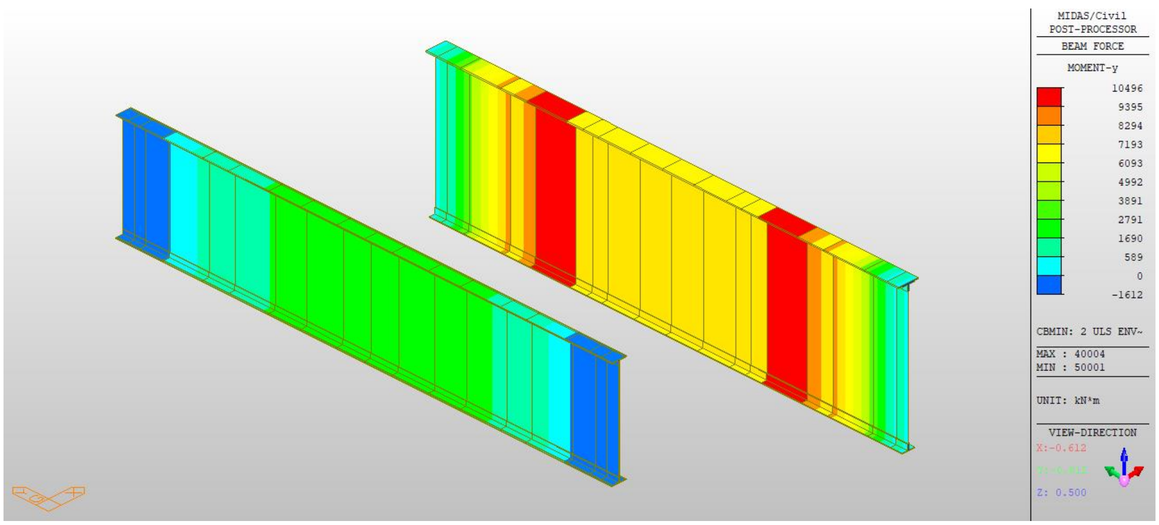

Figure 33 Girders G7 and G8 - Case 2 ULS M_y Min

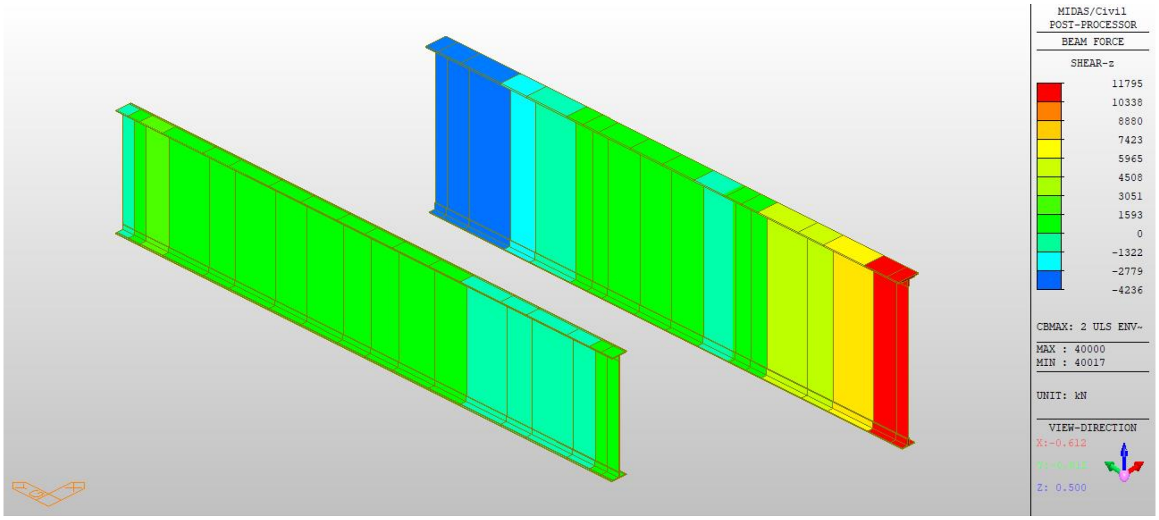

Figure 34 Girders G7 and G8 - Case 2 ULS F_z Max

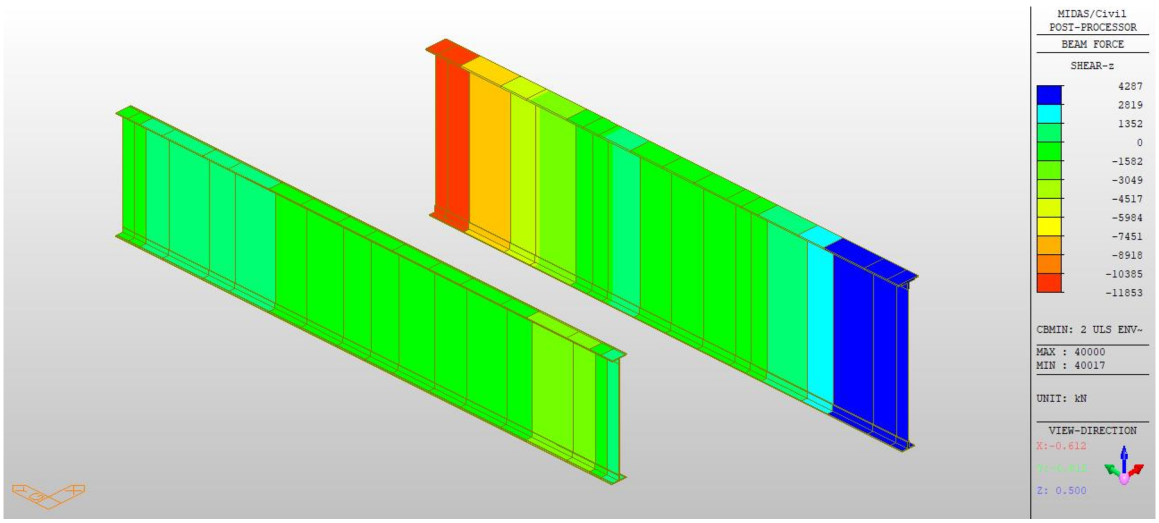

Figure 35 Girders G7 and G8 - Case 2 ULS F_z Min

Exhibit C.2.4. Rehabilitation Case 3

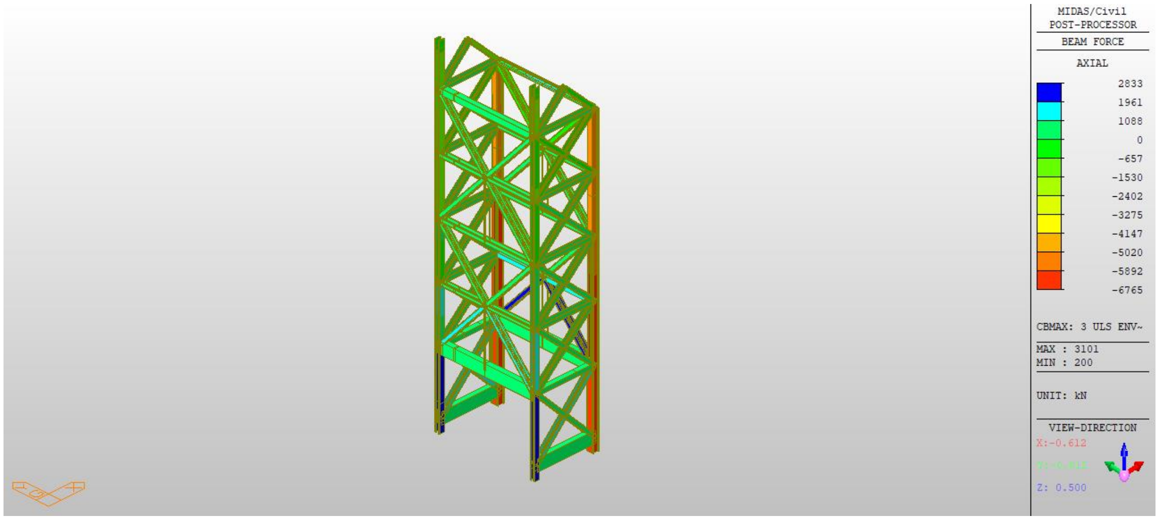

Figure 36 Truss Member - Case 3 ULS Axial Max

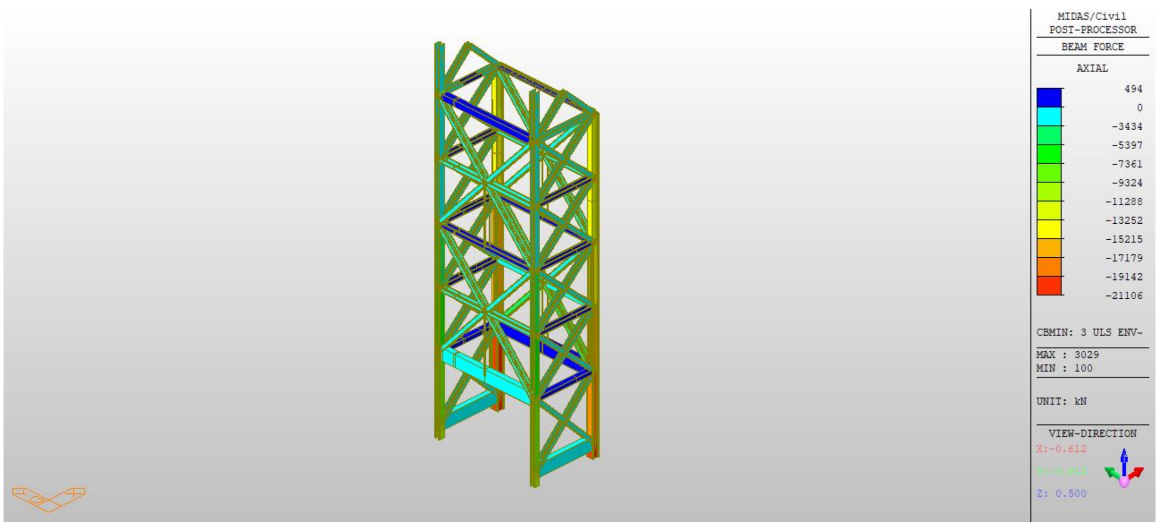

Figure 37 Truss Member - Case 3 ULS Axial Min

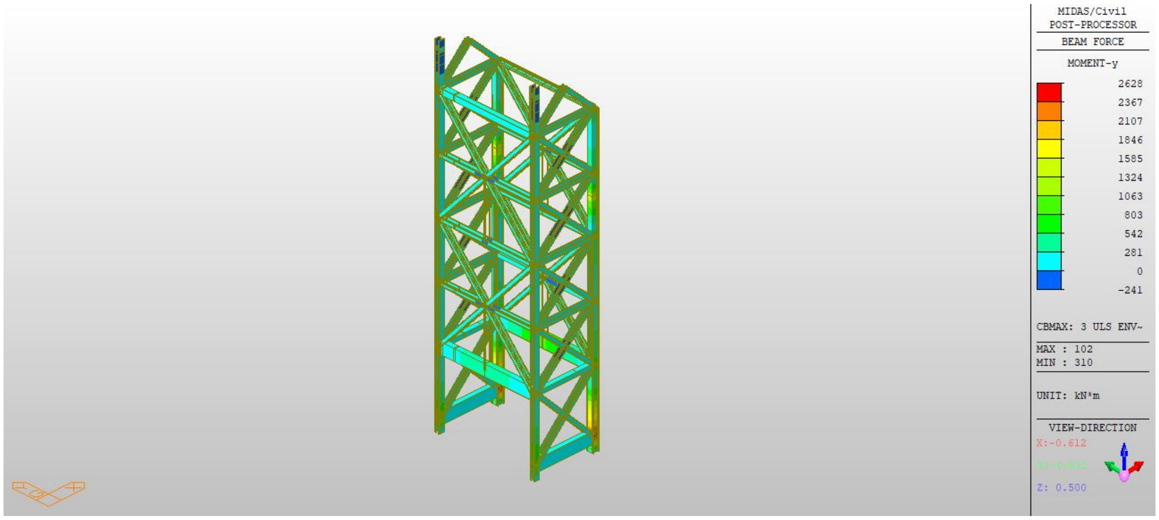

Figure 38 Truss Member - Case 3 ULS M_y Max

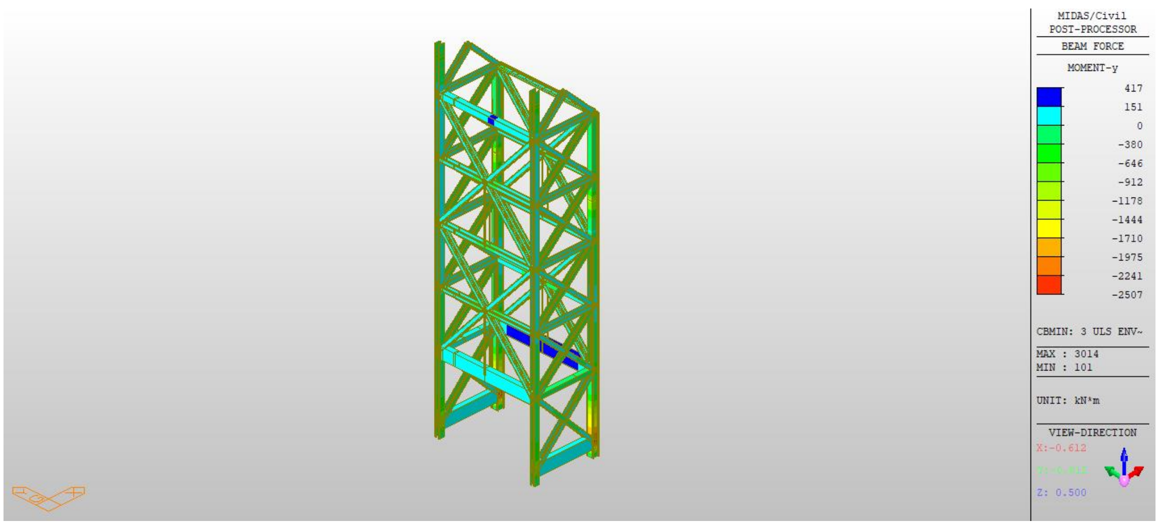

Figure 39 Truss Member - Case 3 ULS M_y Min

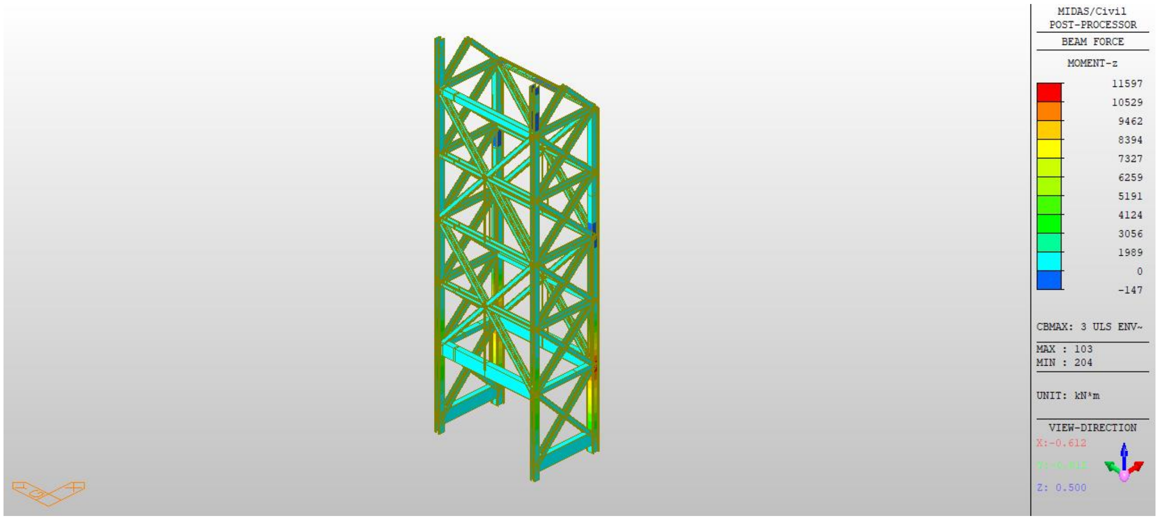

Figure 40 Truss Member - Case 3 ULS M_z Max

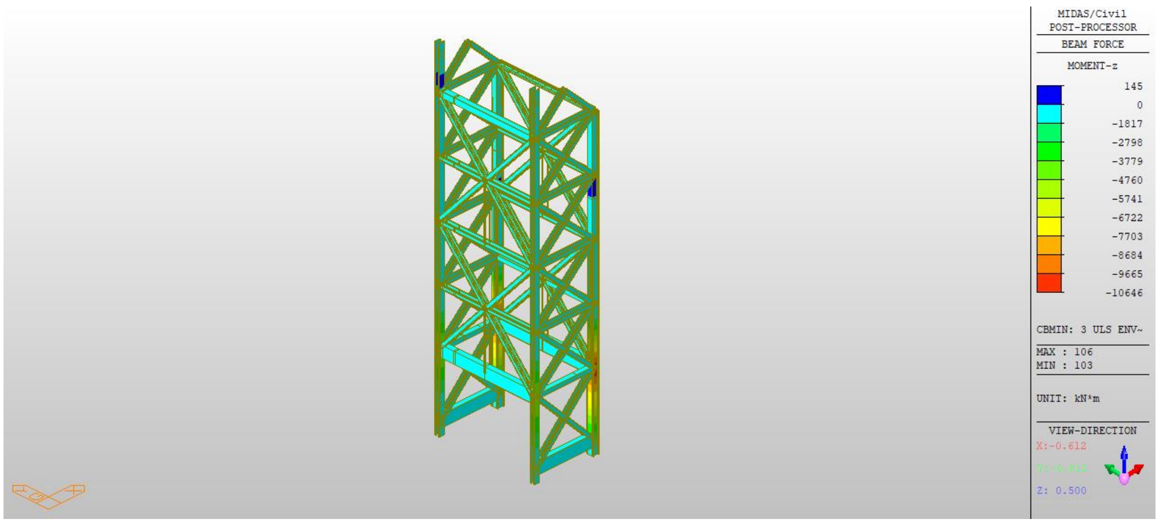

Figure 41 Truss Member - Case 3 ULS M_z Min

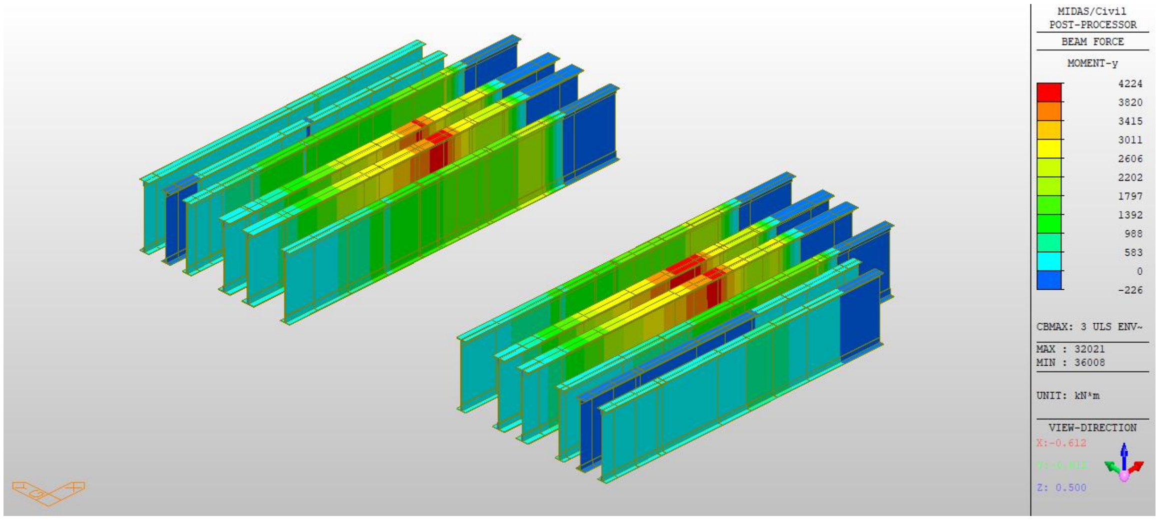

Figure 42 Girders G1 G2 G3 G4 G6 - Case 3 ULS M_y Max

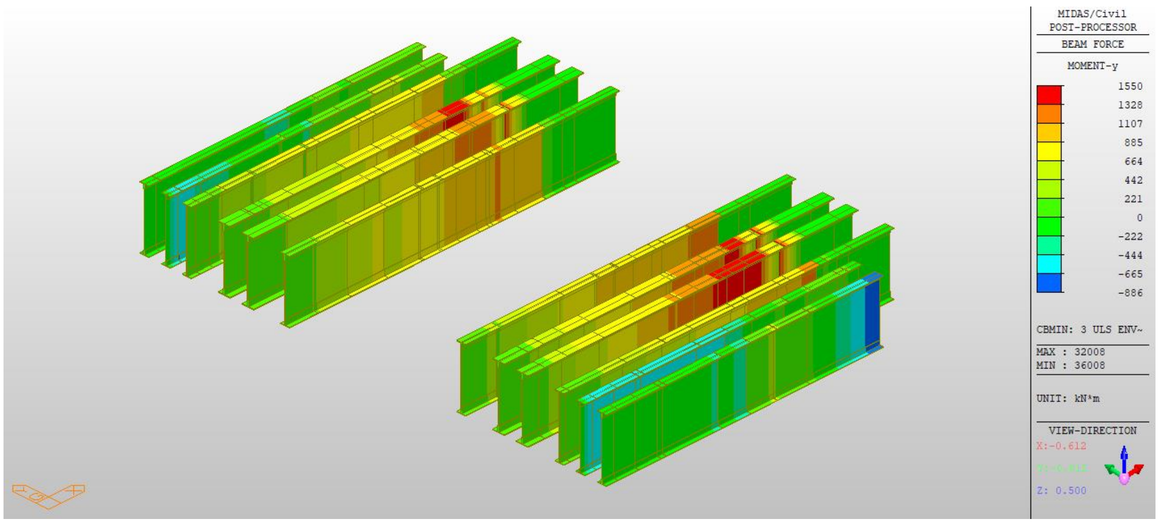

Figure 43 Girders G1 G2 G3 G4 G6 - Case 3 ULS M_y Min

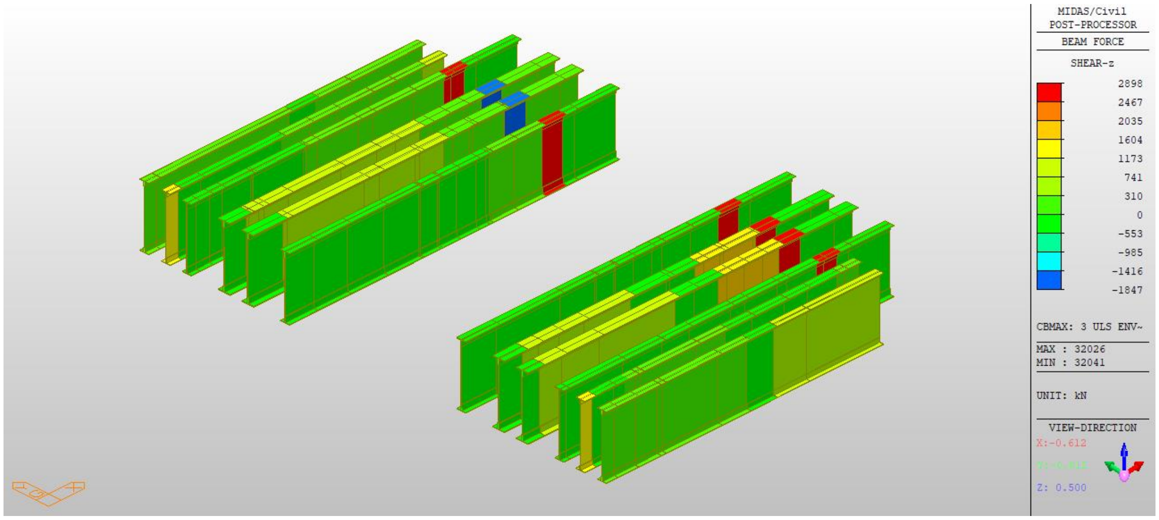

Figure 44 Girders G1 G2 G3 G4 G6 - Case 3 ULS F_z Max

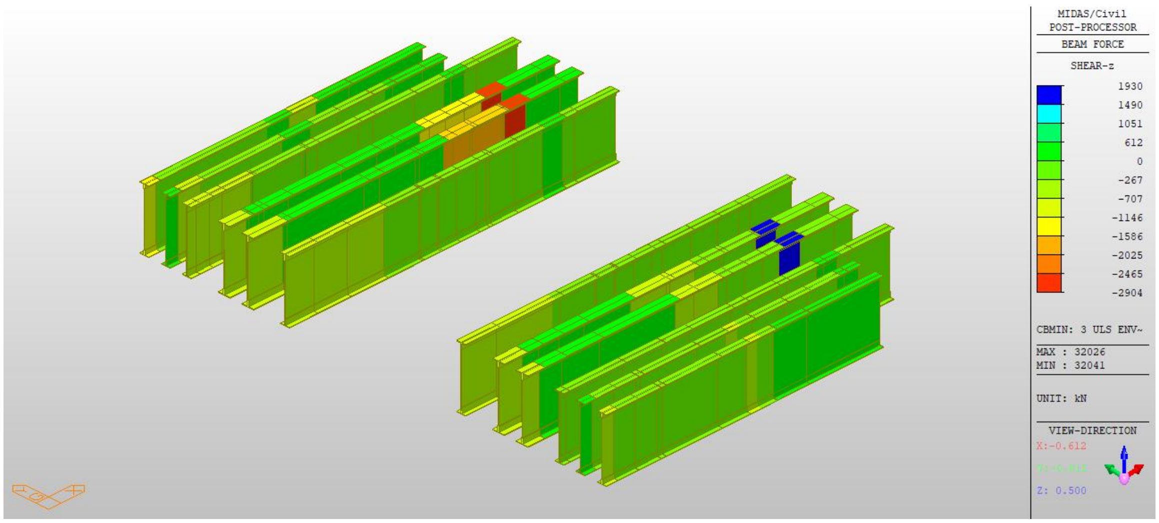

Figure 45 Girders G1 G2 G3 G4 G6 - Case 3 ULS F_z Min

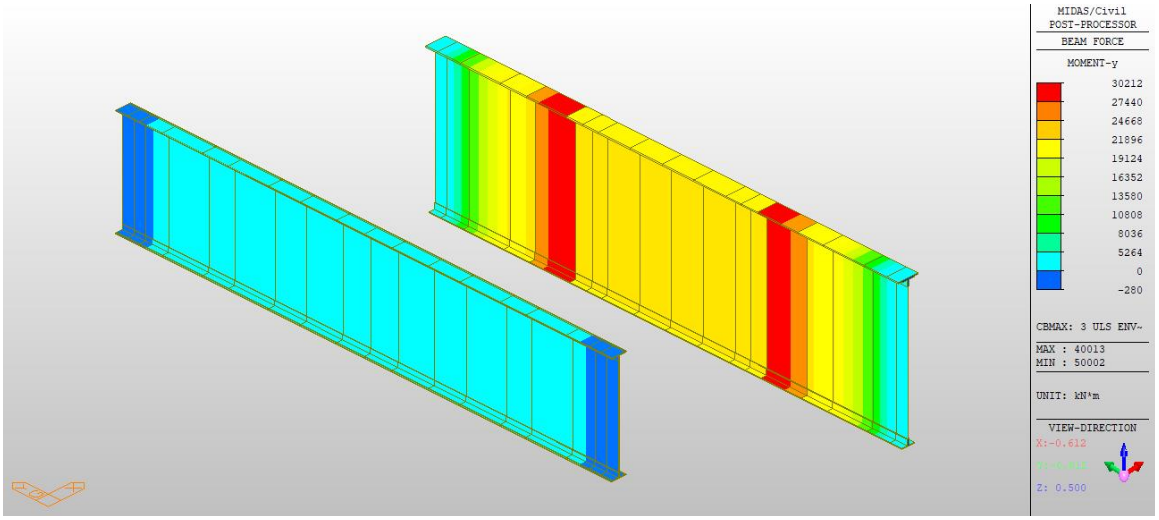

Figure 46 Girders G7 and Girders G7 3 ULS M_y Max

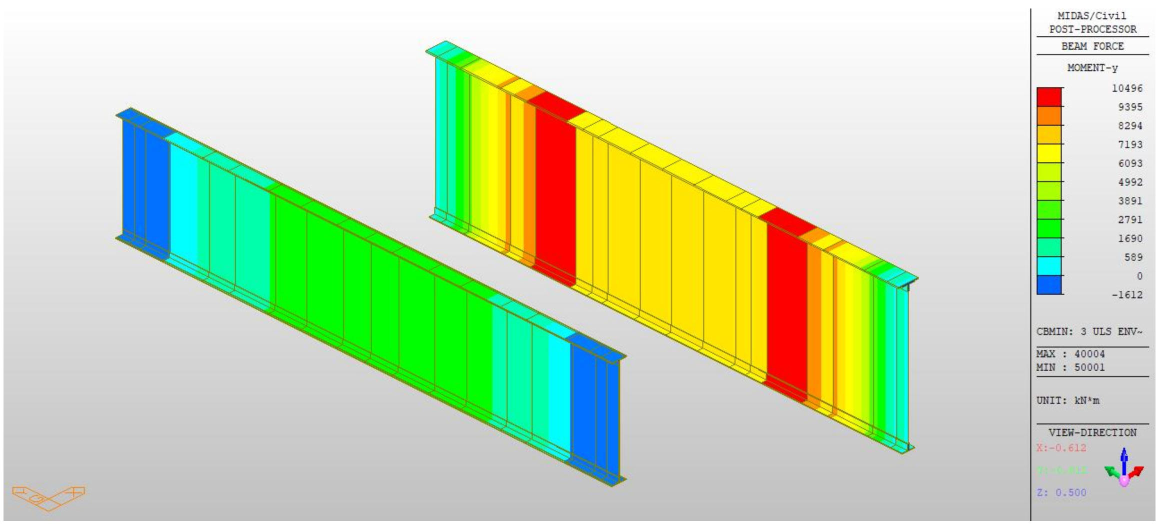

Figure 47 Girders G7 and Girders G7 3 ULS M_y Min

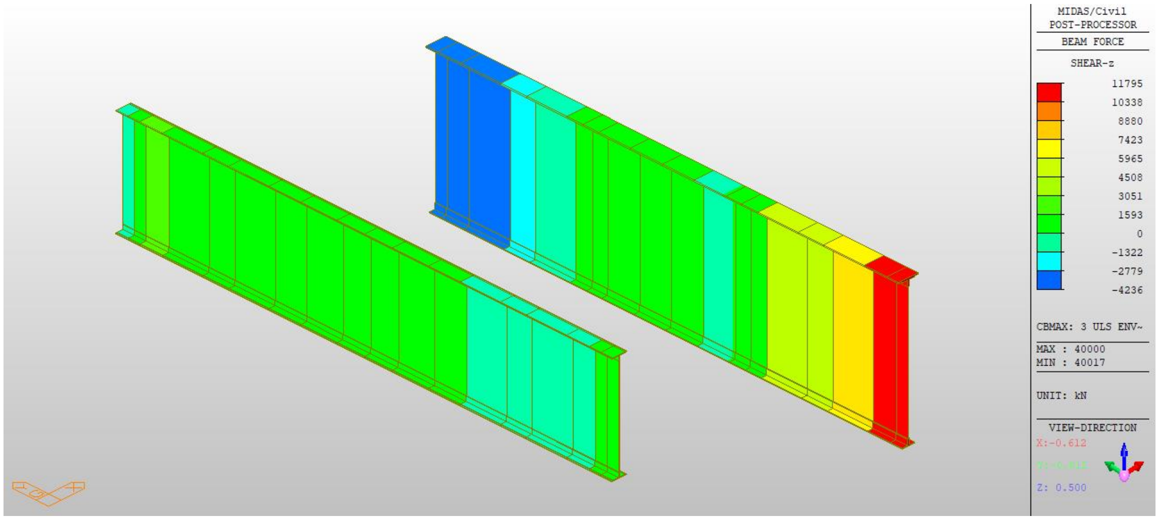

Figure 48 Girders G7 and Girders G7 3 ULS F_z Max

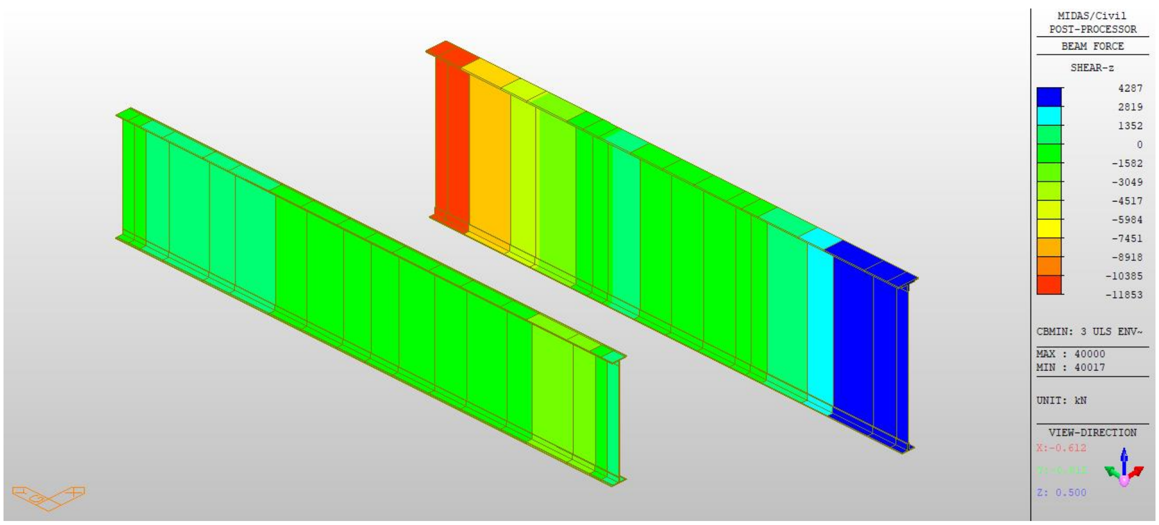

Figure 49 Girders G7 and Girders G7 3 ULS F_z Min

Exhibit C.2.5. Rehabilitation Case 4

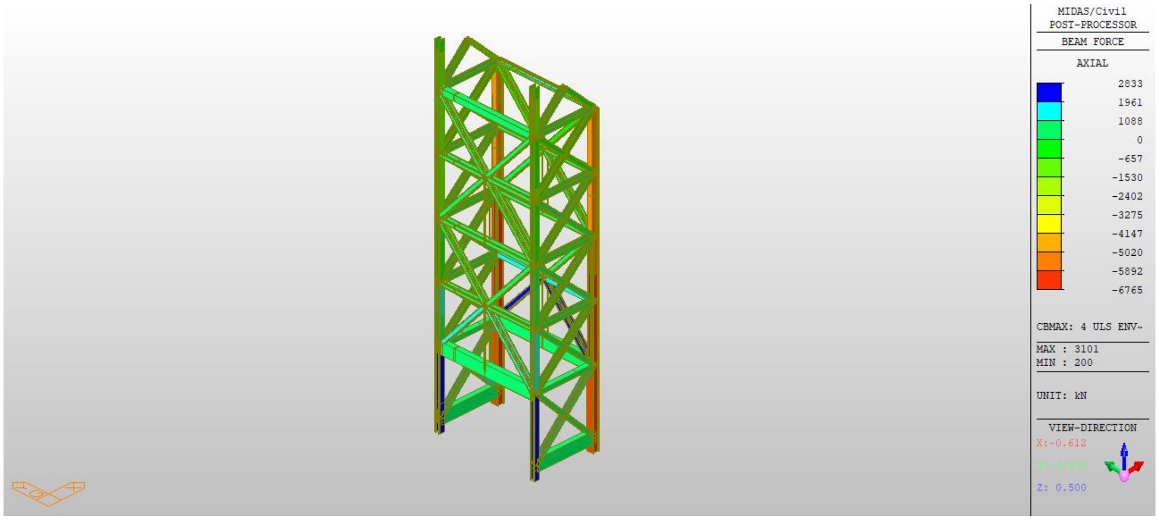

Figure 50 Truss Member - Case 4 ULS Axial Max

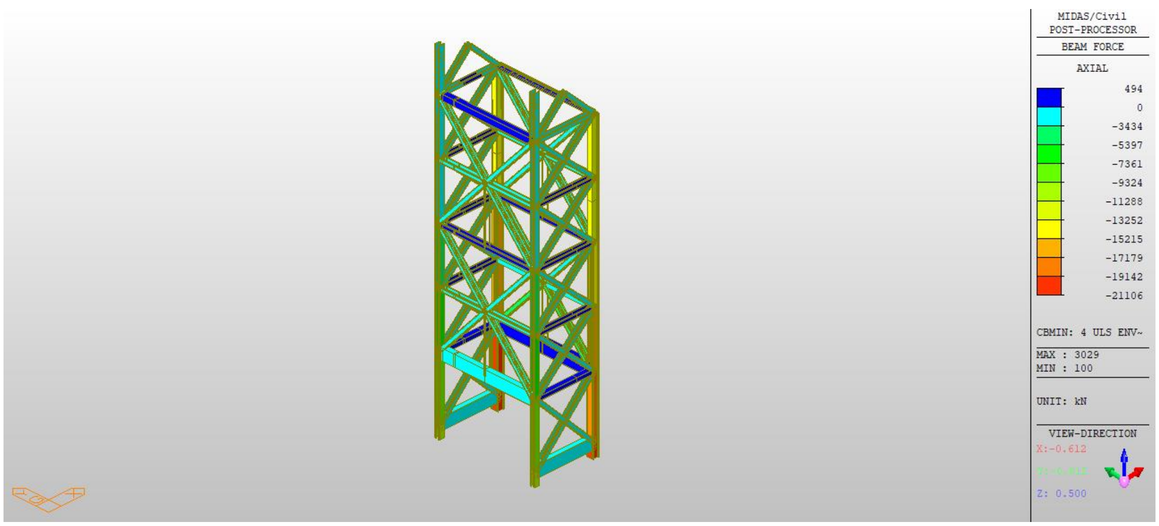

Figure 51 Truss Member - Case 4 ULS Axial Min

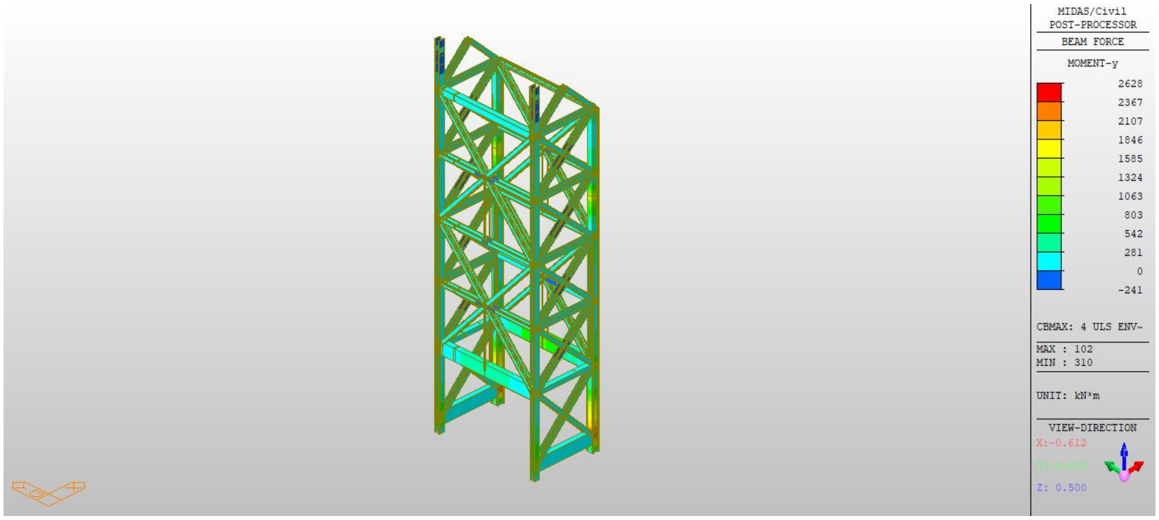

Figure 52 Truss Member - Case 4 ULS M_y Max

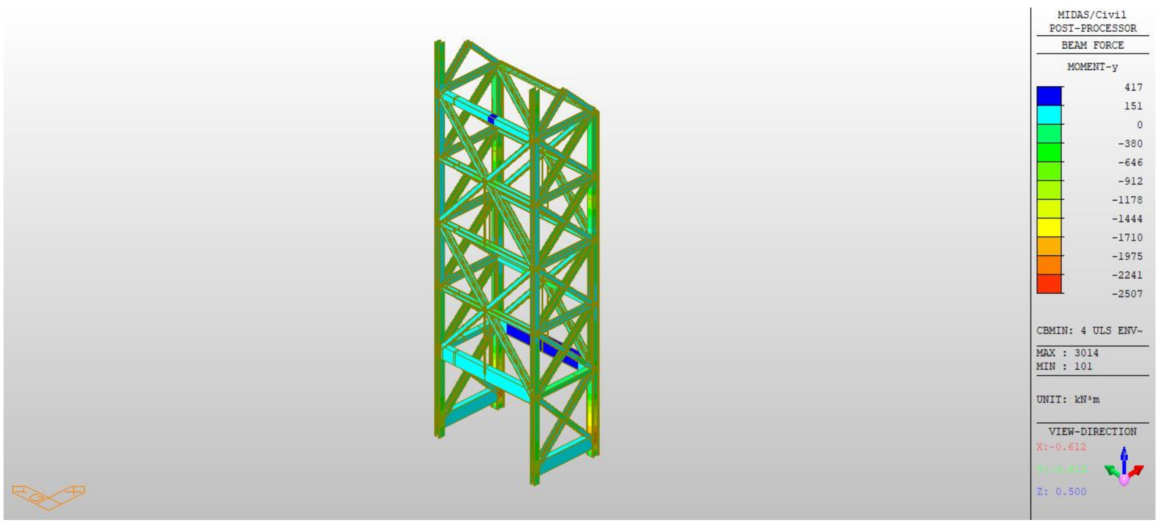

Figure 53 Truss Member - Case 4 ULS M_y Min

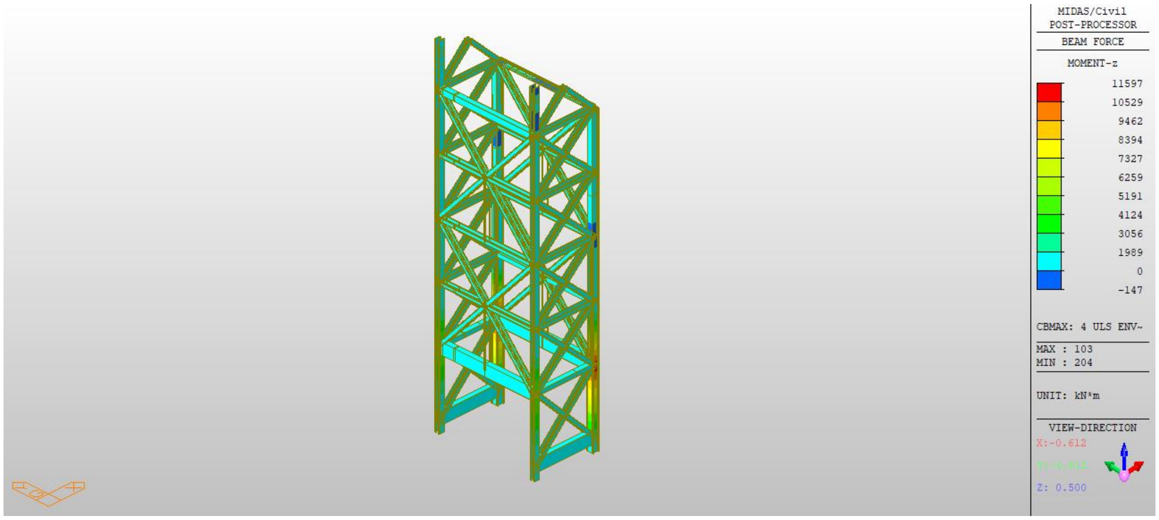

Figure 54 Truss Member - Case 4 ULS M_z Max

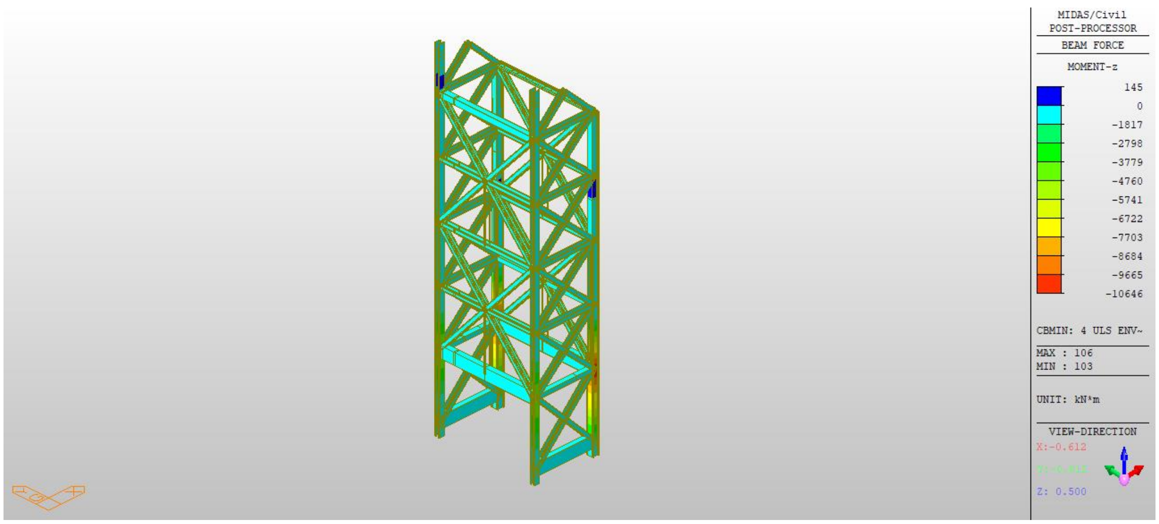

Figure 55 Truss Member - Case 4 ULS M_z Min

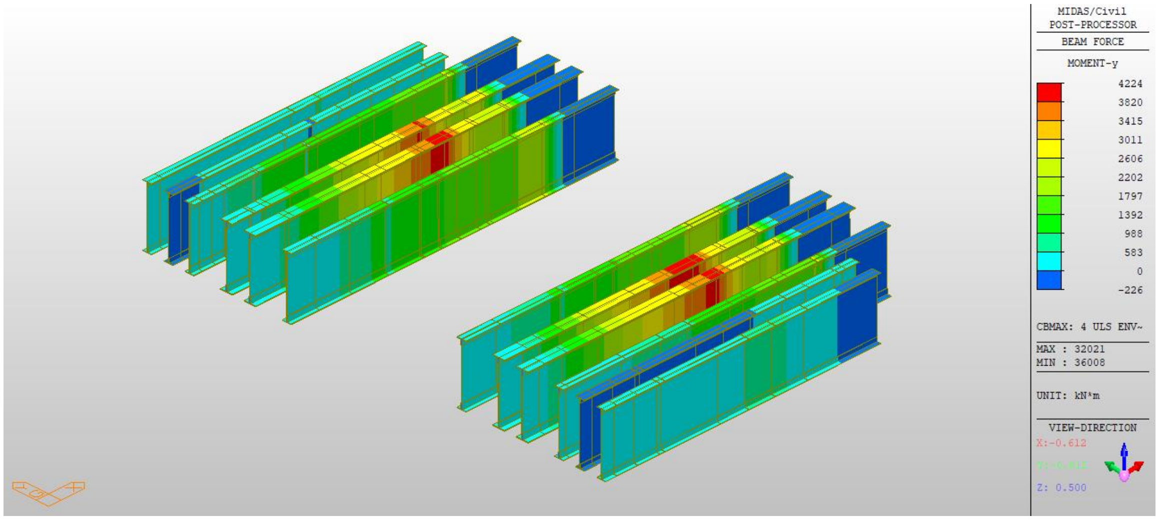

Figure 56 Girders G1 G2 G3 G4 G6 - Case 4 ULS M_y Max

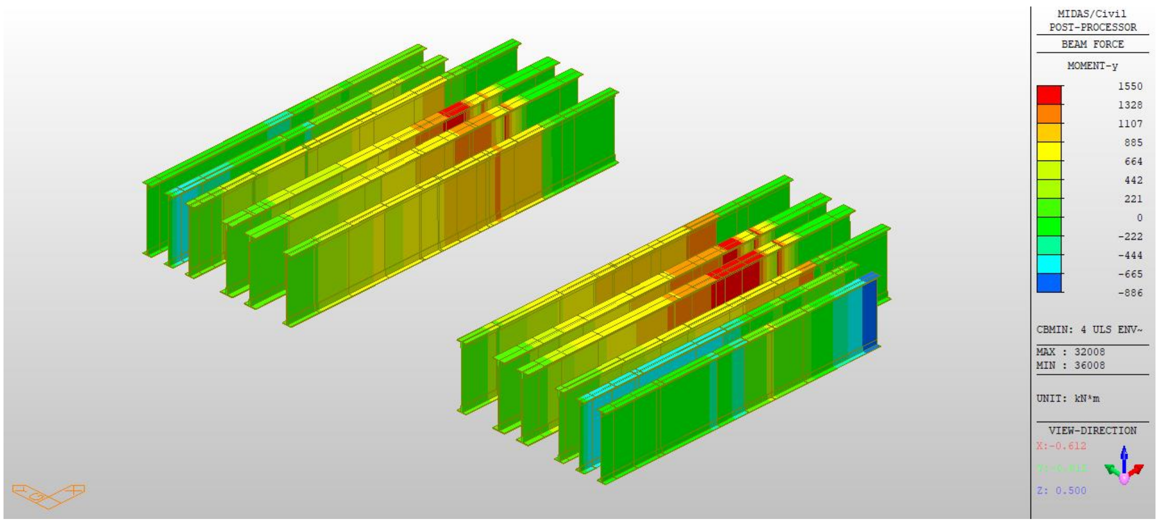

Figure 57 Girders G1 G2 G3 G4 G6 - Case 4 ULS M_y Min

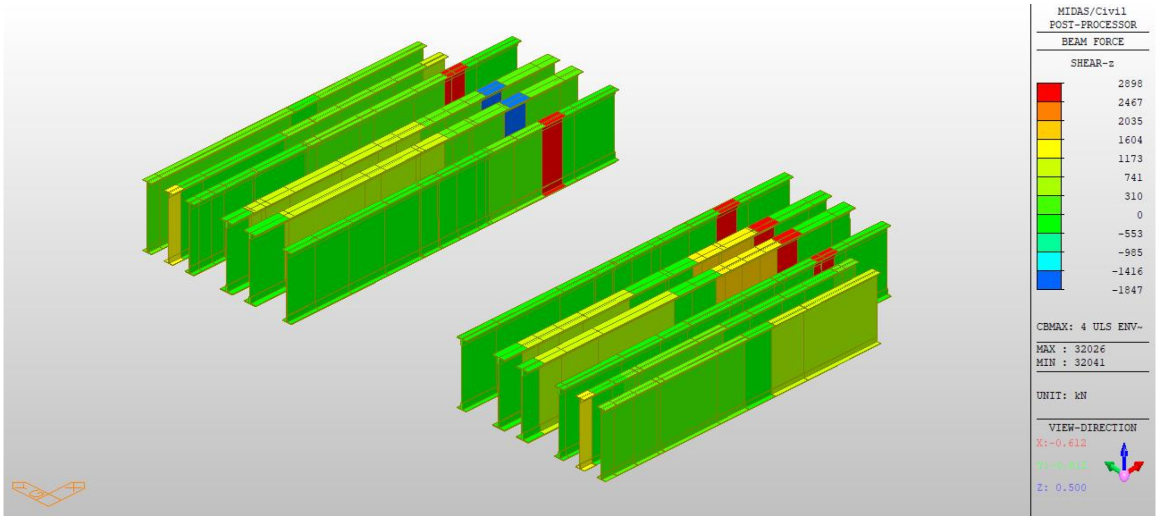

Figure 58 Girders G1 G2 G3 G4 G6 - Case 4 ULS F_z Max

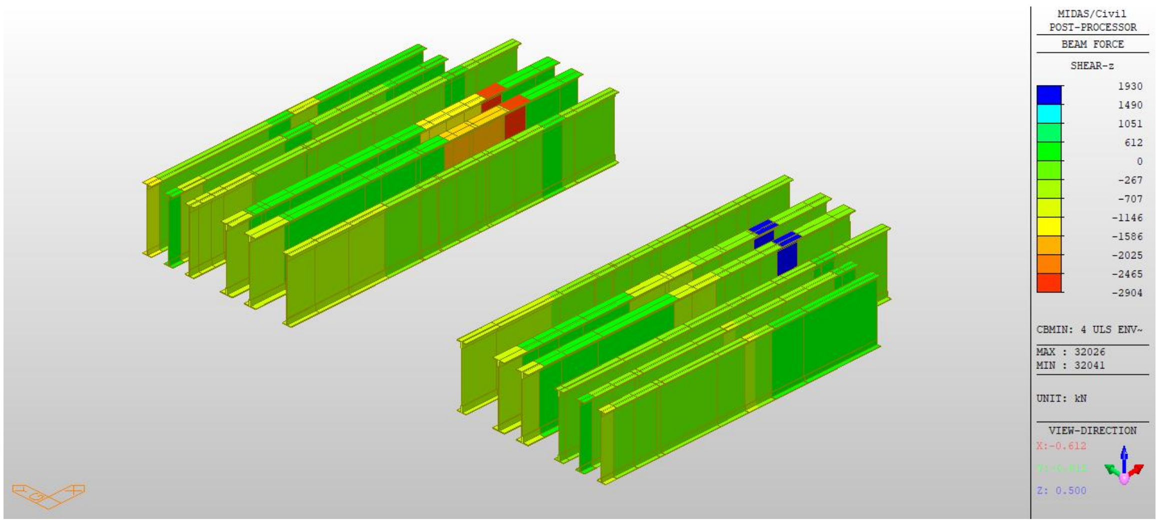

Figure 59 Girders G1 G2 G3 G4 G6 - Case 4 ULS F_z Min

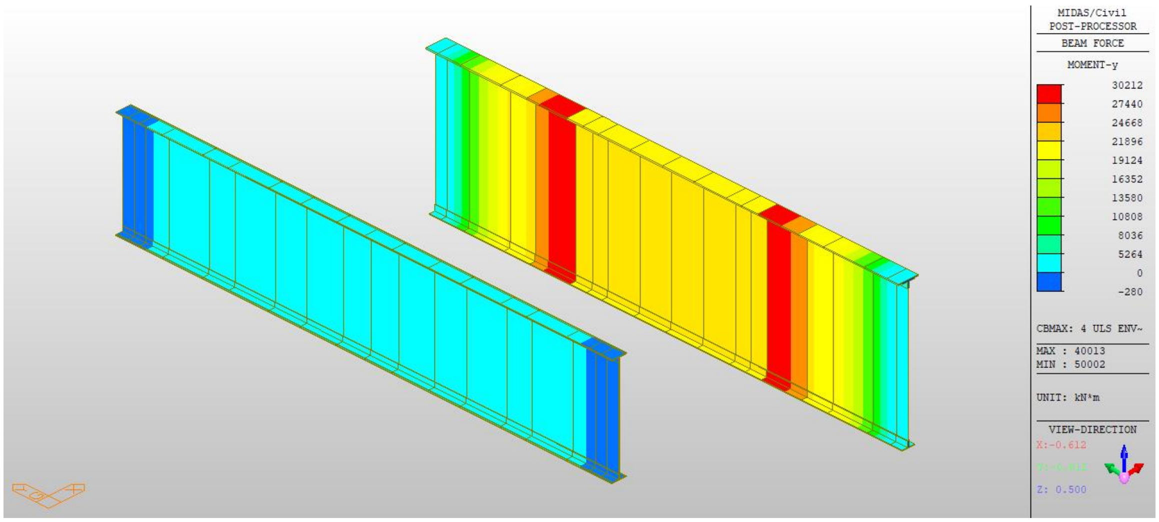

Figure 60 Girders G7 and G8 - Case 4 ULS M_y Max

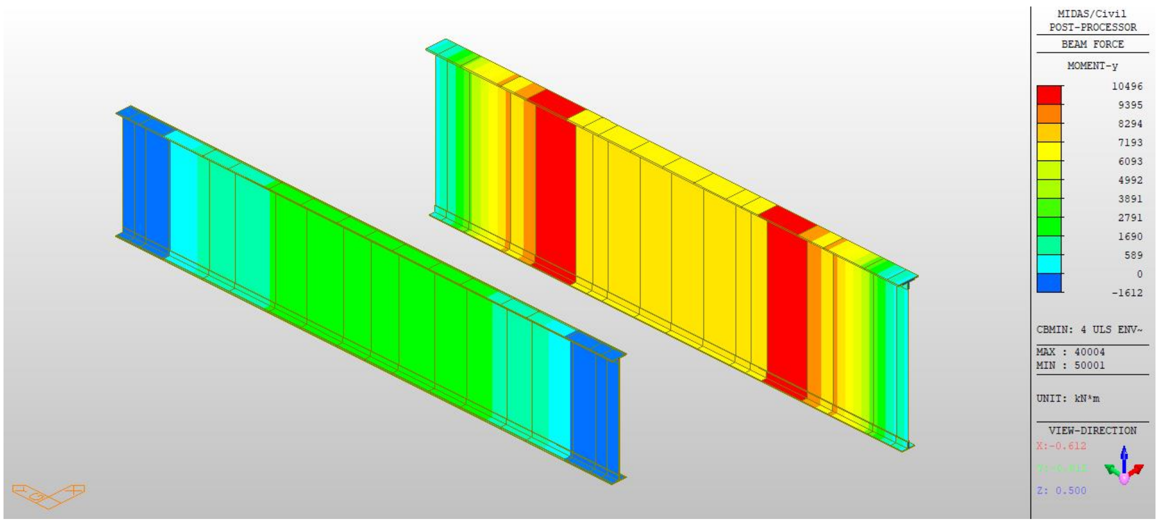

Figure 61 Girders G7 and G8 - Case 4 ULS M_y Min

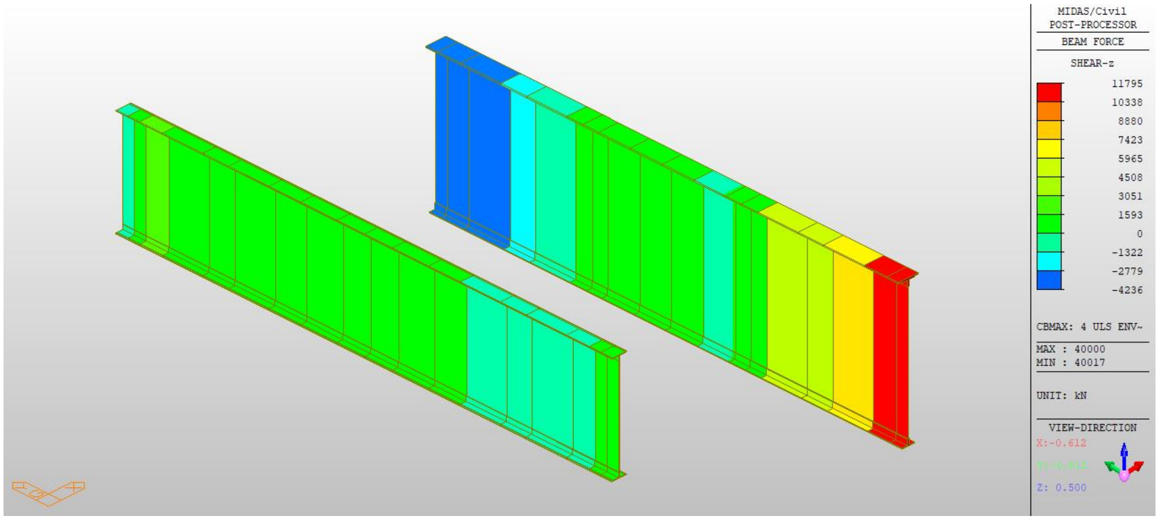

Figure 62 Girders G7 and G8 - Case 4 ULS F_z Max

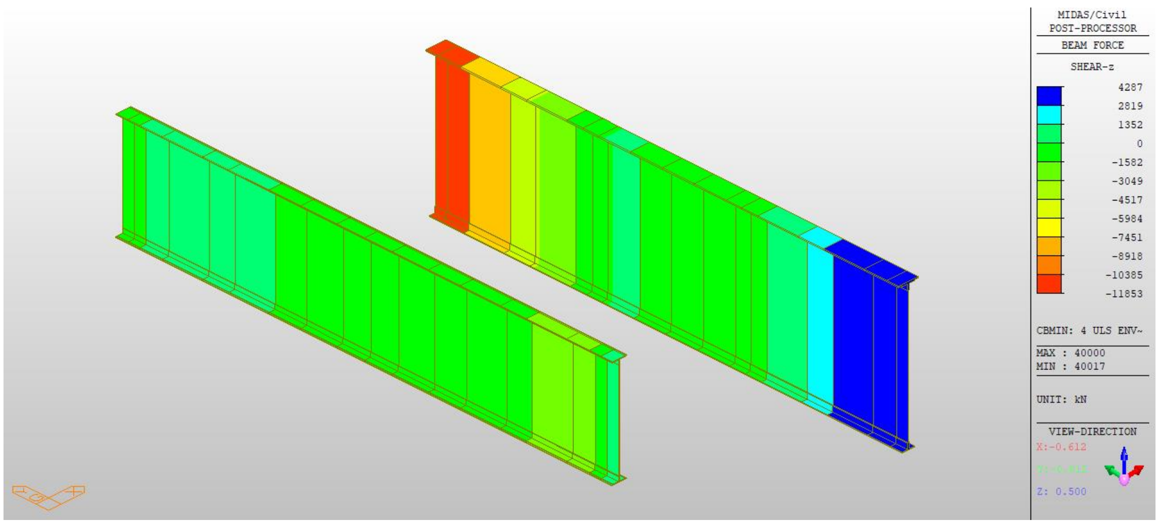

Figure 63 Girders G7 and G8 - Case 4 ULS F_z Min

Exhibit C.2.6. Rehabilitation Case 5

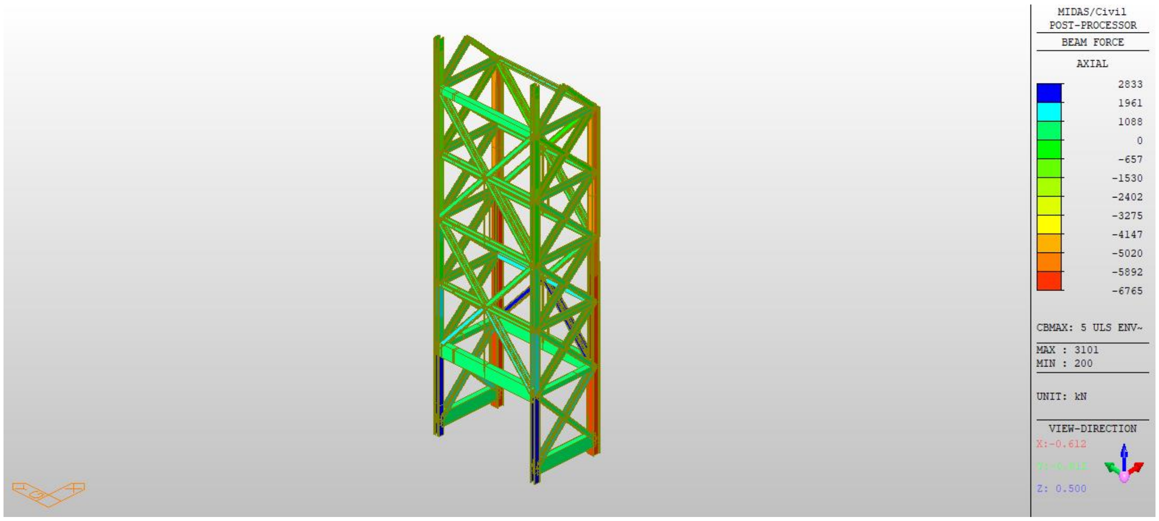

Figure 64 Truss Member - Case 5 ULS Axial Max

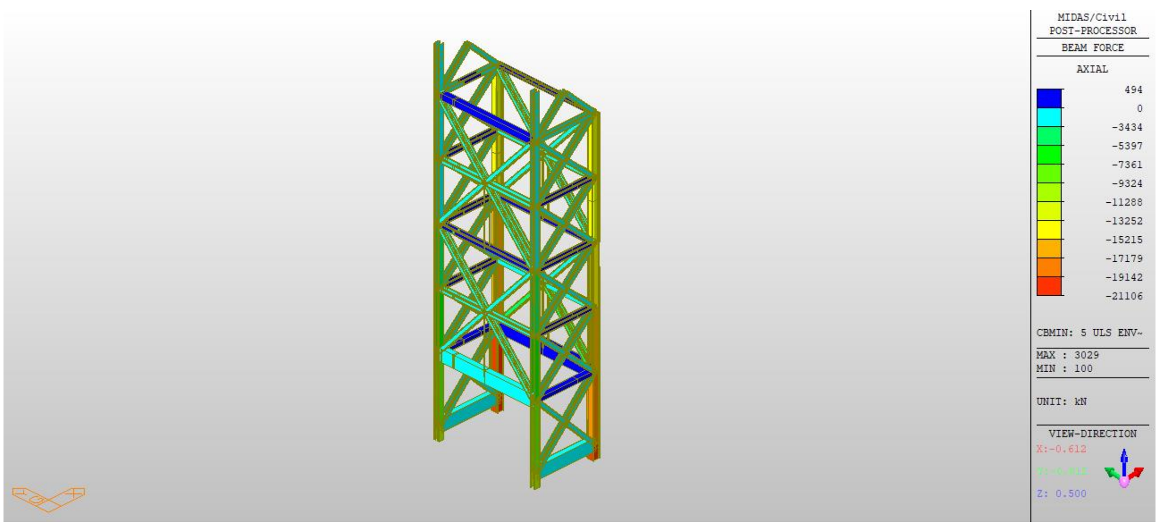

Figure 65 Truss Member - Case 5 ULS Axial Min

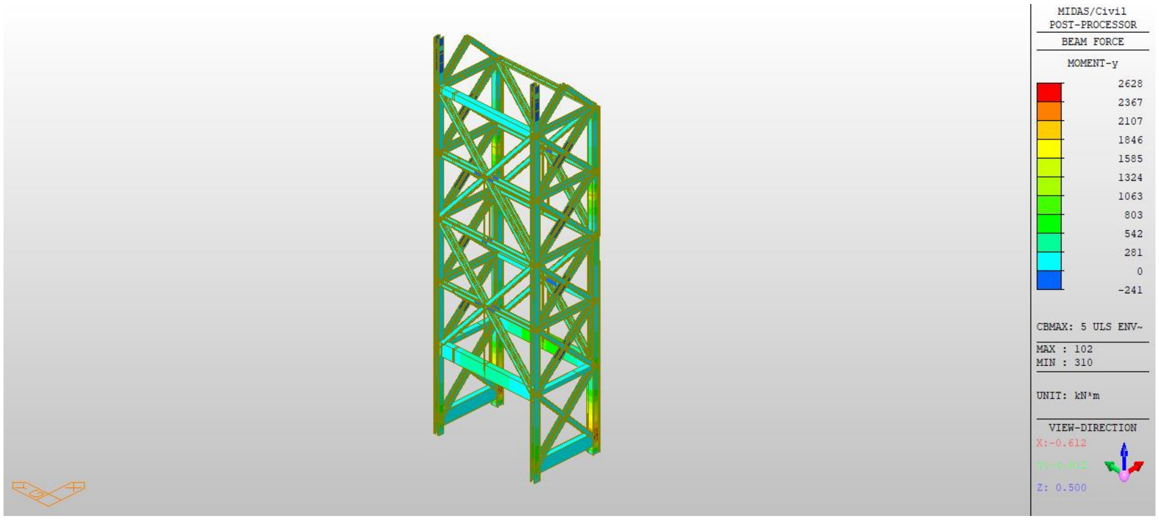

Figure 66 Truss Member - Case 5 ULS M_y Max

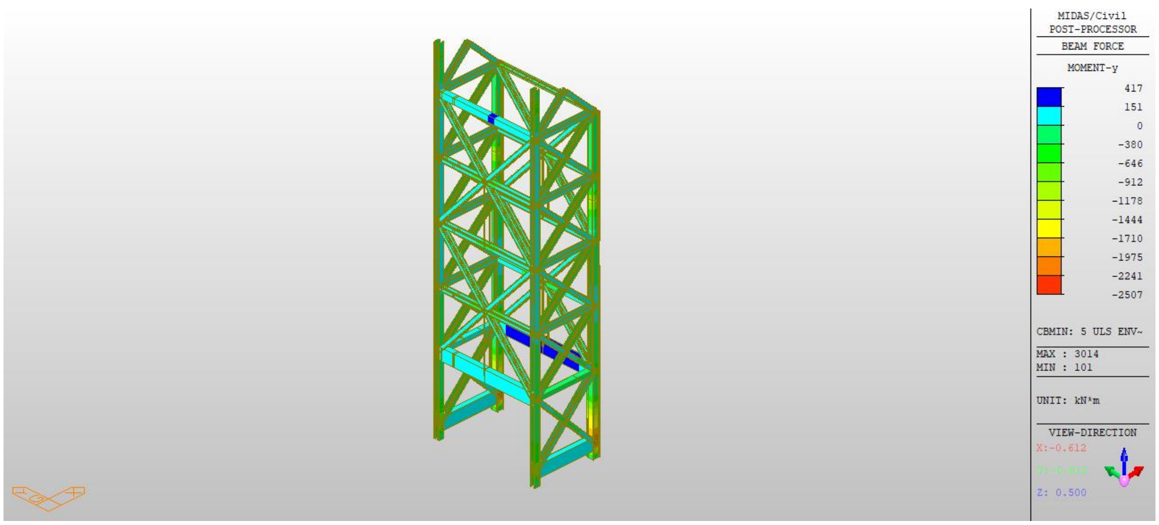

Figure 67 Truss Member - Case 5 ULS M_y Min

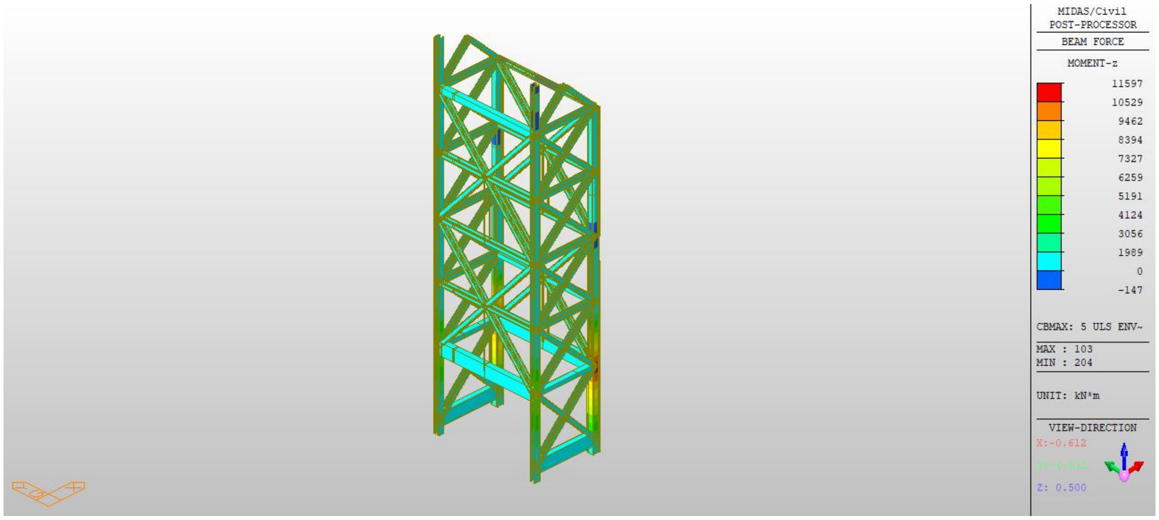

Figure 68 Truss Member - Case 5 ULS M_z Max

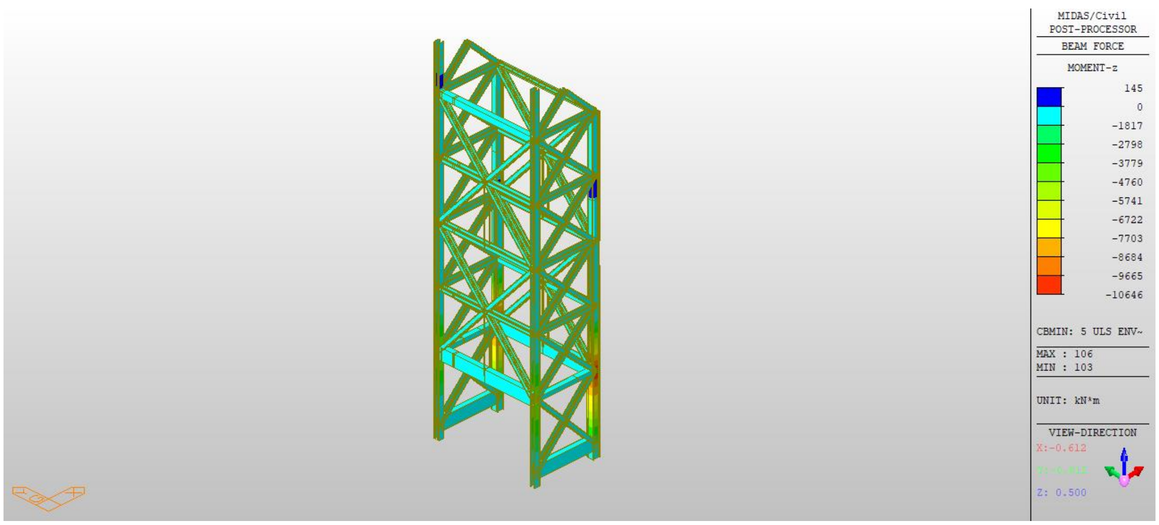

Figure 69 Truss Member - Case 5 ULS M_z Min

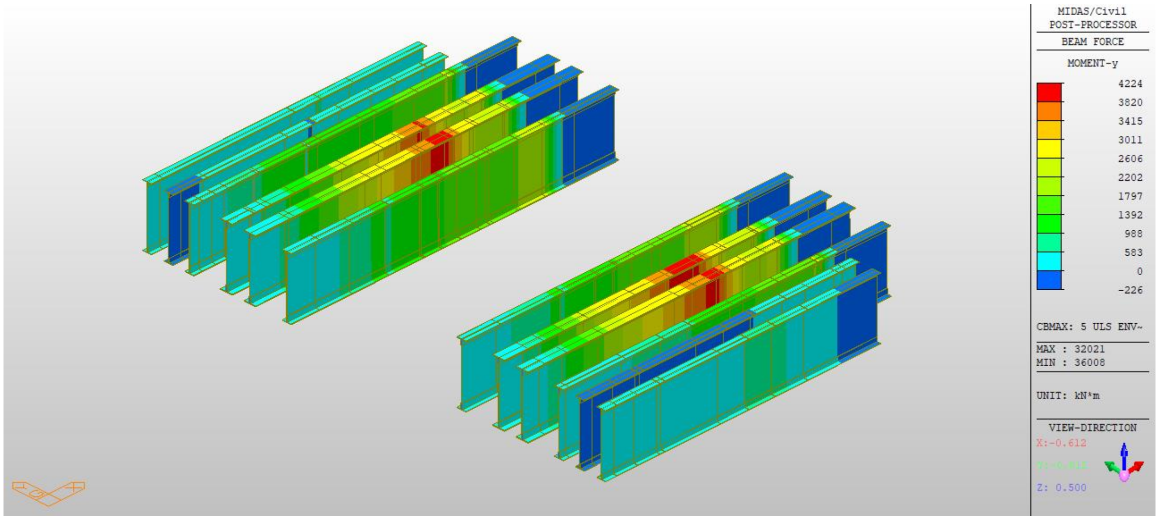

Figure 70 Girders G1 G2 G3 G4 G6 - Case 5 ULS M_y Max

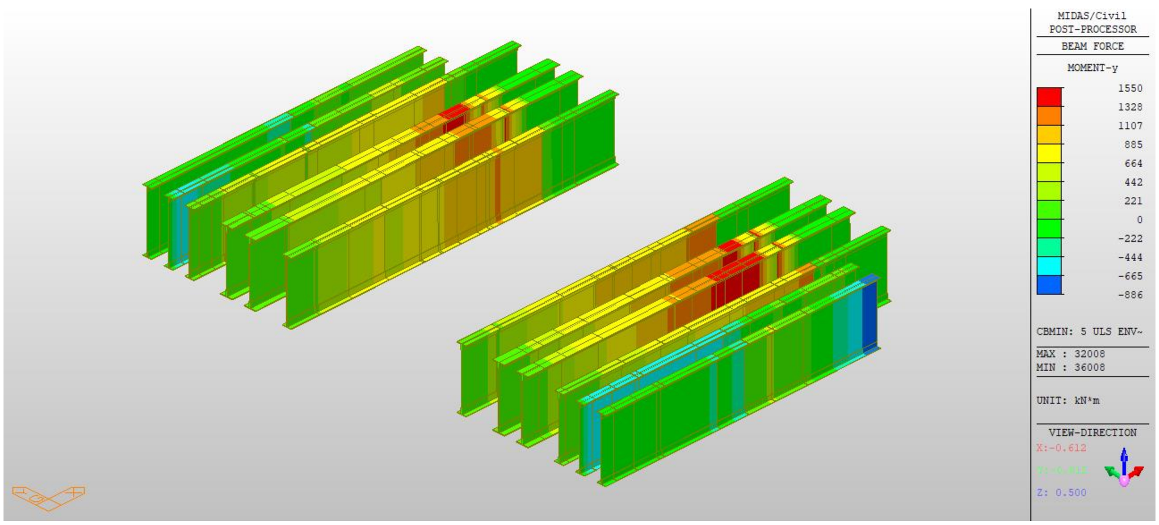

Figure 71 Girders G1 G2 G3 G4 G6 - Case 5 ULS M_y Min

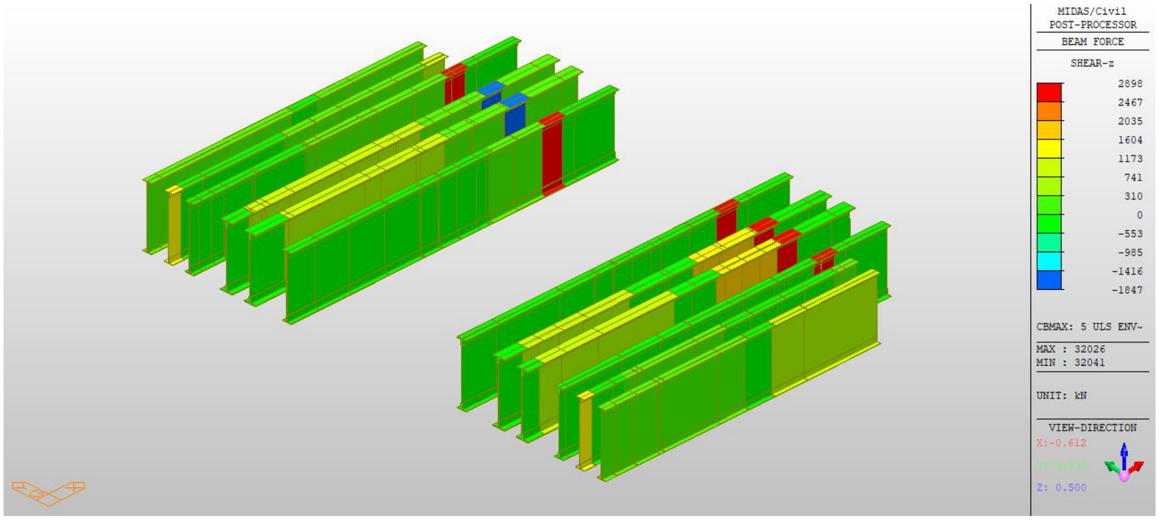

Figure 72 Girders G1 G2 G3 G4 G6 - Case 5 ULS F_z Max

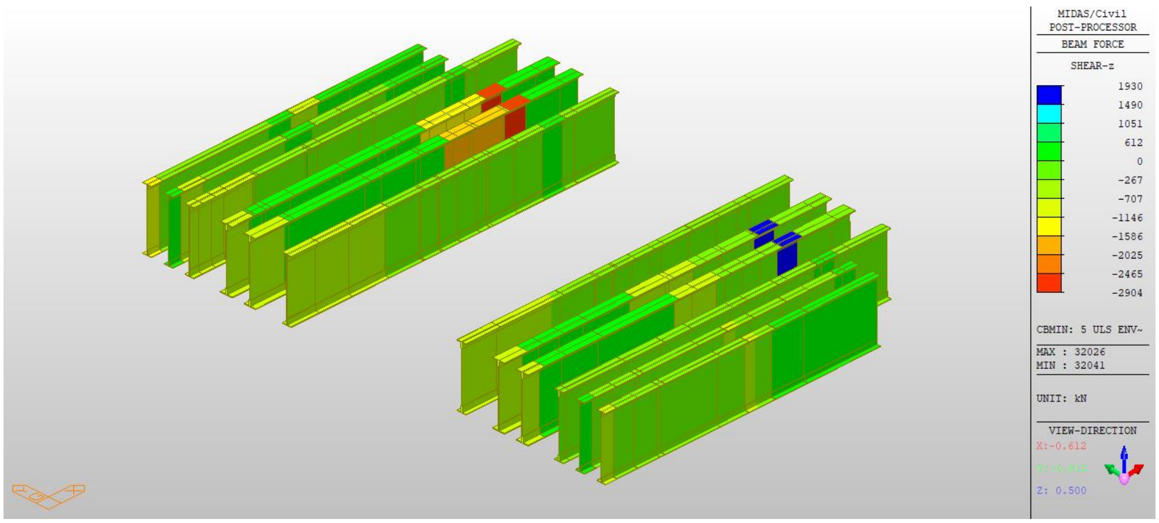

Figure 73 Girders G1 G2 G3 G4 G6 - Case 5 ULS F_z Min

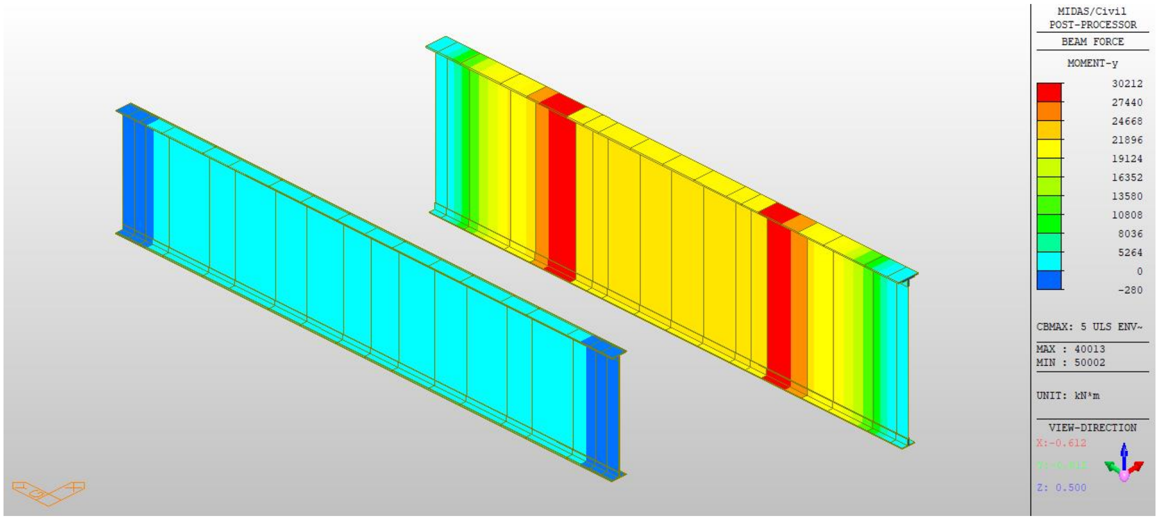

Figure 74 Girders G7 and G8 - Case 5 ULS M_y Max

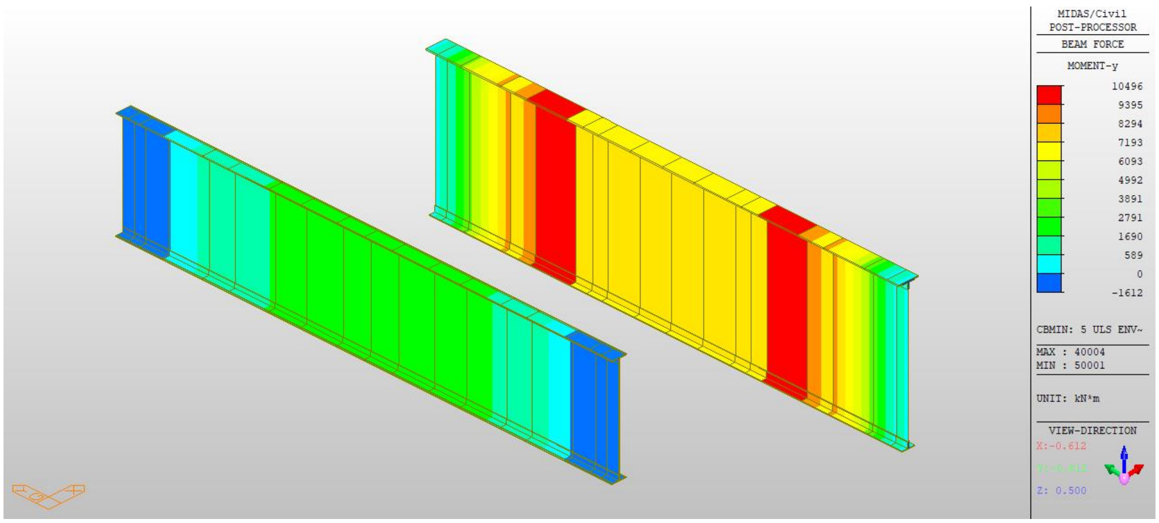

Figure 75 Girders G7 and G8 - Case 5 ULS M_y Min

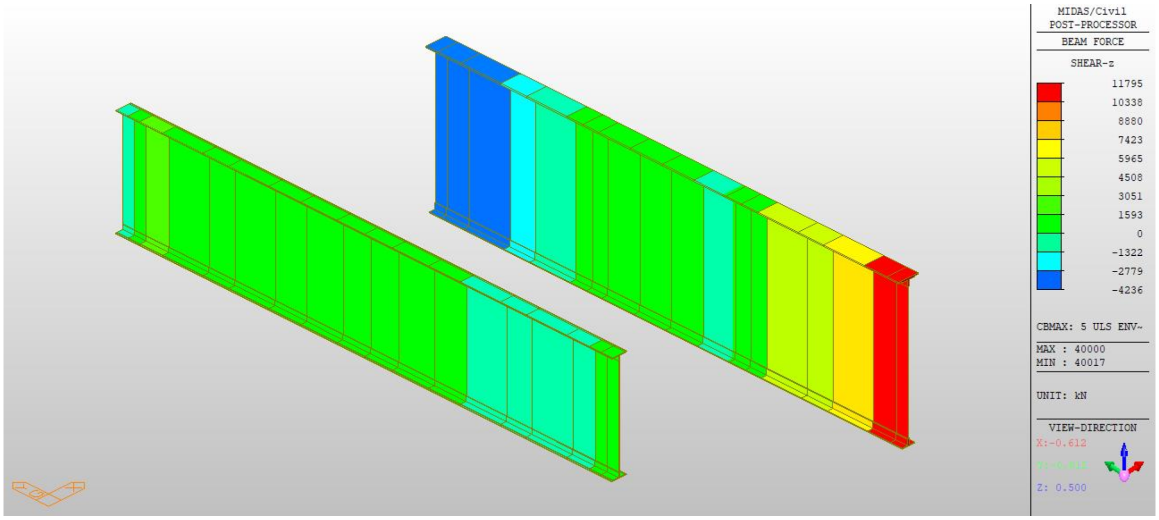

Figure 76 Girders G7 and G8 - Case 5 ULS F_z Max

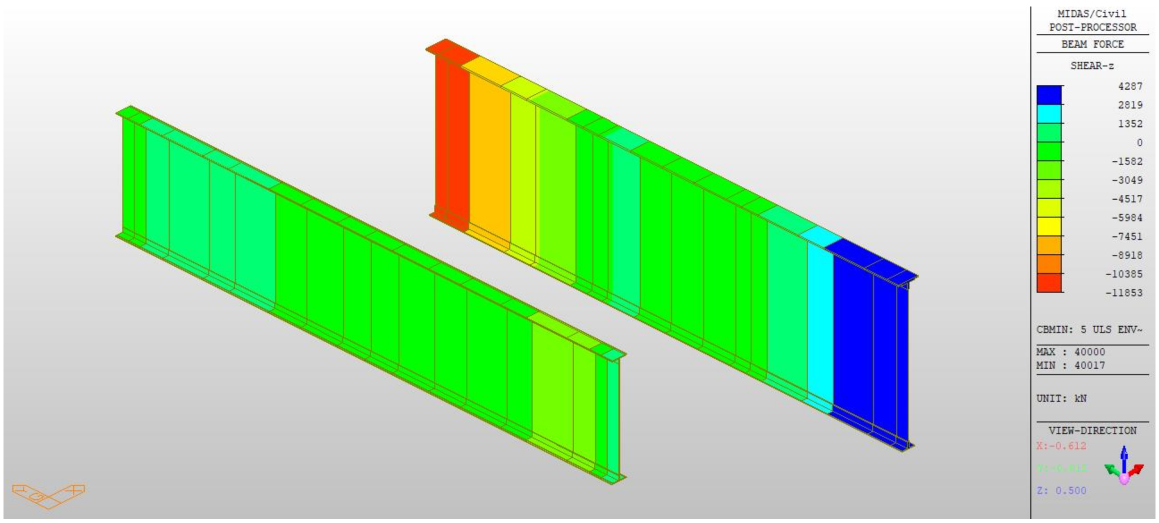

Figure 77 Girders G7 and G8 - Case 5 ULS F_z Min

Exhibit C.2.7. Rehabilitation Case 7

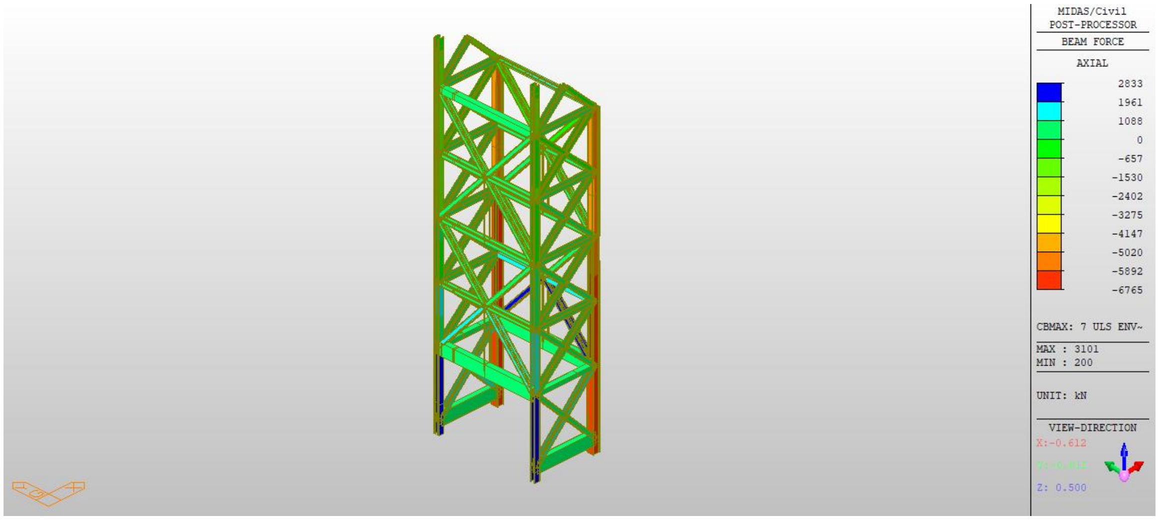

Figure 78 Truss Member - Case 7 ULS Axial Max

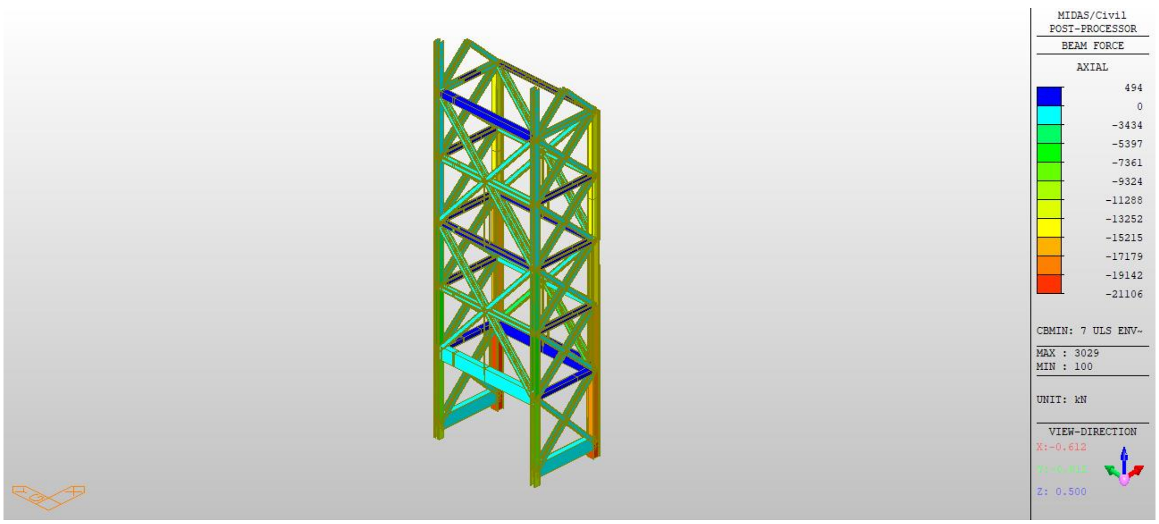

Figure 79 Truss Member - Case 7 ULS Axial Min

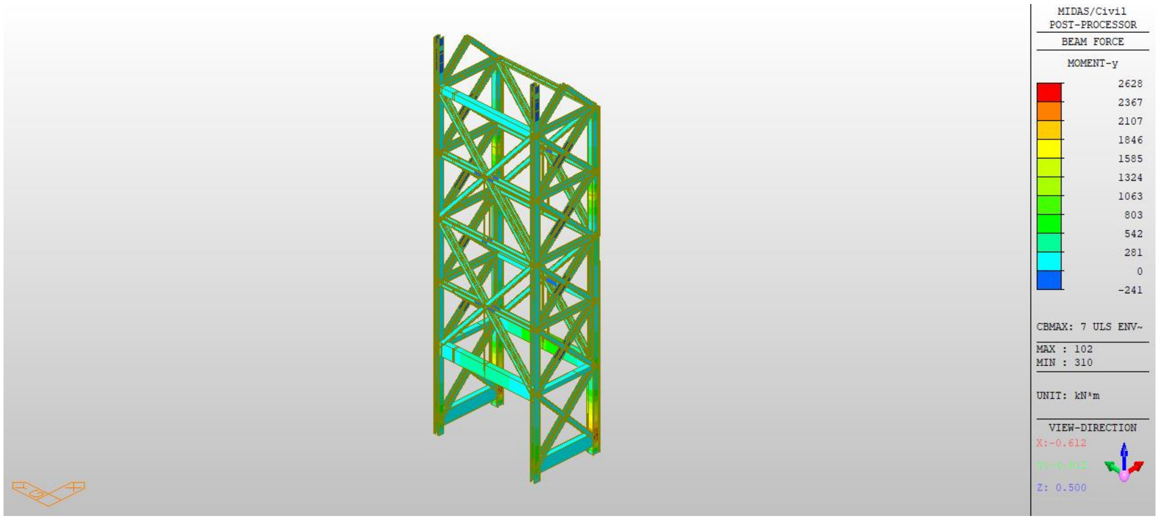

Figure 80 Truss Member - Case 7 ULS M_y Max

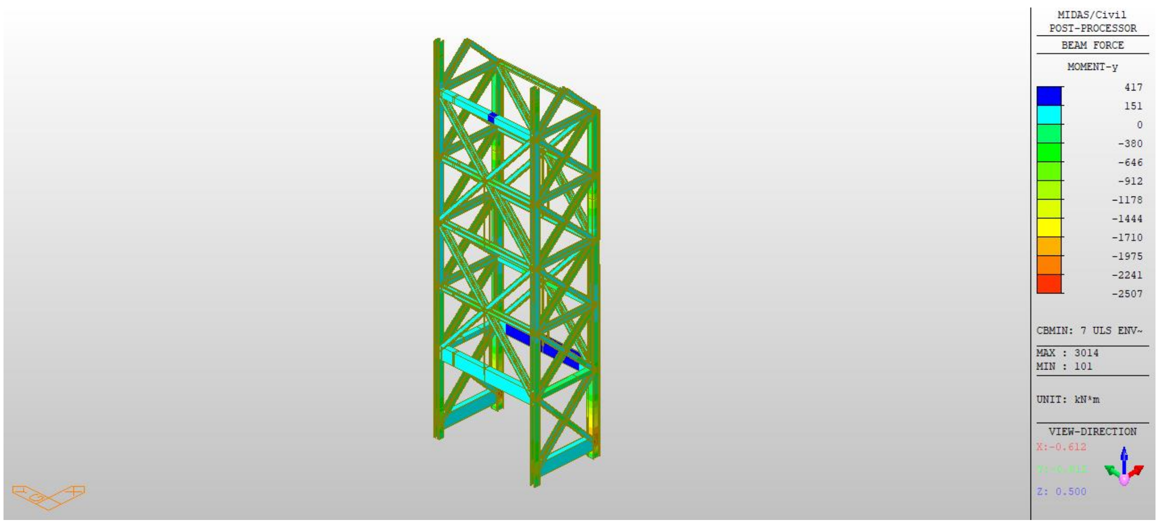

Figure 81 Truss Member - Case 7 ULS M_y Min

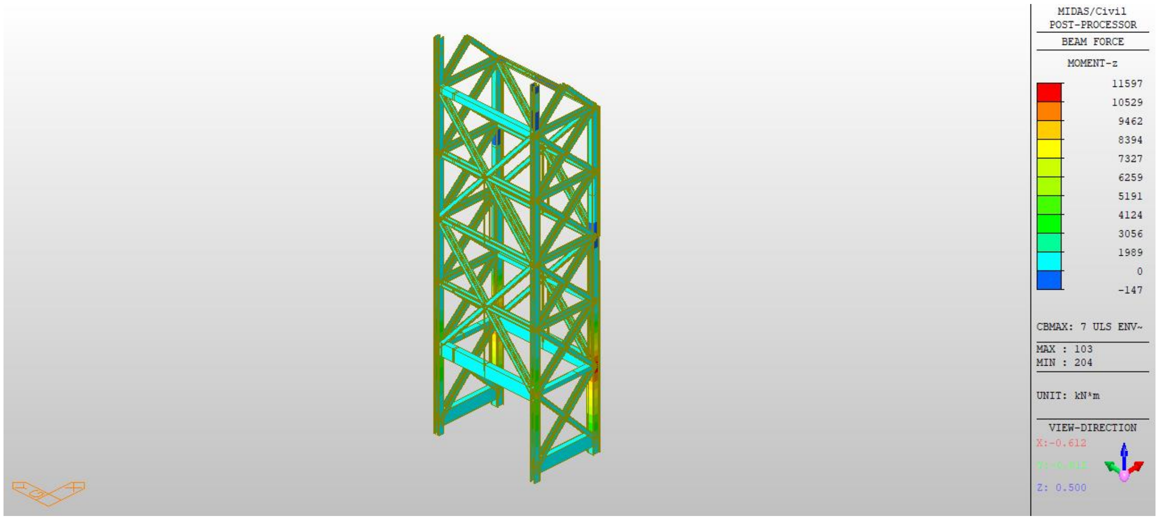

Figure 82 Truss Member - Case 7 ULS M_z Max

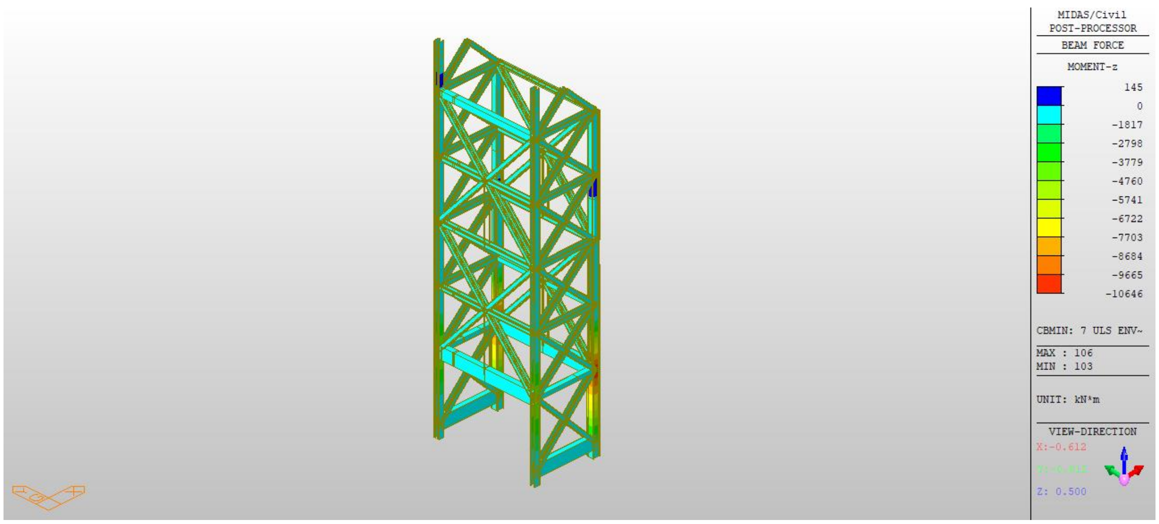

Figure 83 Truss Member - Case 7 ULS M_z Min

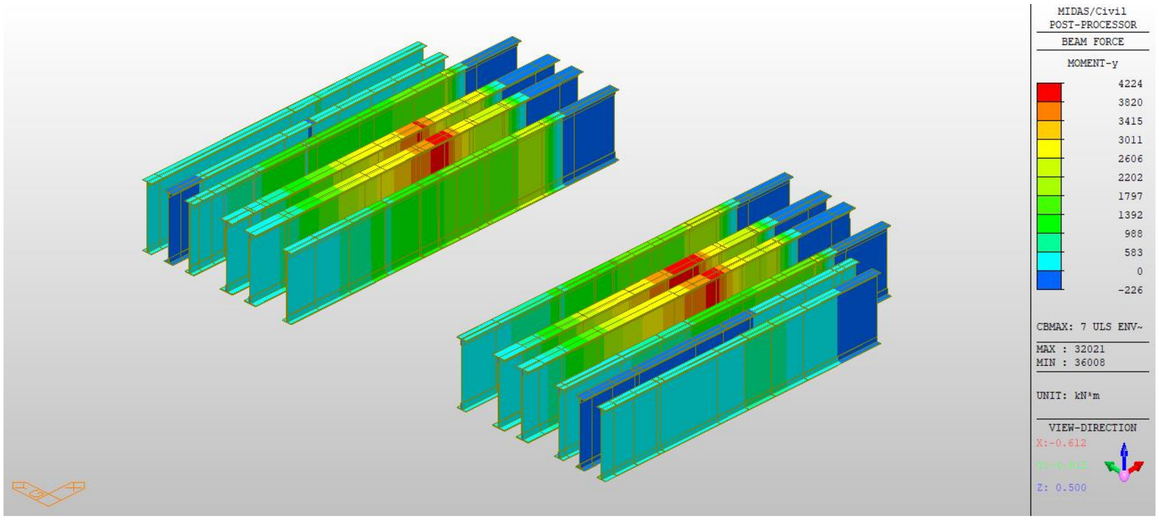

Figure 84 Girders G1 G2 G3 G4 G6 - Case 7 ULS M_y Max

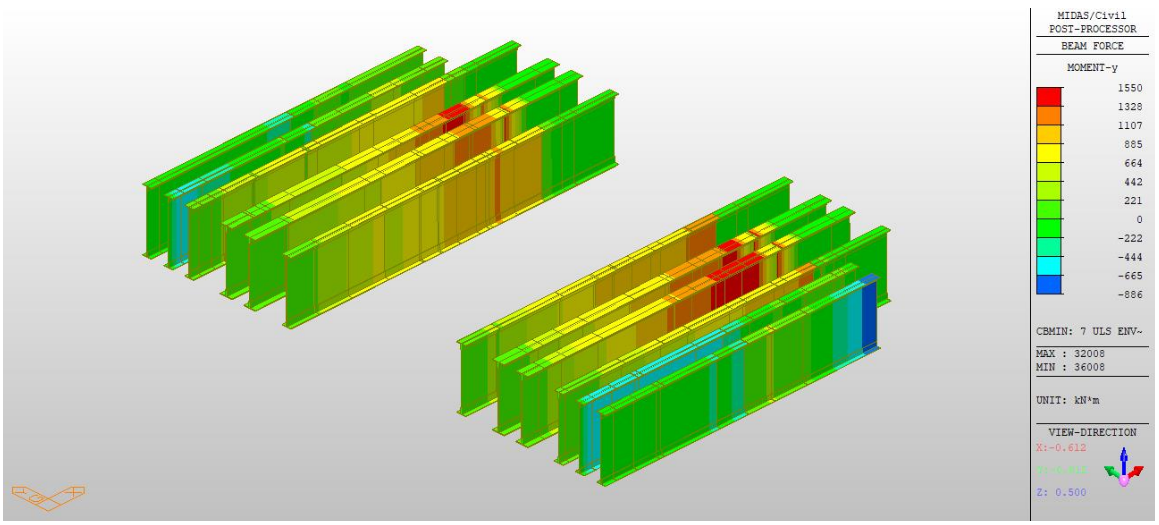

Figure 85 Girders G1 G2 G3 G4 G6 - Case 7 ULS M_y Min

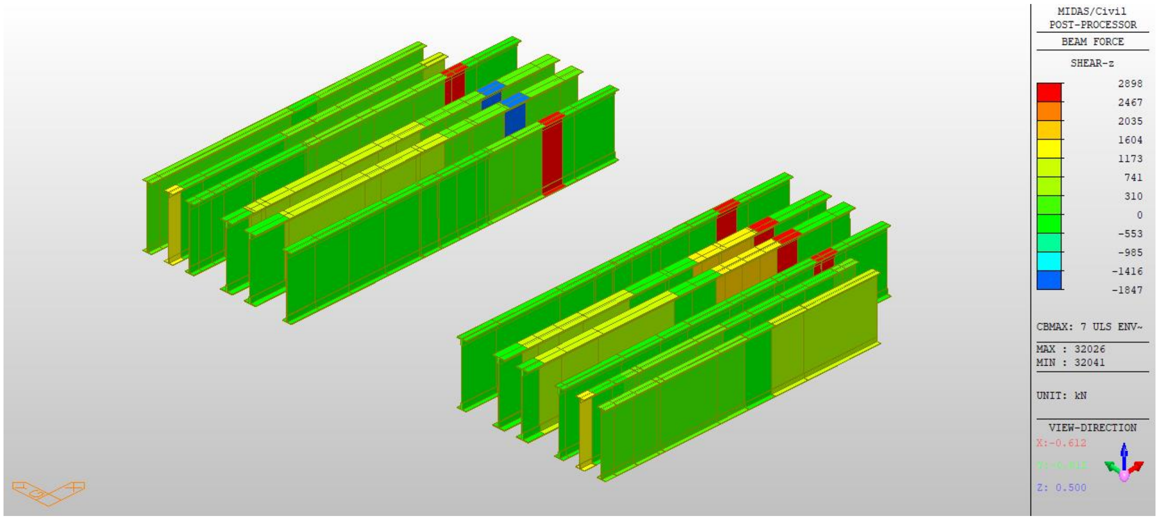

Figure 86 Girders G1 G2 G3 G4 G6 - Case 7 ULS F_z Max

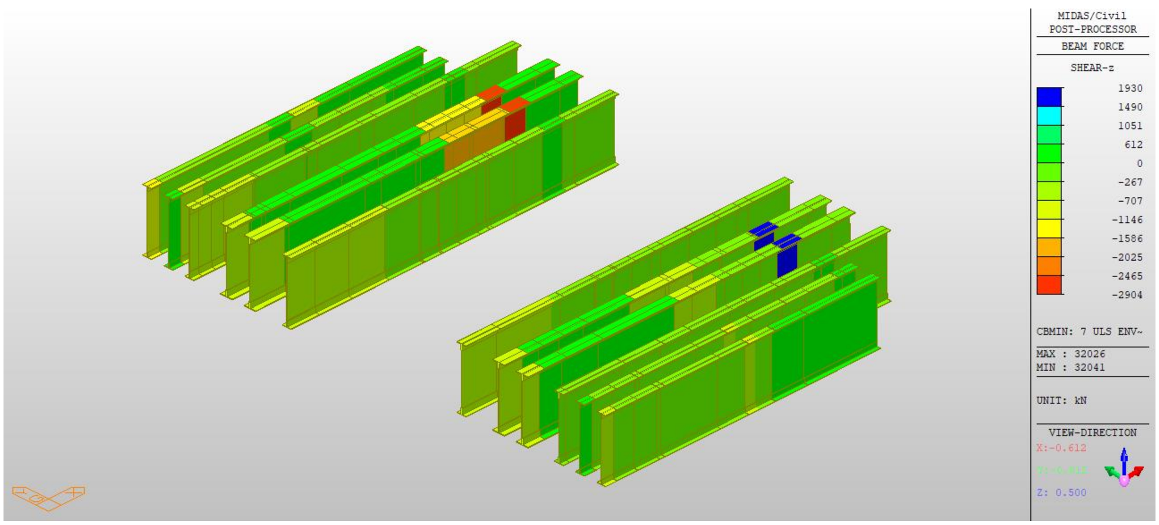

Figure 87 Girders G1 G2 G3 G4 G6 - Case 7 ULS F_z Min

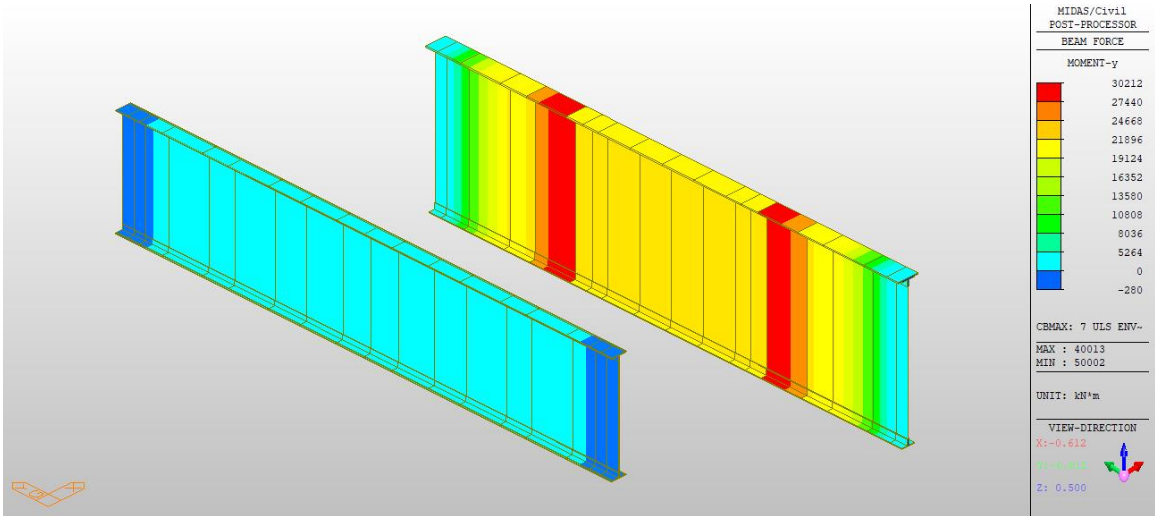

Figure 88 Girders G7 and G8 - Case 7 ULS M_y Max

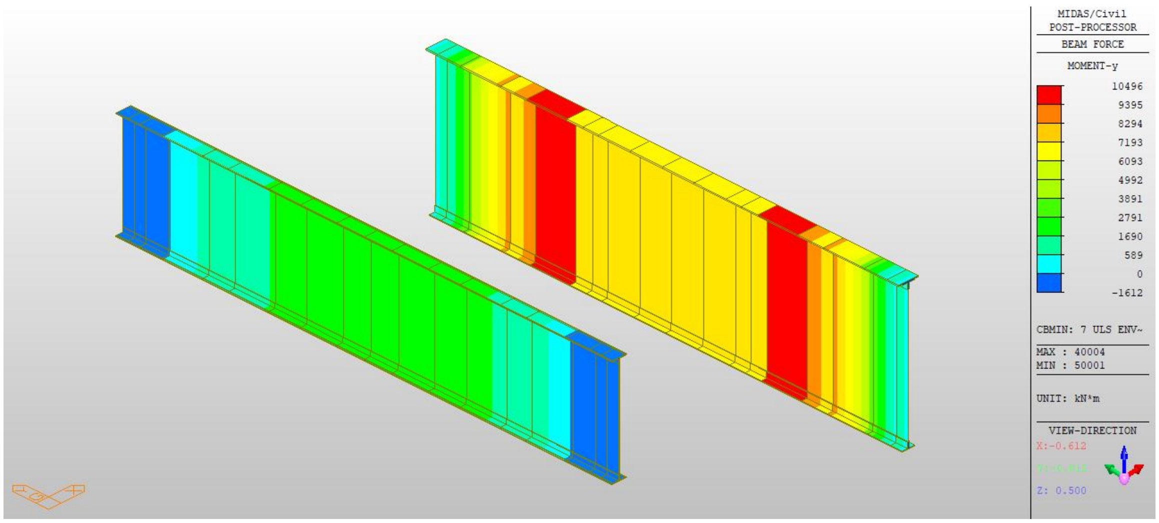

Figure 89 Girders G7 and G8 - Case 7 ULS M_y Min

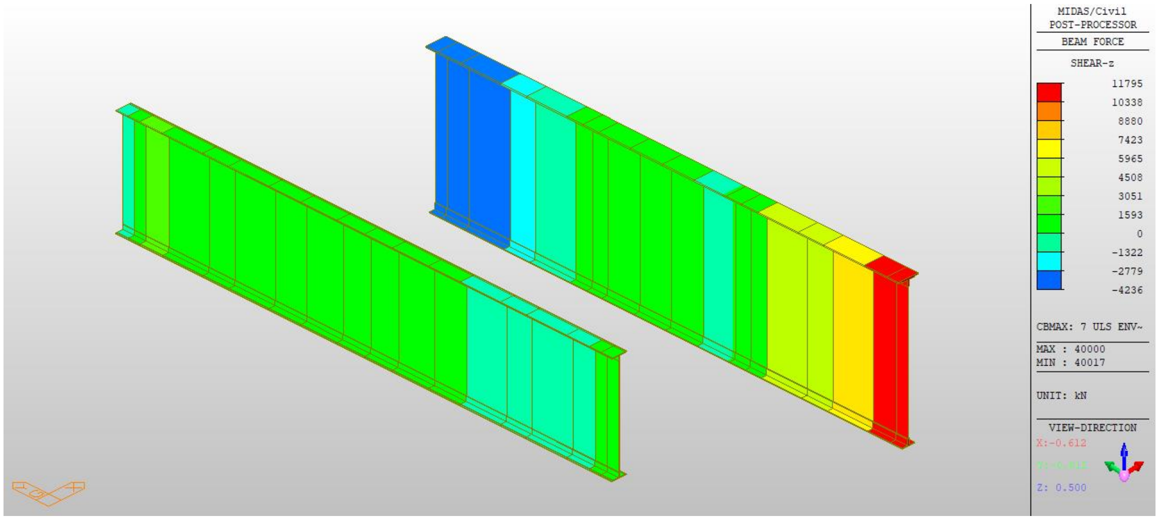

Figure 90 Girders G7 and G8 - Case 7 ULS F_z Max

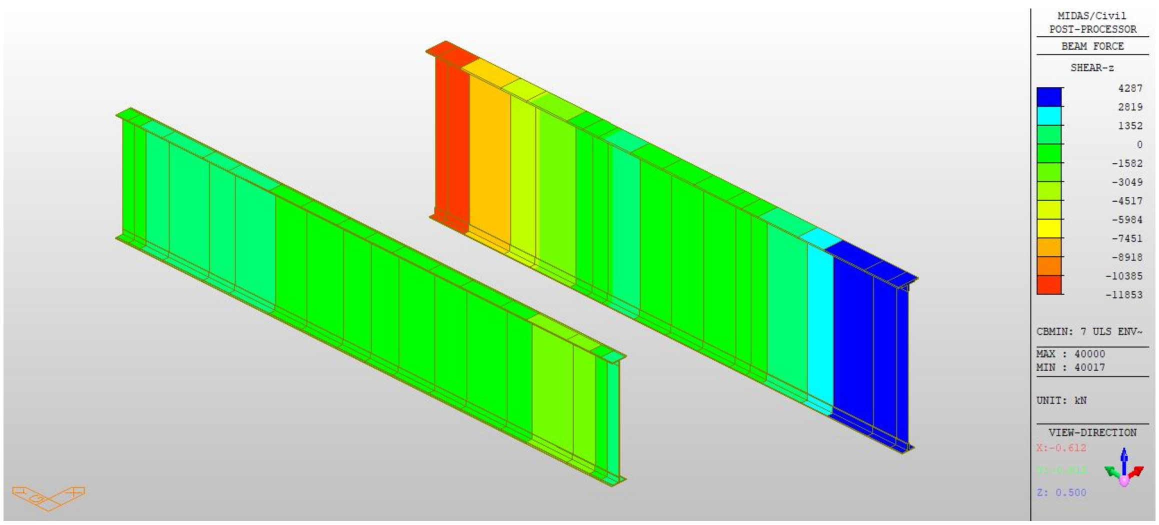

Figure 91 Girders G7 and G8 - Case 7 ULS F_z Min

Exhibit C.2.8. Rehabilitation Case 8

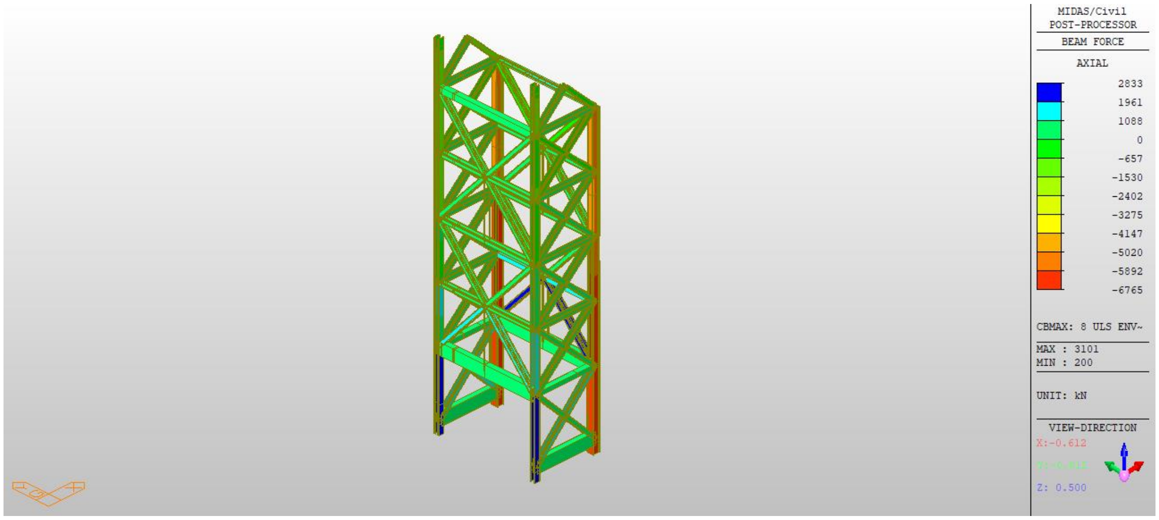

Figure 92 Truss Member - Case 8 ULS Axial Max

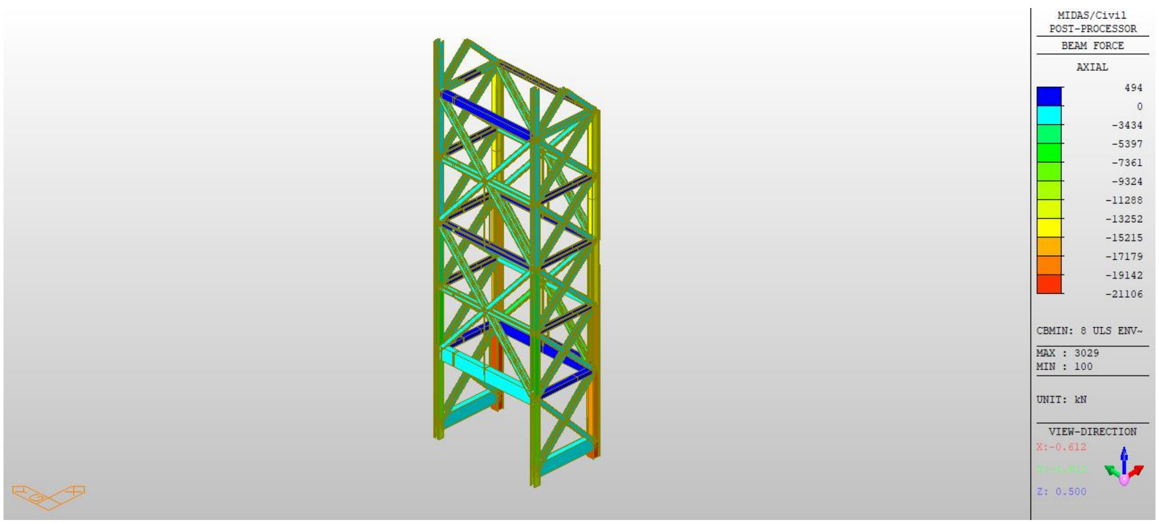

Figure 93 Truss Member - Case 8 ULS Axial Min

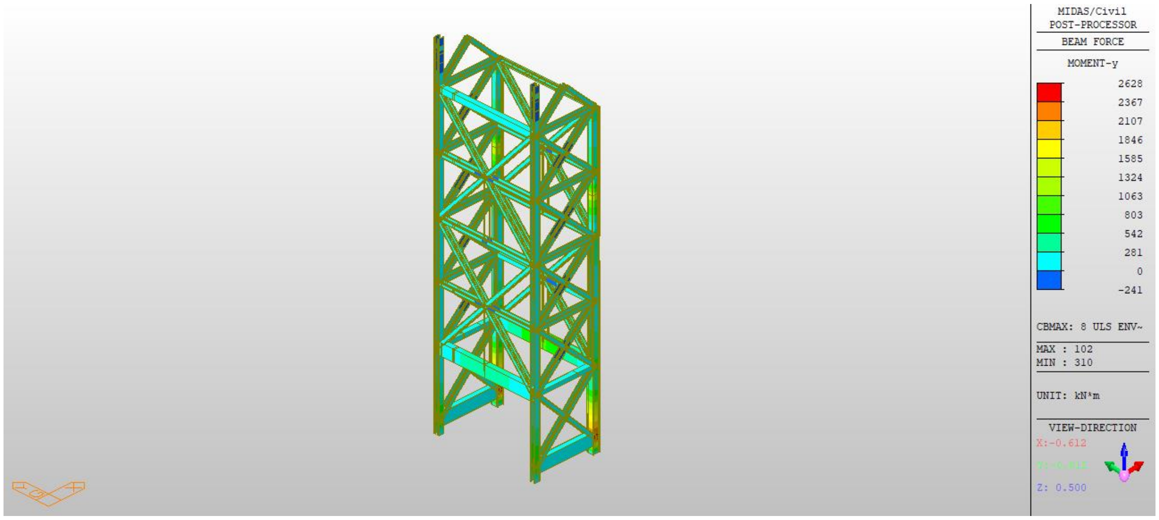

Figure 94 Truss Member - Case 8 ULS M_y Max

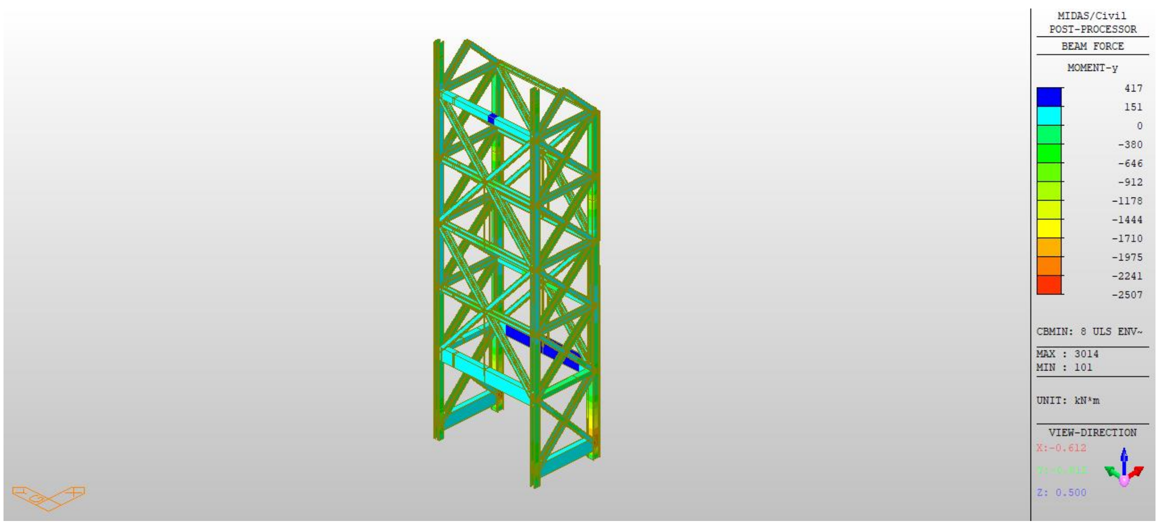

Figure 95 Truss Member - Case 8 ULS M_y Min

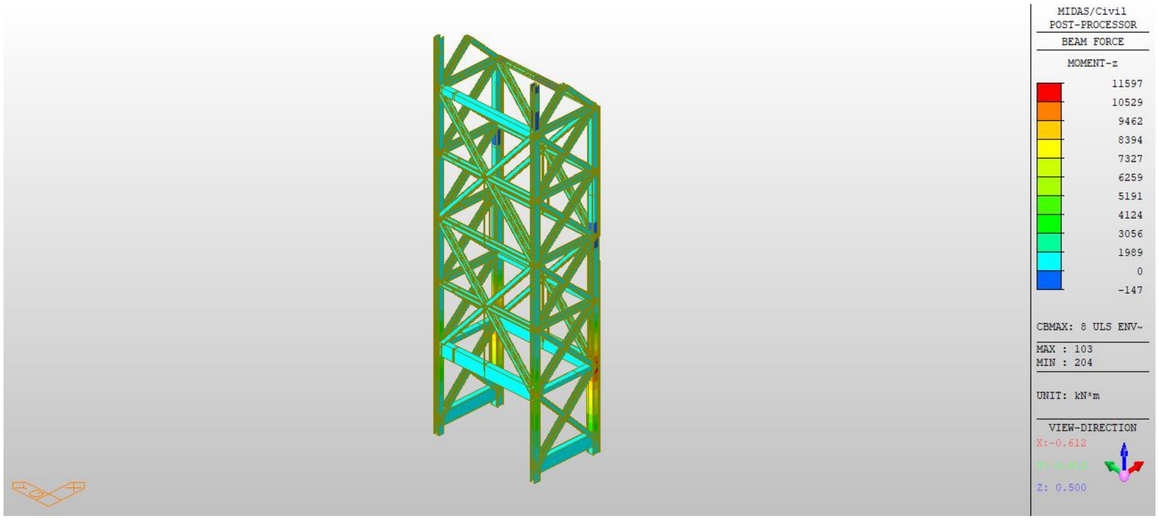

Figure 96 Truss Member - Case 8 ULS M_z Max

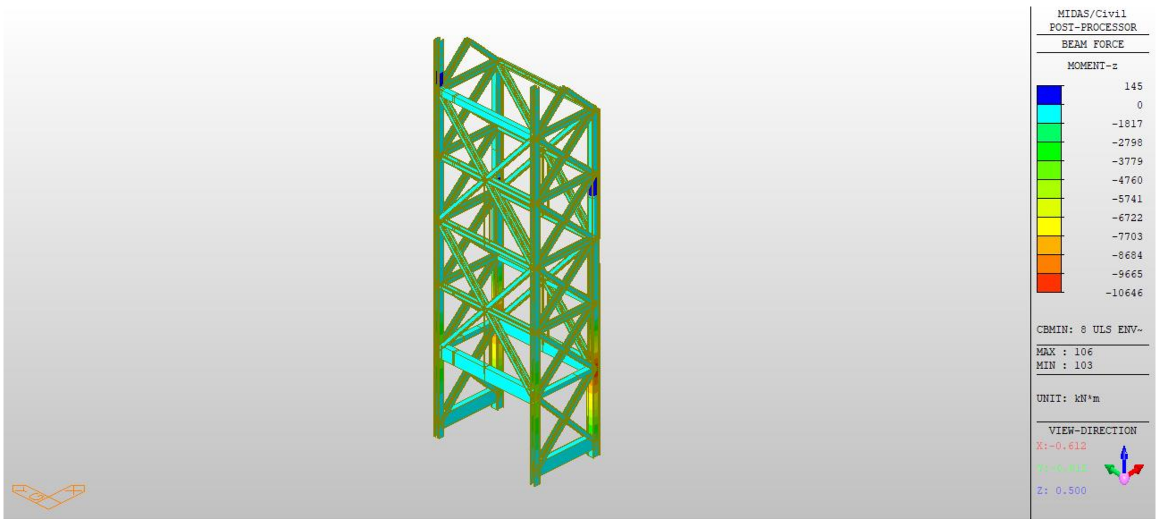

Figure 97 Truss Member - Case 8 ULS M_z Min

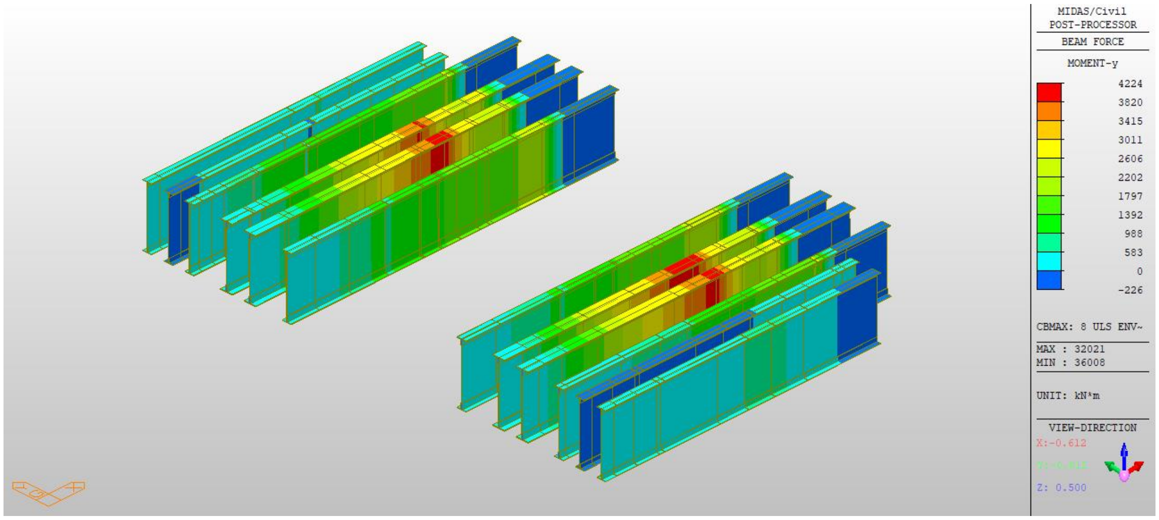

Figure 98 Girders G1 G2 G3 G4 G6 - Case 8 ULS M_y Max

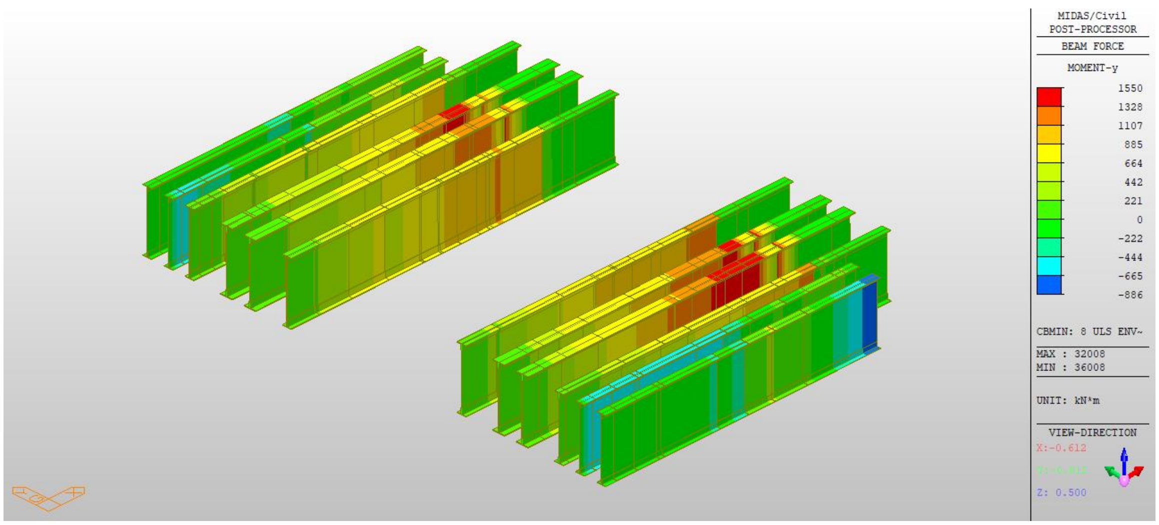

Figure 99 Girders G1 G2 G3 G4 G6 - Case 8 ULS M_y Min

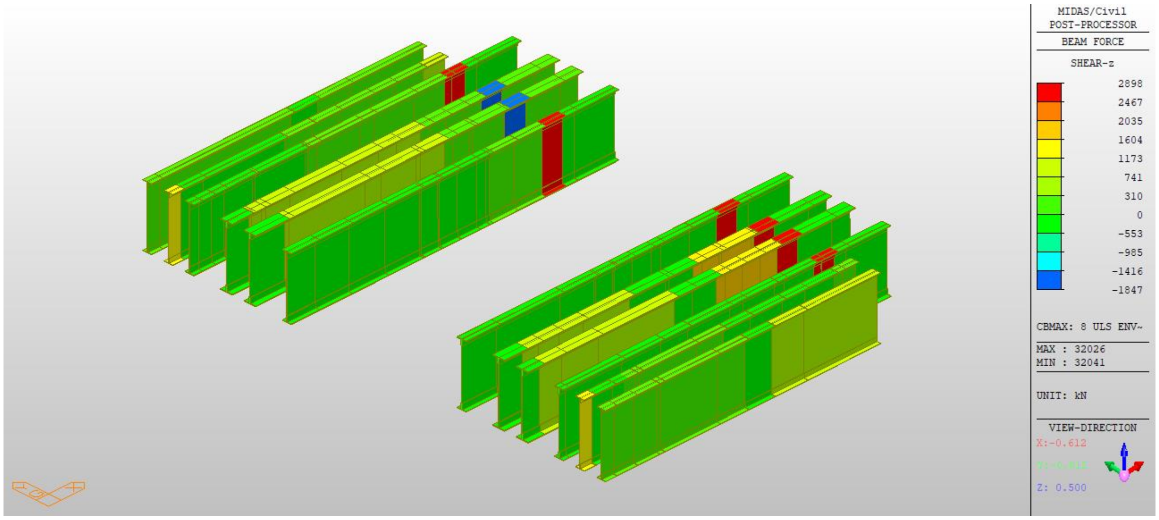

Figure 100 Girders G1 G2 G3 G4 G6 - Case 8 ULS F_z Max

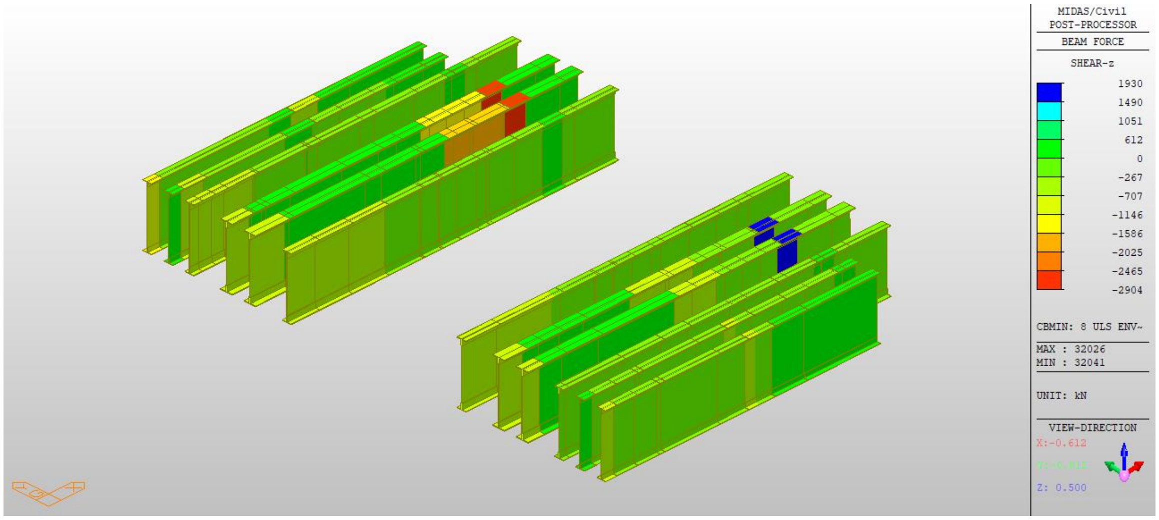

Figure 101 Girders G1 G2 G3 G4 G6 - Case 8 ULS F_z Min

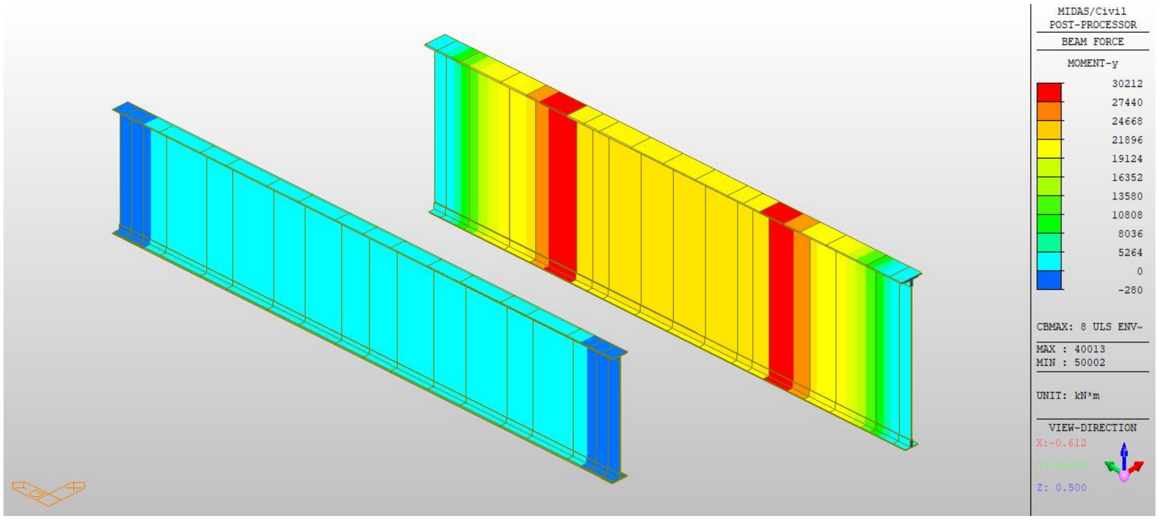

Figure 102 Girders G7 and G8 - Case 8 ULS M_y Max

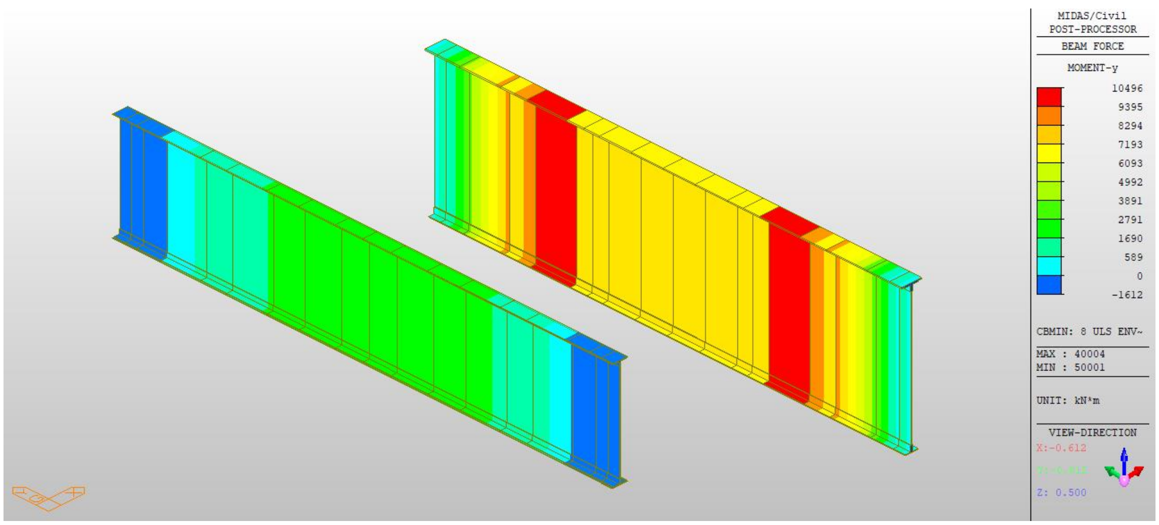

Figure 103 Girders G7 and G8 - Case 8 ULS M_y Min

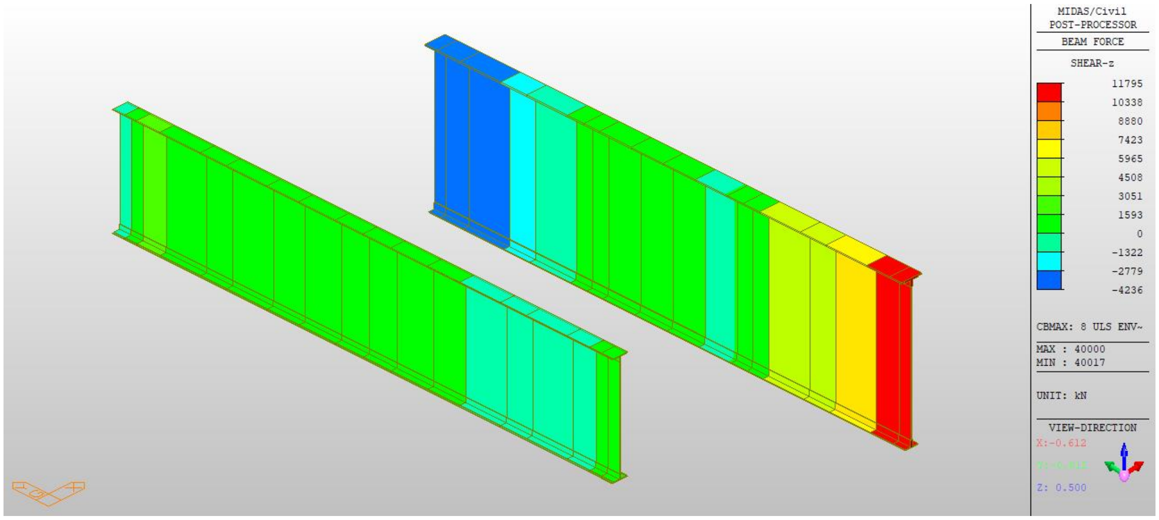

Figure 104 Girders G7 and G8 - Case 8 ULS F_z Max

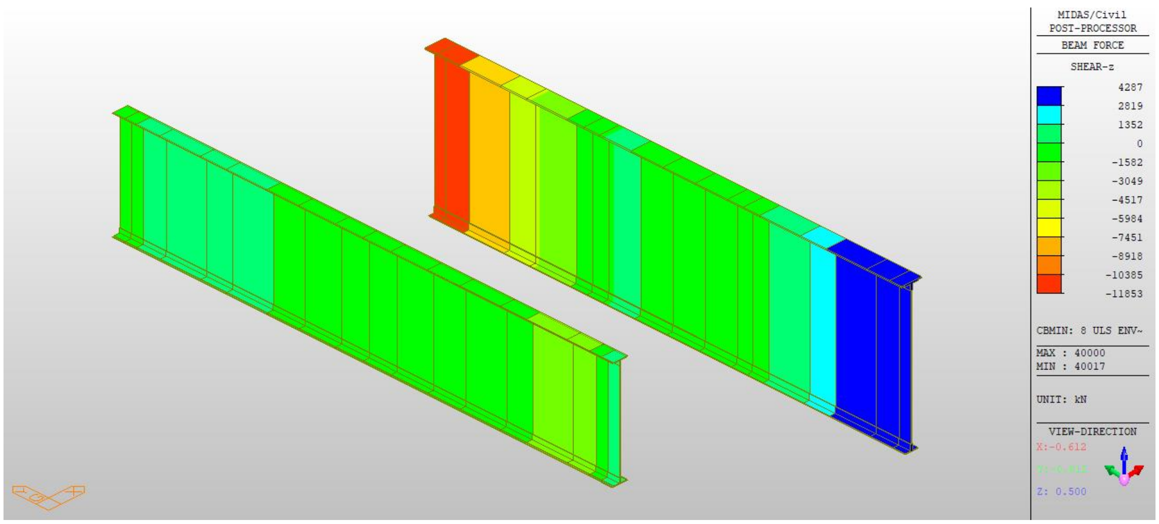

Figure 105 Girders G7 and G8 - Case 8 ULS F_z Min

AECOM Imagine it. Delivered.

Exhibit C.3

Approach Span and Tower Span Rehabilitation 3D Model

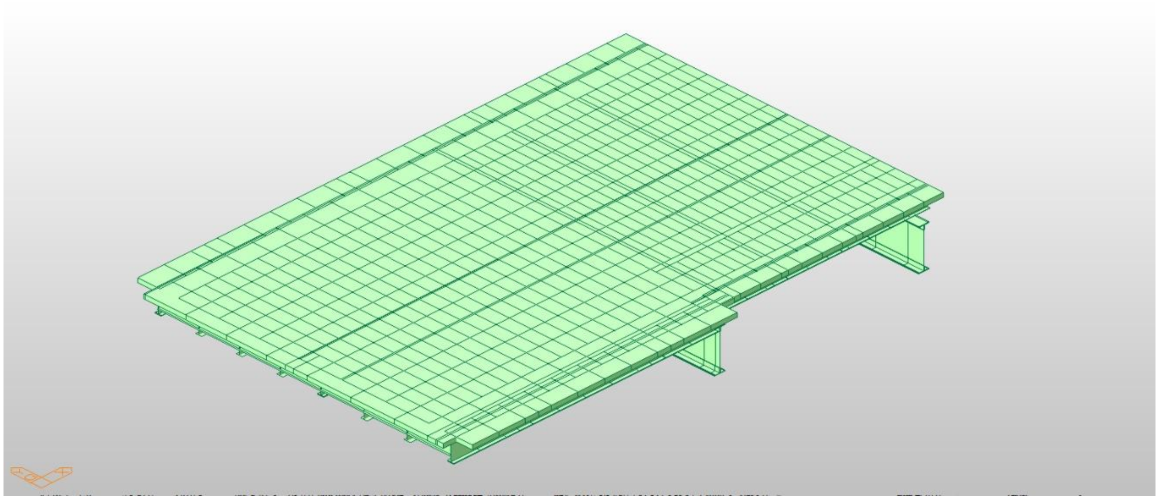

Figure 1 Approach and Tower spans at South Tower for 225mm Concrete and 90 mm Asphalt (Similar to North Tower)

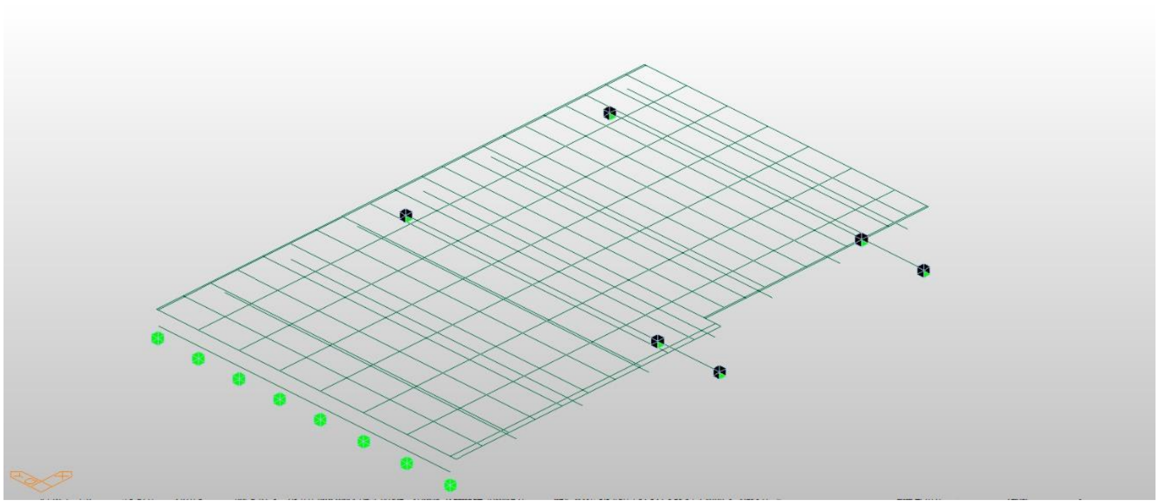

Figure 2 Approach and Tower support conditions for 225mm Concrete and 90mm Asphalt (Similar to North Tower)

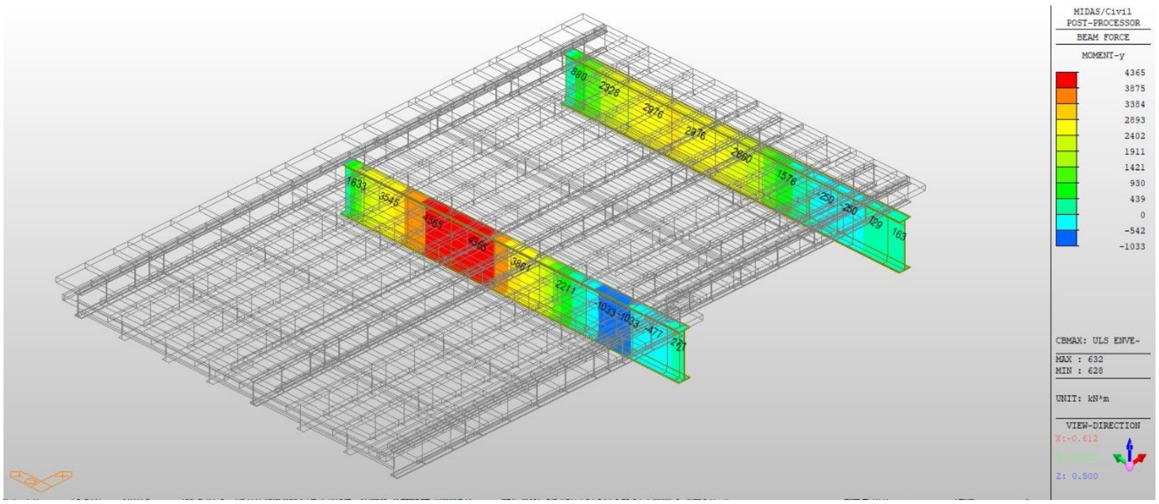

Figure 3 Maximum ULS Moment for Floor Beams

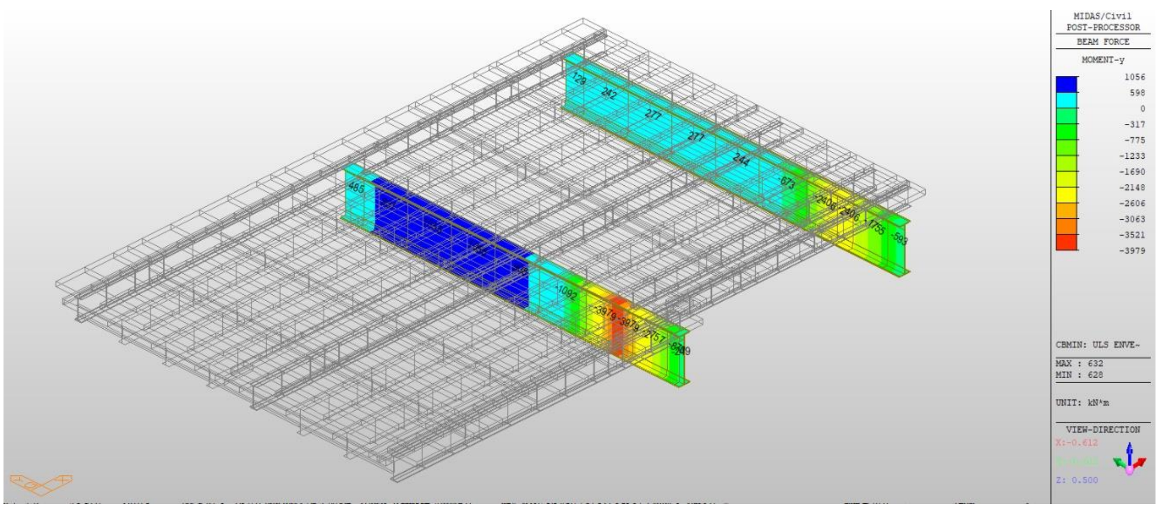

Figure 4 Minimum ULS Moment for Floor Beams

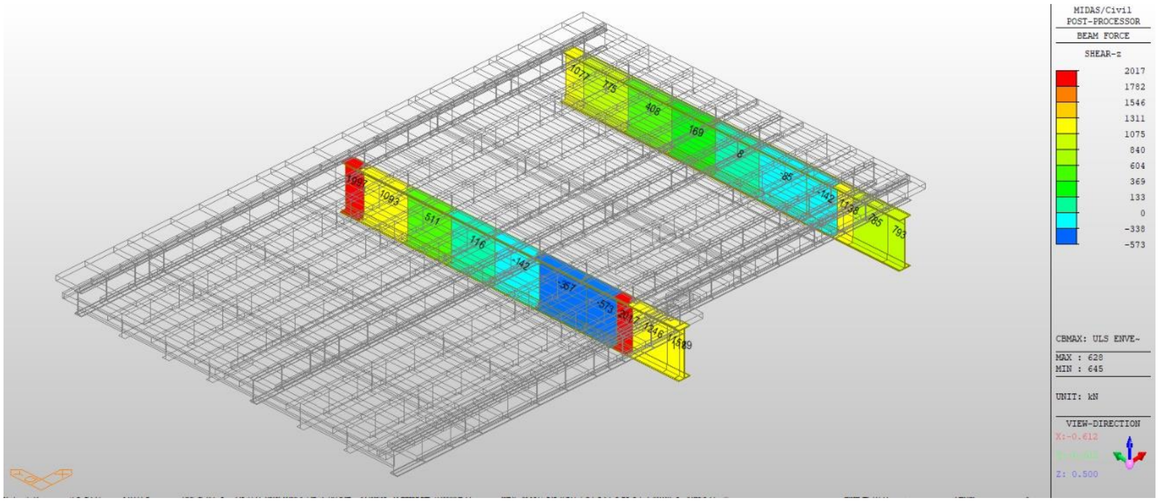

Figure 5 Maximum ULS Shear for Floor Beams

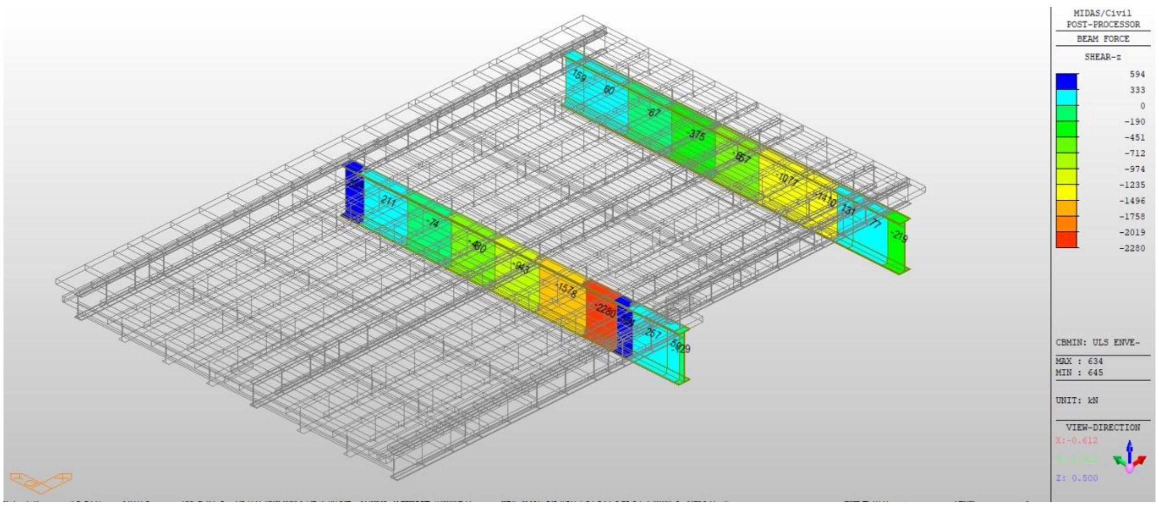

Figure 6 Minimum ULS Shear for Floor Beams

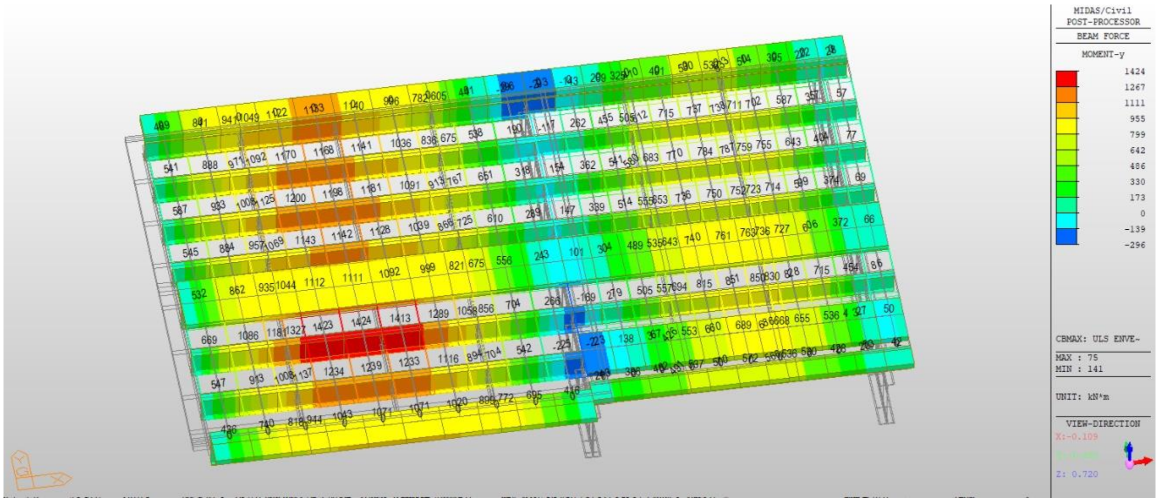

Figure 7 Maximum ULS Moment for Stringers

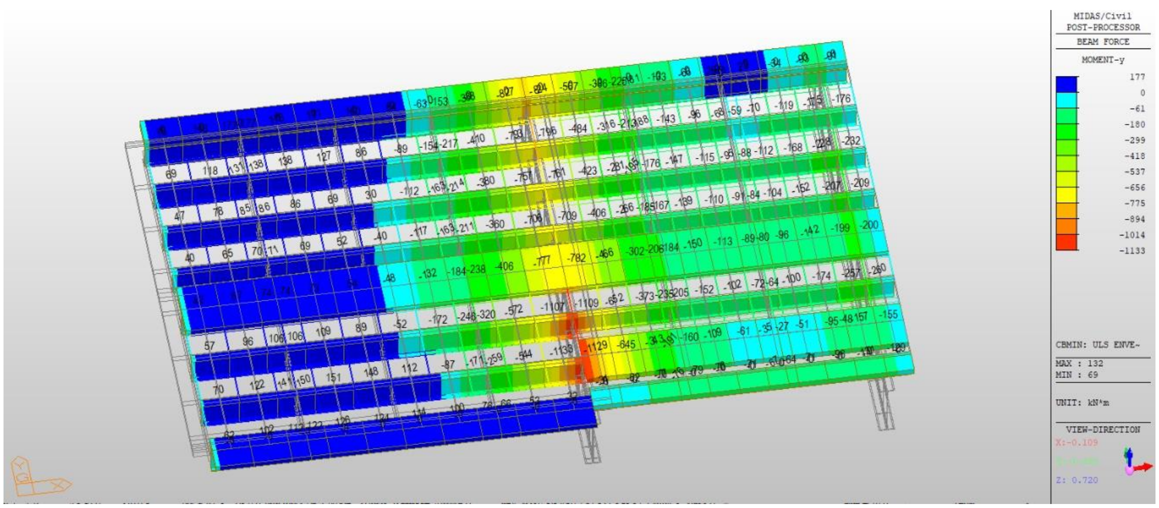

Figure 8 Minimum ULS Moment for Stringers

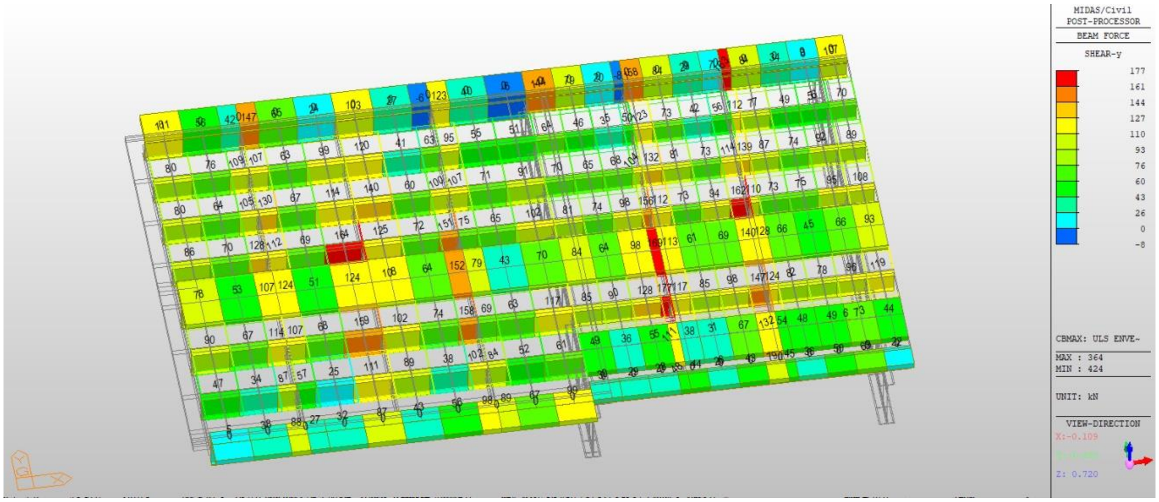

Figure 9 Maximum ULS Shear for Stringers

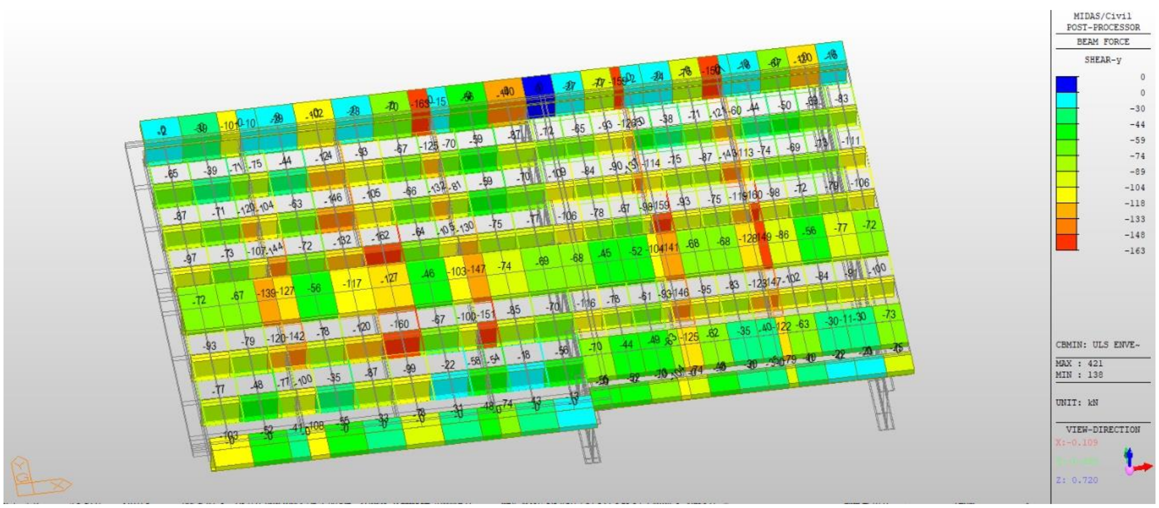

Figure 10 Minimum ULS Shear for Stringers

Exhibit C.4

225 mm Composite Slab Calculation

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JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	TK	DATE	30-Nov-20
CHECKED BY	KG	DATE	16-Dec-20

General Information

Material Specifications

Reinforced Concrete (Cast-in-Place Slab)

28-day Compressive Strength, f'_c	30	***[CSA S6-19 cl. 14.7.4.4 - unknown concrete strength]***
Cracking Stress, f_{cr}	2	***[CSA S6-19 cl. 8.4.1.8.1]***
Unit Density, $\gamma_{concrete}$ (kg/m^3)	2400	***[CSA S6-19 cl. 3.6, Table 3.4]***
Modulus of Elasticity, E_c	24870	
Unit Weight (kN/m^3)	24	
Yield Stress of Rebar, $f_{y\ rebar}$	400	
α_1	0.805	
β_1	0.895	
φ_c	0.75	

Steel (Girders) - Original Girders

Yield Stress, $F_{y\ girder}$	230	***[CISC 6-7, 11TH Edition, 2016]***
Ultimate Stress, $f_{u\ girder}$	410	***[CISC 6-7, 11TH Edition, 2016]***
Unit Density, γ_{steel} (kg/m3)	77000	
Modulus of Elasticity, E_s	200000	
Unit Weight (kN/m^3)	77	***[CSA S6-19 cl. 3.6, Table 3.4]***
φ_s	0.9	***[CSA S6-19 cl. 10.5.7]***

Composite Properties

$b_{v/w}$	n	$3n$
1000	8.04	24.1

Asphalt Wearing Surface

Unit Weight (kN/m^3)	23.5	***[CSA S6-19 cl. 3.6, Table 3.4]***

Concrete Overlay (Plain Concrete)

Unit Weight (kN/m^3)	23.5	***[CSA S6-19 cl. 3.6, Table 3.4]***

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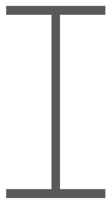
DESIGNED BY		DATE	
ORIGINATOR BY	TK	DATE	30-Nov-20
CHECKED BY	KG	DATE	16-Dec-20

Section Properties

Non-Composite, Bare Steel Girder



Girder at Rear Floor Beam Connection

	A	y	Ay	Ay^2	I_o
	mm^2	mm	mm^3	mm^4	mm^4
d	5,359	11	56,542	596,515	198,838
e	8,460	344	2.9E+06	1.0E+09	2.9E+08
f	5,359	677	3.6E+06	2.5E+09	2.0E+05
∑	**19,179**	**1,032**	**6.6E+06**	**3.5E+09**	**2.9E+08**

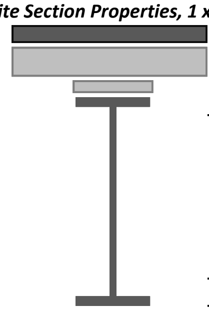
I_x (mm^4)	***y_{top} (mm)***	***344***	***S_{top} (mm)*** ***4.3E+06***
1.5E+09	***y_{bot}***	***344***	***S_{bot} (mm)*** ***4.3E+06***

a – reinforced concrete deck slab
b – top reinforcing steel bars
c – bottom steel reinforcing bars
d – girder top flanges
e – girder web
f – girder bottom flange

	Width	Thick.		Width	Thick.
Top	254 mm	21 mm	**Bottom**	254 mm	21 mm

	Height	Thick.
Web	646 mm	13 mm

Composite Section Properties, 1 x n



Girder at Rear Floor Beam Connection

	A	y	Ay	Ay^2	I_o
	mm^2	mm	mm^3	mm^4	mm^4
a	38,386	113	4,318,473	4.858E+08	1.62E+08
b	2,058	75	154,350	1.158E+07	0
c	1,372	175	240,100	4.202E+07	0
d	5,359	236	1,262,407	2.974E+08	198,838
e	8,460	569	4.8E+06	2.7E+09	2.9E+08
f	5,359	902	4.8E+06	4.4E+09	2.0E+05
∑	**60,995**	**2,070**	**1.6E+07**	**7.9E+09**	**4.6E+08**

I_x (mm^4)	***y_{top} (mm)***	***256***	***$S_{n, top}$***	***1.7E+07***
4.394E+09	***y_{bot} (mm)***	***432***	***$S_{n, bot}$***	***1.0E+07***

a – reinforced concrete deck slab
b – top reinforcing steel bars
c – bottom steel reinforcing bars
d – girder top flanges
e – girder web
f – girder bottom flange

	Width	Thick.		Width	Thick.
Top	254 mm	21 mm	**Bottom**	254 mm	21 mm

	Height	Thick.
Web	646 mm	13 mm

Modular Ratio, *n*	8.04
Slab Thickness	225 mm
Slab Width	1,372 mm
Slab Width / n	171 mm
Top Reinforcing Bars Area	300 mm²
Top Reinforcing Bars Spacing	200 mm
Top Reinforcing Bar Diameter	20 mm
Cover to Top Reinforcing Bars	65 mm
Top Transverse Bar Diameter	0 mm
Bottom Reinforcing Bars Area	200 mm²
Bottom Reinforcing Bars Spacing	200 mm
Bottom Reinforcing Bar Diameter	20 mm
Cover to Bottom Reinforcing Bars	40 mm
Bottom Transverse Bar Diameter	0 mm

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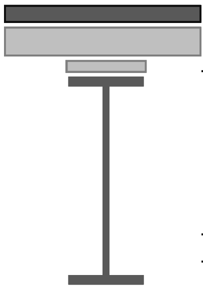
ORIGINATOR BY	TK	DATE	30-Nov-20
CHECKED BY	KG	DATE	16-Dec-20

Composite Section Properties, 3 x n

Girder at Rear Floor Beam Connection



	A	y	Ay	Ay^2	I_o
	mm^2	mm	mm^3	mm^4	mm^4
a	12,795	113	1,439,491	1.619E+08	5.40E+07
b	2,058	75	154,350	1.158E+07	0
c	1,372	175	240,100	4.202E+07	0
d	5,359	236	1,262,407	2.974E+08	198,838
e	8,460	569	4.8E+06	2.7E+09	2.9E+08
f	5,359	902	4.8E+06	4.4E+09	2.0E+05
∑	**35,404**	**2,070**	**1.3E+07**	**7.6E+09**	**3.5E+08**

I_x (mm^4)				
3.376E+09	y_{top} *(mm)*	***360***	$S_{3n, top}$	***9.4E+06***
	y_{bot} *(mm)*	***328***	$S_{3n, bot}$	***1.0E+07***

a – reinforced concrete deck slab
b – top reinforcing steel bars
c – bottom steel reinforcing bars
d – girder top flanges
e – girder web
f – girder bottom flange

	Width	Thick.		Width	Thick.
Top	254 mm	21 mm	**Bottom**	254 mm	21 mm

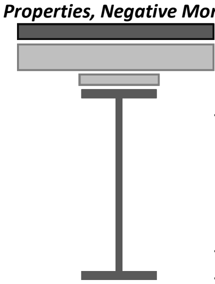
	Height	Thick.
Web	646 mm	13 mm

Modular Ratio, 3*n*	24.13
Slab Thickness	225 mm
Slab Width	1,372 mm
Slab Width / 3n	57 mm
Top Reinforcing Bars Area	300 mm²
Top Reinforcing Bars Spacing	200 mm
Top Reinforcing Bar Diameter	20 mm
Cover to Top Reinforcing Bars	65 mm
Top Transverse Bar Diameter	0 mm
Bottom Reinforcing Bars Area	200 mm²
Bottom Reinforcing Bars Spacing	200 mm
Bottom Reinforcing Bar Diameter	20 mm
Cover to Bottom Reinforcing Bars	40 mm
Bottom Transverse Bar Diameter	0 mm

AECOM Imagine it. Delivered.

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	TK	DATE	30-Nov-20
CHECKED BY	KG	DATE	16-Dec-20

Section Properties, Negative Moment Region



Girder at Rear Floor Beam Connection

	A	y	Ay	Ay^2	I_o
	mm^2	mm	mm^3	mm^4	mm^4
b	2,058	75	154,350	1.158E+07	0
c	2,058	175	360,150	6.303E+07	0
d	5,359	236	1,262,407	2.974E+08	1.99E+05
e	8,460	569	4.8E+06	2.7E+09	2.9E+08
f	5,359	902	4.8E+06	4.4E+09	2.0E+05
∑	**23,295**	**1,957**	**1.1E+07**	**7.5E+09**	**2.9E+08**

I_x (mm^4)	***y(mm)***	***491***	***S_{top}***	***8.2E+06***
2.165E+09	***y_{gtop} (mm)***	***266***	***S_{bot}***	***5.1E+06***
	y_{bot} (mm)	***422***	***S_{bar}***	***5.9E+06***

a – reinforced concrete deck slab
b – top reinforcing steel bars
c – bottom steel reinforcing bars
d – girder top flanges
e – girder web
f – girder bottom flange

	Width	Thick.		Width	Thick.
Top	254 mm	21 mm	**Bottom**	254 mm	21 mm

	Height	Thick.
Web	646 mm	13 mm

Slab Thickness	225 mm
Slab Width	1,372 mm
Top Reinforcing Bars Area	300 mm²
Top Reinforcing Bars Spacing	200 mm
Top Reinforcing Bar Diameter	20 mm
Cover to Top Reinforcing Bars	65 mm
Top Transverse Bar Diameter	0 mm
Bottom Reinforcing Bars Area	300 mm²
Bottom Reinforcing Bars Spacing	200 mm
Bottom Reinforcing Bar Diameter	20 mm
Cover to Bottom Reinforcing Bars	40 mm
Bottom Transverse Bar Diameter	0 mm

JOB TITLE	BCLB DECK PRE-DESIGN		
JOB NO.	60637587	CALCULATION NO.	
DESIGNED BY		DATE	
ORIGINATOR BY	TK	DATE	30-Nov-20
CHECKED BY	KG	DATE	16-Dec-20

ULS Girder Resistance

Width to Thickness Ratios ***[CSA S6-19 cl. 10.9.2.1]***

Flange Class Limits

Max b/t for Class 1	9.56
Max b/t for Class 2	11.21
Max b/t for Class 3	13.19

Web Class Limits

Max h/w for Class 1	72.53
Max h/w for Class 2	112.09
Max h/w for Class 3	125.28

Negative Moment Resistance at ULS

Negative Moment Region @ Pier

Unsupported Length, m	3230	*Distance between diaphragms on tower span side (longer)*

Girder Type # 5

Bottom Flange Class

Half of Width of Flange, b	127
Thickness of Flange, t	21.1
Width-to-Thickness Ratio, b/t	6.0
Flange Class	1

Web Class

Web Height	645.8
Thickness of Web, w	13.1
Width-to-Thickness Ratio, $2d_c/w$	49.30
Web Class	1

Overall Section Class 1

Moment resistance is calculated as a class 1 section [10.11.5.3]. Girder is considered unbraced against lateral torsional buckling between floor beam and nearest line of intermediate diaphragm.

Lateral Torsional Buckling Resistance ***[CSA S6-19 cl. 10.10.2.3]***

Depth of Web, *clear h*	646 mm
Web Thickness, *w*	13 mm
Width of Top Flange, b_{top}	254 mm
Depth of Top Flange	21 mm
Width of Bottom Flange, b_{bot}	254 mm
Depth of Bottom Flange	21 mm
Depth of Web, *h'*	667 mm
Moment of Inertia, I_y	5.77E+07 mm4
Moment of Inertia, I_{yc}	2.88E+07 mm4
Torsion Constant, *J*	2.09E+06 mm4
Warping Constant, C_w	6.41E+12 mm6

Calculating B1 and B2 Terms

Calculating *B1* Term

Section Symmetry Type	Doubly-symmetric
Coefficient of Monosymmetry, β_x	**0.00**
B1 Term	**0.00**

Calculating *B2* Term

Shear Modulus, G_s	77,000 MPa
Modulus of Elasticity, E_s	200,000 MPa
B2 Term	**7.53**

Calculating Critical Elastic Moment, M_u

Maximum Moment in Unbr. Seg., M_{max}	1,140 kN·m	
Minimum Moment in Unbr. Seg., M_{min}	155 kN·m	
1 / 4 Pt. Moment in Unbr. Seg., M_a	401 kN·m	
1 / 2 Pt. Moment in Unbr. Seg., M_b	648 kN·m	
3 / 4 Pt. Moment in Unbr. Seg., M_c	894 kN·m	
Coefficient for Incr. Moment Res., ω_2	1.605	
Critical Elastic Moment, M_u	6,217 kN·m	

Composite Moment Resistance ***[CSA S6-19 cl. 10.10.2.3]***

Section Modulus, S_{bot}	5,123,825 mm3	
Yield Strength of Structural Steel, F_y	230 MPa	
0.67 x Moment M_p, based on F_y	790 kN·m	
Resisting Moment M_r, based on M_p	1,219 kN·m	

Factored Moment ULS Moment

Mf	1,140 kN·m	*2nd Girder from East at Location of Rear Floor Beam*
Utilization of Section	0.94	

Shear Resistance

Shear Resistance of Girder	855 kN	*Resistance calculated for existing girders in Tower Span Evaluation*
Maximum Factored Shear Force in Model	655 kN	*At location of front floor beam*
Utilization of Section	0.77	

AECOM Imagine it. Delivered.

Exhibit C.5

Mechanical Component Rehabilitation Calculation Summary

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Motor Sizing Calculation

Aluminium Deck

1727 tonnes

TABLE OF CONTENTS :

1.0 GENERAL INFORMATION

1.1 CONSTANTS

$\mu_{stat\_roller} := 0.004$ — Static coefficient of friction for roller bearing

Ref.: S6-14 Table 13.10

$\mu_{dyn\_roller} := 0.003$ — Static coefficient of friction for roller bearing

$Acc_{time} := 10s$ — Maximum time available to reach full lifting speed

Ref. S6-14 article 13.7.14.8.4

$Brake_{time} := 10s$ — Maximum time available to stop the bridge from the maximum speed

$P_{wind} := 0.12kPa$ — Wind pressure

Ref.: S6-14 article 13.7.14.7.4

$P_{ice} := 0.12kPa$ — Ice load per unit area

$Start_{overload} := 1.25$

$Acc_{overload} := 1.5$ — Ref.: S6-14 Table 13.14 — Allowable torque overloads

$Cons_{overload} := 1$

$\eta_{bearings} := 0.98$

$\eta_{sheaves} := \eta_{bearings}{}^{2} = 0.96$

Ref. S6-14
(article 13.7.19.4 & 13.7.19.6.1) and
Machinery Handbook

Components efficiencies

$\eta_{gears} := 0.96^{2}$

$\eta_{reducer} := 0.94$

1.2 GENERAL DATA

$W_{span} := 1727tonne$ — Weigth of span

$W_{cwt} := W_{span}$ — Weigth of counterweight (hypothesis)

$W_{sheave} := 50000lb$ — Weight of sheave (hypothesis)

$W_{trunnion} := 7500lb$ — Weight of trunnion (hypothesis)

$W_{gear} := 8 \cdot 540lb$ — Weight of gear sets (per sheave) (hypothesis)

$W_{total} := W_{span} + W_{cwt} + 8 \cdot W_{sheave} + 8W_{trunnion} + 8W_{gear} = 8.109 \times 10^{6} \cdot lb$ — Weight to be lifted

$r_{rb} := 12in$ — Radius of roller bearings

$r_{s} := \dfrac{180in}{2}$ — Radius of sheave

$S_{speed} := 1\dfrac{ft}{s}$ — Maximum lifting speed of span

$D_{rope} := 2.25in$ — Diameter of main counterweight ropes

$IMB_{South} := 7450lbf$ Seated imbalance, north tower

$IMB_{North} := 6296lbf$ Seated imbalance, south tower

$L_{open} := 0ft$ Length of span (open deck - approximative)

$W_{open} := 0ft$ Width of span (open deck - approximative)

$L_{closed} := 370ft$ Length of span (close deck - approximative)

$W_{closed} := 60ft$ Width of span (close deck - approximative)

2.0 CALCULATION OF LOADS

2.1 FRICTION LOAD - ROLLER BEARINGS OF COUNTERWEIGHT SHEAVES

$$F_{friction\_stat} := \frac{W_{total} \cdot r_{rb} \cdot \mu_{stat\_roller} \cdot g}{r_s} = 19.238 \cdot kN$$

$$F_{friction\_dyn} := \frac{W_{total} \cdot r_{rb} \cdot \mu_{dyn\_roller} \cdot g}{r_s} = 14.429 \cdot kN$$

2.2 INERTIA

$$A_{acc} := \frac{S_{speed}}{Acc_{time}} = 0.1 \cdot \frac{ft}{s^2}$$

$$A_{brake} := \frac{S_{speed}}{Brake_{time}} = 0.1 \cdot \frac{ft}{s^2}$$

$$F_{acc} := 1.25 W_{total} \cdot A_{acc} = 140.144 \cdot kN$$

$$F_{braking} := 1.25 W_{total} \cdot A_{brake} = 140.144 \cdot kN$$

2.3 ROPE BENDING

$$F_{bend} := \frac{W_{total}}{2} \cdot 0.3 \frac{D_{rope}}{2 \cdot r_s} \cdot g = 67.635 \cdot kN$$

Ref. CSA S6-14 article 13.7.20.17

2.4 UNBALANCED CONDITIONS

$$F_{balance} := IMB_{North} + IMB_{South} = 61.145 \cdot kN$$

2.5 WIND LOADING

$$F_{wind} := \left(L_{open} \cdot W_{open} \cdot 0.85 + L_{closed} \cdot W_{closed}\right) \cdot P_{wind} = 247.494 \cdot kN$$

2.6 ICE LOADING (WORST CASE SCENARIO - BRIDGE IS NOT OPENED DURING WINTER)

$$F_{ice} := \left(L_{open} \cdot W_{open} \cdot 0.85 + L_{closed} \cdot W_{closed}\right) \cdot P_{ice} = 247.494 \cdot kN$$

3.0 LOAD CASES

Case 1: Starting Load

$$F_{starting\_lc1} := F_{friction\_stat} + F_{acc} + F_{bend} + F_{balance} + F_{wind} + F_{ice} = 783.151 \cdot kN$$

Case 2: Accelerating Load

$$F_{acc\_lc2} := F_{friction\_dyn} + F_{acc} + F_{bend} + F_{balance} + F_{wind} = 530.847 \cdot kN$$

Case 3: Constant Velocity

$$F_{cons\_lc3} := F_{friction\_dyn} + F_{bend} + F_{balance} + F_{wind} = 390.703 \cdot kN$$

Case 4: Braking Load

$$F_{braking\_lc4} := F_{friction\_dyn} + F_{braking} + F_{bend} + F_{balance} + F_{wind} = 530.847 \cdot kN$$

4.0 MOTOR SELECTION

4.1 GOVERNING FORCE FOR MOTOR SELECTION

$$F_{motor.lc1} := \frac{F_{starting\_lc1}}{Start_{overload}} = 626.52 \cdot kN$$

$$F_{motor.lc2} := \frac{F_{acc\_lc2}}{Acc_{overload}} = 353.898 \cdot kN$$

$$F_{motor.lc3} := \frac{F_{cons\_lc3}}{Cons_{overload}} = 390.703 \cdot kN$$

$$F_{motor.lc4} := \frac{F_{braking\_lc4}}{Acc_{overload}} = 353.898 \cdot kN$$

$$F_{motor} := \max\left(F_{motor.lc1}, F_{motor.lc2}, F_{motor.lc3}, F_{motor.lc4}\right) = 626.52 \cdot kN$$

4.2 MOTOR POWER REQUIRED (per tower)

$$\eta_{lift} := \eta_{sheaves} \cdot \eta_{gears} \cdot \eta_{reducer} = 0.832$$

Efficiency of system

$$Hp_{motor} := \frac{F_{motor} \cdot S_{speed}}{\eta_{lift} \cdot 2} = 154 \cdot hp$$

Required power of motor in worst case scenario (wind + ice load)

Current HP of motors is 150 HP.

AECOM

Calculations

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Motor Sizing Calculation

Fiber Reinforced

1733 tonnes

TABLE OF CONTENTS :

1.0 GENERAL INFORMATION

1.1 CONSTANTS

$\mu_{stat\_roller} := 0.004$ — Static coefficient of friction for roller bearing

Ref.: S6-14 Table 13.10

$\mu_{dyn\_roller} := 0.003$ — Static coefficient of friction for roller bearing

$Acc_{time} := 10s$ — Maximum time available to reach full lifting speed

Ref. S6-14 article 13.7.14.8.4

$Brake_{time} := 10s$ — Maximum time available to stop the bridge from the maximum speed

$P_{wind} := 0.12kPa$ — Wind pressure

Ref.: S6-14 article 13.7.14.7.4

$P_{ice} := 0.12kPa$ — Ice load per unit area

$Start_{overload} := 1.25$

$Acc_{overload} := 1.5$ — Ref.: S6-14 Table 13.14 — Allowable torque overloads

$Cons_{overload} := 1$

$\eta_{bearings} := 0.98$

$\eta_{sheaves} := \eta_{bearings}{}^2 = 0.96$

Ref. S6-14
(article 13.7.19.4 & 13.7.19.6.1) and
Machinery Handbook

Components efficiencies

$\eta_{gears} := 0.96^2$

$\eta_{reducer} := 0.94$

1.2 GENERAL DATA

$W_{span} := 1733tonne$ — Weigth of span

$W_{cwt} := W_{span}$ — Weigth of counterweight (hypothesis)

$W_{sheave} := 50000lb$ — Weight of sheave (hypothesis)

$W_{trunnion} := 7500lb$ — Weight of trunnion (hypothesis)

$W_{gear} := 8 \cdot 540lb$ — Weight of gear sets (per sheave) (hypothesis)

$W_{total} := W_{span} + W_{cwt} + 8 \cdot W_{sheave} + 8W_{trunnion} + 8W_{gear} = 8.136 \times 10^6 \cdot lb$ — Weight to be lifted

$r_{rb} := 12in$ — Radius of roller bearings

$r_s := \dfrac{180in}{2}$ — Radius of sheave

$S_{speed} := 1\dfrac{ft}{s}$ — Maximum lifting speed of span

$D_{rope} := 2.25in$ — Diameter of main counterweight ropes

$IMB_{South} := 7450lbf$ Seated imbalance, north tower

$IMB_{North} := 6296lbf$ Seated imbalance, south tower

$L_{open} := 0ft$ Length of span (open deck - approximative)

$W_{open} := 0ft$ Width of span (open deck - approximative)

$L_{closed} := 370ft$ Length of span (close deck - approximative)

$W_{closed} := 60ft$ Width of span (close deck - approximative)

2.0 CALCULATION OF LOADS

2.1 FRICTION LOAD - ROLLER BEARINGS OF COUNTERWEIGHT SHEAVES

$$F_{friction\_stat} := \frac{W_{total} \cdot r_{rb} \cdot \mu_{stat\_roller} \cdot g}{r_s} = 19.301 \cdot kN$$

$$F_{friction\_dyn} := \frac{W_{total} \cdot r_{rb} \cdot \mu_{dyn\_roller} \cdot g}{r_s} = 14.476 \cdot kN$$

2.2 INERTIA

$$A_{acc} := \frac{S_{speed}}{Acc_{time}} = 0.1 \cdot \frac{ft}{s^2}$$

$$A_{brake} := \frac{S_{speed}}{Brake_{time}} = 0.1 \cdot \frac{ft}{s^2}$$

$$F_{acc} := 1.25 W_{total} \cdot A_{acc} = 140.602 \cdot kN$$

$$F_{braking} := 1.25 W_{total} \cdot A_{brake} = 140.602 \cdot kN$$

2.3 ROPE BENDING

$$F_{bend} := \frac{W_{total}}{2} \cdot 0.3 \frac{D_{rope}}{2 \cdot r_s} \cdot g = 67.856 \cdot kN$$

Ref. CSA S6-14 article 13.7.20.17

2.4 UNBALANCED CONDITIONS

$$F_{balance} := IMB_{North} + IMB_{South} = 61.145 \cdot kN$$

2.5 WIND LOADING

$$F_{wind} := \left(L_{open} \cdot W_{open} \cdot 0.85 + L_{closed} \cdot W_{closed}\right) \cdot P_{wind} = 247.494 \cdot kN$$

2.6 ICE LOADING (WORST CASE SCENARIO - BRIDGE IS NOT OPENED DURING WINTER)

$$F_{ice} := \left(L_{open} \cdot W_{open} \cdot 0.85 + L_{closed} \cdot W_{closed}\right) \cdot P_{ice} = 247.494 \cdot kN$$

3.0 LOAD CASES

Case 1: Starting Load

$$F_{starting\_lc1} := F_{friction\_stat} + F_{acc} + F_{bend} + F_{balance} + F_{wind} + F_{ice} = 783.891 \cdot kN$$

Case 2: Accelerating Load

$$F_{acc\_lc2} := F_{friction\_dyn} + F_{acc} + F_{bend} + F_{balance} + F_{wind} = 531.572 \cdot kN$$

Case 3: Constant Velocity

$$F_{cons\_lc3} := F_{friction\_dyn} + F_{bend} + F_{balance} + F_{wind} = 390.971 \cdot kN$$

Case 4: Braking Load

$$F_{braking\_lc4} := F_{friction\_dyn} + F_{braking} + F_{bend} + F_{balance} + F_{wind} = 531.572 \cdot kN$$

4.0 MOTOR SELECTION

4.1 GOVERNING FORCE FOR MOTOR SELECTION

$$F_{motor.lc1} := \frac{F_{starting\_lc1}}{Start_{overload}} = 627.113 \cdot kN$$

$$F_{motor.lc2} := \frac{F_{acc\_lc2}}{Acc_{overload}} = 354.381 \cdot kN$$

$$F_{motor.lc3} := \frac{F_{cons\_lc3}}{Cons_{overload}} = 390.971 \cdot kN$$

$$F_{motor.lc4} := \frac{F_{braking\_lc4}}{Acc_{overload}} = 354.381 \cdot kN$$

$$F_{.motor} := \max\left(F_{.motor.lc1}, F_{.motor.lc2}, F_{.motor.lc3}, F_{.motor.lc4}\right) = 627.113 \cdot kN$$

4.2 MOTOR POWER REQUIRED (per tower)

$$\eta_{lift} := \eta_{sheaves} \cdot \eta_{gears} \cdot \eta_{reducer} = 0.832$$

Efficiency of system

$$Hp_{motor} := \frac{F_{motor} \cdot S_{speed}}{\eta_{lift} \cdot 2} = 154 \cdot hp$$

Required power of motor in worst case scenario (wind + ice load)

Current HP of motors is 150 HP.

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Motor Sizing Calculation

Open Steel Grid Deck (Crimped I bar)

1799 tonnes

TABLE OF CONTENTS :

1.0 GENERAL INFORMATION

1.1 CONSTANTS

$\mu_{stat\_roller} := 0.004$ — Static coefficient of friction for roller bearing

Ref.: S6-14 Table 13.10

$\mu_{dyn\_roller} := 0.003$ — Static coefficient of friction for roller bearing

$Acc_{time} := 10s$ — Maximum time available to reach full lifting speed

Ref. S6-14 article 13.7.14.8.4

$Brake_{time} := 10s$ — Maximum time available to stop the bridge from the maximum speed

$P_{wind} := 0.12kPa$ — Wind pressure

Ref.: S6-14 article 13.7.14.7.4

$P_{ice} := 0.12kPa$ — Ice load per unit area

$Start_{overload} := 1.25$

$Acc_{overload} := 1.5$ — Ref.: S6-14 Table 13.14 — Allowable torque overloads

$Cons_{overload} := 1$

$\eta_{bearings} := 0.98$

$\eta_{sheaves} := \eta_{bearings}{}^{2} = 0.96$

Ref. S6-14
(article 13.7.19.4 & 13.7.19.6.1) and
Machinery Handbook

Components efficiencies

$\eta_{gears} := 0.96^{2}$

$\eta_{reducer} := 0.94$

1.2 GENERAL DATA

$W_{span} := 1799tonne$ — Weigth of span

$W_{cwt} := W_{span}$ — Weigth of counterweight (hypothesis)

$W_{sheave} := 50000lb$ — Weight of sheave (hypothesis)

$W_{trunnion} := 7500lb$ — Weight of trunnion (hypothesis)

$W_{gear} := 8 \cdot 540lb$ — Weight of gear sets (per sheave) (hypothesis)

$W_{total} := W_{span} + W_{cwt} + 8 \cdot W_{sheave} + 8W_{trunnion} + 8W_{gear} = 8.427 \times 10^{6} \cdot lb$ — Weight to be lifted

$r_{rb} := 12in$ — Radius of roller bearings

$r_{s} := \dfrac{180in}{2}$ — Radius of sheave

$S_{speed} := 1\dfrac{ft}{s}$ — Maximum lifting speed of span

$D_{rope} := 2.25in$ — Diameter of main counterweight ropes

$IMB_{South} := 7450lbf$ Seated imbalance, north tower

$IMB_{North} := 6296lbf$ Seated imbalance, south tower

$L_{open} := 370ft$ Length of span (open deck - approximative)

$W_{open} := 51ft$ Width of span (open deck - approximative)

$L_{closed} := 370ft$ Length of span (close deck - approximative)

$W_{closed} := 10ft$ Width of span (close deck - approximative)

2.0 CALCULATION OF LOADS

2.1 FRICTION LOAD - ROLLER BEARINGS OF COUNTERWEIGHT SHEAVES

$$F_{friction\_stat} := \frac{W_{total} \cdot r_{rb} \cdot \mu_{stat\_roller} \cdot g}{r_s} = 19.992 \cdot kN$$

$$F_{friction\_dyn} := \frac{W_{total} \cdot r_{rb} \cdot \mu_{dyn\_roller} \cdot g}{r_s} = 14.994 \cdot kN$$

2.2 INERTIA

$$A_{acc} := \frac{S_{speed}}{Acc_{time}} = 0.1 \cdot \frac{ft}{s^2}$$

$$A_{brake} := \frac{S_{speed}}{Brake_{time}} = 0.1 \cdot \frac{ft}{s^2}$$

$$F_{acc} := 1.25 W_{total} \cdot A_{acc} = 145.631 \cdot kN$$

$$F_{braking} := 1.25 W_{total} \cdot A_{brake} = 145.631 \cdot kN$$

2.3 ROPE BENDING

$$F_{bend} := \frac{W_{total}}{2} \cdot 0.3 \, \frac{D_{rope}}{2 \cdot r_s} \cdot g = 70.283 \cdot kN$$

Ref. CSA S6-14 article 13.7.20.17

2.4 UNBALANCED CONDITIONS

$$F_{balance} := IMB_{North} + IMB_{South} = 61.145 \cdot kN$$

2.5 WIND LOADING

$$F_{wind} := \left(L_{open} \cdot W_{open} \cdot 0.85 + L_{closed} \cdot W_{closed}\right) \cdot P_{wind} = 220.063 \cdot kN$$

2.6 ICE LOADING (WORST CASE SCENARIO - BRIDGE IS NOT OPENED DURING WINTER)

$$F_{ice} := \left(L_{open} \cdot W_{open} \cdot 0.85 + L_{closed} \cdot W_{closed}\right) \cdot P_{ice} = 220.063 \cdot kN$$

3.0 LOAD CASES

Case 1: Starting Load

$$F_{starting\_lc1} := F_{friction\_stat} + F_{acc} + F_{bend} + F_{balance} + F_{wind} + F_{ice} = 737.177 \cdot kN$$

Case 2: Accelerating Load

$$F_{acc\_lc2} := F_{friction\_dyn} + F_{acc} + F_{bend} + F_{balance} + F_{wind} = 512.116 \cdot kN$$

Case 3: Constant Velocity

$$F_{cons\_lc3} := F_{friction\_dyn} + F_{bend} + F_{balance} + F_{wind} = 366.485 \cdot kN$$

Case 4: Braking Load

$$F_{braking\_lc4} := F_{friction\_dyn} + F_{braking} + F_{bend} + F_{balance} + F_{wind} = 512.116 \cdot kN$$

4.0 MOTOR SELECTION

4.1 GOVERNING FORCE FOR MOTOR SELECTION

$$F_{motor.lc1} := \frac{F_{starting\_lc1}}{Start_{overload}} = 589.741 \cdot kN$$

$$F_{motor.lc2} := \frac{F_{acc\_lc2}}{Acc_{overload}} = 341.411 \cdot kN$$

$$F_{motor.lc3} := \frac{F_{cons\_lc3}}{Cons_{overload}} = 366.485 \cdot kN$$

$$F_{motor.lc4} := \frac{F_{braking\_lc4}}{Acc_{overload}} = 341.411 \cdot kN$$

$$F_{motor} := \max\left(F_{motor.lc1}, F_{motor.lc2}, F_{motor.lc3}, F_{motor.lc4}\right) = 589.741 \cdot kN$$

4.2 MOTOR POWER REQUIRED (per tower)

$$\eta_{lift} := \eta_{sheaves} \cdot \eta_{gears} \cdot \eta_{reducer} = 0.832$$

Efficiency of system

$$Hp_{motor} := \frac{F_{motor} \cdot S_{speed}}{\eta_{lift} \cdot 2} = 145 \cdot hp$$

Required power of motor in worst case scenario (wind + ice load)

Current HP of motors is 150 HP.

Calculations

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Motor Sizing Calculation

Open Steel Grid Deck (Rivetted)

1826 tonnes

TABLE OF CONTENTS :

1.0 GENERAL INFORMATION

1.1 CONSTANTS

$\mu_{stat\_roller} := 0.004$ — Static coefficient of friction for roller bearing

Ref.: S6-14 Table 13.10

$\mu_{dyn\_roller} := 0.003$ — Static coefficient of friction for roller bearing

$Acc_{time} := 10s$ — Maximum time available to reach full lifting speed

Ref. S6-14 article 13.7.14.8.4

$Brake_{time} := 10s$ — Maximum time available to stop the bridge from the maximum speed

$P_{wind} := 0.12kPa$ — Wind pressure

Ref.: S6-14 article 13.7.14.7.4

$P_{ice} := 0.12kPa$ — Ice load per unit area

$Start_{overload} := 1.25$

$Acc_{overload} := 1.5$ — Ref.: S6-14 Table 13.14 — Allowable torque overloads

$Cons_{overload} := 1$

$\eta_{bearings} := 0.98$

$\eta_{sheaves} := \eta_{bearings}^{\;2} = 0.96$

Ref. S6-14
(article 13.7.19.4 & 13.7.19.6.1) and
Machinery Handbook — Components efficiencies

$\eta_{gears} := 0.96^{2}$

$\eta_{reducer} := 0.94$

1.2 GENERAL DATA

$W_{span} := 1826tonne$ — Weigth of span

$W_{cwt} := W_{span}$ — Weigth of counterweight (hypothesis)

$W_{sheave} := 50000lb$ — Weight of sheave (hypothesis)

$W_{trunnion} := 7500lb$ — Weight of trunnion (hypothesis)

$W_{gear} := 8 \cdot 540lb$ — Weight of gear sets (per sheave) (hypothesis)

$W_{total} := W_{span} + W_{cwt} + 8 \cdot W_{sheave} + 8W_{trunnion} + 8W_{gear} = 8.546 \times 10^{6} \cdot lb$ — Weight to be lifted

$r_{rb} := 12in$ — Radius of roller bearings

$r_{s} := \dfrac{180in}{2}$ — Radius of sheave

$S_{speed} := 1\dfrac{ft}{s}$ — Maximum lifting speed of span

$D_{rope} := 2.25in$ — Diameter of main counterweight ropes

$IMB_{South} := 7450lbf$ Seated imbalance, north tower

$IMB_{North} := 6296lbf$ Seated imbalance, south tower

$L_{open} := 370ft$ Length of span (open deck - approximative)

$W_{open} := 51ft$ Width of span (open deck - approximative)

$L_{closed} := 370ft$ Length of span (close deck - approximative)

$W_{closed} := 10ft$ Width of span (close deck - approximative)

2.0 CALCULATION OF LOADS

2.1 FRICTION LOAD - ROLLER BEARINGS OF COUNTERWEIGHT SHEAVES

$$F_{friction\_stat} := \frac{W_{total} \cdot r_{rb} \cdot \mu_{stat\_roller} \cdot g}{r_s} = 20.274 \cdot kN$$

$$F_{friction\_dyn} := \frac{W_{total} \cdot r_{rb} \cdot \mu_{dyn\_roller} \cdot g}{r_s} = 15.206 \cdot kN$$

2.2 INERTIA

$$A_{acc} := \frac{S_{speed}}{Acc_{time}} = 0.1 \cdot \frac{ft}{s^2}$$

$$A_{brake} := \frac{S_{speed}}{Brake_{time}} = 0.1 \cdot \frac{ft}{s^2}$$

$$F_{acc} := 1.25 W_{total} \cdot A_{acc} = 147.688 \cdot kN$$

$$F_{braking} := 1.25 W_{total} \cdot A_{brake} = 147.688 \cdot kN$$

2.3 ROPE BENDING

$$F_{bend} := \frac{W_{total}}{2} \cdot 0.3 \frac{D_{rope}}{2 \cdot r_s} \cdot g = 71.276 \cdot kN$$

Ref. CSA S6-14 article 13.7.20.17

2.4 UNBALANCED CONDITIONS

$$F_{balance} := IMB_{North} + IMB_{South} = 61.145 \cdot kN$$

2.5 WIND LOADING

$$F_{wind} := \left(L_{open} \cdot W_{open} \cdot 0.85 + L_{closed} \cdot W_{closed}\right) \cdot P_{wind} = 220.063 \cdot kN$$

2.6 ICE LOADING (WORST CASE SCENARIO - BRIDGE IS NOT OPENED DURING WINTER)

$$F_{ice} := \left(L_{open} \cdot W_{open} \cdot 0.85 + L_{closed} \cdot W_{closed}\right) \cdot P_{ice} = 220.063 \cdot kN$$

3.0 LOAD CASES

Case 1: Starting Load

$$F_{starting\_lc1} := F_{friction\_stat} + F_{acc} + F_{bend} + F_{balance} + F_{wind} + F_{ice} = 740.51 \cdot kN$$

Case 2: Accelerating Load

$$F_{acc\_lc2} := F_{friction\_dyn} + F_{acc} + F_{bend} + F_{balance} + F_{wind} = 515.378 \cdot kN$$

Case 3: Constant Velocity

$$F_{cons\_lc3} := F_{friction\_dyn} + F_{bend} + F_{balance} + F_{wind} = 367.69 \cdot kN$$

Case 4: Braking Load

$$F_{braking\_lc4} := F_{friction\_dyn} + F_{braking} + F_{bend} + F_{balance} + F_{wind} = 515.378 \cdot kN$$

4.0 MOTOR SELECTION

4.1 GOVERNING FORCE FOR MOTOR SELECTION

$$F_{motor.lc1} := \frac{F_{starting\_lc1}}{Start_{overload}} = 592.408 \cdot kN$$

$$F_{motor.lc2} := \frac{F_{acc\_lc2}}{Acc_{overload}} = 343.585 \cdot kN$$

$$F_{motor.lc3} := \frac{F_{cons\_lc3}}{Cons_{overload}} = 367.69 \cdot kN$$

$$F_{motor.lc4} := \frac{F_{braking\_lc4}}{Acc_{overload}} = 343.585 \cdot kN$$

$$F_{motor} := \max\left(F_{motor.lc1}, F_{motor.lc2}, F_{motor.lc3}, F_{motor.lc4}\right) = 592.408 \cdot kN$$

4.2 MOTOR POWER REQUIRED (per tower)

$$\eta_{lift} := \eta_{sheaves} \cdot \eta_{gears} \cdot \eta_{reducer} = 0.832$$

Efficiency of system

$$Hp_{motor} := \frac{F_{motor} \cdot S_{speed}}{\eta_{lift} \cdot 2} = 146 \cdot hp$$

Required power of motor in worst case scenario (wind + ice load)

Current HP of motors is 150 HP.

AECOM

Calculations

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Motor Sizing Calculation

Orthotropic Steel Deck

1924.6 tonnes

TABLE OF CONTENTS :

1.0 GENERAL INFORMATION

1.1 CONSTANTS

$\mu_{stat\_roller} := 0.004$ — Static coefficient of friction for roller bearing

$\mu_{dyn\_roller} := 0.003$ — Static coefficient of friction for roller bearing

Ref.: S6-14 Table 13.10

$Acc_{time} := 10s$ — Maximum time available to reach full lifting speed

$Brake_{time} := 10s$ — Maximum time available to stop the bridge from the maximum speed

Ref. S6-14 article 13.7.14.8.4

$P_{wind} := 0.12kPa$ — Wind pressure

$P_{ice} := 0.12kPa$ — Ice load per unit area

Ref.: S6-14 article 13.7.14.7.4

$Start_{overload} := 1.25$

$Acc_{overload} := 1.5$

$Cons_{overload} := 1$

Ref.: S6-14 Table 13.14 — Allowable torque overloads

$\eta_{bearings} := 0.98$

$\eta_{sheaves} := \eta_{bearings}{}^2 = 0.96$

$\eta_{gears} := 0.96^2$

$\eta_{reducer} := 0.94$

Ref. S6-14
(article 13.7.19.4 & 13.7.19.6.1) and
Machinery Handbook — Components efficiencies

1.2 GENERAL DATA

$W_{span} := 1924.6tonne$ — Weigth of span

$W_{cwt} := W_{span}$ — Weigth of counterweight (hypothesis)

$W_{sheave} := 50000lb$ — Weight of sheave (hypothesis)

$W_{trunnion} := 7500lb$ — Weight of trunnion (hypothesis)

$W_{gear} := 8 \cdot 540lb$ — Weight of gear sets (per sheave) (hypothesis)

$W_{total} := W_{span} + W_{cwt} + 8 \cdot W_{sheave} + 8W_{trunnion} + 8W_{gear} = 8.981 \times 10^6 \cdot lb$ — Weight to be lifted

$r_{rb} := 12in$ — Radius of roller bearings

$r_s := \frac{180in}{2}$ — Radius of sheave

$S_{speed} := 1\frac{ft}{s}$ — Maximum lifting speed of span

$D_{rope} := 2.25in$ — Diameter of main counterweight ropes

$IMB_{South} := 7450lbf$ Seated imbalance, north tower

$IMB_{North} := 6296lbf$ Seated imbalance, south tower

$L_{open} := 0ft$ Length of span (open deck - approximative)

$W_{open} := 0ft$ Width of span (open deck - approximative)

$L_{closed} := 370ft$ Length of span (close deck - approximative)

$W_{closed} := 60ft$ Width of span (close deck - approximative)

2.0 CALCULATION OF LOADS

2.1 FRICTION LOAD - ROLLER BEARINGS OF COUNTERWEIGHT SHEAVES

$$F_{friction\_stat} := \frac{W_{total} \cdot r_{rb} \cdot \mu_{stat\_roller} \cdot g}{r_s} = 21.305 \cdot kN$$

$$F_{friction\_dyn} := \frac{W_{total} \cdot r_{rb} \cdot \mu_{dyn\_roller} \cdot g}{r_s} = 15.979 \cdot kN$$

2.2 INERTIA

$$A_{acc} := \frac{S_{speed}}{Acc_{time}} = 0.1 \cdot \frac{ft}{s^2}$$

$$A_{brake} := \frac{S_{speed}}{Brake_{time}} = 0.1 \cdot \frac{ft}{s^2}$$

$$F_{acc} := 1.25 W_{total} \cdot A_{acc} = 155.201 \cdot kN$$

$$F_{braking} := 1.25 W_{total} \cdot A_{brake} = 155.201 \cdot kN$$

2.3 ROPE BENDING

$$F_{bend} := \frac{W_{total}}{2} \cdot 0.3 \frac{D_{rope}}{2 \cdot r_s} \cdot g = 74.902 \cdot kN$$

Ref. CSA S6-14 article 13.7.20.17

2.4 UNBALANCED CONDITIONS

$$F_{balance} := IMB_{North} + IMB_{South} = 61.145 \cdot kN$$

2.5 WIND LOADING

$$F_{wind} := \left(L_{open} \cdot W_{open} \cdot 0.85 + L_{closed} \cdot W_{closed}\right) \cdot P_{wind} = 247.494 \cdot kN$$

2.6 ICE LOADING (WORST CASE SCENARIO - BRIDGE IS NOT OPENED DURING WINTER)

$$F_{ice} := \left(L_{open} \cdot W_{open} \cdot 0.85 + L_{closed} \cdot W_{closed}\right) \cdot P_{ice} = 247.494 \cdot kN$$

3.0 LOAD CASES

Case 1: Starting Load

$$F_{starting\_lc1} := F_{friction\_stat} + F_{acc} + F_{bend} + F_{balance} + F_{wind} + F_{ice} = 807.541 \cdot kN$$

Case 2: Accelerating Load

$$F_{acc\_lc2} := F_{friction\_dyn} + F_{acc} + F_{bend} + F_{balance} + F_{wind} = 554.721 \cdot kN$$

Case 3: Constant Velocity

$$F_{cons\_lc3} := F_{friction\_dyn} + F_{bend} + F_{balance} + F_{wind} = 399.52 \cdot kN$$

Case 4: Braking Load

$$F_{braking\_lc4} := F_{friction\_dyn} + F_{braking} + F_{bend} + F_{balance} + F_{wind} = 554.721 \cdot kN$$

4.0 MOTOR SELECTION

4.1 GOVERNING FORCE FOR MOTOR SELECTION

$$F_{motor.lc1} := \frac{F_{starting\_lc1}}{Start_{overload}} = 646.033 \cdot kN$$

$$F_{motor.lc2} := \frac{F_{acc\_lc2}}{Acc_{overload}} = 369.814 \cdot kN$$

$$F_{motor.lc3} := \frac{F_{cons\_lc3}}{Cons_{overload}} = 399.52 \cdot kN$$

$$F_{motor.lc4} := \frac{F_{braking\_lc4}}{Acc_{overload}} = 369.814 \cdot kN$$

$$F_{motor} := \max\left(F_{motor.lc1}, F_{motor.lc2}, F_{motor.lc3}, F_{motor.lc4}\right) = 646.033 \cdot kN$$

4.2 MOTOR POWER REQUIRED (per tower)

$$\eta_{lift} := \eta_{sheaves} \cdot \eta_{gears} \cdot \eta_{reducer} = 0.832$$

Efficiency of system

$$Hp_{motor} := \frac{F_{motor} \cdot S_{speed}}{\eta_{lift} \cdot 2} = 159 \cdot hp$$

Required power of motor in worst case scenario (wind + ice load)

Current HP of motors is 150 HP.

AECOM

Calculations

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Motor Sizing Calculation

Exodermic Deck

2048 tonnes

TABLE OF CONTENTS :

1.0 GENERAL INFORMATION

1.1 CONSTANTS

$\mu_{stat\_roller} := 0.004$ — Static coefficient of friction for roller bearing

Ref.: S6-14 Table 13.10

$\mu_{dyn\_roller} := 0.003$ — Static coefficient of friction for roller bearing

$Acc_{time} := 10s$ — Maximum time available to reach full lifting speed

Ref. S6-14 article 13.7.14.8.4

$Brake_{time} := 10s$ — Maximum time available to stop the bridge from the maximum speed

$P_{wind} := 0.12kPa$ — Wind pressure

Ref.: S6-14 article 13.7.14.7.4

$P_{ice} := 0.12kPa$ — Ice load per unit area

$Start_{overload} := 1.25$

$Acc_{overload} := 1.5$ — Ref.: S6-14 Table 13.14 — Allowable torque overloads

$Cons_{overload} := 1$

$\eta_{bearings} := 0.98$

$\eta_{sheaves} := \eta_{bearings}{}^{2} = 0.96$

Ref. S6-14
(article 13.7.19.4 & 13.7.19.6.1) and
Machinery Handbook

Components efficiencies

$\eta_{gears} := 0.96^{2}$

$\eta_{reducer} := 0.94$

1.2 GENERAL DATA

$W_{span} := 2048tonne$ — Weigth of span

$W_{cwt} := W_{span}$ — Weigth of counterweight (hypothesis)

$W_{sheave} := 50000lb$ — Weight of sheave (hypothesis)

$W_{trunnion} := 7500lb$ — Weight of trunnion (hypothesis)

$W_{gear} := 8\cdot 540lb$ — Weight of gear sets (per sheave) (hypothesis)

$W_{total} := W_{span} + W_{cwt} + 8\cdot W_{sheave} + 8W_{trunnion} + 8W_{gear} = 9.525\times 10^{6}\cdot lb$ — Weight to be lifted

$r_{rb} := 12in$ — Radius of roller bearings

$r_{s} := \dfrac{180in}{2}$ — Radius of sheave

$S_{speed} := 1\dfrac{ft}{s}$ — Maximum lifting speed of span

$D_{rope} := 2.25in$ — Diameter of main counterweight ropes

$IMB_{South} := 7450lbf$ Seated imbalance, north tower

$IMB_{North} := 6296lbf$ Seated imbalance, south tower

$L_{open} := 0ft$ Length of span (open deck - approximative)

$W_{open} := 0ft$ Width of span (open deck - approximative)

$L_{closed} := 370ft$ Length of span (close deck - approximative)

$W_{closed} := 60ft$ Width of span (close deck - approximative)

2.0 CALCULATION OF LOADS

2.1 FRICTION LOAD - ROLLER BEARINGS OF COUNTERWEIGHT SHEAVES

$$F_{friction\_stat} := \frac{W_{total} \cdot r_{rb} \cdot \mu_{stat\_roller} \cdot g}{r_s} = 22.596 \cdot kN$$

$$F_{friction\_dyn} := \frac{W_{total} \cdot r_{rb} \cdot \mu_{dyn\_roller} \cdot g}{r_s} = 16.947 \cdot kN$$

2.2 INERTIA

$$A_{acc} := \frac{S_{speed}}{Acc_{time}} = 0.1 \cdot \frac{ft}{s^2}$$

$$A_{brake} := \frac{S_{speed}}{Brake_{time}} = 0.1 \cdot \frac{ft}{s^2}$$

$$F_{acc} := 1.25 W_{total} \cdot A_{acc} = 164.605 \cdot kN$$

$$F_{braking} := 1.25 W_{total} \cdot A_{brake} = 164.605 \cdot kN$$

2.3 ROPE BENDING

$$F_{bend} := \frac{W_{total}}{2} \cdot 0.3 \frac{D_{rope}}{2 \cdot r_s} \cdot g = 79.44 \cdot kN$$

Ref. CSA S6-14 article 13.7.20.17

2.4 UNBALANCED CONDITIONS

$$F_{balance} := IMB_{North} + IMB_{South} = 61.145 \cdot kN$$

2.5 WIND LOADING

$$F_{wind} := \left(L_{open} \cdot W_{open} \cdot 0.85 + L_{closed} \cdot W_{closed}\right) \cdot P_{wind} = 247.494 \cdot kN$$

2.6 ICE LOADING (WORST CASE SCENARIO - BRIDGE IS NOT OPENED DURING WINTER)

$$F_{ice} := \left(L_{open} \cdot W_{open} \cdot 0.85 + L_{closed} \cdot W_{closed}\right) \cdot P_{ice} = 247.494 \cdot kN$$

3.0 LOAD CASES

Case 1: Starting Load

$$F_{starting\_lc1} := F_{friction\_stat} + F_{acc} + F_{bend} + F_{balance} + F_{wind} + F_{ice} = 822.773 \cdot kN$$

Case 2: Accelerating Load

$$F_{acc\_lc2} := F_{friction\_dyn} + F_{acc} + F_{bend} + F_{balance} + F_{wind} = 569.631 \cdot kN$$

Case 3: Constant Velocity

$$F_{cons\_lc3} := F_{friction\_dyn} + F_{bend} + F_{balance} + F_{wind} = 405.026 \cdot kN$$

Case 4: Braking Load

$$F_{braking\_lc4} := F_{friction\_dyn} + F_{braking} + F_{bend} + F_{balance} + F_{wind} = 569.631 \cdot kN$$

4.0 MOTOR SELECTION

4.1 GOVERNING FORCE FOR MOTOR SELECTION

$$F_{motor.lc1} := \frac{F_{starting\_lc1}}{Start_{overload}} = 658.219 \cdot kN$$

$$F_{motor.lc2} := \frac{F_{acc\_lc2}}{Acc_{overload}} = 379.754 \cdot kN$$

$$F_{motor.lc3} := \frac{F_{cons\_lc3}}{Cons_{overload}} = 405.026 \cdot kN$$

$$F_{motor.lc4} := \frac{F_{braking\_lc4}}{Acc_{overload}} = 379.754 \cdot kN$$

$$F_{motor} := \max\left(F_{motor.lc1}, F_{motor.lc2}, F_{motor.lc3}, F_{motor.lc4}\right) = 658.219 \cdot kN$$

4.2 MOTOR POWER REQUIRED (per tower)

$$\eta_{lift} := \eta_{sheaves} \cdot \eta_{gears} \cdot \eta_{reducer} = 0.832$$

Efficiency of system

$$Hp_{motor} := \frac{F_{motor} \cdot S_{speed}}{\eta_{lift} \cdot 2} = 162 \cdot hp$$

Required power of motor in worst case scenario (wind + ice load)

Current HP of motors is 150 HP.

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Motor Sizing Calculation

Half-Filled Deck (50mm overlay)

2087 tonnes

TABLE OF CONTENTS :

1.0 GENERAL INFORMATION

1.1 CONSTANTS

$\mu_{stat\_roller} := 0.004$ — Static coefficient of friction for roller bearing

Ref.: S6-14 Table 13.10

$\mu_{dyn\_roller} := 0.003$ — Static coefficient of friction for roller bearing

$Acc_{time} := 10s$ — Maximum time available to reach full lifting speed

Ref. S6-14 article 13.7.14.8.4

$Brake_{time} := 10s$ — Maximum time available to stop the bridge from the maximum speed

$P_{wind} := 0.12kPa$ — Wind pressure

Ref.: S6-14 article 13.7.14.7.4

$P_{ice} := 0.12kPa$ — Ice load per unit area

$Start_{overload} := 1.25$

$Acc_{overload} := 1.5$ — Ref.: S6-14 Table 13.14 — Allowable torque overloads

$Cons_{overload} := 1$

$\eta_{bearings} := 0.98$

$\eta_{sheaves} := \eta_{bearings}{}^{2} = 0.96$

Ref. S6-14
(article 13.7.19.4 & 13.7.19.6.1) and
Machinery Handbook

Components efficiencies

$\eta_{gears} := 0.96^{2}$

$\eta_{reducer} := 0.94$

1.2 GENERAL DATA

$W_{span} := 2087tonne$ — Weigth of span

$W_{cwt} := W_{span}$ — Weigth of counterweight (hypothesis)

$W_{sheave} := 50000lb$ — Weight of sheave (hypothesis)

$W_{trunnion} := 7500lb$ — Weight of trunnion (hypothesis)

$W_{gear} := 8\cdot 540lb$ — Weight of gear sets (per sheave) (hypothesis)

$W_{total} := W_{span} + W_{cwt} + 8\cdot W_{sheave} + 8W_{trunnion} + 8W_{gear} = 9.697 \times 10^{6}\cdot lb$ — Weight to be lifted

$r_{rb} := 12in$ — Radius of roller bearings

$r_{s} := \dfrac{180in}{2}$ — Radius of sheave

$S_{speed} := 1\dfrac{ft}{s}$ — Maximum lifting speed of span

$D_{rope} := 2.25in$ — Diameter of main counterweight ropes

$IMB_{South} := 7450lbf$ Seated imbalance, north tower

$IMB_{North} := 6296lbf$ Seated imbalance, south tower

$L_{open} := 0ft$ Length of span (open deck - approximative)

$W_{open} := 0ft$ Width of span (open deck - approximative)

$L_{closed} := 370ft$ Length of span (close deck - approximative)

$W_{closed} := 60ft$ Width of span (close deck - approximative)

2.0 CALCULATION OF LOADS

2.1 FRICTION LOAD - ROLLER BEARINGS OF COUNTERWEIGHT SHEAVES

$$F_{friction\_stat} := \frac{W_{total} \cdot r_{rb} \cdot \mu_{stat\_roller} \cdot g}{r_s} = 23.004 \cdot kN$$

$$F_{friction\_dyn} := \frac{W_{total} \cdot r_{rb} \cdot \mu_{dyn\_roller} \cdot g}{r_s} = 17.253 \cdot kN$$

2.2 INERTIA

$$A_{acc} := \frac{S_{speed}}{Acc_{time}} = 0.1 \cdot \frac{ft}{s^2}$$

$$A_{brake} := \frac{S_{speed}}{Brake_{time}} = 0.1 \cdot \frac{ft}{s^2}$$

$$F_{acc} := 1.25 W_{total} \cdot A_{acc} = 167.576 \cdot kN$$

$$F_{braking} := 1.25 W_{total} \cdot A_{brake} = 167.576 \cdot kN$$

2.3 ROPE BENDING

$$F_{bend} := \frac{W_{total}}{2} \cdot 0.3 \frac{D_{rope}}{2 \cdot r_s} \cdot g = 80.874 \cdot kN$$

Ref. CSA S6-14 article 13.7.20.17

2.4 UNBALANCED CONDITIONS

$$F_{balance} := IMB_{North} + IMB_{South} = 61.145 \cdot kN$$

2.5 WIND LOADING

$$F_{wind} := \left(L_{open} \cdot W_{open} \cdot 0.85 + L_{closed} \cdot W_{closed}\right) \cdot P_{wind} = 247.494 \cdot kN$$

2.6 ICE LOADING (WORST CASE SCENARIO - BRIDGE IS NOT OPENED DURING WINTER)

$$F_{ice} := \left(L_{open} \cdot W_{open} \cdot 0.85 + L_{closed} \cdot W_{closed}\right) \cdot P_{ice} = 247.494 \cdot kN$$

3.0 LOAD CASES

Case 1: Starting Load

$$F_{starting\_lc1} := F_{friction\_stat} + F_{acc} + F_{bend} + F_{balance} + F_{wind} + F_{ice} = 827.587 \cdot kN$$

Case 2: Accelerating Load

$$F_{acc\_lc2} := F_{friction\_dyn} + F_{acc} + F_{bend} + F_{balance} + F_{wind} = 574.343 \cdot kN$$

Case 3: Constant Velocity

$$F_{cons\_lc3} := F_{friction\_dyn} + F_{bend} + F_{balance} + F_{wind} = 406.766 \cdot kN$$

Case 4: Braking Load

$$F_{braking\_lc4} := F_{friction\_dyn} + F_{braking} + F_{bend} + F_{balance} + F_{wind} = 574.343 \cdot kN$$

4.0 MOTOR SELECTION

4.1 GOVERNING FORCE FOR MOTOR SELECTION

$$F_{motor.lc1} := \frac{F_{starting\_lc1}}{Start_{overload}} = 662.07 \cdot kN$$

$$F_{motor.lc2} := \frac{F_{acc\_lc2}}{Acc_{overload}} = 382.895 \cdot kN$$

$$F_{motor.lc3} := \frac{F_{cons\_lc3}}{Cons_{overload}} = 406.766 \cdot kN$$

$$F_{motor.lc4} := \frac{F_{braking\_lc4}}{Acc_{overload}} = 382.895 \cdot kN$$

$$F_{motor} := \max\left(F_{motor.lc1}, F_{motor.lc2}, F_{motor.lc3}, F_{motor.lc4}\right) = 662.07 \cdot kN$$

4.2 MOTOR POWER REQUIRED (per tower)

$$\eta_{lift} := \eta_{sheaves} \cdot \eta_{gears} \cdot \eta_{reducer} = 0.832$$

Efficiency of system

$$Hp_{motor} := \frac{F_{motor} \cdot S_{speed}}{\eta_{lift} \cdot 2} = 163 \cdot hp$$

Required power of motor in worst case scenario (wind + ice load)

Current HP of motors is 150 HP.

AECOM

Calculations

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Motor Sizing Calculation

Precast Concrete Deck

2458 tonnes

TABLE OF CONTENTS :

1.0 GENERAL INFORMATION

1.1 CONSTANTS

$\mu_{stat\_roller} := 0.004$ — Static coefficient of friction for roller bearing

Ref.: S6-14 Table 13.10

$\mu_{dyn\_roller} := 0.003$ — Static coefficient of friction for roller bearing

$Acc_{time} := 10s$ — Maximum time available to reach full lifting speed

Ref. S6-14 article 13.7.14.8.4

$Brake_{time} := 10s$ — Maximum time available to stop the bridge from the maximum speed

$P_{wind} := 0.12kPa$ — Wind pressure

Ref.: S6-14 article 13.7.14.7.4

$P_{ice} := 0.12kPa$ — Ice load per unit area

$Start_{overload} := 1.25$

$Acc_{overload} := 1.5$ — Ref.: S6-14 Table 13.14 — Allowable torque overloads

$Cons_{overload} := 1$

$\eta_{bearings} := 0.98$

$\eta_{sheaves} := \eta_{bearings}{}^{2} = 0.96$

Ref. S6-14
(article 13.7.19.4 & 13.7.19.6.1) and
Machinery Handbook

Components efficiencies

$\eta_{gears} := 0.96^{2}$

$\eta_{reducer} := 0.94$

1.2 GENERAL DATA

$W_{span} := 2458tonne$ — Weigth of span

$W_{cwt} := W_{span}$ — Weigth of counterweight (hypothesis)

$W_{sheave} := 50000lb$ — Weight of sheave (hypothesis)

$W_{trunnion} := 7500lb$ — Weight of trunnion (hypothesis)

$W_{gear} := 8 \cdot 540lb$ — Weight of gear sets (per sheave) (hypothesis)

$W_{total} := W_{span} + W_{cwt} + 8 \cdot W_{sheave} + 8W_{trunnion} + 8W_{gear} = 1.133 \times 10^{7} \cdot lb$ — Weight to be lifted

$r_{rb} := 12in$ — Radius of roller bearings

$r_{s} := \dfrac{180in}{2}$ — Radius of sheave

$S_{speed} := 1\dfrac{ft}{s}$ — Maximum lifting speed of span

$D_{rope} := 2.25in$ — Diameter of main counterweight ropes

$IMB_{South} := 7450lbf$ Seated imbalance, north tower

$IMB_{North} := 6296lbf$ Seated imbalance, south tower

$L_{open} := 0ft$ Length of span (open deck - approximative)

$W_{open} := 0ft$ Width of span (open deck - approximative)

$L_{closed} := 370ft$ Length of span (close deck - approximative)

$W_{closed} := 60ft$ Width of span (close deck - approximative)

2.0 CALCULATION OF LOADS

2.1 FRICTION LOAD - ROLLER BEARINGS OF COUNTERWEIGHT SHEAVES

$$F_{friction\_stat} := \frac{W_{total} \cdot r_{rb} \cdot \mu_{stat\_roller} \cdot g}{r_s} = 26.885 \cdot kN$$

$$F_{friction\_dyn} := \frac{W_{total} \cdot r_{rb} \cdot \mu_{dyn\_roller} \cdot g}{r_s} = 20.164 \cdot kN$$

2.2 INERTIA

$$A_{acc} := \frac{S_{speed}}{Acc_{time}} = 0.1 \cdot \frac{ft}{s^2}$$

$$A_{brake} := \frac{S_{speed}}{Brake_{time}} = 0.1 \cdot \frac{ft}{s^2}$$

$$F_{acc} := 1.25 W_{total} \cdot A_{acc} = 195.847 \cdot kN$$

$$F_{braking} := 1.25 W_{total} \cdot A_{brake} = 195.847 \cdot kN$$

2.3 ROPE BENDING

$$F_{bend} := \frac{W_{total}}{2} \cdot 0.3 \frac{D_{rope}}{2 \cdot r_s} \cdot g = 94.518 \cdot kN$$

Ref. CSA S6-14 article 13.7.20.17

2.4 UNBALANCED CONDITIONS

$$F_{balance} := IMB_{North} + IMB_{South} = 61.145 \cdot kN$$

2.5 WIND LOADING

$$F_{wind} := \left(L_{open} \cdot W_{open} \cdot 0.85 + L_{closed} \cdot W_{closed}\right) \cdot P_{wind} = 247.494 \cdot kN$$

2.6 ICE LOADING (WORST CASE SCENARIO - BRIDGE IS NOT OPENED DURING WINTER)

$$F_{ice} := \left(L_{open} \cdot W_{open} \cdot 0.85 + L_{closed} \cdot W_{closed}\right) \cdot P_{ice} = 247.494 \cdot kN$$

3.0 LOAD CASES

Case 1: Starting Load

$$F_{starting\_lc1} := F_{friction\_stat} + F_{acc} + F_{bend} + F_{balance} + F_{wind} + F_{ice} = 873.382 \cdot kN$$

Case 2: Accelerating Load

$$F_{acc\_lc2} := F_{friction\_dyn} + F_{acc} + F_{bend} + F_{balance} + F_{wind} = 619.167 \cdot kN$$

Case 3: Constant Velocity

$$F_{cons\_lc3} := F_{friction\_dyn} + F_{bend} + F_{balance} + F_{wind} = 423.32 \cdot kN$$

Case 4: Braking Load

$$F_{braking\_lc4} := F_{friction\_dyn} + F_{braking} + F_{bend} + F_{balance} + F_{wind} = 619.167 \cdot kN$$

4.0 MOTOR SELECTION

4.1 GOVERNING FORCE FOR MOTOR SELECTION

$$F_{motor.lc1} := \frac{F_{starting\_lc1}}{Start_{overload}} = 698.705 \cdot kN$$

$$F_{motor.lc2} := \frac{F_{acc\_lc2}}{Acc_{overload}} = 412.778 \cdot kN$$

$$F_{motor.lc3} := \frac{F_{cons\_lc3}}{Cons_{overload}} = 423.32 \cdot kN$$

$$F_{motor.lc4} := \frac{F_{braking\_lc4}}{Acc_{overload}} = 412.778 \cdot kN$$

$$F_{motor} := \max\left(F_{motor.lc1}, F_{motor.lc2}, F_{motor.lc3}, F_{motor.lc4}\right) = 698.705 \cdot kN$$

4.2 MOTOR POWER REQUIRED (per tower)

$$\eta_{lift} := \eta_{sheaves} \cdot \eta_{gears} \cdot \eta_{reducer} = 0.832$$

Efficiency of system

$$Hp_{motor} := \frac{F_{motor} \cdot S_{speed}}{\eta_{lift} \cdot 2} = 172 \cdot hp$$

Required power of motor in worst case scenario (wind + ice load)

Current HP of motors is 150 HP.

AECOM

Calculations

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Motor Sizing Calculation

Half-Fille Deck (No overlay)

1919 tonnes

TABLE OF CONTENTS :

1.0 GENERAL INFORMATION

1.1 CONSTANTS

$\mu_{stat\_roller} := 0.004$ — Static coefficient of friction for roller bearing

Ref.: S6-14 Table 13.10

$\mu_{dyn\_roller} := 0.003$ — Static coefficient of friction for roller bearing

$Acc_{time} := 10s$ — Maximum time available to reach full lifting speed

Ref. S6-14 article 13.7.14.8.4

$Brake_{time} := 10s$ — Maximum time available to stop the bridge from the maximum speed

$P_{wind} := 0.12kPa$ — Wind pressure

Ref.: S6-14 article 13.7.14.7.4

$P_{ice} := 0.12kPa$ — Ice load per unit area

$Start_{overload} := 1.25$

$Acc_{overload} := 1.5$ — Ref.: S6-14 Table 13.14 — Allowable torque overloads

$Cons_{overload} := 1$

$\eta_{bearings} := 0.98$

$\eta_{sheaves} := \eta_{bearings}{}^{2} = 0.96$

Ref. S6-14
(article 13.7.19.4 & 13.7.19.6.1) and
Machinery Handbook — Components efficiencies

$\eta_{gears} := 0.96^{2}$

$\eta_{reducer} := 0.94$

1.2 GENERAL DATA

$W_{span} := 1919tonne$ — Weigth of span

$W_{cwt} := W_{span}$ — Weigth of counterweight (hypothesis)

$W_{sheave} := 50000lb$ — Weight of sheave (hypothesis)

$W_{trunnion} := 7500lb$ — Weight of trunnion (hypothesis)

$W_{gear} := 8\cdot 540lb$ — Weight of gear sets (per sheave) (hypothesis)

$W_{total} := W_{span} + W_{cwt} + 8\cdot W_{sheave} + 8W_{trunnion} + 8W_{gear} = 8.956 \times 10^{6}\cdot lb$ — Weight to be lifted

$r_{rb} := 12in$ — Radius of roller bearings

$r_{s} := \dfrac{180in}{2}$ — Radius of sheave

$S_{speed} := 1\dfrac{ft}{s}$ — Maximum lifting speed of span

$D_{rope} := 2.25in$ — Diameter of main counterweight ropes

$IMB_{South} := 7450lbf$ Seated imbalance, north tower

$IMB_{North} := 6296lbf$ Seated imbalance, south tower

$L_{open} := 0ft$ Length of span (open deck - approximative)

$W_{open} := 0ft$ Width of span (open deck - approximative)

$L_{closed} := 370ft$ Length of span (close deck - approximative)

$W_{closed} := 60ft$ Width of span (close deck - approximative)

2.0 CALCULATION OF LOADS

2.1 FRICTION LOAD - ROLLER BEARINGS OF COUNTERWEIGHT SHEAVES

$$F_{friction\_stat} := \frac{W_{total} \cdot r_{rb} \cdot \mu_{stat\_roller} \cdot g}{r_s} = 21.247 \cdot kN$$

$$F_{friction\_dyn} := \frac{W_{total} \cdot r_{rb} \cdot \mu_{dyn\_roller} \cdot g}{r_s} = 15.935 \cdot kN$$

2.2 INERTIA

$$A_{acc} := \frac{S_{speed}}{Acc_{time}} = 0.1 \cdot \frac{ft}{s^2}$$

$$A_{brake} := \frac{S_{speed}}{Brake_{time}} = 0.1 \cdot \frac{ft}{s^2}$$

$$F_{acc} := 1.25 W_{total} \cdot A_{acc} = 154.775 \cdot kN$$

$$F_{braking} := 1.25 W_{total} \cdot A_{brake} = 154.775 \cdot kN$$

2.3 ROPE BENDING

$$F_{bend} := \frac{W_{total}}{2} \cdot 0.3 \frac{D_{rope}}{2 \cdot r_s} \cdot g = 74.696 \cdot kN$$

Ref. CSA S6-14 article 13.7.20.17

2.4 UNBALANCED CONDITIONS

$$F_{balance} := IMB_{North} + IMB_{South} = 61.145 \cdot kN$$

2.5 WIND LOADING

$$F_{wind} := \left(L_{open} \cdot W_{open} \cdot 0.85 + L_{closed} \cdot W_{closed}\right) \cdot P_{wind} = 247.494 \cdot kN$$

2.6 ICE LOADING (WORST CASE SCENARIO - BRIDGE IS NOT OPENED DURING WINTER)

$$F_{ice} := \left(L_{open} \cdot W_{open} \cdot 0.85 + L_{closed} \cdot W_{closed}\right) \cdot P_{ice} = 247.494 \cdot kN$$

3.0 LOAD CASES

Case 1: Starting Load

$$F_{starting\_lc1} := F_{friction\_stat} + F_{acc} + F_{bend} + F_{balance} + F_{wind} + F_{ice} = 806.85 \cdot kN$$

Case 2: Accelerating Load

$$F_{acc\_lc2} := F_{friction\_dyn} + F_{acc} + F_{bend} + F_{balance} + F_{wind} = 554.045 \cdot kN$$

Case 3: Constant Velocity

$$F_{cons\_lc3} := F_{friction\_dyn} + F_{bend} + F_{balance} + F_{wind} = 399.27 \cdot kN$$

Case 4: Braking Load

$$F_{braking\_lc4} := F_{friction\_dyn} + F_{braking} + F_{bend} + F_{balance} + F_{wind} = 554.045 \cdot kN$$

4.0 MOTOR SELECTION

4.1 GOVERNING FORCE FOR MOTOR SELECTION

$$F_{motor.lc1} := \frac{F_{starting\_lc1}}{Start_{overload}} = 645.48 \cdot kN$$

$$F_{motor.lc2} := \frac{F_{acc\_lc2}}{Acc_{overload}} = 369.363 \cdot kN$$

$$F_{motor.lc3} := \frac{F_{cons\_lc3}}{Cons_{overload}} = 399.27 \cdot kN$$

$$F_{motor.lc4} := \frac{F_{braking\_lc4}}{Acc_{overload}} = 369.363 \cdot kN$$

$$F_{motor} := \max\left(F_{motor.lc1}, F_{motor.lc2}, F_{motor.lc3}, F_{motor.lc4}\right) = 645.48 \cdot kN$$

4.2 MOTOR POWER REQUIRED (per tower)

$$\eta_{lift} := \eta_{sheaves} \cdot \eta_{gears} \cdot \eta_{reducer} = 0.832$$

Efficiency of system

$$Hp_{motor} := \frac{F_{motor} \cdot S_{speed}}{\eta_{lift} \cdot 2} = 159 \cdot hp$$

Required power of motor in worst case scenario (wind + ice load)

Current HP of motors is 150 HP.

AECOM

Calculations

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Main Counterweight Rope Capacity Calculations

Fiber Reinforced

1733 tonnes

1.0 GENERAL INFORMATION

1.1 GENERAL DATA

$W_{span} := 1733\text{tonne}$ — Weigth of span and deck

$D := 177.75\text{in}$ — Tread diameter of sheave rope grooves

$d := 2.25\text{in}$ — Diameter of main counterweight ropes

$d_w := \frac{d}{16} = 0.141 \cdot \text{in}$ Ref.: AASHTO Article 6.8.3.3.4 — Diameter of the outer wires in the wire rope

$E_w := 30 \times 10^6 \text{psi}$ — Tensile modulus of elasticity of the steel wire

$A_{rope} := 0.4 \cdot d^2 = 2.025 \cdot \text{in}^2$ Ref.: S6-14 Table 13.20 — Effective cross sectional are of the ropes (approx.)

$N_{rope} := 80$ — Number of ropes

1.2 ALLOWABLE STRESSES

Ref.: AASHTO Article 6.6.5 & CHBDC article 13.7.20.18

$P_{ult} := 420000\text{lbf}$ — Minimum ultimate tensile strength of rope (ref. BLB 2002 Main CW Wire Rope Replacement)

$\sigma_{ult} := \frac{P_{ult}}{A_{rope}} = 1430 \cdot \text{MPa}$ — Allowable tensile load

$\sigma_{allowable} := 0.222 \cdot \sigma_{ult} = 317 \cdot \text{MPa}$ — Maximum allowable tensile stress (for combined effect of bending and direct load)

2.0 STRESSES CALCULATIONS

Ref.: AASHTO Article 6.8.3.3.4 & CHBDC article 13.7.20.18

$\sigma_b := E_w \cdot \frac{d_w}{D} = 163.641 \cdot \text{MPa}$ — Maximum bending stress

$P := \frac{W_{span} \cdot g}{80} = 212.437 \cdot \text{kN}$ — Direct load (per rope)

$P_{ol} := \frac{627.113 \text{ kN}}{80} = 7.839 \cdot \text{kN}$ — Operating loads (per rope) (value from motor sizing calculation)

$\sigma_r := \frac{P}{A_{rope}} + \sigma_b + \frac{P_{ol}}{A_{rope}} = 332.248 \cdot \text{MPa}$ — Maximum total stress (per rope)

$SF := \frac{\sigma_r}{\sigma_{allowable}} \cdot 100\% = 104.656 \cdot \%$ — Value of over stress

AECOM

Calculations

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Main Counterweight Rope Capacity Calculations

Orthotropic Steel Deck

1924.6 tonnes

1.0 GENERAL INFORMATION

1.1 GENERAL DATA

$W_{span} := 1924.6\text{tonne}$ — Weigth of span and deck

$D := 177.75\text{in}$ — Tread diameter of sheave rope grooves

$d := 2.25\text{in}$ — Diameter of main counterweight ropes

$d_w := \frac{d}{16} = 0.141 \cdot \text{in}$ Ref.: AASHTO Article 6.8.3.3.4 — Diameter of the outer wires in the wire rope

$E_w := 30 \times 10^6 \text{psi}$ — Tensile modulus of elasticity of the steel wire

$A_{rope} := 0.4 \cdot d^2 = 2.025 \cdot \text{in}^2$ Ref.: S6-14 Table 13.20 — Effective cross sectional are of the ropes (approx.)

$N_{rope} := 80$ — Number of ropes

1.2 ALLOWABLE STRESSES

Ref.: AASHTO Article 6.6.5 & CHBDC article 13.7.20.18

$P_{ult} := 420000\text{lbf}$ — Minimum ultimate tensile strength of rope (ref. BLB 2002 Main CW Wire Rope Replacement)

$\sigma_{ult} := \frac{P_{ult}}{A_{rope}} = 1430 \cdot \text{MPa}$ — Allowable tensile load

$\sigma_{allowable} := 0.222 \cdot \sigma_{ult} = 317 \cdot \text{MPa}$ — Maximum allowable tensile stress (for combined effect of bending and direct load)

2.0 STRESSES CALCULATIONS

Ref.: AASHTO Article 6.8.3.3.4 & CHBDC article 13.7.20.18

$\sigma_b := E_w \cdot \frac{d_w}{D} = 163.641 \cdot \text{MPa}$ — Maximum bending stress

$P := \frac{W_{span} \cdot g}{80} = 235.923 \cdot \text{kN}$ — Direct load (per rope)

$P_{ol} := \frac{646.033\ \text{kN}}{80} = 8.075 \cdot \text{kN}$ — Operating loads (per rope) (value from motor sizing calculation)

$\sigma_r := \frac{P}{A_{rope}} + \sigma_b + \frac{P_{ol}}{A_{rope}} = 350.406 \cdot \text{MPa}$ — Maximum total stress (per rope)

$SF := \frac{\sigma_r}{\sigma_{allowable}} \cdot 100\% = 110.376 \cdot \%$ — Value of over stress

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Main Counterweight Rope Capacity Calculations

Aluminium Deck

1727 tonnes

1.0 GENERAL INFORMATION

1.1 GENERAL DATA

$W_{span} := 1727\text{tonne}$ — Weigth of span and deck

$D := 177.75\text{in}$ — Tread diameter of sheave rope grooves

$d := 2.25\text{in}$ — Diameter of main counterweight ropes

$d_w := \frac{d}{16} = 0.141 \cdot \text{in}$ — Ref.: AASHTO Article 6.8.3.3.4 — Diameter of the outer wires in the wire rope

$E_w := 30 \times 10^6 \text{psi}$ — Tensile modulus of elasticity of the steel wire

$A_{rope} := 0.4 \cdot d^2 = 2.025\ \text{in}^2$ — Ref.: S6-14 Table 13.20 — Effective cross sectional are of the ropes (approx.)

$N_{rope} := 80$ — Number of ropes

1.2 ALLOWABLE STRESSES

Ref.: AASHTO Article 6.6.5 & CHBDC article 13.7.20.18

$P_{ult} := 420000\text{lbf}$ — Minimum ultimate tensile strength of rope (ref. BLB 2002 Main CW Wire Rope Replacement)

$\sigma_{ult} := \frac{P_{ult}}{A_{rope}} = 1430 \cdot \text{MPa}$ — Allowable tensile load

$\sigma_{allowable} := 0.222 \cdot \sigma_{ult} = 317 \cdot \text{MPa}$ — Maximum allowable tensile stress (for combined effect of bending and direct load)

2.0 STRESSES CALCULATIONS

Ref.: AASHTO Article 6.8.3.3.4 & CHBDC article 13.7.20.18

$\sigma_b := E_w \cdot \frac{d_w}{D} = 163.641 \cdot \text{MPa}$ — Maximum bending stress

$P := \frac{W_{span} \cdot g}{80} = 211.701 \cdot \text{kN}$ — Direct load (per rope)

$P_{ol} := \frac{626.52\ \text{kN}}{80} = 7.832 \cdot \text{kN}$ — Operating loads (per rope) (value from motor sizing calculation)

$\sigma_r := \frac{P}{A_{rope}} + \sigma_b + \frac{P_{ol}}{A_{rope}} = 331.679 \cdot \text{MPa}$ — Maximum total stress (per rope)

$SF := \frac{\sigma_r}{\sigma_{allowable}} \cdot 100\% = 104.477 \cdot \%$ — Value of over stress

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Main Counterweight Rope Capacity Calculations

Open Steel Grid Deck (Crimped I bar)

1799 tonnes

1.0 GENERAL INFORMATION

1.1 GENERAL DATA

$W_{span} := 1799\text{tonne}$ — Weigth of span and deck

$D := 177.75\text{in}$ — Tread diameter of sheave rope grooves

$d := 2.25\text{in}$ — Diameter of main counterweight ropes

$d_w := \frac{d}{16} = 0.141 \cdot \text{in}$ Ref.: AASHTO Article 6.8.3.3.4 — Diameter of the outer wires in the wire rope

$E_w := 30 \times 10^6 \text{psi}$ — Tensile modulus of elasticity of the steel wire

$A_{rope} := 0.4 \cdot d^2 = 2.025 \text{ in}^2$ Ref.: S6-14 Table 13.20 — Effective cross sectional are of the ropes (approx.)

$N_{rope} := 80$ — Number of ropes

1.2 ALLOWABLE STRESSES

Ref.: AASHTO Article 6.6.5 & CHBDC article 13.7.20.18

$P_{ult} := 420000\text{lbf}$ — Minimum ultimate tensile strength of rope (ref. BLB 2002 Main CW Wire Rope Replacement)

$\sigma_{ult} := \frac{P_{ult}}{A_{rope}} = 1430 \cdot \text{MPa}$ — Allowable tensile load

$\sigma_{allowable} := 0.222 \cdot \sigma_{ult} = 317 \cdot \text{MPa}$ — Maximum allowable tensile stress (for combined effect of bending and direct load)

2.0 STRESSES CALCULATIONS

Ref.: AASHTO Article 6.8.3.3.4 & CHBDC article 13.7.20.18

$\sigma_b := E_w \cdot \frac{d_w}{D} = 163.641 \cdot \text{MPa}$ — Maximum bending stress

$P := \frac{W_{span} \cdot g}{80} = 220.527 \cdot \text{kN}$ — Direct load (per rope)

$P_{ol} := \frac{737.177 \text{ kN}}{80} = 9.215 \cdot \text{kN}$ — Operating loads (per rope) (value from motor sizing calculation)

$\sigma_r := \frac{P}{A_{rope}} + \sigma_b + \frac{P_{ol}}{A_{rope}} = 339.493 \cdot \text{MPa}$ — Maximum total stress (per rope)

$SF := \frac{\sigma_r}{\sigma_{allowable}} \cdot 100\% = 106.939 \cdot \%$ — Value of over stress

AECOM

Calculations

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Main Counterweight Rope Capacity Calculations

Open Steel Grid Deck (Rivetted)

1826 tonnes

1.0 GENERAL INFORMATION

1.1 GENERAL DATA

$W_{span} := 1826\text{tonne}$ — Weigth of span and deck

$D := 177.75\text{in}$ — Tread diameter of sheave rope grooves

$d := 2.25\text{in}$ — Diameter of main counterweight ropes

$d_w := \dfrac{d}{16} = 0.141 \cdot \text{in}$ — Ref.: AASHTO Article 6.8.3.3.4 — Diameter of the outer wires in the wire rope

$E_w := 30 \times 10^6 \text{psi}$ — Tensile modulus of elasticity of the steel wire

$A_{rope} := 0.4 \cdot d^2 = 2.025\ \text{in}^2$ — Ref.: S6-14 Table 13.20 — Effective cross sectional are of the ropes (approx.)

$N_{rope} := 80$ — Number of ropes

1.2 ALLOWABLE STRESSES

Ref.: AASHTO Article 6.6.5 & CHBDC article 13.7.20.18

$P_{ult} := 420000\text{lbf}$ — Minimum ultimate tensile strength of rope (ref. BLB 2002 Main CW Wire Rope Replacement)

$\sigma_{ult} := \dfrac{P_{ult}}{A_{rope}} = 1430 \cdot \text{MPa}$ — Allowable tensile load

$\sigma_{allowable} := 0.222 \cdot \sigma_{ult} = 317 \cdot \text{MPa}$ — Maximum allowable tensile stress (for combined effect of bending and direct load)

2.0 STRESSES CALCULATIONS

Ref.: AASHTO Article 6.8.3.3.4 & CHBDC article 13.7.20.18

$\sigma_b := E_w \cdot \dfrac{d_w}{D} = 163.641 \cdot \text{MPa}$ — Maximum bending stress

$P := \dfrac{W_{span} \cdot g}{80} = 223.837 \cdot \text{kN}$ — Direct load (per rope)

$P_{ol} := \dfrac{636.297\ \text{kN}}{80} = 7.954 \cdot \text{kN}$ — Operating loads (per rope) (value from motor sizing calculation)

$\sigma_r := \dfrac{P}{A_{rope}} + \sigma_b + \dfrac{P_{ol}}{A_{rope}} = 341.062 \cdot \text{MPa}$ — Maximum total stress (per rope)

$SF := \dfrac{\sigma_r}{\sigma_{allowable}} \cdot 100\% = 107.433 \cdot \%$ — Value of over stress

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Main Counterweight Rope Capacity Calculations

Half-Filled (No overlay)

1919 tonnes

1.0 GENERAL INFORMATION

1.1 GENERAL DATA

$W_{span} := 1919 tonne$ — Weigth of span and deck

$D := 177.75 in$ — Tread diameter of sheave rope grooves

$d := 2.25 in$ — Diameter of main counterweight ropes

$d_w := \frac{d}{16} = 0.141 \cdot in$ Ref.: AASHTO Article 6.8.3.3.4 — Diameter of the outer wires in the wire rope

$E_w := 30 \times 10^6 psi$ — Tensile modulus of elasticity of the steel wire

$A_{rope} := 0.4 \cdot d^2 = 2.025 \cdot in^2$ Ref.: S6-14 Table 13.20 — Effective cross sectional are of the ropes (approx.)

$N_{rope} := 80$ — Number of ropes

1.2 ALLOWABLE STRESSES

Ref.: AASHTO Article 6.6.5 & CHBDC article 13.7.20.18

$P_{ult} := 420000 lbf$ — Minimum ultimate tensile strength of rope (ref. BLB 2002 Main CW Wire Rope Replacement)

$\sigma_{ult} := \frac{P_{ult}}{A_{rope}} = 1430 \cdot MPa$ — Allowable tensile load

$\sigma_{allowable} := 0.222 \cdot \sigma_{ult} = 317 \cdot MPa$ — Maximum allowable tensile stress (for combined effect of bending and direct load)

2.0 STRESSES CALCULATIONS

Ref.: AASHTO Article 6.8.3.3.4 & CHBDC article 13.7.20.18

$\sigma_b := E_w \cdot \frac{d_w}{D} = 163.641 \cdot MPa$ — Maximum bending stress

$P := \frac{W_{span} \cdot g}{80} = 235.237 \cdot kN$ — Direct load (per rope)

$P_{ol} := \frac{645.48\ kN}{80} = 8.069 \cdot kN$ — Operating loads (per rope) (value from motor sizing calculation)

$\sigma_r := \frac{P}{A_{rope}} + \sigma_b + \frac{P_{ol}}{A_{rope}} = 349.876 \cdot MPa$ — Maximum total stress (per rope)

$SF := \frac{\sigma_r}{\sigma_{allowable}} \cdot 100\% = 110.209 \cdot \%$ — Value of over stress

AECOM

Calculations

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Main Counterweight Rope Capacity Calculations

Exodermic Deck

2048 tonnes

1.0 GENERAL INFORMATION

1.1 GENERAL DATA

$W_{span} := 2048\text{tonne}$ — Weigth of span and deck

$D := 177.75\text{in}$ — Tread diameter of sheave rope grooves

$d := 2.25\text{in}$ — Diameter of main counterweight ropes

$d_w := \frac{d}{16} = 0.141 \cdot \text{in}$ Ref.: AASHTO Article 6.8.3.3.4 — Diameter of the outer wires in the wire rope

$E_w := 30 \times 10^6 \text{psi}$ — Tensile modulus of elasticity of the steel wire

$A_{rope} := 0.4 \cdot d^2 = 2.025 \cdot \text{in}^2$ Ref.: S6-14 Table 13.20 — Effective cross sectional are of the ropes (approx.)

$N_{rope} := 80$ — Number of ropes

1.2 ALLOWABLE STRESSES

Ref.: AASHTO Article 6.6.5 & CHBDC article 13.7.20.18

$P_{ult} := 420000\text{lbf}$ — Minimum ultimate tensile strength of rope (ref. BLB 2002 Main CW Wire Rope Replacement)

$\sigma_{ult} := \frac{P_{ult}}{A_{rope}} = 1430 \cdot \text{MPa}$ — Allowable tensile load

$\sigma_{allowable} := 0.222 \cdot \sigma_{ult} = 317 \cdot \text{MPa}$ — Maximum allowable tensile stress (for combined effect of bending and direct load)

2.0 STRESSES CALCULATIONS

Ref.: AASHTO Article 6.8.3.3.4 & CHBDC article 13.7.20.18

$\sigma_b := E_w \cdot \frac{d_w}{D} = 163.641 \cdot \text{MPa}$ — Maximum bending stress

$P := \frac{W_{span} \cdot g}{80} = 251.05 \cdot \text{kN}$ — Direct load (per rope)

$P_{ol} := \frac{658.219\ \text{kN}}{80} = 8.228 \cdot \text{kN}$ — Operating loads (per rope) (value from motor sizing calculation)

$\sigma_r := \frac{P}{A_{rope}} + \sigma_b + \frac{P_{ol}}{A_{rope}} = 362.101 \cdot \text{MPa}$ — Maximum total stress (per rope)

$SF := \frac{\sigma_r}{\sigma_{allowable}} \cdot 100\% = 114.06 \cdot \%$ — Value of over stress

AECOM

Calculations

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Main Counterweight Rope Capacity Calculations

Half-Filled (50mm overlay)

2087 tonnes

1.0 GENERAL INFORMATION

1.1 GENERAL DATA

$W_{span} := 2087\text{tonne}$ — Weigth of span and deck

$D := 177.75\text{in}$ — Tread diameter of sheave rope grooves

$d := 2.25\text{in}$ — Diameter of main counterweight ropes

$d_w := \frac{d}{16} = 0.141\cdot\text{in}$ Ref.: AASHTO Article 6.8.3.3.4 — Diameter of the outer wires in the wire rope

$E_w := 30 \times 10^6\text{psi}$ — Tensile modulus of elasticity of the steel wire

$A_{rope} := 0.4\cdot d^2 = 2.025\cdot\text{in}^2$ Ref.: S6-14 Table 13.20 — Effective cross sectional are of the ropes (approx.)

$N_{rope} := 80$ — Number of ropes

1.2 ALLOWABLE STRESSES

Ref.: AASHTO Article 6.6.5 & CHBDC article 13.7.20.18

$P_{ult} := 420000\text{lbf}$ — Minimum ultimate tensile strength of rope (ref. BLB 2002 Main CW Wire Rope Replacement)

$\sigma_{ult} := \frac{P_{ult}}{A_{rope}} = 1430\cdot\text{MPa}$ — Allowable tensile load

$\sigma_{allowable} := 0.222\cdot\sigma_{ult} = 317\cdot\text{MPa}$ — Maximum allowable tensile stress (for combined effect of bending and direct load)

2.0 STRESSES CALCULATIONS

Ref.: AASHTO Article 6.8.3.3.4 & CHBDC article 13.7.20.18

$\sigma_b := E_w\cdot\frac{d_w}{D} = 163.641\cdot\text{MPa}$ — Maximum bending stress

$P := \frac{W_{span}\cdot g}{80} = 255.831\cdot\text{kN}$ — Direct load (per rope)

$P_{ol} := \frac{662.07\ \text{kN}}{80} = 8.276\cdot\text{kN}$ — Operating loads (per rope) (value from motor sizing calculation)

$\sigma_r := \frac{P}{A_{rope}} + \sigma_b + \frac{P_{ol}}{A_{rope}} = 365.798\cdot\text{MPa}$ — Maximum total stress (per rope)

$SF := \frac{\sigma_r}{\sigma_{allowable}}\cdot 100\% = 115.224\cdot\%$ — Value of over stress

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Main Counterweight Rope Capacity Calculations

Precast Concrete Deck

2458 tonnes

1.0 GENERAL INFORMATION

1.1 GENERAL DATA

$W_{span} := 2458\text{tonne}$ — Weigth of span and deck

$D := 177.75\text{in}$ — Tread diameter of sheave rope grooves

$d := 2.25\text{in}$ — Diameter of main counterweight ropes

$d_w := \frac{d}{16} = 0.141 \cdot \text{in}$ Ref.: AASHTO Article 6.8.3.3.4 — Diameter of the outer wires in the wire rope

$E_w := 30 \times 10^6 \text{psi}$ — Tensile modulus of elasticity of the steel wire

$A_{rope} := 0.4 \cdot d^2 = 2.025 \cdot \text{in}^2$ Ref.: S6-14 Table 13.20 — Effective cross sectional are of the ropes (approx.)

$N_{rope} := 80$ — Number of ropes

1.2 ALLOWABLE STRESSES

Ref.: AASHTO Article 6.6.5 & CHBDC article 13.7.20.18

$P_{ult} := 420000\text{lbf}$ — Minimum ultimate tensile strength of rope (ref. BLB 2002 Main CW Wire Rope Replacement)

$\sigma_{ult} := \frac{P_{ult}}{A_{rope}} = 1430 \cdot \text{MPa}$ — Allowable tensile load

$\sigma_{allowable} := 0.222 \cdot \sigma_{ult} = 317 \cdot \text{MPa}$ — Maximum allowable tensile stress (for combined effect of bending and direct load)

2.0 STRESSES CALCULATIONS

Ref.: AASHTO Article 6.8.3.3.4 & CHBDC article 13.7.20.18

$\sigma_b := E_w \cdot \frac{d_w}{D} = 163.641 \cdot \text{MPa}$ — Maximum bending stress

$P := \frac{W_{span} \cdot g}{80} = 301.309 \cdot \text{kN}$ — Direct load (per rope)

$P_{ol} := \frac{698.705\ \text{kN}}{80} = 8.734 \cdot \text{kN}$ — Operating loads (per rope) (value from motor sizing calculation)

$\sigma_r := \frac{P}{A_{rope}} + \sigma_b + \frac{P_{ol}}{A_{rope}} = 400.959 \cdot \text{MPa}$ — Maximum total stress (per rope)

$SF := \frac{\sigma_r}{\sigma_{allowable}} \cdot 100\% = 126.3 \cdot \%$ — Value of over stress

Calculations

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Trunnion Shaft Bearing Capacity

1.0 GENERAL INFORMATION

1.1 GENERAL DATA

$D_b := 21.250in$ — Diameter of Shaft at Section B (bore diameter)

$r_s := \frac{180in}{2} = 90 \cdot in$ — Radius of sheave

$S_{speed} := 1\frac{ft}{s}$ — Maximum lifting speed of span

$rpm_{bearing} := \frac{S_{speed} \cdot 60s}{2\pi \cdot r_s} = 1.273$ — Rotation speed of trunnion bearing (approximative)

Assume a large rolling element bearing, as per AASHTO C6.7.7.2.4

C6.7.7.2.4

Large rolling element bearings generally have a bore larger than 4 in., and a rotational speed less than 5 rpm.

It is necessary to work closely with bearing manufacturers on the large rolling element bearings. The specific operating parameters may necessitate special lubricating or other requirements, especially in applications such as a bascule trunnion bearing whose inner race operates at less than one quarter revolution each cycle.

$Span_w := 1727tonne$ — Weight of span and new deck

$Cwt := Span_w$ — Weight of Counterweights (hypothesis)

$W := \frac{(Span_w + Cwt)}{16} = 216 \cdot tonne$ — Weight on Trunnion Shaft

1.2 ALLOWABLE STRESSES

Ref.: AASHTO article 6.7.7.2.4

$C_{or} := 4586124lb$ — Basic static radial load rating of the bearing (hypothesis)

$n_s := 5$ — Design factor

$P_{cor} := \frac{C_{or}}{5} = 917225 \cdot lb$ — Factor radial design resistance

$X_o := 1$ — Static axial load factor (hypothesis)

$Y_o := 2$ — Static radial load factor (hypothesis)

$F_{oxy} := X_o \cdot W + 0.15 \cdot Y_o \cdot W = 618700 \cdot lb$

$Verification := if\left(F_{oxy} \le P_{cor}, \text{"OK"}, \text{"NOT ACCEPTABLE"}\right) = \text{"OK"}$

Calculations

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Trunnion Shaft Bearing Capacity

1.0 GENERAL INFORMATION

1.1 GENERAL DATA

$D_b := 21.250in$ — Diameter of Shaft at Section B (bore diameter)

$r_s := \frac{180in}{2} = 90 \cdot in$ — Radius of sheave

$S_{speed} := 1 \frac{ft}{s}$ — Maximum lifting speed of span

$rpm_{bearing} := \frac{S_{speed} \cdot 60s}{2\pi \cdot r_s} = 1.273$ — Rotation speed of trunnion bearing (approximative)

Assume a large rolling element bearing, as per AASHTO C6.7.7.2.4

C6.7.7.2.4

Large rolling element bearings generally have a bore larger than 4 in., and a rotational speed less than 5 rpm.

It is necessary to work closely with bearing manufacturers on the large rolling element bearings. The specific operating parameters may necessitate special lubricating or other requirements, especially in applications such as a bascule trunnion bearing whose inner race operates at less than one quarter revolution each cycle.

$Span_w := 1733tonne$ — Weight of span and new deck

$Cwt := Span_w$ — Weight of Counterweights (hypothesis)

$W := \frac{(Span_w + Cwt)}{16} = 217 \cdot tonne$ — Weight on Trunnion Shaft

1.2 ALLOWABLE STRESSES

Ref.: AASHTO article 6.7.7.2.4

$C_{or} := 4586124lb$ — Basic static radial load rating of the bearing (hypothesis)

$n_s := 5$ — Design factor

$P_{cor} := \frac{C_{or}}{5} = 917225 \cdot lb$ — Factor radial design resistance

$X_o := 1$ — Static axial load factor (hypothesis)

$Y_o := 2$ — Static radial load factor (hypothesis)

$F_{oxy} := X_o \cdot W + 0.15 \cdot Y_o \cdot W = 620849 \cdot lb$

$\text{Verification} := \text{if}\left(F_{oxy} \le P_{cor}, \text{"OK"}, \text{"NOT ACCEPTABLE"}\right) = \text{"OK"}$

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Trunnion Shaft Bearing Capacity

1.0 GENERAL INFORMATION

1.1 GENERAL DATA

$D_b := 21.250in$ — Diameter of Shaft at Section B (bore diameter)

$r_s := \frac{180in}{2} = 90 \cdot in$ — Radius of sheave

$S_{speed} := 1 \frac{ft}{s}$ — Maximum lifting speed of span

$rpm_{bearing} := \frac{S_{speed} \cdot 60s}{2\pi \cdot r_s} = 1.273$ — Rotation speed of trunnion bearing (approximative)

Assume a large rolling element bearing, as per AASHTO C6.7.7.2.4

> *C6.7.7.2.4*
>
> Large rolling element bearings generally have a bore larger than 4 in., and a rotational speed less than 5 rpm.
>
> It is necessary to work closely with bearing manufacturers on the large rolling element bearings. The specific operating parameters may necessitate special lubricating or other requirements, especially in applications such as a bascule trunnion bearing whose inner race operates at less than one quarter revolution each cycle.

$Span_w := 1799tonne$ — Weight of span and new deck

$Cwt := Span_w$ — Weight of Counterweights (hypothesis)

$W := \frac{(Span_w + Cwt)}{16} = 225 \cdot tonne$ — Weight on Trunnion Shaft

1.2 ALLOWABLE STRESSES

Ref.: AASHTO article 6.7.7.2.4

$C_{or} := 4586124lb$ — Basic static radial load rating of the bearing (hypothesis)

$n_s := 5$ — Design factor

$P_{cor} := \frac{C_{or}}{5} = 917225 \cdot lb$ — Factor radial design resistance

$X_o := 1$ — Static axial load factor (hypothesis)

$Y_o := 2$ — Static radial load factor (hypothesis)

$F_{oxy} := X_o \cdot W + 0.15 \cdot Y_o \cdot W = 644494 \cdot lb$

$Verification := if\left(F_{oxy} \le P_{cor}, \text{"OK"}, \text{"NOT ACCEPTABLE"}\right) = \text{"OK"}$

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Trunnion Shaft Bearing Capacity

1.0 GENERAL INFORMATION

1.1 GENERAL DATA

$D_b := 21.250in$ — Diameter of Shaft at Section B (bore diameter)

$r_s := \frac{180in}{2} = 90 \cdot in$ — Radius of sheave

$S_{speed} := 1 \frac{ft}{s}$ — Maximum lifting speed of span

$rpm_{bearing} := \frac{S_{speed} \cdot 60s}{2\pi \cdot r_s} = 1.273$ — Rotation speed of trunnion bearing (approximative)

Assume a large rolling element bearing, as per AASHTO C6.7.7.2.4

> *C6.7.7.2.4*
>
> Large rolling element bearings generally have a bore larger than 4 in., and a rotational speed less than 5 rpm.
>
> It is necessary to work closely with bearing manufacturers on the large rolling element bearings. The specific operating parameters may necessitate special lubricating or other requirements, especially in applications such as a bascule trunnion bearing whose inner race operates at less than one quarter revolution each cycle.

$Span_w := 1826tonne$ — Weight of span and new deck

$Cwt := Span_w$ — Weight of Counterweights (hypothesis)

$W := \frac{(Span_w + Cwt)}{16} = 228 \cdot tonne$ — Weight on Trunnion Shaft

1.2 ALLOWABLE STRESSES

Ref.: AASHTO article 6.7.7.2.4

$C_{or} := 4586124lb$ — Basic static radial load rating of the bearing (hypothesis)

$n_s := 5$ — Design factor

$P_{cor} := \frac{C_{or}}{5} = 917225 \cdot lb$ — Factor radial design resistance

$X_o := 1$ — Static axial load factor (hypothesis)

$Y_o := 2$ — Static radial load factor (hypothesis)

$F_{oxy} := X_o \cdot W + 0.15 \cdot Y_o \cdot W = 654167 \cdot lb$

$Verification := if\left(F_{oxy} \le P_{cor}, "OK", "NOT\ ACCEPTABLE"\right) = "OK"$

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Trunnion Shaft Bearing Capacity

1.0 GENERAL INFORMATION

1.1 GENERAL DATA

$D_b := 21.250in$ — Diameter of Shaft at Section B (bore diameter)

$r_s := \frac{180in}{2} = 90\cdot in$ — Radius of sheave

$S_{speed} := 1\frac{ft}{s}$ — Maximum lifting speed of span

$rpm_{bearing} := \frac{S_{speed}\cdot 60s}{2\pi\cdot r_s} = 1.273$ — Rotation speed of trunnion bearing (approximative)

Assume a large rolling element bearing, as per AASHTO C6.7.7.2.4

C6.7.7.2.4

Large rolling element bearings generally have a bore larger than 4 in., and a rotational speed less than 5 rpm.

It is necessary to work closely with bearing manufacturers on the large rolling element bearings. The specific operating parameters may necessitate special lubricating or other requirements, especially in applications such as a bascule trunnion bearing whose inner race operates at less than one quarter revolution each cycle.

$Span_w := 1919tonne$ — Weight of span and new deck

$Cwt := Span_w$ — Weight of Counterweights (hypothesis)

$W := \frac{(Span_w + Cwt)}{16} = 240\cdot tonne$ — Weight on Trunnion Shaft

1.2 ALLOWABLE STRESSES

Ref.: AASHTO article 6.7.7.2.4

$C_{or} := 4586124lb$ — Basic static radial load rating of the bearing (hypothesis)

$n_s := 5$ — Design factor

$P_{cor} := \frac{C_{or}}{5} = 917225\cdot lb$ — Factor radial design resistance

$X_o := 1$ — Static axial load factor (hypothesis)

$Y_o := 2$ — Static radial load factor (hypothesis)

$F_{oxy} := X_o \cdot W + 0.15 \cdot Y_o \cdot W = 687484 \cdot lb$

$\text{Verification} := \text{if}\left(F_{oxy} \le P_{cor}, \text{"OK"}, \text{"NOT ACCEPTABLE"}\right) = \text{"OK"}$

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Trunnion Bearing Capacity

π

1.0 GENERAL INFORMATION

1.1 GENERAL DATA

$D_b := 21.625in$ — Diameter of Shaft at Section B (bore diameter)

$r_s := \frac{180in}{2} = 90 \cdot in$ — Radius of sheave

$S_{speed} := 1 \frac{ft}{s}$ — Maximum lifting speed of span

$rpm_{bearing} := \frac{S_{speed} \cdot 60s}{2\pi \cdot r_s} = 1.273$ — Rotation speed of trunnion bearing (approximative)

Assume a large rolling element bearing, as per AASHTO C6.7.7.2.4

C6.7.7.2.4

Large rolling element bearings generally have a bore larger than 4 in., and a rotational speed less than 5 rpm.

It is necessary to work closely with bearing manufacturers on the large rolling element bearings. The specific operating parameters may necessitate special lubricating or other requirements, especially in applications such as a bascule trunnion bearing whose inner race operates at less than one quarter revolution each cycle.

$Span_w := 1924.6tonne$ — Weight of span and new deck (to be confirmed)

$Cwt := Span_w$ — Weight of Counterweights (hypothesis)

$W := \frac{(Span_w + Cwt)}{16} = 241 \cdot tonne$ — Weight on Trunnion Shaft

1.2 ALLOWABLE STRESSES

Ref.: AASHTO article 6.7.7.2.4

$C_{or} := 4586124lb$ — Basic static radial load rating of the bearing

$n_s := 5$ — Design factor

$P_{cor} := \frac{C_{or}}{5} = 917225 \cdot lb$ — Factor radial design resistance

$X_o := 1$ — Static axial load factor

$Y_o := 2$ — Static radial load factor

$F_{oxy} := X_o \cdot W + 0.15 \cdot Y_o \cdot W = 689490 \cdot lb$

$\text{Verification} := \text{if}\left(F_{oxy} \le P_{cor}, \text{"OK"}, \text{"NOT ACCEPTABLE"}\right) = \text{"OK"}$

Calculations

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Trunnion Shaft Bearing Capacity

1.0 GENERAL INFORMATION

1.1 GENERAL DATA

$D_b := 21.250in$ — Diameter of Shaft at Section B (bore diameter)

$r_s := \frac{180in}{2} = 90 \cdot in$ — Radius of sheave

$S_{speed} := 1 \frac{ft}{s}$ — Maximum lifting speed of span

$rpm_{bearing} := \frac{S_{speed} \cdot 60s}{2\pi \cdot r_s} = 1.273$ — Rotation speed of trunnion bearing (approximative)

Assume a large rolling element bearing, as per AASHTO C6.7.7.2.4

C6.7.7.2.4

Large rolling element bearings generally have a bore larger than 4 in., and a rotational speed less than 5 rpm. It is necessary to work closely with bearing manufacturers on the large rolling element bearings. The specific operating parameters may necessitate special lubricating or other requirements, especially in applications such as a bascule trunnion bearing whose inner race operates at less than one quarter revolution each cycle.

$Span_w := 2048tonne$ — Weight of span and new deck

$Cwt := Span_w$ — Weight of Counterweights (hypothesis)

$W := \frac{(Span_w + Cwt)}{16} = 256 \cdot tonne$ — Weight on Trunnion Shaft

1.2 ALLOWABLE STRESSES

Ref.: AASHTO article 6.7.7.2.4

$C_{or} := 4586124lb$ — Basic static radial load rating of the bearing (hypothesis)

$n_s := 5$ — Design factor

$P_{cor} := \frac{C_{or}}{5} = 917225 \cdot lb$ — Factor radial design resistance

$X_o := 1$ — Static axial load factor (hypothesis)

$Y_o := 2$ — Static radial load factor (hypothesis)

$F_{oxy} := X_o \cdot W + 0.15 \cdot Y_o \cdot W = 733698 \cdot lb$

$Verification := if\left(F_{oxy} \le P_{cor}, \text{"OK"}, \text{"NOT ACCEPTABLE"}\right) = \text{"OK"}$

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Trunnion Shaft Bearing Capacity

1.0 GENERAL INFORMATION

1.1 GENERAL DATA

$D_b := 21.250\text{in}$ — Diameter of Shaft at Section B (bore diameter)

$r_s := \frac{180\text{in}}{2} = 90 \cdot \text{in}$ — Radius of sheave

$S_{speed} := 1\frac{\text{ft}}{\text{s}}$ — Maximum lifting speed of span

$rpm_{bearing} := \frac{S_{speed} \cdot 60\text{s}}{2\pi \cdot r_s} = 1.273$ — Rotation speed of trunnion bearing (approximative)

Assume a large rolling element bearing, as per AASHTO C6.7.7.2.4

C6.7.7.2.4

Large rolling element bearings generally have a bore larger than 4 in., and a rotational speed less than 5 rpm.

It is necessary to work closely with bearing manufacturers on the large rolling element bearings. The specific operating parameters may necessitate special lubricating or other requirements, especially in applications such as a bascule trunnion bearing whose inner race operates at less than one quarter revolution each cycle.

$Span_w := 2087\text{tonne}$ — Weight of span and new deck

$Cwt := Span_w$ — Weight of Counterweights (hypothesis)

$W := \frac{(Span_w + Cwt)}{16} = 261 \cdot \text{tonne}$ — Weight on Trunnion Shaft

1.2 ALLOWABLE STRESSES

Ref.: AASHTO article 6.7.7.2.4

$C_{or} := 4586124\text{lb}$ — Basic static radial load rating of the bearing (hypothesis)

$n_s := 5$ — Design factor

$P_{cor} := \frac{C_{or}}{5} = 917225 \cdot \text{lb}$ — Factor radial design resistance

$X_o := 1$ — Static axial load factor (hypothesis)

$Y_o := 2$ — Static radial load factor (hypothesis)

$F_{oxy} := X_o \cdot W + 0.15 \cdot Y_o \cdot W = 747670 \cdot lb$

$\text{Verification} := \text{if}\left(F_{oxy} \le P_{cor}, \text{"OK"}, \text{"NOT ACCEPTABLE"}\right) = \text{"OK"}$

AECOM

Calculations

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Trunnion Shaft Bearing Capacity

1.0 GENERAL INFORMATION

1.1 GENERAL DATA

$D_b := 21.250in$ — Diameter of Shaft at Section B (bore diameter)

$r_s := \frac{180in}{2} = 90 \cdot in$ — Radius of sheave

$S_{speed} := 1\frac{ft}{s}$ — Maximum lifting speed of span

$rpm_{bearing} := \frac{S_{speed} \cdot 60s}{2\pi \cdot r_s} = 1.273$ — Rotation speed of trunnion bearing (approximative)

Assume a large rolling element bearing, as per AASHTO C6.7.7.2.4

C6.7.7.2.4

Large rolling element bearings generally have a bore larger than 4 in., and a rotational speed less than 5 rpm.

It is necessary to work closely with bearing manufacturers on the large rolling element bearings. The specific operating parameters may necessitate special lubricating or other requirements, especially in applications such as a bascule trunnion bearing whose inner race operates at less than one quarter revolution each cycle.

$Span_w := 2458tonne$ — Weight of span and new deck

$Cwt := Span_w$ — Weight of Counterweights (hypothesis)

$W := \frac{(Span_w + Cwt)}{16} = 307 \cdot tonne$ — Weight on Trunnion Shaft

1.2 ALLOWABLE STRESSES

Ref.: AASHTO article 6.7.7.2.4

$C_{or} := 4586124lb$ — Basic static radial load rating of the bearing (hypothesis)

$n_s := 5$ — Design factor

$P_{cor} := \frac{C_{or}}{5} = 917225 \cdot lb$ — Factor radial design resistance

$X_o := 1$ — Static axial load factor (hypothesis)

$Y_o := 2$ — Static radial load factor (hypothesis)

$F_{oxy} := X_o \cdot W + 0.15 \cdot Y_o \cdot W = 880581 \cdot lb$

$\text{Verification} := \text{if}\left(F_{oxy} \le P_{cor}, \text{"OK"}, \text{"NOT ACCEPTABLE"}\right) = \text{"OK"}$

Calculations

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Fatigue Check of Trunnion Shaft

Critical Sections:

A - Maximum bending moment, torsional moment, and stress concentration of keyway

B - Bending moment, torsional moment, and stress concentrations of fillet

Shaft Dimensions and other Variables

Enter information in Yellow boxes:

Results are in Blue boxes

Sections AB & B Diameters — Section AB is middle of turnnion shaft Section B is at fillet

$D_{ab} := 24in$ — Diameter of Shaft at Section AB

$D_b := 22.084in$ — Diameter of Shaft at Section B

$r_f := .625$ — Fillet Radius in inches, but do not use dimension

$Span_w := 3807kip$ — Weight of Span

$Cwt := Span_w$ — Weight of Counterweights (hypothesis)

$$W_l := \frac{(Span_w + Cwt)}{8} = 952 \cdot kip$$ Weight on Trunnion Shaft

$\sigma ut := 75ksi$ — Ultimate Tensile Strength of Shaft Material (ASTM A235 Class E)

$\sigma y := 37.500ksi$ — Yield Strenght for material

Distance from bearings to area of concern:

$l_s := 13in + 13in + 27.5in = 53.5 \cdot in$ — Length of Shaft Between Bearing Centers

$$l_a := \frac{l_s}{2}$$ Distance to Center of Shaft from center of Bearing

$l_b := 13in$ — Distance from Center of Bearing to fillet

$c_{fr} := .004$ — Coefficient of friction for Bronze on Steel (Greased)

Torque on Shaft Due to Friction

$T_{fr} := W_l \cdot D_b \cdot c_{fr}$ $\qquad$ $T_{fr} = 584.558\,J \cdot 16.250$

Find Endurance Limit:

σe = α σut * (Cd*Cs*Ck*Ct*Cm)

$\alpha := .5$

From CSA Section 13.7.3.5.4 Endurance Limit

$Cr := 0.814$

$Cm := 1$

$Cs := 1.459$ $\qquad$ $4.51 \cdot (75)^{-0.265} = 1.436$

$Ct := 1$

Size Factor; $\qquad$ Cd = (D/7.6)$^{-0.113}$

$$Cd_{ab} := \left[\left(\frac{D_{ab}}{7.6mm}\right)^{-.113}\right] \qquad Cd_{ab} = 0.609$$

$$Cd_b := \left[\left(\frac{D_b}{7.6mm}\right)^{-.113}\right] \qquad Cd_b = 0.615$$

$$\sigma e_a := \alpha \cdot \sigma ut \cdot \left(Cd_{ab} \cdot Cr \cdot Ct \cdot Cs \cdot Cm\right) \qquad \sigma e_a = 27.135 \cdot ksi$$

$$\sigma e_b := \alpha \cdot \sigma ut \cdot \left(Cd_b \cdot Cr \cdot Ct \cdot Cs \cdot Cm\right) \qquad \sigma e_b = 27.392 \cdot ksi$$

Find - Bending Moments at each Section:

Section A -

Bending moment due to weight on Shaft

$M_a := W_l \cdot l_a$ $\qquad M_a = 2.122 \times 10^3 \cdot ft \cdot kip$

Section B -

Bending moment due to weight on Shaft

$M_b := W_l \cdot l_b$ $\qquad M_b = 1.031 \times 10^3 \cdot ft \cdot kip$

Find Stress Concentration Factors:

$\nu := .049$

$$q := \frac{1}{\left[1 + \left(\frac{\nu}{r_f^{.5}}\right)\right]} \qquad q = 0.942$$

$Kt_a := 1$ For Sled-run keyway; Use 1 if no Keyway

$Kf_a := 1 + q \cdot (Kt_a - 1)$ $\qquad Kf_a = 1$

$K\tau_a := 1$ For Sled-run keyway; Use 1 if no Keyway

$Kf\tau_a := 1 + q \cdot (K\tau_a - 1)$ $\qquad Kf\tau_a = 1$

2.22

$Kt_b := 2.02$

$Kf_b := 1 + q \cdot (Kt_b - 1)$ $\qquad Kf_b = 1.96$ From AASHTO Section 6.7.3.2

$K\tau_b := 1.61$

1.61

$Kf\tau_b := 1 + q \cdot (K\tau_b - 1)$ $\qquad Kf\tau_b = 1.574$

Find Stress Concentration Factors (v.2):

From Peterson's Stress Concentration Factors, 2nd Ed. 1997, Chapter 3: Shoulder fillet in bar of circular cross section

$r_{f.} := .625$ Fillet Radius

$$t := \frac{D_{ab} - 22.084in}{2in} = 0.958$$ Fillet Height

$D := 24$ $\frac{t}{r_f} = 1.533$

Bending Factor

$$C1b := 0.947 + 1.206\sqrt{\frac{t}{r_f}} - 0.131\cdot\frac{t}{r_f} = 2.239$$

$$C2b := 0.022 - 3.405\sqrt{\frac{t}{r_f}} + 0.915\cdot\frac{t}{r_f} = -2.791$$

$$C3b := 0.869 + 1.777\sqrt{\frac{t}{r_f}} - 0.555\cdot\frac{t}{r_f} = 2.218$$

$$C4b := -0.810 + 0.422\sqrt{\frac{t}{r_f}} - 0.260\cdot\frac{t}{r_f} = -0.686$$

$$Kt_b := C1b + C2b\cdot\left(\frac{2t}{D}\right) + C3b\cdot\left[\left(\frac{2t}{D}\right)^2\right] + C4b\cdot\left[\left(\frac{2t}{D}\right)^3\right]$$

$Kf_b := 1 + q\cdot(Kt_b - 1)$ $Kf_b = 1.97$

Torsional Factor

$$C1 := 0.905 + 0.783\sqrt{\frac{t}{r_f}} - 0.075\cdot\frac{t}{r_f} = 1.759$$

$$C2 := -0.437 - 1.969\sqrt{\frac{t}{r_f}} - 0.553\cdot\frac{t}{r_f} = -3.722$$

$$C3 := 1.557 + 1.073\sqrt{\frac{t}{r_f}} - 0.578\cdot\frac{t}{r_f} = 1.999$$

$$C4 := -1.061 + 0.171\sqrt{\frac{t}{r_f}} + 0.086\cdot\frac{t}{r_f} = -0.717$$

$$K\tau_b := C1 + C2\cdot\left(\frac{2t}{D}\right) + C3\cdot\left[\left(\frac{2t}{D}\right)^2\right] + C4\cdot\left[\left(\frac{2t}{D}\right)^3\right] = 1.475$$

$Kf\tau_b := 1 + q\cdot(K\tau_b - 1)$ $Kf\tau_b = 1.447$

Find Number of Cycles at Each Section

Section A:

$T_r := \frac{T_{fr}}{1ft \cdot kip}$ $T_r = 7.006$ $\sigma y_a := \frac{\sigma y}{1psi}$ $\sigma y_a = 3.75 \times 10^4$

$$AL_{ab} := \left[\frac{32}{\left(\pi \cdot D_{ab}^3\right)}\right] \cdot \left[\frac{\left(Kt_a \cdot M_a\right)}{\sigma e_a}\right] + \frac{\left(\sqrt{3} \cdot Kf\tau_a \cdot T_r\right)}{\left(2 \cdot \sigma y_a\right)}$$

$AL_{ab} = 0.691$

$Check_{SectionAB} := if\left(AL_{ab} \le .8, \text{"Infinite"}, \text{"Finite"}\right) = \text{"Infinite"}$

$\sigma x_a := \left[\frac{\left(32 \cdot M_a\right)}{\pi \cdot D_{ab}^3}\right] \cdot Kf_a$ $\sigma x_a = 18.759 \cdot ksi$

$\tau y_a := \left[\frac{\left(16 \cdot T_{fr}\right)}{\left(\pi \cdot D_{ab}^3\right)}\right] \cdot Kf_a$ $\tau y_a = 0.031 \cdot ksi$

$\tau m_a := \left[\left(\frac{\sigma x_a}{2}\right)^2 + \tau y_a^2\right]^{.5}$ $\tau m_a = 9.38 \cdot ksi$ τma = Max Torsional Stress

$\sigma max_a := \left(\frac{\sigma x_a}{2}\right) + \tau m_a$

$\sigma min_a := -\left(\frac{\sigma x_a}{2}\right) - \tau m_a$ $\sigma r_a := \frac{\left(\sigma max_a - \sigma min_a\right)}{2}$ $\sigma r_a = 18.759 \cdot ksi$ $\sigma e_a = 27.135 \cdot ksi$

Find Number of Cycles:

$A_a := \frac{(.9 \cdot \sigma y)^2}{\sigma e_a}$ $B_a := \left(\frac{-1}{3}\right) \cdot \log\left(\frac{.9 \cdot \sigma y}{\sigma e_a}\right)$

$N_a := \left(\frac{\sigma r_a}{A_a}\right)^{\frac{1}{B_a}}$ $N_a = 1.193 \times 10^{11}$

Section B:

$$AL_b := \left[\frac{32}{\left(\pi \cdot D_b^{\,3}\right)}\right] \cdot \left[\frac{\left(Kt_b \cdot M_b\right)}{\sigma e_b}\right] + \frac{\left(\sqrt{3} \cdot Kf\tau_b \cdot T_r\right)}{\left(2 \cdot \sigma y_a\right)}$$

$$AL_b = 0.868$$

$$Check_{SectionB} := \text{if}\left(AL_b \le .8, \text{"Infinite"}, \text{"Finite"}\right) = \text{"Finite"}$$

$$\sigma x_b := \left[\frac{\left(32 \cdot M_b\right)}{\pi \cdot D_b^{\,3}}\right] \cdot Kf_b \qquad \sigma x_b = 23.053 \cdot ksi$$

$$\tau y_b := \left[\frac{\left(16 \cdot T_{fr}\right)}{\left(\pi \cdot D_b^{\,3}\right)}\right] \cdot Kf_a \qquad \tau y_b = 0.04 \cdot ksi$$

$$\tau m_b := \left[\left(\frac{\sigma x_b}{2}\right)^2 + \tau y_b^{\,2}\right]^{.5} \qquad \tau m_b = 11.527 \cdot ksi$$

τmb = Max Torsional Stress

$$\sigma max_b := \left(\frac{\sigma x_b}{2}\right) + \tau m_b$$

$$\sigma min_b := -\left(\frac{\sigma x_b}{2}\right) - \tau m_b \qquad \sigma r_b := \frac{\left(\sigma max_b - \sigma min_b\right)}{2} \qquad \sigma r_b = 23.053 \cdot ksi \qquad \sigma e_b = 27.392 \cdot ksi$$

Find Number of Cycles:

$$A_b := \frac{(.9 \cdot \sigma y)^2}{\sigma e_b} \qquad B_b := \left(\frac{-1}{3}\right) \cdot \log\left(\frac{.9 \cdot \sigma y}{\sigma e_b}\right)$$

$$N_b := \left(\frac{\sigma r_b}{A_b}\right)^{\frac{1}{B_b}} \qquad N_b = 3.006 \times 10^8$$

Remaining Life:

$$lifting := 100ft$$

$$r_s := \frac{180in}{2} = 90 \cdot in$$

$$\frac{lifting}{2r_s \cdot \pi} = 2.122$$

$$\frac{N_b}{2.122 \cdot 2 \cdot 3300} = 2.146 \times 10^4$$

AECOM

Calculations

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Fatigue Check of Trunnion Shaft

Critical Sections:

A - Maximum bending moment, torsional moment, and stress concentration of keyway

B - Bending moment, torsional moment, and stress concentrations of fillet

Shaft Dimensions and other Variables

Enter information in Yellow boxes:

Results are in Blue boxes

Sections AB & B Diameters — Section AB is middle of turnnion shaft Section B is at fillet

$D_{ab} := 24in$ — Diameter of Shaft at Section AB

$D_b := 22.084in$ — Diameter of Shaft at Section B

$r_f := .625$ — Fillet Radius in inches, but do not use dimension

$Span_w := 3820kip$ — Weight of Span

$Cwt := Span_w$ — Weight of Counterweights (hypothesis)

$W_1 := \frac{(Span_w + Cwt)}{8} = 955 \cdot kip$ — Weight on Trunnion Shaft

$\sigma ut := 75ksi$ — Ultimate Tensile Strength of Shaft Material (ASTM A235 Class E)

$\sigma y := 37.500ksi$ — Yield Strenght for material

Distance from bearings to area of concern:

$l_s := 13in + 13in + 27.5in = 53.5 \cdot in$ — Length of Shaft Between Bearing Centers

$l_a := \frac{l_s}{2}$ — Distance to Center of Shaft from center of Bearing

$l_b := 13in$ — Distance from Center of Bearing to fillet

$c_{fr} := .004$ — Coefficient of friction for Bronze on Steel (Greased)

Torque on Shaft Due to Friction

$T_{fr} := W_l \cdot D_b \cdot c_{fr}$ $\qquad$ $T_{fr} = 586.554\,J \cdot 16.250$

Find Endurance Limit:

σe = α σut * (Cd*Cs*Ck*Ct*Cm)

$\alpha := .5$

From CSA Section 13.7.3.5.4 Endurance Limit

$Cr := 0.814$

$Cm := 1$

$Cs := 1.459$ $\qquad$ $4.51 \cdot (75)^{-0.265} = 1.436$

$Ct := 1$

Size Factor; $\qquad$ Cd = (D/7.6)$^{-0.113}$

$$Cd_{ab} := \left[\left(\frac{D_{ab}}{7.6mm}\right)^{-.113}\right] \qquad Cd_{ab} = 0.609$$

$$Cd_b := \left[\left(\frac{D_b}{7.6mm}\right)^{-.113}\right] \qquad Cd_b = 0.615$$

$\sigma e_a := \alpha \cdot \sigma ut \cdot \left(Cd_{ab} \cdot Cr \cdot Ct \cdot Cs \cdot Cm\right)$ $\qquad$ $\sigma e_a = 27.135 \cdot ksi$

$\sigma e_b := \alpha \cdot \sigma ut \cdot \left(Cd_b \cdot Cr \cdot Ct \cdot Cs \cdot Cm\right)$ $\qquad$ $\sigma e_b = 27.392 \cdot ksi$

Find - Bending Moments at each Section:

Section A -

Bending moment due to weight on Shaft

$M_a := W_l \cdot l_a$ $\qquad$ $M_a = 2.129 \times 10^3 \cdot ft \cdot kip$

Section B -

Bending moment due to weight on Shaft

$M_b := W_l \cdot l_b$ $\qquad$ $M_b = 1.035 \times 10^3 \cdot ft \cdot kip$

Find Stress Concentration Factors:

$\nu := .049$

$$q := \frac{1}{\left[1 + \left(\frac{\nu}{r_f^{.5}}\right)\right]} \qquad q = 0.942$$

$Kt_a := 1$ $\qquad$ For Sled-run keyway; Use 1 if no Keyway

$Kf_a := 1 + q \cdot (Kt_a - 1)$ $\qquad$ $Kf_a = 1$

$K\tau_a := 1$ $\qquad$ For Sled-run keyway; Use 1 if no Keyway

$Kf\tau_a := 1 + q \cdot (K\tau_a - 1)$ $\qquad$ $Kf\tau_a = 1$

2.22

$Kt_b := 2.02$

$Kf_b := 1 + q \cdot (Kt_b - 1)$ $\qquad$ $Kf_b = 1.96$ $\qquad$ From AASHTO Section 6.7.3.2

$K\tau_b := 1.61$ $\qquad$ 1.61

$Kf\tau_b := 1 + q \cdot (K\tau_b - 1)$ $\qquad$ $Kf\tau_b = 1.574$

Find Stress Concentration Factors (v.2):

$r_{f.} := .625$ Fillet Radius

From Peterson's Stress Concentration Factors, 2nd Ed. 1997, Chapter 3: Shoulder fillet in bar of circular cross section

$$t := \frac{D_{ab} - 22.084in}{2in} = 0.958$$ Fillet Height

$D := 24$ $\qquad \frac{t}{r_f} = 1.533$

Bending Factor

$$C1b := 0.947 + 1.206\sqrt{\frac{t}{r_f}} - 0.131 \cdot \frac{t}{r_f} = 2.239$$

$$C2b := 0.022 - 3.405\sqrt{\frac{t}{r_f}} + 0.915 \cdot \frac{t}{r_f} = -2.791$$

$$C3b := 0.869 + 1.777\sqrt{\frac{t}{r_f}} - 0.555 \cdot \frac{t}{r_f} = 2.218$$

$$C4b := -0.810 + 0.422\sqrt{\frac{t}{r_f}} - 0.260 \cdot \frac{t}{r_f} = -0.686$$

$$Kt_b := C1b + C2b \cdot \left(\frac{2t}{D}\right) + C3b \cdot \left[\left(\frac{2t}{D}\right)^2\right] + C4b \cdot \left[\left(\frac{2t}{D}\right)^3\right]$$

$Kf_b := 1 + q \cdot (Kt_b - 1)$ $\qquad Kf_b = 1.97$

Torsional Factor

$$C1 := 0.905 + 0.783\sqrt{\frac{t}{r_f}} - 0.075 \cdot \frac{t}{r_f} = 1.759$$

$$C2 := -0.437 - 1.969\sqrt{\frac{t}{r_f}} - 0.553 \cdot \frac{t}{r_f} = -3.722$$

$$C3 := 1.557 + 1.073\sqrt{\frac{t}{r_f}} - 0.578 \cdot \frac{t}{r_f} = 1.999$$

$$C4 := -1.061 + 0.171\sqrt{\frac{t}{r_f}} + 0.086 \cdot \frac{t}{r_f} = -0.717$$

$$K\tau_b := C1 + C2 \cdot \left(\frac{2t}{D}\right) + C3 \cdot \left[\left(\frac{2t}{D}\right)^2\right] + C4 \cdot \left[\left(\frac{2t}{D}\right)^3\right] = 1.475$$

$Kf\tau_b := 1 + q \cdot (K\tau_b - 1)$ $\qquad Kf\tau_b = 1.447$

Find Number of Cycles at Each Section

Section A:

$T_r := \frac{T_{fr}}{1ft \cdot kip}$ $T_r = 7.03$ $\sigma y_a := \frac{\sigma y}{1psi}$ $\sigma y_a = 3.75 \times 10^4$

$$AL_{ab} := \left[\frac{32}{\left(\pi \cdot D_{ab}^3\right)}\right] \cdot \left[\frac{\left(Kt_a \cdot M_a\right)}{\sigma e_a}\right] + \frac{\left(\sqrt{3} \cdot Kf\tau_a \cdot T_r\right)}{\left(2 \cdot \sigma y_a\right)}$$

$AL_{ab} = 0.694$

$Check_{SectionAB} := if\left(AL_{ab} \le .8, \text{"Infinite"}, \text{"Finite"}\right) = \text{"Infinite"}$

$\sigma x_a := \left[\frac{\left(32 \cdot M_a\right)}{\pi \cdot D_{ab}^3}\right] \cdot Kf_a$ $\sigma x_a = 18.823 \cdot ksi$

$\tau y_a := \left[\frac{\left(16 \cdot T_{fr}\right)}{\left(\pi \cdot D_{ab}^3\right)}\right] \cdot Kf_a$ $\tau y_a = 0.031 \cdot ksi$

$\tau m_a := \left[\left(\frac{\sigma x_a}{2}\right)^2 + \tau y_a^2\right]^{.5}$ $\tau m_a = 9.412 \cdot ksi$ τma = Max Torsional Stress

$\sigma max_a := \left(\frac{\sigma x_a}{2}\right) + \tau m_a$

$\sigma min_a := -\left(\frac{\sigma x_a}{2}\right) - \tau m_a$ $\sigma r_a := \frac{\left(\sigma max_a - \sigma min_a\right)}{2}$ $\sigma r_a = 18.823 \cdot ksi$ $\sigma e_a = 27.135 \cdot ksi$

Find Number of Cycles:

$A_a := \frac{(.9 \cdot \sigma y)^2}{\sigma e_a}$ $B_a := \left(\frac{-1}{3}\right) \cdot \log\left(\frac{.9 \cdot \sigma y}{\sigma e_a}\right)$

$N_a := \left(\frac{\sigma r_a}{A_a}\right)^{\frac{1}{B_a}}$ $N_a = 1.071 \times 10^{11}$

Section B:

$$AL_b := \left[\frac{32}{\left(\pi \cdot D_b^{3}\right)}\right] \cdot \left[\frac{\left(Kt_b \cdot M_b\right)}{\sigma e_b}\right] + \frac{\left(\sqrt{3} \cdot Kf\tau_b \cdot T_r\right)}{\left(2 \cdot \sigma y_a\right)}$$

$$AL_b = 0.871$$

$$Check_{SectionB} := \text{if}\left(AL_b \le .8, \text{"Infinite"}, \text{"Finite"}\right) = \text{"Finite"}$$

$$\sigma x_b := \left[\frac{\left(32 \cdot M_b\right)}{\pi \cdot D_b^{3}}\right] \cdot Kf_b \qquad \sigma x_b = 23.132 \cdot ksi$$

$$\tau y_b := \left[\frac{\left(16 \cdot T_{fr}\right)}{\left(\pi \cdot D_b^{3}\right)}\right] \cdot Kf_a \qquad \tau y_b = 0.04 \cdot ksi$$

$$\tau m_b := \left[\left(\frac{\sigma x_b}{2}\right)^2 + \tau y_b^{2}\right]^{.5} \qquad \tau m_b = 11.566 \cdot ksi$$

τmb = Max Torsional Stress

$$\sigma max_b := \left(\frac{\sigma x_b}{2}\right) + \tau m_b$$

$$\sigma min_b := -\left(\frac{\sigma x_b}{2}\right) - \tau m_b \qquad \sigma r_b := \frac{\left(\sigma max_b - \sigma min_b\right)}{2} \qquad \sigma r_b = 23.132 \cdot ksi \qquad \sigma e_b = 27.392 \cdot ksi$$

Find Number of Cycles:

$$A_b := \frac{(.9 \cdot \sigma y)^2}{\sigma e_b} \qquad B_b := \left(\frac{-1}{3}\right) \cdot \log\left(\frac{.9 \cdot \sigma y}{\sigma e_b}\right)$$

$$N_b := \left(\frac{\sigma r_b}{A_b}\right)^{\frac{1}{B_b}} \qquad N_b = 2.685 \times 10^{8}$$

Remaining Life:

$\text{lifting} := 100\text{ft}$

$r_s := \dfrac{180\text{in}}{2} = 90\cdot\text{in}$

$\dfrac{\text{lifting}}{2r_s\cdot\pi} = 2.122$

$\dfrac{N_b}{2.122\cdot2\cdot3300} = 1.917\times10^{4}$

Calculations

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Fatigue Check of Trunnion Shaft

Critical Sections:

A - Maximum bending moment, torsional moment, and stress concentration of keyway

B - Bending moment, torsional moment, and stress concentrations of fillet

Shaft Dimensions and other Variables

Enter information in Yellow boxes:

Results are in Blue boxes

Sections AB & B Diameters	Section AB is middle of turnnion shaft Section B is at fillet
$D_{ab} := 24in$	Diameter of Shaft at Section AB
$D_b := 22.084in$	Diameter of Shaft at Section B
$r_f := .625$	Fillet Radius in inches, but do not use dimension
$Span_w := 3966kip$	Weight of Span
$Cwt := Span_w$	Weight of Counterweights (hypothesis)
$W_l := \dfrac{(Span_w + Cwt)}{8} = 992 \cdot kip$	Weight on Trunnion Shaft
$\sigma ut := 75ksi$	Ultimate Tensile Strength of Shaft Material (ASTM A235 Class E)
$\sigma y := 37.500ksi$	Yield Strenght for material

Distance from bearings to area of concern:

$l_s := 13in + 13in + 27.5in = 53.5 \cdot in$	Length of Shaft Between Bearing Centers
$l_a := \dfrac{l_s}{2}$	Distance to Center of Shaft from center of Bearing
$l_b := 13in$	Distance from Center of Bearing to fillet
$c_{fr} := .004$	Coefficient of friction for Bronze on Steel (Greased)

Torque on Shaft Due to Friction

$T_{fr} := W_l \cdot D_b \cdot c_{fr}$ $\quad T_{fr} = 608.972\,J \cdot 16.250$

Find Endurance Limit:

σe = α σut * (Cd*Cs*Ck*Ct*Cm)

$\alpha := .5$

From CSA Section 13.7.3.5.4 Endurance Limit

$Cr := 0.814$

$Cm := 1$

$Cs := 1.459$ $\quad 4.51 \cdot (75)^{-0.265} = 1.436$

$Ct := 1$

Size Factor; Cd = (D/7.6)$^{-0.113}$

$Cd_{ab} := \left[\left(\frac{D_{ab}}{7.6mm}\right)^{-.113}\right]$ $\quad Cd_{ab} = 0.609$

$Cd_b := \left[\left(\frac{D_b}{7.6mm}\right)^{-.113}\right]$ $\quad Cd_b = 0.615$

$\sigma e_a := \alpha \cdot \sigma ut \cdot (Cd_{ab} \cdot Cr \cdot Ct \cdot Cs \cdot Cm)$ $\quad \sigma e_a = 27.135 \cdot ksi$

$\sigma e_b := \alpha \cdot \sigma ut \cdot (Cd_b \cdot Cr \cdot Ct \cdot Cs \cdot Cm)$ $\quad \sigma e_b = 27.392 \cdot ksi$

Find - Bending Moments at each Section:

Section A -

Bending moment due to weight on Shaft

$M_a := W_l \cdot l_a$ $\qquad M_a = 2.21 \times 10^3 \cdot ft \cdot kip$

Section B -

Bending moment due to weight on Shaft

$M_b := W_l \cdot l_b$ $\qquad M_b = 1.074 \times 10^3 \cdot ft \cdot kip$

Find Stress Concentration Factors:

$\nu := .049$

$$q := \frac{1}{\left[1 + \left(\frac{\nu}{r_f^{.5}}\right)\right]} \qquad q = 0.942$$

$Kt_a := 1$ For Sled-run keyway; Use 1 if no Keyway

$Kf_a := 1 + q \cdot (Kt_a - 1)$ $\qquad Kf_a = 1$

$K\tau_a := 1$ For Sled-run keyway; Use 1 if no Keyway

$Kf\tau_a := 1 + q \cdot (K\tau_a - 1)$ $\qquad Kf\tau_a = 1$

2.22

$Kt_b := 2.02$

$Kf_b := 1 + q \cdot (Kt_b - 1)$ $\qquad Kf_b = 1.96$ From AASHTO Section 6.7.3.2

$K\tau_b := 1.61$

1.61

$Kf\tau_b := 1 + q \cdot (K\tau_b - 1)$ $\qquad Kf\tau_b = 1.574$

Find Stress Concentration Factors (v.2):

$r_{f.} := .625$ Fillet Radius

From Peterson's Stress Concentration Factors, 2nd Ed. 1997, Chapter 3: Shoulder fillet in bar of circular cross section

$$t := \frac{D_{ab} - 22.084in}{2in} = 0.958$$ Fillet Height

$D := 24$ $\quad \frac{t}{r_f} = 1.533$

Bending Factor

$$C1b := 0.947 + 1.206\sqrt{\frac{t}{r_f}} - 0.131\cdot\frac{t}{r_f} = 2.239$$

$$C2b := 0.022 - 3.405\sqrt{\frac{t}{r_f}} + 0.915\cdot\frac{t}{r_f} = -2.791$$

$$C3b := 0.869 + 1.777\sqrt{\frac{t}{r_f}} - 0.555\cdot\frac{t}{r_f} = 2.218$$

$$C4b := -0.810 + 0.422\sqrt{\frac{t}{r_f}} - 0.260\cdot\frac{t}{r_f} = -0.686$$

$$Kt_b := C1b + C2b\cdot\left(\frac{2t}{D}\right) + C3b\cdot\left[\left(\frac{2t}{D}\right)^2\right] + C4b\cdot\left[\left(\frac{2t}{D}\right)^3\right]$$

$Kf_b := 1 + q\cdot\left(Kt_b - 1\right)$ $\quad Kf_b = 1.97$

Torsional Factor

$$C1 := 0.905 + 0.783\sqrt{\frac{t}{r_f}} - 0.075\cdot\frac{t}{r_f} = 1.759$$

$$C2 := -0.437 - 1.969\sqrt{\frac{t}{r_f}} - 0.553\cdot\frac{t}{r_f} = -3.722$$

$$C3 := 1.557 + 1.073\sqrt{\frac{t}{r_f}} - 0.578\cdot\frac{t}{r_f} = 1.999$$

$$C4 := -1.061 + 0.171\sqrt{\frac{t}{r_f}} + 0.086\cdot\frac{t}{r_f} = -0.717$$

$$K\tau_b := C1 + C2\cdot\left(\frac{2t}{D}\right) + C3\cdot\left[\left(\frac{2t}{D}\right)^2\right] + C4\cdot\left[\left(\frac{2t}{D}\right)^3\right] = 1.475$$

$Kf\tau_b := 1 + q\cdot\left(K\tau_b - 1\right)$ $\quad Kf\tau_b = 1.447$

Find Number of Cycles at Each Section

Section A:

$T_r := \frac{T_{fr}}{1ft \cdot kip}$ $T_r = 7.299$ $\sigma y_a := \frac{\sigma y}{1psi}$ $\sigma y_a = 3.75 \times 10^4$

$$AL_{ab} := \left[\frac{32}{\left(\pi \cdot D_{ab}^{3}\right)}\right] \cdot \left[\frac{\left(Kt_a \cdot M_a\right)}{\sigma e_a}\right] + \frac{\left(\sqrt{3} \cdot Kf\tau_a \cdot T_r\right)}{\left(2 \cdot \sigma y_a\right)}$$

$AL_{ab} = 0.72$

$\boxed{Check_{SectionAB} := if\left(AL_{ab} \le .8, \text{"Infinite"}, \text{"Finite"}\right) = \text{"Infinite"}}$

$\sigma x_a := \left[\frac{\left(32 \cdot M_a\right)}{\pi \cdot D_{ab}^{3}}\right] \cdot Kf_a$ $\sigma x_a = 19.543 \cdot ksi$

$\tau y_a := \left[\frac{\left(16 \cdot T_{fr}\right)}{\left(\pi \cdot D_{ab}^{3}\right)}\right] \cdot Kf_a$ $\tau y_a = 0.032 \cdot ksi$

$\tau m_a := \left[\left(\frac{\sigma x_a}{2}\right)^2 + \tau y_a^{2}\right]^{.5}$ $\tau m_a = 9.771 \cdot ksi$ τma = Max Torsional Stress

$\sigma max_a := \left(\frac{\sigma x_a}{2}\right) + \tau m_a$

$\sigma min_a := -\left(\frac{\sigma x_a}{2}\right) - \tau m_a$ $\sigma r_a := \frac{\left(\sigma max_a - \sigma min_a\right)}{2}$ $\sigma r_a = 19.543 \cdot ksi$ $\sigma e_a = 27.135 \cdot ksi$

Find Number of Cycles:

$A_a := \frac{(.9 \cdot \sigma y)^2}{\sigma e_a}$ $B_a := \left(\frac{-1}{3}\right) \cdot \log\left(\frac{.9 \cdot \sigma y}{\sigma e_a}\right)$

$N_a := \left(\frac{\sigma r_a}{A_a}\right)^{\frac{1}{B_a}}$ $N_a = 3.265 \times 10^{10}$

Section B:

$$AL_b := \left[\frac{32}{\left(\pi \cdot D_b^{\,3}\right)}\right] \cdot \left[\frac{\left(Kt_b \cdot M_b\right)}{\sigma e_b}\right] + \frac{\left(\sqrt{3} \cdot Kf\tau_b \cdot T_r\right)}{\left(2 \cdot \sigma y_a\right)}$$

$$AL_b = 0.904$$

$$Check_{SectionB} := if\left(AL_b \le .8, \text{"Infinite"}, \text{"Finite"}\right) = \text{"Finite"}$$

$$\sigma x_b := \left[\frac{\left(32 \cdot M_b\right)}{\pi \cdot D_b^{\,3}}\right] \cdot Kf_b \qquad \sigma x_b = 24.016 \cdot ksi$$

$$\tau y_b := \left[\frac{\left(16 \cdot T_{fr}\right)}{\left(\pi \cdot D_b^{\,3}\right)}\right] \cdot Kf_a \qquad \tau y_b = 0.041 \cdot ksi$$

$$\tau m_b := \left[\left(\frac{\sigma x_b}{2}\right)^2 + \tau y_b^{\,2}\right]^{.5} \qquad \tau m_b = 12.008 \cdot ksi$$

τmb = Max Torsional Stress

$$\sigma max_b := \left(\frac{\sigma x_b}{2}\right) + \tau m_b$$

$$\sigma min_b := -\left(\frac{\sigma x_b}{2}\right) - \tau m_b \qquad \sigma r_b := \frac{\left(\sigma max_b - \sigma min_b\right)}{2} \qquad \sigma r_b = 24.016 \cdot ksi \qquad \sigma e_b = 27.392 \cdot ksi$$

Find Number of Cycles:

$$A_b := \frac{(.9 \cdot \sigma y)^2}{\sigma e_b} \qquad B_b := \left(\frac{-1}{3}\right) \cdot \log\left(\frac{.9 \cdot \sigma y}{\sigma e_b}\right)$$

$$N_b := \left(\frac{\sigma r_b}{A_b}\right)^{\frac{1}{B_b}} \qquad N_b = 7.762 \times 10^7$$

Remaining Life:

$lifting := 100ft$

$r_s := \frac{180in}{2} = 90\cdot in$

$\frac{lifting}{2r_s\cdot\pi} = 2.122$

$\frac{N_b}{2.122\cdot 2\cdot 3300} = 5.542\times 10^3$

AECOM

Calculations

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Fatigue Check of Trunnion Shaft

Critical Sections:

A - Maximum bending moment, torsional moment, and stress concentration of keyway

B - Bending moment, torsional moment, and stress concentrations of fillet

Shaft Dimensions and other Variables

Enter information in Yellow boxes:

Results are in Blue boxes

Sections AB & B Diameters	Section AB is middle of turnnion shaft Section B is at fillet
$D_{ab} := 24in$	Diameter of Shaft at Section AB
$D_b := 22.084in$	Diameter of Shaft at Section B
$r_f := .625$	Fillet Radius in inches, but do not use dimension
$Span_w := 4025kip$	Weight of Span
$Cwt := Span_w$	Weight of Counterweights (hypothesis)
$W_l := \frac{(Span_w + Cwt)}{8} = 1006 \cdot kip$	Weight on Trunnion Shaft
$\sigma ut := 75ksi$	Ultimate Tensile Strength of Shaft Material (ASTM A235 Class E)
$\sigma y := 37.500ksi$	Yield Strenght for material

Distance from bearings to area of concern:

$l_s := 13in + 13in + 27.5in = 53.5 \cdot in$	Length of Shaft Between Bearing Centers
$l_a := \frac{l_s}{2}$	Distance to Center of Shaft from center of Bearing
$l_b := 13in$	Distance from Center of Bearing to fillet
$c_{fr} := .004$	Coefficient of friction for Bronze on Steel (Greased)

Torque on Shaft Due to Friction

$T_{fr} := W_l \cdot D_b \cdot c_{fr}$ $\quad$ $T_{fr} = 618.031\,J \cdot 16.250$

Find Endurance Limit:

σe = α σut * (Cd*Cs*Ck*Ct*Cm)

$\alpha := .5$

From CSA Section 13.7.3.5.4 Endurance Limit

$Cr := 0.814$

$Cm := 1$

$Cs := 1.459$ $\quad$ $4.51 \cdot (75)^{-0.265} = 1.436$

$Ct := 1$

Size Factor; $\quad$ Cd = (D/7.6)$^{-0.113}$

$$Cd_{ab} := \left[\left(\frac{D_{ab}}{7.6mm}\right)^{-.113}\right] \qquad Cd_{ab} = 0.609$$

$$Cd_b := \left[\left(\frac{D_b}{7.6mm}\right)^{-.113}\right] \qquad Cd_b = 0.615$$

$$\sigma e_a := \alpha \cdot \sigma ut \cdot \left(Cd_{ab} \cdot Cr \cdot Ct \cdot Cs \cdot Cm\right) \qquad \sigma e_a = 27.135 \cdot ksi$$

$$\sigma e_b := \alpha \cdot \sigma ut \cdot \left(Cd_b \cdot Cr \cdot Ct \cdot Cs \cdot Cm\right) \qquad \sigma e_b = 27.392 \cdot ksi$$

Find - Bending Moments at each Section:

Section A -

Bending moment due to weight on Shaft

$M_a := W_l \cdot l_a$ $\qquad M_a = 2.243 \times 10^3 \cdot ft \cdot kip$

Section B -

Bending moment due to weight on Shaft

$M_b := W_l \cdot l_b$ $\qquad M_b = 1.09 \times 10^3 \cdot ft \cdot kip$

Find Stress Concentration Factors:

$\nu := .049$

$$q := \frac{1}{\left[1 + \left(\frac{\nu}{r_f^{.5}}\right)\right]} \qquad q = 0.942$$

$Kt_a := 1$ For Sled-run keyway; Use 1 if no Keyway

$Kf_a := 1 + q \cdot (Kt_a - 1)$ $\qquad Kf_a = 1$

$K\tau_a := 1$ For Sled-run keyway; Use 1 if no Keyway

$Kf\tau_a := 1 + q \cdot (K\tau_a - 1)$ $\qquad Kf\tau_a = 1$

2.22

$Kt_b := 2.02$

$Kf_b := 1 + q \cdot (Kt_b - 1)$ $\qquad Kf_b = 1.96$ From AASHTO Section 6.7.3.2

$K\tau_b := 1.61$

1.61

$Kf\tau_b := 1 + q \cdot (K\tau_b - 1)$ $\qquad Kf\tau_b = 1.574$

Find Stress Concentration Factors (v.2):

From Peterson's Stress Concentration Factors, 2nd Ed. 1997, Chapter 3: Shoulder fillet in bar of circular cross section

$r_{f.} := .625$ Fillet Radius

$t := \dfrac{D_{ab} - 22.084in}{2in} = 0.958$ Fillet Height

$D := 24$ $\dfrac{t}{r_f} = 1.533$

Bending Factor

$$C1b := 0.947 + 1.206\sqrt{\frac{t}{r_f}} - 0.131 \cdot \frac{t}{r_f} = 2.239$$

$$C2b := 0.022 - 3.405\sqrt{\frac{t}{r_f}} + 0.915 \cdot \frac{t}{r_f} = -2.791$$

$$C3b := 0.869 + 1.777\sqrt{\frac{t}{r_f}} - 0.555 \cdot \frac{t}{r_f} = 2.218$$

$$C4b := -0.810 + 0.422\sqrt{\frac{t}{r_f}} - 0.260 \cdot \frac{t}{r_f} = -0.686$$

$$Kt_b := C1b + C2b \cdot \left(\frac{2t}{D}\right) + C3b \cdot \left[\left(\frac{2t}{D}\right)^2\right] + C4b \cdot \left[\left(\frac{2t}{D}\right)^3\right]$$

$Kf_b := 1 + q \cdot (Kt_b - 1)$ $Kf_b = 1.97$

Torsional Factor

$$C1 := 0.905 + 0.783\sqrt{\frac{t}{r_f}} - 0.075 \cdot \frac{t}{r_f} = 1.759$$

$$C2 := -0.437 - 1.969\sqrt{\frac{t}{r_f}} - 0.553 \cdot \frac{t}{r_f} = -3.722$$

$$C3 := 1.557 + 1.073\sqrt{\frac{t}{r_f}} - 0.578 \cdot \frac{t}{r_f} = 1.999$$

$$C4 := -1.061 + 0.171\sqrt{\frac{t}{r_f}} + 0.086 \cdot \frac{t}{r_f} = -0.717$$

$$K\tau_b := C1 + C2 \cdot \left(\frac{2t}{D}\right) + C3 \cdot \left[\left(\frac{2t}{D}\right)^2\right] + C4 \cdot \left[\left(\frac{2t}{D}\right)^3\right] = 1.475$$

$Kf\tau_b := 1 + q \cdot (K\tau_b - 1)$ $Kf\tau_b = 1.447$

Find Number of Cycles at Each Section

Section A:

$T_r := \frac{T_{fr}}{1ft \cdot kip}$ $\quad T_r = 7.407$ $\quad \sigma y_a := \frac{\sigma y}{1psi}$ $\quad \sigma y_a = 3.75 \times 10^4$

$$AL_{ab} := \left[\frac{32}{\left(\pi \cdot D_{ab}{}^3\right)}\right] \cdot \left[\frac{\left(Kt_a \cdot M_a\right)}{\sigma e_a}\right] + \frac{\left(\sqrt{3} \cdot Kf\tau_a \cdot T_r\right)}{\left(2 \cdot \sigma y_a\right)}$$

$AL_{ab} = 0.731$

$Check_{SectionAB} := if\left(AL_{ab} \le .8, \text{"Infinite"}, \text{"Finite"}\right) = \text{"Infinite"}$

$\sigma x_a := \left[\frac{\left(32 \cdot M_a\right)}{\pi \cdot D_{ab}{}^3}\right] \cdot Kf_a$ $\quad \sigma x_a = 19.833 \cdot ksi$

$\tau y_a := \left[\frac{\left(16 \cdot T_{fr}\right)}{\left(\pi \cdot D_{ab}{}^3\right)}\right] \cdot Kf_a$ $\quad \tau y_a = 0.033 \cdot ksi$

$\tau m_a := \left[\left(\frac{\sigma x_a}{2}\right)^2 + \tau y_a{}^2\right]^{.5}$ $\quad \tau m_a = 9.917 \cdot ksi$ $\quad$ τma = Max Torsional Stress

$\sigma max_a := \left(\frac{\sigma x_a}{2}\right) + \tau m_a$

$\sigma min_a := -\left(\frac{\sigma x_a}{2}\right) - \tau m_a$ $\quad \sigma r_a := \frac{\left(\sigma max_a - \sigma min_a\right)}{2}$ $\quad \sigma r_a = 19.833 \cdot ksi$ $\quad \sigma e_a = 27.135 \cdot ksi$

Find Number of Cycles:

$A_a := \frac{(.9 \cdot \sigma y)^2}{\sigma e_a}$ $\quad B_a := \left(\frac{-1}{3}\right) \cdot \log\left(\frac{.9 \cdot \sigma y}{\sigma e_a}\right)$

$N_a := \left(\frac{\sigma r_a}{A_a}\right)^{\frac{1}{B_a}}$ $\quad N_a = 2.045 \times 10^{10}$

Section B:

$$AL_b := \left[\frac{32}{\left(\pi \cdot D_b^{\,3}\right)}\right] \cdot \left[\frac{\left(Kt_b \cdot M_b\right)}{\sigma e_b}\right] + \frac{\left(\sqrt{3} \cdot Kf\tau_b \cdot T_r\right)}{\left(2 \cdot \sigma y_a\right)}$$

$$AL_b = 0.917$$

$$Check_{SectionB} := if\left(AL_b \le .8, \text{"Infinite"}, \text{"Finite"}\right) = \text{"Finite"}$$

$$\sigma x_b := \left[\frac{\left(32 \cdot M_b\right)}{\pi \cdot D_b^{\,3}}\right] \cdot Kf_b \qquad \sigma x_b = 24.373 \cdot ksi$$

$$\tau y_b := \left[\frac{\left(16 \cdot T_{fr}\right)}{\left(\pi \cdot D_b^{\,3}\right)}\right] \cdot Kf_a \qquad \tau y_b = 0.042 \cdot ksi$$

$$\tau m_b := \left[\left(\frac{\sigma x_b}{2}\right)^2 + \tau y_b^{\,2}\right]^{.5} \qquad \tau m_b = 12.187 \cdot ksi$$

τmb = Max Torsional Stress

$$\sigma max_b := \left(\frac{\sigma x_b}{2}\right) + \tau m_b$$

$$\sigma min_b := -\left(\frac{\sigma x_b}{2}\right) - \tau m_b \qquad \sigma r_b := \frac{\left(\sigma max_b - \sigma min_b\right)}{2} \qquad \sigma r_b = 24.373 \cdot ksi \qquad \sigma e_b = 27.392 \cdot ksi$$

Find Number of Cycles:

$$A_b := \frac{(.9 \cdot \sigma y)^2}{\sigma e_b} \qquad B_b := \left(\frac{-1}{3}\right) \cdot \log\left(\frac{.9 \cdot \sigma y}{\sigma e_b}\right)$$

$$N_b := \left(\frac{\sigma r_b}{A_b}\right)^{\frac{1}{B_b}} \qquad N_b = 4.762 \times 10^7$$

Remaining Life:

$lifting := 100ft$

$$r_s := \frac{180in}{2} = 90 \cdot in$$

$$\frac{lifting}{2r_s \cdot \pi} = 2.122$$

$$\frac{N_b}{2.122 \cdot 2 \cdot 3300} = 3.4 \times 10^3$$

AECOM

Calculations

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Fatigue Check of Trunnion Shaft

Critical Sections:

A - Maximum bending moment, torsional moment, and stress concentration of keyway

B - Bending moment, torsional moment, and stress concentrations of fillet

Shaft Dimensions and other Variables

Enter information in Yellow boxes:

Results are in Blue boxes

Sections AB & B Diameters	Section AB is middle of turnnion shaft Section B is at fillet
$D_{ab} := 24in$	Diameter of Shaft at Section AB
$D_b := 22.084in$	Diameter of Shaft at Section B
$r_f := .625$	Fillet Radius in inches, but do not use dimension
$Span_w := 4230kip$	Weight of Span
$Cwt := Span_w$	Weight of Counterweights (hypothesis)
$W_l := \frac{(Span_w + Cwt)}{8} = 1058 \cdot kip$	Weight on Trunnion Shaft
$\sigma ut := 75ksi$	Ultimate Tensile Strength of Shaft Material (ASTM A235 Class E)
$\sigma y := 37.500ksi$	Yield Strenght for material

Distance from bearings to area of concern:

$l_s := 13in + 13in + 27.5in = 53.5 \cdot in$	Length of Shaft Between Bearing Centers
$l_a := \frac{l_s}{2}$	Distance to Center of Shaft from center of Bearing
$l_b := 13in$	Distance from Center of Bearing to fillet
$c_{fr} := .004$	Coefficient of friction for Bronze on Steel (Greased)

Torque on Shaft Due to Friction

$T_{fr} := W_l \cdot D_b \cdot c_{fr}$ $\qquad T_{fr} = 649.509\,J \cdot 16.250$

Find Endurance Limit:

σe = α σut * (Cd*Cs*Ck*Ct*Cm)

$\alpha := .5$

From CSA Section 13.7.3.5.4 Endurance Limit

$Cr := 0.814$

$Cm := 1$

$Cs := 1.459$ $\qquad 4.51 \cdot (75)^{-0.265} = 1.436$

$Ct := 1$

Size Factor; $\qquad$ $Cd = (D/7.6)^{-0.113}$

$$Cd_{ab} := \left[\left(\frac{D_{ab}}{7.6mm}\right)^{-.113}\right] \qquad Cd_{ab} = 0.609$$

$$Cd_{b} := \left[\left(\frac{D_{b}}{7.6mm}\right)^{-.113}\right] \qquad Cd_{b} = 0.615$$

$$\sigma e_a := \alpha \cdot \sigma ut \cdot \left(Cd_{ab} \cdot Cr \cdot Ct \cdot Cs \cdot Cm\right) \qquad \sigma e_a = 27.135 \cdot ksi$$

$$\sigma e_b := \alpha \cdot \sigma ut \cdot \left(Cd_{b} \cdot Cr \cdot Ct \cdot Cs \cdot Cm\right) \qquad \sigma e_b = 27.392 \cdot ksi$$

Find - Bending Moments at each Section:

Section A -

Bending moment due to weight on Shaft

$M_a := W_l \cdot l_a$ $\qquad$ $M_a = 2.357 \times 10^3 \cdot ft \cdot kip$

Section B -

Bending moment due to weight on Shaft

$M_b := W_l \cdot l_b$ $\qquad$ $M_b = 1.146 \times 10^3 \cdot ft \cdot kip$

Find Stress Concentration Factors:

$\nu := .049$

$$q := \frac{1}{\left[1 + \left(\frac{\nu}{r_f^{.5}}\right)\right]} \qquad q = 0.942$$

$Kt_a := 1$ $\qquad$ For Sled-run keyway; Use 1 if no Keyway

$Kf_a := 1 + q \cdot (Kt_a - 1)$ $\qquad$ $Kf_a = 1$

$K\tau_a := 1$ $\qquad$ For Sled-run keyway; Use 1 if no Keyway

$Kf\tau_a := 1 + q \cdot (K\tau_a - 1)$ $\qquad$ $Kf\tau_a = 1$

2.22

$Kt_b := 2.02$

$Kf_b := 1 + q \cdot (Kt_b - 1)$ $\qquad$ $Kf_b = 1.96$ $\qquad$ From AASHTO Section 6.7.3.2

$K\tau_b := 1.61$ $\qquad$ 1.61

$Kf\tau_b := 1 + q \cdot (K\tau_b - 1)$ $\qquad$ $Kf\tau_b = 1.574$

Find Stress Concentration Factors (v.2):

$r_{f.} := .625$ Fillet Radius

From Peterson's Stress Concentration Factors, 2nd Ed. 1997, Chapter 3: Shoulder fillet in bar of circular cross section

$$t := \frac{D_{ab} - 22.084in}{2in} = 0.958$$ Fillet Height

$D := 24$ $\quad \frac{t}{r_f} = 1.533$

Bending Factor

$$C1b := 0.947 + 1.206\sqrt{\frac{t}{r_f}} - 0.131\cdot\frac{t}{r_f} = 2.239$$

$$C2b := 0.022 - 3.405\sqrt{\frac{t}{r_f}} + 0.915\cdot\frac{t}{r_f} = -2.791$$

$$C3b := 0.869 + 1.777\sqrt{\frac{t}{r_f}} - 0.555\cdot\frac{t}{r_f} = 2.218$$

$$C4b := -0.810 + 0.422\sqrt{\frac{t}{r_f}} - 0.260\cdot\frac{t}{r_f} = -0.686$$

$$Kt_b := C1b + C2b\cdot\left(\frac{2t}{D}\right) + C3b\cdot\left[\left(\frac{2t}{D}\right)^2\right] + C4b\cdot\left[\left(\frac{2t}{D}\right)^3\right]$$

$Kf_b := 1 + q\cdot(Kt_b - 1)$ $\quad Kf_b = 1.97$

Torsional Factor

$$C1 := 0.905 + 0.783\sqrt{\frac{t}{r_f}} - 0.075\cdot\frac{t}{r_f} = 1.759$$

$$C2 := -0.437 - 1.969\sqrt{\frac{t}{r_f}} - 0.553\cdot\frac{t}{r_f} = -3.722$$

$$C3 := 1.557 + 1.073\sqrt{\frac{t}{r_f}} - 0.578\cdot\frac{t}{r_f} = 1.999$$

$$C4 := -1.061 + 0.171\sqrt{\frac{t}{r_f}} + 0.086\cdot\frac{t}{r_f} = -0.717$$

$$K\tau_b := C1 + C2\cdot\left(\frac{2t}{D}\right) + C3\cdot\left[\left(\frac{2t}{D}\right)^2\right] + C4\cdot\left[\left(\frac{2t}{D}\right)^3\right] = 1.475$$

$Kf\tau_b := 1 + q\cdot(K\tau_b - 1)$ $\quad Kf\tau_b = 1.447$

Find Number of Cycles at Each Section

Section A:

$$T_r := \frac{T_{fr}}{1ft \cdot kip} \qquad T_r = 7.785 \qquad \sigma y_a := \frac{\sigma y}{1psi} \qquad \sigma y_a = 3.75 \times 10^4$$

$$AL_{ab} := \left[\frac{32}{\left(\pi \cdot D_{ab}{}^3\right)}\right] \cdot \left[\frac{\left(Kt_a \cdot M_a\right)}{\sigma e_a}\right] + \frac{\left(\sqrt{3} \cdot Kf\tau_a \cdot T_r\right)}{\left(2 \cdot \sigma y_a\right)}$$

$$AL_{ab} = 0.768$$

$$\text{Check}_{\text{SectionAB}} := \text{if}\left(AL_{ab} \le .8, \text{"Infinite"}, \text{"Finite"}\right) = \text{"Infinite"}$$

$$\sigma x_a := \left[\frac{\left(32 \cdot M_a\right)}{\pi \cdot D_{ab}{}^3}\right] \cdot Kf_a \qquad \sigma x_a = 20.843 \cdot ksi$$

$$\tau y_a := \left[\frac{\left(16 \cdot T_{fr}\right)}{\left(\pi \cdot D_{ab}{}^3\right)}\right] \cdot Kf_a \qquad \tau y_a = 0.034 \cdot ksi$$

$$\tau m_a := \left[\left(\frac{\sigma x_a}{2}\right)^2 + \tau y_a{}^2\right]^{.5} \qquad \tau m_a = 10.422 \cdot ksi$$

τma = Max Torsional Stress

$$\sigma max_a := \left(\frac{\sigma x_a}{2}\right) + \tau m_a$$

$$\sigma min_a := -\left(\frac{\sigma x_a}{2}\right) - \tau m_a \qquad \sigma r_a := \frac{\left(\sigma max_a - \sigma min_a\right)}{2} \qquad \sigma r_a = 20.844 \cdot ksi \qquad \sigma e_a = 27.135 \cdot ksi$$

Find Number of Cycles:

$$A_a := \frac{(.9 \cdot \sigma y)^2}{\sigma e_a} \qquad B_a := \left(\frac{-1}{3}\right) \cdot \log\left(\frac{.9 \cdot \sigma y}{\sigma e_a}\right)$$

$$N_a := \left(\frac{\sigma r_a}{A_a}\right)^{\frac{1}{B_a}} \qquad N_a = 4.242 \times 10^9$$

Section B:

$$AL_b := \left[\frac{32}{\left(\pi \cdot D_b^{\,3}\right)}\right] \cdot \left[\frac{\left(Kt_b \cdot M_b\right)}{\sigma e_b}\right] + \frac{\left(\sqrt{3} \cdot Kf\tau_b \cdot T_r\right)}{\left(2 \cdot \sigma y_a\right)}$$

$$AL_b = 0.964$$

$$Check_{SectionB} := if\left(AL_b \le .8, \text{"Infinite"}, \text{"Finite"}\right) = \text{"Finite"}$$

$$\sigma x_b := \left[\frac{\left(32 \cdot M_b\right)}{\pi \cdot D_b^{\,3}}\right] \cdot Kf_b \qquad \sigma x_b = 25.615 \cdot ksi$$

$$\tau y_b := \left[\frac{\left(16 \cdot T_{fr}\right)}{\left(\pi \cdot D_b^{\,3}\right)}\right] \cdot Kf_a \qquad \tau y_b = 0.044 \cdot ksi$$

$$\tau m_b := \left[\left(\frac{\sigma x_b}{2}\right)^2 + \tau y_b^{\,2}\right]^{.5} \qquad \tau m_b = 12.807 \cdot ksi$$

τmb = Max Torsional Stress

$$\sigma max_b := \left(\frac{\sigma x_b}{2}\right) + \tau m_b$$

$$\sigma min_b := -\left(\frac{\sigma x_b}{2}\right) - \tau m_b \qquad \sigma r_b := \frac{\left(\sigma max_b - \sigma min_b\right)}{2} \qquad \sigma r_b = 25.615 \cdot ksi \qquad \sigma e_b = 27.392 \cdot ksi$$

Find Number of Cycles:

$$A_b := \frac{(.9 \cdot \sigma y)^2}{\sigma e_b} \qquad B_b := \left(\frac{-1}{3}\right) \cdot \log\left(\frac{.9 \cdot \sigma y}{\sigma e_b}\right)$$

$$N_b := \left(\frac{\sigma r_b}{A_b}\right)^{\frac{1}{B_b}} \qquad N_b = 9.201 \times 10^6$$

Remaining Life:

$$\text{lifting} := 100\text{ft}$$

$$r_s := \frac{180\text{in}}{2} = 90 \cdot \text{in}$$

$$\frac{\text{lifting}}{2r_s \cdot \pi} = 2.122$$

$$\frac{N_b}{2.122 \cdot 2 \cdot 3300} = 656.951$$

AECOM

Calculations

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Fatigue Check of Trunnion Shaft

Critical Sections:

A - Maximum bending moment, torsional moment, and stress concentration of keyway

B - Bending moment, torsional moment, and stress concentrations of fillet

Shaft Dimensions and other Variables

Enter information in Yellow boxes:

Results are in Blue boxes

Sections AB & B Diameters — Section AB is middle of turnnion shaft Section B is at fillet

$D_{ab} := 24in$ — Diameter of Shaft at Section AB

$D_b := 22.084in$ — Diameter of Shaft at Section B

$r_f := .625$ — Fillet Radius in inches, but do not use dimension

$Span_w := 4515kip$ — Weight of Span

$Cwt := Span_w$ — Weight of Counterweights (hypothesis)

$W_l := \frac{(Span_w + Cwt)}{8} = 1129 \cdot kip$ — Weight on Trunnion Shaft

$\sigma ut := 75ksi$ — Ultimate Tensile Strength of Shaft Material (ASTM A235 Class E)

$\sigma y := 37.500ksi$ — Yield Strenght for material

Distance from bearings to area of concern:

$l_s := 13in + 13in + 27.5in = 53.5 \cdot in$ — Length of Shaft Between Bearing Centers

$l_a := \frac{l_s}{2}$ — Distance to Center of Shaft from center of Bearing

$l_b := 13in$ — Distance from Center of Bearing to fillet

$c_{fr} := .004$ — Coefficient of friction for Bronze on Steel (Greased)

Torque on Shaft Due to Friction

$T_{fr} := W_l \cdot D_b \cdot c_{fr}$ $\quad$ $T_{fr} = 693.27\,J \cdot 16.250$

Find Endurance Limit:

σe = α σut * (Cd*Cs*Ck*Ct*Cm)

$\alpha := .5$

From CSA Section 13.7.3.5.4 Endurance Limit

$Cr := 0.814$

$Cm := 1$

$Cs := 1.459$ $\quad$ $4.51 \cdot (75)^{-0.265} = 1.436$

$Ct := 1$

Size Factor; $\quad$ $Cd = (D/7.6)^{-0.113}$

$$Cd_{ab} := \left[\left(\frac{D_{ab}}{7.6mm}\right)^{-.113}\right] \qquad Cd_{ab} = 0.609$$

$$Cd_b := \left[\left(\frac{D_b}{7.6mm}\right)^{-.113}\right] \qquad Cd_b = 0.615$$

$$\sigma e_a := \alpha \cdot \sigma ut \cdot \left(Cd_{ab} \cdot Cr \cdot Ct \cdot Cs \cdot Cm\right) \qquad \sigma e_a = 27.135 \cdot ksi$$

$$\sigma e_b := \alpha \cdot \sigma ut \cdot \left(Cd_b \cdot Cr \cdot Ct \cdot Cs \cdot Cm\right) \qquad \sigma e_b = 27.392 \cdot ksi$$

Find - Bending Moments at each Section:

Section A -

Bending moment due to weight on Shaft

$M_a := W_l \cdot l_a$ $\qquad M_a = 2.516 \times 10^3 \cdot ft \cdot kip$

Section B -

Bending moment due to weight on Shaft

$M_b := W_l \cdot l_b$ $\qquad M_b = 1.223 \times 10^3 \cdot ft \cdot kip$

Find Stress Concentration Factors:

$\nu := .049$

$$q := \frac{1}{\left[1 + \left(\frac{\nu}{r_f^{.5}}\right)\right]} \qquad q = 0.942$$

$Kt_a := 1$ For Sled-run keyway; Use 1 if no Keyway

$Kf_a := 1 + q \cdot (Kt_a - 1)$ $\qquad Kf_a = 1$

$K\tau_a := 1$ For Sled-run keyway; Use 1 if no Keyway

$Kf\tau_a := 1 + q \cdot (K\tau_a - 1)$ $\qquad Kf\tau_a = 1$

2.22

$Kt_b := 2.02$

$Kf_b := 1 + q \cdot (Kt_b - 1)$ $\qquad Kf_b = 1.96$ From AASHTO Section 6.7.3.2

$K\tau_b := 1.61$

1.61

$Kf\tau_b := 1 + q \cdot (K\tau_b - 1)$ $\qquad Kf\tau_b = 1.574$

Find Stress Concentration Factors (v.2):

From Peterson's Stress Concentration Factors, 2nd Ed. 1997, Chapter 3: Shoulder fillet in bar of circular cross section

$r_{f.} := .625$ Fillet Radius

$t := \dfrac{D_{ab} - 22.084in}{2in} = 0.958$ Fillet Height

$D := 24$ $\dfrac{t}{r_f} = 1.533$

Bending Factor

$$C1b := 0.947 + 1.206\sqrt{\frac{t}{r_f}} - 0.131\cdot\frac{t}{r_f} = 2.239$$

$$C2b := 0.022 - 3.405\sqrt{\frac{t}{r_f}} + 0.915\cdot\frac{t}{r_f} = -2.791$$

$$C3b := 0.869 + 1.777\sqrt{\frac{t}{r_f}} - 0.555\cdot\frac{t}{r_f} = 2.218$$

$$C4b := -0.810 + 0.422\sqrt{\frac{t}{r_f}} - 0.260\cdot\frac{t}{r_f} = -0.686$$

$$Kt_b := C1b + C2b\cdot\left(\frac{2t}{D}\right) + C3b\cdot\left[\left(\frac{2t}{D}\right)^2\right] + C4b\cdot\left[\left(\frac{2t}{D}\right)^3\right]$$

$Kf_b := 1 + q\cdot(Kt_b - 1)$ $Kf_b = 1.97$

Torsional Factor

$$C1 := 0.905 + 0.783\sqrt{\frac{t}{r_f}} - 0.075\cdot\frac{t}{r_f} = 1.759$$

$$C2 := -0.437 - 1.969\sqrt{\frac{t}{r_f}} - 0.553\cdot\frac{t}{r_f} = -3.722$$

$$C3 := 1.557 + 1.073\sqrt{\frac{t}{r_f}} - 0.578\cdot\frac{t}{r_f} = 1.999$$

$$C4 := -1.061 + 0.171\sqrt{\frac{t}{r_f}} + 0.086\cdot\frac{t}{r_f} = -0.717$$

$$K\tau_b := C1 + C2\cdot\left(\frac{2t}{D}\right) + C3\cdot\left[\left(\frac{2t}{D}\right)^2\right] + C4\cdot\left[\left(\frac{2t}{D}\right)^3\right] = 1.475$$

$Kf\tau_b := 1 + q\cdot(K\tau_b - 1)$ $Kf\tau_b = 1.447$

Find Number of Cycles at Each Section

Section A:

$T_r := \frac{T_{fr}}{1ft \cdot kip}$ $T_r = 8.309$ $\sigma y_a := \frac{\sigma y}{1psi}$ $\sigma y_a = 3.75 \times 10^4$

$$AL_{ab} := \left[\frac{32}{\left(\pi \cdot D_{ab}^{3}\right)}\right] \cdot \left[\frac{\left(Kt_a \cdot M_a\right)}{\sigma e_a}\right] + \frac{\left(\sqrt{3} \cdot Kf\tau_a \cdot T_r\right)}{\left(2 \cdot \sigma y_a\right)}$$

$AL_{ab} = 0.82$

$\boxed{Check_{SectionAB} := if\left(AL_{ab} \le .8, \text{"Infinite"}, \text{"Finite"}\right) = \text{"Finite"}}$

$\sigma x_a := \left[\frac{\left(32 \cdot M_a\right)}{\pi \cdot D_{ab}^{3}}\right] \cdot Kf_a$ $\sigma x_a = 22.248 \cdot ksi$

$\tau y_a := \left[\frac{\left(16 \cdot T_{fr}\right)}{\left(\pi \cdot D_{ab}^{3}\right)}\right] \cdot Kf_a$ $\tau y_a = 0.037 \cdot ksi$

$\tau m_a := \left[\left(\frac{\sigma x_a}{2}\right)^2 + \tau y_a^{2}\right]^{.5}$ $\tau m_a = 11.124 \cdot ksi$ τma = Max Torsional Stress

$\sigma max_a := \left(\frac{\sigma x_a}{2}\right) + \tau m_a$

$\sigma min_a := -\left(\frac{\sigma x_a}{2}\right) - \tau m_a$ $\sigma r_a := \frac{\left(\sigma max_a - \sigma min_a\right)}{2}$ $\sigma r_a = 22.248 \cdot ksi$ $\sigma e_a = 27.135 \cdot ksi$

Find Number of Cycles:

$A_a := \frac{(.9 \cdot \sigma y)^2}{\sigma e_a}$ $B_a := \left(\frac{-1}{3}\right) \cdot \log\left(\frac{.9 \cdot \sigma y}{\sigma e_a}\right)$

$N_a := \left(\frac{\sigma r_a}{A_a}\right)^{\frac{1}{B_a}}$ $N_a = 5.382 \times 10^8$

Section B:

$$AL_b := \left[\frac{32}{\left(\pi \cdot D_b^{\,3}\right)}\right] \cdot \left[\frac{\left(Kt_b \cdot M_b\right)}{\sigma e_b}\right] + \frac{\left(\sqrt{3} \cdot Kf\tau_b \cdot T_r\right)}{\left(2 \cdot \sigma y_a\right)}$$

$$AL_b = 1.029$$

$$Check_{SectionB} := if\left(AL_b \le .8\,, \text{"Infinite"}\,, \text{"Finite"}\right) = \text{"Finite"}$$

$$\sigma x_b := \left[\frac{\left(32 \cdot M_b\right)}{\pi \cdot D_b^{\,3}}\right] \cdot Kf_b \qquad \sigma x_b = 27.34 \cdot ksi$$

$$\tau y_b := \left[\frac{\left(16 \cdot T_{fr}\right)}{\left(\pi \cdot D_b^{\,3}\right)}\right] \cdot Kf_a \qquad \tau y_b = 0.047 \cdot ksi$$

$$\tau m_b := \left[\left(\frac{\sigma x_b}{2}\right)^2 + \tau y_b^{\,2}\right]^{.5} \qquad \tau m_b = 13.67 \cdot ksi$$

τmb = Max Torsional Stress

$$\sigma max_b := \left(\frac{\sigma x_b}{2}\right) + \tau m_b$$

$$\sigma min_b := -\left(\frac{\sigma x_b}{2}\right) - \tau m_b \qquad \sigma r_b := \frac{\left(\sigma max_b - \sigma min_b\right)}{2} \qquad \sigma r_b = 27.341 \cdot ksi \qquad \sigma e_b = 27.392 \cdot ksi$$

Find Number of Cycles:

$$A_b := \frac{(.9 \cdot \sigma y)^2}{\sigma e_b} \qquad B_b := \left(\frac{-1}{3}\right) \cdot \log\left(\frac{.9 \cdot \sigma y}{\sigma e_b}\right)$$

$$N_b := \left(\frac{\sigma r_b}{A_b}\right)^{\frac{1}{B_b}} \qquad N_b = 1.064 \times 10^6$$

Remaining Life:

$\text{lifting} := 100\text{ft}$

$r_s := \dfrac{180\text{in}}{2} = 90\cdot\text{in}$

$\dfrac{\text{lifting}}{2r_s\cdot\pi} = 2.122$

$\dfrac{N_b}{2.122\cdot 2\cdot 3300} = 75.94$

AECOM

Calculations

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Fatigue Check of Trunnion Shaft

Critical Sections:

A - Maximum bending moment, torsional moment, and stress concentration of keyway

B - Bending moment, torsional moment, and stress concentrations of fillet

Shaft Dimensions and other Variables

Enter information in Yellow boxes:

Results are in Blue boxes

Sections AB & B Diameters — Section AB is middle of turnnion shaft Section B is at fillet

$D_{ab} := 24\text{in}$ — Diameter of Shaft at Section AB

$D_b := 22.084\text{in}$ — Diameter of Shaft at Section B

$r_f := .625$ — Fillet Radius in inches, but do not use dimension

$Span_w := 4601\text{kip}$ — Weight of Span

$Cwt := Span_w$ — Weight of Counterweights (hypothesis)

$W_l := \dfrac{(Span_w + Cwt)}{8} = 1150 \cdot \text{kip}$ — Weight on Trunnion Shaft

$\sigma ut := 75\text{ksi}$ — Ultimate Tensile Strength of Shaft Material (ASTM A235 Class E)

$\sigma y := 37.500\text{ksi}$ — Yield Strenght for material

Distance from bearings to area of concern:

$l_s := 13\text{in} + 13\text{in} + 27.5\text{in} = 53.5 \cdot \text{in}$ — Length of Shaft Between Bearing Centers

$l_a := \dfrac{l_s}{2}$ — Distance to Center of Shaft from center of Bearing

$l_b := 13\text{in}$ — Distance from Center of Bearing to fillet

$c_{fr} := .004$ — Coefficient of friction for Bronze on Steel (Greased)

Torque on Shaft Due to Friction

$T_{fr} := W_l \cdot D_b \cdot c_{fr}$ $\quad\quad T_{fr} = 706.475\,J \cdot 16.250$

Find Endurance Limit:

σe = α σut * (Cd*Cs*Ck*Ct*Cm)

$\alpha := .5$

From CSA Section 13.7.3.5.4 Endurance Limit

$Cr := 0.814$

$Cm := 1$

$Cs := 1.459 \quad\quad 4.51\cdot(75)^{-0.265} = 1.436$

$Ct := 1$

Size Factor; Cd = $(D/7.6)^{-0.113}$

$$Cd_{ab} := \left[\left(\frac{D_{ab}}{7.6mm}\right)^{-.113}\right] \quad\quad Cd_{ab} = 0.609$$

$$Cd_b := \left[\left(\frac{D_b}{7.6mm}\right)^{-.113}\right] \quad\quad Cd_b = 0.615$$

$\sigma e_a := \alpha \cdot \sigma ut \cdot \left(Cd_{ab} \cdot Cr \cdot Ct \cdot Cs \cdot Cm\right)$ $\quad\quad \sigma e_a = 27.135 \cdot ksi$

$\sigma e_b := \alpha \cdot \sigma ut \cdot \left(Cd_b \cdot Cr \cdot Ct \cdot Cs \cdot Cm\right)$ $\quad\quad \sigma e_b = 27.392 \cdot ksi$

Find - Bending Moments at each Section:

Section A -

Bending moment due to weight on Shaft

$M_a := W_l \cdot l_a$ $\qquad M_a = 2.564 \times 10^3 \cdot ft \cdot kip$

Section B -

Bending moment due to weight on Shaft

$M_b := W_l \cdot l_b$ $\qquad M_b = 1.246 \times 10^3 \cdot ft \cdot kip$

Find Stress Concentration Factors:

$\nu := .049$

$$q := \frac{1}{\left[1 + \left(\frac{\nu}{r_f^{.5}}\right)\right]} \qquad q = 0.942$$

$Kt_a := 1$ For Sled-run keyway; Use 1 if no Keyway

$Kf_a := 1 + q \cdot (Kt_a - 1)$ $\qquad Kf_a = 1$

$K\tau_a := 1$ For Sled-run keyway; Use 1 if no Keyway

$Kf\tau_a := 1 + q \cdot (K\tau_a - 1)$ $\qquad Kf\tau_a = 1$

2.22

$Kt_b := 2.02$

$Kf_b := 1 + q \cdot (Kt_b - 1)$ $\qquad Kf_b = 1.96$ From AASHTO Section 6.7.3.2

$K\tau_b := 1.61$

1.61

$Kf\tau_b := 1 + q \cdot (K\tau_b - 1)$ $\qquad Kf\tau_b = 1.574$

Find Stress Concentration Factors (v.2):

$r_{f.} := .625$ Fillet Radius

From Peterson's Stress Concentration Factors, 2nd Ed. 1997, Chapter 3: Shoulder fillet in bar of circular cross section

$$t := \frac{D_{ab} - 22.084in}{2in} = 0.958$$ Fillet Height

$D := 24$ $\qquad \frac{t}{r_f} = 1.533$

Bending Factor

$$C1b := 0.947 + 1.206\sqrt{\frac{t}{r_f}} - 0.131 \cdot \frac{t}{r_f} = 2.239$$

$$C2b := 0.022 - 3.405\sqrt{\frac{t}{r_f}} + 0.915 \cdot \frac{t}{r_f} = -2.791$$

$$C3b := 0.869 + 1.777\sqrt{\frac{t}{r_f}} - 0.555 \cdot \frac{t}{r_f} = 2.218$$

$$C4b := -0.810 + 0.422\sqrt{\frac{t}{r_f}} - 0.260 \cdot \frac{t}{r_f} = -0.686$$

$$Kt_b := C1b + C2b \cdot \left(\frac{2t}{D}\right) + C3b \cdot \left[\left(\frac{2t}{D}\right)^2\right] + C4b \cdot \left[\left(\frac{2t}{D}\right)^3\right]$$

$Kf_b := 1 + q \cdot (Kt_b - 1)$ $\qquad Kf_b = 1.97$

Torsional Factor

$$C1 := 0.905 + 0.783\sqrt{\frac{t}{r_f}} - 0.075 \cdot \frac{t}{r_f} = 1.759$$

$$C2 := -0.437 - 1.969\sqrt{\frac{t}{r_f}} - 0.553 \cdot \frac{t}{r_f} = -3.722$$

$$C3 := 1.557 + 1.073\sqrt{\frac{t}{r_f}} - 0.578 \cdot \frac{t}{r_f} = 1.999$$

$$C4 := -1.061 + 0.171\sqrt{\frac{t}{r_f}} + 0.086 \cdot \frac{t}{r_f} = -0.717$$

$$K\tau_b := C1 + C2 \cdot \left(\frac{2t}{D}\right) + C3 \cdot \left[\left(\frac{2t}{D}\right)^2\right] + C4 \cdot \left[\left(\frac{2t}{D}\right)^3\right] = 1.475$$

$Kf\tau_b := 1 + q \cdot (K\tau_b - 1)$ $\qquad Kf\tau_b = 1.447$

Find Number of Cycles at Each Section

Section A:

$T_r := \frac{T_{fr}}{1ft \cdot kip}$ $\quad T_r = 8.467$ $\quad \sigma y_a := \frac{\sigma y}{1psi}$ $\quad \sigma y_a = 3.75 \times 10^4$

$$AL_{ab} := \left[\frac{32}{\left(\pi \cdot D_{ab}^{3}\right)}\right] \cdot \left[\frac{\left(Kt_a \cdot M_a\right)}{\sigma e_a}\right] + \frac{\left(\sqrt{3} \cdot Kf\tau_a \cdot T_r\right)}{\left(2 \cdot \sigma y_a\right)}$$

$AL_{ab} = 0.836$

$Check_{SectionAB} := if(AL_{ab} \le .8, \text{"Infinite"}, \text{"Finite"}) = \text{"Finite"}$

$\sigma x_a := \left[\frac{(32 \cdot M_a)}{\pi \cdot D_{ab}^{3}}\right] \cdot Kf_a$ $\quad \sigma x_a = 22.672 \cdot ksi$

$\tau y_a := \left[\frac{(16 \cdot T_{fr})}{\left(\pi \cdot D_{ab}^{3}\right)}\right] \cdot Kf_a$ $\quad \tau y_a = 0.037 \cdot ksi$

$\tau m_a := \left[\left(\frac{\sigma x_a}{2}\right)^2 + \tau y_a^{2}\right]^{.5}$ $\quad \tau m_a = 11.336 \cdot ksi$ $\quad$ τma = Max Torsional Stress

$\sigma max_a := \left(\frac{\sigma x_a}{2}\right) + \tau m_a$

$\sigma min_a := -\left(\frac{\sigma x_a}{2}\right) - \tau m_a$ $\quad \sigma r_a := \frac{(\sigma max_a - \sigma min_a)}{2}$ $\quad \sigma r_a = 22.672 \cdot ksi$ $\quad \sigma e_a = 27.135 \cdot ksi$

Find Number of Cycles:

$A_a := \frac{(.9 \cdot \sigma y)^2}{\sigma e_a}$ $\quad B_a := \left(\frac{-1}{3}\right) \cdot \log\left(\frac{.9 \cdot \sigma y}{\sigma e_a}\right)$

$N_a := \left(\frac{\sigma r_a}{A_a}\right)^{\frac{1}{B_a}}$ $\quad N_a = 2.961 \times 10^8$

Section B:

$$AL_b := \left[\frac{32}{\left(\pi\cdot D_b^{\,3}\right)}\right]\cdot\left[\frac{\left(Kt_b\cdot M_b\right)}{\sigma e_b}\right] + \frac{\left(\sqrt{3}\cdot Kf\tau_b\cdot T_r\right)}{\left(2\cdot\sigma y_a\right)}$$

$$AL_b = 1.048$$

$$Check_{SectionB} := if\left(AL_b \le .8, "Infinite", "Finite"\right) = "Finite"$$

$$\sigma x_b := \left[\frac{\left(32\cdot M_b\right)}{\pi\cdot D_b^{\,3}}\right]\cdot Kf_b \qquad \sigma x_b = 27.861\cdot ksi$$

$$\tau y_b := \left[\frac{\left(16\cdot T_{fr}\right)}{\left(\pi\cdot D_b^{\,3}\right)}\right]\cdot Kf_a \qquad \tau y_b = 0.048\cdot ksi$$

$$\tau m_b := \left[\left(\frac{\sigma x_b}{2}\right)^2 + \tau y_b^{\,2}\right]^{.5} \qquad \tau m_b = 13.931\cdot ksi$$

τmb = Max Torsional Stress

$$\sigma max_b := \left(\frac{\sigma x_b}{2}\right) + \tau m_b$$

$$\sigma min_b := -\left(\frac{\sigma x_b}{2}\right) - \tau m_b \qquad \sigma r_b := \frac{\left(\sigma max_b - \sigma min_b\right)}{2} \qquad \sigma r_b = 27.861\cdot ksi \qquad \sigma e_b = 27.392\cdot ksi$$

Find Number of Cycles:

$$A_b := \frac{(.9\cdot\sigma y)^2}{\sigma e_b} \qquad B_b := \left(\frac{-1}{3}\right)\cdot\log\left(\frac{.9\cdot\sigma y}{\sigma e_b}\right)$$

$$N_b := \left(\frac{\sigma r_b}{A_b}\right)^{\frac{1}{B_b}} \qquad N_b = 5.696\times 10^5$$

Remaining Life:

$\text{lifting} := 100\text{ft}$

$r_s := \dfrac{180\text{in}}{2} = 90\cdot\text{in}$

$\dfrac{\text{lifting}}{2r_s\cdot\pi} = 2.122$

$\dfrac{N_b}{2.122\cdot 2\cdot 3300} = 40.673$

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Main Counterweight Rope Capacity Calculations

Half-Filled (50mm overlay)

2087 tonnes

1.0 GENERAL INFORMATION

1.1 GENERAL DATA

$W_{span} := 2087tonne$ — Weigth of span and deck

$D := 177.75in$ — Tread diameter of sheave rope grooves

$d := 2.25in$ — Diameter of main counterweight ropes

$d_w := \frac{d}{16} = 0.141 \cdot in$ Ref.: AASHTO Article 6.8.3.3.4 — Diameter of the outer wires in the wire rope

$E_w := 30 \times 10^6 psi$ — Tensile modulus of elasticity of the steel wire

$A_{rope} := 0.4 \cdot d^2 = 2.025 \cdot in^2$ Ref.: S6-14 Table 13.20 — Effective cross sectional are of the ropes (approx.)

$N_{rope} := 80$ — Number of ropes

1.2 ALLOWABLE STRESSES

Ref.: AASHTO Article 6.6.5 & CHBDC article 13.7.20.18

$P_{ult} := 420000lbf$ — Minimum ultimate tensile strength of rope (ref. BLB 2002 Main CW Wire Rope Replacement)

$\sigma_{ult} := \frac{P_{ult}}{A_{rope}} = 1430 \cdot MPa$ — Allowable tensile load

$\sigma_{allowable} := 0.222 \cdot \sigma_{ult} = 317 \cdot MPa$ — Maximum allowable tensile stress (for combined effect of bending and direct load)

2.0 STRESSES CALCULATIONS

Ref.: AASHTO Article 6.8.3.3.4 & CHBDC article 13.7.20.18

$\sigma_b := E_w \cdot \frac{d_w}{D} = 163.641 \cdot MPa$ — Maximum bending stress

$P := \frac{W_{span} \cdot g}{80} = 255.831 \cdot kN$ — Direct load (per rope)

$P_{ol} := \frac{662.07\ kN}{80} = 8.276 \cdot kN$ — Operating loads (per rope) (value from motor sizing calculation)

$\sigma_r := \frac{P}{A_{rope}} + \sigma_b + \frac{P_{ol}}{A_{rope}} = 365.798 \cdot MPa$ — Maximum total stress (per rope)

$SF := \frac{\sigma_r}{\sigma_{allowable}} \cdot 100\% = 115.224 \cdot \%$ — Value of over stress

AECOM

Calculations

Burlington Canal Lift Bridge
Pre-Design and Concept Design

Fatigue Check of Trunnion Shaft

Critical Sections:

A - Maximum bending moment, torsional moment, and stress concentration of keyway

B - Bending moment, torsional moment, and stress concentrations of fillet

Shaft Dimensions and other Variables

Enter information in Yellow boxes:

Results are in Blue boxes

Sections AB & B Diameters — Section AB is middle of turnnion shaft Section B is at fillet

$D_{ab} := 24\text{in}$ — Diameter of Shaft at Section AB

$D_b := 22.084\text{in}$ — Diameter of Shaft at Section B

$r_f := .625$ — Fillet Radius in inches, but do not use dimension

$Span_w := 5418\text{kip}$ — Weight of Span

$Cwt := Span_w$ — Weight of Counterweights (hypothesis)

$W_1 := \frac{(Span_w + Cwt)}{8} = 1355 \cdot \text{kip}$ — Weight on Trunnion Shaft

$\sigma ut := 75\text{ksi}$ — Ultimate Tensile Strength of Shaft Material (ASTM A235 Class E)

$\sigma y := 37.500\text{ksi}$ — Yield Strenght for material

Distance from bearings to area of concern:

$l_s := 13\text{in} + 13\text{in} + 27.5\text{in} = 53.5 \cdot \text{in}$ — Length of Shaft Between Bearing Centers

$l_a := \frac{l_s}{2}$ — Distance to Center of Shaft from center of Bearing

$l_b := 13\text{in}$ — Distance from Center of Bearing to fillet

$c_{fr} := .004$ — Coefficient of friction for Bronze on Steel (Greased)

Torque on Shaft Due to Friction

$T_{fr} := W_l \cdot D_b \cdot c_{fr}$ $\qquad$ $T_{fr} = 831.924\,J \cdot 16.250$

Find Endurance Limit:

σe = α σut * (Cd*Cs*Ck*Ct*Cm)

$\alpha := .5$

From CSA Section 13.7.3.5.4 Endurance Limit

$Cr := 0.814$

$Cm := 1$

$Cs := 1.459$ $\qquad$ $4.51 \cdot (75)^{-0.265} = 1.436$

$Ct := 1$

Size Factor; $\qquad$ $Cd = (D/7.6)^{-0.113}$

$$Cd_{ab} := \left[\left(\frac{D_{ab}}{7.6mm}\right)^{-.113}\right] \qquad Cd_{ab} = 0.609$$

$$Cd_b := \left[\left(\frac{D_b}{7.6mm}\right)^{-.113}\right] \qquad Cd_b = 0.615$$

$\sigma e_a := \alpha \cdot \sigma ut \cdot (Cd_{ab} \cdot Cr \cdot Ct \cdot Cs \cdot Cm)$ $\qquad$ $\sigma e_a = 27.135 \cdot ksi$

$\sigma e_b := \alpha \cdot \sigma ut \cdot (Cd_b \cdot Cr \cdot Ct \cdot Cs \cdot Cm)$ $\qquad$ $\sigma e_b = 27.392 \cdot ksi$

Find - Bending Moments at each Section:

Section A -

Bending moment due to weight on Shaft

$M_a := W_l \cdot l_a$ $\qquad M_a = 3.019 \times 10^3 \cdot ft \cdot kip$

Section B -

Bending moment due to weight on Shaft

$M_b := W_l \cdot l_b$ $\qquad M_b = 1.467 \times 10^3 \cdot ft \cdot kip$

Find Stress Concentration Factors:

$\nu := .049$

$$q := \frac{1}{\left[1 + \left(\frac{\nu}{r_f^{.5}}\right)\right]} \qquad q = 0.942$$

$Kt_a := 1$ For Sled-run keyway; Use 1 if no Keyway

$Kf_a := 1 + q \cdot (Kt_a - 1) \qquad Kf_a = 1$

$K\tau_a := 1$ For Sled-run keyway; Use 1 if no Keyway

$Kf\tau_a := 1 + q \cdot (K\tau_a - 1) \qquad Kf\tau_a = 1$

2.22

$Kt_b := 2.02$

$Kf_b := 1 + q \cdot (Kt_b - 1) \qquad Kf_b = 1.96$ From AASHTO Section 6.7.3.2

$K\tau_b := 1.61$ 1.61

$Kf\tau_b := 1 + q \cdot (K\tau_b - 1) \qquad Kf\tau_b = 1.574$

Find Stress Concentration Factors (v.2):

From Peterson's Stress Concentration Factors, 2nd Ed. 1997, Chapter 3: Shoulder fillet in bar of circular cross section

$r_{f.} := .625$ Fillet Radius

$t := \dfrac{D_{ab} - 22.084in}{2in} = 0.958$ Fillet Height

$D := 24$ $\dfrac{t}{r_f} = 1.533$

Bending Factor

$$C1b := 0.947 + 1.206\sqrt{\frac{t}{r_f}} - 0.131 \cdot \frac{t}{r_f} = 2.239$$

$$C2b := 0.022 - 3.405\sqrt{\frac{t}{r_f}} + 0.915 \cdot \frac{t}{r_f} = -2.791$$

$$C3b := 0.869 + 1.777\sqrt{\frac{t}{r_f}} - 0.555 \cdot \frac{t}{r_f} = 2.218$$

$$C4b := -0.810 + 0.422\sqrt{\frac{t}{r_f}} - 0.260 \cdot \frac{t}{r_f} = -0.686$$

$$Kt_b := C1b + C2b \cdot \left(\frac{2t}{D}\right) + C3b \cdot \left[\left(\frac{2t}{D}\right)^2\right] + C4b \cdot \left[\left(\frac{2t}{D}\right)^3\right]$$

$Kf_b := 1 + q \cdot (Kt_b - 1)$ $Kf_b = 1.97$

Torsional Factor

$$C1 := 0.905 + 0.783\sqrt{\frac{t}{r_f}} - 0.075 \cdot \frac{t}{r_f} = 1.759$$

$$C2 := -0.437 - 1.969\sqrt{\frac{t}{r_f}} - 0.553 \cdot \frac{t}{r_f} = -3.722$$

$$C3 := 1.557 + 1.073\sqrt{\frac{t}{r_f}} - 0.578 \cdot \frac{t}{r_f} = 1.999$$

$$C4 := -1.061 + 0.171\sqrt{\frac{t}{r_f}} + 0.086 \cdot \frac{t}{r_f} = -0.717$$

$$K\tau_b := C1 + C2 \cdot \left(\frac{2t}{D}\right) + C3 \cdot \left[\left(\frac{2t}{D}\right)^2\right] + C4 \cdot \left[\left(\frac{2t}{D}\right)^3\right] = 1.475$$

$Kf\tau_b := 1 + q \cdot (K\tau_b - 1)$ $Kf\tau_b = 1.447$

Find Number of Cycles at Each Section

Section A:

$$T_r := \frac{T_{fr}}{1ft \cdot kip} \qquad T_r = 9.971 \qquad \sigma y_a := \frac{\sigma y}{1psi} \qquad \sigma y_a = 3.75 \times 10^4$$

$$AL_{ab} := \left[\frac{32}{\left(\pi \cdot D_{ab}{}^3\right)}\right] \cdot \left[\frac{\left(Kt_a \cdot M_a\right)}{\sigma e_a}\right] + \frac{\left(\sqrt{3} \cdot Kf\tau_a \cdot T_r\right)}{\left(2 \cdot \sigma y_a\right)}$$

$$AL_{ab} = 0.984$$

$Check_{SectionAB} := if\left(AL_{ab} \le .8, \text{"Infinite"}, \text{"Finite"}\right) = \text{"Finite"}$

$$\sigma x_a := \left[\frac{\left(32 \cdot M_a\right)}{\pi \cdot D_{ab}{}^3}\right] \cdot Kf_a \qquad \sigma x_a = 26.697 \cdot ksi$$

$$\tau y_a := \left[\frac{\left(16 \cdot T_{fr}\right)}{\left(\pi \cdot D_{ab}{}^3\right)}\right] \cdot Kf_a \qquad \tau y_a = 0.044 \cdot ksi$$

$$\tau m_a := \left[\left(\frac{\sigma x_a}{2}\right)^2 + \tau y_a{}^2\right]^{.5} \qquad \tau m_a = 13.349 \cdot ksi$$

τma = Max Torsional Stress

$$\sigma max_a := \left(\frac{\sigma x_a}{2}\right) + \tau m_a$$

$$\sigma min_a := -\left(\frac{\sigma x_a}{2}\right) - \tau m_a \qquad \sigma r_a := \frac{\left(\sigma max_a - \sigma min_a\right)}{2} \qquad \sigma r_a = 26.697 \cdot ksi \qquad \sigma e_a = 27.135 \cdot ksi$$

Find Number of Cycles:

$$A_a := \frac{(.9 \cdot \sigma y)^2}{\sigma e_a} \qquad B_a := \left(\frac{-1}{3}\right) \cdot \log\left(\frac{.9 \cdot \sigma y}{\sigma e_a}\right)$$

$$N_a := \left(\frac{\sigma r_a}{A_a}\right)^{\frac{1}{B_a}} \qquad N_a = 1.674 \times 10^6$$

Section B:

$$AL_b := \left[\frac{32}{\left(\pi \cdot D_b^{\,3}\right)}\right] \cdot \left[\frac{\left(Kt_b \cdot M_b\right)}{\sigma e_b}\right] + \frac{\left(\sqrt{3} \cdot Kf\tau_b \cdot T_r\right)}{\left(2 \cdot \sigma y_a\right)}$$

$$AL_b = 1.235$$

$$Check_{SectionB} := \text{if}\left(AL_b \le .8, \text{"Infinite"}, \text{"Finite"}\right) = \text{"Finite"}$$

$$\sigma x_b := \left[\frac{\left(32 \cdot M_b\right)}{\pi \cdot D_b^{\,3}}\right] \cdot Kf_b \qquad \sigma x_b = 32.809 \cdot \text{ksi}$$

$$\tau y_b := \left[\frac{\left(16 \cdot T_{fr}\right)}{\left(\pi \cdot D_b^{\,3}\right)}\right] \cdot Kf_a \qquad \tau y_b = 0.057 \cdot \text{ksi}$$

$$\tau m_b := \left[\left(\frac{\sigma x_b}{2}\right)^2 + \tau y_b^{\,2}\right]^{.5} \qquad \tau m_b = 16.404 \cdot \text{ksi}$$

τmb = Max Torsional Stress

$$\sigma max_b := \left(\frac{\sigma x_b}{2}\right) + \tau m_b$$

$$\sigma min_b := -\left(\frac{\sigma x_b}{2}\right) - \tau m_b \qquad \sigma r_b := \frac{\left(\sigma max_b - \sigma min_b\right)}{2} \qquad \sigma r_b = 32.809 \cdot \text{ksi} \qquad \sigma e_b = 27.392 \cdot \text{ksi}$$

Find Number of Cycles:

$$A_b := \frac{(.9 \cdot \sigma y)^2}{\sigma e_b} \qquad B_b := \left(\frac{-1}{3}\right) \cdot \log\left(\frac{.9 \cdot \sigma y}{\sigma e_b}\right)$$

$$N_b := \left(\frac{\sigma r_b}{A_b}\right)^{\frac{1}{B_b}} \qquad N_b = 2.55 \times 10^3$$

Remaining Life:

$$lifting := 100ft$$

$$r_s := \frac{180in}{2} = 90 \cdot in$$

$$\frac{lifting}{2r_s \cdot \pi} = 2.122$$

$$\frac{N_b}{2.122 \cdot 2 \cdot 3300} = 0.182$$

Contact

Christine Beard Laaber
Senior Structural Engineer/ Project Manager
T +226-750-5413
E christine.laaber@aecom.com

aecom.com