



<b>Document Type:</b>	<b>TECHNICAL APPRAISAL FORM Bridges</b>
<b>Submission Name:</b>	HWY 3 Underpass Near Montgomery
<b>Document Number:</b>	285380-03-127-0010

<b>Design Consultant:</b>		<b>HMM</b>
<b>Date</b>	<b>Revision</b>	<b>Description</b>
April 12, 2012	0	Substructure IFC Submission

Issued by: Radek Falar  
NameApril 12, 2012

Date

  
Signature

This document has been prepared for the titled project or named part thereof and should not be relied upon or used for any other project without an independent check being carried out as to its suitability and prior written authority of HMM being obtained. HMM accepts no responsibility or liability for the consequence of this document being used for a purpose other than the purposes for which it was commissioned. Any person using or relying on the document for such other purpose agrees, and will by such use or reliance be taken to confirm his agreement to indemnify HMM for all loss or damage resulting therefrom. HMM accepts no responsibility or liability for this document to any party other than the person by whom it was commissioned.

To the extent that this report is based on information supplied by other parties, HMM accepts no liability for any loss or damage suffered by the client, whether contractual or tortious, stemming from any conclusions based on data supplied by parties other than HMM used by HMM in preparing this report.

## TABLE OF CONTENTS

<b>1</b>	<b>PHASE DESCRIPTION.....</b>	<b>4</b>
1.1	NAME AND LOCATION OF STRUCTURE.....	4
1.2	POSTED TRAFFIC SPEED .....	4
<b>2</b>	<b>PROPOSED STRUCTURE .....</b>	<b>4</b>
2.1	DESCRIPTION OF STRUCTURE .....	4
2.2	STRUCTURAL TYPE.....	4
2.3	FOUNDATION TYPE .....	4
2.4	SPAN ARRANGEMENTS .....	4
2.5	BARRIER TYPE .....	5
2.6	PROPOSED ARRANGEMENTS FOR INSPECTION AND MAINTENANCE .....	5
2.7	MATERIALS AND FINISHES .....	5
<b>3</b>	<b>DESIGN/ASSESSMENT CRITERIA .....</b>	<b>5</b>
3.1	LIVE LOADING, CLEARANCES.....	5
3.1.1	Bridge code loading .....	5
3.1.2	Design vehicle .....	5
3.1.3	Other live loading.....	6
3.1.4	Provision for exceptional abnormal loads: None .....	6
3.1.4.1	Gross weight.....	6
3.1.4.2	Axle load and spacing .....	6
3.1.4.3	Location of vehicle track on deck cross-section.....	6
3.1.5	Any special loading not covered above .....	6
3.1.6	Minimum clearance provided (vertical and horizontal) .....	6
3.1.7	Authorities consulted and any special conditions required .....	6
3.2	LIST OF RELEVANT DESIGN DOCUMENTS .....	6
<b>4</b>	<b>STRUCTURAL ANALYSIS .....</b>	<b>6</b>
4.1	METHODS OF ANALYSIS PROPOSED FOR SUPERSTRUCTURE, SUBSTRUCTURE AND FOUNDATIONS.....	6
4.2	DESCRIPTION AND DIAGRAM OF STRUCTURE TO BE USED FOR ANALYSIS.....	6
4.3	ASSUMPTIONS INTENDED FOR CALCULATION OF STRUCTURAL ELEMENT PROPERTY AND STIFFNESS .....	7
4.4	PROPOSED EARTH PRESSURE COEFFICIENTS ( $K_A$ , $K_O$ , OR $K_P$ ) TO BE USED IN DESIGN OF EARTH RETAINING ELEMENTS. ....	7
<b>5</b>	<b>GROUND CONDITIONS .....</b>	<b>8</b>
5.1	ACCEPTANCE OF INTERPRETATIVE RECOMMENDATIONS OF THE SOILS REPORT TO BE USED IN THE DESIGN AND REASONS FOR ANY PROPOSED DEPARTURES .....	8
5.2	DESCRIBE FOUNDATIONS FULLY INCLUDING THE REASONS FOR ADOPTION OF ALLOWABLE AND PROPOSED BEARING PRESSURES/PILE LOADS, STRATA IN WHICH FOUNDATIONS ARE LOCATED, PROVISION FOR SKIN FRICTION EFFECTS ON PILES AND FOR LATERAL PRESSURES DUE TO COMPRESSION OF UNDERLYING STRATA, ETC .....	8
5.3	DIFFERENTIAL SETTLEMENT TO BE ALLOWED FOR IN DESIGN OF STRUCTURE .....	8
5.4	ANTICIPATED GROUND MOVEMENTS OR SETTLEMENT DUE TO EMBANKMENT LOADING, FLOWING WATER, AND MEASURES PROPOSED TO DEAL WITH THESE DEFECTS AS FAR AS THEY AFFECT STRUCTURE .....	8
5.5	RESULTS OF TEST OF GROUND WATER (E.G. PH VALUE, CHLORIDE OR SULPHATE CONTENT) AND ANY COUNTERACTING MEASURE PROPOSED (AS APPLICABLE).....	8
5.6	VARIANCE FROM GEOTECHNICAL MEMO RECOMMENDATIONS .....	8
<b>6</b>	<b>CHECKING .....</b>	<b>8</b>

6.1	NAME OF PROPOSED CHECKING TEAM.....	8
<b>7</b>	<b>DRAWINGS AND DOCUMENTS .....</b>	<b>9</b>
7.1	LIST OF DRAWINGS (INCLUDING NUMBERS) AND DOCUMENTS ACCOMPANYING THE SUBMISSION. TO INCLUDE:..	9
7.1.1	List of drawings: .....	9
7.1.2	Other documents .....	10
<b>8</b>	<b>THE ABOVE DESIGN AND CONSTRUCTION PROPOSALS ARE SUBMITTED FOR REVIEW</b>	<b>11</b>

Appendix A – Design Documentation

## **1 Phase Description**

### **1.1 Name and location of structure**

Bridge B11 carries Highway 3 over Highway 401. The North structure is extended from station 41+414.064 to 41+594.064 on Highway 3. The South structure is extended from station 41+456.623 to 41+646.623 on Highway 3

### **1.2 Posted traffic speed**

Posted speed for traffic on Highway 3 crossing over the bridge is 80 km/h. Posted speed on highway 401 (passing under the bridge) is 100 km/h.

## **2 Proposed Structure**

### **2.1 Description of Structure**

The structure is composed of two post-tensioned concrete underpass bridge which carries the traffic of Highway 3 above Highway 401. Both structures are comprised of four spans, true abutments with structural wing walls and three intermediate piers all founded on deep end bearing piles. Deck width for North structure is 14.50m and for South structure is 12.00m.

### **2.2 Structural type**

Both North and South structures are 4-span cast-in-place post-tensioned box girder structures. North structure superstructure is comprised of two cell box girder with the width of 14.50m and the South structure is a single-cell box girder with the width of 12.00m. The reason for choosing concrete is maintenance and aesthetic advantages over steel, while choosing post tensioning system is due to long span and increasing the capacity of section. Two cell box girder section has been chosen for North structure due to wider width and keeping the width to depth ratio of the boxes in reasonable range, and providing enough space for tendons.

### **2.3 Foundation type**

The foundation type is deep foundation, in which the footing is supported by almost 30m long steel H-piles to strong soil layer / bedrock. This foundation type was a recommendation by the geotechnical consultant due to poor bearing capacity of the soil.

### **2.4 Span arrangements**

Spans for North structure are 24m – 66m – 66m and 24m.  
Spans for South structure are 23m – 60m – 67m and 40m.

The reason for choosing the above span is mainly based on the available space for considering the piers and abutments, considering the geometry and required clearance of the highway beneath and the alignment of the bridge.

## 2.5 Barrier type

Concrete PL-3 barrier placed along outer side of each structure.

## 2.6 Proposed arrangements for inspection and maintenance

Access hatches are in accordance with OPSS 3339.100 and are provided in each span for access inside the boxes. For B11 North structure hatches are provided for each cell in each span. The provision of MTO structural manual has been considered for the maintenance of bearings.

## 2.7 Materials and finishes

### Pre-stressing Strands:

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

### Concrete:

Deck: 50 MPa  
Remainder: 30 MPa

### Reinforcing Steel:

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

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: None****3.1.4.1 Gross weight****3.1.4.2 Axle load and spacing****3.1.4.3 Location of vehicle track on deck cross-section****3.1.5 Any special loading not covered above**

None

**3.1.6 Minimum clearance provided (vertical and horizontal)**

Minimum required vertical clearance is 4.80 meters and the actual clearance provided is 4.926 meters.

**3.1.7 Authorities consulted and any special conditions required**

As per project agreement.

**3.2 List of relevant design documents**

## **4 Structural Analysis**

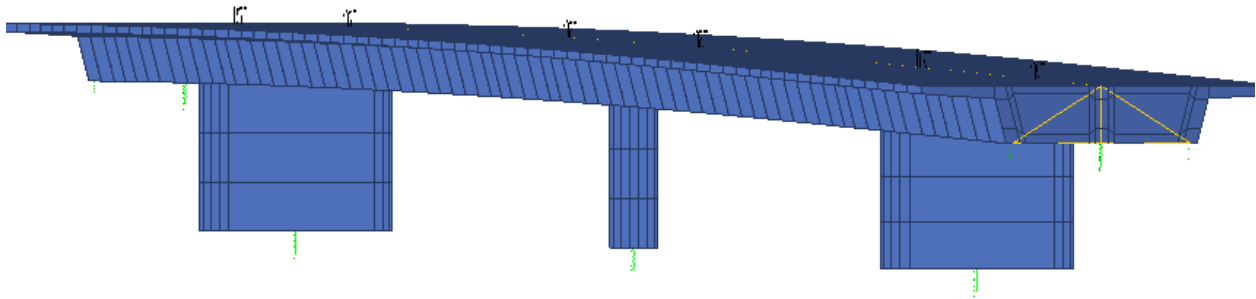
**4.1 Methods of analysis proposed for superstructure, substructure and foundations**

Analysis has been done with two separate 3D model with different designers to double check the results. The main software for analysis has been RM Bridge V8i, version 08.09.90.01. For the substructure, Pile Analysis has been Done by Amec, considering the interaction of soil and group of piles. Design for superstructure has been done with RM bridge V8i software.

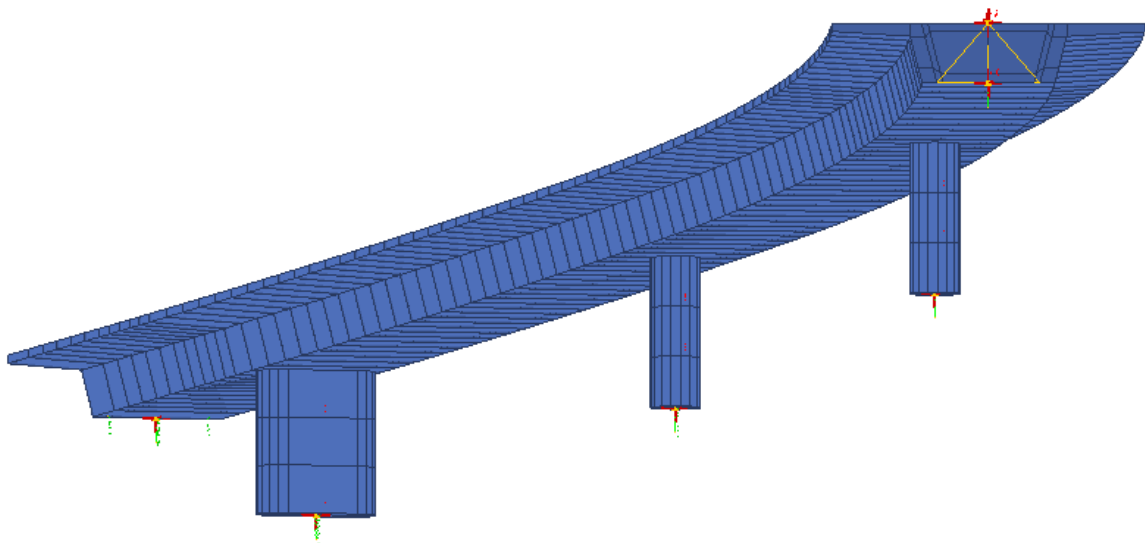
**4.2 Description and diagram of structure to be used for analysis**

The structure has been modeled using FEM elements of RM bridge, and the overall diagram of the model for North and South structure are as following:

B11 North:



B11 South:



4.3 Assumptions intended for calculation of structural element property and stiffness  
Structural stiffness was calculated according to CAN/CSA-S6-06.

4.4 Proposed earth pressure coefficients ( $k_a$ ,  $k_o$ , or  $k_p$ ) to be used in design of earth retaining elements.

Refer to Geotechnical Investigation and Design Report Bridge B-11 dated April 3, 2012.



## **5 Ground Conditions**

- 5.1 Acceptance of interpretative recommendations of the soils report to be used in the design and reasons for any proposed departures

Refer to Geotechnical Investigation and Design Report - Bridge B-11, AMEC Earth and Environmental file dated April 3, 2012.

- 5.2 Describe foundations fully including the reasons for adoption of allowable and proposed bearing pressures/pile loads, strata in which foundations are located, provision for skin friction effects on piles and for lateral pressures due to compression of underlying strata, etc

Refer to Geotechnical Investigation and Design Report - Bridge B-11, AMEC Earth and Environmental file dated April 3, 2012.

- 5.3 Differential settlement to be allowed for in design of structure

Due to lack of recommendation from geotechnical consultant, 10mm differential settlement has been considered for each of piers and abutments.

- 5.4 Anticipated ground movements or settlement due to embankment loading, flowing water, and measures proposed to deal with these defects as far as they affect structure

Refer to Geotechnical Investigation and Design Report - Bridge B-11, AMEC Earth and Environmental file dated April 3, 2012.

- 5.5 Results of test of ground water (e.g. pH value, chloride or sulphate content) and any counteracting measure proposed (as applicable)

Refer to Geotechnical Investigation and Design Report - Bridge B-11, AMEC Earth and Environmental file dated April 3, 2012.

- 5.6 Variance from Geotechnical Memo Recommendations

None.

## **6 Checking**

- 6.1 Name of proposed Checking Team

Checking team would be INTERNATIONAL BRIDGE TECHNOLOGIES, INC.



## 7 Drawings and Documents

7.1 List of drawings (including numbers) and documents accompanying the submission. To include:

7.1.1 List of drawings:

HMM drawing No.	Revision	TITLE
285380-03-060-SEG1-1100	0	COVER SHEET
285380-03-060-SEG1-1101	0	GENERAL ARRANGEMENT
285380-04-090-SEG1-1102	0	BOREHOLE LOCATIONS PLAN AND SOIL STRATA
285380-04-091-SEG1-1103	0	SOIL STRATIGRAPHY
285380-03-061-SEG1-1104	0	NORTH SIDE - FOUNDATION LAYOUT I
285380-03-061-SEG1-1105	0	NORTH SIDE - FOUNDATION LAYOUT II
285380-03-061-SEG1-1106	0	SOUTH SIDE - FOUNDATION LAYOUT I
285380-03-061-SEG1-1107	0	SOUTH SIDE - FOUNDATION LAYOUT II
285380-04-094-SEG1-1108	0	ABUTMENT EXCAVATION AND BACKFILL DETAILS
285380-03-061-SEG1-1109	0	NW - ABUTMENT LAYOUT I
285380-03-061-SEG1-1110	0	NE - ABUTMENT LAYOUT II
285380-03-061-SEG1-1111	0	SW - ABUTMENT LAYOUT III
285380-03-061-SEG1-1112	0	SE - ABUTMENT LAYOUT IV
285380-03-061-SEG1-1113	0	NW -ABUTMENT REINFORCEMENT I
285380-03-061-SEG1-1114	0	NE - ABUTMENT REINFORCEMENT II
285380-03-061-SEG1-1115	0	SW - ABUTMENT REINFORCEMENT III
285380-03-061-SEG1-1116	0	SE - ABUTMENT REINFORCEMENT IV
285380-03-061-SEG1-1117	0	NORTH SIDE - WINGWALL LAYOUT AND REINFORCEMENT
285380-03-061-SEG1-1118	0	SOUTH SIDE - WINGWALL LAYOUT AND REINFORCEMENT
285380-03-061-SEG1-1119	0	WEST SIDE RSS WALLS LAYOUT
285380-03-061-SEG1-1120	0	EAST SIDE RSS WALLS LAYOUT
285380-03-061-SEG1-1121	0	NORTH SIDE - PIER REINFORCEMENT
285380-03-061-SEG1-1122	0	SOUTH SIDE - PIER REINFORCEMENT
285380-03-062-SEG1-1123	0	NORTH SIDE – BEARING LAYOUT AND DETAILS
285380-03-062-SEG1-1124	0	SOUTH SIDE – BEARING LAYOUT AND DETAILS
285380-03-065-SEG1-1150	0	MODULAR EXPANSION JOINT WITH INJECTION HOSE
285380-03-065-SEG1-1151	0	MODULAR EXPANSION JOINT I
285380-03-065-SEG1-1152	0	MODULAR EXPANSION JOINT II
285380-03-065-SEG1-1153	0	BARRIER WALL LAYOUT
285380-03-065-SEG1-1154	0	BARRIER WALL W/O RAILING -PL3 - GFRP REBAR W/ ANCHOR HEAD

285380-03-065-SEG1-1155	0	6000 mm APPROACH SLAB
285380-03-065-SEG1-1156	0	DETAILS OF CONCRETE SLOPE PAVING
285380-03-066-SEG1-1157	0	STANDARD DETAILS
285380-07-444-SEG1-1158	0	EMBEDDED ELECTRICAL WORK
285380-04-094-SEG1-1160	0	CONSTRUCTION NOTES – BACKFILL AT STRUCTURES
285380-04-094-SEG1-1161	0	CONSTRUCTION NOTES – LIGHTWEIGHT FILL MATERIAL

#### 7.1.2 Other documents

- Geotechnical Investigation and Design Report - Bridge B-11
- Final Pile Group Analysis Report - Bridge B-11

**8 The above design and construction proposals are submitted  
for review**

Signed:   
Design Manager

Name: Biljana Rajlic

Engineering Qualifications: P.Eng.

Date: April 12, 2012

Professional Registration Number: 100041385

Affix Professional Seal



Signed: .....

Project Co Representative

Name: .....

Date: .....

Professional Registration Number: .....

Affix Professional Seal