



THURBER ENGINEERING LTD.

**PRELIMINARY
FOUNDATION INVESTIGATION REPORT
HIGHWAY 17 TWINNING, RENFREW AREA
EASTBOUND DEEP CUT
STA.20+450 TO 20+900, HORTON TOWNSHIP
WP 4068-09-00 / ASSIGNMENT NO. 4018-E-0009**

Geocres No.: 31F07-008

Report to:

Ministry of Transportation Ontario

Latitude: 45.484176°
Longitude: -76.652285°

December 2024
Thurber File No.: 24726



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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 within the County of Renfrew, Ontario. Thurber carried out the investigations under Ministry of Transportation (MTO) Assignment No. 4018-E-0009.

This report addresses the proposed eastbound Highway 17 cut slope located between the Bonnechere River and O'Brien Road (approx. Sta. 20+450 to 20+900) in Horton Township within the Renfrew County, Ontario. The existing Highway 17 alignment at this site will become the future Highway 17 westbound lanes and new eastbound lanes will be constructed to the south of the existing alignment at this location.

This section of the report presents the factual findings obtained from the foundation investigation conducted by Thurber 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.

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

For project purposes, Highway 17 is described as oriented east-west. It is noted that the stations on the proposed eastbound lanes do not match those of the existing highway (future westbound lanes). For clarity, all station references in this report will be with respect to the new eastbound alignment unless noted otherwise. The proposed earth cut is located along the south side of the



proposed Highway 17 eastbound lanes between the Bonnechere River and the O'Brien Road intersection (between Sta. 20+450 and 20+900).

The side slope of the existing cut to the south of the current Highway 17 is inclined at approximately 2.5H:1V to 2.0H:1V. Between the crest of that existing cut slope and the southern right-of-way limit, the ground is relatively flat. Slope heights are variable but are typically less than 10 m between Sta. 20+450 and 20+900. Visible signs of global instabilities were not observed. Some trees, grass, shrubs characterize the face of the slopes.

At the site, the existing Highway 17 is a two-lane highway and has a posted speed limit of 90 km/h. Based on the available CAD profile drawings, the existing highway profile increases from Elevation 112.0 m at Sta. 20+450 to 124.9 m at Sta. 20+900. The eastbound shoulder has a width ranging from approximately 4.5 m to 5.0 m. Traffic volumes on this section of Highway 17 are understood to have been 12,300 AADT in 2016.

The area directly north of the highway generally consists of undeveloped private property vegetated with grasses, shrubs, deciduous, and coniferous trees. A grassed property is present at the crest of the existing slope, directly south of the highway right-of-way, and includes a Library and Archives building between approximately Sta. 20+600 and 20+700. Overhead utility lines parallel the westbound ditch and cross the highway near Sta. 20+925. Storm water drainage in the area is to roadside ditch at the toe of the slope. Water flows toward the Bonnechere, which is located approximately 170 m west of Sta. 20+450.

Photographs of the project area are included in Appendix D. These photographs show the existing condition of the highway embankment and existing earth cut slope at the time of the field investigation.

2.2 Site Geology

According to Crins et al. 2009¹ the project area is described as Ecoregion 6E (Lake Simcoe-Rideau Ecoregion) within the Mixedwood Plains Ecozone. According to Wester et al. 2018² the ecoregion is subdivided into Ecodistrict 6E-16 (Pembroke Ecodistrict). The area is characterized by glaciolacustrine dominated landscape overlying a mix of Paleozoic to Precambrian bedrock.

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.

¹ <https://files.ontario.ca/mnrf-ecosystemspart1-accessible-july2018-en-2020-01-16.pdf>

² <https://files.ontario.ca/ecosystems-ontario-part2-03262019.pdf>



Base mapping by the Ontario Geological Survey (MRD126)³ indicates the bedrock in the area is carbonate metasedimentary rocks, marble, calc-silicate rocks, skarn, tectonic breccias of the Grenville Supergroup and Flinton Group.

3 SITE INVESTIGATION AND FIELD TESTING

As part of the current assignment, foundation investigations were conducted by Thurber at several locations along the Highway 17 twinning project boundaries. The available information relevant to the current site was reviewed prior to this investigation and can be found in the Geocres Library under Geocres Number 31F-216 (O'Brien Road Interchange) and 31F-236 (Bonnechere River Bridge). From those investigations, Boreholes OBR19-14, OBR19-15, OBR19-16, BON19-6, BON19-7, BON19-8, and BON19-9 are relevant to the present report and have been included in the discussion below and in Appendix B.

Boreholes BON19-6 through BON19-9 were drilled off-road between approximate Sta. 20+400 and 20+530 between September 14 and 17, 2020, using a CME 45 track mounted drill equipped with hollow stem augers. Boreholes OBR19-14, OBR19-15, and OBR19-16 were drilled off-road between approximate Sta. 20+860 and 20+960 on February 5 and 6, 2020, using a CME 55 track mounted drill equipped with hollow stem augers.

The foundation investigation and field-testing program was augmented with ten additional off-road boreholes identified as EB23-01 through EB23-10 that were put down between March 13 and 26, 2024. The boreholes were advanced with a CME 75 track mounted drill rig utilizing hollow stem augers and NW casing.

Prior to commencement of drilling, utility clearances were obtained in the vicinity of the borehole locations.

A summary of the borehole coordinates, elevations, and termination depths is provided in Table 3-1. The locations and elevations of the boreholes were surveyed by Thurber with a Trimble Catalyst DA1 antenna with centimeter accuracy and were measured relative to BM HCP 102 (Elevation 129.023 m). Horizontal locations were measured by Thurber relative to existing site features. The elevations and borehole coordinates were reviewed and referenced to the survey data provided by the MTO. The borehole coordinates and elevations are shown on the Borehole Location and Soil Strata drawing included in Appendix A and on the individual Record of Borehole sheets included in Appendix B. The borehole coordinates are referenced to MTM Zone 9. The reference stations correspond to those for the new eastbound lanes.

³ <http://www.geologyontario.mndm.gov.on.ca/index.html>

Table 3-1: Borehole Summary

Borehole No.	Drilled Location	Northing (Latitude)	Easting (Longitude)	Ground Surface Elevation (m)	Termination Depth (m)
EB23-01	Near Crest Sta. 20+450	5 038 384.5 (45.485281)	292 670.5 (-76.655167)	118.6	15.8 (DCPT 21.0)
EB23-02	Near Crest Sta. 20+490	5 038 364 (45.485096)	292 706.1 (-76.65471)	119.6	15.8
EB23-03	Near Crest Sta. 20+545	5 038 340.2 (45.484883)	292 757.0 (-76.654061)	119.8	15.8
EB23-04	Near Crest Sta. 20+590	5 038 317.6 (45.484679)	292 792.8 (-76.653601)	120.7	15.8
EB23-05	Near Crest Sta. 20+645	5 038 290.9 (45.484441)	292 842.5 (-76.652965)	121.6	15.8
EB23-06	Near Crest Sta. 20+705	5 038 261.4 (45.484176)	292 895.5 (-76.652285)	122.7	16.6
EB23-07	Near Crest Sta. 20+745	5 038 243.3 (45.484013)	292 929.8 (-76.651846)	123.5	20.4 (DCPT 22.7)
EB23-08	Near Crest Sta. 20+800	5 038 218.6 (45.483792)	292 981.4 (-76.651186)	126.1	16.6
EB23-09	Near Crest Sta. 20+860	5 038 191.4 (45.483548)	293 030.0 (-76.650563)	127.7	17.5
EB23-10	Near Crest Sta. 20+900	5 038 167.1 (45.483331)	293 064.3 (-76.650124)	128.4	15.8
BON19-6	Near Crest Sta. 20+420	5 038 422.9 (45.485625)	292 651.3 (-76.655414)	116.9	14.3
BON19-7	Near Crest Sta. 20+445	5 038 407.3 (45.485485)	292 674.7 (-76.655113)	118.0	14.3
BON19-8	Near Toe Sta. 20+495	5 038 384.8 (45.485283)	292 718.9 (-76.654548)	117.7	14.3
BON19-9	Near Toe Sta. 20+530	5 038 365.0 (45.485106)	292 751.0 (-76.654137)	117.8	14.0
OBR19-14	Near Crest Sta. 20+970	5 038 130.9 (45.483006)	293 126.1 (-76.649333)	132.2	14.3
OBR19-15	Near Crest Sta. 20+920	5 038 164.8 (45.483311)	293 088.4 (-76.649816)	129.1	12.8
OBR19-16	Near Crest Sta. 20+880	5 038 190.7 (45.483542)	293 049.7 (-76.650316)	127.9	8.2 (DCPT 15.2)



Soil samples were obtained at selected intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT) in general accordance with ASTM D 1586. In-situ shear vane testing was carried out within the cohesive layers, where possible, using an MTO 'N' sized vane in general accordance with ASTM D 2573. Thin-walled (Shelby) Tube samples were obtained in Borehole EB23-01 for further laboratory testing.

Monitoring wells, 50 mm in diameter, were installed in each of Boreholes EB23-02, EB23-05, EB23-09, BON19-6, and OBR19-15 to allow for measurements of the groundwater level after drilling. The details of the well installation are illustrated on the respective Record of Borehole sheets provided in Appendix B. The monitoring wells installed as part of the current investigation will be decommissioned by Thurber, as outlined in the Hydrogeological Investigation and Design Report.

Boreholes without a well 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 a member of Thurber's technical staff. The drilling supervisor logged the boreholes and processed the recovered soil samples for transport to Thurber's Ottawa laboratory for further examination and testing.

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.

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.

5 GENERAL DESCRIPTION OF SUBSURFACE CONDITIONS

Details of the encountered soil stratigraphy are presented on the Record of Borehole sheets included in Appendix B and the Borehole Location and Soil Strata Drawing 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 and groundwater conditions may vary between and beyond borehole locations. Soil classification is in accordance with the MTO Guideline for Foundation Engineering Services (GFES) Manual (April 2022) and the 5th edition of the Canadian Foundation Engineering Manual (2024).

In general, the stratigraphy west of about Sta. 20+750 consists of a native deposit of clay to silty clay underlain by clayey silt, overlying dense silty sand. The stratigraphy east of about Sta.



20+750 consists of a native deposit of sand over silty clay to clayey silt, which is underlain by a deeper deposit of sand.

5.1 Topsoil

A 50 to 150 mm thick layer topsoil was encountered at the ground surface in Boreholes BON19-6, BON19-7, OBR19-14, OBR19-15, and OBR19-16.

5.2 Sandy Clayey Silt (CL)

A native deposit of sandy clayey silt was encountered at the ground surface in Boreholes EB23-01 through EB23-05 and EB23-08. Varying amounts of organics were noted within the layer. The thickness of the layer ranged from 0.8 to 1.8 m (base Elevation 124.3 to 117.7 m). The SPT N-values ranged from 5 to 10 blows, indicating a very stiff relative density.

The moisture content of the samples tested ranged from 23 to 42%. The results of grain size analyses conducted on two samples of this layer are summarized in the table below and are illustrated on Figure C1 in Appendix C.

Summary of Grain Size Distribution Testing – Sandy Clayey Silt

Soil Particle	Percentage (%)
Gravel	0 – 6
Sand	22 – 32
Silt	37 – 51
Clay	21 – 31

The results of Atterberg Limits testing carried out on two samples of this material are summarized below and are illustrated on Figure C2 in Appendix C. The laboratory results indicate that the sandy clayey silt is of low plasticity (CL).

Summary of Atterberg Limit Testing – Sandy Clayey Silt

Parameter	Value
Liquid Limit	32 – 34
Plastic Limit	19 – 22
Plasticity Index	10 – 15

5.3 Upper Sand and Silty Sand

A deposit of sand to silty sand was encountered at the ground surface in Boreholes EB23-09 and EB23-10, below the topsoil in Boreholes OBR19-14 through OBR19-16, and below the sandy clayey silt in Borehole EB23-08. Shells were encountered within the layer in Boreholes EB23-09 and EB23-10. Where fully penetrated, the thickness of this sand layer ranged from 4.1 m to 10.1 m

(base Elevation 120.2 m to 117.6 m). The layer was not fully penetrated in Boreholes OBR19-14 and OBR19-16 but was proven to extend to depths ranging from 8.2 m to 14.3 m (Elevation 119.7 m to 117.9 m).

The SPT N-values ranged from 2 blows per 0.3 m of penetration to 100 blows for 150 mm of penetration but were generally between about 5 and 26 blows per 0.3 m of penetration, indicating a loose to compact relative density. The practical refusal blow count may also be attributed to the presence of cobbles within the layer.

The moisture content of the samples tested ranged from 3 to 44% but were typically less than 25%. The results of gradation analyses completed on 12 samples of the layer are illustrated in Figures C3 and C4 of Appendix C. The results of the tests are summarized below and on the Record of Borehole sheets in Appendix B.

Summary of Grain Size Distribution Testing – Upper Sand to Silty Sand

Soil Particle	Percentage (%)	
Gravel	0 – 36	
Sand	55 – 98	
Silt	19 – 27	2 – 20
Clay	10 – 17	

The results of Atterberg Limit testing conducted on the fines portion of a sample of the deposit from Borehole EB23-10 indicate a non-plastic material.

A sample from the layer in Borehole OBR19-14 had a higher gravel content and a lower sand content than the rest of the tested samples. The results of gradation analyses completed on that sample are summarized below and are illustrated on Figure C5 of Appendix C.

Summary of Grain Size Distribution Testing – Gravel with Silt and Sand

Soil Particle	Percentage (%)
Gravel	62
Sand	32
Silt	6
Clay	

The results of the grainsize analyses carried out on samples of this deposit are also summarized on the Record of Borehole sheets in Appendix B.

5.4 Silty Clay

A native deposit of clay to silty clay to clayey silt was encountered at the ground surface in Boreholes EB23-06, EB23-07, BON19-8, and BON19-9; below the topsoil in Boreholes BON19-6 and BON19-7; below the sandy clayey silt in Boreholes EB23-01 through EB23-05; and below the upper sand to silty sand in Boreholes EB23-08 through EB23-10 and OBR19-15. Sand partings and seams were encountered throughout the deposit.

The upper portion of the deposit has been identified as weathered crust and was noted in all boreholes except for Boreholes EB23-08 through EB23-10 and OBR19-14 through OBR19-16. The thickness of the weathered crust ranges from 7.1 m to 10.7 m (base Elevation 115.9 m to 110.0 m). Where SPTs were conducted within the weathered crust, the N-values ranged from 3 to 17 blows per 0.3 m of penetration but were typically greater 5 blows per 0.3 m of penetration. Field vane tests were attempted within this layer and gave undrained shear strengths of 118 kPa (the maximum values recordable with the available shear vanes), indicating a very stiff consistency. The moisture content of the samples tested ranged from 20 to 46%.

Below the weathered crust, an unweathered portion of the deposit was generally encountered. The unweathered silty clay to clayey silt was also encountered beneath the upper sand to silty sand in Boreholes EB23-08 through EB23-10 and OBR19-15. The unweathered deposit was not fully penetrated in Boreholes EB23-01 and EB23-05 through EB23-09 but was proven to extend to depths ranging from 15.8 m to 20.4 m (Elevation 110.2 to 102.8 m). Where SPT was conducted within the unweathered deposit, the N-values ranged from weight-of-hammer (WH) to 17 blows per 0.3 m of penetration but were typically less than 4 blows. Field vane tests were performed within this layer where possible. Undrained shear strengths were obtained and ranged from 47 kPa to greater than 118 kPa, but were typically greater than 80 kPa, indicating a stiff to very stiff in consistency. Remolded vane tests recorded sensitives typically ranging from 4 to 12, indicating a sensitive to extra sensitive material (CFEM, 2006). The moisture content of the samples tested ranged from 19 to 61%.

The results of grain size analysis tests conducted on 38 samples of this material are summarized in the table below and are illustrated on Figures C6 to C12 in Appendix C.

Summary of Grain Size Distribution Testing – Clay to Silty Clay to Clayey Silt

Soil Particle	Percentage (%)
Gravel	0 – 6
Sand	0 – 9
Silt	36 – 64
Clay	26 – 62

The results of Atterberg Limits testing carried out on 38 samples of this material are summarized below and are illustrated on Figures C13 to C19 in Appendix C. The laboratory results indicate that the clay to silty clay to clayey silt is of high to low plasticity (CH to CI to CL).

Summary of Atterberg Limit Testing – Clay to Silty Clay to Clayey Silt

Parameter	Value
Liquid Limit	23 – 54
Plastic Limit	15 – 29
Plasticity Index	8 – 29

Three samples from the lower portion of the silty clay to clayey silt deposit in Boreholes EB23-04 and EB23-07 had a higher sand content. The results of grain size analysis tests conducted on the three samples from this portion of the deposit are summarized in the table below and are illustrated on Figure C20 in Appendix C.

Summary of Grain Size Distribution Testing – Clayey Silt, some Sand

Soil Particle	Percentage (%)
Gravel	0
Sand	13 – 16
Silt	51 – 66
Clay	21 – 34

The results of Atterberg Limits testing carried out on those 3 samples are illustrated in Figures C13 to C19 in Appendix C. The laboratory results indicate that the clayey silt, some sand is of low plasticity (CL).

Summary of Atterberg Limit Testing – Clayey Silt, some Sand

Parameter	Value
Liquid Limit	26 – 32
Plastic Limit	17 – 18
Plasticity Index	9 – 14

5.5 Lower Sand to Silty Sand

A deeper deposit of dense sand to silty sand was encountered below the clay to silty clay to clayey silt in Boreholes EB23-02, EB23-03, EB23-04, EB23-10, BON19-6 through BON19-9, and OBR19-15. This lower layer was not fully penetrated but was proven to extend to depths ranging from 12.8 m to 15.8 m (Elevation 116.3 m to 102.6 m).

The SPT N-values ranged from 18 blows per 0.3 m of penetration to 100 blow for 280 mm of penetration, but were generally greater than about 35 blows per 0.3 m of penetration, indicating a dense to very dense relative density. Refusal blow counts may also be attributed to the presence of cobbles within the layer.

The moisture content of the samples tested ranged from 2 to 24%. The results of gradation analyses completed on six samples of the layer are illustrated on Figure C21 of Appendix C. The results of the tests are summarized below and on the Record of Borehole sheets in Appendix B.

Summary of Grain Size Distribution Testing – Lower Sand to Silty Sand

Soil Particle	Percentage (%)
Gravel	0 – 28
Sand	55 – 83
Silt & Clay	11 – 23

5.6 Refusal

Bedrock was not encountered within the depth of the borehole investigation. However, a Dynamic Cone Penetration Test (DCPT) was carried out below the sampled depth in Boreholes EB23-01 and EB23-07, and a refusal blow count was encountered at tip elevations of 97.6 m and 100.8 m, respectively. A DCPT was also carried out below the sampled depth in Borehole OBR19-16 to a depth of 15.2 m (Elevation 112.7 m), but did not encounter refusal.

5.7 Groundwater

Monitoring wells with a 50 mm of diameter were installed in each of Boreholes EB23-02, EB23-05, EB23-09, BON19-6, and OBR19-15. Groundwater levels recorded in the wells are presented in Table 5-1.

Table 5-1: Summary of Groundwater Levels

Borehole No.	Bottom of Screen Elevation (m)	Groundwater Depth (m)	Groundwater Elevation (m)	Date of Measurement
EB23-02	108.9	6.1	113.5	March 28, 2024
		3.7	115.9	April 10, 2024
		5.7	113.9	April 24, 2024
		7.4	112.2	June 20, 2024
		8.2	111.4	June 26, 2024
		7.5	112.1	June 28, 2024
		7.6	112.0	August 29, 2024
EB23-05	112.5	0.8	120.8	March 26, 2024
		0.9	120.7	March 28, 2024
		0.6	121.0	April 10, 2024
		0.6	121.0	April 24, 2024
		1.7	119.9	June 27, 2024
		1.7	119.9	June 28, 2024
		1.5	120.1	July 15, 2024
		3.8	117.8	August 29, 2024

Borehole No.	Bottom of Screen Elevation (m)	Groundwater Depth (m)	Groundwater Elevation (m)	Date of Measurement
EB23-09	118.3	5.7	122.0	March 20, 2024
		5.7	122.0	March 28, 2024
		5.7	122.0	April 10, 2024
		5.5	122.2	April 24, 2024
		5.5	122.2	June 20, 2024
		5.4	122.3	June 27, 2024
		5.9	121.8	July 16, 2024
		5.4	122.3	August 29, 2024
BON19-6 Shallow	110.2	Dry	-	September 29, 2020
		Dry		November 11, 2020
		Dry		August 06, 2021
		Dry		January 11, 2022
		Dry ^(a)		August 29, 2024
BON19-6 Deep	103.3	Dry	-	September 29, 2020
		Dry		November 11, 2020
		Dry		August 06, 2021
		Dry		January 11, 2022
		Dry ^(a)		August 29, 2024
OBR19-15	119.8	8.0	121.1	February 07, 2020
		6.3	122.8	April 21, 2020
		6.9	122.2	September 29, 2020
		6.9	122.2	September 29, 2021
		6.9	122.2	October 04, 2021
		8.0	121.1	October 20, 2021
		7.1	122.0	January 20, 2022
		6.9 ^(a)	122.2	April 24, 2024
		6.8 ^(a)	122.3	August 29, 2024

Note: ^(a) water level taken after borehole log was finalized

These observations are considered short term as they were recorded at discrete times, and it should be noted that the groundwater level at the time of construction may be different and seasonal fluctuations of the groundwater level are to be expected. In particular, groundwater levels may be at a higher elevation after periods of significant and/or prolonged precipitation.

6 MISCELLANEOUS

The borehole locations reflect existing site features and access constraints. The as-drilled locations and ground surface elevation were measured by Thurber following completion of the field program. George Downing Estate Drilling Ltd. of Hawkesbury, Ontario, supplied and operated the drill rigs used to drill, test, sample, install the monitoring wells, and decommission the boreholes. The field investigation was supervised on a full-time basis by Mr. B. Coote, EIT. Overall supervision of the field investigation program was provided by Mr. J. Gray, P.Eng.

Routine geotechnical laboratory testing was completed by Thurber's laboratory in Ottawa.

Interpretation of the factual data and preparation of this report was completed A. de Oliveira, P.Eng. and M. Kennedy, P.Eng. The report was reviewed by Dr. F. Griffiths, P.Eng., and Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundation Projects.

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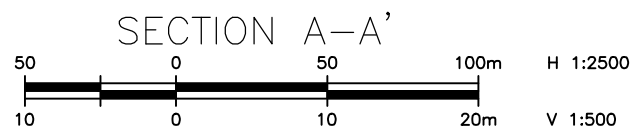
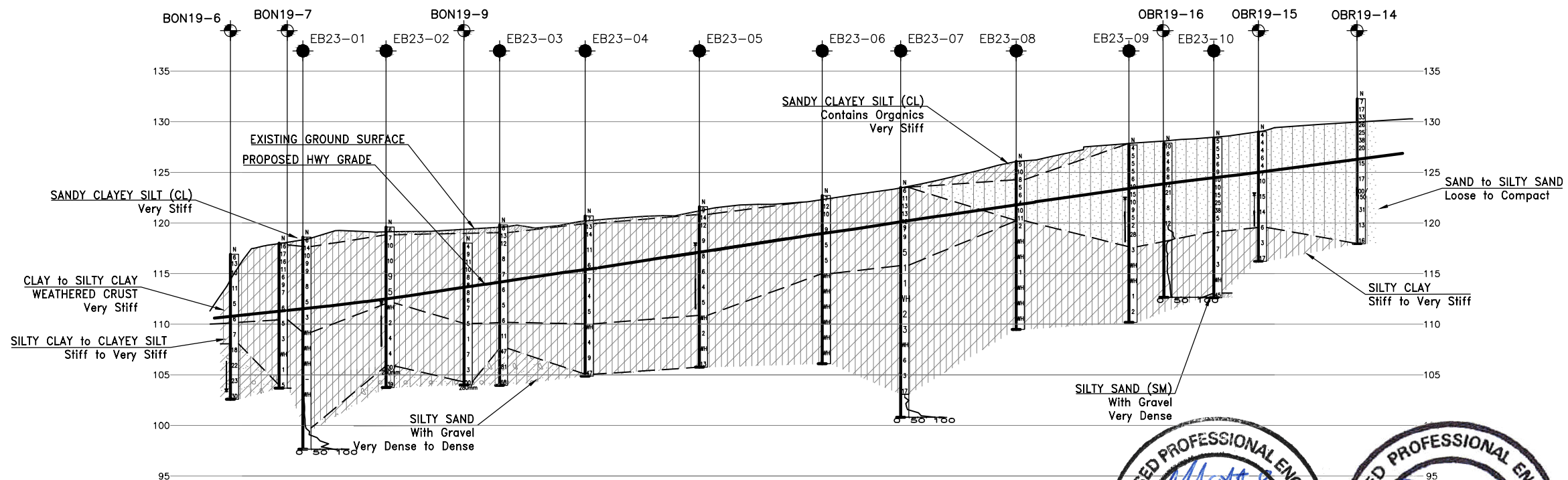
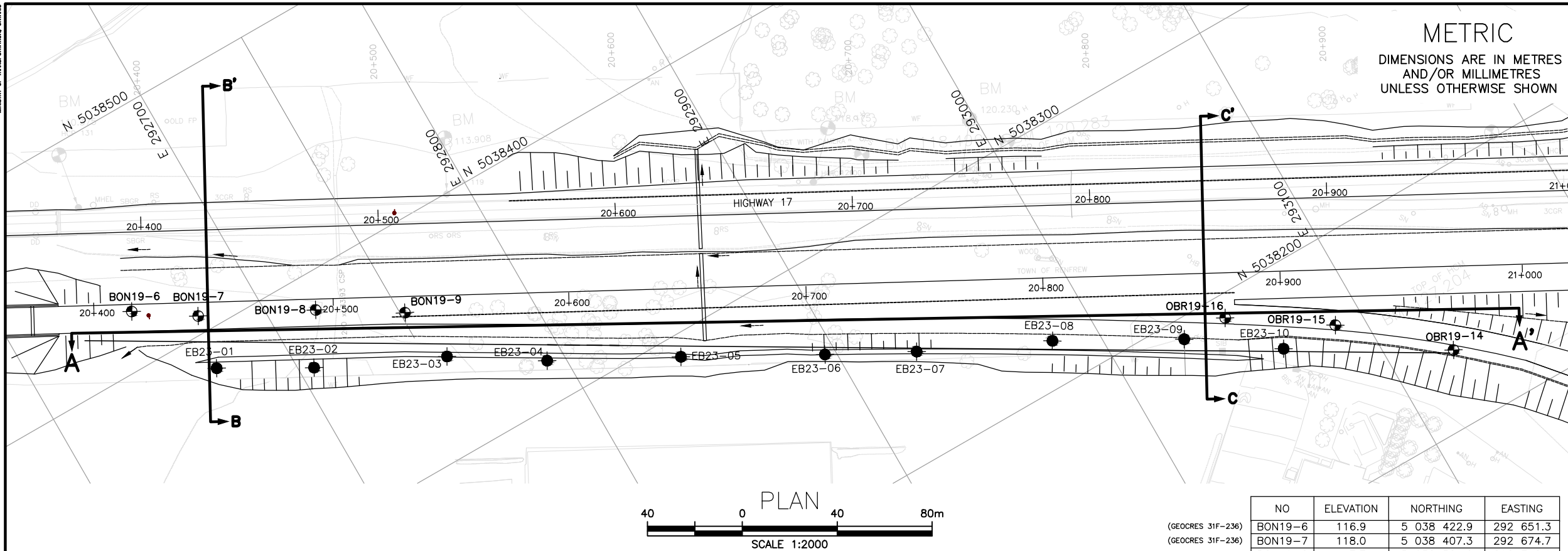


Dr. P.K. Chatterji, P.Eng.
Designated Principal Contact,
Senior Geotechnical Engineer



Appendix A.

Borehole Location Plan and Stratigraphic Drawings



A circular professional engineer seal for the Province of Ontario. The outer ring contains the text "LICENSED PROFESSIONAL ENGINEER" at the top and "PROVINCE OF ONTARIO" at the bottom. In the center, the name "M. J. KENNEDY" and license number "100188946" are printed. A blue ink signature "M. J. Kennedy" is written over the name. Below the license number, the expiration date "Dec 18, 2024" is handwritten in blue ink.

95
P. K. CHATTERJI
Dec 18, 2024
PROVINCE OF ONTARIO

CONT No
GWP No 4068-09-00





HIGHWAY 17 TWINNING
 STATION 20+450 to 20+900
 HORTON TOWNSHIP
 BOREHOLE LOCATION PLAN AND SOIL STRATA

Ontario 


THURBER

KEYPLAN

LEGEND

- | | |
|---|---|
|  | Borehole |
|  | Historic Borehole |
| N | Blows /0.3m (Std Pen Test, 475J/blow) |
| CONE | Blows /0.3m (60° Cone, 475J/blow) |
| PH | Pressure, Hydraulic |
|  | Water Level Upon Completion of Drilling |
|  | Water Level in Monitoring Well/Piezometer |
| 90% | Monitoring Well/Piezometer Screen |
| | Rock Quality Designation (RQD) |
| A/R | Auger Refusal |

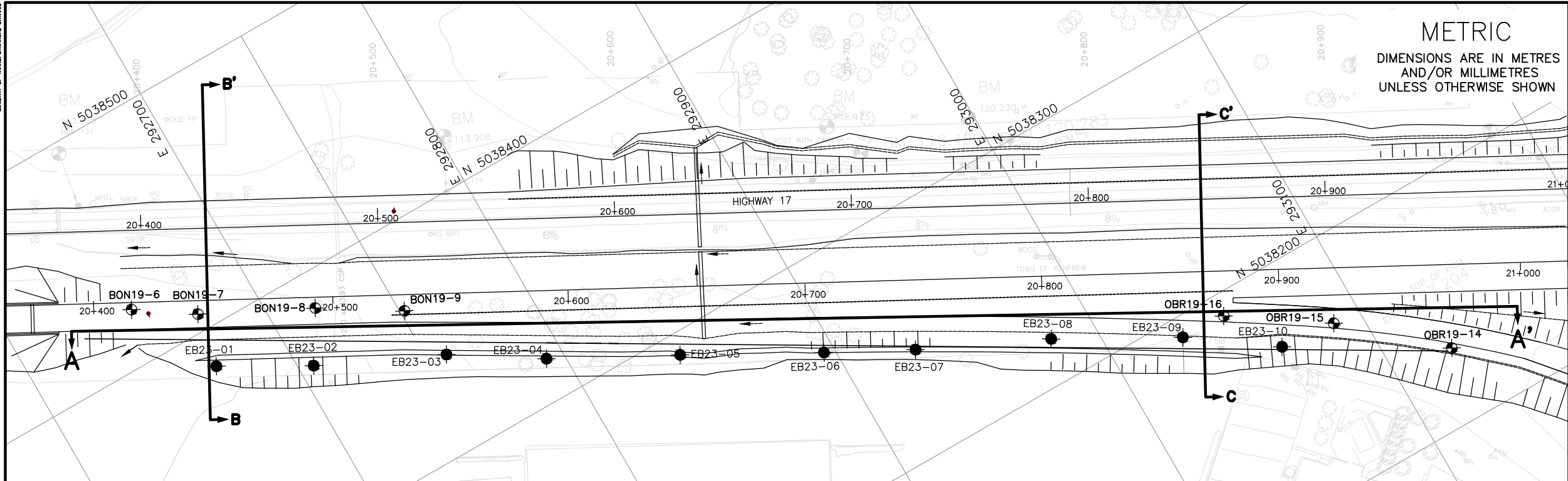
NO	ELEVATION	NORTHING	EASTING
EB23-01	118.6	5 038 384.5	292 670.5
EB23-02	119.6	5 038 364.0	292 706.1
EB23-03	119.8	5 038 340.2	292 757.0
EB23-04	120.7	5 038 317.6	292 792.8
EB23-05	121.6	5 038 290.9	292 842.5
EB23-06	122.7	5 038 261.4	292 895.5
EB23-07	123.5	5 038 243.3	292 929.8
EB23-08	126.1	5 038 218.6	292 981.4
EB23-09	127.7	5 038 191.4	293 030.0
EB23-10	128.4	5 038 167.1	293 064.3

-NOTES-

- 1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- 2) This drawing is for subsurface information only. Surface details and features are for conceptual illustration.
- 3) Coordinate system is MTM NAD 83 Zone 9.

GEOCRES No. 31F07-008

[illegible]



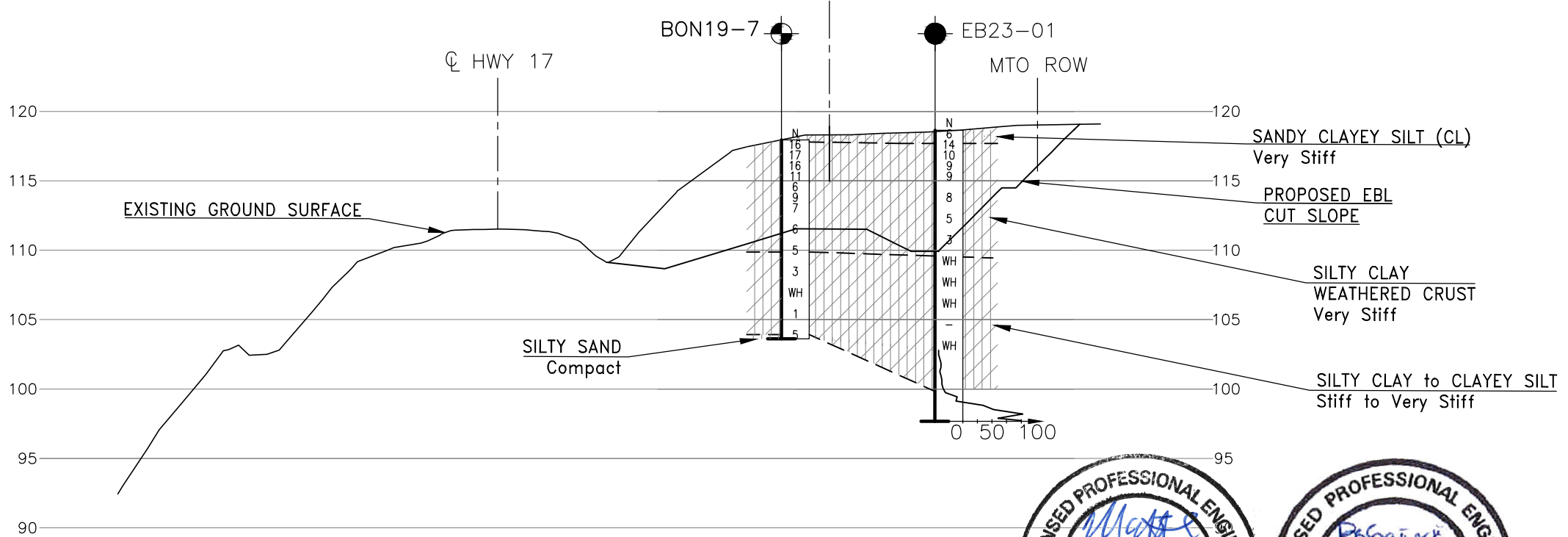
METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN



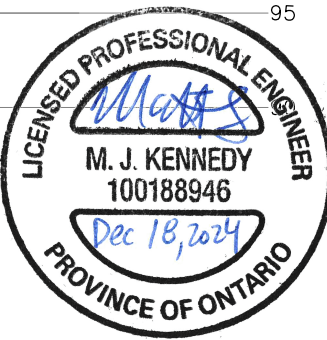
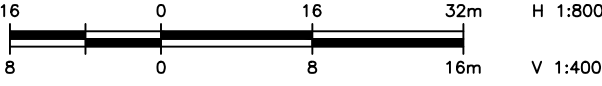
PLAN

NO	ELEVATION	NORTHING	EASTING
(GEOCRES 31F-236) BON19-6	116.9	5 038 422.9	292 651.3
(GEOCRES 31F-236) BON19-7	118.0	5 038 407.3	292 674.7
(GEOCRES 31F-236) BON19-8	117.7	5 038 384.8	292 718.9
(GEOCRES 31F-236) BON19-9	117.8	5 038 365.0	292 751.0
(GEOCRES 31F-216) OBR19-14	132.2	5 038 130.9	293 126.1
(GEOCRES 31F-216) OBR19-15	129.1	5 038 164.8	293 088.4
(GEOCRES 31F-216) OBR19-16	127.9	5 038 190.7	293 049.4

CL PROPOSED EBL
HWY 17



SECTION B-B' (STA. 20+450)



CONT No
GWP No 4068-09-00

HIGHWAY 17 TWINNING
STATION 20+450 to 20+900
HORTON TOWNSHIP
BOREHOLE LOCATION PLAN AND SOIL STRATA



SHEET
2



KEYPLAN

LEGEND

- Borehole
- Historic Borehole
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60° Cone, 475J/blow)
- PH Pressure, Hydraulic
- Water Level Upon Completion of Drilling
- Water Level in Monitoring Well/Piezometer
- Monitoring Well/Piezometer Screen
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

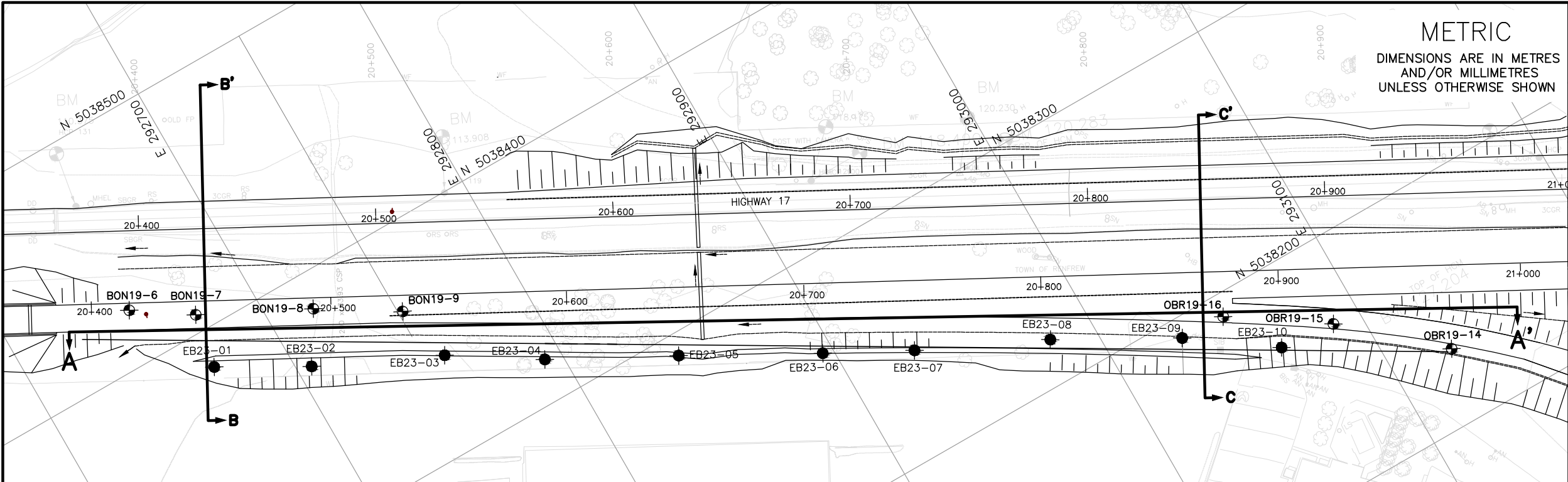
NO	ELEVATION	NORTHING	EASTING
EB23-01	118.6	5 038 384.5	292 670.5
EB23-02	119.6	5 038 364.0	292 706.1
EB23-03	119.8	5 038 340.2	292 757.0
EB23-04	120.7	5 038 317.6	292 792.8
EB23-05	121.6	5 038 290.9	292 842.5
EB23-06	122.7	5 038 261.4	292 895.5
EB23-07	123.5	5 038 243.3	292 929.8
EB23-08	126.1	5 038 218.6	292 981.4
EB23-09	127.7	5 038 191.4	293 030.0
EB23-10	128.4	5 038 167.1	293 064.3

-NOTES-

- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.
- Coordinate system is MTM NAD 83 Zone 9.

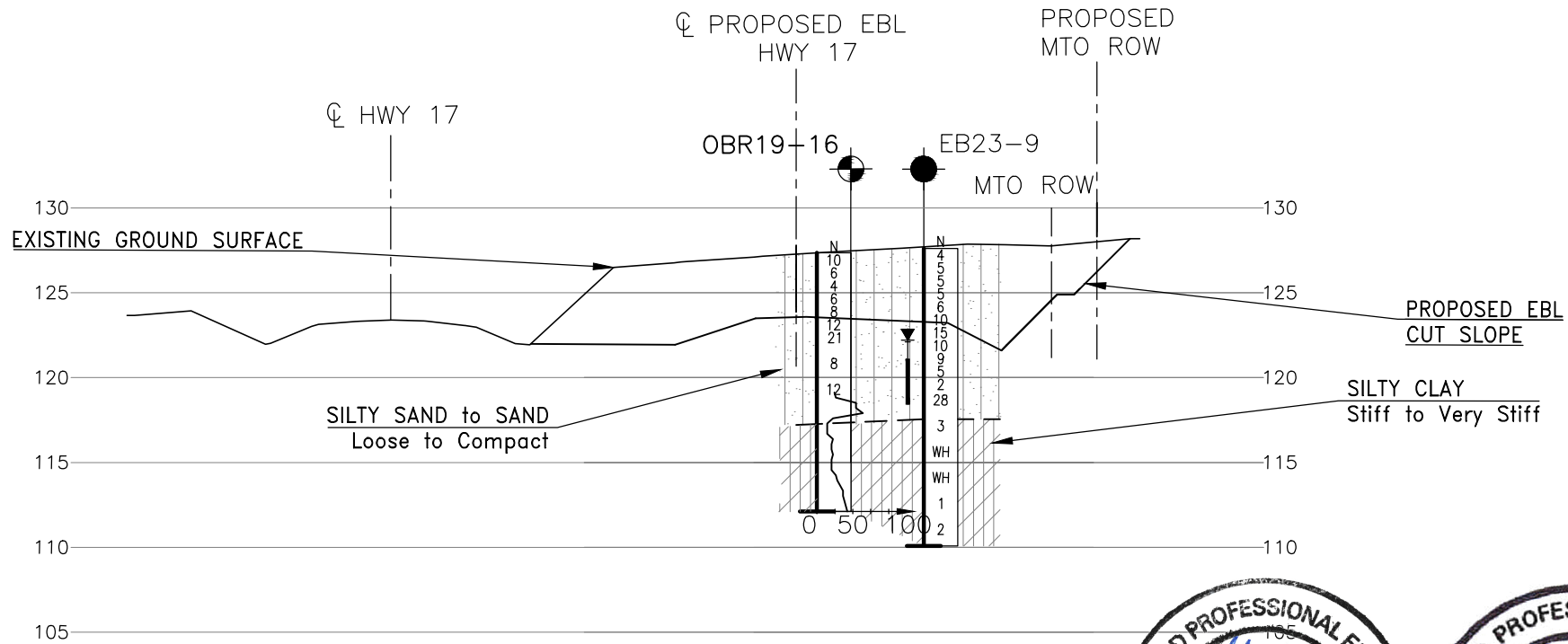
GEOCRES No. 31F07-008

REVISIONS	DATE	BY	DESCRIPTION
DESIGN	AO	CHK -	CODE
DRAWN	RH	CHK FG	SITE
			LOAD
			STRUCT
			DWG 1
			DATE NOV 2024

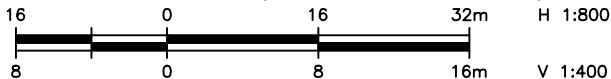


(GEOCRES 31F-236)
(GEOCRES 31F-236)
(GEOCRES 31F-236)
(GEOCRES 31F-236)
(GEOCRES 31F-216)
(GEOCRES 31F-216)
(GEOCRES 31F-216)

NO	ELEVATION	NORTHING	EASTING
BON19-6	116.9	5 038 422.9	292 651.3
BON19-7	118.0	5 038 407.3	292 674.7
BON19-8	117.7	5 038 384.8	292 718.9
BON19-9	117.8	5 038 365.0	292 751.0
OBR19-14	132.2	5 038 130.9	293 126.1
OBR19-15	129.1	5 038 164.8	293 088.4
OBR19-16	127.9	5 038 190.7	293 049.4



SECTION C-C' (STA. 20+875)



CONT No
GWP No 4068-09-00

HIGHWAY 17 TWINNING
STATION 20+450 to 20+900
HORTON TOWNSHIP
BOREHOLE LOCATION PLAN AND SOIL STRATA

Ontario

THURBER



KEYPLAN

LEGEND

●	Borehole
●	Historic Borehole
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
▽	Water Level Upon Completion of Drilling
▽	Water Level in Monitoring Well/Piezometer
▽	Monitoring Well/Piezometer Screen
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

NO	ELEVATION	NORTHING	EASTING
EB23-01	118.6	5 038 384.5	292 670.5
EB23-02	119.6	5 038 364.0	292 706.1
EB23-03	119.8	5 038 340.2	292 757.0
EB23-04	120.7	5 038 317.6	292 792.8
EB23-05	121.6	5 038 290.9	292 842.5
EB23-06	122.7	5 038 261.4	292 895.5
EB23-07	123.5	5 038 243.3	292 929.8
EB23-08	126.1	5 038 218.6	292 981.4
EB23-09	127.7	5 038 191.4	293 030.0
EB23-10	128.4	5 038 167.1	293 064.3

-NOTES-

- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.
- Coordinate system is MTM NAD 83 Zone 9.

GEOCRES No. 31F07-008

REVISIONS	DATE	BY	DESCRIPTION
DESIGN	AO	CHK -	CODE
DRAWN	RH	CHK FG	SITE
			LOAD
			STRUCT
			DWG 1
			DATE SEPT 2024



Appendix B.

Record of Borehole Sheets



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.



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

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



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

METRIC

SOIL PROFILE				SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT		UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		W _p W W _L				WATER CONTENT (%)
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						
118.6 0.0	Ground Surface													
117.7 0.9	Sandy CLAYEY SILT (CL) Trace gravel Contains organics Very stiff Brown		1	SS	6									
	SILTY CLAY (CI) Contains sand partings and seams Very stiff Greyish brown WEATHERED CRUST		2	SS	14									
			3	SS	10									
			4	SS	9									
			5	SS	9									
			6	SS	8									
			7	SS	5									
			8	SS	3									
109.5 9.1	SILTY CLAY (CI) Contains sand partings and seams Stiff to very stiff Grey		9	SS	WH									

+³, ×³: Numbers refer to Sensitivity

RECORD OF BOREHOLE No EB23-01

2 OF 3

METRIC

WP# 4068-09-00 LOCATION Lat: 45.485281°, Long: -76.655167°
Eastbound 20+450 to 20+900; Horton Twp; MTM z9: N 5 038 384.5 E 292 670.5 ORIGINATED BY BC
HWY 17 BOREHOLE TYPE CME 75 Trackmount / HSA COMPILED BY RH
DATUM Geodetic DATE 2024.03.26 - 2024.03.26 CHECKED BY AO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)							
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100			w _p	w	w _L	GR	SA	SI	CL
SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE																					
	Continued From Previous Page							20	40	60	80	100	20	40	60						
	SILTY CLAY (CI) Contains sand partings and seams Stiff to very stiff Grey																				
			10	SS	WH		108														
			11	SS	WH		107														
			12	TW	-		106														

Continued Next Page

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

DOUBLE LINE 24726 EASTBOUND 20+450 TO 20+900.GPJ 2012TEMPLATE(MTO).GDT 12-16-24

RECORD OF BOREHOLE No EB23-01 3 OF 3 METRIC

WP# 4068-09-00 LOCATION Lat: 45.485281°, Long: -76.655167°
Eastbound 20+450 to 20+900; Horton Twp; MTM z9: N 5 038 384.5 E 292 670.5 ORIGINATED BY BC
HWY 17 BOREHOLE TYPE CME 75 Trackmount / HSA COMPILED BY RH
DATUM Geodetic DATE 2024.03.26 - 2024.03.26 CHECKED BY AO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
	Continued From Previous Page Borehole Advanced with DCPT													
97.6							98							
21.0	End of Borehole on DCPT refusal Borehole dry upon completion.													

DOUBLE LINE 24726 EASTBOUND 20+450 TO 20+900.GPJ 2012TEMPLATE(MTO).GDT 12-16-24

METRIC

[illegible]

+³, ×³: Numbers refer to Sensitivity

METRIC

Eastbound 20+450 to 20+900; Horton Twp; MTM z9: N 5 038 364.0 E 292 706.1

+³, ×³: Numbers refer to Sensitivity

DOUBLE LINE 24726 EASTBOUND 20+450 TO 20+900.GPJ 2012TEMPLATE(MTO).GDT 12-16-24

RECORD OF BOREHOLE No EB23-03

1 OF 2

METRIC

WP# 4068-09-00 LOCATION Lat: 45.484883°, Long: -76.654061°
Eastbound 20+450 to 20+900; Horton Twp; MTM z9: N 5 038 340.2 E 292 757.0 ORIGINATED BY BC
HWY 17 BOREHOLE TYPE CME 75 Trackmount / HSA COMPILED BY RH
DATUM Geodetic DATE 2024.03.25 - 2024.03.25 CHECKED BY AO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE										w _p w w _L		
119.8	Ground Surface							20	40	60	80	100		20	40	60				
0.0	Sandy CLAYEY SILT (CL) Trace gravel Contains organics Very stiff Brown		1	SS	8															
119.0																				
0.8	SILTY CLAY (CI) Contains sand partings and seams Very stiff Greyish brown WEATHERED CRUST		2	SS	13		119													
			3	SS	12		118													
			4	SS	8															
			5	SS	7		115													

Continued Next Page

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

DOUBLE LINE 24726 EASTBOUND 20+450 TO 20+900.GPJ 2012TEMPLATE(MTO).GDT 12-16-24

RECORD OF BOREHOLE No EB23-03

2 OF 2

METRIC

WP# 4068-09-00 LOCATION Lat: 45.484883°, Long: -76.654061°
Eastbound 20+450 to 20+900; Horton Twp; MTM z9: N 5 038 340.2 E 292 757.0 ORIGINATED BY BC
HWY 17 BOREHOLE TYPE CME 75 Trackmount / HSA COMPILED BY RH
DATUM Geodetic DATE 2024.03.25 - 2024.03.25 CHECKED BY AO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)					
								20	40	60	80	100	w _p	w	w _L			
						○ UNCONFINED + FIELD VANE												
						● QUICK TRIAXIAL × LAB VANE												
						20	40	60	80	100	20	40	60					
	Continued From Previous Page																	
	SILTY CLAY (CI) Contains sand partings and seams Very stiff Greyish brown WEATHERED CRUST - Unable to push vane						109											
			9	SS	11								○					
							108											
107.6																		
12.2	SAND with silt and gravel Dense to very dense Brown						107							○				
			10	SS	47													
							106											
			11	SS	81								○					
							105											
			12	SS	68								○					
104.0							104											
15.8	End of Borehole Borehole dry upon completion.																	

RECORD OF BOREHOLE No EB23-04

1 OF 2

METRIC

WP# 4068-09-00 LOCATION Lat: 45.484679°, Long: -76.653601°
Eastbound 20+450 to 20+900; Horton Twp; MTM z9: N 5 038 317.6 E 292 792.8 ORIGINATED BY BC
HWY 17 BOREHOLE TYPE CME 75 Trackmount / HSA COMPILED BY RH
DATUM Geodetic DATE 2024.03.21 - 2024.03.21 CHECKED BY AO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE LIQUID CONTENT LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa			WATER CONTENT (%)					
								○ UNCONFINED + FIELD VANE								
								● QUICK TRIAXIAL × LAB VANE								
120.7	Ground Surface						20	40	60	80	100		W _P			
0.0	Sandy CLAYEY SILT (CL) Contains organics Very stiff Brown		1	SS	7									○		
119.9																
0.8	SILTY CLAY (CI) Contains sand partings and seams Very stiff Greyish brown WEATHERED CRUST		2	SS	13									○		
			3	SS	14									○		
			4	SS	11									○		
			5	SS	6									○		
			6	SS	7									○		

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

DOUBLE LINE 24726 EASTBOUND 20+450 TO 20+900.GPJ 2012TEMPLATE(MTO).GDT 12-16-24

METRIC

Lat: 45.484679°, Long: -76.653601°
Eastbound 20+450 to 20+900; Horton Twp; MTM z9: N 5 038 317.6 E 292 792.8 ORIGINATED BY BC

+³, ×³: Numbers refer to Sensitivity

DOUBLE LINE 24726 EASTBOUND 20+450 TO 20+900.GPJ 2012TEMPLATE(MTO).GDT 12-16-24

RECORD OF BOREHOLE No EB23-05

1 OF 2

METRIC

WP# 4068-09-00 LOCATION Lat: 45.484441°, Long: -76.652965°
Eastbound 20+450 to 20+900; Horton Twp; MTM z9: N 5 038 290.9 E 292 842.5 ORIGINATED BY BC
HWY 17 BOREHOLE TYPE CME 75 Trackmount / HSA COMPILED BY RH
DATUM Geodetic DATE 2024.03.20 - 2024.03.20 CHECKED BY AO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				
								20	40	60		
121.6	Ground Surface											
0.0	Sandy CLAYEY SILT (CL) Contains organics Very stiff Brown		1	SS	9							
120.8	CLAY (CH) to SILTY CLAY (CI) Contains sand partings and seams Very stiff Greyish brown WEATHERED CRUST		2	SS	14							
0.8			3	SS	12							
			4	SS	9							
			5	SS	8							
			6	SS	6							
			7	SS	4							
			8	SS	5							

Continued Next Page

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

DOUBLE LINE 24726 EASTBOUND 20+450 TO 20+900.GPJ 2012TEMPLATE(MTO).GDT 12-16-24

METRIC

Eastbound 20+450 to 20+900; Horton Twp; MTM z9: N 5 038 290.9 E 292 842.5 ORIGINATED BY BC

+³, ×³: Numbers refer to Sensitivity


DOUBLE LINE 24726 EASTBOUND 20+450 TO 20+900.GPJ 2012TEMPLATE(MTO).GDT 12-16-24

RECORD OF BOREHOLE No EB23-06

1 OF 2

METRIC

WP# 4068-09-00 LOCATION Lat: 45.484176°, Long: -76.652285°
Eastbound 20+450 to 20+900; Horton Twp; MTM z9: N 5 038 261.4 E 292 895.5 ORIGINATED BY BC
HWY 17 BOREHOLE TYPE CME 75 Trackmount / HSA COMPILED BY RH
DATUM Geodetic DATE 2024.03.19 - 2024.03.20 CHECKED BY AO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT		NATURAL MOISTURE CONTENT		LIQUID LIMIT		UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		WATER CONTENT (%)		w _p		w			w _L		GR	SA	SI	CL
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE											
122.7	Ground Surface																					
0.0	CLAY (CH) to SILTY CLAY (CI) Contains sand partings and seams Very stiff Greyish brown WEATHERED CRUST		1	SS	7																	
			2	SS	12																	
			3	SS	10																	
			4	SS	9																	
			5	SS	5																	
			6	SS	5																	

Continued Next Page

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

DOUBLE LINE 24726 EASTBOUND 20+450 TO 20+900.GPJ 2012TEMPLATE(MTO).GDT 12-16-24

RECORD OF BOREHOLE No EB23-06

2 OF 2

METRIC

WP# 4068-09-00 LOCATION Lat: 45.484176°, Long: -76.652285°
Eastbound 20+450 to 20+900; Horton Twp; MTM z9: N 5 038 261.4 E 292 895.5 ORIGINATED BY BC
HWY 17 BOREHOLE TYPE CME 75 Trackmount / HSA COMPILED BY RH
DATUM Geodetic DATE 2024.03.19 - 2024.03.20 CHECKED BY AO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)						
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					w _p w w _L						
	Continued From Previous Page						20	40	60	80	100								
112.0	SILTY CLAY (CI) Contains sand partings and seams Very stiff Greyish brown											> 113 kPa							
10.7	CLAYEY SILT (CL) Contains sand partings and seams Very stiff Grey - Unable to push vane		9	SS	WH									○					
			10	SS	WH									□		0 1 61 38			
												4.0 +							
												> 113 kPa							
			11	SS	WH									○					
												> 113 kPa							
												> 113 kPa							
			12	SS	WH									○					
												> 113 kPa							
												> 113 kPa							
106.1																			
16.6	End of Borehole																		

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


DOUBLE LINE 24726 EASTBOUND 20+450 TO 20+900.GPJ 2012TEMPLATE(MTO).GDT 12-16-24

RECORD OF BOREHOLE No EB23-07

1 OF 3

METRIC

WP# 4068-09-00 LOCATION Lat: 45.484013°, Long: -76.651846°
Eastbound 20+450 to 20+900; Horton Twp; MTM z9: N 5 038 243.3 E 292 929.8 ORIGINATED BY BC
HWY 17 BOREHOLE TYPE CME 75 Trackmount / HSA COMPILED BY RH
DATUM Geodetic DATE 2024.03.13 - 2024.03.13 CHECKED BY AO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)				GR	SA	SI	CL
								20 40 60 80 100				w _P w w _L							
123.5	Ground Surface																		
0.0	CLAY (CH) to SILTY CLAY (CI) Contains sand partings and seams Very stiff Greyish brown WEATHERED CRUST		1	SS	6														
			2	SS	11														
			3	SS	13														
			4	SS	13														
			5	SS	12														
			6	SS	7														
			7	SS	9														
			8	SS	5														

Continued Next Page

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

DOUBLE LINE 24726 EASTBOUND 20+450 TO 20+900.GPJ 2012TEMPLATE(MTO).GDT 12-16-24

METRIC

Lat: 45.484013°, Long: -76.651846°
Eastbound 20+450 to 20+900; Horto

DOUBLE LINE 24726 EASTBOUND 20+450 TO 20+900.GPJ 2012TEMPLATE(MTO).GDT 12-16-24

+³, ×³: Numbers refer to Sensitivity

RECORD OF BOREHOLE No EB23-07

3 OF 3

METRIC

WP# 4068-09-00 LOCATION Lat: 45.484013°, Long: -76.651846°
Eastbound 20+450 to 20+900; Horton Twp; MTM z9: N 5 038 243.3 E 292 929.8 ORIGINATED BY BC
HWY 17 BOREHOLE TYPE CME 75 Trackmount / HSA COMPILED BY RH
DATUM Geodetic DATE 2024.03.13 - 2024.03.13 CHECKED BY AO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
	Continued From Previous Page							SHEAR STRENGTH kPa						
								○ UNCONFINED + FIELD VANE						
								● QUICK TRIAXIAL × LAB VANE						
								WATER CONTENT (%)						
								20	40	60				
103.1	CLAYEY SILT (CL) Contains sand partings and seams Very stiff Grey		17	SS	17		103							0 13 66 21
20.4	End of Sampled Borehole Borehole Advanced with DCPT						102							
							101							
100.8	End of Borehole on DCPT refusal													
22.7	Borehole dry upon completion.													

RECORD OF BOREHOLE No EB23-08

1 OF 2

METRIC

WP# 4068-09-00 LOCATION Lat: 45.483792°, Long: -76.651186°
Eastbound 20+450 to 20+900; Horton Twp; MTM z9: N 5 038 218.6 E 292 981.4 ORIGINATED BY BC
HWY 17 BOREHOLE TYPE CME 75 Trackmount / HSA COMPILED BY RH
DATUM Geodetic DATE 2024.03.14 - 2024.03.14 CHECKED BY AO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE		WATER CONTENT (%) w _p w w _L				GR	SA	SI	CL	
126.1	Ground Surface																	
0.0	Sandy CLAYEY SILT (CL) Contains organics Very stiff Brown to greyish brown		1	SS	5													
			2	SS	10													0 32 37 31
124.3			3	SS	8													
1.8	SAND with silt Loose to compact Brown																	
			4	SS	5													
			5	SS	6													
			6	SS	4													
			7	SS	10													2 90 8 (SI+CL)
		8	SS	11														
120.2																		
5.9	SILTY CLAY (CI) Contains sand partings and seams Stiff to very stiff Grey		9	SS	2												0 3 40 57	
			10	SS	WH													
</																		

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

DOUBLE LINE 24726 EASTBOUND 20+450 TO 20+900.GPJ 2012TEMPLATE(MTO).GDT 12-16-24

RECORD OF BOREHOLE No EB23-08

2 OF 2

METRIC

WP# 4068-09-00 LOCATION Lat: 45.483792°, Long: -76.651186°
Eastbound 20+450 to 20+900; Horton Twp; MTM z9: N 5 038 218.6 E 292 981.4 ORIGINATED BY BC
HWY 17 BOREHOLE TYPE CME 75 Trackmount / HSA COMPILED BY RH
DATUM Geodetic DATE 2024.03.14 - 2024.03.14 CHECKED BY AO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
	Continued From Previous Page						20 40 60 80 100										
109.5 16.6	SILTY CLAY (CI) Contains sand partings and seams Stiff to very stiff Grey - Unable to push vane - Unable to push vane					116											
			12	SS	1	115											
			13	SS	WH	114											
			14	SS	WH	113											

RECORD OF BOREHOLE No EB23-09

1 OF 2

METRIC

WP# 4068-09-00 LOCATION Lat: 45.483548°, Long: -76.650563°
Eastbound 20+450 to 20+900; Horton Twp; MTM z9: N 5 038 191.4 E 293 030.0 ORIGINATED BY BC
HWY 17 BOREHOLE TYPE CME 75 Trackmount / HSA / NW Casing COMPILED BY RH
DATUM Geodetic DATE 2024.03.15 - 2024.03.18 CHECKED BY AO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					WATER CONTENT (%) w _p w w _L				GR	SA	SI	CL	
127.7	Ground Surface							20	40	60	80	100									
0.0	SILTY SAND to SAND Very loose to compact Brown to greyish brown		1	SS	4									○							
							127														
			2	SS	5									○						0 56 27 17	
			3	SS	5		126							○							
			4	SS	5		125							○							
			5	SS	6		124							○							
			6	SS	10		123							○							
			7	SS	15		122							○							
			8	SS	10		121							○							
			9	SS	9		120							○							
			10	SS	5		119							○							
			11	SS	2		118							○							
			12	SS	28		117							○							

Continued Next Page

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

RECORD OF BOREHOLE No EB23-09

2 OF 2

METRIC

WP# 4068-09-00 LOCATION Lat: 45.483548°, Long: -76.650563°
Eastbound 20+450 to 20+900; Horton Twp; MTM z9: N 5 038 191.4 E 293 030.0 ORIGINATED BY BC
HWY 17 BOREHOLE TYPE CME 75 Trackmount / HSA / NW Casing COMPILED BY RH
DATUM Geodetic DATE 2024.03.15 - 2024.03.18 CHECKED BY AO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		WATER CONTENT (%)					
								20 40 60 80 100		20 40 60					
								○ UNCONFINED + FIELD VANE							
								● QUICK TRIAXIAL × LAB VANE							
	Continued From Previous Page							20 40 60 80 100		20 40 60					
117.6 10.1	SILTY CLAY (CI) Contains sand partings and seams Stiff to very stiff Greyish brown		13	SS	3		117							0 1 37 62	
			14	SS	WH		116								

METRIC

Eastbound 20+450 to 20+900; Horton Twp; MTM z9: N 5 038 167.1 E 293 064.3 ORIGINATED BY BC

DATUM	Geodetic	DATE	2024.03.19 - 2024.03.19	CHECKED BY	AO
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DOUBLE LINE 24726 EASTBOUND 20+450 TO 20+900.GPJ 2012TEMPLATE(MTO).GDT 12-16-24

+³, ×³: Numbers refer to Sensitivity

RECORD OF BOREHOLE No EB23-10

2 OF 2

METRIC

WP# 4068-09-00 LOCATION Lat: 45.483331°, Long: -76.650124°
Eastbound 20+450 to 20+900; Horton Twp; MTM z9: N 5 038 167.1 E 293 064.3 ORIGINATED BY BC
HWY 17 BOREHOLE TYPE CME 75 Trackmount / HSA COMPILED BY RH
DATUM Geodetic DATE 2024.03.19 - 2024.03.19 CHECKED BY AO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				GR	SA	SI	CL	
								○ UNCONFINED	+	FIELD VANE	● QUICK TRIAXIAL	×	LAB VANE	w _p	w		w _L				
	Continued From Previous Page						20	40	60	80	100										
	SILTY CLAY (CI) Contains sand partings and seams Stiff to very stiff Greyish brown																				
			13	SS	7									○							
			14	SS	3									┌─┐	○				0 2 52 46		
													14.0 +								
													9.0 +								
			15	SS	WH									○							
	- Unable to push vane																				
113.1														○							
15.3	SILTY SAND (SM) with gravel Dense Greyish brown		16	SS	45									○					15 62 23 (SI+CL)		
112.6																					
15.8	End of Borehole Open hole water level at a depth of 6.8 m (elev. 121.6 m) upon completion of drilling.																				

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

DOUBLE LINE 24726 EASTBOUND 20+450 TO 20+900.GPJ 2012TEMPLATE(MTO).GDT 12-16-24

RECORD OF BOREHOLE No B0N19-6

1 OF 2

METRIC

WP# 4068-09-00 LOCATION Lat: 45.485625°, Long: -76.655414°
Bonnechere River Bridge N 5 038 422.9 E 292 651.3 ORIGINATED BY JG
HWY 17 BOREHOLE TYPE CME 45 Trackmount / HSA COMPILED BY JP
DATUM Geodetic DATE 2020.09.17 - 2020.09.17 CHECKED BY MJK

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL LIMIT MOISTURE LIQUID CONTENT LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)						
116.9	Ground Surface							20	40	60	80	100		W _P	W	W _L	kN/m ³	GR SA SI CL
0.0	TOPSOIL (100 mm)							20	40	60	80	100						
0.1	SILTY CLAY (CI) Occasional silty sand seam Very stiff Brown WEATHERED CRUST		1	SS	6										○			
			2	SS	13										○			
			3	SS	10										○			0 2 40 58
			4	SS	11										○			
			5	SS	5										○			
			6	SS	6										○			0 1 58 41
			7	SS	7										○			
			8	SS	18										○			
108.1	SAND, some silt to silty Compact Brown																	
8.8																		

Continued Next Page

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

DOUBLE LINE 24726 EASTBOUND 20+450 TO 20+900.GPJ 2012TEMPLATE(MTO).GDT 11-20-24

METRIC

SOIL PROFILE							SAMPLES								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	GROUND WATER CONDITIONS	ELEVATION SCALE	SHEAR STRENGTH kPa						WATER CONTENT (%)			γ kN/m ³	GR SA SI CL									
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE																				
	Continued From Previous Page																											
	SAND, some silt to silty Compact Brown			9	SS	22		106														0 83 17 (SI+CL)						
								105																				
				10	SS	23		104																				
								103																				
102.6				11	SS	30																						
14.3	End of Borehole Borehole dry on completion.																											
	Monitoring well installation consists of two nested 50 mm diameter Schedule 40 PVC pipe with a 3.0 m slotted screen																											
	Water Level Readings: Shallow Well DATE DEPTH (m) ELEV. (m) 2020/09/29 dry 2020/11/11 dry 2021/08/06 dry 2022/01/11 dry Deep Well DATE DEPTH (m) ELEV. (m) 2020/09/29 dry 2020/11/11 dry 2021/08/06 dry 2022/01/11 dry																											

+³, ×³: Numbers refer to Sensitivity

RECORD OF BOREHOLE No B0N19-7

1 OF 2

METRIC

WP# 4068-09-00 LOCATION Lat: 45.485485°, Long: -76.655113°
Bonnechere River Bridge N 5 038 407.3 E 292 674.7 ORIGINATED BY SH
HWY 17 BOREHOLE TYPE CME 45 Trackmount / HSA COMPILED BY JP
DATUM Geodetic DATE 2020.09.16 - 2020.09.17 CHECKED BY MJK

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		WATER CONTENT (%)					
								○ UNCONFINED + FIELD VANE							
								● QUICK TRIAXIAL × LAB VANE	20 40 60 80 100	20 40 60					
118.0	Ground Surface														
0.0	TOPSOIL (150mm)														
0.2	SILTY CLAY (CI) Occasional sand seam Very stiff Grey-brown WEATHERED CRUST		1	SS	16										
			2	SS	17		117								0 2 36 62
			3	SS	16		116								
			4	SS	11		115								
			5	SS	6		114								
			6	SS	9		113								
			7	SS	7		112						0 0 54 46		
			8	SS	6		111								
			9	SS	5		110								
109.9															
8.1	CLAYEY SILT (CL) Very stiff Grey														
			10	SS	3		109						0 0 58 42		

Continued Next Page

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



DOUBLE LINE 24726 EASTBOUND 20+450 TO 20+900.GPJ 2012TEMPLATE(MTO).GDT 11-20-24

RECORD OF BOREHOLE No B0N19-7

2 OF 2

METRIC

WP# 4068-09-00 LOCATION Lat: 45.485485°, Long: -76.655113°
Bonnechere River Bridge N 5 038 407.3 E 292 674.7 ORIGINATED BY SH
HWY 17 BOREHOLE TYPE CME 45 Trackmount / HSA COMPILED BY JP
DATUM Geodetic DATE 2020.09.16 - 2020.09.17 CHECKED BY MJK

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE												
	Continued From Previous Page						20	40	60	80	100	20	40	60						
104.0	CLAYEY SILT (CL) Very stiff Grey		11	SS	WH		107										0 1 62 37			
			12	SS	1															
14.0	SILTY SAND		13	SS	5		104													
103.7	Compact																			
14.3	Brown																			
	End of Borehole																			
	Borehole dry upon completion.																			

DOUBLE LINE 24726 EASTBOUND 20+450 TO 20+900.GPJ 2012TEMPLATE(MTO).GDT 11-20-24

RECORD OF BOREHOLE No B0N19-8

1 OF 2

METRIC

WP# 4068-09-00 LOCATION Lat: 45.485283°, Long: -76.654548°
Bonnechere River Bridge N 5 038 384.8 E 292 718.9 ORIGINATED BY JP
HWY 17 BOREHOLE TYPE CME 45 Trackmount / HSA COMPILED BY JP
DATUM Geodetic DATE 2020.09.15 - 2020.09.15 CHECKED BY MJK

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				W P W W L				GR	SA	SI	CL	
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	20	40	60	80	100	20		40	60			
117.7	Ground Surface																			
0.0	SILTY CLAY (CI) Occasional sand seams Very stiff Grey-brown WEATHERED CRUST		1	SS	4								○							
			2	SS	7								┌─○─┐				0	7	40	53
			3	SS	7								○							
			4	SS	5								○							
			5	SS	5								○							
			6	SS	6								┌─○─┐				0	0	52	48
			7	SS	5								○							
			8	SS	6								○							
			9	SS	4								┌─○─┐				0	1	56	43
109.5																				
8.2	CLAYEY SILT (CL) Stiff to very stiff Grey-brown to brown																			

Continued Next Page

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

DOUBLE LINE 24726 EASTBOUND 20+450 TO 20+900.GPJ 2012TEMPLATE(MTO).GDT 11-20-24

RECORD OF BOREHOLE No B0N19-8

2 OF 2

METRIC

WP# 4068-09-00 LOCATION Lat: 45.485283°, Long: -76.654548°
Bonnehchere River Bridge N 5 038 384.8 E 292 718.9 ORIGINATED BY JP
HWY 17 BOREHOLE TYPE CME 45 Trackmount / HSA COMPILED BY JP
DATUM Geodetic DATE 2020.09.15 - 2020.09.15 CHECKED BY MJK

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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106.4	CLAYEY SILT (CL) Stiff to very stiff Grey-brown to brown		11	SS	9		107																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							

DOUBLE LINE 24726 EASTBOUND 20+450 TO 20+900.GPJ 2012TEMPLATE(MTO).GDT 11-20-24

RECORD OF BOREHOLE No B0N19-9

1 OF 2

METRIC

WP# 4068-09-00 LOCATION Lat: 45.485106°, Long: -76.654137°
Bonnechere River Bridge N 5 038 365.0 E 292 751.0 ORIGINATED BY JP
HWY 17 BOREHOLE TYPE CME 45 Trackmount / HSA COMPILED BY JP
DATUM Geodetic DATE 2020.09.14 - 2020.09.14 CHECKED BY MJK

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W P W W L								
								○ UNCONFINED + FIELD VANE													
								● QUICK TRIAXIAL × LAB VANE					WATER CONTENT (%)								
117.8	Ground Surface						20	40	60	80	100	20	40	60							
0.0	SILTY CLAY (CI) Occasional sand seams Very stiff Grey-brown WEATHERED CRUST		1	SS	4								○								
			2	SS	9								○								
			3	SS	11								○								
			4	SS	10								○								
			5	SS	8								○								
			6	SS	8								○								
			7	SS	8								○								
			8	SS	6								○								
			9	SS	7								○								
109.9			10	SS	5								○								
7.9	CLAYEY SILT (CL) Occasional sand seams Stiff Grey																				
			11	SS	1																

DOUBLE LINE 24726 EASTBOUND 20+450 TO 20+900.GPJ 2012TEMPLATE(MTO).GDT 11-20-24

Continued Next Page

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

METRIC

[illegible]

DOUBLE LINE 24726 EASTBOUND 20+450 TO 20+900.GPJ 2012TEMPLATE(MTO).GDT 11-20-24

+³, ×³: Numbers refer to Sensitivity

RECORD OF BOREHOLE No OBR19-14

1 OF 2

METRIC

WP# 4068-09-00 LOCATION Lat: 45.483006°, Long: -76.649333°
O'Brien Road W-S Ramp N 5 038 130.9 E 293 126.1 ORIGINATED BY NW
HWY 17 BOREHOLE TYPE CME 55 Trackmount / HSA COMPILED BY JP
DATUM Geodetic DATE 2020.02.05 - 2020.02.05 CHECKED BY FG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				
132.2	Ground Surface											
0.1	TOPSOIL (50 mm)											
	SILTY SAND Loose to compact Brown		1	SS	7		132					
			2	SS	17		131					
130.7												
1.5	SAND with silt and gravel to GRAVEL with silt and sand Occasional to frequent cobbles Compact to very dense Brown		3	SS	33		130					
			4	SS	26							
			5	SS	25		129					
			6	SS	38		128					
	- Grinding while augering		7	SS	20		127					
	- Poor sample recovery below elevation 126 m		8	SS	15		126					
							125					
			9	SS	17		124					
	- Very heavy grinding while augering		10	SS	100/ 150mm		123					

DOUBLE LINE 24726 EASTBOUND 20+450 TO 20+900.GPJ 2012TEMPLATE(MTO).GDT 11-20-24

Continued Next Page

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

RECORD OF BOREHOLE No OBR19-14

2 OF 2

METRIC

WP# 4068-09-00 LOCATION Lat: 45.483006°, Long: -76.649333°
O'Brien Road W-S Ramp N 5 038 130.9 E 293 126.1 ORIGINATED BY NW
HWY 17 BOREHOLE TYPE CME 55 Trackmount / HSA COMPILED BY JP
DATUM Geodetic DATE 2020.02.05 - 2020.02.05 CHECKED BY FG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
	Continued From Previous Page						20	40	60	80	100	20	40	60			
117.9 																	

DOUBLE LINE 24726 EASTBOUND 20+450 TO 20+900.GPJ 2012TEMPLATE(MTO).GDT 11-20-24

RECORD OF BOREHOLE No OBR19-15

1 OF 2

METRIC

WP# 4068-09-00 LOCATION Lat: 45.483311°, Long: -76.649816°
O'Brien Road W-S Ramp N 5 038 164.8 E 293 088.4 ORIGINATED BY NW
HWY 17 BOREHOLE TYPE CME 55 Trackmount / HSA COMPILED BY JP
DATUM Geodetic DATE 2020.02.06 - 2020.02.06 CHECKED BY FG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		W _P	W	W _L		
129.1	Ground Surface							20 40 60 80 100						0 85 15 (SI+CL)
0.0	TOPSOIL (50 mm)							20 40 60 80 100						
	SILTY SAND to SAND with silt Loose to compact Brown		1	SS	4							○		
			2	SS	4							○		
			3	SS	4							○		
			4	SS	6							○		
			5	SS	4							○		
			6	SS	7							○		
			7	SS	10							○		
			8	SS	15							○		3 86 11 (SI+CL)
			9	SS	14							○		
119.7	CLAYEY SILT (CL)		10	SS	6							○	○	
9.4	Stiff Brown													

Continued Next Page



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

RECORD OF BOREHOLE No OBR19-15

2 OF 2

METRIC

WP# 4068-09-00 LOCATION Lat: 45.483311°, Long: -76.649816°
O'Brien Road W-S Ramp N 5 038 164.8 E 293 088.4 ORIGINATED BY NW
HWY 17 BOREHOLE TYPE CME 55 Trackmount / HSA COMPILED BY JP
DATUM Geodetic DATE 2020.02.06 - 2020.02.06 CHECKED BY FG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE										
								20 40 60 80 100	20 40 60									
	Continued From Previous Page						119											
	CLAYEY SILT (CL) Stiff Brown		11	SS	3		118						○		0 2 64 34			
116.4			12	SS	17		117						○					
116.3													○					
12.8	SILTY SAND Compact Brown																	
	End of Borehole Monitoring well consists of 50mm diameter Schedule 40 PVC pipe with a 1.5 m slotted screen Water Level Readings: DATE DEPTH (m) ELEV. (m) 2020/02/07 8.0 121.1 2020/04/21 6.3 122.8 2020/09/29 6.9 122.2 2021/09/29 6.9 122.2 2021/10/04 6.9 122.2 2021/10/20 8.0 121.1 2022/01/20 7.1 122.0																	

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

RECORD OF BOREHOLE No OBR19-16

1 OF 2

METRIC

WP# 4068-09-00 LOCATION Lat: 45.483542°, Long: -76.650316°
O'Brien Road W-S Ramp N 5 038 190.7 E 293 049.4 ORIGINATED BY NW
HWY 17 BOREHOLE TYPE CME 55 Trackmount / HSA COMPILED BY JP
DATUM Geodetic DATE 2020.02.05 - 2020.02.05 CHECKED BY FG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)					
								○ UNCONFINED + FIELD VANE				W _P W W _L					
								● QUICK TRIAXIAL × LAB VANE	20 40 60 80 100				20 40 60				
127.9	Ground Surface																
0.0	TOPSOIL (50 mm)																
0.1	SILTY SAND Loose Brown		1	SS	10												
			2	SS	6												
			3	SS	4												
			4	SS	6												
			5	SS	8												
124.1																	
3.8	SAND with silt Loose to compact Brown		6	SS	12												
			7	SS	21												
	- Running sands below 5.8 m																
			8	SS	8												
			9	SS	12												
119.7																	
8.2	Begin DCPT at 8.2 m																
														</			

Continued Next Page

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

DOUBLE LINE 24726 EASTBOUND 20+450 TO 20+900.GPJ 2012TEMPLATE(MTO).GDT 11-20-24

RECORD OF BOREHOLE No OBR19-16

2 OF 2

METRIC

WP# 4068-09-00 LOCATION Lat: 45.483542°, Long: -76.650316°
O'Brien Road W-S Ramp N 5 038 190.7 E 293 049.4 ORIGINATED BY NW
HWY 17 BOREHOLE TYPE CME 55 Trackmount / HSA COMPILED BY JP
DATUM Geodetic DATE 2020.02.05 - 2020.02.05 CHECKED BY FG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
	Continued From Previous Page DCPT continued																
							117										
							116										
							115										
							114										
							113										
112.7	DCPT ended																
15.2	End of Borehole																

DOUBLE LINE 24726 EASTBOUND 20+450 TO 20+900.GPJ 2012TEMPLATE(MTO).GDT 11-20-24



Appendix C.

Laboratory Testing



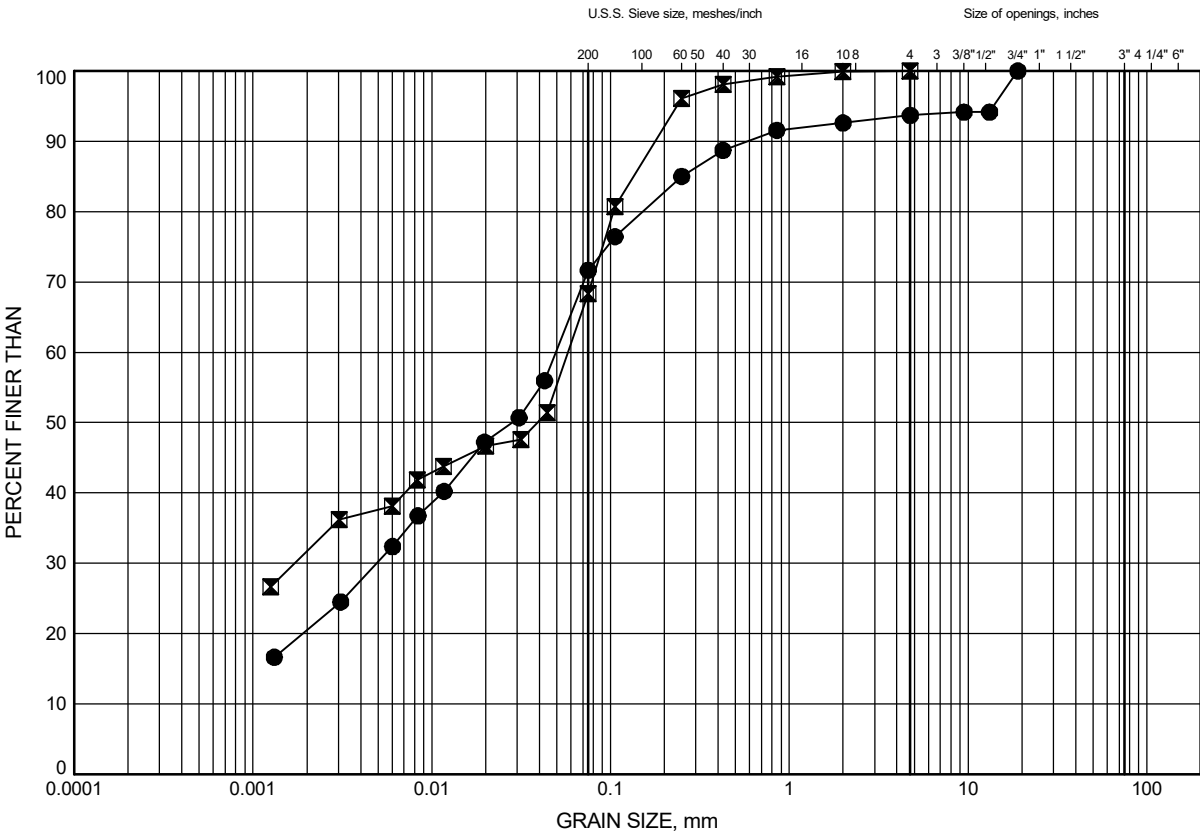
Appendix C.1
Particle Size Analysis Figures
Atterberg Limit Test Results

Highway 17 Twinning, Sta. 20+450 to 20+900

GRAIN SIZE DISTRIBUTION

FIGURE C1

Sandy Clayey Silt (CL)

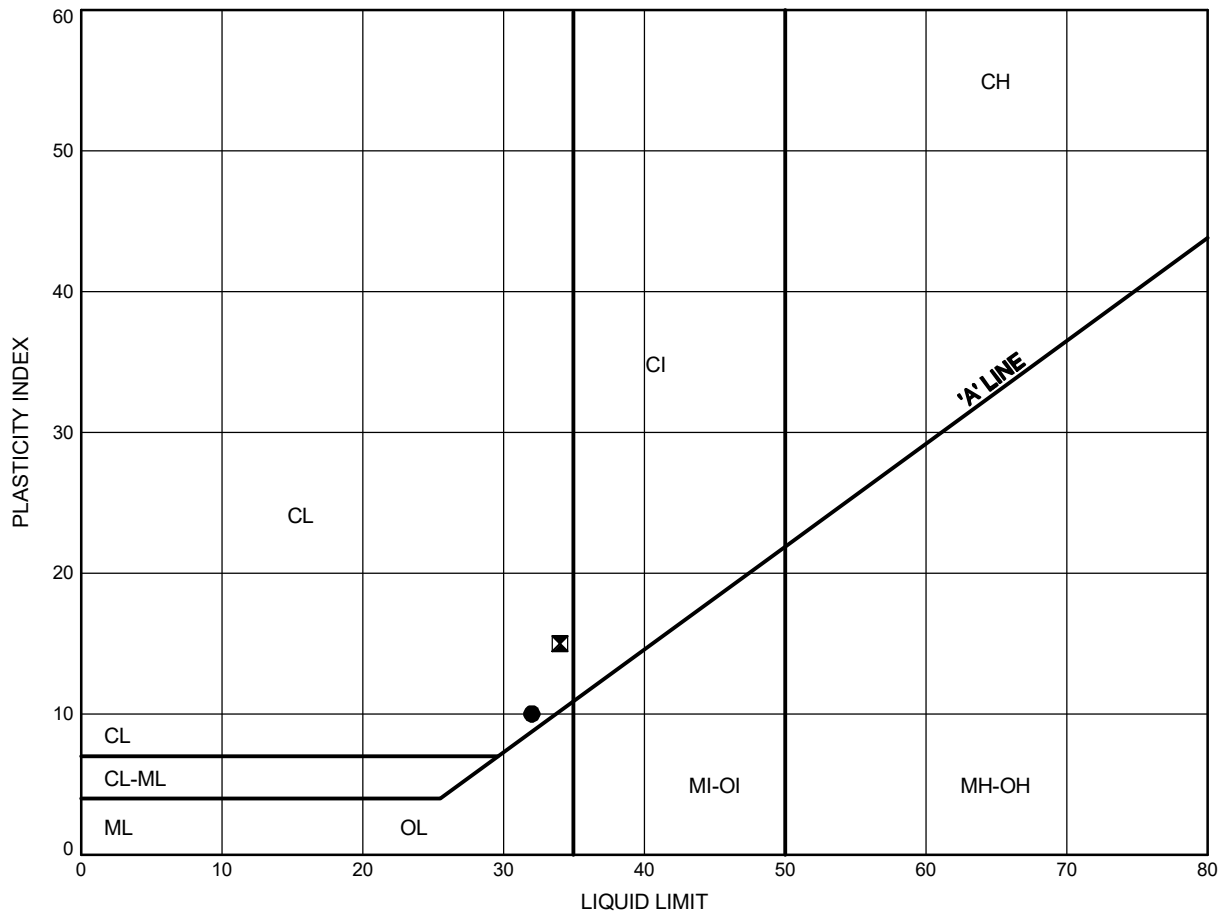


Highway 17 Twinning, Sta. 20+450 to 20+900

ATTERBERG LIMITS TEST RESULTS

FIGURE C2

Sandy Clayey Silt (CL)



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	EB23-03	0.3	119.5
⊠	EB23-08	1.1	125.0

Date ..October 2024.....
WP# ..4068-09-00.....



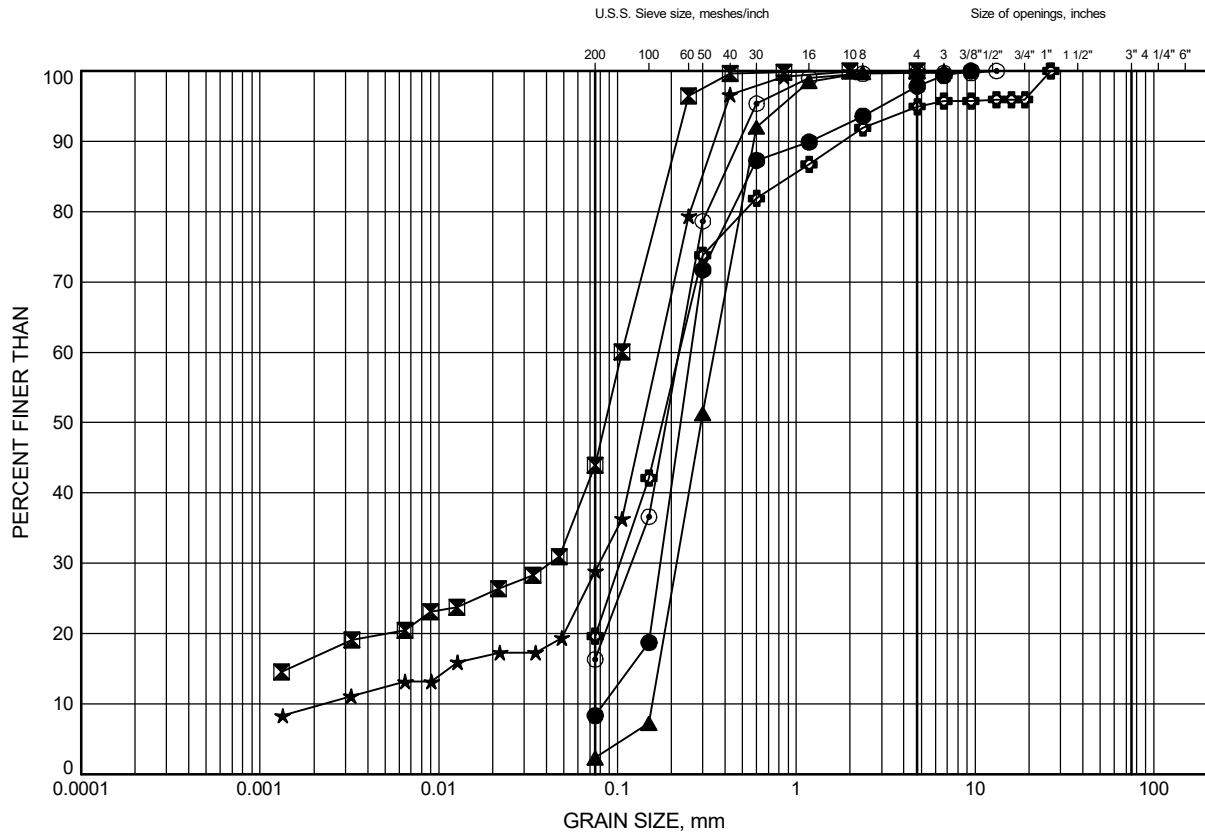
Prep'dRH.....
Chkd.AO.....

Highway 17 Twinning, Sta. 20+450 to 20+900

GRAIN SIZE DISTRIBUTION

FIGURE C3

Upper Sand to Silty Sand



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	EB23-08	4.9	121.2
⊠	EB23-09	1.1	126.6
▲	EB23-09	7.9	119.8
★	EB23-10	1.1	127.3
⊙	EB23-10	5.6	122.8
⊕	EB23-10	7.9	120.5

Date ..October 2024.....
 WP# ..4068-09-00.....



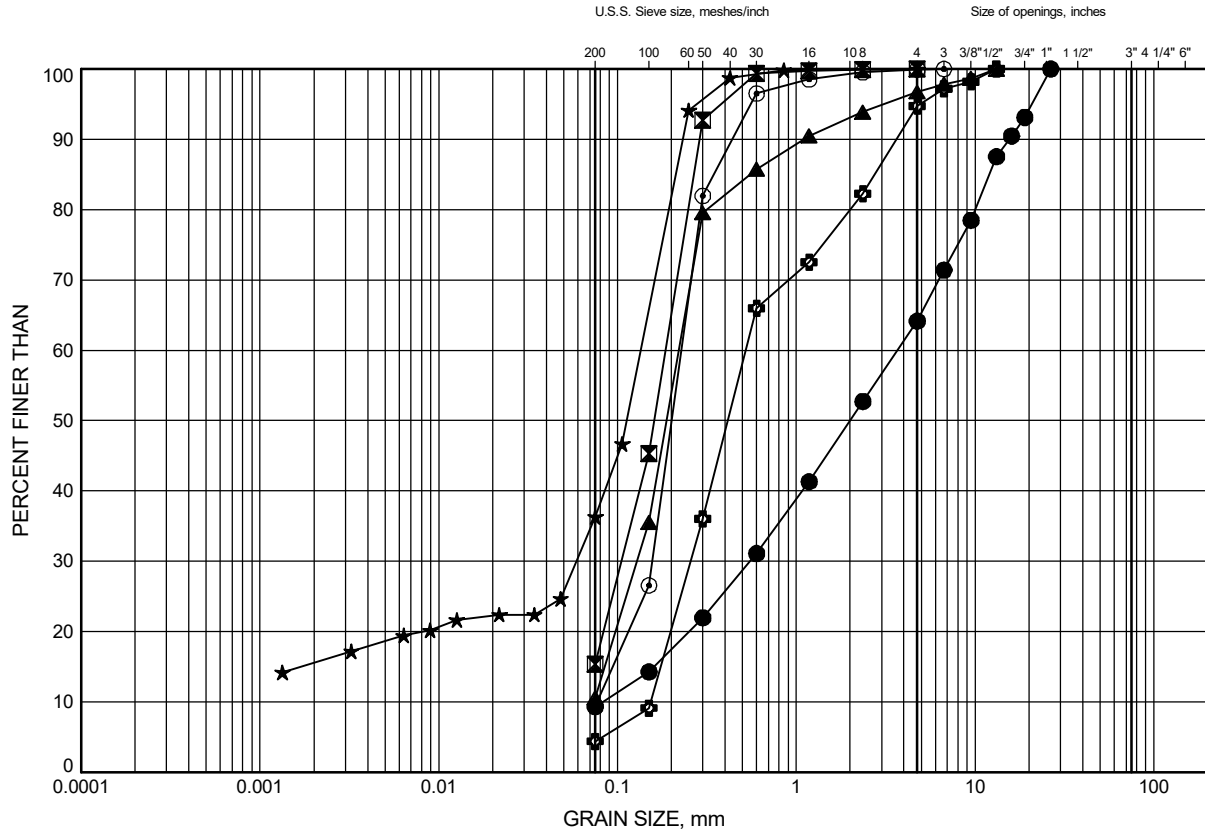
Prep'dRH.....
 Chkd.AO.....

Highway 17 Twinning, Sta. 20+450 to 20+900

GRAIN SIZE DISTRIBUTION

FIGURE C4

Upper Sand to Silty Sand



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	OBR19-14	2.6	129.6
⊠	OBR19-15	1.8	127.3
▲	OBR19-15	6.4	122.7
★	OBR19-16	2.6	125.3
⊙	OBR19-16	4.9	123.0
⊕	OBR19-16	7.9	120.0

Date ..October 2024.....

WP# ..4068-09-00.....



Prep'dRH.....

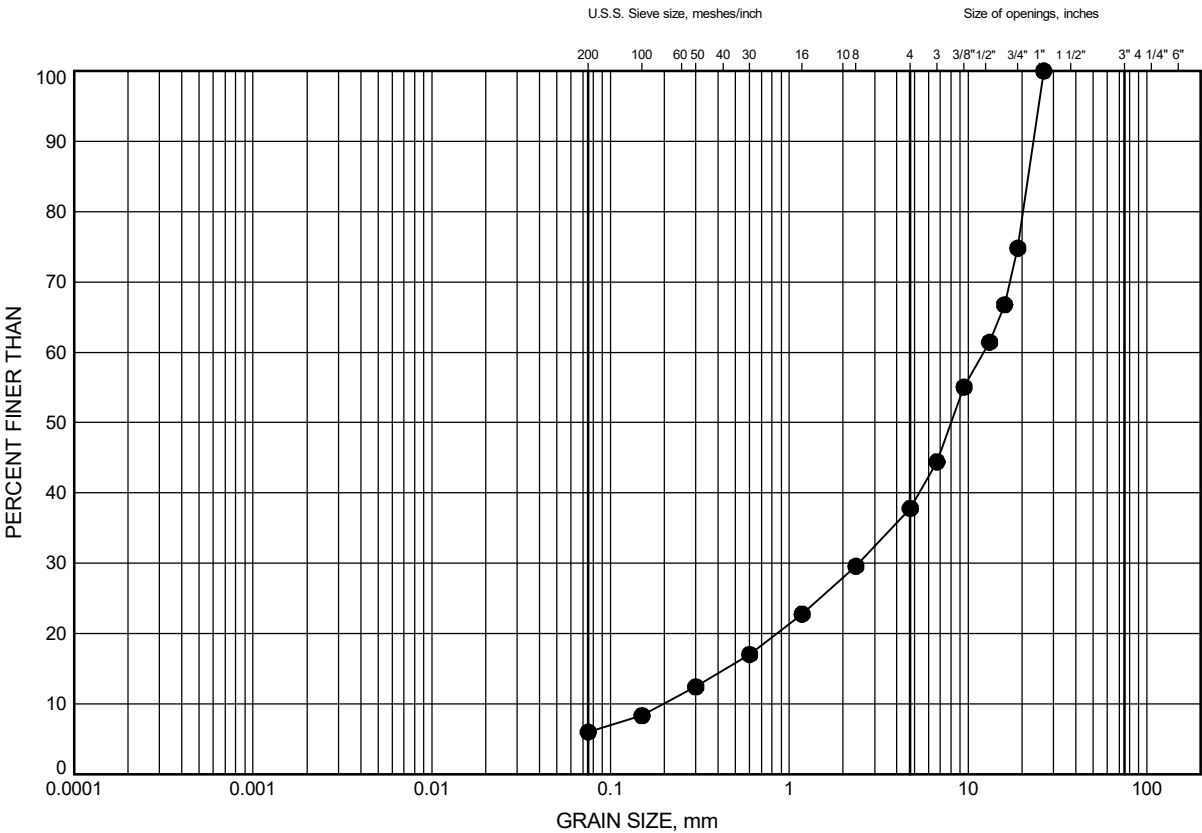
Chkd.AO.....

Highway 17 Twinning, Sta. 20+450 to 20+900

GRAIN SIZE DISTRIBUTION

FIGURE C5

Gravel with Silt and Sand



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	OBR19-14	11.0	121.2

GRAIN SIZE DISTRIBUTION - THURBER 24726 EASTBOUND 20+450 TO 20+900.GPJ 10-1-24

Date ..October 2024.....
WP# ..4068-09-00.....



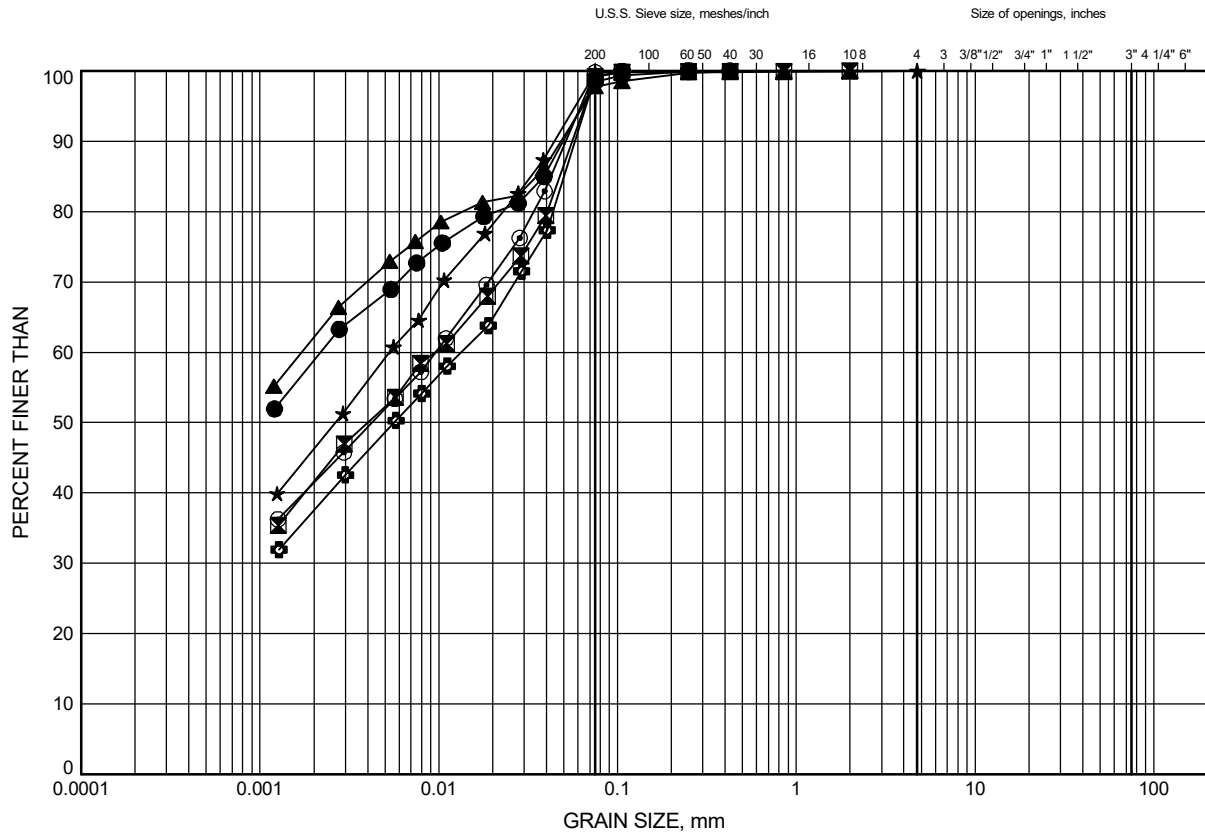
Prep'dRH.....
Chkd.AO.....

Highway 17 Twinning, Sta. 20+450 to 20+900

GRAIN SIZE DISTRIBUTION

FIGURE C6

Clay (CH) to Silty Clay (CI) to Clayey Silt (CL)



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BON19-6	1.8	115.1
⊠	BON19-6	6.4	110.5
▲	BON19-7	1.1	116.9
★	BON19-7	4.9	113.1
⊙	BON19-7	9.4	108.6
⊕	BON19-7	12.5	105.5

Date ..October 2024.....
 WP# ..4068-09-00.....



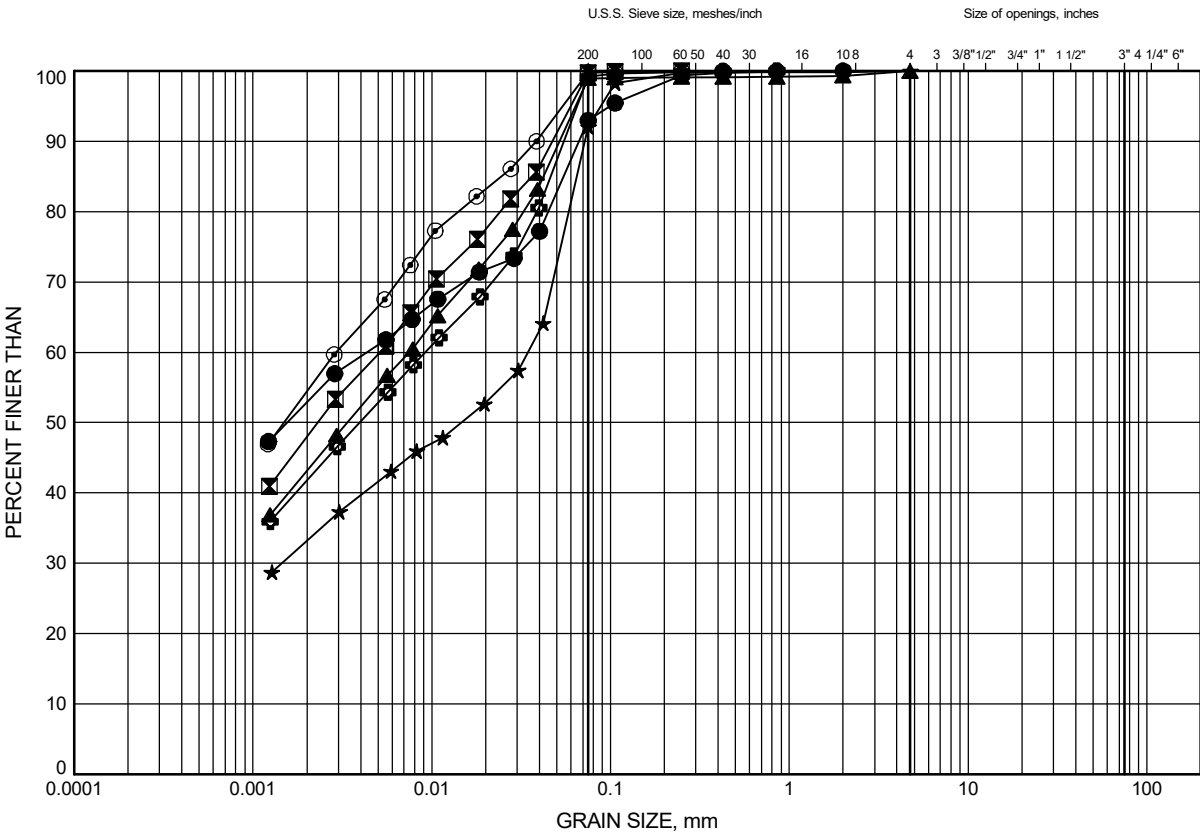
Prep'dRH.....
 Chkd.AO.....

Highway 17 Twinning, Sta. 20+450 to 20+900

GRAIN SIZE DISTRIBUTION

FIGURE C7

Clay (CH) to Silty Clay (CI) to Clayey Silt (CL)



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BON19-8	1.1	116.6
⊠	BON19-8	4.9	112.8
▲	BON19-8	7.9	109.8
★	BON19-8	11.0	106.7
⊙	BON19-9	2.6	115.2
⊕	BON19-9	9.4	108.4

GRAIN SIZE DISTRIBUTION - THURBER 24726 EASTBOUND 20+450 TO 20+900.GPJ 10-1-24

Date ..October 2024.....
WP# ..4068-09-00.....

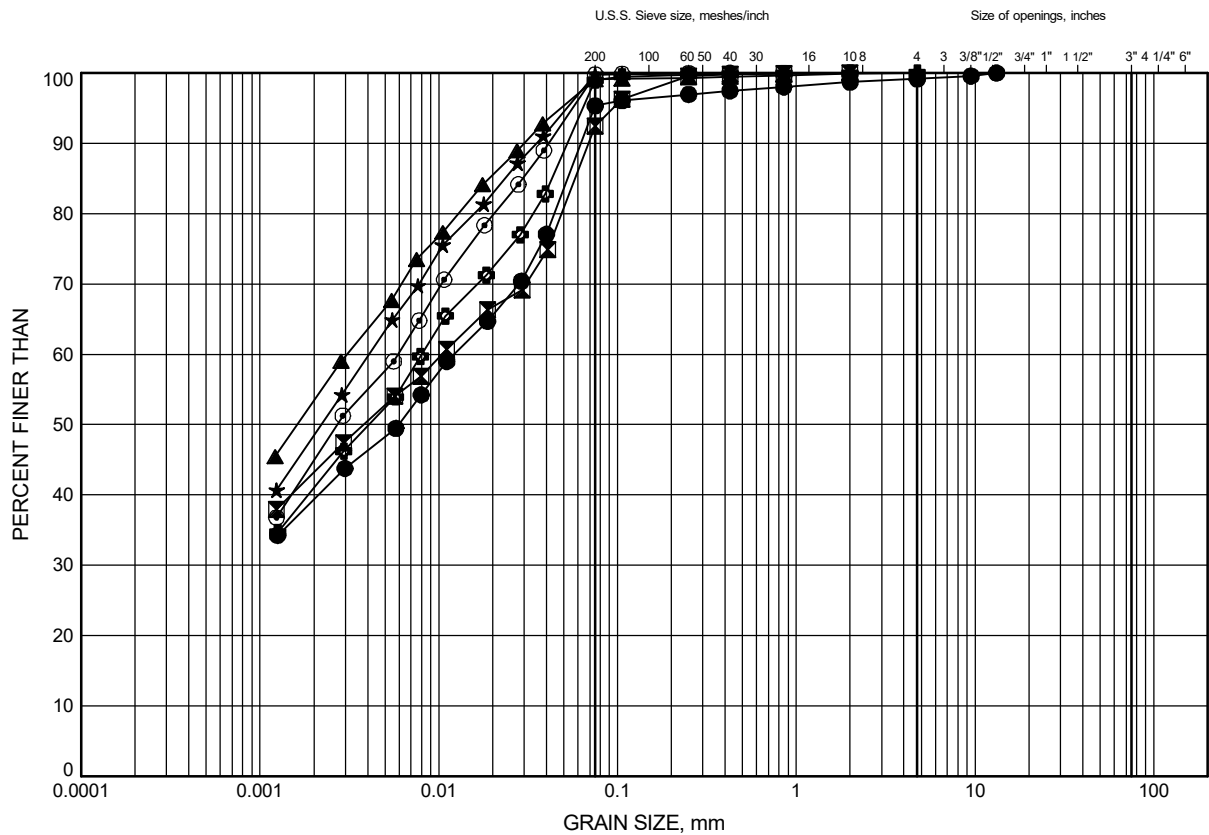


Prep'dRH.....
Chkd.AO.....

Highway 17 Twinning, Sta. 20+450 to 20+900 GRAIN SIZE DISTRIBUTION

FIGURE C8

Clay (CH) to Silty Clay (CI) to Clayey Silt (CL)



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BON19-9	11.0	106.8
⊠	EB23-01	1.2	117.4
▲	EB23-01	6.4	112.2
★	EB23-01	11.0	107.6
⊙	EB23-02	3.4	116.2
⊕	EB23-02	9.4	110.2

Date ..October 2024.....

WP# ..4068-09-00.....



Prep'dRH.....

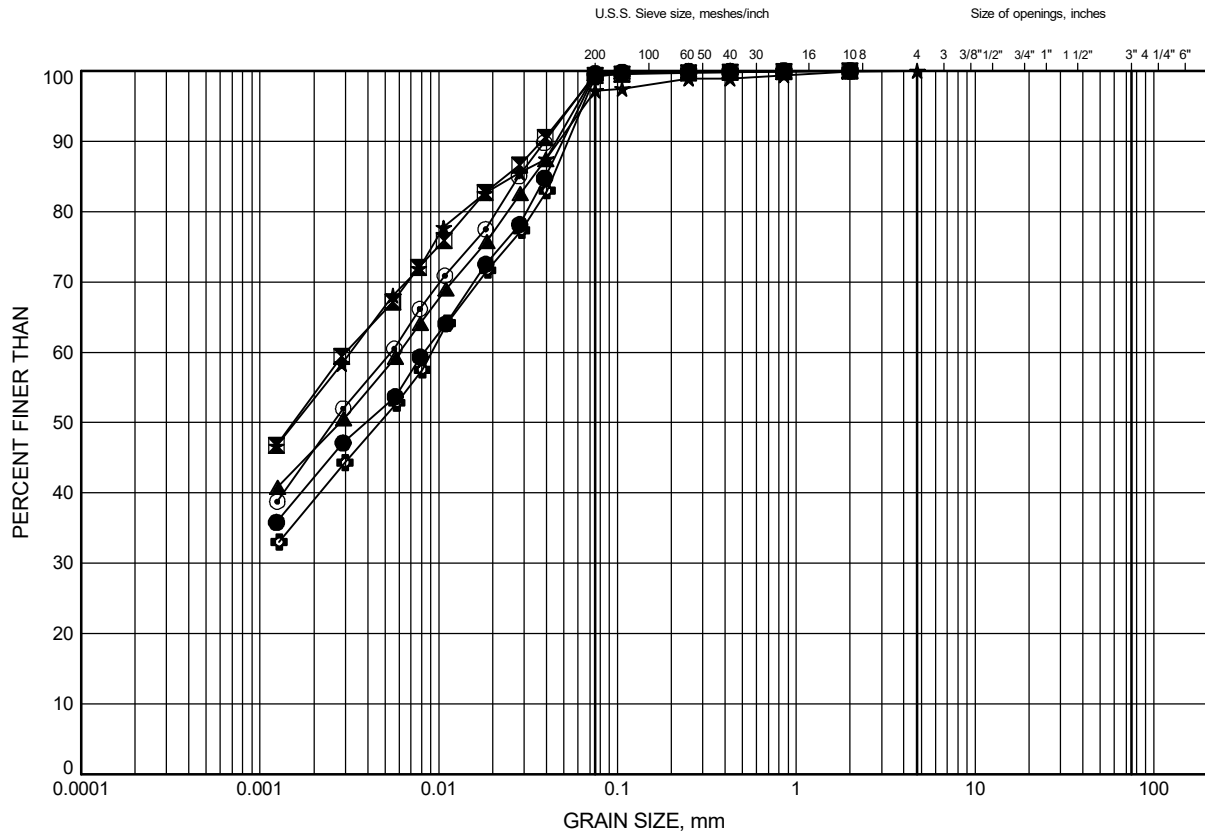
Chkd.AO.....

Highway 17 Twinning, Sta. 20+450 to 20+900

GRAIN SIZE DISTRIBUTION

FIGURE C9

Clay (CH) to Silty Clay (CI) to Clayey Silt (CL)



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	EB23-03	6.4	113.4
⊠	EB23-04	1.8	118.9
▲	EB23-04	7.9	112.8
★	EB23-05	1.1	120.5
⊙	EB23-05	7.9	113.7
⊕	EB23-05	12.5	109.1

Date ..October 2024.....
 WP# ..4068-09-00.....

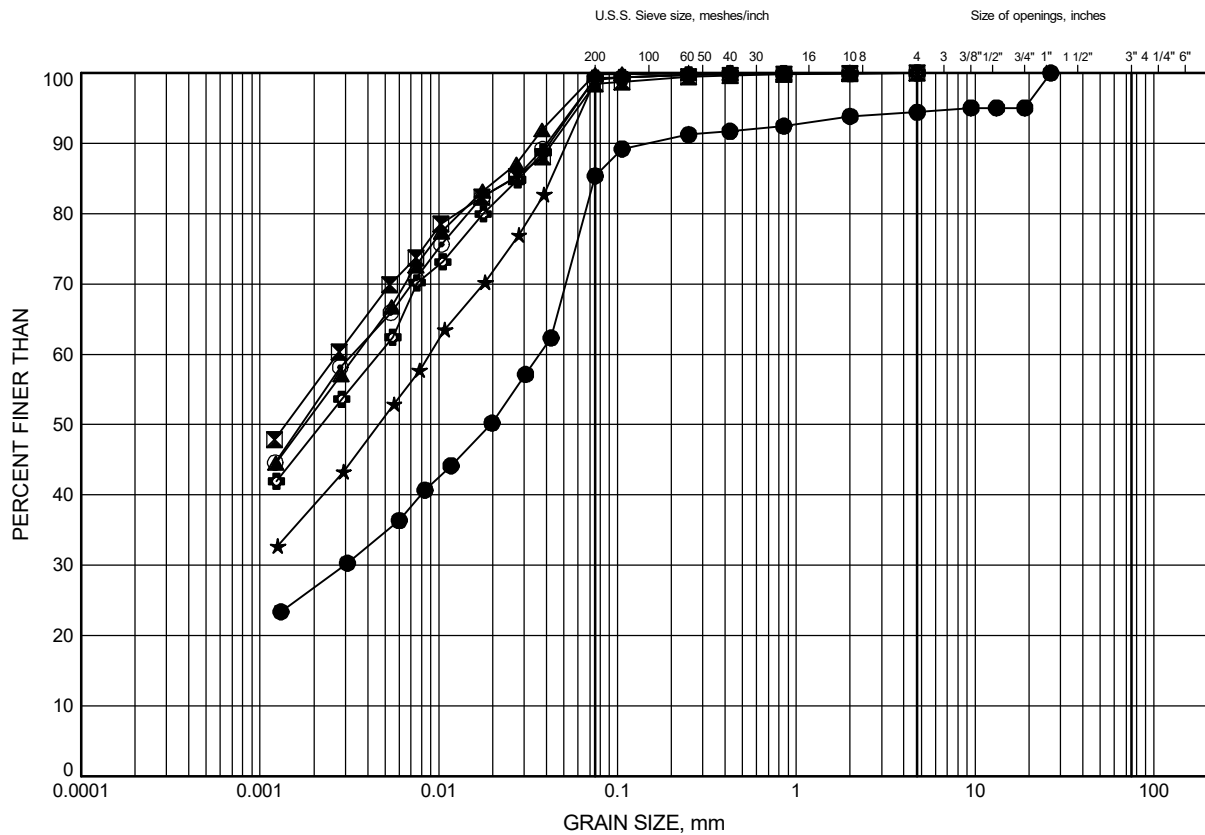


Prep'dRH.....
 Chkd.AO.....

Highway 17 Twinning, Sta. 20+450 to 20+900
GRAIN SIZE DISTRIBUTION

FIGURE C10

Clay (CH) to Silty Clay (CI) to Clayey Silt (CL)



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	EB23-05	15.5	106.1
⊠	EB23-06	1.1	121.6
▲	EB23-06	4.9	117.8
★	EB23-06	12.5	110.2
⊙	EB23-07	1.8	121.7
⊕	EB23-07	6.4	117.1

Date ..October 2024.....
WP# ..4068-09-00.....



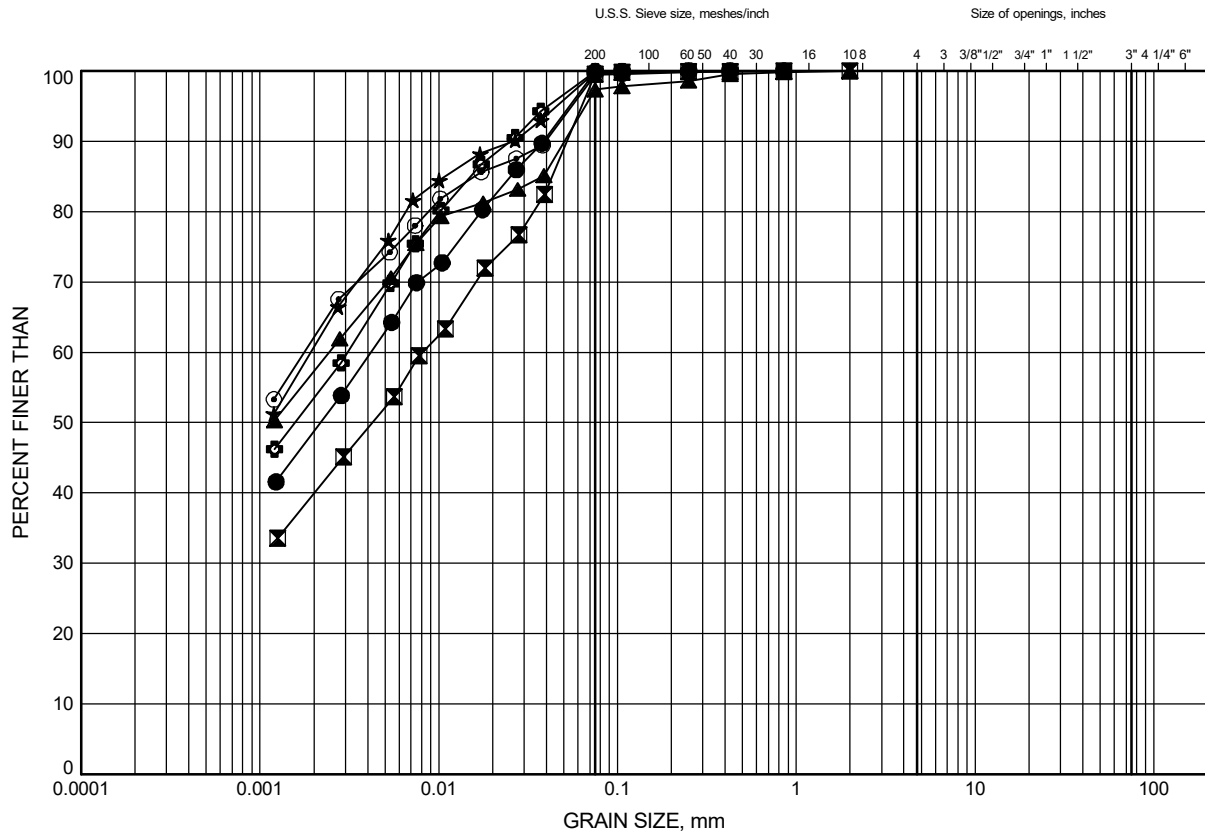
Prep'dRH.....
Chkd.AO.....

Highway 17 Twinning, Sta. 20+450 to 20+900

GRAIN SIZE DISTRIBUTION

FIGURE C11

Clay (CH) to Silty Clay (CI) to Clayey Silt (CL)



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	EB23-07	7.9	115.6
⊠	EB23-07	14.0	109.5
▲	EB23-08	6.4	119.7
★	EB23-08	12.5	113.6
⊙	EB23-09	10.4	117.3
⊕	EB23-09	14.9	112.8

Date ..October 2024.....
 WP# ..4068-09-00.....



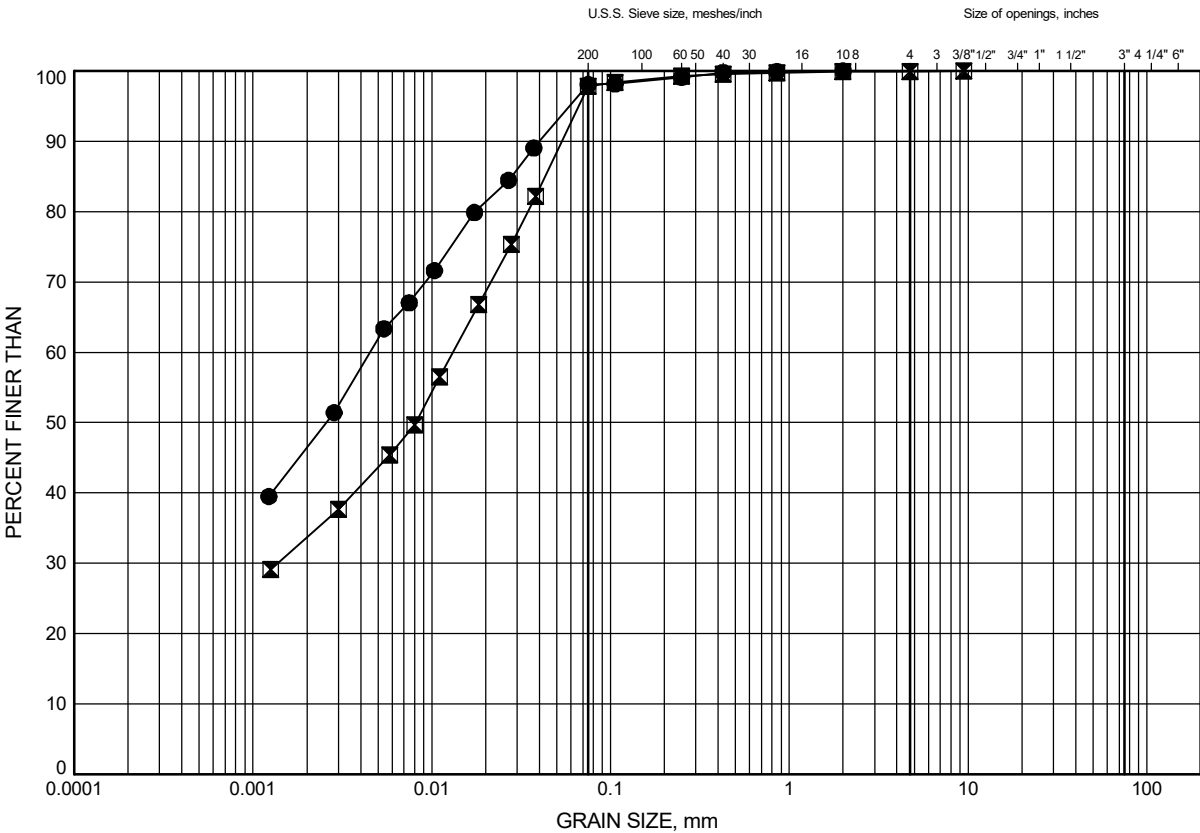
Prep'd ..RH.....
 Chkd.AO.....

Highway 17 Twinning, Sta. 20+450 to 20+900

GRAIN SIZE DISTRIBUTION

FIGURE C12

Clay (CH) to Silty Clay (CI) to Clayey Silt (CL)



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	EB23-10	12.5	115.9
⊠	OBR19-15	11.0	118.1

GRAIN SIZE DISTRIBUTION - THURBER 24726 EASTBOUND 20+450 TO 20+900.GPJ 10-1-24

Date ..October 2024.....
WP# ..4068-09-00.....



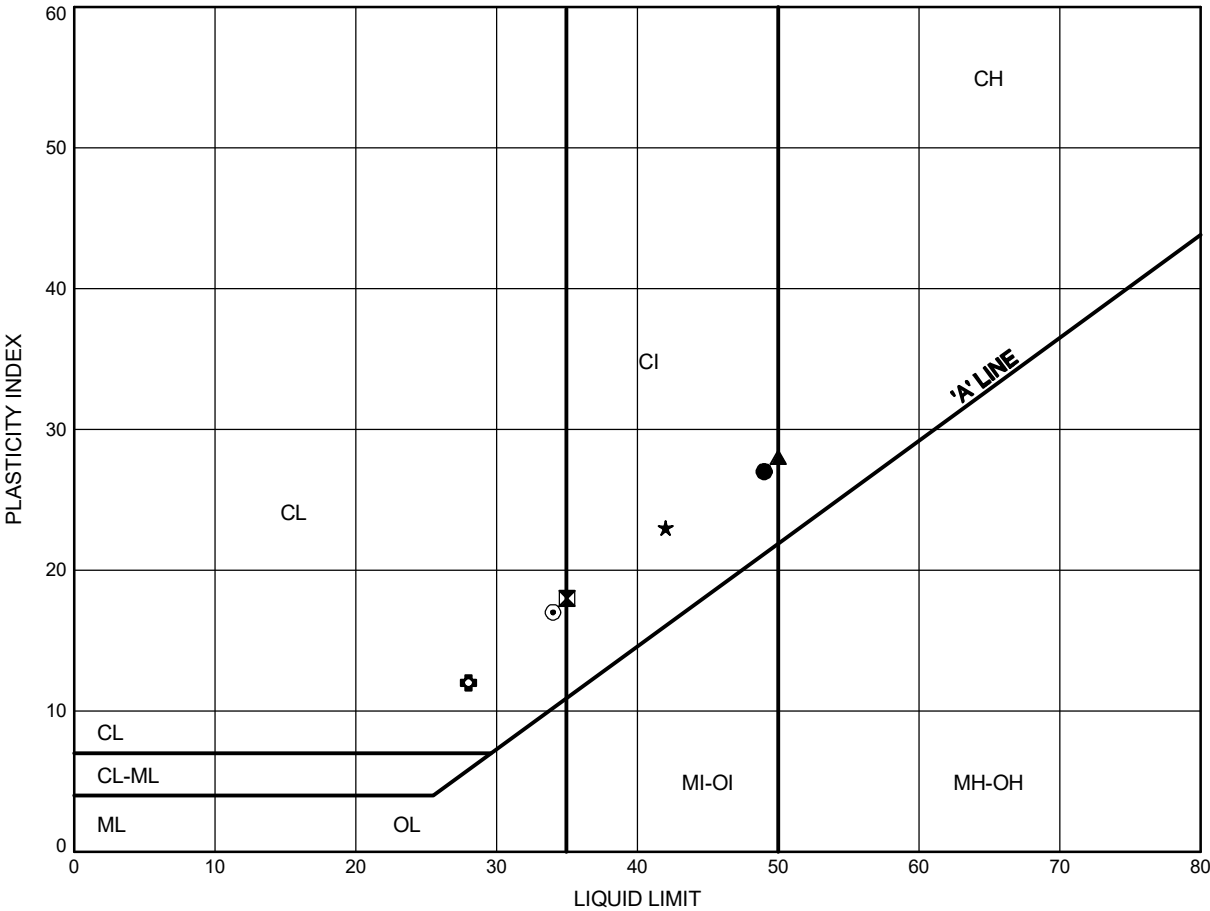
Prep'dRH.....
Chkd.AO.....

Highway 17 Twinning, Sta. 20+450 to 20+900

ATTERBERG LIMITS TEST RESULTS

FIGURE C13

Clay (CH) to Silty Clay (CI) to Clayey Silt (CL)



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BON19-6	1.8	115.1
⊠	BON19-6	6.4	110.5
▲	BON19-7	1.1	116.9
★	BON19-7	4.9	113.1
⊙	BON19-7	9.4	108.6
⊕	BON19-7	12.5	105.5

Date ..October 2024.....
WP# ..4068-09-00.....



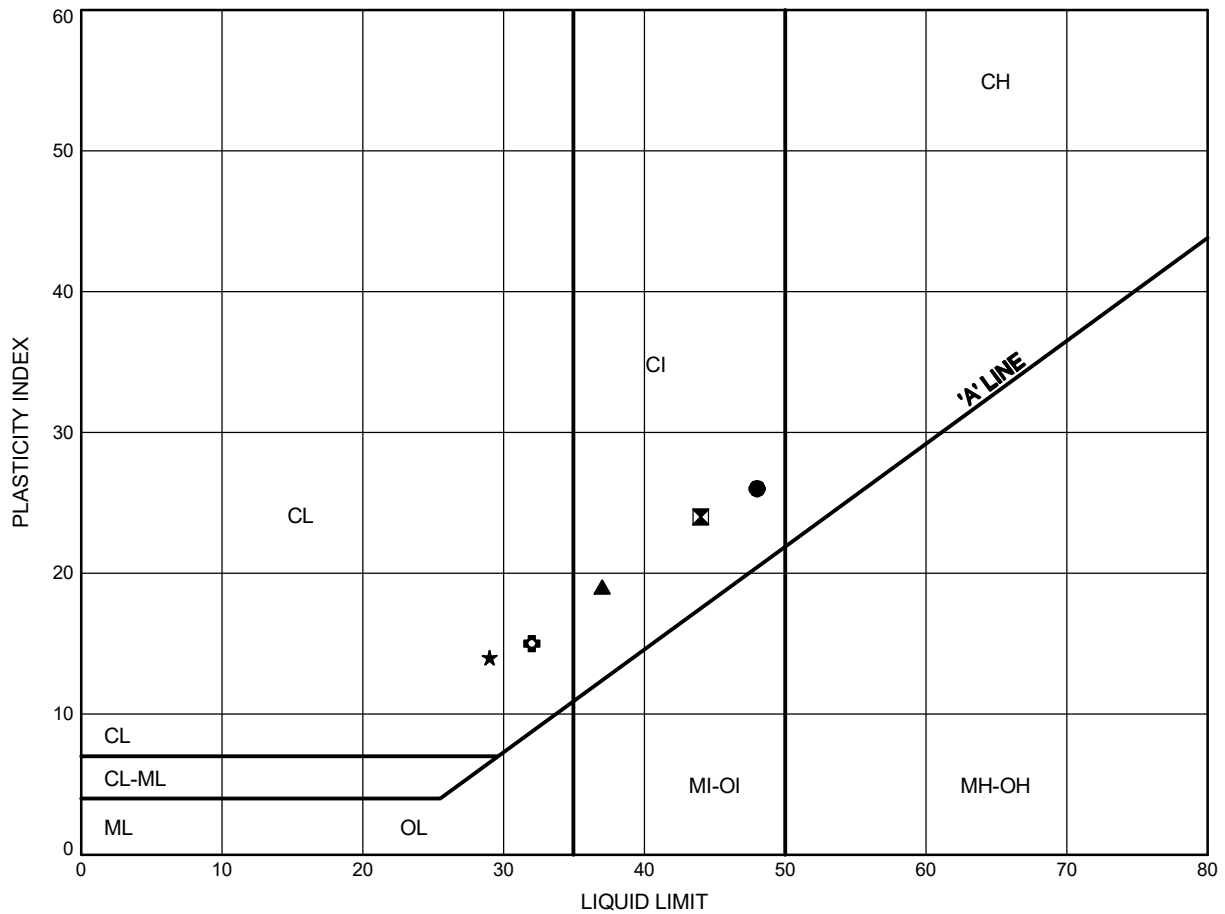
Prep'dRH.....
Chkd.AO.....

Highway 17 Twinning, Sta. 20+450 to 20+900

ATTERBERG LIMITS TEST RESULTS

FIGURE C14

Clay (CH) to Silty Clay (CI) to Clayey Silt (CL)



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BON19-8	1.1	116.6
⊠	BON19-8	4.9	112.8
▲	BON19-8	7.9	109.8
★	BON19-8	11.0	106.7
⊙	BON19-9	2.6	115.2
⊕	BON19-9	9.4	108.4

Date ..October 2024.....
 WP# ..4068-09-00.....



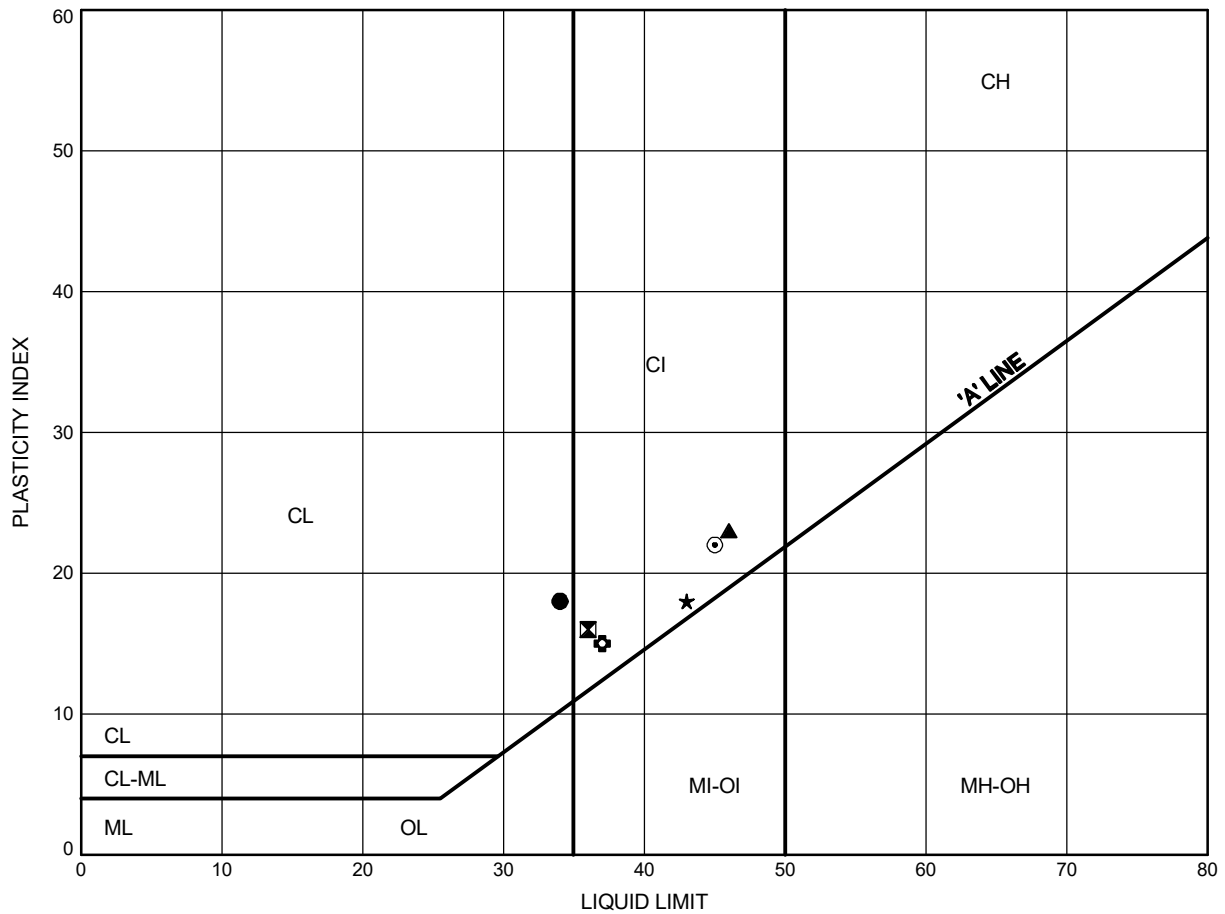
Prep'dRH.....
 Chkd.AO.....

Highway 17 Twinning, Sta. 20+450 to 20+900

ATTERBERG LIMITS TEST RESULTS

FIGURE C15

Clay (CH) to Silty Clay (CI) to Clayey Silt (CL)



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BON19-9	11.0	106.8
⊠	EB23-01	1.2	117.4
▲	EB23-01	6.4	112.2
★	EB23-01	11.0	107.6
⊙	EB23-02	3.4	116.2
⊕	EB23-02	9.4	110.2

Date ..October 2024.....
 WP# ..4068-09-00.....



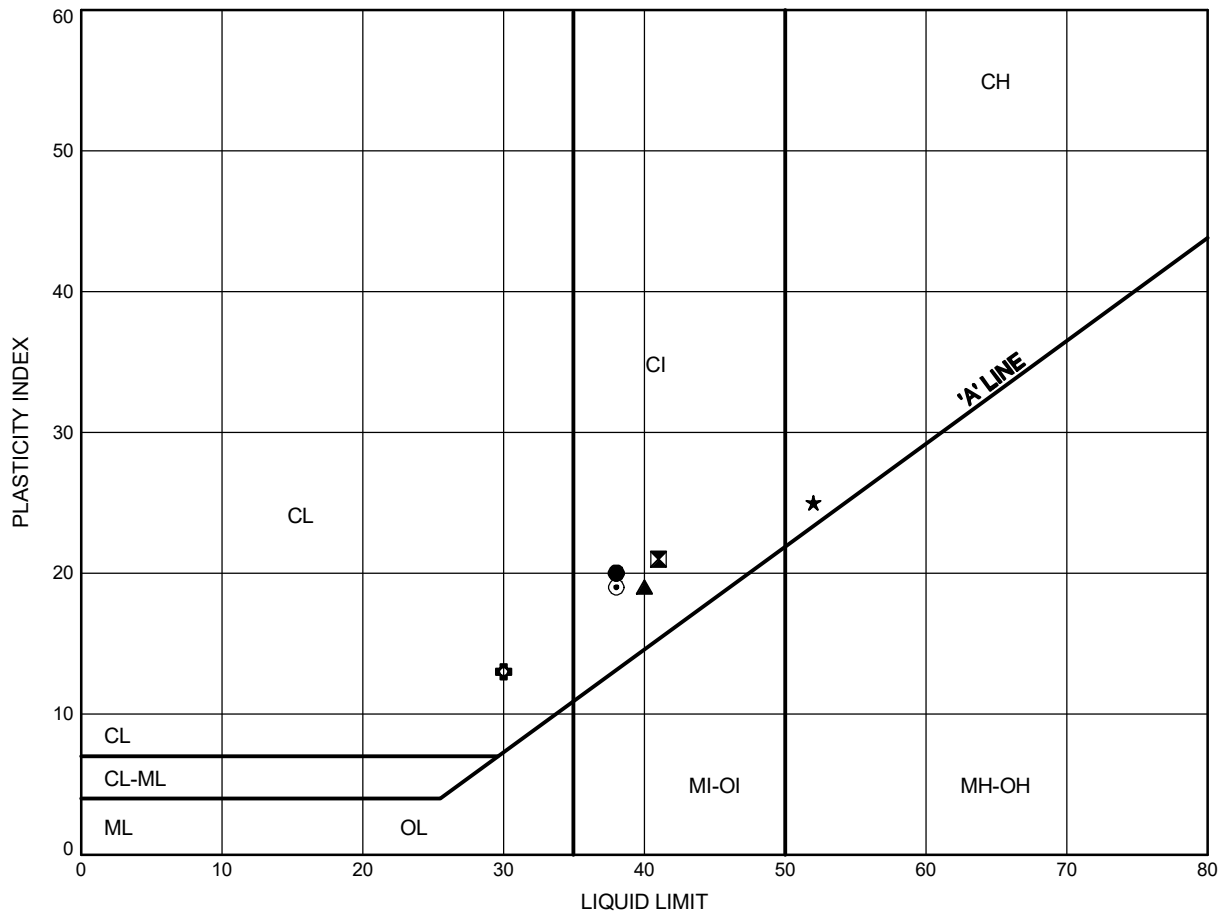
Prep'dRH.....
 Chkd.AO.....

Highway 17 Twinning, Sta. 20+450 to 20+900

ATTERBERG LIMITS TEST RESULTS

FIGURE C16

Clay (CH) to Silty Clay (CI) to Clayey Silt (CL)



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	EB23-03	6.4	113.4
⊠	EB23-04	1.8	118.9
▲	EB23-04	7.9	112.8
★	EB23-05	1.1	120.5
⊙	EB23-05	7.9	113.7
⊕	EB23-05	12.5	109.1

Date ..October 2024.....
 WP# ..4068-09-00.....



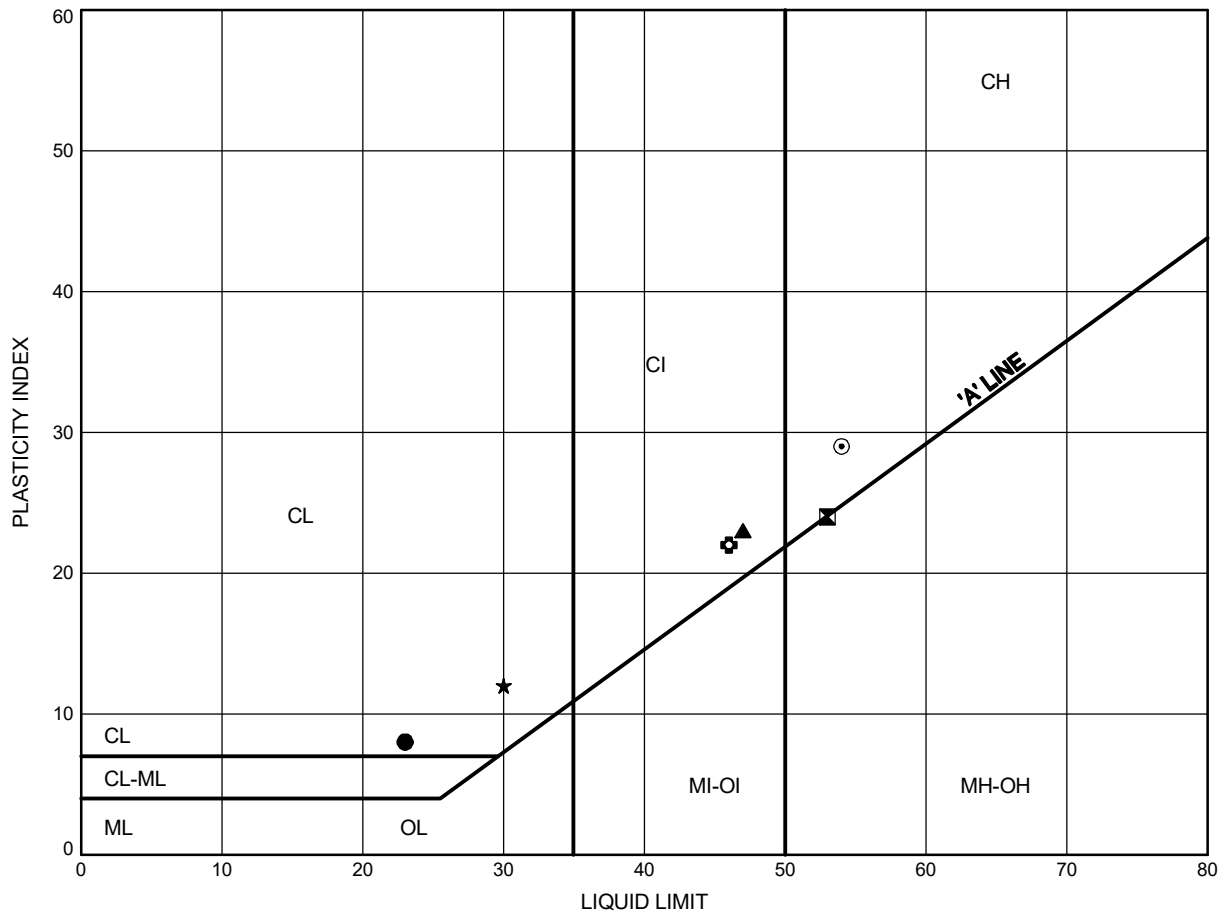
Prep'dRH.....
 Chkd.AO.....

Highway 17 Twinning, Sta. 20+450 to 20+900

ATTERBERG LIMITS TEST RESULTS

FIGURE C17

Clay (CH) to Silty Clay (CI) to Clayey Silt (CL)



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	EB23-05	15.5	106.1
⊠	EB23-06	1.1	121.6
▲	EB23-06	4.9	117.8
★	EB23-06	12.5	110.2
⊙	EB23-07	1.8	121.7
⊕	EB23-07	6.4	117.1

Date ..October 2024.....
 WP# ..4068-09-00.....



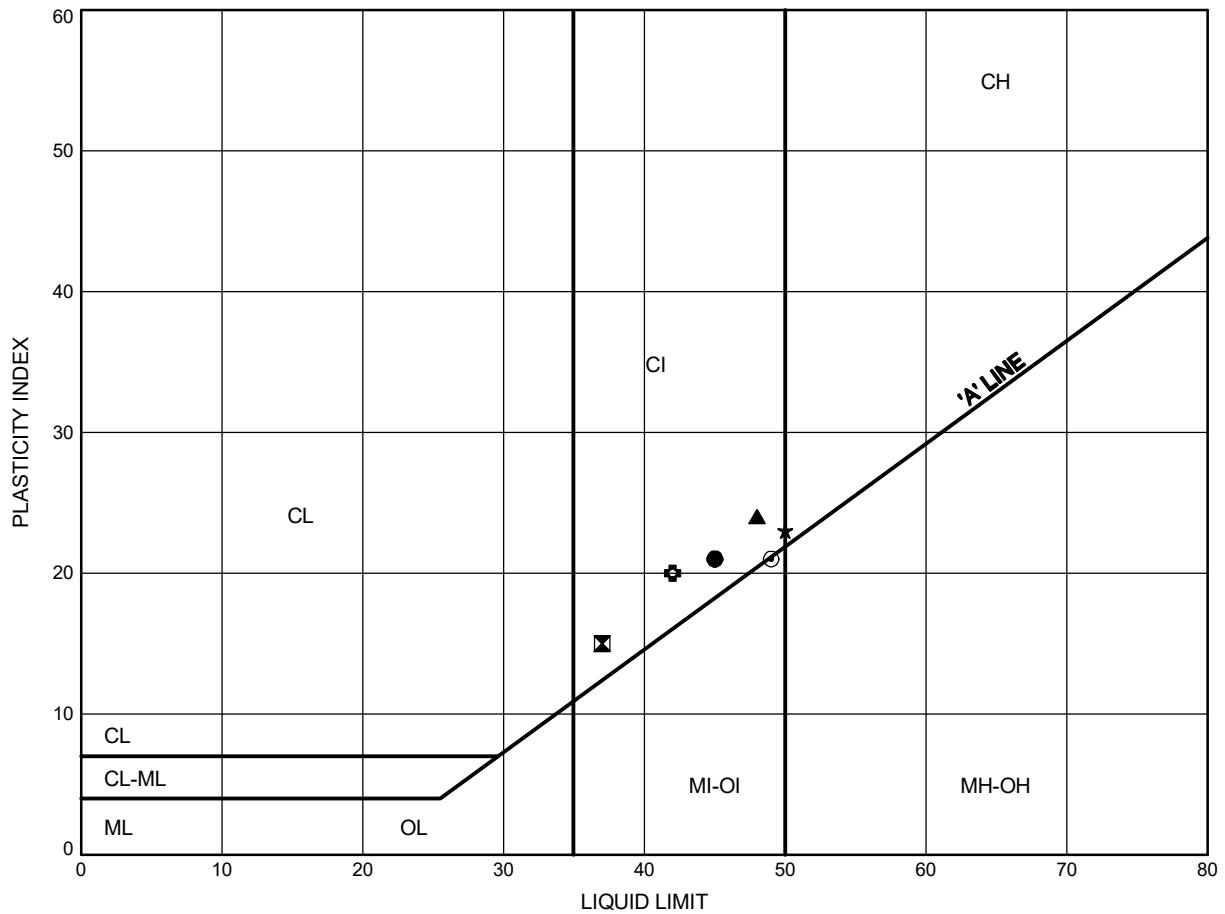
Prep'dRH.....
 Chkd.AO.....

Highway 17 Twinning, Sta. 20+450 to 20+900

ATTERBERG LIMITS TEST RESULTS

FIGURE C18

Clay (CH) to Silty Clay (CI) to Clayey Silt (CL)



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	EB23-07	7.9	115.6
⊠	EB23-07	14.0	109.5
▲	EB23-08	6.4	119.7
★	EB23-08	12.5	113.6
⊙	EB23-09	10.4	117.3
⊕	EB23-09	14.9	112.8

Date ..October 2024.....
 WP# ..4068-09-00.....



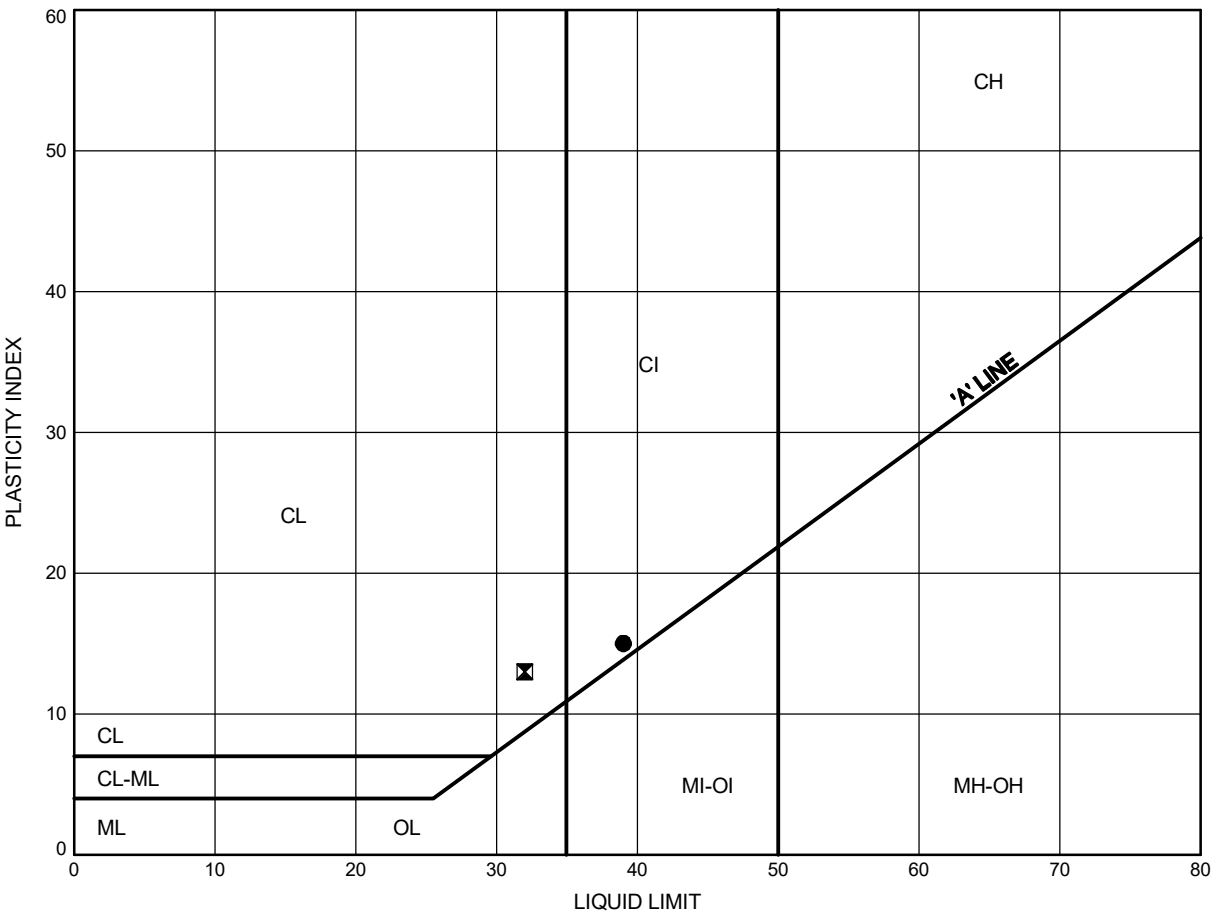
Prep'dRH.....
 Chkd.AO.....

Highway 17 Twinning, Sta. 20+450 to 20+900

ATTERBERG LIMITS TEST RESULTS

FIGURE C19

Clay (CH) to Silty Clay (CI) to Clayey Silt (CL)



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	EB23-10	12.5	115.9
⊠	OBR19-15	11.0	118.1

Date ..October 2024.....
WP# ..4068-09-00.....



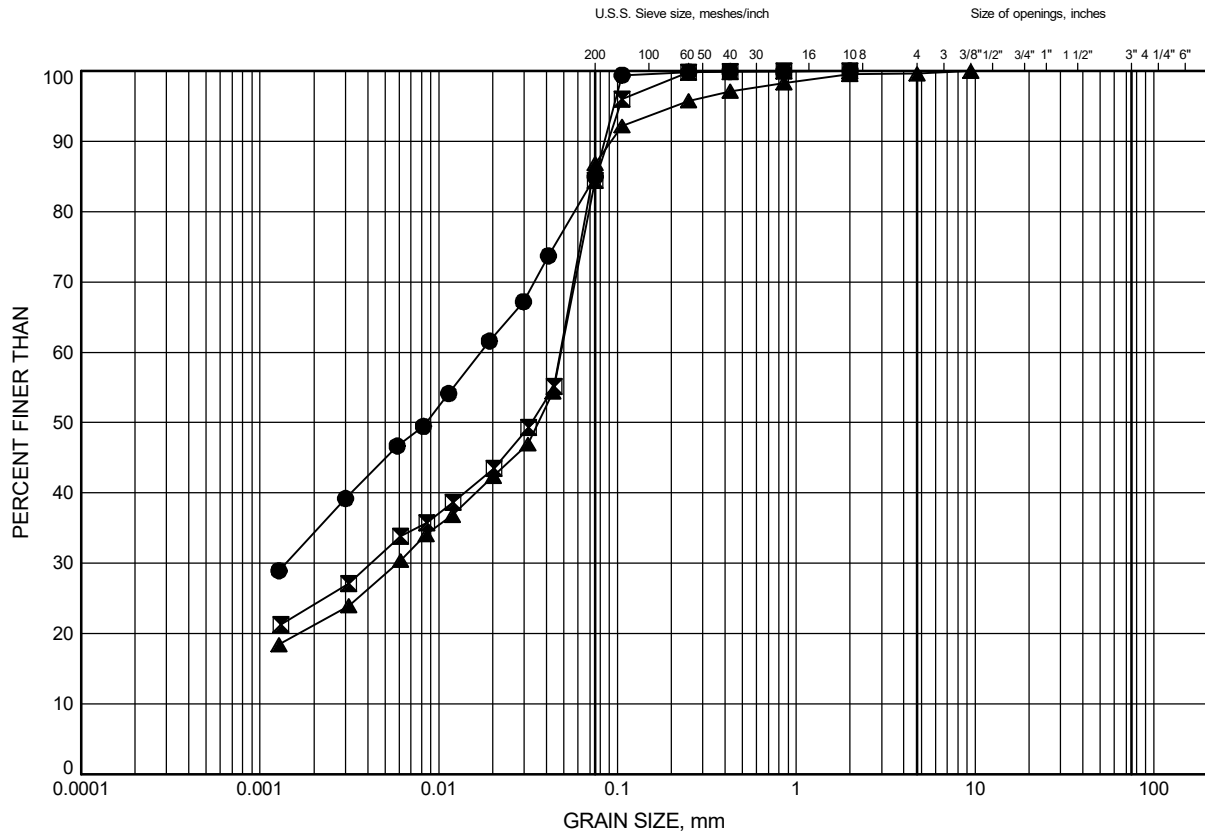
Prep'dRH.....
Chkd.AO.....

Highway 17 Twinning, Sta. 20+450 to 20+900

GRAIN SIZE DISTRIBUTION

FIGURE C20

Clayey Silt (CL), some Sand



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	EB23-04	12.5	108.2
⊠	EB23-04	14.0	106.7
▲	EB23-07	20.2	103.3

Date ..October 2024.....
 WP# ..4068-09-00.....

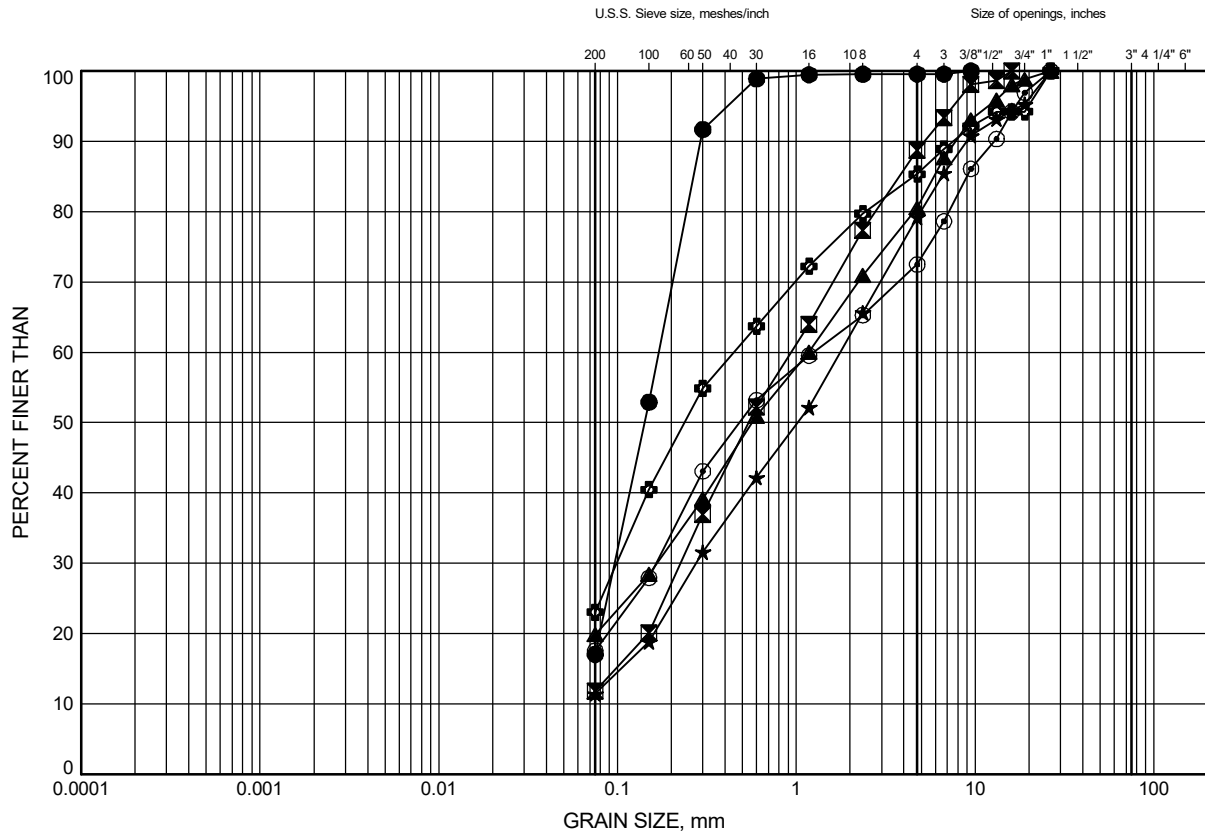


Prep'dRH.....
 Chkd.AO.....

Highway 17 Twinning, Sta. 20+450 to 20+900 GRAIN SIZE DISTRIBUTION

FIGURE C21

Lower Sand to Silty Sand



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BON19-6	11.0	105.9
⊠	BON19-9	13.9	103.9
▲	EB23-02	13.9	105.7
★	EB23-03	14.0	105.8
⊙	EB23-04	15.7	105.0
⊕	EB23-10	15.6	112.8

Date October 2024

WP# 4068-09-00



Prep'd RH

Chkd. AO



Appendix D.

Site Photographs



Photo 1. Looking east from crest of slope near Sta. 20+450 (March 08, 2024)



Photo 2. Looking east from crest of slope near Sta. 20+500 (March 08, 2024)



Photo 3. Looking east from crest of slope near Sta. 20+580 (March 08, 2024)



Photo 4. Looking southwest from toe of slope near Sta. 20+700 (March 08, 2024)



Photo 5. Looking west from crest of slope near Sta. 20+800 (March 08, 2024)