

**DATE** January 27, 2015**PROJECT No.** 13-1184-0171**TO** Dennis Baxter, P.Eng.  
AECOM**GEOCRES No.** 30M14-411**CC** David Leblanc, P.Eng.**FROM** Kevin J. Bentley, P.Eng.**EMAIL** kbentley@golder.com

**DESKTOP STUDY FOUNDATION ASSESSMENT  
SITE NOS. 37-324/1 AND 37-328/1  
HIGHWAY 401/404 BRIDGE REHABILITATION  
TORONTO, ONTARIO  
GWP#2029-13-00**

This technical memorandum summarizes the results of a desktop study of available subsurface information and provides preliminary foundation recommendations for the existing structures at Site No. 37-324/1 and Site No. 37-328/1, which carry the Southbound Don Valley Parkway (DVP) to Hwy 401 Eastbound Ramp over Highway 401 and the Northbound DVP to Hwy 401 Westbound Ramp over Highway 401, respectively (see Drawing 1). The geotechnical recommendations provided in this technical memorandum are intended to support the structural design of the proposed rehabilitation option(s) being considered at these sites.

The General Arrangement (GA) drawings for the proposed rehabilitation of the structures at Site Nos. 37-324/1 and 37-328/1 (Sheet Nos. 133 and 145) were provided in the 90% design package sent to us by AECOM on December 2, 2014 and copies of these GA drawings are attached following the text of this memorandum. Based on our review of the drawings and discussions with MTO structural section, the rehabilitation of both structures will involve conversion to semi-integral abutments and replacement of the asphalt deck and parapet walls. The bridge deck will be widened slightly (less than about 750 mm) on the west side of Site No. 37-324/1 and on the east side of Site No. 37-328/1.

## **1.0 REVIEW OF AVAILABLE INFORMATION**

The following reports and original design drawings have been obtained and reviewed to carry out the required foundation engineering assessment for the bridge structures:

- MTO GEOCRES No. 30M14-081: Report titled "D.H.O. Foundation Investigation Report – Proposed Don Valley Parkway Interchange, Hwy. 401 and Woodbine Rd., N. York County, District No. 6, W.J. 63-F-19, W.P.253-61", prepared by the MTO Foundations Section, dated April 2, 1963.

- MTO GEOCRES No. 30M14-239: Report titled "Foundation Investigation Report For W-N Ramp from 401E to 404N, W.P. NOS. 11-96-01 & 12-96-01, Central Region, Toronto", prepared by McClymont & Rak Engineers, Inc., dated December 1996.
- General Arrangement – Sheets 1 and 2 (Drawings D5218-1 and D5218-2) prepared by the Department of Highways Ontario – Bridge Division, titled "South Bound Don Valley Pkwy. Over Hwy. 401 (and S.B. to E.B. Ramp Over 401)", Site No. 37-324, Bridge#2 and #11, dated September 1964; provided by AECOM.
- General Arrangement – Sheets 1 and 2 (Drawings D5222-1 and D5222-2) prepared by the Department of Highways Ontario – Bridge Division, titled "North Bound Don Valley Parkway Over Hwy. 401 (and N.B. to W.B. Ramp Over 401)", Site No. 37-328, Bridge#3 and #12, dated September 1964; provided by AECOM.

Based on the 1964 design drawings and previous investigation, the original ground surface at Site No 37-324/1 was at approximately Elevation 175 m. Referring to the 90% GA drawing provided by AECOM (December 2, 2014), the existing bridge deck surface near the abutments is at about Elevation 176 m and the Hwy 401 road surface is at about Elevation 167 m below the bridge, consistent with the original design drawings.

Similarly, the 1964 design drawings and previous investigation indicate that the original ground surface at Site No 37-328/1 ranged from approximately Elevation 174 m at the south side to about Elevation 176 m at the north side. Referring to the latest 90% GA drawing provided AECOM (December 2, 2014), the existing bridge deck surface near the abutments is at about Elevation 178 m and the Hwy 401 road surface is about Elevation 170 m below the bridge, consistent with the original design drawings.

Golder visited the site on August 28, 2014 and observed no visual evidence to suggest that the foundations are not performing satisfactorily. The piers appeared to be vertical there was no obvious signs of settlement/displacement.

## 2.0 SUBSURFACE CONDITIONS

The approximate location of the boreholes considered to contain pertinent subsurface information collected from previous investigations performed at the site(s) in 1963 and 1996 are shown on Drawing 1 – Borehole Locations. A total of 14 boreholes were drilled near the existing bridge structures at Site No. 37-324/1 and 37-328/1 (GEOCRES No. 30M14-081 and 30M14-239) and copies of the Record of Boreholes are attached to this memorandum. The GEOCRES sourced boreholes used in this report have been re-numbered to show the MTO GEOCRES No. followed by the original borehole designation; for example, the boreholes from MTO GEOCRES 30M14-081 have been re-numbered to 081-X, where X is the original borehole number.

The GEOCRES sourced borehole locations shown on Drawing 1 were obtained from converting the co-ordinates shown on the Record of Boreholes, where provided. Where borehole location co-ordinates were not provided, the borehole locations were identified on the GEOCRES drawings and cross-referenced with the Highway 401 / 404 predominant surface features. Thus, borehole locations shown on Drawing 1 are considered approximate.

The available information in GEOCRES indicates that the previous boreholes were advanced through the overburden using conventional solid stem auger boring methods. Soil samples were generally obtained at 0.75 m to 1.5 m intervals of depth, using 50 mm outer diameter split spoon samplers. It is assumed that sampling was carried out by driving the split spoon using a manual hammer as part of the Standard Penetration Test (SPT) procedure.

Groundwater levels recorded in the open boreholes and piezometers are shown on the copies of the Record of Borehole sheets.

## **2.1 Site No. 37-324/1**

A total of two boreholes (081-4 and 081-5) were advanced in the vicinity of this bridge structure as part of the investigation at the interchange in 1963, as shown on Drawing 1. One borehole (081-4) was advanced near the northwest corner of the north abutment of the bridge and the other borehole (081-5) was advanced about 20 m east of the southeast corner of the south abutment.

Based on Boreholes 081-4 and 081-5, the subsurface conditions at the bridge site consist of sandy silt till to silty sand till that extends from ground surface to the termination of the boreholes at a depth of 8.1 m (Elevation 167.2 m) and 9.6 m (Elevation 165.1 m) below ground surface at the respective boreholes. The Standard Penetration Test (SPT) 'N'-values measured within the glacial till deposit ranged between 35 and greater than 100 blows per 0.3 m of penetration indicating a dense to very dense relative density. The natural water content of the glacial till soils ranges from about 6 per cent to 9 per cent.

The presence of groundwater was not indicated in the Record of Borehole 081-4. However, the groundwater level encountered in Borehole 081-5 during drilling operations is shown to be at 5.3 m below ground surface (Elevation 169.5 m). The groundwater level measured may not be representative of stabilized conditions and should be expected to fluctuate seasonally in response to changes in precipitation and snow melt, and should be expected to be higher during the spring season or during periods of heavy precipitation. Considering the groundwater level measurement was taken in 1963, it is likely that the static groundwater level in the area has changed over the past 50 years.

## **2.2 Site No. 37-328/1**

A total of twelve (12) boreholes (Borehole Nos. 081-6, 081-7, 239-1 to 239-10) advanced in the vicinity (i.e., within about 60 m) of the bridge structure are shown on Drawing 1. Boreholes 081-6 and 081-7 were advanced as part of the 1963 investigation and the remaining Boreholes 239-1 to 239-10 were advanced as part of the 1996 investigation. Based on our review of the borehole records, the subsurface conditions at the bridge site predominantly consist of a thin layer of topsoil (0.1 m to 0.3 m thick) underlain by a silt till deposit that extends to the termination of the boreholes at depths ranging from 4.7 m to 9.2 m below ground surface, corresponding to between Elevations 172.4 m to 161.6 m. The silt till is generally classified as a clayey silt till to sandy silt till and contained silt/sand seams and inferred cobbles/boulders based on grinding of the augers during drilling operations as described on the Record of Boreholes. The more recent boreholes from the 1996 investigation indicate the presence of a loose to compact clayey silt to silt fill layer (0.7 m to 3.7 m thick) above the till near the abutments and north approach embankment (i.e. Boreholes 239-2, 239-3 and 239-8 to 239-10), inferred to have been placed as part of the construction activities near the bridge site between 1963 and 1996.

The SPT 'N'-values shown on the Record of Boreholes within the silt till deposit range from 20 blows to greater than 100 blows per 0.3 m of penetration. The lower 'N' values were recorded near ground surface and typically the 'N'-values within the clayey silt till range from about 29 to greater than 100 blows per 0.3 m of penetration suggesting a very stiff to hard consistency; and the 'N'-values within the sandy silt to silt till generally range from 52 blows to greater than 100 blows per 0.3 m indicating a very dense relative density.

Laboratory testing performed on samples of the glacial till are provided on the copies of the Record of Borehole sheets attached. In summary, the water content of the till soils range from about 5 per cent to 15 per cent. Atterberg Limits testing performed on samples of the silt till indicate plastic limits ranging between about 10 per

cent and 13 per cent, liquid limits ranging between about 17 per cent and 24 per cent, and corresponding plasticity indices ranging between about 5 per cent and 13 per cent, consistent with the sandy silt to clayey silt classification.

The Record of Borehole sheets indicate Boreholes 081-7, 239-9 and 239-10 to be dry on completion of drilling and the remaining boreholes encountered groundwater at depths between 4.9 m and 7.6 m below ground surface during drilling operations. A piezometer installed in each of Boreholes 239-1, 239-3, 239-5 and 239-8 measured groundwater levels ranging from 1.2 m to 5.5 m below ground surface (corresponding to between Elevations 168.1 m and 170.3 m) in August 1996. Considering the latest groundwater level measurement was taken in 1996, it is likely that the static groundwater level in the area has changed over the past 19 years, although the water levels taken in 1963 and 1996 are generally consistent. The groundwater level(s) at the bridge site should be expected to fluctuate seasonally in response to changes in precipitation and snow melt, and should be expected to be higher during the spring season or during periods of heavy precipitation.

### **3.0 PRELIMINARY FOUNDATION RECOMMENDATIONS**

We understand that AECOM/MTO require preliminary geotechnical axial resistance values at the existing bridge foundations at Site Nos. 37-324/1 and 37-328/1 to assess the proposed rehabilitation design. Based on the 90% design GA drawings for the proposed rehabilitation option at each structure, the existing foundations are shown to remain in place and there is no indication that new foundations will be constructed, or that the existing foundations will need to be supplemented to accommodate additional design loads.

### **3.1 ASSESSMENT OF EXISTING FOUNDATIONS**

#### **3.1.1 Site No 37-324/1**

Based on the 90% GA drawing and the original 1964 design drawings provided to us, the existing Site No. 37-324/1 structure consists of a four-span structure with a total length of approximately 169 m. The North abutment, Pier 1, Pier 4, Pier 6, and South abutment are shown to consist of reinforced concrete structures supported on conventional concrete spread footings. The "General Notes" section of the original design drawing (Drawing No. D5218-2) states that "concrete in spread footings to be placed against undisturbed ground" for foundations.

The 1964 design drawings indicate that the North and South Abutment footings are 3.7 m wide and founded at Elevations 171.0 m and 170.7 m, respectively. Pier 1, Pier 4, and Pier 6 are shown to be about 4.6 m wide and founded at Elevations 165.2 m, 165.7 m and 166.4 m, respectively. Although the foundation design bearing capacities are not indicated on the original design drawings, the 1963 Foundation Investigation Report recommends a "safe bearing capacity of 4 tons/ft<sup>2</sup>" (approximately 383 kPa) for spread footings founded on the dense to very dense till and at least 1.5 m of soil cover is provided for frost protection.

Based on the existing information, we interpret/infer that the original foundations are founded within the dense to very dense / very stiff to hard glacial till deposit. For spread footings (approximately 3.7 m wide at the abutments and 4.6 m wide at the piers) founded on the dense to very dense / very stiff to hard glacial till soils at the design elevations noted above, the factored geotechnical axial resistance at Ultimate Limit States (ULS) and the geotechnical resistance at Serviceability Limit States (SLS) for 25 mm of settlement provided below may be used for preliminary design.

Foundation Element	Founding Elevation (m)	Inferred Founding Stratum (based on Borehole Nos. 081-4 and No. 081-5)	Factored Geotechnical Resistance at ULS	Geotechnical Resistance at SLS <sup>1</sup>
North Abutment	171.0	Very dense sandy silt till	800 kPa	600 kPa
Pier 1	165.2	Very dense sandy silt to silty sand till	800 kPa	600 kPa
Pier 4	165.7	Very dense sandy silt to silty sand till	800 kPa	600 kPa
Pier 6	166.4	Very dense sandy silt to silty sand till	800 kPa	600 kPa
South Abutment	170.7	Very dense sandy silt to silty sand till	800 kPa	600 kPa

<sup>1</sup> For 25 mm of settlement

The geotechnical resistance values provided above are given for loads applied perpendicular to the surface of the footing. Where the load is not applied perpendicular to the surface of the footing, inclination of the load should be taken into account in accordance with Sections 6.7.4 and C6.7.4 in the CHBDC.

### 3.1.2 Site No 37-328/1

Based on the 90% GA drawing and the original 1964 design drawings provided to us, the existing Site No. 37-328/1 structure consists of a four-span structure with a total length of approximately 165 m. The North Abutment, Pier 1, Pier 3, Pier 5, and South Abutment are shown to consist of reinforced concrete structures supported on conventional concrete spread footings. The "General Notes" section of the original design drawing (Drawing No. D5222-2) states that "concrete in spread footings to be placed against undisturbed ground" for foundations.

The 1964 design drawings indicate that the North and South Abutment footings are 3.7 m wide and founded at Elevations 172.7 m and 172.2 m respectively. Pier 1, Pier 3, and Pier 5 are shown to be about 4.6 m wide and founded at Elevations 169.5 m, 169.5 m and 167.8 m respectively. Although the foundation design bearing capacities are not indicated on the original design drawings, the 1963 Foundation Investigation Report recommends a "safe bearing capacity of 4 tons/ft<sup>2</sup>" (approximately 383 kPa) for spread footings founded on the dense to very dense till and at least 1.5 m of soil cover is provided for frost protection.

Based on the existing information, we interpret/infer that the original foundations are founded within the dense to very dense / very stiff to hard glacial till deposit. It is noted that the founding elevations of the footings at Pier 1 and potentially Pier 3 are higher than the ground surface of the closest existing borehole from the 1996 investigation. As the boreholes are up to 50 m west of the structure at some locations and considering that the topography generally slopes downward from east to west, it is likely that all the pier footings are founded on the dense to very dense / very stiff to hard till deposit that is typically encountered within one metre below the native ground surface. For spread footings (approximately 3.7 m wide at the abutments and 4.6 m wide at the piers) founded on the dense to very dense / very stiff to hard glacial till soils at the design elevations noted above, the factored geotechnical axial resistance at Ultimate Limit States (ULS) and the geotechnical resistance at Serviceability Limit States (SLS) for 25 mm of settlement provided below may be used for preliminary design.

Foundation Element	Founding Elevation (m)	Inferred Founding Stratum	Factored Geotechnical Resistance at ULS	Geotechnical Resistance at SLS <sup>1</sup>
North Abutment	172.7	Hard clayey silt till / Very dense sandy silt till	800 kPa	600 kPa
Pier 1	169.5	Hard clayey silt till	800 kPa	600 kPa
Pier 3	169.5	Hard clayey silt till / Very dense sandy silt till	800 kPa	600 kPa
Pier 5	167.8	Very dense sandy silt till	800 kPa	600 kPa
South Abutment	172.2	Very dense sandy silt till	800 kPa	600 kPa

<sup>1</sup> For 25 mm of settlement

The geotechnical resistance values provided above are given for loads applied perpendicular to the surface of the footing. Where the load is not applied perpendicular to the surface of the footing, inclination of the load should be taken into account in accordance with Sections 6.7.4 and C6.7.4 in the CHBDC.

### 3.2 REQUIRED FOUNDATION RESISTANCE FOR REHABILITATION OPTION

The structural designer must check/confirm that the geotechnical resistances provided in Section 3.1 for each bridge foundation structure are adequate to support the existing and proposed bridge loads.

It is noted that the preliminary geotechnical resistances provided above are based on the results of existing boreholes that were advanced in the general vicinity of the bridge structures as part of the original design and the extent of the geotechnical investigation does not meet the current standard Terms of Reference for foundation requirements for bridges and approach embankments. However, provided the preliminary foundation resistance values provided are adequate for the existing and new rehabilitated design loads on the abutments and piers, consideration could be given to modifying the standard MTO Foundations requirements for bridge and approach embankments to accept / adopt the information from the previous investigations and the preliminary design geotechnical resistance values can be used for detail design, subject to the agreement of MTO.

If the proposed design loadings change and exceed the preliminary design geotechnical resistances provided, new foundation elements may be required or the existing foundations may need to be modified or supplemented to resist the additional loads. In this case, additional subsurface investigation is recommended consistent with the Terms of Reference outlined in "Attachment 6.8 - Minimum Requirements for Foundation Engineering Applications" contained in the original MTO Request for Proposal.

## 4.0 CONSTRUCTION CONSIDERATIONS

### 4.1 TEMPORARY EXCAVATION / DEWATERING

Temporary excavations for the rehabilitation of the abutment walls and wing walls will typically extend through the existing inferred fill materials up to 3 m below the existing road surface. All excavations should be carried out in accordance with the guidelines outlined in the latest edition of the Ontario Occupational Health and Safety Act and Regulations for Construction Projects (OHSA). Provided the fill materials were properly compacted during original construction, they are assumed to be classified as Type 3 soils, however this should be confirmed during construction. As such, temporary open cut slopes within the fill materials should be maintained no

steeper than 1H:1V. Localized slope flattening may be required within cohesionless fill soils. Perched water within the fill soils and above the native till soils should be expected.

Excavations in areas where perched water levels are present will require dewatering methods such as pumping from properly filtered sumps to ensure that removals and construction is carried out in the dry. Surface water runoff should be directed away from the excavations at all times.

## 4.2 TEMPORARY SHORING

Temporary shoring may be required for staged construction in order to maintain live traffic on or below the bridges or if there is insufficient space for open cuts due to the presence of existing utilities. Any temporary excavation support system should be designed and constructed in accordance with OPSS 539 (Temporary Protection Systems). The lateral movement of the temporary shoring system should meet Performance Level 2 as specified in OPSS 539, provided that any adjacent utilities can tolerate this magnitude of deformation.

## 4.3 ABUTMENT WALL / WING WALL BACKFILL

The lateral earth pressures acting on the rehabilitated abutment stem walls and wing walls/retaining walls will depend on the type and method of placement of the backfill materials, the nature of the soils behind the backfill, the magnitude of any surcharge including construction loadings, the freedom of lateral movement of the structure, and the drainage conditions behind the walls.

The existing backfill material against the abutment walls and wing walls is not known; however, it is assumed that granular material is present behind the walls as per conventional MTO practice. Where temporary excavations into the existing backfill are made to accommodate the rehabilitation of the abutments and walls, the excavated material should be assessed and can be re-used provided it is free-draining granular fill meeting the specifications of OPSS.PROV 1010 Granular 'A' or 'B' Type II containing less than 5% material passing the No. 200 sieve. Alternatively, new backfill materials meeting this specification will need to be imported and the excavated soils removed from or used elsewhere on site. Compaction (including type of equipment, target densities, etc.) of the backfill should be carried out in accordance with OPSS.PROV 501 (Compacting). Longitudinal drains and weep holes should be maintained or designed to provide positive drainage of the granular backfill. Other aspects of the granular backfill requirements with respect to such sub-drains and frost taper should be in accordance with OPSD 3101.150 (Walls, Abutment, Backfill, Minimum Granular Requirement) and OPSD 3121.150 (Walls, Retaining, Backfill, Minimum Granular Requirements).

A minimum compaction surcharge of 12 kPa should be included for the structural design of the wall stem, in accordance with CHBDC Section 6.9.3 and Figure 6.6. Compaction equipment should be used in accordance with OPSS.PROV 501 (Compacting). Other surcharge loadings should be accounted for in the design as required.

The granular fill may be placed either in a zone with the width equal to at least 1.2 m behind the back of the walls (see Figure C6.20 (a) of the *Commentary to the CHBDC*), or within the wedge shaped zone defined by a line drawn at 1.5 horizontal to 1 vertical (1.5H:1V) extending up and back from the rear face of the footing (see Figure C6.20(b) of the *Commentary to the CHBDC*).

Assuming the existing and new backfill soils consist of granular soils meeting the Granular A or Granular B Type II specification, the following parameters (unfactored) may be assumed:

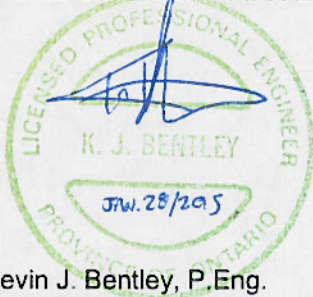
	Granular A	Granular B Type II
Soil unit weight	22 kN/m <sup>3</sup>	21 kN/m <sup>3</sup>
Coefficients of static lateral earth pressure		
Active, K <sub>a</sub>	0.27	0.27
At rest, K <sub>o</sub>	0.43	0.43

Where the wall support does not allow lateral yielding, at-rest earth pressures should be assumed for the geotechnical design. Where the wall support allows lateral yielding of the stem, active earth pressures should be used in the geotechnical design of the wall structure(s). The movement required to allow active pressures to develop within the backfill, and thereby assume an unrestrained structure for design, should be calculated in accordance with Section C6.9.1 and Table C6.6 of the *Commentary to the CHBDC*.

## 5.0 CLOSURE

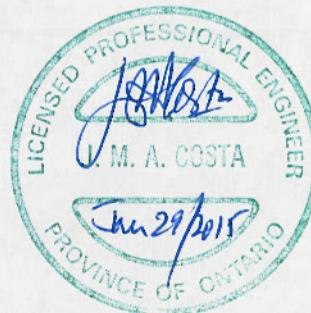
This technical memorandum was prepared by Mr. Kevin J. Bentley, P.Eng., a geotechnical engineer and Associate with Golder. Mr. Jorge M.A. Costa, P.Eng., a Designated MTO Contact and Principal of Golder, conducted an independent review of the technical memorandum. We trust the above information meets with your current requirements, but should you have any questions, please do not hesitate to contact us.

## GOLDER ASSOCIATES LTD.



Kevin J. Bentley, P.Eng.  
Geotechnical Engineer, Associate

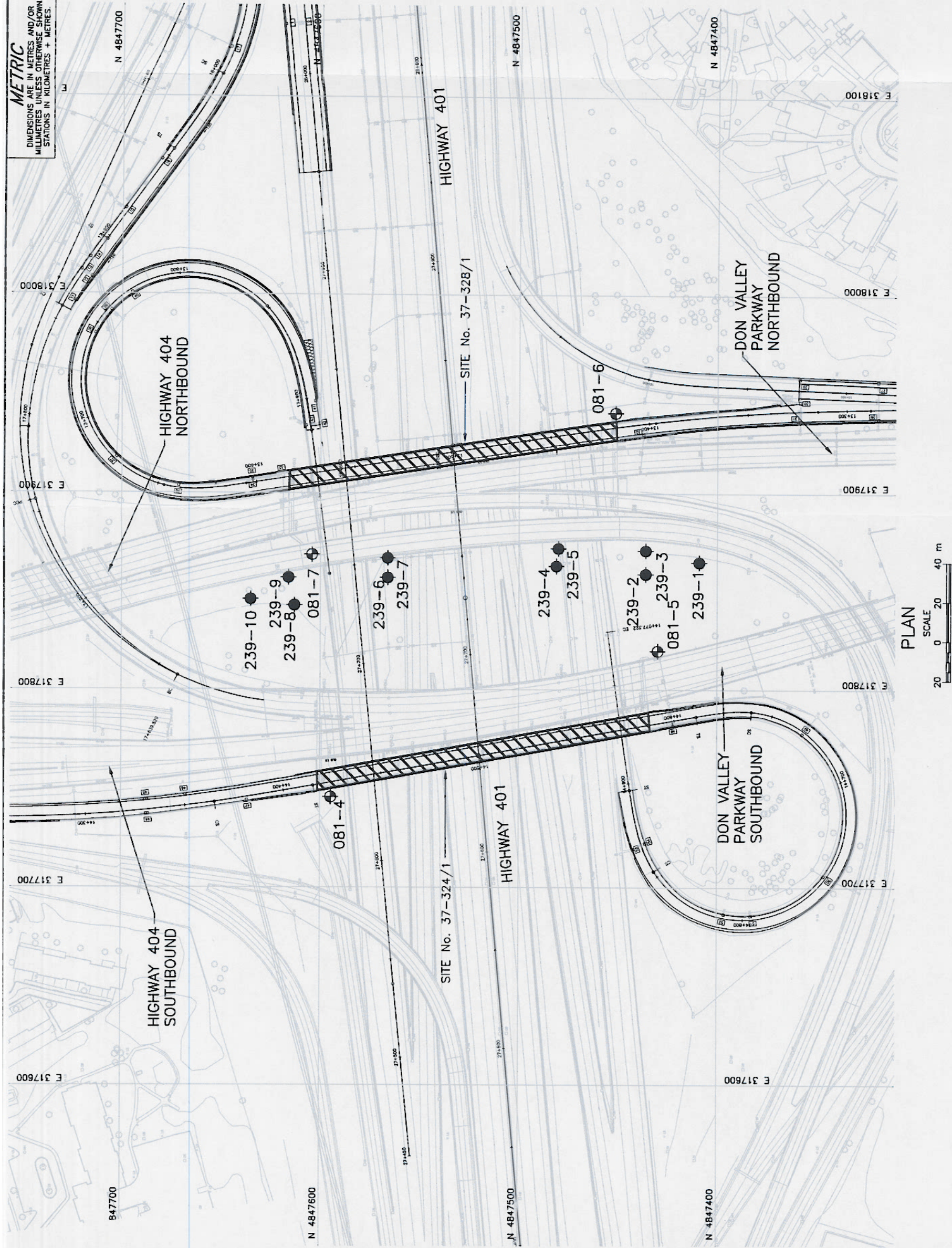
KJB/JMAC/rb/jl



Jorge M.A. Costa, P.Eng.  
Designated MTO Contact, Principal

### Attachments:

1. Drawing 1 – Borehole Locations
2. 90% Submission Drawing Sheet No. 133 titled "SB DVP to EB Ramp Over Hwy 401 Bridge Rehabilitation - General Arrangement", dated Nov. 2013, provided by AECOM.
3. 90% Submission Drawing Sheet No. 145 titled "NB DVP to WB Ramp Over Hwy 401 Bridge Rehabilitation - General Arrangement", dated March 2014, provided by AECOM.
4. Copy of Record of Borehole Nos. 081-4 to 081-7 and 239-1 to 239-10



CONT No. GWP No. 2029-13-00	SHEET
HWY 401/404 BRIDGE REHAB. (SITE #37-324/1&328/1) BOREHOLE LOCATIONS	



LEGEND	
	Borehole - Geocres No. 30M14-239
	Borehole - Geocres No. 30M14-081

BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
081-4	175.3	4847594.6	317745.9
081-5	174.7	4847429.9	317819.6
081-6	173.9	4847451.3	317940.8
081-7	175.8	4847604.1	317868.4
239-1	173.3	4847409.0	317864.6
239-2	173.9	4847436.0	317858.6
239-3	174.7	4847436.0	317870.6
239-4	168.9	4847481.0	317862.6
239-5	169.3	4847480.0	317871.6
239-6	169.4	4847566.0	317856.6
239-7	170.0	4847566.0	317866.6
239-8	175.8	4847613.0	317842.6
239-9	178.1	4847616.0	317856.6
239-10	177.1	4847635.0	317845.6

**NOTES**

This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.


The complete Foundation Investigation and Design Report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with Section GC 2.01 of QPS General Conditions.

REFERENCE	
Base plan provided in digital format by AECOM, drawing file no. 50317606-Plan-401-404.dwg, received January 09, 2015. Datum of file is MTM NAD83 Zone 10	

NO.	DATE	BY	REVISION
Geocres No. 30M14-411			
HWY. 401/404	PROJECT NO. 13-1184-0171	DIST.	
SUBM'D. KJB	CHKD. KJB	DATE: 6/14/2013	SITE: 37324/328
DRAWN: JFC	CHKD. JMAC	APPD. JMAC	DWG. 1

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

NB DVP TO WB RAMP OVER HWY 401 BRIDGE REHABILITATION	SHEET 145
GENERAL ARRANGEMENT	



**Ontario**  
 Ministry of Transportation  
 Highway Standards Branch  
 Bridge Office

GENERAL NOTES:

CLASS OF CONCRETE 30M  
UNLESS OTHERWISE NOTED

CLEAR COVER TO REINFORCING STEEL		
- DECK TOP, CURB & SIDEWALK	70±20mm	(UND)
- DECK SOFTIT	40±10mm	(UND)
- REMAINDER	70±20mm	

## REINFORCING STEEL

1. STEEL SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED.
2. STAINLESS STEEL SHALL BE TYPE 316 L OR DUPLEX 2205 AND HAVE A MINIMUM YIELD STRENGTH OF 500 MPa. BAR MARKS WITH PREFIX "S" DENOTES STAINLESS STEEL BARS.
3. UNLESS SHOWN OTHERWISE, TENSION LAP SPICES FOR REINFORCING STEEL BARS SHALL BE CLASS B.
4. BAR HOOKS SHALL HAVE STANDARD HOOK DIMENSIONS USING MINIMUM BEND DIAMETERS, WHILE STRIPS AND TIES SHALL ACCORDING HOOK DIMENSIONS. ALL HOOKS SHALL BE IN ACCORDANCE WITH STRUCTURAL STANDARD DRAWING SS12-1, UNLESS INDICATED OTHERWISE.

## GFRP REINFORCEMENT

GLASS FIBRE REINFORCED POLYMER (GFRP) REINFORCING BARS SHALL BE GRADE 1, GRADE 2, OR GRADE 3 AS SPECIFIED IN THE CONTRACT DOCUMENTS. BARS MARKS WITH PREFIX G1 DENOTE GRADE 1 GFRP BARS, BARS MARKS WITH PREFIX G2 DENOTE GRADE 2 GFRP BARS, AND BARS MARKS WITH PREFIX G3 DENOTE GRADE 3 GFRP BARS. THE NOMINAL DIAMETER, TENSILE MODULUS OF ELASTICITY AND GUARANTEED MINIMUM TENSILE STRENGTH SHALL BE AS SPECIFIED IN THE CONTRACT DOCUMENTS.

### CONSTRUCTION NOTES

- DETAILS OF THE WORK ON SITE PRIOR TO COMMENCEMENT OF THE RELATED FIELD WORKS AND/OR SHOP FABRICATION. THE CONTRACTOR SHALL REPORT ANY DISCREPANCIES TO THE CONTRACT ADMINISTRATOR, AND SHALL SUBMIT THE PROPOSED ADJUSTMENT OF THE WORK TO MATCH THE EXISTING STRUCTURE TO THE CONTRACT ADMINISTRATOR FOR APPROVAL.
2. DETERIORATED, SPALLED AND DELAMINATED AREAS SHOWN ON THE DRAWINGS ARE APPROXIMATE AND DO NOT REFLECT THE FULL EXTENT OR LOCATION OF THE PARTIAL DEPTH CONCRETE REMOVALS AND REPAIRS. LIMITS OF CONCRETE REMOVAL SHALL BE AS SHOWN ON THE DRAWINGS OR AS DELINEATED ON SITE BY THE CONTRACT ADMINISTRATOR.
3. SAWCUTS IN CONCRETE, WHERE SPECIFIED, SHALL BE 25mm DEEP AND TO THE FIRST LAYER OF REINFORCING STEEL, WHICHEVER IS LESS.
4. PROVIDE 20mmx20mm CHAMFER AT ALL EXPOSED EDGES OF NEW CONCRETE.
5. ALL EXISTING CONCRETE SURFACES, AGAINST WHICH NEW CONCRETE IS TO BE PLACED, SHALL BE ROUGHENED BY MEANS OF SCABBING, CHIPPING, OR BUSH HAMMING TO ACHIEVE A SURFACE PROFILE WITH AMPLITUDE OF ABOUT 5mm AND A SPACING OF ABOUT 15mm, AND SHALL BE FREE OF LAITENCE.
6. ABRASIVE BLAST CLEANING ALL EXISTING REINFORCING STEEL THAT IS TO BE RETAINED.
7. FOR CONSTRUCTION STAGING AND MAINTENANCE OF TRAFFIC, REFER TO R2-2 AND TRAFFIC STAGING DRAWINGS.
8. ANY DAMAGE DONE TO THE EXISTING STRUCTURE AND ROADWAY DURING REMOVALS OR CONSTRUCTION SHALL BE REPAIRED BY THE CONTRACTOR TO THE SATISFACTION OF THE CONTRACT ADMINISTRATOR AND AT NO COST TO THE OWNER.

**LIST OF DRAWINGS**

1. GENERAL ARRANGEMENT
2. CONSTRUCTION STAGING
3. REMOVAL 1
4. REMOVAL 2
5. REMOVAL 3
6. NEW CONSTRUCTION 1
7. NEW CONSTRUCTION 2
8. NEW CONSTRUCTION 3
9. BARRIER WALL W/O RAINING
10. 600mm APPROACH SLAB
11. TYPE "C" STRIP SEAL EXPANSION JOINT AND SLEEPER SLAB
12. STRIP SEAL EXPANSION JOINT
13. TYPE "C" DETAILS

**APPLICABLE STANDARD DRAWINGS**

- |               |   |
|---------------|---|
| OPSD 3328.100 | SUPPORTS FOR REINFORCING STEEL FOR SLAB CONNECTION                                |
| OPSD 3328.101 | SUPPORTS FOR REINFORCING STEEL FOR SLAB DEPTH 300mm OR LESS                       |
| OPSD 3330.150 | DECK DRAINS WITH TRANSVERSE BAR OPENINGS DEPTH GREATER THAN 300mm                 |
| OPSD 3330.160 | DECK WATERPROOFING NOT APPLIED ASPHALT MEMBRANE WITH PROTECTION BOARD             |
| OPSD 3330.170 | DECK WATERPROOFING NOT APPLIED ASPHALT MEMBRANE AT ACTIVE CRACKS GREATER THAN 2mm |
| OPSD 3330.180 | WIDE AND CONSTRUCTION JOINTS  |
| OPSD 3330.190 | DICK, DRIP CHANNEL  |
| OPSD 3341.200 | CHANNEL ANCHORAGE   |
| OPSD 3341.200 | FIGURES IN CONCRETE - SITE NUMBER AND DATE LAYOUT                                 |
| OPSD 3341.100 | GUDERAIL AND CHANNEL ANCHORAGE  |
| OPSD 3340.150 | DECK DRAINS WITH TRANSVERSE BAR OPENING   |

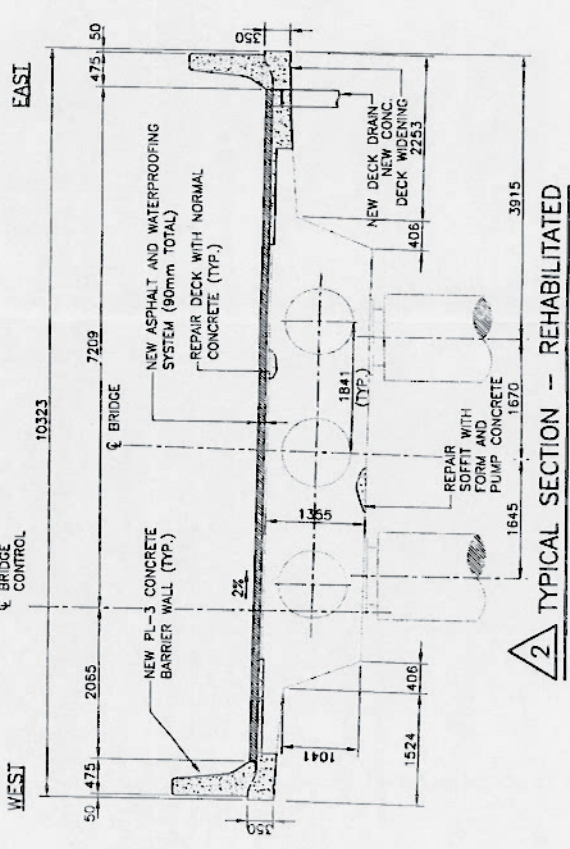
## LIST OF ABBREVIATIONS

- |     |                        |
|-----|------------------------|
| UNO | UNLESS NOTED OTHERWISE |
| CJ  | CONSTRUCTION JOINT     |
| TY  | TYPICAL                |
| EF  | EACH FACE              |
| IF  | INSIDE FACE            |
| OF  | OUTSIDE FACE           |
| N   | NORTH                  |
| S   | SOUTH                  |

**LEGEND**

- |   |                              |  |
|---|------------------------------|--|
| 5 | FULL DEPTH CONCRETE REMOVALS |  |
| 6 | NEW CONCRETE                 |  |
| 7 | BRIGS BEARINGS               |  |
| 8 | UNLESS NOTED OTHERWISE       |  |
|   | CONSTRUCTION JOINT           |  |
|   | TYPE TYPICAL                 |  |
|   | EACH FACE                    |  |
|   | INSIDE FACE                  |  |
|   | OUTSIDE FACE                 |  |
|   | NORTH                        |  |
|   | SOUTH                        |  |

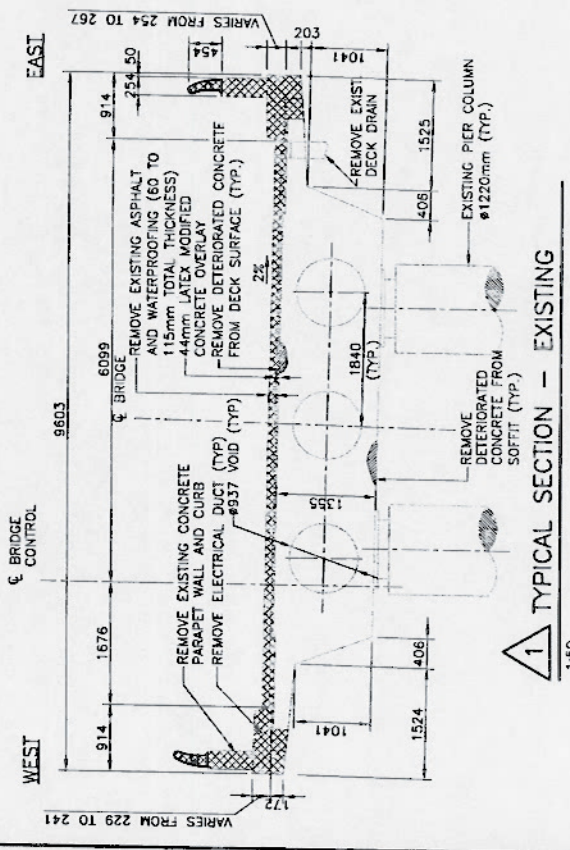
2 TYPICAL SECTION -- REHABILITATED



1

TYPICAL SECTION - EXISTING

DETERIORATED CONCRETE FROM SOFFIT (TYP.)



**90% SUBMISSION**

[illegible]

OPSD 3541.200 CHANNEL ANCHORAGE  
FIGURES IN CONCRETE - SITE NUMBER AND DATE  
LAYOUT  
OPSD 3417.100 GUTTERAL AND CHANNEL ANCHORAGE  
OPSD 3340.150 DECK DRAINS WITH TRANSVERSE BAR OPENING  
DRAWING NOT TO BE SCALED  
100mm ON ORIGINAL DRAWING

12

CONT No  
WP No 2052-13-01

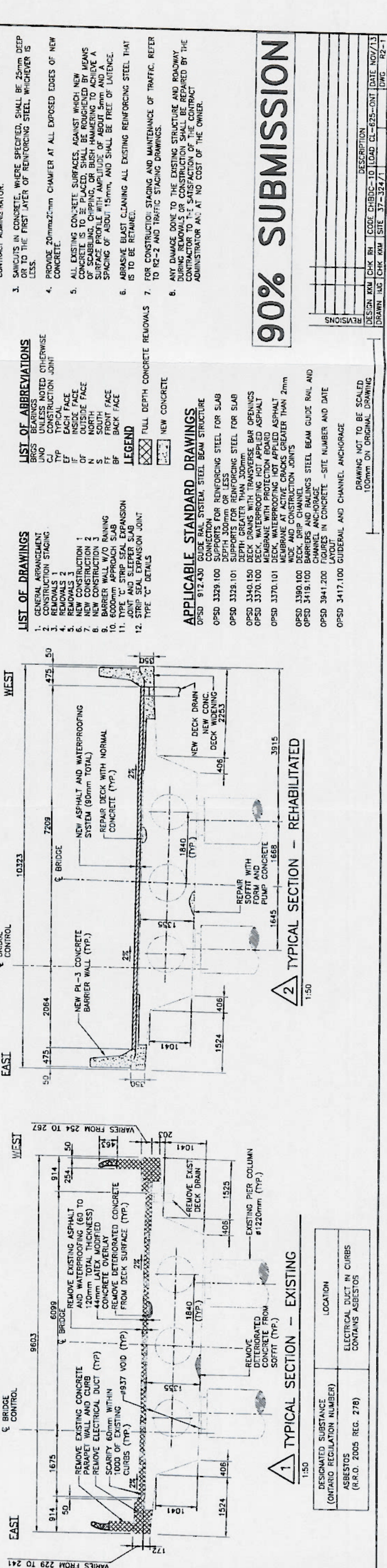
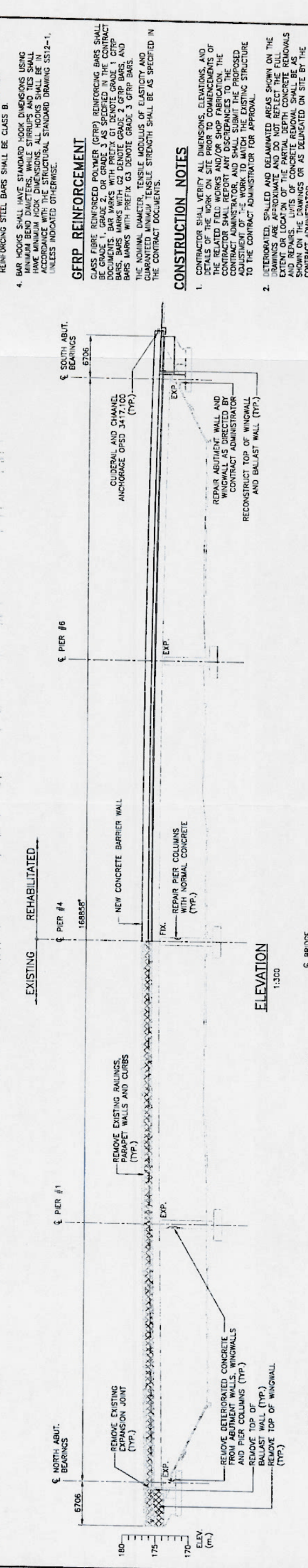
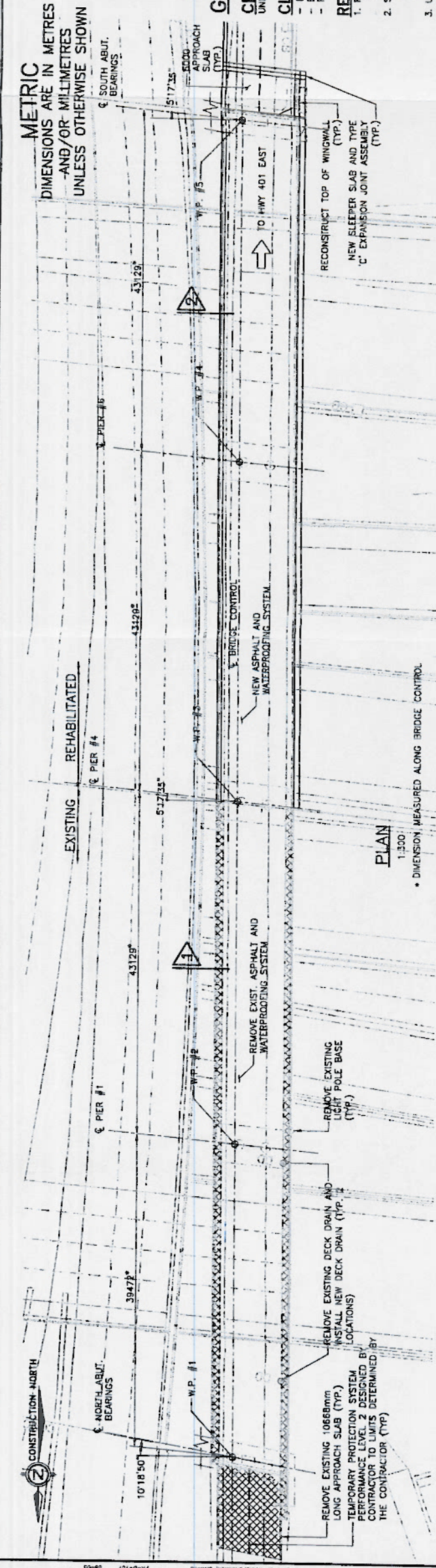
SB DWP TO EB RAMP OVER HWY 401  
BRIDGE REHABILITATION

GENERAL ARRANGEMENT

133

SHEET

Ministry of Transportation  
Highway Standards Branch  
Ontario  
Bridge Office



DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH DIVISION

## RECORD OF BOREHOLE NO. 4 (081-4)

FOUNDATION SECTION

JOB 61-P-19

LOCATION 203/15 (326' T.E.)

ORIGINATED BY V.K.

W.P.

BORING DATE March 11, 1963

COMPILED BY V.K.

DATUM Geodetic

BOREHOLE TYPE Peimdrill (5" Ø Auger)

CHECKED BY M.D.

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — WL			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLAT.	NUMBER	TYPE		BLOWS / FOOT	SHEAR STRENGTH P.S.F.	PLASTIC LIMIT — WP	WATER CONTENT — W	WATER CONTENT %		
175.3												
525.10	Groundlevel											
0.0												
	Sandy silt V. dense (Brown) Traces of gravel (Glacial Till)		1	SS	55	570						
			2	SS	86							
			3	SS	>100							
			4	SS	>100	560						
			5	SS	>100							
			6	SS	>100	550						
167.2m												
548.60	End of borehole											
26.5												
541.5												
						560						
						530						

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH DIVISION

## RECORD OF BOREHOLE NO. 5 (081-S)

FOUNDATION SECTION

JOB 63-F-19

LOCATION 204<sup>th</sup> 82 195<sup>th</sup> Rd.

ORIGINATED BY V.K.

W.P.

BORING DATE March 5, 1963.

COMPILED BY V.K.

DATUM Geodetic

BOREHOLE TYPE Penndrill (5" Ø Auger)

CHECKED BY H.D.

SOIL PROFILE		SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — WL		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	NUMBER	TYPE		BLOWS / FOOT	SHEAR STRENGTH P.S.F.	PLASTIC LIMIT — WP	WATER CONTENT — W		
171.7m										
573.26	Groundlevel									
	Brown sandy silt to silty sand. Dense to very dense. (Glacial Till)	1	SS 35	570						
		2	SS 38							
		3	SS >100							
				560						
		4	SS >100							
		5	SS >100	550						
		6	SS >100							
165.1m										
541.76		7	SS >100	540						
31.5	End of borehole			530						
29.6m										

0.5561 g/cm<sup>3</sup>

169.5

138.0

DEPARTMENT OF HIGHWAYS - ONTARIO  
 MATERIALS & RESEARCH DIVISION

# RECORD OF BOREHOLE NO. 6 (081-6)

FOUNDATION SECTION

JOB: 63-F-19

LOCATION: 208/88 (192' Rt.)

ORIGINATED BY: V.S.

W.P. -

BORING DATE: March 7, 1963

COMPILED BY: V.K.

DATUM: Geodetic

BOREHOLE TYPE: Permdrill (5" Ø Auger)

CHECKED BY: M.D.

SOIL PROFILE		SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — "L			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	NUMBER	TYPE		BLOWS / FOOT	SHEAR STRENGTH P.S.F.	PLASTIC LIMIT — "P	WATER CONTENT — "W	WATER CONTENT %		
173.9m											
570.44	Groundlevel			570							
0.0											
	Brown silt to sandy silt.	1	SS	52							
	V. dense (Glacial Till)	2	SS	>100							
		3	SS	>100	560						
		4	SS	>100							
167.3m				530							
548.94		5	SS	>100							
21.5	End of borehole										
6.6m											
				540							
				530							

553' WL  
 = 168.6m

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH DIVISION

# RECORD OF BOREHOLE NO. 7 (081-7)

FOUNDATION SECTION

JOB: 63-F-19

LOCATION: 207239 (348' L.L.)

ORIGINATED BY: V.A.

W.P.

BORING DATE: March 7, 1963.

COMPILED BY: V.A.

DATUM: Geodetic

BOREHOLE TYPE: Penndrill (5" Ø Auger)

CHECKED BY: M.D.

SOIL PROFILE		SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — WL		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER TYPE		BLOWS / FOOT	SHEAR STRENGTH P.S.F.	PLASTIC LIMIT — WP	WATER CONTENT — W		
								WD — WL		
								10 20 30		
75.8 m	Groundlevel									
576.7	Heterogeneous mixture of clayey silt, sand (Glacial Till)		1 SS 31							
572.0										
4.7	Brown silt to sandy silt V. dense (Glacial Till)		2 SS >100	570						
			3 SS 92							
			4 SS >100	560						
557.16										
9.2	555.18 (Gray)		5 SS >100							
21.5	End of borehole									
6.6 m										
				550						
				540						

# RECORD OF BOREHOLE No 1 (239-1) 1 OF 1 METRIC

W.P. 11-88-01 LOCATION Co-ordinate: N 4 847 193.0; E 317 884.7  
 DIST CR HWY 401/404 BOREHOLE TYPE Continuous Flight Solid Stem Auger  
 DATUM Geodetic DATE 88.08.04 - 88.08.04  
 ORIGINATED BY O.B.  
 COMPILED BY O.B.  
 CHECKED BY S.B.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100					
173.3 0.0	Ground Surface Topsoil 15cm Clayey Silt to Silt, with sand, trace of gravel, oxidized fissures, brown, dry to moist, very stiff to hard (Glacial Till)		1	SS	18		173							22.2	
			2	SS	50/		172								
			3	SS	65		171								
			4	SS	80		170							22.0	
			5	SS	50/		169								
			6	SS	50/										
			7	SS	50/										
168.6 4.7	End of Borehole Notes: 1) Piezometer installed in the borehole at 4.8m depth 2) Water level in the piezometer on Aug. 12, 1998 at 3.4m 3) Combustible vapour reading in the borehole at 1.5m was 25 ppm 4) Combustible vapour reading in the open borehole on completion of drilling was 10 ppm				13cm										

# RECORD OF BOREHOLE No 2 (239-2) 1 OF 1

METRIC

W.P. 11-88-01 LOCATION Co-ordinate: N 4 847 220.3; E 317 859.4 ORIGINATED BY O.B.  
 DIST CR HWY 401/404 BOREHOLE TYPE Continuous Flight Solid Stem Auger COMPILED BY O.B.  
 DATUM Geodetic DATE 88.08.04 - 88.08.04 CHECKED BY S.B.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								20	40	60	80	100						10	20	30
173.8	Ground Surface																			
0.0	Topsoil 20cm		1	SS	25											22.4				
173.2	Clayey Silt to Silt, with sand, trace of gravel, trace of topsoil in upper 150mm, dark brown to brown, dry to moist, compact (Fm)		2	SS	29															
0.7	Clayey Silt to Silt, with sand, trace of gravel, brown, dry to moist, very stiff to hard (Glacial Till) oxidized fissures below 1.5m		3	SS	50/ 10cm															
			4	SS	50/ 13cm															
			5	SS	50/ 15cm															
			6	SS	50/ 15cm															
			7	SS	50/ 8cm															
168.7	Silt to Sandy Silt, trace of clay, trace of gravel, brown, grey below 5.8m, very moist at 5.3m, moist below, very dense (Glacial Till)		8	SS	50/ 10cm											22.9				
5.2			9	SS	50/ 10cm															
			10	SS	50/ 5cm															
164.7	End of Borehole Notes: 1) Water level in the open borehole on completion of drilling at 6.2m 2) Combustible vapour reading in the borehole at 2.3m was 80 ppm 3) Combustible vapour reading in the open borehole on completion of drilling was 75 ppm		11	SS	50/ 2.5cm															
9.2																				

+3, x3: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE



RECORD OF BOREHOLE No 4 (239-4) 1 OF 1										METRIC								
W.P. 11-86-01		LOCATION Co-ords: N 4 847 264.6; E 317 863.0		ORIGINATED BY O.B.														
DIST CR HWY 401/404		BOREHOLE TYPE Continuous Flight Solid Stem Auger		COMPILED BY O.B.														
DATUM Geodetic		DATE 88.08.05 - 88.08.05		CHECKED BY S.B.														
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60						80	100	10
188.8 0.0	Ground Surface Topsoil 10cm Silt to Sandy Silt, trace of clay, trace of rootlets in upper 150mm, brown, dry to moist, compact to very dense		1	SS	20													
187.8 1.1	Silt to Sandy Silt, trace of clay, trace of gravel, grey, moist, very dense (Glacial Till)		2	SS	50/5cm													
			3	SS	50/2.5cm													
			4	SS	50/5cm													
			5	SS	50/2.5cm													
185.2 3.7	Clayey Silt, trace of gravel, light grey silt partings, grey, moist, hard (Glacial Till)		6	SS	50/15cm													
			7	SS	88													
183.4 6.5	Silt to Sandy Silt, trace of clay, trace of gravel, grey, moist, very dense; (Glacial Till)																	
182.8 8.1	End of Borehole Notes: 1) Water level in the open borehole on completion of drilling at 4.9m 2) Combustible vapour reading in the borehole at 2.3m was 75 ppm 3) Combustible vapour reading in the open borehole on completion of drilling was 50 ppm		8	SS	50/2.5cm													

# RECORD OF BOREHOLE No 5 (239-5) 1 OF 1 METRIC

W.P. 11-88-01 LOCATION Co-ords: N 4 847 264.4; E 317 872.0 ORIGINATED BY O.B.  
 DIST CR HWY 401/404 BOREHOLE TYPE Continuous Flight Solid Stem Auger COMPILED BY O.B.  
 DATUM Geodetic DATE 98.08.05 - 98.08.05 CHECKED BY S.B.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
189.3	Ground Surface													
0.0	Topsoil 15cm		1	SS	11		189						20.8	
187.9	Silt to Sandy Silt, trace of clay, trace of rootlets in upper 150mm, brown, gray below 0.8m, moist to very moist, compact to very dense		2	SS	58		188							O 22 72 6
1.4	Silt to Sandy Silt, trace of clay, trace of gravel, gray, moist to very moist, very dense (Glacial Till)		3	SS	50/ 15cm		187						22.5	O 11 81 8
			4	SS	50/ 10cm		186							
			5	SS	50/ 5cm		185							
	water encountered during drilling at 3.8m		6	SS	50/ 15cm		184							
			7	SS	50/ 8cm		183							
			8	SS	50/ 5cm		182							
181.8	End of Borehole		9	SS	50/ 5cm									
7.7	Notes: 1) Piezometer installed in the borehole at 7.6m depth 2) Water level in the piezometer on Aug. 12, 1988 at 1.2m 3) Combustible vapour reading in the borehole at 1.5m was 40 ppm 4) Combustible vapour reading in the open borehole on completion of drilling was 450 ppm													

## METRIC

ORIGINATED BY O.B.

COMPILED BY C.B.

CHECKED BY S.B.

+3, x3: Numbers refer to Sensitivity      3% STRAIN AT FAILURE

RECORD OF BOREHOLE No 7 (239-7) 1 OF 1

METRIC

W.P. 11-88-01 LOCATION Co-ords: N 4 847 350.0; E 317 886.5 ORIGINATED BY O.B.  
DIST CR HWY 401/404 BOREHOLE TYPE Continuous Flight Solid Stem Auger COMPILED BY O.B.  
DATUM Geodetic DATE 98.08.05 - 98.08.05 CHECKED BY S.B.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20	40	60	80	100		
170.0	Ground Surface												
0.0	Topsoil 20cm Clayey Silt to Silt, with sand, trace of gravel, oxidized fissures, brown, gray below 2.1m, dry to moist, very stiff to hard (Glacial Till)		1	SS	20							23.2	
			2	SS	50/ 13cm	169							
	boulder inferred at 1.7m due to grinding of augers					168							
167.1													
2.0	Silt to Sandy Silt, trace of clay, trace of gravel, occasional rock fragments, grey, moist to very moist, very dense (Glacial Till)		5	SS	50/ 2.5cm	167						2 31 58 9	
			6	SS	50/ 2.5cm	166							
			7	SS	50/ 8cm	165						22.7	
						164							
						163							
162.3													
7.7	End of Borehole Notes: 1) Water level in the open borehole on completion of drilling at 7.6m 2) Combustible vapour reading in the borehole at 1.5m was 80 ppm 3) Combustible vapour reading in the open borehole on completion of drilling was 10% LEL				50/ 5cm								

# RECORD OF BOREHOLE No 8 (239-8) 1 OF 1

METRIC

W.P. 11-88-01 LOCATION Co-ords: N 4 847 395.8; E 317 843.1 ORIGINATED BY O.B.  
DIST CR HWY 401/404 BOREHOLE TYPE Continuous Flight Solid Stem Auger COMPILED BY O.B.  
DATUM Geodetic DATE 98.08.31 - 98.08.31 CHECKED BY S.B.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
175.8	Ground Surface																
0.0	Topsoil 25cm		1	SS	0		175									21.0	
	Clayey Silt to Silt, with sand, trace of gravel, trace of rootlets/ organics, trace to some topsoil, dark brown, moist, firm to very stiff (Fill)		2	SS	28												
174.1			3	SS	27		174									23.9	
1.7	Clayey Silt to Silt, with sand, trace of gravel, oxidized fissures, brown, gray below 5.8m, dry to moist, very stiff to hard (Glacial Till)		4	SS	50/ 15cm												
			5	SS	50/ 8cm		173										
			6	SS	50/ 15cm		172										
			7	SS	50/ 8cm		171										
			8	SS	50/ 8cm		170										
			9	SS	50/ 8cm		169										
			10	SS	50/ 8cm		168										
168.8			11	SS	50/ 5cm		167										
9.2	End of Borehole Notes: 1) Piezometer installed in the borehole at 8.1m depth 2) Water level in the piezometer on Aug. 12, 1988 at 5.5m 3) Combustible vapour reading in the borehole at 1.2m was 45 ppm 4) Combustible vapour reading in the open borehole on completion of drilling was 50 ppm																

# RECORD OF BOREHOLE No 9 (239-9) 1 OF 1 METRIC

W.P. 11-95-01 LOCATION Co-ords: N 4 847 388.8; E 317 857.0 ORIGINATED BY O.B.  
 DIST CR HWY 401/404 BOREHOLE TYPE Continuous Flight Solid Stem Auger COMPILED BY O.B.  
 DATUM Geodetic DATE 86.05.31 - 86.05.31 CHECKED BY S.S.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	
178.1	Ground Surface												
0.0	Topsoil 20cm Clayey Silt to Silt, with sand, trace of gravel, trace of rootlets, with topsoil below 2.3m, trace of wood below 3.0m, brown to grayish brown, moist to very moist, stiff to very stiff (Fill)		1	SS	9		177						22.5
			2	SS	9		176						5 35 44 16
			3	SS	14		175						
			4	SS	16		174						
			5	SS	18		173						
174.4	3.7 Clayey Silt to Silt, with sand, trace of gravel, oxidized fissures, brown, dry to moist, hard (Glacial Till)		6	SS	40		172						22.8
			7	SS	50/ 10cm								
			8	SS	50/ 8cm								
			9	SS	50/ 10cm								
171.9	6.2 End of Borehole Notes: 1) Borehole remained dry on completion of drilling 2) Combustible vapour reading in the borehole at 3.0m was 300 ppm 3) Combustible vapour reading in the open borehole on completion of drilling was 175 ppm												

# RECORD OF BOREHOLE No 10 (239-10) OF 1

METRIC

W.P. 11-98-01 LOCATION Co-ords: N 4 847 418.2; E 317 845.6 ORIGINATED BY O.B.  
 DIST CR HWY 401/404 BOREHOLE TYPE Continuous Flight Solid Stem Auger COMPILED BY O.B.  
 DATUM Geodetic DATE 98.05.31 - 98.05.31 CHECKED BY S.B.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	*N* VALUES			20	40						60	80
177.1	Ground Surface															
0.0	Topsoil 30cm Clayey Silt to Sandy silt, trace gravel, trace of rootlets above 0.6m, trace of topsoil below 2.3m, brown, moist, soft to stiff (Fill)		1	SS	4											
			2	SS	12											
			3	SS	8											
174.7			4	SS	37											
2.4	Clayey Silt to Silt, with sand, trace of gravel, oxidized fissures, brown, moist, hard (Glacial Till)		5	SS	70											
			6	SS	50/											
					13cm											
172.4			7	SS	50/											
4.7	End of Borehole Notes: 1) Borehole remained dry on completion of drilling 2) Combustible vapour reading in the borehole at 1.5m was 25 ppm 3) Combustible vapour reading in the open borehole on completion of drilling was 50 ppm				13cm											