CLIENT: City of Mississauga/City of Brampton

PROJECT: Hurontario-Main St LRT Project Preliminary Design and TPAP

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REVISION INDEX

<table>
<thead>
<tr>
<th>Revision No.</th>
<th>Prepared Date</th>
<th>Reviewed Date</th>
<th>Approved Date</th>
<th>Pages Revised</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2014-03-20</td>
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<td>2014/03/20</td>
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EXECUTIVE SUMMARY

A number of existing structures are impacted by the proposed Hurontario-Main Street Light Rail Transit system (HMLRT). In addition, some new structures are proposed. SNC-Lavalin Inc. has completed an assessment of all existing structures in the LRT corridor, identified the new structures required, and provided recommendations for the structural work. The structure locations are shown in Figure E-1.

The proposed structural work is summarized as follows:

**GO Transit-Metrolinx Crossing (Port Credit GO Station):**

The HMLRT will be constructed just west of the existing Hurontario Street Subway at GO Transit-Metrolinx. In order to accommodate the LRT guideway, a new bridge will be constructed immediately west of the existing bridge. Retaining walls are required north and south of the new bridge.
Mary Fix Creek Crossing at Eaglewood Boulevard Extension:

As part of the roadway modifications for this project, Eaglewood Boulevard will be extended to Oriole Avenue (west of Hurontario Street). In addition, the existing bridge to the north which carries Inglewood Drive/Old River Road over the creek will be abandoned, and the existing pedestrian bridge to the south will be removed. A new bridge will carry the Eaglewood Boulevard Extension over the Mary Fix Creek.

Queen Elizabeth Way (QEW) Crossing:

The HMLRT will be constructed below the existing QEW Overpass of Hurontario Street. The northbound lanes of Hurontario Street will be relocated the east of the existing bridge. In order to accommodate the northbound lanes, a new bridge will be constructed.

Canadian Pacific (CP) Rail Crossing:

The HMLRT will be constructed in the median of Hurontario Street, with the northbound and southbound tracks on either side of the pier of the existing Hurontario Street Subway at CP Rail. No structural work is required in order to construct the HMLRT in this location.

Rathburn Road Crossing:

The HMLRT will be constructed in the median of Hurontario Street at this location. The existing Hurontario Street Overpass of Rathburn Road will be modified to carry the LRT guideway.

Cooksville Creek Crossing

The HMLRT will cross the Cooksville Creek in two locations: at an existing culvert below Hurontario Street and at a new crossing location west of Hurontario Street. No structural work is required to construct the HMLRT above the existing culvert. A new bridge will be constructed at the new crossing location.

Highway 403 Crossing:

The HMLRT will be constructed in the median of Hurontario Street at this location. The existing Highway 403 Underpass of Hurontario Street will be widened to the west in order to accommodate additional lanes along Hurontario Street.

Highway 401 Crossing:

The HMLRT will be constructed in the median of Hurontario Street at this location. The existing Highway 401 Underpass of Hurontario Street and Hurontario Street Overpass of Whittle Road will be modified to carry the LRT guideway.

Highway 407 Crossing:

The HMLRT will be constructed in the median of Hurontario Street at this location. The existing Highway 407 Underpass of Hurontario Street will be modified to carry the LRT guideway.
Etobicoke Creek Crossing (South):

The HMLRT will be constructed in the median of Main Street at this location. The superstructure of the existing Main Street Bridge over Etobicoke Creek (South) will be replaced.

Etobicoke Creek Crossing (North):

The HMLRT will be constructed in the median of Main Street at this location. The superstructure of the existing Main Street Bridge over Etobicoke Creek (North) will be replaced.

Canadian National (CN) Rail Crossing:

The HMLRT will be constructed along Hurontario Street, under the existing Main Street Subway at CN Rail. No structural work is required in order to construct the HMLRT in this location.
# Table of Contents

1.0  Introduction ................................................................................................ 1
2.0  Structure Locations ..................................................................................... 2
3.0  Reference Documents .................................................................................. 3
4.0  GO Transit-Metrolinx Crossing (Port Credit GO Station) ......................... 8
   4.1  Existing Structure....................................................................................... 8
   4.2  Existing Structure Condition and Remaining Life ....................................... 8
   4.3  Considered Alternatives and Recommendations (Bridge) ............................ 8
   4.4  Considered Alternatives and Recommendations (Retaining Walls) .......... 9
   4.5  Metrolinx Constraints................................................................................. 11
   4.6  Traffic and Construction Staging ............................................................... 12
   4.7  Utilities ..................................................................................................... 12
   4.8  Lighting ..................................................................................................... 12
5.0  Mary Fix Creek Crossing at Eaglewood Boulevard Extension ............... 13
   5.1  Existing Structures .................................................................................... 13
   5.2  Considered Alternatives and Recommendations ........................................ 13
   5.3  Environmental Constraints ...................................................................... 14
   5.4  Utilities ..................................................................................................... 14
   5.5  Lighting ..................................................................................................... 14
6.0  Queen Elizabeth Way (QEW) Crossing .................................................... 15
   6.1  Existing Structure....................................................................................... 15
   6.2  Existing Structure Condition and Remaining Life ....................................... 15
   6.3  Considered Alternatives and Recommendations ........................................ 15
   6.4  Traffic and Construction Staging ............................................................... 16
   6.5  Utilities ..................................................................................................... 16
   6.6  Lighting ..................................................................................................... 16
7.0  Canadian Pacific (CP) Rail Crossing ........................................................ 17
   7.1  Existing Structures .................................................................................... 17
   7.2  Existing Structure Condition and Remaining Life ....................................... 17
   7.3  Canadian Pacific (CP) Constraints .............................................................. 18
   7.4  Considered Alternatives and Recommendations ........................................ 18
8.0  Rathburn Road Crossing ........................................................................... 19
8.1 Existing Structure ........................................................................................................... 19
8.2 Existing Structure Condition and Remaining Life ......................................................... 20
8.3 Structural Evaluation ...................................................................................................... 20
8.4 Considered Alternatives and Recommendations ............................................................ 20
8.5 Utilities ........................................................................................................................... 20
8.6 Lighting .......................................................................................................................... 20

9.0 Cooksville Creek Crossing .............................................................................................. 21
9.1 Existing Structure .......................................................................................................... 21
9.2 Existing Structure Condition and Remaining Life .......................................................... 21
9.3 Considered Alternatives and Recommendations ............................................................ 21
9.4 Environmental Constraints ............................................................................................ 22
9.5 Utilities ........................................................................................................................... 22
9.6 Lighting .......................................................................................................................... 22

10.0 Highway 403 Crossing ................................................................................................... 23
10.1 Existing Structure .......................................................................................................... 23
10.2 Existing Structure Condition and Remaining Life .......................................................... 23
10.3 Structural Evaluation ...................................................................................................... 24
10.4 Considered Alternatives and Recommendations ............................................................ 24
10.5 Utilities ........................................................................................................................... 25
10.6 Lighting .......................................................................................................................... 25

11.0 Highway 401 Crossing ................................................................................................... 26
11.1 Existing Structures ......................................................................................................... 26
11.2 Existing Structure Condition and Remaining Life .......................................................... 26
11.3 Structural Evaluation ...................................................................................................... 26
11.4 Considered Alternatives and Recommendations ............................................................ 27
11.5 Utilities ........................................................................................................................... 27
11.6 Lighting .......................................................................................................................... 27

12.0 Highway 407 Crossing ................................................................................................... 28
12.1 Existing Structure .......................................................................................................... 28
12.2 Existing Structure Condition and Remaining Life .......................................................... 28
12.3 Structural Evaluation ...................................................................................................... 28
12.4 Considered Alternatives and Recommendations ............................................................ 28
12.5 Utilities ........................................................................................................................... 29
12.6 Lighting .......................................................................................................................... 29
13.0 Etobicoke Creek Crossing (South) ................................................................. 30
13.1 Existing Structure .......................................................................................... 30
13.2 Existing Structure Condition and Remaining Life ......................................... 30
13.3 Structural Evaluation ..................................................................................... 31
13.4 Considered Alternatives and Recommendations ........................................... 31
13.5 Environmental Constraints ......................................................................... 32
13.6 Utilities ........................................................................................................ 32
13.7 Lighting ....................................................................................................... 33

14.0 Etobicoke Creek Crossing (North) ................................................................. 34
14.1 Existing Structure .......................................................................................... 34
14.2 Existing Structure Condition and Remaining Life ......................................... 34
14.3 Structural Evaluation ..................................................................................... 35
14.4 Considered Alternatives and Recommendations ........................................... 35
14.5 Environmental Constraints ......................................................................... 36
14.6 Utilities ........................................................................................................ 37
14.7 Lighting ....................................................................................................... 37

15.0 Canadian National (CN) Rail Crossing ........................................................... 38
15.1 Existing Structure .......................................................................................... 38
15.2 Existing Structure Condition and Remaining Life ......................................... 38
15.3 Canadian National Railway (CNR) and Metrolinx Constraints ....................... 38
15.4 Considered Alternatives and Recommendations ........................................... 39

Appendix A: Drawings ......................................................................................... 40
Appendix B: Photographs ..................................................................................... 59
Appendix C: Memoranda ....................................................................................... 91
Appendix D: Highway 403 Crossing – Non-Preferred Alternatives ....................... 92
Appendix E: Comments on Previous Versions ..................................................... 107
Document Revision History ................................................................................. 108
1.0 Introduction

This report is hereby submitted in agreement with the Work Breakdown Structure (WBS) code 4.2.2.1 for the Hurontario-Main Street Light Rail Transit system (HMLRT) Preliminary Design and Transit Project Assessment Process (TPAP) project. SNC-Lavalin Inc. has completed the following:

- Inspection of all existing structures in the LRT corridor and assessment of their condition (completed in June 2012), including structural deficiencies, unsafe conditions and remaining service life.
- Identification of impacts due to proposed improvements, including conversion of the existing structures to carry LRT trains. Structural evaluations of the existing structures were carried out as required in accordance with Sections 14 and 15 of the Canadian Highway Bridge Design Code CAN/CSA-S6-06 (CHBDC). Aspects of the loading which are not covered by the CHBDC were taken from the TTC Design Manual. All evaluations were based on CHBDC Evaluation Level 1 transitory loads and the LRT vehicle loading shown in Figure 1-1.
- Recommendations on strengthening, rehabilitation, extension, replacement, etc.
- Identification of new structures required, including design and construction constraints, and preliminary General Arrangement drawings for the recommended design concepts.

Construction cost estimates for the work will be included in a separate Cost Estimate Report.

A key plan showing the structure locations is shown in Section 2. All available reference documents are listed in Section 3. Sections 4 through 13 include a discussion of the report's findings, categorized by structure location from south to north.

Figure 1-1 Light Rail Vehicle Loading
2.0 Structure Locations

Figure 2-1: Key Plan
3.0 Reference Documents

General

- Hurontario/Main Street Corridor Master Plan, prepared by MMM Group, dated October 2010.

GO Transit/Metrolinx Crossing (Port Credit GO Station)

Drawings:


Reports:

- Hydraulic Analysis of the Mary Fix Creek options for the Hurontario LRT, prepared by Bill Clarke, dated September 26, 2013.

Mary Fix Creek Crossing at Eaglewood Boulevard

Reports:

- Hydraulic Analysis of the Mary Fix Creek options for the Hurontario LRT, prepared by Bill Clarke, dated September 26, 2013.

Queen Elizabeth Way (QEW) Crossing

Drawings:


Reports:


CP Rail Crossing

Drawings:

• Bridge No. 15.26 Subway near Cooksville, Ont. (Hurontario St.) Drawings B-2-495 and B-1-1751, prepared by Canadian Pacific Railway, dated October 7, 1925 and October 15, 1925.

• Bridge 15.25 Galt Subdivision, The King’s Highway #10 Subway, Drawings B-1-2806 to B-1-2806-7 and RS-1-2806-1 to RS-1-2806-6, prepared by Canadian Pacific Railway, dated June 11, 1964.

• Hurontario/St. L & H Bridge Rehabilitation Drawings C-33210 to C-33216, Project No. 97-145, prepared by UMA Engineering Ltd., dated May 1997.


Reports:

• Biennial Bridge Inspection Report, SLH Rail over Hurontario Street Bridge (Site 022000), prepared by Engineered Management Systems Inc., dated October 17, 2011.

Rathburn Road Crossing

Drawings:

• Rathburn Road – Highway 10 Grade Separation Drawings C-17963 to C-17988, Project No. 78-122, prepared by Totten Sims Hubicki Associates Limited, dated February 1981.

• Bridge Rehabilitation Hurontario Street over Rathburn Road Drawings 8 to 24, Project No. A08-232, prepared by IBI Group, dated March 2010.

Reports:

• Detailed Condition Survey Report, Hurontario Street over Rathburn Road (Site 029001), prepared by Canada-Con. Inc., dated September 10, 2009.

• Bridge Condition Survey and Rehabilitation Report, Hurontario Street over Rathburn Road (Site 029001), prepared by IBI Group, dated December 2009.

Cooksville Creek Crossing

Drawings:

• Rathburn Road – Highway 10 Grade Separation Drawings C-17963 to C-17988, Project No. 78-122, prepared by Totten Sims Hubicki Associates Limited, dated February 1981.

Reports:

• Ontario Structure Inspection Manual – Inspection Form, Hurontario @ Cooksville Creek Culvert (Site 24-772/C), prepared by SNC-Lavalin Inc., dated December 5, 2012.

• Biennial Culvert Inspection Report, Rathburn Road East over Cooksville Creek Culvert (Site 028004), prepared by Engineered Management Systems Inc., dated October 5, 2011.

• Hydraulic Analysis of Proposed Culvert at Cooksville Creek Rathburn Road LRT Crossing, prepared by Bill Clarke, dated September 4, 2013.

Highway 403 Crossing

Drawings:

• Highway 10 Underpass (Bridge 41) Drawings 1 to 30, Contract No. 80-37, prepared by C.C. Parker & Associates Ltd., dated June 20, 1979.

• Cooksville Creek Culvert under Highway 403 General Layout, Contract No. 80-37, dated June 1979.

Reports:

• Detailed Condition Survey Reports, Hwy 403 Hurontario Street Underpass NBL & SBL (Site 24-322/1 and 24-322/2), prepared by SPL Consultants Limited, dated February 21, 2012.


• 403 Crossing Alternatives (v5), prepared by SNC-Lavalin Inc., dated November 25, 2012.

Highway 401 Crossing

Drawings:

• Hurontario Street South Access Road Drawings 1 to 18, Contract 2009-2031, prepared by MMM Group, dated July 2008 to March 2009.

• Hurontario Street IC Underpass Drawings 1 to 30, Contract No. 2009-2031, prepared by MMM Group, dated March to August 2009.
Highway 407 Crossing

Drawings:


Etobicoke Creek Crossing (South)

Drawings:

- Etobicoke Creek South Crossing (4.1 miles north of Hwy. 401) Drawings D5918-1, F4-8-24 to F4-8-27 and D5918-7 to D5918-14, Contract No. 67-115, prepared by Giffels Associates Limited, dated May 1966.

- Main Street South Bridge Repair over Etobicoke Creek Drawings G4-8-149 to G4-8-151, prepared by McCormick Rankin & Associates, dated July 1977.

- Main Street over Etobicoke Creek (Structure No. 251025 / 0.4km North of Bartley Bull Parkway) Drawings F4-8-118 to F4-8-122, Contract No. 2001-022, prepared by Planmac Inc., dated October 31, 2002.

Reports:

- Biennial Bridge Inspection Report, Main St. over Etobicoke Creek (South) Bridge, prepared by Engineered Management Systems Inc., dated November 8, 2011.


Etobicoke Creek Crossing (North)

Drawings:


- Main Street Bridge (North) over Etobicoke Creek Bridge Rehabilitation Drawings F4-0-1 to F4-0-4, Contract No. 2012-062, prepared by SRM Associates, dated July 24, 2012.

Reports:


CN Rail Crossing

Drawings:
- Reconstruction of Main Street Subway (Hwys #7 & #10) Drawings C-20484, C20486, C-20489, C-20490, C-20493, prepared by Canadian National Railways, dated September 17, 1963 and January 10, 1964.

- Reconstruction of Main Street Subway Drawings D1 to D8, D15, D16 and E1, Contract No. 1-9372, prepared by Dominion Bridge Company Limited, dated March 1964.
4.0 GO Transit-Metrolinx Crossing (Port Credit GO Station)

At this location the new HMLRT is proposed to be carried under the existing east-west GO Transit-Metrolinx corridor (formerly owned by Canadian National Railway) just west of the existing Hurontario Street Subway at GO Transit-Metrolinx. The railway at the crossing location is identified as Oakville Subdivision, Mileage 12.73.

4.1 Existing Structure

The existing bridge was constructed in 1963. It is a skewed single span reinforced concrete rigid frame structure with a clear span length of 20.015m. The skew angle of the bridge is 5°45'30" with the abutments parallel to the centreline of Hurontario Street. The bridge is founded on spread footings.

The 22.555m wide deck carries five railway tracks (three of which are currently in use) over Hurontario Street. The bridge was designed to carry Coopers E60 live loading.

No rehabilitation history is available for this bridge. The Hurontario/Main Street Corridor Master Plan has identified the existing bridge as a Built Heritage Resource.

4.2 Existing Structure Condition and Remaining Life

The bridge is generally in good to fair condition with the following defects noted:

- Deck soffit – Medium cracks and localized spalls with areas of rust and wet stains. Leakage of the longitudinal deck expansion joint was noted.
- Abutment walls – Narrow to medium cracks with areas of wet stains.

It is recommended that an investigation be undertaken in order to determine the condition of the top of concrete deck. The bridge has the following maintenance/rehabilitation needs at this time:

- Replace longitudinal expansion joint seal.
- Remove deteriorated concrete from deck soffit and repair with local concrete patches.

If the existing bridge is adequately maintained, its remaining service life is estimated to be about 50 years.

4.3 Considered Alternatives and Recommendations (Bridge)

A new bridge is required in order to carry the HMLRT system under the Metrolinx rail corridor. Two alternatives were considered:

Alternative 1:

This alternative includes replacement of the existing bridge with a new longer bridge which will carry the rail tracks over Hurontario Street and the proposed HMLRT. This alternative may have cultural heritage implications.
**Alternative 2:**

This alternative includes construction of a new bridge immediately west of the existing bridge. The existing retaining walls and soil to the west of the rigid frame structure will be removed to facilitate construction of the new bridge.

Construction of this bridge will require the soil behind the west abutment of the existing rigid frame bridge to be excavated. The construction of the new bridge will need to include measures to prevent any imbalanced earth loading on the existing rigid frame bridge. This may be accomplished by installing a bracing system on the west side of the bridge, installing tie-backs through the east abutment wall, or excavating and reinstating the soil behind the existing east and west abutment walls simultaneously. The new bridge will be designed such that when replacement of the existing bridge is required, it can be completed with minimal impact on the new bridge.

The cost and construction duration for this alternative is expected to be significantly lower than Alternative 1.

In order to minimize impact on cultural heritage, Alternative 2 is recommended. This alternative also has a lower cost and construction duration.

The new bridge will have a single span of 13.471m and will carry five railway tracks over the 7.0m LRT guideway, a 0.6m maintenance passage and a 5.15m sidewalk. The skew angle of the bridge will be 5°45’30” with the abutments parallel to the centreline of guideway. A minimum 4.7m vertical clearance from top of rail will be provided.

It is proposed to construct a concrete deck on precast prestressed concrete box girder bridge with conventional abutments. The use of precast girders is recommended in order to reduce construction duration. To facilitate construction of the abutments as close as possible to the existing bridge, drilled caisson foundations are recommended. Golder Associates has indicated that the abutments can be supported by one line of 900mm diameter caissons.

The overhead catenary wires may be suspended from the proposed bridge. In order to prevent stray currents from impacting the structure and causing safety risks, installation of insulated suspension mechanisms will be required.

A General Arrangement drawing for the recommended design concept is included in Appendix A.

### 4.4 Considered Alternatives and Recommendations (Retaining Walls)

To facilitate construction of the LRT guideway and Port Credit LRT stop, new retaining walls will be constructed to the west of the HMLRRT system from Park Street East to Eaglewood Boulevard. These walls will support the parking lot to the south of the rail corridor, a traction power substation (TPSS) to the north of the rail corridor, and an existing concrete channel which carries the Mary Fix Creek to the north of the rail corridor.

An additional requirement of the new retaining walls is that they retain the 100-year flood without overflow to Hurontario Street and the LRT guideway/stop. The existing earth berm
between the Mary Fix Creek and Hurontario Street will be partially removed in order to construct the LRT. As a result, the retaining wall will need to act as a flood control structure in some locations. The top of wall will be constructed 150mm above the 100-year flood level elevation, in accordance with hydraulic recommendations.

It is proposed to construct sets of stairs perpendicular to the retaining walls at the north and south sides of the proposed bridge. A wheelchair ramp which runs parallel to the retaining wall is required to the south of the bridge.

Three types of retaining walls were considered:

**Alternative 1: Reinforced Concrete Cantilever Retaining Wall on Shallow Foundations**

This type of retaining wall consists of an ‘L’ or inverted ‘T’ shaped cantilever retaining wall which has a vertical or inclined slab monolithic with a base slab.

Advantages of this alternative include:

- Durable
- Conventional construction
- Aesthetic relief features can be incorporated into the finished face
- Wheelchair ramp can be incorporated into retaining wall

Disadvantages of this alternative include:

- Construction of spread footings typically requires large excavation area
- Reasonably good foundation parameters are required
- Curing time is required before becoming effective

**Alternative 2: Retained Soil System (RSS) Wall**

This type of retaining wall consists of vertical wall panels or facing supported by anchored strips placed horizontally within the backfill behind the wall.

Advantages of this alternative include:

- RSS walls higher than 4m are often more economical than conventional retaining walls
- Relatively fast construction time
- Permits construction on weaker foundations
- Visually appealing

Disadvantages of this alternative include:

- Large excavation area behind wall is required
- Less durable than conventional retaining walls
Alternative 3: Soldier Pile Lagging Wall with Tie-Backs on Drilled Caisson Foundations

This type of retaining wall consists of steel H-piles with tie-backs anchored into the soil, supported by drilled caisson foundations. Precast concrete or wood lagging is placed between the H-piles and retains the soil. If timber lagging is used, a concrete facing wall is required.

Advantages of this alternative include:

- Minimal space behind wall required
- Aesthetic relief features can be incorporated into the concrete facing wall

Disadvantages of this alternative include:

- Higher cost
- Less durable than conventional retaining walls

The impact of the retaining wall construction on the adjacent Port Credit GO Station is considered to be a key criterion. In addition, it is preferable to avoid any removal and reconstruction of the existing Mary Fix Creek concrete channel for construction of the walls. Alternative 3 is considered to have the smallest construction footprint with minimal requirements for excavation behind the wall, and therefore the least impact on the GO Station and creek channel. It is recommended that Alternative 3 be applied for the full length of the wall.

A separate retaining wall in front of the main wall will be required to support the wheelchair ramp. An RSS wall is proposed at this location. Construction of this wall can be completed after excavation in front of the main retaining wall is completed.

General Arrangement drawings for the recommended design concept are included in Appendix A.

4.5 Metrolinx Constraints

Metrolinx has indicated that their operations on this rail line require the use of three tracks, and that GO Transit operations cannot be maintained on two tracks at this location without major service impacts.

A new crossing agreement will be required for this crossing. All works on, above or below Metrolinx property will need to be coordinated with railway operations and comply with the following Metrolinx requirements:

- Rules, policies, standards and procedures for working within the Metrolinx right-of-way;
- Liability insurance requirements for works performed on and/or in proximity to the railway or within railway right-of-way; and
- Safety and related requirements and instructions for work on railway right-of-way by non-Metrolinx personnel.
All works during prearranged work blocks under railway flagging protection have to be planned and carried out in a manner to leave the work zone at the end of work block in safe condition for railway traffic.

4.6 Traffic and Construction Staging

In order to satisfy Metrolinx’s constraints and maintain operations on three tracks during construction, it will be necessary to construct the bridge in three stages including temporary diversion of the tracks. It is anticipated that the adjacent GO Station will need to be modified to accommodate the temporary track diversion. All detours will be within the existing right-of-way.

The possibility of tunnelling under the existing tracks was investigated, and it was determined that the vertical profile of the LRT guideway would need to be significantly lowered, which is not feasible due to impacts on serviceability of the Port Credit LRT stop and the nearby intersections.

4.7 Utilities

An existing Bell Canada conduit runs diagonally through the location of the proposed retaining wall and to the west of the proposed bridge. This conduit will be relocated prior to construction of the bridge and retaining walls.

An existing guyed utility pole north of the rail corridor will be relocated nearby and anchored in the vicinity of the proposed retaining wall. The retaining wall design will need to account for anchorage of the guy wires either behind the retaining wall, or to the wall itself.

4.8 Lighting

Underpass lighting will be provided below the new bridge.
5.0 Mary Fix Creek Crossing at Eaglewood Boulevard Extension

At this location, it is proposed to extend Eaglewood Boulevard to Oriole Avenue (west of Hurontario Street). An existing concrete channel between Hurontario Street and Oriole Avenue carries the Mary Fix Creek from north to south. The proposed Eaglewood Boulevard Bridge over Mary Fix Creek will carry the Eaglewood Avenue extension over the creek.

5.1 Existing Structures

An existing bridge carries Inglewood Drive/Old River Road over the Mary Fix Creek approximately 60m north of the location for the proposed bridge (construction year unknown). It is a single span reinforced concrete rigid frame structure with a clear span length of approximately 9.14m. This bridge will be removed as part of the roadway modifications for this project. Hydraulic analysis indicates that this bridge will be overtopped and flooding of Hurontario Street will occur for the 100-year flood scenario.

There is an existing pedestrian bridge over the Mary Fix Creek, approximately 40m south of the location for the proposed bridge. This structure consists of a single concrete T-girder and was constructed in 1963. This bridge will be removed as part of the roadway modifications for this project.

5.2 Considered Alternatives and Recommendations

In accordance with recommendations from the hydrology study completed as part of this project, the clear span of the new bridge will be 11.2m and the existing trapezoidal concrete channel will transition to rectangular at the bridge location. The flood levels will be improved from the existing condition; however, the 100-year flood level will be above the soffit elevation for the new bridge. It is not considered feasible to raise the Eaglewood Blvd. profile by the amount required to provide clearance for the 100-year flood.

The hydrology report also recommends that a flood control structure on the east side of the Mary Fix Creek be installed north and south of the bridge, in order to eliminate overflow to Hurontario Street. It is proposed to design the new retaining walls to act as flood control structures, with the top of wall 150mm above the 100-year flood elevation. This is also discussed in Section 4 of this report in relation to the retaining walls near the GO Transit/Metrolinx Crossing and Port Credit LRT stop. Raising the profile of Oriole Avenue at the bridge location is also recommended by the hydraulic report, in order to prevent flooding of Hurontario Street.

The new bridge will carry two lanes of Eaglewood Boulevard and two sidewalks over the Mary Fix Creek as a replacement access to Inglewood Drive and Old River Road. It is proposed to construct a precast reinforced concrete rigid frame culvert structure on cast-in-place reinforced concrete spread footings. This type of bridge is ideal for this location and span length, and will minimize the construction cost and duration.

A General Arrangement drawing for the recommended design concept is included in Appendix A.
5.3 Environmental Constraints

The proposed construction works are within a regulated area under the jurisdiction of Credit Valley Conservation (CVC) and will require regulatory review by the CVC and a permit under Ontario Regulation 160/06 (Work Permit for Development, Interference with Wetlands, Alternations to Shorelines and Watercourses).

All work shall abide by conditions approval from the above noted regulatory authorities. Key mitigation and protection measures anticipated include:

- Installation of debris collection system to prevent any debris or release of waste water effluent/slurry from concrete cutting from entering the watercourse;
- Completion of all works in the dry, using temporary cofferdam system to isolate the work zone from the watercourse if necessary; and
- Implementation of tree protection measures (fencing, hoarding, etc.) during construction.

The requirements of the Navigable Waters Protection Act do not apply to the Mary Fix Creek.

5.4 Utilities

The existing utilities in the area will not be impacted by construction of the proposed bridge.

5.5 Lighting

No lighting systems are proposed to be installed on the bridge. Sufficient lighting of the bridge deck is provided by the existing lights adjacent to the proposed bridge.
6.0 Queen Elizabeth Way (QEW) Crossing

At this location the new HMLRT is proposed to be carried under the Queen Elizabeth Way (QEW) on the east side of the existing Hurontario Street, under the existing QEW Overpass of Hurontario Street. The northbound lanes of Hurontario Street will be relocated to a new overpass east of the existing bridge.

6.1 Existing Structure

The existing bridge was constructed in 1961. It is a skewed single span concrete slab on prestressed concrete box girder bridge with a span length of 27.054m. The skew angle of the bridge is 6°13’15” with the abutments parallel to the centreline of Hurontario Street. The substructure consists of semi-integral abutments founded on spread footings.

The bridge was rehabilitated in 2007 including superstructure replacement and removal and patch repair of deteriorated concrete in substructure.

The 45.299m wide deck carries three eastbound and three westbound lanes of QEW traffic and an eastbound on-ramp lane over Hurontario Street. The superstructure built in 2007 was not built to the full width of the original abutments, leaving the north portion of the abutment walls overbuilt. Based on the 2007 rehabilitation drawings, the minimum vertical clearance is 5.035m.

6.2 Existing Structure Condition and Remaining Life

The bridge is generally in good condition with the following defects noted:

- Abutment walls – Narrow map cracks noted with a small localized spall on east abutment wall.
- Retaining walls – Localized spalls.

The bridge has the following maintenance/rehabilitation needs at this time:

- Remove deteriorated concrete from east abutment wall and retaining walls and repair with local concrete patches.

If the existing bridge is adequately maintained, its remaining service life is estimated to be about 70 years.

6.3 Considered Alternatives and Recommendations

The QEW Overpass of Hurontario St (NB) will be constructed to the east of the existing bridge. The bridge will have a span of 17.624m and will carry the QEW lanes over two northbound through lanes of Hurontario Street and a left turn lane, as well as a multi-use trail. The skew angle of the bridge will be 6°13’15” with the abutments parallel to the centreline of Hurontario Street (NB). A minimum 5.0m vertical clearance will be provided.

It is proposed to construct a concrete deck on CPCI girder bridge with integral abutments. The use of precast girders is recommended in order to reduce construction duration. The
widths of abutments and superstructure will be constructed to match the existing. This will allow for the provision of future widening of the QEW.

The east wingwalls of the existing bridge will need to be modified in order to facilitate construction of the new bridge. No other modifications to the existing bridge are proposed. The existing minimum vertical clearance is sufficient to accommodate the LRT guideway.

The LRT guideway will be constructed under the existing bridge. In this configuration, the overhead catenary wires may be suspended from the existing bridge. In order to prevent stray currents from impacting the structure and causing safety risks, installation of insulated suspension mechanisms will be required.

A General Arrangement drawing for the recommended design concept is included in Appendix A.

6.4 Traffic and Construction Staging

The new bridge will be constructed to the east of the existing bridge. In order to construct a bridge at this location while maintaining QEW traffic, it will be necessary to construct the bridge in three stages. A preliminary traffic staging scheme is included in Appendix A.

The possibility of installing a bridge under the QEW by jacked box tunnelling was investigated. It was determined that in order to implement this scheme, the vertical profile of the proposed roadway would need to be significantly lowered at the bridge location, which would have a detrimental impact on drainage including the requirement for installation of a permanent pumping system.

6.5 Utilities

Construction of the new bridge will require the relocation of a CCTV pole and cabinet located at the south side of the QEW (part of MTO’s COMPASS system).

6.6 Lighting

Underpass lighting will be provided below the new bridge.
7.0 Canadian Pacific (CP) Rail Crossing

At this location the new HMLRT is proposed to be carried under the existing east-west Canadian Pacific corridor (formerly owned by St. Lawrence and Hudson Railway) in the median of Hurontario Street, with the northbound and southbound tracks on either side of the pier of the existing Hurontario Street Subway at CP Rail. The railway at the crossing location is identified as Galt Subdivision, Mileage 15.25.

7.1 Existing Structures

The existing bridge was constructed in 1925 as a single span concrete slab on steel girder bridge with a span length of approximately 14.542m. In 1964, the bridge was extended including construction of a new span of approximately 13.106m to the east to accommodate widening of Hurontario Street. As part of this construction, the original east abutment was converted to a pier and a new abutment was constructed at the east end.

The bridge was rehabilitated in 1997 including cleaning and coating of structural steel, repair of expansion joints, refacing of piers, removal and patch repair of deteriorated concrete in abutments and wingwalls, application of concrete sealer to abutments and wingwalls, and replacement of steel railings. Also in 1997, pedestrian underpasses were constructed behind the east and west abutments of the existing bridge. These structures are concrete closed box rigid frame structures.

The bridge carries two railway tracks over Hurontario Street. Each track is supported by a concrete slab and floor beams built between two steel girders. The existing minimum vertical clearance adjacent to the median barrier is estimated to be approximately 4.56m.

7.2 Existing Structure Condition and Remaining Life

The overall condition of the original bridge was found to be good to fair. The abutments and pier exhibit typical map cracking and rust staining. The two pedestrian underpasses were found in good condition with some loose and missing wall finishing tiles.

The bridge is generally in good to fair condition with the following defects noted:

- Abutment walls – Typical map cracking and rust stains.
- Piers – Typical map cracking and rust stains.

It is recommended that an investigation be undertaken in order to determine the condition of the top of concrete deck.

The pedestrian underpasses are generally in good condition with the following defects noted:

- Walls – Some sections of the tiles are missing.

Maintenance needs for the pedestrian underpasses include replacement of the missing tiles.

If the bridge and pedestrian underpasses are adequately maintained, their remaining service lives are estimated to be about 25 and 85 years, respectively.
7.3 Canadian Pacific (CP) Constraints

A new crossing agreement will be required for this crossing. All works on, above or below CP property will need to be coordinated with railway operations and comply with the following CP requirements:

- Rules, policies, standards and procedures for working within the CP right-of-way;
- Liability insurance requirements for works performed on and/or in proximity to the railway or within railway right-of-way; and
- Safety and related requirements and instructions for work on railway right-of-way by non-CP personnel.

All works during prearranged work blocks under railway flagging protection have to be planned and carried out in a manner to leave the work zone at the end of work block in safe condition for railway traffic.

7.4 Considered Alternatives and Recommendations

No modifications to the existing bridge or pedestrian underpasses are proposed. The LRT profile below the bridge may need to be slightly lower than the existing pavement surface in order to provide the minimum vertical clearance of 4.7m for the LRT guideway. If the grade is lowered at the pier location, it may be necessary to provide additional frost protection (e.g. insulation). Underpinning of the structure foundations is not anticipated to be necessary based on the existing level of frost protection and the modifications proposed.

The overhead catenary wires may be suspended from the bridge at this location. In order to prevent stray currents from impacting the structure and causing safety risks, installation of insulated suspension mechanisms will be required.
8.0 Rathburn Road Crossing

In order to service downtown Mississauga, a loop around the Square One Shopping Centre is proposed. Several alignment configurations were considered for this loop and the crossing of Highway 403. The preferred alignment runs along Burnhamthorpe Rd. West, Duke of York Blvd., and Rathburn Rd. West and rejoins the Hurontario St. LRT alignment between Rathburn Road and Highway 403. Figure 8-1 shows the locations of the structures impacted by this work.

This section describes the Hurontario Street Overpass of Rathburn Road, which will be modified to carry the LRT guideway in the median of Hurontario Street. The other structures shown above are described in subsequent sections.

8.1 Existing Structure

The existing Hurontario Street Overpass at Rathburn Road was constructed in 1981. It is a skewed two span twin post-tensioned solid concrete slab bridge with span lengths of 19.294m. The skew angle of the bridge is 7°28’20” with the abutments and pier parallel to the centreline of Rathburn Road. The substructure consists of semi-integral abutments and pier columns which are integral with the deck, founded on spread footings.

The twin 18.623m wide decks carry four northbound and three southbound lanes of Hurontario Street and two sidewalks over Rathburn Road.
The bridge was rehabilitated in 2010 including removal of existing asphalt and waterproofing, removal and patch repair of deteriorated concrete, semi-integral abutment conversion, replacement of parapet walls and placement of new asphalt and waterproofing system. In 2011, a hanger system was installed along the east face of the bridge to support a duct bank carrying a number of Bell Canada fibre optic cables.

8.2 Existing Structure Condition and Remaining Life

The bridge is generally in good condition with the following defects noted:

- Abutment walls – Few medium vertical cracks were noted on both abutment walls with some localized spalls near the west end of the south abutment wall.

The bridge has the following maintenance/rehabilitation needs at this time:

- Remove deteriorated concrete from south abutment wall and repair with local concrete patches.

If the existing bridge is adequately maintained, its remaining service life is estimated to be about 45 years.

8.3 Structural Evaluation

A structural evaluation of the bridge was carried out in accordance with Sections 14 and 15 of the Canadian Highway Bridge Design Code CAN/CSA-S6-06 (CHBDC). Aspects of the loading which are not covered by the CHBDC were taken from the TTC Design Manual. The evaluation was based on CHBDC Evaluation Level 1 transitory loads and the LRT vehicle loading shown in Section 1.0.

The results of this evaluation indicate that the existing bridge is able to carry the proposed LRT train loading as well as the associated additional dead load without strengthening.

8.4 Considered Alternatives and Recommendations

It is proposed to modify the existing bridge to carry the LRT guideway in the median of Hurontario Street. This will include removal of existing asphalt and concrete median, installation of rails and rail expansion joints, and construction of a concrete platform. A General Arrangement drawing for the recommended design concept is included in Appendix A.

8.5 Utilities

The proposed modifications to the structure do not impact the existing utilities in the area.

8.6 Lighting

The modifications to the structure described above do not impact the lighting in the area.
9.0 **Cooksville Creek Crossing**

The proposed HMLRT alignment crosses the Cooksville Creek in two locations, as shown in Figure 8-1: at an existing culvert and at a new crossing location west of Hurontario Street.

9.1 **Existing Structure**

The existing Hurontario Street Culvert over Cooksville Creek is a two-cell rigid frame closed box concrete culvert. Each cell is 5.5m width x 2.7m height and the culvert length is 209.15m (original length of 189.65m + extension of 19.5m). It carries the Cooksville Creek under Hurontario Street and Rathburn Road from northwest to southeast.

The culvert was extended at the northwest end in 1988 to facilitate construction of a ramp from Hurontario Street southbound to Rathburn Road westbound.

9.2 **Existing Structure Condition and Remaining Life**

The culvert is generally in good condition with the following defects noted:

- **Barrel** – Several narrow to medium stained cracks on soffit and walls. Leakage noted on soffit and walls at construction joints.

The following maintenance is recommended for this culvert:

- **Seal leaking cracks and joints.**

If the culvert is adequately maintained, its remaining service life is estimated to be about 45 years.

9.3 **Considered Alternatives and Recommendations**

No modifications to the existing Hurontario Street Culvert over Cooksville Creek are necessary. The loading on the culvert is not expected to increase as a result of the proposed work.

A new structure is proposed at the new creek crossing location between City Centre Drive and Hurontario Street. Due to environmental considerations, this structure is required to span the flood plain of the Cooksville Creek. The span length of this structure will be 23.000m and the skew angle will be 30°. The structure will carry the northbound and southbound LRT tracks, which will be ballasted at this location.

It is proposed to construct a concrete deck on CPCI girder bridge with conventional abutments founded on spread footings. The abutment footings can be founded on bedrock outside of the existing Cooksville Creek stream bed.

A General Arrangement drawing for the recommended design concept is included in Appendix A.
9.4 Environmental Constraints

The proposed construction works are within a regulated area under the jurisdiction of Credit Valley Conservation (CVC) and will require regulatory review by the CVC and a permit under Ontario Regulation 160/06 (Work Permit for Development, Interference with Wetlands, Alternations to Shorelines and Watercourses). CVC has indicated that the new bridge will need to span the Cooksville Creek flood plain, and that a culvert is not acceptable for this crossing.

All work shall abide by conditions approval from the above noted regulatory authorities. Key mitigation and protection measures anticipated include:

- Completion of all in-water works (if necessary) within the warmwater construction timing window of July 1 to March 31;
- Completion of all works in the dry, using temporary cofferdam system to isolate the work zone from the watercourse if necessary; and
- Implementation of tree protection measures (fencing, hoarding, etc.) during construction.

The requirements of the Navigable Waters Protection Act do not apply to the Cooksville Creek.

9.5 Utilities

The existing utilities in the area will not be impacted by construction of the proposed culvert.

9.6 Lighting

No lighting systems are proposed to be installed on the culvert.
10.0 Highway 403 Crossing

At the Highway 403 Crossing, the LRT guideway will be constructed in the median of Hurontario Street on the existing underpass bridge, which will be widened to the west in order to accommodate additional lanes along Hurontario Street.

10.1 Existing Structure

The existing Highway 403 Underpass at Hurontario Street was constructed in 1980. It is a skewed two span twin post-tensioned voided concrete slab bridge with span lengths of 35.052m. The skew angle is 7°19'04” with the abutments and pier parallel to the centreline of Highway 403. The substructure consists of conventional abutments and pier columns which are integral with the deck, founded on spread footings.

The twin 14.910m wide decks carry three northbound and southbound lanes of Hurontario Street and two sidewalks over Highway 403.

No rehabilitation history is available for this bridge.

10.2 Existing Structure Condition and Remaining Life

The bridge is generally in good condition with the following defects noted:

- Asphalt wearing surface – Medium to severe cracks along paving joints and concrete end dams.
- Expansion joints – Both expansion joints are damaged and exhibit signs of leakage on abutment walls.
- Deck soffit – Localized areas of delamination and spalls noted on the north span deck soffit with wet stained longitudinal cracks at void locations.
- Abutment walls – Medium vertical cracks.

A bridge deck condition survey completed in 2011 by SPL Consultants Ltd. indicates that the top of concrete deck is in good condition.

The bridge has the following maintenance/rehabilitation needs at this time:

- Remove asphalt, waterproofing and deteriorated concrete from the deck surface. Repair with local concrete patches, waterproof and pave the deck.
- Remove ballast walls, approach slabs and deteriorated concrete at deck ends. Construct semi-integral abutment detail with new approach slabs.
- Replace seal in longitudinal joint between slabs.
- Remove deteriorated concrete from exposed concrete surfaces and repair with local concrete patches.

If the existing bridge is adequately maintained, its remaining service life is estimated to be about 45 years.
10.3 Structural Evaluation

A structural evaluation of the southbound bridge was carried out in accordance with Sections 14 and 15 of the Canadian Highway Bridge Design Code CAN/CSA-S6-06 (CHBDC). Aspects of the loading which are not covered by the CHBDC were taken from the TTC Design Manual. The evaluation was based on CHBDC Evaluation Level 1 transitory loads and the LRT vehicle loading shown in Section 1.0.

The results of this evaluation indicate that the existing southbound bridge is able to carry the proposed LRT train loading as well as the additional dead load, as long as the laminated elastomeric bearings at abutments are replaced with larger bearings. Also, the LRT platform will need to be constructed with lightweight material in order to minimize the amount of dead load added to the structure (see below for discussion).

10.4 Considered Alternatives and Recommendations

Several alternatives for the HMLRT alignment at this location have been considered. The preferred alternative is described in this section. All other alternatives considered are included in Appendix D.

It is proposed to construct both LRT tracks on the existing southbound structure and to widen the bridge to the west in order to provide an expanded cross-section. VISSIM traffic modelling indicates that in order to meet current and future traffic demand, 4 southbound lanes and 3 northbound lanes are required at the bridge location. Immediately south of the bridge, the additional southbound lane will exit to the ramp to Highway 403 Eastbound.

The proposed design includes construction of the widening structure to the west of the existing southbound bridge. Consistent with the existing structures, the widening structure will have two spans of 35.052m and a skew angle of 7°19'04” relative to the centreline of Highway 403. The new structure will be approximately 11.5m wide and will carry a portion of the southbound traffic, a 2.0m bike lane and a 2.0m sidewalk. The existing minimum vertical clearance of 4.8m will be maintained.

It is proposed to construct a prestressed box girder structure with a reinforced concrete distribution slab. The prestressed box girders can also be post-tensioned if required. The new widening structure can be stitched together with the existing southbound bridge using a closure pour after a suitable amount of time for the new structure to develop the majority of the time-dependent prestress losses. A General Arrangement drawing for the recommended design concept is included in Appendix A.

In order to maintain vertical clearance, it is proposed to construct a concrete overlay on the existing southbound bridge and to reduce the crossfall for the southbound lanes from 2% to 1%. These measures will slightly raise the level of the roadway. Further investigation of the roadway geometry indicates that the longitudinal slope on the bridge varies from 0.8% at the north end to 1.5% at the south end. This results in an effective combined drainage slope of 1.3% at the north end increasing to 1.8% at the south end.

When the proposed widening is completed, the existing southbound bridge will carry two LRT tracks and 2 lanes of roadway traffic, in addition to the proposed concrete overlay. This represents an increase in the loading from the original design condition. In order to
minimize this increase, lightweight material is required for infill between the rails. FRP panels are proposed for this application. Before bolting down the FRP panels, the concrete deck would be waterproofed using a methylmethacrylate (MMA) system. Once the system is in place, the panels can be easily removed for inspection of the waterproofing layer and deck top. This system will be provided with an anti-slip surface and will provide a driveable surface for emergency vehicles. A preliminary design detail showing this concept is provided in Appendix A.

MTO has plans to rehabilitate this structure starting in 2014. There is potential for this work to conflict with the HMLRT construction. Given the uncertainty of the HMLRT timeline, we have considered two scenarios for the bridge work:

1. Rehabilitation of the bridge is completed as per MTO’s schedule, before commencement of the LRT construction.

2. The bridge rehabilitation is completed concurrently with the LRT construction.

Scenario #2 would minimize temporary traffic impact and reduce the overall cost of the structural work. However, in order to maintain flexibility in the HMLRT schedule, both scenarios must be considered at this time.

10.5 Utilities

Consideration should be given to relocating the utilities embedded in the east sidewalk, prior to rehabilitation and widening of the bridge.

10.6 Lighting

Street lighting and underpass lighting is required for the bridge widening.
11.0 Highway 401 Crossing

At this location the new HMLRT is proposed to be carried over Highway 401 in the median of Hurontario Street.

11.1 Existing Structures

The existing interchange was reconfigured in 2011, including replacement of the Hurontario Street Underpass at Highway 401 and construction of the Hurontario Street Overpass of Whittle Road.

Highway 401 Underpass of Hurontario Street

The bridge is a skewed three span concrete slab on steel box girder bridge with span lengths of 37.000m, 51.040m and 37.460m from north to south. The skew angle of the bridge is 16°06’54” with the abutments and piers parallel to the centreline of Highway 401. The substructure consists of pier columns founded on caisson foundations and integral abutments.

The 40.500m wide deck carries four northbound and southbound lanes of Hurontario Street and two sidewalks over Highway 401.

The bridge was designed for the future provision of an LRT guideway: a 250mm deep mass concrete infill section has been constructed at the median (approx. 10m width) and overlain with asphalt.

Hurontario Street Overpass of Whittle Road

The bridge is a skewed single span reinforced concrete rigid frame bridge with a clear span length of 11.500m. The skew angle of the bridge is 27°21’48” at the west edge and 2°31’02” at the east edge. The bridge is founded on spread footings.

The deck (which varies in width) carries three northbound and southbound lanes of Hurontario Street and two sidewalks over the Highway 401 eastbound ramp to Whittle Road.

11.2 Existing Structure Condition and Remaining Life

Both bridges are in excellent condition with no defects noted. If the bridges are adequately maintained, their remaining service lives are estimated to be about 75 years.

11.3 Structural Evaluation

A structural evaluation of both bridges was carried out in accordance with Sections 14 and 15 of the Canadian Highway Bridge Design Code CAN/CSA-S6-06 (CHBDC). Aspects of the loading which are not covered by the CHBDC were taken from the TTC Design Manual. The evaluation was based on CHBDC Evaluation Level 1 transitory loads and the LRT vehicle loading shown in Section 1.0.
The results of this evaluation indicate that the existing bridges are able to carry the proposed LRT train loading as well as the associated additional dead load without strengthening.

11.4 Considered Alternatives and Recommendations

It is proposed to modify both of the existing bridges to carry the LRT guideway in the median of Hurontario Street.

Modifications to the Hurontario Street Overpass of Whittle Road include removal of the existing 300mm pavement structure and median curbs; installation of rails; and construction of a concrete platform.

At the Highway 401 Underpass of Hurontario Street, the guideway will be constructed within the existing mass concrete infill section. Modifications to the bridge include removal of existing asphalt, concrete median and mass concrete infill; installation of rails; and construction of a concrete platform.

It is also recommended that the parapet wall height be raised to satisfy bicycle height requirements at both bridges. The existing single tube railing is proposed to be replaced with a taller railing.

General Arrangement drawings for the recommended design concept for both bridges are included in Appendix A.

11.5 Utilities

The proposed modifications to the structures do not impact the existing utilities in the area.

11.6 Lighting

The modifications to the structure described above do not impact the lighting in the area.
12.0 Highway 407 Crossing

At this location the new HMLRT is proposed to be carried over Highway 407 in the median of Hurontario Street.

12.1 Existing Structure

The existing Highway 407 Underpass of Hurontario Street was constructed in 1996. It is a skewed two span concrete slab on prestressed concrete girder bridge with span lengths of 42.000m. The skew angle of the bridge is 2°24'53.5" (relative to the centreline of Hurontario Street) with the abutments and pier parallel to the centreline of Highway 407. The substructure consists of piers founded on piled foundations and integral abutments.

The 33.395m wide deck carries three northbound and southbound lanes of Hurontario Street and two sidewalks over Highway 407.

12.2 Existing Structure Condition and Remaining Life

The bridge is generally in good condition with the following defects noted:

- Retaining walls – Minor outward rotation of the reinforced earth retaining walls at the corners of the bridge was noted

If the existing bridge is adequately maintained, its remaining service life is estimated to be about 60 years.

12.3 Structural Evaluation

A structural evaluation of the bridge was carried out in accordance with Sections 14 and 15 of the Canadian Highway Bridge Design Code CAN/CSA-S6-06 (CHBDC). Aspects of the loading which are not covered by the CHBDC were taken from the TTC Design Manual. The evaluation was based on CHBDC Evaluation Level 1 transitory loads and the LRT vehicle loading shown in Section 1.0.

Initially, this evaluation assumed that concrete would be used as the infill material between rails. The results of this evaluation indicated that the negative moment capacity of the girders below the LRT guideway would be exceeded, and that the elastomeric bearings at piers would be overstressed. Strengthening would be required in this configuration.

In order to avoid these issues and eliminate any requirement for strengthening, lightweight material (e.g. FRP panels) is proposed for infill between the rails. The evaluation was completed assuming the lightweight material would be used instead of concrete, and results indicated that the existing bridge is able to carry the proposed LRT train loading as well as the additional dead load without strengthening (see below for further discussion).

12.4 Considered Alternatives and Recommendations

It is proposed to modify the existing bridge to carry the LRT guideway in the median of Hurontario Street. This will include removal of existing asphalt and concrete median, installation of rails and rail expansion joints, and construction of a concrete platform. The
existing bridge will also be widened in order to maintain three northbound and southbound lanes of Hurontario Street, and a 3.0m sidewalk on both sides of the bridge. The recommended design concept for the widening includes removal of the existing barrier walls, sidewalks and deck cantilevers. Construction of the deck widening will include one new prestressed concrete girder on both sides of the bridge. The existing substructure will also need to be widened; it is anticipated that the widening will be similar to the existing structure (piers founded on piled foundations and integral abutments). A General Arrangement drawing for the recommended design concept is included in Appendix A.

As described in Section 12.3, lightweight material is required for infill between the rails. FRP panels are proposed for this application. Before bolting down the FRP panels, the concrete deck would be waterproofed using a methylmethacrylate (MMA) system. Once the system is in place, the panels can be easily removed for inspection of the waterproofing layer and deck top. This system will be provided with an anti-slip surface and will provide a driveable surface for emergency vehicles. A preliminary design detail showing this concept is provided in Appendix A.

12.5 Utilities

The existing buried Bell Canada and Rogers cables to the east and west of the bridge may need to be protected and/or relocated prior to construction of the bridge widening.

12.6 Lighting

The existing street lighting poles mounted on the bridge will be removed and a new street lighting system will be installed on the widened structure. The existing underpass lighting may also need to be modified to maintain lighting below the bridge.
13.0 Etobicoke Creek Crossing (South)

At this location the new HMLRT is proposed to be carried over the Etobicoke Creek in the median of Main Street.

13.1 Existing Structure

The existing Main Street Bridge over Etobicoke Creek (South) was constructed in 1967. It is a skewed single span concrete slab on prestressed concrete girder bridge with a span length of 25.013m. The skew angle of the bridge is 15°00'00" (relative to the centreline of Main Street). The substructure consists of conventional abutments founded on spread footings.

The deck (which varies in width) carries three northbound and two southbound lanes of Main Street and two sidewalks over the Etobicoke Creek. A pathway has been constructed under the bridge adjacent to the north abutment. The Etobicoke Creek flows from west to east at this location and is considered a sensitive fish habitat.

The bridge was rehabilitated in 1977 including removal and patch repair of deteriorated concrete, replacement of expansion joints and placement of new asphalt and waterproofing system.

The bridge was also rehabilitated in 2002 including removal of existing asphalt and waterproofing, removal and patch repair of deteriorated concrete, replacement of parapet walls and placement of new concrete overlay, asphalt and waterproofing system.

13.2 Existing Structure Condition and Remaining Life

In addition to the inspection completed in June 2012, this bridge was inspected in May 2013 with a focus on the condition of the substructure (including substructure delamination survey). The bridge is generally in good to fair condition with the following defects noted:

- Asphalt wearing surface – Medium longitudinal cracks.
- Expansion joints – the expansion joints appear to have been paved over and are leaking.
- Deck soffit – Narrow cracks with few areas of leakage noted.
- Abutment walls – Localized areas of delamination (mainly near the west end of the north abutment wall and the east end of the south abutment wall), including delamination of areas previously patch repaired. Narrow to medium vertical cracks.
- Ballast walls – Concrete patch repair work on north ballast wall is delaminated.

The bridge has the following maintenance/rehabilitation needs at this time:

- Remove asphalt, waterproofing and deteriorated concrete from the deck surface. Repair with local concrete patches, waterproof and pave the deck.
- Replace expansion joints.
- Remove deteriorated concrete and repair with local concrete patches.
If the existing bridge is adequately maintained, its remaining service life is estimated to be about 25 years.

13.3 Structural Evaluation

A structural evaluation of the bridge was carried out in accordance with Sections 14 and 15 of the Canadian Highway Bridge Design Code CAN/CSA-S6-06 (CHBDC). Aspects of the loading which are not covered by the CHBDC were taken from the TTC Design Manual. The evaluation was based on CHBDC Evaluation Level 1 transitory loads and the LRT vehicle loading shown in Section 1.0.

The results of this evaluation indicate that the existing bridge is able to carry the proposed LRT train loading as well as the associated additional dead load without strengthening. The calculated soil loadings are within the preliminary allowable foundation parameters provided by Golder Associates.

13.4 Considered Alternatives and Recommendations

Two alternatives were considered:

Alternative 1:

This alternative includes rehabilitation of the existing bridge to carry the LRT guideway in the median of Main Street. This will include removal of existing asphalt and concrete median, installation of rails and rail expansion joints, and construction of a concrete platform.

Alternative 2:

This alternative includes complete removal of the existing deck and girders, and construction of a new concrete slab on prestressed concrete girders on the existing abutments. In order to suit the new superstructure and extend the service life of the substructure, it is recommended to rehabilitate the abutments including removal and reconstruction of the top portions, and convert them to a semi-integral configuration which will eliminate the expansion joints and reduce future maintenance costs. This rehabilitation and modification of the substructure is required in order to achieve a remaining service life of 75 years and compatibility with the proposed superstructure.

The cost and construction duration for this alternative is expected to be higher than Alternative 1 and lower than Alternative 3. This alternative will extend the service life of the bridge by approximately 75 years.

Alternative 3:

This alternative includes complete replacement of the existing bridge, including substructures and foundations. This will require excavation in the stream bed of the Etobicoke Creek.

The cost and construction duration for this alternative is expected to be higher than Alternatives 1 and 2. The new bridge will have a service life of approximately 75 years.
In order to provide a long-term solution to the transit needs along Main Street, it is recommended that Alternative 1 be eliminated. While this alternative has a lower initial construction cost and traffic impact, replacement of the existing bridge in 25 years will be much more costly and disruptive to the transportation corridor, since the LRT system will be running and would have to be temporarily relocated in order to maintain service.

Given that the existing substructures are suitable to support the proposed LRT, and that their service life can be extended by rehabilitation, it is recommended that Alternative 2 be adopted. This alternative will also avoid replacement of the existing footings, which will reduce the environmental impact on the Etobicoke Creek.

It should be noted that as long as the existing expansion joints are leaking, the abutments will continue to deteriorate at an accelerated rate. Replacement of the expansion joint seals should be considered on a short-term basis (i.e. between now and the superstructure replacement) to prevent this deterioration from continuing.

A General Arrangement drawing for the recommended design concept is included in Appendix A.

### 13.5 Environmental Constraints

The proposed construction works are within a regulated area under the jurisdiction of the Toronto and Region Conservation Authority (TRCA) and will require regulatory review by the TRCA and a permit under Ontario Regulation 166/06 (Work Permit for Development, Interference with Wetlands, Alternations to Shorelines and Watercourses).

All work shall abide by conditions approval from the above noted regulatory authorities. Key mitigation and protection measures anticipated include:

- Installation of debris collection system/platform (e.g., scaffolding, platforms, polyethylene sheets, etc.) to prevent any debris or release of waste water effluent/slurry from concrete cutting from entering the watercourse;
- Completion of all in-water works for bridge rehabilitation within the warmwater construction timing window of July 1 to March 31;
- Use of temporary cofferdam system to isolate the work zone from the watercourse and complete the work in dry; and
- Implementation of tree protection measures (fencing, hoarding, etc.) during construction.

The requirements of the Navigable Waters Protection Act do not apply to the Etobicoke Creek.

### 13.6 Utilities

The existing utility ducts embedded in the west sidewalk on the bridge, as well as an existing surface mounted conduit at the east side of the deck soffit, will be relocated off the bridge or to a new duct bank mounted to the girders of the new superstructure.
13.7 Lighting

Underpass lighting will be installed for the trail at the north side of the creek. Street lighting will be installed on the new superstructure.
14.0 Etobicoke Creek Crossing (North)

At this location the new HMLRT is proposed to be carried over the Etobicoke Creek in the median of Main Street.

14.1 Existing Structure

The existing Main Street Bridge over Etobicoke Creek (North) was constructed in 1964. It is a skewed three span concrete slab on prestressed concrete girder bridge with span lengths of 15.545m, 15.850m and 15.545m from south to north. The skew angle of the bridge is 45°00'00". The substructure consists of piers and conventional abutments founded on spread footings.

The 21.336m wide deck carries two northbound and two southbound lanes of Main Street and sidewalks over the Etobicoke Creek. A pathway has been constructed adjacent to the south abutment. The Etobicoke Creek flows from east to west at this location and is considered a sensitive fish habitat.

The bridge was rehabilitated in 2012 including removal and patch repair of deteriorated concrete in girders, diaphragms and abutments. The 2012 rehabilitation drawings make reference to previous rehabilitation drawings dated May 2000. These drawings are not available.

14.2 Existing Structure Condition and Remaining Life

In addition to the inspection completed in June 2012, this bridge was inspected in May 2013 with a focus on the condition of the substructure (including substructure delamination survey). The bridge is generally in good to fair condition with the following defects noted:

- Asphalt wearing surface – Severe transverse asphalt cracks visible along the expansion joints, patched potholes and a few areas of pattern cracks.
- Expansion joints – the expansion joints appear to have been paved over and are leaking.
- Deck soffit – Areas of leakage noted with cracking and efflorescence.
- Piers – Medium cracks on both piers.

In addition to the patch repair work completed in 2012, the bridge has the following maintenance/rehabilitation needs at this time:

- Remove asphalt, waterproofing and deteriorated concrete from the deck surface. Repair with local concrete patches, waterproof and pave the deck.
- Replace expansion joints.
- Remove deteriorated concrete and repair with local concrete patches.

If the existing bridge is adequately maintained, its remaining service life is estimated to be about 25 years.
14.3 Structural Evaluation

A structural evaluation of the bridge was carried out in accordance with Sections 14 and 15 of the Canadian Highway Bridge Design Code CAN/CSA-S6-06 (CHBDC). Aspects of the loading which are not covered by the CHBDC were taken from the TTC Design Manual. The evaluation was based on CHBDC Evaluation Level 1 transitory loads and the LRT vehicle loading shown in Section 1.0.

The results of this evaluation indicate that under the proposed LRT train loading and associated additional dead load, the shear capacity of the existing interior girders near the piers is exceeded by approximately 5%. With the exception of this issue, the existing bridge is able to carry the proposed LRT train loading as well as the additional dead load. The calculated soil loadings are within the preliminary allowable foundation parameters provided by Golder Associates.

14.4 Considered Alternatives and Recommendations

Two alternatives were considered:

Alternative 1:

This alternative includes rehabilitation of the existing bridge to carry the LRT guideway in the median of Main Street. This will include removal of existing asphalt and concrete median, installation of rails and rail expansion joints, and construction of a concrete platform.

This alternative will require the existing girders to be strengthened. This can be completed by installing the additional vertical reinforcement with concrete encasement.

Alternative 2:

This alternative includes complete removal of the existing deck and girders, and construction of a new concrete slab on prestressed concrete girders on the existing abutments and piers. In order to suit the new superstructure and extend the service life of the substructure, it is recommended to rehabilitate the piers and abutments including removal and reconstruction of the top portions, and convert the abutments to a semi-integral configuration which will eliminate the expansion joints and reduce future maintenance costs. This rehabilitation and modification of the substructure is required in order to achieve a remaining service life of 75 years and compatibility with the proposed superstructure.

The cost and construction duration for this alternative is expected to be higher than Alternative 1 and lower than Alternative 3. This alternative will extend the service life of the bridge by approximately 75 years.

Alternative 3:

This alternative includes complete replacement of the existing bridge, including substructures and foundations. This will require excavation in the stream bed of the Etobicoke Creek.
The cost and construction duration for this alternative is expected to be higher than Alternatives 1 and 2. The new bridge will have a service life of approximately 75 years.

In order to provide a long-term solution to the transit needs along Main Street, it is recommended that Alternative 1 be eliminated. While this alternative has a lower initial construction cost and traffic impact, replacement of the existing bridge in 25 years will be much more costly and disruptive to the transportation corridor, since the LRT system will be running and would have to be temporarily relocated in order to maintain service.

Given that the existing substructures are suitable to support the proposed LRT, and that their service life can be extended by rehabilitation, it is recommended that Alternative 2 be adopted. This alternative will also avoid replacement of the existing footings, which will reduce the environmental impact on the Etobicoke Creek.

It is proposed to construct a concrete deck on CPCI girder superstructure including conversion of the existing abutments to a semi-integral configuration. This will eliminate the expansion joints and reduce future maintenance costs.

It should be noted that as long as the existing expansion joints are leaking, the abutments will continue to deteriorate at an accelerated rate. Replacement of the expansion joint seals should be considered on a short-term basis (i.e. between now and the superstructure replacement) to prevent this deterioration from continuing.

A General Arrangement drawing for the recommended design concept is included in Appendix A.

14.5 Environmental Constraints

The proposed construction works are within a regulated area under the jurisdiction of the Toronto and Region Conservation Authority (TRCA) and will require regulatory review by the TRCA and a permit under Ontario Regulation 166/06 (Work Permit for Development, Interference with Wetlands, Alternations to Shorelines and Watercourses).

All work shall abide by conditions approval from the above noted regulatory authorities. Key mitigation and protection measures anticipated include:

- Installation of debris collection system/platform (e.g., scaffolding, platforms, polyethylene sheets, etc.) to prevent any debris or release of waste water effluent/slurry from concrete cutting from entering the watercourse;
- Completion of all in-water works for bridge rehabilitation within the warmwater construction timing window of July 1 to March 31;
- Use of temporary cofferdam system to isolate the work zone from the watercourse and complete the work in dry; and
- Implementation of tree protection measures (fencing, hoarding, etc.) during construction.

The requirements of the Navigable Waters Protection Act do not apply to the Etobicoke Creek.
14.6 Utilities

The existing utility ducts embedded in the west sidewalk on the bridge, as well as an existing surface mounted conduit at the east side of the deck soffit, will be relocated off the bridge or to a new duct bank mounted to the girders of the new superstructure.

14.7 Lighting

Underpass lighting will be installed for the trail at the south side of the creek. Street lighting will be installed on the new superstructure.
15.0 Canadian National (CN) Rail Crossing

At this location the new HMLRT is proposed to be carried under the existing east-west CN Rail corridor. The railway at the crossing location is identified as Halton Subdivision, Mileage 15.24.

15.1 Existing Structure

The existing Main Street Subway at CN Rail was constructed in 1964. It is a single span steel through girder bridge with a span length of approximately 27.9m.

The bridge carries two railway tracks over Main Street. The existing minimum vertical clearance at the crown of Main Street is estimated to be approximately 4.44m.

15.2 Existing Structure Condition and Remaining Life

The bridge is generally in fair condition with the following defects noted:

- Abutment walls – medium to wide cracks with wet stains.
- Girders and floor beams – coating is peeling, with some corrosion noted.

The bridge has the following maintenance/rehabilitation needs at this time:

- Remove deteriorated concrete from abutments and repair with local concrete patches.
- Clean and re-coat structural steel girders and floor beams.

If the existing bridge is adequately maintained, its remaining service life is estimated to be about 25 years.

15.3 Canadian National Railway (CNR) and Metrolinx Constraints

Metrolinx is planning on constructing an additional track to the north of the existing tracks, which will require a new bridge. The proposed HMLRT work will accommodate this consideration.

A new crossing agreement will be required for this crossing. All works on, above or below CNR property will need to be coordinated with railway operations and comply with the following CNR requirements:

- Rules, policies, standards and procedures for working within the CN right-of-way;
- Liability insurance requirements for works performed on and/or in proximity to the railway or within railway right-of-way; and
- Safety and related requirements and instructions for work on railway right-of-way by non-CN personnel.
All works during prearranged work blocks under railway flagging protection have to be planned and carried out in a manner to leave the work zone at the end of work block in safe condition for railway traffic.

15.4 Considered Alternatives and Recommendations

No modifications to the existing bridge or pedestrian underpasses are proposed. The LRT can be constructed below the existing bridge without lowering the roadway. This is because the LRT will be operating without an overhead contact system at this location and thus the minimum vertical clearance can be reduced.

In earlier stages of this project, an analysis of the modifications required to construct the LRT with an overhead contact system was carried out. It was determined that the roadway below the bridge would need to be lowered by approximately 0.6m to provide the required vertical clearance to accommodate the LRT guideway and for vehicles to pass under the catenary wires at the intersection to the north. According to the original construction drawings for the bridge, an existing 6’ x 6’ concrete sewer is located directly below the west sidewalk. If the grade is lowered at the abutment locations, it may be necessary to provide additional frost protection (e.g. insulation). Underpinning of the structure foundations is not anticipated to be necessary based on the existing level of frost protection and the modifications proposed. If catenary wires were suspended from the bridge, installation of insulated suspension mechanisms would be required in order to prevent stray currents from impacting the structure and causing safety risks.
Appendix A: Drawings
Appendix B: Photographs
Hurontario Street Subway at GO Transit-Metrolinx

South elevation looking north

North elevation looking south
West approach looking east

Deck top looking west
Underside of bridge looking west; note leakage at longitudinal expansion joint

Underside of bridge looking east; note leakage at longitudinal expansion joint
QEWS Overpass of Hurontario Street

South elevation looking north

North elevation looking south
East approach looking west

West approach looking east
East abutment wall looking northwest

West abutment wall looking southwest
Hurontario Street Subway at CP Rail

South elevation looking north

North elevation looking south
West approach looking east

Underside looking west
East pedestrian underpass looking north

West pedestrian underpass looking south
Hurontario Street Overpass of Rathburn Road

West elevation looking southeast

East elevation looking west
North approach looking south

Underside of west structure looking southeast
Underside of east structure looking south

Close-up of south abutment wall; note delamination/spall
Hurontario Street Culvert over Cooksville Creek

Inlet at northwest end

Outlet at southeast end
Typical condition of culvert barrel; note leakage at construction joint

Close-up of typical construction joint; note leakage
Highway 403 Underpass of Hurontario Street

West elevation looking northeast

East elevation looking northwest
South approach looking north

North approach looking south
Underside looking north; note leaking/missing seal at longitudinal expansion joint

Underside looking south
Highway 401 Underpass of Hurontario Street

West elevation looking northeast; note bridge replacement underway

South abutment looking east; note bridge replacement underway
Highway 407 Underpass of Hurontario Street

West elevation looking north

East elevation looking south
South approach looking north

Deck top looking northeast
Underside looking north

South abutment looking southwest
Main Street Bridge over Etobicoke Creek (South)

East elevation looking southwest

West elevation looking southeast
South approach looking north

North approach looking south
South expansion joint looking west; note paved over

Underside looking north
South abutment looking west; note delaminated areas near top of wall

West end of north abutment wall; note delaminated patches
Main Street Bridge over Etobicoke Creek (North)

East elevation looking north

West elevation looking north
North approach looking south

South approach looking north
South expansion joint looking southwest; note paved over

Deck top looking west; note pattern cracks in asphalt wearing surface
Main Street Subway at CN Rail

North elevation looking southwest

West approach looking east
Underside looking west; note peeling of structural steel coating

West end of north abutment; note cracks and 1964 date stamp
Appendix C: Memoranda
MEMORANDUM

As part of the Hurontario-Main LRT project consideration must be given not only to initial construction and operation of the LRT system, but the long term considerations of maintenance of the system and rehabilitation of structures. The rehabilitation of structures will be of particular importance due to present plans to construct the LRT under a Public Private Partnership approach. This approach will have special issues related to the hand back of any structures at the end of an operations and maintenance contract, and the contractual relationship between the bridge owners (MTO and 407) and the LRT system operator and their particular maintenance responsibilities.

Rehabilitation of bridges and structures where an LRT system is in place is similar to any other bridge rehabilitation. The rehabilitation works must be conducted as a staged process where a portion of the bridge is rehabilitated at one time and the work on remaining portions of the bridge is undertaken in stages. The example herein is based on a two stage remediation.

Figure 1 shows normal operation for a typical bridge. In order to conduct the staged operation both traffic and LRT must be diverted onto portions of the bridge not being affected. For roads this is a straight forward diversion. For rail it will require the use of special crossover trackwork that permits the Light Rail Vehicle to move from one set of tracks to the other. Crossovers are installed as part of the rail system on day one every two to four kilometres for operational flexibility.

When the East Side of the bridge is closed for rehabilitation (for discussion the top of the page will be treated as north) the northbound LRT will be diverted to the southbound tracks at the first crossover south of the bridge. At the first crossover north of the bridge, the northbound LRT will be diverted back to the northbound tracks. The southbound LRT will continue service on the southbound tracks with no diversions. The southbound number 2 lane traffic will be diverted to the southbound number 1
lane north of the bridge and will revert back to normal south of the bridge. The northbound traffic will be diverted to the southbound number 2 lane south of the bridge and will revert back to normal north of the bridge. An illustration of this staging process can be seen in Figure 2. Clearly delays will be incurred in LRT operations for the duration of the rehabilitation to allow for light rail vehicles to clear through the single rail sections.

When the West side of the bridge is closed for rehabilitation, the vice-versa of the aforementioned traffic diversion will occur with similar impact on LRT operations. This is illustrated in Figure 3.

Figure 2 - East-side Bridge Rehabilitation Traffic Diversion

Figure 3 - West-side Bridge Rehabilitation Traffic Diversion
MEMORANDUM

The Hurontario-Main Light Rail Transit system (HMLRT) is proposed to run for approximately 24 km from a southern terminus in Port Credit, Ontario north to the GO station in downtown Brampton, with possible future northern extensions. In order to service downtown Mississauga, a loop around the Square One Shopping Centre is proposed. A number of alignment alternatives were considered for this loop. The preferred alignment runs along Burnhamthorpe Rd. West, Duke of York Blvd., and Rathburn Road West and rejoins Hurontario St. between Rathburn Road and Highway 403. At the Highway 403 crossing, the LRT guideway will be constructed in the median of Hurontario Street on the existing underpass bridge, which will be widened to the west in order to accommodate additional lanes along Hurontario Street. Plan and profile drawings for the preferred alternative are included in Appendix A of this memorandum.

This memo will present the preferred design for the crossing of Highway 403 to MTO. The existing Highway 403 underpass bridge, owned by MTO, consists of twin two-span post-tensioned circular voided slab structures, built in 1980 under MTO Contract No. 80-37. The existing southbound and northbound structures each carry 3 lanes of Hurontario Street. It is proposed to construct both tracks of the LRT guideway on the existing southbound bridge, and to widen the bridge to the west in order to provide an expanded cross-section. VISSIM traffic modelling indicates that in order to meet current and future traffic demand, 4 southbound lanes and 3 northbound lanes are required at the bridge location. Immediately south of the bridge location, the additional southbound lane will exit to the ramp to Highway 403 Eastbound.

Proposed Work:

A preliminary General Arrangement drawing for the structure work is provided in Appendix B of this memorandum. The proposed design includes construction of an independent structure to the west of the existing southbound bridge, separated by a longitudinal expansion joint. Consistent with the existing structures, the new structure will have two spans of 35.052m each and a skew angle of 7°19’04” relative to the centreline of Highway 403. The new structure will be approximately 11.5m wide and will carry a portion of the southbound traffic, a 2.0m bike lane and a 2.0m sidewalk. The existing minimum vertical clearance of 4.8m will be maintained.

It is proposed to construct a prestressed concrete box girder structure with a reinforced concrete distribution slab. The prestressed box girders can also be post-tensioned if required. In order to maintain vertical clearance, it is proposed to construct a concrete overlay on the existing southbound bridge in order to slightly raise the level of the roadway, and to reduce the crossfall for the southbound lanes from 2% to 1%.

A structural evaluation of the existing southbound bridge indicates that the existing southbound bridge is able to carry the loading imposed by the LRT modification, as long as the elastomeric laminated bearings at abutments are replaced. Also, the raised LRT platform will need to be constructed with lightweight material. FRP infill deck panels are recommended for this application.

MTO has plans to rehabilitate this structure starting in 2014. There is potential for this work to conflict with the HMLRT construction. Given the uncertainty of the HMLRT timeline, we have considered two scenarios for the bridge work:

1. Rehabilitation of the bridge is completed as per MTO’s schedule, before commencement of the LRT construction.
2. The bridge rehabilitation is completed concurrently with the LRT construction. Scenario #2 would minimize temporary traffic impact and reduce the overall cost of the structural work. However, in order to maintain flexibility in the HMLRT schedule, both scenarios must be considered at this time.

Traffic Staging:
Scenario #1 – LRT construction after rehabilitation is complete:
   Stage #1:
   - Traffic remains as is (3 lanes in each direction)
   - Construct new structure at the west side
   Stage #2:
   - Close existing west sidewalk and redirect pedestrian traffic to sidewalk on new bridge (3 lanes in each direction)
   - Remove existing west sidewalk and barrier wall; construct longitudinal expansion joint between structures
   Stage #3:
   - Shift southbound traffic to the new widened structure (4 southbound lanes, 3 northbound lanes)
   - Construct LRT guideway on existing bridge
Scenario #2 – LRT construction completed together with rehabilitation:
   Stage #1:
   - Traffic remains as is (3 lanes in each direction)
   - Construct new structure at the west side
   Stage #2:
   - Shift southbound traffic to new bridge; shift northbound traffic to existing southbound bridge (3 southbound lanes utilizing bike lane and sidewalk, 3 northbound lanes)
   - Rehabilitate existing northbound bridge
   Stage #3:
   - Shift northbound traffic to existing northbound bridge (3 southbound lanes utilizing bike lane and sidewalk, 3 northbound lanes)
   - Rehabilitate existing southbound bridge and construct LRT guideway

Future Considerations:
Assuming a 75 year life cycle, the existing bridge over Highway 403 has approximately 33 years of useful service life remaining. Concerns related to rehabilitation of bridges where an LRT system is in place are addressed in the memo entitled *Bridge Rehabilitation Staging Schemes*, entitled July 23, 2013.
Appendix A – Plan and Profile Drawings
Appendix B – General Arrangement Drawings
MEMORANDUM

The Hurontario-Main Light Rail Transit system (HMLRT) is proposed to run for approximately 24 km from a southern terminus in Port Credit, Ontario north to the GO station in downtown Brampton, with possible future northern extensions. In order to service downtown Mississauga, a loop around the Square One Shopping Centre is proposed. A number of alignment alternatives were considered for this loop. The preferred alignment runs along Burnhamthorpe Rd. West, Duke of York Blvd., and Rathburn Road West and rejoins Hurontario St. between Rathburn Road and Highway 403. At the Highway 403 crossing, the LRT guideway will be constructed in the median of Hurontario Street on the existing underpass bridge, which will be widened to the west in order to accommodate additional lanes along Hurontario Street. This has been presented to MTO in a previous memo entitled *Highway 403 Crossing – Preferred Alternative*, dated August 21, 2013.

MTO has requested that a life-cycle cost analysis be carried out in order to assess the life-cycle cost of the preferred alternative against that of full replacement of the existing underpass bridge. This memo will present the results of this analysis.

**Considered Alternatives:**

**Alternative 1: Widening and Rehabilitation**

This alternative includes construction of a new widening portion, along with rehabilitation of the existing portion in order to allow it to carry LRT guideway and extend its useful service life. A preliminary General Arrangement drawing for this alternative is provided in **Appendix B** of this memorandum. It should be noted that due to the potential conflict of the HMLRT construction with MTO’s plans to rehabilitate this structure, two scenarios were considered for this work:

1. Rehabilitation of the bridge is completed as per MTO’s schedule, before commencement of the LRT construction.

2. The bridge rehabilitation is completed concurrently with the LRT construction.

In order to maintain flexibility in the HMLRT schedule, both scenarios must be considered at this time. For this life cycle analysis, the first scenario is assumed since the overall cost associated with this scenario is expected to be higher.

**Alternative 2: Full Replacement**

This alternative includes replacement of the existing bridge with a new bridge. A preliminary General Arrangement drawing for this alternative is provided in **Appendix C** of this memorandum.

Full replacement of this structure will be challenging, since removal of each of the twin structures will need to be completed with all traffic detoured off the twin structure being replaced. Each of the structures has an existing roadway width of approximately 11.9m and cannot accommodate two lanes in each direction. If two lanes in each direction need to be maintained during construction, a temporary modular bridge will be necessary.
Assumptions:
The life cycle cost analysis was carried out over a 50 year period, with assumed discount rates of 3% and 4%. The structures are assumed to be rehabilitated on a 25 year cycle, with the exception of the existing bridge, which is assumed to require replacement in 42 years. This is based on:

- A 75 year life cycle; and
- The bridge was constructed in 1980 and is approximately 33 years old.

Rehabilitation of the widened portion is assumed to be carried out at the same time as replacement of the original portion.

Conclusions:
The results of the analysis indicate that over the 50 year period considered, the net present value of life cycle costs for Alternative 1 is $4,590,287 less than Alternative 2 assuming a discount rate of 3%; and $5,598,988 less than Alternative 2 assuming a discount rate of 4%. The analysis is enclosed as Appendix A to this report. It is concluded that Alternative 1 is the most economical option given that its net present value is less than the net present value of Alternative 2 for all assumed discount rates.
Appendix A – Life Cycle Cost Analysis
**Highway 403 Underpass at Hurontario Street**

**Life Cycle Cost Analysis**

Discount Rate = 3%

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**Alternative 1: Widening and Rehabilitation**

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**Alternative 2: Full Replacement**

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Net Present Value

$15,804,621

($4,590,287)

Discount Rate = 4%

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**Alternative 1: Widening and Rehabilitation**

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**Alternative 2: Full Replacement**

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Net Present Value

$13,926,778

($5,598,988)

December 2013
Appendix B – General Arrangement Drawing – Alternative 1
Appendix D: Highway 403 Crossing – Non-Preferred Alternatives
Alternative 1:

This alternative requires three new structures:

Highway 403 Underpass of City Centre Drive

This bridge will carry City Centre Drive and the LRT guideway over Highway 403 and the W-N/S Ramp. It is proposed to construct a skewed three span concrete slab on steel box girder bridge with span lengths of 36.000m, 39.000m and 40.000m from south to north. The skew angle of the bridge will be 2°32'10" with the abutments and piers parallel to the centreline of Highway 403. The substructure will consist of piers and semi-integral abutments founded on spread footings. A General Arrangement drawing for the recommended design concept is included in Appendix A.

Northern Distribution Road Culvert over Cooksville Creek

This culvert will carry the Northern Distribution Road over the Cooksville Creek. It is proposed to construct a rigid frame box culvert with a width of 6.096m and height of 3.658m. These dimensions will match that of the adjacent Cooksville Creek Culvert under Highway 403.

N-W Ramp Underpass of Northern Distribution Road

This bridge will carry the Northern Distribution Road over the Hurontario Street (N) to Highway 403 (W) ramp. The structure will be curved to follow the alignment of the ramp. It is proposed to construct a reinforced concrete rigid frame bridge with a clear
span length of 9.000m (measured perpendicular from face to face of abutment). The bridge will be founded on spread footings. A General Arrangement drawing for the recommended design concept is included in this Appendix.

Retaining walls on the north and south sides of the Northern Distribution Road (up to 8m height) will be required for this alternative. Due to the height of these retaining walls, a retained soil system (RSS) type wall is recommended.

**Alternative 2A:**

This alternative requires one new structure:

Highway 403 Underpass of HMLRT

This bridge will carry the LRT guideway over Highway 403 and the W-N/S ramp. It is proposed to construct a four span concrete slab on steel box girder bridge with span lengths of 27.500m, 34.000m, 45.500m and 56.000m from south to north. The substructure will consist of piers and conventional abutments founded on spread footings.

A General Arrangement drawing for the recommended design concept is included in this Appendix.
Alternative 2B:

This alternative is similar to Alternative 2A, except the LRT guideway is carried below the intersection at Hurontario Street. Two new structures are required:

**Highway 403 Underpass of HMLRT**

This bridge will carry the LRT guideway over Highway 403 and the W-N/S ramp. It is proposed to construct a four span concrete slab on steel box girder bridge with span lengths of 27.500m, 34.000m, 45.500m and 56.000m from south to north. The substructure will consist of piers and conventional abutments founded on spread footings.

**HMLRT Underpass of Hurontario Street**

This bridge will carry the guideway under Hurontario Street and allow it to emerge in the middle of the street to the north of the intersection. The structure will be curved to follow the alignment of the guideway. It is proposed to construct a reinforced concrete rigid frame bridge with a clear span length of 8.9m (measured perpendicular from face to face of abutment). The bridge will be founded on spread footings.

General Arrangement drawings for the recommended design concept are included in this Appendix.
Alternative 2C:

This alternative includes construction of a bridge which will carry the guideway over Highway 403, the W-N/S ramp and the intersection at Hurontario Street. One structure is required:

Highway 403 Underpass of HMLRT

This bridge will carry the LRT guideway over Highway 403, the W-N/S ramp and the intersection at Hurontario Street. It is proposed to construct a ten span concrete slab on steel box girder bridge with span lengths of 27.500m, 34.000m, 45.500m, 56.000m, 55.000m, 55.000m, 55.000m, 71.300m, 55.000m and 35.000m from south to north. The substructure will consist of piers and conventional abutments founded on spread footings.

A General Arrangement drawing for the recommended design concept is included in this Appendix.
Alternative 3A:

This alternative includes construction of the LRT guideway in the median of Hurontario Street on the existing bridge. This will include removal of existing asphalt and concrete median, installation of rails and rail expansion joints, and construction of a concrete platform. In order to support the proposed loading, the existing elastomeric laminated bearings at abutments will need to be replaced. In the new configuration, the twin structures will accommodate the 8.1m LRT guideway (guideway is wider than 7.6m since catenary pole cannot be centred on longitudinal joint), two 3.5m lanes in each direction, two shoulders and two 1.981m sidewalks.

A General Arrangement drawing for the recommended design concept is included in this Appendix.

Alternative 3B:

This alternative includes construction of the LRT guideway in the median of Hurontario Street and the replacement of the existing bridge. The new bridge will have a width of 37.2m and will accommodate the 7.6m LRT guideway, three 3.5m northbound and southbound lanes, two 2.0m bike lanes (including 0.5m buffer) and two 2.0m sidewalks.

It is proposed to retain the existing abutments and construct a concrete deck on steel box girder bridge with two spans of 35.052m. A General Arrangement drawing for the recommended design concept is included in this Appendix.
Replacement of this bridge can be completed in two stages including a detour on a temporary modular bridge. A preliminary traffic staging scheme is included in this Appendix.

D.1 – Utilities:

The following existing utilities are noted at the proposed crossing locations:

- Utility ducts located in the east sidewalk of the existing bridge;
- High voltage wires in the east-west hydro corridor north of Highway 403;
- Two east-west natural gas pipelines north of Highway 403;
- Two east-west oil pipelines north of Highway 403; and
- Buried Rogers and hydro cables west of Hurontario Street (near the location of the proposed bridge for Alternative 2A/2B/2C).

If Alternative 2A is adopted, the following existing utilities will be impacted:

- The buried Rogers and hydro cables will be in close proximity to construction of the Highway 403 Underpass of HMLRT.

If Alternative 2B is adopted, the following existing utilities will be impacted:

- The new HMLRT Underpass of Hurontario Street will be constructed below the existing oil and gas pipelines north of Highway 403. The pipelines will be temporarily supported during construction of the bridge.
- The buried Rogers and hydro cables will be in close proximity to construction of the abutment and pier footings of the Highway 403 Underpass of HMLRT.

If Alternative 2C is adopted, the following existing utilities will be impacted:

- The high voltage wires in the hydro corridor north of Highway 403 may need to be raised to provide clearance for the LRT guideway and catenary wires.
- The oil and gas pipelines will be in close proximity to construction of the pier footings for the new bridge.
- The buried Rogers and hydro cables will be in close proximity to construction of the south abutment and pier footings for the new bridge.

If Alternative 3A is adopted, consideration should be given to relocating the utilities embedded in the east sidewalk, prior to rehabilitation of the bridge.

If Alternative 3B is adopted, the existing utility ducts in the east sidewalk of the existing bridge will have to be relocated off the bridge.
Appendix E: Comments on Previous Versions
## Preliminary Structural Assessment Report (Draft)

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Section</th>
<th>City</th>
<th>Reviewer Name</th>
<th>Review Date</th>
<th>Code</th>
<th>Reader Comments</th>
<th>Consultant Team Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hwy 407</td>
<td>Brampton</td>
<td>Borendra Sanyal</td>
<td>2013/03/28</td>
<td>B</td>
<td>As per GA of the Highway 407 underpass structure, the Barrier wall height is not as per City of Brampton standards. However, the modification of the Barrier wall is probably beyond the scope of this project. As indicated in the report the suggested modifications of the structure (additional longitudinal reinforcement for deck and bearing replacement at the piers) are required for the additional/increased loading condition. Additional longitudinal reinforcement for deck and bearing replacement at the piers are required for the additional/increased loading condition.</td>
<td>G.Bajlon/A.Ward</td>
</tr>
<tr>
<td>2</td>
<td>Etobicoke Creek 27 &amp; 30</td>
<td>Brampton</td>
<td>Borendra Sanyal</td>
<td>2013/03/28</td>
<td>B</td>
<td>The executive summary of the report and the GA’s for both of these structures are indicating that the superstructures will be replaced completely. Section 11.4 and 12.4 (Considered Alternatives and Recommendations) of the report recommended the complete replacement of the superstructure in alternative 2. However, Section 11.2 and 12.2 recommended for the minor rehabilitations and rehabilitation drawings are not included. It appears, Section 11.2 and 12.2 are in contradiction with the rest of the report (section 11.4, 12.4 and Executive summary and GA’s).</td>
<td>G.Bajlon/A.Ward</td>
</tr>
<tr>
<td>3</td>
<td>Etobicoke Creek 27 &amp; 30</td>
<td>Brampton</td>
<td>Borendra Sanyal</td>
<td>2013/03/28</td>
<td>B</td>
<td>The other issues about the Section 11.4 and 12.4 of the report (Considered Alternatives and Recommendations) are the replacement of the superstructures keeping the old substructures with minor or little modifications. This will result in the differential durability of the substructures and superstructures. As per CHBDC the usual life span of a structure is usually 75 years. By the time these superstructures will be replaced the substructures will be already 50 years old. By looking at the enclosed pictures of the substructures in the report for these bridges, it appears that these substructures will require major rehabilitations afterwards. Therefore, the consultant should look into these issues more elaborately and should consider the long term requirements of these structures.</td>
<td>G.Bajlon/A.Ward</td>
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<td>Item No.</td>
<td>Section</td>
<td>Pg. #</td>
<td>City</td>
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| 4       | Canadian National (CN) Rail Crossing | 33    | Brampton | Borenda Sanyal | 2013/03/28 |  | Section 13.3 (Considered Alternatives and Recommendations) recommended “No modification to the existing bridge or pedestrian underpasses are proposed” However, the report also recommended to lower the road grade (if necessary) to accommodate the vertical clearance of the LRT guide way. This Canadian National (CN) Rail Crossing Bridge is a closed abutment bridge and the report did not indicate anything about the existing or available frost depth of these abutments. Moreover, detailed highway engineering study requires in determining the actual amount of clearance requirements to accommodate the LRT guide way. Therefore, at this point it is very hard to predict or consider this the grade lowering options. This option may require underpinning of these abutments. Let the consultant further elaborate this option considering all of these and other parameters which may encounter during study. | A. Delchev
A. Delchev 1 | The amount of lowering of the profile at the existing bridge will be noted in the report. CN has indicated that they are planning on constructing an additional track to the north of the existing tracks, which will require a new bridge. As a result of this consideration and the fact that Main St. slopes up toward the north at the bridge location, Main St. will need to be lowered north of the bridge to accommodate the vertical clearance for the new bridge. Detailed investigation is underway to determine the amount of lowering required for the new bridge. |
<p>| 5       | CP Rail |  | Brampton | Khurram Tunio | 2013/03/28 |  | The report identified some recommendations / actions for CP Rail for their bridge including lowering of Main Street road profile (Brampton Downtown) under the bridge. Thus please forward the specific sections of the report to CP rail for review and comments. | A. Delchev 1 | This bridge is owned by CN. The report has been sent to CN for review and comments. |
| 6       | 407ETR | 25    | Brampton | Khurram Tunio | 2013/03/28 |  | Please forward the report to 407ETR (Jeff Booker) in addition to MTO as the report identified modifications to existing 407ETR bridge. If the proposed changes result in significant liability towards the operator of LRT / Cities, will it be worthwhile to have separate structure for LRT? | A. Delchev 1 | The report has been sent to 407ETR for review and comments. |
| 7       | 407ETR | 25    | Brampton | Khurram Tunio | 2013/03/28 |  | For 407ETR structure, please identify remaining service life. | G.Bajlon/ A.Ward 2 | As per Section 10.2, the remaining service life of this structure is anticipated to be about 60 years |
| 8       | Etobicoke Creek Crossing South | 27    | Brampton | Khurram Tunio | 2013/03/28 |  | If the remaining service life is only 27 years old. Then suggest to replace the structure, as within 5-10 years (subject to phasing of project) of opening day the bridge will requires replacement anyway. Alternative 2 identify only replacement of super structure, confirm in the report existing substructure is sufficient for LRT design and load. If cannot be confirmed, suggest to identify full structure replacement as foundations will likely be at their end of service life. | G.Bajlon/ A.Ward 1 | The evaluation of existing substructure is currently being finalized. Based on preliminary results, the existing substructure appears to be adequate. The report will be amended following further consultation with our geotechnical engineer. Also, please see our reply to item 2. |
| 9       | Etobicoke Creek Crossing South | 27    | Brampton | Khurram Tunio | 2013/03/28 |  | Etobicoke Creek Crossing South: As commented during design concept workshops, provide for wider pedestrian sidewalks and realms through the Etobicoke Creek crossing structures. Thus revise the GA drawings to reflect wider pedestrian pathways and buffers. Also raise the height of parapet walls / railings to reflect cyclist safety crossing requirements. | A. Delchev 5 | The proposed sidewalk widths are 2.0m at the south bridge and 1.7m at the north bridge. This represents a slight improvement over the existing condition. The parapet wall raling height of 1425mm satisfies the CHBDC requirement for minimum barrier height for bicycles. |</p>
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<tr>
<td>10</td>
<td>4.3</td>
<td>7</td>
<td>Metrolinx/ GO</td>
<td>Mel White/ Dan Francey</td>
<td>2013/03/22</td>
<td>7</td>
<td>Agree with Alt 2, new bridge. This will be much less disruptive to service during construction.</td>
<td>G.Bajlon/ A.Ward</td>
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<td></td>
<td>Should be noted that new bridge should be designed to current loading requirements, E-90 (or maximum GO DRM Specifications)</td>
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<td>During prelim design, foundation design should take into consideration methods that could enhance/ extend life of existing bridge foundation.</td>
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<td></td>
<td>Not a structural item, new crossings of the rail corridor will require a new crossing agreement.</td>
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<tr>
<td>11</td>
<td>4.4</td>
<td>7</td>
<td>Metrolinx/ GO</td>
<td>Mel White/ Dan Francey</td>
<td>2013/03/22</td>
<td>7</td>
<td>Retaining Wall Alternatives; Agree that Alt 1 (Cantilever Retaining Wall) has many benefits, however Alt 3 (Soldier Pile Lagging Wall) will have the least impact on GO rail operations. Construction disruption impact will need to be a key criteria in evaluating options.</td>
<td>G.Bajlon/ A.Ward</td>
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<td>The design of the MSF structures will be addressed in a separate report.</td>
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<tr>
<td>12</td>
<td>General</td>
<td></td>
<td>Metrolinx/ GO</td>
<td>Mel White/ Dan Francey</td>
<td>2013/03/22</td>
<td></td>
<td>Coordination of future surface parking expansion at Port Credit will be required.</td>
<td>A. Delchev</td>
</tr>
<tr>
<td>13</td>
<td>General re: rail bridges at Port Credit, Cooksville and Brampton GO Stations</td>
<td></td>
<td>Metrolinx/ GO</td>
<td>Mel White/ Dan Francey</td>
<td>2013/03/22</td>
<td></td>
<td>Not a structural item - Not identified in report but should be noted, if catenary is planned to be suspended from existing bridge structure, then insulated suspension mechanisms will be required to prevent stray currents from impacting structures and causing potential safety risks to tracks and signals, and will require coordination with rail corridor owner.</td>
<td>A. Delchev</td>
</tr>
<tr>
<td>14</td>
<td>Executive Summary</td>
<td>iii</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 03</td>
<td>3</td>
<td>Potentially new MSF structures?</td>
<td>A. Delchev</td>
</tr>
<tr>
<td>15</td>
<td>iii</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 03</td>
<td>3</td>
<td>Any potential impact to Existing GO Transit / Metrolinx Crossing? Rehabilitation Cost Estimate?</td>
<td>A. Delchev</td>
<td>1</td>
</tr>
<tr>
<td>16</td>
<td>iv</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 03</td>
<td>3</td>
<td>Has investigation shown Rathburn Road Bridge sound for additional loading?</td>
<td>G.Bajlon/ A.Ward</td>
<td>2</td>
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<tr>
<td>17</td>
<td>iv</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 03</td>
<td>3</td>
<td>Is Alternative 3b) realistic if Existing bridge can be modified (Alternative 3a)?</td>
<td>G.Bajlon/ A.Ward</td>
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<tr>
<td>18</td>
<td>2.0</td>
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<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 03</td>
<td>1</td>
<td>Add &quot;(QEW)&quot; to Crossing heading</td>
<td>G.Bajlon/ A.Ward</td>
</tr>
<tr>
<td>19</td>
<td>4.3</td>
<td>7</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 03</td>
<td>3</td>
<td>Maintenance Walk of 0.6m sufficient?</td>
<td>A. Delchev</td>
</tr>
<tr>
<td>Item No.</td>
<td>Section</td>
<td>Pg. #</td>
<td>City</td>
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<td>Reviewer Comments</td>
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<td>20</td>
<td>7</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 03</td>
<td>3</td>
<td>Requires discussion of staging methodology to maintain existing rail. (Found on pg. 9 - Requires Staging Plan noting loc'n/extent/impact of diversion.)</td>
<td>G.Bajlon/ A.Ward 1 Will be added.</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>4.4</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 03</td>
<td>5</td>
<td>Any potential application of GRANDE wall (Conc Block) OR EQUIVALENT? Shortened construction window. Reduced tie backs?</td>
<td>G.Bajlon/ A.Ward 1 Please see reply to item 11.</td>
<td></td>
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<tr>
<td>22</td>
<td>4.6</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 03</td>
<td>5</td>
<td>Will need direction from GO Transit/Metrolinx, re permitted construction windows/conditions, as this may significantly affect cost estimate.</td>
<td>A. Delchev 1 GO Transit/Metrolinx will be contacted to determine the construction constraints at this site. Also, please see replies to GO Transit/Metrolinx comments above.</td>
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<tr>
<td>23</td>
<td>4.7</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 03</td>
<td>3</td>
<td>What Alternative is being carried as the Construction cost estimate? Are all Alternatives to be broken down with estimates in pending Appendix B?</td>
<td>A. Delchev 1 Cost estimates will not be included in this report. All cost estimates for this project will be included in a separate Cost Estimate Report.</td>
<td></td>
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<tr>
<td>24</td>
<td>5.0</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 03</td>
<td>3</td>
<td>Are there any alternatives being considered?</td>
<td>G.Bajlon/ A.Ward 2 Tunnelling under the QEW was considered. However, it is not considered to be feasible due to the required changes in vertical profile. This is discussed briefly in Section 5.4.</td>
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<td>25</td>
<td>12</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 03</td>
<td>1</td>
<td>2nd Paragraph... The ends of the east wingwalls of the existing bridge need to be removed, and modified...</td>
<td>G.Bajlon/ A.Ward 1 Will be revised.</td>
<td></td>
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<tr>
<td>26</td>
<td>12</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 03</td>
<td>3</td>
<td>Will construction cost estimate include rehabilitation of existing bridge?</td>
<td>A. Delchev 2 Please see reply to item 15.</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>6.0</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 03</td>
<td>1</td>
<td>The pedestrian tunnels were built in 2000, not 1997.</td>
<td>G.Bajlon/ A.Ward 1 The revision block on the available drawings indicates that they were issued as record drawings on March 11, 1998. This will be verified.</td>
<td></td>
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<td>28</td>
<td>6.1</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 03</td>
<td>1</td>
<td>The existing bridge was constructed in 1963.</td>
<td>G.Bajlon/ A.Ward 1 Will be added.</td>
<td></td>
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<tr>
<td>29</td>
<td>6.3</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 03</td>
<td>3</td>
<td>Can it not be confirmed now, whether the road profile has to be lowered?</td>
<td>A. Delchev 1 No lowering of the road profile is required at this bridge. The report will be revised accordingly.</td>
<td></td>
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<tr>
<td>30</td>
<td>7.1</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 03</td>
<td>1</td>
<td>To be added to paragraph 4 - In 2011, a Hanger system was installed along the east face of the bridge to support a duct bank, carrying number of Bell Canada fibre optic cables.</td>
<td>G.Bajlon/ A.Ward 1 Will be added.</td>
<td></td>
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<tr>
<td>31</td>
<td>8.1</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 03</td>
<td>(Pending - internal request for update of any rehabilitation history subsequent to 1980) (Loudel)</td>
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<tr>
<td>32</td>
<td>8.4</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 03</td>
<td>1</td>
<td>Alternative 1 - City Centre Underpass at Highway 403: This bridge will carry City Centre Drive and the LRT guideway over Highway 403 and the W-N/S ramp.</td>
<td>G.Bajlon/ A.Ward 1 Will be revised.</td>
<td></td>
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<td>33</td>
<td>19</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 03</td>
<td>1</td>
<td>Title should read: N-W Ramp Underpass at Northern Distribution Road. As an aside, I would prefer HMLRT (The Project) to be the driver of the crossing nomenclature, rather than by Hierarchy of Road ownership, as seems to be the method used.</td>
<td>G.Bajlon/ A.Ward 1 Names of bridge structures will be adequately revised in the following version of the report.</td>
<td></td>
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<tr>
<td>34</td>
<td>8.4</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 03</td>
<td>3</td>
<td>How does the interface of City Centre Drive with Centreview Drive work, immediately north of Rathburn Road?</td>
<td>A. Delchev 2 We have prepared a detailed plan &amp; profile for this intersection, which will be included separately from this report.</td>
<td></td>
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<td>35</td>
<td>21</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 03</td>
<td>3</td>
<td>Is there no GA Drawing for available for Alternative 2B - HMLRT Overpass at Hurontario Street?</td>
<td>G.Bajlon/ A.Ward 1 This GA Drawing will be included in the following version of the report.</td>
<td></td>
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<tr>
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<tr>
<td>36</td>
<td>22</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 03</td>
<td>3</td>
<td>Are GA Drawings available for Alternatives 3A and 3B ?</td>
<td>G.Bajlon/ A.Ward 1</td>
<td>General Arrangement drawing for Alternative 3A is included in Appendix A. General Arrangement drawing for Alternative 3B will be added in the following version of the report.</td>
</tr>
<tr>
<td>37</td>
<td>Appendix A</td>
<td>A2</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 03</td>
<td>3</td>
<td>Stair tunnel - Is an accessibility ramp possible on the north side? Pedestrian connection and flow seems unclear. (both north, and south, of the bridge.) Unclear of tunnel - to support the stairs?</td>
<td>A. Delchev 2</td>
</tr>
<tr>
<td>38</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 03</td>
<td>3</td>
<td>Is there no GA Drawing available for Alternative 2B - HMLRT Overpass at Hurontario Street?</td>
<td>G.Bajlon/ A.Ward 1</td>
<td>Will be included in the following version of the report.</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 03</td>
<td>3</td>
<td>Are GA Drawings available for Alternatives 3A and 3B?</td>
<td>G.Bajlon/ A.Ward 1</td>
<td>Please see reply to item 36.</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Executive Summary</td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013 04</td>
<td>3</td>
<td>Provide cost of each alternative along with the cost breakdown.</td>
<td>A. Delchev 1</td>
<td>Cost estimates will not be included in this report. All cost estimates for this project will be included in a separate Cost Estimate Report.</td>
</tr>
<tr>
<td>41</td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013 04</td>
<td>3</td>
<td>Alternative 2 should mention of underpass</td>
<td>G.Bajlon/ A.Ward 1</td>
<td>Please see reply to item 33.</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013 04</td>
<td>3</td>
<td>Provide detail drawings of Port Credit Station with plan and profile drawings and provide discussion of key items such as platform slope, intersection impacts, approaches, drainage etc</td>
<td>A. Delchev 1</td>
<td>These details will be provided on the Plan &amp; Profile Engineering Drawings.</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013 04</td>
<td>3</td>
<td>Is there any hydraulics impact of having retaining wall around channel north of Port Credit Station?</td>
<td>A. Delchev 1</td>
<td>The channel will not be altered at this location - therefore, no hydraulic impact is anticipated.</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013 04</td>
<td>3</td>
<td>Mention of required min. vertical clearance(is 4.8m acceptable?)</td>
<td>G.Bajlon/ A.Ward 1</td>
<td>Will be added. 4.8m is acceptable in this location.</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013 04</td>
<td>3</td>
<td>Utilities impact need to assessed</td>
<td>G.Bajlon/ A.Ward 1</td>
<td>The utility relocation plan is in process and the impacts at structures will be included in the report.</td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013 04</td>
<td>3</td>
<td>This section is very general. Should be more specific to site conditions.</td>
<td>A. Delchev 1</td>
<td>This section discusses the structures only (bridge and retaining walls). Issues relating to the conditions at the site which do not impact the structures will be addressed in Plan &amp; Profile Engineering Drawings in the next phase of the project.</td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013 04</td>
<td>3</td>
<td>Cost of track diversion during construction should be factored in an overall cost. Also, provide details of track diversion to determine the property impacts etc.</td>
<td>G.Bajlon/ A.Ward 1</td>
<td>Track diversion will be within existing GO/Metrolinx corridor. Cost of track diversion will be included in the Cost Estimate Report.</td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013 04</td>
<td>3</td>
<td>Discussion on interchange reconfiguration should be discussed.</td>
<td>A. Delchev 1</td>
<td>These details will be provided on the Plan &amp; Profile Engineering Drawings.</td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013 04</td>
<td>3</td>
<td>Utilities impact need to assessed. There is probably a fibre optic crossing the QEW at this location.</td>
<td>G.Bajlon/ A.Ward 1</td>
<td>The utility relocation plan is in process and the impacts at structures will be included in the report.</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013 04</td>
<td>3</td>
<td>Provide detail drawings of alternative including plan and profile drawings and provide discussion of key items such as interchange, property impact, drainage etc</td>
<td>A. Delchev 1</td>
<td>The provided General Arrangement drawing is based on the Plan &amp; Profile Engineering Drawings, which include interchange, property impacts and drainage items.</td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013 04</td>
<td>3</td>
<td>Profile adjustment needs to be confirmed by this study.</td>
<td>A. Delchev 1</td>
<td>Please see reply to item 29.</td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013 04</td>
<td>3</td>
<td>Mention of recent BRT construction and long term BRT impacts</td>
<td>A. Delchev 1</td>
<td>BRT construction and long term impacts have been accounted for in the Plan &amp; Profile Engineering Drawings.</td>
<td></td>
</tr>
<tr>
<td>Item No.</td>
<td>Section</td>
<td>Pg. #</td>
<td>City</td>
<td>Reviewer Name</td>
<td>Review Date</td>
<td>Code</td>
<td>Reviewer Comments</td>
<td>Consultant Team Response</td>
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<tr>
<td>53</td>
<td>7.0</td>
<td></td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013 04</td>
<td>3</td>
<td>Are we widening this bridge for Alternative 3B of Hwy. 403 crossing?</td>
<td>G.Bajlon/ A.Ward</td>
</tr>
<tr>
<td>54</td>
<td>7.0</td>
<td></td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013 04</td>
<td>3</td>
<td>Provide GA drawings</td>
<td>G.Bajlon/ A.Ward</td>
</tr>
<tr>
<td>55</td>
<td>8.0</td>
<td></td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013 04</td>
<td>3</td>
<td>Does it require hydraulic analysis to confirm sizing for the Cooksville Creek</td>
<td>A. Delchev</td>
</tr>
<tr>
<td>56</td>
<td>8.0</td>
<td></td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013 04</td>
<td>3</td>
<td>Provide Hwy. 403 crossing Alternative Nov 25, 2012 as mentioned in the report</td>
<td>A. Delchev</td>
</tr>
<tr>
<td>57</td>
<td>8.0</td>
<td></td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013 04</td>
<td>3</td>
<td>Terminology of underpass and overpass needs to be corrected</td>
<td>G.Bajlon/ A.Ward</td>
</tr>
<tr>
<td>58</td>
<td>8.0</td>
<td>20</td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013 04</td>
<td>3</td>
<td>Confirm cross section requirements (bike path or bike lanes)</td>
<td>A. Delchev</td>
</tr>
<tr>
<td>59</td>
<td>8.0</td>
<td></td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013 04</td>
<td>3</td>
<td>Profile detailed drawings including plan and profile for all alternatives</td>
<td>A. Delchev</td>
</tr>
<tr>
<td>60</td>
<td>8.0</td>
<td>11</td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013 04</td>
<td>3</td>
<td>Structures should be compatible with the DT21 long term vision. Discussion on the DT21 road reconfiguration around this interchange needs to be discussed in the section.</td>
<td>A. Delchev</td>
</tr>
<tr>
<td>61</td>
<td>8.0</td>
<td>11</td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013 04</td>
<td>3</td>
<td>Utilities impact need to be assessed</td>
<td>G.Bajlon/ A.Ward</td>
</tr>
<tr>
<td>62</td>
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<td>11</td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013 04</td>
<td>3</td>
<td>Provide staging details for Alternative 3B</td>
<td>A. Delchev</td>
</tr>
<tr>
<td>63</td>
<td>9.0</td>
<td></td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013 04</td>
<td>3</td>
<td>The newly constructed underpass structure for Hwy. 401 off ramp (connection to Whittle Road) should be included in this report.</td>
<td>G.Bajlon/ A.Ward</td>
</tr>
<tr>
<td>64</td>
<td>5.0</td>
<td></td>
<td>MTO</td>
<td>Rebecca Li</td>
<td>2013 04 16</td>
<td>3</td>
<td>Please confirm if tunnelling has been ruled out based on statements contained in Section 5.4 of the report.</td>
<td>A. Delchev</td>
</tr>
<tr>
<td>65</td>
<td>8.0</td>
<td></td>
<td>MTO</td>
<td>Rebecca Li</td>
<td>2013 04 16</td>
<td>3</td>
<td>Alternative 2A – Proposed Steel I-Girder bridge</td>
<td>V. Zubacs/ A.Ward</td>
</tr>
<tr>
<td>66</td>
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<td>MTO</td>
<td>Rebecca Li</td>
<td>2013 04 16</td>
<td>3</td>
<td>Alternative 3A</td>
<td>V. Zubacs/ A.Ward</td>
</tr>
</tbody>
</table>

The proponent indicates that the existing elastomeric laminated bearings at abutments will need to be replaced due to overstressing. Does the structure evaluation reveal other deficient structure elements? What did the structure evaluation reveal about the adequacy of the bridge foundations?
<table>
<thead>
<tr>
<th>Item No.</th>
<th>Section</th>
<th>Pg.</th>
<th>City</th>
<th>Reviewer Name</th>
<th>Review Date</th>
<th>Code</th>
<th>Reviewer Comments</th>
<th>Consultant Team Response</th>
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<tbody>
<tr>
<td>67</td>
<td>8.0</td>
<td></td>
<td>MTO</td>
<td>Rebecca Li</td>
<td>2013 04 16</td>
<td>Alternative 3B</td>
<td>V. Zubacs/ A.Ward</td>
<td>A semi-integral structure (jointless) utilizing the existing abutments is proposed for this alternative.</td>
</tr>
</tbody>
</table>

What type of structure is being proposed for this alternative? MTO policy requires integral abutment bridge type (i.e. jointless) for new structures.
### COMMENTS ON VERSION PD:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Section</th>
<th>Pg.</th>
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<th>Code</th>
<th>Reviewer Comments</th>
<th>Consultant Team Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>68</td>
<td>Executive Summary</td>
<td>v</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 07 03</td>
<td>1</td>
<td>Highway 403 Crossing: Alternatives 3A and 3B - Underpass should be replaced with “Overpass”.</td>
<td>A.Ward / V. Zubacs 1</td>
</tr>
<tr>
<td>69</td>
<td>v</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 07 03</td>
<td>1</td>
<td>Highway 401 Crossing: Replace description with &quot;Hurontario Street Overpass of Highway 401&quot;.</td>
<td>A.Ward / V. Zubacs 1</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>v</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 07 03</td>
<td>1</td>
<td>Highway 407 Crossing: Replace description with &quot;Hurontario Street Overpass of Highway 407&quot;.</td>
<td>A.Ward / V. Zubacs 1</td>
<td></td>
</tr>
<tr>
<td>71</td>
<td>4.5</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 07 03</td>
<td>5</td>
<td>For the Rail detouring - what is the proposed Allignment?/ Extent?/ Property impacts?</td>
<td>A. Delchev 1</td>
<td></td>
</tr>
<tr>
<td>72</td>
<td>4.7</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 07 03</td>
<td>3</td>
<td>Can the specific utility(s) be identified here?</td>
<td>A. Delchev 1</td>
<td></td>
</tr>
<tr>
<td>73</td>
<td>5.1</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 07 03</td>
<td>3</td>
<td>I presume, the existing bridge is to be removed (rather than &quot;closed&quot;)?</td>
<td>A. Delchev 1</td>
<td></td>
</tr>
<tr>
<td>74</td>
<td>5.5</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 07 03</td>
<td>1</td>
<td>Add- Sufficient lighting of the bridge deck is provided by the existing lights adjacent to the proposed bridge.</td>
<td>A.Ward / V. Zubacs 1</td>
<td></td>
</tr>
<tr>
<td>75</td>
<td>6.0</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 07 03</td>
<td>1</td>
<td>Insert - will be relocated 'to a new underpass&quot; east of the existing bridge.</td>
<td>A.Ward / V. Zubacs 1</td>
<td></td>
</tr>
<tr>
<td>76</td>
<td>6.3</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 07 03</td>
<td>1</td>
<td>Replace with &quot;The Hurontario Street (NB) Underpass of the QEW&quot;.</td>
<td>A.Ward / V. Zubacs 1</td>
<td></td>
</tr>
<tr>
<td>77</td>
<td>9.1</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 07 03</td>
<td>1</td>
<td>Should read Highway 403 &quot;Overpass&quot;.</td>
<td>A.Ward / V. Zubacs 1</td>
<td></td>
</tr>
<tr>
<td>78</td>
<td>9.4</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 07 03</td>
<td>1</td>
<td>Replace headings and text with &quot;City Centre Drive Overpass of Highway 403&quot; and &quot;Northern Distribution Road Overpass of N-S Ramp&quot;.</td>
<td>A.Ward / V. Zubacs 1</td>
<td></td>
</tr>
<tr>
<td>79</td>
<td>9.4</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 07 03</td>
<td>1</td>
<td>Replace headings and text with &quot;HMLRT Overpass of Highway 403&quot; and &quot;HMLRT Underpass at Hurontario Street&quot;.</td>
<td>A.Ward / V. Zubacs 1</td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>9.4</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 07 03</td>
<td>1</td>
<td>In Alternative 3A, outline what the bridge will accommodate, as is done in Alternative 3B.</td>
<td>A.Ward / V. Zubacs 1</td>
<td></td>
</tr>
<tr>
<td>81</td>
<td>10.1</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 07 03</td>
<td>1</td>
<td>Replace headings and text with &quot;Hurontario Street Overpass of Highway 401&quot; and &quot;Whittle Road Underpass of Hurontario Street&quot;.</td>
<td>A.Ward / V. Zubacs 1</td>
<td></td>
</tr>
<tr>
<td>82</td>
<td>Appendix A</td>
<td>Dwg 6</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013 07 03</td>
<td>3</td>
<td>Unsure of why 1/2 shade area work zone shown. (typ.)</td>
<td>A.Ward / V. Zubacs 1</td>
</tr>
</tbody>
</table>

*Please note that this bridge is described as an "underpass" on the existing bridge drawings. This is in agreement with the naming convention shown in Figure 2.5.8(2) on Page 2-26 of MTO's Structural Manual (see attached). We suggest this naming convention be maintained for consistency and clarity.*

*Please see reply to item 68.*

*Metrolinx/GO Transit has been contacted regarding this detour. All detours will be within the existing ROW. Please see reply to item 47.*

*The utility described in this section is a Bell Canada conduit. This will be included in the report.*

*The existing bridge is to be removed. The report will be revised.*

*We suggest the naming convention shown in MTO's Structural Manual be maintained for consistency and clarity.*

*We suggest the naming convention shown in MTO's Structural Manual be maintained for consistency and clarity.*

*Please see reply to item 68.*

*The shaded area shown on the drawing indicates the location of the new bridge construction. The drawing will be revised for clarity.
<table>
<thead>
<tr>
<th>Item No.</th>
<th>Section</th>
<th>Pg. #</th>
<th>City</th>
<th>Reviewer Name</th>
<th>Review Date</th>
<th>Code</th>
<th>Reviewer Comments</th>
<th>Consultant Team Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>83</td>
<td>Appendix A</td>
<td>Dwgs 1,12</td>
<td>Mississauga</td>
<td>W Scott Anderson</td>
<td>2013/07/03</td>
<td>3</td>
<td>Dwg 1 shows minimum vertical clearance to be 4800, while Dwg 12 shows minimum vertical clearance to be 5000. Amend Dwg 1 to be 5000.</td>
<td>A. Delchev 1</td>
</tr>
<tr>
<td>84</td>
<td>General</td>
<td>28</td>
<td>LEA</td>
<td>JS</td>
<td>2013/06/16</td>
<td>A</td>
<td>Lighting calls for street lighting and underpass lighting for all Hwy 403 crossing alternatives. Please confirm that this would apply to the dedicated LRT ROW alternatives 2A, 2B, 2C.</td>
<td>A. Delchev 1</td>
</tr>
<tr>
<td>85</td>
<td>Infrastructure Planning</td>
<td></td>
<td>Brampton</td>
<td>Khurram Tunio</td>
<td>2013/07/23</td>
<td></td>
<td>Please confirm the structural report has been circulated to CN/GO as well as to 407ETR for review and comments. Please provide copy of comments/response for our records.</td>
<td>A. Delchev 1</td>
</tr>
<tr>
<td>86</td>
<td>Infrastructure Planning</td>
<td></td>
<td>Brampton</td>
<td>Khurram Tunio</td>
<td>2013/07/23</td>
<td></td>
<td>Provide GA drawing of CN bridge crossing at north end of project limits including recommended road profile likely under pinning the structure.</td>
<td>A.Ward / V. Zubacs 1</td>
</tr>
<tr>
<td>87</td>
<td>Infrastructure Planning</td>
<td></td>
<td>Brampton</td>
<td>Khurram Tunio</td>
<td>2013/07/23</td>
<td></td>
<td>As mentioned in previous comments, increase the sidewalk widths on both structures of Etobicoke Creek to approx. 2.5m-3m to accommodate wider sidewalks or future extension of multi-use / bike paths through the bridge crossing. We have request from City's Planning section to extend multi-use path north of Steeles along Hurontario Street. Note that SNC still has to review feasibility of extension of multi-use path / bike path along Hurontario Street north of Steeles all the way to north of Nanwood.</td>
<td>A. Delchev 1</td>
</tr>
<tr>
<td>88</td>
<td>Infrastructure Planning</td>
<td></td>
<td>Brampton</td>
<td>Khurram Tunio</td>
<td>2013/07/23</td>
<td></td>
<td>Modify / confirm parapet wall width to accommodate double tube railings on top of parapet wall to satisfy safety considerations of cyclists crossing the structure.</td>
<td>A.Ward / V. Zubacs 1</td>
</tr>
<tr>
<td>89</td>
<td>Infrastructure Planning</td>
<td></td>
<td>Brampton</td>
<td>Khurram Tunio</td>
<td>2013/07/23</td>
<td></td>
<td>Conduct sub structure field investigations on Etobicoke creek crossing structures and confirm the structural conditions including life expectancy. If remaining life of super structure is 25 years, have cracks and not suitable for increase in load, can we anticipate the same for sub structure and may likely requires rehabilitation / replacement accordingly? Report to clearly identify the assessments and investigations on compatibility of sub structure with super structure.</td>
<td>A.Ward / V. Zubacs 1</td>
</tr>
<tr>
<td>Item No.</td>
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<td>Reviewer Name</td>
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<tr>
<td>90</td>
<td>Infrastructure Planning</td>
<td>Brampton</td>
<td>Khurram Tunio</td>
<td>2013/07/23</td>
<td></td>
<td>The GA of the rehabilitated structure indicates two 3300 mm Lanes to the Right and Left of the LRT tracks. This lane width do not fulfills the requirements of “Geometric Design Standards for Ontario Highways Manual Table D2-3” requirements.</td>
<td>A. Delchev 1</td>
<td></td>
</tr>
<tr>
<td>91</td>
<td>Infrastructure Planning</td>
<td>Brampton</td>
<td>Khurram Tunio</td>
<td>2013/07/23</td>
<td></td>
<td>There seems to be little typo in section 12.4 Alternative 3 (2nd paragraph)</td>
<td>A.Ward / V. Zubacs 1</td>
<td></td>
</tr>
<tr>
<td>92</td>
<td>Infrastructure Planning</td>
<td>Brampton</td>
<td>Khurram Tunio</td>
<td>2013/07/23</td>
<td></td>
<td>“Given that the existing substructures are suitable to support the proposed LRT, and that their service life can be extended by rehabilitation, it is recommended that Alternative 2 be adopted. This alternative also avoid replacement of the existing footings, which will reduce the environmental impact on the Etobicoke Creek.” - According to Alternative 2, the existing substructures will remain and the superstructure will be replaced. The durability of the existing substructures and the new superstructure will be the same or not? There is no recommendation about this.</td>
<td>A.Ward / V. Zubacs 1</td>
<td></td>
</tr>
<tr>
<td>93</td>
<td>Engineering - Etobicoke Creek Crossings North - Section 13</td>
<td>Brampton</td>
<td>Khurram Tunio</td>
<td>2013/07/23</td>
<td></td>
<td>There seems to be little typo in section 13.4 Alternative 3 (2nd paragraph)</td>
<td>A.Ward / V. Zubacs 1</td>
<td></td>
</tr>
<tr>
<td>94</td>
<td>Engineering - Etobicoke Creek Crossings North - Section 13</td>
<td>Brampton</td>
<td>Khurram Tunio</td>
<td>2013/07/23</td>
<td></td>
<td>“Given that the existing substructures are suitable to support the proposed LRT, and that their service life can be extended by rehabilitation, it is recommended that Alternative 2 be adopted. This alternative also avoid replacement of the existing footings, which will reduce the environmental impact on the Etobicoke Creek.” - According to Alternative 2, the existing substructures will remain and the superstructure will be replaced. The durability of the existing substructures and the new superstructure will be the same or not? There is no recommendation about this.</td>
<td>A.Ward / V. Zubacs 1</td>
<td></td>
</tr>
<tr>
<td>95</td>
<td>Section 9.0 Highway 403 Crossing (Alternative 3A)</td>
<td>MTO</td>
<td>Clement Shim</td>
<td>2013/07/22</td>
<td></td>
<td>The rehabilitated bridge deck cross-section provides only 2 (as opposed to 3) traffic lanes in each direction on Hurontario Street.</td>
<td>A. Delchev 1</td>
<td></td>
</tr>
<tr>
<td>96</td>
<td>Section 9.0 Highway 403 Crossing (Alternative 3A)</td>
<td>MTO</td>
<td>Clement Shim</td>
<td>2013/07/22</td>
<td></td>
<td>The structural evaluation of the existing bridge indicates that the laminated elastomeric bearings at abutments will be overstressed under the proposed LRT train loading and the associated additional dead load. If these bearings are to be replaced with larger bearings, the proponent must ensure that the resulting bearing seat dimensions can be adequately accommodated at the top of the existing abutment.</td>
<td>A.Ward / V. Zubacs 1</td>
<td></td>
</tr>
<tr>
<td>Item No.</td>
<td>Section</td>
<td>Pg. #</td>
<td>City</td>
<td>Reviewer Name</td>
<td>Review Date</td>
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<td>Reviewer Comments</td>
<td>Consultant Team Response</td>
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<tr>
<td>97</td>
<td>Section 9.0</td>
<td>Highway 403 Crossing (Alternative 3A)</td>
<td>MTO</td>
<td>Clement Shim</td>
<td>2013/07/22</td>
<td></td>
<td>Did the structural evaluation include the bridge foundations? complete structural evaluation report is required for ministry record purposes.</td>
<td>A.Ward / V. Zubacs</td>
</tr>
<tr>
<td>98</td>
<td>Section 9.0</td>
<td>Highway 403 Crossing (Alternative 3A)</td>
<td>MTO</td>
<td>Clement Shim</td>
<td>2013/07/22</td>
<td></td>
<td>Please provide details of the proposed longitudinal joint between the twin structures.</td>
<td>A.Ward / V. Zubacs</td>
</tr>
<tr>
<td>99</td>
<td>Section 9.0</td>
<td>Highway 403 Crossing (Alternative 3A)</td>
<td>MTO</td>
<td>Clement Shim</td>
<td>2013/07/22</td>
<td></td>
<td>Please provide the retrofit design details of the new raised concrete LRT platform on the existing post-tensioned deck.</td>
<td>A.Ward / V. Zubacs</td>
</tr>
<tr>
<td>100</td>
<td>Section 9.0</td>
<td>Highway 403 Crossing (Alternative 3A)</td>
<td>MTO</td>
<td>Clement Shim</td>
<td>2013/07/22</td>
<td></td>
<td>MTO has plans to rehabilitate this structure in 2014. What is the anticipated LRT construction start date?</td>
<td>A. Delchev</td>
</tr>
<tr>
<td>101</td>
<td>Section 9.0</td>
<td>Highway 403 Crossing (Alternative 3A)</td>
<td>MTO</td>
<td>Clement Shim</td>
<td>2013/07/22</td>
<td></td>
<td>Any future structure rehabilitation/reconstruction will impact the LRT service and operation on this bridge. Does LRT have any plans put in place to accommodate bridge reconstruction works?</td>
<td>A. Delchev</td>
</tr>
<tr>
<td>102</td>
<td>General</td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013/07/22</td>
<td></td>
<td>Structure terminology is a bit confusion. In our point of view underpass should be referred as overpass and vice versa. Needs to be corrected.</td>
<td>A.Ward / V. Zubacs</td>
<td>Please see response to item 68.</td>
</tr>
<tr>
<td>103</td>
<td>General</td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013/07/22</td>
<td></td>
<td>Property impacts are to be identified in the report.</td>
<td>A. Delchev</td>
<td>Please see response to item 40.</td>
</tr>
<tr>
<td>104</td>
<td>General</td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013/07/22</td>
<td></td>
<td>Property impacts are to be identified in the report.</td>
<td>A. Delchev</td>
<td>Please see response to item 50.</td>
</tr>
<tr>
<td>105</td>
<td>4.0</td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013/07/22</td>
<td></td>
<td>Page 8 mentions of minimum 4.8m vertical clearance whereas plan and profile shows 4.7m.</td>
<td>A. Delchev</td>
<td>The report will be revised to show 4.7m vertical clearance.</td>
</tr>
<tr>
<td>106</td>
<td>4.0</td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013/07/22</td>
<td></td>
<td>Page 11 We need to see construction staging information (any property impacts?)</td>
<td>A. Delchev</td>
<td>As discussed in the report, the new bridge will be constructed in 3 stages including temporary diversion of the tracks. This will allow for operation of three tracks during construction. No property impacts are anticipated as the track diversion will be within the width of the existing bridge (and ROW). Please also see response to item 47.</td>
</tr>
<tr>
<td>107</td>
<td>4.0</td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013/07/22</td>
<td></td>
<td>Page 11 Costs of utilities to be factored in.</td>
<td>A. Delchev</td>
<td>Please see response to item 40.</td>
</tr>
<tr>
<td>Item No.</td>
<td>Section</td>
<td>Pg. #</td>
<td>City</td>
<td>Reviewer Name</td>
<td>Review Date</td>
<td>Code</td>
<td>Reviewer Comments</td>
<td>Consultant Team Response</td>
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<tr>
<td>108</td>
<td>6.0</td>
<td>14</td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013/07/22</td>
<td></td>
<td>Page 14 Shows minimum of 5m vertical clearance where as P&amp;P shows 5.4m</td>
<td>A. Delchev 1</td>
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<td></td>
<td>4.7m is considered the minimum vertical clearance for the LRT guideway (see response to item 83). 5.0m is the minimum vertical clearance for the roadway. The dimension of 5.4m shown on the P&amp;P drawings is a measured dimension, which satisfies the minimum clearance constraint. The P&amp;P drawing will be revised.</td>
<td></td>
</tr>
<tr>
<td>109</td>
<td>9.0</td>
<td></td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013/07/22</td>
<td></td>
<td>Include a preferred option for the LRT for Hwy. 403. Include a new structure for Cooksville creek. Any retaining wall requirements and property impacts should be identified particularly around Sherwood intersection.</td>
<td>A. Delchev 1</td>
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<td></td>
<td>The preferred option for the LRT for Highway 403 is Alternative 3C (see memorandum included as addendum to report). The new structure over Cooksville Creek required for this option is considered in the revised report, with a GA drawing included. Any additional retaining walls will be considered as well.</td>
<td></td>
</tr>
<tr>
<td>110</td>
<td>9.0</td>
<td></td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013/07/22</td>
<td></td>
<td>Include recent MTO’s comments (bridge is scheduled to be rehabilitated in 2014)</td>
<td>A. Delchev 1</td>
</tr>
<tr>
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<td></td>
<td>MTO’s recent comments are included above (items 95-101) and will be addressed in the report.</td>
<td></td>
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<tr>
<td>111</td>
<td>9.0</td>
<td></td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013/07/22</td>
<td></td>
<td>The preferred alignment is not in conflict with the Northern Distribution Road or DT21 interests.</td>
<td>A. Ward / V. Zubacs 1</td>
</tr>
<tr>
<td>112</td>
<td>9.0</td>
<td></td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013/07/22</td>
<td></td>
<td>The possibility of including a bicycle and pedestrian trail as part of these options was considered and rejected during earlier stages of the project.</td>
<td>A. Delchev 1</td>
</tr>
<tr>
<td>113</td>
<td>9.0</td>
<td></td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013/07/22</td>
<td></td>
<td>The utilities information is based on all available information/investigations. The preferred alignment does not conflict with these utilities.</td>
<td>A. Ward / V. Zubacs 1</td>
</tr>
<tr>
<td>114</td>
<td>9.0</td>
<td></td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013/07/22</td>
<td></td>
<td>The preferred alignment is not in conflict with the Northern Distribution Road or DT21 interests.</td>
<td>A. Delchev 1</td>
</tr>
<tr>
<td>115</td>
<td>9.0</td>
<td></td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013/07/22</td>
<td></td>
<td>Please see response to item 114.</td>
<td>A. Delchev 1</td>
</tr>
<tr>
<td>116</td>
<td>Appendix A</td>
<td></td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013/07/22</td>
<td></td>
<td>Go Station GA - Sidewalk is 5.15m wide where as P&amp;P shows 5.7m</td>
<td>A. Delchev 1</td>
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<td></td>
<td>The P&amp;P drawings show a sidewalk/platform width of 5.7m to the south of the bridge. The width below the bridge is approximately 5.15m.</td>
<td></td>
</tr>
<tr>
<td>117</td>
<td>Appendix A</td>
<td></td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013/07/22</td>
<td></td>
<td>QEW Overpass - GA shows 3.5m MUT where as P&amp;P shows 4m. Why we have Guideway information under the existing (Sherwood intersection)</td>
<td>A. Delchev 1</td>
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<td></td>
<td>The existing QEW structure can handle the staging requirements as a limiting factor.</td>
<td></td>
</tr>
<tr>
<td>118</td>
<td>Appendix A</td>
<td></td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013/07/22</td>
<td></td>
<td>Confirm existing QEW structure can handle the staging requirements to construct a new bridge</td>
<td>A. Ward / V. Zubacs 1</td>
</tr>
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<td></td>
<td>The existing QEW structure can handle the staging requirements. The staging included in the report was developed with the width of the existing bridge as a limiting factor.</td>
<td></td>
</tr>
<tr>
<td>119</td>
<td>Appendix A</td>
<td></td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013/07/22</td>
<td></td>
<td>Provide GA drawing for the recommended option of Hwy. 403 crossing and any additional bridge (Cooksville) and retaining wall (Sherwood intersection)</td>
<td>A. Ward / V. Zubacs 1</td>
</tr>
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<td></td>
<td>Please see response to item 109.</td>
<td></td>
</tr>
<tr>
<td>120</td>
<td>Appendix A</td>
<td></td>
<td>Mississauga</td>
<td>Abdul Shaikh</td>
<td>2013/07/22</td>
<td></td>
<td>Update GA drawings for 2A, 2B and 2C by considering the pedestrian and cycling (active transportation)</td>
<td>A. Delchev 1</td>
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<td>Please see response to item 112.</td>
<td></td>
</tr>
<tr>
<td>121</td>
<td>9.0</td>
<td></td>
<td>MTO</td>
<td>Rebecca Li</td>
<td>2013/08/06</td>
<td></td>
<td>Hwy 403/Hurontario St. Underpass is in need of major rehabilitation within the next 5 years. There is a potential conflict in construction timing between the LRT work and the MTO’s rehab work.</td>
<td>A. Ward / V. Zubacs 1</td>
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<td>Please refer to the memorandum entitled &quot;Highway 403 Crossing – Preferred Alternative&quot; which outlines 2 scenarios for completion of the LRT work.</td>
<td></td>
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<td>Item No.</td>
<td>Section</td>
<td>City</td>
<td>City Reviewer Name</td>
<td>Review Date</td>
<td>Code</td>
<td>Reviewer Comments</td>
<td>Consultant Team Response</td>
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<tr>
<td>122</td>
<td>9.0</td>
<td>MTO</td>
<td>Rebecca Li</td>
<td>2013/08/06</td>
<td>1</td>
<td>If [Alternative 3C] is selected, the preference is to have the City undertake the Hwy 403/Hurontario structure rehabilitation work as part of the LRT work: better efficiency in retrofitting LRT design on the existing structure; better control in terms of design and administering traffic staging, etc.</td>
<td>A. Delchev</td>
<td>1</td>
</tr>
<tr>
<td>123</td>
<td>9.0</td>
<td>MTO</td>
<td>Rebecca Li</td>
<td>2013/08/06</td>
<td>1</td>
<td>A Legal Agreement for the proposed work is required.</td>
<td>A. Delchev</td>
<td>1</td>
</tr>
<tr>
<td>124</td>
<td>407 ETR</td>
<td>Jeff Booker</td>
<td>2013/09/03</td>
<td>1</td>
<td>The PSA report indicates that the precast girders at the piers below the proposed LRT guide way will be overstressed by 13% and the existing pier bearings will also be overstressed with the addition of the proposed LRT guide way. This is a major concern/issue for 407ETR.</td>
<td>A. Ward / V. Zubacs</td>
<td>1</td>
<td>As discussed in the report, the required moment capacity can be achieved through placement of a 150mm concrete overlay with additional longitudinal reinforcing steel at the location of the proposed guideway. It is also recommended that the pier bearings be replaced. Once these measures are implemented, the bridge will be able to resist the applied loading at SLS and ULS. We are also proposing the use of FRP panels as infill between rails in order to reduce the dead load and avoid any strengthening. A proposed detail is included in the report.</td>
</tr>
<tr>
<td>125</td>
<td>407 ETR</td>
<td>Jeff Booker</td>
<td>2013/09/03</td>
<td>1</td>
<td>Also a structural evaluation of the load increase to the abutment piles has not been completed and provided for review.</td>
<td>A. Ward / V. Zubacs</td>
<td>1</td>
<td>Our structural evaluation indicates that the load increase to the abutment piles is acceptable. A structural evaluation summary report will be provided for review.</td>
</tr>
<tr>
<td>126</td>
<td>407 ETR</td>
<td>Jeff Booker</td>
<td>2013/09/03</td>
<td>1</td>
<td>407 ETR would also like to receive additional information on the structural evaluation of the existing pier column/pier cap (the existing pier cap may have to be strengthened to accommodate the proposed LRT), as well as an evaluation on the ability of the overall structure to accommodate thermal movements since the addition of the proposed LRT guide way may have an effect on this.</td>
<td>A. Ward / V. Zubacs</td>
<td>1</td>
<td>As mentioned above, a structural evaluation summary report will be provided for review. Our evaluation indicates that the load increase to the pier columns and cap is acceptable. As for the structure’s thermal movements, it is proposed to install expansion joints in the rails at the ends of the approach slabs. This will allow for the structure and rails to expand and contract freely.</td>
</tr>
<tr>
<td>127</td>
<td>MTO</td>
<td>Clement Shim</td>
<td>2013/09/04</td>
<td>1</td>
<td>MTO’s proposed work is to eliminate expansion joints by making the bridge semi-integral in its rehabilitation contract. The submitted PSA indicates that it is necessary to replace the bearings at the abutments. Have you taken the proposed semi-integral conversion into your design consideration?</td>
<td>A. Ward / V. Zubacs</td>
<td>1</td>
<td>Yes, semi-integral abutment conversion is proposed for Scenario No. 2. Scenario No. 1 assumes that semi-integral abutment conversion will be completed as part of MTO’s proposed rehabilitation.</td>
</tr>
<tr>
<td>128</td>
<td>MTO</td>
<td>Clement Shim</td>
<td>2013/09/04</td>
<td>1</td>
<td>In addition, a new overlay, waterproofing, paving, replacement of parapet walls and many other activities have been proposed as part of the MTO’s bridge rehabilitation project. These items will be wasted (throw-away) if Scenario No.1 is implemented.</td>
<td>A. Delchev</td>
<td>1</td>
<td>We agree that Scenario No. 2 would minimize cost and traffic impacts. However, at this time the HMLRT schedule cannot be tied to MTO’s plans for bridge rehabilitation.</td>
</tr>
<tr>
<td>129</td>
<td>MTO</td>
<td>Clement Shim</td>
<td>2013/09/04</td>
<td>1</td>
<td>Did your structural evaluation include the structure foundations? A complete detailed structural evaluation report is required to assess the overall structural integrity of the bridge.</td>
<td>A. Ward / V. Zubacs</td>
<td>1</td>
<td>Please see response to item 97.</td>
</tr>
<tr>
<td>Item No.</td>
<td>Section</td>
<td>City</td>
<td>Reviewer Name</td>
<td>Review Date</td>
<td>Code</td>
<td>Reviewer Comments</td>
<td>Consultant Team Response</td>
<td>Response Description</td>
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<tr>
<td>130</td>
<td>MTO</td>
<td>Clement Shim</td>
<td>2013/09/04</td>
<td>Y.</td>
<td>Your memo entitled Bridge Rehabilitation Staging Schemes of July 23, 2013 outlines the rehabilitation staging concept with an LRT system in place. Will this staging concept be valid/workable when the future traffic volumes (both LRT and vehicular) are applied?</td>
<td>A. Ward / V. Zubacs</td>
<td>It is our opinion that the staging concepts will be workable and better than a similar future rehabilitation of the existing structure since an additional southbound lane will be added as a result of the LRT.</td>
<td></td>
</tr>
<tr>
<td>131</td>
<td>MTO</td>
<td>Clement Shim</td>
<td>2013/09/04</td>
<td>Y.</td>
<td>Have you considered other design alternatives in lieu of having the longitudinal expansion joint installed between the driving lanes (e.g. a continuous monolithic section between the existing and new structures)? The proposed longitudinal joint may not only have long term durability issues and related maintenance concerns, there is also a potential safety concern relating to vehicles, motorcycles and bicycles operating on the road with this kind of joint.</td>
<td>A. Ward / V. Zubacs</td>
<td>This concern is shared and a stitching together of the structures is being examined, since they have stiffnesses in the order of 10% of each other, using a closure pour after a suitable time in the order of 4 months for the new structure to develop the majority of the time dependent losses.</td>
<td></td>
</tr>
<tr>
<td>132</td>
<td>MTO</td>
<td>Clement Shim</td>
<td>2013/09/04</td>
<td>Y.</td>
<td>The proposed cross fall of 1% on the bridge deck is sub-standard. Minimum required is 2% to achieve effective drainage. Every effort shall be exercised to achieve design standards.</td>
<td>A. Delchev</td>
<td>The reason for the 1% crossfall is a result of maintaining the existing 4.8 m clearance under the structure. The drainage will be better than 1% due to the longitudinal slope on the bridge which varies from 0.8% at the north end of the bridge to 1.5% at the south end. This results in an effective combined slope of 1.3% drainage slope at the north end increasing to 1.8% drainage slope at the south end.</td>
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<tr>
<td>133</td>
<td>MTO</td>
<td>Clement Shim</td>
<td>2013/09/04</td>
<td>Y.</td>
<td>In the GA Drawing, &quot;Section – Rehabilitated&quot; shows that a section of the guide way (297 ±) has extended easterly onto the east structure. Have you considered moving this extended section back so that the entire guide way section is contained on the west structure only?</td>
<td>A. Ward / V. Zubacs</td>
<td>The curb shown on the northbound structure is not part of the guideway; it is simply an independent curb which will need to be reconstructed.</td>
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<tr>
<td>134</td>
<td>MTO</td>
<td>Clement Shim</td>
<td>2013/09/04</td>
<td>Y.</td>
<td>With Scenario No.2, how do you propose to waterproof and conduct future bridge deck inspection on the part of the deck under the FRP infill deck panels (with the tracks in place)?</td>
<td>A. Ward / V. Zubacs</td>
<td>With the FRP panels, the concrete deck would be waterproofed using Stirling-Lloyd’s Eliminator system or equal methylmethacrylate (MMA) system. After the rail anchors are drilled, the lift plates and rails are installed. The lift plate assembly including the grout pad would be waterproofed with the MMA system to lap the deck waterproofing. The bolts holding down the FRP panels would also be similarly waterproofed after installation. The panels can be removed for inspection of the waterproofing layer and deck top.</td>
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<tr>
<td>135</td>
<td>MTO</td>
<td>Clement Shim</td>
<td>2013/09/04</td>
<td>Y.</td>
<td>Under “Future Considerations” in your memo of August 21, 2013, have you carried out a Life Cycle Cost analysis to determine the most cost effective alternative of Rehabilitation and Widening/Retrofitting Design versus a Total Structure Replacement in light of the implementation of the LRT facility in this case?</td>
<td>A. Delchev</td>
<td>Please refer to the memorandum entitled &quot;Highway 403 Crossing – Life Cycle Cost Analysis&quot; included in Appendix C of the report.</td>
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<tr>
<td>136</td>
<td>MTO</td>
<td>Clement Shim</td>
<td>2013/09/04</td>
<td>Y.</td>
<td>Given the above, Scenario No.2 seems to be more preferable.</td>
<td>A. Delchev</td>
<td>Please see response to item 128.</td>
<td></td>
</tr>
</tbody>
</table>
thickness of any pier shafts, and both the required and the actual minimum vertical clearances under the structure, with the location of the critical point indicated. Sometimes it is not possible to indicate this location clearly on the Elevation and an indication also has to be given on the Plan. Use the W.P. symbol \( \cdot \). Print in small text footing top elevations, water levels, (see 2.5.4) an approximate lower pavement level, bearing types ("exp", "fixed" etc.), existing ground line designation, minimum soffit elevation for water crossings, railing type, railing anchorage required, rock protection or slope paving notes, and such other notes as are necessary. Note that elevations should always be given to the top of footings and never to the bottom. If it is necessary to define the bottom of footing level, give the top elevation and dimension the footing depth.

A triangular numbered symbol (optional Elevation title) followed by the scale should show, by reference to the corresponding symbol on the plan, where and in what direction the view is taken.

Figure 2.5.8(2) UNDERPASS, OVERPASS, SUBWAY AND OVERHEAD BRIDGES
Document Revision History

Revision 0:

Initial report