APPENDIX 8

LIFE CYCLE COST ANALYSIS

R.V. Anderson Associates Limited
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TECHNICAL MEMORANDUM

TO: Arash Olia **RVA:** 195072

FROM: Sardar A Nabi/ Prakash Nadesparan

DATE: July 28, 2021

SUBJECT: Life Cycle Cost Analysis (LCCA) of the Coventry Bridge

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1.0 BACKGROUND AND PROJECT INFORMATION

The Town of Caledon retained R.V. Anderson Associates Limited (RVA) to carry out a Schedule 'B' Class Environmental Assessment and 30% Preliminary Design for the reconstruction of Columbia Way from Highway 50 to Caledon King Townline. Included in the scope of work is the 30% Design for structural culverts or bridges requiring rehabilitation or replacement. The Coventry Bridge is located along Columbia Way, approximately 0.48 km west of Caledon- King Townline (Figure 1).

The purpose of this memorandum is to present the Life Cycle Cost Analysis (LCCA) for the Coventry Bridge.

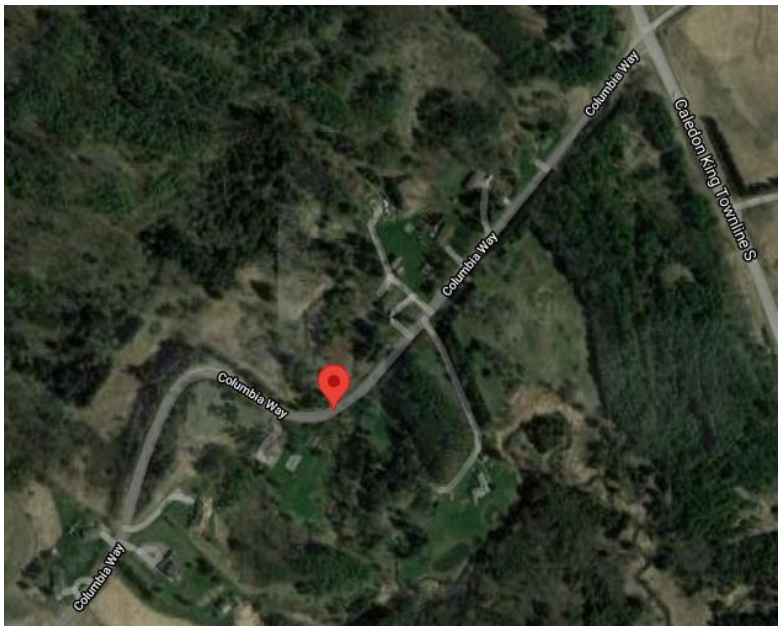

Figure 1 – Coventry Bridge

2.0 EXISTING STRUCTURE

The existing structure is a cast-in-place rigid frame bridge built in 1955, overlain with an asphalt wearing surface and carries a single lane of traffic along Columbia Way in each direction. The bridge has a single span of approximately 10.6m and is 8.6 m wide.

3.0 EXISTING CONDITION

A detailed visual condition assessment report of the bridge was prepared by RVA as a part of this project and the final version of the report was submitted to the town on September 18, 2020 (Appendix 2).

4.0 REHABILITATION ALTERNATIVES

Given the condition and the age of the existing structure and findings of the recent visual condition assessment, the following alternatives for the structural rehabilitation are considered and evaluated in order to select the preferred alternative at this site.

4.1 Alternative 1: Widening and repair of the existing bridge

Alternative 1 is to remove the existing asphalt, the waterproofing system and delaminated and deteriorated concrete from the deck. Then the deck surface will be patched. This alternative also includes repair to the abutments, wing walls, soffit and facia. The existing bridge deck will be widened to accommodate the new road profile width and a new parapet wall and railing will be constructed on both sides of the bridge to meet the height requirements for cyclists (1400 mm). The widened bridge deck will be dowelled into the exiting concrete bridge slab. A new 6 m long cast-in-place concrete approach slab will be constructed on either side of the bridge. The approach slabs and the top layer of the sidewalks will be reinforced with stainless steel to increase the service life. A new asphalt and waterproofing system will be installed. The failed connection between the southeast wing wall and the south abutment will be repaired. The northwest and southeast wing walls will be extended to retain the new grading around the bridge.

With this option, we estimate the bridge to be rehabilitated again in 20 years and to be replaced in 40 years.

Construction Cost Estimate: $ 650,000

Net Present Value: $ 905,500

4.2 Alternative 2: Replacement of the bridge

Alternative 2 is to remove the existing bridge and build a new bridge with a 21m span, at the same location. New wing walls, abutments, footings, a deep foundation will be constructed.

With this option, our estimate of the service life of the bridge will be 75 years. The new bridge will significantly affect the capital cost and schedule of the construction.

Construction Cost Estimate: $ 1,260,000

Net Present Value: $ 1,359,574

5.0 COST ESTIMATE AND PREFERED ALTERNATIVE

The capital costs (not including traffic management or project management cost) are based on a detailed capital cost estimate for alternative 1. Alternative 2 is based on recommendations in MTO parametric estimating guide and $ 5,000 per m2 is used in the calculation. The initial cost estimates for Alternative 1 and 2 are $869,965 and $1,299,574.

The capital construction cost and the Net Present Value (NPV) of the widening of existing bridge are lower than the construction of a 21m span new bridge.

The results of life cycle cost analysis for alternatives 1 and 2 are shown in Table 1 below and Figure 2. The timeline for both alternatives is shown in Figure 3.

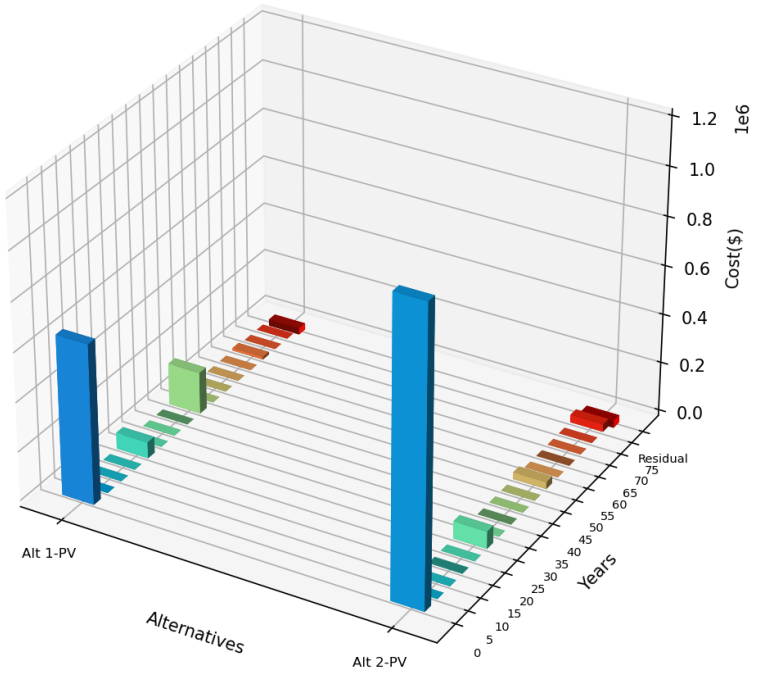

Figure 2 – LLCA-Present Value for both Alternatives

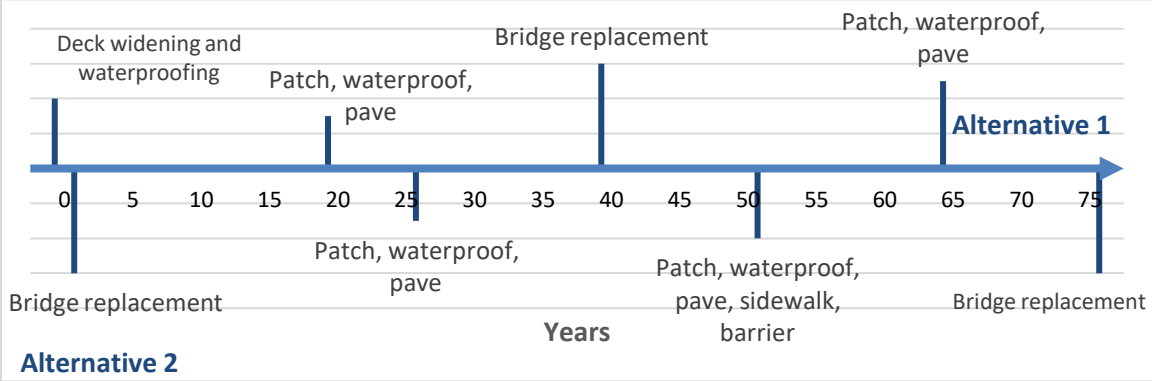

Figure 3 – Timeline of alternatives

Table 1 – LCCA summary

Year	Alternative 1		Alternative 2	
	Cost	PV	Cost	PV
0	$650,000	$650,000	$1,200,000	$1,260,000
5	$0	$0	$0	$0
10	$0	$0	$0	$0
15	$0	$0	$0	$0
20	$175,000	$65,956	$0	$0
25	$0	$0	$240,000	$70,873
30	$0	$0	$0	$0
35	$0	$0	$0	$0
40	$1,260,000	$170,455	$0	$0
45	$0	$0	$0	$0
50	$0	$0	$320,000	$27,905
55	$0	$0	$0	$0
60	$0	$0	$0	$0
65	$240,000	$10,067	$0	$0
70	$0	$0	$0	$0
75	$0	$0	$1,260,000	$30,902
Total		$905,478		$1,389,680
Residual Value		-$26,512		-$30,106
Net Present Value		**$878,488**		**$1,359,574**

Notes: The rehabilitation sequences until the end of the new bridge design life is summarized in the above table. Discount rate: 5%

As shown above, alternative 1 has a lower initial construction cost and net present value than alternative 2.

6.0 SUMMARY AND RECOMMENDATION

As highlighted in the visual condition assessment report, the Bridge Condition Index (BCI) of the Coventry Bridge falls between the BCI range of 60-70 and it is recommended to undergo structural rehabilitation within 1-5 years.

It is recommended to proceed with rehabilitation Alternative 1 because it has a lower capital cost and net present value. Hence, to extend the service life of the structure by 20 years to a time when the next cycle of rehabilitation or replacement occurs, the existing waterproofing and asphalt paving will be replaced. Also, the bridge deck width will be widened to accommodate proposed the road widening. Modifications to the wing wall will be completed to accommodate the new grade profile.

Table 2 below summarizes the comparison between the advantages of the Alternatives:

Table 2 – LCCA alternative comparison

	Alternative 1	Alternative 2
Low initial construction cost	√	X
Low life cycle cost	√	X
Ease of installation	√	X
Construction Duration	√	X
Traffic staging required	√	√

In summary we recommend adopting Alternative 1.

APPENDIX 1

Alternative 1- Cost Estimate

ITEM	ITEM CODE	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
1	0314-0190	Granular B, Type II	t	180	$30.00	$5,386
2	0510-3134	Removal of Asphalt Pavement from Concrete Surfaces	m2	200	$30.00	$6,000
3	0539-0040	Protection System	lump sum	1	$18,000.00	$18,000
4	0902-0010	Earth Excavation for Structure	m3	412	$20.00	$8,230
5	0902-0030	Dewatering Structure Excavations	lump sum	1	$-	$0
6	0904-0035	Mass Concrete	m3	0	$1,000.00	$0
7	0904-0055	Concrete in Footings	m3	0	$1,100.00	$0
8	0904-0095	Concrete in Substructure and Retaining Walls (Wingwalls)	LS/m3	64	$2,500.00	$159,500
9	0904-0105	Concrete in Deck	LS/m3	27	$3,000.00	$81,000
10	0904-0125	Concrete in Parapet Walls	LS/m3	7	$4,000.00	$29,600
11	0904-0135	Concrete in Approach Slabs	LS/m3	34	$2,000.00	$67,980
12	0905-0010	Reinforcing Steel Bar	LS/T	17	$3,500.00	$59,500
13	0905-0025	Stainless Steel Reinforcing Bar	LS/T	2	$5,000.00	$10,000
14	0905-0030	Mechanical connectors - Provisional	each	96	$50.00	$4,800
15	0908-0030	Parapet Wall Railing	m	16	$500.00	$8,000
16	0908-0030	Bridge Deck Waterproofing	LS/m2	158	$30.00	$4,752
17	0914-0031	Form and Fill Grooves	m	23	$30.00	$680
18	0914-0040	Membrane Reinforcement	m	71	$50.00	$3,531
19	0914-0050	Deck Surface Preparation	m2	158	$100.00	$15,839
20	0928-0055	Access to Work Area - Platform and Scaffolding	LS	1	$25,000.00	$25,000
21	0928-0060	Concrete Removal - Partial Depth - Type A	m3	2	$1,500.00	$3,000
22	0928-0065	Concrete Removal - Partial Depth - Type B	m3	2	$7,000.00	$14,000
23	0928-0070	Concrete Removal - Partial Depth - Type C	m3	3	$3,000.00	$9,000
24	0928-0075	Concrete Removal - Full Depth	m3	60	$1,000.00	$60,000
25	0929-0030	Abrasive Blast Cleaning of Reinforcing Steel	LS/m2	44	$200.00	$8,800
26	0930-0136	Concrete Patches, Unformed Surface	m3	2	$2,000.00	$4,000

27	0930-0146	Concrete Patches, Formed Surface	m3	3	$3,000.00	$9,000
28	0930-0151	Concrete Patches, Form and Pump	m3	2	$5,000.00	$10,000
29	0932-0010	Crack Injection	m	50	$300.00	$15,000
30	0999-0165	Dowels into Concrete	each	237	$30.00	$7,096
					Total	$647,694

APPENDIX 2

Visual Condition Assessment Report

R.V. Anderson Associates Limited
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Toronto Ontario M2J 4Z8 Canada
Tel 416 497 8600 Fax 416 497 0342
www.rvanderson.com

September 18, 2020 RVA 195072

The Corporation of the Town of Caledon
6311 Old Church Road
Caledon, ON
L7C 1J6

Attention: Mr. Arash Olia, Manager
Transportation Engineering

Dear Mr. Olia:

Re: Coventry Bridge Visual Condition Assessment
Final Report

1.0 INTRODUCTION

The Town of Caledon retained R.V. Anderson Associates Limited (RVA) to carry out a Schedule 'B' Class Environmental Assessment and 30% Preliminary Design for the reconstruction of Columbia Way from Highway 50 to Caledon King Townline. Included in the scope of work is the 30% Design for structural culverts or bridges requiring rehabilitation or replacement.

A field inspection was carried out by David O'Sullivan, P.Eng. of RVA on September 10, 2020. Work included an inspection of all visible portions of the bridge, with recommendations for remedial work or replacement as required.

1.1. Background Information

The Coventry Bridge is located on Columbia Way, approximately 0.48 km west of Caledon-King Townline. It is an approximately 10.6 m long by 8.6 m wide cast in place concrete single-span rigid frame structure. The bridge was constructed in 1950, and it was rehabilitated in approximately 1998.

The structure comprises of a cast in place deck with arched soffit and full-height abutments, with wingwalls at all four corners of the bridge. Rigid moment connections are provided at the deck-abutment interfaces, as well as at the abutment-wingwall interfaces. Based on the information available, the bridge does not have any approach slabs.

The bridge is founded on cast-in-place footings atop of timber piles.

The Ontario Structure Inspection Manual (OSIM) inspections from 2017 and 2019 were reviewed after carrying out the inspection on site. The 2019 report indicated that reviewed rehabilitation of the Abutment Walls, Wing Walls, and Soffits is estimated to be required within one to five years of the date of the inspection (June 2019). It also noted that the bridge railings required rehabilitation within one year and the wearing surface at the bridge approached required rehabilitation within two years of the date of the report.

The overall Bridge Condition Index (BCI) of 69.4 noted in 2019 is just under the threshold value of 70 which is generally considered to be “good” condition. Structures falling within the BCI in the range of 60-70 are generally slated for rehabilitation within 1 to 5 years.

RVA was informed that Columbia Way was resurfaced during the Summer of 2020 in the area near to and including the Bridge. Significant settlement cracks were present in the road near to the East bridge abutment, which were observed in review of OSIM Reports, Google Streetview, and identified in discussions with the Town.

2. METHODOLOGY

RVA carried out a field inspection on September 10, 2020, at 3:30 pm. The weather was overcast and the ambient temperature was approximately 20°C. The purpose of the inspection was to document the condition of all accessible and visible portions of the bridge structure. The visual inspection included accessing the underside of the bridge. Visible structural elements above the water and ground surface were assessed and photographed.

No destructive or non-destructive performance testing was conducted as a part of this review. Photographs of areas of concern taken during this inspection are provided at the end of this Report.

3. OBSERVATIONS

3.1. Approaches

There was perceptible settlement of the roadway at the approach, nor any visible erosion to approaches to the bridge (See Figure 1 and Figure 7**)**.

3.2. Wearing Surface

The wearing surface (See Figure 1) was replaced in Summer 2020, and no concerns were noted. Previously observed cracking in the wearing surface prior to repaving is no longer present. The wearing surface is in good condition.

3.3. Parapet Walls

The parapet walls were observed to be in good condition. Some minor staining was observed. Shrinkage cracks which are typically present on this type of parapet wall were observed (See Figure 1, Figure 6, Figure 10, and Figure 12).

3.4. Railings

The railings were in good condition. The current railing height is set for pedestrians (1070 mm) and does not meet requirements for protecting cyclists (1400 mm). (see Figure 2 and Figure 10)

3.5. Guiderails

The southwest guiderail is in poor condition from what appears to be collision damage (see Figure 15). All other guiderails are in good condition. (See Figure 1 and Figure 7)

3.6. Abutments – Abutment Walls

The east abutment is in good condition (See Figure 8). The west abutment is in fair condition, with a few areas of spalling, and exposed, corroded reinforcing steel (See Figure 9).

3.7. Abutments - Wingwalls

The connection between the southeast wingwall and the south abutment has failed. Movement of the wingwall exceeding 50 mm was observed (See Figure 8 and Figure 11). This is believed to be a structural failure of the connection caused by forces acting on the wingwall and transferred into the joint, which does not have adequate structural capacity to withstand the applied load.

Moderate cracking of the face of the southwest abutment was observed (See Figure 10 and Figure 12). Minor cracking and spalling of the northwest and northeast wingwalls was observed (See Figure 2 and Figure 3).

3.8. Deck - Soffit

The deck soffit is in fair condition, with minor spalling visible (See Figure 8). The west abutment is in fair condition, with a few areas of spalling and exposed, corroded reinforcing steel. (See Figure 9)

3.9. Deck - Soffit

The deck soffit is in fair condition with minor spalling observed (See Figure 9 and Figure 14**)**

3.10. Deck - Fascia

The deck fascia on the south side is in poor condition with major spalling observed (See Figure 10 and Figure 14). The deck fascia on the north side is in good condition (See Figure 4).

3.11. Embankments

Minor erosion was observed at the northwest embankment (See Figure 2). All other embankments appeared to be in good condition (See Figure 6, Figure 10 and Figure 12).

4. RECOMMENDATIONS

The most recent OSIM inspection provided a Bridge Condition Index (BCI) of 69.4, which is below the threshold BCI of 70 for a bridge in "Good" condition. Bridges with a BCI in the range of 60-70 are generally are recommended to undergo a structural rehabilitation within 1-5.

Of particular concern is the structural failure of the connection between the southeast wingwall and the east abutment. This joint is no longer restraining movement of the wingwall, and further movement of the wingwall could result in slope erosion and / or settlement of the road.

Structural rehabilitation of this bridge, including the following scope is recommended:

- Carry out detailed structural analysis for the southwest and southeast wingwalls. If the wall(s) are determined to be structurally adequate, they should be modified or replaced.
- Replace the southwest guiderail and all other guiderails that have sustained damage at the time of the rehabilitation work. At this time, the end treatments should also be replaced if they have been determined to have sustained impact damage. This would provide the Town an opportunity to use SoftStop or other current standard end treatments.
- Carry out repairs to all spalling of the abutments, wingwall, soffit and fascia.
- Clean all staining from the concrete and steel bridge components and apply sealer.
- Clean and touch up any corrosion on existing railings with zinc rich primer or replace railings with bicycle-height railings.

Complete replacement of the bridge structure is not recommended at this time, unless it is required for another reason such as hydraulic capacity improvements, improvements to the vertical / horizontal profile of the road or widening of the road platform.

Should you have any questions or require additional clarification, please do not hesitate to contact the undersigned.

Yours very truly,

R.V. ANDERSON ASSOCIATES LIMITED

David O'Sullivan, P.Eng, PMP
Structural Engineer, Associate

Figure 1 – View of Bridge, looking West

Figure 2 – North Parapet Wall and Railing, Northwest Wingwall

Figure 3 – Northeast Wingwall at Abutment

Figure 4 – Underside of Bridge, looking west

Figure 5 – Underside of Bridge, looking south

Figure 6 – North Elevation of Bridge

Figure 7 – Guiderails at east side of Bridge

Figure 8 – East abutment, looking south shifted southwest abutment visible)

Figure 9 – West abutment and soffit, looking west

Figure 10 – South side of bridge, southwest wingwall

Figure 11 – Structural failure at connection between east abutment and southeast wingwall

Figure 12 – South elevation of Bridge

Figure 13 – Southwest wingwall (cracking visible)

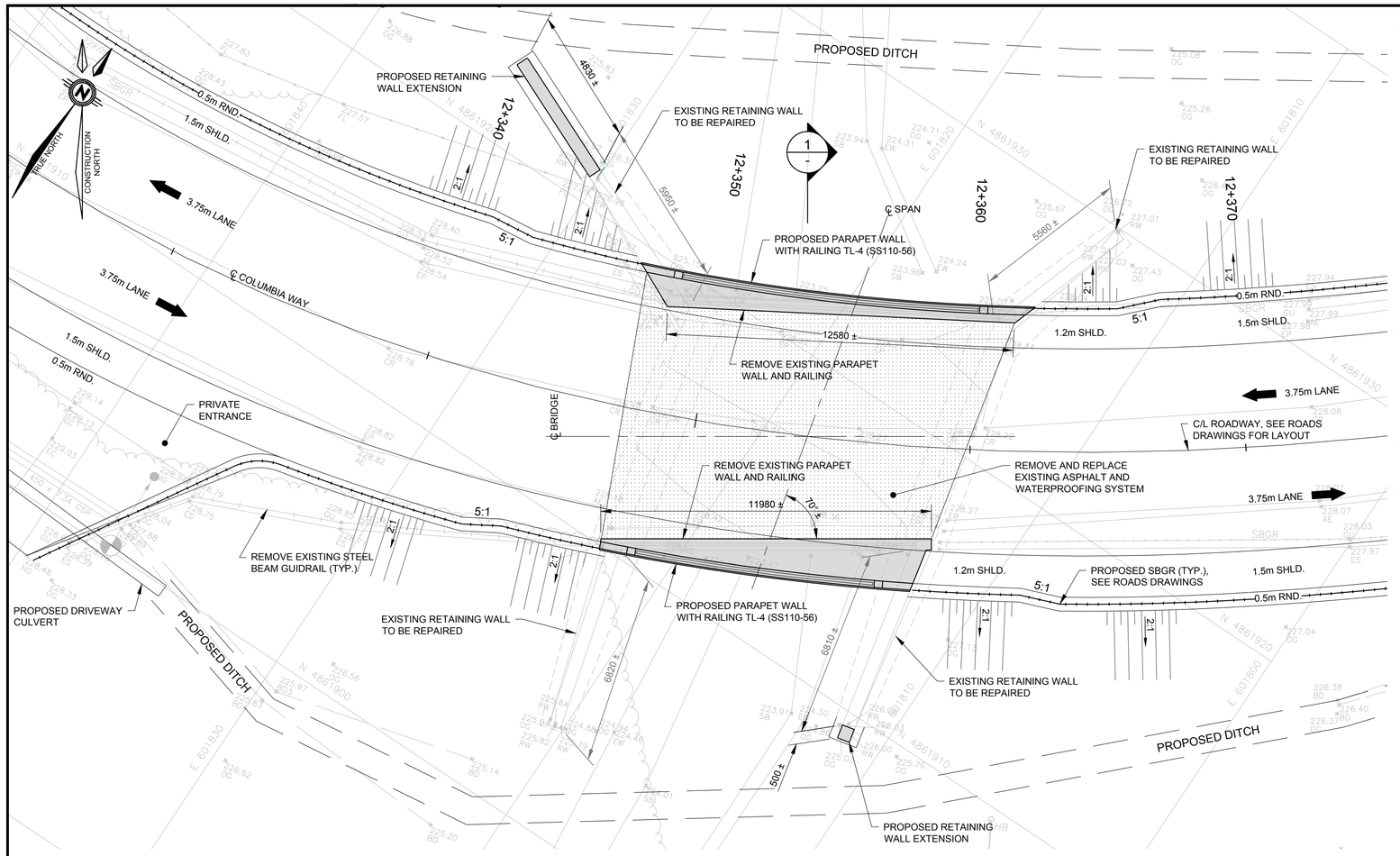
Figure 14 – Soffit of bridge looking north (spalling visible)

Figure 15 – Damaged southwest guiderail

Figure 16 – Damaged southwest guiderail

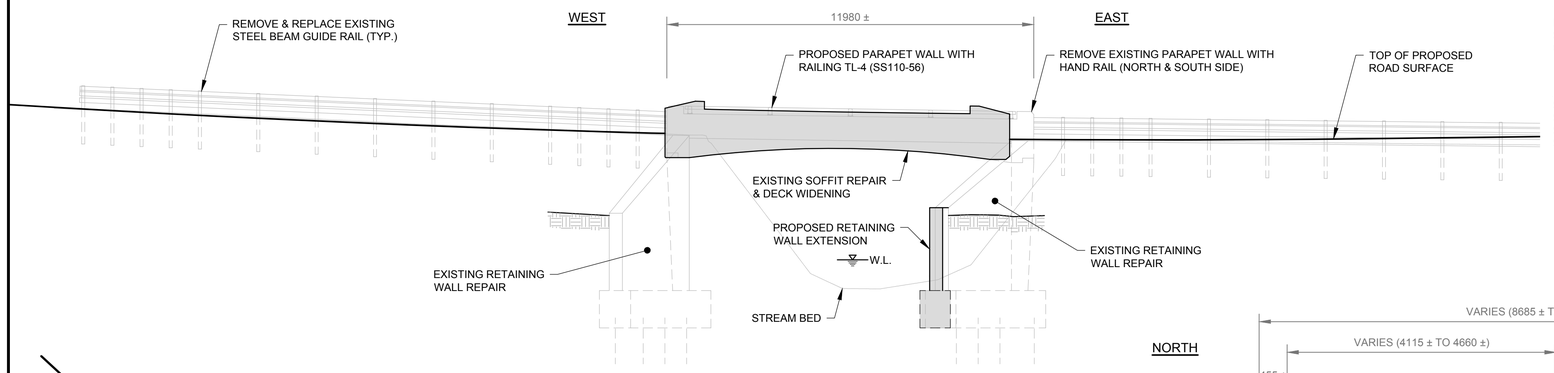
APPENDIX 3

General Arrangement Drawing - Rehabilitation



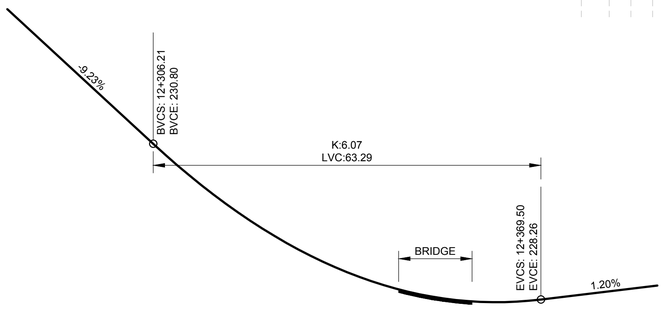
PLAN

1m 0 2m 4m #M100

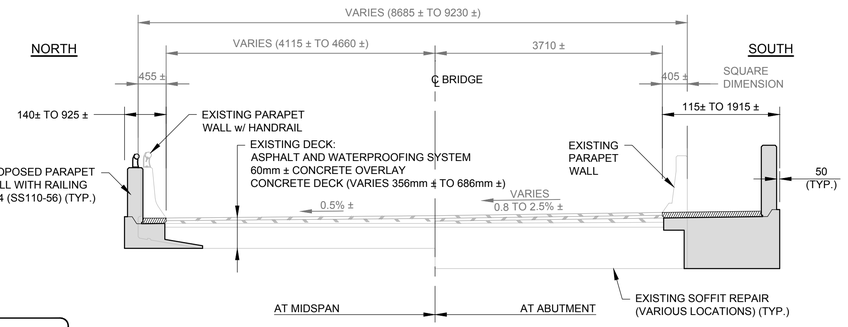


SOUTH ELEVATION

1m 0 2m 4m #M100



PROFILE CONTROL OF ROAD



SECTION

1m 0 0.5m 2.0m #M50

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

PRELIMINARY DESIGN NOT FOR CONSTRUCTION

JULY26, 2021

GENERAL NOTES

1. CLASS OF CONCRETE:
   - PRECAST CONCRETE..... 35 MPa
   - REMAINDER..... 35 MPa

2. CLEAR COVER TO REINFORCING STEEL:
   - PRECAST CONCRETE ..... 60±10
   - FOOTING ..... 100±25
   - REMAINDER ..... 70±20 UNLESS OTHERWISE NOTED

3. REINFORCING STEEL:
   - REINFORCING STEEL SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED.
   - BAR MARKS WITH PREFIX `C' DENOTE COATED BARS.
   - BAR MARKS WITH PREFIX `S' DENOTE STAINLESS STEEL BARS.
   - STAINLESS REINFORCING STEEL SHALL BE TYPE 316LN, DUPLEX 2205 OR XM-28 AND HAVE A MINIMUM YIELD STRENGTH OF 500 MPa, UNLESS OTHER SPECIFIED.
   - UNLESS SHOWN OTHERWISE, TENSION LAP LENGTHS NOT INDICATED ON THE CONTRACT DRAWINGS SHALL BE CLASS B. HOOKS AND BENDS FOR REINFORCING STEEL SHALL BE DETAILED ACCORDING TO CHBDC-S6-06.
   - UNLESS SHOWN OTHERWISE, THE FOLLOWING SHALL APPLY :

a) STANDARD HOOKS WITH MINIMUM BEND DIAMETERS SHALL BE USED FOR STIRRUPS AND TIES, ACCORDING TO CHBDC-S6-14.
b) OTHER BARS SHALL HAVE STANDARD HOOKS WITH BEND DIAMETERS ACCORDING TO CHBDC-S6-14.

CONSTRUCTION NOTES

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL OTHER APPLICABLE CONTRACT DRAWINGS.
2. CLASS OF CONCRETE: EXPOSURE CLASS C-1 TO CSA A23.1, STRENGTH : 35MPa AT 56 d.
3. CLEAR COVER TO REINFORCING STEEL SHALL BE 70mm ± 20 UNLESS NOTED OTHERWISE.
4. REINFORCING STEEL SHALL BE GRADE 400W. BAR MARKS WITH PREFIX `S' DENOTES STAINLESS STEEL BARS.
5. ALL CONSTRUCTION PROCEDURES AND MATERIALS SHALL BE IN ACCORDANCE WITH CURRENT ONTARIO PROVINCIAL STANDARDS. ALL MATERIAL SUPPLIED SHALL BE FROM MTO DESIGNATED SOURCES, WHERE APPLICABLE.
6. ALL EXISTING CONDITIONS SHOWN ON THE EXISTING CONTRACT DRAWINGS ARE TAKEN FROM FIELD MEASUREMENTS AND AVAILABLE DRAWINGS. THE CONTRACTOR SHALL VERIFY ALL SITE CONDITIONS PRIOR TO COMMENCEMENT OF CONSTRUCTION AND REPORT ANY DISCREPANCIES TO THE ENGINEER PRIOR TO COMMENCING WORK.
7. THE CONTRACTOR SHALL OBTAIN APPROVAL FOR THEIR ENVIRONMENTAL PROTECTION PLAN, EROSION AND SEDIMENT CONTROL PLAN AND DEWATERING PLAN FROM ALL AUTHORITIES HAVING JURISDICTION. THE EXISTING STREAMBED AND SURROUNDING AREAS SHALL BE FULLY PROTECTED AT ALL TIMES FOR THE DURATION OF THE WORK.
8. ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS NOTED OTHERWISE.
9. THE CONTRACTOR'S PRICE FOR THE WORK SHALL INCLUDE ALL LABOUR, EQUIPMENT, MATERIAL AND TRANSPORTATION NECESSARY TO COMPLETE THE WORK, INCLUDING ANY AND ALL INCIDENTAL WORK WHETHER OR NOT EXPLICITLY DETAILED ON THE CONTRACT DRAWINGS BUT REQUIRED FOR PROPER PERFORMANCE AND COMPLETION OF THE WORKS AS PER THE DRAWINGS AND SPECIFICATIONS.
10. ALL TRAFFIC CONTROL SHALL BE RESPONSIBILITY OF THE CONTRACTOR AND SHALL BE AS PER BOOK 7 OF ONTARIO TRAFFIC MANUAL. LANE CLOSURES ARE REQUIRED UNDER THIS CONTRACT.
11. THE FINAL LOCATION AND OVERALL EXTENT OF ALL WORK UNDER THIS CONTRACT WILL BE AS DIRECTED OR DELINEATED ON SITE BY THE ENGINEER.
12. THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWER AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES, AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.
13. THE CONTRACTOR SHALL PREVENT DEBRIS FROM ENTERING THE WATERCOURSE OR LAND BELOW DURING CONSTRUCTION.

COLD WATER TIMING WINDOW

TO PROTECT LOCAL FISH POPULATION DURING THEIR SPAWNING AND NURSERY PERIODS, NO IN-WATER/ NEAR WATER WORK/ ACTIVITY SHALL OCCUR BETWEEN SEPTEMBER 16 TO JUNE 14. IN-WATER/ NEAR WATER WORK INCLUDES TIMBER CRIBBING REMOVAL, AND EXCAVATION AND GRADING WORKS WITHIN BANKS.

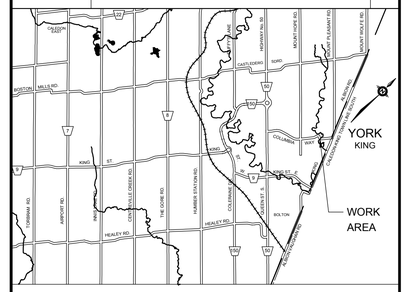
LIST OF DRAWINGS

SERVICE DATA

SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
HYDRO ONE					
WATERMAINS					
GAS MAINS					
BELL U/G CABLE					
HYDRO U/G CABLE					
ROGERS PLANT					

REVISIONS

DATE	DETAILS	INIT.



NOTE:

TYPICAL PAVEMENT STRUCTURE

PROPOSED PAVEMENT COMPONENTS:

50mm HL1
100mm HDBC (2 LIFTS)
150mm GRANULAR A CRL
450mm GRANULAR B CRL

SPLASH PAD:
130mm IMPRESSED CONCRETE
150mm GRANULAR A CRL

SIDEWALK:
130mm CONCRETE
150mm GRANULAR A CRL

PERMEABLE PAVEMENT:
150mm +/- PAVE DRAIN BLOCKS
150mm 19mm CLEAR STONE
300mm 53mm CLEAR STONE
GRANULAR 'B' CRL TO MATCH BOTTOM OF SUBBASE FROM ROAD STRUCTURE

arva
R.V. Anderson Associates Limited
engineering • environment • infrastructure

195072

General Notes

All Driveways Are ASPHALT Unless Otherwise Noted
All Water And Sanitary Service Locations Are Approximate And Must Be Located Accurately In The Field
Any Existing Water Service That Is Altered or Adjusted Is To Be Upgraded To 25mm And Fitted With Anodes As Per Peel Standard
All Horizontal And Vertical Bends Are In Degrees
All Pipes Size In mm
20C Existing Water Service, Size In mm
WS25 Proposed Water Service, Size In mm
B.M. No. 798475 Elev. 412.263 m
Description
Location Lat. 43-50.8 Long. 80-03.0
The Contractor Is Responsible For Locating And Protecting All Existing Utilities Prior To And During Construction. Location Of Existing Utilities Approximate Only, To Be Verified In Field By Contractor.

SCALE: NTS

Chkd

Approved by

NOTICE TO CONTRACTOR

48 HOURS PRIOR TO COMMENCING WORK NOTIFY THE FOLLOWING

THE REGIONAL MUNICIPALITY OF PEEL	CABLE TELEVISION/FIBREOPTIC PROVIDERS:
CITY OF MISSISSAUGA WORKS DEPT.	BELL CANADA
CITY OF BRAMPTON WORKS DEPT.	ENERSOURCE TELECOM
TOWN OF CALEDON WORKS DEPT.	HYDRO ONE TELECOM
BELL CANADA	ROGERS CABLE
ENBRIDGE INCORPORATED-GAS DISTRIBUTION	ALLSTREAM
ONTARIO MINISTRY OF TRANSPORTATION	PSN (PUBLIC SECTOR NETWORK)
ONTARIO CLEAN WATER AGENCY	FUTUREWAY (FCI BROADBAND)
HYDRO ONE NETWORKS	
ENERSOURCE. HYDRO MISSISSAUGA	
HYDRO ONE BRAMPTON	

TOWN OF CALEDON

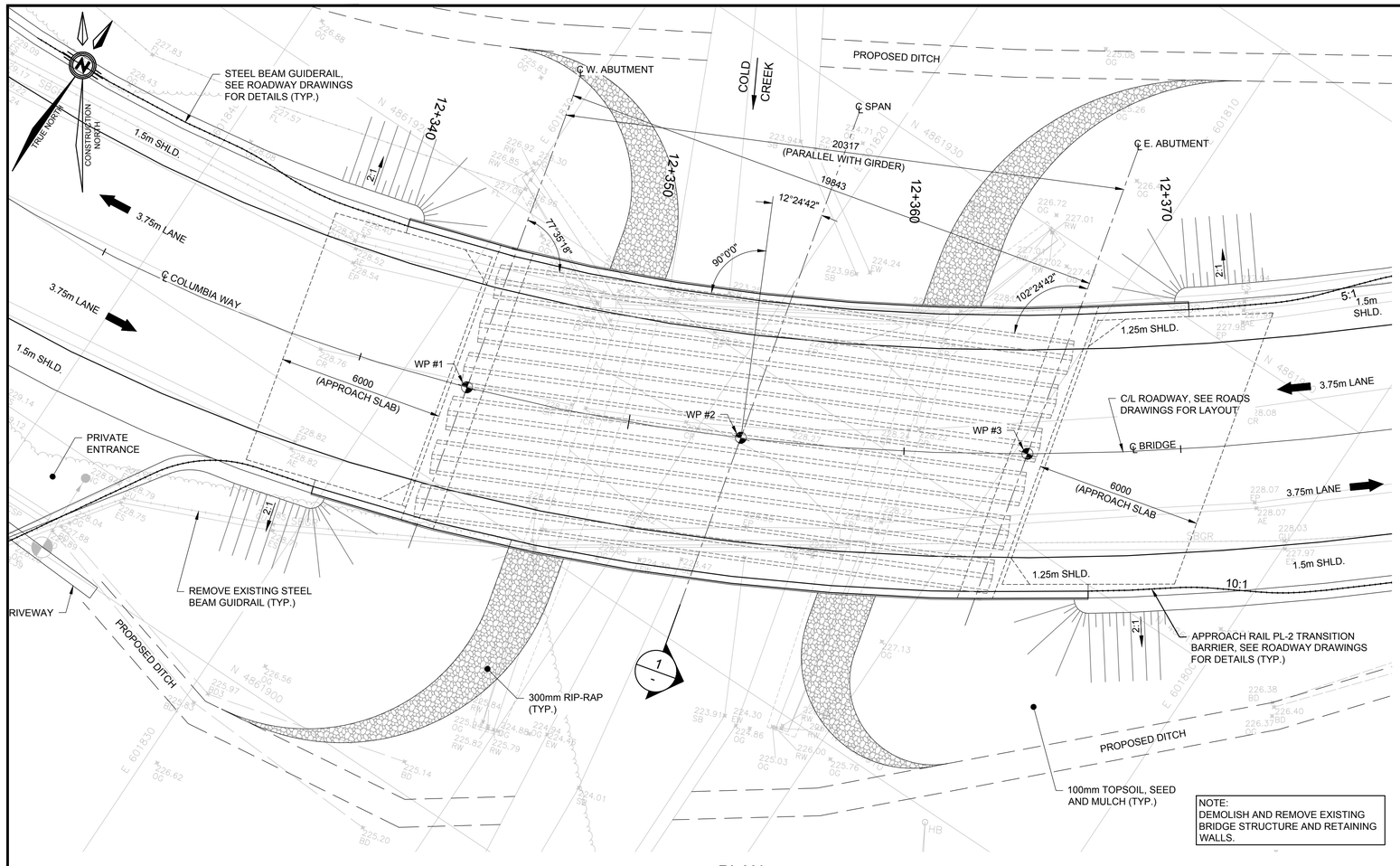
COLUMBIA WAY ENVIRONMENTAL ASSESSMENT (EA) STUDY

GENERAL ARRANGEMENT

CAD Area	Area	Project No.
Checked by XXX	Drawn by R.R.G	
Date JULY 2021	Sheet 1 of XX	Plan No.

APPENDIX 4

General Arrangement Drawing - Replacement



PLAN

1m 0 2m 4m #M100

NOTE:
DEMOLISH AND REMOVE EXISTING BRIDGE STRUCTURE AND RETAINING WALLS.

GENERAL NOTES

1. CLASS OF CONCRETE:
   - PRECAST CONCRETE..... 55 MPa
   - REMAINDER..... 35 MPa

2. CLEAR COVER TO REINFORCING STEEL:
   - PRECAST CONCRETE ..... 60±10
   - FOOTING ..... 100±25
   - REMAINDER ..... 70±20 UNLESS OTHERWISE NOTED

3. REINFORCING STEEL:
   - REINFORCING STEEL SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED.
   - BAR MARKS WITH PREFIX `C' DENOTE COATED BARS.
   - BAR MARKS WITH PREFIX `S' DENOTE STAINLESS STEEL BARS.
   - STAINLESS REINFORCING STEEL SHALL BE TYPE 316LN, DUPLEX 2205 OR XM-28 AND HAVE A MINIMUM YIELD STRENGTH OF 500 MPa, UNLESS OTHER SPECIFIED.
   - UNLESS SHOWN OTHERWISE, TENSION LAP LENGTHS NOT INDICATED ON THE CONTRACT DRAWINGS SHALL BE CLASS B. HOOKS AND BENDS FOR REINFORCING STEEL SHALL BE DETAILED ACCORDING TO CHBDC-S6-06.
   - UNLESS SHOWN OTHERWISE, THE FOLLOWING SHALL APPLY :

a) STANDARD HOOKS WITH MINIMUM BEND DIAMETERS SHALL BE USED FOR STIRRUPS AND TIES, ACCORDING TO CHBDC-S6-14.
b) OTHER BARS SHALL HAVE STANDARD HOOKS WITH BEND DIAMETERS ACCORDING TO CHBDC-S6-14.

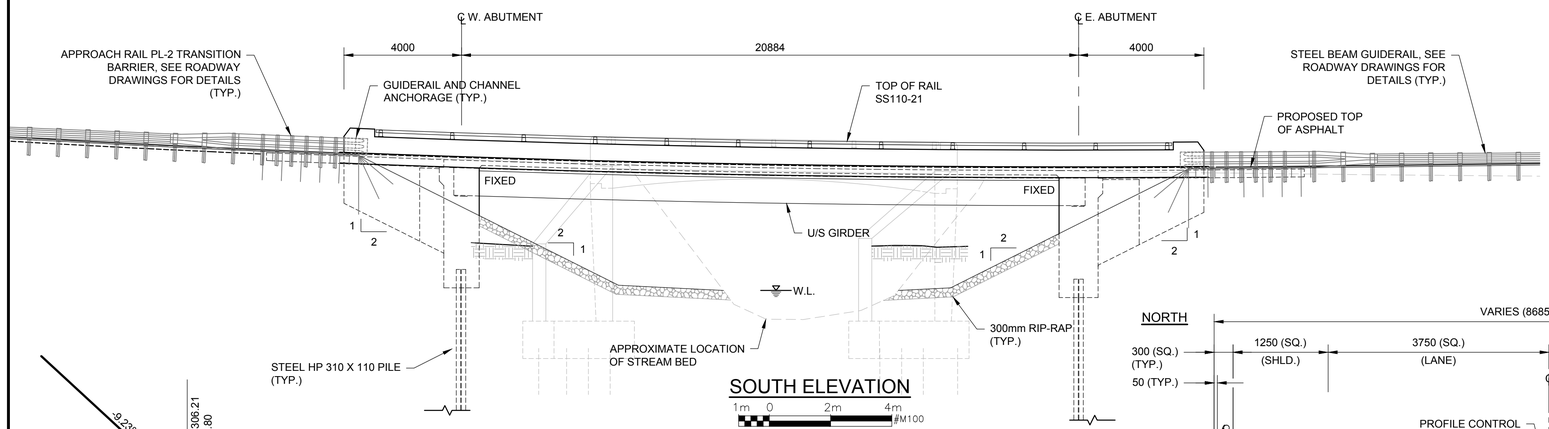
CONSTRUCTION NOTES

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL OTHER APPLICABLE CONTRACT DRAWINGS.
2. CLASS OF CONCRETE: EXPOSURE CLASS C-1 TO CSA A23.1, STRENGTH : 35MPa AT 56 d.
3. CLEAR COVER TO REINFORCING STEEL SHALL BE 70mm ± 20 UNLESS NOTED OTHERWISE.
4. REINFORCING STEEL SHALL BE GRADE 400W.
   BAR MARKS WITH PREFIX `S' DENOTES STAINLESS STEEL BARS.
5. ALL CONSTRUCTION PROCEDURES AND MATERIALS SHALL BE IN ACCORDANCE WITH CURRENT ONTARIO PROVINCIAL STANDARDS. ALL MATERIAL SUPPLIED SHALL BE FROM MTO DESIGNATED SOURCES, WHERE APPLICABLE.
6. ALL EXISTING CONDITIONS SHOWN ON THE EXISTING CONTRACT DRAWINGS ARE TAKEN FROM FIELD MEASUREMENTS AND AVAILABLE DRAWINGS. THE CONTRACTOR SHALL VERIFY ALL SITE CONDITIONS PRIOR TO COMMENCEMENT OF CONSTRUCTION AND REPORT ANY DISCREPANCIES TO THE ENGINEER PRIOR TO COMMENCING WORK.
7. THE CONTRACTOR SHALL OBTAIN APPROVAL FOR THEIR ENVIRONMENTAL PROTECTION PLAN, EROSION AND SEDIMENT CONTROL PLAN AND DEWATERING PLAN FROM ALL AUTHORITIES HAVING JURISDICTION. THE EXISTING STREAMBED AND SURROUNDING AREAS SHALL BE FULLY PROTECTED AT ALL TIMES FOR THE DURATION OF THE WORK.
8. ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS NOTED OTHERWISE.
9. THE CONTRACTOR'S PRICE FOR THE WORK SHALL INCLUDE ALL LABOUR, EQUIPMENT, MATERIAL AND TRANSPORTATION NECESSARY TO COMPLETE THE WORK, INCLUDING ANY AND ALL INCIDENTAL WORK WHETHER OR NOT EXPLICITLY DETAILED ON THE CONTRACT DRAWINGS BUT REQUIRED FOR PROPER PERFORMANCE AND COMPLETION OF THE WORKS AS PER THE DRAWINGS AND SPECIFICATIONS.
10. ALL TRAFFIC CONTROL SHALL BE RESPONSIBILITY OF THE CONTRACTOR AND SHALL BE AS PER BOOK 7 OF ONTARIO TRAFFIC MANUAL. LANE CLOSURES ARE REQUIRED UNDER THIS CONTRACT.
11. THE FINAL LOCATION AND OVERALL EXTENT OF ALL WORK UNDER THIS CONTRACT WILL BE AS DIRECTED OR DELINEATED ON SITE BY THE ENGINEER.
12. THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWER AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES, AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.
13. THE CONTRACTOR SHALL PREVENT DEBRIS FROM ENTERING THE WATERCOURSE OR LAND BELOW DURING CONSTRUCTION.

COLD WATER TIMING WINDOW

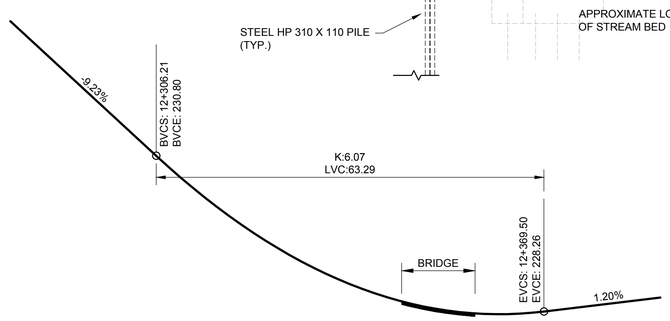
TO PROTECT LOCAL FISH POPULATION DURING THEIR SPAWNING AND NURSERY PERIODS, NO IN-WATER/ NEAR WATER WORK/ ACTIVITY SHALL OCCUR BETWEEN SEPTEMBER 16 TO JUNE 14. IN-WATER/ NEAR WATER WORK INCLUDES TIMBER CRIBBING REMOVAL, AND EXCAVATION AND GRADING WORKS WITHIN BANKS.

LIST OF DRAWINGS

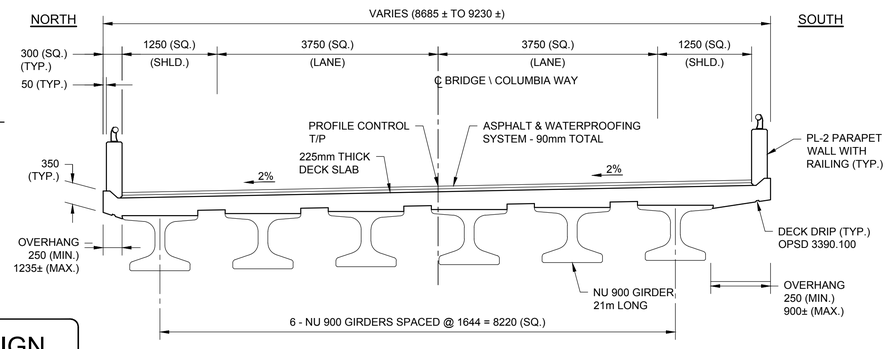


SOUTH ELEVATION

1m 0 2m 4m #M100



PROFILE CONTROL OF ROAD



1 - SECTION

0.5m 0 1m 2.0m #M50

PRELIMINARY DESIGN
NOT FOR CONSTRUCTION
SEPTEMBER 14, 2021

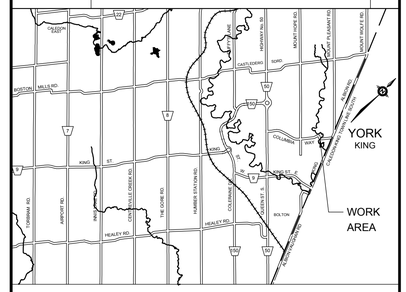
DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

SERVICE DATA

SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
HYDRO ONE					
WATERMAINS					
GAS MAINS					
BELL U/G CABLE					
HYDRO U/G CABLE					
ROGERS PLANT					

REVISIONS

DATE	DETAILS	INIT.



NOTE:

TYPICAL PAVEMENT STRUCTURE

PROPOSED PAVEMENT COMPONENTS:
50mm HL1
100mm HDBC (2 LIFTS)
150mm GRANULAR A CRL
450mm GRANULAR B CRL

SPLASH PAD:
130mm IMPRESSED CONCRETE
150mm GRANULAR A CRL

SIDEWALK:
130mm CONCRETE
150mm GRANULAR A CRL

PERMEABLE PAVEMENT:
150mm +/- PAVE DRAIN BLOCKS
150mm 19mm CLEAR STONE
300mm 53mm CLEAR STONE
GRANULAR 'B' CRL TO MATCH BOTTOM OF SUBBASE FROM ROAD STRUCTURE

arva
R.V. Anderson Associates Limited
engineering • environment • infrastructure
195072

General Notes

All Driveways Are ASPHALT Unless Otherwise Noted
All Water And Sanitary Service Locations Are Approximate And Must Be Located Accurately In The Field
Any Existing Water Service That Is Altered or Adjusted Is To Be Upgraded To 25mm And Fitted With Anodes As Per Peel Standard
All Horizontal And Vertical Bends Are In Degrees
All Pipes Size In mm
20C Existing Water Service, Size In mm
WS25 Proposed Water Service, Size In mm
B.M. No. 798475 Elev. 412.263 m
Description
Location Lat. 43-50.8 Long. 80-03.0
The Contractor Is Responsible For Locating And Protecting All Existing Utilities Prior To And During Construction. Location Of Existing Utilities Approximate Only, To Be Verified In Field By Contractor.

SCALE: NTS

Chkd

Approved by

NOTICE TO CONTRACTOR

48 HOURS PRIOR TO COMMENCING WORK NOTIFY THE FOLLOWING

THE REGIONAL MUNICIPALITY OF PEEL	CABLE TELEVISION/FIBREOPTIC PROVIDERS:
CITY OF MISSISSAUGA WORKS DEPT.	BELL CANADA
CITY OF BRAMPTON WORKS DEPT.	ENERSOURCE TELECOM
TOWN OF CALEDON WORKS DEPT.	HYDRO ONE TELECOM
BELL CANADA	ROGERS CABLE
ENBRIDGE INCORPORATED-GAS DISTRIBUTION	ALLSTREAM
ONTARIO MINISTRY OF TRANSPORTATION	PSN (PUBLIC SECTOR NETWORK)
ONTARIO CLEAN WATER AGENCY	FUTUREWAY (FCI BROADBAND)
HYDRO ONE NETWORKS	
ENERSOURCE. HYDRO MISSISSAUGA	
HYDRO ONE BRAMPTON	

TOWN OF CALEDON

COLUMBIA WAY ENVIRONMENTAL ASSESSMENT (EA) STUDY

GENERAL ARRANGEMENT

CAD Area	Area	Project No.
Checked by XXX	Drawn by R.R.G	
Date JULY 2021	Sheet 1 of XX	Plan No.