Presented To:

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

Inspection Report and Concept Repair Design

SOLICITATION No.:
PEQ754-161278/001/PWL:
Burlington Canal Lift Bridge Engineering Services

PROJECT No.:
R.081864.001
Urgent Steel Deck Grating Repairs

Morrison Hershfield Limited
Suite 300, 125 Commerce Valley Drive West
Markham, ON L3T 7W4

1160268.03

MORRISON HERSHFIELD

April, 2017

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EXECUTIVE SUMMARY

Morrison Hershfield (MH) has been retained by Public Works and Government Services Canada (PWGSC) to provide professional engineering services associated with an inspection and design related to Urgent Steel Deck Grating Repairs for The Burlington Canal Lift Bridge. The structure is a tower-driven vertical lift bridge constructed in 1958, with an overall lift span of 116 meters. The bridge is located in Hamilton, Ontario and carries 4 lanes of Eastport Drive traffic over the Burlington Canal, with a posted speed limit of 50 km/hr.

The Urgent Steel Deck Grating Repairs pertain to the current deck grating on the lift span. The deck is comprised of total 98 steel grating panels.

A field visual inspection was completed by MH on October 14-15, 2016. The significant findings from MH's visual inspection included the following:

- Cracked welded connections within the grating panels were observed throughout the entire bridge deck surface.
- Cracked welds between the panels and the bridge floorbeams were observed in numerous locations.
- Large areas within the panels with complete failure of joints between grating members were observed throughout the deck with NB outside lane being affected above average. Those Local Grating Failure Areas were classified as critically important.
- The deck grating is subjected to repetitive wheel loading exerted by the heavy volumes of traffic on the bridge.
- Evidence of multiple on-site welding repairs of the cracked welded connections.

Based on the findings of this inspection MH recommends that the repairs to the steel grating panels and to the grating to floorbeam connections need to be completed as soon as possible. Local Grating Failure Areas repairs are classified as of critical importance since they are considered hazardous and present an imminent public safety concern.

The major work items include:

- Pre-Construction Inspection
- Button Weld Crack Repair
- Local Grating Failure Area Repair (Critical Repair)
- M-Beam-to-Stringer Repair

The estimated cost of construction is approximately $415,000.00, including contingency but excluding HST and Departmental Representative fees.

The recommended repairs constitute a holding strategy until the deck is replaced and upgraded to CHBDC performance levels, which is expected to be within 2 to 3 years. Additional monitoring and regular inspections are also recommended until the deck panels are fully replaced.

1. INTRODUCTION

Morrison Hershfield Limited (MH) has been retained by Public Works and Government Services Canada (PWGSC) to provide engineering services for the design and construction of required short term repairs on the Burlington Canal Lift Bridge under PWGSC Standing Offer No. EQ754-161278/001/PWL: BCLB Bridge Engineering Services, Project Number: R.081864.001 Urgent Steel Deck Grating Repairs.

The detailed scope of services to be provided under this assignment is listed in our proposal dated June 13, 2016. The scope of services consists of:

1. Obtain all necessary approvals and all traffic management schemes required during implementation of the emergency repair work;
2. Close-up inspection of the steel deck grating and identification of all distressed locations;
    a. This includes the inspection of the test panel installed in 2014 as part of the emergency repairs and the documentation of its performance since installation
3. Design of urgent (short term) repairs to address defects and deficiencies observed in order to allow the bridge to continue safe operation until the long-term deck replacement work is completed;
4. Preparation of drawings and documents of the proposed emergency repairs to the defective panels, as well as assistance to PWGSC during the tendering, award process, and implementation;
5. Non-resident engineering supervision and support services during construction.

2. BACKGROUND

The Burlington Canal Lift Bridge carries 2 NB and 2 SB lanes of Eastport Drive traffic over the navigation channel linking Hamilton Harbour with Lake Ontario. The bridge carries local traffic and part of the detour route in the event of Burlington Skyway Bridge/QEW closures.

The Burlington Lift Bridge was constructed circa 1958 to carry rail and road traffic. The bridge structure is a tower-driven vertical lift bridge. The lift span is 116 metres long, weighs 1,996 tonnes and has a vertical lift of 33.5 metres. At full lift height, maximum clearance for marine traffic is approximately 36.5 metres during typical water level conditions. When locked in its lowered position, a clearance of approximately 5 metres, during typical water level conditions, allows very small pleasure craft, kayaks and canoes to pass easily beneath the bridge.

Modifications to the lift span were made in 1982 to convert the bridge to only carry car and truck traffic. The current deck grating on the lift span was installed in 2000. The deck is comprised of total 98 steel grating panels spanning across WBL and EBL, 49 steel panels in each direction. The typical panels are 3124mm x 7105mm and 3124mm x 7620mm, 130mm 4-way open grating type, made of grade ASTM A588 steel and welded in accordance with AASHTO/AWS D1.5-95. Each panel consists of 130 mm-deep transverse main bearing beams (M-beams) spaced at 190 mm that connect the grating panel to the longitudinal floorbeams (stringers) below. These M-beams are interspersed with 25 mm-deep supplementary bars (S-bars). 50 mm-deep members (C-bars) spaced at 95 mm are transverse to the M-beams and S-bars to form the grid. The 25 mm-deep diagonal bars connect all members to stiffen the grid. All connections are formed

by seating the members against each other and fused with factory-performed button welds. The drawings for the existing panels are provided in **Appendix A – Reference Structural Drawings.**

The deck grating is in seriously deteriorated condition. It is unknown when the deterioration first manifested itself. As part of an earlier assignment to replace a failed deck panel, MH performed a simplified structural evaluation to select an appropriate replacement grating panel. The evaluation estimated the spacing of the M-beams required to take the highest factored CHBDC wheel load using the section modulus of the existing grating and found the existing spacing is not adequate to carry these wheel loads. This replacement panel (Panel E1) was designed to satisfy CHBDC loading criteria and was installed in March 2014. It was to serve as a Test Panel for the possibility for similar future replacement of the remaining panels, which have been subjected to multiple on-site welding repairs due to structural failures of the welded connections within the grating and between the grating and stringer.

MH bridge engineering specialists performed an emergency inspection of the deck on April 7th, 2016 and observed that the steel grating was failing under traffic load in several modes including: grating to stringer weld failures, button weld cracks and M-beam cracks. Following the observations, immediate actions were recommended for remediation of the most affected panels. The findings, discussion and recommendations are documented in MH Report No 2.1: 1160268.02 Burlington Lift Bridge – Call up 2 Bridge Deck Cracking.

3. DESIGN REFERENCES

Structural Drawings:	104365 New Deck Grating, Drawing 1, dated October 29, 1999 by National Centre of Expertise Architecture and Engineering Services, Real Property Services Branch.
	Burlington Lift Bridge – New Grid Deck, Drawings 1 to 3, dated January 19, 2000 by IKG Greulich.
	R.012843.055 PWGSC Steel Panel Replacement, Drawings B-0 to B-2, dated January 24, 2014 by Morrison Hershfield
Codes and Standards:	CSA S6-14 – Canadian Highway Bridge Design Code
	CSA S16-14 - Design of Steel Structures
	CSA W59-13 - Welded Steel Construction (metal arc welding

4. CONDITION ASSESSMENT

MH bridge engineers conducted a steel grating deck visual inspection on October 14-15, 2016.

The investigation examined all 98 panels on the bridge. The entire surface of each single panel was inspected for structural and non-structural damages.

This visual inspection was made from the top side of the deck. The panels were checked for structural discontinuity, vibrations and sound response by means of a rubber mallet. MH validated the dimensions of the existing grating and components relevant to the deck repair. Deck deficiencies were marked with temporary spray paint. Each panel was then photographed including close of details of failure modes. (See photos 1 and 2 of **Appendix B – Inspection**

Photographs) During the inspection, the existing roadway and traffic conditions were observed for significance of the relationship between the location of concentrated wheel loads and localized/concentrated deck failures.

The inspection at some locations was obscured by dirt at the level of the M-beams and debris embedded in the grating (see Photos 23 to 26 in **Appendix B**). However, it is estimated that less than 1% of the grating area was obscured.

5. CLASSIFICATION OF GRATING FAILURES WITH CONCLUSIONS

Please refer to **Appendix C: Inspection Summary** and **Appendix D: Inspection Findings Drawings** for specific number and location of the major grating failures described below.

5.1 Button Weld Cracks

See photos 7 and 8 of Appendix B.

Cracks typically occur in the Button Welds that connect the steel grating members to the primary "M-beams" and the transverse "C-bars". The original welds were performed under shop conditions, but several welds have been field-repaired since the original panel installation in 2000.

Cracks can propagate through latent weaknesses in the weld or insufficient weld coverage. The problem is aggravated when the grating is regularly exposed to concentrated wheel loads, particularly from truck traffic that is more than its design capacity. The connecting members in each weld have differing structural properties, which exacerbate induced cyclical strains. The deck panel redistributes the load path around a cracked weld, thus increasing the likelihood of cracks in adjacent welds.

The incidence of button weld cracks is widespread. The frequency of occurrence is greatest within the wheel paths. The quality of the field-repaired welds is likely inferior to that of the factory welds, and thus appear to be cracking at an accelerated rate compared to the original welds. (See photos 21, 22 of **Appendix B**)

Based on highest stress range directly below wheel loads due to local effects, all current button weld cracks are subjected to repetitive fatigue cycles. These failures will eventually progress into connection discontinuities which then lead to appearance of Local Grating Failure areas (see 5.3). The button weld cracks do not necessarily coincide with M-Beam to stringer weld failures (see 5.2) although it can be reasonably assumed that these failures are related. When the stringer welds fail, the flexibility of the panel is increased and the impact loads are magnified. This results in a greater dynamic load and movement range at the button welds that could then result in further cracking.

5.2 M-beam to Stringer Weld Failure

See photos 9 and 10 of Appendix B.

Cracks typically occur in the field fillet welds connecting the 130 mm-deep M-beams to the stringers. It was noted that the welds are often incomplete (e.g. welds on only one side of the flange, discontinuous or inconsistent weld size, etc.). The reduction in connectivity between the M-beam and the stringer due to the cracked welds contribute to the "bounciness" of the panels under heavy traffic load conditions. As the damage progresses more welds are affected leading to instability of the panel due to improper anchorage onto the stringer of the bridge.

5.3 Local Grating Failure

See photos 13 and 20 of Appendix B.

Local Grating Failure (LGF) on single panel is defined as an area of up to 1 m^2 with complete failure of one or more joints between grating members. It was observed that LGF areas typically did not extend beyond 1 m^2, but had high concentration of connection damage. Such failures are characterized by the complete failure of the Button Welds and presence of vertical cracks throughout the entire section of the adjoining deck grating member. In addition, such failures are often combined with missing grating members and sharp edges that suggest the members broke after the welds had failed. The LGF areas do not always correspond with M-beam-to-stringer weld cracks, although these cracks could be contributing to the formation of LGF areas.

LGF areas are detected when subjected to impact load, such as a strike of a mallet or high speed rolling vehicle wheel. The response is deflection and vibration of one or more grating members, and is both visibly and audibly detectable.

Several LGF areas coincide with where the Button Welds were field-repaired.

More LGF areas are likely to develop. The existing areas will likely increase due progressive crack development and fatigue because of load redistribution. Presently affected grating members can result in openings of at least the size of a grating unit. Further development of LGF areas is considered hazardous and presents an imminent public safety concern. This is particularly dangerous for motorcyclists and bicyclists who may be more susceptible to their tires punching through the grating openings.

5.4 M-beam Cracks

During MH's emergency inspection of the deck on April 7th, 2016, a single crack was observed in the web of the M-beam supporting deck panel E7 at its connection to the stringer. This damage was subsequently repaired by welding a steel plate to the web as recommended in MH Report No 2.1: 1160268.02 Burlington Lift Bridge – Call up 2 Bridge Deck Cracking. The condition of this repair was good and no further cracking was observed in this location.

All accessible panels were checked for presence of similar M-beam cracks. No occurrences of M-beam cracks were found.

5.5 Other deficiencies

Broken grating members (See photo 12 of Appendix B)

Broken or missing grating members adversely affect panel performance and public safety. They are often associated with LGF areas.

Warped grating members (See photo 11 of Appendix B)

Warped members do not correspond with Button Weld cracks or LGF areas. The cause of the warping is unknown.

Field weld repairs (See photos 21 and 22 of Appendix B)

Re-welded connections appear to be prone to re-cracking.

Surface Rust, Flaking Paint and Debris (See photos 23 and 26 of Appendix B)

The listed items are classified as non-structural deficiencies and require no immediate action. However, those items tend to conceal the grating steel's surface therefore could prevent from accurate monitoring and inspections procedures.

6. PERFORMANCE OF TEST PANEL E1

The Test Panel E1 was checked for any signs of performance deficiencies. All the structural members and connections of the panel were visually checked for, but not limited to, damages listed in point 5.1 of this Report. It was noted that the Test Panel was sturdier and less prone to vibrations than the other panels. There were no structural deficiencies noted for the Test Panel E1. (See photos 3 to 6 of **Appendix B**)

7. OTHER OBSERVATIONS

a. It is reasonable to conclude that NB lanes are subjected to more traffic than SB lanes, in particular heavy load traffic. The conclusion is derived from the fact that the NB lanes on the adjacent Burlington Skyway Bridge have been affected by frequent closures during recent years.

   This observation is consistent with the fact that the BCLB NB lanes are damaged to greater extent than the BCLB SB lanes.

b. Transition between wearing surface at approaches onto the grating is not smooth due to a small change in elevation. Wheels on vehicles travelling northbound impact on the panels upon transition. This observation does not seem to correspond an increase in grating defects; no defects were observed in the end panels.

c. During our inspection, the speed limit appeared to be frequently exceeded by vehicles on the bridge.

d. LGF areas pose a significant risk for tire impact or puncture for bicyclists and motorcyclists. Additionally, the vibration noises in these areas may be unsettling.

8. TEMPORARY REPAIR OPTIONS WITH RECOMMENDATIONS

Urgent repair of the steel deck is required. The recommendations below are "holding" repairs for short term. Permanent repair is likely not feasible. It is strongly advised that the deck be replaced within the next 2-3 years horizon. Our recommendation is based on our observations of considerable damage consistent with repeated heavy wheel loading, the high frequency of local failures reported by the bridge operations staff and observed on site, the pre-existing failure of one panel that forced its emergency replacement, and a lack of structural capacity in the existing grating. See **Appendix E: Repair Options** for concept sketches.

8.1 Button Weld Cracks

Repair button weld cracks by welding vertically along the entire depth of the grating members to improve the weld connectivity. This weld is to be performed and inspected according to a rigorous protocol that is based on CSA W59-13.

Routine button weld monitoring and weld repairs as required should continue until the panels are replaced. Cracks with width more than 1 mm should be welded as per the method discussed in point 8.3.

8.2 M-beam to Stringer Weld Failure

Option A – Re-Welding (see Sketch SK-01, Appendix E)

Cracked M-beam to stringer welds will be re-welded on-site. This option is the most cost effective approach but due to the difficulty in accessing the weld location from above the deck, the quality of the field is difficult to control and re-cracking of the welds is likely.

This option is the least preferred from a technical standpoint. However, it is recommended as an alternative to Option D described below due to its simplicity and cost effectiveness. It is to be applied only if application of Option D is not feasible.

Option B – Clamp Panel Grating to Stringer Flange (see Sketch SK-02 and SK-03, Appendix E)

Mechanical clamp will hold the M-beam in place and transfer the compressive force through the epoxy filler and 4 holding bolts to the stringer flange. This application is possible with an installation crew working from both below and atop the deck. Traffic control is required at all times during the repairs. Access is required to the underside of grating. All access options are costly and logistically challenging.

Option B is a non-invasive method of holding the panels to the stringers.

Option C – Bolt Panel to Stringer using Welded Plates and Studs (see Sketch SK-04 and SK-05, Appendix E)

Steel plate welded to the M-beam web will be held down by threaded studs welded to the top of stringer flange. This application is possible from the top of deck. The method requires minimal removal of grating section. After installation, the missing grating members will be replaced with members having equivalent or better structural properties. Traffic control is required at all times during the repairs.

Option C is considered technically appropriate; it requires structural amendments to existing stringers and grating.

Option D – Weld Hold-Down Plates onto Stringer and C-bars (see Sketch SK-06 and SK-07, Appendix E)

Steel plates welded to C-bars will be welded down to the top of stringer flange. This application is possible from the top of deck. The method requires no removal of grating section and provides an alternate load path from the grating to the top of the stringer by utilizing the C-bars. Traffic control is required at all times during the repairs.

Option D is considered technically appropriate and is the preferred choice due to the simplicity of the components and the effectiveness of the hold-down connection. However, it can be time-consuming to weld.

8.3 Local Grating Failure Areas

The condition of the panels affected by Local Grating Failure Areas warrant immediate remedial action.

The recommended temporary repair is to reinforce the broken grating panels by welding solid round bars to both the broken and the good sections of the panel grating. This provides an alternate load path around the cracks while mitigating the local failed section from bouncing or failing completely. This solution is an intermediate-term holding

measure until the panel is fully replaced. This solution can be applied from the top of the deck with traffic control measures in place. The concept is shown in ***Sketch SK*-08, Appendix E**.

8.4 M-beam Cracks

The short-term recommendation for the M-beam cracks is monitoring at approximately monthly intervals.

8.5 Other deficiencies

Broken or missing grating members are subject to remedial action. Priority should be given to the deficiencies directly associated with Local Grating Failure areas within the Traffic Lanes. Recommended method of temporary repair is similar to the method proposed in point 8.3 that is application of solid round bars that can be welded to both the broken and the good sections of the panel grating. The missing grating members should be replaced with members of equivalent or better structural properties. Where appropriate, a lap plate can be used to fill in the missing member.

9. SUMMARY OF RECOMMENDED REPAIRS

The summary of Recommended Repairs sorted in accordance with the importance factor can be found in the table below:

DEFECT	IMPORTANCE	RECOMMENDATIONS	TIMELINE
Local Grating Failure Areas	**Critical**	• **Welding Repairs with use of Solid Round Bar** as a structural connector; • Application from top of deck only with Traffic Control; • See point 8.3 and sketch SK-08	**Priority, immediate**
M-beam to Stringer Weld Failures	Urgent	**PREFERRED:** • **Option D – Weld Hold-Down Plates** onto Stringer and C-bars; • Application from top of deck only with Traffic Control; • See point 8.2 and sketch SK-01 **ALTERNATIVE:** • **Option A** – **Re-Welding** of cracked welds; • Application from top of deck only with Traffic Control; • See point 8.2 and sketch SK-06, SK-07	Within 0-3 months
Button Weld Cracks	Moderate to Urgent	• **Re-Welding** of cracked Button Welds; • Application from top of deck only with Traffic Control; • See point 8.1	Within 0-3 months
Other deficiencies	Low to Urgent	• **Repairs as needed**; to be assessed in conjunction with proximity to other defects; • **Monitoring**; • See point 8.5	Urgent repairs to be conducted within 3 months. Monitoring to continue until panel is replaced
M-beam Cracks	Low	• **Monitoring**; • See point 8.4	3 month intervals

NOTES:

1. **All repairs are intended to act as holding measures until deck is replaced and upgraded to CHBDC performance levels, which is expected to be within 2 to 3 years.**
2. **Recommended repairs are conceptual designs only and are subject to changes during the detailed design stage.**

10. CLASS 'C' COST ESTIMATE

The estimated construction cost is shown in the table below.

BCLB BRIDGE ENGINEERING SERVICES URGENT STEEL DECK GRATING REPAIR	COST
Pre-Construction Inspection	$4,044
Button Weld Crack Repair	$107,660
M-Beam-to-Stringer Repair (Option D)	$202,104
Local Grating Failure Area Repair	$100,870
TOTAL (excluding HST)	**$414,678**

The estimated construction cost includes contingency, engineering fees, and Departmental Representative fees. Cost estimate details are provided in **Appendix F**.

11. CLOSURE

We trust that this report satisfies your immediate requirements.

Prepared by:

David Wang, E.I.T.
Structural Designer
Morrison Hershfield Ltd.

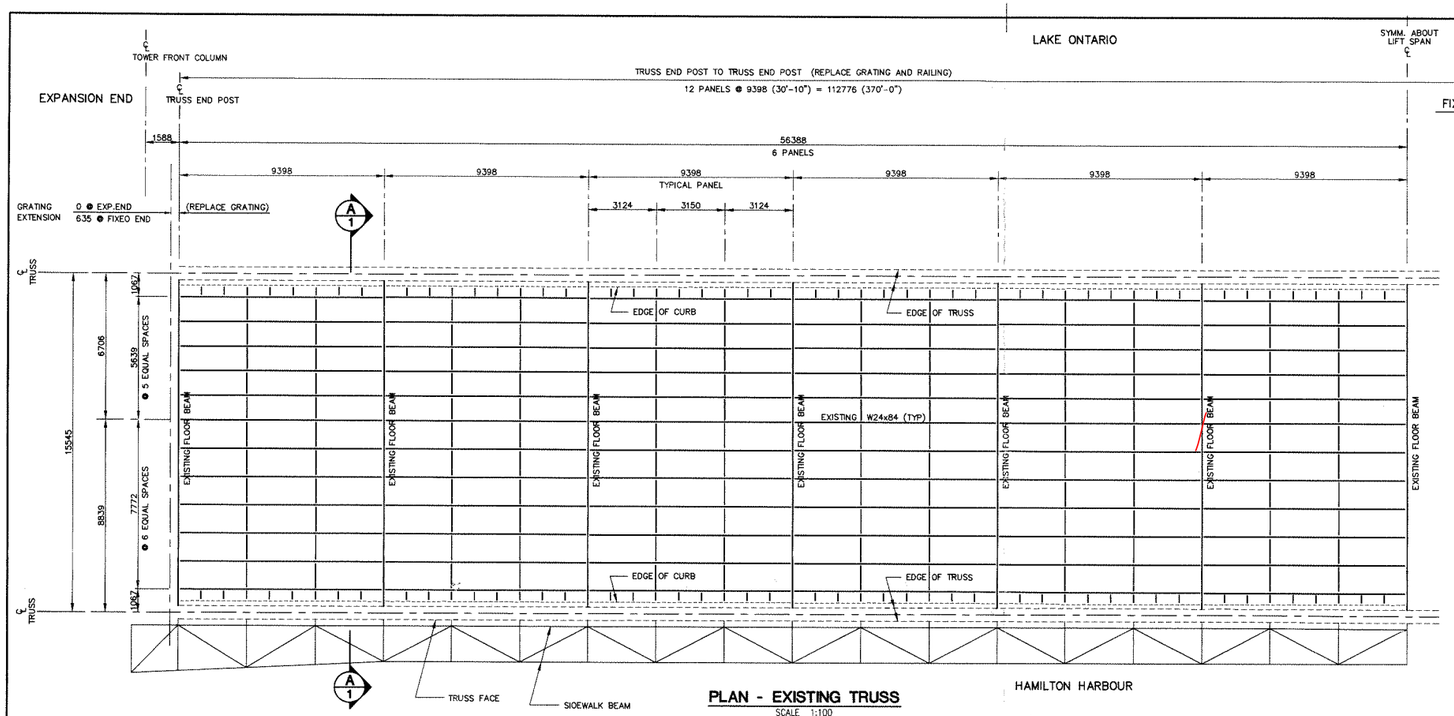
Michal Szafarski, P.Eng.
Bridge Engineer
Morrison Hershfield Ltd.

Reviewed by:

Joe Ostrowski, P.Eng.
Project Manager
Morrison Hershfield Ltd.

Appendix A

REFERENCE STRUCTURAL DRAWINGS



PLAN - EXISTING TRUSS

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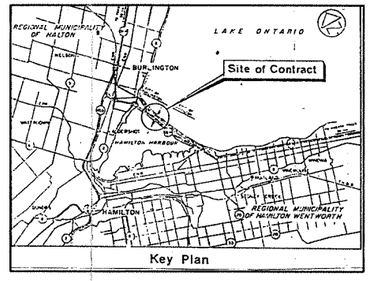
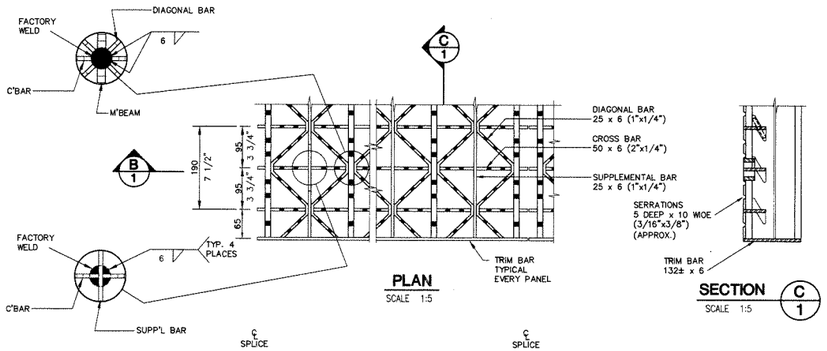


Key Plan

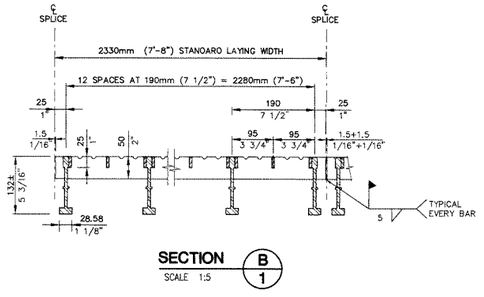
GENERAL NOTES

1. SPECIFICATIONS: PROJECT SPECIFICATIONS (HEREINAFTER THESE WILL BE REFERRED TO AS SPECS) AASHTO SPECIFICATIONS, CSA STANDARDS AND AS NOTED.
2. DESIGN CODE: CAN/CSA S6, UNLESS NOTED OTHERWISE.
3. DESIGN LOAD: CAN/CSA S6, CS600.
4. UNITS: 1. CHAINAGES AND ELEVATIONS IN m.
   2. DIMENSIONS IN mm.
   3. STEEL SECTIONS: IMPERIAL UNITS.
5. STRUCTURAL STEEL: TO CSA CAN3-G40.21, GRADE 300W. UNLESS NOTED OTHERWISE.
6. WELDING: TO CSA W59, UNLESS NOTED OTHERWISE.
7. DIMENSIONS OF EXISTING STRUCTURE TO BE VERIFIED BY CONTRACTOR IN FIELD, BEFORE COMMENCEMENT OF WORK.
8. INFORMATION AND BENCH MARKS, EXISTING STRUCTURE, LOCATION AND ORIENTATION TO BE OBTAINED FROM:
   PUBLIC WORKS AND GOVERNMENT SERVICES CANADA
   ONTARIO REGION
   4900 YONGE STREET
   WILLOWDALE, ONTARIO. M2N 6A6



PLAN
SCALE 1:5

SECTION C-1
SCALE 1:5



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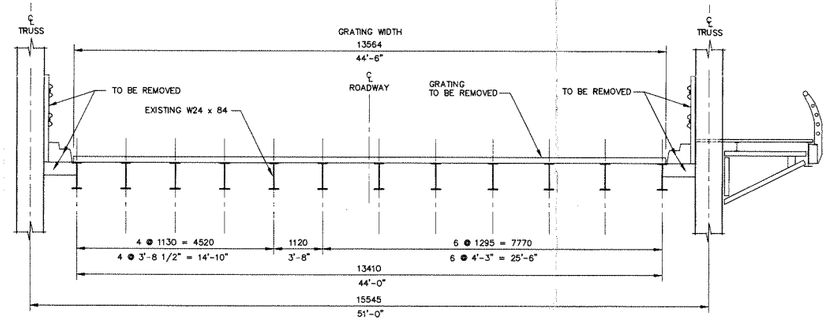
PROPOSED STEEL DECK GRATING - 130mm 4-WAY OPEN GRATING



EXISTING SECTION A-A-1
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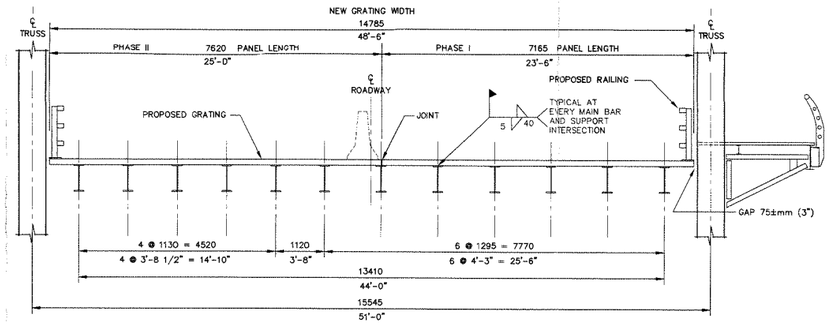

PROPOSED SECTION A-A-1
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PLOT SCALE 1:1

PWGSC B1

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

National Centre of Expertise
Centre d'expertise national

National Center of Expertise
Architectural and Engineering Services
Real Property Services Branch

Centre d'expertise national
Services d'architecture et génie
Direction générale des services immobiliers

REGISTERED PROFESSIONAL ENGINEER PROVINCE OF ONTARIO R. K. PION

revisions	date

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

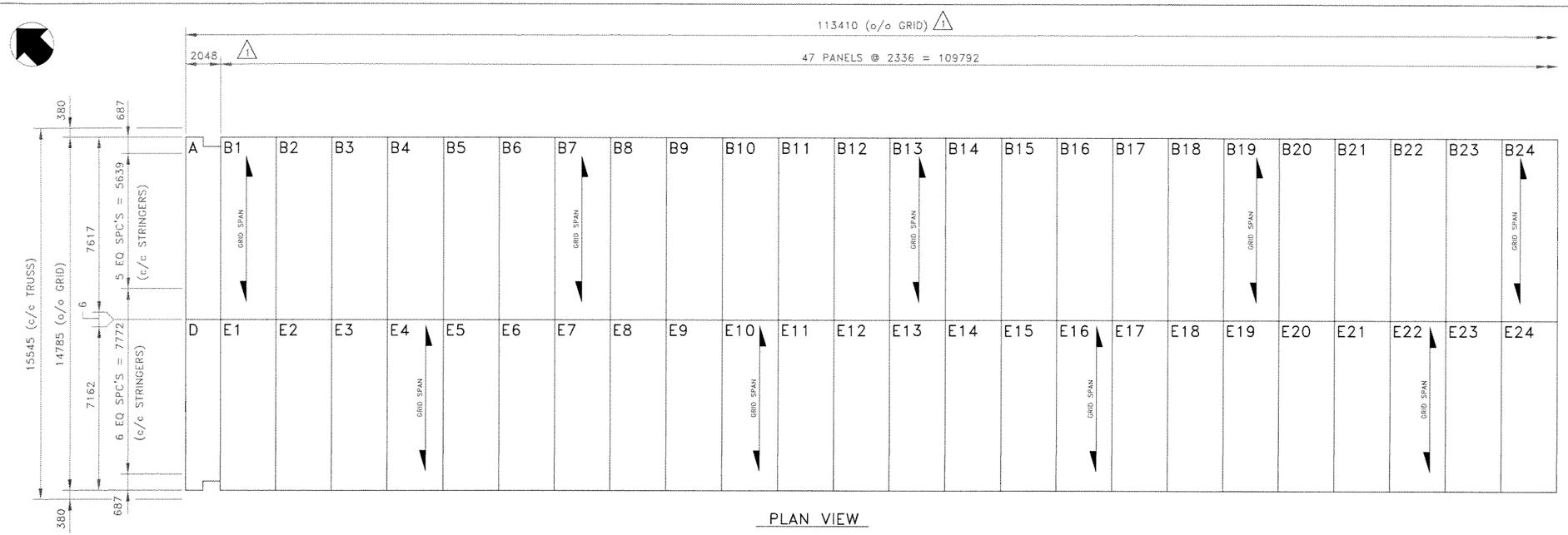
project / projet

BURLINGTON CANAL LIFT BRIDGE

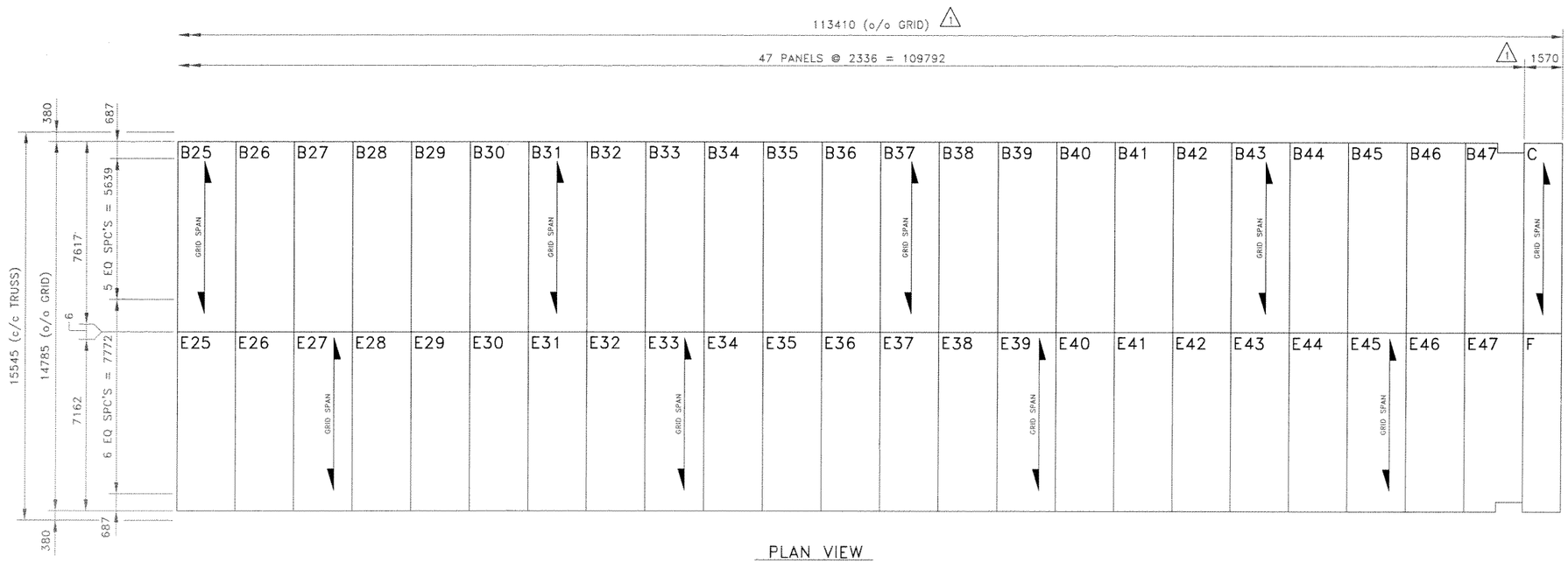
drawing / dessin

NEW DECK GRATING

designed / conçu	R.H. PION
date	
drawn / dessiné	G.E. ROBERTS 99-10-29
date	
reviewed / examiné	R.H. PION
date	
approved / approuvé	
date	
Tender / Soumission	
Project Manager / Administrateur de projets	ENN LEESTI
project no. / no. du projet	104365
drawing no. / no. du dessin	1 / 3



PLAN VIEW



PLAN VIEW

FOR APPROVAL STAMP

1 PER APPROVER COMMENTS	1/19/00	
REVISIONS	DATE	
CAD FILE: G080007-1.DWG DISC #: SM 110		
CONTRACT DWGS.: PUBLIC WORKS DWG'S 1, 2, & 3 of 3, 0 REV.		
DRAWING NOT TO SCALE UNLESS NOTED DRAWING AND CONTENTS PROPERTY OF IKG/GREULICH		

CONTRACT NO.:	
B.I.N.:	
P.I.N.: 104365	
GRID: 5" 4WAY OPEN	
SEE STD. DWG.: No. 2	
SUBMITTALS: 1st 1/11/00	2nd
APPROVED: AS NOTED 1/19/00	FINAL
REL. TO FABRICATION: 1/19/00	
DRAWN: SM 12/15/99	
CHECKED: CMS 12/15/99	

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BRIDGE FLOORING SYSTEMS
A Division of Harsco Corporation
Route 910, P.O. Box 295, Chesnick, Pennsylvania 15024-9401
Telephone: (412) 828-2223 Fax: (412) 828-4103 Shop: (412) 828-6444

CUSTOMER:	LOUIS BRAY CONSTRUCTION
FOR:	PUBLIC WORKS CANADA
ENG.:	PUBLIC WORKS CANADA
PROJ.:	BURLINGTON LIFT BRIDGE-NEW GRID DECK
LOCATION:	HAMILTON, ONTARIO
TITLE:	PLAN VIEW

CUST./P.O. NO.	IKG JOB NO.	DWG. NO.	TOTAL	REV.
	G-080007	1	3	1

WELDING PROCESS

ALL WELDING TO BE DONE IN ACCORDANCE WITH AASHTO HIGHWAY AND BRIDGE SPEC. A.W.S.D1.5-95.

MATERIAL SPECIFICATIONS

M'BEAMS (7.8 kg/m)TO BE A.S.T.M. A588

C'BARS (6.35 x 50.80) TO BE A.S.T.M. A588

SUPP'L BARS (6.35 x 25.40) TO BE A.S.T.M. A588

DIAG. BARS (6.35 x 25.40) TO BE A.S.T.M. A588

FINISH SPECIFICATIONS

PREP.:

* NO SANDBLASTING BY IKG INDUSTRIES

PAINT:

GALVANIZING SPECIFICATIONS

WHEN REQUIRED, MATERIAL TO BE HOT-DIP GALVANIZED AFTER FABRICATION AS PER A.S.T.M. A123 LATEST REVISION. PANELS NOT TO EXCEED 2337 WIDE WHEN GALVANIZING.

CUSTOMER NOTES

IKG DRAWINGS MUST BE REVIEWED BY THE CONTRACTOR FOR CONFORMITY, WORKABILITY & COMPATIBILITY WITH THE EXISTING STRUCTURE PRIOR TO AUTHORIZING FABRICATION.

SHOP MARK EACH PANEL IN UPPER LEFT HAND CORNER AND FIELD MATCH AT INSTALLATION.

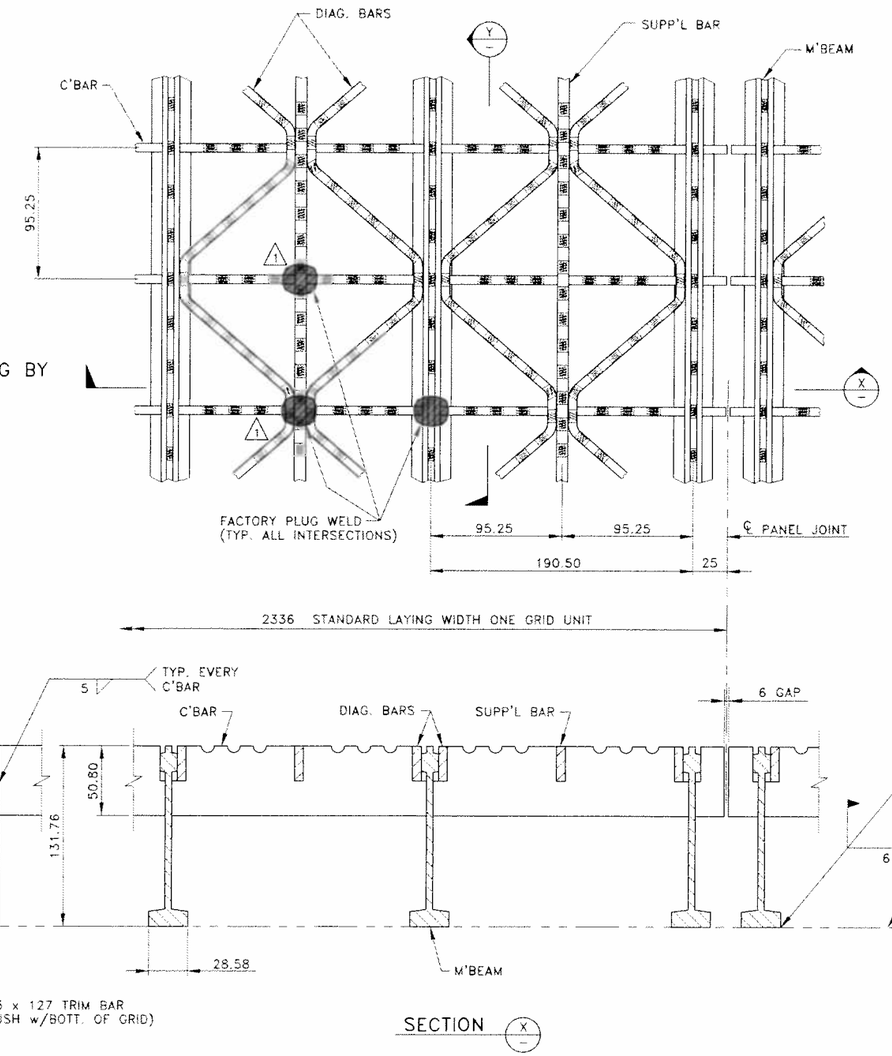
ALL MATERIAL SUBJECT TO SHOP/MILL TOLERANCES.

MANUFACTURER RESERVES THE RIGHT TO MAKE MINOR CHANGES FOR PRODUCT IMPROVEMENT.

WHEN REQUIRED SERRATIONS TO BE APPROXIMATELY 4.76 DEEP x 9.53 WIDE AND SPACED AT RANDOM.

WHEN THIS PRODUCT IS USED ON A MOVEABLE BRIDGE OR OTHER WEIGHT CRITICAL APPLICATION, ACTUAL FINISH WEIGHT TO BE DETERMINED BY THE CONTRACTOR PRIOR TO INSTALLATION.

IKG STANDARD PANEL TOLERANCES	
PANEL WIDTH	+0mm -3mm
PANEL LENGTH	±6mm
SQUARENESS	±12mm MEASURED DIAGONALLY
TRANSVERSE CAMBER (WIDTH)	.005 x WIDTH
LONGITUDINAL CAMBER (LENGTH)	.003 x LENGTH
SIDE BOW (SWEEP)	±3mm PER 1000 LINEAL mm
MAIN BAR VERTICALITY	±3mm
CROSS BAR VERTICALITY	±2mm



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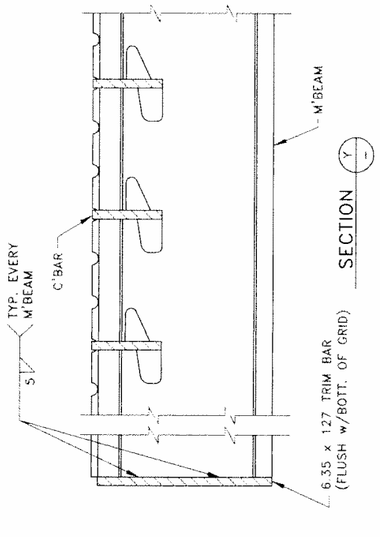

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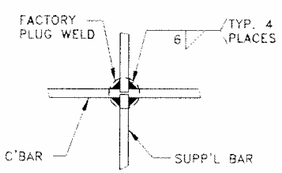
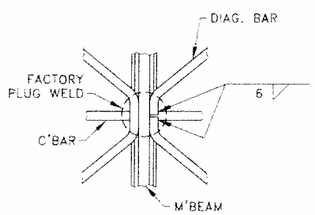


TYP. SUPP'L BAR SPLICE
(WHERE REQ'D.)



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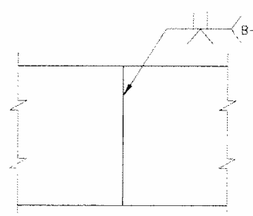
(WHERE REQ'D.)



TYP. SHOP TRIM SPLICE
(WHERE REQ'D.)

FOR APPROVAL STAMP

FOR GREULICH USE ONLY

⚠ PER APPROVER COMMENTS	1/19/00	CONTRACT NO.:	
REVISIONS	DATE	B.I.N.:	
CAD FILE: G080007-2.DWG DISC # SM 110		P.I.N.: 104365	
CONTRACT DWGS.:		GRID: 5" 4way OPEN (METRIC)	
		SEE STD. DWG.: -	
		SUBMITTALS: 1st 1/11/00 / 2nd	
		APPROVED: AS NOTED 1/19/00 / FINAL	
		REL. TO FABRICATION: 1/19/00	
		DRAWN: SM 12/15/99	
DRAWING NOT TO SCALE UNLESS NOTED		CHECKED: CMS 12/15/99	

IKG GREULICH
BRIDGE FLOORING SYSTEMS
A Division of Harsco Corporation
Route 910, P.O. Box 295, Cheswick, Pennsylvania 15024-9401
Telephone: (412) 828-2223 Fax: (412) 828-4103 Shop: (412) 828-6444

CUSTOMER:	LOUIS BRAY CONSTRUCTION
FOR:	PUBLIC WORKS CANADA
ENG.:	PUBLIC WORKS CANADA
PROJ.:	BURLINGTON LIFT BRIDGE-NEW GRID DECK
LOCATION:	HAMILTON, ONTARIO
TITLE:	STANDARD (METRIC)

CUST./P.O. NO.	IKG JOB NO.	DWG. NO.	TOTAL	REV.
	G-080007	2	3	⚠

MATERIAL SPECIFICATION CHART			
MK	DESCRIPTION	SIZE	MATERIAL
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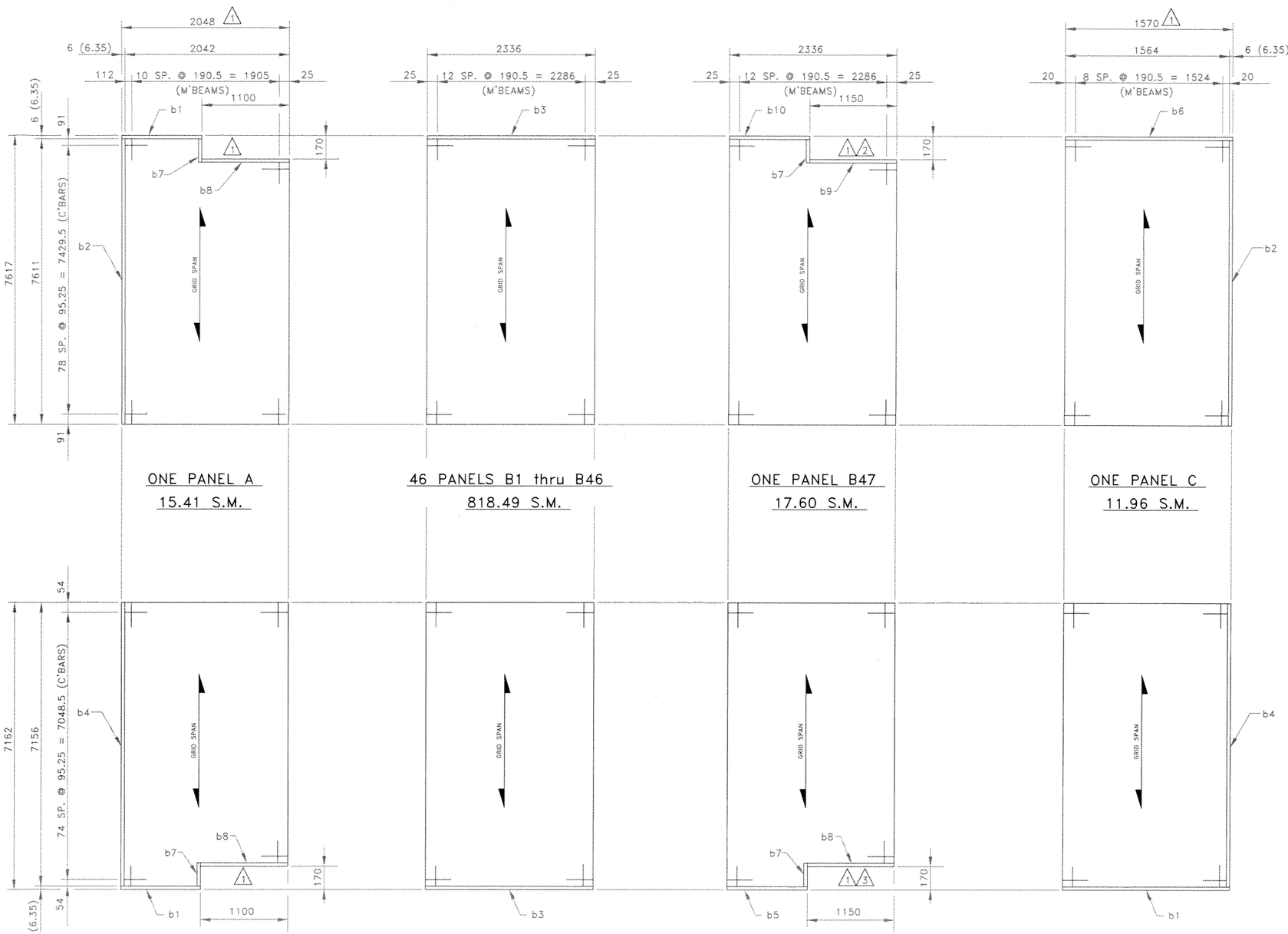
		TOTAL SQUARE METERS	1671.10



ONE PANEL A
15.41 S.M.

46 PANELS B1 thru B46
818.49 S.M.

ONE PANEL B47
17.60 S.M.

ONE PANEL C
11.96 S.M.

ONE PANEL D
14.48 S.M.

46 PANELS E1 thru E46
769.60 S.M.

ONE PANEL E47
16.54 S.M.

ONE PANEL F
11.24 S.M.

FOR APPROVAL STAMP

FOR GREULICH USE ONLY

REVISIONS	DATE
6	
5	
4	
3 PER CUSTOMER REQUEST	2/3/00
2 PER CUSTOMER REQUEST	1/28/00
1 PER APPROVER COMMENTS	1/19/00

CAD FILE: G080007-3.DWG DISC #: SM 110

CONTRACT DWGS.:

DRAWING NOT TO SCALE UNLESS NOTED
DRAWING AND CONTENTS PROPERTY OF IKG/GREULICH

CONTRACT NO.:
B.I.N.:
P.I.N.: 104365
GRID: 5" 4WAY OPEN
SEE STD. DWG.: No. 2

SUBMITTALS:	1st	2nd
	1/11/00	

APPROVED:	AS NOTED	FINAL
	1/19/00	

REL. TO FABRICATION: 1/19/00
DRAWN: SM 12/15/99
CHECKED: CMS 12/15/99

IKG GREULICH
BRIDGE FLOORING SYSTEMS
A Division of Harsco Corporation
Route 910, P.O. Box 295, Cheswick, Pennsylvania 15024-9401
Telephone: (412) 828-2223 Fax: (412) 828-4103 Shop: (412) 828-6444

CUSTOMER: LOUIS BRAY CONSTRUCTION
FOR: PUBLIC WORKS CANADA
ENG.: PUBLIC WORKS CANADA
PROJ.: BURLINGTON LIFT BRIDGE-NEW GRID DECK
LOCATION: HAMILTON, ONTARIO
TITLE: PANEL DETAILS

CUST./P.O. NO.	IKG JOB NO.	DWG. NO.	TOTAL	REV.
	G-080007	3	3	3

Public Works
Government Services
Canada

Architectural and
Engineering Services

Ontario Region

Travaux publics
Services gouvernementaux
Canada

Services d'architecture
et de génie

Région de l'Ontario

LIST OF DRAWINGS

BRIDGES

B–0 – R01	01	COVER SHEET
B–1 – R01		GENERAL ARRANGEMENT
B–2 – R01		PART PLANS GRATING AND RAILING POST DETAILS

HIGHWAYS

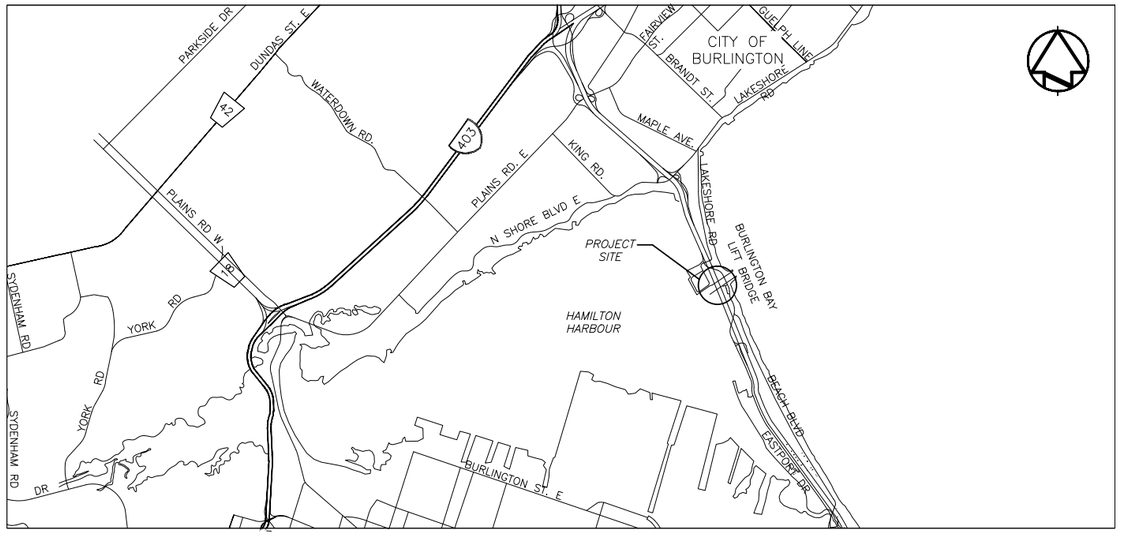
G–1	TRAFFIC CONTROL PLAN AND PAVEMENT MARKING

HAMILTON, ONTARIO.

PWGSC

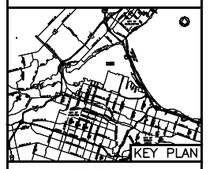
EMERGENCY STEEL PANEL REPLACEMENT

PWGSC Proj. No.: R.012843.055



SITE PLAN

Canada



MORRISON HERSHFIELD

04	–	–
03	–	–
02	–	–
01	DRAWING TITLE REVISIONS	2013–12–31
revision		date

Do not scale drawings.
Verify all dimensions and conditions on site and immediately notify the Departmental Representative of all discrepancies.

A Detail No. No. du détail
B drawing no. – where detail required dessin no. – où détail exigé
C drawing no. – where detailed dessin no. – où détaillé

project title
titre du projet
HAMILTON ONTARIO
PWGSC
1157 BEACH BOULEVARD,
HAMILTON, ONTARIO,
EMERGENCY STEEL PANEL REPLACEMENT

drawing title
titre du dessin
COVER SHEET

drawn by / dessiné par: M.B.
designed by / conc par: M.S.
approved by / approuvé par: J.O.
bid / offre: A.G. — project manager / administrateur de projets
project date / date du projet: 2013–12–20
project no. / no. du projet: R.012843.055
drawing no. / dessin no.: B–0 – R01

GSC–AO DATE PLOTTED: YY/01–MM–DD PLOT SCALE: PLSCALE CAD FILE: DWG

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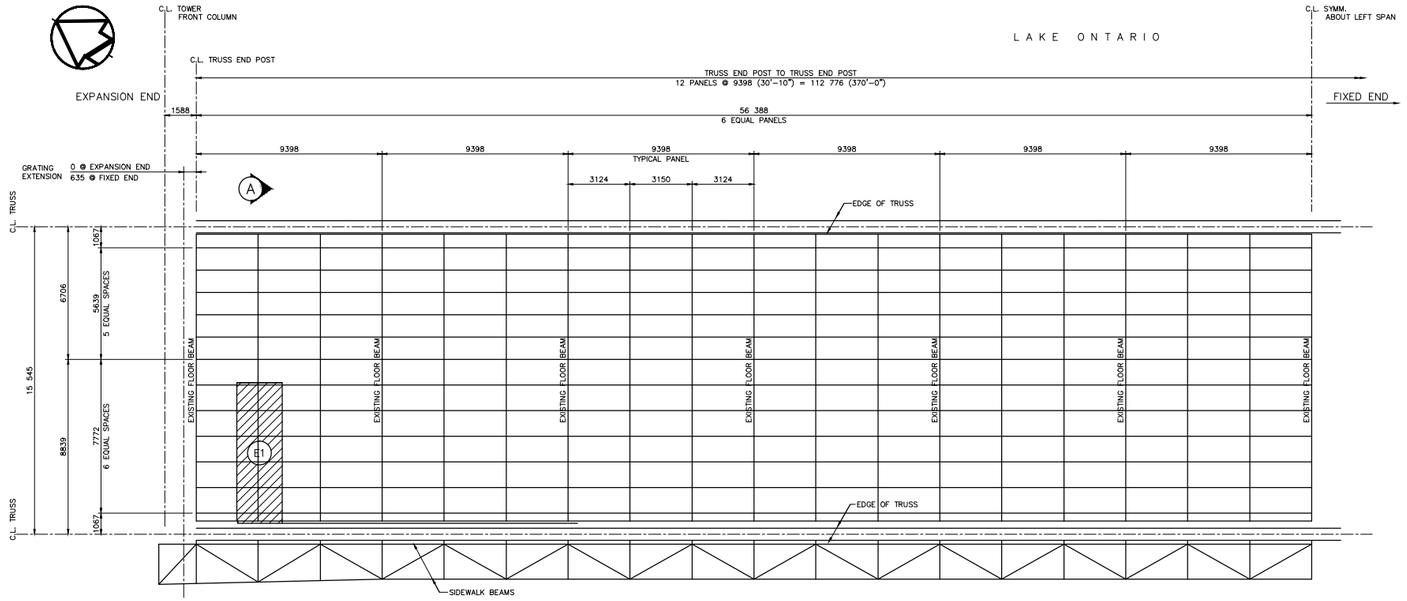
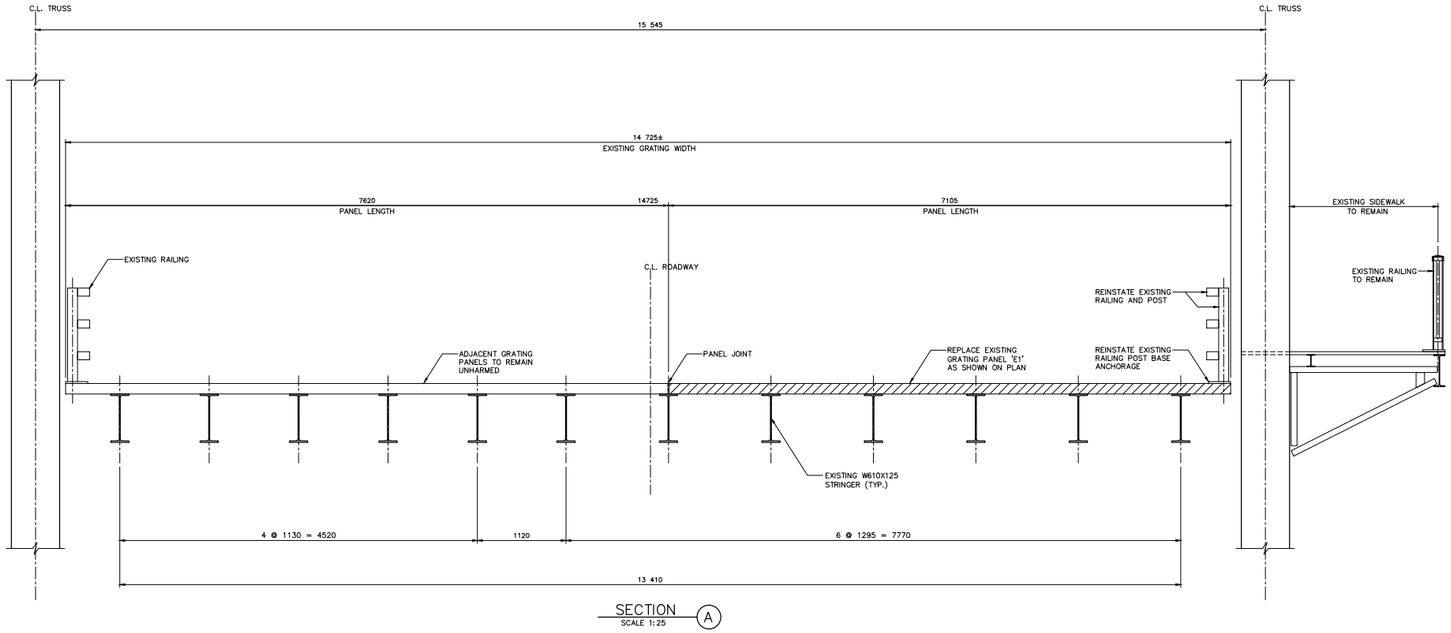


PLAN – EXISTING TRUSS AND GRATING REMOVAL
SCALE 1:100



SECTION A
SCALE 1:25

GENERAL NOTES:

1. STRUCTURAL LAYOUT BASED ON REFERENCE DRAWINGS PROVIDED BY PWGSC.
2. TRAFFIC CONTROL DETAILED ELSEWHERE IN THE CONTRACT DOCUMENTS.
3. ALL DIMENSIONS IN mm UNLESS NOTED OTHERWISE.

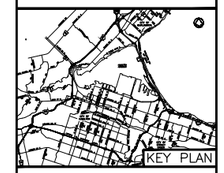
SCOPE OF WORK:

1. IMPLEMENT ENVIRONMENTAL ENCLOSURE AND REMOVE BIRD GUANO FROM WORK AREA.
2. IMPLEMENT TRAFFIC CONTROL.
3. REMOVE AND DISPOSE OF EXISTING GRATING PANEL E1 AS IDENTIFIED ELSEWHERE IN THE CONTRACT DOCUMENTS.
4. PREPARE EXISTING STRINGERS TO RECEIVE NEW GRATING PANEL.
5. FABRICATE, DELIVER AND INSTALL NEW GRATING PANEL ALONG WITH INSTALLATION HARDWARE AND ALL APPURTENANCES.
6. REINSTATE EXISTING RAILING POST BASE ANCHORAGE.
7. COAT TOP FLANGE OF STRINGERS AS SPECIFIED ELSEWHERE IN THE CONTRACT DOCUMENTS.

CONSTRUCTION NOTES:

1. EXISTING DIMENSIONS ARE BASED ON AVAILABLE REFERENCE DRAWINGS AND ARE NOT NECESSARILY THE SAME AS AS-BUILT DIMENSIONS. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, DETAILS AND ELEVATIONS OF THE EXISTING STRUCTURE THAT ARE RELEVANT TO THE WORK SHOWN ON THE DRAWINGS PRIOR TO COMMENCEMENT OF THE WORK.
2. THE CONTRACTOR IS ADVISED TO TAKE GREAT CARE IN MEASURING FOR THE FABRICATION OF THE REPLACEMENT GRATING PANEL AND TO VERIFY AFTER FABRICATION BUT BEFORE PERFORMING ANY REMOVALS, THAT THE FABRICATED PANEL AND ASSOCIATED ANCHORAGE COMPONENTS CAN BE INSTALLED AS SHOWN ON THE CONTRACT DRAWINGS.

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



MORRISON HERSHFIELD

04	–	–
03	–	–
02	–	–
01	NOTE REVISION	2013-12-31
revision		date

Do not scale drawings.
Verify all dimensions and conditions on site and immediately notify the Departmental Representative of all discrepancies.

A/B/C
A Detail No. No. du détail
B drawing no. – where detail required dessin no. – où détail exigé
C drawing no. – where detailed dessin no. – où détaillé

project title
titre du projet
HAMILTON ONTARIO
PWGSC
1157 BEACH BOULEVARD,
HAMILTON, ONTARIO,
EMERGENCY STEEL PANEL REPLACEMENT

drawing title
titre du dessin
GENERAL ARRANGEMENT

drawn by dessiné par	M.B.
designed by conc par	M.S.
approved by approuvé par	J.O.
bid offre	A.G. (project manager administrateur de projets)
project date date du projet	2013-12-20
project no. no. du projet	R.012843.055
drawing no. dessine no.	B-1 – R01

LICENCED PROFESSIONAL ENGINEER JOSTROWSKI 21 Dec 13 PROVINCE OF ONTARIO

LICENCED PROFESSIONAL ENGINEER JOHN B. ECCLES 21 Dec 13 PROVINCE OF ONTARIO

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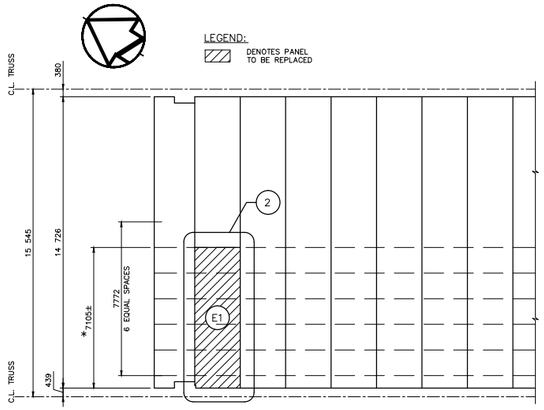
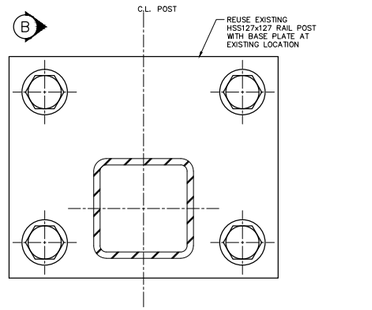
DRAWING LAYOUT: Layout1
PLOT STAMP: Dec 31, 2013 - 11:28
LAST UPDATED: Dec 31, 2013-11:28

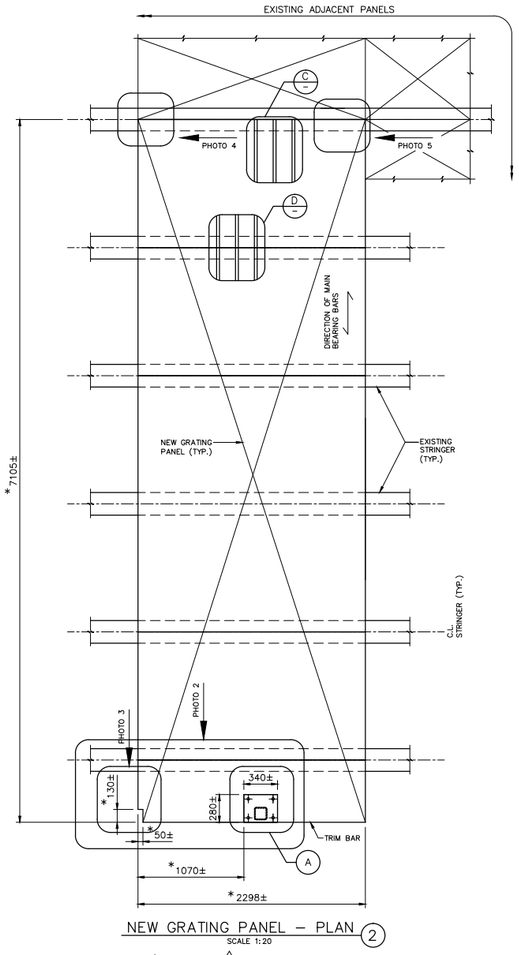
GSC-A0 DATE PLOTTED: YYYY-MM-DD PLOT SCALE: CAD FILE:



EXISTING GRATING PLAN – PART PLAN (1)
SCALE = 1:100



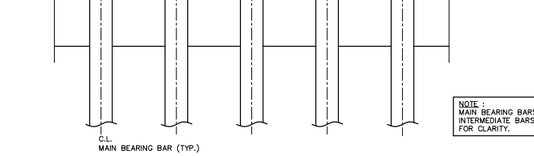
EXISTING RAIL POST BASE PLATE DETAIL – PLAN (A)
SCALE 1:2.5



NEW GRATING PANEL – PLAN (2)
SCALE 1:20

* NOTES:

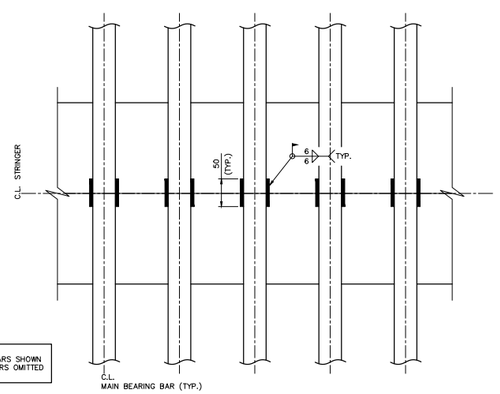
1. ALLOW 6mm GAP BETWEEN NEW AND EXISTING PANELS. (01)
2. FIELD VERIFY PANEL DIMENSIONS BEFORE AND AFTER FABRICATING PANEL TO ENSURE FIT PRIOR TO COMMENCING REMOVALS.



ELEVATION (B)
SCALE 1:2.5

TYPICAL WELD DETAIL AT END JOINT (C)
SCALE 1:2.5

NOTE :
MAIN BEARING BARS SHOWN INTERMEDIATE BARS OMITTED FOR CLARITY.



TYPICAL WELD DETAIL (D)
SCALE 1:2.5

PHOTO – 1

GENERAL VIEW OF GRATING PANEL AT BRIDGE C.L.

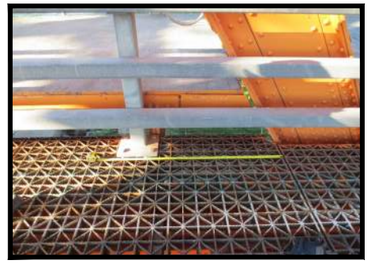


PHOTO – 2

RAILING POST AND BASE

PHOTO – 3

130x50 COPED PANEL CORNER

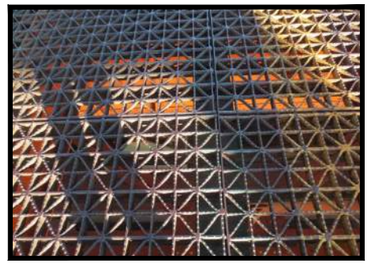


PHOTO – 4

NORTH EAST GRATING CORNER

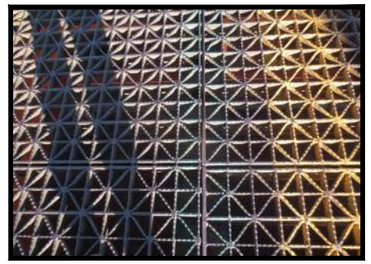


PHOTO – 5

SOUTH EAST GRATING CORNER

STRUCTURAL STEEL NOTES:

1. GRATING PANEL SHALL BE AS SPECIFIED ELSEWHERE IN THE CONTRACT DOCUMENTS.
2. ALL OTHER STRUCTURAL STEEL SHALL CONFORM TO CSA STANDARD CAN/CSA G 40.21-04 GRADE 350 WT CAT II.
3. ALL WELDING SHALL BE IN ACCORDANCE WITH CSA W59 UNLESS NOTED OTHERWISE.
4. BOLTS SHALL BE GALVANIZED ASTM A325M TYPE 1.
5. ALL FIELD DRILLED HOLES SHALL BE COATED WITH A SINGLE COAT OF ZINC RICH PAINT.
6. TOPS OF EXISTING STRINGERS SHALL BE COATED AS SPECIFIED ELSEWHERE IN THE CONTRACT DOCUMENTS.
7. UNLESS SPECIFIED OTHERWISE, THE MINIMUM FILLET WELD SHALL BE AS FOLLOWS:

MATERIAL THICKNESS OF THICKER PART JOINED (mm)	MINIMUM SIZE OF SINGLE WELD (mm)
TO 12 INCLUSIVE	5
OVER 12 TO 20	6

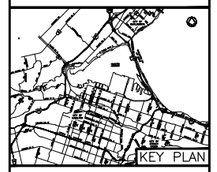
8. TRIM BARS SHALL BE FULLY SHOP WELDED TO ENDS OF BEARING BARS AND ARE REQUIRED ON ALL EDGES WHERE EXPOSED ENDS OF BEARING BARS WOULD OTHERWISE BE PRESENT. TRIM BARS SHALL BE FLUSH WITH THE TOP OF MAIN BEARING BARS.

LEGEND:

DENOTES REMOVAL

PHOTO VIEWING

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



MORRISON HERSHFIELD

revision		date
04	–	–
03	–	–
02	–	–
01	ADDED DIMENSIONS	2013-12-31

Do not scale drawings.
Verify all dimensions and conditions on site and immediately notify the Departmental Representative of all discrepancies.

A/B/C A Detail No. No. du détail
B drawing no. – where detail required dessin no. – où détail exigé
C drawing no. – where detailed dessin no. – où détaillé

project title
titre du projet
HAMILTON ONTARIO
PWGSC
1157 BEACH BOULEVARD,
HAMILTON, ONTARIO,
EMERGENCY STEEL PANEL REPLACEMENT

drawing title
titre du dessin
PART PLANS AND RAILING POST DETAILS

drawn by dessiné par	M.B.
designed by conc par	M.S.
approved by approuvé par	J.O.
bld ofire	A.G. (project manager administrateur de projets)
project date date du projet	2013-12-20
project no. no. du projet	R.012843.055
drawing no. dessin no.	B-2 – R01

LICENCED PROFESSIONAL ENGINEER JOSTROWSKI 21 DEC 13 PROVINCE OF ONTARIO

LICENCED PROFESSIONAL ENGINEER JOHN B. ECCLES PROVINCE OF ONTARIO

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DRAWING LAYOUT: Layout1
LAST UPDATED ON: 2013-12-31 11:59

GSC-A0 DATE PLOTTED: YYYY-MM-DD PLOT SCALE: CAD FILE:

Appendix B

INSPECTION PHOTOGRAPHS

Photo 1: Typical BCLB Grating view with Traffic Control during inspection

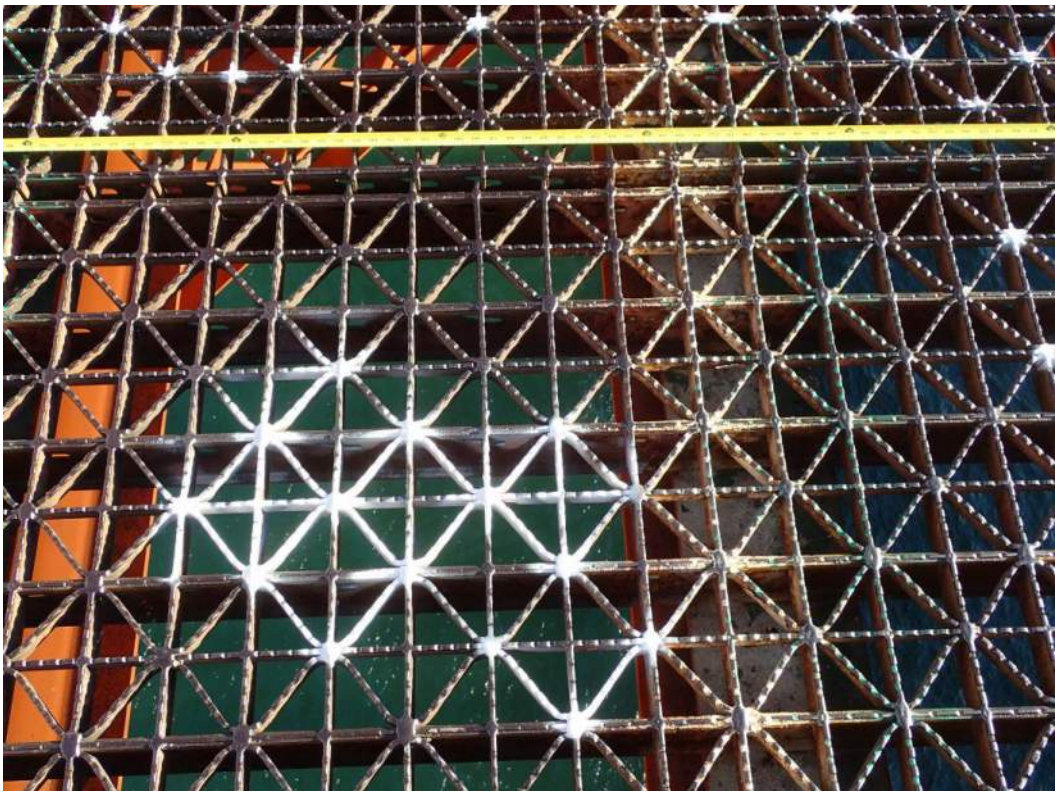


Photo 2: Typical picture of grating with spray-on markups taken during inspection

Photo 3: Test Panel E1 (left) and regular panel D (right)

Photo 4: Test Panel detail

Photo 5: Test Panel E1 (left) and regular panel D (right)

Photo 6: Test Panel – Typical M-beam to stringer connection

Photo7: Button Weld crack – typical example

Photo 8: BW crack – typical example

Photo 9: M-beam to stringer fillet weld deterioration and damage to stringer's flange

Photo 10: M-beam to stringer fillet weld – typical crack, full length and depth

Photo 11: Typical warped grating members

Photo 12: Typical broken grating members

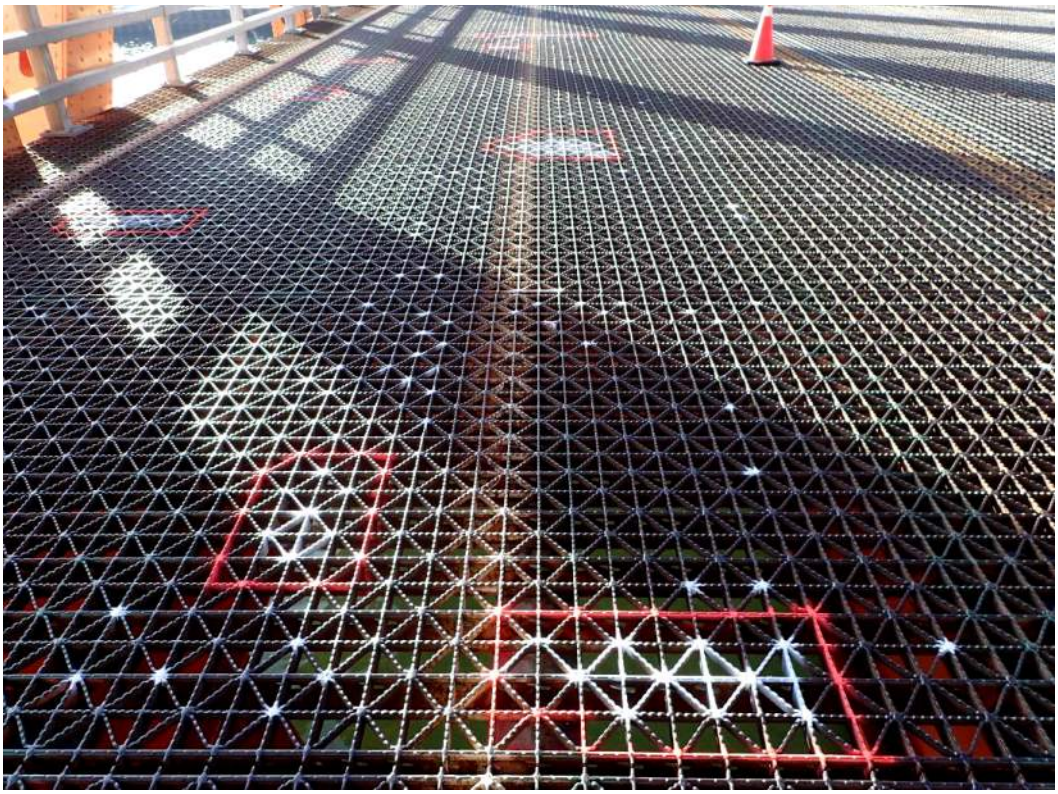


Photo 13: Local Grating Failure areas marked in orange – NB Lanes

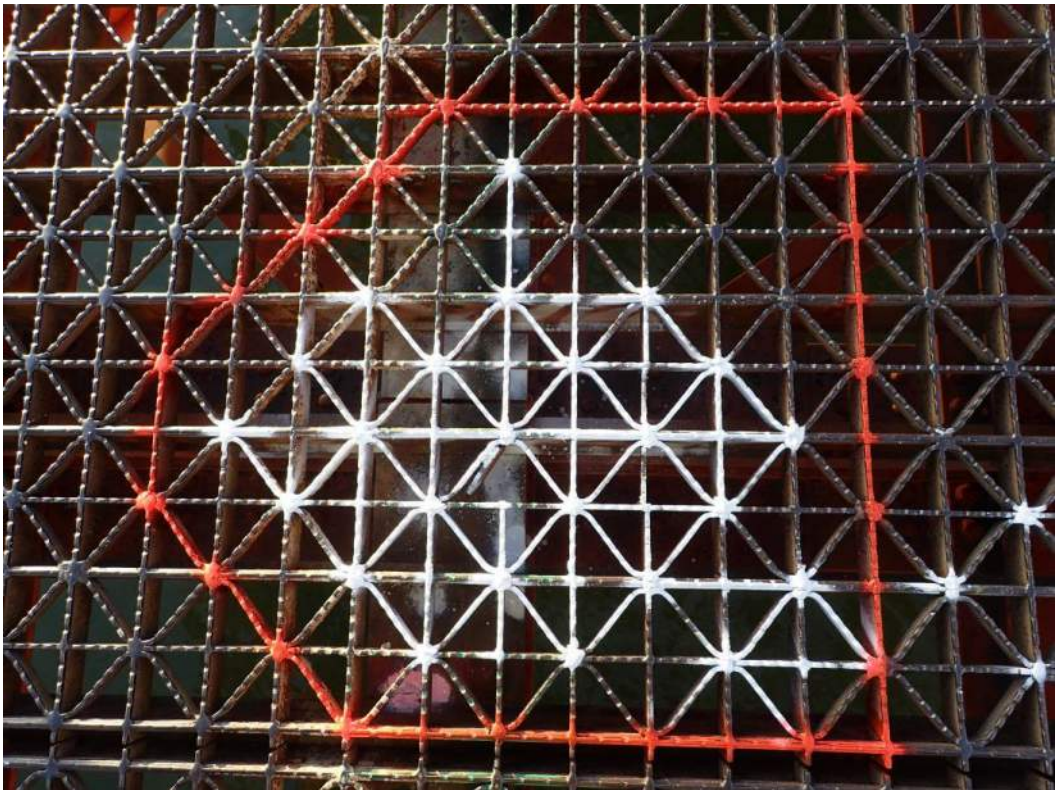


Photo 14: Typical Local Grating Failure area

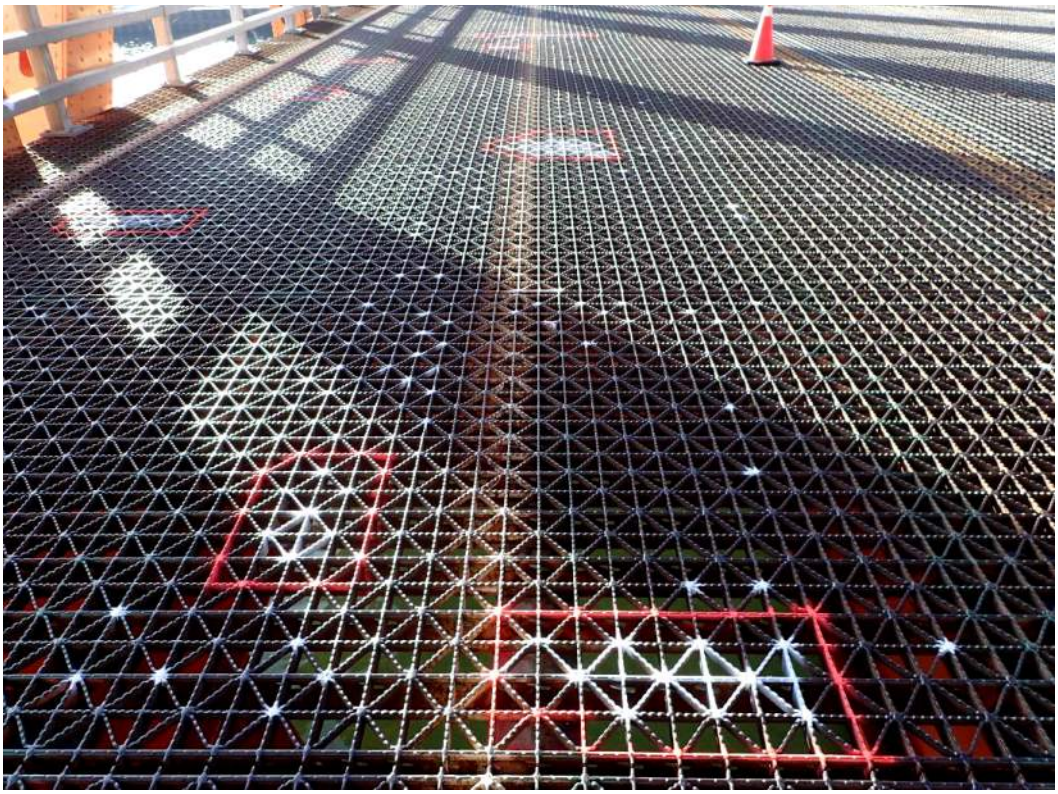


Photo 15: LGF areas marked with orange and BW cracks shown as white dots

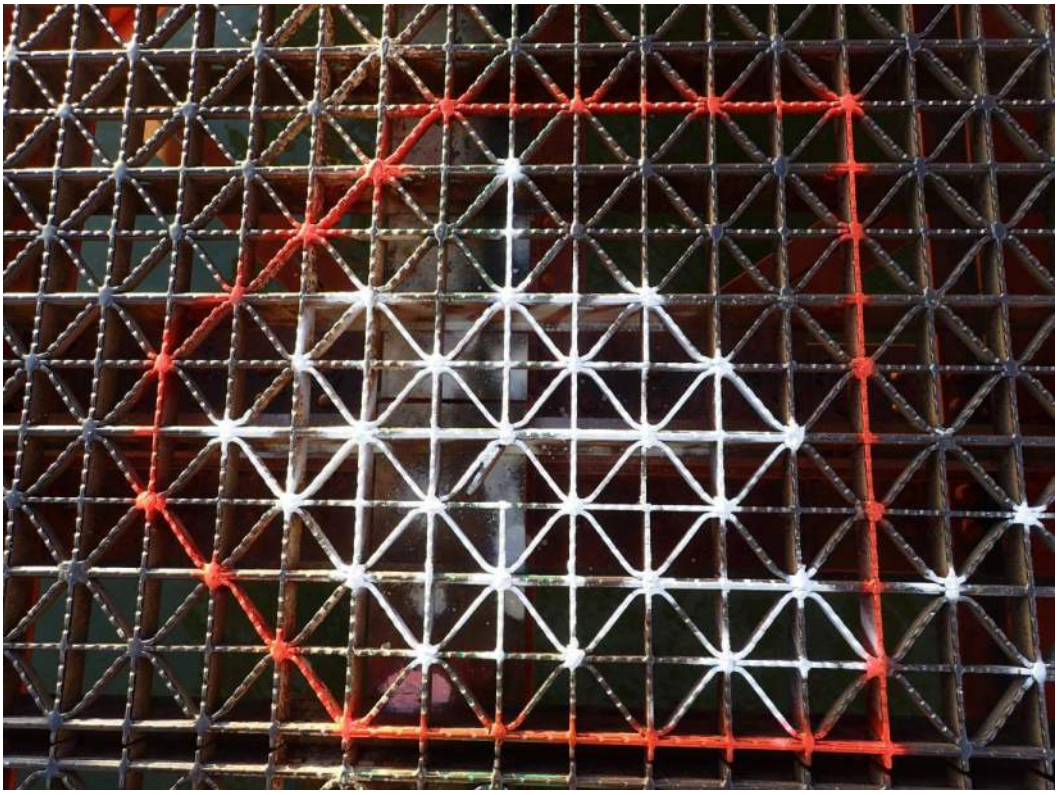


Photo 16: All members within LGF marked with white are affected

Photo 17: LGF – visible grating structural discontinuity along diagonal members

Photo 18: LGF detail – BW crack, full depth, complete connection failure

Photo 19: LGF detail – BW crack, full depth, complete connection failure

Photo 20: LGF area – all members and welds marked with white are affected

Photo 21: Previous Welding Repairs – typical example of failure at Repaired Button Weld

Photo 22: Previous Welding Repairs – typical example of failure between panels

Photo 23: Surface rust on panels – mostly outside of traffic load zone

Photo 24: Surface rust on panels – paint facilitates corrosion of Button Welds

Photo 25: Flaking paint – typical for all lane markings

Photo 26: Debris – typical - mostly at end panels (A, C, D, F)

Appendix C

INSPECTION SUMMARY

SB Lanes							NB Lanes						
Panel	Inner Lane		Outer Lane		M-beam to stringer weld cracks	BW crack failures per panel	Panel	Inner Lane		Outer Lane		M-beam to stringer weld cracks	BW crack failures per panel
	BW cracks	LGF Areas	BW cracks	LGF Areas				BW cracks	LGF Areas	BW cracks	LGF Areas		
D	20	1	18	1		4.40%	A	9					1.04%
E01						0.00%	B01	38		18	1		5.67%
E02	1		29			3.04%	B02	9		13			2.23%
E03			6			0.61%	B03	46		21	2		6.79%
E04	3		15			1.82%	B04	43		21			6.48%
E05	4		17		1	2.13%	B05	24		2			2.63%
E06	5		7		3	1.22%	B06	40	1	31	1		7.19%
E07	4		19		8	2.33%	B07	25		5		1	3.04%
E08			13			1.32%	B08	16	1	36	1	4	5.27%
E09	11	1	21	1	2	3.24%	B09	39		3	1	1	4.26%
E10	4		33	1	1	3.75%	B10	22		20	2	4	4.26%
E11			14		3	1.42%	B11	51	1	38	1	3	9.02%
E12	3		17		1	2.03%	B12	23		27		2	5.07%
E13	4		34		1	3.85%	B13	12	1	22			3.44%
E14	2		23		2	2.53%	B14	11		21		3	3.24%
E15	1		20			2.13%	B15	36		8	1	2	4.46%
E16	1		38		2	3.95%	B16	39		5	1		4.46%
E17	9		50			5.98%	B17	12		8		3	2.03%
E18	10	1	53	1	5	6.38%	B18	57		3	2	3	6.08%
E19	16		13		4	2.94%	B19	42		9	1	1	5.17%
E20	2		10		3	1.22%	B20	32		13	1	2	4.56%
E21	2		15		1	1.72%	B21	13		20		3	3.34%
E22	2		25		1	2.74%	B22	25		15	2		4.05%
E23	2		31	1	2	3.34%	B23	32		16			4.86%
E24	3		32		3	3.55%	B24	37		20	2	1	5.78%
E25	2		11		1	1.32%	B25	56		35		2	9.22%
E26	1		62		2	6.38%	B26	18		7			2.53%
E27			8			0.81%	B27	24		27		1	5.17%
E28	1		26			2.74%	B28	18		13		1	3.14%
E29	8		34	1	6	4.26%	B29	5		6		2	1.11%
E30	3		12		3	1.52%	B30	17		8	1	2	2.53%
E31	2		9			1.11%	B31	36		21		2	5.78%
E32	2		38			4.05%	B32	55		13		1	6.89%
E33			44		4	4.46%	B33	55				1	5.57%
E34	12		41		1	5.37%	B34	13		6			1.93%
E35	5		44			4.96%	B35	29		8			3.75%
E36	4		1		4	0.51%	B36	2				2	0.20%
E37	1		14		3	1.52%	B37	20		7			2.74%
E38			20	1	1	2.03%	B38	43		10			5.37%
E39	3		22		2	2.53%	B39	16		11			2.74%
E40	8		32			4.05%	B40	2		6			0.81%
E41	14	1	43	1		5.78%	B41	9					0.91%
E42	11		41		1	5.27%	B42	29		3	1		3.24%
E43	1		9		1	1.01%	B43	17					1.72%
E44	2		25			2.74%	B44	2		1		2	0.30%
E45			1			0.10%	B45	1		1		2	0.20%
E46	1		5		2	0.61%	B46	6		1		3	0.71%
E47	3		4		3	0.71%	B47	15		25	1	2	4.05%
F			5			0.58%	C						0.00%
Totals	193	4	1104	8	77	2.70%	Totals	1221	4	604	22	56	3.79%
Total BW cracks SB lanes:						1297	Total BW cracks NB lanes:						1825
Total LGF areas SB lanes:						12	Total LGF areas NB lanes:						26

Total BW cracks:	**3122**
Total LGF areas:	**38**
Total M-beam to stringer weld cracks:	**133**

XX - indicates panels requiring immediate repairs due to the worst combination of damages

Appendix D

INSPECTION FINDINGS DRAWINGS

Public Works and Government Services Canada

Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

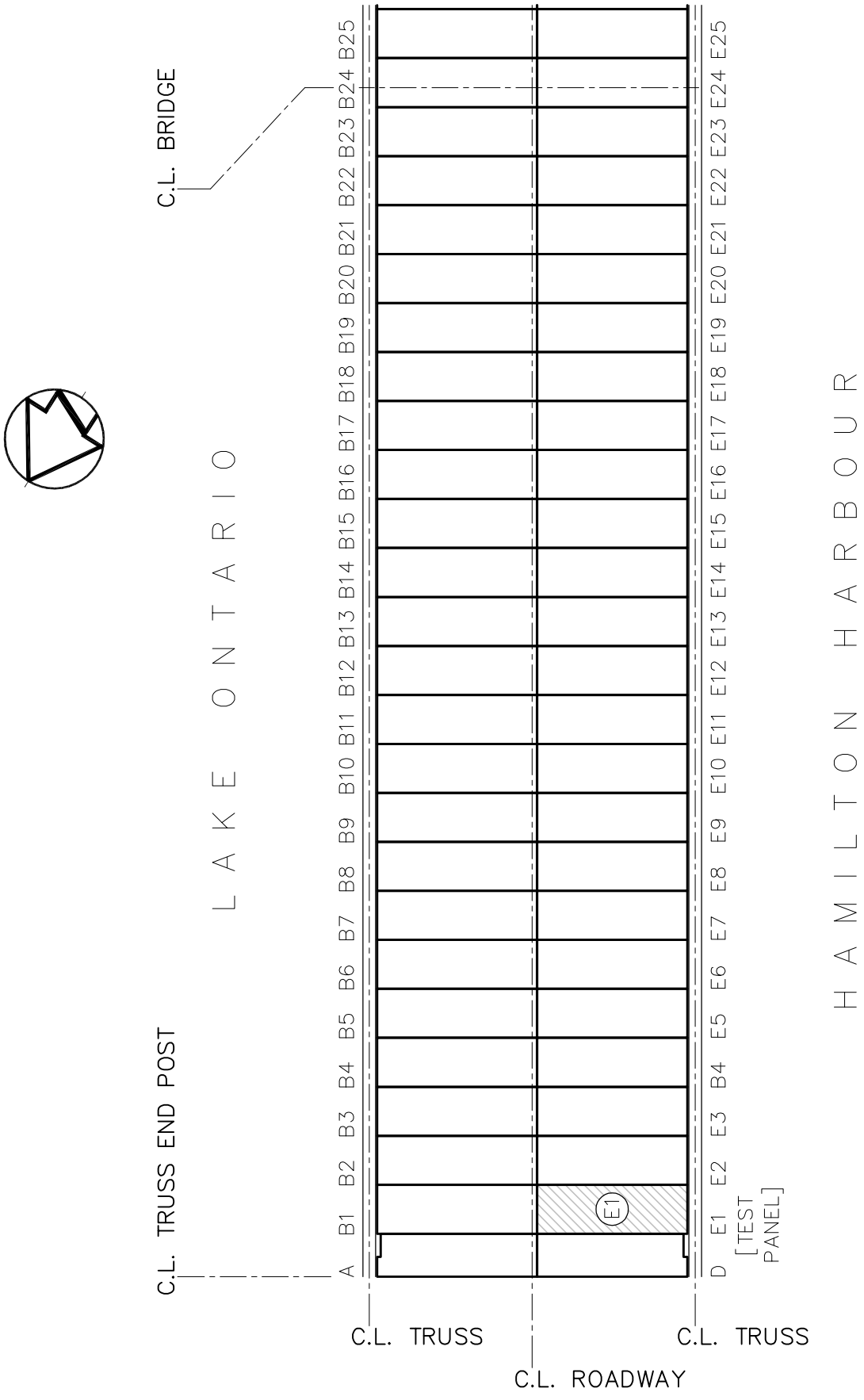
Project title:

BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:

KEY PLAN

Drawing no.:	K–01
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



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LAST UPDATED: Oct 28, 2016–09:19
PRINTED: Oct 28, 2016–09:30

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

Public Works and Government Services Canada

Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

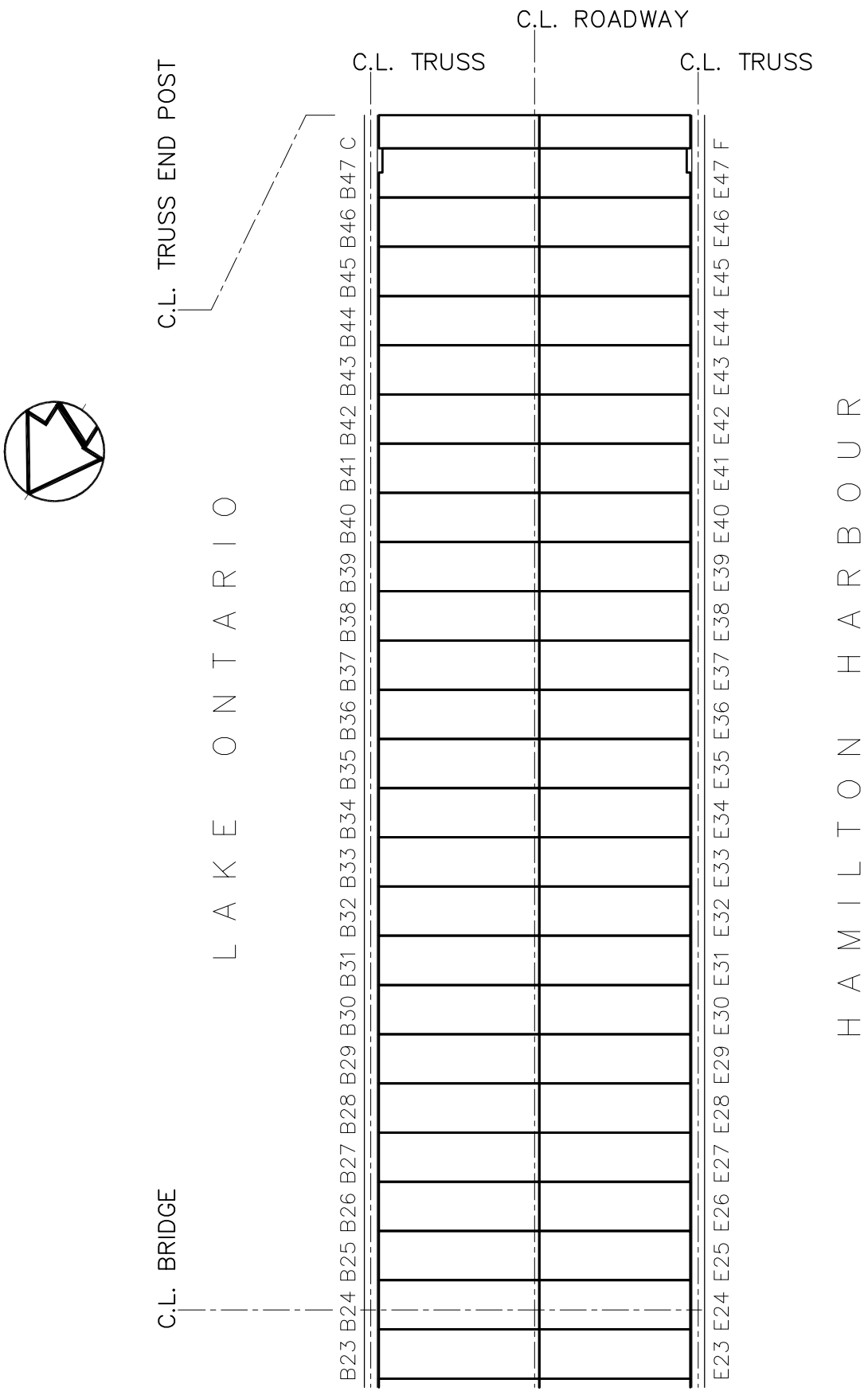
Project title:

BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:

KEY PLAN

Drawing no.:	K–02
Project no.:	R.081864.001
Project date:	**2017 - 04 - 05**
Designed by:	D.W.
Approved by:	M.S.
Bid:	



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LAST UPDATED: Oct 28, 2016-09:19
PRINTED: Oct 28, 2016-09:31

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

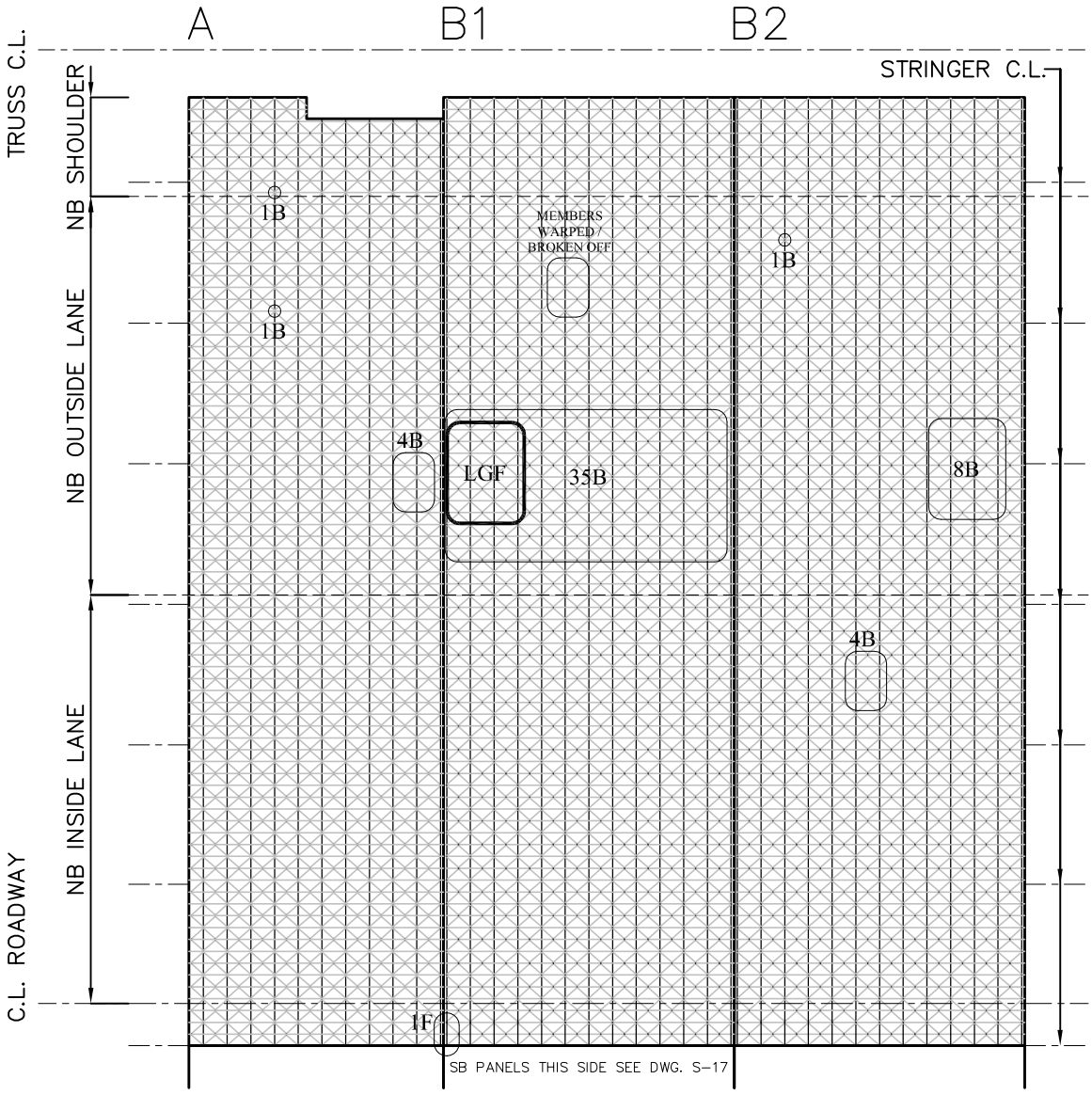
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:
DECK INSPECTION – NB LANES

Drawing no.:	S–01
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



NOTES:

1. ABBREVIATIONS USED:
   - LGF – LOCAL GRATING FAILURE
   - B – BUTTON WELD CRACK
   - F – 'M' BEAM TO STRINGER FILLET WELD CRACK
2. INSPECTION MARKUPS SHOW DISTRIBUTION OF WELDS AND/OR MEMBERS FAILURES OVER PANEL AREA.
3. LOCATION OF WELDS AND/OR MEMBER FAILURES IS APPROXIMATE.

DRAWING PATH AND NAME: K:\Proj\1160268\03 Bridge Deck Grating- Urgent Repair\08 Design and Development\Structural\Working Drawings\1160268-Inspection-1-01 to S-32.dwg
DRAWING LAYOUT: S-01
LAST UPDATED: Oct 27, 2016-15:06
PRINTED: Oct 27, 2016-15:07

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

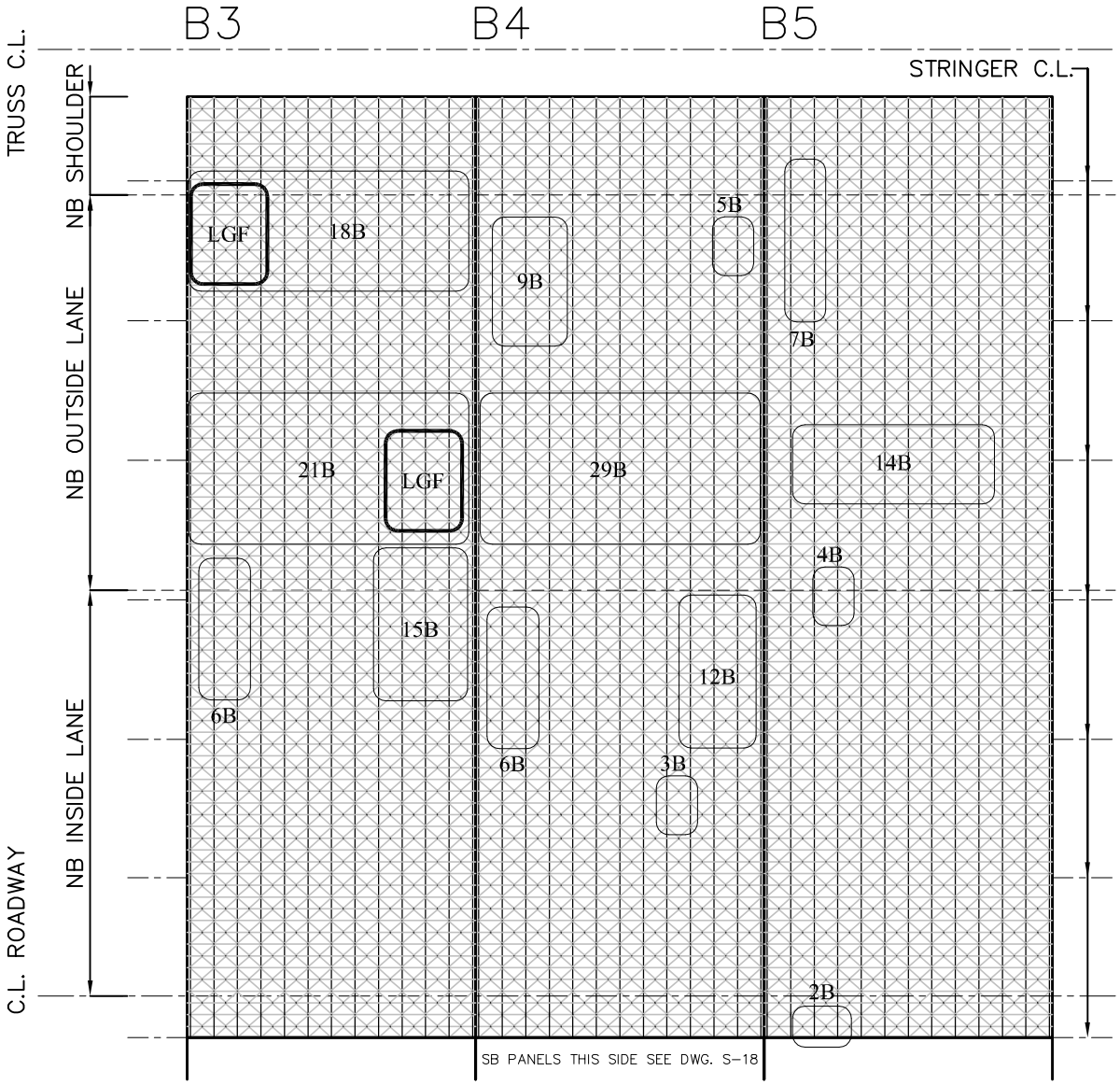
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:
DECK INSPECTION – NB LANES

Drawing no.:	S–02
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



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DRAWING PATH AND NAME: K:\Proj\1160268\03 Bridge Deck Grating- Urgent Repair\08 Design and Development\Structural\Working Drawings\1160268-Inspection-1-01 to S-32.dwg
DRAWING LAYOUT: S-02
LAST UPDATED: Oct 27, 2016-15:06
PRINTED: Oct 27, 2016-15:07

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

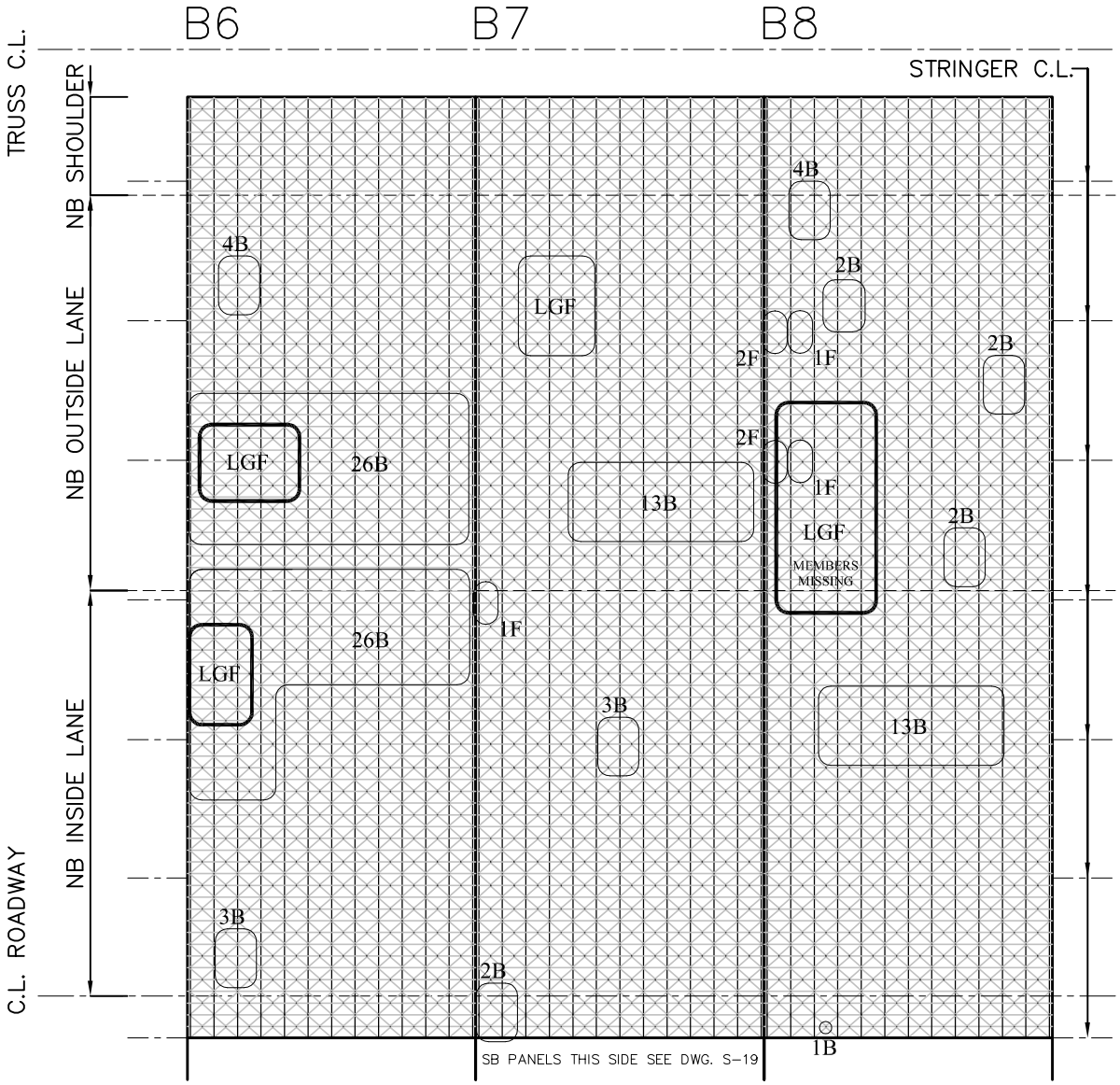
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:
DECK INSPECTION – NB LANES

Drawing no.:	S–03
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



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3. LOCATION OF WELDS AND/OR MEMBER FAILURES IS APPROXIMATE.

DRAWING PATH AND NAME: K:\Proj\1160268\03 Bridge Deck Grating- Urgent Repair\08 Design and Development\Structural\Working Drawings\1160268-Inspection-1-01 to S-32.dwg
DRAWING LAYOUT: S-03
LAST UPDATED: Oct 27, 2016-15:06
PRINTED: Oct 27, 2016-15:07

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

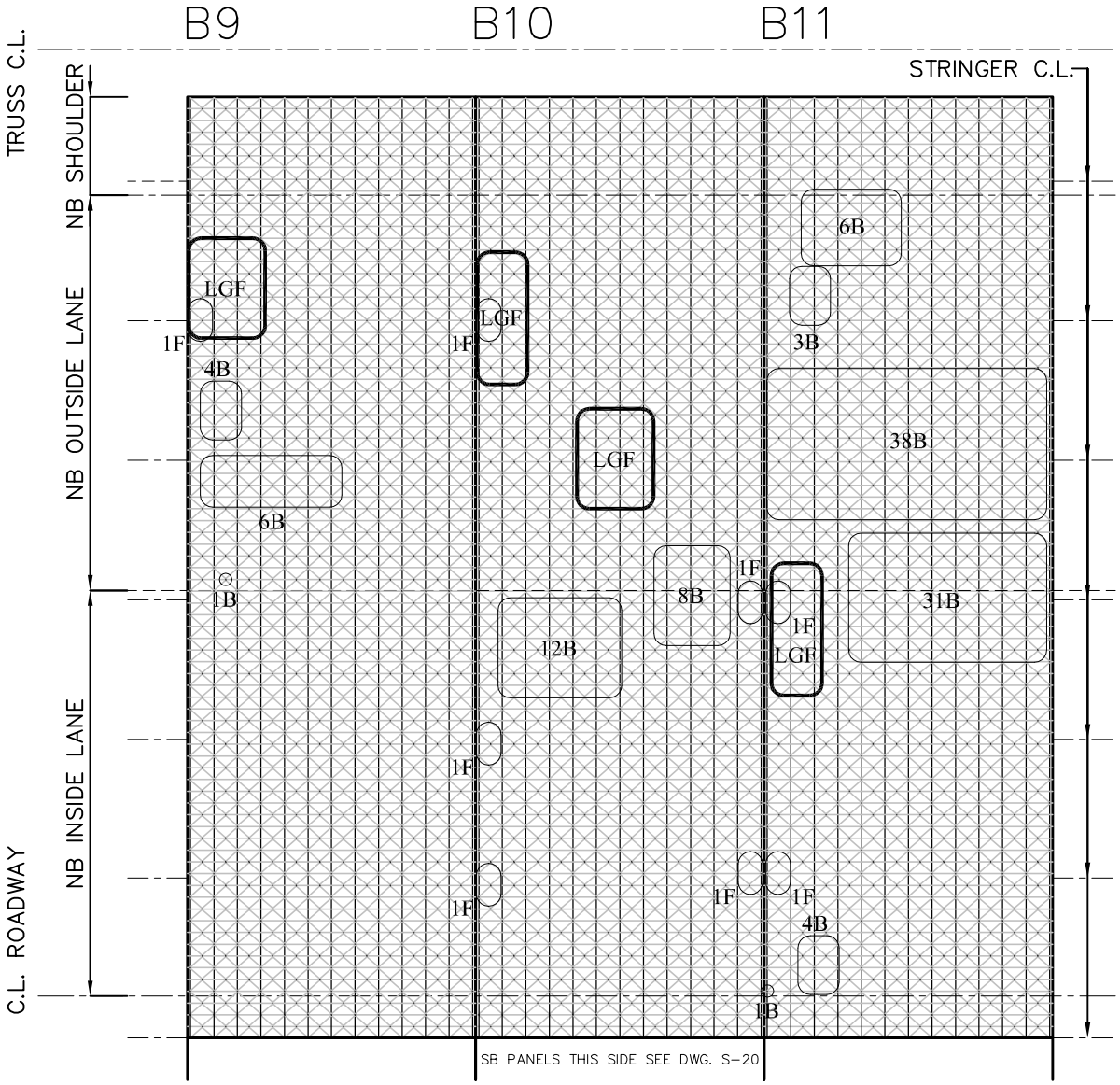
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:
DECK INSPECTION – NB LANES

Drawing no.:	S–04
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



NOTES:

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3. LOCATION OF WELDS AND/OR MEMBER FAILURES IS APPROXIMATE.

DRAWING PATH AND NAME: K:\Proj\1160268\03 Bridge Deck Grating- Urgent Repair\08 Design and Development\Structural\Working Drawings\1160268-Inspection-1-01 to S-32.dwg
DRAWING LAYOUT: A4
LAST UPDATED: Oct 27, 2016-15:06
PRINTED: Oct 27, 2016-15:07

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

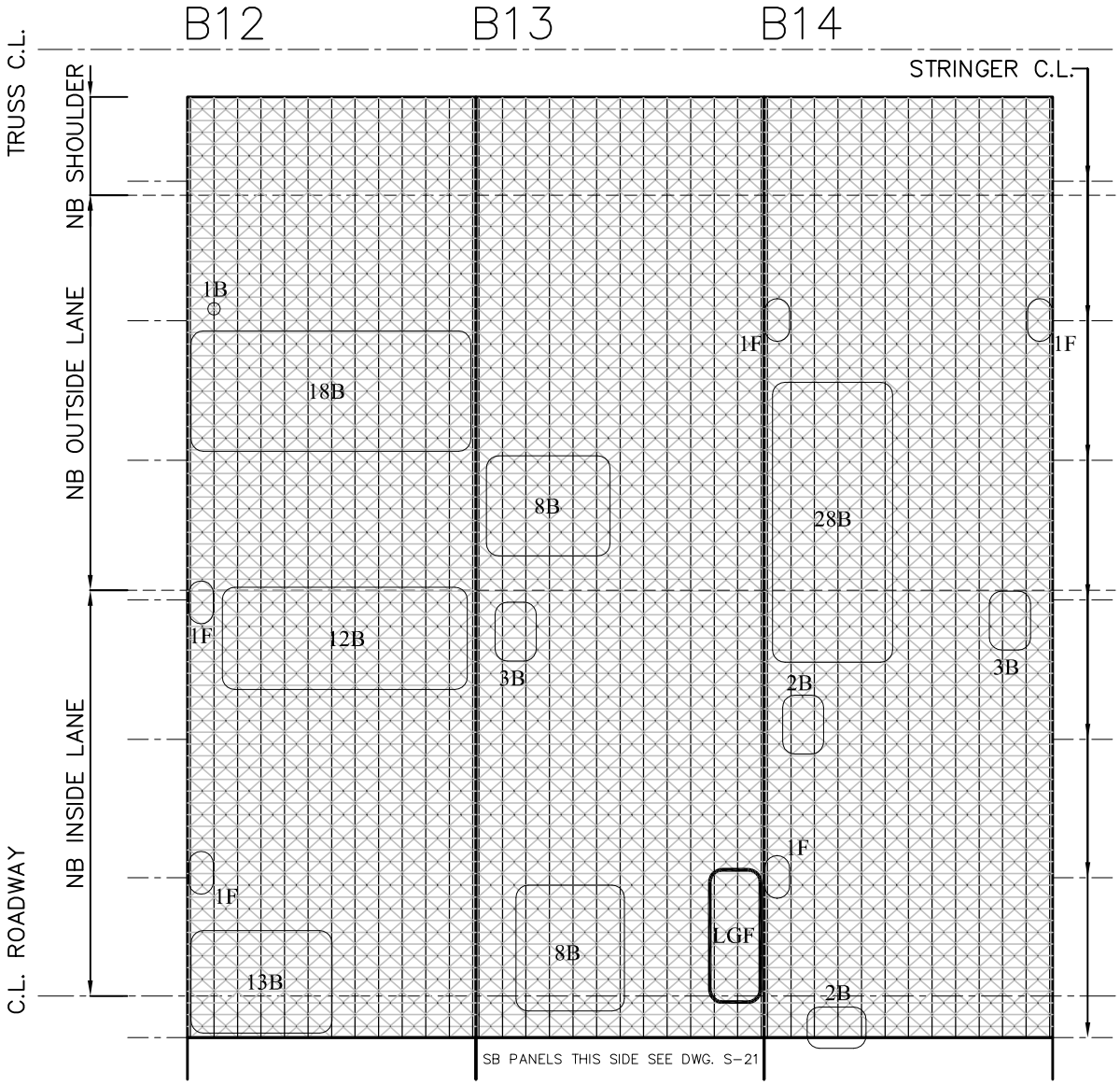
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:
DECK INSPECTION – NB LANES

Drawing no.:	S–05
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



NOTES:

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3. LOCATION OF WELDS AND/OR MEMBER FAILURES IS APPROXIMATE.

DRAWING PATH AND NAME: K:\Proj\1160268\03 Bridge Deck Grating- Urgent Repair\08 Design and Development\Structural\Working Drawings\1160268-Inspection-1-01 to S-32.dwg
DRAWING LAYOUT: S-05
LAST UPDATED: Oct 27, 2016-15:06
PRINTED: Oct 27, 2016-15:07

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

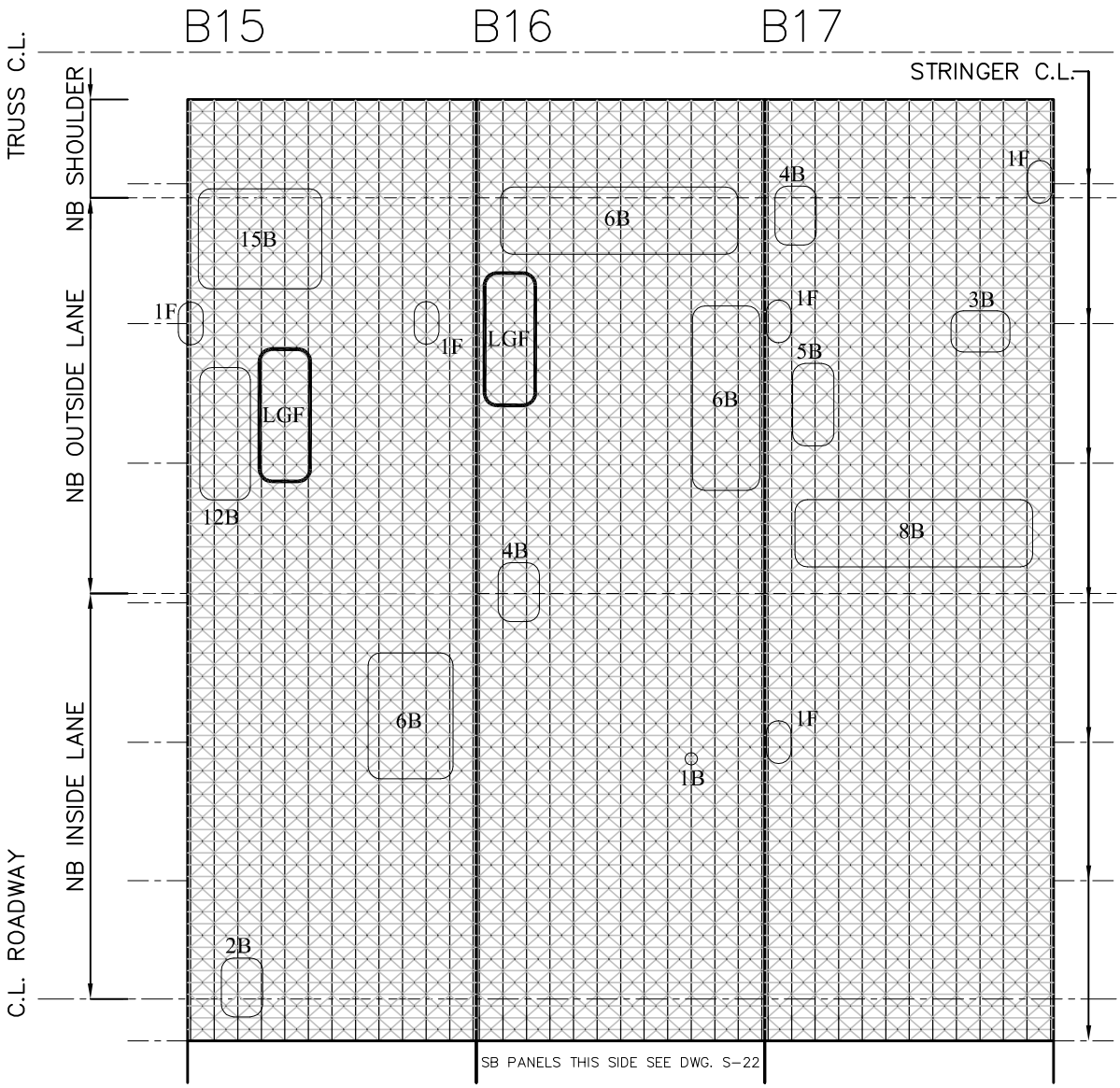
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:
DECK INSPECTION – NB LANES

Drawing no.:	S–06
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



NOTES:

1. ABBREVIATIONS USED:
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   - F – 'M' BEAM TO STRINGER FILLET WELD CRACK
2. INSPECTION MARKUPS SHOW DISTRIBUTION OF WELDS AND/OR MEMBERS FAILURES OVER PANEL AREA.
3. LOCATION OF WELDS AND/OR MEMBER FAILURES IS APPROXIMATE.

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DRAWING LAYOUT: S-06
LAST UPDATED: Oct 27, 2016-15:06
PRINTED: Oct 27, 2016-15:07

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

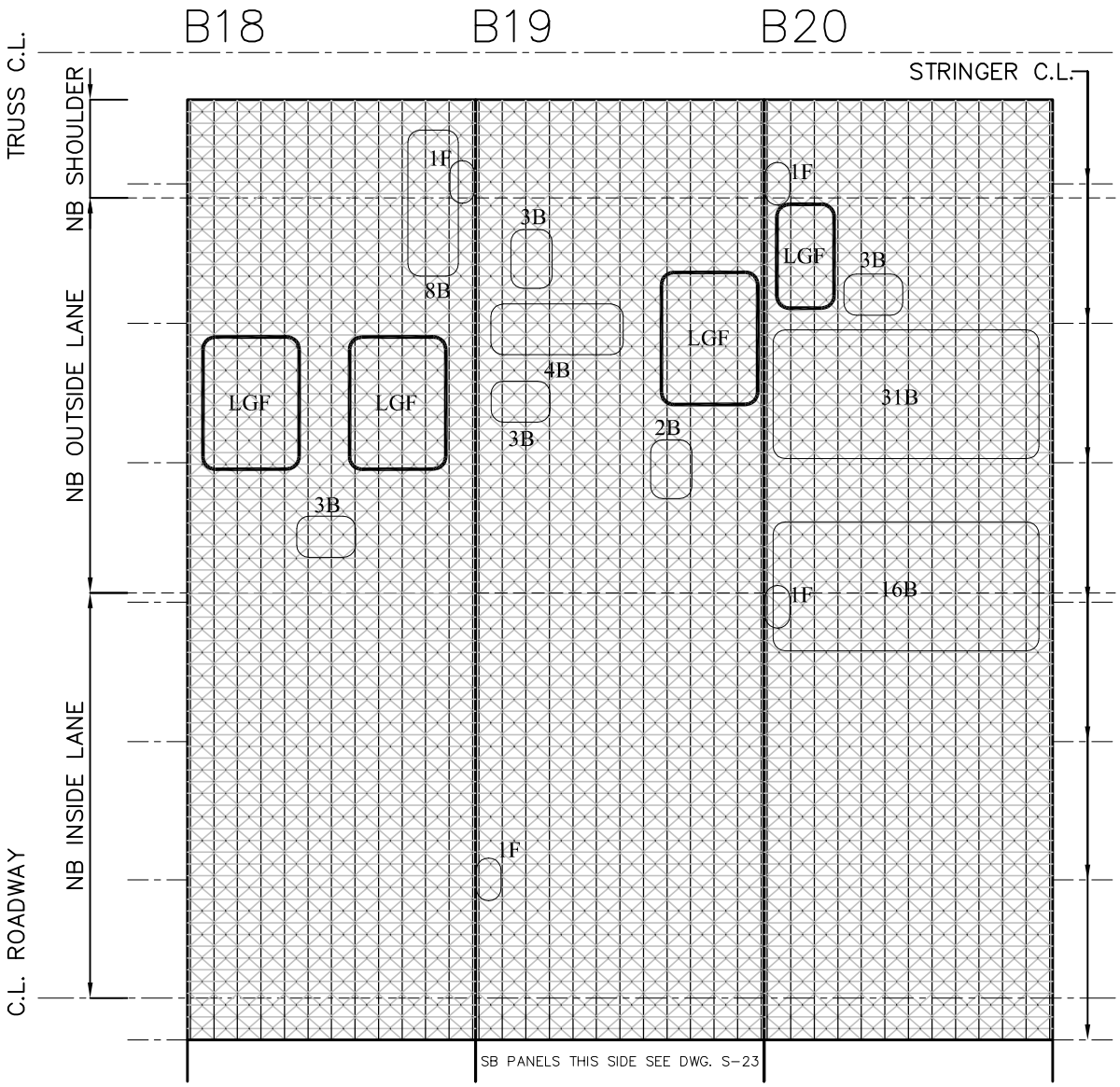
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:
DECK INSPECTION – NB LANES

Drawing no.:	S–07
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



NOTES:

1. ABBREVIATIONS USED:
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2. INSPECTION MARKUPS SHOW DISTRIBUTION OF WELDS AND/OR MEMBERS FAILURES OVER PANEL AREA.
3. LOCATION OF WELDS AND/OR MEMBER FAILURES IS APPROXIMATE.

DRAWING PATH AND NAME: K:\Proj\1160268\03 Bridge Deck Grating- Urgent Repair\08 Design and Development\Structural\Working Drawings\1160268-Inspection-1-01 to S-32.dwg
DRAWING LAYOUT: S-07
LAST UPDATED: Oct 27, 2016-15:06
PRINTED: Oct 27, 2016-15:07

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

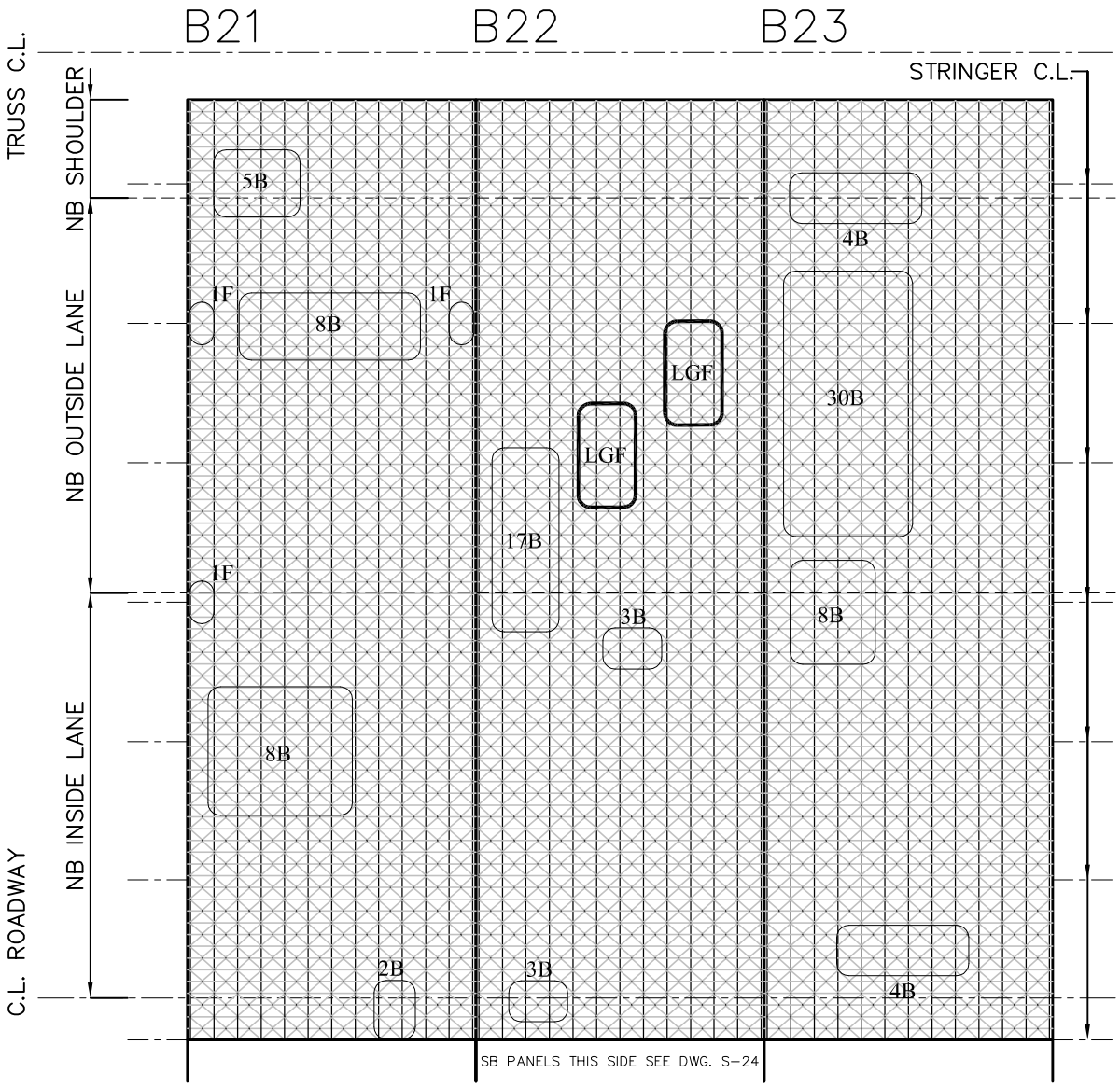
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:
DECK INSPECTION – NB LANES

Drawing no.:	S–08
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



NOTES:

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3. LOCATION OF WELDS AND/OR MEMBER FAILURES IS APPROXIMATE.

DRAWING PATH AND NAME: K:\Proj\1160268\03 Bridge Deck Grating- Urgent Repair\08 Design and Development\Structural\Working Drawings\1160268-Inspection-1-01 to S-32.dwg
DRAWING LAYOUT: S-08
LAST UPDATED: Oct 27, 2016-15:06
PRINTED: Oct 27, 2016-15:07

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

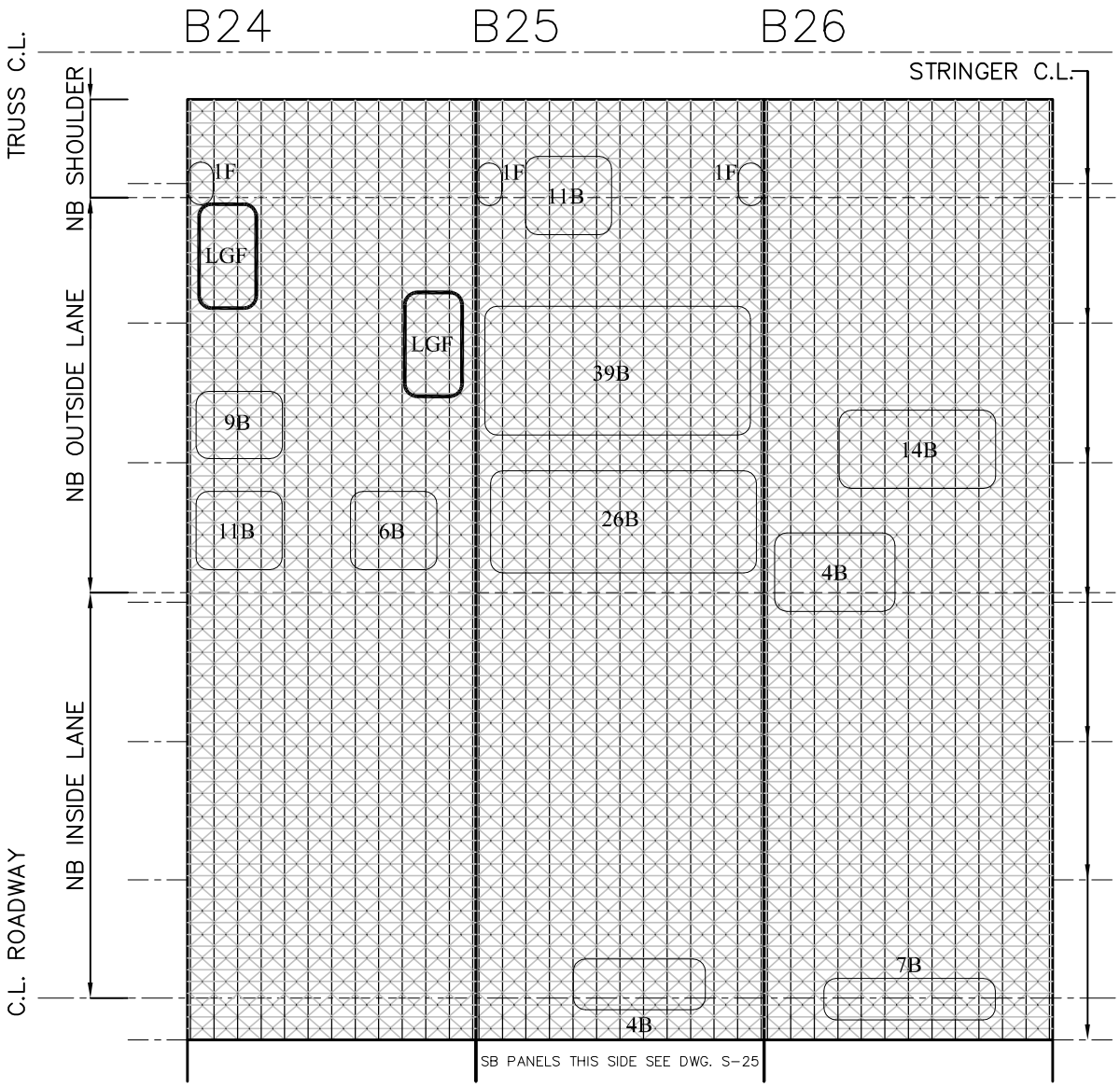
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:
DECK INSPECTION – NB LANES

Drawing no.:	S–09
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



NOTES:

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   - F – 'M' BEAM TO STRINGER FILLET WELD CRACK
2. INSPECTION MARKUPS SHOW DISTRIBUTION OF WELDS AND/OR MEMBERS FAILURES OVER PANEL AREA.
3. LOCATION OF WELDS AND/OR MEMBER FAILURES IS APPROXIMATE.

DRAWING PATH AND NAME: K:\Proj\1160268\03 Bridge Deck Grating- Urgent Repair\08 Design and Development\Structural\Working Drawings\1160268-Inspection-1-01 to S-32.dwg
DRAWING LAYOUT: S-09
LAST UPDATED: Oct 27, 2016-15:06
PRINTED: Oct 27, 2016-15:07

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

Public Works and Government Services Canada

Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

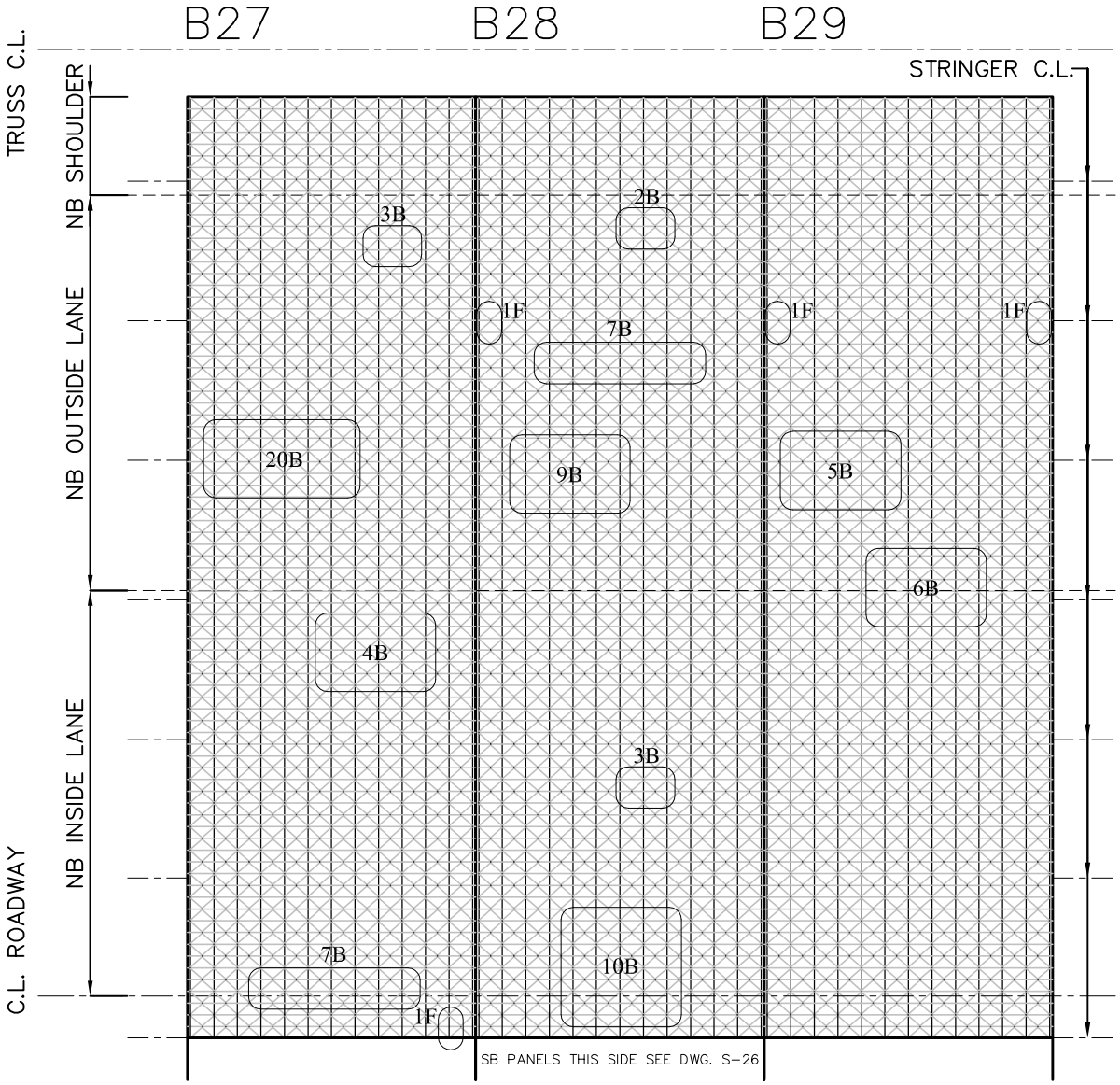
Project title:

BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:

DECK INSPECTION – NB LANES

Drawing no.:	S–10
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



NOTES:

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   - B – BUTTON WELD CRACK
   - F – 'M' BEAM TO STRINGER FILLET WELD CRACK
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3. LOCATION OF WELDS AND/OR MEMBER FAILURES IS APPROXIMATE.

DRAWING PATH AND NAME: K:\Proj\1160268\03 Bridge Deck Grating- Urgent Repair\08 Design and Development\Structural\Working Drawings\1160268-Inspection-1-01 to S-32.dwg
DRAWING LAYOUT: S-10
LAST UPDATED: Oct 27, 2016-15:06
PRINTED: Oct 27, 2016-15:07

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

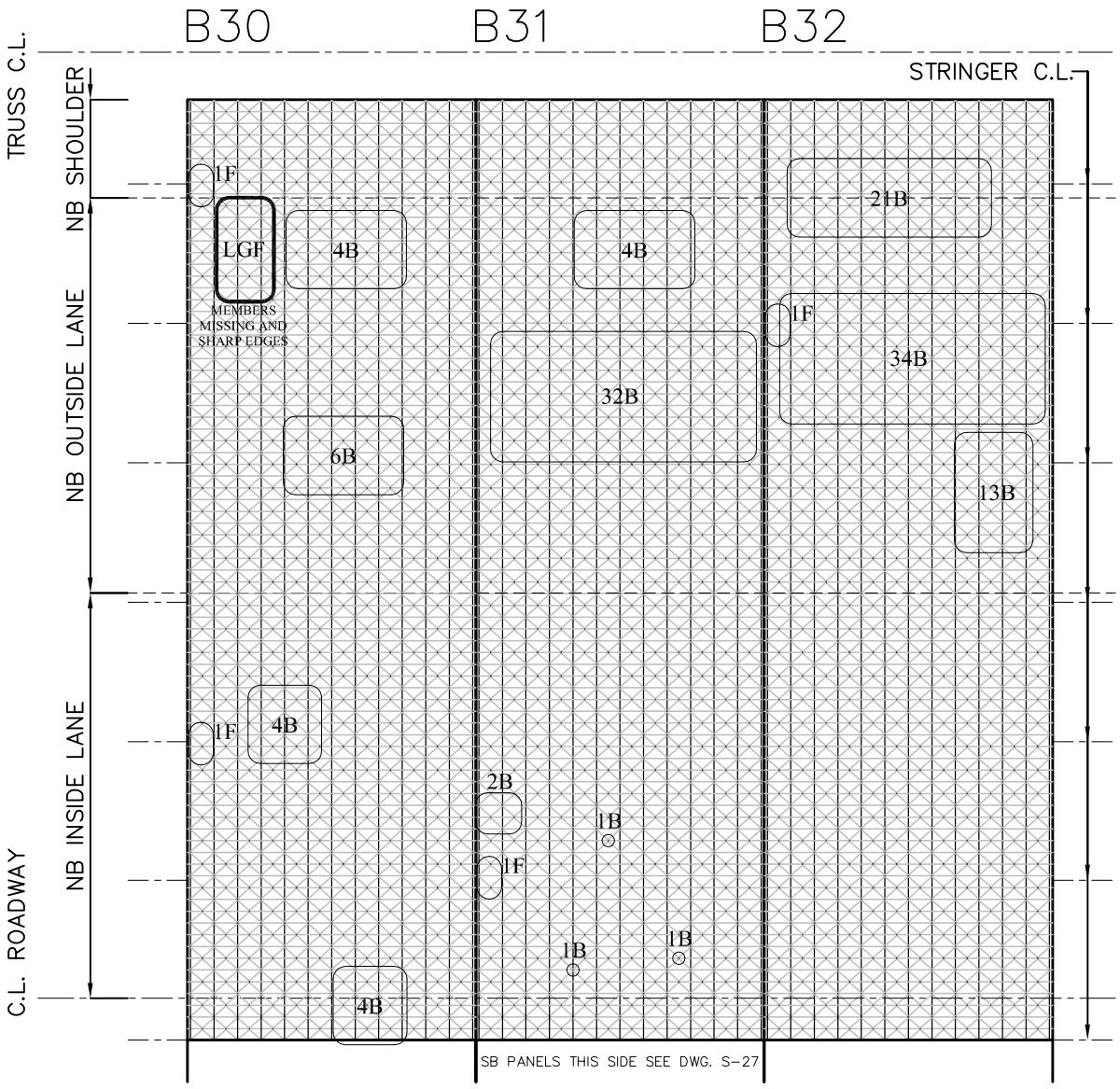
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:
DECK INSPECTION – NB LANES

Drawing no.:	S–11
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



NOTES:

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DRAWING PATH AND NAME: K:\Proj\1160268\03 Bridge Deck Grating– Urgent Repair\08 Design and Development\Structural\Working Drawings\1160268–Inspection–1–01 to S–32.dwg
DRAWING LAYOUT: S–11
LAST UPDATED: Oct 27, 2016–15:06
PRINTED: Oct 27, 2016–15:07

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

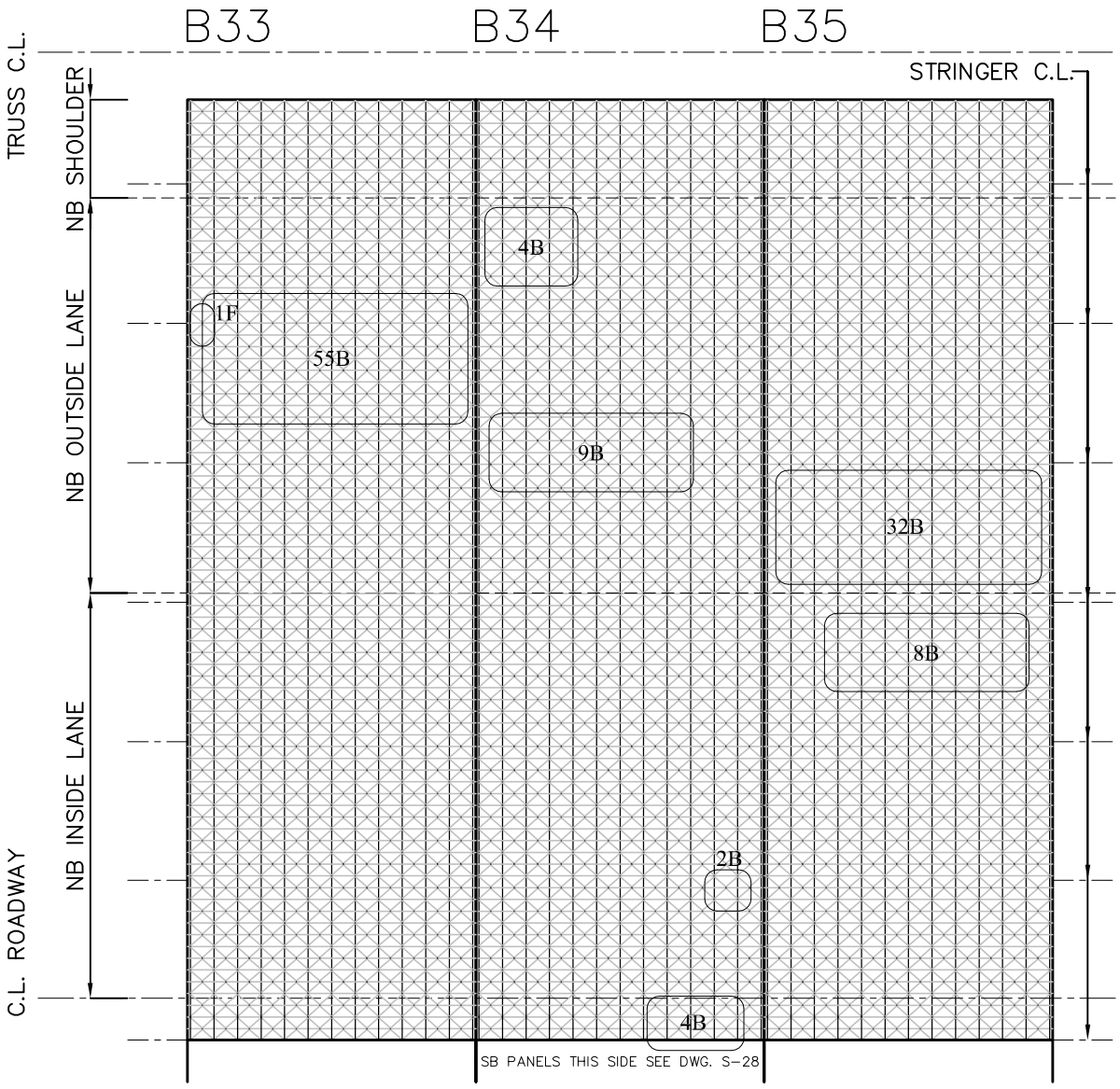
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:
DECK INSPECTION – NB LANES

Drawing no.:	S–12
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



NOTES:

1. ABBREVIATIONS USED:
   - LGF – LOCAL GRATING FAILURE
   - B – BUTTON WELD CRACK
   - F – 'M' BEAM TO STRINGER FILLET WELD CRACK
2. INSPECTION MARKUPS SHOW DISTRIBUTION OF WELDS AND/OR MEMBERS FAILURES OVER PANEL AREA.
3. LOCATION OF WELDS AND/OR MEMBER FAILURES IS APPROXIMATE.

DRAWING PATH AND NAME: K:\Proj\1160268\03 Bridge Deck Grating- Urgent Repair\08 Design and Development\Structural\Working Drawings\1160268-Inspection-1-01 to S-32.dwg
DRAWING LAYOUT: S-12 LAST UPDATED: Oct 27, 2016-15:08
PRINTED: Oct 27, 2016-15:08

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

Public Works and Government Services Canada

Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

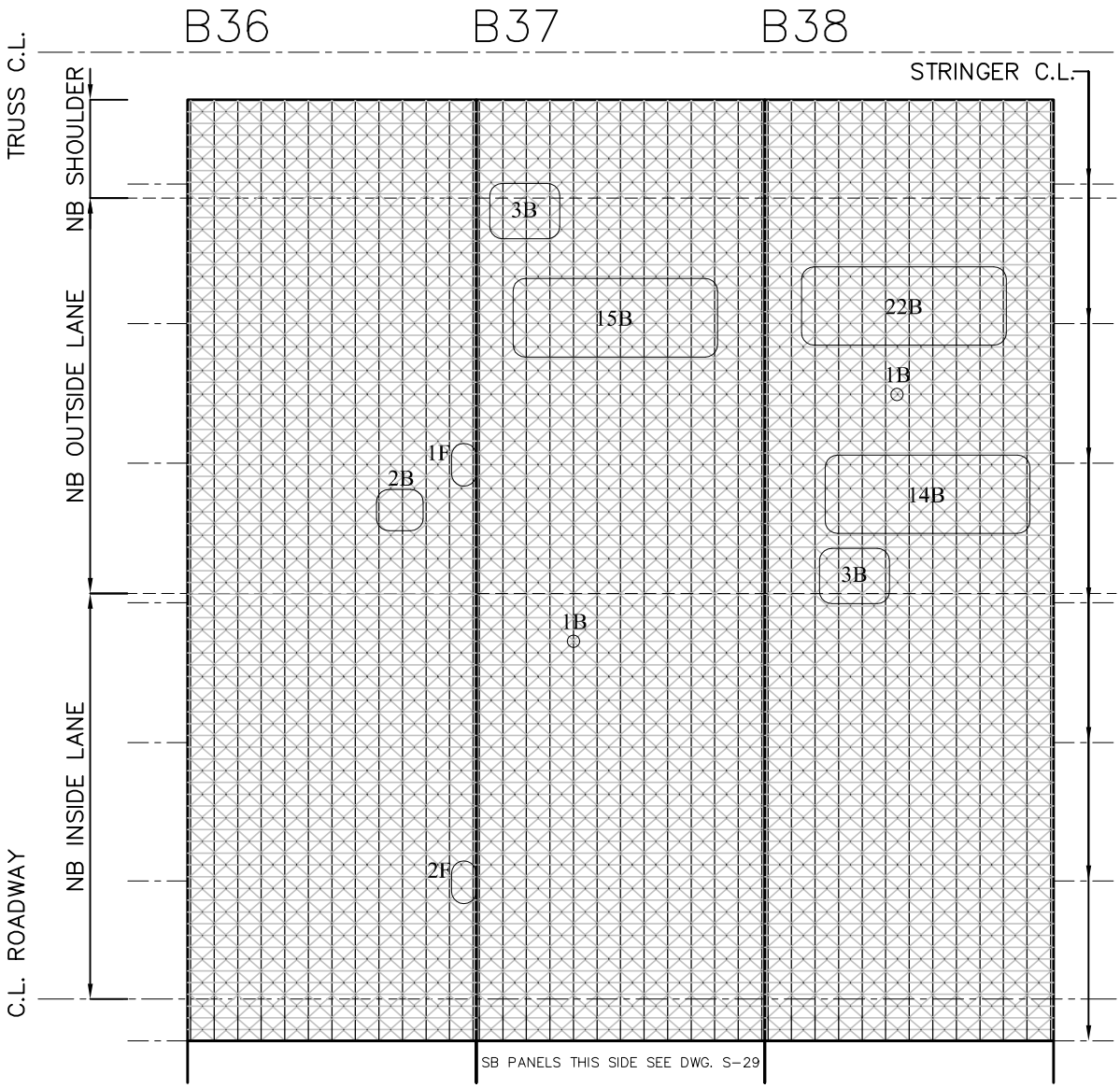
Project title:

BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:

DECK INSPECTION – NB LANES

Drawing no.:	S–13
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



NOTES:

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3. LOCATION OF WELDS AND/OR MEMBER FAILURES IS APPROXIMATE.

DRAWING PATH AND NAME: K:\Proj\1160268\03 Bridge Deck Grating- Urgent Repair\08 Design and Development\Structural\Working Drawings\1160268-Inspection-1-01 to S-32.dwg
DRAWING LAYOUT: S-13 LAST UPDATED: Oct 27, 2016-15:08
PRINTED: Oct 27, 2016-15:08

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

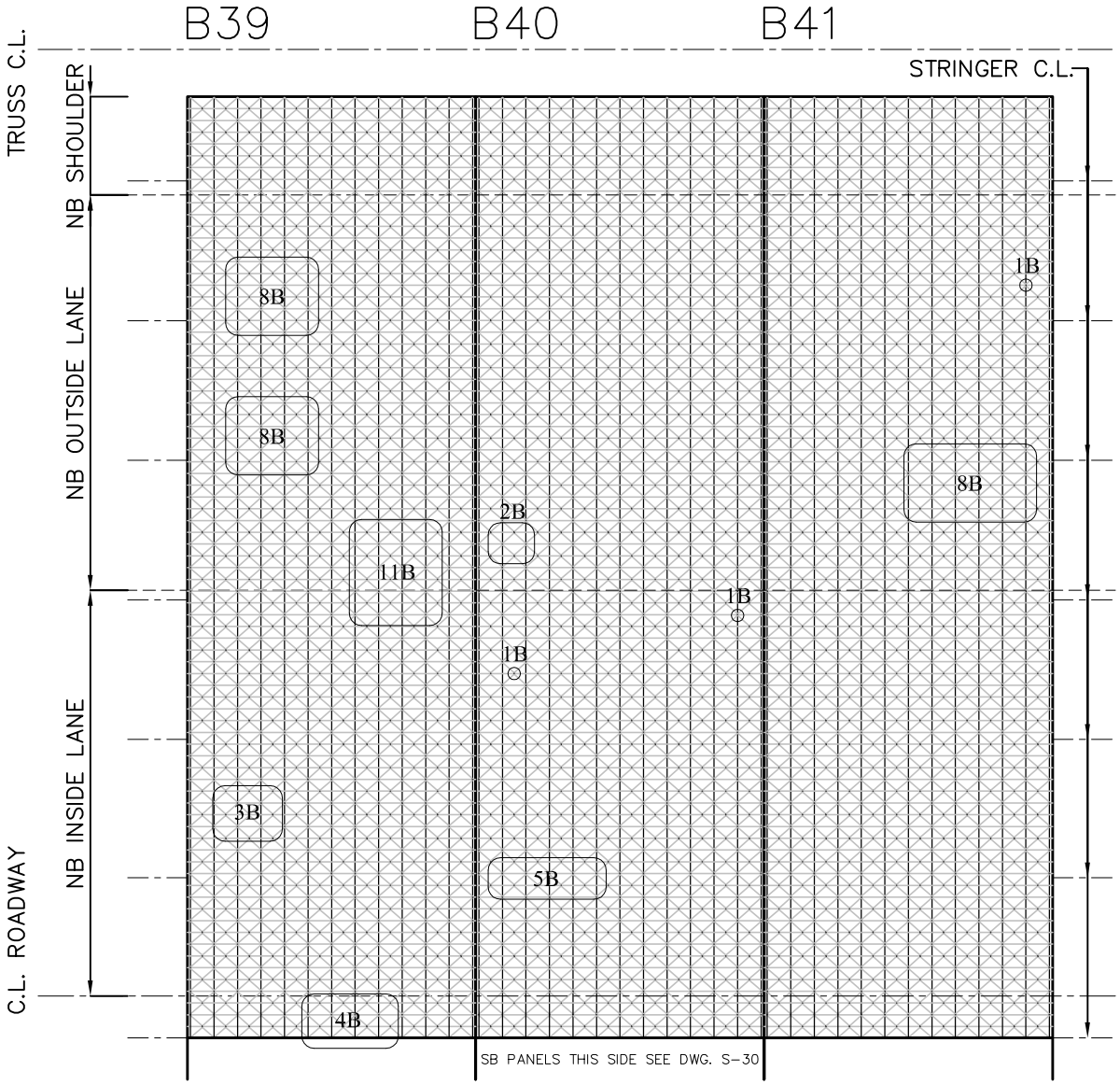
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:
DECK INSPECTION – NB LANES

Drawing no.:	S–14
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



NOTES:

1. ABBREVIATIONS USED:
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3. LOCATION OF WELDS AND/OR MEMBER FAILURES IS APPROXIMATE.

DRAWING PATH AND NAME: K:\Proj\1160268\03 Bridge Deck Grating- Urgent Repair\08 Design and Development\Structural\Working Drawings\1160268-Inspection-1-01 to S-32.dwg
DRAWING LAYOUT: A4
LAST UPDATED: Oct 27, 2016-15:08
PRINTED: Oct 27, 2016-15:08

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

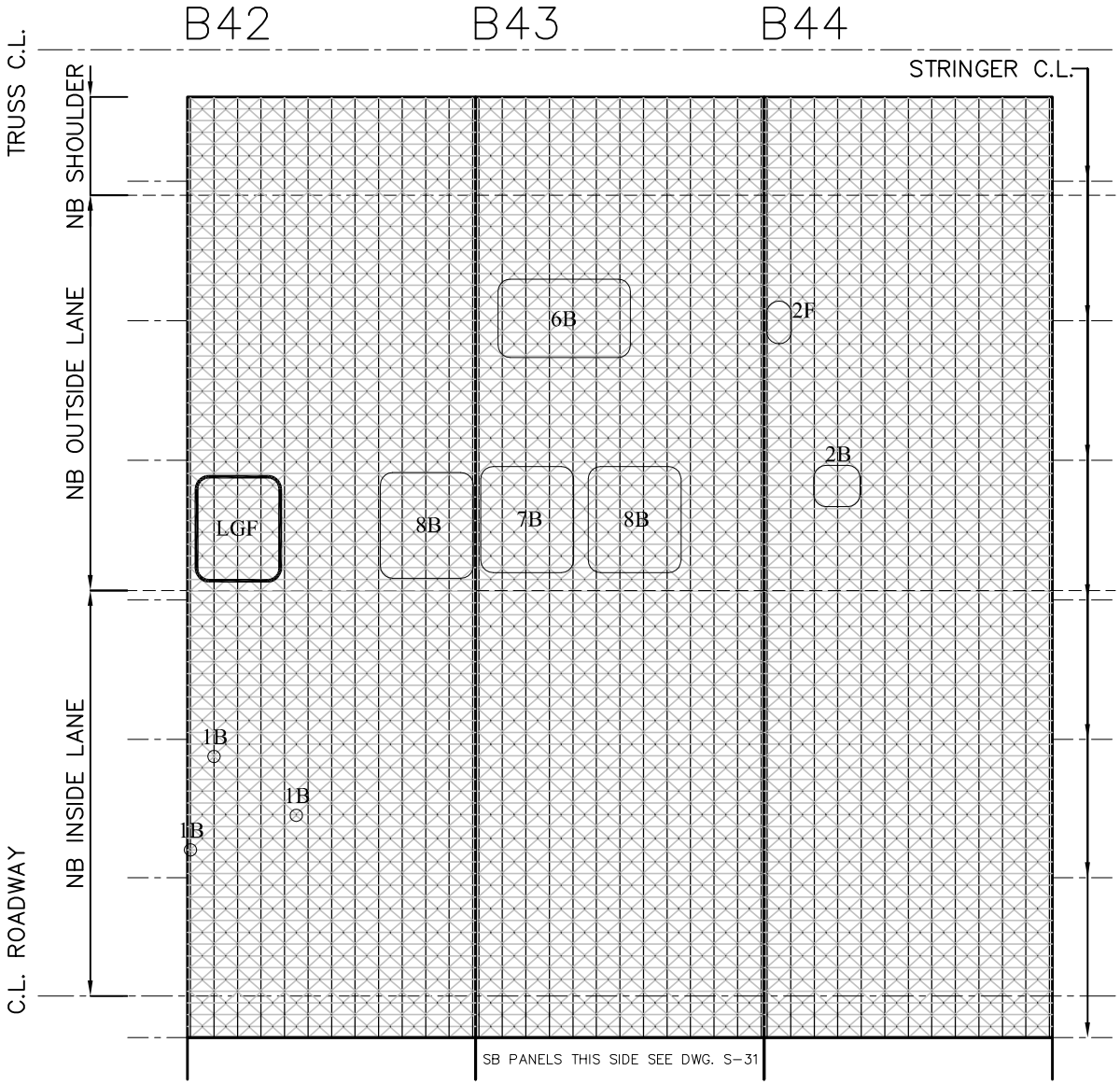
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:
DECK INSPECTION – NB LANES

Drawing no.:	S–15
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



NOTES:

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3. LOCATION OF WELDS AND/OR MEMBER FAILURES IS APPROXIMATE.

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

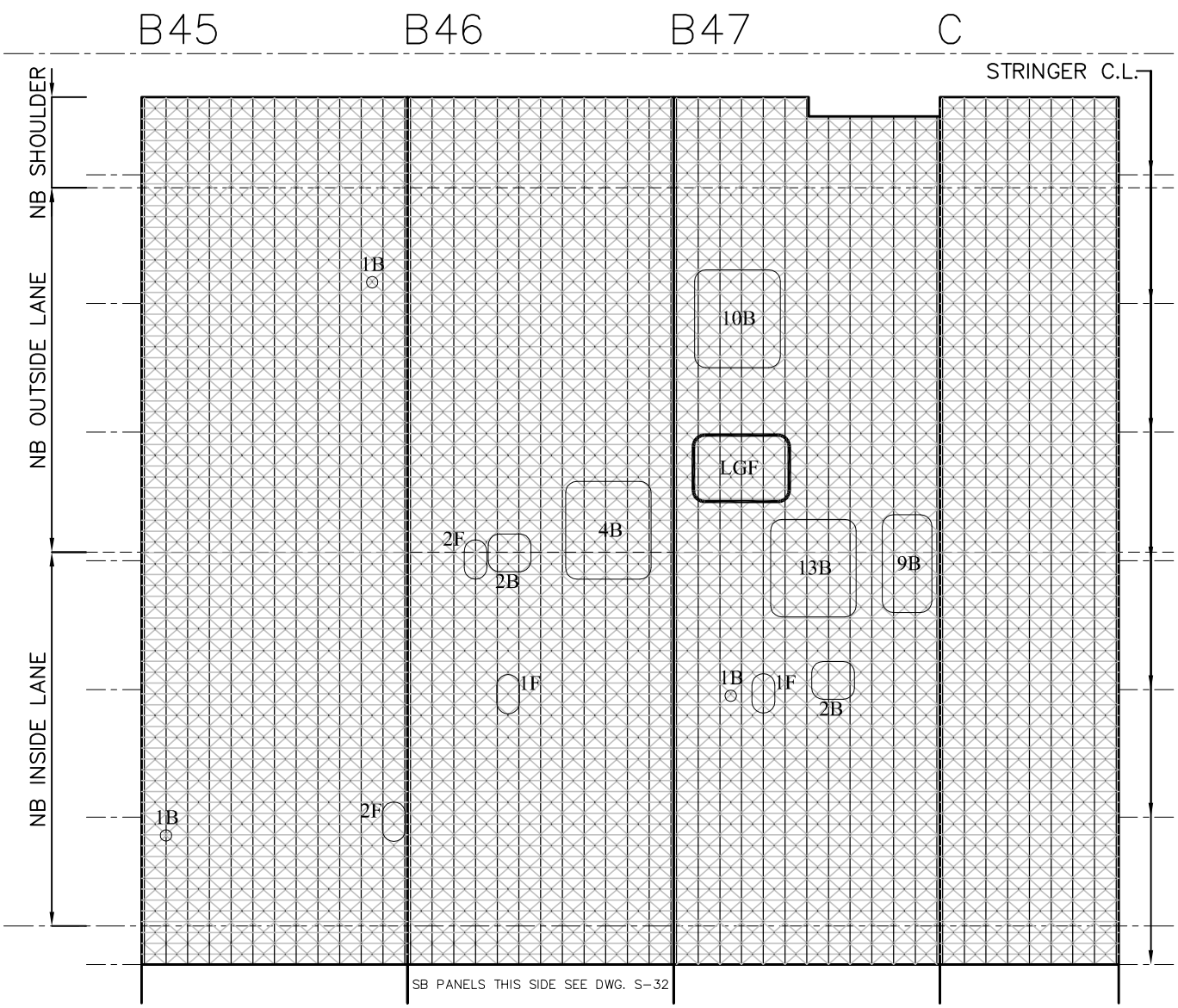
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:
DECK INSPECTION – NB LANES

Drawing no.:	S–16
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



NOTES:

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DRAWING PATH AND NAME: K:\Proj\1160268\03 Bridge Deck Grating- Urgent Repair\08 Design and Development\Structural\Working Drawings\1160268-Inspection-1-01 to S-32.dwg
DRAWING LAYOUT: S-16
LAST UPDATED: Oct 27, 2016-15:08
PRINTED: Oct 27, 2016-15:08

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

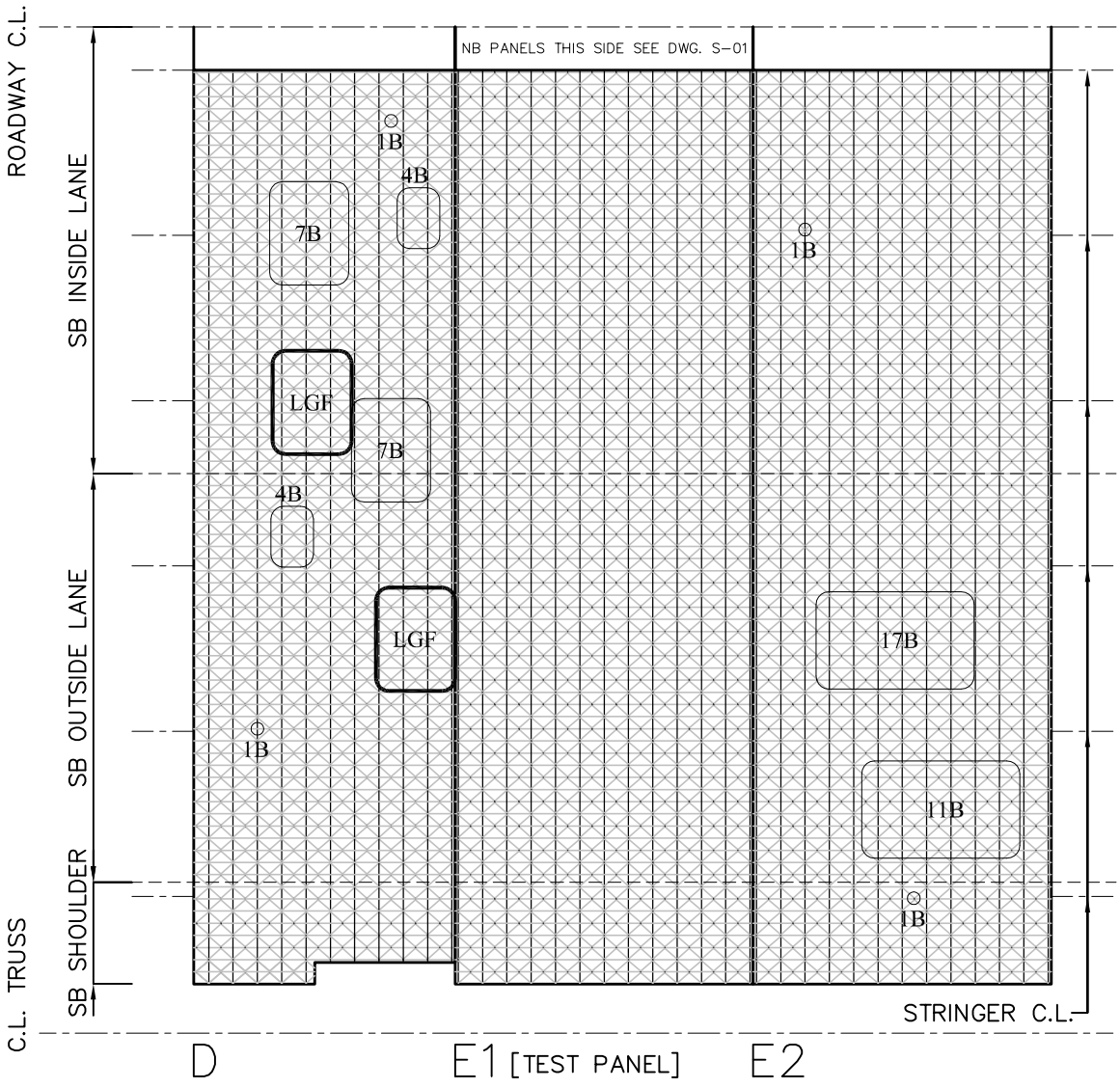
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:
DECK INSPECTION – SB LANES

Drawing no.:	S–17
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



NOTES:

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DRAWING PATH AND NAME: K:\Proj\1160268\03 Bridge Deck Grating– Urgent Repair\08 Design and Development\Structural\Working Drawings\1160268–Inspection–1–01 to S–32.dwg
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PRINTED: Oct 27, 2016–15:08

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

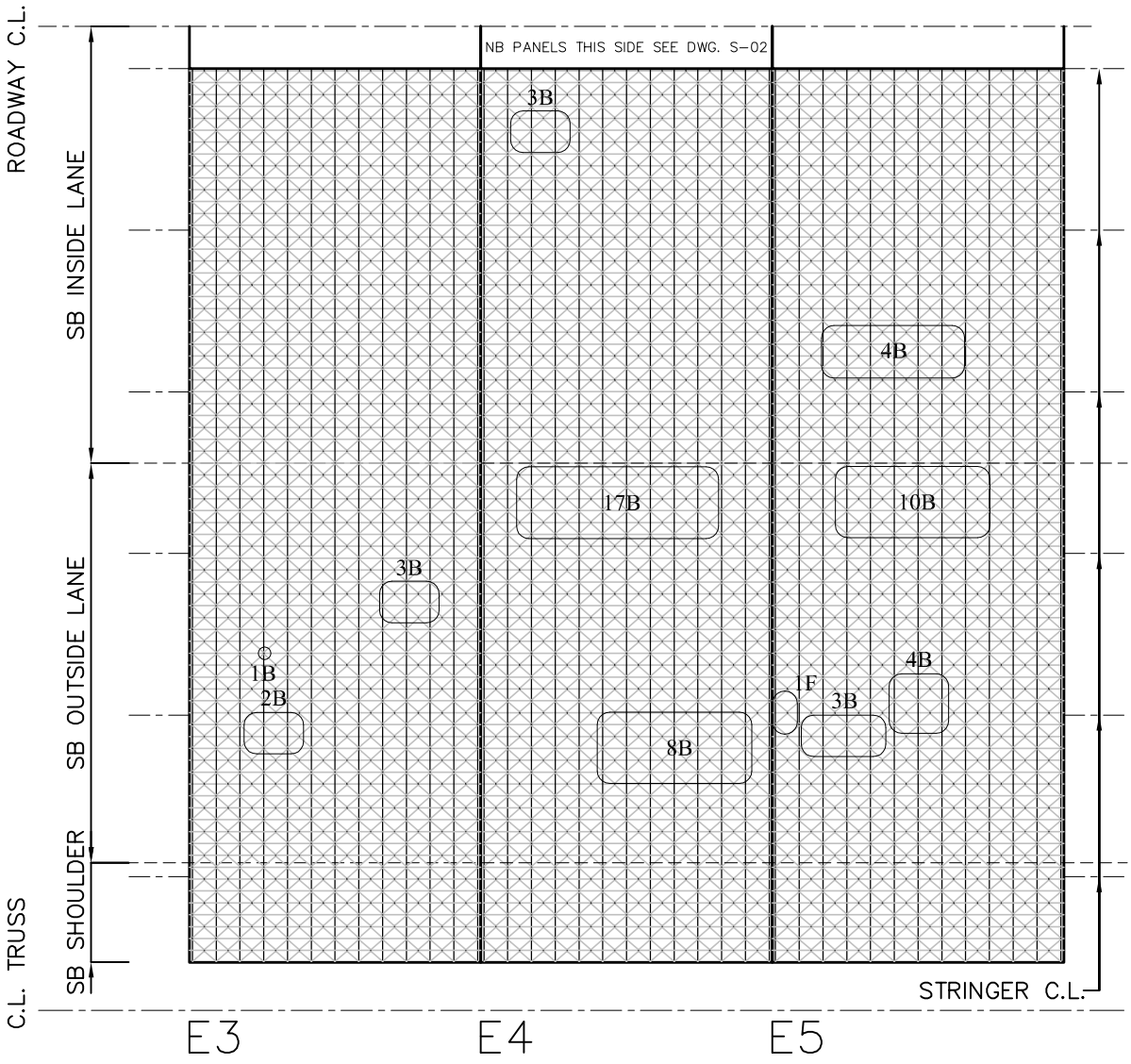
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:
DECK INSPECTION – SB LANES

Drawing no.:	S–18
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



NOTES:

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GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

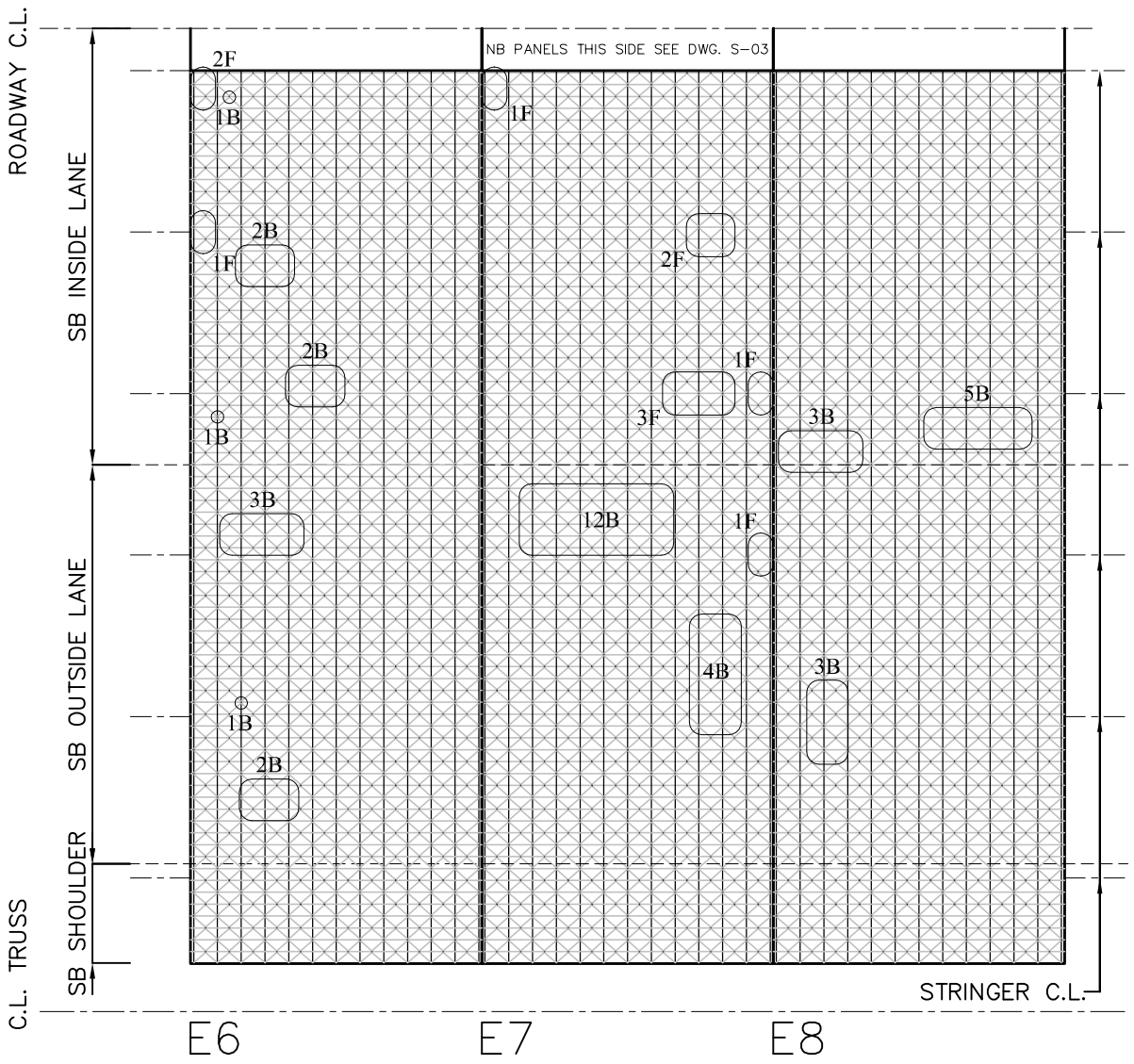
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:
DECK INSPECTION – SB LANES

Drawing no.:	S–19
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



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DRAWING PATH AND NAME: K:\Proj\1160268\03 Bridge Deck Grating- Urgent Repair\08 Design and Development\Structural\Working Drawings\1160268-Inspection-1-01 to S-32.dwg
DRAWING LAYOUT: S-19
LAST UPDATED: Oct 27, 2016-15:08
PRINTED: Oct 27, 2016-15:08

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

Public Works and Government Services Canada

Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

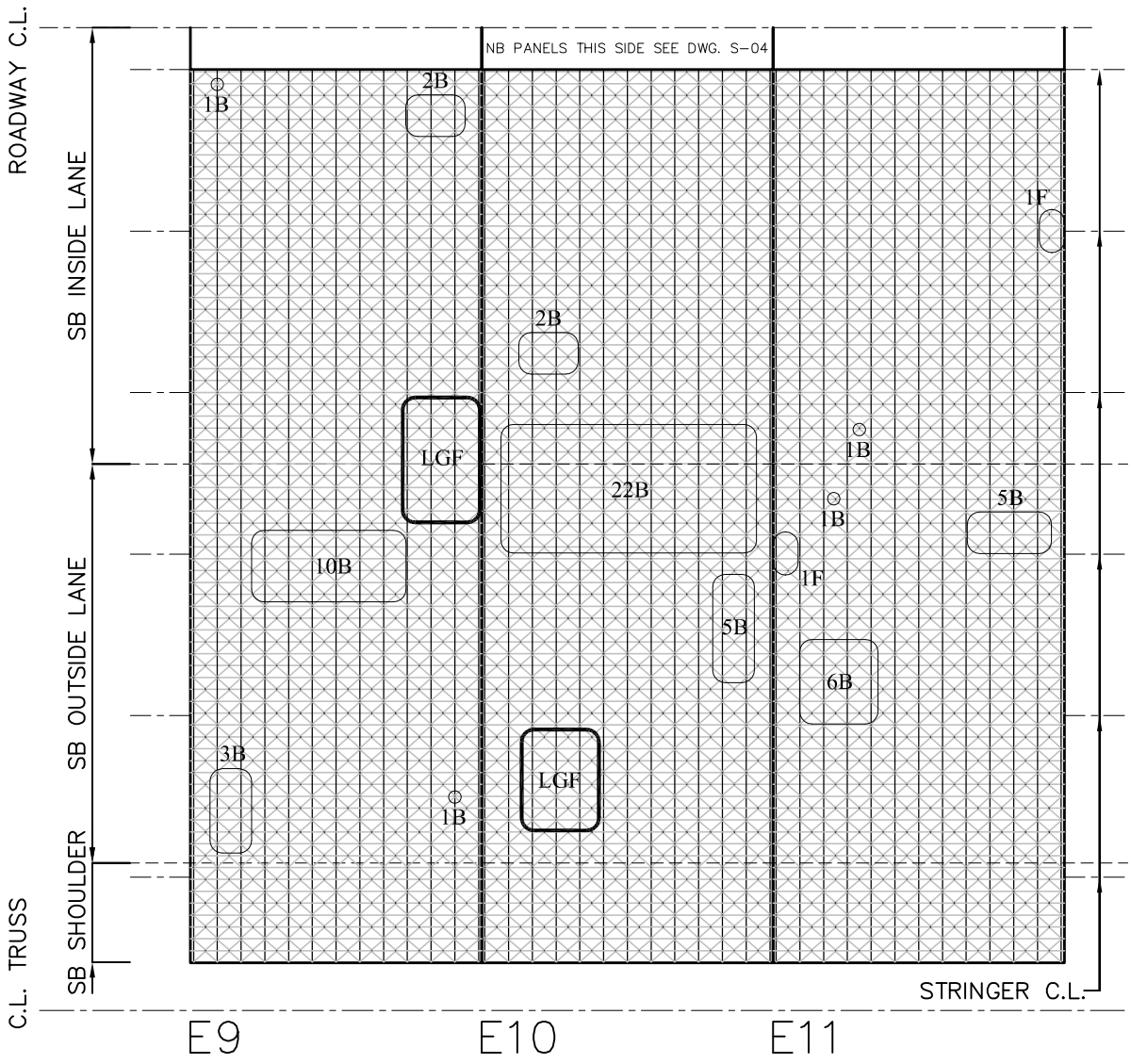
Project title:

BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:

DECK INSPECTION – SB LANES

Drawing no.:	S–20
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



NOTES:

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DRAWING PATH AND NAME: K:\Proj\1160268\03 Bridge Deck Grating- Urgent Repair\08 Design and Development\Structural\Working Drawings\1160268-Inspection-1-01 to S-32.dwg
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LAST UPDATED: Oct 27, 2016-15:08
PRINTED: Oct 27, 2016-15:08

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

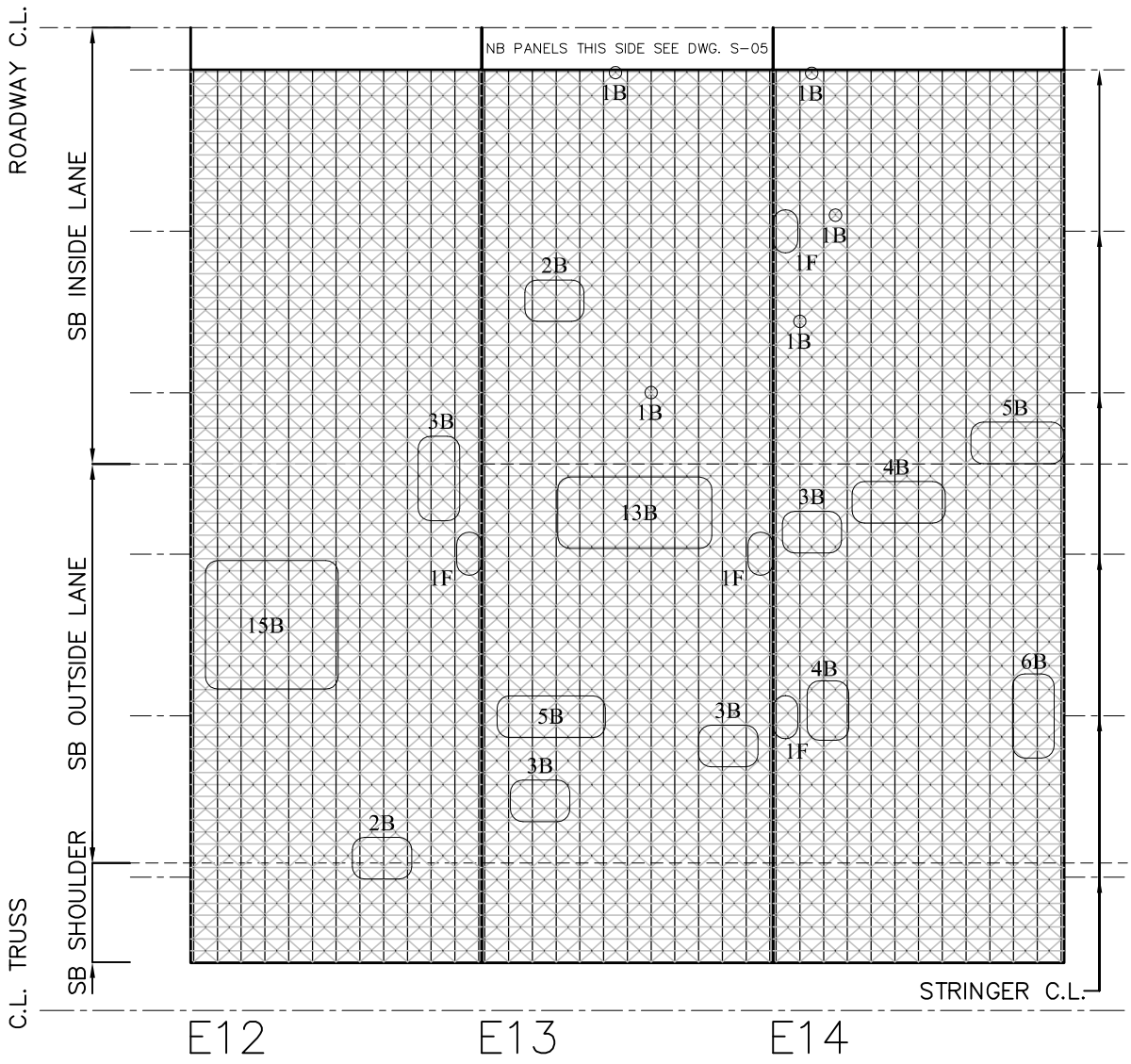
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:
DECK INSPECTION – SB LANES

Drawing no.:	S–21
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



NOTES:

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DRAWING PATH AND NAME: K:\Proj\1160268\03 Bridge Deck Grating- Urgent Repair\08 Design and Development\Structural\Working Drawings\1160268-Inspection-1-01 to S-32.dwg
DRAWING LAYOUT: S-21
LAST UPDATED: Oct 27, 2016-15:08
PRINTED: Oct 27, 2016-15:08

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

Public Works and Government Services Canada

Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

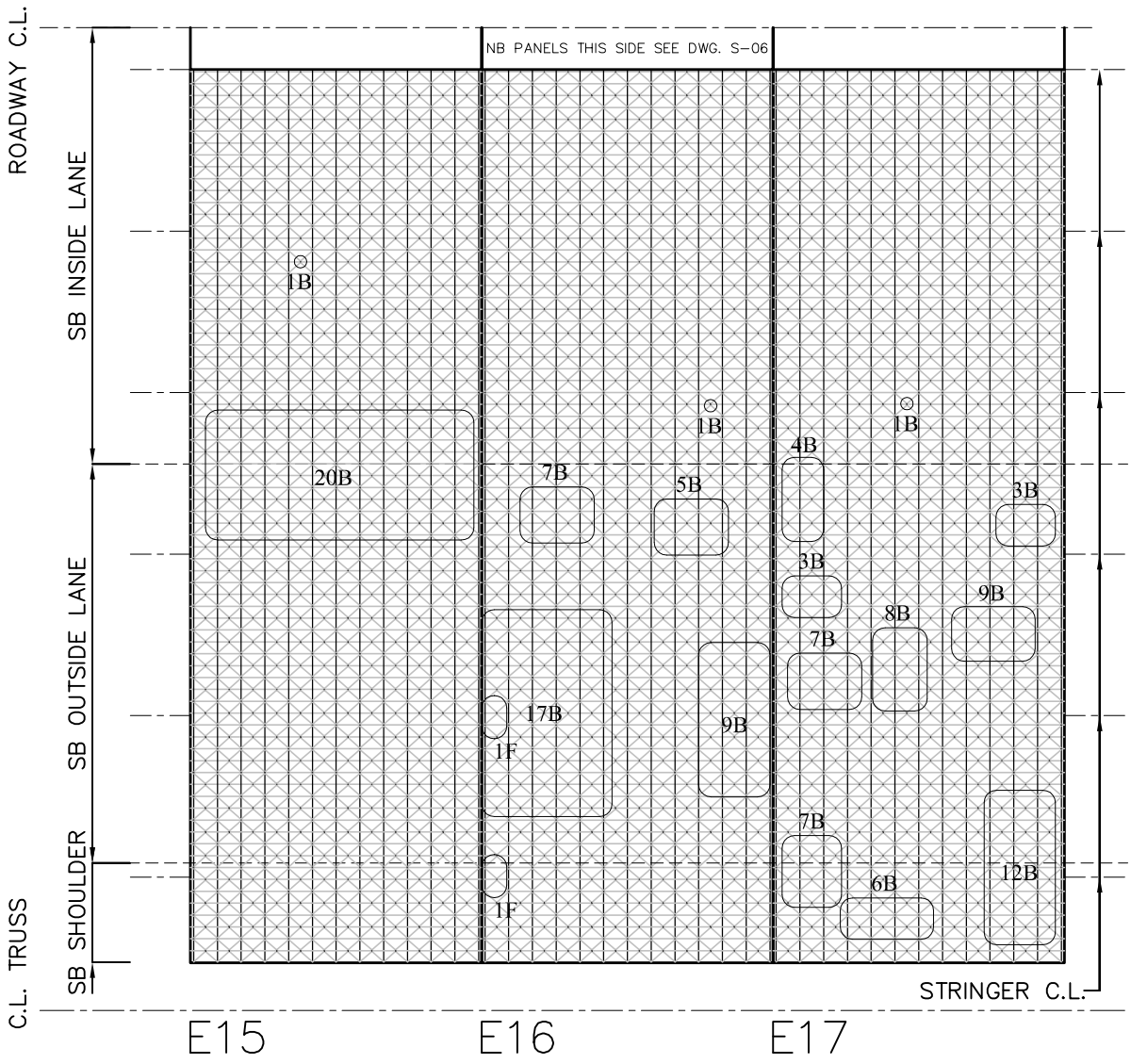
Project title:

BCLB BRIDGE ENGINEERING SERVICES URGENT STEEL DECK GRATING REPAIRS

Drawing title:

DECK INSPECTION – SB LANES

Drawing no.:	S–22
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



NOTES:

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DRAWING PATH AND NAME: K:\Proj\1160268\03 Bridge Deck Grating- Urgent Repair\08 Design and Development\Structural\Working Drawings\1160268-Inspection-1-01 to S-32.dwg
DRAWING LAYOUT: S-22 LAST UPDATED: Oct 27, 2016-15:08
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GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

Public Works and Government Services Canada

Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

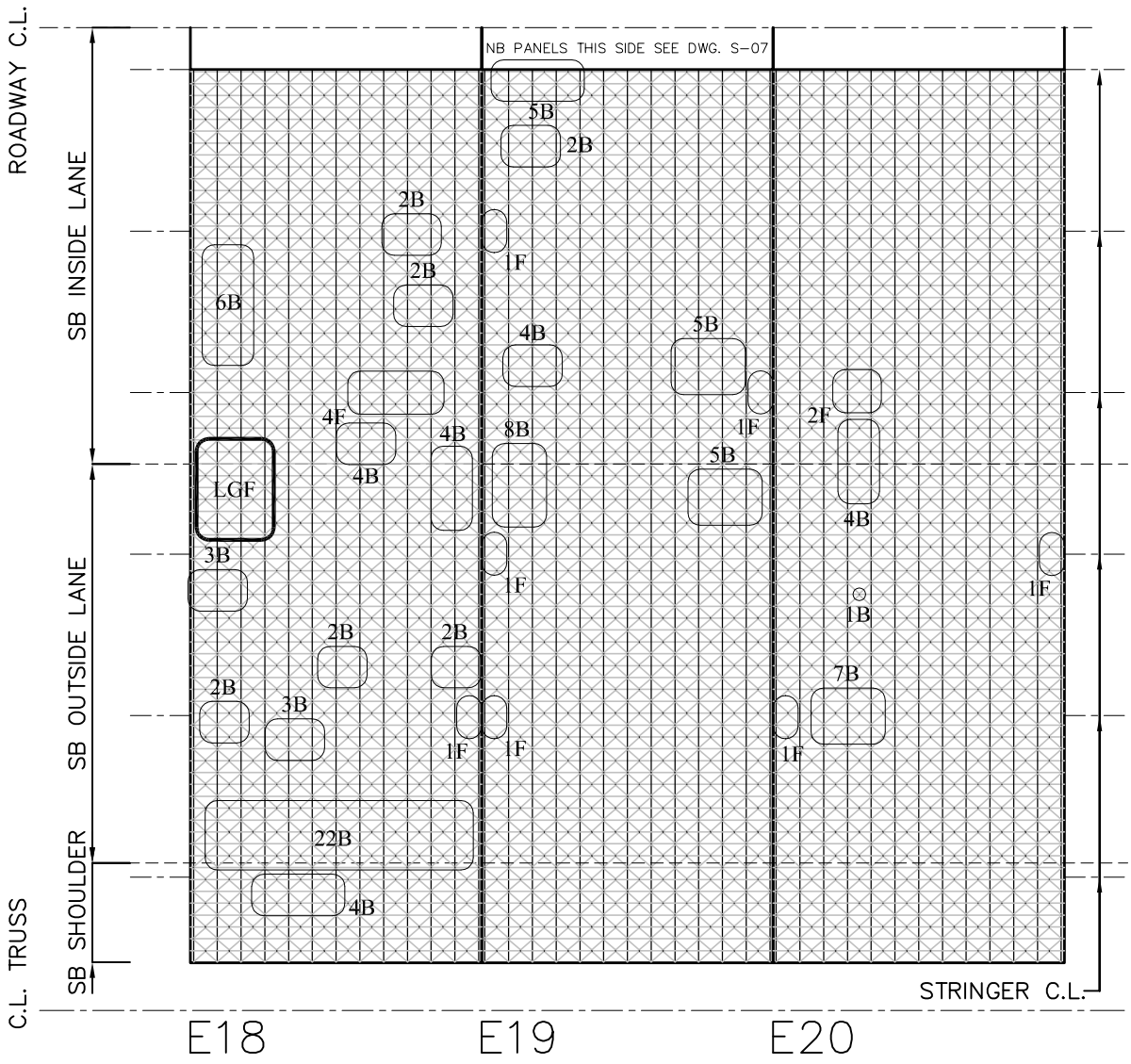
Project title:

BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:

DECK INSPECTION – SB LANES

Drawing no.:	S–23
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



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LAST UPDATED: Oct 27, 2016-15:06
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GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

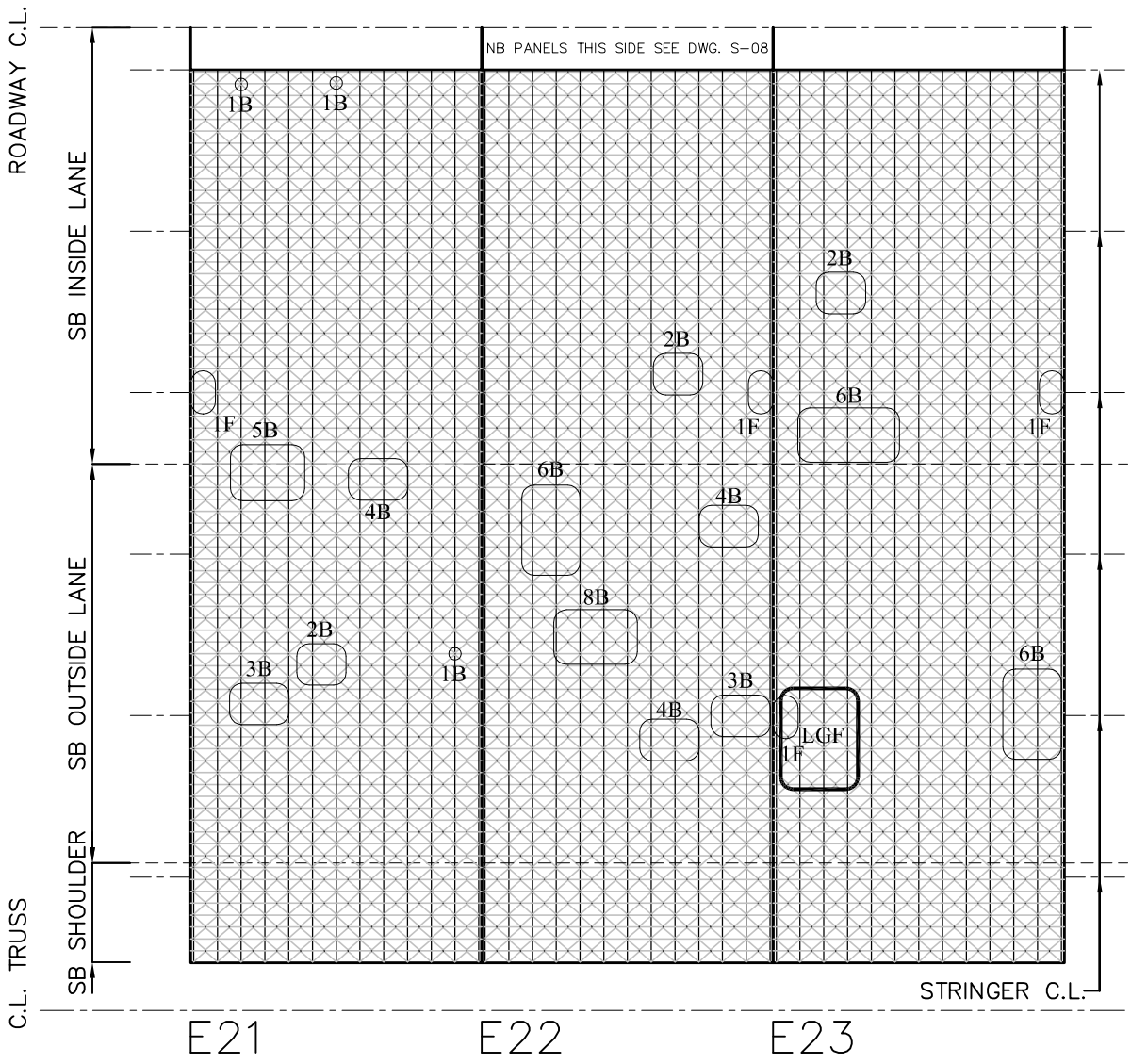
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:
DECK INSPECTION – SB LANES

Drawing no.:	S–24
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



NOTES:

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DRAWING PATH AND NAME: K:\Proj\1160268\03 Bridge Deck Grating- Urgent Repair\08 Design and Development\Structural\Working Drawings\1160268-Inspection-1-01 to S-32.dwg
DRAWING LAYOUT: S-24
LAST UPDATED: Oct 27, 2016-15:06
PRINTED: Oct 27, 2016-15:09

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

Public Works and Government Services Canada

Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

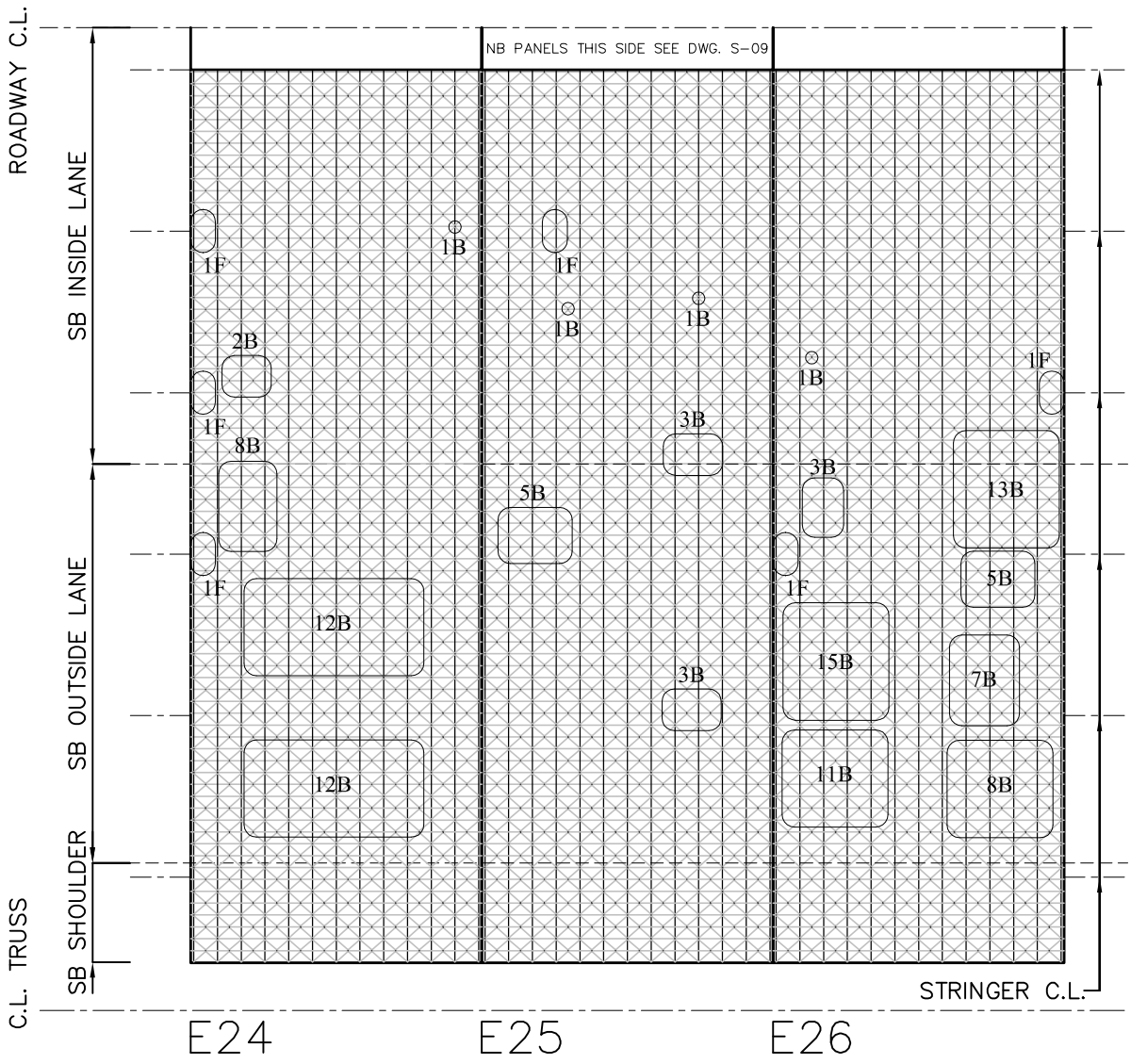
Project title:

BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:

DECK INSPECTION – SB LANES

Drawing no.:	S–25
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



NOTES:

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DRAWING PATH AND NAME: K:\Proj\1160268\03 Bridge Deck Grating- Urgent Repair\08 Design and Development\Structural\Working Drawings\1160268-Inspection-1-01 to S-32.dwg
DRAWING LAYOUT: S-25
LAST UPDATED: Oct 27, 2016-15:06
PRINTED: Oct 27, 2016-15:09

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

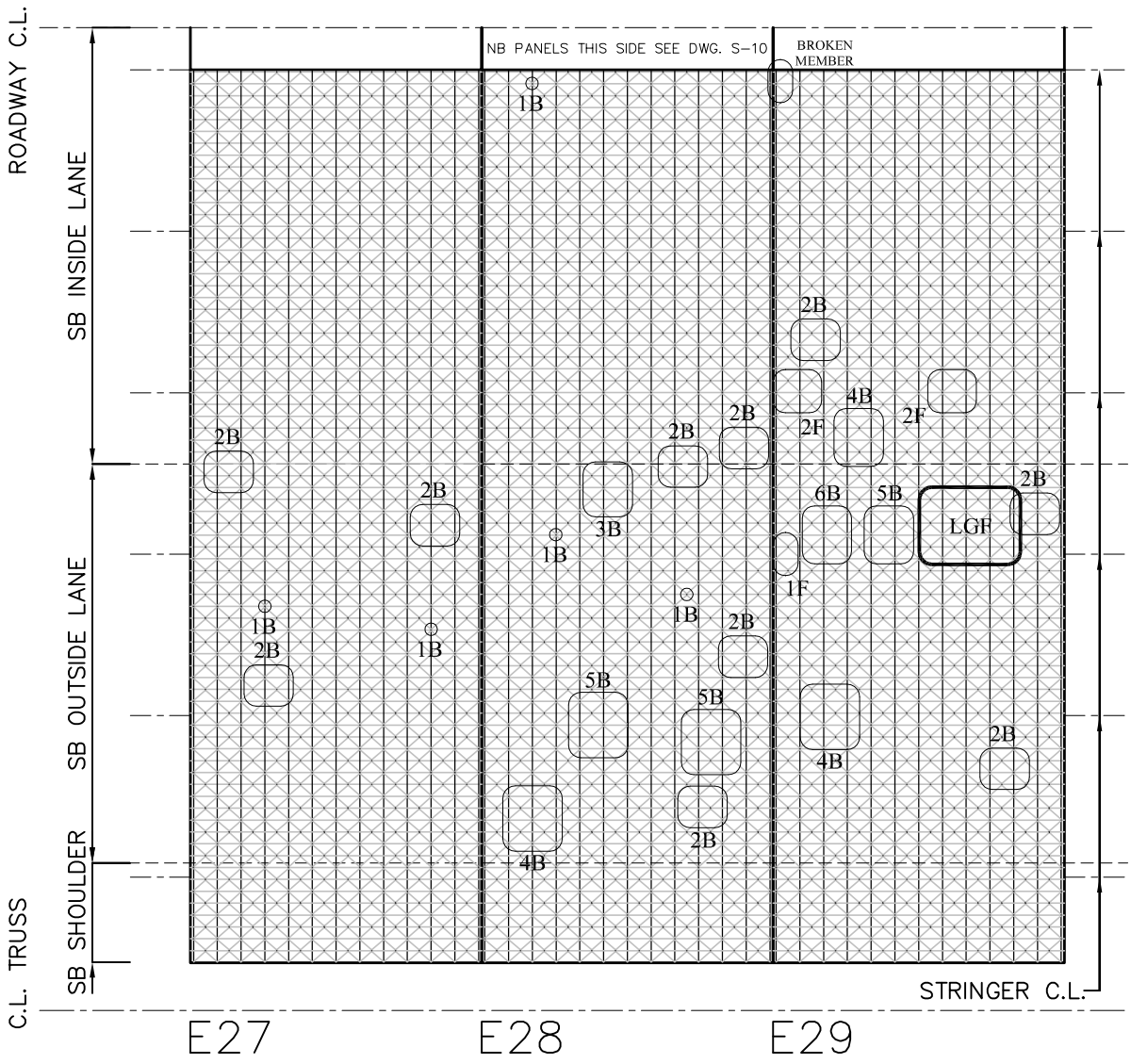
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:
DECK INSPECTION – SB LANES

Drawing no.:	S–26
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



NOTES:

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Public Works and Government Services Canada

Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

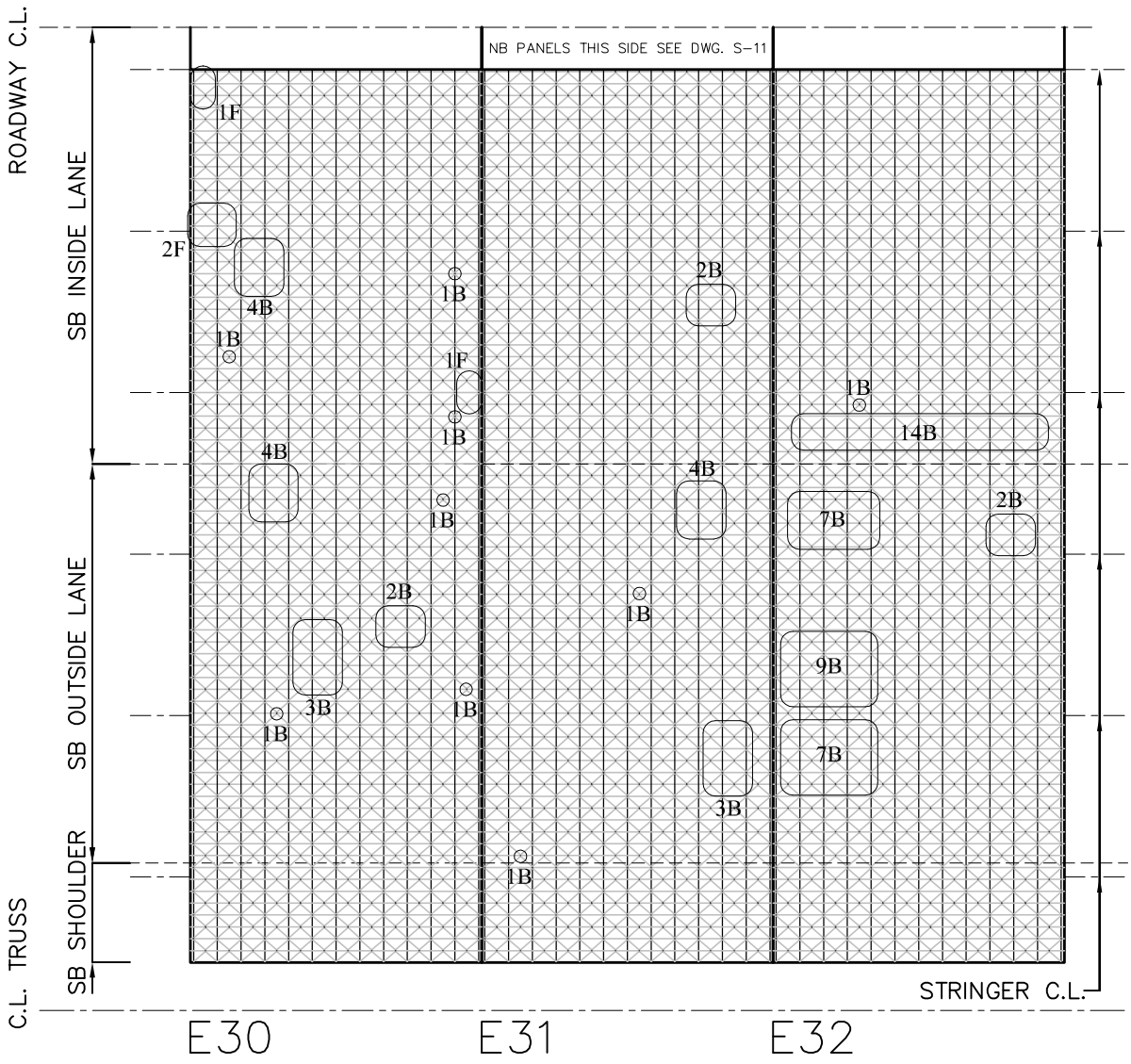
Project title:

BCLB BRIDGE ENGINEERING SERVICES URGENT STEEL DECK GRATING REPAIRS

Drawing title:

DECK INSPECTION – SB LANES

Drawing no.:	S–27
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



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DRAWING PATH AND NAME: K:\Proj\1160268\03 Bridge Deck Grating- Urgent Repair\08 Design and Development\Structural\Working Drawings\1160268-Inspection-1-01 to S-32.dwg
DRAWING LAYOUT: S-27 LAST UPDATED: Oct 27, 2016-15:06
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GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

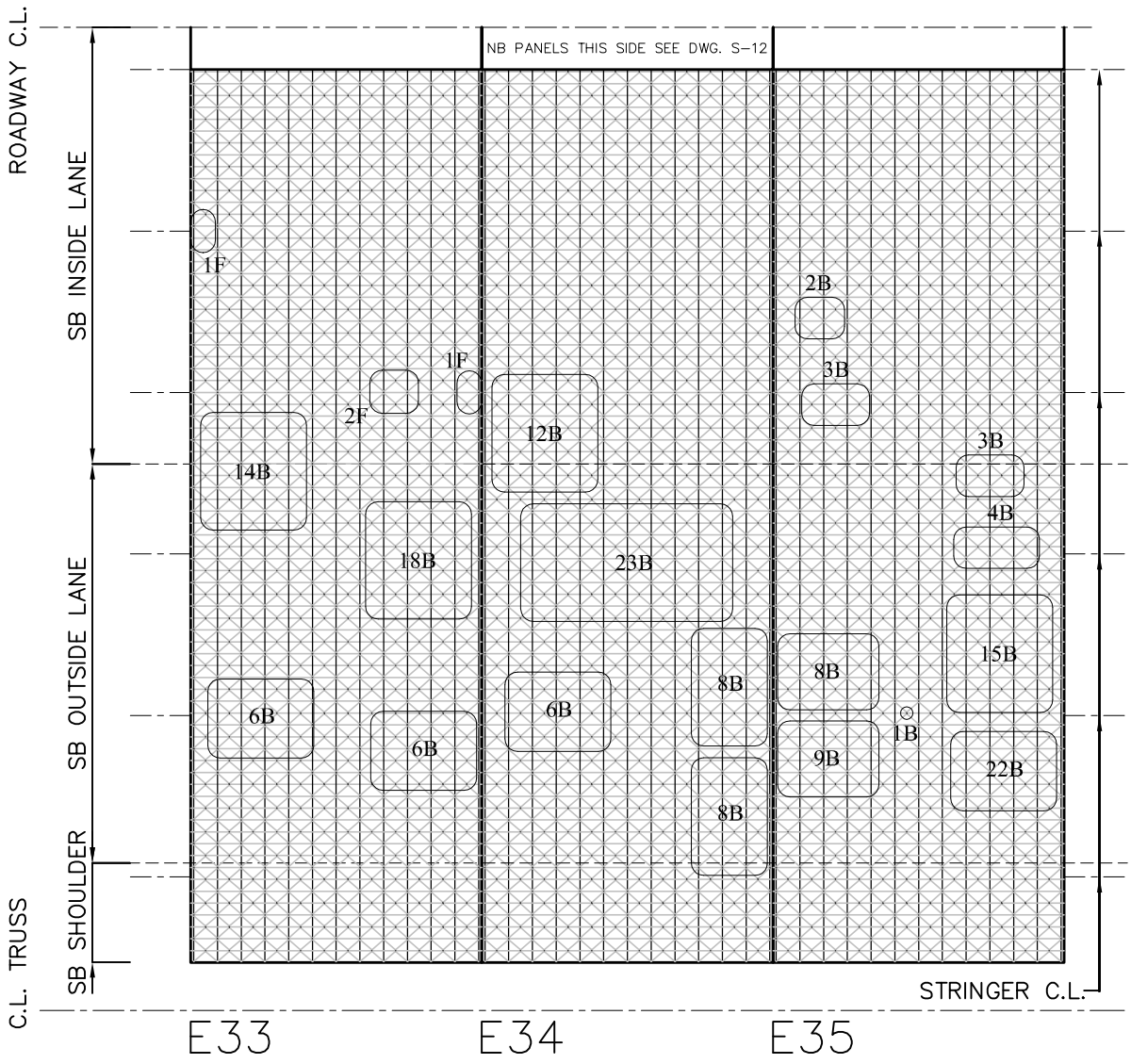
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:
DECK INSPECTION – SB LANES

Drawing no.:	S–28
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



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DRAWING LAYOUT: S-28
LAST UPDATED: Oct 27, 2016-15:06
PRINTED: Oct 27, 2016-15:09

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

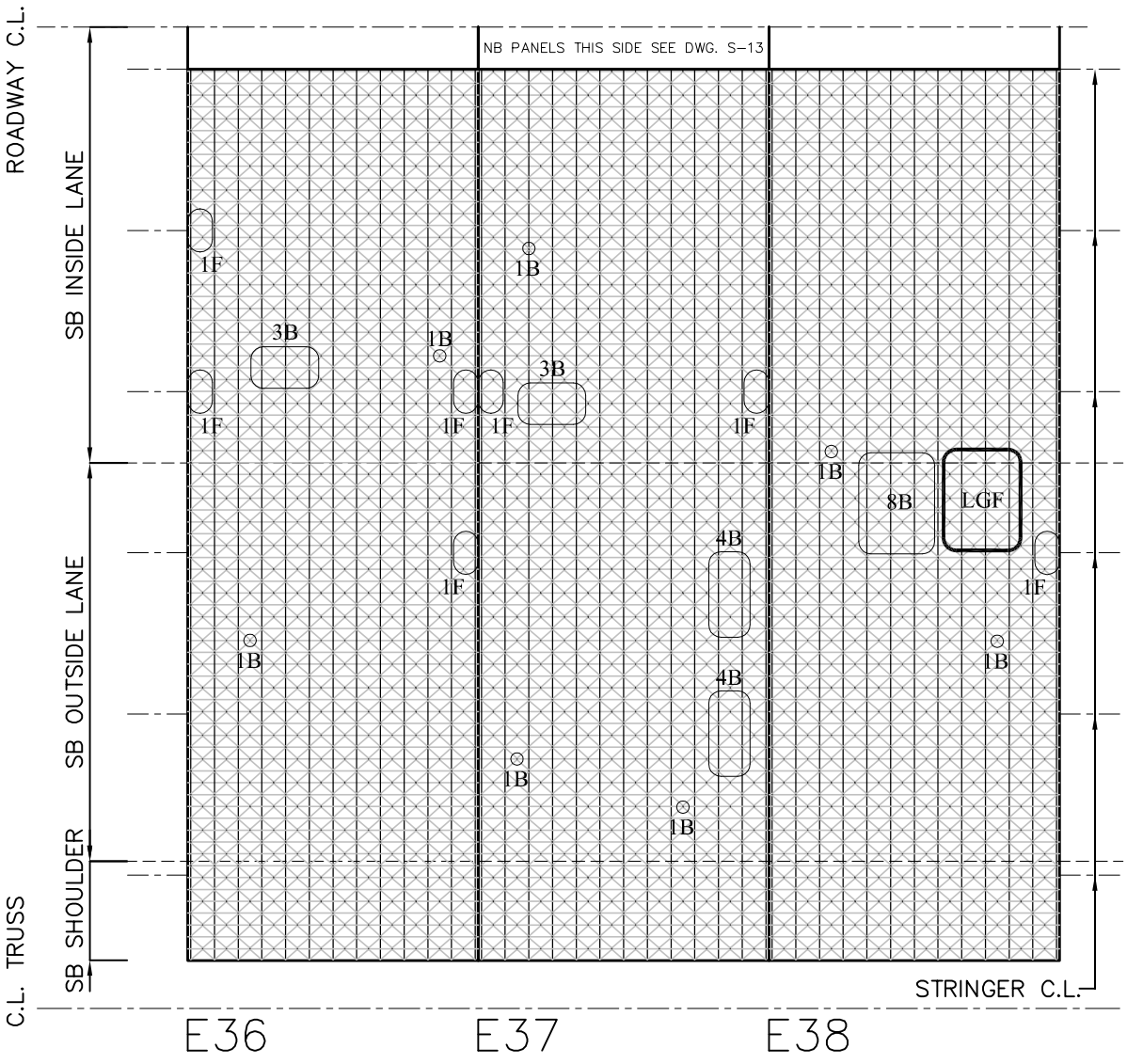
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:
DECK INSPECTION – SB LANES

Drawing no.:	S–29
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



NOTES:

1. ABBREVIATIONS USED:
   - LGF – LOCAL GRATING FAILURE
   - B – BUTTON WELD CRACK
   - F – 'M' BEAM TO STRINGER FILLET WELD CRACK
2. INSPECTION MARKUPS SHOW DISTRIBUTION OF WELDS AND/OR MEMBERS FAILURES OVER PANEL AREA.
3. LOCATION OF WELDS AND/OR MEMBER FAILURES IS APPROXIMATE.

DRAWING PATH AND NAME: K:\Proj\1160268\03 Bridge Deck Grating- Urgent Repair\08 Design and Development\Structural\Working Drawings\1160268-Inspection-1-01 to S-32.dwg
DRAWING LAYOUT: S-29
LAST UPDATED: Oct 27, 2016-15:06
PRINTED: Oct 27, 2016-15:09

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

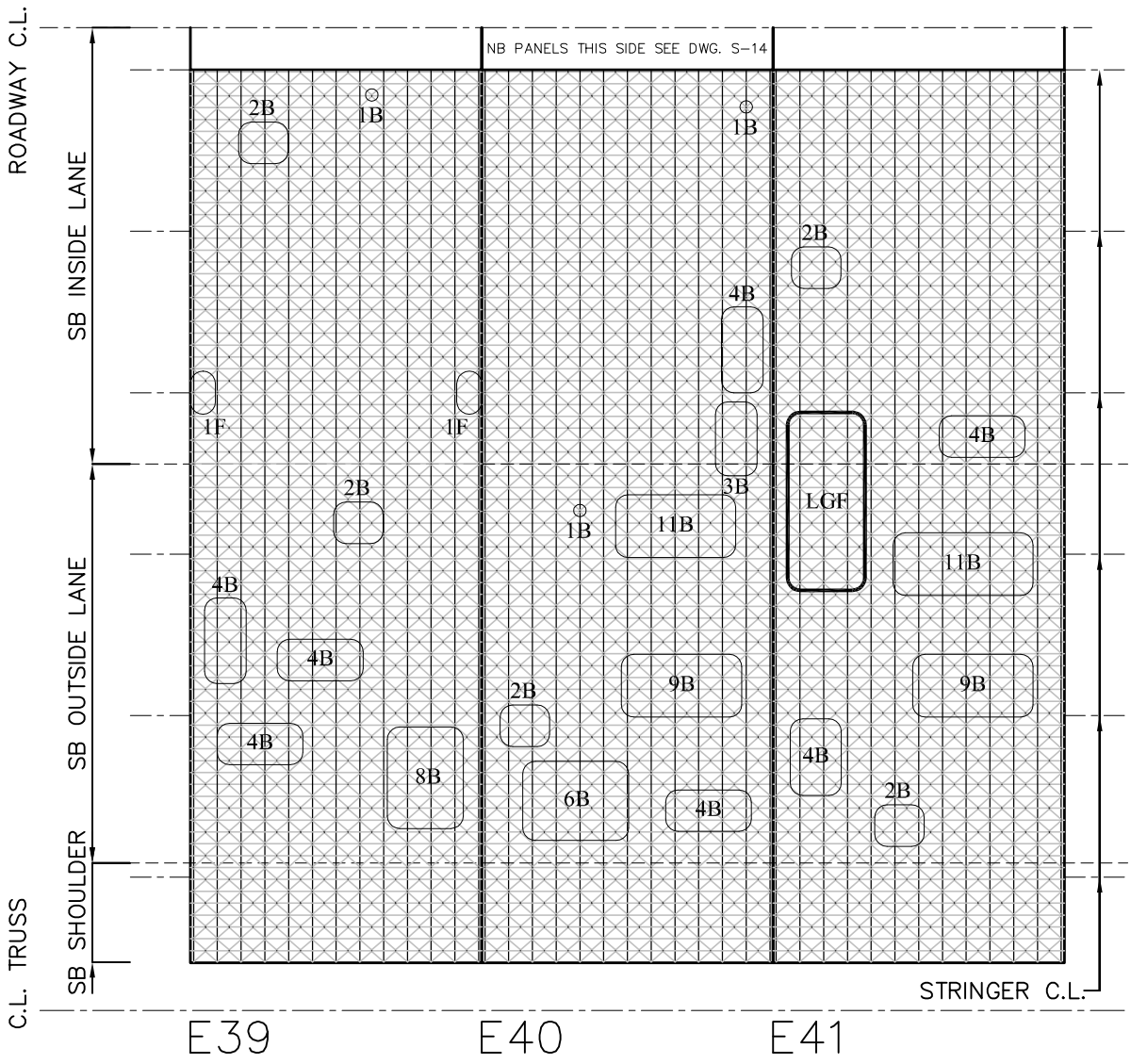
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:
DECK INSPECTION – SB LANES

Drawing no.:	S–30
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



NOTES:

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   - LGF – LOCAL GRATING FAILURE
   - B – BUTTON WELD CRACK
   - F – 'M' BEAM TO STRINGER FILLET WELD CRACK
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3. LOCATION OF WELDS AND/OR MEMBER FAILURES IS APPROXIMATE.

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DRAWING LAYOUT: S–30
LAST UPDATED: Oct 27, 2016–15:06
PRINTED: Oct 27, 2016–15:09

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

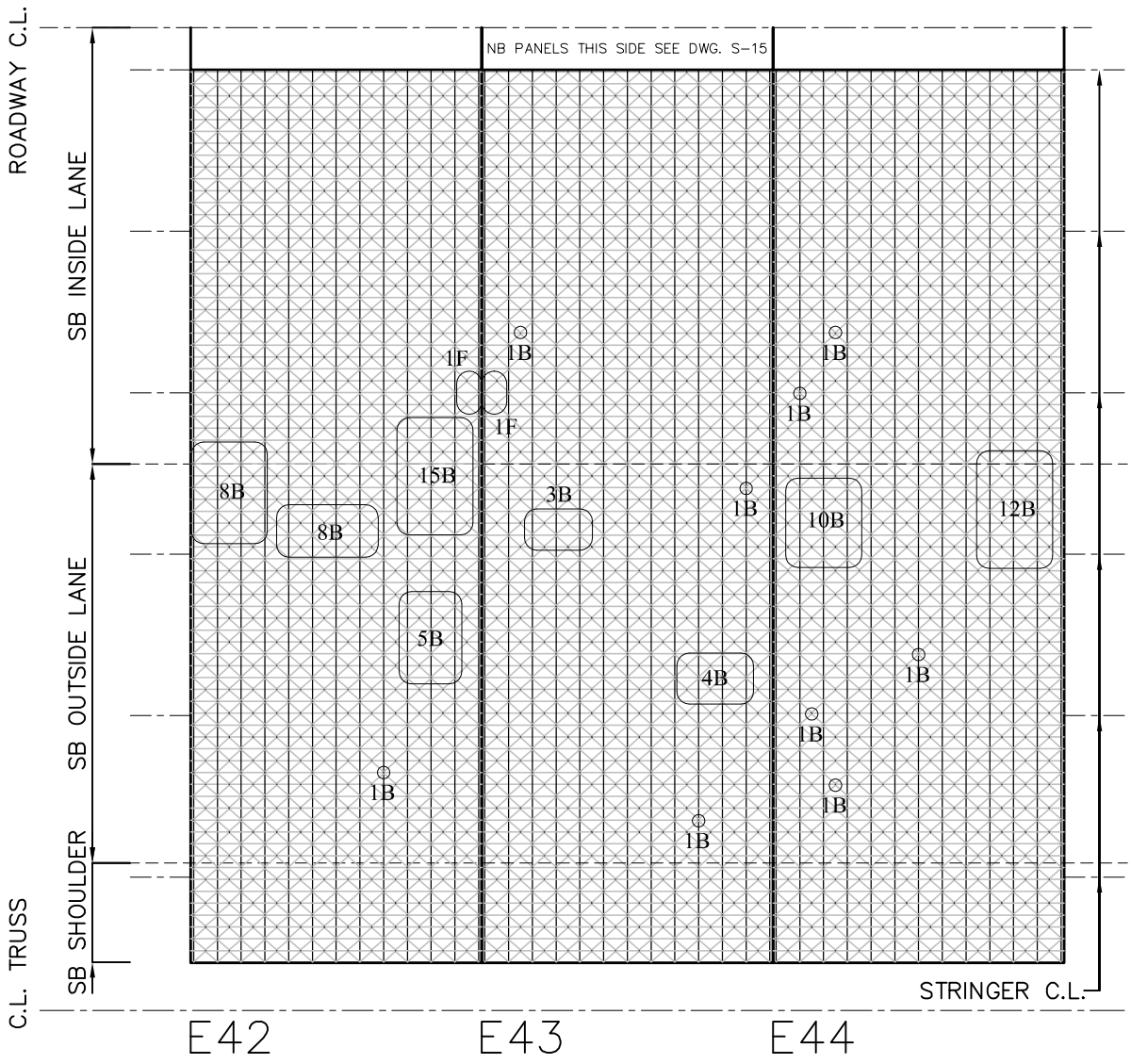
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:
DECK INSPECTION – SB LANES

Drawing no.:	S–31
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



NOTES:

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   - F – 'M' BEAM TO STRINGER FILLET WELD CRACK
2. INSPECTION MARKUPS SHOW DISTRIBUTION OF WELDS AND/OR MEMBERS FAILURES OVER PANEL AREA.
3. LOCATION OF WELDS AND/OR MEMBER FAILURES IS APPROXIMATE.

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

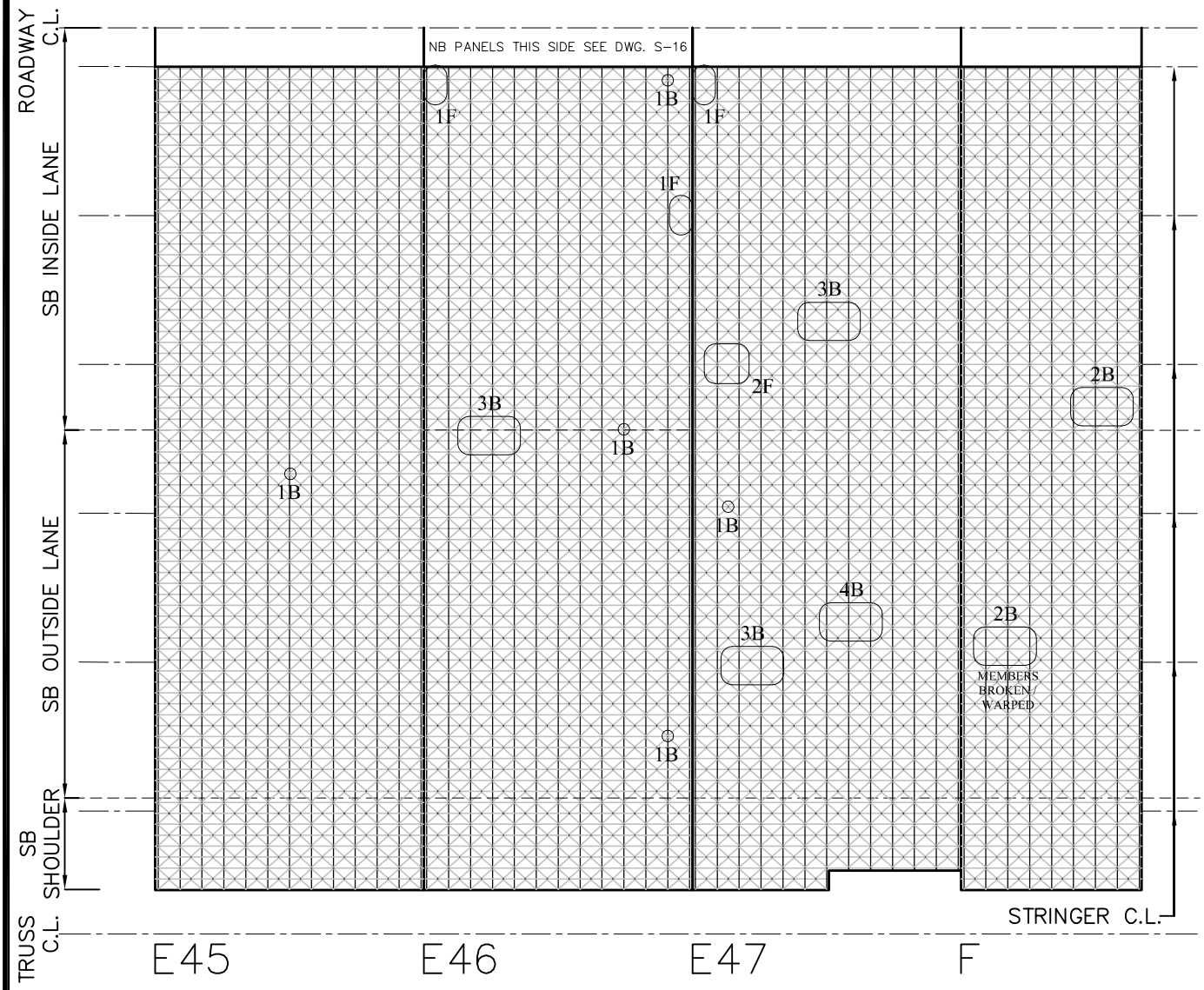
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BCLB BRIDGE ENGINEERING SERVICES
URGENT STEEL DECK GRATING REPAIRS

Drawing title:
DECK INSPECTION – SB LANES

Drawing no.:	S–32
Project no.:	R.081864.001
Project date:	2017 - 04 - 05
Designed by:	D.W.
Approved by:	M.S.
Bid:	



NOTES:

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   - B – BUTTON WELD CRACK
   - F – 'M' BEAM TO STRINGER FILLET WELD CRACK
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3. LOCATION OF WELDS AND/OR MEMBER FAILURES IS APPROXIMATE.

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DRAWING LAYOUT: S-32
LAST UPDATED: Oct 27, 2016-15:06
PRINTED: Oct 27, 2016-15:09

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

Appendix E

REPAIR OPTIONS

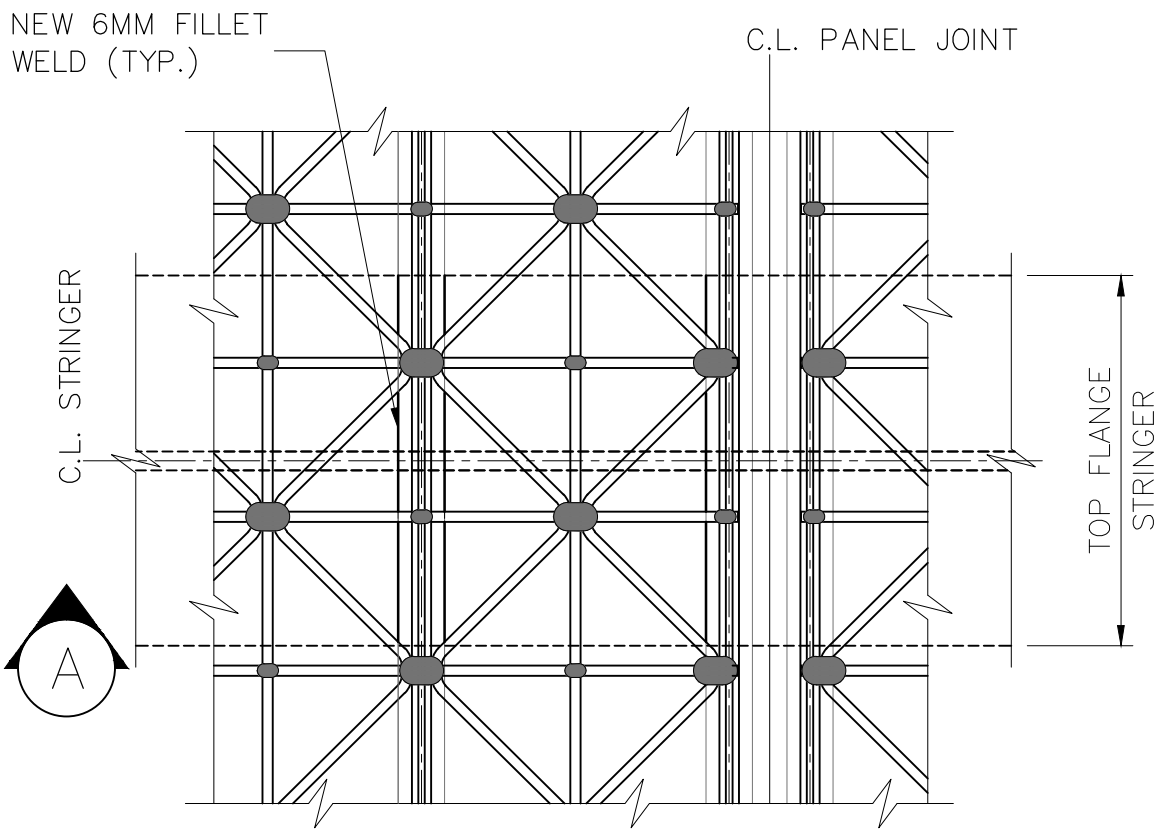
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BURLINGTON CANAL LIFT BRIDGE

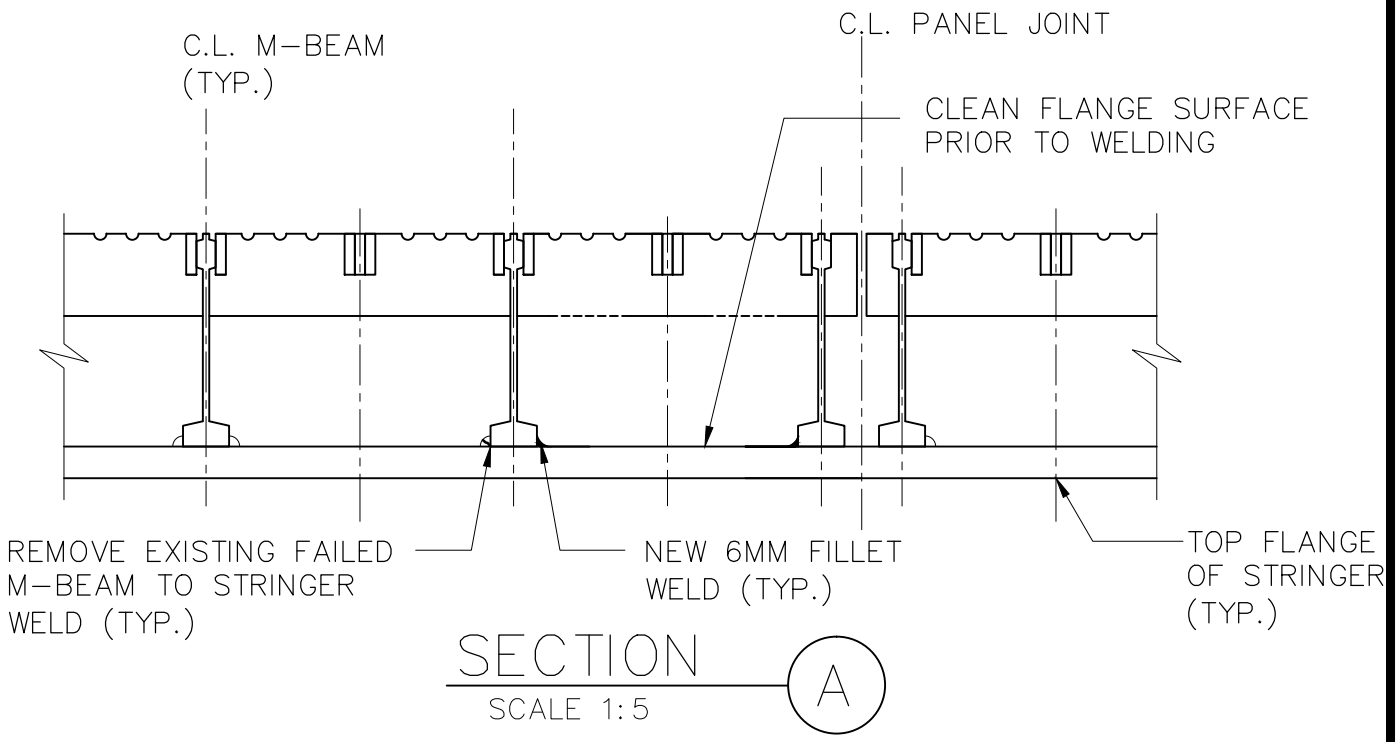
Drawing title:
M–BEAM TO STRINGER OPTION A

Drawing no.:	SK–01
Project no.:	**R.081864.001**
Project date:	**2017 - 04 - 05**
Designed by:	**D.W.**
Approved by:	**M.S.**
Bid:	



PART PLAN GRATING PANEL

SCALE 1:5



SECTION A

SCALE 1:5

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

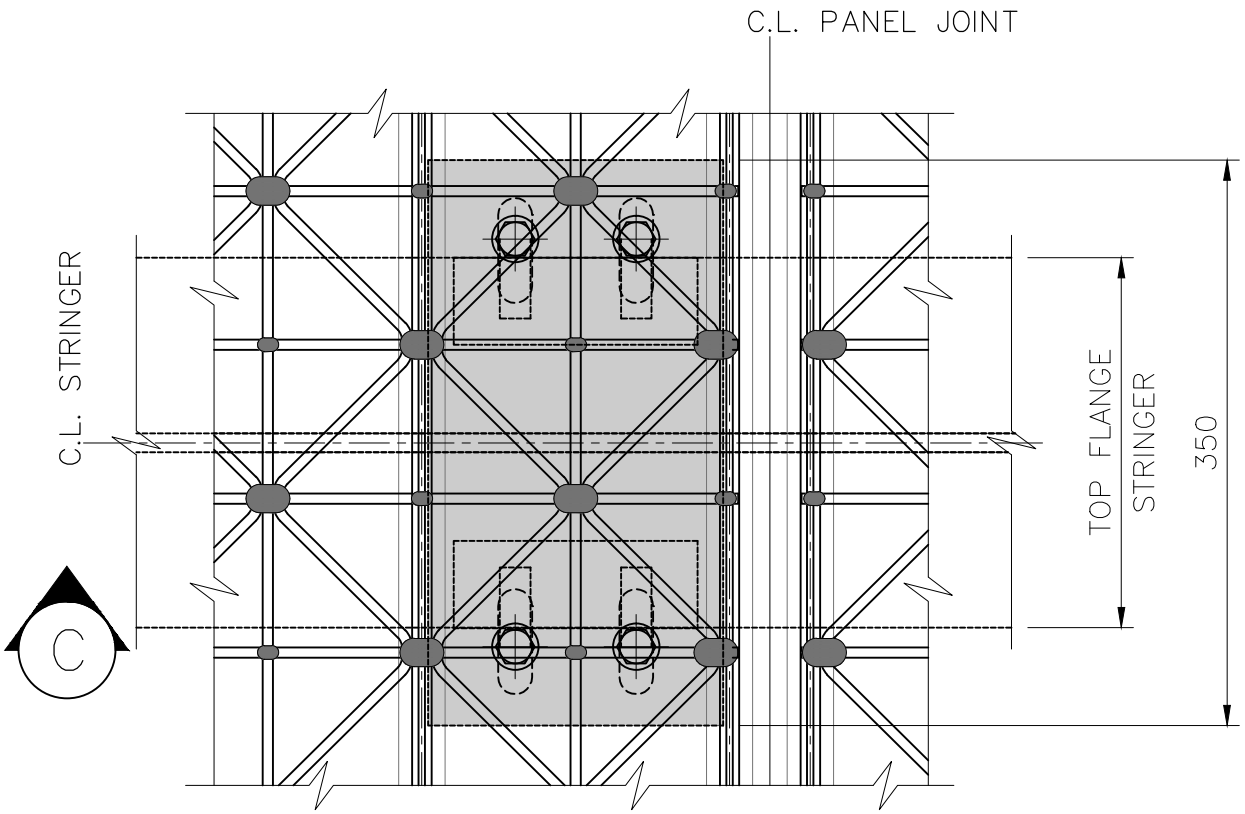
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BURLINGTON CANAL LIFT BRIDGE

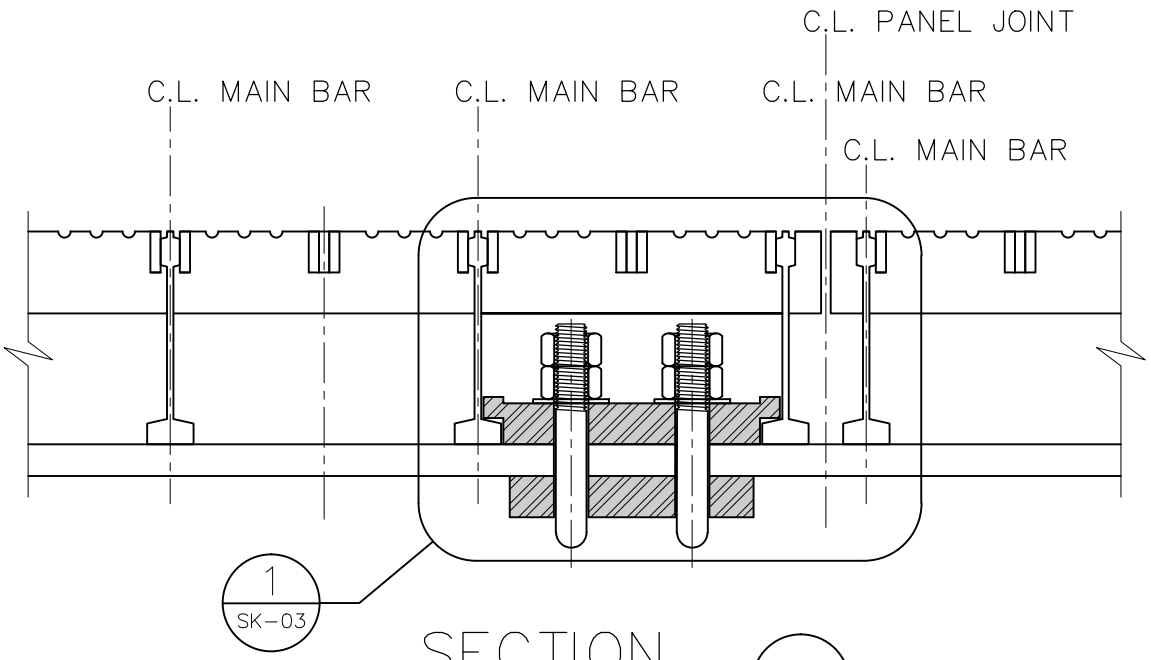
Drawing title:
M–BEAM TO STRINGER OPTION B

Drawing no.:	SK–02
Project no.:	**R.081864.001**
Project date:	**2017 - 04 - 05**
Designed by:	**D.W.**
Approved by:	**M.S.**
Bid:	



PART PLAN GRATING PANEL B

SCALE 1:5



SECTION C

SCALE 1:5

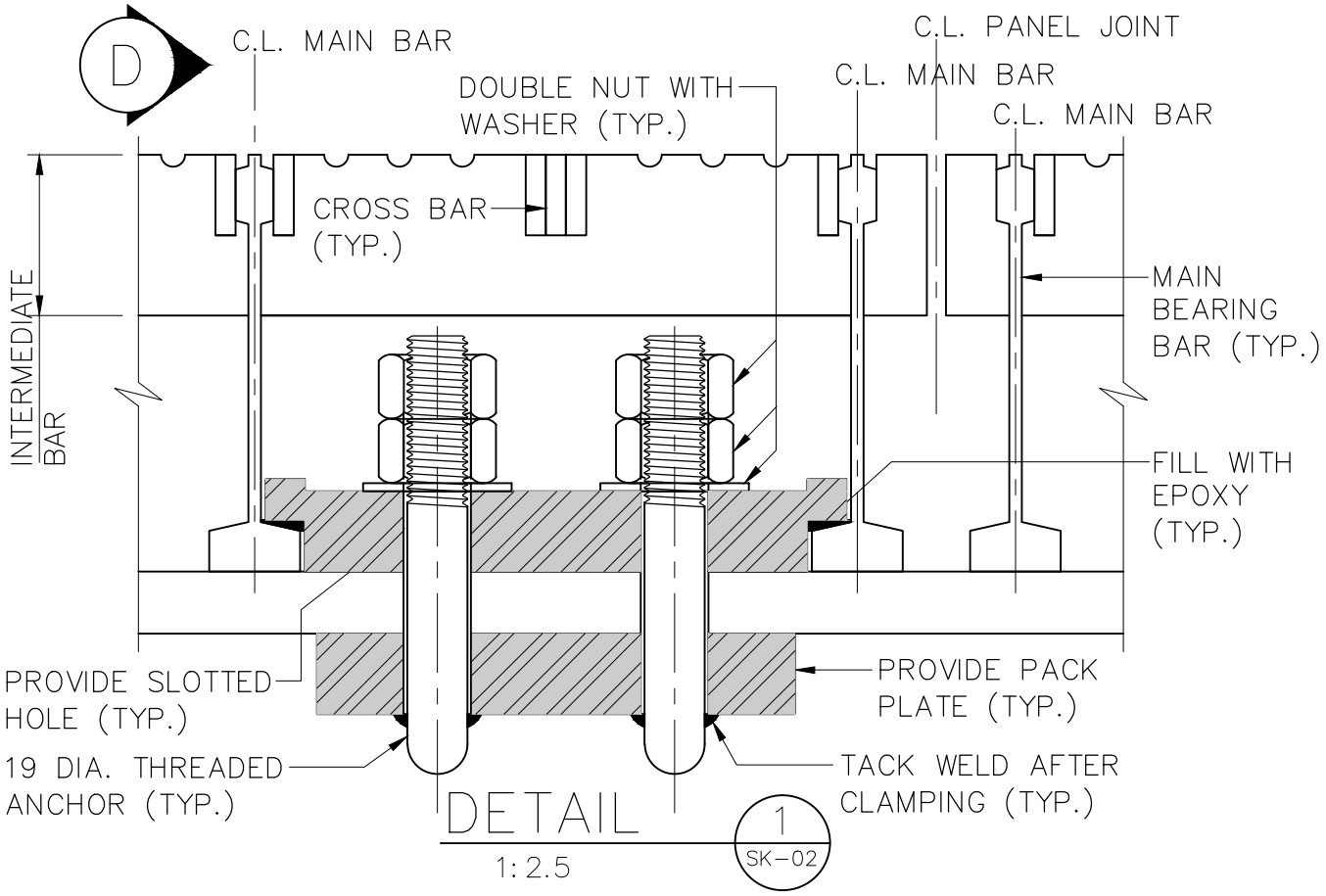
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BURLINGTON CANAL LIFT BRIDGE

Drawing title:
M–BEAM TO STRINGER OPTION B

Drawing no.:	SK–03
Project no.:	**R.081864.001**
Project date:	**2017 - 04 - 05**
Designed by:	**D.W.**
Approved by:	**M.S.**
Bid:	



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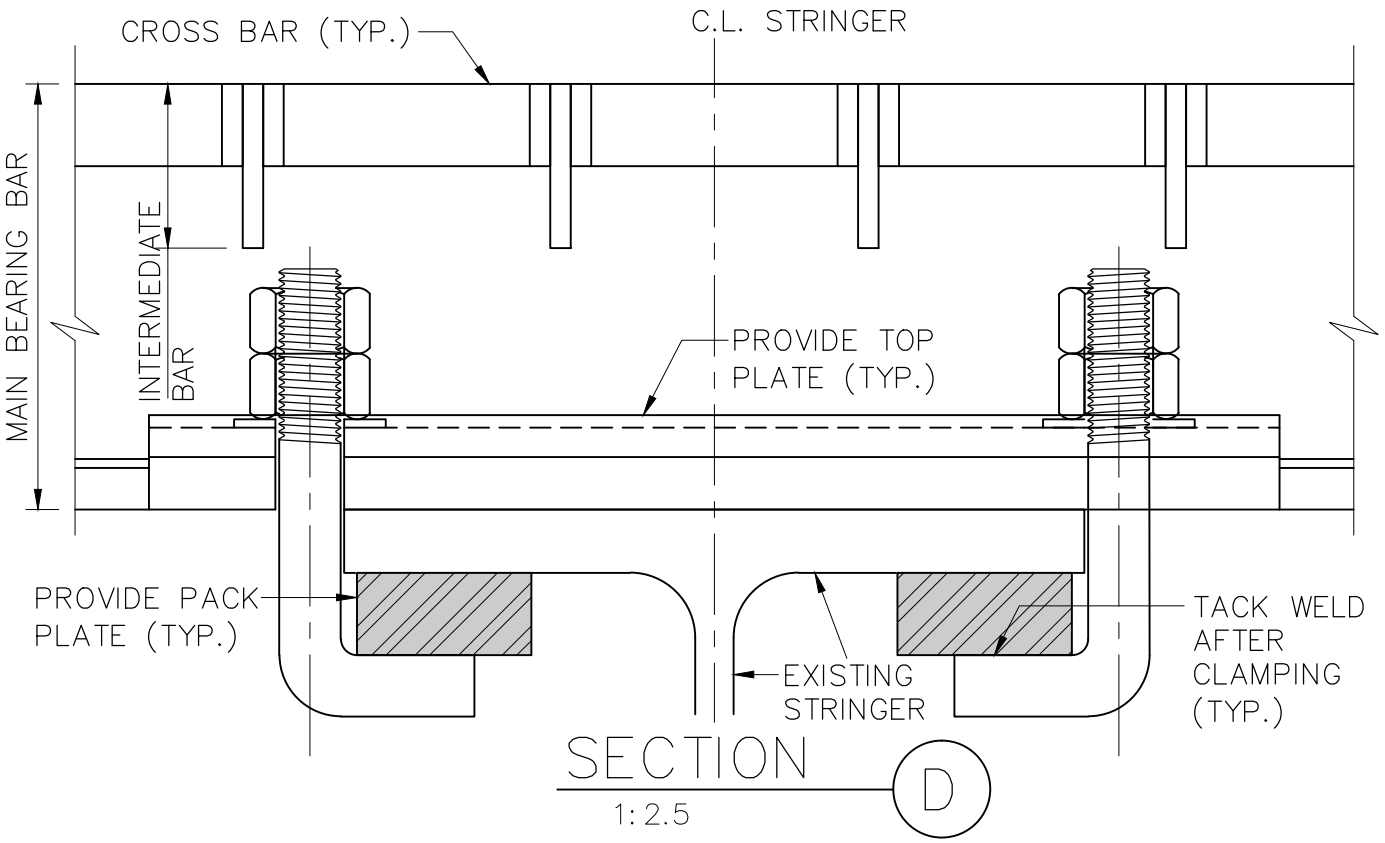

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GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

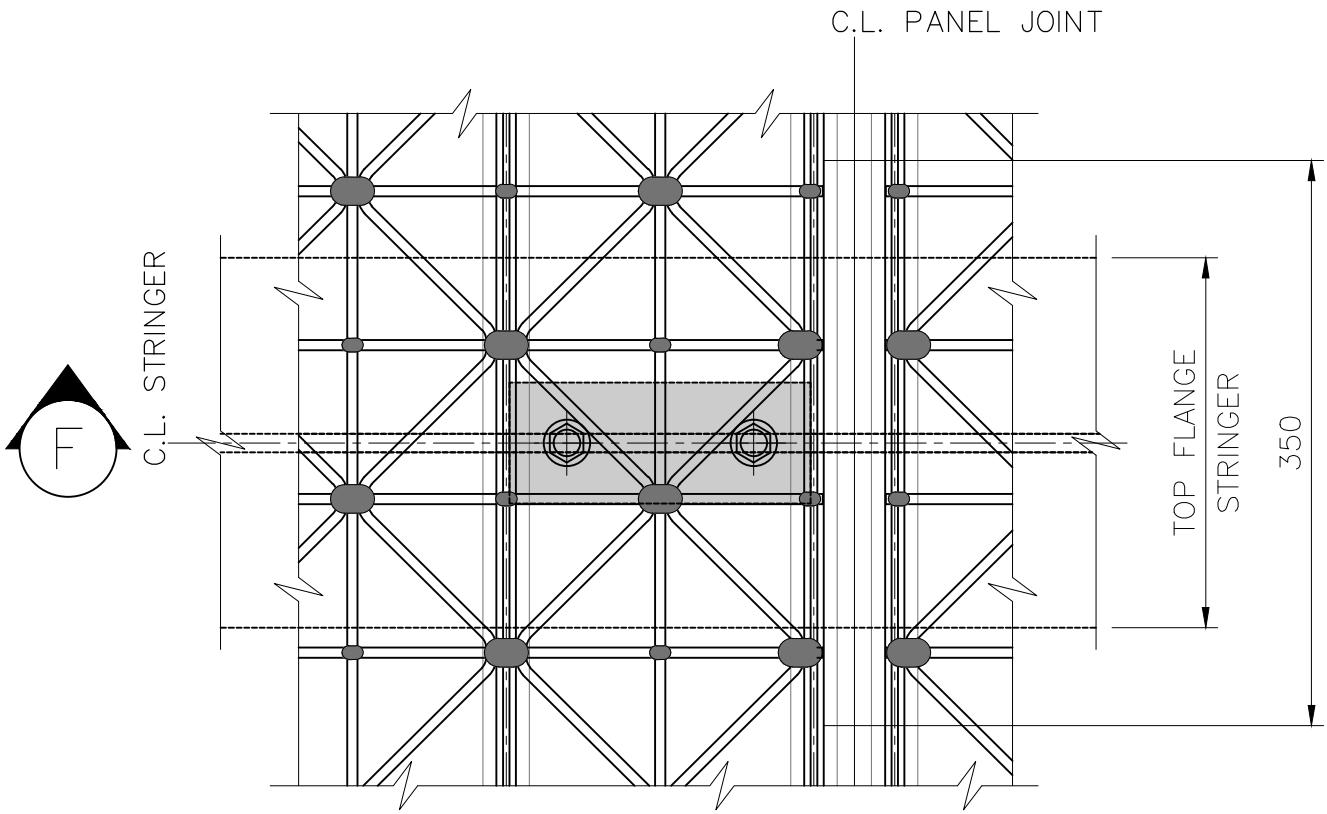
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BURLINGTON CANAL LIFT BRIDGE

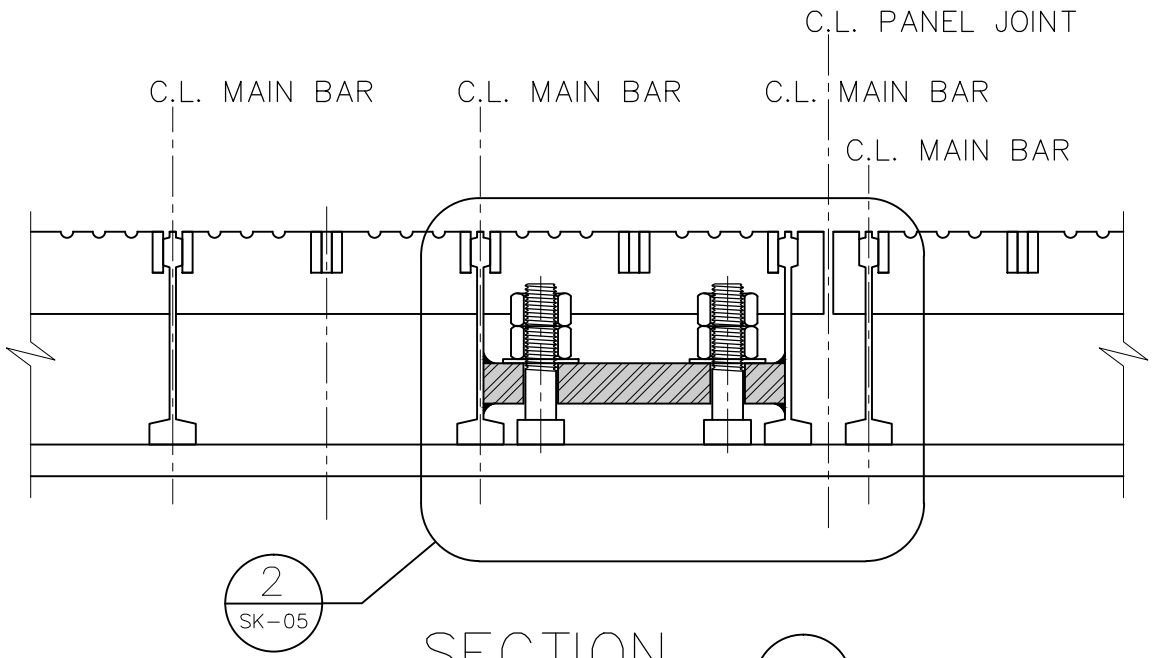
Drawing title:
M–BEAM TO STRINGER OPTION C

Drawing no.:	SK–04
Project no.:	**R.081864.001**
Project date:	**2017 - 04 - 05**
Designed by:	**D.W.**
Approved by:	**M.S.**
Bid:	



PART PLAN GRATING PANEL E

SCALE 1:5



SECTION F

SCALE 1:5

GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

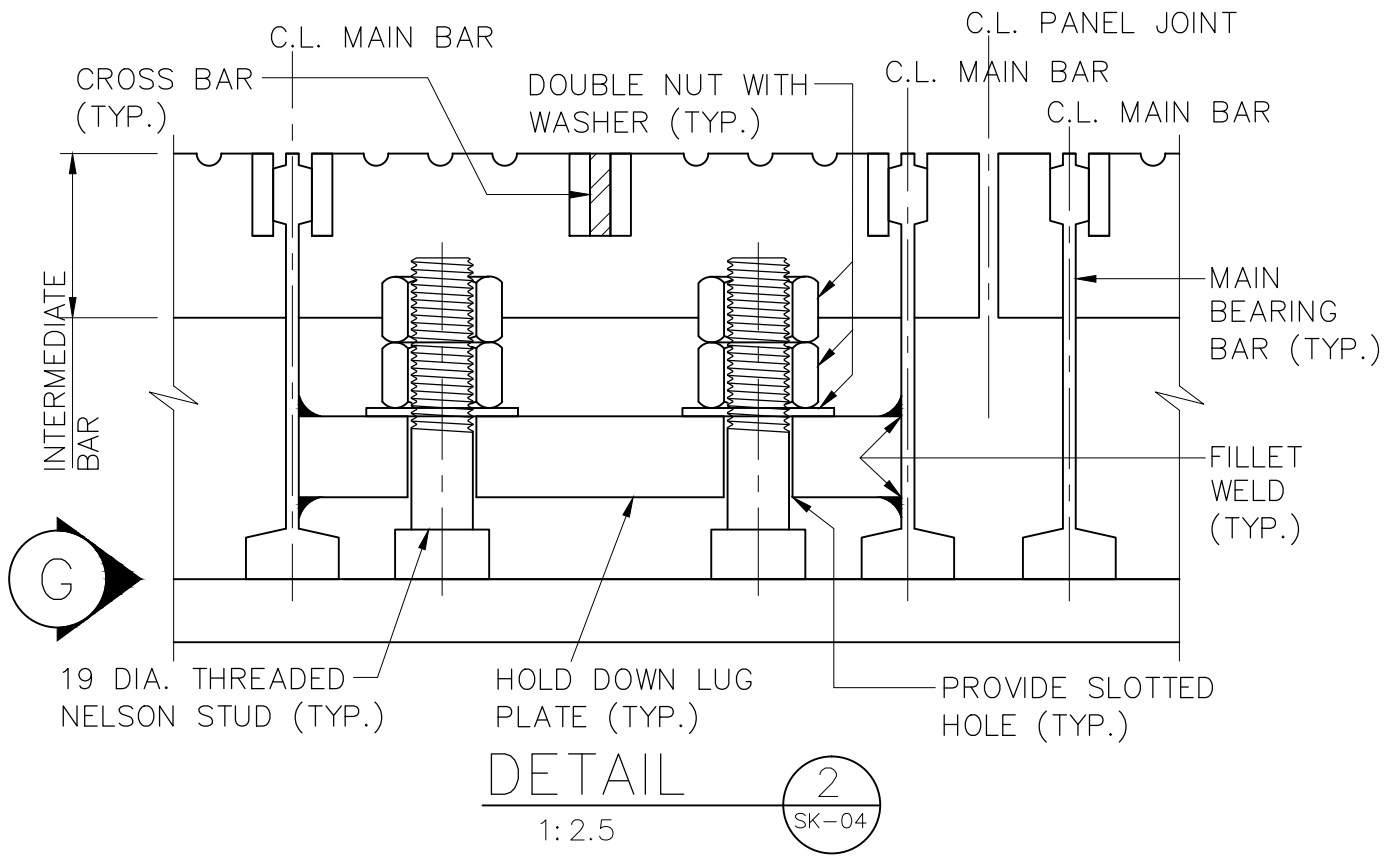
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BURLINGTON CANAL LIFT BRIDGE

Drawing title:
M–BEAM TO STRINGER OPTION C

Drawing no.:	SK–05
Project no.:	**R.081864.001**
Project date:	**2017 - 04 - 05**
Designed by:	**D.W.**
Approved by:	**M.S.**
Bid:	



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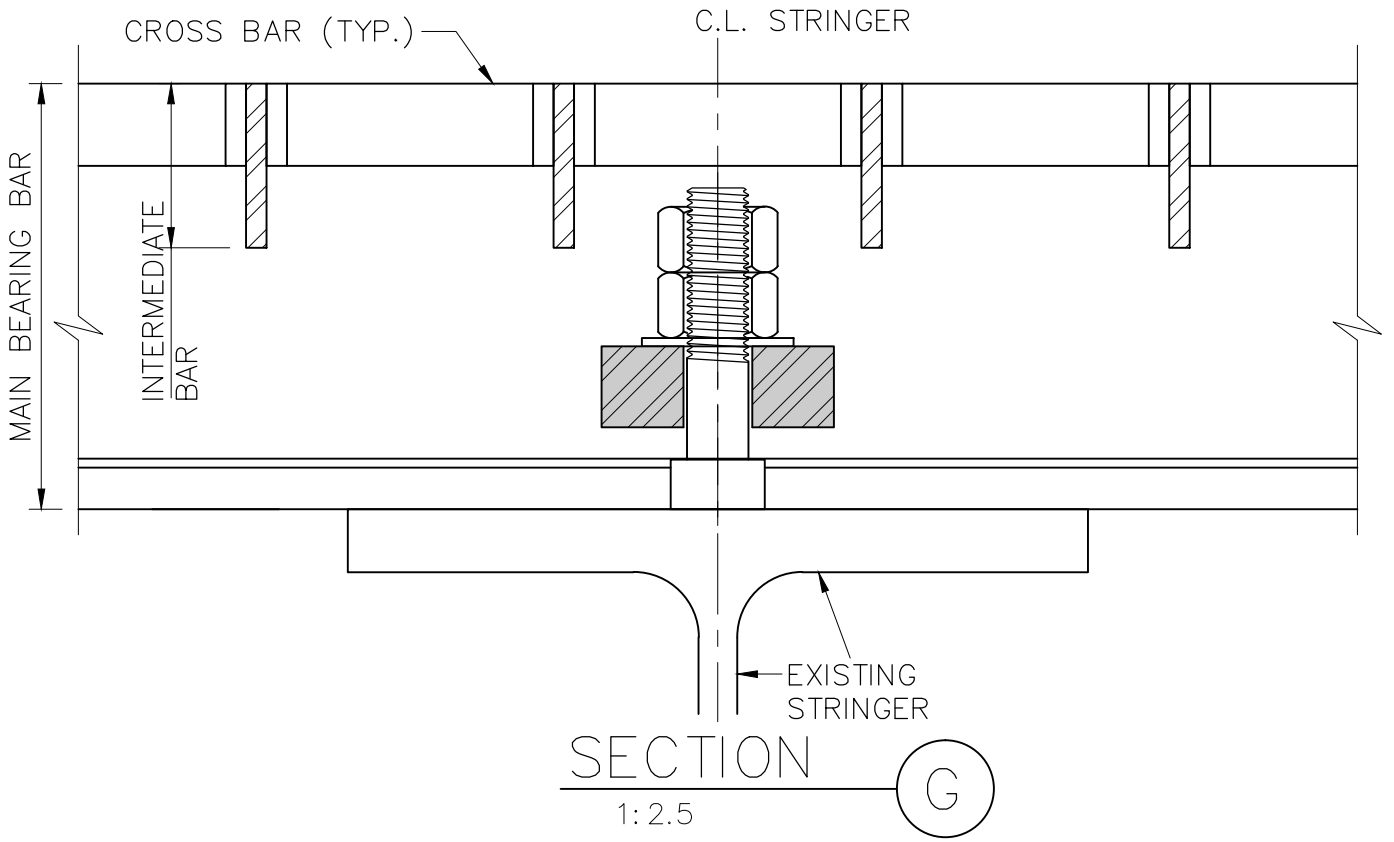

SECTION G
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GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

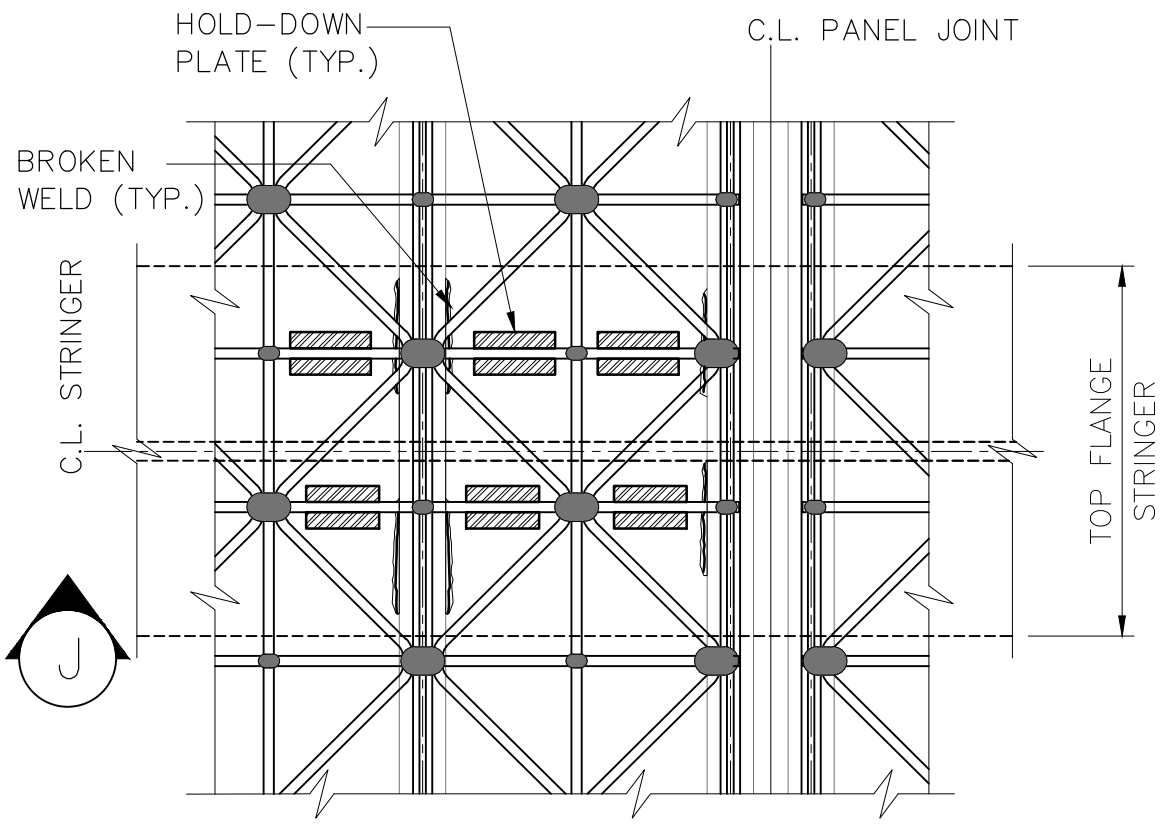
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BURLINGTON CANAL LIFT BRIDGE

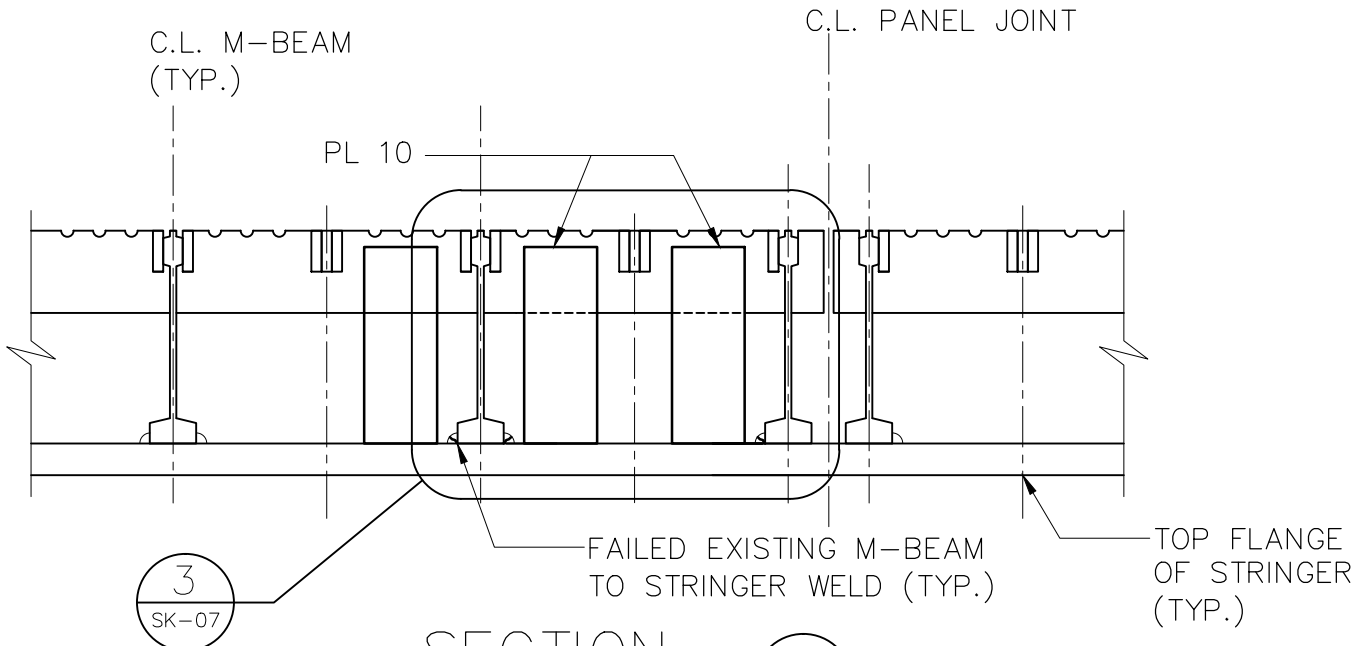
Drawing title:
M–BEAM TO STRINGER OPTION D

Drawing no.:	SK–06
Project no.:	**R.081864.001**
Project date:	**2017 - 04 - 05**
Designed by:	**D.W.**
Approved by:	**M.S.**
Bid:	



PART PLAN GRATING PANEL H

SCALE 1:5



SECTION J

SCALE 1:5

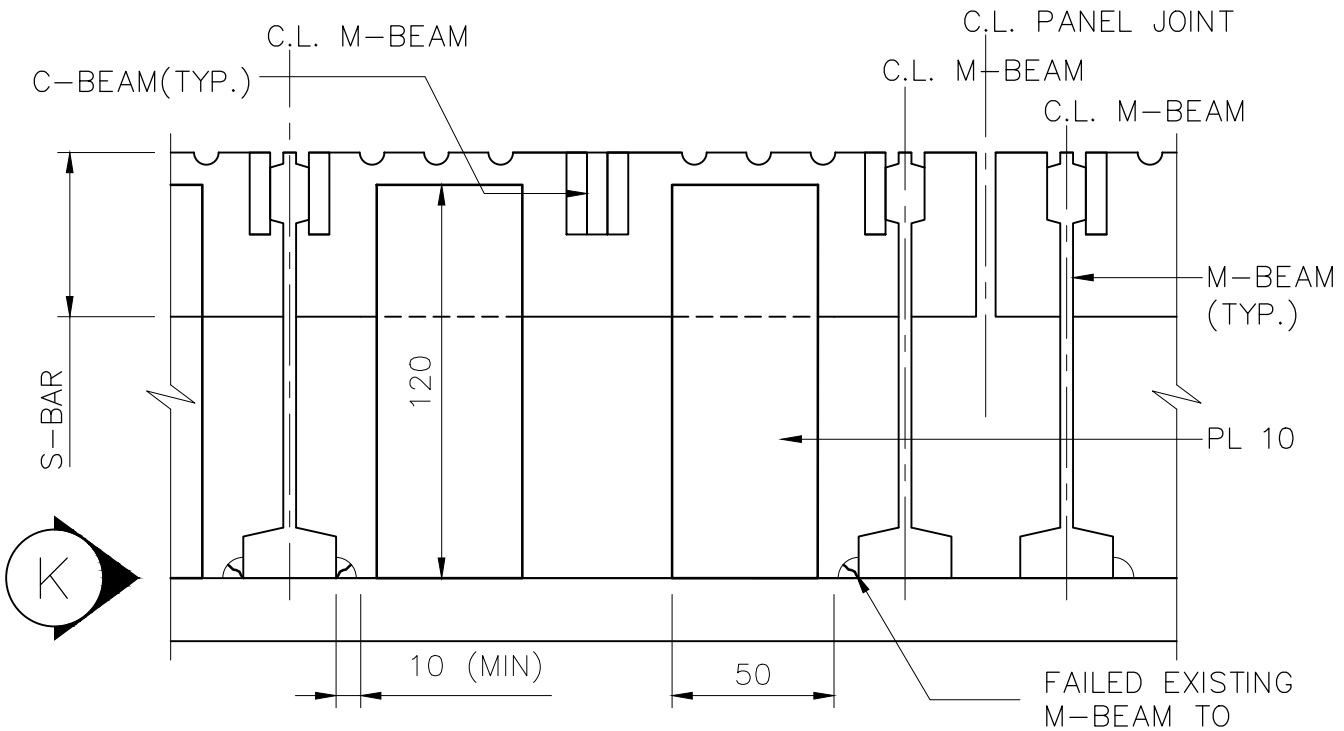
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BURLINGTON CANAL LIFT BRIDGE

Drawing title:
M–BEAM TO STRINGER OPTION D

Drawing no.:	SK–07
Project no.:	**R.081864.001**
Project date:	**2017 - 04 - 05**
Designed by:	**D.W.**
Approved by:	**M.S.**
Bid:	



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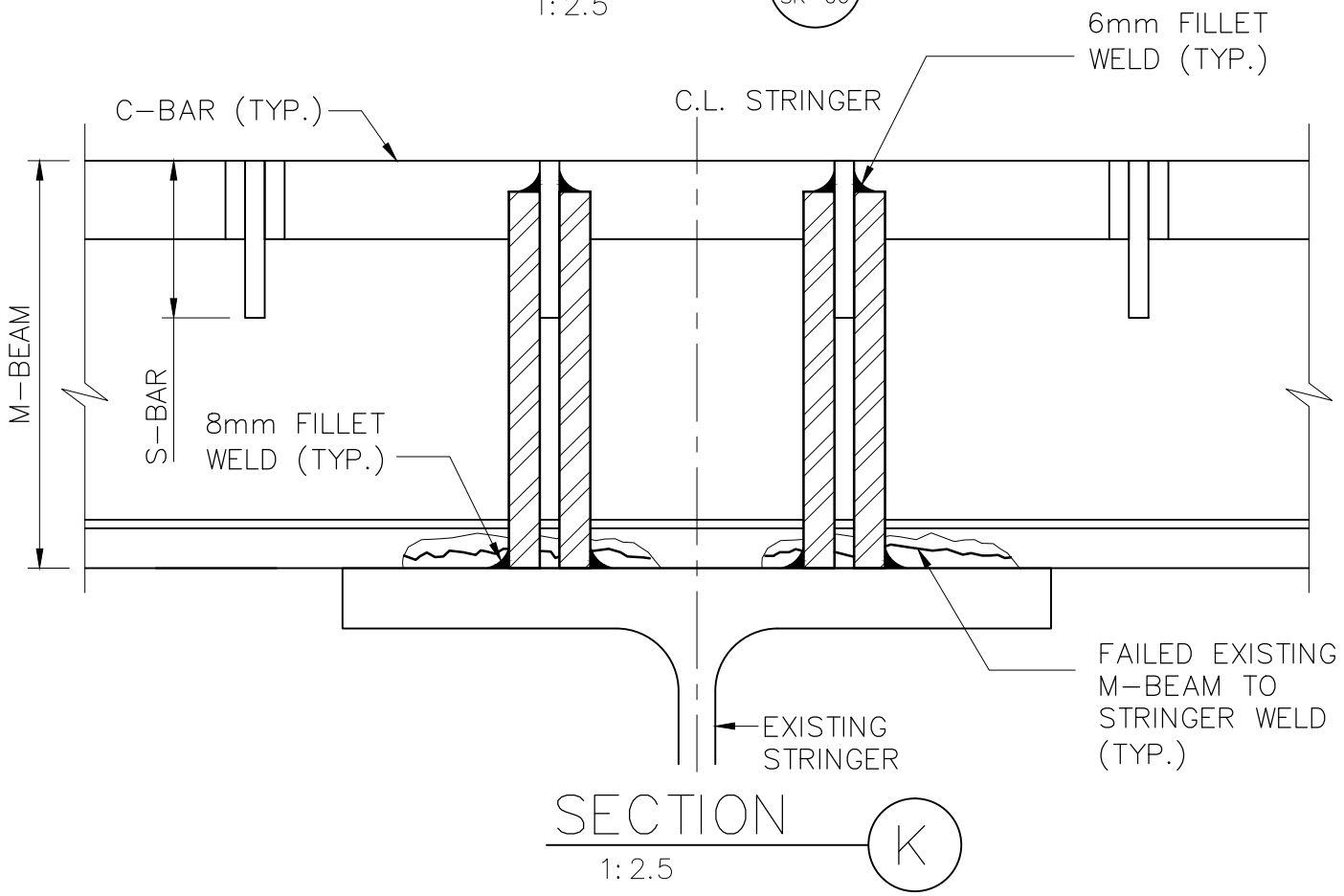

SECTION K
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GSC–A4A1 DATE PLOTTED: PLOT SCALE: CAD FILE:

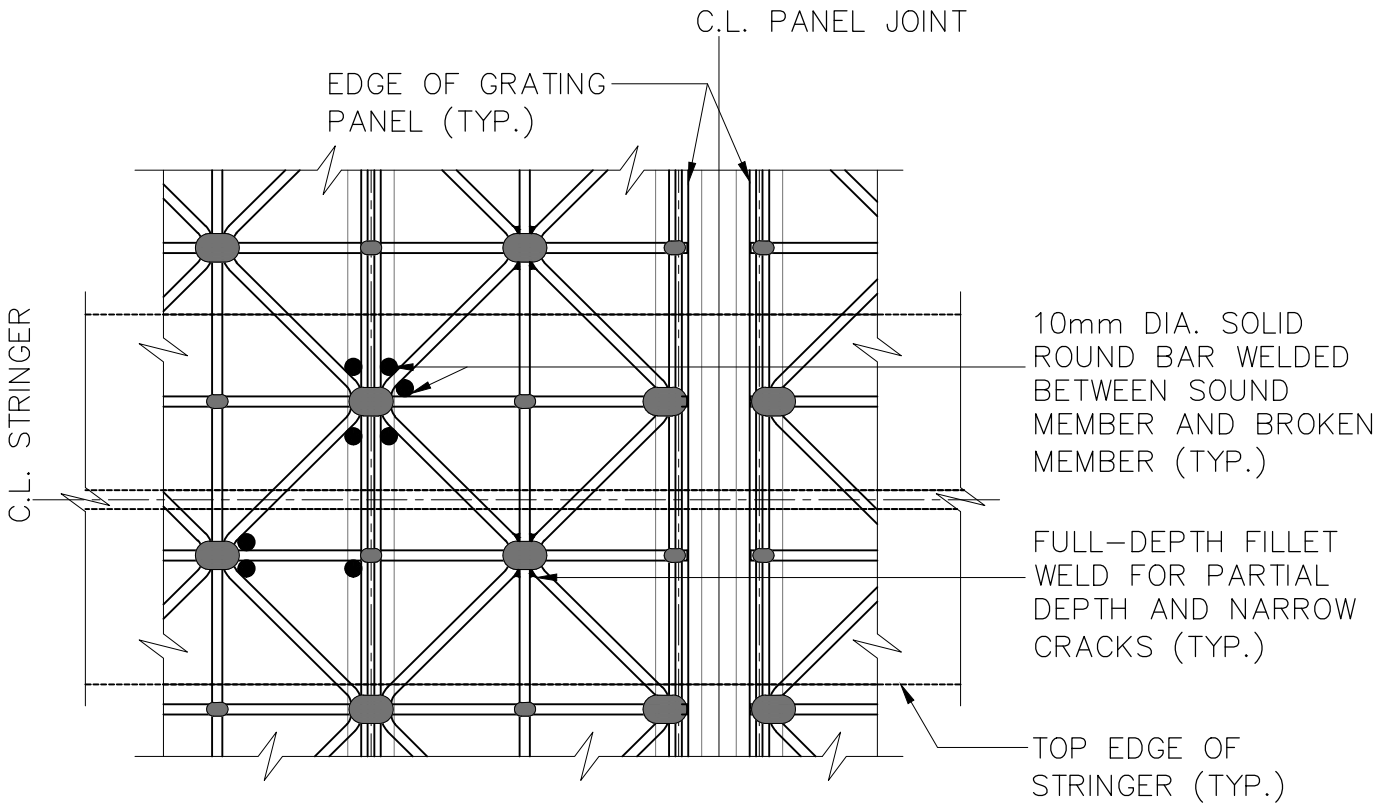
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

MORRISON HERSHFIELD

Project title:
BURLINGTON CANAL LIFT BRIDGE

Drawing title:
LOCAL GRATING FAILURE AREA REPAIR

Drawing no.:	SK–08
Project no.:	**R.081864.001**
Project date:	**2017 - 04 - 05**
Designed by:	**D.W.**
Approved by:	**M.S.**
Bid:	



PART PLAN GRATING PANEL L

SCALE 1:5

LEGEND:

FACTORY OR EXISTING PLUG WELD (TYPICAL ALL INTERSECTIONS)

Appendix F

COST ESTIMATE

BCLB: Urgent Steel Deck Grating Repairs

April 2017

Recommended Repairs

Item No.	Item Description	Unit	Quantity	Estimated Unit Price	Total
Pre-Construction Inspection					
1	Traffic Control	hour	17	$ 110.00	$ 1,870.00
2	Site Inspection by Contractor's Representative	hour	15	$ 100.00	$ 1,500.00
				Subtotal	**$ 3,370.00**
				20% Contingency	**$ 674.00**
				Total with Contingency	**$ 4,044.00**
Repair Item 8.1 Button Welds Cracks - Re-Welding (estimated amount of weld repairs - 4000)					
3	Traffic Control	hour	150	$ 110.00	$ 16,500.00
4	Site supervision	hour	100	$ 130.00	$ 13,000.00
5	Weld Repairs	hour	400	$ 70.00	$ 28,000.00
6	Preparation (locating, grinding, cleaning)	hour	100	$ 50.00	$ 5,000.00
7	Equipment (pick up + welding arc)	hour	400	$ 36.00	$ 14,400.00
				Subtotal	**$ 76,900.00**
				40% Contingency	**$ 30,760.00**
				Total with Contingency	**$ 107,660.00**
Repair Item 8.2 M-beam to Stringer Failure - Repair OPTION D - Hold Down					
8	Traffic Control	hour	260	$ 110.00	$ 28,600.00
9	Site supervision	hour	180	$ 130.00	$ 23,400.00
10	Deck Surface preparation (locating, cleaning, clamping)	hour	350	$ 50.00	$ 17,500.00
11	Weld Repairs	hour	700	$ 70.00	$ 49,000.00
12	Material (4 No steel plates per 1 cracked weld)	kg	330	$ 2.00	$ 660.00
13	Equipment (pick up + welding arc)	hour	700	$ 36.00	$ 25,200.00
				Subtotal	**$ 144,360.00**
				40% Contingency	**$ 57,744.00**
				Total with Contingency	**$ 202,104.00**
Repair Item 8.3 Local Grating Failure Areas - Re-Welding with Solid Round Bars (each - approx. 1m2)					
14	Traffic Control	hour	130	$ 110.00	$ 14,300.00
15	Site supervision	hour	90	$ 130.00	$ 11,700.00
16	Surface Preparation (locating, grinding, cleaning, clamping)	hour	175	$ 50.00	$ 8,750.00
17	Weld Repairs	hour	350	$ 70.00	$ 24,500.00
18	Material (round steel bars)	kg	100	$ 2.00	$ 200.00
19	Equipment (pick up + welding arc)	hour	350	$ 36.00	$ 12,600.00
				Subtotal	**$ 72,050.00**
				40% Contingency	**$ 28,820.00**
				Total with Contingency	**$ 100,870.00**
				Grand Total with Contingency	**$ 414,678.00**