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Issued by: Chris Haines  
Name

March 19, 2012  
Date

  
Signature



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## **1 Project Description**

### **1.1 Name and Location of Bridge**

Bridge B10 carries Highway 3 over Highway 401 and is located at STA 30+508.615 of Highway 3 and STA 11+125.927 of Highway 401.

### **1.2 Permitted Traffic Speed**

Permitted speed for traffic on Highway 3 crossing over the bridge is 80 km/h. Permitted speed for traffic on highway 401 passing under the bridge is 90 km/h.

## **2 Description of Structure**

### **2.1 Structure Type**

The structure is a 4-span cast-in-place post-tensioned single-cell box girder structure. Structure B10 is a twin structure, with north and south structures that are almost identical, with the north structure carrying the westbound lanes of Highway 3 and the south structure carrying the eastbound lanes. The clear width of the roadway on each structure is 12.0 meters, made up of two 3.75 meter wide lanes, a median shoulder width of 0.4 meters and a right hand shoulder of 3.00 meters.

Most of the post-tensioning is provided in the form of 6 continuous tendons in each web, draped in a conventional parabolic profile along the structure. These tendons are supplemented by additional discontinuous tendons located where needed.

Conventional pile-supported cast-in-place concrete abutments are provided at each end.

### **2.2 Foundation Type**

The foundations consist of HP 310x110 steel piles driven to refusal, either in bedrock or in the very dense deposit overlying the bedrock. Pilecaps are conventional cast-in-place concrete construction.

### **2.3 Span Arrangement**

The span arrangement is 40m – 65m – 65m – 59.5m

### **2.4 Fixity**

Pier 2 is constructed integral with the pier shaft and is thus fixed. Piers 1 and 3 and the abutments are expansion locations, using a combination of unidirectional and multidirectional pot bearings. A coefficient of friction of 0.03 has been assumed for the expansion location bearings. One bearing at each abutment will be unidirectional to accept lateral loads.

## 2.5 Barrier Type

A concrete barrier to OPSD 911.130 is provided along the right hand side of each roadway, and a curb is used along the median of Highway 3. A concrete barrier to OPSD 911.132 (Modified) is provided at the median of Highway 401 to protect both sides of the intermediate bridge support, and a concrete barrier to OPSD 911.130 is provided for the outer shoulders to protect the adjacent piers.

## 2.6 Inspection and Maintenance

### 2.6.1 Access Hatches

Access hatches in accordance with OPSS 3339.100 are provided in each span.

### 2.6.2 Other Elements

Other exposed elements are accessible through the use of scaffolding or mobile manlifts.

## 2.7 Materials and Finishes

### 2.7.1 Concrete

Deck: Minimum compressive strength at 28 days: 50 MPa  
Other: Minimum compressive strength at 28 days: 30 MPa

### 2.7.2 Prestressing Strands

Low relaxation, Grade 1860 in accordance with CSA Standard G279. Seven-wire strands, size designation 15 (0.6 inch).

### 2.7.3 Reinforcing Steel

Grade 400W in accordance with CSA Standard G30.18. Stainless steel and/or epoxy coated reinforcement will be used in locations as indicated in the MTO Bridge Office Design Bulletin "Interim Revision to the Corrosion Protection Strategies as Stipulated in the Structural Manual."

### 2.7.4 Concrete Finish

Concrete finish will comply with the requirements of the Project Agreement, Schedule 15-2.

# 3 Design Criteria

## 3.1 Live Load

### 3.1.1 Bridge Code Loading

Structure is designed for CL625-ONT loading as defined in the CSA Standard S6-06, the Canadian Highway Bridge Design Code (S6), 2010 revision. Dynamic load allowance (DLA) applied as applicable.

### 3.1.2 Other Live Loading

None

### 3.1.3 Provision for Exceptional Abnormal Loads

None

### 3.1.4 Any Special Loading Not Covered

None

## 3.2 Clearance

### 3.2.1 Minimum Vertical Clearance

Minimum required vertical clearance is 4.80 meters. The actual clearance provided is 5.236 meters at Highway 401 and 5.093 meters at EBR8.

## 3.3 Relevant Design Documents

Design in accordance with Part 2 of the 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 a discrepancy between design documents, the hierarchy listed in the Project Agreement will be followed.

# 4 Structural Analysis and Design

## 4.1 Method of Analysis

Primary analysis for design of B10 will be completed with 3D finite element models using the software package CSiBridge from Computers and Structures Inc. The results of these models will be supplemented with empirical design guidelines from CSA S6 and with hand calculations / MS Excel spreadsheets as required.

Two finite element models will be used – a spine model using frame elements to model the superstructure will be the primary analysis model and will include calculation of time-dependent effects such as creep, shrinkage and relaxation. A second model using shell elements to explicitly model the superstructure cross-section will be used to determine diaphragm forces and the distribution of girder moments and shears between the two webs.

## 4.2 Structural Stiffness

Gross concrete section properties (uncracked) were assumed for all structural elements.

## 4.3 Earth Pressure Coefficient

An active pressure coefficient of 0.55 and a passive pressure coefficient of 2.8 will be used for design of the abutments. These are conservative values corresponding to Soil Group II as given in the report "Geotechnical Investigation and Design Report – Bridge

B-10 (West of Geraedts Drive over Highway 401)" prepared by AMEC Earth & Environmental. This report is identified by HMM document number 23830-04-119-0018.

## **5 Geotechnical Conditions**

### **5.1 Design / Assessment Criteria**

Refer to the report "Geotechnical Investigation and Design Report – Bridge B-10 (West of Geraedts Drive over Highway 401)" prepared by AMEC Earth & Environmental. This report is identified by HMM document number 23830-04-119-0018.

### **5.2 Ground Conditions**

Refer to the report "Geotechnical Investigation and Design Report – Bridge B-10 (West of Geraedts Drive over Highway 401)" prepared by AMEC Earth & Environmental. This report is identified by HMM document number 23830-04-119-0018.

### **5.3 Description of Foundations**

Refer to the report "Geotechnical Investigation and Design Report – Bridge B-10 (West of Geraedts Drive over Highway 401)" prepared by AMEC Earth & Environmental. This report is identified by HMM document number 23830-04-119-0018.

### **5.4 Abutments**

Refer to the report "Geotechnical Investigation and Design Report – Bridge B-10 (West of Geraedts Drive over Highway 401)" prepared by AMEC Earth & Environmental. This report is identified by HMM document number 23830-04-119-0018.

### **5.5 Approachway Retaining Walls**

Refer to the report "Geotechnical Investigation and Design Report – Bridge B-10 (West of Geraedts Drive over Highway 401)" prepared by AMEC Earth & Environmental. This report is identified by HMM document number 23830-04-119-0018.

### **5.6 Groundwater**

Refer to the report "Geotechnical Investigation and Design Report – Bridge B-10 (West of Geraedts Drive over Highway 401)" prepared by AMEC Earth & Environmental. This report is identified by HMM document number 23830-04-119-0018.

### **5.7 Differential Settlement**

Refer to the report "Geotechnical Investigation and Design Report – Bridge B-10 (West of Geraedts Drive over Highway 401)" prepared by AMEC Earth & Environmental. This report is identified by HMM document number 23830-04-119-0018.

### **5.8 Variance from Geotechnical Report Recommendations**

None



## 6 Construction Considerations

For information on excavation, temporary cut slopes, backfilling and frost protection, refer to the report "Geotechnical Investigation and Design Report – Bridge B-10 (West of Geraedts Drive over Highway 401)" prepared by AMEC Earth & Environmental. This report is identified by HMM document number 23830-04-119-0018.

## 7 Drawings and Documents

### 7.1 List of Included Drawings

Note the following drawings have been split into substructure and superstructure packages. All of the drawings have been included in this submission. Drawings previously submitted with a substructure package have been labelled revision C.

Drawing Number	Rev.	Included	Drawing Title
			COVER
285380-03-060-SEG1-1001	0	included	GENERAL ARRANGEMENT
285380-04-090-SEG1-1002	0	included	BOREHOLE LOCATION & SOIL STRATA
285380-04-091-SEG1-1003	0	included	SOIL STRATIGRAPHY
285380-03-061-SEG1-1004	0	included	NORTH STRUCTURE - FOUNDATION LAYOUT I
285380-03-061-SEG1-1005	0	included	NORTH STRUCTURE - FOUNDATION LAYOUT II
285380-03-061-SEG1-1006	0	included	NORTH STRUCTURE - FOUNDATION LAYOUT III
285380-03-061-SEG1-1007	0	included	SOUTH STRUCTURE - FOUNDATION LAYOUT I
285380-03-061-SEG1-1008	0	included	SOUTH STRUCTURE - FOUNDATION LAYOUT II
285380-03-061-SEG1-1009	0	included	SOUTH STRUCTURE - FOUNDATION LAYOUT III
285380-03-060-SEG1-1010	0	included	ABUTMENT EXCAVATION AND BACKFILL DETAILS I
285380-03-061-SEG1-1011	0	included	ABUTMENT LAYOUT AND REINFORCEMENT - NW
285380-03-061-SEG1-1012	0	included	ABUTMENT LAYOUT AND REINFORCEMENT - NE
285380-03-061-SEG1-1013	0	included	ABUTMENT LAYOUT AND REINFORCEMENT - SW
285380-03-061-SEG1-1014	0	included	ABUTMENT LAYOUT AND REINFORCEMENT - SE
285380-03-061-SEG1-1015	0	included	WINGWALL LAYOUT AND REINFORCEMENT I
285380-03-061-SEG1-1016	0	included	WINGWALL LAYOUT AND REINFORCEMENT II
285380-03-061-SEG1-1017	0	included	RSS WALLS LAYOUT AND DETAILS
285380-03-061-SEG1-1018	0	included	PIER LAYOUT AND REINFORCEMENT
285380-03-062-WIP1-1019	0		BEARING LAYOUT AND DETAILS - NORTH STRUCTURE
285380-03-062-WIP1-1020	0		BEARING LAYOUT AND DETAILS - SOUTH STRUCTURE
285380-03-064-WIP1-1021	0		DECK LAYOUT
285380-03-064-WIP1-1022	0		DECK SCREED ELEVATIONS
285380-03-064-WIP1-1023	0		DECK DETAILS I
285380-03-064-WIP1-1024	0		DECK DETAILS II



285380-03-064-WIP1-1025	0		LONGITUDINAL TENDONS I
285380-03-064-WIP1-1026	0		LONGITUDINAL TENDONS II
285380-03-064-WIP1-1027	0		LONGITUDINAL TENDONS III
285380-03-064-WIP1-1028	0		TRANSVERSE TENDONS I
285380-03-064-WIP1-1029	0		TRANSVERSE TENDONS II
285380-03-064-WIP1-1030	0		DECK REINFORCEMENT I
285380-03-064-WIP1-1031	0		DECK REINFORCEMENT II
285380-03-064-WIP1-1032	0		DECK REINFORCEMENT III
285380-03-064-WIP1-1033	0		DECK REINFORCEMENT IV
285380-03-064-WIP1-1034	0		DECK REINFORCEMENT V
285380-03-065-WIP1-1050	0		DECK REINFORCEMENT VI
285380-03-065-WIP1-1051	0		DECK REINFORCEMENT VII
285380-03-064-WIP1-1035	0		MODULAR EXPANSION JOINT WITH INJECTION HOSE
285380-03-064-WIP1-1036	0		MODULAR EXPANSION JOINT I
285380-03-065-WIP1-1037	0		MODULAR EXPANSION JOINT II
285380-03-065-WIP1-1038	0		6000mm APPROACH SLAB
285380-03-065-WIP1-1039	0		BARRIER WALL W/O RAILING-PL3 GFRP REBAR
285380-03-065-WIP1-1040	0		BARRIER WALL LAYOUT
285380-03-065-WIP1-1048	0		BARRIER WALL PL3 GRASSLAND TREATMENT
285380-03-065-WIP1-1041	0		DETAILS OF CONCRETE SLOPE PAVING
285380-03-065-SEG1-1042	0	included	STANDARD DETAILS
285380-03-065-SEG1-1044	0	included	EMBEDDED ELECTRICAL WORK
285380-03-065-SEG1-1045	0	included	CONSTRUCTION NOTES – BACKFILL AT STRUCTURES
285380-03-065-SEG1-1046	0	included	CONSTRUCTION NOTES – LIGHTWEIGHT FILL MATERIAL

## 7.2 List of Included Documents

Document No.	Revision	Title
285380-04-119-0018	0	Geotechnical Investigation and Design Report – Bridge B-10 (West of Geraedts Drive over Highway 401)
285380-03-127-0009	0	Technical Appraisal Form (this document)

## 7.3 List of Reference Drawings and Documents (Not Included)

See Appendix A at the end of this document.

## **8 Checking and Review**

### **8.1 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.

### **8.2 Responsible Design Personnel**

Originator: Brent Visscher, P.Eng.

Checker: Brad Schmidt, P.Eng

Reviewer: Chris Haines, P.Eng.

**The above TAF is submitted for review**

Signed: Biljana Rajlic

**Design/Construction Manager**

Name: Biljana Rajlic

Date: March 19, 2012

Professional Registration Number: 100041385



Signed: Ignacio LaSA

**Project Company Representative**

Name: IGNACIO LASA

Date: April 30, 2012

Professional Registration Number:

## **Appendix A: Referenced Drawings and Documents**

### **Drawings**

<b>Drawing No.</b>	<b>Revision</b>	<b>Title</b>
-	-	-

### **Documents**

<b>Document No.</b>	<b>Revision</b>	<b>Title</b>
285380-03-126-0027		Safety of Working in Post-Tensioned Bridge Cells