APPENDIX F2

CNR OVERHEAD BRIDGE EA 2014

CLASS ENVIRONMENTAL ASSESSMENT REPORT

CNR OVERHEAD STRUCTURE

DUNDAS STREET OVER CN RAILWAYS

CITY OF BURLINGTON, ON

REGIONAL MUNICIPALITY OF HALTON

MTO SITE NO. 10-175

Halton REGION 35 YEARS OF SERVICE

MMM GROUP

MMM Group Limited

August 2014

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August 2014

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EXECUTIVE SUMMARY

MMM Group Limited was retained by the Regional Municipality of Halton to review four (4) alternatives to facilitate the planned widening along Dundas Street from the existing four (4) lanes to six (6) lanes. The proposed work requires the CNR Overhead Structures along Dundas Street be widened to accommodate two (2) new HOV lanes.

Three (3) of the Alternatives reviewed, identified as Alternatives 2-4 in this report, have property limit restrictions to accommodate the widening. These issues, such as the premium costs associated with property acquisition of developed land, make these alternatives less than desirable and are not considered feasible options.

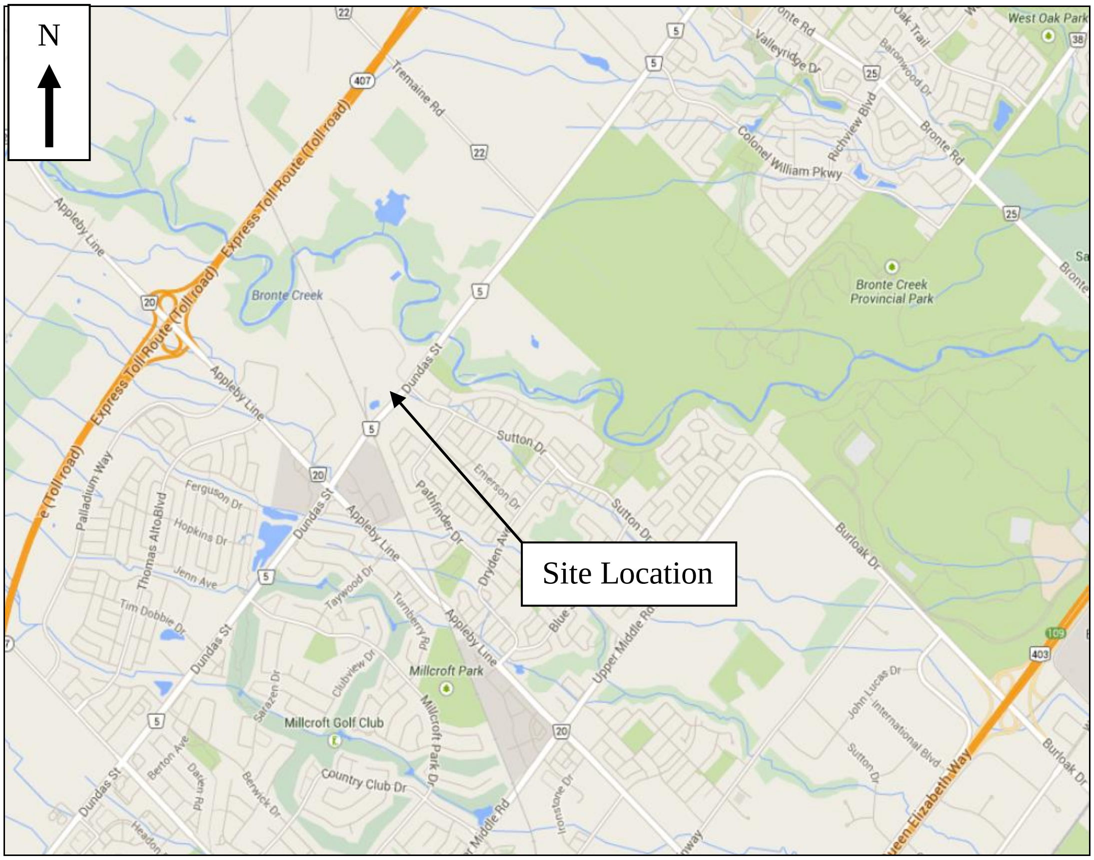
Alternative 1, widening the existing structure two (2) lanes to the north to accommodate the additional lanes, is the retained alternative as appears to be the most practical option since it does not require new property acquisition or represent significant impacts to nearby utilities.

Criteria and constraints such as pedestrian and traffic impacts, constructability, property requirements, impact to utilities, construction duration, future rehabilitation and durability, and cost were used to evaluate Alternative 1.

The estimated cost of Alternative 1 would be $6M.

Prior to undertaking preliminary design, discussions with CN and field survey of the existing tracks (to be used to set possible locations for substructure components) should be undertaken.

KEY PLAN



CNR Overhead Structure along Dundas Street
Burlington, Ontario

KEY PLAN
Scale: Not to scale

1. INTRODUCTION

MMM Group Limited was retained by the Regional Municipality of Halton to undertake a Municipal Class Environmental Assessment (EA) for the planned widening of Dundas Street from the existing four (4) lanes to six (6) lanes, to accommodate new HOV lanes. The study limits for the widening are from Guelph Line to Appleby Line. The CNR Overhead Structures are within the study limits and will also need to be widened to accommodate the planned increase in the number of traffic lanes.

The CNR Overhead bridges were constructed in 1962 as two (2) adjacent, yet independent, structures: one (1) for Hamilton-(west)-bound traffic and one (1) for Toronto-(east)-bound traffic. Each bridge carries two (2) traffic lanes located along Dundas Street (King's Highway No.5), which crosses over the CN Railways.

The superstructure comprises of three (3) simply-support pre-stressed concrete girders supporting a reinforced concrete deck, asphalt wearing surface, PL2 concrete barrier wall with traffic railing, and a median barrier on each deck edge. The two (2) superstructures are separated by a 25 mm wide longitudinal joint located between the medians. The substructures for each structure also are independent of each other.

The three spans are each 12.2± m, 17.8± m, and 12.2± m in length, supported by piers and abutments that are on a 25.8 degree skew relative to the profile control line, in order to accommodate the rail lines passing underneath the bridges. The profile control line has an 873 m horizontal curve to the south. Approach slabs, each 4.3 m long, flank both ends of the bridges.

This report discusses the future requirements for the planned widening and presents the following information:

- Overview of the history of the bridge;
- Detailed description of the structural implications of the four (4) widening alternatives considered;
- Criteria and constraints for the retained alternative;
- Cost estimate of the retained alternative; and
- Concluding remarks of the retained alternative.

Key Plan showing the structure location is shown above.

2. REHABILITATIONS, INSPECTIONS AND EVALUATIONS

2.1 2003 Rehabilitation

In 2003, the structure was rehabilitated under Contract No. R-1853B-2003. The scope of work included the following:

- Remove and repair deteriorated concrete from deck soffit and diaphragm ends;

- Remove and repair deteriorated concrete from pier caps;
- Construct new concrete crash walls on pier columns;
- Repair concrete slope paving;
- Remove traffic railings, steel beam guide rails, curbs and gutters;
- Install new concrete barriers and steel beam guide rails;
- Remove north and south edges of approach slab;
- Modify existing approach slabs by placing new concrete curb and gutter;
- Removed and replace existing caulking/seal from longitudinal expansion joint;
- Milled existing pavement and place new surface course asphalt;
- Reinstated pavement markings; and
- Installed asphaltic plug seals at abutment and pier expansion joints.

2.2 2006 Bi-Annual Bridge Appraisal Report

The 2006 bi-annual was completed by TSH for the Regional Municipality of Halton. The following summarizes the findings of their inspection:

- The asphalt wearing surface is in good condition;
- Concrete barrier walls and steel barrier rails are in good condition with surface rust stains noted;
- Concrete median is in generally good condition with localized cracking;
- A longitudinal expansion joint in the median is sealed and is in poor condition (localized leakage was noted);
- Deck expansion joints are paved over and are in poor condition with leakage noted;
- Concrete deck soffit is in good condition with localized water staining along the deck fascia at piers and longitudinal expansion joint. Localized patching was noted on both the south and north deck cantilever. Localized spalling and delaminations were noted along longitudinal joints. Exposed corroded rebar chains were also noted along joint;
- Precast concrete girders are in generally good condition with delaminations and spalling of several girders at the support points;
- Elastomeric bearing pads are in good condition;
- Concrete piers are in generally good condition with extensive water staining, localized cracking and patching of the pier caps. The pier columns are in good condition. Railway crash walls are in good condition;
- Concrete abutments are in good condition with extensive water staining and localized vertical cracking;
- Concrete wingwalls are in good condition;
- Slope paving is in good condition;
- Steel beam guiderail and channel on the bridge approaches are in good condition with extruder end treatments complete with hazard markers in all four quadrants;
- Concrete approach slabs are in good condition;
- Asphalt paved approach roads are in good condition;
- Raised concrete median on the approaches is in generally good condition;

- Concrete curb and gutter on the approaches are in good condition; and
- Asphalt paved boulevards are in good condition.

2.3 2009 Bridge Condition Survey

A detailed bridge condition survey of both structures was performed in July 2009 by MMM. Detailed findings from the survey may be found in the Bridge Deck Condition Survey Report by MMM, dated September 2009. A summary of the significant findings from the deck condition survey is as follows:

- Six (6%) percent of the bridge deck, that was inspected, is within the high range of corrosion potential (< -0.350 V);
- Core samples extracted from the bridge deck for testing indicate compressive strengths ranging from 58-63 MPa;
- The asphalt wearing surface was found to be in fair condition with few areas of narrow and medium cracking in the asphalt. The average thickness of the asphalt wearing surface was measured to be 132 mm at core and sawn sample locations;
- Asphaltic plug seals appeared depressed below the deck wearing surface creating an uneven riding surface. In several areas, the asphaltic plug seals were reported to have been previously patched with cold mix asphalt and some of these areas contained voids or missing material;
- Reinforcing steel generally appeared to be in fair-to-good condition, with light corrosion noted in the cores sample extracted;
- The existing concrete barrier walls were noted to be in good condition and meet the code requirements at the time of inspection;
- The steel beam guiderail connection to the concrete barriers was also noted to meet the requirements code requirements; and
- Settlement at the east and west approaches were noted, which has contributed to the slight settlement of concrete roadside curbs.

2.4 2009 Structural Evaluation Report

A structural evaluation of the CNR Structures was performed in October 2009 by MMM. Detailed findings from the evaluation may be found in the Structural Evaluation Report by MMM, dated October 2009. The evaluation provided insight to the current condition of the structure and as well as the potential for widening to accommodate the planned increase in the number of traffic lanes. In this report, MMM noted the following:

- CNR Overpass is theoretically adequate in bending moment and shear;
- The barrier wall currently in place conforms to current MTO standards and is reported to be in good condition;
- The response of the structures to live load was also evaluated to determine the feasibility of increasing the concrete slab thickness from 178 mm to 225 mm with an asphalt thickness of 90 mm. Results of the analysis indicate that an increased deck slab thickness of 225 mm is feasible for the future widening of each overhead structure to carry three (3) traffic lanes; and

- The pre-stressed girder structures have adequate load capacity and may be incorporated into the widening of Dundas Street.

3. WIDENING ALTERNATIVES

MMM assessed the following four (4) alternatives. The cross-section of the widened structure will include the following (for all alternatives considered):

- One (1) 0.255 m wide parapet walls at the north end;
- One (1) 2.0 m wide sidewalk at the north end;*
- One (1) 0.25 m wide barrier wall at the north end;
- One (1) 1.5 m wide WBL bike lane;
- Three (3) 0.3 wide WBL shoulders;
- One (1) 3.5 m wide WBL HOV lane;
- Two (2) 3.5 m wide WBL vehicle traffic lanes;
- One (1) 1.4 m wide median;
- Two (2) 3.5 m wide EBL vehicle traffic lanes;
- One (1) 3.5 m wide EBL HOV lane;
- Three (3) 0.3 wide EBL shoulders;
- One (1) 1.5 m wide EBL bike lane;
- One (1) 0.25 m wide barrier wall at the south end;
- One (1) 3.0 m wide sidewalk at the south end;
- One (1) 0.255 m wide parapet walls at the south end;

The resulting overall width of the structure will be 33.21 m. The following provides a discussion of each of the four (4) alternatives considered.

*Note: *Dimension of the side walk on the north side had subsequently been updated to 3.0 m.*

3.1 Alternative #1 – Widen Two Lanes to the North

This alternative involves widening the existing structure to the north to accommodate two (2) additional (bus) lanes. A new concrete pier on spread footings will be constructed to the north to support the new pre-stressed concrete girders. To facilitate the widening, the existing bridge deck will be completely removed and replaced with a new 225 mm concrete deck continuous over all three (3) piers. The overall width of the bridge deck increases from 23.17 m to 33.21 m and the crown of the road shifts approximately 5.7± m north.

The new structure will not include the longitudinal joint currently separating the two (2) adjacent structures. The longitudinal joint provides a passage way for moisture and road salts to access the girders and substructure. This will result in corrosion of reinforcing steel and spalling/delamination of concrete adjacent to the median, just to name a few. Removing the longitudinal joint will benefit the long-term durability of the structure, which should mitigate future rehabilitation, maintenance operations, and avoid interruptions to traffic.

The existing structure will be converted to semi-integral abutment bridge to enhance the performance and durability of the structure. Expansion joints will be eliminated at the end of the deck; however, the superstructure is not continuous with the abutments. The existing bearings under the girders will be replaced. Conventional bearings will be used to allow horizontal movement between the deck and the abutments.

There are potential design issues that may become evident during detailed design which are involved with the connection of three (3) independent substructures, which will now be forced to work in unison. While this is not unproven construction technology, the interaction between the substructures requires more modelling and analysis than MMM has currently undertaken. A larger contingency allowance for this option would be required for construction and future rehabilitation.

Despite that the Structural Evaluation Report by MMM in 2009 reveals that the existing pre-stressed concrete girders contain adequate theoretical load capacity and may be incorporated in the widening, this alternative replaces the existing girders with new pre-stressed concrete girders and retains the existing substructures only. It is recommended to replace the existing girders to mitigate future maintenance/repair and associated interruptions to traffic that will be required for the existing girders, which is typical with age.

3.2 Alternative #2 – Widen Four Lanes to the North

This alternative involves the complete removal of the existing Toronto-(east)-bound superstructure and substructure, and constructing four (4) traffic lanes at the north end. However, this alternative is restricted by property limits. To avoid the costs associated with property acquisition and removing/relocating the existing east structure, Alternative 2 not carried forward for further consideration in this report.

3.3 Alternative #3 – Widen One Lane to the North and One Lane to the South

This alternative maintains the existing centreline of Dundas Street and adds one (1) lane to the north and one (1) lane to the south of the existing bridge. Widening to the south of the existing structure is not a feasible option due to property limit restrictions. To avoid the premium costs associated with property acquisition of developed land, Alternative 3 is not carried forward for further consideration in this report.

3.4 Alternative #4 – Widen Two Lane to the South

This alternative involves widening the existing structure to the south to accommodate tow (2) additional (bus) lanes. A new concrete pier on spread footings would be required to the south to support the new pre-stressed concrete girders. However, as mentioned in Alternative #3, widening to the south is not a feasible option due to property limit restrictions. To avoid the cost of property acquisition of developed land, Alternative 4 has been abandoned.

4. EVALUATION OF ALTERNATIVES

4.1 Introduction

Alternative 1 is considered to be the most feasible option, and as such is evaluated based on the following constraints:

1. Impact on Pedestrian;
2. Traffic Impacts;
3. Impact on Utilities;
4. Constructability;
5. Construction Duration;
6. Future Rehabilitation, Maintenance and Durability; and
7. Cost.

Each of these seven (7) criterion and constraints are discussed in the following Alternative 1.

4.2 Impact on Pedestrian

We believe the impacts on pedestrians during Alternative 1 will be minor. Currently, the CNR Overhead Bridges have two (2) sidewalks at the north and south end for pedestrian use. The final configuration of the structure will also have two (2) sidewalks; one (1) at each end. Alternative 1 provides at least one (1) sidewalk for pedestrian use during each phase of construction. Stage 1 construction permits pedestrian use on the existing sidewalk at the south end. During stages 2 and 3 construction, pedestrians will be shifted to the newly constructed sidewalk at the north end.

4.3 Traffic Impacts

Duration of construction may have the most impact on traffic during construction. We believe that Alternative 1 minimizes traffic impacts as four (4) lanes of traffic (two in each direction) will be provided during phases. Currently, four (4) lanes of traffic are currently in use.

4.4 Impact on Utilities

Alternative 1 results in minor impacts to the existing utilities and does not require permanent removal/relocation.

4.5 Constructability

In the following, MMM has assessed the associated risk with construction activities only, and has not considered either cost or construction duration. As discussed previously discussed in Sections 3.2, 3.3 and 3.4, Alternatives 2, 3 and 4 (respectively) are not considered constructible alternatives.

In MMM's opinion, Alternative 1 is a constructible method provided that:

- Foundations are possible north of the existing structure; and
- Access to the railway lands below is permitted.

The proposed new pre-stressed I girder structure for the north widening in Alternative 1 is premised on having two (2) piers adjacent to the existing. A survey of the existing track has not been undertaken; MMM utilized only existing information to establish possible locations for the foundations. As such, should foundations not be possible at or near the assumed locations a girder type structure proposed in Alternative 1 may not be feasible. MMM recommends a detailed geotechnical investigation be carried out by a qualified Engineer to access the constructability of the founding soils north of the existing structure. Detailed information such as characteristics of the soils, groundwater, geology, and slope stability is required for design and construction.

Access to the railway lands below is required for erection, to install access and protection, and to construct new (or strengthen existing) substructure. All such activities will require co-operation and flagging services from CN Railway. Construction of the foundations for the new pier may require working within CN's right-of-way and may impact their operations. As long as agreements and flagging are forthcoming from CN, foundation construction should be accommodated.

4.6 Construction Duration

Alternative 1 does not require any new or "unproven" construction technologies be undertaken. Therefore no unique "activities", which may affect the overall duration of construction, is expected. In total, three (3) years of construction is estimated for Alternative 1.

4.7 Future Rehabilitation, Maintenance and Durability

All alternatives have approximately the same gross bridge deck area (traffic and pedestrian structures) to be maintained in the future.

The combination of converting the two independent structures to a single structure behaving in unison and eliminating the existing longitudinal joint in the median significantly improves the long-term performance and durability of the structure. The longitudinal joint provides a passage way for moisture and road salts to access the girders and substructure, which will result in corrosion of reinforcing steel, and spalling/delamination of concrete adjacent to the median, just to name a few.

The abutments and piers will require substantial maintenance in the future and regular inspections by qualified inspectors to monitor any potential signs of structural distress typical with age.

The new pre-stressed concrete girders will be a future maintenance requirement to monitor potential signs of structural distress (typical with age) and deterioration, such as delamination, spalling, ect.

Although MMM has not review Alternative 1 in sufficient detail at this point to fully assess all aspects of the detailed design, we believe that this widening method enhances the durability and performance of the structure.

4.8 Cost

MMM has estimated the cost of Alternative 1 to be approximately $6M. The following assumptions should be noted:

- Cost is based on the MTO "Parametric Estimating Guide" and previous MMM project database;
- Inflation was not considered;
- Initial construction costs are considered only;
- Traffic control costs are not included;
- Engineering fees are included;
- Contingency fees (30%) is considered;
- Does not include any potential need to stabilize the slope at the east abutment;
- Prices are in 2014 dollars.

5. CONSTRUCTION STAGING

Currently, CNR Overhead Bridge accommodates four (4) lanes of traffic and two (2) sidewalks for pedestrian use. Construction staging is discussed for Alternative 1 only.

Stage 1 Construct new substructure and superstructure north of the existing Waterdown-(west)-bound bridge. Vehicular and pedestrian use will be accommodated using the current configuration of CNR Overhead Bridge. Four (4) traffic lanes and two (2) sidewalks will be maintained at all times during this construction stage.

Stage 2 Remove/replace the concrete deck over the existing Waterdown-(west)-bound bridge superstructure by shifting two (2) lanes of traffic and one (1) sidewalk for pedestrian use to the newly constructed north structure. The existing Toronto-(east)-bound bridge will continue to carry two (2) lanes of traffic and one (1) sidewalk for pedestrians.

Stage 3 Remove/replace the concrete deck over the existing Toronto-(east)-bound superstructure by shifting two (2) lanes of traffic to the newly rehabilitated Waterdown-(west)-bound structure. The north end will continue to accommodate two (2) traffic lanes and one (1) sidewalk for pedestrian use from Stage 2. This construction stage will only accommodate one (1) sidewalk for pedestrian use.

Final — Place all six (6) traffic lanes and two (2) sidewalks for pedestrian use onto the structure for permanent use.

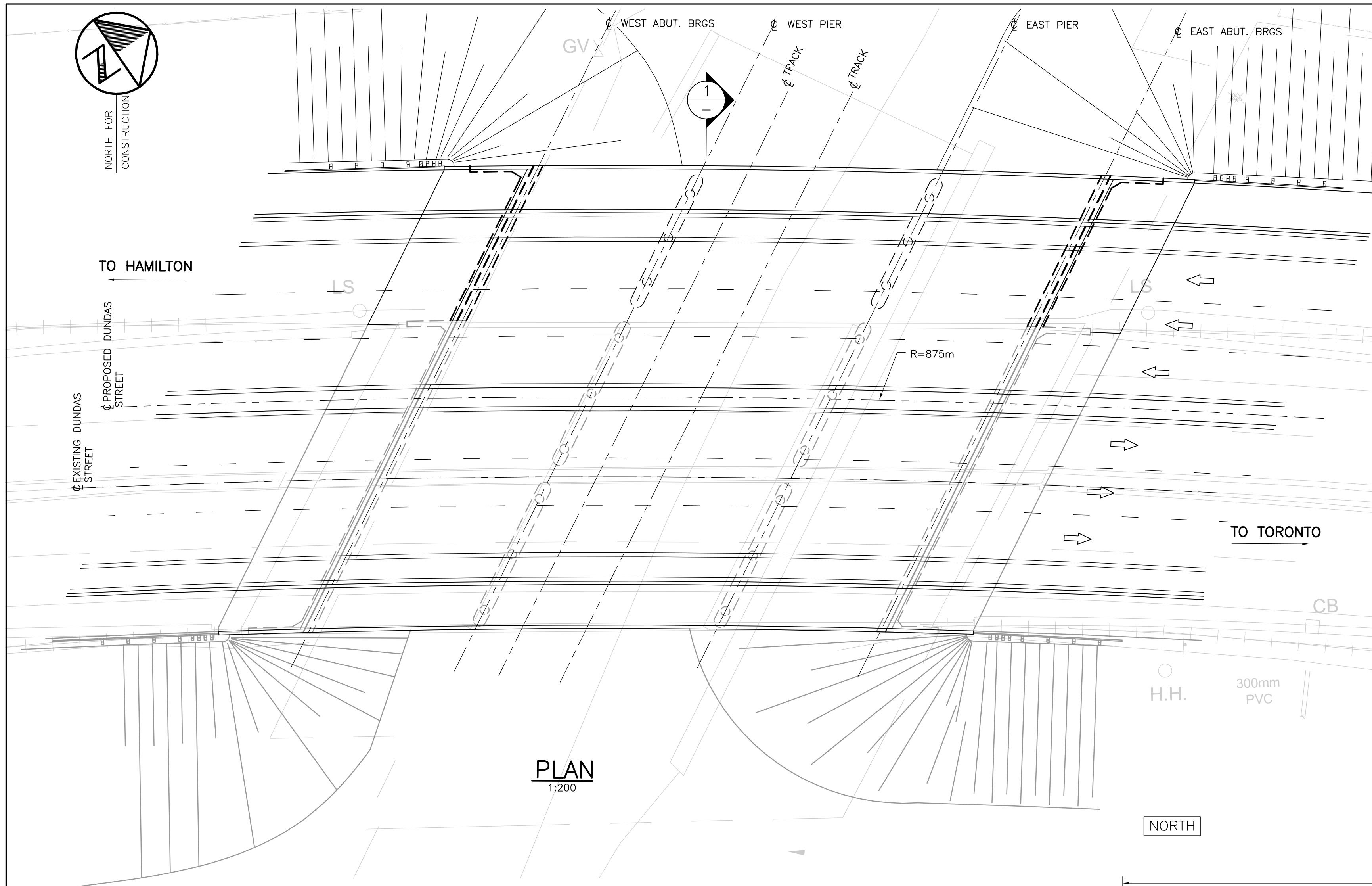
6. CONCLUSIONS

Based on the above, Alternative 1 is recommended to be the most feasible alternative when considering practicality, constructability, construction duration, property access, traffic impacts, and economy. This solution does not require property acquisition, in comparison to the other three (3) alternatives.

The longitudinal joint between the two structures has proven to a source of problems. The elimination of the longitudinal joint in Alternative 1 is considered necessary to enhance long-term performance and durability, minimize future rehabilitation and maintenance, and allow traffic to comfortably cross the joint.

MMM recommends a survey of the existing railway tracks be undertaken along with detailed geotechnical investigations to access the constructability of the founding soils north of the existing structure. Detailed information such as characteristics of the soils, groundwater, geology, and slope stability is required for design and construction.

Construction will require access to the railway lands, and co-operation and flagging services from CN Railway. Construction of the foundations for the new pier may require working within CN's right-of-way and may impact their operations. MMM recommends formulating cooperative agreements and flagging with CN to accommodate construction.



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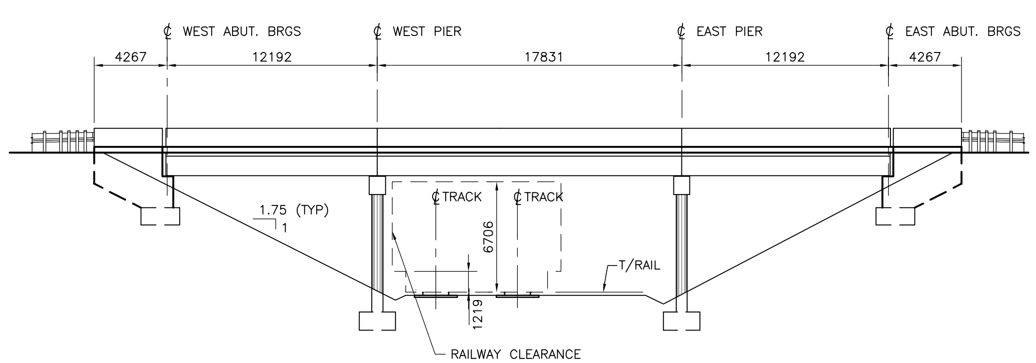

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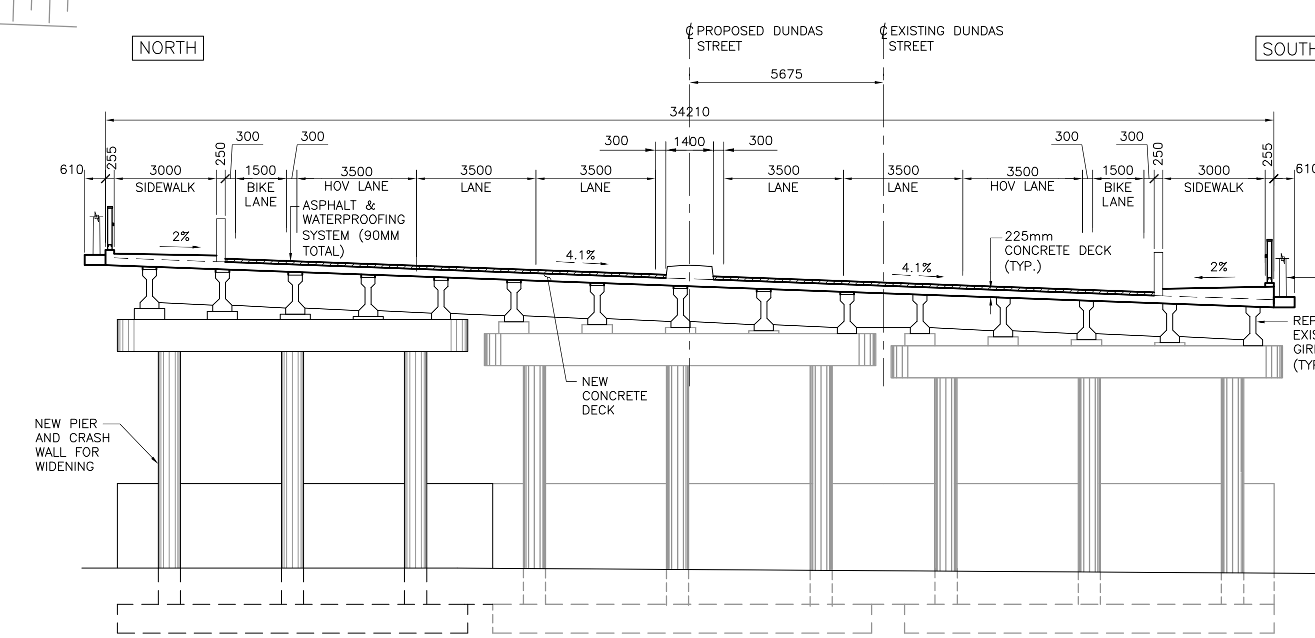

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Notes

Nº	Date	By	REVISIONS	MANU	CAD

Design	MT	Ch'kd	TS	Date JULY 2012
Drawn	GL	Ch'kd	MT	
Scale AS SHOWN				References

Field Notes
REGION BOOK

Stamp

Regional
ACCEPTED FOR CONSTRUCTION OF REGIONAL INFRASTRUCTURE
Reviewed For Compliance With Regional Standards Only.

Director

Manager

MMM GROUP

Halton REGION

TITLE
GENERAL ARRANGEMENT
DUNDAS STREET WIDENING
BURLINGTON – HALTON
CNR OVERHEAD

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