APPENDIX C: TECHNICAL SUPPORTING DOCUMENTS

APPENDIX C-8: GEOTECHNICAL B-LINE

PART 1/1
Memorandum

To: Peter Olak, P.Eng.  

Subject: Geotechnical Review- Hamilton Rapid Transit Preliminary Design and Feasibility Study (B-line), September 2011

From: Gwangha Roh, P.Eng., Ph.D., Eric Tiedje, EIT, Ph.D., Miln Harvey, P.Eng., Ph.D.

Date: October 14, 2016  
Project Number: 60507521

1. Introduction

Metrolinx is working with the City of Hamilton to develop rapid transit through a Light Rail Transit (LRT) system. An Engineering and Environmental Assessment (EA) has been conducted by Steer Davis and Gleave (September 2011) for the initial proposed LRT consisting of a 14 km east-west B-Line. As part of the EA engineering support (requested by SDG and Metrolinx), the previous geotechnical EA assessment (Appendix B.7 of SDG EA report) prepared by Thurber Engineering Ltd. for the B-line only was reviewed by AECOM.

This memorandum presents a review summary of geotechnical evaluation and provides additional preliminary recommendations to finalize the B-line geotechnical EA report.

2. Project Changes after EA Submission in 2011

The following changes were made after submission of the SDG EA report (September 2011):

- Total B-line length was reduced from approximately 14 km to approximately 11 km; and,
- Number of stops on the B-line was reduced from 18 to 13.

3. Subsurface and Groundwater Conditions

Since the proposed LRT alignment is not changed, the previous geotechnical EA findings on the subsurface and groundwater conditions are still applicable. Eight (8) additional boreholes close to the proposed B-Line corridor were found in a review of the City of Hamilton’s geotechnical database, but there is no significant impact on the provided subsurface and groundwater conditions in the 2011 geotechnical EA report.
4. Review of EA Geotechnical Evaluation and Preliminary Recommendations

A preliminary geotechnical evaluation and various recommendations were provided in Section 5.0 of the geotechnical EA report. AECOM has provided comments on this section and additional recommendations are provided below.

4.1 Track Design

The provided LRT track design is similar to the typical LRT track design presented in the Transpiration Research Board (TRB) Transit Cooperative Research Program (TCRP) Report 155 “Track Design Handbook for Light Rail Transit”. Typical 3% cross fall on the subgrade level, 300 mm thick Granular ‘A’, sub-drain, an approximately thick 250 mm first pour and 200 mm thick second pour were presented on the typical cross section. Actual track structural design should be carried out with consideration of site-specific subsurface and groundwater conditions as well as traffic loading conditions.

Provided subgrade modulus values should be verified during the detailed design stage, and typical values for a preliminary design purposes can be found in the Chapter 7 of the latest Canadian Foundation Engineering Manual (CFEM, 4th Edition).
Table 4.1.1. Typical Ranges in Vertical Modulus of Subgrade Reaction, From CFEM, Chapter 7.

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>$k_v$ (MPa/m) (*)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Granular Soils (Moist to Dry)</strong></td>
<td></td>
</tr>
<tr>
<td>Loose</td>
<td>5 – 20</td>
</tr>
<tr>
<td>Compact Sand</td>
<td>20 – 60</td>
</tr>
<tr>
<td>Dense</td>
<td>60 – 160</td>
</tr>
<tr>
<td>Very Dense</td>
<td>160 – 300 (*)</td>
</tr>
<tr>
<td><strong>Cohesive Soils</strong></td>
<td></td>
</tr>
<tr>
<td>Soft</td>
<td>&lt; 5</td>
</tr>
<tr>
<td>Firm</td>
<td>5 – 10</td>
</tr>
<tr>
<td>Stiff</td>
<td>10 – 30</td>
</tr>
<tr>
<td>Very Stiff</td>
<td>30 – 80</td>
</tr>
<tr>
<td>Hard</td>
<td>80 – 200 (*)</td>
</tr>
</tbody>
</table>

*Detail notes, please refer to CFEM Chapter 7

Depending on the site-specific subsurface conditions and subgrade inspection findings during construction, proper frost mitigation measures should be implemented to minimize any frost related maintenance issues. For a preliminary design purposes, most commonly used MTO frost susceptibility criteria is provided in the table below.

Table 4.1.2. Frost Susceptibility of Soils (MTO).

<table>
<thead>
<tr>
<th>Grain Size (5 to 75 µm)</th>
<th>Susceptibility to Frost Heave</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 40%</td>
<td>Low</td>
</tr>
<tr>
<td>40 to 55%</td>
<td>Moderate</td>
</tr>
<tr>
<td>55 to 100%</td>
<td>High</td>
</tr>
</tbody>
</table>

If a detailed frost study is required, the following factors should be considered:

- Seasonal ground temperatures and thermal gradients;
- Mobility of water;
- Seasonal depth of the groundwater table; and
- Soil type and condition (e.g. segregation potential).

Consideration can also be given to the use of geo-synthetics depending on subgrade condition.

4.2 LRT Stop Foundations

Although the geotechnical EA report noted that foundations should be placed below the frost depth (1.2 m), the typical stop platform detail presented in the geotechnical EA report has about 1.8 m of earth cover, reprinted in Figure 4.2.1. This may be due to site-specific subsurface and groundwater conditions. It is suggested to present a minimum frost cover requirement (1.2 m) on the typical drawing instead of site-specific foundation depth.

In case of using short caisson foundations in a frost susceptible soil with a high groundwater table, adfreezing/frost heave uplift mitigation should also be considered.
4.3 OCS Pole Foundations

Based on the available borehole data, it is anticipated that conventional concrete cast-in-place piles (caissons) could be used for supporting the LRT OCS and light poles. Locally deeper caissons may be required due to the observed poor quality fill and loose native soils near the existing grade. It should be pointed out that the Contractor shall be aware of the possible obstructions (such as demolition rubble in the fill and cobbles/boulders in the native sand/gravel and clay till) during the caisson installation.

Caissons under lateral loading conditions should be analyzed and designed using the method described by Broms, as detailed in the following papers:


Alternatively, consideration can be given to the use of p-y curve approach (as per CFEM Chapter 18).

In any case, a passive resistance of soil within the frost depth should be ignored for the OCS pole design.
4.4 Highway 403 Structure Foundations

AECOM has prepared General Arrangement drawings (see Appendix A) for a 10-span highway bridge which will carry two LRT tracks over Highway 403 between Main Street West and King Street West. This structure can be supported on deep foundations such as driven steel H-piles or cast-in-place concrete caissons.

It should be noted that a buried CSO storage tank and outfall channel are located between King Street West and Main Street West on the east side of the Highway 403 and the exact location and depth of these structures should be considered for the detailed bridge foundation design.

The provided driven H-pile capacities (a factored geotechnical axial resistance of 1600 kN/pile at ULS and geotechnical axial reaction of 1200 kN/pile at SLS, for HP 310x110) may be based on the previous MTO pile load test results (in early 1960’s, GEOCRES 30M05-65) in the vicinity and the old MTO driven pile capacity guidelines. MTO driven H-pile capacity limits have been changed as outlined in Table 4.4.1:

<table>
<thead>
<tr>
<th>Year</th>
<th>Pile Types</th>
<th>Factored axial geotechnical resistance at ULS (kN)</th>
<th>Pile Capacity Limit</th>
<th>Axial geotechnical reaction at SLS (kN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before 1998</td>
<td>HP 310x110</td>
<td>1600</td>
<td>1150</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HP 310 X 79</td>
<td>1150</td>
<td></td>
<td>825</td>
</tr>
<tr>
<td>1998-2011</td>
<td>HP 310x110</td>
<td>2000</td>
<td>Upon pile settlement &lt; ULS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HP 310 X 79</td>
<td>1450</td>
<td>Upon pile settlement &lt; ULS</td>
<td></td>
</tr>
<tr>
<td>After 2011</td>
<td>regardless</td>
<td>Based on the geotechnical resistance of piles</td>
<td>Upon pile settlement</td>
<td></td>
</tr>
</tbody>
</table>

It is suggested that dynamic pile load tests be performed (e.g. PDA, CAPWAP etc.) to confirm the design pile capacity for a cost-effective foundation design.

Typical rock-shale adhesion of 400 to 800 kPa (factored) can be used for cast-in-place concrete pile designs (socketed into bedrock) depending on the bedrock quality. Rock socketed caisson capacity can be verified by field tests (e.g. Osterberg cell). Typically rock socketed caissons use either shaft resistance or end bearing only depending on construction details due to the anticipated strain related pile resistance development.

The use of wing walls or RSS walls at the abutment locations is not clearly identified. Approach fill details are not known. Embankment and retaining structure stability and serviceability (settlement) should be assessed in the detailed design stage.

4.5 CP Crossing at King Street and Highway 403 Foundations

Based on the latest LRT plan drawing, no widening of existing CP overhead will be required. MTO GEOCRES 30M05-034 (King Street Overhead & Church Access Overhead for Chedoke Express way, 1960) and contract drawings (see Appendix A) are available for the nearby CP overhead structure on Hunt Street. The Hunt Street CP overhead structure is supported by spread footings placed at approximately El. 85 m and a bearing capacity of 6000 pounds/square foot, or 3 t.s.f. (equivalent to an allowable bearing capacity of 285 kPa) was used. Another nearby existing CP overhead structure between King Street and Hunt Street is also supported by spread footings based on the available structural drawings.
No as-built drawing and subsurface information of the existing King Street CP overhead structures are available at the time of preparing this memorandum. In addition, site-specific subsurface and groundwater conditions should also be verified during the detailed investigation stage.

4.6 Existing Pedestrian Bridge and MacNab Truck Tunnel

No geotechnical issues are anticipated at the existing pedestrian bridge and MacNab truck tunnel locations.

It is our understanding that the existing pedestrian bridge can be removed to maintain minimum LRT vertical clearance.

4.7 Proposed CP Spur Line Crossing Near East Bend Avenue

The existing CP at-grade crossing near East Bend Avenue South on King Street East is planned for a grade separation. The two LRT tracks will pass underneath the CP tracks.

Based on the AECOM prepared GA drawing for this grade separation (included in Appendix A), approximately 6.5 m of vertical clearance will be provided for the LRT, and retaining walls (most likely in-situ walls, such as contiguous caisson wall or soldier pile and concrete lagging) will be constructed on both sides of the crossing.

For a temporary braced support of excavation (SOE) system, the earth pressure distribution (apparent) can be estimated as described in Section 26.10 of the CFEM (2006) or Chapter 28 of Metrolinx Design Criteria Manual (DCM). A typical triangular earth pressure distribution can be used for a temporary SOE without internal bracing, or permanent earth retention system design. Surcharge and water pressure should be taken into consideration, as appropriate, for all temporary excavation support systems and permanent earth retention systems.

A detailed construction staging plan and temporary excavation support design should be prepared in the detailed design phase.

4.8 Relocation of Underground Utilities

All utilities within the LRT footprint should be relocated/installed in accordance with the provided Metrolinx utility zoning scheme (Figure 4.8.1). Due to space limitations, consideration may be given to the use of a trench box or an internally braced temporary shoring system. The internally braced retaining structure should be designed in accordance with the relevant provincial standards and design codes (OPSS, CFEM and Metrolinx DCM). Surcharge and water pressure should be taken into consideration, as appropriate, for all temporary excavation support systems.

All other excavations should be carried out as per OHSA requirements.

Pipe bedding and backfill should be placed in accordance with relevant City of Hamilton Standards (watermain and sewer standard drawings, and relevant specifications)
All utility excavations/trenches should be backfilled and restored as per City of Hamilton requirements (both materials and construction quality requirements). The existing pavement structure should be matched as much as possible to maintain the drainage and provide uniform support to the traffic.

4.9 New Pavement or Pavement Rehabilitation Design

The current standard for pavement design in the City of Hamilton (2016) is specified based on the Superpave Design Method. For arterial roads, the minimum design standard for flexible pavements is as follows:

- Superpave 12.5 FC2 (PG 64-28) 40 mm
- Superpave SP 19.0 (PG 64-28) in two lifts 120 mm
- OPSS Granular A Base 150 mm
- OPSS Granular B Type II Subbase 450 mm

Although the City of Hamilton does not have a minimum requirement/standard for a composite pavement structural design, composite pavements with variable thickness were encountered throughout the existing King Street and Main Street.

Adequate pavement design (flexible or composite) should be carried out during the detailed design phase with consideration given to subsurface and traffic conditions.

5. Hydrogeology Overview and Construction Groundwater Control

A preliminary hydrogeological assessment of the B-Line alignment was completed for the EA Geotechnical Report (Appendix B.2 Hydrogeology and Contaminated Soil) and summarized in the Geotechnical Report (Appendix B.7 Geotechnical: Section 4.0 Summary of Geotechnical Conditions). A summary of this information includes the following:

- The study area (B-Line alignment) consists of heavily urbanized areas (residential, commercial and industrial development) with the presence of underground utilities;
- The alignment crosses 3 entrenched rivers (Coldwater Creek and Chedoke Creek in the west end, and Red Hill Creek in the east end);
• The topography is typically flat, sloping gently northward toward Cootes Paradise, Hamilton Harbour and Lake Ontario, which reflects the fact that the City of Hamilton is situated on a nearly level terrace of the Iroquois Plain (Chapman and Putnam, 1966);
• The only regional aquifer identified in the study area is the overburden sand and gravel aquifer located at the west end of the B-Line. there are no other regional aquifer identified in the rest of the study area;
• The water table is relatively deep to the west of Highway 403, ranging from approximately 2 m bgs to 16 m bgs, whereas the water table is relatively shallower east of Highway 403, ranging from approximately 2 m bgs to 9 m bgs; a perched water table at approximately 1 m bgs may be present at various locations along the central portion of the study area;
• The general direction of groundwater flow is from the southern highlands (and the Niagara Escarpment) toward Cootes Paradise and Hamilton Harbour to the north, but the presence of deep infrastructure and other shallow linear infrastructure will affect groundwater flow within the study area;
• The majority of the study area is considered to be a discharge area where groundwater flow is upwards toward the ground surface, except in the Red Hill Valley, which is considered to be a recharge area;
• There are no municipal wells within the study area, and as a result, there are no Source Water Protection Areas along the alignment. The closest Wellhead Protection Area is for the Greensville wellfield, which is located 5 km northeast of the western portion of the alignment;
• The closest Permit to Take Water is located approximately 1 km north of the alignment in the vicinity of the intersection of King and Queen Streets;
• A number of contaminated sites have been identified along the alignment, and an assessment of the potential for more contaminated sites is being completed concurrently.

The B-Line is planned to be at-grade construction and from a groundwater construction control perspective, the following observations are relevant:

• Shallow groundwater levels may occur along the proposed route and, as a result, dewatering parts of the proposed route during construction may be required;
• A Permit to Take Water may be required to address groundwater extraction for construction dewatering;
• During construction, contaminated groundwater may be encountered at some locations along the alignment and, as a result, any groundwater that is pumped from construction dewatering should be assessed for water quality parameters prior to disposal.

6. Recommendations for IO AFP Due Diligence Investigation

The available subsurface and groundwater information was reviewed and the investigation requirements for the next stage are identified with consideration of Infrastructure Ontario (IO) AFP-Geotechnical, Hydrogeology, Environmental Due Diligence Technical Requirements-Civil Infrastructure Projects (final draft dated on January, 2016). The minimum due diligence geotechnical investigation requirements are summarized in Table 6.1.
Table 6.1. Minimum Geotechnical Investigation Requirements (Infrastructure Ontario).

<table>
<thead>
<tr>
<th>#</th>
<th>Type of Structure</th>
<th>Conditions</th>
<th>Recommended Borehole</th>
<th>Minimum Depth (m)</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Location/Detail</td>
<td>Spacing (m)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Road (surface)</td>
<td>Urban-Existing Road, No widening</td>
<td>Each direction</td>
<td>50 to 100</td>
<td>4.5 m BSGE or ARBR</td>
</tr>
<tr>
<td>2</td>
<td>Track (surface)</td>
<td>Rural/Urban-New Track</td>
<td>Each direction</td>
<td>35 to 70</td>
<td>5 m BSGE or ARBR</td>
</tr>
<tr>
<td>3</td>
<td>Surface Station/Associated building structures</td>
<td>Formerly developed (With subsurface structure)</td>
<td>Building Area</td>
<td>15 to 30</td>
<td>6 m BFBE/BPTE or ARBR, 3 m rock coring in case of shallow bedrock, in case of poor subsurface condition extend boreholes deeper to encounter 3 m competent soil.</td>
</tr>
<tr>
<td>4</td>
<td>Surface Parking</td>
<td>Formerly Developed (With subsurface structure)</td>
<td>Parking Area</td>
<td>30 to 60</td>
<td>4.5 m BSGE or ARBR</td>
</tr>
</tbody>
</table>

Formerly developed (No subsurface structure)
<table>
<thead>
<tr>
<th>#</th>
<th>Structure</th>
<th>Conditions</th>
<th>Location/Detail</th>
<th>Recommended Borehole Spacing (m)</th>
<th>Minimum Depth (m)</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Utilities</td>
<td>Formerly developed</td>
<td>Alignment</td>
<td>30 to 60</td>
<td>6 m BIL or 2 TDOE-WEG (this seems extensive, typical utility borehole extended to 2 times of the pipe diameter below the proposed invert level)</td>
<td>Utilities boreholes are combined with LRT track boreholes. Depending on the actual utility depth, borehole depth should be adjusted.</td>
</tr>
<tr>
<td></td>
<td>Alignment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Abutments</td>
<td>Two way single lane</td>
<td>2 BHs</td>
<td>Deep foundations - minimum 10 m BPTE or auger refusal at Bedrock, At least one BH to minimum 30 m BPTE. If bedrock is encountered, minimum 5 m rock coring into competent bedrock (IO AFP guidelines may be extensive and these should be discussed with Metrolinx).</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bridge</td>
<td>Two way multilane</td>
<td>3 BHs</td>
<td>Shallow foundations - Increase BH to five for each foundation element. If bedrock is encountered, minimum 3 m rock coring should be done in 50% of BHs. Artesian condition (if encountered) should be recorded and sealed properly.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Piers</td>
<td>Per pier</td>
<td>1 BH</td>
<td>Same as abutments</td>
<td></td>
<td>Highway 403 flyover, CP overpass extension at King Street near Highway 403. The proposed Highway 403 overpass will carry two tracks and 2 BHs per each abutment to 30 m depth below the existing grade (including 3 m rock coring) are proposed for a preliminary work plan. Same investigation scheme was used for the CP overpass extension.</td>
</tr>
<tr>
<td></td>
<td>MSE or retaining walls</td>
<td>Each side</td>
<td>25 m c/c with minimum 3 BHs</td>
<td>10 m BFBE or ARBR</td>
<td></td>
<td>Locations and details are not available No BH for this element is included in a preliminary work plan.</td>
</tr>
<tr>
<td>#</td>
<td>Type of Structure</td>
<td>Conditions</td>
<td>Location/Detail</td>
<td>Recommended Borehole Spacing (m)</td>
<td>Minimum Depth (m)</td>
<td>Remark</td>
</tr>
<tr>
<td>----</td>
<td>------------------</td>
<td>------------</td>
<td>----------------</td>
<td>-------------------------------</td>
<td>------------------</td>
<td>--------</td>
</tr>
<tr>
<td>6</td>
<td>Wing walls</td>
<td>Each side</td>
<td></td>
<td>25 m c/c with minimum 1 BH</td>
<td>6 m BFBE or ARBR</td>
<td>No information available No BH for this element is included in a preliminary work plan.</td>
</tr>
<tr>
<td>7</td>
<td>Approach fills</td>
<td>Each side</td>
<td></td>
<td>25 m c/c with minimum 1 BH</td>
<td>Extend 6 m BSGE or 100% of embankment height (fill) or 50% of cut depth below the base of embankment. If bedrock is encountered, presence of bedrock should be confirmed with multiple boreholes</td>
<td>Extent of approach embankment is not available</td>
</tr>
<tr>
<td>8</td>
<td>Culvert</td>
<td>-</td>
<td>BHs at Inlet and outlet location</td>
<td>25 m interval along culvert alignment</td>
<td>Same as bridge abutment (IO AFP guidelines may be extensive and these should be discussed with Metrolinx)</td>
<td>No culvert work is identified No BH for this element is included in a preliminary work plan.</td>
</tr>
<tr>
<td>9</td>
<td>Slope stability</td>
<td>V:H=1:3 or steeper</td>
<td>Each side</td>
<td>50 m c/c at toe minimum 3 50 m c/c at top of slope</td>
<td>3 m below toe elevation or ARBR</td>
<td>No detail information available No BH for this element is included in a preliminary work plan.</td>
</tr>
<tr>
<td>9</td>
<td>Tunnel</td>
<td>Cut and Cover (soil, formerly developed) Favorable medium</td>
<td>20 to 40 25 to 50</td>
<td>9 m BFBE/BPTE, outer rows of BHs should be as close as possible to perimeter of excavation</td>
<td>CP Spur line crossing near East Bend Avenue. 6 BHs to 20 m depth are included in a preliminary work plan.</td>
<td></td>
</tr>
</tbody>
</table>

Notes:  
BSGE: below subgrade elevation  
ARBR: auger refusal at bedrock  
BFBE: below foundation base elevation  
BPTE: below pile tip elevation  
BIL: below invert level  
TDOE: times depth of excavation  
WEG: whichever is greater  
c/c: centre to centre
As part of the hydrogeology investigation, we proposed to include the following hydrogeological testing of the geotechnical boreholes:

- Monitoring wells for one (1) of every three (3) boreholes;
- Well development prior to testing;
- Water quality sampling of every monitoring well;
- Slug testing of every second monitoring well; and
- A short-term pumping test for each of the excavations for deep structures.

Due to the extensive minimum investigation requirements stipulated in the current IO AFP Document (2016), consideration can be given to the use of Infrastructure Ontario (IO) AFP-Geotechnical, Hydrogeology, Environmental Due Diligence Technical Requirements (May, 2012), which has been successfully used for a number of large scale transit projects in the GTA.

7. Closure

We trust that the information provided in this memorandum is sufficient for the EA amendment. Should you have any questions, please do not hesitate to contact the undersigned.

Eric Tiedje, E.I.T., Ph.D.
Geotechnical Engineer-in-Training

Miln Harvey, Ph.D., P.Eng., FEC
Senior Hydrogeologist

Memorandum Reviewed By

Gwangha Roh, P.Eng., Ph.D.
Senior Geotechnical Engineer
References

1. SDG-SNC Lavalin: Hamilton Rapid Transit Preliminary Design and Feasibility Study, Appendix B7 Geotechnical Design Brief, September 2011
3. Canadian Standards Association, Canadian Highway Bridge Design Code S6-14
10. Infrastructure Ontario (IO) AFP-Geotechnical, Hydrogeology, Environmental Due Diligence Technical Requirements (final draft dated on May, 2012).
11. Ontario Department of Mines, Map 2034, Bedrock Topography of the Hamilton Area

Appendix A

- Highway 403 Overpass GA Drawings
- CP Underpass (Eastbend Ave.) GA Drawings
- CP King St. Overpass – M58.92 Hamilton Subdivision
- CP Overpass Hunt St. Contract Drawings
Appendix A

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- CP King St. Overpass – M58.92 Hamilton Subdivision
- CP Overpass Hunt St. Contract Drawings
Highway 403 Overpass GA Drawings
CP Underpass (Eastbend Ave.) GA Drawings
KING STREET EAST

CANTILEVER SECANT PILE WALL WITH REINFORCED FACING
TOE WALL LENGTH 50.00m+ (TYP.)
LENGTH 81.50m+ (TYP.)

CONCRETE CAP

TOP OF CONCRETE SLAB

T/RAIL

EXISTING GROUND

PLAN

PARTIAL

ELEVATION

PARTIAL

LENGTH 47.50m+ NORTH AND 35.30m+ SOUTH

STRUTTED SECANT PILE WALL

WITH REINFORCED CONCRETE FACING

CONCRETE CAP

TOP OF CONCRETE SLAB

T/RAIL

EXISTING GROUND

PLAN

PARTIAL

ELEVATION

NOTE: PARAPET AND RAILING NOT SHOWN FOR CLARITY.

PROFILE OF ROAD NORTH AND SOUTH OF RETAINING WALLS SHOULD BE ADJUST TO SUIT NEW PROFILE PROVIDED BY OTHERS AND TOP OF WALL OF RETAINING WALLS SHOULD BE MATCH LINE SEE DRAWING

WEST ELEVATION SIMILAR

EAST WALL ELEVATION SHOWN

WEST BOUND TRACK

EAST BOUND TRACK

HALRT-CS-RW03

HALRT-CS-RW03

M A T C H L IN E  S EE  D R A W IN G

RETAINING WALL 1/3

RETAINING WALL 1/3

MATCH LINE SEE DRAWING

PROFILE OF ROAD NORTH AND SOUTH OF RETAINING WALLS SHOULD BE ADJUST TO SUIT NEW PROFILE PROVIDED BY OTHERS AND TOP OF WALL SHOULDBE ADJUST TO SUIT NEW PROFILE

NOTE: PARAPET AND RAILING NOT SHOWN FOR CLARITY.

EXISTING 500 DIA. WATERMAIN

EXISTING 600 DIA. COMBINED SEWER

EXISTING STORM SEWER

EXISTING 150 DIA. WATERMAIN

EXISTING GAS MAIN

EXISTING GAS MAIN

EXISTING WATERMAIN

EXISTING COMBINED SEWER

PROFILE OF ROAD NORTH AND SOUTH OF RETAINING WALLS SHOULD BE ADJUST TO SUIT NEW PROFILE PROVIDED BY OTHERS AND TOP OF WALL SHOULD BE ADJUST TO SUIT NEW PROFILE

NOTE: PARAPET AND RAILING NOT SHOWN FOR CLARITY.

EXISTING 600 DIA. COMBINED SEWER

EXISTING 150 DIA. WATERMAIN

EXISTING WATERMAIN

EXISTING COMBINED SEWER

NOTE: PARAPET AND RAILING NOT SHOWN FOR CLARITY.
CP King St. Overpass - M58.92 Hamilton Subdivision
KING ST. OVERPASS - M 58.92

HAMPTON SUBDIVISION

NTS.
CP Overpass Hunt St. Contract Drawings