



THURBER ENGINEERING LTD.



**FOUNDATION INVESTIGATION REPORT
NEW SALT/SAND STORAGE BUILDING
MTO PATROL YARD – DRYDEN SITE
CITY OF DRYDEN, ONTARIO
LAT. 49.792542, LONG. -92.849897
AGREEMENT NO. 6015-E-0023, ASSIGNMENT NO. 5
G.W.P. 6054-16-00**

GEOCRES No. 52F-59

Report to

Ministry of Transportation of Ontario

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Date: August 9, 2017
File: 18934

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1. INTRODUCTION

This report presents the factual findings obtained from a foundation investigation conducted at the site of a proposed salt and sand storage building located at an existing Ministry of Transportation of Ontario (MTO) Patrol Yard in Northwestern Ontario. The patrol yard is located on Highway 17 (Grand Trunk Avenue), across from Wice Road, in the City of Dryden, Ontario.

The purpose of the investigation was to explore the subsurface conditions at the site and, based on the data obtained, provide a borehole location plan, record of borehole sheets, a stratigraphic profile, laboratory test results and a written description of the subsurface conditions.

Thurber carried out the investigation as a consultant to the MTO under the Ministry of Transportation Ontario (MTO) Agreement Number 6015-E-0023.

2. SITE DESCRIPTION

The patrol yard is located on Highway 17 (Grand Trunk Avenue), across from Wice Road, in the City of Dryden, Ontario.

The site includes an existing sand dome, salt shed, and 4 door garage and office. There is an asphalt access road to the site which extends to the existing sand dome and garage and office and surrounds the existing salt shed and sand dome. The remainder of the site has a gravel surface. The site terrain is generally flat. The site is bounded by Wabigoon River to the west, Highway 17 (Grand Trunk Avenue) to the east, and residential properties to the north and south. Photographs of the site are presented in Appendix C.

The general site area is located within an area characterized by glaciolacustrine deposits consisting of silt and clay, minor sand, basin and quiet water deposits over granite bedrock.

3. SITE INVESTIGATION AND FIELD TESTING

The site investigation and field testing for this project was carried out between June 12 and 13, 2017, and consisted of drilling and sampling four boreholes (DRY-01 to DRY-04) near the corners of the proposed salt and sand storage building. The boreholes were advanced through the overburden to depths ranging from 7.7 to 12.9 m below ground surface and terminated on or within bedrock (Elev. 361.0 to 356.3 m).

The approximate borehole locations are shown on the Borehole Locations and Soil Strata Drawing in Appendix D. The boreholes were drilled near the corners of the proposed building that were staked out by the MTO prior to commencement of the field investigation. The coordinates and elevations of the boreholes are given on these drawings and on the individual Record of Borehole Sheets in Appendix A.

Prior to commencement of drilling, utility clearances were obtained for all borehole locations.

Hollow stems augers were used to advance the boreholes in the overburden. Samples were obtained at selected intervals using a 50 mm diameter split spoon sampler in conjunction with the Standard Penetration Test (SPT). Field vane tests (FVTs) were also performed in the cohesive soils to obtain undrained shear strength measurements. Where bedrock was encountered, N casing with a NQ core barrel was used to core the bedrock.

A member of Thurber's engineering staff supervised the drilling and sampling operations on a full time basis. The supervisor logged the boreholes, visually examined the recovered samples, and transported the samples to Thurber's laboratory in Oakville, Ontario, for further examination and laboratory testing.

Groundwater conditions in the open boreholes were observed throughout the drilling operations. A standpipe piezometer consisting of a 25 mm diameter PVC pipe with slotted screen was installed in DRY-02 to permit monitoring of the groundwater level. Details of the piezometer installation and other borehole completion details are on the Record of Borehole Sheets in Appendix A.

The boreholes in which no piezometers were installed were backfilled with bentonite and cuttings to the ground surface in general accordance with MOE Regulation 903. The piezometer in Borehole DRY-02 was abandoned in accordance with Reg. 903 upon completion of the field program.

4. LABORATORY TESTING

All recovered soil and rock samples were subjected to Visual Identification (VI) and natural moisture content determination. At least 25% of the recovered soil samples were also subjected to grain size distribution analysis (sieve and hydrometer) and Atterberg Limits testing where appropriate. The results of the testing program are shown on the Record of Borehole Sheets in Appendix A and on the Figures contained in Appendix B.

5. SUBSURFACE CONDITIONS

Details of the encountered soil and rock stratigraphy are presented on the Record of Borehole Sheets in Appendix A and the Borehole Locations and Soil Strata Drawing in Appendix D.

The stratigraphic boundaries shown on the borehole sheets and on the interpreted stratigraphic profile and cross-sections are inferred observations of drilling progress and from non-continuous sampling and, therefore, represent transitions between soil types rather than exact planes of geological change. The subsoil conditions will vary between and beyond the borehole locations.

In general, the subsurface conditions at the site consist of a surficial gravelly sand layer overlying a layer of silty clay fill, which is in turn underlain by, in succession, deposits of silty clay, sandy silt, and sand and gravel, overlying granite bedrock.

A more detailed description of the subsurface conditions encountered in the boreholes is provided below.

5.1 Gravelly Sand Fill

A 0.2 to 0.8 m thick layer of brown gravelly sand fill was encountered from the ground surface in all of the boreholes between Elev. 368.7 and 369.6 m. The gravelly sand fill was described as containing trace amounts of silt and clay and organics as well as some asphalt fragments. The base of the gravelly sand fill was encountered between Elev. 369.0 and 368.4 m.

The measured SPT 'N' values within the gravelly sand fill ranged from 12 to 38 blows per 0.3 m penetration suggesting a compact to dense relative density. Natural moisture contents measured on samples of the fill ranged from 1 to 5%.

The results of a grain size analysis conducted on a selected sample of the gravelly sand fill is provided on the Record of Borehole sheets in Appendix A, and illustrated in Figure B1 of Appendix B. The results of the grain size analysis are also summarized in the table below.

Soil Particle	%
Gravel	23
Sand	66
Silt + Clay	11

5.2 Silty Clay Fill

A 0.1 to 0.4 m thick layer of brown silty clay fill was encountered underlying the gravelly sand fill in Boreholes DRY-01, DRY-02, and DRY-03. The silty clay fill was described as being sandy and gravelly to containing trace amounts of sand and gravel. The fill was also noted to contain trace organics. The upper boundary of the silty clay fill layer was encountered between Elev. 368.8 and 368.4 m in the boreholes. The base of the silty clay fill was encountered between Elev. 368.7 and 368.2 m.

The measured SPT 'N' values within the silty clay fill ranged from 6 to 14 blows per 0.3 m penetration suggesting a firm to stiff consistency. Natural moisture contents measured on samples of the silty clay fill ranged from 20 to 28%.

The results of a grain size analysis conducted on a selected sample of the silty clay fill is provided on the Record of Borehole sheets in Appendix A, and illustrated in Figure B2 of Appendix B. The results of the grain size analysis are also summarized in the table below.

Soil Particle	%
Gravel	0
Sand	0
Silt	48
Clay	52

5.3 Silty Clay

A 3.5 to 5.8 m thick deposit of brown to grey silty clay was encountered underlying the silty clay fill in boreholes DRY-01, DRY-02, DRY-03, and below the gravelly sand fill in Borehole DRY-04. Trace organics were encountered within the deposit in Boreholes DRY-01 and DRY-04. The upper boundary of the deposit was encountered between Elev. 369.0 and 368.2 m. The base of the deposit was encountered between Elev. 364.8 and 362.9 m.

The measured SPT 'N' values within the silty clay ranged from 6 to 23 blows per 0.3 m penetration, indicating a firm to very stiff consistency. In general, the 'N' values ranged from 7 to

13. The natural water moisture content measured on samples of the silty clay ranged from 23 to 36%.

The results of grain size analyses conducted on selected samples silty clay are provided on the Record of Borehole sheets in Appendix A, and illustrated in Figures B3 and B4 in Appendix B. The results of the grain size analyses are also summarized in the table below.

Soil Particle	%
Gravel	0
Sand	0
Silt	46 to 84
Clay	16 to 54

Atterberg limits testing carried out on four samples of the silty clay measured plastic limits of 17 to 21%, liquid limits of 27 to 48%, and corresponding plasticity indices of 10 to 27%. The results, which are plotted on Figure B7 of Appendix B, indicate that the deposit consists of low to medium plasticity silty clay.

The results of an Oedometer (one-dimensional consolidation) test carried out on a sample of the silty clay are summarized in Table 5.1 below. The test was performed by TBT Engineering, of Thunder Bay, Ontario. The test results are graphically presented in Appendix B following the grain size distribution and plasticity charts.

Table 5.1: Oedometer Test Results

Borehole	DRY-03
Sample No.	TW1
Depth (m)	2.7
Elevation (m)	366.9
Soil Type	Silty Clay
Clay Content (%)	51
Moisture Content (%)	31.4
Liquid Limit (%)	23
Plasticity Index (%)	18
γ_b - Bulk Unit Weight (kN/m ³)	17.7
G_s - Specific Gravity	2.80
e_o - Initial Void Ratio	1.033
P'_0 - In situ effective vertical stress (kPa)	48
P'_c - Preconsolidation Pressure (kPa)	350
OCR - Overconsolidation Ratio	7.3
C_{ce} - Compression Ratio	0.126
C_{re} - Recompression Ratio	0.011
C_v - Coefficient of Consolidation in NC range (m ² /yr)	0.4 – 2.7
C_{vr} - Coefficient of Consolidation in OC range (m ² /yr)	2 - 16

5.4 Silty Sand to Sandy Silt

A 3.3 to 4.9 m thick deposit of grey silty sand to sandy silt was encountered underlying the silty clay deposit in all of the boreholes. The sandy silt contained trace amounts of clay but was noted to contain occasional thin lenses of silty clay. The upper boundary of the deposit was encountered between Elev. 364.8 and 362.9 m. The base of the deposit was encountered between Elev. 361.0 and 359.4 m.

The measured SPT 'N' values within the silty sand to sandy silt ranged from 12 to 26 blows per 0.3 m penetration suggesting a compact relative density. The natural water moisture content measured on samples of the silty sand to sandy silt ranged from 3 to 23%.

The results of grain size analyses conducted on samples of the silty sand to sandy silt are provided on the Record of Borehole sheets in Appendix A, and illustrated in Figure B5 of Appendix B. The results of the grain size analyses are also summarized in the table below.

Soil Particle	%
Gravel	0
Sand	0 to 22
Silt	72 to 84
Clay	6 to 16

5.5 Sand and Gravel

A 0.4 m thick deposit of sand and gravel was encountered underlying the silty sand to sandy silt deposit in Borehole DRY-04. The upper boundary of the deposit was encountered at Elev. 359.9 m and the lower boundary was at Elev. 359.5 m.

An SPT 'N' values of 50 blows per 0.075 m penetration was measured within the sand and gravel, indicating a very dense relative density. The natural water moisture content measured on a sample of the sand and gravel was 19%.

The results of a grain size analysis conducted on a sample of the sand and gravel are provided on the Record of Borehole sheets in Appendix A, and illustrated in Figure B6 of Appendix B. The results of the grain size analysis are also summarized in the table below.

Soil Particle	%
Gravel	45
Sand	50
Silt + Clay	5

5.6 Granite Bedrock

Granite bedrock was encountered underlying the sandy silt deposit in Borehole DRY-01 and underlying the sand and gravel deposit in DRY-04. Boreholes DRY-02 and DRY-03 were also likely terminated on refusal on probable bedrock although rock coring was not undertaken in those boreholes.

The granite bedrock is generally grey with white, pink, and black specs. The rock was described as lightly weathered, with discolouration visible on the joint surfaces. Total Core Recovery (TCR) in the core runs ranged from 92% to 100%. The Rock Quality Designation (RQD) determined from the cores recovered ranged from 36 to 100%, indicating poor to excellent rock quality.

Table 5.2 below summarizes the depth to bedrock and the bedrock surface elevations encountered in the boreholes.

Table 5.2 – Depth and Elevation of Top of Bedrock

Location	Borehole	Depth to Bedrock Below Existing Ground Surface (m)	Elevation of Top of Bedrock (m)
SW Building Corner	DRY-01	8.8	360.1
NW Building Corner	DRY-02	7.7*	361.0
SE Building Corner	DRY-03	10.2*	359.4
NE Building Corner	DRY-04	9.7	359.5

*probable bedrock

5.7 Water Levels

Water levels were observed in the boreholes during and upon completion of drilling. A standpipe piezometer was installed in Borehole DRY-02 to monitor the groundwater level at the site. Table 5.3 summarizes the water levels measured in the open boreholes and piezometer.

Table 5.3 – Water Level Measurements

Borehole	Date	Water Level (m)		Comment
		Depth	Elevation	
DRY-01	June 12, 2017	Dry	Dry	In open borehole
DRY-02	June 13, 2017	Dry	Dry	In piezometer
DRY-03	June 13, 2017	Dry	Dry	In open borehole
DRY-04	June 13, 2017	Dry	Dry	In open borehole

As per the above table, groundwater was not observed within the open boreholes or in the piezometer. However, these are short term readings and seasonal fluctuations in the groundwater table are expected. In particular, the groundwater table may be higher during spring snowmelt or after heavy precipitation.

6. MISCELLANEOUS

The boreholes locations were surveyed by Deltasurvey Inc. following completion of drilling.

RPM Drilling of Thunder Bay, Ontario supplied and operated the drilling, sampling and in-situ testing equipment for the field investigation. The field investigation was supervised on a full time basis by Mr. Simon Paxton of Thurber. Overall supervision of the field program was provided by Mr. Geoff Lay, P.Eng., of Thurber.

Routine laboratory testing was carried out at Thurber's geotechnical laboratory in Oakville, Ontario. Interpretation of the field data and preparation of this report was carried out by Mr. Geoff Lay, P.Eng. The report was reviewed by Mr. Keli Shi, P.Eng., and Dr. P.K. Chatterji, P.Eng, a Designated Principal Contact for MTO Foundations Projects.

Thurber Engineering Ltd.



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Geotechnical Engineer



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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


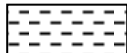



SYMBOLS AND ABBREVIATIONS FOR SAMPLE TYPE	SS Split Spoon Sample	WS Wash Sample	AS Auger (Grab) Sample
	TW Thin Wall Shelby Tube Sample	TP Thin Wall Piston Sample	
	PH Sampler Advanced by Hydraulic Pressure	PM Sampler Advanced by Manual Pressure	
	WH Sampler Advanced by Self Static Weight	RC Rock Core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

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

 Water Level
 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.

EXPLANATION OF ROCK LOGGING TERMS

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

<u>DISCONTINUITY SPACING</u>		<u>STRENGTH CLASSIFICATION</u>			
Bedding	Bedding Plane Spacing	Rock Strength	Approximate Uniaxial Compressive Strength		Field Estimation of Hardness*
			(MPa)	(psi)	
Very thickly bedded	Greater than 2m	Extremely Strong	Greater than 250	Greater than 36,000	Specimen can only be chipped with a geological hammer
Thickly bedded	0.6 to 2m				
Medium bedded	0.2 to 0.6m	Very Strong	100-250	15,000 to 36,000	Requires many blows of geological hammer to break
Thinly bedded	60mm to 0.2m	Strong	50-100	7,500 to 15,000	Requires more than one blow of geological hammer to break
Very thinly bedded	20 to 60mm				
Laminated	6 to 20mm	Medium Strong	25.0 to 50.0	3,500 to 7,500	Breaks under single blow of geological hammer.
Thinly Laminated	Less than 6mm				
<u>TERMS</u>		Weak	5.0 to 25.0	750 to 3,500	Can be peeled by a pocket knife with difficulty
Total Core Recovery: (TCR)	Core recovered as a percentage of total core run length.	Very Weak	1.0 to 5.0	150 to 750	Can be peeled by a pocket knife, crumbles under firm blows of geological pick.
Solid Core Recovery: (SCR)	Percent Ratio of solid core of full cylindrical shape recovered. Expressed with respect to the total length of core run.	Extremely Weak (Rock)	0.25 to 1.0	35 to 150	Indented by thumbnail
Rock Quality Designation: (RQD)	Total length of sound core recovered in pieces 0.1m in length or larger as a percentage of total core run length.				
Uniaxial Compressive Strength (UCS)	Axial stress required to break the specimen				
Fracture Index: (FI)	Frequency of natural fractures per 0.3m of core run.				

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			

METRIC

[illegible]

+³, ×³: Numbers refer to Sensitivity

ONTMT4S MTO-18934.GPJ 2017TEMPLATE(MTO).GDT 17/8/3

RECORD OF BOREHOLE No DRY-01

2 OF 2

METRIC

GWP# 6054-16-00 LOCATION SW Building Corner, NAD 83-16 N 5 517 214.7 E 315 581.7 ORIGINATED BY SMP
 HWY 17 BOREHOLE TYPE Hollow Stem Augers/NQ Coring COMPILED BY AN
 DATUM Geodetic DATE 2017.06.12 - 2017.06.12 CHECKED BY GRL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					WATER CONTENT (%) W _p W W _L				
	Continued From Previous Page																
357.0			2	RUN			358									RUN #2 TCR=100% SCR=36% RQD=36%	
			3	RUN												RUN #3 TCR=100% SCR=80% RQD=68%	
11.9	END OF BOREHOLE AT 11.9m. BOREHOLE DRY UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.																

METRIC

[illegible]

+³, ×³: Numbers refer to Sensitivity

RECORD OF BOREHOLE No DRY-03

1 OF 2

METRIC

GWP# 6054-16-00 LOCATION SE Building Corner, NAD 83-16 N 5 517 213.7 E 315 599.6 ORIGINATED BY SMP
 HWY 17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.06.13 - 2017.06.13 CHECKED BY GRL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
369.6	GROUND SURFACE							20 40 60 80 100		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	
0.0	Gravelly SAND , trace silt, trace clay Dense Brown Moist (FILL)		1	SS	38		369						23 66 11 (SI+CL)
368.8													
368.8	Silty CLAY , sandy, gravelly Firm Brown Moist (FILL)		2	SS	6								
0.9													
	Silty CLAY Firm to Very Stiff Brown to Grey Moist		3	SS	7		368						0 0 46 54
			4	SS	10								
			1	TW			367						
			5	SS	7								
							366						
			6	SS	8		365						
							364						
			7	SS	23		363						
362.9	Sandy SILT Compact Grey Moist to Wet												
6.7			8	SS	20		362						0 19 72 9
							361						
			9	SS	24		360						

Continued Next Page

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

RECORD OF BOREHOLE No DRY-03

2 OF 2

METRIC

GWP# 6054-16-00 LOCATION SE Building Corner, NAD 83-16 N 5 517 213.7 E 315 599.6 ORIGINATED BY SMP
 HWY 17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.06.13 - 2017.06.13 CHECKED BY GRL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
	Continued From Previous Page																
359.4																	
10.2	END OF BOREHOLE AT 10.2m UPON AUGER REFUSAL ON PROBABLE BEDROCK. BOREHOLE DRY UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.																

ONTMT4S MTO-18934.GPJ 2017TEMPLATE(MTO).GDT 17/8/3

RECORD OF BOREHOLE No DRY-04

1 OF 2

METRIC

GWP# 6054-16-00 LOCATION NE Building Corner, NAD 83-16 N 5 517 237.1 E 315 600.7 ORIGINATED BY SMP
 HWY 17 BOREHOLE TYPE Hollow Stem Augers/NQ Coring COMPILED BY AN
 DATUM Geodetic DATE 2017.06.13 - 2017.06.13 CHECKED BY GRL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)								
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa													
369.2	GROUND SURFACE							20	40	60	80	100									
0.0																					
0.2	Gravelly SAND , trace silt Loose Brown Moist (FILL)		1	SS	6		369														
	Silty CLAY , trace organics, with black staining Firm to Very Stiff Brown to Grey Moist		2	SS	13																
			3	SS	13		368														
			4	SS	8		367														
			5	SS	8																
	Some sand lenses		6	SS	7		366														
			7	SS	8																
364.8			8	SS	16		365											0	0	78	22
4.4	Sandy SILT , containing lenses of silty clay from 4.6m to 6.2m Compact Grey Moist to Wet																				
							364														
			9	SS	26		363														
							362														
			10	SS	22																
							361														
359.9							360														
9.3	SAND and GRAVEL , trace silt		11	SS	50/																
359.5	Very Dense Grey				0.075																
9.7	Wet																				

Continued Next Page

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

RECORD OF BOREHOLE No DRY-04

2 OF 2

METRIC

GWP# 6054-16-00 LOCATION NE Building Corner, NAD 83-16 N 5 517 237.1 E 315 600.7 ORIGINATED BY SMP
 HWY 17 BOREHOLE TYPE Hollow Stem Augers/NQ Coring COMPILED BY AN
 DATUM Geodetic DATE 2017.06.13 - 2017.06.13 CHECKED BY GRL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL LIMIT MOISTURE LIQUID CONTENT LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE								
	Continued From Previous Page		1	RUN			359								GR SA SI CL RQD=92%	
	GRANITE BEDROCK slightly weathered, grey with white, pink and black specs		2	RUN			358								RUN #2 TCR=92% SCR=67% RQD=63%	
			3	RUN			357								RUN #3 TCR=100% SCR=100% RQD=100%	
356.3																
12.9	END OF BOREHOLE AT 12.9m. BOREHOLE DRY UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.															

ONTMT4S MTO-18934.GPJ 2017TEMPLATE(MTO).GDT 17/8/3



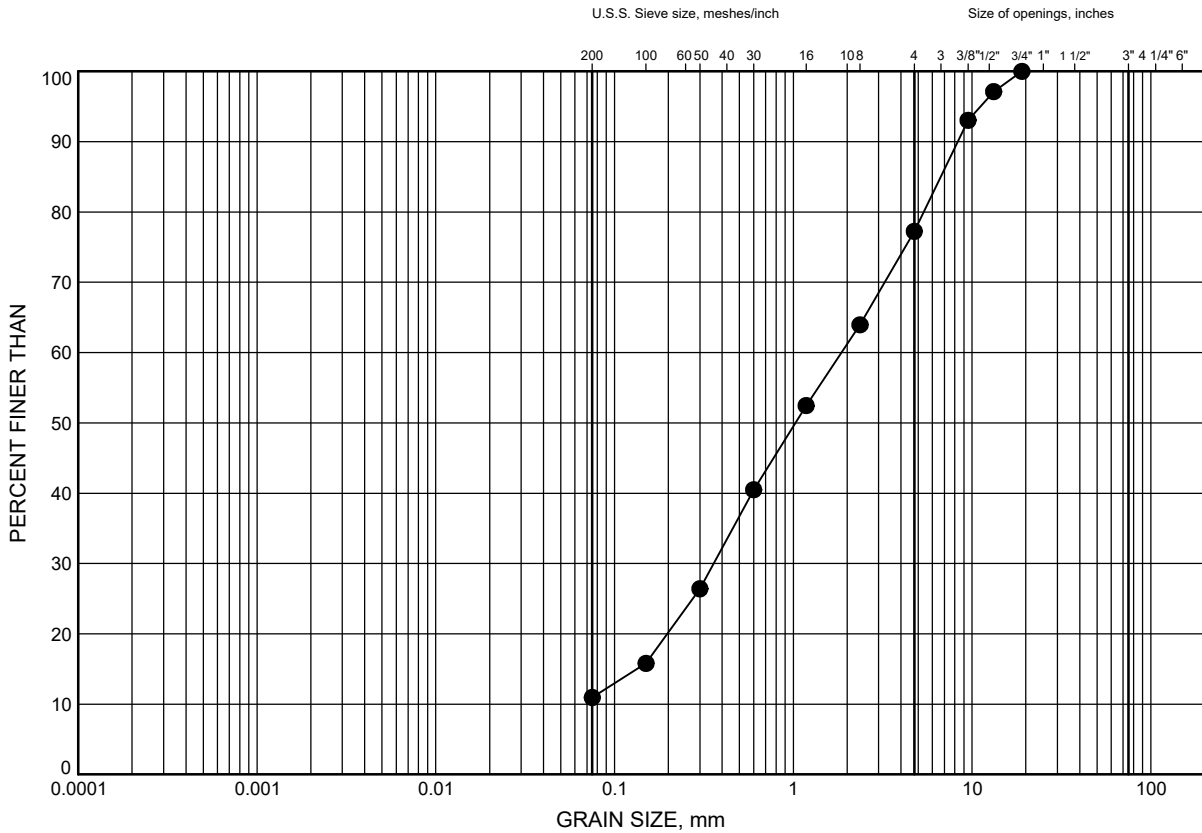
Appendix B

Laboratory Test Results

GRAIN SIZE DISTRIBUTION

FIGURE B1

Gravelly SAND FILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	DRY-03	0.3	369.3

Date August 2017
GWP# 6054-16-00

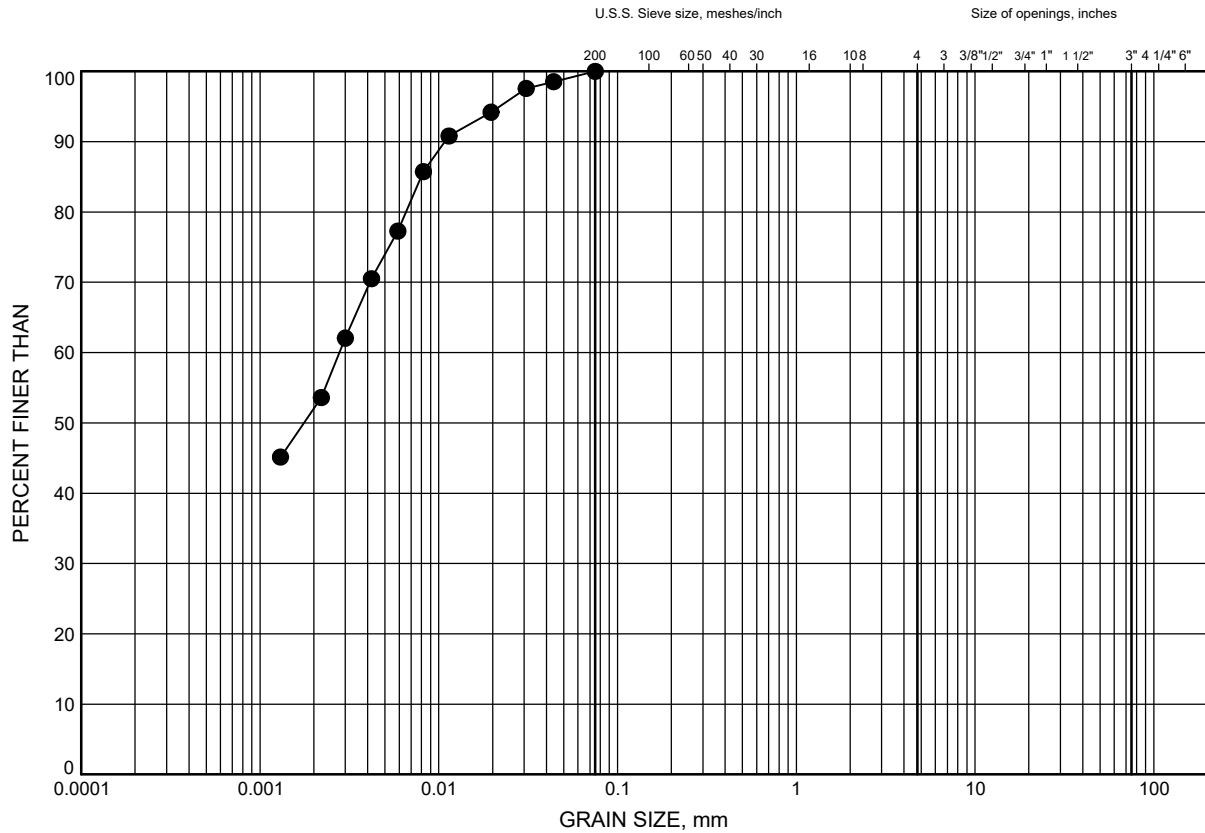


Prep'd AN
Chkd. GRL

GRAIN SIZE DISTRIBUTION

FIGURE B2

Silty CLAY FILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	DRY-02	0.4	368.3

Date August 2017
GWP# 6054-16-00

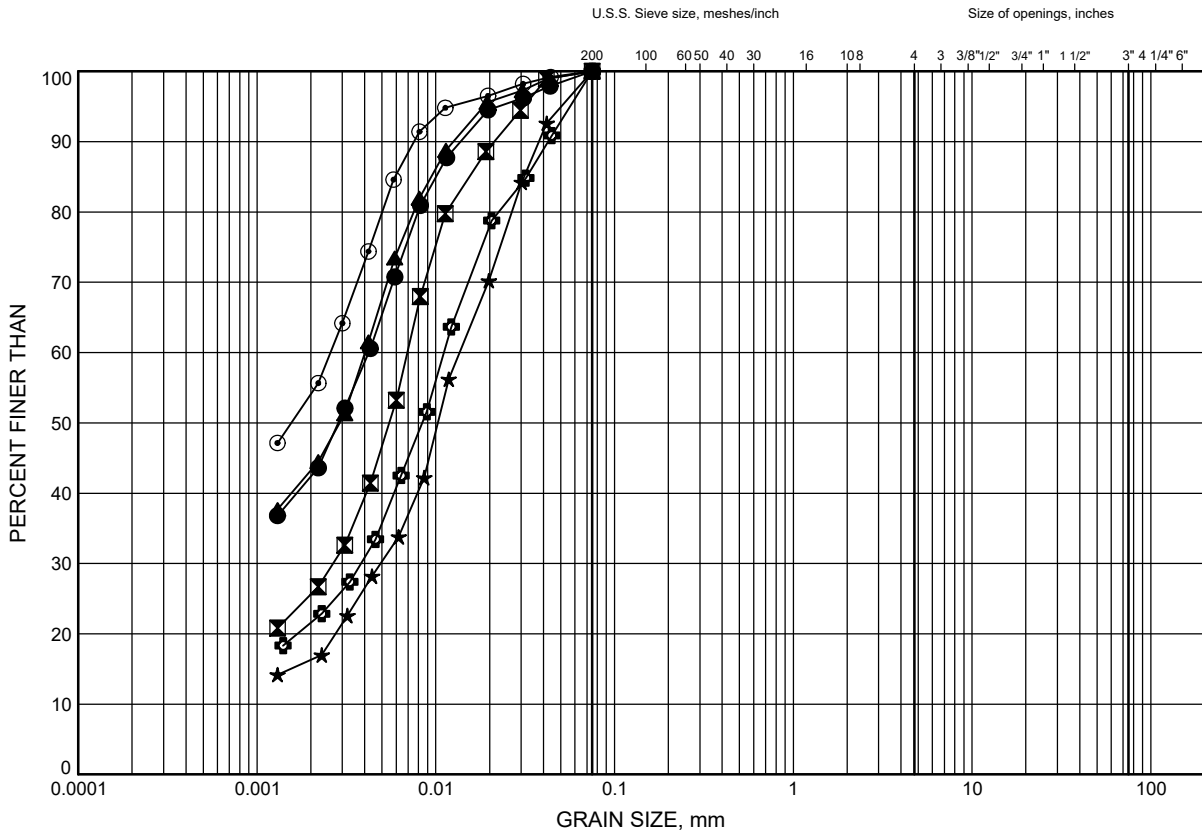


Prep'd AN
Chkd. GRL

GRAIN SIZE DISTRIBUTION

FIGURE B3

Silty CLAY



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	DRY-01	2.4	366.5
⊠	DRY-01	4.0	364.9
▲	DRY-02	1.5	367.2
★	DRY-02	2.7	366.0
⊙	DRY-03	1.5	368.1
⊕	DRY-04	4.1	365.1

Date August 2017

GWP# 6054-16-00



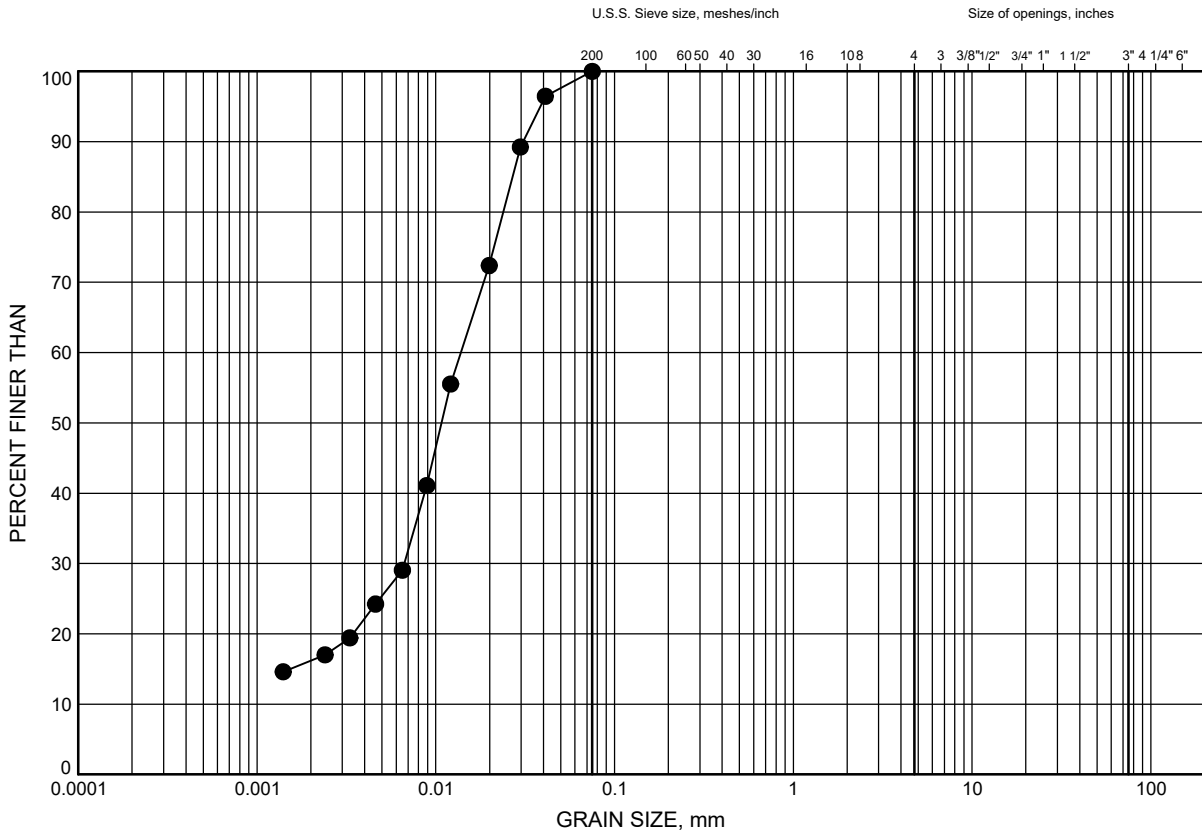
Prep'd AN

Chkd. GRL

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)
●	DRY-04	4.6	364.6

Date August 2017

GWP# 6054-16-00



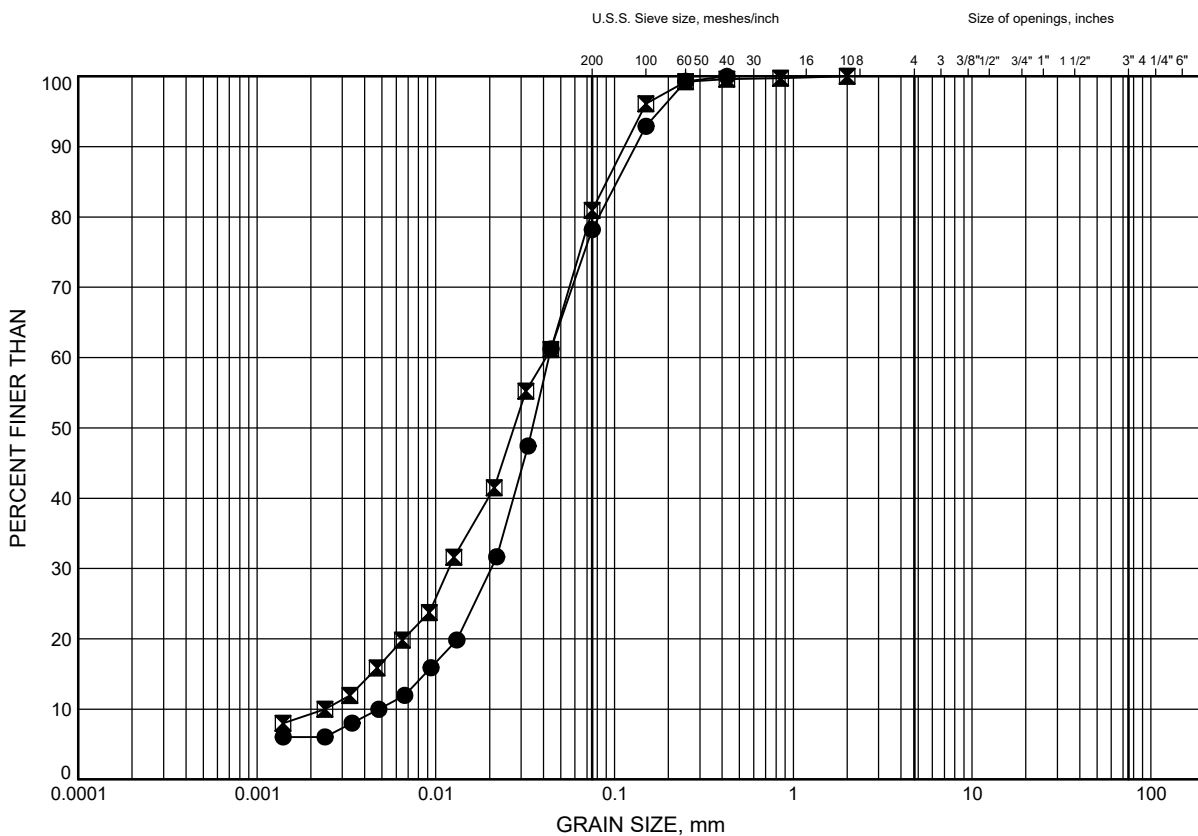
Prep'd AN

Chkd. GRL

GRAIN SIZE DISTRIBUTION

FIGURE B5

Silty SAND to Sandy SILT



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	DRY-01	6.4	362.5
◻	DRY-03	7.9	361.7

Date August 2017

GWP# 6054-16-00



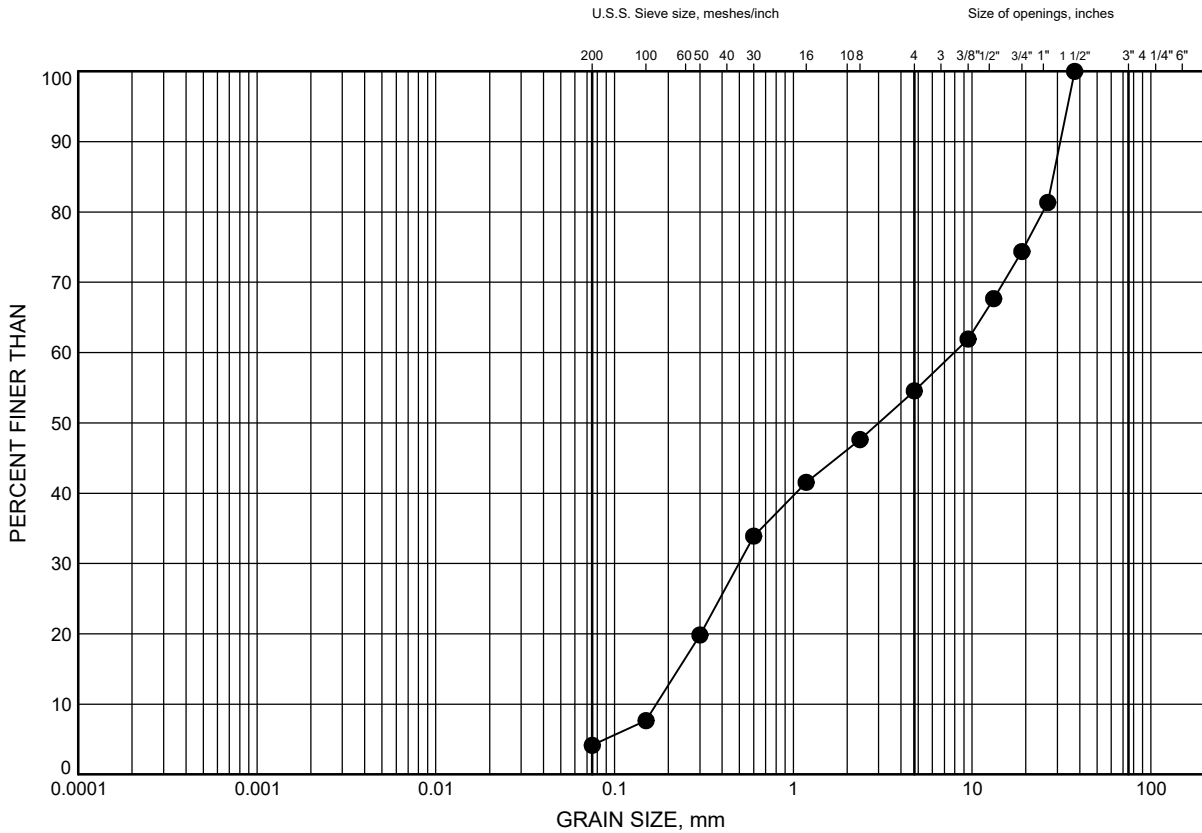
Prep'd AN

Chkd. GRL

GRAIN SIZE DISTRIBUTION

FIGURE B6

SAND & GRAVEL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	DRY-04	9.5	359.7

Date August 2017
GWP# 6054-16-00

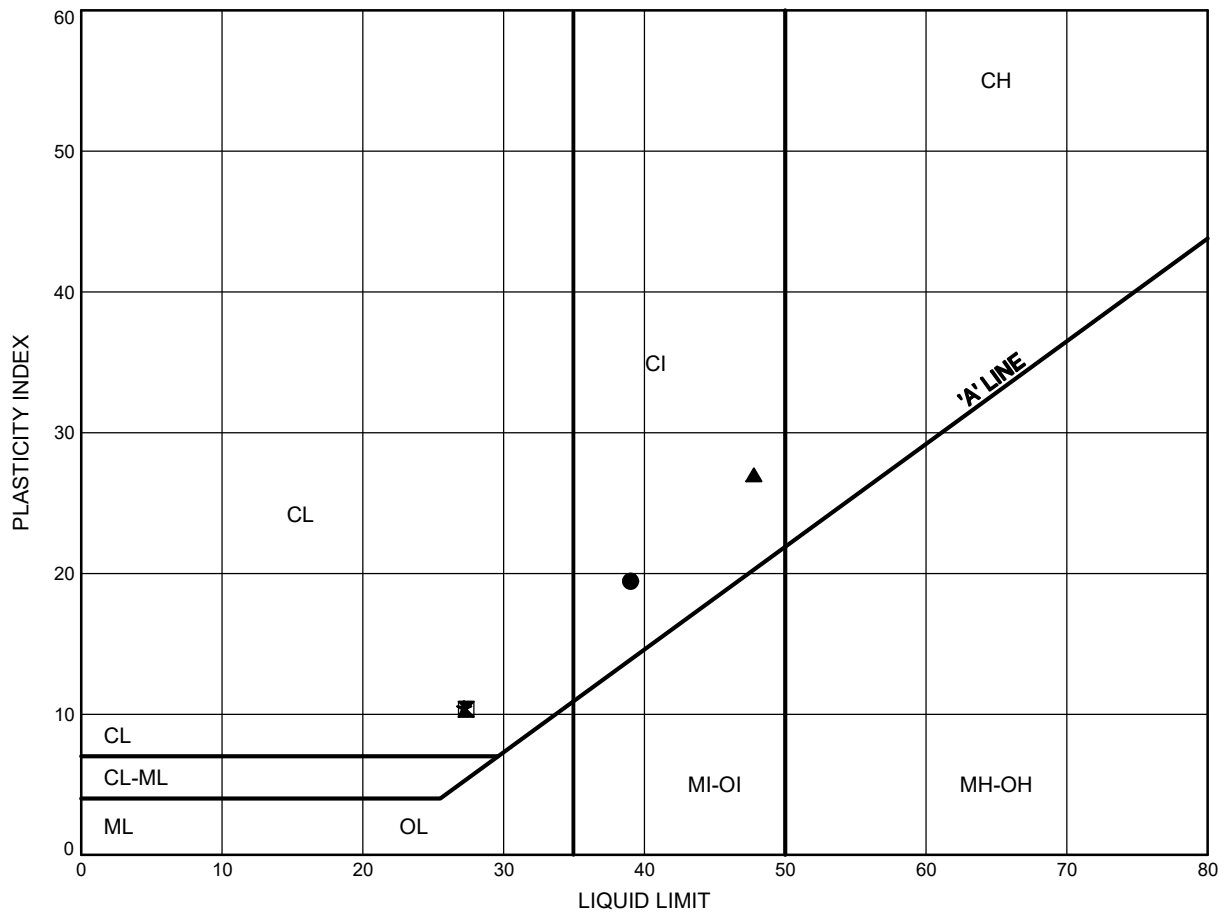


Prep'd AN
Chkd. GRL

ATTERBERG LIMITS TEST RESULTS

FIGURE B7

Silty CLAY



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	DRY-01	2.4	366.5
⊠	DRY-01	4.0	364.9
▲	DRY-03	1.5	368.1
★	DRY-04	4.1	365.1

Date August 2017

GWP# 6054-16-00

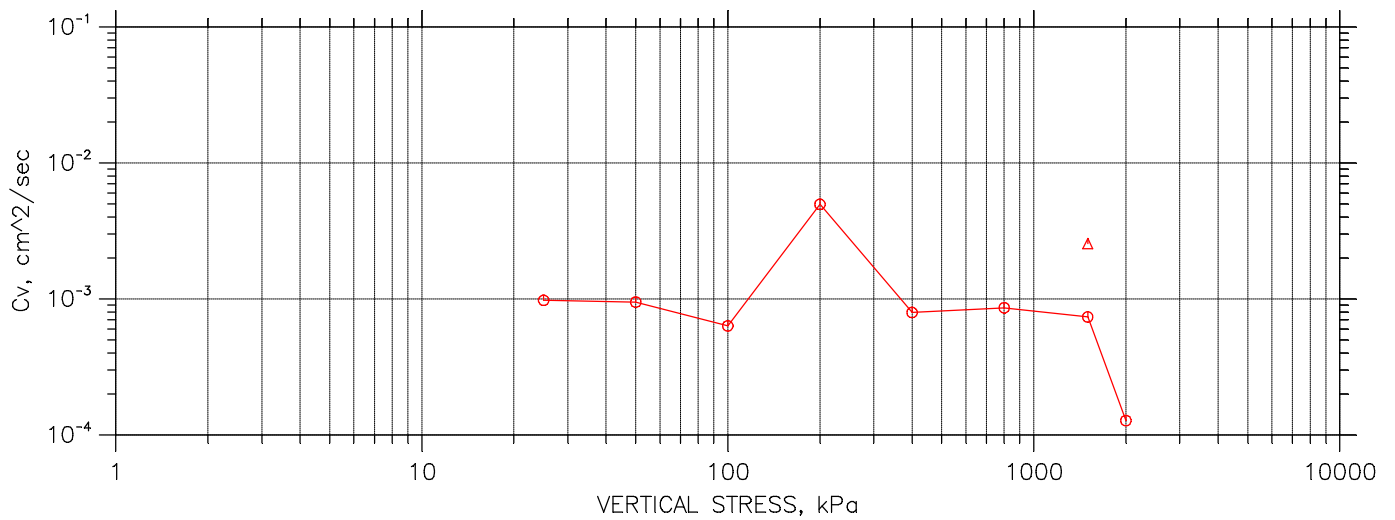
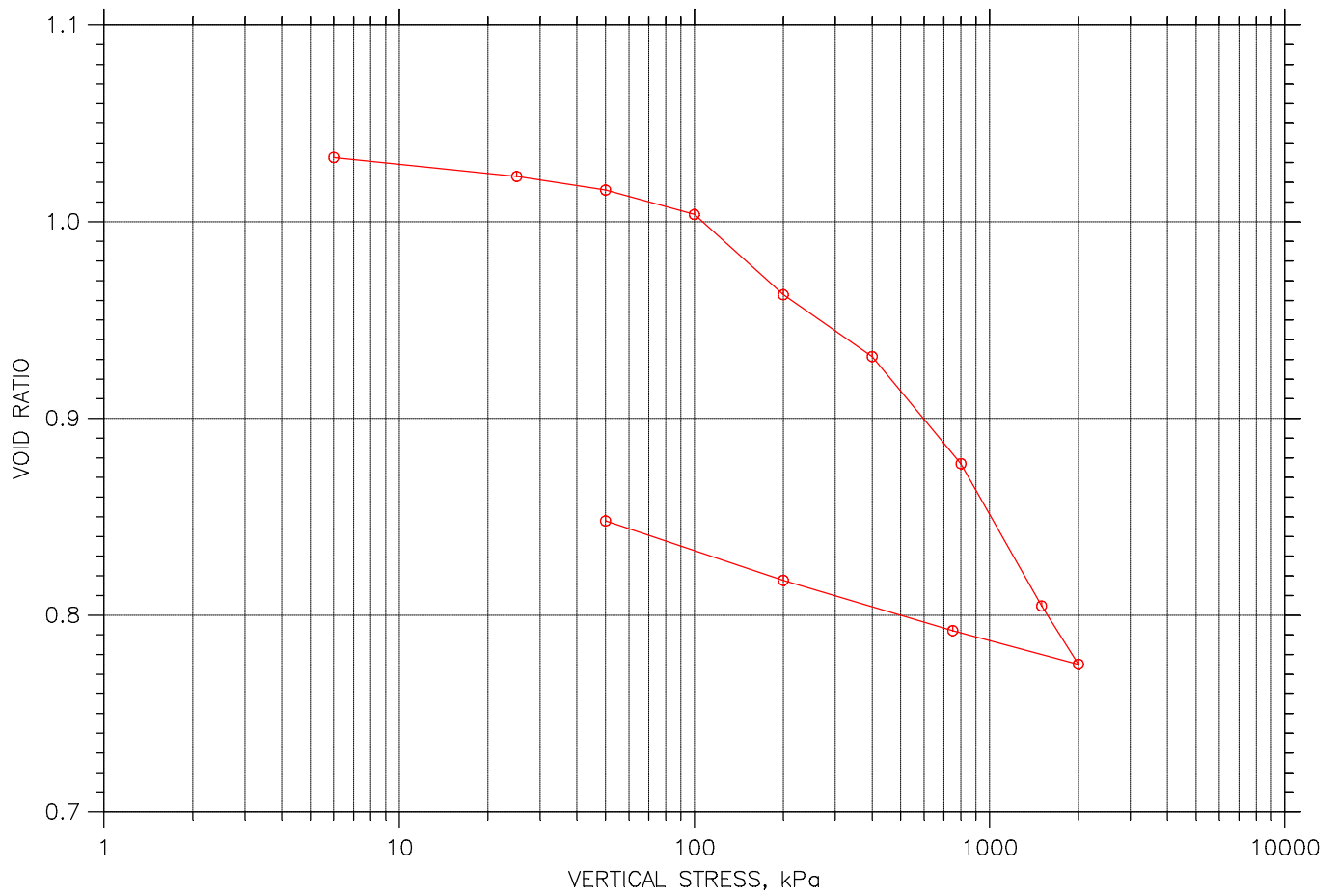



Prep'd AN

Chkd. GRL

CONSOLIDATION TEST DATA

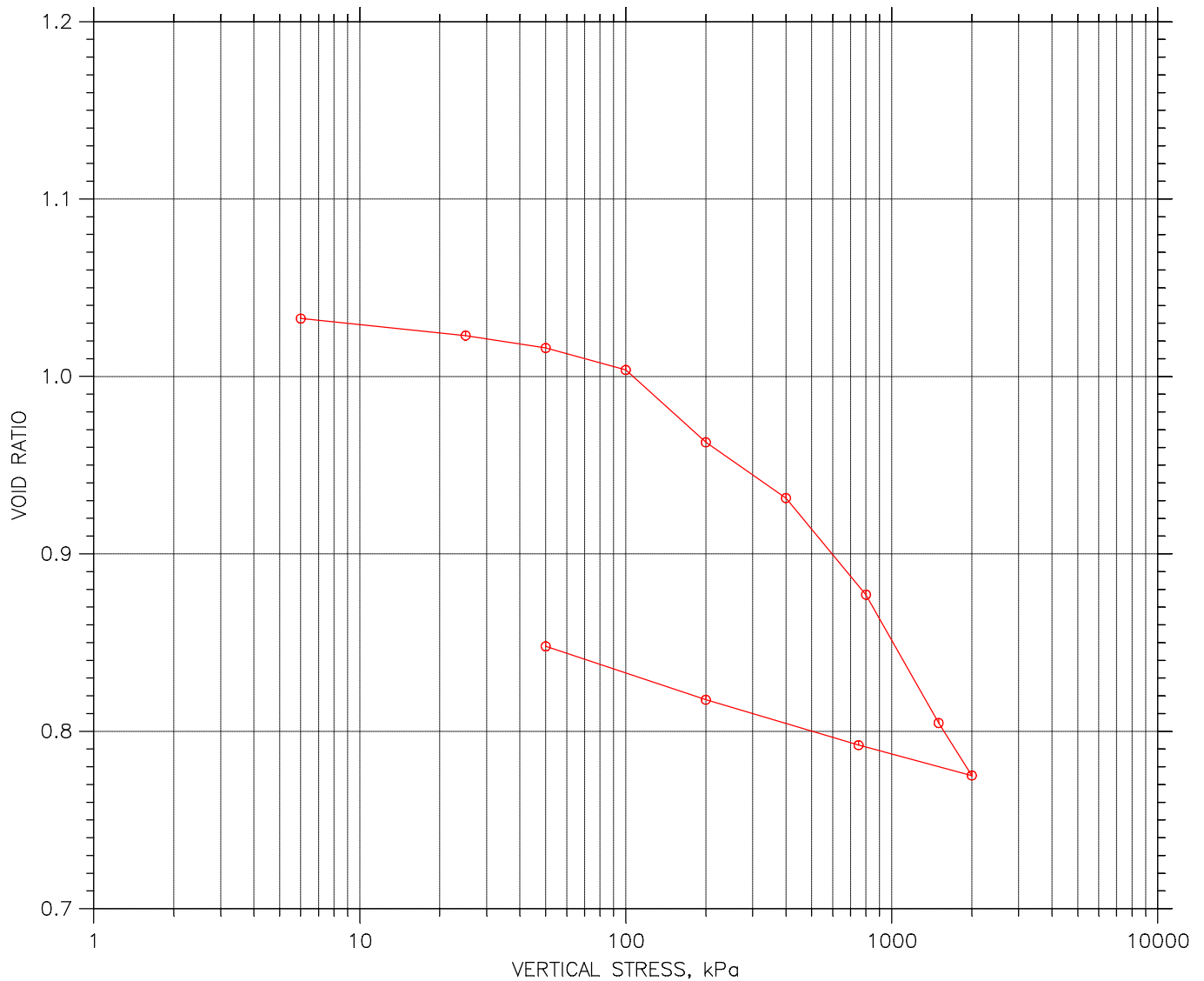
SUMMARY REPORT




	Project: MTO Patrol Yard	Location: Dryden ON	Project No.: 17-252
	Boring No.: ST6	Tested By: FV	Checked By: TF
	Sample No.: 17-469	Test Date: June 23,17	Depth: 8 - 10 ft
	Test No.: 3	Sample Type: TW	Elevation:
	Description: Clay, light grey		
	Remarks:		

CONSOLIDATION TEST DATA

SUMMARY REPORT



				Before Test	After Test	
Overburden Pressure: 0 kPa				Water Content, %	31.35	33.19
Preconsolidation Pressure: 0 kPa				Dry Unit Weight, N/m^3	13500	14860
Compression Index: 0				Saturation, %	84.88	109.62
Diameter: 50.15 mm		Height: 18.9 mm		Void Ratio	1.03	0.85
LL: 23	PL: 18	PI: 5	GS: 2.80			

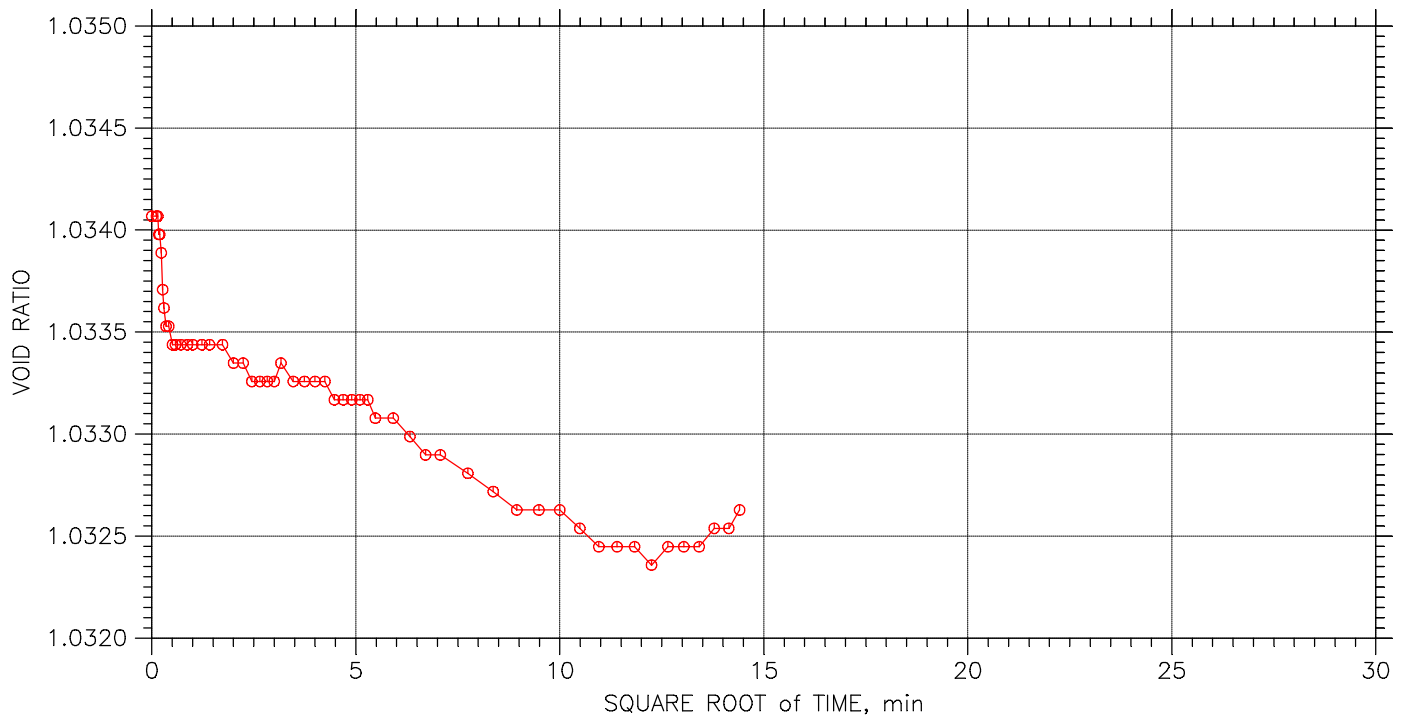
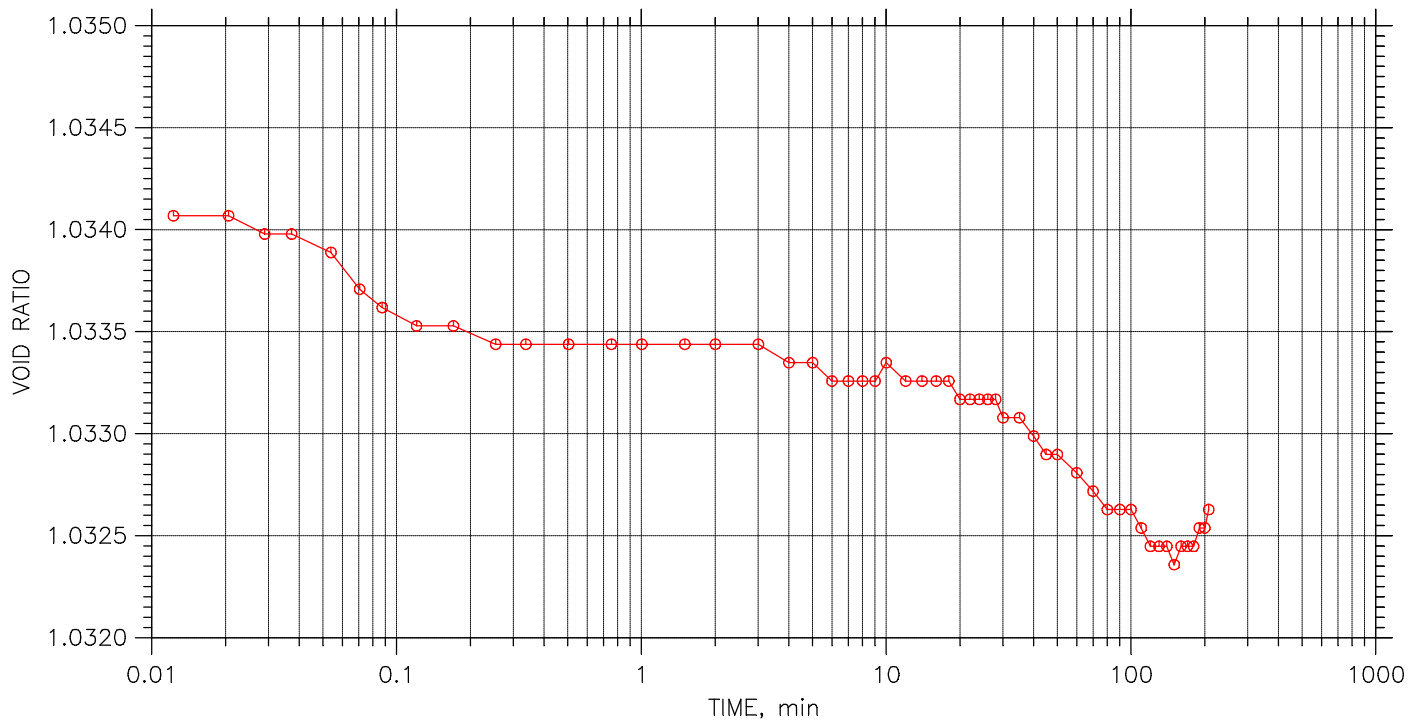
	Project: MTO Patrol Yard	Location: Dryden ON	Project No.: 17-252
	Boring No.: ST6	Tested By: FV	Checked By: TF
	Sample No.: 17-469	Test Date: June 23,17	Depth: 8 - 10 ft
	Test No.: 3	Sample Type: TW	Elevation:
	Description: Clay, light grey		
	Remarks:		


CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 1 of 12

Stress: 6. kPa



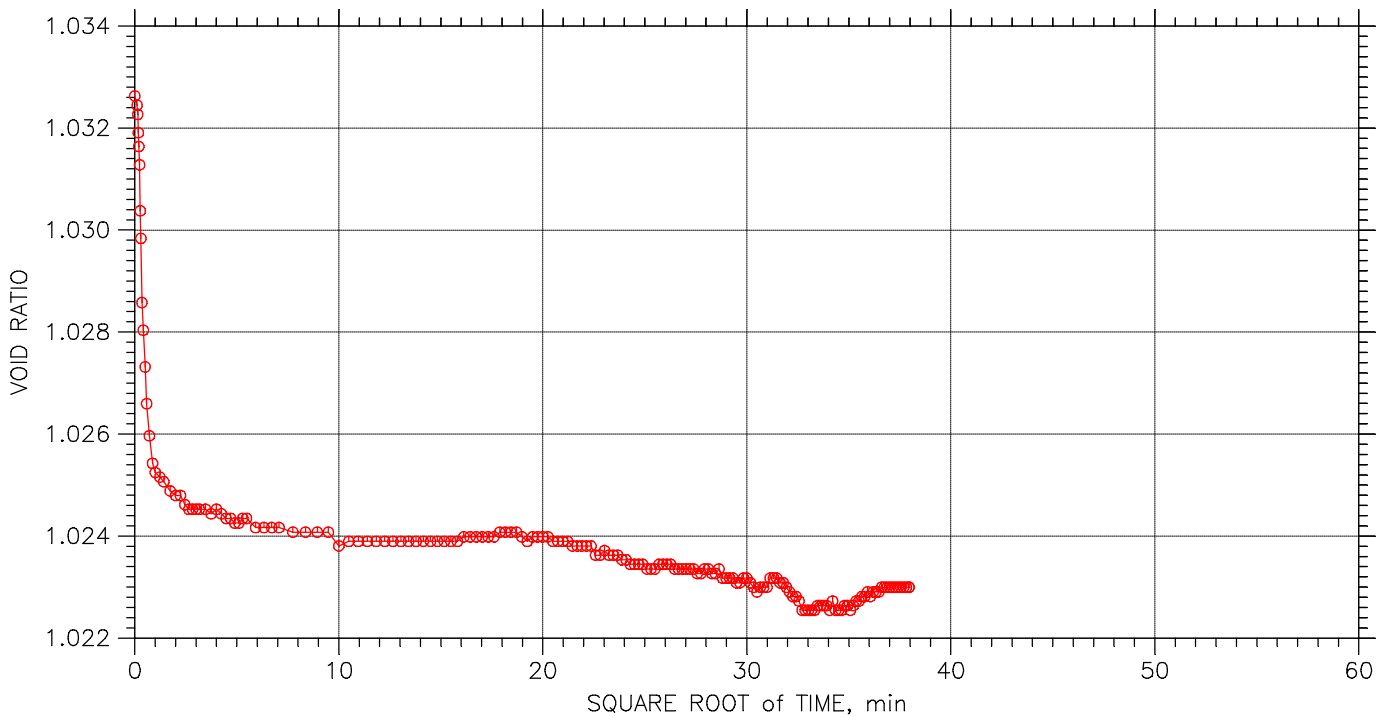
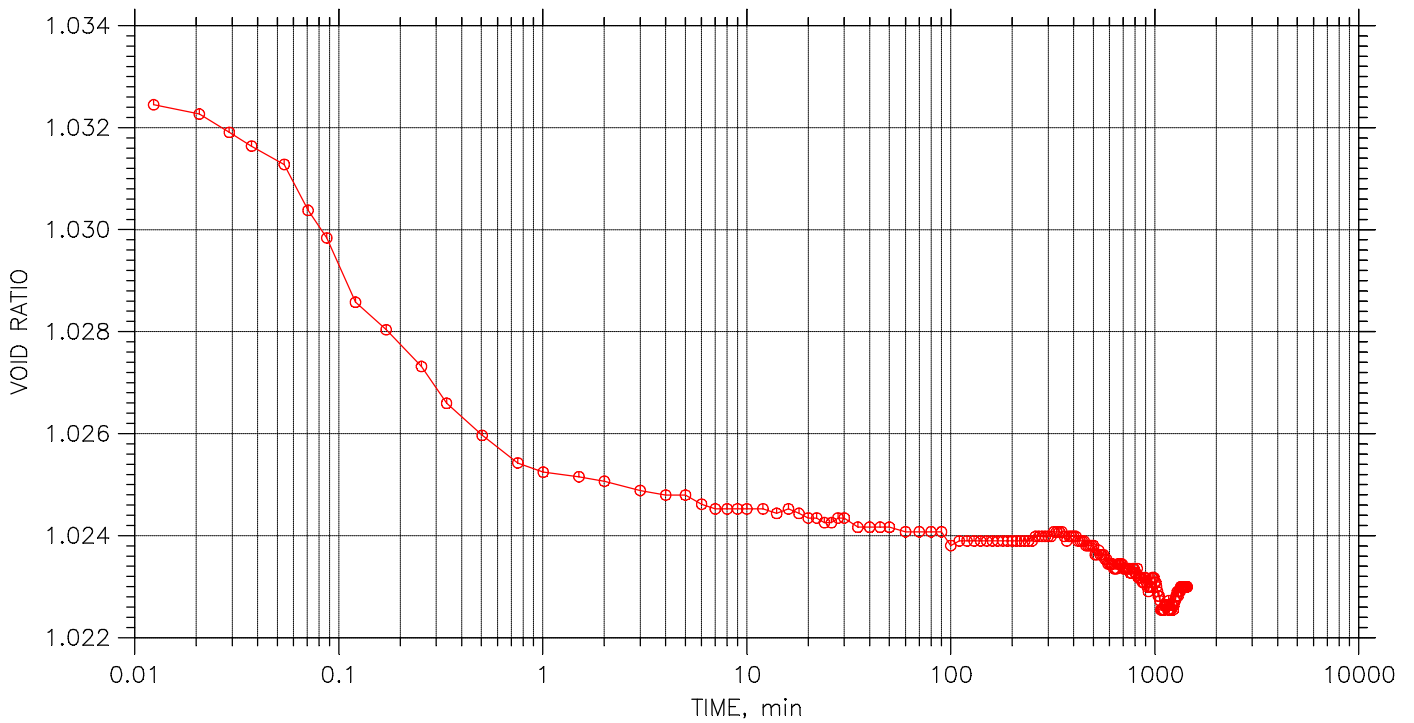
	Project: MTO Patrol Yard	Location: Dryden ON	Project No.: 17-252
	Boring No.: ST6	Tested By: FV	Checked By: TF
	Sample No.: 17-469	Test Date: June 23,17	Depth: 8 - 10 ft
	Test No.: 3	Sample Type: TW	Elevation:
	Description: Clay, light grey		
	Remarks:		


CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 2 of 12

Stress: 25. kPa



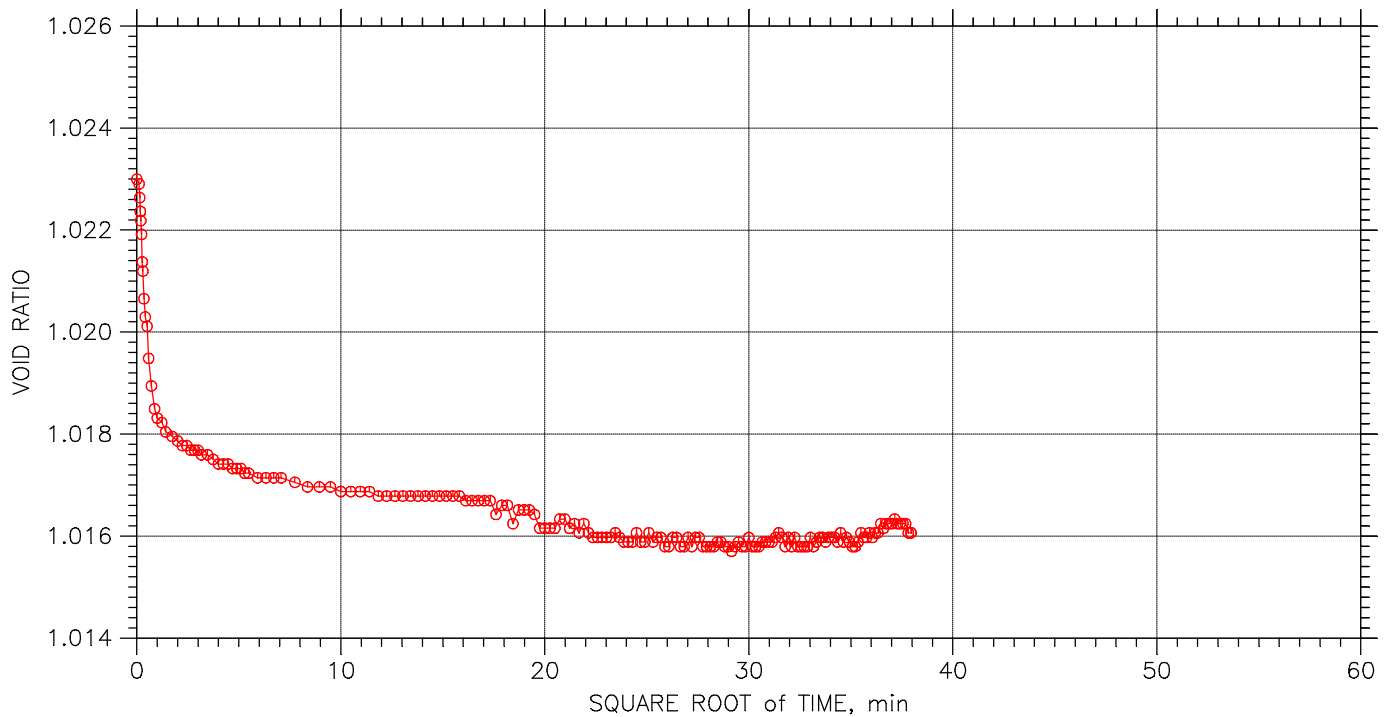
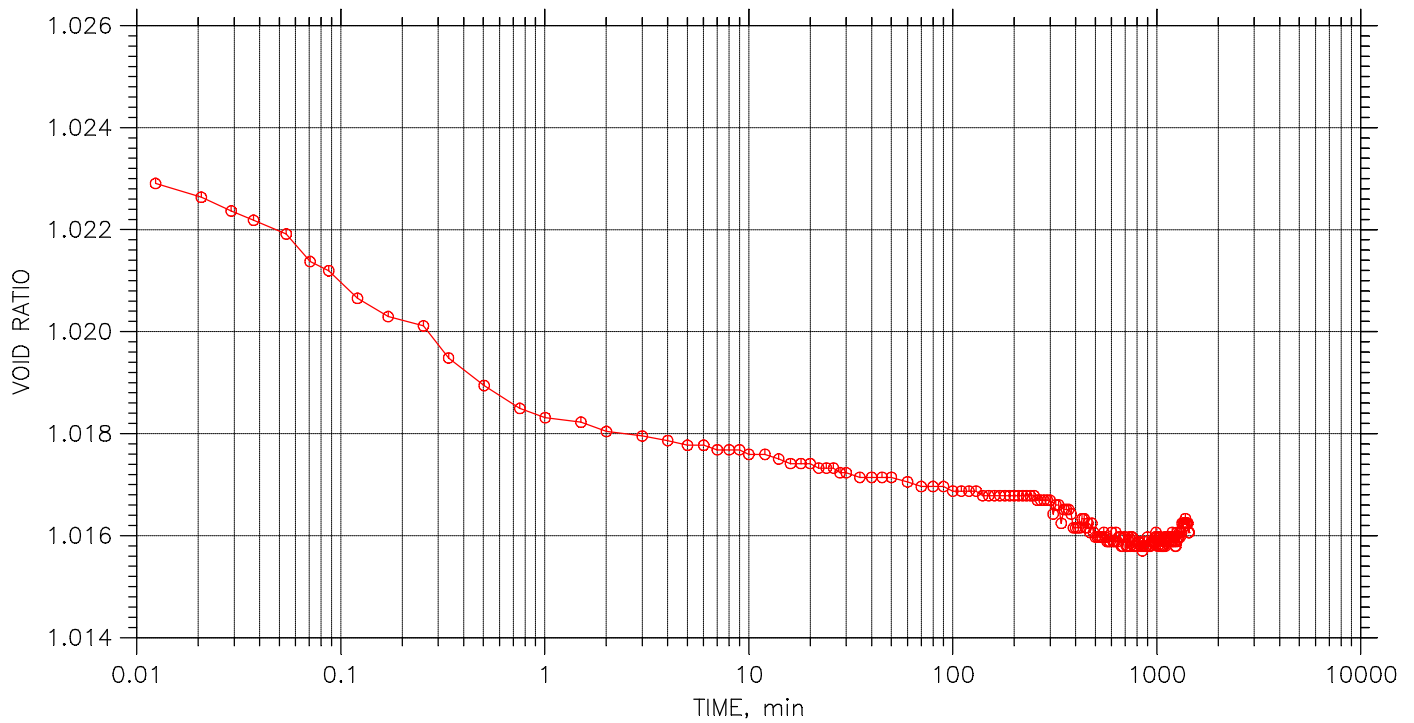
	Project: MTO Patrol Yard	Location: Dryden ON	Project No.: 17-252
	Boring No.: ST6	Tested By: FV	Checked By: TF
	Sample No.: 17-469	Test Date: June 23,17	Depth: 8 - 10 ft
	Test No.: 3	Sample Type: TW	Elevation:
	Description: Clay, light grey		
	Remarks:		


CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 3 of 12

Stress: 50. kPa



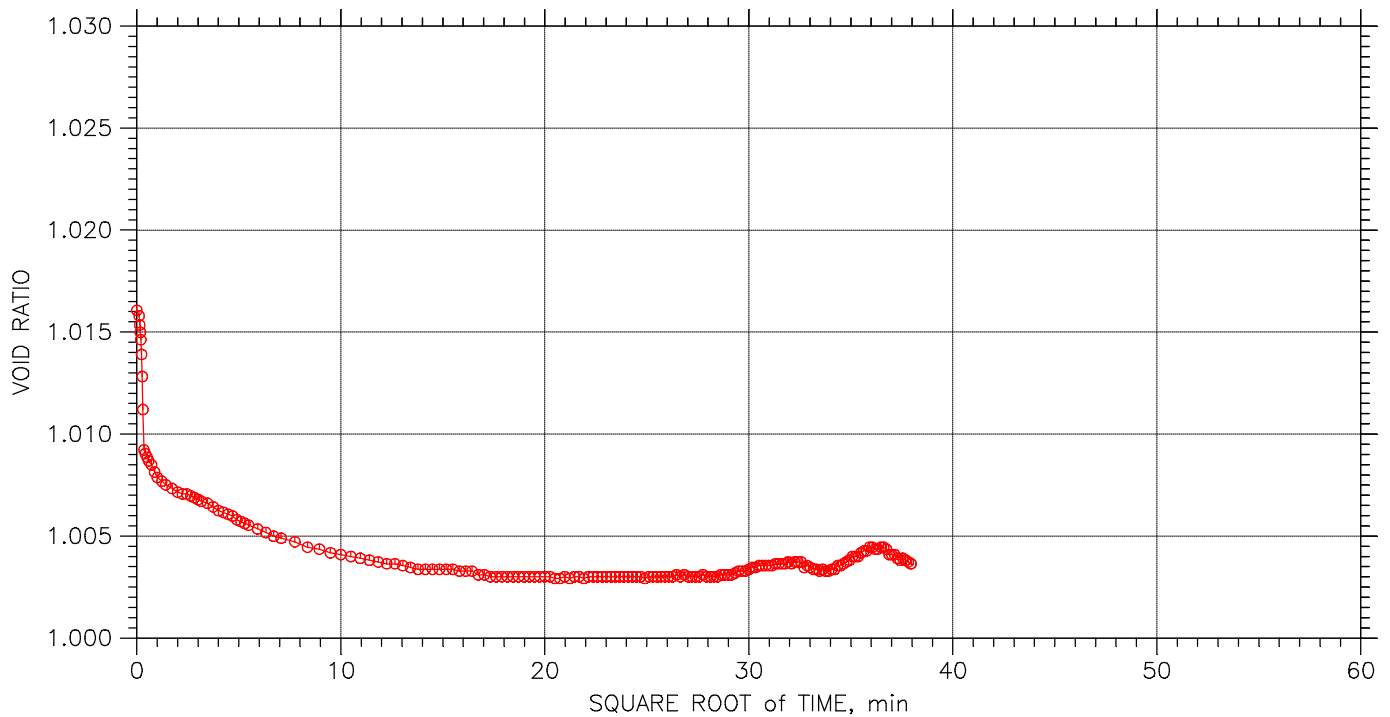
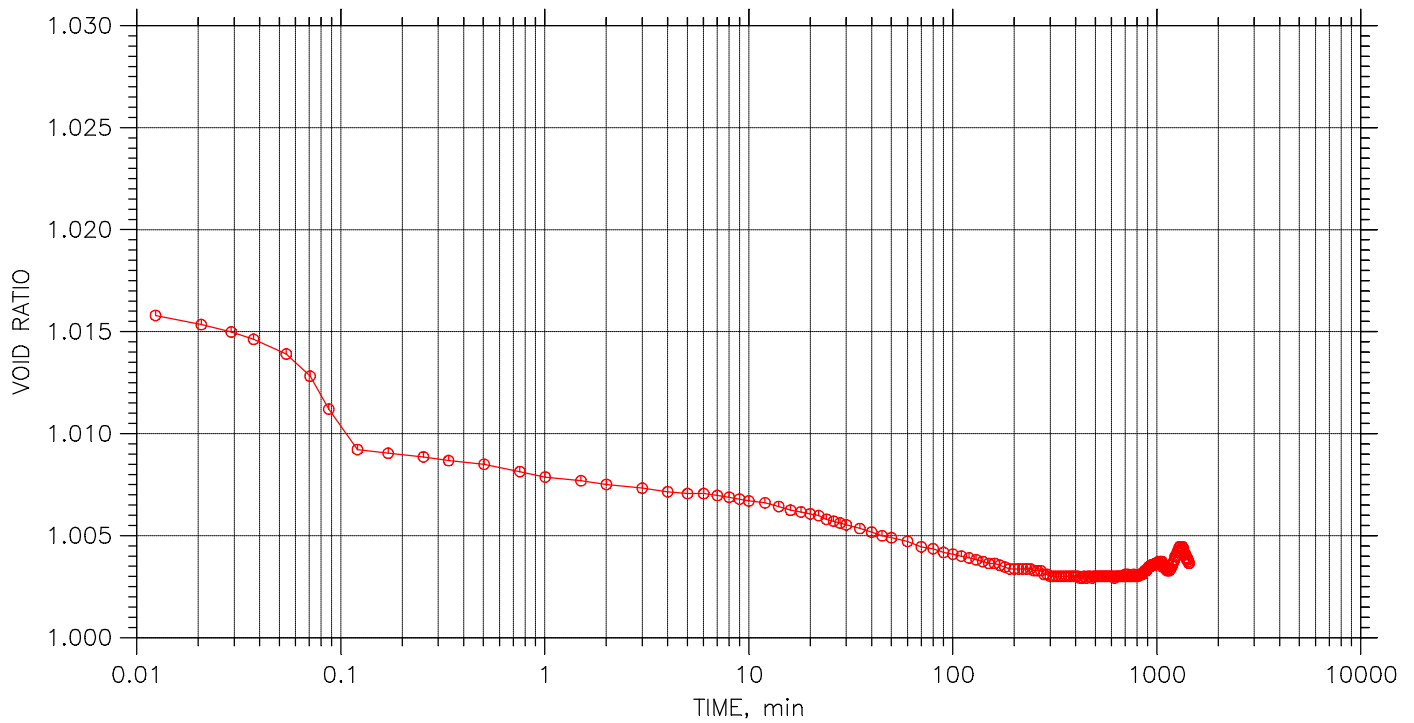
	Project: MTO Patrol Yard	Location: Dryden ON	Project No.: 17-252
	Boring No.: ST6	Tested By: FV	Checked By: TF
	Sample No.: 17-469	Test Date: June 23,17	Depth: 8 - 10 ft
	Test No.: 3	Sample Type: TW	Elevation:
	Description: Clay, light grey		
	Remarks:		


CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 4 of 12

Stress: 100. kPa



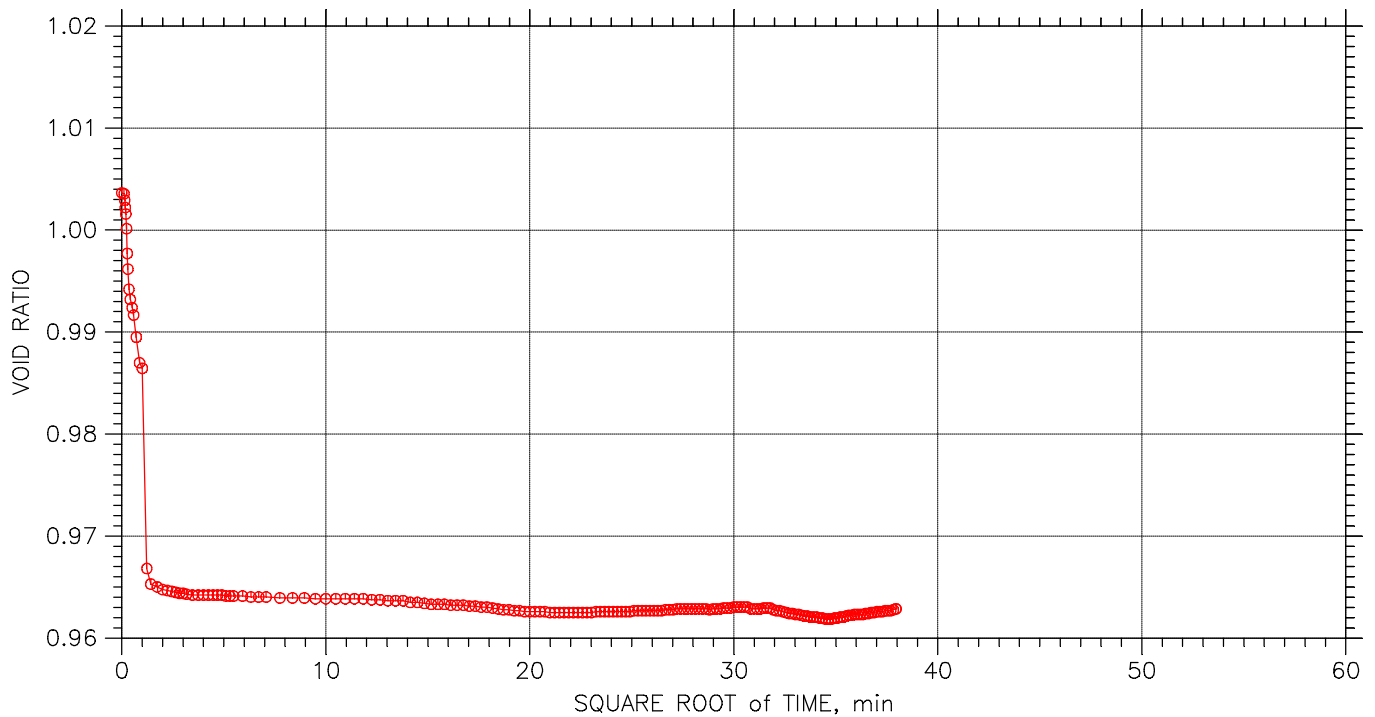
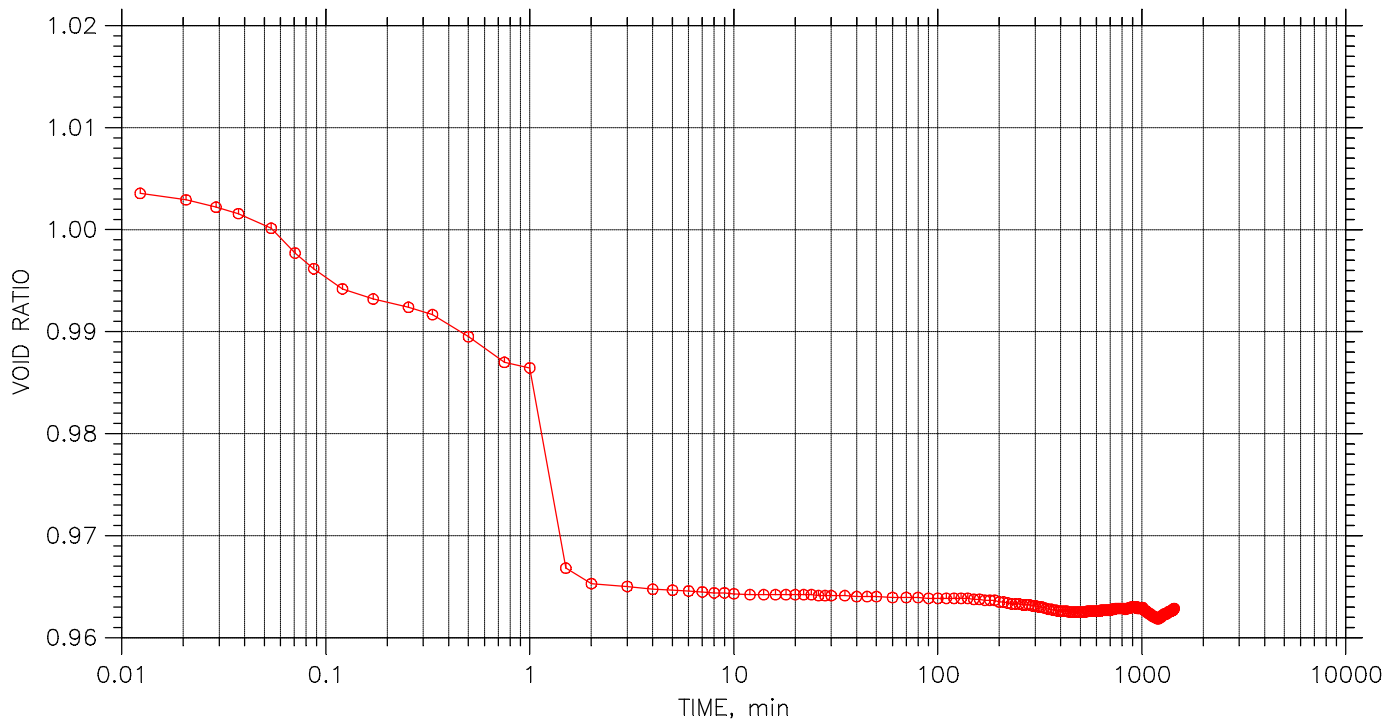
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	Boring No.: ST6	Tested By: FV	Checked By: TF
	Sample No.: 17-469	Test Date: June 23,17	Depth: 8 - 10 ft
	Test No.: 3	Sample Type: TW	Elevation:
	Description: Clay, light grey		
	Remarks:		


CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 5 of 12

Stress: 200. kPa



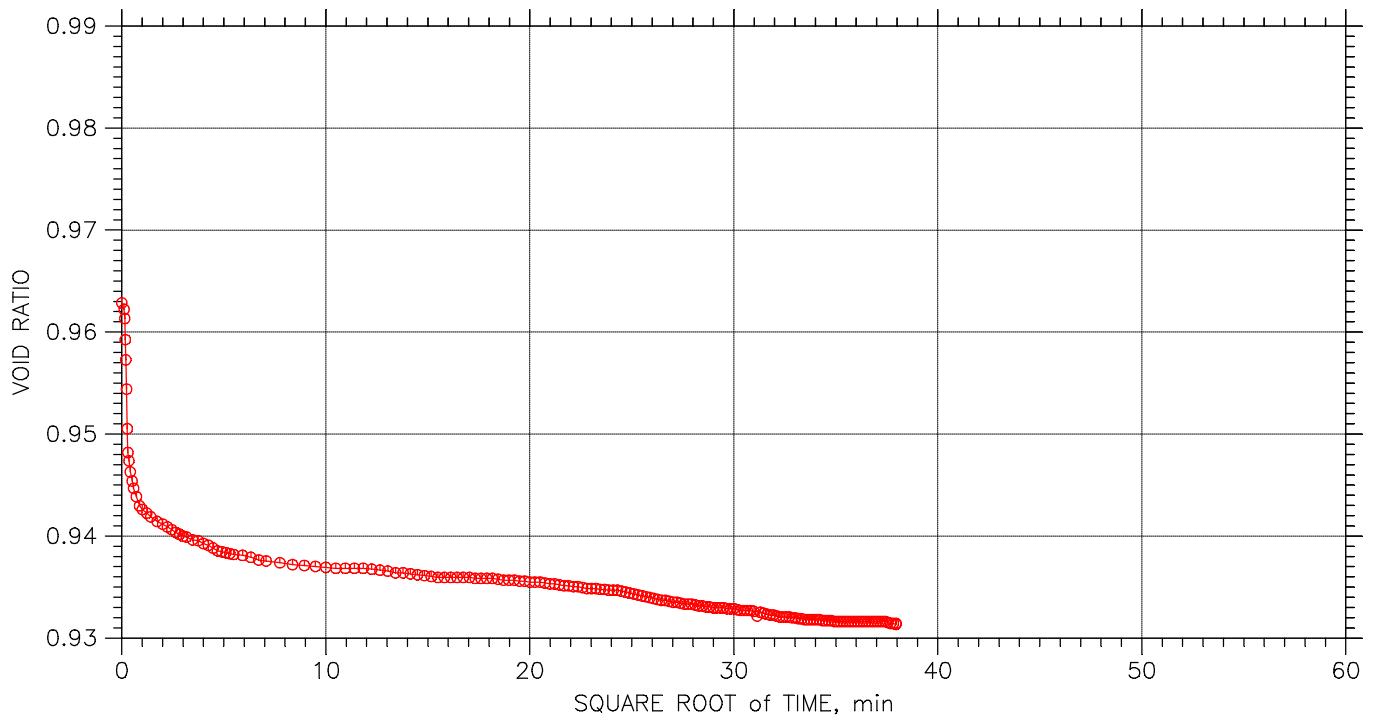
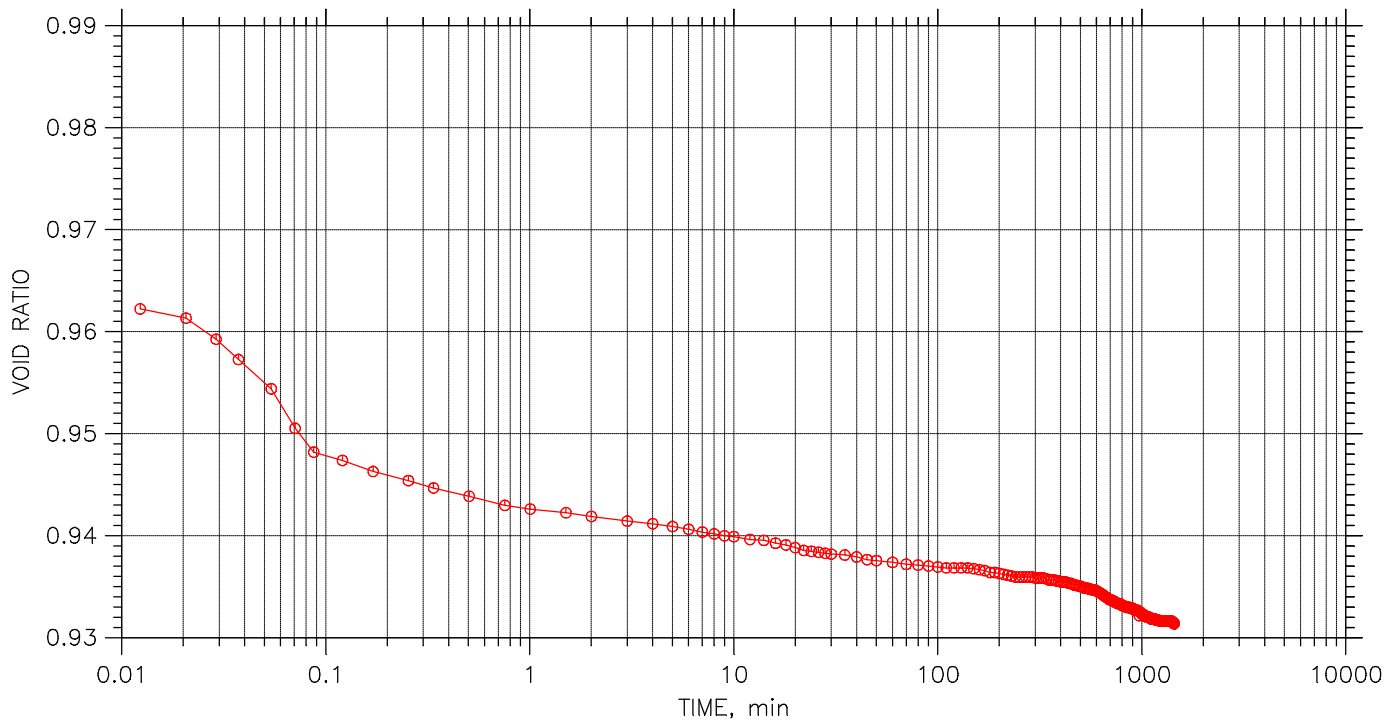
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	Boring No.: ST6	Tested By: FV	Checked By: TF
	Sample No.: 17-469	Test Date: June 23,17	Depth: 8 - 10 ft
	Test No.: 3	Sample Type: TW	Elevation:
	Description: Clay, light grey		
	Remarks:		


CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 6 of 12

Stress: 400. kPa



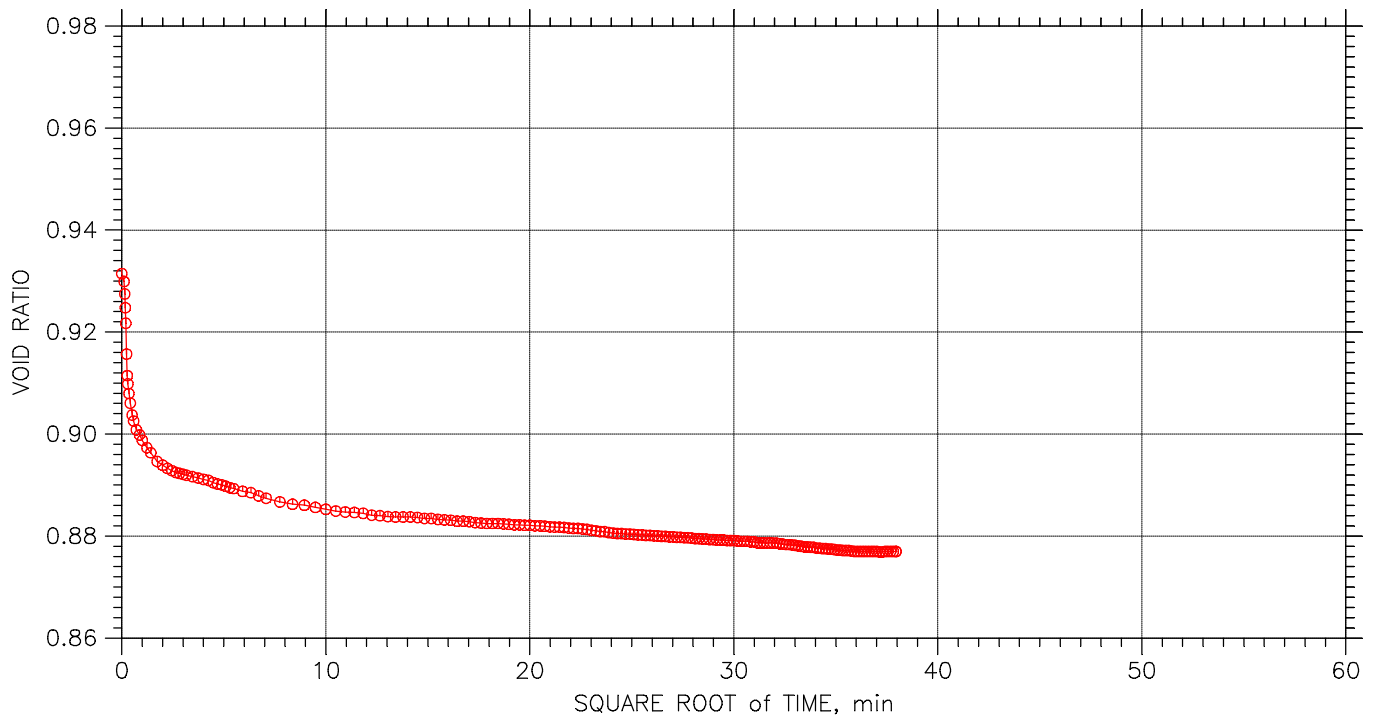
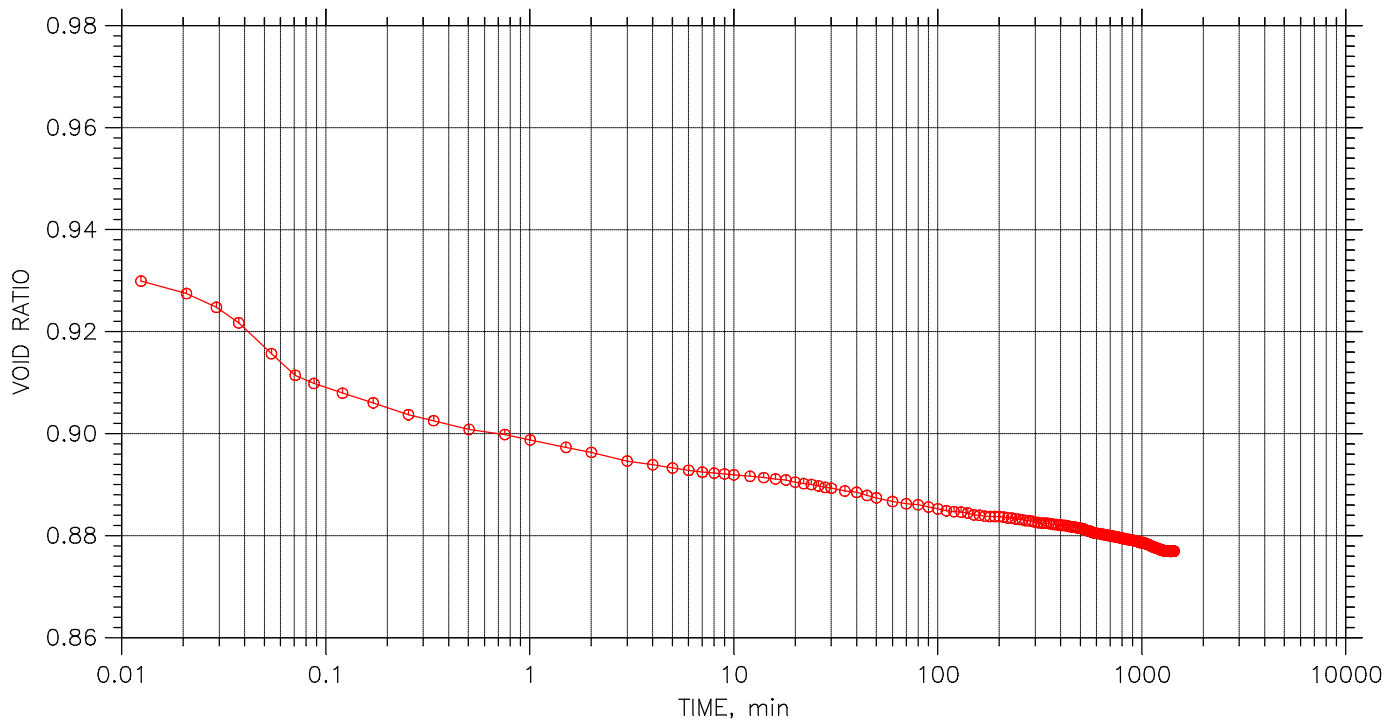
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	Boring No.: ST6	Tested By: FV	Checked By: TF
	Sample No.: 17-469	Test Date: June 23,17	Depth: 8 - 10 ft
	Test No.: 3	Sample Type: TW	Elevation:
	Description: Clay, light grey		
	Remarks:		


CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 7 of 12

Stress: 800. kPa



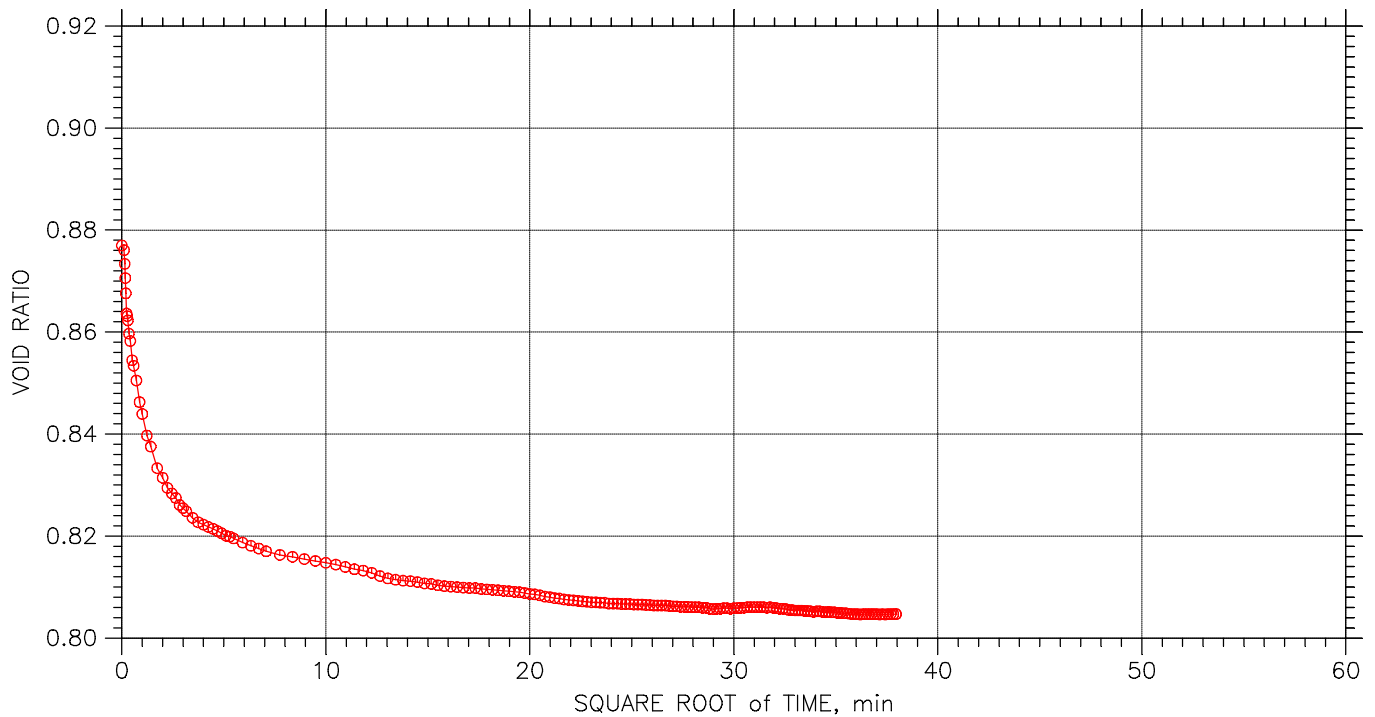
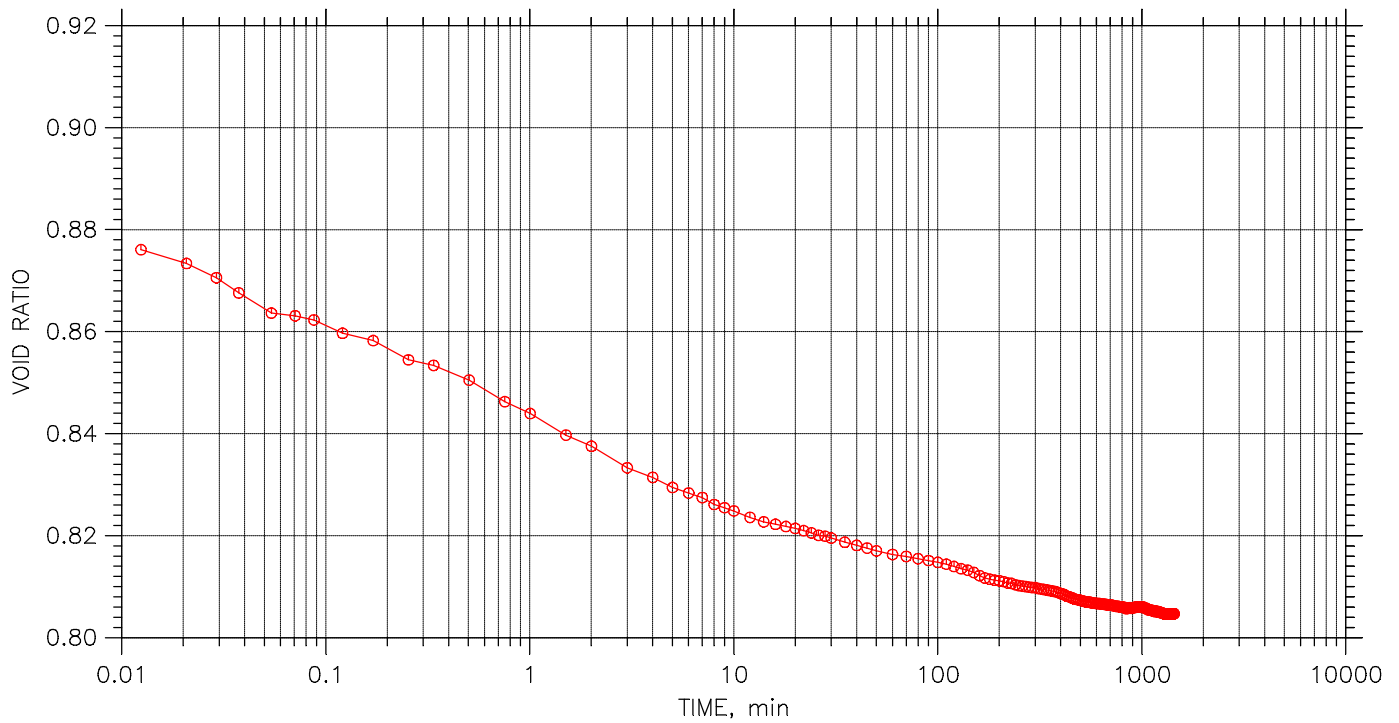
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	Boring No.: ST6	Tested By: FV	Checked By: TF
	Sample No.: 17-469	Test Date: June 23,17	Depth: 8 - 10 ft
	Test No.: 3	Sample Type: TW	Elevation:
	Description: Clay, light grey		
	Remarks:		


CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 8 of 12

Stress: 1500. kPa



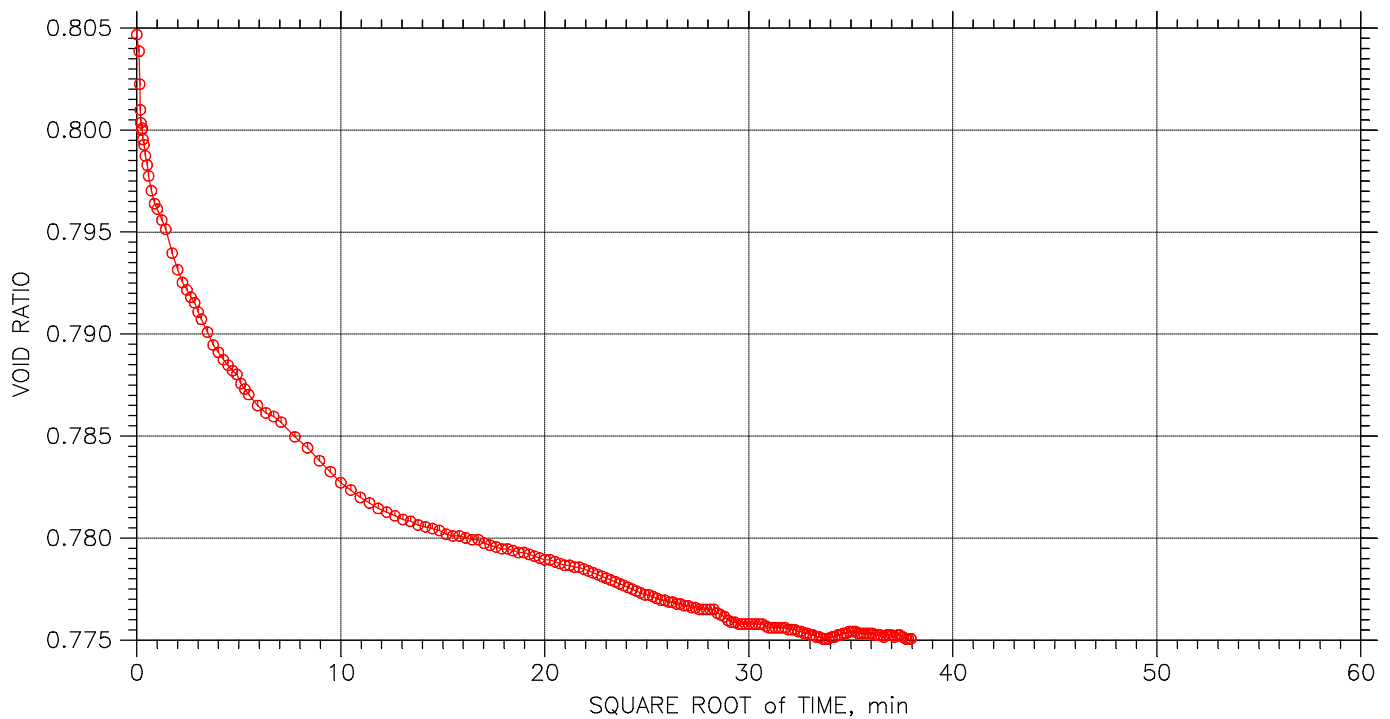
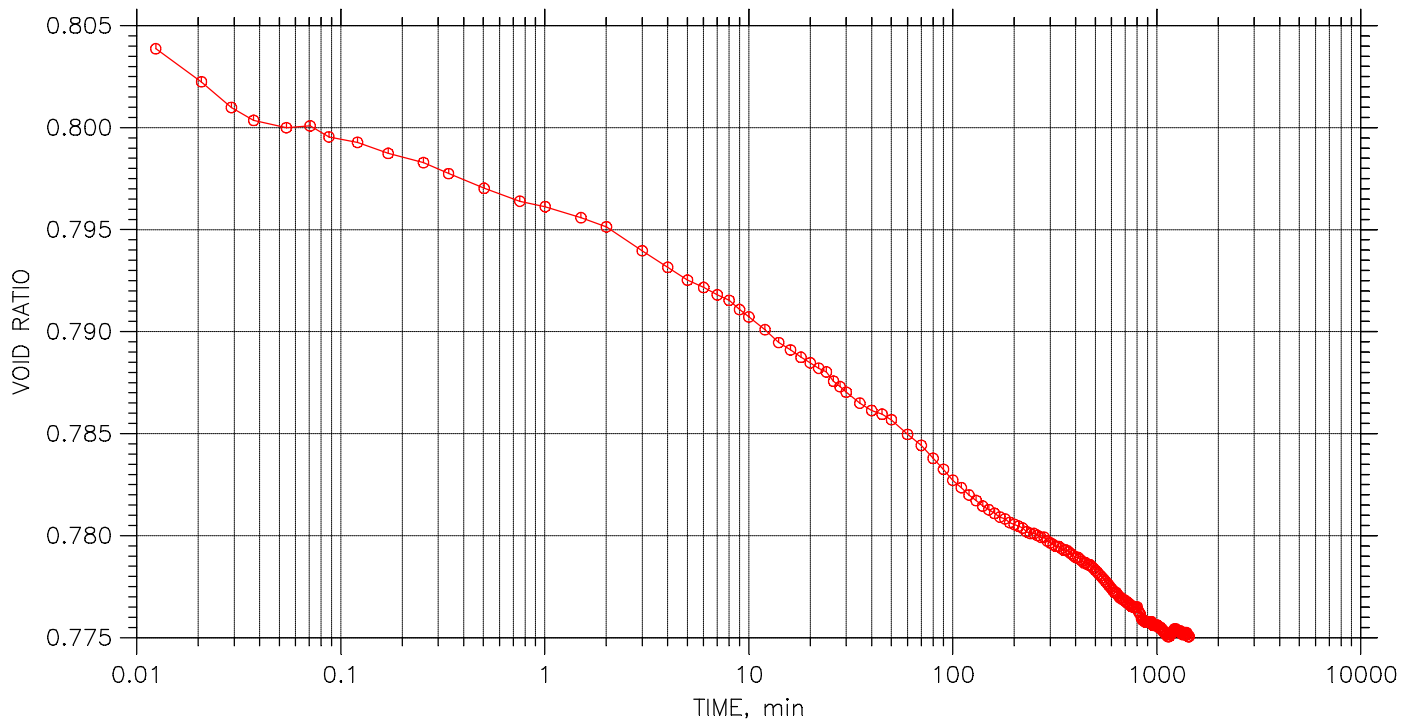
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	Boring No.: ST6	Tested By: FV	Checked By: TF
	Sample No.: 17-469	Test Date: June 23,17	Depth: 8 - 10 ft
	Test No.: 3	Sample Type: TW	Elevation:
	Description: Clay, light grey		
	Remarks:		


CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 9 of 12

Stress: 2000. kPa



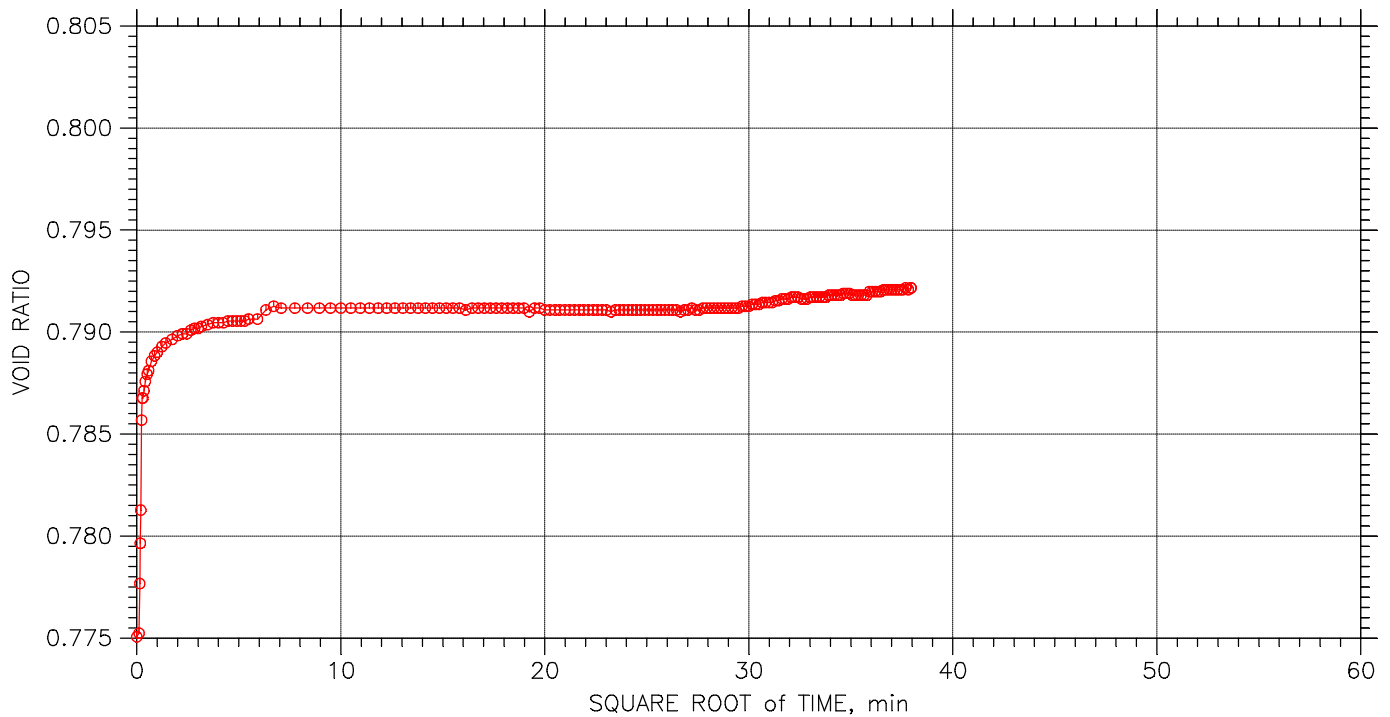
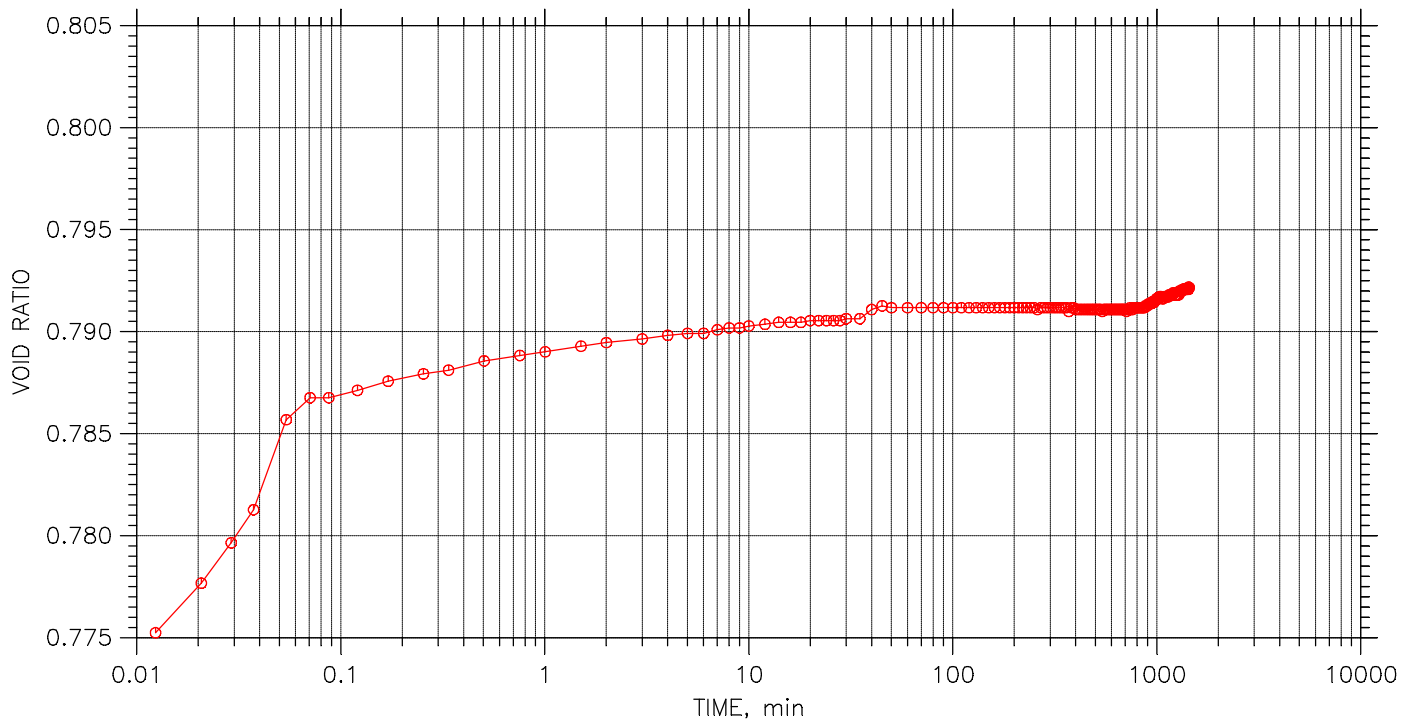
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	Boring No.: ST6	Tested By: FV	Checked By: TF
	Sample No.: 17-469	Test Date: June 23,17	Depth: 8 - 10 ft
	Test No.: 3	Sample Type: TW	Elevation:
	Description: Clay, light grey		
	Remarks:		


CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 10 of 12

Stress: 750. kPa



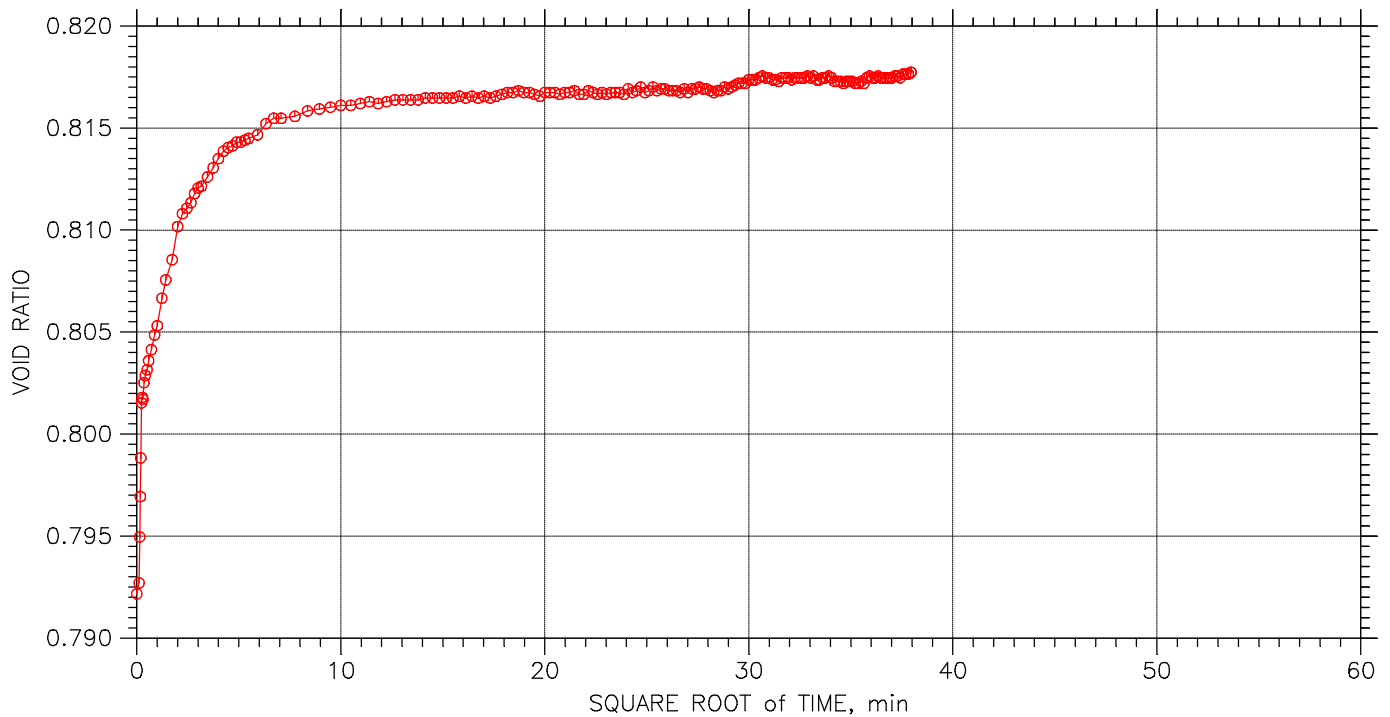
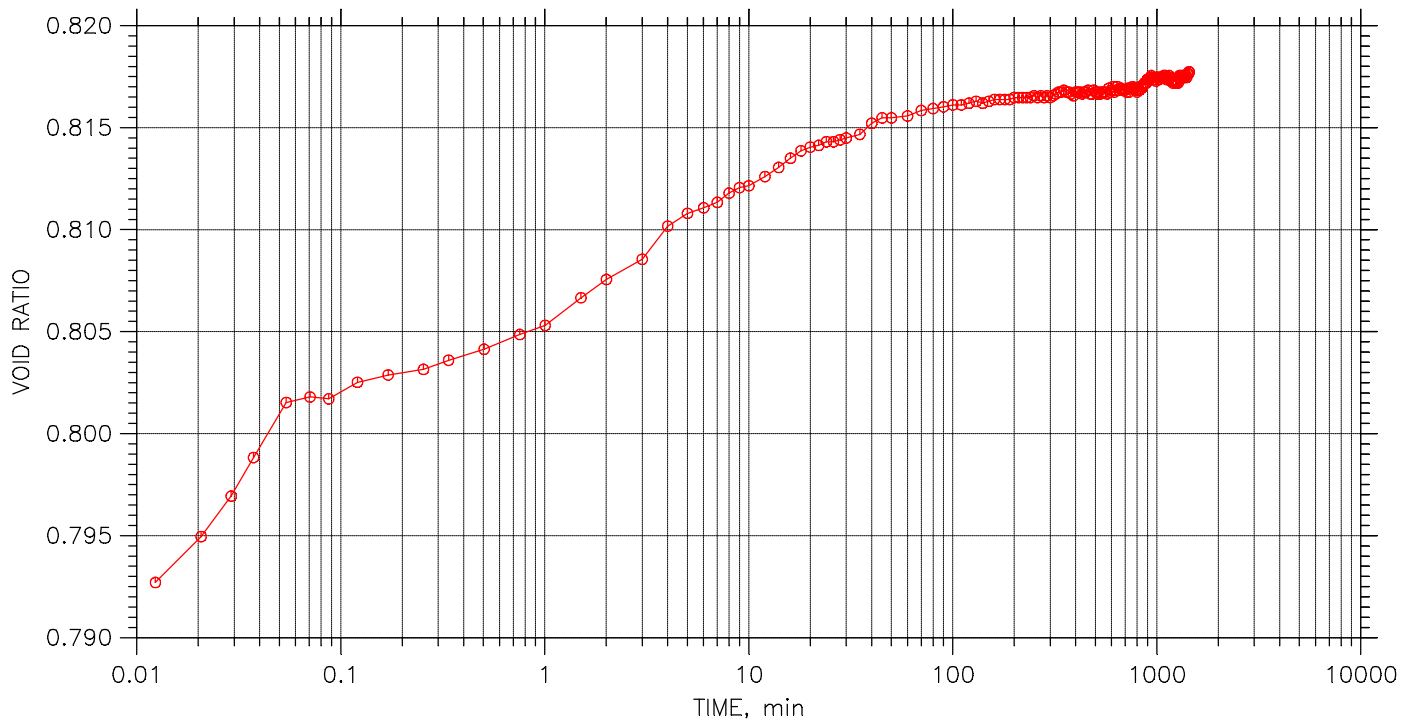
	Project: MTO Patrol Yard	Location: Dryden ON	Project No.: 17-252
	Boring No.: ST6	Tested By: FV	Checked By: TF
	Sample No.: 17-469	Test Date: June 23,17	Depth: 8 - 10 ft
	Test No.: 3	Sample Type: TW	Elevation:
	Description: Clay, light grey		
	Remarks:		


CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 11 of 12

Stress: 200. kPa



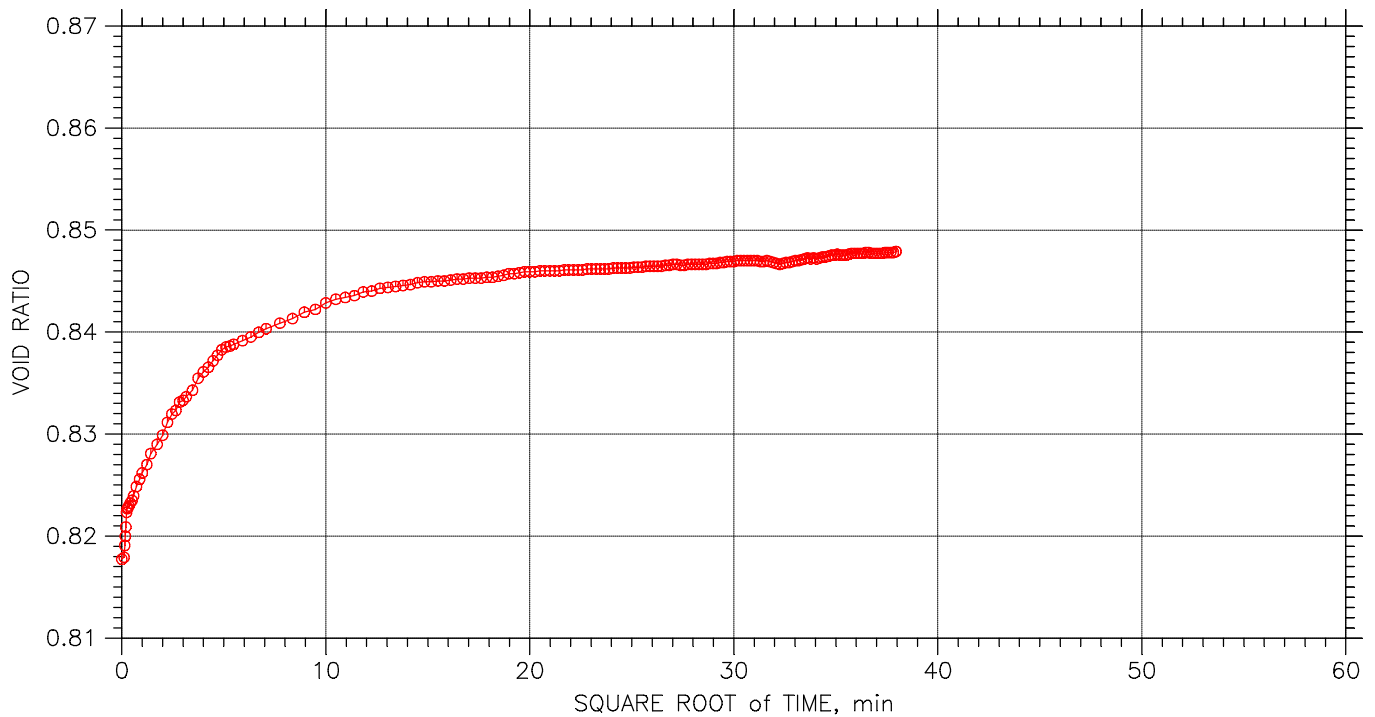
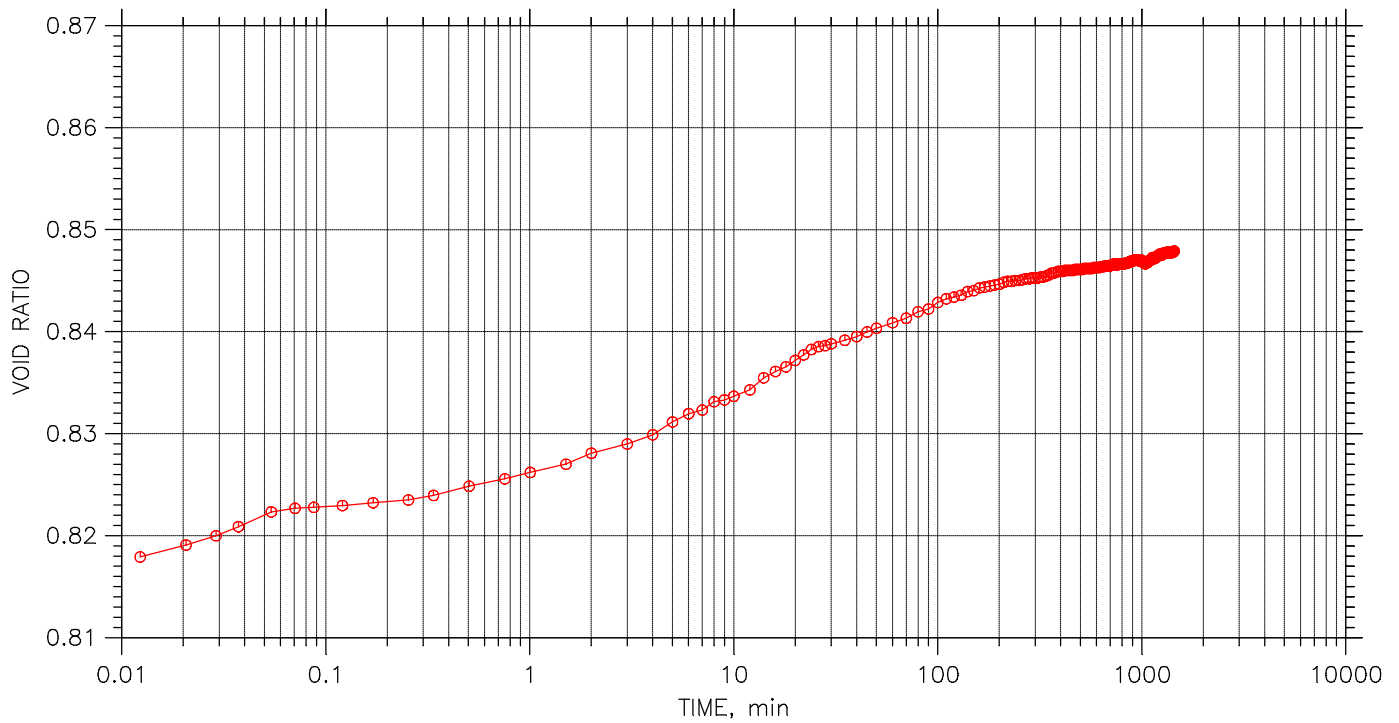
	Project: MTO Patrol Yard	Location: Dryden ON	Project No.: 17-252
	Boring No.: ST6	Tested By: FV	Checked By: TF
	Sample No.: 17-469	Test Date: June 23,17	Depth: 8 - 10 ft
	Test No.: 3	Sample Type: TW	Elevation:
	Description: Clay, light grey		
	Remarks:		


CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 12 of 12

Stress: 50. kPa



	Project: MTO Patrol Yard	Location: Dryden ON	Project No.: 17-252
	Boring No.: ST6	Tested By: FV	Checked By: TF
	Sample No.: 17-469	Test Date: June 23,17	Depth: 8 - 10 ft
	Test No.: 3	Sample Type: TW	Elevation:
	Description: Clay, light grey		
	Remarks:		

BOREHOLE: **DRY-01**
CORE RUN #1: 28'10" – 33'10"
CORE RUN #2: 33'10" – 36'2"
CORE RUN #3: 36'2" – 38'11"



BOREHOLE: **DRY-04**
CORE RUN #1: 32'0" – 34'0"
CORE RUN #2: 34'0" – 39'0"
CORE RUN #3: 39'0" – 42'4"





Appendix C

Site Photographs



Photograph 1 – Proposed building location, looking east



Photograph 2 – Proposed building location showing drill rig at Borehole DRY-01 location, looking east



Appendix D

Borehole Locations and Soil Strata Drawing

