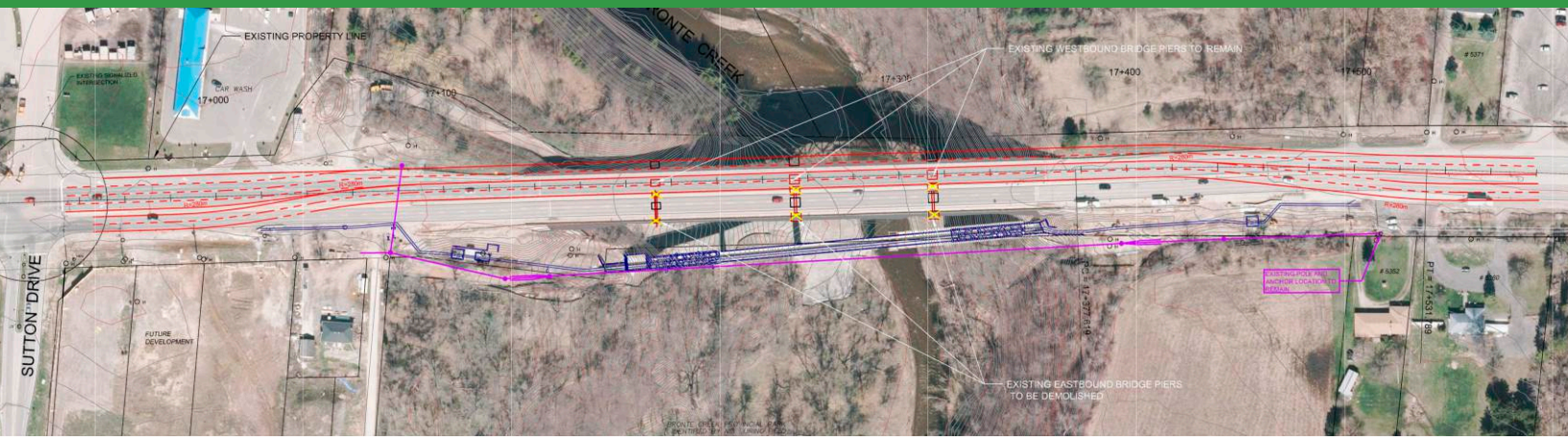
APPENDIX L

TANSLEY BRIDGE CONSTRUCTABILITY REVIEW REPORT



TANSLEY BRIDGE
CONSTRUCTABILITY REVIEW REPORT

Dundas Street (Regional Road 5)
Transportation Corridor Improvements
Brant Street to Bronte Road

Class Environmental Assessment

MMM GROUP

November 2014

Executive Summary

Dundas Street is one of the most important transportation facilities in the existing and future Halton Region transportation network. The need to widen Dundas Street was identified and reaffirmed through several major planning studies dating between 1999 and 2013. Given the foregoing, Halton Region is carrying out a Class EA Study for Dundas Street between Brant Street and Bronte Road through the City of Burlington and the Town of Oakville, in order to implement the proposed widening as identified through earlier studies and the Region's Transportation Master Plan.

The proposed improvements include the widening of Dundas Street from 4 to 6 lanes and the addition of active transportation elements, such as bike lanes and sidewalk/multi-use pathways. Within the study limits, one of the major features is the crossing of Bronte Creek (west of Tremaine Road), which is also proposed to be widened from 4 to 6 lanes. This crossing is also known as the Tansley Bridge.

Recognizing the sensitivity of the Bronte Creek Valley and the need to confirm the constructability for the widening of Tansley Bridge, a 1-day Constructability Workshop was held as part of the Class EA Study. The purpose of the Workshop was to better understand the methods to construct the widening of Tansley Bridge such that elements of design, construction, and mitigation can be integrated into the Environmental Study Report (ESR). The final construction method will be determined at detailed design with consultation with the required approval agency.
The Constructability Review was undertaken in a Workshop environment that included a team of experts who were predominately independent of the Project Team. The following represent a summary of the most significant findings and issues discussed at the Workshop.

Dundas Street Lane Closures

The ability to enact short-term lane closures on Dundas Street during the reconstruction of the Tansley Bridge will significantly reduce the impacts on the environmentally sensitive creek valley as well as dramatically reduce construction costs and duration. The Project Team confirmed that, based on recent traffic counts, Dundas Street may be reduced to one lane in each direction between 8 pm and 6 am. This indicates a more severe restriction on lane closures than allowed under the Regional Policy. Updated / current traffic counts and the timing for the closure will be reassessed at detailed design.

For specific critical operations such as girder erection or the existing truss demolition, Regional staff indicated that traffic could be reduced to a single lane across the structure for short 15 minute durations with flag-persons or rolling closures used to manage the traffic. It is preferred that these single lane operations be undertaken at night.

Construction Staging and Property Access

Conceptual Staging drawings for the bridge construction are provided in Appendix D along with a plan showing the roadway alignment in Stage 2 when traffic is detoured onto the new north structure. The Constructability Review Team confirmed that the staging proposed by the Project

Team was feasible, provided sufficient access to the work areas and facilitated the erection of the new steel girders and demolition of the existing truss structure when the lane closure allowances are considered.

In Stage 2 of the construction, when all the traffic is detoured to the north as shown on Figure 3 included in Appendix D, the length of the westbound dedicated left-turn at Sutton Drive will be reduced to approximately half of its current length. It is recommended that traffic analysis be undertaken during detailed design so that the impacts of this reduction can be evaluated, the signal timings adjusted or other mitigation measures be enacted. Such a reduction in the left turn lane would be realized with almost all practical staging schemes. The importance of this issue will be heightened by the planned condominium and townhouse development in the south east quadrant of the Dundas Street – Sutton Drive intersection. This development will attract new additional westbound left turn movements from Dundas Street to Sutton Drive during the PM peak period.

Direct access to the proposed right-in/right-out at Dundas Street to the new planned condominium / townhouse development at Sutton Drive intersection may be problematic or not possible (at times) during construction. Subsequent to the Constructability Workshop, the site plan for the proposed development was updated and the right-in/right-out access is to be located at the mid-point of the property (instead of at the east end of the property initially assumed at the Constructability Workshop). The potential to maintain access during construction is more likely by having the right-in/right-out access located at the mid-point of the property. Should the access be located at the east end of the property, it would be too close to the bridge to accommodate a (large enough and) necessary laydown area at the west end of the bridge while still keeping the access to the future development open.

East of the bridge, the existing left turn lane (for First Group's property) may be impacted during all stages of construction. It is recommended that further traffic analysis be carried out during detailed design to determine any impacts.

Structural Steel - Girder Erection

Various alternatives for erecting the new steel girders were discussed. Erecting the new steel girders from the existing north structure was deemed to be the most cost effective alternative. It also minimizes the environmental impacts to the creek valley. It was concluded that two, 110 t cranes positioned on the existing bridge, each with an outrigger width of 7 m, would be required to lift the new girders into place. To facilitate erection of the first 4 girders, the northern most girders, the cranes would be located on the existing north structure with the girders "picked" from the northern most lane of the existing south structure while traffic was reduced to a single lane on the southern structure. As discussed above, this would require rolling short duration closures of the west bound lanes or flagging of the traffic to manage both east and west bound traffic in the single lane while steel erection was underway. Rolling closures would be approximately 15 minutes in length. Regional staff expressed their preference for the use of flag persons.

Upon completion of Stage 1 and with the traffic transferred onto the new north structure, demolition of the existing south structure would commence (as discussed below). Once

demolition of the existing truss (south) structure was complete and the new piers constructed, erection of the 4 new southern girders would commence. These would be erected in much the same manner as the 4 northern girders. With traffic detoured and restricted to a single lane on the new north structure, two, 110 t cranes would be located on the existing north structure and would pick the new girders from trucks located on the southern-most lane of the new northern structure.

The loads imposed on the existing north bridge by the cranes and their outriggers as they lift the structural steel would be similar for the erection of the 4 new northern and 4 new southern girders. Estimates of these loads have been provided by the ES Fox (the erection specialist attending the Constructability Review). These are included in Appendix E. Detailed analysis of the existing structure is required to confirm that the structure is capable of resisting the imposed loads and/or where the cranes can be positioned or what strengthening needs to be undertaken to facilitate erection from the existing bridge. Without such evaluation it is not possible to definitely state that the existing structure has the capacity to support the crane loads. However, the members of the Constructability Review team who are bridge specialists are reasonably confident that a detailed analysis will indicate that the structure is capable of safely supporting the erection loading.

It is strongly recommended that a detailed structural analysis of the existing bridge be carried out during detailed design to confirm that the bridge is capable of safely supporting the loads associated with erecting the new north and south bridge girders from it. Furthermore, it is strongly recommended that the results of the evaluation together with its assumptions be included in the contract tender documents so that the contractors are able to make an informed assessment of the feasibility of erecting the girders from the existing structure.

South Structure Deck and Truss Demolition

The existing south structure is to be removed in its entirety except for its foundations. It is recommended that the specifications associated with the removal of the concrete deck include constraints that would prohibit contractors from dropping any of the bridge deck materials or the effluent from cutting the concrete deck into the creek valley. Upon completion of the deck removal, the existing steel trusses would be fully exposed and would be ready for removal.

Demolition of the structural steel can be undertaken by cutting the trusses into pieces and lifting them (by cranes situated on the existing north bridge) onto trucks situated on the newly constructed northern most bridge in a manner similar (but opposite to) the erection of the new north and south girders. Again it is necessary to confirm, during detailed design, that the existing north structure is capable of safely supporting the loads imposed on it by the cranes lifting the truss pieces. It is also recommended that the crane positions and load assumptions be included in the tender documents to assist the contractors in determining the most economical and environmentally friendly way to demolish the existing trusses.

Alternatively, contractors may find it more cost effective to drop the trusses into the creek valley and then proceed to cut them up and remove them from the site. This method of demolition would have less impacts on traffic management (and not required to restrict traffic to a single lane during truss demolition); however, it would potentially have a greater potential impact on

the creek valley environment. Provided the work is completed outside of the in-water constraint window, it can be undertaken within typical environmental constraints imposed on a typical contract.

South Structure Pier Demolition

Pier demolition, to the top of the existing footing elevations, can be undertaken in many different ways, all of which are constructible and can be completed in accordance with the environmental constraints currently proposed or suggested for the Project. Blasting is not considered a viable option as it may be difficult to effectively contain the blast materials from entering areas of the valley outside of the bridge right-of-way. Viable alternatives for undertaking the demolition of the concrete piers include:

- Breaking the concrete piers into relatively small pieces using large hydraulic hoe-rams mounted on large backhoes working in the creek valley
- Saw-cutting the concrete piers into large pieces using diamond wire cutters and lifting the pieces off the piers
- Breaking the concrete into relatively small pieces using expansive grouts placed in holes drilled into the concrete piers
- Toppling the piers onto the valley floor in a manner similar to felling a tree and then breaking the concrete into pieces on the valley floor using large hoe-rams
- A combination of the above

The most significant issue associated with the pier demolition from a constructability point of view is associated with the disposal or reuse of the demolished concrete. The concrete could be used as rock protection and or rip-rap steep valley slopes, the valley floor and potentially even on the actual creek banks depending on how the material is handled and processed. At the time of the constructability review, it had not been established if the creek banks and valley slopes and floor are to be lined with vegetation or rock / rip-rap, or a combination of the three to prevent erosion and thus ensure long-term slope stability. This fundamental decision must be made prior to determining if it is possible to reuse the concrete from the demolished piers. Conservation Halton recommends that a checklist for environmental features in Bronte Creek be developed to ensure any work completed remains consistent with Halton Region's "environmental design standards". Reuse of the concrete within the valley will certainly result in a more cost effective design.

South Structure - East Abutment Removal

The existing east abutment and retaining wall has a massive perched foundation that is not founded on bedrock. The Constructability Review Team expressed concern with respect to the impacts the removal of the existing abutment and its footing would have on the long term stability of the very steep east valley slope. Disturbance of the slope associated with the removal will likely create slope instability issues down the slope. Difficulties in accessing the slope may make it impractical to install further slope stability measures. It is therefore recommended that much of the existing east abutment be maintained.

South Structure Pier Footing Demolition

The need to remove the massive existing footings of the south structure piers revolves around the ability to construct the new piers and their foundations. That is directly related to the configuration of the new pier foundations. Based on the available information (which does not include any new project specific foundations investigations), it was agreed that large diameter caissons drilled into the shale bedrock were the most feasible and cost effective means of founding the new piers.

By utilizing large diameter caissons, it would appear possible to advance these between the existing twin spread footings which comprise the foundations for each pier. The 1948 drawings indicate there is approximately 7.7 m between these foundation units so it would appear that complete removal of the existing foundations is not necessary. It is strongly recommended that subsurface investigations be carried out during or in advance of detailed design to uncover and core through the existing footings to determine their depths and plan limits as reliance on the 1948 drawings is not considered sufficient to confirm the constructability of new pier caissons located adjacent to or between the existing footings without their removal. The investigations will provide the necessary information to delineate the concrete to be removed from the existing piers and to provide the engineers and the contractors with the information necessary to deal with potential issues of dewatering any excavations associated with the removals.

Valley Access

Access to the valley with heavy equipment and trucks will be necessary for a host of reasons. Recognizing the environment and topographic constraints associated with the Bronte Creek Valley, it was agreed that access to the valley from the north west quadrant of Tansley Bridge would be most suitable. There is an existing road that was used previously to gain access to the valley that starts in the northwest quadrant of the bridge and crosses under the bridge between the west abutment and the first pier. Some grading of this road and the adjacent knoll north of the west pier would be necessary but much of this clearing and grading would be necessary for the new pier construction.

There was consensus amongst the Constructability Review Team that it was not feasible to gain access to the valley or the east piers down the east valley slope. As such, it was concluded that it would be necessary to construct a temporary bridge across the creek to gain access to the east piers.

Creek Crossing

Following considerable discussion, it was agreed that from a construction access perspective, it was preferable that the temporary creek crossing be constructed well south of the existing bridge, potentially outside of the existing right of way. By constructing the temporary bridge well away from existing piers and the new pier construction, access to the east side is not constrained by any pier construction or demolition activities that might otherwise occur right at the end of the temporary bridge if it was constructed directly below the existing bridge. The width of the bridge could also be minimized as it would not be necessary to widen it to also serve as a platform from which to advance the new caissons or to accommodate turning vehicles. Further

study (during detailed design) of potential temporary river crossing locations and the property / permitting requirements is recommended.
The temporary bridge span will need to be sizeable to accommodate a 2 year or 5 year storm event. Bank-full widths are approximately 20 m. Much longer spans are needed to accommodate the 2 and 5 year return period events. Based on the drainage calculation, the temporary bridge may need to span approximately 55m bridge. This will necessitate the placement of a temporary pier or crib within the creek bed. Peak flow events need to be accommodated in the design of any temporary structure in order to prevent bank erosion, instability of the temporary bridge or its crib foundations and to avoid construction debris from entering the river.

Construction and removal of the crib will have to be carried out within the permissible "in-water work window" of July 1st to Sept 15th annually. The temporary bridge will be needed for almost the 3 year duration of the construction and hence liaison with MNRF is required to obtain approval, and possibly a permit, to leave the crib in place outside of the "in-water work window."

East Pier Construction

Access to the east bank of the creek will be necessary to construct the new east piers (and their foundations) and to remove the existing south pier. Access to the north and the south of the existing piers will be required for light and heavy vehicles including light cranes, a caisson boring rig (refer to Appendix G), excavators, tandems and possibly concrete ready-mix trucks. However, to reduce costs and environmental impacts, only a single temporary creek crossing is envisioned. To gain access north and south of the piers, it will be necessary to construct a temporary access road approximately 5 m in width immediately west of the east pier since it was deemed infeasible to construct a similar roadway on the east side of the pier due to the steep valley slope on that side of the pier. The proximity of the creek bank to the pier will require shoring of the bank to ensure the stability of the temporary access roadway constructed at the top of the creek bank. Such shoring could take the form of a gabion wall. There was considerable discussion about what type of bank protection was best suited for the application given that long term erosion protection measures are needed on the bank in the same location. It is recommended that a full HECRAS model of the creek be undertaken during detailed design to establish potential meander scenarios and to protect against them at the structure location. It was agreed that several alternatives for long term and short term erosion control were feasible and could be constructed within the "in-water window". However, it is recommended that further study of the alternatives be carried out in detailed design. Such study should involve foundations, terrestrial, aquatic and geomorphology specialist and be undertaken in consultation with the MNRF and Conservation Halton.

Storm Water Management

The Constructability Review Team commented that more work had to be completed to address best practices associated with storm water management at the reconstructed / widened crossing of the Tansley Bridge. Conservation Halton stated that there is precedent for runoff in other low-impact developments for at least an 80 percent removal of total suspended solids from storm water. To this end, Conservation Halton suggested the possibility of building a storm water

management pond in the vicinity of Tansley Bridge to address long-term storm water management needs.

It is recommended that a hydraulic analysis be completed to determine if it is possible to carry all the storm water across the structure without the storm water encroaching on the traffic lanes to an extent greater than provided for in the Bridge Code. Consideration may have to be given to constructing the shoulders / cycle lane areas at an increased slope to be able to satisfy the code requirements. Should this be found to be possible, then the establishment of storm water management ponds could potentially be possible without the need for deck drains and a highly undesirable below-deck collection system. Finding the necessary room to construct the ponds will be challenging. Although it is not preferable to have direct drainage of the storm water into the creek valley during the construction phase (as is occurring on the existing bridge currently), there will not be sufficient room on the deck to store and transmit the water off the bridge beyond the abutments during construction due to narrow deck widths in the various stages of construction. It is strongly recommended that temporary deck drains be installed in the new north and south structures to accommodate storm water management during construction. Subject to the results of the hydraulic analysis, these temporary drains can be filled in once the entire deck has been constructed and all detours removed.

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1.0 BACKGROUND

The Ministry of Transportation, Ontario has developed a guide for undertaking Constructability Reviews of its major projects ("Constructability Review Procedures Guide, Version 2.0 dated April 2010)". A Constructability Review for this project was carried out by a team of specialists using the procedures and review processes generally adopted from the MTO's Guide for a 50% Internal Review. However, it was necessary to modify the approach since the review was undertaken as part of the Environmental Assessment and Preliminary Design for the project and hence the development of the design was significantly less advanced than would typically be available to a Constructability Review Team. Where design development was lacking but concerns expressed by the Constructability Team, the Constructability Team undertook to further develop key portions of the design to determine if indeed, constructability issues existed.

2.0 DEFINITION AND PURPOSE

A formal Constructability Review is a multidisciplinary independent review, usually conducted in a workshop environment, aimed at reducing overruns, schedule delays and claims that are associated with the tender, award and construction phases of the Project. Emerging trends in constructability reviews include a formalized process conducted by a team of specialists experienced in construction with reporting, accountability and traceability of issues raised, action taken and justifications for any deviations made from the recommendations put forward by the review team. The team of specialists can be comprised of individuals independent of the Project team yet members of the same firm(s) or individuals from the industry.

3.0 PROJECT DESCRIPTION

The Dundas Street is one of the most important transportation facilities in the existing and future Halton Region transportation network. This roadway serves the movement of goods and commuters and distributes traffic to and from the Provincial freeway system, as well as providing access to residential, commercial and industrial land uses in north Oakville, Burlington and neighbouring municipalities of Hamilton to the west and Mississauga to the east.

The need to widen Dundas Street was identified and reaffirmed through the Halton Functional Road Network and North Halton Transportation Study (1999), Halton Transportation Master Plan (2004) and the Halton Region Transportation Master Plan (to 2031) – The Road to Change (October 2011). As part of an integrated transportation strategy, Halton Region has determined that Dundas Street will continue to provide four general traffic lanes and protect for two lanes for Transit / High Occupancy Vehicles (HOV). This is consistent across recent planning documents.

Given the foregoing, Halton Region is carrying out a Class EA Study for Dundas Street between Brant Street and Bronte Road through the City of Burlington and the Town of Oakville, in order to implement the proposed widening as identified through earlier studies and the Region's Transportation Master Plan.

The proposed improvements include the widening of Dundas Street from 4 to 6 lanes and the addition of active transportation elements, such as bike lanes and sidewalks/multi-use paths. Within the study limit, one of the major features is the crossing of the Bronte Creek (west of Tremaine Road), which is also proposed to be widened from 4 to 6 lanes. This crossing is also known as the Tansley Bridge. The existing crossing is actually two (2) structures, constructed at different times.

Four alternatives were evaluated by MMM Group (formerly MRC) in August 2010 for the widening of Tansley Bridge from 4 to 6 lanes:

- Option 1: widen 2 lanes to the north
- Option 2: widen 4 lanes to the north
- Option 3: maintain existing centre and widen on both sides
- Option 4: widen 2 lanes to the south

The evaluation of these options took into consideration factors in socio-economic environment, cultural environment, natural environment, transportation, and costs. Option 1 was identified as the preferred alternative as it provides the best balance amongst the factors considered. Given the condition of the south structure, it was proposed that the south structure be replaced as part of the widening.

Recognizing the sensitivity of the Bronte Creek Valley, a 1-day Constructability Workshop (the subject of this report) was held as part of the Class EA Study to better understand the methods to construct the widening of Tansley Bridge such that elements of design, construction, and mitigation can be integrated into the Environmental Study Report (ESR). This report has been prepared for discussion purposes and the final methods for construction will be determined at detailed design.

4.0 CONSTRUCTABILITY PROCESS

4.1 General Approach

At the time of the Constructability Workshop, the Environmental Assessment Study had identified a technically preferred preliminary design. In the absence of any guidelines for preliminary design projects, the Constructability Review generally followed the 50% review procedure for detailed design contained in the MTO Guide.

Given the large scope of the project but relatively conventional nature of most of the highway widening works, the Constructability Review focused on the most complicated aspects of the Project. These included:

- Tansley Bridge construction staging and Dundas Street traffic management
- Construction egress and access to the work areas at street level
- Access to the creek valley and any temporary creek crossings
- Steel erection methodology
- Demolition of the existing south structure including the deck, trusses and piers
- Environmental impacts of working in the valley and close proximity to Bronte Creek

4.2 Scope of Review

Constructability and Bid-ability Reviews were conducted. The following were reviewed:

- Preliminary Bridge Staging
- Preliminary Traffic Management on Dundas Street
- Valley Access and Creek Crossing
- Ingress and Egress from construction zones
- Environmental Impacts
- Steel Erection Techniques
- South Structure Demolition
- Pier and Foundation Construction
- Storm water management and creek morphology
- Erosion and sediment control and long-term bank stability
- Adjacent Property Access

The reviews focused on confirming that the work program requirements are achievable in keeping with common construction methods and standards.

4.3 Format and Duration

The formal Constructability Review was carried out in a 1-day workshop session on September 23, 2014 at the MMM Group's Mississauga Office. To successfully manage the considerable scope of the Constructability Review, team members thoroughly reviewed and critiqued the information provided to them prior to the workshop. All members of the team conducted a site visit on the morning of September 23rd. The site visit included a walk down into the Bronte Creek Valley, along the existing bridge and along the length of the utility bridge to the south of the existing bridge.

The agenda for the workshop is included in Appendix A. The agenda remained flexible throughout the workshop, however all review activities were covered within the full day period.

4.4 Documents Provided to the Constructability Review Team

The following list of documents / information was provided to the Team approximately one week before the Workshop:

- Workshop Overview
- Preliminary General Arrangement Drawing of the Tansley Bridge
- Preliminary bridge staging drawing
- Preliminary Design Plans
- Preliminary traffic management plan for Stage 1
- Site photographs and Site Conditions
- Draft Design Criteria
- Preliminary cost estimate
- Tansley Bridge Reports including condition surveys and structural evaluation
- Preliminary geotechnical summary
- Summary of the Social, Cultural and Natural Environments including Key Features

- Preliminary Drainage and Storm Water Management summary
- Existing Bridge Drawings and Urgent Repair Contract
- Potential Expansion of Bronte Creek Provincial Park

5.0 CONSTRUCTABILITY TEAM AND WORKSHOP ATTENDEES

The following people attended the Workshop.

Independent Constructability Team

Tony Wing (MMM) – Constructability Team Lead and Structural Expert
Bob Stofko (MMM) – Structural and Construction Expert
Ray Roscoe (Independent) – Contractor, Construction Expert
Steve Matthews (ES Fox) – Steel Erection Expert
Karen Zan (MMM) – Highway Design, Utilities and Drainage Expert
Anne MacMillan (MMM) – Environmental Expert
Alastair Gorman (Thurber Engineering) – Foundation Design Expert

Project Team

Neil Ahmed (MMM) – Consultant Project Manager
Katherine Jim (MMM) – Consultant Assistant Project Manager
Trevor Small (MMM) – Consultant Structural Manager
Kim LeBrun (MMM) – Consultant Hydrogeology Expert
Stefan Sirianni (MMM) – Consultant Designer
Sally Kelday (Kelday Geomorphic) – Geomorphic Expert
Maureen Van Ravens – Halton Region
Jeffrey Reid – Halton Region
Melissa Green-Battiston – Halton Region
Andrew Gorman – Halton Region
Patrick Monaghan – Halton Region

External Agencies

Leah Chisimba – Halton Conservation
Samantha Mason - Conservation Halton
Cory Harris - Conservation Halton
Holly Anderson - Conservation Halton
Sarah Matchett - Conservation Halton

6.0 PREWORKSHOP COMMENTS RECEIVED

Prior to the workshop, comments where elicited from the Constructability Team Experts. These comments were compiled by the Team Lead and sorted to facilitate discussion and ease of reference at the workshop. They are included in Appendix B.

7.0 ASSUMPTIONS MADE

It was deemed necessary to make a number of assumptions in order to proceed with the constructability review. The assumptions made are as follows:

- The construction will be undertaken in accordance with the preferred alternative (Option 1) comprising the construction of a widened structure to the north, demolition and reconstruction of the existing south structure and replacement of the bridge deck on the existing west bound structure.
- The new overhead hydro lines which are to be installed across the valley on the south side of the existing bridge will not interfere with the construction of the new bridge or demolition of the south structure
- Valley access for heavy construction vehicles will be permitted subject to environmental constraints

8.0 CONSTRUCTABILITY ISSUES DISCUSSED AT THE WORKSHOP

A large number of comments were provided by the Constructability Team prior to the Workshop. The list of comments / potential concerns was expanded in a brainstorming session completed on the morning of the workshop. Most of these comments were discussed by the Constructability Review Team during the workshop. Each of the comments was also prioritized for further discussion. Not all of these issues and concerns discussed have been brought forward into the main body of the report. Accordingly, it is strongly recommended that the Design Team review all of the comments included in the appendices in addition to the ones listed and discussed in the main body of this report below.

Table 1 included in Appendix B contains a listing of all constructability issues and comments made by the Constructability Review Team prior to the Workshop. The comments have not been expanded, critiqued or addressed on the table; this was done in the text in the main body of the report below.

The Minutes of Meeting which summarize the comments made during the workshop are included in Appendix F. The Minutes also include a summary of the top constructability issues requiring further design development as identified by each person present at the workshop.

The most significant recommendations of the Constructability Team are summarized below.

Dundas Street Lane Closures

The ability to enact short-term lane closures on Dundas Street during the reconstruction of the Tansley Bridge will significantly reduce the impacts on the environmentally sensitive creek valley as well as dramatically reduce construction costs and duration. In order to assess the constructability of the preferred structural alternative, it was deemed necessary to first establish what temporary lane closures would be permitted. Regional staff confirmed Regional policy with respect to traffic operations and lane closures in the vicinity of the bridge to be:

- Two east-bound lanes are to be operational between 6:00am and 9:00am
- Two west-bound lanes are to be operational between 3:00pm and 7:00pm
- Single lane closure during the off peak hours are acceptable to the Region

Furthermore, the Project Team confirmed that, based on recent traffic counts, the capacity on Dundas Street may be reduced to one lane in each direction between 8 pm and 6 am. This indicates a more severe restriction on lane closures than allowed under the Regional Policy.

For specific critical operations such as girder erection or the existing truss demolition, Regional staff indicated that traffic could be reduced to a single lane across the structure for short 15 minute durations with flag-persons or rolling closures used to manage the traffic. It is preferred that these single lane operations be undertaken at night.

Active Transportation

The existing active transportation provisions across the bridge are restricted to a single 1.8 m wide sidewalk on the south side of the bridge. There are no marked bike lanes on the roadway.

The General Arrangement Drawing provided to the Constructability Review Team prior to the workshop (refer to Appendix C) showed active transportation facilities across the bridge including a 1.5 m on-road bike lane (with 0.3 m buffer strips on either side of it) and a 2.0 m sidewalk on both sides of the road. During the workshop, Regional staff clarified that the sidewalk widths on the bridge were to be 3.0 m.

Subsequent to the workshop, the General Arrangement Drawing was updated to reflect the 3.0 m sidewalk widths on the bridge (refer to Appendix C). The resultant increased width of the bridge lead to the need for an additional line of girders on both sides of the structure. This was anticipated at the workshop. The Constructability Review Team confirmed that discussions with respect to the constructability of the bridge would not be impacted significantly by the increased width of the bridge or the additional girder lines.

Construction Staging and Property Access

Staging drawings for the bridge construction are provided in Appendix D along with a plan showing the roadway alignment in Stage 2 when traffic is detoured onto the new north structure. The staging for the reconstruction of the bridge can be summarized as follows:

- Stage 1: Build a new 2-lane bridge (inclusive of a sidewalk) to the north of the existing structure. During this stage, four lanes (two eastbound lanes and two westbound lanes) of traffic will be maintained on the existing structures. Pedestrians will be accommodated on the existing sidewalk located on the south side of the existing bridge.
- Stage 2: Divert two westbound lanes onto the “new north structure”; divert two eastbound lanes onto the “existing north structure”; move sidewalks to north side

of new south structure. Existing south structure together with the piers will be demolished. Following demolition, a new south structure will be constructed.

- Stage 3: Two westbound lanes to remain on the "new north structure"; divert two eastbound lanes onto the "new south structure". Rebuild the "middle structure" (previously the "existing north structure") including the construction of the centre median, and tie the new deck into the structures to the north and south.

The Constructability Review Team confirmed that the staging proposed by the Project Team was feasible, provided sufficient access to the work areas is provided and that it facilitated the erection of the new steel girders and demolition of the existing truss structure when the lane closure allowances are considered.

Truck access and egress is most problematic in Stage 3 of the construction where the work is being carried out between the active east and west bound lanes. It was agreed that trucks could enter the centre construction area by slipping off the centre lanes (in either direction) at each end of the bridge provided this was done in the off-peak hours. Similarly, egress from the central construction zone can be achieved by slipping on to the centre lanes in off peak hours.

In Stage 2 of the construction, when all the traffic is detoured to the north as shown on Figure 3 included in Appendix D, the length of the west bound dedicated left-turn at Sutton Drive will be reduced to approximately half of its current length. It is recommended that traffic analysis be undertaken during detailed design so that the impacts of this reduction can be evaluated, the signal timings adjusted or other mitigation measures be enacted. Such a reduction in the left turn lane would be realized with almost all practical staging schemes. The importance of this issue will be heightened by the planned condominium and townhouse development in the south east quadrant of the Dundas Street – Sutton Drive intersection. This development will attract new additional westbound left turn movements from Dundas to Sutton Drive during the PM peak period.

Direct access to the proposed right-in/right-out at Dundas Street to the new planned condominium / townhouse development at Sutton Drive intersection may be problematic or not possible (at times) during construction. Subsequent to the Constructability Workshop, the site plan for the proposed development was updated and the right-in/right-out access is to be located at the mid-point of the property (instead of at the east end of the property initially assumed at the Constructability Workshop). The potential to maintain access during construction is more likely by having the right-in/right-out access located at the mid-point of the property. Should the access be located at the east end of the property, it would be too close to the bridge to accommodate a (large enough and) necessary laydown area at the west end of the bridge while still keeping the access to the future development open.

East of the bridge, the existing left turn lane (for First Group's property) may be impacted during all stages of construction. It is recommended that further traffic analysis be carried out during detailed design to determine the impacts of this.

Structural Steel - Girder Erection

Various alternatives for erecting the new steel girders were discussed. Alternatives deemed feasible were:

- Erect girders from the valley floor using large 300 t cranes
- Launch girders from the abutment
- Erect girders from the existing north bridge

It was agreed that all three erection alternatives were constructible. Erection from the valley floor is not preferable since the environmental impact of operating down in the valley would be substantial due to the size and number of the temporary granular pads needed to support the very large 300 t crane that would be needed to erect the girders from the valley floor. Each crane pad would be approximately 12 m x 18 m. At least two crane pads would be needed for each of the middle two spans for each bridge.

Launching of the girders was considered feasible but the costs associated with this erection methodology are considerably more than the other two alternatives and the risks associated with damaging the steel during erection are far greater.

Erecting the new steel girders from the existing north structure was deemed to be the most cost effective alternative. It also minimizes the environmental impacts to the creek valley. It was concluded that two, 110 t cranes positioned on the existing bridge, each with an outrigger width of 7 m, would be required to lift the new girders into place. To facilitate erection of the first 4 girders, the northern most girders, the cranes would be located on the existing north structure with the girders "picked" from the northern most lane of the existing south structure while traffic was reduced to a single lane on the southern structure. As discussed above, this would require rolling short duration closures of the west bound lanes or flagging of the traffic to manage both east and west bound traffic in the single lane while steel erection was underway. Rolling closures would be approximately 15 minutes in length. Regional staff expressed their preference for the use of flag persons.

Temporary bents to support the ends of the girder segments would not be needed. Instead, a tensioned cable system could be used to hold the girder segments in place over the piers with the cables being anchored to rings embedded in the new footings for the bridge. Alternatively, or for the end span segments, the ends of the girders could be held in place by a third crane perched on the abutment while the next segments are erected.

Upon completion of Stage 1 and with the traffic transferred onto the new north structure, demolition of the existing south structure would commence (as discussed below). Once demolition of the existing truss (south) structure was complete and the new piers constructed, erection of the 4 new southern girders would commence. These would be erected in much the same manner as the 4 northern girders. With traffic detoured and restricted to a single lane on the new north structure, two, 110 t cranes would be located on the existing north structure and would pick the new girders from trucks located on the southern-most lane of the new northern structure.

The loads imposed on the existing north bridge by the cranes and their outriggers as they lift the structural steel would be similar for the erection of the 4 new northern and 4 new southern girders. Estimates of these loads have been provided by ES Fox (the erection specialist attending the Constructability Review). These are included in Appendix E. Detailed analysis of the existing structure is required to confirm that the structure is capable of resisting the imposed loads and/or where the cranes can be positioned or what strengthening needs to be undertaken to facilitate erection from the existing bridge. Without such evaluation it is not possible to definitely state that the existing structure has the capacity to support the crane loads. However, the members of the Constructability Review team who are bridge specialists are reasonably confident that a detailed analysis will indicate that the structure is capable of safely supporting the erection loading.

It is strongly recommended that a detailed structural analysis of the existing bridge be carried out during detailed design to confirm that the bridge is capable of safely supporting the loads associated with erecting the new north and south bridge girders from it. Furthermore, it is strongly recommended that the results of the evaluation together with its assumptions be included in the contract tender documents so that the contractors are able to make an informed assessment of the feasibility of erecting the girders from the existing structure. Without this assessment, given the relatively short duration of a typical tender period and the large number of potential contractors who will be bidding on the Project, it is not reasonable to assume that the analysis would otherwise be undertaken during the tender period. As contractors are generally risk adverse, they will likely not assume that the existing structure is capable of supporting the crane loads during erection and instead possibly cost an erection methodology using cranes located on large granular crane pads constructed on the creek valley floor.

The recommended approach of supplying the tenderers with information regarding the evaluation of the ability of the structure to support erection loads is not typically done and it must be specified to be included in the scope of work for the detailed design, otherwise, consultants will try to transfer the contractual risk to the contractors and not undertake this evaluation. It will also be necessary to include, as part of the detailed design scope of work, consultation with an erection specialist firm who would be able to confirm the outrigger loads and locations associated with erection from the existing bridge.

South Structure Deck and Truss Demolition

The existing south structure is to be removed in its entirety except for its foundations. It is recommended that the specifications associated with the removal of the concrete deck include constraints that would prohibit contractors from dropping any of the bridge deck materials or the effluent from cutting the concrete deck into the creek valley. This approach has been successfully carried out on many structures and is feasible and economical. The bridge deck would be cut into small sections and then loaded onto a flatbed truck and hauled off site. The removal would start in the middle of the bridge working towards the ends or alternatively, by starting at one end and working towards the other. Upon completion of the deck removal, the existing steel trusses would be fully exposed and would be ready for removal.

Demolition of the structural steel can be undertaken by cutting the trusses into pieces and lifting them (by cranes situated on the existing north bridge) onto trucks situated on the newly constructed northern most bridge in a manner similar (but opposite to) the erection of the new north and south girders. Again it is necessary to confirm, during detailed design, that the existing north structure is capable of safely supporting the loads imposed on it by the cranes lifting the truss pieces. It is also recommended that the crane positions and load assumptions be included in the tender documents to assist the contractors in determining the most economical and environmentally friendly way to demolish the existing trusses.

Alternatively, contractors may find it more cost effective to drop the trusses into the creek valley and then proceed to cut them up and remove them from the site. This method of demolition would have less impacts on traffic management (and no need to restrict traffic to a single lane during truss demolition) and but would potentially be a greater impact on the creek valley environment. Provided the work is done outside of the in-water constraint window, it can be undertaken within typical environmental constraints imposed on a typical contract.

Given the steepness of the east bank, it is possible that contractors may use a combination of the two above-noted approaches. That is, contractors may remove the east end span trusses from above using cranes and then demolish the remaining spans from the valley floor.

South Structure Pier Demolition

Pier demolition, down to the top of the existing footing elevations, can be undertaken in many different ways, all of which are constructible and can be completed in accordance with the environmental constraints currently proposed or suggested for the Project. Blasting is not considered a viable option as it may be difficult to effectively contain the blast materials from entering areas of the valley outside of the bridge right-of-way. Viable alternatives for undertaking the demolition of the concrete piers include:

- Breaking the concrete piers into relatively small pieces using large hydraulic hoe-rams mounted on large backhoes working in the creek valley
- Saw-cutting the concrete piers into large pieces using diamond wire cutters and lifting the pieces off the piers
- Breaking the concrete into relatively small pieces using expansive grouts placed in holes drilled into the concrete piers
- Toppling the piers onto the valley floor in a manner similar to felling a tree and then breaking the concrete into pieces on the valley floor using large hoe-rams
- A combination of the above

The demolition of the east pier using hoe-rams was discussed in detail, specifically in regards to how to prevent concrete debris and rebar from entering the creek and where to locate the hoe-rams during the demolition. It was suggested that a full height plywood hoarding system, offset from, but braced to the existing pier, could be erected on the west side of the east pier to contain the debris. The hoarding would be removed from the top down as the pier demolition proceeds downwards. This methodology has been used

successfully in the past. There was consensus among the Constructability Review Team that such a system would also be constructible on this project and that hoe-rams situated on the south side of the east pier would be effective in demolishing the pier. (Refer to the sections entitled "*Valley Access"* and *"Creek Crossing"* for further discussion on getting heavy construction equipment to the east bank of the creek.)
The most significant issue associated with the pier demolition from a constructability point of view is associated with the disposal or reuse of the demolished concrete. The concrete could be used as rock protection and or rip-rap steep valley slopes, the valley floor and potentially even on the actual creek banks depending on how the material is handled and processed. At the time of the constructability review, it had not been established if the creek banks and valley slopes and floor are to be lined with vegetation or rock / rip-rap, or a combination of the three to prevent erosion and thus ensure long-term slope stability. This fundamental decision must be made prior to determining if it is possible to reuse the concrete from the demolished piers. Conservation Halton recommends that a checklist for environmental features in Bronte Creek be developed to ensure any work completed remains consistent with Halton Region's "environmental design standards".

If it is not possible to reuse all of the concrete from the piers, the concrete would most cost effectively be removed from the valley by loading it onto trucks and hauling it out of the valley (refer to the sections entitled "Valley Access" and "Creek Crossing"). Although it will be necessary to remove the reinforcing steel from the demolished concrete and haul it out of the valley, far more trucking would be required if the concrete cannot be reused. There will be a requirement for at least some rock protection or rip-rap and if the recycled concrete cannot be used in this regard, even more trucks would be required to enter the valley to bring in the new rock protection. Reuse of the concrete within the valley will certainly result in a more cost effective design.

South Structure - East Abutment Removal

The existing east abutment and retaining wall for both existing bridges have a massive perched foundation that is not founded on bedrock. The Constructability Review Team expressed concern with respect to the impacts the removal of the existing abutment and its footing would have on the long term stability of the very steep east valley slope. Disturbance of the slope associated with the removal will likely create slope instability issues down the slope. Difficulties in accessing the slope may make it impractical to install further slope stability measures. It is therefore recommended that much of the existing east abutment be maintained. This should be possible since the new abutment is to be offset further east than the existing abutment. However, the preliminary design indicates that the new abutment is to be founded on piles and it would be necessary to excavate the fill down to the top of the existing footing and break through the footing prior to driving the piles. The use of caissons in place of piles was also deemed feasible by the Constructability Review Team. By using caissons, there would be no need to excavate the fill above the existing footings but it may be necessary to manually cut through the rebar in the footing from within the caissons.

South Structure Pier Footing Demolition

The need to remove the massive existing footings of the south structure piers revolves around the ability to construct the new piers and their foundations. That is directly related to the configuration of the new pier foundations. Based on the available information (which does not include any new project specific foundations investigations), it was agreed that large diameter caissons drilled into the shale bedrock were the most feasible and cost effective means of founding the new piers. By utilizing large diameter caissons, it would appear possible to advance these between the existing twin spread footings which comprise the foundations for each pier. The 1948 drawings indicate there is approximately 7.7 m between these foundation units so it would appear that complete removal of the existing foundations is not necessary. It is strongly recommended that subsurface investigations be carried out during or in advance of detailed design to uncover and core through the existing footings to determine their depths and plan limits as reliance on the 1948 drawings is not considered sufficient to confirm the constructability of new pier caissons located adjacent to or between the existing footings without their removal. The investigations will provide the necessary information to delineate the concrete to be removed from the existing piers and to provide the engineers and the contractors with the information necessary to deal with potential issues of dewatering any excavations associated with the removals.

Valley Access

Access to the valley with heavy equipment and trucks will be necessary for a host of reasons including, but not limited to:

- Pier demolition
- Partial footing demolition
- Grading for the construction of the new north piers
- New footing and pier construction
- Creek embankment protection and stabilization
- Slope protection and/or re-vegetation

Recognizing the environment and topographic constraints associated with the Bronte Creek Valley, it was agreed that access to the valley from the north west quadrant of Tansley Bridge would be most suitable. There is an existing road that was used previously to gain access to the valley that starts in the northwest quadrant of the bridge and crosses under the bridge between the west abutment and the first pier. Some grading of this road and the adjacent knoll north of the west pier would be necessary but much of this clearing and grading would be necessary for the new pier construction. Property lines and ownership in the vicinity of the access point and the knoll should be verified to determine if it is necessary to contact Infrastructure Ontario (the assumed adjacent land owner) to obtain a temporary easement to allow access across the property and for excavation of the knoll. It may also be necessary to give notice and/or seek approval from Bronte Creek Provincial Park as this work might fall within their limits of interest.

There was consensus amongst the Constructability Review Team that it was not feasible to gain access to the valley or the east piers down the east valley slope. The steepness of the slope and the proximity of the toe of the slope to the creek would result in the need to

cut into the slope to develop any access road down it. Extensive roadway protection would be needed but it would be extremely difficult to construct the roadway protection as heavy equipment would be needed to install it ahead of the access roadway construction. As such, it was concluded that it was not feasible to gain access to the east pier down the east slope and that it would be necessary to construct a temporary bridge across the creek to gain access to the east piers.

Creek Crossing

Following considerable discussion, it was agreed that from a construction access perspective, it was preferable that the temporary creek crossing be constructed well south of the existing bridge, potentially outside of the existing right of way. By constructing the temporary bridge well away from existing piers and the new pier construction, access to the east side is not constrained by any pier construction or demolition activities that might otherwise occur right at the end of the temporary bridge if it was constructed directly below the existing bridge. The width of the bridge could also be minimized as it would not be necessary to widen it to also serve as a platform from which to advance the new caissons or to accommodate turning vehicles. Further study (during detailed design) of potential temporary creek crossing locations and the property / permitting requirements is recommended.

The temporary bridge span will need to be sizeable to accommodate a 2 year or 5 year storm event. Bank-full widths are approximately 20 m. Much longer spans are needed to accommodate the 2 and 5 year return period events. Based on the drainage calculation, the temporary bridge may need to span approximately 55 m. This will necessitate the placement of a temporary pier or crib within the creek bed. Peak flow events need to be accommodated for in the design of any temporary structure in order to prevent bank erosion, instability of the temporary bridge or its crib foundations and to avoid construction debris from entering the river.

Construction and removal of the crib will have to be carried out within the permissible "in-water work window" of July 1st to Sept 15th annually. The temporary bridge will be needed for almost the 3 year duration of the construction and hence liaison with MNRF is required to obtain approval, and possibly a permit, to leave the crib in place outside of the "in-water work window."

East Pier Construction

Access to the east bank of the creek will be necessary to construct the new east piers (and their foundations) and to remove the existing south pier. Access to the north and the south of the existing piers will be required for light and heavy vehicles including light cranes, a caisson boring rig, excavators, tandems and possibly concrete ready-mix trucks. However, to reduce costs and environmental impacts, only a single temporary creek crossing is envisioned. To gain access north and south of the piers, it will be necessary to construct a temporary access road approximately 5 m in width immediately west of the east pier since it was deemed infeasible to construct a similar roadway on the east side of the pier due to the steep valley slope on that side of the pier. The proximity of the creek bank to the pier will require shoring of the bank to ensure the stability of the temporary

access roadway constructed at the top of the creek bank. Such shoring could take the form of a gabion wall. There was considerable discussion about what type of bank protection was best suited for the application given that long term erosion protection measures are needed on the bank in the same location. It is recommended that a full HECRAS model of the creek be undertaken during detailed design to establish potential meander scenarios and to protect against them at the structure location. It was agreed that several alternatives for long term and short term erosion control were feasible and could be constructed within the "in-water window". However, it is recommended that further study of the alternatives be carried out in detailed design. Such study should involve foundations, terrestrial, aquatic and geomorphology specialist and be undertaken in consultation with the MNR and Halton Conservation.

Following considerable discussion, it was agreed that there was sufficient room, reach and accessibility to sit the caisson boring rigs to the north and south of the existing piers so that all new caissons in the new north and south foundations respectively could be advanced without having to move the boring rig immediately to the east or west of the foundation units.

Dewatering of the caisson and footing excavations was raised as a concern. Based on other projects constructed in the shale along Bronte Creek, it is anticipated that ground water will pass quickly through the bedrock and into the caissons and foundations. It was considered likely that the concrete in the caissons would have to be placed by tremie methods. Furthermore, since the shale deteriorates quickly upon exposure to air, efforts must be made to place the concrete in the caissons immediately after excavation. It is recommended that further study of the site specific constraints in this respect (and how they relate to concrete placement by tremie methods) be carried out during detailed design.

Storm Water Management

The Constructability Review Team commented that more work had to be completed to address best practices associated with storm water management at the reconstructed / widened crossing of the Tansley Bridge. Conservation Halton stated that there is precedent for runoff in other low-impact developments for at least an 80 percent removal of total suspended solids from storm water. To this end, Conservation Halton suggested the possibility of building a storm water management pond in the vicinity of Tansley Bridge to address long-term storm water management needs.

It is recommended that a hydraulic analysis be completed to determine if it is possible to carry all the storm water across the structure without the storm water encroaching on the traffic lanes to an extent greater than provided for in the Bridge Code. Consideration may have to be given to constructing the shoulders / cycle lane areas at an increased slope to be able to satisfy the code requirements. Should this be found to be possible, then the establishment of storm water management ponds could potentially be possible without the need for deck drains and a highly undesirable below-deck collection system. Finding the necessary room to construct the ponds will be challenging. Although it is not preferable to have direct drainage of the storm water into the creek valley during the construction phase (as is occurring on the existing bridge currently), there will not be

sufficient room on the deck to store and transmit the water off the bridge beyond the abutments during construction due to narrow deck widths in the various stages of construction. It is strongly recommended that temporary deck drains be installed in the new north and south structures to accommodate storm water management during construction. Subject to the results of the hydraulic analysis, these temporary drains can be filled in once the entire deck has been constructed and all detours removed.

APPENDIX A

Constructability Workshop Agenda

1.1 Workshop Agenda - Tuesday, September 23, 2014

Time	Activity
8:00 am to 10:30 am	Site visit – meet at the vacant property on the south side of Dundas Street, west of Tansley Bridge (in front of the house pictured below). Designated on-street parking can be found on the side-roads in the adjacent community (e.g. Tydman Way, Auckland Drive). Please do not park at the school or nearby businesses. Directions to the location from MMM's office can be found here: https://goo.gl/maps/uuuKQ  Project Overview / Bronte Creek Crossing Widening
10:30 am to 11:00 am	Return to MMM Mississauga Office, 3rd Floor Boardroom
11:00 am to 12:00 noon	Recap of Site Visit Constructability Workshop Focus Review Comments Received from Constructability Team
12:00 noon to 1:00 pm	Lunch
1:00 pm to 5:00 pm	Staging and staging layout / Work area Access and egress details Steel erection Operational constraints and environmental considerations Worker and traffic safety Construction schedule and working day estimates Major item quantities (and list of items for completeness) Construction Cost Estimate

APPENDIX B

Comments Received Prior to Workshop

DUNDAS STREET (REGIONAL ROAD 5) TRANSPORTATION CORRIDOR IMPROVEMENTS
CLASS ENVIRONMENTAL ASSESSMENT - BRANT STREET TO BRONTE ROAD
SEPTEMBER 23, 2014 TANSLEY BRIDGE CONSTRUCTABILITY WORKSHOP
WORKBOOK REVIEW

ISSUE	REVIEWER	SHEET/REF	COMMENT
Access	Tony Wing	Staging Plan	There are private entrances on either side of the right-of-way at either ends of the bridge. Can access to these still be maintained in all stages? Will this access cut-off the Contractor's access or will there be a need to share accesses?
Access	Tony Wing	Staging Plan	In all stages, but particularly in Stage 3, what restrictions are going to be placed on accessing the work area at the ends of the bridge? Are there going to be timing restrictions? Does access always have to be in the direction of traffic and if so, is there room to turn large vehicles around? If not, will it be necessary to remove and replace the existing bridge deck in two stages to maintain access across the bridge in the work zone?
Access	Ray Roscoe	Pg. 14	Vegetation - Implications: Due to East valley slope restrictions for access, a crossing will be required from the west. Will this be permitted for only the 3.5 month in temporary creek water works window?
Access	Holly Anderson		What are the location/grading/access requirements for cranes.
Access	Holly Anderson		Staff strongly agree that staging of construction should occur from the west side of Bronte Creek, which has been previously disturbed due to construction of the Zone 3 Watermain, to minimize the amount of disturbance to natural heritage features and functions.
Access, Env. and Back-water	Tony Wing	Staging Plan	How is access to the valley to be obtained? It is assumed that access to the east pier location will be from the west side. What restrictions are there on constructing a temporary crossing of the River? Will temporary roadway and bridge cause excessive backwater?
Cost	Tony Wing	Workbook Pg. 7	What is the breakdown of the cost? What costs have been assumed for the demolition of the existing bridge? What is the cost per square metre for the new bridge exclusive of rehab of the existing girder structure?
Drainage	Tony Wing	Workbook	There is no mention in the workbook of the proposed treatment of stormwater from the bridge. What is proposed and what has been accepted by the Conservation Authority or other agencies? Are there different restrictions on the final drainage concept as opposed to temporary conditions during construction?

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ISSUE	REVIEWER	SHEET/REF	COMMENT
Environmental	Ray Roscoe	Pg. 14	Species at Risk: Last sentence of implications states "General construction specifications can be included in Contract to protect any SAR incidentally encountered during construction." How this is to be managed in the field needs to be clearly set out so that the not anticipating schedule delays or extra costs. (Contingency costs added to bid or potential Contractor is claims.)
Environmental	Holly Anderson		Please ensure that a mitigation plan is in place for encountering wildlife and Species At Risk on site prior to any works beginning. Part of this plan should be exclusionary measures, tree protection (e.g. Flowering Dogwood) and potential transplant/relocation procedures. However, staff defer to the Ministry of Natural Resources and Forestry for any requirements under the Endangered Species Act (ESA 2007).
Environmental	Holly Anderson		Was bird nesting observed on the bridge? This type of bridge is of a style that is attractive to many species of birds including Barn and Cliff Swallow.
Environmental	Holly Anderson		A summary table listing the potential SAR for the area would have been helpful for the review. Please ensure a summary table is included in future submissions.
Environmental	Holly Anderson		Has shadow modelling been contemplated to determine areas that will be problematic to re-establish vegetation?
Environmental	Holly Anderson	Appendix E (photos 69 and 82)	From a review of photos in Appendix E (Photos #69 and #82) it appears that the area beneath the bridge on the west side of Bronte Creek was revegetated. It was staff's understanding that the area would be revegetated post bridge construction. Please clarify.
Environmental	Holly Anderson		Avoid transportation of non-native and invasive species into sensitive vegetation communities due to seed dispersal/disturbance along cleared areas and construction equipment. Equipment should be cleaned prior to entering / leaving the sensitive locations.
Environmental	Holly Anderson		Vegetation removals (if any) should take place outside the Breeding Bird timing window May 1 - July 31.
Environmental	Holly Anderson		Is there a concept of the amount of removals (if any) that will be required (e.g. 0.5 ha)? Please be aware of the Region of Halton's Tree-Canopy Replacement Policy. A Tree Preservation Plan should be developed as part of the mitigation measures to determine compensation required based on the Regional policy.

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ISSUE	REVIEWER	SHEET/REF	COMMENT
Fluvial G.	Sally Kelday	Pg. 9	Paragraph 2 states that there is no erosion associated with the rip rap . There is erosion along the creek at the upstream extent where it meets the natural creek bank (creek erosion not slope/ valley wall erosion).
Fluvial G.	Sally Kelday	Pg. 16	Bankfull widths are given in column 3 of the table, last paragraph. They contradict those given in the geomorphology section. We measured these following standard approaches and I would recommend changing to the geomorphology widths.
Foundation	Ray Roscoe		If available, present a drawing showing a footprint of the existing pier foundations for both the existing structures along with the proposed foundations for the North extension and the new South structure.
Foundation	Tony Wing	App. A - Structural Report	It is not clear what the existing truss structures are founded on other than they are on spread footings. Are they founded on bedrock? If not, is there any potential that the pile driving for the new abutments will cause instability in the existing footings?
Foundation	Tony Wing	App. A - Structural Report	The existing girder structure abutments are founded on piles driven to bedrock. Is enough known about their position and batter so that we can be assured that there will not be interference between the new and existing piles?
Foundation	Tony Wing	Workbook Pg. 9 - Geotech	The last paragraph on Page 9 - Geotech Evaluation speaks of a "suitable set-back of the crane from the edge of slope. What does this mean? It needs to be defined better to be useful.
Foundation	Tony Wing	App. A - Structural Report	It is mentioned on Pg. 18 of the Str Report that the removal of the existing east abutment and east pier may cause instability issues with the east bank. What measures are required to ensure stability is not compromised? The depth of the existing abutments is considerable. How can they be removed without undermining the piles for the existing girder structure and the adjacent roadway? Has any feasibility study been done to see if roadway protection can be advanced between the two structures without hitting the top of the existing footing of the truss structure?

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ISSUE	REVIEWER	SHEET/REF	COMMENT
Foundation	Holly Anderson		Staff are concerned about slope stability in relation to protection natural heritage features and functions with regards to the recent instability of the Zone 3 watermain installation on the east side of Bronte Creek. How will slope stability be maintained? *Cory? Do I leave a question such as this to you?*
General	Ray Roscoe		Key Constructability issues from a Contractors perspective:
			Access to valley floor for heavy equipment.
			Stormwater management and frequency.
			South structure pier and footing demolition
			South structure truss removal
			North widening and south structure replacement pier foundation construction
			Structural steel erection methods
			Slope stabilization and remediation
General	Holly Anderson		It is staff's understanding at this time that the preferred alternative is to widen the Tansley Bridge 2 lanes on the north side of the bridge. Should a different route and/or construction methodology be identified at a later date, additional comments may be forthcoming.
General	Holly Anderson	Appendix K	Staff note in on the figure titled "Draft Partial Plan in the Proximity of Tansley Bridge" (Appendix K, dated August 19, 2014), two Multi-use pathways (MUPs) are identified on both the north and south sides of the bridge. Are these intended to be constructed as part of the widening? If so, they should be illustrated on figures within the report, and their potential impacts to natural heritage features and functions discussed. Please clarify.
General	Holly Anderson		Mitigation measures should include a specification to utilize machinery that is appropriate for the job and which will minimize impact on the adjacent natural heritage features.
General	Holly Anderson		Mitigation measures should include a requirement to fence off all staging locations, storage areas, access routes and construction zones to prevent intentional/unintentional impacts to the adjacent significant and sensitive natural heritage features and functions.

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ISSUE	REVIEWER	SHEET/REF	COMMENT
General	Holly Anderson		Bronte Creek is an important Linkage area and should be restored and enhanced through post-construction mitigation measures as per the commitment made by the Region. Restoration must be in keeping with Conservation Halton Landscape Guidelines to our satisfaction.
General	Holly Anderson		Please delineate the proposed limits of disturbance (e.g. vegetation removals/access/grading limits/trails) on a figure. Please ensure that this is included in future submissions.
General	Holly Anderson		A figure identifying the designated natural heritage features (e.g. ARL, Floodplain, ANSI, etc.) in conjunction with the description, would have been helpful for this review. Please ensure this is included in future submissions.
Heritage	Ray Roscoe	Pg. 17	Heritage Asset - note that the repurposed utility bridge partially obstructs the view of the truss structure from the south.
Lay-down Areas	Karen Zan		Has an area been identified for storage of materials? Is the property adjacent to the creek owned by the Province?
Lay-down Areas	Tony Wing	Staging Plan	Ideally there would be a staging area immediately east and west of the bridge approximately 90 m long in which the girders can be spliced together prior to erection to reduce the need for temporary props of the piers.
Lay-down Areas	Holly Anderson		Where will equipment yard/materials storage/access routes be located? This should also be identified on a figure to determine the potential for impacts. Please ensure this is included in future submissions.
Schedule	Ray Roscoe	Pg. 12	Aquatic Features - Implications: In water works restricted to 3.5 months will need to be recognized as a schedule constraint. This could potentially add as much as an additional full construction season.
Staging	Karen Zan		No roadway staging plans to review. Does the proximity of the intersection have an adverse effect on the ability to provide adequate storage for turning lanes when traffic is shifted fully to the north on the widened section of the WB bridge?
Staging	Karen Zan		Does the proximity of the developing EB left turn lane to the east have an adverse effect on the ability to shift traffic during staging or vice versa?

DUNDAS STREET (REGIONAL ROAD 5) TRANSPORTATION CORRIDOR IMPROVEMENTS
CLASS ENVIRONMENTAL ASSESSMENT - BRANT STREET TO BRONTE ROAD
SEPTEMBER 23, 2014 TANSLEY BRIDGE CONSTRUCTABILITY WORKSHOP
WORKBOOK REVIEW

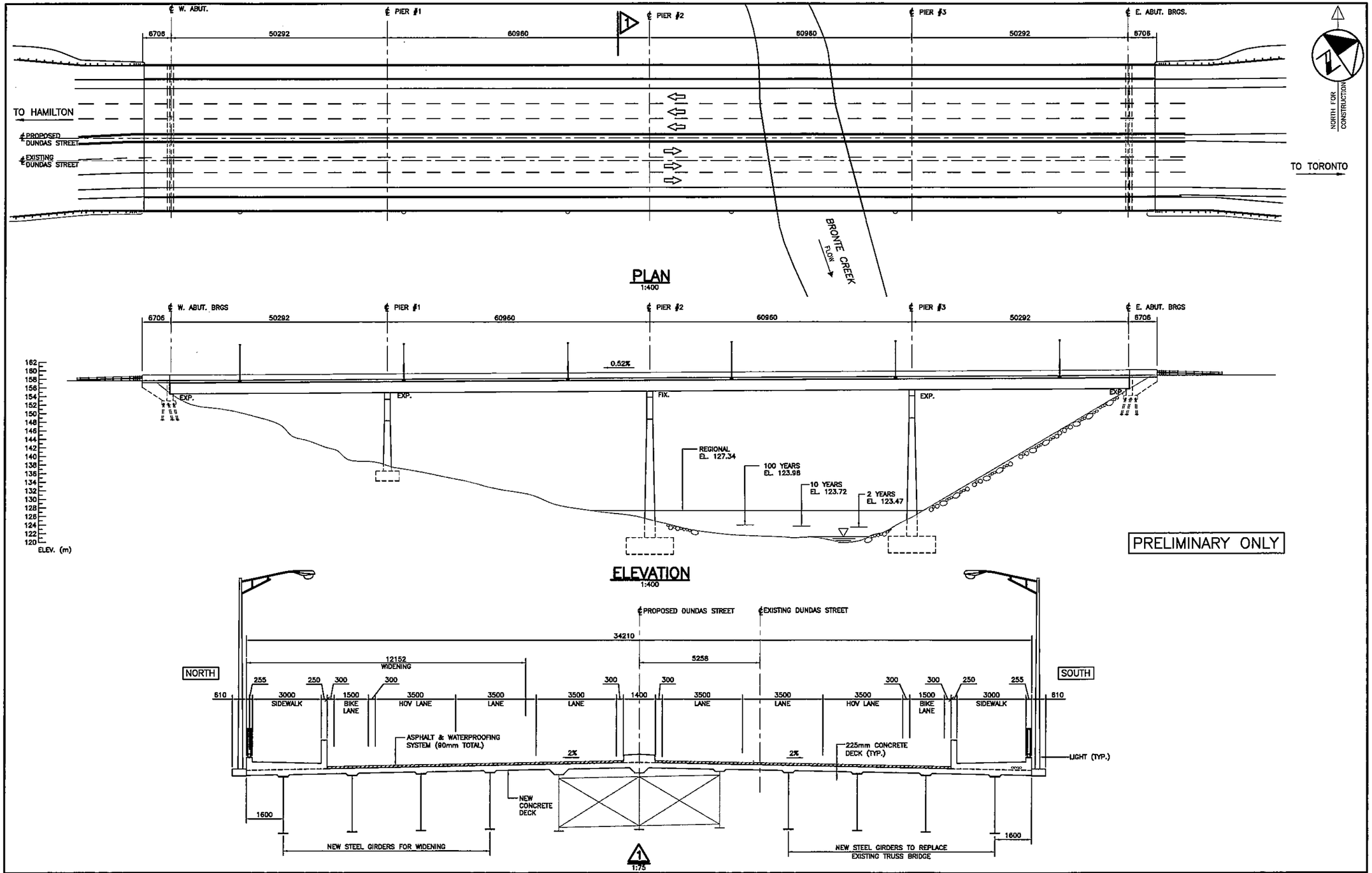
ISSUE	REVIEWER	SHEET/REF	COMMENT
Staging	Karen Zan	Pg. 21 EA Report	When pedestrians are moved to the north side of the widened bridge (noted in Stage 2), how and where will they cross Dundas (more specifically at the east end of the bridge)
Staging	Karen Zan	Pg. 21 EA Report	Will there be space off the structure at the ends of the "temporary barrier wall" (noted in Stage 2) to provide an end treatment and provide adequate lane widths?
Staging	Tony Wing	Staging c/s	The north cantilever on the south widening in Stage 2 appears to be excessive. This may be associated with the incorrectly drafted girder spacing and bridge centreline. Girder cantilever needs to be confirmed as it has to support live load in Stage 3 and 4.
Staging	Tony Wing	Staging c/s	Is the existing truss structure strong enough to support the crane loads associated with lifting the girders into place from it without significant strengthening? Will this be determined as part of the detailed design or downloaded onto the contractor to confirm the feasibility and costs?
Staging / Traffic	Tony Wing	Staging c/s	There are no closure strips shown between adjacent sections of the deck longitudinally where live load will be present adjacent to green concrete. Will lane closures be required to limit the vibrations while the concrete sets and cures? Is there a need for high-early concrete in the closure strip?
Structural	Tony Wing	Staging c/s	Is 250 mm width sufficient for the parapet wall? Is this a PL-2 or PL-3 requirement?
Structural	Trevor Small Tony Wing	Staging c/s Design Criteria	Sidewalk on the bridge should be wider than 2 m (e.g. 2.5m) to accommodate winter maintenance. The design criteria indicates a proposed width of 3.0 m
Structural	Sally Kelday	Exhibit 8-1	I think we mislabelled the heritage piers
Traffic / Staging	Tony Wing	Staging Plan and c/s. Also App A Str Report Pg. 19	What restrictions are to be placed on closing lanes on Dundas Street? The entire construction could be dramatically simplifies if lanes could be closed during off-peak hours. There would be no need for launching as indicated in the structural report as girders could be erected from the existing bridges, concrete trucks could be kept out of the valley as pier concrete could be placed from above and the existing truss structure lifted out without need for large cranes in the valley.

DUNDAS STREET (REGIONAL ROAD 5) TRANSPORTATION CORRIDOR IMPROVEMENTS
CLASS ENVIRONMENTAL ASSESSMENT - BRANT STREET TO BRONTE ROAD
SEPTEMBER 23, 2014 TANSLEY BRIDGE CONSTRUCTABILITY WORKSHOP
WORKBOOK REVIEW

ISSUE	REVIEWER	SHEET/REF	COMMENT
Utilities	Tony Wing	Partial Plan	What offset from the hydro lines located on the south side of the bridge is required? This will determine where cranes can be located to erect the new pier formwork at the very least. If erection off the existing structures is not permitted, larger and more cranes will be needed in the valley
Utilities	Holly Anderson		Please label the watermain bridge appropriately on figures.

APPENDIX C

Tansley Bridge General Arrangement Drawings



Notes

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Design	MT	Ch'kd	TS	Date	OCT. 2011
Drawn	GL	Ch'kd	MT		
Scale	AS SHOWN			References	

Field Notes
REGION BOOK

Stamp

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Manager

MMM GROUP
Halton REGION

TITLE
GENERAL ARRANGEMENT
TANSLEY BRIDGE WIDENING
BURLINGTON – HALTON
OVER BRONTE CREEK

Consultant File Nº	Regional Drawing Nº
CONTRACT Nº PR–	Drawing Nº SHEET OF

PR–XXXXX XX OF XX

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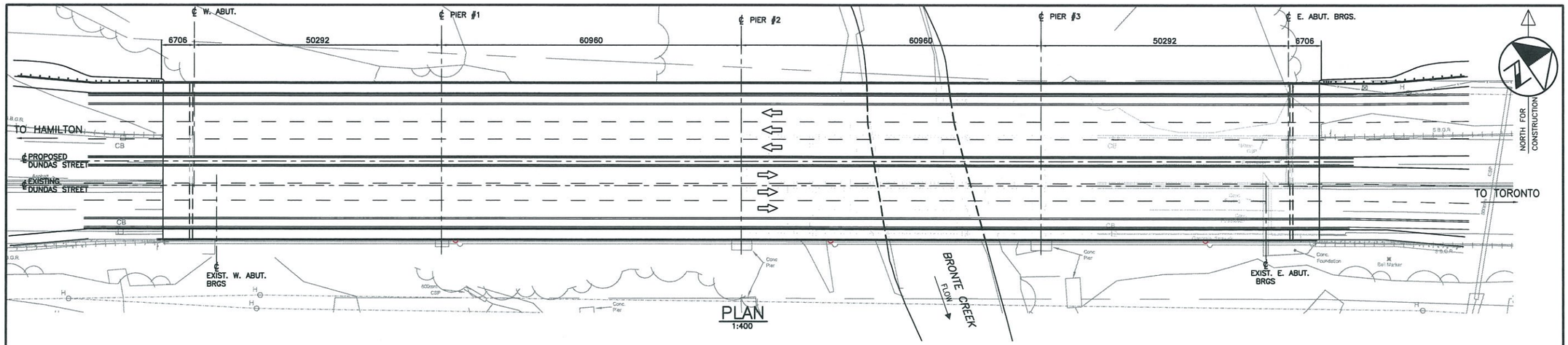

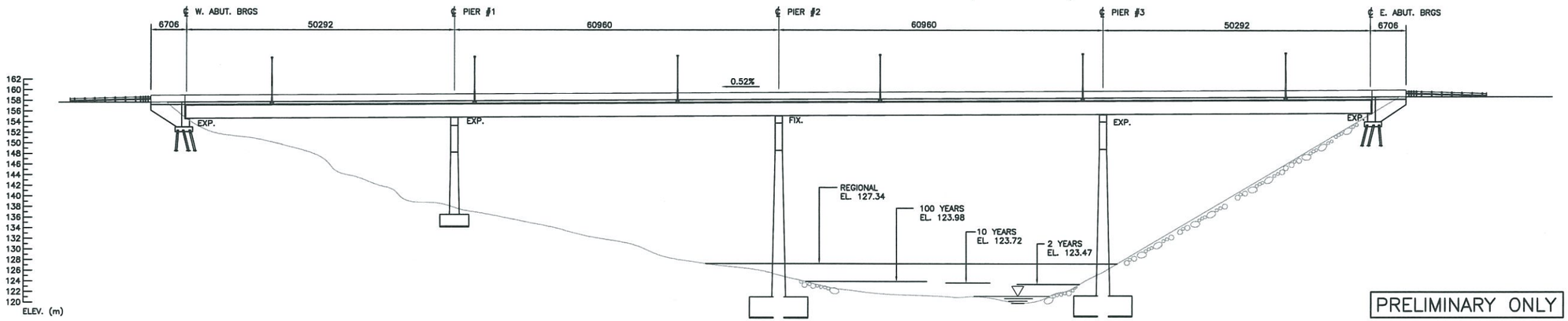

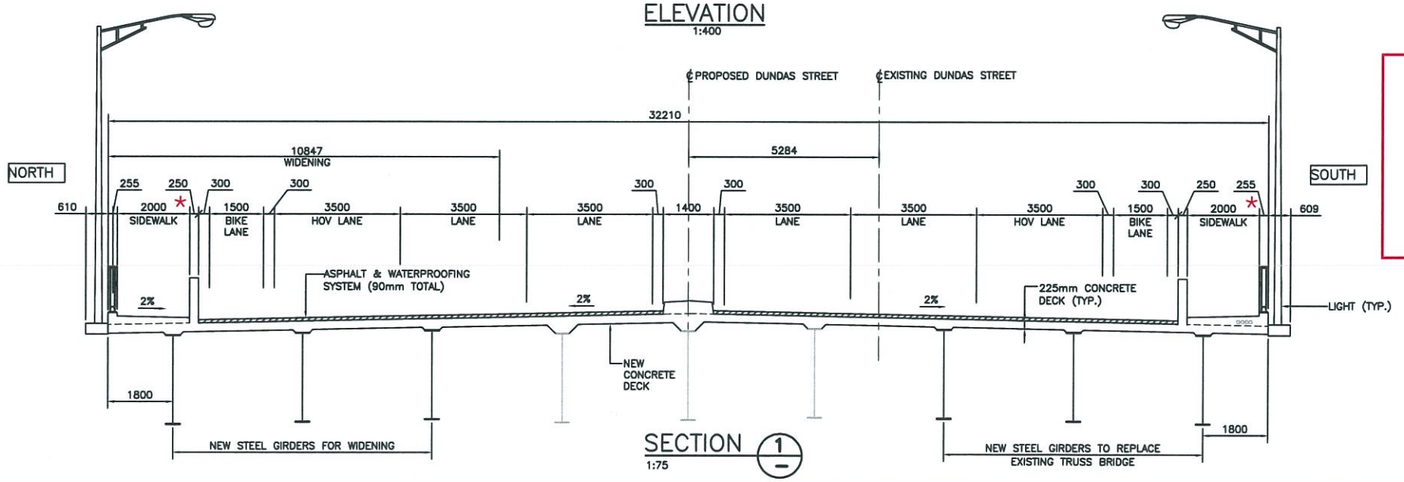

PRELIMINARY ONLY

DRAWING SUPERSEDED

*** Sidewalk width revised to 3.0 m at outset of the Constructability Review.**

PR-XXXXX XX OF XX

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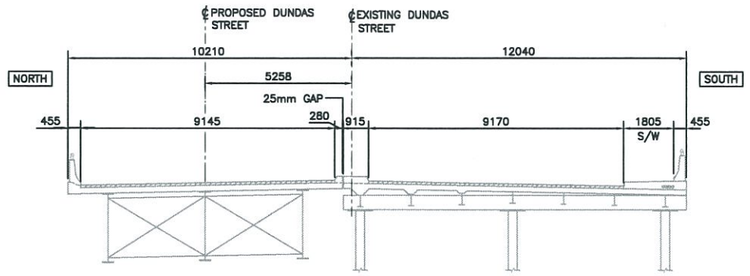
BURLINGTON – HALTON
OVER BRONTE CREEK

Consultant File Nº	Regional Drawing Nº
CONTRACT Nº PR–	Drawing Nº SHEET OF

APPENDIX D

Tansley Bridge Staging Drawings and Stage 2 Dundas St. Detour Plan



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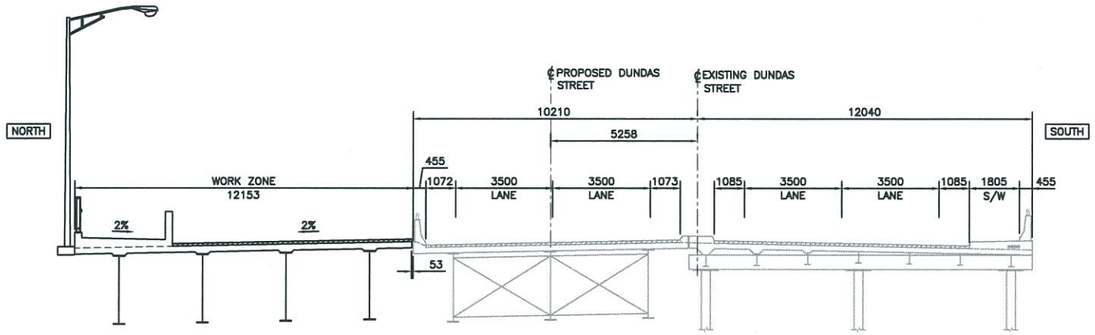

STAGE 1
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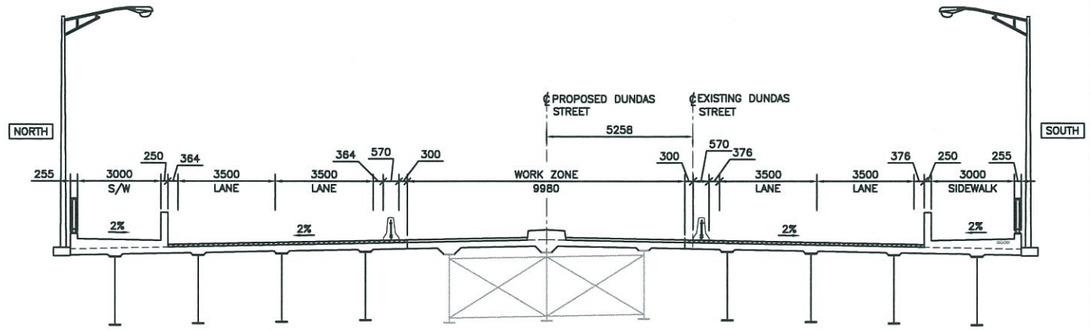

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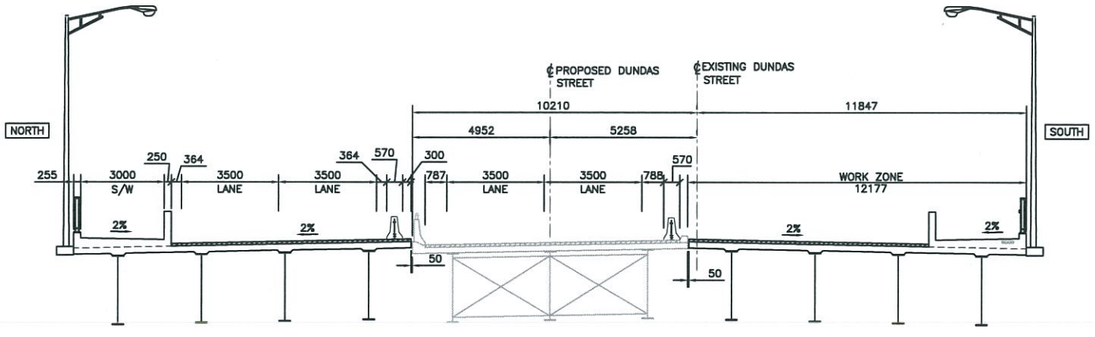

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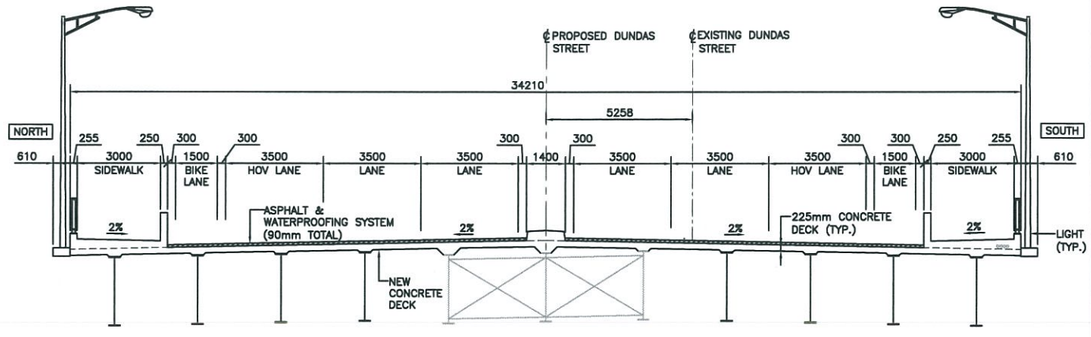

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FIGURE 1

PRELIMINARY ONLY

Notes: BRACING ON NEW GIRDERS NOT SHOWN FOR CLARITY

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Drawn	CA	Ch'kd	MT		
Scale	AS SHOWN			References	

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CONSTRUCTION STAGING
TANSLEY BRIDGE WIDENING
BURLINGTON – HALTON
OVER BRONTE CREEK

Consultant File Nº	Regional Drawing Nº
CONTRACT Nº PR–	Drawing Nº SHEET OF

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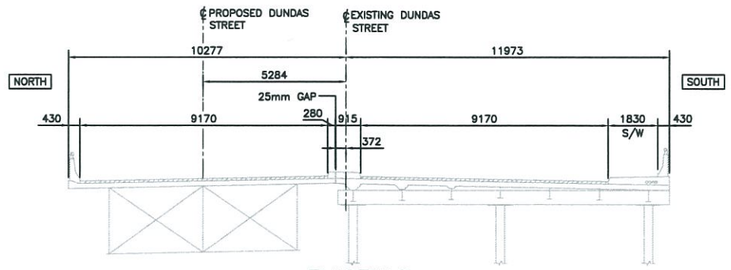

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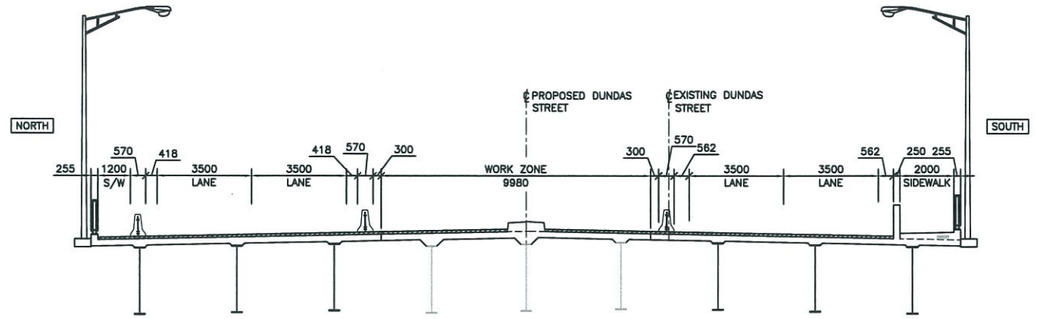

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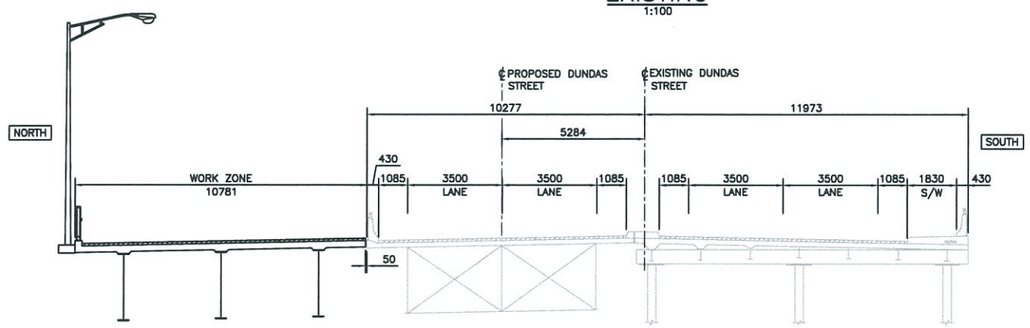

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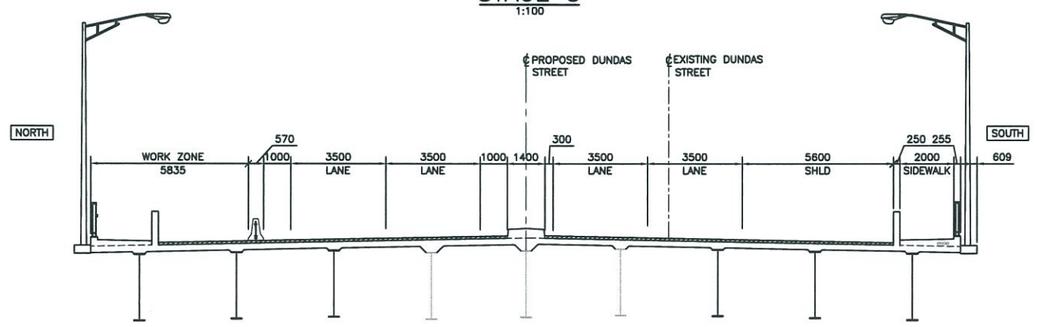

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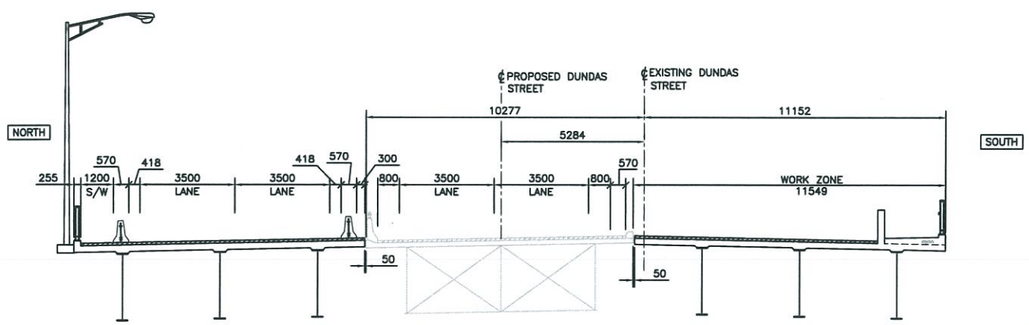

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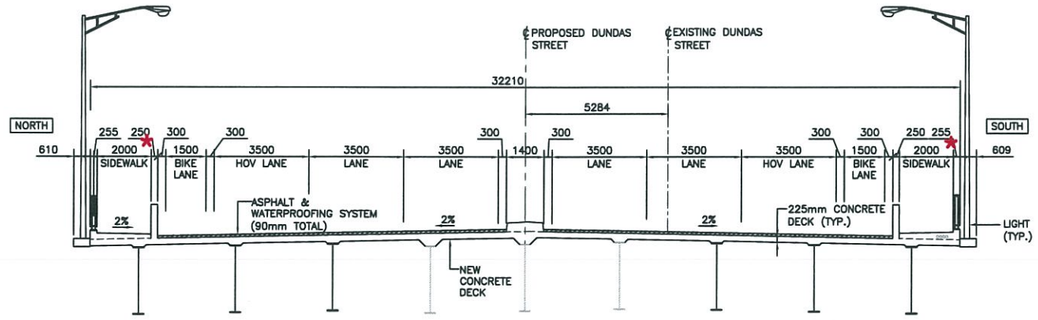

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FIGURE 2

*** Sidewalk width revised to 3.0 m**

PRELIMINARY ONLY

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TANSLEY BRIDGE WIDENING
BURLINGTON – HALTON
OVER BRONTE CREEK

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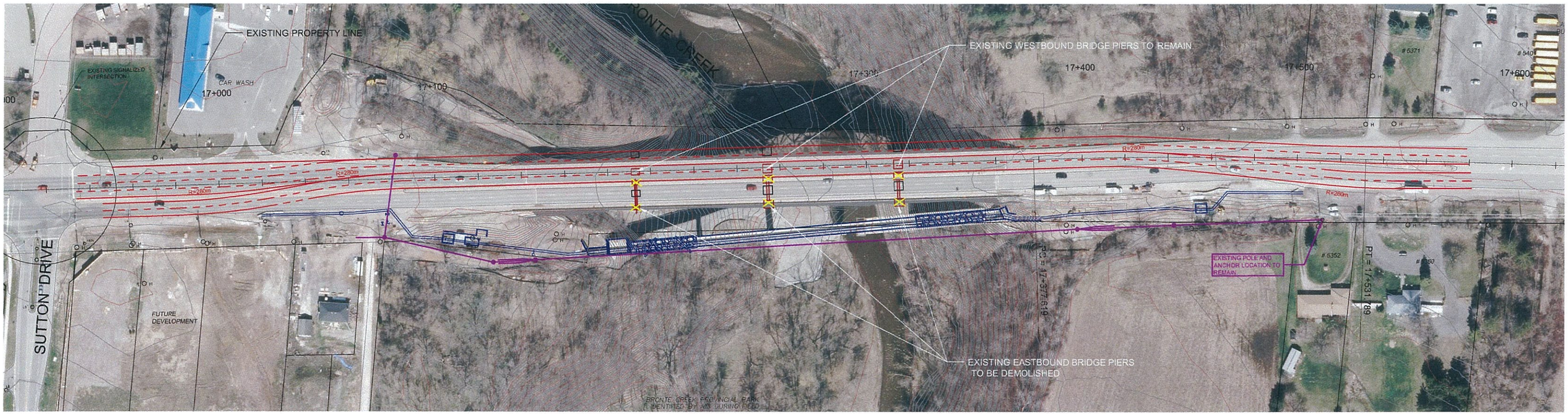
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EXISTING SIGNALIZED INTERSECTION
CAR WASH
17+000
17+100
17+300
17+400
17+500
17+600
EXISTING WESTBOUND BRIDGE PIERS TO REMAIN
# 5371
# 5401
R=280m
R=280m
R=280m
R=280m
SUTTON DRIVE
FUTURE DEVELOPMENT
PC = 17+377.619
PT = 17+531.789
EXISTING POLE AND ANCHOR LOCATION TO REMAIN
5352
5360
EXISTING EASTBOUND BRIDGE PIERS TO BE DEMOLISHED
BRONTE CREEK PROVINCIAL PARK
(LIMITS TO BE VERIFIED AS DURING FIELD

FIGURE 3

APPENDIX E

Preliminary Erection Loads Provided by ES Fox

Outrigger Pad Loads - All Terrain - Results

Enter Email > Select Model > Configure Boom > Lift Details > Results

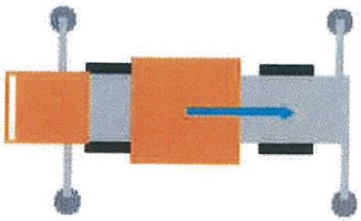
Model: Grove GMK5165-2 w/ Main Boom Only - English
Boom Length: 165.5 ft [0-100-100-100-100]
Counterweight: 88400# Cwt
Support Base: 25.6 x 24.6
Load Radius: 50 ft
Load Weight: 25000 lbs

Slew Angle: 0° = Directly Over Rear

Max Chart 26400 Load lbs =

Front Right: 38598 lbs

Front Left: 38598 lbs



Rear Right: 69808 lbs

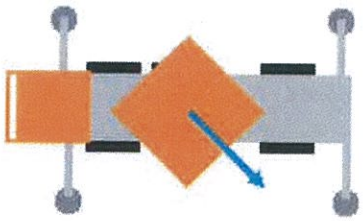
Rear Left: 69808 lbs

Slew Angle: 45° = Over Rear Left Outrigger

Max Chart 26400 Load lbs =

Front Right: 35401 lbs

Front Left: 48183 lbs



Rear Right: 57209 lbs

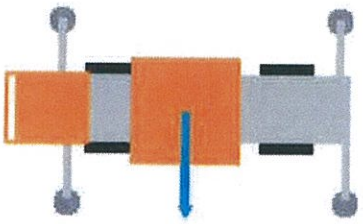
Rear Left: 76202 lbs

Slew Angle: 90° = Directly Over Left Side

Max Chart 26400 Load lbs =

Front Right: 40370 lbs

Front Left: 58384 lbs



Rear Right: 45678 lbs

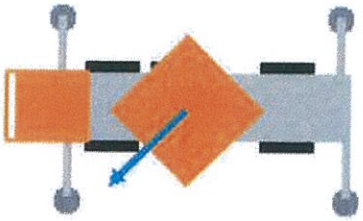
Rear Left: 72473 lbs

Slew Angle: 135° = Over Front Left Outrigger

Max Chart 26400 Load lbs =

Front Right: 50665 lbs

Front Left: 63353 lbs



Rear Right: 41945 lbs

Rear Left: 60937 lbs

Slew Angle: 180° = Directly

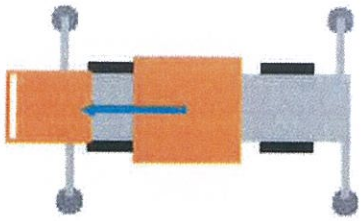
Front Right: 60161 lbs

Rear Right: 48339 lbs

Over Front

Max Chart 26400 Load lbs =

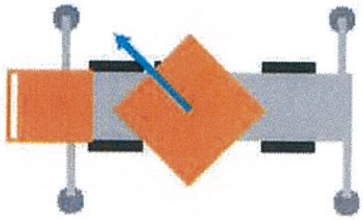
Front Left: 60161 lbs



Rear Left: 48339 lbs

Slew Angle: 225° = Over Front Right Outrigger

Front Right: 63353 lbs



Rear Right: 60937 lbs

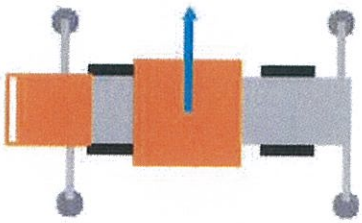
Max Chart 26400 Load lbs =

Front Left: 50665 lbs

Rear Left: 41945 lbs

Slew Angle: 270° = Directly Over Right Side

Front Right: 58384 lbs



Rear Right: 72473 lbs

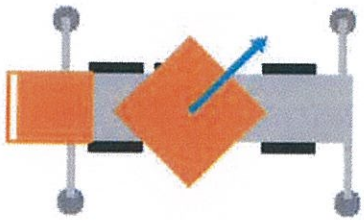
Max Chart 26400 Load lbs =

Front Left: 40370 lbs

Rear Left: 45678 lbs

Slew Angle: 315° = Over Rear Right Outrigger

Front Right: 48183 lbs



Rear Right: 76202 lbs

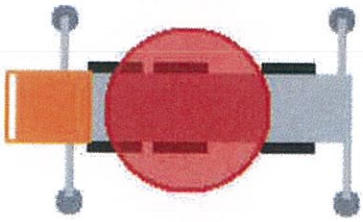
Max Chart 26400 Load lbs =

Front Left: 35401 lbs

Rear Left: 57209 lbs

Slew Angle: Maximum Outrigger Pad Loads

Front Right: 63353 lbs



Rear Right: 76202 lbs

Max Chart 26400 Load lbs =

Front Left: 63353 lbs

Rear Left: 76202 lbs

Back Start Over

APPENDIX F

Minutes of Constructability Review Workshop
September 23, 2014

MMM GROUP

2655 North Sheridan Way, #300
Mississauga, Ontario, L5K 2P8
Tel: (905)823-8500
Fax: (905) 823-8503
Website: www.mmm.ca

MINUTES OF MEETING

PROJECT: Dundas Street Corridor Improvements Class EA
Brant Street to Bronte Road

MEETING: Tansley Bridge Constructability Workshop

FILE NO.: 3212082

DATE: Tuesday September 23, 2014 **TIME:** 10:30 a.m. to 5:00 p.m.

PLACE: 2655 North Sheridan Way, 3rd Floor Boardroom

PURPOSE: To discuss issues associated with constructability for the widening of Tansley Bridge as part of the Dundas Street Class EA Study

PRESENT:

Tony Wing	MMM Group
Bob Stofko	MMM Group
Karen Zan	MMM Group
Neil Ahmed	MMM Group
Katherine Jim	MMM Group
Trevor Small	MMM Group
Kim LeBrun	MMM Group
Anne MacMillan	MMM Group
Stefan Sirianni	MMM Group
Ray Roscoe	Construction Specialist
Steve Matthews	ES Fox
Alastair Gorman	Thurber Engineering
Sally Kelday	Kelday Geomorphic Consulting Ltd
Leah Chisimba	Conservation Halton
Samantha Mason	Conservation Halton
Cory Harris	Conservation Halton
Holly Anderson	Conservation Halton
Sarah Matchett	Conservation Halton
Maureen Van Ravens	Halton Region
Jeffrey Reid	Halton Region
Melissa Green-Battiston	Halton Region
Andrew Gorman	Halton Region
Patrick Monaghan	Halton Region

MINUTES:		ACTION BY:
ITEM 1 – RECAP OF SITE VISIT		
1.1	A site visit at Tansley Bridge was conducted prior to the Workshop from 8:00 am to 9:30 am. An overview of the Dundas Street EA Study and the background of Tansley Bridge were provided during the site visit. The morning's site visit was briefly recapped by Tony Wing.	
ITEM 2 – CONSTRUCTABILITY WORKSHOP FOCUS		
2.1	The overarching goal of the Workshop was discussed, and the purpose of the Workshop is: *to discuss issues associated with the constructability of Tansley Bridge over Bronte Creek.*	
2.2	Four design alternatives were considered by the Project Team for the widening of Tansley Bridge. Through the EA process, Alternative 1 (widen 2 lanes to the north) was identified as preferred and is the basis of the Workshop. General Arrangement and Staging Plan were distributed.	
2.3	In general, staging for the widening of Tansley Bridge are as follows: • Stage 1: Build new 2-lane bridge to the north. Four lanes (two eastbound lanes and two westbound lanes) of traffic on Dundas Street will utilize the existing structures. • Stage 2: Divert two westbound lanes onto the "new north structure"; divert two eastbound lanes onto the "existing north structure". Existing south structure together with the piers will be demolished. A new south structure will be constructed • Stage 3: Two westbound lanes to remain on the "new north structure"; divert two eastbound lanes onto the "new south structure". Rebuild the "middle structure" (previously the "existing north structure") including the construction of the centre median, and tie into the structures to the north and south. • Stage 4: Construct the sidewalk and bike lane on the "new north structure".	
2.4	Halton Region noted that active transportation facilities will be provided throughout the Dundas Street corridor between Appleby Line and Tremaine Road. A 1.5 m on-road bike lane with 0.3 m stripped buffer and a 3.0 m multi-use path on both sides of the road will be provided. The 3.0 m multi-use path with the on-road bike lane will be carried through on Tansley Bridge. MMM will update the General Arrangement to reflect the 3.0 m multi-use path on the bridge (both sides of the road). This may lead to the need for an additional girder on the structure; however, this will not change the discussion related to the overall constructability of the bridge.	
2.5	The Workshop began with the review of comments provided by those in attendance (see attached PDF), with a focus on construction staging and project management, access and egress, steel erection, and removal of the existing steel bridge and piers. Comments from all	

MINUTES:		ACTION BY:
	participants, including Conservation Halton, were provided at the meeting.	
2.6	A summary report will be prepared documenting the Workshop.	MMM
ITEM 3 – REVIEW COMMENTS RECEIVED FROM CONSTRUCTABILITY TEAM		
3.1	Attendees at the Workshop were asked to review the comments received and rank their "top 3" issues. The full list of items can be found in Table 1 appended to the end of this document.	
3.2	Through a roundtable discussion, a shortlist of discussion items for the Workshop was identified: 1. Steel erection, structural capacity, lane closures 2. Erosion and Sediment control 3. Pier and truss demolition 4. Foundation Construction and Interaction 5. Valley Access and Creek Crossing 6. Traffic staging and storage 7. Long-term bank stability A summary of the discussion on these topics is documented under Items 4.1 to 4.7.	
ITEM 4 – DISCUSSION ON TOP ITEMS OF CONCERN		
4.1	**Steel Erection, Structural Capacity, Lane Closures**	
	• **Steel Erection** o ES Fox stated that the environmental impact of operating down in the valley would be substantial due to the weight of the pads that would be required—the minimum crane size would be 300 tonnes. The pier/pad for this crane would be 40 ft. x 60ft. • **Structural Capacity of Bridge** o Due to the limited time available to contractors in the bidding process and the sheer number of competing bidders, there is a high time/cost requirement to generate a bid. As a result, ES Fox noted that it would be in the best interest of the Region to provide as much information as possible in the tender package regarding the load bearing capacity of the bridge/piers. For example: the contract could show what loads the bridge was evaluated at (and at what locations) to provide a starting point for contractors. o If such details are not present in contract documents, a contractor will not be able to properly evaluate the risks associated with erecting a crane on the bridge. o ES Fox further noted that contractors would be able to provide information concerning outrigger loading, point loads, etc. for engineers to evaluate. o ESFox stated that erecting cranes on bridge (two, 110 tonne	

MINUTES:		ACTION BY:
	cranes with 23 ft. width) looked very feasible and would take about 3 weeks and cost approximately $280,000 per crane, or $1.5M total including take-down costs. o No temporary bents would be required in valley if cables are used to brace the piers. o There was some discussion about the load capacity of the existing south structure (the older structure). The structural team stated that it is likely the south structure will be able to handle the load of the 110 tonne cranes. Further analysis will need to be completed during detailed design. • **Lane Closures** o During construction, it is required to temporarily close one lane in each direction for the placement of the cranes and to launch the girders. o The Region advised that during construction, two eastbound lanes must be operational between 6:00am and 9:00am; and two westbound must be operational between 3:00pm and 7:00pm. o Lane closures during the off peak hours are acceptable to the Region. Based on recent traffic counts, the capacity of Dundas Street may be reduced to one lane in each direction between 8 pm and 6 am subject to further review at detailed design. o An additional lane will be required for picking up materials with crane, which can be accommodated on 15 minute rolling closures. This could be accommodated at night. o Traffic could still flow in one direction when trucks stopped to unload girders by using rolling lane/flag closures to manage traffic.	
4.2	**Erosion and Sediment Control**	
	• The OPSS is somewhat dated. Other methods for best management practices will need to be used. • Construction work needs to stay out of the bankfull conditions zone as much as possible. Water levels can change rapidly and introduce foreign materials/sediments from construction work into creek. • Conservation Halton suggested that there should be more focus on erosion control (preventative measures) rather than sediment control (proactive measures).	
4.3	**Pier and Truss Demolition**	
	• ESFox stated that a procedure outlining the criteria for demolition engineers should be included in the tender. • Bridge Deck demolition can be completed by centre-to-edge teardown with trucks, using a tarp to catch residual materials. • All demolition within the bankfull limits must occur within the	

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	aforementioned July 1st to September 15th window.
	• Pier Demolition:
	  o Various demolition strategies were discussed.
	  o MMM suggested that the construction of the Sixteen Mile Creek structure would serve as a good example of best practices.
	• Disposal of broken-up concrete from old piers:
	  o There would be cost savings and sustainability benefits associated with reusing the broken-up concrete for slope stability on site vs. trucking it away as waste and bringing in new material for slope stability.
	  o MMM stated that a steep valley slope lined with crushed rock could result in erosion of rock into the river. Other slope protection/management measures should be explored.
	  o Further to this, Conservation Halton prefers to use rounded rock vs. riprap as it is more conducive to fish habitats and passage.
	  o MMM added that if riprap is double crushed (i.e. size parameters are implemented) issues associated with harming fish habitats may be avoided.
	  o First and foremost, the team needs to determine whether rock lining or vegetation growth on the bank is desirable.
	  o From a constructability standpoint, the main question is whether the rubble is going to be left down in the valley, or hauled away.
	  o Conservation Halton proposed that a checklist for environmental features in Bronte Creek be developed to ensure any work completed remains consistent with Halton Region's environmental design requirements e.g. rock lining (be it riprap or rounded stones) on slopes vs. vegetation growth.
	• Pier Footing Demolition:
	  o No foundation investigation has been completed at this time. MMM Group recommends that the existing footings be assessed to determine what is currently present and where, as the drawings from 1948 need to be confirmed for accuracy.
	  o Thurber Engineering stated that there should be sufficient space to put in caissons between existing piers (~7.7m), so complete removal might not be necessary.
	  o It was discussed whether the existing 6 m footings are to be removed:
	  ▪ Structural wants to make sure they can be worked around properly first.
	  ▪ An investigation to core through existing footings to find out what they're like and what their limits are will be required.	

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4.4	**Foundation Construction and Interaction**	

	• Piers of the existing structure (eastbound lanes structure) currently stand in pairs, forming a single pier further off the ground via an arch. These piers will need to be cut down to accommodate a new pier between said pairs. Structural team may need to investigate bracing concerns between the footings of the existing piers.
	• There is a very high likelihood of water entering any digs that occur due to shale rock in area; as observed at other projects along Bronte Creek.
	  o Issues with this include dewatering the pits or constant flooding/head that will need to be pumped out as concrete is poured.
	  o Thurber Engineering stated that shale rock deteriorates when pits are dug, so pours should occur ASAP once exposed (within 24 hours).
	• Abutments
	  o Caissons are a workable option so the original abutments may not need to be dug out, and drilling with manual rebar cuts would be done.
	• Longitudinal joints between the existing north and south structures would be removed.	

4.5	**Valley Access and Creek Crossing**	

	• Recognizing the environment and topographic constraints associated with the east and west side of the Bronte Creek valley, it was agreed that access to the valley from the northwest of Tansley Bridge would be most suitable.
	  o Property lines in the vicinity of the access point are to be checked, and Infrastructure Ontario will have to be contacted for temporary easement to allow knoll to be excavated.
	  o Bronte Creek Provincial Park should also be informed as this work might fall within their limits of interest.
	  o The widening and construction of the new bridge will result in minor vegetation removal.
	• Piers west of the creek are to have a pad placed in between them.
	• Piers east of the creek:
	  o The steep approach with Bronte Creek to the east makes demolition and construction on these piers difficult.
	  o A ~5 m wide road running adjacent to the east piers on the east side of creek will therefore be required during construction. The road will likely be present for the duration of construction.
	  o It is important to identify measures to mitigate the impacts of this road or any temporary structure will have on fish habitat.
	  o Peak flow events need to be accommodated for in the design of
		MMM

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	this or any temporary structure in order to prevent harmful runoff/construction debris from entering the creek. o Geomorphology issues may result from construction of this road (e.g. erosion and stability of the bank). o Cutting the slope to construct the road was deemed unrealistic so it will need to be shored instead. o Caissons for the two piers can be drilled from the north and the south side respectively. o MNRF has criteria for what they deem as "critical conditions" for certain fish species, and these may impact what options are available. The EA Study team should get preliminary comments from MNRF. o Overall, from a constructability point of view, the team recommends that there be access to the west of the piers from the creek-side. The planning team is to explore this further.	Planning Team
	• During construction, a sizeable temporary bridge will need to be built to accommodate a 2 year, or 5 year storm; the bankfull width is approximately 20 m. Based on the drainage calculation, a ~55m bridge may be required, meaning a temporary pier/crib will be needed in the creek bed. o In-water-work is defined as any work within "bankfull width"; this is approximately 20 metres which is less than a 2-year flood event. o Bronte Creek supports coldwater fish community; therefore, any in-water-work is to occur within the window of July 1st to September 15th. o The installation or removal of a temporary pier will need to occur within this window. MNRF needs to be brought into the discussion to confirm whether the pier can be left in place outside of this window. A permit may be required. o The geomorphology team prefers crossing immediately south of Tansley Bridge as there is a riffle and a more robust creek bed exist. o Terrestrial prefers placing the crossing on the south side of Tansley Bridge rather than the north side. o From a constructability point of view, separating the bridge from the construction zone as much as possible is preferred (i.e. not immediately south of Tansley Bridge, but further south or north of the bridge).	MMM
4.6	**Traffic Staging and Storage**	
	• Facilitating trucks in and out of construction zone (slip on and slip off) should not be an issue if completed off-peak via centre lane. Halton Region is in agreement with this approach. • Westbound left at Dundas Street and Sutton Drive will lose about	

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	half the storage lane due to construction operations. • The location of the new access road/lot configuration for the future development (condominium and townhouses) in the southeast quadrant of Dundas Street / Sutton Drive will be confirmed subject to OMB hearing. The location as it is currently shown on the preliminary plan is too close to the bridge to allow for construction storage in the area. o Construction of the future development will be in advance of the Tansley Bridge widening. o Halton Region will need to work with the developer (ADI) to add caveats to plan regarding future bridge construction project which will begin after the site development is completed. • [*Post meeting notes: Subsequent to the Constructability Workshop, the site plan for the proposed development was updated and the right-in/right-out access is to be located at the mid-point of the property (instead of at the east end of the property initially assumed at the Constructability Workshop). The potential to maintain access during construction is more likely under the current plan (i.e. access at mid-point of the property).*] • East of the bridge, the existing left turn lane (for First Group's property) may be impacted during all stages of construction.	
4.7	**Long-Term Bank Stability**	
	• Conservation Halton stated that rounded river stone on a face sloping back is ideal. • The velocity impacts of Bronte Creek on the meander at this location are likely very high. Mitigation measures will be identified during detailed design. General recommendations can be made in the interim (i.e. as part of the EA Study). A full HECRAS model will be carried out during detailed design.	
ITEM 5 – OPERATIONAL CONSTRAINTS AND ENVIRONMENTAL CONSIDERATIONS		
	• Stormwater management: o Conservation Halton stated that there is precedent for runoff in other low-impact developments for 80+% removal of total suspended solids per portion rather than the minimum 80%, and suggested the possibility of building a pond in the vicinity of Tansley Bridge to do so. o It is not preferred to have direct drainage into the river/valley during construction phase. o Conservation Halton would like to have a longer deck drain installed to bring drainage from deck over to a better runoff area for filtration. o Saltwater management during construction and in the long-term need to be addressed.	MMM

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	○ This work would run on the assumption that the use of temporary deck drains during construction is acceptable. • Snow Removal: ○ Halton Region does not operate plows in construction zones. It should be stipulated in the contract that the contractor is responsible for removal of snow on the roadways, sidewalks, and bike lanes within construction limits. • Fill Management: ○ Disposal of excess material is a key concern in the Province right now. It would be a good practice to itemize what to include in a fill management plan. • Species at Risk: ○ Mitigation measures for Species at Risk should be clearly addressed in contract documents. ○ Conservation Halton requested that any issues related to protected species should be examined in finer detail via a standard process as the detailed design phase draws nearer. • Spills Management: Environment Canada will need to be involved regarding spills management.	MMM
ITEM 6 – MAJOR ITEM QUANTITIES		
	List of construction items that will be required in the valley (on-going) • Backhoe • Pincers (cut steel) • Concrete pincers • Tandem dump trucks (haul out excess material) • Caisson driller • Crawler crane (modest size) plus second one to support it. • Loader	
ITEM 7 – CONCLUDING REMARKS AND OUTSTANDING ITEMS OF CONCERN		
	At the end of the workshop, all members of the team were asked to state their top three outstanding concerns related to constructability. These are summarized in Table 3 (appended to this document), and cover items that were not addressed, or not fully addressed, during the course of the day's workshop.	

The foregoing represents the writer's understanding of the major items of discussion and the decisions reached and/or future actions required. If the above does not accurately represent the understanding of all parties attending, please notify the undersigned within 48 hours of receiving these minutes at 905-823-8500.

Minutes prepared by,
MMM Group

Stefan Sirianni
cc: all attending

Table 1: Results of Roundtable Discussion on Potential Items of Concern

No.	Item of Concern	Tabled By
1	Valley Access	Ray Roscoe
2	Temporary Creek Crossing	Ray Roscoe
3	Pier and Truss Demolition	Ray Roscoe
4	Foundation Investigation is missing	Alastair Gorman
5	South structure east abutment removal (stability concerns)	Alastair Gorman
6	Interaction between driven piles—existing piles—make sure on bedrock and would not be undermining new construction while still in service	Alastair Gorman
7	Vegetation Removals, where?—some species of concern present	Holly Anderson
8	Species at Risk (SAR) mitigation measures. Should be addressed as clearly as possible in contract document for contractors.	Holly Anderson
9	Long term stream and bank stability. Integrate preferred staging method mitigations with long term measures.	Corey Harris, Neil Ahmed
10	Erosion and Sediment Control	Corey Harris
11	Fill mgmt.—specifically disposal of excess material. Big issue in province right now. Would be helpful to itemize what needs to be included in a fill mgmt. plan.	Corey Harris
12	Sidewalk widths and Access to them: During construction we will not have a full sidewalk width. For 2-3 years it will only be 1200mm. During winter time it will be difficult to clear.	Trevor Small
13	Should be written in contract that contractor clear snow in construction zone.	Jeff Reid
14	Steel erection (crane pads included)	Bob Stofko
15	Staging and Storage Areas	Karen Zan
16	Traffic Shifts and mgmt.	Karen Zan
17	Timing: Can we build the foundations that sit in the water within available windows. Could increase duration of construction. i.e. can in-water work be done within constraints? Need to put in temp. pier, and take out during window. Can it be *left* there during window? MNRF to be brought into discussion to discuss/confirm. May require permit. Any demolition to be done during same window.	Anne MacMillan Sarah Matchett
18	Zone three water main	Sarah Matchett
19	Vegetation	Leah Chisimba
20	Lane Closures	Steve Matthews
21	Load capacity of existing structure for cranes, etc.	Steve Matthews
22	Foundation construction dewatering/excavation and impacts (from a fish community perspective)	Samantha Mason
23	Stormwater mgmt. from road	Samantha Mason
24	Saltwater mgmt. during construction and in long-term	Samantha Mason
25	Temporary creek crossing and how it relates to stream flow	Sally Kelday
26	Culvert 18 removal: links in to erosion sediment control concerns	Sally Kelday

Table 2: Top Seven Items of Concern Tabled for Detailed Discussion as Voted on by Team

No.	Item of Concern	Original No.
1	Valley Access and Creek Crossing	1, 2
2	Steel erection, structural capacity, lane closures	14, 20, 21
3	Erosion and Sediment control	10
4	Pier and truss demolition	3, 5, 22
5	Foundation Construction and Interaction	4, 6, 22
6	Traffic staging and storage	15, 16, 20
7	Long-term bank stability	9, 10, 11

Table 3: Top Issues for Planning Team to Explore Further (Outstanding Items of Concern)

Name	Top Issues
Ray Roscoe	1. Valley Access: issues that we've identified, creek crossing and location of it on the east bank is the biggest issue left. 2. Tied to this, pier demolition as it's associated with the access on the east side of the creek; 3. Access to the caisson construction for the east piers
Alastair Gorman Thurber Engineering	1. Construction Access 2. Pier demolition 3. Foundation construction in general: I think we need a little more investigation into where the abutments are going relative to the existing structure (what layer of shale); Queenston (upper, softer red) and Dundas (lower, harder, grey)
Holly Anderson Conservation Halton	1. Valley Access in terms of potential widening for equipment 2. Vegetation requirements to do so 3. SAR 4. Lighting to limit impact on wildlife
Cory Harris Conservation Halton	1. Creek crossing in the area around the piers on the east side 2. Getting more info on the dimensions and a plan for working around constraints 3. Temporary crossing: we should work with Sally to find a location that will be stable for the 3-4 years it will be in place 4. Overall creek protection measures during the demolition of the bridge (e.g. demolishing the east pier)
Trevor Small MMM	1. Road protections between staging is going to be difficult. 2. Creek crossing location. Getting material in and out of the east bank.
Neil Ahmed MMM	1. The need to minimize disruptions to traffic is going to be important. How impacts are mitigated for the community are going to really impact the success of the project (public perspective) 2. Aesthetics: look into making it aesthetically pleasing to view/view off of during construction. E.g. viewing points off the bridge into the valley 3. Pedestrian access during staging (directing them to north side). There is currently no sidewalk on either side of the road east of the bridge. From a liability perspective: will need to provide a crossing for pedestrian access.
Bob Stofko MMM	1. Sorting out the abutment issues and how the foundations will work their relative to the original 2. Work area on the east bank 3. Crane loads
Karen Zan MMM	1. Space down below in the valley 2. More work up top with respect to construction ingress and egress 3. How we manage construction with respect to public access, businesses, side streets, etc.
Leah Chisimba Conservation Halton	1. Creek crossing 2. Figuring out the staging areas in the valley: size and location
Steve Matthews ES Fox	1. Bob's 2. Looking at the existing bridge: verifying closure times 3. Dimensions look fine, need custom load riggers needed. Get sketch off of Tony 4. Could stipulate noise controls in contract to prevent contractors from completing loud work at night time.
Patrick Monaghan Halton Region	1. Valley Access 2. Long Term Bank Stability 3. Making sure Halton's policies (e.g. times outlined in tender for closures)

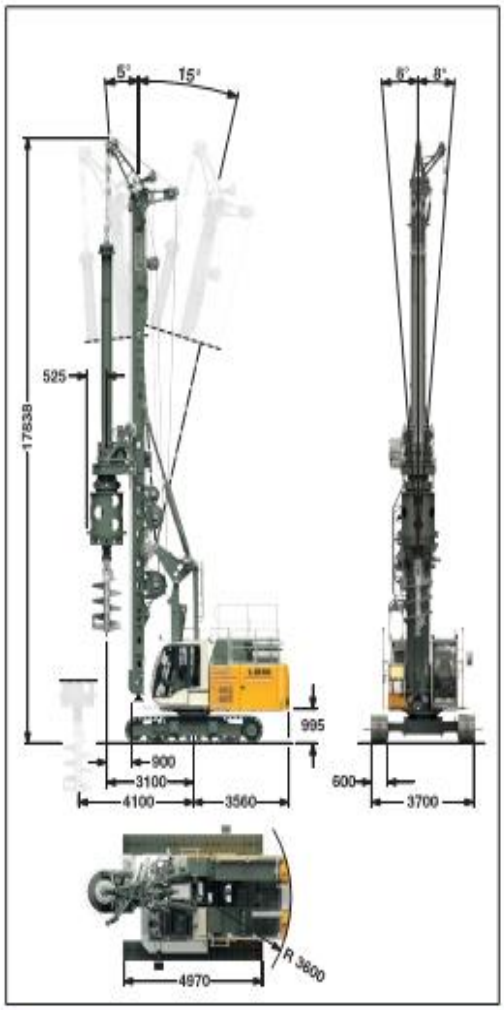
Name	Top Issues
	are abided by.
Melissa Green-Battiston Halton Region	1. Construction Staging for traffic at various stages 2. Creek crossing 3. Valley access
Jeff Reid Halton Region	1. Creek crossing 2. Coordination with CN crossing to the west: should be completed around the same time so that the roadwork in between can be completed in one shot. **They should be included within the same contract**. 3. Traffic: huge project, so want to have a positive impact on the community i.e. notifying residents well in advance of any closures or disruptive work
Andrew Gorman Halton Region	1. Creek crossing: type (impact on cost) 2. Steel erection: launching vs. crane erection (feasibility of) 3. Traffic Staging
Sally Kelday Kelday Geomorphic	1. East bank working area: how it relates to the stability of the bank 2. Temporary Creek Crossing
Katherine Jim MMM	1. Staging area space on east bank 2. Following up with water resource group on drainage from deck and culvert 3. Will not have the answer to everything in this stage, so some things will need to be marked for addressing during detailed design work
Kim LeBrun MMM	1. East bank 2. Creek crossing 3. SAR
Samantha Mason Conservation Halton	1. Amount of dirt that would be in staging area and how it would remain out creek during construction 2. How to get between both sides of the creek 3. Long term bank stability for fish habitats 4. May be a requirement from oceans/fisheries due to proximity to water and infilling of fish habitat and potential serious harm to fish. 5. MNRF should be included in future talks
Sarah Matchett Conservation Halton	1. Creek crossing/access 2. Sediment erosion control during and post construction 3. Uncertainty surrounding approvals that may be required from various agencies. If it affects the project they should be brought into discussions early on. 4. Demolition of the east pier: e.g. dropping them, piece by piece, etc.
Tony Wing MMM	1. More time on issues of the abutments (how we build around old ones) 2. Roadway protection 3. East bank area 4. Making sure we have access to various residences up top. Getting in and out of construction zone.

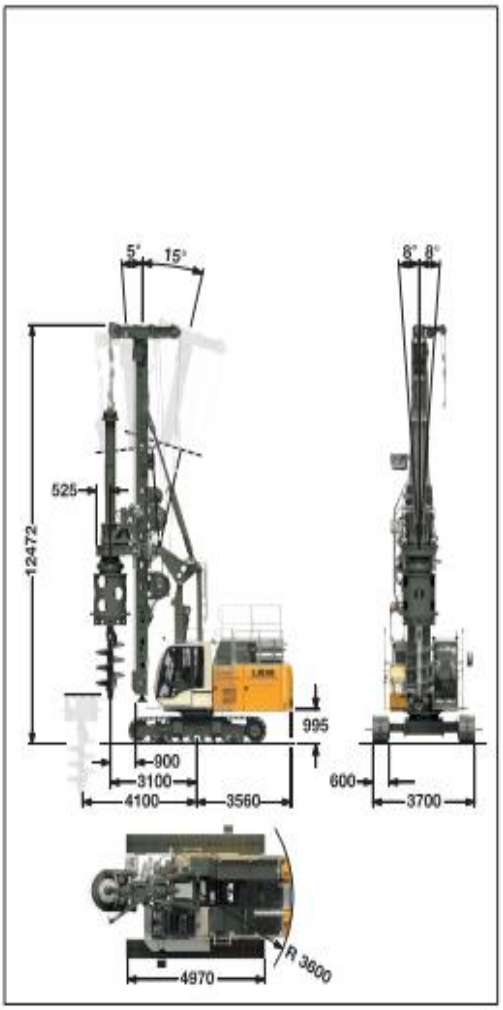
APPENDIX G

Caisson Boring Rig

Dimensions

Basic machine LB 16 and LB 16 Low Head





Technical data

Technical data