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July 26, 2019

CIMA
3027 Harvester Road
Suite 400
Burlington ON
L7N 3G7

Attn: Martin Scott P. Eng.
Senior Project Manager - Transportation

**RE: Burnhamthorpe Road Class EA
Multi-use Path over the Highway 403 Burnhamthorpe Bridge
Our File 17-008**

Dear Martin:

In your email of August 22, 2018, CIMA requested Doug Dixon & Associates (DDA) to review the ability of the existing Highway 403 Burnhamthorpe Road Underpass to accommodate a new raised concrete multi-use path. Since this time, we have met with the MTO by teleconference and in person to discuss preferred options. The following letter provides a summary of the consensus reached and DDA's assessment of the impacts of the installation of the proposed multi-use trail on the above noted bridge.

We have reviewed the existing structure drawings from Contract 79-31 (July 1978) by DeLeuw Cather, as well as the 2012 McCormick Rankin Corporation (MRC) Rehabilitation Drawings. The 2012 Rehabilitation added an overlay to both the deck and the south sidewalk. As part of the detailed design for that rehabilitation, MRC would have completed an evaluation for the rehabilitated condition of the bridge as shown on that General Arrangement (Contract 2012-2015).

To provide a 3.0m wide multi-use trail on the north side of the bridge, it has been agreed through discussion with the MTO Structural Section that the bridge superstructure will be widened by 300 mm on the north side. This will occur at the time the north parapet wall is removed to construct the multi-use trail. The proposed 300mm widening will facilitate a full 3000mm wide trail on the bridge which will be consistent with the trail width on the approaches. Based on past experience (Trafalgar Road Bridge Widening and others) a nominal widening of only 300mm, by itself, is not expected to impact the structural integrity of a voided, post tensioned deck of the type at Burnhamthorpe Road.

In the following, DDA provides some engineering basis to the hypothesis that the existing bridge is capable to support the 300mm widening and the other proposed modifications. DDA compared the total dead load that the bridge would have been evaluated for at the time of the MRC 2012 rehabilitation with the additional dead load from all other modifications that would be required to construct the proposed new raised multi-use trail (including the 300mm widening). As shown in Table 1, attached to this letter, the total additional uniformly distributed load from the new multi-use trail is approximately 18.6 kN/m.

The additional load that would result from the proposed new multi-use trail on the bridge is only 3.7% of the rehabilitated mass. Given the small increase in the dead load of only 3.7%, DDA concludes that the additional load due to the multi-use trail and the 300mm widening should not result in any issues relating to serviceability or ultimate performance of the bridge.

This percentage (3.7%) is well within general tolerance for estimating loads and is adequately provided for in the load factors provided to the dead and live loads that would have been used in the 2012 evaluation at the time of the most recent rehabilitation.

The bridge bearings were also replaced during the 2012 rehabilitation when the bridge was converted to a semi-integral configuration. The new bearings are 600 mm x 500 mm x 80 mm elastomeric laminated. Using our calculated uniformly distributed load for the proposed multi-use trail of 18.6 kN/m, provides an additional reaction of approximately 200 kN to be carried by only the most northerly bearings. This is a conservative approximation of the increased reaction in the north bearing.

The Serviceability Limit State (SLS) capacity of this size of bridge bearing is 1350 kN. Adding the additional 200 kN to the MRC calculated reactions of 1145 kN (taken from the MRC Drawings) provides a conservative upper limit estimate of the total dead load reaction equal to the SLS capacity of 1350kN.

DDA is also aware that the next version of the CHBDC, S6-19, anticipated to be released within the next 5 months, will revise the bearing design approach for elastomeric bearings by increasing the SLS capacity of this 600 mm x 500 mm x 80 mm bearing significantly. We therefore do not anticipate any issues relating to the existing bearings ability to carry the dead load if the multi-use trail is added.

To maintain a parapet wall that complies with the current required Test Level (TL) and has been crash tested, the approach recommended is to remove the existing north parapet. The method of removing the existing parapet wall will be determined at the time of detailed design, however, saw cutting may be the most cost effective.

The 300mm widening of the deck would be completed next (The sketch of the new raised multi-use trail, parapet and railing is attached to this letter). This would be followed by the construction of the new raised multi-use trail.

To avoid transverse and longitudinal stressing tendons (over the pier) as well as tendon anchorages, ground penetrating radar or other similar testing methods would be used to identify possible conflict locations before the dowels are installed. As required, the location of the dowels can be adjusted nominally to avoid any interference.

A new parapet wall would be constructed on the sidewalk to meet the requirements of SS110-57. A metal railing on top of the parapet to meet the requirements for a bicycle height barrier would be installed. This could be the standard railing SS110-85.

The existing sign board mounted on the north parapet over the southbound lane of Highway 403 would need to be removed, salvaged, temporarily installed on ground mounted supports during construction and reinstated at the conclusion of the work.

We trust the above provides adequate discussion on the anticipated approach to providing a raised multi-use trail on the Highway 403 Underpass at Burnhamthorpe Road. Based on the above analysis, DDA anticipates no structural issues implementing the design.

Although no issues are anticipated, it is DDA's recommendation that a complete evaluation and assessment of the existing bridge should be undertaken during the detailed design. This will include serviceability and ultimate limit states for shear and bending in the superstructure, a review of the capacity of the existing bearings in load as well as the transverse bending in the deck over the piers.

If you have any questions with the above, please do not hesitate to contact the undersigned.


Yours very truly,
Doug Dixon & Associates Inc.

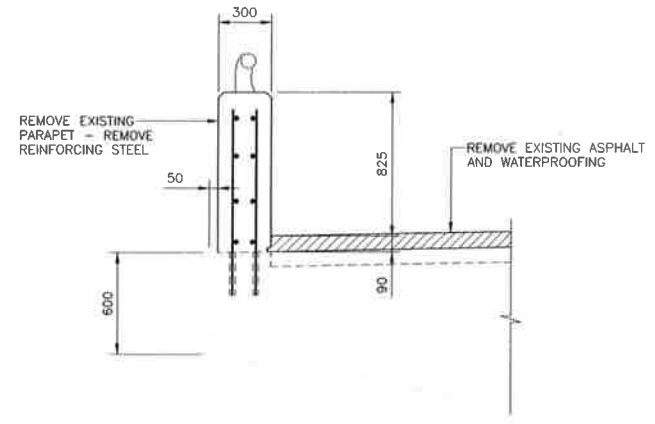


Prepared by:
Doug Dixon, P. Eng
President/Senior Bridge Designer

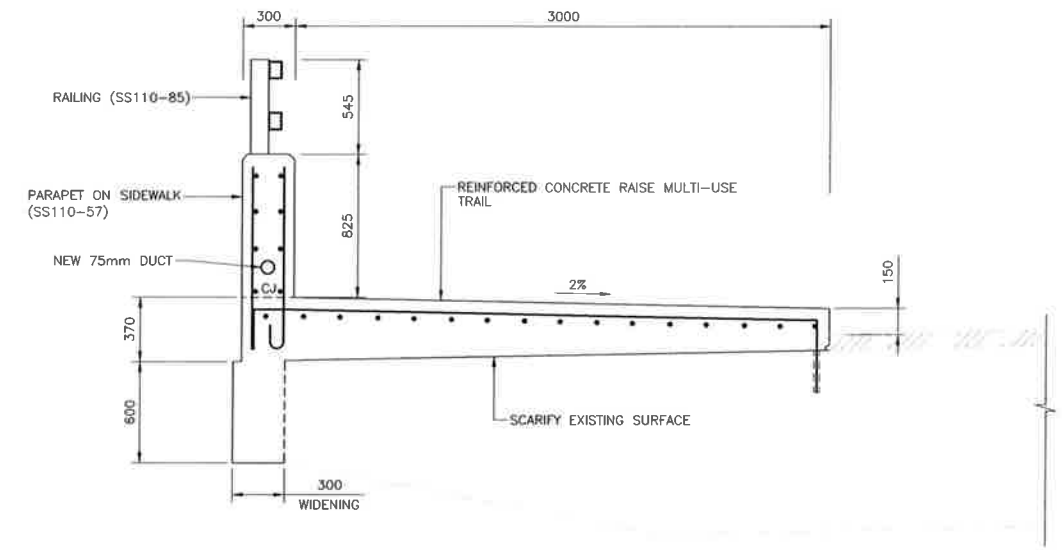
Additional Proposed Work	Length (m)	Width (m)	Depth (m)	Volume (m3)	Unit Weight (kN/m3)	Weight (kN)	UDL (kN/m)
Concrete raised trail	51.8	2.9	0.27	40.6	24.0	973.7	18.8
Concrete Parapet	51.8	0.3	0.30	4.7	24.0	111.9	2.2
Remove Asphalt	51.8	2.9	-0.09	-13.5	23.5	-317.8	-6.1
300mm widening	51.8	0.3	0.53	8.2	24.0	197.7	3.8
				TOTAL		965.5	18.6

Existing Structure	Length (m)	Width (m)	Depth (m)	Volume (m3)	Unit Weight (kN/m3)	Weight (kN)	UDL (kN/m)
Concrete Top Deck Section	51.8	20.4	0.5	563.0	24.5	13793.5	266.2
Concrete Bottom Deck Section	51.8	18.0	0.4	354.4	24.5	8682.0	167.6
Raised Sidewalk	51.8	2.0	0.3	30.4	24.0	729.4	14.1
Concrete Parapet North Side	51.8	0.3	0.8	12.8	24.0	307.8	5.9
Concrete Parapet South Side	51.8	0.3	0.8	12.8	24.0	307.8	5.9
Asphalt and Waterproofing	51.8	18.1	0.1	84.5	23.5	1985.2	38.3
Railing North Side	51.8	0.00079	1.1	0.05	77.0	3.5	0.1
Railing South Side	51.8	0.00079	1.1	0.05	77.0	3.5	0.1
				TOTAL		25812.6	498.2

DISTRICT CONT. No. WP No.	
HIGHWAY 403 BURNHAMTHORPE ROAD UNDERPASS	SHEET
SKETCH	
 DOUG DIXON & ASSOCIATES INC	METRIC



EXISTING SECTION
1:20



REHABILITATED SECTION
1:20

CAD FILE: \\MYCLOUD\DR4100\Public\Projects\17-008 Burnhamthorpe Road Ciess EA\DDA CAD Drawings\17-008_001SK.dwg
 MODIFIED: VThakkar
 PLOTTED: VThakkar

MINISTRY OF TRANSPORTATION, ONTARIO
 PH-2-107 84-05

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

REVISIONS		DESCRIPTION				
DATE	BY	DESIGN	CHK	CODE	LOAD	DATE JUL/19
		DRAWN	CHK	SITE	STRUCT	SCHEME DWG