FOUNDATION INVESTIGATION AND DESIGN REPORT
HIGHWAY 427 SOUTHBOUND COLLECTOR LANES
BETWEEN HIGHWAY 401 AND QEW
OVERHEAD SIGN SUPPORTS
TORONTO, ONTARIO
G.W.P. 2219-03-00

Geocres Number: 30M11-235

Report to

McCormick Rankin Corporation

Thurber Engineering Ltd.
2010 Winston Park Drive, Suite 103
Oakville, Ontario
L6H 5R7
Phone: (905) 829 8666
Fax: (905) 829 1166

November 1, 2010
File: 19-1351-163

H:\19\1351\163 Hwy427 SBL\Reports & Memos\Hwy 427 SB OHS FIDR_Final.doc

TABLE OF CONTENTS

Tables

Appendices

FOUNDATION INVESTIGATION AND DESIGN REPORT
HIGHWAY 427 SOUTHBOUND COLLECTOR LANES
BETWEEN HIGHWAY 401 AND QEW
OVERHEAD SIGN SUPPORTS
TORONTO, ONTARIO
G.W.P. 2219-03-00

Geocres Number: 30M11-235

1 INTRODUCTION

This report presents the factual findings obtained from current and previous foundation investigations conducted for the Ministry of Transportation Ontario (MTO) along Highway 427 from Highway 401 to the Queen Elizabeth Way (QEW) in Toronto, Ontario. This information is provided for foundation design for Overhead Sign (OHS) supports for the proposed rehabilitation of the collector lanes of Highway 427 southbound.

The purpose of the investigation was to explore the subsurface conditions along the alignment of the Highway 427 southbound collector lanes in the general vicinities of the proposed OHS supports and, based on the current and previous data obtained, to provide a borehole location plan, records of boreholes, laboratory test results and a written description of the subsurface conditions.

Thurber carried out this study as a sub-consultant to McCormick Rankin Corporation under the Ministry of Transportation Ontario (MTO) Agreement Number 2007-E-0051.

2 PROJECT AND SITE DESCRIPTION

The rehabilitation of the collector lanes of Highway 427 southbound from Highway 401 to QEW includes the installation of a number of overhead and variable message signs. Highway 427 follows a general north-south alignment and is surrounded by industrial, commercial and residential properties along the route. The existing grades along Highway 427 within the project area range from approximate elevations 114 m to 147 m, with the ground surface generally sloping from the north end at Highway 401 towards Lake Ontario in the south.

The site is situated on the boundary of the South Slope and Iroquois Plain physiographic regions. The geology of the South Slope region (which includes the area north of the CP Rail crossing near Dundas Street West) generally consists of a till plain consisting of clayey silt to silty clay till (Halton Till) grading into a sandy silt to silty sand till with depth. The area south of the CP Rail tracks lies within the Iroquois Plain physiographic region, which generally consists of sand and till deposits overlying bedrock at relatively shallow depth. The underlying bedrock in the area consists of grey shale with hard siltstone and limestone interlayers of the Georgian Bay Formation.

3 SITE INVESTIGATION AND FIELD TESTING

The site investigation and field testing for this project was carried out on May 7, 2010, during which two boreholes numbered 10-01 and 10-02 were drilled to depths of 9.3 to 9.4 m at the locations of two OHS supports at the Highway 427 southbound off-ramps to Burnhamthorpe Road and Dundas Street West respectively. The locations of the boreholes were determined based on drawings provided by McCormick Rankin and were surveyed in the field using a Trimble Pathfinder ProXRT GPS unit with an accuracy of +/- 0.5 m. Underground utility clearances were obtained prior to drilling.

The boreholes were advanced using solid stem auger drilling techniques. Samples were obtained at selected intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT) in the overburden soils. The borehole logs for the current investigation are included in Appendix A.

Groundwater conditions in the open boreholes were observed throughout the drilling operations, and a standpipe piezometer was installed in each borehole to permit longer term groundwater level monitoring. The piezometers consisted of 19 mm PVC pipe with a slotted screen enclosed in filter sand. The piezometer completion details are shown in Table A-1 in Appendix A.

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.

For the remainder of the OHS supports, borehole information from previous investigations along Highway 427 has been used. Table 1 at the end of the text outlines the reference boreholes (and their respective Geocres numbers) that were used to assess the subsurface conditions at the OHS supports. These are generally based on the closest available boreholes to each OHS support. Since the previous boreholes were drilled from 1965 to 1967, it is possible that the current ground surface elevations may differ and the subsurface stratigraphy may include additional fill that is not shown on the reference borehole logs. The borehole logs from the previous investigations are included in Appendix B. A list of the referenced reports is included in Appendix B with the borehole logs. Only the most relevant borehole logs from the previous investigations have been included in this report.

The approximate locations of the OHS supports and the boreholes from the current and previous investigations are shown on the Borehole Location Drawings in Appendix D. Table 2 at the end of the text provides geotechnical design parameters for the OHS support foundations based on the current and previous boreholes.

4 LABORATORY TESTING

The recovered soil samples from the current investigation were subjected to Visual Identification (VI) and to natural moisture content determination. The results of this testing are shown on the borehole logs in Appendix A. Selected samples were also subjected to gradation analysis and Atterberg Limit

tests and the results of this testing program are shown on the borehole logs in Appendix A and on the figures contained in Appendix C.

5 DESCRIPTION OF SUBSURFACE CONDITIONS

Details of the encountered soil stratigraphy are presented on the borehole logs in Appendices A and B obtained from the current and previous investigations. An overall description of the stratigraphy is given below. However, the factual data presented in the borehole logs governs any interpretation of the site conditions.

In general, the site stratigraphy encountered in the boreholes consists of silty clay to clayey silt glacial till, overlying silty sand to sandy silt. In the south part of the site, the stratigraphy transitions into sandy silt to clayey silt glacial till with zones of sand and gravel, overlying grey shale bedrock with hard limestone interbeds. Fill material was also encountered overlying the native material in the boreholes from the current investigation, and occasionally during the previous investigations.

5.1 Topsoil, Asphalt and Fill

A 75 mm thick topsoil layer was encountered at the ground surface in Borehole 10-01 during the current investigation. A 150 to 200 mm thick topsoil layer was also encountered at the ground surface in Boreholes 18, 104 and 99 from the previous investigations at the south end of the project.

In Borehole 10-02 from the current investigation, a 50 mm thick asphalt layer was encountered at the ground surface.

Underlying the topsoil and asphalt in Boreholes 10-01 and 10-02, was a layer of sand to sand and gravel fill extending to depths from 0.2 to 0.3 m. The sand was underlain by silty clay fill with some sand and trace gravel to depths ranging from 0.8 to 2.4 m (elev. 118.9 to 140.3 m). The silty clay fill was stiff to hard, with Standard Penetration Test (SPT) N values ranging from 13 to 36 blows per 0.3 m penetration. Moisture contents in the silty clay fill ranged from 10 to 19%.

Fill material consisting of gravelly sand with some silt was also encountered in Boreholes 104 and 99 from the previous investigations at the south end of the project. The gravelly sand fill extended from below the topsoil layer to depths ranging from 7.5 to 10.6 m (elev. 115.4 to 118.2 m). The gravelly sand fill was loose to dense with SPT N values ranging from 8 to 54 blows per 0.3 m penetration. Since the boreholes from the previous investigations were drilled from 1965 to 1967, there may be some additional fill placed at these locations. The presence of additional fill that is not shown on the borehole logs should be anticipated during construction, as well as differences in the ground surface elevations.

A sample of the silty clay fill from Borehole 10-01 was subjected to grain size distribution testing and the result is shown on Figure C1 in Appendix C. The result of an Atterberg Limit

test conducted on the sample is shown on Figure C4 and indicates that the material has low plasticity.

5.2 Silty Clay to Clayey Silt Till

The majority of the boreholes encountered glacial till ranging in composition from silty clay to clayey silt, with sand ranging from some sand to sandy, and trace gravel. The till was encountered at depths ranging from the ground surface to 12.6 m below the ground surface, (elev. ranging from 146.9 to 110.0 m), and extended to depths ranging from 1.5 to 13.9 m below the ground surface (elev. ranging from 139.8 to 108.8 m).

The till ranges in consistency from stiff to hard based on SPT N values from 11 to greater than 100 blows per 0.3 m penetration, however the majority of the N values were in the range of 33 to greater than 100 blows per 0.3 m penetration, indicating that the material is hard. The moisture content of the till ranges from 6 to 23%. Glacial tills inherently contain cobbles and boulders. The borehole logs indicate that the lower part of the till contains fragments and slabs of shale bedrock.

A sample of the silty clay till from Borehole 10-01 was subjected to grain size distribution testing and the result is shown on Figure C1 in Appendix C. The result of an Atterberg Limit test conducted on the sample is shown on Figure C4 and indicates that the material has low plasticity.

5.3 Silty Sand to Sandy Silt

A deposit of silty sand to sandy silt was encountered in several boreholes throughout the project area, generally underlying the silty clay to clayey silt till. The silty sand to sandy silt also contained trace to some clay and trace to some gravel. The deposit was encountered at depths ranging from the ground surface to 10.6 m below the ground surface (elev. ranging from 146.8 to 114.2 m), and extended to depths ranging from 2.3 to 17.4 m below the ground surface (elev. ranging from 137.7 to 110.0 m), or to the termination depths of the boreholes at 5.7 to 9.6 m below the ground surface (elev. 138.7 to 117.7 m).

SPT N values in the deposit ranged from 22 to greater than 100 blows per 0.3 m penetration, indicating that the density of the material ranges from compact to very dense, however most of the N values were greater than 100 blows per 0.3 m penetration, indicating that the deposit is generally very dense. Moisture contents in the silty sand to sandy silt deposit range from 4 to 14%. The lower part of this deposit also contains cobbles, boulders and shale bedrock fragments or slabs.

A sample of the silty sand from Borehole 10-01 was subjected to grain size distribution testing and the result is shown on Figure C2 in Appendix C.

5.4 Sand to Sand and Gravel

Deposits of sand to sand and gravel with trace to some silt were occasionally encountered in the boreholes. These deposits were encountered at depths ranging from 0.8 to 9.8 m below the ground surface (elev. ranging from 126.9 to 118.9 m). Where encountered, these deposits extended to depths of 9.4 to 10.4 m below the ground surface (elev. 126.2 to 110.3 m).

The sand to sand and gravel deposits were dense to very dense, based on SPT N values ranging from 46 to greater than 100 blows per 0.3 m penetration. Moisture contents in the deposits ranged from 3 to 19%.

Selected samples of the sand to sand and gravel deposits from Borehole 10-02 were subjected to grain size distribution testing and the results are shown on Figure C3 in Appendix C.

5.5 Bedrock

Bedrock was encountered in three boreholes (Boreholes 18, 104, and 99) from the previous investigations at the south end of the project area. The bedrock was described as grey shale with intermittent hard limestone layers to shaley limestone. Shale fragments were also encountered in one borehole at elevation 137.7 m at the north end of the project (Borehole 5). The bedrock was encountered at depths ranging from 4.3 to 17.4 m below the ground surface (elev. 111.3 to 108.8 m).

5.6 Groundwater Conditions

Water levels were observed in the boreholes from the current investigation during drilling and in standpipe piezometers installed in both boreholes following completion of drilling. The water level readings are presented in Table 5.1.

Table 5.1: Water Level Measurements

Borehole	Water Level Depth (m)	Water Level Elevation (m)	Date of Reading
10-01	Dry	Dry	May 7, 2010
	Dry	Dry	May 12, 2010
10-02	3.9	115.8	May 7, 2010
	3.8	115.9	May 12, 2010

In addition to the above readings, water levels were also recorded on several borehole logs from the previous investigations. The water level readings are shown on the borehole logs in Appendix B, but range in elevation from 145.4 to 113.2 m.

The above values are short-term readings and seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level may reach higher elevations after the spring snowmelt or after periods of heavy rainfall. Further, perched water may be encountered at higher levels in pockets or zones of more permeable sands and silts present within the heterogeneous tills, or within the fill.

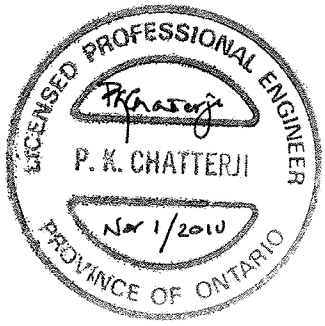
6 MISCELLANEOUS

Interpretation of the subsurface data and preparation of this report were carried out by Mr. Mark Farrant, P.Eng.

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

THURBER ENGINEERING LTD.

Mark Farrant, P.Eng.
Geotechnical Engineer



P.K. Chatterji, P.Eng.
Review Principal

Table 1 – Reference Borehole Numbers for OHS Supports

OHS Number	Location	Support Structure Type	Reference Borehole Number	Geocres Reference Number for Previous Investigations
OHS-1	Stn 9+899 Collector	Tri-chord	18	30M11-15
OHS-2	Stn 10+200 Collector	Tri-chord	104	30M11-13
OHS-3	Stn 10+334 Express	Tri-chord	99	30M11-19
OHS-4	Stn 10+700 Collector	Tri-chord	58	30M11-40
OHS-5	Stn 10+875 Express	Tri-chord	60	30M11-40
OHS-15	Dundas Off-Ramp	Tri-chord	10-02	Current Investigation
OHS-6	Stn 11+813 Collector	Cantilever	17	30M11-42
OHS-7	Stn 12+166 Express	Tri-chord	21	30M11-42
OHS-8	Stn 12+447 Collector	Tri-chord	25	30M11-42
OHS-9	Stn 12+657 Express	Tri-chord	29	30M11-42
VMS-1	Stn 12+750 Collector	VMS	30	30M11-42
OHS-16	Burnhamthorpe Off-Ramp	Tri-chord	10-01	Current Investigation
VMS-2	Stn 13+095 Express	VMS	4	30M11-49
OHS-10	Stn 13+382 Collector	Tri-chord	40	30M11-42
OHS-11	Stn 13+615 Express	Tri-chord	44	30M11-42
OHS-12	Stn 13+682 Collector	Tri-chord	44	30M11-42
OHS-13	Stn 15+301 Collector	Tri-chord	1	30M11-46
OHS-14	Stn 16+579 Collector	Cantilever	5	30M11-44

TABLE 2
GEOTECHNICAL DESIGN PARAMETERS
OVERHEAD SIGN SUPPORTS
HIGHWAY 427 SOUTHBOUND, TORONTO

OHS No.	Reference Borehole [2]	Location	Recommended Subsurface Stratigraphy For Design	Depth Below Existing Ground Surface (m)	Geotechnical Design Parameters[1]					
					q_u (kPa)	ϕ' (deg.)	n_h (MN/m^3)	γ (kN/m^3)	γ' (kN/m^3)	Groundwater Depth (m)
OHS-1	18	Stn 9+899 Collector	Topsoil	0.0 – 0.2	-	-	-	-	-	1.2 (below existing ground surface)
			Silty Sand, compact	0.2 – 1.2	-	32	5.5	20	-	
			Silty Sand, compact	1.2 – 1.9	-	32	4.0	-	10	
			Clayey Silt Till, hard	1.9 – 4.3	300	-	-	-	10	
			Shale Bedrock	4.3 – 6.4	750	-	-	-	14	
OHS-2	104	Stn 10+200 Collector	Topsoil	0.0 – 0.2	-	-	-	-	-	3.8 (below existing ground surface)
			Gravelly Sand, compact (FILL)	0.2 – 3.8	-	30	3.0	20	-	
			Gravelly Sand, compact (FILL)	3.8 – 7.5	-	30	2.0	-	10	
			Sandy Silt Till, very dense	7.5 – 12.6	-	35	7.0	-	11	
			Clayey Silt Till, hard	12.6 – 13.9	300	-	-	-	10	
			Shale Bedrock	13.9 – 15.6	750	-	-	-	14	
OHS-3	99	Stn 10+334 Express	Topsoil	0.0 – 0.2	-	-	-	-	-	11.0 (below existing ground surface)
			Gravelly Sand, compact/dense (FILL)	0.2 – 10.6	-	30	3.0	20	-	
							-	19	-	
			Sandy Silt Till, very dense	10.6 – 17.4	-	35	7.0	-	11	
			Shale Bedrock	17.4 – 19.1	750	-	-	-	14	

Notes: 1. This table must be read in conjunction with the text of this report.
2. Refer to Records of Boreholes for details.

LEGEND

q_u = Unconfined Compressive Strength (= 2 x C_u, undrained shear strength) (kPa)
ϕ' = Angle of Internal Friction (degrees)
n_h = Coefficient of Horizontal Subgrade Reaction (MN/m^3 or X 10^3 kN/m^3)
γ = Soil Unit Weight (kN/m^3)
γ' = Submerged Soil Unit Weight (kN/m^3)

Note : In order to take into account frost action and surficial disturbance, the ultimate lateral passive resistance in front of the caisson within the upper 1.2 m below final grade should be neglected in the foundation design.

OHS No.	Reference Borehole [2]	Location	Recommended Subsurface Stratigraphy For Design	Depth Below Existing Ground Surface (m)	Geotechnical Design Parameters[1]					
					q_u (kPa)	ϕ' (deg.)	n_h (MN/m^3)	γ (kN/m^3)	γ' (kN/m^3)	Groundwater Depth (m)
OHS-4	58	Stn 10+700 Collector	Clayey Silt Till, hard Clayey Silt Till, hard	0.0 – 1.2 1.2 – 4.8	300 300	- -	- -	20 -	- 10	1.2 (below existing ground surface)
OHS-5	60	Stn 10+875 Express	Sandy Silt, very dense	0.0 – 5.7	-	34	6.0	-	11	0.5 (below existing ground surface)
OHS-15	10-02	Dundas Off-Ramp	Asphalt/Sand and Gravel (FILL) Silty Clay, very stiff (FILL) Sand and Gravel, dense Sandy Silt Till, very dense Sand and Gravel, very dense Sand, very dense	0.0 – 0.2 0.2 – 0.8 0.8 – 1.4 1.4 – 2.3 2.3 – 4.0 4.0 – 9.4	- 100 - - - -	- - 34 35 35 35	- - 8.0 10 10 7.0	- 19 22 21 22 -	- - - - - 11	4.0 (below existing ground surface)
OHS-6	17	Stn 11+813 Collector	Clayey Silt Till, stiff/hard Sandy Silt to Silty Sand, very dense	0.0 – 3.0 3.0 – 7.6	175 -	- 34	- 6.0	20 -	- 11	3.0 (below existing ground surface)
OHS-7	21	Stn 12+166 Express	Clayey Silt Till, hard Silty Sand, very dense	0.0 – 5.5 5.5 – 9.3	300 -	- 34	- 6.0	- -	10 11	0.0 (below existing ground surface)
OHS-8	25	Stn 12+447 Collector	Clayey Silt Till, very stiff/hard Clayey Silt Till, very stiff/hard Sand and Gravel, very dense	0.0 – 1.1 1.1 – 9.8 9.8 – 10.4	250 250 -	- - 35	- - 7.0	20 - -	- 10 12	1.1 (below existing ground surface)
OHS-9	29	Stn 12+657 Express	Clayey Silt Till, hard Silty Sand, very dense	0.0 – 4.7 4.7 – 6.9	300 -	- 34	- 6.0	20 -	- 11	4.7 (below existing ground surface)
VMS-1	30	Stn 12+750 Collector	Clayey Silt Till, hard Sandy Silt to Silty Sand, very dense	0.0 – 4.6 4.6 – 7.5	300 -	- 34	- 6.0	20 -	- 11	4.6 (below existing ground surface)

Note : In order to take into account frost action and surficial disturbance, the ultimate lateral passive resistance in front of the caisson within the upper 1.2 m below final grade should be neglected in the foundation design.

OHS No.	Reference Borehole [2]	Location	Recommended Subsurface Stratigraphy For Design	Depth Below Existing Ground Surface (m)	Geotechnical Design Parameters[1]					
					q_u (kPa)	ϕ' (deg.)	n_h (MN/m^3)	γ (kN/m^3)	γ' (kN/m^3)	Groundwater Depth (m)
OHS-16	10-01	Burnhamthorpe Off-Ramp	Topsoil and Sand (FILL) Silty Clay, stiff/hard (FILL) Sandy Silt, dense Silty Clay Till, hard Silty Sand, very dense	0.0 – 0.3 0.3 – 2.4 2.4 – 3.0 3.0 – 4.6 4.6 – 9.3	- 100 - 200 -	- - 32 - 34	- - 5.5 - 8.0	- 19 21 19 21	- - - - -	>9.3 (below existing ground surface)
VMS-2	4	Stn 13+095 Express	Clayey Silt Till, hard Silty Sand, very dense	0.0 – 1.5 1.5 – 9.6	300 -	- 34	- 6.0	20 -	- 11	1.5 (below existing ground surface)
OHS-10	40	Stn 13+382 Collector	Clayey Silt Till, very stiff/hard Silty Sand to Sand, very dense	0.0 – 3.4 3.4 – 7.6	250 -	- 34	- 8.0	20 21	- -	>7.6 (below existing ground surface)
OHS-11, OHS-12	44	Stn 13+615 Express, Stn 13+682 Collector	Clayey Silt Till, very stiff/hard	0.0 – 6.1	250	-	-	20	-	>6.1 (below existing ground surface)
OHS-13	1	Stn 15+301 Collector	Clayey Silt Till, stiff/hard Clayey Silt Till, hard Silty Sand, very dense	0.0 – 1.5 1.5 – 7.0 7.0 – 8.1	175 300 -	- - 34	- - 6.0	20 -	- 10 11	1.5 (below existing ground surface)
OHS-14	5	Stn 16+579 Collector	Sandy Silt to Silt, very dense Silty Sand, very dense Shale Fragments	0.0 – 6.1 6.1 – 9.1 9.1 – 9.6	- - -	32 34 34	5.5 6.0 6.0	21 - -	- 11 11	5.8 (below existing ground surface)

Note : In order to take into account frost action and surficial disturbance, the ultimate lateral passive resistance in front of the caisson within the upper 1.2 m below final grade should be neglected in the foundation design.

Appendix A

Borehole Logs – Current Investigation

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[(1)] '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

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

$\underline{\blacktriangledown}$ Water Level

C_{pen} 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			

Table A-1 – Borehole Completion Details

Location	Details	
	Piezometer Tip Depth/ Elevation (m)	**Completion Details**
10-01	9.1 / 133.6	Piezometer with 1.5 m slotted screen installed with sand filter to 7.3 m and bentonite from 7.3 m to ground surface.
10-02	8.2 / 111.5	Piezometer with 1.5 m slotted screen installed with sand filter to 6.4 m, bentonite seal from 6.4 m to 0.3 m, sand from 0.3 m to 0.2 m, and asphalt with a flushmount casing from 0.2 m to ground surface.

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 10-01 1 OF 2 METRIC

G.W.P. 2219-03-00 LOCATION N 4 833 948.9 E 299 537.4 ORIGINATED BY GA
HWY 427 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2010.07.05 - 2010.07.05 CHECKED BY MEF

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (o UNCONFINED, • QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
142.7											
0.0 / 142.4	**TOPSOIL:** (75mm)										
0.1	**SAND**, trace rootlets Brown Dry (FILL)		1	SS	20				o		
0.3	Silty **CLAY**, sandy, trace gravel Stiff to Hard Brown to Grey (FILL)(CL)		2	SS	13		142		o		
140.3			3	SS	36		141		o⊢		2 33 45 20
2.4	Sandy **SILT**, trace gravel Dense Grey Moist		4	SS	31		140		o		
139.7											
3.0	Silty **CLAY**, sandy, trace gravel Hard Grey (TILL)(CL)		5	SS	33		139		o⊢		2 32 43 23
138.1											
4.6	Silty **SAND**, some clay, trace gravel Very Dense Brown Dry		6	SS	101		138		o		
			7	SS	150/ 0.125		137		o		
			8	SS	100/ 0.150		136				
133.4			9	SS	100/ 0.125		135		o		5 47 33 15
9.3	END OF BOREHOLE AT 9.3m. BOREHOLE OPEN TO 9.3m AND DRY. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe						134		o		

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 1163.GPJ 5/12/10

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 10-01 2 OF 2 METRIC

G.W.P. 2219-03-00 LOCATION N 4 833 948.9 E 299 537.4 ORIGINATED BY GA
HWY 427 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2010.07.05 - 2010.07.05 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: O UNCONFINED + FIELD VANE; ● QUICK TRIAXIAL × LAB VANE; 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	with a 1.52m slotted screen.										
	WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) May 07/ 10 Dry - May 12/ 10 Dry -										

+ ^{3}, × ^{3}: Numbers refer to Sensitivity

15 (20/10) 5 (%) STRAIN AT FAILURE

ONTMT4S 1163.GPJ 5/12/10

Ministry of Transportation
Ontario

RECORD OF BOREHOLE No 10-02 1 OF 2 METRIC

G.W.P. 2219-03-00 LOCATION N 4 832 065.4 E 300 023.7 ORIGINATED BY GA
HWY 427 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2010.07.05 - 2010.07.05 CHECKED BY MEF

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
119.7									
0.0	**ASPHALT:** (50mm)								
0.2	**SAND** and **GRAVEL**, (Crusher Run) Brown Dry (FILL)		1	SS	20				
118.9							119		
0.8	Silty **CLAY**, some sand, trace gravel Very Stiff Grey (FILL)		2	SS	46				40 43 17 (SI+CL)
118.3									
1.4	**SAND** and **GRAVEL**, some silt Dense Brown Dry		3	SS	111		118		
117.4	Sandy **SILT**, trace gravel Very Dense Brown to Grey Dry (TILL)		4	SS	117		117		42 41 17 (SI+CL)
2.3	**SAND** and **GRAVEL**, some silt Very Dense Brown Dry Becoming grey Wet		5	SS	110				
115.6							116		
4.1	**SAND**, some silt, trace gravel Very Dense Grey Wet		6	SS	116		115		
			7	SS	110		114		1 89 10 (SI+CL)
			8	SS	115		113		
							112		
110.3			9	SS	126		111		
9.4	END OF BOREHOLE AT 9.4m. BOREHOLE OPEN TO 8.2m AND WATER LEVEL AT 3.9m.								

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100
SHEAR STRENGTH kPa 20 40 60 80 100
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE
PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L
WATER CONTENT (%) 20 40 60

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 1163.GPJ 5/12/10

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 10-02 2 OF 2 METRIC

G.W.P. 2219-03-00 LOCATION N 4 832 065.4 E 300 023.7 ORIGINATED BY GA
HWY 427 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2010.07.05 - 2010.07.05 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
	Continued From Previous Page										
	Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) May 07/ 10 3.9 115.8 May 12/ 10 3.8 115.9										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$15 \overset{20}{\oplus} 5$ 10 (%) STRAIN AT FAILURE

ONTMT4S 1163.GPJ 5/12/10

Appendix B

Borehole Logs – Previous Investigations

References for Borehole Logs

- Supplementary Foundation Investigation Report for QEW and Highway #27 Interchange Twp. of Etobicoke, Overpass, W.P. 275-44-1 and W.P. 275-64-4, W.J. 67-F-104, GEOCRES 30M11-15, 1966.

- Supplementary Foundation Investigation Report for QEW and Highway #27 Interchange Twp. of Etobicoke, Overpass, W.P. 275-44-1 and W.P. 275-64-4, W.J. 67-F-104, GEOCRES 30M11-13, 1966.

- Supplementary Foundation Investigation Report for QEW and Highway #27 Interchange Twp. of Etobicoke, Overpass, W.P. 275-44-1 and W.P. 275-64-4, W.J. 67-F-104, GEOCRES 30M11-19, 1966.

- Foundation Investigation Report for Proposed Retaining Walls at the Dundas St. and Hwy #27 Interchange, District #6 (Toronto), W.J. 67-F-37, W.P. 275-64-2, GEOCRES 30M11-40, 1967.

- Soils Investigation at the Site of the Proposed Trunk Sewer, Hwy #27 West Side, District No. 6 (Toronto), W.J. 67-F-101, W.P. 178-67-1, GEOCRES 30M11-42, 1967.

- Foundation Investigation Report for Contract #8 (Blue) Hwy #27 Improvement, District #6 (Toronto), W.J. 67-F-16, W.P. 275-64-3, GEOCRES 30M11-49, 1967.

- Foundation Investigation Report for Proposed Retaining Walls at the Site of Hwy #401, 27 and Richview Expressway Interchange, District 6 (Toronto), W.J. 67-F-68, W.P. 201-62-1, GEOCRES 30M11-46, 1967.

- Foundation Investigation Report for the Proposed Trunk Sewer Project At Hwy #401 and Hwy #27, District #6 (Toronto), W.J. 67-F-35, W.P. 201-62, GEOCRES 30M11-44, 1967.

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 18

FOUNDATION SECTION

JOB 65-F-104 LOCATION 179,809 N 208,521 E ORIGINATED BY P.Mc

W.P. 275-64-1 BORING DATE Oct. 15, 1965. COMPILED BY H.S.

DATUM G.S.C. BOREHOLE TYPE Washboring - NX Casing. CHECKED BY GVK

SOIL PROFILE			SAMPLES				DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 25 50 75 100 125 SHEAR STRENGTH P.S.F.	LIQUID LIMIT w_L PLASTIC LIMIT w_P WATER CONTENT w WATER CONTENT % 20 40 60	BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE				
114.4m 375.4	Groundlevel									
	Topsoil									
0.8 / 0.2m	Silty sand with some gravel. Compact.		1	SS	22			o		GWL Below 4.0'
369.1 / 112.5m 6.3 / 1.9m	Clayey silt with sand & gravel & fragments of shale below elev. 366.1 (Glacial Till) Very dense.		2	SS	90 for 3"	370		o		
			3	SS	130 for 6"			o		
			4	SS	100 for 5"			o		
361.4 / 110.2m 14.0 / 4.3m	Shaley limestone with intermittent limestone.		5	RC	89%					
			6	RC	93%	360				
354.5 / 108.1m 20.9 / 6.4m	End of borehole.					350				

OUR REFERENCE NO 6 - 6 - 24

GEOTECHNICAL DATA SHEET FOR BOREHOLE . . 104 .

CLIENT: D. H. O.
PROJECT. Q.E.W. & HWY. Nº 27 INTERCHANGE
LOCATION. 180, 705 N.; 208,332 E.
DATUM ELEVATION: G. S. C.

METHOD OF BORING AUGERING & WASHBORING
DIAMETER OF BOREHOLE 2 3/8"
DATE. JUNE 24 & 25, 1966
W.P. 35-65
ENCLOSURE NO

ELEVATION ft	DEPTH ft	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES —N— or Advancement of Sampler	PENETRATION RESISTANCE blows per foot 2,0 4,0 6,0 8,0 10ρ / SHEAR STRENGTH lbs./sq ft	CONSISTENCY water content % PL W Ll	REMARKS
402.4 / 122.7 m	0	GROUND SURFACE							
		6" TOPSOIL							
400.0		Generally Loose to Compact Brown GRAVELLY SAND with some SILT (FILL)		1	S.S.	8			
395.0	5								
	10			2	S.S.	10			Gr. 17 % ; Sa 62 % Si. 20 %
390.0									W.L. 390.0 Ft. JUNE 28. 1966.
	15			3	S.S.	21			
385.0									
	20			4	S.S.	9			Gr. 32 % ; Sa. 56 % Si ~ %
380.0									
378.9 / 115.4 m	24.5 / 25	7.5 m							
		Very Dense Brown / Grey SANDY SILT with a trace of GRAVEL and CLAY (GLACIAL TILL)		5 A/B	S.S.	58/6"			
375.0				6	S.S.	86			Gr. 4 % ; Sa. 33 % Si. 48 % ; Cl. 15 %
	30			7	S.S.	73/6"			
370.0				8	W.S.				
				9	S.S.	58/6"			Gr. 1 % ; Sa. 31 % Si. 65 % ; Cl. 3 %
	35			10	S.S.	25/½"			
365.0									
	40			11	S.S.	79/3"			
110.0 m		12.6 m							
360.9	41.5	alternate layers of Hard CLAYEY SILT and SHALE		12	R.C.	28·1%			
360.0									
	45	13.9 m							
356.9 / 108.8 m	45.5	Dark Grey SHALE with intermittent LIMESTONE bands BEDROCK		13	R.C.				
355.0				14	R.C.	72·7%			
	50			15	R.C.	92·3%			
351.9 / 107.1 m	51·1 / 51·1	15.6 m							
350.0		END OF BOREHOLE							

VERTICAL SCALE. 1 IN TO 5 FT.

DOMINION SOIL INVESTIGATION LIMITED

MADE D.A.M. CH'D.

GEOTECHNICAL DATA SHEET FOR BOREHOLE . 99 . .

OUR REFERENCE NO 6-6-25

CLIENT D.H.O.
PROJECT O.E.W. & HWY. no. 27 INTERCHANGE
LOCATION 181,760 N ; 207,987 E
DATUM ELEVATION G.S.C.

METHOD OF BORING AUGERING & WASHBORING
DIAMETER OF BOREHOLE 4½" – 2⅜"
DATE JUNE 21 – 23, 1966
W.P. 276-64
ENCLOSURE NO

ELEVATION ft	DEPTH ft	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES % OF RECOVERY	PENETRATION RESISTANCE blows per foot 2,0 4,0 6,0 8,0 10,0 / SHEAR STRENGTH tons/sq ft	CONSISTENCY water content % PL W LL	REMARKS
422.5	0	GROUND SURFACE							
128.8m		8" TOPSOIL							
420.0		Generally Compact To Dense Brown GRAVELLY SAND with some SILT (FILL)		1	SS	33			
415.0	5								
	10			2	SS	17			
410.0									
	15			3	SS	24			
405.0									
	20			4	SS	15			HOLE DRY CAVE – IN 401 Ft JUNE 25. 1966.
400.0									
	25			5	SS	35			
395.0									
	30			6	SS	54			
390.0									
	35			7	W.S				
387.4		10.6m							
118.2m		Dark Brown Organic SANDY SILT		8	SS	47			
117.7m 386.0	36.5								W L 386.3 Ft. JUNE 24, 1966.
385.0		16.1m Very Dense SANDY SILT with some GRAVEL and CLAY (GLACIAL TILL)		9	SS	96			
	40			10	SS	85/9"			
380.0				11	SS	85/9"			
	45	Brown / Grey		12	SS	94			
375.0	47			13		5½			
		Numerous SHALE Fragments and BOULDERS		14	RC	25.7%			
	50			15	SS	75/5"			
370.0				16	RC	100%			
	55			17	RC	19.7%			
365.0	57.0	17.4m							
111.3m	60	Grey SHALE with bands of LIMESTONE		18	RC	68.5%			
360.0		19.1m BEDROCK		19	RC	70.5%			
109.7m		END OF BOREHOLE							
	65								

FORM OR MT-126
66-4546

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 58

FOUNDATION SECTION

JOB 67-F-37 LOCATION Hwy. 27, 182,535 N; 207,590 E. ORIGINATED BY KAL
W.P. 275-64-2 BORING DATE May 3, 1967 COMPILED BY AP
DATUM Geodetic BOREHOLE TYPE Cont. Flight Auger CHECKED BY

SOIL PROFILE ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT — SHEAR STRENGTH P.S.F.	LIQUID LIMIT w_L / PLASTIC LIMIT w_p / WATER CONTENT w — WATER CONTENT % (10, 20, 30)	BULK DENSITY P.C.F.	REMARKS
397.0 / 0.0	GROUND LEVEL									
121.0 m	Clayey silt becoming sandy silt with some clay.									▼ 393.0
			1	SS	13½	390		o		
	Very dense & hard		2	SS	100/6"			o —		
381.2 / 116.2 m			3	SS	100/3½"			▼		Gr.2, Sa.35 Si.56, Cl.7
15.8 / 4.8 m	End of Borehole					380				

FORM DB-MT-126
66-4546

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 60

FOUNDATION SECTION

JOB 67-P-37 LOCATION Hwy. 27, 133,180 N; 207,370 E. ORIGINATED BY AP

W.P. 275-64-2 BORING DATE May 3, 1967 COMPILED BY BRG

DATUM Geodetic BOREHOLE TYPE Cont. Flight Auger CHECKED BY [illegible]

SOIL PROFILE			SAMPLES				DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT / SHEAR STRENGTH P.S.F.	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w	BULK DENSITY γ P.C.F.	REMARKS
ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE		WATER CONTENT % 10 20 30		
123.4m / 404.7	GROUND LEVEL									
0.0	Sandy silt with traces of gravel and clay.		1	SS	185	400		o		▽ 403.0 May 4/67
	Very dense.		2	SS	170/10"			o		
			3	SS	100/4½"	390		o		
386.1 / 117.7m			4	SS	200/7"			o		Gr. 6, Sa. 41 Si. 47, Cl. 6
18.6 / 5.7m	End of Borehole									

FORM 08-MT-126
66-4546

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 17

FOUNDATION SECTION

JOB 67-F-101 LOCATION Co-ord. 186,233 N; 206,322 E. ORIGINATED BY SN
W.P. 275-64-2 & 3 BORING DATE Oct. 27, 1967 COMPILED BY AKB
DATUM Geodetic BOREHOLE TYPE Auger CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT / SHEAR STRENGTH P.S.F.	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w — WATER CONTENT % 10 20 30	BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT					
432.1 / 0.0	131.7 m Ground Level									
	Clayey silt with sand & gravel.		1	SS	11	430				
	Stiff to hard.		2	SS	28					
422.1 / 10.0	128.7 m Brown		3	SS	68					▼ 422.0'
	Sandy silt to silty sand with gravel.		4	SS	~~100/6"~~	420				
	Very dense.		5	SS	~~100/6"~~					
406.6 / 25.0	123.9 m Grey		6	SS	~~100/3"~~	410				
	End of Borehole									

FORM 08-MT-126
66-4546

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 21

FOUNDATION SECTION

JOB 67-F-101
W.P. 275-64-2 & 3
DATUM Geodetic
LOCATION Co-ord. 187,242 N; 206,237 E.
BORING DATE Oct. 25, 1967
BOREHOLE TYPE Auger
ORIGINATED BY SN
COMPILED BY AKB
CHECKED BY AKB

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT — SHEAR STRENGTH P.S.F.	LIQUID LIMIT — WL; PLASTIC LIMIT — WP; WATER CONTENT — W; WP W WL; WATER CONTENT % 10 20 30	BULK DENSITY γ P.C.F.	REMARKS
131.2 m / 430.3	Ground Level									WL at ground
0.0	Clayey silt with sand and gravel. Hard. Brown		1	SS	52					
420.8 / 128.3 m			2	SS	43					
9.5 / 2.9 m	Clayey silt to silt Hard Grey		3	SS	100/4"	420				
412.8 / 125.8 m			4	SS	100/4"					
			5	SS	100/3"					
18.0 / 5.5 m	Silty sand, some gravel. Very dense. Grey		6	SS	100/4"	410				
399.8 / 121.9 m			7	SS	100/3"					Gr. 11. Sa. 54 Si. 32 Cl. 3
30.5 / 9.3 m	End of Borehole		8	SS	100/5"	400				

FORM OB-MT-126
66-4546

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 25

FOUNDATION SECTION

JOB 67-F-101 LOCATION Co-ord. 188,160 N; 206,045 E. ORIGINATED BY SN

W.P. 275-64-2 & 3 BORING DATE Oct. 23, 1967 COMPILED BY AKB

DATUM Geodetic BOREHOLE TYPE Auger CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT — SHEAR STRENGTH P.S.F.	LIQUID LIMIT — w_L PLASTIC LIMIT — w_P WATER CONTENT — w WATER CONTENT % 10 20 30	BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT					
136.6m / 448.2	Ground Level									
0.0	Clayey silt with sand and gravel. Very stiff to Hard. Brown		1	SS	25	440				▼444.7'
			2	SS	55					
			3	SS	87					
435.7 / 132.8m			4	SS	75					
12.5 / 3.8m	Clayey silt, some sand and gravel. Hard. Grey		5	SS	60	430				
			6	SS	54					
			7	SS	76	420				
416.2 / 126.9m										
32.0 / 9.8m 416.0	Sand with gravel		8	SS	100/2"	410				
34.2 / 10.4m	End of Borehole									

FORM 08-MT-126
66-4546

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 29

FOUNDATION SECTION

JOB 67-F-101 LOCATION Co-ords. 188,894 N; 205,815 E. ORIGINATED BY HS
W.P. 275-64-2 & 3 BORING DATE Nov. 2, 1967 COMPILED BY AKB
DATUM Geodetic BOREHOLE TYPE Auger CHECKED BY

SOIL PROFILE			SAMPLES				DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT / SHEAR STRENGTH P.S.F.	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w	BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE		WATER CONTENT % (10 20 30)	P.C.F.	
138.7 m / 455.0	Ground Level									
0.0	Clayey silt with some sand & gravel. Hard. Brown					450				
			1	SS	111			o		
443.0 / 135.0 m			2	SS	124			o		
12.0 / 439.5	Clayey silt with sand & gravel. Hard. Grey		3	SS	108	440		o		▼ 439.5'
15.5 / 4.7 m	Silty sand, traces of gravel.		4	SS	157/11"			o		
			5	SS	100/6"			o		
432.5 / 131.8 m	Very dense.		6	SS	100/5"			o		
22.5 / 6.9 m	End of Borehole					430				

FORM OB-MT-126
56-4846

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 30

FOUNDATION SECTION

JOB 67-F-101 LOCATION Co-ords. 189,070 N; 205,760 E. ORIGINATED BY HS
W.P. 275-64-2 & 3 BORING DATE Nov. 3, 1967 COMPILED BY AKB
DATUM Geodetic BOREHOLE TYPE Auger CHECKED BY

SOIL PROFILE			SAMPLES				DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT / SHEAR STRENGTH P.S.F.	LIQUID LIMIT — w_L / PLASTIC LIMIT — w_P / WATER CONTENT — w / WATER CONTENT %	BULK DENSITY γ P.C.F.	REMARKS
ELEV. / DEPTH 139.1 m / 456.3	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE				
0.0	Clayey silt with sand and gravel. Hard Brown		1	SS	80	450				
			2	SS	177/10"			o		
441.3 / 134.5 m			3	SS	176/10"			o		
15.0 / 4.6 m	Sandy silt to silty sand, traces of gravel		4	SS	100/4"	440		o		▽438.3'
			5	SS	100/4"			o		
431.8 / 131.6 m	Very dense.		6	SS	100/5"			o		
24.5 / 7.5 m	End of Borehole									

FORM 08-MT-126
66-4546

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 4

FOUNDATION SECTION

JOB 67-F-16
W.P. 262-65
DATUM Geodetic

LOCATION Co-ord. 190,160 N; 205,525 E.
BORING DATE June 9, 1967
BOREHOLE TYPE Cont. Flight Auger

ORIGINATED BY KL
COMPILED BY KL; BG
CHECKED BY [illegible]

SOIL PROFILE			SAMPLES				DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w	BULK DENSITY γ P.C.F.	REMARKS
ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F.	WATER CONTENT % (10, 20, 30)		
457.0 / 139.3 m	Ground Level									
0.0 / 452.0 / 137.8 m	Clayey silt, trace of sand and gravel. Hard.		1	SS	83					▼ 451.0'
5.0 / 1.5 m	Silty sand with gravel, traces of clay. Very dense.		2	SS	44	450				
			3	SS	88					
			4	SS	100/4"					Gr.15, Sa.54 Si.& Cl.31
			5	SS	100/3"	440				
			6	SS	100/1"					
			7	SS	110/6"	430				
425.5 / 129.7 m			8	SS	100/1.5"					
31.5 / 9.6 m	End of Borehole									

FORM OB-MT-126
66-4846

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 40

FOUNDATION SECTION

JOB 67-F-101 LOCATION Co-Ords. 190,861 N; 205,144 E. ORIGINATED BY SN
W.P. 275-64-2 & 3 BORING DATE Nov. 3, 1967 COMPILED BY AKB
DATUM Geodetic BOREHOLE TYPE Auger CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT / SHEAR STRENGTH P.S.F.	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w — WATER CONTENT % 10 20 30	BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT					
460.4 / 0.0	140.3m Ground Level									
	Clayey silt with some organics, traces of sand & gravel. Very stiff to hard.		1	SS	18					
			2	SS	41					
449.4 / 11.0	137.0m Brown		3	SS	34	450				
3.4m	Silty sand to sand		4	SS	92					
	Very dense		5	SS	115					
			6	SS	117					
	Brown		7	SS	142	440				
435.4 / 25.0	132.7m End of Borehole		8	SS	124					
7.6m										

FORM 08-MT-126
66-4546

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 44

FOUNDATION SECTION

JOB 67-F-101 LOCATION Co-ords. 191,672 N; 204,920 E. ORIGINATED BY SN
W.P. 275-64-2 & 3 BORING DATE November 1, 1967 COMPILED BY AKB
DATUM Geodetic BOREHOLE TYPE Auger CHECKED BY

SOIL PROFILE			SAMPLES				DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w	BULK DENSITY	REMARKS
ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F.	WATER CONTENT % (10 20 30)	γ P.C.F.	
464.2 / 141.5m	Ground Level									
0.0	Clayey silt with sand & gravel. Very stiff to hard		1	SS	19	460		o		
454.7 / 138.6m	Brown		2	SS	45			o		
9.5			3	SS	105			o		
2.9m	Clayey silt, trace of sand & gravel. Hard		4	SS	100/4"					
444.2 / 135.4m	Grey		5	SS	100/4"	450		o		
			6	SS	57					
20.0 / 6.1m	End of Borehole									

FORM OEI-MT-126
66-4546

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

JOB 67-F-68
W.P. 201-62-1
DATUM Geodetic

LOCATION Co-ord 866,132 N; 980,874 E.
BORING DATE August 1, 1967
BOREHOLE TYPE Penn Drill

ORIGINATED BY BRG
COMPILED BY BRG
CHECKED BY [illegible]

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT / SHEAR STRENGTH P.S.F.	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w — WATER CONTENT %	BULK DENSITY γ P.C.F.	REMARKS
ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT					
481.8 / 146.9m	Ground Level									
0.0	Clayey silt with sand and gravel.					480				
			1	SS	14					▼ 477.0
			2	SS	35					
	Stiff to hard.		3	SS	43					
			4	SS	127	470				
			5	SS	140					
458.8 / 139.8m			6	SS	33	460				
23.0 / 455.2	Silty sand, some gravel. Very dense.		7	SS	72					Gr.4, Sa.49 Si.46, Cl.1
26.6 / 8.1m	End of Borehole									

FORM 08-MT-126
66-4546

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 5

FOUNDATION SECTION

JOB 67-F-35 LOCATION 868,631 N; 980,141 E, ORIGINATED BY AKB
W.P. BORING DATE April 24, 1967 COMPILED BY AKB
DATUM Geodetic BOREHOLE TYPE Continuous Flight auger CHECKED BY

SOIL PROFILE			SAMPLES				DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT; SHEAR STRENGTH P.S.F.	LIQUID LIMIT W_L; PLASTIC LIMIT W_P; WATER CONTENT w; W_P — w — W_L; WATER CONTENT % (10 20 30)	BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE				
146.8m / 481.7	GROUND LEVEL									
0.0	Sandy silt to silt with traces of gravel & clay. Very dense.		1	SS	26	480				
			2	SS	45					
			3	SS	40					
			4	SS	127	470				
			5	SS	74					
461.7 / 140.7m										
20.0 / 6.1m	Grey silty sand with some clay. Very dense.		6	SS	87	460				▼ WL. 462,7
			7	SS	135/5"					Gr.8, Sa.57 Si.& Cl.35
451.7 / 137.7m										
30.0	Shale fragements		8	SS	125/5"	450				Gr.12, Sa.21 Si.45, Cl.22
31.5 / 9.6m	End of Borehole									
						440				

Appendix C

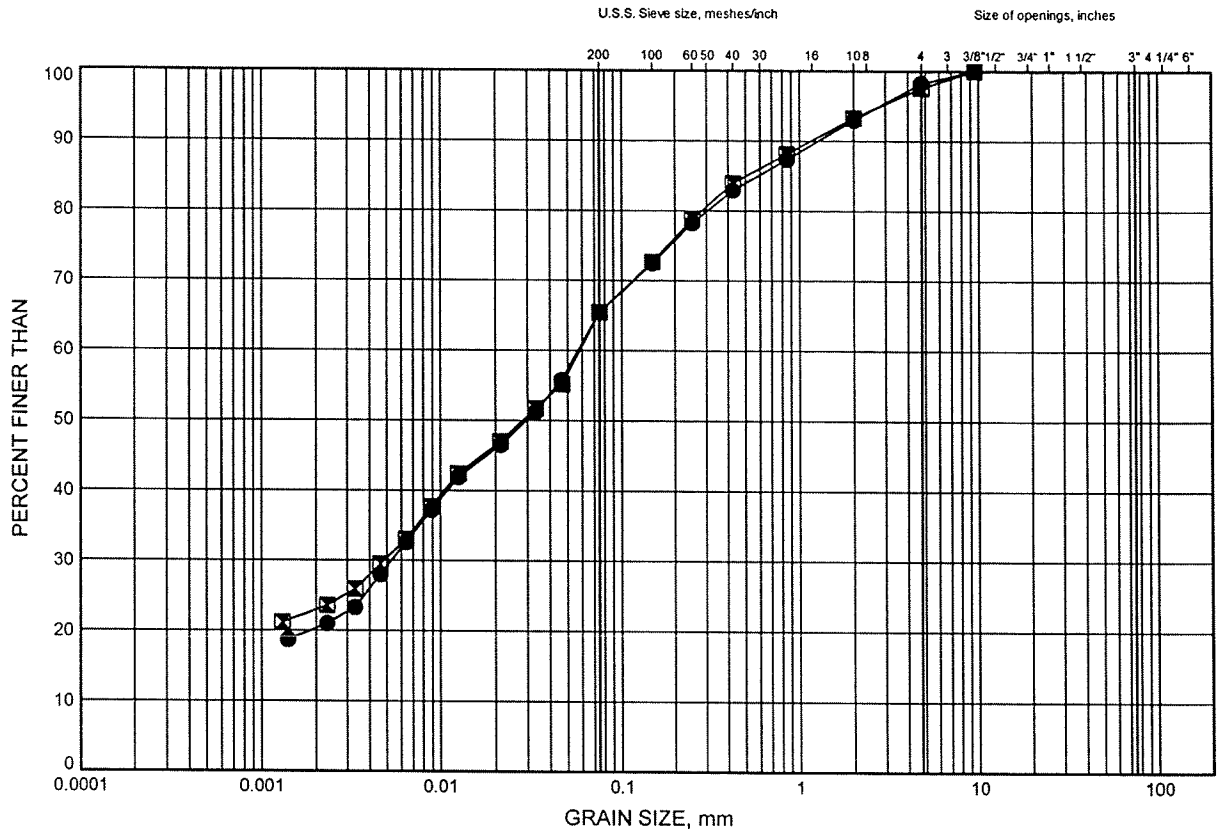
Geotechnical Laboratory Test Results

Highway 427 SBL

GRAIN SIZE DISTRIBUTION

FIGURE C1

SILTY CLAY FILL & GLACIAL TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	10-01	1.83	140.87
⊠	10-01	3.35	139.35

W.P.# 2219-03-00
Prepared By AN
Checked By MEF

THURBER

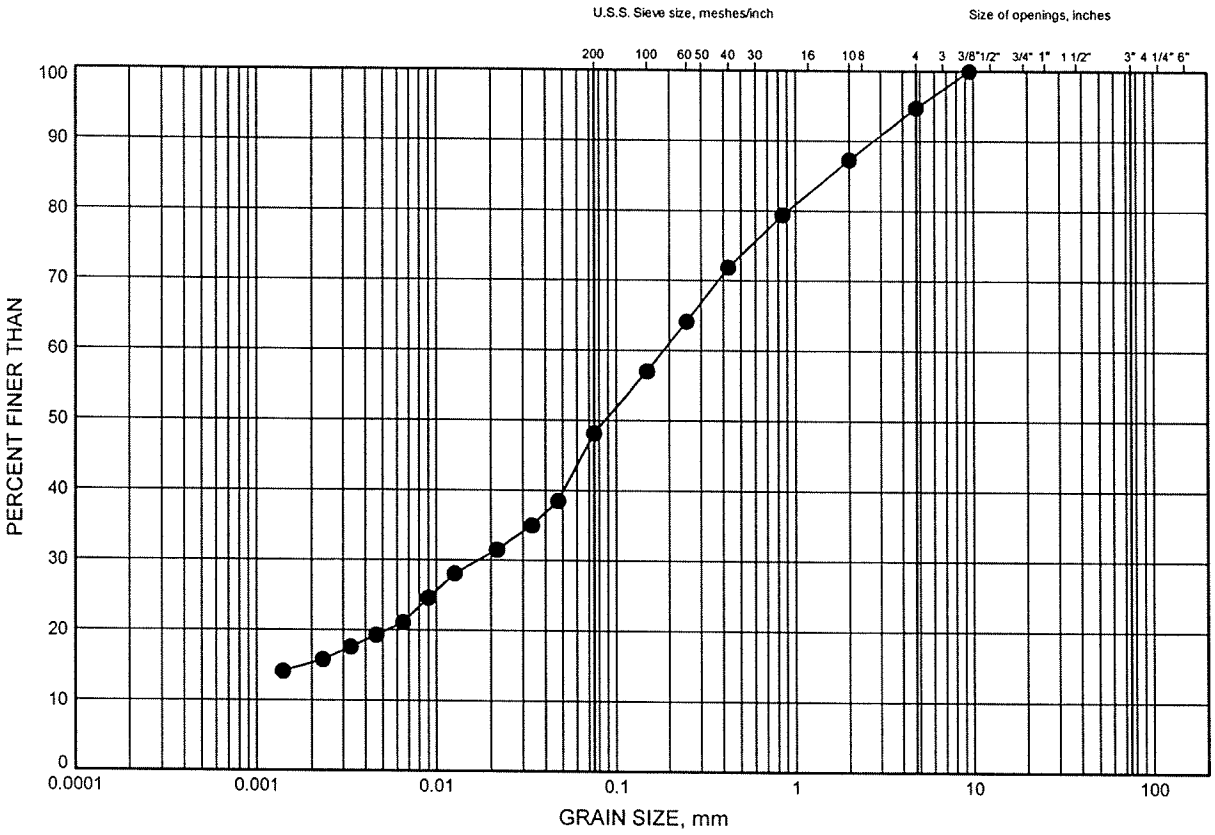
GRAIN SIZE DISTRIBUTION - THURBER 1163.GPJ 5/12/10

Highway 427 SBL

GRAIN SIZE DISTRIBUTION

FIGURE C2

SILTY SAND, Some Clay



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	10-01	7.92	134.78

W.P.# 2219-03-00
Prepared By AN
Checked By MEF

THURBER

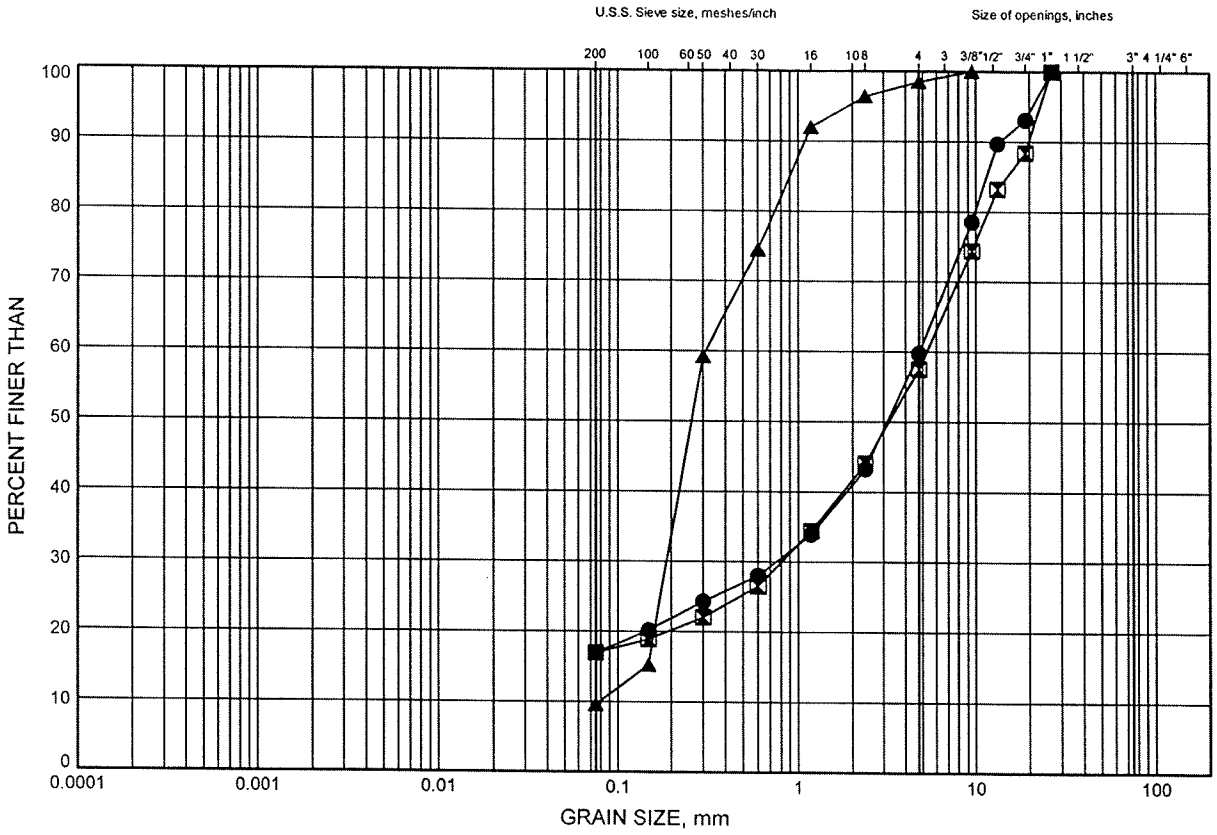
GRAIN SIZE DISTRIBUTION - THURBER 1163.GPJ 5/12/10

Highway 427 SBL

GRAIN SIZE DISTRIBUTION

FIGURE C3

SAND to SAND & GRAVEL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	10-02	1.07	118.63
⊠	10-02	2.59	117.11
▲	10-02	6.40	113.30

W.P.# 2219-03-00
Prepared By AN
Checked By MEF

THURBER

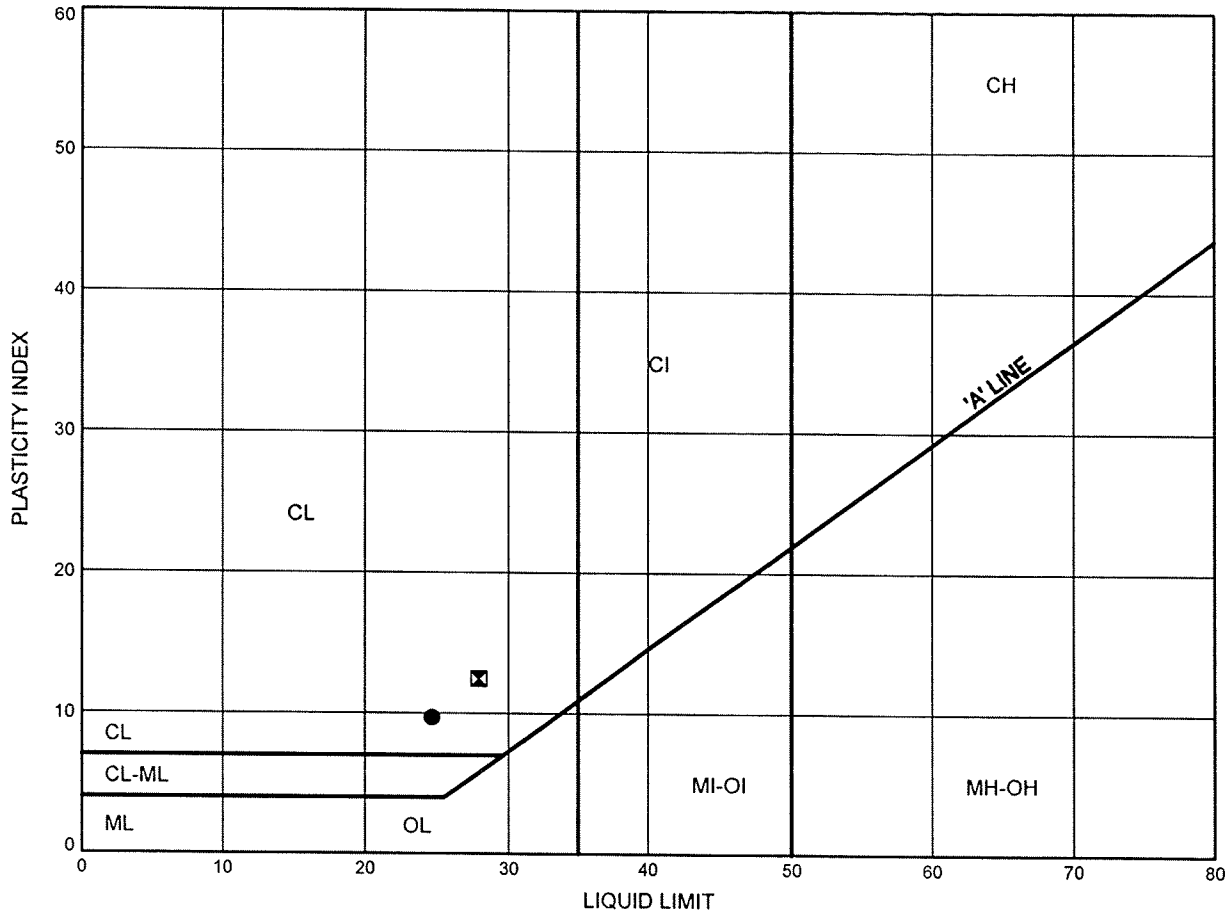
GRAIN SIZE DISTRIBUTION - THURBER 1163.GPJ 5/12/10

Highway 427 SBL

ATTERBERG LIMITS TEST RESULTS

FIGURE C4

SILTY CLAY FILL & GLACIAL TILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	10-01	1.83	140.87
⊠	10-01	3.35	139.35

Date May 2010

Project 2219-03-00

THURBER

Prep'd AN

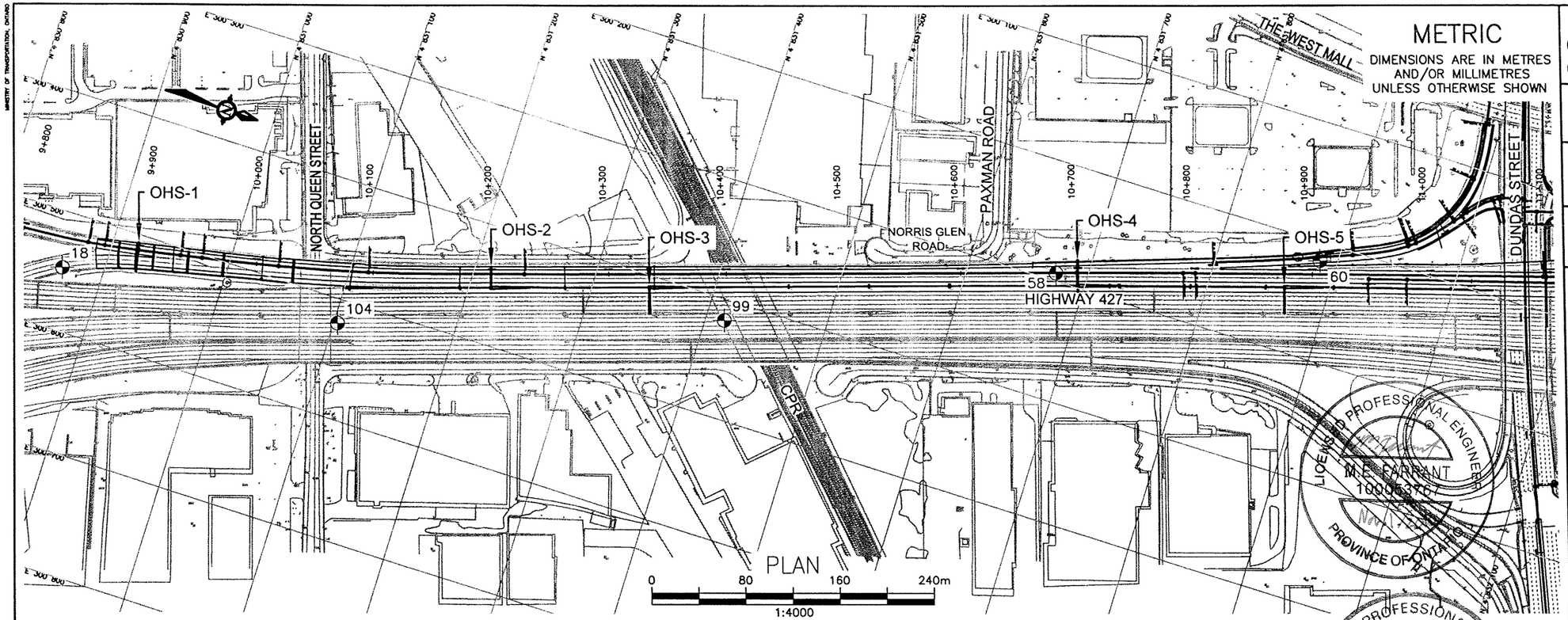
Chkd. MEF

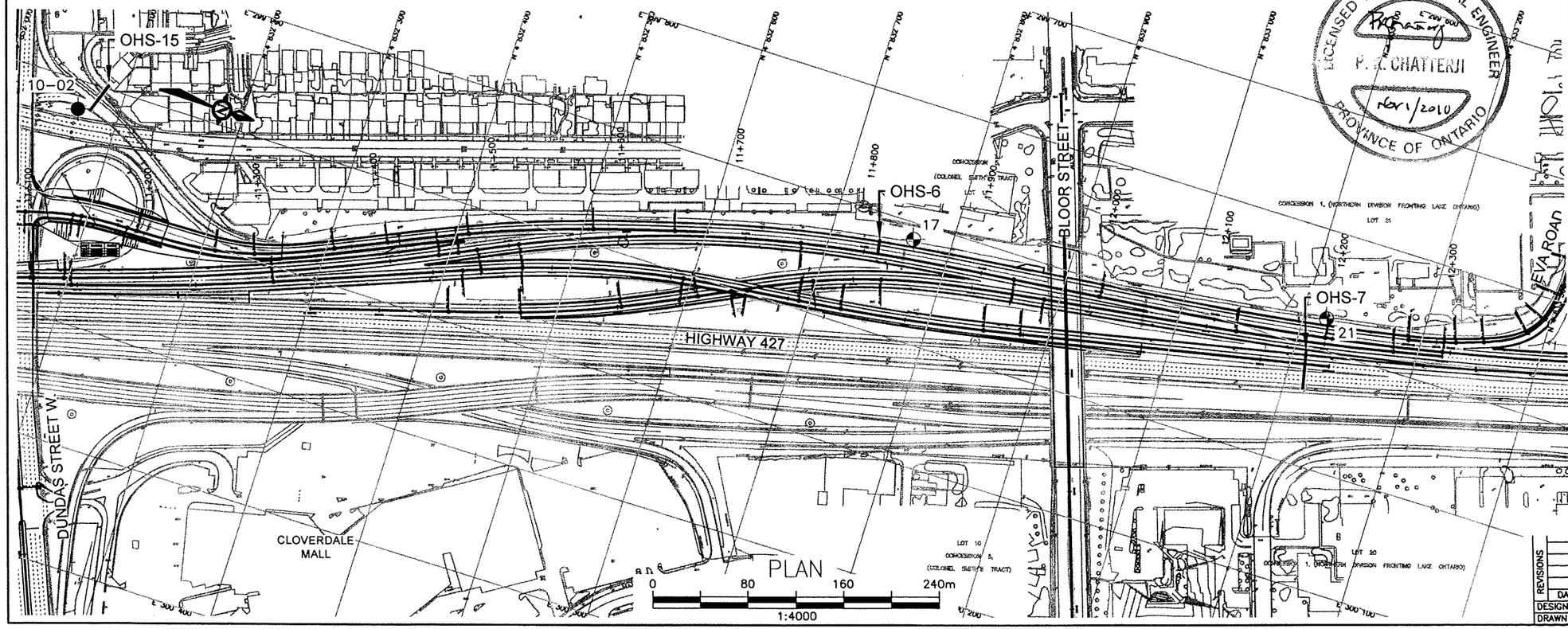
THURBALT 1163.GPJ 5/12/10

Appendix D

Borehole Location Drawings

MINISTRY OF TRANSPORTATION, ONTARIO





METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

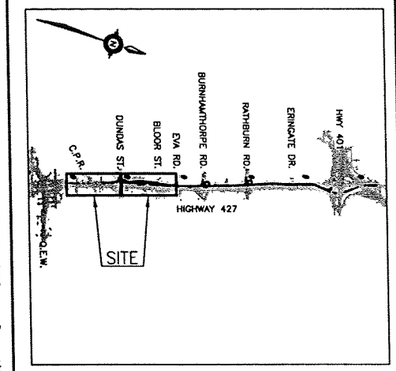
CONT No
GWP No 2219-03-00

HIGHWAY 427 SOUTHBOUND
HIGHWAY 401 TO Q.E.W
OVERHEAD SIGN SUPPORTS
BOREHOLE LOCATION PLAN

SHEET

McCORMICK RANKIN CORPORATION

THURBER ENGINEERING LTD.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS



KEYPLAN

LEGEND

- Approx. Borehole Location (Current Investigation)
- Approx. Borehole Location (Previous Investigations)

NO	ELEVATION	NORTHING	EASTING
10-02	119.7	4 832 065.4	300 023.7

LICENSED PROFESSIONAL ENGINEER
M. E. FARRANT
100063767
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. K. CHATTERJI
Nov 1/2010
PROVINCE OF ONTARIO

GEOCRES No. 30M11-235

REVISIONS		
DATE	BY	DESCRIPTION

DESIGN	MEF	CHK	PKC	CODE	LOAD	DATE	NOV. 2010
DRAWN	MFA	CHK	PKC	SITE	STRUCT	DWG	1

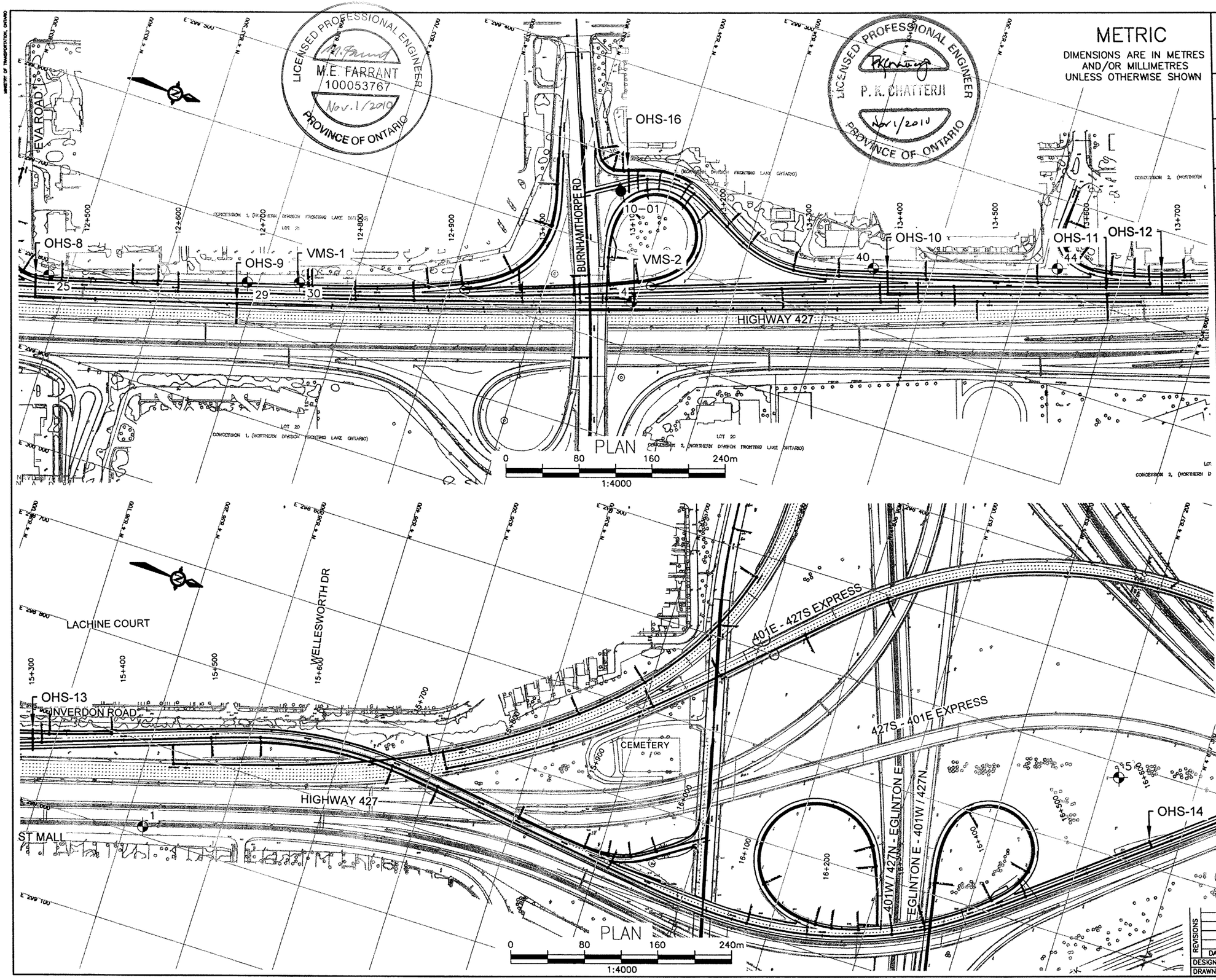
FILENAME: D:\Drafting\19\1351\163\sd1163-BoreholePlan.dwg
PLOTDATE: Nov 01, 2010 - 2:03pm

LICENSED PROFESSIONAL ENGINEER
M.E. FARRANT
100053767
Nov. 1/2010
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P.K. CHATTERJI
Nov 1/2010
PROVINCE OF ONTARIO

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN



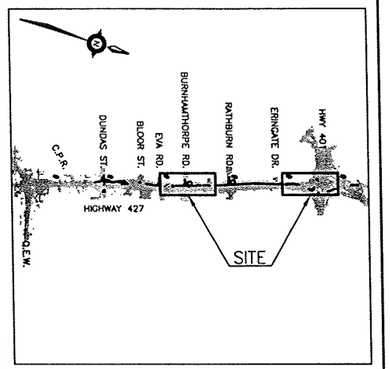
CONT No
GWP No 2219-03-00

HIGHWAY 427 SOUTHBOUND
HIGHWAY 401 TO Q.E.W
OVERHEAD SIGN SUPPORTS
BOREHOLE LOCATION PLAN

SHEET

McCORMICK RANKIN CORPORATION

THURBER ENGINEERING LTD.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS



KEYPLAN

LEGEND

- Approx. Borehole Location (Current Investigation)
- Approx. Borehole Location (Previous Investigations)

NO	ELEVATION	NORTHING	EASTING
10-01	142.7	4 833 948.9	299 537.4

GEOCRES No. 30M11-235

REVISIONS		
DATE	BY	DESCRIPTION

DESIGN	MEF	CHK	PKC	CODE	LOAD	DATE	NOV. 2010
DRAWN	MFA	CHK	PKC	SITE	STRUCT	DWG	2

FILENAME: G:\Jobfiles\19\12511\163\acd1163-BoreholePlan.dwg
PLOTDATE: Nov 01, 2010 - 2:03pm