Appendix K CROSSING ASSESSMENT MEMO

Highway 400 Crossing Assessment Memo

Bass Pro Mills Drive Extension MCEA Study

May 2022

Prepared for:

City of Vaughan

Prepared by:

Stantec Consulting Ltd.
300W – 675 Cochrane Drive
Markham, ON, L3R 0B8

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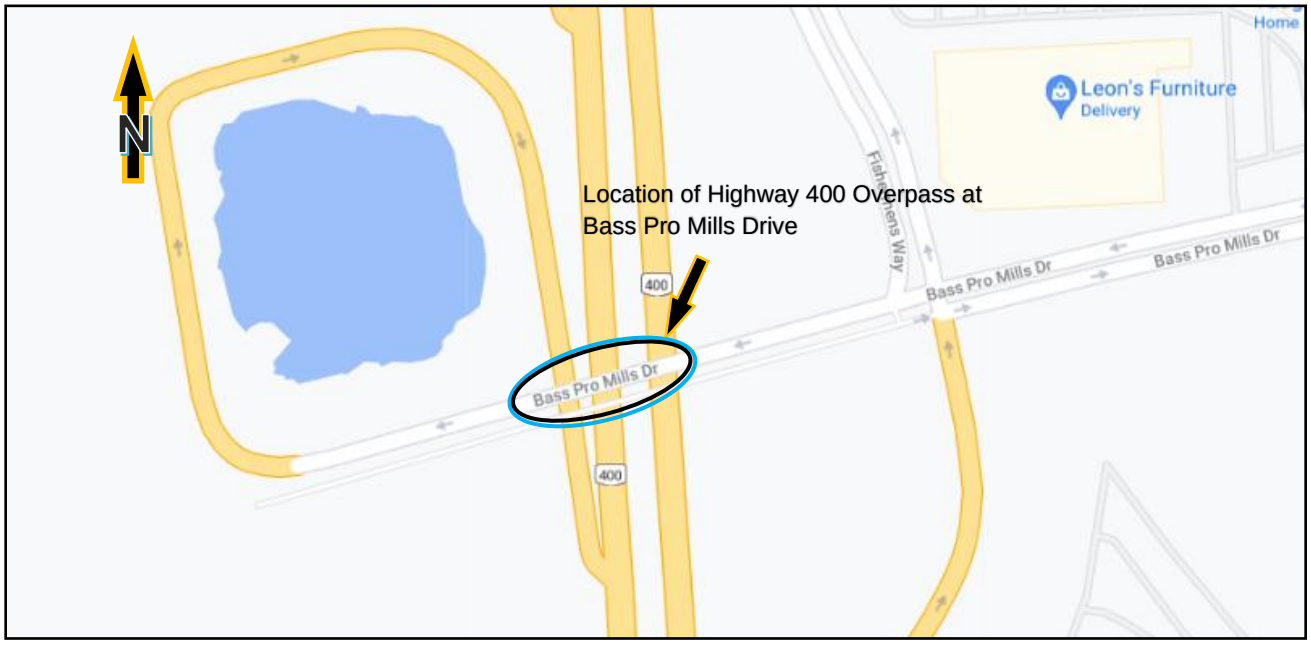
1.0 INTRODUCTION

The existing Bass Pro Mills Drive within the City of Vaughan is proposed to be extended from Highway 400 to Weston Road as a 4-lane urban road. The extension is planned to include a 30.0 m wide municipal Right-of-Way (ROW) and provide for Active Transportation (AT) and Storm Water Management (SWM) features within the boulevard. The purpose of this memo is to summarize the review of solutions that were considered under the Municipal Class Environmental Assessment (Class EA) study and identify the preferred design to provide for 4-lanes of traffic (2 in each direction) and accommodate AT facilities across the existing Bass Pro Mills Drive bridge over Highway 400.

2.0 PROJECT LOCATION

The existing bridge is located on Bass Pro Mills Drive over Highway 400 in the City of Vaughan, as shown in **Figure 1**.

Figure 1 Key Plan of Bass Pro Mills Drive Bridge over Highway 400

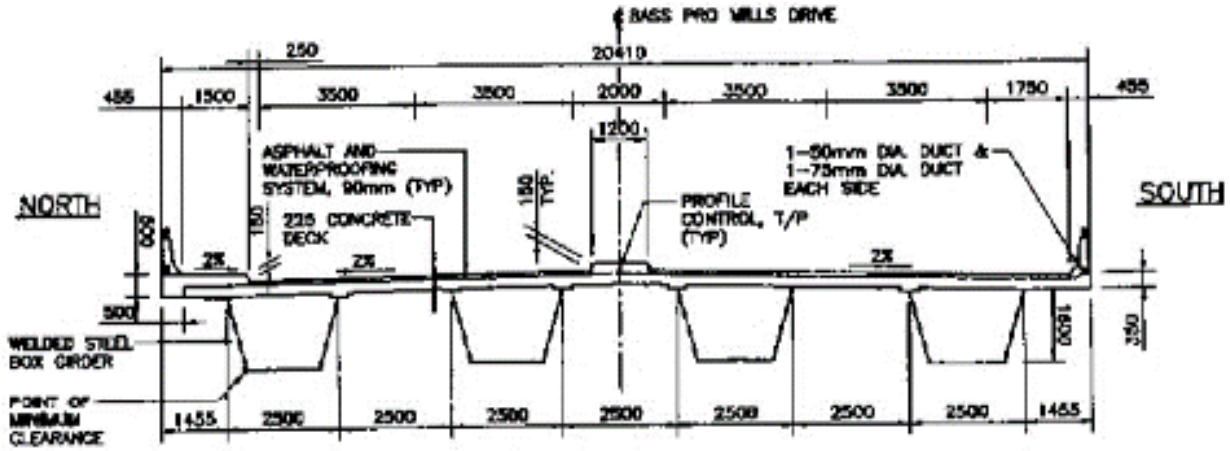


3.0 EXISTING STRUCTURE

Constructed in 2004, the existing Highway 400 overpass is a two-span slab on a steel box girder bridge with an overall length of 91 m supported on integral abutments. The bridge has a skew angle of 11°27’26”, and for the purpose of this report, the structure is generally oriented in an east-west direction. The existing structure has an overall width of 20.41 m, and currently provides for 2 westbound lanes and 2 eastbound lanes; however, only the westbound direction is open to traffic for direct connection to Highway 400 southbound. As shown in **Figure 2** below, the existing structure currently accommodates a sidewalk on the north side, a shoulder on the south side, and concrete barrier walls with railings on both

sides of the structure with 0.25 m lateral clearance provided on the west side adjacent to the raised sidewalk.

Figure 2 Cross Section of Existing Bass Pro Mills Drive Bridge Over Highway 400



- 0.455 m north barrier wall
- 1.50 m north sidewalk
- 0.25 m buffer
- 3.50 m westbound lane
- 3.50 m westbound lane
- 2.00 m median
- 3.50 m eastbound lane
- 3.50 m eastbound lane
- 1.75 m shoulder
- 0.455 m south barrier wall

4.0 ALTERNATIVE SOLUTIONS

To accommodate continuous AT facilities, the existing bridge structure was reviewed in relation to the existing bridge General Arrangement drawing, Ministry of Transportation Ontario (MTO) requirements and TAC design guidelines. The bridge is located within the MTO Controlled Access Highway (CAH) limit and therefore subject to MTO consultation and requirements.

In July 2021, four (4) Options for modifying the existing bridge without widening the existing structure were reviewed and evaluated. These Options were:

1. Maintaining the existing bridge width as-is while making modifications to the existing bridge configuration to accommodate two lanes of traffic in each direction (3.3m inner lanes and 3.5m outer lanes), no median and provide a 3.15 m wide Multi-Use Path (MUP) on both sides of the bridge. In this option, no side clearance was provided, which is not in compliance with the minimum side clearance requirements specified in Exhibit 4-O of the MTO Design Supplement for TAC Geometric Design Guide for Canadian Roads, dated June 2017 (Exhibit 4-O) for a 70 km/hr design speed.

2. Making modifications to the existing bridge configuration to accommodate two lanes of traffic in each direction and provide a 3.0 m wide MUP and 0.25 m side clearance on both sides of the bridge with no median. The outside lanes were reduced to 3.4 m whereas the inside lanes would be 3.3 m. In this Option, an assumption was made that the current Bass Pro Mills Drive is classified as "*Local Undivided Urban Road*", and the design speed is 70 km/h. Per Exhibit 4-U requirement, the minimum side clearance will need to be 0.5 m for this classification. The proposed 0.25 m side clearance in this Option did not meet this requirement; however, is the same as the existing bridge structure. For this reason, this option was later revised to have 0.5m clearance with 2.65m MUPs on both sides, 3.5m outer lanes and 3.3m inner lanes and no median.

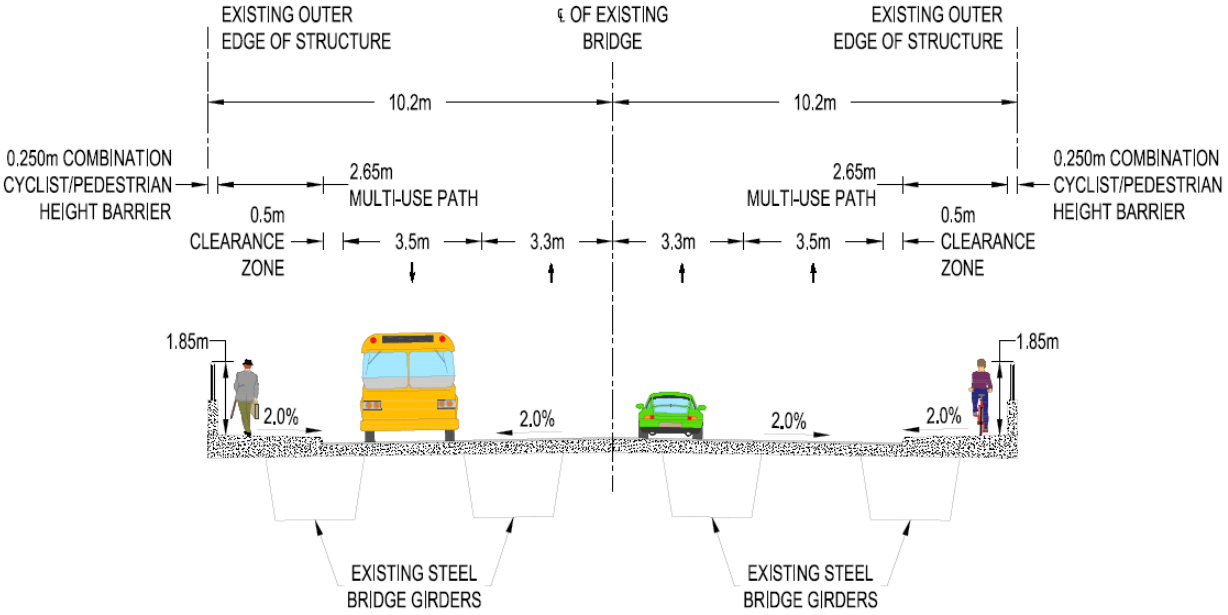
3. Modifying the existing bridge configuration to accommodate two lanes of traffic in each direction, 3.5m outer lanes and 3.3m inner lanes, and provide a 2.15 m wide MUP with a 1.0 m side clearance on both sides of the bridge. The proposed 1.0 m side clearance meets the requirement of Exhibit 4-U based on the assumption that the current Bass Pro Mills Drive is classified as "*Collector Undivided Urban Road*" and the design speed is 70 km/h. In this Option no median would be provided.

4. Construction of a separate 4.0 m wide pedestrian bridge north of the existing bridge to accommodate cycling and pedestrian facilities; and modification of the existing bridge to accommodate two lanes of vehicular traffic in each direction and cyclists/pedestrians on the south side of the existing bridge. The modifications would include the removal of the existing median and lane reconfiguration to provide a 2.1 m shoulder on the north side, two lanes of traffic in each direction with 3.5 m and 3.3 m lane widths, and a 3.0 m wide MUP with a 1.0 m side clearance on the south side of the bridge. The proposed 1.0 m side clearance meets the requirement of Exhibit 4-U based on the assumption that the current Bass Pro Mills Drive is classified as "*Collector Undivided Urban Road*" and the design speed is 70 km/h.

4.1 TECHNICAL ADVISORY COMMITTEE MEETING #2

Following the evaluation of the four alternatives, a Preferred Alternative was presented at Technical Advisory Committee (TAC) meeting 2 in July 2021, which was a modification of Option 2. The Preferred Alternative included 2.65 m wide MUPs, 0.5 m clearance, 3.5 m and 3.3 m lanes with no median, as shown in **Figure 3** below.

Figure 3 Preferred Alternative for the Highway 400 Bridge Cross-Section Presented at TAC 2



The four (4) Options considered were provided to MTO in August 2021 for comment.

The Preferred Alternative shown in Figure 3 was presented to the public as part of Public Information Centre #2 that was held in August 2021.

4.2 MTO STANDARDS

In response to the submission made to MTO in August, MTO advised that any modifications to the Highway 400 crossing would need to satisfy the following MTO and TAC standards and requirements:

- Road Classification (TAC Design Supplement GDC Exhibit 2-G)
- Lane widths (MTO Design Supplement Exhibit 4-B)
- Shoulders (MTO Design Supplement Exhibit 4-U)
- Path Widths (Bikeway Design Manual Table 5-2)
- Barrier (Bikeway Design Manual Figure 4.64)

4.3 MTO'S OPINION

MTO stated that Bass Pro Mills Drive should be classified as a 70 km/hr urban collector undivided road (UCU 70) and as such, does not recommend proceeding with Option 1 or Option 2. In addition, MTO indicated that the AT facilities within Option 3 do not meet the minimum width requirements (3.6 m), nor does it include the required barrier between vehicles and cyclists, and the proposed shoulders are 0.5 m smaller than required. To meet the required widths, the bridge deck would need to be widened by 5.2 m.

Further, a separate AT path, as proposed in Option 4 would need to have a width of 3.6 m from barrier to barrier (4.1 m inclusive of barriers). A total width of 4.6 m (5.1 m inclusive) is desired. The AT path proposed on the side of the roadway is absent a barrier and required shoulder, and would require widening to 3.6 m. To meet the required widths, the bridge deck would have to be widened by 1.34 m. MTO also stated all lane widths are to be 3.5 m on the bridge deck.

Based on comments received from MTO none of the four (4) Options presented meet the agency's requirements.

4.4 OPTION 5

In response to MTO's comments, a fifth Option was prepared that provided for 3.6 m sidewalks, 1m clearance, 3.5 m lanes and a raised centre median. This Option was presented to MTO in November 2021. The revised submission considered Bass Pro Mills Drive as an urban collector undivided roadway with a design speed of 70 km/h (UCU 70) and includes 3.5 m lanes widths as outlined within MTO Design Supplement Exhibit 4-B. A shoulder clearance of 1 m was provided per MTO Design Supplement Exhibit 4-U, with 3.6 m raised sidewalks on each side of the structure and a parapet wall for combination traffic/bicycle rail. These net modifications amount to a widening of the existing bridge by 5 m, which was considered for the south side of the structure with the introduction of a new girder line.

MTO's opinion on Option 5 was that the re-submission did not comply with MUP width and intermediate barrier requirements.

4.5 MTO CONTRACT STANDARDS OFFICE

MTO Design and Contract Standards Office #2018-07 discusses incorporating cycling facilities into bridge rehabilitation projects and restricted areas within provincial highway ROW and recognizes that it is not always feasible to apply design guidelines that are used for design of provincial highways or new bridges and for such situations, consideration may be given to apply alternative design guidelines or aspects at the lower end of the design domain. The MTO policy statement allows the narrowing of such features as centre islands and shoulders; elimination of shoulders entirely can also be considered. Further, the policy suggests that consideration be given to road diet and removal of lanes, if possible.

4.6 EA STUDY SUBMISSION

Following a meeting with MTO on February 9, 2022 and comments received from MTO on March 9, 2022, the study team examined and deliberated on various Options for the Highway 400 crossing location to accommodate safe and comfortable AT facilities, including for those requiring mobility assistance, at the Bass Pro Mills Drive bridge structure over Highway 400. The various schemes examined by the study team considered the existing General Bridge Arrangement, MTO and other (TAC) design guidelines, cost, property impacts, functionality, and safety.

The Options considered ranged from 'do nothing', modify existing structure to actual bridge widening; with or without a separate accompanying pedestrian bridge depending on scenario Option examined. Options that did not require any widening of the bridge sub-structure, yet satisfied prevailing criteria, were more economical solutions (estimated costs of $2M +/-) to provide adequate and safe measures for non-vehicle traffic at the bridge crossing. The underlying objective for extending Bass Pro Mills Drive from Highway

400 to Weston Road is to alleviate area traffic congestion, provide a direct east-west connection between Jane Street and Weston Road and to promote emerging area development; all at an economical cost. Solutions that entail a widening of the existing bridge would significantly increase project costs ($10M - $15M bridge widening/separate pedestrian structure) and have property impacts (north-east quadrant) to achieve the study objective, without providing any added benefit to functionality or safety.

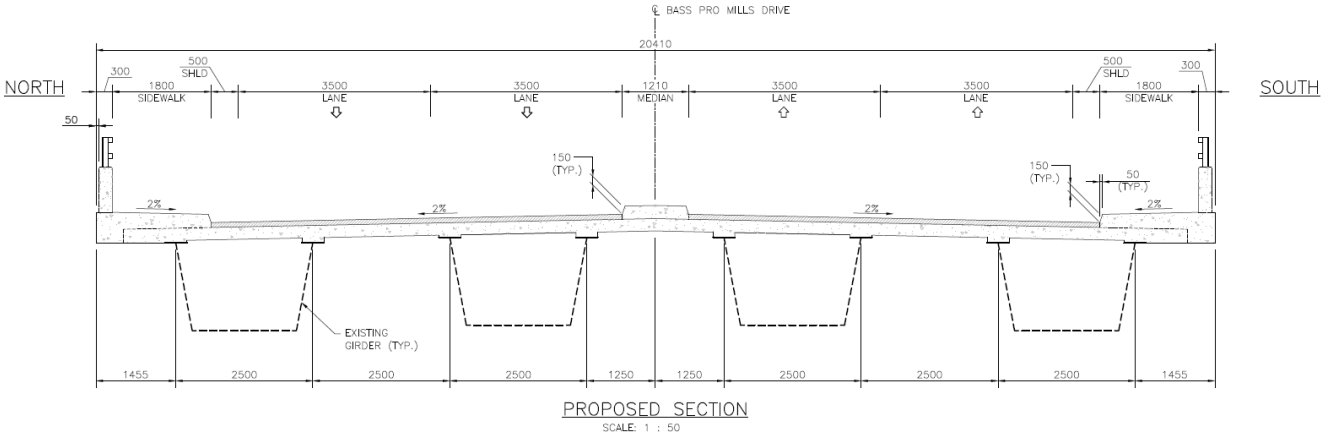
The study team also took into consideration timelines associated with MTO planning for the widening of Highway 400 to 10-lanes (with anticipated 2024-2026 construction period) and the Region of York planning for the improvement of Langstaff Road and Highway 400 interchange south of Bass Pro Mills Drive, the timing of which is unknown at this time.

4.7 RECOMMENDED OPTION

Following the evaluation of alternatives and considering feedback from MTO, the public and other stakeholders, the recommended Option is to avoid a widening of the Bass Pro Mills Drive structure over Highway 400. City Financial Planning and Capital Programming provides that the extension of Bass Pro Mills Drive to Weston Road proceeds to construction in 2027 and ideally in concert with the Region of York widening of Weston Road (this timeline is subject to City internal processes).

The recommended Option includes modifying the existing structure to provide a 1.8 m wide sidewalk on each side of the roadway, a 500 mm shoulder clearance, four vehicle lanes at 3.5 m wide each, and a raised 1.2 m centre median, as seen in Figure 4 below. These design modifications are based on a 60 km/hour design speed. The existing Bass Pro Mills Drive east of Highway 400 is posted for 50 km/hour.

Figure 4 Recommended Cross-Section for Bass Pro Mills Drive over Highway 400



Ministry Design and Contract Standards Office #2018-07 discusses incorporating cycling facilities into bridge rehabilitation projects within provincial highway rights-of-way. The recommended Option reflects the MTO policy statement and satisfies the criteria and permissiveness under MTO policy #2018-17, as indicated within **Table 1** below.

Table 1 Preferred Design Parameters vs. MTO Design and Contract Standard Criteria

	Sidewalk (m)	Lane Width (m)	Traffic Median	Railing Height (m)	Shoulder Width (m)
Minimum Required	1.8	3.5	1.2	1.37	0.5
Parameter Proposed	1.8	3.5	1.2	1.37	0.5
Standard/ Guideline/ Reference	AODA	MTO Design Supplement Exhibit 4-B	City Standard/MTO #2018-07	CHBDC	MTO Design Supplement Exhibit 4-U / TAC Table 4.10.1 (60 Design Speed)
Compliance	Yes	Yes	Yes	Yes	Yes

The EA Study will further recommend that signage be posted on the bridge advising cyclists to dismount before crossing the structure and that design criteria be further reviewed at the detail design stage with MTO and the City of Vaughan.

5.0 CONSTRUCTION COST

The approximate construction cost of the EA recommendation for the Highway 400 crossing is estimated to be in the range of $2,000,000. The breakdown of the major items is presented below within **Table 2**. Asphalt paving costs are included within the road construction cost estimate, while contingency is carried in the overall project cost estimate.

Table 2 Approximate Construction Cost

Item #	Item Description	Unit	Quantity	Unit Price ($)	Total Cost ($)
1	Removal of Existing Sidewalk	m^3	28	$ 3,000	$ 84,000
2	Removal of Existing Barriers	m	182	$ 3,000	$ 546,000
3	Concrete in Sidewalk	m^3	162	$ 2,000	$ 324,000
4	Waterproofing Membrane	m^2	1820	$ 90	$ 163,800
5	Combination Barrier	m	182	$ 4,000	$ 728,000
6	Construction Staging & Highway 400 Traffic Control	LS	1	$ 250,000	$ 250,000
				Approximate Cost Total:	**$2,095,800**

6.0 SUMMARY AND RECOMMENDATIONS

It is recommended that the existing Highway 400 bridge be modified to provide a 1.8 m wide sidewalk and 500 mm shoulder clearance on either side of the roadway, four 3.5 m wide vehicle lanes (2 lanes in each direction), a 1.2 m wide raised centre median, and that the design modifications be based on a 60 km/hr design and 50 km/hr posted speed limit. Signs will be posted at each end of the bridge showing that cyclists must dismount.

The condition assessment and structural evaluation of the existing bridge is not included in the current scope of work; however, it is recommended that during the detailed design stage the condition of the existing bridge should be inspected, and structural analysis should be performed to ensure the existing bridge has sufficient capacity to accommodate the proposed work.

Prepared by:

Karen Liu, P.Eng.

Senior Structural Engineer

Reviewed by:

Peter Cholewa, P.Eng.

Senior Project Manager