

**FOUNDATION INVESTIGATION REPORT  
W-N/S RAMP LESLIE STREET/CNR OVERHEAD  
AND PEDESTRIAN OVERPASS  
HIGHWAY 401 AND LESLIE STREET INTERCHANGE  
CITY OF TORONTO  
W.P. 2061-13-00, Site 37-206/5**

**GEOCRES NO.: 30M14-440**

**Report to**

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October 26, 2016  
File: 19-5161-205

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- Appendix A W-N/S Ramp CNR Overhead  
Boreholes R-01 to R-05, R-07 to R-09, and selected boreholes from previous investigations by others
- Appendix B Pedestrian Overpass and Retaining/Noise Barrier Combination Wall  
Boreholes PB-01 and PB-02; Boreholes W-01 and W-02
- Appendix C Site Photographs

Appendices A and B include:

- Record of Borehole Sheets
- Laboratory Test Results
- Drawings titled “Borehole Locations and Soil Strata”

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**PART 1: FACTUAL INFORMATION**

**1 INTRODUCTION**

This report presents the factual findings obtained from a foundation investigation conducted at the site of the proposed replacement of the Highway 401 W-N/S Ramp, Leslie Street/CNR Overhead, and relocation of the pedestrian bridge over the CNR tracks located at the Oriole GO Station in the City of Toronto, Ontario. Both structures are part of the proposed reconstruction and rehabilitation of the Highway 401 and Leslie Street interchange. There is also a proposed retaining/noise barrier combination wall to be located along the south side of the future EBL Collector adjacent to the west approach to the new W-N/S Ramp bridge. This report covers the proposed W-N/S Ramp structure and its approaches, the retaining/noise barrier wall and the pedestrian bridge.

The purpose of this investigation was to explore the subsurface conditions along both structures, and based on the data obtained, to provide borehole location and soil strata drawings with stratigraphic profiles and cross sections (where applicable), records of boreholes, laboratory test results and a written description of the subsurface conditions. A model of the subsurface conditions was developed from the data obtained during the course of the present investigation and selected data from a preliminary investigation carried out previously by others.

Thurber was retained by MMM Group Limited (MMM) to carry out the foundation investigation at this site on behalf of the Ministry of Transportation Ontario (MTO) under Purchase Order No. 2013-E-0032.

During the preparation of this report and in addition to the boreholes drilled, reference has been made to subsurface information contained in previous foundation reports for the general vicinity of the interchange. The titles of these reports are listed as follows:

- Coffey Geotechnics Inc. report titled "Preliminary Foundation Investigation and Design Report, CN Rail Overpass Structure, Highway 401 Rehabilitation from Leslie Street to

Warden Avenue, MTO Central Region”, G.W.P. 2130-01-00, GEOCREs No. 30M14-330, Delcan Corporation, Project TRANETOB01245AA-AB, dated September 30, 2011 (Reference 1).

- Coffey Geotechnics Inc. report titled “Preliminary Foundation Investigation and Design Report, Oriole GO Parking Overpass Structure, Highway 401 Rehabilitation from Leslie Street to Warden Avenue, MTO Central Region”, G.W.P. 2130-01-00, GEOCREs No. 30M14-333, Delcan Corporation, Project TRANETOB01245AA-AC, dated September 30, 2011 (Reference 2).
- Coffey Geotechnics Inc. report titled “Foundation Engineering Assessment Report, Highway 401 and Leslie Street Interchange, Toronto, Ontario”, G.W.P. 2130-01-00, GEOCREs No. 30M14-328, Delcan Corporation, Project TRANETOB01245AA-AA, dated August 10, 2011 (Reference 3).

## **2 SITE AND PROJECT DESCRIPTION**

The site is located at the southwest quadrant of the existing Highway 401 and Leslie Street interchange in the City of Toronto, Ontario. The existing CNR overhead and pedestrian bridges are located at the Oriole GO Station, which is on the west side of Leslie Street and south side of Highway 401. The proposed ramp is to replace the existing ramp which connects the Highway 401 Eastbound Collectors with northbound and southbound traffic on Leslie Street.

It is understood that the proposed W-N/S ramp includes a new three-span bridge with approach embankments, and the pedestrian overpass is to be relocated to the south with a new foundation.

The site lies within an area of industrial and commercial lands and the terrain is generally flat. Overall, this physiographic region is slightly undulating and decreases in elevation in a southerly direction toward Lake Ontario.

Photographs in Appendix C show the general layout of the site and the existing structures at the time of the investigation.

According to the Physiography of Southern Ontario by L.J. Chapman and D.F. Putnam, 1984, the project site is located within the physiographic region known as the South Slope. The South Slope is a smooth and drumlinized till plain that has formed as a result of glacial action and deposition of till materials just south of the Oak Ridges Moraine. The South Slope contains a variety of soils that have developed over till. The depth of the overburden in the general area can be expected to be more than 50 m. Within and adjacent to the Don River valley, the site area is underlain by glacio-lacustrine sands, silts, silty clay and glacial till deposits.

### **3 SITE INVESTIGATION AND FIELD TESTING**

The site investigation and field testing for this project was carried out from March 17 to April 16, 2015. A total of ten boreholes were drilled for the proposed structures at the site. Six boreholes (numbered R-03 to R-05, R-07 to R-09) were drilled and sampled along the proposed alignment of the new structure and approaches to depths ranging from 23.3 to 30.8 m (Elevations 114.1 to 117.5m). Two boreholes (numbered PB-01 and PB-02) were drilled near each end of the proposed, relocated pedestrian bridge to 23.2 and 26.3 m depths (Elevations 117.5 and 115.8 m), respectively. Boreholes R-01 and R-02 were located close to the westerly limit of the proposed retaining wall alignment.

Boreholes R-04, R-05, R-07, PB-02 and R-09 were originally positioned for a “short 3-span” bridge configuration based on information provided by MMM. Subsequent to completion of these boreholes, information from MMM indicated that a “long 3-span” configuration was instead adopted by Metrolinx. As a result of the significance increase in length of the mid-span, Borehole R-07 is now approximately 15 m away from the proposed location of Pier 2.

Reference has been made to Boreholes W3, 11 and 14, drilled during the previous investigations conducted in 1964 and 2009 (References 1, 2 and 3) by others. These boreholes are included in Appendix A.

The site investigation and field testing for the retaining/noise barrier combination wall was carried out on November 30, 2015 when two boreholes, numbered W-01 and W-02, were drilled and sampled near the proposed wall alignment. The boreholes were advanced to depths of 9.6 m to 9.8, or Elevations 143.2 m to 145.0 m.

The approximate locations of the boreholes drilled for the CNR overhead and the retaining wall during the current investigation are shown on a Borehole Locations and Soil Strata Drawing in Appendix A. The approximate locations of the boreholes drilled for the pedestrian bridge are presented on a Borehole Locations and Soil Strata Drawing in Appendix B. The coordinates and elevations of the boreholes are given on the drawings and on the individual Record of Borehole Sheets in Appendices A and B.

The borehole locations were initially established in the field by Thurber relative to existing site features. Utility clearance was obtained at all borehole locations prior to drilling.

During the current investigation, a track mounted D54 drill rig was used in conjunction with hollow-stem augers to advance the boreholes. Soil samples were obtained at selected intervals using a 50 mm nominal diameter split spoon sampler in conjunction with the Standard Penetration Test (SPT).

In addition to the SPT samples, relatively undisturbed samples of cohesive soils were collected from twelve thin wall Shelby tubes advanced at selected depths in most boreholes except in

Boreholes R-05 and R-07. The in situ shear strength of the firm cohesive soils was also assessed using an MTO 'N' size shear vane.

Borehole R-03 was supplemented by a dynamic cone penetration testing (DCPT) conducted from the base of the sampled borehole until practical refusal to dynamic cone advance.

The drilling and sampling operations were supervised on a full time basis by a member of Thurber's technical staff. The supervisor logged the boreholes and processed the recovered soil samples for transport to Thurber's laboratory for further examination and testing.

Groundwater conditions were observed in the open boreholes during and upon completion of the drilling operations. Standpipe piezometers consisting of a 19 mm diameter Schedule 40 PVC pipe with a 3.0 m long slotted screen were installed within a column of filter sand in five selected boreholes to permit longer term groundwater level monitoring. The completion details of the piezometers and boreholes are summarized in Table 3.1.

**Table 3.1 – Piezometer and Borehole Completion Details**

<b>Borehole Number</b>	<b>Piezometer Tip Depth / Elevation (m)</b>	<b>Completion Details</b>
R-01	None installed	Backfilled with bentonite holeplug and auger cuttings to surface.
R-02	23.2/122.5	Backfilled with filter sand from 24.8 to 19.2 m, bentonite holeplug from 19.2 to 15.2 m, bentonite holeplug and auger cuttings from 15.2m to ground surface.
R-03	None installed	Backfilled with bentonite holeplug and auger cuttings to surface.
R-04	15.5/127.7	Borehole caved from 27.6 to 15.5 m. Backfilled with filter sand from 15.5 to 10.4 m, bentonite holeplug from 10.4 to 7.9 m, bentonite holeplug and auger cuttings from 7.9 m to ground surface.
R-05	None installed	Backfilled with bentonite holeplug and auger cuttings to surface.
R-07	None installed	Backfilled with bentonite holeplug and auger cuttings to surface.
R-08	26.1/115.9	Backfilled with filter sand from 26.1 to 22.3 m, bentonite holeplug from 22.3 to 19.9 m, bentonite holeplug and auger cuttings from 19.9 m to ground surface.
R-09	27.7/116.2	Borehole caved in from 29.2 to 27.7 m. Backfilled with filter sand from 27.7 to 24.1 m, bentonite holeplug from 24.1 to 21.9 m, bentonite holeplug and auger cuttings from 21.9 to 1.5 m, then bentonite holeplug from 1.5 m to ground surface.
PB-01	22.9/117.8	Backfilled with filter sand from 23.4 to 18.9 m, bentonite holeplug from 18.9 to 15.2 m, bentonite

Borehole Number	Piezometer Tip Depth / Elevation (m)	Completion Details
		holeplug and auger cuttings from 15.2 to 2.1 m, then bentonite holeplug from 2.1 m to ground surface.
PB-02	None installed	Backfilled with bentonite holeplug and auger cuttings to surface.
W-01	None installed	Backfilled with bentonite holeplug and auger cuttings to 0.2 m, then asphalt to ground surface.
W-02	9.2/143.8	Backfilled with filter sand from 9.8 to 5.2 m, bentonite holeplug from 5.2 to 4.6 m, bentonite holeplug and auger cuttings from 4.6 to 0.3 m, sand from 0.3 to 0.1 m, cement from 0.1 m to ground surface.

#### 4 LABORATORY TESTING

All recovered soil samples were subjected to visual identification and to natural moisture content determination. At least 25% of the recovered soil samples were subjected to grain size distribution analysis. Atterberg Limits tests were carried out on selected samples of native silty clay to determine the plasticity characteristics. The results of the laboratory testing are summarized on the Record of Borehole sheets and figures included in Appendices A and B.

Three specimens were prepared from thin wall Shelby tube samples obtained in Boreholes R-04, R-08 and R-09 for one-dimensional oedometer (consolidation) tests. The detailed results are shown in Appendix A.

#### 5 DESCRIPTION OF SUBSURFACE CONDITIONS

Reference is made to the Record of Borehole sheets in Appendices A and B. Details of the encountered soil stratigraphy are presented in these records and on the “Borehole Locations and Soil Strata” drawings in Appendices A and B. General description of the stratigraphy is given in the following paragraphs. The factual information established at the borehole locations governs any interpretation of the site conditions.

##### 5.1 CNR Overhead and Approaches (Boreholes R-01 to R-05, R07 to R-09, PB-02)

Boreholes R-03 to R-05, R-07 to R-09 and PB-02 were drilled near the proposed CNR overhead foundation elements and approaches. Boreholes R-01 and R-02 were drilled along the proposed retaining/noise barrier wall alignment. Records of boreholes, laboratory testing results and stratigraphic drawings are contained in Appendix A.

In general, the stratigraphy along the alignment of the new bridge and its approaches typically consists of surficial topsoil, and sand and silt/silty clay fill overlying native, compact sands and silts. Occasional layers of organics and clayey silt mixed with organics



were noted below the fill. A deposit of very soft to firm silty clay was contacted below the sandy silt to silty sand layer. The silty clay is underlain by very dense sandy silt to silty sand till. The groundwater level is typically at or within 2 m depth of the top surface of native soils.

#### **5.1.1 Topsoil**

Topsoil was encountered surficially in all of the boreholes except in Borehole R-05. The thickness of the topsoil ranged from 50 to 200 mm. The topsoil thickness may vary between and beyond the borehole locations, and the data is not intended for the purpose of estimating quantities.

#### **5.1.2 Sand and Silt Fill**

A layer of brown to grey sand and silt to silty sand fill was contacted below the topsoil in Boreholes R-03, R-04, R-07, R-08, R-09, PB-02 and surficially in Borehole R-05. The cohesionless fill typically contains trace gravel, trace to some clay and occasional rootlets. Occasional cobbles were inferred within the sand and silt fill near 2.9 m depth in Borehole R-09. The thickness of this fill ranges from 1.4 to 4.2 m. The depth to the base of the sand and silt fill varied from 1.6 to 4.3 m (Elevations 137.7 to 143.3 m).

The SPT 'N' values measured in the sand and silt fill typically ranged from 13 to 41 blows per 0.3 m of penetration indicating a compact to dense condition. SPT 'N' values of 3 to 8 blows per 0.3 m of penetration indicate the presence of very loose to loose zones in Boreholes R-05, R-08 and PB-02. In Borehole R-09, SPT 'N' values of 55 to 60 blows per 0.3 m of penetration were measured indicating very dense conditions. The moisture content in the sand and silt fill ranged from 9% to 23%.

Samples of sand and silt fill were subjected to laboratory gradation analysis. Grain size distribution curves for the sand and silt fill samples are presented on the Record of Borehole sheets included in Appendix A and on Figure A1 of Appendix A. The results of the laboratory tests are summarized as follows:

<b>Soil Particles</b>	<b>Percentage (%)</b>
Gravel	0 to 11
Sand	53 to 59
Silt	26 to 38
Clay	4 to 10

### 5.1.3 Silty Clay Fill

A layer of silty clay fill containing some to with sand, trace gravel and occasional rootlets was contacted below the topsoil in Boreholes R-01 and R-02 and below the sand and silt fill in Borehole R-03, at 1.6 m depth. The silty clay fill was brown to grey in colour. The thickness of the silty clay fill ranged from 1.9 to 2.5 m. The depth to the base of the silty clay fill was 2.1 m (Elevations 146.0 and 143.6 m) in Boreholes R-01 and R-02, respectively, and 4.1 m (Elevation 140.8 m) in Borehole R-03.

SPT 'N' values in the silty clay fill varied from 9 to 31 blows per 0.3 m of penetration, indicating a stiff to hard consistency. The moisture contents ranged from 11% to 21%.

Two samples of silty clay fill were subjected to laboratory gradation analysis. Grain size distribution curves for the silty clay fill samples are presented on the Record of Borehole sheets included in Appendix A and on Figure A2 of Appendix A. The results of the laboratory tests are summarized as follows:

Soil Particles	Percentage (%)
Gravel	0
Sand	31 to 32
Silt	34 to 39
Clay	30 to 34

### 5.1.4 Organics and Clayey Silt mixed with Organics

Layers of organics and clayey silt mixed with organics and occasional rootlets were encountered below the fill in Boreholes R-04 and R-09, at 2.0 and 4.1 m depths, respectively. These layers were brown to dark brown in colour, and had thicknesses of 300 mm in Borehole R-04 and 1.5 m in Borehole R-09.

An SPT 'N' value of 19 blows per 0.3 m of penetration, indicating a very stiff consistency, was measured in Borehole R-09. The moisture contents of samples from these layers were 15% and 17%.

### 5.1.5 Sands and Silts

Native brown to grey sand and silt, sandy silt and silty sand to sand were contacted below the fill and organics at depths ranging from 2.1 to 5.6 m in Boreholes R-02 to R-05, R-07 to R-09, and PB-02. These cohesionless soils contain trace to some gravel and clay. Occasional cobbles were inferred in Boreholes R-01 and R-03. The thickness of the sand and silt layers varied from 1.3 to 5.2 m. The depth to the base of the sands and silts ranged from 4.1 to 10.8 m (Elevations 133.1 to 141.6 m).

Layers of sand with trace to some silt and clay, trace gravel were contacted immediately below the fill in Boreholes R-06 and R-07 at 4.1 and 2.3 m depths, respectively. In Borehole R-03, a 4.6 m thick layer of sand was encountered at 22.4 m depth immediately above the glacial till.

Sand and silt interlayers were encountered within the silty clay deposit at 5.6 m depth in Borehole R-01, at 15.2 m depth in Borehole R-03, and at 17.1 m depth in Borehole R-06. The thickness of these interlayers within the silty clay deposit ranged between 1.1 and 1.6m.

SPT 'N' values of the sands and silts ranged from 6 to 53 blows per 0.3 m of penetration, with most values lying between 10 and 30 blows, indicating a typically compact state. Lower 'N' values of 6 to 8 blows and higher 'N' values of 31 to 53 blows indicate the presence of loose zones and dense to very dense zones, respectively. The moisture contents varied from 7% to 25%.

Samples of the sands and silts were subjected to laboratory gradation analysis. Results of the tests are presented on the Record of Borehole sheets included in Appendix A and on Figures A3, A4 and A5 of Appendix A. The results of the laboratory test are summarized as follows:

<b>Soil Particles</b>	<b>Sandy Silt/Silty Sand Percentage (%)</b>	<b>Sand Percentage (%)</b>	<b>Silt Percentage (%)</b>
Gravel	0 to 11	0	0
Sand	39 to 61	83 to 86	6 to 11
Silt	21 to 57	10 to 14	73 to 90
Clay	4 to 12	3 to 4	4 to 16

#### **5.1.6 Silty Clay**

An extensive deposit of brown to grey silty clay was encountered below the fill at 2.1 m depth in Borehole R-01 and below the sand and silt layers in the remaining boreholes at depths ranging from 2.1 to 10.8 m. The silty clay contains some sand to with sand and trace gravel with occasional sand seams. The thickness of the silty clay ranged from 10.1 to 16.3 m. The depths to the base of the silty clay ranged from 12.2 to 24.4 m (Elevations 119.5 to 135.9 m).

SPT 'N' values of 9 to 25 blows per 0.3 m of penetration, indicating a stiff to very stiff consistency, were measured within the upper 2 to 3 m of the silty clay in Boreholes R-01, R-02 and R-08. The SPT 'N' values measured in the silty clay ranged from 0 to 10 blows per 0.3 m of penetration with most values lying between 1 and 8 blows. In situ vane

testing indicated that the undrained shear strength ranges from 30 to 50 kPa. This data indicated that the silty clay has a typically soft to firm consistency with occasional stiff zones. Locally in Boreholes R-02, R-04, R-08 and R-09 below about 15 to 20 m depths, the situ vane testing indicated that the undrained shear strength ranges from 55 to 80 kPa corresponding to a stiff consistency. The moisture contents of the silty clay ranged from 10% to 43%.

Samples of silty clay were subjected to gradation analysis and Atterberg Limits testing. Grain size distribution results are presented on the Record of Borehole sheets of Appendix A and in Figures A6 to A8 of Appendix A. Atterberg Limits test results are shown on the Records of Boreholes and also presented on Figures A11 to A13 of Appendix A. The results of the laboratory test are summarized as follows:

Soil Particles	Percentage (%)
Gravel	0 to 5
Sand	0 to 38
Silt	27 to 51
Clay	21 to 62

Soil Particles	Percentage (%)
Liquid Limit	18 to 44
Plasticity Index	7 to 25

The results indicate that the silty clay typically has low to medium plasticity (CL to CI). One sample from Borehole R-03 taken at 17.1 m depth (Elevation 127.6) was in the group CL-ML.

The results of oedometer (consolidation) testing conducted on two samples of the silty clay obtained from Borehole R-04 and R-09 are included in Appendix A and are summarized in Table 5.1.

**Table 5.1 – Consolidation Test Parameters**

Borehole	Sample Depth (m)	Soil Type	w <sub>o</sub> (%)	γ (kN/m <sup>3</sup> )	e <sub>o</sub>	P <sub>o</sub> ' (kPa)	P <sub>c</sub> ' (kPa)	OCR	C <sub>c</sub>	C <sub>r</sub>
R-04	10.7 - 11.3	Silty clay (CL)	37.3	18.4	1.01	150	145	0.97	0.37	0.085
R-08	12.2 - 12.8	Silty clay (CI)	52.4	17.1	1.40	183	180	0.98	0.76	0.043
R-09	15.2- 15.8	Silty clay (CI)	39.1	18.1	1.1	195	200	1.02	0.45	0.043

Comparison of the existing and preconsolidation pressures ( $p_o'$  and  $p_c'$ ) derived from the test results indicate that the silty clay is typically normally consolidated. The coefficient of consolidation,  $c_v$ , recorded during the test was generally in the order of  $4.5 \times 10^{-4}$  to  $6.5 \times 10^{-3}$   $\text{cm}^2/\text{s}$  for the typical pressure range anticipated in the field. The compressibility characteristics of the silty clay vary with depth and are dependent on the moisture content and shear strength profiles.

#### 5.1.7 Sandy Silty to Silty Sand Till

Grey sandy silt to silty sand till was encountered below the silty clay in all the boreholes, at depths ranging from 12.2 to 27.0 m. The till contains trace gravel, trace to some clay and occasional inferred cobbles. Occasional sand seams were also noted within the till.

A 1.6 m thick layer of sand was found embedded within the till in Borehole R-06 at 26.7 m depth. A 1.3 m thick layer of silt was contacted within the till at 16.3 m depth in Borehole R-01.

All the boreholes were terminated within the sandy silt to silty sand till at depths ranging from 20.2 to 30.8 m (Elevations 114.1 to 127.9 m).

A dynamic cone penetration test was conducted in Borehole R-03 below 30.6 m depth (Elevation 114.3 m) and terminated upon refusal at 30.8 m depth (Elevation 114.1 m).

Most SPT 'N' values ranged from 78 blows per 0.3 m of penetration to greater than 100 blows for less than 0.3 m of penetration indicating a typically very dense state. SPT 'N' values ranging from 14 to 48 blows per 0.3 m of penetration, indicating compact to dense zones, were noted in Boreholes R-01, R-02, R-04 and R-05 at various elevations. In Borehole R-03, an SPT 'N' value of 8 blows per 0.3 m of penetration indicates a loose zone. The moisture content ranged from 7% to 24%.

Samples of the sandy silt to silty sand till were subjected to laboratory gradation analysis. Test results are presented on the Record of Borehole sheets included in Appendix A and in Figures A9 and A10 of Appendix A. The results of the laboratory test are summarized as follows:

Soil Particles	Percentage (%)
Gravel	0 to 9
Sand	26 to 64
Silt	31 to 55
Clay	5 to 24

Glacial till deposits contain cobbles and boulders which may account for the high SPT 'N' values and resistance to augering.

### 5.1.8 Groundwater Level

Water levels were observed in the open boreholes upon completion of drilling operations. A total of four standpipe piezometers were installed to monitor water levels after completion of drilling. The water levels measured in the piezometers are summarized in Table 5.2 which also includes water levels observed in the open boreholes upon completion of drilling.

**Table 5.2 – Water Level Measurements**

Borehole Number	Date	Water Levels		Comment
		Depth (m)	Elevation (m)	
R-01	March 30, 2015	5.5	142.6	Open borehole
R-02	March 31, 2015	5.4	140.3	Piezometer
	April 22, 2015	5.3	140.4	
	June 3, 2015	5.2	140.5	
	June 17, 2015	5.3	140.4	
R-03	March 25, 2015	4.3	140.6	Open borehole
R-04	March 31, 2015	4.5	138.7	Piezometer
	April 22, 2015	4.7	138.5	
	June 3, 2015	4.6	138.6	
	June 17, 2015	4.6	138.6	
R-05	March 19, 2015	5.2	135.6	Open borehole
R-07	March 23, 2015	5.0	135.7	Open borehole
R-08	April 22, 2015	5.9	136.1	Piezometer
	June 3, 2015	3.7	138.3	
	June 17, 2015	5.5	136.5	
R-09	April 22, 2015	5.9	138.0	Piezometer
	June 3, 2015	5.6	138.3	
	June 17, 2015	3.7	140.2	
PB-02	April 15, 2015	7.0	135.1	Open borehole

The groundwater readings presented above are short term observations. Seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level may be at higher elevations after the spring snowmelt or after periods of heavy rainfall.

### 5.2 Pedestrian Overpass

Two boreholes, numbered PB-01 and PB-02, were drilled near each abutment of the proposed pedestrian bridge. Records of boreholes, laboratory testing results and stratigraphic drawings are contained in Appendix B.

In general, the stratigraphy at the pedestrian bridge consists of surficial topsoil overlying a layer of cohesionless fill, which is underlain by native sands and silts. A layer of organics

was contacted below the fill in Borehole PB-01. The sands and silts are underlain by an extensive deposit of soft to firm and occasionally stiff silty clay. Below the silty clay, hard silty clay till was contacted in Borehole PB-01 and very dense sand and silt till was encountered in Borehole PB-02.

### 5.2.1 Topsoil

Topsoil was encountered surficially in both boreholes. The thickness of the topsoil was 200 and 75 mm, respectively, in Boreholes PB-01 and PB-02.

The topsoil thickness may vary between and beyond the borehole locations, and the data is not intended for the purpose of estimating quantities.

### 5.2.2 Sand and Silt Fill

A layer of sand and silt to silty sand fill containing trace gravel and some clay was encountered below the topsoil in both boreholes. The thickness of this fill was 2.0 and 4.0m in Boreholes PB-01 and PB-02, respectively. The depth to the base of the fill was 2.2 and 4.1 m (Elevations 138.5 and 138.0 m) in Boreholes PB-01 and PB-02, respectively.

SPT 'N' values in the fill ranged from 7 to 31 blows per 0.3 m of penetration, indicating a loose to dense state. The moisture content of the fill ranged from 10% to 21%.

A sample of the sand and silt fill was subjected to laboratory gradation analysis. Grain size distribution curve for the fill sample is presented on the Record of Borehole sheets included in Appendix B and Figure B1 of Appendix B. The results of the laboratory test are summarized as follows:

Soil Particles	Percentage (%)
Gravel	6
Sand	54
Silt	30
Clay	10

### 5.2.3 Organics

A 300 mm thick layer of organics was contacted below the fill at 2.2 m depth in Borehole PB-01. The layer of organics contains roots and rootlets, and was dark brown in colour. The depth to the base of the organics was at 2.5 m (Elevation 138.2 m).

The moisture content in the organics was measured at 26%.

#### 5.2.4 Sands and Silts

Native silty sand to sand and silt was contacted below the layer of organics at 2.5 m depth in Borehole PB-01 and below the fill at 4.1 m depth in Borehole PB-02. These deposits contain trace clay and trace gravel. The thickness of the sands and silts ranged from 3.1 to 4.6 m. The depth to the base of the sands and silts was 5.6 and 8.7 m (Elevations 135.1 and 133.4 m) in Boreholes PB-01 and PB-02, respectively.

SPT 'N' values of the sands and silts typically ranged from 12 to 27 blows per 0.3 m of penetration indicating a compact state. An SPT 'N' value of 6 blows per 0.3 m of penetration, indicating a loose zone, was measured in Borehole PB-02. The moisture content varied from 4% to 27%.

Two samples of the sands and silts were subjected to laboratory gradation analysis. Results of the tests are presented on the Record of Borehole sheets included in Appendix B and on Figure B2 of Appendix B. The results of the laboratory test are summarized as follows:

Soil Particles	Percentage (%)
Gravel	0
Sand	40 to 60
Silt	33 to 58
Clay	2 to 7

#### 5.2.5 Silty Clay

Brown to grey silty clay was encountered below the sands and silts in both boreholes at 5.6 and 8.7 m depths. The silty clay generally contains some to with sand with occasional sand seams. Locally in Borehole PB-01, a 0.9 m thick layer of sandy silt was contacted within the silty clay at 13.3 m depth. The overall thickness of the silty clay deposit was 13.2 to 13.6 m. The depth to the base of the silty clay was 19.2 and 21.9 m (Elevations 121.5 and 120.2 m) in Boreholes PB-01 and PB-02, respectively.

SPT 'N' values ranged between 0 and 14 blows per 0.3 m of penetration with most values lying between 0 and 3 blows. In situ vane testing indicated that the undrained shear strength ranges from 28 to 72 kPa with most values lying between 28 and 47 kPa. This data indicates that the silty clay is typically soft to firm with occasional stiff zones. The moisture content in the silty clay ranged from 10% to 26%.

Samples of the silty clay were subjected to gradation analysis and Atterberg Limits testing. Grain size distribution results are presented on the Record of Borehole sheets in Appendix B and on Figure B3 in Appendix B. Atterberg Limits test results are shown on the Records



of Boreholes and also presented on Figure B5 of Appendix B. The results of the laboratory test are summarized as follows:

Soil Particles	Percentage (%)
Gravel	0 to 3
Sand	24 to 37
Silt	27 to 47
Clay	21 to 46

Soil Particles	Percentage (%)
Liquid Limit	20 to 38
Plasticity Index	9 to 21

The results indicate that the silty clay typically has low (CL) to occasional medium (CI) plasticity.

#### 5.2.6 Silty Clay Till

Grey silty clay till containing trace of sand was contacted below the silty clay at 19.2 m depth in Borehole PB-01 which was terminated within the till at 23.2 m depth (Elevation 117.5 m).

The SPT 'N' values recorded in the silty clay till were greater than 100 blows for less than 0.3 m of penetration indicating a hard consistency. The moisture content of the silty clay till varied from 5% to 21%.

A sample of the silty clay till was subjected to gradation analysis. Grain size distribution results are presented on the Record of Borehole sheets in Appendix B and on Figure B4 in Appendix B. The results of the laboratory test are summarized as follows:

Soil Particles	Percentage (%)
Gravel	0
Sand	5
Silt	65
Clay	30

Glacial till deposits contain cobbles and boulders which may account for the high SPT 'N' values.

#### 5.2.7 Sand and Silt Till

Grey sand and silt till containing some clay, trace gravel and occasional sand layers was contacted below the silty clay at 21.9 m in Borehole PB-02. A 700 mm thick layer of

cobbles and gravel was contacted within the till at 24.4 m depth. Borehole PB-02 was terminated within this till at 26.3 m depth (Elevation 115.8 m).

SPT 'N' values were greater than 100 blows for less than 0.3 m of penetration indicating a very dense state. The moisture content varied from 3% to 9%.

Glacial till deposits contain cobbles and boulders which may account for the high SPT 'N' values.

### 5.2.8 Groundwater Level

Water levels were observed in the open boreholes upon completion of drilling operations. One standpipe piezometer was installed to monitor water levels after completion of drilling. The water levels measured in the piezometer are summarized in Table 5.3 which includes the water level observed in the open borehole upon completion of drilling.

**Table 5.3 – Water Level Measurements**

Borehole Number	Date	Water Levels		Comment
		Depth (m)	Elevation (m)	
PB-01	April 22, 2015	5.4	135.3	Piezometer
	June 3, 2015	2.8	137.9	Piezometer
PB-02	April 15, 2015	7.0	135.1	Open borehole

The groundwater readings at this site are short term observations. Seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level may be at higher elevations after the spring snowmelt or after periods of heavy rainfall.

### 5.3 Retaining/Noise Barrier Combination Wall

Two boreholes, numbered W-01 and W-02, were drilled near the alignment of the proposed combination wall which will serve the dual purpose of retaining a slope within its lower portion and as a noise barrier wall within its upper portion. Records of boreholes, laboratory testing results and stratigraphic drawings are provided in Appendix B.

In general, the stratigraphy at the boreholes consists of the pavement structure and surficial cohesionless fill or very stiff to hard native silty clay overlying compact to very dense native sands and silts, which are underlain by hard silty clay. The groundwater level was measured at about 6.5 m depth below existing ground surface.

#### 5.3.1 Pavement Structure and Fill

The pavement structure consists of 125 mm to 150 mm of asphalt overlying 0.6 m to 0.8 m of sand, some gravel. Below the pavement, sand and silt fill containing some clay and

trace gravel was encountered in Borehole W-02. The depth to the base of the pavement structure and fill was 0.9 m (Elevation 153.7 m) and 3.0 m (Elevation 150.0 m) in Boreholes W-01 and W-02, respectively.

In Borehole W-02, the sand fill was in a compact state as indicated by an SPT 'N' value of 19 blows for 0.3 m penetration. 'N' values of 75 and 46 blows per 0.3 m of penetration measured in the sand and silt fill indicated very dense to dense conditions. Measured moisture contents of the fill ranged between 10 and 11 percent.

A sample of the sand and silt fill was subjected to laboratory gradation analysis. Grain size distribution curve for the fill sample is presented on the Record of Borehole sheets included on Figure B6 of Appendix B. The results of the laboratory test are summarized as follows:

Soil Particles	Percentage (%)
Gravel	2
Sand	43
Silt	42
Clay	13

### 5.3.2 Sand and Silt

A deposit of native sand and silt, trace to some clay and trace gravel was encountered in Borehole W-01 below an upper silty clay layer and in Borehole W-02 below the fill. The thickness of the sand and silt was 4.4 m and 2.6 m in Boreholes W-01 and W-02, respectively. The depth to the base of the sand and silt is between 7.2 m and 5.6 m (Elevation 147.4 m).

SPT 'N' values of the sand and silt ranged from 24 blows per 0.3 m of penetration to greater than 100 blows for less than 0.3 m penetration, indicating a compact to very dense condition. Measured moisture contents varied from 2 to 15 percent.

Two samples of the sand and silt were subjected to laboratory gradation analysis. Results of the tests are presented on the Record of Borehole sheets included in Appendix B and on Figure B7 of Appendix B. The results of the laboratory test are summarized as follows:

Soil Particles	Percentage (%)
Gravel	2 to 3
Sand	35 to 43
Silt	42 to 50
Clay	4 to 21

### 5.3.3 Silty Clay

The upper silty clay layer encountered in Borehole W-01 was 1.9 m thick with a base at 2.8m depth (Elevation 151.8 m). A lower, grey silty clay deposit containing trace to some sand was encountered below the sand and silt in both boreholes, which were terminated within this deposit at depths of 9.6 m to 9.8 m (Elevations 145.0 and 143.2 m) in Boreholes W-01 and W-02, respectively.

In the upper silty clay, SPT 'N' values ranged from 21 blows for 0.3 m penetration to greater than 100 blows for less than 0.3 m penetration indicating a very stiff to hard consistency. 'N' values, ranging between 58 and 88 blows per 0.3 m of penetration, indicated that the lower silty clay has a hard consistency throughout. Measured moisture contents in the silty clay ranged between 10 and 20 percent.

Samples of the silty clay were subjected to gradation analysis and Atterberg Limits testing. Grain size distribution results are presented on the Record of Borehole sheets in Appendix B and on Figure B8 in Appendix B. Atterberg Limits test results are shown on the Records of Boreholes and also presented on Figure B9 of Appendix B. The results of the laboratory test are summarized as follows:

Soil Particles	Percentage (%)
Gravel	0
Sand	10 to 13
Silt	58 to 63
Clay	24 to 32

Soil Particles	Percentage (%)
Liquid Limit	25
Plasticity Index	8

The results indicate that the silty clay has low (CL) plasticity.

### 5.3.4 Groundwater Level

Water levels were observed in the open boreholes upon completion of drilling operations. One standpipe piezometer was installed in Borehole W-02 to monitor water levels after completion of drilling. The water level data is summarized in Table 5.4 which includes the water level observed in the open boreholes upon completion of drilling.

**Table 5.4 – Water Level Measurements**

Borehole Number	Date	Water Levels		Comment
		Depth (m)	Elevation (m)	
W-01	November 30, 2015	dry	-	Open borehole
W-02	November 30, 2015 March 29, 2016	Dry 6.5	- 146.5	Open borehole Piezometer

The groundwater readings at this site are short term observations. Seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level may be at higher elevations after the spring snowmelt or after periods of heavy rainfall.

## **6 MISCELLANEOUS**

The borehole locations on site were initially established by Thurber. Underground utility clearances were obtained for the borehole locations prior to drilling. The northing and easting coordinates and elevation at each as-drilled borehole location were provided by MMM surveyors.

The drilling and sampling equipment was supplied and operated by Walker Drilling Ltd. of Utopia, Ontario. The field work was supervised on a full time basis by Ms. Eckie Siu of Thurber.

Laboratory testing was carried out at Thurber's Toronto area, MTO approved, high complexity laboratory.

Overall supervision of the field program was conducted by Mr. Stephane Loranger, C.E.T. of Thurber. Compilation of data and preparation of the report were carried out by Ms. R. Palomeque Reyna, P.Eng. and Dr. Sydney Pang, P.Eng.

Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects, reviewed the report.

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Review Principal, Designated MTO Contact

## SYMBOLS, ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES

### 1. TEXTURAL CLASSIFICATION OF SOILS

CLASSIFICATION	PARTICLE SIZE	VISUAL IDENTIFICATION
Boulders	Greater than 200mm	same
Cobbles	75 to 200mm	same
Gravel	4.75 to 75mm	5 to 75mm
Sand	0.075 to 4.75mm	Not visible particles to 5mm
Silt	0.002 to 0.075mm	Non-plastic particles, not visible to the naked eye
Clay	Less than 0.002mm	Plastic particles, not visible to the naked eye

### 2. COARSE GRAIN SOIL DESCRIPTION (50% greater than 0.075mm)

TERMINOLOGY	PROPORTION
Trace or Occasional	Less than 10%
Some	10 to 20%
Adjective (e.g. silty or sandy)	20 to 35%
And (e.g. sand and gravel)	35 to 50%

### 3. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

DESCRIPTIVE TERM	UNDRAINED SHEAR STRENGTH (kPa)	APPROXIMATE SPT <sup>(1)</sup> 'N' VALUE
Very Soft	12 or less	Less than 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	Greater than 200	Greater than 30

NOTE: Hierarchy of Soil Strength Prediction

- 1) Laboratory Triaxial Testing
- 2) Field Insitu Vane Testing
- 3) Laboratory Vane Testing
- 4) SPT value
- 5) Pocket Penetrometer



### 4. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

DESCRIPTIVE TERM	SPT "N" VALUE
Very Loose	Less than 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	Greater than 50

### 5. LEGEND FOR RECORDS OF BOREHOLES

SYMBOLS AND ABBREVIATIONS FOR SAMPLE TYPE	SS Split Spoon Sample	WS Wash Sample	AS Auger (Grab) Sample
	TW Thin Wall Shelby Tube Sample	TP Thin Wall Piston Sample	
	PH Sampler Advanced by Hydraulic Pressure	PM Sampler Advanced by Manual Pressure	
	WH Sampler Advanced by Self Static Weight	RC Rock Core	SC Soil Core

$$\text{Sensitivity} = \frac{\text{Undisturbed Shear Strength}}{\text{Remoulded Shear Strength}}$$

 Water Level  
 Shear Strength Determination by Pocket Penetrometer






- (1) SPT 'N' Value Standard Penetration Test 'N' Value – refers to the number of blows from a 63.5kg hammer free falling a height of 0.76m to advance a standard 50 mm outside diameter split spoon sampler for 0.3 m depth into undisturbed ground.
- (2) DCPT Dynamic Cone Penetration Test – Continuous penetration of a 50 mm outside diameter, 60° conical steel point attached to "A" size rods driven by a 63.5 kg hammer free falling a height of 0.76 m. The resistance to cone penetration is the number of hammer blows required for each 0.3 m advance of the conical point into undisturbed ground.

# UNIFIED SOILS CLASSIFICATION

MAJOR DIVISIONS		GROUP SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels or gravel-sand mixtures, little or no fines.
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines.
		GM	Silty gravels, gravel-sand-silt mixtures.
		GC	Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS	SW	Well-graded sands or gravelly sands, little or no fines.
		SP	Poorly-graded sands or gravelly sands, little or no fines.
		SM	Silty sands, sand-silt mixtures.
		SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS	SILTS AND CLAYS $W_L < 50\%$	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. ( $W_L < 30\%$ ).
		CI	Inorganic clays of medium plasticity, silty clays. ( $30\% < W_L < 50\%$ ).
		OL	Organic silts and organic silty-clays of low plasticity.
	SILTS AND CLAYS $W_L > 50\%$	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
		OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils.
CLAY SHALE			
SANDSTONE			
SILTSTONE			
CLAYSTONE			
COAL			



## EXPLANATION OF ROCK LOGGING TERMS

ROCK WEATHERING CLASSIFICATION		SYMBOLS	
Fresh (FR)	No visible signs of weathering.		
Fresh Jointed (FJ)	Weathering limited to the surface of major discontinuities.		CLAYSTONE
Slightly Weathered (SW)	Penetrative weathering developed on open discontinuity surfaces, but only slight weathering of rock material.		SILTSTONE
Moderately Weathered (MW)	Weathering extends throughout the rock mass, but the rock material is not friable.		SANDSTONE
Highly Weathered (HW)	Weathering extends throughout the rock mass and the rock is partly friable.		COAL
Completely Weathered (CW)	Rock is wholly decomposed and in a friable condition, but the rock texture and structure are preserved.		Bedrock (general)

DISCONTINUITY SPACING		STRENGTH CLASSIFICATION			
Bedding	Bedding Plane Spacing	Rock Strength	Approximate Uniaxial Compressive Strength		Field Estimation of Hardness*
			(MPa)	(psi)	
Very thickly bedded	Greater than 2m	Extremely Strong	Greater than 250	Greater than 36,000	Specimen can only be chipped with a geological hammer
Thickly bedded	0.6 to 2m				
Medium bedded	0.2 to 0.6m	Very Strong	100-250	15,000 to 36,000	Requires many blows of geological hammer to break
Thinly bedded	60mm to 0.2m				
Very thinly bedded	20 to 60mm	Strong	50-100	7,500 to 15,000	Requires more than one blow of geological hammer to break
Laminated	6 to 20mm				
Thinly Laminated	Less than 6mm	Medium Strong	25.0 to 50.0	3,500 to 7,500	Breaks under single blow of geological hammer.
		Weak	5.0 to 25.0	750 to 3,500	Can be peeled by a pocket knife with difficulty
		Very Weak	1.0 to 5.0	150 to 750	Can be peeled by a pocket knife, crumbles under firm blows of geological pick.
		Extremely Weak (Rock)	0.25 to 1.0	35 to 150	Indented by thumbnail

TERMS	
Total Core Recovery: (TCR)	Core recovered as a percentage of total core run length.
Solid Core Recovery: (SCR)	Percent Ratio of solid core of full cylindrical shape recovered. Expressed with respect to the total length of core run.
Rock Quality Designation: (RQD)	Total length of sound core recovered in pieces 0.1m in length or larger as a percentage of total core run length.
Uniaxial Compressive Strength (UCS)	Axial stress required to break the specimen
Fracture Index: (FI)	Frequency of natural fractures per 0.3m of core run.

## **Appendix A**

### **West N/S Ramp CNR Overpass at Leslie Street Boreholes R-01 to R-05, R-07 to R-09, PB-02 and Boreholes from previous investigation**

- Record of Borehole Sheets
- Laboratory Test Results
- Drawing titled “Borehole Locations and Soil Strata

# RECORD OF BOREHOLE No PB-02

1 OF 3

METRIC

W.P. 2061-13-00 LOCATION Pedestrian Overpass N 4 847 255.7 E 315 747.1 ORIGINATED BY ES  
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2015.04.14 - 2015.04.15 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				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			SHEAR STRENGTH kPa						WATER CONTENT (%)			
								○ UNCONFINED      + FIELD VANE		● QUICK TRIAXIAL      × LAB VANE				PLASTIC LIMIT W <sub>P</sub>		NATURAL MOISTURE CONTENT W	
142.1	GROUND SURFACE																
0.0 0.1	<b>TOPSOIL:</b> (75mm)  Silty <b>SAND</b> , some clay, trace gravel Dense Brown to Dark Brown Moist (FILL)		1	SS	31		142										
140.7							141										
1.4	Compact to Loose		2	SS	14		140							6 54 30 10			
			3	SS	7												
			4	SS	8		139										
138.0							138										
4.1	<b>SAND</b> and <b>SILT</b> , trace clay, trace gravel Compact Brown Moist		5	SS	23		137										
	Wet		6	SS	12		136							0 40 58 2			
	Loose Grey		7	SS	6		135										
							134										
133.4																	
8.7	Silty <b>CLAY</b> , some to with sand Soft to Firm Grey Wet		8	SS	3		133										

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No PB-02

2 OF 3

METRIC

W.P. 2061-13-00 LOCATION Pedestrian Overpass N 4 847 255.7 E 315 747.1 ORIGINATED BY ES  
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2015.04.14 - 2015.04.15 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT		NATURAL MOISTURE CONTENT		LIQUID LIMIT		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			SHEAR STRENGTH kPa		WATER CONTENT (%)											
								○ UNCONFINED    + FIELD VANE			W <sub>p</sub>	W	W <sub>L</sub>								
							● QUICK TRIAXIAL    × LAB VANE														
							20    40    60    80    100			20	40	60									
	Continued From Previous Page						132		3.3 +												
	Silty <b>CLAY</b> , some to with sand, trace gravel Firm Grey Wet		1	TW	PH		131						○								
								2.3 +													
			9	SS	1		130						○								
							129		3.1 +												
			10	SS	0		128						○					3	24	27	46
							127		3.1 +												
	Sand seams		11	SS	1		126														
125.8 16.3	Stiff						125		4.3 +												
			12	SS	1		124						○								
							123		4.0 +												
122.7 19.4			13	SS	14								○								

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
15 10 5 0  
 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No PB-02

3 OF 3

METRIC

W.P. 2061-13-00 LOCATION Pedestrian Overpass N 4 847 255.7 E 315 747.1 ORIGINATED BY ES  
HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
DATUM Geodetic DATE 2015.04.14 - 2015.04.15 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				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			SHEAR STRENGTH kPa						
								20 40 60 80 100						
	Continued From Previous Page		14	SS	2		122							
120.2	Silty <b>CLAY</b> , some to with sand, trace gravel Soft Grey Wet						121							
21.9	<b>SAND</b> and <b>SILT</b> , some clay, trace gravel Very Dense Grey Moist (TILL)		15	SS	101/ 0.250		119							
117.7							118							
24.4	Some gravel and cobbles Very Dense		16	SS	100/ 0.075		117							
117.0	Occasional sand layers						116							
115.8			17	SS	108/ 0.250									
26.3	END OF BOREHOLE AT 26.3m. WATER LEVEL AT 7.0m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO SURFACE.													

ONTMT4S 1205.GPJ 2015TEMPLATE(MTO).GDT 11/3/15

# RECORD OF BOREHOLE No R-01

1 OF 3

METRIC

W.P. 2061-13-00 LOCATION W-N/S Ramp Leslie St. / CNR Overhead N 4 847 294.4 E 315 382.5 ORIGINATED BY ES  
HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
DATUM Geodetic DATE 2015.03.27 - 2015.03.30 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT		NATURAL MOISTURE CONTENT		LIQUID LIMIT		UNIT WEIGHT  <b>γ</b>  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					w <sub>p</sub>		w		w <sub>L</sub>		GR	SA	SI	CL	
								20	40	60	80	100	○ UNCONFINED      + FIELD VANE		● QUICK TRIAXIAL      × LAB VANE		WATER CONTENT (%)						
148.1	GROUND SURFACE							20	40	60	80	100											
0.0	TOPSOIL: (175mm)						148																
0.2	Silty <b>CLAY</b> , some to with sand, trace gravel, occasional rootlets Stiff Brown to Dark Brown (FILL)		1	SS	10		147																
			2	SS	11		146																
146.0							145																
2.1	Silty <b>CLAY</b> , trace sand, trace gravel Stiff Brown Moist		3	SS	13		144																
	Occasional sand seams		4	SS	15		143																
							142																
	Very Stiff Grey		5	SS	21		141																
142.5							140																
5.6	<b>SAND</b> and <b>SILT</b> , some clay Compact Grey Wet		6	SS	11		139																
140.9																							
7.2	Stiff Wet		7	SS	11																		
	Firm		8	SS	6																		

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
20  
15 10 5 0 (%) STRAIN AT FAILURE

## METRIC

[illegible]

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity

ONTMT4S 1205.GPJ 2015TEMPLATE(MTO).GDT 11/3/15

# RECORD OF BOREHOLE No R-01

3 OF 3

METRIC

W.P. 2061-13-00 LOCATION W-N/S Ramp Leslie St. / CNR Overhead N 4 847 294.4 E 315 382.5 ORIGINATED BY ES  
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2015.03.27 - 2015.03.30 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					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			SHEAR STRENGTH kPa ○ UNCONFINED    + FIELD VANE ● QUICK TRIAXIAL    × LAB VANE							WATER CONTENT (%) W <sub>P</sub> W    W <sub>L</sub>
	Continued From Previous Page		14	SS	102/ 0.250		128								
127.9	<b>SAND and SILT</b> (TILL)  END OF BOREHOLE AT 20.2m. WATER LEVEL AT 5.5m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO SURFACE.														
20.2															



# RECORD OF BOREHOLE No R-02

1 OF 3

METRIC

W.P. 2061-13-00 LOCATION W-N/S Ramp Leslie St. / CNR Overhead N 4 847 294.8 E 315 475.5 ORIGINATED BY ES  
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2015.03.26 - 2015.03.26 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT      NATURAL MOISTURE CONTENT      LIQUID LIMIT			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			SHEAR STRENGTH kPa				WATER CONTENT (%)					
								○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL      × LAB VANE				W <sub>P</sub> W      W <sub>L</sub>					
145.7	GROUND SURFACE							20	40	60	80	100	20	40	60		
0.0	TOPSOIL: (100mm)							20	40	60	80	100	20	40	60		
0.1	Silty <b>CLAY</b> , some to with sand, trace gravel Very Stiff to Stiff Brown to Grey Moist (FILL)		1	SS	16		145						○				
			2	SS	9		144						○				0   31   39   30
143.6																	
2.1	Sandy <b>SILT</b> , trace clay, trace gravel Compact Grey Moist		3	SS	14		143						○				
	Dark Brown to Brown		4	SS	17		142						○				
							141										
141.6																	
4.1	Silty <b>CLAY</b> , some to with sand, trace gravel Very Stiff Brown Moist		5	SS	25		140										
			6	SS	15		139						○				
138.5																	
7.2	Firm																
			7	SS	6		138						●				3   38   28   31
			1	TW	PH		137			3.0							
							136										

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
 15  
 10  
 (%) STRAIN AT FAILURE

## METRIC

[illegible]

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity

# RECORD OF BOREHOLE No R-02

3 OF 3

METRIC

W.P. 2061-13-00 LOCATION W-N/S Ramp Leslie St. / CNR Overhead N 4 847 294.8 E 315 475.5 ORIGINATED BY ES  
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2015.03.26 - 2015.03.26 CHECKED BY RPR

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			SHEAR STRENGTH kPa 20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
	Continued From Previous Page		14	SS	78												
	<b>SAND</b> and <b>SILT</b> , trace gravel, trace clay, occasional inferred cobbles Very Dense Grey Wet (TILL)																
			15	SS	133/ 0.300												
			26	SS	113/ 0.300												
			27	SS	100/ 0.250												
120.9																	
24.8	END OF BOREHOLE AT 24.8m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 3.04m slotted screen.  WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m)  Mar 31/2015 5.4 140.3 Apr 22/2015 5.3 140.4 Jun 03/2015 5.2 140.5 Jun 17/2015 5.3 140.4																

ONTMT4S 1205.GPJ 2015TEMPLATE(MTO).GDT 11/3/15

# RECORD OF BOREHOLE No R-03

1 OF 4

METRIC

W.P. 2061-13-00 LOCATION W-N/S Ramp Leslie St. / CNR Overhead N 4 847 296.9 E 315 615.8 ORIGINATED BY ES  
HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
DATUM Geodetic DATE 2015.03.24 - 2015.03.25 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			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 (%)					
144.9	GROUND SURFACE							20	40	60	80	100					
0.0	TOPSOIL: (175mm)							20	40	60	80	100					
0.2	SAND and SILT, trace gravel Compact Brown Moist (FILL)		1	SS	25		144							○			
143.3																	
1.6	Silty CLAY, some to with sand, trace gravel Very Stiff to Hard Grey to Brown Moist (FILL)		2	SS	17		143							○			
			3	SS	31		142							○			
			4	SS	29		141							○			
140.8																	
4.1	Silty SAND, some gravel, trace to some clay, occasional inferred cobbles Very Dense to Dense Brown Moist		5	SS	53		140							○			
							139										
			6	SS	30		138							○			
	Moist to Wet													○			
			7	SS	44		137							○			
							136										
135.7																	
9.2	Silty CLAY, some sand Soft Grey Wet		8	SS	3		135							○			

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No R-03

2 OF 4

METRIC

W.P. 2061-13-00 LOCATION W-N/S Ramp Leslie St. / CNR Overhead N 4 847 296.9 E 315 615.8 ORIGINATED BY ES  
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2015.03.24 - 2015.03.25 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT		NATURAL MOISTURE CONTENT		LIQUID LIMIT		UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		W P		W		W L			GR SA SI CL				
								○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL    × LAB VANE	WATER CONTENT (%)												
	Continued From Previous Page							20 40 60 80 100													
	Silty <b>CLAY</b> , some sand Firm Grey Wet							3.0 +													
			1	TW	PH		134														
								3.0 +													
			9	SS	3		133														
							132														
								3.0 +													
	Some sand		10	SS	1		131														
							130	3.0 +													
129.7																					
15.2	Sandy <b>SILT</b> , trace gravel Very Loose Grey Wet		11	SS	3		129														
128.6																					
16.3	some to with sand, trace gravel Firm																				
							128														
			12	SS	3																
								3.0 +													
							127														
			13	SS	8																
							126														
							125														

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
 15  
 10  
 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No R-03

3 OF 4

METRIC

W.P. 2061-13-00 LOCATION W-N/S Ramp Leslie St. / CNR Overhead N 4 847 296.9 E 315 615.8 ORIGINATED BY ES  
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2015.03.24 - 2015.03.25 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	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			SHEAR STRENGTH kPa				WATER CONTENT (%)				
								○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL    × LAB VANE				W P                      W                      W L				
	Continued From Previous Page						20	40	60	80	100	20	40	60		
123.9	Silty <b>CLAY</b> , some to with sand, occasional silt seams Firm Grey Wet		14	SS	8							○				
21.0	Sandy <b>SILT</b> , trace gravel, trace clay Very Dense Grey Moist		15	SS	107/ 0.250							○				
122.5																
22.4	<b>SAND</b> , some silt, trace clay Very Dense Grey Wet		16	SS	78							○				0 86 10 4
			17	SS	100/ 0.250							○				
			18	SS	8							○				
117.9																
27.0	Silty <b>SAND</b> , trace clay, trace gravel Very Dense Grey Moist (TILL)		19	SS	113/ 0.225							○				
	Compact Wet		20	SS	16							○				0 64 31 5
							</									

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No R-03

4 OF 4

METRIC

W.P. 2061-13-00 LOCATION W-N/S Ramp Leslie St. / CNR Overhead N 4 847 296.9 E 315 615.8 ORIGINATED BY ES  
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2015.03.24 - 2015.03.25 CHECKED BY RPR

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			SHEAR STRENGTH kPa									
	Continued From Previous Page																
114.1	Silty <b>SAND</b> , trace gravel, trace clay Very Dense Grey Wet (TILL)		21	SS	114/												
30.8	SAMPLED BOREHOLE TO 30.6m. START DCPT AT 30.6m. END OF BOREHOLE AT 30.8m UPON DCPT REFUSAL. WATER LEVEL AT 4.3m UPON COMPLETION. BOREHOLE BACKFILED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO SURFACE.				0.250												

# RECORD OF BOREHOLE No R-04

1 OF 3

METRIC

W.P. 2061-13-00 LOCATION W-N/S Ramp Leslie St. / CNR Overhead N 4 847 301.7 E 315 659.3 ORIGINATED BY ES  
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2015.03.17 - 2015.03.17 CHECKED BY RPR

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 $\gamma$  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
143.2	GROUND SURFACE															
0.0	<b>TOPSOIL:</b> (50mm)															
	<b>SAND</b> and <b>SILT</b> , trace gravel Compact Brown to Grey Moist (FILL)		1	SS	26											
			2	SS	26											
141.2																
2.0	<b>TOPSOIL</b> , occasional rootlets															
140.9	Compact Dark Brown (300mm)		3	SS	13											
2.3	Silty <b>SAND</b> , trace clay, trace gravel Compact to Dense Dark Brown to Grey Moist															
			4	SS	10											
	Brown		5	SS	31											
	Wet		6	SS	26											
136.0																
7.2	Silty <b>CLAY</b> , some to with sand, trace gravel Firm Grey Moist		7	SS	4											
			8	SS	3											
													</			

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE



# RECORD OF BOREHOLE No R-04

2 OF 3

METRIC

W.P. 2061-13-00 LOCATION W-N/S Ramp Leslie St. / CNR Overhead N 4 847 301.7 E 315 659.3 ORIGINATED BY ES  
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2015.03.17 - 2015.03.17 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	W <sub>p</sub> W W <sub>L</sub>	WATER CONTENT (%)				
	Continued From Previous Page													
	Silty <b>CLAY</b> , trace to some sand, trace gravel Firm Grey Wet		1	TW	PH		133	2.0						
							132	1.0						
			9	SS	2		131							
	Becoming some to with sand		10	SS	1		130	2.0						
							129	2.0						
128.0							128							
15.2	<b>SILT</b> , some sand, trace gravel Very Loose Wet		11	SS	1		127							
126.9							126							
16.3			12	SS	6		125	2.5						
	Stiff		13	SS	3		124							

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
 15  
 10  
 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No R-04

3 OF 3

METRIC

W.P. 2061-13-00 LOCATION W-N/S Ramp Leslie St. / CNR Overhead N 4 847 301.7 E 315 659.3 ORIGINATED BY ES  
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2015.03.17 - 2015.03.17 CHECKED BY RPR

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 (%)			GR	SA	SI	CL
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE					20	40	60				
Continued From Previous Page																						
123.1			14	SS	8		123							○			3	38	48	11		
20.1	<b>SAND</b> and <b>SILT</b> , some clay, trace gravel Very Dense Grey Moist (TILL)																					
			15	SS	108		122							○								
							121															
120.6	Wet																					
22.6	Dense		16	SS	48		120							○								
119.3							119															
23.9	Some clay to clayey, trace gravel Moist		17	SS	100/ 0.250									○					7	26	43	24
							118															
			18	SS	100/ 0.250		117							○								
							116															
115.6	Occasional sand seams		19	SS	108/									○								
27.6	END OF BOREHOLE AT 27.6m. BOREHOLE CAVED FROM 27.6m TO 15.5m DEPTHS UPON COMPLETION. WATER LEVEL AT 5.9m UPON COMPLETION. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.  WATER LEVEL READINGS: DATE        DEPTH (m)    ELEV. (m)  Mar 31/2015    4.5        138.7 Apr 22/2015    4.7        138.5 Jun 03/2015    4.6        138.6 Jun 17/2015    4.6        138.6				0.175																	

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No R-05

1 OF 3

METRIC

W.P. 2061-13-00 LOCATION W-N/S Ramp Leslie St. / CNR Overhead N 4 847 304.4 E 315 700.8 ORIGINATED BY ES  
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2015.03.18 - 2015.03.19 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			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 (%)				GR	SA	SI	CL
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE										
140.8	GROUND SURFACE																		
0.0	<b>SAND</b> and <b>SILT</b> , trace gravel Loose to Compact Brown Moist (FILL)		1	SS	5														
			2	SS	17														
	Trace clay		3	SS	19												0	58 38 4	
137.9																			
2.9	Sandy <b>SILT</b> , trace gravel, trace clay Compact Brown Moist to Wet		4	SS	22														
	Loose		5	SS	8														
135.2																			
5.6	Silty <b>CLAY</b> , some to trace sand Very Soft to Soft Grey Wet		6	SS	1														
			7	SS	1												0	18 32 50	
			8	SS	3														

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
15  
10  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No R-05

2 OF 3

METRIC

W.P. 2061-13-00 LOCATION W-N/S Ramp Leslie St. / CNR Overhead N 4 847 304.4 E 315 700.8 ORIGINATED BY ES  
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2015.03.18 - 2015.03.19 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa 20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					W <sub>p</sub>	W	W <sub>L</sub>		
	Continued From Previous Page																
	Silty <b>CLAY</b> , trace to some sand, trace gravel Very Soft to Firm Grey Wet		9	SS	2		130										
							129										
			10	SS	3		128										
							127										
	Becoming some to with sand, occasional sand seams		11	SS	2		126										
							125										
			12	SS	4		124										
							123										
			13	SS	1		122										
							121										
122.2 18.6	<b>SAND</b> and <b>SILT</b> , trace gravel, occasional sand seams Compact Grey Moist (TILL)		14	SS	14												

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity 20 15 10 5 0 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No R-05

3 OF 3

METRIC

W.P. 2061-13-00 LOCATION W-N/S Ramp Leslie St. / CNR Overhead N 4 847 304.4 E 315 700.8 ORIGINATED BY ES  
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2015.03.18 - 2015.03.19 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					WATER CONTENT (%)				
							20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>			
	Continued From Previous Page		15	SS	108												
	<b>SAND</b> and <b>SILT</b> , trace gravel, occasional sand seams Very Dense Grey Moist (TILL)																
			16	SS	100/ 0.250											6 36 49 9	
117.5			17	SS	106/ 0.250												
23.3	END OF BOREHOLE AT 23.3m. WATER LEVEL AT 5.2m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO SURFACE.																

# RECORD OF BOREHOLE No R-07

1 OF 3

METRIC

W.P. 2061-13-00 LOCATION W-N/S Ramp Leslie St. / CNR Overhead N 4 847 296.2 E 315 705.8 ORIGINATED BY ES  
HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
DATUM Geodetic DATE 2015.03.20 - 2015.03.23 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT  <b>γ</b>  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)								
								20 40 60 80 100				w <sub>p</sub> w w <sub>L</sub>								
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE												
140.7	GROUND SURFACE																			
0.0 0.1	<b>TOPSOIL:</b> (75mm)  Silty <b>SAND</b> , trace gravel, trace clay, occasional rootlets Dense Grey Moist (FILL)																			
			1	SS	38		140							○						
			2	SS	41		139							○						
138.4																				
2.3	<b>SAND</b> , some silt, trace clay, trace gravel Compact Brown Moist to Wet		3	SS	19		138							○						
			4	SS	19									○						
							137													
136.5																				
4.2	Sandy <b>SILT</b> , trace clay, trace gravel Compact Brown to Grey Wet		5	SS	10		136							○						
							135													
	Loose		6	SS	7		134							○						
133.5																				
7.2	Silty <b>CLAY</b> , some to with sand, trace gravel Soft to Very Soft Grey Wet		7	SS	2		133							○						
							132													
			8	SS	1		131							○						

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No R-07

2 OF 3

METRIC

W.P. 2061-13-00 LOCATION W-N/S Ramp Leslie St. / CNR Overhead N 4 847 296.2 E 315 705.8 ORIGINATED BY ES  
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2015.03.20 - 2015.03.23 CHECKED BY RPR

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			SHEAR STRENGTH kPa	WATER CONTENT (%)					
	Continued From Previous Page													
	Silty <b>CLAY</b> , some to with sand, trace gravel Soft to Very Soft Grey Wet		9	SS	2		130							0 27 40 33
							129							
			10	SS	1		128							
							127							
			11	SS	1		126							
125.9							125							
14.8			12	SS	5		124							
	Firm						123							
			13	SS	4		122							0 21 36 43
							121							
122.9			14	SS	1									
17.8														

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
 15  
 10  
 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No R-07

3 OF 3

METRIC

W.P. 2061-13-00 LOCATION W-N/S Ramp Leslie St. / CNR Overhead N 4 847 296.2 E 315 705.8 ORIGINATED BY ES  
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2015.03.20 - 2015.03.23 CHECKED BY RPR

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			SHEAR STRENGTH kPa								
								○ UNCONFINED    + FIELD VANE ● QUICK TRIAXIAL    × LAB VANE								
	Continued From Previous Page		15	SS	15											
120.0	Silty <b>CLAY</b> , some to with sand, trace gravel Stiff to Very Stiff Grey Moist						120									
20.7	<b>SAND</b> and <b>SILT</b> , trace to some clay, trace gravel Very Dense Grey Moist (TILL)		16	SS	100/ 0.100		119									4 41 40 15
							118									
			17	SS	104											
							117									
116.1			18	SS	109/ 0.250											
24.6	END OF BOREHOLE AT 24.6m. WATER LEVEL AT 5.0m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO SURFACE.															

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity 20 15 10 5 0 (%) STRAIN AT FAILURE



# RECORD OF BOREHOLE No R-08

1 OF 3

METRIC

W.P. 2061-13-00 LOCATION W-N/S Ramp Leslie St. / CNR Overhead N 4 847 243.4 E 315 754.1 ORIGINATED BY ES  
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2015.04.15 - 2015.04.16 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					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			SHEAR STRENGTH kPa									
								○ UNCONFINED    + FIELD VANE ● QUICK TRIAXIAL    × LAB VANE									
142.0	GROUND SURFACE							20	40	60	80	100					
0.0	<b>TOPSOIL:</b> (63mm)																
0.1	<b>SAND</b> and <b>SILT</b> , some clay, trace gravel Compact Brown to Dark Brown Moist (FILL)		1	SS	29		141							○			
	Occasional rootlets		2	SS	15		140							○			
			3	SS	13		139							○			0 53 37 10
	Very Loose		4	SS	3		138							○			
137.7																	
4.3	<b>SAND</b> and <b>SILT</b> Compact Brown Moist		5	SS	22		137							○			
136.4																	
5.6	Silty <b>CLAY</b> , trace sand occasional oxide staining Very Stiff to Stiff Brown Wet		6	SS	17		136							○			0 0 51 49
							135										
			7	SS	9		134							○			
133.3																	
8.7							133										
	Occasional sand seams Very Soft Grey		8	SS	1									○			

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
 15  
 10  
 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No R-08

2 OF 3

METRIC

W.P. 2061-13-00 LOCATION W-N/S Ramp Leslie St. / CNR Overhead N 4 847 243.4 E 315 754.1 ORIGINATED BY ES  
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2015.04.15 - 2015.04.16 CHECKED BY RPR

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			SHEAR STRENGTH kPa							
								○ UNCONFINED    + FIELD VANE ● QUICK TRIAXIAL    × LAB VANE							
	Continued From Previous Page						20	40	60	80	100	PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	
	Silty <b>CLAY</b> , trace sand Firm Grey Wet		9	SS	0		3.2 +						○		
							2.7 +								
			1	TW	PH								○		Oedometer Test 0   0   38   62
							2.9 +								
			10	SS	2										0   8   35   57
							2.7 +								
			11	SS	0								○		
							4.3 +								
	Firm to Stiff		12	SS	1								○		
							3.4 +								
			13	SS	1								○		
							4.3 +								

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
 15  
 10  
 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No R-08

3 OF 3

METRIC

W.P. 2061-13-00 LOCATION W-N/S Ramp Leslie St. / CNR Overhead N 4 847 243.4 E 315 754.1 ORIGINATED BY ES  
HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
DATUM Geodetic DATE 2015.04.15 - 2015.04.16 CHECKED BY RPR

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			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
	Continued From Previous Page																
120.1	Silty <b>CLAY</b> , trace sand, occasional sand seams Firm to Stiff Grey Wet		14	SS	4												
21.9	<b>SAND</b> and <b>SILT</b> , trace gravel, trace clay Very Dense Grey Moist (TILL)																
			15	SS	100/ 0.250												
	Occasional sand layer		16	SS	103/ 0.225												
115.7			17	SS	100/ 0.275												
26.3	END OF BOREHOLE AT 26.3m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 3.04m slotted screen.  WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Apr 22/2015 5.9 136.1 Jun 03/2015 3.7 138.3 Jun 17/2015 5.5 136.5																





ONTMT4S 1205.GPJ 2015TEMPLATE(MTO).GDT 11/3/15

# RECORD OF BOREHOLE No R-09

1 OF 4

METRIC

W.P. 2061-13-00 LOCATION W-N/S Ramp Leslie St. / CNR Overhead N 4 847 279.3 E 315 738.4 ORIGINATED BY ES  
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2015.04.13 - 2015.04.13 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT  <b>γ</b>  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
								20 40 60 80 100							
143.9	GROUND SURFACE														
0.0	TOPSOIL: (200mm)														
0.2	SAND and SILT, some clay, trace gravel Compact to Very Dense Brown Moist (FILL)														
			1	SS	26										
			2	SS	18										
	Occasional rootlets														
			2	SS	18										
			3	SS	60										
	Occasional inferred cobbles														
			4	SS	55										
139.8															
4.1	Clayey SILT, mixed with organics, occasional roots Very Stiff Brown Moist														
			5	SS	19										
138.3															
5.6	Sandy SILT, trace clay, trace gravel Compact Brown Moist														
			6	SS	16										
			7	SS	20										
135.1															
8.8	SILT, trace sand, trace clay Compact Brown Moist														
			8	SS	20										

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
15  
10  
(%) STRAIN AT FAILURE

## METRIC

[illegible]

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity

# RECORD OF BOREHOLE No R-09

3 OF 4

METRIC

W.P. 2061-13-00 LOCATION W-N/S Ramp Leslie St. / CNR Overhead N 4 847 279.3 E 315 738.4 ORIGINATED BY ES  
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2015.04.13 - 2015.04.13 CHECKED BY RPR

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			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
	Continued From Previous Page		13	SS	7												
	Silty <b>CLAY</b> , some to with sand, trace gravel Firm Grey Wet																
	Stiff Moist		14	SS	10												
119.5																	
24.4	Sandy <b>SILT</b> , some clay, trace gravel Very Dense Grey Moist (TILL)																
			15	SS	100/ 0.250											9 34 41 16	
			16	SS	104/ 0.300												
114.7			17	SS	108/ 0.225												
29.2	END OF BOREHOLE AT 29.1m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 3.04m slotted screen. BOREHOLE CAVED FROM 29.2m																

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity 20  
15 10 5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No R-09

4 OF 4

METRIC

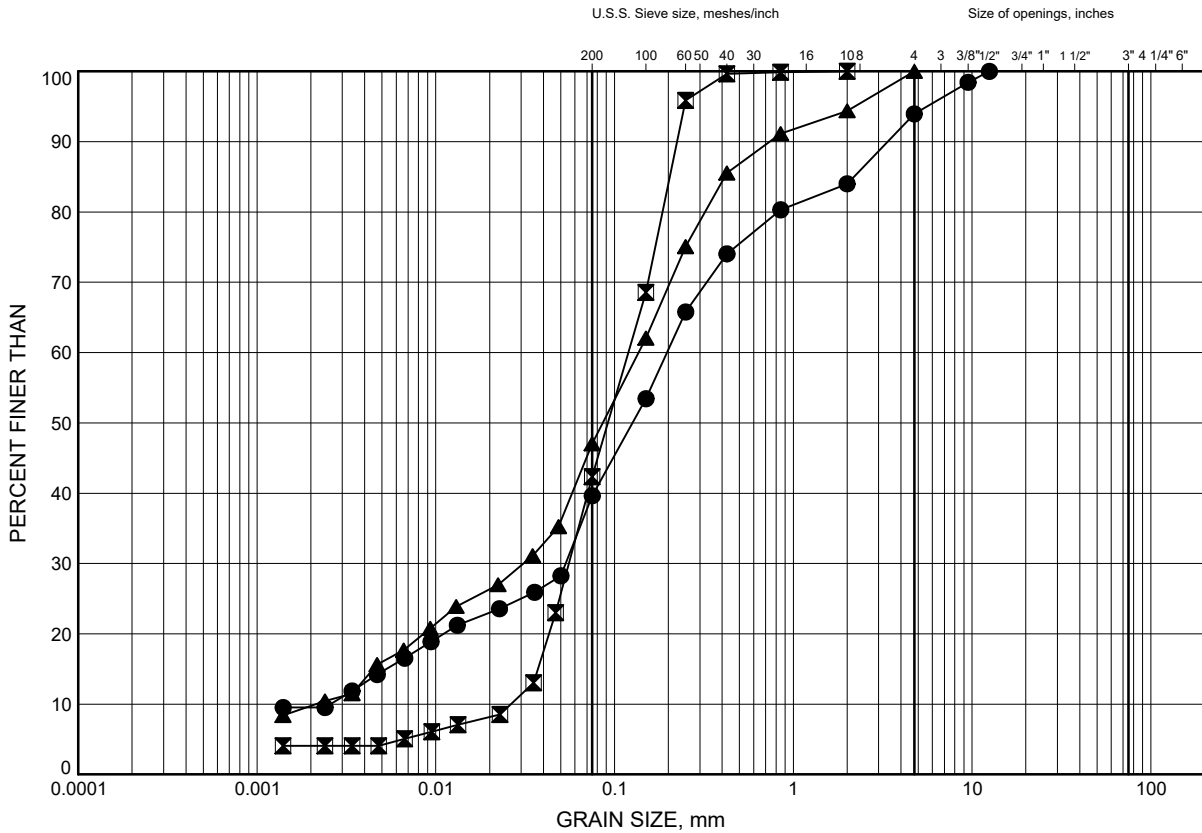
W.P. 2061-13-00 LOCATION W-N/S Ramp Leslie St. / CNR Overhead N 4 847 279.3 E 315 738.4 ORIGINATED BY ES  
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2015.04.13 - 2015.04.13 CHECKED BY RPR

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			SHEAR STRENGTH kPa									
	Continued From Previous Page																
	TO 27.7m DEPTHS UPON COMPLETION.																
	WATER LEVEL READINGS: DATE      DEPTH (m)      ELEV. (m)  Apr 22/2015      5.9      138.0 Jun 03/2015      5.6      138.3 Jun 17/2015      3.7      140.2																

Hwy 401 Leslie Street 2013-E-0032  
**GRAIN SIZE DISTRIBUTION**

FIGURE A1

**SAND & SILT FILL**



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	PB-02	1.83	140.27
⊠	R-05	2.59	138.21
▲	R-08	2.59	139.41

Date November 2015  
W.P. 2061-13-00



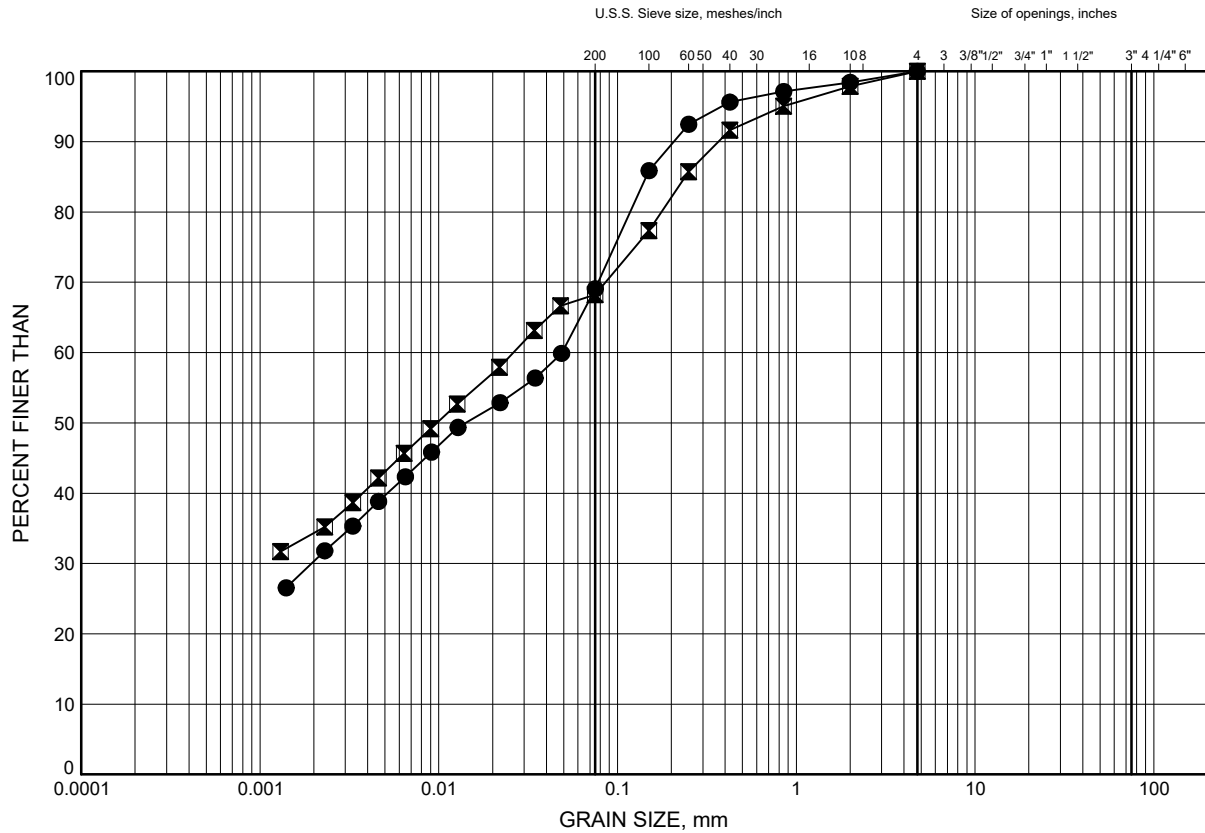
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Hwy 401 Leslie Street 2013-E-0032  
**GRAIN SIZE DISTRIBUTION**

FIGURE A2

**SILTY CLAY FILL**



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	R-02	1.83	143.87
⊠	R-03	2.59	142.31

Date November 2015  
W.P. 2061-13-00

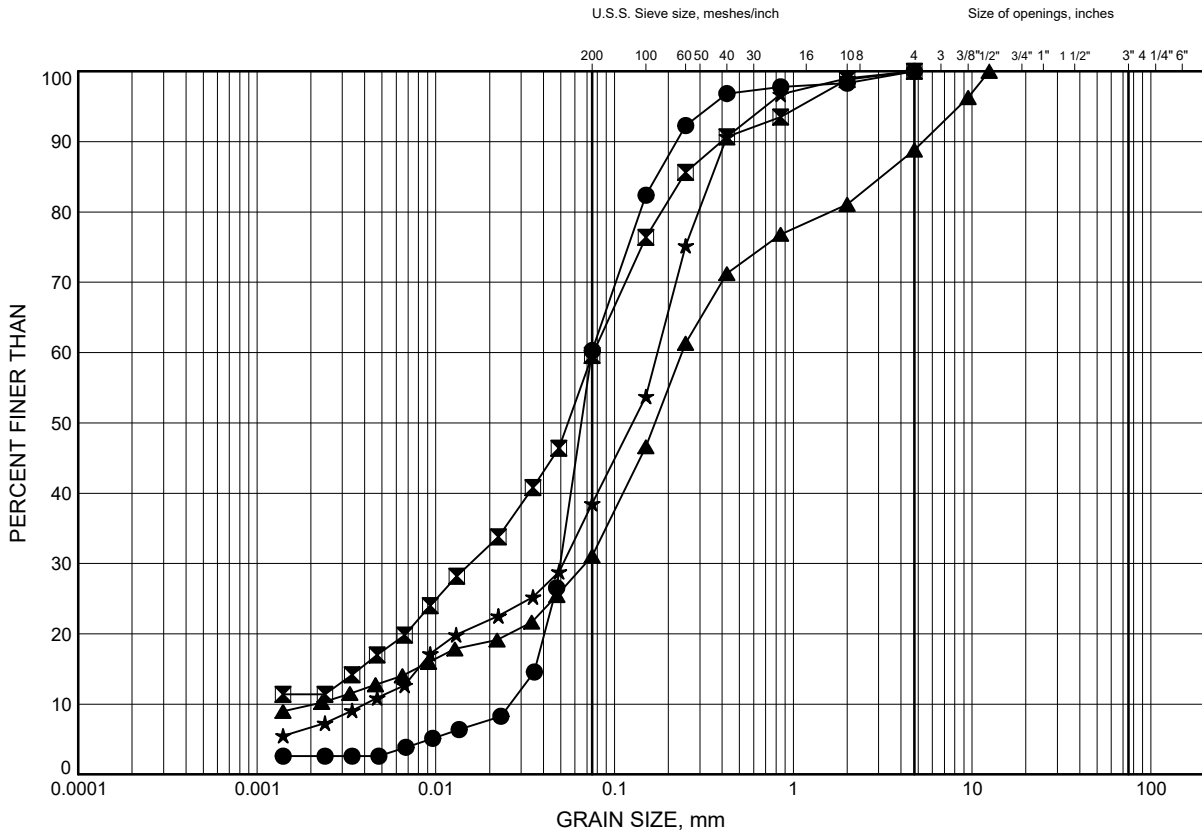


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Hwy 401 Leslie Street 2013-E-0032  
**GRAIN SIZE DISTRIBUTION**

FIGURE A3

**SAND & SILT to SILTY SAND**



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	PB-02	6.40	135.70
⊠	R-01	6.40	141.70
▲	R-03	4.88	140.02
★	R-04	3.35	139.85

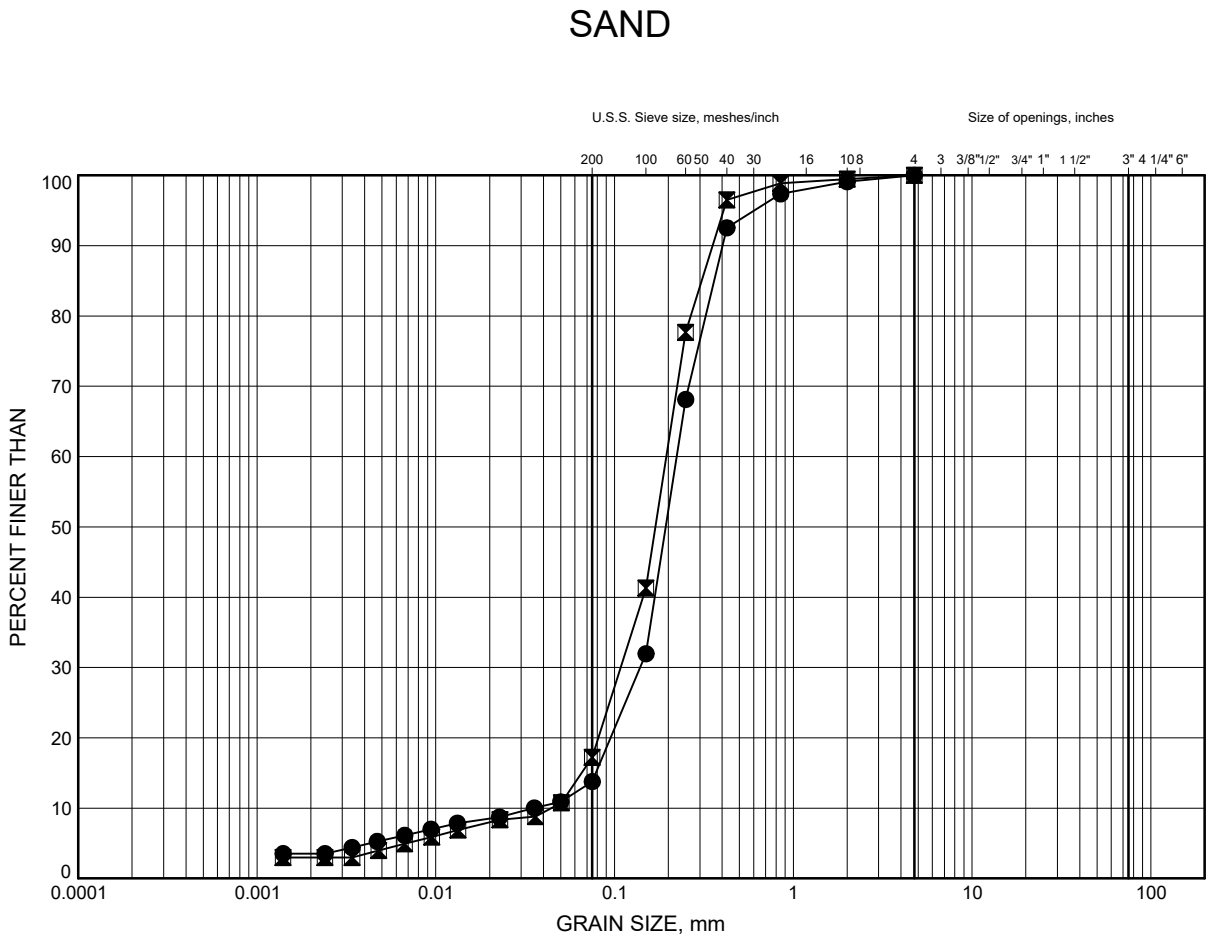
Date November 2015  
W.P. 2061-13-00



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Hwy 401 Leslie Street 2013-E-0032  
**GRAIN SIZE DISTRIBUTION**

FIGURE A4



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	R-03	23.16	121.74
⊠	R-07	3.35	137.35

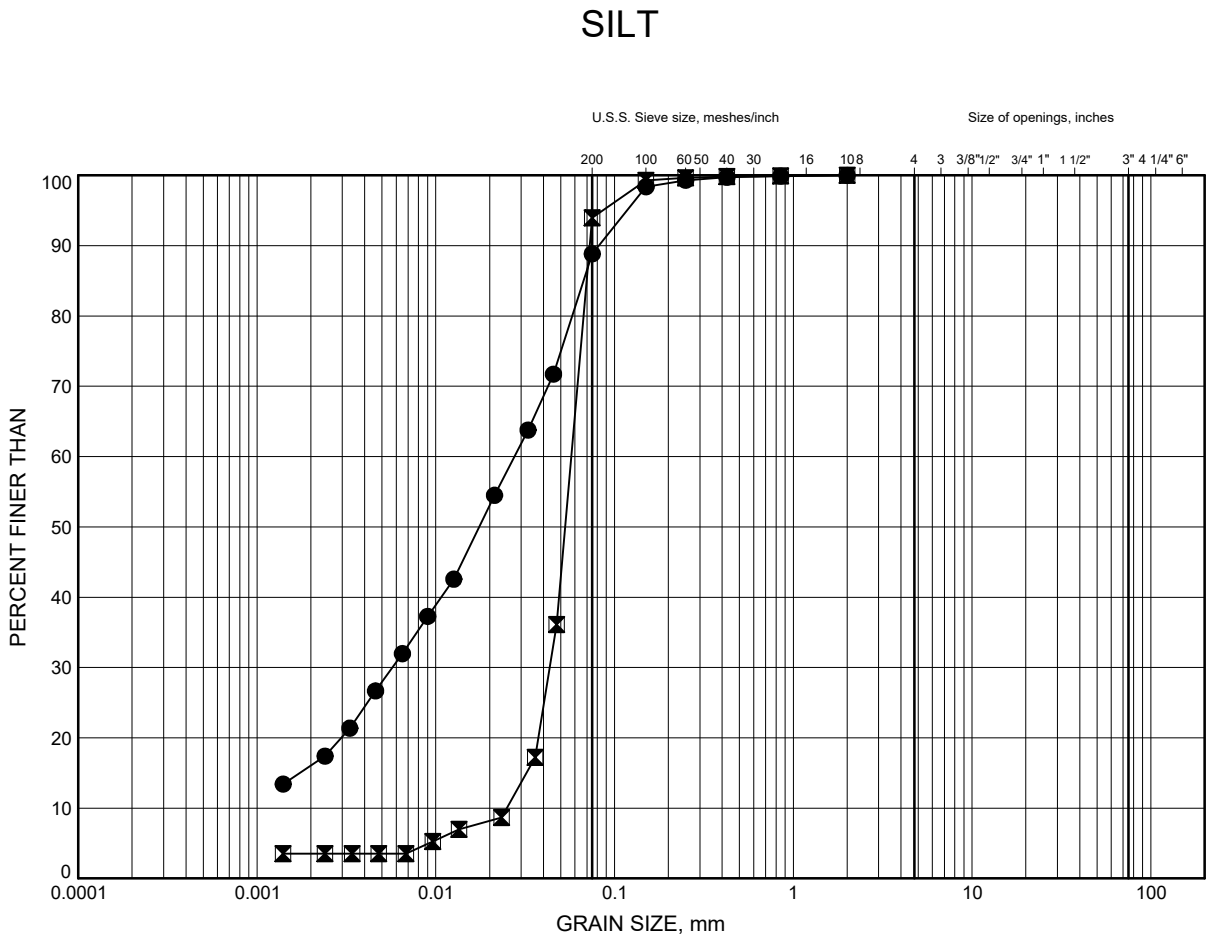
Date November 2015  
W.P. 2061-13-00



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**GRAIN SIZE DISTRIBUTION**

FIGURE A5



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	R-01	17.07	131.03
⊠	R-09	9.45	134.45

Date November 2015  
W.P. 2061-13-00



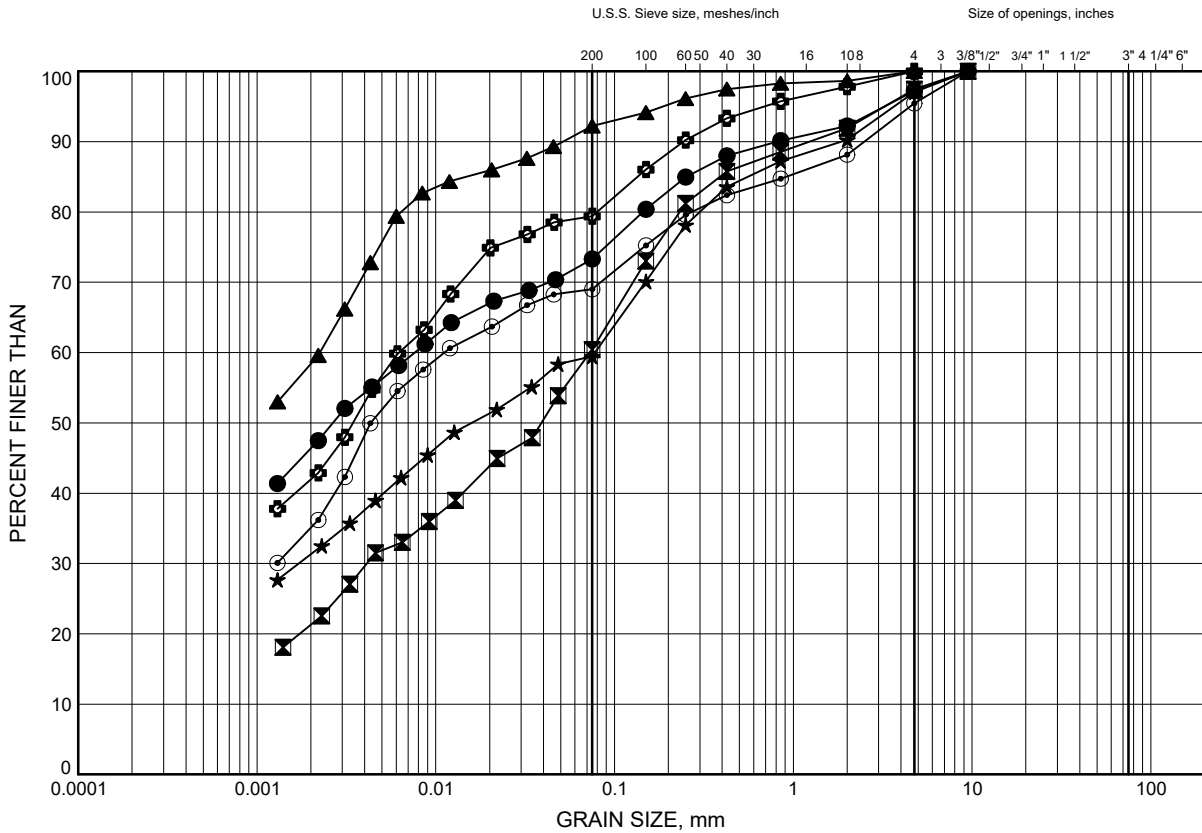
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Hwy 401 Leslie Street 2013-E-0032

# GRAIN SIZE DISTRIBUTION

FIGURE A6

## SILTY CLAY



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

### LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	PB-02	14.02	128.08
⊠	PB-02	17.07	125.03
▲	R-01	2.59	145.51
★	R-02	7.92	137.78
⊙	R-02	14.02	131.68
⊕	R-03	9.45	135.45

Date November 2015

W.P. 2061-13-00



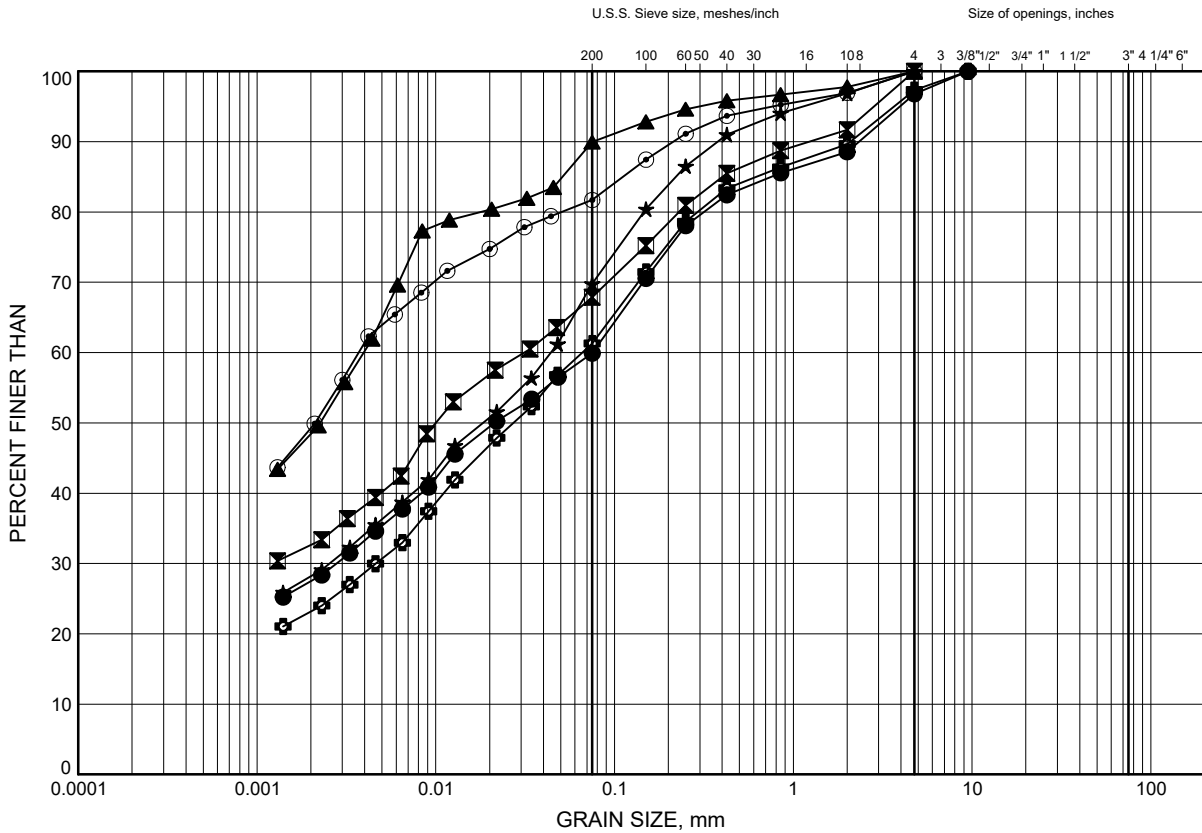
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Hwy 401 Leslie Street 2013-E-0032  
**GRAIN SIZE DISTRIBUTION**

FIGURE A7

**SILTY CLAY**



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	R-03	17.07	127.83
⊠	R-04	7.92	135.28
▲	R-04	10.97	132.23
★	R-04	14.02	129.18
⊙	R-05	7.92	132.88
⊕	R-05	15.54	125.26

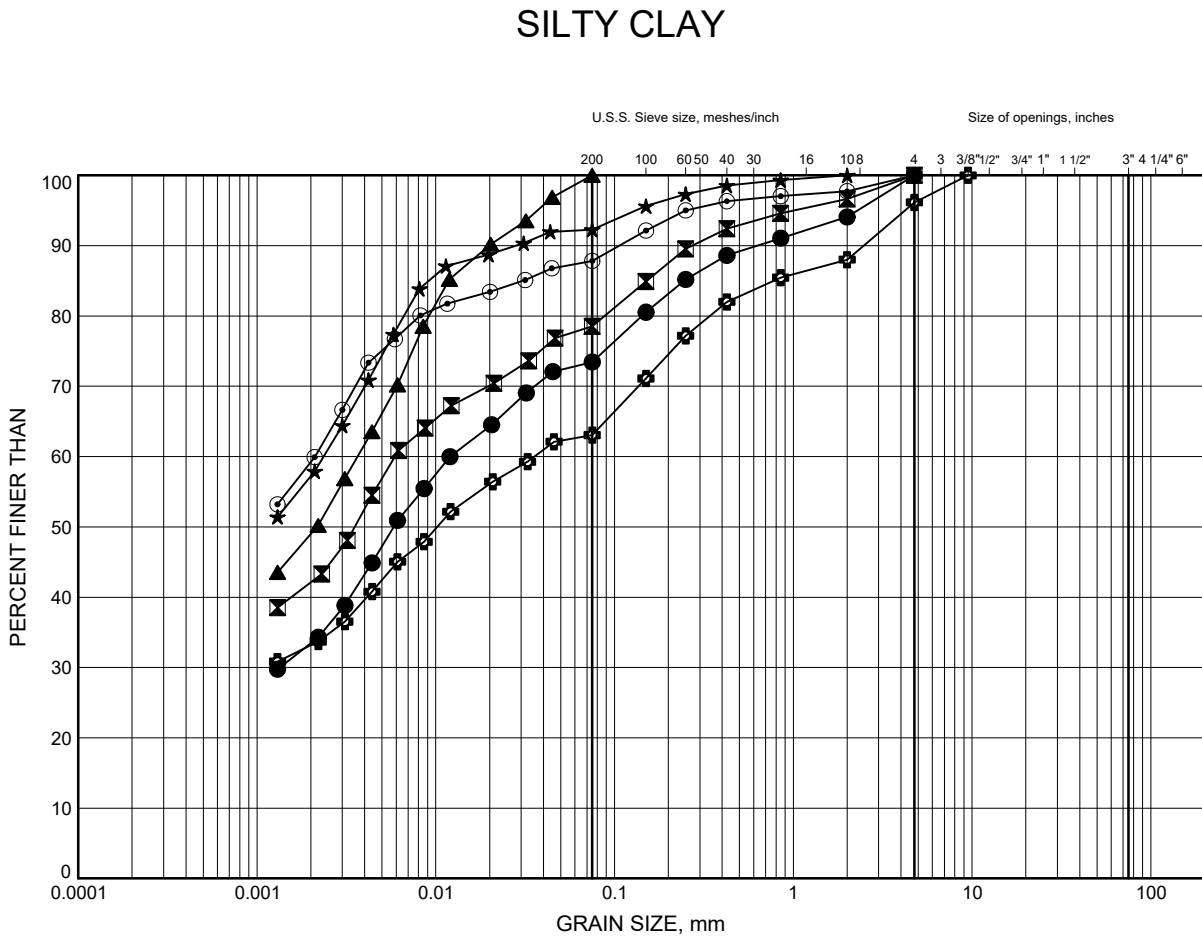
Date November 2015  
W.P. 2061-13-00



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Hwy 401 Leslie Street 2013-E-0032  
**GRAIN SIZE DISTRIBUTION**

FIGURE A8



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	R-07	10.97	129.73
⊠	R-07	17.07	123.63
▲	R-08	6.40	135.60
★	R-08	14.02	127.98
⊙	R-09	15.54	128.36
⊕	R-09	18.59	125.31

Date November 2015  
W.P. 2061-13-00

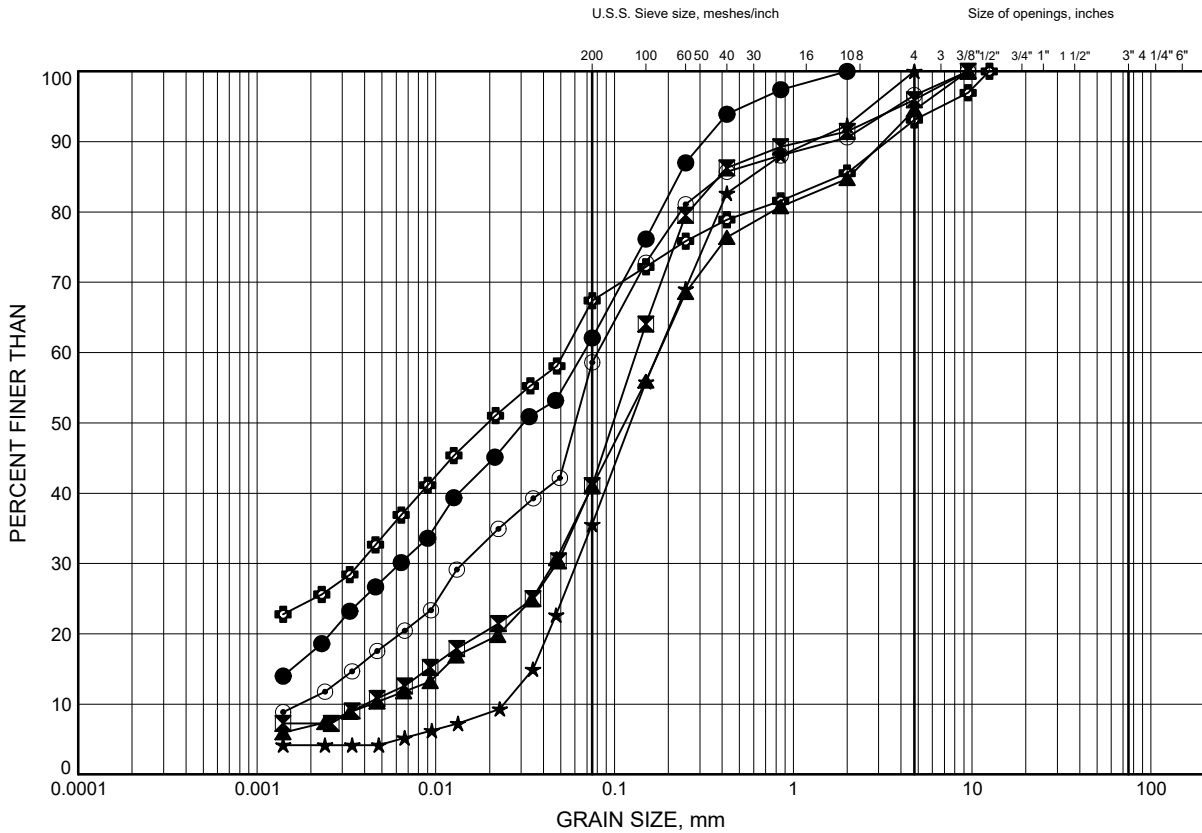


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Hwy 401 Leslie Street 2013-E-0032  
**GRAIN SIZE DISTRIBUTION**

FIGURE A9

**SANDY SILT to SILTY SAND TILL**



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	R-01	12.50	135.60
⊠	R-02	18.59	127.11
▲	R-02	23.16	122.54
★	R-03	29.26	115.64
⊙	R-04	20.12	123.08
⊕	R-04	24.69	118.51

Date November 2015  
W.P. 2061-13-00



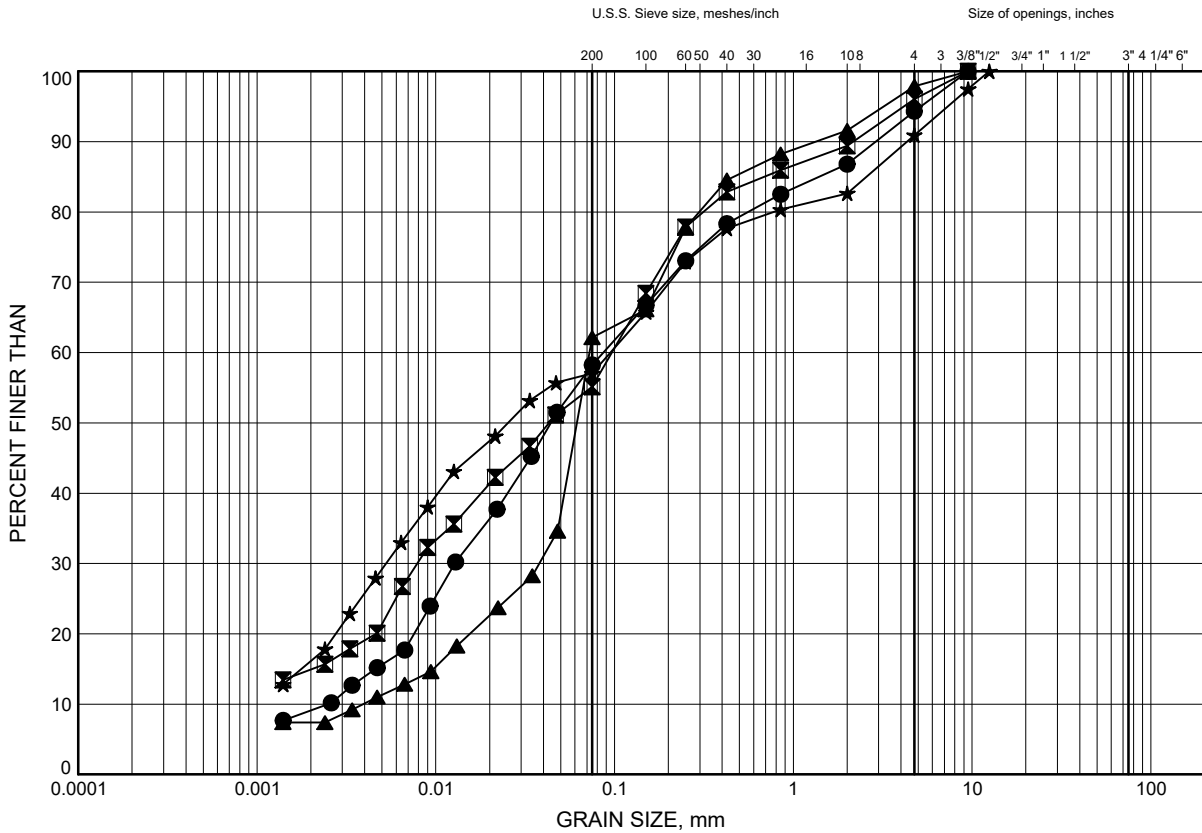
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Hwy 401 Leslie Street 2013-E-0032  
**GRAIN SIZE DISTRIBUTION**

FIGURE A10

**SANDY SILT to SILTY SAND TILL**



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	R-05	21.64	119.16
⊠	R-07	21.64	119.06
▲	R-08	23.16	118.84
★	R-09	26.21	117.69

Date November 2015  
W.P. 2061-13-00



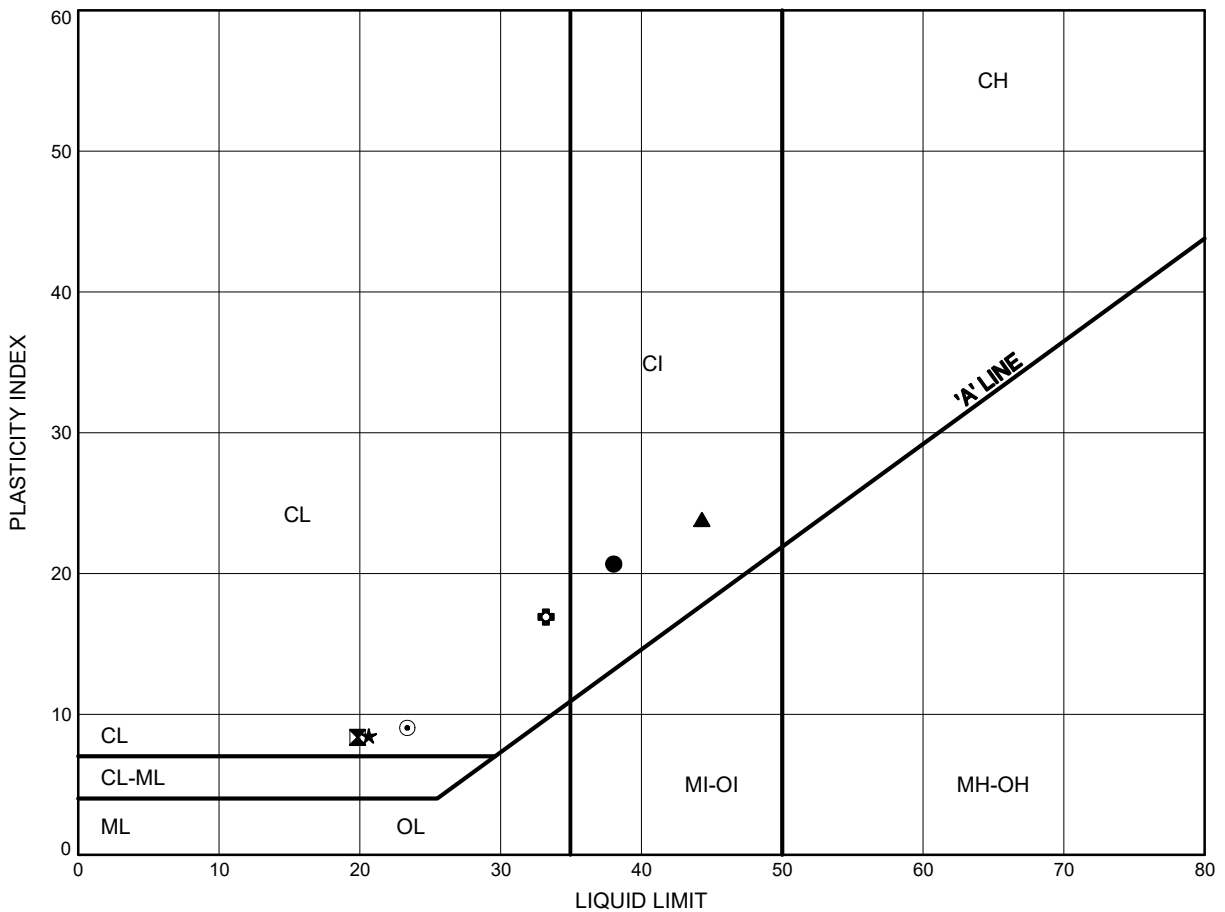
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Hwy 401 Leslie Street 2013-E-0032

# ATTERBERG LIMITS TEST RESULTS

FIGURE A11

## SILTY CLAY



### LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	PB-02	14.02	128.08
⊠	PB-02	17.07	125.03
▲	R-01	2.59	145.51
★	R-02	7.92	137.78
⊙	R-02	14.02	131.68
⊕	R-03	9.45	135.45

Date November 2015  
W.P. 2061-13-00



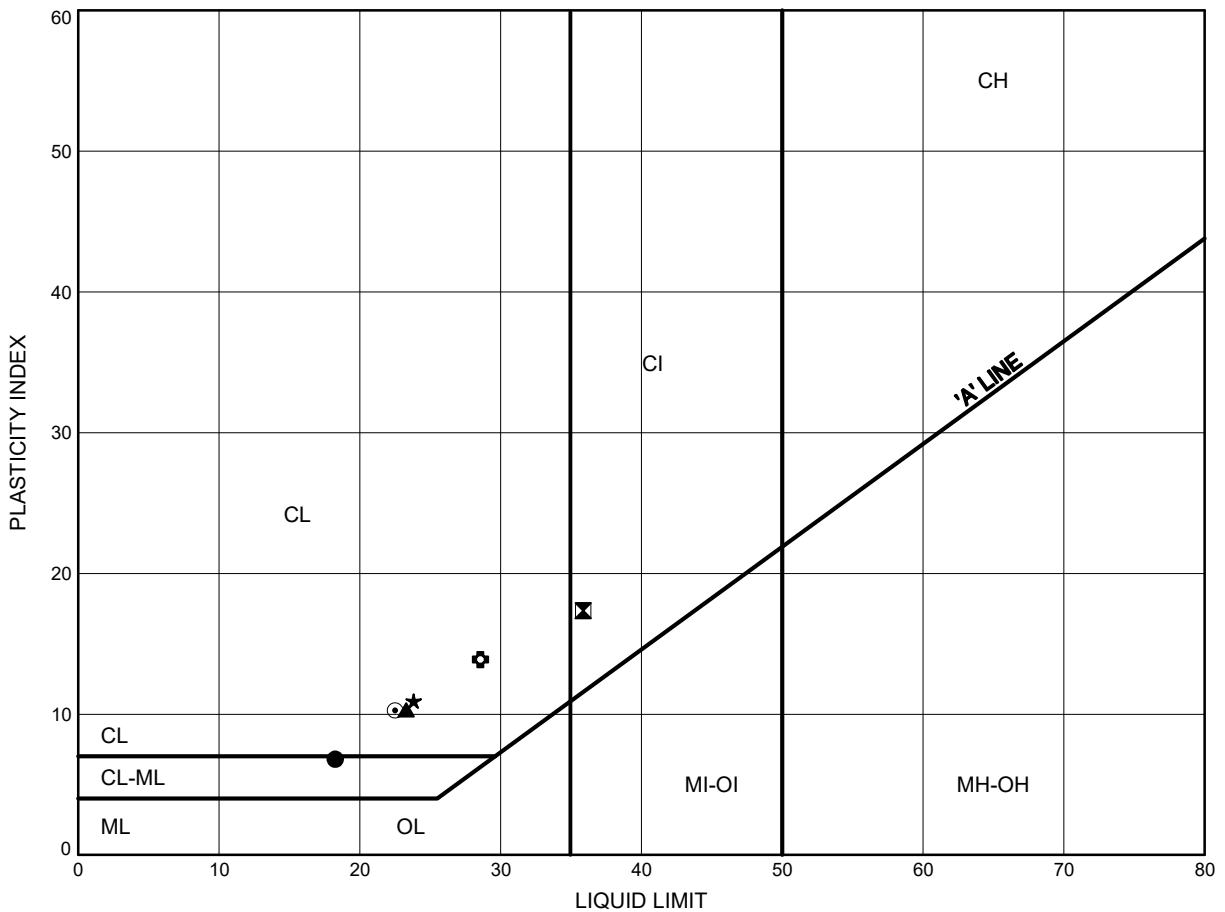
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Hwy 401 Leslie Street 2013-E-0032

# ATTERBERG LIMITS TEST RESULTS

FIGURE A12

## SILTY CLAY



### LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	R-03	17.07	127.83
⊠	R-04	10.97	132.23
▲	R-04	14.02	129.18
★	R-05	7.92	132.88
⊙	R-05	15.54	125.26
⊕	R-07	10.97	129.73

Date November 2015  
W.P. 2061-13-00



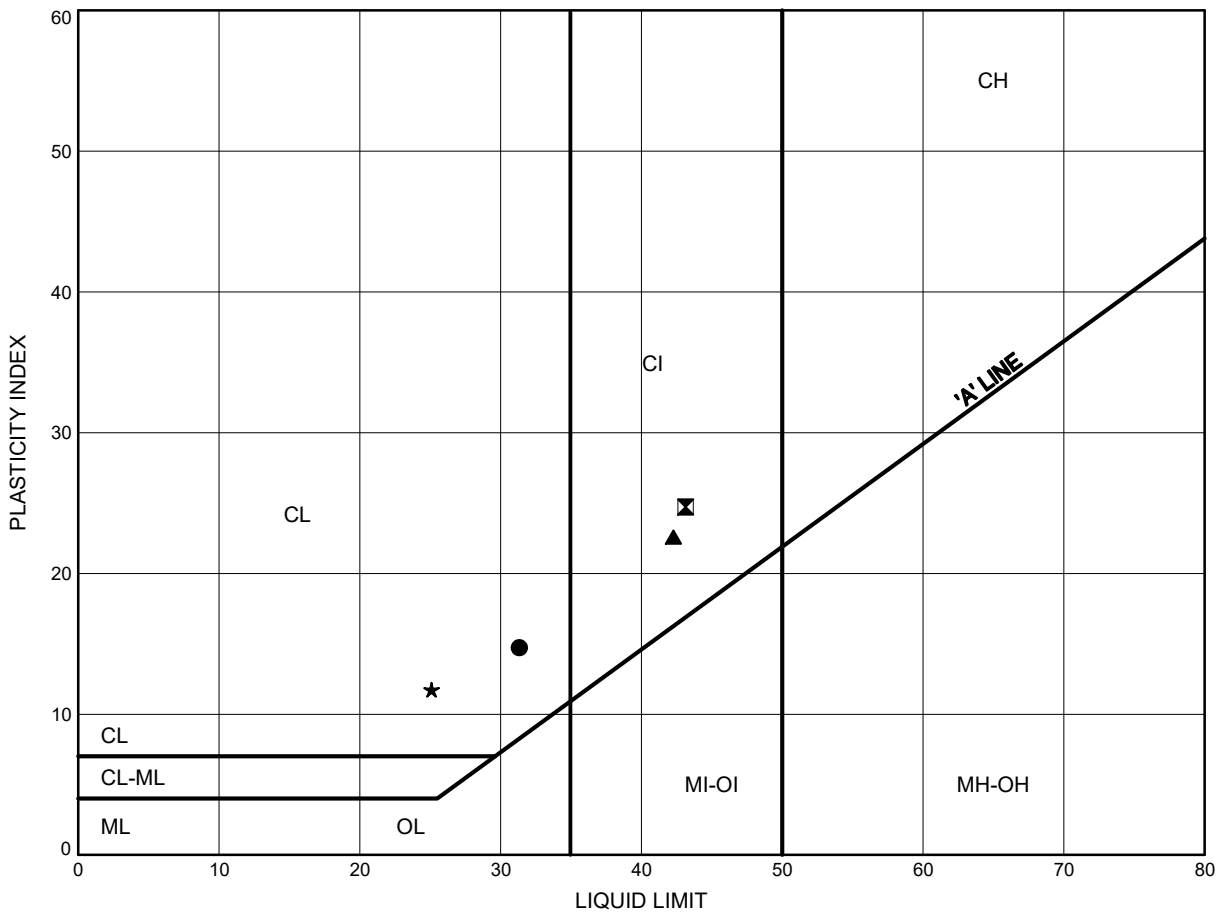
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Hwy 401 Leslie Street 2013-E-0032

# ATTERBERG LIMITS TEST RESULTS

FIGURE A13

## SILTY CLAY



### LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	R-07	17.07	123.63
⊠	R-08	14.02	127.98
▲	R-09	15.54	128.36
★	R-09	18.59	125.31

Date November 2015  
W.P. 2061-13-00



Prep'd AN  
Chkd. RPR

## Consolidation Test Report

CLIENT: **MMM Group Limited**

FILE NUMBER: **19-5161-205**

PROJECT: **Highway 401 and Leslie Foundations**

REPORT DATE: **9-Apr-2015**

TEST DATES: **March 24, 2015 - April 06, 2015**

SAMPLE: **BH R-04 TW1 (35' - 37')**  
**Silty Clay, grey, 10% Sand, 42% Silt and 48% Clay, LL=35.9%, PL=18.5%.**

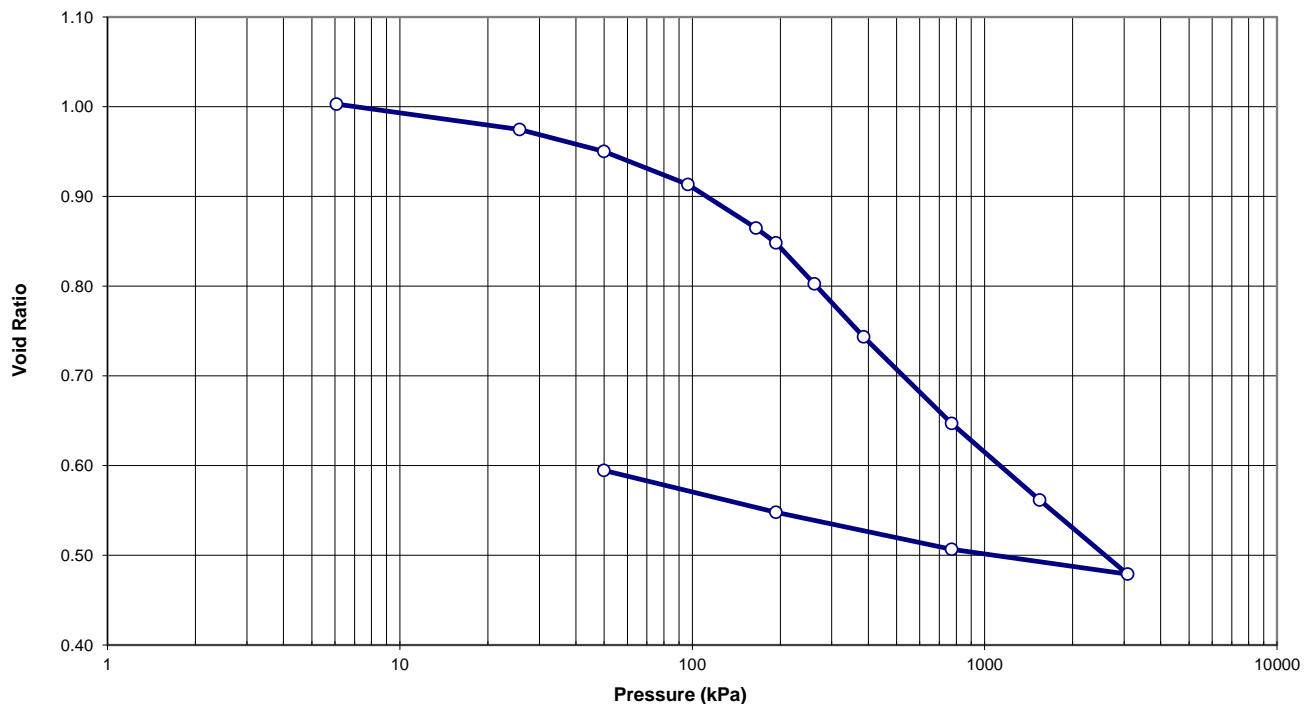
PROCEDURE: Test carried out in accordance with Standard Test Method for One-Dimensional Consolidation Properties of Soils, ASTM D 2435-04, method A

	<u>Start of Test</u>	<u>End of Test</u>
Wet Dens. (kg/m <sup>3</sup> )	1876.4	2139.0
Dry Dens. (kg/m <sup>3</sup> )	1366.6	1726.0
Moisture Cont. (%)	37.3	23.9
Void Ratio	1.014	0.595

Note: A Specific Gravity (Gs) of 2.75 was measured for the void ratio and saturation calculations.

**Void Ratio vs. Pressure**

Project #: 19-5161-205  
 Client: MMM Group Limited  
 Project Name: Highway 401 and Leslie Foundations  
 Sample: BH-R-04-TW1 (35' - 37')



## Consolidation Test Report

Highway 401 and Leslie Foundations

19-5161-205

BH R-04 TW1 (35' - 37')

**TRIMMING:** The Specimen was manually trimmed to the size of consolidation ring, then mounted in a fixed ring consolidometer.

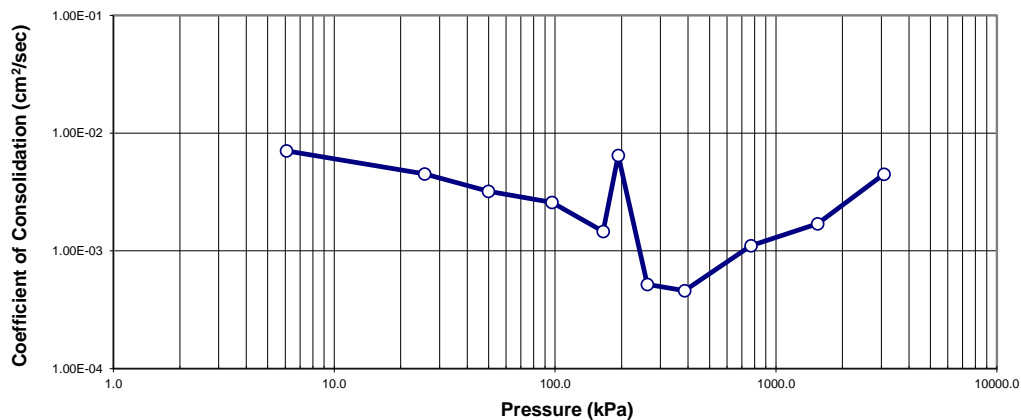
**LOADING:** A seating load of 6.1 kPa was applied and the consolidometer was flooded with distilled water. Sample was monitored to ensure no swelling effect occurred before the start of the test. Subsequent loads were applied after a constant load increment duration of 24 hours.

**CALCULATIONS:** Coefficients of Consolidation were calculated by the square root time method.

Pressure (kPa)	Corr. H. (mm)	Avg. H. (mm)	$D_{90}$ (mm)	$t_{90}$ (min)	$c_v$ (cm <sup>2</sup> /s)	Void Ratio	$m_v$ (m <sup>2</sup> /kN)	$k$ (cm/s)
0.0	25.400					1.014		
6.1	25.261	25.331	-0.069	3.20	7.08E-03	1.003	9.01E-04	6.26E-07
25.7	24.903	25.082	-0.180	4.93	4.51E-03	0.975	7.23E-04	3.20E-07
49.9	24.597	24.750	-0.133	6.76	3.20E-03	0.950	5.08E-04	1.59E-07
96.6	24.132	24.365	-0.230	8.12	2.58E-03	0.913	4.04E-04	1.02E-07
164.9	23.519	23.826	-0.288	13.69	1.47E-03	0.865	3.72E-04	5.35E-08
193.2	23.310	23.415	-0.032	2.99	6.47E-03	0.848	3.14E-04	1.99E-07
261.5	22.733	23.022	-0.260	36.00	5.20E-04	0.803	3.63E-04	1.85E-08
385.7	21.989	22.361	-0.450	38.44	4.60E-04	0.744	2.63E-04	1.19E-08
770.7	20.773	21.381	-0.785	14.59	1.11E-03	0.647	1.44E-04	1.56E-08
1540.7	19.695	20.234	-0.650	8.53	1.70E-03	0.562	6.74E-05	1.12E-08
3081.4	18.652	19.174	-0.460	2.89	4.49E-03	0.479	3.44E-05	1.51E-08
770.7	19.002	18.827				0.507		
193.2	19.521	19.262				0.548		
49.9	20.111	19.816				0.595		

**Coefficient of Consolidation vs. Pressure**

Project #: 19-5161-205  
Client: MMM Group Limited  
Project Name: Highway 401 and Leslie Foundations  
Sample: BH-R-04-TW1 (35' - 37')



Notes:  $C_v$  and  $k$  calculated using  $t_{90}$  values

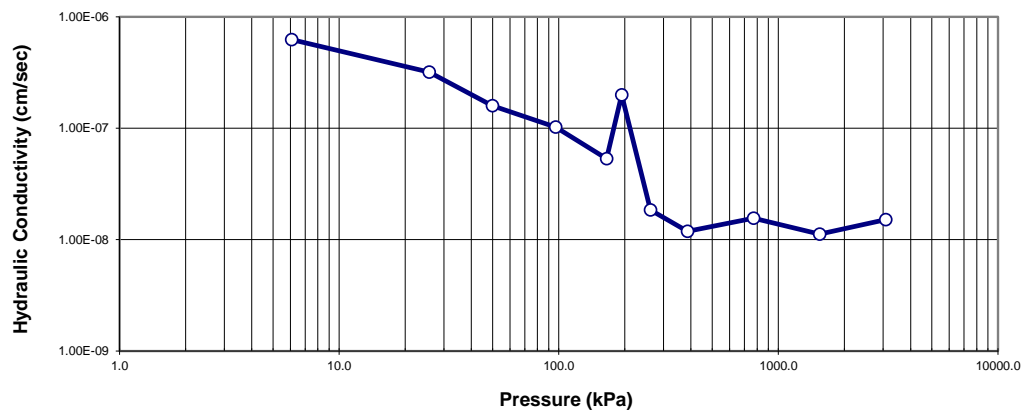
## Consolidation Test Report

Highway 401 and Leslie Foundations  
19-5161-205

BH R-04 TW1 (35' - 37')

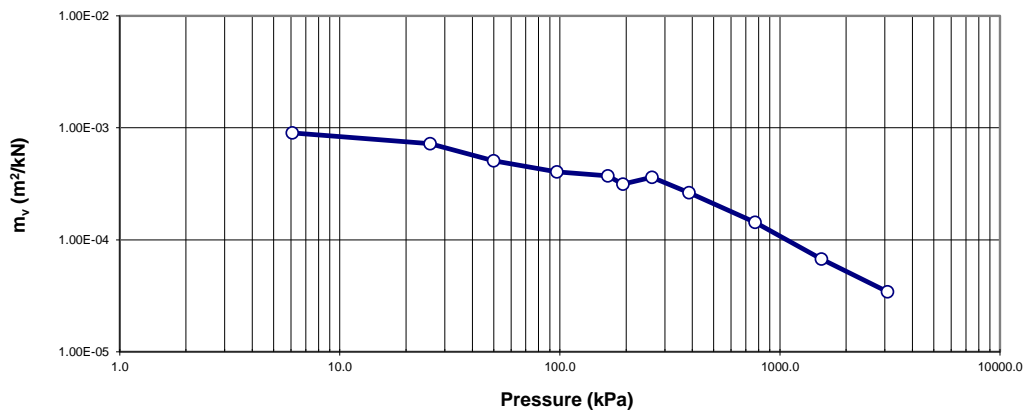
**Hydraulic Conductivity vs. Pressure**

Project #: 19-5161-205  
Client: MMM Group Limited  
Project Name: Highway 401 and Leslie Foundations  
Sample: BH-R-04-TW1 (35' - 37')



**$m_v$  vs. Pressure**

Project #: 19-5161-205  
Client: MMM Group Limited  
Project Name: Highway 401 and Leslie Foundations  
Sample: BH-R-04-TW1 (35' - 37')



## Consolidation Test Report

CLIENT: **MMM Group Limited**

FILE NUMBER: **19-5161-205**

PROJECT: **Highway 401 & Leslie Foundations**

REPORT DATE: **25-Aug-2015**

TEST DATES: **August 05, 2015 - August 17, 2015**

SAMPLE: **BH R8-TW1 (40' - 42')**  
**Silty Clay, grey, 38% Silt and 62% Clay, PL=23%, LL=47%**

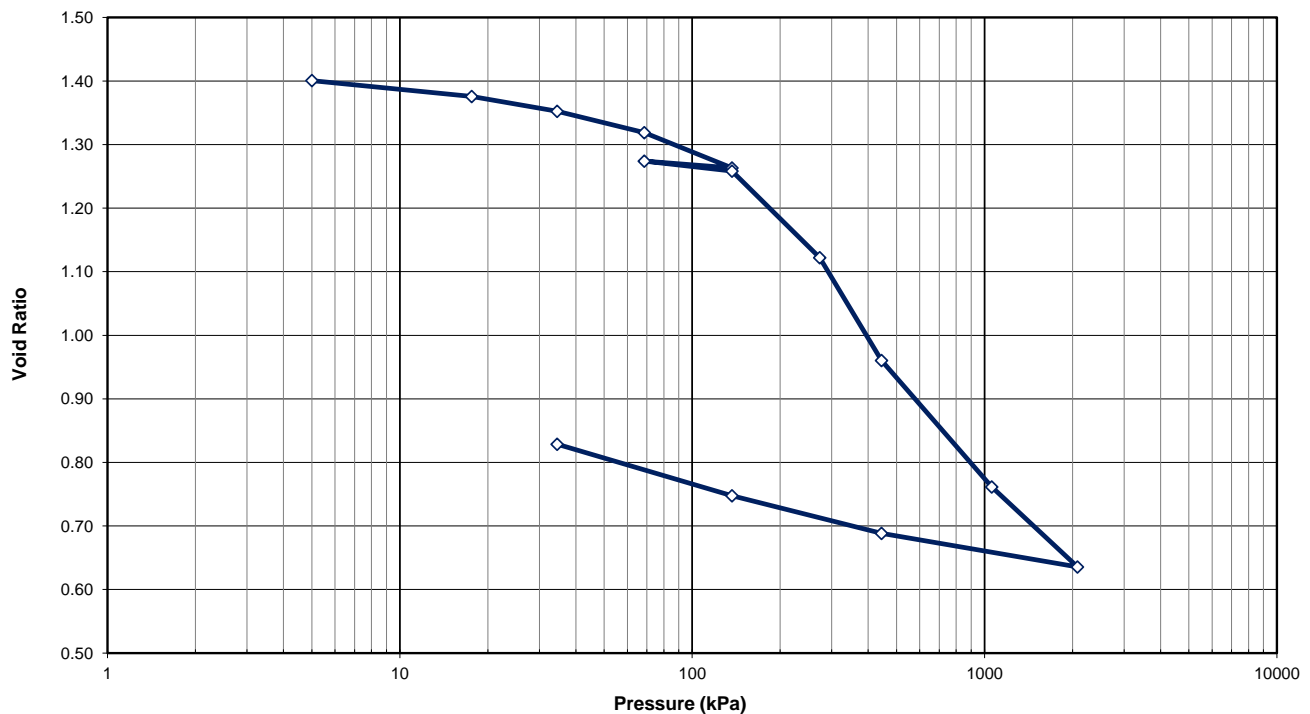
PROCEDURE: Tested in accordance with Standard Test Method for One-Dimensional Consolidation Properties of Soils, ASTM D 2435-04, method B

	<u>Start of Test</u>	<u>End of Test</u>
Wet Dens. (kg/m <sup>3</sup> )	1741.9	2011.4
Dry Dens. (kg/m <sup>3</sup> )	1143.1	1505.5
Moisture Cont. (%)	52.4	33.6
Void Ratio	1.408	0.829

Note: A Specific Gravity of 2.75 was measured for the void ratio and saturation calculations.

**Void Ratio vs Pressure**

Project #: 19-5161-205  
 Client: MMM Group Limited  
 Project Name: Highway 401 & Leslie Foundations  
 Sample: BH R8-TW1 (40' - 42')





## Consolidation Test Report

Highway 401 & Leslie Foundations  
19-5161-205

BH R8-TW1 (40' - 42')

**TRIMMING:** The Specimen was manually trimmed to the size of consolidation ring, then mounted in a fixed ring consolidometer

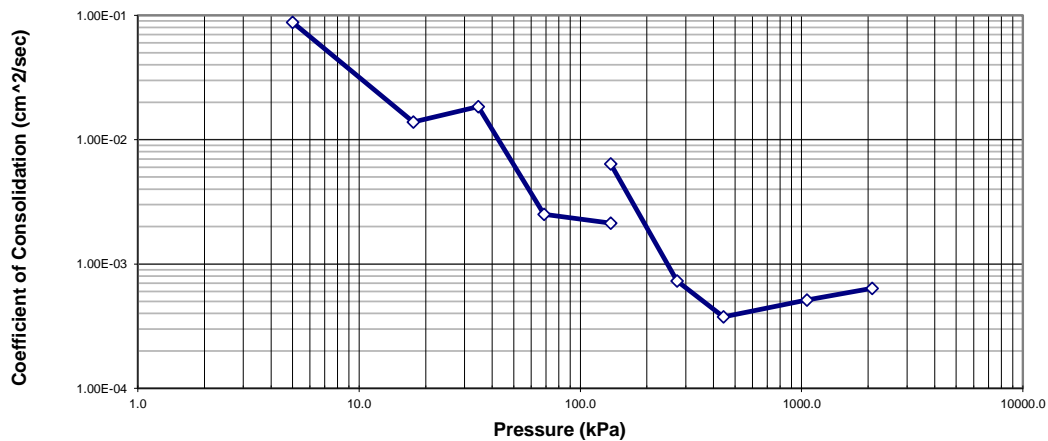
**LOADING:** A seating load of 5.0 kPa was applied and the consolidometer was flooded with distilled water. Sample was monitored to ensure no swelling effect occurred before the start of the test. Subsequent loads were applied after 100% primary consolidation was reached.

**CALCULATIONS:** Coefficients of Consolidation were calculated by the square root time method.

Pressure (kPa)	Corr. Hgt (mm)	Avg. Hgt. (mm)	D <sub>90</sub> (mm)	t <sub>90</sub> (min)	C <sub>v</sub> (cm <sup>2</sup> /s)	Void Ratio	m <sub>v</sub> (m <sup>2</sup> /kN)	k (cm/s)
0.0	20.000					1.408		
5.0	19.935	19.968	-0.024	0.16	8.80E-02	1.401	6.50E-04	5.61E-06
17.6	19.730	19.833	-0.072	1.00	1.39E-02	1.376	8.16E-04	1.11E-06
34.5	19.536	19.633	-0.048	0.74	1.84E-02	1.353	5.82E-04	1.05E-06
68.5	19.256	19.396	-0.145	5.29	2.51E-03	1.319	4.22E-04	1.04E-07
136.9	18.793	19.025	-0.257	6.00	2.13E-03	1.263	3.52E-04	7.34E-08
68.5	18.883	18.838				1.274		
136.9	18.755	18.819	-0.067	1.96	6.38E-03	1.259	9.91E-05	6.20E-08
273.2	17.621	18.188	-0.535	16.00	7.31E-04	1.122	4.44E-04	3.18E-08
443.8	16.279	16.950	-0.960	27.04	3.75E-04	0.960	4.46E-04	1.64E-08
1057.7	14.629	15.454	-1.220	16.40	5.14E-04	0.762	1.65E-04	8.33E-09
2080.1	13.582	14.106	-0.696	11.02	6.38E-04	0.636	7.00E-05	4.38E-09
443.8	14.020	13.801				0.688		
136.9	14.511	14.266				0.747		
34.5	15.185	14.848				0.829		

**Coefficient of Consolidation vs Pressure**

Project #: 19-5161-205  
Client: MMM Group Limited  
Project Name: Highway 401 & Leslie Foundations  
Sample: BH R8-TW1 (40' - 42')



Notes: C<sub>v</sub> and k calculated using t<sub>90</sub> values

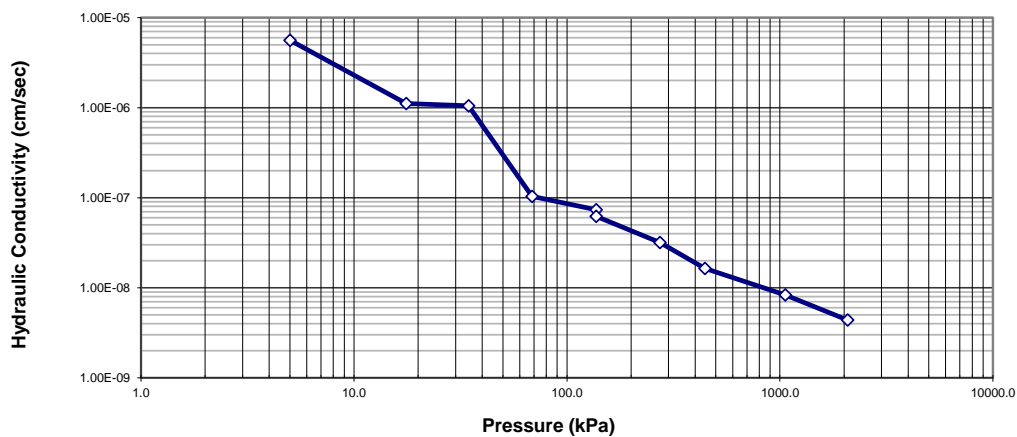
## Consolidation Test Report

Highway 401 & Leslie Foundations  
19-5161-205

BH R8-TW1 (40' - 42')

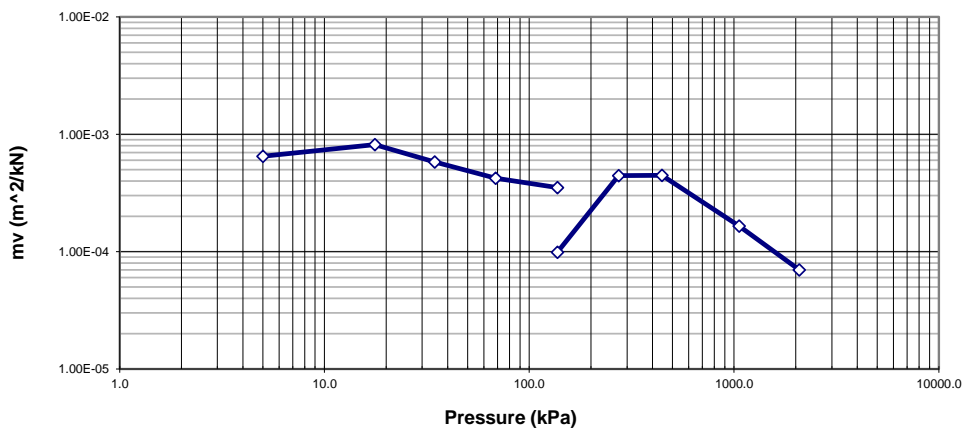
**Hydraulic Conductivity vs Pressure**

Project #: 19-5161-205  
Client: MMM Group Limited  
Project Name: Highway 401 & Leslie Foundations  
Sample: BH R8-TW1 (40' - 42')



**mv vs Pressure**

Project #: 19-5161-205  
Client: MMM Group Limited  
Project Name: Highway 401 & Leslie Foundations  
Sample: BH R8-TW1 (40' - 42')



## Consolidation Test Report

CLIENT: **MMM Group Limited**

FILE NUMBER: **19-5161-205**

PROJECT: **Highway 401 and Leslie Foundations**

REPORT DATE: **14-May-2015**

TEST DATES: **April 20, 2015 - May 01, 2015**

SAMPLE: **BH R-09 TW2 (50' - 52')**  
**Silty Clay, grey, 12% Sand, 29% Silt and 59% Clay, LL=42.3%, PL=19.7%.**

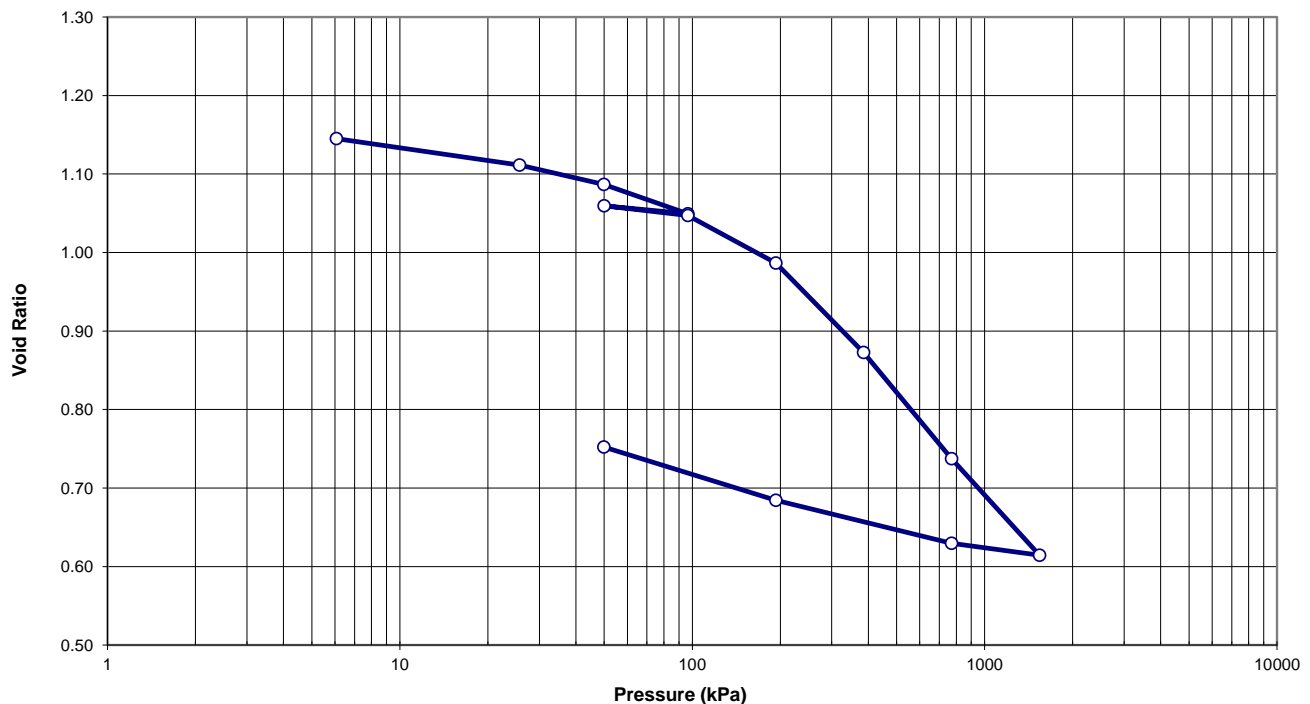
PROCEDURE: Test carried out in accordance with Standard Test Method for One-Dimensional Consolidation Properties of Soils, ASTM D 2435-04, method A

	<u>Start of Test</u>	<u>End of Test</u>
Wet Dens. (kg/m <sup>3</sup> )	1843.0	2070.0
Dry Dens. (kg/m <sup>3</sup> )	1281.1	1570.4
Moisture Cont. (%)	39.1	31.8
Void Ratio	1.148	0.752

Note: A Specific Gravity (Gs) of 2.75 was assumed for the void ratio and saturation calculations.

**Void Ratio vs. Pressure**

Project #: 19-5161-205  
 Client: MMM Group Limited  
 Project Name: Highway 401 and Leslie Foundations  
 Sample: BH R-09 TW2 (50' - 52')



## Consolidation Test Report

Highway 401 and Leslie Foundations  
19-5161-205

BH R-09 TW2 (50' - 52')

**TRIMMING:** The Specimen was manually trimmed to the size of consolidation ring, then mounted in a fixed ring consolidometer.

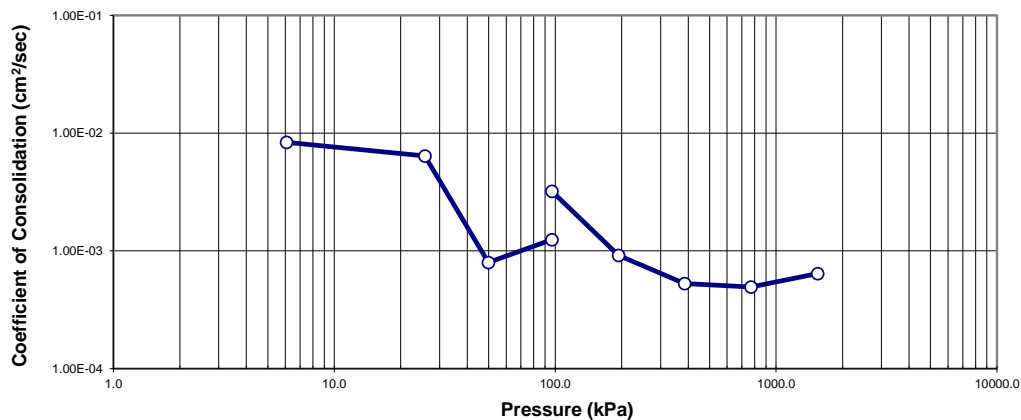
**LOADING:** A seating load of 6.1 kPa was applied and the consolidometer was flooded with distilled water. Sample was monitored to ensure no swelling effect occurred before the start of the test. Subsequent loads were applied after a constant load increment duration of 24 hours.

**CALCULATIONS:** Coefficients of Consolidation were calculated by the square root time method.

Pressure (kPa)	Corr. H. (mm)	Avg. H. (mm)	$D_{90}$ (mm)	$t_{90}$ (min)	$c_v$ (cm <sup>2</sup> /s)	Void Ratio	$m_v$ (m <sup>2</sup> /kN)	k (cm/s)
0.0	25.400					1.148		
6.1	25.365	25.383	-0.044	2.72	8.36E-03	1.145	2.27E-04	1.86E-07
25.7	24.968	25.167	-0.214	3.50	6.40E-03	1.111	7.99E-04	5.01E-07
49.9	24.675	24.822	-0.200	27.35	7.96E-04	1.087	4.85E-04	3.79E-08
96.6	24.234	24.455	-0.265	16.97	1.24E-03	1.049	3.82E-04	4.66E-08
49.9	24.353	24.294				1.059		
96.6	24.208	24.281	-0.089	6.50	3.20E-03	1.047	1.28E-04	4.01E-08
193.2	23.492	23.850	-0.434	21.90	9.18E-04	0.987	3.06E-04	2.75E-08
385.7	22.143	22.818	-0.900	34.81	5.28E-04	0.873	2.98E-04	1.55E-08
770.7	20.544	21.344	-1.140	32.60	4.94E-04	0.737	1.88E-04	9.08E-09
1540.7	19.091	19.818	-1.000	21.62	6.42E-04	0.614	9.19E-05	5.78E-09
770.7	19.269	19.180				0.629		
193.2	19.919	19.594				0.684		
49.9	20.720	20.320				0.752		

**Coefficient of Consolidation vs. Pressure**

Project #: 19-5161-205  
Client: MMM Group Limited  
Project Name: Highway 401 and Leslie Foundations  
Sample: BH R-09 TW2 (50' - 52')



Notes:  $C_v$  and k calculated using  $t_{90}$  values

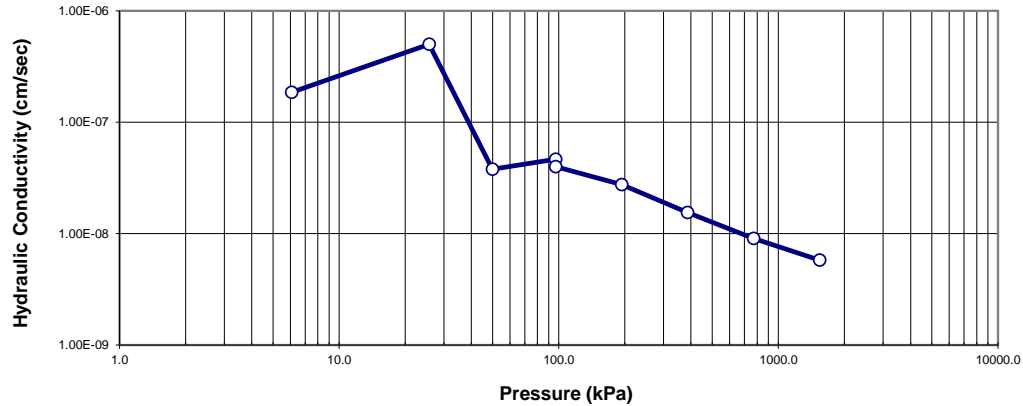
## Consolidation Test Report

Highway 401 and Leslie Foundations  
19-5161-205

BH R-09 TW2 (50' - 52')

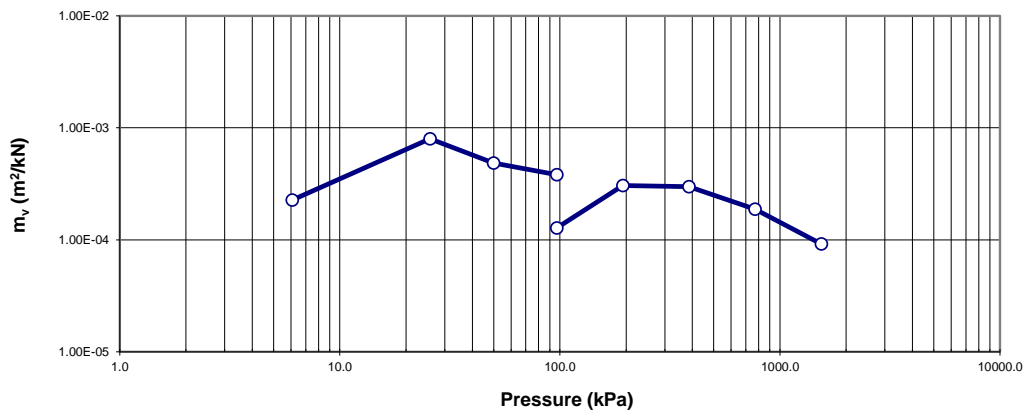
**Hydraulic Conductivity vs. Pressure**

Project #: 19-5161-205  
Client: MMM Group Limited  
Project Name: Highway 401 and Leslie Foundations  
Sample: BH R-09 TW2 (50' - 52')

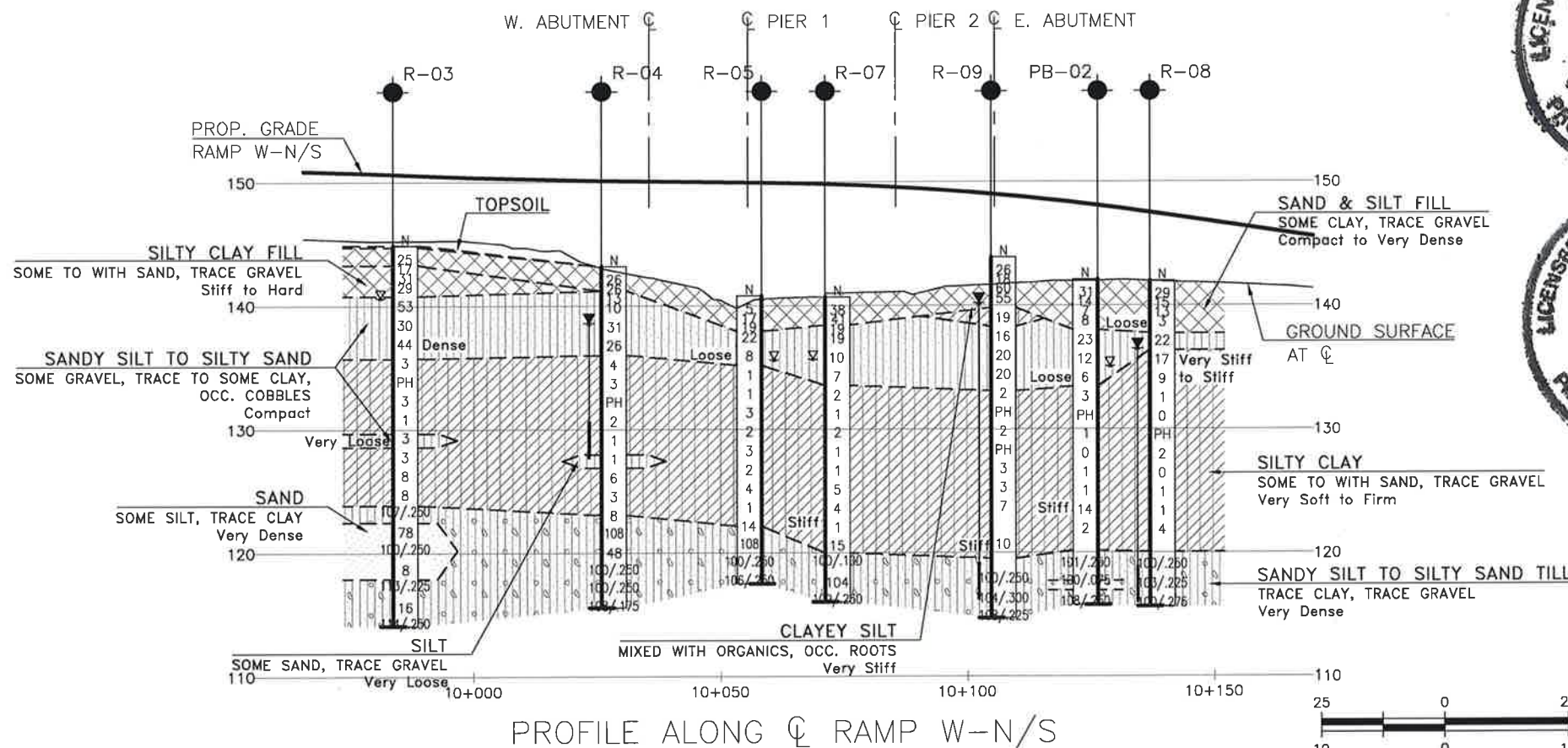
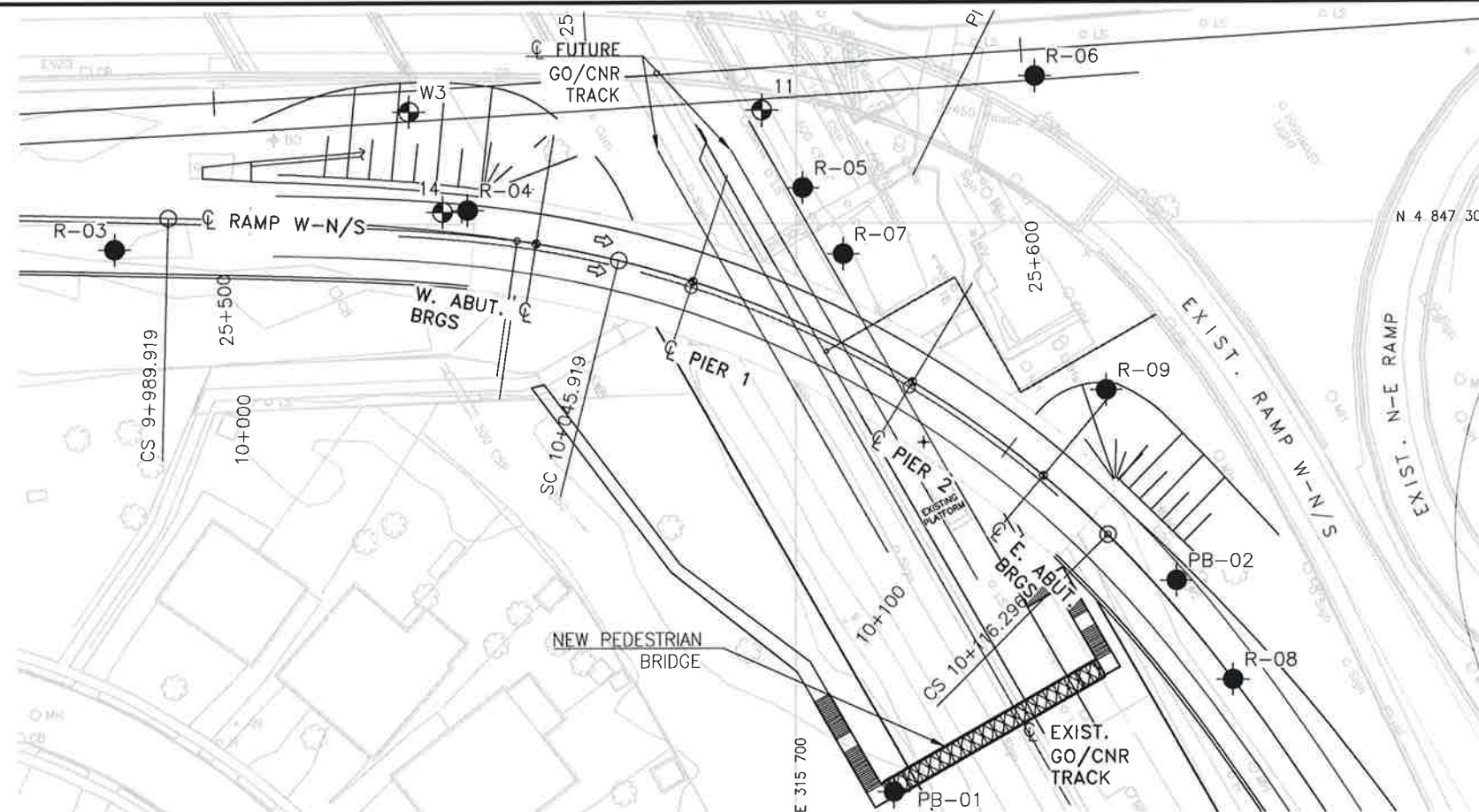


**$m_v$  vs. Pressure**

Project #: 19-5161-205  
Client: MMM Group Limited  
Project Name: Highway 401 and Leslie Foundations  
Sample: BH R-09 TW2 (50' - 52')







PROFILE ALONG CL RAMP W-N/S



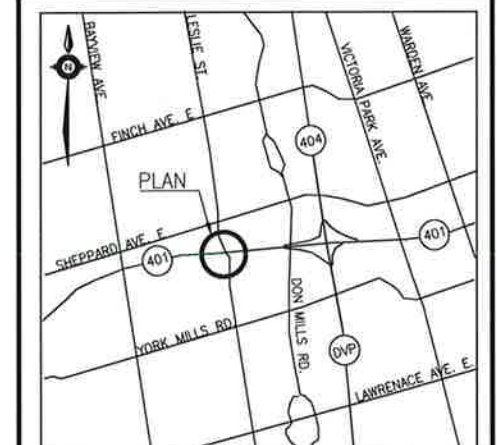
METRIC  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

CONT No  
WP No 2061-13-00

HIGHWAY 401  
W-N/S RAMP BRIDGE  
LESLIE ST./CNR OVERHEAD  
BOREHOLE LOCATIONS AND SOIL STRATA

**MMM GROUP**

**THURBER ENGINEERING LTD.**



KEYPLAN

LEGEND

◆	Borehole (Current Investigation)
◆	Borehole (Previous Investigation)
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60' Cone, 475J/blow)
PH	Pressure, Hydraulic
W	Water Level
W	Head Artesian Water
W	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

NO	ELEVATION	NORTHING	EASTING
PB-01	140.7	4 847 229.6	315 712.1
PB-02	142.1	4 847 255.7	315 747.1
R-01	148.1	4 847 294.4	315 382.5
R-02	145.7	4 847 294.8	315 475.5
R-03	144.9	4 847 296.9	315 615.8
R-04	143.2	4 847 301.7	315 659.3
R-05	140.8	4 847 304.4	315 700.8
R-06	143.6	4 847 318.2	315 729.5
R-07	140.7	4 847 296.2	315 705.8
R-08	142.0	4 847 243.4	315 754.1
R-09	143.9	4 847 279.3	315 738.4

NOTES

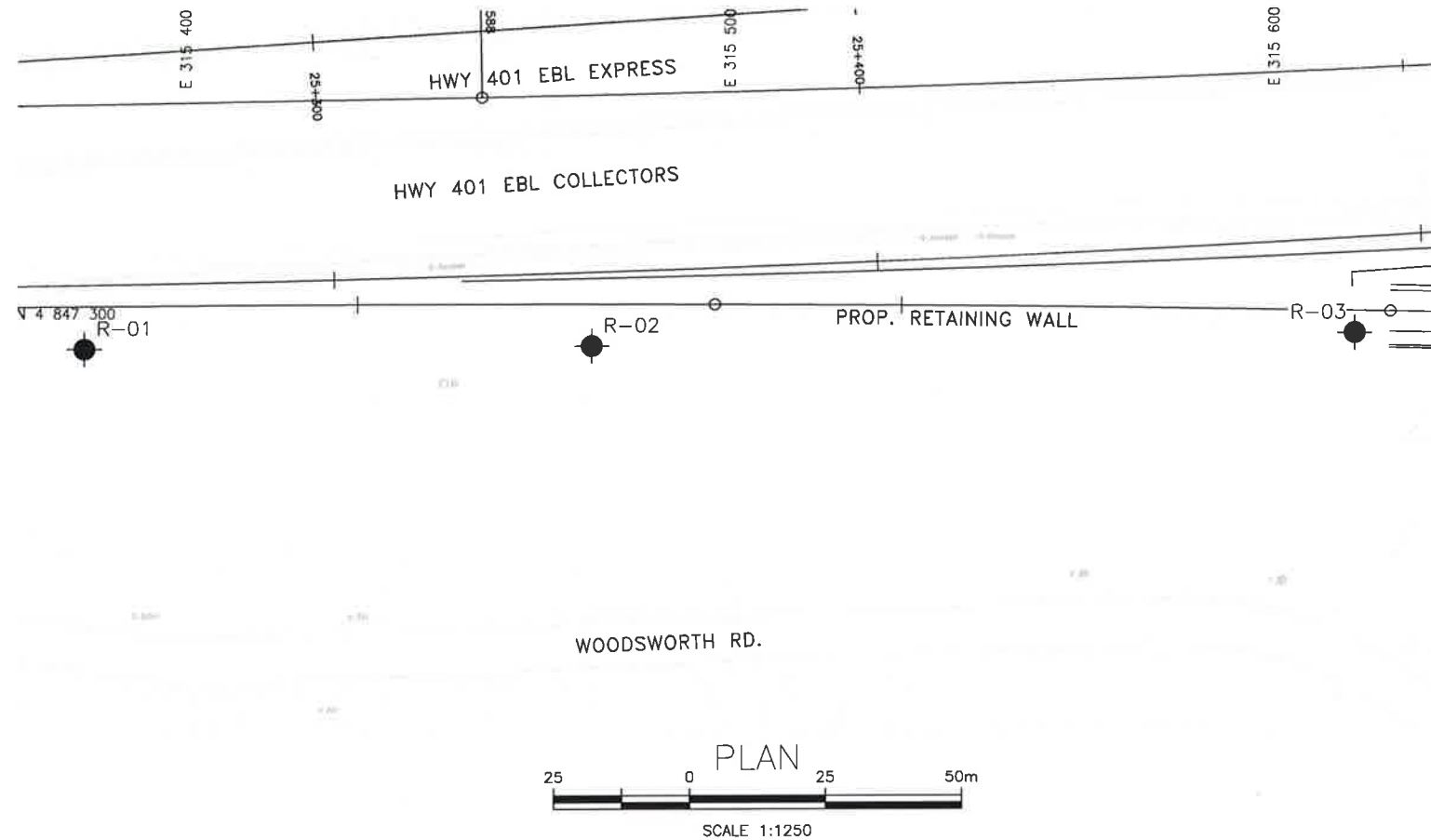
- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

GEOCREs No. 40M14-440



REVISIONS	DATE	BY	DESCRIPTION
DESIGN	RPR	CHK SKP	CODE
DRAWN	AN	CHK RPR	SITE
			STRUCT
			DWG 1
			DATE OCT 2016





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

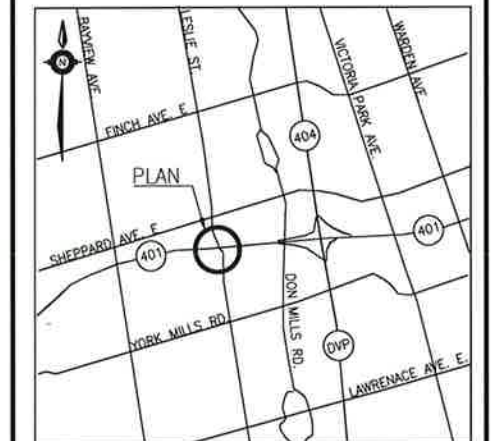


CONT No  
WP No 2061-13-00

HIGHWAY 401  
W-N/S RAMP WEST APPROACH  
LESLIE ST./CNR OVERHEAD  
BOREHOLE LOCATIONS AND SOIL STRATA



SHEET



LEGEND

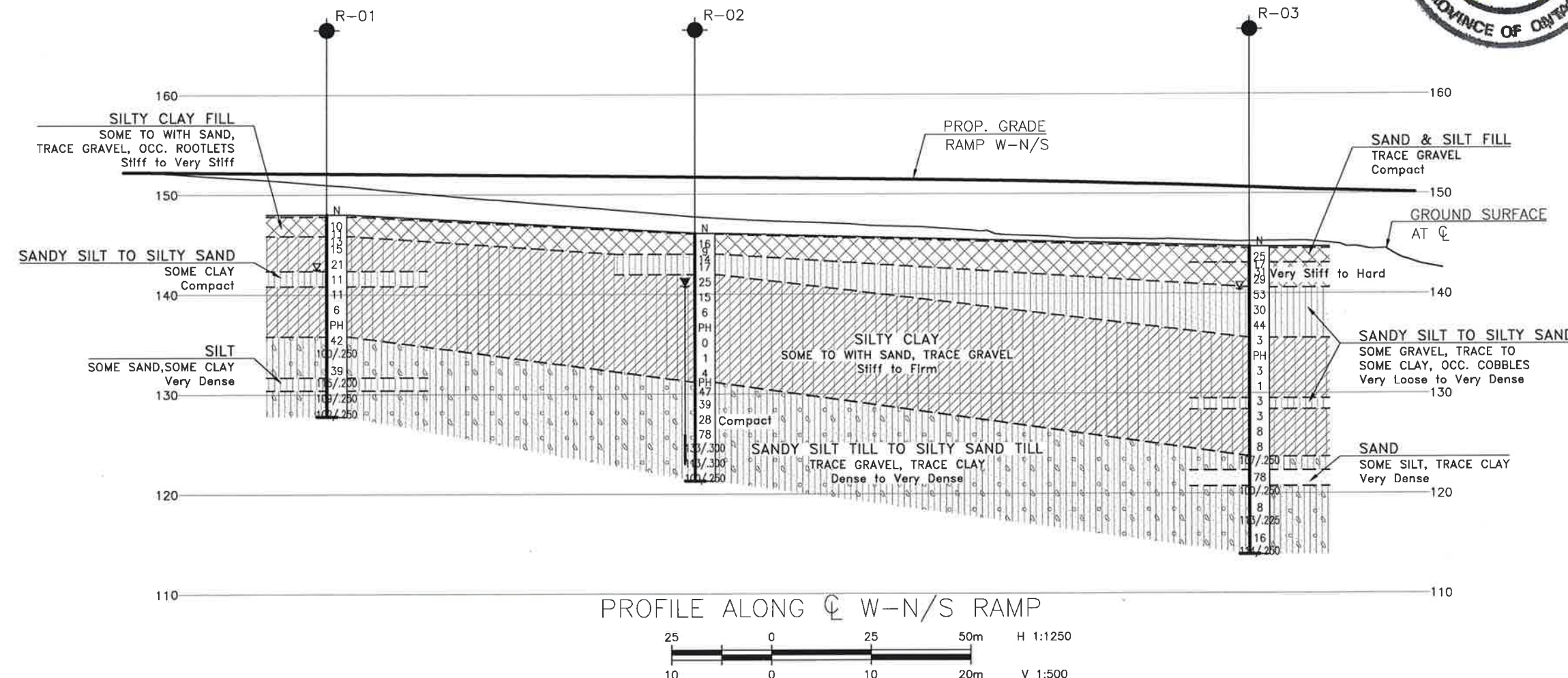
●	Borehole
⊙	Borehole and Cone
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
▽	Water Level
⊥	Head Artesian Water
⊥	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

NO	ELEVATION	NORTHING	EASTING
PB-01	140.7	4 847 229.6	315 712.1
PB-02	142.1	4 847 255.7	315 747.1
R-01	148.1	4 847 294.4	315 382.5
R-02	145.7	4 847 294.8	315 475.5
R-03	144.9	4 847 296.9	315 615.8
R-04	143.2	4 847 301.7	315 659.3
R-05	140.8	4 847 304.4	315 700.8
R-06	143.6	4 847 318.2	315 729.5
R-07	140.7	4 847 296.2	315 705.8
R-08	142.0	4 847 243.4	315 754.1
R-09	143.9	4 847 279.3	315 738.4

-NOTES-

- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

GEOCREs No. 40M14-440



REVISIONS	DATE	BY	DESCRIPTION
DESIGN	RPR	CHK SKP	CODE
DRAWN	AN	CHK RPR	SITE
			STRUCT
			DWG 1
			DATE OCT 2016

## **Appendix B**

### **Pedestrian Overpass and Retaining/Noise Barrier Combination Wall Boreholes PB-01 and PB-02; Boreholes W-01 and W-02**

- Record of Borehole Sheets
- Laboratory Test Results
- Drawing titled “Borehole Locations and Soil Strata



# RECORD OF BOREHOLE No PB-01

1 OF 3

METRIC

W.P. 2061-13-00 LOCATION Pedestrian Overpass N 4 847 229.6 E 315 712.2 ORIGINATED BY ES  
HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
DATUM Geodetic DATE 2015.03.30 - 2015.03.31 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT  <b>γ</b>  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
140.7	GROUND SURFACE							<div><div>20406080100</div><div>○ UNCONFINED + FIELD VANE</div><div>● QUICK TRIAXIAL × LAB VANE</div></div>					
0.0	TOPSOIL: (200mm)							<div><div>20406080100</div><div>○ UNCONFINED + FIELD VANE</div><div>● QUICK TRIAXIAL × LAB VANE</div></div>					
0.2	<b>SAND</b> and <b>SILT</b> , trace gravel Compact Dark Brown to Brown Moist (FILL)						140						
		1	SS	13									
			2	SS	11		139						
138.5													
2.2	<b>ORGANICS</b> clayey, roots and rootlets Compact Dark Brown Moist (300mm)												
138.2		3	SS	20									
2.5	Silty <b>SAND</b> , trace clay, trace gravel Compact Brown Moist		4	SS	20		138						
							137						
			5	SS	27		136						
135.1							135						
5.6	Silty <b>CLAY</b> , some to with sand Soft to Firm Grey Moist		6	SS	3		134						
			7	SS	1		133						
							132	2.7					
			1	TW	PH								
							131						

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

## METRIC

[illegible]

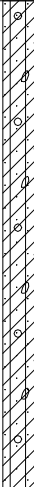
+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity

# RECORD OF BOREHOLE No PB-01

3 OF 3

METRIC

W.P. 2061-13-00 LOCATION Pedestrian Overpass N 4 847 229.6 E 315 712.2 ORIGINATED BY ES  
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2015.03.30 - 2015.03.31 CHECKED BY RPR

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			SHEAR STRENGTH kPa 20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
	Continued From Previous Page																
	Silty <b>CLAY</b> , trace sand Hard Grey Moist (TILL)				0.175												
			15	SS	102/ 0.250												
			16	SS	100/ 0.225												
117.5																	
23.2	END OF BOREHOLE AT 23.2m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 3.0m slotted screen.  WATER LEVEL READINGS: DATE      DEPTH (m)      ELEV. (m)  Apr 22/2015      5.4      135.3 Jun 03/2015      2.8      137.9																

# RECORD OF BOREHOLE No PB-02

1 OF 3

METRIC

W.P. 2061-13-00 LOCATION Pedestrian Overpass N 4 847 255.7 E 315 747.1 ORIGINATED BY ES  
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2015.04.14 - 2015.04.15 CHECKED BY RPR

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			SHEAR STRENGTH kPa ○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL    × LAB VANE									WATER CONTENT (%)
142.1	GROUND SURFACE							20	40	60	80	100					
0.0 0.1	TOPSOIL: (75mm)  Silty <b>SAND</b> , some clay, trace gravel Dense Brown to Dark Brown Moist (FILL)		1	SS	31		142							○			
140.7							141							○			
1.4	Compact to Loose		2	SS	14		140							○			6 54 30 10
			3	SS	7									○			
			4	SS	8		139							○			
138.0							138										
4.1	<b>SAND</b> and <b>SILT</b> , trace clay, trace gravel Compact Brown Moist		5	SS	23		137							○			
	Wet		6	SS	12		136							○			0 40 58 2
	Loose Grey		7	SS	6		135							○			
133.4							134										
8.7	Silty <b>CLAY</b> , some to with sand Soft to Firm Grey Wet		8	SS	3		133							○			

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity


20  
15 5  
10 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No PB-02

2 OF 3

METRIC

W.P. 2061-13-00 LOCATION Pedestrian Overpass N 4 847 255.7 E 315 747.1 ORIGINATED BY ES  
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2015.04.14 - 2015.04.15 CHECKED BY RPR

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			SHEAR STRENGTH kPa							WATER CONTENT (%)	
								○ UNCONFINED    + FIELD VANE	● QUICK TRIAXIAL    × LAB VANE							
	Continued From Previous Page						20 40 60 80 100	20 40 60 80 100	20 40 60							
	Silty <b>CLAY</b> , some to with sand, trace gravel Firm Grey Wet						132	3.3 +								
			1	TW	PH		131									
							130	2.3 +								
			9	SS	1		129									
							128	3.1 +								
			10	SS	0		127									
							126	3.1 +								
			Sand seams	11	SS	1	125									
							124									
							123									
125.8 16.3	Stiff					126	4.3 +									
			12	SS	1		125									
						124	4.0 +									
			13	SS	14											
122.7 19.4																

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
15  
10  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No PB-02

3 OF 3

METRIC

W.P. 2061-13-00 LOCATION Pedestrian Overpass N 4 847 255.7 E 315 747.1 ORIGINATED BY ES  
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2015.04.14 - 2015.04.15 CHECKED BY RPR

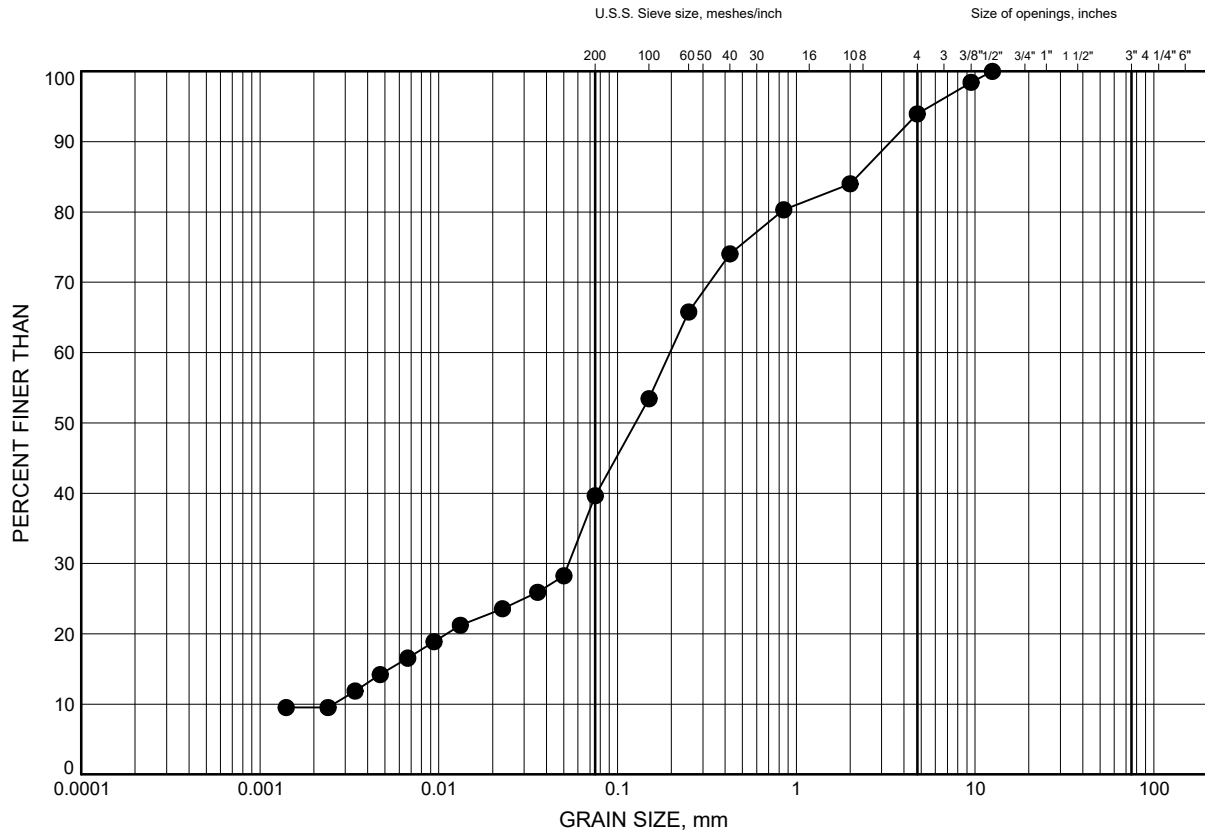
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT  $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
								20 40 60 80 100							
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE							
						WATER CONTENT (%)									
						20 40 60									
						PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT									
						W P W W L									

ONTMT4S 1205.GPJ 2015TEMPLATE(MTO).GDT 11/3/15

Hwy 401 Leslie Street 2013-E-0032  
**GRAIN SIZE DISTRIBUTION**

FIGURE B1

**SILTY SAND TILL**



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	PB-02	1.83	140.27

Date November 2015  
W.P. 2061-13-00



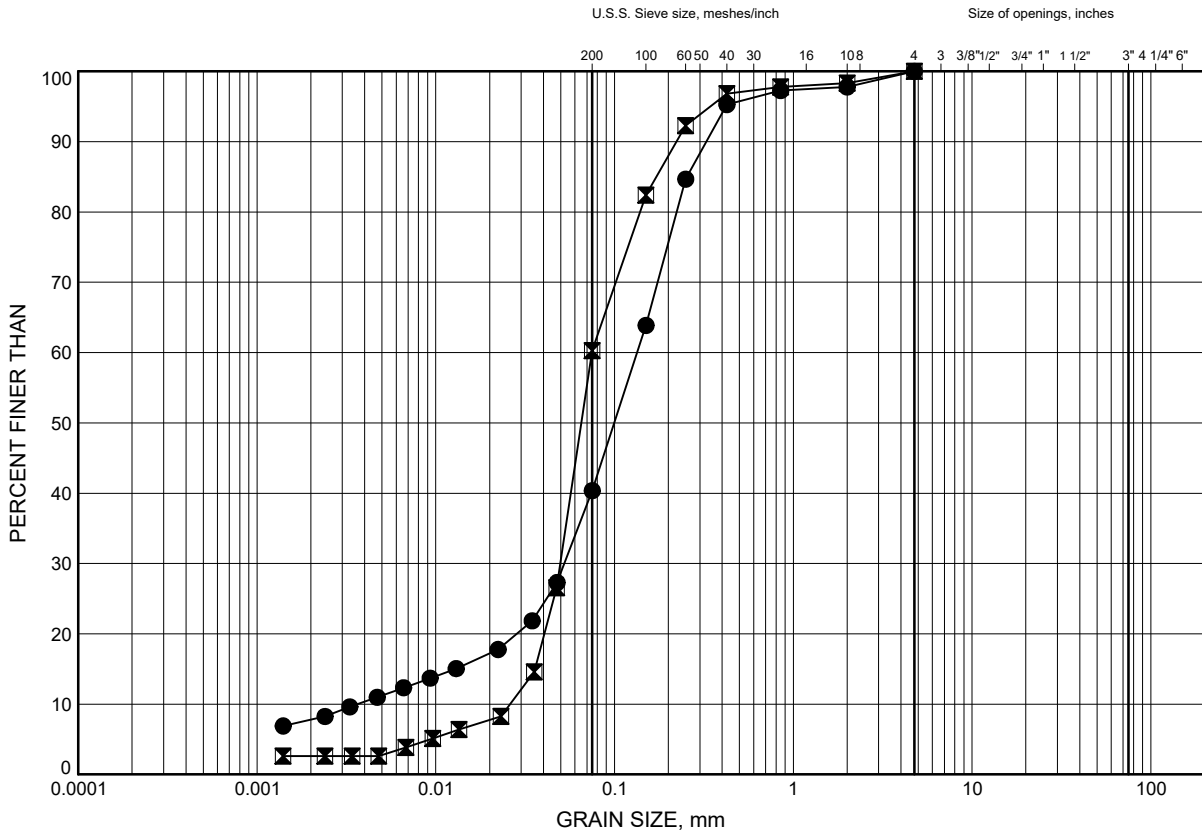
Prep'd AN  
Chkd. RPR

Hwy 401 Leslie Street 2013-E-0032

# GRAIN SIZE DISTRIBUTION

FIGURE B2

## SILTY SAND to SAND & SILT



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

### LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	PB-01	4.88	135.82
⊠	PB-02	6.40	135.70

Date November 2015  
W.P. 2061-13-00



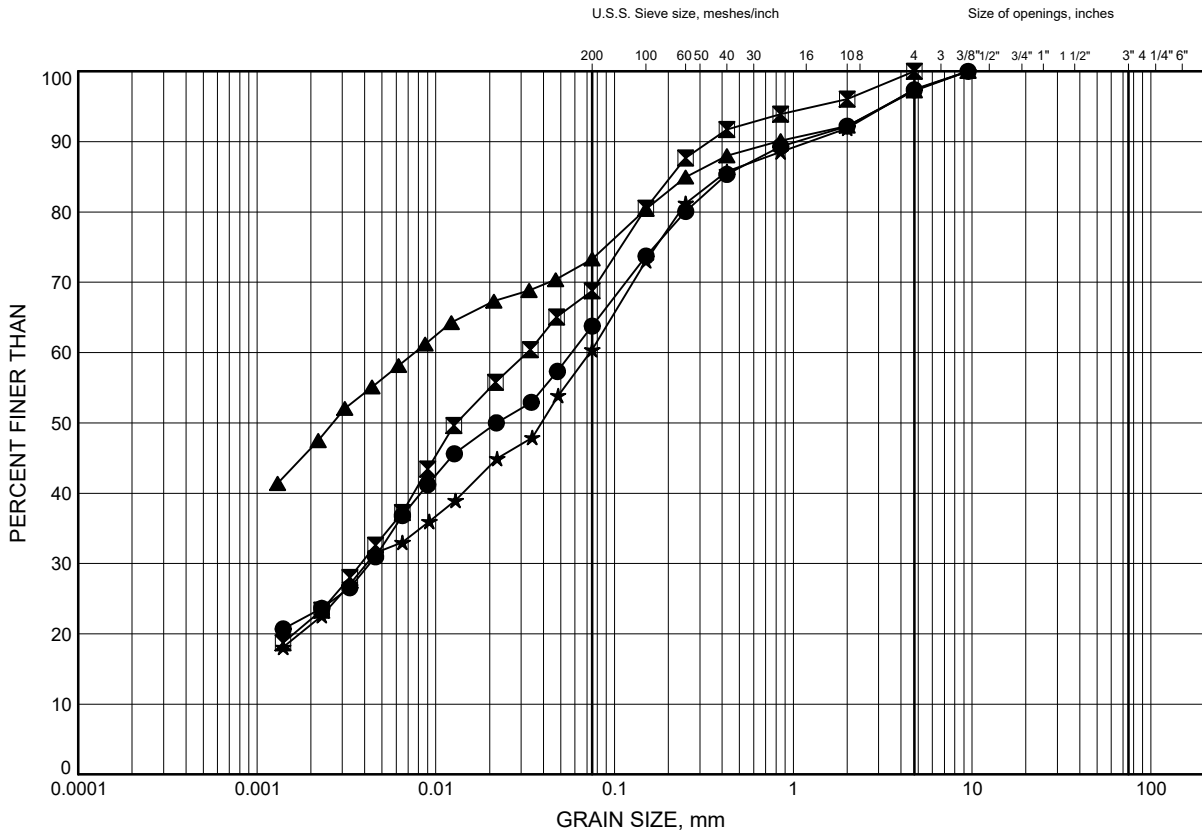
Prep'd AN  
Chkd. RPR



Hwy 401 Leslie Street 2013-E-0032  
**GRAIN SIZE DISTRIBUTION**

FIGURE B3

**SILTY CLAY**



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	PB-01	12.50	128.20
■	PB-01	18.59	122.11
▲	PB-02	14.02	128.08
★	PB-02	17.07	125.03

Date November 2015  
W.P. 2061-13-00

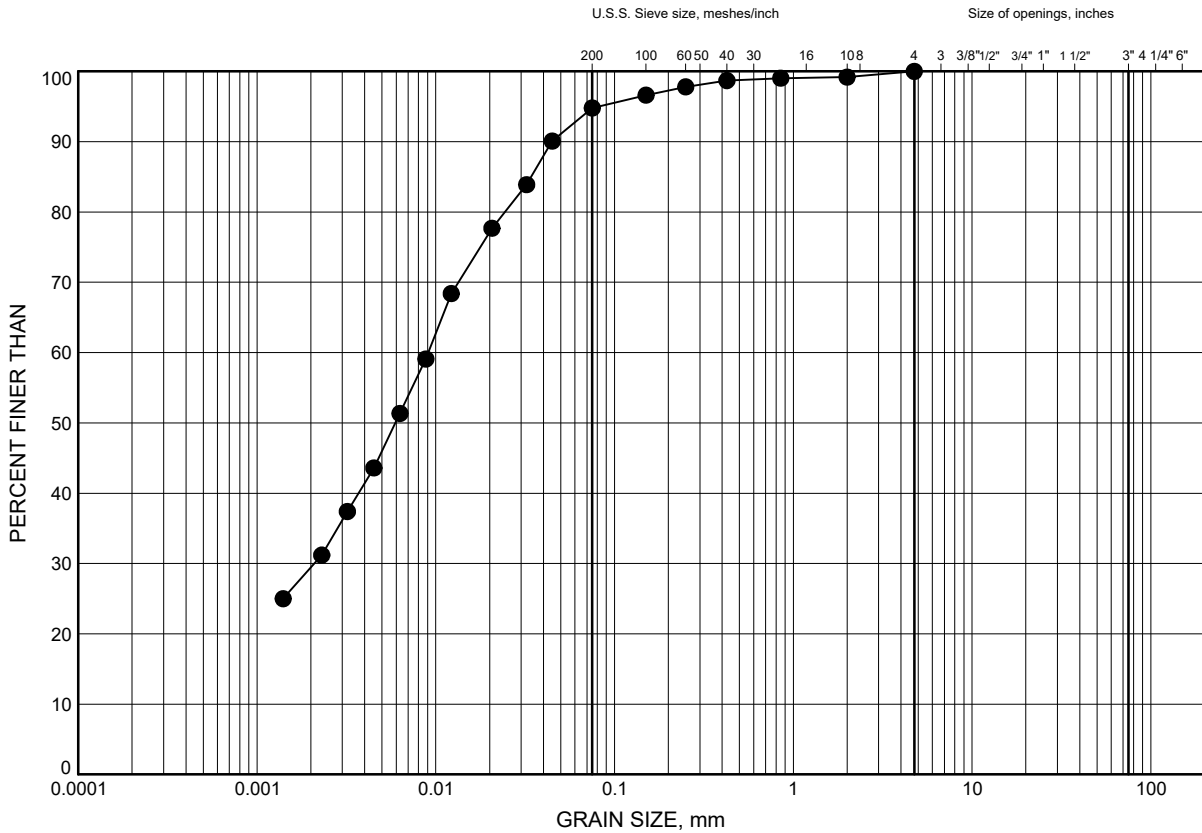


Prep'd AN  
Chkd. RPR

Hwy 401 Leslie Street 2013-E-0032  
**GRAIN SIZE DISTRIBUTION**

FIGURE B4

**SILTY CLAY TILL**



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	PB-01	21.64	119.06

Date November 2015  
W.P. 2061-13-00



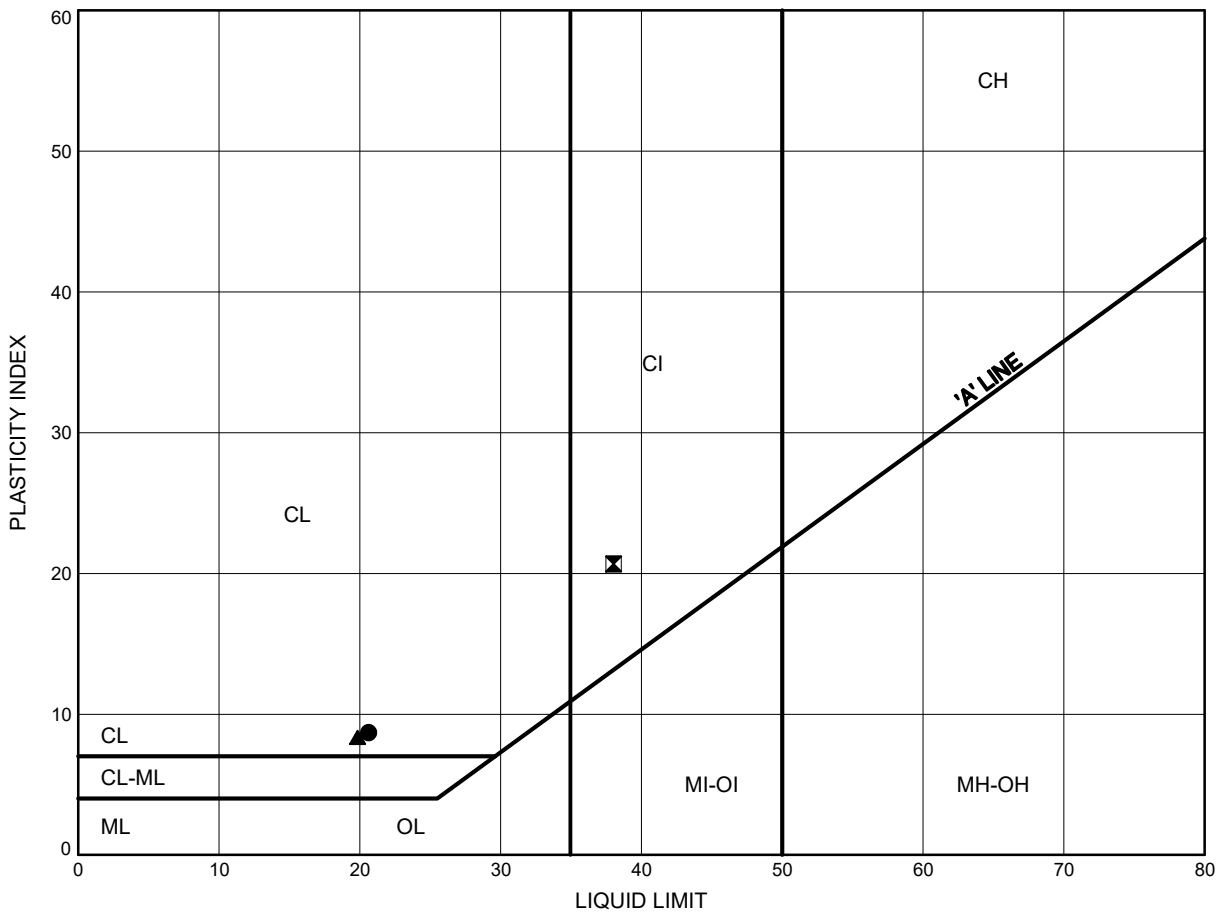
Prep'd AN  
Chkd. RPR

Hwy 401 Leslie Street 2013-E-0032

# ATTERBERG LIMITS TEST RESULTS

FIGURE B5

## SILTY CLAY



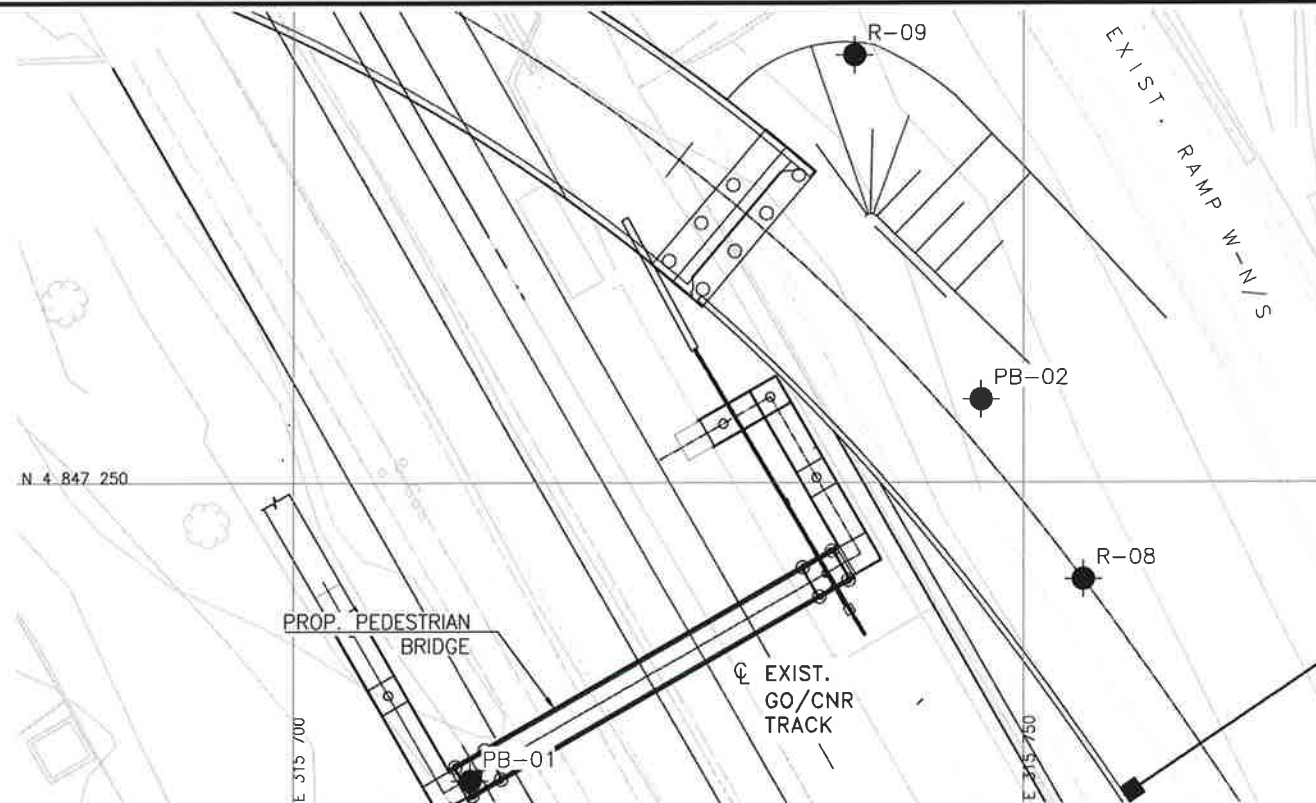
### LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	PB-01	12.50	128.20
⊠	PB-02	14.02	128.08
▲	PB-02	17.07	125.03

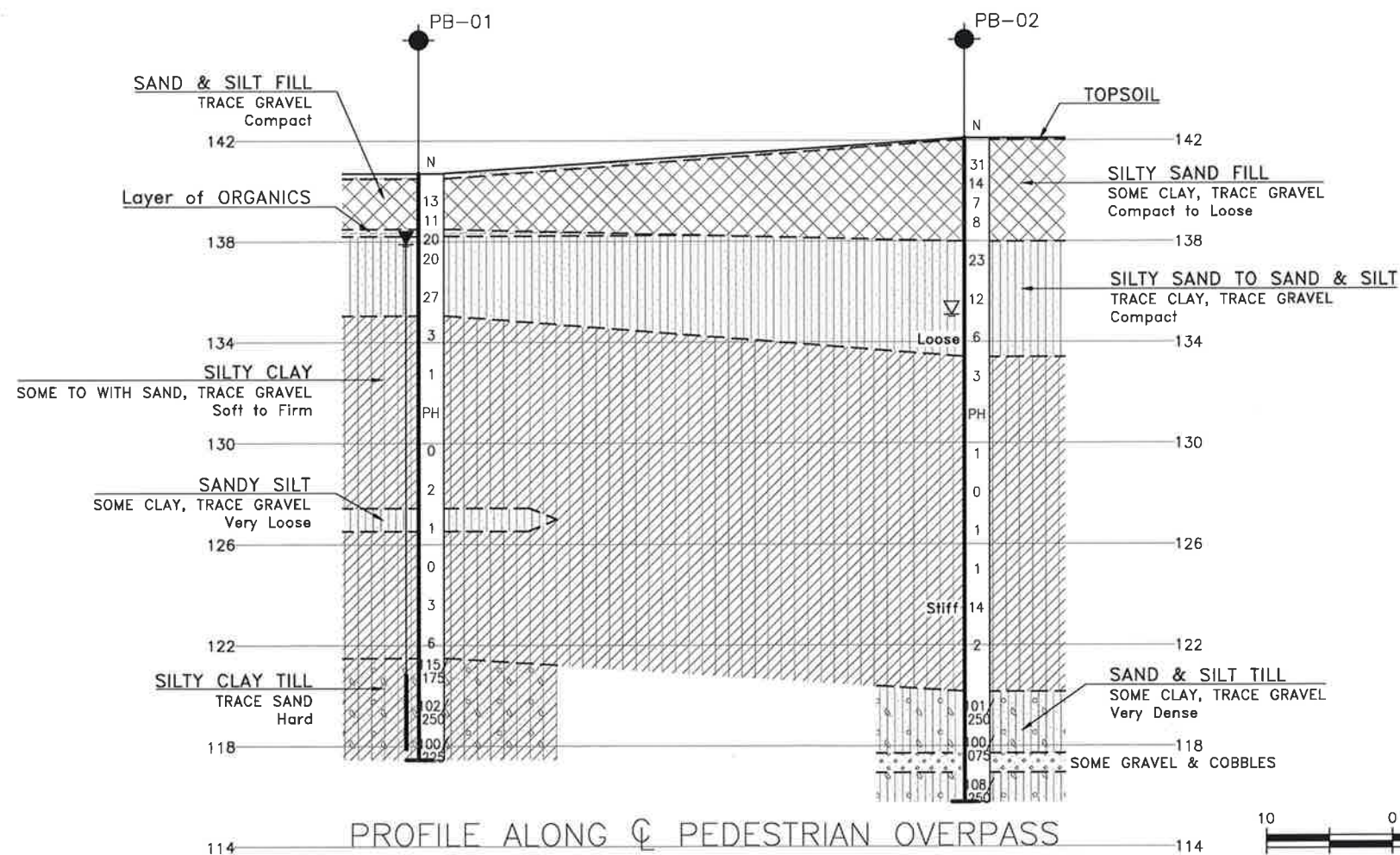
Date November 2015  
W.P. 2061-13-00



Prep'd AN  
Chkd. RPR



PLAN  
SCALE 1:500



PROFILE ALONG  $\phi$  PEDESTRIAN OVERPASS



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

CONT No  
WP No 2061-13-00

HIGHWAY 401  
PEDESTRIAN OVERPASS  
LESLIE ST./CNR OVERHEAD  
BOREHOLE LOCATIONS AND SOIL STRATA

**MMM GROUP**

**THURBER ENGINEERING LTD.**



KEYPLAN

LEGEND

- ◆ Borehole (Current Investigation)
- ⊙ Borehole (Previous Investigation)
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60° Cone, 475J/blow)
- PH Pressure, Hydraulic
- ▽ Water Level
- ▽ Head Artesian Water
- ⊥ Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

NO	ELEVATION	NORTHING	EASTING
PB-01	140.7	4 847 229.6	315 712.1
PB-02	142.1	4 847 255.7	315 747.1
R-01	148.1	4 847 294.4	315 382.5
R-02	145.7	4 847 294.8	315 475.5
R-03	144.9	4 847 296.9	315 615.8
R-04	143.2	4 847 301.7	315 659.3
R-05	140.8	4 847 304.4	315 700.8
R-06	143.6	4 847 318.2	315 729.5
R-07	140.7	4 847 296.2	315 705.8
R-08	142.0	4 847 243.4	315 754.1
R-09	143.9	4 847 279.3	315 738.4

-NOTES-

- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

GEOCREs No. 30M14-440



DATE	BY	DESCRIPTION
DESIGN	RPR	CHK SKP CODE
DRAWN	AN	CHK RPR SITE
		STRUCT DWG 1

# RECORD OF BOREHOLE No W-01

1 OF 2

METRIC

W.P. 2061-13-00 LOCATION Combination Wall N 4 847 294.6 E 315 151.6 ORIGINATED BY ES  
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2015.11.30 - 2015.11.30 CHECKED BY SKP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT      NATURAL MOISTURE CONTENT      LIQUID LIMIT			UNIT WEIGHT  <b>γ</b>  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL      × LAB VANE				WATER CONTENT (%) w <sub>p</sub> w      w <sub>L</sub>				GR	SA	SI	CL
154.6	GROUND SURFACE							20	40	60	80	100							
0.0	ASPHALT:(125mm)							20	40	60	80	100							
0.1	SAND, some gravel Brown Moist (FILL)		1	GS			154							○					
153.7																			
0.9	Silty CLAY, some sand, trace gravel Very Stiff to Hard Brown Moist		1	SS	21		153							○					0 11 63 26
			2	SS	85/ 0.250									○					0 13 63 24
			3	SS	100/ 0.175		152							○					
151.8																			
2.8	SAND and SILT, trace clay, trace gravel Very Dense Brown to Grey Moist		4	SS	79		151							○					
			5	SS	50/ 0.125		150							○					3 43 50 4
							149												
			6	SS	71		148							○					
147.4																			
7.2	Silty CLAY, trace to some sand Hard Grey Moist		7	SS	88		147							○					0 10 58 32
							146												
			8	SS	82									○					
145.0							145												
9.6	END OF BOREHOLE AT 9.6m. BOREHOLE OPEN AND DRY UPON																		

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No W-01

2 OF 2

METRIC

W.P. 2061-13-00 LOCATION Combination Wall N 4 847 294.6 E 315 151.6 ORIGINATED BY ES  
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2015.11.30 - 2015.11.30 CHECKED BY SKP

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			SHEAR STRENGTH kPa									
	Continued From Previous Page																
	COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO 0.2m, THEN ASPHALT TO SURFACE.																



# RECORD OF BOREHOLE No W-02

1 OF 2

METRIC

W.P. 2061-13-00 LOCATION Combination Wall N 4 847 300.2 E 315 227.7 ORIGINATED BY ES  
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2015.11.30 - 2015.11.30 CHECKED BY SKP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT  <b>γ</b>  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa											
153.0	GROUND SURFACE							20	40	60	80	100							
0.0	ASPHALT:(150mm)							20	40	60	80	100							
0.2	SAND, some gravel Brown Moist (FILL)		1	GS															
152.2																			
0.8	SAND, some silt, trace gravel Compact Brown Moist (FILL)		1	SS	19		152												
151.5																			
1.5	SAND and SILT, some clay, trace gravel Very Dense to Dense Brown Moist (FILL)		2	SS	75		151												
			3	SS	46														
150.0							150												
3.0	SAND and SILT, some clay, trace gravel Compact to Very Dense Grey and Brown Moist		4	SS	24		149												
			5	SS	103/ 0.275		148												
147.4																			
5.6	Silty CLAY, trace to some sand Hard Grey Moist		6	SS	58		147												
							146												
			7	SS	74		145												
							144												
143.2			8	SS	65														
9.8	END OF BOREHOLE AT 9.8m.																		

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE

## METRIC

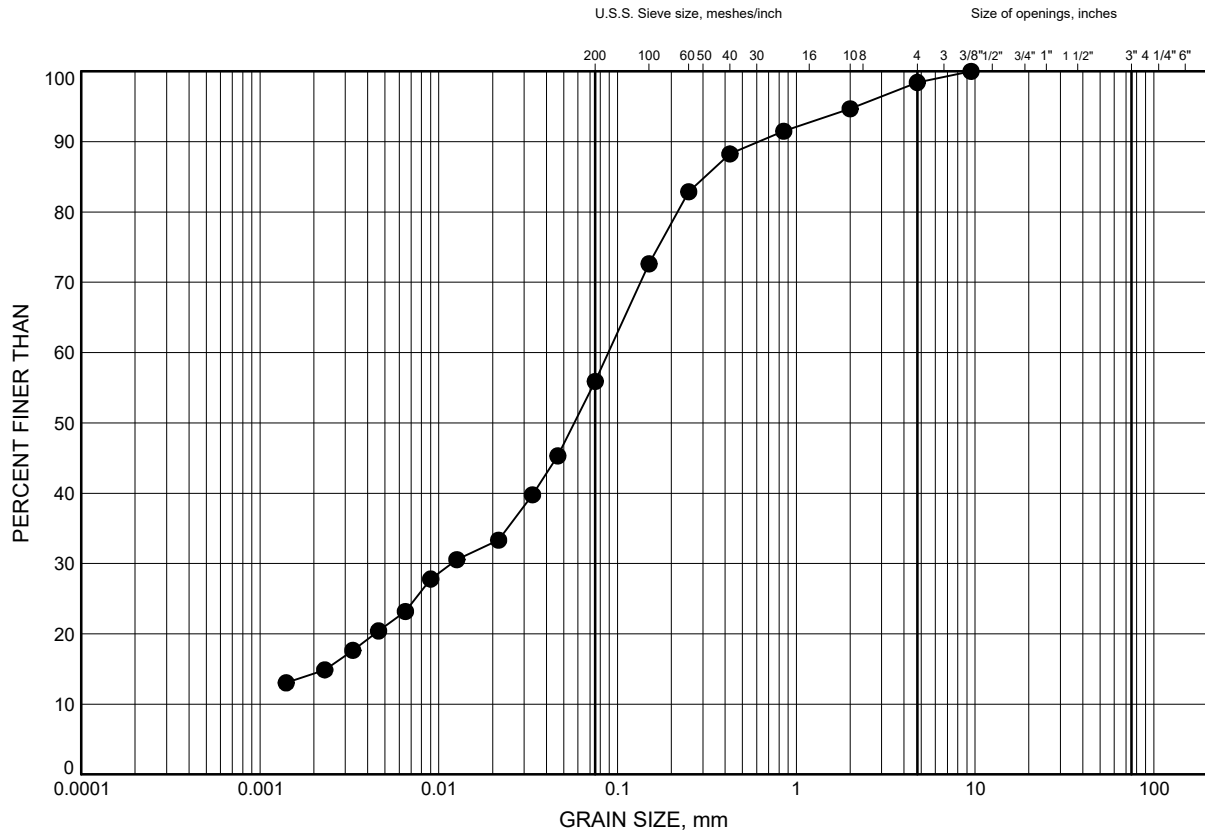
[illegible]



# Combination Wall GRAIN SIZE DISTRIBUTION

FIGURE B6

## SAND & SILT FILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

### LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	W-02	2.59	150.41

Date March 2016  
W.P. 2061-13-00

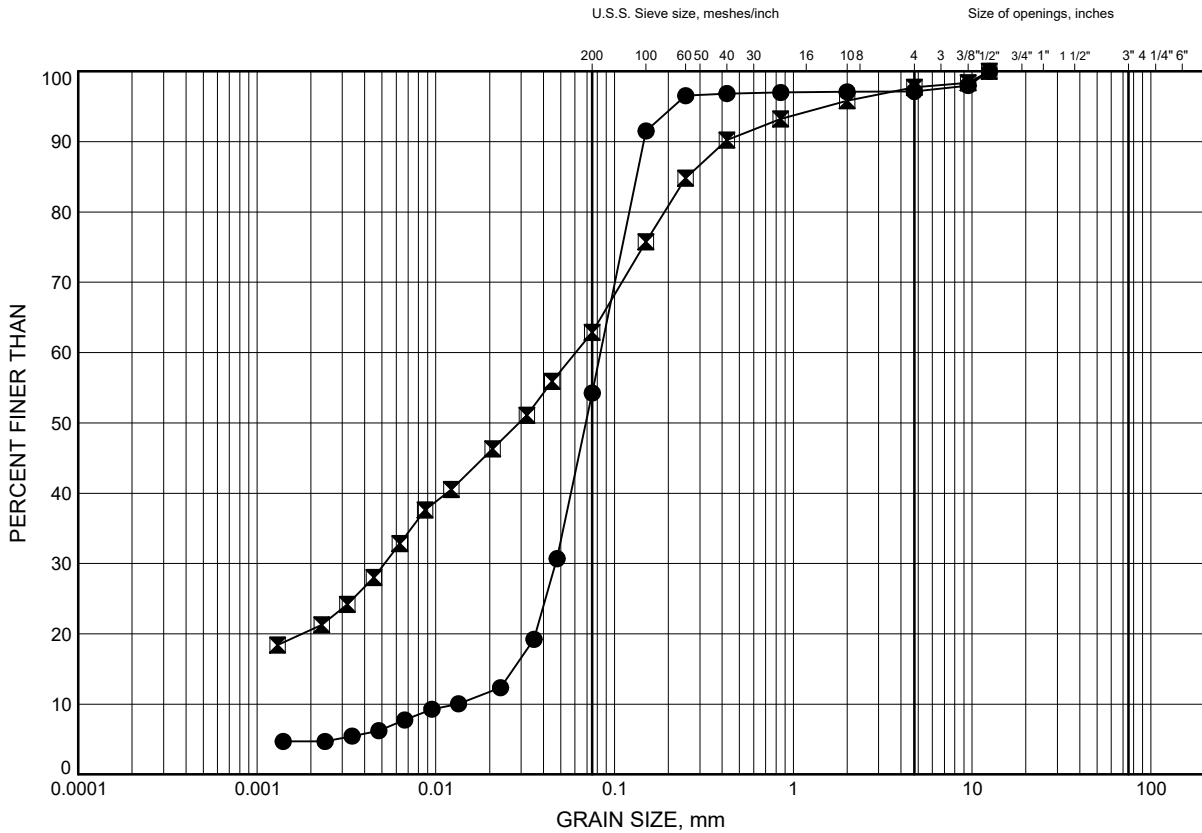


Prep'd AN  
Chkd. SKP

# Combination Wall GRAIN SIZE DISTRIBUTION

FIGURE B7

## SAND & SILT



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

## LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	W-01	4.71	149.89
⊠	W-02	3.35	149.65

Date March 2016  
W.P. 2061-13-00

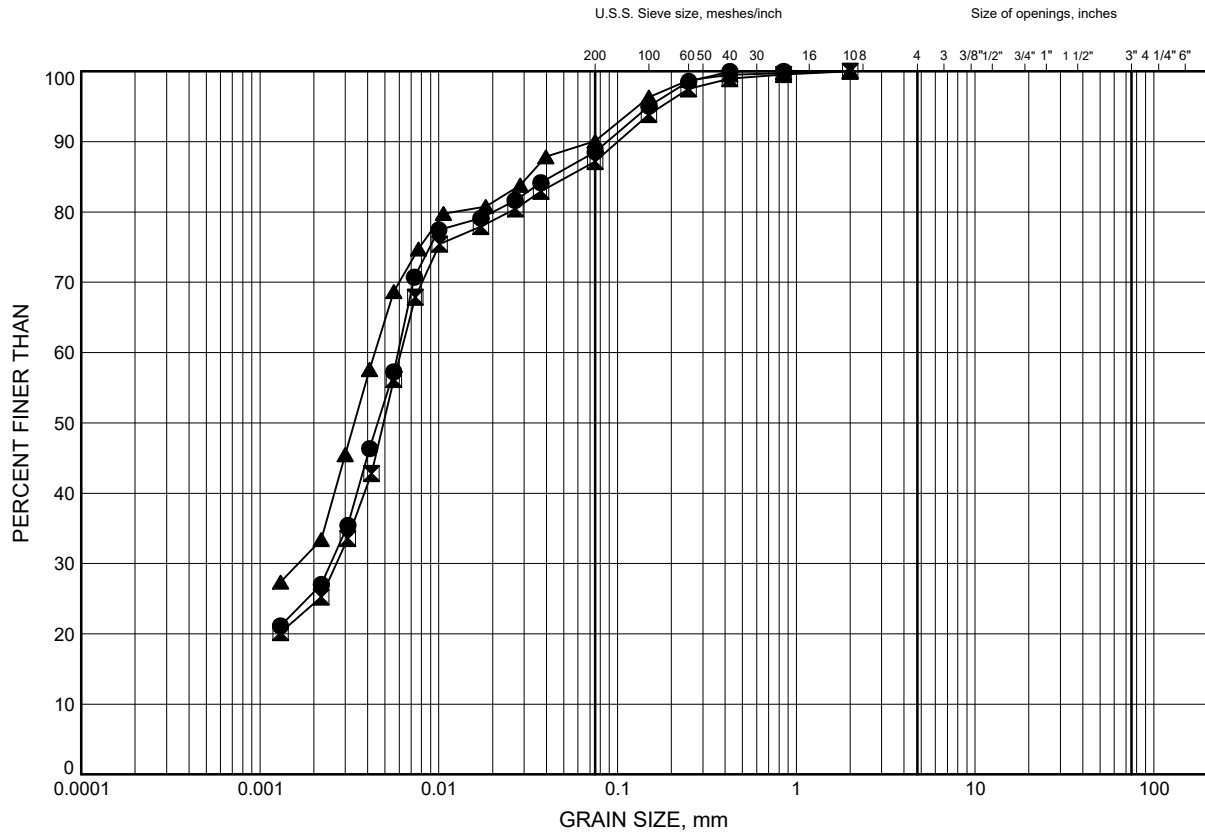


Prep'd AN  
Chkd. SKP

# Combination Wall GRAIN SIZE DISTRIBUTION

FIGURE B8

## Silty CLAY



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

## LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	W-01	1.07	153.53
⊠	W-01	1.73	152.87
▲	W-01	7.85	146.75

Date March 2016  
W.P. 2061-13-00

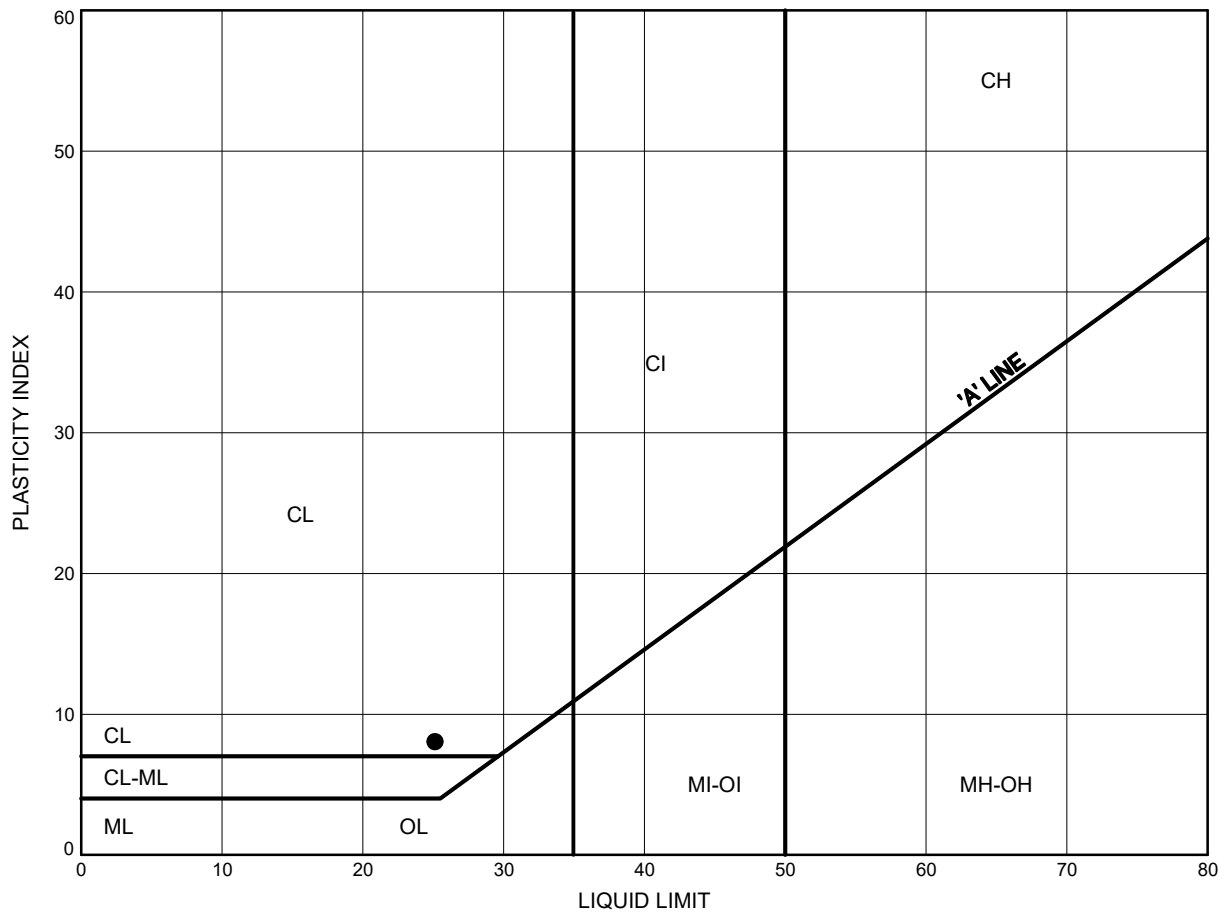


Prep'd AN  
Chkd. SKP

Combination Wall  
**ATTERBERG LIMITS TEST RESULTS**

FIGURE B9

Silty CLAY



**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	W-01	1.07	153.53

Date March 2016  
 W.P. 2061-13-00

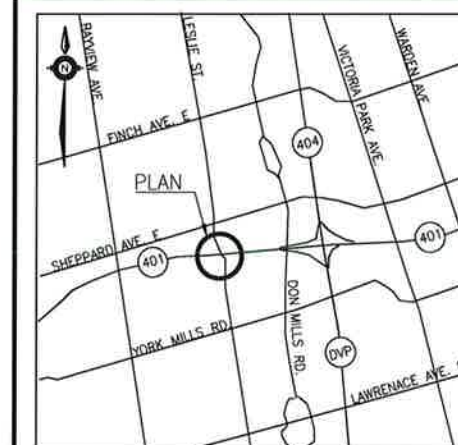


Prep'd AN  
 Chkd. SKP

HIGHWAY 401  
EASTBOUND LANES COLLECTORS  
COMBINATION WALL  
BOREHOLE LOCATIONS AND SOIL STRATA







**MMM GROUP**

**THURBER** ENGINEERING LTD.



## KEYPLAN

## LEGEND

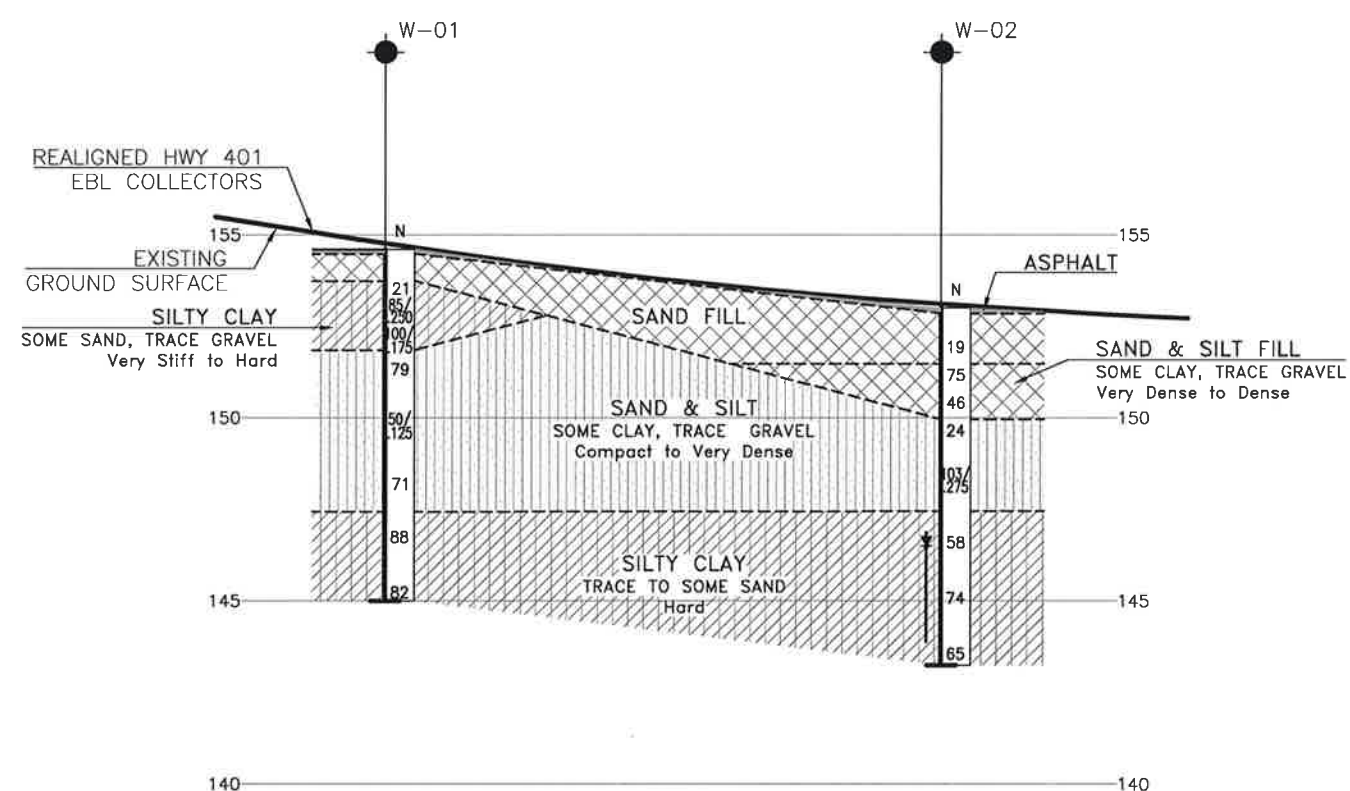
- |   |                                       |
|---|---------------------------------------|
|  | Borehole                              |
|  | Borehole and Cone                     |
| N   | Blows /0.3m (Std Pen Test, 475J/blow) |
| CONE  | Blows /0.3m (60° Cone, 475J/blow)     |
| PH  | Pressure, Hydraulic                   |
|  | Water Level                           |
|  | Head Artesian Water                   |
|  | Piezometer                            |
| 90%   | Rock Quality Designation (RQD)        |
| A/R   | Auger Refusal                         |

NO	ELEVATION	NORTHING	EASTING
W-01	154.6	4 847 294.6	315 151.6
W-02	153.0	4 847 300.2	315 227.7

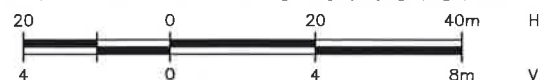
-NOTES-

- 1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- 2) This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

**GEOCRES No. 40M14-440**



PROFILE ALONG  $\mathbb{C}$  REALIGNED  
HWY 401 EBL COLLECTORS

[illegible]

## **Appendix C**

### **Site Photographs**

Replacement of CNR Overpass and Pedestrian Bridge  
Highway 401 & Leslie St., Toronto, Ontario

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**Photo 1.- Existing CNR Overpass at Highway 401 & Leslie St.**



Replacement of CNR Overpass and Pedestrian Bridge  
Highway 401 & Leslie St., Toronto, Ontario

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Pedestrian bridge over tracks

CNR Overpass



**Photo 2.- Existing CNR Overpass and Pedestrian Bridge at Oriole GO Station**



Replacement of CNR Overpass and Pedestrian Bridge  
Highway 401 & Leslie St., Toronto, Ontario

---



**Photos 3 and 4.- Existing CNR Overpass and Pedestrian Bridge**



**Photo 5.- Existing CNR Overpass /Hwy 401**