THURBER ENGINEERING LTD.

PRELIMINARY
FOUNDATION INVESTIGATION REPORT
HIGHWAY 17 TWINNING, RENFREW AREA
BRUCE STREET (COUNTY ROAD 20) INTERCHANGE
STA. 18+517, HORTON TOWNSHIP
BRUCE STREET UNDERPASS - SITE NO. 29X-0408/B1
WP 4068-09-00 / ASSIGNMENT NO. 4018-E-0009

Geocres No.: 31F-234

Report to:

Ministry of Transportation Ontario

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Longitude: -76.670952°

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PART 1. FACTUAL INFORMATION

1 INTRODUCTION

Thurber Engineering Ltd. (Thurber) has been engaged by the Ministry of Transportation Ontario (MTO) to carry out Foundation Investigations to support the design of the Highway 17 Twinning Project which extends from Scheel Drive westerly to 3 km west of Bruce Street in the Renfrew area. Thurber carried out the investigation under MTO Assignment No. 4018-E-0009.

This report addresses the Bruce Street Interchange, which includes the proposed Highway 17 Bruce Street Underpass (Site No. 29X-0408/B1) to carry local traffic over the new highway, and the four associated ramps: the W-N/S Ramp, the N-E Ramp, the S-W Ramp, and the E-N/S Ramp. The existing Highway 17 alignment at this site will become the future Highway 17 westbound lanes and new eastbound lanes will be constructed adjacent to the existing alignment.

Previous foundation investigation information from boreholes completed in 2004 for the proposed underpass was available under Geocres 31F-139.

This section of the report presents the factual findings obtained from historical foundation investigations available from the online Geocres Library and from the foundation investigation completed as part of the current study.

The purpose of this investigation was to explore the subsurface conditions at the site and, based on the data obtained, to provide a borehole location plan, records of boreholes, stratigraphic profile, laboratory test results and a written description of the subsurface conditions. A model of the subsurface conditions influencing design and construction of the proposed underpass and associated ramps was developed in the course of the investigation.

It should be noted that the use of and reliance on Part 1 of the Report is governed by and limited to the terms and conditions set out in the Report and a reliance letter. The Preferred Proponent remains responsible to assess the need for additional investigations and to complete that work.

2 SITE DESCRIPTION

2.1 General

The site is located on Highway 17 at the existing County Road 20 intersection. For project purposes, although Highway 17 is oriented north south at the site it is generally an eastbound westbound highway thus it will be described as oriented east west and County Road 20 will be described as being oriented north south. Within the project limits County Road 20 is also known as Bruce Street to the south and Castleford Road to the north of Highway 17. For clarity and consistency with project documentation, County Road 20 will typically be referred to by its local road names, and the structure as the Bruce Street Underpass.

The existing intersection is an at-grade crossing controlled with traffic lights. In the vicinity of the site, Highway 17 is an undivided highway with one through lane in each direction, left and right turning lanes from westbound Highway 17 to Castleford Road and Bruce Street, as well as off- and on-ramps at Bruce Street and a left turn lane to Castleford Road from the eastbound direction. Highway 17 has gravel shoulders and a posted speed limit of 90 km/hr. It is understood that the AADT projected for 2022 for the section of Highway 17 just east of the site is 15,100.

At the intersection, the Highway 17 road surface elevation is approximately 150.9 m and decreases to the east towards the Bonnechere River. The existing road surface along Bruce Street/Castleford Road decreases nominally from south to north; however, the existing ground northeast of the intersection in the vicinity of the proposed E-N/S Ramp slopes up and away from Castleford Road to a plateau at about Elevation 154.9 m.

West of the intersection, Highway 17 is at or slightly above the natural ground surface elevation. East of the intersection, Highway 17 enters a cut section with the slope heights increasing to the east to as much as about 9 m, within the area of interest addressed herein (to approximately 300 m east of the intersection). The cut slopes generally include a bench at around mid-height and are vegetated with grass. Further to the east, bedrock outcrops are visible about 300 m and 450 m east of the intersection on the south and north sides of the highway, respectively.

Near the intersection, Bruce Street and Castleford Road comprise two-lane roadways with gravel shoulders and a rural cross-section. Elevated and paved bull-noses are present at the northwest and southwest quadrants of the intersection, directing traffic flow from the eastbound off-ramp and to the eastbound on-ramps. It is understood that the AADT values projected for 2022 are approximately 6,500 and 2,300 for Bruce Street and Castleford Road respectively. An at-grade T-intersection is present on Bruce Street approximately 140 m north of Highway 17 connecting to Dugald Road which heads eastward.

It is understood that the intersection of County Road 20 and Highway 17 was reconfigured at some point in the past with the current intersection located approximately 50 m to the west of the previous, and the old alignment of Bruce Street more linear prior to its shift to the currently curved alignment to the east.

Photographs showing the existing conditions in the area of the site are included in Appendix E for reference.

2.2 Site Geology

Based on published geological information in *The Physiography of Southern Ontario* by Chapman and Putnam (1984), the site lies within the physiographic region known as the Ottawa Valley Clay Plains. The Ottawa Valley Clay Plains are characterized primarily by clay plains deposited by the Champlain Sea (Leda Clay) interrupted by ridges of rock or sand.

Ontario Geological Survey Map P.3784 for Precambrian Geology for the Horton Area suggests the bedrock is dolomitic and calcitic carbonate metasedimentary bedrock including dolomite and calcite marble.

3 SITE INVESTIGATION AND FIELD TESTING

An initial foundation investigation was carried out at the site in October 2003 (Geocres 31F-139) as input to the preliminary design and environmental assessment study completed at that time. The current investigation was carried out in 2019, 2020, and 2021 to collect additional subsurface information for design of the proposed underpass structure and associated ramps at the interchange.

3.1 Previous Investigation (2003)

A total of three boreholes were put down as part of the 2003 investigation. The boreholes were advanced to depths of up to about 53.2 m below the existing ground surface at the time of the investigation using hollow stem augers, casing and wash-boring, and NQ sized coring equipment.

The northing, easting and elevation of the 2003 boreholes are shown on the Borehole Location and Soil Strata Drawings No. 1 to 3 in Appendix A, the individual Record of Borehole sheets in Appendix B, and in the table below. The site is located within MTM Zone 9.

Table 3-1: Borehole Summary – Previous Investigation (2003)

Test Hole No.	Drilled Location	Northing (Latitude)	Easting (Longitude)	Ground Surface* Elevation (m)	Termination Depth (m)
BRU-1	South Abutment	5039748.0 (45.497526)	291406.0 (-76.671380)	151.6	50.2
BRU-2	Pier	5039748.7 (45.497533)	291445.8 (-76.670871)	150.3	53.2
BRU-3	North Abutment	5039768.7 (45.497714)	291479.6 (-76.670439)	149.3	51.2

* Ground surface elevation measured during investigation and may have changed in intervening time.

Piezometers, 19 mm in diameter, were installed in all three boreholes. The installation details are illustrated on the respective Record of Borehole sheets provided in Appendix B.

3.2 Current Investigation (2019/2020/2021)

The current site investigation and field-testing program was carried out in several phases in the period between September 2019 and November 2021. The current investigation consisted of advancing a total of 42 testholes which comprised: initial boreholes put down at 25 locations, supplementary boreholes put down for additional information at four of those locations, five additional boreholes for subsequent installation of monitoring wells and eight Cone Penetration Tests (CPTu). Shear wave velocity measurements were taken at regular intervals of depth during advancement of two of the CPTu soundings (BRU19-20 and BRU19-24). Prior to commencement of drilling, utility clearances were obtained in the vicinity of the borehole locations.

The locations and elevations of the testholes were surveyed by Thurber with a Trimble Catalyst DA1 antenna with centimeter accuracy. The locations were surveyed prior to advancement of the testholes and, at locations where the testholes were shifted due to utility or access conflicts they were re-surveyed at the completed location. The northing, easting and elevation of the boreholes are shown on the Borehole Location and Soil Strata Drawings No. 1 to 3 in Appendix A, the individual Record of Borehole sheets and CPTu summary plots in Appendix B and in Table 3-2, below.

Table 3-2: Testhole Summary – Current Investigation (2019/2020/2021)

Test Hole No.	Drilled Location	Northing (Latitude)	Easting (Longitude)	Ground Surface Elevation (m)	Termination Depth (m)
BRU19-01	South Abutment	5039726.4 (45.497332)	291413.0 (-76.671291)	151.2	48.2
BRU19-01A	South Abutment	5039731.4 (45.497377)	291409.7 (-76.671333)	152.2	26.5
BRU19-02	Pier	5039766.5 (45.497693)	291439.5 (-76.670952)	150.1	52.4
BRU19-03	North Abutment	5039787.2 (45.497881)	291475.1 (-76.670497)	149.8	54.1
BRU19-03A	North Abutment	5039786.4 (45.497873)	291482.2 (-76.670407)	149.9	31.1
BRU19-04	North Approach	5039792.9 (45.497932)	291496.6 (-76.670223)	149.8	1.5
BRU19-04A	North Approach	5039792.9 (45.497932)	291496.6 (-76.670223)	149.8	32.6
BRU19-05 (CPTu)	North Approach	5039813.7 (45.498119)	291524.1 (-76.669871)	149.0	31.0
BRU19-06	North Approach	5039844.3 (45.498396)	291564.0 (-76.669361)	148.5	32.0
BRU19-07	North Approach	5039876.9 (45.498689)	291602.4 (-76.668871)	148.1	29.6
BRU19-08 (CPTu)	North Approach	5039910.2 (45.49899)	291640.1 (-76.668390)	147.4	25.6
BRU19-09	North Approach	5039944.0 (45.499294)	291677.4 (-76.667913)	146.9	24.5

Test Hole No.	Drilled Location	Northing (Latitude)	Easting (Longitude)	Ground Surface Elevation (m)	Termination Depth (m)
BRU19-10	North Approach	5039979.2 (45.499612)	291713.0 (-76.667459)	146.2	11.3
BRU19-11 (CPTu)	South Approach	5039628.1 (45.496444)	291230.2 (-76.673626)	152.7	13.7
BRU19-12	South Approach	5039651.1 (45.496651)	291274.4 (-76.673061)	152.7	24.1
BRU19-13	South Approach	5039677.0 (45.496886)	291320.2 (-76.672476)	152.5	40.6
BRU19-14 (CPTu)	South Approach	5039706.8 (45.497155)	291367.5 (-76.671872)	152.6	46.5
BRU19-15	South Approach	5039724.0 (45.497310)	291393.0 (-76.671546)	152.6	40.2
BRU19-15A	South Approach	5039724.0 (45.497310)	291393.0 (-76.671546)	152.6	2.9
BRU19-16	W-N/S Ramp	5039789.1 (45.497892)	291224.4 (-76.673705)	151.5	44.5
BRU19-17 (CPTu)	W-N/S Ramp	5039729.3 (45.497354)	291240.2 (-76.673501)	149.9	32.8
BRU19-18	N-E Ramp	5039695.1 (45.497047)	291274.9 (-76.673056)	150.9	34.1
BRU19-19	N-E Ramp	5039715.7 (45.497234)	291347.4 (-76.672129)	152.2	40.9
BRU19-20 (CPTu)	South Abutment	5039735.1 (45.49741)	291411.0 (-76.671317)	152.1	39.1
BRU19-21	N-E Ramp	5039747.3 (45.497517)	291247.1 (-76.673413)	150.7	41.8
BRU19-22	S-W Ramp	5039809.4 (45.498081)	291558.9 (-76.669425)	147.3	39.5
BRU19-23	S-W Ramp	5039802.4 (45.498019)	291606.4 (-76.668817)	146.6	31.8
BRU19-24 (CPTu)	North Abutment	5039779.7 (45.497812)	291476.8 (-76.670475)	149.7	34.9
BRU19-25	S-W Ramp	5039790.3 (45.497909)	291513.8 (-76.670002)	147.9	42.4
BRU19-26	E-N/S Ramp	5039464.6 (45.494980)	291599.5 (-76.668897)	149.7	17.4
BRU19-27	E-N/S Ramp	5039515.3 (45.495436)	291601.2 (-76.668876)	154.6	21.4
BRU19-28	E-N/S Ramp	5039562.5 (45.495861)	291611.3 (-76.668749)	155.0	32.1
BRU19-29	E-N/S Ramp	5039614.8 (45.496331)	291618.2 (-76.668662)	154.7	36.5
BRU19-30	E-N/S Ramp	5039657.2 (45.496713)	291643.3 (-76.668342)	154.1	35.4
BRU19-31	E-N/S Ramp	5039746.3 (45.497516)	291650.0 (-76.668258)	149.9	37.9

Test Hole No.	Drilled Location	Northing (Latitude)	Easting (Longitude)	Ground Surface Elevation (m)	Termination Depth (m)
BRU19-32 (CPTu)	E-N/S Ramp	5039793.0 (45.497935)	291638.4 (-76.668408)	146.9	31.6
BRU19-33	E-N/S Ramp	5039840.9 (45.498365)	291598.8 (-76.668916)	146.9	33.6
BRU21-02	Pier	5039761.4 (45.497647)	291427.9 (-76.671101)	151.4	6.7
BRU21-05	North Approach	5039811.7 (45.498101)	291523.6 (-76.669878)	149.2	6.7
BRU21-15	South Approach	5039724.3 (45.497312)	291390.6 (-76.671577)	152.6	6.1
BRU21-18	N-E Ramp	5039688.1 (45.496984)	291279.4 (-76.672999)	151.4	6.1
BRU21-23	S-W Ramp	5039799.9 (45.497997)	291606.7 (-76.668814)	146.6	6.1

Boreholes BRU19-04, BRU19-04A, BRU19-06, BRU19-07, BRU19-12, BRU-13, and BRU19-15 were put down with a CME 75 truck-mounted drill rig equipped with hollow stem augers and NW casing. Boreholes BRU21-02, BRU21-05, BRU21-15, BRU21-18, and BRU21-23 were drilled with a Diedrich 50, track-mount rig equipped with hollow stem augers. The remaining boreholes were put down from a track-mounted drill rig (CME 55, CME 75, or CME 850) equipped with hollow stem augers and either NW or HW casing. Bedrock was cored in Boreholes BRU19-01, BRU19-02, and BRU19-03 with NQ-sized coring.

Soil samples were obtained at selected intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT). Thin-walled (Shelby) tube samples of the cohesive materials were retrieved at various elevations in the boreholes to obtain relatively undisturbed soil samples for further laboratory testing. In-situ vane shear testing was conducted in the cohesive deposits with an MTO ‘N’ sized vane.

Piezometers, 19 mm in diameter, were installed in Boreholes BRU19-01, BRU19-03, BRU19-06, and BRU19-13. Monitoring wells, 50 mm in diameter, were installed in Boreholes BRU19-21, BRU19-29, BRU21-02, BRU21-05, BRU21-15, BRU21-18, and BRU21-23. The installation details are illustrated on the respective Record of Borehole sheets provided in Appendix B. The piezometers and monitoring wells installed as part of the current investigation will be decommissioned by Thurber, as outlined in the Hydrogeological Investigation and Design Report..

The boreholes were backfilled in accordance with MOE requirements (O.Reg 903, as amended).

The drilling and sampling operations were supervised on a full-time basis by members of Thurber’s geotechnical staff. The drilling supervisors logged the boreholes and processed the recovered soil samples for transport to Thurber’s Ottawa geotechnical laboratory for further examination and testing, as well as submission to external laboratories.

4 LABORATORY TESTING

Laboratory testing was selected in accordance with the current MTO Guideline for Foundation Engineering Services, Section 5. Geotechnical laboratory testing consisted of natural moisture content determination and visual identification of all retained soil samples. At least 25% of the recovered soil samples were subjected to testing for grain size distribution analysis and, where appropriate, Atterberg Limits in accordance with MTO and ASTM standards. Supplementary specialized laboratory testing was carried out on selected soil samples in accordance with the project-specific requirements outlined in Section 7.7.1.3 RFP and included one-dimensional consolidation testing (standard incremental loading, long-term incremental loading, and controlled-strain loading), triaxial testing (unconsolidated-undrained and consolidated-drained), and unconfined compressive strength testing.

Rock cores were logged and total core recovery (TCR), solid core recovery (SCR) and rock quality designation (RQD) were determined in the field. Unconfined compressive strength (UCS) testing was carried out on selected samples to give an indication of the bedrock strength.

Chemical analysis for determination of pH, conductivity, resistivity, sulphide, sulphate, and chloride was carried out on three soil samples.

The results of the geotechnical tests are summarized on the Record of Borehole sheets included in Appendix B and all laboratory results are presented on the figures included in Appendix C (current investigation) and Appendix D (2003 investigation).

5 GENERAL DESCRIPTION OF SUBSURFACE CONDITIONS

Details of the encountered soil stratigraphy are presented on the Record of Borehole sheets and CPTu summary plots included in Appendix B, as well as the Borehole Location and Soil Strata Drawings included in Appendix A. 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 on the Borehole Records takes precedence over the Soil Strata Drawing and the general description. It must be recognized that the soil, bedrock and groundwater conditions may vary between and beyond borehole locations. Soil classification is in accordance with ASTM D2487. Description of cohesive soils and secondary components of all deposits from the current boreholes are described as outlined in the MTO Guideline for Foundation Engineering Services manual (October 2020). Terminology from the 2003 borehole information may vary from current practice.

The stratigraphy at the site generally consists of topsoil and/or granular fill overlying an extensive native deposit of silty clay to clayey silt. Toward the eastern extend of the site, the silty clay to clayey silt is overlain by a deposit of native sand and silt. The extensive silty clay to clayey silt deposit is underlain by interlayered silt, sand and clayey silt which is, in turn, underlain by glacial till and marble bedrock.

5.1 Topsoil

Topsoil was encountered at surface at several boreholes put down near the proposed Bruce Street alignment (BRU-1, BRU-3, BRU19-06, BRU19-07, BRU19-13, BRU-19-22, BRU19-25 and BRU21-05), the W-N/S and N-E Ramps (BRU19-16 and BRU19-21), and the E-N/S Ramp (BRU19-23, BRU19-26, BRU19-29, and BRU19-31). The topsoil thickness ranged from about 50 to 800 mm. The topsoil ranged from clayey silt and organics to silty sand trace gravel trace roots. The N-values obtained from three SPTs completed within the topsoil ranged from 11 to 14 blows per 0.3 m of penetration, indicating a compact relative density.

The moisture content of recovered topsoil samples ranged from about 11% to 37%. The results of a grain size analysis test conducted on one sample of topsoil from Borehole BRU19-25 are summarized below and are illustrated on Figure C1.1 in Appendix C.

Soil Particle	Percentage (%)
Gravel	4
Sand	80
Silt	16
Clay	

5.2 Fill

Non-cohesive granular fill consisting of sand to gravelly silty sand was encountered at boreholes put down along the proposed Bruce Street alignment (BRU-1, BRU-2, and BRU19-01 to BRU19-15A, BRU21-02 and BRU 21-05). The thickness ranged from 0.6 m to 2.3 m (base elevation 144.7 m to 151.8 m). The SPT N-values in the fill material ranged from 4 to 73 blows but were generally between about 10 and 25 blows per 0.3 m of penetration, indicating a compact relative density.

The moisture content of samples of the granular fill ranged from 2% to 34%. The results of grain size analysis tests conducted on eight samples of fill are summarized below and are illustrated on Figures C2.1 and C2.2 in Appendix C.

Soil Particle	Percentage (%)
Gravel	5 – 46
Sand	37 – 86
Silt	8 – 30
Clay	

5.3 Upper Sand and Silt

A near-surface layer of sand and silt was encountered at boreholes BRU19-26 to BRU19-30, put down along the proposed E-N/S Ramp. The layer ranged from silt trace sand to sand trace silt. The thickness ranged from 1.5 m to 2.4 m (base elevation 147.7 m to 153.1 m). The N-values obtained from SPTs conducted in this material ranged from 4 to 23 indicating a loose to compact relative density.

The moisture content of samples of the sand and silt ranged from 7% to 33%. The results of grain size analysis tests conducted on four samples are summarized below and are illustrated on Figure C3.1 in Appendix C. Atterberg Limit testing carried out on one sample of the deposit from Borehole BRU19-30 gave non-plastic results. This soil unit could be classified as ML to SM.

Soil Particle	Percentage (%)
Gravel	0
Sand	9 – 82
Silt	18 – 91
Clay	

5.4 Silty Clay to Clayey Silt

Beneath the topsoil and fill or upper sand and silt, an extensive deposit of silty clay to clayey silt was encountered at all test hole locations. The deposit generally transitions from silty clay to clayey silt with depth. The overall thickness of the deposit ranges from about 9 m at the northern extent of the proposed Bruce Street alignment (Borehole 19-10) to 40 m within the southern portion (Borehole 19-19) with base elevations ranging from 135.6 m to 112.6 m. Along the proposed E-N/S Ramp the deposit ranges from about 14 m to 25 m thick, with base elevations ranging from 133.7 to 120.2 m.

Further description of the material properties and field test results within the layers are described in the following sections.

5.4.1 Silty Clay to Clay (Weathered Crust, CI to CH)

The upper portion of the deposit is weathered to a grey-brown crust, which generally ranges from about 1.5 to 6.9 m thick (base elevations 149.2 to 141.2m). It generally consists of silty clay to clay. SPTs conducted in the weathered crust gave N-values ranging from ranged from 3 to 28 blows per 0.3 m of penetration. In-situ shear vane tests gave the maximum recordable undrained shear strength values of 93 to 108 kPa (depending on the dimensions of the vane used), except for isolated tests carried out within the deposit at Boreholes BRU19-15 and BRU19-25 which gave undrained shear strengths of 81 and 76 kPa, respectively. These values indicate that the weathered crust is stiff to very stiff.

The corrected CPTu tip resistance (q_t) recorded during advancement of the CPTu through the weathered crust ranged between about 1,300 and 3,000 kPa, with spikes up to about 5,000 kPa.

The natural moisture content of samples of the weathered crust portion of the silty clay deposit ranged from about 16% to 52%. The results of grain size analysis tests conducted on 32 samples of the weathered crust collected during the current investigation and three samples collected during the 2003 investigation are summarized below and are illustrated on Figures C4.1 to C4.6 in Appendix C and Figures D1.1 and D1.2 in Appendix D.

Soil Particle	Percentage (%)
Gravel	0 – 1
Sand	0 – 8
Silt	37 – 51
Clay	47 – 63

The results of Atterberg Limits testing carried out on 31 samples of the weathered silty clay crust collected during the current investigation and three samples obtained during the 2003 investigation are summarized below and are illustrated on Figures C5.1 to C5.6 in Appendix C and Figure D2 in Appendix D. The laboratory results indicate that the material is generally a silty clay to clay of intermediate to high plasticity (CI to CH).

Parameter	Value
Liquid Limit	40 – 57
Plastic Limit	20 – 30
Plasticity Index	18 – 32

5.4.2 Silty Clay to Clayey Silt (CI to CL-ML)

Beneath the weathered crust, the lower portion of the deposit consists of grey silty clay to clayey silt. Along the proposed Bruce Street alignment, it extends to depths ranging up to about 40 m below the existing ground surface (base elevations ranging from 135.6 m to 112.6 m). Along the proposed E-N/S Ramp alignment, it extends to depths up to about 27 m below the existing ground surface (base elevations ranging from 133.7 to 120.2 m).

The SPT N-values recorded ranged from weight-of-hammer (WH) to 23 blows per 0.3 m of penetration but were generally between about 1 and 6 blows. In situ shear vane gave undrained shear strengths between about 50 kPa and the maximum recordable value ranging from 98 to 108 kPa (depending on the vane size).

The peak shear strength values measured at borehole locations along the proposed Bruce Street and the E-N/S Ramp alignments are shown on Figures B4.1 and B4.2 in Appendix B, respectively.

The corrected CPTu tip resistance (q_t) recorded during advancement of the CPTu through the unweathered silty clay to clayey silt ranged between about 1,000 and 3,500 kPa, with spikes up to about 7,800 kPa in the lower portions.

The moisture content of samples of the unweathered silty clay to clayey silt ranged from 23% to 54%.

Above about Elevation 133 m, the deposit generally consists of a silty clay to clayey silt.

The results of grain size analysis test conducted on 40 samples of silty clay to clayey silt from the current investigation and three samples from the 2003 investigation from above Elevation 133 m are summarized below and are illustrated on Figures C6.1 to C6.7 in Appendix C and Figures D1.1 and D1.2 in Appendix D.

Soil Particle	Percentage (%)
Gravel	0 – 5
Sand	0 – 20
Silt	39 – 61
Clay	29 – 61

The results of Atterberg Limits testing carried out on 36 samples of the deposit from the current investigation and three samples from the 2003 investigation from above Elevation 133 m are summarized below and are illustrated on Figures C7.1 to C7.6 in Appendix C and Figure D2 in Appendix D. The laboratory results indicate that the material is generally a silty clay to clayey silt of intermediate to low plasticity (CI to CL). Five additional Atterberg Limit tests carried out on samples obtained from the deposit above Elevation 133 m in Boreholes BRU19-01A, BRU19-03A, BRU19-18, BRU19-28, and BRU19-29 gave non-plastic results.

Parameter	Value
Liquid Limit	22 – 52
Plastic Limit	13 – 25
Plasticity Index	4 – 33

Below about Elevation 133 m, the deposit generally consists of a clayey silt.

The results of grain size analysis test conducted on 26 samples of clayey silt from the current investigation and four samples from the 2003 investigation from below Elevation 133 m are summarized below and are illustrated on Figures C8.1 to C8.5 in Appendix C Figures D1.1 and D1.2 in Appendix D.

Soil Particle	Percentage (%)
Gravel	0 – 2
Sand	0 – 19
Silt	49 – 66
Clay	22 – 47

The results of Atterberg Limits testing carried out on 22 samples of the deposit below Elevation 133 m are summarized below and are illustrated on Figures C9.1 to C9.4 in Appendix C. The laboratory results indicate that the material is generally a clayey silt low plasticity (CL-ML to CL). Six additional Atterberg Limit tests carried out on samples obtained from the deposit below Elevation 133 m in Boreholes BRU19-01, BRU19-03A, BRU19-15, BRU19-18, and BRU19-29 gave non-plastic results.

Parameter	Value
Liquid Limit	16 – 51
Plastic Limit	12 – 22
Plasticity Index	3 – 29

Additional laboratory testing was carried out on relatively undisturbed samples of the unweathered silty clay to clayey silt obtained with thin-walled tubes during the current investigation at Boreholes BRU19-01, BRU19-01A, BRU19-03, and BRU19-03A.

Laboratory oedometer (one-dimensional consolidation) tests using standard incremental loading per ASTM D2435, and as outlined in the RFP, were carried out on five samples of the silty clay to clayey silt. The results of testing carried out on samples from the current investigation from Boreholes BRU19-01, BRU19-01A, and BRU19-03A are presented in Appendix C. The results of testing carried out on one sample from the 2003 investigation from Borehole BRU-1 are presented in Appendix D. The results from all five tests are summarized in Table 5-1, below.

Table 5-1: Summary of One-Dimensional Consolidation Testing – Silty Clay to Clayey Silt

Parameter	Results				
Borehole	BRU19-01	BRU19-01A	BRU19-01A	BRU19-03	BRU-1
Sample	ST10	ST1	ST5	ST14	TW1
Sample Depth (m)	11	4.9	17.7	14.0	11.9
Sample Elevation (m)	140.2	147.3	134.5	135.8	139.7
Approx. Existing Effective Stress, P_0' (kPa)	104.1	57.3	167.3	120.6	160.2
Moisture Content (%)	35.6	43.7	38.4	36.3	40.7
Liquid Limit (%)	34.5	49	NP	38.9	33
Plastic Limit (%)	22	23	NP	24.8	22
Plasticity Index (%)	12.5	26	NP	14.1	11
Unit Weight, γ (kN/m^3)	17.4	17.3	18.1	17.5	18
Degree of Saturation, S_{ro} (%)	88	97	99	90	100
Specific Gravity, G_s	2.80	2.75	2.76	2.79	2.79
Initial Void Ratio e_o	1.137	1.234	1.069	1.128	1.14
Pre-consolidation Pressure, P_c' (kPa)	310	666	282	570	360
Over Consol. Ratio, OCR	3	11	2	4	2
Compression Index, C_c	0.33	0.72	0.50	0.55	0.44
Recompression Index, C_r	0.055	0.053	0.036	0.023	0.086
Coefficient of consolidation, c_v (cm^2/s)	0.007	0.001	0.001	0.009	0.003
Coefficient of re-consolidation, c_{vr} (cm^2/s)	0.022	0.003	0.003	0.060	0.013

Laboratory oedometer tests using controlled-strain loading (constant rate-of-strain, CRS) were carried out on six samples of the silty clay to clayey silt per ASTM D4186, and as outlined in the RFP. All tests imposed a strain rate of 0.8% per hour during loading, and 0.1% per hour for

unloading. The results of the testing are presented in Appendix C and summarized in Table 5-2 below.

Table 5-2: Summary of One-Dimensional Consolidation (CRS) Testing – Silty Clay to Clayey Silt

Parameter	Results					
Borehole (BRU*)	19-01	19-01	19-01A	19-01A	19-03A	19-03A
Sample	ST14	ST20	ST2	ST6	ST3	ST8
Sample Depth (m)	17.1	26.2	7.9	20.1	14.0	30.8
Sample Elevation (m)	134.1	125.0	144.3	132.1	135.9	119.4
Approx. Existing Effective Stress, P_0' (kPa)	150.4	250.9	82.9	177.2	119.0	283.5
Moisture Content (%)	40.1	29.7	41.3	37.4	38.8	29.8
Liquid Limit (%)	N/A	29.3	36.6	17.5	31.3	19.8
Plastic Limit (%)	N/A	14.2	21.2	13.7	20.8	13
Liquidity Index	N/A	15.1	15.4	3.8	10.5	6.8
Unit Weight, γ (kN/m^3)	17.4	18.6	17.7	17.6	17.4	18.6
Degree of Saturation, S_{ro}	-	-	-	-	-	-
Specific Gravity, G_s	2.77	2.78	2.75	2.78	2.78	2.76
Initial Void Ratio e_o	1.2	0.92	1.15	1.19	1.2	0.94
Pre-consolidation Pressure, P_c' (kPa)	270	600	690	320	780	710
Over Consol. Ratio, OCR	2	2	8	2	7	3
Compression Index, C_c	0.39	0.35	0.59	0.67	0.68	0.38
Recompression Index, C_r	0.100	0.033	0.043	0.050	0.020	0.049
Coefficient of consolidation, c_v (cm^2/s)	0.040	0.008	0.190	0.002	0.034	0.007
Coefficient of re-consolidation, c_{vr} (cm^2/s)	0.120	0.045	0.650	0.016	0.400	0.052

Long-term laboratory oedometer (creep) tests were carried out on samples of the silty clay to clayey silt using standard incremental loading per ASTM D2435, and as outlined in the RFP to include minimum 7-day loading hold times once the test had reached the approximate estimated sampled in-situ effective stress, and then again once the test had reached the effective stress associated with the final proposed embankment height. The test parameters and results are presented in Appendix C and summarized in Table 5-3 below.

Triaxial testing was carried out on selected samples of the silty clay to clayey silt and included testing of four samples under unconsolidated-undrained conditions and two samples under consolidated-drained conditions. The test results are presented in Appendix C and summarized in Table 5-4 and Table 5-5 below.

Table 5-3: Summary of One-Dimensional Consolidation (Creep) Testing – Silty Clay to Clayey Silt

Parameter		Results	
Borehole		BRU19-01	BRU19-03
Sample		ST16	ST20
Sample Depth (m)		20.1	23.2
Sample Elevation (m)		131.1	126.6
Approx. Existing Effective Stress, P_0' (kPa)		173.2	230.6
Moisture Content (%)		37.9	27.7
Liquid Limit (%)		31.2	24.1
Plastic Limit (%)		18.3	14.8
Plasticity Index, %		12.9	9.3
Unit Weight, γ (kN/m^3)		17.4	19.2
Degree of Saturation, S_{ro}		90.4	95.7
Specific Gravity, G_s		2.79	2.74
Initial Void Ratio e_o		1.167	0.795
Secondary Compression Index, C_α	σ' = 193.2 kPa	0.004	0.003
	σ' = 385.7 kPa	0.014	0.010

Table 5-4: Summary of Triaxial (Unconsolidated-Undrained) Testing – Silty Clay to Clayey Silt

Parameter	Results			
Borehole	BRU19-01A	BRU19-01A	BRU19-03A	BRU19-03A
Sample	ST2	ST6	ST3	ST7
Sample Depth, (m)	7.9	20.1	14.0	27.7
Sample Elevation, (m)	144.3	132.1	135.9	122.2
Approx. Exist Eff. Stress, P_0', (kPa)	86.3	205.5	123.9	281.0
Moisture Content, (%)	37.0	36.6	38.7	29.5
Liquid Limit, %	36.6	17.5	31.3	20.5
Plastic Limit, %	21.2	13.7	20.8	17.4
Plasticity Index, %	15.4	3.8	10.5	3.1
Moist Unit Weight, γ (kN/m^3)	18.1	19.0	17.7	19.5
Specific Gravity, G_s	2.75	2.76	2.78	2.77
Initial Void Ratio e_o	1.045	0.943	1.129	0.808
Deviator Stress at Failure (kPa)	208	100	213	135
Undrained Shear Strength (kPa)	104	50	107	67

Table 5-5: Summary of Triaxial (Consolidated-Drained) Testing – Silty Clay to Clayey Silt

Parameter	Results					
Borehole	BRU19-01A			BRU19-03A		
Sample	ST4			ST5		
Sample Depth, (m)	14.6			18.6		
Sample Elevation, (m)	137.6			131.3		
Max. Major Principal Stress, σ_1 (kPa)	505.1	661.5	978.9	617.0	800.5	1112.1
Max. Minor Principal Stress, σ_3 (kPa)	188.0	280	465	214	320	531
Drained Shear Strength, c' (kPa)	68			101		
Drained Friction Angle, ϕ' (deg)	15			13		

Unconfined compressive strength testing was carried out on select soil samples as per ASTM D2166, and as outlined in the RFP. The test parameters and results are presented in Appendix C and summarized in Table 5-6 below.

Table 5-6: Summary of Unconfined Compressive Strength Testing – Silty Clay to Clayey Silt

Parameter	Results		
Borehole	BRU19-01	BRU19-03	BRU19-03
Sample	ST20	ST7	ST25
Sample Depth, (m)	26.8	4.9	30.8
Sample Elevation, (m)	124.4	144.9	119.0
Approx. Existing Effective Stress, P_0', (kPa)	259.8	61.6	296.0
Moisture Content, (%)	36.0	38.7	35.2
Liquid Limit, %	29.3	62.3	32.7
Plastic Limit, %	14.2	22.3	16.2
Plasticity Index, %	15.1	40.0	16.5
Moist Unit Weight, γ (kN/m^3)	18.7	18.2	19.0
Unconfined Compressive Strength (kPa)	101	175	100
Shear Strength (kPa)	50	87	50

5.5 Interlayered Silt, Sand and Clayey Silt

Interlayered silt, sand and clayey silt was encountered at all boreholes that penetrated the extensive silty clay to clayey silt deposit it except at Boreholes BRU19-09, BRU19-10, BRU19-12 and BRU19-28. Where fully penetrated, the interlayered deposits generally consist of a predominantly silt and sand portion overlying a sandy clayey silt portion. At some borehole locations the interlayering was more irregular, and distinct portions were not discernable.

The thickness of the interlayered silt, sand, and clayey silt, when fully penetrated ranges from 1.5 m to greater than 11.9 m (base elevations ranging from 133.3 m to 105.2 m). The N-values

obtained from SPTs conducted in this material ranged from weight-of-hammer (WH) to 67 blows per 0.3 m of penetration. At Borehole BRU19-16, a Dynamic Cone Penetration Test (DCPT) was carried out within the deposit from about Elevation 111.3 m to 107.0 m and gave DCPT N-values ranging from 11 to 65 blows per 0.3 m of advancement of the probe. The SPT and DCPT results indicate that the interlayered deposits have a very loose to very dense relative density.

The moisture content ranged from 15% to 41%. The results of grain size analysis tests conducted on 25 samples of the interlayered, sand and clayey silt obtained during the current investigation and two samples obtained during the 2003 investigation are summarized below and are illustrated on Figures C10.1 to C10.5 in Appendix C and Figure D3 in Appendix D.

Soil Particle	Percentage (%)	
Gravel	0 – 12	
Sand	1 – 86	
Silt	20 – 63	14 – 38
Clay	6 – 36	

The results of Atterberg Limits testing carried out on 16 samples recovered from cohesive interlayers of this material are summarized below and are illustrated on Figures C11.1 to C11.3 in Appendix C. The laboratory results indicate that the fines are generally a clayey silt of low plasticity (CL to CL-ML). Six additional Atterberg Limit tests carried out on samples obtained from the interlayered deposits in Boreholes BRU19-01, BRU19-02, BRU19-07, BRU19-23, BRU19-25, and BRU19-33 gave non-plastic results.

Parameter	Value
Liquid Limit	15 – 29
Plastic Limit	12 – 17
Plasticity Index	3 – 14

5.6 Till

A deposit of glacial till consisting of silty sand and gravel, containing occasional to frequent cobbles and boulders was encountered beneath the silty clay to clayey silt and interbedded layers of silt, sand, and clayey silt, where fully penetrated. The glacial till was fully penetrated at Boreholes BRU-1, BRU-2, BRU-3, BRU19-01, BRU19-02, and BRU19-03. The thickness at these locations ranged from 2.3 m to 7.4 m (base elevations ranging from 106.2 m to 98.8 m).

The N-values obtained from SPTs conducted in the till material ranged from 7 to greater than 100 blows per 0.3 m of penetration but were generally greater than 50 blows indicating a very dense relative density. Refusals within this deposit are likely due to presence of cobbles and boulders. Penetration through this layer often required the use of coring techniques.

The moisture content of samples tested ranged from 6% to 30%. The results of grain size analysis test conducted on 11 samples of till material are summarized below and are illustrated on Figures C12.1 and C12.2 in Appendix C.

Soil Particle	Percentage (%)
Gravel	3 – 52
Sand	41 – 79
Silt	7 – 34
Clay	

5.7 Bedrock

Bedrock was encountered in Boreholes BRU19-01, BRU19-02, BRU19-03, BRU-1, BRU-2, and BRU-3. The bedrock encountered consisted of moderately weathered to fresh, fine to large grained, marble that is predominantly white, grey, and black in colour. Bedrock logs are provided in Appendix B. Photographs of the bedrock cores are provided in Appendix C. The following table summarizes the rock core quality:

Summary of Rock Core Quality Parameter	Range	Average
Total Core Recovery (TCR), %	98 – 100	99
Solid Core Recovery (SCR), %	29 – 100	76
Rock Quality Designation (RQD), %	39 – 100	77
Fracture Index (fractures per 0.3m)	0 – >10	2

Based on the RQD values, the bedrock is classified as poor to excellent quality.

Unconfined compressive strength (UCS) testing was carried out on eight samples of the bedrock in the boreholes listed above. The UCS values ranged from 42 MPa to 133 MPa with an average of 86 MPa. Based on the unconfined compressive strength testing the bedrock is classified as medium strong to very strong. It should be noted that fractured zones and vertical and sub-vertical fractures were present in the bedrock encountered in most boreholes.

A summary of the bedrock surface information is provided in the table below.

Borehole No.	Depth to Bedrock Surface (mbgs)	Bedrock Surface Elevation (m)
BRU19-01	45.0	106.2
BRU19-02	48.3	101.8
BRU19-03	51.0	98.8
BRU-1	48.8	102.8
BRU-2	50.3	100.0
BRU-3	48.6	100.7

5.8 Groundwater

Groundwater levels recorded in the piezometer and monitoring wells are presented in Table 5-7.

Table 5-7: Summary of Groundwater Levels

Borehole No.	Elevation (m)		Screened Material	Groundwater Depth (m)	Groundwater Elevation (m)	Date of Measurement
	Ground Surface*	Screen Bottom				
BRU19-01	151.2	141.3	Clayey Silt	2.1	149.1	November 26, 2019
				1.3	149.9	April 21, 2020
				1.3	149.9	December 15, 2020
				1.7	149.5	August 4, 2021
				1.4	149.8	December 22, 2021
				1.8	149.4	January 11, 2022
				1.8	149.4	January 18, 2022
BRU19-03	149.8	139.7	Silty Clay	1.3	148.4	November 26, 2019
				-0.2	149.9	April 21, 2020
				0.8	148.9	December 15, 2020
				1.2	148.5	August 4, 2021
				0.8	148.9	December 22, 2021
				1.5	148.2	January 11, 2022
				1.5	148.2	January 18, 2022
BRU19-06	148.5	141.2	Silty Clay	1.9	146.6	November 26, 2019
				1.8	146.7	April 21, 2020
				1.8	146.7	December 15, 2020
				2.0	146.5	August 4, 2021
				1.8	146.7	December 22, 2021
				2.1	146.4	January 11, 2022
				2.1	146.4	January 18, 2022
BRU19-13	152.5	142.1	Clayey Silt	2.6	149.9	November 26, 2019
				2.2	150.3	April 21, 2020
				2.5	150.0	December 15, 2020
				2.4	150.1	August 4, 2021
				2.4	150.1	December 22, 2021
				2.4	150.1	January 11, 2022
				2.4	150.1	January 18, 2022
BRU19-21	150.7	141.6	Clayey Silt	1.9	148.8	December 15, 2020
				0.7	150.0	August 4, 2021
				0.9	149.8	September 22, 2021
				7.1	143.6	October 21, 2021
				6.9	143.8	November 1, 2021
				4.1	146.6	January 11, 2022
				4.1	146.6	January 18, 2022
				3.8	146.9	January 27, 2022
BRU19-29	154.7	147.4	Silty Clay Crust	3.3	151.4	December 15, 2020
				3.5	151.2	August 4, 2021
				4.3	150.4	September 30, 2021
				4.3	150.4	October 5, 2021

BRU19-29	154.7	147.4	Silty Clay Crust	3.5	151.2	January 11, 2022
				3.6	151.1	January 18, 2022
				3.5	151.2	January 26, 2022
BRU21-02	151.4	145.3	Clay Crust	2.4	149.0	November 4, 2021
				2.3	149.1	November 30, 2021
				2.2	149.2	December 23, 2021
				2.5	148.9	January 19, 2022
BRU 21-05	149.2	143.1	Silty Clay Crust	2.0	147.2	November 16, 2021
				2.0	147.2	December 1, 2021
				2.3	146.9	January 19, 2022
BRU21-15	152.6	146.5	Silty Clay Crust	2.6	150.0	November 2, 2021
				2.6	150.0	November 3, 2021
				3	149.6	January 19, 2022
BRU21-18	151.4	145.3	Silty Clay	1.5	149.9	November 2, 2021
				1.6	149.8	November 3, 2021
				1.7	149.7	January 19, 2022
BRU21-23	146.6	140.5	Silty Clay Crust	0.3	146.3	November 16, 2021
				0.3	146.3	November 24, 2021
				0.7	145.9	January 19, 2022
BRU-1	151.6	105.9	Till	6.4	145.2	October 22, 2003
				5.4	146.2	December 18, 2003
				5.8	145.8	February 4, 2004
				5.6	146.0	March 11, 2004
BRU-2	150.3	97.1	Bedrock	1.8	148.5	October 22, 2003
BRU-3	149.3	98.1	Bedrock	3.5	145.8	December 18, 2003
				4.1	145.2	February 4, 2004
				3.6	145.7	March 11, 2004

* Ground surface elevation at the time of borehole survey

5.9 Analytical Testing

Three samples were submitted to Paracel Laboratories in Ottawa, Ontario for analysis of pH, water soluble sulphate, sulphide and chloride concentrations, resistivity and conductivity. The analysis results are summarized in the table below. Copies of the test results are provided in Appendix C.

Borehole	Sample (Soil Type)	Depth (m)	Chloride (µg/g)	Sulphate (µg/g)	Sulphide (%)	pH (-)	Resistivity (Ohm-cm)
BRU19-01	SS4 (Silty Clay)	2.3 – 2.9	9	9	0.02	7.78	4850
BRU19-02	SS3 (Silty Clay)	1.5 – 2.1	1280	55	< 0.02	7.91	524
BRU19-03	SS5 (Silty Clay)	3.0 – 3.7	662	38	< 0.02	7.5	902

6 MISCELLANEOUS

Borehole locations were selected by Thurber relative to existing site features. The as-drilled locations and ground surface elevation of the boreholes were surveyed by Thurber following completion of the field program. The elevation survey was carried out with reference to geodetic elevation benchmarks provided by the MTO.

Eastern Ontario Diamond Drilling Ltd. of Hawkesbury, Ontario and Marathon Underground Ltd. of Greely, Ontario supplied and operated the drilling equipment and carried out the drilling, soil sampling, in-situ testing, piezometer/monitoring well installation. ConeTec Investigations Ltd. of Richmond Hill, Ontario supplied and operated the CPT equipment and carried out the in-situ testing. The field investigation was supervised on a full-time basis by Richard Howarth, Michel Johnston, Anderson de Oliveira, and Michael Wong of Thurber. Overall supervision of the investigation program was provided by Justin Gray, P.Eng.

Routine geotechnical laboratory testing was completed by Thurber's laboratory in Ottawa, Ontario. One-dimensional oedometer testing was carried out by Thurber's laboratories in Ottawa and Oakville, Ontario. UCS testing of soil and rock was completed by Thurber's laboratory in Oakville. Triaxial testing was carried out by Thurber's laboratory in Oakville and by Golder Associates Ltd. in Mississuaga. Specific gravity testing was carried out by Stantec Consulting Ltd. in Ottawa. Analytical testing was completed by Paracel Laboratories in Ottawa.

Overall project management and direction of the field program was provided by Fred Griffiths, P.Eng. Interpretation of the factual data and preparation of this report were carried out by Muhammad Imran Khan, EIT, Matt Kennedy, P.Eng., and Fred Griffiths, P.Eng. The report was reviewed by P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.

THURBER

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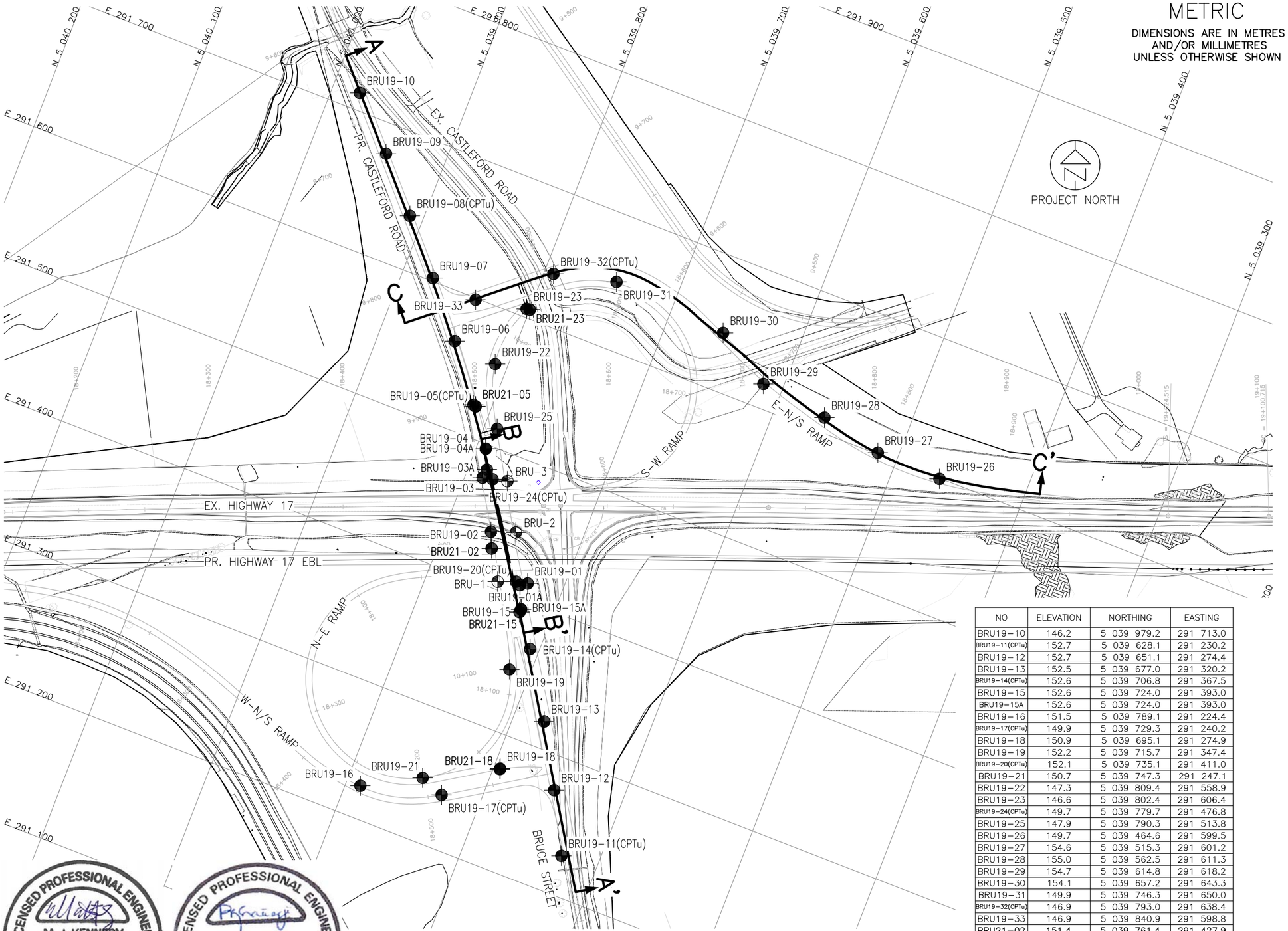
Appendix A.

Borehole Location Plan and Stratigraphic Drawings

MINISTRY OF TRANSPORTATION, ONTARIO

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN



PLAN OF BRUCE STREET INTERCHANGE

60 0 60 120m

SCALE 1:3000

NO	ELEVATION	NORTHING	EASTING
BRU19–10	146.2	5 039 979.2	291 713.0
BRU19–11(CPTu)	152.7	5 039 628.1	291 230.2
BRU19–12	152.7	5 039 651.1	291 274.4
BRU19–13	152.5	5 039 677.0	291 320.2
BRU19–14(CPTu)	152.6	5 039 706.8	291 367.5
BRU19–15	152.6	5 039 724.0	291 393.0
BRU19–15A	152.6	5 039 724.0	291 393.0
BRU19–16	151.5	5 039 789.1	291 224.4
BRU19–17(CPTu)	149.9	5 039 729.3	291 240.2
BRU19–18	150.9	5 039 695.1	291 274.9
BRU19–19	152.2	5 039 715.7	291 347.4
BRU19–20(CPTu)	152.1	5 039 735.1	291 411.0
BRU19–21	150.7	5 039 747.3	291 247.1
BRU19–22	147.3	5 039 809.4	291 558.9
BRU19–23	146.6	5 039 802.4	291 606.4
BRU19–24(CPTu)	149.7	5 039 779.7	291 476.8
BRU19–25	147.9	5 039 790.3	291 513.8
BRU19–26	149.7	5 039 464.6	291 599.5
BRU19–27	154.6	5 039 515.3	291 601.2
BRU19–28	155.0	5 039 562.5	291 611.3
BRU19–29	154.7	5 039 614.8	291 618.2
BRU19–30	154.1	5 039 657.2	291 643.3
BRU19–31	149.9	5 039 746.3	291 650.0
BRU19–32(CPTu)	146.9	5 039 793.0	291 638.4
BRU19–33	146.9	5 039 840.9	291 598.8
BRU21–02	151.4	5 039 761.4	291 427.9
BRU21–05	149.2	5 039 811.7	291 523.6
BRU21–15	152.6	5 039 724.3	291 390.6
BRU21–18	151.4	5 039 695.2	291 274.5
BRU21–23	146.6	5 039 799.9	291 606.7
BRU–1	151.6	5 039 748.0	291 406.0
BRU–2	150.3	5 039 748.7	291 445.8
BRU–3	149.3	5 039 768.7	291 479.6

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CONT No
WP No 4068–09–00

SHEET

HIGHWAY 17 TWINNING
BRUCE STREET
INTERCHANGE
BOREHOLE LOCATION PLAN

Ontario

THURBER ENGINEERING LTD.

KEYPLAN

LEGEND

	Borehole
	Borehole (2003 Investigation)
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	Water Level
	Head Artesian Water
	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

NO	ELEVATION	NORTHING	EASTING
BRU19–01	151.2	5 039 726.4	291 413.0
BRU19–01A	152.2	5 039 731.4	291 409.7
BRU19–02	150.1	5 039 766.5	291 439.5
BRU19–03	149.8	5 039 787.2	291 475.1
BRU19–03A	149.9	5 039 786.4	291 482.2
BRU19–04	149.8	5 039 792.9	291 496.6
BRU19–04A	149.8	5 039 792.9	291 496.6
BRU19–05(CPTu)	149.0	5 039 813.7	291 524.1
BRU19–06	148.5	5 039 844.3	291 564.0
BRU19–07	148.1	5 039 876.9	291 602.4
BRU19–08(CPTu)	147.4	5 039 910.2	291 640.1
BRU19–09	146.9	5 039 944.0	291 677.4

-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.
3) Coordinate system is MTM NAD 83 Zone 9.

GEOCRES No. 31F-234

REVISIONS

DATE	BY	DESCRIPTION

DESIGN MJK	CHK –	CODE	LOAD	DATE JUL 2022	
DRAWN MFA	CHK MJK	SITE	STRUCT	DWG 1	

FILENAME: H:\Drafting\24000\24726\TED–24726–BHPP–BRU.dwg
PLOTDATE: 7/21/2022 11:17 AM

MINISTRY OF TRANSPORTATION, ONTARIO

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

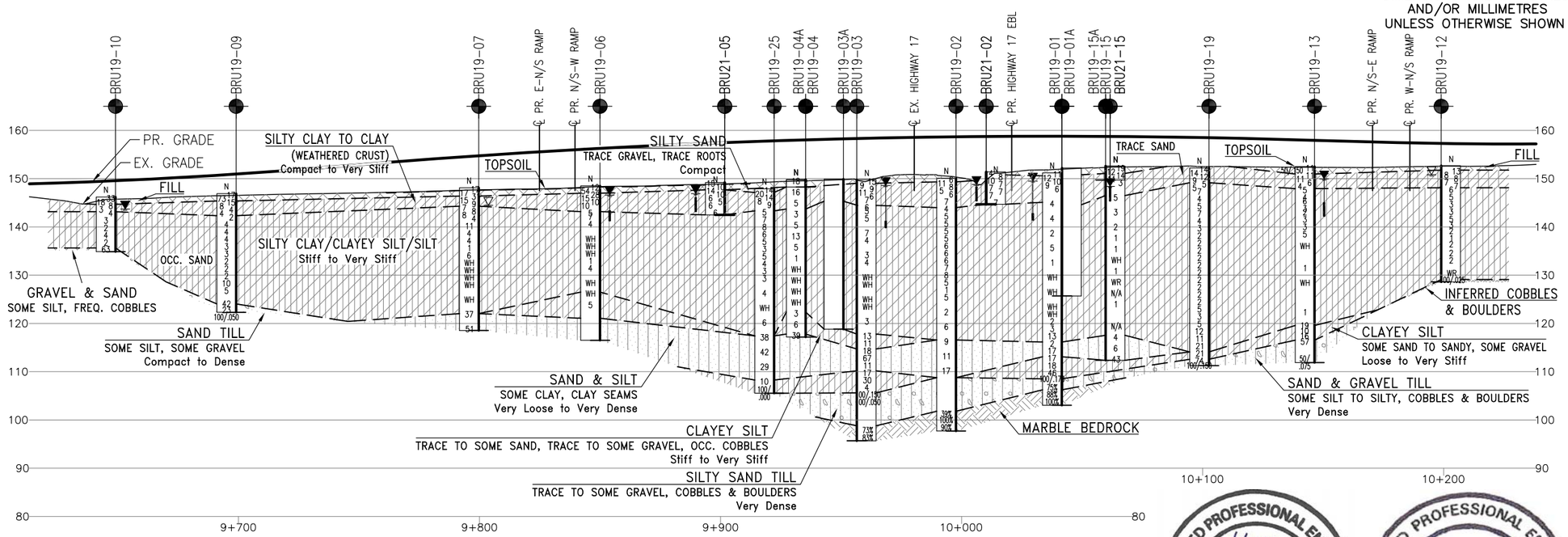
CONT No
WP No 4068-09-00

HIGHWAY 17 TWINNING
BRUCE STREET INTERCHANGE
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET

Ontario

THURBER ENGINEERING LTD.



PROFILE A–A' (℄ PR. CASTLEFORD RD/BRUCE ST)

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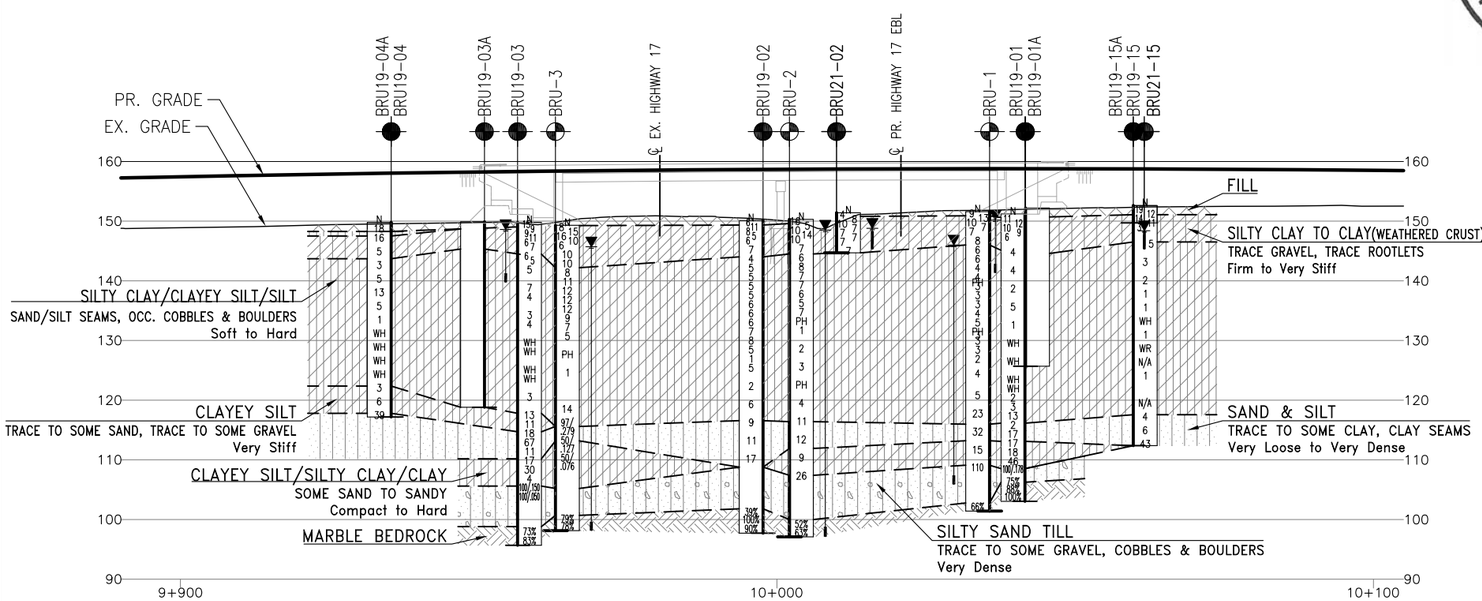
20 0 20 40m V 1:1000



PROFILE B–B' (℄ PR. CASTLEFORD RD/BRUCE ST)

20 0 20 40m H 1:1000
20 0 20 40m V 1:1000

LICENSED PROFESSIONAL ENGINEER
M. J. KENNEDY
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July 22, 2022
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LICENSED PROFESSIONAL ENGINEER
P. K. CHATTERJI
July 22, 2022
PROVINCE OF ONTARIO

NO	ELEVATION	NORTHING	EASTING
BRU19–10	146.2	5 039 979.2	291 713.0
BRU19–11(CPTu)	152.7	5 039 628.1	291 230.2
BRU19–12	152.7	5 039 651.1	291 274.4
BRU19–13	152.5	5 039 677.0	291 320.2
BRU19–14(CPTu)	152.6	5 039 706.8	291 367.5
BRU19–15	152.6	5 039 724.0	291 393.0
BRU19–15A	152.6	5 039 724.0	291 393.0
BRU19–16	151.5	5 039 789.1	291 224.4
BRU19–17(CPTu)	149.9	5 039 729.3	291 240.2
BRU19–18	150.9	5 039 695.1	291 274.9
BRU19–19	152.2	5 039 715.7	291 347.4
BRU19–20(CPTu)	152.1	5 039 735.1	291 411.0
BRU19–21	150.7	5 039 747.3	291 247.1
BRU19–22	147.3	5 039 809.4	291 558.9
BRU19–23	146.6	5 039 802.4	291 606.4
BRU19–24(CPTu)	149.7	5 039 779.7	291 476.8
BRU19–25	147.9	5 039 790.3	291 513.8
BRU19–26	149.7	5 039 464.6	291 599.5
BRU19–27	154.6	5 039 515.3	291 601.2
BRU19–28	155.0	5 039 562.5	291 611.3
BRU19–29	154.7	5 039 614.8	291 618.2
BRU19–30	154.1	5 039 657.2	291 643.3
BRU19–31	149.9	5 039 746.3	291 650.0
BRU19–32(CPTu)	146.9	5 039 793.0	291 638.4
BRU19–33	146.9	5 039 840.9	291 598.8
BRU21–02	151.4	5 039 761.4	291 427.9
BRU21–05	149.2	5 039 811.7	291 523.6
BRU21–15	152.6	5 039 724.3	291 390.6
BRU21–18	151.4	5 039 695.2	291 274.5
BRU21–23	146.6	5 039 799.9	291 606.7
BRU–1	151.6	5 039 748.0	291 406.0
BRU–2	150.3	5 039 748.7	291 445.8
BRU–3	149.3	5 039 768.7	291 479.6

KEYPLAN

LEGEND

●	Borehole
⊕	Borehole (2003 Investigation)
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
▽	Water Level
▼	Head Artesian Water
┃	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

NO	ELEVATION	NORTHING	EASTING
BRU19–01	151.2	5 039 726.4	291 413.0
BRU19–01A	152.2	5 039 731.4	291 409.7
BRU19–02	150.1	5 039 766.5	291 439.5
BRU19–03	149.8	5 039 787.2	291 475.1
BRU19–03A	149.9	5 039 786.4	291 482.2
BRU19–04	149.8	5 039 792.9	291 496.6
BRU19–04A	149.8	5 039 792.9	291 496.6
BRU19–05(CPTu)	149.0	5 039 813.7	291 524.1
BRU19–06	148.5	5 039 844.3	291 564.0
BRU19–07	148.1	5 039 876.9	291 602.4
BRU19–08(CPTu)	147.4	5 039 910.2	291 640.1
BRU19–09	146.9	5 039 944.0	291 677.4

-NOTES-

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GEOCRES No. 31F-234

REVISIONS

DATE	BY	DESCRIPTION

DESIGN	MJK	CHK –	CODE	LOAD	DATE JUL 2022
DRAWN	MFA	CHK MJK	SITE	STRUCT	DWG 2

FILENAME: H:\Drafting\24000\24726\TED-24726-BHPP-BRU.dwg
PLOTDATE: 7/21/2022 11:19 AM

MINISTRY OF TRANSPORTATION, ONTARIO

METRIC

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CONT No
WP No 4068-09-00

HIGHWAY 17 TWINNING
BRUCE STREET
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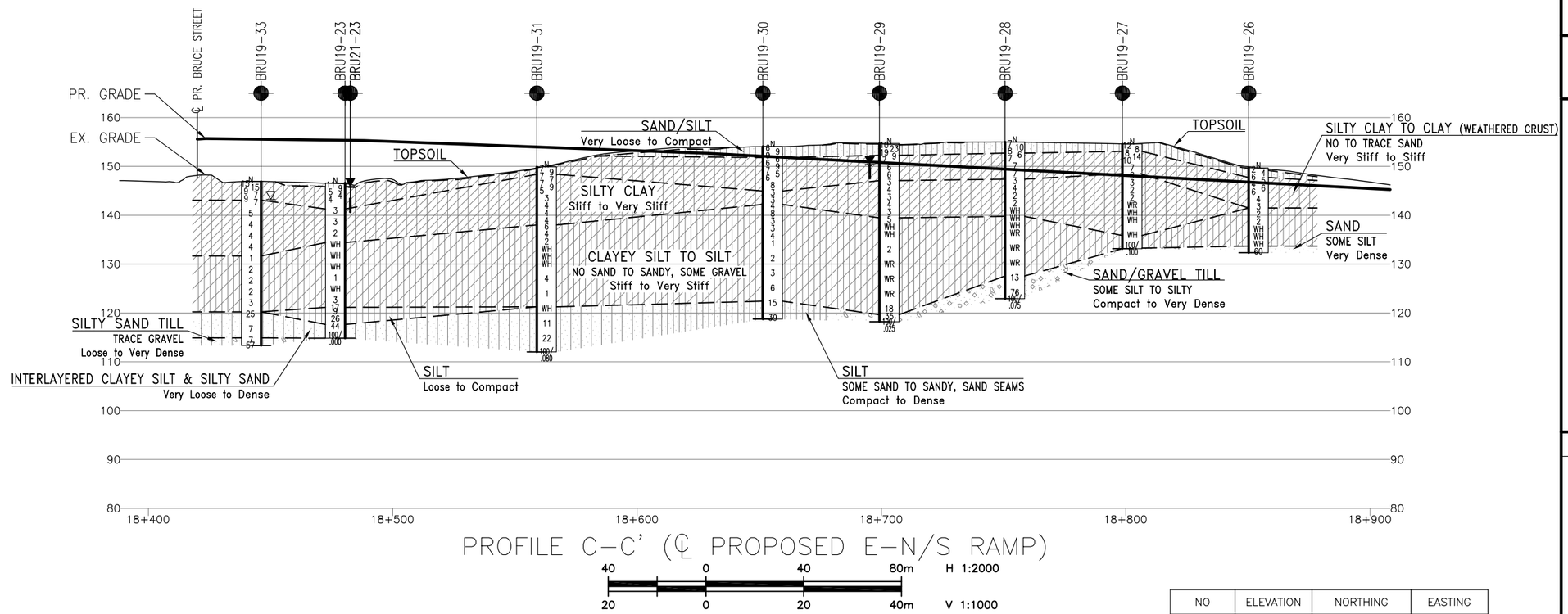
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET

Ontario

THURBER ENGINEERING LTD.



PROFILE C-C' (℄ PROPOSED E-N/S RAMP)

40 0 40 80m H 1:2000

20 0 20 40m V 1:1000

KEYPLAN

LEGEND

●	Borehole
⊕	Borehole (2003 Investigation)
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
▽	Water Level
▼	Head Artesian Water
┃	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

NO	ELEVATION	NORTHING	EASTING
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BRU19-01A	152.2	5 039 731.4	291 409.7
BRU19-02	150.1	5 039 766.5	291 439.5
BRU19-03	149.8	5 039 787.2	291 475.1
BRU19-03A	149.9	5 039 786.4	291 482.2
BRU19-04	149.8	5 039 792.9	291 496.6
BRU19-04A	149.8	5 039 792.9	291 496.6
BRU19-05(CPTu)	149.0	5 039 813.7	291 524.1
BRU19-06	148.5	5 039 844.3	291 564.0
BRU19-07	148.1	5 039 876.9	291 602.4
BRU19-08(CPTu)	147.4	5 039 910.2	291 640.1
BRU19-09	146.9	5 039 944.0	291 677.4

NO	ELEVATION	NORTHING	EASTING
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BRU19-15	152.6	5 039 724.0	291 393.0
BRU19-15A	152.6	5 039 724.0	291 393.0
BRU19-16	151.5	5 039 789.1	291 224.4
BRU19-17(CPTu)	149.9	5 039 729.3	291 240.2
BRU19-18	150.9	5 039 695.1	291 274.9
BRU19-19	152.2	5 039 715.7	291 347.4
BRU19-20(CPTu)	152.1	5 039 735.1	291 411.0
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BRU19-22	147.3	5 039 809.4	291 558.9
BRU19-23	146.6	5 039 802.4	291 606.4
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BRU19-25	147.9	5 039 790.3	291 513.8
BRU19-26	149.7	5 039 464.6	291 599.5
BRU19-27	154.6	5 039 515.3	291 601.2
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GEOCRES No. 31F-234

LICENSED PROFESSIONAL ENGINEER
M. J. KENNEDY
100188946
July 22, 2022
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. K. CHATTERJI
July 22, 2022
PROVINCE OF ONTARIO

REVISIONS			
DATE	BY	DESCRIPTION	
DESIGN MJK	CHK –	CODE	LOAD	DATE JUL 2022
DRAWN MFA	CHK MJK	SITE	STRUCT	DWG 3

FILENAME: H:\Drafting\24000\24726\TED-24726-BHPP-BRU.dwg
PLOTDATE: 7/21/2022 11:19 AM

THURBER

Appendix B.

Record of Test Hole Sheets

THURBER

Appendix B.1

Current (2019/2020/2021) Investigation

THURBER

SYMBOLS, ABBREVIATIONS AND TERMS USED ON TEST HOLE RECORDS

TERMINOLOGY DESCRIBING COMMON SOIL GENESIS

Topsoil	mixture of soil and humus capable of supporting vegetative growth
Peat	mixture of fragments of decayed organic matter
Till	unstratified glacial deposit which may include particles ranging in sizes from clay to boulder
Fill	material below the surface identified as placed by humans (excluding buried services)

TERMINOLOGY DESCRIBING SOIL STRUCTURE:

Desiccated	having visible signs of weathering by oxidization of clay materials, shrinkage cracks, etc.
Fissured	having cracks, and hence a blocky structure
Varved	composed of alternating layers of silt and clay
Stratified	composed of alternating successions of different soil types, e.g. silt and sand
Layer	> 75 mm in thickness
Seam	2 mm to 75 mm in thickness
Parting	< 2 mm in thickness

RECOVERY:

For soil samples, the recovery is recorded as the length of the soil sample recovered.

N-VALUE:

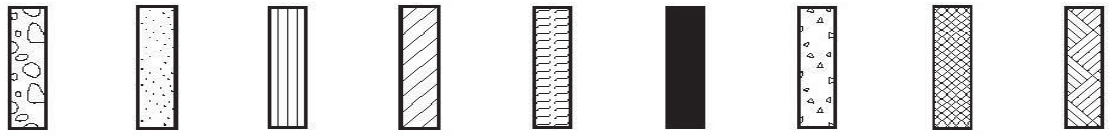
Numbers in this column are the field results of the Standard Penetration Test: the number of blows of a 63.5 kg hammer falling 0.76 m, required to drive a 50 mm O.D. split spoon sampler 0.3 m into undisturbed soil. For samples where insufficient penetration was achieved and N-value cannot be presented, the number of blows are reported over the sampler penetration in millimetres (e.g. 50/75).

DYNAMIC CONE PENETRATION TEST (DCPT):

Dynamic cone penetration tests are performed using a standard 60 degree apex cone connected to an “A” size drill rods with the same standard fall height and weight as the Standard Penetration Test. The DCPT value is the number of blows of the hammer required to drive the cone 0.3 m into the soil. The DCPT is used as a probe to assess soil variability.

THURBER

STRATA PLOT:
Strata plots symbolize the soil and bedrock description. They are combinations of the following basic symbols. The dimensions within the strata symbols are not indicative of the particle size, layer thickness, etc.



Boulders Cobbles Gravel | Sand | Silt | Clay | Organics | Asphalt | Concrete | Fill | Bedrock

TEXTURING CLASSIFICATION OF SOILS

Classification	Particle Size
Boulders	Greater than 200 mm
Cobbles	75 – 200 mm
Gravel	4.75 – 75 mm
Sand	0.075 – 4.75 mm
Silt	0.002 – 0.075 mm
Clay	Less than 0.002 mm

TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

Descriptive Term	Undrained Shear Strength (kPa)
Very Soft	12 or less
Soft	12 – 25
Firm	25 – 50
Stiff	50 – 100
Very Stiff	100 – 200
Hard	Greater than 200

NOTE: Clay sensitivity is defined as the ratio of the undisturbed strength over the remolded strength.

SAMPLE TYPES

SS	Split spoon samples
ST	Shelby tube or thin wall tube
DP	Direct push sample
PS	Piston sample
BS	Bulk sample
WS	Wash sample
HQ, NQ, BQ etc.	Rock core sample obtained with the use of standard size diamond coring equipment

TERMS DESCRIBING CONSISTENCY (COHESIONLESS SOILS ONLY)

Descriptive Term	SPT “N” Value
Very Loose	Less than 4
Loose	4 – 10
Compact	10 – 30
Dense	30 – 50
Very Dense	Greater than 50

THURBER

MODIFIED UNIFIED SOIL CLASSIFICATION

Major Divisions		Group Symbol	Typical Description
COARSE GRAINED SOIL	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	SILT AND CLAY SOILS $W_L < 35\%$	ML	Inorganic silts, 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.
		OL	Organic silts and organic silty-clays of low plasticity.
	SILT AND CLAY SOILS $35\% < W_L < 50\%$	MI	Inorganic compressible fine sandy silt with clay of medium plasticity, clayey silts.
		CI	Inorganic clays of medium plasticity, silty clays.
		OI	Organic silty clays of medium plasticity.
	SILT AND CLAY SOILS $W_L > 50\%$	MH	Inorganic silts, micaceous or diatomaceous fine sandy of silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
		OH	Organic clays of high plasticity, organic silts.
HIGHLY ORGANIC SOILS		Pt	Peat and other organic soils.

Note - W_L= Liquid Limit

THURBER

EXPLANATION OF ROCK LOGGING TERMS

ROCK WEATHERING CLASSIFICATION

Fresh (FR)	No visible signs of weathering.
Fresh Jointed (FJ)	Weathering limited to surface of major discontinuities.
Slightly Weathered (SW)	Penetrative weathering developed on open discontinuity surfaces, but only slight weathering of rock materials.
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 structures are preserved.

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 0.1 m in length or larger, as a percentage of total core length
Unconfined Compressive Strength: (UCS)	Axial stress required to break the specimen.
Fracture Index: (FI)	Frequency of natural fractures per 0.3 m of core run.

DISCONTINUITY SPACING

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

STRENGTH CLASSIFICATION

Rock Strength	Approximate Uniaxial Compressive Strength (MPa)
Extremely Strong	Greater than 250
Very Strong	100 – 250
Strong	50 – 100
Medium Strong	25 – 50
Weak	5 – 25
Very Weak	1 – 5
Extremely Weak	0.25 – 1

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-01

METRIC

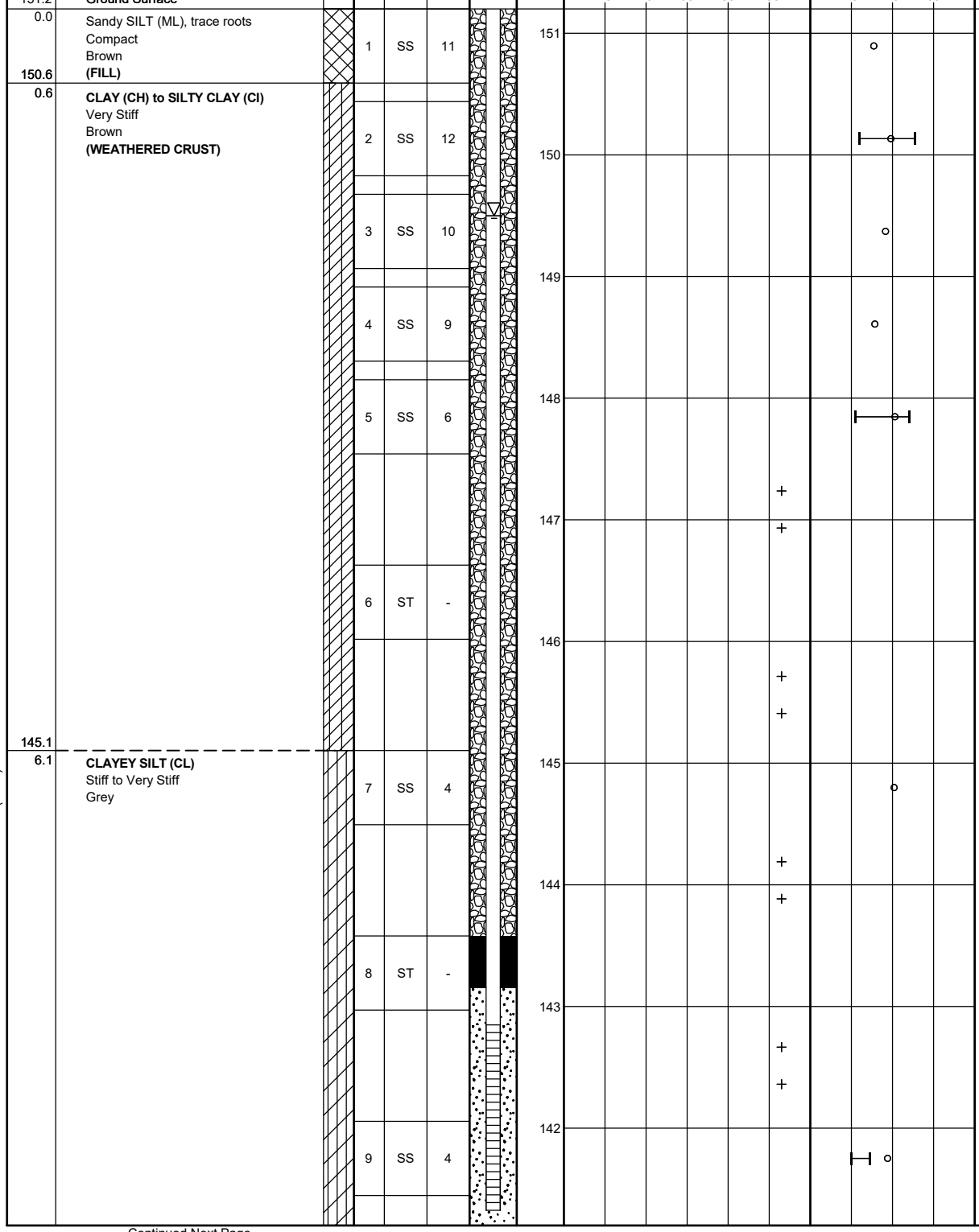
WP# 4068-09-00 | LOCATION Lat: 45.497332°, Long: -76.671291° Bruce Street MTM Zone 9: N 5 039 726.4 E 291 413.0 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA, NW Casing, NQ Coring | COMPILED BY MW

DATUM Geodetic | DATE 2019.10.07 - 2019.10.10 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GR	SA	SI	CL
151.2	Ground Surface							
0.0	Sandy SILT (ML), trace roots Compact Brown	1	SS	11				
150.6	**(FILL)**							
0.6	**CLAY (CH) to SILTY CLAY (CI)** Very Stiff Brown **(WEATHERED CRUST)**	2	SS	12	0	2	38	60
		3	SS	10				
		4	SS	9				
		5	SS	6	0	0	41	59
		6	ST	-				
145.1								
6.1	**CLAYEY SILT (CL)** Stiff to Very Stiff Grey	7	SS	4				
		8	ST	-				
		9	SS	4	0	0	53	47

SOIL PROFILE | SAMPLES | 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) | 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 (%)



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+ 3, × 3: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-01

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497332°, Long: -76.671291° Bruce Street MTM Zone 9: N 5 039 726.4 E 291 413.0 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA, NW Casing, NQ Coring | COMPILED BY MW

DATUM Geodetic | DATE 2019.10.07 - 2019.10.10 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
	Continued From Previous Page									
	CLAYEY SILT (CL) Stiff to Very Stiff Grey				141					
		10	ST	-	140					
		11	SS	2	139					
		12	ST	-	138					
		13	SS	5	137					
		14	ST	-	136					
133.2 / 18.0	**CLAYEY SILT (CL)** to **SILT (ML)** Stiff to Very Stiff Grey	15	SS	1	135	NP	0	0	56	44
					134					
					133					
					132					

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)

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

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THURBER

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HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA, NW Casing, NQ Coring | COMPILED BY MW

DATUM Geodetic | DATE 2019.10.07 - 2019.10.10 | CHECKED BY

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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	CLAYEY SILT (CL) to **SILT (ML)** Stiff to Very Stiff Grey		16	ST	-		131	3.2			
							130		○		
			17	SS	WH		129	4.3			
			18	ST	-		128				
			19	SS	WH		127		○		
			20	ST	-		126				
			21	SS	WH		125		○		
			22	SS	WH		124				
							123		○		
							122				

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-01

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497332°, Long: -76.671291° Bruce Street MTM Zone 9: N 5 039 726.4 E 291 413.0 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA, NW Casing, NQ Coring | COMPILED BY MW

DATUM Geodetic | DATE 2019.10.07 - 2019.10.10 | CHECKED BY

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L (WATER CONTENT (%))	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
	Continued From Previous Page													
	CLAYEY SILT (CL) to **SILT (ML)** Stiff to Very Stiff Grey						121							
			23	SS	2					NP	0	4	53	43
							120							
			24	SS	3		119							
							118							
			25	SS	13									
							117							
116.1														
35.1	Sandy **SILT (ML)** Very loose to Compact Grey		26	SS	2		116							
							115							
			27	SS	17					NP	0	36	50	14
							114							
113.1														
38.1	Sandy **CLAYEY SILT (CL-ML)** Compact to Dense Grey		28	SS	17		113							
							112							
			29	SS	18						1	33	46	20

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-01

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497332°, Long: -76.671291° Bruce Street MTM Zone 9: N 5 039 726.4 E 291 413.0 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA, NW Casing, NQ Coring | COMPILED BY MW

DATUM Geodetic | DATE 2019.10.07 - 2019.10.10 | CHECKED BY

ELEV / DEPTH	DESCRIPTION (Continued From Previous Page)	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 + FIELD VANE ● QUICK TRIAXIAL × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Sandy **CLAYEY SILT (CL-ML)** Compact to Dense Grey						111				
							110				
			30	SS	46				○		
							109				
108.5											
42.7	**SILTY SAND**, trace gravel Occasional cobbles Very Dense Black and Grey **(TILL)**		31	SS	100/ 178mm		108				
			32	NQ					○		
	- 300mm diameter boulder encountered at 43.8 m depth.						107				
			33	NQ					○		3 70 27 (SI+CL)
106.2										FI	RUN #1 TCR=100% SCR=63% RQD=75%
45.0	**MARBLE BEDROCK** Strong, slightly weathered to fresh jointed, grey and white		1	RUN			106			2 0 0	
			2	RUN						0 3 6	RUN #2 TCR=100% SCR=93% RQD=88% UCS=47MPa
							105			0 0	
			3	RUN			104			0 0 1	RUN #3 TCR=100% SCR=100% RQD=100%
103.0											
48.2	**End of Borehole**										

Piezometer consists of 19 mm diameter Schedule 40 PVC pipe with a 1.5 m slotted screen

WATER LEVEL READINGS:

DATE	DEPTH (m)	ELEV. (m)
2019.11.26	2.1	149.1
2020.04.21	1.3	149.9
2020.12.15	1.3	149.9
2021.08.04	1.7	149.5
2021.12.22	1.4	149.8
2022.01.11	1.8	149.4

+ ³, × ³: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-01A

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497377°, Long: -76.671333° Bruce Street MTM Zone 9: N 5 039 731.4 E 291 409.7 | ORIGINATED BY RH

HWY 17 | BOREHOLE TYPE CME 75 Trackmount, HSA, H Casing | COMPILED BY AO

DATUM Geodetic | DATE 2020.12.02 - 2020.12.03 | CHECKED BY

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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
152.2											
0.0	See borehole BRU19-01 for Stratigraphy.						152				
							151				
							150				
							149				
							148				
147.6											
4.6	**SILTY CLAY (CI)** Stiff to Very Stiff Grey **(WEATHERED CRUST)**		1	ST	-		147		w_P 20, w 40, w_L 60		0 0 41 59
							146				
							145				
144.6											
7.6	**CLAYEY SILT (CL)** Stiff to Very Stiff		2	ST	-		144				
							143				

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-01A

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497377°, Long: -76.671333° Bruce Street MTM Zone 9: N 5 039 731.4 E 291 409.7 | ORIGINATED BY RH

HWY 17 | BOREHOLE TYPE CME 75 Trackmount, HSA, H Casing | COMPILED BY AO

DATUM Geodetic | DATE 2020.12.02 - 2020.12.03 | CHECKED BY

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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	CLAYEY SILT (CL) Stiff to Very Stiff						142				
							141				
			3	ST	-				○		
							140				
							139				
							138				
			4	ST	-						
							137				
							136				
134.8							135				
17.4	**CLAYEY SILT (CL)** to **SILT (ML)** Stiff to Very Stiff		5	ST	-				○	NP	0 1 58 41
							134				
							133				

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-01A

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497377°, Long: -76.671333° Bruce Street MTM Zone 9: N 5 039 731.4 E 291 409.7 | ORIGINATED BY RH

HWY 17 | BOREHOLE TYPE CME 75 Trackmount, HSA, H Casing | COMPILED BY AO

DATUM Geodetic | DATE 2020.12.02 - 2020.12.03 | CHECKED BY

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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	CLAYEY SILT (CL) to **SILT (ML)** Stiff to Very Stiff		6	ST	-		132				
							131				
							130				
			7	ST	-		129				0 1 56 43
							128				
							127				
			8	ST	-		126				
125.7 / 26.5	**End of Borehole**										

+ ³, × ³: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-02

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497693°, Long: -76.670952° Bruce Street MTM Zone 9: N 5 039 766.5 E 291 439.5 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0' to 5'), NW (5' to 135'7"), NQ | COMPILED BY MW

DATUM Geodetic | DATE 2019.10.15 - 2019.10.18 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
150.1	**Ground Surface**								
0.0	Silty SAND , some gravel, trace roots Loose Brown **(FILL)**	1	SS	6					
149.3									
0.8	**CLAY (CH)** Very Stiff Brown **(WEATHERED CRUST)**	2	SS	11					
		3	SS	8					
		4	SS	5		0	0	44	56
		5	SS	6					
		6	SS	7					
144.0									
6.1	**SILTY CLAY (CI)** Very Stiff Grey	7	SS	4					
		8	SS	5					
		9	SS	5					

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

ELEVATION SCALE: 150, 149, 148, 147, 146, 145, 144, 143, 142, 141

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-02

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497693°, Long: -76.670952° Bruce Street MTM Zone 9: N 5 039 766.5 E 291 439.5 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0' to 5'), NW (5' to 135'7"), NQ | COMPILED BY MW

DATUM Geodetic | DATE 2019.10.15 - 2019.10.18 | CHECKED BY

ELEV / DEPTH	DESCRIPTION (Continued From Previous Page)	STRAT PLOT	SAMPLE NUMBER	TYPE	"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
	CLAY (CI) Very Stiff Grey						140							
			10	SS	5		139							
			11	SS	5		138					0	0	50	50
			12	SS	6		137							
			13	SS	6		136					0	0	55	45
133.3 / 16.8	**CLAYEY SILT (CL-ML)** Very Stiff Grey		14	SS	6		135							
			15	SS	7		134							
							133							
							132							
							131							

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-02

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497693°, Long: -76.670952° Bruce Street MTM Zone 9: N 5 039 766.5 E 291 439.5 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0' to 5'), NW (5' to 135'7"), NQ | COMPILED BY MW

DATUM Geodetic | DATE 2019.10.15 - 2019.10.18 | CHECKED BY

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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	CLAYEY SILT (CL-ML) Very Stiff Grey		16	SS	8		130				
							129				
			17	SS	5						
							128				
			18	SS	1		127				
							126				
			19	SS	5						
							125				
							124				
							123				
			20	SS	2						
							122				
							121				

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-02

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497693°, Long: -76.670952° Bruce Street MTM Zone 9: N 5 039 766.5 E 291 439.5 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0' to 5'), NW (5' to 135'7"), NQ | COMPILED BY MW

DATUM Geodetic | DATE 2019.10.15 - 2019.10.18 | CHECKED BY

ELEV / DEPTH	DESCRIPTION (Continued From Previous Page)	NUMBER	TYPE	"N" VALUES	UNIT WEIGHT γ kN/m³	GR	SA	SI	CL
	CLAYEY SILT (CL-ML) Very Stiff Grey	21	SS	6		0	4	60	36
116.6 / 33.5	**SAND** and **SILT (SM)** , some clay Loose Grey	22	SS	9	NP	0	37	45	18
113.5 / 36.6	Silty **SAND (SM)** Compact Grey	23	SS	11					
		24	SS	17					

Continued Next Page

+³, ×³: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-02

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497693°, Long: -76.670952° Bruce Street MTM Zone 9: N 5 039 766.5 E 291 439.5 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0' to 5'), NW (5' to 135'7"), NQ | COMPILED BY MW

DATUM Geodetic | DATE 2019.10.15 - 2019.10.18 | CHECKED BY

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"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 **SAND (SM)** Compact Grey						110				
108.8							109				
41.3	Silty **SAND (SM)** ,trace to some gravel Occasional cobbles and boulders Very Dense Grey and Black **(TILL)**		25	NQ	-		108		○		
							107				
			26	NQ	-		106		○		7 70 23 (SI+CL)
			27	NQ	-		105		○		
	- increasing amounts of gravel						104				
			28	NQ	-		103		○		
101.8			29	NQ	-		102		○	FI	20 57 23 (SI+CL)
48.3	**MARBLE BEDROCK** Strong, moderately to slightly weathered, grey and white - highly fractured with some vertical fractures from 48.3 m to 49.4 m		1	RUN			101			1 6 >10 >10 2 1	RUN #1 TCR=100% SCR=29% RQD=39%
	- silt seams at 49.5 m and 49.6 m										

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-02

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497693°, Long: -76.670952° Bruce Street MTM Zone 9: N 5 039 766.5 E 291 439.5 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0' to 5'), NW (5' to 135'7"), NQ | COMPILED BY MW

DATUM Geodetic | DATE 2019.10.15 - 2019.10.18 | CHECKED BY

SOIL PROFILE ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"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										
	MARBLE BEDROCK Strong, moderately to slightly weathered, grey and white		2	RUN			100			2	RUN #2 TCR=100% SCR=85% RQD=100% UCS=42MPa
										1	
										1	
							99			1	
										1	
			3	RUN						1	RUN #3 TCR=100% SCR=80% RQD=90%
										1	
							98			2	
97.7											
52.4	**End of Borehole**										

+ 3, × 3: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-03

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497881°, Long: -76.670497° Bruce Street MTM Zone 9: N 5 039 787.2 E 291 475.1 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0'-20'), NW (20'-167'4"), NQ | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.27 - 2019.10.04 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GR	SA	SI	CL
149.8	**Ground Surface**							
0.0	Silty SAND, trace roots Compact Brown **(FILL)**	1	SS	15				
149.0								
0.8	**SILTY CLAY (CI)** Very Stiff Brown **(WEATHERED CRUST)**	2	SS	9				
		3	SS	9				
		4	SS	11				
		5	SS	6				
		6	SS	7	0	0	44	56
		7	ST	-				
144.5								
5.3	**SILTY CLAY (CI)** to **SILT (ML)** Stiff to Very Stiff Grey	8	SS	6				
		9	SS	5	0	0	51	49
		10	SS	5				
		11	ST	-				

Elevation scale: 149, 148, 147, 146, 145, 144, 143, 142, 141, 140

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

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-03

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497881°, Long: -76.670497° Bruce Street MTM Zone 9: N 5 039 787.2 E 291 475.1 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0'-20'), NW (20'-167'4"), NQ | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.27 - 2019.10.04 | CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa: ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE (20 40 60 80 100)	w_P — w — w_L; WATER CONTENT (%) 20 40 60	γ kN/m³	GR SA SI CL
	Continued From Previous Page										
	SILTY CLAY (CI) to **SILT (ML)** Stiff to Very Stiff Grey										
			12	SS	7		139				
			13	SS	4		138				
			14	ST	-		137	6.6			
			15	SS	3		136				
			16	SS	4		135				
			17	ST	-		134	9.2			
							133	>10			
							132	8.0			
							131	10.0			
							130				

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-03

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497881°, Long: -76.670497° Bruce Street MTM Zone 9: N 5 039 787.2 E 291 475.1 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0'-20'), NW (20'-167'4"), NQ | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.27 - 2019.10.04 | CHECKED BY

SOIL PROFILE			SAMPLES			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 (%)			
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR	SA	SI	CL
	Continued From Previous Page													
	SILTY CLAY (CI) to **SILT (ML)** Stiff to Very Stiff Grey		18	SS	WH									
							129	3.1 3.1						
			19	SS	WH		128		H		0	7	62	31
							127							
			20	ST	-									
							126	8.0 4.9						
			21	SS	WH		125							
							124							
			22	SS	WH									
							123	7.7						
			23	ST	-		122							
							121							
			24	SS	3									
119.9							120							
29.9														

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-03

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497881°, Long: -76.670497° Bruce Street MTM Zone 9: N 5 039 787.2 E 291 475.1 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0'-20'), NW (20'-167'4"), NQ | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.27 - 2019.10.04 | CHECKED BY

ELEV / DEPTH	DESCRIPTION (Continued From Previous Page)	NUMBER	TYPE	"N" VALUES	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
	SILTY CLAY (CI) to **SILT (ML)** Stiff to Very Stiff Grey							
		25	ST	-				
		26	ST	-				
117.8								
32.0	**CLAYEY SILT (CL-ML)** , some sand Trace to some gravel Very Stiff Grey	27	SS	13	2	18	55	25
		28	SS	11				
114.7								
35.1	Silty **SAND**, contains clay seams Compact to Very Dense Grey	29	SS	18				
		30	SS	67				
		31	SS	11	0	63	37 (SI+CL)	
110.2								
39.6	**CLAYEY SILT (CL)** , some sand	32	SS	17				

GROUND WATER CONDITIONS

ELEVATION SCALE: 119, 118, 117, 116, 115, 114, 113, 112, 111, 110

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

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

20 15 5 10 (%) STRAIN AT FAILURE

Continued Next Page

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-03

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497881°, Long: -76.670497° Bruce Street MTM Zone 9: N 5 039 787.2 E 291 475.1 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0'-20'), NW (20'-167'4"), NQ | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.27 - 2019.10.04 | CHECKED BY

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	Clayey **SILT (CL)** , with sand Very Stiff Grey						109				
			33	SS	30		108		○		
			34	SS	4		107		⊢●⊣		0 20 45 35
105.6							106				
44.2	Silty **SAND (SM)** , trace to some gravel Frequent Cobbles and Boulders Very Dense Grey **(TILL)**		35	SS	100/150 mm		105				
			36	SS	100/50 mm		104				
	- 180mm cobble at depth. 47.7 m		37	NQ	-		103		○		
			38	NQ	-		102		○		3 63 34 (SI+CL)
							101				
							100				

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-03

METRIC

WP#	4068-09-00	LOCATION	Lat: 45.497881°, Long: -76.670497° Bruce Street MTM Zone 9: N 5 039 787.2 E 291 475.1	ORIGINATED BY	MW
HWY	17	BOREHOLE TYPE	CME 850 Trackmount, HSA (0'-20'), NW (20'-167'4"), NQ	COMPILED BY	JP
DATUM	Geodetic	DATE	2019.09.27 - 2019.10.04	CHECKED BY	

SOIL PROFILE ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	Silty **SAND (SM)** , trace to some gravel Frequent Cobbles and Boulders Very Dense Grey **(TILL)**		39	NQ	-		99		○	FI	
98.8											
51.0	**MARBLE BEDROCK** Moderately Weathered Coarse Grain Grey, Black, White, and Red		1	RUN			98			2 6 >10 3 2 2	RUN #1 TCR=100% SCR=37% RQD=73%
	- Silt Seam at 53.4 m		2	RUN			97			4 2 >10 >10	RUN #2 TCR=100% SCR=65% RQD=83% UCS=70MPa
95.7	- Silt Seam at 54.0 m						96			3	
54.1	**End of Borehole** Piezometer consists of 19 mm diameter Schedule 40 PVC pipe with a 1.5 m slotted screen **WATER LEVEL READINGS:** DATE DEPTH (m) ELEV. (m) 2019.11.26 1.3 148.4 2020.04.21 -0.2 149.9 2020.12.15 0.8 148.9 2021.08.04 1.2 148.5 2021.12.22 0.8 148.9 2022.01.11 1.5 148.2 2022.01.18 1.5 148.2										

+ ³, × ³: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-03A

METRIC

WP#	4068-09-00	LOCATION	Lat: 45.497873°, Long: -76.670407° Bruce Street MTM Zone 9: N 5 039 786.4 E 291 482.2	ORIGINATED BY	RH
HWY	17	BOREHOLE TYPE	CME 75 Trackmount, HSA, H Casing	COMPILED BY	AO
DATUM	Geodetic	DATE	2020.12.03 - 2020.12.03	CHECKED BY	

SOIL PROFILE: ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"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
149.9											
0.0											
							149				
							148				
							147				
							146				
145.3											
4.6	**SILTY CLAY (CI)** to **SILT (ML)** Stiff to Very stiff Grey		1	ST	-		145				
							144				
							143				
							142				
							141				
			2	ST	-		140				

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-03A

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497873°, Long: -76.670407° Bruce Street MTM Zone 9: N 5 039 786.4 E 291 482.2 | ORIGINATED BY RH

HWY 17 | BOREHOLE TYPE CME 75 Trackmount, HSA, H Casing | COMPILED BY AO

DATUM Geodetic | DATE 2020.12.03 - 2020.12.03 | CHECKED BY

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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	SILTY CLAY (CI) to **SILT (ML)** Stiff to Very stiff Grey										
							139				
							138				
							137				
			3	ST	-		136			NP	0 1 48 51
							135				
			4	ST	-		134				
							133				
							132				
			5	ST	-		131				
							130				

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-03A

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497873°, Long: -76.670407° Bruce Street MTM Zone 9: N 5 039 786.4 E 291 482.2 | ORIGINATED BY RH

HWY 17 | BOREHOLE TYPE CME 75 Trackmount, HSA, H Casing | COMPILED BY AO

DATUM Geodetic | DATE 2020.12.03 - 2020.12.03 | CHECKED BY

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										
	SILTY CLAY (CI) to **SILT (ML)** Stiff to Very stiff Grey										
							129				
							128				
			6	ST	-		127		○	NP	
							126				
							125				
							124				
							123				
			7	ST	-		122				
							121				
							120				

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-03A

METRIC

WP# 4068-09-00 LOCATION Lat: 45.497873°, Long: -76.670407° Bruce Street MTM Zone 9: N 5 039 786.4 E 291 482.2 ORIGINATED BY RH

HWY 17 BOREHOLE TYPE CME 75 Trackmount, HSA, H Casing COMPILED BY AO

DATUM Geodetic DATE 2020.12.03 - 2020.12.03 CHECKED BY

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										
	SILTY CLAY (CI) to **SILT (ML)** Stiff to Very stiff Grey										
			8	ST	-		119				
118.8											
31.1	**End of Borehole**										

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

+ 3, × 3: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-04

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497932°, Long: -76.670223° Bruce Street MTM Zone 9: N 5 039 792.9 E 291 496.6 | ORIGINATED BY MJJ

HWY 17 | BOREHOLE TYPE CME 75 Truckmount, HSA, NW Casing | COMPILED BY MW

DATUM Geodetic | DATE 2019.09.20 - 2019.09.20 | CHECKED BY

SOIL PROFILE ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"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
149.8	**Ground Surface**										
0.0	**SAND**, some silt, trace gravel Compact Brown **(FILL)**		1	SS	18		149		○		6 86 8 (SI+CL)
148.3											
1.5	**End of Borehole** See BRU19-04A for continuation of log										

+ 3, × 3: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-04A

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497932°, Long: -76.670223° Bruce Street MTM Zone 9: N 5 039 792.9 E 291 496.6 | ORIGINATED BY MJJ

HWY 17 | BOREHOLE TYPE CME 75 Truckmount, HSA, NW Casing | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.20 - 2019.09.24 | CHECKED BY

SOIL PROFILE: ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"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
149.8	**Ground Surface**										
0.0	See Borehole BRU19-04 for stratigraphy										
147.5											
2.3	**SILTY CLAY (CI)** Very Stiff Brown **(WEATHERED CRUST)**		1	SS	16						
			2	SS	5						0 0 46 54
143.7											
6.1	**SILTY CLAY (CI)** to **CLAYEY SILT (CL-ML)** Very stiff Brown		3	SS	3			8.0			
			4	SS	5						0 0 50 50

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-04A

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497932°, Long: -76.670223° Bruce Street MTM Zone 9: N 5 039 792.9 E 291 496.6 | ORIGINATED BY MJJ

HWY 17 | BOREHOLE TYPE CME 75 Truckmount, HSA, NW Casing | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.20 - 2019.09.24 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLE NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	SILTY CLAY (CI) to **CLAYEY SILT (CL-ML)** Very stiff Brown										
			5	SS	13						
			6	SS	5						
133.8 / 16.0	**CLAYEY SILT (CL to CL-ML)** Stiff to very stiff Grey		7	SS	1						
			8	SS	WH						0 2 63 35

ELEVATION SCALE: 139, 138, 137, 136, 135, 134, 133, 132, 131, 130

SHEAR STRENGTH: 6.6, 7.0, 5.6, 5.5, 4.3

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-04A

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497932°, Long: -76.670223° Bruce Street MTM Zone 9: N 5 039 792.9 E 291 496.6 | ORIGINATED BY MJJ

HWY 17 | BOREHOLE TYPE CME 75 Truckmount, HSA, NW Casing | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.20 - 2019.09.24 | CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT / WATER CONTENT (%)	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES					γ kN/m³	GR SA SI CL
	Continued From Previous Page										
	CLAYEY SILT (CL to CL-ML) Stiff to very stiff Grey										
			9	SS	WH		129				
							128	4.8, 4.6			
			10	SS	WH		127				
							126				
							125				
			11	SS	WH		124				
							123	5.3			
122.4 / 27.4	**CLAYEY SILT (CL-ML)** , trace sand Very Stiff Grey		12	SS	3		122				
							121				
							120				

Continued Next Page

+ 3 , × 3 : Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-04A

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497932°, Long: -76.670223° Bruce Street MTM Zone 9: N 5 039 792.9 E 291 496.6 | ORIGINATED BY MJJ

HWY 17 | BOREHOLE TYPE CME 75 Truckmount, HSA, NW Casing | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.20 - 2019.09.24 | CHECKED BY

SOIL PROFILE ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES 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
	Continued From Previous Page										
	CLAYEY SILT (CL-ML), trace sand Very Stiff Grey		13	SS	6						0 7 61 32
							119				
							118				
117.8											
32.0	**SAND** and **SILT (SM)** Dense Grey		14	SS	39						0 43 39 18
117.2											
32.6	**End of Borehole**										

+ 3, × 3: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-06

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.498396°, Long: -76.669361° Bruce Street MTM Zone 9: N 5 039 844.3 E 291 564.0 | ORIGINATED BY MJJ

HWY 17 | BOREHOLE TYPE CME 75 Truckmount | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.24 - 2019.09.27 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	GR	SA	SI	CL
148.5	**Ground Surface**									
0.0 / 0.1	**50mm TOPSOIL**									
	Silty gravelly **SAND (SM)** Compact to Very Dense Light Brown **(FILL)**	1	SS	12	148					
		2	SS	54			22	48	30 (SI+CL)	
147.0 / 1.5	**SILTY CLAY (CI/CH)** Very Stiff Brown **(WEATHERED CRUST)**	3	SS	28	147					
		4	SS	15	146					
		5	SS	10	145		0	1	44	55
		6	SS	10	144					
143.2 / 5.3	**SILTY CLAY (CI)** to **CLAYEY SILT (CL)** Stiff to Very Stiff Grey	7	SS	5	143					
		8	SS	7	142					
		9	SS	4	141					
		1	ST	-	140					
					139					

SOIL PROFILE | SAMPLES | GROUND WATER CONDITIONS | ELEVATION SCALE | STRAT PLOT | REMARKS & GRAIN SIZE DISTRIBUTION (%)

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

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-06

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.498396°, Long: -76.669361° Bruce Street MTM Zone 9: N 5 039 844.3 E 291 564.0 | ORIGINATED BY MJJ

HWY 17 | BOREHOLE TYPE CME 75 Truckmount | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.24 - 2019.09.27 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLE 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)	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 (CI) to **CLAYEY SILT (CL)** Stiff to Very Stiff Grey							5.3			
							138				
			10	SS	WH						0 0 50 50
							137	5.1			
			11	SS	WH		136				
								>10			
							135				
			12	SS	WH						
							134				
			13	SS	1		133				
							132				
			14	SS	4						
							131	5.3			
			2	ST	-		130				
								3.1			
							129				
128.7 / 19.8											

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-06

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.498396°, Long: -76.669361° Bruce Street MTM Zone 9: N 5 039 844.3 E 291 564.0 | ORIGINATED BY MJJ

HWY 17 | BOREHOLE TYPE CME 75 Truckmount | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.24 - 2019.09.27 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLE NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
	Continued From Previous Page													
	SILTY CLAY (CI) to **CLAYEY SILT (CL)** Stiff to Very Stiff Grey		15	SS	WH						0	3	61	36
126.5							128	4.2						
22.0	**CLAYEY SILT (CL-ML)** , some sand Stiff to Very Stiff Grey Occasional Cobbles		16	SS	WH		127				0	19	60	21
							126	2.5 5.8						
			17	SS	5		125							
							124							
							123							
							122							
121.1							121							
27.4	Inferred Silty Sand		3	ST	-		120							
							119							

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-06

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.498396°, Long: -76.669361° Bruce Street MTM Zone 9: N 5 039 844.3 E 291 564.0 | ORIGINATED BY MJJ

HWY 17 | BOREHOLE TYPE CME 75 Truckmount | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.24 - 2019.09.27 | CHECKED BY

ELEV / DEPTH	DESCRIPTION (SOIL PROFILE)	STRAT PLOT	SAMPLES 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/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	Inferred Silty Sand						118				
			18	SS	-						
							117				
116.5			19	SS							
32.0	**End of Borehole**										

Piezometer consists of 19 mm diameter Schedule 40 PVC pipe with a 1.5 m slotted screen

WATER LEVEL READINGS:

DATE	DEPTH (m)	ELEV. (m)
2019.11.26	1.9	146.6
2020.04.21	1.9	146.7
2020.12.15	1.8	146.7
2021.08.04	2.0	146.5
2021.12.22	1.8	146.7
2022.01.11	2.1	146.4
2022.01.18	2.1	146.4

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

15 20 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-07

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.498689°, Long: -76.668871° Bruce Street MTM Zone 9: N 5 039 876.9 E 291 602.4 | ORIGINATED BY MJJ

HWY 17 | BOREHOLE TYPE CME 75 Truckmount | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.26 - 2019.09.27 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GR	SA	SI	CL
148.1	Ground Surface							
0.0 / 0.1	**50mm TOPSOIL**							
	SAND, trace silt Compact Light to Dark Brown **(FILL)**	1	SS	17	6	86	8 (SI+CL)	
		2	SS	17				
146.4 / 1.7	**SILTY CLAY (CI/CH)** Compact Dark Brown **(WEATHERED CRUST)**	3	SS	31				
		4	SS	15	1	8	40	51
		5	SS	9				
144.3 / 3.8	**SILTY CLAY (CI)** to **CLAYEY SILT (CL)** Stiff to Very Stiff Grey	6	SS	7				
		7	SS	8				
		8	SS	8				
		9	SS	4	0	0	52	48
		10	SS	11				
		11	SS	4				

GROUND WATER CONDITIONS

ELEVATION SCALE: 148, 147, 146, 145, 144, 143, 142, 141, 140, 139

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 (%)

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Continued Next Page

+ [3], × [3]: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-07

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.498689°, Long: -76.668871° Bruce Street MTM Zone 9: N 5 039 876.9 E 291 602.4 | ORIGINATED BY MJJ

HWY 17 | BOREHOLE TYPE CME 75 Truckmount | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.26 - 2019.09.27 | CHECKED BY

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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	SILTY CLAY (CI) to **CLAYEY SILT (CL)** Stiff to Very Stiff Grey						138				
			12	SS	4		137				
							136				
			13	SS	1						
							135				
			14	SS	6		134				0 4 52 44
							133	3.3			
			15	SS	WH						
							132	7.3 4.4			
			16	SS	WH		131				
							130	6.0 4.3			
			17	SS	WH						
							129	6.0 4.3			

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-07

METRIC

WP#	4068-09-00	LOCATION	Lat: 45.498689°, Long: -76.668871° Bruce Street MTM Zone 9: N 5 039 876.9 E 291 602.4	ORIGINATED BY	MJJ
HWY	17	BOREHOLE TYPE	CME 75 Truckmount	COMPILED BY	JP
DATUM	Geodetic	DATE	2019.09.26 - 2019.09.27	CHECKED BY	

ELEV / DEPTH	DESCRIPTION (SOIL PROFILE)	STRAT PLOT	SAMPLE NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	SILTY CLAY (CI) to **CLAYEY SILT (CL)** Stiff to Very Stiff Grey		18	SS	WH		128				
							127				
							126				
			19	SS	WH		125				
							124				
							123				
122.0											
26.1	Silty **SAND (SM)** Dense to very dense Grey		20	SS	37		122			NP	0 69 20 11
							121				
							120				
			21	SS	51		119				
118.5											
29.6	**End of Borehole**										

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

(%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-09

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.499294°, Long: -76.667913° Bruce Street MTM Zone 9: N 5 039 944.0 E 291 677.4 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0'-20'), NW (20'-80'8") | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.26 - 2019.09.27 | CHECKED BY

SOIL PROFILE ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
146.9	Ground Surface											
0.0	Gravelly **SAND (SM)** Compact to Very Dense Brown **(FILL)**		1	SS	17							
			2	SS	73		146		27	58	15 (SI+CL)	
145.4												
1.5	**SILTY CLAY (CI)** Very Stiff Brown **(WEATHERED CRUST)**		3	SS	15		145					
			4	SS	8		144					
			5	SS	4				0	1	48	51
			6	SS	4		143					
142.3												
4.6	**SILTY CLAY (CI)** to **CLAYEY SILT (CL-ML)**, occasional silt seams Very Stiff Grey		7	SS	2		142					
			8	SS	4		141					
			9	SS	4		140		0	0	54	46
			10	SS	4		139					
							138					
							137					

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

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-09

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.499294°, Long: -76.667913° Bruce Street MTM Zone 9: N 5 039 944.0 E 291 677.4 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0'-20'), NW (20'-80'8") | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.26 - 2019.09.27 | CHECKED BY

SOIL PROFILE: ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page								
	SILTY CLAY (CI) to **CLAYEY SILT (CL-ML)**, occasional silt seams Very Stiff Grey								
			11	SS	3		136		
			12	SS	3		135		
			13	SS	2		134		
			14	SS	2		133		
			15	SS	2		132		0 4 63 33
			16	SS	10		131		
							130		
							129		
							128		
							127		

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

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-09

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.499294°, Long: -76.667913° Bruce Street MTM Zone 9: N 5 039 944.0 E 291 677.4 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0'-20'), NW (20'-80'8") | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.26 - 2019.09.27 | CHECKED BY

SOIL PROFILE ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES 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
	Continued From Previous Page										
	SILTY CLAY (CI) to **CLAYEY SILT (CL-ML)**, occasional silt seams Very Stiff Grey		17	SS	5				○		
							126				
							125				
124.0											
22.9	**SAND**, some silt, some gravel Compact to Dense Grey **(TILL)**		18	SS	42		124		○		
			19	SS	23		123		○		14 76 10 (SI+CL)
122.4											
24.5	**End of Borehole**		20	SS	100/ 50 mm				○		

+ ³, × ³: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-10

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.499612°, Long: -76.667459° Bruce Street MTM Zone 9: N 5 039 979.2 E 291 713.0 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA, NW | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.26 - 2019.09.29 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GR	SA	SI	CL
146.2	Ground Surface							
0.0	Silty SAND, trace gravel, trace organics Dense Brown **(FILL)**	1	SS	33	5	73	22 (SI+CL)	
145.4								
0.8	Sandy SILT, some gravel, trace organics Compact Brown **(FILL)**	2	SS	18				
144.7								
1.5	**SILTY CLAY (CI)** Very Stiff Brown **(WEATHERED CRUST)**	3	SS	8				
		4	SS	3	0	1	48	51
143.2								
3.0	**CLAYEY SILT (CL)** Very Stiff Grey	5	SS	4				
		6	SS	3				
		7	SS	2	0	3	61	36
		8	SS	4				
		9	SS	2				

GROUND WATER CONDITIONS: ▽

ELEVATION SCALE: 146, 145, 144, 143, 142, 141, 140, 139, 138, 137

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 (%)

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-10

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.499612°, Long: -76.667459° Bruce Street MTM Zone 9: N 5 039 979.2 E 291 713.0 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA, NW | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.26 - 2019.09.29 | CHECKED BY

ELEV / DEPTH	DESCRIPTION (Continued From Previous Page)	STRAT PLOT	SAMPLE 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
135.6	**CLAYEY SILT (CL)** Very Stiff Grey						136	+			
10.6	**GRAVEL** and **SAND**, some silt Frequent Cobbles **(TILL)**		10	SS	63			+	○		47 41 12 (SI+CL)
134.9							135				
11.3	**End of Borehole**										

WATER LEVEL READINGS:

DATE	DEPTH (m)	ELEV. (m)
2019.09.26	2.5	143.5

+ ³, × ³: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-12

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.496651°, Long: -76.673061° Bruce Street MTM Zone 9: N 5 039 651.1 E 291 274.4 | ORIGINATED BY MJJ

HWY 17 | BOREHOLE TYPE CME 75 Truckmount, HSA, NW, NQ | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.09 - 2019.09.10 | CHECKED BY

SOIL PROFILE ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES 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)	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
152.7	Ground Surface										
0.0	**SAND** and **GRAVEL** , some silt and organics Brown sand, White gravel **(FILL)**		1	GS							40 46 14 (SI+CL)
151.8							152				
0.9	**SILTY CLAY (CI/CH)** Very Stiff Brown **(WEATHERED CRUST)**		1	SS	13						
			2	SS	8		151				
			3	SS	8		150				
			4	SS	7						0 1 46 53
			5	SS	7		149				
148.1											
4.6	**SILTY CLAY (CI)** Stiff to Very Stiff Grey		6	SS	6		148				
							147	8.0			
			7	SS	5						0 0 53 47
							146				
			8	SS	3		145	>10			
							144				
			9	SS	3		143				

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-12

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.496651°, Long: -76.673061° Bruce Street MTM Zone 9: N 5 039 651.1 E 291 274.4 | ORIGINATED BY MJJ

HWY 17 | BOREHOLE TYPE CME 75 Truckmount, HSA, NW, NQ | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.09 - 2019.09.10 | CHECKED BY

SOIL PROFILE			SAMPLES			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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	SILTY CLAY (CI) Stiff to Very Stiff Grey										
			10	SS	5		142				
			11	SS	3		141				
			12	SS	2		140				
			13	SS	1		139				0 1 52 47
			14	SS	2		138				
			15	SS	2		137				
			16	SS	2		136	8.8			
							135	4.0			
							134				
							133				

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-12

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.496651°, Long: -76.673061° Bruce Street MTM Zone 9: N 5 039 651.1 E 291 274.4 | ORIGINATED BY MJJ

HWY 17 | BOREHOLE TYPE CME 75 Truckmount, HSA, NW, NQ | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.09 - 2019.09.10 | CHECKED BY

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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	SILTY CLAY (CI) Stiff to Very Stiff Grey						132	6.3			
							131				
			17	SS	WR		130		○		
129.1								9.0			
23.6	Inferred Cobbles and Boulders **(TILL)**		~~18~~	~~SS~~	~~100/~~		129				
128.6			19	NQ	25 mm						
24.1	**End of Borehole**										

+ ³, × ³: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-13

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.496886°, Long: -76.672476° Bruce Street MTM Zone 9: N 5 039 677.0 E 291 320.2 | ORIGINATED BY MJJ

HWY 17 | BOREHOLE TYPE CME 75 Truckmount, HSA, NW, NQ | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.11 - 2019.09.17 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
152.5	**Ground Surface**							
0.0 / 0.1	**TOPSOIL**							
	Gravelly SAND to SAND Compact Brown **(FILL)**	1	SS	11				
151.7 / 0.8	GRAVEL and SAND, some silt Very Dense Brown **(FILL)**	2	SS	50/0.15 m	46	37	17 (SI+CL)	
151.0 / 1.5	**SILTY CLAY (CI/CH)** Very Stiff Brown **(WEATHERED CRUST)**	3	SS	11				
		4	SS	11				
		5	SS	6				
		6	SS	4	0	1	44	55
147.9 / 4.6	**CLAYEY SILT (CL to CL-ML)** Very Stiff Grey	7	SS	5				
		8	SS	4				
		9	SS	6				
		10	SS	3				
		11	SS	2	0	0	49	51

Elevation scale: 152, 151, 150, 149, 148, 147, 146, 145, 144, 143

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

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-13

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.496886°, Long: -76.672476° Bruce Street MTM Zone 9: N 5 039 677.0 E 291 320.2 | ORIGINATED BY MJJ

HWY 17 | BOREHOLE TYPE CME 75 Truckmount, HSA, NW, NQ | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.11 - 2019.09.17 | CHECKED BY

SOIL PROFILE: ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: 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
	Continued From Previous Page										
	CLAYEY SILT (CL to CL-ML) Very Stiff Grey		1	ST			142				
			12	SS	3						
							141				
			13	SS	3		140				
							139				
			14	SS	5				H		0 1 47 52
							138				
							137				
136.3 / 16.2	**CLAYEY SILT (CL-ML)** Stiff to Very Stiff Grey		15	SS	WH		136				
							135				
			2	ST			134	7.2			
							133				

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-13

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.496886°, Long: -76.672476° Bruce Street MTM Zone 9: N 5 039 677.0 E 291 320.2 | ORIGINATED BY MJJ

HWY 17 | BOREHOLE TYPE CME 75 Truckmount, HSA, NW, NQ | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.11 - 2019.09.17 | CHECKED BY

SOIL PROFILE			SAMPLES			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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	CLAYEY SILT (CL-ML) Stiff to Very Stiff Grey						132				
			16	SS	1						
							131				
							130				
							129				
			17	SS	WH						0 1 62 37
							128				
							127				
							126				
			3	ST							
							125				
							124				
							123				

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-13

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.496886°, Long: -76.672476° Bruce Street MTM Zone 9: N 5 039 677.0 E 291 320.2 | ORIGINATED BY MJJ

HWY 17 | BOREHOLE TYPE CME 75 Truckmount, HSA, NW, NQ | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.11 - 2019.09.17 | CHECKED BY

SOIL PROFILE: ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page								
	CLAYEY SILT (CL-ML) Stiff to Very Stiff Grey		18	SS	1		122, 121, 120		
119.6 / 32.9	**CLAYEY SILT (CL)**, some sand, some gravel Loose to Dense Grey		19	SS	19		119		
	-difficult to advance casing from 33.8 m depth		20	SS	10				12 13 48 27
			21	SS	16		118, 117		
116.5 / 36.0	**SAND** and **GRAVEL**, some silt to silty Very Dense Grey **(TILL)**		22	SS	57		116, 115, 114, 113		45 47 8 (SI+CL)
	- frequent cobbles and boulders below 39.6 m depth								

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

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-13

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.496886°, Long: -76.672476° Bruce Street MTM Zone 9: N 5 039 677.0 E 291 320.2 | ORIGINATED BY MJJ

HWY 17 | BOREHOLE TYPE CME 75 Truckmount, HSA, NW, NQ | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.11 - 2019.09.17 | CHECKED BY

SOIL PROFILE ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"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										
111.9			23	SS	50/ 75 mm		112		○		
40.6	**End of Borehole**										

Piezometer consists of 19 mm diameter Schedule 40 PVC pipe with a 1.5 m slotted screen

WATER LEVEL READINGS:

DATE	DEPTH (m)	ELEV. (m)
2019.11.26	2.6	149.9
2020.04.21	2.2	150.3
2020.12.15	2.5	150.0
2021.08.04	2.4	150.1
2021.12.22	2.4	150.1
2022.01.11	2.4	150.1
2022.01.18	2.4	150.1

+ ³, × ³: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-15

METRIC

WP#	4068-09-00	LOCATION	Lat: 45.497311°, Long: -76.671546° Bruce Street MTM Zone 9: N 5 039 724.0 E 291 393.0	ORIGINATED BY	MJJ
HWY	17	BOREHOLE TYPE	CME 75 Truckmount, HSA, NW	COMPILED BY	JP
DATUM	Geodetic	DATE	2019.09.17 - 2019.09.20	CHECKED BY	

SOIL PROFILE: ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
152.6	**Ground Surface**										
0.0	See Borehole BRU19-15A for stratigraphy										
149.7											
2.9	**SILTY CLAY (CI)** Stiff to Very Stiff Brown **(WEATHERED CRUST)**		2	SS	3			0	0	42	58
146.5											
6.1	**CLAYEY SILT (CL)** Very Stiff Grey		3	SS	5						
			4	SS	3			0	0	51	49

ELEVATION SCALE: 152, 151, 150, 149, 148, 147, 146, 145, 144, 143

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)

7.6

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L

WATER CONTENT (%): 20 40 60

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-15

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497311°, Long: -76.671546° Bruce Street MTM Zone 9: N 5 039 724.0 E 291 393.0 | ORIGINATED BY MJJ

HWY 17 | BOREHOLE TYPE CME 75 Truckmount, HSA, NW | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.17 - 2019.09.20 | CHECKED BY

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)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	CLAYEY SILT (CL) Very Stiff Grey						142				
							141				
			5	SS	2		140				
							139				
			6	SS	1		138				
136.4 / 16.2	**CLAYEY SILT (CL-ML)** to **SILT(ML)** Stiff to Very Stiff Grey						137	10.0			
			7	SS	1		136	>10			
							135	6.4			
							134	7.6			
			8	SS	WH		133	5.3			

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-15

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497311°, Long: -76.671546° Bruce Street MTM Zone 9: N 5 039 724.0 E 291 393.0 | ORIGINATED BY MJJ

HWY 17 | BOREHOLE TYPE CME 75 Truckmount, HSA, NW | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.17 - 2019.09.20 | CHECKED BY

SOIL PROFILE			SAMPLES			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 (%)			
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR	SA	SI	CL
	Continued From Previous Page													
	CLAYEY SILT (CL-ML) to **SILT(ML)** Stiff to Very Stiff Grey						132							
			9	SS	1		131			NP	0	3	51	46
							130	9.5						
			10	SS	WR		129							
							128							
			11	SS	N/A		127							
							126							
			12	SS	1		125							
							124							
							123							

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-15

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497311°, Long: -76.671546° Bruce Street MTM Zone 9: N 5 039 724.0 E 291 393.0 | ORIGINATED BY MJJ

HWY 17 | BOREHOLE TYPE CME 75 Truckmount, HSA, NW | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.17 - 2019.09.20 | CHECKED BY

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	CLAYEY SILT (CL-ML) to **SILT(ML)** Stiff to Very Stiff Grey						122				
							121				
							120				
			13	SS	N/A						0 4 62 34
							119				
117.5							118				
35.1	Sandy **SILT** Loose Grey		14	SS	4		117				
							116				
115.3											
37.3	Sandy **SILT**, low-plastic fines (CL-ML) Loose to Dense Grey		15	SS	6		115				
							114				
							113				
			16	SS	43						1 35 40 24

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-15

METRIC

WP# 4068-09-00 LOCATION Lat: 45.497311°, Long: -76.671546° Bruce Street MTM Zone 9: N 5 039 724.0 E 291 393.0 ORIGINATED BY MJJ

HWY 17 BOREHOLE TYPE CME 75 Truckmount, HSA, NW COMPILED BY JP

DATUM Geodetic DATE 2019.09.17 - 2019.09.20 CHECKED BY

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/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
112.4											
40.2	**End of Borehole**										

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

15 20 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-15A

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497311°, Long: -76.671546° Bruce Street MTM Zone 9: N 5 039 724.0 E 291 393.0 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0'-9'5") | COMPILED BY MW

DATUM Geodetic | DATE 2019.10.07 - 2019.10.07 | CHECKED BY

SOIL PROFILE ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"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
152.6	**Ground Surface**										
0.0	Silty SAND, trace gravel and roots Compact Brown **(FILL)**		1	SS	19		152		○		
151.8											
0.8	SILT, with sand Compact Brown **(FILL)**		2	SS	12				○		
151.1											
1.5	Clayey **SILTY CLAY (CI)** Very Stiff Brown **(WEATHERED CRUST)**		3	SS	14		151		○		
			4	SS	11		150		○		
149.7											
2.9	**End of Borehole**										

+ ³, × ³: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-16

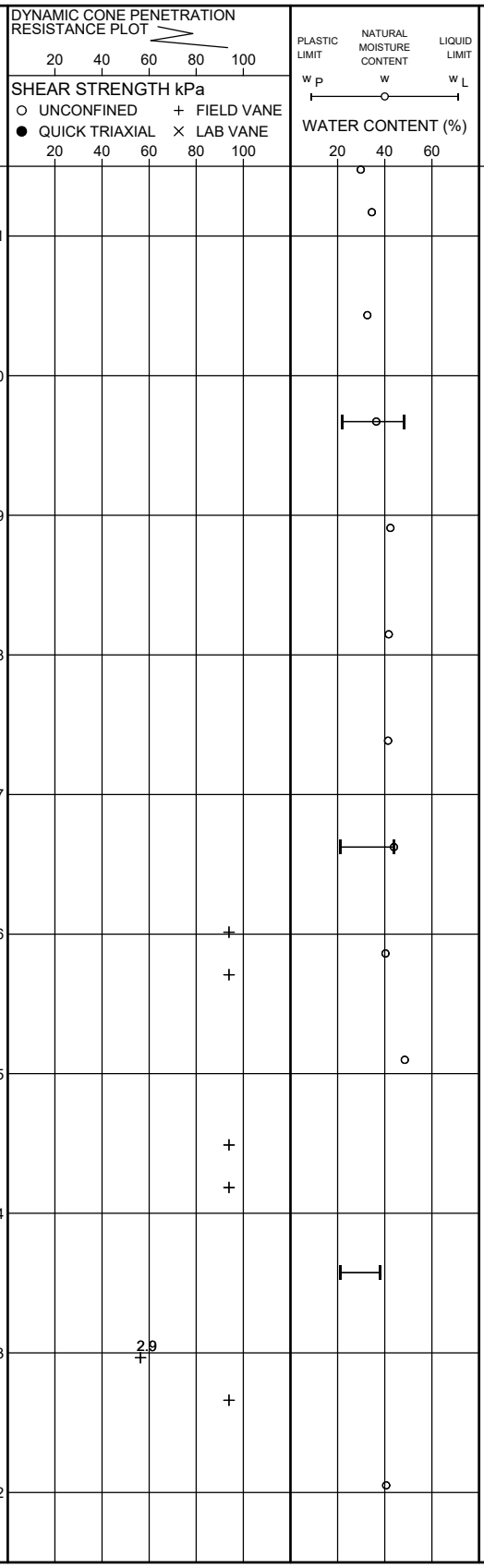
METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497892°, Long: -76.673705° Bruce Street MTM Zone 9: N 5 039 789.1 E 291 224.4 | ORIGINATED BY AO

HWY 17 | BOREHOLE TYPE CME 850 Trackmount (HSA) | COMPILED BY AO

DATUM Geodetic | DATE 2020.12.10 - 2020.12.21 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GR	SA	SI	CL
151.5 / 0.0	**TOPSOIL (50mm)** CLAYEY SILT Some organics Trace fine sand Stiff Brown	1	SS	10				
0.1	**SILTY CLAY (CI)** Stiff to Very Stiff **(WEATHERED CRUST)**	2	SS	12				
		3	SS	12	0	1	44	55
		4	SS	7				
		5	SS	7				
		6	SS	7				
		7	SS	9	0	0	45	55
		8	SS	3				
144.8 / 6.7	**SILTY CLAY (CI)** Stiff to Very stiff Grey	9	SS	3	0	0	47	53
		10	SS	5				



UNIT WEIGHT γ kN/m³

REMARKS & GRAIN SIZE DISTRIBUTION (%)

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-16

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497892°, Long: -76.673705° Bruce Street MTM Zone 9: N 5 039 789.1 E 291 224.4 | ORIGINATED BY AO

HWY 17 | BOREHOLE TYPE CME 850 Trackmount (HSA) | COMPILED BY AO

DATUM Geodetic | DATE 2020.12.10 - 2020.12.21 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
	Continued From Previous Page								
	SILTY CLAY (CI) Stiff to Very stiff Grey								
		11	SS	4					
		12	SS	4					
137.8 / 13.7	**CLAYEY SILT (CL to CL/ML)** Stiff to Very stiff Grey	13	SS	1		0	0	43	57
		14	SS	1					
		15	SS	1					
		16	SS	WH					

Continued Next Page

GROUND WATER CONDITIONS

ELEVATION SCALE: 141, 140, 139, 138, 137, 136, 135, 134, 133, 132

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)

9.8 / 10.0 / 4.0 / 7.3 / 5.0

+ ³, × ³: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-16

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497892°, Long: -76.673705° Bruce Street MTM Zone 9: N 5 039 789.1 E 291 224.4 | ORIGINATED BY AO

HWY 17 | BOREHOLE TYPE CME 850 Trackmount (HSA) | COMPILED BY AO

DATUM Geodetic | DATE 2020.12.10 - 2020.12.21 | CHECKED BY

SOIL PROFILE: ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
	Continued From Previous Page											
	CLAYEY SILT (CL to CL/ML) Stiff to Very stiff Grey		17	SS	WR		131					
			18	SS	1		130		0	1	63	36
			19	SS	3		129					
			20	SS	WH		128					
			21	SS	1		127					
			22	SS	WH		126					
			23	SS	WR		125					
							124					
							123					
							122					

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)

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-16

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497892°, Long: -76.673705° Bruce Street MTM Zone 9: N 5 039 789.1 E 291 224.4 | ORIGINATED BY AO

HWY 17 | BOREHOLE TYPE CME 850 Trackmount (HSA) | COMPILED BY AO

DATUM Geodetic | DATE 2020.12.10 - 2020.12.21 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLE NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page								
	CLAYEY SILT (CL to CL/ML) Stiff to Very stiff Grey								
			24	SS	WH				
			25	SS	1				
			26	SS	1				
			27	SS	WH				
			28	SS	4				
113.4 38.1	**CLAYEY SILT(CL-ML)**, some sand Stiff to Very Stiff Grey		29	SS	1				
			30	SS	6				5 18 53 24

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)

ELEVATION SCALE: 121, 120, 119, 118, 117, 116, 115, 114, 113, 112

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-16

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497892°, Long: -76.673705° Bruce Street MTM Zone 9: N 5 039 789.1 E 291 224.4 | ORIGINATED BY AO

HWY 17 | BOREHOLE TYPE CME 850 Trackmount (HSA) | COMPILED BY AO

DATUM Geodetic | DATE 2020.12.10 - 2020.12.21 | CHECKED BY

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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
111.3											
40.2	Inferred CLAYEY SILT						111				
							110				
							109				
							108				
107.0							107				
44.5	**End of Borehole**										

+ ³, × ³: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-18

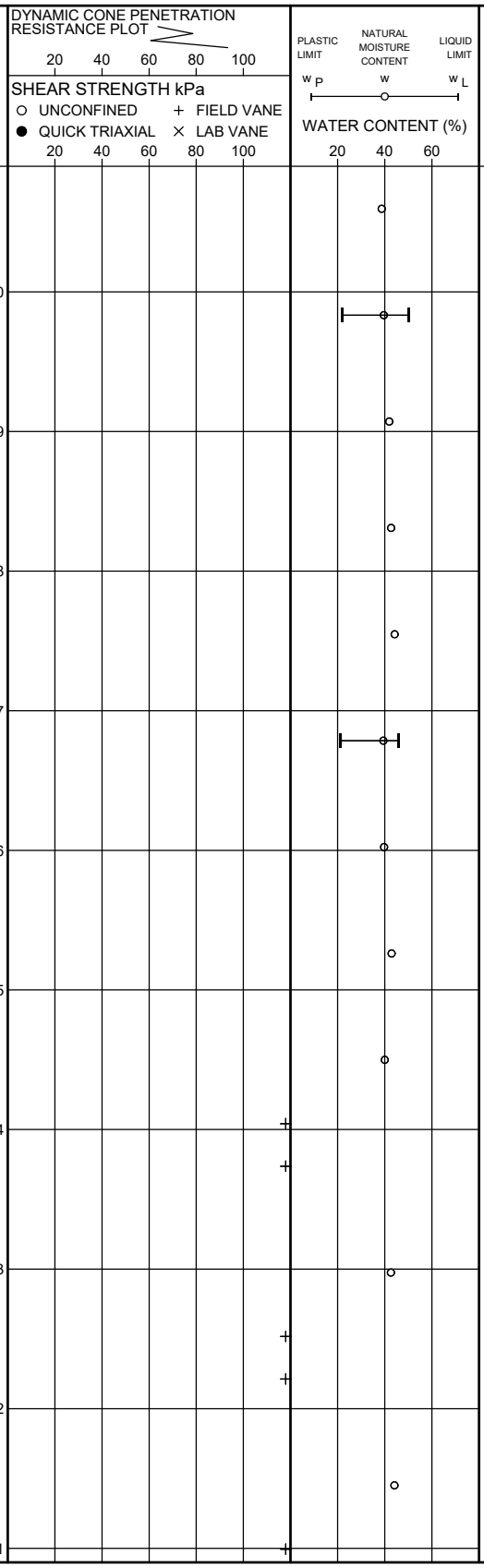
METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497047°, Long: -76.673056° Bruce Street MTM Zone 9: N 5 039 695.1 E 291 274.9 | ORIGINATED BY RH

HWY 17 | BOREHOLE TYPE CME 75 Trackmount, HSA, H Casing | COMPILED BY AO

DATUM Geodetic | DATE 2020.11.27 - 2020.11.27 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	UNIT WEIGHT γ kN/m³	GR	SA	SI	CL
150.9									
0.0	**SILTY CLAY (CI/CH)** Very Stiff Grey brown to grey **(WEATHERED CRUST)**	1	SS	6					
		2	SS	6		1	3	86	10
		3	SS	5					
		4	SS	4					
147.9									
3.0	**SILTY CLAY (CI)** to **CLAYEY SILT (CL-ML)** Very stiff to stiff Grey	5	SS	4					
		6	SS	5		0	1	48	51
		7	SS	3					
		8	SS	3					
		9	SS	3					
		10	SS	3					
141.8									
9.1	**CLAYEY SILT (CL-ML)** to **SILT (ML)** Very stiff to stiff Grey	11	SS	2	NP	0	0	51	49



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+ 3, × 3: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-18

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497047°, Long: -76.673056° Bruce Street MTM Zone 9: N 5 039 695.1 E 291 274.9 | ORIGINATED BY RH

HWY 17 | BOREHOLE TYPE CME 75 Trackmount, HSA, H Casing | COMPILED BY AO

DATUM Geodetic | DATE 2020.11.27 - 2020.11.27 | CHECKED BY

SOIL PROFILE			SAMPLES			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)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	CLAYEY SILT (CL-ML) to **SILT (ML)** Very stiff to stiff Grey										
			12	SS	3		140				
			13	SS	WH		139				
							138	>10, >10			
							137				
			14	SS	3		136				
							135				
							134				
							133				
			15	SS	WH		132	>10, >10			
							131				

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-18

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497047°, Long: -76.673056° Bruce Street MTM Zone 9: N 5 039 695.1 E 291 274.9 | ORIGINATED BY RH

HWY 17 | BOREHOLE TYPE CME 75 Trackmount, HSA, H Casing | COMPILED BY AO

DATUM Geodetic | DATE 2020.11.27 - 2020.11.27 | CHECKED BY

SOIL PROFILE			SAMPLES			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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	CLAYEY SILT (CL-ML) to **SILT (ML)** Very stiff to stiff Grey										
							130				
			16	SS	2				○	NP	0 4 58 38
							129	>10 +			
								+			Vane sunk during remold
							128				
							127				
			17	SS	WH						
							126	>10 +			
								>10 +			
							125				
							124				
			18	SS	WH						
							123	>10 +			
								>10 +			
							122				
							121				

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+ ³, × ³: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-18

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497047°, Long: -76.673056° Bruce Street MTM Zone 9: N 5 039 695.1 E 291 274.9 | ORIGINATED BY RH

HWY 17 | BOREHOLE TYPE CME 75 Trackmount, HSA, H Casing | COMPILED BY AO

DATUM Geodetic | DATE 2020.11.27 - 2020.11.27 | CHECKED BY

ELEV / DEPTH	SOIL PROFILE: DESCRIPTION	STRAT PLOT	SAMPLES: 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
	Continued From Previous Page										
120.4	**CLAYEY SILT (CL-ML)** to **SILT (ML)** Very stiff to stiff Grey										
30.5	**CLAYEY SILT (CL)**, some sand, trace gravel Very Stiff Grey		19	SS	9		120		○		
							119				
							118				
116.8			20	SS	29		117		⊢⊣ ○		5 14 57 24
34.1	**End of Borehole**										

+ ³, × ³: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-19

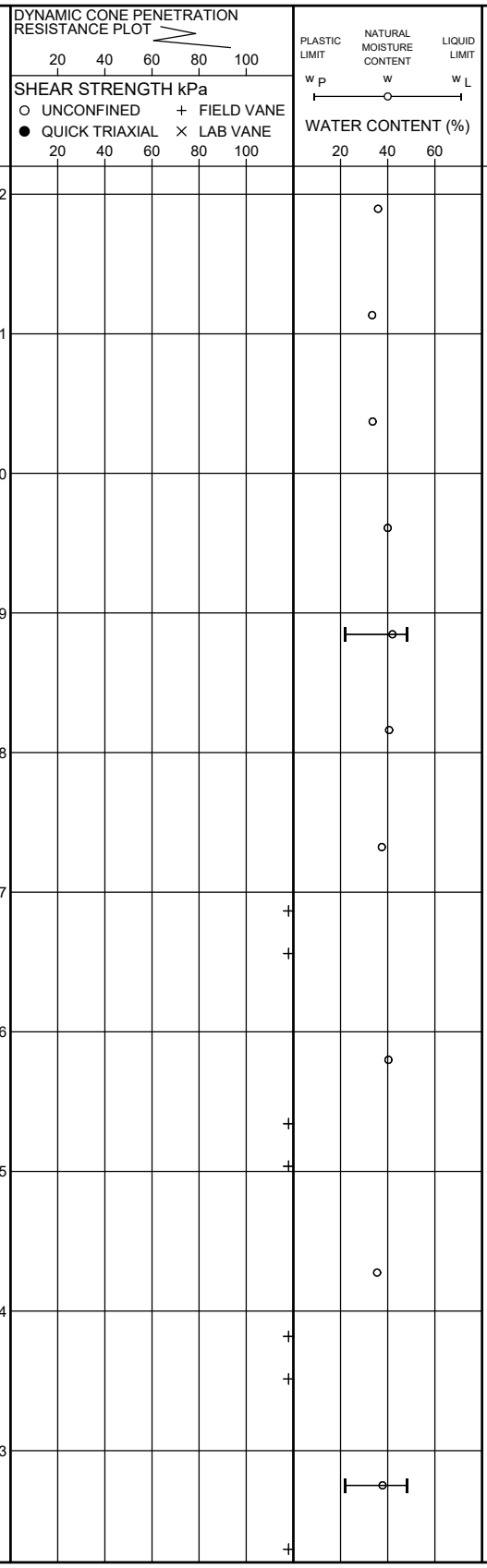
METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497234°, Long: -76.672129° Bruce Street MTM Zone 9: N 5 039 715.7 E 291 347.4 | ORIGINATED BY RH

HWY 17 | BOREHOLE TYPE CME 75 Trackmount, HSA, H Casing | COMPILED BY AO

DATUM Geodetic | DATE 2020.11.25 - 2020.11.25 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GR	SA	SI	CL
152.2								
0.0	**SILTY CLAY (CI/CH)** Trace sand Very stiff Grey **(WEATHERED CRUST)**	1	SS	14				
151.4								
0.8	**SILTY CLAY (CI/CH)** Very stiff Grey **(WEATHERED CRUST)**	2	SS	14				
		3	SS	12				
		4	SS	9				
149.2								
3.0	**SILTY CLAY (CI/CH)** Very stiff Grey	5	SS	5	0	0	39	61
		6	SS	5				
		7	SS	7				
		8	SS	4				
		9	SS	5				
		10	SS	7	0	1	55	44



UNIT WEIGHT γ kN/m³

REMARKS & GRAIN SIZE DISTRIBUTION (%)

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-19

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497234°, Long: -76.672129° Bruce Street MTM Zone 9: N 5 039 715.7 E 291 347.4 | ORIGINATED BY RH

HWY 17 | BOREHOLE TYPE CME 75 Trackmount, HSA, H Casing | COMPILED BY AO

DATUM Geodetic | DATE 2020.11.25 - 2020.11.25 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLE NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
	Continued From Previous Page										
	SILTY CLAY (CI/CH) Very stiff Grey						142				
			11	SS	4						
							141				
			12	SS	3		140				
							139				
			13	SS	2			0	0	47	53
							138				
			14	SS	2		137				
							136				
135.4 / 16.8	**SILTY CLAY (CH)** to **SILT (CL-ML)** Stiff to very stiff Grey		15	SS	2		135				
			16	SS	2		134				
							133				

Continued Next Page

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

+ 3, × 3: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-19

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497234°, Long: -76.672129° Bruce Street MTM Zone 9: N 5 039 715.7 E 291 347.4 | ORIGINATED BY RH

HWY 17 | BOREHOLE TYPE CME 75 Trackmount, HSA, H Casing | COMPILED BY AO

DATUM Geodetic | DATE 2020.11.25 - 2020.11.25 | CHECKED BY

SOIL PROFILE			SAMPLES			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 (%)			
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR	SA	SI	CL
	Continued From Previous Page													
	SILTY CLAY (CH) to **SILT (CL-ML)** Stiff to very stiff Grey		17	SS	2		132				0	4	49	47
								>10, >10						
							131							
			18	SS	2									
								>10						
							130	>10						
			19	SS	2		129							
								>10, >10						
							128							
			20	SS	2						0	2	57	41
								>10						
							127	>10						
			21	SS	2		126							
								>10, >10						
							125							
			22	SS	2									
							124	>10, >10						
			23	SS	5		123							
								>10						

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-19

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497234°, Long: -76.672129° Bruce Street MTM Zone 9: N 5 039 715.7 E 291 347.4 | ORIGINATED BY RH

HWY 17 | BOREHOLE TYPE CME 75 Trackmount, HSA, H Casing | COMPILED BY AO

DATUM Geodetic | DATE 2020.11.25 - 2020.11.25 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLE NUMBER	TYPE	"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 (CH) to **SILT (CL-ML)** Stiff to very stiff Grey						122							
			24	SS	3									
							121							
			25	SS	5		120							
							119							
			26	SS	12									
							118							
			27	SS	11		117					0	6	61	33
							116							
			28	SS	21									
							115							
114.1 / 38.1	Sandy **CLAYEY SILT** Very stiff Grey		29	SS	21		114					0	31	43	26
							113							
112.6 / 39.6	**GRAVEL** and **SAND** Very dense		30	SS	74							52	41		7

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-19

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497234°, Long: -76.672129° Bruce Street MTM Zone 9: N 5 039 715.7 E 291 347.4 | ORIGINATED BY RH

HWY 17 | BOREHOLE TYPE CME 75 Trackmount, HSA, H Casing | COMPILED BY AO

DATUM Geodetic | DATE 2020.11.25 - 2020.11.25 | CHECKED BY

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 (SI+CL)
ELEV / DEPTH	DESCRIPTION Continued From Previous Page	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
	GRAVEL and **SAND** Very dense Grey **(TILL)**						112				
111.3			31	SS	100/6"						
40.9	**End of Borehole**										

+ ³, × ³: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No BRU19-21

METRIC

WP#	4068-09-00	LOCATION	Lat: 45.497517°, Long: -76.673413° Bruce Street MTM Zone 9: N 5 039 747.3 E 291 247.1	ORIGINATED BY	AO
HWY	17	BOREHOLE TYPE	CME 850 Trackmount (HSA)	COMPILED BY	AO
DATUM	Geodetic	DATE	2020.12.04 - 2020.12.10	CHECKED BY	

SOIL PROFILE | SAMPLES | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT | UNIT WEIGHT | REMARKS & GRAIN SIZE DISTRIBUTION (%)

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

WATER CONTENT (%): w_P — w — w_L

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GR	SA	SI	CL
150.7 / 0.0	**TOPSOIL (50 mm)**							
0.1	CLAYEY SILT and organics, Very soft, Brown	1	SS	8				
	SILTY CLAY (CH), Stiff to Very Stiff, Grey brown, **(WEATHERED CRUST)**	2	SS	6	0	1	37	62
		3	SS	9				
		4	SS	9				
		5	SS	8				
		6	SS	8				
146.0 / 4.7	**CLAYEY SILT (CL/CL-ML)**, Firm to Stiff, Grey	7	SS	3				
		8	SS	4				
		9	SS	3				
		10	SS	2	0	0	52	48

Elevation scale: 150, 149, 148, 147, 146, 145, 144, 143, 142, 141

Dynamic cone penetration resistance: 3.8; >10

Unit weight γ kN/m³

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-21

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497517°, Long: -76.673413° Bruce Street MTM Zone 9: N 5 039 747.3 E 291 247.1 | ORIGINATED BY AO

HWY 17 | BOREHOLE TYPE CME 850 Trackmount (HSA) | COMPILED BY AO

DATUM Geodetic | DATE 2020.12.04 - 2020.12.10 | CHECKED BY

SOIL PROFILE			SAMPLES			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 (%)			
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR	SA	SI	CL
	Continued From Previous Page													
	CLAYEY SILT (CL/CL-ML) Firm to Stiff Grey							9.4 7.1						
			11	SS	1		140							
								6.9 5.8						
			12	SS	2		139							
							138	4.4 7.0						
			13	SS	1		137							
							136	8.0 >10						
			14	SS	2		135				0	0	51	49
								6.7						
			15	SS	1		134							
							133	4.4						
			16	SS	WH		132							
							131							

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-21

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497517°, Long: -76.673413° Bruce Street MTM Zone 9: N 5 039 747.3 E 291 247.1 | ORIGINATED BY AO

HWY 17 | BOREHOLE TYPE CME 850 Trackmount (HSA) | COMPILED BY AO

DATUM Geodetic | DATE 2020.12.04 - 2020.12.10 | CHECKED BY

SOIL PROFILE			SAMPLES			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 (%)			
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR	SA	SI	CL
	Continued From Previous Page													
	CLAYEY SILT (CL/CL-ML) Trace to some sand Stiff Grey		17	SS	1									
							130							
							129							
							128							
			18	SS	WR						0	1	66	33
							127	3.4						
							126							
							125							
			19	SS	2									
							124							
							123							
							122							
			20	SS	1									
							121							

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-21

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497517°, Long: -76.673413° Bruce Street MTM Zone 9: N 5 039 747.3 E 291 247.1 | ORIGINATED BY AO

HWY 17 | BOREHOLE TYPE CME 850 Trackmount (HSA) | COMPILED BY AO

DATUM Geodetic | DATE 2020.12.04 - 2020.12.10 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLE 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)	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										
	CLAYEY SILT (CL/CL-ML) Trace to some sand Stiff Grey							28			
							120				
							119				
			21	SS	WR						1 12 54 33
							118				
							117				
							116				
			22	SS	6						
							115				
							114				
							113				
112.6 38.1	Sandy **CLAYEY SILT** Very Stiff Grey		23	SS	8						1 25 51 23
							112				
							111				
110.8											

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-21

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497517°, Long: -76.673413° Bruce Street MTM Zone 9: N 5 039 747.3 E 291 247.1 | ORIGINATED BY AO

HWY 17 | BOREHOLE TYPE CME 850 Trackmount (HSA) | COMPILED BY AO

DATUM Geodetic | DATE 2020.12.04 - 2020.12.10 | CHECKED BY

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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
39.9	**INFERRED TILL**						110				
			24	SS	40						
108.9							109				
41.8	**End of Borehole**										

Monitoring well consists of 51 mm diameter Schedule 40 PVC pipe with a 3 m slotted screen

WATER LEVEL READINGS:

DATE	DEPTH (m)	ELEV. (m)
2020.12.15	1.9	148.8
2021.08.04	0.7	150.0
2021.09.22	0.9	149.8
2021.10.21	7.1	143.6
2021.11.01	6.9	143.8
2022.01.11	4.1	146.6
2022.01.18	4.1	146.6
2022.01.27	3.8	146.9

+ ³, × ³: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-22

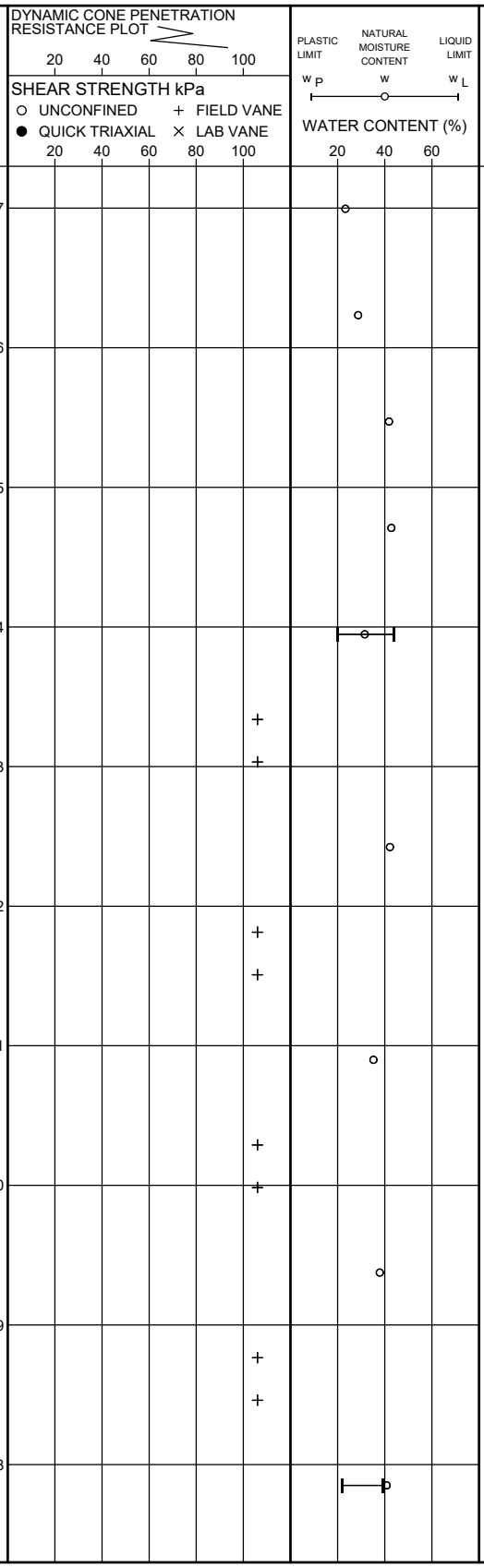
METRIC

WP# 4068-09-00 | LOCATION Lat: 45.498081°, Long: -76.669425° Bruce Street MTM Zone 9: N 5 039 809.4 E 291 558.9 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0'-20'), NW (20'-129'9") | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.19 - 2019.09.20 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GR	SA	SI	CL
147.3	Ground Surface							
0.0	Silty **SAND**, some gravel, trace roots Compact Brown **(TOPSOIL)**	1	SS	13				
146.5								
0.8	**SILTY CLAY (CI)** Very Stiff Brown **(WEATHERED CRUST)**	2	SS	18				
		3	SS	8				
		4	SS	8				
		5	SS	6	0	0	47	53
		6	SS	4				
141.2								
6.1	**SILTY CLAY (CI)** to Clayey **SILT (CL-ML)** Very Stiff Grey	7	SS	4				
		8	SS	6				
		9	SS	5	0	0	50	50



UNIT WEIGHT γ kN/m³

REMARKS & GRAIN SIZE DISTRIBUTION (%)

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-22

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.498081°, Long: -76.669425° Bruce Street MTM Zone 9: N 5 039 809.4 E 291 558.9 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0'-20'), NW (20'-129'9") | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.19 - 2019.09.20 | CHECKED BY

ELEV / DEPTH	DESCRIPTION (SOIL PROFILE)	STRAT PLOT	SAMPLE 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)	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										
	CLAY (CI) to Clayey **SILT (CL-ML)** Very Stiff Grey						137				
			10	SS	5						
							136				
			11	SS	4		135				
							134				
			12	SS	4		133				
			13	SS	3		132				
130.5 / 16.8	**CLAYEY SILT (CL/CL-ML)** Stiff to very stiff Grey		14	SS	1		131				
							130	7.7			
			15	SS	1		129				
							128	>10 8.4			

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-22

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.498081°, Long: -76.669425° Bruce Street MTM Zone 9: N 5 039 809.4 E 291 558.9 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0'-20'), NW (20'-129'9") | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.19 - 2019.09.20 | CHECKED BY

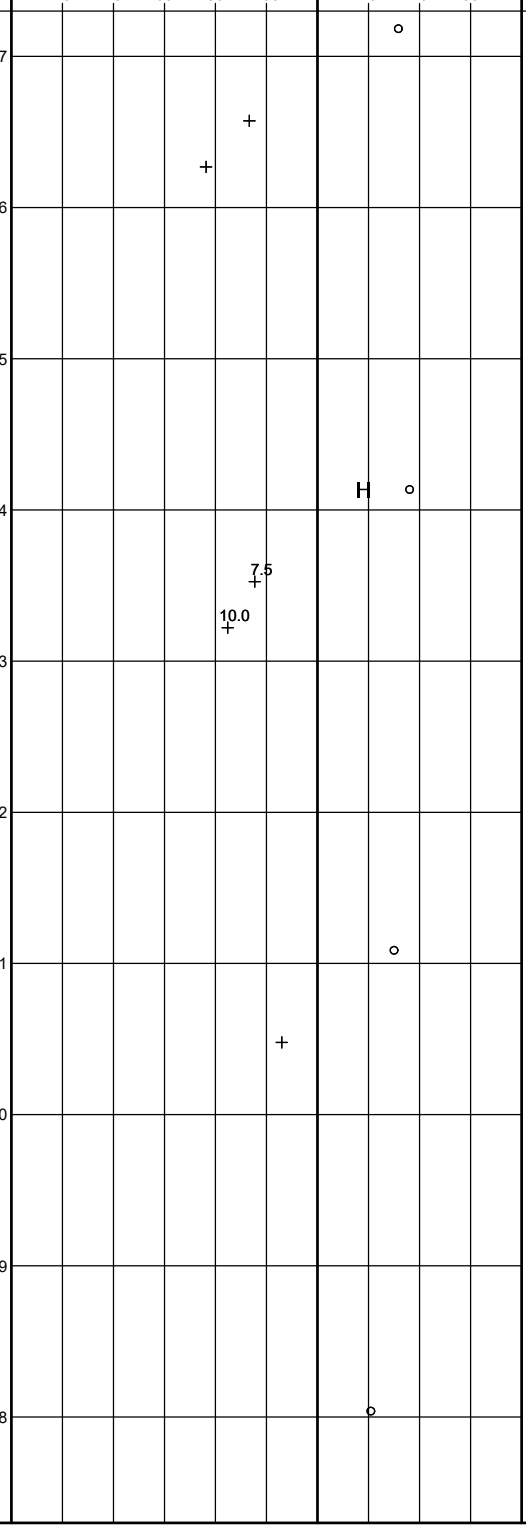
ELEV / DEPTH	DESCRIPTION (Continued From Previous Page)	STRAT PLOT	SAMPLE NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL	UNIT WEIGHT γ kN/m³
	CLAYEY SILT (CL/CL-ML) Stiff to very stiff Grey		16	SS	1		127					
			17	SS	3		124	0	1	58	41	
			18	SS	3		121					
118.3 / 29.0	**SAND** and **SILT** Compact to Dense Grey		19	SS	31		118					

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)



Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-22

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.498081°, Long: -76.669425° Bruce Street MTM Zone 9: N 5 039 809.4 E 291 558.9 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0'-20'), NW (20'-129'9") | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.19 - 2019.09.20 | CHECKED BY

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES 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
	Continued From Previous Page										
	SAND and **SILT** Compact to Dense Grey						117				
							116				
			20	SS	32		115				0 62 38 (SI+CL)
							114				
							113				
			21	SS	17		112				
							111				
							110				
109.2											
38.1	Sandy **CLAYEY SILT (CL-ML)** Compact Grey		22	SS	25		109				0 29 49 22
							108				
107.8			23	SS	100/ 75 mm						
39.5	**End of Borehole**										

+ ³, × ³: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-23

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.498019°, Long: -76.668817° Bruce Street MTM Zone 9: N 5 039 802.4 E 291 606.4 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0'-20'), NW (20'-104'3") | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.23 - 2019.09.24 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GR	SA	SI	CL
146.6	Ground Surface							
0.0	**SILT**, trace roots Compact Brown **(TOPSOIL)**	1	SS	11				
145.8								
0.8	**SILTY CLAY (CI/CH)** Very Stiff Brown **(WEATHERED CRUST)**	2	SS	9				
		3	SS	5				
		4	SS	4	0	0	48	52
		5	SS	4				
141.3								
5.3	**SILTY CLAY (CI)** Very Stiff Grey	6	SS	3				
		7	SS	3	0	0	46	54

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-23

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.498019°, Long: -76.668817° Bruce Street MTM Zone 9: N 5 039 802.4 E 291 606.4 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0'-20'), NW (20'-104'3") | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.23 - 2019.09.24 | CHECKED BY

ELEV / DEPTH	DESCRIPTION (Continued From Previous Page)	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	GR	SA	SI	CL
	SILTY CLAY (CI) Stiff to Very Stiff Grey	8	SS	2							
134.4 / 12.2	**CLAYEY SILT (CL-ML)** Stiff to Very Stiff Grey	9	SS	WH							
		10	SS	WH				0	0	58	42
		11	SS	WH							
		12	SS	1							

Elevation scale: 136, 135, 134, 133, 132, 131, 130, 129, 128, 127

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)

Remarks & grain size distribution (%): GR SA SI CL

Plotted values: 6.0; >10; 5.9; 4.0; >10; 6.7; 12.0

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-23

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.498019°, Long: -76.668817° Bruce Street MTM Zone 9: N 5 039 802.4 E 291 606.4 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0'-20'), NW (20'-104'3") | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.23 - 2019.09.24 | CHECKED BY

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	CLAYEY SILT (CL-ML) Stiff to Very Stiff Grey										
			13	SS	WH						
			14	SS	3						0 3 63 34
121.1 / 25.5	**SILT** Loose to Compact Grey		15	SS	17						
			16	SS	9						
			17	SS	26						
117.6 / 29.0	Silty **SAND** Dense Grey		18	SS	44					NP	0 72 22 6

Elevation scale: 126, 125, 124, 123, 122, 121, 120, 119, 118, 117

Dynamic cone penetration resistance plot: 20 40 60 80 100

Shear strength kPa: 20 40 60 80 100

Water content (%): 20 40 60

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-23

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.498019°, Long: -76.668817° Bruce Street MTM Zone 9: N 5 039 802.4 E 291 606.4 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0'-20'), NW (20'-104'3") | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.23 - 2019.09.24 | CHECKED BY

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										
	Silty **SAND** Dense Grey						116 115				
114.8			19	SS	100/0						
31.8	**End of Borehole**										

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

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No BRU19-25

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497909°, Long: -76.670002° Bruce Street MTM Zone 9: N 5 039 790.3 E 291 513.8 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0'-40'), NW (40'-139') | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.17 - 2019.09.18 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GR	SA	SI	CL
147.9	Ground Surface							
0.0	Silty **SAND**, trace gravel, trace roots Compact Brown **(TOPSOIL)**	1	SS	14	4	80	16 (SI+CL)	
147.1								
0.8	**CLAY (CH)** Stiff to Very Stiff Brown **(WEATHERED CRUST)**	2	SS	20				
		3	SS	14				
		4	SS	8	0	1	44	55
		5	SS	9				
143.3								
4.6	**SILTY CLAY (CI)** Very Stiff Grey	6	SS	5	0	0	51	49
		7	SS	7				
		8	SS	8				
		9	SS	6				

GROUND WATER CONDITIONS

ELEVATION SCALE: 147, 146, 145, 144, 143, 142, 141, 140, 139, 138

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/m³

REMARKS & GRAIN SIZE DISTRIBUTION (%)

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-25

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497909°, Long: -76.670002° Bruce Street MTM Zone 9: N 5 039 790.3 E 291 513.8 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0'-40'), NW (40'-139') | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.17 - 2019.09.18 | CHECKED BY

SOIL PROFILE: ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"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 (CI) Stiff to Very Stiff Grey										
			10	SS	5		137				
							136				
			11	SS	3						
							135				
			12	SS	5		134				0 0 55 45
							133				
			13	SS	4						
							132				
			14	SS	3		131				
							130				
			15	SS	3						
							129				
							128				

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-25

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497909°, Long: -76.670002° Bruce Street MTM Zone 9: N 5 039 790.3 E 291 513.8 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0'-40'), NW (40'-139') | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.17 - 2019.09.18 | CHECKED BY

SOIL PROFILE			SAMPLES			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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	SILTY CLAY (CI) Stiff to Very Stiff Grey										
							127				
			16	SS	4				○		
							126	8.0 +			
								6.7 +			
							125				
							124				
			17	SS	WH				○		
							123	7.3 +			
								+			
							122				
							121				
			18	SS	6				○		
							120	+			
								+			
							119				
							118				

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-25

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497909°, Long: -76.670002° Bruce Street MTM Zone 9: N 5 039 790.3 E 291 513.8 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0'-40'), NW (40'-139') | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.17 - 2019.09.18 | CHECKED BY

ELEV / DEPTH	DESCRIPTION (Continued From Previous Page)	NUMBER	TYPE	"N" VALUES	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
117.4	**SILTY CLAY (CI)** Stiff to Very Stiff Grey								
30.5	**SILT** and **SAND** Compact to Dense Grey	19	SS	38	NP	0	39	47	14
		20	SS	42					
		21	SS	29					
108.3									
39.6	**CLAYEY SILT (CL)**, some sand Compact, Grey	22	SS	10		0	19	48	33

SOIL PROFILE | STRAT PLOT | 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

ELEVATION SCALE: 117, 116, 115, 114, 113, 112, 111, 110, 109, 108

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 BRU19-25

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497909°, Long: -76.670002° Bruce Street MTM Zone 9: N 5 039 790.3 E 291 513.8 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0'-40'), NW (40'-139') | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.17 - 2019.09.18 | CHECKED BY

SOIL PROFILE: ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: 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/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	CLAYEY SILT (CL), some sand Compact Grey						107 106				
105.5			23	SS	100/ 0mm						
42.4	**End of Borehole**										

+ 3, × 3: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-26

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.494981°, Long: -76.668897° Bruce Street MTM Zone 9: N 5 039 464.6 E 291 599.5 | ORIGINATED BY AO

HWY 17 | BOREHOLE TYPE CME850 Trackmount, HSA | COMPILED BY AO

DATUM Geodetic | DATE 2021.05.19 - 2021.05.20 | CHECKED BY

SOIL PROFILE			SAMPLES			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
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
149.7											
0.0 / 149.4	**TOPSOIL (300 mm)**		1	SS	2						
0.3	**SAND**, some silt Yellow-brown Very loose to loose		2	SS	4		149				
147.7			3	SS	6		148				0 82 18 (SI+CL)
2.0	**SILTY CLAY (CI)** No to trace sand Grey-brown with yellow mottles Very stiff **(WEATHERED CRUST)**		4	SS	5		147				
			5	SS	4		146				
			6	SS	6						0 1 47 52
			7	SS	6		145				
			8	SS	4		144				
							143	+ +			
141.5			9	SS	3		142				
8.2	**CLAYEY SILT (CL)** Contains sand seams and partings Grey-brown Stiff		10	SS	2		141				
							140				

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-26

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.494981°, Long: -76.668897° Bruce Street MTM Zone 9: N 5 039 464.6 E 291 599.5 | ORIGINATED BY AO

HWY 17 | BOREHOLE TYPE CME850 Trackmount, HSA | COMPILED BY AO

DATUM Geodetic | DATE 2021.05.19 - 2021.05.20 | CHECKED BY

ELEV / DEPTH	DESCRIPTION (Continued From Previous Page)	NUMBER	TYPE	"N" VALUES	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
	CLAYEY SILT (CL) Contains sand seams and partings Grey-brown Stiff							
		11	SS	2	0	4	57	39
		12	SS	WH				
		13	SS	WH				
		14	SS	WH				
133.7 / 16.0	**SAND**, some silt Grey Very dense	15	SS	60	0	86	14 (SI+CL)	
132.3 / 17.4	**End of Borehole**							

Elevation scale: 139, 138, 137, 136, 135, 134, 133

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

+ 3, × 3: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-27

METRIC

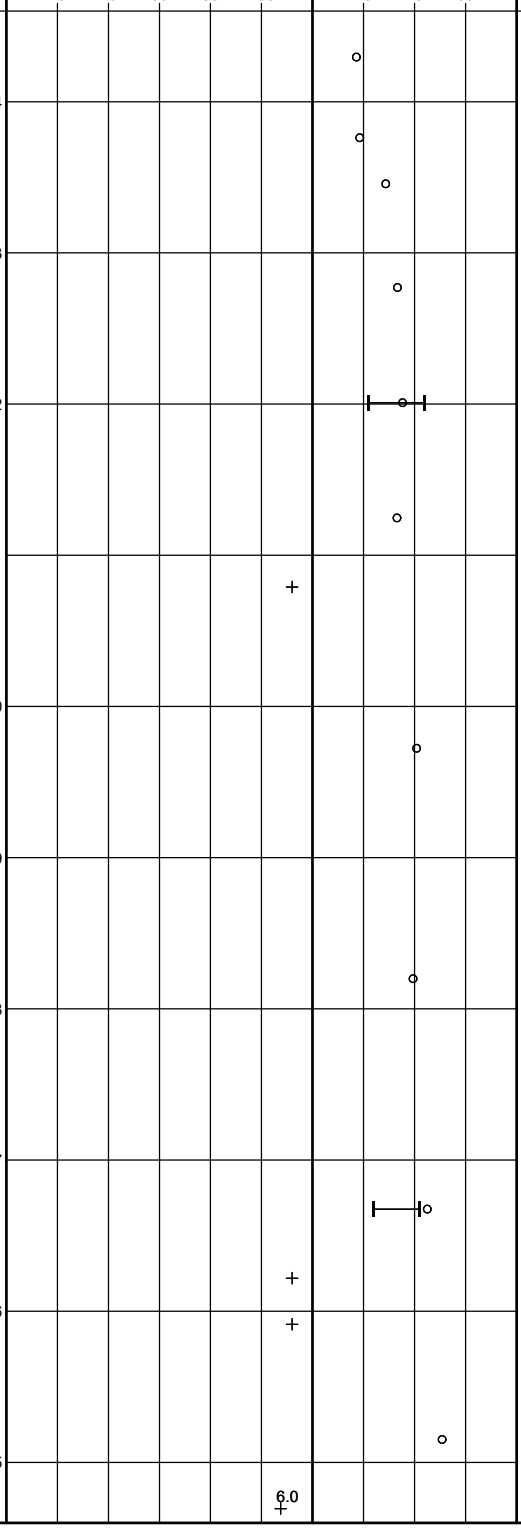
WP#	4068-09-00	LOCATION	Lat: 45.495436°, Long: -76.668876° Bruce Street MTM Zone 9: N 5 039 515.3 E 291 601.2	ORIGINATED BY	RH
HWY	17	BOREHOLE TYPE	CME 75 Trackmount, HSA, H Casing	COMPILED BY	AO
DATUM	Geodetic	DATE	2020.11.19 - 2020.11.19	CHECKED BY	

SOIL PROFILE ELEV / DEPTH	DESCRIPTION	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
154.6											
0.0	**SAND** trace to some silt Loose to compact Brown	1	SS	12							
		2	SS	8		154					
153.1											
1.5	**SILTY CLAY (CI)** Very stiff Grey **(WEATHERED CRUST)**	3	SS	8		153					
		4	SS	14		152		0	2	47	51
		5	SS	10							
						151					
		6	SS	7		150					
						149					
148.5											
6.1	**SILTY CLAY (CI)** Very stiff to stiff Grey	7	SS	8		148					
						147					
		8	SS	3				0	0	50	50
						146					
		9	SS	2		145					

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



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+ ³, × ³: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-27

METRIC

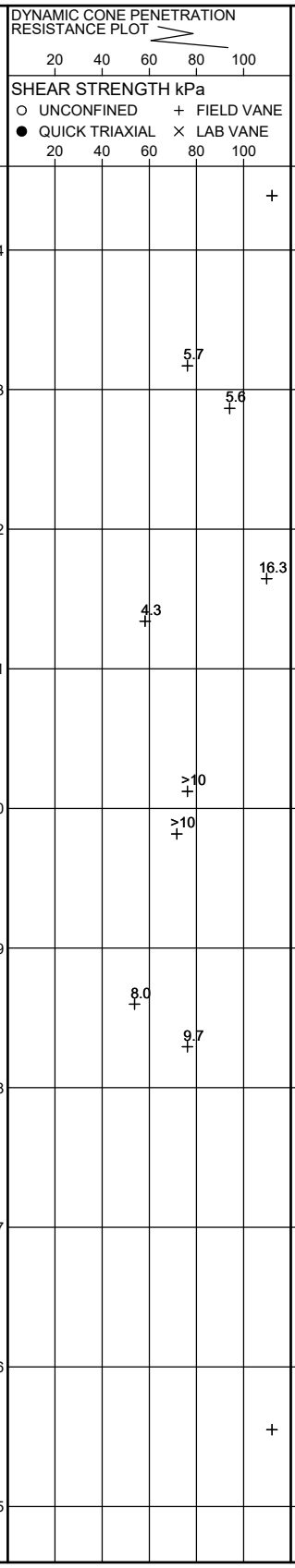
WP# 4068-09-00 | LOCATION Lat: 45.495436°, Long: -76.668876° Bruce Street MTM Zone 9: N 5 039 515.3 E 291 601.2 | ORIGINATED BY RH

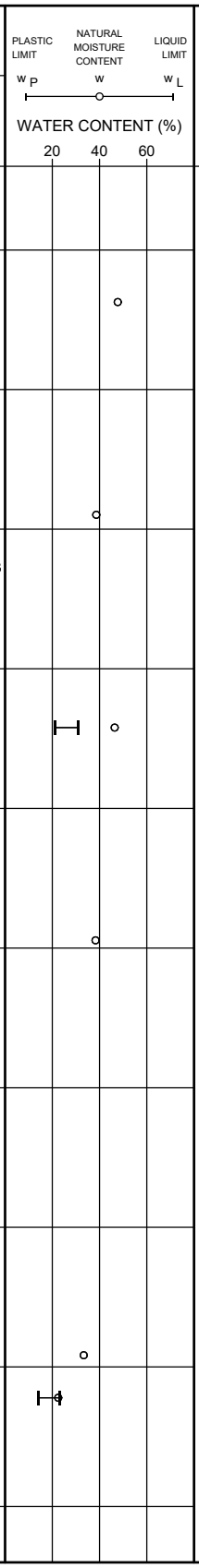
HWY 17 | BOREHOLE TYPE CME 75 Trackmount, HSA, H Casing | COMPILED BY AO

DATUM Geodetic | DATE 2020.11.19 - 2020.11.19 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GR	SA	SI	CL
	Continued From Previous Page							
	SILTY CLAY (CI) Very stiff to stiff Grey							
		10	SS	2				
		11	SS	WR				
		12	SS	WH	5	1	55	39
		13	SS	WH				
		14	SS	WH				
135.9 18.7	Sandy **CLAYEY SILT (CL)**, some gravel Stiff Grey				11	27	40	22

Continued Next Page





UNIT WEIGHT γ kN/m 3

REMARKS & GRAIN SIZE DISTRIBUTION (%)

+ 3, × 3: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-27

METRIC

WP# 4068-09-00 LOCATION Lat: 45.495436°, Long: -76.668876° Bruce Street MTM Zone 9: N 5 039 515.3 E 291 601.2 ORIGINATED BY RH

HWY 17 BOREHOLE TYPE CME 75 Trackmount, HSA, H Casing COMPILED BY AO

DATUM Geodetic DATE 2020.11.19 - 2020.11.19 CHECKED BY

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 Continued From Previous Page	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
	Sandy **CLAYEY SILT (CL)**, some gravel Stiff Grey						134				
133.3											
133.2 21.4	GRAVEL trace sand Trace silt Very dense Grey **(TILL)**		15	SS	100/4"						
	End of Borehole										

+ ³, × ³: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-28

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.495861°, Long: -76.668749° Bruce Street MTM Zone 9: N 5 039 562.5 E 291 611.3 | ORIGINATED BY RH

HWY 17 | BOREHOLE TYPE CME 75 Trackmount, HSA, H Casing | COMPILED BY AO

DATUM Geodetic | DATE 2020.11.18 - 2020.11.19 | CHECKED BY

ELEV / DEPTH (155.0)	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GR	SA	SI	CL
0.0	**SILT**, trace to some sand Compact to loose Grey brown	1	SS	7				
		2	SS	10	0	9	82	9
		3	SS	8				
152.7								
2.3	**SILTY CLAY (CI)** Very Stiff Grey **(WEATHERED CRUST)**	4	SS	6				
		5	SS	7				
		6	SS	7	0	0	46	54
		7	SS	7				
147.4								
7.6	**SILTY CLAY (CI)** Very Stiff Grey	8	SS	3				
		9	SS	4				

STRAT PLOT | GROUND WATER CONDITIONS | ELEVATION SCALE (154, 153, 152, 151, 150, 149, 148, 147, 146)

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 (%)

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Continued Next Page

+ [3], × [3]: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-28

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.495861°, Long: -76.668749° Bruce Street MTM Zone 9: N 5 039 562.5 E 291 611.3 | ORIGINATED BY RH

HWY 17 | BOREHOLE TYPE CME 75 Trackmount, HSA, H Casing | COMPILED BY AO

DATUM Geodetic | DATE 2020.11.18 - 2020.11.19 | CHECKED BY

ELEV / DEPTH	DESCRIPTION (SOIL PROFILE)	STRAT PLOT	SAMPLE NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	SILTY CLAY (CI) Very Stiff Grey										
			10	SS	2		144				0 0 53 47
							143				
			11	SS	2						
							142	>10			
			12	SS	WH		141				
								>10, >10			
139.8							140				
15.2	**CLAYEY SILT (CL)** to **SILT (ML)** Stiff to Very Stiff Grey		13	SS	WH						
							139	>10, >10			
			14	SS	WH		138	>10, >10			
			15	SS	WR		137				
							136	>10, >10			

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-28

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.495861°, Long: -76.668749° Bruce Street MTM Zone 9: N 5 039 562.5 E 291 611.3 | ORIGINATED BY RH

HWY 17 | BOREHOLE TYPE CME 75 Trackmount, HSA, H Casing | COMPILED BY AO

DATUM Geodetic | DATE 2020.11.18 - 2020.11.19 | CHECKED BY

SOIL PROFILE			SAMPLES			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)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	CLAYEY SILT (CL/CL-ML) Stiff to Very Stiff Grey						134				
			16	SS	WR				○	NP	0 0 61 39
							133	>10 (+), >10 (+)			
							132				
							131				
			17	SS	WR				○		
							130	4.2 (+), +			
							129				
							128				
127.6 / 27.4	**SAND**, some silt to silty Compact to very dense Grey **(TILL)**		18	SS	13		127		○		
							126				

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-28

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.495861°, Long: -76.668749° Bruce Street MTM Zone 9: N 5 039 562.5 E 291 611.3 | ORIGINATED BY RH

HWY 17 | BOREHOLE TYPE CME 75 Trackmount, HSA, H Casing | COMPILED BY AO

DATUM Geodetic | DATE 2020.11.18 - 2020.11.19 | CHECKED BY

ELEV / DEPTH	DESCRIPTION (SOIL PROFILE)	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / 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 (%) GR SA SI CL
	Continued From Previous Page										
	SAND, some silt to silty Compact to very dense Grey **(TILL)**		19	SS	76		124		○		7 79 14 (SI+CL)
122.9			20	SS	100/3"		123				
32.1	**End of Borehole**										

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

+ 3, × 3: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-29

METRIC

WP#	4068-09-00	LOCATION	Lat: 45.496331°, Long: -76.668662° Bruce Street MTM Zone 9: N 5 039 614.8 E 291 618.2	ORIGINATED BY	RH
HWY	17	BOREHOLE TYPE	CME 75 Trackmount, HSA, H Casing	COMPILED BY	AO
DATUM	Geodetic	DATE	2020.11.16 - 2020.11.18	CHECKED BY	

SOIL PROFILE | SAMPLES | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | SHEAR STRENGTH kPa | WATER CONTENT (%) | UNIT WEIGHT | REMARKS & GRAIN SIZE DISTRIBUTION (%)

154.7

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GR	SA	SI	CL
0.0 / 0.1	**TOPSOIL**							
	SAND and **SILT** Compact to loose Brown	1	SS	10				
		2	SS	23				
		3	SS	19	0	50	50 (SI+CL)	
152.3 / 2.4	**SILTY CLAY (CI)** Very stiff to Stiff Grey **(WEATHERED CRUST)**	4	SS	9				
		5	SS	7	0	2	51	47
		6	SS	6				
		7	SS	6				
147.1 / 7.6	**SILTY CLAY (CI)** Very stiff to Stiff Grey	8	SS	3				
		9	SS	4				

Elevation scale: 154, 153, 152, 151, 150, 149, 148, 147, 146, 145

Dynamic cone penetration resistance plot: 20 40 60 80 100

Shear strength kPa: ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE

Water content (%): PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; 20 40 60

Unit weight γ kN/m³

Field vane values: 3.3, 3.8

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-29

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.496331°, Long: -76.668662° Bruce Street MTM Zone 9: N 5 039 614.8 E 291 618.2 | ORIGINATED BY RH

HWY 17 | BOREHOLE TYPE CME 75 Trackmount, HSA, H Casing | COMPILED BY AO

DATUM Geodetic | DATE 2020.11.16 - 2020.11.18 | CHECKED BY

ELEV / DEPTH	DESCRIPTION (Continued From Previous Page)	STRAT PLOT	SAMPLE NUMBER	TYPE	"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
	SILTY CLAY (CI) Very stiff Grey										
			10	SS	3		144				
							143				
			11	SS	4		142				
			12	SS	3		141				
139.5							140				
15.2	**CLAYEY SILT (CL/CL-ML)** Stiff to Very stiff Grey		13	SS	5		139	2.4; 2.4			
			14	SS	WH		138	>10		NP	0 0 55 45
			15	SS	WH		137	>10			
							136	10.0; >10			
							135				

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-29

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.496331°, Long: -76.668662° Bruce Street MTM Zone 9: N 5 039 614.8 E 291 618.2 | ORIGINATED BY RH

HWY 17 | BOREHOLE TYPE CME 75 Trackmount, HSA, H Casing | COMPILED BY AO

DATUM Geodetic | DATE 2020.11.16 - 2020.11.18 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLE 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)	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										
	CLAYEY SILT (CL/CL-ML) Stiff to Very stiff Grey						134				
			16	SS	2		133				
								>10			
								>10			
							132				
							131				
			17	SS	WR		130			NP	0 0 57 43
								+			
								>10			
							129				
							128				
			18	SS	WR		127				
								>10			
								>10			
							126				
124.8							125				
29.9											

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-29

METRIC

WP#	4068-09-00	LOCATION	Lat: 45.496331°, Long: -76.668662° Bruce Street MTM Zone 9: N 5 039 614.8 E 291 618.2	ORIGINATED BY	RH
HWY	17	BOREHOLE TYPE	CME 75 Trackmount, HSA, H Casing	COMPILED BY	AO
DATUM	Geodetic	DATE	2020.11.16 - 2020.11.18	CHECKED BY	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT / WATER CONTENT (%)	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE (20 40 60 80 100)	w_P w w_L (20 40 60)	γ kN/m³	GR SA SI CL
	Continued From Previous Page										
	CLAYEY SILT (CL/CL-ML) Stiff to Very stiff Grey		19	SS	WR		124				
							123				
							122				
121.2											
33.5	**CLAYEY SILT (CL)**, some sand Very stiff Grey		20	SS	18		121				1 12 54 33
							120				
119.6											
35.1	Gravelly **SAND**, some silt Very dense Grey **(TILL)**		21	SS	35		119				29 59 12 (SI+CL)
118.2			22	SS	100/1"						
36.5	**End of Borehole** Monitoring well consists of 51 mm diameter Schedule 40 PVC pipe with a 3 m slotted screen										

WATER LEVEL READINGS:

DATE	DEPTH (m)	ELEV. (m)
2020.12.15	3.3	151.4
2021.08.04	3.5	151.2
2021.09.30	4.3	150.4
2021.10.05	4.3	150.4
2022.01.11	3.5	151.2
2022.01.18	3.6	151.1
2022.01.26	3.5	151.2

+ ³, × ³: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No BRU19-30

METRIC

WP#	4068-09-00	LOCATION	Lat: 45.496713°, Long: -76.668342° Bruce Street MTM Zone 9: N 5 039 657.2 E 291 643.3	ORIGINATED BY	MJJ
HWY	17	BOREHOLE TYPE	CME 55 Trackmount HSA (0'-40'), NW (40'-	COMPILED BY	JP
DATUM	Geodetic	DATE	2019.11.28 - 2019.11.29	CHECKED BY	

SOIL PROFILE ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
154.1	**Ground Surface**													
0.0	Sandy **SILT** Loose Brown		1	SS	6		154							
			2	SS	9		153			NP	0	23	66	11
			3	SS	9		152							
151.8														
2.3	**SILTY CLAY (CI)** Very Stiff Grey **(WEATHERED CRUST)**		4	SS	6									
			5	SS	6		151				0	1	47	52
			6	SS	9		150							
			7	SS	7		149							
			8	SS	5									
			9	SS	6		148							
							147	+						
			10	SS	8		146				0	0	48	52
145.0														
9.1	**SILTY CLAY (CI)** Very Stiff Grey		11	SS	3		145							
144.1														

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-30

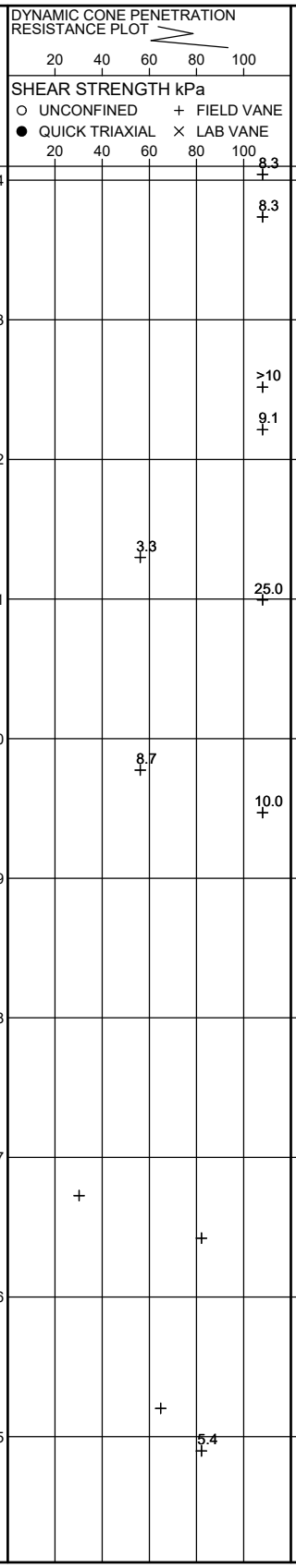
METRIC

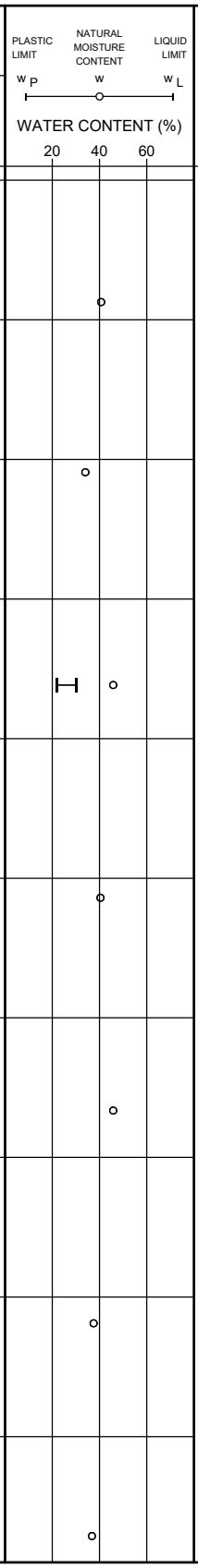
WP# 4068-09-00 | LOCATION Lat: 45.496713°, Long: -76.668342° Bruce Street MTM Zone 9: N 5 039 657.2 E 291 643.3 | ORIGINATED BY MJJ

HWY 17 | BOREHOLE TYPE CME 55 Trackmount HSA (0'-40'), NW (40'- | COMPILED BY JP

DATUM Geodetic | DATE 2019.11.28 - 2019.11.29 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GR	SA	SI	CL
	Continued From Previous Page							
10.0	**SILTY CLAY (CI)** Very Stiff Grey							
		12	SS	3				
142.2								
11.9	**CLAYEY SILT (CL/CL-ML)** Stiff to Very Stiff Grey	13	SS	4				
		14	SS	8	0	0	52	48
		15	SS	3				
		16	SS	3				
		17	SS	4				
		18	SS	1				





UNIT WEIGHT γ kN/m³

REMARKS & GRAIN SIZE DISTRIBUTION (%)

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-30

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.496713°, Long: -76.668342° Bruce Street MTM Zone 9: N 5 039 657.2 E 291 643.3 | ORIGINATED BY MJJ

HWY 17 | BOREHOLE TYPE CME 55 Trackmount HSA (0'-40'), NW (40'- | COMPILED BY JP

DATUM Geodetic | DATE 2019.11.28 - 2019.11.29 | CHECKED BY

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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	CLAYEY SILT (CL/CL-ML) Stiff to Very Stiff Grey						134				
							133				
							132				
			19	SS	2						0 1 54 45
							131	2.2			
							130				
							129				
			20	SS	3						
							128				
							127				
							126				
			21	SS	6						
							125				

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-30

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.496713°, Long: -76.668342° Bruce Street MTM Zone 9: N 5 039 657.2 E 291 643.3 | ORIGINATED BY MJJ

HWY 17 | BOREHOLE TYPE CME 55 Trackmount HSA (0'-40'), NW (40'- | COMPILED BY JP

DATUM Geodetic | DATE 2019.11.28 - 2019.11.29 | CHECKED BY

ELEV / DEPTH	DESCRIPTION (SOIL PROFILE)	STRAT PLOT	SAMPLE 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
	Continued From Previous Page										
	CLAYEY SILT (CL/CL-ML) Stiff to Very Stiff Grey						124				
							123				
122.4											
31.7	**SILT**, some sand to sandy With sand seams, contains low-plastic fines Compact to Dense Grey		22	SS	15		122		⊢ ○		0 10 59 31
							121				
							120				
			23	SS	39		119				
118.7											
35.4	**End of Borehole**										

+ 3, × 3: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-31

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497516°, Long: -76.668258° Bruce Street MTM Zone 9: N 5 039 746.3 E 291 650.0 | ORIGINATED BY MJJ

HWY 17 | BOREHOLE TYPE CME 55 Trackmount, HSA (0'-35'), NW (35'-124'3") | COMPILED BY JP

DATUM Geodetic | DATE 2019.11.26 - 2019.11.27 | CHECKED BY

SOIL PROFILE ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
149.9	**Ground Surface**										
0.0	**100mm TOPSOIL**										
0.1	**CLAY (CH)** Very Stiff Brown **(WEATHERED CRUST)**		1	SS	7						
			2	SS	9		149				0 1 42 57
148.4											
1.5	**SILTY CLAY (CI)** Very Stiff Grey		3	SS	7		148				
			4	SS	7		147				
			5	SS	7						
			6	SS	9		146				0 0 45 55
			7	SS	5		145				
							144				
			8	SS	3						
							143				
			9	SS	4		142				
							141				
			10	SS	4						0 0 49 51
							140				

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-31

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497516°, Long: -76.668258° Bruce Street MTM Zone 9: N 5 039 746.3 E 291 650.0 | ORIGINATED BY MJJ

HWY 17 | BOREHOLE TYPE CME 55 Trackmount, HSA (0'-35'), NW (35'-124'3") | COMPILED BY JP

DATUM Geodetic | DATE 2019.11.26 - 2019.11.27 | CHECKED BY

ELEV / DEPTH	DESCRIPTION (Continued From Previous Page)	STRAT PLOT	SAMPLE 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)	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
	SILTY CLAY (CI) Very Stiff Grey										
			11	SS	4		139				
								3.7			
138.0							138				
11.9	**CLAYEY SILT (CL/CL-ML)** Stiff to Very Stiff Grey		12	SS	6						
								4.8			
							137	7.5			
			13	SS	4						
							136				
							135				
			14	SS	2						
							134	>10			
			15	SS	WH		133				2 20 49 29
							132				
			16	SS	WH						
							131				
			17	SS	WH		130				

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-31

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497516°, Long: -76.668258° Bruce Street MTM Zone 9: N 5 039 746.3 E 291 650.0 | ORIGINATED BY MJJ

HWY 17 | BOREHOLE TYPE CME 55 Trackmount, HSA (0'-35'), NW (35'-124'3") | COMPILED BY JP

DATUM Geodetic | DATE 2019.11.26 - 2019.11.27 | CHECKED BY

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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	CLAYEY SILT (CL/CL-ML) Stiff to Very Stiff Grey						129				
							128				
			18	SS	4		127				
							126				
							125				
			19	SS	1		124				
							123				
							122				
121.2 / 28.7	Interlayered **CLAYEY SILT (CL/CL-ML)** and Silty **SAND (SM)** Very Loose to Compact Grey		20	SS	WH		121				0 23 50 27
							120				

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-31

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.497516°, Long: -76.668258° Bruce Street MTM Zone 9: N 5 039 746.3 E 291 650.0 | ORIGINATED BY MJJ

HWY 17 | BOREHOLE TYPE CME 55 Trackmount, HSA (0'-35'), NW (35'-124'3") | COMPILED BY JP

DATUM Geodetic | DATE 2019.11.26 - 2019.11.27 | CHECKED BY

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 (%)			
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR	SA	SI	CL
	Continued From Previous Page													
	Interlayered **CLAYEY SILT (CL/CL-ML)** and Silty **SAND (SM)** Very Loose to Compact Grey						119							
			21	SS	11		118		○					
							117							
							116							
			22	SS	22		115		⊢⊕		0	1	63	36
							114							
							113							
112.0			23	SS	100/ 0.08m									
37.9	**End of Borehole**													

+ ³, × ³: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-33

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.498365°, Long: -76.668916° Bruce Street MTM Zone 9: N 5 039 840.9 E 291 598.8 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0'-20'), NW (20'-110'2") | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.24 - 2019.09.25 | CHECKED BY

SOIL PROFILE: ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
146.9	Ground Surface											
0.0	**CLAY (CH)** Very Stiff Brown **(WEATHERED CRUST)**		1	SS	15							
			2	SS	15		146					
			3	SS	9		145		0	0	42	58
			4	SS	7		144					
			5	SS	9	▽						
143.1												
3.8	**SILTY CLAY (CI)** Very Stiff Grey-Brown to Grey		6	SS	7		143					
							142					
							141					
			7	SS	5				0	0	50	50
							140					
							139					
			8	SS	4							
							138					
							137					

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

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-33

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.498365°, Long: -76.668916° Bruce Street MTM Zone 9: N 5 039 840.9 E 291 598.8 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0'-20'), NW (20'-110'2") | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.24 - 2019.09.25 | CHECKED BY

SOIL PROFILE: ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	SILTY CLAY (CI) Very Stiff Grey-Brown to Grey										
			9	SS	4		136				
							135				
			10	SS	4		134				
							133				
							132				
131.7 / 15.2	**CLAYEY SILT (CL)** Stiff to Very Stiff Grey		11	SS	1						0 1 65 34
							131				
							130	8.0 8.0			
			12	SS	2		129				
							128	4.6 >10			
							127				

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-33

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.498365°, Long: -76.668916° Bruce Street MTM Zone 9: N 5 039 840.9 E 291 598.8 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0'-20'), NW (20'-110'2") | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.24 - 2019.09.25 | CHECKED BY

SOIL PROFILE: ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: 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
	Continued From Previous Page										
	CLAYEY SILT (CL) Stiff to Very Stiff Grey		13	SS	2						
			14	SS	2		126				
			15	SS	3		125				
							124				
							123				
120.2							122				
26.7	Interlayered Silty **SAND (SM)** and **CLAYEY SILT (CL/CL-ML)** Compact Grey		16	SS	25		121			NP	0 68 25 7
							120				
							119				
							118				
							117				

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU19-33

METRIC

WP# 4068-09-00 | LOCATION Lat: 45.498365°, Long: -76.668916° Bruce Street MTM Zone 9: N 5 039 840.9 E 291 598.8 | ORIGINATED BY MW

HWY 17 | BOREHOLE TYPE CME 850 Trackmount, HSA (0'-20'), NW (20'-110'2") | COMPILED BY JP

DATUM Geodetic | DATE 2019.09.24 - 2019.09.25 | CHECKED BY

ELEV / DEPTH	DESCRIPTION (SOIL PROFILE)	STRAT PLOT	SAMPLE NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	Interlayered Silty **SAND (SM)** and **CLAYEY SILT (CL/CL-ML)** Compact Grey		17	SS	7						
114.9							116				
32.0	Silty **SAND**, trace gravel Loose to Very Dense Grey **(TILL)**		18	SS	7		115				
113.3			19	SS	57		114				6 73 21 (SI+CL)
33.6	**End of Borehole**										

+ 3, × 3: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU21-02

METRIC

WP#	4068-09-00	LOCATION	Lat: 45.497647°, Long: -76.671101° Bruce Street MTM Zone 9: N 5 039 761.4 E 291 427.9	ORIGINATED BY	NW
HWY	17	BOREHOLE TYPE	Diedrich 50 (D-50) Trackmount, HSA	COMPILED BY	AO
DATUM	Geodetic	DATE	2021.11.01 - 2021.11.01	CHECKED BY	

SOIL PROFILE ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES 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
151.4	**Ground Surface**										
0.0	SILTY SAND some gravel Loose Brown		1	SS	4		151				
150.8	**[FILL]**										
0.6	**CLAY (CH)** Very stiff Brown to Grey **(WEATHERED CRUST)**		2	SS	8		150				
			3	SS	10						
			4	SS	7		149				0 1 38 61
			5	SS	7		148				
			6	SS	7		147				
			7	SS	7						0 0 41 59
							146				
			8	SS	7		145				
144.7											
6.7	**End of Borehole** Monitoring well consists of 50 mm diameter Schedule 40 PVC pipe with a 3.0 m slotted screen Water level readings: **Date / Depth (m) / Elev. (m)** 2021.11.04 / 2.4 / 149.0 2022.11.30 / 2.3 / 149.1 2021.12.23 / 2.2 / 149.2 2022.01.19 / 2.5 / 148.9										

+ ³, × ³: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU21-05

METRIC

WP#	4068-09-00	LOCATION	Lat: 45.498101°, Long: -76.669878° Bruce Street MTM Zone 9: N 5 039 811.7 E 291 523.6	ORIGINATED BY	NW
HWY	17	BOREHOLE TYPE	Diedrich 50 (D-50) Trackmount, HSA	COMPILED BY	AO
DATUM	Geodetic	DATE	2021.11.02 - 2021.11.02	CHECKED BY	

SOIL PROFILE | SAMPLES | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT | UNIT WEIGHT | REMARKS & GRAIN SIZE DISTRIBUTION (%)

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	w_P	w	w_L	γ kN/m³	GR	SA	SI	CL
149.2	**Ground Surface**											
0.0	**TOPSOIL (75 mm)**											
0.1	SILTY SAND some gravel Contains asphalt Compact Brown to Grey **[FILL]**	1	SS	15					11	81	8 (SI+CL)	
		2	SS	10								
147.7												
1.5	**CLAY (CH)** to **SILTY CLAY (CI)** Very stiff Brown **(WEATHERED CRUST)**	3	SS	14								
		4	SS	10					0	1	38	61
		5	SS	6								
		6	SS	5								
		7	SS	6								
		8	SS	6					0	0	51	49
142.5												
6.7	**End of Borehole**											

Monitoring well consists of 50 mm diameter Schedule 40 PVC pipe with a 3.0 m slotted screen

Water level readings:

Date	Depth (m)	Elev. (m)
2021.11.16	2.0	147.2
2021.12.01	2.0	147.2
2022.01.19	2.3	146.9

ELEVATION SCALE: 149, 148, 147, 146, 145, 144, 143

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)

WATER CONTENT (%): 20 40 60

+ ³, × ³: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU21-15

METRIC

WP#	4068-09-00	LOCATION	Lat: 45.497312°, Long: -76.671577° Bruce Street MTM Zone 9: N 5 039 724.3 E 291 390.6	ORIGINATED BY	NW
HWY	17	BOREHOLE TYPE	Diedrich 50 (D-50) Trackmount, HSA	COMPILED BY	AO
DATUM	Geodetic	DATE	2021.10.29 - 2021.10.29	CHECKED BY	

SOIL PROFILE: ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"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
152.6	**Ground Surface**										
0.0	See borehole BRU19-15 for stratigraphy.						152				
							151				
							150				
							149				
							148				
							147				
146.5											
6.1	**End of Borehole**										

Monitoring well consists of 50 mm diameter Schedule 40 PVC pipe with a 3.0 m slotted screen

Water level readings:

Date	Depth (m)	Elev. (m)
2021.11.03	2.6	150.0
2022.01.19	3.0	149.6

+ ³, × ³: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU21-18

METRIC

WP#	4068-09-00	LOCATION	Lat: 45.497048°, Long: -76.673058° Bruce Street MTM Zone 9: N 5 039 695.2 E 291 274.5	ORIGINATED BY	NW
HWY	17	BOREHOLE TYPE	Diedrich 50 (D-50) Trackmount, HSA	COMPILED BY	AO
DATUM	Geodetic	DATE	2021.10.29 - 2021.10.29	CHECKED BY	

SOIL PROFILE: ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"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
151.4	**Ground Surface**										
0.0	See borehole BRU19-18 for stratigraphy.						151				
							150				
							149				
							148				
							147				
							146				
145.3											
6.1	**End of Borehole**										

Monitoring well consists of 50 mm diameter Schedule 40 PVC pipe with a 3.0 m slotted screen

Water level readings:

Date	Depth (m)	Elev. (m)
2021.11.03	1.6	149.8
2022.01.19	1.7	149.7

+ ³, × ³: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BRU21-23

METRIC

WP#	4068-09-00	LOCATION	Lat: 45.497997°, Long: -76.668814° Bruce Street MTM Zone 9: N 5 039 799.9 E 291 606.7	ORIGINATED BY	NW
HWY	17	BOREHOLE TYPE	Diedrich 50 (D-50) Trackmount, HSA	COMPILED BY	AO
DATUM	Geodetic	DATE	2021.11.02 - 2021.11.02	CHECKED BY	

SOIL PROFILE: ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: 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
146.6	**Ground Surface**										
0.0	See BRU19-23 for stratigraphy.						146				
							145				
							144				
							143				
							142				
							141				
140.5											
6.1	**End of Borehole**										

Monitoring well consists of 50 mm diameter Schedule 40 PVC pipe with a 3.0 m slotted screen

Water level readings:

Date	Depth (m)	Elev. (m)
2021.11.16	0.3	146.3
2021.11.24	0.3	146.3
2022.01.19	0.7	145.9

+ ³, × ³: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

DOUBLE LINE 24726 BRUCE STREET GINT.GPJ 2012TEMPLATE(MTO).GDT 22-6-29

THURBER

Appendix B.2

Previous (2003) Investigation

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No BRU-1

METRIC

G.W.P. 647-92-00 | LOCATION N 5 039 748.0 E 291 406.0 (Bruce Street) | ORIGINATED BY JL
HWY HWY 17 | BOREHOLE TYPE Hollow Stem Augers, Casing and Washboring, NQ Coring | COMPILED BY SS
DATUM Geodetic | DATE 07.10.03 - 10.10.03 | CHECKED BY SKP

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	UNIT WEIGHT γ kN/m³	GR	SA	SI	CL
151.6 / 150.6	**TOPSOIL** (125mm)								
0.1	Sandy **SILT**, some gravel, occasional rootlets Loose Brown Moist (FILL) (ML)	1	SS	9					
150.9 / 0.7	Silty **CLAY** to **CLAY**, occasional oxide staining, sand seams and trace rootlets to 2.2m Stiff to Firm Brown/ Grey Moist (CI-CH) (dessicated crust)	2	SS	13					
		3	SS	10					
		4	SS	7		0	1	37	63
		5	SS	7					
		6	SS	8					
146.0 / 5.6	Grey	7	SS	6					
		8	SS	6					
		9	SS	4					
141.6									

STRAT PLOT | GROUND WATER CONDITIONS | ELEVATION SCALE (151, 150, 149, 148, 147, 146, 145, 144, 143, 142)

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)

REMARKS & GRAIN SIZE DISTRIBUTION (%)

Continued Next Page

+³, ×³: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4 7450BRU.GPJ 04/06/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No BRU-1

METRIC

G.W.P. 647-92-00 | LOCATION N 5 039 746.0 E 291 406.0 (Bruce Street) | ORIGINATED BY JL
HWY HWY 17 | BOREHOLE TYPE Hollow Stem Augers, Casing and Washboring, NQ Coring | COMPILED BY SS
DATUM Geodetic | DATE 07.10.03 - 10.10.03 | CHECKED BY SKP

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
10.0	Silty **CLAY**, to **CLAY**, sand seams Firm Grey (CI-CH)					
		10	SS	4		0 1 63 37
		1	TW	PH	18.0	Consolidation Test
		11	SS	3		
	inferred sand and silt layers and seams	12	SS	3		Blow back in augers
		13	SS	3		
		14	SS	4		Commence casing and washboring
		15	SS	5		
131.6						

SOIL PROFILE: STRAT PLOT; GROUND WATER CONDITIONS; ELEVATION SCALE (141, 140, 139, 138, 137, 136, 135, 134, 133, 132)

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)

Plot points: 10.5; >10; >10

Continued Next Page

+³, ×³: Numbers refer to Sensitivity

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

ONTMT4 7450BRU.GPJ 04/06/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No BRU-1

METRIC

G.W.P. 647-92-00 | LOCATION N 5 039 748.0 E 291 406.0 (Bruce Street) | ORIGINATED BY JL
HWY HWY 17 | BOREHOLE TYPE Hollow Stem Augers, Casing and Washboring, NQ Coring | COMPILED BY SS
DATUM Geodetic | DATE 07.10.03 - 10.10.03 | CHECKED BY SKP

SOIL PROFILE ELEV DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES 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
20.0	Silty **CLAY**, to **CLAY** Firm to Soft Grey (CI-CH)		2	TW	PH						
			16	SS	3		131		○		0 5 64 31
	sand and silt layers and seams		17	SS	3		130		○		
							129				
			18	SS	3				○		
							128	>10 +			
			19	SS	2		127		○		
											Blow back in augers
							126				
							125				
			20	SS	4				○		0 1 68 31
							124				
							123				Commence use of drilling mud
							122				
121.6											

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+ 3, × 3: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4 7450BRU.GPJ 04/06/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No BRU-1

METRIC

G.W.P. 647-92-00 | LOCATION N 5 039 748.0 E 291 406.0 (Bruce Street) | ORIGINATED BY JL
HWY HWY 17 | BOREHOLE TYPE Hollow Stem Augers, Casing and Washboring, NQ Coring | COMPILED BY SS
DATUM Geodetic | DATE 07.10.03 - 10.10.03 | CHECKED BY SKP

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES
30.0	Silty **CLAY** to **CLAY**, with sand and silt layers and seams Firm Grey (CI-CH)	21	SS	5
	move frequent sand layers	22	SS	23
116.0				
35.6	Silty **SAND** to Sandy **SILT**, trace clay Dense Grey Wet	23	SS	32
113.2				
38.4	Silty **CLAY** to **CLAY**, with sand and silt layers and seams Stiff Grey Moist to Wet	24	SS	15

SOIL PROFILE | STRAT PLOT | SAMPLES | GROUND WATER CONDITIONS | ELEVATION SCALE

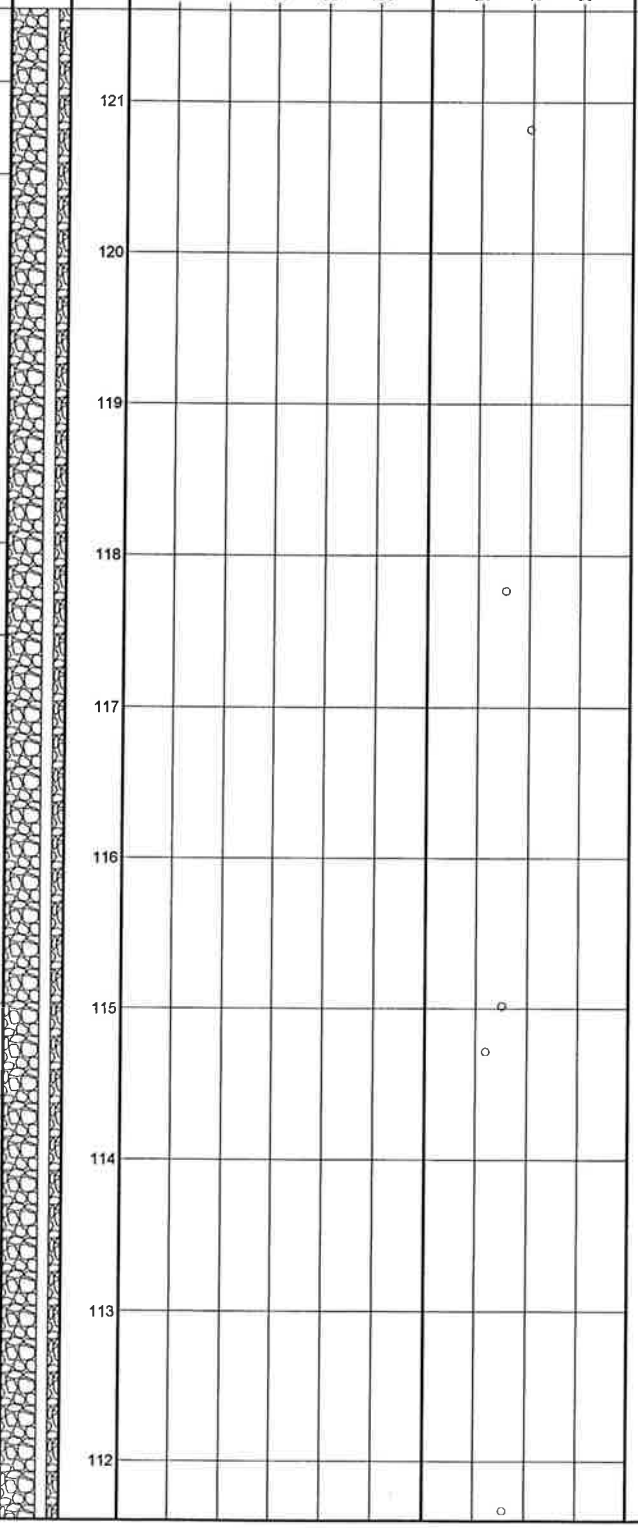
DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

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



Continued Next Page

+³, ×³: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No BRU-1

METRIC

G.W.P. 647-92-00 | LOCATION N 5 039 748.0 E 291 406.0 (Bruce Street) | ORIGINATED BY JL
HWY HWY 17 | BOREHOLE TYPE Hollow Stem Augers, Casing and Washboring, NQ Coring | COMPILED BY SS
DATUM Geodetic | DATE 07.10.03 - 10.10.03 | CHECKED BY SKP

ELEV / DEPTH	SOIL PROFILE: DESCRIPTION	STRAT PLOT	SAMPLES: 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
	Silty **CLAY** to **CLAY**, with sand and silt layers and seams Stiff Grey						111 110				
109.1											
42.5	Silty **SAND**, some gravel, frequent cobbles and boulders Very Dense Grey (TILL)		25	SS	110		109				
			1	RUN			108				
	no recovery from 44.42m to 45.62m		2	RUN			107				
	boulder from 46.13m to 46.76m		3	RUN			106				
	no recovery from 46.69m to 47.14m						105				
	no recovery from 47.88m to 48.67m		4	RUN			104				
102.8					FI		103				
48.8	**MARBLE (BEDROCK)** Slightly to moderately weathered, grey, brown and white with subhorizontal black banding, strong. Subvertical joint at 49.8m. Multiple vertical and subvertical joints at 49.9m		5	RUN	1 0 1 >5		102				RUN 5# TCR=98%, SCR=67%, RQD=66%, UCS=79MPa

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+³, ×³: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No BRU-1

METRIC

G.W.P. 647-92-00 | LOCATION N 5 039 748.0 E 291 406.0 (Bruce Street) | ORIGINATED BY JL
HWY HWY 17 | BOREHOLE TYPE Hollow Stem Augers, Casing and Washboring, NQ Coring | COMPILED BY SS
DATUM Geodetic | DATE 07.10.03 - 10.10.03 | CHECKED BY SKP

SOIL PROFILE			SAMPLES					DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE; ● QUICK TRIAXIAL × LAB VANE (20 40 60 80 100)	WATER CONTENT (%) (20 40 60)	γ kN/m^3	GR SA SI CL
101.4											
50.2	END OF BOREHOLE AT 50.19m. BOREHOLE OPEN TO 45.72m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.						101				

WATER LEVEL READINGS:

DATE	ELEVATION(m)
22/10/03	145.2
18/12/03	146.2
04/02/04	145.8
11/03/04	146.0

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

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4 7450BRU.GPJ 04/06/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No BRU-2

METRIC

G.W.P. 647-92-00 | LOCATION N 5 039 748.7 E 291 445.8 (Bruce Street) | ORIGINATED BY JL
HWY HWY 17 | BOREHOLE TYPE Hollow Stem Augers, Casing and Washboring, NQ Coring | COMPILED BY SS
DATUM Geodetic | DATE 17.10.03 - 21.10.03 | CHECKED BY SKP

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	GR	SA	SI	CL
150.3 / 0.0	**SAND and GRAVEL** Compact Brown Moist (FILL)	1	SS	16	150						
149.6 / 0.7	Silty **CLAY** to **CLAY**, sand seams Firm to Stiff Grey/ Brown (CI-CH) (dessicated crust)	2	SS	5	149						
		3	SS	10							
		4	SS	14	148			0	1	46	53
		5	SS	10	147						
		6	SS	7	146						
144.5 / 5.8	grey				145						
		7	SS	6	144						
		8	SS	8	143						
		9	SS	7	142						
					141						

Legend: 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

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+³, ×³: Numbers refer to Sensitivity

15 ⊕ 20 5 10 (%) STRAIN AT FAILURE

Ministry of Transportation
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THURBER

RECORD OF BOREHOLE No BRU-2

METRIC

G.W.P. 647-92-00 | LOCATION N 5 039 748.7 E 291 445.8 (Bruce Street) | ORIGINATED BY JL
HWY HWY 17 | BOREHOLE TYPE Hollow Stem Augers, Casing and Washboring, NQ Coring | COMPILED BY SS
DATUM Geodetic | DATE 17.10.03 - 21.10.03 | CHECKED BY SKP

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	GR	SA	SI	CL	REMARKS & GRAIN SIZE DISTRIBUTION (%)
	Silty **CLAY** to **CLAY**, sand seams Firm Grey (CI-CH)				140						
		10	SS	7			0	2	61	37	
					139						
		11	SS	6	138						
					137						
		12	SS	5	136						
		13	SS	7	135						
					134						
		1	TW	PH	133						
	Very Soft to Soft										Commence casing and washboring
		14	SS	1	132						
					131						

STRAT PLOT | GROUND WATER CONDITIONS

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

Continued Next Page

+³, ×³: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No BRU-2

METRIC

G.W.P. 647-92-00 | LOCATION N 5 039 748.7 E 291 445.8 (Bruce Street) | ORIGINATED BY JL
HWY HWY 17 | BOREHOLE TYPE Hollow Stem Augers, Casing and Washboring, NQ Coring | COMPILED BY SS
DATUM Geodetic | DATE 17.10.03 - 21.10.03 | CHECKED BY SKP

SOIL PROFILE			SAMPLES			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 (%)			
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR	SA	SI	CL
	Silty **CLAY** to **CLAY** with sand and silt layers and seams Very Soft to Soft Grey (CI-CH)						130							
							129							
			15	SS	2				○					
							128							
							127							
							126							
			16	SS	3				○		0	0	62	37
								+>10						
							125							
							124							
							123							
			2	TW	PH									
							122							
							121							

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+ 3, × 3 : Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No BRU-2

METRIC

G.W.P. 647-92-00 | LOCATION N 5 039 748.7 E 291 445.8 (Bruce Street) | ORIGINATED BY JL
HWY HWY 17 | BOREHOLE TYPE Hollow Stem Augers, Casing and Washboring, NQ Coring | COMPILED BY SS
DATUM Geodetic | DATE 17.10.03 - 21.10.03 | CHECKED BY SKP

SOIL PROFILE ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES 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
	Silty **CLAY** to **CLAY** with sand and silt layers and seams Soft to Firm Grey (CI-CH)						120				
			17	SS	4				○		
							119				
							118				
							117				
116.4			18	SS	11				○		
33.9	Silty **SAND** to Sandy **SILT**, trace to some clay Compact Grey Wet								○		
							116				
							115				
							114				
			19	SS	12				○		0 28 50 22
							113				
111.9							112				
38.4	Silty **CLAY** to **CLAY**, with sand and silt layers and seams Stiff Grey Wet						111				
			20	SS	9				○		

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+³, ×³: Numbers refer to Sensitivity

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

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No BRU-2

METRIC

G.W.P. 647-92-00 | LOCATION N 5 039 748.7 E 291 445.8 (Bruce Street) | ORIGINATED BY JL
HWY HWY 17 | BOREHOLE TYPE Hollow Stem Augers, Casing and Washboring, NQ Coring | COMPILED BY SS
DATUM Geodetic | DATE 17.10.03 - 21.10.03 | CHECKED BY SKP

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Silty **CLAY** to **CLAY**						110, 109, 108				
107.4											
42.9	Silty **SAND**, some gravel, frequent cobbles and boulders, occasional clayey silt seams/ partings Grey Very Dense Wet (TILL)		21	SS	26		107				Advancing NW casing and cleaning with NQ core barrel
			1	WS			106				
			2	WS			105				
			3	WS			104				
			4	WS			103, 102				
			5	WS			101				

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+ 3, × 3: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 7450BRU.GPJ 04/06/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No BRU-2

METRIC

G.W.P. 647-92-00 | LOCATION N 5 039 748.7 E 291 445.8 (Bruce Street) | ORIGINATED BY JL
HWY HWY 17 | BOREHOLE TYPE Hollow Stem Augers, Casing and Washboring, NQ Coring | COMPILED BY SS
DATUM Geodetic | DATE 17.10.03 - 21.10.03 | CHECKED BY SKP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES 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
100.0			6	WS	FI						
50.3	**MARBLE (BEDROCK)** Slightly to moderately weathered, grey, brown and white with subhorizontal black banding, very strong. Subvertical joint from 50.8m to 50.9m. Vertical joint at 52.7m.		1	RUN	0, 2, 4, 3, 3		100, 99				RUN 1# TCR=100%, SCR=73%, RQD=52%, UCS=128MPa
			2	RUN	1, 4, 3, 5, 4		98				RUN 2# TCR=98%, SCR=88%, RQD=63%, UCS=133MPa
97.1											
53.2	END OF BOREHOLE AT 53.2m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.										

WATER LEVEL READINGS:

DATE	ELEVATION(m)
22/10/2003	148.5
18/12/2003	destroyed

+ ³, × ³: Numbers refer to Sensitivity

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

ONTMT4 7450BRU.GPJ 04/06/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No BRU-3

METRIC

G.W.P. 647-92-00 | LOCATION N 5 039 768.7 E 291 479.6 (Bruce Street) | ORIGINATED BY JL
HWY HWY 17 | BOREHOLE TYPE Hollow Stem Augers, Casing and Washboring, NQ Coring | COMPILED BY SS
DATUM Geodetic | DATE 27.10.03 - 29.10.03 | CHECKED BY SKP

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
149.3									
149.2 / 0.2	**TOPSOIL** (150mm)								
	Black Silty **CLAY** to **CLAY**, trace rootlets, trace gravel to 1.4m Stiff to Very Stiff Brown Moist to Wet (CI-CH) (dessicated crust)	1	SS	8					
		2	SS	15					
		3	SS	16					
		4	SS	10		0	0	40	60
		5	SS	6					
		6	SS	10					
		7	SS	10					
142.2 / 7.1	becoming grey								
		8	SS	8					
	frequent sand and silt layers and seams								Vane could not be turned
		9	SS	11					
139.3									

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+ ³, × ³: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4 7450BRU.GPJ 04/06/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No BRU-3

METRIC

G.W.P. 647-92-00 | LOCATION N 5 039 768.7 E 291 479.6 (Bruce Street) | ORIGINATED BY JL
HWY HWY 17 | BOREHOLE TYPE Hollow Stem Augers, Casing and Washboring, NQ Coring | COMPILED BY SS
DATUM Geodetic | DATE 27.10.03 - 29.10.03 | CHECKED BY SKP

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	GR	SA	SI	CL	REMARKS & GRAIN SIZE DISTRIBUTION (%)
10.0	Silty **CLAY** to **CLAY** Stiff Grey (CI-CH) (dessicated crust)				139							
		10	SS	12								
					138							
					137							
		11	SS	12								
					136							
	with sand and silt layers and seams below this level	12	SS	12								
					135							
					134							
		13	SS	9				0	2	73	25	
					133							
	Firm	14	SS	7								Commence casing and washboring Vane could not be turned
					132							
					131							
		15	SS	5								
					130							
129.3												

STRAT PLOT | GROUND WATER CONDITIONS

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

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+³, ×³: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No BRU-3

METRIC

G.W.P. 647-92-00 | LOCATION N 5 039 768.7 E 291 479.6 (Bruce Street) | ORIGINATED BY JL
HWY HWY 17 | BOREHOLE TYPE Hollow Stem Augers, Casing and Washboring, NQ Coring | COMPILED BY SS
DATUM Geodetic | DATE 27.10.03 - 29.10.03 | CHECKED BY SKP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"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
20.0	Silty **CLAY** to **CLAY**, with sand and silt layers and seams Soft to Firm Grey (CI-CH)						129				
							128				
			1	TW	PH						
							127				Vane could not be turned Casing sank under self weight from 22.5m to 24.4m depth
							126				
							125				
			16	SS	1				○		
							124				
							123				Casing sank under self weight from 25.9m to 27.4m depth
							122				
	move frequent sand and silt layers and seams						121				
			17	SS					○		0 3 78 19
							120				Sampler dropped down hole, no "N" value obtained
119.3											

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

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

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No BRU-3

METRIC

G.W.P. 647-92-00 | LOCATION N 5 039 768.7 E 291 479.6 (Bruce Street) | ORIGINATED BY JL
HWY HWY 17 | BOREHOLE TYPE Hollow Stem Augers, Casing and Washboring, NQ Coring | COMPILED BY SS
DATUM Geodetic | DATE 27.10.03 - 29.10.03 | CHECKED BY SKP

ELEV / DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	SAMPLE NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
30.0	Silty **CLAY** to **CLAY**, with sand and silt layers and seams Stiff Grey (CI-CH)		18	SS	14		119 118 117 116				Vane could not be turned
115.6											
33.7	Silty **SAND** to Sandy **SILT** Very Dense Grey Wet		19	SS	97/.279		115 114				0 73 27 (SI+CL)
113.2											
36.1	Silty **CLAY** to **CLAY**, with sand and silt layers and seams Hard Grey Wet		20	SS	50/.127		113 112 111 110				
	frequent inferred cobbles		21	SS	50/.076						
109.3											

Continued Next Page

+³, ×³: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No BRU-3

METRIC

G.W.P. 647-92-00 | LOCATION N 5 039 768.7 E 291 479.6 (Bruce Street) | ORIGINATED BY JL
HWY HWY 17 | BOREHOLE TYPE Hollow Stem Augers, Casing and Washboring, NQ Coring | COMPILED BY SS
DATUM Geodetic | DATE 27.10.03 - 29.10.03 | CHECKED BY SKP

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
40.0	Silty **CLAY** to **CLAY**, with sand and silt layers and seams Grey				
	some gravel, occasional cobbles and boulders	1	WS		
105.2					
44.1	Silty **SAND**, some gravel, occasional cobbles and boulders Grey Wet (TILL)				
	boulder from 45.11m to 45.49m	2	WS		
		3	WS		
100.7				FI	
48.6	**MARBLE (BEDROCK)** Slightly to moderately weathered, grey, brown and white with subhorizontal black banding, strong Multiple subvertical joints at 50.2m Subvertical joints at 49.2m and 50.0m Vertical joint at 50.9m	1	RUN	0 3 3 3	RUN 1# TCR=100%, SCR=100%, RQD=79%, UCS=90MPa

STRAT PLOT | GROUND WATER CONDITIONS | ELEVATION SCALE (109, 108, 107, 106, 105, 104, 103, 102, 101, 100)

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

Continued Next Page

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

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4 7450BRU.GPJ 04/06/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No BRU-3

METRIC

G.W.P. 647-92-00 | LOCATION N 5 039 768.7 E 291 479.6 (Bruce Street) | ORIGINATED BY JL

HWY HWY 17 | BOREHOLE TYPE Hollow Stem Augers, Casing and Washboring, NQ Coring | COMPILED BY SS

DATUM Geodetic | DATE 27.10.03 - 29.10.03 | CHECKED BY SKP

SOIL PROFILE			SAMPLES					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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE				GR SA SI CL
	MARBLE		2	RUN	2 3 0 5		99				RUN 2# TCR=100%, SCR=98%, RQD=78%, UCS=99MPa
98.1											
51.2	END OF BOREHOLE AT 51.18m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.										

WATER LEVEL READINGS:

DATE	ELEVATION(m)
18/12/2003	145.8
04/02/2004	145.2
11/03/2004	145.7

+ 3, × 3 : Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

THURBER

Appendix B.3

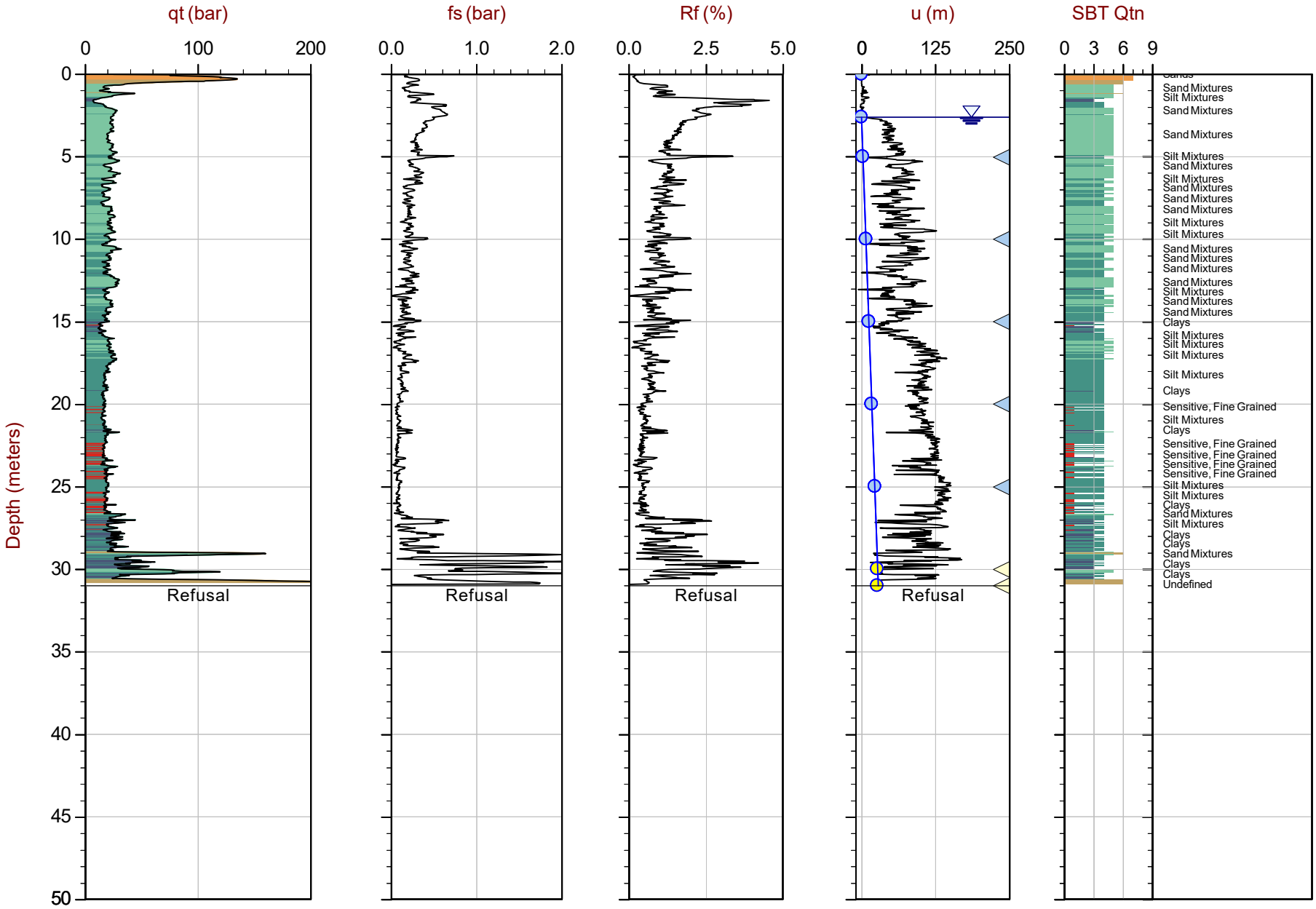
Cone Penetration Test Summary Sheets (ConeTec Investigations Ltd.)

CONETEC

Thurber

Job No: 19-05076
Date: 2019-11-28 07:10
Site: Bruce Street

Sounding: BRU19-05
Cone: 377:T1000F10U500



Max Depth: 31.000 m / 101.70 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 19-05076_CP05.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: MTM 9N N: 5039813.70m E: 291524.10m Elev: 149.00m
Sheet No: 1 of 1

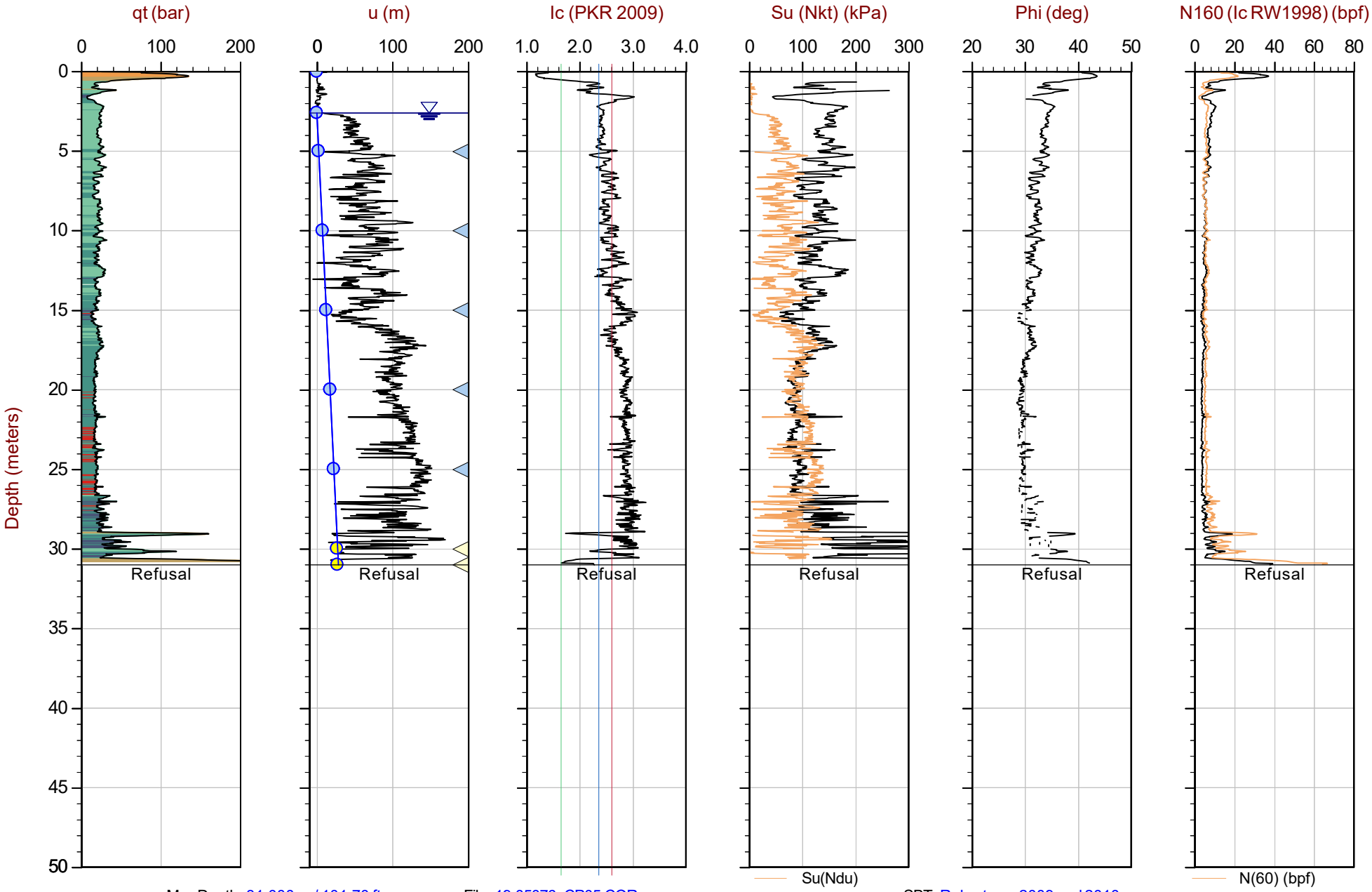
Overplot Item: Ueq · Assumed Ueq · Dissipation, Ueq achieved · Dissipation, Ueq not achieved · Dissipation, Ueq assumed · Hydrostatic Line

CONETEC

Thurber

Job No: 19-05076
Date: 2019-11-28 07:10
Site: Bruce Street

Sounding: BRU19-05
Cone: 377:T1000F10U500



Max Depth: 31.000 m / 101.70 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point
Overplot Item: Ueq, Assumed Ueq, Dissipation, Ueq achieved, Dissipation, Ueq not achieved, Dissipation, Ueq assumed, Hydrostatic Line

File: 19-05076_CP05.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt/Ndu: 15.0 / 9.0

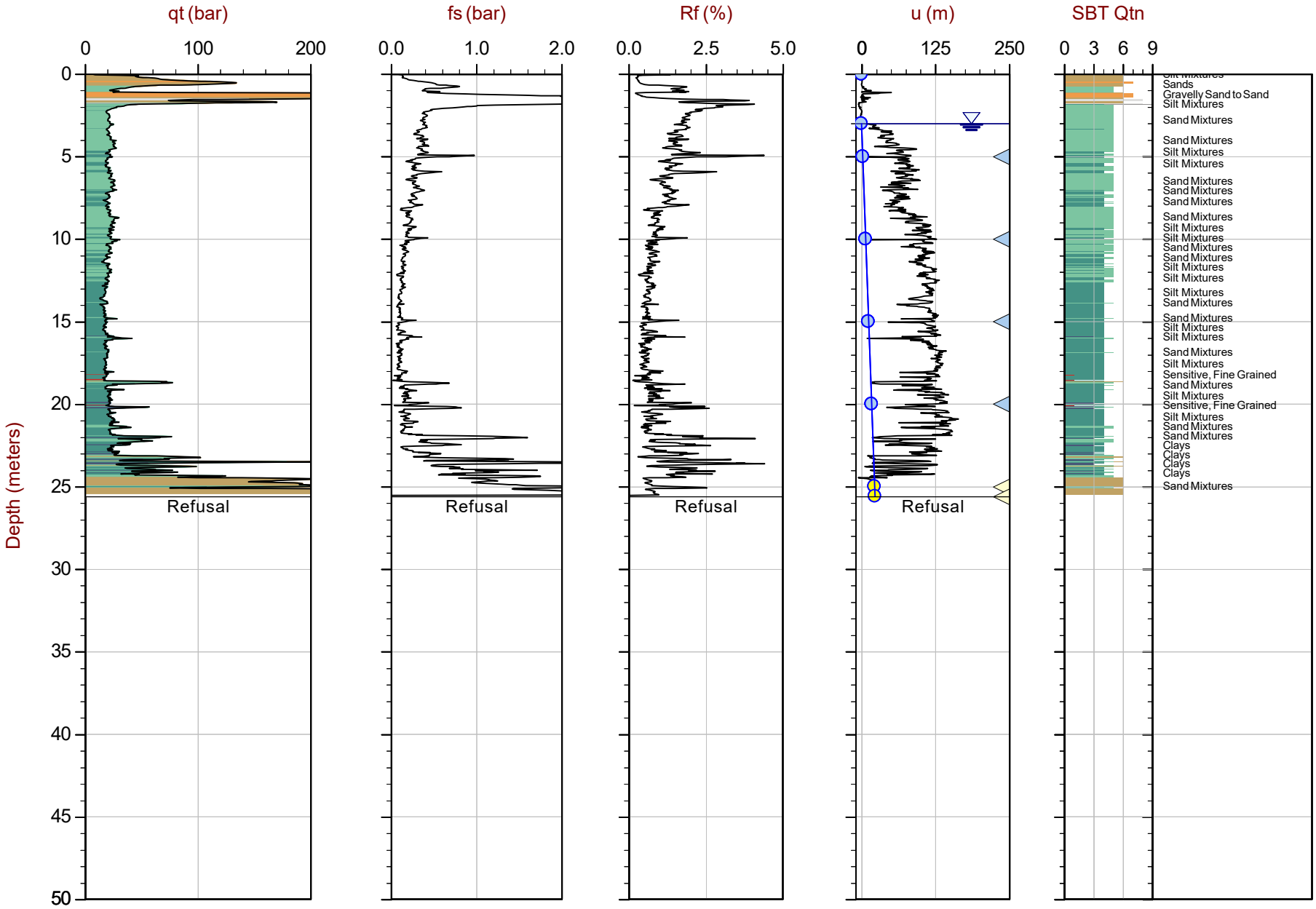
SBT: Robertson, 2009 and 2010
Coords: MTM 9N N: 5039813.70m E: 291524.10m Elev: 149.00m
Sheet No: 1 of 1

CONETEC

Thurber

Job No: 19-05076
Date: 2019-11-27 13:44
Site: Bruce Street

Sounding: BRU19-08
Cone: 377:T1000F10U500



Max Depth: 25.600 m / 83.99 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 19-05076_CP08.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: MTM 9N N: 5039910.20m E: 291640.10m Elev: 147.40m
Sheet No: 1 of 1

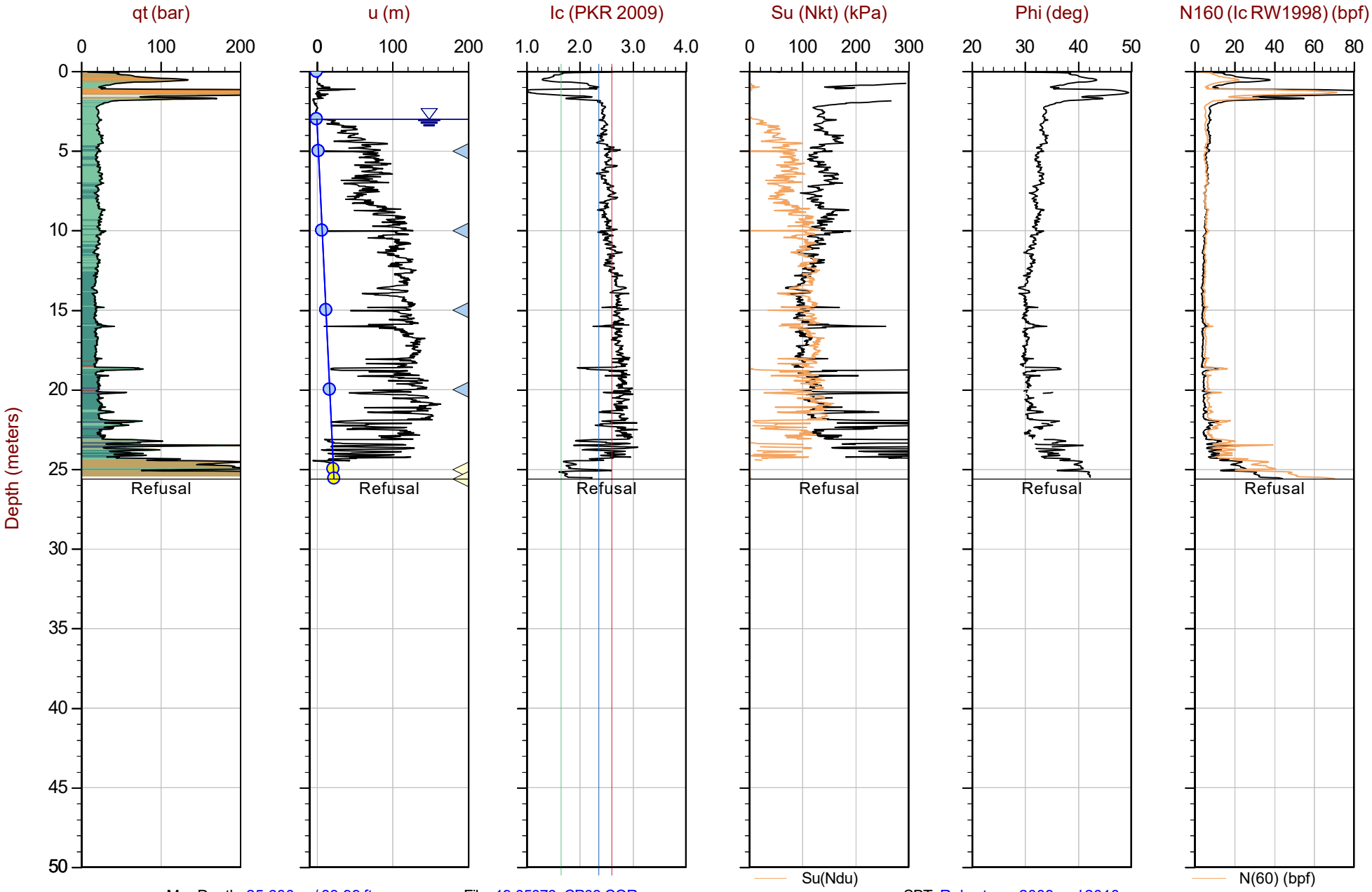
Overplot Item: Ueq, Assumed Ueq, Dissipation, Ueq achieved, Dissipation, Ueq not achieved, Dissipation, Ueq assumed, Hydrostatic Line

CONETEC

Thurber

Job No: 19-05076
Date: 2019-11-27 13:44
Site: Bruce Street

Sounding: BRU19-08
Cone: 377:T1000F10U500



Max Depth: 25.600 m / 83.99 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point
Overplot Item: Ueq, Assumed Ueq, Dissipation, Ueq achieved, Dissipation, Ueq not achieved, Dissipation, Ueq assumed, Hydrostatic Line

File: 19-05076_CP08.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt/Ndu: 15.0 / 9.0

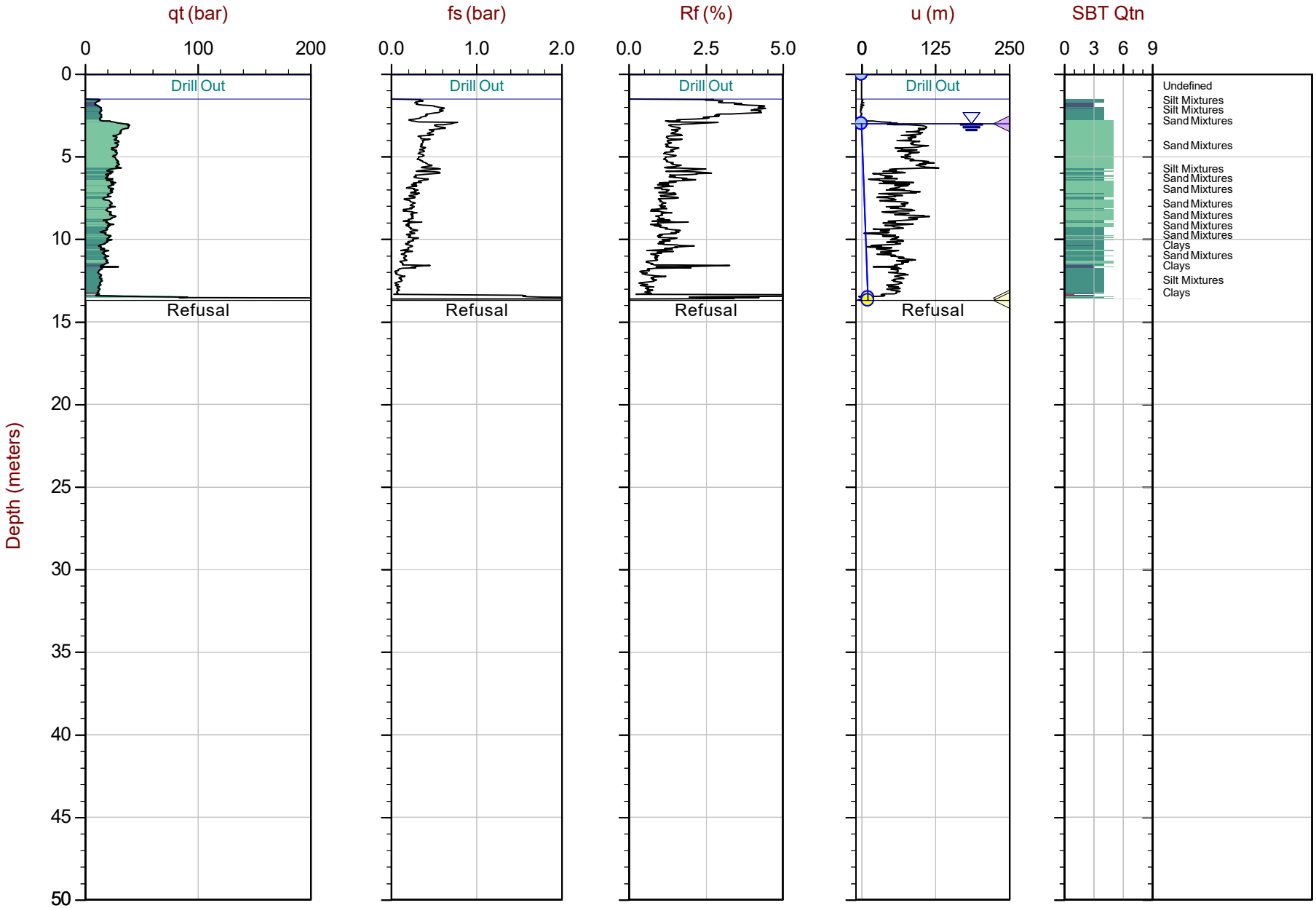
SBT: Robertson, 2009 and 2010
Coords: MTM 9N N: 5039910.20m E: 291640.10m Elev: 147.40m
Sheet No: 1 of 1

CONETEC

Thurber

Job No: 19-05076
Date: 2019-11-27 07:45
Site: Bruce Street

Sounding: BRU19-11
Cone: 377:T1000F10U500



Max Depth: 13.700 m / 44.95 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 19-05076_CP11.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: MTM 9N N: 5039628.10m E: 291230.20m Elev: 152.70m
Sheet No: 1 of 1

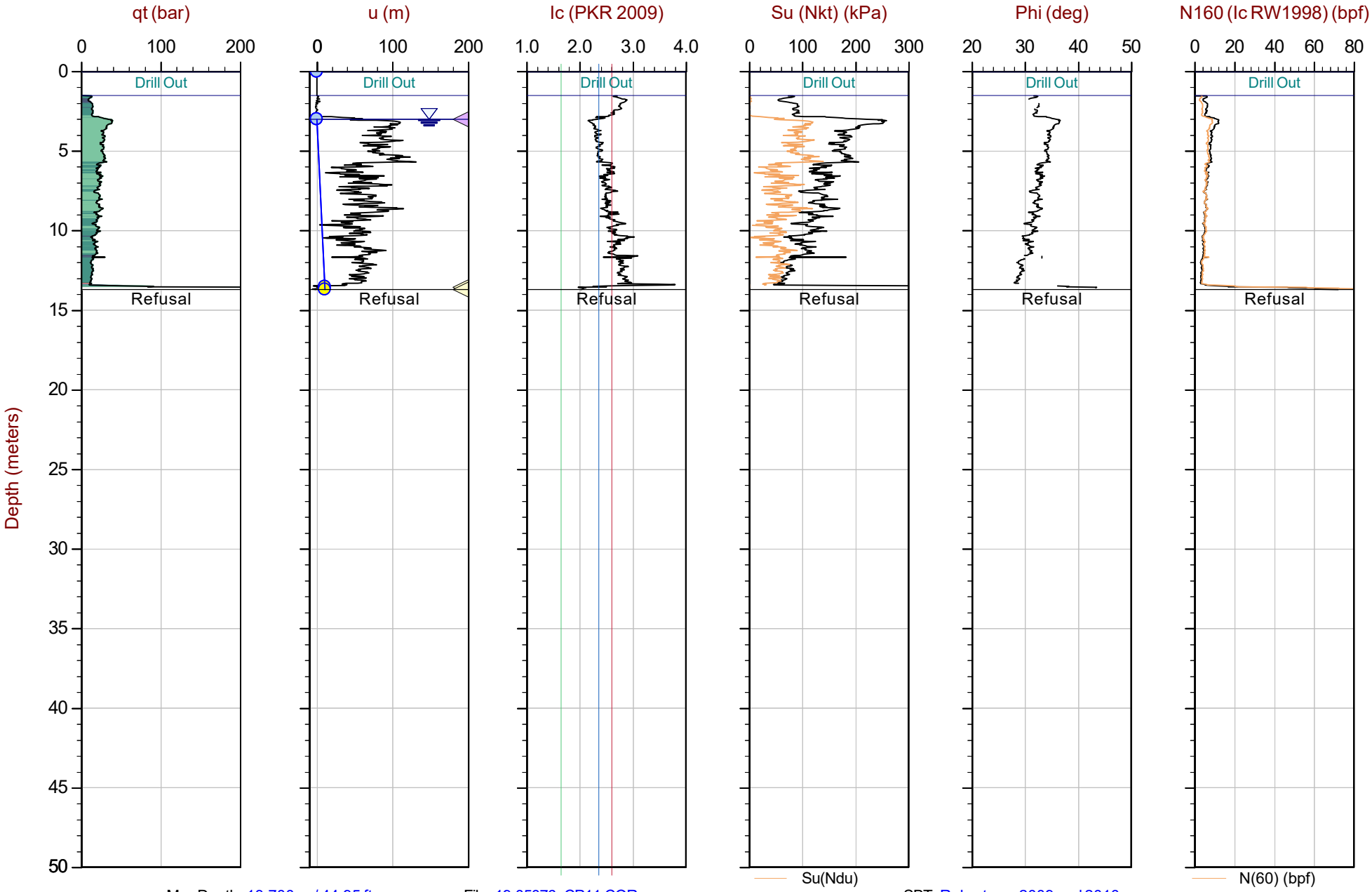
Overplot Item: Ueq, Assumed Ueq, Dissipation, Ueq achieved, Dissipation, Ueq not achieved, Dissipation, Ueq assumed, Hydrostatic Line

CONETEC

Thurber

Job No: 19-05076
Date: 2019-11-27 07:45
Site: Bruce Street

Sounding: BRU19-11
Cone: 377:T1000F10U500



Max Depth: 13.700 m / 44.95 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 19-05076_CP11.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt/Ndu: 15.0 / 9.0

SBT: Robertson, 2009 and 2010
Coords: MTM 9N N: 5039628.10m E: 291230.20m Elev: 152.70m
Sheet No: 1 of 1

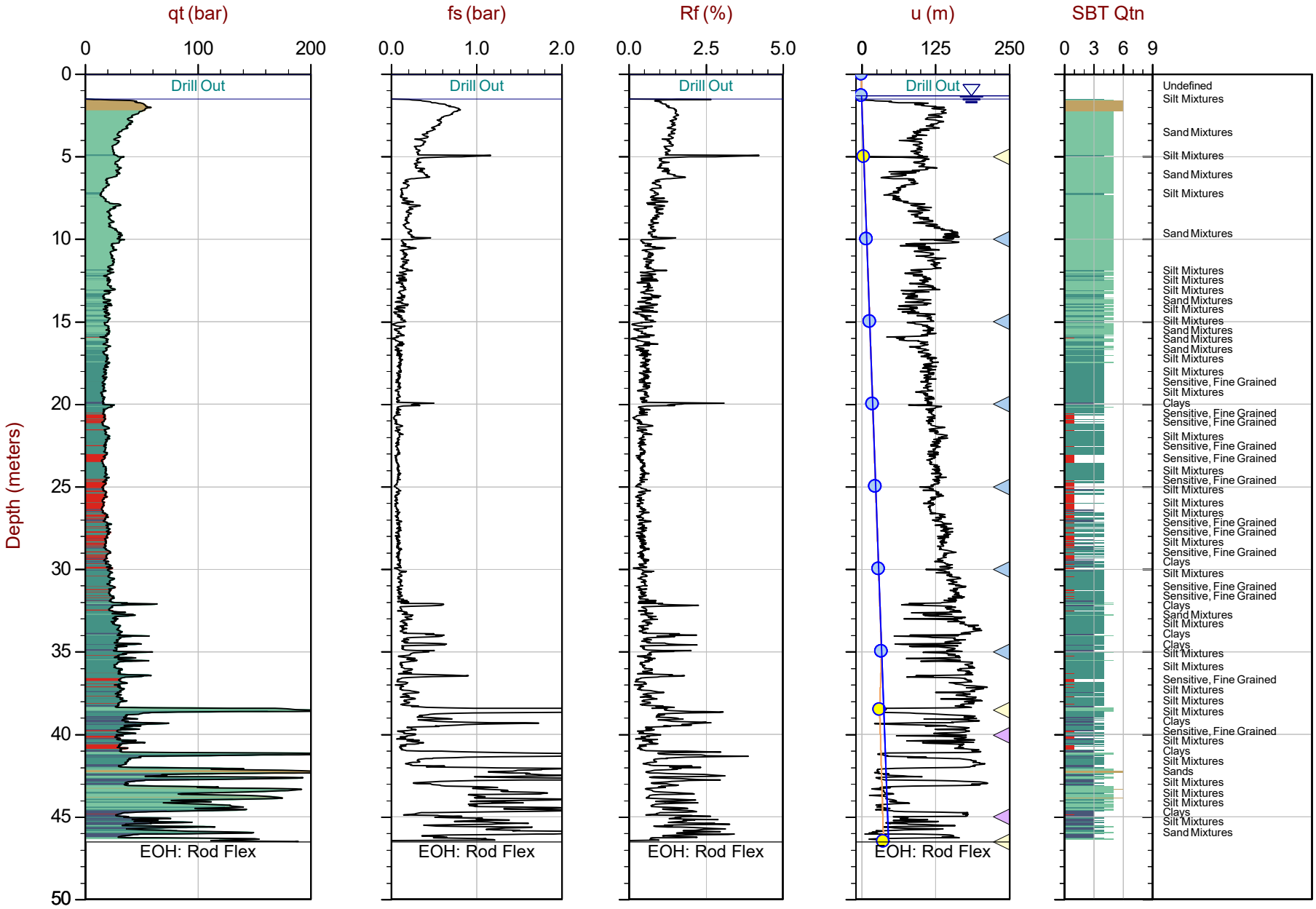
Overplot Item: Ueq, Assumed Ueq, Dissipation, Ueq achieved, Dissipation, Ueq not achieved, Dissipation, Ueq assumed, Hydrostatic Line

CONETEC

Thurber

Job No: 19-05076
Date: 2019-11-26 11:31
Site: Bruce Street

Sounding: BRU19-14
Cone: 377:T1000F10U500



Max Depth: 46.525 m / 152.64 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 19-05076_CP14.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: MTM 9N N: 5039706.80m E: 291367.50m Elev: 152.60m
Sheet No: 1 of 1

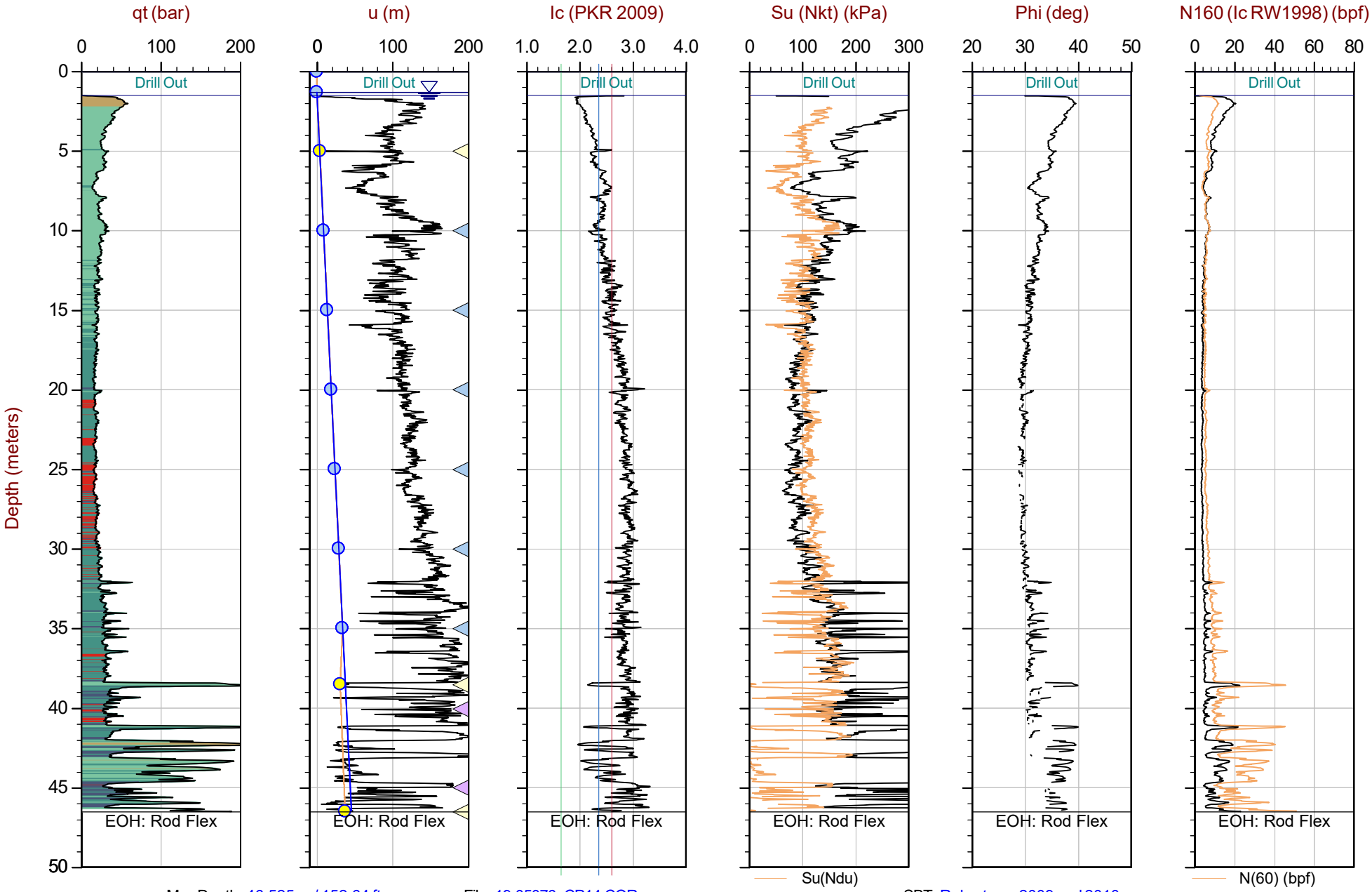
Overplot Item: Ueq, Assumed Ueq, Dissipation, Ueq achieved, Dissipation, Ueq not achieved, Dissipation, Ueq assumed, Hydrostatic Line, Ueq Line

CONETEC

Thurber

Job No: 19-05076
Date: 2019-11-26 11:31
Site: Bruce Street

Sounding: BRU19-14
Cone: 377:T1000F10U500



Max Depth: 46.525 m / 152.64 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point
Overplot Item: Ueq, Assumed Ueq

File: 19-05076_CP14.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt/Ndu: 15.0 / 9.0

SBT: Robertson, 2009 and 2010
Coords: MTM 9N N: 5039706.80m E: 291367.50m Elev: 152.60m
Sheet No: 1 of 1

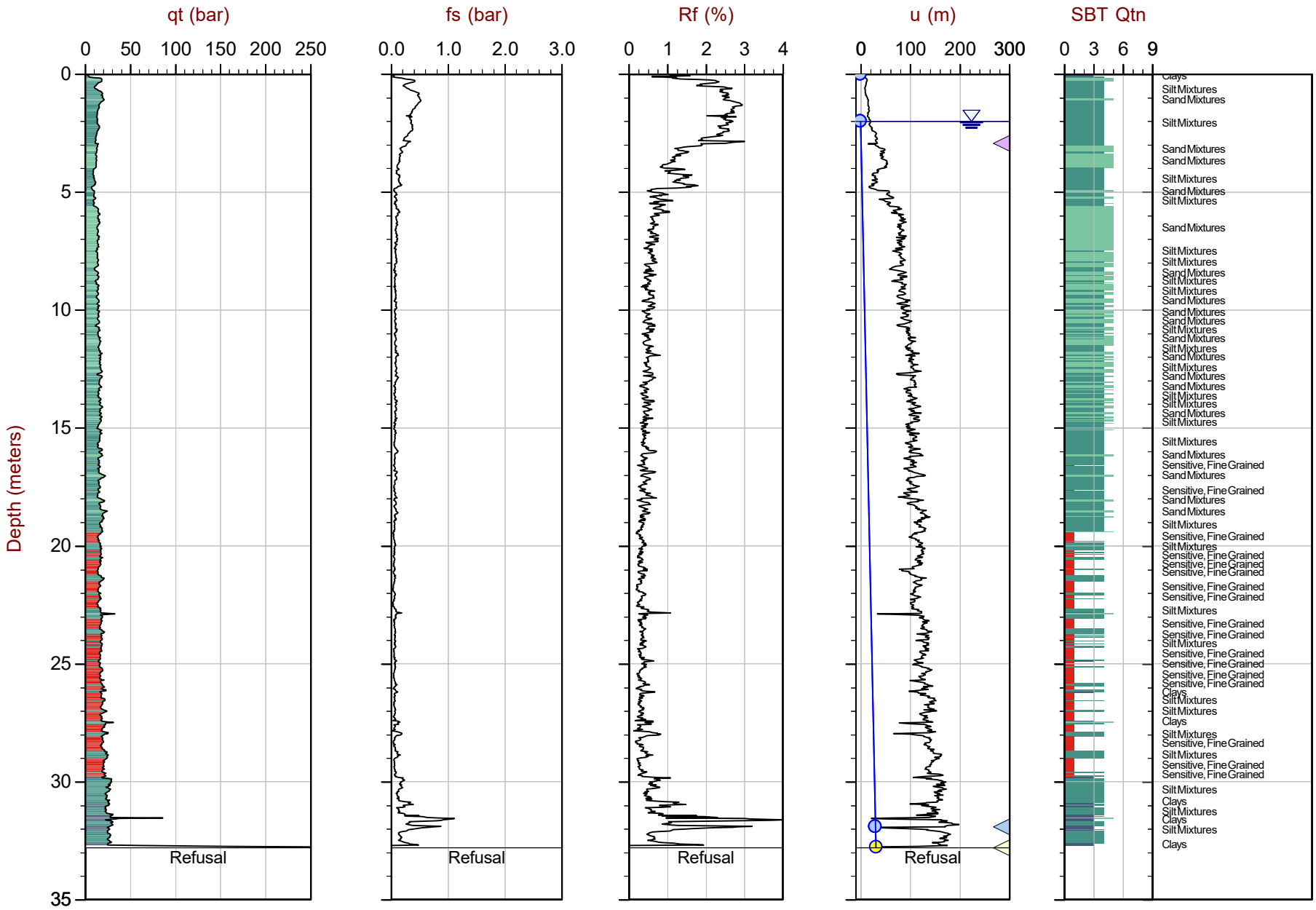
Dissipation, Ueq achieved; Dissipation, Ueq not achieved; Dissipation, Ueq assumed; Hydrostatic Line; Ueq Line

CONETEC

Thurber Engineering

Job No: 21-05-22576
Date: 2021-08-04 08:13
Site: Renfrew Ontario

Sounding: BRU-19-17
Cone: 609:T1500F15U35



Max Depth: 32.800 m / 107.61 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 21-05-22576_CP-19-17.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: MTM 9N N: 5039729.30m E: 291240.20m Elev: 149.9m
Page No: 1 of 1

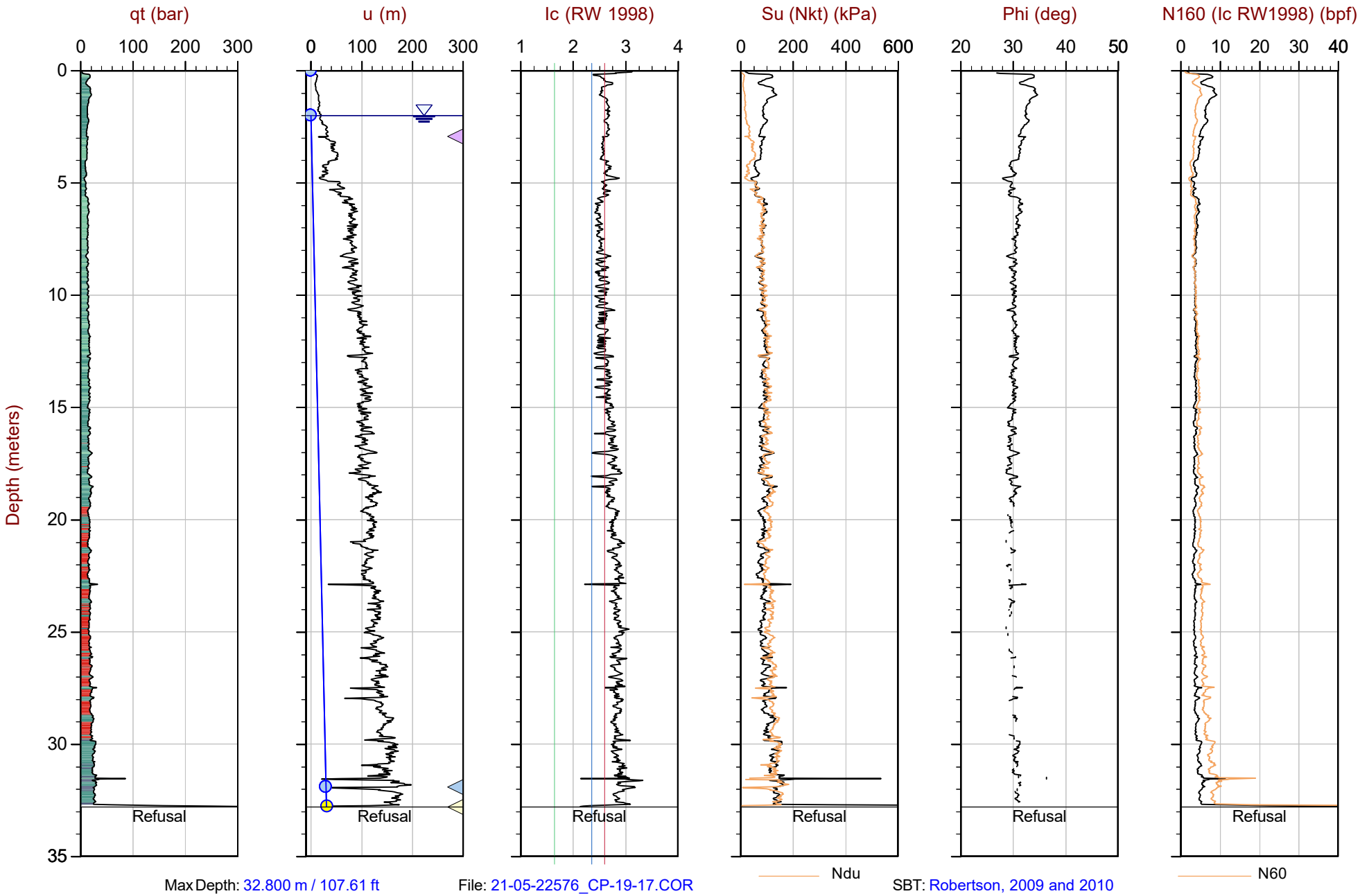
Overplot Item:
- Assumed Ueq
- Ueq
- Dissipation, equilibrium achieved
- Dissipation, equilibrium assumed
- Hydrostatic Line
- Dissipation, equilibrium not achieved
- Equilibrium Profile

CONETEC

Thurber Engineering

Job No: 21-05-22576
Date: 2021-08-04 08:13
Site: Renfrew Ontario

Sounding: BRU-19-17
Cone: 609:T1500F15U35



Max Depth: 32.800 m / 107.61 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point
Overplot Item:

File: 21-05-22576_CP-19-17.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt/Ndu: 15.0 / 9.0

SBT: Robertson, 2009 and 2010
Coords: MTM 9N N: 5039729.30m E: 291240.20m Elev: 149.9m
Page No: 1 of 1

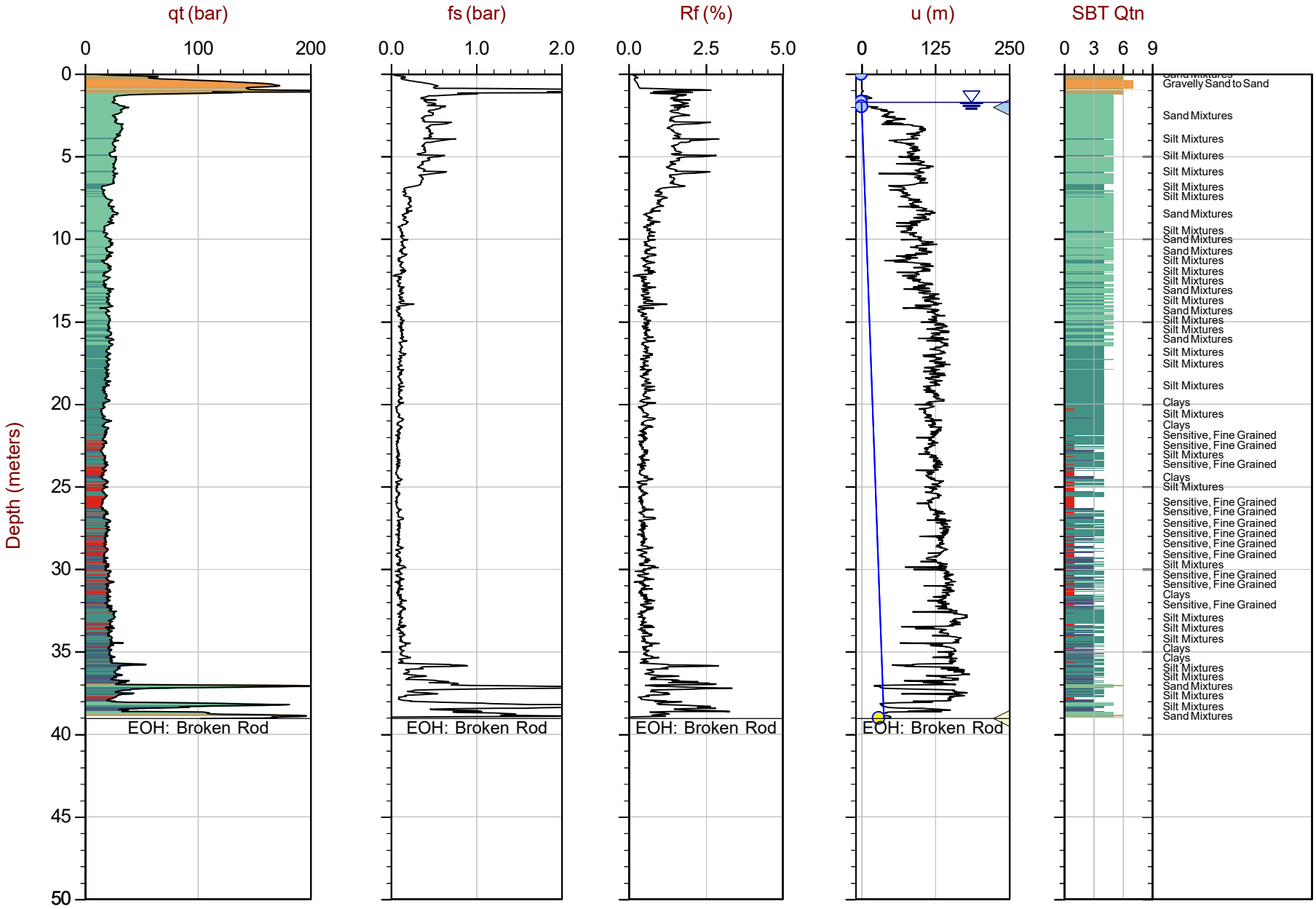
Assumed Ueq
Ueq
Dissipation, equilibrium achieved
Dissipation, equilibrium assumed
Hydrostatic Line
Equilibrium Profile
Dissipation, equilibrium not achieved

CONETEC

Thurber

Job No: 19-05076
Date: 2019-11-26 07:42
Site: Bruce Street

Sounding: BRU19-20
Cone: 377:T1000F10U500



Max Depth: 39.050 m / 128.12 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 19-05076_SP20.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: MTM 9N N: 5039735.10m E: 291411.00m Elev: 152.10m
Sheet No: 1 of 1

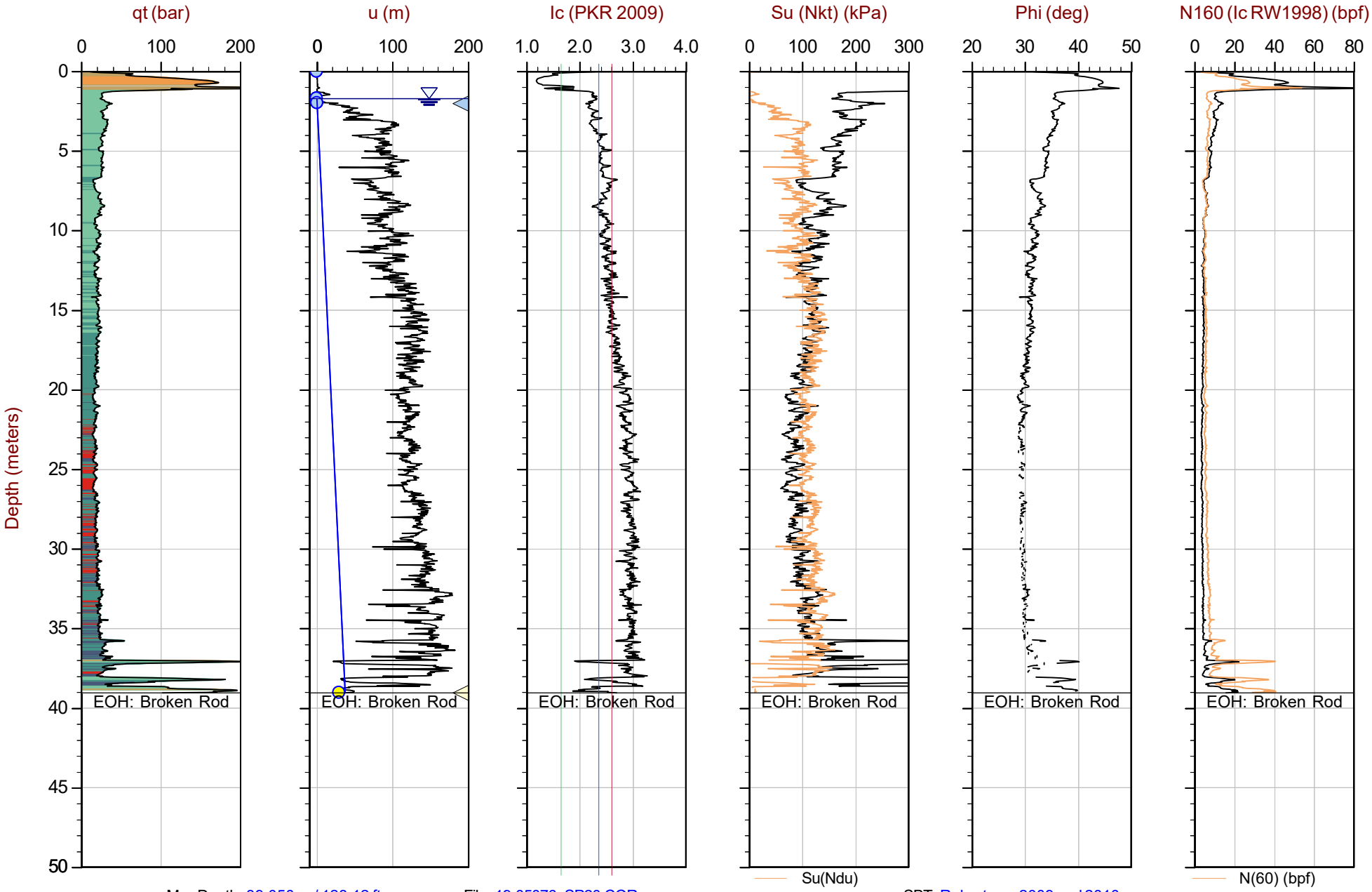
Overplot Item: Ueq, Assumed Ueq, Dissipation, Ueq achieved, Dissipation, Ueq not achieved, Dissipation, Ueq assumed, Hydrostatic Line

CONETEC

Thurber

Job No: 19-05076
Date: 2019-11-26 07:42
Site: Bruce Street

Sounding: BRU19-20
Cone: 377:T1000F10U500



Max Depth: 39.050 m / 128.12 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point
Overplot Item: Ueq, Assumed Ueq, Dissipation, Ueq achieved, Dissipation, Ueq not achieved, Dissipation, Ueq assumed, Hydrostatic Line

File: 19-05076_SP20.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt/Ndu: 15.0 / 9.0

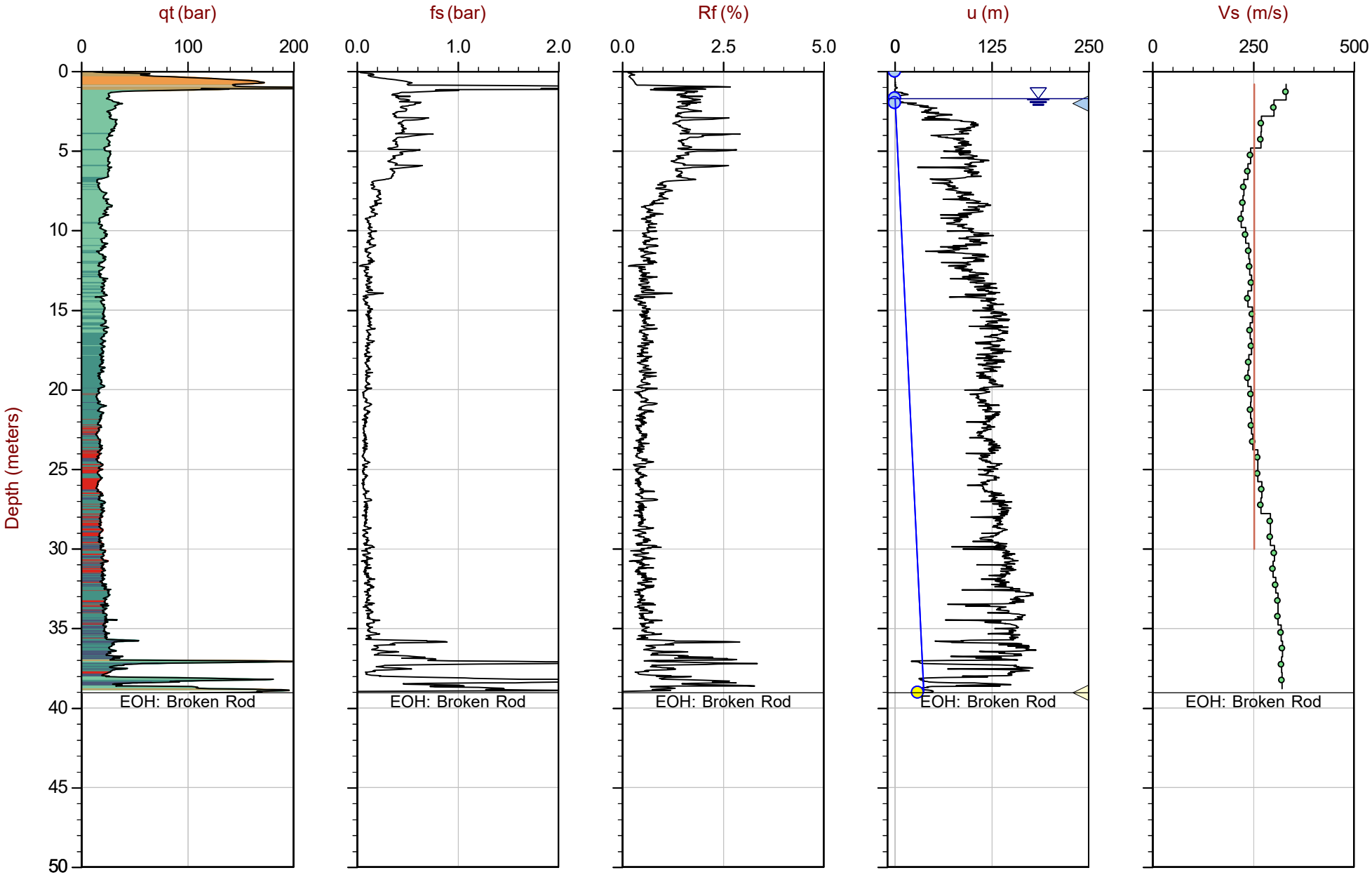
SBT: Robertson, 2009 and 2010
Coords: MTM 9N N: 5039735.10m E: 291411.00m Elev: 152.10m
Sheet No: 1 of 1

CONETEC

Thurber

Job No: 19-05076
Date: 2019-11-26 07:42
Site: Bruce Street

Sounding: BRU19-20
Cone: 377:T1000F10U500



Max Depth: 39.050 m / 128.12 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 19-05076_SP20.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: MTM 9N N: 5039735.10m E: 291411.00m Elev: 152.10m
Sheet No: 1 of 1

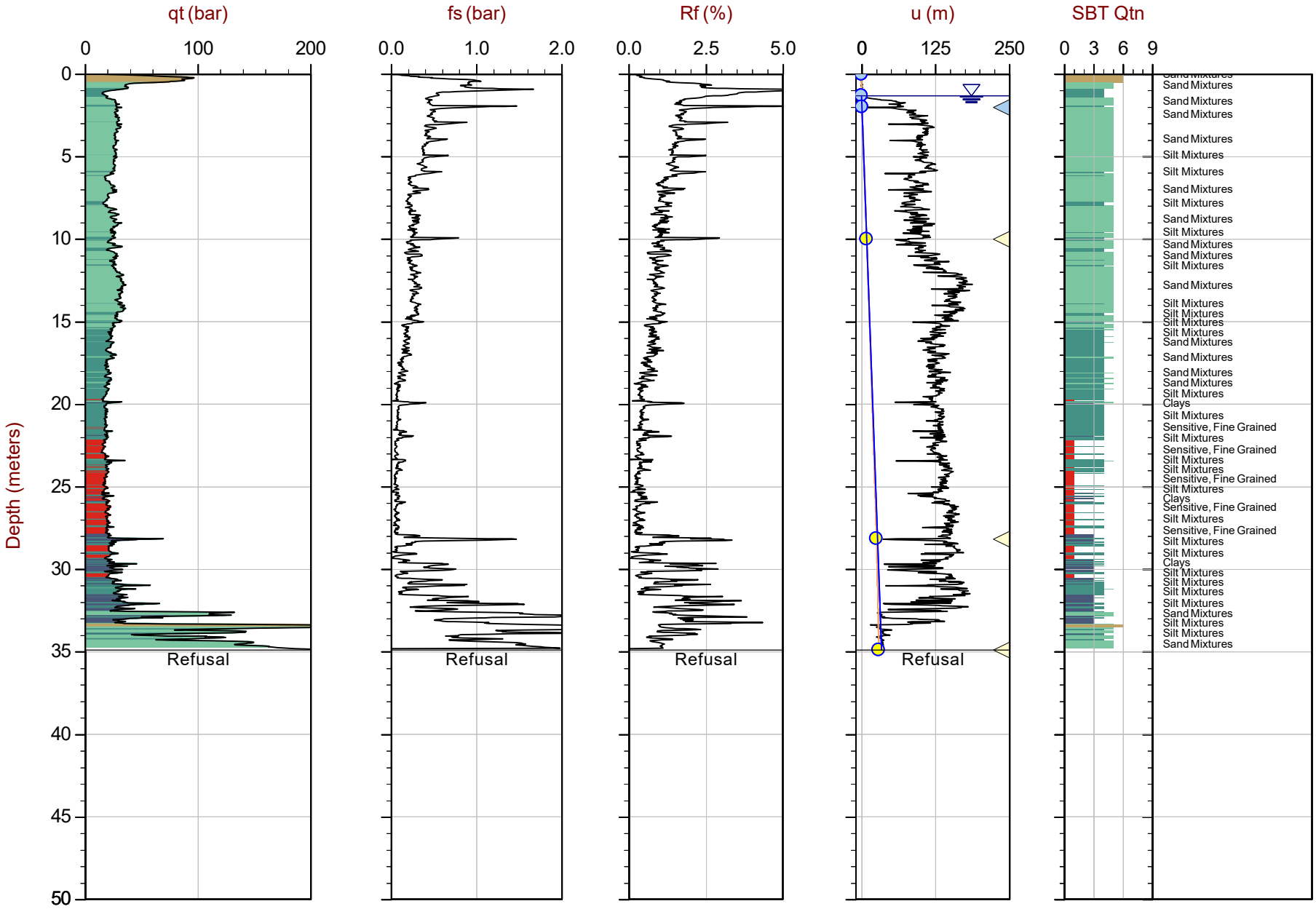
Overplot Item: Ueq | Assumed Ueq | Dissipation, Ueq achieved | Dissipation, Ueq not achieved | Dissipation, Ueq assumed | Hydrostatic Line

CONETEC

Thurber

Job No: 19-05076
Date: 2019-11-28 10:39
Site: Bruce Street

Sounding: BRU19-24
Cone: 377:T1000F10U500



Max Depth: 34.900 m / 114.50 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 19-05076_SP24.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: MTM 9N N: 5039779.70m E: 291476.80m Elev: 149.70m
Sheet No: 1 of 1

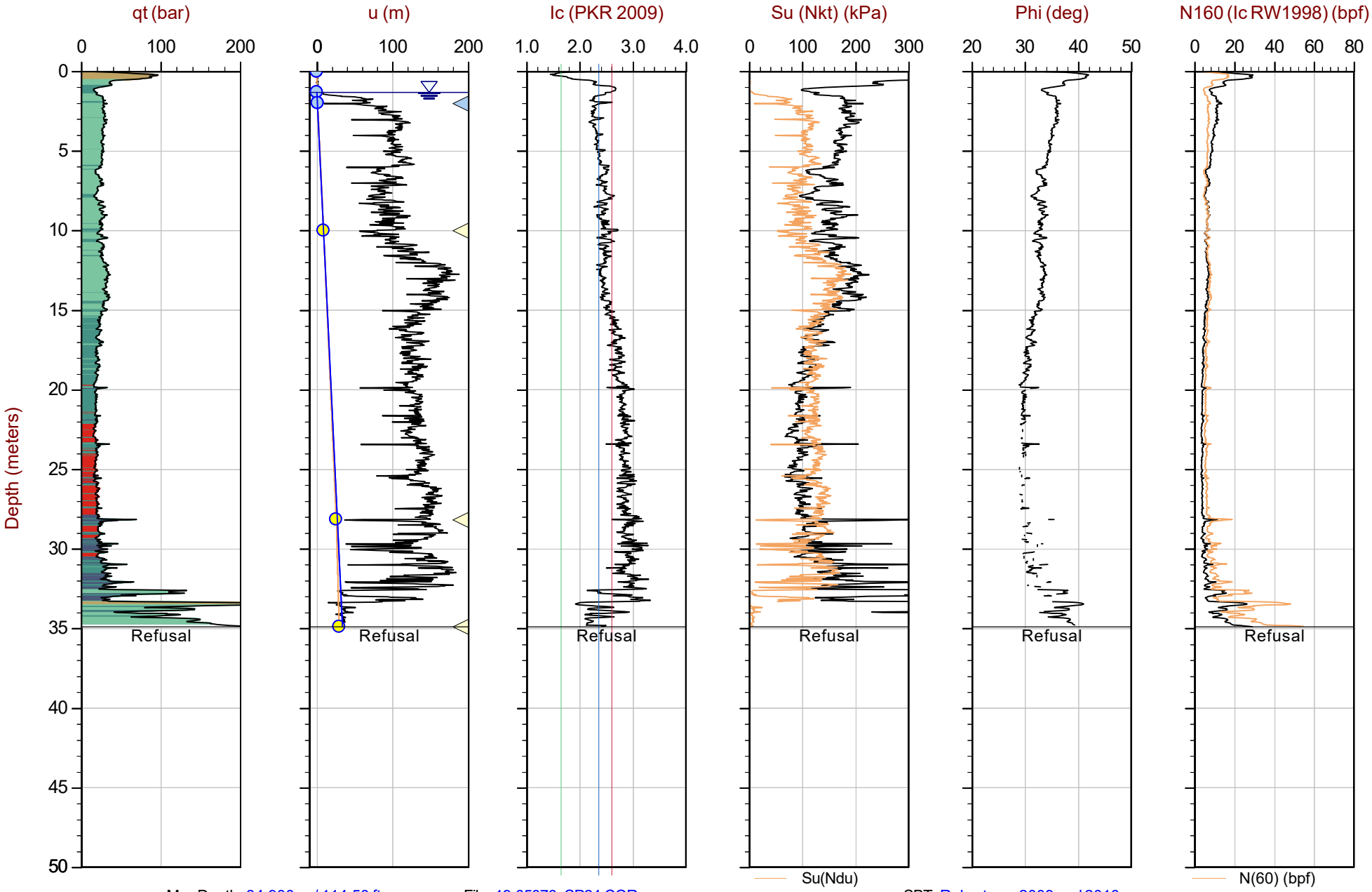
Overplot Item: Ueq, Assumed Ueq, Dissipation, Ueq achieved, Dissipation, Ueq not achieved, Dissipation, Ueq assumed, Hydrostatic Line, Ueq Line

CONETEC

Thurber

Job No: 19-05076
Date: 2019-11-28 10:39
Site: Bruce Street

Sounding: BRU19-24
Cone: 377:T1000F10U500



Max Depth: 34.900 m / 114.50 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 19-05076_SP24.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt/Ndu: 15.0 / 9.0

SBT: Robertson, 2009 and 2010
Coords: MTM 9N N: 5039779.70m E: 291476.80m Elev: 149.70m
Sheet No: 1 of 1

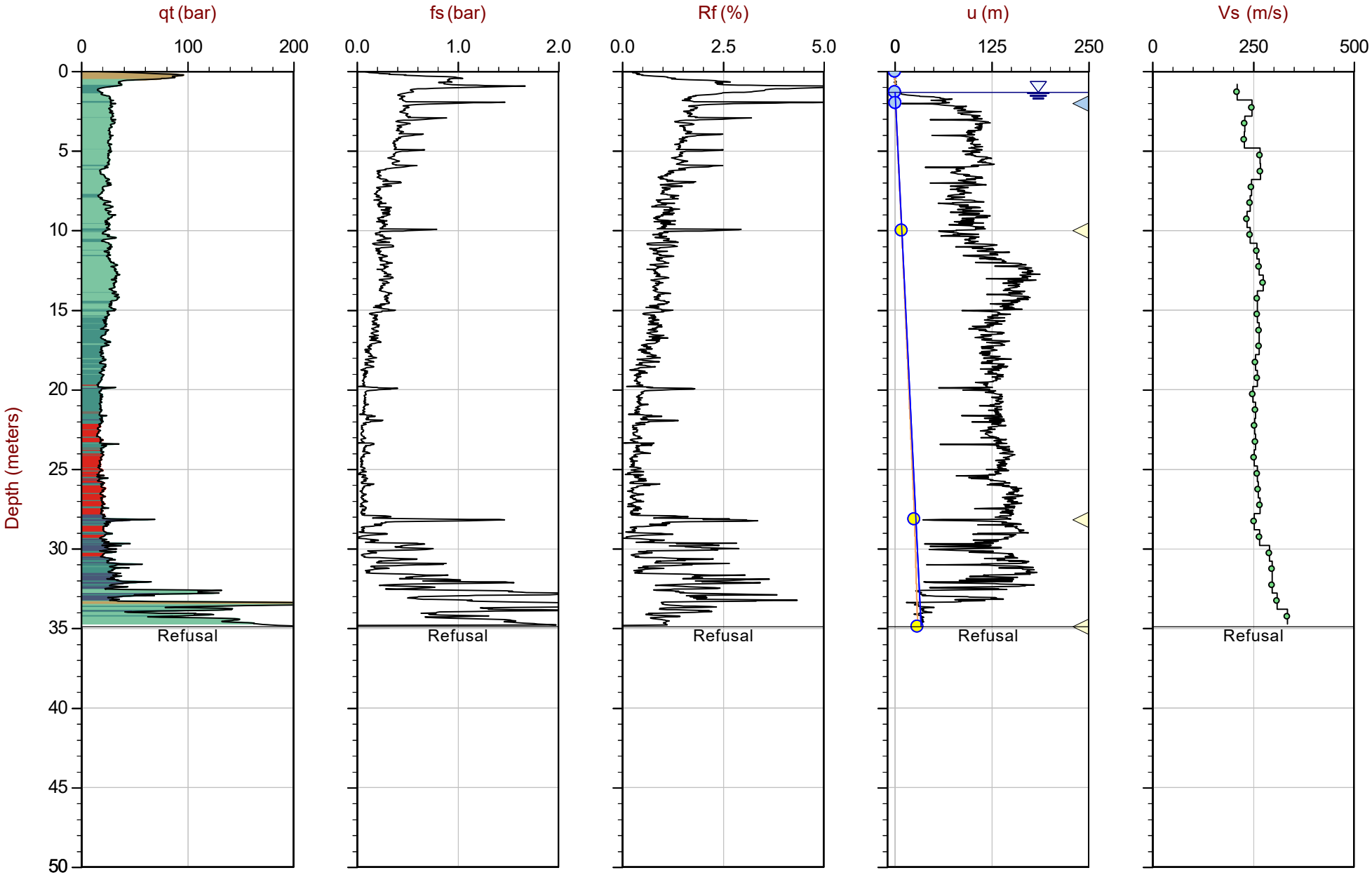
Overplot Item: Ueq, Assumed Ueq, Dissipation, Ueq achieved, Dissipation, Ueq not achieved, Dissipation, Ueq assumed, Hydrostatic Line, Ueq Line

CONETEC

Thurber

Job No: 19-05076
Date: 2019-11-28 10:39
Site: Bruce Street

Sounding: BRU19-24
Cone: 377:T1000F10U500



Max Depth: 34.900 m / 114.50 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 19-05076_SP24.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: MTM 9N N: 5039779.70m E: 291476.80m Elev: 149.70m
Sheet No: 1 of 1

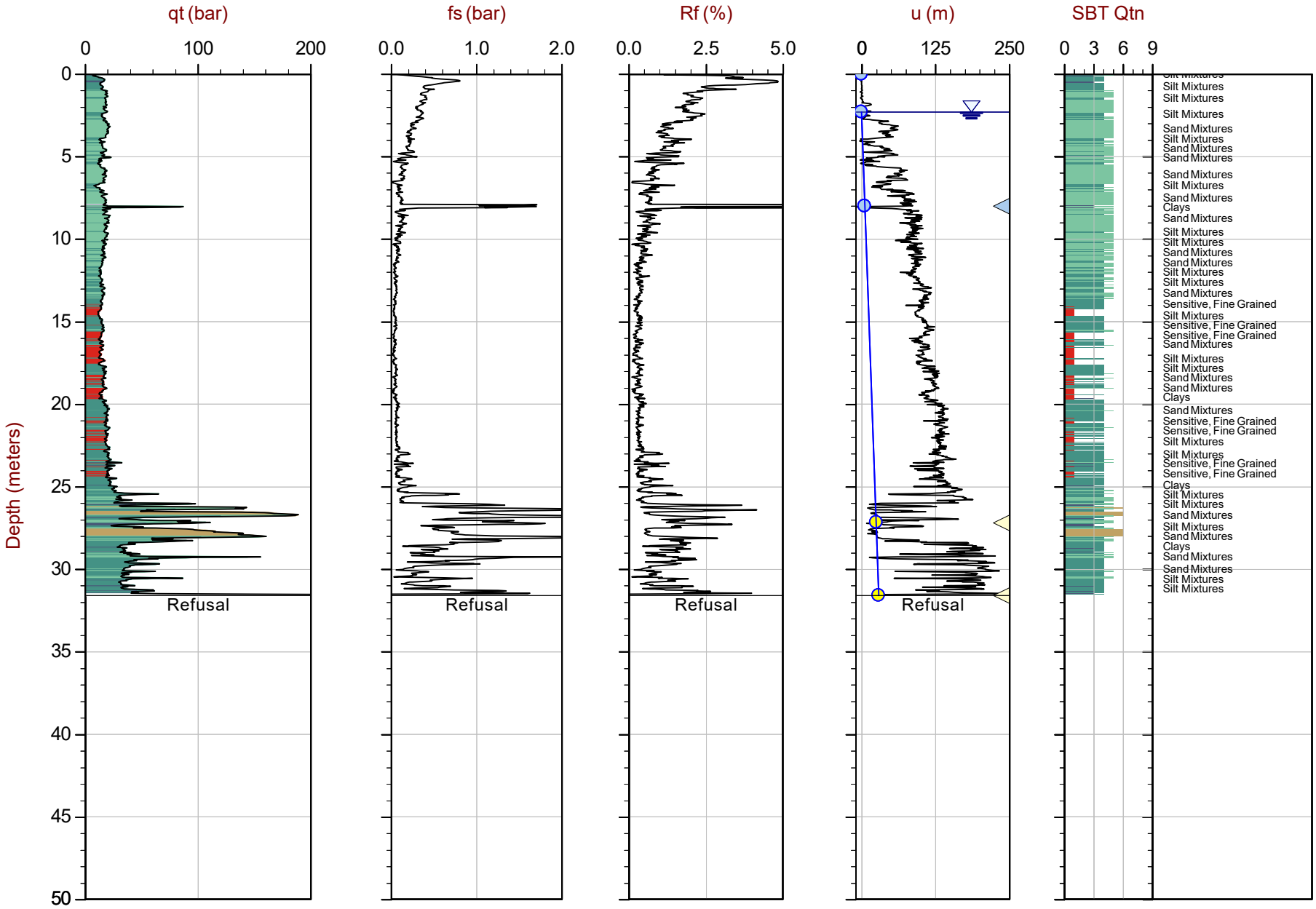
Overplot Item: Ueq · Assumed Ueq · Dissipation, Ueq achieved · Dissipation, Ueq not achieved · Dissipation, Ueq assumed · Hydrostatic Line · Ueq Line

CONETEC

Thurber

Job No: 19-05076
Date: 2019-11-27 10:25
Site: Bruce Street

Sounding: BRU19-32
Cone: 377:T1000F10U500



Max Depth: 31.600 m / 103.67 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 19-05076_CP32.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: MTM 9N N: 5039793.00m E: 291638.40m Elev: 146.90m
Sheet No: 1 of 1

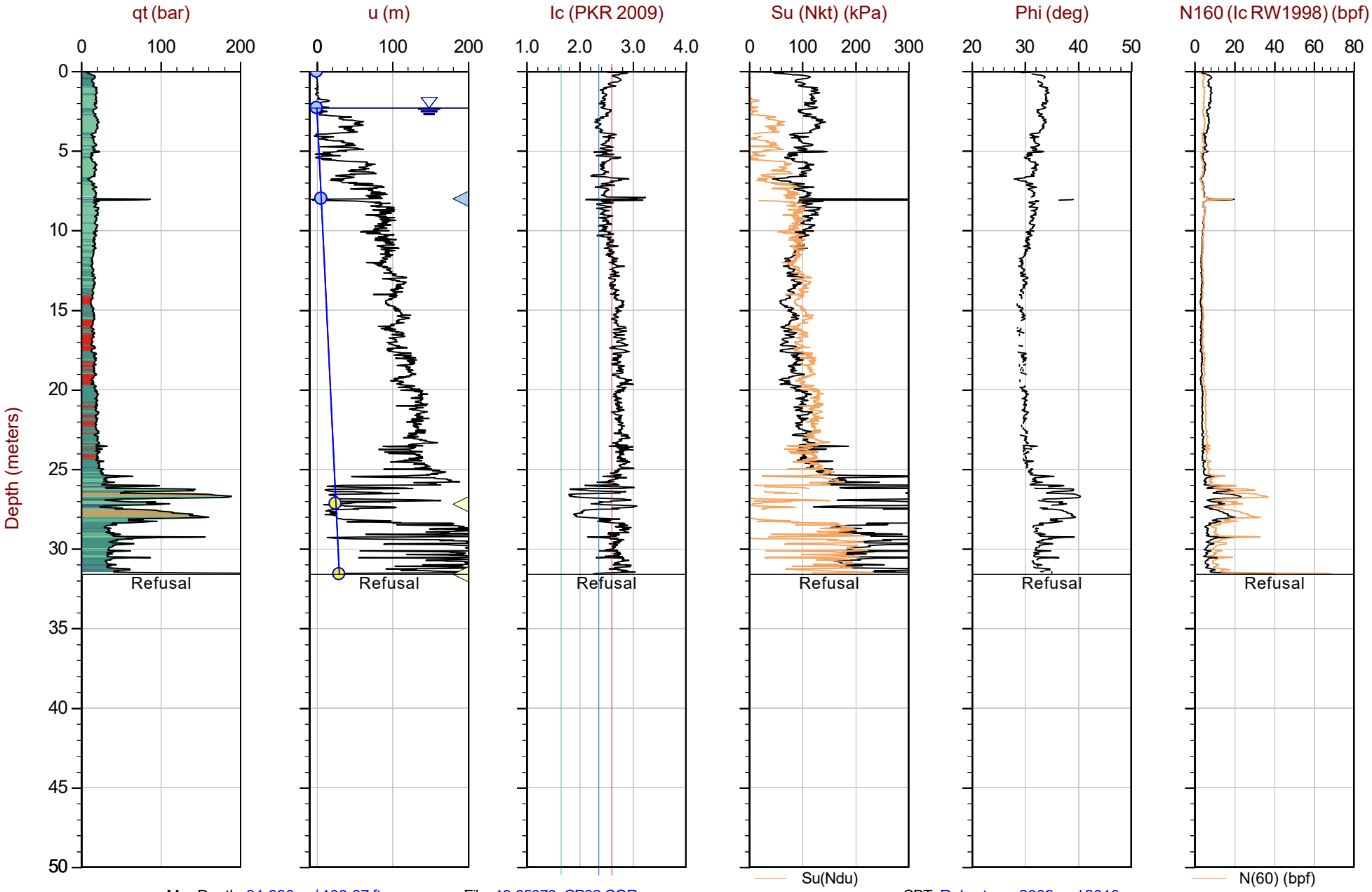
Overplot Item: Ueq, Assumed Ueq, Dissipation, Ueq achieved, Dissipation, Ueq not achieved, Dissipation, Ueq assumed, Hydrostatic Line

CONETEC

Thurber

Job No: 19-05076
Date: 2019-11-27 10:25
Site: Bruce Street

Sounding: BRU19-32
Cone: 377:T1000F10U500



Max Depth: 31.600 m / 103.67 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point
Overplot Item: Ueq, Assumed Ueq, Dissipation, Ueq achieved, Dissipation, Ueq not achieved, Dissipation, Ueq assumed, Hydrostatic Line

File: 19-05076_CP32.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt/Ndu: 15.0 / 9.0

SBT: Robertson, 2009 and 2010
Coords: MTM 9N N: 5039793.00m E: 291638.40m Elev: 146.90m
Sheet No: 1 of 1

THURBER

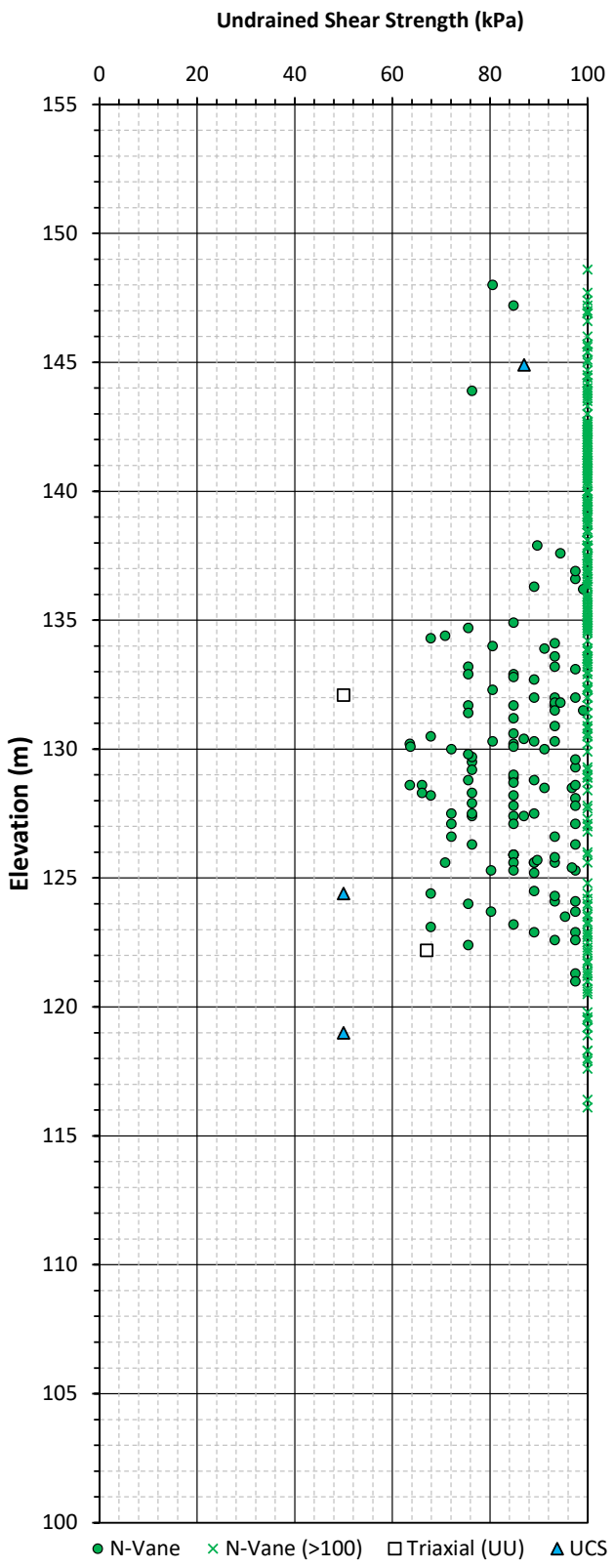
Appendix B.4

Soil Summary Figures

FIGURE B4.1

SOIL SUMMARY - BRUCE STREET ALIGNMENT

(BRU19-01 to BRU19-15A, BRU19-18, BRU19-19, BRU19-22 to BRU19-25)



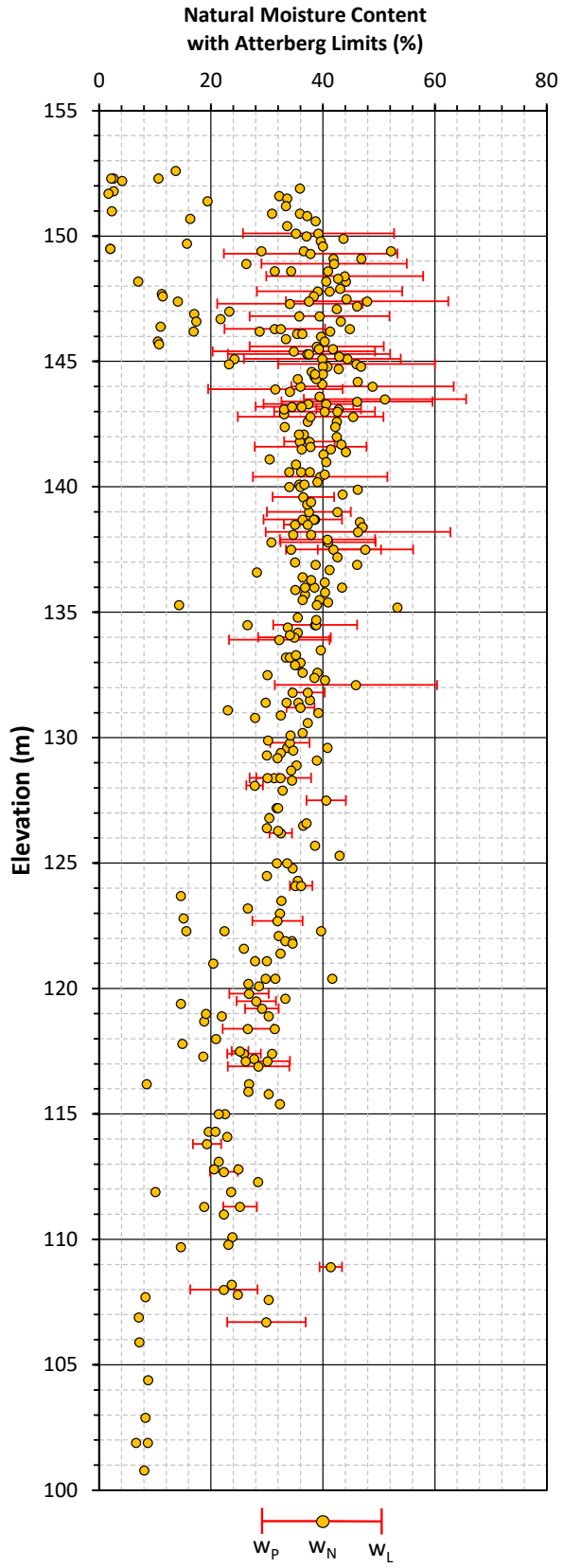
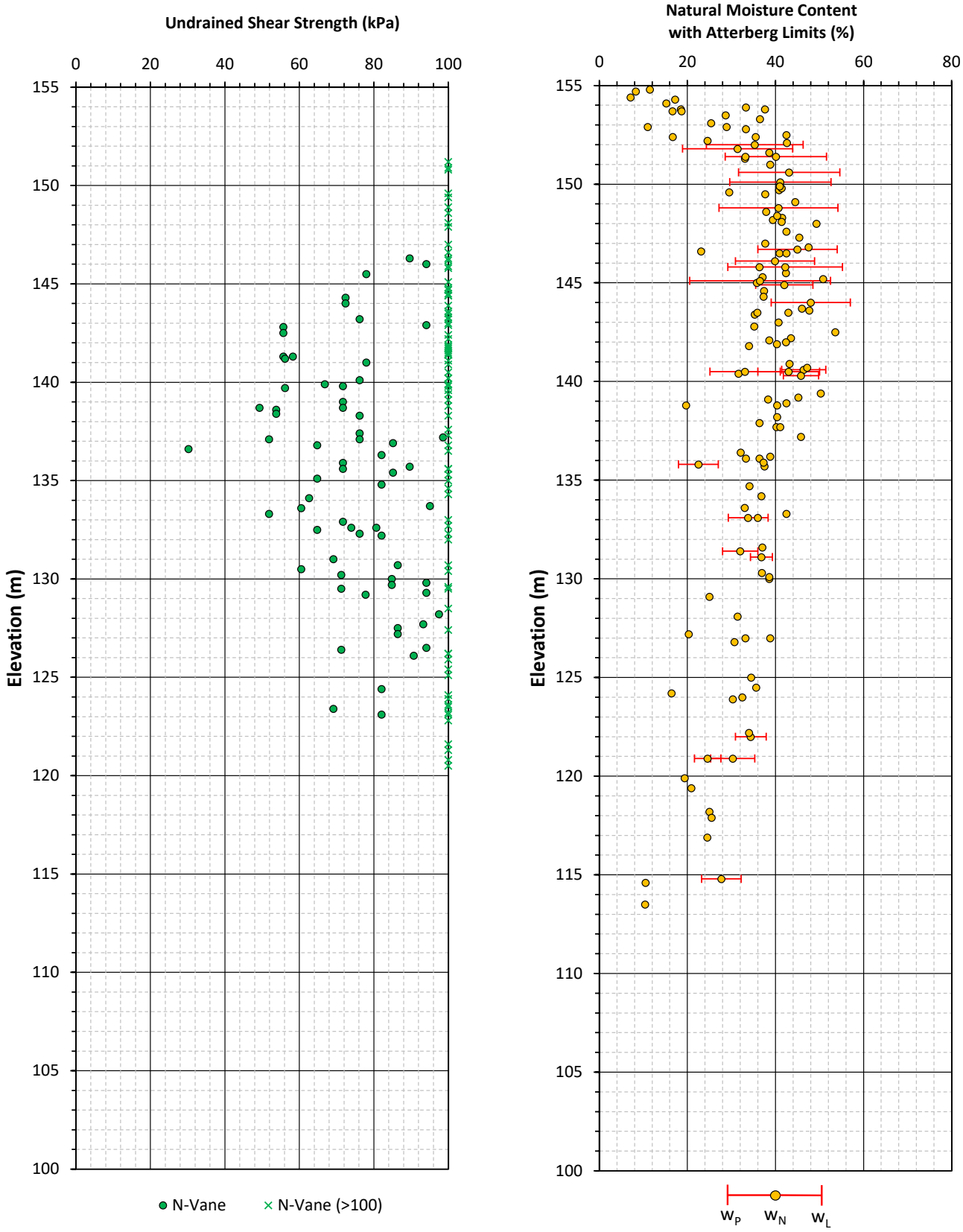


FIGURE B4.2

SOIL SUMMARY - E-N/S RAMP ALIGNMENT
(BRU19-26 to BRU19-33)



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Appendix C.

Laboratory Testing

Current (2019/2020/2021) Investigation

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Appendix C.1

Particle Size Analysis Figures

Atterberg Limit Test Results

List of Figures – Appendix C.1

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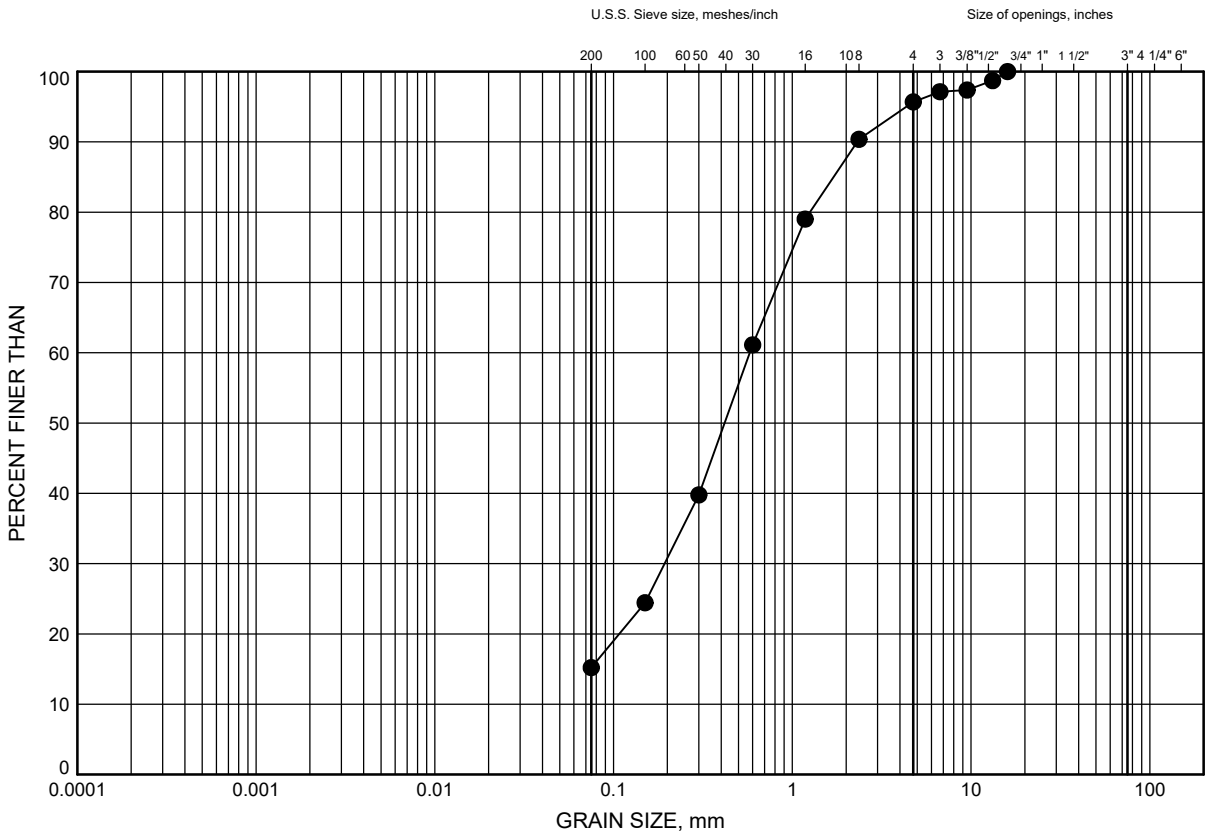
Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

GRAIN SIZE DISTRIBUTION

FIGURE C1.1

Topsoil



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-25	0.3	147.6

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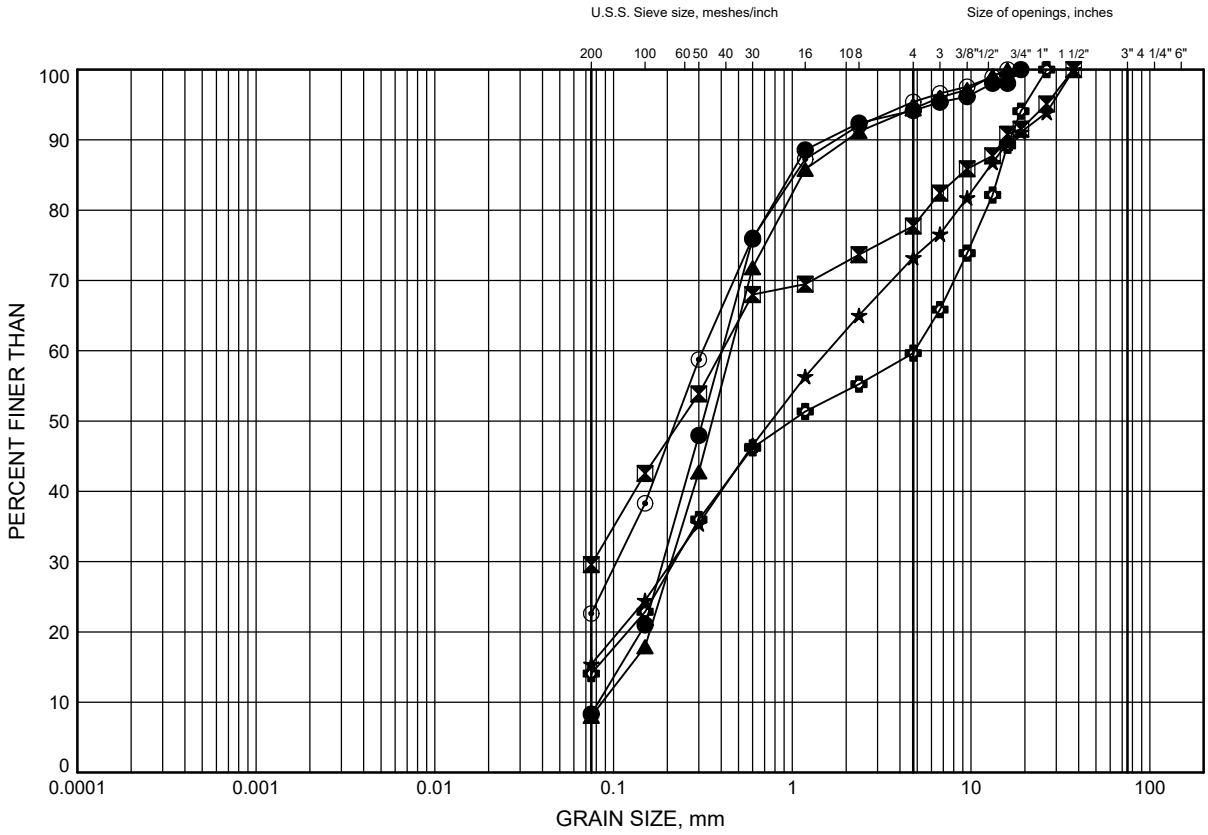
GRAIN SIZE DISTRIBUTION - THURBER 24726 BRUCE STREET GINT.GPJ 22-2-25

Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

GRAIN SIZE DISTRIBUTION

FIGURE C2.1

Fill



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-04	0.3	149.5
⊠	BRU19-06	1.1	147.4
▲	BRU19-07	0.3	147.8
★	BRU19-09	1.1	145.8
⊙	BRU19-10	0.3	145.9
✿	BRU19-12	0.4	152.3

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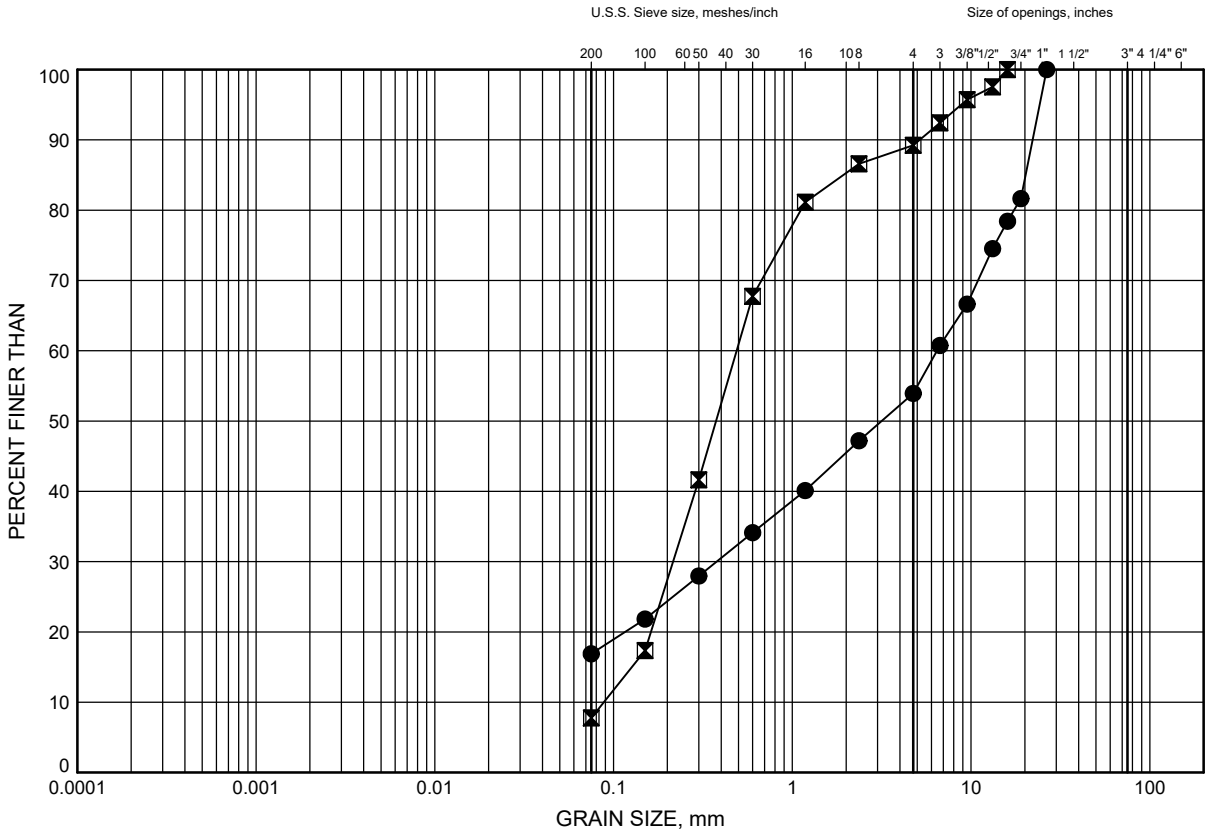
Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

GRAIN SIZE DISTRIBUTION

FIGURE C2.2

Fill



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-13	0.9	151.6
⊠	BRU21-05	0.3	148.9

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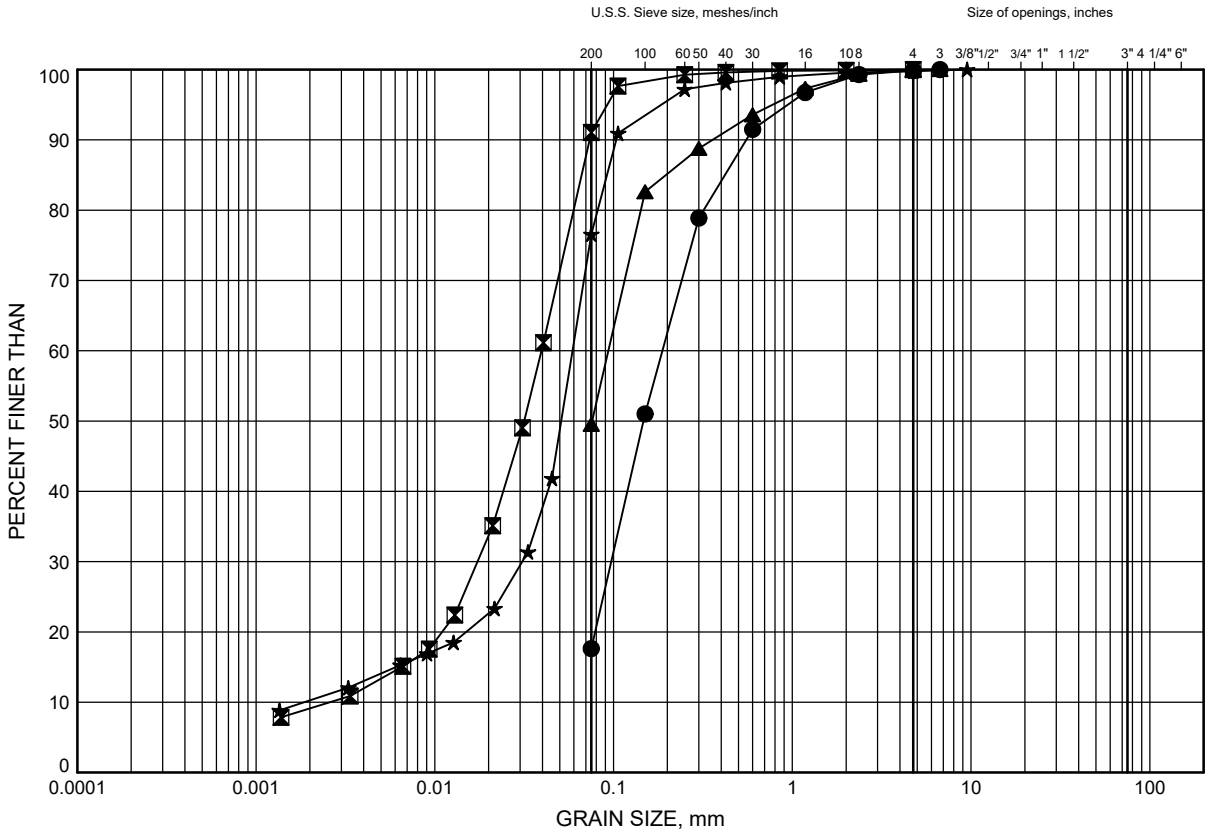
GRAIN SIZE DISTRIBUTION - THURBER 24726 BRUCE STREET GINT.GPJ 22-2-25

Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

GRAIN SIZE DISTRIBUTION

FIGURE C3.1

Upper Sand and Silt



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-26	1.8	147.9
⊠	BRU19-28	1.1	153.9
▲	BRU19-29	1.8	152.9
★	BRU19-30	1.1	153.0

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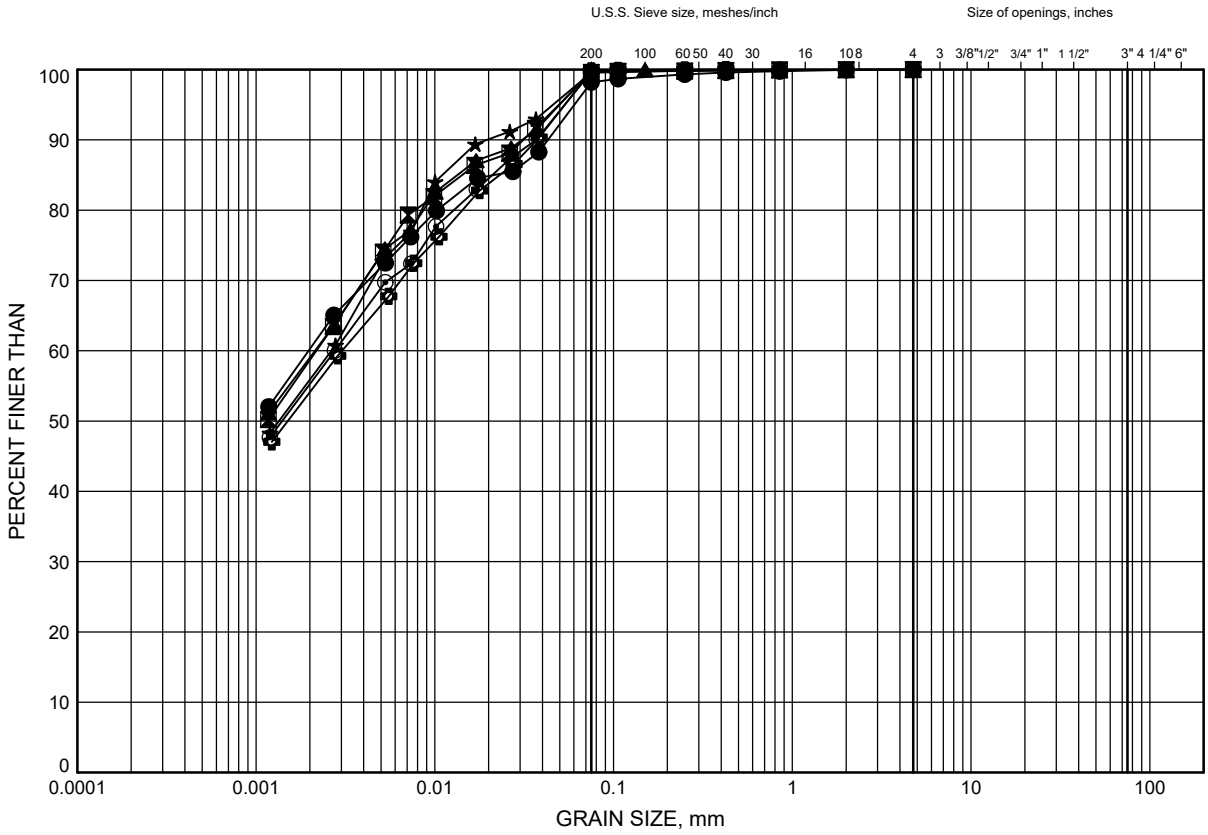
GRAIN SIZE DISTRIBUTION - THURBER 24726 BRUCE STREET GINT.GPJ 22-2-25

Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

GRAIN SIZE DISTRIBUTION

FIGURE C4.1

Silty Clay (Weathered Crust)



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-01	1.1	150.1
⊠	BRU19-01	3.4	147.8
▲	BRU19-01A	4.9	147.3
★	BRU19-02	2.6	147.5
⊙	BRU19-03	4.1	145.7
✿	BRU19-04A	4.9	144.9

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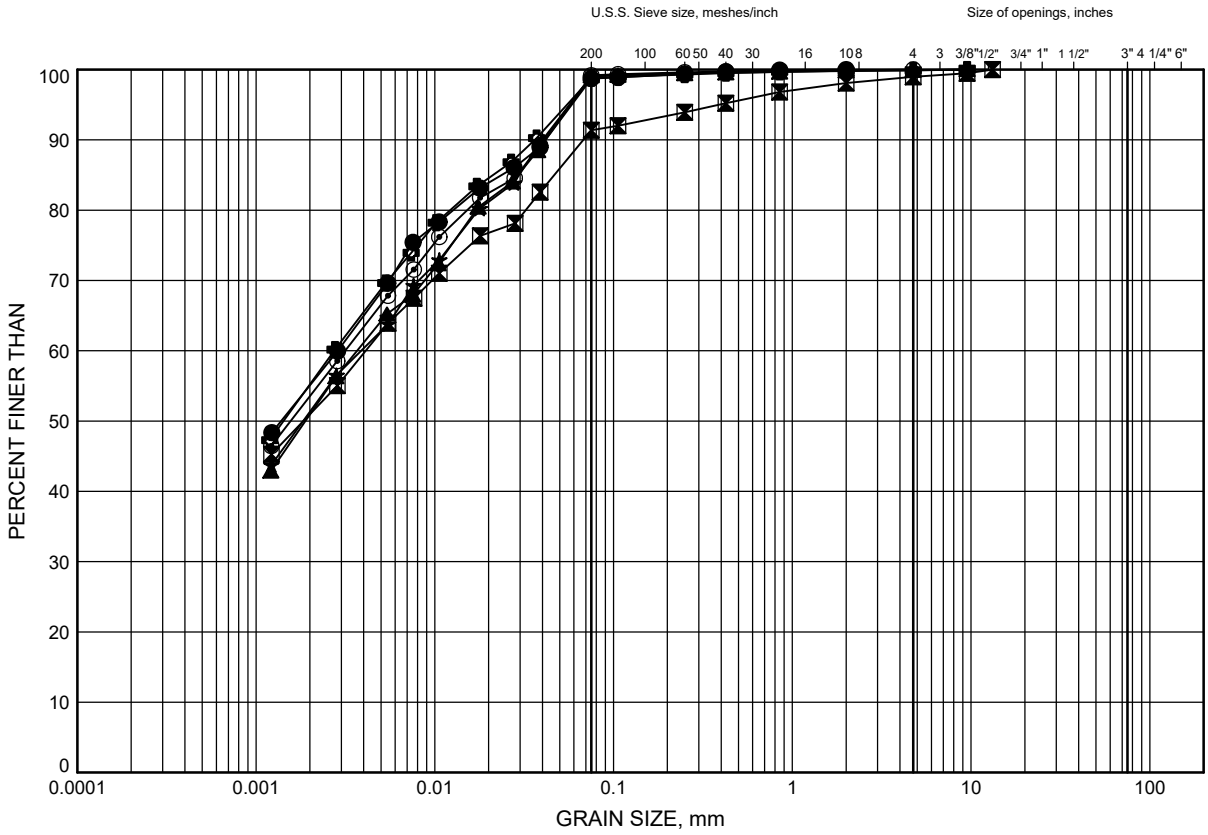
Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

GRAIN SIZE DISTRIBUTION

FIGURE C4.2

Silty Clay (Weathered Crust)



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-06	3.4	145.1
⊠	BRU19-07	2.6	145.5
▲	BRU19-09	3.4	143.5
★	BRU19-10	2.6	143.6
⊙	BRU19-12	3.4	149.3
✿	BRU19-13	4.1	148.4

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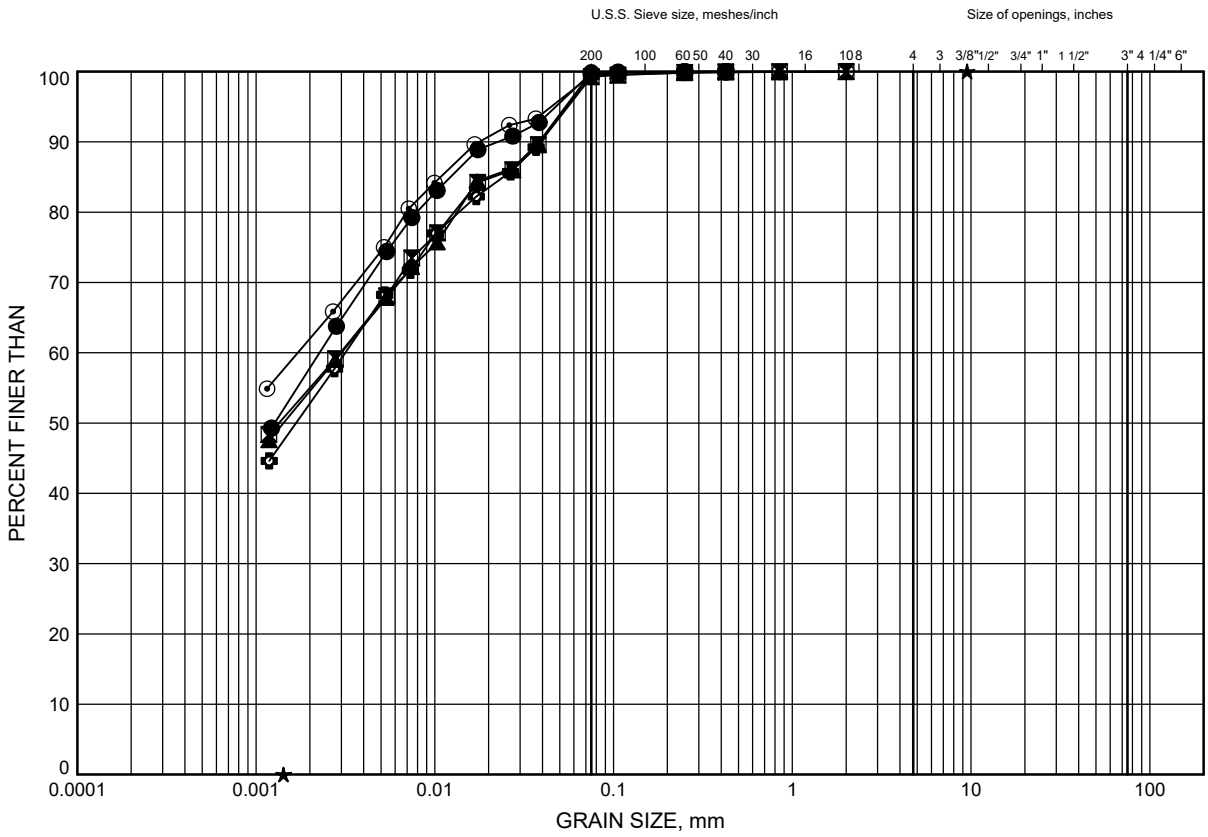
Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

GRAIN SIZE DISTRIBUTION

FIGURE C4.3

Silty Clay (Weathered Crust)



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-15	3.5	149.1
⊠	BRU19-16	1.8	149.7
▲	BRU19-16	4.9	146.6
⊙	BRU19-21	1.1	149.6
✿	BRU19-22	3.4	143.9

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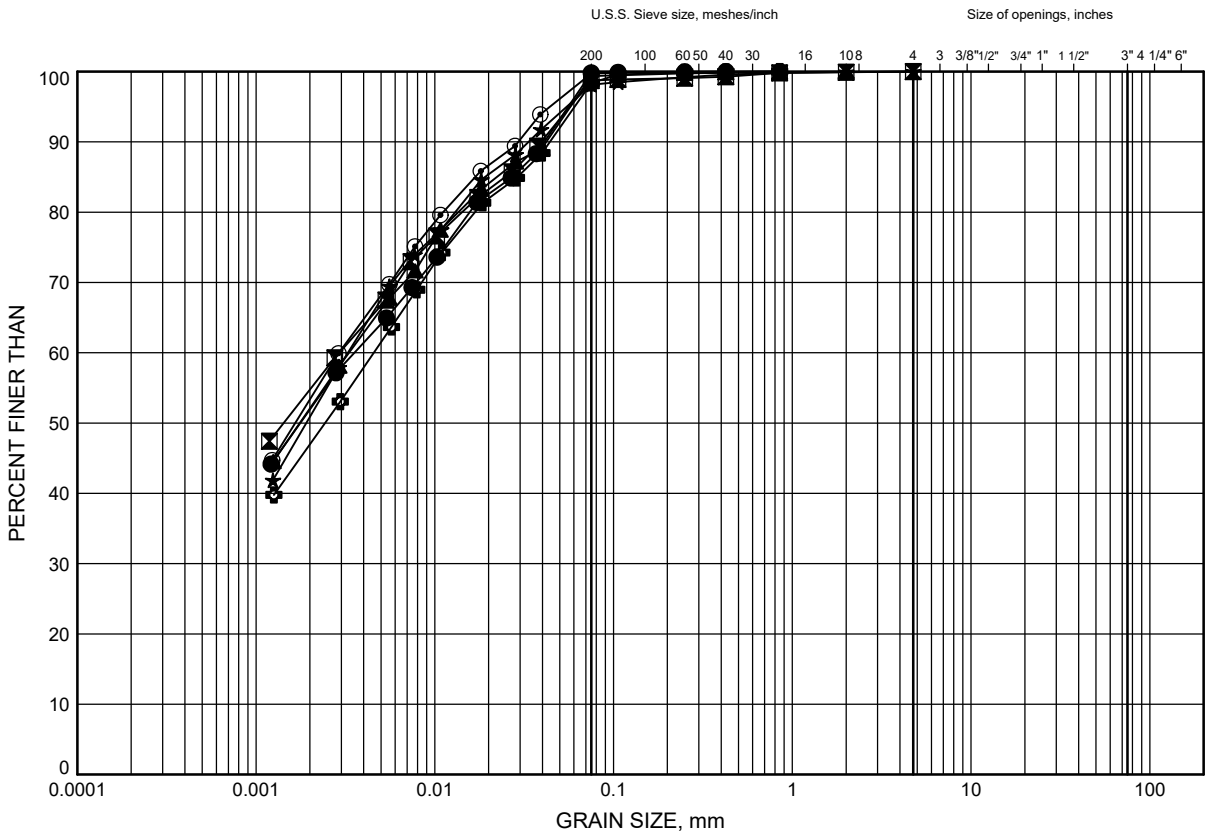
GRAIN SIZE DISTRIBUTION - THURBER 24726 BRUCE STREET GINT.GPJ 22-2-25

Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

GRAIN SIZE DISTRIBUTION

FIGURE C4.4

Silty Clay (Weathered Crust)



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-23	2.6	144.0
⊠	BRU19-25	2.6	145.3
▲	BRU19-26	4.1	145.6
★	BRU19-27	2.6	152.0
⊙	BRU19-28	4.9	150.1
✿	BRU19-29	3.4	151.3

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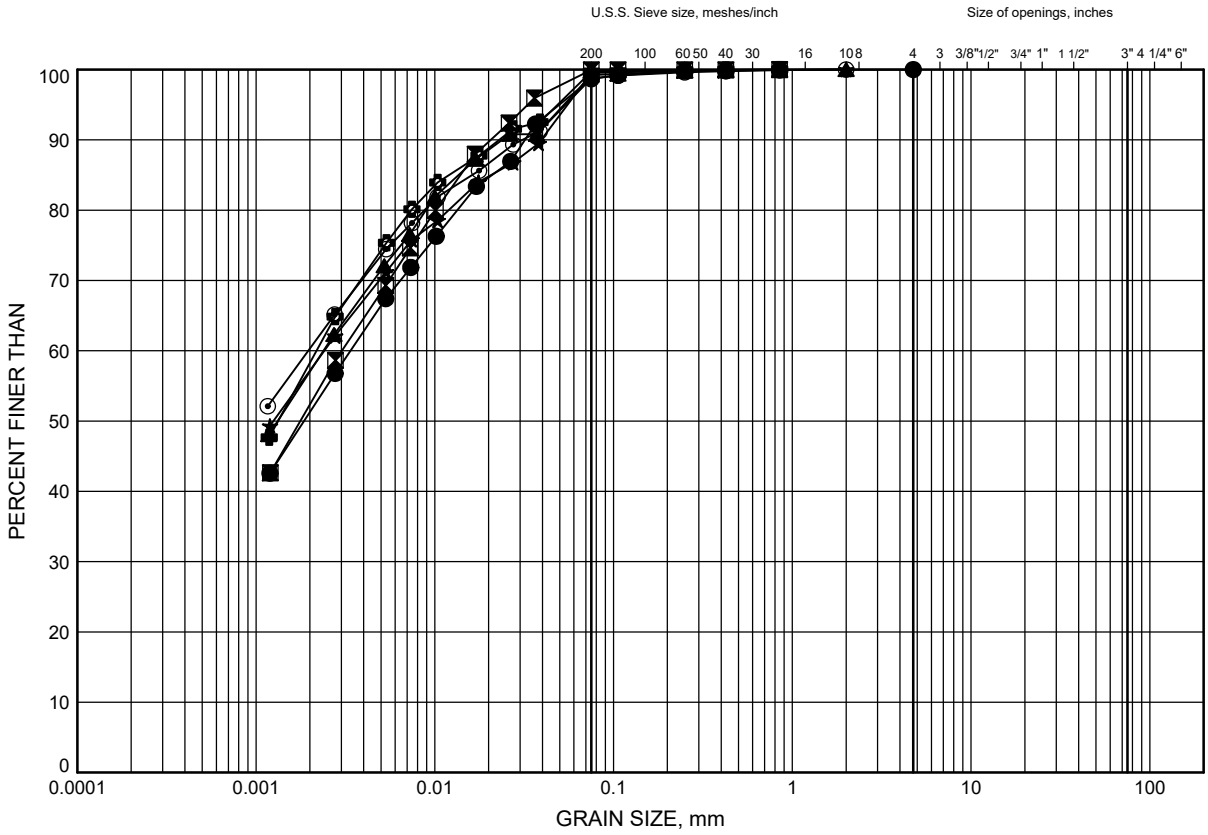
GRAIN SIZE DISTRIBUTION

FIGURE C4.5

Silty Clay (Weathered Crust)



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-30	3.4	150.7
⊠	BRU19-30	7.9	146.2
▲	BRU19-31	1.1	148.8
★	BRU19-33	1.8	145.1
⊙	BRU21-02	2.6	148.8
✿	BRU21-02	4.9	146.5

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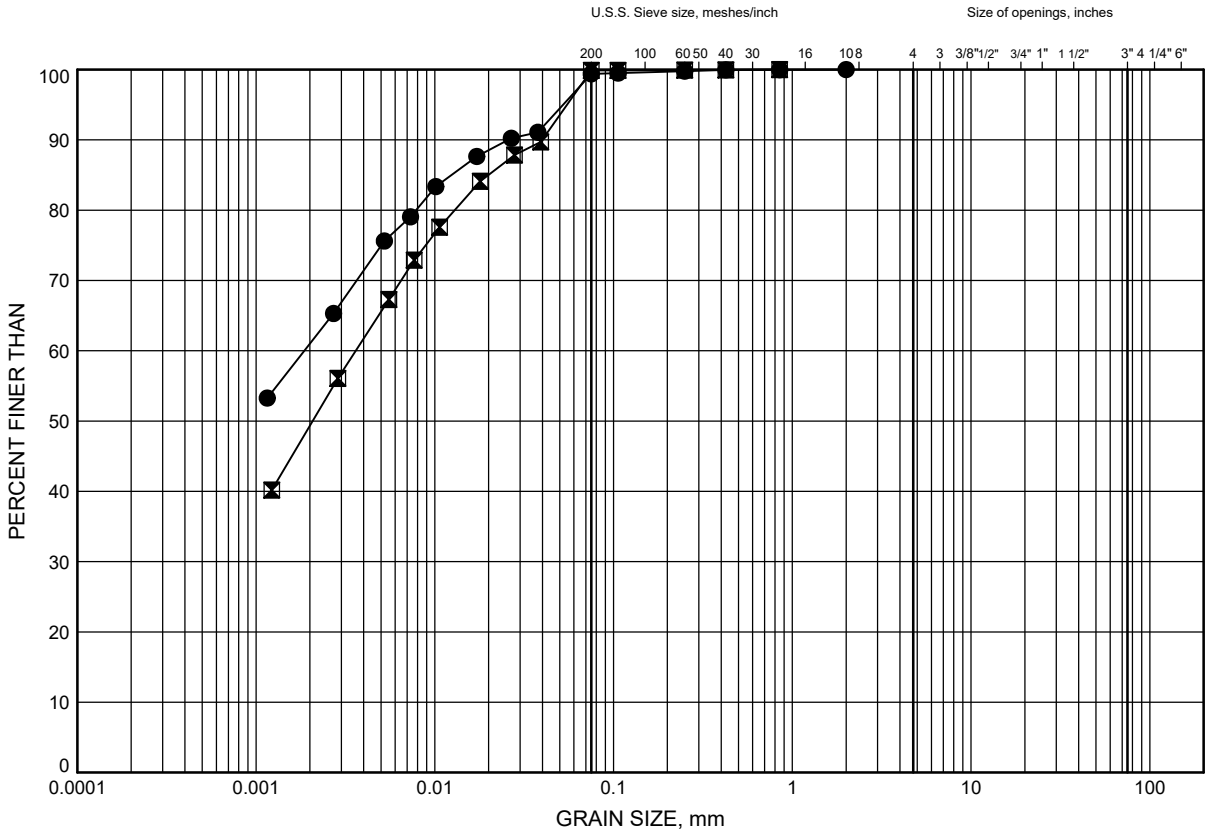
Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

GRAIN SIZE DISTRIBUTION

FIGURE C4.6

Silty Clay (Weathered Crust)



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU21-05	2.4	146.8
⊠	BRU21-05	6.4	142.8

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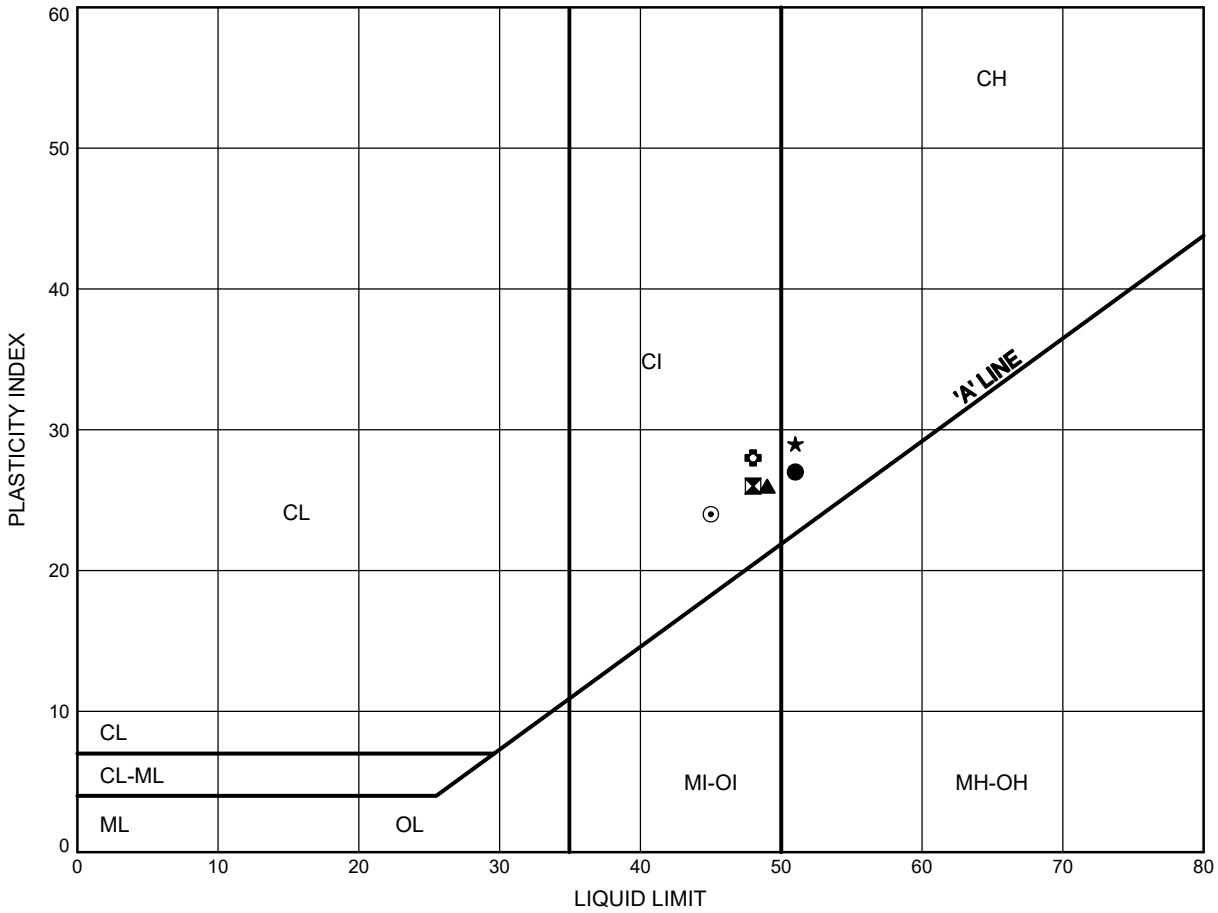
GRAIN SIZE DISTRIBUTION - THURBER 24726 BRUCE STREET GINT.GPJ 22-2-25

Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

ATTERBERG LIMITS TEST RESULTS

FIGURE C5.1

Silty Clay (Weathered Crust)



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-01	1.1	150.1
⊠	BRU19-01	3.4	147.8
▲	BRU19-01A	4.9	147.3
★	BRU19-02	2.6	147.5
⊙	BRU19-03	4.1	145.7
✿	BRU19-04A	4.9	144.9

Date February 2022

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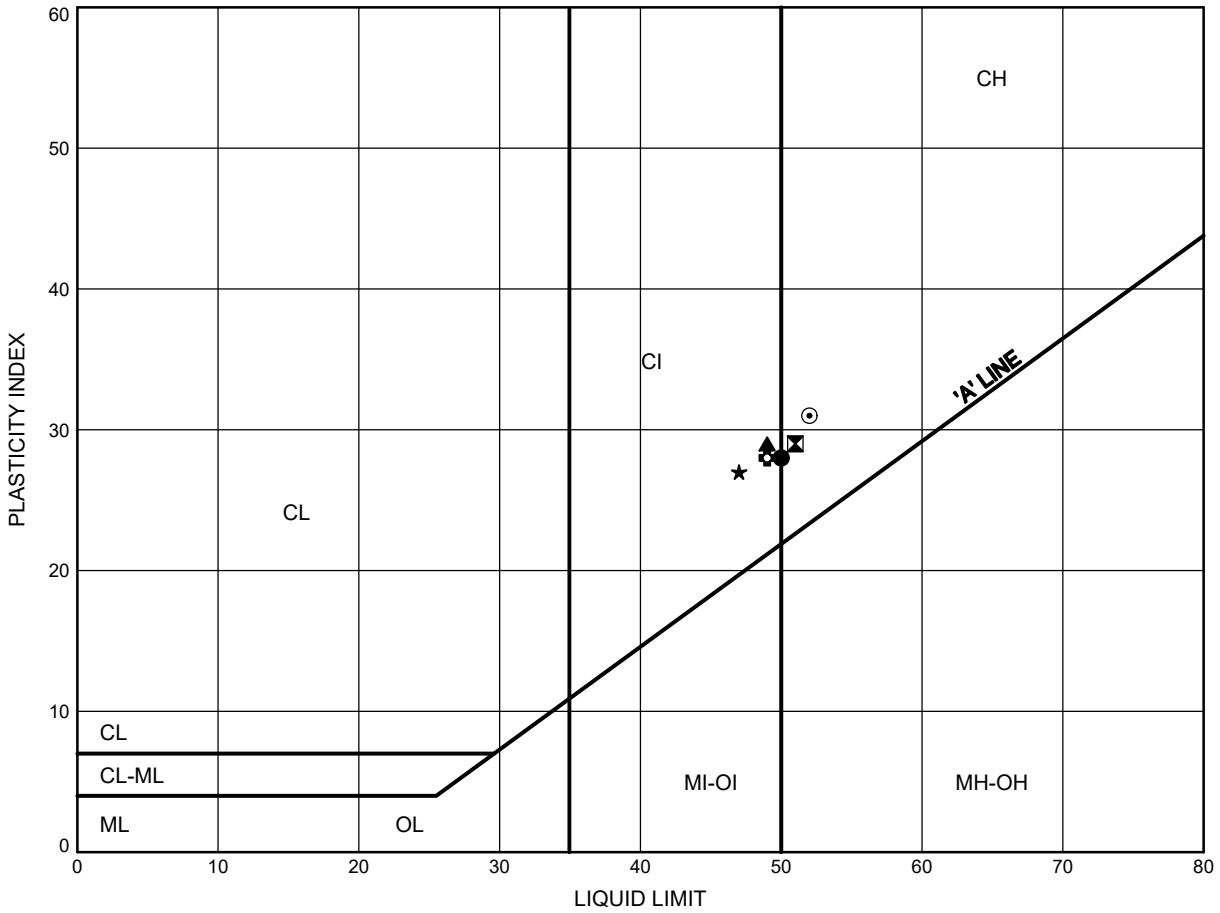
THURBALT 24726 BRUCE STREET GINT.GPJ 22-2-25

Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

ATTERBERG LIMITS TEST RESULTS

FIGURE C5.2

Silty Clay (Weathered Crust)



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-06	3.4	145.1
⊠	BRU19-07	2.6	145.5
▲	BRU19-09	3.4	143.5
★	BRU19-10	2.6	143.6
⊙	BRU19-12	3.4	149.3
✿	BRU19-13	4.1	148.4

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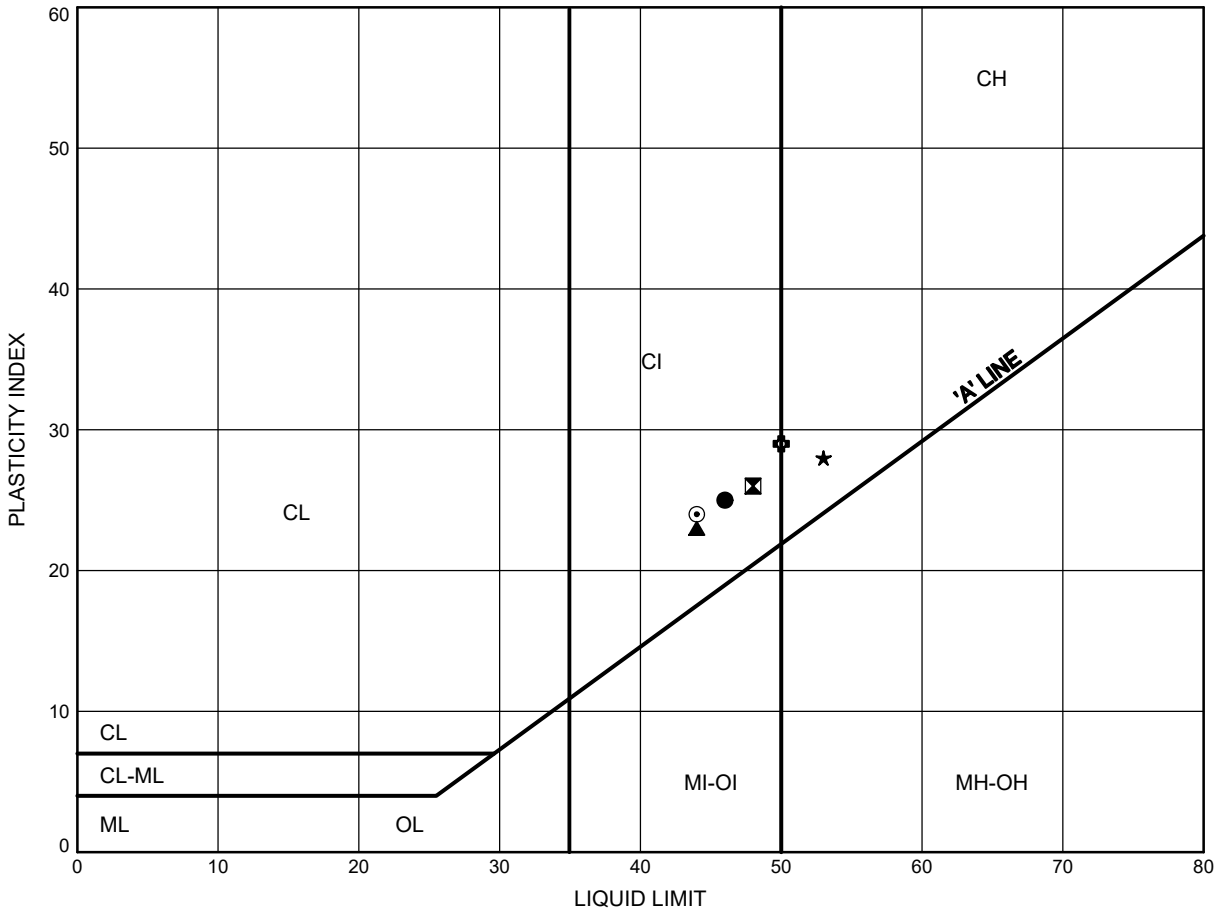
Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

ATTERBERG LIMITS TEST RESULTS

FIGURE C5.3

Silty Clay (Weathered Crust)



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-15	3.5	149.1
⊠	BRU19-16	1.8	149.7
▲	BRU19-16	4.9	146.6
★	BRU19-21	1.1	149.6
⊙	BRU19-22	3.4	143.9
✚	BRU19-23	2.6	144.0

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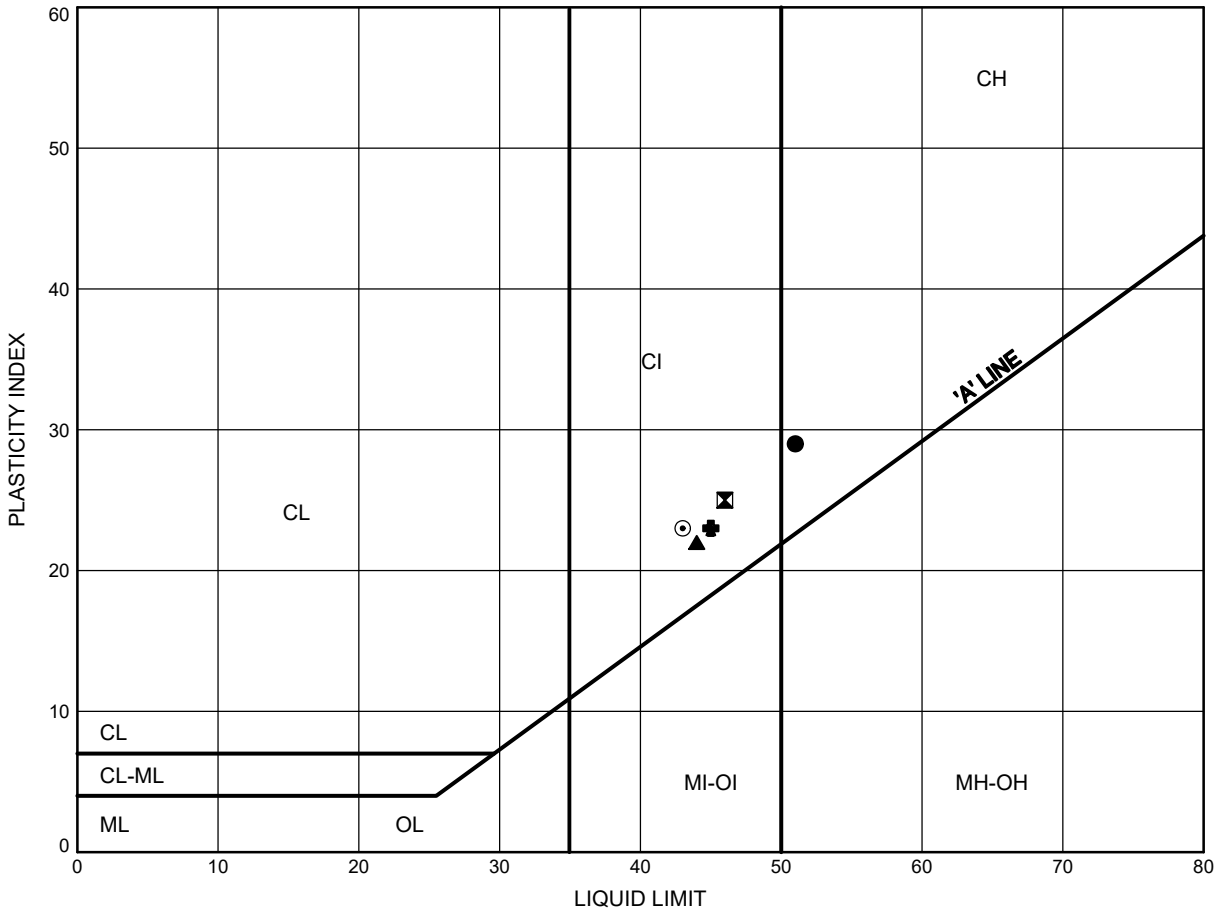
ATTERBERG LIMITS TEST RESULTS

FIGURE C5.4

Silty Clay (Weathered Crust)



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-25	2.6	145.3
⊠	BRU19-26	4.1	145.6
▲	BRU19-27	2.6	152.0
★	BRU19-28	4.9	150.1
⊙	BRU19-29	3.4	151.3
✚	BRU19-30	3.4	150.7

Date February 2022

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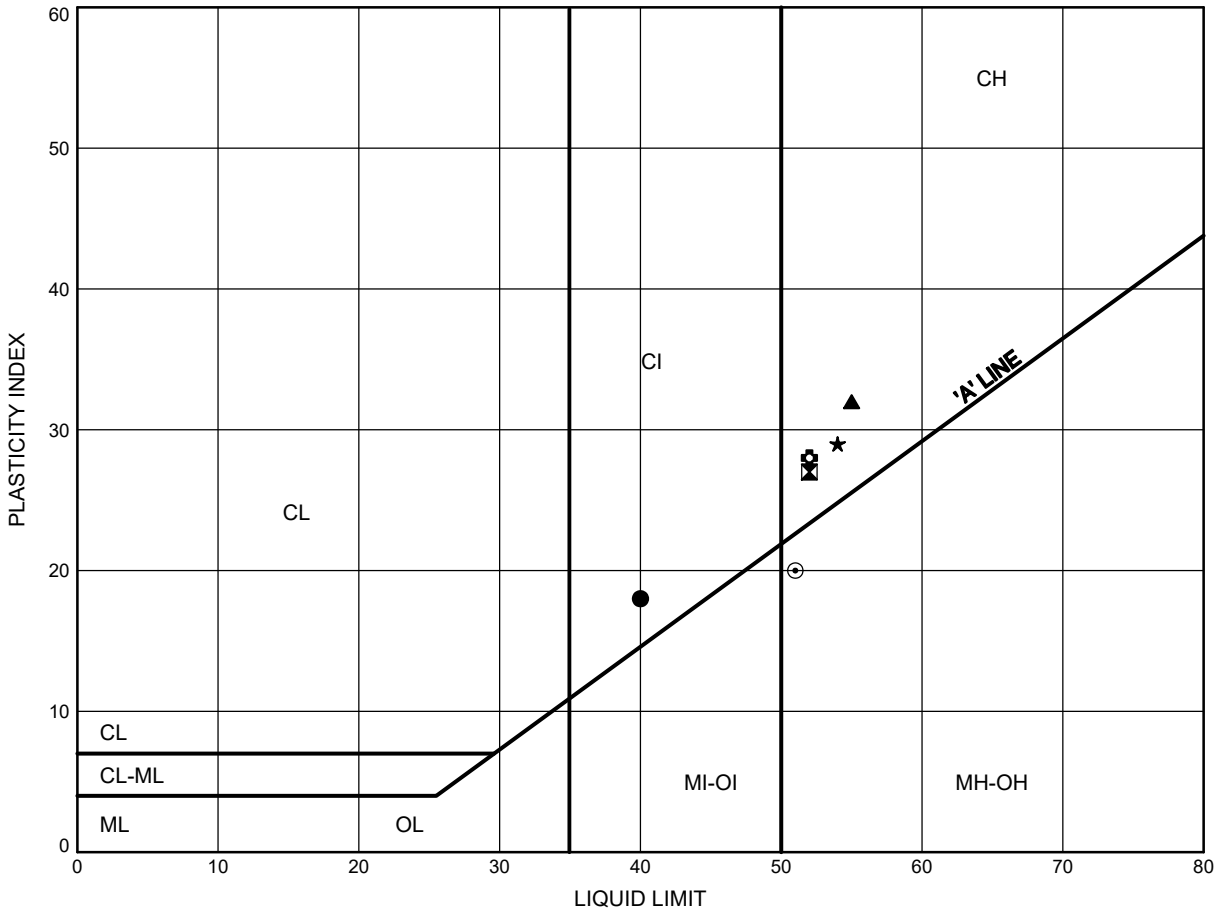
Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

ATTERBERG LIMITS TEST RESULTS

FIGURE C5.5

Silty Clay (Weathered Crust)



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-30	7.9	146.2
⊠	BRU19-31	1.1	148.8
▲	BRU19-33	1.8	145.1
★	BRU21-02	2.6	148.8
⊙	BRU21-02	4.9	146.5
✿	BRU21-05	2.4	146.8

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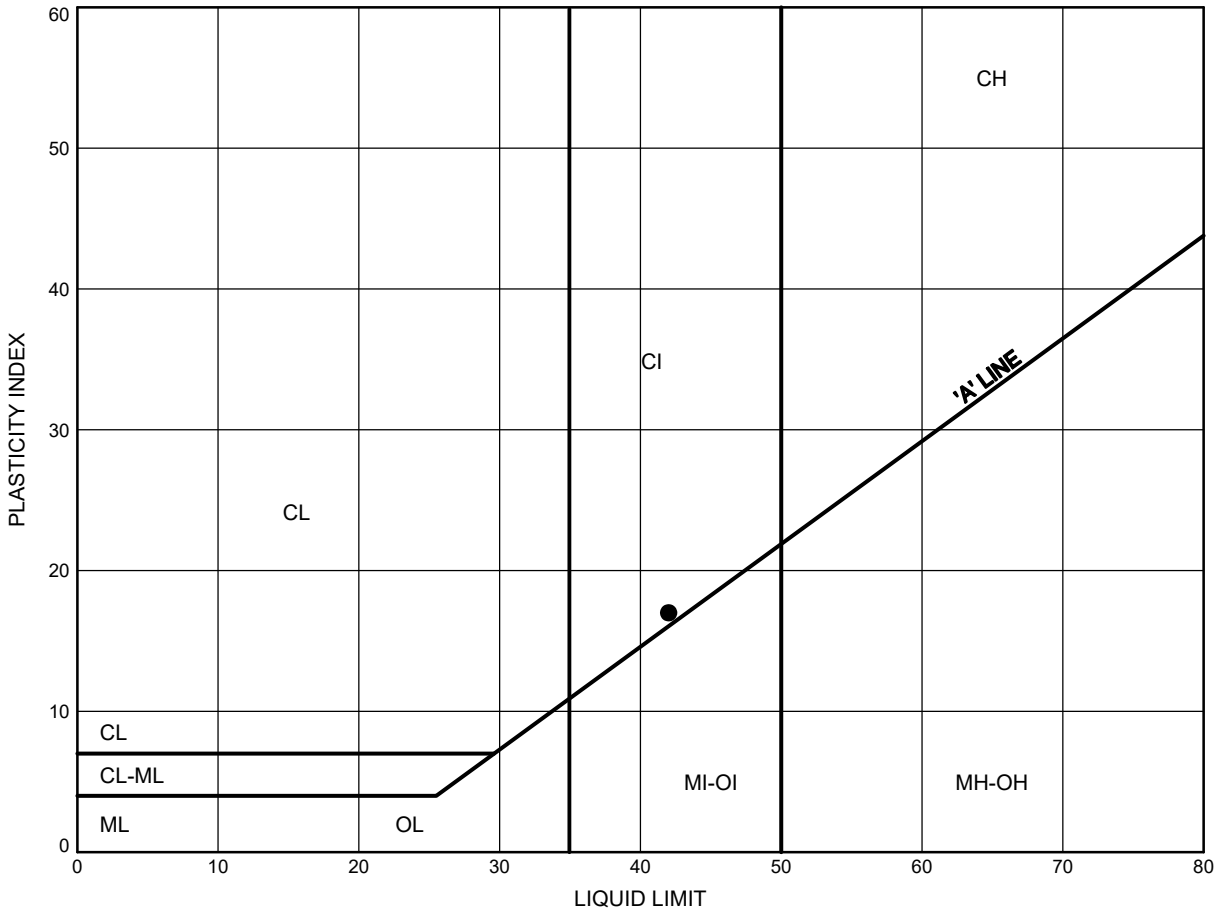
Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

ATTERBERG LIMITS TEST RESULTS

FIGURE C5.6

Silty Clay (Weathered Crust)



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU21-05	6.4	142.8

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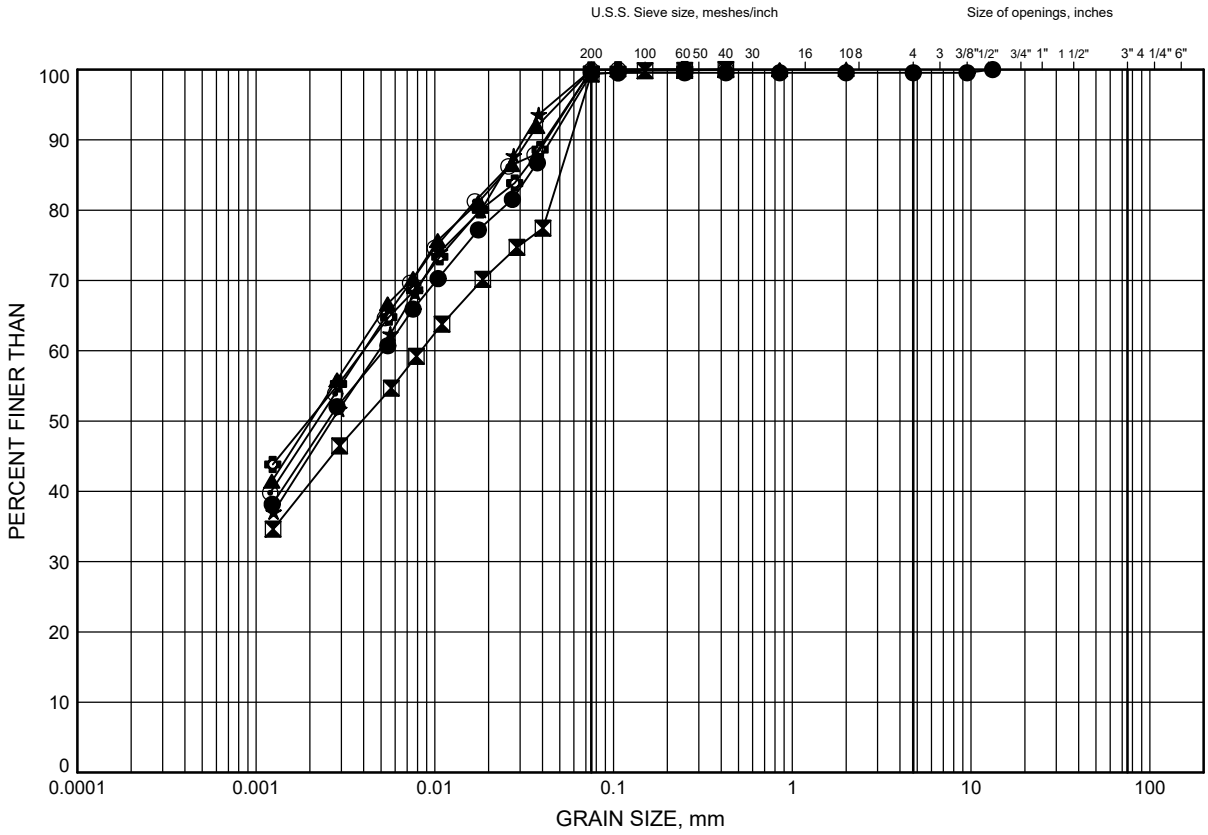
THURBALT 24726 BRUCE STREET GINT.GPJ 22-2-25

Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

GRAIN SIZE DISTRIBUTION

FIGURE C6.1

Silty Clay to Clayey Silt (Above Elevation 133 m)



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-01	9.4	141.8
⊠	BRU19-01A	17.7	134.5
▲	BRU19-02	12.5	137.6
★	BRU19-02	15.5	134.6
⊙	BRU19-03	6.4	143.4
✿	BRU19-04A	9.4	140.4

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GRAIN SIZE DISTRIBUTION - THURBER 24726 BRUCE STREET GINT.GPJ 22-2-25

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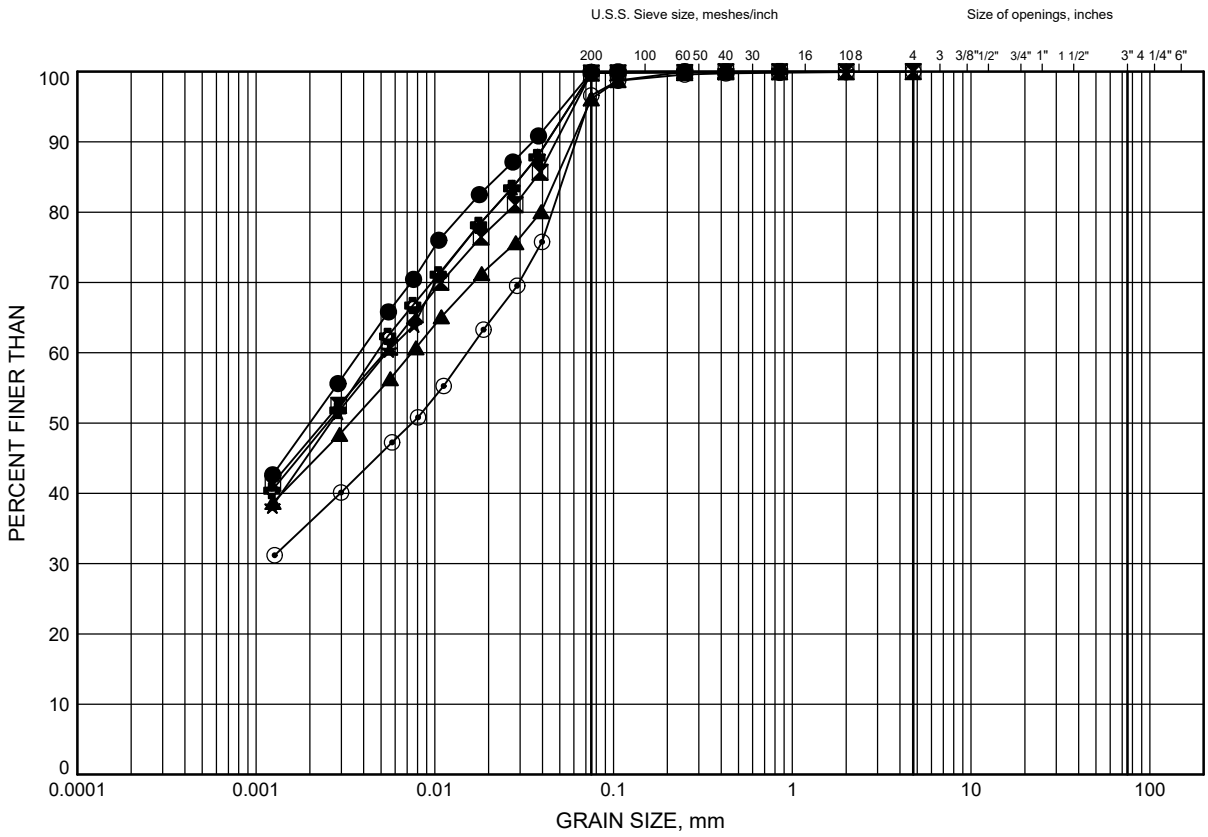
GRAIN SIZE DISTRIBUTION

FIGURE C6.2

Silty Clay to Clayey Silt (Above Elevation 133 m)



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-06	11.0	137.5
⊠	BRU19-07	6.4	141.7
▲	BRU19-07	14.0	134.1
★	BRU19-09	7.9	139.0
⊙	BRU19-10	6.4	139.8
✿	BRU19-12	6.4	146.3

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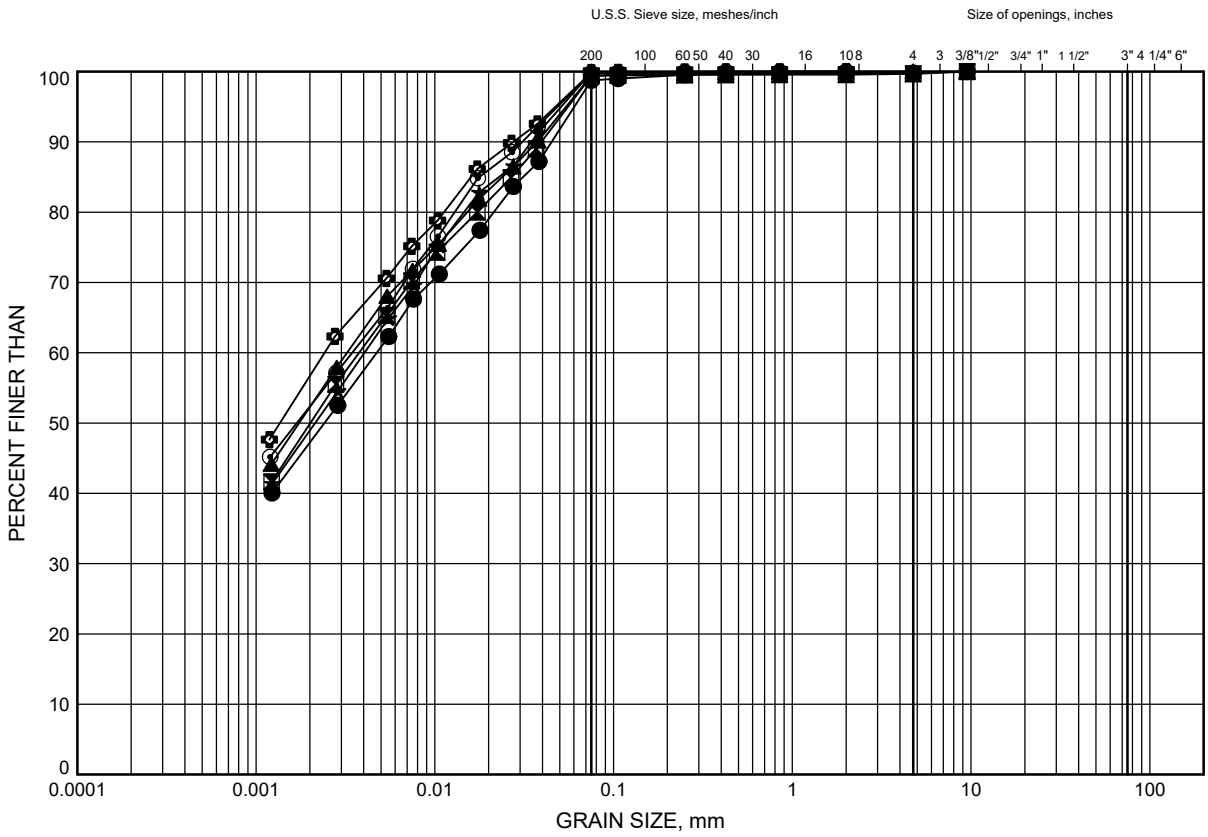
GRAIN SIZE DISTRIBUTION

FIGURE C6.3

Silty Clay to Clayey Silt (Above Elevation 133 m)



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-12	14.9	137.8
⊠	BRU19-13	9.4	143.1
▲	BRU19-13	14.0	138.5
★	BRU19-15	9.4	143.2
⊙	BRU19-16	7.9	143.6
✿	BRU19-16	14.0	137.5

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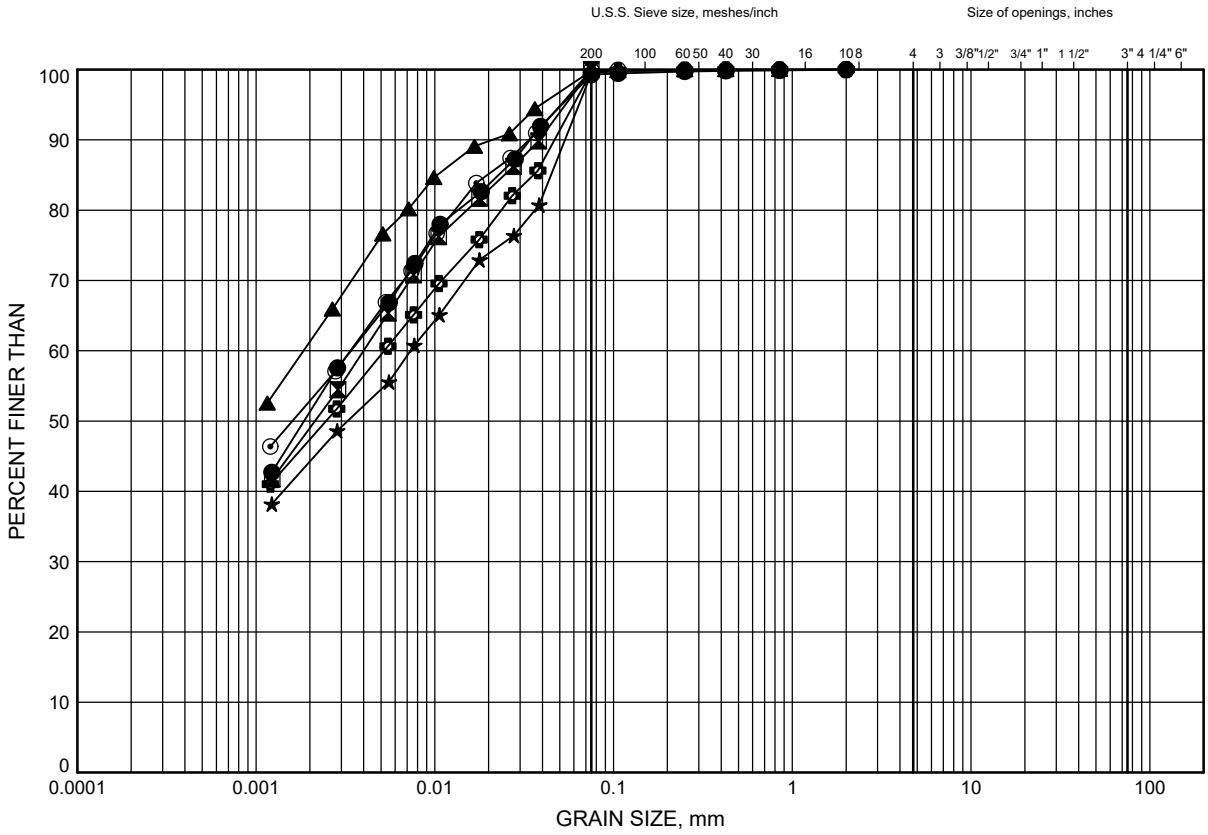
Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

GRAIN SIZE DISTRIBUTION

FIGURE C6.4

Silty Clay to Clayey Silt (Above Elevation 133 m)



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-18	4.1	146.8
⊠	BRU19-18	9.4	141.5
▲	BRU19-19	3.4	148.8
★	BRU19-19	9.4	142.8
⊙	BRU19-19	14.0	138.2
✿	BRU19-21	9.4	141.3

Date February 2022

WP# 4068-09-00

THURBER

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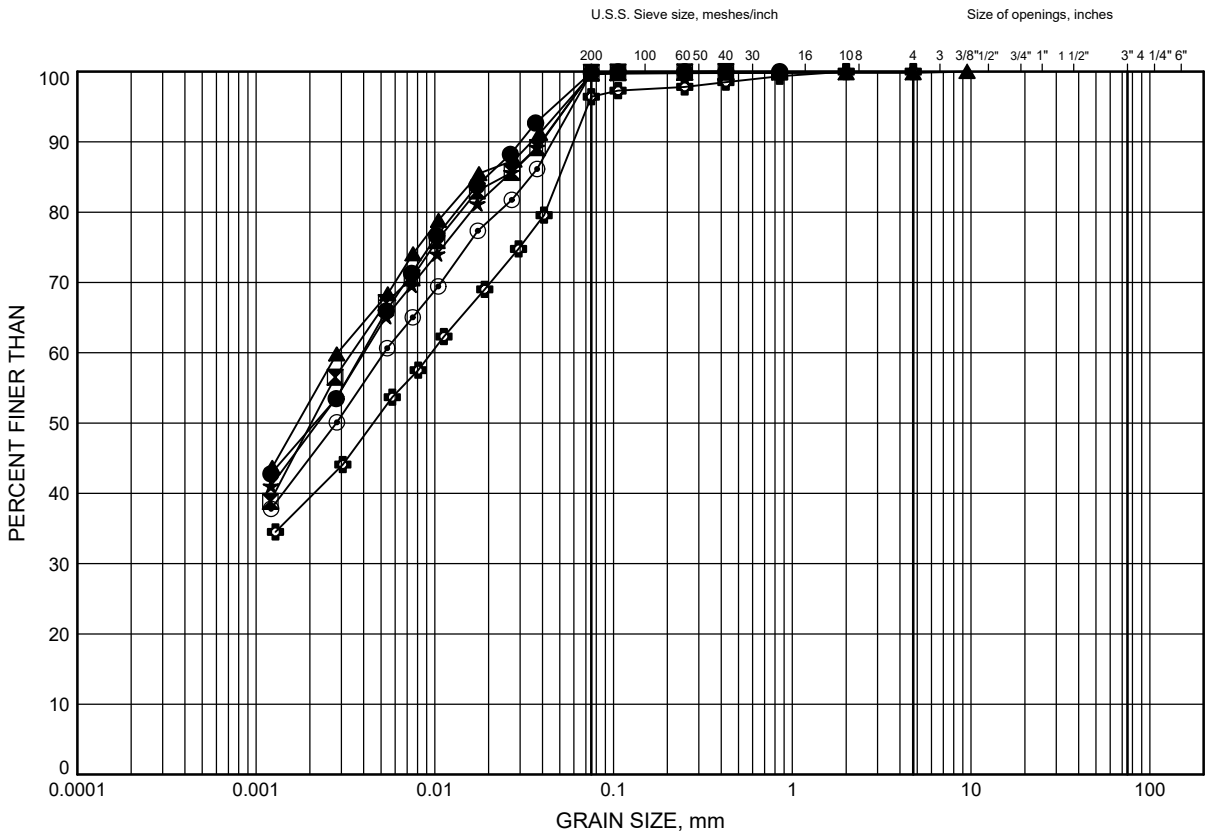
GRAIN SIZE DISTRIBUTION - THURBER 24726 BRUCE STREET GINT.GPJ 22-2-25

Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

GRAIN SIZE DISTRIBUTION

FIGURE C6.5

Silty Clay to Clayey Silt (Above Elevation 133 m)



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-21	15.5	135.2
⊠	BRU19-22	9.4	137.9
▲	BRU19-23	7.9	138.7
★	BRU19-25	4.9	143.0
⊙	BRU19-25	14.0	133.9
✿	BRU19-26	11.0	138.7

Date February 2022

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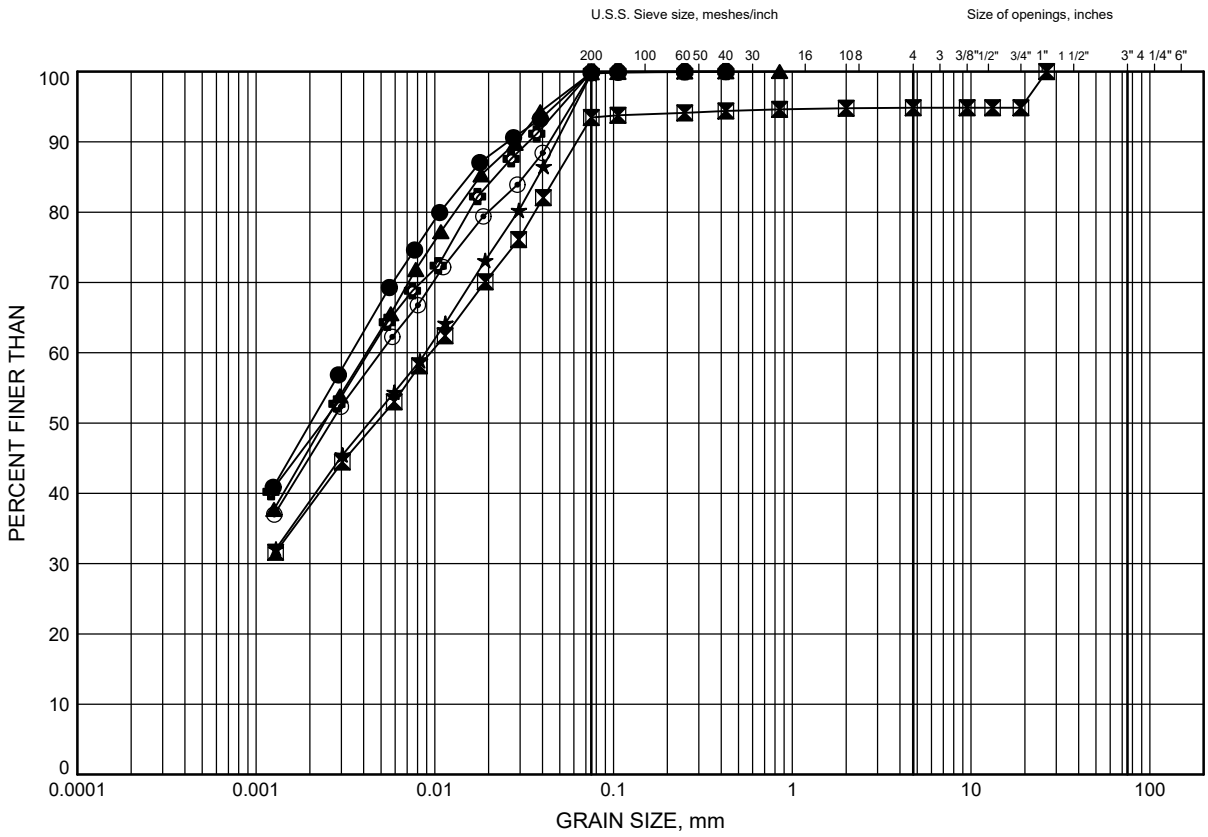
GRAIN SIZE DISTRIBUTION - THURBER 24726 BRUCE STREET GINT.GPJ 22-2-25

Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

GRAIN SIZE DISTRIBUTION

FIGURE C6.6

Silty Clay to Clayey Silt (Above Elevation 133 m)



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-27	7.9	146.7
⊠	BRU19-27	14.0	140.6
▲	BRU19-28	11.0	144.0
★	BRU19-28	21.6	133.4
⊙	BRU19-29	17.1	137.6
✿	BRU19-30	13.7	140.4

Date February 2022

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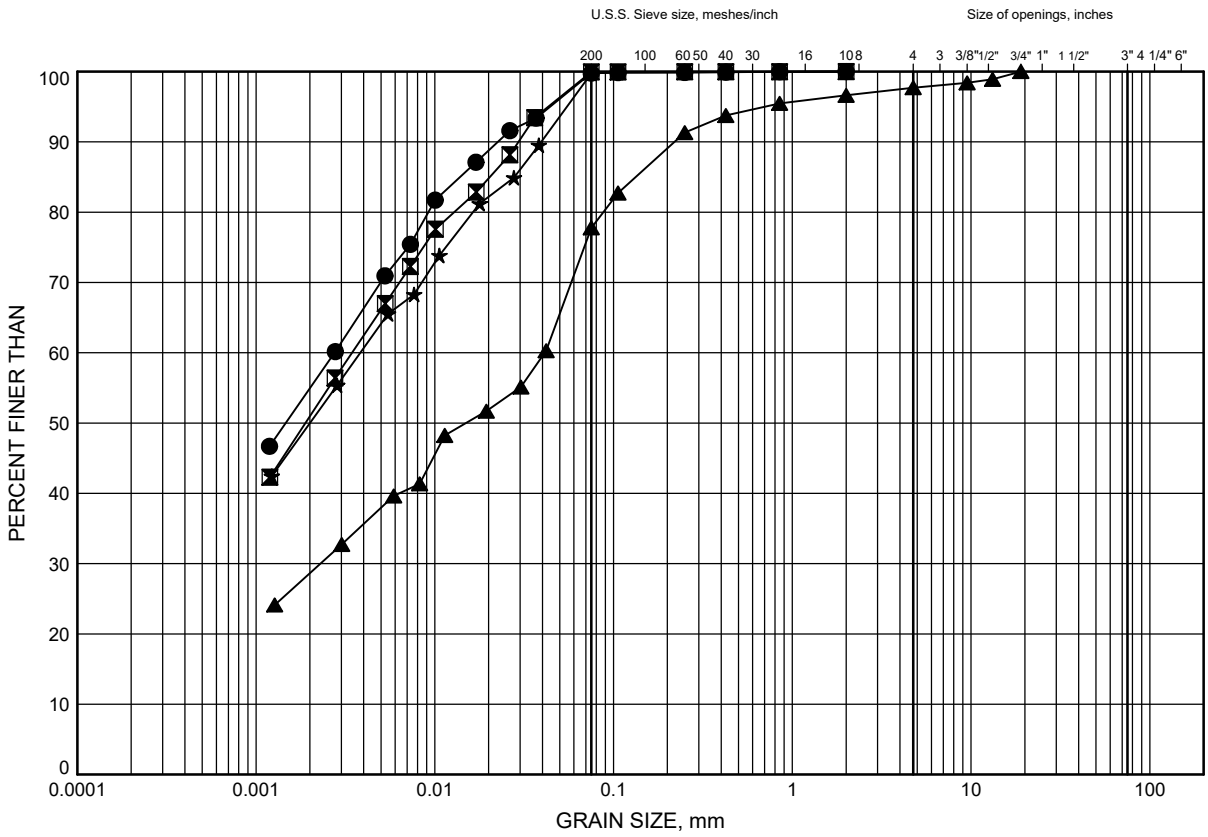
Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

GRAIN SIZE DISTRIBUTION

FIGURE C6.7

Silty Clay to Clayey Silt (Above Elevation 133 m)



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-31	4.1	145.8
⊠	BRU19-31	9.4	140.5
▲	BRU19-31	16.8	133.1
★	BRU19-33	6.4	140.5

Date February 2022

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THURBER

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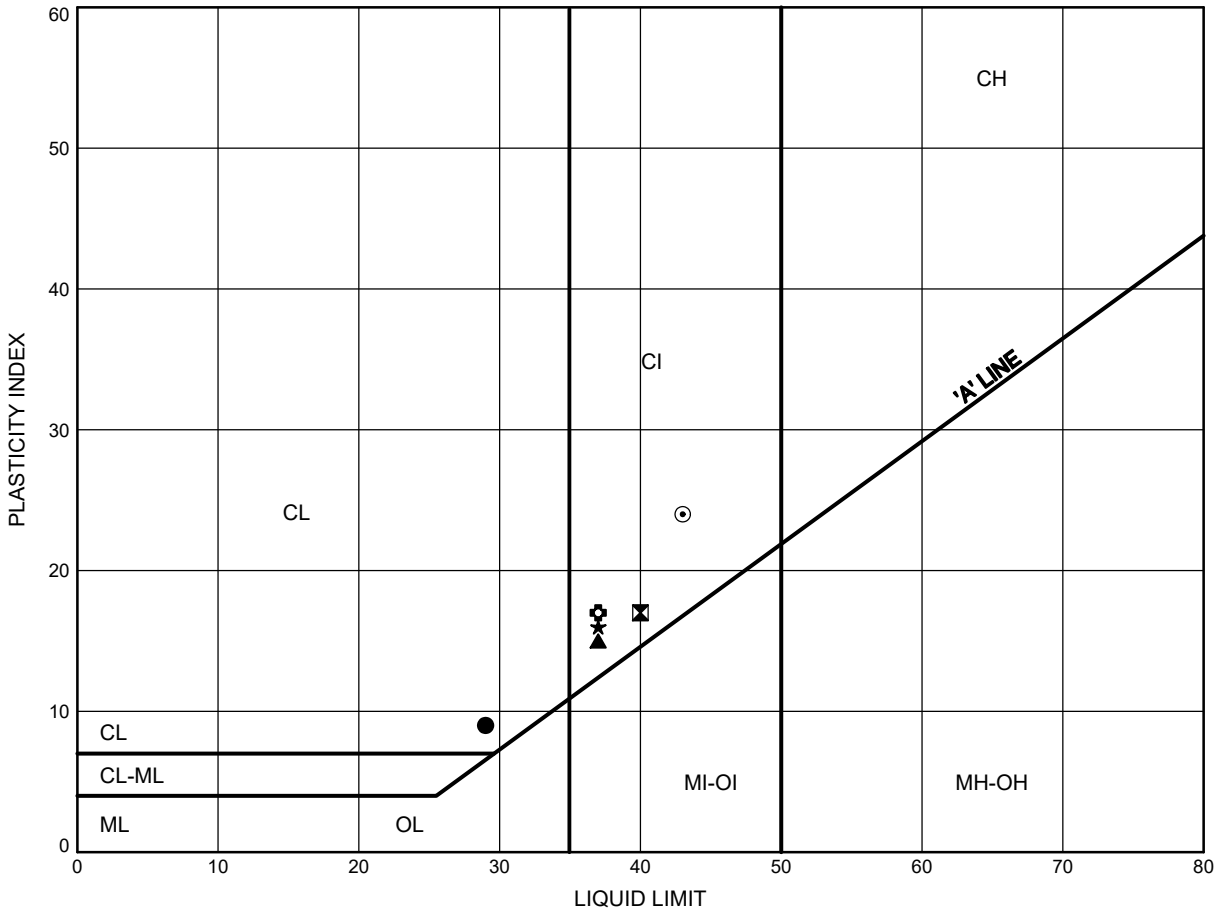
Chkd. MJK

Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

ATTERBERG LIMITS TEST RESULTS

FIGURE C7.1

Silty Clay to Clayey Silt (Above Elevation 133 m)



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-01	9.4	141.8
⊠	BRU19-02	12.5	137.6
▲	BRU19-02	15.5	134.6
★	BRU19-03	6.4	143.4
⊙	BRU19-04A	9.4	140.4
✿	BRU19-06	11.0	137.5

Date February 2022

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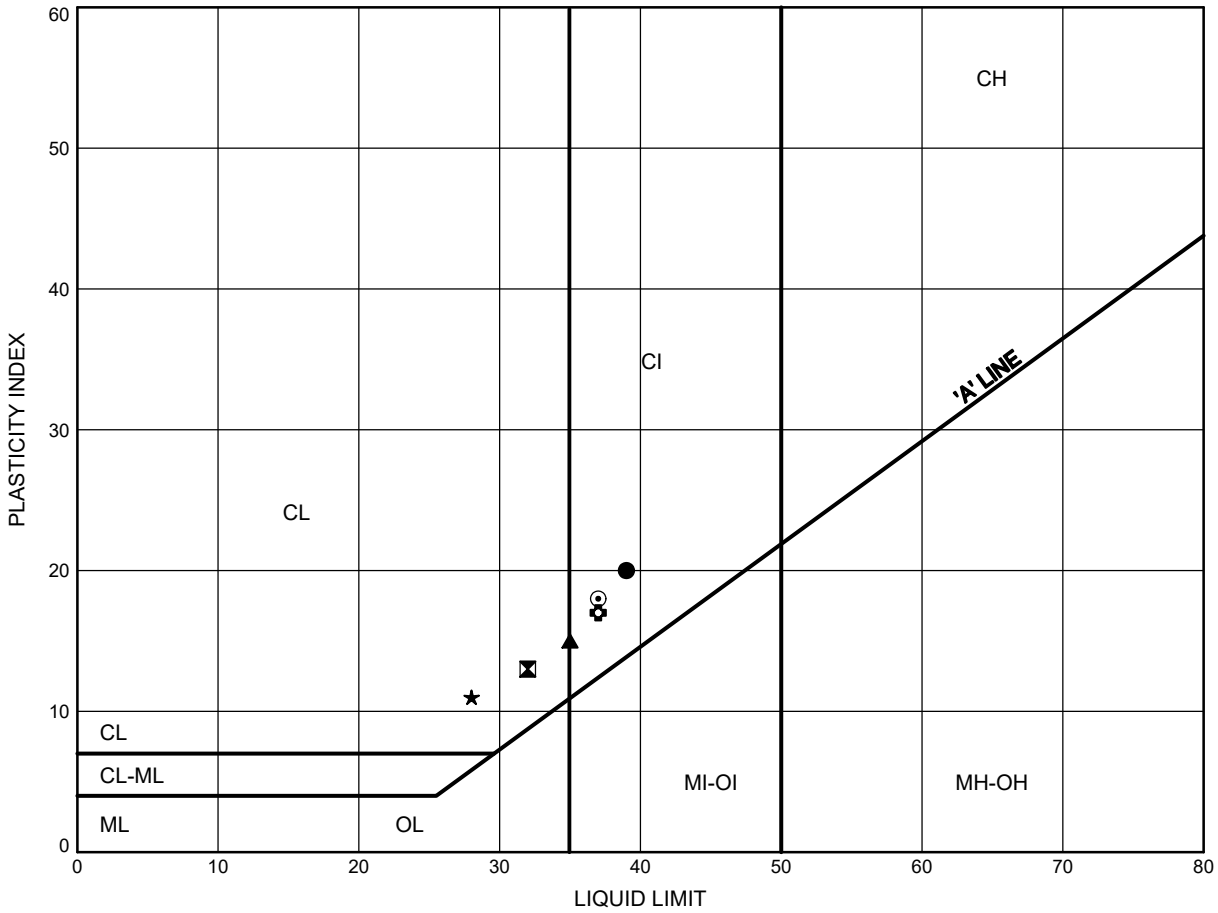
THURBALT 24726 BRUCE STREET GINT.GPJ 22-2-25

Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

ATTERBERG LIMITS TEST RESULTS

FIGURE C7.2

Silty Clay to Clayey Silt (Above Elevation 133 m)



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-07	6.4	141.7
⊠	BRU19-07	14.0	134.1
▲	BRU19-09	7.9	139.0
★	BRU19-10	6.4	139.8
⊙	BRU19-12	6.4	146.3
✿	BRU19-12	14.9	137.8

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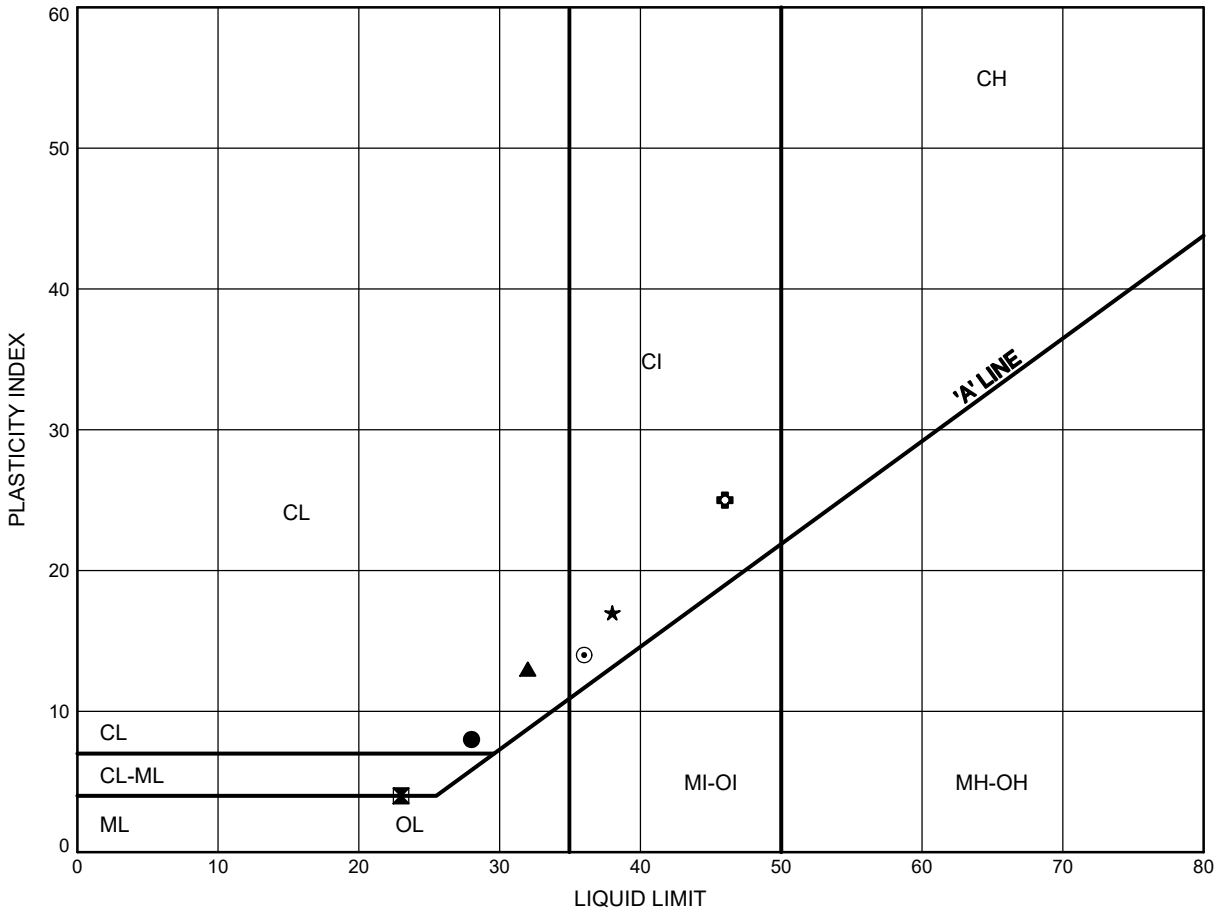
Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

ATTERBERG LIMITS TEST RESULTS

FIGURE C7.3

Silty Clay to Clayey Silt (Above Elevation 133 m)



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-13	9.4	143.1
⊠	BRU19-13	14.0	138.5
▲	BRU19-15	9.4	143.2
★	BRU19-16	7.9	143.6
⊙	BRU19-16	14.0	137.5
✿	BRU19-18	4.1	146.8

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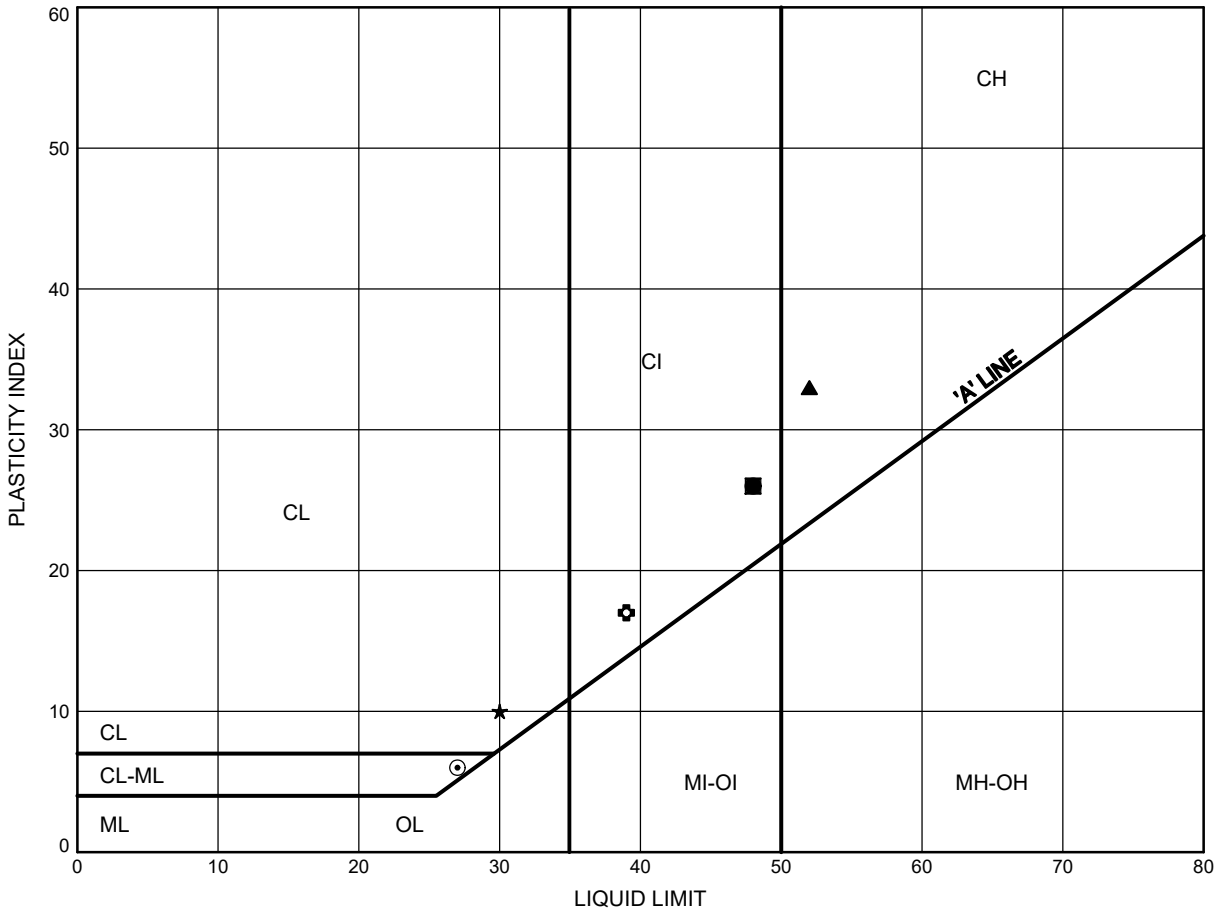
Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

ATTERBERG LIMITS TEST RESULTS

FIGURE C7.4

Silty Clay to Clayey Silt (Above Elevation 133 m)



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-19	3.4	148.8
⊠	BRU19-19	9.4	142.8
▲	BRU19-19	14.0	138.2
★	BRU19-21	9.4	141.3
⊙	BRU19-21	15.5	135.2
✿	BRU19-22	9.4	137.9

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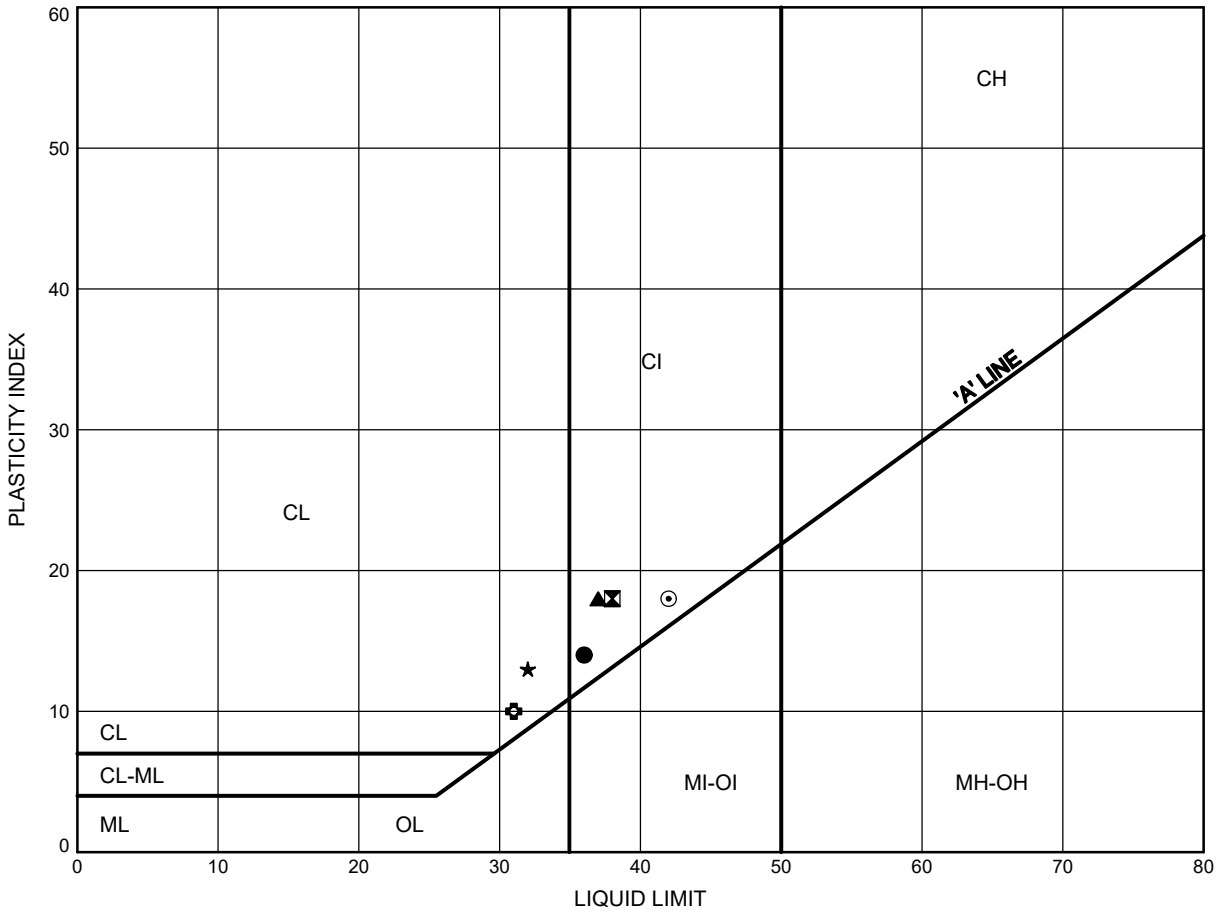
THURBALT 24726 BRUCE STREET GINT.GPJ 22-2-25

Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

ATTERBERG LIMITS TEST RESULTS

FIGURE C7.5

Silty Clay to Clayey Silt (Above Elevation 133 m)



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-23	7.9	138.7
⊠	BRU19-25	4.9	143.0
▲	BRU19-25	14.0	133.9
★	BRU19-26	11.0	138.7
⊙	BRU19-27	7.9	146.7
✿	BRU19-27	14.0	140.6

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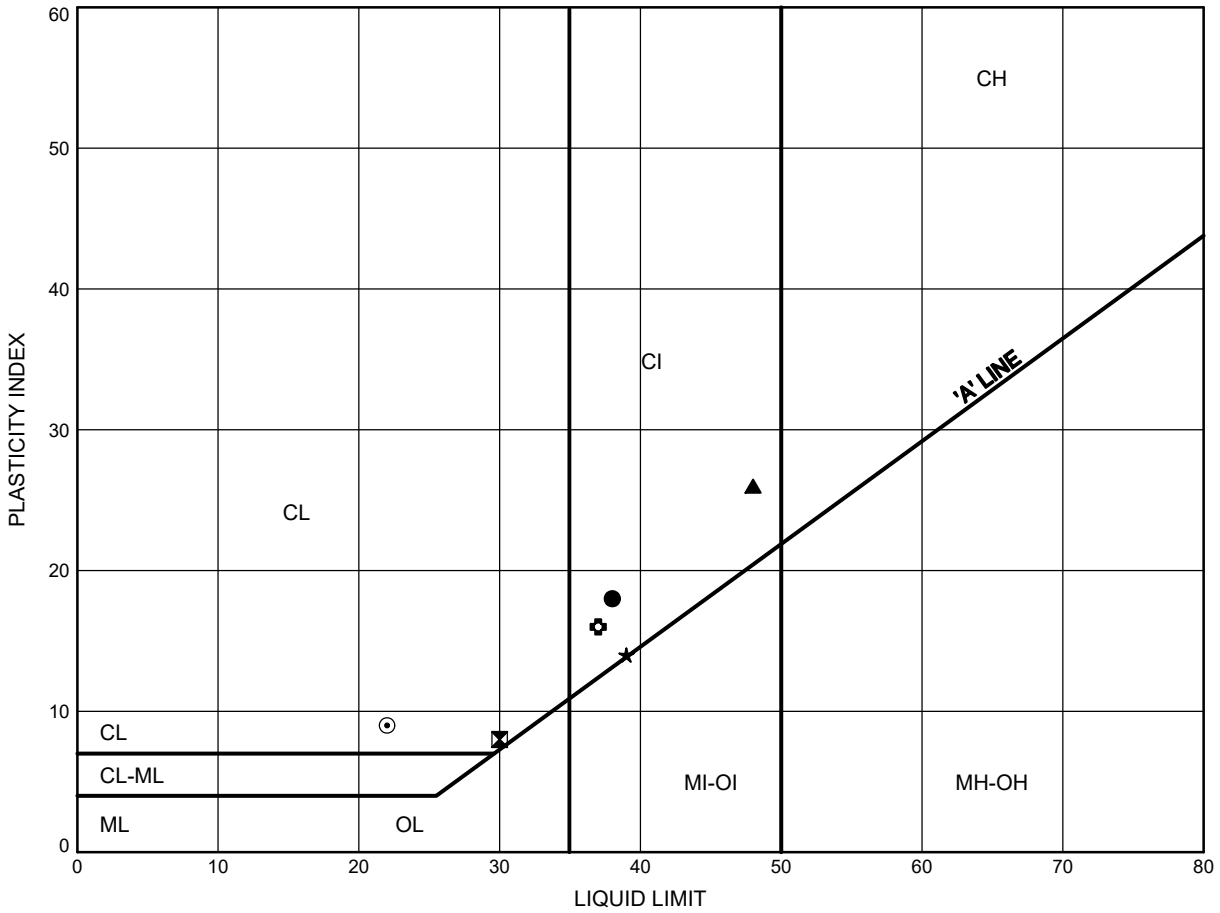
THURBALT 24726 BRUCE STREET GINT.GPJ 22-2-25

Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

ATTERBERG LIMITS TEST RESULTS

FIGURE C7.6

Silty Clay to Clayey Silt (Above Elevation 133 m)



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-28	11.0	144.0
⊠	BRU19-30	13.7	140.4
▲	BRU19-31	4.1	145.8
★	BRU19-31	9.4	140.5
⊙	BRU19-31	16.8	133.1
✿	BRU19-33	6.4	140.5

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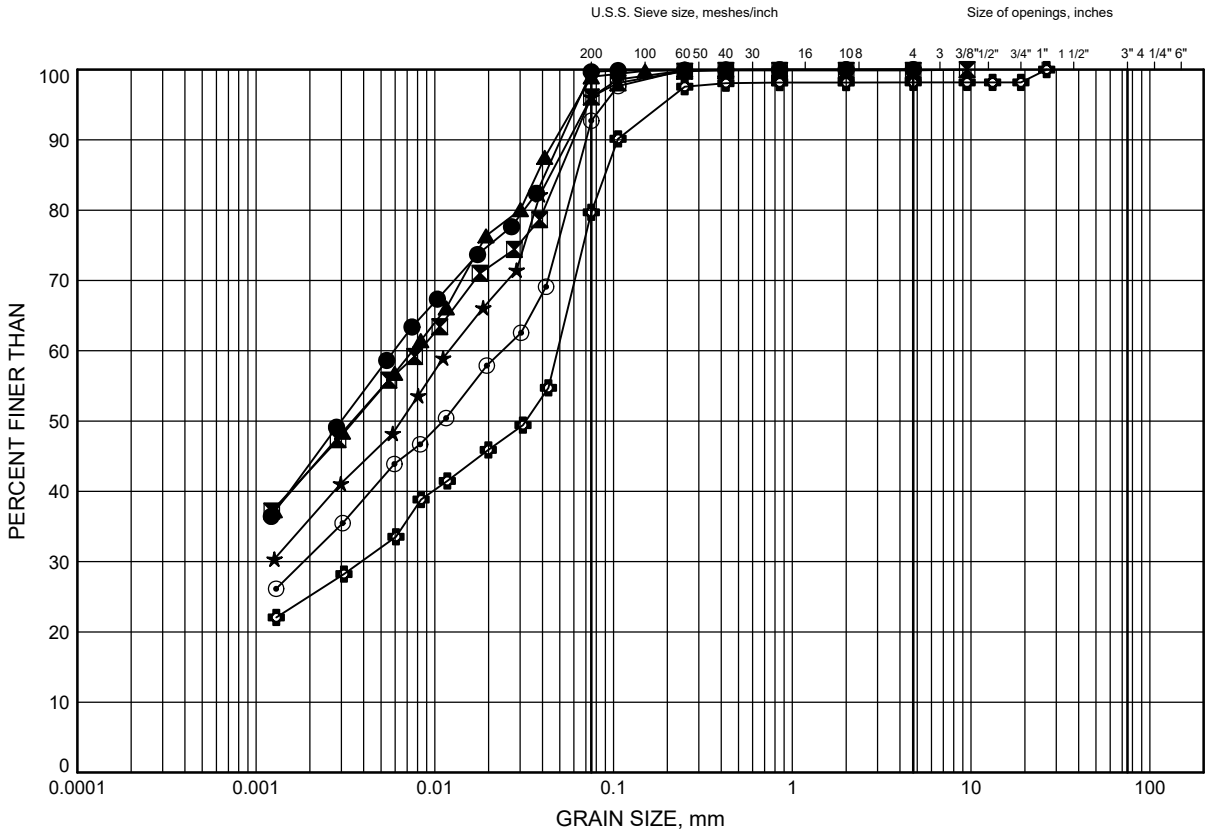
Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

GRAIN SIZE DISTRIBUTION

FIGURE C8.1

Clayey Silt (Below Elevation 133 m)



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-01	18.6	132.6
⊠	BRU19-01	30.8	120.4
▲	BRU19-01A	23.2	129.0
★	BRU19-02	30.8	119.3
⊙	BRU19-03	21.6	128.2
✿	BRU19-03	32.3	117.5

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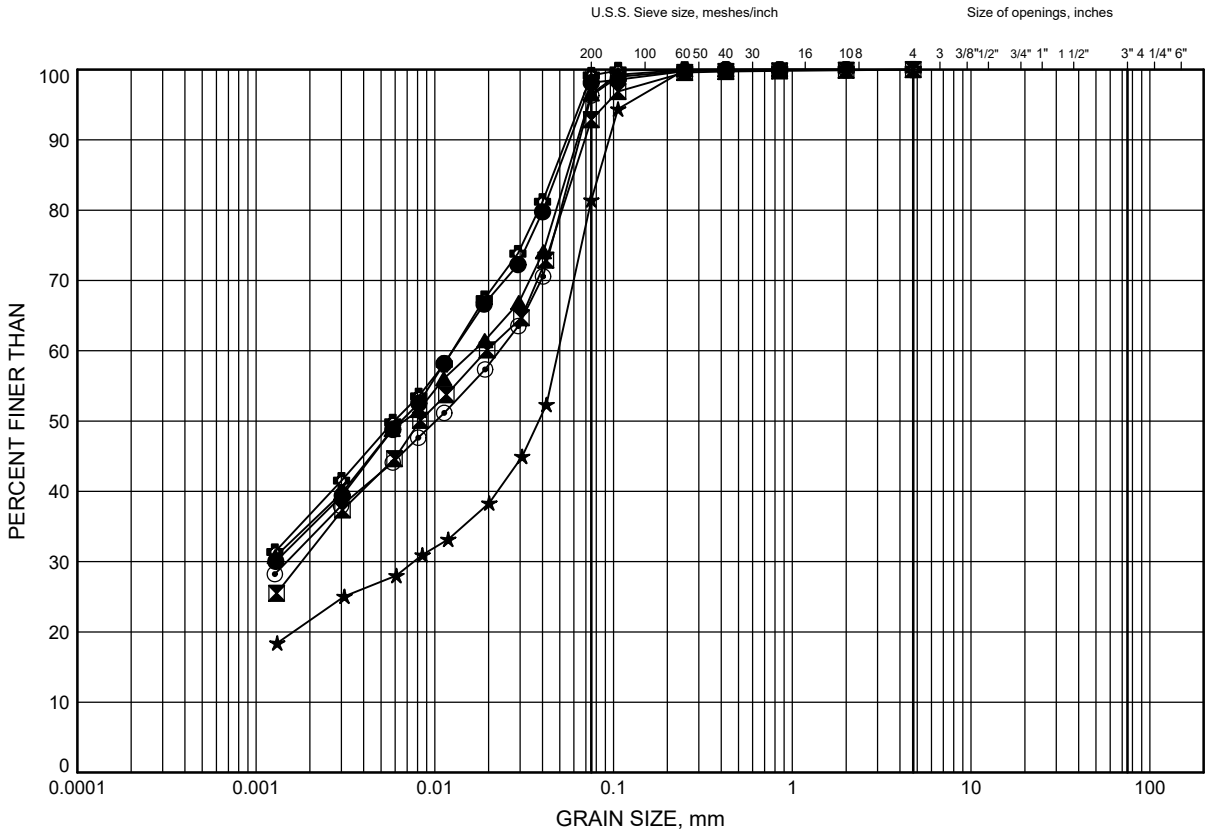
GRAIN SIZE DISTRIBUTION - THURBER 24726 BRUCE STREET GINT.GPJ 22-2-25

Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

GRAIN SIZE DISTRIBUTION

FIGURE C8.2

Clayey Silt (Below Elevation 133 m)



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-04A	18.6	131.2
⊠	BRU19-04A	30.0	119.8
▲	BRU19-06	20.1	128.4
★	BRU19-06	22.3	126.2
⊙	BRU19-09	17.1	129.8
✿	BRU19-13	24.1	128.4

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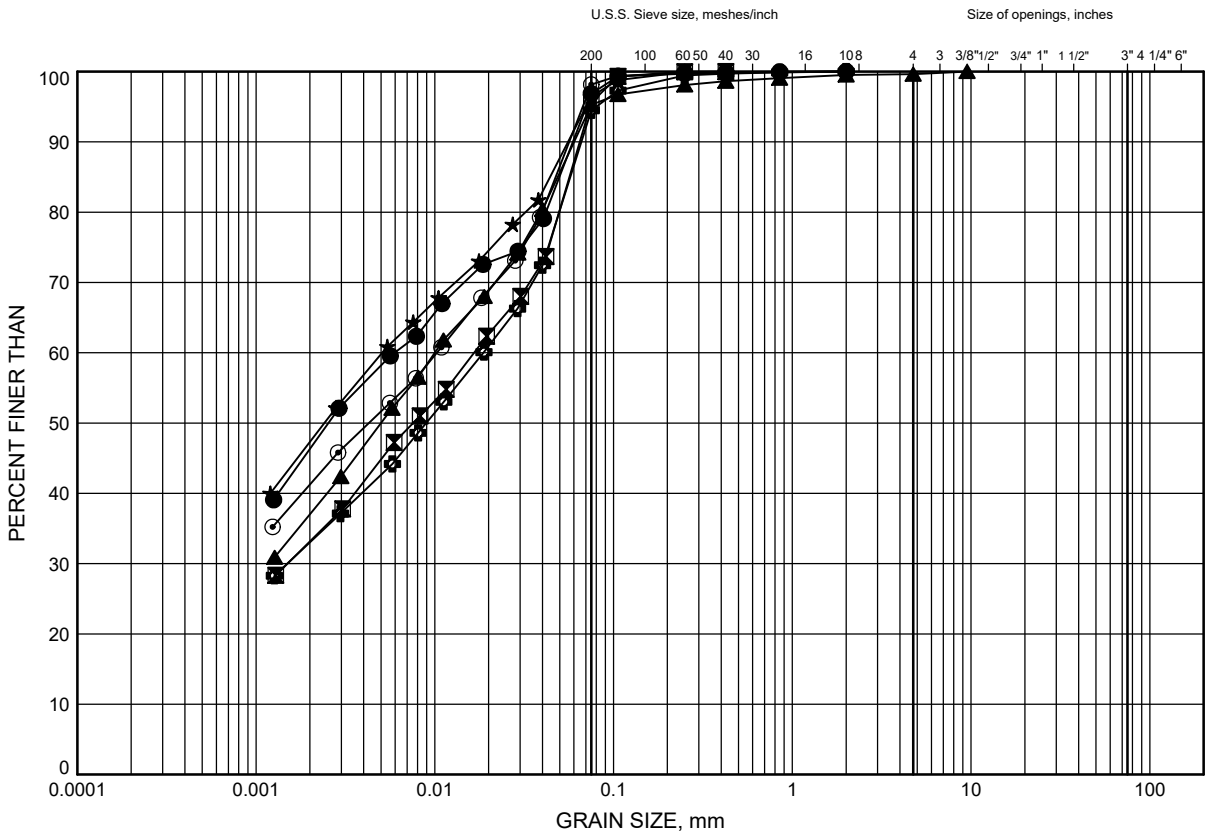
Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

GRAIN SIZE DISTRIBUTION

FIGURE C8.3

Clayey Silt (Below Elevation 133 m)



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-15	21.6	131.0
⊠	BRU19-15	33.1	119.5
▲	BRU19-18	21.6	129.3
★	BRU19-19	20.1	132.1
⊙	BRU19-19	24.7	127.5
✿	BRU19-19	35.4	116.8

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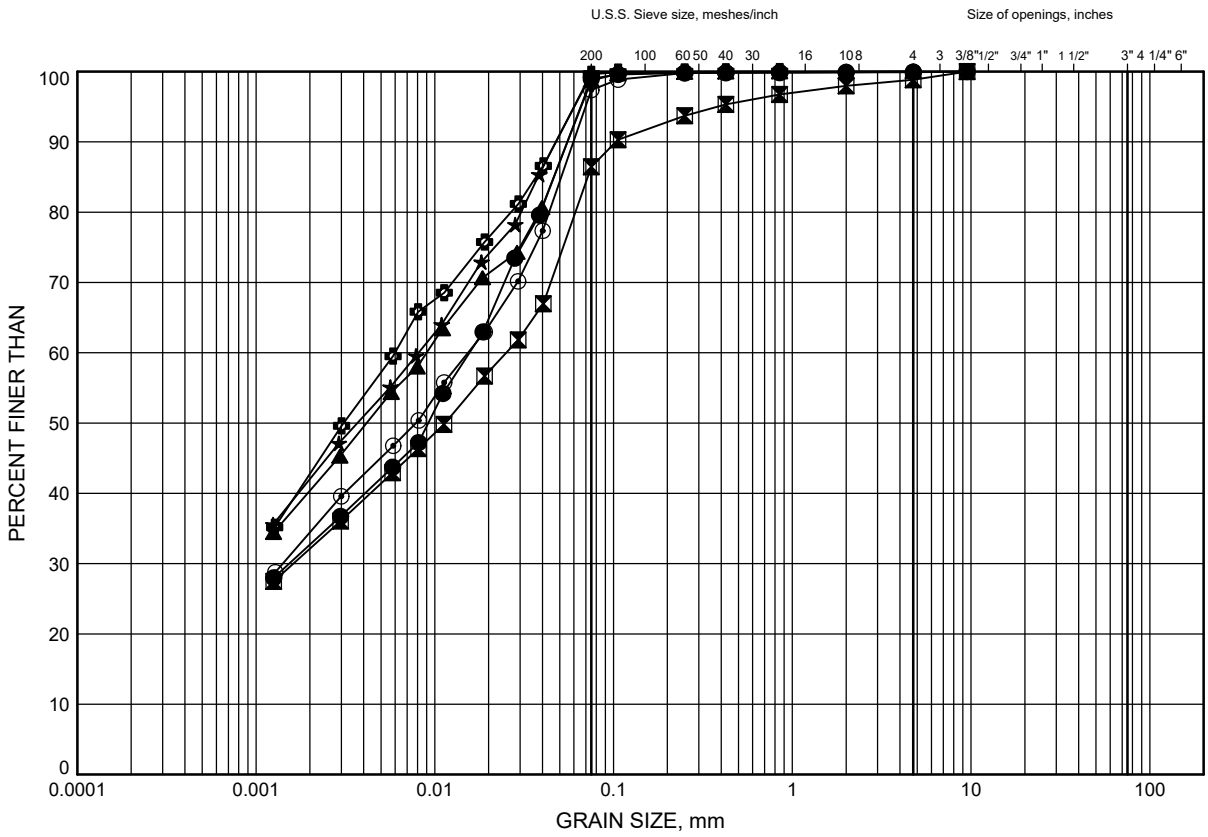
Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

GRAIN SIZE DISTRIBUTION

FIGURE C8.4

Clayey Silt (Below Elevation 133 m)



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-21	23.2	127.5
⊠	BRU19-21	32.3	118.4
▲	BRU19-22	23.2	124.1
★	BRU19-23	14.8	131.8
⊙	BRU19-23	23.9	122.7
✿	BRU19-29	24.7	130.0

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THURBER

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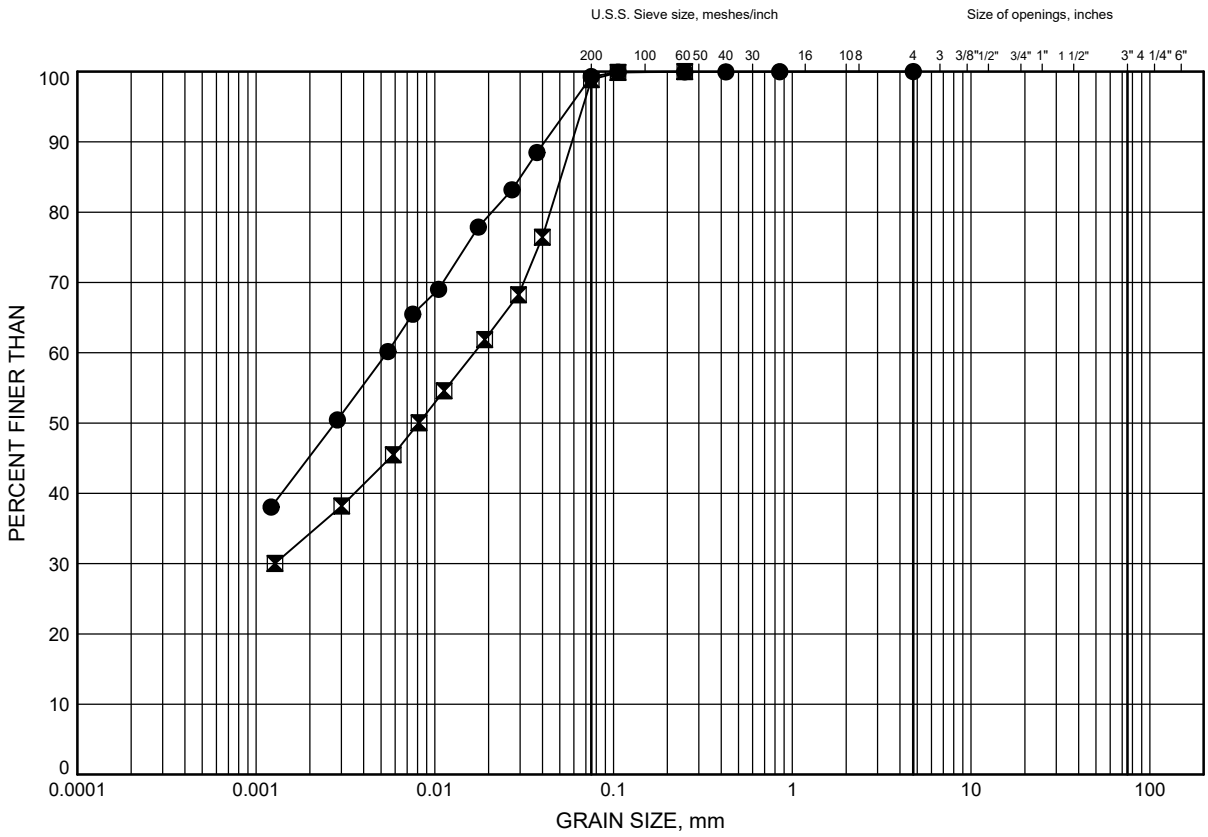
GRAIN SIZE DISTRIBUTION - THURBER 24726 BRUCE STREET GINT.GPJ 22-2-25

Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

GRAIN SIZE DISTRIBUTION

FIGURE C8.5

Clayey Silt (Below Elevation 133 m)



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-30	22.9	131.2
⊠	BRU19-33	15.5	131.4

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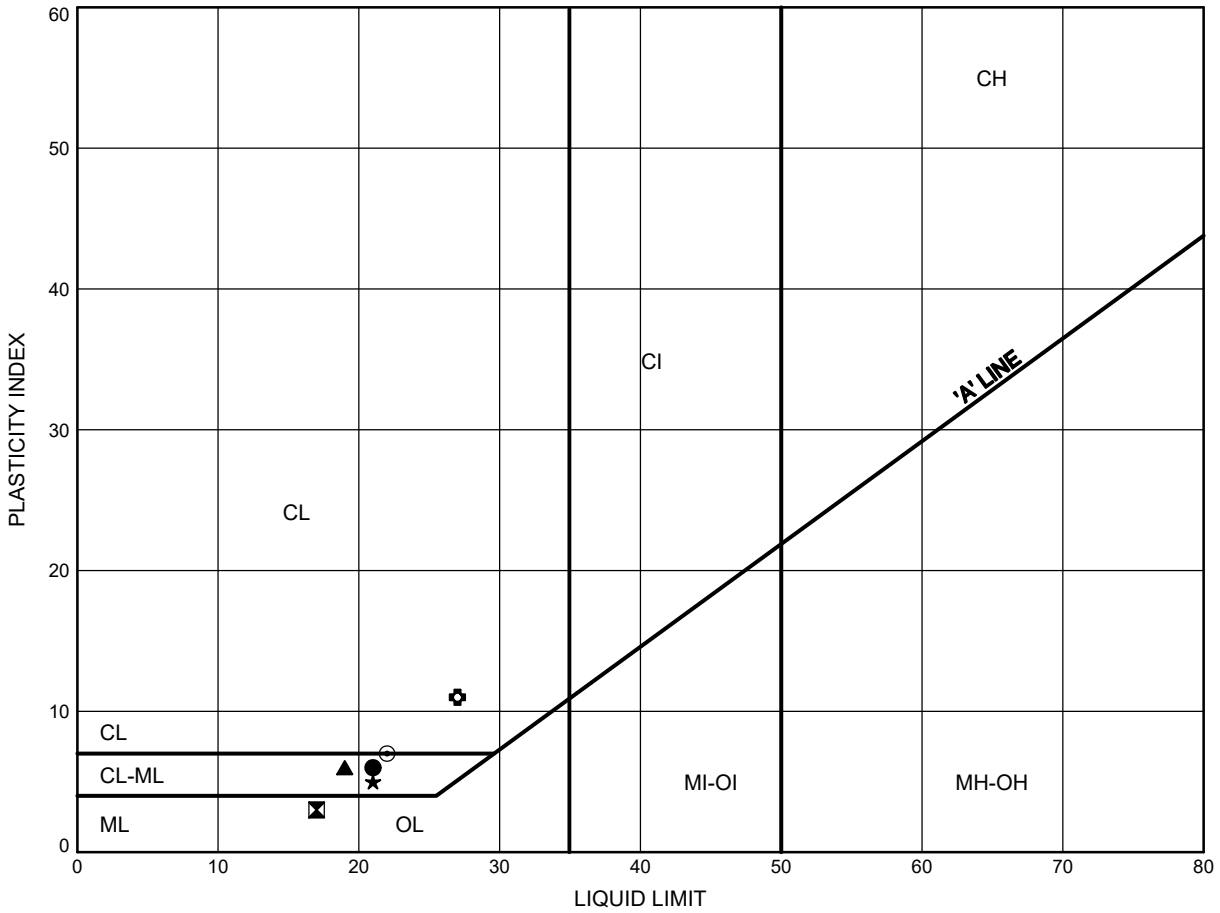
GRAIN SIZE DISTRIBUTION - THURBER 24726 BRUCE STREET GINT.GPJ 22-2-25

Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

ATTERBERG LIMITS TEST RESULTS

FIGURE C9.1

Clayey Silt (Below Elevation 133 m)



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-02	30.8	119.3
⊠	BRU19-03	21.6	128.2
▲	BRU19-03	32.3	117.5
★	BRU19-04A	18.6	131.2
⊙	BRU19-04A	30.0	119.8
✿	BRU19-06	20.1	128.4

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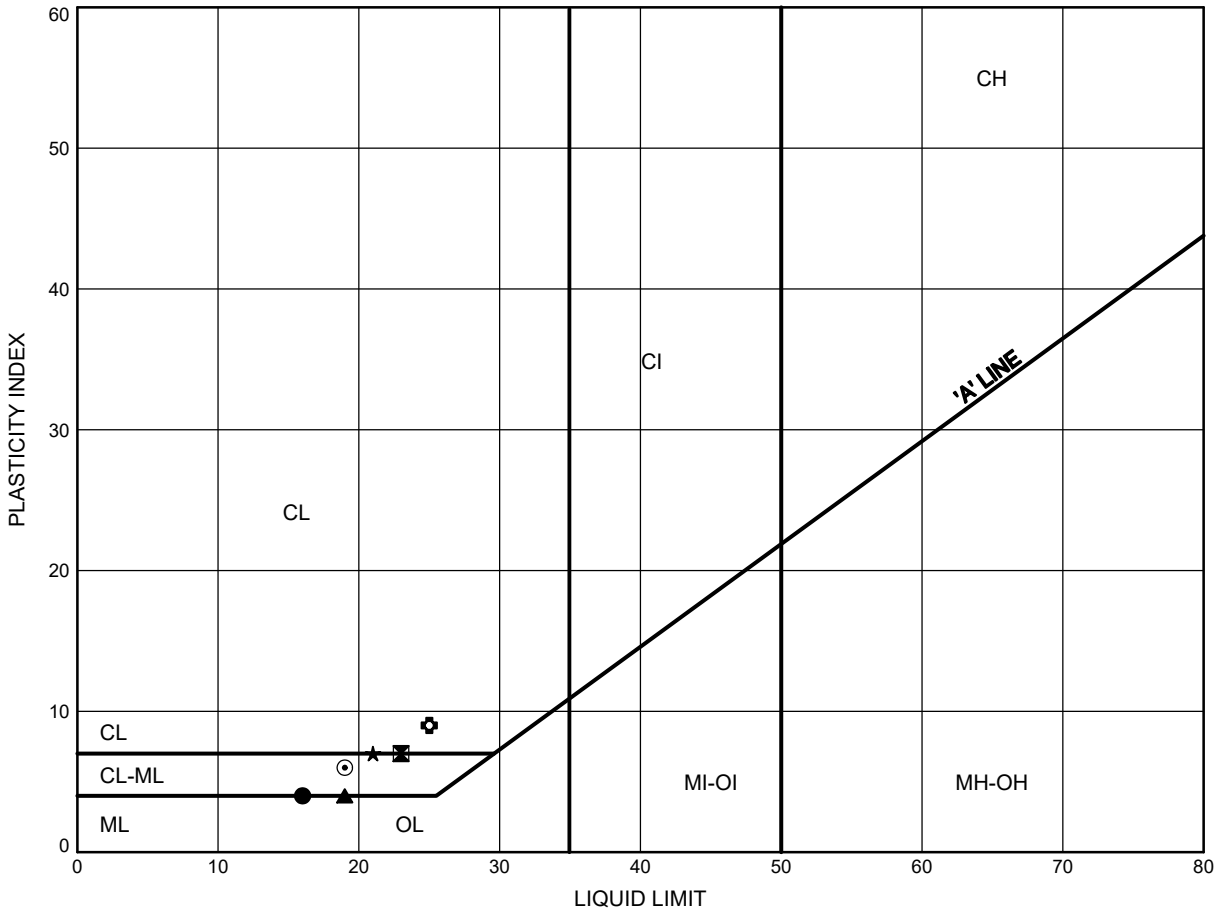
THURBALT 24726 BRUCE STREET GINT.GPJ 22-2-25

Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

ATTERBERG LIMITS TEST RESULTS

FIGURE C9.2

Clayey Silt (Below Elevation 133 m)



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-06	22.3	126.2
⊠	BRU19-09	17.1	129.8
▲	BRU19-13	24.1	128.4
★	BRU19-15	33.1	119.5
⊙	BRU19-16	27.7	123.8
✿	BRU19-16	33.8	117.7

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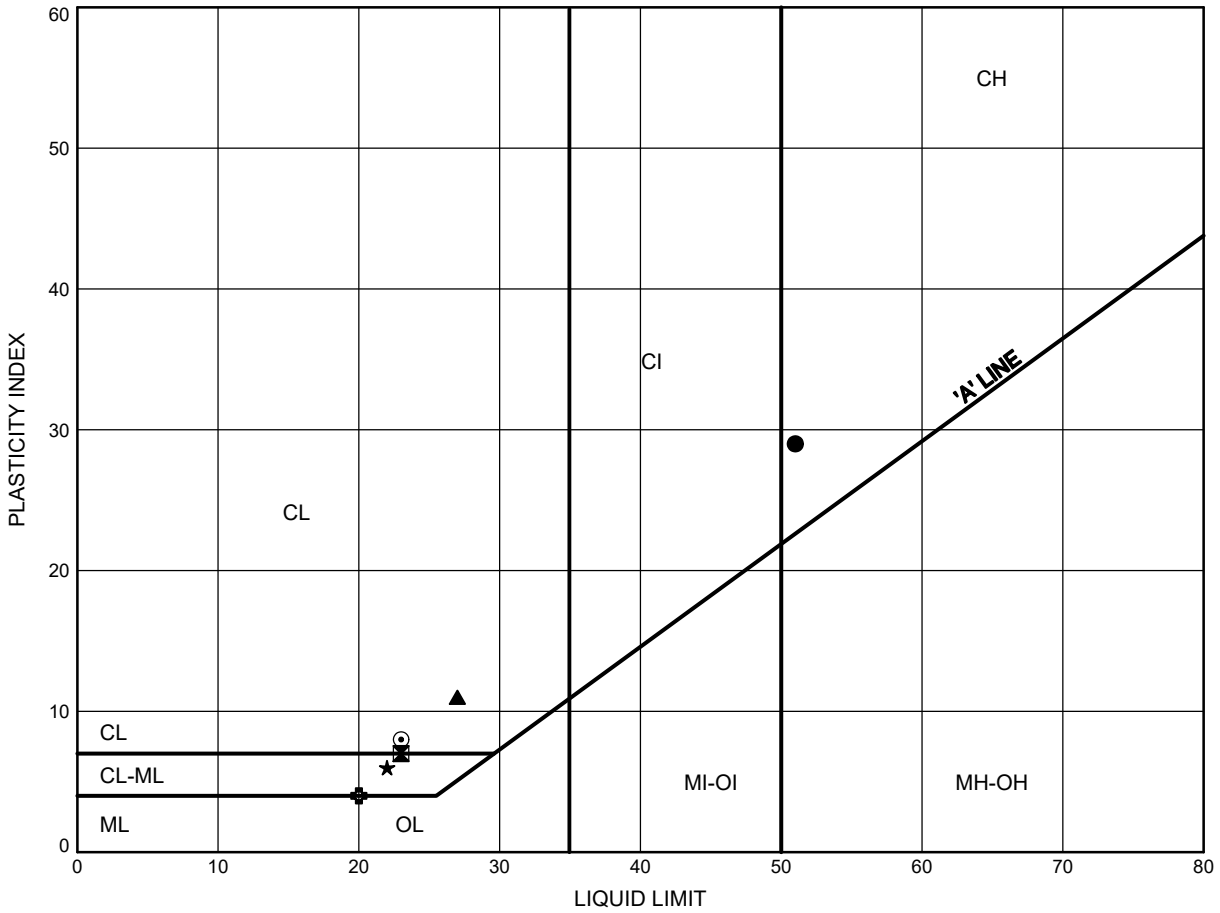
THURBALT 24726 BRUCE STREET GINT.GPJ 22-2-25

Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

ATTERBERG LIMITS TEST RESULTS

FIGURE C9.3

Clayey Silt (Below Elevation 133 m)



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-19	20.1	132.1
⊠	BRU19-19	24.7	127.5
▲	BRU19-19	35.4	116.8
★	BRU19-21	23.2	127.5
⊙	BRU19-21	32.3	118.4
✿	BRU19-22	23.2	124.1

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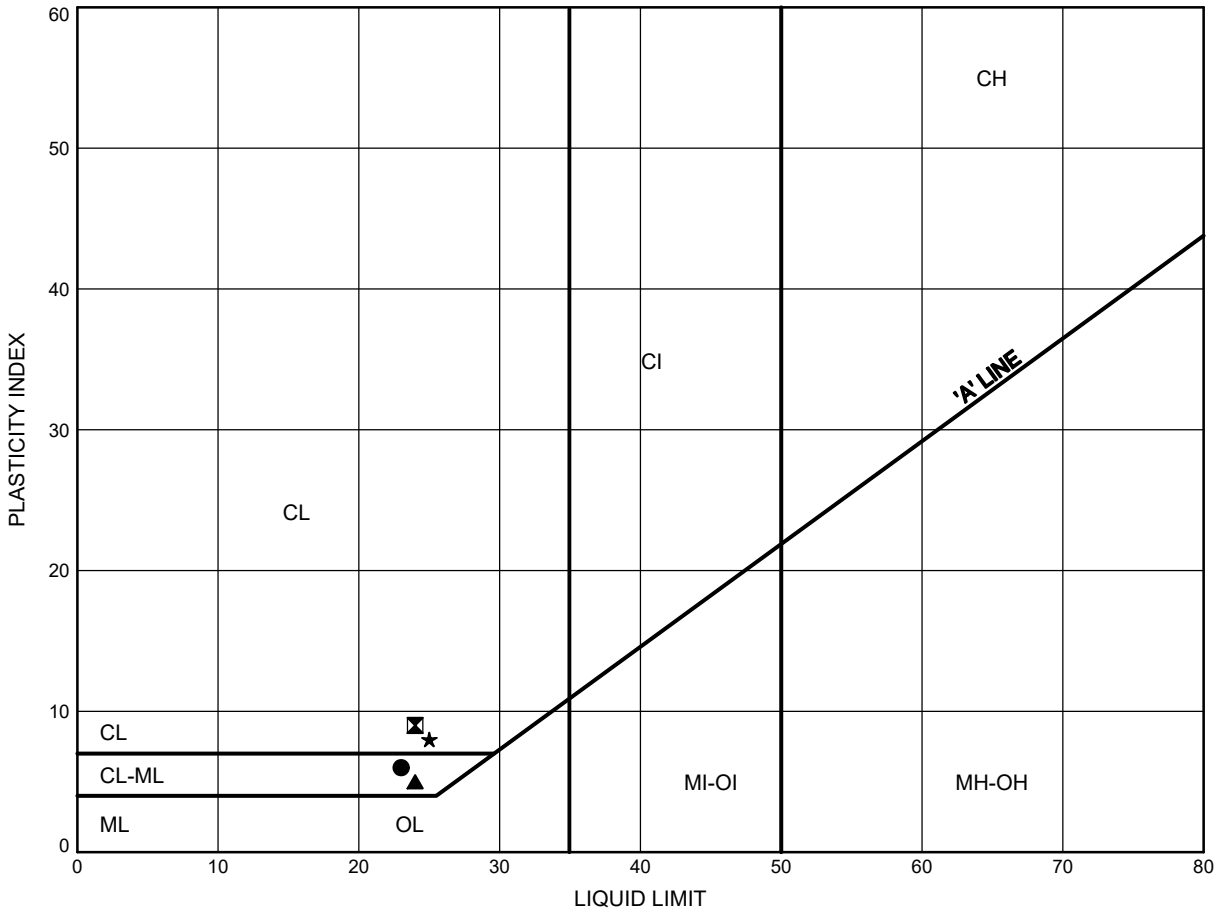
THURBALT 24726 BRUCE STREET GINT.GPJ 22-2-25

Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

ATTERBERG LIMITS TEST RESULTS

FIGURE C9.4

Clayey Silt (Below Elevation 133 m)



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-23	14.8	131.8
⊠	BRU19-23	23.9	122.7
▲	BRU19-30	22.9	131.2
★	BRU19-33	15.5	131.4

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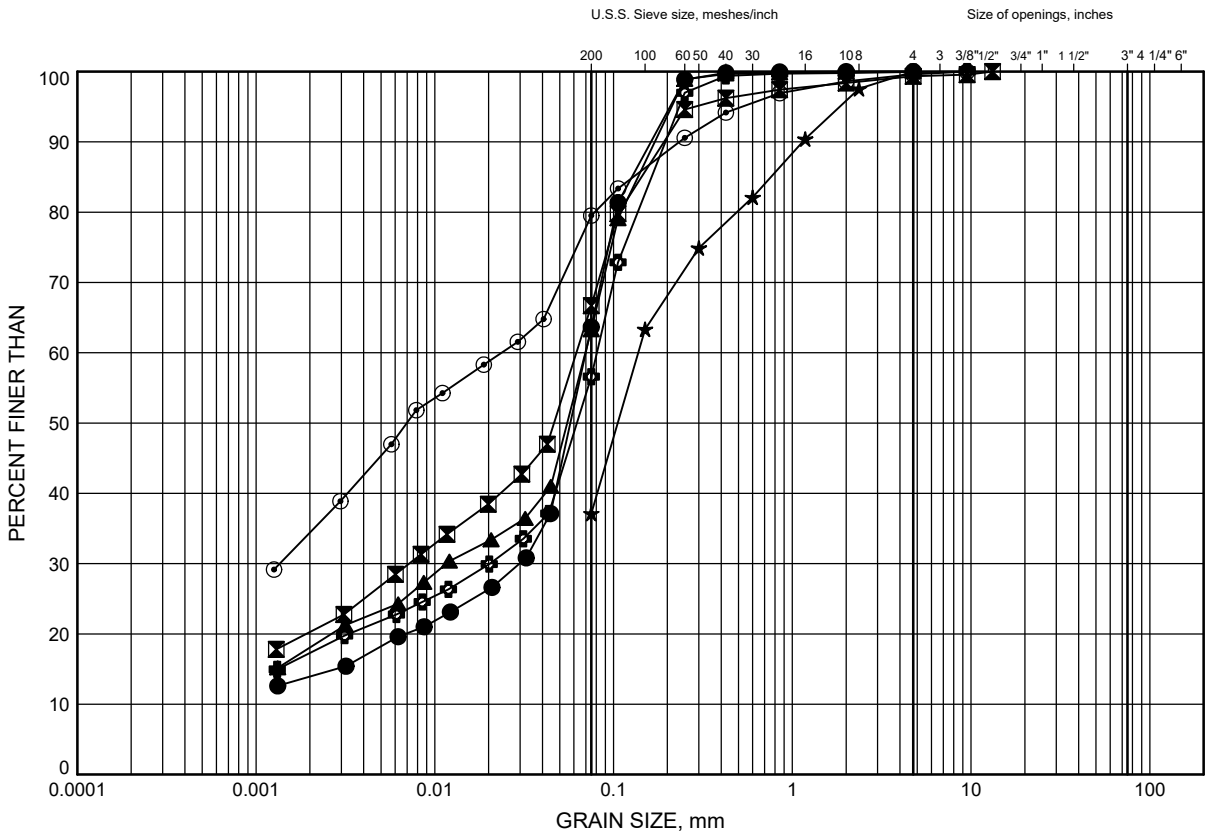
THURBALT 24726 BRUCE STREET GINT.GPJ 22-2-25

Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

GRAIN SIZE DISTRIBUTION

FIGURE C10.1

Interlayered Silt, Sand, and Clayey Silt



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-01	36.9	114.3
⊠	BRU19-01	39.9	111.3
▲	BRU19-02	33.8	116.3
★	BRU19-03	38.4	111.4
⊙	BRU19-03	43.0	106.8
✿	BRU19-04A	32.3	117.5

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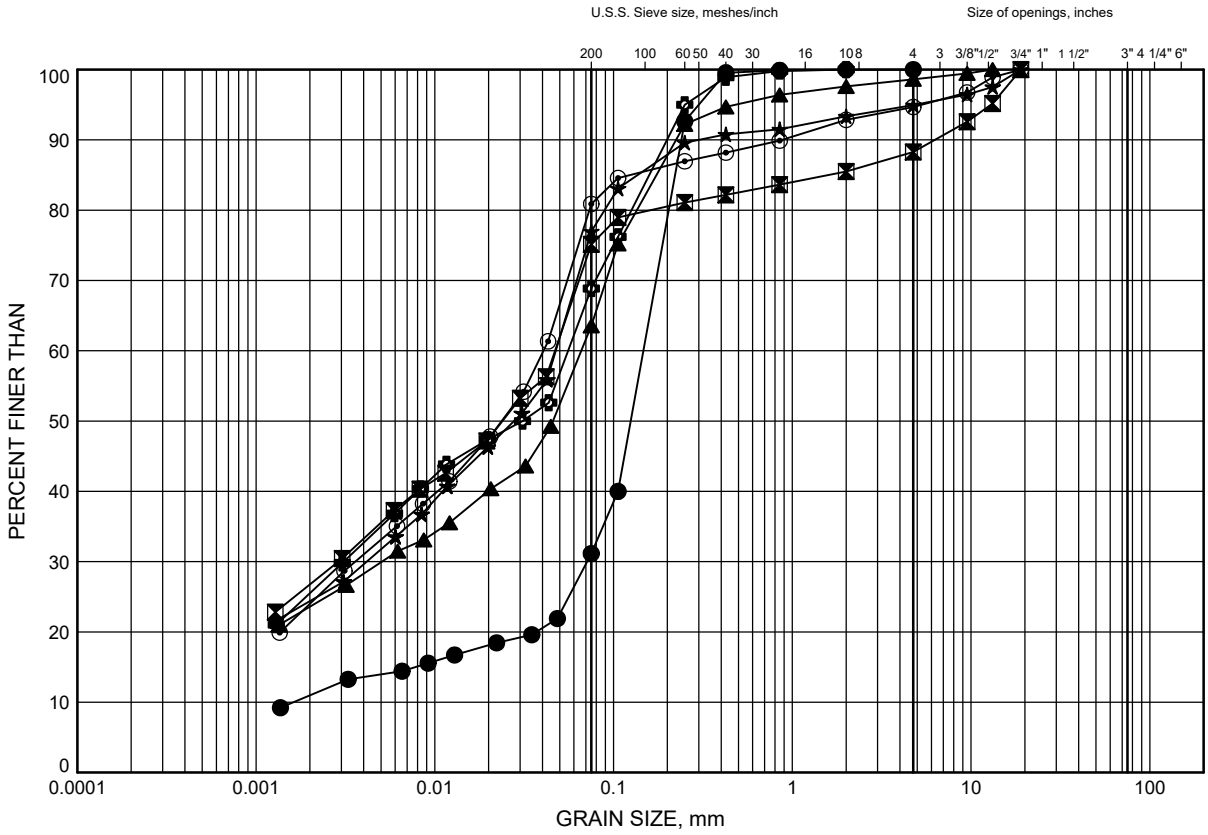
GRAIN SIZE DISTRIBUTION - THURBER 24726 BRUCE STREET GINT.GPJ 22-2-25

Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

GRAIN SIZE DISTRIBUTION

FIGURE C10.2

Interlayered Silt, Sand, and Clayey Silt



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-07	26.4	121.7
⊠	BRU19-13	34.1	118.4
▲	BRU19-15	39.9	112.7
★	BRU19-16	39.9	111.6
⊙	BRU19-18	33.8	117.1
✿	BRU19-19	38.4	113.8

Date February 2022

WP# 4068-09-00

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Prep'd MIK

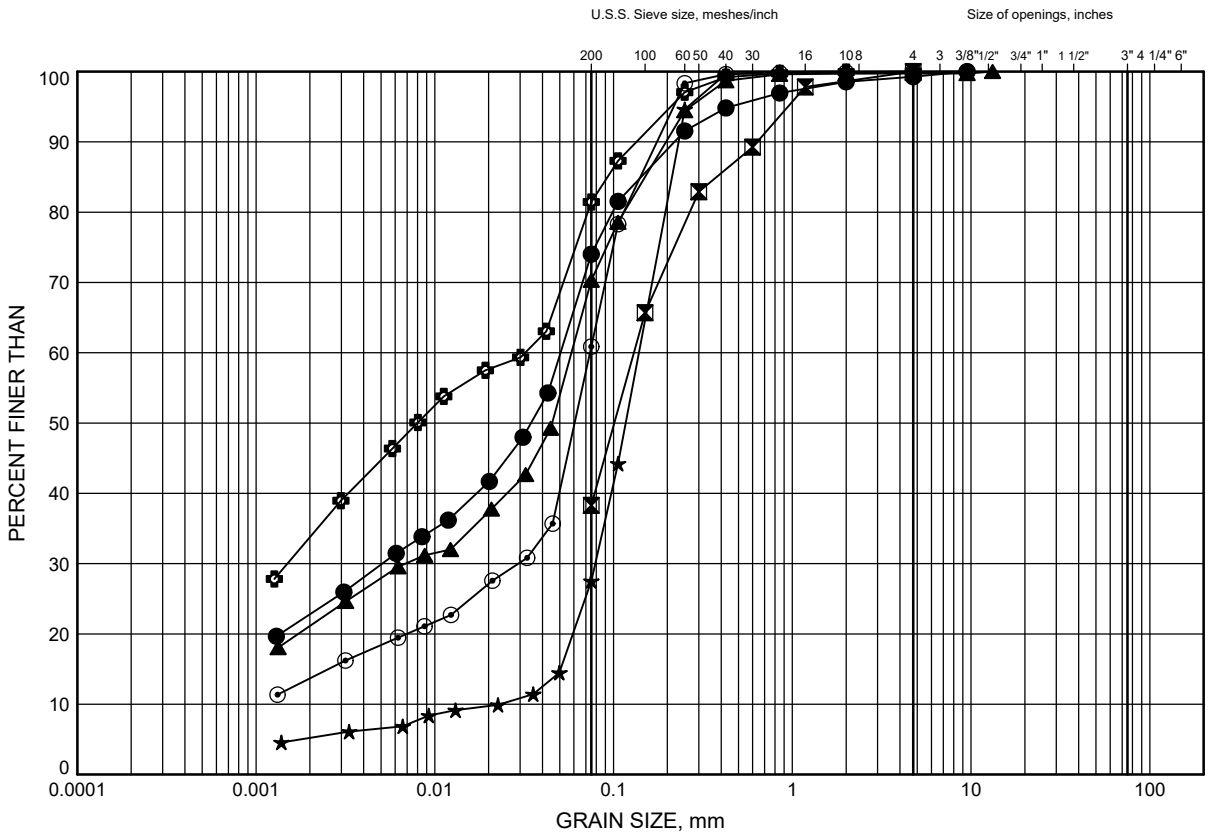
Chkd. MJK

Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

GRAIN SIZE DISTRIBUTION

FIGURE C10.3

Interlayered Silt, Sand, and Clayey Silt



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-21	38.4	112.3
⊠	BRU19-22	32.3	115.0
▲	BRU19-22	38.4	108.9
★	BRU19-23	29.3	117.3
⊙	BRU19-25	30.8	117.1
✿	BRU19-25	39.9	108.0

Date February 2022

WP# 4068-09-00

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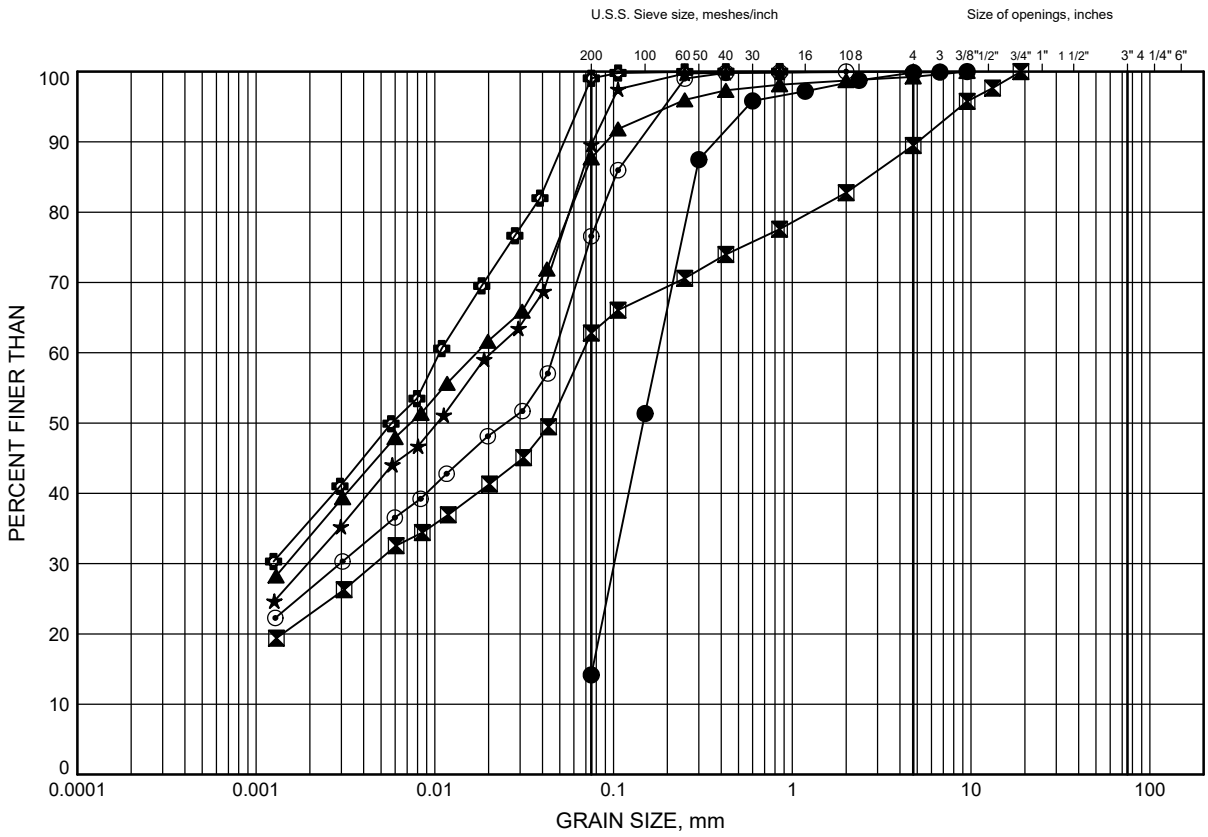
Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

GRAIN SIZE DISTRIBUTION

FIGURE C10.4

Interlayered Silt, Sand, and Clayey Silt



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-26	17.1	132.6
⊠	BRU19-27	18.8	135.8
▲	BRU19-29	33.8	120.9
★	BRU19-30	32.0	122.1
⊙	BRU19-31	29.0	120.9
✿	BRU19-31	35.1	114.8

Date February 2022

WP# 4068-09-00

THURBER

Prep'd MIK

Chkd. MJK

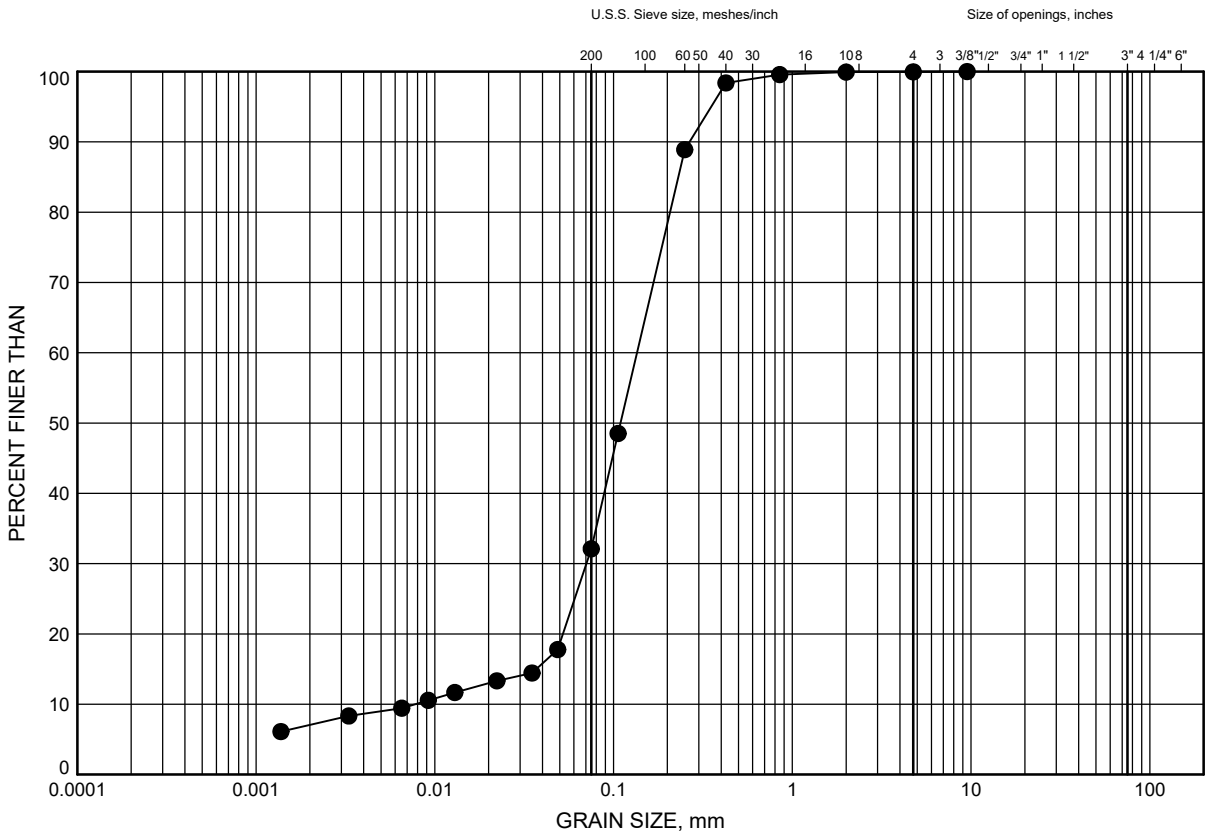
GRAIN SIZE DISTRIBUTION - THURBER 24726 BRUCE STREET GINT.GPJ 22-2-25

Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

GRAIN SIZE DISTRIBUTION

FIGURE C10.5

Interlayered Silt, Sand, and Clayey Silt



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-33	27.0	119.9

Date February 2022

WP# 4068-09-00

THURBER

Prep'd MIK

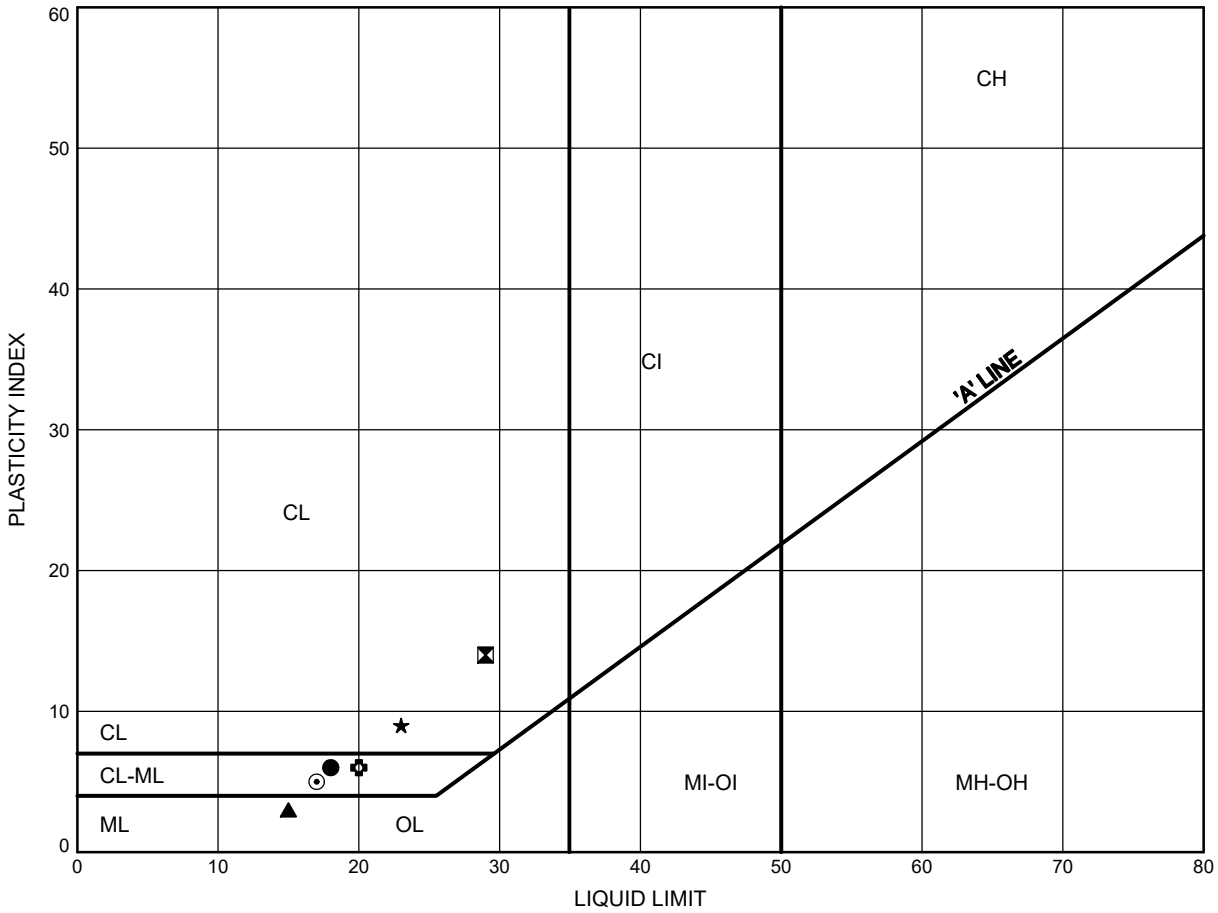
Chkd. MJK

Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

ATTERBERG LIMITS TEST RESULTS

FIGURE C11.1

Interlayered Silt, Sand, and Clayey Silt



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-01	39.9	111.3
⊠	BRU19-03	43.0	106.8
▲	BRU19-04A	32.3	117.5
★	BRU19-13	34.1	118.4
⊙	BRU19-15	39.9	112.7
✿	BRU19-16	39.9	111.6

Date February 2022

WP# 4068-09-00

THURBER

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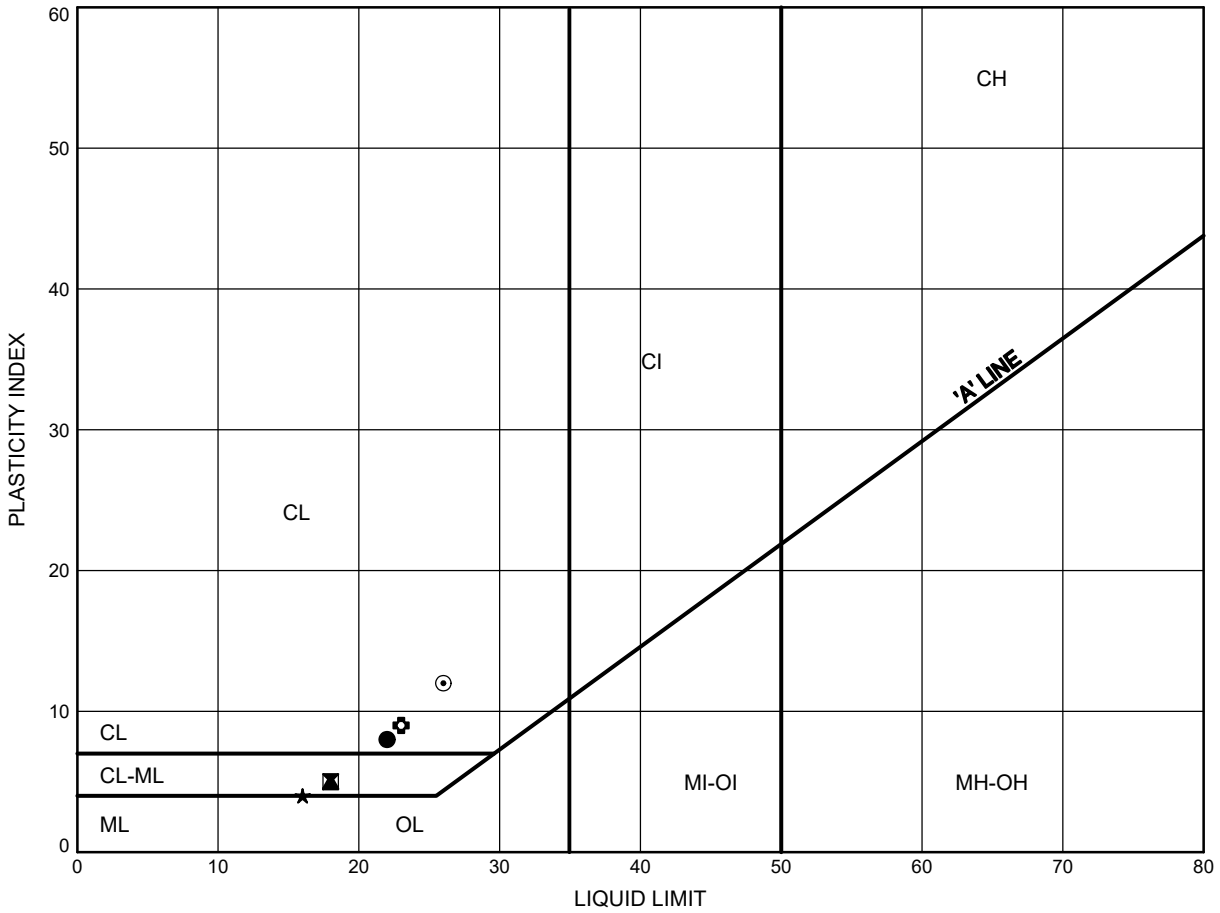
Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

ATTERBERG LIMITS TEST RESULTS

FIGURE C11.2

Interlayered Silt, Sand, and Clayey Silt



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-18	33.8	117.1
⊠	BRU19-19	38.4	113.8
▲	BRU19-21	38.4	112.3
★	BRU19-22	38.4	108.9
⊙	BRU19-25	39.9	108.0
✿	BRU19-27	18.8	135.8

Date February 2022

WP# 4068-09-00

THURBER

Prep'd MIK

Chkd. MJK

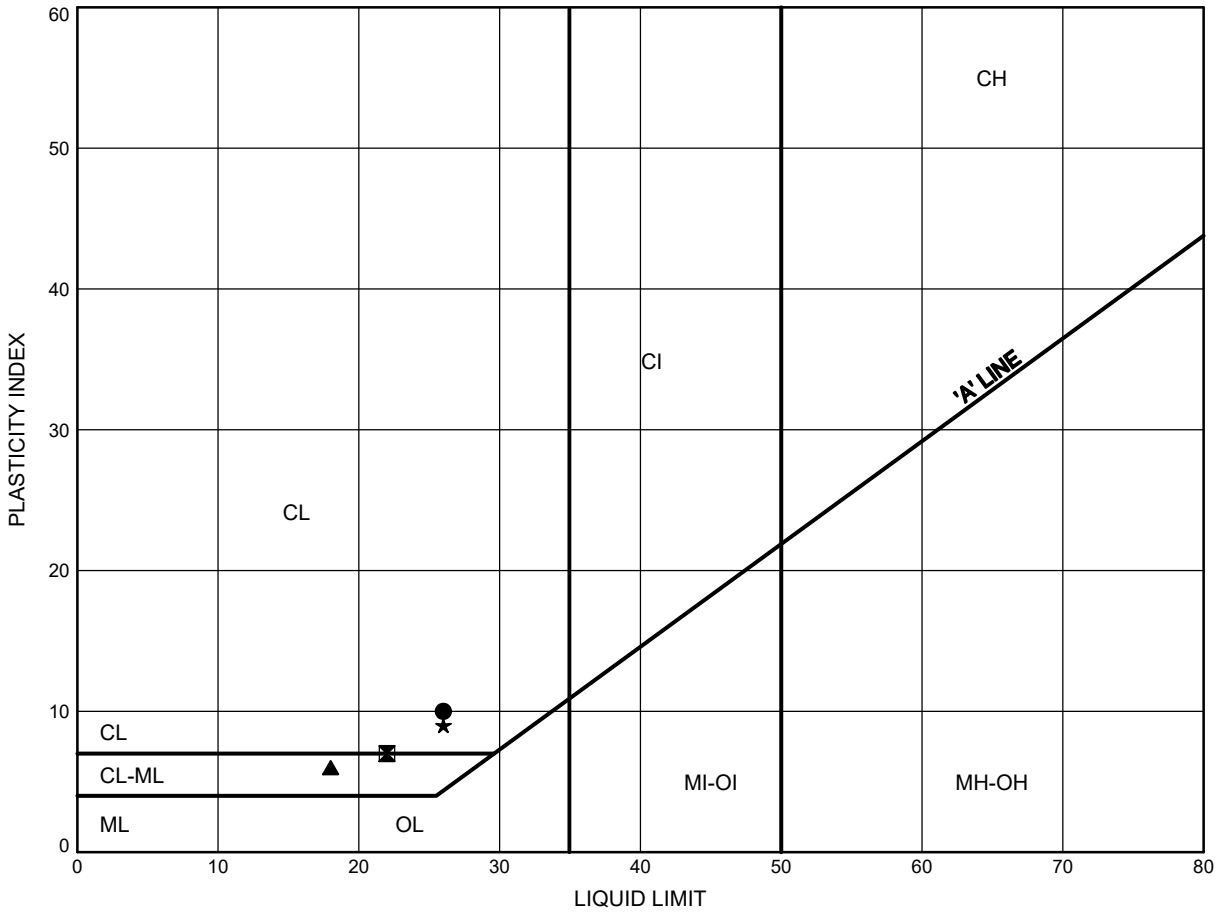
THURBALT 24726 BRUCE STREET GINT.GPJ 22-2-25

Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

ATTERBERG LIMITS TEST RESULTS

FIGURE C11.3

Interlayered Silt, Sand, and Clayey Silt



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-29	33.8	120.9
⊠	BRU19-30	32.0	122.1
▲	BRU19-31	29.0	120.9
★	BRU19-31	35.1	114.8

Date February 2022

WP# 4068-09-00

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Prep'd MIK

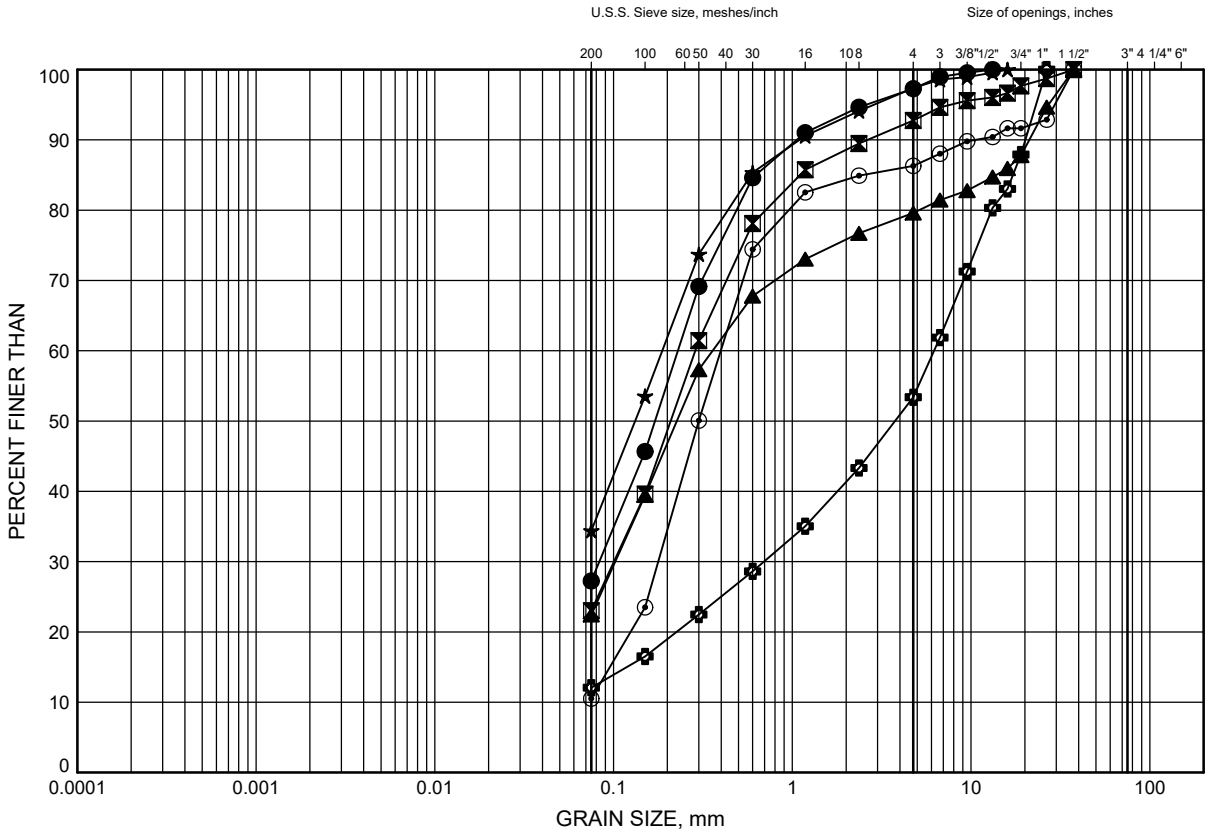
Chkd. MJK

Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

GRAIN SIZE DISTRIBUTION

FIGURE C12.1

Till Silty Sand and Gravel



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-01	44.3	106.9
⊠	BRU19-02	44.1	106.0
▲	BRU19-02	48.1	102.0
★	BRU19-03	48.9	100.9
⊙	BRU19-09	24.1	122.8
✿	BRU19-10	10.7	135.5

Date February 2022

WP# 4068-09-00

THURBER

Prep'd MIk

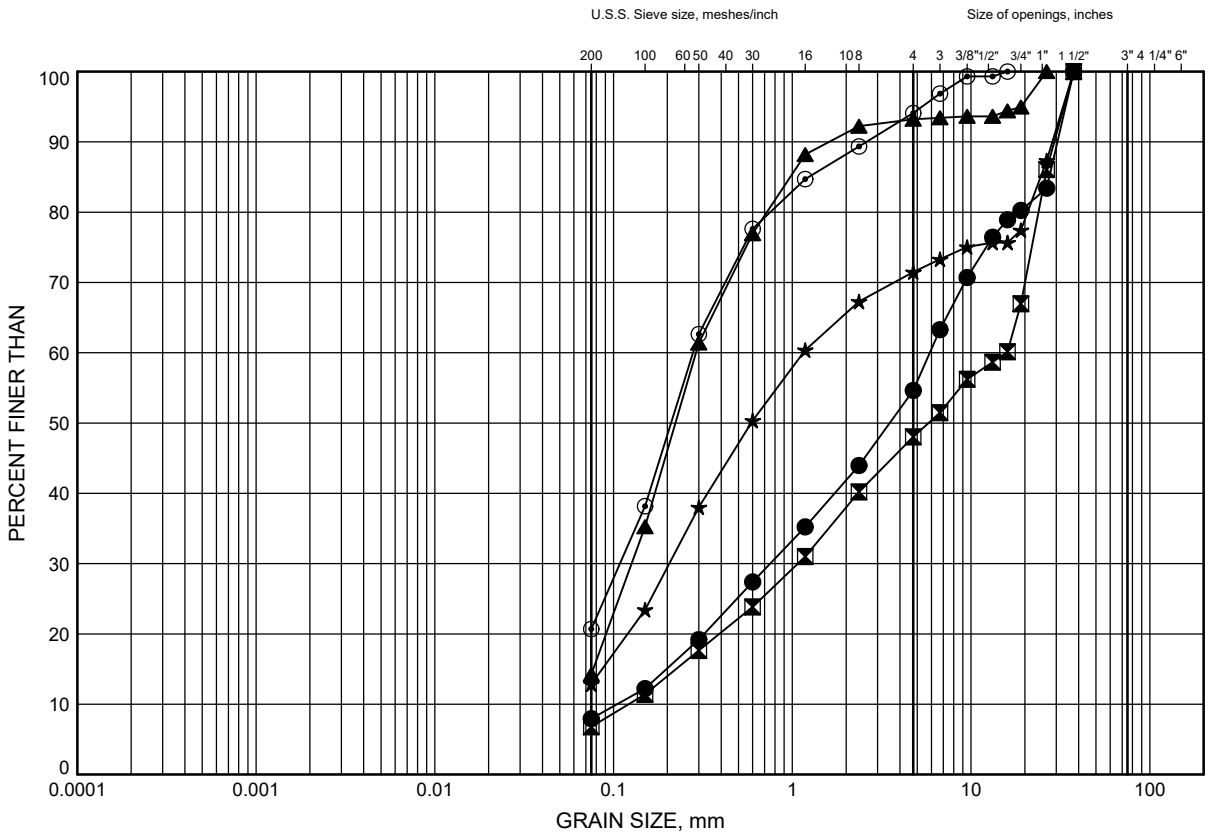
Chkd. MJK

Hwy 17 Twinning, Bruce Street (County Road 20) Interchange

GRAIN SIZE DISTRIBUTION

FIGURE C12.2

Till Silty Sand and Gravel



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BRU19-13	36.3	116.2
⊠	BRU19-19	39.9	112.3
▲	BRU19-28	30.8	124.2
★	BRU19-29	35.4	119.3
⊙	BRU19-33	33.4	113.5

Date February 2022

WP# 4068-09-00

THURBER

Prep'd MIk

Chkd. MJK

GRAIN SIZE DISTRIBUTION - THURBER 24726 BRUCE STREET GINT.GPJ 22-2-25

THURBER

Appendix C.2

One-Dimensional Consolidation Test Results (Standard)

THURBER ENGINEERING LTD.

Consolidation Test Report

CLIENT: Thurber Engineering (Ottawa) FILE NUMBER: 24726

PROJECT: Highway 17 Twinning - Renfrew REPORT DATE: August 10, 2020

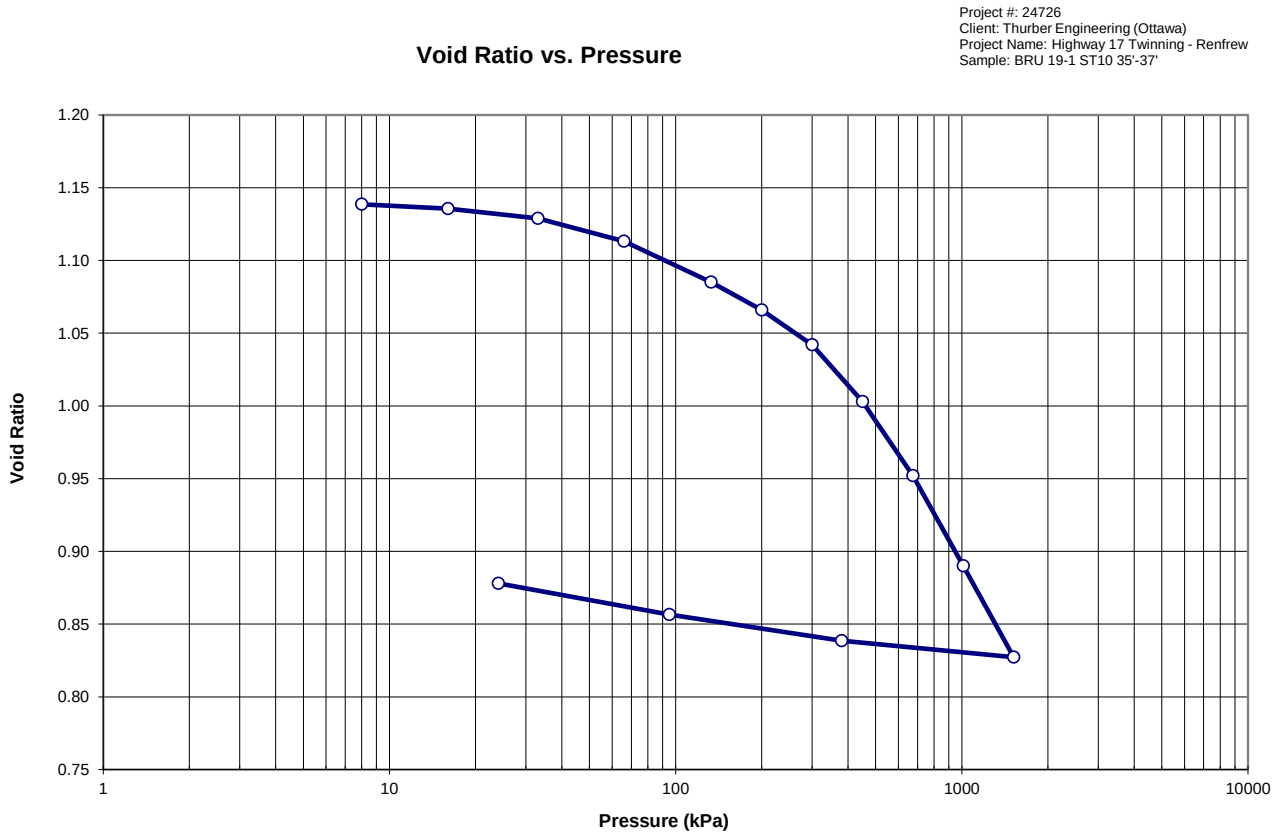
TEST DATES: April 01, 2020 - April 13, 2020

SAMPLE: BRU 19-1 ST10 35'-37'
Clay, silty, trace sand, grey, moist.
LL = 34.5, PL = 22.0, I_p = 12.5

PROCEDURE: Test carried out in accordance with Standard Test Method for One-Dimensional Consolidation Properties of Soils, ASTM D 2435-11, method B

	Start of Test	End of Test
Sample Height (mm)	25.40	22.32
Wet Dens. (kg/m^3)	1778.5	1954.1
Dry Dens. (kg/m^3)	1311.9	1493.0
Moisture Cont. (%)	35.6	30.9
Void Ratio	1.137	0.878
Saturation (%)	87.7	98.7

Note: A Specific Gravity (Gs) of 2.803 was obtained for the void ratio and saturation calculations.



TEST DONE BY: BT
REVIEWED BY: WM

THURBER ENGINEERING LTD.

Consolidation Test Report

Highway 17 Twinning - Renfrew
24726 BRU 19-1 ST10 35'-37'

TRIMMING: The Specimen was manually trimmed to the size of consolidation ring, then mounted in a fixed ring consolidometer. The average moisture content of the trimmings was 34.5%.

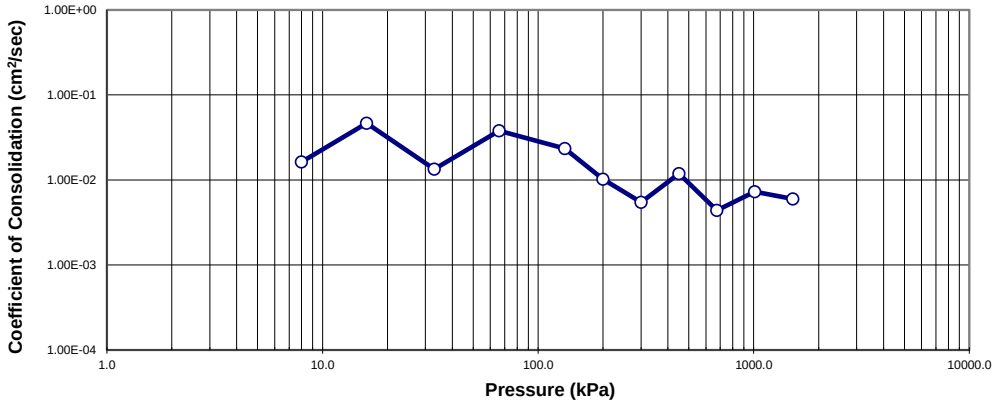
LOADING: A seating load of 8 kPa was applied and the consolidometer was flooded with distilled water. Sample was monitored to ensure no swelling effect occurred before the start of the test. Subsequent loads were applied after 100% primary consolidation was reached at each load increment.

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

Pressure (kPa)	Corr. H. (mm)	Avg. H. (mm)	D_{90} (mm)	t_{90} (min)	c_v (cm^2/s)	Void Ratio	m_v (m^2/kN)	k (cm/s)
0.0	25.400					1.137		
8.0	25.419	25.409	-0.007	1.40	1.62E-02	1.139	-9.21E-05	-1.47E-07
16.0	25.383	25.401	-0.024	0.49	4.65E-02	1.136	1.78E-04	8.11E-07
33.0	25.305	25.344	-0.058	1.69	1.34E-02	1.129	1.80E-04	2.37E-07
66.0	25.118	25.212	-0.115	0.59	3.79E-02	1.113	2.23E-04	8.30E-07
133.0	24.783	24.951	-0.237	0.94	2.34E-02	1.085	1.99E-04	4.57E-07
200.0	24.556	24.669	-0.132	2.10	1.02E-02	1.066	1.37E-04	1.37E-07
300.0	24.271	24.413	-0.160	3.84	5.48E-03	1.042	1.16E-04	6.23E-08
450.0	23.806	24.038	-0.210	1.72	1.19E-02	1.003	1.28E-04	1.49E-07
675.0	23.202	23.504	-0.306	4.45	4.38E-03	0.952	1.13E-04	4.84E-08
1012.0	22.463	22.833	-0.310	2.53	7.29E-03	0.890	9.45E-05	6.75E-08
1518.0	21.718	22.090	-0.350	2.89	5.97E-03	0.827	6.56E-05	3.84E-08
380.0	21.852	21.785				0.839		
95.0	22.066	21.959				0.857		
24.0	22.320	22.193				0.878		

Project #: 24726
Client: Thurber Engineering (Ottawa)
Project Name: Highway 17 Twinning - Renfrew
Sample: BRU 19-1 ST10 35'-37'

Coefficient of Consoildation vs. Pressure



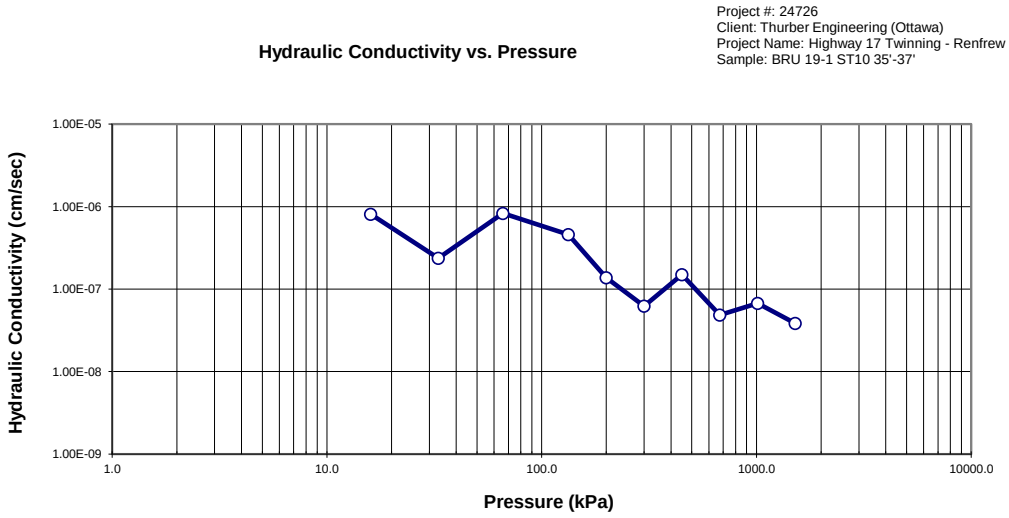
Note: C_v and k calculated using t_{90} values (square root of time method)

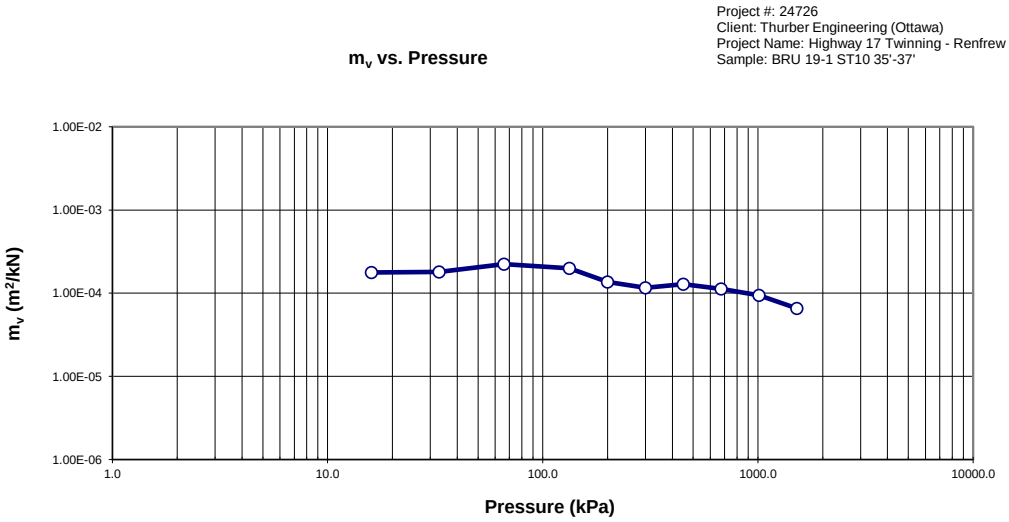
TEST DONE BY: BT
REVIEWED BY: WM

THURBER ENGINEERING LTD.

Consolidation Test Report

Highway 17 Twinning - Renfrew
24726 BRU 19-1 ST10 35'-37'

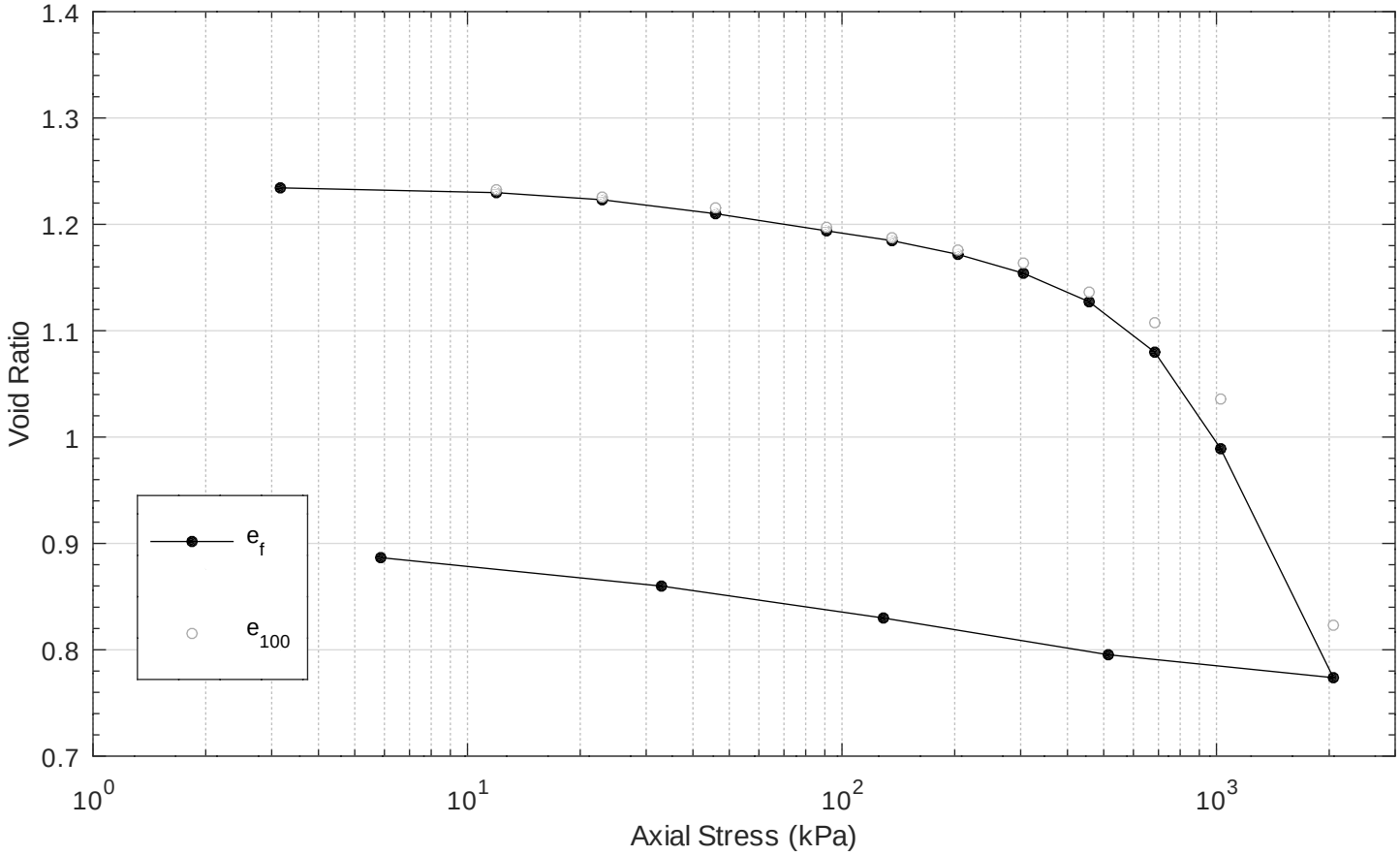




TEST DONE BY: BT
REVIEWED BY: WM

THURBER

Project: 24726
Highway 17, Bruce Street
Borehole: BRU19-1-2
Sample: ST1
Depth: 4.9m
Client: Ontario Ministry of Transportation



Start of Test			2020-12-29
Diameter of Sample	cm	D	6.349
Height of Sample	cm	H_o	2.537
Height of Solids	cm	H_s	1.136
Water Content	%	w_o	43.73
Dry Density	g/cm^3	ρ_d	1.23
Moist Unit Weight	kN/m^3	γ	17.3
Void Ratio	-	e_o	1.234
Degree of Saturation	-	S_{ro}	0.97
Specific Gravity	-	G_s	2.750

End of Test			2021-01-14
Height of Sample	cm	H_f	2.143
Water Content	%	w_f	34.13
Void Ratio	-	e_f	0.887

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

LOADING: the consolidometer was flooded with water with the seating load adjusted to limit swelling

CALCULATIONS: coefficients of consolidation were calculated by the square root time method

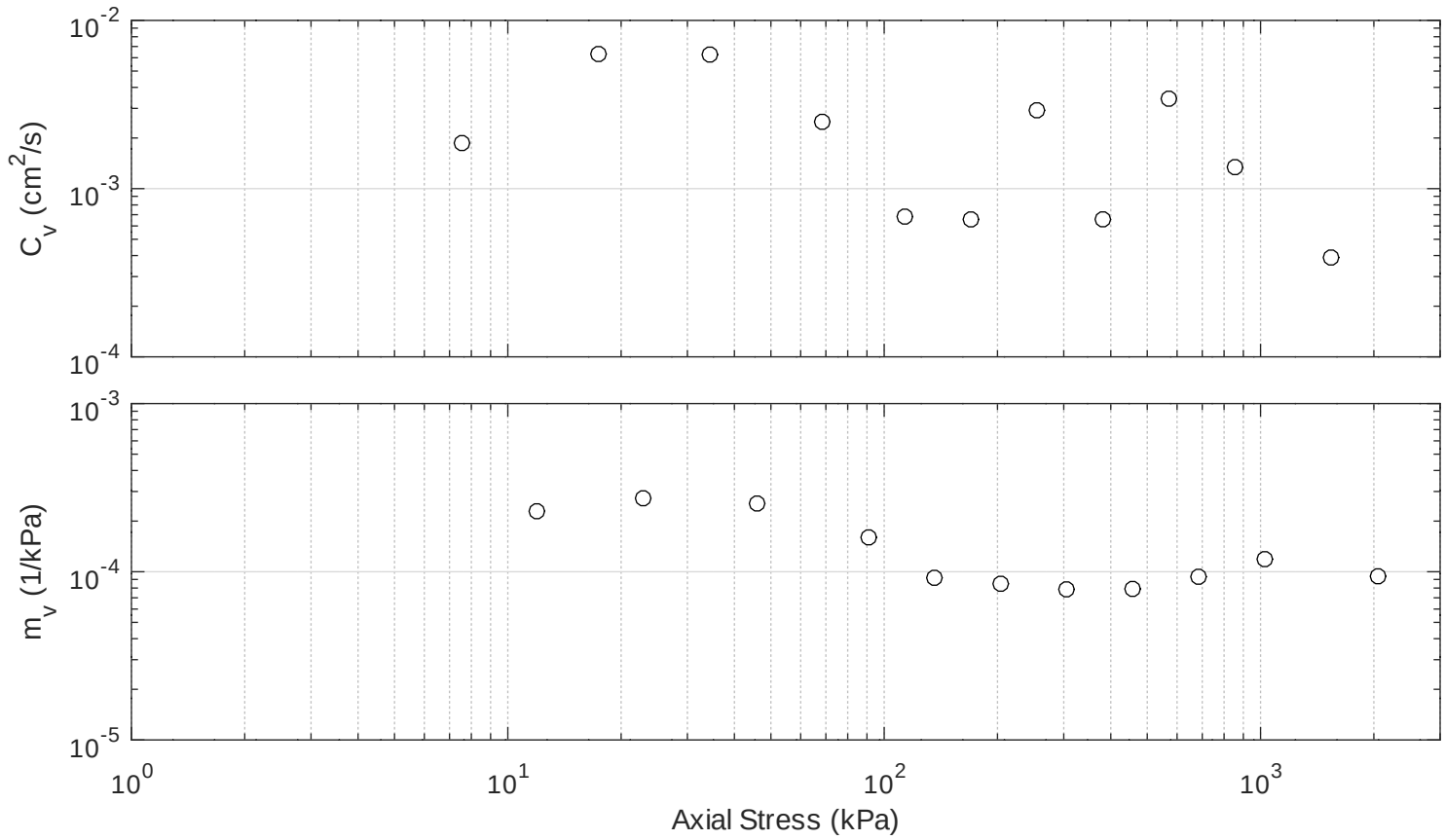
Interpreted Results

Recompression Index (reloading)	-	C_r	0.053
Compression Index	-	C_c	0.715
Recompression Index (unloading)	-	C_r	0.054
Preconsolidation Pressure	kPa	p'_c	666

Check: SP Review: PKC

THURBER

Project: 24726
Highway 17, Bruce Street
Borehole: BRU19-1-2
Sample: ST1
Depth: 4.9m
Client: Ontario Ministry of Transportation



Load No.	Axial Stress	Load Duration	System Deflec.	Dial	Sample Height	Axial Strain	Void Ratio	Time U(0.99)	C_v	k_v	$C_{a\varepsilon}$
	kPa	min	mm	mm	cm	%	-	min	cm^2/s	cm/s	-
0				10.000	2.537	0.00	1.234				
1	3.2	1440.2	0.011	9.997	2.538	-0.03	1.234				
2	11.9	1440.2	0.065	9.892	2.533	0.17	1.230	25.4	1.87e-03	4.19e-08	0.0007
3	22.9	1440.2	0.096	9.785	2.525	0.47	1.223	7.5	6.31e-03	1.69e-07	0.0005
4	46.0	1440.1	0.153	9.580	2.510	1.06	1.210	7.4	6.27e-03	1.57e-07	0.0012
5	91.0	1440.2	0.197	9.354	2.492	1.78	1.194	18.2	2.50e-03	3.92e-08	0.0008
6	136.0	1440.3	0.249	9.198	2.481	2.19	1.185	65.6	6.82e-04	6.16e-09	0.0011
7	204.0	1440.5	0.285	9.016	2.467	2.77	1.172	67.4	6.56e-04	5.46e-09	0.0017
8	305.0	1440.0	0.342	8.757	2.447	3.56	1.154	14.9	2.92e-03	2.25e-08	0.0022
9	457.1	1440.2	0.388	8.407	2.416	4.76	1.127	63.6	6.57e-04	5.09e-09	0.0034
10	684.2	1440.4	0.455	7.801	2.362	6.89	1.080	11.5	3.43e-03	3.14e-08	0.0064
11	1026.3	1440.1	0.521	6.704	2.259	10.95	0.989	24.8	1.34e-03	1.56e-08	0.0134
12	2051.7	1440.4	0.630	4.150	2.015	20.59	0.774	34.8	3.89e-04	3.59e-09	0.0146
13	514.2	1440.5	0.511	4.515	2.039	19.62	0.795				
14	129.0	1440.1	0.389	5.029	2.078	18.08	0.830				
15	33.0	1440.0	0.304	5.455	2.113	16.73	0.860				
16	5.9	1440.0	0.230	5.833	2.143	15.53	0.887				

Stantec Consulting Ltd
2781 Lancaster Rd, Suite 100 A&B
Ottawa, ON K1B 1A7
Tel: (613) 738-6075
Fax: (613) 722-2799

January 22, 2021
File: 122410864

Attention: **Thurber Engineering, File #24726**

Reference: **Thurber File #24726.200a.202, LS-705 Specific Gravity**

The following table summarizes two Specific Gravity results for Bruce Street.

Source	Depth (m)	Specific Gravity
BRU19-1.2 ST1	4.9	2.750
BRU19-1.2 ST5	17.7	2.755

Sincerely,

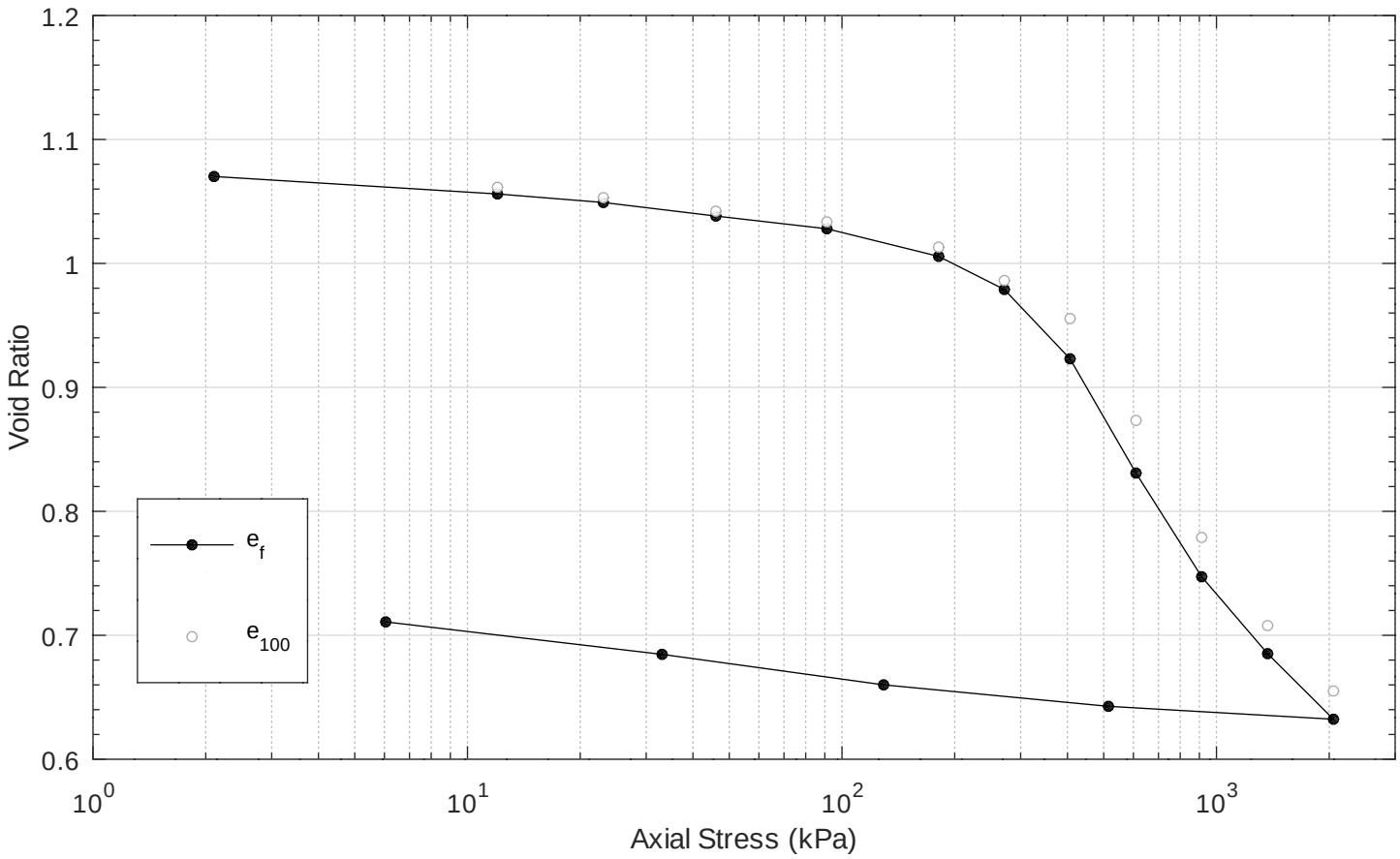
Stantec Consulting Ltd

Brian Prevost

Brian Prevost
Laboratory Supervisor
Tel: 613-738-6075
Fax: 613-722-2799
brian.prevost@stantec.com

THURBER

Project: 24726
Highway 17, Bruce Street
Borehole: BRU19-1-2
Sample: ST5
Depth: 17.7m
Client: Ontario Ministry of Transportation



Start of Test			2020-12-29
Diameter of Sample	cm	D	6.347
Height of Sample	cm	H_o	2.535
Height of Solids	cm	H_s	1.225
Water Content	%	w_o	38.37
Dry Density	g/cm^3	ρ_d	1.33
Moist Unit Weight	kN/m^3	γ	18.1
Void Ratio	-	e_o	1.069
Degree of Saturation	-	S_{ro}	0.99
Specific Gravity	-	G_s	2.755

End of Test			2021-01-14
Height of Sample	cm	H_f	2.096
Water Content	%	w_f	26.54
Void Ratio	-	e_f	0.711

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

LOADING: the consolidometer was flooded with water with the seating load adjusted to limit swelling

CALCULATIONS: coefficients of consolidation were calculated by the square root time method

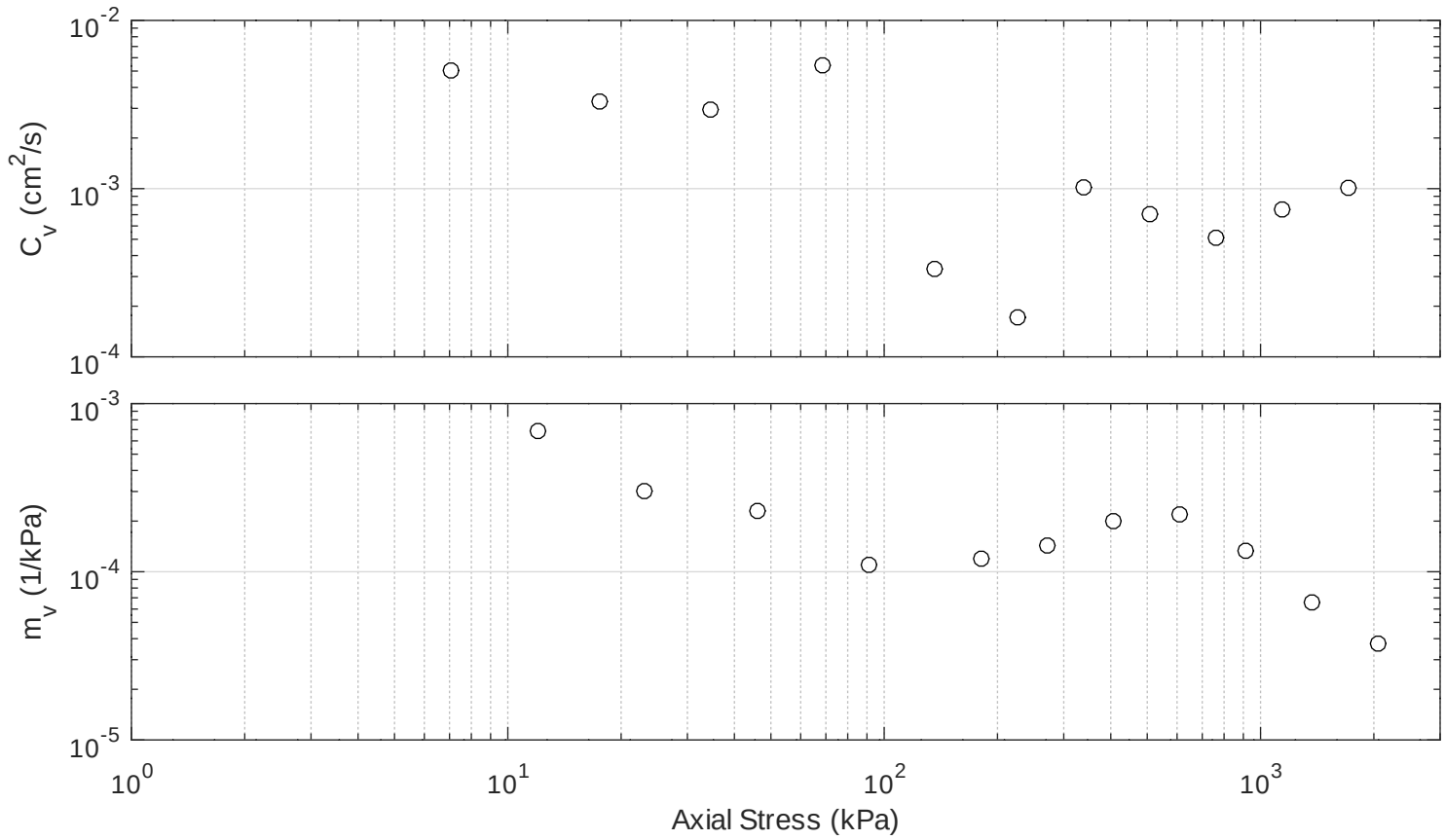
Interpreted Results

Recompression Index (reloading)	-	C_r	0.036
Compression Index	-	C_c	0.500
Recompression Index (unloading)	-	C_r	0.035
Preconsolidation Pressure	kPa	p'_c	282

Check: SP Review: PKC

THURBER

Project: 24726
Highway 17, Bruce Street
Borehole: BRU19-1-2
Sample: ST5
Depth: 17.7m
Client: Ontario Ministry of Transportation



Load No.	Axial Stress	Load Duration	System Deflec.	Dial	Sample Height	Axial Strain	Void Ratio	Time U(0.99)	C_v	k_v	$C_{a\varepsilon}$
	kPa	min	mm	mm	cm	%	-	min	cm^2/s	cm/s	-
0				10.000	2.535	0.00	1.069				
1	2.1	1440.5	0.005	10.003	2.536	-0.03	1.070				
2	12.0	1440.0	0.031	9.805	2.519	0.65	1.056	9.3	5.04e-03	3.40e-07	0.0013
3	23.1	1440.0	0.093	9.658	2.510	0.98	1.049	14.1	3.30e-03	9.75e-08	0.0010
4	46.1	1440.4	0.152	9.467	2.497	1.51	1.038	15.5	2.95e-03	6.65e-08	0.0009
5	91.1	1440.3	0.218	9.275	2.484	2.00	1.028	8.3	5.41e-03	5.83e-08	0.0013
6	181.2	1440.2	0.318	8.902	2.457	3.08	1.006	130.4	3.33e-04	3.91e-09	0.0044
7	271.3	1440.4	0.368	8.525	2.424	4.37	0.979	237.7	1.72e-04	2.41e-09	0.0051
8	406.4	1440.2	0.440	7.768	2.356	7.07	0.923	37.9	1.02e-03	2.00e-08	0.0111
9	609.6	1440.1	0.503	6.576	2.243	11.53	0.831	44.7	7.05e-04	1.52e-08	0.0149
10	913.0	1440.2	0.594	5.461	2.140	15.57	0.747	53.8	5.10e-04	6.67e-09	0.0118
11	1369.3	1440.0	0.671	4.623	2.064	18.57	0.685	35.8	7.52e-04	4.85e-09	0.0081
12	2052.9	1440.0	0.801	3.845	2.000	21.12	0.632	26.1	1.01e-03	3.71e-09	0.0075
13	514.5	1440.2	0.595	4.178	2.012	20.62	0.643				
14	129.2	1440.0	0.473	4.512	2.034	19.78	0.660				
15	33.1	1440.1	0.353	4.932	2.064	18.60	0.685				
16	6.0	1440.1	0.251	5.357	2.096	17.33	0.711				

Stantec Consulting Ltd
2781 Lancaster Rd, Suite 100 A&B
Ottawa, ON K1B 1A7
Tel: (613) 738-6075
Fax: (613) 722-2799

January 22, 2021
File: 122410864

Attention: **Thurber Engineering, File #24726**

Reference: **Thurber File #24726.200a.202, LS-705 Specific Gravity**

The following table summarizes two Specific Gravity results for Bruce Street.

Source	Depth (m)	Specific Gravity
BRU19-1.2 ST1	4.9	2.750
BRU19-1.2 ST5	17.7	2.755

Sincerely,

Stantec Consulting Ltd

Brian Prevost

Brian Prevost
Laboratory Supervisor
Tel: 613-738-6075
Fax: 613-722-2799
brian.prevost@stantec.com

THURBER ENGINEERING LTD.

Consolidation Test Report

CLIENT: Thurber Engineering (Ottawa) FILE NUMBER: 24726

PROJECT: Highway 17 Twinning - Renfrew REPORT DATE: August 10, 2020

TEST DATES: April 02, 2020 - April 14, 2020

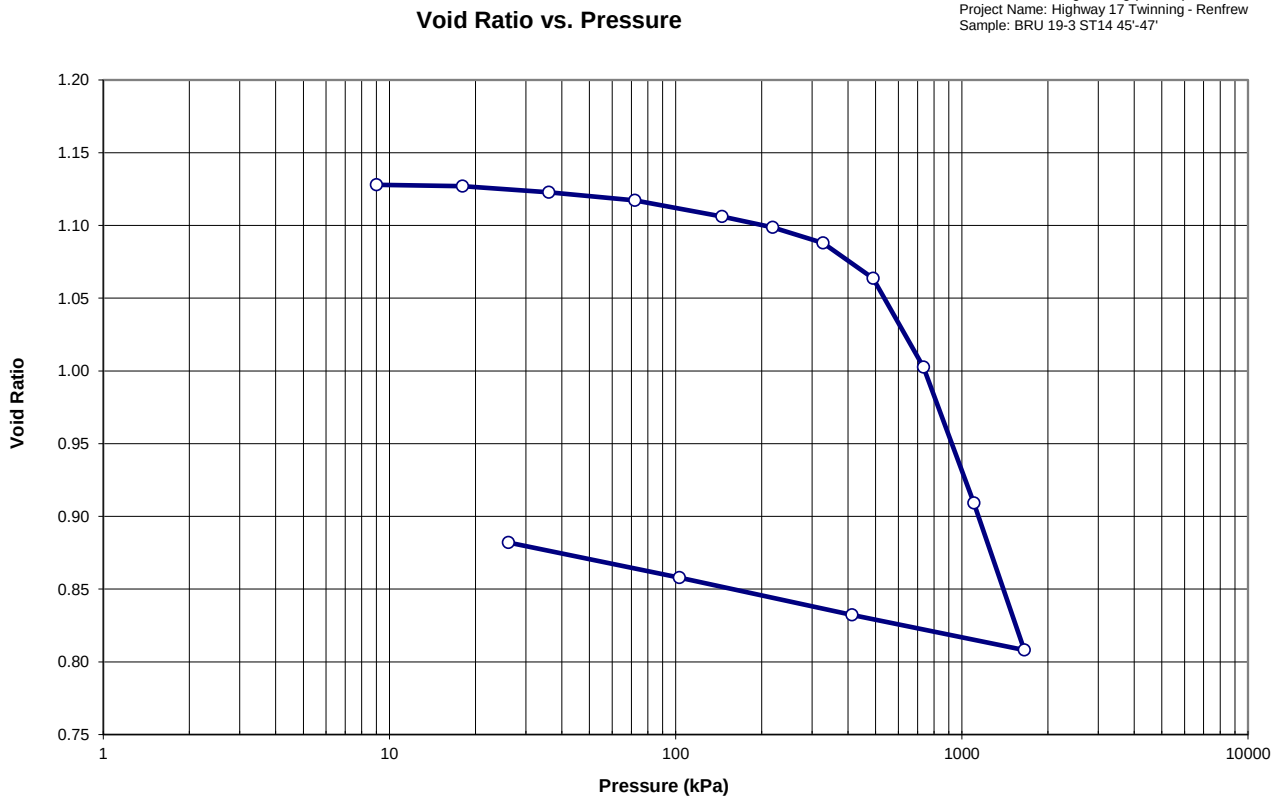
SAMPLE: BRU 19-3 ST14 45'-47'
Clay, silty, trace sand, grey, moist.
LL = 38.9, PL = 24.8, I_p = 14.1

PROCEDURE: Test carried out in accordance with Standard Test Method for One-Dimensional Consolidation Properties of Soils, ASTM D 2435-11, method B

	Start of Test	End of Test
Sample Height (mm)	25.40	22.46
Wet Dens. (kg/m^3)	1784.1	1933.5
Dry Dens. (kg/m^3)	1309.0	1480.2
Moisture Cont. (%)	36.3	30.6
Void Ratio	1.128	0.882
Saturation (%)	89.6	96.8

Note: A Specific Gravity (Gs) of 2.785 was obtained for the void ratio and saturation calculations.

Project #: 24726
Client: Thurber Engineering (Ottawa)
Project Name: Highway 17 Twinning - Renfrew
Sample: BRU 19-3 ST14 45'-47'



TEST DONE BY: BT
REVIEWED BY: WM

THURBER ENGINEERING LTD.

Consolidation Test Report

Highway 17 Twinning - Renfrew
24726 BRU 19-3 ST14 45'-47'

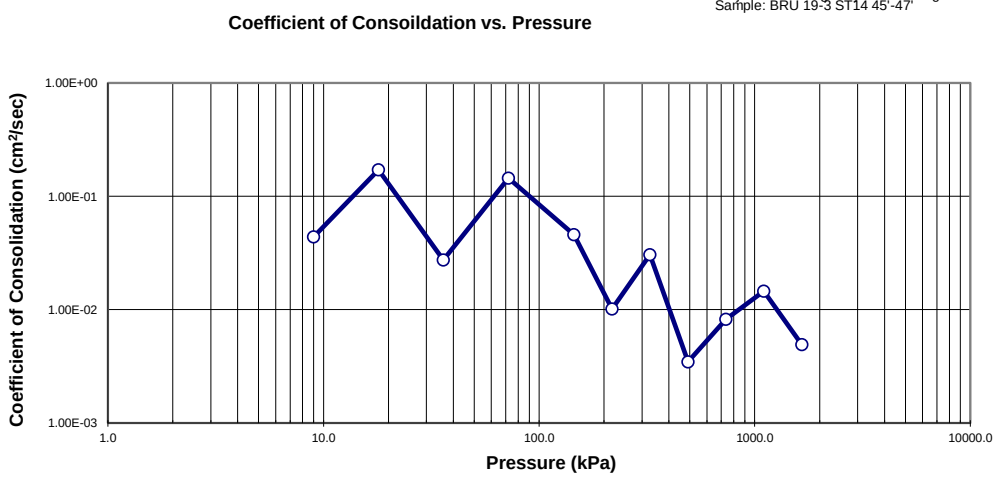
TRIMMING: The Specimen was manually trimmed to the size of consolidation ring, then mounted in a fixed ring consolidometer. The average moisture content of the trimmings was 36.1%.

LOADING: A seating load of 9 kPa was applied and the consolidometer was flooded with distilled water. Sample was monitored to ensure no swelling effect occurred before the start of the test. Subsequent loads were applied after 100% primary consolidation was reached at each load increment.

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

Pressure (kPa)	Corr. H. (mm)	Avg. H. (mm)	D_{90} (mm)	t_{90} (min)	c_v (cm^2/s)	Void Ratio	m_v (m^2/kN)	k (cm/s)
0.0	25.400					1.128		
9.0	25.399	25.400	-0.002	0.52	4.40E-02	1.128	3.02E-06	1.30E-08
18.0	25.389	25.394	-0.011	0.13	1.71E-01	1.127	4.50E-05	7.55E-07
36.0	25.338	25.363	-0.035	0.83	2.74E-02	1.123	1.12E-04	3.02E-07
72.0	25.273	25.305	-0.056	0.16	1.45E-01	1.117	7.15E-05	1.02E-06
145.0	25.139	25.206	-0.074	0.49	4.58E-02	1.106	7.24E-05	3.25E-07
218.0	25.049	25.094	-0.053	2.19	1.02E-02	1.099	4.92E-05	4.90E-08
327.0	24.923	24.986	-0.071	0.72	3.05E-02	1.088	4.60E-05	1.38E-07
490.0	24.632	24.777	-0.144	6.25	3.47E-03	1.064	7.16E-05	2.44E-08
735.0	23.902	24.267	-0.270	2.53	8.23E-03	1.003	1.21E-04	9.76E-08
1102.0	22.789	23.346	-0.412	1.32	1.46E-02	0.909	1.27E-04	1.81E-07
1653.0	21.581	22.185	-0.580	3.53	4.92E-03	0.808	9.62E-05	4.64E-08
413.0	21.870	21.725				0.832		
103.0	22.176	22.023				0.858		
26.0	22.463	22.320				0.882		

Project #: 24726
Client: Thurber Engineering (Ottawa)
Project Name: Highway 17 Twinning - Renfrew
Sample: BRU 19-3 ST14 45'-47'



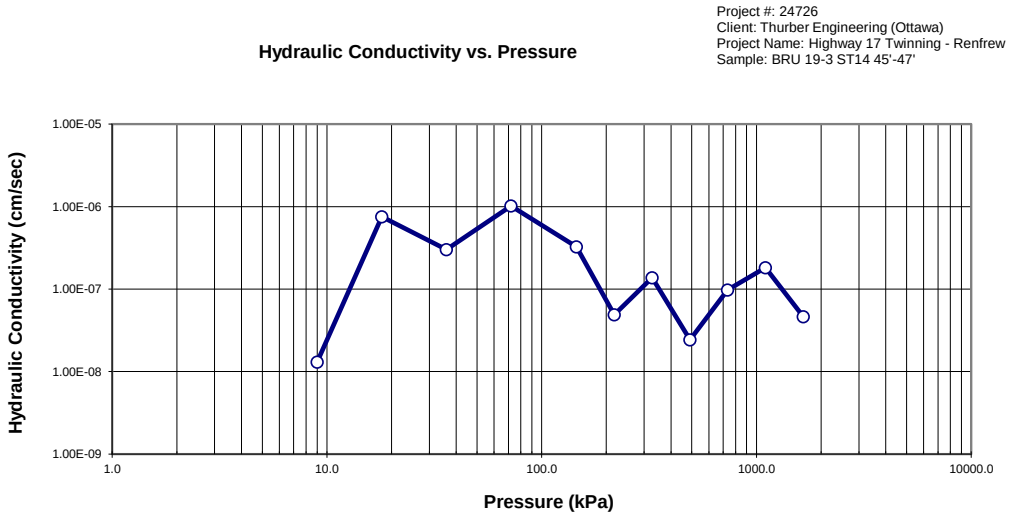
Note: C_v and k calculated using t_{90} values (square root of time method)

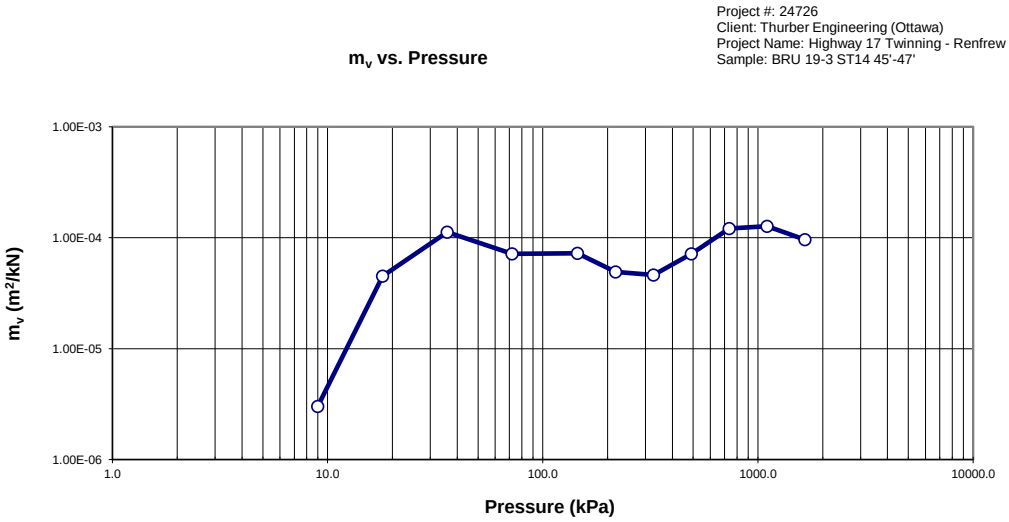
TEST DONE BY: BT
REVIEWED BY: WM

THURBER ENGINEERING LTD.

Consolidation Test Report

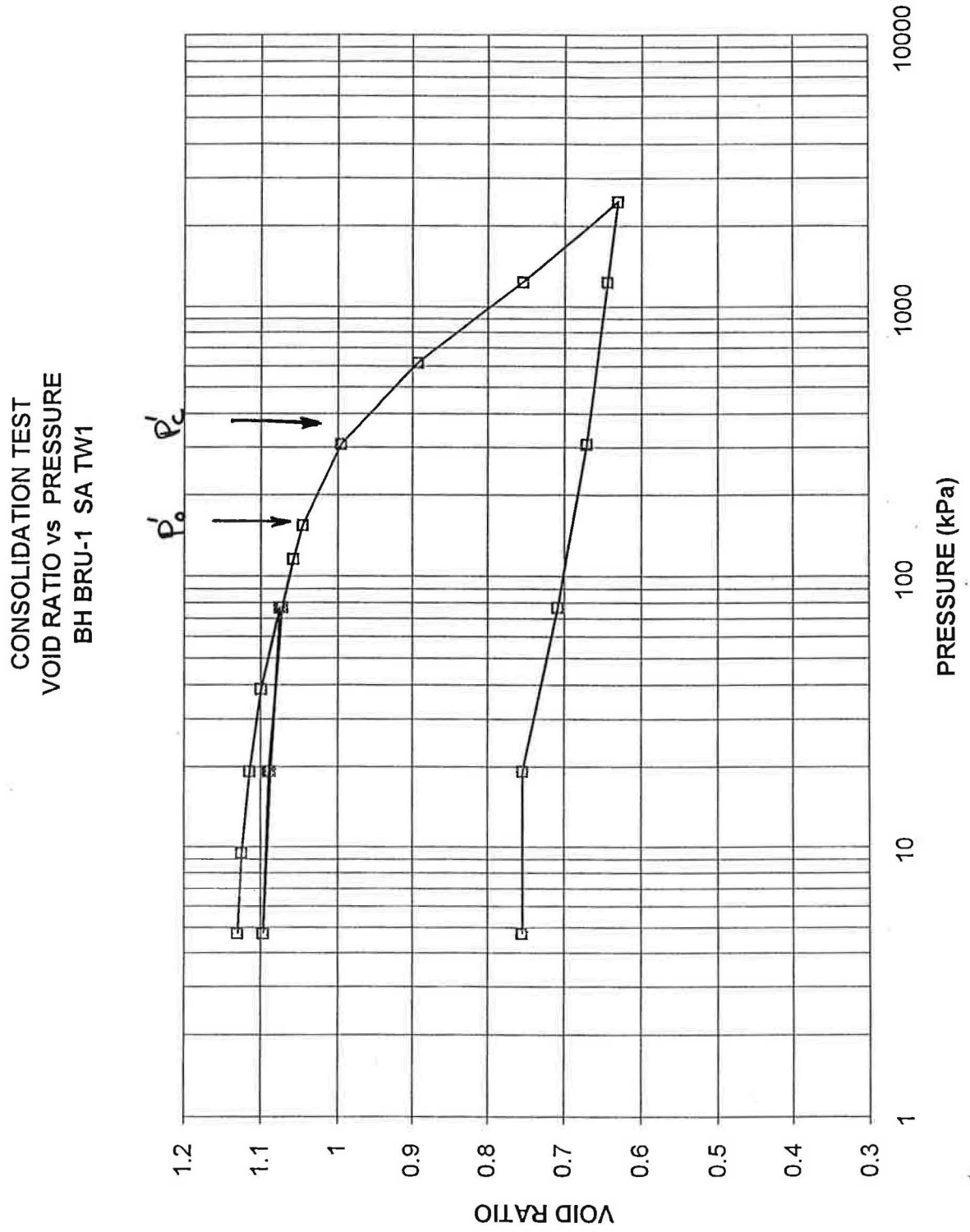
Highway 17 Twinning - Renfrew
24726 BRU 19-3 ST14 45'-47'





TEST DONE BY: BT
REVIEWED BY: WM

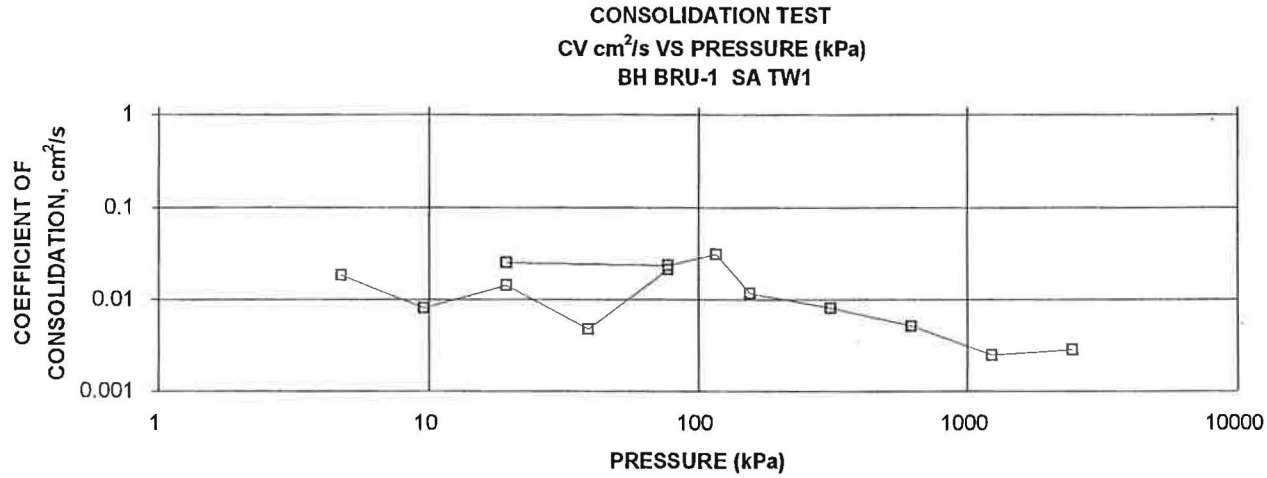
CONSOLIDATION TEST
VOID RATIO VS. LOG PRESSURE

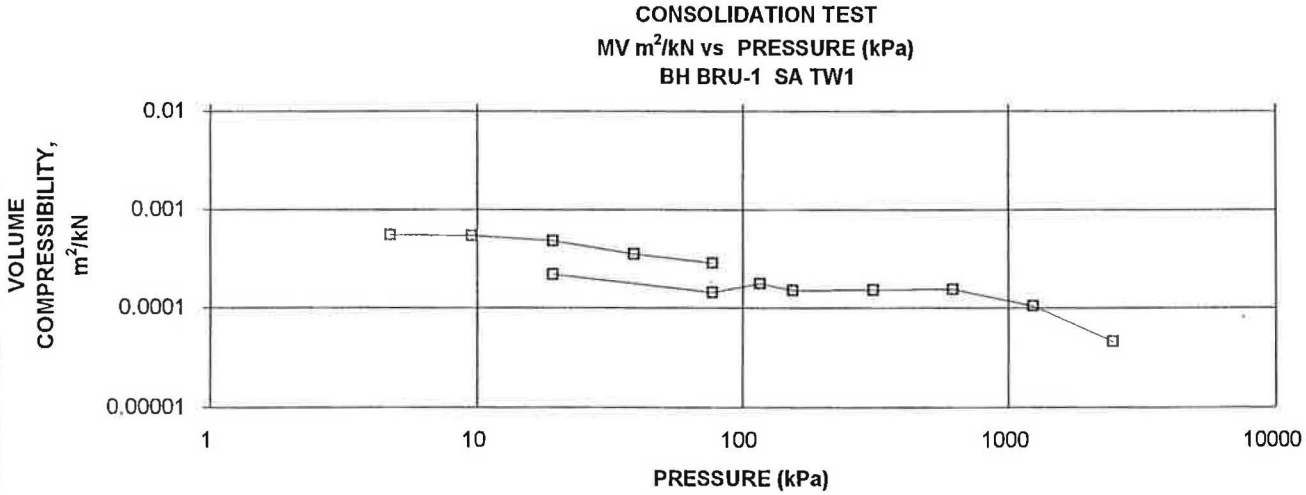


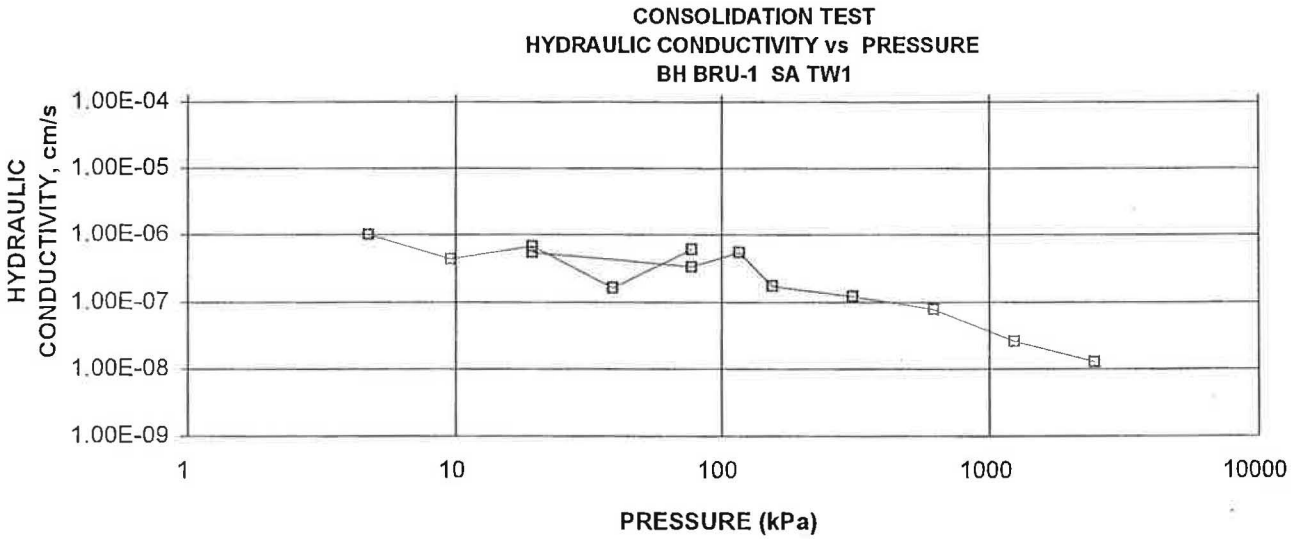
Project No. 04-1116-011

Golder Associates

OEDOMETER CONSOLIDATION SUMMARY







Project No. 04-1116-011

Golder Associates

OEDOMETER CONSOLIDATION SUMMARY

SAMPLE IDENTIFICATION

Project Number	04-1116-011	Sample Number	TW1
Borehole Number	BRU-1	Sample Depth, m	11.6-12.2

TEST CONDITIONS

Test Type	Standard	Load Duration, hr	(0.7-24)
Oedometer Number	6		
Date Started	1/30/2004		
Date Completed	2/12/2004		

SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	1.90	Unit Weight, kN/m^3	18.03
Sample Diameter, cm	6.35	Dry Unit Weight, kN/m^3	12.81
Area, cm^2	31.67	Specific Gravity, measured	2.79
Volume, cm^3	60.17	Solids Height, cm	0.890
Water Content, %	40.70	Volume of Solids, cm^3	28.18
Wet Mass, g	110.62	Volume of Voids, cm^3	31.99
Dry Mass, g	78.62	Degree of Saturation, %	100.0

TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t_{90} sec	cv. cm^2/s	mv m^2/kN	k cm/s
0.00	1.900	1.135	1.900				
4.75	1.895	1.130	1.898	41	1.86E-02	5.54E-04	1.01E-06
9.54	1.890	1.124	1.893	94	8.08E-03	5.49E-04	4.35E-07
19.25	1.881	1.114	1.886	53	1.42E-02	4.88E-04	6.80E-07
38.68	1.868	1.099	1.875	158	4.71E-03	3.52E-04	1.63E-07
77.38	1.847	1.076	1.858	34	2.15E-02	2.86E-04	6.02E-07
19.25	1.857	1.087	1.852				
4.75	1.866	1.097	1.862				
19.25	1.860	1.090	1.863	29	2.54E-02	2.18E-04	5.42E-07
77.38	1.844	1.072	1.852	31	2.35E-02	1.45E-04	3.33E-07
116.07	1.831	1.058	1.838	23	3.11E-02	1.77E-04	5.39E-07
154.68	1.820	1.045	1.826	60	1.18E-02	1.50E-04	1.73E-07
309.16	1.775	0.995	1.798	85	8.06E-03	1.53E-04	1.21E-07
618.45	1.684	0.893	1.730	124	5.11E-03	1.55E-04	7.76E-08
1237.35	1.560	0.753	1.622	225	2.48E-03	1.05E-04	2.56E-08
2472.95	1.451	0.631	1.506	171	2.81E-03	4.64E-05	1.28E-08
1237.35	1.463	0.644	1.457				
309.16	1.487	0.671	1.475				
77.38	1.520	0.708	1.504				
19.25	1.560	0.753	1.540				
4.75	1.561	0.754	1.561				

Notes:
k calculated using cv based on t_{90} values.

SAMPLE DIMENSIONS AND PROPERTIES - FINAL

Sample Height, cm	1.56	Unit Weight, kN/m^3	20.41
Sample Diameter, cm	6.35	Dry Unit Weight, kN/m^3	15.60
Area, cm^2	31.67	Specific Gravity, measured	2.79
Volume, cm^3	49.44	Solids Height, cm	0.890
Water Content, %	30.87	Volume of Solids, cm^3	28.18
Wet Mass, g	102.89	Volume of Voids, cm^3	21.26
Dry Mass, g	78.62		

THURBER

Appendix C.3

One-Dimensional Consolidation Test Results (Constant Rate of Strain)

THURBER ENGINEERING LTD.

Constant Rate of Strain (CRS) Test Report

CLIENT: Ministry of Transportation (MTO) FILE NUMBER: 24726

PROJECT: Twinning of Hwy 17 from Arnprior to Haley Station REPORT DATE: May 10, 2021

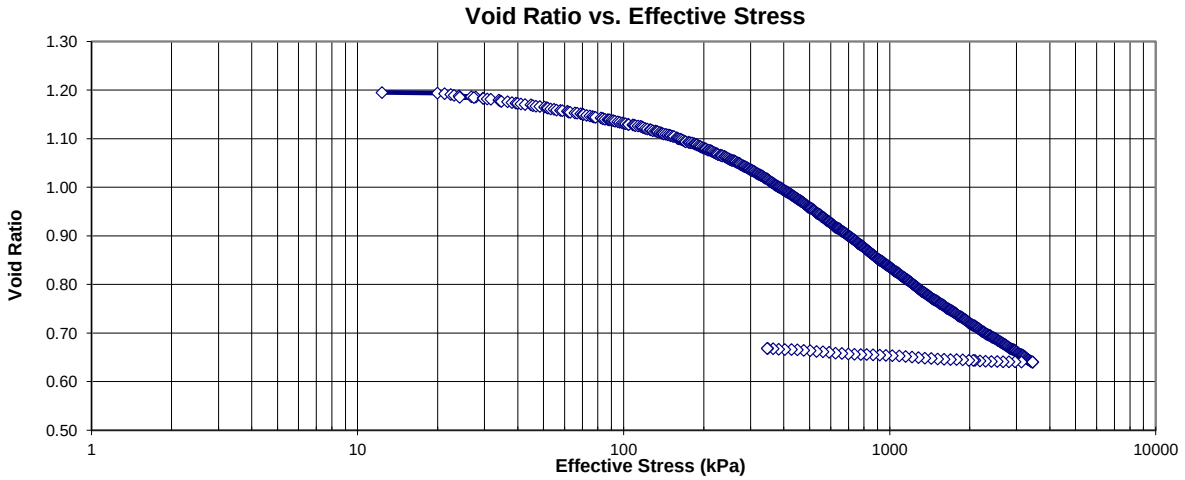
TEST DATES: November 27, 2020 - November 30, 2020

SAMPLE: BRU19-1 ST14 55'-57'
Clayey silt, grey, moist

PROCEDURE: Test carried out in general accordance with Standard Test Method for One-Dimensional Consolidation Properties of Saturated Cohesive Soils Using Controlled-Strain Loading, ASTM D4186.

Sample Characteristics		
	Initial	Final
Sample Height (mm):	25.40	19.27
Sample Diameter (mm):	50.70	50.70
Wet Dens. (kg/m^3):	1773	2108
Dry Dens. (kg/m^3):	1262	1664
Moisture Content (%):	40.1	26.7
Void Ratio:	1.20	0.67

Test Conditions	
Back Pressure (kPa):	400
Seating Pressure (kPa):	12.35
Strain After Seating (%):	0.12
Strain Rate - Loading (%/hr):	0.8
Strain Rate - Unloading (%/hr):	0.1
R_u at end of loading:	0.003



Note: A Specific Gravity (Gs) of 2.769 was measured for the void ratio calculations.

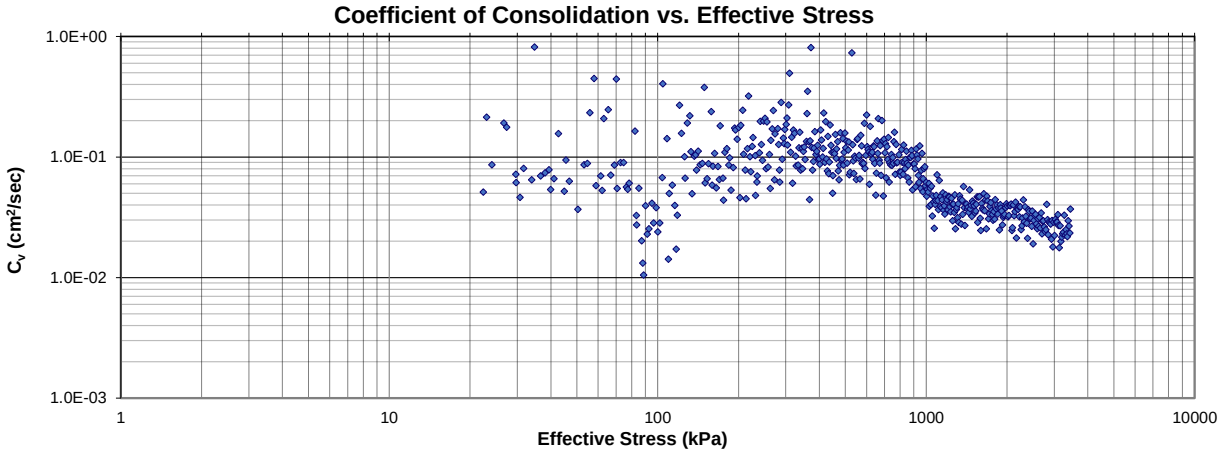
TESTED BY: BT, AA
REVIEWED BY: JL

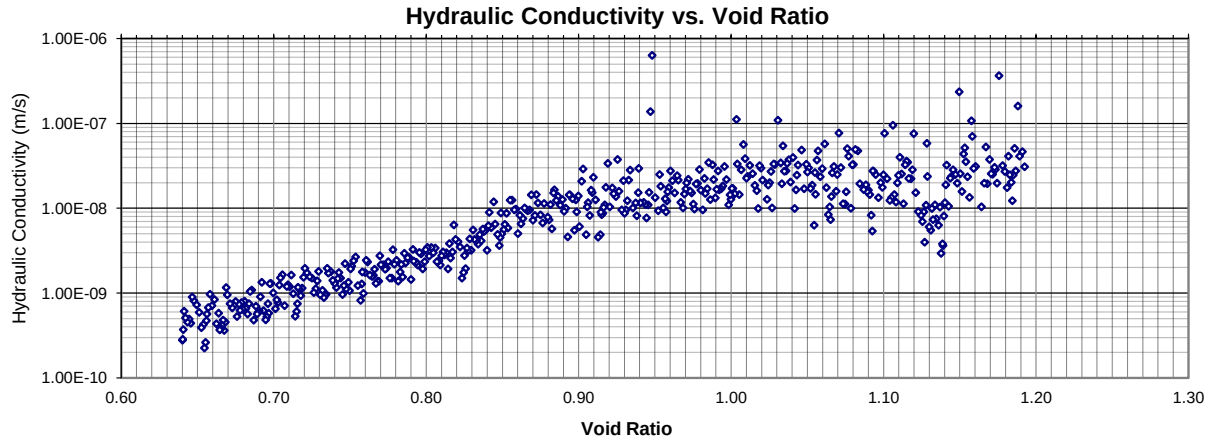
THURBER ENGINEERING LTD.

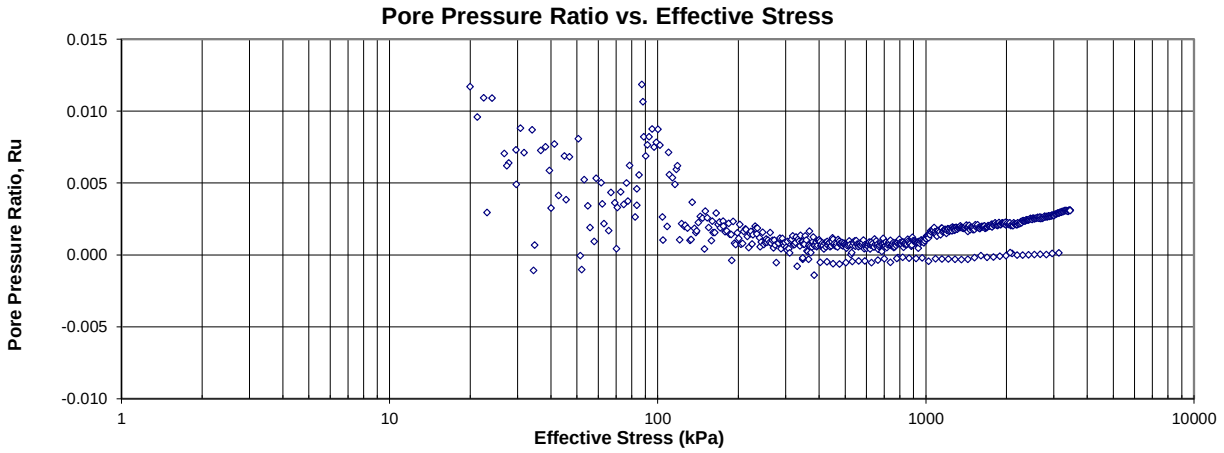
Constant Rate of Strain (CRS) Test Report

24726 BRU19-1 ST14 55'-57'

Twinning of Hwy 17 from Arnprior to Haley Station







Note: Only data from loading stage are shown in coefficient of consolidation vs. effective stress, and hydraulic conductivity vs. void ratio plots.

TESTED BY: BT, AA

REVIEWED BY: JL

THURBER ENGINEERING LTD.

Constant Rate of Strain (CRS) Test Report

CLIENT: Ministry of Transportation (MTO) FILE NUMBER: 24726

PROJECT: Twinning of Hwy 17 from Arnprior to Haley Station REPORT DATE: May 19, 2021

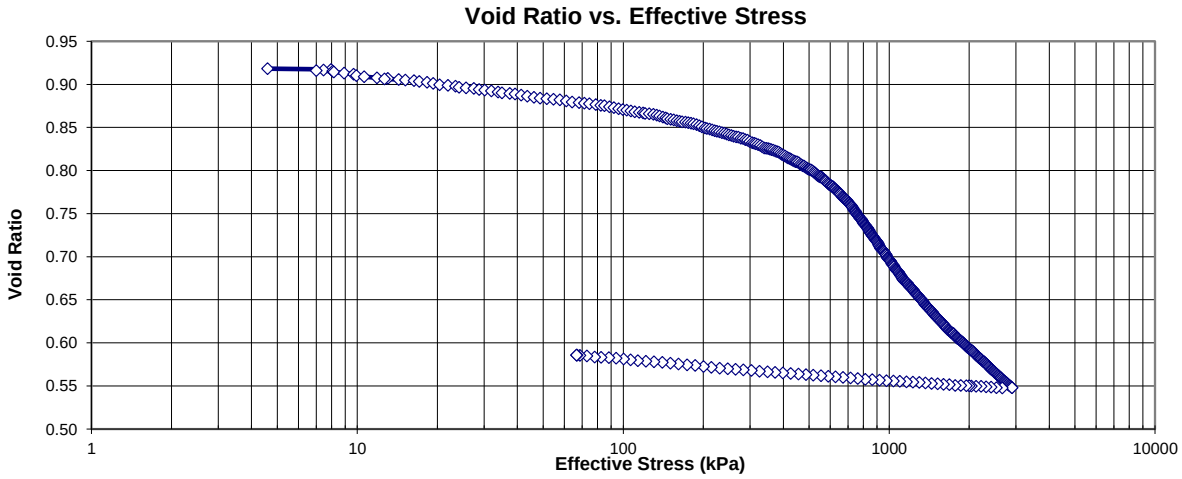
TEST DATES: November 24, 2020 - November 26, 2020

SAMPLE: BRU19-1 ST20 85'-87'
Silty clay, grey, moist
LL = 29.3, PL = 14.2

PROCEDURE: Test carried out in general accordance with Standard Test Method for One-Dimensional Consolidation Properties of Saturated Cohesive Soils Using Controlled-Strain Loading, ASTM D4186.

Sample Characteristics		
	Initial	Final
Sample Height (mm):	25.40	20.96
Sample Diameter (mm):	63.50	63.50
Wet Dens. (kg/m^3):	1895	2151
Dry Dens. (kg/m^3):	1451	1758
Moisture Content (%):	29.7	22.3
Void Ratio:	0.92	0.59

Test Conditions	
Back Pressure (kPa):	400
Seating Pressure (kPa):	4.60
Strain After Seating (%):	0.17
Strain Rate - Loading (%/hr):	0.8
Strain Rate - Unloading (%/hr):	0.1
R_u at end of loading:	0.01



Note: A Specific Gravity (Gs) of 2.783 was measured for the void ratio calculations.

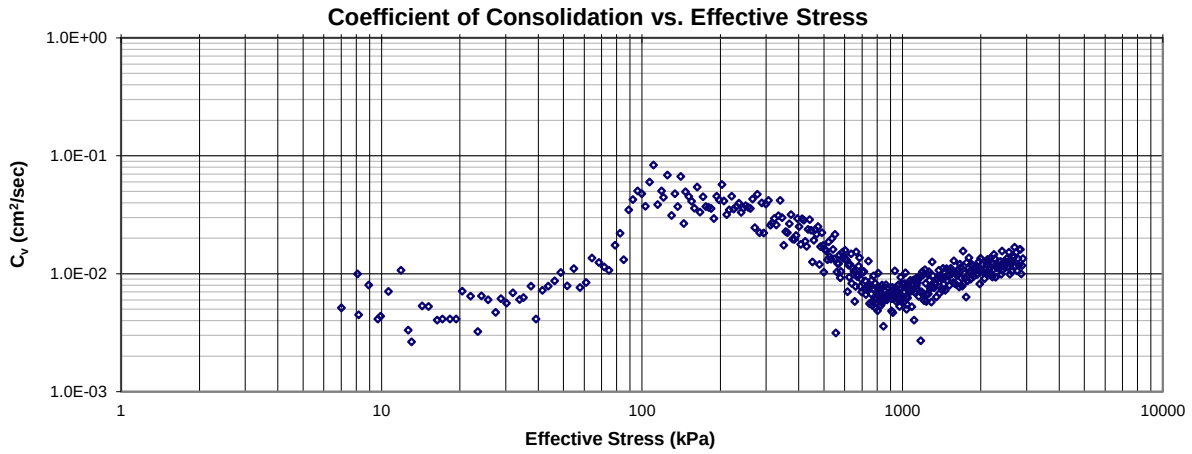
TESTED BY: BT, AA
REVIEWED BY: JL

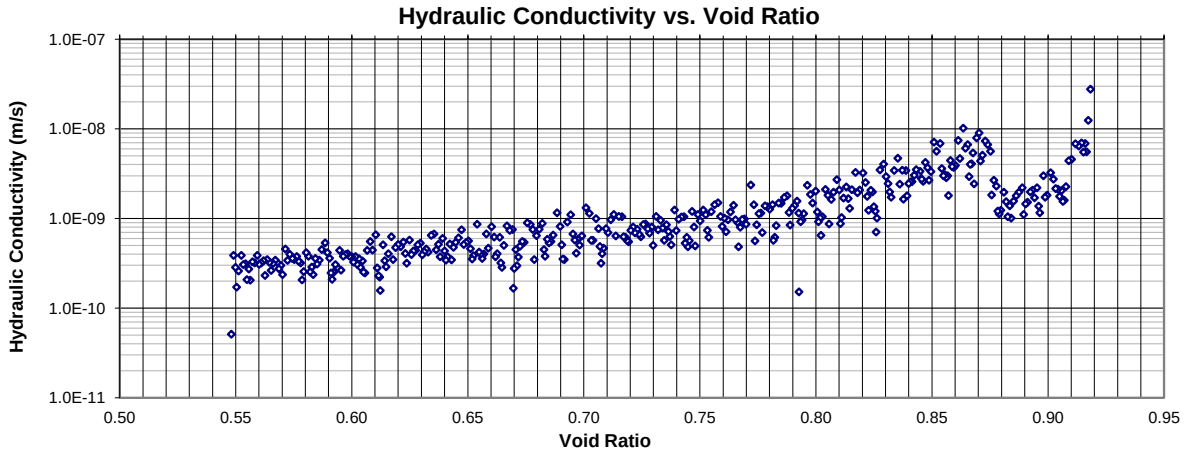
THURBER ENGINEERING LTD.

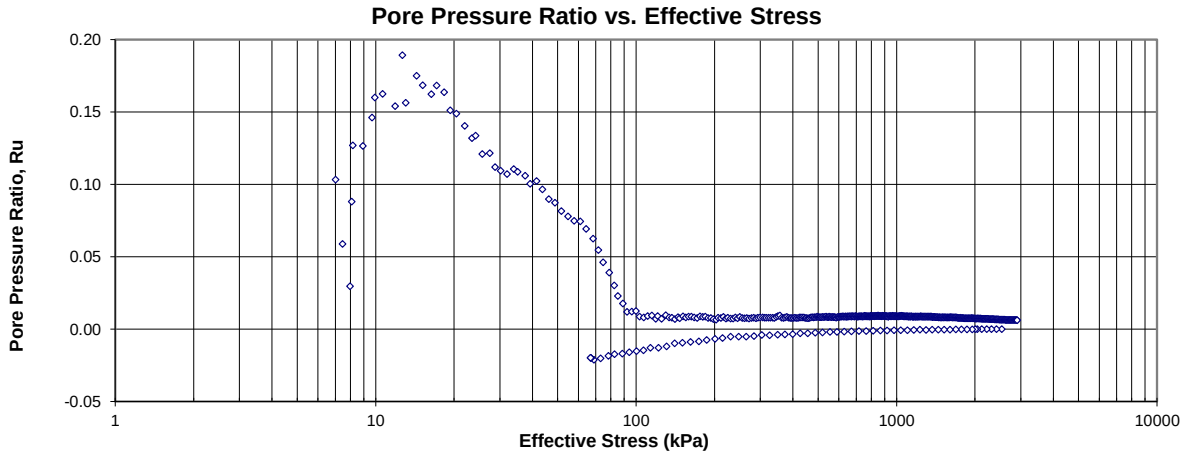
Constant Rate of Strain (CRS) Test Report

24726 BRU19-1 ST20 85'-87'

Twinning of Hwy 17 from Arnprior to Haley Station







Note: Only data from loading stage are shown in coefficient of consolidation vs. effective stress, and hydraulic conductivity vs. void ratio plots.

TESTED BY: BT, AA

REVIEWED BY: JL

THURBER ENGINEERING LTD.

Constant Rate of Strain (CRS) Test Report

CLIENT: Ministry of Transportation (MTO) FILE NUMBER: 24726

PROJECT: Twinning of Hwy 17 from Arnprior to Haley Station REPORT DATE: May 19, 2021

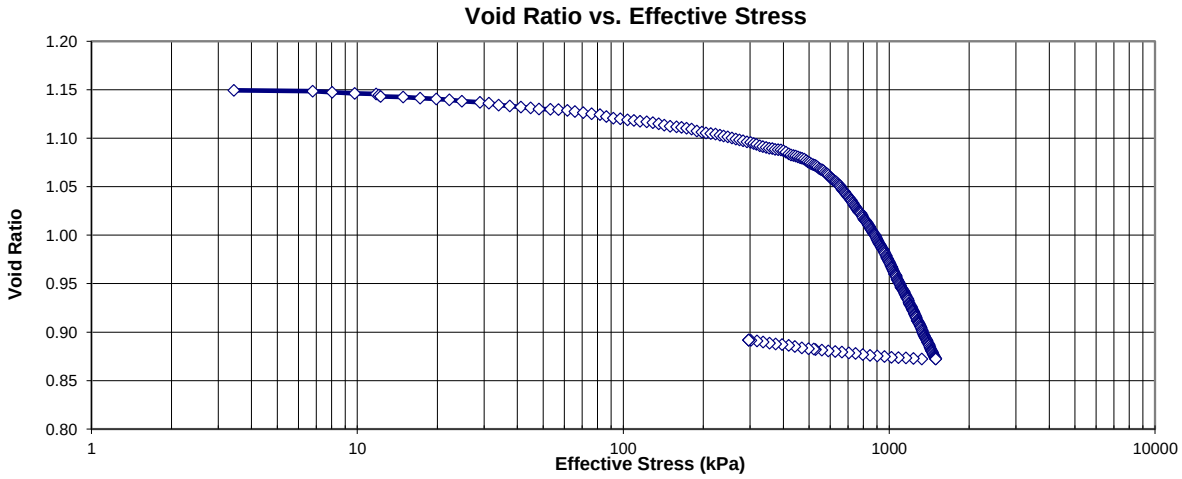
TEST DATES: January 20, 2021 - January 22, 2021

SAMPLE: BRU19-1.2 ST2 25'-27'
Silty clay, grey, moist
LL = 36.6, PL = 21.2

PROCEDURE: Test carried out in general accordance with Standard Test Method for One-Dimensional Consolidation Properties of Saturated Cohesive Soils Using Controlled-Strain Loading, ASTM D4186.

Sample Characteristics		
	Initial	Final
Sample Height (mm):	25.40	22.32
Sample Diameter (mm):	63.50	63.50
Wet Dens. (kg/m^3):	1806	1967
Dry Dens. (kg/m^3):	1282	1458
Moisture Content (%):	41.3	34.9
Void Ratio:	1.15	0.89

Test Conditions	
Back Pressure (kPa):	400
Seating Pressure (kPa):	3.45
Strain After Seating (%):	0.15
Strain Rate - Loading (%/hr):	0.8
Strain Rate - Unloading (%/hr):	0.1
R_u at end of loading:	0.0002



Note: A Specific Gravity (Gs) of 2.754 was measured for the void ratio calculations.

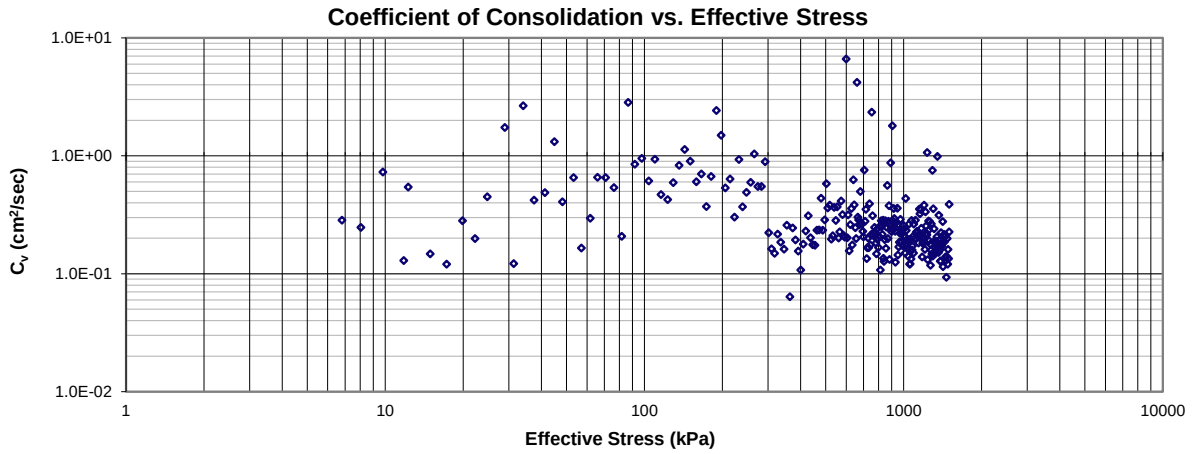
TESTED BY: BT, AA
REVIEWED BY: JL

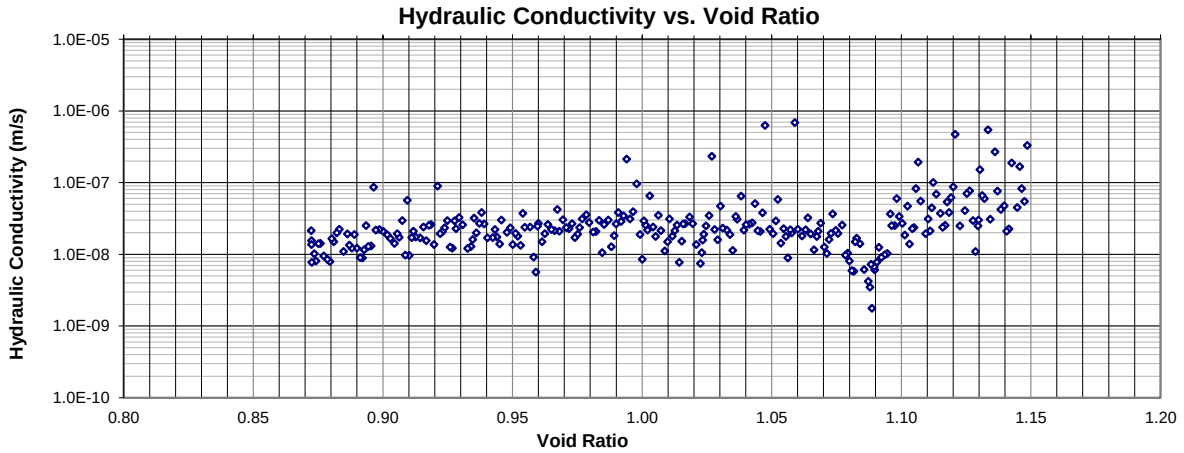
THURBER ENGINEERING LTD.

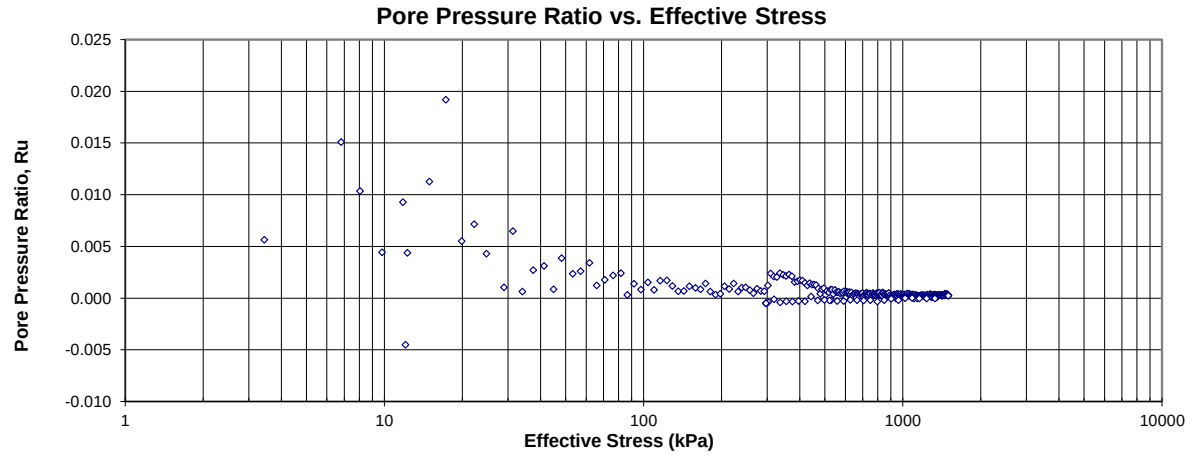
Constant Rate of Strain (CRS) Test Report

24726 BRU19-1.2 ST2 25'-27'

Twinning of Hwy 17 from Arnprior to Haley Station







Note: Only data from loading stage are shown in coefficient of consolidation vs. effective stress, and hydraulic conductivity vs. void ratio plots.

TESTED BY: BT, AA

REVIEWED BY: JL

THURBER ENGINEERING LTD.

Constant Rate of Strain (CRS) Test Report

CLIENT: Ministry of Transportation (MTO) FILE NUMBER: 24726

PROJECT: Twinning of Hwy 17 from Arnprior to Haley Station REPORT DATE: May 10, 2021

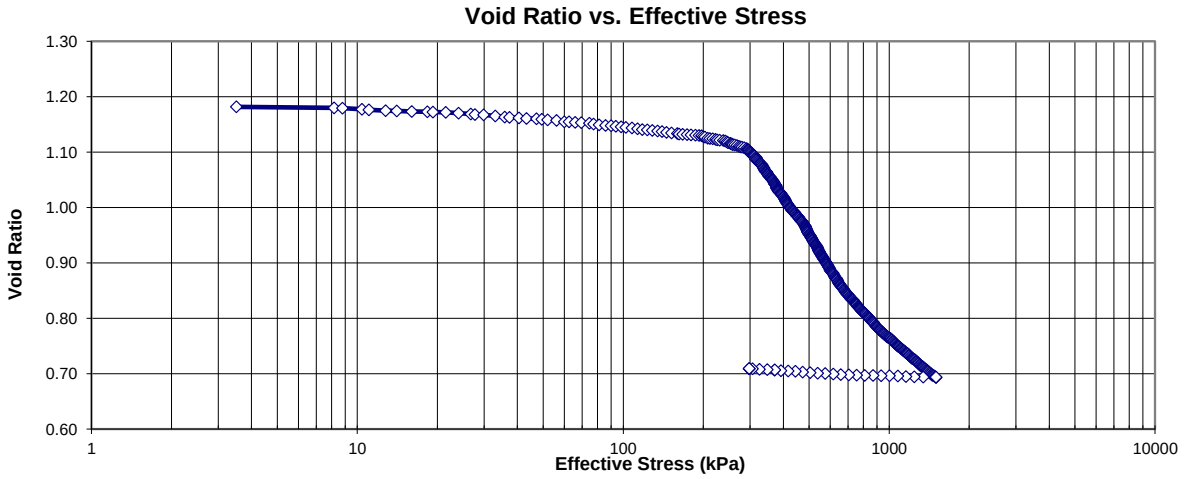
TEST DATES: January 22, 2021 - January 25, 2021

SAMPLE: BRU19-1.2 ST6 65'-67'
Clayey silt, grey, moist
LL = 17.5, PL = 13.7

PROCEDURE: Test carried out in general accordance with Standard Test Method for One-Dimensional Consolidation Properties of Saturated Cohesive Soils Using Controlled-Strain Loading, ASTM D4186.

Sample Characteristics		
	Initial	Final
Sample Height (mm):	25.40	19.87
Sample Diameter (mm):	63.50	63.50
Wet Dens. (kg/m^3):	1789	2064
Dry Dens. (kg/m^3):	1263	1615
Moisture Content (%):	37.4	27.8
Void Ratio:	1.19	0.71

Test Conditions	
Back Pressure (kPa):	400
Seating Pressure (kPa):	3.51
Strain After Seating (%):	0.17
Strain Rate - Loading (%/hr):	0.8
Strain Rate - Unloading (%/hr):	0.1
R_u at end of loading:	0.0163



Note: A Specific Gravity (Gs) of 2.755 was measured for the void ratio calculations.

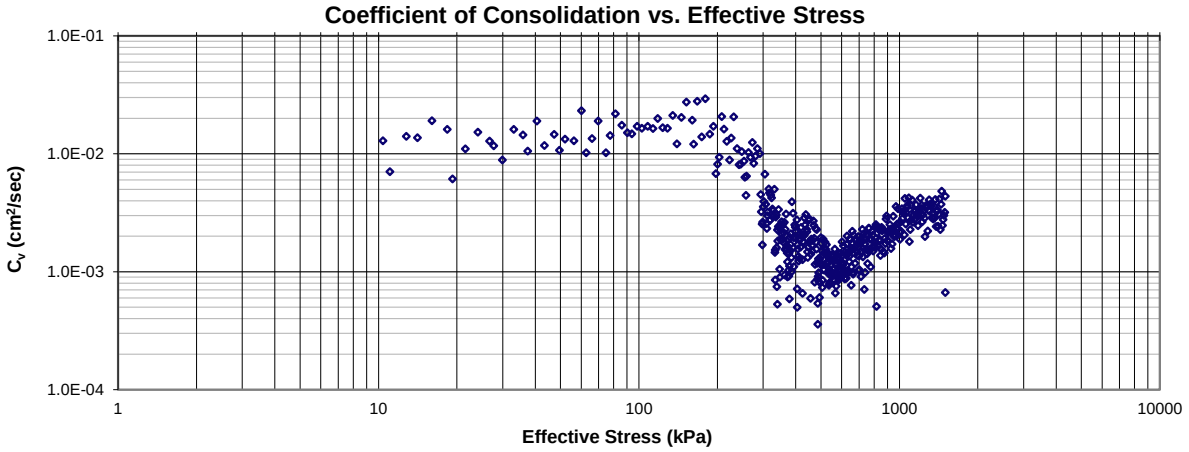
TESTED BY: BT, AA
REVIEWED BY: JL

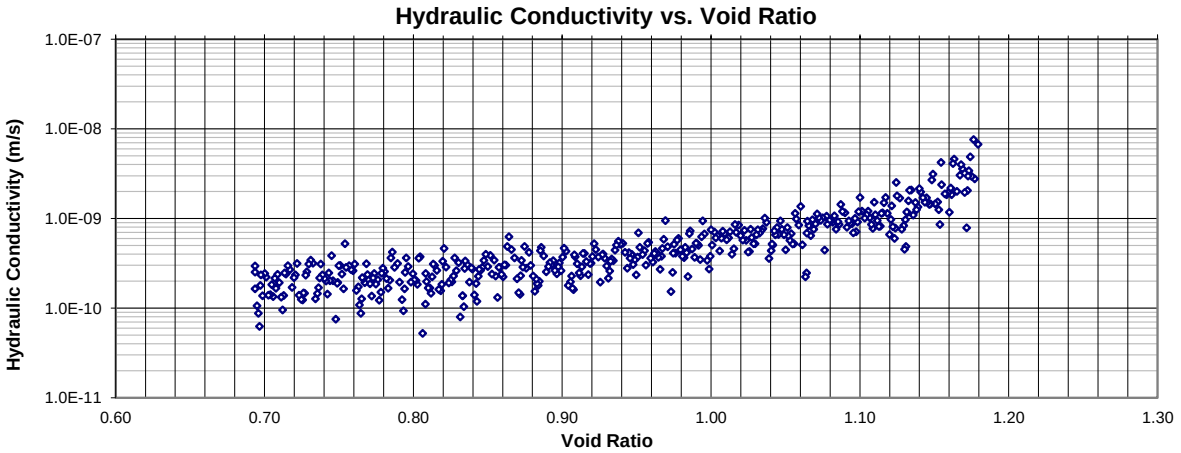
THURBER ENGINEERING LTD.

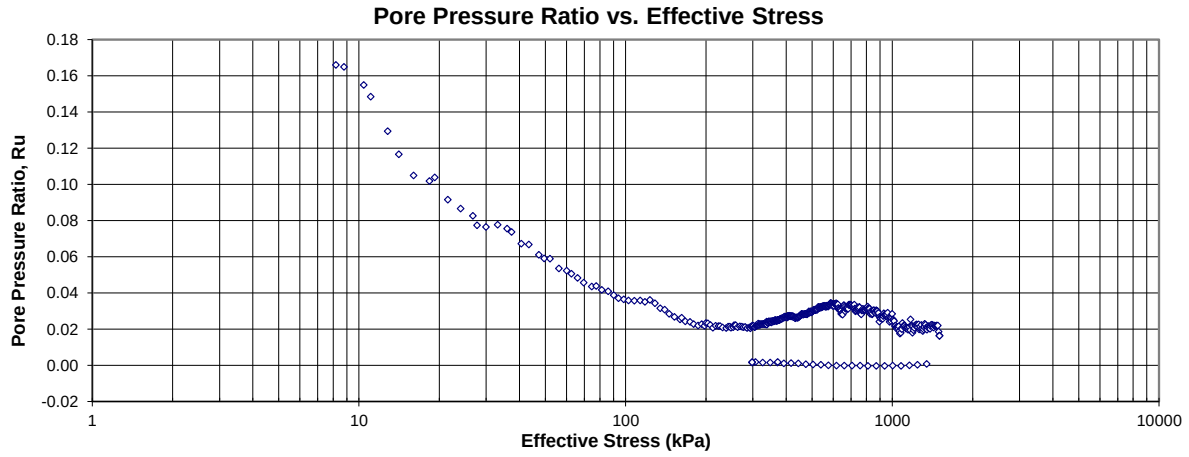
Constant Rate of Strain (CRS) Test Report

24726 BRU19-1.2 ST6 65'-67'

Twinning of Hwy 17 from Arnprior to Haley Station







Note: Only data from loading stage are shown in coefficient of consolidation vs. effective stress, and hydraulic conductivity vs. void ratio plots.

TESTED BY: BT, AA

REVIEWED BY: JL

THURBER ENGINEERING LTD.

Constant Rate of Strain (CRS) Test Report

CLIENT: Ministry of Transportation (MTO) FILE NUMBER: 24726

PROJECT: Twinning of Hwy 17 from Arnprior to Haley Station REPORT DATE: May 10, 2021

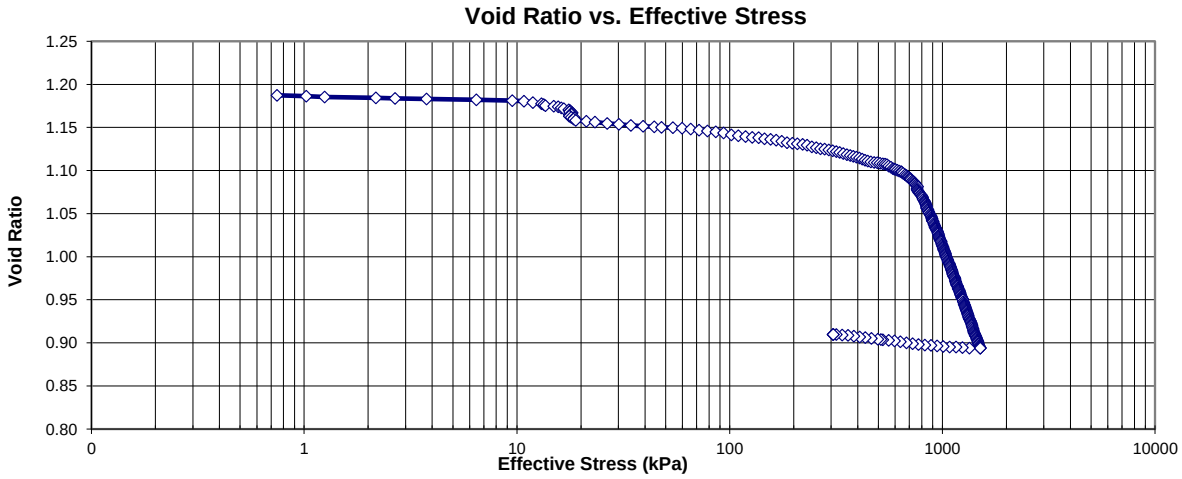
TEST DATES: January 18, 2021 - January 19, 2021

SAMPLE: BRU19-3.2 ST3 45'-47'
Silty clay, grey, moist
LL = 31.3, PL = 20.8

PROCEDURE: Test carried out in general accordance with Standard Test Method for One-Dimensional Consolidation Properties of Saturated Cohesive Soils Using Controlled-Strain Loading, ASTM D4186.

Sample Characteristics		
	Initial	Final
Sample Height (mm):	25.40	22.08
Sample Diameter (mm):	63.50	63.50
Wet Dens. (kg/m^3):	1778	1976
Dry Dens. (kg/m^3):	1266	1456
Moisture Content (%):	38.8	35.7
Void Ratio:	1.20	0.91

Test Conditions	
Back Pressure (kPa):	400
Seating Pressure (kPa):	0.78
Strain After Seating (%):	0.42
Strain Rate - Loading (%/hr):	0.8
Strain Rate - Unloading (%/hr):	0.1
R_u at end of loading:	0.0002



Note: A Specific Gravity (Gs) of 2.775 was measured for the void ratio calculations.

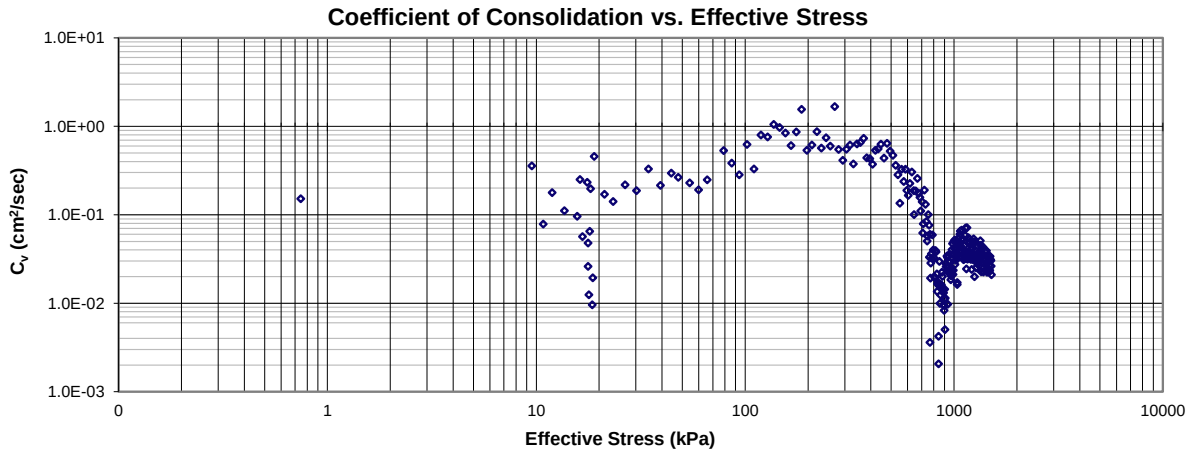
TESTED BY: BT, AA
REVIEWED BY: JL

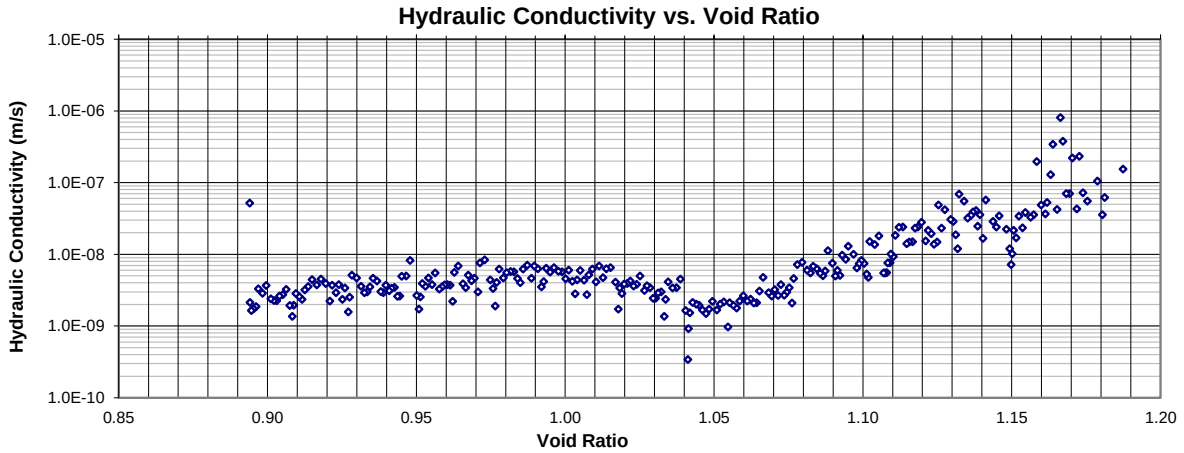
THURBER ENGINEERING LTD.

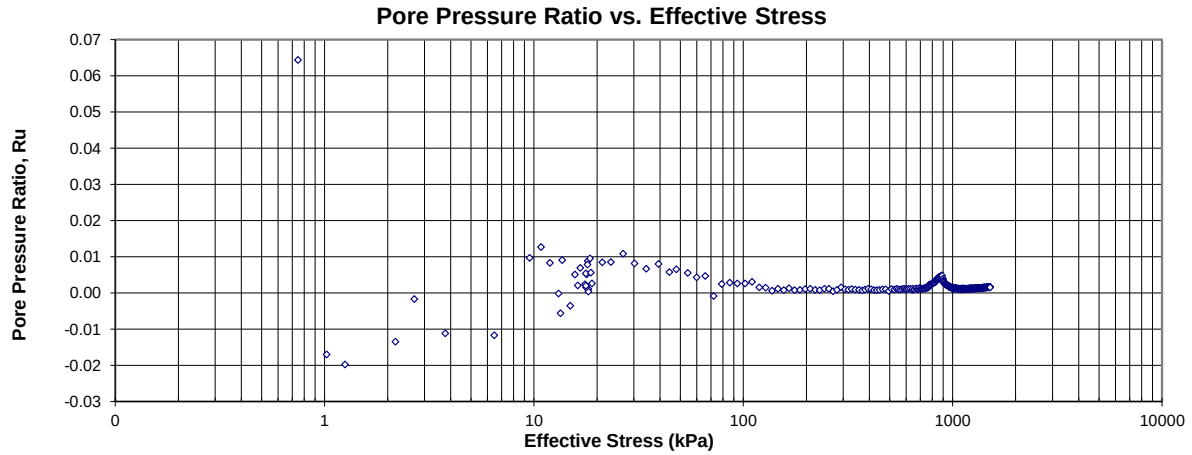
Constant Rate of Strain (CRS) Test Report

24726 BRU19-3.2 ST3 45'-47'

Twinning of Hwy 17 from Arnprior to Haley Station







Note: Only data from loading stage are shown in coefficient of consolidation vs. effective stress, and hydraulic conductivity vs. void ratio plots.

TESTED BY: BT, AA

REVIEWED BY: JL

THURBER ENGINEERING LTD.

Constant Rate of Strain (CRS) Test Report

CLIENT: Ministry of Transportation (MTO) FILE NUMBER: 24726

PROJECT: Twinning of Hwy 17 from Arnprior to Haley Station REPORT DATE: May 10, 2021

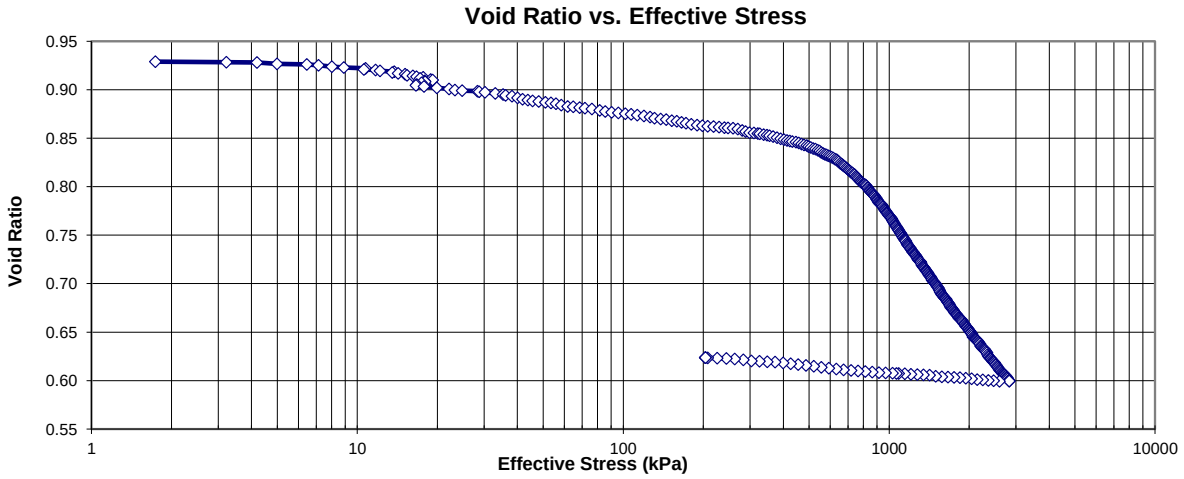
TEST DATES: January 8, 2021 - January 9, 2021

SAMPLE: BRU19-3.2 ST8 100'-102'
Silty clay, grey, moist
LL = 19.8, PL = 13.0

PROCEDURE: Test carried out in general accordance with Standard Test Method for One-Dimensional Consolidation Properties of Saturated Cohesive Soils Using Controlled-Strain Loading, ASTM D4186.

Sample Characteristics		
	Initial	Final
Sample Height (mm):	25.40	21.31
Sample Diameter (mm):	63.50	63.50
Wet Dens. (kg/m^3):	1893	2126
Dry Dens. (kg/m^3):	1428	1703
Moisture Content (%):	29.8	24.8
Void Ratio:	0.94	0.62

Test Conditions	
Back Pressure (kPa):	400
Seating Pressure (kPa):	2.77
Strain After Seating (%):	0.35
Strain Rate - Loading (%/hr):	0.8
Strain Rate - Unloading (%/hr):	0.1
R_u at end of loading:	-0.0040



Note: A Specific Gravity (Gs) of 2.76 was measured for the void ratio calculations.

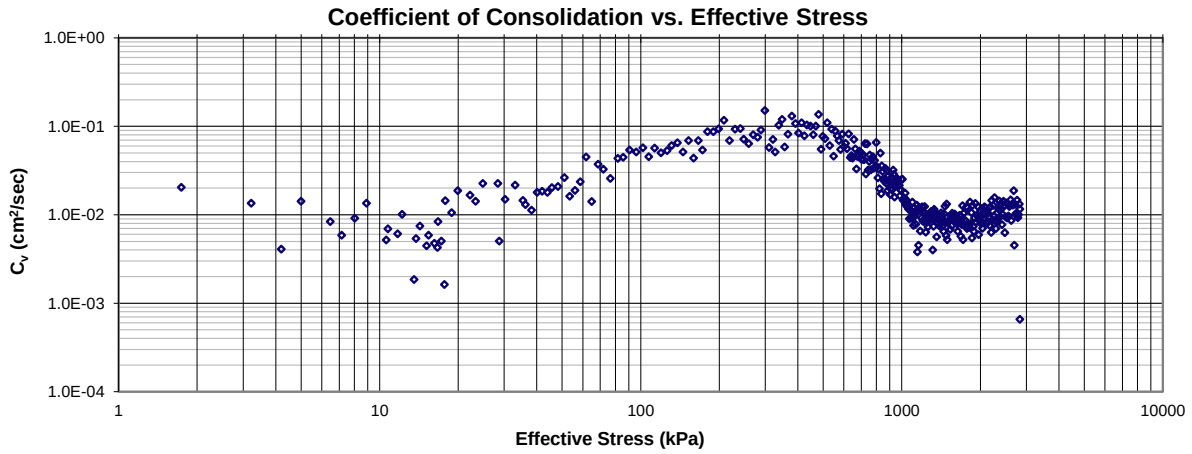
TESTED BY: BT, AA
REVIEWED BY: JL

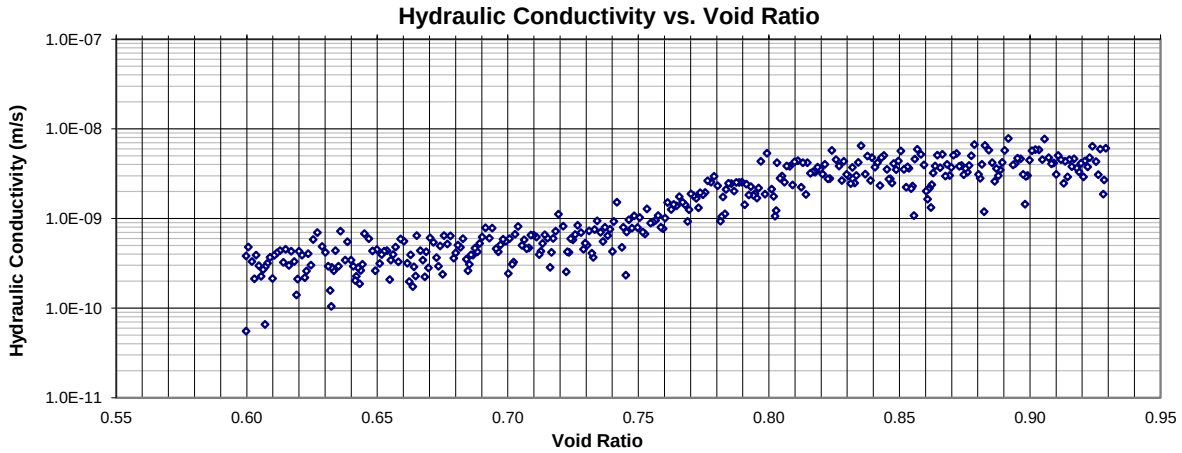
THURBER ENGINEERING LTD.

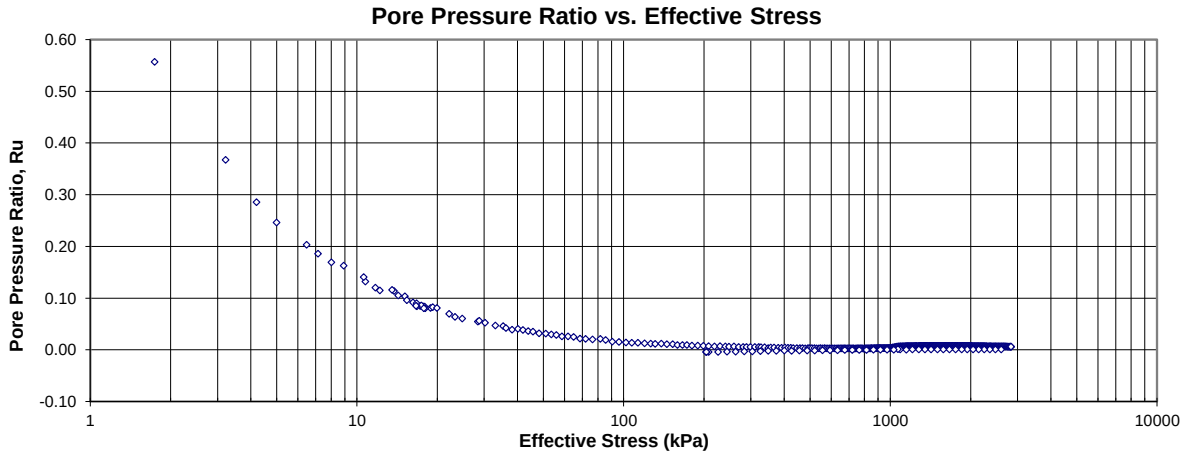
Constant Rate of Strain (CRS) Test Report

24726 BRU19-3.2 ST8 100'-102'

Twinning of Hwy 17 from Arnprior to Haley Station







Note: Only data from loading stage are shown in coefficient of consolidation vs. effective stress, and hydraulic conductivity vs. void ratio plots.

TESTED BY: BT, AA

REVIEWED BY: JL

THURBER

Appendix C.4

One-Dimensional Consolidation Test Results (Creep)

THURBER ENGINEERING LTD.

Consolidation Test Report

CLIENT: Thurber Engineering (Ottawa) FILE NUMBER: 24726

PROJECT: Highway 17 Twinning - Renfrew REPORT DATE: September 15, 2020

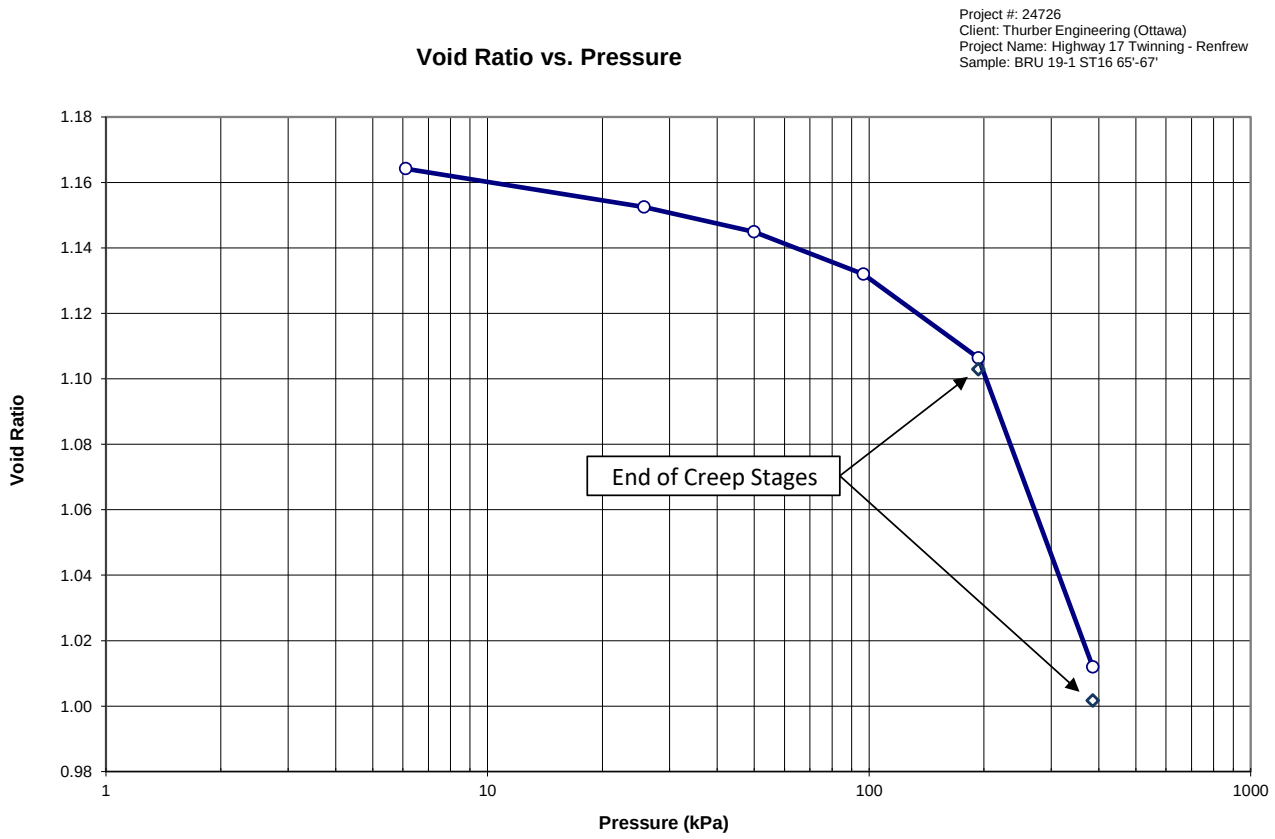
TEST DATES: May 20, 2020 - June 07, 2020

SAMPLE: BRU 19-1 ST16 65'-67'
Clay, silty, trace sand, brown, moist.
LL = 31.2, PL = 18.3, I_p = 12.9

PROCEDURE: Test carried out in accordance with Standard Test Method for One-Dimensional Consolidation Properties of Soils, ASTM D 2435-11, method B

	Start of Test	End of Test
Sample Height (mm)	25.40	23.46
Wet Dens. (kg/m^3)	1772.5	1892.0
Dry Dens. (kg/m^3)	1285.6	1391.7
Moisture Cont. (%)	37.9	35.9
Void Ratio	1.167	1.002
Saturation (%)	90.4	100.0

Note: A Specific Gravity (Gs) of 2.786 was obtained for the void ratio and saturation calculations.



TEST DONE BY: BT
REVIEWED BY: WM

THURBER ENGINEERING LTD.

Consolidation Test Report

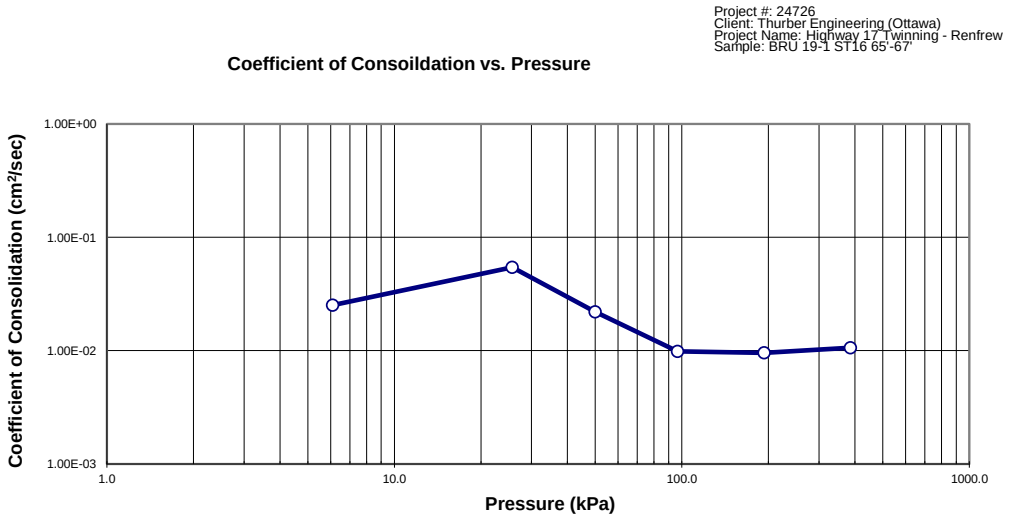
Highway 17 Twinning - Renfrew
24726 BRU 19-1 ST16 65'-67'

TRIMMING: The Specimen was manually trimmed to the size of consolidation ring, then mounted in a fixed ring consolidometer. The average moisture content of the trimmings was 34.9%.

LOADING: A seating load of 6.1 kPa was applied and the consolidometer was flooded with distilled water. Sample was monitored to ensure no swelling effect occurred before the start of the test. Subsequent loads were applied after a constant load increment duration of 24 hours. Creep stages were conducted at 193.2 kPa and 385.7 kPa; and were maintained for 7 and 8 days, respectively.

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

Pressure (kPa)	Corr. H. (mm)	Avg. H. (mm)	D_{90} (mm)	t_{90} (min)	c_v (cm^2/s)	Void Ratio	m_v (m^2/kN)	k (cm/s)
0.0	25.400					1.167		
6.1	25.367	25.384	-0.026	0.90	2.52E-02	1.164	2.13E-04	5.27E-07
25.7	25.230	25.299	-0.097	0.42	5.44E-02	1.152	2.76E-04	1.47E-06
49.9	25.141	25.186	-0.046	1.02	2.20E-02	1.145	1.46E-04	3.14E-07
96.6	24.990	25.066	-0.086	2.25	9.87E-03	1.132	1.29E-04	1.24E-07
193.2	24.690	24.840	-0.161	2.28	9.56E-03	1.106	1.24E-04	1.17E-07
193.2 (Creep)	24.649	24.670				1.103		
385.7	23.583	24.116	-0.483	1.93	1.06E-02	1.012	2.25E-04	2.34E-07
385.7 (Creep)	23.462	23.523				1.002		



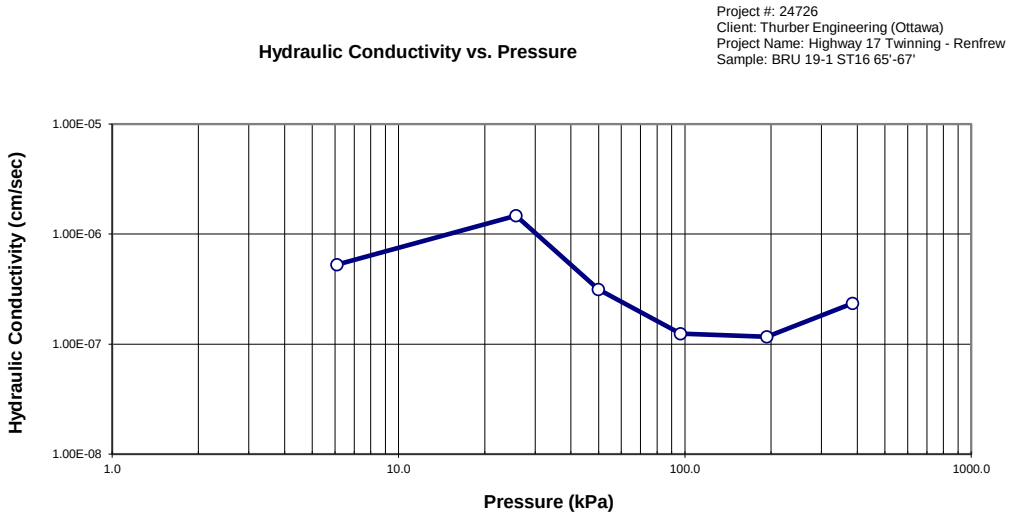
Note: C_v and k calculated using t_{90} values (square root of time method)

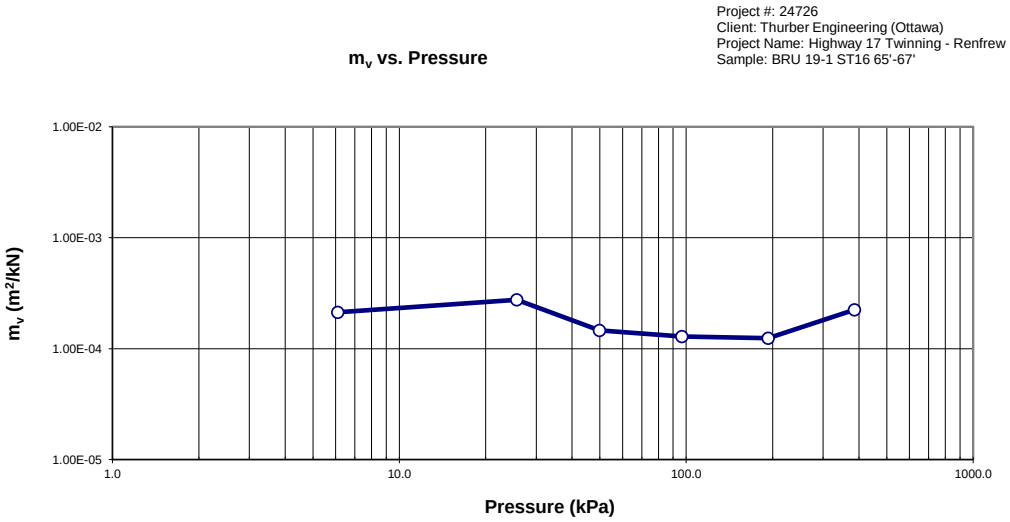
TEST DONE BY: BT
REVIEWED BY: WM

THURBER ENGINEERING LTD.

Consolidation Test Report

Highway 17 Twinning - Renfrew
24726 BRU 19-1 ST16 65'-67'



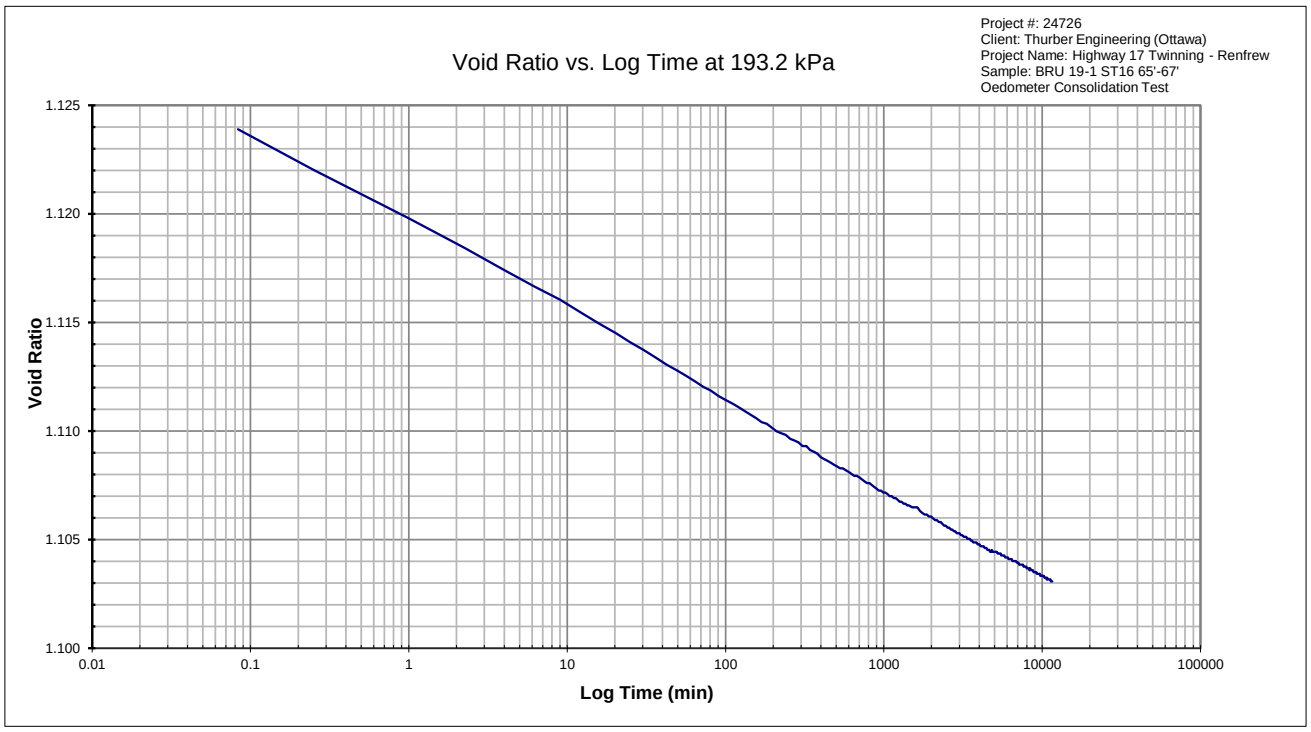


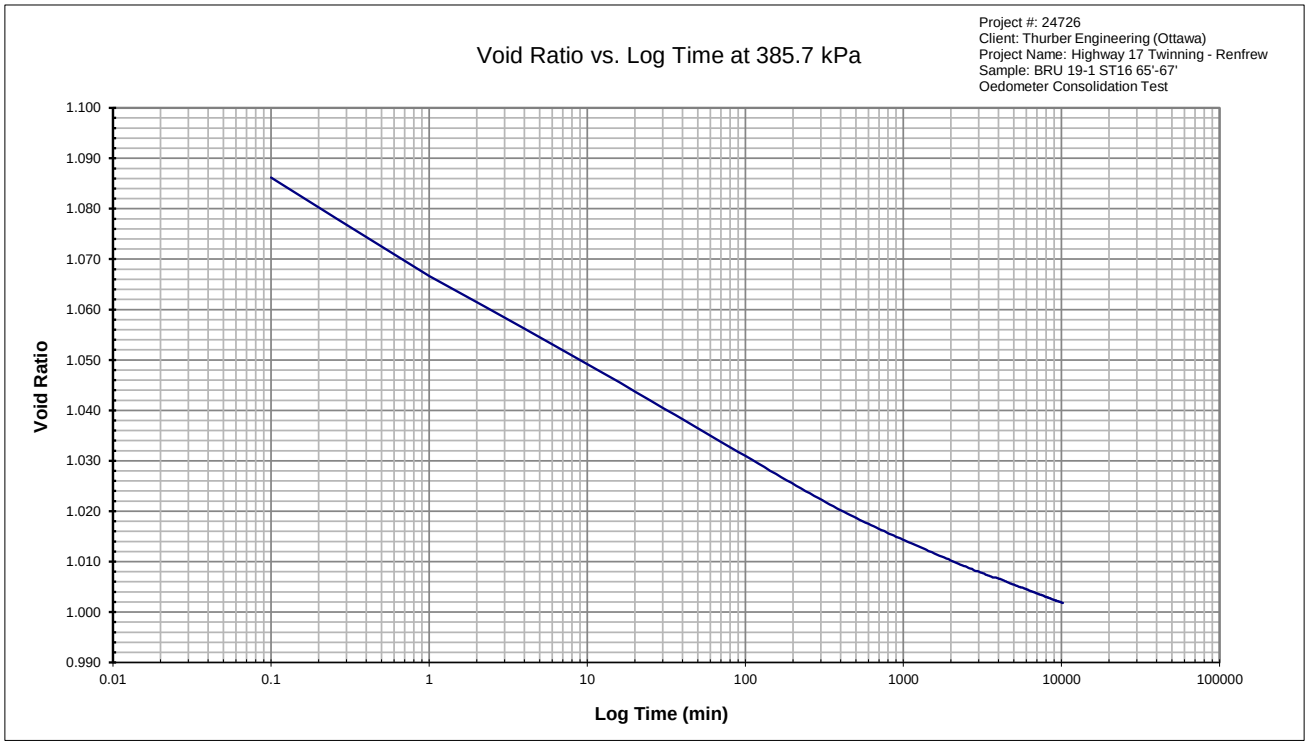
TEST DONE BY: BT
REVIEWED BY: WM

THURBER ENGINEERING LTD.

Consolidation Test Report

Highway 17 Twinning - Renfrew
24726 BRU 19-1 ST16 65'-67'





TEST DONE BY: BT
REVIEWED BY: WM

THURBER ENGINEERING LTD.

Consolidation Test Report

CLIENT: Thurber Engineering (Ottawa) FILE NUMBER: 24726

PROJECT: Highway 17 Twinning - Renfrew REPORT DATE: September 15, 2020

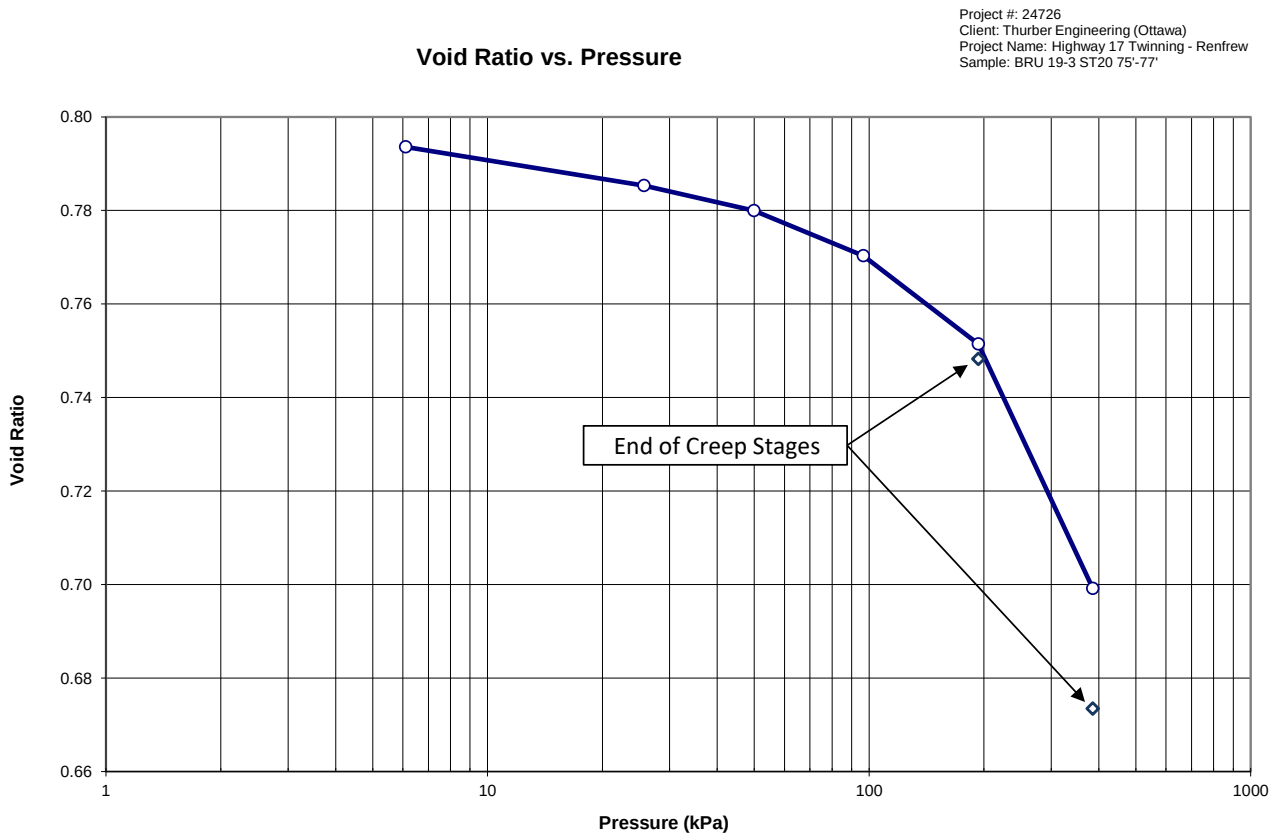
TEST DATES: July 22, 2020 - August 13, 2020

SAMPLE: BRU 19-3 ST20 75'-77'
Clay, silty, trace sand, grey, moist.
LL = 24.1, PL = 14.8, I_p = 9.3

PROCEDURE: Test carried out in accordance with Standard Test Method for One-Dimensional Consolidation Properties of Soils, ASTM D 2435-11, method B

	Start of Test	End of Test
Sample Height (mm)	25.40	23.68
Wet Dens. (kg/m^3)	1952.6	2042.2
Dry Dens. (kg/m^3)	1528.7	1639.8
Moisture Cont. (%)	27.7	24.5
Void Ratio	0.795	0.673
Saturation (%)	95.7	100.0

Note: A Specific Gravity (Gs) of 2.744 was obtained for the void ratio and saturation calculations.



TEST DONE BY: BT
REVIEWED BY: WM

THURBER ENGINEERING LTD.

Consolidation Test Report

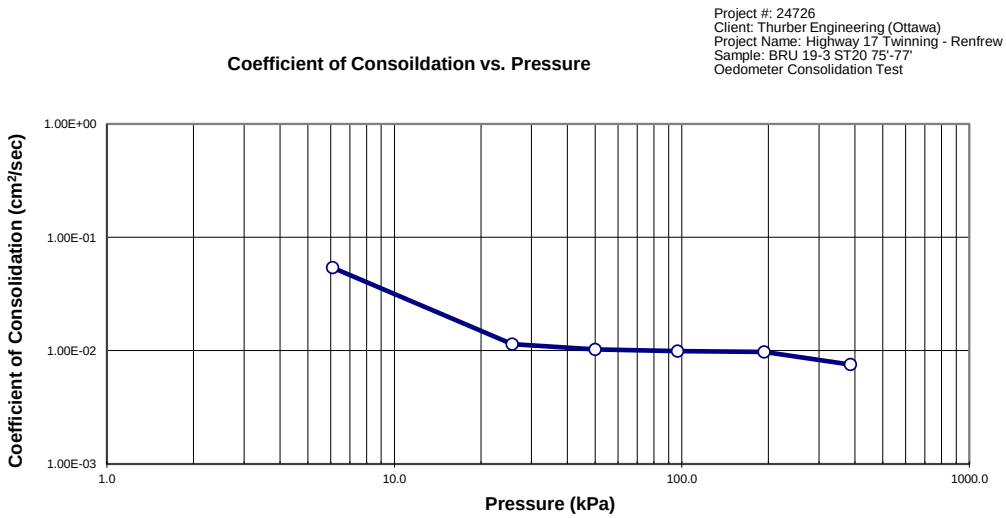
Highway 17 Twinning - Renfrew
24726 BRU 19-3 ST20 75'-77'

TRIMMING: The Specimen was manually trimmed to the size of consolidation ring, then mounted in a fixed ring consolidometer. The average moisture content of the trimmings was 28.5%.

LOADING: A seating load of 6.1 kPa was applied and the consolidometer was flooded with distilled water. Sample was monitored to ensure no swelling effect occurred before the start of the test. Subsequent loads were applied after a constant load increment duration of 24 hours. Creep stages were conducted at 193.2 kPa and 385.7 kPa; and were maintained for 9 and 10 days, respectively.

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

Pressure (kPa)	Corr. H. (mm)	Avg. H. (mm)	D_{90} (mm)	t_{90} (min)	c_v (cm^2/s)	Void Ratio	m_v (m^2/kN)	k (cm/s)
0.0	25.400					0.795		
6.1	25.380	25.390	-0.019	0.42	5.39E-02	0.794	1.29E-04	6.82E-07
25.7	25.263	25.322	-0.085	1.99	1.14E-02	0.785	2.35E-04	2.63E-07
49.9	25.187	25.225	-0.043	2.19	1.03E-02	0.780	1.24E-04	1.25E-07
96.6	25.051	25.119	-0.078	2.25	9.91E-03	0.770	1.16E-04	1.12E-07
193.2	24.784	24.918	-0.150	2.25	9.75E-03	0.751	1.10E-04	1.05E-07
193.2 (Creep)	24.738	24.761				0.748		
385.7	24.044	24.391	-0.303	2.79	7.54E-03	0.699	1.46E-04	1.08E-07
385.7 (Creep)	23.680	23.862				0.673		



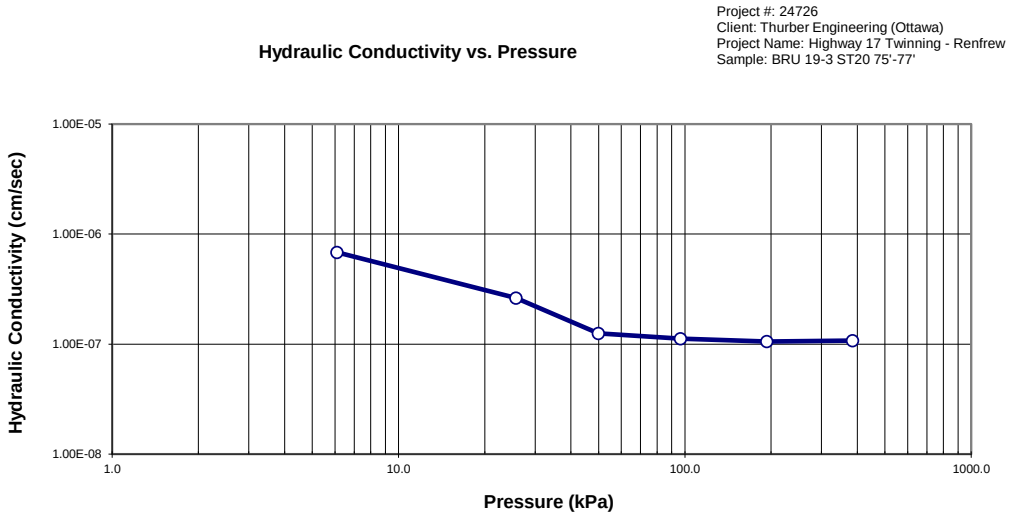
Note: C_v and k calculated using t_{90} values (square root of time method)

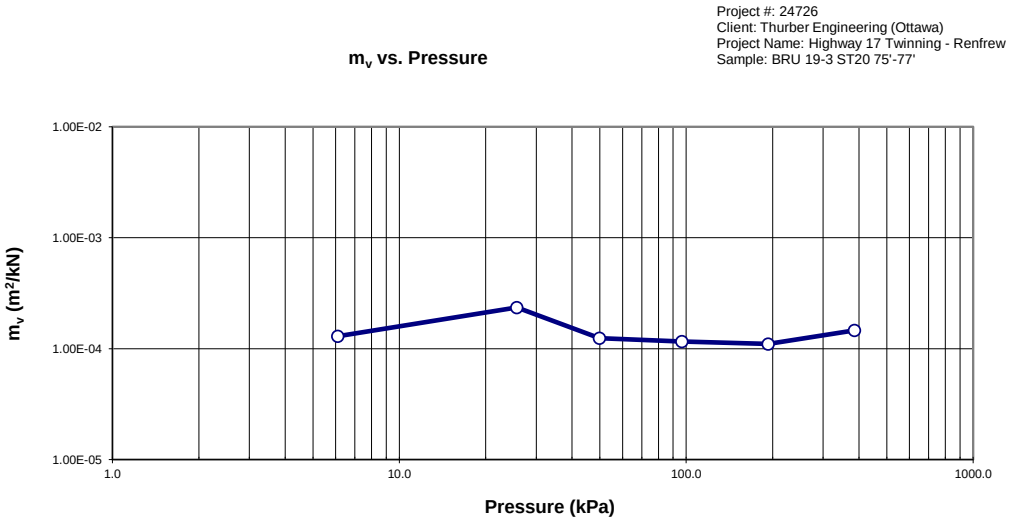
TEST DONE BY: BT
REVIEWED BY: WM

THURBER ENGINEERING LTD.

Consolidation Test Report

Highway 17 Twinning - Renfrew
24726 BRU 19-3 ST20 75'-77'



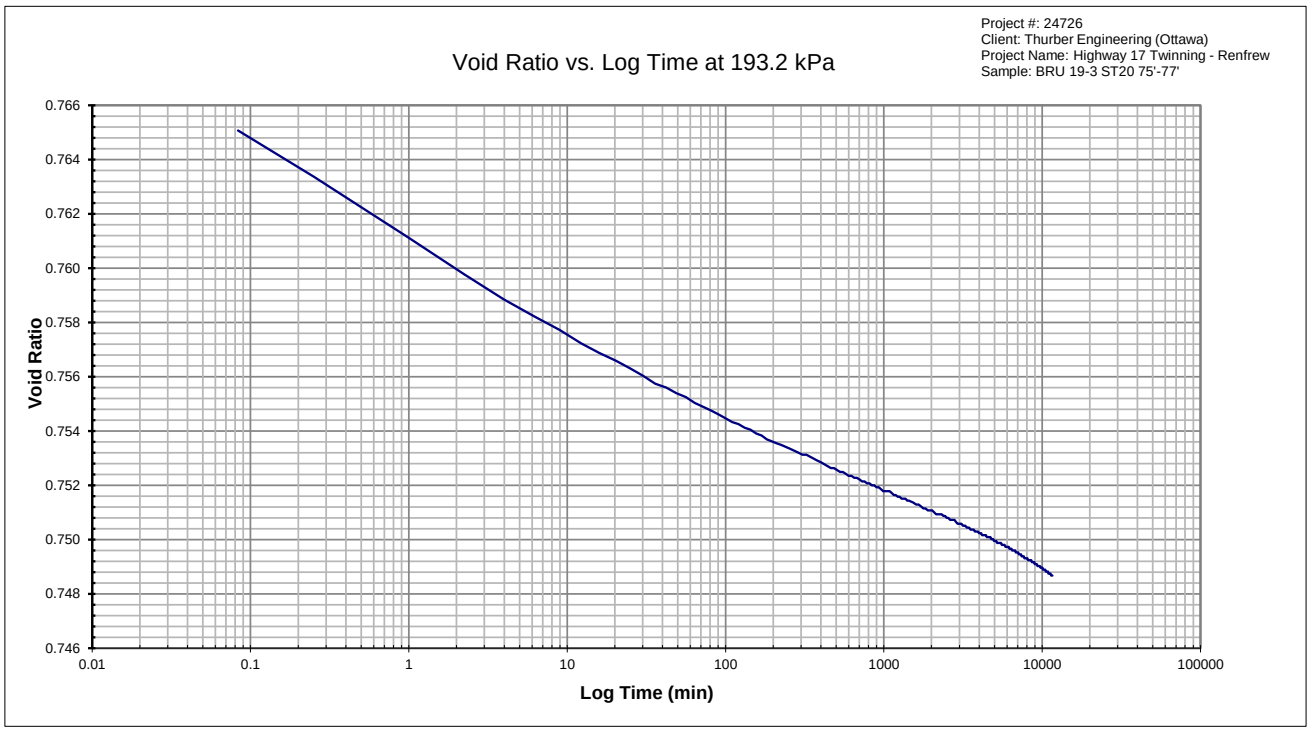


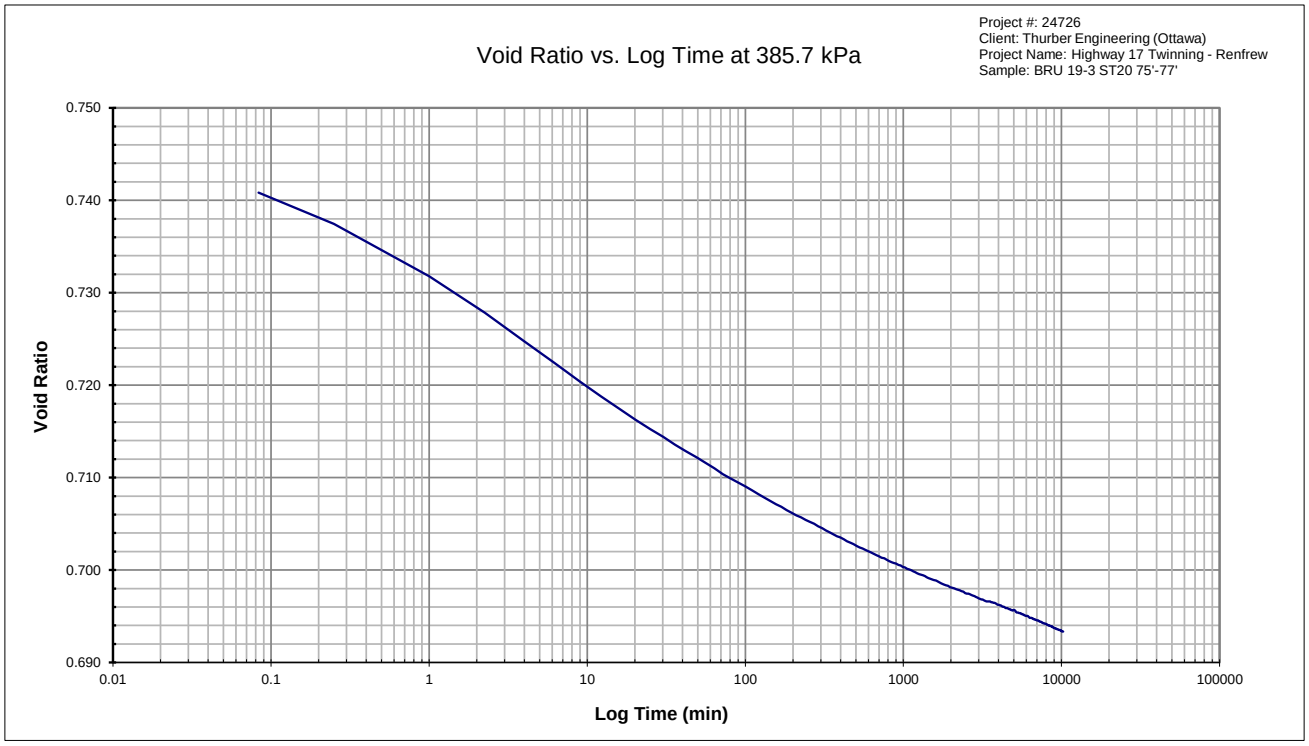
TEST DONE BY: BT
REVIEWED BY: WM

THURBER ENGINEERING LTD.

Consolidation Test Report

Highway 17 Twinning - Renfrew
24726 BRU 19-3 ST20 75'-77'





TEST DONE BY: BT
REVIEWED BY: WM

THURBER

Appendix C.5

Triaxial Test Results

Unconfined Compressive Strength Test Results

THURBER ENGINEERING LTD.

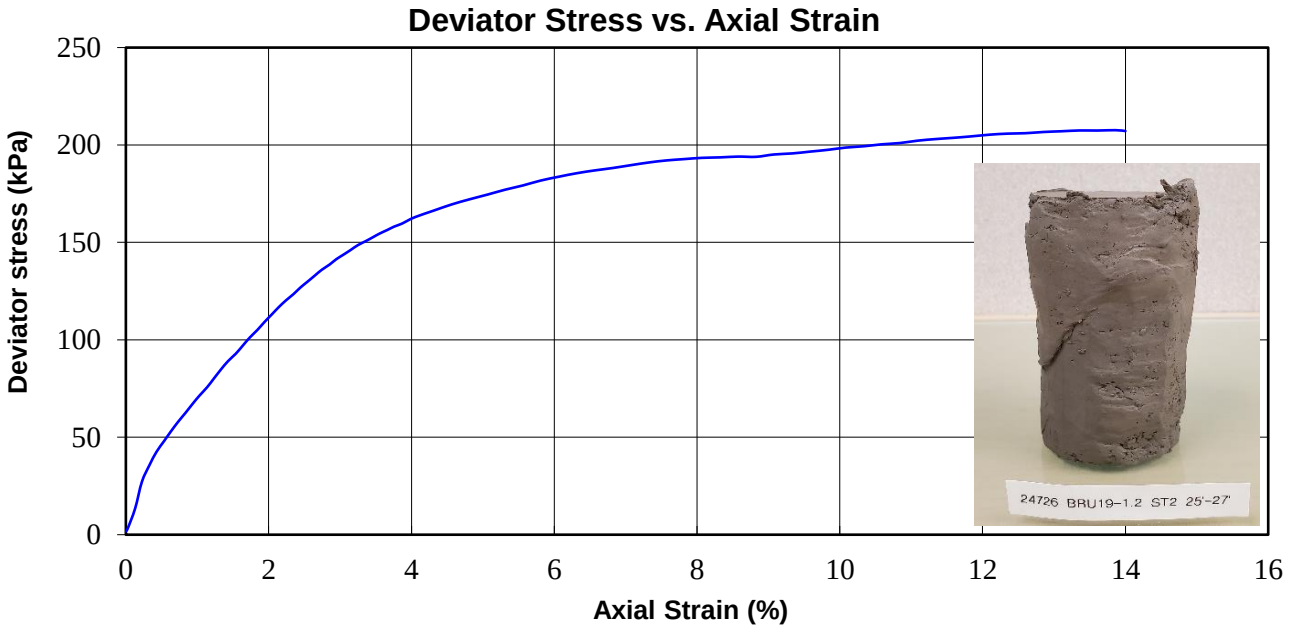
UNCONSOLIDATED-UNDRAINED TRIAXAL TEST REPORT

ASTM D2850

CLIENT:	Ministry of Transportation (MTO)	FILE NUMBER:	24726
PROJECT NAME:	Highway 17 - Twinning	REPORT DATE:	17-May-21
BOREHOLE No.:	BRU19-1.2	TEST DATE:	14-May-21
SAMPLE No.:	ST2	ATTERBERG LIMITS:	LL = 36.6, PL = 21.2
SAMPLE DEPTH:	25'-27'	PARTICLE SIZES:	CL = 49%, SI = 51%
DESCRIPTION:	Silty clay, grey, moist		SA = 0%, GR = 0%

Avg. Height (mm):	108.7	Weight (g):	400.2
Avg. Diameter (mm):	50.4	Wet Density (kg/m^3):	1,845
H. to Dia. Ratio:	2.2:1	Dry Density (kg/m^3):	1,347
Cross Sectional Area (mm^2):	1995.0	Moisture Content* (%):	37.0
G_s (Measured):	2.754	Void Ratio:	1.045

Rate of Strain to Failure (% / min):	1
Minor principal stress, $\sigma_{3\ (kPa)}$	110
Major principal stress, $\sigma_{1\ (kPa)}$	318
Deviator Stress at failure (kPa)	208
Vertical Strain at failure (%)	13.9



Note: * Moisture content was obtained from the entire specimen after the test

** Type of Failure: Diagonal Shear

TEST DONE BY: BT
REVIEWED BY: JPL

24726 BRU19-1.2 ST2 25'-27' UU

THURBER ENGINEERING LTD.

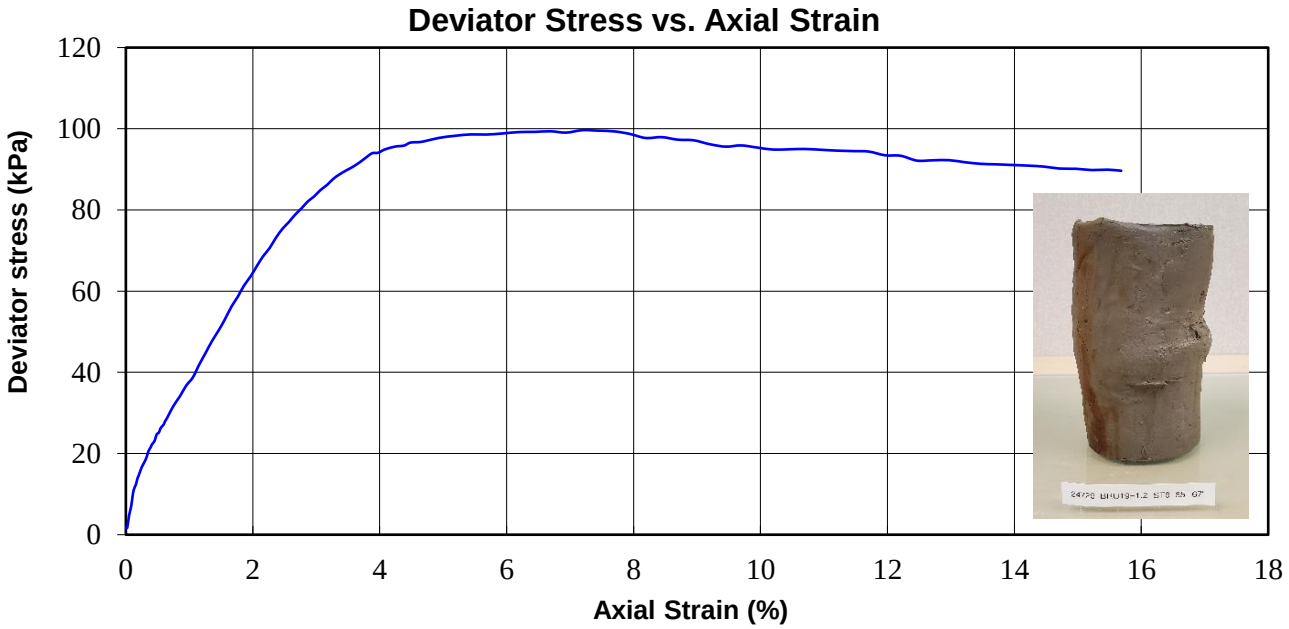
UNCONSOLIDATED-UNDRAINED TRIAXAL TEST REPORT

ASTM D2850

CLIENT:	Ministry of Transportation (MTO)	FILE NUMBER:	24726
PROJECT NAME:	Highway 17 - Twinning	REPORT DATE:	9-Jun-21
BOREHOLE No.:	BRU19-1.2	TEST DATE:	12-May-21
SAMPLE No.:	ST6	ATTERBERG LIMITS:	LL = 17.5, PL = 13.7
SAMPLE DEPTH:	65'-67'	PARTICLE SIZES:	CL = 33%, SI = 66%
DESCRIPTION:	Silty clay, grey, moist		SA = 1%, GR = 0%

Avg. Height (mm):	154.5	Weight (g):	1052.0
Avg. Diameter (mm):	66.9	Wet Density (kg/m^3):	1,937
H. to Dia. Ratio:	2.3:1	Dry Density (kg/m^3):	1,418
Cross Sectional Area (mm^2):	3515.1	Moisture Content* (%):	36.6
G_s (Measured):	2.755	Void Ratio:	0.943

Rate of Strain to Failure (% / min):	1
Minor principal stress, $\sigma_{3\ (kPa)}$	201
Major principal stress, $\sigma_{1\ (kPa)}$	301
Deviator Stress at failure (kPa)	100
Vertical Strain at failure (%)	7.2



Note: * Moisture content was obtained from the entire specimen after the test

** Type of Failure: Bulge

TEST DONE BY: BT
REVIEWED BY: JPL

24726 BRU19-1.2 ST6 65'-67' - UU

THURBER ENGINEERING LTD.

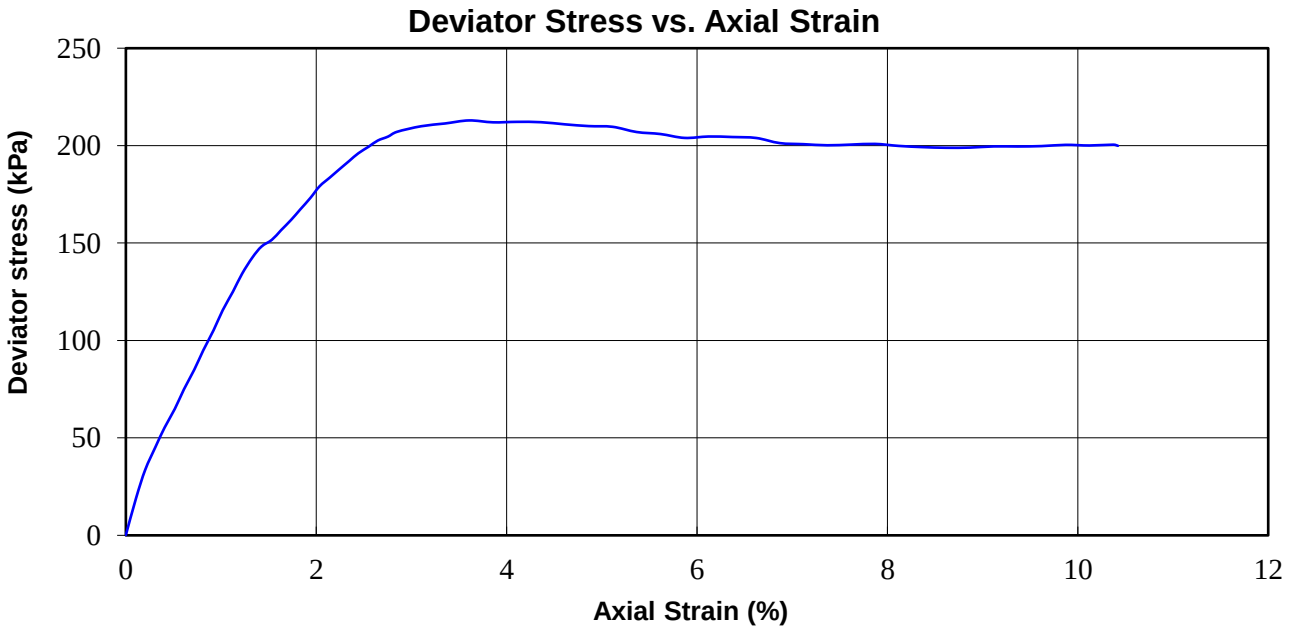
UNCONSOLIDATED-UNDRAINED TRIAXAL TEST REPORT

ASTM D2850

CLIENT:	Ministry of Transportation (MTO)	FILE NUMBER:	24726
PROJECT NAME:	Highway 17 - Twinning	REPORT DATE:	11-Feb-21
BOREHOLE No.:	BRU19-3.2	TEST DATE:	27-Jan-21
SAMPLE No.:	ST3	ATTERBERG LIMITS:	LL = 31.3, PL = 20.8
SAMPLE DEPTH:	45'-47'	PARTICLE SIZES:	CL = 43%, SI = 57%
DESCRIPTION:	Silty clay, grey, moist		SA = 0%, GR = 0%

Avg. Height (mm):	151.8	Weight (g):	1041.0
Avg. Diameter (mm):	69.5	Wet Density (kg/m^3):	1,808
H. to Dia. Ratio:	2.2:1	Dry Density (kg/m^3):	1,303
Cross Sectional Area (mm^2):	3793.7	Moisture Content* (%):	38.7
G_s (Measured):	2.775	Void Ratio:	1.129

Rate of Strain to Failure (% / min):	1
Minor principal stress, $\sigma_{3\ (kPa)}$	305
Major principal stress, $\sigma_{1\ (kPa)}$	518
Deviator Stress at failure (kPa)	213
Vertical Strain at failure (%)	3.6



Note: * Moisture content was obtained from the entire specimen after the test

** Type of Failure: Diagonal shear

TEST DONE BY: BT
REVIEWED BY: JPL

THURBER ENGINEERING LTD.

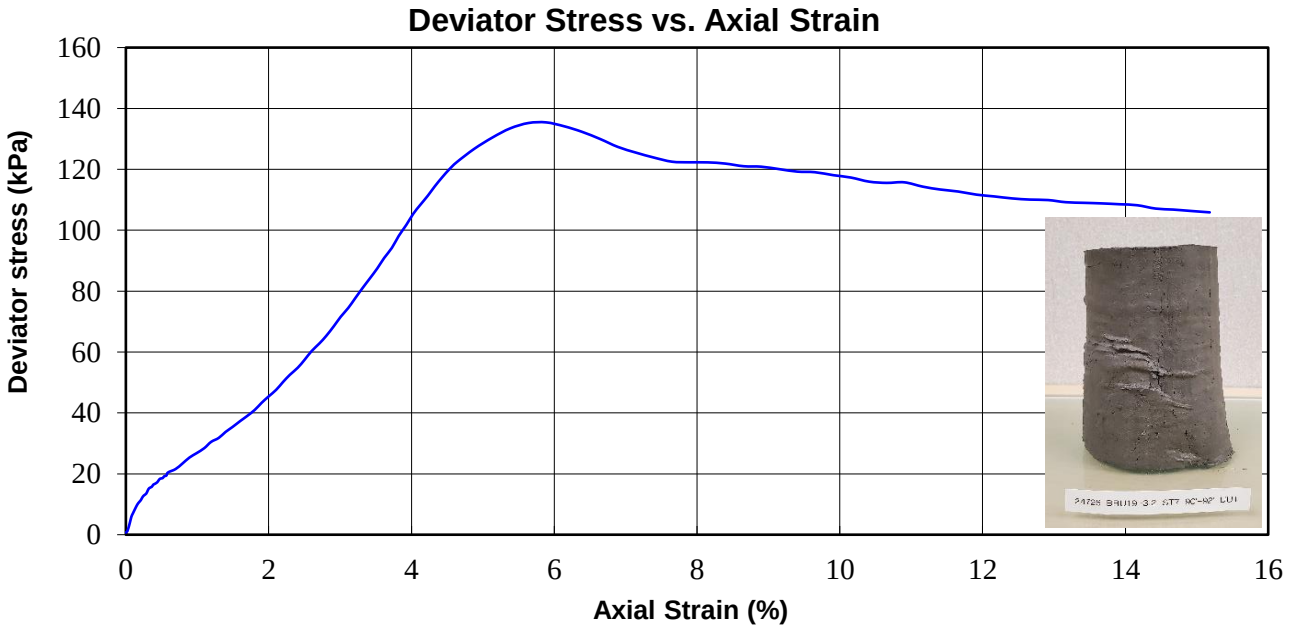
UNCONSOLIDATED-UNDRAINED TRIAXAL TEST REPORT

ASTM D2850

CLIENT:	Ministry of Transportation (MTO)	FILE NUMBER:	24726
PROJECT NAME:	Highway 17 - Twinning	REPORT DATE:	9-Jun-21
BOREHOLE No.:	BRU19-3.2	TEST DATE:	18-May-21
SAMPLE No.:	ST7	ATTERBERG LIMITS:	LL = 20.5, PL = 17.4
SAMPLE DEPTH:	90'-92'	PARTICLE SIZES:	CL = 23%, SI = 77%
DESCRIPTION:	Silt, clayey, grey, moist		SA = 0%, GR = 0%

Avg. Height (mm):	144.9	Weight (g):	1041.9
Avg. Diameter (mm):	67.9	Wet Density (kg/m^3):	1,986
H. to Dia. Ratio:	2.1:1	Dry Density (kg/m^3):	1,533
Cross Sectional Area (mm^2):	3621.0	Moisture Content* (%):	29.5
G_s (Measured):	2.773	Void Ratio:	0.808

Rate of Strain to Failure (% / min):	1
Minor principal stress, $\sigma_{3\ (kPa)}$	240
Major principal stress, $\sigma_{1\ (kPa)}$	375
Deviator Stress at failure (kPa)	135
Vertical Strain at failure (%)	5.9



Note: * Moisture content was obtained from the entire specimen after the test

** Type of Failure: Diagonal Shear

TEST DONE BY: BT
REVIEWED BY: JPL

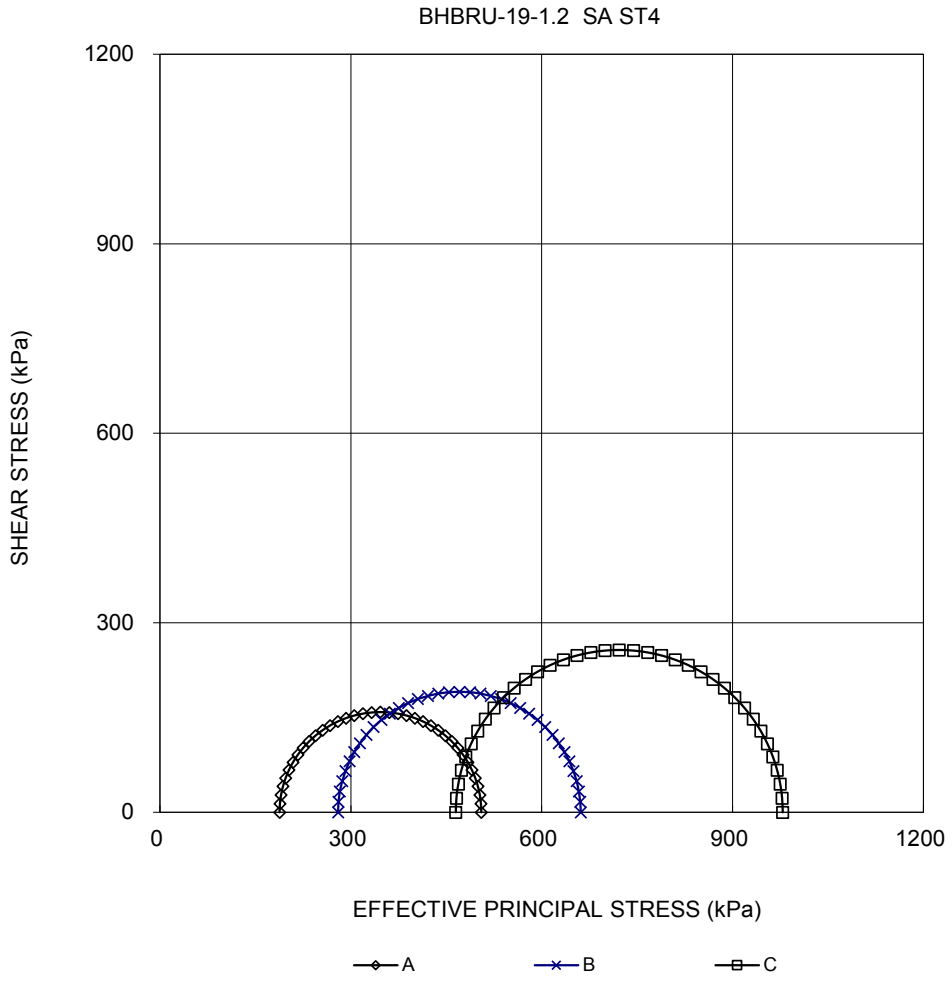
24726 BRU19-3.2 ST7 90'-92' UU

CONSOLIDATED DRAINED TRIAXIAL ASTM D7181 SHEET 1 OF 4			FIGURE
TEST STAGE	A	B	C
BOREHOLE NUMBER		BRU19-1.2	
SAMPLE NUMBER		ST4	
DEPTH, m		14.63-14.94	
SPECIMEN DIAMETER, cm	6.96	7.00	7.02
SPECIMEN HEIGHT, cm	14.03	13.91	14.01
NATURAL WATER CONTENT, %	45.2	46.9	43.6
DRY DENSITY, Mg/m^3	1.19	1.19	1.24
WATER CONTENT BEFORE CONSOLIDATION, %	43.7	43.7	40.3
CELL PRESSURE, σ_3, kPa	458.0	550.0	735.0
BACK PRESSURE, kPa	270.0	270.0	270.0
PORE PRESSURE PARAMETER "B"	0.96	0.96	0.96
CONSOLIDATION PRESSURE, σc, kPa	188.0	280.0	465.0
VOLUMETRIC STRAIN DURING CONSOLIDATION, %	3.1	4.9	6.2
WATER CONTENT AFTER CONSOLIDATION, %	41.1	39.6	35.3
AVERAGE RATE OF STRAIN, %/hr	0.5	0.5	0.5
TIME TO FAILURE, HOURS	12	16	30
WATER CONTENT AFTER TEST, %	39.5	36.9	34.4
MAX. DEVIATOR STRESS, $(\sigma_1-\sigma_3)$, kPa	317.1	381.5	513.9
AXIAL STRAIN AT $(\sigma_1-\sigma_3)$ MAXIMUM, %	6.0	7.8	15.0
MAX PRINCIPAL STRESS RATIO, (σ'_1/σ'_3) maximum	2.7	2.4	2.2
FILTER DRAINS USED, y/n	y	y	y
TEST NOTES:			
Specimen A taken 0-15 cm from top of tube.			
Specimen B taken 15-35.5cm from top of tube.			
Specimen C taken 35.5-52cm from top of tube.			
FAILURE PLANE NUMBER	-	1.0	-
ANGLE OF FAILURE, DEGREES	Bulged	55.0	Bulged

Date: 4/01/2021 Prepared By: LH

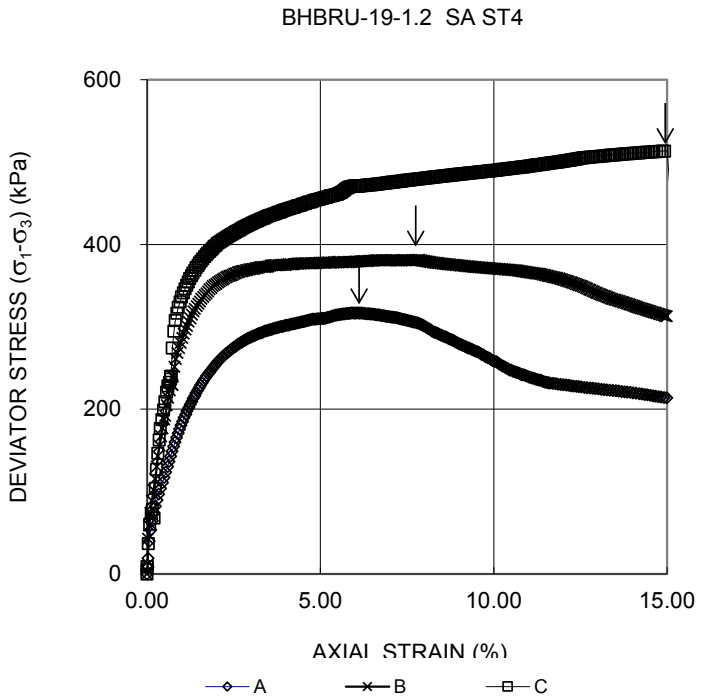
Project No. 21453742(3000) **Golder Associates** Checked By: MM

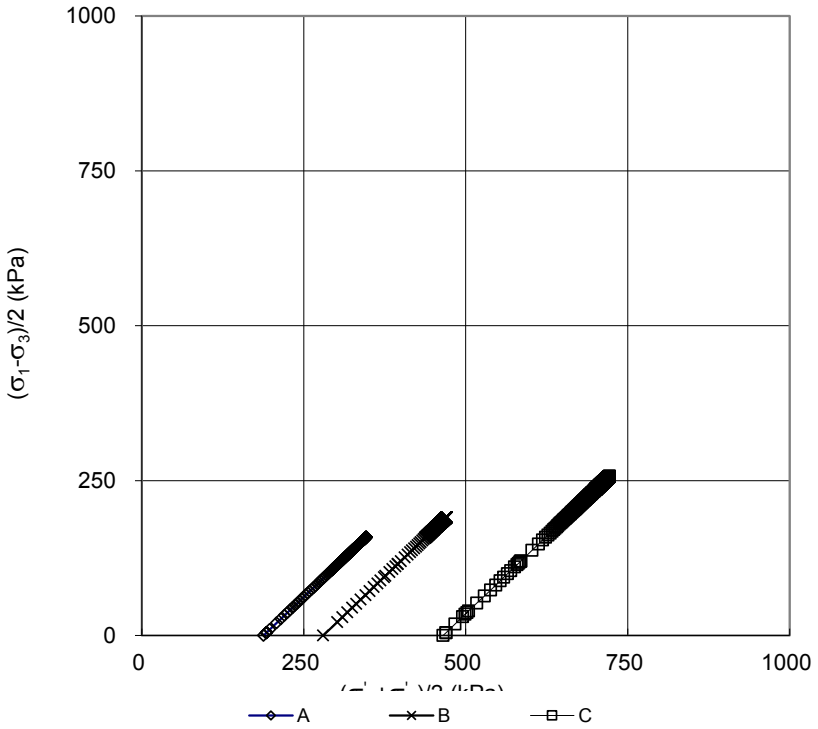
CONSOLIDATED DRAINED TRIAXIAL ASTM D7181 SHEET 2 OF 4	FIGURE



Date:	4/01/2021		Prepared By:	LH
Project No.	21453742(3000)	**Golder Associates**	Checked By:	MM

CONSOLIDATED DRAINED TRIAXIAL ASTM D7181 SHEET 3 OF 4	FIGURE

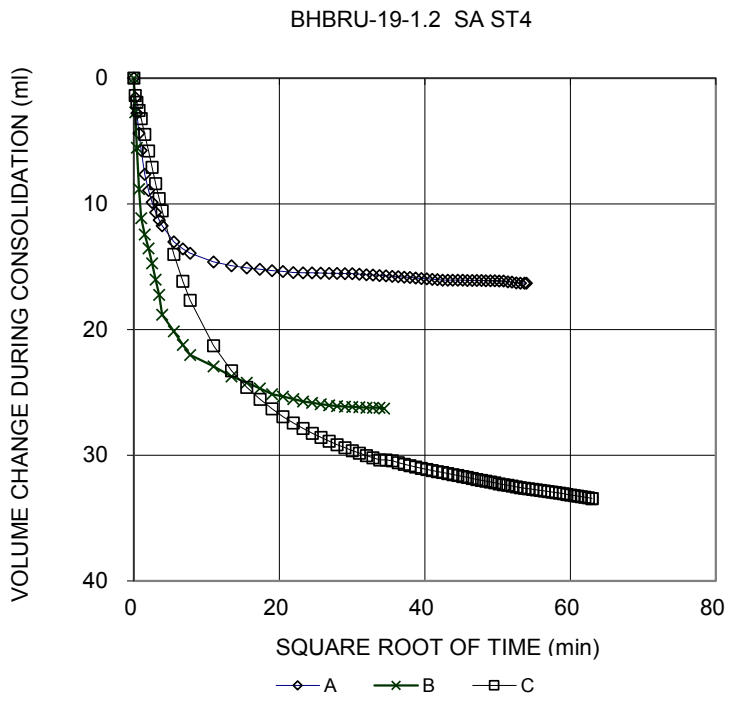


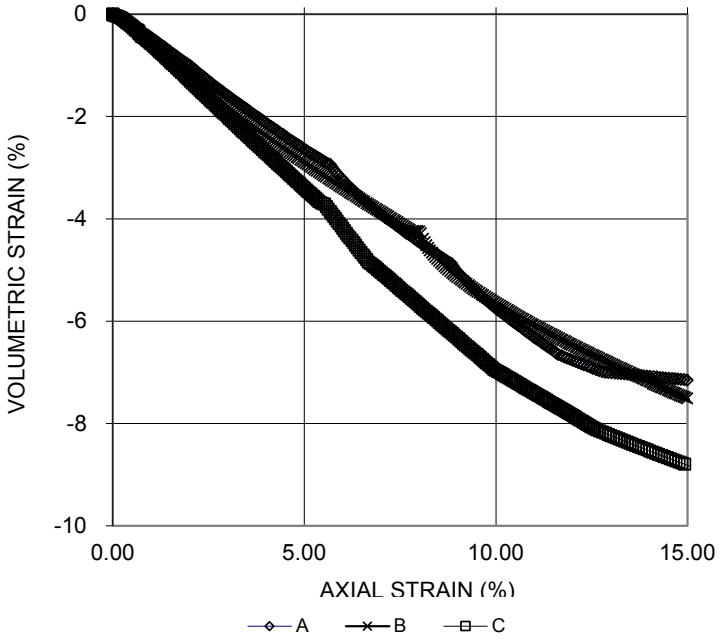


Date:	4/01/2021	Prepared By:	LH
Project No.	21453742(3000)	Checked By:	MM

Golder Associates

CONSOLIDATED DRAINED TRIAXIAL ASTM D7181 SHEET 4 OF 4	FIGURE





NOTES: POSITIVE (+) VOLUMETRIC STRAIN = SAMPLE VOLUME DECREASING

NEGATIVE(-) VOLUMETRIC STRAIN = SAMPLE VOLUME INCREASING

Date:	4/01/2021		Prepared By:	LH
Project No.	21453742(3000)	**Golder Associates**	Checked By:	MM

CONSOLIDATED DRAINED TRIAXIAL ASTM D7181 SHEET 1 OF 4			FIGURE
TEST STAGE	A	B	C
BOREHOLE NUMBER		BRU19-3.2	
SAMPLE NUMBER		ST5	
DEPTH, m		18.29-18.90	
SPECIMEN DIAMETER, cm	6.97	6.97	6.97
SPECIMEN HEIGHT, cm	14.01	14.00	14.01
NATURAL WATER CONTENT, %	34.3	35.5	38.2
DRY DENSITY, Mg/m^3	1.41	1.38	1.32
WATER CONTENT BEFORE CONSOLIDATION, %	33.2	33.6	36.4
CELL PRESSURE, σ_3, kPa	414.0	590.0	731.0
BACK PRESSURE, kPa	200.0	270.0	200.0
PORE PRESSURE PARAMETER "B"	0.96	0.96	0.96
CONSOLIDATION PRESSURE, σc, kPa	214.0	320.0	531.0
VOLUMETRIC STRAIN DURING CONSOLIDATION, %	2.7	3.4	7.2
WATER CONTENT AFTER CONSOLIDATION, %	31.3	31.2	31.0
AVERAGE RATE OF STRAIN, %/hr	0.5	0.5	0.5
TIME TO FAILURE, HOURS	10	30	27
WATER CONTENT AFTER TEST, %	31.1	27.9	30.1
MAX. DEVIATOR STRESS, $(\sigma_1-\sigma_3)$, kPa	403.0	480.5	581.1
AXIAL STRAIN AT $(\sigma_1-\sigma_3)$ MAXIMUM, %	5.0	15.0	13.3
MAX PRINCIPAL STRESS RATIO, (σ'_1/σ'_3) maximum	2.9	2.5	0.0
FILTER DRAINS USED, y/n	y	y	y

TEST NOTES:

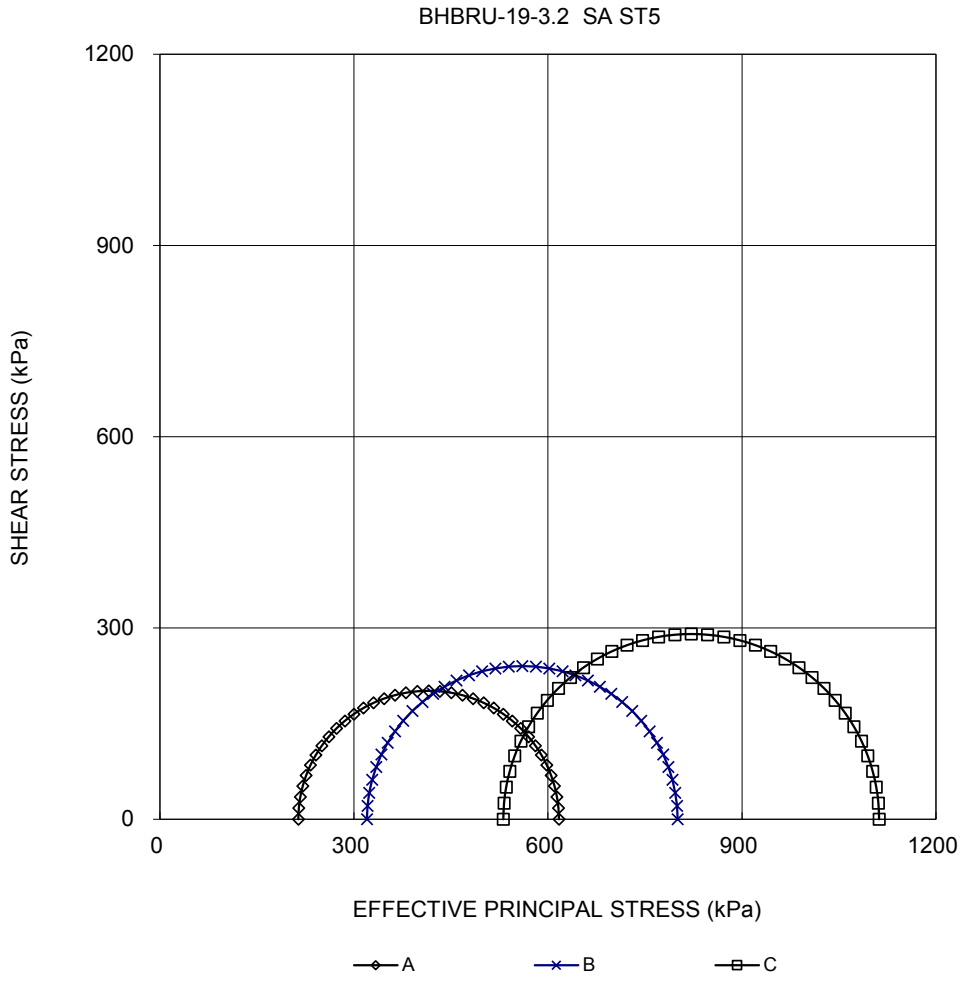
Specimen A taken 0-15 cm from top of tube.
Specimen B taken 15-33cm from top of tube.
Specimen C taken 33-51cm from top of tube.

FAILURE PLANE NUMBER	1.0	-	-
ANGLE OF FAILURE, DEGREES	65.0	Bulged	Bulged

Date: 3/31/2021 Prepared By: LH

Project No. 21453742(3000) **Golder Associates** Checked By: MM

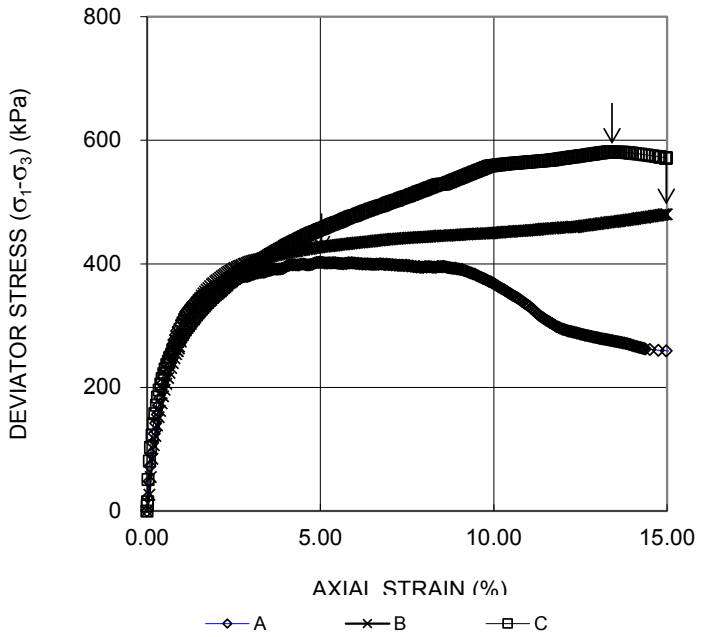
CONSOLIDATED DRAINED TRIAXIAL ASTM D7181 SHEET 2 OF 4	FIGURE

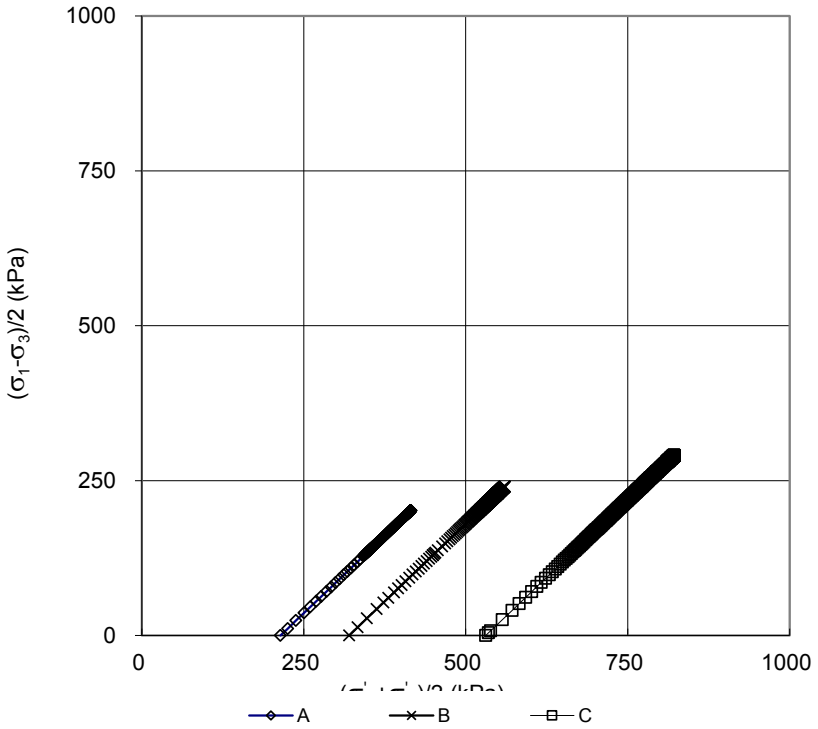


Date:	3/31/2021		Prepared By:	LH
Project No.	21453742(3000)	**Golder Associates**	Checked By:	MM

CONSOLIDATED DRAINED TRIAXIAL ASTM D7181 SHEET 3 OF 4	FIGURE

BHBRU-19-3.2 SA ST5

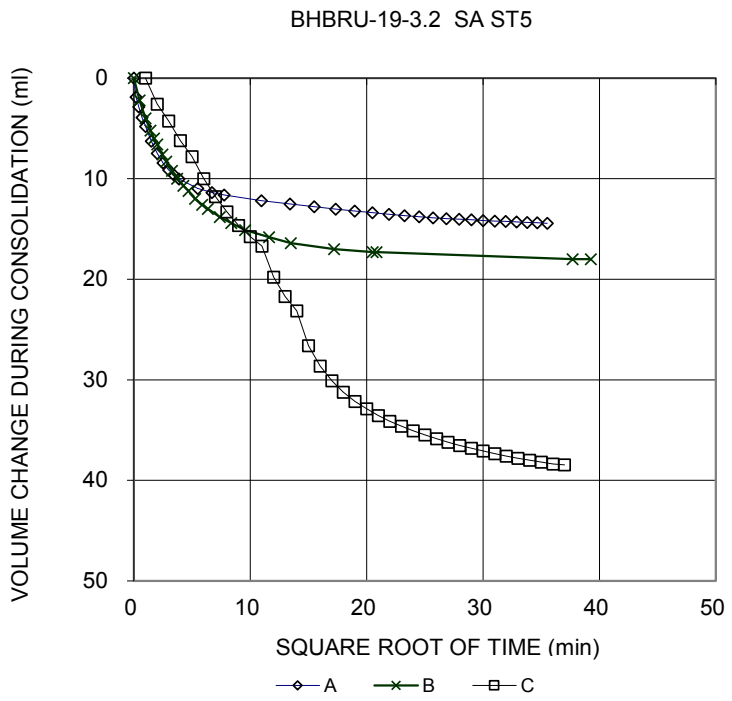


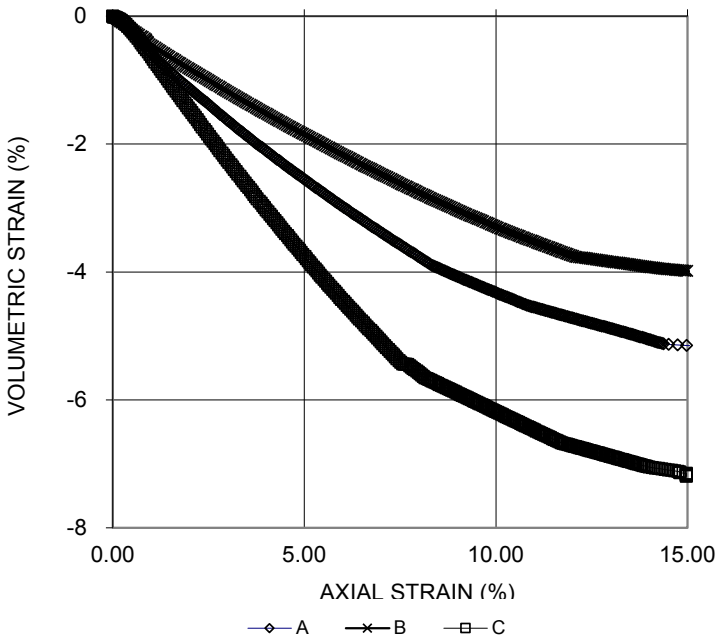


Date:	3/31/2021	Prepared By:	LH
Project No.	21453742(3000)	Checked By:	MM

Golder Associates

CONSOLIDATED DRAINED TRIAXIAL ASTM D7181 SHEET 4 OF 4	FIGURE





NOTES: POSITIVE (+) VOLUMETRIC STRAIN = SAMPLE VOLUME DECREASING

NEGATIVE(-) VOLUMETRIC STRAIN = SAMPLE VOLUME INCREASING

Date:	3/31/2021		Prepared By:	LH
Project No.	21453742(3000)	**Golder Associates**	Checked By:	MM

THURBER ENGINEERING LTD.

UNCONFINED COMPRESSIVE STRENGTH TEST REPORT

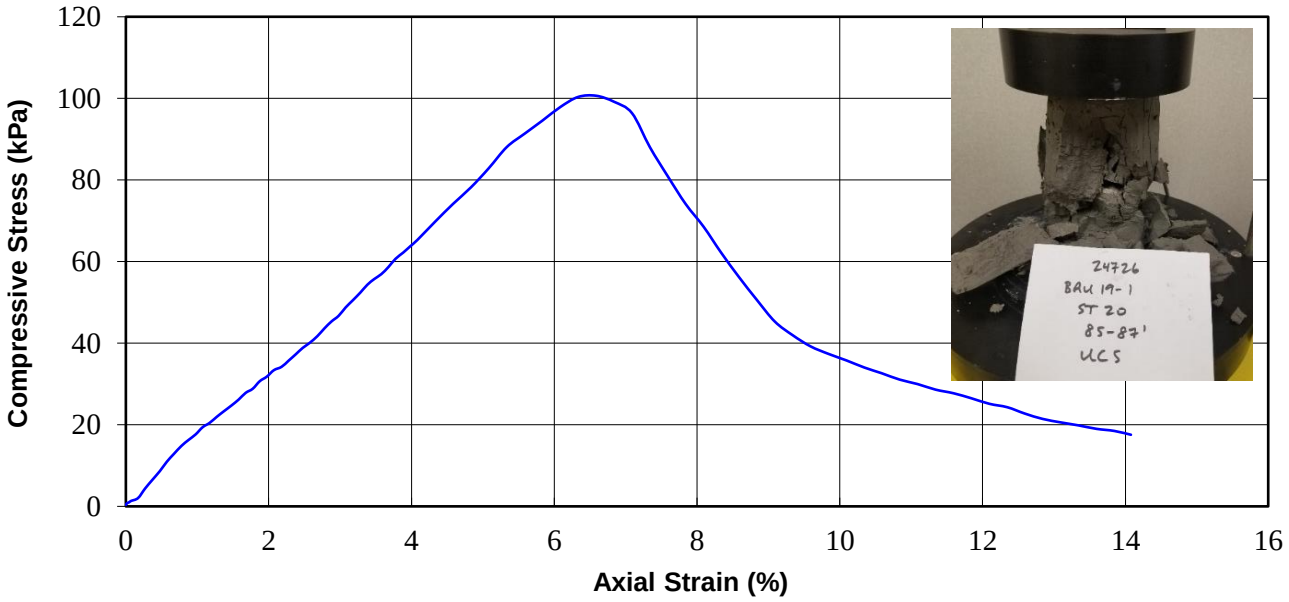
ASTM D2166 - 16

CLIENT:	Ministry of Transportation (MTO)	FILE NUMBER:	24726
PROJECT NAME:	Highway 17 - Twinning	REPORT DATE:	11-Feb-21
BOREHOLE No.:	BRU19-1	TEST DATE:	18-Nov-20
SAMPLE No.:	ST20	ATTERBERG LIMITS:	LL = 29.3, PL = 14.2
SAMPLE DEPTH:	85'-87'	PARTICLE SIZES:	CL = 36%, SI = 58%
DESCRIPTION:	Silty clay, trace sand, grey, moist		SA = 6%, GR = 0%

Avg. Height (mm):	140	Weight (g):	999.3
Avg. Diameter (mm):	69	Wet Density (kg/m^3):	1,909
H. to Dia. Ratio:	2:1	Dry Density (kg/m^3):	1,404
Cross Sectional Area (mm^2):	3739.3	Moisture Content* (%):	36.0

Avg. Rate of Strain to Failure:	1 % / min
Unconfined Compressive Strength:	100.6 kPa @ 6.6 % strain
Shear Strength:	50.3 kPa

Compressive Stress vs. Axial Strain



Note: * Moisture content was obtained from the entire specimen after the test

** Type of Failure: Multiple sub-vertical splits

TEST DONE BY: BT

REVIEWED BY: JPL

24726 BRU19-1 ST20 85'-87' UCS

THURBER ENGINEERING LTD.

UNCONFINED COMPRESSIVE STRENGTH TEST REPORT

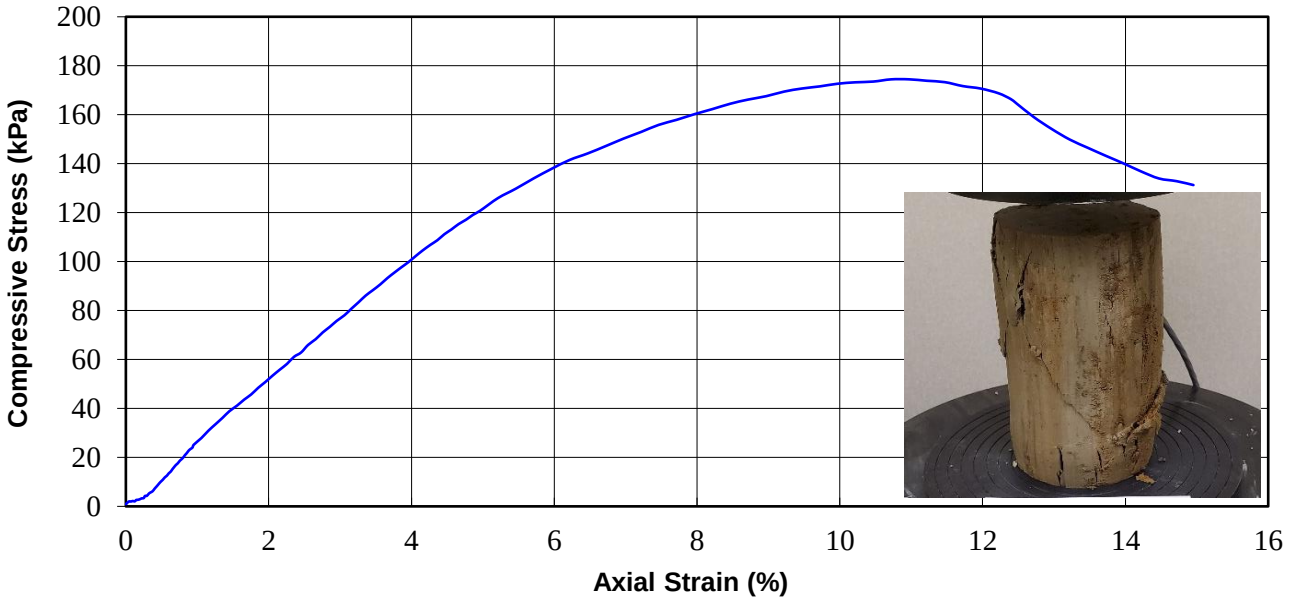
ASTM D2166 - 16

CLIENT:	Ministry of Transportation (MTO)	FILE NUMBER:	24726
PROJECT NAME:	Highway 17 - Twinning	REPORT DATE:	11-Feb-21
BOREHOLE No.:	BRU19-3	TEST DATE:	24-Nov-20
SAMPLE No.:	ST7	ATTERBERG LIMITS:	LL = 62.3, PL = 22.3
SAMPLE DEPTH:	15'-17'	PARTICLE SIZES:	CL = 54%, SI = 45%
DESCRIPTION:	Silty clay, trace sand, grey, moist		SA = 1%, GR = 0%

Avg. Height (mm):	150	Weight (g):	1041.6
Avg. Diameter (mm):	69	Wet Density (kg/m^3):	1,857
H. to Dia. Ratio:	2.2:1	Dry Density (kg/m^3):	1,339
Cross Sectional Area (mm^2):	3739.3	Moisture Content* (%):	38.7

Avg. Rate of Strain to Failure:	1 % / min
Unconfined Compressive Strength:	174.5 kPa @ 11 % strain
Shear Strength:	87.2 kPa

Compressive Stress vs. Axial Strain



Note: * Moisture content was obtained from the entire specimen after the test

** Type of Failure: Diagonal shear

TEST DONE BY: BT
REVIEWED BY: JPL

24726 BRU19-3 ST7 15'-17' UCS

THURBER ENGINEERING LTD.

UNCONFINED COMPRESSIVE STRENGTH TEST REPORT

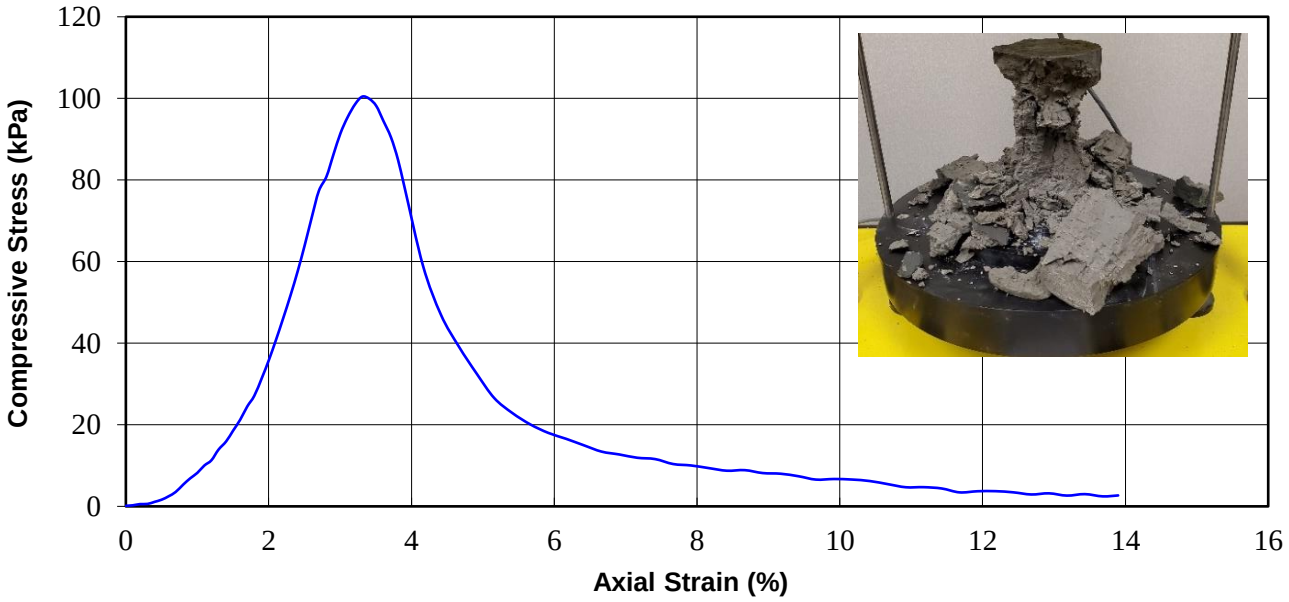
ASTM D2166 - 16

CLIENT:	Ministry of Transportation (MTO)	FILE NUMBER:	24726
PROJECT NAME:	Highway 17 - Twinning	REPORT DATE:	11-Feb-21
BOREHOLE No.:	BRU19-3	TEST DATE:	23-Nov-20
SAMPLE No.:	ST25	ATTERBERG LIMITS:	LL = 32.7, PL = 16.2
SAMPLE DEPTH:	100'-102'	PARTICLE SIZES:	CL = 37%, SI = 61%
DESCRIPTION:	Silty clay, trace sand, grey, moist		SA = 2%, GR = 0%

Avg. Height (mm):	135	Weight (g):	978.2
Avg. Diameter (mm):	69	Wet Density (kg/m^3):	1,938
H. to Dia. Ratio:	2:1	Dry Density (kg/m^3):	1,433
Cross Sectional Area (mm^2):	3739.3	Moisture Content* (%):	35.2

Avg. Rate of Strain to Failure:	1 % / min
Unconfined Compressive Strength:	100.4 kPa @ 3.3 % strain
Shear Strength:	50.2 kPa

Compressive Stress vs. Axial Strain



Note: * Moisture content was obtained from the entire specimen after the test

** Type of Failure: Multiple sub-vertical splits

TEST DONE BY: BT
REVIEWED BY: JPL

24726 BRU19-3 ST25 100'-102' UCS

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Appendix C.6

Analytical Test Results

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www.paracellabs.com

Certificate of Analysis

Thurber Engineering Ltd.

2460 Lancaster Rd, Suite 104
Ottawa, ON K1B 4S5
Attn: Justin Gray

Client PO: 24726
Project: Hwy 17, Bruce Street Interchange
Custody: 49179

Report Date: 20-Oct-2019
Order Date: 16-Oct-2019

Order #: 1942188

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1942188-01	BRU19-1, SS4 (7'6" - 9'6")
1942188-02	BRU19-2, SS3 (5' - 7')
1942188-03	BRU19-3, SS5 (10' - 12')

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Any use of these results implies your agreement that our total liabilty in connection with this work, however arising, shall be limited to the amount paid by you for this work, and that our employees or agents shall not under any circumstances be liable to you in connection with this work.

Certificate of Analysis
Client: Thurber Engineering Ltd.
Client PO: 24726

Report Date: 20-Oct-2019
Order Date: 16-Oct-2019
Project Description: Hwy 17, Bruce Street Interchange

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Anions	EPA 300.1 - IC, water extraction	17-Oct-19	17-Oct-19
Conductivity	MOE E3138 - probe @25 °C, water ext	17-Oct-19	18-Oct-19
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	18-Oct-19	19-Oct-19
Resistivity	EPA 120.1 - probe, water extraction	17-Oct-19	18-Oct-19
Solids, %	Gravimetric, calculation	17-Oct-19	17-Oct-19

PARACEL LABORATORIES LTD.

Order #: 1942188

Certificate of Analysis

Client: Thurber Engineering Ltd.

Client PO: 24726

Report Date: 20-Oct-2019

Order Date: 16-Oct-2019

Project Description: Hwy 17, Bruce Street Interchange

	Client ID:	BRU19-1, SS4 (7'6" - 9'6")	BRU19-2, SS3 (5' - 7')	BRU19-3, SS5 (10' - 12')	-
	Sample Date:	07-Oct-19 09:00	15-Oct-19 09:00	27-Sep-19 09:00	-
	Sample ID:	1942188-01	1942188-02	1942188-03	-
	MDL/Units	Soil	Soil	Soil	-
Physical Characteristics					
% Solids	0.1 % by Wt.	71.4	71.2	75.6	-
General Inorganics					
Conductivity	5 uS/cm	206	1910	1110	-
pH	0.05 pH Units	7.78	7.91	7.50	-
Resistivity	0.10 Ohm.m	48.5	5.24	9.02	-
Anions					
Chloride	5 ug/g dry	9	1280	662	-
Sulphate	5 ug/g dry	9	55	38	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	5	ug/g						
Sulphate	ND	5	ug/g						
General Inorganics									
Conductivity	ND	5	uS/cm						
Resistivity	ND	0.10	Ohm.m						

Certificate of Analysis
Client: Thurber Engineering Ltd.
Client PO: 24726

Report Date: 20-Oct-2019
Order Date: 16-Oct-2019
Project Description: Hwy 17, Bruce Street Interchange

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	120	5	ug/g dry	123			3.1	20	
Sulphate	323	5	ug/g dry	332			2.8	20	
General Inorganics									
Conductivity	114	5	uS/cm	117			2.6	5	
pH	7.30	0.05	pH Units	7.33			0.4	2.3	
Resistivity	87.7	0.10	Ohm.m	85.5			2.6	20	
Physical Characteristics									
% Solids	87.2	0.1	% by Wt.	87.5			0.4	25	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	215	5	ug/g	123	91.2	82-118			
Sulphate	421	5	ug/g	332	88.8	80-120			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.

Soil results are reported on a dry weight basis when the units are denoted with 'dry'.
Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

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Subcontracted Analysis

Thurber Engineering Ltd.
2460 Lancaster Rd, Suite 104
Ottawa, ON K1B 4S5
Attn: Justin Gray

Tel: (613) 408-6795
Fax: (613) 247-2185

Paracel Report No	**1942188**
Client Project(s):	**Hwy 17, Bruce Street Interchange**
Client PO:	**24726**
Reference:	**Standing Offer**
CoC Number:	**49179**

Order Date:	16-Oct-19
Report Date:	20-Oct-19

Sample(s) from this project were subcontracted for the listed parameters. A copy of the subcontractor's report is attached

Paracel ID	Client ID	Analysis
1942188-01	BRU19-1, SS4 (7'6" - 9'6")	Sulphide, solid
1942188-02	BRU19-2, SS3 (5' - 7')	Sulphide, solid
1942188-03	BRU19-3, SS5 (10' - 12')	Sulphide, solid

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

23-October-2019

Paracel Laboratories
Attn : Dale Robertson

300-2319 St.Laurent Blvd.
Ottawa, ON
K1G 4K6, Canada

Phone: 613-731-9577
Fax:613-731-9064

Date Rec. : 17 October 2019
LR Report: **CA15380-OCT19**
Reference: Project#: 1942188

Copy: #1

CERTIFICATE OF ANALYSIS
Final Report

Sample ID	Sample Date & Time	Sulphide %
1: Analysis Start Date		23-Oct-19
2: Analysis Start Time		14:17
3: Analysis Completed Date		23-Oct-19
4: Analysis Completed Time		14:33
5: QC - Blank		< 0.02
6: QC - STD % Recovery		113%
7: QC - DUP % RPD		4%
8: RL		0.02
9: BRU19-1, SS4 (7'6"-9'6")	07-Oct-19	0.02
10: BRU19-2, SS3 (5'-7')	15-Oct-19	< 0.02
11: BRU19-3, SS5 (10'-12')	27-Sep-19	< 0.02

RL - SGS Reporting Limit

Note: Sample BRU19-3, SS5 (10'-12') was received past the 14 day holding time; result may be unreliable.

Kimberley Didsbury
Project Specialist,
Environment, Health & Safety

OnLine LIMS

0001934780

Data reported represents the sample submitted to SGS. Reproduction of this analytical report in full or in part is prohibited without prior written approval. Please refer to SGS General Conditions of Services located at http://www.sgs.com/terms_and_conditions_service.htm. (Printed copies are available upon request.)
Test method information available upon request. “Temperature Upon Receipt” is representative of the whole shipment and may not reflect the temperature of individual samples.

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Appendix C.7

Uniaxial Compressive Strength Test Results

THURBER ENGINEERING LTD.

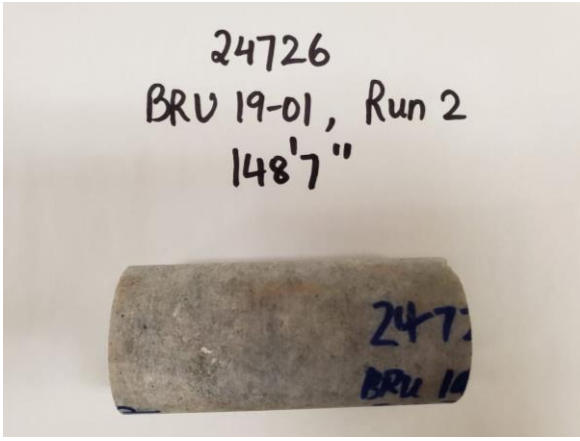
UNCONFINED COMPRESSION TEST REPORT

ASTM D7012-14

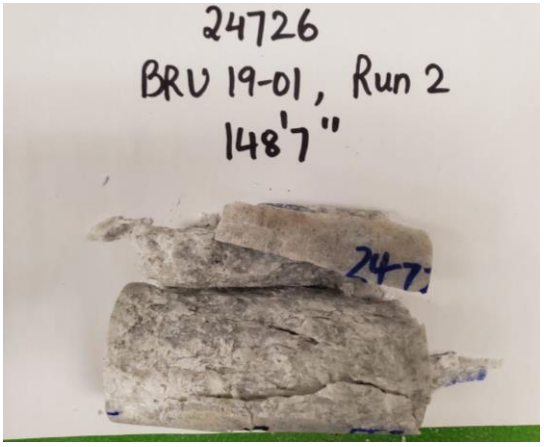
CLIENT:	Thurber Engineering (Ottawa)	FILE NUMBER:	24726
PROJECT NAME:	Highway 17 Twinning - Renfrew	REPORT DATE:	24-Mar-20
BOREHOLE No.:	BRU 19-1	TEST DATE:	12-Dec-19
SAMPLE No.:	NQ RUN 2		
SAMPLE DEPTH:	45.3m		
DESCRIPTION:	Marble		

Avg. Height (cm):	9.8	Weight (g):	471.2
Avg. Diameter (cm):	4.7	Wet Density (kg/m^3):	2,772
H. to Dia. Ratio**:	2.1:1	Dry Density (kg/m^3):	2,772
Cross Sectional Area (cm^2):	17.35	Moisture Content* (%):	N/A
Sample Volume (cm^3):	170.02		

ORIGINAL SPECIMEN



FRACTURED SPECIMEN



AVG. RATE OF STRAIN TO FAILURE:	1.5%	/ min
MAXIMUM COMPRESSIVE LOAD:	80.8	kN
UNCONFINED COMPRESSIVE STRENGTH:	46.6	MPa

Note: * Dimensions of Specimen conform to ASTM D 4543-04.

TEST DONE BY: BS
REVIEWED BY: WM

24726 - BRU 19-1 UCS Run 2, 148'7

THURBER ENGINEERING LTD.

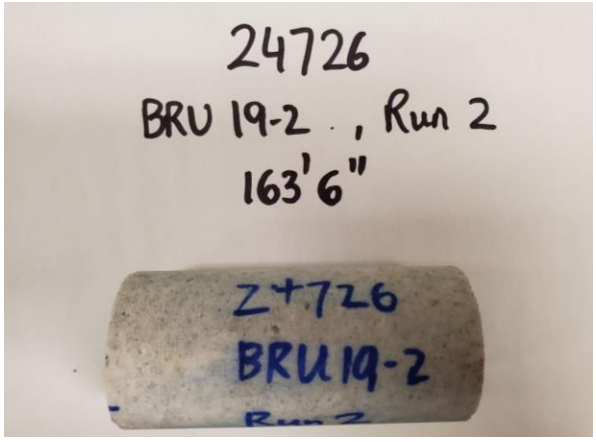
UNCONFINED COMPRESSION TEST REPORT

ASTM D7012-14

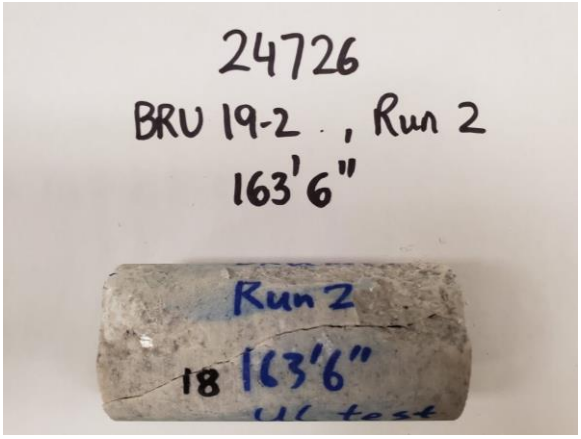
CLIENT:	Thurber Engineering (Ottawa)	FILE NUMBER:	24726
PROJECT NAME:	Highway 17 Twinning - Renfrew	REPORT DATE:	24-Mar-20
BOREHOLE No.:	BRU 19-2	TEST DATE:	12-Dec-19
SAMPLE No.:	NQ RUN 2		
SAMPLE DEPTH:	49.8m		
DESCRIPTION:	Marble		

Avg. Height (cm):	9.6	Weight (g):	473.9
Avg. Diameter (cm):	4.7	Wet Density (kg/m^3):	2,845
H. to Dia. Ratio**:	2:1	Dry Density (kg/m^3):	2,845
Cross Sectional Area (cm^2):	17.35	Moisture Content* (%):	N/A
Sample Volume (cm^3):	166.55		

ORIGINAL SPECIMEN



FRACTURED SPECIMEN



AVG. RATE OF STRAIN TO FAILURE:	1.6%	/ min
MAXIMUM COMPRESSIVE LOAD:	72.4	kN
UNCONFINED COMPRESSIVE STRENGTH:	41.7	MPa

Note: * Dimensions of Specimen conform to ASTM D 4543-04.

TEST DONE BY: BS
REVIEWED BY: WM

THURBER ENGINEERING LTD.

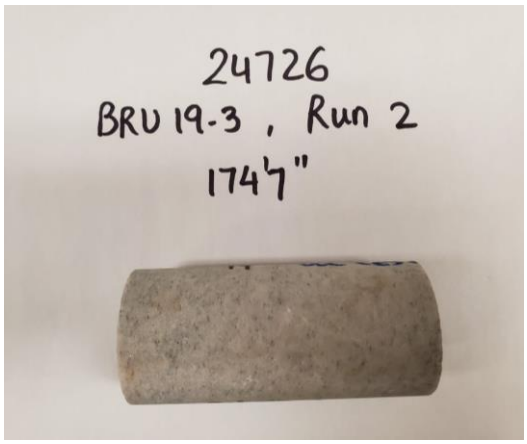
UNCONFINED COMPRESSION TEST REPORT

ASTM D7012-14

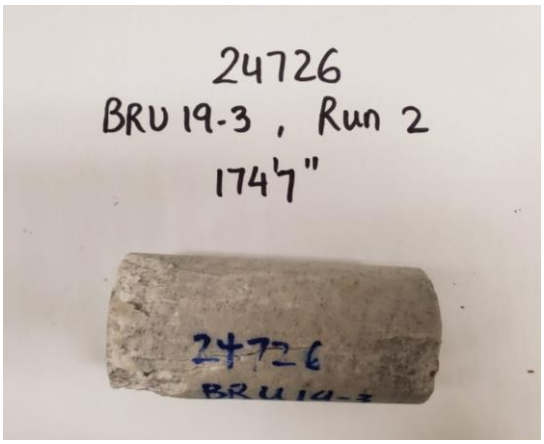
CLIENT:	Thurber Engineering (Ottawa)	FILE NUMBER:	24726
PROJECT NAME:	Highway 17 Twinning - Renfrew	REPORT DATE:	24-Mar-20
BOREHOLE No.:	BRU 19-3	TEST DATE:	12-Dec-19
SAMPLE No.:	NQ RUN 2		
SAMPLE DEPTH:	53.2m		
DESCRIPTION:	Marble		

Avg. Height (cm):	9.8	Weight (g):	480.9
Avg. Diameter (cm):	4.7	Wet Density (kg/m^3):	2,828
H. to Dia. Ratio**:	2.1:1	Dry Density (kg/m^3):	2,828
Cross Sectional Area (cm^2):	17.35	Moisture Content* (%):	N/A
Sample Volume (cm^3):	170.02		

ORIGINAL SPECIMEN



FRACTURED SPECIMEN



AVG. RATE OF STRAIN TO FAILURE:	1.5%	/ min
MAXIMUM COMPRESSIVE LOAD:	121.8	kN
UNCONFINED COMPRESSIVE STRENGTH:	70.2	MPa

Note: * Dimensions of Specimen conform to ASTM D 4543-04.

TEST DONE BY: BS
REVIEWED BY: WM

THURBER

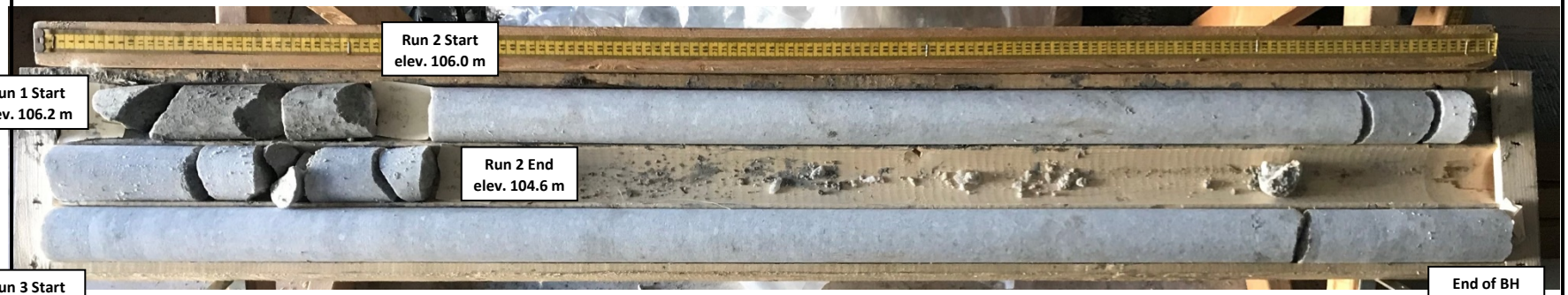
Appendix C.8

Bedrock Core Photographs

Borehole BRU19-01

Run 1 to 3 (of 3)

Elevation 106.2 m to 103.0 m



THURBER ENGINEERING LTD.

Foundation Investigation
Bruce Street (County Road 20) Interchange
Renfrew County, Ontario

W.P. 4068-09-00
Project No.: 24726

Borehole BRU19-02

Run 1 to 2 (of 2)

Elevation 101.8 m to 97.7 m

THURBER ENGINEERING LTD.

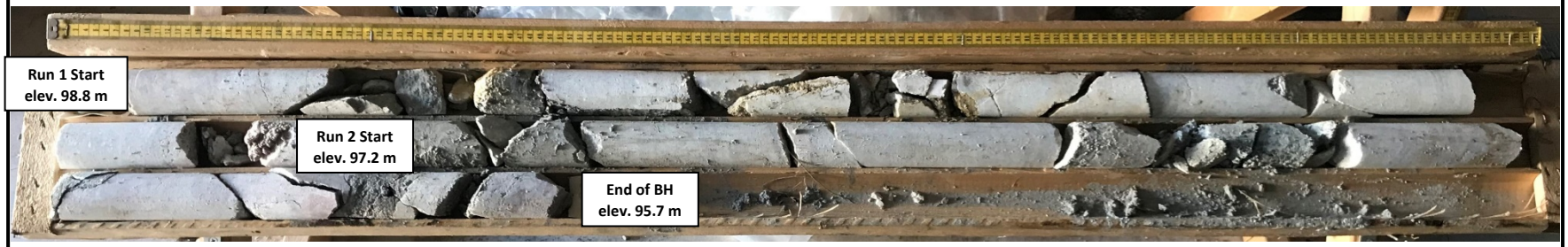
Foundation Investigation
Bruce Street (County Road 20) Interchange
Renfrew County, Ontario

W.P. 4068-09-00
Project No.: 24726

Borehole BRU19-03

Run 1 to 2 (of 2)

Elevation 98.8 m to 95.7 m



THURBER ENGINEERING LTD.

Foundation Investigation
Bruce Street (County Road 20) Interchange
Renfrew County, Ontario

W.P. 4068-09-00
Project No.: 24726

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Appendix D.

Laboratory Testing

Previous (2003) Investigation

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Appendix D.1

Particle Size Analysis Figures

Atterberg Limit Test Results

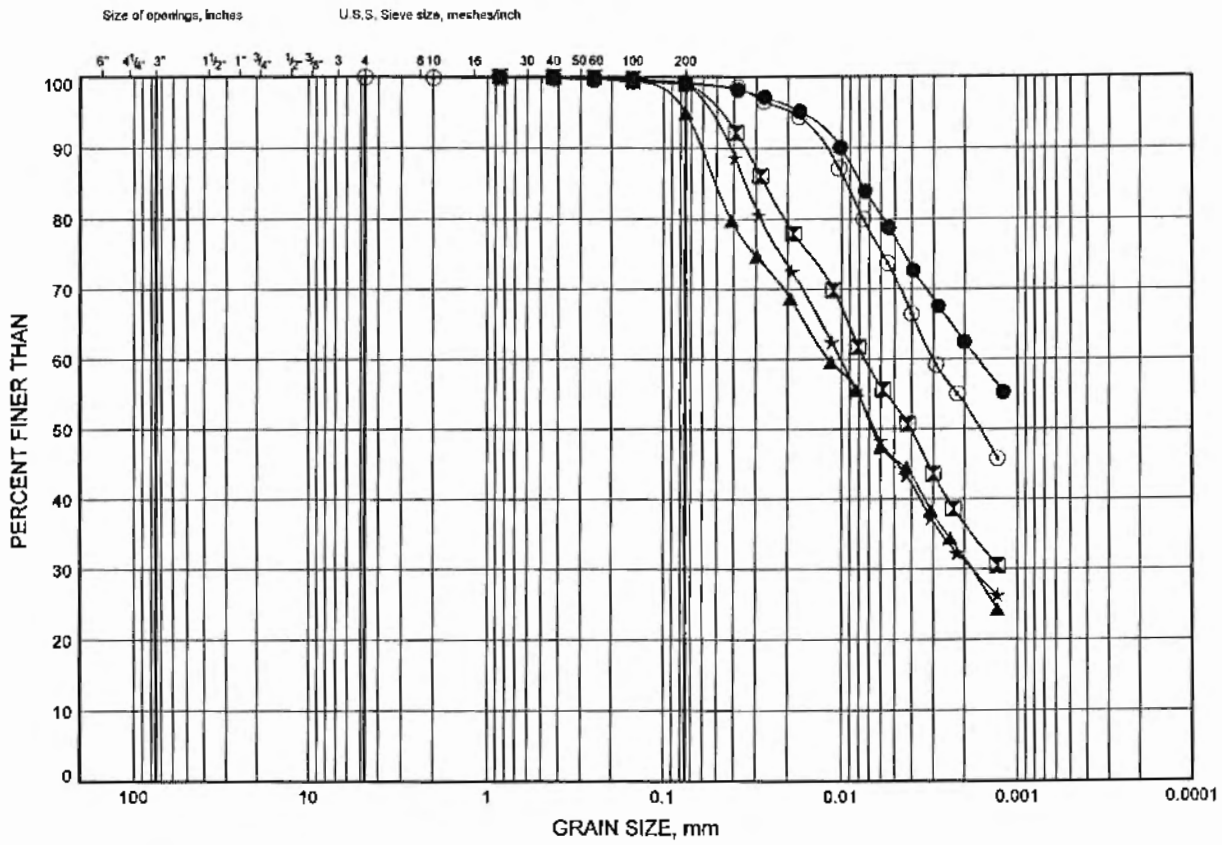
One-Dimensional Consolidation Test Results

HWY 17 Twinning, Arnprior to Renfrew

GRAIN SIZE DISTRIBUTION

FIGURE D1.1

SILTY CLAY TO CLAY



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	BRU-1	2.59	149.01
⊠	BRU-1	10.97	140.63
▲	BRU-1	20.73	130.87
★	BRU-1	27.13	124.47
⊙	BRU-2	2.59	147.71

Date May 2004

Project 647-92-00

THURBER

Prep'd SS

Chkd. SP

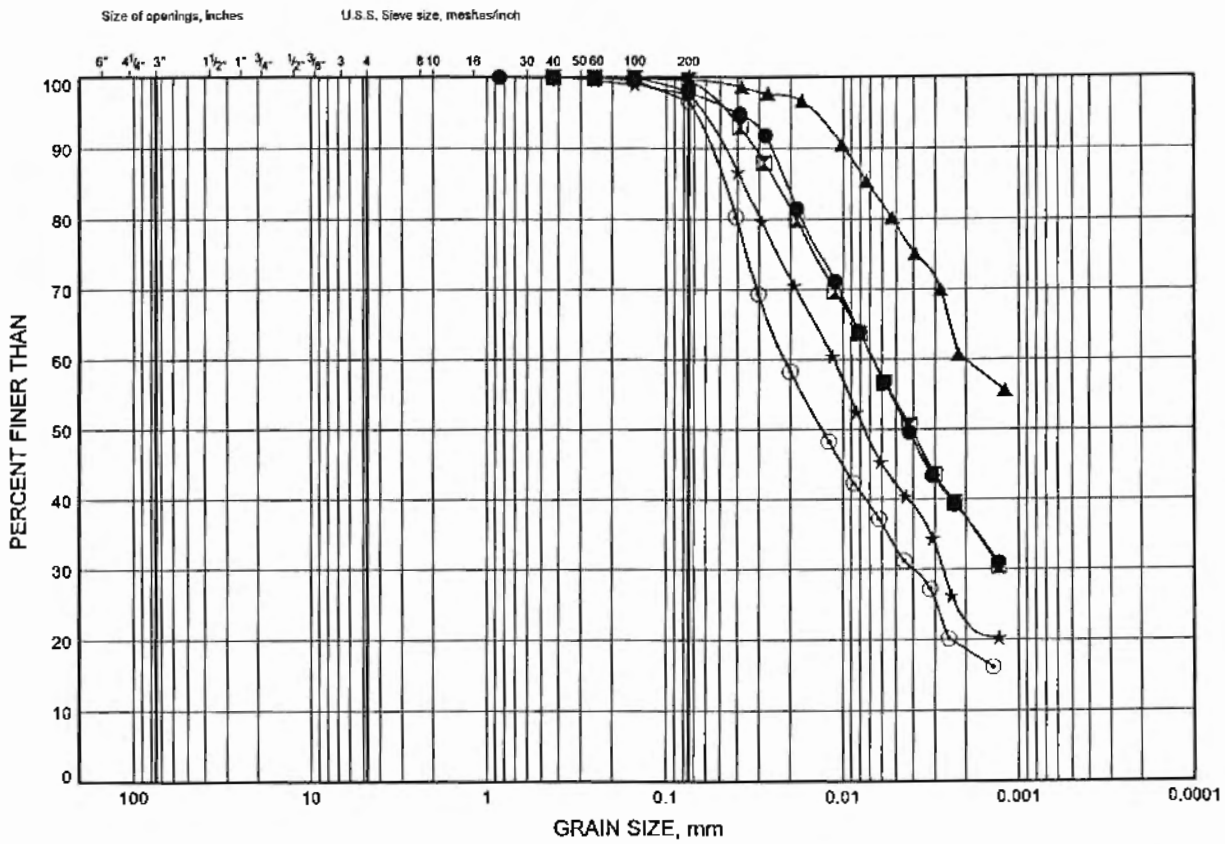
THURBGSD 7450BRU.GPJ 14/05/04

HWY 17 Twinning, Arnprior to Renfrew

GRAIN SIZE DISTRIBUTION

FIGURE D1.2

SILTY CLAY TO CLAY



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	BRU-2	10.97	139.33
⊠	BRU-2	24.69	125.61
▲	BRU-3	2.59	146.71
★	BRU-3	15.54	133.76
⊙	BRU-3	28.65	120.65

Date May 2004

Project 647-92-00

THURBER

Prep'd SS

Chkd. SP

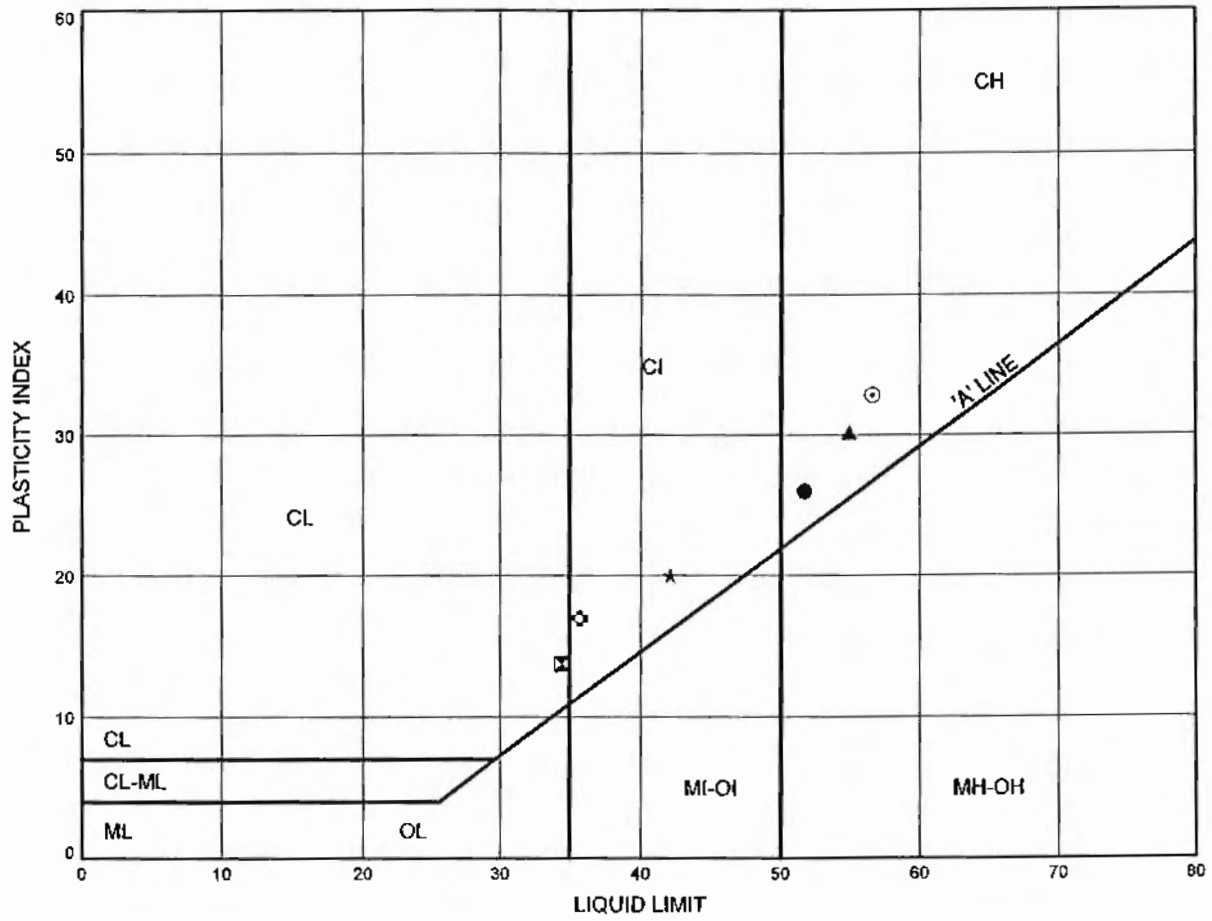
THURBGSD 7450BRU.GPJ 14/05/04

HWY 17 Twinning, Arnprior to Renfrew

ATTERBERG LIMITS TEST RESULTS

FIGURE D2

SILTY CLAY TO CLAY



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	BRU-1	2.59	149.01
⊠	BRU-1	10.97	140.63
▲	BRU-2	2.59	147.71
★	BRU-2	10.97	139.33
⊙	BRU-3	2.59	146.71
✿	BRU-3	15.54	133.76

Date May 2004

Project 647-92-00

THURBER

Prep'd SS

Chkd. SP

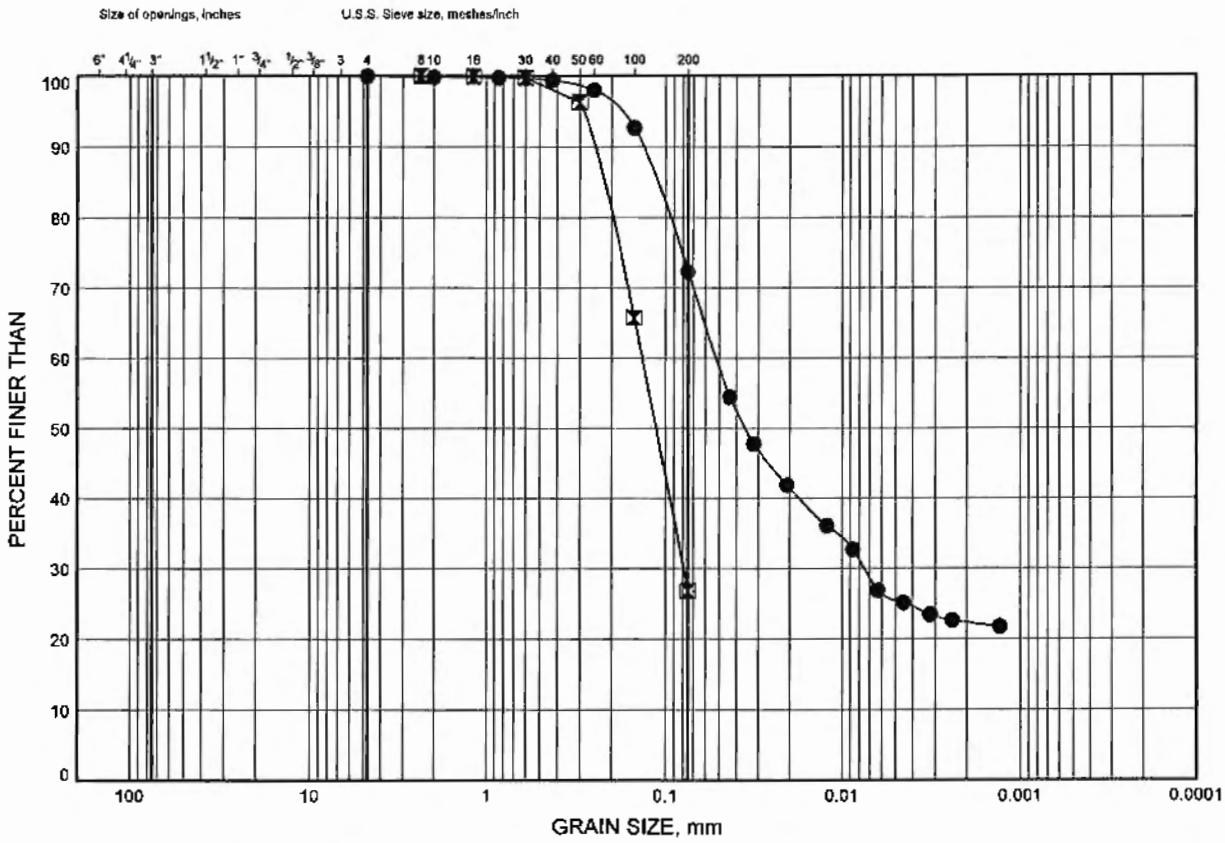
THURBALT 7450BRU.GPJ 14/05/04

HWY 17 Twinning, Arnprior to Renfrew

GRAIN SIZE DISTRIBUTION

FIGURE D3

SILTY SAND TO SANDY SILT



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	BRU-2	36.88	113.42
⊠	BRU-3	33.83	115.47

Date June 2004

Project 647-92-00

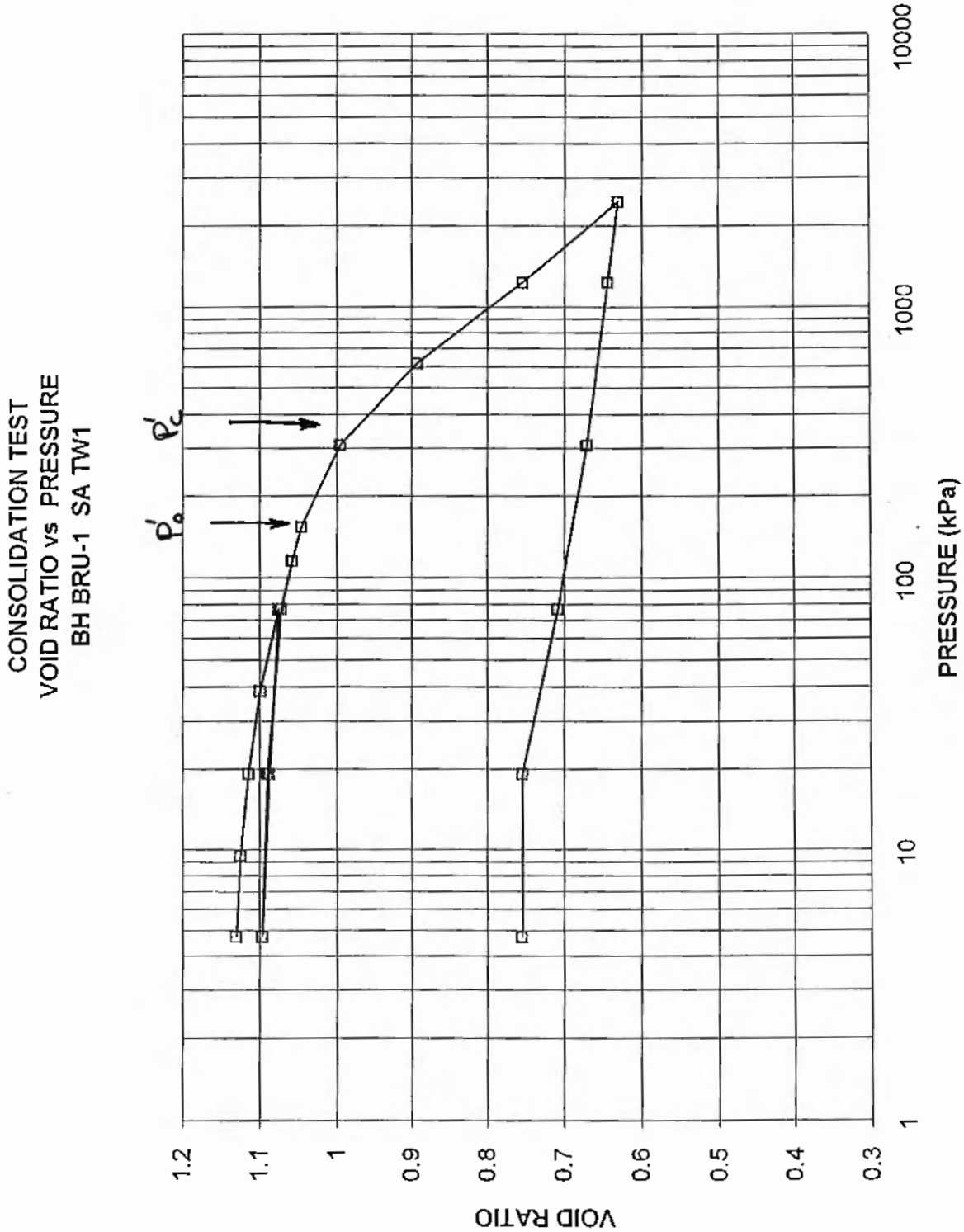
THURBER

Prep'd SS

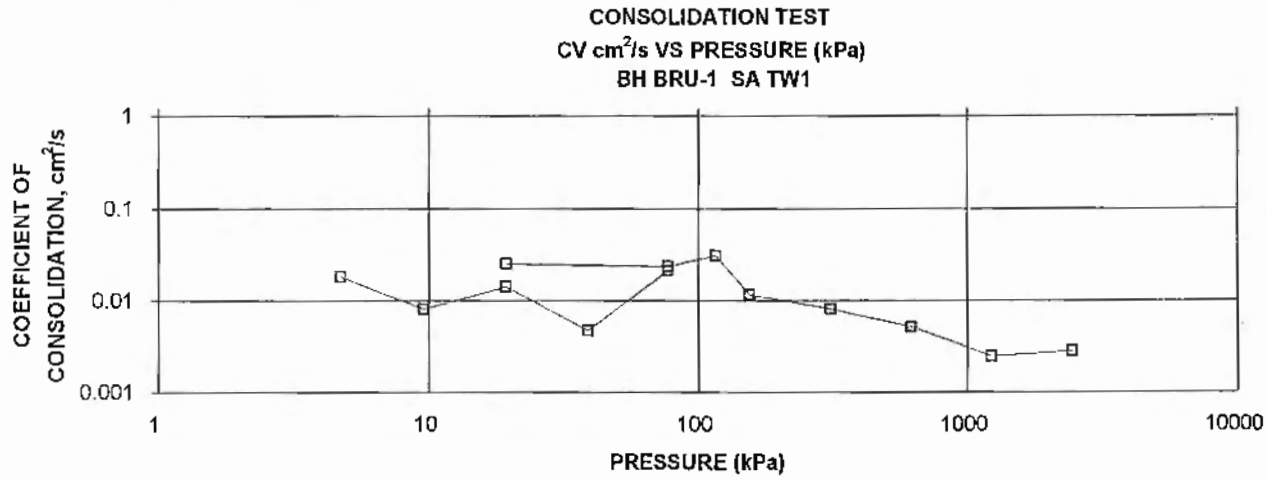
Chkd. SP

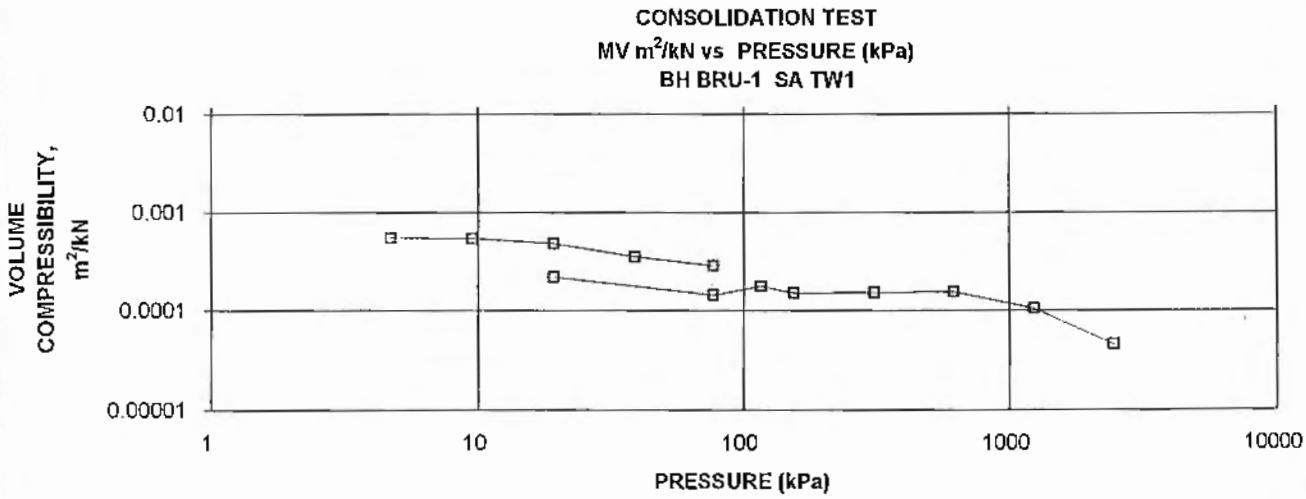
THURBGSD 7450BRU.GPJ 03/06/04

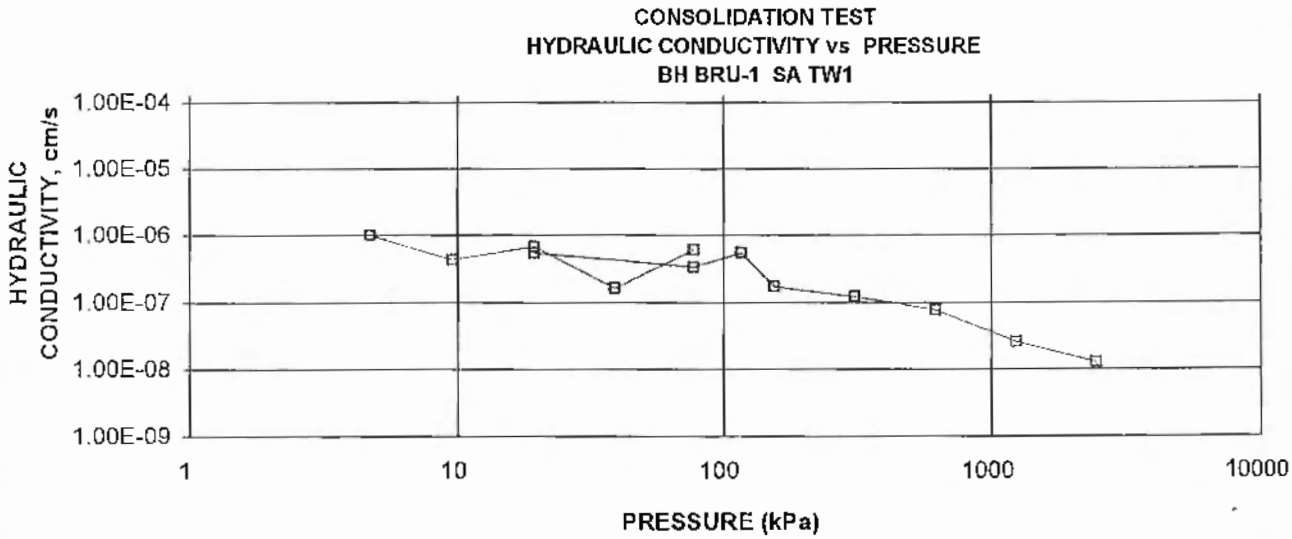
CONSOLIDATION TEST VOID RATIO VS. LOG PRESSURE	FIGURE D4



OEDOMETER CONSOLIDATION SUMMARY







OEDOMETER CONSOLIDATION SUMMARY

SAMPLE IDENTIFICATION

Project Number	04-1116-011	Sample Number	TW1
Borehole Number	BRU-1	Sample Depth, m	11.6-12.2

TEST CONDITIONS

Test Type	Standard	Load Duration, hr	(0.7-24)
Oedometer Number	6		
Date Started	1/30/2004		
Date Completed	2/12/2004		

SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	1.90	Unit Weight, kN/m^3	18.03
Sample Diameter, cm	6.35	Dry Unit Weight, kN/m^3	12.81
Area, cm^2	31.67	Specific Gravity, measured	2.79
Volume, cm^3	60.17	Solids Height, cm	0.890
Water Content, %	40.70	Volume of Solids, cm^3	28.18
Wet Mass, g	110.62	Volume of Voids, cm^3	31.99
Dry Mass, g	78.62	Degree of Saturation, %	100.0

TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t_{90} sec	cv. cm^2/s	mv m^2/kN	k cm/s
0.00	1.900	1.135	1.900				
4.75	1.895	1.130	1.898	41	1.86E-02	5.54E-04	1.01E-06
9.54	1.890	1.124	1.893	94	8.08E-03	5.49E-04	4.35E-07
19.25	1.881	1.114	1.886	53	1.42E-02	4.88E-04	6.80E-07
38.68	1.868	1.099	1.875	158	4.71E-03	3.52E-04	1.63E-07
77.38	1.847	1.076	1.858	34	2.15E-02	2.86E-04	6.02E-07
19.25	1.857	1.087	1.852				
4.75	1.866	1.097	1.862				
19.25	1.860	1.090	1.863	29	2.54E-02	2.18E-04	5.42E-07
77.38	1.844	1.072	1.852	31	2.35E-02	1.45E-04	3.33E-07
116.07	1.831	1.058	1.838	23	3.11E-02	1.77E-04	5.39E-07
154.68	1.820	1.045	1.826	60	1.18E-02	1.50E-04	1.73E-07
309.16	1.775	0.995	1.798	85	8.06E-03	1.53E-04	1.21E-07
618.45	1.684	0.893	1.730	124	5.11E-03	1.55E-04	7.76E-08
1237.35	1.560	0.753	1.622	225	2.48E-03	1.05E-04	2.56E-08
2472.95	1.451	0.631	1.506	171	2.81E-03	4.64E-05	1.28E-08
1237.35	1.463	0.644	1.457				
309.16	1.487	0.671	1.475				
77.38	1.520	0.708	1.504				
19.25	1.560	0.753	1.540				
4.75	1.561	0.754	1.561				

Notes:
k calculated using cv based on t_{90} values.

SAMPLE DIMENSIONS AND PROPERTIES - FINAL

Sample Height, cm	1.56	Unit Weight, kN/m^3	20.41
Sample Diameter, cm	6.35	Dry Unit Weight, kN/m^3	15.60
Area, cm^2	31.67	Specific Gravity, measured	2.79
Volume, cm^3	49.44	Solids Height, cm	0.890
Water Content, %	30.87	Volume of Solids, cm^3	28.18
Wet Mass, g	102.89	Volume of Voids, cm^3	21.26
Dry Mass, g	78.62		

THURBER

Appendix E.

Site Photographs

Photo 1. Looking southwest from Castleford Road across Highway 17 towards Bruce Street. (2019/11/05)

Photo 2. Looking southeast towards Highway 17 and Bonnechere River valley. (2019/11/05)

Photo 3. Looking southwest along proposed Castleford Road alignment and towards Highway 17 intersection. Existing Castleford Road pictured to the left. (2019/11/26)

Photo 4. Looking southeast across Castleford Road towards existing Dugald Road and proposed E-N/S Ramp. (2019/11/26)

Photo 5. Looking northeast along proposed Bruce Street alignment and towards Highway 17 intersection. Existing Bruce Street pictured to the right. (2019/09/04)

Photo 6. Looking northeast along proposed Bruce Street alignment and towards Highway 17. (2019/09/04)

Photo 7. Looking northeast towards Garden of Eden Road and Highway 17 across proposed N-E Ramp site. (2020/11/19)

Photo 8. Looking northeast across Highway 17 toward proposed E-NS Ramp alignment. (2020/11/19)