

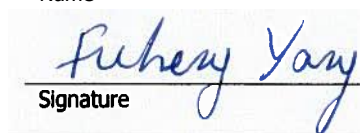


Document Type:	TECHNICAL APPRAISAL FORM Bridges
Submission Name:	B3 - Realigned E.C. ROW - EBL Expressway Underpass Near Matchette Road
Document Number:	285380-03-127-0002

Design Consultant:		HMM
Date	Revision	Description
Nov. 1, 2012	A	60% MTO SUBMISSION

Issued by: Stephen F. Yang
Name

Nov. 1, 2012
Date


Signature

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Project:	Windsor-Essex Parkway	Date:	1-NOV-2012
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1 Design package Description

1.1 Name and location of structure

Bridge B3 carries the realigned E.C Row- EBL Expressway over Highway 401 near Matchette Road located on Highway 401 between Ojibway Parkway and Malden Road and between STA. 10+930.439E and 11+110.939E (E.C. Row Expressway stations). Four retaining walls (HRW40L, MSEW41R, MSEW42L and MSEW43R) are directly connected to the wing walls of this bridge.

1.2 Permitted traffic speed

Posted speed for traffic on the realigned E.C. ROW - EBL Expressway crossing over the bridge is 80 km/h. Posted speed on highway 401 (passing under the bridge) is 80 km/h.

Highway Classification:	UED for realigned E.C. Row - EBL Expressway over structure UFD for HWY 401
Design Speed:	100 km/h for realigned E.C. Row - EBL Expressway over structure 100 km/h for HWY 401 under structure
Posted Speed:	80 km/h for realigned E.C. Row - EBL Expressway over structure 80 km/h for HWY 401 under structure
Laning:	3 over structure for realigned E.C. Row - EBL Expressway 8 under structure for HWY 401
Design Clearance:	Minimum 4.8 m vertical clearance
Bridge Design Vehicle:	CL-625-ONT

2 Proposed Structure

2.1 Description of Structure

The structure is comprised of continuous four-span post-tensioned prestress concrete girder with three webs and double cell boxes. Main dimensions of the girder cross-section are as follows:

Thickness of the top slab: 350mm
Thickness of the bottom slab: 250mm
Thickness of the webs: 550mm
Width of end diaphragms: 3.3m
Width of diaphragms over piers: 4.0m

The box-girders have constant depth of 2.5m and a width of deck varying from 16.05m to 19.013m.

The span length allocation is as 34m+49m+58.5m+39m.

The structure is supported on true abutments with structural wing walls and three intermediate piers of 2.1m or 2.4m circular reinforced concrete columns. The abutments and piers are in turn seating on large foundations of concrete of 1.5m (abutment) and 2.0m (pile) depth supported in turn on deep driven HP 310x110 steel piles.

The girder is post-tensioned with a total of 18 ducts of 7-wire 15 designation prestressing strands installed in three webs along the entire girder in a tendon arrangement of three layers and two tendons per layer in each web; each duct has an outer diameter of 130mm with 27 prestressing strands inside. Transversal prestressing strands are used over the abutments and the piers to strengthen the concrete sections at these locations due to large forces created by reactions and prestressing forces.

The deep steel H-piles are driven down about 26m into bedrock. The minimum geotechnical resistance of steel H-piles is 4000kN per pile, and the ULS design resistance is 2000 kN per pile. This foundation type was a recommendation by the geotechnical consultant due to poor bearing capacity of the soil, Refer to Geotechnical Investigation and Design Report (90%) Bridge B-3, Rev. A, Doc. No. 285380-04-119-0114, dated June 22, 2012.

Concrete PL-3 barriers are placed along outer sides of the traffic route on the structure. Water drain on top of the bridge deck conforms to Highway and Roadway Drainage Design Report – Phase 3.

Structure Summary

Structural Type:	Continuous Post-tensioning prestress concrete box girder with double-cell trapezoidal box
Span Arrangement:	34m+49m+58.5m+39m
Foundation Type: Abutments: Piers:	Concrete footings on deep HP steel piles 7m long, about 20m wide and 1.5m deep 7.2m long x 7.2m wide x 2.0m deep or 9.4m long x 9.4m wide x 2.0m deep
Span Articulation:	Concrete girder has a fixed connection at the center pier and is supported at other support locations with unidirectional or multi-directional pot-bearings. The girder has a strip seal expansion joint at the west abutment end and a sliding expansion joint at the east abutment end to accommodate girder movements due to loads and thermal expansions.
Barrier Type:	PL3 concrete barrier wall on top of deck

2.2 Proposed arrangements for inspection and maintenance

Access hatches are in accordance with OPSD 3339.100 and are provided in each span for access inside the boxes. The provision of MTO Structural Manual 2008 has been considered for the maintenance of bearings.

2.3 Materials and finishes

2.3.1 Pre-stressing Strands:

Type: (CSA G279-M 1982) low relaxation, seven wire strands, size designation 15, Grade 1860.

2.3.2 Concrete:

Deck: 50 MPa (minimum compressive strength at 28 days)
Remainder: 30 MPa (minimum compressive strength at 28 days)

2.3.3 Reinforcing Steel:

Plain reinforcing steel bars: CAN/CSA G30.18-M92; Grade 400W
Coated reinforcing steel bars: CAN/CSA G30.18-M92; Grade 400W
Stainless steel reinforcing bars: Type 316LN or Duplex 2205 or XM-28; Grade 500

2.3.4 Steel H-Piles:

HP 310x110 to OPSS 903: CAN/CSA G40.20/G40.21; Grade 350W

2.3.5 Finishes

Concrete finishes shall comply with the applicable requirements of Project Agreement, Schedule 15-2.

3 Design/Assessment Criteria

3.1 Live Loading, Clearances

3.1.1 Bridge code loading

CL-625-ONT Truck and Lane loading plus dynamic load allowance to CAN/CSA-S6-06.

3.1.2 Design vehicle

CL-625-ONT TRUCK

3.1.3 Other live loading

None

3.1.4 Provision for exceptional abnormal loads**3.1.4.1 Gross weight**

None

3.1.4.2 Axle load and spacing

None

3.1.4.3 Location of vehicle track on deck cross-section

None

3.1.5 Any special loading not covered above

None

3.1.6 Minimum clearance provided (vertical and horizontal)

Minimum required vertical clearance is 4.80m and the actual clearance provided is 4.90m.

3.1.7 Authorities consulted and any special conditions required

As per Part 2 of Project Agreement – Schedule 15-2.

3.2 List of relevant design documents

Design Criteria in accordance with Part 2 of Project Agreement - Schedule 15-2:

Article 1 - Highway Geometrics Design Criteria

Article 3 - Structural Design Criteria

Article 5 - Geotechnical and Foundation Design Criteria

In the event of discrepancy, the hierarchy of referenced documents shall be as instructed.

No deviation from the standards is used including design traffic flows and speeds.

4 Structural Analysis**4.1 Methods of analysis**

A 2D-frame Finite Element Model based on beam elements in STAAD is constructed to analyze the mechanical responses of the structure under all load cases. A 3D Finite Element Model based on plate elements is used to study the torsion behaviour of the structure due its curve nature, the supports with single columns in the middle spans and the variations of the deck width near the two abutments.

The dead and live loads on the structure are calculated as per CAN/CSA CHBDC S6-06.

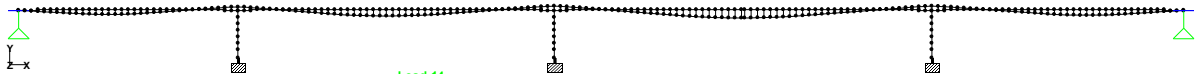
Loads due to temperature changes and uneven settlement are calculated as per CAN/CSA CHBDC S6-06.

Wind loads are also considered according to CAN/CSA CHBDC S6-06.

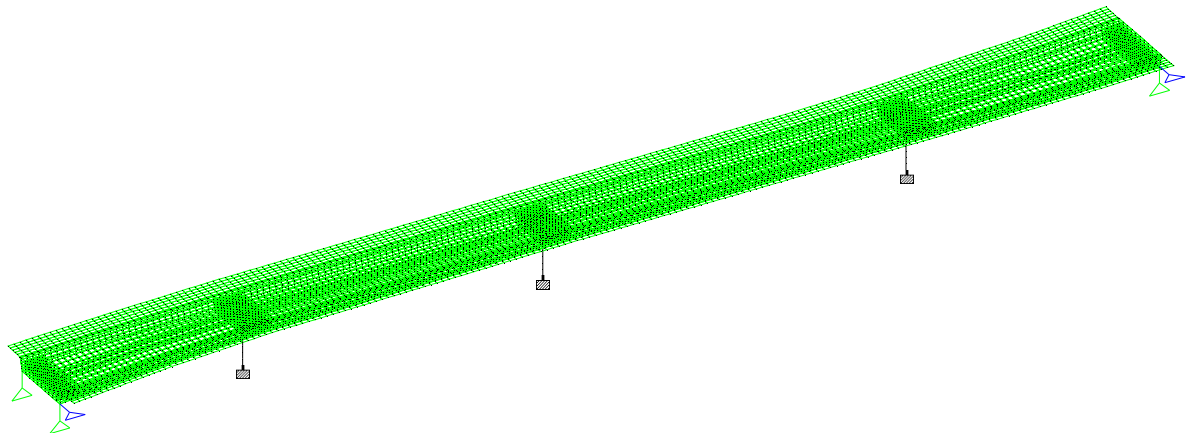
4.2 Description and diagram of structure

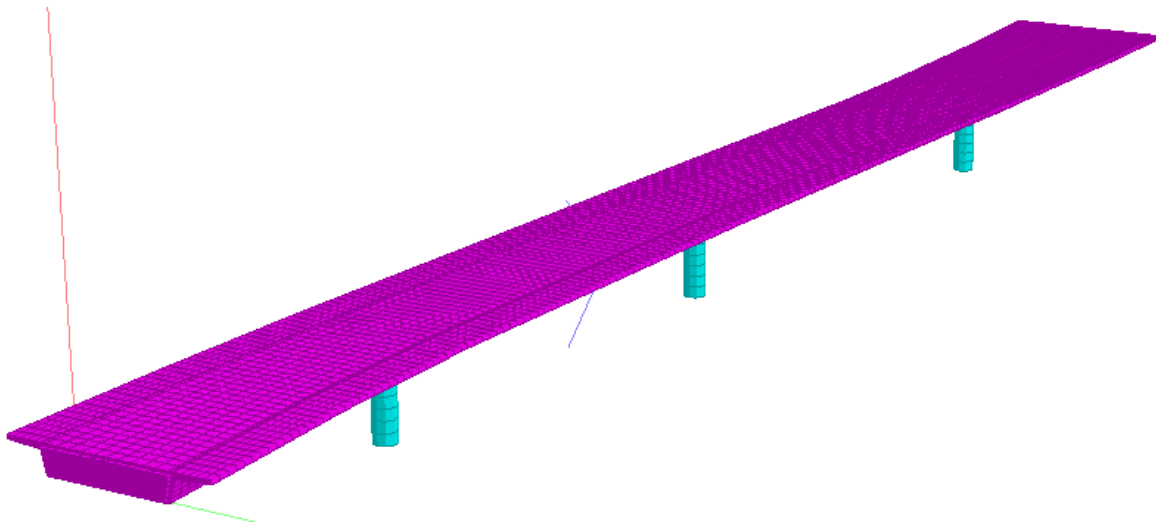
The structure is consisted of 4 continuous spans with the span lengths as 34m+49m+58.5m+39m. The structure is supported vertically on two abutments and three middle circular piers; the structure is fixed at the central pier (2nd pier); pot bearings are used at abutments and other piers with proper fixations or expansion settings to keep the structure stable with the least internal forces induced by support restraints.

A simplified 2D frame model with prestressing strands is as follows:



To better account the torsion behaviour of the structure, a 3D FEM model is considered using plate elements, as shown below:





4.3 Assumptions intended for calculation of structural element property and stiffness

Structural stiffness was calculated according to CAN/CSA-S6-06. The entire deck is considered structurally effective to support loads.

4.4 Proposed earth pressure coefficients (k_a , k_o , or k_p)

Refer to Geotechnical Investigation and Design Report (90%) Bridge B-3, Rev. A, Doc. No. 285380-04-119-0114, dated June 22, 2012.

5 Construction Considerations

This is a permanent works submission. All submissions related to temporary works will be provided, if required, under a separate cover.

6 Ground Design Conditions

6.1 Ground Conditions

Refer to Geotechnical Investigation and Design Report (90%) Bridge B-3, Rev. A, Doc. No. 285380-04-119-0114, dated June 22, 2012.

6.2 Geotechnical Design Parameters

For proposed HP 310x110 steel piles, the design ULS capacity is 2000kN.

Effective angle of soil internal friction, ϕ' , is 30°.

Refer to Geotechnical Investigation and Design Report (90%) Bridge B-3, Rev. A, Doc. No. 285380-04-119-0114, dated June 22, 2012.

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6.3 Differential Settlement

A value of 15mm for differential settlement has been considered in design calculations. Refer to Geotechnical Investigation and Design Report (90%) Bridge B-3, Rev. A, Doc. No. 285380-04-119-0114, dated June 22, 2012.

6.4 Anticipated Ground Movements or Settlement

Refer to Geotechnical Investigation and Design Report (90%) Bridge B-3, Rev. A, Doc. No. 285380-04-119-0114, dated June 22, 2012.

6.5 Groundwater and Counter Measures

Groundwater is present at the site at the surface level. Groundwater control will be required based on timing of construction and prevailing weather conditions.

Refer to Geotechnical Investigation and Design Report (90%) Bridge B-3, Rev. A, Doc. No. 285380-04-119-0114, dated June 22, 2012.

6.6 Variance from Geotechnical Memo Recommendations

None

7 Checking

7.1 Independent check

Independent check is required as per Project Agreement – Schedule 15-2, Part 2, Article 3 3.2 (c) (i).

Independent Checking Team: INTERNATIONAL BRIDGE TECHNOLOGIES, INC

7.2 Responsible design personnel

Originator: Stephen Fuheng Yang, P. Eng.

Checker: Radek Falar

Reviewer: Biljana Rajlic, P.Eng.

8 Drawings and Documents

8.1 List of drawings (including numbers) and documents accompanying the submission

8.1.1 List of drawings:

HMM drawing No.	Revision	TITLE
285380-03-060-SEG3-0300	A	COVER SHEET
285380-03-060-SEG3-0301	A	GENERAL ARRANGEMENT
285380-04-090-SEG3-0302	A	BOREHOLE LOCATIONS AND SOIL STRATA
285380-04-091-SEG3-0303	A	SOIL STRATIGRAPHY
285380-03-061-SEG3-0304	A	FOUNDATION LAYOUT & REINFORCEMENT I
285380-03-061-SEG3-0305	A	FOUNDATION LAYOUT & REINFORCEMENT II
285380-03-061-SEG3-0306	A	WEST ABUTMENT LAYOUT & REINFORCEMENT I
285380-03-061-SEG3-0307	A	EAST ABUTMENT LAYOUT & REINFORCEMENT II
285380-03-061-SEG3-0308	A	WINGWALL LAYOUT & REINFORCEMENT I (NOT IN USE)
285380-03-061-SEG3-0309	A	WING WALL LAYOUT
285380-03-061-SEG3-0310	A	PIER LAYOUT & REINFORCEMENT
285380-03-062-SEG3-0311	A	BEARINGS LAYOUT AND DETAILS
285380-03-064-SEG3-0312	A	DECK LAYOUT AND SCREED ELEVATIONS
285380-03-064-SEG3-0313	A	DECK DETAILS
285380-03-064-SEG3-0314	A	LONGITUDINAL TENDON I
285380-03-064-SEG3-0315	A	LONGITUDINAL TENDONS II
285380-03-064-SEG3-0316	A	TRANSVERSE TENDONS I
285380-03-064-SEG3-0317	A	TRANSVERSE TENDONS II
285380-03-064-SEG3-0318	A	DECK REINFORCEMENT I
285380-03-064-SEG3-0319	A	DECK REINFORCEMENT II
285380-03-064-SEG3-0320	A	DECK REINFORCEMENT III
285380-03-064-SEG3-0321	A	DECK REINFORCEMENT IV
285380-03-064-SEG3-0322	A	DECK REINFORCEMENT V
285380-03-065-SEG3-0323	A	STRIP SEAL EXPANSION JOINT ASSEMBLY
285380-03-065-SEG3-0324	A	STRIP SEAL EXPANSION JOINT TYPE A DETAILS
285380-03-065-SEG3-0325	A	SLIDING PLATE EXPANSION JOINT ASSEMBLY
285380-03-065-SEG3-0326	A	SLIDING PLATE EXPANSION JOINT DETAILS I
285380-03-065-SEG3-0327	A	SLIDING PLATE EXPANSION JOINT DETAILS II
285380-03-065-SEG3-0328	A	BARRIER WALL W/O RAILING/EXPANSION JOINTS
285380-03-065-SEG3-0329	A	BARRIER WALL W/O TAILING-PL3 GFRP REBAR

285380-03-065-SEG3-0330	A	BARRIER WALL PL3 GRASSLAND TREATMENT
285380-03-065-SEG3-0331	A	6000mm APPROACH SLAB
285380-03-065-SEG3-0332	A	DETAILS OF CONCRETE SLOPE PAVING
285380-03-066-SEG3-0333	A	STANDARD DETAILS
285380-07-444-SEG3-0334	A	EMBEDDED ELECTRICAL WORK
285380-03-060-SEG3-0335	A	ABUTMENT EXCAVATION AND BACKFILL DETAILS I (IN PROGRESS)
285380-03-060-SEG3-0336	A	ABUTMENT EXCAVATION AND BACKFILL DETAILS II (IN PROGRESS)
285380-04-094-SEG3-0337	A	CONSTRUCTION NOTES – BACKFILL AT STRUCTURES
285380-04-094-SEG3-0338	A	CONSTRUCTION NOTES – LIGHTWEIGHT FILL MATERIAL

8.1.2 List of Documents

Document No.	Revision	Document Name
285380-04-119-0114	A	Geotechnical Investigation and Design Report (90%) Bridge B-3
285380-03-127-0002	A	Technical Appraisal Form

8.1.3 List of Reference Drawings and Documents (not included in this submission)

See Appendix A.

The above design and construction proposals are submitted for review

Signed:



Design/Construction Manager

Name: Biljana Rajlic

Engineering Qualifications: P. Eng.

Date: NOV. 01, 2012

Professional Registration Number: 10041385

Affix Professional Seal

Signed:

Project Co Representative

Name:

Date:

Professional Registration Number:

Affix Professional Seal

Appendix A – Referenced Drawings and Documents

Referenced Drawing(s)

Drawing No.	Revision	Drawing Name

Certificate(s)

Certificate No.	Revision	Certificate Name

Special Provision(s)

Document No.	Revision	Document Name
		Highway and Roadway Drainage Design Report - Phase 3