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Issued by: Lokesh Mathur  
Name

Feb. 05, 2013  
Date

  
Signature

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**Document:** B4 – Malden Road Overpass  
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## 1 Design Package Description

This submission contains design drawings and geotechnical recommendations associated with Malden Road Overpass. This is the IFC submission for the structure deliverables.

### 1.1 Name and Location of Structure

Malden Road Overpass carries eastbound and westbound traffic on Highway 401 (HWY401) from STA. 11+727.5 to STA. 11+759.5 over Malden Road.

### 1.2 Permitted Traffic Speed

Highway Classification:	UFD for Alignment HWY 401 Municipal Road for Malden Road
Design Speed:	100 km/h for UFD over structure 60 km/h for municipal road under structure
Posted Speed:	80 km/h for UFD over structure 60 km/h for municipal road under structure
Laning:	6 over structure for Alignment HWY401 2 under structure for Malden Road
Design Clearance:	Minimum 5.0 m vertical clearance
Bridge Design Vehicle:	CL-625-ONT

## 2 Proposed Structure

### 2.1 Description of Structure

The Malden Road Overpass is a single span, slab-on-girder bridge carrying three 3.75 m eastbound lanes and three 3.75 m westbound lanes on Highway 401 (HWY401) over Malden Road. The clear width of the roadway is 35.3 m which accommodates the specified lanes, a reinforced concrete median barrier Type 1 in the centre, and two 3.0 m shoulders on the north and south sides of both the eastbound and westbound lanes. The centerline of Highway 401 (HWY401) is skewed at 16° 14' 35" to the centreline of Malden Road. On each side of the bridge deck, there is a PL3 concrete barrier wall without railing.

#### Structural Summary

Structure Type:	Concrete slab on prestressed concrete NU girders spanning continuously between two concrete integral abutments.
Span Arrangement:	One span with a length of 32.0 m, aligned east-west and parallel to the centreline of Highway 401 (HWY401).
North Abutment:	Reinforced concrete beam supported on HP 310 x 110 steel piles and integral with slab-on-girder superstructure.

South Abutment:	Reinforced concrete beam supported on HP 310 x 110 steel piles and integral with slab-on-girder superstructure.
Span Articulation:	Continuous slab-on-girder superstructure is integral with the abutments.
Barrier Type:	PL-3 concrete parapet wall without steel railing.

## 2.2 Proposed Means for Inspection and Maintenance

All exposed elements are accessible through the use of scaffolding and / or mobile manlifts.

## 2.3 Materials and Finishes

### 2.3.1 Cast-In-Place Concrete

Substructure: Minimum compressive strength at 28 days: 30 MPa.

Deck: Minimum compressive strength at 28 days: 40 MPa.

### 2.3.2 Precast Prestressed Concrete

Girders: Minimum compressive strength at transfer: 42 MPa.

Minimum compressive strength at 28 days: 60 MPa.

Deck Panels: Minimum compressive strength at 28 days: 40 MPa.

### 2.3.3 Reinforcing Steel

Plain and coated reinforcing steel bars: CAN/CSA G30.18-M92; Grade 400W

Stainless steel reinforcing bars: Type 316LN or Duplex 2205 or Type XM-28;  
Grade 500

GFRP bars: Min. Tensile strength (Fu) = 655 MPa 16mm  
=620 MPa 19mm

Min. Tensile modulus of elasticity (E) = 40.8  
GPa

### 2.3.4 Prestressing Steel

Tendons shall be low-relaxation, seven wire strands, size designation 15, Grade 1860.

### 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 and Clearances

##### 3.1.1 Design Live Loading

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

##### 3.1.2 Design vehicle

HWY401: CL-625-ONT

Malden Road: CL-625-ONT

##### 3.1.3 Other Live Loading

None

##### 3.1.4 Provision for Exceptional Abnormal Loads

None

##### 3.1.5 Any Special Loading Not Covered

None

##### 3.1.6 Minimum Clearance Provided

Vertical: 5.0 m for Malden Road  
not applicable for Highway 401

##### 3.1.7 Authorities Consulted and Any Special Conditions Required

None

#### 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.

### 4 Structural Analysis

#### 4.1 Methods of Analysis

##### 4.1.1 Superstructure

A combination of hand calculations, 3-D frame model, and spreadsheets was used to analyse and design the slab-on-girder superstructure for safe support of the loads prescribed by CAN/CSA-S6-06. The commercial software, S-Frame, was used for the

frame analysis. Concise Beam Version 4.57 was used for the final analysis and design of the prestressed concrete NU girders.

#### 4.1.2 Substructure and Foundations

Analysis and design of the abutments and supporting piles were carried out by including these components in the 3-D frame model noted above. A combination of hand calculations and spreadsheets was used to determine reinforcing steel requirements and for checking stresses in steel H-piles.

#### 4.2 Calculation of Structural Stiffness

Structural stiffness was calculated according to CAN/CSA-S6-06.

#### 4.3 Earth Pressure Coefficients

Refer to Geotechnical Investigation and Design Report prepared by AMEC Earth and Environmental, dated December, 2012.

### 5 Ground Design Considerations

#### 5.1 Ground Conditions

Refer to Geotechnical Investigation and Design Report prepared by AMEC Earth and Environmental, dated December, 2012.

#### 5.2 Geotechnical Design Parameters

Refer to Geotechnical Investigation and Design Report prepared by AMEC Earth and Environmental, dated December, 2012.

#### 5.3 Differential Settlement

Refer to Geotechnical Investigation and Design Report prepared by AMEC Earth and Environmental, dated December, 2012.

#### 5.4 Anticipated Ground Movements or Settlement

Refer to Geotechnical Investigation and Design Report prepared by AMEC Earth and Environmental, dated December, 2012.

#### 5.5 Groundwater Conditions and Mitigative Measures

Refer to Geotechnical Investigation and Design Report prepared by AMEC Earth and Environmental, dated December, 2012.

#### 5.6 Variance from Geotechnical Memo Recommendations

None.

## 6 Construction Considerations

Refer to Geotechnical Investigation and Design Report prepared by AMEC Earth and Environmental, dated December, 2012 for excavation, temporary cut slopes, backfilling, and frost protection.

## 7 Drawings and Documents

### 7.1 List of Drawings (included in this submission)

Drawing No.	Revision	Drawing Title
285380-03-060-SEG3-0400	0	COVER SHEET, SITE PLAN, AND KEY PLAN
285380-03-060-SEG3-0401	0	GENERAL ARRANGEMENT
285380-04-090-SEG3-0402	0	BOREHOLE LOCATIONS AND SOIL STRATA
285380-04-091-SEG3-0403	0	SOIL STRATIGRAPHY
285380-03-061-SEG3-0404	0	FOUNDATION LAYOUT
285380-03-061-SEG3-0405	0	WEST ABUTMENT LAYOUT
285380-03-061-SEG3-0406	0	EAST ABUTMENT LAYOUT
285380-03-061-SEG3-0407	0	ABUTMENT REINFORCEMENT
285380-03-061-SEG3-0408	0	WEST WINGWALL DETAILS
285380-03-061-SEG3-0409	0	EAST WINGWALL DETAILS
285380-03-061-SEG3-0410	0	RSS WALL PLAN AND SECTION
285380-03-061-SEG3-0411	0	RSS WALL ELEVATIONS
285380-03-063-SEG3-0412	0	PRESTRESSED GIRDERS I
285380-03-063-SEG3-0413	0	PRESTRESSED GIRDERS II
285380-03-063-SEG3-0414	0	PRESTRESSED GIRDERS III
285380-03-064-SEG3-0415	0	PRESTRESSED DECK PANEL
285380-03-064-SEG3-0416	0	DECK LAYOUT & SCREED ELEVATIONS
285380-03-064-SEG3-0417	0	DECK REINFORCEMENT
285380-03-064-SEG3-0418	0	ABUTMENT DIAPHRAGM REINFORCEMENT
285380-03-065-SEG3-0419	0	BARRIER WALL W/O RAILING
285380-03-065-SEG3-0420	0	REINFORCED CONCRETE MEDIAN BARRIER WALL (TYPE 1)
285380-03-065-SEG3-0421	0	BARRIER WALL PL3 GRASSLANDTREATMENT
285380-03-065-SEG3-0422	0	6000 mm APPROACH SLABS
285380-03-066-SEG3-0423	0	STANDARD DETAILS



285380-07-444-SEG3-0424	0	EMBEDDED ELECTRICAL WORK
285380-04-094-SEG3-0425	0	ABUTMENT EXCAVATION AND BACKFILL DETAILS
285380-04-094-SEG3-0426	0	CONSTRUCTION NOTES – BACKFILL AT STRUCTURES
285380-04-094-SEG3-0427	0	CONSTRUCTION NOTES – LIGHTWEIGHT FILL MATERIAL

## 7.2 List of Documents (included in this submission)

Document No.	Revision	Description
285380-04-119-0111	0	Geotechnical Investigation and Design Report, Dec. 17, 2012.
285380-03-127-0003	0	Technical Appraisal Form

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

See Appendix A.

# 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: Lokesh Mathur

Checker: Khaled Almaaz

Reviewer: Biljana Rajlic

**The above TAF is submitted for review**

Signed: 

Design Manager

Name: BILJANA RAJLIC

Engineering Qualifications: P. Eng.

Date: February 5, 2013

Professional Registration Number: 100041385

Affix Professional Seal:



Signed:  .....

Project Co Representative

Name: IONACIO LARA .....

Date: March 6, 2013 .....

Professional Registration Number: .....

Affix Professional Seal:

## 9 Appendix A - Referenced Drawings and Documents

### Referenced Drawing(s)

Drawing No.	Revision	Drawing Title
OPSD 911.130	0	GUIDE RAIL SYSTEM, CONCRETE BARRIER CAST-IN-PLACE, TYPE A INSTALLATION
OPSD 911.381	1	GUIDE RAIL SYSTEM, CONCRETE BARRIER PERMANENT TRANSITION INSTALLATION CONCRETE BARRIER TO STRUCTURE
OPSD 980.101	2	PEDESTRIAN BARRICADE INSTALLATION
OPSD 3000.100	2	FOUNDATION, PILES, STEEL H-PILE DRIVING SHOE
OPSD 3000.150	1	FOUNDATION, PILES, STEEL H-PILE SPLICE
OPSD 3101.150	1	WALLS, ABUTMENT, BACKFILL, MINIMUM GRANULAR REQUIREMENT
OPSD 3121.150	1	WALLS, RETAINING, BACKFILL, MINIMUM GRANULAR REQUIREMENT
OPSD 3190.100	1	WALLS, RETAINING AND ABUTMENT, WALL DRAIN
OPSD 3360.100	1	DECK LIGHT POLE BASES STRUCTURES WITH BARRIER WALLS
OPSD 3370.100	2	DECK, WATERPROOFING, HOT APPLIED ASPHALT MEMBRANE WITH PROTECTION BOARD
OPSD 3370.101	2	DECK, WATERPROOFING, HOT APPLIED ASPHALT MEMBRANE AT ACTIVE CRACKS GREATER THAN 2 mm WIDE AND CONSTRUCTION JOINTS
OPSD 3390.100	1	DECK DRIP CHANNEL
OPSD 3419.100	1	BARRIERS AND RAILINGS, STEEL GUARDRAIL AND CHANNEL ANCHORAGE
OPSD 3941.200	1	FIGURES IN CONCRETE, SITE NUMBER AND DATE, LAYOUT
OPSD 3950.100	0	JOINTS, CONCRETE EXPANSION AND CONSTRUCTION, ON STRUCTURE

**Certificate(s)**

Certificate No.	Revision	Certificate Name

**Special Provision(s)**

Document No.	Revision	Description