FOUNDATION INVESTIGATION REPORT
NOISE BARRIER WALL
STA. 28+380 TO 28+690 HWY 417 EBL
HIGHWAY 417 OPERATIONAL IMPROVEMENTS – LYON TO BANK STREET
OTTAWA, ONTARIO
W.P. 4088-07-01

Geocres Number: 31G5-265

Report to

MMM GROUP LTD

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THURBER

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NOISE BARRIER WALL

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PART 1: FACTUAL INFORMATION

1 INTRODUCTION

This report presents the factual findings obtained from a foundation investigation conducted along the proposed alignment of a noise barrier wall on Highway 417 Eastbound at Kent Street in Ottawa, Ontario. The noise barrier is part of the Highway 417 Operational Improvements between Lyon Street and Bank Street.

The purpose of the investigation was to explore the subsurface conditions along the proposed noise barrier alignment and, based on the data obtained, to provide record of borehole sheets, borehole location plans, stratigraphic profiles, laboratory test results, and a generalized description of the subsurface conditions. A model of the subsurface conditions was developed from the data obtained in the course of the investigation.

Thurber Engineering Ltd. carried out the investigation as a sub-consultant to MMM Group Limited (MMM), formerly McCormick Rankin Corporation, under the Ministry of Transportation Ontario (MTO) Agreement Number 4009-E-0007.

2 SITE DESCRIPTION

Highway 417 is a limited access divided highway with three eastbound lanes and four westbound lanes. The highway is elevated on a fill embankment and crosses overpass structures at Kent Street and Bank Street. A new noise barrier wall will be installed along the eastbound shoulder as part of the Kent Street superstructure replacement project.

The lands adjacent to Highway 417 comprise a mix of residential and commercial properties.

The site lies within the Ottawa Valley Clay Plains physiographic region, a clay plains interrupted by ridges of sand and rock. The underlying bedrock consists of limestone with shale interbeds of

the Lindsay Formation, Ottawa Group (to the west) and dark brown to black shale of the Billings Formation (to the east).

3 SITE INVESTIGATION AND FIELD TESTING

The site investigation and field testing for this assignment were carried out on July 25 and July 26, 2012 and consisted of advancing five boreholes (identified as Boreholes NB-15 to NB-19) to depths of 6.7 to 10.1 m.

Two additional boreholes were subsequently drilled along the alignment during the period November 14 to 19, 2012 as part of the Kent Street Staging Area investigation. These boreholes (designated Boreholes KSS-04 and KSS-05) were advanced 3.4 and 4.5 m below the bedrock surface to total depths of 19.4 and 21.5 m.

The approximate locations of the boreholes are shown on the Borehole Locations and Soil Strata Drawing included in Appendix C. The coordinates and ground surface elevations of the boreholes are provided on the drawings and on the individual Record of Borehole sheets.

The borehole locations were marked in the field and utility clearances were obtained prior to commencement of drilling operations. Boreholes were repositioned as necessary to avoid conflicts with utilities.

The advancement of the boreholes was carried out using a truck-mounted drill rig in conjunction with hollow stem augers, wash-boring and NQ coring methods. Soil samples were obtained at selected intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT). In situ vane shear testing was carried out to assess the undrained shear strength of the cohesive deposits.

In selected boreholes where bedrock was encountered, cores of the rock were recovered. All rock cores were logged, and the Total Core Recovery (TCR), Solid Core Recovery (SCR), Rock Quality Designation (RQD) and the Fracture Indices (FI) were determined.

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

Groundwater conditions in the open boreholes were observed throughout the drilling operations. Standpipe piezometers consisting of 19 mm diameter PVC pipe with a slotted screen were installed in selected boreholes to monitor groundwater levels after drilling. Where no piezometer was installed, the boreholes were backfilled with a mixture of bentonite and cuttings in general accordance with MOE Regulation 903 as amended, with asphalt patch at the surface. The piezometer installation and borehole completion details are summarized in Table 3.1. Following the final water level readings, the piezometers were decommissioned in general accordance with MOE Regulation 903.

Table 3.1 - Piezometer Installation and Borehole Completion Details

Borehole	Tip Position (m) Depth / Elev.	Installation / Completion Details
NB-15	6.1 / 65.7	Sand filter from 6.1 to 4.3 m, bentonite from 4.3 to 3.4 m, cuttings from 3.4 to 0.1 m, then asphalt at surface. Flush-mount protective casing installed at surface.
NB-17	6.1 / 66.8	Sand filter from 6.1 to 4.3 m, bentonite from 4.3 to 3.4 m, cuttings from 3.4 to 0.1 m, then asphalt at surface. Flush-mount protective casing installed at surface.
NB-19	9.1 / 63.2	Sand filter from 9.1 to 7.3 m, bentonite from 7.3 to 6.4 m, cuttings from 6.4 to 0.1 m, then asphalt at surface. Flush-mount protective casing installed at surface.
KSS-04	19.4 / 53.6	Sand filter from 19.4 to 15.1 m, bentonite from 15.1 to 14.2 m, then sand/bentonite mixture to surface. Flush-mount protective casing installed at surface with asphalt patch.

4 LABORATORY TESTING

The recovered soil samples were subjected to Visual Identification (VI) and to natural moisture content determination. Selected samples were also subjected to gradation analysis (hydrometer and/or sieve) and Atterberg Limits testing, where appropriate. The results of this testing program are shown on the Record of Borehole sheets in Appendix A and plotted on the figures included in Appendix B.

Point load tests were carried out on selected samples of intact bedrock core to assist in the evaluation of the compressive strength of the bedrock. The results of the point load tests are presented on the Record of Borehole sheets in Appendix A as the average unconfined compressive strength (UCS) per core run.

5 DESCRIPTION OF SUBSURFACE CONDITIONS

Details of the encountered soil stratigraphy are presented on the Record of Borehole sheets in Appendix A and the Borehole Locations and Soil Strata Drawing included in Appendix C. A general description of the stratigraphy, based on the conditions encountered in the boreholes, is given in the following sections. However, the factual data presented in the borehole logs shall take precedence over these general descriptions and interpretations of the site conditions. It must be recognized that the soil conditions may vary between and beyond the investigated borehole locations.

In general, the subsurface stratigraphy encountered in the boreholes consists of existing sand embankment fill underlain by native silt and sand (to the west of Kent Street) and silty clay (to the east of Kent Street). A deposit of silty sand was encountered below the silty clay in one borehole. Bedrock was encountered in the two deep boreholes.

5.1 Asphalt and Concrete

Asphalt was encountered at the surface in all seven boreholes drilled along the proposed noise barrier wall alignment. The thickness of the asphalt ranged from 175 to 300 mm.

A 200 mm thick layer of concrete was encountered below the asphalt in Borehole NB-19.

5.2 Sand Fill

Sand fill, trace silt to silty, with trace to some gravel and occasional cobbles was encountered below the asphalt and concrete in all boreholes. Where fully penetrated, the thickness of the fill ranged from 5.1 to 7.0 m with a lower boundary encountered at depths of 5.5 to 7.2 m (Elev. 66.9 to 65.7 m). Boreholes NB-17 and NB-18 were terminated within the fill at 6.7 m depth (Elev. 66.2 and 66.3 m). A zone of dark brown topsoil was encountered within the fill at 4.8 m depth in Borehole NB-18.

SPT 'N' values recorded in the fill typically ranged from 25 blows per 0.3 m of penetration to 100 blows per 0.25 m of penetration, indicating a compact to very dense relative density. In five of the boreholes, the 'N' values decreased to 12 to 15 blows per 0.3 m (compact) in the lower 1.5 to 2.5 m of the fill, with one value of 4 blows per 0.3 m (loose) obtained at the base of Borehole NB-17. The moisture content of the fill ranged from 4 to 26%, typically less than 10%.

Grain size distribution testing was carried out on eight samples of the fill. The results of the testing are presented on the Record of Borehole sheets included in Appendix A and the grain size distribution curves are plotted on Figures B1 and B2 of Appendix B. The results of the laboratory tests are summarized as follows:

Gravel %	0 to 7
Sand %	63 to 90
Silt & Clay %	8 to 37

5.3 Silt and Sand

A deposit of native silt and sand with some clay was encountered below the fill in Boreholes NB-15 and NB-16. Both boreholes were terminated within this deposit at a depth of 6.7 m (Elev. 65.1 and 65.6 m).

SPT 'N' values of 10 and 11 blows per 0.3 m of penetration were recorded in the silt and sand, indicating a compact relative density. Moisture contents of 19 and 22% were recorded.

Grain size distribution testing was carried out on one sample of the silt and sand. The results of the testing are presented on the Record of Borehole sheet included in Appendix A and the grain size distribution curve is plotted on Figure B3 of Appendix B. The results of the laboratory tests are summarized as follows:

Gravel %	0
Sand %	40
Silt %	45
Clay %	15

5.4 Silty Clay

Silty clay was encountered below the fill in Boreholes NB-19, KSS-04 and KSS-05. Borehole NB-19 was terminated within the silty clay at a depth of 10.1 m (Elev. 62.3 m). In Boreholes KSS-04 and KSS-05, the thickness of the silty clay was 8.8 m with a lower boundary encountered at depths of 16.0 and 14.9 m (Elev. 57.0 and 57.6 m).

SPT 'N' values recorded in the silty clay ranged from 0 to 6 blows per 0.3 m of penetration, typically 0 to 1 blows per 0.3 m. In situ field vane testing conducted within the silty clay measured undrained shear strengths ranging from 30 to 68 kPa, with measured sensitivities of 5 to 16 based on remolded field vane testing. The field vane testing indicates a consistency of firm to stiff.

Grain size distribution testing was carried out on three samples of the silty clay. The results of the testing are presented on the Record of Borehole sheets included in Appendix A and the grain size distribution curves are plotted in Figure B4. Atterberg limits testing was conducted on two samples of the silty clay and the results are plotted on Figure B5 of Appendix B. The results of the laboratory testing are summarized as follows:

Gravel %	0
Sand %	0
Silt %	29 to 48
Clay %	52 to 71
Liquid Limit %	51 to 56
Plastic Limit %	23 to 26

The results indicate that the silty clay displays high plasticity with a group symbol CH.

5.5 Silty Sand

A layer of silty sand was encountered below the silty clay in Borehole KSS-05. The thickness of the silty sand layer was 2.1 m with a lower boundary encountered at a depth of 17.0 m (Elev. 55.6 m).

An SPT 'N' value of 25 blows per 0.3 m of penetration was recorded in the silty sand, indicating a compact relative density. A higher value of 54 blows per 0.15 m (very dense)

was obtained at the base of this deposit. A moisture content of 22% was recorded in the silty sand.

5.6 Bedrock

Bedrock was proven in Boreholes KSS-04 and KSS-05 by coring to a depth of 3.4 and 4.5 m below the bedrock surface. The depths and elevations of the bedrock surface encountered in the boreholes are summarized below in Table 5.1:

Table 5.1 - Depths and Elevations of Bedrock Surface

Borehole	Bedrock Surface Proven By Coring	
	Depth (m)	Elevation (m)
KSS-04	16.0	57.0
KSS-05	17.0	55.6

The bedrock was described as dark grey to black shale with calcareous siltstone interbeds and occasional bituminous seams up to 20 mm thick. The total core recovery (TCR) ranged from 31 to 100% and the rock quality designation (RQD) varied between 14 and 100%. The fracture index (FI) of the rock, expressed as fractures per 0.3 m of core, typically ranged from 0 to 4.

The estimated unconfined compressive strength (UCS) of the rock, interpreted from point load testing, varied from 43 to 122 MPa, indicating a medium to very strong strength classification.

5.7 Groundwater Conditions

Standpipe piezometers were installed in four boreholes to monitor groundwater levels after completion of drilling. A summary of the recorded groundwater levels is provided below in Table 5.2.

Groundwater was measured at a depth of 4.8 m (Elev. 68.2) in Borehole NB-18 upon completion of drilling. Considering the lower groundwater levels measured in the piezometers, this water appears to be locally perched within the embankment fill.

Table 5.2 – Groundwater Depths and Elevations

Borehole	Date	Groundwater Level		Comments
		Depth (m)	Elevation (m)	
NB-15	Aug 21, 2012	Dry	-	In piezometer
	Nov 21, 2012	Dry	-	In piezometer
NB-17	Aug 21, 2012	Dry	-	In piezometer
	Nov 21, 2012	Dry	-	In piezometer
NB-19	Aug 21, 2012	6.2	66.1	In piezometer
	Nov 19, 2012	6.5	65.8	In piezometer
KSS-04	Nov 15, 2012	9.9	63.1	In piezometer
	Dec 5, 2012	10.2	62.8	In piezometer

The recorded groundwater levels are considered short term readings and seasonal fluctuations of the groundwater level are to be expected, particularly after spring snowmelt and periods of prolonged or significant precipitation.

6 MISCELLANEOUS

The borehole locations were selected and established in the field by Thurber staff. The coordinates and ground surface elevations at the boreholes were determined by surveyors from MMM Group Limited after completion of the site investigation.

Eastern Ontario Diamond Drilling Limited from Hawkesbury, Ontario supplied and operated the drilling and sampling equipment for the field program. Full time supervision of the field activities was carried out by Gabrielle Marcotte of Thurber.

Supervision of the field program was performed by Ms. Lindsey Blaine, E.I.T. Interpretation of the field data and preparation of the report was performed by Mr. Michael Eastman, E.I.T. The report was reviewed by Mr. Murray Anderson, P.Eng. and Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.

Thurber Engineering Ltd.

Michael Eastman, E.I.T
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Review Principal

Appendix A

Record of Borehole Sheets

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

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

▼ 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			

EXPLANATION OF ROCK LOGGING TERMS

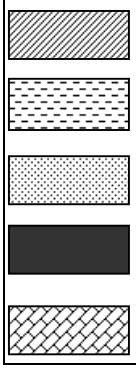
ROCK WEATHERING CLASSIFICATION

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

DISCONTINUITY SPACING

Bedding	**Bedding Plane Spacing**
Very thickly bedded	Greater than 2m
Thickly bedded	0.6 to 2m
Medium bedded	0.2 to 0.6m
Thinly bedded	60mm to 0.2m
Very thinly bedded	20 to 60mm
Laminated	6 to 20mm
Thinly Laminated	Less than 6mm

SYMBOLS



CLAYSTONE

SILTSTONE

SANDSTONE

COAL

BEDROCK

STRENGTH CLASSIFICATION

Rock Strength	**Approximate Uniaxial Compressive Strength (MPa)**	**(psi)**	**Field Estimation of Hardness***
Extremely Strong	Greater than 250	Greater than 36,000	Specimen can only be chipped with a geological hammer
Very Strong	100-250	15,000 to 36,000	Requires many blows of geological hammer to break
Strong	50-100	7,500 to 15,000	Requires more than one blow of geological hammer to break
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 % 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.

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RECORD OF BOREHOLE No NB-15 1 OF 1 METRIC

W.P. 4088-07-01 LOCATION N 5 030 008.5 E 367 811.5 ORIGINATED BY GM

HWY 417 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA

DATUM Geodetic DATE 2012.07.26 - 2012.07.26 CHECKED BY LRB

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	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
71.8	GROUND SURFACE										
0.0	**ASPHALT:** (200mm)										
0.2	**SAND**, trace gravel, trace silt Dense to Compact Brown Damp (FILL)		1	SS	43		71				
			2	SS	25		70				
			3	GS	36		69				2 90 8 (SI+CL)
	Occasional cobbles		4	SS	39		68				
			5	SS	15		67				
65.7							66				
6.1	**SILT** and **SAND**, with clay inclusions Compact Brown		6	SS	10						
65.1	Moist										
6.7	END OF BOREHOLE AT 6.7m. BOREHOLE DRY 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) Aug. 21/12 Dry - Nov. 21/12 Dry -										

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

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

ONTMT4S 1201G.GPJ 2012TEMPLATE(MTO).GDT 10/21/14

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RECORD OF BOREHOLE No NB-16 1 OF 1 METRIC

W.P. 4088-07-01 LOCATION N 5 030 038.8 E 367 859.8 ORIGINATED BY GM

HWY 417 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA

DATUM Geodetic DATE 2012.07.25 - 2012.07.25 CHECKED BY LRB

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	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
72.3	GROUND SURFACE										
0.0	**ASPHALT:** (225mm)										
0.2	**SAND**, trace to some gravel, trace silt Very Dense to Dense Brown Dry to moist (FILL)		1	SS	57		72		○		
			2	SS	33		71		○		
			3	GS	33		70		○		2 89 9 (SI+CL)
			4	SS	36		69		○		
			5	SS	41		68		○		
66.0							67				
6.3	**SILT** and **SAND**, some clay Compact Brown Wet		6	SS	11		66		○		0 40 45 15
65.6											
6.7	END OF BOREHOLE AT 6.7m. BOREHOLE BACKFILLED WITH MIXTURE OF CUTTINGS AND BENTONITE TO 0.1m, THEN ASPHALT TO SURFACE.										

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

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

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Ministry of Transportation
Ontario

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RECORD OF BOREHOLE No NB-17 1 OF 1 METRIC

W.P. 4088-07-01 LOCATION N 5 030 077.8 E 367 919.1 ORIGINATED BY GM

HWY 417 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA

DATUM Geodetic DATE 2012.07.25 - 2012.07.25 CHECKED BY LRB

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	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/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
72.9	GROUND SURFACE										
0.0	**ASPHALT:** (175mm)										
0.2	**SAND**, trace to some gravel, trace to some silt Dense Brown Damp (FILL)		1	SS	48		72		○		
			2	SS	53		71		○		
			3	SS	38				○		
			4	SS	35		70		○		
							69				
	Compact		5	GS	14		68		○		4 83 13 (SI+CL)
							67				
66.2	Loose		6	SS	4				○		
6.7	END OF BOREHOLE AT 6.7m. BOREHOLE DRY 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) Aug. 21/12 Dry - Nov. 21/12 Dry -										

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

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

ONTMT4S 1201G.GPJ 2012TEMPLATE(MTO).GDT 10/21/14

Ministry of Transportation
Ontario

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RECORD OF BOREHOLE No NB-18 1 OF 1 METRIC

W.P. 4088-07-01 LOCATION N 5 030 128.5 E 367 994.5 ORIGINATED BY GM

HWY 417 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA

DATUM Geodetic DATE 2012.07.25 - 2012.07.25 CHECKED BY LRB

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ 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/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
73.0	GROUND SURFACE										
0.0 / 72.7	**ASPHALT:** (250mm)										
0.3	**SAND**, some silt to silty, trace to some gravel, occasional cobbles Very Dense to Compact Brown Damp (FILL)		1	SS	84		72		○		
			2	SS	41		71		○		
			3	SS	100/ 0.250				○		7 72 21 (SI+CL)
			4	SS	56/ .125		70		○		
	Layer of dark brown topsoil		5	SS	34	▽	69		○		
	Wet						68		○		
			6	SS	14		67		○		
66.3											
6.7	END OF BOREHOLE AT 6.7m. WATER LEVEL AT 4.8m UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS AND BENTONITE TO 0.1m, THEN ASPHALT COLD PATCH TO SURFACE.										

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

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

ONTMT4S 1201G.GPJ 2012TEMPLATE(MTO).GDT 10/21/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No NB-19 1 OF 2 METRIC

W.P. 4088-07-01 LOCATION N 5 030 166.2 E 368 051.8 ORIGINATED BY GM

HWY 417 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA

DATUM Geodetic DATE 2012.07.26 - 2012.07.26 CHECKED BY LRB

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 (○ 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
72.3	GROUND SURFACE										
0.0	**ASPHALT:** (175mm)										
72.2	**CONCRETE:** (200mm)										
0.4	**SAND**, trace to some gravel, some silt to silty, occasional cobbles Very Dense to Dense Brown/Light Grey Damp (FILL)		1	SS	77		72		○		
			2	SS	101		71		○		
			3	GS	53		70		○		5 72 23 (SI+CL)
			4	SS	38		69		○		
			5	SS	57		68		○		
	Hydrocarbon odour during drilling						67				
66.9											
5.5	Silty **CLAY** Firm to Soft Grey		6	SS	6	▼	66		○		
	Sample has hydrocarbon odour						65				
	Sample has hydrocarbon odour		7	SS	0		64		○		0 0 29 71
			8	SS	1		63		○		

Continued Next Page

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

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

ONTMT4S 1201G.GPJ 2012TEMPLATE(MTO).GDT 10/21/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No NB-19 2 OF 2 METRIC

W.P. 4088-07-01 LOCATION N 5 030 166.2 E 368 051.8 ORIGINATED BY GM

HWY 417 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA

DATUM Geodetic DATE 2012.07.26 - 2012.07.26 CHECKED BY LRB

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	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)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
62.3 / 10.1	END OF BOREHOLE AT 10.1m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.										
	WATER LEVEL READINGS: DATE / DEPTH (m) / ELEV. (m): Aug. 21/12 6.2 66.1; Nov. 19/12 6.5 65.8										

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

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

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No KSS-04 1 OF 3 METRIC

W.P. 4088-07-01 LOCATION N 5 030 119.9 E 367 980.3 ORIGINATED BY GM

HWY 417 BOREHOLE TYPE Casing/NQ Coring COMPILED BY AN

DATUM Geodetic DATE 2012.11.14 - 2012.11.15 CHECKED BY LRB

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ 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
73.0	GROUND SURFACE										
0.0	**ASPHALT:** (200mm)										
0.2	**SAND**, some silt to silty, trace to some gravel Very Dense to Compact Brown Damp (FILL)		1	SS	57		72		○		
			2	SS	61		71		○		4 71 17 8
			3	SS	72		70		○		
			4	SS	78		69		○		
			5	SS	15		68		○		0 63 29 8
65.8							67				
7.2	Silty **CLAY**, trace sand Firm to Stiff Grey		6	SS	2		66		○		
							65			○	
							64	5.0			

Continued Next Page

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

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

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Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No KSS-04 2 OF 3 METRIC

W.P. 4088-07-01 LOCATION N 5 030 119.9 E 367 980.3 ORIGINATED BY GM

HWY 417 BOREHOLE TYPE Casing/NQ Coring COMPILED BY AN

DATUM Geodetic DATE 2012.11.14 - 2012.11.15 CHECKED BY LRB

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	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
	Continued From Previous Page										
	Silty **CLAY**, trace sand Firm to Stiff Grey										
			7	SS	1		62				0 0 42 58
								5.0			
			8	SS	1		61				
							60	16.0			
			9	SS	1		59				
							58				
57.0			10	SS	0						
16.0	**SHALE BEDROCK**, dark grey, with calcareous siltstone interbeds, highly weathered		11	SS	50/ 0.100		57			FI	
			1	RUN			56			4 1	RUN #1 TCR=31% SCR=19% RQD=19% UCS=63MPa (Average)
			2	RUN						3 4	RUN #2 TCR=75% SCR=68% RQD=44% UCS=122MPa (Average)
	Interbedded dark grey shale and light grey calcareous siltstone, occasional bituminous seams to 20mm thick, slightly weathered		3	RUN			55			4 0	RUN #3 TCR=100% SCR=63% RQD=100% UCS=59MPa (Average)
53.6			4	RUN			54			3 1	RUN #4 TCR=100% SCR=98% RQD=83%
19.4	END OF BOREHOLE AT 19.4m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 3.96m slotted screen.										UCS=52MPa (Average)

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

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

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No KSS-04 3 OF 3 METRIC

W.P. 4088-07-01 LOCATION N 5 030 119.9 E 367 980.3 ORIGINATED BY GM

HWY 417 BOREHOLE TYPE Casing/NQ Coring COMPILED BY AN

DATUM Geodetic DATE 2012.11.14 - 2012.11.15 CHECKED BY LRB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa 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										
	WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Nov. 15/12 9.9 63.1 Dec. 05/12 10.2 62.8										

SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE

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

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

ONTMT4S 1201G.GPJ 2012TEMPLATE(MTO).GDT 10/21/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No KSS-05 1 OF 3 METRIC

W.P. 4088-07-01 LOCATION N 5 030 155.6 E 368 036.3 ORIGINATED BY GM

HWY 417 BOREHOLE TYPE Casing/NQ Coring COMPILED BY AN

DATUM Geodetic DATE 2012.11.18 - 2012.11.19 CHECKED BY LRB

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	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/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
72.6	GROUND SURFACE										
0.0 / 72.2	**ASPHALT:** (300mm)										
0.3	**SAND**, trace to some gravel, some silt Very Dense to Compact Grey Damp (FILL)		1	SS	44		72		○		
			2	SS	65		71		○		
			3	SS	47		70		○		4 74 15 7
			4	SS	12		69		○		
	Occasional clay pockets						68		○		
66.5							67				
6.1	Silty **CLAY** Firm to Stiff Brown		5	SS	3		66		○		
	Grey		6	SS	0		65		⊢○⊣		0 0 48 52
							64	5.0 +			
			7	SS	0		63		○		

Continued Next Page

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

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

ONTMT4S 1201G.GPJ 2012TEMPLATE(MTO).GDT 10/21/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No KSS-05 2 OF 3 METRIC

W.P. 4088-07-01 LOCATION N 5 030 155.6 E 368 036.3 ORIGINATED BY GM

HWY 417 BOREHOLE TYPE Casing/NQ Coring COMPILED BY AN

DATUM Geodetic DATE 2012.11.18 - 2012.11.19 CHECKED BY LRB

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	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
	Continued From Previous Page										
	Silty **CLAY** Firm to Stiff Brown							7.0			
			8	SS	0		62				
								11.0			
							61				
			9	SS	0		60		○		
								+			
			10	SS	0		59		○		
57.6							58	+			
14.9	Silty **SAND** Compact Grey										
			11	SS	25		57		○		
	Auger refual at 17m, begin coring						56				
55.6			12	SS	54/						
17.0	**SHALE BEDROCK**, dark grey to black, with calcarious siltstone interbeds, occasional bituminous seams to 20mm thick, highly to moderately weathered				0.150					FI	
			1	RUN			55			>10	RUN #1 TCR=38% SCR=11% RQD=14%
							54			3 2 4	RUN #2 TCR=100% SCR=92% RQD=92% UCS=73MPa (Average)
			2	RUN			53			0 0 0	

Continued Next Page

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

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

ONTMT4S 1201G.GPJ 2012TEMPLATE(MTO).GDT 10/21/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No KSS-05 3 OF 3 METRIC

W.P. 4088-07-01 LOCATION N 5 030 155.6 E 368 036.3 ORIGINATED BY GM

HWY 417 BOREHOLE TYPE Casing/NQ Coring COMPILED BY AN

DATUM Geodetic DATE 2012.11.18 - 2012.11.19 CHECKED BY LRB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	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)	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										
	Slightly weathered		3	RUN			52			3 3 0	RUN #3 TCR=77% SCR=77% RQD=67% UCS=43MPa (Average)
51.1			4	RUN						2 0	RUN #4 TCR=100% SCR=97%
21.5	END OF BOREHOLE AT 21.5m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG WITH ASPHALT PATCH AT SURFACE.										RQD=90% UCS=55MPa (Average)

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

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

ONTMT4S 1201G.GPJ 2012TEMPLATE(MTO).GDT 10/21/14

Appendix B

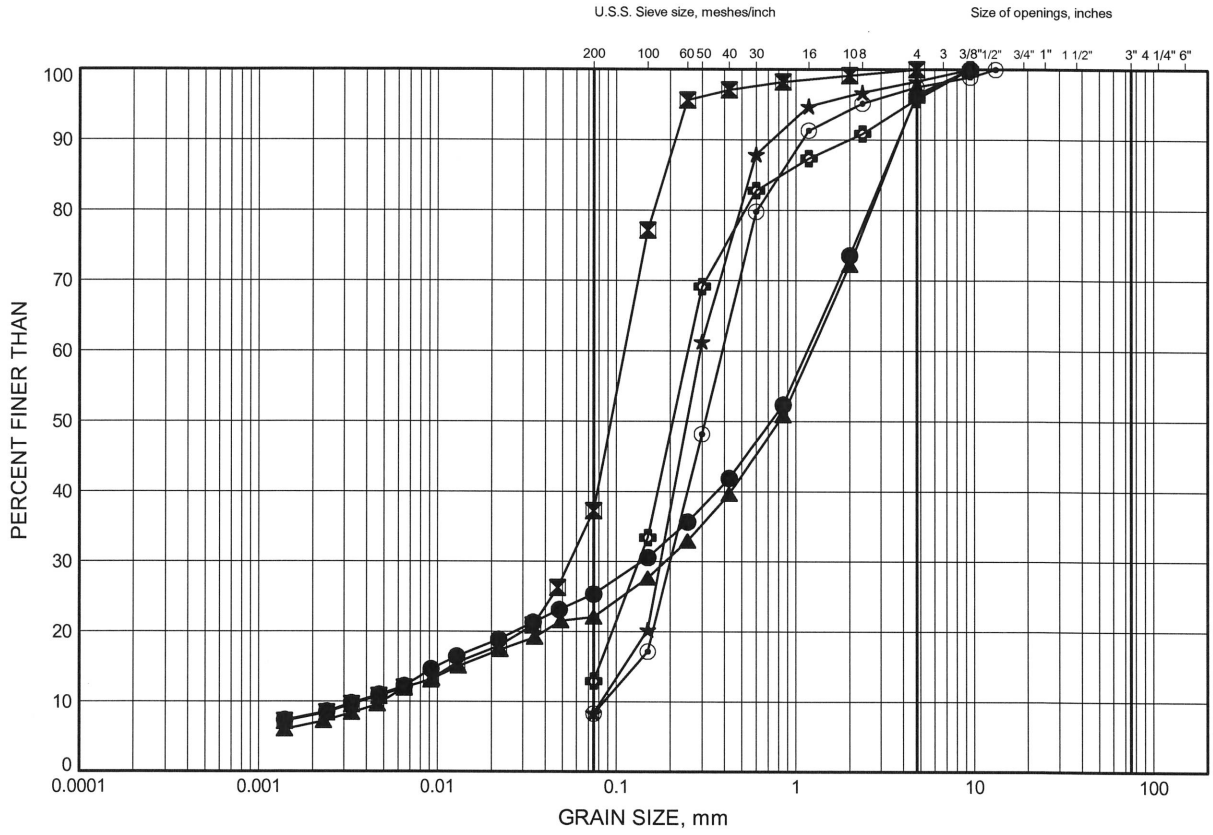
Laboratory Test Results

Highway 417 Ottawa: Noise Barriers

GRAIN SIZE DISTRIBUTION

FIGURE B1

SAND FILL to SILTY SAND FILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	KSS-04	1.83	71.18
⊠	KSS-04	6.40	66.61
▲	KSS-05	3.35	69.20
★	NB-15	2.59	69.22
⊙	NB-16	2.59	69.76
✿	NB-17	4.88	68.06

Date October 2014

W.P. 4088-07-01

THURBER

Prep'd AN

Chkd. MKE

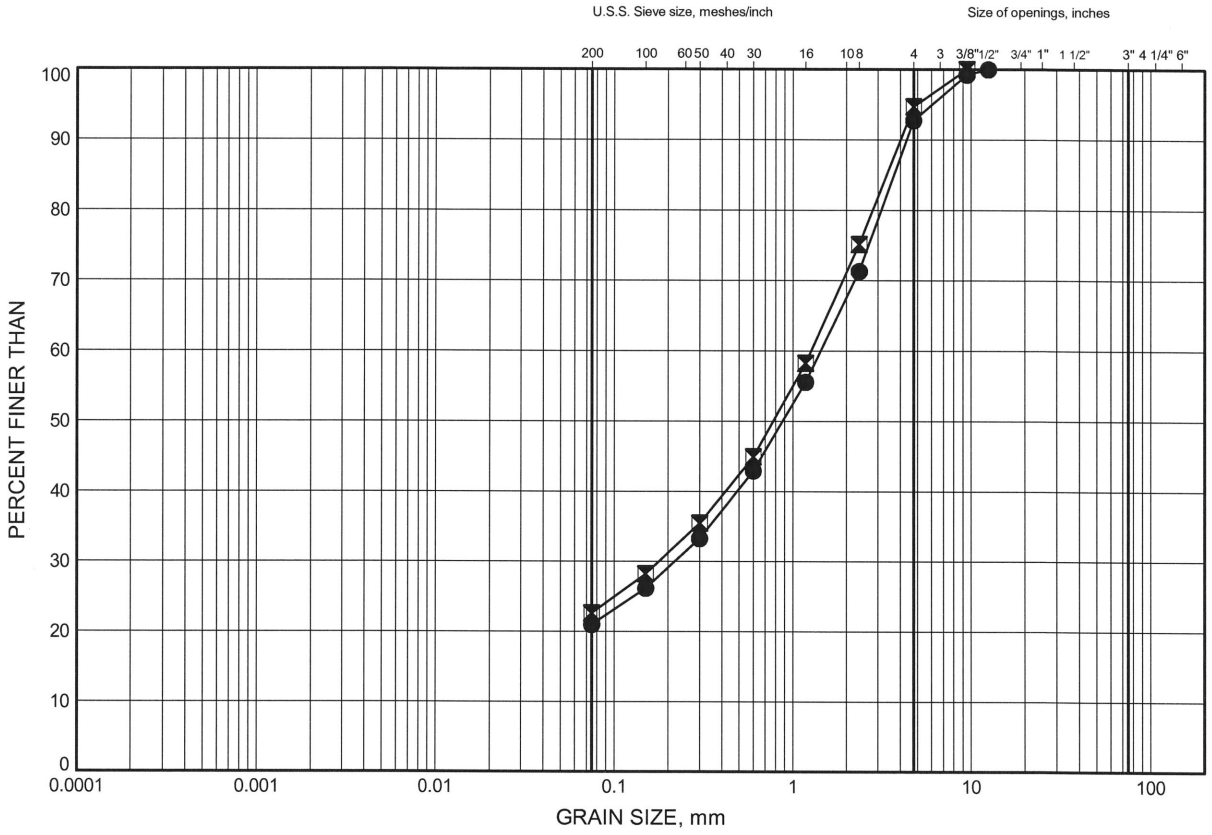
GRAIN SIZE DISTRIBUTION - THURBER 1201G.GPJ 10/17/14

Highway 417 Ottawa: Noise Barriers

GRAIN SIZE DISTRIBUTION

FIGURE B2

SAND FILL to SILTY SAND FILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	NB-18	2.59	70.37
⊠	NB-19	2.59	69.75

Date October 2014

W.P. 4088-07-01

THURBER

Prep'd AN

Chkd. MKE

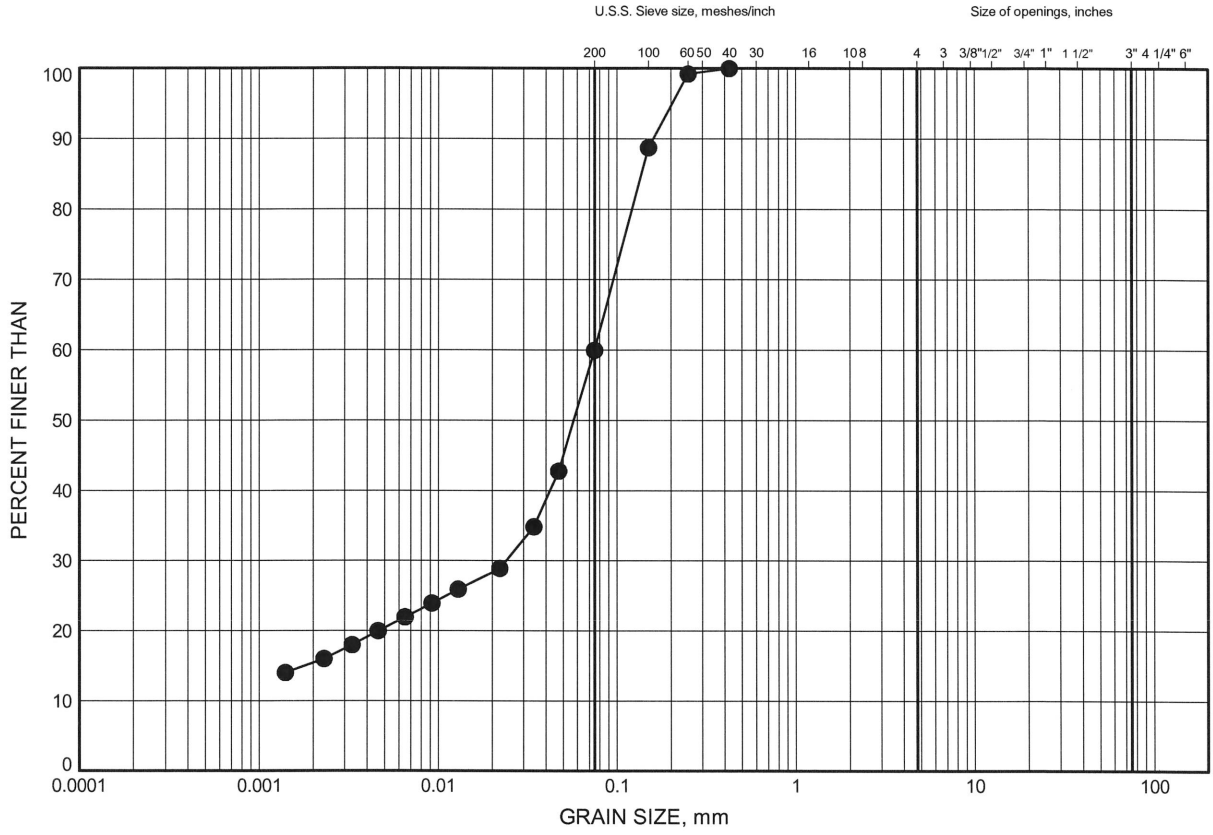
GRAIN SIZE DISTRIBUTION - THURBER 1201G.GPJ 10/17/14

Highway 417 Ottawa: Noise Barriers

GRAIN SIZE DISTRIBUTION

FIGURE B3

SILT & SAND



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	NB-16	6.35	66.00

Date October 2014

W.P. 4088-07-01

THURBER

Prep'd AN

Chkd. MKE

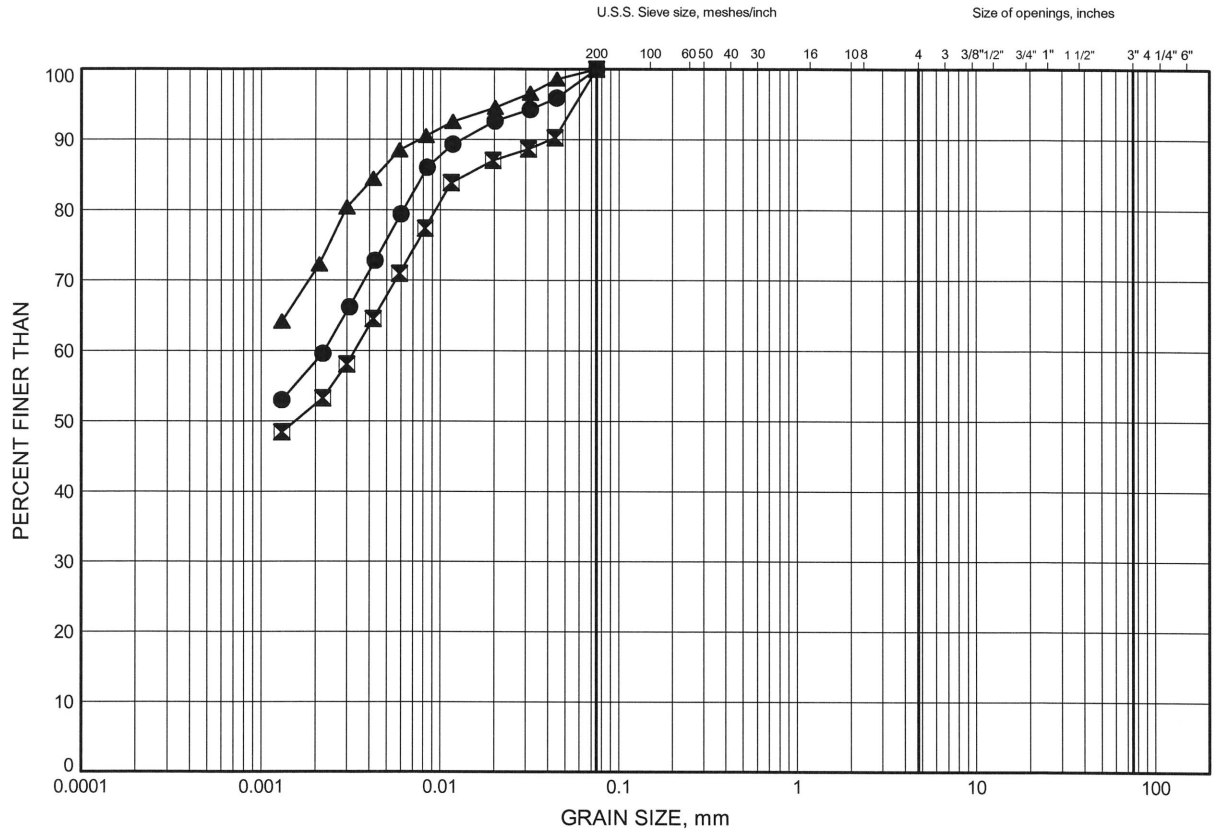
GRAIN SIZE DISTRIBUTION - THURBER 1201G.GPJ 10/17/14

Highway 417 Ottawa: Noise Barriers

GRAIN SIZE DISTRIBUTION

FIGURE B4

SILTY CLAY



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	KSS-04	10.97	62.04
⊠	KSS-05	7.92	64.63
▲	NB-19	7.92	64.41

Date October 2014

W.P. 4088-07-01

THURBER

Prep'd AN

Chkd. MKE

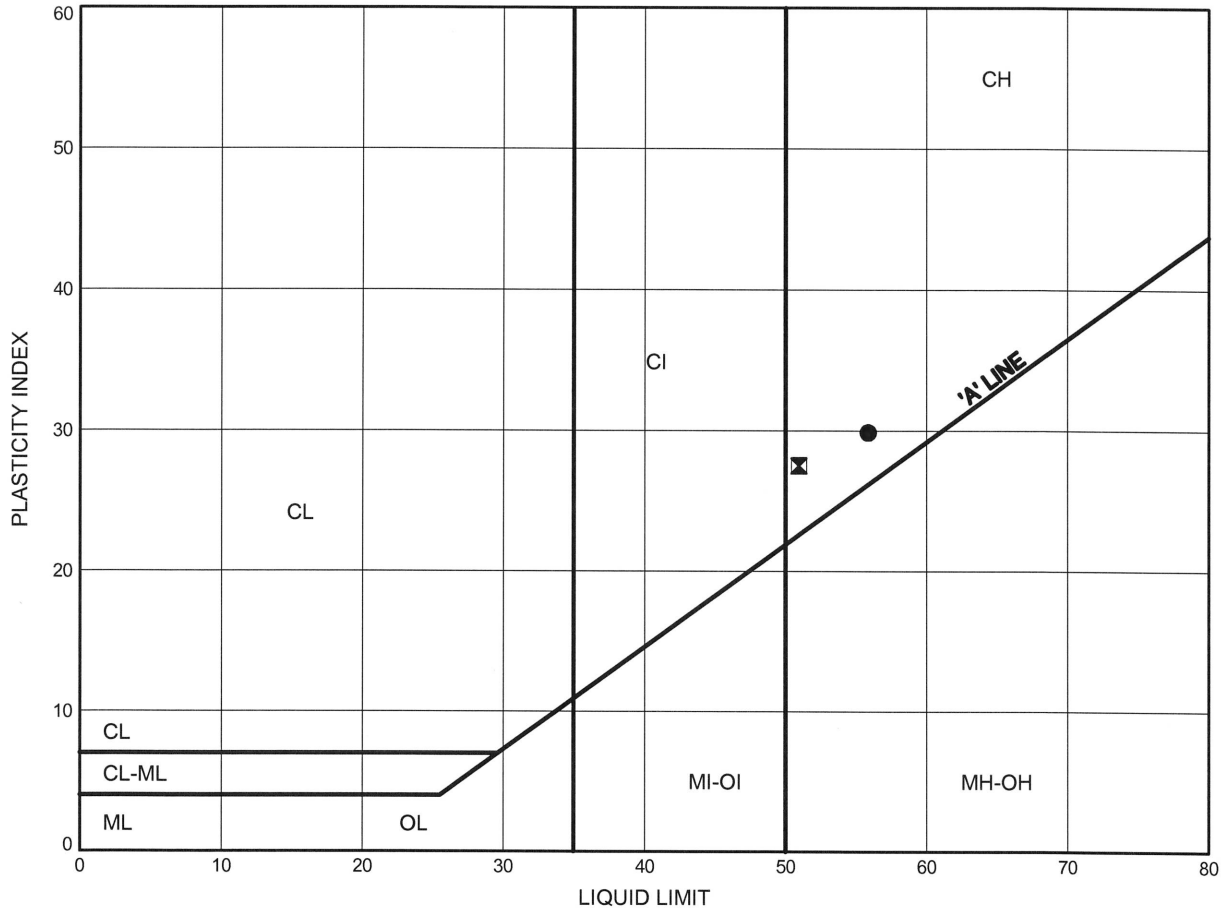
GRAIN SIZE DISTRIBUTION - THURBER 1201G.GPJ 10/17/14

Highway 417 Ottawa: Noise Barriers

ATTERBERG LIMITS TEST RESULTS

FIGURE B5

SILTY CLAY



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	KSS-04	10.97	62.04
⊠	KSS-05	7.92	64.63

Date October 2014

W.P. 4088-07-01

THURBER

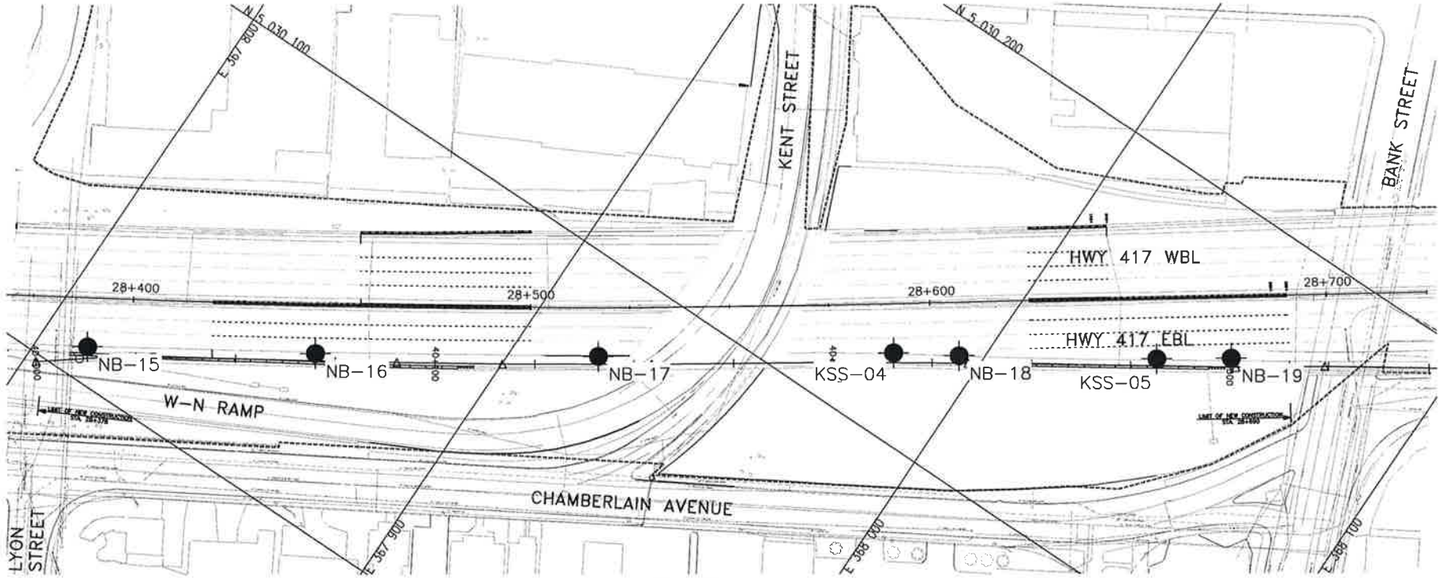
Prep'd AN

Chkd. MKE

THURBALT 1201G.GPJ 10/17/14

Appendix C

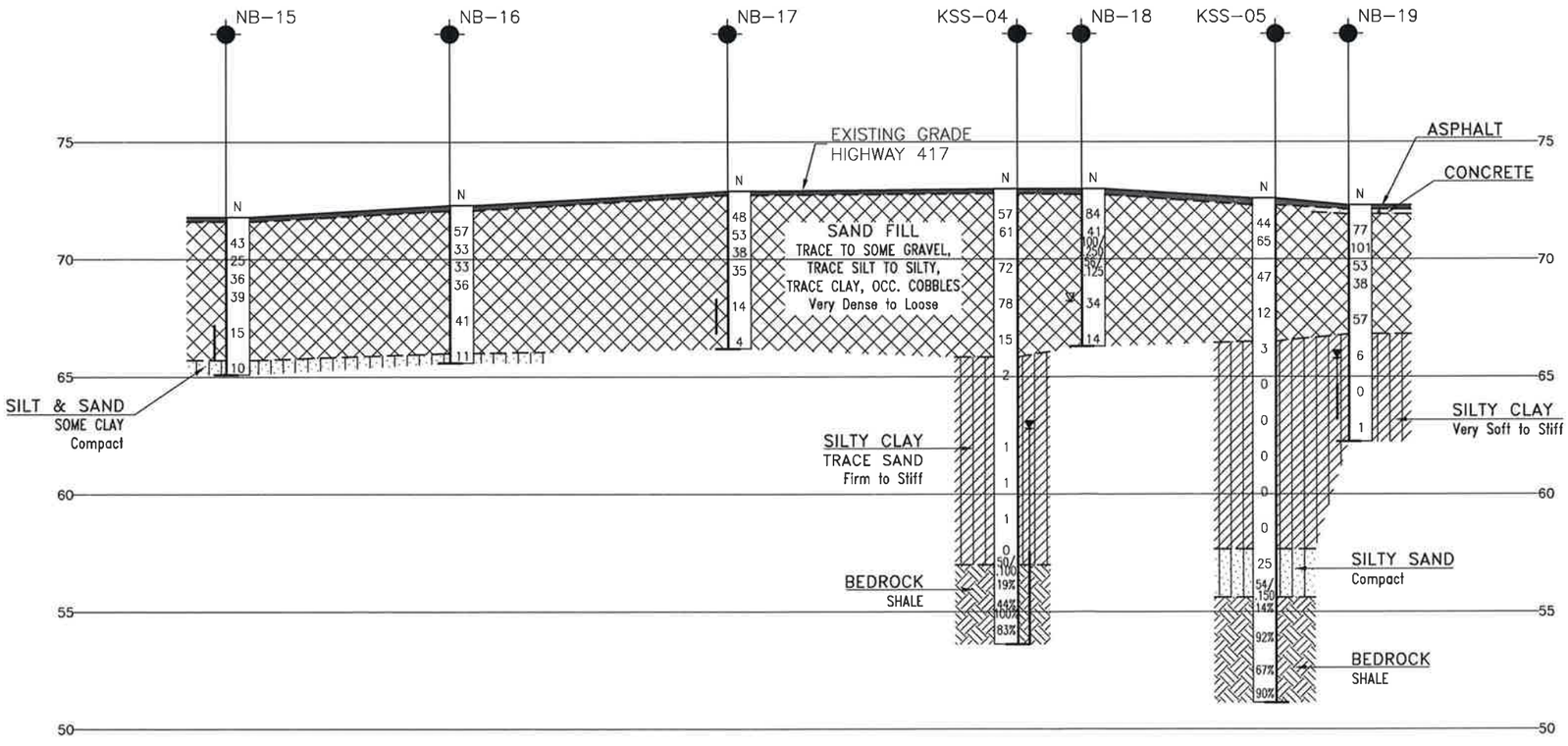
Borehole Locations and Soil Strata Drawing



PLAN

30 0 30 60m

SCALE 1:1500



PROFILE ALONG HWY 417

30 0 30 60m H 1:1500

5 0 5 10 V 1:250

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

LICENSED PROFESSIONAL ENGINEER
M. R. ANDERSON
Jan 15/15
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. K. CHATTERJI
Jan 15/15
PROVINCE OF ONTARIO

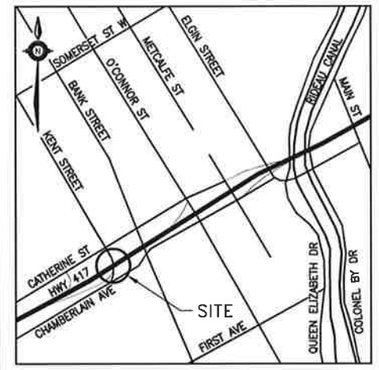
CONT No
WP No 4088–07–01

SHEET

HIGHWAY 417
NOISE BARRIER WALL
STA. 28+380 TO 28+690
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 During Drilling
▽	Water Level In Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

NO	ELEVATION	NORTHING	EASTING
NB–15	71.8	5 030 008.5	367 811.5
NB–16	72.3	5 030 038.8	367 859.8
NB–17	72.9	5 030 077.8	367 919.1
NB–18	73.0	5 030 128.5	367 994.5
NB–19	72.3	5 030 166.2	368 051.8
KSS–04	73.0	5 030 119.9	367 980.3
KSS–05	72.6	5 030 155.6	368 036.3

-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. 31G5-265

REVISIONS		
DATE	BY	DESCRIPTION

DESIGN	LRB	CHK	MRA	CODE	LOAD	DATE JAN 2015
DRAWN	MFA	CHK	LRB	SITE	STRUCT	DWG 1

FILENAME: H:\Drafting\191351\2015\tec1201-BoreholePlan&Profile(NB15-19)-Revise.dwg
PLOTDATE: 1/14/2015 4:45 PM