APPENDIX K

Consultation Records
Landowners Group Meetings
Good morning,

This morning I presented the preferred alternative designs for the proposed improvements for the three study areas. There were no major comments with regards to the preferred alternative designs. There were comments about financing and “tweaking” ROW requirements but it was understood these were beyond the Class EA objectives and would be dealt with in future stages of study.

The LOG asked for the CAD files for all the roadways. We have provided these in the past, so I would hope we can comply with this latest request. Can you please have these to me by early next week?

We spoke about the SWM-LID strategy and agreed to provide the LOG with a draft of the SWM Strategy once the City has reviewed the document. Any information you can provide them in advance with regards to any upsizing of the ponds, etc., would be appreciated.

FYI –

• I’m meeting with Town of Innisfil staff on March 24 to present the preferred design for Huronia, Lockhart, Big Bay Point Rd.
• I’m meeting with the LSCRA to provide an overview of our SWM strategy on March 31
• I’m in the process of scheduling a meeting with the County
• I’m meeting with property owners where there is “significant” impact to their property (4 properties, all in the Hewitt’s Area)

Kind regards,
Alvaro
FOR IMMEDIATE RELEASE

Public invited to review transportation plans for growth

(Barrie, ON) A second Public Information Centre (PIC) is being held this week with regards to transportation improvements required to service growth in the annexed lands. The PIC will allow the public to review and provide feedback on the preferred alternative roadway design for three Class Environmental Assessments (EAs). The PIC is scheduled for Thursday, April 6 at the Liberty North Banquet Hall (100 Caplan Avenue) from 4 to 7 p.m.

The three EA studies that will be discussed at this meeting include:

- Hewitt’s Secondary Plan Area Transportation Improvements
  - Purpose: Present the preferred design alternative for transportation improvements in the Hewitt’s Secondary Plan Area.

- McKay Rd East / Hwy 400 Interchange, Lockhart Rd / Salem Road Highway 400 Crossing & Associated Works
  - Purpose: Present the preferred design preferred design alternative for transportation improvements on McKay Road East - Highway 400 Interchange, Lockhart Road/Salem Road Highway 400 Crossing and associated works.

- Salem Secondary Plan Area Improvements.
  - Purpose: Present the preferred design preferred design alternative for transportation improvements in the Salem Secondary Plan Area and
present the preferred site and the design concept for the Salem Water Reservoir and Pumping Station.

The comments and responses received from the PIC will be considered in the refining of the designs and will be presented to Council on June 26, 2017. Anyone who is not able to attend and would like to provide feedback can contact Alvaro Almuina, Project Coordinator at 705-739-4220, ext. 4458 or Alvaro.almuina@barrie.ca.

For more information about the EA Studies, visit barrie.ca/EASTudies.

-30-

For more information, please contact:

Scott LaMantia  
Senior Communications Advisor  
(705) 739-4220 ext. 4529  
scott.lamantia@barrie.ca

Scott LaMantia  
Senior Communications Advisor  
Access Barrie  
City of Barrie  
Central Ontario's Premier Waterfront Community

Mayor & City Administrator's Office  
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Please consider the environment before printing this email.
Public invited to review transportation plans for growth

(Barrie, ON) A second Public Information Centre (PIC) is being held this week with regards to transportation improvements required to service growth in the annexed lands. The PIC will allow the public to review and provide feedback on the preferred alternative roadway design for three Class Environmental Assessments (EAs). The PIC is scheduled for **Thursday, April 6** at the Liberty North Banquet Hall (100 Caplan Avenue) from 4 to 7 p.m.

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- **Hewitt’s Secondary Plan Area Transportation Improvements**
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- **McKay Rd East / Hwy 400 Interchange, Lockhart Rd / Salem Road Highway 400 Crossing & Associated Works**
  - Purpose: Present the preferred design alternative for transportation improvements on McKay Road East - Highway 400 Interchange, Lockhart Road/Salem Road Highway 400 Crossing and associated works.

- **Salem Secondary Plan Area Improvements.**
  - Purpose: Present the preferred design alternative for transportation improvements in the Salem Secondary Plan Area and present the preferred site and the design concept for the Salem Water Reservoir and Pumping Station.

The comments and responses received from the PIC will be considered in the refining of the designs and will be presented to Council on June 26, 2017. Anyone who is not able to attend and would like to provide feedback can contact Alvaro Almuina, Project Coordinator at 705-739-4220, ext. 4458 or Alvaro.almuina@barrie.ca.

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Senior Communications Advisor
(705) 739-4220 ext. 4529
scott.lamantia@barrie.ca
Where the new roads could go in south-end Barrie will be on display Thursday at a public information meeting.

This meeting is Sept. 22, 4-7 p.m. at Liberty North Banquet Hall, 100 Caplan Ave. in Barrie.

It's to allow the public to both review and provide feedback on proposed, alternative designs for transportation in the Hewitt's Secondary Plan area, the McKay Road East and Highway 400 interchange, the Lockhart Road and Salem Road Highway 400 crossing and the Salem Secondary Plan area.

Comments and responses will be considered in the selection and development of the roads.

Anyone unable to attend and wanting to provide feedback can contact Alvaro Almuina, project co-ordinator, at 705-739-4220, ext. 4458 or at Alvaro.almuina@barrie.ca.

For more information about these matters, visit barrie.ca/EASTudies.
MTO and Municipalities
MTO & Barrie Meeting
Highway 400 Preliminary Design Update
11 December 2015
Downsview Complex, 1201 Wilson Avenue, Toronto, ON

Attendees:
Rakesh Shreewastav     MTO
Rob Vandenberg     MTO
Salia Kalali     MTO
Peter Dorton     MTO
Susan Sieradzki     MTO
Liaquat Ali     MTO
Jacqueline Weston     Barrie
Sheri Dimert     Barrie
Ralph Scheunemann     Barrie
Bala Araniyasundaran    Barrie
Brent Gotts     MMM
Phil Pawliuk     MHPM

ITEMS
MTO provided a brief update on the ongoing preliminary design and EA study for Highway 400, from Highway 89 to Highway 11. The meeting was attended by MTO project team members, City of Barrie engineering staff, and consultants hired by the City for their projects within the Hwy 400 corridor.

The following is a summary of the key items for which an update was provided:

• A brief outline of the latest project schedule was given. It was noted that the schedule has changed since the MTO-Barrie liaison meeting in October. It is anticipated that the team will be to finalise the study by the fall.

• The preferred mainline and interchange alternatives have been chosen internally.

• A VE workshop will take place in early February. Pending recommendations from the VE workshop, PIC#2 is currently scheduled for the summer.

• Potential VE topics include analysis of the following preferred alternatives: the westerly shift of Highway 400 centreline between Highway 89 and Mapleview Drive, constructability and staging for the diverging diamond interchange at Mapleview Drive, and constructability of the preferred interchange at Dunlop Street.

• At this stage of the project, the Highway 400 centreline shift ends just south of Mapleview, meaning the ultimate Hwy 400 centreline at Harvie Road would be kept in its current location.

• The replacement of the overpass structure at Tiffin Road is in detailed design and won’t be affected by current study.

• HOV lanes add ~5m to the overall platform of Highway 400.

• A core-collector system through Barrie is no longer under consideration.
Memorandum

To: Rob Vandenberg

CC: The City of Barrie

Subject: WO 08-20016, Contract 2015-2015, Highway 400 / 10th Line (McKay Road) Underpass Replacement – City of Barrie Request Not to Preclude a Future Interchange and Future 10th Line Widening to 7 Lanes

From: Karen Cooper

Date: January 14, 2016

1. Introduction
   1.1. Chronology
   1.2. Scope Change Order

2. Proposed Design
   2.1. Bridge
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      2.1.2. Preferred Bridge Type
      2.1.3. Span Arrangements
      2.1.4. Bridge Cross Section
      2.1.5. Heritage Features
      2.1.6. Horizontal and Vertical Clearances
      2.1.7. Retaining Wall
      2.1.8. Substructure
   2.2. Plan and Profile
   2.3. 10th Line (McKay Road) Cross Section
   2.4. 10th Line (McKay Road) Recommended Pavement Design
   2.5. Staging

3. Environmental
   3.1. Features
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4. Drainage
   4.1. Features
   4.2. Mitigation

5. Utilities
   5.1. Existing Utilities
   5.2. Utility Relocation

6. Construction
   6.1. Delivery Method
   6.2. Timing

7. Cost Sharing
   7.1. Engineering Cost Sharing
   7.2. Construction Cost Sharing

8. Conclusion
1. Introduction

The purpose of this memo is to present to City of Barrie representatives the Design Build Ready Design of the Highway 400 / 10th Line (McKay Road) Underpass Replacement completed by MTO and MTO's Consultant, AECOM.

1.1 Chronology

The Ministry of Transportation Ontario (MTO) retained AECOM (formerly URS) to complete Design Build Ready (DBR) Design of the Highway 400 / 10th Line Underpass Replacement as part of Work Order 06-20016, which also included Preliminary Design of highway improvements along approximately 30 km of Highway 400 and DBR Design for the Highway 400 / 4th Line (Churchill Sideroad) and Highway 400 / Line 11 (Coulson Road) Underpass Replacements. In response to notification of study commencement, representatives from the City of Barrie requested that MTO not preclude a future interchange and future widening of 10th Line (McKay Road) to an ultimate 7 lanes (subject to interchange type).

A meeting between MTO and City of Barrie representatives, attended by AECOM, was held on September 4, 2014 to discuss the particulars of the MTO and City of Barrie projects (see minutes in Appendix A), and it was agreed that the City of Barrie would fund additional work required to develop a design for the Highway 400 / 10th Line (McKay Road) underpass replacement that would not preclude the City of Barrie plans for a future interchange and 10th Line widening.

In 2015, the City of Barrie initiated the process for Environmental Assessment (EA) of 10th Line (McKay Road) widening from 2 to 4 lanes in the vicinity of the Highway 400 crossing. The EA is scheduled to begin in 2016.

The MTO DBR Design was effectively completed between January 2014 and October 2015. A Request for Proposals for Design Build Services was published in mid-October 2015.

MTO and AECOM presented the DBR Design to City of Barrie representatives on December 11, 2015. (see minutes and presentation slides in Appendix A)

MTO will select the DB firm in early 2016 and construction may begin by Spring 2016.

1.2 Scope Change Order

In accordance with MTO procedures, the change in scope not to preclude a future Highway 400 / 10th Line interchange and widening to 7 lanes (subject to interchange type) was documented in a Change Request Letter prepared by AECOM and a Change Order issued by MTO. The letter is in Appendix A.

The additional scope of work included:
- Development of a preliminary interchange layout (Parclo A4) to determine the requirements for a bridge that could be expanded in the future for a new interchange; and
- Structural Design (Design-Build Ready) of a bridge that could be expanded in the future to accommodate the potential future interchange instead of a simple underpass.

Assumptions and limitations of this exercise included the following:
- AECOM would not be required to complete additional traffic analysis beyond the original scope of work for the DBR assignment. For example, no traffic analysis of a future interchange at this location would be undertaken by AECOM.
- Should additional base mapping and/or DTM be required to support the potential interchange layout, this would be supplied by MTO or the Municipality.
- It was assumed that the proposed horizontal alignment of McKay Road would remain on the existing roadway alignment.
- No additional foundations investigations and analysis beyond that required for the 2-lane bridge structure would be completed.

2. Proposed Design

The proposed design discussed in this section includes the bridge design and the proposed 10th Line (McKay Road) plan, profile, cross section and pavement structure recommended.

2.1 Bridge

This section includes discussion of constraints, preferred bridge type, span, retaining wall and abutments.

2.1.1 Constraints

Preliminary Parclo A4 interchange layouts were developed to identify reasonable ultimate (Exhibit 1) and interim (Exhibit 2) bridge sizing and clearance requirements. This included a review of sight distances and optimization of the McKay Road profile to accommodate the future interchange ramp terminals. The preliminary layout and profile information were provided to AECOM Structural to support the bridge design.

Exhibit 1: Preliminary Interchange Layout with Ultimate 10–Lane Highway 400 and 6–Lane 10th Line
Exhibit 2: Preliminary Interchange Layout with Interim 6-Lane Highway 400 and 6-Lane 10th Line

2.1.2 Preferred Bridge Type

Bridge alternatives to provide future flexibility for expansion were developed and assessed as part of this undertaking.

The estimated span length(s) for the replacement bridge configuration is beyond the range of pre-stressed concrete box girders. MTO does not favour the use of steel I-girders for underpass structures over high volume traffic highways and therefore this structure type is also discarded from further evaluation. The following six structure types were considered for the replacement structure and were compared based on considerations of expandability, structure depth, design complexity, construction cost, duration of construction, long term durability, and uniformity with other structures in close proximity along Highway 400.

Alternative 1  Single Span Post-tensioned Rigid Frame - Compared to the two span alternatives with lower depth superstructures, this alternative involves significant design complexities, construction time, costs, grade raise, and reduced safety, and was therefore eliminated from further consideration.

Alternative 2  Single Span Steel Box Girder - Compared to the two span alternatives with lower depth superstructures, this alternative involves significant design complexities, costs, and grade raise, and was therefore eliminated from further consideration.

Alternative 3  Two-Span Post-tensioned Voided Slab - This type of structure cannot practically be widened and would result in significant design issues and complexities when 10th Line is widened to the ultimate lane configuration. One solution would be to overbuild the bridge now in anticipation of the
ultimate condition and requirements. This may result in additional initial costs and maintenance costs, and also preclude opportunities for changes in the cross-section.

Alternative 4 Two-Span Steel Box Girders - This type of structure can be widened; however, the amount of widening would be dependent on the width of the box and may result in potential over-widening or in longer deck cantilevers, and potentially a less efficient design. Furthermore, a “Steel Box Girder” structure is not compatible with the Heritage Guidelines which show preference to maintain a concrete structure at the site.

Alternative 5 Two-Span Pre-stressed CPC II Girders - This alternative is compatible with an integral abutment articulation resulting in increased durability and reduced required maintenance. Preliminary analysis indicates that this is a functional design and provides a durable structure with a low construction cost.

Alternative 6 Two-Span Pre-stressed NU Girders - This alternative is compatible with an integral abutment articulation resulting in increased durability and reduced required maintenance. Preliminary analysis indicates that this is a functional design and provides a durable structure with a low construction cost; however, there is an anticipated cost premium of 15% for NU girders.

In order to select the preferred structure replacement alternative, criteria were developed and weighted out of 100 points based on their significance or importance. The alternatives were scored on a scale of 1 to 5 for best satisfying those criteria. The evaluation criteria and their individual weights are as follows:

1. Required Grade Raise (25)
2. Construction Cost (25)
3. Constructability (20)
4. Durability and Maintenance (15)
5. Expandability (15)

Grade raise is given 25 points due to the increased environmental and property impacts with increasing the existing grade, the higher road construction costs, and reduced sight distance on the 10th Line crest curve with increasing grade raise. The span arrangement and superstructure type resulting in lower grade raises of the 10th Line profile are given a higher score.

Construction cost is given 25 points. Costs are based on the unit cost per m² of deck area and vary based on the type of superstructure and number of spans and structures. The structures with the lower construction costs are given a higher score.

Constructability is assigned a weight of 20 points and alternatives are assessed based on ease and speed of construction, fabrication, delivery, and erection of structural components (e.g. girders), and overall simplicity of construction of the structure. The structures with fewer constructability issues are given a higher score.

Maintenance is assigned a weight of 15 points. Alternatives without expansion joints, or alternatives whose design provides for ease of inspection with few hidden components, are given a higher score.

Expandability is assigned a weight of 15 points. With plans for future widening of 10th Line to a six-lane configuration, alternatives that can more readily accommodate the future widening of 10th Line with greater ease and flexibility and less complexity are given a higher score.
Based on the requirements for the ultimate condition, the total length of the replacement structure is 84 m. The interim two-lane cross-section of 10th Line has a width of 11.6 m, for a total deck area of 975 m².

Based on the results of the evaluation matrix, Alternative 5, a two-span prestressed CPCi girder bridge with integral abutments is the recommended preferred alternative for the replacement structure. The replacement structure will be on the same alignment as existing. This alternative will result in a minimal grade raise, and will provide a cost-effective structure with long term durability through the elimination of the expansion joints with the integral abutment design. It has few construction limitations and can be constructed using conventional methods and readily available construction materials, methods and equipment.

2.1.3 Span Arrangements

The Highway 400 / 10th Line (McKay Road) Underpass General Arrangement drawing is in Appendix B. The proposed replacement structure at 10th Line will consist of a two span (42 m – 42 m) pre-cast concrete girder bridge, which is a type that can be widened in the future. Six (6.0) m approach slabs will be constructed at each approach end. Expansion joints on sleeper slabs will be constructed at the ends of the approach slabs.

The replacement structure will be designed to accommodate both the interim 6-lane and ultimate 10-lane cross-section of Highway 400 including speed change lanes (SCLs) associated with a potential future 10th Line (McKay Road) interchange by the City of Barrie. A standard clear zone will be provided in the ultimate condition between the edge of the outside travelled lane and the abutment wall, on each side of the bridge, in accordance with the Roadside Safety Manual.

In the event that a new interchange at 10th Line (McKay Road) is constructed as part of a separate municipal undertaking prior to the ultimate widening of Highway 400, the bridge has been designed to accommodate an interim condition where the future ramp lane(s) from the 10th Line interchange pass under the bridge with 6-lane Highway 400. Preliminary calculations indicate that a total roadway width of approximately 69 m is required to accommodate the Highway 400 cross section in the interim and ultimate configurations. Considering the skew angle and the thickness of the abutment wall, the total span length (measured along 10th Line between centerline of bearings) is estimated at 84 m which includes provisions for the required clear zone on Highway 400.

For the interim condition (6-Lane Highway 400 with no interchange), the existing 6-Lane Highway 400 lanes can be accommodated within the east span of the new bridge. The 42 m long east span length is designed to accommodate a future Ramp W-N, should it be required as part of a future municipal undertaking for an interchange at this location, if such an interchange is constructed prior to Highway 400 widening from 6 to 10 lanes. The Ramp W-N would cross at the east span and a resulting minimum horizontal clear zone width of 8.57 m, measured from the edge of the northbound outside through lane to the east abutment wall, would be provided in this interim Highway 400 configuration. In the ultimate 10-Lane Highway 400 configuration, the southbound lanes would be relocated to the west bridge span and standard horizontal clearances would be provided in both directions.
2.1.4 Bridge Cross Section

The replacement structure will be designed such that it can be easily widened to accommodate widening of 10th Line to a 6-lane configuration, plus SCLs. Alternatively, a 7-lane 10th Line could be accommodated, depending on the interchange configuration.

The cross-section of the bridge will comprise 5 CPCI 2300 girders spaced at 2.6 m c/c and supporting a 225 mm concrete deck slab with 90 mm waterproofing and paving. The total width of the bridge deck is 11.6 m, and will carry two 3.5 m lanes of 10th Line traffic with 2.0 m shoulders. PL2 parapet walls with open railing system including pickets will be constructed along the sides of the bridge.

2.1.5 Heritage Features

For consistency with other bridge replacements along the Highway 400 corridor, heritage features will be included on the replacement structure. The heritage elements that will be incorporated into the design of the replacement bridge include:

1. Radial chamfers at the girder ends at the abutments and pier to mimic the curved fascia and soffit of the existing bridge, as a sympathetic design feature to mimic the curved fascia and soffit of the existing rigid frame bridge.
2. Open type railings including pickets along the tops of the parapet walls.

2.1.6 Horizontal and Vertical Clearances

Additional design was completed to determine the future structural provisions for expansion of the new bridge. This was included in the Highway 400 / 10th Line (McKay Road) Underpass Replacement Design Build Ready project documentation.

The horizontal and vertical clearances for interim (6-Lane Highway 400) and ultimate (10-Lane Highway 400) conditions provided in the design are summarized in Table 1.

<table>
<thead>
<tr>
<th>TABLE 1: Proposed Clearances</th>
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<tbody>
<tr>
<td>Scenario</td>
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<tr>
<td>Interim 6-Lane Highway 400 and 2-Lane 10th Line (McKay Road)</td>
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<tr>
<td>Interim 6-Lane Highway 400 and 7-Lane 10th Line (McKay Road) and Future Interchange</td>
</tr>
<tr>
<td>Ultimate 10-Lane Highway 400 and 7-Lane 10th Line (McKay Road)</td>
</tr>
</tbody>
</table>
2.1.7 Retaining Wall

A retaining wall is required in the event that a future interchange including a loop Ramp W-N is constructed as part of a future municipal undertaking prior to Highway 400 widening to 10 lanes. This retaining wall is to be constructed now to avoid prohibitive cost in the future to support the structure and excavate the embankment. An RSS type wall is recommended and a stone face type has been considered for aesthetics.

2.1.8 Substructure

The substructure will consist of integral abutments with HP piles driven to refusal into very dense sand and silt to sandy silt till, and the pier will consist of circular reinforced concrete columns with reinforced concrete cap, supported on spread footings.

Integral abutment bridges are preferred over bridges with expansion joints, for their improved durability and reduced future maintenance, and therefore life cycle costs. At the December 4, 2015 meeting with the City of Barrie, there was discussion regarding the selection of integral abutments. AECOM notes that there are no provisions in the Ministry Integral Abutment guidelines, or in the literature, that would preclude future widening of these bridges. However, symmetrical widening would be preferable to widening on only one side. The Ministry guidelines state that constructing the wider abutment to the level of the bearing seat should be considered for future widening. At this site, there may potentially be an interim and ultimate future widening as well. If the interim widening would take place within a few years, then consideration should be given to building the wider bridge now to at least the interim width, and since the ultimate was only slightly wider, then even to consider building to the ultimate during initial construction. Due to the uncertainty of timing, extent and details for a future interim and ultimate widening, only the design for the two-lane bridge was completed. For any type of bridge, differential (shrinkage, etc.) stresses in the new bridge and deck across the interface with the existing bridge and deck when widening may occur. This also depends on the length of time between construction of the original bridge and construction of the widening. These stresses and effects are to be considered and accounted for during Detail Design at that time.

2.2 Plan and Profile

The proposed design for the 10th Line (McKay Road) bridge replacement, which does not preclude a future interchange or 10th Line widening to 7 lanes, is illustrated in the plan and profile drawings in Appendix B.

The bridge approaches were designed with maximum grades of 3.0% so that ramp terminals for a future interchange would meet MTO standards.

As noted above, the proposed 10th Line (McKay Road) horizontal alignment is tangent and follows the existing alignment. The vertical alignment includes a crest curve with K value of 50 for a 90 km/h design speed, improved from the existing K value of 20, which only accommodates a design speed of 85 km/h. The profile was designed to accommodate the required bridge clearances noted in Section 2.1.4.

2.3 10th Line (McKay Road) Cross Section

MTO will construct 2-lane 10th Line, including the new bridge and approaches. The cross section will match existing east and west of the construction limits. On the bridge, 2 m side clearances will be
provided. The shoulders at the bridge approaches will be 2 m wide, tapering to 1.0 m wide at the east limit and 1.5 m wide at the west limit. Typical sections of existing, proposed 6-lane and proposed 7-lane 10th Line are in Appendix B.

2.4 10th Line (McKay Road) Recommended Pavement Structure

Pavement design for the 10th Line (McKay Road) approaches was developed by Thurber Engineering and includes the following:

- 40 mm Superpave 12.5 (or 12.5 FC2)
- 100 mm Superpave 19
- 150 mm Granular A Base
- 300 mm Granular B, Type I Subbase

2.5 Staging

Tenth Line (McKay Road) is to be closed for the duration of construction (estimated 2 construction seasons). Temporary cul-de-sacs will be constructed along 10th Line east and west of the bridge before the existing bridge is removed, and signage regarding the road closure will be posted.

Highway 400 staging includes overnight closure for removal of the existing bridge, rolling 15-minute closures for launching the new girders, lane shifting to create work zones for construction of the piers, storm sewer and median barrier. This will include use of Highway 400 shoulders for traffic.

3. Environmental

No additional environmental work was completed beyond the work required for the DBR assignment; several features are noted in this section.

3.1 Features

Using the available specialist information gathered as part of the current scope, a high-level review and assessment of potential environmental issues associated with the future interchange was undertaken. This exercise is for information purposes only as the Environmental Assessment for the interchange will be undertaken by the City of Barrie.

The Lovers Creek Swamp Provincialy Significant Wetland crosses the Highway 400 corridor approximately 600 metres north of 10th Line which is also used as a wildlife travel corridor and is identified as Stratum 1 deer wintering area.

There is a warm water stream crossing Highway 400 approximately 500 m south of the Highway 400 / 10th Line structure. There are no creek crossings along 10th Line (McKay Road) within the limits of construction.

AECOM completed a Stage 2 Archaeological Assessment in the area that was being impacted by the Highway 400 / 10th Line Underpass replacement. The Stage 2 Archaeological Assessment for the underpass replacement has indicated that an archaeological site is present in the northeast quadrant of the Highway 400 / 10th Line Underpass. There is a 20 m protective buffer around the site, which was not assessed by AECOM.
AECOM flagged a berm in the southeast quadrant of the 10th Line (McKay Road) crossing. Soil testing was recommended and is described in the next section.

3.2 Mitigation

Should the archaeological site noted in Section 3.1 be disturbed, these lands will require Stage 3 Archaeological Assessment by a licenced archaeologist and include engagement of First Nations groups expressing interest in the archaeological resources in the area. Additional mitigation measures are outlined in the Stage 2 Archaeological Assessment for the Highway 400 / 10th Line Underpass replacement including monitoring, inspection, and reporting within a 50 m monitoring buffer of the site.

As the Highway 400 / 10th Line bridge was designed not to preclude a future interchange, the replacement bridge includes a larger structure footprint relative to the recommended plan outlined in the 2004 TESR, which resulted in steeper slopes at the bridge abutments and along 10th Line. Additional landscaping was required in order to expedite the retention of the steeper slopes.

In the southeast quadrant of the Highway 400 / 10th Line crossing, environmental soil sampling and testing was carried out to determine the environmental quality of the soil within the berm material. The testing revealed it was “non-hazardous” solid waste and could be disposed of off-site at a licensed landfill.

4. Drainage

4.1 Features

Roadside ditching will be constructed along the 10th Line (McKay Road) approaches. New culverts are to be constructed at the 5 private entrances, including field entrances. There are no existing or proposed stormwater ponds or creek crossings within the 10th Line (McKay Road) construction limits.

4.2 Mitigation

Drainage design for the proposed structure replacement was reviewed to potentially avoid throw-away costs of culverts and other drainage features. In the future if 10th Line is widened and interchange ramp terminals are located, the culverts will likely require relocation and entrance locations may change to accommodate the ramp terminals, resulting in replacement of roadway elements well before their respective service lives are over. As MTO has only acquired sufficient property for two-lane 10th Line (McKay Road), mitigation for this potential throwaway by constructing a platform and drainage ditching for the wider cross section is not feasible.

5. Utilities

AECOM contacted local utility companies for updated information regarding existing utilities within the project limits. Based on this information, conflicts were identified and utility relocation procedures were initiated.

5.1 Existing Utilities

Existing utilities within the project limits include Innpower above-ground and underground lines and ten hydro poles. Also present are Bell telephone lines and underground Bell fibre-optic cable. Hand holes and pedestals are present for the Bell plant. The composite utility plan drawing is in Appendix B.
5.2 Utility Relocation

The draft utility relocation plan, in Appendix B, provides a summary of the proposed relocation of Innpower poles and Bell underground telephone lines. The Bell fibre optic cable along southbound Highway 400 is also indicated on the drawing and no impacts to this plant are anticipated. Bell hand holes and pedestals are to be raised to the new approach elevations.

Utility relocation requirements determined for the 10th Line (McKay Road) structure replacement include relocation of 11 Innpower hydro poles, relocation of Bell underground telephone cable to the Innpower poles and raising of Bell hand holes and pedestals to the new approach grade. These relocations may not be compatible with a future interchange and future 10th Line (McKay Road) widening, in part because the relocations will be within MTO or Municipal right-of-way, and it is anticipated that the City of Barrie will acquire additional property for the interchange and the widening, which would also accommodate utilities but which is currently private property. Secondly, utility relocations required as part of the 2-lane bridge replacement cannot easily accommodate a future interchange as the configuration of the future interchange is not confirmed at this stage.

As noted earlier, no additional property was acquired by MTO beyond the EA approved property limits. Utility relocation is to occur within this property footprint. For this reason, when 10th Line is widened in the future, Innpower poles may be in conflict with the widened cross section and require relocation. No conflict with the Bell fibre optic cable is anticipated (see draft utility relocation plan in Appendix B).

Test pits were completed to determine the depth of the fibre optic cable west of Highway 400 at 10th Line. The conduit is located more than 2 m below original ground. The test pit locations are shown on the subsurface utility investigation drawing in Appendix B.

Construction of the Innpower pole relocations is tentatively scheduled for January 2016.

6. Construction

MTO has determined the delivery method and the timing of construction as summarized below.

6.1 Delivery Method

MTO will retain the services of a Design Build firm in early 2016 to complete Detail Design of the bridge replacement and construct the improvements. There may be some flexibility available to the DB firm for design efficiencies, cost savings and the like, which may involve changes to the design prepared by AECOM.

6.2 Construction Timing

The DB RFP was published in October 2015 and submissions were received in late 2015. MTO anticipates selection of the successful bidder in early 2016.

Depending on the DB firm, construction may begin in parallel with Detail Design as early as Spring 2016. It is anticipated that construction will continue through the 2017 construction season, with the exception of the winter shut down season.

7. Cost Sharing

Cost sharing discussions included cost sharing for engineering and for construction.
7.1 Engineering Cost Sharing

Table 2 summarizes design costs for the Design Build Ready phase, which were shared by MTO and the City of Barrie as per a Memorandum of Understanding (MOU) between MTO and the City of Barrie. AECOM completed work according to MTO Change Order 4 for this project.

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Task Description</th>
<th>Associated Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Management</td>
<td>Additional Meeting with City of Barrie</td>
<td>$4,640</td>
</tr>
<tr>
<td>Highway Engineering</td>
<td>Development of ultimate interchange design, identifying conflicts between interim and ultimate design, and utility relocations.</td>
<td>$12,490</td>
</tr>
<tr>
<td>Bridge Engineering</td>
<td>Develop structural alternatives and update SDR and GA to consider future provisions for expansion.</td>
<td>$12,030</td>
</tr>
<tr>
<td>Drainage Engineering</td>
<td>Optimize drainage design considering future interchange features.</td>
<td>$3,460</td>
</tr>
<tr>
<td>Environmental</td>
<td>High-level identification and documentation of potential environmental implications of future interchange.</td>
<td>$3,700</td>
</tr>
<tr>
<td>Administration</td>
<td>Staff Time &amp; Contingency (20%)</td>
<td>$9,780</td>
</tr>
</tbody>
</table>

**Total Design Build Ready Engineering Services Cost**

$46,100

7.2. Construction Cost Sharing

Table 3 summarizes estimated construction costs. The first column indicates the MTO costs to replace the existing bridge with a longer bridge to accommodate future Highway 400 widening. No provisions for a future interchange or horizontal or vertical clearances for future 10th Line widening are included. The second column indicates the costs to construct an even longer bridge at a higher elevation so as not to preclude 10th Line widening to 7 lanes and the additional fill and other elements required not to preclude 10th Line (McKay Road) widening as well as a future interchange. The third column includes the difference in construction costs between the two scenarios which the City of Barrie is to fund. The construction cost amount to be funded by the City of Barrie is approximately $1.5M. This does not include the Detail Design Project Management and Administration component to be completed by the Design Build firm. It also does not include future maintenance (life-cycle) costs.

<table>
<thead>
<tr>
<th>Construction Item</th>
<th>2-Lane Bridge, No Future Widening or Interchange</th>
<th>2-Lane Bridge, Does Not Preclude Future Widening or Interchange</th>
<th>City of Barrie Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removals</td>
<td>$32,304</td>
<td>$32,304</td>
<td>$0</td>
</tr>
<tr>
<td>Earthworks</td>
<td>$295,000</td>
<td>$501,500</td>
<td>$206,500</td>
</tr>
<tr>
<td>Pavement Structure</td>
<td>$201,300</td>
<td>$305,520</td>
<td>$104,220</td>
</tr>
<tr>
<td>Roadworks</td>
<td>$595,500</td>
<td>$615,500</td>
<td>$20,000</td>
</tr>
<tr>
<td>Landscaping</td>
<td>$11,000</td>
<td>$11,000</td>
<td>$0</td>
</tr>
<tr>
<td>Structure</td>
<td>$3,006,475</td>
<td>$3,825,300</td>
<td>$818,825</td>
</tr>
<tr>
<td>Retaining Wall</td>
<td>$0</td>
<td>$223,200</td>
<td>$223,200</td>
</tr>
<tr>
<td>Staging, Traffic Control and Signage</td>
<td>$1,008,325</td>
<td>$1,073,325</td>
<td>$65,000</td>
</tr>
<tr>
<td>Drainage</td>
<td>$143,600</td>
<td>$143,600</td>
<td>$0</td>
</tr>
<tr>
<td>Utility Relocations</td>
<td>$200,000</td>
<td>$200,000</td>
<td>$0</td>
</tr>
<tr>
<td><strong>Construction Total ($)</strong></td>
<td><strong>$5,493,504</strong></td>
<td><strong>$6,931,249</strong></td>
<td><strong>$1,437,745</strong></td>
</tr>
</tbody>
</table>
8. Conclusion

The next steps for the City of Barrie are to:

- Participate as a stakeholder during the Design Build phase of the Highway 400 / 10th Line (McKay Road) Underpass replacement project and fund the additional construction costs not to preclude a future interchange and 10th Line (McKay Road) widening.
- Complete the municipal EA for the widening of 10th Line from 2 to 4 lanes, including obtaining EA clearance.
- Consult with MTO Corridor Management regarding the municipal widening project.
Memorandum

To
Rob Vandenberg

CC
The City of Barrie

Subject
WO 06-20016, Contract 2015-2015, Highway 400 / 10th Line (McKay Road) Underpass Replacement – City of Barrie Request Not to Preclude a Future Interchange and Future 10th Line Widening to 7 Lanes Addendum

From
Tim Sorochinsky

Date
March 8, 2016

The memorandum prepared for the City of Barrie ‘WO 06-20016, Contract 2015-2015, Highway 400 / 10th Line (McKay Road) Underpass Replacement – City of Barrie Request Not to Preclude a Future Interchange and Future 10th Line Widening to 7 Lanes Addendum’ assumed that a 2 lane bridge would be constructed along existing centerline of McKay Road, with provisions for future widening symmetrical to the north and south sides. The following is a high level overview of implications for alternate future widening alternatives which are non-symmetrical.

Our analysis is based on the following key assumption: Ultimate widening of McKay Road would be by 3 lanes in each direction for an ultimate 8 lane cross-section, consisting of 3 traffic lanes and 1 SCL in each direction. Estimated width of ultimate bridge is approximately 40 m. If outside traffic lane and SCL are combined into one multi-purpose lane (each side) the width of bridge is reduced by at least 7 m for a total width of approximately 33 m.

The following alternatives were reviewed:

- Alternative 1 - Widening Symmetrically on Centerline (recommended design);
- Alternative 2 – Shift of Centreline of McKay Rd to the South and Partial Widening to the South and North;
- Alternative 2B – Shift of Centreline of McKay Rd to the South and Partial Widening to the South and North;
- Alternative 3A – Complete Shift of Centreline of McKay Rd and Widening Entirely to the North;
- Alternative 3B – Shift of Centreline of McKay Rd to the North and Partial Widening to the North and South;
- Alternatives 4A – Shift of Centreline of McKay Rd South and Provision for Separate Crown for EB and WB structures; and
- Alternatives 4B – Shift of Centreline of McKay Rd North and Provision for Separate Crown for EB and WB structures.

Alternative 1 - Widening Symmetrically on Centerline

For this alternative, a 2 lane bridge is constructed along existing centerline of McKay Road. Future widening is symmetrical to the north and south, maintaining existing centerline.

Advantages/Disadvantages/ Costs

- Widening is symmetrical. No unbalanced forces/stresses induced into existing 2 lane structure;
- Maintain minimum vertical clearance;
- Future separation of deck slab feasible;
• Future construction of expansion joint to separate existing superstructure/substructure at the diaphragms and abutment may not be practical. Note: the maximum width of deck (and structure) can be significantly reduced by combining outside lanes with SCL, each direction, which will reduce deck width by at least 7 m. With reduced deck width, potential thermal effects for widened bridge are significantly reduced;
• Future construction of both sides of the existing bridge, requiring property on both north and side sides;
• Additional cost for removals along both sides of the existing bridge.

**Alternative 2A – Complete Shift of Centreline of McKay Rd and Widening Entirely to the South**

For this alternative, a 2 lane bridge is constructed along existing centerline of McKay Road and future widening is entirely to the south. Centreline and crown of McKay Road is shifted completely to the south by a maximum of approximately 14 m, maintaining the north edge of the existing deck.

**Advantages/Disadvantages/ Costs**

• Accommodates future separation of widened structure and construction of a longitudinal expansion joint to mitigate potential thermal effects with the ultimate wide deck platform;
• Property required on south side only. Property on south side may be either more or less expensive or more or less problematic to acquire;
• Removals on one side only of existing bridge, provided no additional removals required, eg., to construct future sidewalk;
• Padding required on deck, estimated at 250 mm to adjust cross-fall. Additional dead load on girders and abutments;
• Results in grade raise for widened McKay Road, estimated at 280 mm. Steeper grade for widened McKay Road;
• Asymmetrical widening introduces unbalanced forces/stresses into the existing two lane structure. This can be mitigated by staged construction of the deck slab widening and closure pour;
• Reduce vertical clearance south side by approximately 100 mm, temporarily until ultimate widening of Hwy 400.

**Alternative 2B – Shift of Centreline of McKay Rd to the South and Partial Widening to the South and North**

For this alternative, a 2 lane bridge is constructed along existing centerline of McKay Road. Future widening includes shifting the centreline and crown of McKay Road to the south by varying amounts, and widening of the bridge is partially to the south and north depending on the extent of the shift in centerline and crown. The practical limits of widening is such that the resulting amount of widening either side will be by one girder spacing (adding one girder) or approximately 2.4 m, or multiples of girder spacing, ie., 4.8 m, 7.2 m etc.

**Advantages/Disadvantages/ Costs**

• Accommodates future separation of widened structure and construction of a longitudinal expansion joint to mitigate potential thermal effects with the ultimate wide deck platform. Centerline/crown shift should be at least half width (6 m) of the existing bridge;
• Property required on south side and north side to varying amounts;
• Results in some grade raise for widened McKay Road, for up to 280 mm. Slightly steeper approach grades for widened McKay Road;
• Padding required on deck, of up to 250 mm depending on crown shift. Additional deal load on girders and abutments;
• Asymmetrical widening introduces unbalanced forces/stresses into the existing two lane structure. This can be mitigated by staged construction of the deck slab widening and closure pour;
• Reduce vertical clearance south side by up to approximately 100 mm, temporarily until ultimate widening of Hwy 400.

**Alternative 3A – Complete Shift of Centreline of McKay Rd and Widening Entirely to the North**

For this alternative, a 2 lane bridge is constructed along existing centerline of McKay Road and future widening is entirely to the north. Centreline and crown and of McKay Road is shifted completely to the north by a maximum of approximately 14 m, maintaining the south edge of the existing deck.

**Advantages/Disadvantages/ Costs**

• These are similar to those for the complete widening and centerline shift to the south except the impacts are appropriate for the north side. Also, results in slightly higher/wider embankments and additional approach roadway costs.

**Alternative 3B – Shift of Centreline of McKay Rd to the North and Partial Widening to the North and South**

For this alternative, a 2 lane bridge is constructed along existing centerline of McKay Road. Future widening includes shifting the centreline and crown of McKay Road to the north by varying amounts, and widening of the bridge is partially to the north and south depending on the extent of the north shift in centerline and crown.

**Advantages/Disadvantages/ Costs**

• These are similar to those for the centerline shift to the north and partial widening to the north and south except the impacts are appropriate for the north side. Also, results in slightly higher/wider embankments and additional approach roadway costs.

**Alternatives 4A and 4B – Shift of Centreline of McKay Rd South or North and Provision for Separate Crown for EB and WB structures**

For these alternatives, a 2 lane bridge is constructed along existing centerline of McKay Road. Future widening is partially to the south and north. The existing crown for the existing bridge is maintained, and centreline of McKay Road is shifted either 6 m to the south or 6 m to the north to align with the existing edge of deck. With a CL shift to
one side, then that side is widened by approximately 8 m, and a complete new 20 m wide structure with provision for a separate crown is constructed on the other side.

Advantages/Disadvantages/ Costs

- Accommodates future separation of widened structure (EB and WB) and construction of a longitudinal expansion joint to mitigate potential thermal effects with the ultimate wide deck platform;
- No padding of deck required;
- Mitigate grade raise for McKay Road;
- Roadway deck drainage towards median as well as outside shoulders, to be managed at approaches
- Feasibility and complexity to revert to single crown for roadway at/beyond the bridge approaches
- property required on both sides;
- Results in wider (5 m) median lane (assuming 2 m raised median) and wider deck platform;
- Unbalanced widening introduces unbalanced forces/stresses into existing 2 lane structure.

Advance Widening of Substructure, Abutments and Pier

Advantages/Disadvantages/ Costs

- None or minimal future disruption to Hwy 400 traffic during construction of pier, driving abutment piles, construction of RSS retaining walls, etc.;
- Elimination of construction joints in substructure. Improvement in end quality of construction;
- Reduced duration of construction during superstructure widening;
- Minimize re-mobilization costs. Reduce or eliminate roadway protection, embankment protection, staging and traffic protection costs for widening at pier and abutments;
- Cost savings associated with reduced duration of future substructure construction. Anticipated savings of up to 6 weeks of construction and associated costs;
- Cost reductions with construction of entire substructure with economy of scale for larger quantities;
- Higher initial construction costs;
- Uncertain as to extent and location of future widening. No flexibility to revise extent or location of widening;
- Potential for significant throwaway.
ALTERNATIVE 1 - ON CENTRE LINE

ALTERNATIVE 3B - SHIFT CENTRE LINE 6m NORTH
<table>
<thead>
<tr>
<th>Alternative</th>
<th>Description</th>
<th>Advantages / Benefits</th>
<th>Disadvantages / Risks</th>
<th>Additional Costs</th>
<th>Potential Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Widening on Centreline</td>
<td>Future separation of deck slab feasible</td>
<td>Future separation of entire superstructure may not be practical; however, if ultimate cross-section is reduced to 6 lanes with use of multi-purpose lanes, thermal effects should be marginal and longitudinal separation of structure not required.</td>
<td>Cost for removal along both sides of bridge.</td>
<td>No additional costs for grade raise and larger embankments</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No padding on deck required</td>
<td>Balanced widening. No unbalanced forces/stresses induced into existing 2 lane structure</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>No grade raise for widened McKay Road. No increase in approach grades for McKay Road</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maintain minimum vertical clearance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2A</td>
<td>Complete Widening and Crown Shift to the South</td>
<td>Accommodates future separation of widened structure (EB and WB) to mitigate potential thermal effects with wide deck platform</td>
<td>Require realignment of McKay Road centreline at bridge by approx 14 m south</td>
<td></td>
<td>Maintain existing north side parapet wall, provided no additional north side modifications, eg., sidewalks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All property required on south side only</td>
<td>Results in grade raise for widened McKay Road, estimated at 280 mm. Steeper grade for widened McKay Road</td>
<td>Property on south side may be more expensive or less problematic to acquire</td>
<td>Property on south side may be less expensive or less problematic to acquire</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Removels on one side only of existing bridge, provided no additional removals required, eg., to construct future sidewalk.</td>
<td>Paddng required on deck, estimated at 250 mm to adjust cross-fall. Additional deal load on girders and abutments.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unbalanced widening introduces unbalanced forces/stresses into existing two lane structure</td>
<td>Reduce vertical clearance south side by approx 100 mm. Temporary basis until widening of Hwy 400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2B</td>
<td>Crown Shift South and Variable Widening to the South and North</td>
<td>Accommodates future separation of widened structure (EB and WB) to mitigate potential thermal effects with wide deck platform</td>
<td>Results in grade raise for widened McKay Road, estimated at 120 mm. Slight increase in approach grades</td>
<td>Property on south side may be more expensive or less problematic to acquire</td>
<td>Property on south side may be less expensive or less problematic to acquire</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Require realignment of McKay Road centreline at bridge by approx 6+ m south</td>
<td></td>
<td>Cost for removal along both sides of bridge.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reduce vertical clearance south side by about 50 mm</td>
<td>Unbalanced widening introduces unbalanced forces/stresses into existing 2 lane structure</td>
<td>Property required on both sides.</td>
<td></td>
</tr>
<tr>
<td>Alternative</td>
<td>Description</td>
<td>Advantages / Benefits</td>
<td>Disadvantages / Risks</td>
<td>Additional Costs</td>
<td>Potential Savings</td>
</tr>
<tr>
<td>-------------</td>
<td>-------------</td>
<td>-----------------------</td>
<td>-----------------------</td>
<td>------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>3A</td>
<td>Complete Widening and Crown Shift to the North</td>
<td>Accommodates future separation of widened structure (EB and WB) to mitigate potential thermal effects with wide deck platform</td>
<td>Results in grade raise for widened McKay Road, estimated at 280 mm. Steeper grade for widened McKay Road</td>
<td>Taller/larger/wider embankments. Additional approach roadway costs</td>
<td>Maintain existing north side parapet wall, provided no additional north side modifications, eg., sidewalks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increase in minimum vertical clearance</td>
<td>Require realignment of McKay Road centreline at bridge by approx 14 m north</td>
<td>Property on north side may be more expensive or problematic to acquire</td>
<td>Property on north side may be less expensive or less problematic to acquire</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All property required on north side only</td>
<td>Padding required on deck, estimated at 250 mm to adjust cross-fall. Additional deal load on girders and abutments.</td>
<td>Property on north side may be less expensive or less problematic to acquire</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Removals on one side only of existing bridge, provided no additional removals required, eg., to construct future sidewalk.</td>
<td>Unbalanced widening introduces unbalanced forces/stresses into existing 2 lane structure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3B</td>
<td>Crown Shift North and Variable Widening to the North and South</td>
<td>Accommodates future separation of widened structure (EB and WB) to mitigate potential thermal effects with wide deck platform</td>
<td>Results in grade raise for widened McKay Road, estimated at 120 mm. Slight increase in approach grades</td>
<td>Taller/larger/wider embankments. Additional approach roadway costs</td>
<td>Property on north side may be less expensive or less problematic to acquire</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increase in minimum vertical clearance</td>
<td>Require realignment of McKay Road centreline at bridge by approx 6+ m north</td>
<td>Cost for removal along both sides of bridge.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unbalanced widening introduces unbalanced forces/stresses into existing two lane structure</td>
<td>Property required on both sides</td>
<td>Property on north side may be more expensive or problematic to acquire</td>
<td></td>
</tr>
</tbody>
</table>
### Crown Shift South or North with Variable Widening and Separate Crown for EB and WB Structures

<table>
<thead>
<tr>
<th>Description</th>
<th>Advantages / Benefits</th>
<th>Disadvantages / Risks</th>
<th>Additional Costs</th>
<th>Potential Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accommodates future separation of widened structure (EB and WB) to mitigate potential thermal effects with wide deck platform</td>
<td>Roadway deck drainage towards median as well as outside shoulders, to be managed at approaches</td>
<td>Slightly taller/larger/wider embankments. Additional approach roadway costs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No padding of deck required</td>
<td>Feasibility and complexity to revert to single crown for roadway at/beyond the bridge approaches</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mitigate grade raise for McKay Rd</td>
<td>Wider (5 m) median lane. Results in wider deck platform. Unbalanced widening introduces unbalanced forces/stresses into existing 2 lane structure</td>
<td>Additional costs to construct wider deck</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Advance Widening of Substructure Abutments and Pier

**AWS**

<table>
<thead>
<tr>
<th>Description</th>
<th>Advantages / Benefits</th>
<th>Disadvantages / Risks</th>
<th>Additional Costs</th>
<th>Potential Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>None or minimal future disruption to Hwy 400 traffic during construction of pier, driving abutment piles, construction of RSS retaining walls, etc.,</td>
<td>Uncertain as to extent and location of future widening. No flexibility to revise extent or location of widening. Potential for significant throwaway.</td>
<td>Initial construction costs higher</td>
<td>Minimize re-mobilization costs. Reduce or eliminate roadway protection, embankment protection, staging and traffic protection costs for widening at pier and abutments</td>
<td></td>
</tr>
<tr>
<td>Elimination of construction joints in substructure. Improvement in end quality of construction</td>
<td></td>
<td></td>
<td>Cost savings associated with reduced duration of future substructure construction. Anticipated savings of up to 6 weeks of construction and associated costs.</td>
<td></td>
</tr>
<tr>
<td>Reduced duration of construction during superstructure widening</td>
<td></td>
<td></td>
<td>Costs associated with economy of scale with larger quantities</td>
<td></td>
</tr>
</tbody>
</table>
Memorandum

To: Rob Vandenberg

CC: The City of Barrie

Subject: WO 06-20016, Contract 2015-2015, Highway 400 / 10th Line (McKay Road) Underpass Replacement – City of Barrie Request Not to Preclude a Future Interchange and Future 10th Line Widening to 7 Lanes Addendum

From: Tim Sorochinsky

Date: March 23, 2016

The memorandum prepared for the City of Barrie “WO 06-20016, Contract 2015-2015, Highway 400 / 10th Line (McKay Road) Underpass Replacement – City of Barrie Request Not to Preclude a Future Interchange and Future 10th Line Widening to 7 Lanes Addendum” assumed that a 2 lane bridge would be constructed along existing centerline of McKay Road, with provisions for future widening symmetrical to the north and south sides. The following is a high level overview of implications for alternate future widening alternatives which are non-symmetrical.

Our analysis is based on the following key assumption: Ultimate widening of McKay Road would be by 3 lanes in each direction for an ultimate 8 lane cross-section, consisting of 3 traffic lanes and 1 SCL in each direction. Estimated width of ultimate bridge is approximately 40 m. If outside traffic lane and SCL are combined into one multi-purpose lane (each side) the width of bridge is reduced by at least 7 m for a total width of approximately 33 m.

The following alternatives were reviewed. Summary tables and sketches are in the Appendix:

- Alternative 1 - Widening Symmetrically on Centerline (recommended design);
- Alternative 2A - Complete Shift of Centreline of McKay Rd and Widening Entirely to the South;
- Alternative 2B - Shift Centreline of McKay Rd to the South and Partial Widening to the South and North;
- Alternative 3A - Complete Shift of Centreline of McKay Rd and Widening Entirely to the North;
- Alternative 3B - Shift Centreline of McKay Rd to the North and Partial Widening to the North and South;
- Alternatives 4A - Shift Centreline of McKay Rd South. Provision for Separate Crown for EB and WB structures;
- Alternative XS - Constant Slope (down to the North). Widening, Crown, and Centreline Shift of McKay Rd South.
- Alternative XN - Constant Slope (down to the South). Widening, Crown, and Centreline Shift of McKay Rd North.

**Alternative 1 - Widening Symmetrically on Centerline**

For this alternative, a 2 lane bridge is constructed along existing centerline of McKay Road. Future widening is symmetrical to the north and south, maintaining existing centerline.

**Advantages/Disadvantages**

- Widening is symmetrical. No unbalanced forces/stresses induced into existing 2 lane structure;
- Maintain minimum vertical clearance;
• Future separation of deck slab feasible;
• Future construction of expansion joint to separate existing superstructure/substructure at the diaphragms and abutment may not be practical. Note: the maximum width of deck (and structure) can be significantly reduced by combining outside lanes with SCL, each direction, which will reduce deck width by at least 7 m. With reduced deck width, potential thermal effects for widened bridge are significantly reduced;
• Future construction of both sides of the existing bridge, requiring property on both north and south sides;
• Additional cost for removals along both sides of the existing bridge;
• Costs for removals and modifications for separation of deck in future;
• Costs for additional reinforcing steel for strength of deck cantilevers to provide for future deck separation. Note: premium stainless reinforcing to be provided for durability at expansion gap.

**Alternative 2A – Complete Shift of Centreline of McKay Rd and Widening Entirely to the South**

For this alternative, a 2 lane bridge is constructed along existing centerline of McKay Road and future widening is entirely to the south. Centreline and crown of McKay Road is shifted completely to the south by a maximum of approximately 14 m, maintaining the north edge of the existing deck.

**Advantages/Disadvantages**

• Accommodates future separation of widened structure and construction of a longitudinal expansion joint to mitigate potential thermal effects with the ultimate wide deck platform;
• Property required on south side only. Property on south side may be either more or less expensive or more or less problematic to acquire;
• Padding required on deck, estimated at 250 mm to adjust cross-fall. Additional dead load on girders and abutments;
• Results in grade raise for widened McKay Road, estimated at 280 mm. Steeper grade for widened McKay Road;
• Asymmetrical widening introduces unbalanced forces/stresses into the existing two lane structure. This can be mitigated by staged construction of the deck slab widening and closure pour;
• Reduce vertical clearance south side by approximately 100 mm, temporarily until ultimate widening of Hwy 400.

**Alternative 2B – Shift of Centreline of McKay Rd to the South and Partial Widening to the South and North**

For this alternative, a 2 lane bridge is constructed along existing centerline of McKay Road. Future widening includes shifting the centreline and crown of McKay Road to the south by varying amounts, and widening of the bridge is partially to the south and north depending on the extent of the shift in centerline and crown. The practical limits of widening is such that the resulting amount of widening either side will be by one girder spacing (adding one girder) or approximately 2.4 m, or multiples of girder spacing, ie., 4.8 m, 7.2 m etc.
Advantages/Disadvantages

- Accommodates future separation of widened structure and construction of a longitudinal expansion joint to mitigate potential thermal effects with the ultimate wide deck platform. Centerline/crown shift should be at least half width (6 m) of the existing bridge;
- Property required on south side and north side to varying amounts;
- Results in some grade raise for widened McKay Road, for up to 280 mm. Slightly steeper approach grades for widened McKay Road;
- Padding required on deck, of up to 250 mm depending on crown shift. Additional deal load on girders and abutments;
- Asymmetrical widening introduces unbalanced forces/stresses into the existing two lane structure. This can be mitigated by staged construction of the deck slab widening and closure pour;
- Reduce vertical clearance south side by up to approximately 100 mm, temporarily until ultimate widening of Hwy 400.

Alternative 3A – Complete Shift of Centreline of McKay Rd and Widening Entirely to the North

For this alternative, a 2 lane bridge is constructed along existing centerline of McKay Road and future widening is entirely to the north. Centreline and crown and of McKay Road is shifted completely to the north by a maximum of approximately 14 m, maintaining the south edge of the existing deck.

Advantages/Disadvantages

- These are similar to those for the complete widening and centerline shift to the south except the impacts are appropriate for the north side. Also, results in slightly higher/wider embankments and additional approach roadway costs.

Alternative 3B – Shift Centreline of McKay Rd to the North and Partial Widening to the North and South

For this alternative, a 2 lane bridge is constructed along existing centerline of McKay Road. Future widening includes shifting the centreline and crown of McKay Road to the north by varying amounts, and widening of the bridge is partially to the north and south depending on the extent of the north shift in centerline and crown.

Advantages/Disadvantages

- These are similar to those for the centerline shift to the north and partial widening to the north and south except the impacts are appropriate for the north side. Also, results in slightly higher/wider embankments and additional approach roadway costs.
**Alternatives 4A and 4B – Shift Centreline of McKay Rd South or North and Provision for Separate Crown for EB and WB structures**

For these alternatives, a 2 lane bridge is constructed along existing centerline of McKay Road. Future widening is partially to the south and north.

For Alternative 4A, the crown for the existing bridge is maintained and centreline of McKay Road is shifted 6 m to the south to align with the existing south edge of deck. The north edge of the existing deck is widened by approximately 8 m, and together with the existing 2 lane bridge forms the McKay Road WB Bridge. A complete new 20 m wide structure is constructed on the south side of the existing bridge, with a separate crown, and forms the McKay Road EB Bridge.

For Alternative 4B, the crown for the existing bridge is maintained and centreline of McKay Road is shifted 6 m to the north to align with the existing north edge of deck. The south edge of the existing deck is widened by approximately 8 m, and together with the existing 2 lane bridge forms the McKay Road EB Bridge. A complete new 20 m wide structure is constructed on the north side of the existing bridge, with a separate crown, and forms the McKay Road WB Bridge.

**Advantages/Disadvantages**

Accommodates future separation of widened structure (EB and WB) and construction of a longitudinal expansion joint to mitigate potential thermal effects with the ultimate wide deck platform;

- No padding of deck required;
- Mitigate grade raise for McKay Road;
- Roadway deck drainage towards median as well as outside shoulders, to be managed at approaches;
- Feasibility and complexity to revert to single crown for roadway at/beyond the bridge approaches;
- Property required on both sides;
- Results in wider (5 m) median lane (assuming 2 m raised median) and wider deck platform;
- Unbalanced widening introduces unbalanced forces/stresses into existing 2 lane structure.

**Alternative XS and XN – Construct 2 lane Bridge with Constant Slope (no Crown). Construct Future Widening with Crown and Shift Centreline McKay Road to the South or North**

For these alternatives, a 2 lane bridge is constructed along existing centerline of McKay Road with constant cross-fall of 2% (either sloping to the south or north and no crown). The future widening of McKay Road will be predominately to either the south or north depending on the direction of the slope of deck. The centerline of McKay Road can be shifted from 6m to 14 m either south or north, and the roadway crown is constructed with the widening.

For Alternative XS, the deck is sloped down towards the north. The future widening of McKay Road will be predominately to the south. With the crown placed along the south edge of the deck, the centerline of McKay Road is shift 6 m south, and the bridge widened 8 m north to complete the 20 m wide WB Bridge. A separate new bridge is constructed to the south and forms the McKay Road EB Bridge. (Widening is thus 8 m north and 20 m south). At the other extreme, the north edge of deck is maintained and the centerline of McKay Road is shifted 14 south. The bridge is widened and a crown placed 8 m south from the south edge of the existing deck and will form the WB Bridge. A
separate new 20 m bridge is constructed to the south and will form the EB Bridge (Widening is 0 m north and 28 m south).

The details for Alternative XN are similar to alternative XS except in reverse. For Alternative XN the deck is sloped down towards the south and the future widening of McKay Road will be predominately to the north. The centerline of McKay Road will be shifted to the north, varying from 6 to 14 m, and the existing bridge widened from as much as 8 m south and up to 28 m north.

Advantages/Disadvantages

• Accommodates future separation of widened structure (EB and WB) and construction of a longitudinal expansion joint, at the location of the future crown, to mitigate potential thermal effects with the ultimate wide deck platform;
• No padding of deck required, and deck crown constructed at time of widening;
• Deck slopes in “wrong” direction in the interim for traffic coming along one side of the bridge until bridge is widened, e.g., for deck sloped to the north and future widening and crown to the south, then for EB traffic the roadway for existing 2 lane bridge slopes towards the oncoming WB lane traffic as opposed to the shoulder;
• Once the deck cross-fall is set it cannot be changed without significant deck and structure modifications. Committed to shift centerline and construct widening predominately to either south or north depending on which way the deck is initially sloped;
• Unbalanced widening on one side introduces unbalanced forces/stresses into existing 2 lane structure;
• Results in some grade raise for widened McKay Road, up to 160 mm. Slightly steeper approach grades for widened McKay Road.

Advance Widening of Substructure, Including Abutments and Pier

Advantages/Disadvantages

• None or minimal future disruption to Hwy 400 traffic during construction of pier, driving abutment piles, construction of RSS retaining walls, etc.;
• Elimination of construction joints in substructure. Improvement in end quality of construction;
• Reduced duration of construction during superstructure widening;
• Minimize re-mobilization costs. Reduce or eliminate roadway protection, embankment protection, staging and traffic protection costs for widening at pier and abutments;
• Cost savings associated with reduced duration of future construction of substructure. Anticipated reduction in duration of future construction estimated at about 7 weeks;
• Cost reductions with construction of entire substructure with economy of scale for larger quantities;
• Higher initial construction costs;
• Uncertain as to extent and location of future widening of superstructure. Potential for significant throwaway and re-construction if limits of future superstructure widening are not compatible with substructure as widened.
## Estimates of Additional Costs for the Alternatives

### Alt 1 – Cost Estimates for Deck Separation (Removals/Modification of Deck)

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Unit cost</th>
<th>Sub-total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Depth Removal of Portion of Deck (0.5 m x 84 m) (m³)</td>
<td>9.5</td>
<td>$5,000</td>
<td>$47,500</td>
</tr>
<tr>
<td>Concrete in Deck (m³)</td>
<td>8.5</td>
<td>$1,800</td>
<td>$15,300</td>
</tr>
<tr>
<td>Additional SS Reinf Steel in Deck (t)</td>
<td>2.7</td>
<td>$15,000</td>
<td>$40,500</td>
</tr>
<tr>
<td>Subtotal</td>
<td></td>
<td></td>
<td>$103,300</td>
</tr>
</tbody>
</table>

Alt 1 – Cost Estimate for Embankment and Roadway

1 L.S. $300,000

### Alt 2A/2B/3A/3B - Cost Estimates for Centreline/Crown Shift and Padding of Deck

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Unit cost</th>
<th>Sub-total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete Padding on Deck (m³)</td>
<td>63</td>
<td>$800</td>
<td>$50,400</td>
</tr>
<tr>
<td>Finish and Cure Concrete Padding (m²)</td>
<td>504</td>
<td>$40</td>
<td>$20,200</td>
</tr>
<tr>
<td>Subtotal</td>
<td></td>
<td></td>
<td>$70,600</td>
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</tbody>
</table>

Alts 2A and 3A – Cost Estimate for Embankment and Roadway

1 L.S. $1,000,000

Alts 2B and 3B – Cost Estimate for Embankment and Roadway

1 L.S. $900,000

### Common Elements

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Unit cost</th>
<th>Sub-total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removal of Parapet Walls (m³)</td>
<td>40</td>
<td>$1,800</td>
<td>$72,000</td>
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</tbody>
</table>
## Alt AWS – Duration of Future Construction for Substructure Widening, Abutments and Pier

<table>
<thead>
<tr>
<th>Item</th>
<th>Duration</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobilization/ Setting up Work Zone</td>
<td>1</td>
<td>$50,000</td>
</tr>
<tr>
<td>Install Roadway Protection</td>
<td>3</td>
<td>$50,000</td>
</tr>
<tr>
<td>Install Embankment Protection</td>
<td>3</td>
<td>$75,000</td>
</tr>
<tr>
<td>Excavation for Pier Footing</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Re-Mobilization for Pile Driving</td>
<td>1</td>
<td>$25,000</td>
</tr>
<tr>
<td>Driving Piles at Abutments (53 more piles)</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Construct Pier Footing (forming, place reinf, concrete, and cure)</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Construct Abutments and Pier Columns/Cap (forming, place reinf, concrete, and cure)</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Re-instate Roadway</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Sub-total (days)</strong></td>
<td><strong>36</strong></td>
<td></td>
</tr>
</tbody>
</table>

## Alt AWS – Cost Estimate for Construction of Complete Widened Substructure, Including Abutments and Pier

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Unit cost ($)</th>
<th>Subtotal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Install Piles (m)</td>
<td>873</td>
<td>$500</td>
<td>$436,364</td>
</tr>
<tr>
<td>Supply Equipment for Driving Piles (LS)</td>
<td>1</td>
<td>$50,000</td>
<td>$50,000</td>
</tr>
<tr>
<td>CSP for Integral Abutment (m)</td>
<td>288</td>
<td>$600</td>
<td>$172,800</td>
</tr>
<tr>
<td>Concrete in E and W Abutment Walls (m3)</td>
<td>420</td>
<td>$1,200</td>
<td>$504,000</td>
</tr>
<tr>
<td>Concrete in Pier Footing (m3)</td>
<td>270</td>
<td>$800</td>
<td>$216,000</td>
</tr>
<tr>
<td>Concrete in Pier Columns (m3)</td>
<td>61</td>
<td>$1,200</td>
<td>$73,250</td>
</tr>
<tr>
<td>Concrete in Pier Cap (m3)</td>
<td>90</td>
<td>$1,200</td>
<td>$108,000</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td></td>
<td></td>
<td><strong>$1,560,414</strong></td>
</tr>
</tbody>
</table>

This memo is a preliminary document and is not to be used as a basis for final design or construction or as a basis for major capital decisions.
APPENDIX

ALTERNATIVE SUMMARY TABLES

SKETCHES
<table>
<thead>
<tr>
<th>Alternative</th>
<th>Description</th>
<th>Advantages / Benefits</th>
<th>Disadvantages / Risks</th>
<th>Additional Costs</th>
<th>Potential Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Widening on Centreline</td>
<td>Future separation of deck slab feasible</td>
<td>Future separation of entire superstructure may not be practical; however, if ultimate cross-section is reduced to 6 lanes with use of multi-purpose lanes, thermal effects should be marginal and longitudinal separation of structure not required.</td>
<td>Future removal of narrow strip of deck to provide longitudinal expansion gap</td>
<td>no additional costs for grade raise and larger embankments</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No padding on deck required</td>
<td>Provide additional reinforcing in deck slab for strength of resulting deck cantilever in the event that future expansion gap in deck is constructed</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Balanced widening, No unbalanced forces/stresses induced into existing 2 lane structure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>No grade raise for widened McKay Road. No increase in approach grades for McKay Road</td>
<td>Property required on both sides</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Roadway safety with maintaining alignment of roadway across the bridge and avoiding alignment shift and back to back curves from roadway at approaches and across the bridge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maintain minimum vertical clearance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2A</td>
<td>Complete Widening and Crown Shift to the South</td>
<td>Accommodates future separation of widened structure (EB and WB) to mitigate potential thermal effects with wide deck platform</td>
<td>Require realignment of McKay Road centreline at bridge by approx 14 m south</td>
<td>Costs for concrete padding on the deck</td>
<td>Maintain existing north side parapet wall, provided no additional north side modifications, eg., sidewalks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All property required on south side only</td>
<td>Results in grade raise for widened McKay Road, estimated at 280 mm. Steeper grade for widened McKay Road</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Removals on one side only of existing bridge, provided no additional removals required, eg., to construct future sidewalk.</td>
<td>Padding required on deck, estimated at 250 mm to adjust cross-fall. Additional deal load on girders and abutments.</td>
<td>Property on south side may be more expensive or problematic to acquire</td>
<td>Property on south side may be less expensive or less problematic to acquire</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Unbalanced widening introduces unbalanced forces/stresses into existing two lane structure</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Reduce vertical clearance south side by approx 100 mm. Temporary basis until widening of Hwy 400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2B</td>
<td>Crown Shift South and Variable Widening to the South and North</td>
<td>Accommodates future separation of widened structure (EB and WB) to mitigate potential thermal effects with wide deck platform</td>
<td>Results in grade raise for widened McKay Road, estimated at 120 mm. Slight increase in approach grades</td>
<td>Property on south side may be more expensive or problematic to acquire</td>
<td>Property on south side may be less expensive or less problematic to acquire</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Require realignment of McKay Road centreline at bridge by approx 6+ m south</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Reduce vertical clearance south side by about 50 mm</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Unbalanced widening introduces unbalanced forces/stresses into existing 2 lane structure</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Property required on both sides</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alternative</td>
<td>Description</td>
<td>Advantages / Benefits</td>
<td>Disadvantages / Risks</td>
<td>Additional Costs</td>
<td>Potential Savings</td>
</tr>
<tr>
<td>-------------</td>
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<td>-----------------------</td>
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<td>------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>3A</td>
<td>Complete Widening and Crown Shift to the North</td>
<td>Accommodates future separation of widened structure (EB and WB) to mitigate potential thermal effects with wide deck platform</td>
<td>Results in grade raise for widened McKay Road, estimated at 280 mm. Steeper grade for widened McKay Road</td>
<td>Taller/larger/wider embankments. Additional approach roadway costs</td>
<td>Maintain existing north side parapet wall, provided no additional north side modifications, eg., sidewalks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increase in minimum vertical clearance</td>
<td>Require realignment of McKay Road centreline at bridge by approx 14 m north</td>
<td>Property on north side may be more expensive or problematic to acquire</td>
<td>Property on north side may be less expensive or less problematic to acquire</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Property on north side only</td>
<td>Padding required on deck, estimated at 250 mm to adjust cross-fall. Additional deal load on girders and abutments.</td>
<td>Costs for concrete padding on the deck</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Property on north side may be less expensive or more problematic to acquire</td>
<td>Property on north side may be less expensive or less problematic to acquire</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3B</td>
<td>Crown Shift North and Variable Widening to the North and South</td>
<td>Accommodates future separation of widened structure (EB and WB) to mitigate potential thermal effects with wide deck platform</td>
<td>Results in grade raise for widened McKay Road, estimated at 120 mm. Slight increase in approach grades</td>
<td>Taller/larger/wider embankments. Additional approach roadway costs</td>
<td>Property on north side may be less expensive or more problematic to acquire</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increase in minimum vertical clearance</td>
<td>Require realignment of McKay Road centreline at bridge by approx 6+ m north</td>
<td>Property on north side may be more expensive or less problematic to acquire</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>unbalanced widening introduces unbalanced forces/stresses into existing two lane structure</td>
<td>Costs for concrete padding on the deck</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Property on north side may be more expensive or less problematic to acquire</td>
<td>Property on north side may be less expensive or less problematic to acquire</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alternative</td>
<td>Description</td>
<td>Advantages / Benefits</td>
<td>Disadvantages / Risks</td>
<td>Additional Costs</td>
<td>Potential Savings</td>
</tr>
<tr>
<td>-------------</td>
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<td>-----------------------</td>
<td>-----------------------</td>
<td>------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>4</td>
<td>Crown Shift South or North with Variable Widening and Separate Crown for EB and WB Structures</td>
<td>Accommodates future separation of widened structure (EB and WB) to mitigate potential thermal effects with wide deck platform</td>
<td>Roadway deck drainage towards median as well as outside shoulders, to be managed at approaches.</td>
<td>Slightly taller/larger/wider embankments. Additional approach roadway costs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>No padding of deck required</td>
<td>Feasibility and complexity to revert to single crown for roadway at beyond the bridge approaches</td>
<td>Wider (5 m) median lane. Results in wider deck platform.</td>
<td>Additional costs to construct wider deck</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mitigate grade raise for McKay Rd</td>
<td>Property required on both sides</td>
<td>Unbalanced widening introduces unbalanced forces/stresses into existing 2 lane structure</td>
<td></td>
</tr>
<tr>
<td>XS and XN</td>
<td>Constant Slope on Deck. Future Widening with Crown</td>
<td>Accommodates future separation of widened structure (EB and WB) to mitigate potential thermal effects with wide deck platform</td>
<td>Committed to widening to one side or the other depending on initial slope of deck. No flexibility to alter minimum limits of widening without significant deck modifications and costs</td>
<td>Grade raise for McKay Rd</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>No padding of deck required</td>
<td>Deck slopes in &quot;wrong&quot; way in one direction for interim condition, until widening</td>
<td>Unbalanced widening introduces unbalanced forces/stresses into existing 2 lane structure</td>
<td></td>
</tr>
<tr>
<td>AWS</td>
<td>Advance Widening of Substructure Abutments and Pier</td>
<td>None or minimal future disruption to Hwy 400 traffic during construction of pier, driving abutment piles, construction of RSS retaining walls, etc.,</td>
<td>Uncertain as to extent and location of future widening. No flexibility to revise extent or location of widening. Potential for significant throwaway.</td>
<td>Initial construction costs higher</td>
<td>Minimize re-mobilization costs, reduce or eliminate roadway protection, embankment protection, staging and traffic protection costs for widening at pier and abutments</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reduced duration of construction during superstructure widening</td>
<td>Costs associated with economy of scale with larger quantities</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Elimination of construction joints with future widening of substructure, results in improvements in quality of construction</td>
<td>Cost savings associated with reduced duration of future substructure construction. Anticipated savings of up to 6 weeks of construction and associated costs.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Permits construction of expansion gap in substructure and facilitate future separation of deck</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
ALTERNATIVE 1 - ON CENTRE LINE

ALTERNATIVE 4A - SHIFT CENTRE LINE 5m SOUTH (DOUBLE CROWN)
ALTERNATIVE XN Construct Deck with Single Cross-fall (no Crown)

ALTERNATIVE XN Variable Widths to the North
Hwy 400 and 10th Line (Innisfil) - Showing Cont No 2015-2015/WP No 06-20016 - Stage 1 Drawing

Date: 03/17/2016
December 22, 2015

City of Barrie, Engineering Department
70 Collier Street, PO Box 400
Barrie, ON, L4M 4T5

Attention: Bala Araniyasundaran, P. Eng., PMP, LEED GA
MHPM PROJECT MANAGERS INC.
Program Coordinator – Growth Development Projects

RE: Review of the Structural Design Report and General Arrangement drawing for the Proposed 10th Line (McKay Road) Underpass Design Build
MMM File No.: 3215075

Dear Sir,

As requested, MMM Group Limited (MMM) has reviewed the Structural Design Report (SDR) and General Arrangement (GA) drawing for the proposed 10th Line (McKay Road) Underpass over Highway 400 with respect to potential structural issues for the future widening (total width of 40.6 m) of the bridge.

PROPOSED (INTERIM) 10TH LINE UNDERPASS

The proposed Underpass, which will replace the existing two span rigid frame bridge, is a two span continuous (42.0 m – 42.0 m) cast in place concrete slab (225 mm thick) on five CPCI 2300 girders spaced at 2.4 m. The bridge will have approximately 19.4 degree skew with centreline of Highway 400. The bridge will accommodate a 3.5 m traffic lane and 2.0 m shoulder in each direction with an overall structural width of 11.6 m. There will be a TL-3 (equivalent to PL-2) concrete parapet wall with bicycle railing constructed at the north and south edges of the bridge. The superstructure will be made continuous over the pier for live load and super-imposed dead load (asphalt and parapets). The deck diaphragm at the pier will be constructed integrally with the pier cap. The pier will consist of three 1200 mm
diameter reinforced concrete columns supported on a spread footing. A cast in place reinforced concrete integral abutment with steel H-piles is proposed at both ends thus eliminating expansion joints.

**FUTURE ULTIMATE CONDITION OF 10TH LINE UNDERPASS**

The future ultimate condition of the 10th line Underpass will consist of 6 lanes with speed change lanes, with an overall deck width of 40.6 m. Each direction will consist of a 2.0 m sidewalk, 1.5 m bike lane, 5.0 m speed change lane, and 3 - 3.5 m wide through traffic lanes. A 2.0 m wide concrete median will be constructed to separate each direction of traffic and a TL-3 concrete parapet wall will be constructed at the north and south edges of the structure. The SDR indicates that the future widening will be accommodated by widening 10th line Underpass symmetrically on both the north and south sides of the proposed bridge. There is no indication that a longitudinal expansion joint will be provided.

**POTENTIAL STRUCTURAL ISSUES WITH FUTURE WIDENING OF 10TH LINE UNDERPASS TO 6 LANE CONFIGURATION**

Based on the SDR, the bridge will be widened from 11.6 m to 40.6 m which will make each span length almost equal to the width (42 m verses 40.6 m). Based on this, MMM has identified the following potential issues that should be considered in the design of both the interim and ultimate structures:

- The exterior H-piles will take biaxial bending and torsion due thermal expansion/contraction caused by ‘racking’ of the deck. Since the bridge has 19.4 degree skew, the acute angle direction will have a larger expansion and contraction compared to the obtuse angle direction. In the interim configuration, this is likely not a significant effect, however, in the ultimate configuration, it may be.
- The racking of the deck may result in cracks in the deck and vertical cracks in the diaphragms since the deck is restrained by the diaphragms/piers/abutments. As a result, long-term durability of the structure may be a concern.
- Pre-stressed girders have long-term creep/shrinkage along their length due to the compression provided by the prestressing. The creep and shrinkage in the proposed interim girders will have largely been completed by the time the bridge is widened. However, the girders for the future widening will be subject to creep and shrinkage after they are installed. When the superstructure for the widening is connected to the interim structure, this creep and shrinkage will be restrained. As a result, the differential creep/shrinkage may result in transverse cracks in the deck between the future widening and the interim deck.
• MTO Guidelines for Staged Construction, Chapter 5, Shrinkage and Thermal – Induced Lateral Movement, suggests that “In long and wide bridges, the resulting lateral forces induced at transversely fixed bearings or shear keys/pins can be extremely high leading to failure of those elements.” Therefore, the fixity provided between the pier cap and deck diaphragm at the pier and abutment wall and deck at abutments could result in restraint cracks in the pier cap, deck diaphragm over the pier and in the abutment walls.

• There could be a potential differential settlement of the pier foundation between the proposed interim structure and the future widening since the pier will be founded on a spread footing.

Mitigation Measures for the Above Noted Structural Issues

Although MMM has not undertaken a detailed analysis of the structure to quantify the above-noted issues, we offer the following as potential mitigation measures that could be considered by the designers.

Typically, wide bridges such as the ultimate 10th Line Underpass incorporate a longitudinal expansion joint within a raised median along centreline. In general, most of the potential structural issues noted above for the future widening could be mitigated by providing such a joint. However, the designers should weigh this against the dis-benefits of introducing a joint. These include potential for future leakage and associated deterioration of components below (long-term maintenance costs) and some additional costs now and in the future.

A longitudinal joint at the north or south edge of the interim bridge could be also considered; however, in MMM's opinion, this is not ideal since it would result in joints within traffic lanes and not within a raised median.

Accordingly, MMM suggests that the following to be considered in the proposed interim and ultimate bridge design.

• Provide an expansion joint in the substructure (pier cap, abutment walls) between the interim and future widening to reduce cracks in pier cap and abutment walls.
• Provide an expansion joint near centreline in the deck diaphragms at the pier and abutments and in the abutment stems
• Either remove the fixity between the pier cap and the deck diaphragm to allow transverse and rotational movement of the superstructure under thermal expansion/contraction or design the pier to accommodate the generated responses (particularly the future pier widenings). Thicker bearings over the pier could be considered to allow more movement to be accommodated.
• Provide a longitudinal expansion joint near the centre of the proposed deck (at edge of top flange of centre girder) when the bridge is widened so that the thermal movement is reduced by half. The interim deck can be saw-cut near centreline in the future and locally rebuilt with an expansion joint in the new raised median. The concrete deck near the expansion joint needs to be designed accordingly for the future cantilever condition.

Should you have any questions, please contact at me at yuna@mmm.ca.

Yours truly,

MMM Group

Augustin Yun, P. Eng.
Senior Project Engineer
Transportation, Bridge Engineering

cc: Bob Stofko, P. Eng., Senior Project Manager, MMM Group Limited
    Michael Chiu, P. Eng., Vice President, MMM Group Limited
    Brent Gotts, P. Eng., Project Manager, MMM Group Limited
PROJECT: Ministry of Transportation
DB-2015-2015 Highway 400/10th Line (McKay Road) Bridge Replacement
115124

DATE: June 23, 2016

LOCATION: Main Boardroom, Ainley & Associates, Barrie

TIME: 1:00 p.m. – 2:00 p.m.

PRESENT: Ministry of Transportation
Andrew Parulski CSA - Operations
Robert Vanderberg Project Manager – Planning and Design
Mariusz Kobiela Structural Engineer – Structural
Shirin Ghatreh Samani
Kevin Scholtz
Dufferin Construction
Paul Ileliji Project Superintendent – Central District
Planmac
Mike Neumann Design – Project Manager
Ainley & Associates
Mark MacLeod Design - Transportation
Brown and Company
Jason Jelinek Design - Structural
City of Barrie
Bala Araniyasundaran Program Coordinator
MMM
Brent Gotts Project Manager

DISTRIBUTION: All Present

Dufferin Construction
Ravinder Dhupar Senior Quality Control Administrator
Brendan Radeff Construction Coordinator
PURPOSE: DB-2015-2015 Highway 400/10th Line (McKay Road) Bridge Replacement – Bridge Modification Meeting 2

Action by:

1. **Introductions**
   All of the meeting attendants introduced themselves.

2. **Structural Analysis**
   - Jason Jelinek, Brown and Company (Brown), provided a brief overview of the results of their analysis of the future structure widening analysis. The following information was provided:
   - Analysis indicated that a centerline expansion joints will not be required for the widened structure.
   - There will be no connection between the future pier caps and footings.
   - The abutments will be continuous.
   - Analysis was carried out using a CSI model. With girders being placed as follows:
     2. Step 2 - add 4 girders by 2022 on outsides.
   - Cracking is expected in the future but under allowable limits and without expansion joints. Brown indicated that some additional steel reinforcing would be needed to control cracking. They assigned different temperatures to model to determine the thermal effects at various locations within the structure. The intent was to provide for a worst case scenario for the bridge design.
   - A maximum movement of 6mm was used in the model to account for racking. Initial structure is not impacted by widening the structure.
   - The initial pile design included the placement of battered piles on the outside of each abutment to control lateral forces. This cannot be done now as the abutments will be widened and the battered piles will interfere with future piles. Lateral forces were reviewed for bending to account for this. Racking has very little influence to no effect.
   - The widening has little effect on the girders but some added compression in girders anticipated.
   - Cracking in the abutment walls is expected to be a maximum of 0.17mm and is within the specified limits. Some additional reinforcing steel is recommended.
   - There are no issues with the pier and pier diaphragms.
• The RSS walls will be impacted by future excavations for CSP extensions. Options to consider are placing the CSP extensions now for the future piles and lowering wing walls to avoid re-excavations.

• In summary, conventional materials will be used for the construction of the 10th line bridge and future widening. No centerline expansion joints are required. The only issue the design of the RSS walls to avoid future conflicts with construction of the widened structure.

• Other Design items:
  1. Review the pre-cast panel analysis. Some cracking is expected but needs further review. The bridge deck may have to be cast in place. The City of Barrie and MMM will need to review.

• Brown indicated that the final version of the analysis report will be sealed.

• MTO asked if the design will include embedded couplers for the future widening. Brown confirmed that the design will include this item.

• Brown confirmed that battered piles cannot be used because of the future widening. The following options were provided to address this issue:
  1. Option 1 – Turn the outer H-pile so that the stronger axis is parallel to Hwy 400.
  2. Option 2 – Install some of the CSP’s and piles now to eliminate the need for excavation during the widening.

• Brown advised that 30 days was allowed for closure strip with maintained traffic flow.

• The structure is independent of RSS walls.

• The City of Barrie wants to minimize future constructability issues and construction costs. If there is a need for future CSP’s and piles now, the Dufferin will provide a cost to the City to complete this work.

• Pile Driving is scheduled for the 3rd week in July.

3. **Vertical Clearance**

• Ultimate clearance will not be 5.38m after the structure has been widened. MTO indicated that the minimum ultimate should be 5.1m. AAL advised that the profile of 10th Line may need to be raised to accommodate this minimum vertical clearance requirement.

• The vertical clearance at PT1 (5.061) and PT2 (5.017) as noted in the drawing provided by AAL are based on 8-lane McKay Road cross section with the construction under this contract on Hwy 400 completed.

• To maintain a minimum clearance of 5.1 m, Highway 400 has to be lowered or the profile on McKay Road has to be raised. The vertical clearance for the 10th Line structure proposed under this contract will be 5.879m.

• MTO to provide copies of the Highway 400 preliminary design to

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**Action by:**

Brown

Barrie/Dufferin

MTO
confirm if the profile of Highway 400 will be changed due to the substandard vertical curve to the south of the structure. This will impact the future footings for the proposed structure if MTO plans to lower the profile of Highway 400. MTO to provide additional information on the future ultimate profile for Highway 400

- MMM will provide AutoCAD drawings for the 6 and 8 lane cross sections for 10th Line (McKay Road).

### 4. Other Items

- Archaeology – MTO needs to get clearance for the line. It is anticipated to be clear. Dufferin is doing the excavation to avoid constructor issues.
- An additional meeting will be held on Wednesday July 13.
- MMM needs to complete some field work in order to complete the EA for the future bridge widening and interchange. The work to be completed includes surveying, natural science reviews, and foundation & pavement boreholes. MMM to coordinate the work through Dufferin Construction to avoid contractor issues. MMM indicated that the boreholes can be completed in the fall with only the foundation boreholes being in close proximity to the 10th Line structure. The pavement boreholes will be located on the alignments for the future interchange ramps and widened McKay Road.

Any errors and/or omissions from these Minutes should be reported to the undersigned as soon as possible.

Minutes prepared by:

Mark MacLeod, P.Eng.
Senior Transportation Engineering
Ainley & Associates Limited
PROJECT: Ministry of Transportation  
DB-2015-2015 Highway 400/10th Line (McKay Road) Bridge Replacement  
115124

DATE: July 13, 2016

LOCATION: Main Boardroom, Ainley & Associates, Barrie

TIME: 2:30 p.m. – 3:30 p.m.

PRESENT:  Ministry of Transportation

Rinaldo Rossi  ACE - Operations
Andrew Parulski  CSA - Operations
Robert Vanderberg  Project Manager – Planning and Design
Mariusz Kobiela  Structural Engineer – Structural
Shirin Ghatrehsamani

Dufferin Construction

Paul Ileliji  Project Superintendent – Central District
Ravinder Dhupar  Senior Quality Control Administrator
Brendan Radeff  Construction Coordinator

Ainley & Associates

Mark MacLeod  Design - Transportation

Brown and Company

Jason Jelinek  Design - Structural

City of Barrie

Bala Araniyasundaran  Program Coordinator

MMM

Augustin Yun  Structural

DISTRIBUTION: All Present

Ministry of Transportation  
Kevin Scholtz
1. **Introductions**
   All of the meeting attendants introduced themselves.

2. **MTO Comments**
   The MTO had the following comments to start the meeting:
   - The meeting will look at the changes to the structure being constructed under this contract.
   - The model used to analyze the bridge considered the ultimate structure width.
   - Consider the detrimental effects the widening of the structure will have on the design of two lane structure.
   - The use of conventional models to design the present and future structures.

3. **Assumptions used in Structural Analysis**
   MMM and the City of Barrie asked if the assumptions used in the structural analysis will be provided to the future structural designers.

   Brown and Company (Brown) indicated that the assumptions used in the analysis will be made available to the future structural designer. To provide the assumptions made will be included in the contract package. It may be placed on a second GA drawing. The new drawing will include all of the conditions and assumptions used to complete the analysis to determine the effects widening the structure will have on the present structure.

   Brown indicated that the structural memo was written to outline the method used to analyze the effects that the future widening the will have the structure. It included all of the assumptions that were made regarding the materials and construction methods used for the future widening. Brown confirmed that the assumptions made included using standard materials and construction methods.
MTO indicated that the assumptions used Brown’s analysis can be imposed on the future structural designers.

4. **Structure Racking**
   With respect to Racking in the structure, Brown confirmed that they looked at racking within the 2 lane structure only. They flagged that the future structural designers will have to consider racking with completing design for widening the structure. They indicated that based on the analysis, the racking was greater on the widened structure but was within normal design limits.

5. **Stresses within the Structure**
   Brown indicated that when completing the analysis, they did not consider stresses in the widened structure but nothing in the model indicated that the stresses in the widened structure were outside of normal parameters. Brown indicated that the higher stresses will be in the 2 lane structure and not the widened sections of the future structure.

6. **Bending in the Piles**
   Brown indicated that bending in the H piles due to lateral forces will not be an issue. As part of the design, the H piles will be rotated to have the stronger axis parallel to Highway 400. Brown indicated that axially loading is more critical than bending in this design. Adding additional piles in the future widening will further reduce the lateral loading from wind. MMM asked what size of H being used in the piles is being used in the design. Brown indicated that standard 310 x 110 H piles are being recommended for the foundations.

7. **Precast Deck Panels**
   MMM asked if precast deck panels are still part of the design for the 2 lane bridge. Brown indicated that the design still includes precast deck panels. MMM asked if precast deck panels can be used in the future widening. Brown indicated that once the overhang has been removed, there will be 650mm exposed on the flanges of the outside girders for the placement of precast deck panels. It will be up to the future designer to determine if precast panels will be used in the widening.

8. **Precast Deck Panels**
   Brown indicated that couplers will be added in this design in order to make future widening easier for the City of Barrie.

9. **Structural Memo**
   Brown indicated that they will respond in writing to MMM’s comments on the structural memo.

10. **Foundations**
    Brown indicated that they did not look at the foundations for the widened structure.
11. **Additional Piles and CSPs**

Brown indicated that as part of this construction, an additional 5 CSP and 2 H piles will be required on both sides of the East and West abutments. These items are required now because of constructability issues when the structure is being widened. If the 5 CSPs are not placed now, future placement will undermine the foundation of the RSS wall. The 2 future H piles cannot be placed due to proximity to the abutment walls. Equipment will not be able to get close enough to the abutment wall for placement of the piles. MMM and the City of Barrie agreed with the analysis.

Dufferin will provide a quote for the placement of the additional CSPs, H Piles, and rebar required due to the future widening of the structure.

12. **Black Steel**

MTO indicated that black steel can be used to replace the stainless steel in the barrier walls and overhang. MTO asked that the City of Barrie provide a written confirmation that they will move forward with the construction of the interchange and bridge widening within the next 5 to 10 years. The City of Barrie indicated that they are committed to completing this work.

Dufferin to submit a RFC for use of black rebar in parapet and overhang.

Any errors and/or omissions from these Minutes should be reported to the undersigned as soon as possible.

Minutes prepared by:

Mark MacLeod, P.Eng.
Senior Transportation Engineering
Ainley & Associates Limited
PROJECT: Ministry of Transportation  
DB-2015-2015 Highway 400/10th Line (McKay Road) Bridge Replacement  
115124

DATE: May 27, 2016

LOCATION: Main Boardroom, Ainley & Associates, Barrie

TIME: 11:30 a.m. – 12:30 p.m.

PRESENT:
- Ministry of Transportation
  - Andrew Parulski, CSA - Operations
  - Robert Vanderberg, Project Manager – Planning and Design
  - Mariusz Kobiela, Structural Engineer – Structural

- Dufferin Construction
  - Paul Ileliji, Project Superintendent – Central District
  - Ravinder Dhupar, Senior Quality Control Administrator
  - Brendan Radeff, Construction Coordinator

- Planmac
  - Mike Neumann, Design – Project Manager

- Ainley & Associates
  - Mark MacLeod, Design - Transportation

- Brown and Company
  - Jason Jelinek, Design - Structural

- City of Barrie
  - Ralph Scheunemann, Senior Infrastructure Planning Engineer
  - Bala Araniyasundaran, Program Coordinator

- MMM
  - Brent Gotts, Project Manager
  - Augustin Yun, Structural
PURPOSE:  DB-2015-2015 Highway 400/10th Line (McKay Road) Bridge Replacement – Bridge Modification Meeting

1. **Introductions**
   All of the meeting attendants introduced themselves.

2. **City of Barrie Requirements**
   The City of Barrie has requested the modifications be made to the bridge design to minimize throw away and to make it easier to widen the structure when the City builds a new interchange at this location.

3. **Future Bridge Requirements**
   Staff from Marshall Maclin and Monaghan (MMM) advised that overall span of the bridge is acceptable and the future width will be as follows:
   - 6 lanes
   - Bike lanes
   - Sidewalks
   - Overall width 40 m

   MMM also advised that the 6 lane cross section may have to be widened to 8 lanes with an overall width of 47.5m in the future.

   MMM is presently completing the EA for the future interchange at 10th Line for the City of Barrie. Both the City of Barrie and MMM want assurances that the proposed bridge design can be easily expanded to the ultimate 8 lane cross section with bike lanes and sidewalks.

   MMM is recommending an expansion joint in the center of the structure since the future width may be wider than the span. MMM is concerned that thermal movement in the future widened structure could impact pile tips with current design (after future expansion). MMM advises that there could be some cracking if not accounted for future work.

   Brown and Company (Brown) indicated that Dufferin wants to use precast panels so there will be some issues with the proposed expansion joint. Brown indicated that the expansion joint may not be necessary if the structure is designed for the ultimate configuration and takes into account the thermal expansion of the wider structure.

   MMM will provide the cross-section and a plan showing both the 6 and 8 lane configurations. It was confirm that the structure would be widened equally to both the north and south.

Action by:
4. **Foundation Design**

Thurber will review the proposed cross sections and advise if any foundation impacts. If there are foundation impacts associated with the widened structure, they will make recommendations on the location of additional boreholes, testing, etc. as required for the ultimate bridge width.

**Action by:**

Thuber

5. **Vertical Clearance**

AAL was concerned that the widened bridge will require changes to the profile of 10th Line in order to maintain the minimum 5200mm of clearance above Highway 400. AAL indicated that since south side of the structure is dropping at 2% and the profile of Highway 400 is rising at 3%, the vertical clearance is being reduced by 5% or approximately 200mm if the structure is widened from 6 lanes to 8 lanes. AAL also indicated that the information supplied by the Ministry does not indicate whether the vertical clearance measurements provided on the GA drawing were measured from the existing asphalt or from the revised Highway 400 elevation which would include additional padding to relocate the crown line due to a 5m horizontal shift on Highway 400. AAL will review the bridge cross sections and determine if any changes to the 10th Line profile are required to maintain the required vertical clearances for the proposed structure.

**Action by:**

AAL

6. **Proposed Interchange**

The City of Barrie asked if the proposed interchange will require changes to the profile on Highway 400. MTO indicated that the preliminary design accounted for the ultimate width of the structure.

MMM advised that the sidewalks and bike lanes will likely be wider than what was proposed at the 30% design level but confirmed that the EA was recommending symmetrical widening for the future structure.

**Action by:**

City of Barrie

7. **Schedule**

Dufferin noted that they are planning to start placing the piles and building the abutments this summer. Dufferin will provide a date at which this must be resolved without having an adverse effect on their schedule.

MMM indicated that they could supply the cross section within 2 weeks and MTO requested that they be provided within 1 week. MMM indicated that they would try to expedite the delivery of the cross sections.

**Action by:**

Dufferin

City of Barrie
Because of this, the MTO is advised if the decorative features such as curved facia, handrails, etc. can be eliminated to reduce the amount of throw away work associated with the structure. MTO will advise if this will be permitted.

9. **Bridge Substructure**
   Brown confirmed that the abutments will be placed on piles and the center piers will be placed on a spread footing.

10. **Watermain and Sanitary Sewer**
    The City of Barrie indicated that a watermain and sanitary sewer will be constructed when 10th Line is widened to 6 lanes.

11. **INC**
    MTO will issue an INC for the additional work required to change the design to accommodate the City of Barrie’s request for changes to meet their future plans. Dufferin will provide a cost estimate to complete the extra work and MTO will issue a change order for the extra work.

Any errors and/or omissions from these Minutes should be reported to the undersigned as soon as possible.

Minutes prepared by:

Mark MacLeod, P.Eng.
Senior Transportation Engineering
Ainley & Associates Limited
MEMO

TO: Mark MacLeod, P.Eng., Ahlney Group
FROM: Jason Jelinek
CC: Paul Illelji, Dufferin Construction
DATE: August 19, 2016
SUBJECT: MTO DB 2015-2015 – Hwy 400 / 10th Line (McKay Road) Bridge Replacement

REF: Preliminary Analysis of Bridge’s Ultimate Configuration (REV. 1)

Mark,

We have completed a preliminary review of the 10th Line over Highway 400 bridge with specific consideration made for the bridge’s maximum anticipated width at the ultimate condition. The specific purpose of the preliminary review was to determine what provisions should be implemented in the current phase of construction for the initial structure to facilitate future widening work. It is understood that rework of the initially built structure during future widening work is to be minimized. This review is intended to provide general design recommendations for proceeding with the initial structure and is not intended to provide detailed design information.

The new 10th Line over Highway 400 structure is a two-span (42000mm-42000mm), continuous concrete, integral abutment bridge. The bridge carries east/west traffic on 10th Line over the northbound and southbound lanes of Highway 400 just south of the City of Barrie. For the current phase of construction, the bridge’s out-to-out width is 11600mm. The planned cross section is comprised of four 2400mm deep NU girders with a 225mm concrete deck built-up from partial depth precast concrete panels and cast-in-place concrete topping. The superstructure is supported at its east and west ends on cast-in-place concrete integral abutments founded on driven piles. The superstructure is supported mid-length on conventional elastomeric bearings on a cast-in-place concrete pier comprised of three columns and a cap beam. The pier is founded on spread footings on native soils. Retained soil system (RSS) walls are planned for the structure’s wingwalls at both abutments.

It is understood that the 10th Line over Highway 400 bridge will undergo three primary phases of construction:

1. Initial Construction Phase. The initial structure will start construction imminently and will be completed in 2017. The overall width of the initial structure will be 11600mm, as defined by the original RFP documentation.
2. Interim Construction Phase. The initial structure will be widened to an overall width of approximately 33500mm. Widening of the initial structure will occur approximately equally on the north and south sides. Widening will be completed by driving new piles, extending the existing abutments, adding new girders and extending the deck. Two new, isolated pier bents will be built as part of this phase. The interim construction phase is anticipated to occur approximately five years after completion of the initial construction phase.
3. Ultimate Construction Phase. The interim structure will be widened to an overall width of approximately 47140mm, as per the updated cross section provided by WSP/MMM (June 2016). Widening of the interim structure will occur approximately equally on the north and
sides. Widening will be completed by driving new piles, extending the existing
abutments, adding new girders and extending the deck. Two new, isolated pier bents will be
built as part of this phase. The ultimate construction phase is anticipated to occur
approximately 20 years after completion of the interim construction phase.

Analysis of Structure
The performance of the initial structure in the ultimate condition will depend heavily on the
construction sequencing over its lifespan. A three-dimensional, staged construction analysis model of
the 10th Line over Highway 400 bridge was built in CSI Bridge to review the performance of the initial
structure through the three anticipated construction phases.

CSI Bridge Model at End of Initial Construction Phase

CSI Bridge Model at End of Interim Construction Phase
CSI Bridge Model at End of Ultimate Construction Phase

The CSI Bridge model utilizes time dependent properties for the concrete components and accumulates the effects of each construction stage over time. The basic construction sequence for each phase is typically as follows:

- Install piles at abutments and footings at pier
- Build abutment walls and build pier
- Place girders on substructure as two-simple spans
- Place weight of deck on girders
- Incorporate stiffness of deck to make girders composite and continuous
- Apply backfill pressures at abutments
- Apply weight of barriers and wearing surface

The detailed construction schedule used for the staged model is attached for reference with this memo. A full summary of the members used through each phase of construction has also been attached for reference. The connection of the superstructure between different construction phases has been made with closure strips cast after a 30 day open period. Sketches of the bridge cross sections considered for each construction phase are included with this memo. The full range of thermal effects and live load envelopes have been considered in each time step of the staged model.

Two specific concerns were initially noted by WSP/MMM with regards to the width of the ultimate condition. They are as follows:

- Potential cracking of the deck due to restraint along the support lines
- Potential cracking of the deck and diaphragms due to the skewed structure being racked as a result of thermal effects

In an email received from WSP/MMM on 22 July 2016, an additional concern was identified with regards to differential settlement between the pier footings in different phases of construction.

Each of these concerns are explicitly addressed below along with general comments and observations for the primary components of the initial structure. General review and analysis has been completed in accordance with CAN/CSA-S6-06.

Commentary for Restraint of Deck Along Supports

The concrete deck for the initial structure will crack transversely due to applied loads and superimposed deformations prior to the widenings being constructed. The intensity of the cracking was found to be greatest where restraint was afforded along the support lines at the abutments and pier. With an assumed area of transverse reinforcing steel of 1333mm²/m (15M@300 top and bottom)
the maximum anticipated crack width is approximately 0.15mm for the initial structure. Maximum crack widths of 0.25mm are permitted in the top surface of the deck in accordance with Table 8.6 of CAN/CSA-S6-06.

For each subsequent phase of widening, the zone of transverse cracking in the deck extends both transversely and longitudinally. For the interim structure and the same quantity of transverse reinforcement, the maximum anticipated crack width within the initial structure is approximately 0.19mm. For the ultimate structure and the same quantity of reinforcement, the maximum anticipated crack width within the initial structure is approximately 0.20mm.

Stress distribution diagrams for the deck at each of the construction phases are shown below. Differential thermal loads have been used for the deck and abutments to reflect the effects of the abutments' mass to the thermal response. Additionally, a higher relative humidity has been assigned to the abutment walls for the shrinkage calculation to reflect a partially buried condition. Detailed design review of the initial deck structure is still required to determine suitability of the intended use of the partial depth precast concrete deck panels within the initial structure.
Commentary for Racking of Structure

The absolute movement of the four corners of the initial structure due to thermal effects remain relatively constant through each of the construction phases. With regards to racking, there is only a small additional effect on any of the initial structure components due to future widening. The maximum lateral movement due to racking at each of the four corners is approximately 5mm for each of the construction phases. A summary of the observed movements for the initial structure’s four corners is attached with this memo. Consideration for the racking movements will become more critical for design of the widened sections.

Commentary for Differential Settlements at the Pier

Differential settlement between the initial construction pier footing and widening pier footings could potentially lead to increased transverse stress in the pier diaphragm and deck along the longitudinal construction joint between the structures. Differential settlement is not anticipated to be a significant concern at this site. For the current construction, a maximum differential settlement between either the pier and abutments or across the width of the pier is expected to be 15mm. Although specific bore holes have not been taken for consideration of the future widening work, it would be reasonable to assume that consistent soil conditions exist directly adjacent to the initial structure. Settlement of the pier footing is anticipated to occur almost immediately with the application of load with negligible long term increase. Given the requirement for the delayed pour pour, almost all settlement expected in both the initial and widening structures would have occurred when the structures are connected.

Our current assessment of the work has assumed isolated pier footings for the initial and widening structures. If the designers for the future widenings encounter less favourable soil conditions, a potential means of mitigating differential settlement issues would be to dowel the new widening pier footings into the initial structure’s pier footing.

Commentary for Piles

To permit for installation of the piles in the future widening, all piles for the initial structure will be required to be driven vertically. Battering the outer piles to provide lateral restraint to the structure at the abutments will not be an option as they will interfere with future piles. Lateral loads at the abutments for the initial structure will be resisted through a combination of bending in the piles and at the pier through lateral flexure in the deck. The piles for the initial structure will be oriented with strong axis bending occurring parallel to the axis of the abutment.

Vertical loads in the initial structure piles are not anticipated to vary significantly with future construction phases. Lateral loads on the initial structure piles are also not anticipated to vary significantly with future construction phases. As noted above, the change in racking movements with progressive widening of the initial structure are minimal. Additionally, the overall lateral loads do not change significantly and are ultimately resisted by more piles.

Installation of piles for future widenings directly adjacent to the original construction abutments will be difficult due to the clearance requirements for conventional piling rigs. It is recommended that consideration be given to installing select piles for the future widening work as part of the current construction programme. Installing two future piles on each side of each abutment with the current construction would alleviate access concerns for the future works.

Commentary for Girders

The widening of the initial structure will tend to introduce slightly more compression into the girders of the Initial structure. The creep and shrinkage strains in the widenings will be partially restrained by the
axial stiffness of the initial structure. Positive effects from the additional compression will not be considered in the design for the initial structure’s girders.

**Commentary for Abutment Walls**

The thermal mass of the abutments, soil friction behind the abutments, and different shrinkage properties will result in the abutments lagging behind any transverse movement of the deck. The result is that the abutment walls will tend to restrain deck movements for all configurations of the structure. Transverse contraction of the deck by shrinkage and/or thermal contraction will tend to compress the abutment walls. This effect is beneficial. Transverse expansion of the deck by thermal expansion will tend to elongate the abutment walls. The elongation experienced by the abutment walls in the initial structure is insufficient to crack the abutment walls. However, the elongation experienced by the abutment walls in both the interim and ultimate structures is sufficient to crack the full width of the initial structure abutment walls. For the interim structure, with an assumed area of transverse reinforcing steel of 6000mm²/m, the maximum anticipated crack width within the initial structure is 0.17mm. For the ultimate structure, with an assumed area of transverse reinforcing steel of 6000mm²/m, the maximum anticipated crack width within the initial structure is 0.23mm. Note that both of these crack widths are less than the maximum permitted crack width of 0.25mm, per Table 8.6 of CAN/CSA-S6-06.

**Commentary for Pier Diaphragms**

Similar to the abutment walls, the pier diaphragms will tend to restrain deck movements for all configurations of the structure. The elongation experienced by the pier diaphragms in the initial structure is insufficient to crack the pier diaphragms. For an assumed area of transverse reinforcing steel of 4500mm²/m, the maximum anticipated crack width within the initial structure is 0.07mm. For the interim structure, with an assumed area of transverse reinforcing steel of 4500mm²/m, the maximum anticipated crack width within the initial structure is 0.08mm. For the ultimate structure, with an assumed area of transverse reinforcing steel of 4500mm²/m, the maximum anticipated crack width within the initial structure is 0.11mm. Note that all of these crack widths are less than the maximum permitted crack width of 0.25mm, per Table 8.6 of CAN/CSA-S6-06.

**Commentary for Pier**

Longitudinal loads at the pier are introduced through the racking movements forced at the abutments. As noted above, the anticipated racking movements for the initial structure increase only slightly as the structure is progressively widened. It is not anticipated that the initial pier structure and pier bearings will require any additional provisions to incorporate effects from the future widenings.

It is anticipated that the pier structure for the adjacent widening will be built independent of the initial structure’s pier. The design of the pier and bearings for the widening structures will require closer consideration for the racking movements.

**RSS Retaining Wall / RSS Wingwall Comments**

Although not directly affected by widening of the superstructure, there are potential issues with the arrangement of the RSS wingwalls and retaining wall shown on the original Aecom GA drawing at the abutments. Excavation for future widening cannot take place directly adjacent to the initial abutments without undermining the footings for the RSS wingwalls. The wingwall footings would require a temporary protection system or to be founded at a lower elevation for excavation to occur. Additionally, the straps for the RSS retaining wall extending along the shoulder of the Hwy 400 northbound lane will interfere with the future installation of piles.

Potential means by which to address these future construction issues within the current construction phase are as follows:
• Start the toe of the embankment slope at the structure approximately at the roadway elevation. This would require longer wingwalls but would provide direct access to the side of the initial abutment in the future and would eliminate the north and south extensions of the retaining wall along Highway 400.

• Build the RSS retaining wall along the northbound shoulder for the full height approximately 3000mm beyond the extents of the initial structure with small returns and pre-install CSP’s for the piles of the widening structure

Summary
A preliminary review of the 10th Line over Highway 400 bridge structure was completed for the purpose of determining what potential influence future widenings would have on the initially built structure. The current bridge design has an overall structure width of 11600mm. It is anticipated that an interim widening to an overall width of 33500mm will be completed approximately five years after the initial construction and it is anticipated that an ultimate widening to an overall width of 47140mm will be completed approximately 20 years later. It is anticipated that both widenings will occur in an approximately balanced condition about the initial structure’s centre line and will be attached via closure pours. The analytic review for the progressive widening of the initial structure was conducted with the use of a three dimensional, time dependent, staged construction model built in CSI Bridge. It was found that the effect of the widenings typically had minor additional detrimental effect on the initial structure. Small increases in transverse cracking in the deck and support lines are expected, but are still below normally acceptable limits. Racking of the initial structure becomes marginally worse due to the widenings, but the total effect on the initial structure for the ultimate condition remains within acceptable limits. Design of the structural components for the future widenings were not included as part of this review. Careful analysis and consideration for the design of the future widening components should be made when connecting to the initial structure.

Yours truly,

Jason Jelinek, P.Eng.
Brown & Company Engineering Ltd.
Analysis Component Summary – Initial Structure

General
Span: 36000mm - 36000mm
Width: 11600mm (out-to-out)
Skew: 19°22’18”
Year of Construction: 2017
Comments: -

Loads
Asphalt: 2.2kPa area load on deck (90mm thick total system)
Barrier: 5.5kN/m line load along exterior deck edges
Max. Thermal Increase: +18°C (+15°C to +33°C)
Max. Thermal Decrease: -42°C (+15°C to -27°C)
Backfill Pressure: based on γtot = 21kN/m³ and appropriate movement
LL: CL-625-ONT Truck or Lane Load

Abutments
Piles: 10-HP310x110’s @ 1200mm (no batter)
Pile Length: 6000mm free zone, 6000mm embedment into grade
Orientation: weak axis bending parallel to span
Abutment Dimensions: 12300mm L x 4350mm H x 1500mm W
Abutment Concrete: f’c = 30MPa, RH = 90%, αconc = 10 x 10⁻⁶/°C
Abutment Reinforcement: A_s = 6000mm²/m

Pier
Pier Columns: 3-1200mm Ø
Pier Column Height: 4000mm
Pier Beam Dimensions: 9540mm L x 1800mm H x 1500mm W
Pier Concrete: f’c = 30MPa, RH = 70%, αconc = 10 x 10⁻⁶/°C
Pier Bearings: 600mm x 600mm x 50mm elastomeric bearings at girder ends

Superstructure
Girders: 4-NU2400’s @ 3000mm C/C
Girder Prestress Force: 8854kN per girder at transfer
Girder Concrete: f’c = 50MPa, RH = 70%, αconc = 10 x 10⁻⁶/°C
Deck Thickness: 225mm
Deck Reinforcement: 1333mm²/m each way (15M@300 each way top and bottom)
Deck Concrete: f’c = 30MPa, RH = 70%, αconc = 10 x 10⁻⁶/°C
Pier Diaphragm Dim.: 9540mm L x 2700mm H x 1000mm W
Pier Diaphragm Rein.: A_s = 4500mm²/m
Analysis Component Summary – Interim Structure

General
Span: 36000mm – 36000mm
Width: 10950mm each new widening each side, 33500mm total bridge width
Skew: 19°22′18″
Year of Construction: 2022
Comments: Connection made to the initial structure with closure pour after minimum 30 day wait from casting deck

Loads
Asphalt: 2.2kPa area load on deck (90mm thick total system)
Barrier: 5.5kN/m line load along exterior deck edges
Max. Thermal Increase: +18°C (+15°C to +33°C)
Max. Thermal Decrease: -42°C (+15°C to -27°C)
Backfill Pressure: based on γsand = 21kN/m³ and appropriate movement
LL: CL-625-ONT Truck or Lane Load

Abutments (Each Widening)
Piles: 10-HP310x110’s @ 1200mm (no batter)
Pile Length: 6000mm free zone, 6000mm embedment into grade
Orientation: weak axis bending parallel to span
Abutment Dimensions: 10950mm L x 4350mm H x 1500mm W
Abutment Concrete: f′c = 30MPa, RH = 90%, αcosec = 10 x 10⁻⁴/°C
Abutment Reinforcement: As = 6000mm²/m

Pier (Each Widening)
Pier Columns: 3-1200mm ø
Pier Column Height: 4000mm
Pier Beam Dimensions: 8710mm L x 1800mm H x 1500mm W
Pier Concrete: f′c = 30MPa, RH = 70%, αcosec = 10 x 10⁻⁴/°C
Pier Bearings: 600mm x 600mm x 50mm elastomeric bearings at girder ends

Superstructure (Each Widening)
Girders: 4-NU2400’s @ 2738mm C/C
Girder Prestress Force: 8854kN per girder at transfer
Girder Concrete: f′c = 50MPa, RH = 70%, αcosec = 10 x 10⁻⁴/°C
Deck Thickness: 225mm
Deck Reinforcement: 1333mm²/m each way (15M@300 each way top and bottom)
Deck Concrete: f′c = 30MPa, RH = 70%, αcosec = 10 x 10⁻⁴/°C
Pier Diaphragm Dim.: 11610mm L x 2700mm H x 1000mm W
Pier Diaphragm. Reinf.: As = 4500mm²/m
**Analysis Component Summary – Ultimate Structure**

**General**

- Span: 36000mm – 36000mm
- Width: 6820mm each new widening each side, 47140mm total bridge width
- Skew: 19°22'18"
- Year of Construction: 2042
- Comments: Connection made to the interim structure with closure pour after minimum 30 day wait from casting deck

**Loads**

- Asphalt: 2.2kPa area load on deck (90mm thick total system)
- Barrier: 5.5kN/m line load along exterior deck edges
- Max. Thermal Increase: +18°C (+15°C to +33°C)
- Max. Thermal Decrease: -42°C (+15°C to -27°C)
- Backfill Pressure: based on $\gamma_{soil} = 21kN/m^3$ and appropriate movement
- LL: CL-625-ONT Truck or Lane Load

**Abutments (Each Widening)**

- Piles: 6-HP310x110's @ 1200mm (no batter)
- Pile Length: 6000mm free zone, 6000mm embedment into grade
- Orientation: weak axis bending parallel to span
- Abutment Dimensions: 6820mm L x 4350mm H x 1500mm W
- Abutment Concrete: $f'_c = 30MPa$, $RH = 90\%$, $\alpha_{concrete} = 10 \times 10^{-6}/^\circ C$
- Abutment Reinforcement: $A_s = 6000mm^2/m$

**Pier (Each Widening)**

- Pier Columns: 2-1200mm $\phi$
- Pier Column Height: 4000mm
- Pier Beam Dimensions: 6910mm L x 1800mm H x 1500mm W
- Pier Concrete: $f'_c = 30MPa$, $RH = 70\%$, $\alpha_{concrete} = 10 \times 10^{-6}/^\circ C$
- Pier Bearings: 600mm x 600mm x 50mm elastomeric bearings at girder ends

**Superstructure (Each Widening)**

- Girders: 2-NU2400's @ 3260mm C/C
- Girder Prestress Force: 8854kN per girder at transfer
- Girder Concrete: $f'_c = 50MPa$, $RH = 70\%$, $\alpha_{concrete} = 10 \times 10^{-6}/^\circ C$
- Deck Thickness: 225mm
- Deck Reinforcement: 133mm²/m each way (15M@300 each way top and bottom)
- Deck Concrete: $f'_c = 30MPa$, $RH = 70\%$, $\alpha_{concrete} = 10 \times 10^{-6}/^\circ C$
- Pier Diaphragm Dim.: 9820mm L x 2700mm H x 1000mm W
- Pier Diaphragm. Reinf.: $A_s = 4500mm^2/m$
From: Hiett, David
Sent: Thursday, August 31, 2017 2:47 PM
To: Hiett, David
Subject: FW: McKay Class EA - Hwy 400/McKay Interchange

From: Bala Araniyasundaran
Sent: Monday, July 11, 2016 4:42 PM
To: Vandenberg, Robert (MTO) <Robert.Vandenberg@ontario.ca>
Cc: Gotts, Brent <GottsB@mmm.ca>; alvaro.almuina@colliersprojectleaders.com
Subject: McKay Class EA - Hwy 400/McKay Interchange

Hello Robert,

I have attached a Technical Memorandum prepared by WSP / MMM Group in relation to the McKay Class EA that is currently underway. The Memo covers the alternative design concepts that have been developed for the proposed interchange at Highway 400 and McKay. We would like input from the MTO as part of the Class EA process. The project team is available to meet with the MTO. Please provide your comments and feedback at your earliest convenience.

Going forward, please note that Alvaro Almuina (copied on this Email) will lead this Class EA on behalf of the City. Alvaro will communicate with you to follow-up on this Memo. I will continue to be involved with the overall program and please do not hesitate to contact me if I can be of assistance.

Regards,

Bala Araniyasundaran, P. Eng., PMP, LEED GA
COLLIERS PROJECT LEADERS
Program Coordinator – Growth Development Projects
City of Barrie, Engineering Department
70 Collier Street, PO Box 400
Barrie, ON, L4M 4T5.
Direct Tel: (705) 739 4220 Ext: 4471
Mobile: (416) 275 2942
Email: Bala.Araniyasundaran@Barrie.ca
Introduction & Background

On behalf of the City of Barrie, MMM Group is currently conducting a Municipal Class Environmental Assessment (EA) for a new Highway 400 interchange at McKay Road (also known as 10th Line). In 2010, the City of Barrie annexed approximately 2,300 ha of land from the north part of the Town of Innisfil, effectively extending Barrie’s municipal boundary to the south. Much of the annexed lands are slated for significant development, and a new interchange at McKay Road will support that development. The need for a new interchange at McKay Road was identified as part of the City’s 2014 Multi-Modal Active Transportation Master Plan.

It is understood that the Ontario Ministry of Transportation (MTO) is currently conducting an update to the 2004 Highway 400 Class EA and Preliminary Design Study for widening of the freeway to 10 lanes. Related to the Highway 400 expansion project is the replacement of the McKay Road (10th Line) underpass, which is to be completed under a design/build contract, with construction expected to begin in 2016. It is understood that the replacement structure will accommodate a future 10-lane Highway 400 cross section; further, the City has coordinated with MTO to ensure that the bridge can accommodate an additional speed-change lane in each direction, so as not to preclude a ‘parclo’ interchange in the future. A general arrangement drawing for the proposed replacement bridge is appended to this memo as Attachment A.

As part of the development of the annexed lands, McKay Road will be widened to four basic lanes. The road will have a design speed of 80 km/h, a posted speed of 60 km/h, and will include bike lanes and sidewalks in each direction. In the long term, assumed to be 2051, it may be necessary to widen McKay Road to six basic lanes. As part of the McKay Road Municipal Class EA, approval will be sought for the four-lane configuration; however, consideration will be given to the ultimate six-lane configuration in order to minimize throw-away costs associated with future expansion.

Development of Alternatives

As part of the EA process, a range of interchange alternatives has been developed. The alternatives will be evaluated based on environmental factors (natural, socio-economic, cultural/heritage), technical considerations (cost, traffic operational performance, constructability, etc.), and any other relevant criteria. Three interchange configuration alternatives have been developed, as follows:

- Parclo A4
- Parclo A3 (Configuration largely avoids construction in the northeast quadrant)
- Diamond

A brief discussion of each interchange type is provided in the following sections.

Parclo A4

The parclo A4 alternative at McKay Road is shown in Attachment B. All things being equal, the parclo A4 is the most desirable arterial interchange configuration, evidenced by their prevalence in Southern Ontario, and the Greater Golden Horseshoe, in particular. As compared with other arterial interchange types, a parclo A4 interchange offers high capacity, excellent traffic operations, and excellent safety performance on both the freeway and crossing road.

The inner loop ramps will have radii of 55 m, per Section F.5.2.2 and Table F5-1 of MTO’s Geometric Design Standards for Ontario Highways (GDSOH). Direct ramps can have radii of R-130 m per the same standards; however, it is noted that the direct ramp radii could be increased R-250 m in order to meet ramp profile requirements. The outer-loop off-ramps will have back-to-back curves of R-250 m and R-130 m, per the GDSOH and typical MTO practice.
For a crossing road design speed of 80 km/h, the preferred exit terminal design is a direct taper; however, direct-taper ramp terminals on underpass structures are normally accommodated by constructing the underpass such that it is skewed relative to the roadway centreline, as shown in Figure 1. As the proposed McKay Road replacement structure will not be constructed on a skew, it is not possible to accommodate direct-taper ramp terminals without building a significantly wider bridge; this configuration would see large sections of unused bridge deck, which would be uneconomical, and inconsistent with typical practices. To address this issue, speed-change lanes (SCLs) are proposed on the structure as part of the initial configuration. It is noted that, per Figure FA-1 in the GDSOH, SCLs are only required for exit terminals where the design speed of exiting roadway (McKay Road, in this case) is 110 km/h or greater.

Per the City’s Transportation Master Plan (TMP), McKay Road may be widened to an ultimate cross-section that accommodates six basic lanes (by 2051), resulting in a theoretical maximum width of eight lanes through the interchange (six basic lanes and two speed-change lanes). The property requirement detailed in Attachment B will accommodate this condition though it is acknowledged that it is common MTO practice to convert speed-change lane exit terminals over bridges into direct spiral ramp terminals upon widening.

In the long-term configuration, we propose that the inner loop ramp exit terminals be reconfigured to ‘direct spiral’ designs, as shown in Attachment C. This would eliminate the need to widen the bridge to eight lanes, at which point the bridge would have a width of almost 50 m. This would also reduce construction and ongoing maintenance costs.

We note that a conversion to direct-spiral exit terminals may be commensurate with a reduction of the McKay Road design speed to 60 km/h, and a reduction of posted speed to 50 km/h; this would ensure compliance with the table in Figure FA-1 in the GDSOH. As mentioned, it would be consistent with MTO’s common practice of providing direct-spiral ramp terminals at six-lane arterial roads; this practice is commonplace, even where design speeds exceed 60 km/h.

Table 1 provides examples of interchanges in Central Region with six-lane crossing roads, posted speeds of 60 km/h or greater, and direct-spiral exit ramp terminals. It is noted that the examples provided have been limited to interchanges that were constructed relatively recently (Highway 407 or Highway 410 Extension).
It is understood that any widening of McKay Road and reconfiguration of the interchange exit terminals would require an environmental assessment at that time, and would involve consultation with MTO. Any alterations to the interchange would require MTO’s approval at that time, and would require an assessment of traffic operations under the proposed reconfiguration to ensure that there are no significant concerns associated with the design.

Table 1: Examples of Interchanges with Direct-Spiral Exit Terminals and Posted Speed ≥ 60 km/h

<table>
<thead>
<tr>
<th>Freeway</th>
<th>Crossing Road</th>
<th># Lanes</th>
<th>Crossing Road Posted Speed (km/h)</th>
</tr>
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<tr>
<td>407 ETR</td>
<td>Mississauga Road</td>
<td>6</td>
<td>60</td>
</tr>
<tr>
<td>407 ETR</td>
<td>Dixie Road</td>
<td>6</td>
<td>70</td>
</tr>
<tr>
<td>407 ETR</td>
<td>Airport Road</td>
<td>6</td>
<td>80</td>
</tr>
<tr>
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</tr>
<tr>
<td>407 ETR</td>
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<td>Warden Avenue</td>
<td>6</td>
<td>60</td>
</tr>
<tr>
<td>410</td>
<td>Bovaird Drive</td>
<td>6</td>
<td>70</td>
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<tr>
<td>410</td>
<td>Sandalwood Parkway East</td>
<td>6</td>
<td>60</td>
</tr>
</tbody>
</table>

The final long-term interchange configuration will be confirmed in later preliminary design phases, and will be dependent on the findings of the traffic analysis of the alternatives. It is also noted that the design/build team for the McKay Road/10th Line underpass replacement is currently reviewing the ultimate McKay Road cross section to assess structural performance and confirm that the design of replacement structure does not preclude future interchange improvements.

**Parclo A3**

A parclo A3 interchange configuration has been developed, and is shown in Attachment D. The primary advantage of the parclo A3 configuration, as compared with the parclo A4, is that there are minimal property impacts to the northeast quadrant of the interchange. Avoiding the NE quadrant may be desirable, as there is a known archaeological site in the area may prove to be a significant constraint. The parclo A3 configuration has a lower capacity than the parclo A4, as vehicles making the east-to-north move must turn left onto the E/W-N inner loop ramp, as opposed to using a direct ramp. A further disadvantage is that the westbound left-turn lane that must be provided at the east ramp terminal requires a wider McKay Road cross section, and will require a wider median immediately to the west of the ramp terminal.

Similar to the parclo A4 alternative, the parclo A3 configuration could be widened to eight lanes on the structure, including six general-purpose lanes and two speed-change lanes. As with the parclo A4 interchange configuration, the inner loop ramp exit terminals of the parclo A3 configuration could also be converted to direct spirals, which would eliminate the need to widen the bridge in the very long term.

**Diamond**

A diamond interchange alternative has been developed and is shown in Attachment E. The diamond interchange has no free-flow ramp terminals, and thus has the lowest capacity of the any of the three alternatives under consideration. The typical advantages of a diamond configuration as compared with a parclo A4 configuration are that the diamond has a smaller footprint, and has a lower cost. The lower cost is partly as a result of not requiring speed-change lanes under the crossing road structure, as there are no inner loop ramps; however, as the forthcoming McKay Road replacement structure will provide sufficient span to accommodate speed-change lanes, this potential cost savings would not be realized.

While the diamond interchange may have a slightly smaller footprint than the parclo alternatives, it is noted that the E/W-N diamond ramp would have the greatest property requirements in the northeast quadrant, which is of
particular concern in terms of archaeological impacts; thus, the benefits of the smaller footprint may not be realized.

The key disadvantage of the diamond interchange is its relatively low capacity. Thus, the diamond interchange would experience lower levels of service before either of the parclo alternatives; further, expansion of diamond interchanges to address capacity issues may require the provision of double-left turns at the ramp terminals and two-lane on-ramps to Highway 400; the former would be costly, while the latter would have a greater impact on Highway 400 mainline traffic, as compared with a parclo A4 configuration.

**Design Criteria**

Draft design criteria have been prepared, and are appended to this memo as **Attachment F**. The design criteria provided are preliminary, and are intended as guidance in the development of alternatives. As part of the study, a formal set of design criteria for the preferred alternative will be submitted to the Ministry. It is noted that design criteria will also be provided for the future Salem Rd./Lockhart Rd. underpass, which is also being developed as part of the McKay Interchange EA study.

**Widening of McKay Road: Rationale for widening about the centreline**

Per the City's TMP, McKay Road is proposed to be widened to four basic lanes by 2031. The road will have a design speed of 80 km/h, a posted speed of 60 km/h, and will include bike lanes and sidewalks in each direction. The TMP shows that McKay Road may be widened to six basic lanes by 2051. The widening of McKay Road is anticipated to occur about the centreline for the following reasons:

- Maintains existing McKay Road alignment
- Limits property impacts to the north and south of McKay Road
- Compatible with the upcoming 10th Line Bridge Replacement
Attachment B

Approximate location of Archeological Site - BbGw10 (Cleary), per AECOM Project# 33017553, Jul-15
Approximate location of Archeological Site - BbGw10 (Cleary), per AECOM Project# 33017553, Jul-15
Attachment E

= Approximate location of Archeological Site - BbGw10 (Cleary),
per AECOM Project# 33017553, Jul-15
WORK PROJECT NO.  GWP not applicable  HWY NO.  400
TYPE OF PROJECTSalem Rd Crossing and McKay Rd Interchange Preliminary Design, per Salem Secondary Plan

LOCATION Highway 400
LIMITS FROM STA TBD PLAN TBD TO STA TBD PLAN TBD LENGTH 1.6 km

MUNICIPAL JURISDICTIONS
Geographic Township(s)
City of Barrie

<table>
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<th>PRESENT CONDITIONS</th>
<th>DESIGN STANDARDS¹</th>
<th>PROPOSED STANDARDS</th>
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<td>2005 Hwy 400 PDR</td>
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<td>MISCELLANEOUS</td>
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NOTES:

a) MTO’s Geometric Design Standards for Ontario Highways (GDSOH) for a Rural Freeway Divided with a design speed of 120 km/h (RFD120).

b) HOV width (5 m) includes the travelled lane (3.75 m) and buffer (1.25m)

c) Cross-section dimensions sourced from the Conceptual Property Requirement Plan, published at the Open House for the Hwy 400 PDR Update (November 2014).
TRAFFIC:
To be determined
LOCATION: McKay Road
LENGTH: 1 km

JURISDICTIONS:
- Ministry of Transportation Ontario (MTO)
- City of Barrie

**NOTES:**

a) “Present Conditions” assumes upcoming 10th Line Bridge Replacement completed.

b) Design standards shown are from the Geometric Design Guideline for Ontario Highways (GDSOH), published by MTO for a Rural Arterial Undivided road with a design speed of 80 km/h (RAU80). MTO will have jurisdiction of McKay Road over the interchange and either side of the interchange, the City of Barrie will have jurisdiction. In areas of the City’s jurisdiction, the Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads standards should be applied.

c) It is anticipated that by 2051, the design speed will be reduced to 60 km/h with a posted speed of 50 km/h. The reduced design speed will enable the use of direct spirals for the ramps from McKay Road onto Highway 400; this will reduce the required cross-section of the bridge. By 2051, McKay Road is anticipated to have a seven lane cross-section: six general purpose lanes and one two-way left turn lane.

d) When urbanised, the 2.0 m shoulders will accommodate curb and gutter, a bicycle lane (1.5 m) width and a bicycle lane buffer (0.5 m) either side of the road.

e) At locations of steel-beam guiderail

<table>
<thead>
<tr>
<th>ROAD CLASSIFICATION</th>
<th>DESIGN CONDITIONS</th>
<th>DESIGN STANDARDS b</th>
<th>PROPOSED STANDARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DESIGN SPEED (km/h)</td>
<td>Rural Collector Undivided</td>
<td>Rural Arterial Undivided</td>
<td>Urban Arterial Undivided</td>
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<tr>
<td>MINIMUM STOPPING SIGHT DISTANCE (m)</td>
<td>160</td>
<td>135</td>
<td>160</td>
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<tr>
<td>EQUIVALENT MINIMUM “K” FACTOR</td>
<td>CREST</td>
<td>50</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>SAG</td>
<td>40</td>
<td>30</td>
</tr>
<tr>
<td>GRADES MAXIMUM (%)</td>
<td>3</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>RADIUS MINIMUM (m)</td>
<td>Tangent</td>
<td>340</td>
<td>Tangent</td>
</tr>
<tr>
<td>PAVEMENT WIDTH (m)</td>
<td>2 GPL @ 3.5</td>
<td>GPL @ 3.5</td>
<td>4 GPL @ 3.75c</td>
</tr>
<tr>
<td>SHOULDER WIDTH (m)</td>
<td>2.0</td>
<td>3.0</td>
<td>2.0d</td>
</tr>
<tr>
<td>SIDEWALK (m)</td>
<td>N/A</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>SHOULDER ROUNING (m)</td>
<td>0.5 / 1.0</td>
<td>0.5 / 1.0e</td>
<td>0.5 / 1.0e</td>
</tr>
<tr>
<td>MEDIAN WIDTH (m)</td>
<td>N/A</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>R.O.W. WIDTH (m)</td>
<td>21 to 40</td>
<td>Varies</td>
<td>34</td>
</tr>
<tr>
<td>POSTED SPEED (km/h)</td>
<td>80</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>MISCELLANEOUS - Boulevard</td>
<td>-</td>
<td>-</td>
<td>2.9</td>
</tr>
</tbody>
</table>
TRAFFIC:
To be determined
**LOCATION**  Salem Road / Lockhart Road  
**LENGTH**  1.4 km

**JURISDICTIONS**  
City of Barrie

<table>
<thead>
<tr>
<th><strong>PRESENT CONDITIONS</strong></th>
<th><strong>DESIGN STANDARDS</strong></th>
<th><strong>PROPOSED STANDARDS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SALEM ROAD</strong></td>
<td><strong>LOCKHART ROAD</strong></td>
<td><strong>URBAN ARTERIAL UNDIVIDED</strong></td>
</tr>
<tr>
<td><strong>FUNCTIONAL HIGHWAY CLASSIFICATION</strong></td>
<td>Major Collector</td>
<td>Major Collector</td>
</tr>
<tr>
<td><strong>DESIGN SPEED (km/h)</strong></td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td><strong>MINIMUM STOPPING SIGHT DISTANCE (m)</strong></td>
<td>106</td>
<td>73</td>
</tr>
<tr>
<td><strong>EQUIVALENT MINIMUM “K” FACTOR</strong></td>
<td>CREST</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>SAG</td>
<td>7.2</td>
</tr>
<tr>
<td><strong>GRADES MAXIMUM (%)</strong></td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td><strong>RADIUS MINIMUM (m)</strong></td>
<td>Tangent</td>
<td>Tangent</td>
</tr>
<tr>
<td><strong>PAVEMENT WIDTH (m)</strong></td>
<td>2 GPL @ 4.0</td>
<td>2 GPL @ 3.5</td>
</tr>
<tr>
<td><strong>SIDEWALK (m)</strong></td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>SHOULDER WIDTH (m)</strong></td>
<td>0.7</td>
<td>1.0</td>
</tr>
<tr>
<td><strong>SHOULDER ROUNDING (m)</strong></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>MEDIAN WIDTH (m)</strong></td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>R.O.W. WIDTH (m)</strong></td>
<td>20 - 25</td>
<td>23 - 25</td>
</tr>
<tr>
<td><strong>POSTED SPEED (km/h)</strong></td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td><strong>MISCELLANEOUS - Boulevard</strong></td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**NOTES:**

a) Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads for a Rural Arterial Undivided road with a design speed of 70 km/h (RAU70)

b) Not on structure. Structure retains 4 GPL @ 3.5 m only.

c) Design speed is assumed 10 km/h above posted speed. Posted speed of 60 km/h is used for Urban Arterial Roads, per the City of Barrie Secondary Plan, Master Plan Multi-Modal Active Transportation Master Plan.

d) When urbanised, the 2.0 m shoulders will accommodate curb and gutter, a bicycle lane (1.5 m) width and a bicycle lane buffer (0.5 m) either side of the road.

e) At locations of steel-beam guiderail

f) Paving stops at approximately Sta. 0+600 and Sta. 1+710 for Salem Road and Lockhart Road, respectively. After these locations both roads are gravel roads.
TRAFFIC:
To be determined
DRAFT PRELIMINARY DESIGN CRITERIA

WORK PROJECT NO. GWP not applicable          HWY NO. 400
TYPE OF PROJECT  Salem Rd Crossing and McKay Rd Interchange Preliminary Design, as per Salem Secondary Plan

TYPICAL SECTIONS

McKay and Salem Road – 5 Lanes
Note: the two way left-turn lane will not be continued over the respective structures

Source: City of Barrie Secondary Plan, Background Studies & Infrastructure Master Plans – Intensification & Annexed Lands, Master Plan Multi-Modal Active Transportation Master Plan, Appendix I.
Future McKay Road – 7 Lanes
Note: the two-way left turn lane will not be continued over the underpass.

Arterial Road
41m | 7-lane with buffered bike lanes

Note: At intersections, 4.2m median becomes 3.0m left turn lane and 1.2m raised median.

Source: City of Barrie Secondary Plan, Background Studies & Infrastructure Master Plans – Intensification & Annexed Lands, Master Plan Multi-Modal Active Transportation Master Plan, Appendix I.
McKay Road Underpass Cross-section Requirements

Note: If direct spirals are utilized in the future, the interim cross-section requirements could be larger than that of the long-term requirements. The 2051 cross-section requirements will be confirmed during later preliminary design phases. The total bridge width will also be confirmed in later design phases as it is dependent on structural analysis undertaken by others. It is proposed that the bridge will be constructed to a single width that would accommodate the 2031 requirements and the identified preferred 2051 widening strategy. The cross-sections are also dependent on interchange configuration. The cross-sections below detail the 2031 requirements at the mid-span of the crossing structure (conceptual bridge width is the maximum required width of the widened structure and does not accommodate girder spacing requirements).

Parclo A4 – 2031

Parclo A3 – 2031
WORK PROJECT NO.  GWP not applicable   HWY NO.  400
TYPE OF PROJECT  Salem Rd Crossing and McKay Rd Interchange Preliminary Design, per Salem Secondary Plan

Parclo A4 – 2051
TBC

Parclo A3 – 2051
TBC
DRAFT PRELIMINARY DESIGN CRITERIA

WORK PROJECT NO.  GWP not applicable  HWY NO.  400
TYPE OF PROJECT  Salem Rd Crossing and McKay Rd Interchange Preliminary Design, as per Salem Secondary Plan

Salem Road

[Diagram of Salem Road at structure with proposed R.O.W. = 34.0 m]

[Diagram of Salem Road with proposed R.O.W. = 34.0 m]
DRAFT PRELIMINARY DESIGN CRITERIA

WORK PROJECT NO. GWP not applicable
TYPE OF PROJECT Salem Rd Crossing and McKay Rd Interchange Preliminary Design, as per Salem Secondary Plan
LOCATION MAP
Interchange Standards Table

To be determined

Interchange Ramp Standards

<table>
<thead>
<tr>
<th>RAMP NAME</th>
<th>DESIGN STANDARDS</th>
<th>PROPOSED STANDARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CROSSING ROAD DESIGN SPEED (km/h)</td>
<td>-</td>
<td>80</td>
</tr>
<tr>
<td>RAMP DESIGN SPEED (km/h)</td>
<td>Direct Off-Ramp</td>
<td>80 / 60</td>
</tr>
<tr>
<td></td>
<td>Inner-Loop Ramp</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Direct On-Ramp</td>
<td>60</td>
</tr>
<tr>
<td>SIGHT DISTANCE REQUIREMENT FOR STOPPING, CROSSING AND TURNING MOVEMENTS AT THE CROSSING ROAD (m)</td>
<td>All Ramps</td>
<td>25</td>
</tr>
<tr>
<td>EQUIVALENT MINIMUM “K” FACTOR</td>
<td>CREST</td>
<td>Direct Off-Ramp</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inner-Loop On-Ramp</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Direct On-Ramp</td>
</tr>
<tr>
<td></td>
<td>SAG</td>
<td>Direct Off-Ramp</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inner-Loop On-Ramp</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Direct On-Ramp</td>
</tr>
<tr>
<td>GRADES MAXIMUM (%)</td>
<td>All Ramps</td>
<td>6%</td>
</tr>
<tr>
<td>RADIUS MINIMUM (m)</td>
<td>Direct Off-Ramp</td>
<td>250 / 130</td>
</tr>
<tr>
<td></td>
<td>Inner-Loop On-Ramp</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>Direct On-Ramp</td>
<td>130</td>
</tr>
<tr>
<td>PAVEMENT WIDTH (LANE WIDTH)</td>
<td>Direct Off-Ramp</td>
<td>3.75 a</td>
</tr>
<tr>
<td></td>
<td>Inner-Loop On-Ramp</td>
<td>4.75</td>
</tr>
<tr>
<td></td>
<td>Direct On-Ramp</td>
<td>4.75</td>
</tr>
<tr>
<td>SHOULDER WIDTH (Right / Left) (m)</td>
<td>All Ramps</td>
<td>1.0 / 2.5</td>
</tr>
<tr>
<td>SHOULDER ROUNding (m)</td>
<td>All Ramps</td>
<td>0.5</td>
</tr>
<tr>
<td>SUPERELEVATION MAXIMUM RATE (%)</td>
<td>All Ramps</td>
<td>6%</td>
</tr>
<tr>
<td>EXIT TERMINAL SPEED-CHANGE LANE LENGTH (m)</td>
<td>All Ramps</td>
<td>500 c</td>
</tr>
<tr>
<td>ENTRANCE TERMINAL SPEED-CHANGE LANE LENGTH (m)</td>
<td>All Ramps</td>
<td>345 c</td>
</tr>
</tbody>
</table>

Notes:

a) The crossing road design speed will be reduced to 60 km/h when McKay Road is widened to six general purpose lanes in the future. This enables the use of direct spirals to access the inner-loop ramps, avoiding the need to widen the underpass in the future.

b) The Highway 400 off-ramps will ultimately be multi-lane ramps (per Multi-Modal Active Transportation Master Plan) and would require 3.75 m lanes, per GDSOH.

c) Speed-change lane lengths on freeways have standard lengths of 500 m and 345 m for off- and on-ramps (per GDSOH). The standard lengths will be amended for grade.
Alvaro:

Thanks for sending the draft display boards. I’ve taken a look at the McKay boards and I’d like to give the following comments:

- The 2nd bullet on page 1 talks about Needs and Justification having been completed. The city has submitted some traffic analysis during the project, but the needs and justification have not been met, at this time. Phases 1 and 2 of the Class EA process (Needs & Justification) were met by the City’s TMP. That said, we’re working to confirm this work with MTO through their own ‘need and justification’ process. We’ll add some wording to the boards that reflects the need for MTO confirmation.

- The studies listed on page 2 have not been provided to MTO. Since MTO would be the owner of this potential IC, we would be included in the review of these studies, especially for permanent features, such as SWM ponds. Further, the IC design alternatives have not been circulated for MTO review. Also, keep in mind the possibility that the timelines of MTO’s Hwy 400 widening and the city’s IC could require an alternative that is not shown. An IC compatible with both the existing 6-lane Hwy 400 cross-section and the ultimate 10-lane cross-section may be required. This could even necessitate some phasing to build the preferred IC. We’re waiting for MTO’s presentation/completion of the Hwy 400 design in order to finalize reports such as the SWM report. We agree that we’ll likely need to develop an interim configuration that ties in with the existing Hwy 400 configuration.

The interchange configurations were sent to Rob over a year ago (February, and again in July – both emails are attached), and he said he would provide some high-level comments on the configurations.

- The public might ask why design alternatives are being considered without traffic operations analysis. It’s possible to read the page 2 bullet, “traffic operations/analysis to be completed” and think that no traffic analysis has taken place during the study. We have evaluated traffic qualitatively (and with some limited quantitative analysis). The interchange configurations we’ve considered clearly have 1st-, 2nd- and 3rd-place rankings for traffic operations by virtue of their designs.

- I’d advise that traffic operations should be a key factor in the evaluation of alternatives. Slide 3 only shows traffic as an item under technical considerations. We agree that traffic operations analysis will be needed to confirm the selection of the preferred alternative, and we’ll do this as soon as MTO endorses the TMP and associated traffic work.

- The boards mention Kell’s Garden City, but it’s labelled on any of the plans. We’ll add this to the boards.
As part of any new interchange project, MTO prepares an Interchange Highway Access Management Plan (IHAMP). An IHAMP would be required as a supplement to Preliminary Design and the Needs and Justification Study.

This will be noted in the TESR and DC.

We have concerns with the display board that shows the location of the Cleary archaeological site (the Huron-Wendat village, identified throughout the slides and depicted on slide #4 as a yellow area). It is MTO’s practice, following on the policies of the Ministry of Tourism Culture and Sport (MTCS) not to divulge site locations for sites that have not been fully excavated / disturbed (i.e. locations where all or a portion of the original site is preserved) to the public, as is the case with the Cleary Site. The practice is to only share the information with people that “need to know” to complete a given project (e.g., project managers, design teams, constructors, etc.). This is done to protect the site from curious members of the public and potential looters / pot hunters. This is a very important measure that is done to prevent these sites being disturbed and is important for the long term preservation of these sites. This has also been identified as an important measure to ensure site preservation by a number of First Nations. We would recommend removing the depiction of the site from the maps and instead speak about the archaeological site solely in the text, in general terms.

As discussed, we’ll add a generic ‘dot’ that denotes a registered archaeological site to the plans.

From: Alvaro Almuina [mailto:Alvaro.Almuina@barrie.ca]
Sent: 05 April 2017 10:11 AM
To: Vandenberg, Robert (MTO)
Cc: Bala Araniyasundaran
Subject: FW: PIC Boards

Good morning Rob

I was out of the office yesterday. Regarding your vmail, attached is the first draft of the PIC Boards. These do not reflect my comments to WSP and I have not received the revised deck, however, as you will note, there is a note indicating the IC is subject to MTO approval and the missing figures in the deck will have the same note.

Kind regards,
Alvaro
Hello Rob,

Thank you for your comments. Please see below for our responses to you suggestions/queries (your comment is in italics):

The 2nd bullet on page 1 talks about Needs and Justification having been completed. The city has submitted some traffic analysis during the project, but the needs and justification have not been met, at this time.

Phases 1 and 2 of the Class EA process (Needs & Justification) were met by the City’s TMP. That said we’re working to confirm this work with MTO through its ‘need and justification’ process. WSP is working closely with Arthur Tai and the County of Simcoe on the modelling aspects to ensure the work is conducted to the MTO’s satisfaction. Having said this, we have modified the PIC 2 presentation board on this matter to reflect the work still needs MTO confirmation.

The studies listed on page 2 have not been provided to MTO. Since MTO would be the owner of this potential IC, we would be included in the review of these studies, especially for permanent features, such as SWM ponds.

In order to provide a comprehensive assessment, we will not be finalizing our SWM strategy until MTO’s presentation/completion of the Highway 400 design.

Further, the IC design alternatives have not been circulated for MTO review.

The interchange configurations were provided to MTO as follows:
- Email from Brent Gotts, dated February 5, 2016
- Email from Bala Araniyasundaran, dated July 11, 2016

In addition, these alternatives were presented at the first PIC (September 2016). We had provided you a copy of the presentation deck at that time as well.

Also, keep in mind the possibility that the timelines of MTO’s Hwy 400 widening and the city’s IC could require an alternative that is not shown. An IC compatible with both the existing 6-lane Hwy 400 cross-section and the ultimate 10-lane cross-section may be required. This could even necessitate some phasing to build the preferred IC.

We agree that we’ll likely need to develop an interim configuration that ties in with the existing Highway 400 configuration. This will be addressed in the ESR dealing with Phasing.

The public might ask why design alternatives are being considered without traffic operations analysis. It’s possible to read the page 2 bullet, “traffic operations/analysis to be completed” and think that no traffic analysis has taken place during the study.
We have evaluated traffic qualitatively (and with some limited quantitative analysis). The interchange configurations we’ve considered clearly have 1st-, 2nd- and 3rd-place rankings for traffic operations by virtue of their designs.

I’d advise that traffic operations should be a key factor in the evaluation of alternatives. Slide 3 only shows traffic as an item under technical considerations.

We agree that traffic operations analysis will be needed to confirm the selection of the preferred alternative, and we’ll do this as soon as MTO endorses the TMP and associated traffic work.

The boards mention Kell’s Garden City, but it’s labelled on any of the plans.

The label has been added to the appropriate boards.

As part of any new interchange project, MTO prepares an Interchange Highway Access Management Plan (IHAMP). An IHAMP would be required as a supplement to Preliminary Design and the Needs and Justification Study.

This will be noted in the TESR and DC.

We have concerns with the display board that shows the location of the Cleary archaeological site (the Huron-Wendat village, identified throughout the slides and depicted on slide #4 as a yellow area). It is MTO’s practice, following on the policies of the Ministry of Tourism Culture and Sport (MTCS) not to divulge site locations for sites that have not been fully excavated / disturbed (i.e. locations where all or a portion of the original site is preserved) to the public, as is the case with the Cleary Site. The practice is to only share the information with people that “need to know” to complete a given project (e.g. project managers, design teams, constructors, etc.). This is done to protect the site from curious members of the public and potential looters / pot hunters. This is a very important measure that is done to prevent these sites being disturbed and is important for the long term preservation of these sites. This has also been identified as an important measure to ensure site preservation by a number of First Nations. We would recommend removing the depiction of the site from the maps and instead speak about the archaeological site solely in the text, in general terms.

We have modified this graphic to include only a text label denoting a registered archaeological site in the northeast quadrant of the interchange.

Kind regards,

Alvaro L. Almuina, P. Eng., PMP
COLLIERS PROJECT LEADERS
City of Barrie, Engineering Department
70 Collier Street, PO Box 400
Barrie, ON, L4M 4T5
Direct Tel: (705) 739 4220 Ext: 4458
Mobile: (416) 648 3024 *(New)
Email: Alvaro.Almuina@Barrie.ca
FYI

From: Alvaro Almuina [mailto:Alvaro.Almuina@barrie.ca]
Sent: Tuesday, July 04, 2017 4:57 PM
To: Vandenbeek, Robert (MTO) <Robert.Vandenbeek@ontario.ca>
Cc: Bala Araniyasundaran <Bala.Araniyasundaran@barrie.ca>; Dorton, Peter (MTO) <Peter.Dorton@ontario.ca>; Robert Sutton <Robert.Sutton@barrie.ca>; Ralph Scheunemann <Ralph.Scheunemann@barrie.ca>; Gotts, Brent <Brent.Gotts@wsp.com>
Subject: RE: McKay EA Study
Hello Robert

The report to Council was to provide an overview of the preferred alternative designs and to receive Council approval to finalize the ESR and submit for the 30-day review period. The verbal presentation to Council also indicated the McKay Interchange EA would not be filed until the Fall 2017 due to ongoing studies and discussions with MTO. (I’ve attached the report FYI. See Item 21 with regards to the project being subject to MTO approval).

Kind regards,
Alvaro

Alvaro L. Almuina, P. Eng., PMP
COLLIERS PROJECT LEADERS
City of Barrie, Engineering Department
70 Collier Street, PO Box 400
Barrie, ON, L4M 4T5
Direct Tel: (705) 739 4220 Ext: 4458
Mobile: (416) 648 3024
Email: Alvaro.Almuina@Barrie.ca

From: Vandenbeek, Robert (MTO) [mailto:Robert.Vandenbeek@ontario.ca]
Sent: Tuesday, July 04, 2017 4:30 PM
To: Alvaro Almuina
Cc: Bala Araniyasundaran; Dorton, Peter (MTO)
Subject: McKay EA Study

Alvaro:
We noticed a council request report on the City’s website regarding filing the City’s EA report for Hwy 400/McKay. Could you confirm if there’s a caveat in the report regarding MTO approval of a needs and justification study?

From: Alvaro Almuina [mailto:Alvaro.Almuina@barrie.ca]
Sent: 06 April 2017 1:31 PM
To: Vandenberg, Robert (MTO)
Cc: Bala Araniyasundaran; Gotts, Brent
Subject: RE: PIC Boards

Hello Rob,

Thank you for your comments. Please see below for our responses to your suggestions/queries (your comment is in italics):

The 2nd bullet on page 1 talks about Needs and Justification having been completed. The city has submitted some traffic analysis during the project, but the needs and justification have not been met, at this time.

Phases 1 and 2 of the Class EA process (Needs & Justification) were met by the City’s TMP. That said we’re working to confirm this work with MTO through its ‘need and justification’ process. WSP is working closely with Arthur Tai and the County of Simcoe on the modelling aspects to ensure the work is conducted to the MTO’s satisfaction. Having said this, we have modified the PIC 2 presentation board on this matter to reflect the work still needs MTO confirmation.

The studies listed on page 2 have not been provided to MTO. Since MTO would be the owner of this potential IC, we would be included in the review of these studies, especially for permanent features, such as SWM ponds.

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In addition, these alternatives were presented at the first PIC (September 2016). We had provided you a copy of the presentation deck at that time as well.

Also, keep in mind the possibility that the timelines of MTO’s Hwy 400 widening and the city’s IC could require an alternative that is not shown. An IC compatible with both the existing 6-lane Hwy 400 cross-section and the ultimate 10-lane cross-section may be required. This could even necessitate some phasing to build the preferred IC.
We agree that we’ll likely need to develop an interim configuration that ties in with the existing Highway 400 configuration. This will be addressed in the ESR dealing with Phasing.

The public might ask why design alternatives are being considered without traffic operations analysis. It’s possible to read the page 2 bullet, “traffic operations/analysis to be completed” and think that no traffic analysis has taken place during the study.

We have evaluated traffic qualitatively (and with some limited quantitative analysis). The interchange configurations we’ve considered clearly have 1st-, 2nd- and 3rd-place rankings for traffic operations by virtue of their designs.

I’d advise that traffic operations should be a key factor in the evaluation of alternatives. Slide 3 only shows traffic as an item under technical considerations.

We agree that traffic operations analysis will be needed to confirm the selection of the preferred alternative, and we’ll do this as soon as MTO endorses the TMP and associated traffic work.

The boards mention Kell’s Garden City, but it’s labelled on any of the plans.

The label has been added to the appropriate boards.

As part of any new interchange project, MTO prepares an Interchange Highway Access Management Plan (IHAMP). An IHAMP would be required as a supplement to Preliminary Design and the Needs and Justification Study.

This will be noted in the TESR and DC.

We have concerns with the display board that shows the location of the Cleary archaeological site (the Huron-Wendat village, identified throughout the slides and depicted on slide #4 as a yellow area). It is MTO’s practice, following on the policies of the Ministry of Tourism Culture and Sport (MTCS) not to divulge site locations for sites that have not been fully excavated / disturbed (i.e. locations where all or a portion of the original site is preserved) to the public, as is the case with the Cleary Site. The practice is to only share the information with people that “need to know” to complete a given project (e.g. project managers, design teams, constructors, etc.). This is done to protect the site from curious members of the public and potential looters / pot hunters. This is a very important measure that is done to prevent these sites being disturbed and is important for the long term preservation of these sites. This has also been identified as an important measure to ensure site preservation by a number of First Nations. We would recommend removing the depiction of the site from the maps and instead speak about the archaeological site solely in the text, in general terms.

We have modified this graphic to include only a text label denoting a registered archaeological site in the northeast quadrant of the interchange.

Kind regards,

_______________________________
Alvaro L. Almuina, P. Eng., PMP
Legislation Details (With Text)

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Type: Staff Report   Status: Recommended Motion (section B)
File created: 6/7/2017   In control: City Council
On agenda: 6/19/2017   Final action: 6/19/2017
Title: PRESENTATION CONCERNING GROWTH DEVELOPMENT PROJECTS - TRANSPORTATION ENVIRONMENTAL ASSESSMENTS
Sponsors:
Indexes:
Code sections:
Attachments:

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PRESENTATION CONCERNING GROWTH DEVELOPMENT PROJECTS - TRANSPORTATION ENVIRONMENTAL ASSESSMENTS