

# **APPENDIX O**

## **Structural Memorandum**

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To:	Dana Glofcheskie City of Mississauga	From:	Mark D'Andrea Hamilton ON Office
File:	165010564	Date:	July 9, 2015

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**Reference: Courtneypark Drive East Class EA & Preliminary Design  
Structural Memorandum**

## **INTRODUCTION**

The City of Mississauga has retained Stantec Consulting Ltd. (Stantec) to undertake a Class EA and preliminary design for the improvements to Courtneypark Drive East, between Kennedy Road and Dixie Road. These limits include the Courtneypark Drive East interchange with Highway 410, as well as the associated bridge.

This memo presents a brief summary of the widening of the Courtneypark Drive East Underpass necessary to accommodate the proposed roadway improvements.

## **PROJECT LOCATION**

The structure, which carries Courtneypark Drive East traffic over Highway 410, is located approximately 3.5 km west of Hurontario Street and 2.0 km north of Highway 401. Courtneypark Drive East will be referenced as being orientated west to east for the purposes of this memo.

## **AVAILABLE INFORMATION**

Original construction drawings, from Ministry of Transportation Contracts 79-27 and 89-69, have been made available to Stantec. The General Arrangement drawings from these contracts are included with this memo.

## **EXISTING STRUCTURE**

The Courtneypark Drive East Underpass consists of a two-span (35 m – 35 m) slab-on-girder (steel I-girder) bridge.

The original bridge was built circa 1979 and is approximately 15 m wide. In 1989, the bridge was widened to the south by about 12 m. There is a longitudinal joint in the raised concrete median between the two superstructures. There is a sidewalk on each side of the bridge and there are utility ducts within the south sidewalk. A barrier wall is situated on each of the sidewalks and there are electrical conduits within the barrier walls.

The pier consists of two separate units, each of which consist of a concrete pier cap supported on three square concrete pier columns founded on a spread footing. The abutments also consist of separate units, which are conventional concrete abutments supported on spread footings. The wingwalls for the original bridge are conventional concrete walls supported on spread footings;

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Structural Memorandum**

however, the wingwalls for the widened portion of the bridge consist of Retained Soil System (RSS) walls.

## **DESIGN CRITERIA**

### **GENERAL**

Courtneypark Drive East is classified as an Urban Arterial Undivided roadway with a design speed of 80 km/h (UAU 80).

This project does not include any work on Highway 410 at the structure location.

The existing vertical clearance (approximately 5.0 m) under the bridge will be maintained.

### **GEOMETRICS**

The horizontal alignment of Courtneypark Drive East is to be shifted approximately 3.7 m to the south.

There are no significant changes proposed to the vertical alignment.

### **PROPOSED CROSS-SECTION**

The bridge will be widened to accommodate the proposed Courtneypark Drive East improvements. The proposed cross-section of the structure consists of the following (from north to south):

- 0.35 m parapet wall
- 1.5 m sidewalk
- 0.45 m barrier wall
- 1.5 m shoulder
- 3.3 m westbound auxiliary lane
- 3 x 3.5 m westbound through lanes
- 2.0 m median
- 3 x 3.5 m eastbound through lanes
- 3.3 m eastbound auxiliary lane
- 1.5 m shoulder
- 0.45 m barrier wall
- 3.5 m multi-use trail
- 0.35 m parapet wall

## **PROPOSED STRUCTURE WIDENING**

The proposed cross-section requires the bridge to be widened approximately 13 m to the south. The superstructure widening is expected to consist of a slab-on-girder and the substructure widening will be similar to that carried out circa 1989. Modifications to the existing RSS walls along the south side of the structure will be required. The elimination of expansion joints (i.e., the use of semi-integral abutments) for the widening and the existing structure should be investigated in Detail Design.

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In order to maintain the required vertical clearance, the depth and spacing of the steel I-girders for the widening may need to be shallower and smaller, respectively, than typically used for this bridge span configuration. The steel I-girder depth will need to be confirmed in Detail Design; however, it is expected that the depth will need to be approximately 900-950 mm in order to satisfy vertical clearance requirements.

The existing north barrier wall and sidewalk, including street lighting, will be replaced in order to accommodate the roadway improvements. The existing median will require modifications in order to accommodate the shift in the Courneypark Drive East horizontal alignment. A portion of the existing deck will also need to be overlaid to accommodate the alignment shift. These modifications will need to be investigated in Detail Design in order to determine if any structural strengthening of the existing structure is necessary.

Street lighting (light poles, ducts and bases) will be added to the structure in accordance with preliminary street lighting design recommendations.

A Preliminary General Arrangement drawing is provided to illustrate the proposed bridge widening.

The estimated construction cost for the proposed widening is approximately \$4,900,000.

## **DETAIL DESIGN RECOMMENDATIONS**

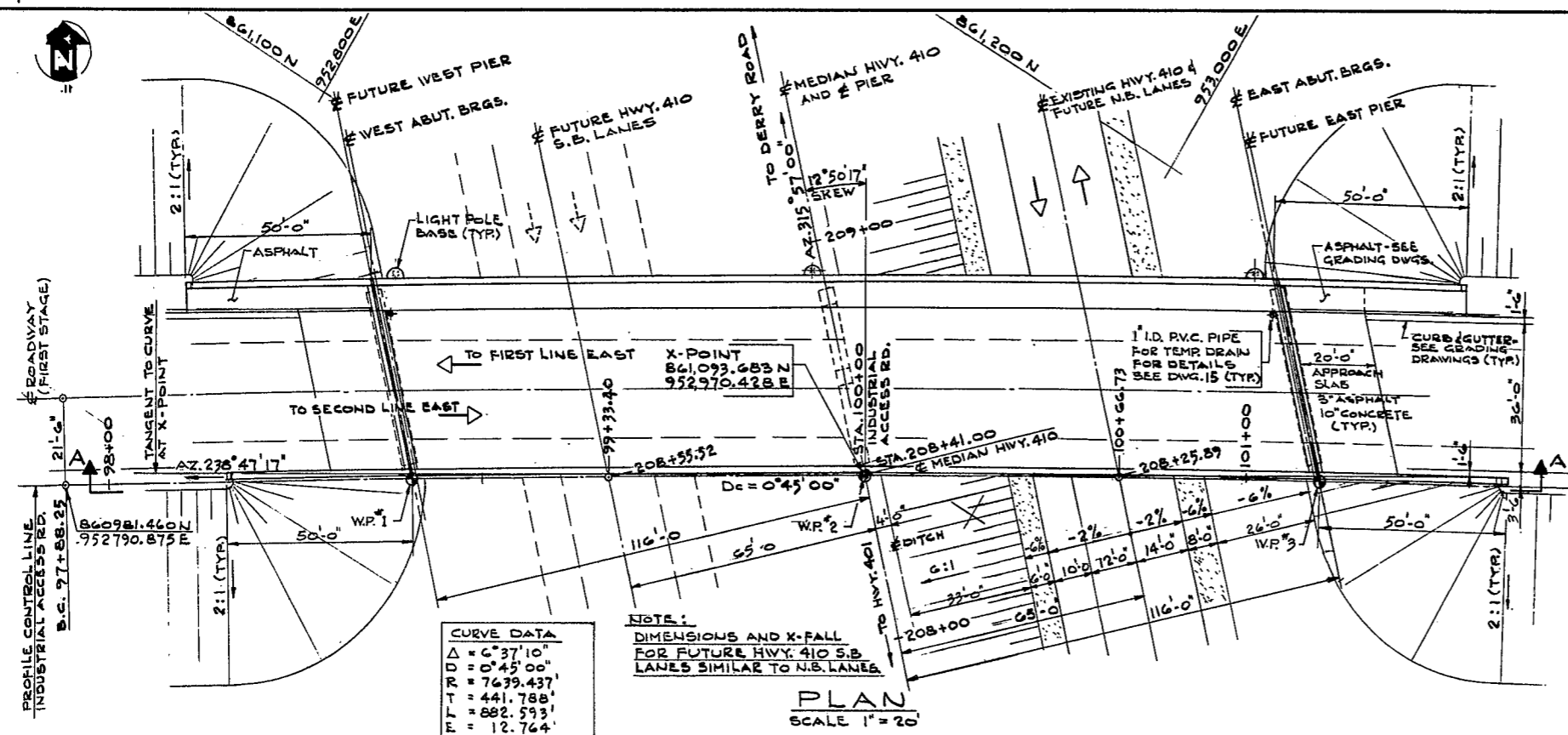
The rehabilitation needs of the existing structure should be determined in Detail Design and any required rehabilitation work should be coordinated with the work necessary for the proposed widening. The determination of rehabilitation scope of work should include field investigations, consisting of at least a bridge deck condition survey, and life cycle cost analysis. A structural analysis of the bridge is also recommended to be completed in Detail Design to investigate impacts from the proposed horizontal alignment shift.

### **STANTEC CONSULTING LTD.**

*M. D'Andrea*

Mark D'Andrea, M.Sc., P.Eng.  
Senior Structural Engineer, Transportation  
Phone: (905) 381-3232  
Fax: (905) 385-3534  
mark.dandrea@stantec.com

Attachment: General Arrangement drawings from Contracts 79-27 and 89-69  
Preliminary cost estimate of proposed widening  
Preliminary General Arrangement drawing of proposed widening



- LIST OF DRAWINGS**
- 1 GENERAL ARRANGEMENT
  - 2 BOREHOLE LOCATIONS & SOIL STRATA.
  - 3 FOUNDATION LAYOUT
  - 4 ABUTMENTS - PLANS
  - 5 ABUTMENTS - ELEVATIONS AND SECTIONS
  - 6 PIER
  - 7 STRUCTURAL STEEL I
  - 8 STRUCTURAL STEEL II
  - 9 DECK - PLANS
  - 10 DECK DETAILS
  - 11 BARRIER WALL
  - 12 APPROACH SLABS
  - 13 AS CONSTRUCTED ELEVATIONS & DIM'S.
  - 14 STANDARD DETAILS I
  - 15 STANDARD DETAILS II
  - 16 ELECTRICAL EMBEDDED WORK I
  - 17 ELECTRICAL EMBEDDED WORK II
  - 18 ELECTRICAL STANDARD DETAILS I
  - 19 ELECTRICAL STANDARD DETAILS II
  - 20 ELECTRICAL STANDARD DETAILS III

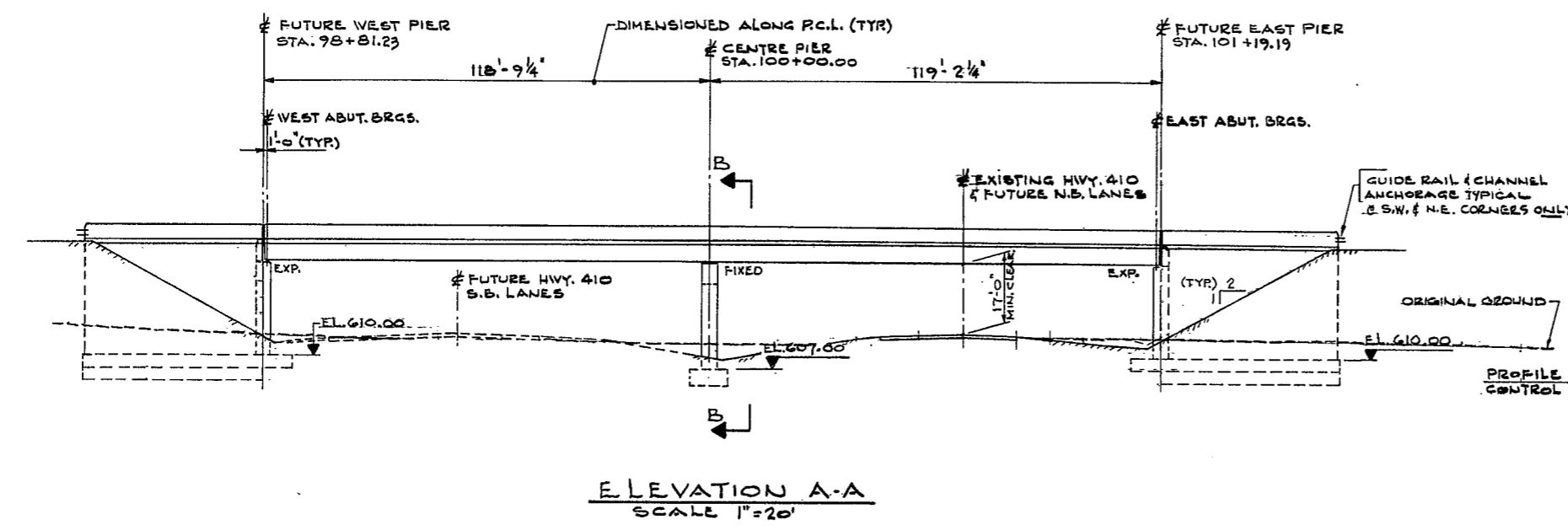
DISTRICT : G  
 CONT No 79-27  
 WP No 103-69-13

INDUSTRIAL ACCESS ROAD UNDERPASS

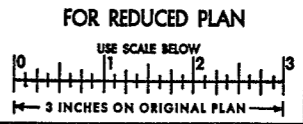
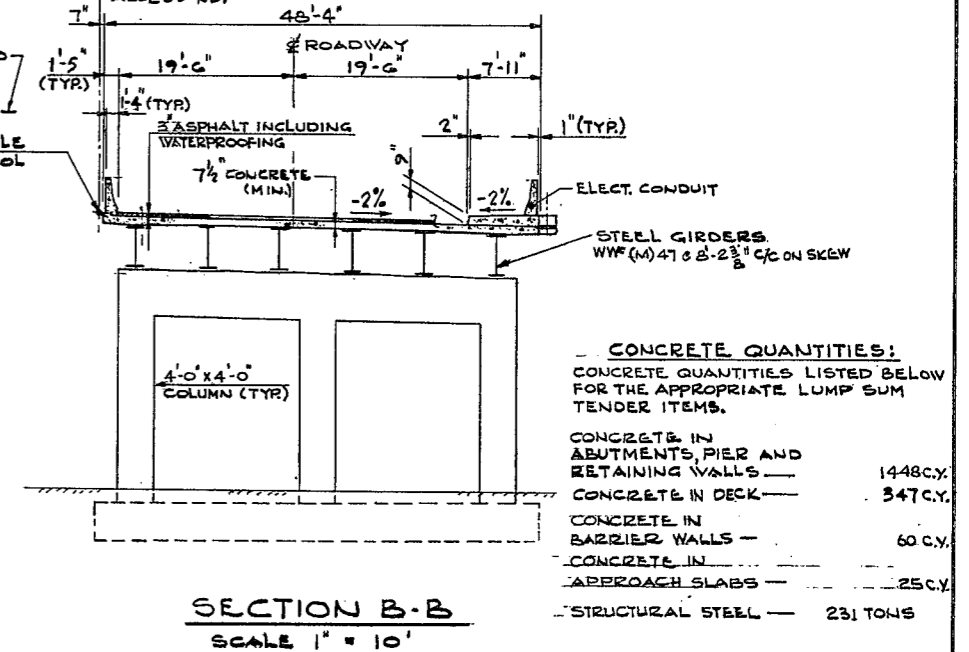
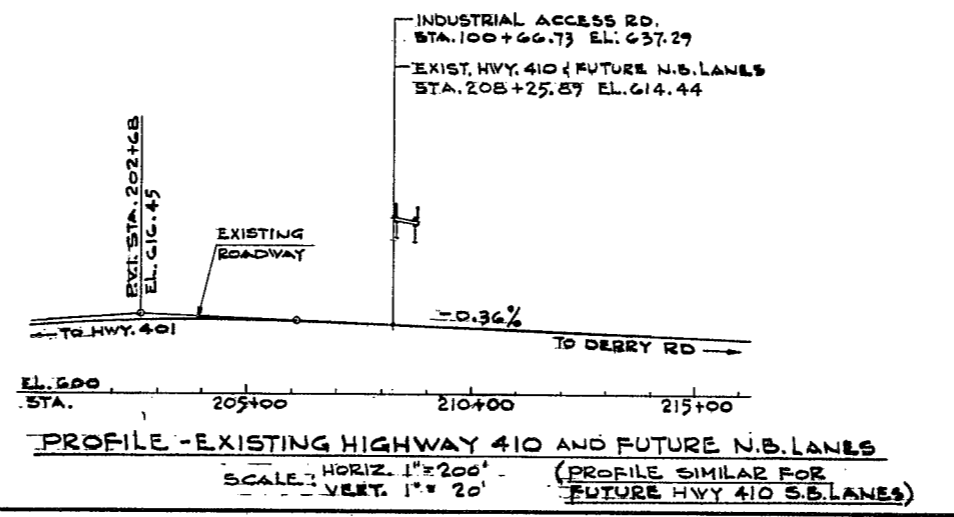
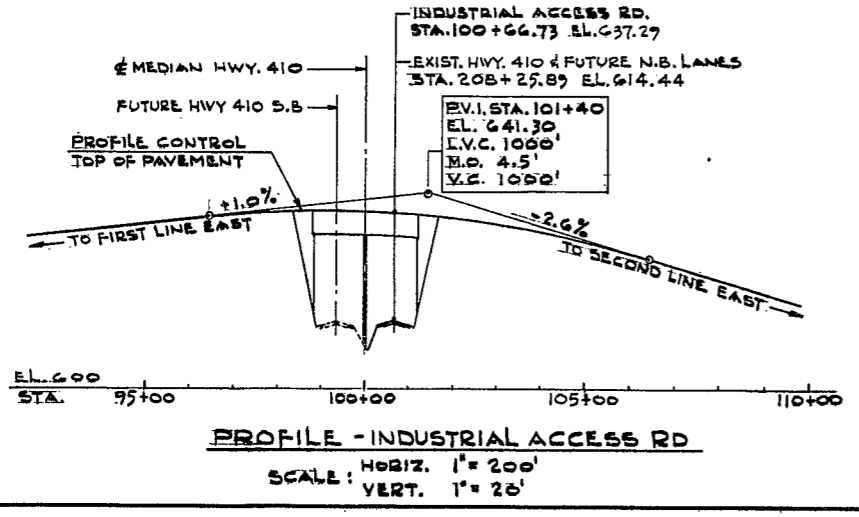
SHEET 31

**FENCO** FENCO CONSULTANTS LTD.

**KEY PLAN**



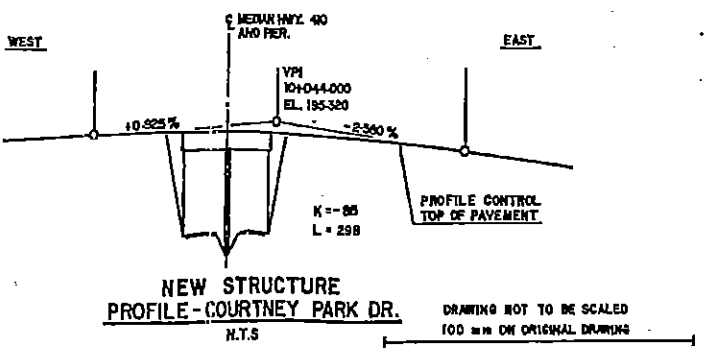
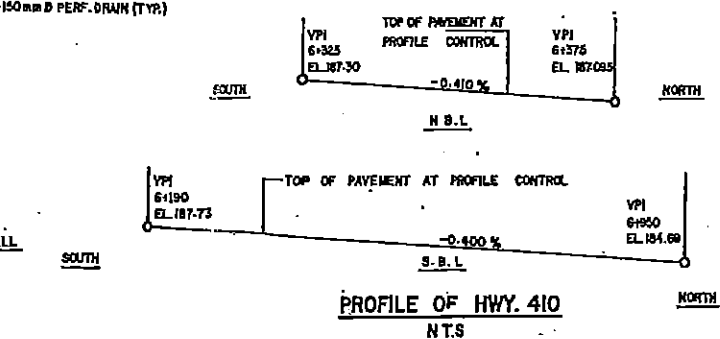
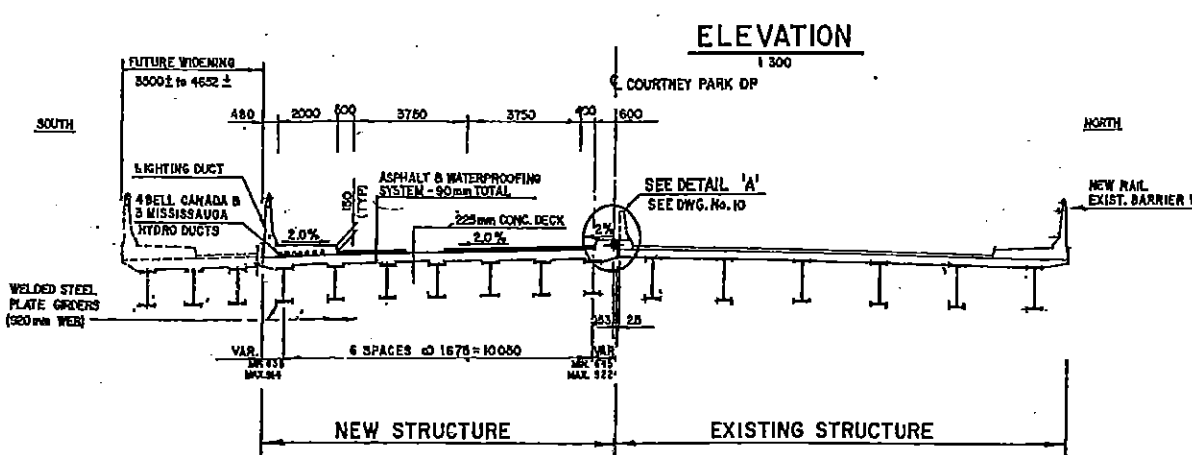
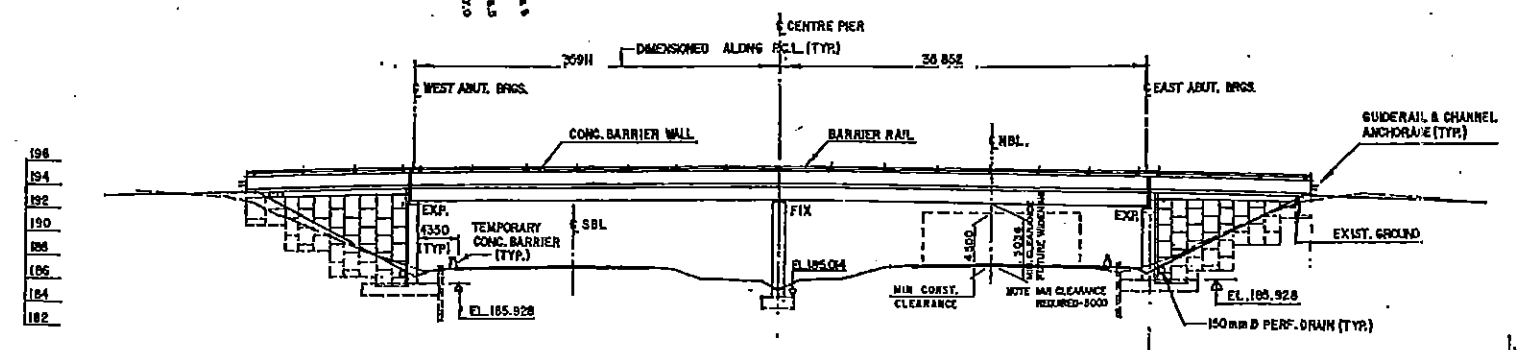
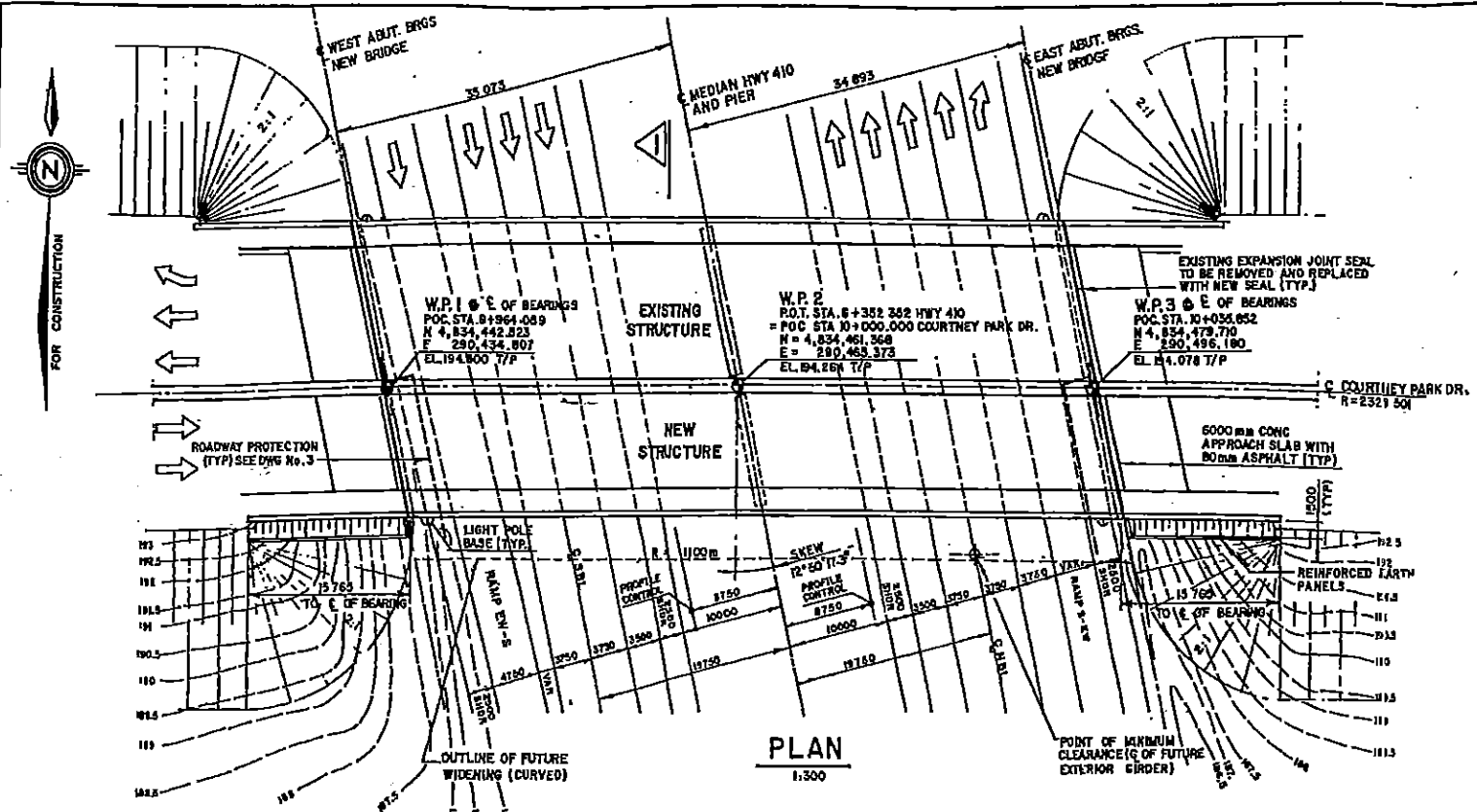
- GENERAL NOTES:**
- CLASS OF CONCRETE**
- ABUTMENTS, PIER, DECK, SIDEWALK & BARRIER WALLS — 4,000 P.S.I.
  - FOUNDATIONS AND APPROACH SLABS — 3,000 P.S.I.
- GRADE OF REINFORCING STEEL**
- ALL REINFORCING STEEL — GRADE 400
  - REINFORCING BARS WITH THE DESIGNATION 'C' AT THE END OF BAR MARKS SHALL BE COATED BARS.
- CLEAR COVER TO REINFORCING STEEL**
- FOOTINGS AND SURFACES IN CONTACT WITH EARTH — 3"
  - DECK SLAB: TOP — 2" BOTTOM 1 1/2"
  - BARRIER WALLS — 1 1/2"
  - REMAINDER — 2"
- \* TO ACHIEVE THE MINIMUM CLEAR COVER OF 2" SPECIFIED THE TOP LAYER SHALL BE PLACED WITH A CLEAR COVER OF 2 1/2" ± 1/2" TOLERANCE.
- CONSTRUCTION NOTES**
- THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BEARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF ± 1/8"
  - NO CONCRETE SHALL BE PLACED ABOVE THE BEARING SEATS UNTIL THE CONCRETE IN THE DECK HAS BEEN PLACED.



REVISIONS	DATE	BY	DESCRIPTION	DATE	SET

DESIGN J.C.D. CHECK W.V.C. LOADING HS 20 DATE SEPT. 78  
 DRAWING W.R. CHECK J.C.D. SITE No 24-441 DWG 1

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO



**METRIC**  
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

DIST No 6  
CONT No 89-69  
WP No 103-69-19



HWY 410 - COURTNEY PARK DRIVE UNDERPASS  
GENERAL ARRANGEMENT

SHEET  
79



**GENERAL NOTES**

**CLASS OF CONCRETE**

\* ALL - 30 MPA

**CLEAR COVER TO REINFORCING STEEL**

* FOOTINGS	100 ± 25
* WINGS	
FRONT FACE	80 ± 20
BACK FACE	70 ± 20
* PIERS & ABUTMENTS	80 ± 20
* DECK	
TOP	70 ± 20
BOTTOM	40 ± 10
* REMAINDER	70 ± 20

UNLESS OTHERWISE NOTED

**REINFORCING STEEL**

REINFORCING STEEL SHALL BE GRADE 400 UNLESS OTHERWISE SPECIFIED. BAR MARKS WITH SUFFIX C DENOTE COATED BARS.

**CONSTRUCTION NOTES**

\* THE CONTRACTOR SHALL FINISH THE BEARING SEATS LEVEL TO THE SPECIFIED ELEVATIONS

W.P. DENOTES WORKING POINT  
T/P DENOTES TOP OF PAVEMENT

**LIST OF DRAWINGS**

1. GENERAL ARRANGEMENT
2. BOREHOLE LOCATIONS AND SOIL STRATA
3. ROADWAY PROTECTION
4. FOOTING LAYOUT AND DETAILS
5. PIER DETAILS
6. WEST ABUTMENT DETAILS
7. EAST ABUTMENT DETAILS
8. STRUCTURAL STEEL - I
9. STRUCTURAL STEEL - II
10. DECK LAYOUT AND DETAILS
11. DECK REINFORCING
12. BEARING LAYOUT AND DETAILS
13. JOINT ANCHORAGE AND ARMOURING - I
14. JOINT ANCHORAGE AND ARMOURING - II
15. BARRIER WALL
16. REINFORCED EARTH - TYPICAL DETAILS
17. REINFORCED EARTH - PLANS, DETAILS
18. REINFORCED EARTH - ELEVATIONS
19. BARRIER WALL ON FILL
20. 6000 mm APPROACH SLAB
21. BARRIER WALL REMOVAL AND NEW MEDIAN CURB RECONSTRUCTION
22. RAILING FOR BARRIER WALL
23. BRIDGE DATE AND SITE NUMBER DATA
24. AS CONSTRUCTED ELEV. AND DIM.
25. STANDARD DETAILS
26. ELECTRICAL EMBEDDED WORK - MIXISTRT
27. QUANTITIES - STRUCTURE I
28. QUANTITIES - STRUCTURE II



**APPLICABLE STANDARD DRAWINGS**

- DD 3502 - MINIMUM GRANULAR BACKFILL REQUIREMENTS
- OPSD 508 02 - BRIDGE DECK WATERPROOFING
- DD 4604 - FALSEWORK CLEARANCES

REVISIONS	DATE	BY	CHECK T.Z.	DESCRIPTION	DATE

DESIGN J.C.S. CHECK T.Z. LOADING ORHDC 83, CL. A DATE APR. 88  
DRAWING G.S. CHECK J.C.S. SITE No 24-441 DWG 79

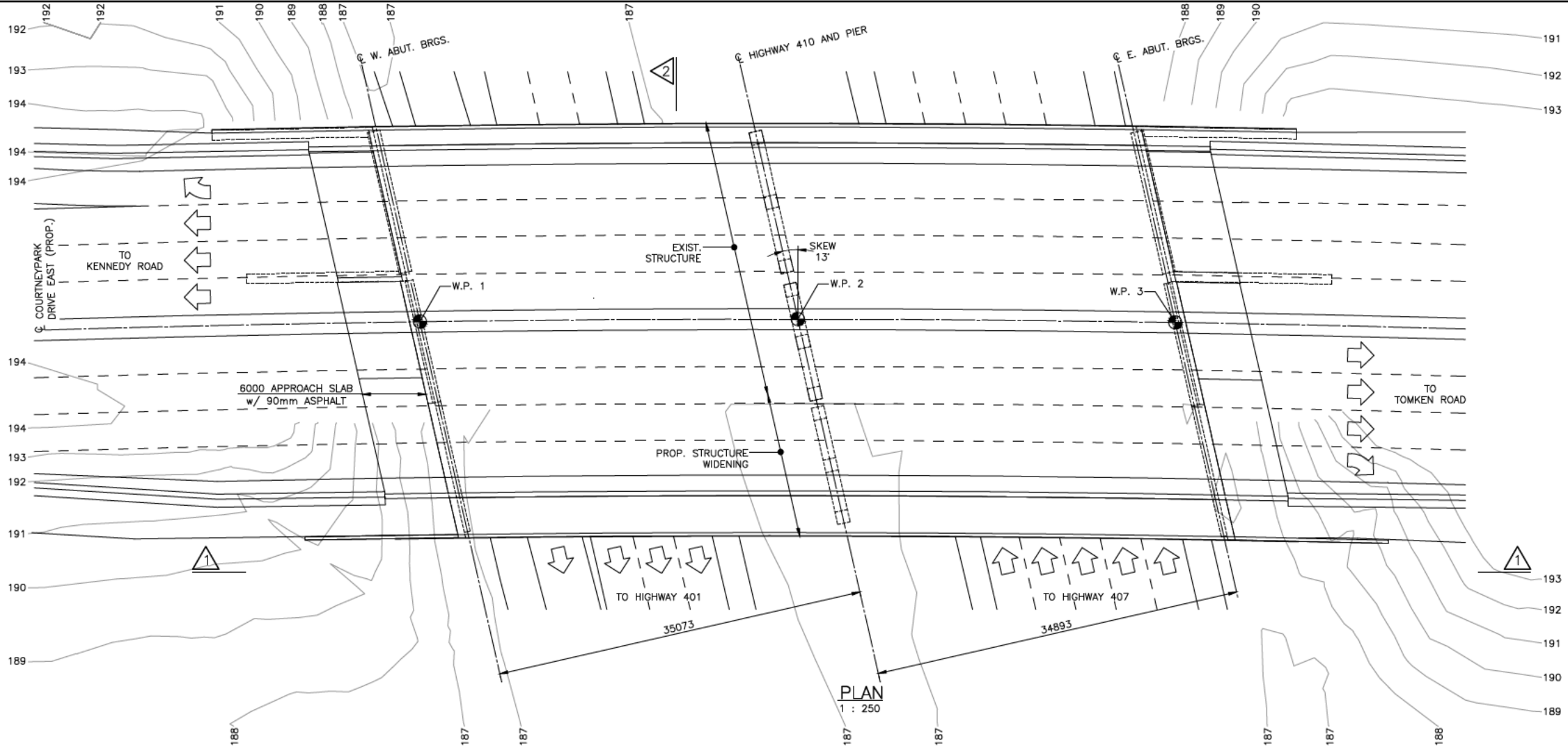
BM 186 996  
CUT 'F' FACE OF  
CENTRE CONCRETE  
FILLAR 0-3 RT 6+2603

**REFERENCE ONLY**

## COURTNEYPARK DRIVE EAST UNDERPASS - WIDENING

### PRELIMINARY COST ESTIMATE

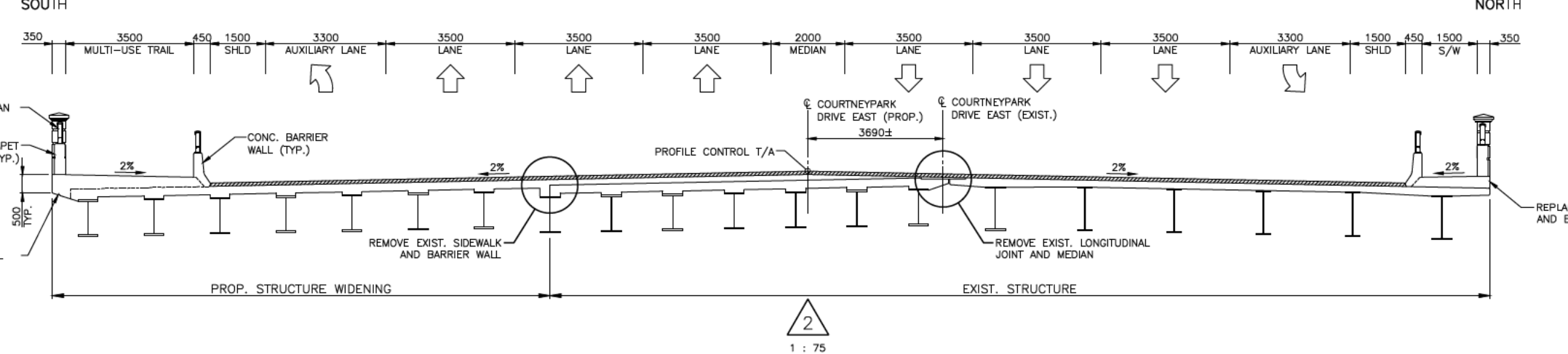
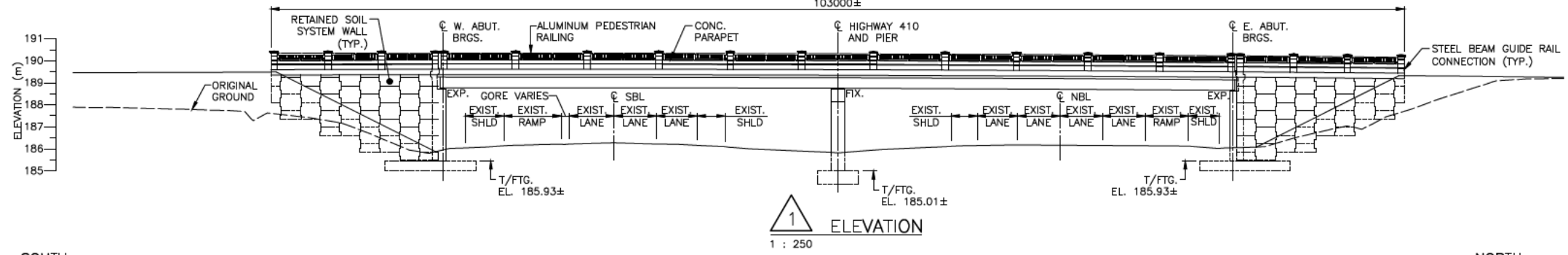
Item Description	Unit	Unit Price	Qty.	Cost
Earth Excavation (structural)	m <sup>3</sup>	\$50	1200	\$60,000
RSS Retaining Wall	m <sup>2</sup>	\$1,000	170	\$170,000
Concrete in Footings	m <sup>3</sup>	\$1,000	250	\$250,000
Concrete in Substructures	m <sup>3</sup>	\$1,200	300	\$360,000
Concrete in Deck – Deck	m <sup>3</sup>	\$1,500	400	\$600,000
Concrete in Deck – Sidewalk	m <sup>3</sup>	\$1,500	160	\$240,000
Concrete in Barrier Walls	m <sup>3</sup>	\$1,750	108	\$189,000
Concrete in Approach Slabs	m <sup>3</sup>	\$800	36	\$28,800
Reinforcing Steel Bar	t	\$3,500	80	\$280,000
Stainless Steel Reinforcing Bar	t	\$10,000	38	\$380,000
Steel Girders	t	\$6,000	190	\$1,140,000
Parapet Railing	m	\$250	400	\$100,000
Bridge Deck Waterproofing	m <sup>2</sup>	\$50	2350	\$117,500
Bearings	L.S.			\$50,000
Concrete Removals - Median and Sidewalks	m <sup>3</sup>	\$500	230	\$115,000
			Sub-total	\$4,080,300
			20% Contingency	\$816,100
			<b>TOTAL</b>	<b>\$4,896,400</b>



- GENERAL NOTES:**
- CLASS OF CONCRETE:**  
30 MPa UNLESS OTHERWISE NOTED
  - CLEAR COVER TO REINFORCING STEEL:**

FOOTING	TOP	100±25
DECK	BOTTOM	70±20
REMAINDER		40±10
		70±20 UNLESS OTHERWISE NOTED
  - REINFORCING STEEL**  
REINFORCING STEEL SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED.  
STAINLESS REINFORCING STEEL SHALL BE TYPE 316LN OR DUPLEX 2205 AND HAVE A MINIMUM YIELD STRENGTH OF 500 MPa.  
BAR HOOKS WITH PREFIX 'S' DENOTE STAINLESS STEEL BARS.  
TENSION LAP LENGTHS NOT INDICATED ON THE CONTRACT DRAWINGS SHALL BE CLASS B.  
BAR HOOKS SHALL HAVE STANDARD HOOK DIMENSIONS USING MINIMUM BEND DIAMETERS, WHILE STIRRUPS AND TIES SHALL HAVE MINIMUM HOOK DIMENSIONS. ALL HOOKS SHALL BE IN ACCORDANCE WITH THE STRUCTURAL STANDARD DRAWING SS12-1, UNLESS INDICATED OTHERWISE.
  - CONSTRUCTION**  
THE CONTRACTOR SHALL ESTABLISH THE BEARING SEAT ELEVATIONS BY DEDUCTING THE ACTUAL BEARING THICKNESSES FROM THE TOP OF BEARING ELEVATIONS. IF THE ACTUAL BEARING THICKNESSES ARE DIFFERENT FROM THOSE GIVEN WITH THE BEARING DESIGN DATA, THE CONTRACTOR SHALL ADJUST THE REINFORCING STEEL TO SUIT.  
PROTECTION SYSTEMS SHALL BE DESIGNED FOR PERFORMANCE LEVEL 1b.

**LEGEND**  
W.P. DENOTES WORKING POINT  
T/A DENOTES TOP OF ASPHALT



<b>MISSISSAUGA</b>		
PRODUCED FOR - TRM ENGINEERING AND WORKS		
<b>COURTNEYPARK DRIVE EAST HIGHWAY 410 INTERCHANGE UNDERPASS WIDENING PRELIMINARY GENERAL ARRANGEMENT</b>		
SCALE AS NOTED	AREA	PROJECT No. 185010564
C.A.D.D. BY B.H.	CHECKED BY M.D.	PLAN No.
DATE 2015/04/28	SHEET 1 OF 1	S-001