County of Bruce

Class Environmental Assessment
Durham Street Bridge, Walkerton
Third-Party Review

Prepared by:
Triton Engineering Services Limited and Burgess Engineering Inc.

February 20, 2024

Table of Contents

List of Appendices

1.0 Introduction

At the request of the County of Bruce (County or Bruce County) Engineering Department, Triton Engineering Services Limited (Triton) along with Burgess Engineering (Burgess) has completed an independent third-party review for various aspects of the *Schedule C Municipal Class Environmental Assessment (MCEA),* Durham Street Bridge (Bridge) Replacement, Walkerton that is currently being completed by BM Ross and Associates (BM Ross). BM Ross has thoroughly worked through the process, initiating the project in February 2021 and hosting public meetings, most recently on May 11, 2023 which presented the preferred alternative to replace the existing bridge with a concrete span structure as well as the associated detouring options during construction. As a result of public and stakeholder comments/feedback received from the May 11, 2023 Public Meeting, Bruce County Council directed staff on July 6, 2023 to procure a third-party consultant to review and provide comment and recommendation on the following topics as part of the MCEA process:

Detour Route Assessments and Unidentified Alternative Locations

1. A review of the proposed detour alternatives for the Durham Street Bridge Replacement, as identified in the ongoing Schedule C MCEA, including reviewing the implications of a temporary bridge and potential locations not currently identified.

Alternative Structure Replacement Material

2. A review of implications (by means of comparison) of a wooden permanent bridge vs. a concrete construction permanent bridge, both in length of construction (time) and cost, as well as consideration of environmental factors such as hydrology, etc.

Proposed Temporary Life Extending Repair Measure

3. A review of BM Ross' proposed life extending measures (reinforcement) for the existing Durham Street Bridge to ensure public safety is maintained and a professional opinion on whether there could be another life extending measure considered.

To assist with the third-party review, the following background and supporting technical and consultation documents were circulated to Triton and Burgess:

- Condition of Half Joints Letter, dated June 17, 2019 (Appendix D)
- 2020 Ontario Structural Inspection Manual (OSIM) Report
- Hydraulic Report, dated October 4, 2022
- Geotechnical Investigation, dated March 24, 2023
- Half Joint Repair Drawing Set, dated June 7, 2022
- Reinforcement of the Durham Street Bridge, dated June 22, 2023
- Consultation Summary from the May 11, 2023 Public Meeting
- Existing bridge drawings, dated January 31, 1936
- Working drawings submitted in AutoCAD .dwg format.

2.0 Third-Party Review

Following review of the background documents, Burgess performed an independent inspection of the Durham Street Bridge and documented the results in a report, completed consistent with the Ontario Structure Inspection Manual (OSIM). A copy of this inspection report is found in Appendix A.

The scoring of the Bridge Condition Index (BCI) indicated that rehabilitation of the existing structure should be considered. To further understand and verify the overall condition of bridge elements including bridge deck, railings, sidewalk, abutments soffit, girders, joints and piers, it was determined that a detailed bridge condition survey was required. The intent of completing a detailed bridge condition survey was to inform whether to include or exclude structure rehabilitation as a viable alternative for consideration and evaluation within the MCEA process.

Consequently, the HAL Group Inc. (HAL) was retained by the County to perform a Detailed Bridge Condition Survey (January 2024). The results of the detailed condition survey were reviewed by Burgess and recommendations were documented in a letter dated, January 12, 2024, which stated a need for immediate repair of the Bridge's half-joints and connected structure elements together with quarterly inspections, until repairs are completed. Further, Burgess recommended the County apply a 3-level load limit of 15, 25 and 30 tonnes to the bridge to reduce the repetitive impact caused by heavy truck traffic. Additional details of the Bridge Condition Survey and the required immediate repair measures are provided in Section 3.0.

Supplemental to the Burgess recommendations, Triton completed a follow-up letter, dated January 19, 2024, which provided the County with direction concerning the signage and updates to the County By-law required for the bridge weight restrictions and alternate truck route signage.

The Burgess letter and Detailed Condition Survey are presented in Appendix B and the Triton letter is presented in Appendix C.

Sections 2.1 through 2.3 review the three topics from the MCEA process, consistent with Bruce County Council direction.

2.1 Detour Route Assessment & Unidentified Alternative Locations

As presented at the May 11, 2023 public meeting, the preferred alternative for the Durham Street Bridge is to replace the existing structure in the same location. As a result of this outcome, BM Ross further investigated potential detouring options to manage vehicle and pedestrian traffic during construction. Based on the background information provided, it is our understanding the detour options are as follows:

- County Road Detour – Use of County Roads North and South of Walkerton to detour truck traffic including possible improvements to County Roads
- Local Detour Route (8.2km) – Local traffic to use detour to the north via Bruce Road 19, Concession 2 and Yonge Street. This route includes various intersection upgrades to enable adequate vehicle turning movements as well as providing a local shuttle service.
- Temporary Vehicle/Pedestrian Bridge – Adjacent to Orange Street
- Temporary Pedestrian Bridge – Adjacent to Orange Street

As part of the Third-Party Review, we feel it is necessary to maintain an alternate truck detour route during construction and as such, the cost for truck detour was not assessed. The following table summarizes the

updated 2024 order of magnitude cost for replacement of the Bridge in the same location and associated detour route.

Item	*Capital Cost (2024)*
Bridge Replacement in same location ***Detour via*** **Local Detour Route (8.2km)**	*$ 15,750,000.00*
Bridge Replacement in same location ***Detour via*** **Temporary Vehicle Bridge Adjacent to Orange Street**	*$ 20,500,000.00*
Bridge Replacement in same location ***Detour via*** **Temporary Pedestrian Bridge Adjacent to Orange Street**	*$ 16,300,000.00*

The above costs include all tangible costs (labour and material), engineering and contingency allowance. It is estimated that the bridge replacement, and the various detours could be complete within a range of 24 to 36 months and extend the Bridge's service life to at least seventy-five (75) years, provided regular preventative maintenance activities are implemented and sustained.

Triton considered possible alternative detour routes for a complete structure replacement in the same location and have concluded that they were either not reasonable/constructable due to traffic volumes or cost prohibitive when compared to the detour alternatives presented in the current MCEA process. The unidentified alternative detour routes considered are as follows:

- A new bridge on Cemetery Road
- Extension of Concession 2 Sideroad and the connection of Karin Crescent and Cunningham Drive.

Therefore, provided the outcome of the MCEA is to replace the Bridge in the same location, with considering a balance in the overall capital cost and reducing the impact to residents and businesses, Triton agrees that the preferred/selected detour route is the "Local Detour Route" alternative along with the County Road Detour as an alternate route for heavy truck traffic.

2.1.1 Alternative Bridge and Detour Considerations

Further to the detour alternatives provided above and the implementation of the immediate bridge repairs, Triton and Burgess have reviewed two (2) unidentified potential alternatives which will impact the requirement for the Local Detour Route, as described below.

Alternative 1 *– Replace Existing Bridge & Offset New Bridge Downstream – Maintain Traffic on Existing Bridge*

Offsetting and relocating the new bridge involves constructing the proposed 13.2-metre-wide bridge immediately downstream of existing bridge. The existing bridge will remain in place during construction to maintain vehicle and pedestrian access; however, at a minimum, requires the repair to all or a portion of the half-joints on the existing bridge to enable this use. This option also requires the acquisition of adjacent property which may constrain the location of the new bridge and use of existing bridge during construction. Depending on the limits of property acquisition, this option can be parted into two options as follows:

- Offset new bridge completely outside of the existing bridge footprint and continued use of the existing bridge during construction to maintain two-way traffic (See Drawing 01).
- Overlap the new bridge within a portion of the existing bridge footprint, including partial demolition of 6.0 to7.0 m of the existing structure width to maintain single lane traffic during construction (See Drawing 02).

The options above would negate the need for a local detour however, it is recommended to maintain an Alternate Truck Route to reduce vehicle loading and traffic volume during construction. The existing bridge could also be utilized as a temporary working platform to facilitate and stage various construction activities. This option to construct a new bridge on the downstream side of the existing bridge considers the following design requirements/constraints:

- Relocation of existing overhead hydro utility
- Realign existing gas utility.
- Road realignment to match new bridge location.
- New bridge to be offset a minimum 1.0 metre downstream of existing bridge.
- Property acquisition
- New pier construction in line or offset from existing piers.
- New bridge soffit design elevation (girder depth) to satisfy hydraulic design criteria.
- Acquire applicable agency permits/approvals

The estimated capital cost for bridge replacement, offset downstream from the existing bridge is reflected in the table, below.

Item	***Capital Cost (2024)***
Immediate Bridge Repairs	*$ 3,200,000.00 - $3,500,000.00*
Replacement (3 span concrete structure)	*$ 13,500,000.00*
Road Realignment	*$ 750,000.00 – $1,000,000.00*
Property Acquisition (estimated)	*$ 500,000.00 - $2,000,000.00*
Total	***$ 17,950,000.00 - $20,000,000.00***

It is estimated that the replacement and relocation could be complete within 18 to24 months; however, this does not include time for any property acquisitions which could delay the project by an additional 12 to 24 months.

The above replacement and relocation option will extend the Bridge's service life to at least seventy-five (75) years, provided regular preventative maintenance activities are implemented and sustained.

Although this Alternative is potentially viable, due to the need to implement the "Immediate Bridge Repairs" as well as the unknowns involved with the outcome of property acquisition, it is not recommended that this Alternative be brought forward for evaluation under the MCEA process.

Alternative 2 *– Rehabilitate Existing Bridge (Various Levels) – Maintain Single Lane Traffic*

Consistent with the findings of the Bridge Condition Survey (HAL, January 2024), the overall condition of various bridge components is in a state that rehabilitation is considered a good approach to increase the

bridge's service life while balancing capital and life cycle costs and reducing socio-economic impacts to the community caused by a crossing closure and lengthy local detour. Completion of the immediate bridge repairs, as detailed in Burgess' January 12, 2024 letter, will enhance the structural performance; however, will leave various bridge elements that need to be addressed and rehabilitated as follows:

- Parapet walls
- Railing system
- Piers
- Abutments
- Expansion joints above abutments (repair or removal)
- Sidewalk
- Deck waterproofing membrane
- Asphalt deck overlay
- Deck drainage piping/system
- Deck lighting

The advantage of structure rehabilitation is that local traffic can be maintained during construction, excluding heavy truck traffic exceeding the prescribed 3-level load limit weight restriction. As rehabilitation activities can be completed independent of a complete bridge closure, the need for a local detour can be eliminated and/or minimized. During rehabilitation of the Bridge, access by light duty and essential/emergency vehicles would be maintained and controlled by temporary signalization on either end of the bridge, reduced to single lane traffic. The complete rehabilitation of the Bridge considers the following design requirements/constraints:

- Design appropriate repair method to half-joints
- Acquire applicable agency permits/approvals

The order of magnitude cost for complete rehabilitation including the immediate bridge repairs, is reflected in the table, below.

Item	***Capital Cost (2024)***
Immediate Bridge Repair	*$ 3,200,000.00 - $3,500,000.00*
Remaining Bridge Rehabilitation	*$ 1,800,000.00 - $2,100,000.00*
Total	***$ 5,000,000.00 - $5,600,000.00***

It is estimated that the rehabilitation construction could be complete within 12 to 16 months. The rehabilitation option will extend the Bridge's service life to a minimum of twenty (20) years and up to forty (40) years. The length of service life is dependent on the extent of half-joint repair, to be further investigated as part of the design phase and contingent on the following:

- Repairs are required to address all visible superstructure and substructure deterioration issues.
- Periodic inspections and preventative maintenance are carried out on an annual basis and;
- The original design load(s) are maintained (otherwise structural evaluation and strengthening may be required)

Achieving a service life up to forty (40) years requires that all proposed rehabilitation items be implemented. As the bridge repairs are required to complete any work involving the use of the existing

Bridge to route traffic during construction, it is recommended that the associated works required to complete the rehabilitation of the remaining Bridge elements be further evaluated within the MCEA process.

2.2 Alternative Structure Replacement Material

The existing Bridge structure is a 67.0 metre, 5 span concrete T-Beam structure. Based on the material presented at the May 11, 2023 public meeting the proposed replacement bridge alternative is a 68.95 metre concrete box-girder structure. The existing structure is located on Bruce County Road 4 (Durham Street, Walkerton) and spans the Saugeen River. County Road 4 is a major corridor which conveys large volumes of traffic, approximately 12,000 vehicles per day through Walkerton, and is classified as an "Arterial" road.

During the public/stakeholder consultation period, a request was made that the County evaluate replacement of the existing structure with a wooden bridge as an alternative substitute to the proposed conventional concrete material. The following table outlines the various performance criteria for which a wood bridge can be considered and evaluated versus bridge replacement with a conventional concrete span bridge.

Performance Criteria	Comparison for Use of Wood Bridge vs Concrete Bridge
Constructability	• Construction time is generally shorter as on-site assembly is streamlined and most components are prefabricated off-site; however, concrete substructure (piers and abutments) is still required due to ice flow conditions which minimizes impact to construction time. • Less expertise and material available in the area to construct or maintain bridges which can cause delays in construction activities.
Capital Cost	• Generally lower capital cost to erect prefabricated wood bridge elements and less labour-intensive construction processes; however, due to limitations in span and need for structural overbuild (i.e.: additional piers on longer span bridge) to satisfy loading requirements would likely offset the savings seen in erection of the new structure.
Life Cycle Cost	• Due to its organic properties, wood is more susceptible to rot, expansion and contraction, insect and road salt damage caused by the local climatic conditions can shorten lifespan to less than 75 years. • Regular maintenance is generally more costly, including sweeping and washing deck, inspections for decay, insect infestation, application of protective coatings to prevent wood deterioration and ensuring proper drainage to prevent water damage and rot. Galvanized bolts and fasteners are more susceptible to corrosion and require replacement over time as well as periodic tightening due to expansion and contraction which, if not maintained, can lead to sagging or misalignment. • Future restoration or repair measures will be more difficult and costly as major repairs typically require full component replacement to maintain structural integrity. • More prone to structural damage caused by vandalism or natural disasters i.e.; by fire or cutting of wooden structure components.

Performance Criteria	Comparison for Use of Wood Bridge vs Concrete Bridge
Hydraulic Design	• Due to its rough surface area (higher Mannings coefficient) and the impervious characteristic of wood, wood allows for ice to embed itself on the surface and become hung up on the bridge itself, promoting ice jams within and upstream of the structure. • Spans require a deeper/wider girder causing either the road height to increase or soffit elevation to decrease making it difficult to satisfy hydraulic design criteria.
Structural Design	• Limitations in load capacity due to the material's organic properties. Strength is influenced by factors such as wood species, quality, and pre-treatment. Overall load-bearing capabilities limit heavy loads and ability to accommodate larger traffic volumes. • The use of wood for girders may require additional piers due to structural limitations in span length. • Lighter weight material does not perform well against ice jams and is more susceptible to substructure damage.

In general, and as outlined in the previous table, as the bridge is located on a heavily used road corridor (approximately 12,000 vehicles per day) which also sees large volumes of heavy truck traffic, the need to implement a new bridge made of a material that provides the most structural durability, load capacity and overall lower maintenance costs is essential in sustaining a long-term safe and reliable bridge crossing. Furthermore, although a wood bridge structure can be a cost-effective alternative to conventional concrete, the use of a wood bridge to replace the Durham Street Bridge is not recommended and should not be considered for further evaluation within the MCEA process.

2.3 Proposed Temporary Life Extending Repair Measures

Consistent with the findings of the Bridge Condition Survey and further to the BM Ross letter regarding Condition of Half Joints, dated June 17, 2019, due to their condition, the need for repair of the half-joints has been reinforced and confirmed. This repair is recommended to occur in 2024 and ahead of the MCEA completion.

Supplemental to their June 17, 2019, letter, BM Ross has designed a temporary support system for the bridge's half joints, as per the drawing set dated June 7, 2022. The temporary support system is an interim repair to extend the life of the existing structure. The half joint repair design has been reviewed by Burgess. In general, as a temporary measure, the proposed repair will function to support the bridge at the half joints; however, the following is recommended to provide further redundancy in the support system:

- Extend I-Beams further beyond the half joint (calculations required).
- Grout space between I-Beam and existing arched girder to provide bearing surface area.
- Incorporate an additional set of threaded bars to provide support on left and right side of the half joint.

Refer to the sketches of the recommended temporary support system presented on Figures 1 and 2.

3.0 Detailed Bridge Condition Survey

As previously mentioned, HAL was retained by the County to perform a detailed bridge condition survey. HAL provides a variety of structural inspection services related to bridge condition surveys and inspections. As part of this specific bridge condition survey, HAL performed visual observation inspections to record surface defects, delamination detection and grid layouts. As well, physical sawn asphalt samples and concrete core samples were taken to perform corrosion potential surveys and complete lab testing of the concrete cores to understand road salt intrusion through the bridge deck.

In general, the bridge's deck, soffit, and girder surfaces exhibit signs of rebar corrosion as a result of concrete delamination. Laboratory testing of the bridge deck core samples show minimal corrosion potential to the deck rebar and the concrete compressive strength is high at an average of 76.8 MPa. The half-joints, located in the centre span of the bridge show signs of leaking.

Burgess assessed the findings from the HAL report and provided a letter dated January 12, 2024 (refer to Appendix B) to Bruce County, which recommends immediate repairs to the half-joints and any associated bridge components that are conjunctive with the half-joints. To reduce the repetitive impact to the structure caused by heavy truck traffic, it was recommended that a weight restriction be implemented on the bridge. The weight restriction is to be accomplished by implementing a 3-Level Load Limit of 15, 25 and 30 tonnes.

3.1 Immediate Bridge Repairs

The immediate need for the bridge's half-joint repairs and associated structural components is recommended to occur in 2024 to maintain safe passage over the Durham Street Bridge while the MCEA process is being finalized.

The existing bridge deck is comprised of a 165 mm conventionally reinforced suspended concrete slab atop of arched concrete girders spanning piers. The bridge deck is designed as a one-way slab resolving both gravitational and lateral loads into the corresponding girders below. Based on the concrete delamination survey contained within Drawings 4A and 4B prepared by HAL, dated October 2023 (refer to Appendix B), the majority of the bridge deck is exhibiting high levels of corroded reinforcing steel on the underside of the bridge (soffit and girders). To facilitate an adequate partial depth concrete repair pursuant to Ministry of Transportation (MTO) Structure Rehabilitation Manual (Article 2.3) and industry standards, along with the need for the bearing plate replacement of the half-joints, the delaminated concrete within the half-joints, soffit and girder areas must be removed to a minimum of 25 mm beyond the corroded reinforcing steel until sound concrete is discovered.

The primary function of reinforced concrete structures relies on the transfer of tensile forces from the concrete into the reinforcing steel. If large areas of this reinforcing steel are locally excavated to facilitate the necessary repairs, we have concerns with the structure's capacity to support functioning live loads (traffic) above and therefore, the underside of the bridge should also form part of the immediate bridge repairs. As such, it is recommended to undertake the immediate bridge repairs to the identified underside of the bridge deck, along with the half joints along the middle bridge span in an unloaded state. These repairs can be facilitated in two-phases by transferring traffic to a single lane and completing the necessary repairs under the unloaded areas on the right and left sides, independently. Figures 1, 2 and 3 provide a visual representation of the various immediate repair techniques for the Durham Street Bridge.

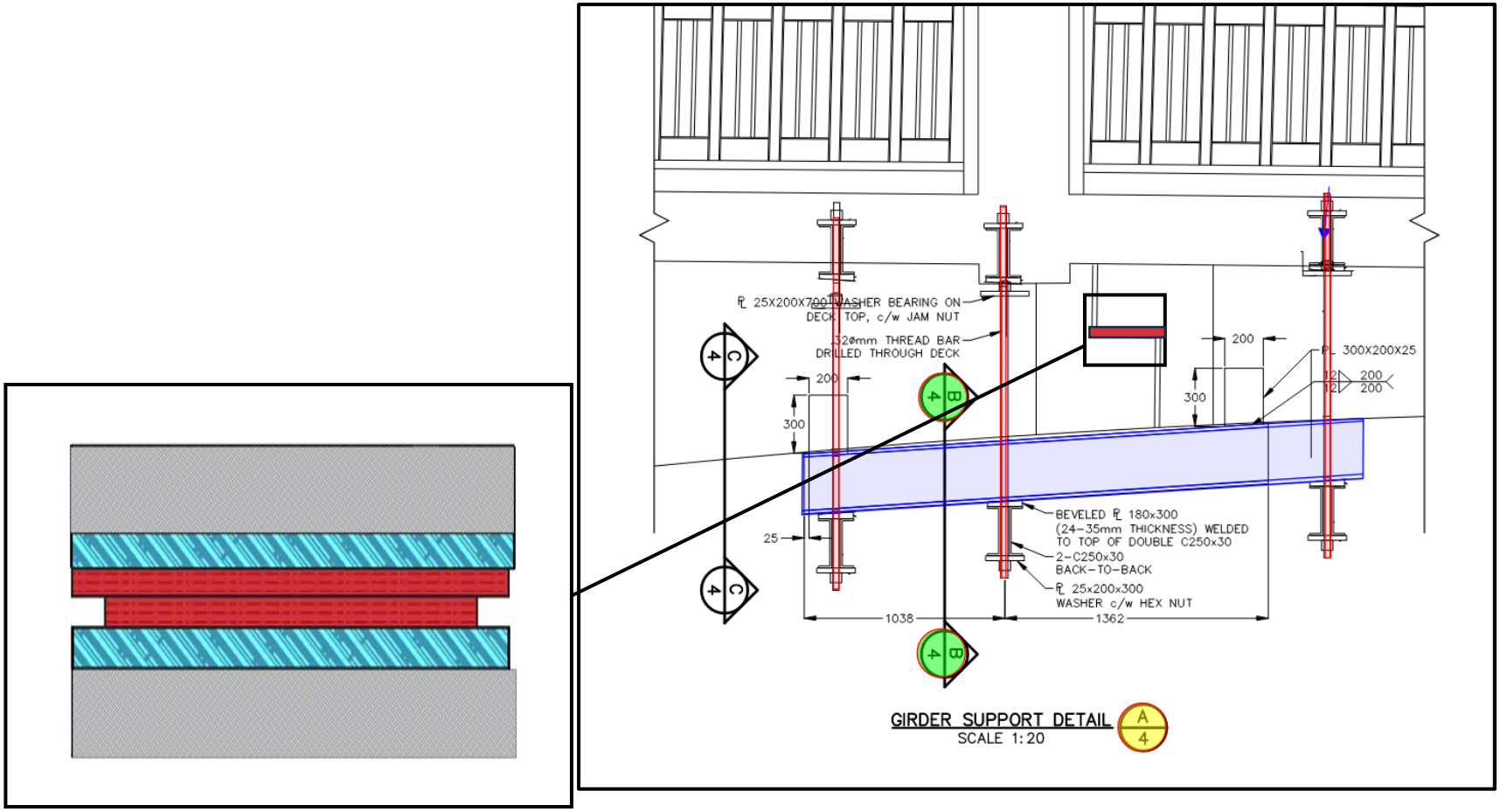


Figure 1: Provides an example of half-joint repair to replace the internal concrete and metal elements and by use of a temporary girder support system.

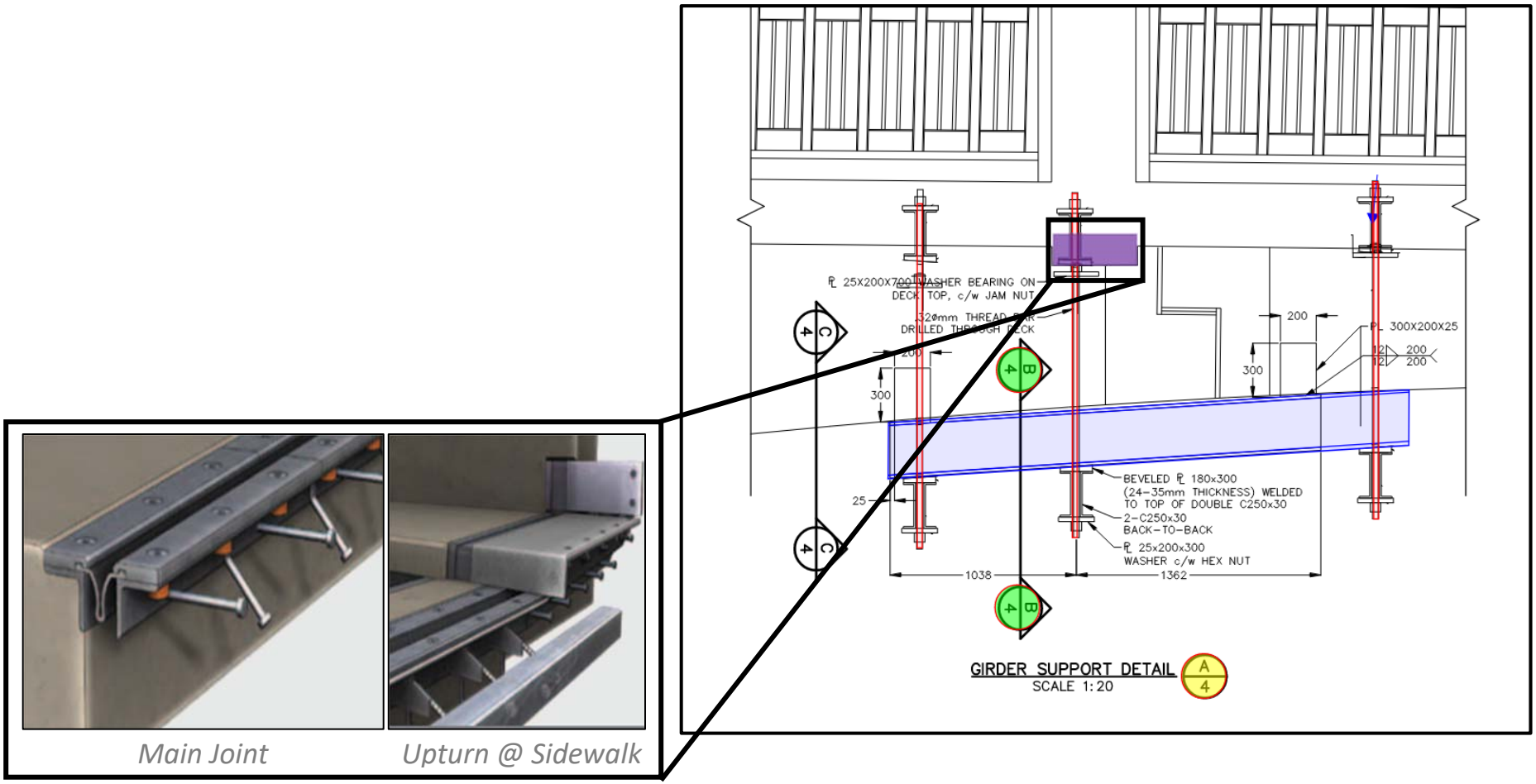


Figure 2: Provides an example of expansion-joint repair by use of a girder support system.

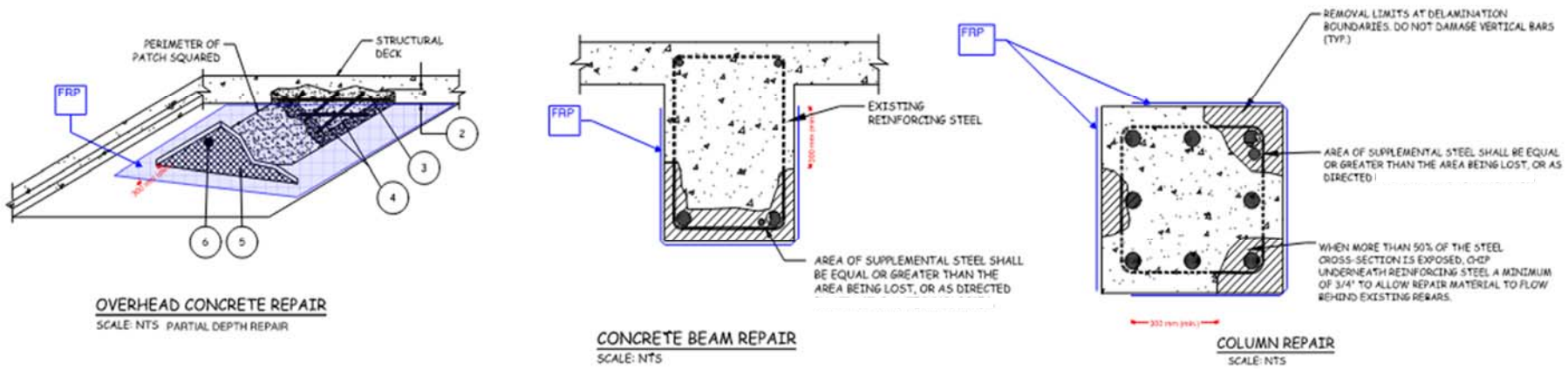


Figure 3: Details typical underside (soffit, girder, beam) repair techniques by way of crack injecting, concrete chipping and form and pump concrete.

The estimated construction value for the immediate repairs to the Durham Street Bridge is approximately $3,200,000.00 - $3,500,000.00. Provided bi-annual bridge inspections are performed, and preventative maintenance measures are regularly implemented, the immediate bridge repairs are estimated to extend the bridges service life to a minimum of twenty (20) years.

To expedite the immediate repairs so that they can be completed within the 2024 construction season, it is recommended that the County procure the services of a “Investigate-Design-Build” (IDB) contractor who specializes in this nature of concrete repairs and in a timely manner. The Investigate-Design-Build process is considered the most appropriate approach to repairing the Durham Street Bridge over a traditional Design-Bid-Build method of procurement due to the time saved in removing the required third-party consultant design and the minimum three (3) week bid process. For the immediate repairs to occur in 2024, it is recommended the repair works commence by no later than May 1, 2024. Figure 4 below displays a comparison between the traditional and IDB approach and illustrates how IDB will achieve the required timeline.

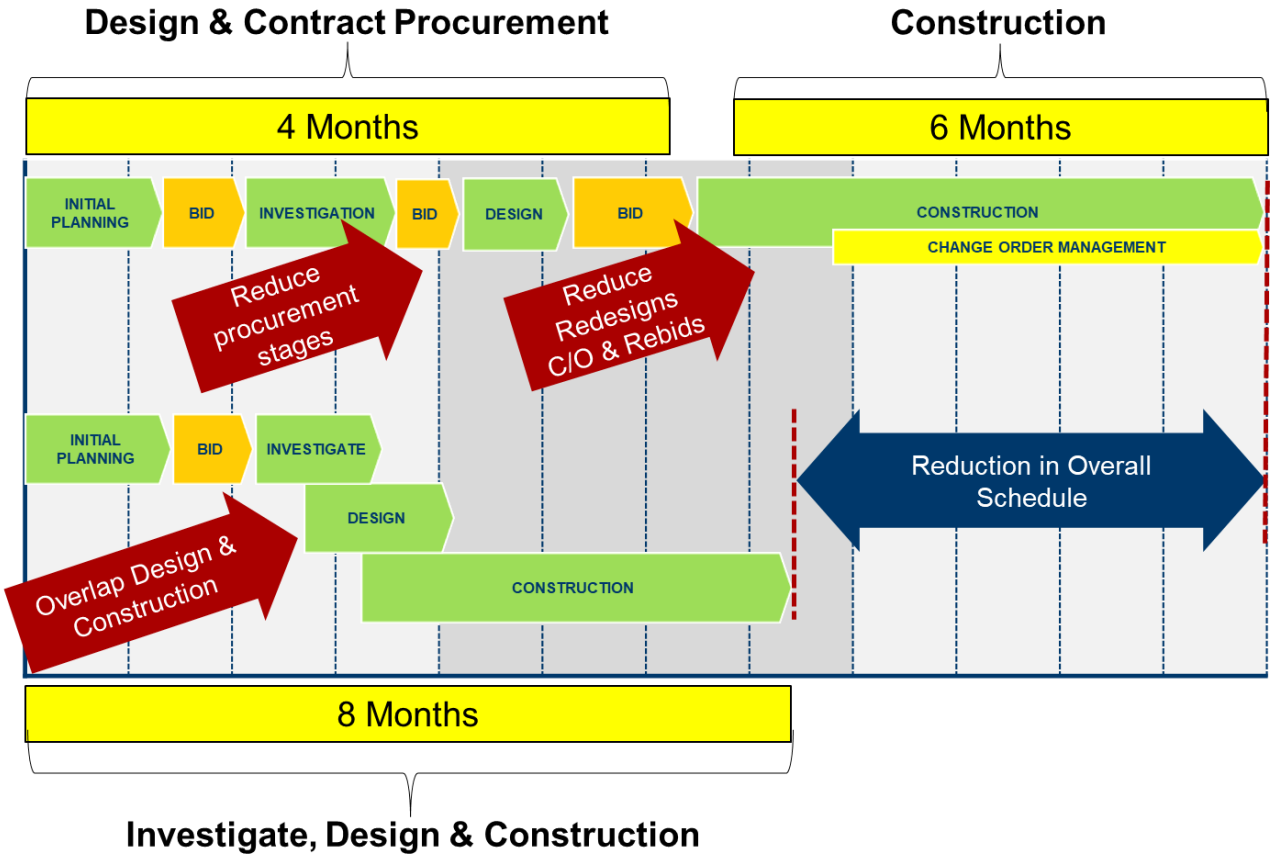


Figure 4: *Provides a schematic comparing Traditional Design-Bid-Build (Top) and Investigate-Design-Build (Bottom) approaches to the immediate Durham Street Bridge repairs.*

Further, the IDB process also offers a collaborative project team who understands the project needs through a single source procurement by; completing preliminary intrusive structure investigation, providing in-house structural designs and acts as the build contractor, reducing any potential project unknowns, change orders during construction and a single source warranty for all aspects of the work. In general, the IDB method provides a “cradle to the grave” approach to design and construction. To complete the

immediate repairs to the Bridge in a timely manner, it is recommended the County procure a qualified IDB company who is capable of expediting and commencing the necessary work, prior to May 1, 2024.

Irrespective of the necessary immediate repairs, the remaining works required for a complete rehabilitation of the Durham Street Bridge should be evaluated and considered as a viable option to address the Problem Statement under the current Schedule C MCEA process and further extend the bridge's service life.

4.0 Recommendations and Conclusions

Triton and Burgess have reviewed the background information and have provided a third-party review on various topics related to the current MCEA being completed by BM Ross, as directed by County Council, and provide the following conclusions:

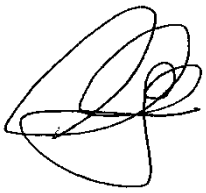
1. Detour Route Assessment & Unidentified Alternative Locations
    - It is necessary to maintain a truck detour route during construction, consistent with BM Ross' current MCEA process.
    - Triton and Burgess have identified that bridge rehabilitation is a viable alternative to be evaluated, and this alternative may not require a local traffic detour route; however, a truck detour route is still required.
2. Alternative Structure Replacement Material
    - Use of a wood bridge as opposed to the proposed conventional concrete material is not recommended and should not be considered for further evaluation due to structural durability, load capacity, and capital and life cycle cost limitations.
3. Proposed Temporary Life Extending Repair Measure
    - Repair of the existing bridge's half-joints via temporary support system is an appropriate life extending measure, consistent with BM Ross' current MCEA process; however, additional redundancy in the support system is recommended.

In general, it is our opinion that BM Ross has adequately addressed the Problem Statement by following the MCEA process set out during the initial Project Commencement phase and due to the nature of the project and implications to public safety selected a suitable Alternative for replacement of the bridge and local detour options. Although we agree with the direction and approaches taken by BM Ross, additional bridge condition investigations completed by the HAL Group Inc. have affected the MCEA process and provide evidence that bridge rehabilitation is a viable alternative. As such, Triton and Burgess provide the following recommendations:

- Re-introduce bridge rehabilitation into the MCEA process as a viable alternative for evaluation, in addition to the bridge replacement option.
- Procure the services of an Investigate-Design-Build Contractor to complete repairs of the bridge's half-joint and accompanied bridge elements (Immediate Bridge Repairs) in 2024 in order to maintain safe passage over the Bridge (while the MCEA process is ongoing), consistent with the recommendations in the Condition of Half Joints Letter, dated June 17, 2019 by BM Ross (Appendix D) and the Durham Street Bridge Structure 0419550 Assessment Summary, dated January 12, 2024 by Burgess (Appendix B).

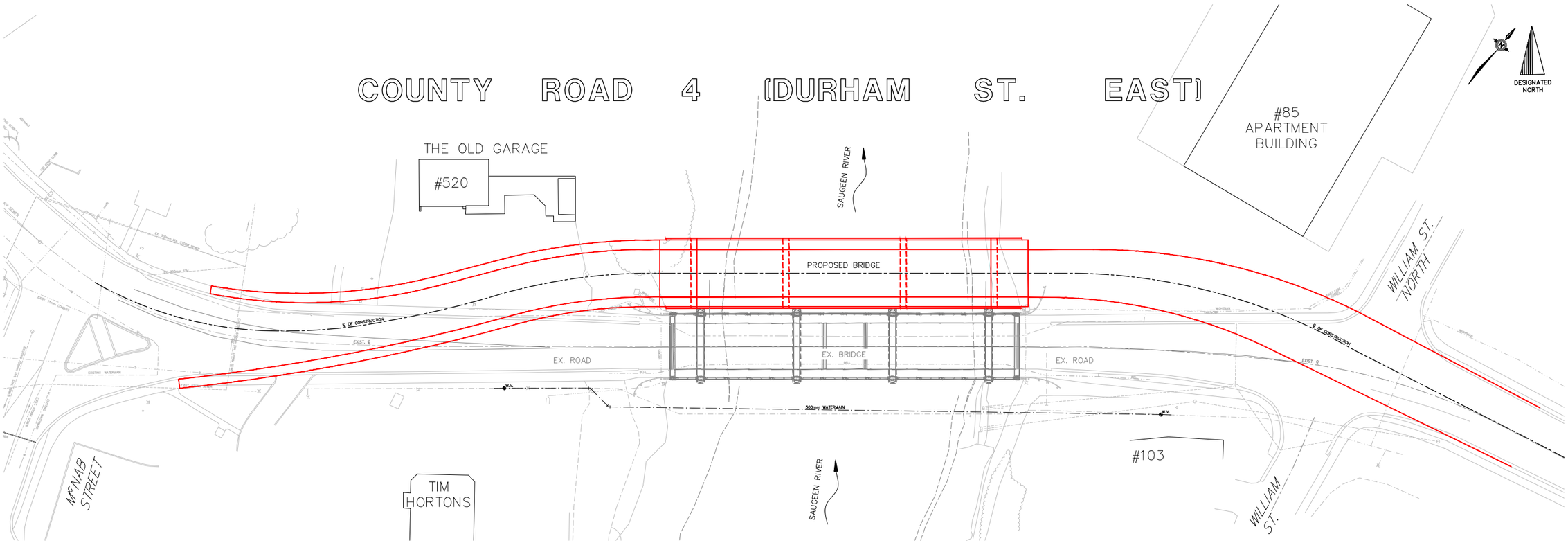
O. Di Carlo, P.Eng
(Triton)

Chris Clark, P.Eng
(Triton)



Andrew Burgess, P.Eng.
(Burgess)

Concept Drawings



PLAN
SCALE: 1:800

DISCLAIMERS:

1. ALL EXISTING ELEVATIONS & DIMENSIONS TO BE CONFIRMED ON SITE. THE LOCATION OF UTILITIES IS APPROXIMATE ONLY AND SHOULD BE, DETERMINED BY CONSULTING THE MUNICIPAL AUTHORITIES AND UTILITY COMPANIES CONCERNED. THE CONTRACTOR SHALL PROVE THE LOCATION OF UTILITIES AND SHALL BE RESPONSIBLE FOR ADEQUATE PROTECTION AGAINST DAMAGE.

No	DATE	REVISION	INITIAL
1	TBD	PRELIMINARY	X.X.X.

REPLACEMENT & RELOCATION OF
DURHAM STREET BRIDGE
(WALKERTON)

BRUCE COUNTY
30 PARK STREET
WALKERTON, ONTARIO N0G 2V0

CONCEPT PLAN
MAINTAIN TWO-WAY TRAFFIC

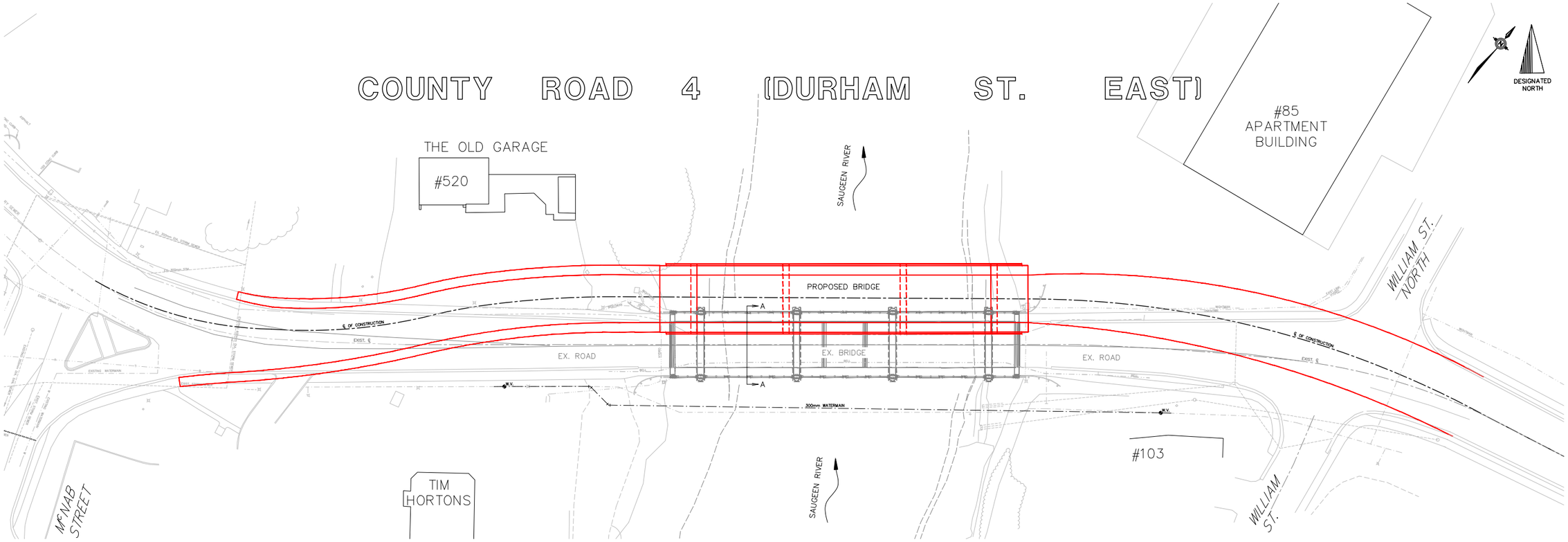
CONTRACT No.	RFT-XX-XX
PROJECT No.	A6560
DRAWN BY:	A.V.R.
CHECKED BY:	X.X.X.
APPROVED BY:	C.P.C.
DATE:	TBD

TRITON ENGINEERING SERVICES LIMITED
Consulting Engineers

SCALE:
AS NOTED
UNLESS OTHERWISE SHOWN

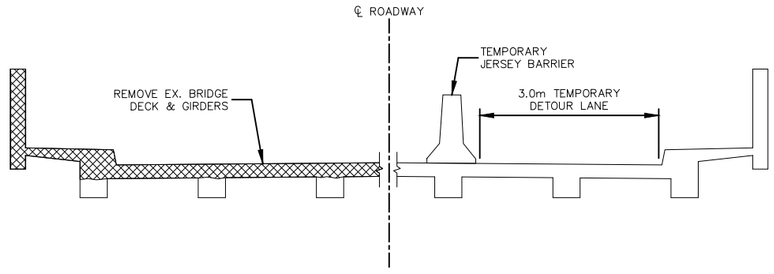
DRAWING NUMBER **01**

ANSI full bleed B (11.00 x 17.00 Inches)



PLAN

SCALE: 1:800



PARTIAL BRIDGE DEMOLITION
SECTION A-A

SCALE: N.T.S.

DISCLAIMERS:

1. ALL EXISTING ELEVATIONS & DIMENSIONS TO BE CONFIRMED ON SITE. THE LOCATION OF UTILITIES IS APPROXIMATE ONLY AND SHOULD BE, DETERMINED BY CONSULTING THE MUNICIPAL AUTHORITIES AND UTILITY COMPANIES CONCERNED. THE CONTRACTOR SHALL PROVE THE LOCATION OF UTILITIES AND SHALL BE RESPONSIBLE FOR ADEQUATE PROTECTION AGAINST DAMAGE.

No	DATE	REVISION	INITIAL
1	TBD	PRELIMINARY	X.X.X.

REPLACEMENT & RELOCATION OF

DURHAM STREET BRIDGE

(WALKERTON)

BRUCE COUNTY

30 PARK STREET
WALKERTON, ONTARIO N0G 2V0

CONCEPT PLAN
MAINTAIN ONE-WAY TRAFFIC

CONTRACT No.	RFT-XX-XX
PROJECT No.	A6560
DRAWN BY:	A.V.R.
CHECKED BY:	X.X.X.
APPROVED BY:	C.P.C.
DATE:	TBD

TRITON ENGINEERING SERVICES LIMITED
Consulting Engineers

SCALE:
AS NOTED
UNLESS OTHERWISE SHOWN

DRAWING NUMBER 02

ANSI full bleed B (11.00 x 17.00 Inches)

List of Appendices

Appendix A

Independent Bridge Inspection (Burgess)

OSIM Biennial Inspection Report

Site Number:

0402500

Durham Street Bridge, Walkerton

North Elevation

Burgess Engineering Inc.

05-Sep-23

Inventory Data

Structure Name:	Durham Street Bridge, Walkerton	**Site Number:**	0402500
District:		**Road Name:**	Durham Street East (Hwy#4)
County:	Bruce	**Owner:**	County
Township:	Brockton		
Bridge or Culvert:	Bridge	**AADT:**	0
Structure Type:	Concrete T-Beam	**Overall Struct. Width:**	12.7 m
Number of Spans:	3	**Roadway Width:**	5.6 m
Direction of Structure:	East-West	**Total Deck Length:**	57.5 m
		Span (s):	17.4,17.4, m
		Total Deck Area:	730 sq.m

GPS Coordinates (Degrees)

Latitude:	44.133487	
Longitude:	-81.144194	

Inspection Data

Date of Inspection:	28-Jul-23
Name of Inspector:	A. Burgess P.Eng. & J. Zeigler CET
Equipment Used:	Sounding hammer, measuring equipment, GPS
Weather Conditions:	Cloudy
Temperature:	24
Special Notes:	Bridge is in fair condition recommend Deck Condition Survey and drop in span joint review and reinforcing.

Overall Inspection Summary

BCI: 72.57

Next Inspection: 28-Jul-25

Additional Investigation Required:	Detailed Coating Condition Survey	**Priority:**	High
Additional Investigation Cost:	$10,000		
Rehabilitation Needs:	Major Rehab		
Rehabilitation Timing:	1 to 5 years		
Total Rehabilitation Budget Costings:			

Historical Data

Year Built:	1936	**Contract Number When Built:**	
Latest Biennial Inspection:		**Latest Specialized Inspection:**	
Latest Structure Rating:		**Latest Structure Condition:**	
RehabHistory:			
Regional Priority Number:		**Programmed Work Year:**	
NatureOfProgramWork:			

Description: Girders: Areas of shallow delaminations

Description: Girders: General

Description: Girders: Mid-span Joint

Description: Girders: Mid-span Joint

Description: Girders: Mid-span Joint

Description: Soffit (ext): Wide cracking and delamination at posts.

Description: Soffit (ext): Wide cracking and delamination at posts.

Description: Deck Wearing Surface: A couple patched areas.

Description: Deck Wearing Surface: Light cracknig.

Description: Deck Wearing Surface: Light ravelling

Description: Deck Soffit (int.): Shallow delaminations throughout with exposed reinforcing.

Description: Deck Seals: Evidence of seal separation.

Description: Joint Armouring: Areas of wide cracking.

Description: Joint Armouring: Missing sections.

Description: Joint End Dams: Shallow popouts adjacent to armouring.

Description: Railing System: Minor impact NE.

Description: Railing System: Major impact damage NW.

Description: Railing System: Added structual reinforcing.

Description: Railing System: A couple replaced sections.

Description: Posts: Areas of concrete deterioration.

Description: Approach Sidewalk: Medium abrasion south.

Description: Piers Shafts: A couple spalls with exposed reinforcing.

Description: Piers Shafts: A couple spalls with exposed reinforcing.

Description: Diaphragms: Shallow delaminations throughout.

Description: East Aproach

Element Inspection

Element Group:	Abutments	**Site Number:**	0402500
Element Name:	Abutment walls	**Width:**	14.4 m
Element type:	Conventional closed	**Height:**	0.25 m
Sub-element:		**Length:**	0 m
Material:	Pre-cast Concrete	**Count:**	2
Location:		**Total Quantity:**	7 sqm
Environment:	Benign	**Not inspected:**	☐

Perform. deficiencies:		**Maintenance Type:**	
Maint needs:		**Maint. Time Period:**	

Condition Data (sqm):

Exec: 0 **Good:** 6 **Fair:** 1 **Poor:** 0

Rehab Needs:		**Unit Cost:**	
Rehab time period:	None Recommended	**Estimated Cost:**	
Quantity:	0		

General Comments:

Element Inspection

Element Group:	Approaches	**Site Number:**	0402500
Element Name:	Approach slab	**Width:**	12.7 m
Element type:		**Height:**	0 m
Sub-element:		**Length:**	5 m
Material:	Cast-in-place Concrete	**Count:**	2
Location:		**Total Quantity:**	127 sqm
Environment:	Moderate	**Not inspected:**	☐

Perform. deficiencies:		**Maintenance Type:**	
Maint needs:		**Maint. Time Period:**	

Condition Data (sqm):

Exec: 0 **Good:** 127 **Fair:** 0 **Poor:** 0

Rehab Needs:		**Unit Cost:**	
Rehab time period:	None Recommended	**Estimated Cost:**	
Quantity:	0		

General Comments:

No signs of settlement.

Element Inspection

Element Group:	Approaches	**Site Number:**	0402500
Element Name:	Wearing surface	**Width:**	12.7 m
Element type:		**Height:**	0 m
Sub-element:		**Length:**	5 m
Material:	Asphalt	**Count:**	2
Location:		**Total Quantity:**	127 sqm
Environment:	Severe	**Not inspected:**	☐

Perform. deficiencies:		**Maintenance Type:**	
Maint needs:		**Maint. Time Period:**	

Condition Data (sqm):

Exec: 0 **Good:** 125 **Fair:** 2 **Poor:** 0

Rehab Needs:		**Unit Cost:**	
Rehab time period:	None Recommended	**Estimated Cost:**	
Quantity:	0		

General Comments:

Element Inspection

Element Group:	Barriers	**Site Number:**	0402500
Element Name:	Railing system	**Width:**	0 m
Element type:		**Height:**	1.2 m
Sub-element:		**Length:**	57.5 m
Material:	Steel	**Count:**	2
Location:		**Total Quantity:**	115 m
Environment:	Severe	**Not inspected:**	☐

Perform. deficiencies:		**Maintenance Type:**	
Maint needs:		**Maint. Time Period:**	

Condition Data (m):

Exec: 0 **Good:** 106 **Fair:** 6 **Poor:** 3

Rehab Needs:		**Unit Cost:**	
Rehab time period:	None Recommended	**Estimated Cost:**	
Quantity:	0		

General Comments:

Minor impact damage NE. Major impact damage NW. Added structual reinforcing. A couple replaced sections.

Element Inspection

Element Group:	Approaches	**Site Number:**	0402500
Element Name:	Railing system	**Width:**	0 m
Element type:		**Height:**	1.2 m
Sub-element:		**Length:**	5 m
Material:	Steel	**Count:**	4
Location:		**Total Quantity:**	20 m
Environment:	Severe	**Not inspected:**	☐

Perform. deficiencies:		**Maintenance Type:**	
Maint needs:		**Maint. Time Period:**	

Condition Data (m):

Exec: 0 **Good:** 20 **Fair:** 0 **Poor:** 0

Rehab Needs:		**Unit Cost:**	
Rehab time period:	None Recommended	**Estimated Cost:**	
Quantity:	0		

General Comments:

Element Inspection

Element Group:	Barriers	**Site Number:**	0402500
Element Name:	Posts	**Width:**	0 m
Element type:		**Height:**	0 m
Sub-element:		**Length:**	0 m
Material:	Cast-in-place Concrete	**Count:**	30
Location:		**Total Quantity:**	30 each
Environment:	Severe	**Not inspected:**	☐

Perform. deficiencies:		**Maintenance Type:**	
Maint needs:		**Maint. Time Period:**	

Condition Data (each):

Exec: 0 **Good:** 27 **Fair:** 2 **Poor:** 1

Rehab Needs:		**Unit Cost:**	
Rehab time period:	None Recommended	**Estimated Cost:**	
Quantity:	0		

General Comments:

Areas of concrete deterioration.

Element Inspection

Element Group:	Decks	**Site Number:**	0402500	
Element Name:	Deck top (with thin slab)	**Width:**	12.78	m
Element type:		**Height:**	0	m
Sub-element:		**Length:**	57.5	m
Material:	Cast-in-place Concrete	**Count:**	0	
Location:		**Total Quantity:**	735	sqm
Environment:	Moderate	**Not inspected:**	☐	

Perform. deficiencies:		**Maintenance Type:**	
Maint needs:		**Maint. Time Period:**	

Condition Data (sqm):

Exec: 0 **Good:** 735 **Fair:** 0 **Poor:** 0

Rehab Needs:		**Unit Cost:**	
Rehab time period:	None Recommended	**Estimated Cost:**	
Quantity:	0		

General Comments:

No signs of bottom up defects.

Element Inspection

Element Group:	Piers	**Site Number:**	0402500	
Element Name:	Shafts	**Width:**	0.76	m
Element type:		**Height:**	5	m
Sub-element:		**Length:**	0.76	m
Material:	Cast-in-place Concrete	**Count:**	12	
Location:		**Total Quantity:**	60	sqm
Environment:	Moderate	**Not inspected:**	☐	

Perform. deficiencies:		**Maintenance Type:**	
Maint needs:		**Maint. Time Period:**	

Condition Data (sqm):

Exec: 0 **Good:** 51 **Fair:** 6 **Poor:** 3

Rehab Needs:		**Unit Cost:**	
Rehab time period:	None Recommended	**Estimated Cost:**	
Quantity:	0		

General Comments:

A couple spalls with exposed reinforcing.

Element Inspection

Element Group:	Embankments and Streams	**Site Number:**	0402500
Element Name:	Streams & waterways	**Width:**	0 m
Element type:		**Height:**	0 m
Sub-element:		**Length:**	0 m
Material:		**Count:**	1
Location:		**Total Quantity:**	1 each
Environment:		**Not inspected:**	☐

Perform. deficiencies:		**Maintenance Type:**	
Maint needs:		**Maint. Time Period:**	

Condition Data (each):

Exec: 0 **Good:** 1 **Fair:** 0 **Poor:** 0

Rehab Needs:		**Unit Cost:**	
Rehab time period:	None Recommended	**Estimated Cost:**	
Quantity:	0		

General Comments:

Element Inspection

Element Group:	Beams/MLE's	**Site Number:**	0402500
Element Name:	Diaphragms	**Width:**	1.2 m
Element type:		**Height:**	0.9 m
Sub-element:		**Length:**	0.7 m
Material:	Cast-in-place Concrete	**Count:**	28
Location:		**Total Quantity:**	28 each
Environment:	Benign	**Not inspected:**	☐

Perform. deficiencies:		**Maintenance Type:**	
Maint needs:		**Maint. Time Period:**	

Condition Data (each):

Exec: 0 **Good:** 26 **Fair:** 2 **Poor:** 0

Rehab Needs:		**Unit Cost:**	
Rehab time period:	None Recommended	**Estimated Cost:**	
Quantity:	0		

General Comments:

Shallow delaminations throughout.

Element Inspection

Element Group:	Embankments and Streams	**Site Number:**	0402500
Element Name:	Embankments	**Width:**	0 m
Element type:		**Height:**	0 m
Sub-element:		**Length:**	0 m
Material:		**Count:**	4
Location:		**Total Quantity:**	4 each
Environment:		**Not inspected:**	☐

Perform. deficiencies:		**Maintenance Type:**	
Maint needs:		**Maint. Time Period:**	

Condition Data (each):

Exec: 0 **Good:** 4 **Fair:** 0 **Poor:** 0

Rehab Needs:		**Unit Cost:**	
Rehab time period:	None Recommended	**Estimated Cost:**	
Quantity:	0		

General Comments:

Element Inspection

Element Group:	Decks	**Site Number:**	0402500
Element Name:	Soffit - thin slab	**Width:**	1.2 m
Element type:		**Height:**	0.6 m
Sub-element:	Exterior	**Length:**	57.5 m
Material:	Cast-in-place Concrete	**Count:**	2
Location:		**Total Quantity:**	207 sqm
Environment:	Moderate	**Not inspected:**	☐

Perform. deficiencies:		**Maintenance Type:**	
Maint needs:		**Maint. Time Period:**	

Condition Data (sqm):

Exec: 0 **Good:** 179 **Fair:** 18 **Poor:** 10

Rehab Needs:		**Unit Cost:**	
Rehab time period:	None Recommended	**Estimated Cost:**	
Quantity:	0		

General Comments:

Wide cracking and delamination at posts.

Element Inspection

Element Group:	Foundations	**Site Number:**	0402500
Element Name:	Foundation (below ground)	**Width:**	0 m
Element type:		**Height:**	0 m
Sub-element:		**Length:**	0 m
Material:	Cast-in-place Concrete	**Count:**	4
Location:		**Total Quantity:**	4 each
Environment:	Benign	**Not inspected:**	☐

Perform. deficiencies:		**Maintenance Type:**	
Maint needs:		**Maint. Time Period:**	

Condition Data (each):

Exec: 0 **Good:** 4 **Fair:** 0 **Poor:** 0

Rehab Needs:		**Unit Cost:**	
Rehab time period:	None Recommended	**Estimated Cost:**	
Quantity:	0		

General Comments:

No signs of settlement.

Element Inspection

Element Group:	Decks	**Site Number:**	0402500
Element Name:	Drainage system	**Width:**	0 m
Element type:		**Height:**	0 m
Sub-element:		**Length:**	0 m
Material:	Steel	**Count:**	12
Location:		**Total Quantity:**	12 each
Environment:	Severe	**Not inspected:**	☐

Perform. deficiencies:		**Maintenance Type:**	
Maint needs:		**Maint. Time Period:**	

Condition Data (each):

Exec: 0 **Good:** 12 **Fair:** 0 **Poor:** 0

Rehab Needs:		**Unit Cost:**	
Rehab time period:	None Recommended	**Estimated Cost:**	
Quantity:	0		

General Comments:

Element Inspection

Element Group:	Beams/MLE's	**Site Number:**	0402500
Element Name:	Girders (concrete)	**Width:**	0.46 m
Element type:	T beam	**Height:**	0.9 m
Sub-element:		**Length:**	57.5 m
Material:	Cast-in-place Concrete	**Count:**	6
Location:		**Total Quantity:**	286 sqm
Environment:	Moderate	**Not inspected:**	☐

Perform. deficiencies:	Load carrying capacity	**Maintenance Type:**	
Maint needs:		**Maint. Time Period:**	

Condition Data (sqm):

Exec: 0 **Good:** 276 **Fair:** 6 **Poor:** 4

Rehab Needs:		**Unit Cost:**	
Rehab time period:		**Estimated Cost:**	
Quantity:	0		

General Comments:

Areas of shallow delaminations. Delamination/cracking with rust straining at drop in span joints. Recommend reinforcing rehabilitation.

Element Inspection

Element Group:	Piers	**Site Number:**	0402500	
Element Name:	Caps	**Width:**	14.4	m
Element type:		**Height:**	0.75	m
Sub-element:		**Length:**	0.75	m
Material:	Cast-in-place Concrete	**Count:**	2	
Location:		**Total Quantity:**	86	sqm
Environment:	Benign	**Not inspected:**	☐	

Perform. deficiencies:		**Maintenance Type:**	
Maint needs:		**Maint. Time Period:**	

Condition Data (sqm):

Exec: 0 **Good:** 85 **Fair:** 1 **Poor:** 0

Rehab Needs:		**Unit Cost:**	
Rehab time period:	None Recommended	**Estimated Cost:**	
Quantity:	0		

General Comments:

Element Inspection

Element Group:	Decks	**Site Number:**	0402500
Element Name:	Wearing surface	**Width:**	5.6 m
Element type:		**Height:**	0 m
Sub-element:		**Length:**	57.5 m
Material:	Asphalt	**Count:**	0
Location:		**Total Quantity:**	322 sqm
Environment:	Severe	**Not inspected:**	☐

Perform. deficiencies:		**Maintenance Type:**	
Maint needs:		**Maint. Time Period:**	

Condition Data (sqm):

Exec: 0 **Good:** 302 **Fair:** 20 **Poor:** 0

Rehab Needs:		**Unit Cost:**	
Rehab time period:	None Recommended	**Estimated Cost:**	
Quantity:	0		

General Comments:

A couple patched areas. Light cracknig. Light ravelling.

Element Inspection

Element Group:	Decks	**Site Number:**	0402500
Element Name:	Soffit - thin slab	**Width:**	12.7 m
Element type:		**Height:**	0 m
Sub-element:	Interior	**Length:**	57.5 m
Material:	Cast-in-place Concrete	**Count:**	0
Location:		**Total Quantity:**	730 sqm
Environment:	Benign	**Not inspected:**	☐

Perform. deficiencies:		**Maintenance Type:**	
Maint needs:		**Maint. Time Period:**	

Condition Data (sqm):

Exec: 0 **Good:** 700 **Fair:** 20 **Poor:** 10

Rehab Needs:		**Unit Cost:**	
Rehab time period:	None Recommended	**Estimated Cost:**	
Quantity:	0		

General Comments:

Shallow delaminations throughout with exposed reinforcing.

Element Inspection

Element Group:	Joints	**Site Number:**	0402500
Element Name:	Seals (strip)	**Width:**	0 m
Element type:		**Height:**	0 m
Sub-element:		**Length:**	0 m
Material:		**Count:**	4
Location:		**Total Quantity:**	4 each
Environment:	Severe	**Not inspected:**	☐

Perform. deficiencies:		**Maintenance Type:**	Routine
Maint needs:	Bridge cleaning	**Maint. Time Period:**	1 Year

Condition Data (each):

Exec: 0 **Good:** 0 **Fair:** 4 **Poor:** 0

Rehab Needs:		**Unit Cost:**	
Rehab time period:	None Recommended	**Estimated Cost:**	
Quantity:	0		

General Comments:

Joints filled with debris, recommend cleaning. Evidence of seal separation.

Element Inspection

Element Group:	Joints	**Site Number:**	0402500	
Element Name:	Concrete end dams	**Width:**	12.7	m
Element type:		**Height:**	0	m
Sub-element:		**Length:**	0.2	m
Material:	Cast-in-place Concrete	**Count:**	8	
Location:		**Total Quantity:**	20	sqm
Environment:	Severe	**Not inspected:**	☐	

Perform. deficiencies:		**Maintenance Type:**	
Maint needs:		**Maint. Time Period:**	

Condition Data (sqm):

Exec: 0 **Good:** 17 **Fair:** 3 **Poor:** 0

Rehab Needs:		**Unit Cost:**	
Rehab time period:	None Recommended	**Estimated Cost:**	
Quantity:	0		

General Comments:

Shallow popouts adjacent to armouring.

Element Inspection

Element Group:	Decks	**Site Number:**	0402500	
Element Name:	Sidewalk	**Width:**	1.5	m
Element type:		**Height:**	0	m
Sub-element:		**Length:**	57.5	m
Material:	Cast-in-place Concrete	**Count:**	2	
Location:		**Total Quantity:**	173	sqm
Environment:	Severe	**Not inspected:**	☐	

Perform. deficiencies:		**Maintenance Type:**	
Maint needs:		**Maint. Time Period:**	

Condition Data (sqm):

Exec: 0 **Good:** 173 **Fair:** 0 **Poor:** 0

Rehab Needs:		**Unit Cost:**	
Rehab time period:	None Recommended	**Estimated Cost:**	
Quantity:	0		

General Comments:

Typical light cracking.Shallow popouts.

Element Inspection

Element Group:	Joints	**Site Number:**	0402500
Element Name:	Armoring/retaining devices	**Width:**	12.7 m
Element type:		**Height:**	0 m
Sub-element:		**Length:**	0 m
Material:	Steel	**Count:**	16
Location:		**Total Quantity:**	203 m
Environment:	Severe	**Not inspected:**	☐

Perform. deficiencies:		**Maintenance Type:**	
Maint needs:		**Maint. Time Period:**	

Condition Data (m):

Exec: 0 **Good:** 201 **Fair:** 1 **Poor:** 1

Rehab Needs:		**Unit Cost:**	
Rehab time period:	None Recommended	**Estimated Cost:**	
Quantity:	0		

General Comments:

Areas of wide cracking. Missing sections.

Element Inspection

Element Group:	Approaches	**Site Number:**	0402500	
Element Name:	Sidewalk	**Width:**	1.5	m
Element type:		**Height:**	0.25	m
Sub-element:		**Length:**	5	m
Material:	Cast-in-place Concrete	**Count:**	4	
Location:		**Total Quantity:**	35	sqm
Environment:	Moderate	**Not inspected:**	☐	

Perform. deficiencies:		**Maintenance Type:**	
Maint needs:		**Maint. Time Period:**	

Condition Data (sqm):

Exec:	0	**Good:**	33	**Fair:**	1	**Poor:**	1

Rehab Needs:		**Unit Cost:**	
Rehab time period:	None Recommended	**Estimated Cost:**	
Quantity:	0		

General Comments:

Medium abrasion south. Wide cracking NW.

Appendix B

Durham Street Bridge Assessment Summary (Burgess)
&
Detailed Condition Survey (HAL)

ATTN: Adam Stanley, C. Tech.
Director, Transportation &
Environmental Services
Corporation of the County of Bruce
30 Park St., Walkerton, Ontario
N0G 2V0

January 12th, 2024

RE: Durham Street (Bruce County Road 4)
Bridge Structure 0419550
Assessment Summary
Walkerton, Ont

Dear Adam,

As part of the third-party review we have reviewed the previous bridge condition information specifically, the BM Ross letter, Condition of Half Joints, dated June 17, 2019, completed an independent visual inspection, and retained the services of HAL Group Inc. to complete a detailed bridge condition survey (appended to this letter). As a result of these investigations, we offer the following.

As shown in the Detailed Condition Survey the existing bridge, although has extensive soffit delamination, is generally structurally sound and therefore, rehabilitation should be investigated as this could be a feasible and economical solution to extending the overall life of the bridge.

However, when reviewing the condition of the drop in span half joints, there is a major structural concern regarding the integrity of these joints, as depicted below.

As previously noted in the BM Ross letter, this is a poor detail and has caused various issues and failures in other municipalities. An example of this is the total span collapse of the bridge in Laval, Quebec (2006), depicted below.

Burgess Engineering Inc., Consulting Engineers
9 Sunset Drive, Northern Bruce Peninsula, Ontario, N0H 2T0, Phone: (905) 741-5427
Email: bei@mailburgesseng.com

Upon review of this failure, it was determined that the following factors played a major role in the collapse.

- Poor construction practices (quality)
- Deterioration of the concrete
- Repetitive High Loading

Therefore, when assessing the Walkerton Durham Street Bridge, we assessed for these factors.

Construction

As we don't have "As-Built" construction notes/drawings, we can not adequately assess the quality control practises implemented for the construction of the bridge. However, we do note that the bridge decks concrete compressive strength is more than adequate at 76.8 MPa with low corrosion potential.

Concrete Deterioration

Due to the age of the bridge (circa 1936), the environment of the constantly leaking joints and the localized spalling in this area (observed visually and noted in the bridge condition survey) the half joints show signs of significant degradation which is a major concern.

Loading

As this is a major road corridor within the County, Durham Street experiences a significant volume of heavy truck traffic on this bridge. As a result, the area of concern in the half joints, is exposed to a relatively large repetitive and constant impact load. It is important to note that this type of repetitive loading to the half joint can cause a concrete shear failure which is instantaneous with little or no advanced warning.

Conclusion/Recommendation

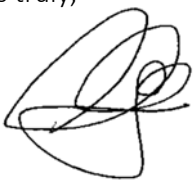
As time has elapsed since the initial 2019 structural analysis based on the condition of the half joint as reported by HAL Group Inc. there is sufficient evidence that at least 2 of 3 of the above factors are present in the Durham Street Bridge and repetitive impact loading by heavy vehicles to these joints is a major cause for concern and if left unrepaired can lead to instantaneous failure.

In order for the bridge to be remain in service, we recommend correcting the half joints by either temporary repair or rehabilitation. Since repair or rehabilitation of the joints will take time and we feel time is of the essence to maintain public safety, we recommend a load limit be implemented for the bridge. The intent is to minimize the repetitive impact load caused by heavy truck traffic while maintaining bridge access to light traffic and EMS vehicles. The posted

loading should be clearly visible and adhere to current MTO OTM Book Guidelines and an alternate route for the heavy truck traffic is to be posted and communicated accordingly. We recommend a triple level posting (Level 1,2,3) for single, double, and triple axel vehicles of 15, 25, 30 tonnes, respectively. This restriction will reduce the load on the bridge but allow for light weight traffic and most maintenance and emergency vehicle traffic. Prior to repair/rehabilitation of the half joints being completed we recommend visual inspection of the joints are regularly performed on a quarterly basis, by a qualified structural engineer.

Let us know if you have any questions or require any clarification.

Yours truly,



Andrew Burgess, P.Eng.
President
ADB/kb

BRUCE COUNTY

STRUCTURE 0419550, DURHAM STREET BRIDGE, WALKERTON, ONTARIO

DETAILED CONDITION SURVEY REPORT

January 2024

Project No.: 20230825

HAL

STRUCTURE 0419550, DURHAM STREET BRIDGE, WALKERTON, ONTARIO

DETAILED CONDITION SURVEY REPORT

BRUCE COUNTY

PROJECT NO.: 20230825
JANUARY 2024

HAL GROUP INC.
25 EDILCAN DRIVE, UNIT 8,
VAUGHAN, ON L4K 3S4

T +1 905 760-7773
F +1 905 760-7774
HALGROUP.CA

HAL

TABLE OF CONTENTS

Structure Identification Sheet

HAL

STRUCTURE IDENTIFICATION SHEET

GENERAL INFORMATION

STRUCTURE NAME	***Durham Street Bridge, Walkerton***		
SITE NUMBER	0419550	**DISTRICT NUMBER**	5
HIGHWAY above	Durham Street East (Hwy 4)	**Below**	Saugeen River
TYPE OF STRUCTURE	Concrete T-Beam		
NUMBER OF SPANS	5	**SPAN LENGTHS**	67.51 m
ROADWAY WIDTH	9.14 m	**YEAR BUILT**	1936
DIRECTION OF STRUCTURE	East to west		
SEQUENCE NUMBER	N/A	**TOWNSHIP NUMBER**	N/A
LHRS NUMBER	N/A	**MUNICIPAL BRIDGE NUMBER**	N/A
LOCATION	44.133487, -81.144194	**JURISDICTION**	Bruce County
INSPECTOR'S NAME	Abbas Haghbin, P.Eng.		
PARTY MEMBERS	Masood Rehman, P.Eng., Saurav Bhuva, Parth Prajapati, Michel El-Khoury		
DATE OF INSPECTION	October 24 & November 16, 2023 (substructure); October 25, 2023 (deck)		
TEMPERATURE	7 to 17 °C	**WEATHER**	Cloudy
MTO REGION	West	**AADT**	N/A
DECK RIDING SURFACE	Asphalt		
YEAR LAST REHABILITATED	1966		

ENGINEER'S STAMP

HAL

Key Plan

HAL

KEY PLAN

STRUCTURE 0419550, DURHAM STREET BRIDGE
WALKERTON, ONTARIO

Summary of Significant Findings

CONTENTS

1 INTRODUCTION

HAL Group Inc. was retained by Triton Engineering Services Limited c/o Bruce County to carry out a detailed bridge condition survey and reporting for Durham Street Bridge, which was carried out by HAL. This report presents HAL's findings, through field investigations and laboratory testing. Field investigation was carried out on October 24 & November 16, 2023 (substructure) and October 25, 2023 (deck).

Structure 0419550, constructed in 1936, is a five (5) span reinforced cast-in-place concrete slab on concrete T-beam girders, overlain with an asphalt wearing surface and carries one (1) traffic lane in each direction along Durham Street East (Hwy 4). The deck cross section consists of a thin deck slab and six (6) T-beam girders.

The span length of the bridge is 67.51 m. The roadway is 9.14 m. The structure has an east to west orientation. The structure has concrete sidewalks, steel handrails and concrete posts on the north and south sides. Photo 1 shows a view of the north elevation of Structure 0419550.

Photo 1: North Elevation of Structure 0419550, Walkerton, Ontario

2 METHODOLOGY

In general, the procedures followed to conduct the condition survey and delamination surveys were those defined in Part 1 of the MTO Structure Rehabilitation Manual (2007). This assignment involved the observation and recording of surface defects, delamination detection, grid layouts (1.5 m x 1.5 m), sawn asphalt samples (minimum 300 mm x 300 mm), concrete cores (70 mm and 100 mm diameter), corrosion potential survey, and laboratory testing of the concrete cores.

Delaminations in the concrete were detected by striking the surface with a chain or hammer and noting the type of sound being emitted. It should be mentioned that, while this method is quite reliable, it may not detect delaminations at a depth greater than 100 mm. The chain drag method was used for all horizontal surfaces inspected and the hammer sounding method was used for all vertical and overhead surfaces inspected. The areas and locations of patches, spalls, delaminations, exposed reinforcement, honeycombing, wet areas, scaling and other observed defects were recorded.

A corrosion potential survey was conducted for the asphalt covered bridge deck and concrete sidewalks in accordance with the requirements of ASTM C876 and the MTO Structure Rehabilitation Manual. A positive ground connection was made directly to the reinforcing steel, at the locations shown on the accompanying drawings.

Thirteen (13) cores (twelve (12) in the bridge deck and one (1) in the east approach) and ten (10) sawn asphalt samples were extracted from deteriorated and sound areas of the structure. The inside of the core holes as well as the concrete surface in the sawn asphalt samples were examined carefully for cracks and other concrete defects. All test holes were reinstated to their original condition using MTO-approved products. Two (2) cores were selected for compressive strength testing (C9 and C13) and five (5) cores for chloride ion content (C3, C4, C10, C11 and C12).

Enclosed with this report are the detailed condition survey summary sheets, survey equipment and calibration procedures, core photos/sketches, core logs, sawn asphalt sample photos, sawn asphalt sample logs, site photographs, laboratory test results, and drawings.

3 BRIDGE STRUCTURE

3.1 ASPHALT WEARING SURFACE

The width of the asphalt covered bridge deck between sidewalks is 9.14 m. The total surveyed area of the deck was 617.04 m^2. The condition of the asphalt wearing surface on the bridge deck was identified through visual field observations and review of cores and sawn asphalt samples. Drawing Nos. 1a and 1b show the location of the cores and sawn asphalt samples. The general pavement surface condition is shown in Photos P3 to P5.

The asphalt wearing surface on the concrete deck was generally in good condition with sealed and unsealed longitudinal medium width cracks (130.1 m), sealed and unsealed transverse width cracks (17.3 m), patches (1.38 m^2), light rutting and light ravelling. The total asphalt thickness, measured at the core and sawn asphalt sample locations, varied from 65 mm to 115 mm with an average depth of 83 mm (refer to Drawing Nos. 1a and 1b).

3.2 WATERPROOFING

Hot poured rubberized asphalt waterproofing system with protection board was observed over the concrete deck, ranging in thickness from 4 mm to 8 mm with an average thickness of 6 mm. The condition of the waterproofing membrane encountered in the test locations was generally in good condition. The bond of waterproofing to the concrete was in fair to good condition.

3.3 CONCRETE DECK

The condition of the concrete deck was observed at twelve (12) core locations and ten (10) sawn asphalt samples. A review of the concrete cores and exposed concrete surface in the sawn asphalt samples revealed a partial delamination plane in core C2 (Photo P91), debonded concrete overlay in core C10 (Photo P94) and a spall in sawn asphalt sample SS9. Refer to the core and sawn asphalt sample logs and photos.

The thickness of the concrete overlay encountered in the core locations ranged from 45 mm to 110 mm.

3.3.1 CONCRETE COVER AND REINFORCEMENT

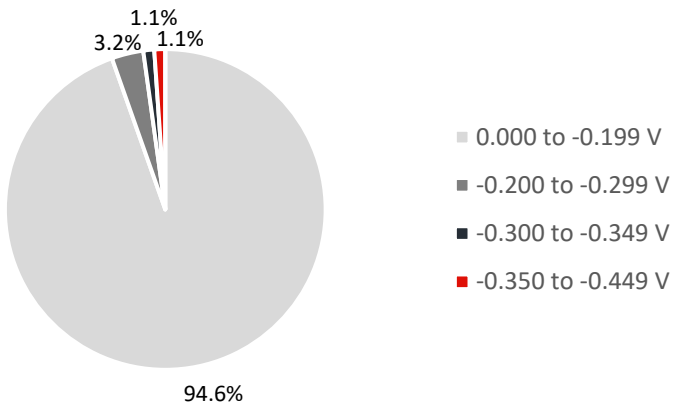
The concrete cover on the upper rebar layer was found to range from 80 mm to 155 mm with an average of 107 mm. Refer to the core and sawn asphalt sample logs.

Examination of the cores extracted from the deck indicated the presence of square steel rebar imprints. Evidence of light corrosion was observed on the reinforcement in cores C3, C7, C8, and severe corrosion in core C4 (Photos P92 to P95). Refer to the core logs and photos.

3.3.2 CORROSION POTENTIAL

Corrosion potential values obtained from the half-cell tests carried out on the asphalt covered deck ranged from –0.011 V to –0.361 V with an average value of –0.082 V. The half-cell survey indicated that 94.6% of the deck area likely had no corrosion activity, with corrosion potential values between 0.000 V and -0.199 V. The half-cell survey identified uncertain low corrosion activity for 4.3% (3.2%+1.1%) of the deck area, with values ranging from -0.200 V to -0.349 V. Probable active corrosion was detected for 1.1% of the deck area with corrosion potential values more negative than -0.350V. Drawing Nos. 3a and 3b show the deck corrosion potential readings.

Chart 3.3.2 Corrosion Potential Distribution in the Deck



3.3.3 COMPRESSIVE STRENGTH

Cores C9 and C13, extracted from the deck, were tested for compressive strength in accordance with CSA A23.2-09-14C. The compressive strength of the concrete in these cores was 76.7 MPa and 76.9 MPa respectively, with an average of 76.8 MPa.

3.3.4 CHLORIDE ION CONTENT

The chloride ion content was determined using MTO LS-417 “Method of Test for Determination of Total Chloride Ion in Concrete – Acid Soluble” on five (5) cores extracted from the deck. These core samples were located at areas prone to salt exposure (e.g. along expansion joints, construction joints, low points of the deck, asphalt cracks). In addition, samples from other moderately exposed areas were also taken. The chloride ion content values are summarized as shown in Table 3.3.4 and also shown in the core logs and laboratory test results.

Table 3.3.4 Chloride Ion Content at Rebar Level and Corrosion Potential

Core No.	C3	C4	C10	C11	C12
Corrected Chloride Content (%)*	0.000	0.001	0.006	0.007	0.000
Corrosion Potential (V)	-0.055	-0.158	-0.044	-0.051	-0.048

* Background chloride ion content was assumed to be 0.038% for parent concrete and 0.033% for concrete overlay.

The chloride threshold value necessary to depassivate embedded steel and to onset corrosion (in the presence of oxygen and moisture) is generally taken as 0.025% by mass of concrete. Background chloride content is the lowest chloride content measured for all of the cores tested. The "background" chlorides do not contribute to corrosion, and thus the results are corrected for the background chloride content. The chloride content at the rebar level, after correcting for the background chloride content, was below the chloride threshold level of 0.025% for all five (5) cores tested. Review of the reinforcement revealed light corrosion on the reinforcement in cores C3, C7, C8, and severe corrosion in core C4. Overall, the results indicate that the chloride content has not reached the threshold to initiate corrosion at the upper rebar level in the deck areas.

Based on the concrete removal policy outlined in the Structure Rehabilitation Manual, the following comments can be made:

- For decks with less than 10% of the total deck area more negative than -0.35 V, the average chloride content shall be calculated using all the cores tested. Therefore, the average adjusted chloride content at the reinforcing steel level is 0.003%.
- Concrete removal for decks with average chloride content at the top reinforcement level (using average cover) less than 0.05% by mass of concrete shall include delaminated concrete only.

3.4 SIDEWALKS

The total surveyed area of the north and south concrete sidewalks was 233.58 m^2. The condition of the concrete surface of the sidewalks was identified through visual field observations and a delamination survey. The general surface condition and surface deterioration is shown on Drawing Nos. 1a, 1b and in Photos P16 to P22. The concrete sidewalks were in fair to good condition with medium width clean cracking (2.8 m), delaminations (6.67 m^2) and spalls (0.02 m^2). A transverse crack was observed above Pier 2. The majority of delaminations were observed on the south sidewalk.

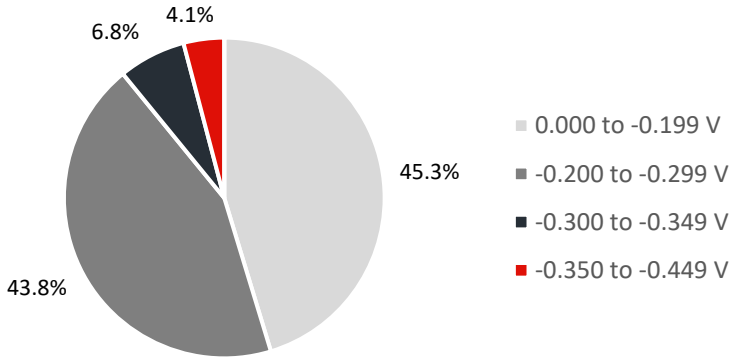
3.4.1 CONCRETE COVER

The concrete cover on the upper rebar layer of the sidewalks was found to range from 43 mm to 89 mm with an average of 64 mm. Refer to Drawing Nos. 2a and 2b.

3.4.2 CORROSION POTENTIAL

Corrosion potential values obtained from the half-cell tests carried out on the concrete sidewalks ranged from –0.095 V to –0.395 V with an average value of –0.210 V. The half-cell survey indicated that 45.3% of the sidewalk areas likely had no corrosion activity, with corrosion potential values between 0.000 V and -0.199 V. The half-cell survey identified uncertain low corrosion activity for 50.6% (43.8%+6.8%) of the sidewalk areas, with values ranging from -0.200 V to -0.349 V. Probable active corrosion was detected for 4.1% of the sidewalk areas with corrosion potential values more negative than -0.350V. Drawing Nos. 3a and 3b show the sidewalk corrosion potential readings.

Chart 3.4.2 **Corrosion Potential Distribution in the Sidewalks**



3.5 STEEL HANDRAILS AND CONCRETE POSTS

The north and south steel handrails were in fair to good condition with impact damage and bent railings. Refer to Photos P16, P18, P19 and P23.

The north and south concrete posts (integrated with the steel handrails) were in fair to poor condition with cracks, severe AAR, delaminations, rust stains and spalls with exposed corroded rebar. Refer to Photos P24 to P30.

3.6 DECK SOFFIT, GIRDERS AND DIAPHRAGMS

The deck soffit and fascia, concrete girders and diaphragms were subjected to a detailed visual inspection and then were hammer sounded to check for delaminations, spalls and other deteriorations utilizing a bridgemaster.

3.6.1 DECK SOFFIT

The bridge deck soffit and fascia, with a total surveyed area of 629.96 m^2, was generally in poor condition with clean and stained medium width cracks (29.5 m), clean wide width cracks (3.1 m), delaminations (111.55 m^2), spalls (19.87 m^2) and patches (10.62 m^2). Spalls with exposed corroded rebar and rust staining was observed throughout. Severe rust and wet stains were observed beneath the intermediate joints, indicating poor seal performance (Photos P62 to P66). Surface deteriorations of the soffit are shown on Drawing Nos. 4a, 4b and in Photos P57, P59 to P69, 71 to P75.

3.6.2 CONCRETE GIRDERS

The total surveyed area of the concrete girders was 754.20 m^2. The concrete girders were in fair to poor condition with clean medium width cracks (12.2 m), delaminations (32.00 m^2) spalls (6.80 m^2), patches (1.00 m^2). Surface deteriorations of the girders are shown on Drawing Nos. 4a, 4b, 7a to 7c and in Photos P58, P60, P61, P62, P68 to P71, P73 and P76 to P83.

3.6.3 CONCRETE DIAPHRAGMS

The total surveyed area of the concrete diaphragms was 47.39 m^2. The concrete diaphragms were in fair to poor condition with clean medium width cracks (0.6 m), delaminations (3.50 m^2), spalls (0.45), patches (0.30 m^2) and

rust stains. Several spalls revealed exposed corroded rebar. Surface deteriorations of the diaphragms are shown on Drawing Nos. 4a, 4b, 6, 8 and in Photos P66, P84 and P85 to P87.

3.7 APPROACHES

The asphalt wearing surface on the approaches was generally in good condition with sealed and unsealed medium width unsealed cracks, patches and light ravelling. The general pavement condition on the bridge approaches is shown in Photos P6 and P7. Examination of core C1 extracted from the east approach, confirmed the presence of a concrete approach slab beneath the asphalt. The asphalt thickness on the east approach measured in core C1 was 85 mm. Photo P96 shows the inside of core C1.

3.8 DECK JOINTS

Photos P8 to P15 show the general condition of the abutment and intermediate joints (half joints). The intermediate expansion joint seals (strip seal joints) were in poor condition. Both intermediate strip seal joints were observed to be leaking, as evidenced by wet stains, rust stains and spalls with exposed corroded rebar beneath the joints (Photos P62 to P66). The seals were covered with dirt and debris. The gap dimensions varied from 40 mm to 55 mm. Cracks, spalls and light to medium scaling were observed on the concrete end dams. Light corrosion was observed at the steel armouring angles, with damaged sections observed in several areas.

3.9 DRAINS

Twelve (12) drains were observed on the bridge deck (Photos P36 and P88). The deck drains were in good condition. Catch basins were observed at the northeast and southeast quadrants outside the structure limits (Photo P35).

3.10 GUIDERAILS

The steel beam guide rails attached to the northeast, northwest, southeast and southwest concrete end posts on the approaches were generally in good condition with splits and rot on wooden posts. Refer to Photos P31 to P34.

4 SUBSTRUCTURE COMPONENTS

The substructure of the bridge includes abutment walls, bearing seats, ballast walls, wingwalls and retaining walls that were inspected and hammer sounded to check for delaminations. The field measurements are presented in the field summary sheets.

4.1 ABUTMENTS

4.1.1 ABUTMENT WALLS

The total surveyed area of the east abutment was 7.48 m^2. The east abutment was in good condition with no observed defects. The observed surface is shown on Drawing No. 6 and in Photo P38.

The total surveyed area of the west abutment was 10.04 m^2. The west abutment was in good condition with no observed defects. The observed surface is shown on Drawing No. 6 and in Photo P37.

4.2 PIERS

The bridge piers, with a total surveyed area of 497.22 m^2, were generally in fair to good condition with clean and stained medium width cracks (35.5 m), delaminations (3.82 m^2), spalls (2.67 m^2), patches (0.40 m^2) and light scaling. The surface deteriorations of the piers are shown on Drawing Nos. 5a to 5d and in Photos P39 to P56.

4.3 EMBANKMENTS

The east and west embankments were in fair to good condition with erosion and loss of rock protection (Photos P37 and P38).

5 CLOSURE

We trust that this detailed bridge condition survey report is complete. Should you have any questions or comments, please do not hesitate to contact this office.

Yours very truly,

HAL GROUP INC.

Abbas Haghbin, P.Eng
President / Principal Engineer

Detailed Condition Survey Summary Sheets

Asphalt Covered Deck

HAL

DETAILED CONDITION SURVEY SUMMARY SHEET
ASPHALT COVERED DECK
DECK RIDING SURFACE

Site No. 0419550

1. Dimensions and Area of Survey

Width between E abutment curbs	9.14 m	Width between W abutment curbs	9.14 m
Length between abutment joints	67.51 m	Area of deck riding surface	617.04 m²

Remarks
Deck dimensions were taken from the structural drawings

2. Asphalt Surface Cracks

Orientation	Unsealed	Sealed	
Transverse	13.8	3.5	**m**
Longitudinal	69.0	61.1	**m**
Random	3.3	0.0	**m**

* Asphalt potholes/patches = 1.38 m²
* Asphalt Alligator Cracks = 0.00 m²
* Asphalt Ravelling = 0.00 m²

3. Asphalt Depth

Remarks

Condition *	Depth			
	Min	Max	Avg	
G	65	115	83	**mm**

* G – Good, F – Fair, P – Poor, V - Variable Good to Poor

Remarks

4. Waterproofing

Type	Condition *	Conc. Bond *	Thickness (mm) **			
			Min	Max	Avg	
Hot rubberized asphalt with protection board	G	F to G	4	8	6	**mm**

* G – Good, F – Fair, P – Poor, V - Variable Good to Poor
** Report only thickness of waterproofing membrane but note presence of protection board

DETAILED CONDITION SURVEY SUMMARY SHEET **Page 2 of 4**
ASPHALT COVERED DECK
DECK RIDING SURFACE

Site No. 0419550

5. Concrete Cover – Cores and Sawn Samples

Remarks

Minimum	Maximum	Average	
80	155	107	mm

Note: Only include covers for upper layer of rebars.

6. Corrosion Activity

Remarks

Minimum	Maximum	Average	
-0.011	-0.361	-0.082	V

0 to -0.20	-0.20 to -0.30	-0.30 to -0.35	-0.35 to -0.45	< -0.45	
583.7	19.7	6.8	6.8	0.0	m^2
94.6	3.2	1.1	1.1	0.0	%

Remarks

7. Defective Cores and Sawn Samples

Corrosion Activity (Volts)	Cores and Sawn Samples						
	Total in Each Area	Delaminated, Spalled, Severe Scaling and Disintegration *			Medium Scaling *		
		No.	m^2	%	No.	m^2	%
0 to -0.20	21	2	55.6	9.0	0	0.0	0.0
-0.20 to -0.30	0	0	0.0	0.0	0	0.0	0.0
-0.30 to -0.35	1	1	6.8	1.1	0	0.0	0.0
-0.35 to -0.45	0	0	0.0	0.0	0	0.0	0.0
<-0.45	0	0	0.0	0.0	0	0.0	0.0

* The percent calculation should be of the entire deck area investigated. The values obtained should be used with caution as large errors may occur when a small number of samples are used for the calculation or when the samples are not randomly distributed over the entire deck area.

HAL

DETAILED CONDITION SURVEY SUMMARY SHEET
ASPHALT COVERED DECK
DECK RIDING SURFACE

Site No. 0419550

8. Adjusted Chloride Content Profile

*Background (parent concrete) chloride content = 0.038
*Background (overlay concrete) chloride content = 0.033

Remarks

Corrosion Activity at Core		0 to -0.20	-0.20 to -0.35	≤-0.35
Chloride Content*	0-10 mm	0.105	-	-
	20-30 mm	0.074	-	-
	40-50 mm	0.033	-	-
	60-70 mm	0.010	-	-
	80-90 mm	0.002	-	-
	100-110 mm	0.002	-	-

* Average chloride content as % chloride by weight of concrete after deducting background chlorides for all cores taken in each range of corrosion potential.

9. Chloride Content at Rebar Level

Core No.	C3	C4	C10	C11	C12		
Chloride Content*	0.000	0.001	0.006	0.007	0.000		
Corrosion Potential	-0.055	-0.158	-0.044	-0.051	-0.048		
Core No.							
Chloride Content*							
Corrosion Potential							
Core No.							
Chloride Content*							
Corrosion Potential							

* Chloride content as % chloride by weight of concrete after deducting background chlorides.

10. AC Resistance Test Data of Epoxy Coated Rebar

Measured AC Resistance between Connection #1 and #2						Calculated AC Resistance
	Connection #2					
Connection #1	G1	G2	G3	G4	G5	
G1	N/A	-	-	-	-	-
G2	-	N/A	-	-	-	-
G3	-	-	N/A	-	-	-
G4	-	-	-	N/A	-	-
G5	-	-	-	-	N/A	-

Remarks
Table # 10 is Not Applicable.

* See Appendix 1E for calculating AC resistance contributed by individual rebar.

HAL

DETAILED CONDITION SURVEY SUMMARY SHEET **Page 4 of 4**
ASPHALT COVERED DECK
DECK RIDING SURFACE

Site No. 0419550

Remarks
Table # 11 is Not Applicable.

11. IR Drop and Truce Half Cell Potential Measurements of Epoxy Coated Rebar

IR Drop Between Connection #1 and #2						True Half Cell Potential *
Connection #1 (positive)	Connection #2 (negative)					
	G1	G2	G3	G4	G5	
G1	N/A	-	-	-	-	-
G2	-	N/A	-	-	-	-
G3	-	-	N/A	-	-	-
G4	-	-	-	N/A	-	-
G5	-	-	-	-	N/A	-

* Half cell reading taken on the same rebar with the ground connection.

12. Concrete Air Entrainment

	Yes	No	Marginal
Concrete Air Entrained?			

13. Compressive Strength

Average Compressive Strength **76.8 MPa**

Detailed Condition Survey Summary Sheets

Exposed Concrete Components

HAL

DETAILED CONDITION SURVEY SUMMARY SHEET

EXPOSED CONCRETE COMPONENTS (Exposed Deck, Deck Soffit, Curbs, Medians, Sidewalks, Barrier/Parapet Walls, etc.): Use separate form for each component

Site No: **0419550**

Component Type & Location: Sidewalks **OSIM Identifier: Sidewalks/curbs**

1. Dimensions and Area

Width	1.73 m	Length	67.51 m	Height	0.22 m
Diameter	-	Total Area Surveyed	233.58 m²		

Remarks

Dimensions were taken from the structural drawings & site measurements

2. Cracks (medium and wide)

Type		Transverse	Longitudinal	Other	Total	
Medium Width	Clean	2.8	0.0	0.0	2.8	m
	Stained	0.0	0.0	0.0		
Wide Width	Clean	0.0	0.0	0.0	0.0	m
	Stained	0.0	0.0	0.0		

3. Alkali Aggregate Reaction

Area of component with severe to very severe aggregate reaction 0.0 m²

4. Concrete Cover

Remarks

Minimum	Maximum	Average	
43	89	64	mm

0 – 20 mm	0.0	40 – 60 mm	94.6	m^2
	0.0		40.5	%
20 – 40 mm	0.0	over 60 mm	139.0	m^2
	0.0		59.5	%

HAL

DETAILED CONDITION SURVEY SUMMARY SHEET
EXPOSED CONCRETE COMPONENTS

Site No: **0419550**

Component Type & Location: Sidewalks **OSIM Identifier: Sidewalks/curbs**

Remarks

5. Corrosion Activity

Minimum	Maximum	Average	
-0.095	-0.395	-0.210	V

0 to -0.20	-0.20 to -0.30	-0.30 to -0.35	-0.35 to -0.45	< -0.45	
105.8	102.3	15.9	9.6	0.0	m^2
45.3	43.8	6.8	4.1	0.0	%

Remarks

6. Delaminations and Spalls

Defect Type	Delaminations	Spalls	Patches
Area (m^2)	6.67	0.02	0.00
Total Delaminations and Spalls		Total Delaminations and Spalls in Areas ≤-0.35 V	
6.69 m²	2.9 %	N/A	N/A

*Wet areas = 0.00 m²

Remarks

7. Scaling

Light	Medium	Severe to Very Severe	
0.00	0.00	0.00	m^2
0.0	0.0	0.0	%

8. Honeycombing

Total Area 0.00 m²

HAL

DETAILED CONDITION SURVEY SUMMARY SHEET **Page 3 of 4**
EXPOSED CONCRETE COMPONENTS

Site No: 0419550

Component Type & Location: Sidewalks **OSIM Identifier: Sidewalks/curbs**

Remarks
Table # 9 and 10 are Not Applicable.

9. Adjusted Chloride Content Profile

Corrosion Activity at Core Location (volts)		0 to -0.20	-0.20 to -0.35	≤ -0.35
Chloride Content*	0-10 mm	-	-	-
	20-30 mm	-	-	-
	40-50 mm	-	-	-
	60-70 mm	-	-	-
	80-90 mm	-	-	-
	100-110 mm	-	-	-

* Average chloride content as % chloride by weight of concrete after deducting background chlorides for all cores taken in each range of corrosion potential.

10. Chloride Content at Rebar Level

Core No.	-	-	-	-	-	-
Chloride Content*	-	-	-	-	-	-

* Chloride content as % chloride by weight of concrete after deducting background chlorides.

Remarks
Table # 11 is Not Applicable.

11. AC Resistance Test Data of Epoxy Coated Rebar

Measured AC Resistance between Connection #1 and #2						Calculated AC Resistance
	Connection #2					
Connection #1	G1	G2	G3	G4	G5	
G1	N/A	-	-	-	-	-
G2	-	N/A	-	-	-	-
G3	-	-	N/A	-	-	-
G4	-	-	-	N/A	-	-
G5	-	-	-	-	N/A	-

* See Appendix 1E for calculating AC resistance contributed by individual rebar.

Site No: 0419550

Component Type & Location: Sidewalks **OSIM Identifier: Sidewalks/curbs**

Remarks
Table # 12 is Not Applicable.

12. IR Drop and Truce Half Cell Potential Measurements of Epoxy Coated Rebar

IR Drop Between Connection #1 and #2						True Half Cell Potential *
Connection #1 (positive)	Connection #2 (negative)					
	G1	G2	G3	G4	G5	
G1	N/A	-	-	-	-	-
G2	-	N/A	-	-	-	-
G3	-	-	N/A	-	-	-
G4	-	-	-	N/A	-	-
G5	-	-	-	-	N/A	-

* Half cell reading taken on the same rebar with the ground connection.

13. Concrete Air Entrainment

Concrete Air Entrained: not tested

14. Compressive Strength

Average Compressive Strength: not tested

HAL

DETAILED CONDITION SURVEY SUMMARY SHEET

EXPOSED CONCRETE COMPONENTS (Exposed Deck, Deck Soffit, Curbs, Medians, Sidewalks, Barrier/Parapet Walls, etc.): Use separate form for each component

Site No: **0419550**

Component Type & Location: Soffit **OSIM Identifier: Decks**

1. Dimensions and Area

Width	12.70 m	Length	67.51 m	Height	0.36 m
Diameter	-	Total Area Surveyed	629.96 m²		

Remarks
Dimensions were taken from the structural drawings & site measurements

2. Cracks (medium and wide)

Type		Transverse	Longitudinal	Other	Total	
Medium Width	Clean	7.5	0.6	0.0	29.5	m
	Stained	20.2	0.3	0.9		
Wide Width	Clean	1.0	2.1	0.0	3.1	m
	Stained	0.0	0.0	0.0		

3. Alkali Aggregate Reaction

Area of component with severe to very severe aggregate reaction 0.0 m²

4. Concrete Cover

Minimum	Maximum	Average	
-	-	-	mm

0 – 20 mm	-	40 – 60 mm	-	m^2
	-		-	%
20 – 40 mm	-	over 60 mm	-	m^2
	-		-	%

Remarks
Table # 4 is Not Applicable.

HAL

DETAILED CONDITION SURVEY SUMMARY SHEET
EXPOSED CONCRETE COMPONENTS

Site No: **0419550**

Component Type & Location: Soffit **OSIM Identifier: Decks**

5. Corrosion Activity

Remarks
Table # 5 is Not Applicable.

Minimum	Maximum	Average	
-	-	-	V

0 to -0.20	-0.20 to -0.30	-0.30 to -0.35	-0.35 to -0.45	< -0.45	
-	-	-	-	-	m^2
-	-	-	-	-	%

6. Delaminations and Spalls

Remarks

Defect Type	Delaminations	Spalls	Patches
Area (m^2)	111.55	19.87	10.62
Total Delaminations and Spalls		Total Delaminations and Spalls in Areas ≤-0.35 V	
131.42 m²	20.9 %	N/A	N/A

*Wet areas = 0.00 m²

7. Scaling

Remarks

Light	Medium	Severe to Very Severe	
0.00	0.00	0.00	m^2
0.0	0.0	0.0	%

8. Honeycombing

Total Area 0.00 m²

HAL

DETAILED CONDITION SURVEY SUMMARY SHEET
EXPOSED CONCRETE COMPONENTS

Site No: **0419550**

Component Type & Location: Soffit **OSIM Identifier: Decks**

Remarks
Table # 9 and 10 are Not Applicable.

9. Adjusted Chloride Content Profile

Corrosion Activity at Core Location (volts)		0 to -0.20	-0.20 to -0.35	≤ -0.35
Chloride Content*	0-10 mm	-	-	-
	20-30 mm	-	-	-
	40-50 mm	-	-	-
	60-70 mm	-	-	-
	80-90 mm	-	-	-
	100-110 mm	-	-	-

* Average chloride content as % chloride by weight of concrete after deducting background chlorides for all cores taken in each range of corrosion potential.

10. Chloride Content at Rebar Level

Core No.	-	-	-	-	-	-
Chloride Content*	-	-	-	-	-	-

* Chloride content as % chloride by weight of concrete after deducting background chlorides.

Remarks
Table # 11 is Not Applicable.

11. AC Resistance Test Data of Epoxy Coated Rebar

Measured AC Resistance between Connection #1 and #2						Calculated AC Resistance
	Connection #2					
Connection #1	G1	G2	G3	G4	G5	
G1	N/A	-	-	-	-	-
G2	-	N/A	-	-	-	-
G3	-	-	N/A	-	-	-
G4	-	-	-	N/A	-	-
G5	-	-	-	-	N/A	-

* See Appendix 1E for calculating AC resistance contributed by individual rebar.

HAL

DETAILED CONDITION SURVEY SUMMARY SHEET **Page 4 of 4**
EXPOSED CONCRETE COMPONENTS

Site No: 0419550

Component Type & Location: Soffit **OSIM Identifier: Decks**

Remarks
Table # 12 is Not Applicable.

12. IR Drop and Truce Half Cell Potential Measurements of Epoxy Coated Rebar

IR Drop Between Connection #1 and #2						True Half Cell Potential *
Connection #1 (positive)	Connection #2 (negative)					
	G1	G2	G3	G4	G5	
G1	N/A	-	-	-	-	-
G2	-	N/A	-	-	-	-
G3	-	-	N/A	-	-	-
G4	-	-	-	N/A	-	-
G5	-	-	-	-	N/A	-

* Half cell reading taken on the same rebar with the ground connection.

13. Concrete Air Entrainment

Concrete Air Entrained: not tested

14. Compressive Strength

Average Compressive Strength: not tested

HAL

DETAILED CONDITION SURVEY SUMMARY SHEET

EXPOSED CONCRETE COMPONENTS (Exposed Deck, Deck Soffit, Curbs, Medians, Sidewalks, Barrier/Parapet Walls, etc.): Use separate form for each component

Site No: 0419550

Component Type & Location: Girders **OSIM Identifier: Beams/MLEs**

1. Dimensions and Area

Width	Varies	Length	67.51 m	Height	Varies
Diameter	-	Total Area Surveyed		754.20 m²	

2. Cracks (medium and wide)

Type		Transverse	Longitudinal	Other	Total	
Medium Width	Clean	3.1	4.1	5.0	12.2	m
	Stained	0.0	0.0	0.0		
Wide Width	Clean	0.0	0.0	0.0	0.0	m
	Stained	0.0	0.0	0.0		

3. Alkali Aggregate Reaction

Area of component with severe to very severe aggregate reaction 0.0 m²

4. Concrete Cover

Minimum	Maximum	Average	
-	-	-	mm

0 – 20 mm	-	40 – 60 mm	-	m^2
	-		-	%
20 – 40 mm	-	over 60 mm	-	m^2
	-		-	%

HAL

DETAILED CONDITION SURVEY SUMMARY SHEET
EXPOSED CONCRETE COMPONENTS

Site No: **0419550**

Component Type & Location: Girders **OSIM Identifier**

5. Corrosion Activity

Minimum	Maximum	Average	
-	-	-	V

0 to -0.20	-0.20 to -0.30	-0.30 to -0.35	-0.35 to -0.45	< -0.45	
-	-	-	-	-	m^2
-	-	-	-	-	%

6. Delaminations and Spalls

Defect Type	Delaminations	Spalls	Patches
Area (m^2)	32.0	6.8	1.0
Total Delaminations and Spalls		Total Delaminations and Spalls in Areas ≤-0.35 V	
38.8 m²	5.1 %	0.0 m²	0.0 %

*Wet areas = 0.0 m²

7. Scaling

Light	Medium	Severe to Very Severe	
0.0	0.0	0.0	m^2
0.0	0.0	0.0	%

8. Honeycombing

Total Area 0.0 m²

HAL

DETAILED CONDITION SURVEY SUMMARY SHEET
EXPOSED CONCRETE COMPONENTS

Site No: **0419550**

Component Type & Location: Girders **OSIM Identifier**

9. Adjusted Chloride Content Profile

Corrosion Activity at Core Location (volts)		0 to -0.20	-0.20 to -0.35	≤ -0.35
Chloride Content*	0-10 mm	-	-	-
	20-30 mm	-	-	-
	40-50 mm	-	-	-
	60-70 mm	-	-	-
	80-90 mm	-	-	-
	100-110 mm	-	-	-

* Average chloride content as % chloride by weight of concrete after deducting background chlorides for all cores taken in each range of corrosion potential.

10. Chloride Content at Rebar Level

Core No.	-	-	-	-	-	-
Chloride Content*	-	-	-	-	-	-

* Chloride content as % chloride by weight of concrete after deducting background chlorides.

11. AC Resistance Test Data of Epoxy Coated Rebar

Measured AC Resistance between Connection #1 and #2						Calculated AC Resistance
	Connection #2					
Connection #1	G1	G2	G3	G4	G5	
G1	N/A	-	-	-	-	-
G2	-	N/A	-	-	-	-
G3	-	-	N/A	-	-	-
G4	-	-	-	N/A	-	-
G5	-	-	-	-	N/A	-

* See Appendix 1E for calculating AC resistance contributed by individual rebar.

Site No: 0419550

Component Type & Location: Girders **OSIM Identifier**

12. IR Drop and Truce Half Cell Potential Measurements of Epoxy Coated Rebar

IR Drop Between Connection #1 and #2						True Half Cell Potential *
Connection #1 (positive)	Connection #2 (negative)					
	G1	G2	G3	G4	G5	
G1	N/A	-	-	-	-	-
G2	-	N/A	-	-	-	-
G3	-	-	N/A	-	-	-
G4	-	-	-	N/A	-	-
G5	-	-	-	-	N/A	-

* Half cell reading taken on the same rebar with the ground connection.

13. Concrete Air Entrainment

Concrete Air Entrained: not tested

14. Compressive Strength

Average Compressive Strength: not tested

HAL

DETAILED CONDITION SURVEY SUMMARY SHEET

EXPOSED CONCRETE COMPONENTS (Exposed Deck, Deck Soffit, Curbs, Medians, Sidewalks, Barrier/Parapet Walls, etc.): Use separate form for each component

Site No: 0419550

Component Type & Location: Diaphragms **OSIM Identifier: OSIM Identifier: Beams/MLEs**

1. Dimensions and Area

Width	13.31 m	Length	-	Height	0.44 m
Diameter	-	Total Area Surveyed		47.39	

2. Cracks (medium and wide)

Type		Transverse	Longitudinal	Other	Total	
Medium Width	Clean	0.0	0.6	0.0	0.6	m
	Stained	0.0	0.0	0.0		
Wide Width	Clean	0.0	0.0	0.0	0.0	m
	Stained	0.0	0.0	0.0		

3. Alkali Aggregate Reaction

Area of component with severe to very severe aggregate reaction 0.0 m²

4. Concrete Cover

Minimum	Maximum	Average	
-	-	-	mm

0 – 20 mm	-	40 – 60 mm	-	m^2
	-		-	%
20 – 40 mm	-	over 60 mm	-	m^2
	-		-	%

HAL

DETAILED CONDITION SURVEY SUMMARY SHEET
EXPOSED CONCRETE COMPONENTS

Site No: **0419550**

Component Type & Location: Diaphragms **OSIM Identifier**

5. Corrosion Activity

Minimum	Maximum	Average	
-	-	-	V

0 to -0.20	-0.20 to -0.30	-0.30 to -0.35	-0.35 to -0.45	< -0.45	
-	-	-	-	-	V
-	-	-	-	-	m^2
-	-	-	-	-	%

6. Delaminations and Spalls

Defect Type	Delaminations	Spalls	Patches
Area (m^2)	3.50	0.45	0.30
Total Delaminations and Spalls		Total Delaminations and Spalls in Areas ≤-0.35 V	
4.0 m²	8.3 %	N/A	N/A

*Wet areas = 0.0 m²

7. Scaling

Light	Medium	Severe to Very Severe	
0.0	0.0	0.0	m^2
0.0	0.0	0.0	%

8. Honeycombing

Total Area 0.0 m²

Site No: 0419550

Component Type & Location: Diaphragms **OSIM Identifier**

9. Adjusted Chloride Content Profile

Corrosion Activity at Core Location (volts)		0 to -0.20	-0.20 to -0.35	≤ -0.35
Chloride Content*	0-10 mm	-	-	-
	20-30 mm	-	-	-
	40-50 mm	-	-	-
	60-70 mm	-	-	-
	80-90 mm	-	-	-
	100-110 mm	-	-	-

* Average chloride content as % chloride by weight of concrete after deducting background chlorides for all cores taken in each range of corrosion potential.

10. Chloride Content at Rebar Level

Core No.	-	-	-	-	-	-
Chloride Content*	-	-	-	-	-	-

* Chloride content as % chloride by weight of concrete after deducting background chlorides.

11. AC Resistance Test Data of Epoxy Coated Rebar

Measured AC Resistance between Connection #1 and #2						Calculated AC Resistance
	Connection #2					
Connection #1	G1	G2	G3	G4	G5	
G1	N/A	-	-	-	-	-
G2	-	N/A	-	-	-	-
G3	-	-	N/A	-	-	-
G4	-	-	-	N/A	-	-
G5	-	-	-	-	N/A	-

* See Appendix 1E for calculating AC resistance contributed by individual rebar.

Site No: 0419550

Component Type & Location: Diaphragms **OSIM Identifier**

12. IR Drop and Truce Half Cell Potential Measurements of Epoxy Coated Rebar

IR Drop Between Connection #1 and #2						True Half Cell Potential *
Connection #1 (positive)	Connection #2 (negative)					
	G1	G2	G3	G4	G5	
G1	N/A	-	-	-	-	-
G2	-	N/A	-	-	-	-
G3	-	-	N/A	-	-	-
G4	-	-	-	N/A	-	-
G5	-	-	-	-	N/A	-

* Half cell reading taken on the same rebar with the ground connection.

13. Concrete Air Entrainment

Concrete Air Entrained: not tested

14. Compressive Strength

Average Compressive Strength: not tested

HAL

DETAILED CONDITION SURVEY SUMMARY SHEET

EXPOSED CONCRETE COMPONENTS (Exposed Deck, Deck Soffit, Curbs, Medians, Sidewalks, Barrier/Parapet Walls, etc.): Use separate form for each component

Site No: 0419550

Component Type & Location: East Abutment Wall **OSIM Identifier: Abutments**

1. Dimensions and Area

Width	11.90 m	Length	-	Height	Varies
Diameter	-	Total Area Surveyed		7.48 m²	

Remarks
Dimensions were taken from the structural drawings & site measurements

2. Cracks (medium and wide)

Type		Vertical	Horizontal	Diagonal	Total	
Medium Width	Clean	0.0	0.0	0.0	0.0	m
	Stained	0.0	0.0	0.0		
Wide Width	Clean	0.0	0.0	0.0	0.0	m
	Stained	0.0	0.0	0.0		

3. Alkali Aggregate Reaction

Area of component with severe to very severe aggregate reaction 0.0 m²

4. Concrete Cover

Minimum	Maximum	Average	
-	-	-	mm

0 – 20 mm	-	40 – 60 mm	-	m^2
	-		-	%
20 – 40 mm	-	over 60 mm	-	m^2
	-		-	%

Remarks
Table # 4 is Not Applicable.

HAL

DETAILED CONDITION SURVEY SUMMARY SHEET **Page 2 of 4**
EXPOSED CONCRETE COMPONENTS

Site No: 0419550

Component Type & Location: East Abutment Wall **OSIM Identifier: Abutments**

5. Corrosion Activity

Remarks
Table # 5 is Not Applicable.

Minimum	Maximum	Average	
-	-	-	V

0 to -0.20	-0.20 to -0.30	-0.30 to -0.35	-0.35 to -0.45	< -0.45	
-	-	-	-	-	m^2
-	-	-	-	-	%

V

6. Delaminations and Spalls

Remarks

Defect Type	Delaminations	Spalls	Patches
Area (m^2)	0.00	0.00	0.00
Total Delaminations and Spalls		Total Delaminations and Spalls in Areas ≤-0.35 V	
0.00 m²	0.0 %	N/A	N/A

*Wet areas = 0.00 m²

7. Scaling

Remarks

Light	Medium	Severe to Very Severe	
0.00	0.00	0.00	m^2
0.0	0.0	0.0	%

8. Honeycombing

Total Area 0.00 m²

HAL

DETAILED CONDITION SURVEY SUMMARY SHEET
EXPOSED CONCRETE COMPONENTS

Site No: 0419550

Component Type & Location: East Abutment Wall **OSIM Identifier: Abutments**

Remarks
Table # 9 and 10 are Not Applicable.

9. Adjusted Chloride Content Profile

Corrosion Activity at Core Location (volts)		0 to -0.20	-0.20 to -0.35	≤ -0.35
Chloride Content*	0-10 mm	-	-	-
	20-30 mm	-	-	-
	40-50 mm	-	-	-
	60-70 mm	-	-	-
	80-90 mm	-	-	-
	100-110 mm	-	-	-

* Average chloride content as % chloride by weight of concrete after deducting background chlorides for all cores taken in each range of corrosion potential.

10. Chloride Content at Rebar Level

Core No.	-	-	-	-	-	-
Chloride Content*	-	-	-	-	-	-

* Chloride content as % chloride by weight of concrete after deducting background chlorides.

Remarks
Table # 11 is Not Applicable.

11. AC Resistance Test Data of Epoxy Coated Rebar

Measured AC Resistance between Connection #1 and #2						Calculated AC Resistance
	Connection #2					
Connection #1	G1	G2	G3	G4	G5	
G1	N/A	-	-	-	-	-
G2	-	N/A	-	-	-	-
G3	-	-	N/A	-	-	-
G4	-	-	-	N/A	-	-
G5	-	-	-	-	N/A	-

* See Appendix 1E for calculating AC resistance contributed by individual rebar.

HAL

DETAILED CONDITION SURVEY SUMMARY SHEET **Page 4 of 4**
EXPOSED CONCRETE COMPONENTS

Site No: 0419550

Component Type & Location: East Abutment Wall **OSIM Identifier: Abutments**

Remarks
Table # 12 is Not Applicable.

12. IR Drop and Truce Half Cell Potential Measurements of Epoxy Coated Rebar

IR Drop Between Connection #1 and #2						True Half Cell Potential *
Connection #1 (positive)	Connection #2 (negative)					
	G1	G2	G3	G4	G5	
G1	N/A	-	-	-	-	-
G2	-	N/A	-	-	-	-
G3	-	-	N/A	-	-	-
G4	-	-	-	N/A	-	-
G5	-	-	-	-	N/A	-

* Half cell reading taken on the same rebar with the ground connection.

13. Concrete Air Entrainment

Concrete Air Entrained: not tested

14. Compressive Strength

Average Compressive Strength: not tested

HAL

DETAILED CONDITION SURVEY SUMMARY SHEET

EXPOSED CONCRETE COMPONENTS (Exposed Deck, Deck Soffit, Curbs, Medians, Sidewalks, Barrier/Parapet Walls, etc.): Use separate form for each component

Site No: 0419550

Component Type & Location: West Abutment Wall **OSIM Identifier: Abutments**

1. Dimensions and Area

Width	11.90 m	Length	-	Height	Varies
Diameter	-	Total Area Surveyed		10.04 m²	

Remarks
Dimensions were taken from the structural drawings & site measurements

2. Cracks (medium and wide)

Type		Vertical	Horizontal	Diagonal	Total	
Medium Width	Clean	0.0	0.0	0.0	0.0	m
	Stained	0.0	0.0	0.0		
Wide Width	Clean	0.0	0.0	0.0	0.0	m
	Stained	0.0	0.0	0.0		

3. Alkali Aggregate Reaction

Area of component with severe to very severe aggregate reaction 0.0 m²

4. Concrete Cover

Minimum	Maximum	Average	
-	-	-	mm

0 – 20 mm	-	40 – 60 mm	-	m^2
	-		-	%
20 – 40 mm	-	over 60 mm	-	m^2
	-		-	%

Remarks
Table # 4 is Not Applicable.

HAL

DETAILED CONDITION SURVEY SUMMARY SHEET
EXPOSED CONCRETE COMPONENTS

Site No: **0419550**

Component Type & Location: West Abutment Wall **OSIM Identifier: Abutments**

Remarks
Table # 5 is Not Applicable.

5. Corrosion Activity

Minimum	Maximum	Average	
-	-	-	V

0 to -0.20	-0.20 to -0.30	-0.30 to -0.35	-0.35 to -0.45	< -0.45	
-	-	-	-	-	V
-	-	-	-	-	m^2
-	-	-	-	-	%

6. Delaminations and Spalls

Remarks

Defect Type	Delaminations	Spalls	Patches
Area (m^2)	0.00	0.00	0.00
Total Delaminations and Spalls		Total Delaminations and Spalls in Areas ≤-0.35 V	
0.00 m²	0.0 %	N/A	N/A

*Wet areas = 0.00 m²

7. Scaling

Remarks

Light	Medium	Severe to Very Severe	
0.00	0.00	0.00	m^2
0.0	0.0	0.0	%

8. Honeycombing

Total Area 0.00 m²

HAL

DETAILED CONDITION SURVEY SUMMARY SHEET
EXPOSED CONCRETE COMPONENTS

Site No: 0419550

Component Type & Location: West Abutment Wall **OSIM Identifier: Abutments**

Remarks
Table # 9 and 10 are Not Applicable.

9. Adjusted Chloride Content Profile

Corrosion Activity at Core Location (volts)		0 to -0.20	-0.20 to -0.35	≤ -0.35
Chloride Content*	0-10 mm	-	-	-
	20-30 mm	-	-	-
	40-50 mm	-	-	-
	60-70 mm	-	-	-
	80-90 mm	-	-	-
	100-110 mm	-	-	-

* Average chloride content as % chloride by weight of concrete after deducting background chlorides for all cores taken in each range of corrosion potential.

10. Chloride Content at Rebar Level

Core No.	-	-	-	-	-	-
Chloride Content*	-	-	-	-	-	-

* Chloride content as % chloride by weight of concrete after deducting background chlorides.

Remarks
Table # 11 is Not Applicable.

11. AC Resistance Test Data of Epoxy Coated Rebar

Measured AC Resistance between Connection #1 and #2						Calculated AC Resistance
	Connection #2					
Connection #1	G1	G2	G3	G4	G5	
G1	N/A	-	-	-	-	-
G2	-	N/A	-	-	-	-
G3	-	-	N/A	-	-	-
G4	-	-	-	N/A	-	-
G5	-	-	-	-	N/A	-

* See Appendix 1E for calculating AC resistance contributed by individual rebar.

HAL

DETAILED CONDITION SURVEY SUMMARY SHEET **Page 4 of 4**
EXPOSED CONCRETE COMPONENTS

Site No: 0419550

Component Type & Location: West Abutment Wall **OSIM Identifier: Abutments**

Remarks
Table # 12 is Not Applicable.

12. IR Drop and Truce Half Cell Potential Measurements of Epoxy Coated Rebar

IR Drop Between Connection #1 and #2						True Half Cell Potential *
Connection #1 (positive)	Connection #2 (negative)					
	G1	G2	G3	G4	G5	
G1	N/A	-	-	-	-	-
G2	-	N/A	-	-	-	-
G3	-	-	N/A	-	-	-
G4	-	-	-	N/A	-	-
G5	-	-	-	-	N/A	-

* Half cell reading taken on the same rebar with the ground connection.

13. Concrete Air Entrainment

Concrete Air Entrained: not tested

14. Compressive Strength

Average Compressive Strength: not tested

HAL

DETAILED CONDITION SURVEY SUMMARY SHEET

EXPOSED CONCRETE COMPONENTS (Exposed Deck, Deck Soffit, Curbs, Medians, Sidewalks, Barrier/Parapet Walls, etc.): Use separate form for each component

Site No: 0419550

Component Type & Location: Piers **OSIM Identifier: Piers**

1. Dimensions and Area

Width	14.07 m	Length	1.22 m	Height	Varies
Diameter	-	Total Area Surveyed		497.22 m²	

Remarks
Dimensions were taken from the structural drawings & site measurements

2. Cracks (medium and wide)

Type		Vertical	Horizontal	Diagonal	Total	
Medium Width	Clean	22.6	3.0	1.3	35.5	m
	Stained	5.2	2.4	0.9		
Wide Width	Clean	0.0	0.0	0.0	0.0	m
	Stained	0.0	0.0	0.0		

Concrete pattern cracking = 48.75 Sq.m

3. Alkali Aggregate Reaction

Area of component with severe to very severe aggregate reaction 0.0 m²

4. Concrete Cover

Minimum	Maximum	Average	
-	-	-	mm

Remarks
Table # 4 is Not Applicable.

0 – 20 mm	-	40 – 60 mm	-	m^2
	-		-	%
20 – 40 mm	-	over 60 mm	-	m^2
	-		-	%

HAL

DETAILED CONDITION SURVEY SUMMARY SHEET **Page 2 of 4**
EXPOSED CONCRETE COMPONENTS

Site No: 0419550

Component Type & Location: Piers **OSIM Identifier: Piers**

5. Corrosion Activity

Remarks
Table # 5 is Not Applicable.

Minimum	Maximum	Average	
-	-	-	V

0 to -0.20	-0.20 to -0.30	-0.30 to -0.35	-0.35 to -0.45	< -0.45	
-	-	-	-	-	m^2
-	-	-	-	-	%

V

6. Delaminations and Spalls

Remarks

Defect Type	Delaminations	Spalls	Patches
Area (m^2)	3.82	2.67	0.40
Total Delaminations and Spalls		Total Delaminations and Spalls in Areas ≤-0.35 V	
6.49 m²	1.3 %	N/A	N/A

*Wet areas = 0.00 m²

Remarks

7. Scaling

Light	Medium	Severe to Very Severe	
0.00	0.00	0.00	m^2
0.0	0.0	0.0	%

8. Honeycombing

Total Area 0.00 m²

HAL

DETAILED CONDITION SURVEY SUMMARY SHEET
EXPOSED CONCRETE COMPONENTS

Site No: **0419550**

Component Type & Location: Piers **OSIM Identifier: Piers**

Remarks
Table # 9 and 10 are Not Applicable.

9. Adjusted Chloride Content Profile

Corrosion Activity at Core Location (volts)		0 to -0.20	-0.20 to -0.35	≤ -0.35
Chloride Content*	0-10 mm	-	-	-
	20-30 mm	-	-	-
	40-50 mm	-	-	-
	60-70 mm	-	-	-
	80-90 mm	-	-	-
	100-110 mm	-	-	-

* Average chloride content as % chloride by weight of concrete after deducting background chlorides for all cores taken in each range of corrosion potential.

10. Chloride Content at Rebar Level

Core No.	-	-	-	-	-	-
Chloride Content*	-	-	-	-	-	-

* Chloride content as % chloride by weight of concrete after deducting background chlorides.

Remarks
Table # 11 is Not Applicable.

11. AC Resistance Test Data of Epoxy Coated Rebar

Measured AC Resistance between Connection #1 and #2						Calculated AC Resistance
	Connection #2					
Connection #1	G1	G2	G3	G4	G5	
G1	N/A	-	-	-	-	-
G2	-	N/A	-	-	-	-
G3	-	-	N/A	-	-	-
G4	-	-	-	N/A	-	-
G5	-	-	-	-	N/A	-

* See Appendix 1E for calculating AC resistance contributed by individual rebar.

HAL

DETAILED CONDITION SURVEY SUMMARY SHEET **Page 4 of 4**
EXPOSED CONCRETE COMPONENTS

Site No: 0419550

Component Type & Location: Piers **OSIM Identifier: Piers**

Remarks
Table # 12 is Not Applicable.

12. IR Drop and Truce Half Cell Potential Measurements of Epoxy Coated Rebar

IR Drop Between Connection #1 and #2						True Half Cell Potential *
Connection #1 (positive)	Connection #2 (negative)					
	G1	G2	G3	G4	G5	
G1	N/A	-	-	-	-	-
G2	-	N/A	-	-	-	-
G3	-	-	N/A	-	-	-
G4	-	-	-	N/A	-	-
G5	-	-	-	-	N/A	-

* Half cell reading taken on the same rebar with the ground connection.

13. Concrete Air Entrainment

Concrete Air Entrained: not tested

14. Compressive Strength

Average Compressive Strength: not tested

Detailed Condition Survey Summary Sheet

Expansion Joints

DETAILED CONDITION SURVEY SUMMARY SHEET

EXPANSION JOINTS

Dimension	Abutments		Intermediate		Remarks
	East	West	East	West	
a (mm)	1,727	1,727	1,727	1,727	
b (mm)	220	220	220	220	
b' (mm)	225	225	225	225	
c (mm)	9,144	9,144	9,144	9,144	
d (mm)	220	220	220	220	
d' (mm)	225	225	225	225	
e (mm)	1,727	1,727	1,727	1,727	

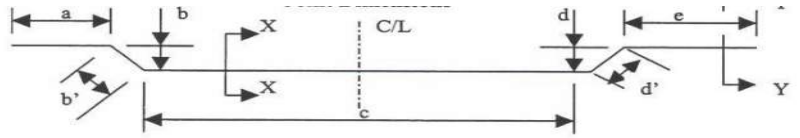
Depth of Asphalt @ Deck Side			N/E	S/E	N/E	S/W
1 (mm)	90	75	-	-	-	-
2 (mm)	90	75	-	-	-	-
3 (mm)	65	70	-	-	-	-

Width: Top of Ballast Wall and End Dams								
	N	S	N	S	N	S	N	S
1 (mm)	-	-	-	-	-	-	-	-
2 (mm)	-	-	-	-	-	-	-	-
3 (mm)	-	-	-	-	-	-	-	-

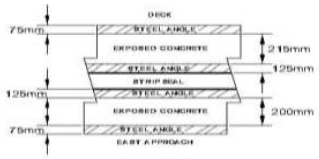
Gap Dimensions				
1 (mm)	45	45	55	55
2 (mm)	45	45	50	50
3 (mm)	45	40	50	50

Misc. Joint Details		Skew Angle	00º 00' 00"
Exp	YES	YES	-	-
Fixed	NO	NO	-	-
Type	STRIP SEAL JOINT			
Leaking	NO	NO	YES	YES
Angle size	-	-	-	-
Temp °C	Deck	17 ºC	Ambient	17 ºC

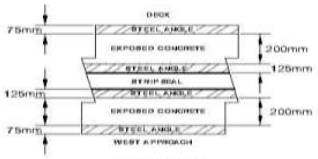
N — JOINT DIMENSIONS — S



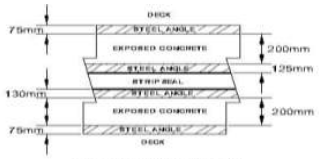
Typical Sections at Joints: N - S



EAST JOINT



WEST JOINT



INTERMEDIATE JOINTS

Detailed Condition Survey Summary Sheet

Drainage

Deck Drains	Number	Type	Length	Angle	Depth *
	12	Steel drain pipes (0.15 m dia.)	1.20 m	-	10 to 15 mm

* For asphalt covered decks, recess depth in mm between top of asphalt and top of drain.

Catch Basins	-	NE
	-	SE

*Identify location of catch basins as N/E, N/W, S/E etc. using the same direction of north as shown on the drawings.

Drainage Tubes	-	Void Drains	-
	-		-

Deck Drains – Typical

Survey Equipment and Calibration Procedures

Component Type: Asphalt Covered Bridge Deck

1. DELAMINATIONS:

Weight of Chain: 2.2 kg/m Other Equipment: Hammer

2. CONCRETE COVER:

Covermeter Make & Model: Elcometer Protovale 331
Batter Check: Reading at Start of Test: OK Reading at End of Test: OK
Concrete Cover Check: Location of Check: SS1
Actual Depth & Rebar Dia: -
Reading Before Test: 101mm Reading Each 30 min During Test: 101mm
Reading End of Test: 101mm

3. CORROSION ACTIVITY

Half Cell Make & Model: MC Miller Electrode RE-5U
Multimeter Make & Model: Mastercraft Digital Multimeter 3 R93
Length and Gauge of Lead Wires: 150 m of 20 gauge
Deck Temp: Start of Test: 17°C End of Test: 17°C
Ambient Temp: Start of Test: 17°C End of Test: 17°C
Battery Check: OK
Ground Check: Method of Connection: Self-tapping screw
Ground Location: C8 Check Location: C4
Measured Resistance: 2.3 Ω (A)
Measured resistance is the circuit resistance of deck, including the resistance of the leads
Lead Resistance: 1.7 Ω (B) Voltage Drop (mV's): 0.1
Net Resistance: 0.6 Ω (C) Resistance Reversed: 0.6 Ω
(C = A - B)

GRID POINT POTENTIAL READINGS CHECK – SEE TABLE BELOW

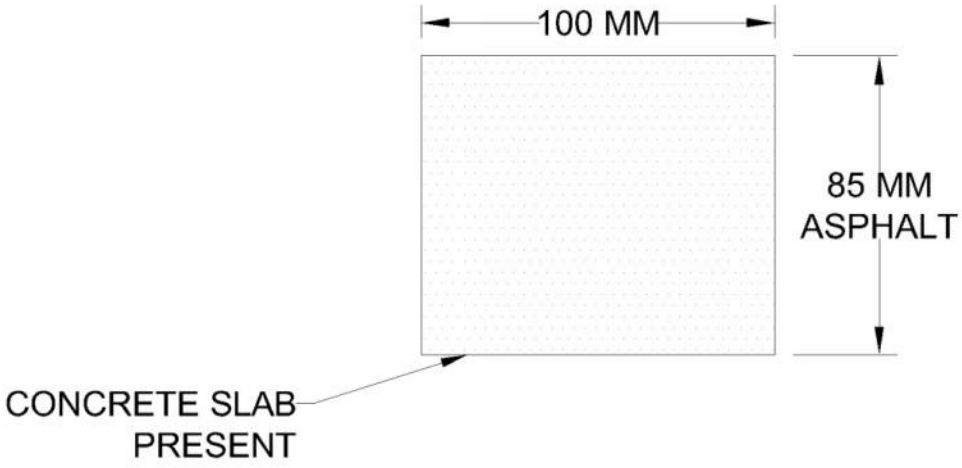
Location	Initial Reading	Check Reading [1]	Check Reading – Latex Concrete Overlay [2]
A1	-0.165	-0.162	-
A2	-0.130	-0.139	-
A3	-0.080	-0.078	-
A4	-0.040	-0.048	-
A5	-0.068	-0.077	-

1 Check at least five readings at beginning of test and each change in ground

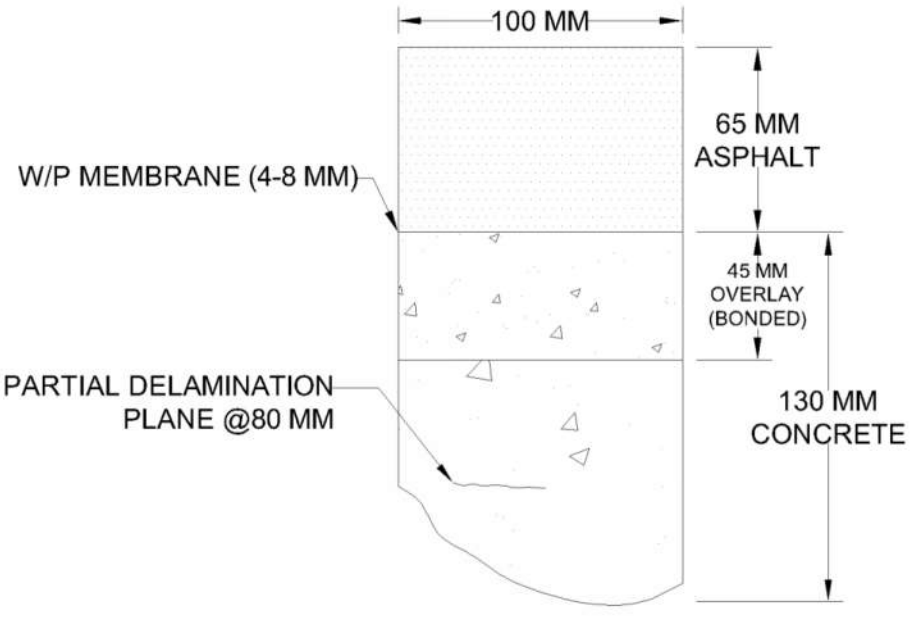
2 On decks with latex modified concrete overlay, check at least five locations by drilling holes through the latex concrete overlay into the original concrete substrate

Core Photographs and Sketches

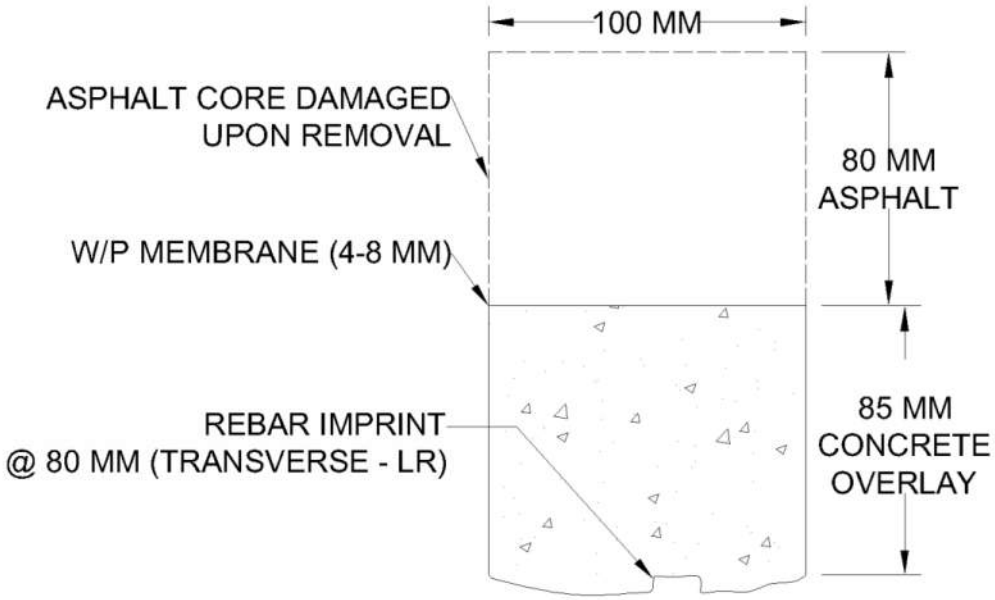
CORE C1



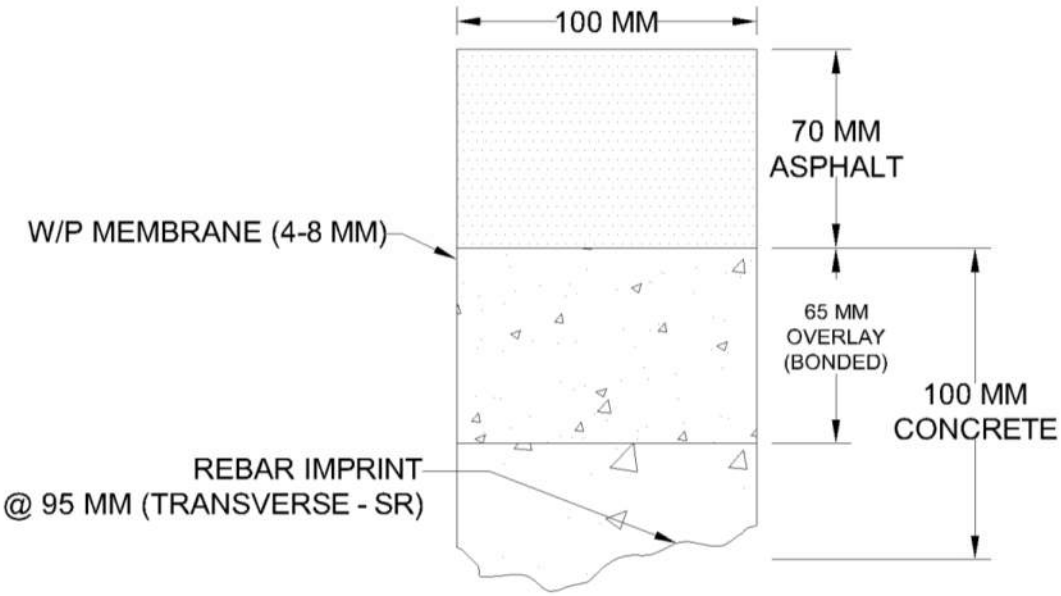
CORE C2


100 MM
65 MM
ASPHALT
W/P MEMBRANE (4-8 MM)
45 MM
OVERLAY
(BONDED)
PARTIAL DELAMINATION
PLANE @80 MM
130 MM
CONCRETE

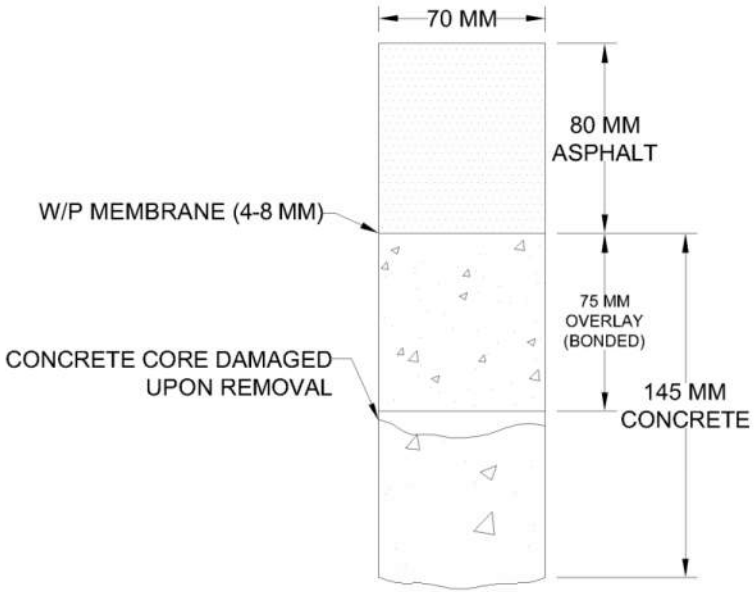
CORE C3


100 MM
ASPHALT CORE DAMAGED
UPON REMOVAL
80 MM
ASPHALT
W/P MEMBRANE (4-8 MM)
REBAR IMPRINT
@ 80 MM (TRANSVERSE - LR)
85 MM
CONCRETE
OVERLAY

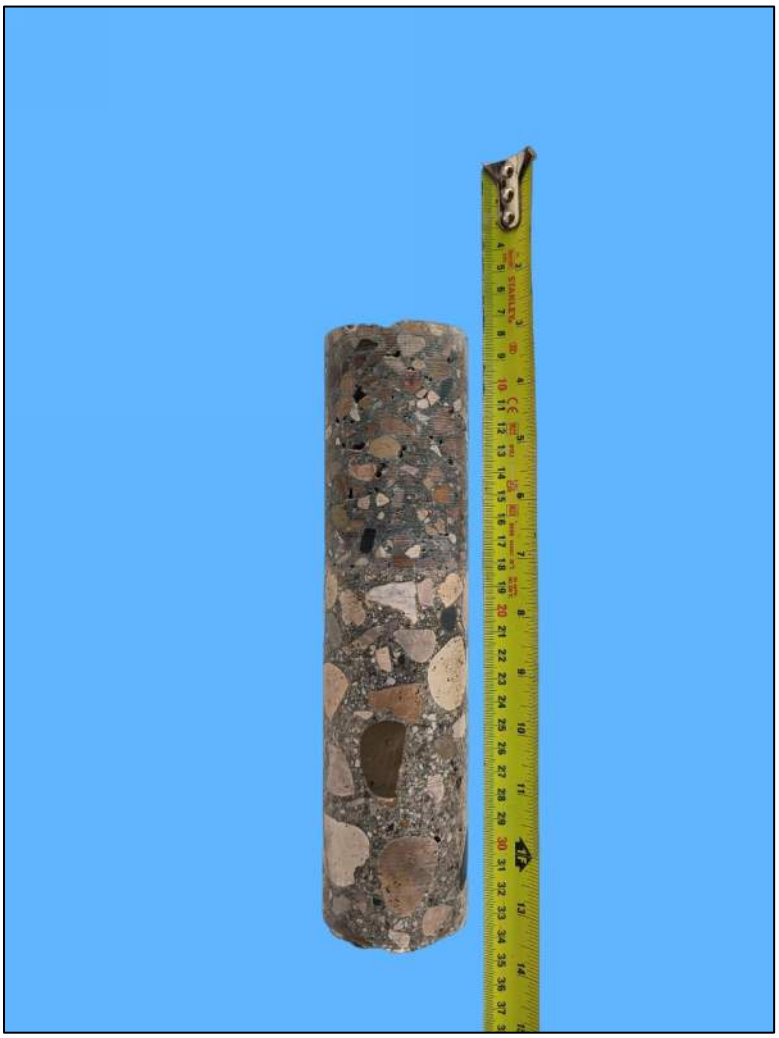
CORE C4

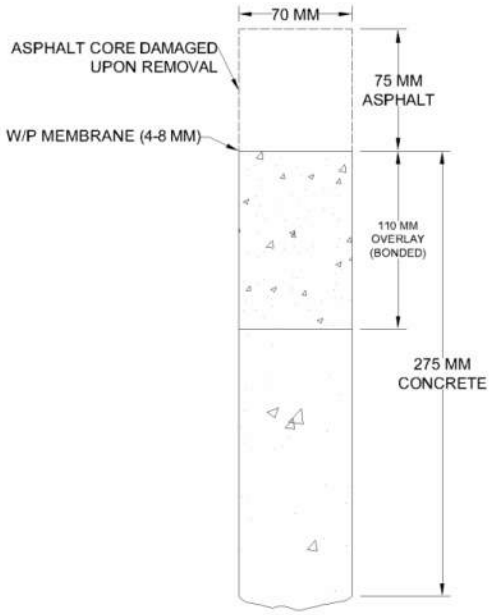

100 MM
70 MM
ASPHALT
W/P MEMBRANE (4-8 MM)
65 MM
OVERLAY
(BONDED)
100 MM
CONCRETE
REBAR IMPRINT
@ 95 MM (TRANSVERSE - SR)

CORE C5

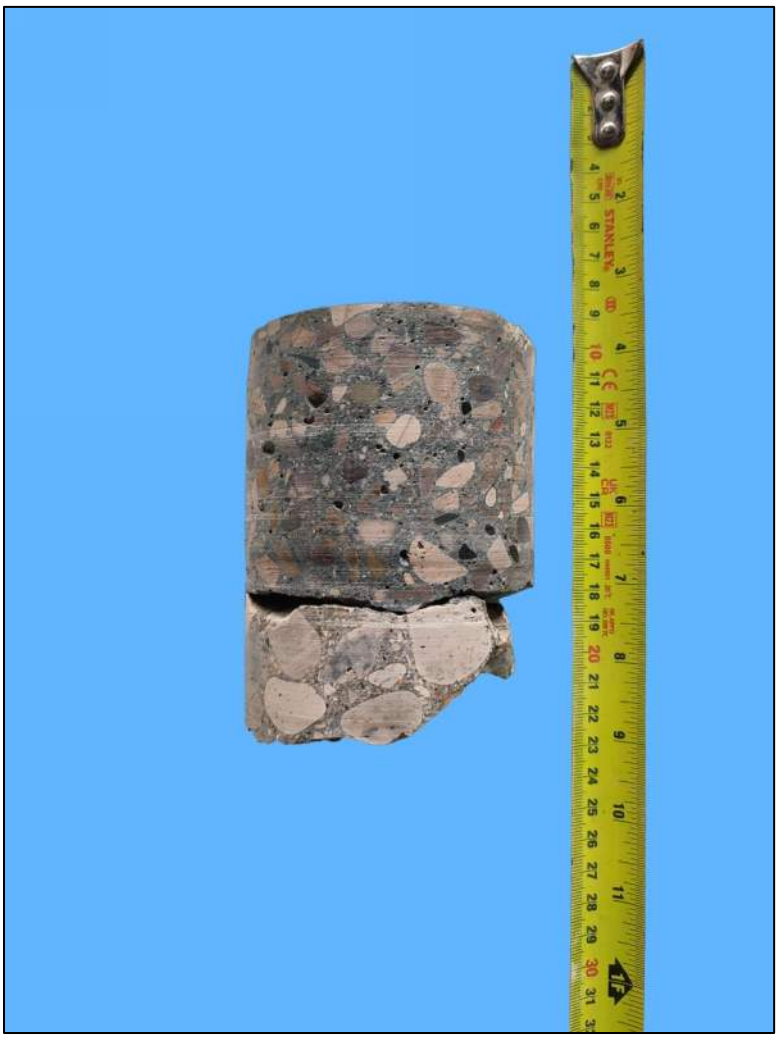

70 MM
80 MM
ASPHALT
W/P MEMBRANE (4-8 MM)
75 MM
OVERLAY
(BONDED)
CONCRETE CORE DAMAGED
UPON REMOVAL
145 MM
CONCRETE

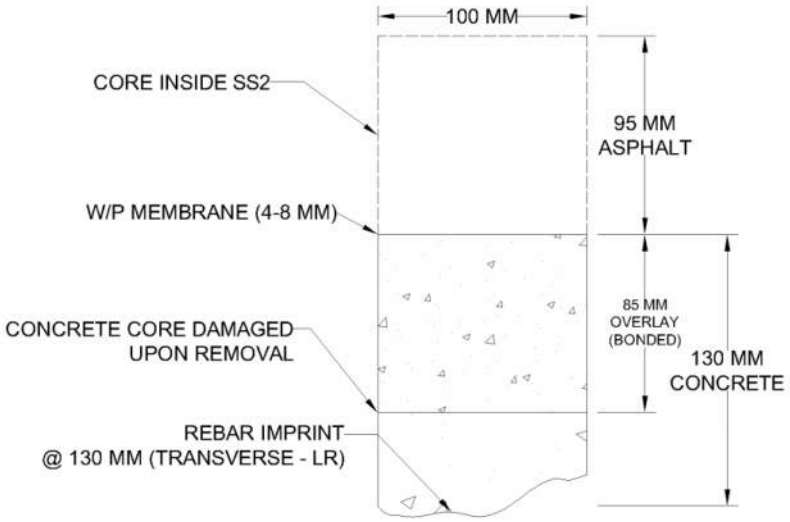
CORE C6



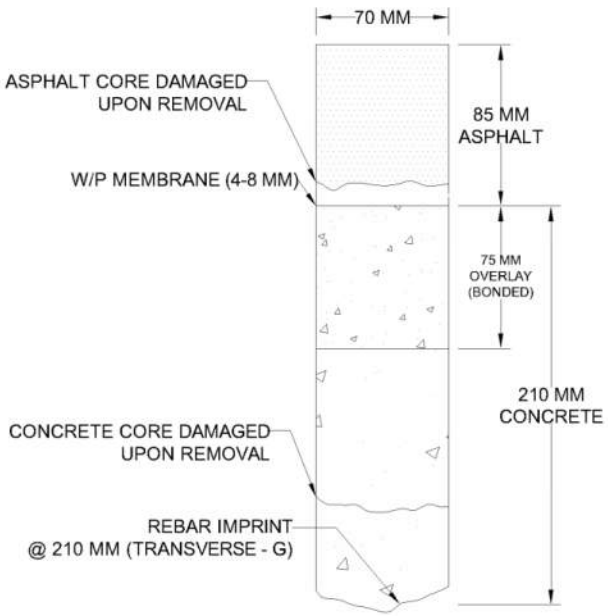

70 MM
ASPHALT CORE DAMAGED UPON REMOVAL
75 MM ASPHALT
W/P MEMBRANE (4-8 MM)
110 MM OVERLAY (BONDED)
275 MM CONCRETE

CORE C7

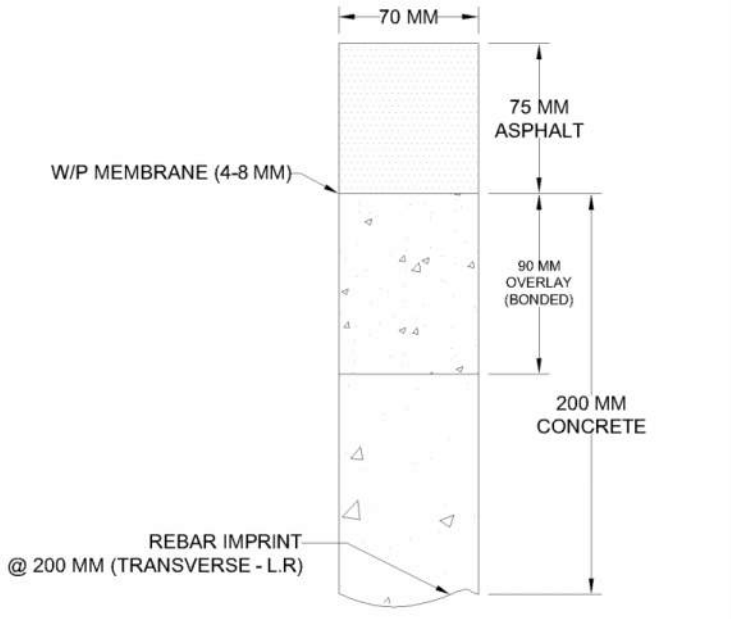



100 MM
CORE INSIDE SS2
95 MM
ASPHALT
W/P MEMBRANE (4-8 MM)
CONCRETE CORE DAMAGED
UPON REMOVAL
85 MM
OVERLAY
(BONDED)
130 MM
CONCRETE
REBAR IMPRINT
@ 130 MM (TRANSVERSE - LR)

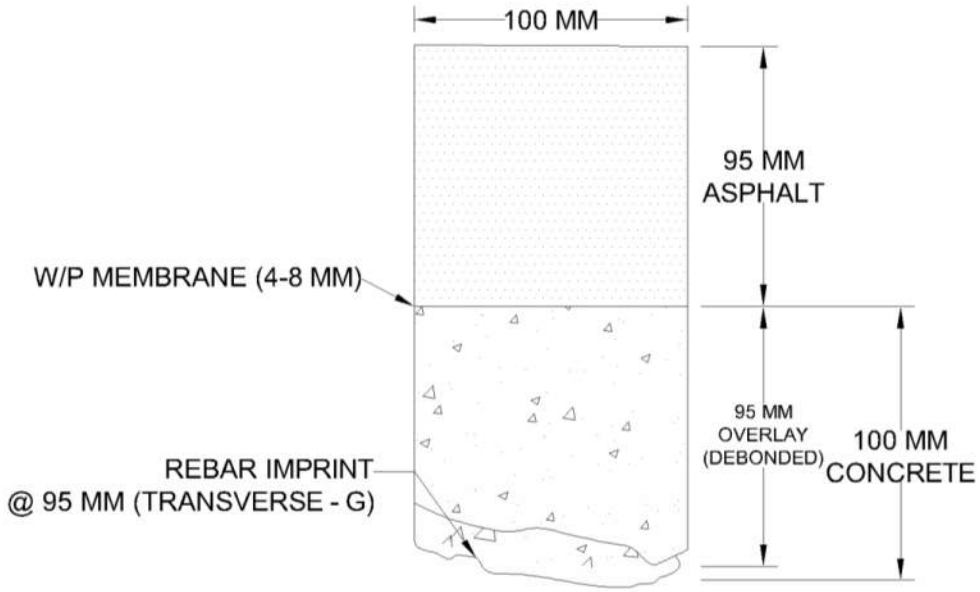
CORE C8


70 MM
ASPHALT CORE DAMAGED
UPON REMOVAL
85 MM
ASPHALT
W/P MEMBRANE (4-8 MM)
75 MM
OVERLAY
(BONDED)
210 MM
CONCRETE
CONCRETE CORE DAMAGED
UPON REMOVAL
REBAR IMPRINT
@ 210 MM (TRANSVERSE - G)

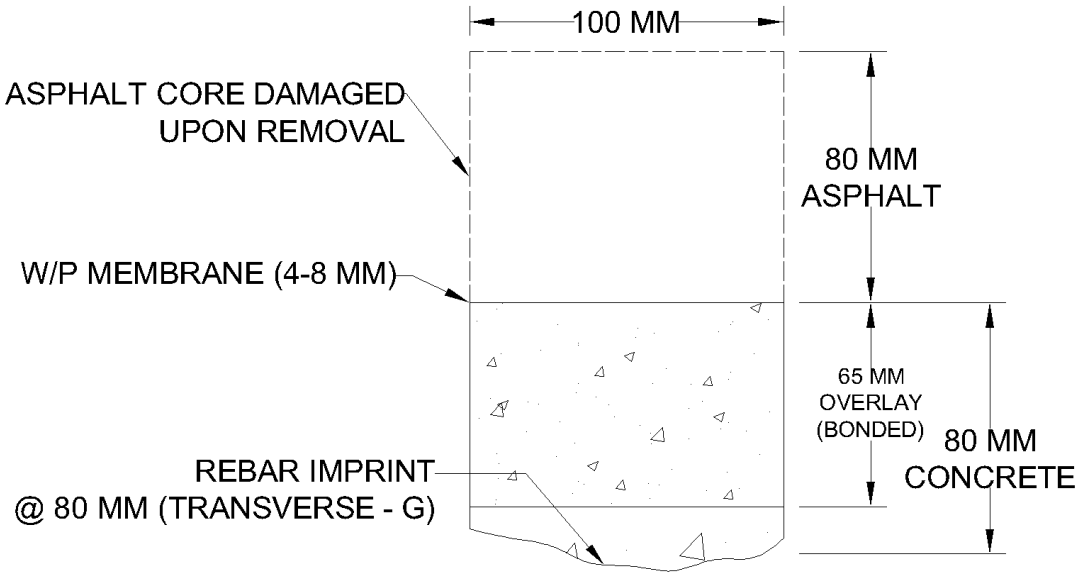
CORE C9


70 MM
75 MM
ASPHALT
W/P MEMBRANE (4-8 MM)
90 MM
OVERLAY
(BONDED)
200 MM
CONCRETE
REBAR IMPRINT
@ 200 MM (TRANSVERSE - L.R)

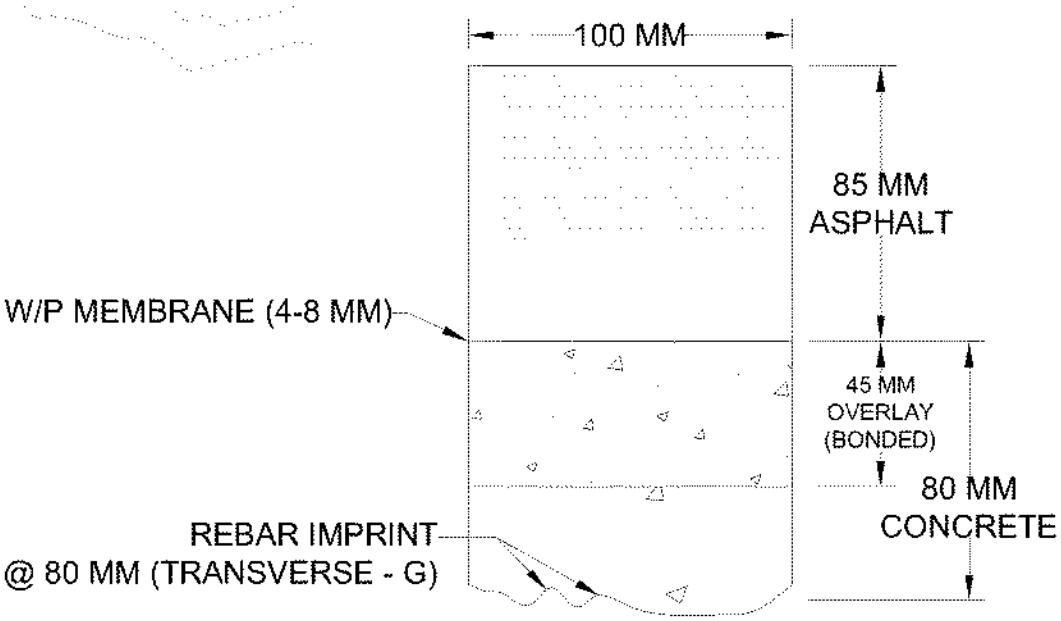
CORE C10


100 MM
95 MM
ASPHALT
W/P MEMBRANE (4-8 MM)
95 MM
OVERLAY
(DEBONDED)
100 MM
CONCRETE
REBAR IMPRINT
@ 95 MM (TRANSVERSE - G)

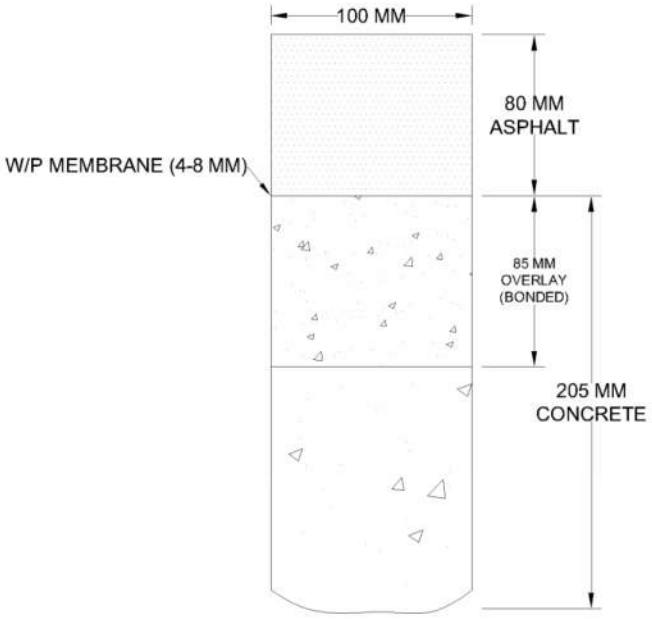
CORE C11


100 MM
ASPHALT CORE DAMAGED
UPON REMOVAL
80 MM
ASPHALT
W/P MEMBRANE (4-8 MM)
65 MM
OVERLAY
(BONDED)
80 MM
CONCRETE
REBAR IMPRINT
@ 80 MM (TRANSVERSE - G)

CORE C12


100 MM
85 MM
ASPHALT
W/P MEMBRANE (4-8 MM)
45 MM
OVERLAY
(BONDED)
80 MM
CONCRETE
REBAR IMPRINT
@ 80 MM (TRANSVERSE - G)

CORE C13


100 MM
80 MM
ASPHALT
W/P MEMBRANE (4-8 MM)
85 MM
OVERLAY
(BONDED)
205 MM
CONCRETE

Core Logs

HAL

CORE LOG ASPHALT COVERED BRIDGE DECKS

Site: 0419550

Core No.		C1		C2		C3	
Location (between gridlines)		East Approach		'A' and '45'		'B' and '24'	
Diameter, mm		100.0		100.0		100.0	
Thickness of Asphalt, mm		85.0		65.0		80.0	
Thickness of Asphalt @ Nearest Grid Point		85.0		65.0		80.0	
Thickness of Concrete, mm		-		130.0		85.0	
Full Depth (yes/no)		No		No		No	
Condition of Asphalt (1)		G		G		G	
Waterproofing (W/P) Type		N/A		Hot rubberized asphalt with protection board		Hot rubberized asphalt with protection board	
Condition of W/P (1)				G		G	
W/P Thickness, mm				4 to 8 mm		4 to 8 mm	
Bond of Asphalt or W/P to Concrete				F		G	
Defects in Concrete (2)				D		-	
Condition of Rebar (3)				-		LR	
Corrosion Potential				-0.323		-0.055	
Compressive Strength, MPa							
		Total	Corrected	Total	Corrected	Total	Corrected
Chloride Content % Chloride by Weight of Concrete	0-10 mm					0.102	0.069
	20-30 mm					0.061	0.028
	40-50 mm					0.047	0.014
	60-70 mm					0.035	0.002
	80-90 mm					0.033	0.000
AIR VOIDS	Air Content,%						
	Spec. Surf.,mm2/mm3						
	Spacing Factor, mm						
TEST LABORATORY						Davroc	
REMARKS - orientation of rebars and cover - presence of overlay, patch and thickness - other observed defects		Concrete approach slab present.		45mm concrete overlay (bonded). Partial delamination plane @ 80mm.		All concrete overlay. Rebar imprint @ 80mm (Transverse-LR).	

1. Condition-G=Good, F=Fair, P=Poor.
2. Defects-C= Cracked, D= Delamination, R= Rough, Sc= Scaling, S= Spalling
3. Condition Rebar-LR= Light Rust, SR= Severe Rust, N/A= No rebar exposed

Condition of Epoxy Coating – ECG=Good, ECF=Fair, ECP=Poor-rusted & debonded areas

HAL

CORE LOG ASPHALT COVERED BRIDGE DECKS

Site: 0419550

Core No.		C4		C5		C6	
Location (between gridlines)		'A' and '1'		'C' and '8'		'C' and '35'	
Diameter, mm		100.0		70.0		70.0	
Thickness of Asphalt, mm		70.0		80.0		75.0	
Thickness of Asphalt @ Nearest Grid Point		70.0		80.0		75.0	
Thickness of Concrete, mm		100.0		145.0		275.0	
Full Depth (yes/no)		No		No		No	
Condition of Asphalt (1)		G		G		G	
Waterproofing (W/P) Type		Hot rubberized asphalt with protection board		Hot rubberized asphalt with protection board		Hot rubberized asphalt with protection board	
Condition of W/P (1)		G		G		G	
W/P Thickness, mm		4 to 8 mm		4 to 8 mm		4 to 8 mm	
Bond of Asphalt or W/P to Concrete		G		G		G	
Defects in Concrete (2)		-		-		-	
Condition of Rebar (3)		SR		-		-	
Corrosion Potential		-0.158		-0.059		-0.062	
Compressive Strength, MPa							
		Total	Corrected	Total	Corrected	Total	Corrected
Chloride Content % Chloride by Weight of Concrete	0-10 mm	0.167	0.134				
	20-30 mm	0.151	0.118				
	40-50 mm	0.075	0.042				
	60-70 mm	0.051	0.018				
	80-90 mm	**0.039**	**0.001**				
AIR VOIDS	Air Content,%						
	Spec. Surf.,mm2/mm3						
	Spacing Factor, mm						
TEST LABORATORY		Davroc					
REMARKS - orientation of rebars and cover - presence of overlay, patch and thickness - other observed defects		65mm concrete overlay (bonded). Rebar imprint @ 95mm (Transverse-SR).		75mm concrete overlay (bonded). Concrete core damaged upon removal.		110mm concrete overlay (bonded).	

1. Condition-G=Good, F=Fair, P=Poor.
2. Defects-C= Cracked, D= Delamination, R= Rough, Sc= Scaling, S= Spalling
3. Condition Rebar-LR= Light Rust, SR= Severe Rust, N/A= No rebar exposed

Condition of Epoxy Coating – ECG=Good, ECF=Fair, ECP=Poor-rusted & debonded areas

HAL

CORE LOG ASPHALT COVERED BRIDGE DECKS

Site: 0419550

Core No.		C7		C8		C9	
Location (between gridlines)		'B' and '33'		'C' and '16'		'E' and '12'	
Diameter, mm		100.0		70.0		70.0	
Thickness of Asphalt, mm		95.0		85.0		75.0	
Thickness of Asphalt @ Nearest Grid Point		95.0		85.0		75.0	
Thickness of Concrete, mm		130.0		210.0		200.0	
Full Depth (yes/no)		No		No		No	
Condition of Asphalt (1)		G		G		G	
Waterproofing (W/P) Type		Hot rubberized asphalt with protection board		Hot rubberized asphalt with protection board		Hot rubberized asphalt with protection board	
Condition of W/P (1)		G		G		G	
W/P Thickness, mm		4 to 8 mm		4 to 8 mm		4 to 8 mm	
Bond of Asphalt or W/P to Concrete		G		G		G	
Defects in Concrete (2)		-		-		-	
Condition of Rebar (3)		LR		G		LR	
Corrosion Potential		-0.040		-0.049		-0.044	
Compressive Strength, MPa						76.7	
Chloride Content % Chloride by Weight of Concrete	0-10 mm 20-30 mm 40-50 mm 60-70 mm 80-90 mm	Total	Corrected	Total	Corrected	Total	Corrected
AIR VOIDS	Air Content,% Spec. Surf.,mm2/mm3 Spacing Factor, mm						
TEST LABORATORY						Davroc	
REMARKS - orientation of rebars and cover - presence of overlay, patch and thickness - other observed defects		85mm concrete overlay (bonded). Core inside SS2. Rebar imprint @ 130mm (Transverse-LR). Concrete core damaged upon removal.		75mm concrete overlay (bonded). Rebar imprint @ 210mm (Transverse-G). Concrete core damaged upon removal.		90mm concrete overlay (bonded). Rebar imprint @ 200mm (Transverse-LR).	

1. Condition-G=Good, F=Fair, P=Poor.
2. Defects-C= Cracked, D= Delamination, R= Rough, Sc= Scaling, S= Spalling
3. Condition Rebar-LR= Light Rust, SR= Severe Rust, N/A= No rebar exposed

Condition of Epoxy Coating – ECG=Good, ECF=Fair, ECP=Poor-rusted & debonded areas

HAL

CORE LOG ASPHALT COVERED BRIDGE DECKS

Site: 0419550

Core No.		C10		C11		C12	
Location (between gridlines)		'F' and '40'		'F' and '5'		'F' and '22'	
Diameter, mm		100.0		100.0		100.0	
Thickness of Asphalt, mm		95.0		80.0		85.0	
Thickness of Asphalt @ Nearest Grid Point		95.0		80.0		85.0	
Thickness of Concrete, mm		100.0		80.0		80.0	
Full Depth (yes/no)		No		No		No	
Condition of Asphalt (1)		G		G		G	
Waterproofing (W/P) Type		Hot rubberized asphalt with protection board		Hot rubberized asphalt with protection board		Hot rubberized asphalt with protection board	
Condition of W/P (1)		G		G		G	
W/P Thickness, mm		4 to 8 mm		4 to 8 mm		4 to 8 mm	
Bond of Asphalt or W/P to Concrete		G		G		G	
Defects in Concrete (2)		D		-		-	
Condition of Rebar (3)		G		G		G	
Corrosion Potential		-0.044		-0.051		-0.048	
Compressive Strength, MPa							
		Total	Corrected	Total	Corrected	Total	Corrected
Chloride Content % Chloride by Weight of Concrete	0-10 mm	0.209	0.176	0.058	0.025	0.155	0.122
	20-30 mm	0.166	0.133	0.034	0.001	0.121	0.088
	40-50 mm	0.113	0.080	0.038	0.005	0.057	0.024
	60-70 mm	0.056	0.023	**0.045**	**0.007**	**0.038**	**0.000**
	80-90 mm	0.039	0.006				
AIR VOIDS	Air Content,%						
	Spec. Surf.,mm2/mm3						
	Spacing Factor, mm						
TEST LABORATORY		Davroc		Davroc		Davroc	
REMARKS - orientation of rebars and cover - presence of overlay, patch and thickness - other observed defects		95mm concrete overlay (debonded). Rebar imprint @ 95mm (Transverse-G).		65mm concrete overlay (bonded). Rebar imprint @ 80mm (Transverse-G).		45mm concrete overlay (bonded). 2X Rebar imprints @ 80mm (Transverse-G).	

1. Condition-G=Good, F=Fair, P=Poor.
2. Defects-C= Cracked, D= Delamination, R= Rough, Sc= Scaling, S= Spalling
3. Condition Rebar-LR= Light Rust, SR= Severe Rust, N/A= No rebar exposed

Condition of Epoxy Coating – ECG=Good, ECF=Fair, ECP=Poor-rusted & debonded areas

HAL

CORE LOG ASPHALT COVERED BRIDGE DECKS

Site: 0419550

Core No.		**C13**				
Location (between gridlines)		‘F’ and ‘31’				
Diameter, mm		100.0				
Thickness of Asphalt, mm		80.0				
Thickness of Asphalt @ Nearest Grid Point		80.0				
Thickness of Concrete, mm		205.0				
Full Depth (yes/no)		No				
Condition of Asphalt [1]		G				
Waterproofing (W/P) Type		Hot rubberized asphalt with protection board				
Condition of W/P [1]		G				
W/P Thickness, mm		4 to 8 mm				
Bond of Asphalt or W/P to Concrete		G				
Defects in Concrete [2]		-				
Condition of Rebar [3]		-				
Corrosion Potential		-0.043				
Compressive Strength, MPa		76.9				
Chloride Content % Chloride by Weight of Concrete	**0-10 mm** **20-30 mm** **40-50 mm** **60-70 mm** **80-90 mm**	Total	Corrected				
AIR VOIDS	**Air Content,%** **Spec. Surf.,mm2/mm3** **Spacing Factor, mm**						
TEST LABORATORY		Davroc				
REMARKS **- orientation of rebars and cover** **- presence of overlay, patch and thickness** **- other observed defects**		85mm concrete overlay (bonded).				

1. Condition-G=Good, F=Fair, P=Poor.
2. Defects-C= Cracked, D= Delamination, R= Rough, Sc= Scaling, S= Spalling
3. Condition Rebar-LR= Light Rust, SR= Severe Rust, N/A= No rebar exposed

Condition of Epoxy Coating – ECG=Good, ECF=Fair, ECP=Poor-rusted & debonded areas

Sawn Asphalt Sample Photographs

Sawn Sample SS1

Sawn Sample SS2

Sawn Sample SS3

Sawn Sample SS4

Sawn Sample SS5

Sawn Sample SS6

Sawn Sample SS7

Sawn Sample SS8

Sawn Sample SS9 (spall)

Sawn Sample SS10

Sawn Asphalt Sample Logs

HAL

SAWN ASPHALT SAMPLE LOG

Site No: 0419550

Sample No.	SS1	SS2	SS3
Location (between gridlines)	'C' and '44'	'A' and '33'	'A' and '21'
Size, mm X mm	315 X 330	305 X 315	310 X 310
Thickness of Asphalt, mm	90	95	75
Thickness of Asphalt @ Nearest Grid Point	90	95	75
Condition of Asphalt (1)	G	G	G
Waterproofing (W/P) Type	Hot rubberized asphalt with protection board	Hot rubberized asphalt with protection board	Hot rubberized asphalt with protection board
W/P Thickness, mm	4 to 8 mm	4 to 8 mm	4 to 8 mm
Condition of W/P (1)	G	G	G
Bond of W/P to Asphalt	F	G	G
Bond of Asphalt or W/P to Concrete	F	F	G
Concrete Cover to Reinf., mm	101	114	113
Defects in Concrete Surface (2)	-	-	-
Corrosion Potential on Concrete Surface	-0.115	-0.042	-0.066
Remarks			

1. Condition - G = Good, F = Fair, P = Poor.
2. Defects - C = Cracked, D = Delamination, R = Rough, Sc = Scaling, S = Spalling

HAL

SAWN ASPHALT SAMPLE LOG

Site No: 0419550

Sample No.	SS4	SS5	SS6
Location (between gridlines)	'C' and '13'	'B' and '3'	'E' and '7'
Size, mm X mm	300 X 305	320 X 315	310 X 300
Thickness of Asphalt, mm	75	75	90
Thickness of Asphalt @ Nearest Grid Point	75	75	90
Condition of Asphalt (1)	G	G	G
Waterproofing (W/P) Type	Hot rubberized asphalt with protection board	Hot rubberized asphalt with protection board	Hot rubberized asphalt with protection board
W/P Thickness, mm	4 to 8 mm	4 to 8 mm	4 to 8 mm
Condition of W/P (1)	G	G	G
Bond of W/P to Asphalt	G	G	G
Bond of Asphalt or W/P to Concrete	F	G	G
Concrete Cover to Reinf., mm	106	105	155
Defects in Concrete Surface (2)	-	-	-
Corrosion Potential on Concrete Surface	-0.059	-0.057	-0.047
Remarks			

1. Condition - G = Good, F = Fair, P = Poor.
2. Defects - C = Cracked, D = Delamination, R = Rough, Sc = Scaling, S = Spalling

HAL

SAWN ASPHALT SAMPLE LOG

Site No: 0419550

Sample No.	SS7	SS8	SS9
Location (between gridlines)	'F' and '19'	'E' and '25'	'E' and '29'
Size, mm X mm	350 X 310	310 X 320	305 x 325
Thickness of Asphalt, mm	80	90	75
Thickness of Asphalt @ Nearest Grid Point	80	90	75
Condition of Asphalt (1)	P	F	G
Waterproofing (W/P) Type	Hot rubberized asphalt with protection board	Hot rubberized asphalt with protection board	Hot rubberized asphalt with protection board
W/P Thickness, mm	4 to 8 mm	4 to 8 mm	4 to 8 mm
Condition of W/P (1)	G	G	G
Bond of W/P to Asphalt	G	G	G
Bond of Asphalt or W/P to Concrete	F	G	F
Concrete Cover to Reinf., mm	104	111	110
Defects in Concrete Surface (2)	-	-	S
Corrosion Potential on Concrete Surface	-0.053	-0.052	-0.061
Remarks			Spall on concrete surface.

1. Condition - G = Good, F = Fair, P = Poor.
2. Defects - C = Cracked, D = Delamination, R = Rough, Sc = Scaling, S = Spalling

HAL

SAWN ASPHALT SAMPLE LOG

Site No: 0419550

Sample No.	SS10		
Location (between gridlines)	'G' and '37'		
Size, mm X mm	300 X 340		
Thickness of Asphalt, mm	115		
Thickness of Asphalt @ Nearest Grid Point	115		
Condition of Asphalt (1)	G		
Waterproofing (W/P) Type	Hot rubberized asphalt with protection board		
W/P Thickness, mm	4 to 8 mm		
Condition of W/P (1)	G		
Bond of W/P to Asphalt	G		
Bond of Asphalt or W/P to Concrete	G		
Concrete Cover to Reinf., mm	126		
Defects in Concrete Surface (2)	-		
Corrosion Potential on Concrete Surface	-0.044		
Remarks			

1. Condition - G = Good, F = Fair, P = Poor.
2. Defects - C = Cracked, D = Delamination, R = Rough, Sc = Scaling, S = Spalling

Site Photographs

Photo P1 – North Elevation

Photo P2 – South Elevation

Photo P3 – General Overview of Deck, looking East

Photo P4 – General Overview of Deck, looking West

Photo P5 – Asphalt Wearing Surface (good condition – sealed/unsealed cracks, light ravelling, light rutting and patched areas)

Photo P6 – East Approach Wearing Surface (good condition – unsealed cracks, patches and light ravelling)

Photo P7 – West Approach Wearing Surface (good condition – sealed/unsealed cracks and light ravelling)

Photo P8 – West Expansion Joint (strip seal joint, light rusting on the steel armoring angles; seals covered with dirt and debris; cracks, spalls and scaling at concrete end dams-gap dimensions vary from 40mm to 45mm)

Photo P9 – West Expansion Joint (light rusting on the steel armoring angles; seals covered with dirt and debris; cracks, spalls and scaling at concrete end dams)

Photo P10 – West Intermediate Expansion Joint (strip seal joint, light rusting on the steel armoring angles; seals covered with dirt and debris; cracks, spalls -gap dimensions are 50mm at north corner and 55mm at centre and south cor gap dimensions vary from 50mm to 55mm)

Photo P11 – West Intermediate Expansion Joint (damaged steel armoring angles; seals cracks, spalls and scaling at concrete end dams)

Photo P12 – East Expansion Joint (strip seal joint; light rusting on the steel armoring angles; seals covered with dirt and debris; cracks, spalls and scaling at concrete end dams- gap dimensions 45mm throughout)

Photo P13 – East Expansion Joint (cracks on the steel armoring angles; cracks, spalls and scaling at concrete end dams)

Photo P14 – East Intermediate Expansion Joint (strip seal joint; light rusting on the steel armoring angles; seals covered with dirt and debris; cracks, spalls and scaling at end dams- gap dimensions vary from 50mm to 55mm)

Photo P15 – East Intermediate Expansion Joint (damaged steel armoring angles; seals covered with dirt and debris; cracks, spalls and scaling at concrete end dams)

Photo P16 – North Sidewalk (good condition – crack, spalls delamination and shallow pop-outs) **and Steel Handrail** (fair to good condition – impact damage)

Photo P17 – North Sidewalk delamination and spall near west intermediate expansion joint)

Photo P18 – North Steel Handrail (impact damage, bent railings) **and Sidewalk** (pop-outs)

Photo P19 – South Sidewalk (fair condition – crack, delaminations and shallow pop-outs) **and Steel Handrail** (fair to good condition – bent railings)

Photo P20 – South Sidewalk (delaminations)

Photo P21 – South Sidewalk (crack above Pier 2, shallow pop-outs – typical)

Photo P22 – South Sidewalk (crack and delamination)

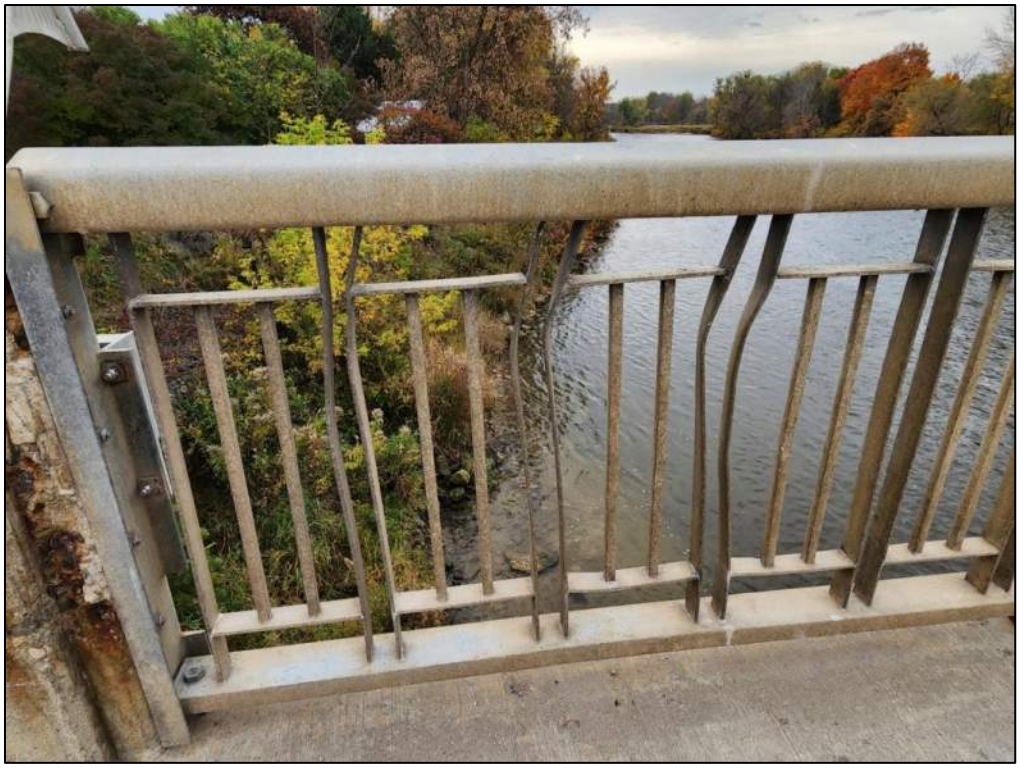


Photo P23 – South Steel Handrail (bent railings)

Photo P24 – South Concrete Post (spalls with exposed corroded rebar)

Photo P25 – North Concrete Post (severe AAR, cracks)

Photo P26 – North Concrete Post (severe rust stains)

Photo P27 – North-East End post (spalls with exposed corroded rebar, patches)

Photo P28 – North-West End post (severe AAR, cracks)

Photo P29 – South-East End post (AAR, spalls with exposed corroded rebar)

Photo P30 – South-West End post (spalls, rust stains)

Photo P31 – North-East Guiderail (good condition – splits on wooden posts)

Photo P32 – North-West Guiderail (good condition – splits and rot on wooden posts)

Photo P33 – South-East Guiderail (good condition – splits on wooden posts, tilted offset blocks)

Photo P34 – South-West Guiderail (good condition – splits on wooden posts)

Photo P35 – North-East Catch Basin

Photo P36 – Deck Drains – Typical

Photo P37 – West Abutment (good condition) **and Embankment** (fair to good condition – erosion, loss of rock protection)

Photo P38 – East Abutment (good condition) **and Embankment** (fair to good condition – erosion, loss of rock protection)

Photo P39 – Pier 1 – West Face (spalls with exposed corroded rebar)

Photo P40 – Pier 1 – West Face (exposed corroded rebar)

Photo P41 – Pier 1 – West Face (crack, spall with exposed corroded rebar)

Photo P42 – Pier 1 – East Face (cracks, spall and exposed rebar)

Photo P43 – Pier 1 – East Face (cracks, delamination at bottom face)

Photo P44 – Pier 2 – West Face (crack and light scaling)

Photo P45 – Pier 2 – South Face (spall, delamination and hairline to narrow efflorescence stained cracks)

Photo P46 – Pier 2 – East Face (spall, delamination and hairline to narrow efflorescence stained cracks, light pattern cracks)

Photo P47 – Pier 2 – East Face (spall with exposed corroded rebar)

Photo P48 – Pier 2 – East Face (spall with exposed rebar)

Photo P49 – Pier 3 – West Face (cracks, spall with exposed corroded rebar and delamination and light pattern cracks)

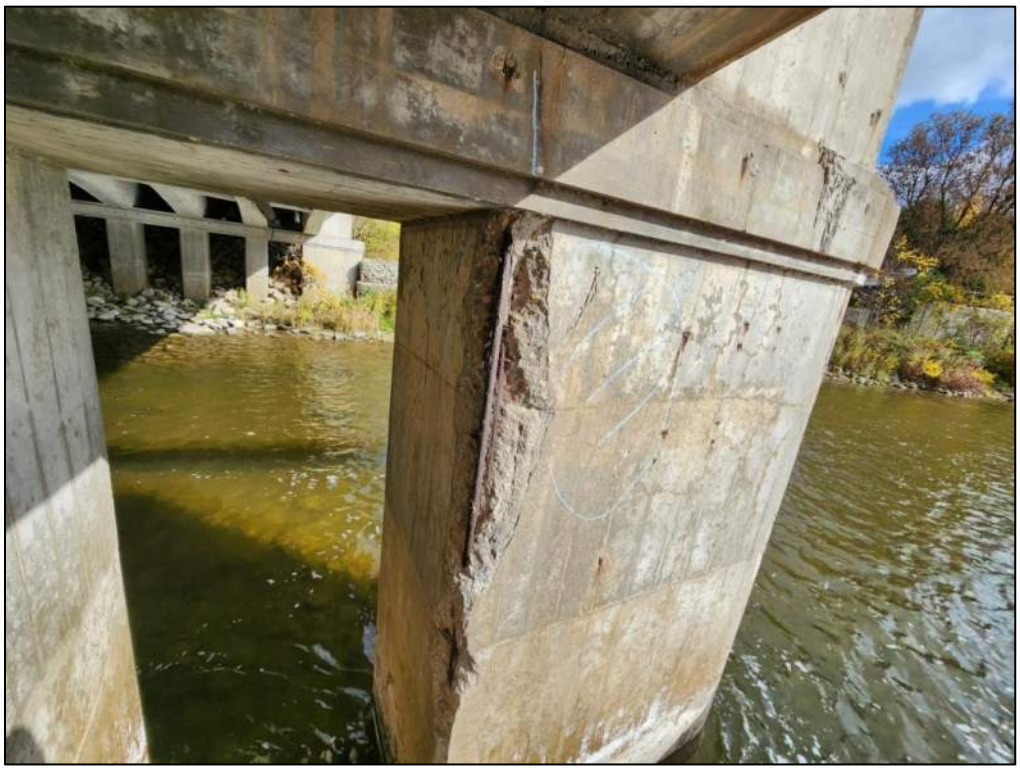


Photo P50 – Pier 3 – West Face (light pattern cracks, spall with exposed corroded rebar and delamination)

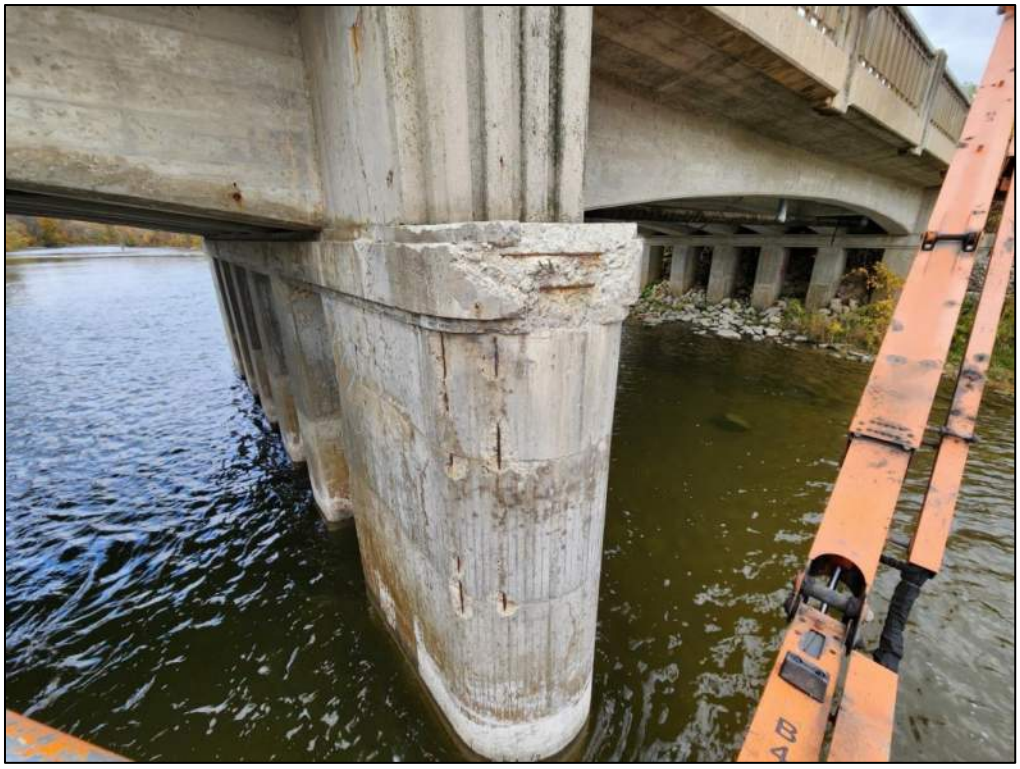


Photo P51 – Pier 3 – South Face (cracks, spall with exposed corroded rebar and delamination)

Photo P52 – Pier 3 – East Face (light pattern cracks, spall and light scaling)

Photo P53 – Pier 3 – East Face (spall with exposed corroded rebar and light scaling)

Photo P54 – Pier 4 – East Face (spall and delamination)

Photo P55 – Pier 4 – West Face (cracks, spall, delamination and light scaling)

Photo P56 – Pier 4 – West Face (spall, delamination, and light scaling)

Photo P57 – Soffit between West Abutment and Pier 1 (poor condition – cracks, spall with exposed corroded rebar, delaminations and patched areas)

Photo P58 – Girder between West Abutment and Pier 1 (spall with exposed corroded rebar)

Photo P59 – Soffit between Pier 1 to Pier 2 (cracks, spall with exposed corroded rebar, delaminations and patched areas)

Photo P60 – Soffit between Pier 1 to Pier 2 (spall with exposed rebar, delamination and patched area) **and Girder** (delaminations and patched area)

Photo P61 – Soffit between Pier 1 to Pier 2 (spalls with exposed corroded rebar, delamination and patched areas) **and Girders** (delaminations and patched area)

Photo P62 – Soffit between Pier 2 to Pier 3 (spall with exposed rebar, delamination and patched area) **and Girder** (delamination and patched area)

Photo P63 – Soffit between Pier 2 to Pier 3 (delamination, spall and rust staining at drop in span joint-severe rust on bearing plates; evidence of leakage)

Photo P64 – Soffit between Pier 2 to Pier 3 (delamination, spall and rust staining at drop in span joint-severe rust on bearing plates; evidence of leakage)

Photo P65 – Soffit between Pier 2 to Pier 3 (delamination, spall with exposed corroded rebar and rust staining at drop in span joint-severe rust on bearing plates; evidence of leakage)

Photo P66 – Soffit between Pier 2 to Pier 3 (spall with exposed corroded rebar and delamination at bottom face of diaphragm; evidence of leakage)

Photo P67 – Soffit between Pier 2 to Pier 3 (spall with exposed corroded rebar and delamination at bottom face of post)

Photo P68 – Soffit between Pier 2 to Pier 3 (spall with exposed corroded rebar, delamination and patched areas) **and Girder** (delaminations and patched area)

Photo P69 – Soffit between Pier 3 to Pier 4 (spalls with exposed rebar, delaminations and patched areas) **and Girder** (delaminations and patched areas)

Photo P70 – Girder between Pier 3 to Pier 4 (spall with exposed corroded rebar, delamination and patched area)

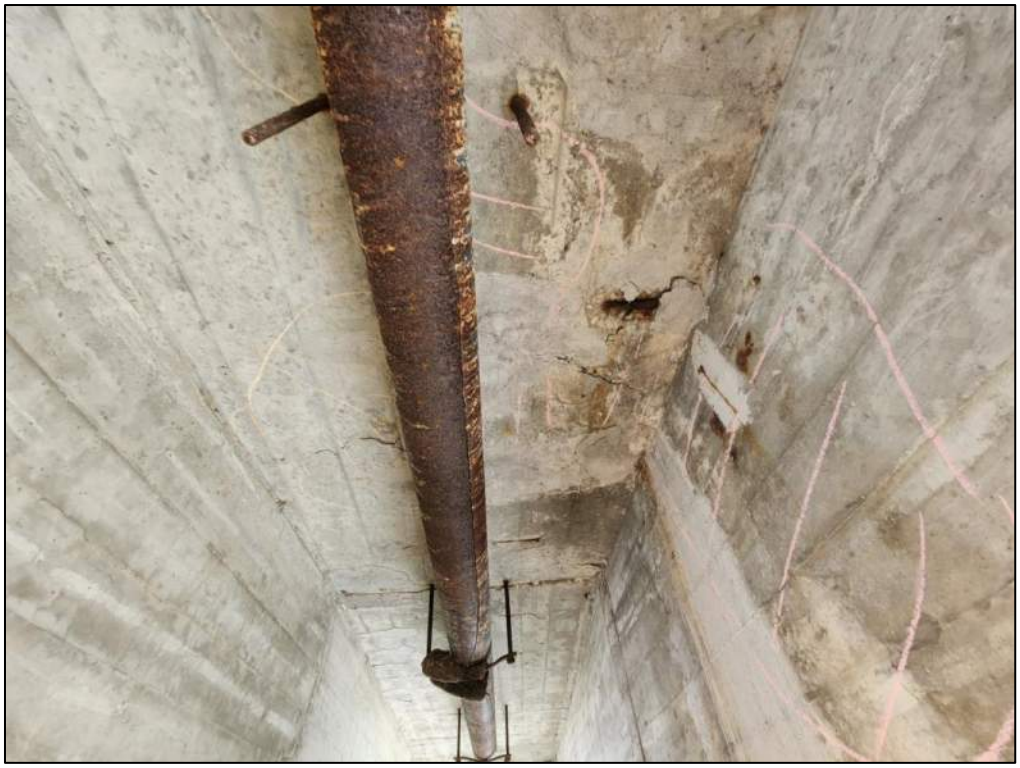


Photo P71 – Soffit between Pier 3 to Pier 4 (spall with exposed corroded rebar, delamination and patched area) **and Girder** (delamination and patched area)

Photo P72 – Soffit between Pier 3 to Pier 4 (spall with exposed corroded rebar, delamination and patched area)

Photo P73 – Soffit between East Abutment to Pier 4 (spall with exposed corroded rebar, delaminations and patched areas) **and Girder** (delaminations and patched areas)

Photo P74 – Soffit between East Abutment to Pier 4 (spall with exposed corroded rebar, delaminations and patched areas)

Photo P75 – Soffit between East Abutment to Pier 4 (spalls with exposed corroded rebar, delaminations and patched areas)

Photo P76 – Girder between West Abutment and Pier 1 (cracks, spall with exposed corroded rebar, delamination)

Photo P77 – Girder at West Abutment (delamination)

Photo P78 – Girder between West Abutment and Pier 1 (delamination)

Photo P79 – Girder between Pier 2 and Pier 3 (spall with exposed corroded rebar, delamination)

Photo P80 – Girder between Pier 2 and Pier 3 (delamination)

Photo P81 – Girder between Pier 3 and Pier 4 (spall with exposed corroded rebar and delamination)

Photo P82 – Girder between Pier 3 and Pier 4 (wide crack)

Photo P83 – Girder between Pier 2 and Pier 3 (delamination)

Photo P84 – West Abutment Diaphragm (delamination)

Photo P85 – East Abutment Diaphragm (crack, spall with exposed corroded rebar and delamination, rust stains)

Photo P86 – East Abutment Diaphragm (delamination, rust stains)

Photo P87 – Diaphragm Between Pier 2 to Pier 3 (spall with exposed corroded rebar and delamination)

Photo P88 – Drains – Typical

Photo P89 – Upstream

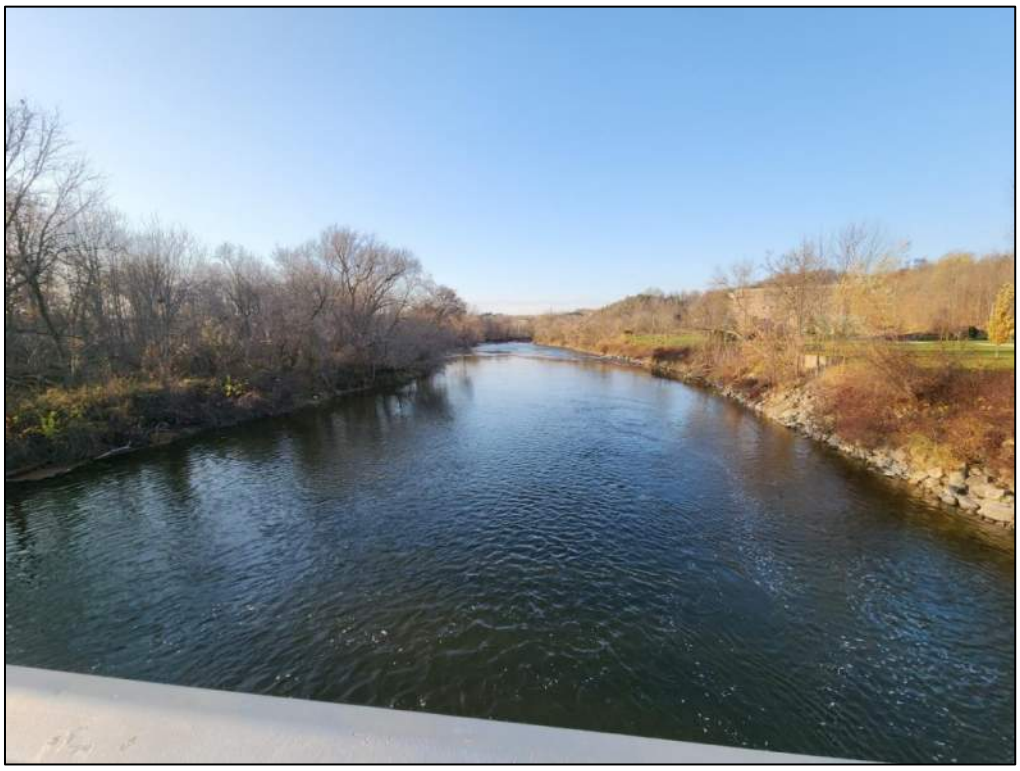


Photo P90 – Downstream

Photo P91 – Inside Core C2
(partial delamination plane)

Photo P92 – Inside Core C3
(square rebar-light rust)

Photo P93 – Inside Core C4
(square rebar-severe rust)

Photo P94 – Inside Core C10
(debonded overlay; square rebar-good condition)

Photo P95 – Inside Core C12
(square rebar-good condition)

Photo P96 – Inside Core C1 at East Approach
(concrete approach slab present)

Laboratory Test Results

DAVROC
TESTING LABORATORIES INC.

CONSULTING ENGINEERS

Materials Testing
and Inspection

File: L22-0753CC

November 30, 2023

HAL Group Inc.
25 Edilcan Drive. Unit 8
Vaughan, Ontario
L4K 3S4

Attn.: Abbas Haghbin, P.Eng.
President / Principal Engineer
abbas@halgroup.ca

Dear Sir;

Concrete Core Testing
Location: Durham Street Bridge
Project No.: 20230825
Davroc No.: C2191

Further to receipt of seven (7) approximately 100mm nominal diameter concrete core samples in our laboratory on November 08, 2023, Davroc Testing Laboratories Inc. are pleased to report the results of our tests. The cores were identified as follows in Table No. 1.

Table No. 1

Davroc Sample No.	Client Core No.	Test Required
C2191-3	C3	Acid Soluble Chloride Ion
C2191-4	C4	Acid Soluble Chloride Ion
C2191-9	C9	Compressive Strength
C2191-10	C10	Acid Soluble Chloride Ion
C2191-11	C11	Acid Soluble Chloride Ion
C2191-12	C12	Acid Soluble Chloride Ion
C2191-13	C13	Compressive Strength

Laboratory Testing Program

As per your request, the following laboratory testing program was carried out to determine the compressive strength and the chloride ion content in the core samples:

1. Two (2) designated specimens from the set of seven (7) cores was trimmed, ends ground and tested for compressive strength in accordance with the CSA A23.2-14C test procedures for "Obtaining and Testing Drilled Cores for Compressive Strength", in a dry condition.

2. Five (5) designated specimens from the set of seven (7) cores were sawn from the noted test horizon and tested for acid-soluble chloride ion content in accordance with the MTO LS-417Method of Test for "Determination of Total Chloride Ion Content in Hardened Concrete (Acid-Soluble)".

Test Results

Concrete Cores

The summary of the compressive strength test results is shown on the attached Table No. 2 along with detailed test information on the attached concrete core test report in Appendix "A".

The results of our tests for acid-soluble chloride ion content are summarized on the attached Table No. 3.

We trust that this letter provides you with the information you require at this time. Should you have any questions, please do not hesitate to contact the undersigned.

Yours very truly,
Davroc Testing Laboratories Inc.

Amritpal Sandhu, B.Eng., E.I.T.
Assistant Laboratory Supervisor

Sal Fasullo, C.E.T.
President

SF/Aps
22-0753-54-Comp-Chlorides-C2191

Table No. 2
Summary of Compressive Strength Test Results

Davroc Sample No.	Client Core No.	Compressive Strength (MPa)
C2191-9	C9	76.7
C2191-13	C13	76.9

Table No. 3
Summary of Chloride Ion Content Test Results

Davroc Sample No.	Client Core No.	Chloride Ion Test Horizon (mm)	Acid-Soluble Chloride Ion, % by Weight of Sample
C2191-3	C3	0 – 10	0.102
		20 – 30	0.061
		40 – 50	0.047
		60 – 70	0.035
		80 – 90	0.033
C2191-4	C4	0 – 10	0.167
		20 – 30	0.151
		40 – 50	0.075
		60 – 70	0.051
		80 – 90	0.039
C2191-10	C10	0 – 10	0.209
		20 – 30	0.166
		40 – 50	0.113
		60 – 70	0.056
		80 – 90	0.039
C2191-11	C11	0 – 10	0.058
		20 – 30	0.034
		40 – 50	0.038
		60 – 70	0.045
		80 – 90	Core was not long enough
C2191-12	C12	0 – 10	0.155
		20 – 30	0.121
		40 – 50	0.057
		60 – 70	0.038

Appendix "A"
Concrete Core Test Report

CONCRETE CORE TEST REPORT

File No.: L22-0753CC
Davroc Lab No.: C2191
Project No.: 20230825
Location: Durham Street Bridge

Davroc/Client Core No.	C2191-9/C9	C2191-13/C13
Nominal Size of Coarse Aggregate, (mm)	20	20
Date Cast	Not Given	Not Given
Date Cored	Not Given	Not Given
Date Tested	November 23, 2023	November 23, 2023
End Ground Height -(mm)	137.4	180.0
Average Diameter (mm)	69.0	100.0
Corrected Compressive Strength, (MPa)	76.7	76.9
Mode of Failure	Satisfactory	Satisfactory
***Direction of Loading**	Same	Same
** **Moisture Condition at Time of Test**	Dry	Dry
Concrete Consolidation	Good	Good

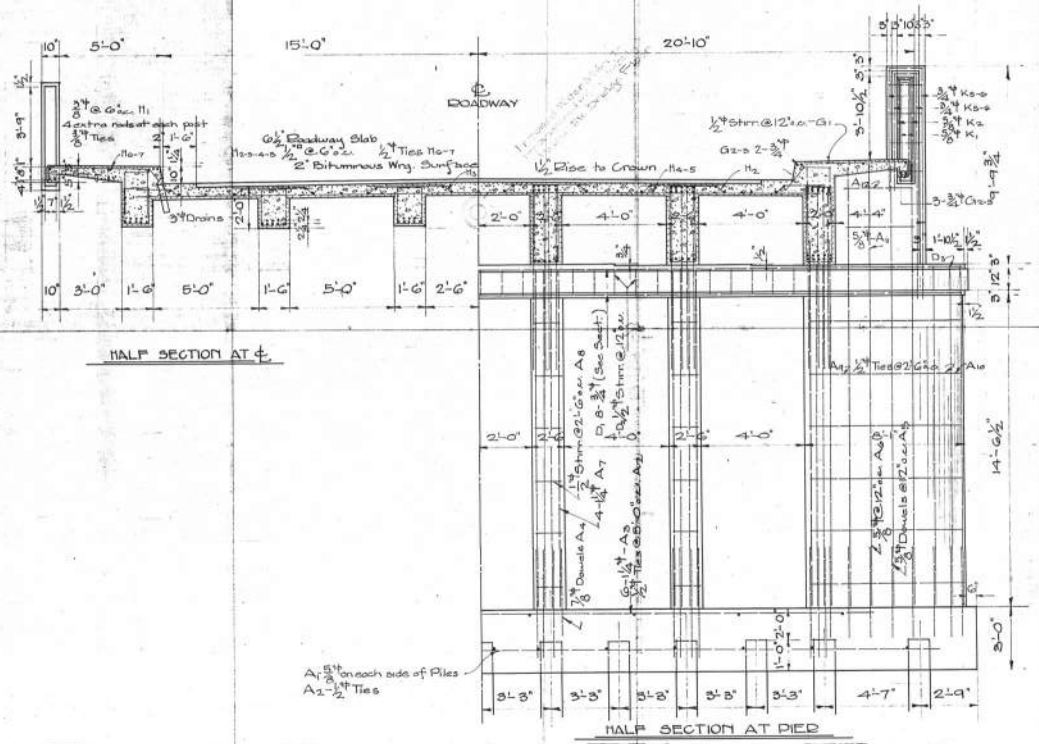
Remarks: None.

Date: November 30, 2023

Signed: **Sal Fasullo C.E.T.**

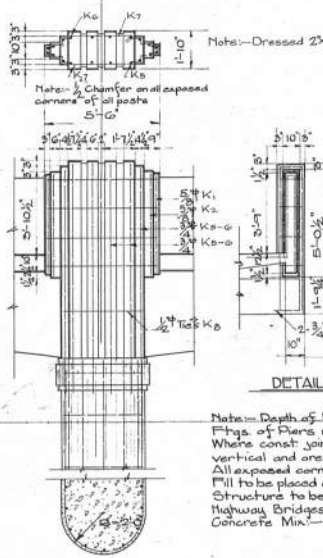
* Relative to direction of compaction of concrete when placed.
** Moisture conditioning as per clause 7.3 of the Test Method CSA A23.2-14C.

General Arrangement Drawing



HALF SECTION AT ℄

HALF SECTION AT PIER



ELEV AT PIER

Note:—Dressed 2"x4" inserts

Note:—¼ Chamfer on all exposed corners of all posts

DETAILS OF END POSTS

DETAILS OF INTERMED. POSTS

Note:—Depth of Ftgs. subject to revision by Engin.
Ftgs. of Piers must extend at least 4'-0" below bed of stream.
Where const. joints are necessary in the floor system, they are to be made truly vertical and are to occur only at the centre of the span unless otherwise indic.
All exposed corners to be chamfered.
Fill to be placed at both ends of the struct. simultaneously.
Structure to be built in accordance with D.H.O. General Specifications for Highway Bridges 1935 and Form No. 9
Concrete Mix:—Entire Superstructure above Ftgs. 1-½-2½, Approach Slab 1-¾-3¼
Ftgs. 1-2¼-3¾

PROPOSED

WALKERTON BRIDGE

OVER THE

SAUGEEN RIVER

THE KING'S HIGHWAY No. 4 — STRUCTURE No.

CO. BRUCE — TWP. BRANT

LOT — CONC.

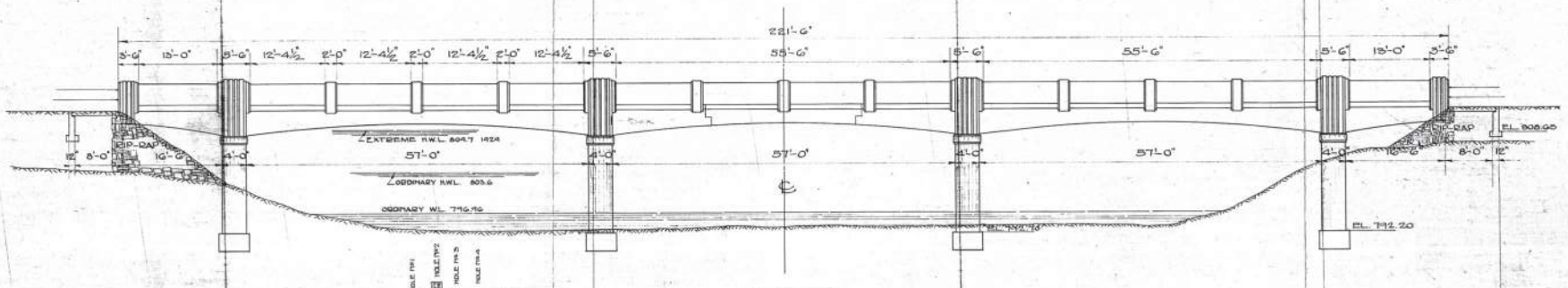
APPROVED

BRIDGE ENGINEER — CHIEF ENGINEER

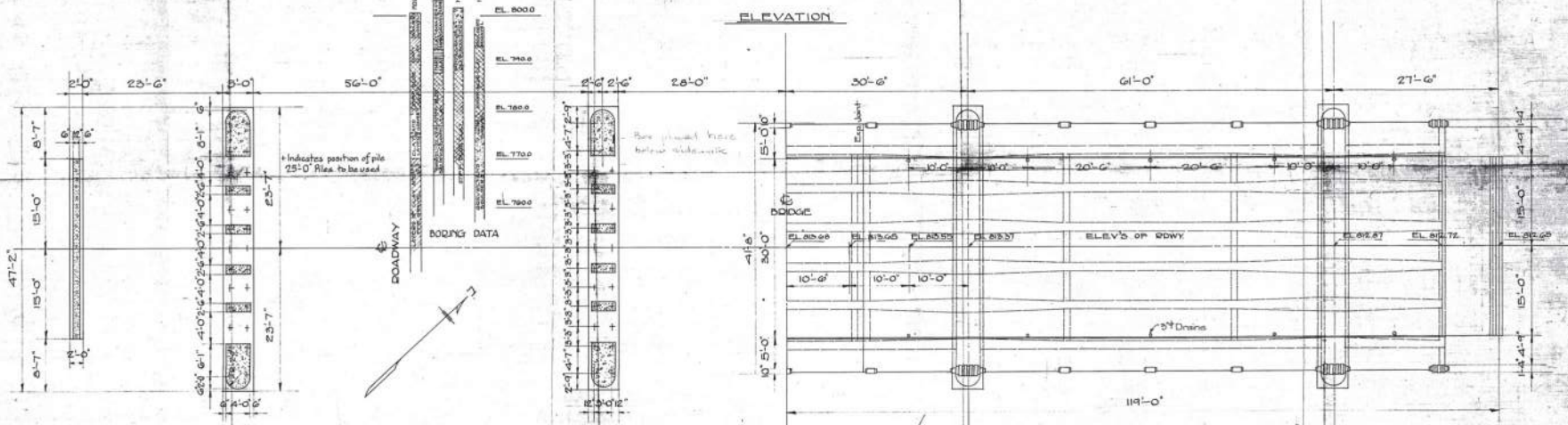
DEPT. OF HIGHWAYS ONTARIO
TORONTO JAN. 31ST 1936

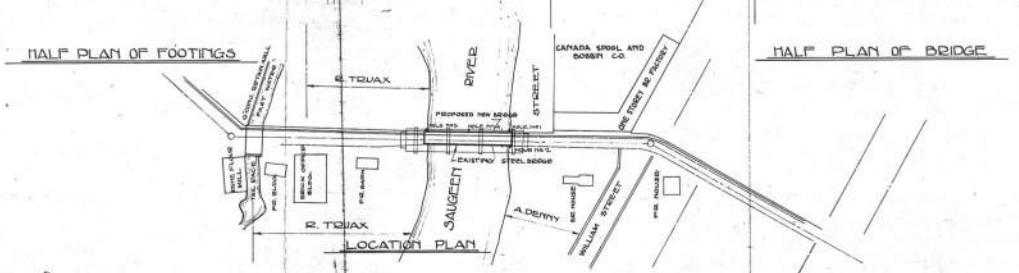
DEPUTY MINISTER

DESIGN	V.M.	DRAWN	V.M.	STEEL	V.M.	CONTRACT No. 36-82
CHECK		CHECK		CHECK		DRAWING No. D-2294-3



ELEVATION





PROPOSED

WALKERTON BRIDGE

OVER THE

SAUGEEN RIVER

THE KING'S HIGHWAY No. 4 STRUCT No.

COUNTY BRUCE TWP BRANT

LOT CONC.

APPROVED

BRIDGE ENGR. CHIEF ENGR.

DEPT OF HIGHWAYS, ONTARIO
TORONTO JAN. 31st 1936

DEPUTY MINISTER

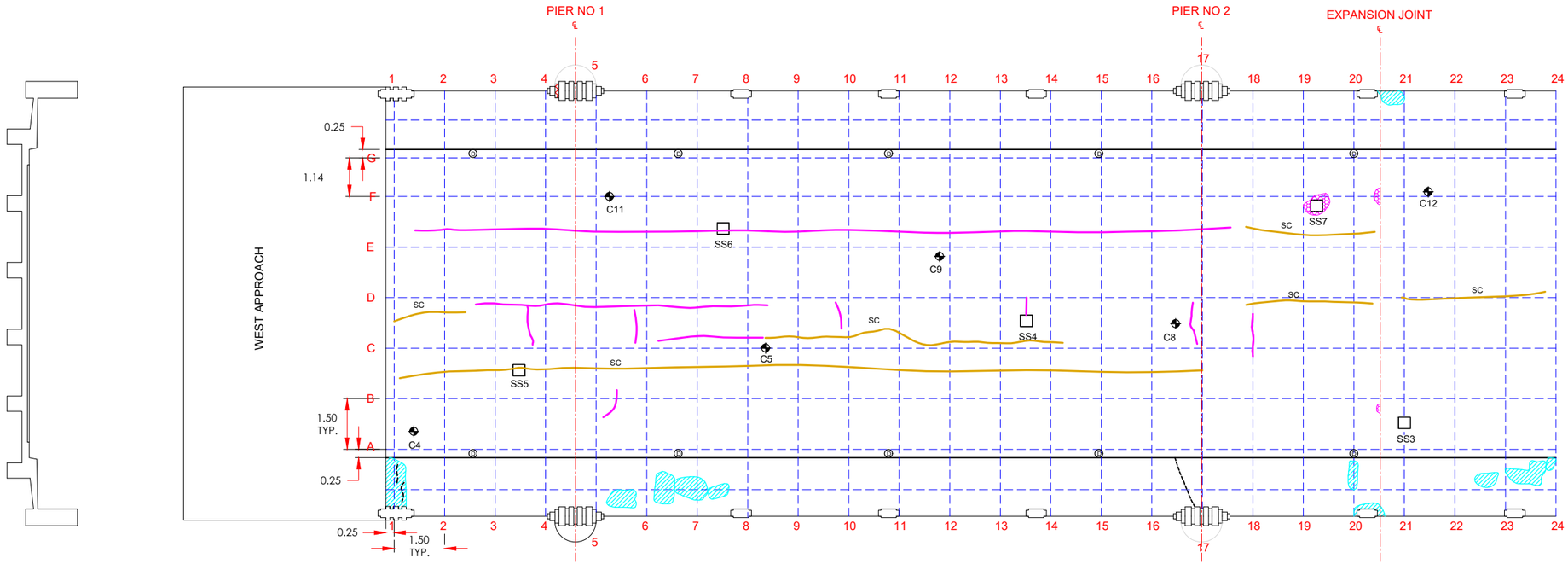
DESIGN V.M.	DRAWN V.M.	STEEL CHECK
CHECK	CHECK	

CONTRACT No. 36-83

DRAWING No. D-2294-1

ACAD Drawings

NORTH POSTS AND RAILING



DECK

SOUTH POSTS AND RAILING

Key Plan

LEGEND

- Drain
- C1 Core Sample Location
- SS1 Sawn Sample Location
- Patched Spalls
- Delaminations
- Spalls
- Severe Scaling
- Concrete Pattern Cracks
- Pot Hole/ Asphalt Patch
- Unsealed Asphalt Cracks
- SC Sealed Asphalt Cracks
- Medium Concrete Cracks

Note: All dimensions are metric unless specified otherwise.

No.	Revision/Issue	Date

HAL

Project Name. Address & Township/City

DURHAM STREET BRIDGE
WALKERTON, ONTARIO

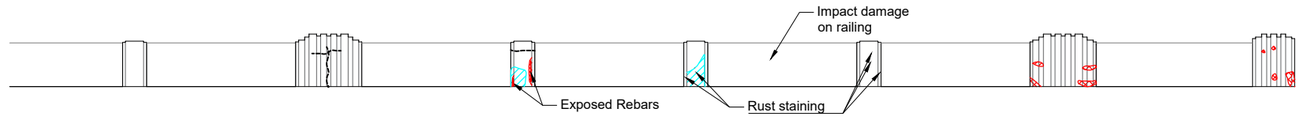
Drawing Title

Surface Deterioration of Asphalt on Deck, Concrete Sidewalks and Posts

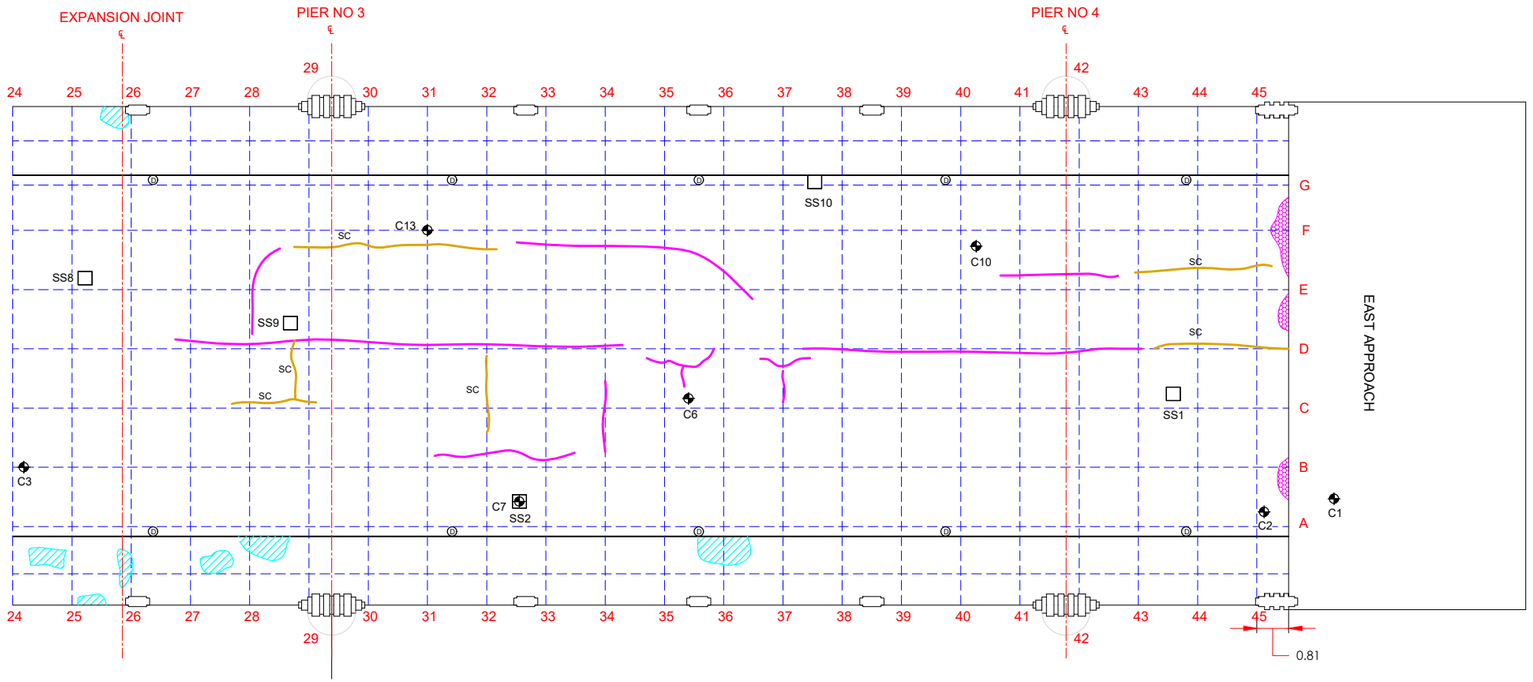
Project No	Site No.
20230921	0419550
Date: OCT 2023	Drawn By: S.B.
Scale: 1:125	Checked By: A.H.

Construction North

Sheet: 1A

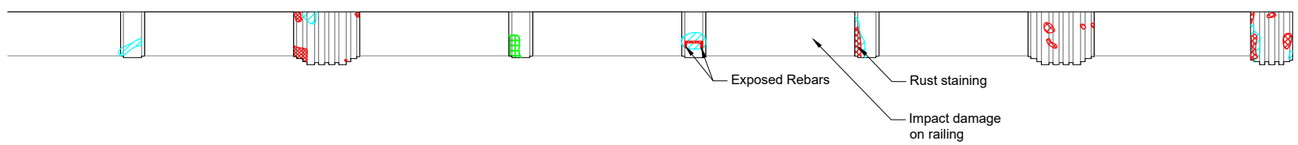


NORTH POSTS AND RAILING



DECK

SOUTH POSTS AND RAILING



Key Plan

LEGEND

- Drain
- C1 Core Sample Location
- SS1 Sawn Sample Location
- Patched Spalls
- Delaminations
- Spalls
- Severe Scaling
- Pot Hole/ Asphalt Patch
- Unsealed Asphalt Cracks
- SC Sealed Asphalt Cracks
- Medium Concrete Cracks

Note: All dimensions are metric unless specified otherwise.

No.	Revision/Issue	Date

HAL

Project Name. Address & Township/City

DURHAM STREET BRIDGE
WALKERTON, ONATRIO

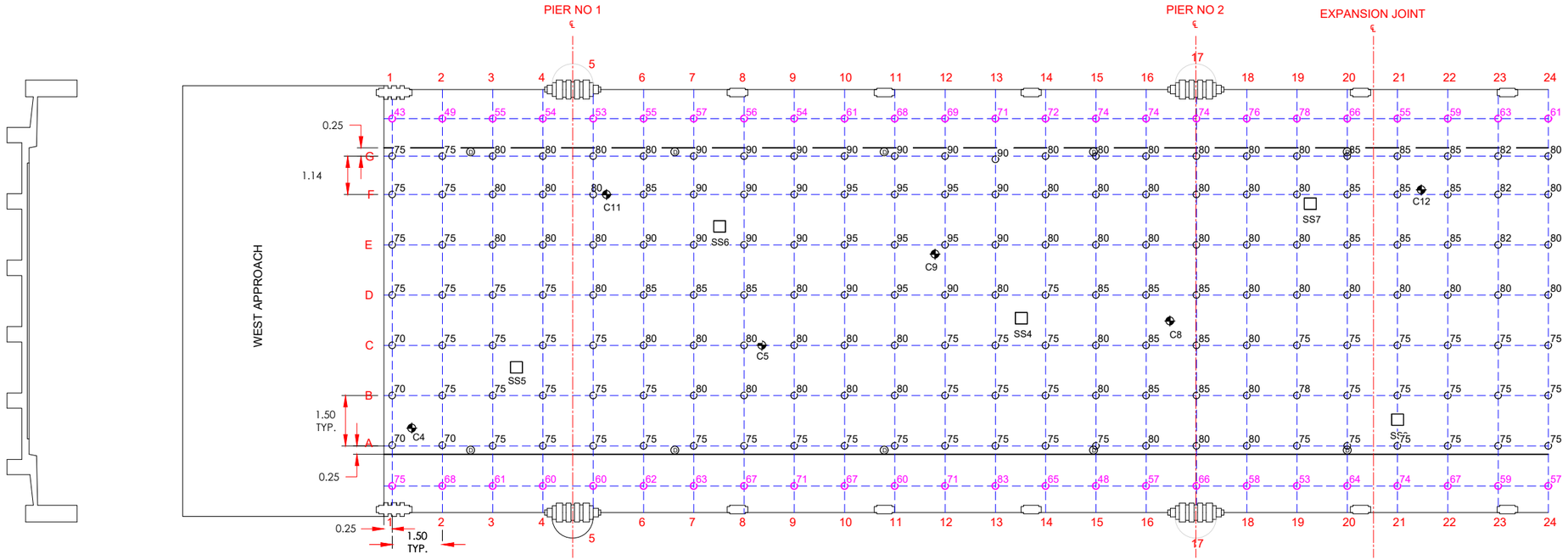
Drawing Title

Surface Deterioration of Asphalt on Deck, Concrete Sidewalks and Posts

Project No 20230921	Site No. 0419550
Date OCT 2023	Drawn By S.B.
Scale 1:125	Checked By A.H.

Construction North

Sheet 1B



DECK

Key Plan

LEGEND

- Drain
- C1 Core Sample Location
- SS1 Sawn Sample Location
- 90 Asphalt Thickness-mm
- 90 Concrete cover-mm

Note: All dimensions are metric unless specified otherwise.

No.	Revision/Issue	Date

HAL

Project Name. Address & Township/City

DURHAM STREET BRIDGE
WALKERTON, ONTARIO

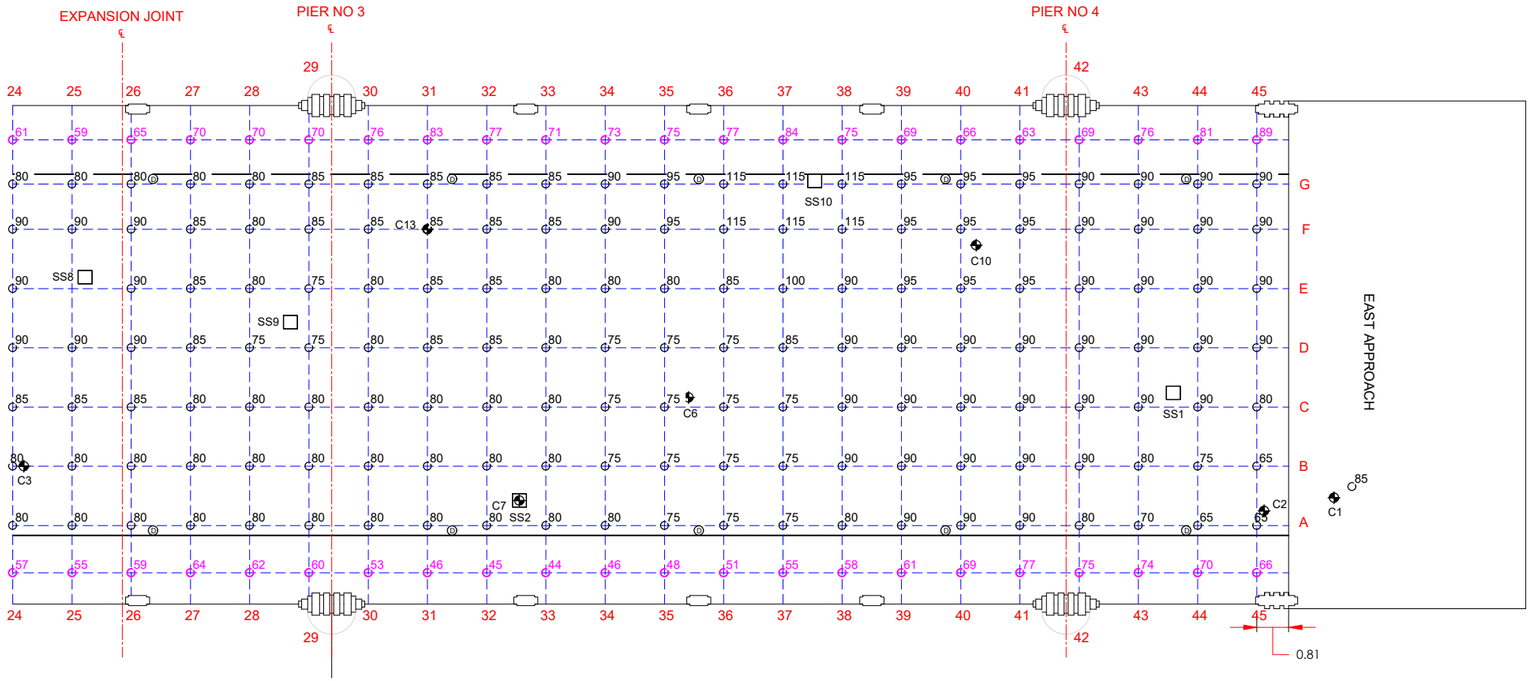
Drawing Title

Asphalt Thickness on Deck and Concrete Cover of Sidewalks

Project No	Site No.
20230921	0419550
Date: OCT 2023	Drawn By: S.B.
Scale: 1:125	Checked By: A.H.

Construction North

Sheet: 2A



DECK

SOUTH POSTS AND RAILING

Key Plan

LEGEND

- Drain
- C1 Core Sample Location
- SS1 Sawn Sample Location
- 90 Asphalt Thickness-mm
- 90 Concrete cover-mm

Note: All dimensions are metric unless specified otherwise.

No.	Revision/Issue	Date

HAL

Project Name. Address & Township/City

DURHAM STREET BRIDGE
WALKERTON, ONTARIO

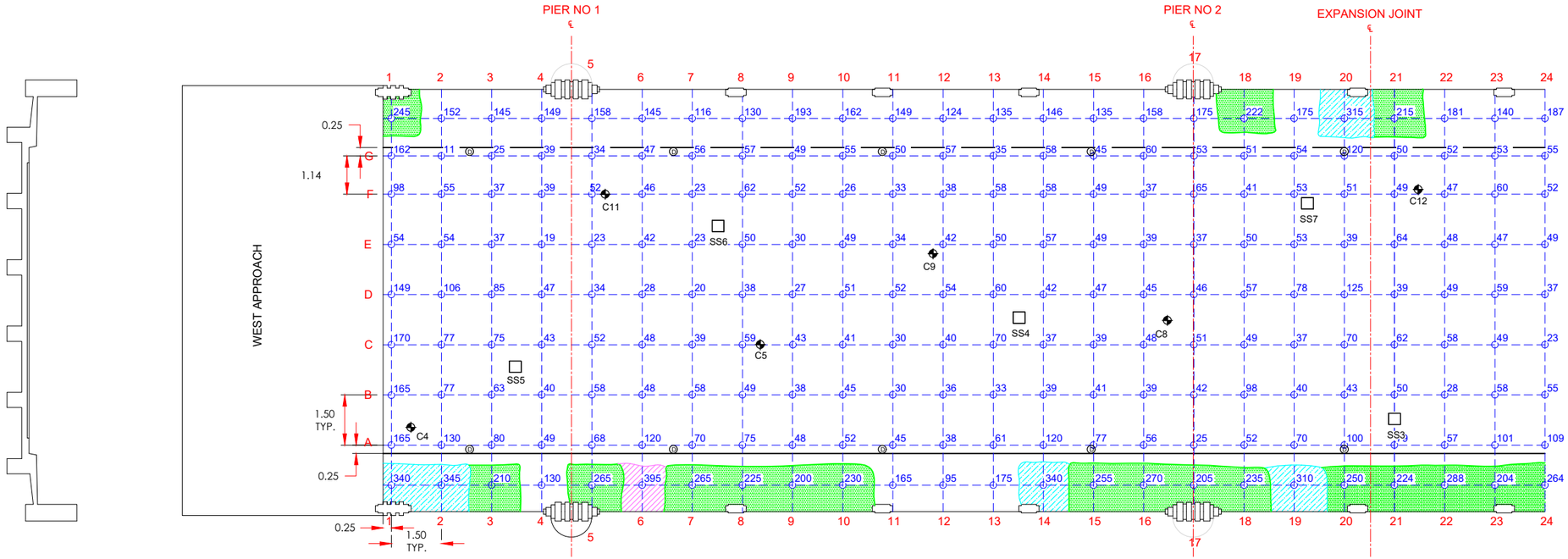
Drawing Title

Asphalt Thickness on Deck and Concrete Cover of Sidewalks

Project No	Site No.
20230921	0419550
Date: OCT 2023	Drawn By: S.B.
Scale: 1:125	Checked By: A.H.

Construction North

Sheet: 2B



DECK

Key Plan

LEGEND

- Drain
- C1 Core Sample Location
- SS1 Sawn Sample Location
- 0.000 to -0.199 volts
- -0.200 to -0.299 volts
- -0.300 to -0.349 volts
- -0.350 to -0.449 volts
- more negative than -0.450 volts
- 450 Copper-Copper Sulphate Half-Cell Potential (negative volts x10^{-3})

Note: All dimensions are metric unless specified otherwise.

No.	Revision/Issue	Date

HAL

Project Name. Address & Township/City

DURHAM STREET BRIDGE
WALKERTON, ONTARIO

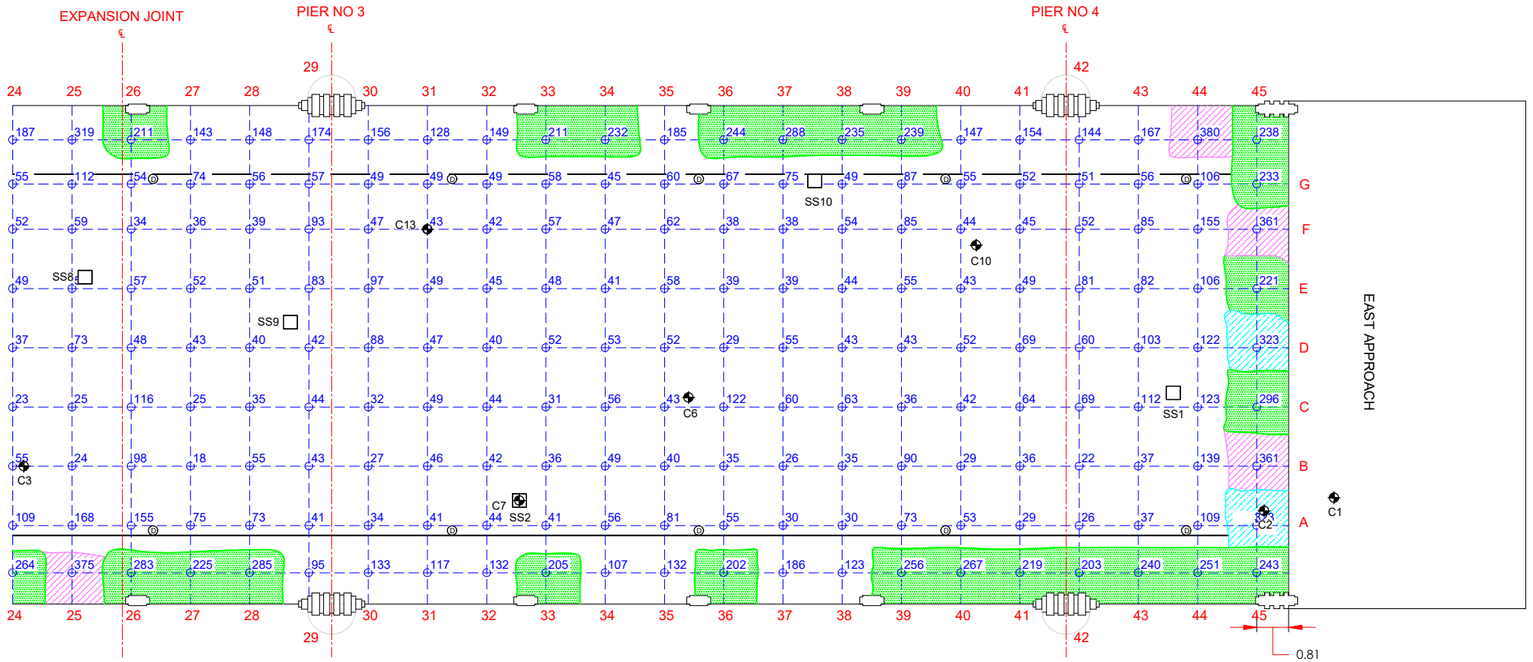
Drawing Title

Corrosion Potential of Deck and Sidewalks

Project No	Site No.
20230921	0419550
Date: OCT 2023	Drawn By: S.B.
Scale: 1:125	Checked By: A.H.

Construction North

Sheet: 3A



DECK

Key Plan

LEGEND

- Drain
- C1 Core Sample Location
- SS1 Sawn Sample Location
- 0.000 to -0.199 volts
- -0.200 to -0.299 volts
- -0.300 to -0.349 volts
- -0.350 to -0.449 volts
- more negative than -0.450 volts
- 450 Copper-Copper Sulphate Half-Cell Potential (negative volts x10^{-3})

Note: All dimensions are metric unless specified otherwise.

No.	Revision/Issue	Date

HAL

Project Name. Address & Township/City

DURHAM STREET BRIDGE
WALKERTON, ONTARIO

Drawing Title

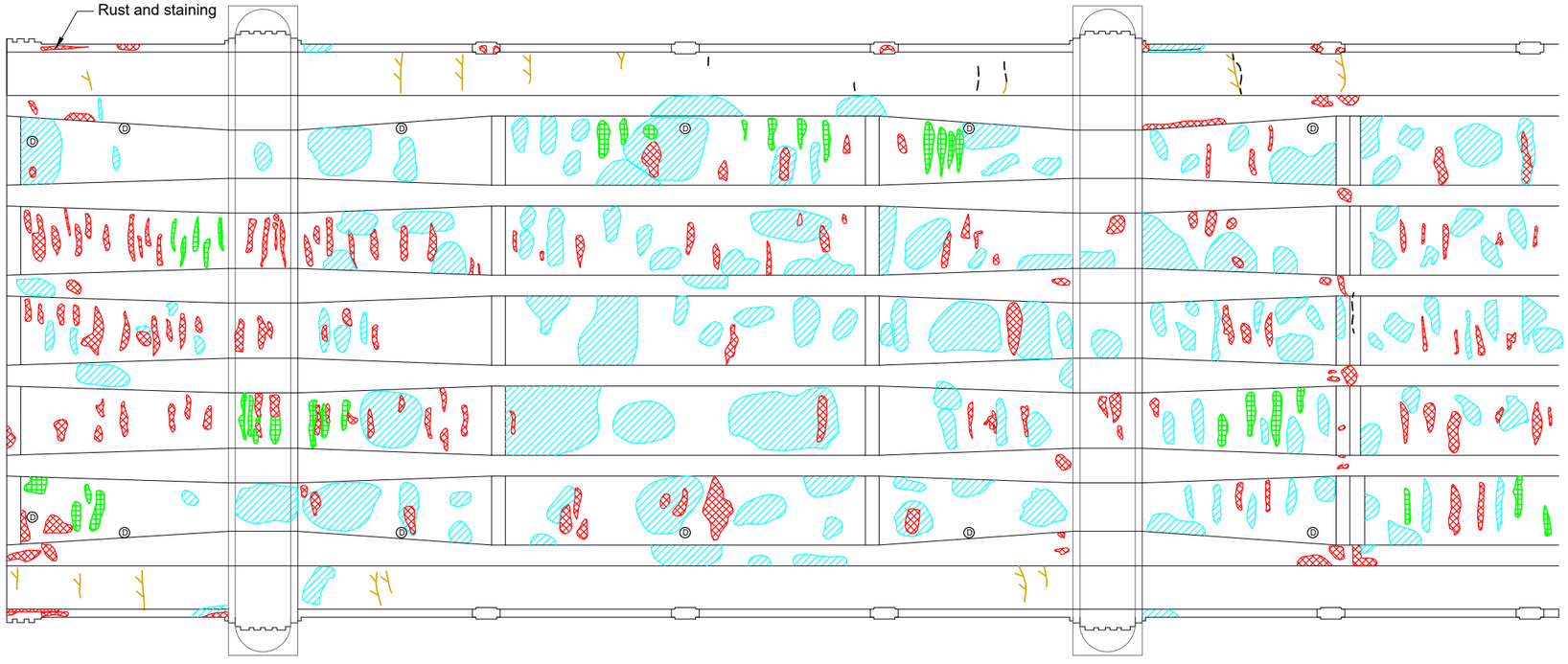
Corrosion Potential of Deck and Sidewalks

Project No	Site No.
20230921	0419550
Date: OCT 2023	Drawn By: S.B.
Scale: 1:125	Checked By: A.H.

Construction North

Sheet: 3B

WEST



SOFFIT

Key Plan

LEGEND

- Drain
- Patched Spalls
- Delaminations
- Spalls
- Medium Concrete Cracks
- Medium Stained Cracks

Note: All dimensions are metric unless specified otherwise.

No.	Revision/Issue	Date

HAL

Project Name. Address & Township/City

DURHAM STREET BRIDGE
WALKERTON, ONTARIO

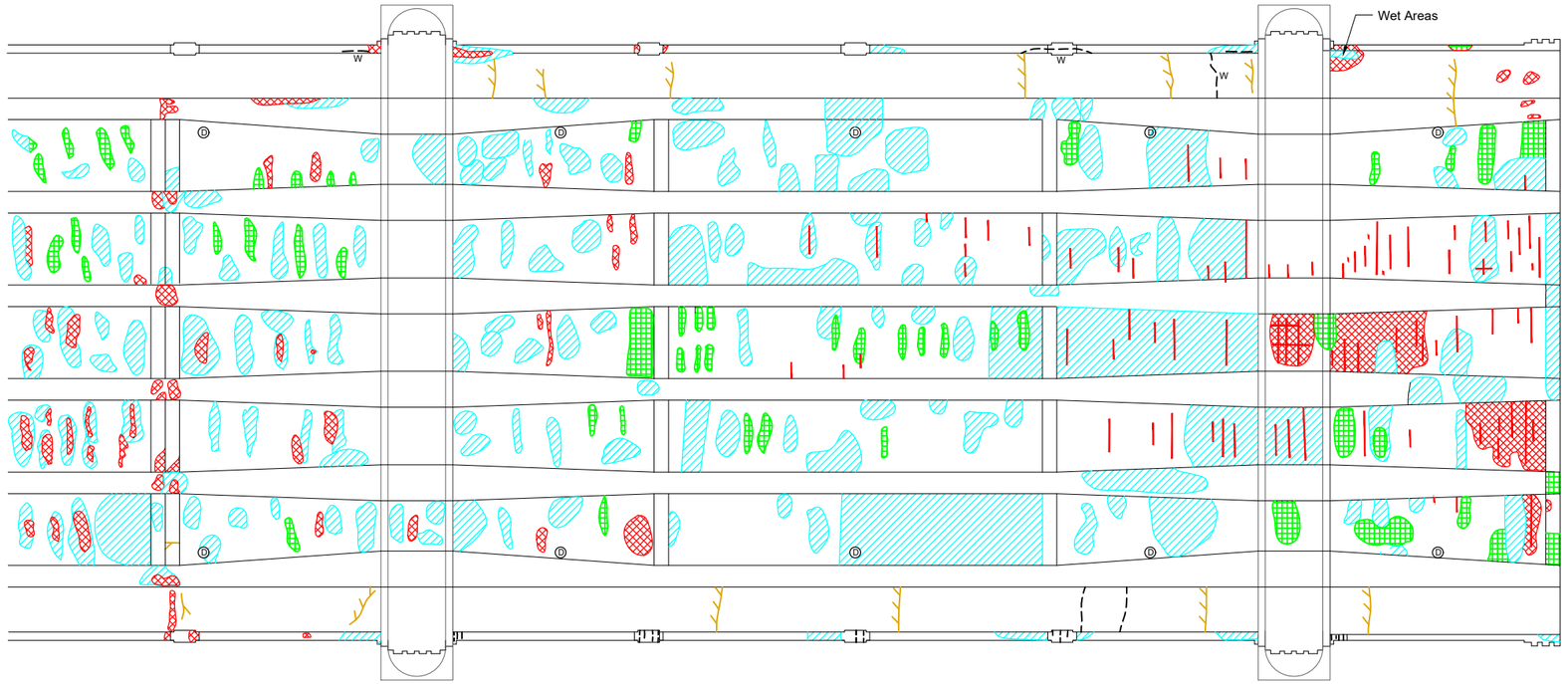
Drawing Title

Surface Deterioration of Soffit, Fascia, Bottom Face of Girders and Diaphragms

Project No	Site No.
20230921	0419550
Date: OCT 2023	Drawn By: S.B.
Scale: 1:125	Checked By: A.H.

Construction North

Sheet: 4A



EAST

SOFFIT

Key Plan

LEGEND

- Drain
- Patched Spalls
- Delaminations
- Spalls
- Medium Concrete Cracks
- Wide Concrete Cracks
- Medium Stained Cracks
- Exposed Rebar

Note: All dimensions are metric unless specified otherwise.

No.	Revision/Issue	Date

HAL

Project Name. Address & Township/City

DURHAM STREET BRIDGE
WALKERTON, ONTARIO

Drawing Title

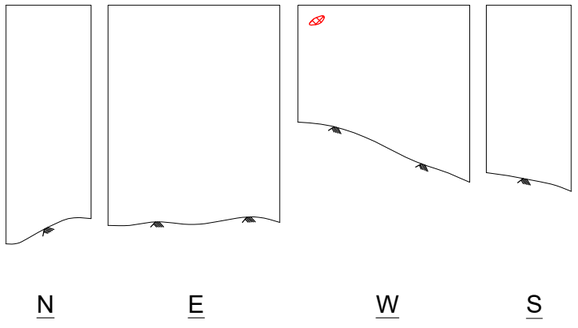
Surface Deterioration of Soffit, Fascia, Bottom Face of Girders and Diaphragms

Project No	Site No.
20230921	0419550
Date: OCT 2023	Drawn By: S.B.
Scale: 1:125	Checked By: A.H.

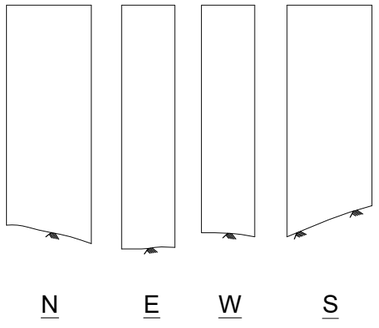
Construction North

Sheet: 4B

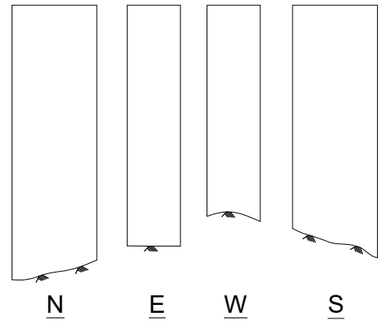
PIER 1



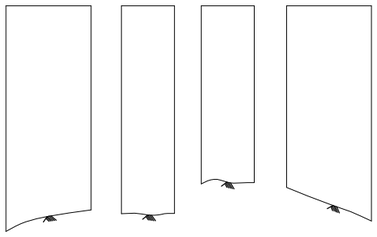
1ST COLUMN FROM NORTH



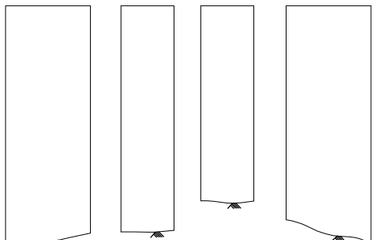
2ND COLUMN FROM NORTH



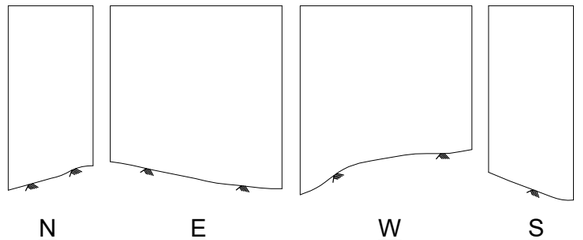
3RD COLUMN FROM NORTH



4TH COLUMN FROM NORTH

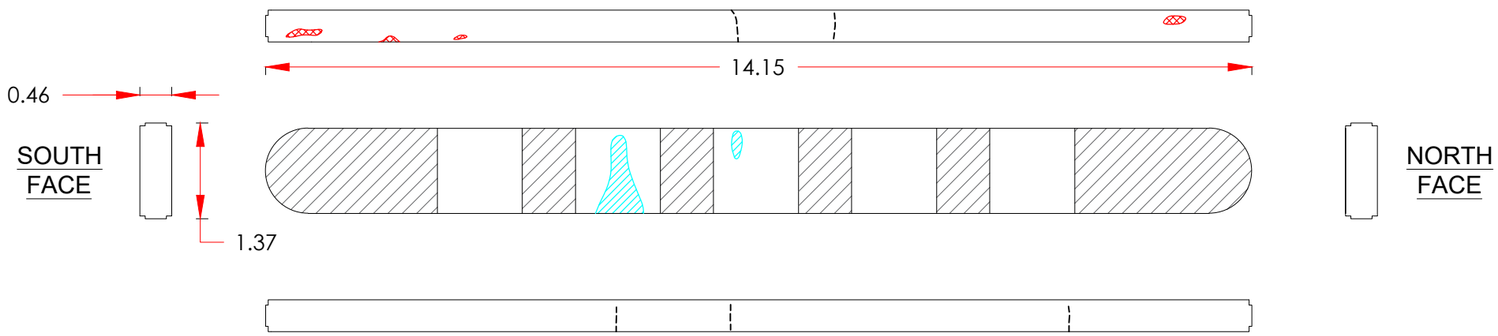


5TH COLUMN FROM NORTH



6TH COLUMN FROM NORTH

WEST FACE



EAST FACE

PIER CAP

Key Plan

LEGEND

- Delaminations
- Spalls
- Medium Concrete Cracks

Note: All dimensions are metric unless specified otherwise.

No.	Revision/Issue	Date

HAL

Project Name. Address & Township/City

DURHAM STREET BRIDGE
WALKERTON, ONTARIO

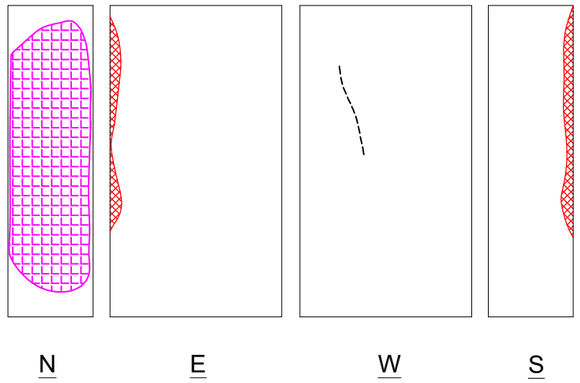
Drawing Title

Surface Deterioration of Pier 1

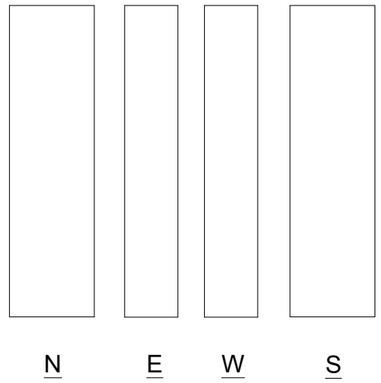
Project No	Site No.
20230921	0419550
Date	Drawn By
OCT 2023	S.B.
Scale	Checked By
1:85	A.H.

Construction North	Sheet
	5A

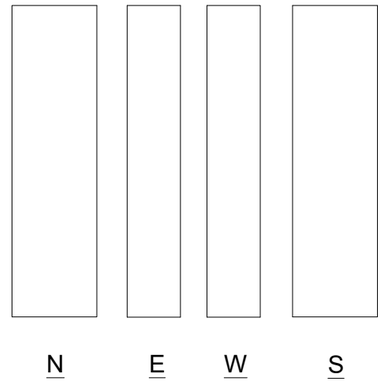
PIER 2



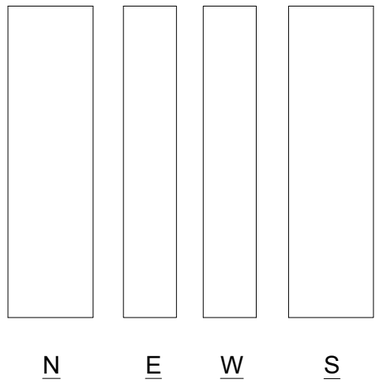
1ST COLUMN FROM NORTH



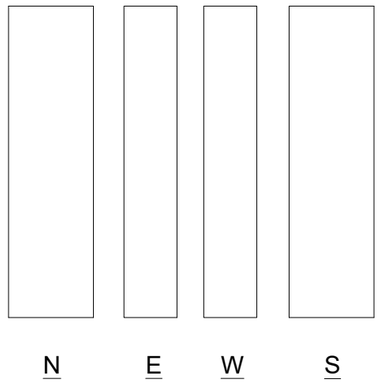
2ND COLUMN FROM NORTH



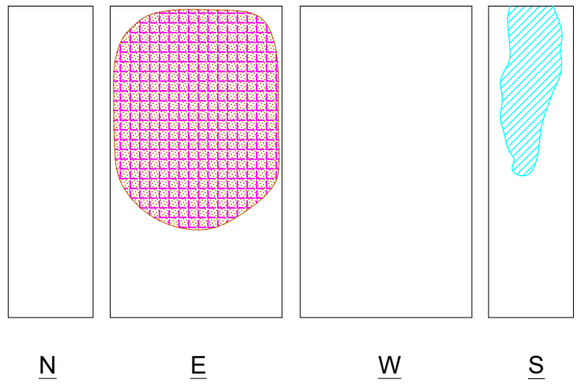
3RD COLUMN FROM NORTH



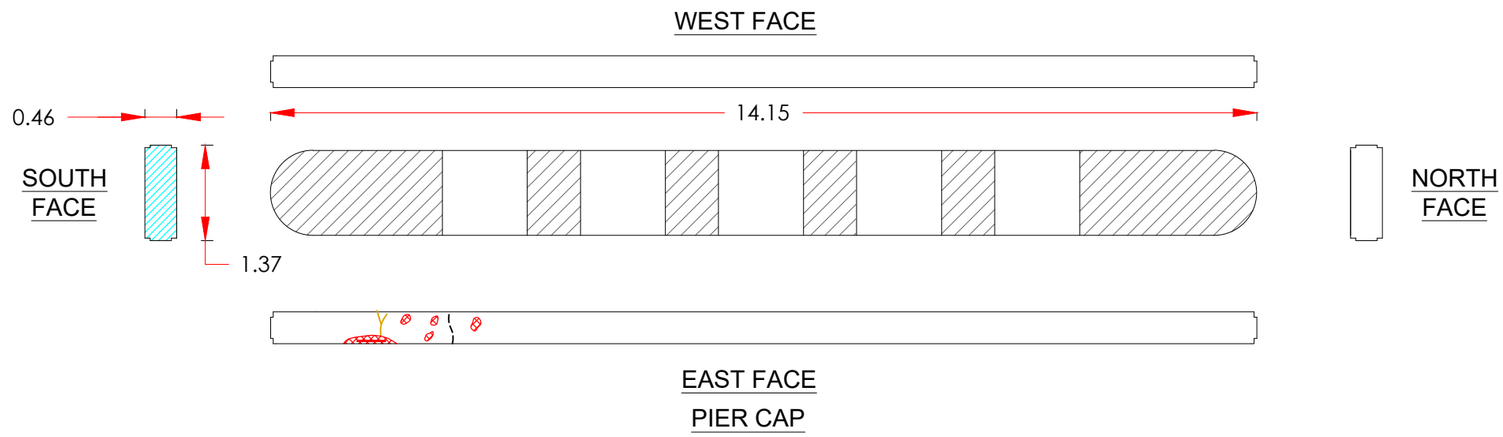
4TH COLUMN FROM NORTH



5TH COLUMN FROM NORTH



6TH COLUMN FROM NORTH



Key Plan

LEGEND

- Delaminations
- Spalls
- Concrete Pattern Cracks
- Light Scaling
- Medium Concrete Cracks
- Medium Stained Cracks
- Exposed Rebar

Note: All dimensions are metric unless specified otherwise.

No.	Revision/Issue	Date

HAL

Project Name. Address & Township/City

DURHAM STREET BRIDGE
WALKERTON, ONTARIO

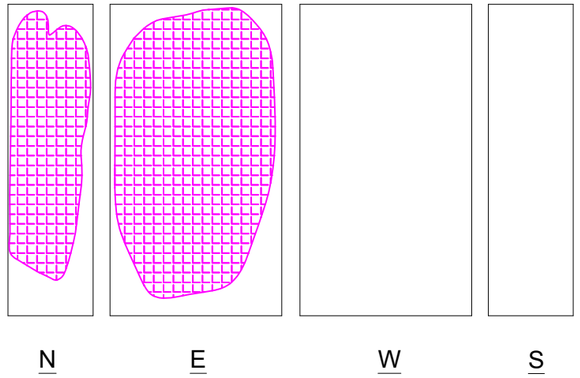
Drawing Title

Surface Deterioration of Pier 2

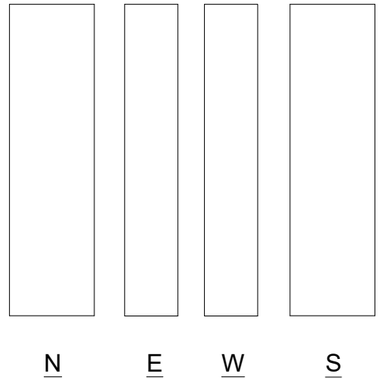
Project No	Site No.
20230921	0419550
Date: OCT 2023	Drawn By: S.B.
Scale: 1:85	Checked By: A.H.

Construction North	Sheet
	5B

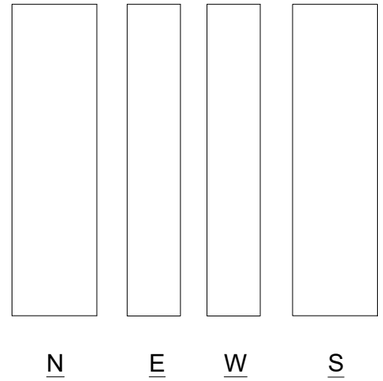
PIER 3



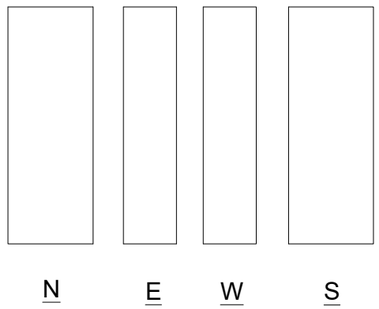
1ST COLUMN FROM NORTH



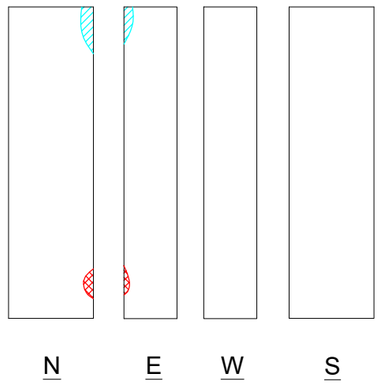
2ND COLUMN FROM NORTH



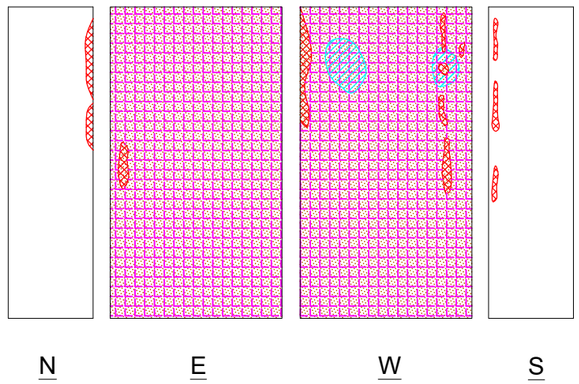
3RD COLUMN FROM NORTH



4TH COLUMN FROM NORTH

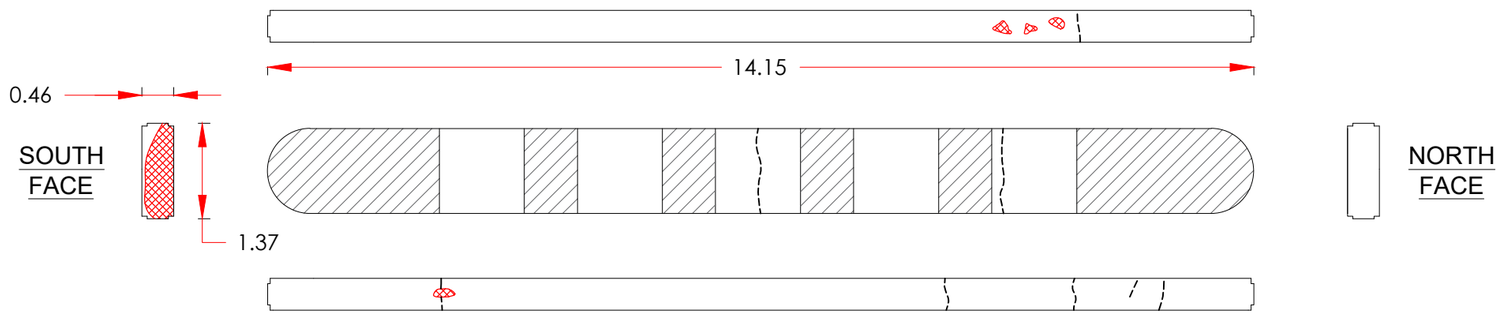


5TH COLUMN FROM NORTH



6TH COLUMN FROM NORTH

WEST FACE



EAST FACE

PIER CAP

Key Plan

LEGEND

- Delaminations
- Spalls
- Concrete Pattern Cracks
- Light Scaling
- Medium Concrete Cracks

Note: All dimensions are metric unless specified otherwise.

No.	Revision/Issue	Date

HAL

Project Name. Address & Township/City

DURHAM STREET BRIDGE
WALKERTON, ONTARIO

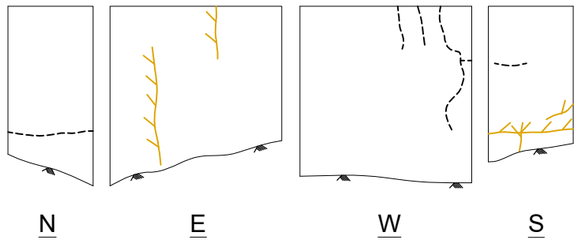
Drawing Title

Surface Deterioration of Pier 3

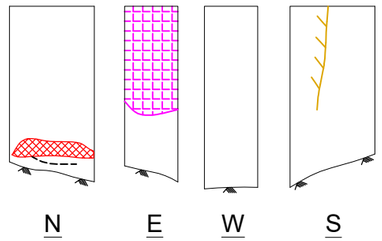
Project No	Site No.
20230921	0419550
Date: OCT 2023	Drawn By: S.B.
Scale: 1:85	Checked By: A.H.

Construction North	Sheet
	5C

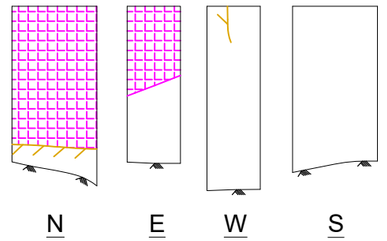
PIER 4



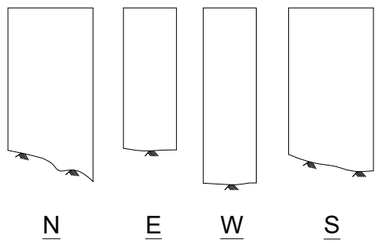
1ST COLUMN FROM NORTH



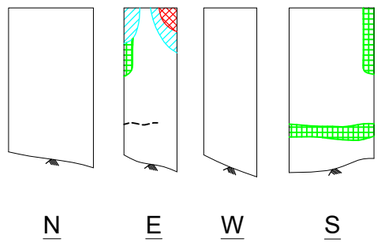
2ND COLUMN FROM NORTH



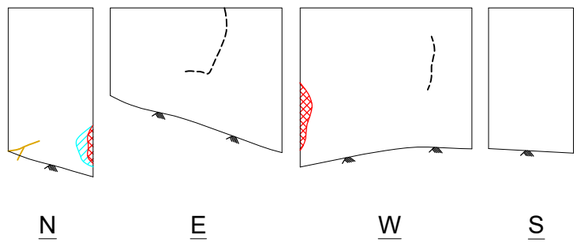
3RD COLUMN FROM NORTH



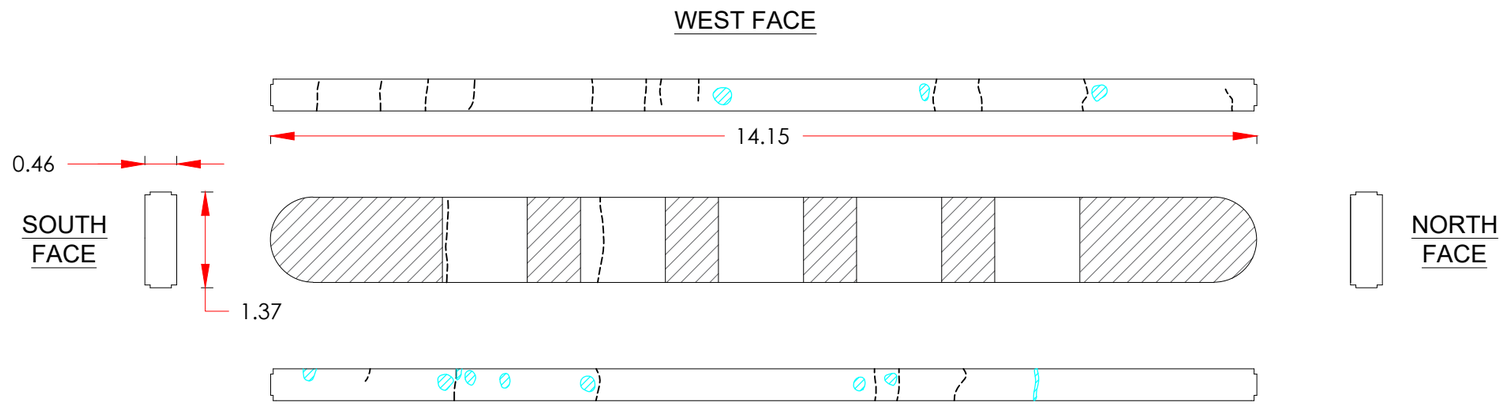
4TH COLUMN FROM NORTH



5TH COLUMN FROM NORTH



6TH COLUMN FROM NORTH



PIER CAP

Key Plan

LEGEND

- Delaminations
- Spalls
- Concrete Pattern Cracks
- Medium Stained Cracks
- Medium Concrete Cracks

Note: All dimensions are metric unless specified otherwise.

No.	Revision/Issue	Date

HAL

Project Name. Address & Township/City

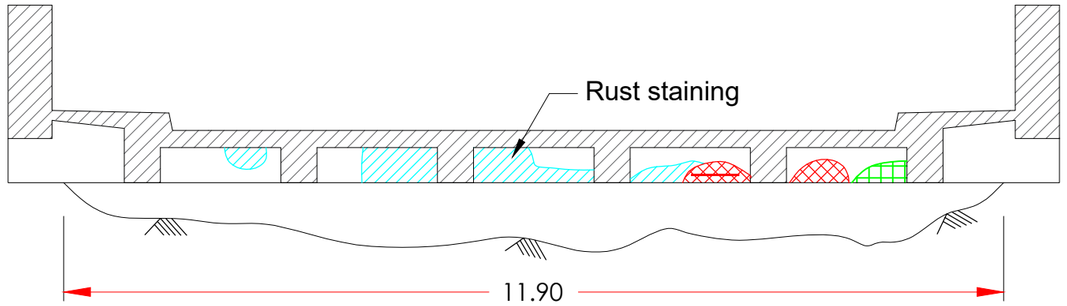
DURHAM STREET BRIDGE
WALKERTON, ONTARIO

Drawing Title

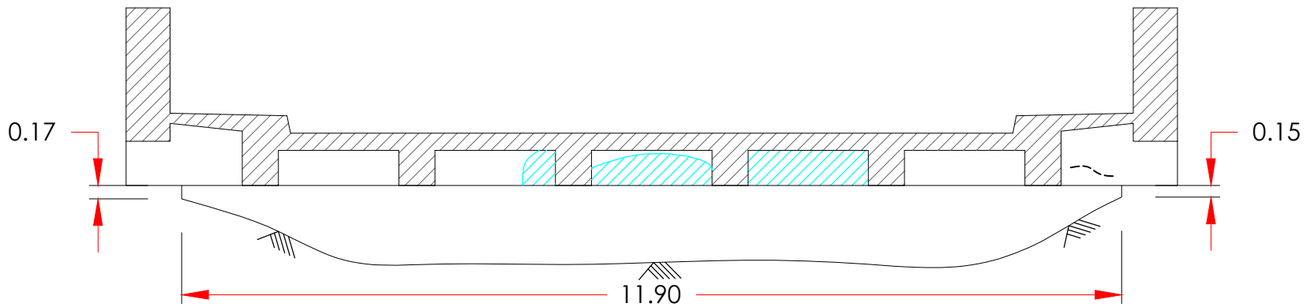
Surface Deterioration of Pier 4

Project No	Site No.
20230921	0419550
Date: OCT 2023	Drawn By: S.B.
Scale: 1:85	Checked By: A.H.

Construction North	Sheet
	5D



EAST ABUTMENT AND DIAPHRAGM



WEST ABUTMENT AND DIAPHRAGM

Key Plan

LEGEND

- Patched Spalls
- Delaminations
- Spalls

Note: All dimensions are metric unless specified otherwise.

No.	Revision/Issue	Date

HAL

Project Name. Address & Township/City

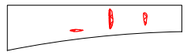
DURHAM STREET BRIDGE
WALKERTO, ONTARIO

Drawing Title

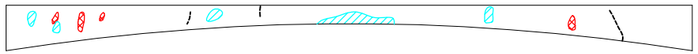
Surface Deterioration of Abutments and Abutment Diaphragms

Project No	Site No.
20230921	0419550
Date: OCT 2023	Drawn By: S.B.
Scale: 1:100	Checked By: A.H.

Construction North	Sheet
	6

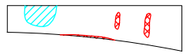


1ST SPAN FROM WEST
1STGIRDER FROM NORTH
NORTH FACE



2ND SPAN FROM WEST
1STGIRDER FROM NORTH
NORTH FACE

3RD SPAN FROM WEST
1STGIRDER FROM NORTH
NORTH FACE

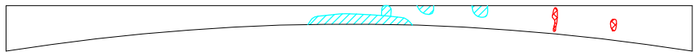


1ST SPAN FROM WEST
1STGIRDER FROM NORTH
SOUTH FACE

2ND SPAN FROM WEST
1STGIRDER FROM NORTH
SOUTH FACE

3RD SPAN FROM WEST
1STGIRDER FROM NORTH
SOUTH FACE

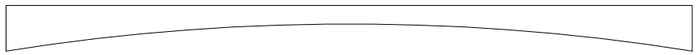
1ST SPAN FROM WEST
2ND GIRDER FROM NORTH
NORTH FACE



2ND SPAN FROM WEST
2ND GIRDER FROM NORTH
NORTH FACE

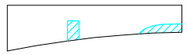
3RD SPAN FROM WEST
2ND GIRDER FROM NORTH
NORTH FACE

1ST SPAN FROM WEST
2ND GIRDER FROM NORTH
SOUTH FACE

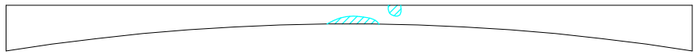


2ND SPAN FROM WEST
2ND GIRDER FROM NORTH
SOUTH FACE

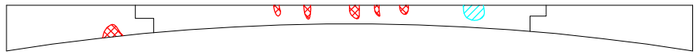
3RD SPAN FROM WEST
2ND GIRDER FROM NORTH
SOUTH FACE



1ST SPAN FROM WEST
3RD GIRDER FROM NORTH
NORTH FACE



2ND SPAN FROM WEST
3RD GIRDER FROM NORTH
NORTH FACE



3RD SPAN FROM WEST
3RD GIRDER FROM NORTH
NORTH FACE

1ST SPAN FROM WEST
3RD GIRDER FROM NORTH
SOUTH FACE

2ND SPAN FROM WEST
3RD GIRDER FROM NORTH
SOUTH FACE

3RD SPAN FROM WEST
3RD GIRDER FROM NORTH
SOUTH FACE

Key Plan

LEGEND

- Delaminations
- Spalls
- Medium Concrete Cracks

Note: All dimensions are metric unless specified otherwise.

No.	Revision/Issue	Date

HAL

Project Name. Address & Township/City

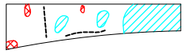
DURHAM STREET BRIDGE
WALKERTON, ONTARIO

Drawing Title

Surface Deterioration of Girders

Project No	Site No.
20230921	0419550
Date	Drawn By
OCT 2023	S.B.
Scale	Checked By
1:125	A.H.

Construction North	Sheet
	7A

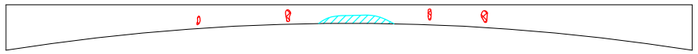


1ST SPAN FROM WEST
4TH GIRDER FROM NORTH
NORTH FACE

2ND SPAN FROM WEST
4TH GIRDER FROM NORTH
NORTH FACE

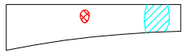
3RD SPAN FROM WEST
4TH GIRDER FROM NORTH
NORTH FACE

1ST SPAN FROM WEST
4TH GIRDER FROM NORTH
SOUTH FACE



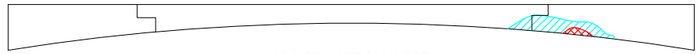
2ND SPAN FROM WEST
4TH GIRDER FROM NORTH
SOUTH FACE

3RD SPAN FROM WEST
4TH GIRDER FROM NORTH
SOUTH FACE

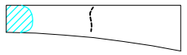


1ST SPAN FROM WEST
5TH GIRDER FROM NORTH
NORTH FACE

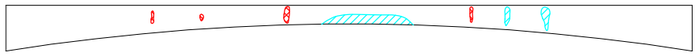
2ND SPAN FROM WEST
5TH GIRDER FROM NORTH
NORTH FACE



3RD SPAN FROM WEST
5TH GIRDER FROM NORTH
NORTH FACE

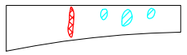


1ST SPAN FROM WEST
5TH GIRDER FROM NORTH
SOUTH FACE



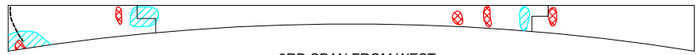
2ND SPAN FROM WEST
5TH GIRDER FROM NORTH
SOUTH FACE

3RD SPAN FROM WEST
5TH GIRDER FROM NORTH
SOUTH FACE

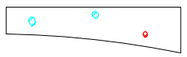


1ST SPAN FROM WEST
6TH GIRDER FROM NORTH
NORTH FACE

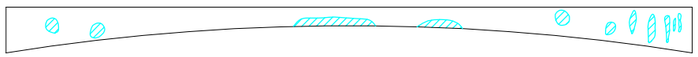
2ND SPAN FROM WEST
6TH GIRDER FROM NORTH
NORTH FACE



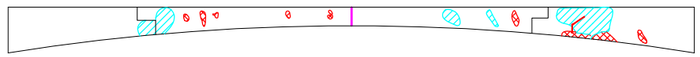
3RD SPAN FROM WEST
6TH GIRDER FROM NORTH
NORTH FACE



1ST SPAN FROM WEST
6TH GIRDER FROM NORTH
SOUTH FACE



2ND SPAN FROM WEST
6TH GIRDER FROM NORTH
SOUTH FACE



3RD SPAN FROM WEST
6TH GIRDER FROM NORTH
SOUTH FACE

Key Plan

LEGEND

- Patched Spalls
- Delaminations
- Spalls
- Exposed Rebar
- Medium Concrete Cracks

Note: All dimensions are metric unless specified otherwise.

No.	Revision/Issue	Date

HAL

Project Name. Address & Township/City

DURHAM STREET BRIDGE
WALKERTON, ONTARIO

Drawing Title

Surface Deterioration of Girders

Project No	Site No.
20230921	0419550
Date: OCT 2023	Drawn By: S.B.
Scale: 1:125	Checked By: A.H.

Construction North	Sheet
	7B

4TH SPAN FROM WEST
1STGIRDER FROM NORTH
NORTH FACE

5TH SPAN FROM WEST
1STGIRDER FROM NORTH
NORTH FACE

4TH SPAN FROM WEST
1STGIRDER FROM NORTH
SOUTH FACE

5TH SPAN FROM WEST
1STGIRDER FROM NORTH
SOUTH FACE

4TH SPAN FROM WEST
2ND GIRDER FROM NORTH
NORTH FACE

5TH SPAN FROM WEST
2ND GIRDER FROM NORTH
NORTH FACE

4TH SPAN FROM WEST
2ND GIRDER FROM NORTH
SOUTH FACE

5TH SPAN FROM WEST
2ND GIRDER FROM NORTH
SOUTH FACE

4TH SPAN FROM WEST
3RD GIRDER FROM NORTH
NORTH FACE

5TH SPAN FROM WEST
3RD GIRDER FROM NORTH
NORTH FACE

4TH SPAN FROM WEST
3RD GIRDER FROM NORTH
SOUTH FACE

5TH SPAN FROM WEST
3RD GIRDER FROM NORTH
SOUTH FACE

4TH SPAN FROM WEST
4TH GIRDER FROM NORTH
NORTH FACE

5TH SPAN FROM WEST
4TH GIRDER FROM NORTH
NORTH FACE

4TH SPAN FROM WEST
4TH GIRDER FROM NORTH
SOUTH FACE

5TH SPAN FROM WEST
4TH GIRDER FROM NORTH
SOUTH FACE

4TH SPAN FROM WEST
5TH GIRDER FROM NORTH
NORTH FACE

5TH SPAN FROM WEST
5TH GIRDER FROM NORTH
NORTH FACE

4TH SPAN FROM WEST
5TH GIRDER FROM NORTH
SOUTH FACE

5TH SPAN FROM WEST
5TH GIRDER FROM NORTH
SOUTH FACE

4TH SPAN FROM WEST
6TH GIRDER FROM NORTH
NORTH FACE

5TH SPAN FROM WEST
6TH GIRDER FROM NORTH
NORTH FACE

4TH SPAN FROM WEST
6TH GIRDER FROM NORTH
SOUTH FACE

5TH SPAN FROM WEST
6TH GIRDER FROM NORTH
SOUTH FACE

Key Plan

LEGEND

- Drain
- C1 Core Sample Location
- SS1 Sawn Sample Location
- Patched Spalls
- Delaminations
- Spalls
- Light Scaling
- Medium Scaling
- Severe Scaling
- Honeycombed Areas
- Medium Concrete Cracks
- W Wide Concrete Cracks
- Medium Stained Cracks
- W Wide Stained Cracks
- Concrete Pattern Cracks
- Wet Areas
- Unsealed Asphalt Cracks
- W Wide Unsealed Asphalt Cracks
- SC Sealed Asphalt Cracks
- Pot Hole/ Asphalt Patch
- Ravelling

Note: All dimensions are metric unless specified otherwise.

No.	Revision/Issue	Date

HAL

Project Name. Address & Township/City

DURHAM STREET BRIDGE
WALKERTON, ONTARIO

Drawing Title

Surface Deterioration of Girders

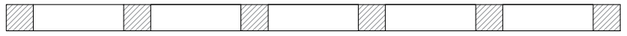
Project No	Site No.
20230921	0419550
Date: OCT 2023	Drawn By: S.B.
Scale: 1:175	Checked By: A.H.

Construction North	Sheet
	7C

2ND SPAN FROM WEST
1ST DIAPHRAGM FROM WEST
EAST FACE

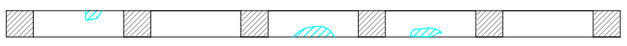
2ND SPAN FROM WEST
1ST DIAPHRAGM FROM WEST
WEST FACE

2ND SPAN FROM WEST
2ND DIAPHRAGM FROM WEST
EAST FACE



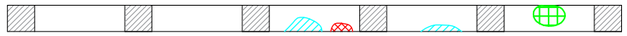
2ND SPAN FROM WEST
2ND DIAPHRAGM FROM WEST
WEST FACE

3RD SPAN FROM WEST
1ST DIAPHRAGM FROM WEST
EAST FACE

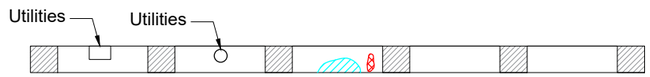


3RD SPAN FROM WEST
1ST DIAPHRAGM FROM WEST
WEST FACE

3RD SPAN FROM WEST
2ND DIAPHRAGM FROM WEST
EAST FACE

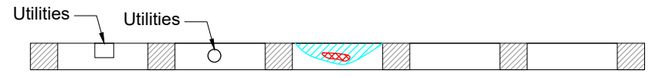


3RD SPAN FROM WEST
2ND DIAPHRAGM FROM WEST
WEST FACE



4TH SPAN FROM WEST
1ST DIAPHRAGM FROM WEST
EAST FACE

4TH SPAN FROM WEST
1ST DIAPHRAGM FROM WEST
WEST FACE



4TH SPAN FROM WEST
2ND DIAPHRAGM FROM WEST
EAST FACE

4TH SPAN FROM WEST
2ND DIAPHRAGM FROM WEST
WEST FACE

Key Plan

LEGEND

- Patched Spalls
- Delaminations
- Spalls

Note: All dimensions are metric unless specified otherwise.

No.	Revision/Issue	Date

HAL

Project Name. Address & Township/City

DURHAM STREET BRIDGE
WALKERTO, ONTARIO

Drawing Title

Surface Deterioration of Diaphragms

Project No	Site No.
20230921	0419550
Date: OCT 2023	Drawn By: S.B.
Scale: 1:100	Checked By: A.H.

Construction North	Sheet
	8

Appendix C

Durham Street Bridge Weight Restriction and
Alternate Truck Route Signage (Triton)

TRITON ENGINEERING SERVICES LIMITED
Consulting Engineers

105 Queen Street West, Unit 14
Fergus
Ontario N1M 1S6
Tel: (519) 843-3920
Fax: (519) 843-1943
Email: info@tritoneng.on.ca

ORANGEVILLE • FERGUS • HARRISTON

January 19, 2024

Attention: Mr. Adam Stanley, C.Tech
Director, Transportation & Environmental Services
Corporation of the County of Bruce
AStanley@brucecounty.on.ca

RE:
Durham Street Bridge, Walkerton
Weight Restriction and Alternate Truck Route Signage

Dear Mr. Stanley:

Further to the Burgess Engineering (Burgess) letter, Durham Street Bridge Structure 0419550 Assessment Summary, dated January 12, 2024, Triton Engineering Services Limited (Triton) has reviewed the recommendations of the letter to limit loading by heavy truck traffic and provides further direction to implement the bridges weight restrictions.

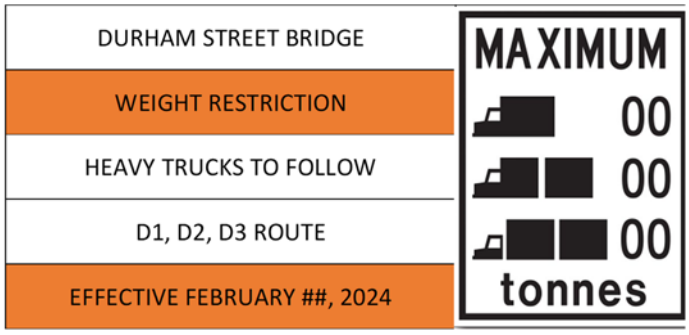
The Burgess letter recommends posting signage to restrict heavy trucks from passing over the bridge by way of a “3-level load limit”. The selection and application of regulatory traffic signage in Ontario is regulated under the Ministry of Transportation (MTO) Ontario Traffic Manual (OTM) Book 5. A 3-level load limit or weight restriction sign differentiates various heavy truck types by the number of “vehicle units”. A vehicle unit corresponds to the number of axels on the truck or a combination of truck and trailers and permits a maximum gross vehicle weight as follows; a single vehicle unit (e.g., a cube truck), a combination of two vehicle units (e.g., a tractor and trailer), and a combination of three vehicle units (e.g., a tractor and two trailers).

In this case, the recommended single vehicle unit, two vehicle unit and three vehicle unit weight restrictions are 15, 25 and 30 tonnes, respectively.

Based on MTO OTM Book 5, a MAXIMUM TONNES (Rb-63A) sign is to be used and mounted on both ends of the bridge as well as on the left side of the roadway approaching the bridge in a visible location. The sign MAXIMUM TONNES appears as follows:

(Rb-63A)

Alternate Truck Route and Advanced Warning signage will also be required and is to be placed strategically ahead of the nearest intersections of the bridge to divert heavy truck traffic from passing over the bridge. These signs will appear as follows:



(TC-64)

(TC-10)

To enforce the weight restrictions for the Durham Street Bridge, the County will be required to amend their existing By-law which restricts the weight of vehicles passing over various County bridges. As such, we recommend the existing By-law be amended to add the Durham Street bridge and read as follows:

Bruce County Bridge No. 0419550, Durham Street Bridge:

No vehicle or combination of vehicles or any class thereof, whether empty or loaded, shall be operated over the bridge known as the Durham Street Bridge crossing the Saugeen River on Durham Street East (Bruce Road 4), Walkerton, in the former Township of Brant where:

(a) in the case of a single vehicle the gross weight exceeds fifteen (15) tonnes,

(b) in the case of a combination of two vehicles the gross weight exceeds twenty-five (25) tonnes,

(c) in the case of a combination of three vehicles the gross weight exceeds thirty (30) tonnes

It is recommended the above measures be implemented immediately once the By-law is passed by Bruce County Council and remain in effect until the necessary repairs to the Durham Street Bridge, under the advisement of a qualified structural engineer, are completed.

We trust that this information is satisfactory for your present requirements and should you have any questions, please do not hesitate to contact us.

Yours truly,

Triton Engineering Services Limited

Chris Clark, P.Eng.

+

Appendix D

Durham Street East Bridge, County Structure 0419550,
Condition of Half Joints (BM Ross)

B. M. ROSS AND ASSOCIATES LIMITED
Engineers and Planners
62 North Street, Goderich, ON N7A 2T4
p. (519) 524-2641 • f. (519) 524-4403
www.bmross.net

File No. BR545A

June 17, 2019

Jim Donohoe, P. Eng.
Transportation & Environmental Services
Corporation of the County of Bruce
30 Park St., Box 398
Walkerton, ON N0G 2V0

Dear Sir:

Re: Durham Street East Bridge
County Structure 0419550
Condition of Half Joints

By way of this letter, we wish to report on the condition of the half-joints for the drop-in span of this bridge. This type of half-joint connection has been proven to be a problem because of sudden collapses with little or no warning. This style of bridge is no longer allowed to be built because it is a single load path structure. That is, failure of one element would result in a collapse. There is no redundancy in the structural support. A good analogy is the weak link in a chain causing a full and sudden breakage of the chain.

Elevation of connection showing support corbel on the right and dapped end of beam on the left

Three examples of bridges demonstrating problems with half joints are as follows:

1. De la Concorde Overpass in Laval, Quebec collapsed in 2006, killing 5 people. This tragic event brought the problem to light and resulted in code changes. The style of bridge was discontinued for new designs and authorities were reviewing any existing bridges of this type. The province of Quebec replaced all of these bridges in the following years. The drop-in span of this bridge was 27.4 m.
2. The Crediton Bridge in Huron County was reviewed in light of the Laval tragedy. This bridge was found to have significant cracks in the problem area. A rehabilitation was made in 2008 to fuse the problem area in new reinforced concrete and introduce additional support. No collapse had happened and the bridge is still in service. The drop-in span of this bridge was 15.2 m.
3. The Margaret Avenue Bridge in Kitchener was closed and demolished in 2013 because it had design features similar to the bridge in Laval. No collapse had happened. This was done even though the bridge had been rehabilitated in 2004 with new drop-in span girders. The drop-in span of this bridge was 11.0 m.

Considering these concerns, the County requested a more thorough investigation and analysis of the half joints of the Durham St. E. Bridge.

Site Investigation

On April 24, 2019, a detailed inspection was made of just the two half joints of this bridge. For the purposes of the field observations, the bridge was assumed to span east-west, with the river flow from south to north.

Site access was provided with a hydraulic Hydra-Platform from the south side of the bridge only. Aerial electric lines prevented access on the north side. The work platform could be extended to fully access the southerly 4 T-beams and the south face of the 5th beam from the south. The north edge beam and the north face of the 5th beam (from the south) were not able to be reached. The south face and soffit of the north beam were visible at close range from the access platform.

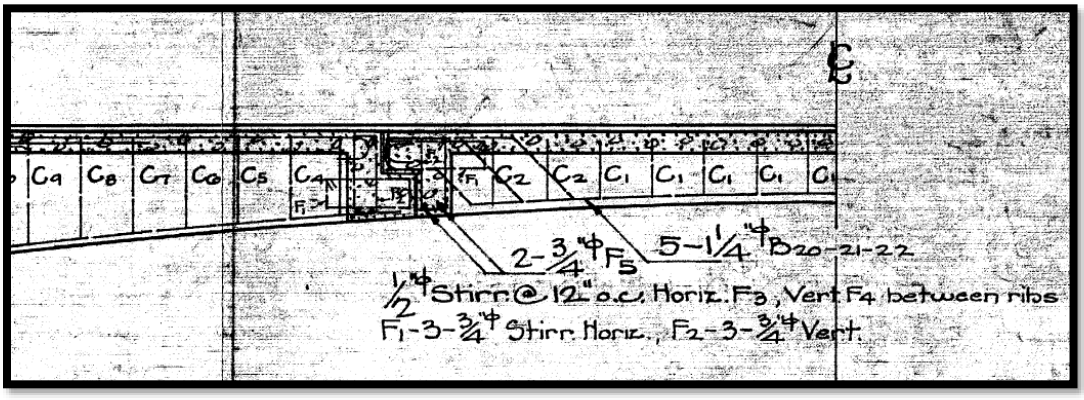
Access platform before turning under bridge deck

Visual and tactile observations were made by Andrew Ross, P.Eng. Andrew has completed the biennial OSIM inspections for this bridge in recent years and was involved in the 1995 deck repairs.

Ground Penetrating Radar (GPR) observations were made of select vertical elevations of some beam stems and the diaphragms between beams, in order to confirm reinforcing steel. The scans were performed by Canadian Cutting and Coring (Toronto) Ltd.

Background

Drawings of the bridge are available and are dated January, 1936. It is assumed that the year of construction is also 1936. The drawings were not marked "as-constructed" to indicate confirmation of the details and dimensions of the drawings. Details of the half-joints show the reinforcing steel and pavement sealant over the joint that included an asphalt plank and filler to prevent water leakage.



Detail from 1936 drawings

In 1966 some repairs were made to the bridge which included replacement of the approach slabs, re-paving the deck including a compression seal and paraplastic joint sealer in the half-joints.

In 1995 the concrete deck was milled and overlaid with new concrete, waterproofing membrane and Class 3 strip seals at the half-joints. Prior to the design of the repairs, a detailed deck condition survey was completed, (Trow 1993). Three concrete compressive cores were taken and showed compressive strengths of 76.9 MPa, 77.7 MPa, and 92.2 MPa. The contract tender was set up forecasting concrete removals and repairs in the deck and end diaphragms of 11 m^3. Only 5.125 m^3 was paid for this item, indicating that actual conditions were better than forecast. The contract called for milling 10 mm of the original deck and overlaying with 60 mm of new concrete.

The 1995 repair contract also included covering thin spalls with a fibre-reinforced non-shrink grout (Gemite Fibre-Patch). This was typically used where concrete cover was so thin over the reinforcing steel that even mild rusting of the bars would cause a spall (cover 20 mm or less). At completion, this patch material gave a good appearance, but many repaired areas showed spalls or delaminations within 2 years.

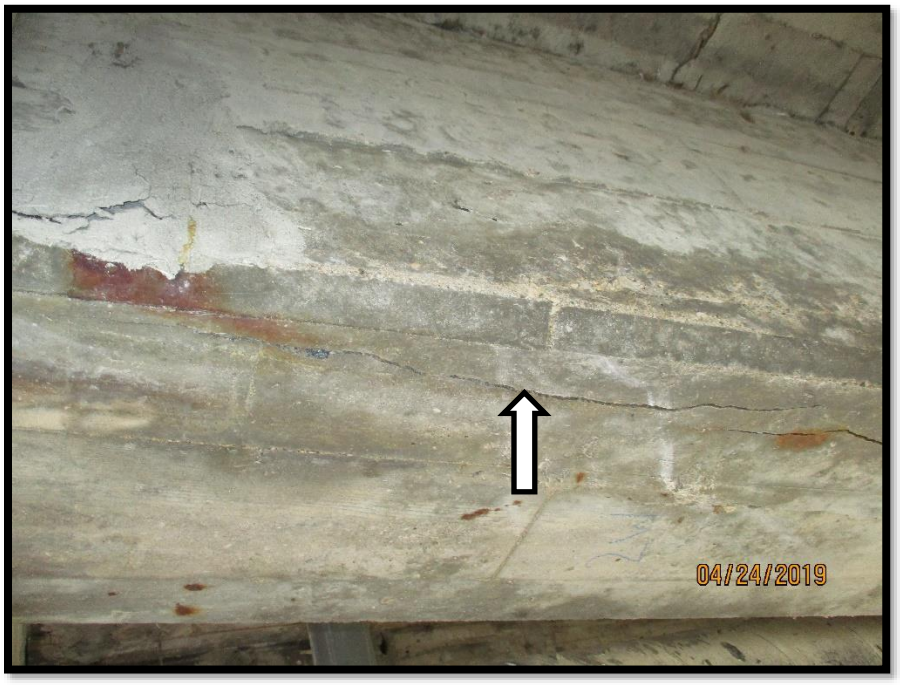
The 1995 repairs removed enough concrete from the half-joints to seat the anchorage assemblies of the new expansion joints. There did not appear to be any concentration of concrete deterioration at these joints.

Observations

From the close observations on April 24, a number of small delaminations and spalls were evident. Cracks were observed that were related to spall or delamination defects. We did not observe any cracks that appeared to be related to principal stresses. That is, no cracks were observed in tensile zones of the beams.

Some small spalls were located at the bottom corners of the half-joints. These corner spalls did expose some of the reinforcing steel of the joints.

The second cantilevered beam (from the south edge) on the west side of the west joint did exhibit longitudinal cracks indicating concrete splitting and spalling due to corrosion of the lower longitudinal reinforcing rod. This may develop into a spall about 1.7 m long, 0.12 m wide and 0.18 m high.



Corner delamination on Beam #2, west side

Field sketches of concrete defects are available in Appendix A.

Typical pop-outs, corner spall from insufficient cover

Soffit of west joint

Typical cantilever beam face in good condition

The exterior faces of the edge girders are exposed to salt spray from the open railing system. These areas exhibit the worst of the delaminations due to rust swelling of the reinforcing steel and the bearing plates.

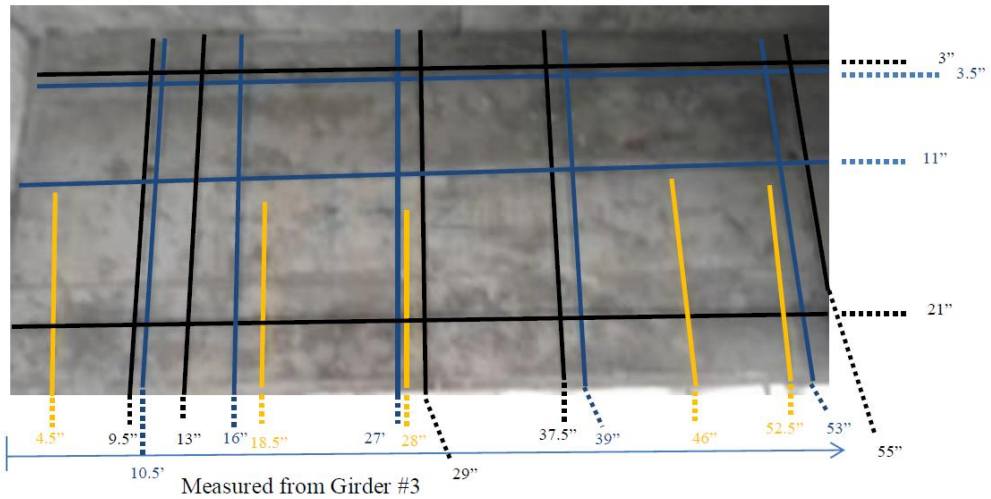
South exterior beam face – after scaling loose concrete

Ground Penetrating Radar

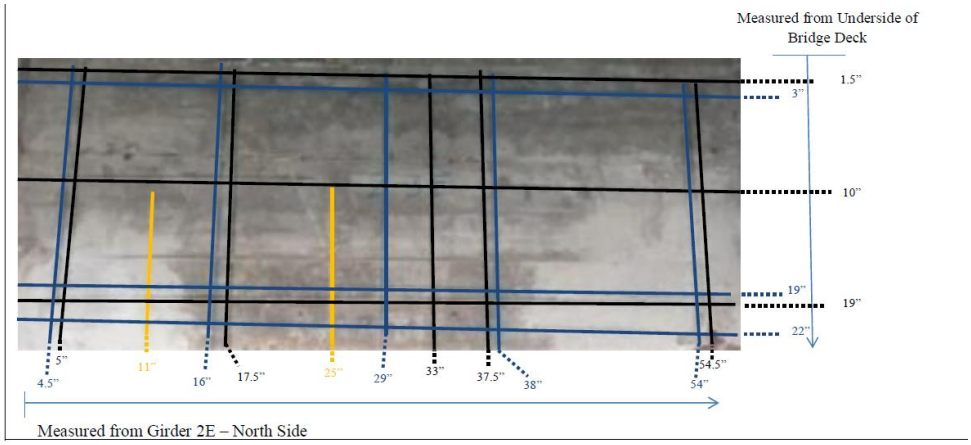
GPR scans were made of available vertical surfaces in order to confirm reinforcing steel placement. The full report by Canadian Cutting and Coring is available as Appendix B. In total, 6 cross beams (diaphragms) were scanned and two faces of girder stems were scanned.

The scans have limitations. The scanning unit cannot detect bars within about 150 mm of inside corner such as exist between beam stems and diaphragms. The scan does not indicate the level of corrosion of the bars.

GPR scan method



Scan results at a diaphragm segment:
Black lines: near surface bars
Blue lines: far surface bars
Yellow Lines: partial height stirrups



Scan results at a beam segment:
Black lines: near surface bars
Blue lines: far surface bars
Yellow Lines: partial height stirrups

The scan results confirm the arrangement of reinforcing bars shown in the 1936 drawings. Although the bar placement is irregular, the total number of bars matches the quantity indicated on the drawings.

Structural Analysis

A structural analysis was done of the cantilevered corbel of the beams, using the simplified method from the evaluation section of CAN/CSA S6-14, the Canadian Highway Bridge Design Code. A factored shear load was determined from the existing dead loads of the structure, combined with live loads from the prescribed evaluation truck loading for Ontario.

For the analysis, the following material strengths were used:
Compressive strength of concrete: 30 MPa. The Trow report measured much stronger values, but it was felt that a typical strength of 30 MPa should be used conservatively and account for some deterioration near the expansion joints.
Yield strength of hard grade reinforcing steel: 345 MPa
Yield strength of soft grade reinforcing steel: 230 MPa

The factored shear force per beam is 547 kN. The calculated resistance of the beam section and diaphragm section is 829 kN.

The factored bending moment of the corbel cantilever calculates to 109.4 kNm. The combined bending moment resistance of the beam and diaphragm segments of the corbel is 150 kNm.

The bending moment resistance governs. If the strength of the steel bars was reduced by 27% due to corrosion, then the resistance would equal the factored load effects.

The shear and moment methods would have been used at the time of design. The analysis included additional dead load from the deck and sidewalk overlays in 1995 and applied

the live loads as prescribed in the current Bridge Code. Another, more refined analysis would be the strut-and-tie model.

The geometry of the corbel connection lends itself well to strut-and-tie modelling. Preliminary results with this modelling gave results more favourable than the conventional shear and moment methods. To be conservative, the shear and moment values were used.

Details from the drawings indicate that the dimensions and reinforcement for the dapped beam ends are identical to the corbel, but inverted. The webs of the drop-in beams also have some diagonal shear reinforcement.

Considerations

In preparing conclusions and recommendations, the following matters were considered:

1. The 1936 drawings show asphalt being used to seal the joint against water damage. The 1966 drawings of repairs also show a detail to seal the half-joints against water. The 1995 drawings of repairs show a Class C strip seal used to protect the joint against water. These details demonstrate an effort to keep the half-joints sealed from corrosive elements throughout the entire service life. It can be expected that some leakage has happened in that time.

2. Comparing the condition photos from 1993 to those of 2019, there appears to be only minor increase in staining and spalling of concrete in the areas of the half-joints.

3. Of the 3 example bridges with half-joint failures, two were solid slab arches with no shear reinforcement in the concrete. The Durham Street East Bridge is made of T-beam sections with significant shear stirrups in the stems of the beams. If there was over-stress in shear, it would most likely show evidence of diagonal cracking on the beam webs. The inspector specifically looked for this pattern of cracking and observed none. The slab style of bridge would have shear cracks hidden within the depth of the slab.

4. Despite the hands-on surface observations and the ground-penetrating radar scans, there is no way to visually inspect the deterioration that is happening at the interior surfaces of the joints. It is possible that shear cracks exist within the corbel, but are not evident at the underside.

5. The structural analysis indicates that the design is adequate for the current load conditions with no deterioration of reinforcing steel. If the bar section is reduced by 27% or more, the factors of safety would be reduced below recommended values.

6. The ground-penetrating radar did confirm the existence of steel reinforcement, where it was expected, based on design drawings. It could not confirm the condition or size of the bars.

Conclusions and Recommendations

1. It is our opinion that the half-joint of this bridge is still in a safe condition and no immediate repairs or load restrictions are warranted.

2. It is recommended that any Permit Vehicles be reviewed so that the axle load effects on the central drop-in span do not exceed those resulting from the evaluation loads from the Bridge Code. This may allow heavy vehicles over a longer length or may require exclusion of other traffic.

3. The half-joint detail is to be avoided because it is a single load path element. For this reason, it is recommended that the County schedule this bridge for replacement within 5 years and do not spend money on rehabilitation.

The recommendation for bridge replacement instead of rehabilitation is also based on the age of the bridge at 83 years. The current bridge code expects a service life of 75 years. The rehabilitation in 1995 was expected to have a service life of about 30 years. A rehabilitation at this time to re-configure the bridge with a continuous link to replace the half joints would likely cost in the range of $800,000 to $1,000,000 and require detour of all traffic. This work may only result in a service life extension of about 20 years before other elements of the original bridge require the entire bridge to be replaced with further capital costs and traffic disruptions.

Yours very truly

B. M. ROSS AND ASSOCIATES LIMITED

Per _____
A. I. Ross, P. Eng.

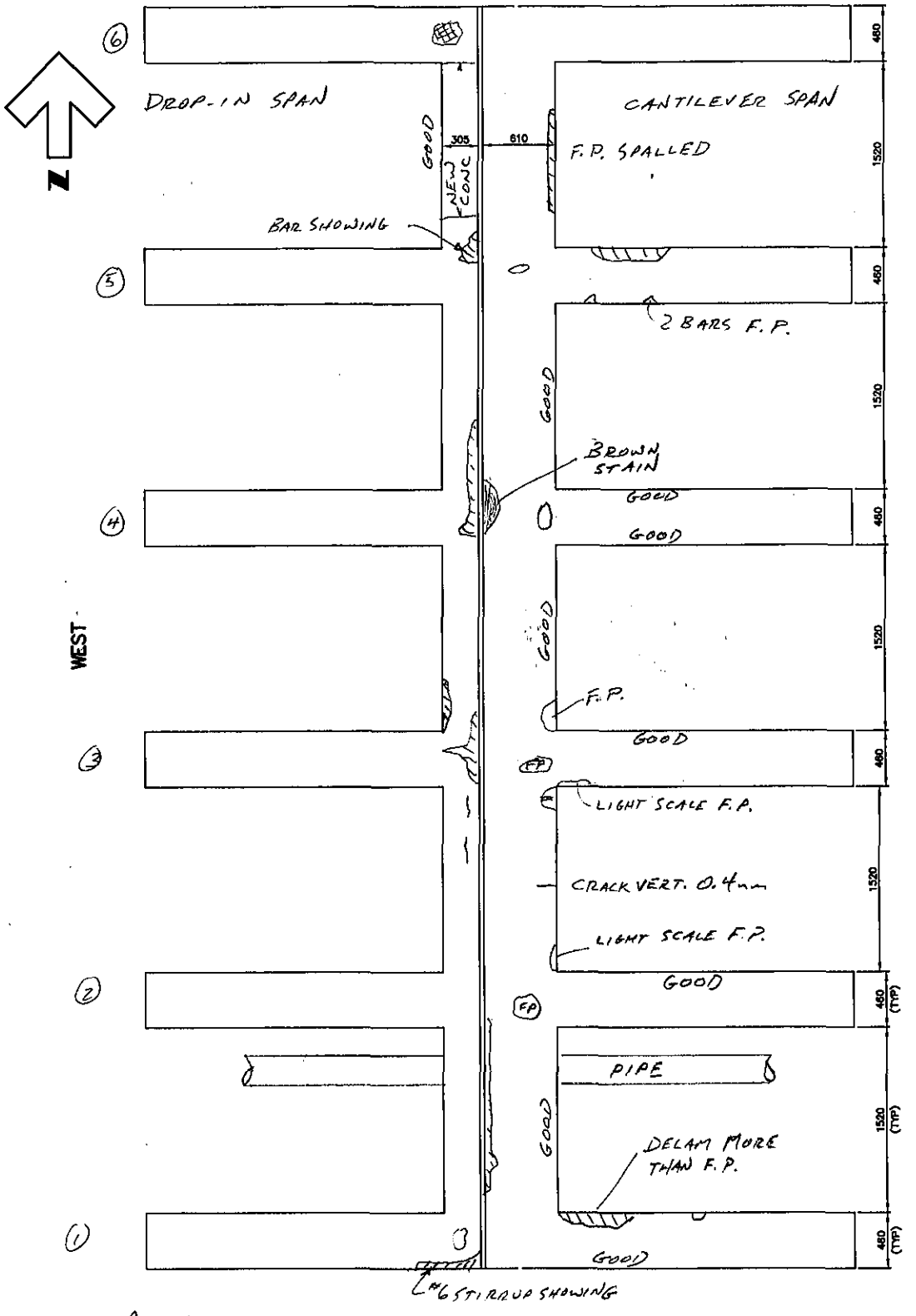
Per _____
Ryan J. Munn, P. Eng.

AIR:sd

APPENDIX A

1993 PHOTOS

APPENDIX B



F.P. = FIBRE PATCH FROM 1995

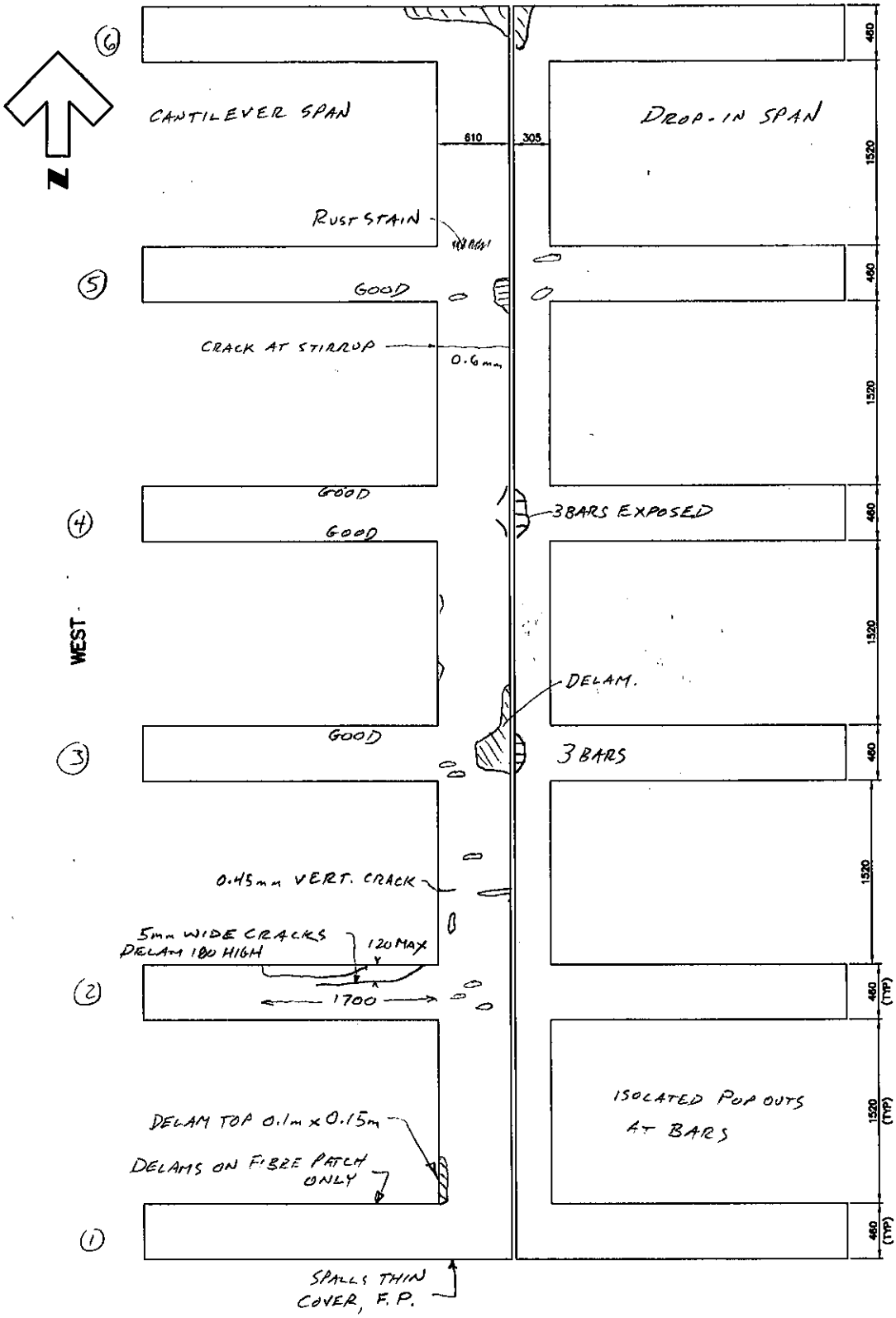
o = POP-OUT

= DELAMINATION

BR545A – EAST JOINT

COUNTY OF BRUCE – WALKERTON BRIDGE

SCALE	PROJECT No.	FIGURE No.
N.T.S.	BR545A	2 of 2



F. P. = FIBRE-PATCH FROM 1995

POP-OUT

DELAMINATION

BR545A – WEST JOINT

COUNTY OF BRUCE – WALKERTON BRIDGE

SCALE	PROJECT No.	FIGURE No.
N.T.S.	BR545A	1 of 2

APPENDIX C

Canadian Cutting and Coring (Toronto) Ltd.
77 Ward Road
Brampton Ontario L6S 6A8
Tel: (905) 624-1414

B. M. Ross and Associated Limited
Engineers and Planners
62 North Street
N7A 2T4

GROUND PENETRATING RADAR SURVEY AT DURHAM STREET BRIDGE, WALKERTON ONTARIO.

ATTN: Andrew Ross P.Eng

May 15, 2019

Canadian Cutting and Coring (Toronto) Ltd.
77 Ward Road
Brampton Ontario L6S 6A8
Tel: (905) 624-1414

B. M. Ross and Associates Limited **May 15, 2019**
Engineers and Planners
62 North Street
Goderich ON
N7A 2T4

ATTN: Andrew Ross P.Eng
aross@bmross.net

RE: GPR Survey at Durham Street East Bridge, Walkerton ON.

Mr. Ross,

As requested, Canadian Cutting & Coring (Toronto) Limited (CCC) completed a high frequency Ground Penetrating Radar (GPR) survey at the Durham Street East Bridge in Walkerton Ontario. The purpose of survey was to map the spatial position of embedded objects in concrete. This work was completed on April 24, 2019 and this information will be used by B. M. Ross and Associates Limited (BM Ross) to assist in an assessment of the structure.

Scope of Work

CCC was retained to collect GPR data, as directed and where accessible along the underside centre section of bridge along two beams (East & West). Access was provided using a bridge platform (hydra-platform) on the south side of the bridge (east-bound lane) and traffic control provided by others.

A total of eight locations were surveyed and each measured approximately 55”x24” in size, all survey areas are referenced with the attached site reference drawing. All GPR anomalies indicative of embedded reinforcing steel bars (rebar) were marked on the surface of the concrete at the time of the survey. In addition to real time GPR interpretation, 1’x1’ data grids were used to collect data at three (3) areas for post processing, interpretation and data quality assurance.

Equipment & Field Procedures

The survey was completed using a 1600MHz high frequency GPR operating system designed for concrete inspection and near surface/ shallow geophysical applications. Prior to data acquisition, GPR equipment was calibrated to enhance data quality and data collection/ position accuracy. GPR line data was collected in both directions of each survey area to map the inferred spacing and depth of cover for horizontal and vertical rebar.

Survey Results

All results and observations for the GPR survey was marked on site and at the time of the survey. Upon completion of each GPR survey a photograph of the area and associated markings was taken and used as the main deliverable for this survey (attached).

Interpretation

Colour Group

Each linear feature inferred to represent rebar was marked using a specific colour that had similar/ typical depth of cover and location characteristics. Each colour represented a group as follows:

Canadian Cutting and Coring (Toronto) Ltd.
77 Ward Road
Brampton Ontario L6S 6A8
Tel: (905) 624-1414

Black Lines - Typically represented rebar that was consistently near surface/ shallow embedment from survey surface.

Blue Lines - Typically represented rebar that was consistently the deepest embedment from survey surface.

Yellow Lines - Typically represented rebar that was consistently coincident of stirrups in the structure.

Depth of Cover

Depth of Cover determination was provided using a range of depths for each group/ survey area as follows:
Vertical Black Lines
Vertical Yellow Lines
Vertical Blue Lines
Horizontal Black Lines
Horizontal Yellow Lines
Horizontal Blue Lines

Spacing

Spacing for each colour group was measured at the time of the survey. For distance control the spacing was measured from a fixed point/ edge of the survey area (typically a perpendicular edge of Girder/ Beam or underside of bridge deck). Each measuring point is labelled on the associated interpretation map/ photo of the results.

Limitations of the Survey

The following conditions and limitations were observed at the time of the survey and may impact the accuracy of these results:

- Surface obstructions limited the amount of data to be collected near any obstruction (adjacent beams and girders, utilities/ pipes etc.).
- Limited survey space to complete/ collect larger 2'x2' Grid mapping techniques.
- Approximate Depth of Penetration of the GPR was observed at approximately 12".
- Corescan Terms and Conditions and manufacturing/ technology limitations may apply.

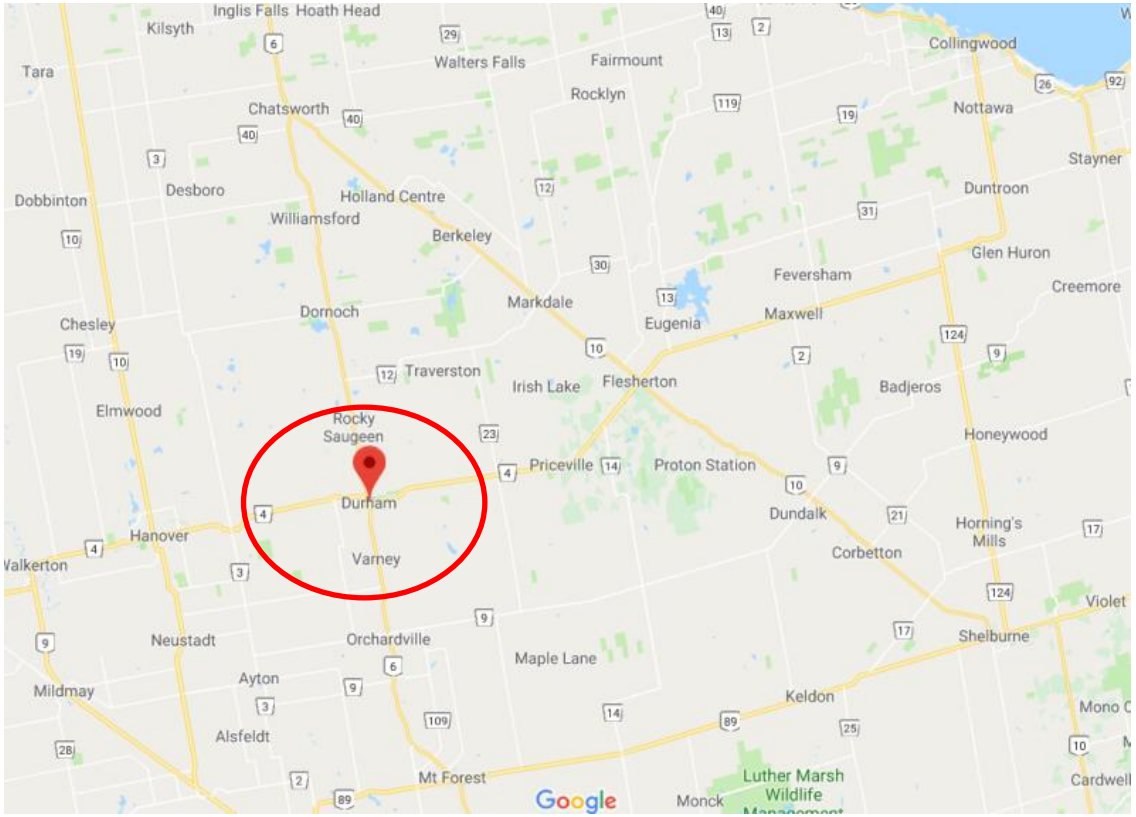
All interpretations are inferred and solely based on the observations collected at the time of the survey. All results are subject to the Service/ and manufacturing limitations of the equipment and technology used. If you have any questions regarding the information provided in this report please contact the undersigned at your earliest convenience.

Regards,

Bryan Grieve
Manager - CORESCAN Division
Canadian Cutting & Coring

Canadian Cutting and Coring (Toronto) Ltd.
77 Ward Road
Brampton Ontario L6S 6A8
Tel: (905) 624-1414

Site Map & Photographs


Inglis Falls
Hoath Head
Kilsyth
Tara
Walters Falls
Fairmount
Collingwood
Rocklyn
Chatsworth
Nottawa
Stayner
Desboro
Dobbinton
Holland Centre
Williamsford
Duntroon
Berkeley
Glen Huron
Feversham
Creemore
Markdale
Dornoch
Chesley
Eugenia
Maxwell
Traverston
Irish Lake
Flesherton
Badjeros
Elmwood
Rocky Saugeen
Honeywood
Priceville
Proton Station
Durham
Dundalk
Hanover
Horning's Mills
Corbetton
Varney
Violet
Neustadt
Orchardville
Shelburne
Maple Lane
Ayton
Keldon
Mildmay
Alsfeldt
Mt Forest
Luther Marsh Wildlife
Monck
Google


Old Durham Rd
Catherine St
Jackson St N
Colborne St N
LCBO
Walker's Landing Pub And Eatery
Old Joe's Cabin
Brown's Guardian Pharmacy
Tim Hortons
Elm St N
Elm St S
William St
George St
Walker St
Price-Schonstrom Inc / Arlat Technology
Orange St


SAUGEEN. RIVE
NO SWIMMING
STRONG CURRENT


SAUGEEN. RIVER
NO SWIMMING
STRONG CURRENT

East Beam Joint

West Beam Joint

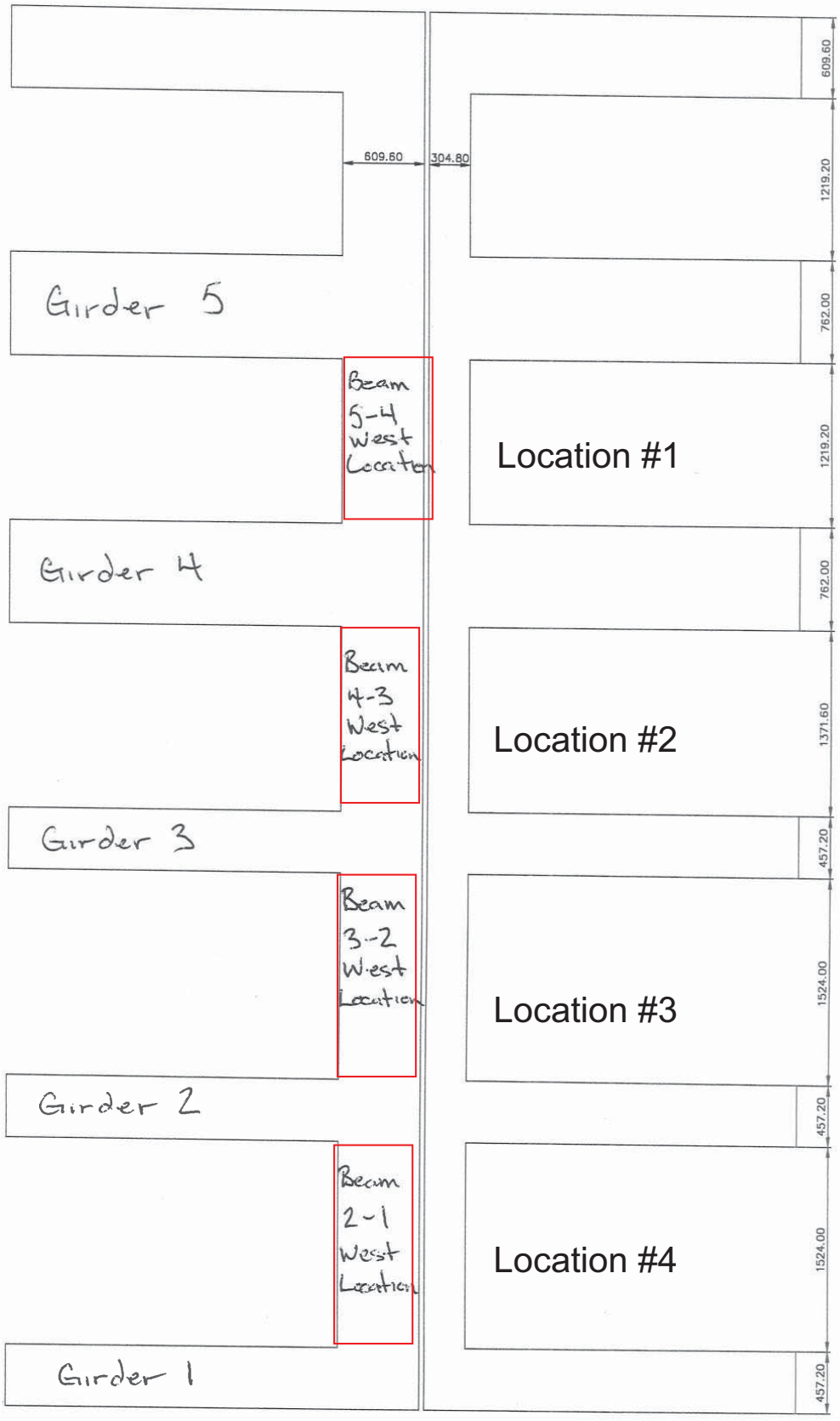
Canadian Cutting and Coring (Toronto) Ltd.
77 Ward Road
Brampton Ontario L6S 6A8
Tel: (905) 624-1414

Site Reference Drawings

East and West Beam
Survey Locations

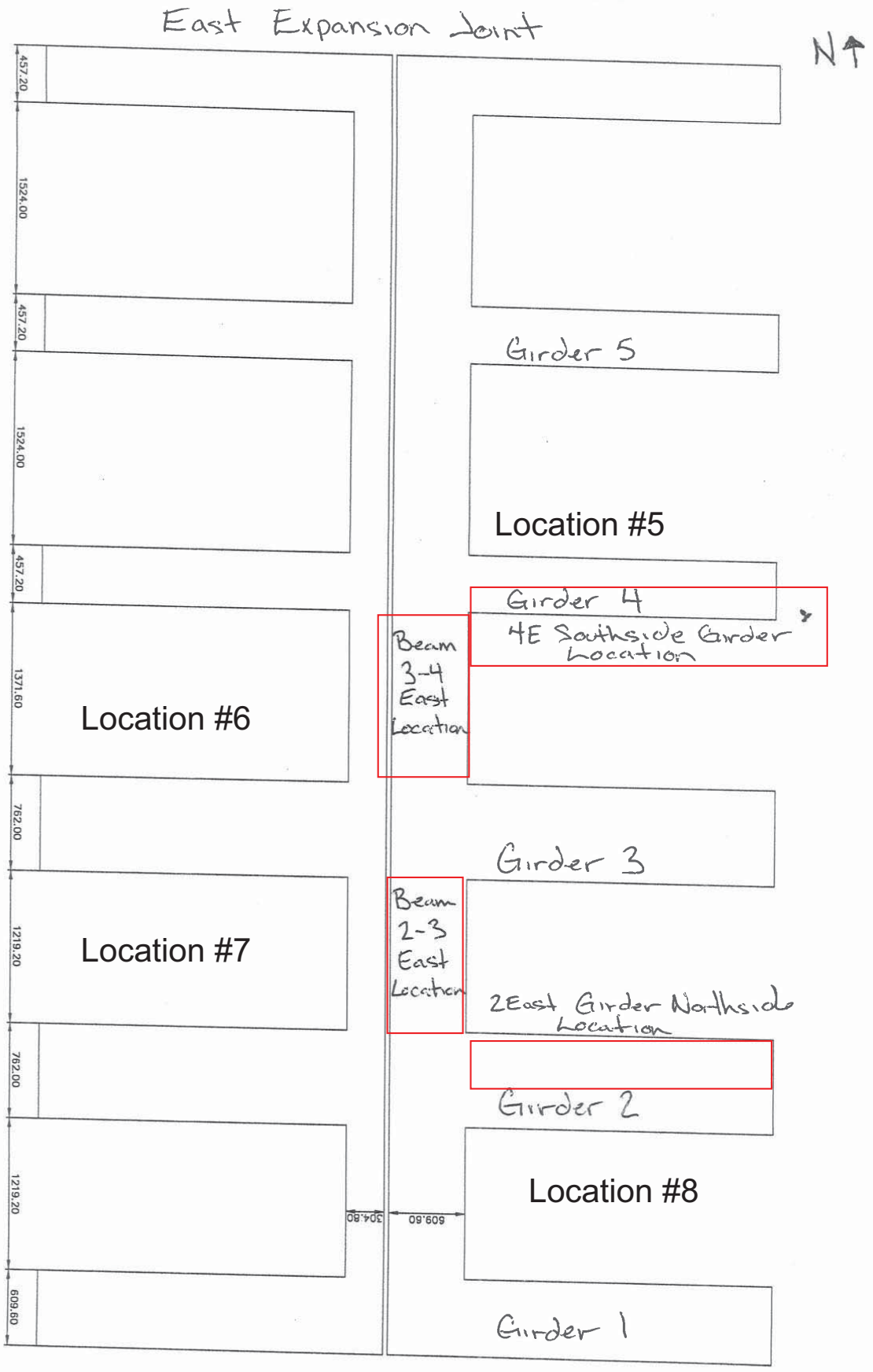
West Expansion Joint

N



BR545A

COUNTY OF BRUCE – WALKERTON BRIDGE


East Expansion Joint
N
457.20
1524.00
457.20
1524.00
457.20
1371.60
762.00
1219.20
762.00
1219.20
609.60
304.80
609.60
Location #6
Location #7
Location #5
Location #8
Girder 5
Girder 4
4E Southside Girder Location
Beam 3-4 East Location
Girder 3
Beam 2-3 East Location
2East Girder Northside Location
Girder 2
Girder 1

Canadian Cutting and Coring (Toronto) Ltd.
77 Ward Road
Brampton Ontario L6S 6A8
Tel: (905) 624-1414

Results and Interpretation

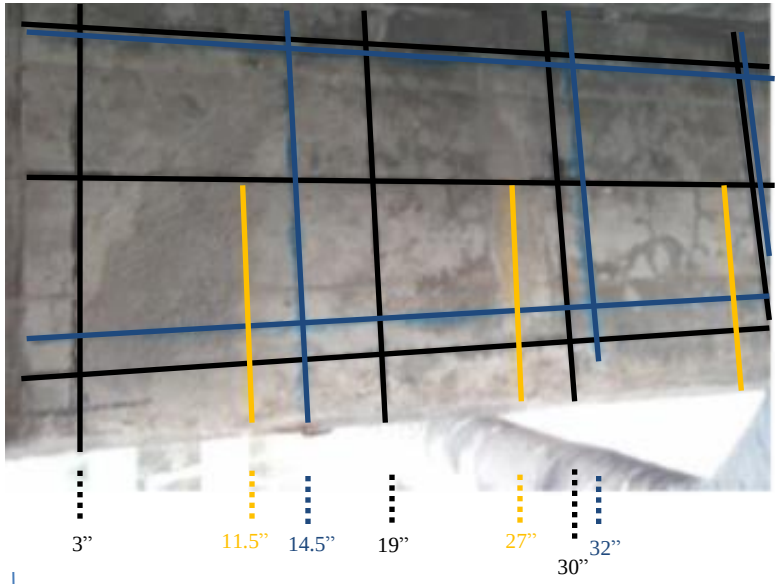
CORE SCAN

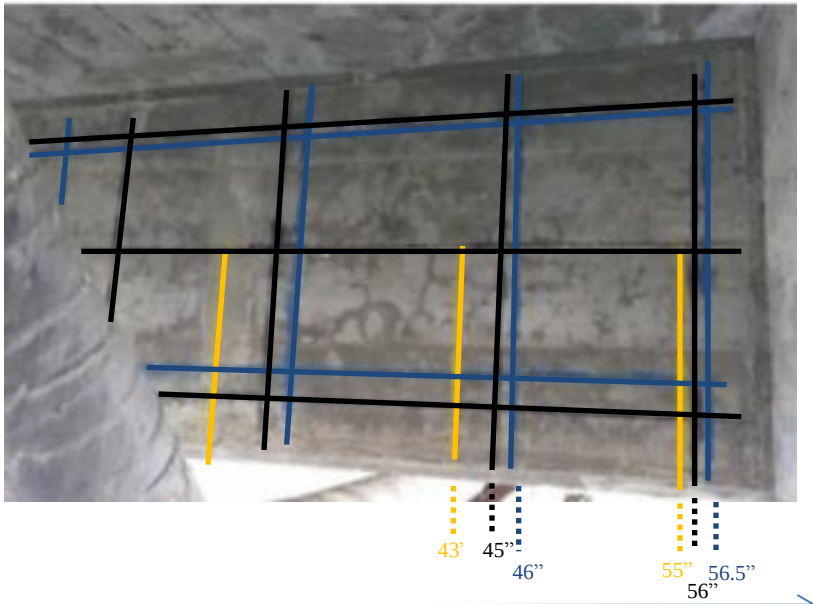
Location #1
5-4 West Beam

North

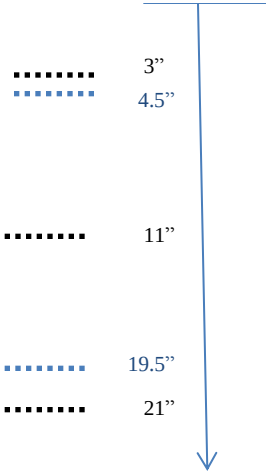
South

Depth of Cover Range
Vertical Black Lines 2” to 4”
Vertical Yellow Lines 1” to 2”
Vertical Blue Lines 10” to 11”
Horizontal Black Lines 3” to 4”
Horizontal Blue Lines 10” to 11”





Measured from Underside of Bridge Deck



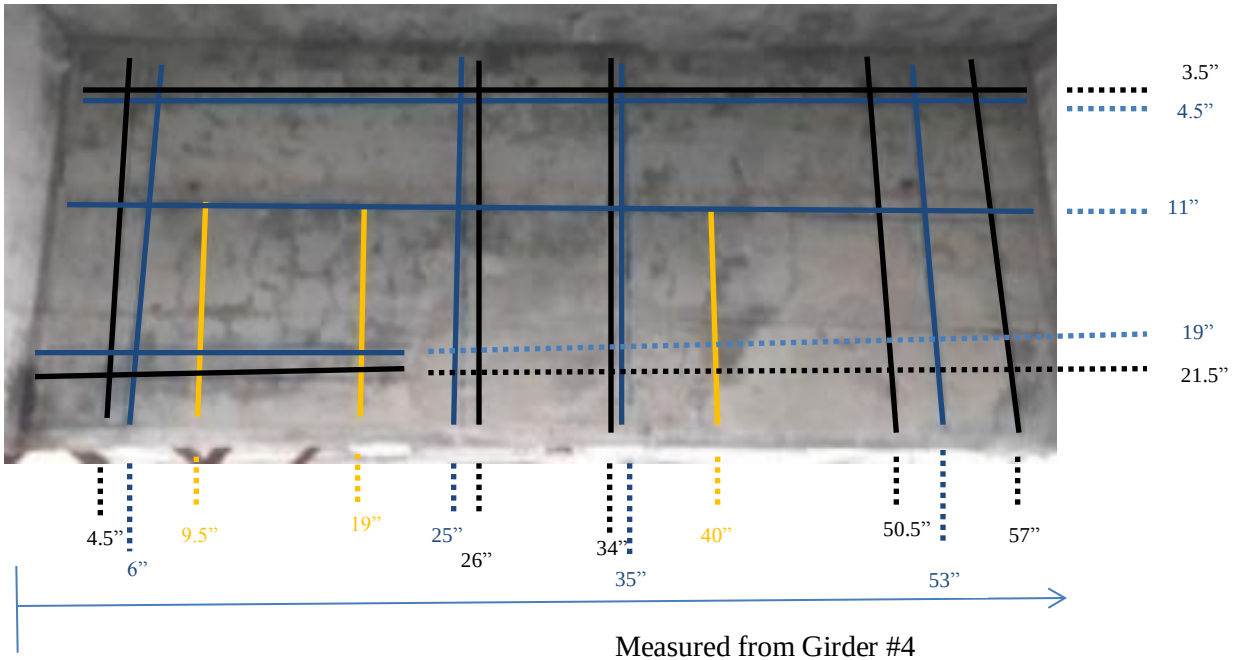
Measured from Girder #5

Location #2
4-3 West Beam

North **South**

Depth of Cover Range

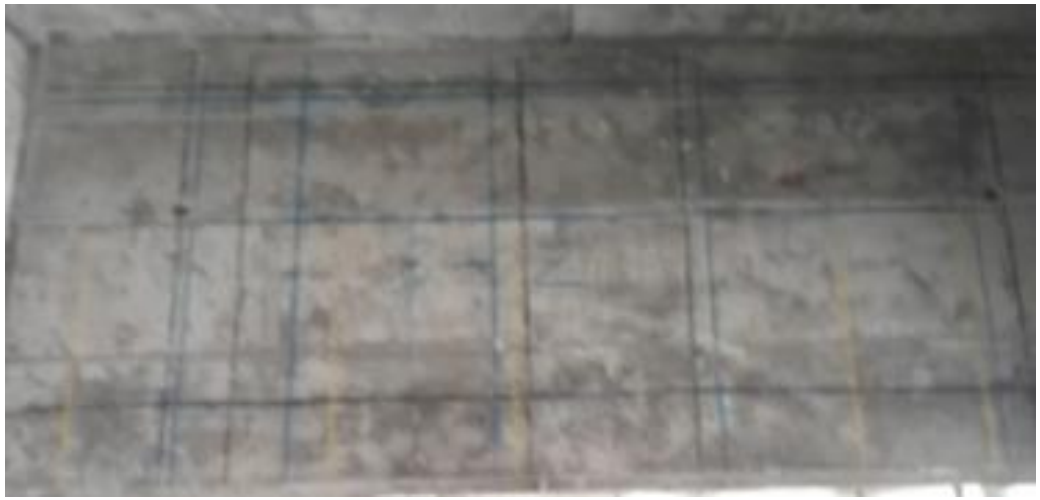
Vertical Black Lines	1” to 2”
Vertical Yellow Lines	2” to 3”
Vertical Blue Lines	10” to 12”
Horizontal Black Lines	2” to 3”
Horizontal Blue Lines	4” to 10”



CORE SCAN

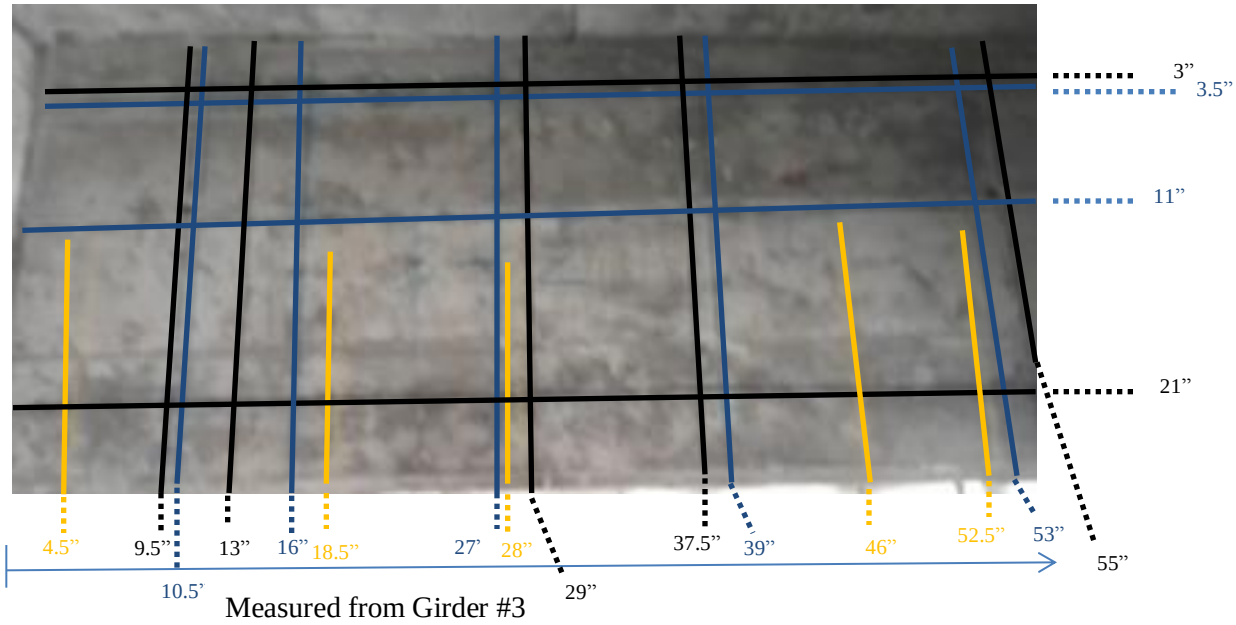
Location #3
3-2 West Beam

North **South**



Depth of Cover Range

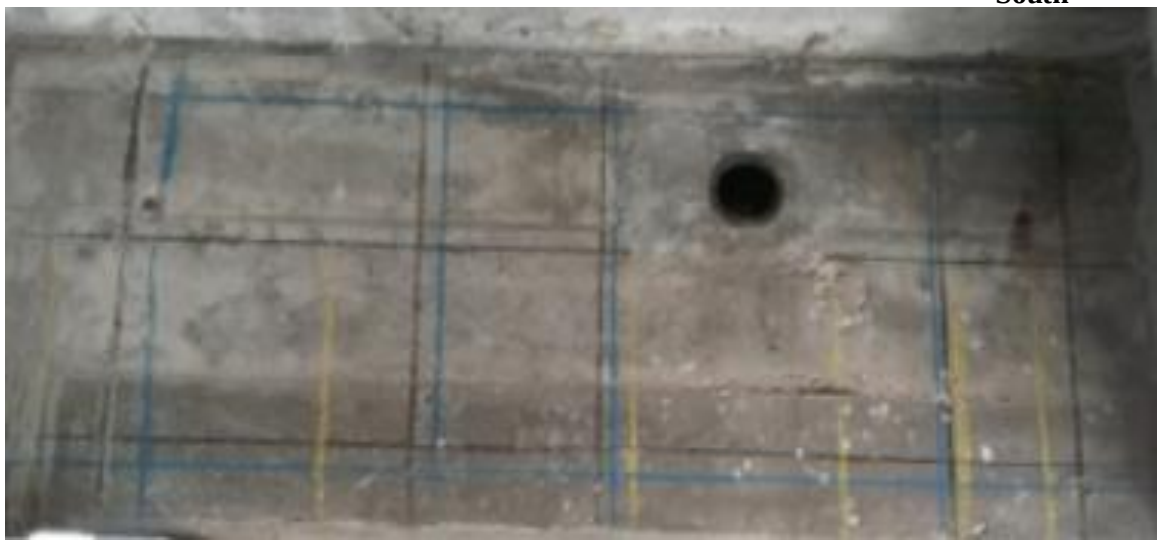
Vertical Black Lines	1” to 2”
Vertical Yellow Lines	2” to 3”
Vertical Blue Lines	10” to 11”
Horizontal Black Lines	2” to 3” (Top)
Horizontal Black Lines	5” (Bottom)
Horizontal Blue Lines	6” to 9”

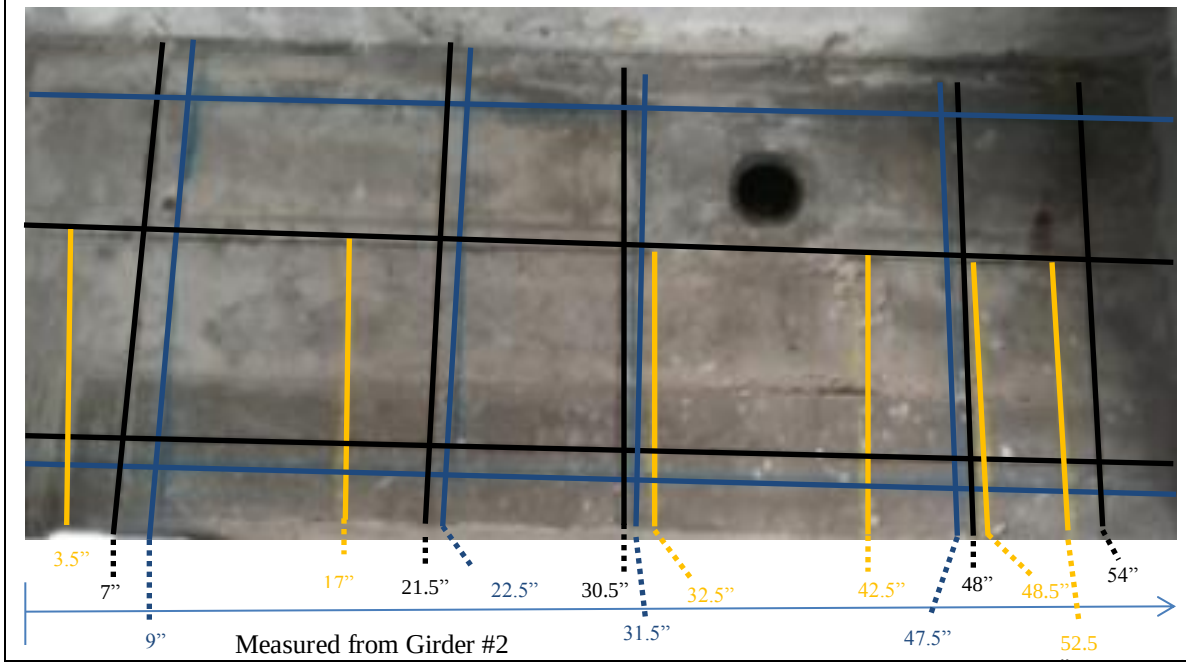


CORE SCAN

Location #4
2-1 West Beam

North **South**





Depth of Cover Range

Vertical Black Lines	1” to 2”
Vertical Yellow Lines	1” to 2.5”
Vertical Blue Lines	10” to 11”
Horizontal Black Lines	3” to 4”
Horizontal Blue Lines	10” to 11”

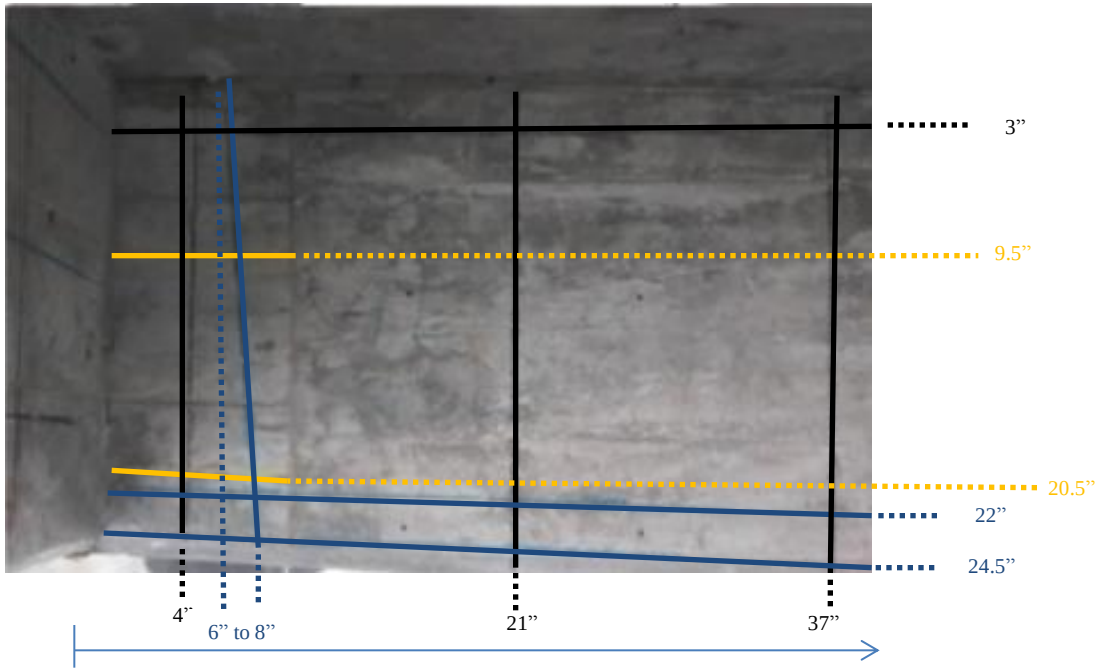
Measured from Underside of Bridge Deck

Note: No Spacing information for horizontal objects was taken at the time of the survey.

CORE SCAN

Location #5
Girder 4 East South Side

East **West**



Depth of Cover Range

Vertical Black Lines	1” to 2”
Vertical Blue Lines	4” to 5”
Horizontal Black Lines	1” to 2”
Horizontal Blue Lines	10” to 12”
Horizontal Yellow Lines	2.5” to 5”

Measured from Underside of Bridge Deck

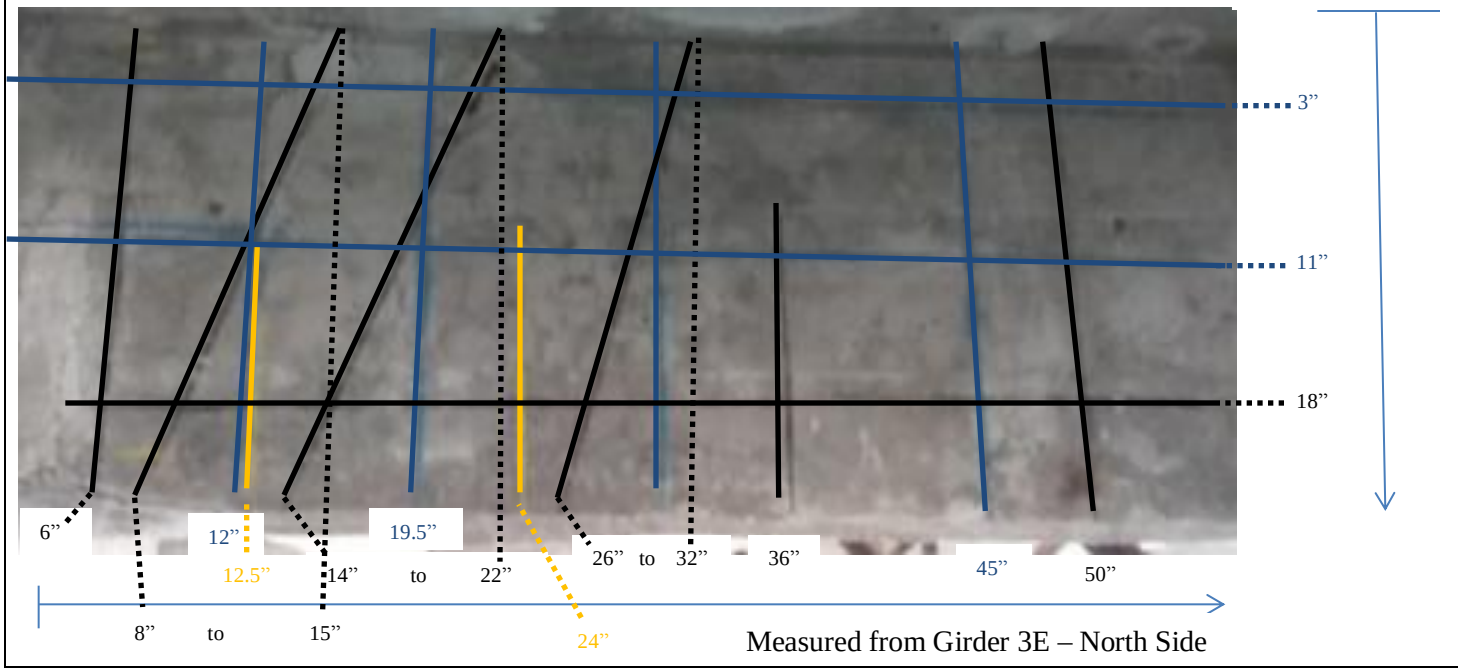
CORE SCAN

Location #6
3-4 East Beam

South **North**

Depth of Cover Range

Vertical Black Lines	1” to 2”
Vertical Blue Lines	9” to 11”
Vertical Yellow Lines	2” to 3”
Horizontal Black Lines	3” to 4”
Horizontal Blue Lines	6” to 7”



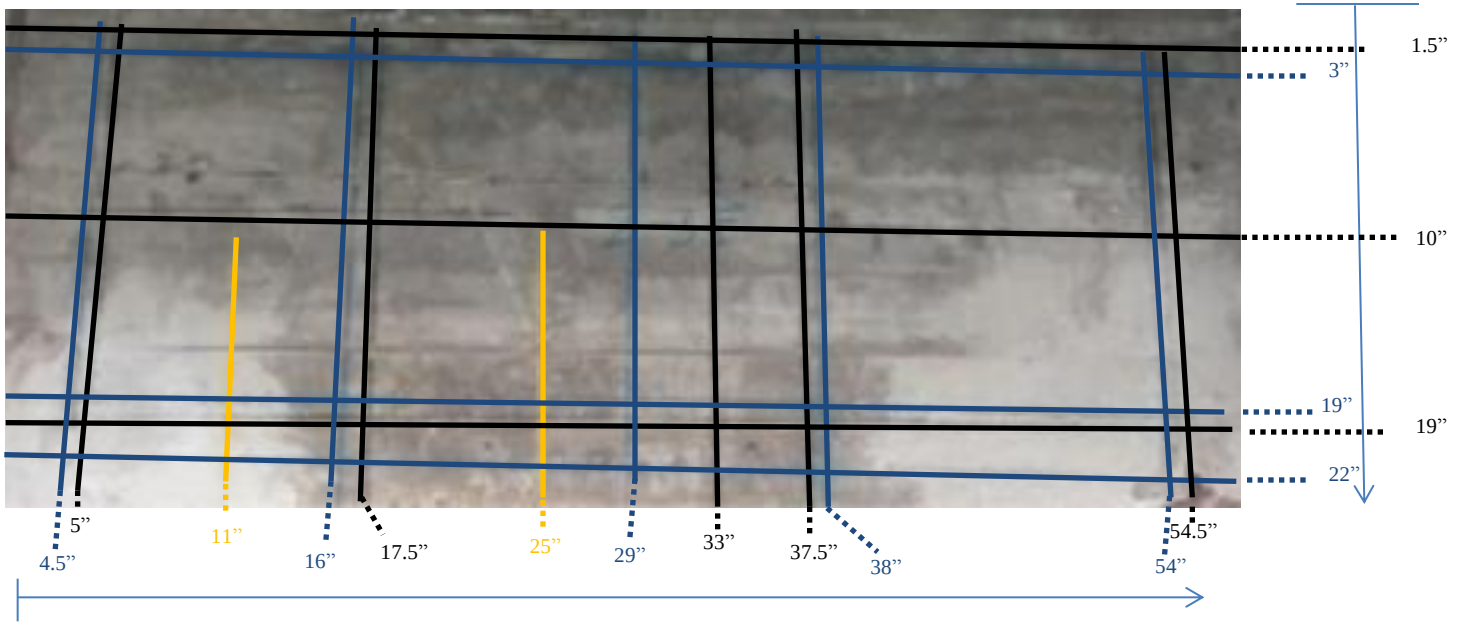
CORE SCAN

Location #7
2-3 East Beam

South **North**

Depth of Cover Range

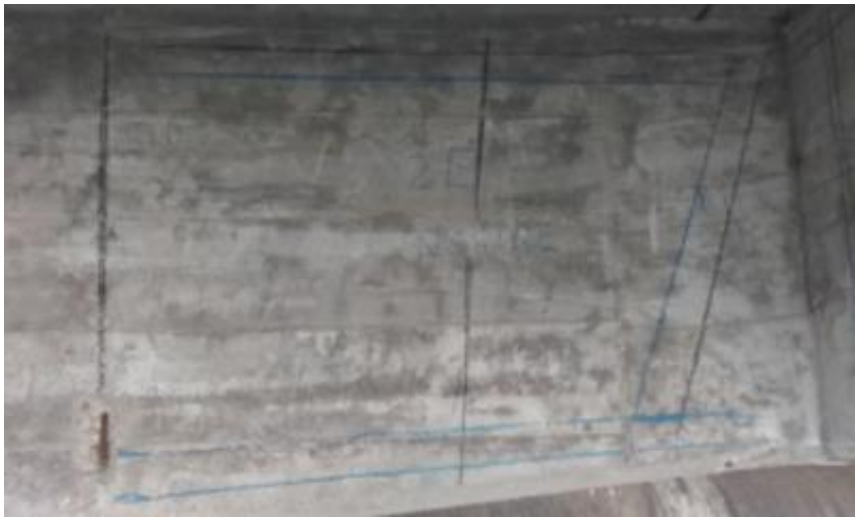
Vertical Black Lines	0.5” to 1.5”
Vertical Blue Lines	10” to 11.5”
Vertical Yellow Lines	1” to 2”
Horizontal Black Lines	3” to 4”
Horizontal Blue Lines	8” to 11”



CORE SCAN

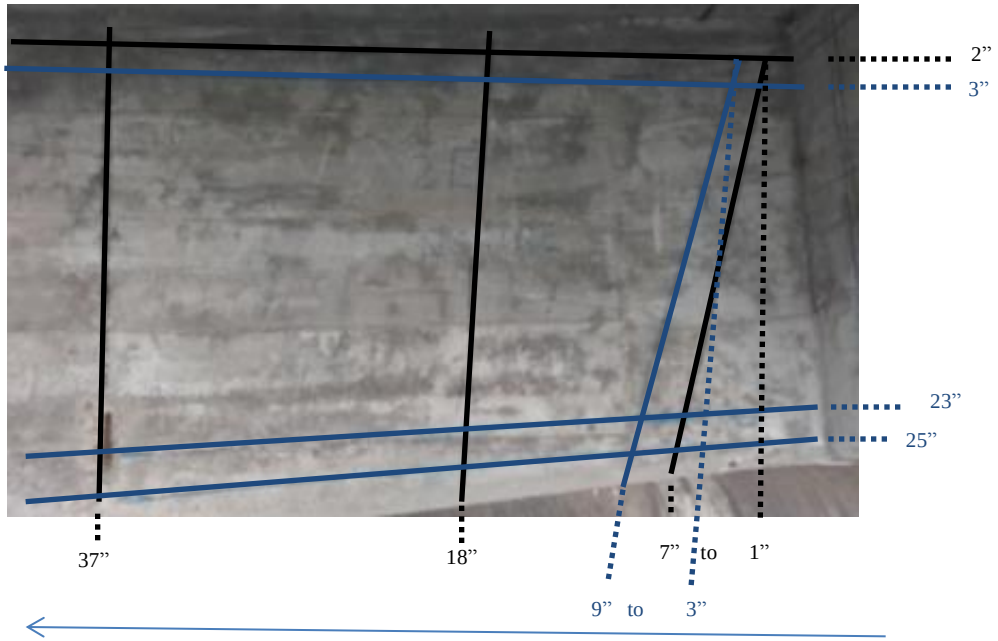
Location #8
2 East Girder Northside

East **West**



Depth of Cover Range

Vertical Black Lines	0.5” to 1”
Vertical Blue Lines	7” to 8”
Could not determine depth of features observed at top of Girder.	
Horizontal Blue Lines	6” to 7” (at bottom of Girder only)



Measured from Underside of Bridge Deck

Measured from 2-3 East Beam

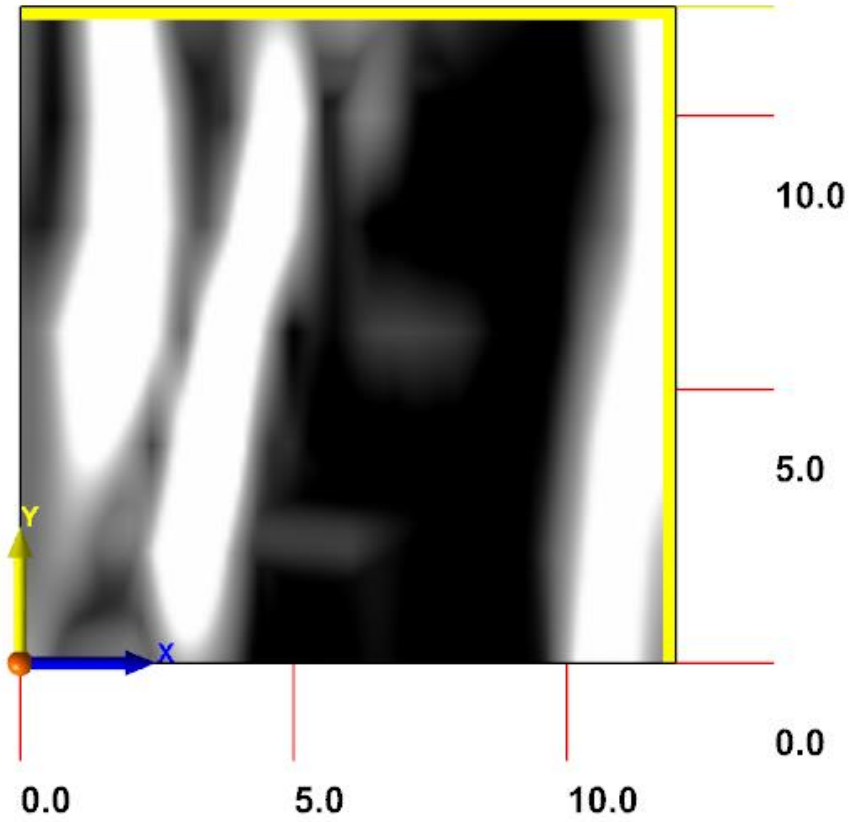
Canadian Cutting and Coring (Toronto) Ltd.
77 Ward Road
Brampton Ontario L6S 6A8
Tel: (905) 624-1414

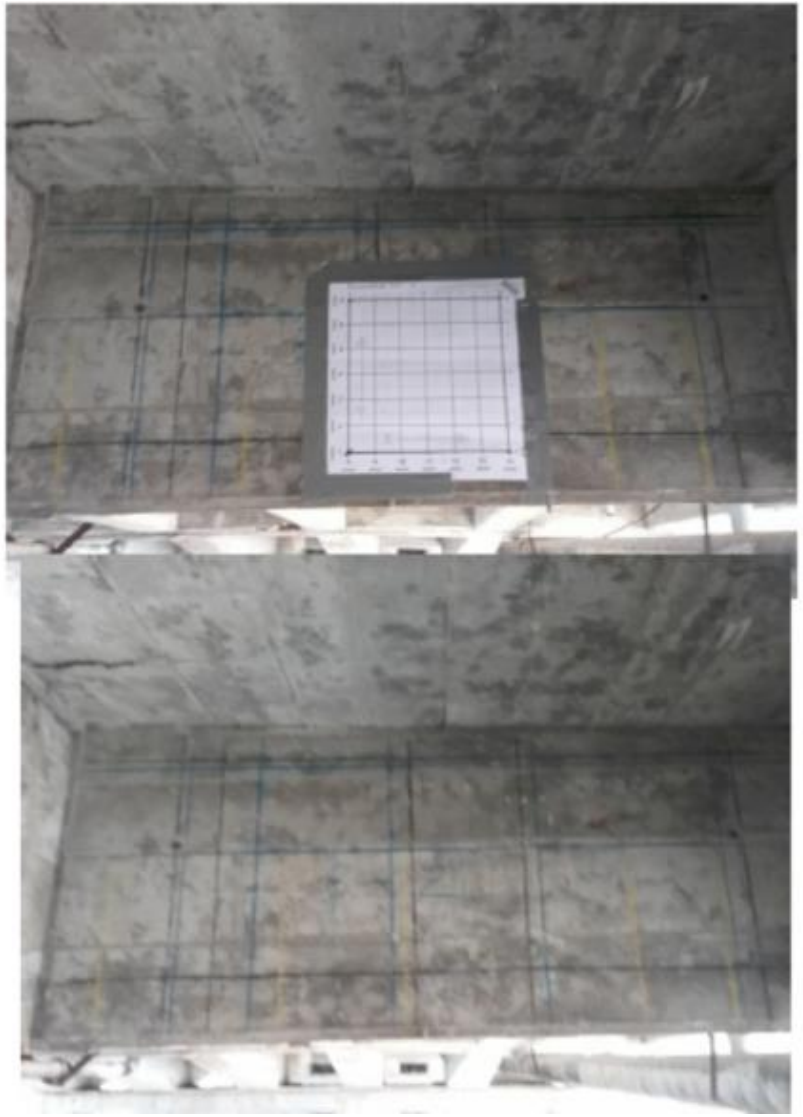
GPR Processed Data

Data Acquisition Quality Assurance

CORE SCAN

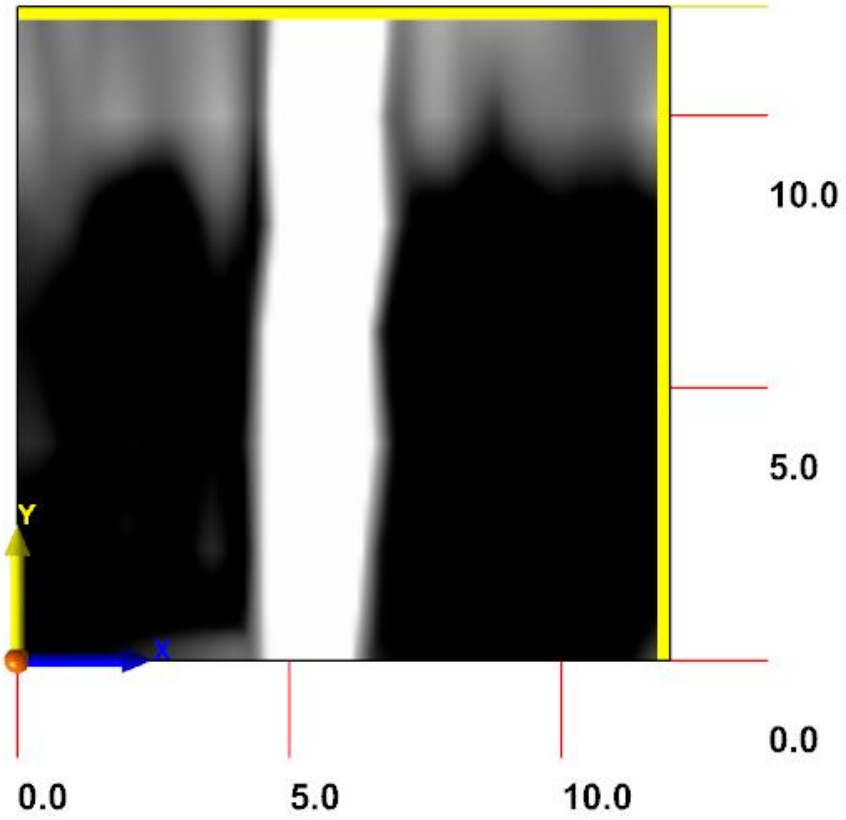
Location #3
3-2 West Beam



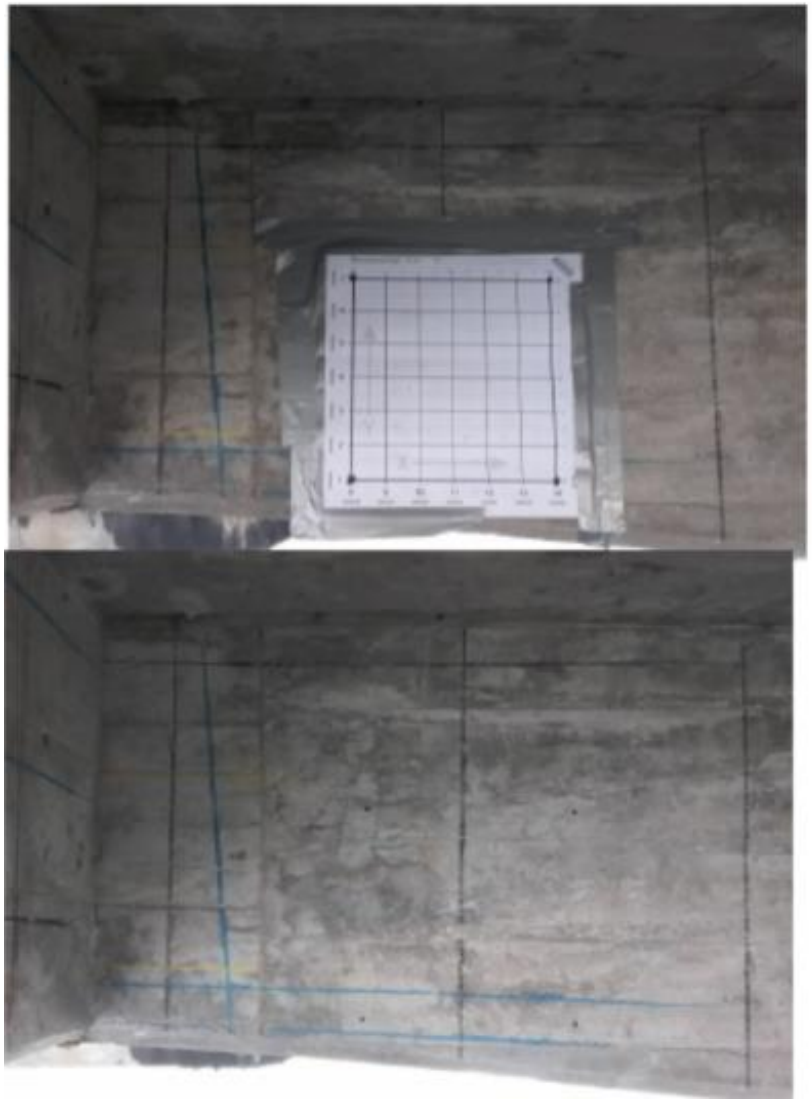


in/in

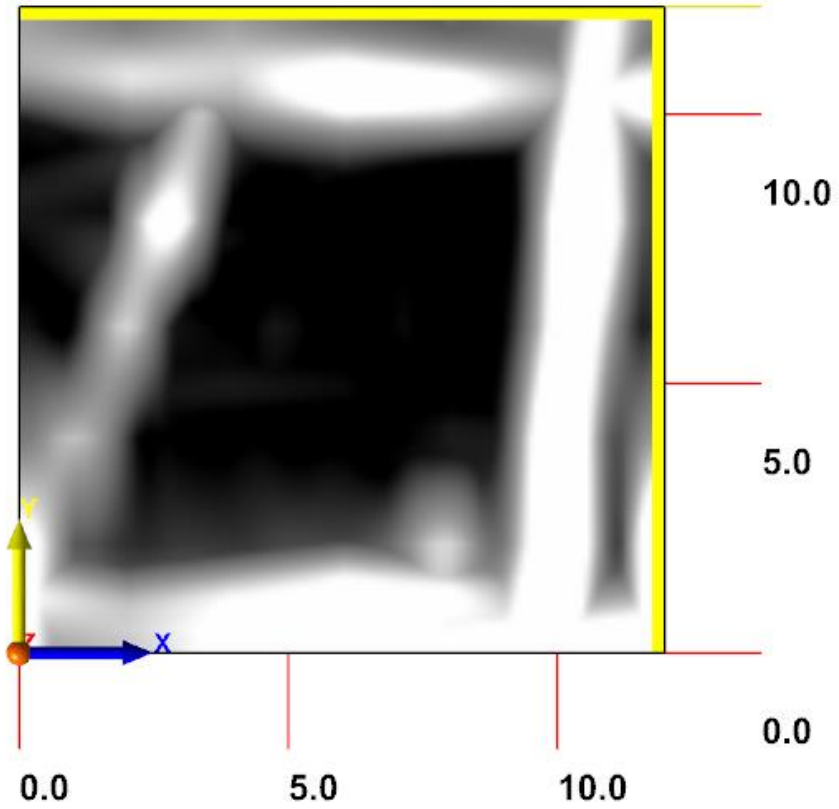
Location #5
Girder 4 East South Side



in/in



Location #7
2-3 East Beam



in/in

Canadian Cutting and Coring (Toronto) Ltd.
77 Ward Road
Brampton Ontario L6S 6A8
Tel: (905) 624-1414

Field Report

Canadian Cutting and Coring (Toronto) Limited
77 Ward Rd., Brampton, ON L6S 6A8
Phone: 905-624-1414
www.cancut.ca

CORE SCAN

Concrete Scanning & Private Utility Locating

W/O# 51081

Truck# 83

PO# BR545A

Company Name: B.M. Ross And Associates Limited Company Contact: Andy

Job Location: Durham St Bridge - Walkerton Ontario

Reason for Survey: GPR Survey to locate inferred depth and spacing of rebar.

Description of Work Area: Centre sections of Bridge in Expasion Joint Locations. Photographs Taken: ☑

Marking Method: Paint ☐ Marker / Crayon ☑ Stakes / Flags ☐ Colour: Black, Blue and Yellow Other: ☐

Limitations of Survey: Obstruction/ Limited Space ☑ Undetectable Utilities ☐ Congestion ☑ EM Distortion ☐ Signal Penetration ☑ Access to Utilities ☐ Other: ☐

Recommendations: X-Ray ☐ Hand Dig ☐ Remove/De-Energise Utilities ☐ **NO WORK** ☐ **POST SCAN MEETING** ☐ Other: ☐

NOTE:
- **CONCRETE SCANNING: To avoid damage stay clear by a minimum of _____ measured horizontally on either side of field markings.**
- **PRIVATE LOCATES: To avoid damage Hand Dig by a minimum of 1m (3.28 ft) measured horizontally on either side of field markings.**
- **PUBLIC UTILITIES: Must be marked / cleared by others prior to this survey.**

LEGEND

Limits of Work Area	
Bore Hole / Drill Location	

SURVEY INTERPRETATION

Electrical	– E –
Water Line	– W –
Sewer	– S –
Gas	– G –
Telecom	– T –
CATV	– TV–
Conduit	– C–
Rebar	– R –
Unknown Utility	– ? –
GPR Anomaly	– GPR –
Hand Dig/ No Cut Zone	

SITE FEATURES

Light Standard	LS
Transformer	
Pedestal	
Valve	
Hydrant	
Manhole	MH
Catch Basin	CB
Column	C
Clean Out	CO
Fence Line	– FL –
Curb Line	– CL –
Wall Line	

Survey Results & Sketch (not to scale)

North

High frequency Ground Penetrating Radar survey of a concrete bridge structure to locate approximate inferred spacing and depth of embedded rebar.
Areas of concentration for survey were along the 2 expansion joints throughout the centre portion of the bridge. The joints run north/south. GPR surveyed beams that joints run through that are also north/south and girder locations that run east/west.
Collected as much data as possible within work window.
Please note that radar unable to accurately detect placement and depth of objects within 4"-6" of any vertical surface.
Line data collected as well as 3D grids. All locations surveyed mapped with crayon on beams and/or girders.
Line data and 3D data saved. Pictures taken of all locations and attached.

For Post Scan Meeting and/ or Clarification of this Report contact the Technician at: _____

CORE DRILL REPORT **Date** 04-24-2019 **Technician** Colin Forbes **Assistant**

NO. OF HOLES	DIA	WALL	FLOOR	DEPTH	MATERIAL				
						Login:	7:45am	Login:	
						OnJob:	9:00am	OnJob:	
						OffJob:	6:15pm	OffJob:	
						LogOut:	7:30pm	LogOut:	
						Radar Time Allotment:			hrs
						Core Drill Time Allotment:			hrs

Any subsequent damage to any utilities based on this survey please call 905-624-1414 immediately.

Accepted By (print): Andy **Signature:** AR

Customer Acknowledgement: I have read and understood the Corescan Terms & Conditions and I hereby accept these conditions as stated on the reverse of this report.

WHITE COPY – CUSTOMER CANARY COPY – FILE/INVOICING GREEN COPY – PAYROLL

COMMERCIAL GENERAL LIABILITY FORM
CORESCAN DISCLAIMER - TERMS AND CONDITIONS

The Service

The Corescan service employs electromagnetic (EM) equipment and technologies for the purpose of locating embedded or subsurface objects for our client or client' representative (Client). This service is provided as a guide and no guarantee is made or implied that it represents anything other than the inferred interpretation of acquired data in an attempt to locate anomalies/ features as requested by the Client.

Canadian Cutting and Coring (Toronto) Limited (The Company), Corescan, affiliated companies and their employees are not liable for any damages that result in the disturbance of any buried or embedded service(s) or objects(s) based on the information provided by this service. Every attempt is made to ensure the accuracy of this service; however, there are limitations that can inherently affect the results of the survey. Therefore it is The Company' responsibility to inform our Client that these results may be rendered inconclusive or inaccurate due to these limitations and not due to The Company' negligence.

Service Limitations - GPR

The Corescan service includes the use of Ground Penetrating Radar (GPR) which emits high frequency EM radio emissions that are used to interpret and observe features of survey materials either embedded or in the subsurface. Due to the required interpretation, physical properties, operating aspects and multiple conditions outside of our control the results from using this technology may be inconclusive by the following factors (but not limited to):

Moisture Content/ Conductivity – water and a survey material with high conductivity (clay, new concrete that hasn't fully hydrated or cured etc…) attenuate GPR signals and may limit signal penetration less than the target depth.

Restricted Survey Space - GPR requires adequate survey space to acquire and interpret data, surface obstructions such as walls, pipes etc…. will limit the ability of GPR to locate embedded/target objects.

Masking - metal filings, rebar, metal lathe, steel wire mesh, anvil topping etc… may interfere, block and/ or reflect GPR signals away from the target object(s).

Survey Surface - surface must be flat & smooth to allow GPR to couple to the surface and observe subsurface or embedded objects.

Data Resolution - objects spaced closely together or within the top 2.5" of the surface may not be individually resolved and/ or may appear as one object (i.e. PVC conduit tied to rebar).

Congestion - multiple subsurface or embedded objects spaced closely together may not be isolated/ located and objects below this layer may not be located.

Target Composition - target objects with a low contrasting dielectric constant such as PVC conduit may not be detected or masked by higher dielectric objects such as rebar/ wire mesh.

Target Geometry/ Orientation - embedded/ subsurface objects that vary in orientation/ direction may not be located (coreflex/ PVC conduit etc…).

Service Limitations – EM Utility Locator

The Corescan service includes the use of an EM Utility Locator to locate EM fields that concentrically surround an embedded or buried conductor that can be measured. Due to the required interpretation, physical properties, operating aspects and multiple conditions outside of our control, the results from using this technology may be inconclusive by the following factors (but not limited to):

Distortion/ Signal Cancellation - multiple EM fields/ conductors within the work area may distort the target field and result in an inaccurate locate and/or cancellation of the target EM field.

Composition - nonconductive utilities cannot be located unless access to the inside of the pipe/ drain is provided for transmitting sondes.

Restricted Survey Space - the measurement of EM fields requires adequate space to determine the inferred location, distortion and accuracy of the field measurement.

Metal Objects - induction properties of metallic materials may cause distortion or interfere with the target EM field.

Detectable Services - conductors that are not under load and do not have significant current running through it may not be located.

DIRECT ACCESS TO ALL UTILITIES THAT ARE LOCATED WITHIN THE SURVEY AREA MUST BE PROVIDED BY THE CLIENT (ELECTRICAL/ UTILITY ROOMS ETC…).

Electrical Interference – all electrical devises, transformers, surface mounted conductors etc… could interfere with the ability to adequately locate the target field.

Intermitted Power - conductors that require intermitted power supply such as pumps, locks, electric motors, backup power etc… may not be detected at the time of the service.

Documentation - All available site drawings, pictures and documentation on the location of all utilities (public & private) within the work area must be provided prior to the start of the survey.

ALL PUBLICLY OWNED UTILITIES MUST BE LOCATED/ CLEARED BY OTHERS PRIOR TO THIS SERVICE.

Expiry

The results of the Corescan service will not be valid/ expire based on the following:

- 30 days has passed from the day the service was provided.
- Any site markings have been removed or worn down.
- The stakeout/ field report has been lost or removed from the job site.
- The intended scope of work has changed since the completion of this service.

Indemnification

Based on the information provided by this service the Client must hereby indemnify and holds harmless the Company against any and all claims, demands, actions, suits, losses, associated costs, charges, expenses, damages and liabilities whatsoever.

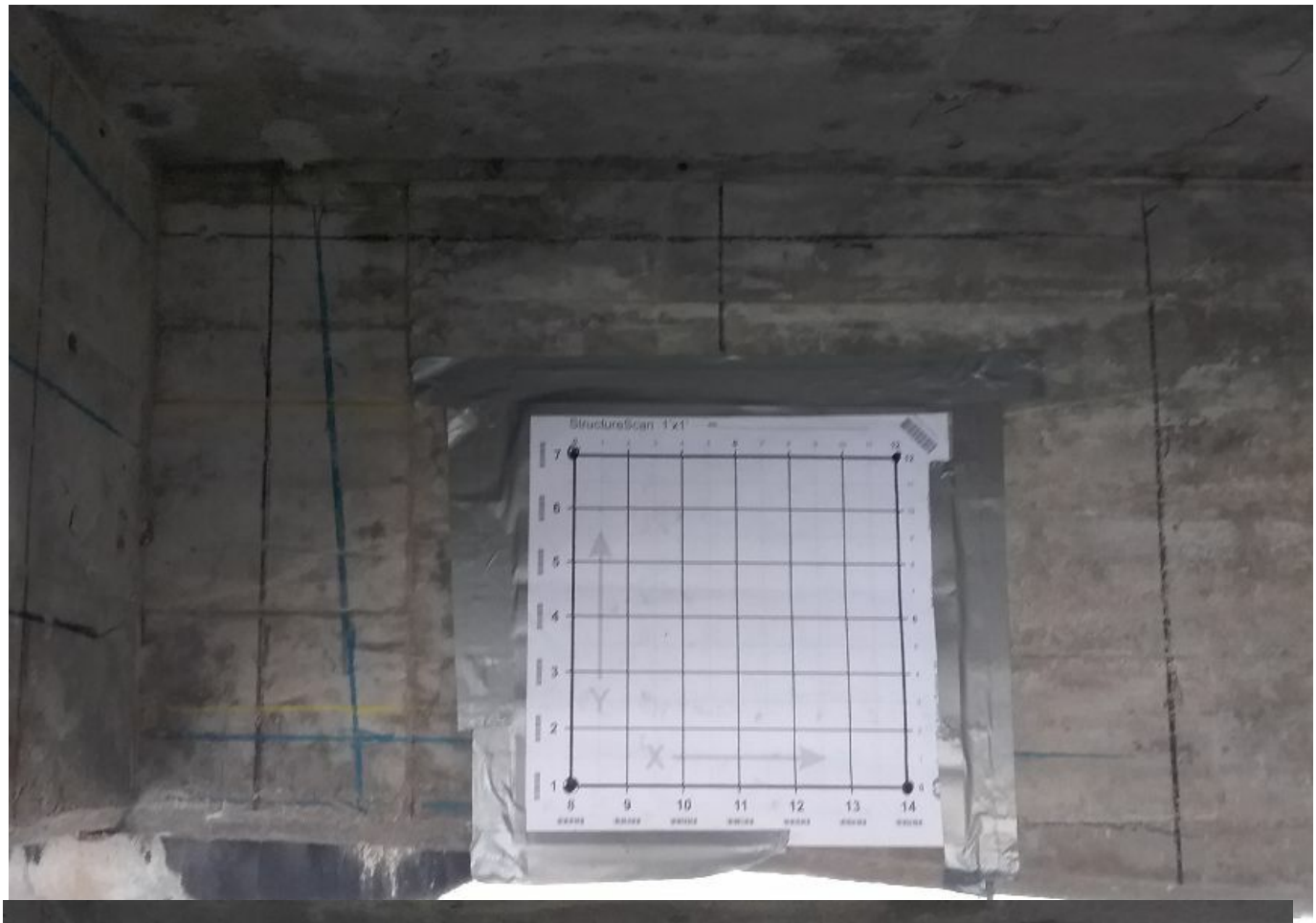
Subrogation

The Client/ clients' representative hereby waive their right to subrogate against The Company with respect to the work order number for this survey for "bodily injury", "property damage", "personal and advertising injury" and "business interruption and/ or any financial losses" for which a claim has been paid under this form & service. Except as otherwise provided in this waiver of subrogation statement, all terms, provisions and conditions of the Commercial General Liability Form shall have full force and effect.

It is understood and agreed upon that The Company, affiliated companies and/ or any employee will not be held liable for any damage to property and / or personal injury / death associated with this service. This service is not valid without the consent of the Client/ Client's representative prior to the commencement of the survey.

Date: 04-24-2019

Initials: 


Structurescan 1'x1'
7
6
5
4
3
2
1
Y
X
8
9
10
11
12
13
14


2-3E

Rebar marked on beams and girders with black, blue and yellow crayon.
Black markings are objects that appear closest to face of areas scanned.
Blue markings are objects that appear deeper in areas scanned.
Yellow markings are those that appear to be stirrup type reinforcing.
Please note that in this application radar unable to detect objects deeper than approximately 10"-12".
Please also note that locations and depths of rebar are approximate only and that rebar that appears at 1"-2" depth may in fact has less coverage.

Location 1:
West Beam location 5-4.
Line data file 1&2.
Depth:
Vertical black markings = 2"-4" depth approximately.
Vertical yellow markings = 1"-2" depth approximately.
Vertical blue markings = 10"-11" depth approximately.
Horizontal black markings = 3"-4" depth approximately.
Horizontal blue markings = 10"-11" depth approximately.
Spacing:
Horizontal's measured from underside of deck down.
Black markings = 3", 11" & 21" approximately.
Blue markings = 4.5" & 19.5" approximately.
Vertical's measured from girder 5-4.
Black markings = 3",19",30",45" h 56" approximately.
Blue markings = 14.5",32",46" & 56.5" approximately.
Yellow markings = 11.5",27",43" & 55" approximately.

Location 2:
West Beam location 4-3.
Line Data file 3&4.
Depth:
Vertical black markings = 1"-2" depth approximately.
Vertical blue markings = 10"-12" depth approximately.
Vertical yellow markings = 2"-3" depth approximately.
Horizontal black markings = 2"-3" depth approximately.
Horizontal blue markings = 4"-10" depth approximately.

Spacing:
Horizontal's measured from underside of deck down.
Black markings = 3.5" & 21.5"
Blue markings = 4.5", 11", 19"
Vertical's measured from girder 4-3.
Black markings = 4.5",26"-34",50.5" & 57"
Blue markings = 6", 25",35" & 53"
Yellow markings = 9.5",19",29" & 40"

Location 3:
West Beam location 3-2.
Line Data file 5.
3D Grid 1
Depth:
Horizontal black markings = top marking 2"-3" & bottom marking 5" approximately.
Horizontal blue markings = 6"-9" approximately.
Vertical black markings = 1"-2" depth approximately.
Vertical blue markings = 10"-11" depth approximately.
Vertical yellow markings = 2"-3" approximately.
Spacing:
Horizontal's measured from underside of deck down.
Black markings = 3" & 21" approximately.
Blue markings = 3.5" & 11" approximately.
Vertical's measured from girder 3-2.
Black markings = 9.5",13",29",37.5" & 55" approximately.
Blue markings = 10.5",16",27",39" & 53" approximately.
Yellow markings = 4.5",18.5",28",46" & 52.5" approximately.

Location 4:
West Beam location 2-1.
Line Data file 6 & 7.
Depth:
Horizontal black markings = 3"-4" depth approximately.
Horizontal blue markings = 10"-1" depth approximately.

Vertical black markings = 1"-2" depth approximately.
Vertical blue markings = 10"-11" depth approximately.
Vertical yellow markings = 1"-2.5" depth approximately.
Spacing:
Measured from girder 2-1.
Vertical black markings = 7",21.5",30.5",48" & 54" approximately.
Vertical blue markings = 9",22.5",31.5" & 47.5" approximately.
Vertical yellow markings = 3.5",17",32.5",42.5",48.5" & 52.5" approximately.

Location 5:
Girder 4 East South Side.
Line Data file 8.
3D Grid 2.
Depth:
Vertical black markings = 1"-2" depth approximately.
Vertical blue markings = 4"-5" depth approximately.
Horizontal black markings = 1"-2" depth approximately.
Horizontal blue markings = 10"-12" depth approximately.
Horizontal yellow markings = 2.5"-5" depth approximately.
Spacing:
Measured from beam to east.
Vertical black markings = 4",21" & 37" approximately.
Vertical blue marking moves from 6" to 8" away from beam approximately.
Horizontal's measured from underside of deck down.
Horizontal black marking = 3"-7.5" approximately on angle.
Horizontal blue markings = 22" & 24.5" approximately.
Horizontal yellow markings = 9.5" & 20.5" approximately.

Location 6:
Beam 3-4 East.
Line Data file's 9 & 10.
Depth:
Vertical black markings = 1"-2" depth approximately.
Vertical blue markings = 9"-11" depth approximately.
Vertical yellow markings = 2"-3" depth approximately.

Horizontal black markings = 3"-4" depth approximately.
Horizontal blue markings = 6"-7" depth approximately.

Spacing:
Horizontal's measured from underside of deck down.
Horizontal black marking = 18" approximately.
Horizontal blue markings = 3" & 11" approximately.
Vertical's measured from 3E N.Side - 4E S.Side.
Vertical blue markings = 12",19.5" & 45" approximately.
Vertical yellow markings = 12.5" & 24" approximately.
Vertical black markings = 6", 15"-8" angle, 22"-14" zangle, 32"-26" angle, 36" & 50" approximately.

Location 7:
East Beam location 2-3.
Line Data file 11.
3D Grid 3.
Depth:
Horizontal black markings = 3"-4" depth approximately.
Horizontal blue markings = 8"-11" depth approximately.
Vertical black markings = .5"-1.5" depth approximately.
Vertical blue markings = 10"-11.5" depth approximately.
Vertical yellow markings = 1"-2" depth approximately.
Spacing:
Measured from 2E North side - 3E South side.
Vertical black markings = 5",17.5",33",37.5" & 54.5" approximately.
Vertical blue markings = 4.5",16",29",38" & 54" approximately.
Vertical yellow markings = 11" & 25" approximately.
Depth:
Measured from underside of deck down.
Horizontal black markings = 1.5",10" & 19" approximately.
Horizontal blue markings = 3",19" & 22" approximately.

Location 8:
Girder 2 East Northside.
Line Data file 12.
Depth:
Vertical black markings =
.5"-1" depth approximately.
Vertical blue markings = 7"-8" depth approximately.
Horizontal markings just under deck cannot give approximate depth.
Horizontal blue marking at bottom of girder approximately 6"-7" depth.
Spacing:
Horizontal's measured from underside of deck down
Horizontal black markings = 2" approximately.
Horizontal blue markings = 3",23" & 25" approximately.
Vertical's measured from 2-3 east.
Vertical black markings = 1"-7" on angle & 18" & 37" approximately.
Vertical blue markings = 3"-9" on angle approximately.