



FINAL REPORT

FOUNDATION INVESTIGATION AND DESIGN REPORT

**Installation of High Tension Cable Median Barrier at Hwy 401, Windsor to
London, Interchanges of Essex Rd. 42 (Sta. 16+200 Tilbury W) and
Victoria Rd. (Sta. 11+200 Howard Twp)**

**Agreement No. 3015-E-0017
Assignment No. 8
WP 3102-15-00
Geocres No. 40J8-69**

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Foundation Investigation and Design Report

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Interchanges of Essex Rd. 42 (Sta. 16+200 Tilbury W) and Victoria Rd. (Sta. 11+200 Howard Twp.)

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1 FOUNDATION INVESTIGATION REPORT

1.1 Introduction

This report presents the results of a geotechnical investigation carried out by **exp** Services Inc. (**exp**) for installation of High Tension Cable Median Barrier (HTCMB) at Hwy 401 from Windsor to London, Southern Ontario; in particular, from the interchange of Essex Rd. 42 (Sta. 16+200 Tilbury W) to the interchange of Victoria Rd. (Sta. 11+200 Howard Twp.), a distance of approximately 52 km. The work was undertaken under Agreement # 3015-E-0017, Assignment No. 8. The terms of reference (TOR) were as presented in the Ministry of Transportation (MTO) email received on October 24, 2017.

The purpose of this investigation is to obtain information on soil type, soil strength and water table elevation such that the manufacturer of end terminals for the HTCMB can adequately design their end terminals and anchor systems for use in Southern Ontario. The site geotechnical investigation consisted of drilling of boreholes approximately every km, soil sampling, and laboratory testing.

This foundation investigation report has been prepared specifically and solely for the project described herein. It contains the factual results of the investigation and the laboratory testing completed for this project.

1.2 Site Description and Geological Setting

1.2.1 Site Description

The investigation site is located along Hwy 401 between Windsor and London, Southern Ontario, from the interchange of Essex Rd. 42 (Sta. 16+200 Tilbury W) to the interchange of Victoria Rd. (Sta. 11+200 Howard Twp.) (see Key Map on drawings in Appendix B). The total of investigated area is approximately 52 km long. At the site location, Hwy 401 is oriented at an east-west direction and the WBL and EBL are separated by a median ditch having the slope of between 4H:1V and 6H:1V toward the middle. The other interchanges within the area are County Rd. 27 (Bloomfield Rd.), Communication Rd. and Kent Bridge Rd. The terrain in the immediate vicinity is relatively flat-lying agricultural lands. Photographs of the site made during this investigation are included in Appendix A.

1.2.2 Geological Setting

The Map 2556 (Quaternary Geology of Ontario, Southern Sheet, 1991) of the Ministry of Natural Resources indicates that the project area is situated within three Physiographic regions (Glaciolacustrine deposits consisting of sand, gravelly sand and gravel of nearshore and beach deposits from east limit of project area to Bloomfield Rd; Lacustrine deposits consisting of silt and clay of basin or quiet water deposits from Bloomfield Rd to Merlin Rd; and Tavistock Till consisting of sandy silt to silt matrix to silty clay matrix with moderate to high carbonate content from Merlin Rd to west limit of project area). The Map 2544 (Bedrock Geology of Ontario, Southern Sheet, 1991) of the Ministry of Northern Development and Mines, indicates that the bedrock in the project site is reported to consist of shale of the Kettle Point

Formation of Upper Devonian Age from east limit of project area to Merlin Rd. and limestone of the Hamilton Group of Middle Devonian Age from Merlin Rd to west limit of project area.

1.3 Investigation Procedures

1.3.1 General

The field investigation was performed between November 20 and December 22, 2017. The field program consisted of drilling fifty-two (52) sampled boreholes drilled approximately every km within the stretch of 52 km. The boreholes were strategically located into the median of Hwy 401 as proposed on the draft design and draft contract standards office drawings (DCSOD 200.041, 200.046, 200.065 and 913-264) provided by MTO. The drawings are attached in Appendix E. Based on these drawings the boreholes were drilled about 1.2 m away from the top of the median slope. The borehole locations are shown on Drawings 1 to 5 in Appendix B. The Table 1.1 below summarizes the borehole locations, ground surface elevations at borehole locations and borehole depths:

Table 1.1. Borehole information

Borehole	Location	MTM Coordinates		Ground Surface Elevation (m)	Borehole Depth (m)
		Northing	Easting		
BH17-52	EBL Median	4680908.59	309283.01	178.6	4.3
BH17-51	EBL Median	4680925.17	309913.81	177.4	4.3
BH17-50	WBL Median	4681316.32	310948.21	177.6	4.3
BH17-49	WBL Median	4681512.44	311741.18	177.7	4.3
BH17-48	WBL Median	4681701.67	312603.20	177.7	4.3
BH17-47	WBL Median	4682000.09	313882.82	179.3	4.3
BH17-46	WBL Median	4682201.47	314741.62	179.1	4.3
BH17-45	WBL Median	4682420.92	316307.63	179.2	4.3
BH17-44	WBL Median	4683081.20	317107.54	179.1	4.3
BH17-43	WBL Median	4683713.30	317805.72	179.3	4.3
BH17-42	WBL Median	4684348.05	318513.36	178.0	4.3
BH17-41	WBL Median	4685056.48	319449.57	177.8	4.3
BH17-40	WBL Median	4685561.12	320374.16	178.8	4.3
BH17-39	WBL Median	4685763.16	320746.72	178.4	4.3
BH17-38	WBL Median	4686302.67	321827.66	178.4	4.3
BH17-37	WBL Median	4686382.47	322626.41	178.1	4.3
BH17-36	WBL Median	4686491.85	323905.99	178.7	4.3
BH17-35	WBL Median	4686803.27	324678.76	178.4	4.3
BH17-34	EBL Median	4687233.23	325780.24	179.8	4.3
BH17-33	EBL Median	4687618.69	326723.66	179.8	4.3
BH17-32	EBL Median	4687973.27	327589.40	179.8	4.3

Borehole	Location	MTM Coordinates		Ground Surface Elevation (m)	Borehole Depth (m)
		Northing	Easting		
BH17-31	EBL Median	4688352.41	328509.43	179.2	4.4
BH17-30	EBL Median	4688779.93	329301.86	179.2	4.3
BH17-29	EBL Median	4689539.81	330125.75	180.1	4.3
BH17-28	EBL Median	4690386.06	331030.64	181.4	4.4
BH17-27	EBL Median	4690835.98	331606.91	180.1	4.4
BH17-26	EBL Median	4691389.89	332514.86	181.4	4.4
BH17-25	EBL Median	4691848.80	333617.65	182.0	4.4
BH17-24	EBL Median	4692184.21	334512.95	182.3	4.3
BH17-23	EBL Median	4692559.68	335483.98	183.2	4.3
BH17-22	EBL Median	4692840.06	336197.49	183.5	4.3
BH17-21	EBL Median	4693358.73	337493.92	184.4	4.3
BH17-20	WBL Median	4693884.47	338856.85	183.5	4.3
BH17-19	WBL Median	4694146.73	339602.70	184.1	4.3
BH17-18	WBL Median	4694388.09	340287.09	185.3	4.3
BH17-17	WBL Median	4694761.52	341335.00	185.9	4.3
BH17-16	WBL Median	4695060.58	342159.24	187.2	4.3
BH17-15	WBL Median	4695462.59	343176.73	188.4	4.3
BH17-14	WBL Median	4696058.10	343832.68	188.7	4.3
BH17-13	WBL Median	4696744.72	344561.14	188.4	4.3
BH17-12	WBL Median	4697510.27	345368.04	189.3	4.3
BH17-11	WBL Median	4698101.89	345967.93	189.9	4.3
BH17-10	WBL Median	4698794.16	346681.49	188.7	4.4
BH17-09	WBL Median	4699534.92	347432.60	188.1	4.3
BH17-08	WBL Median	4700163.44	348093.27	188.4	4.4
BH17-07	WBL Median	4700897.84	348858.20	188.7	4.3
BH17-06	WBL Median	4701567.34	349567.06	188.7	4.3
BH17-05	WBL Median	4702144.10	350185.42	190.2	4.3
BH17-04	WBL Median	4702855.36	350925.36	191.5	4.3
BH17-03	WBL Median	4703594.69	351747.43	191.4	4.3
BH17-02	WBL Median	4704205.76	352427.61	194.5	4.3
BH17-01	WBL Median	4704875.85	353168.98	193.5	4.3

The borehole locations (referenced to the MTM NAD83 coordinate system) and their ground surface elevations were surveyed by **exp** personnel. Coordinates were determined using a GPS, while a leveling instrument was used to determine ground surface elevations at boreholes relative to the adjacent edge of highway pavement.

The boreholes were advanced using a geoprobe truck mounted drill rig (Model 7822DT), equipped with a hollow stem augers and casing. All borehole drilling and sampling operations were performed by a specialist drilling contractor, Landshark Drilling.

During the drilling of boreholes, soil samples were obtained using a 51 mm outside diameter (O.D.) split-spoon sampler in accordance with Standard Penetration Test (SPT) procedures (ASTM D 1586), at intervals shown on the attached borehole logs (Appendix C). The original field (uncorrected) SPT “N” values were recorded on the borehole logs as recommended in the Canadian Foundation Engineering Manual (CFEM pg. 40), and used to provide an assessment of in-situ consistency of cohesive soils or relative density of non-cohesive soils. Pocket penetrometer tests were performed on split spoon samples of cohesive soils to assess undrained shear strength of that soil. In addition, field vane testing was conducted in some boreholes to measure an in-situ undrained shear strength of cohesive soils.

Upon completion of the drilling operations, groundwater level measurements were carried out in the open holes. The boreholes were decommissioned by bentonite/cement mixtures in accordance with the Ministry of the Environment Regulation 903, as amended by Regulation 128/03 (the well regulation under the Ontario Water Resources Act).

The fieldwork was supervised by a member of **exp**'s engineering staff who directed the drilling and sampling operation, logged borehole data in accordance with MTO and/or ASTM standards for soils classification, and retrieved soil samples for subsequent laboratory testing and identification.

All the recovered soil samples were placed in labelled moisture-proof bags and returned to **exp**'s London laboratory for additional visual, textual and olfactory examination, and sampling for laboratory testing.

1.3.2 Laboratory Testing

The laboratory testing program included the determination of natural moisture content and particle size distribution for approximately 25% of the collected soil samples. Atterberg Limits tests were carried out on selected cohesive soil samples. All the laboratory tests were carried out in accordance with MTO and/or ASTM standards as appropriate.

1.4 Subsurface Conditions

The detailed subsurface soil and groundwater conditions encountered in the boreholes advanced during this investigation, together with the results of the laboratory tests carried out on selected soil samples, are presented on the borehole log sheets in Appendix C. The “Explanation of Terms Used in Report” preceding the borehole logs in Appendix C forms an integral part of and should be read in conjunction with this report.

A borehole location plan and stratigraphic section along the Hwy 401 is provided in Appendix B. It should be noted that the stratigraphic boundaries indicated on the borehole logs and stratigraphic section are inferred from non-continuous sampling, observations of drilling progress and results of Standard Penetration Tests. These boundaries typically represent transitions from one soil type to another and

should not be regarded as exact planes of geological change. Further, subsurface conditions may vary between and beyond the borehole locations.

1.4.1 Segment 1 – Essex Rd. 42 to Drake Rd.

A total of seventeen (17) boreholes were drilled within the segment Essex Rd. 42 to Drake Rd. (BH17-52 to BH17-36) along median slope of Hwy 401.

The general stratigraphy encountered within the investigated depths of boreholes indicate the following sub-surface sequence: sand and gravel fill underlain by silty clay fill followed by native silty clay/clayey silt. A detailed description of the stratigraphy encountered in the boreholes is discussed further in subsequent sections.

1.4.1.1 Fill: Sand and Gravel

A sand and gravel fill layer was encountered at the surface of all boreholes drilled within this segment. The fill layer extended to depth about 0.8 m below ground surface with elevations ranging between 176.6 m to 178.5 m. The explored thickness of this layer was about 0.8 m.

The composition of this fill layer is sand and gravel, trace to few silt, trace topsoil, and trace asphalt inclusions. The SPT “N” values from four samples taken within this layer ranged from 9 to 26 blows per 0.3 m penetration, suggesting loose to compact relative density. The grain size distribution test performed on selected sample (BH17-37, SS1), which shown 41% gravel, 50% sand and 9% silt and clay. The results of the grain size distribution test performed are also provided on Figure 1 in Appendix D.

1.4.1.2 Fill: Silty Clay

A silty clay fill layer was encountered below sand and gravel fill in all boreholes drilled within this segment. The approximate elevations of the surface and base, thickness, moisture content, SPT ‘N’ value and undrained shear strength of the fill as encountered in boreholes are summarized in Table 1.2 below:

Table 1.2. Summary of silty clay fill layer

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Moisture Content Range (%)		SPT 'N' Value Range		Undrained Shear Strength (kPa)		
									Vane Test	Pocket Penetrometer Test	
	Top	Bottom			Min.	Max.	Min.	Max.		Min.	Max.
17-52	177.8	174.5	0.8	3.3	22	27	5	17	-	60	215
17-51	176.6	174.8	0.8	1.8	16	24	8	20	-	144	215
17-50	176.8	175.3	0.8	1.5	24	28	5	8	-	144	-
17-49	176.9	174.6	0.8	2.3	17	25	7	10	-	132	215
17-48	176.9	175.4	0.8	1.5	20	22	10	11	-	120	156
17-47	177.5	176.0	0.8	1.5	25	26	5	7	-	84	120

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Moisture Content Range (%)		SPT 'N' Value Range		Undrained Shear Strength (kPa)		
									Vane Test	Pocket Penetrometer Test	
	Top	Bottom			Min.	Max.	Min.	Max.		Min.	Max.
17-46	178.3	176.0	0.8	2.3	20	26	5	10	-	120	192
17-45	178.4	176.1	0.8	2.3	18	28	8	12	-	96	215
17-44	178.3	176.8	0.8	1.5	25	26	7	8	-	84	120
17-43	178.5	177.0	0.8	1.5	24	29	8	9	-	144	-
17-42	177.2	175.4	0.8	1.8	25	27	5	6	-	60	120
17-41	177.0	176.3	0.8	0.7	27	-	10	-	-	132	-
17-40	178.0	175.7	0.8	2.3	16	26	8	12	-	60	168
17-39	177.6	176.9	0.8	0.7	25	-	8	-	-	180	-
17-38	177.6	176.1	0.8	1.5	26	-	7	-	-	72	84
17-37	177.3	175.8	0.8	1.5	20	25	7	11	-	96	120
17-36	177.9	176.4	0.8	1.5	20	26	5	8	-	96	192

Laboratory testing performed on selected samples from this fill layer are summarized on Table 1.3 below:

Table 1.3. Laboratory test results for selected samples from silty clay fill layer

Borehole	Sample	Depth (m)	Atterberg Limits			Grain Size Distribution			
			W _L	W _P	I _P	Gravel	Sand	Silt	Clay
17-52	4	3.05-3.51	44	22	22	1	16	39	44
17-49	1	0.76-1.22	-	-	-	1	17	37	
17-46	2	1.52-1.98	-	-	-	2	19	79	
17-43	3	2.29-2.74	51	22	29	1	11	36	52
17-35	2	1.52-1.98	-	-	-	0	9	41	50

W_L= Liquid Limit; W_P= Plastic Limit; I_P= Plasticity Index

The results of the moisture content, grain size distribution and Atterberg Limit tests are provided on the record of borehole sheets in Appendix C. The results of the grain size distribution test and Atterberg Limit tests performed are also provided on Figures 2 and 3, respectively, in Appendix D.

1.4.1.3 Silty Clay/Clayey Silt

A native silty clay/clayey silt layer was encountered below silty clay fill layer in all boreholes drilled within this segment. The approximate elevations of the surface and base, thickness, moisture content, SPT 'N' value and undrained shear strength of the fill as encountered in boreholes are summarized in Table 1.4 below:

Table 1.4. Summary of silty clay/clay silt layer

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Moisture Content Range (%)		SPT 'N' Value Range		Undrained Shear Strength (kPa)		
									Vane Test	Pocket Penetrometer Test	
	Top	Bottom			Min.	Max.	Min.	Max.		Min.	Max.
17-52	174.5	174.3	4.1	0.2	21	-	18	-	-	-	-
17-51	174.8	173.1	2.6	1.7	16	19	15	20	-	203	215
17-50	175.3	173.3	2.3	2.0	17	21	5	20	-	215	-
17-49	174.6	173.4	3.1	1.2	22	26	8	9	-	192	215
17-48	175.4	173.4	2.3	2.0	19	19	9	17	-	96	215
17-47	176.0	174.0	2.3	2.0	18	19	8	14	-	168	215
17-46	176.0	174.8	3.1	1.2	16	17	12	23	-	215	-
17-45	176.1	174.9	3.1	1.2	18	19	10	15	-	96	215
17-44	176.8	174.8	2.3	2.0	16	21	8	19	-	120	168
17-43	177.0	175.0	2.3	2.0	16	19	12	21	-	215	-
17-42	175.4	173.7	2.6	1.7	16	18	5	18	-	215	-
17-41	176.3	175.3	1.5	2.8	17	22	7	20	-	96	215
17-40	175.7	174.5	3.1	1.2	18	27	8	12	-	84	120
17-39	176.9	174.1	1.5	2.8	24	27	7	14	-	72	156
17-38	176.1	174.1	2.3	2.0	17	25	6	24	-	84	144
17-37	175.8	173.8	2.3	2.0	14	25	14	21	-	120	215
17-36	176.4	174.4	2.3	2.0	18	20	11	15	-	72	180

Laboratory testing performed on selected samples from this fill layer are summarized on Table 1.5 below:

Table 1.5. Laboratory test results for selected samples from silty clay/clay silt layer

Borehole	Sample	Depth (m)	Atterberg Limits			Grain Size Distribution			
			W _L	W _P	I _P	Gravel	Sand	Silt	Clay
17-51	3	2.29-2.74	-	-	-	1	22	77	
17-49	5	3.81-4.27	35	18	17	1	14	42	41
17-47	4	3.05-3.5	31	17	14	2	24	42	
17-45	4	3.05-3.5	-	-	-	2	20	78	
17-44	5	3.81-4.27	34	16	18	1	19	35	35
17-42	3	2.29-2.74	50	23	27	3	14	38	
17-41	5	3.05-3.5	37	18	19	2	19	39	40
17-38	5	4.04-4.50	41	20	21	1	20	41	35
17-37	4	3.28-3.74	45	22	23	1	13	39	44
17-36	4	3.28-3.74	-	-	-	5	21	74	

W_L= Liquid Limit; W_P= Plastic Limit; I_P= Plasticity Index

The results of the moisture content, grain size distribution and Atterberg Limit tests are provided on the record of borehole sheets in Appendix C. The results of the grain size distribution test and Atterberg Limit tests performed are also provided on Figures 4, 5 and 6, respectively, in Appendix D.

1.4.2 Segment 2 - Drake Rd. to Charing Cross Rd.

A total of eleven (11) boreholes were drilled within the segment Drake Rd. to Charing Cross Rd. (BH17-35 to BH17-25) along median slope of Hwy 401.

The general stratigraphy encountered within the investigated depths of boreholes indicate the following sub-surface sequence: sand and gravel/sandy silt fill underlain by silty clay/clayey silt fill followed by native silty clay/clayey silt. A detailed description of the stratigraphy encountered in the boreholes is discussed further in subsequent sections.

1.4.2.1 Fill: Sand and Gravel

A sand and gravel fill layer was encountered at the surface of all boreholes drilled within this segment. The fill layer extended to depth about 0.8 m below ground surface with elevations ranging between 177.6 m to 181.2 m. The explored thickness of this layer was about 0.8 m.

The composition of this fill layer is sand and gravel, trace to few silt, trace topsoil, and trace asphalt inclusions.

1.4.2.2 Fill: Sandy Silt

A sandy silt fill layer was encountered below sand and gravel fill in BH17-26 and BH17-25. The approximate elevations of the surface and base, thickness, SPT 'N' value and moisture content of the fill as encountered in boreholes are summarized in Table 1.6 below:

Table 1.6. Summary of sandy silt fill layer

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Moisture Content Range (%)		SPT 'N' Value Range	
	Top	Bottom			Min.	Max.	Min.	Max.
17-26	180.6	179.9	0.8	0.7	22	-	16	-
17-25	181.2	180.5	0.8	0.7	19	-	13	-

The results of the moisture content are provided on the record of borehole sheets in Appendix C.

1.4.2.3 Fill: Silty Clay/Clayey Silt

A silty clay/clayey silt fill layer was encountered below sandy silt/sand and gravel fill in all drilled boreholes except for BH 17-26 within this segment. The approximate elevations of the surface and base, thickness, moisture content, SPT 'N' value and undrained shear strength of the fill as encountered in these boreholes are summarized in Table 1.7 below:

Table 1.7. Summary of silty clay/clay silt fill layer

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Moisture Content Range (%)		SPT 'N' Value Range		Undrained Shear Strength (kPa)		
									Vane Test	Pocket Penetrometer Test	
	Top	Bottom			Min.	Max.	Min.	Max.		Min.	Max.
17-35	177.6	174.6	0.8	3.0	17	29	6	14	-	96	215
17-34	179.0	177.5	0.8	1.5	17	21	8	12	-	120	144
17-33	179.0	176.7	0.8	2.3	14	25	6	15	-	72	215
17-32	179.0	177.4	0.8	1.6	18	27	6	13	-	96	215
17-31	178.4	177.7	0.8	0.7	14	-	12	-	-	168	-
17-30	178.4	176.1	0.8	2.3	16	23	4	12	-	84	203
17-29	179.3	177.8	0.8	1.5	18	26	11	12	-	156	215
17-28	180.6	178.3	0.8	2.3	16	26	5	18	-	60	132
17-27	179.3	178.6	0.8	0.7	17	-	15	-	-	-	-
17-25	180.5	178.9	1.5	1.6	21	25	6	8	-	60	72

Laboratory testing performed on selected samples from this fill layer are summarized on Table 1.8 below:

Table 1.8. Laboratory test results for selected samples from silty clay/clay silt fill layer

Borehole	Sample	Depth (m)	Atterberg Limits			Grain Size Distribution			
			W _L	W _P	I _P	Gravel	Sand	Silt	Clay
17-33	2	1.52-1.98	-	-	-	2	21	77	
17-28	3	2.28-2.74	-	-	-	0	3	64	33
17-27	1	0.76-1.22	-	-	-	0	11	89	
17-25	2	1.52-1.98	-	-	-	0	7	93	

W_L= Liquid Limit; W_P= Plastic Limit; I_P= Plasticity Index

The results of the moisture content and grain size distribution are provided on the record of borehole sheets in Appendix C. The results of the grain size distribution tests performed are also provided on Figure 7, in Appendix D.

1.4.2.4 Silty Clay/Clayey Silt

A native silty clay/clayey silt layer was encountered below sandy silt/silty clay/clayey silt fill layer in all boreholes drilled within this segment. The approximate elevations of the surface and base, thickness, moisture content, SPT 'N' value and undrained shear strength of the fill as encountered in boreholes are summarized in Table 1.9 below:

Table 1.9. Summary of silty clay/clay silt layer

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Moisture Content Range (%)		SPT 'N' Value Range		Undrained Shear Strength (kPa)		
									Vane Test	Pocket Penetrometer Test	
	Top	Bottom			Min.	Max.	Min.	Max.		Min.	Max.
17-35	174.6	174.1	3.8	0.5	18	-	14	-	-	215	-
17-34	177.5	175.5	2.3	2.0	18	27	6	13	-	48	144
17-33	176.7	175.5	3.1	1.2	16	20	14	15	-	96	192
17-32	177.4	175.5	2.4	1.9	21	30	6	11	-	72	120
17-31	177.7	174.8	1.5	2.9	20	29	5	16	102	24	192
17-30	176.1	174.9	3.1	1.2	22	23	10	21	-	72	215
17-29	177.8	175.8	2.3	2.0	18	-	7	15	-	96	203
17-28	178.3	177.0	3.1	1.3	20	22	7	9	83.8	24	72
17-27	178.6	175.7	1.5	2.9	17	42	4	6	93.1	24	168
17-26	179.9	177.0	1.5	2.9	23	26	WH	6	37	12	-
17-25	178.9	177.6	3.1	1.3	27	37	3	5	46.5	24	-

Laboratory testing performed on selected samples from this silty clay/clayey silt layer are summarized on Table 1.10 below:

Table 1.10. Laboratory test results for selected samples from silty clay/clayey silt layer

Borehole	Sample	Depth (m)	Atterberg Limits			Grain Size Distribution			
			W _L	W _P	I _P	Gravel	Sand	Silt	Clay
17-34	4	3.28-3.74	41	20	21	0	13	52	35
17-31	5	4.04-4.50	35	18	17	1	15	51	33
17-30	4	3.28-3.74	36	17	19	0	16	52	32
17-29	4	3.28-3.74	36	17	19	1	19	45	35
17-26	4	3.28-3.74	27	18	9	0	2	81	17
17-25	4	3.28-3.74	33	20	13	0	2	78	20

W_L= Liquid Limit; W_P= Plastic Limit; I_P= Plasticity Index

The results of the moisture content, grain size distribution and Atterberg Limit tests are provided on the record of borehole sheets in Appendix C. The results of the grain size distribution test and Atterberg Limit tests performed are also provided on Figures 8 and 9, respectively, in Appendix D.

1.4.3 Segment 3 - County Charing Cross Rd. to Harwich Rd.

A total of nine (9) boreholes were drilled within the segment County Charing Cross Rd. to Harwich Rd. (BH17-24 to BH17-16) along median slope of Hwy 401.

The general stratigraphy encountered within the investigated depths of boreholes indicate the following sub-surface sequence: sand and gravel fill underlain by silty clay/clayey silt/silt fill followed by native silty clay/ clayey silt/silty sand. A detailed description of the stratigraphy encountered in the boreholes is discussed further in subsequent sections.

1.4.3.1 Fill: Sand and Gravel

A sand and gravel fill layer was encountered at the surface of all boreholes drilled within this segment. The fill layer extended to depth about 0.8 m below ground surface with elevations ranging between 181.5 m to 186.7 m. The explored thickness of this layer was about 0.8 m.

1.4.3.2 Fill: Silty Clay/Clayey Silt

A silty clay/clayey silt fill layer was encountered below sand and gravel fill in all drilled boreholes within this segment. The approximate elevations of the surface and base, thickness, SPT 'N' value and moisture content of the fill as encountered in these boreholes are summarized in Table 1.12 below:

Table 1.12. Summary of silty clay/clay silt fill layer

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Moisture Content Range (%)		SPT 'N' Value Range		Undrained Shear Strength (kPa)		
									Vane Test	Pocket Penetrometer Test	
	Top	Bottom			Min.	Max.	Min.	Max.		Min.	Max.
17-24	181.5	180.0	0.8	1.5	15	20	10	16	-	132	215
17-23	182.4	180.9	0.8	1.5	14	24	11	15	-	132	215
17-22	182.7	182.0	0.8	0.7	13	-	10	-	-	192	-
17-22	180.4	179.7	3.1	0.7	29	-	9	-	-	36	-
17-21	183.6	182.1	0.8	1.5	15	18	13	-	-	144	215
17-20	182.7	181.8	0.8	0.9	20	-	9	-	-	96	-
17-19	183.3	182.3	0.8	1.0	16	22	6	9	-	72	144
17-18	184.5	183.8	0.8	0.7	20	-	12	-	-	156	-
17-17	185.1	183.6	0.8	1.5	20	23	6	7	-	96	-
17-16	186.4	185.6	0.8	0.7	24	-	7	-	-	72	-

Laboratory testing performed on selected samples from this fill layer are summarized on Table 1.13 below:

Table 1.13. Laboratory test results for selected samples from silty clay/clay silt fill layer

Borehole	Sample	Depth (m)	Atterberg Limits			Grain Size Distribution			
			W _L	W _P	I _P	Gravel	Sand	Silt	Clay
17-17	2	1.52-1.98	-	-	-	0	19	81	

W_L= Liquid Limit; W_P= Plastic Limit; I_P= Plasticity Index

The results of the moisture content and grain size distribution are provided on the record of borehole sheets in Appendix C. The result of the grain size distribution test performed is also provided on Figure 10, in Appendix D.

1.4.3.3 Fill: Silt

A silt fill layer was encountered between clayey silt fill and silty clay fill only in BH 17-22 within this segment. The approximate elevations of the surface and base, thickness, SPT 'N' value and moisture content of the fill as encountered in this borehole are summarized in Table 1.14 below:

Table 1.14. Summary of silt fill layer

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Moisture Content Range (%)		SPT 'N' Value Range	
	Top	Bottom			Min.	Max.	Min.	Max.
17-22	182.0	180.4	1.5	1.6	17	26	12	15

Laboratory testing performed on selected sample from this fill layer are summarized on Table 1.15 below:

Table 1.15. Laboratory test results for selected samples from silt fill layer

Borehole	Sample	Depth (m)	Atterberg Limits			Grain Size Distribution			
			W _L	W _P	I _P	Gravel	Sand	Silt	Clay
17-22	3	2.28-2.74	Non-Plastic			0	2	85	13

W_L= Liquid Limit; W_P= Plastic Limit; I_P= Plasticity Index

The results of the moisture content and grain size distribution are provided on the record of borehole sheets in Appendix C. The result of the grain size distribution test performed is also provided on Figure 11 in Appendix D.

1.4.3.4 Silty Clay/Clayey Silt

A native silty clay/clayey silt layer was encountered below silty clay/clayey silt fill layer in all boreholes drilled except for BH 17-22 within this segment. The approximate elevations of the surface and base, thickness, moisture content, SPT 'N' value and undrained shear strength of the fill as encountered in boreholes are summarized in Table 1.16 below:

Table 1.16. Summary of silty clay/clay silt layer

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Moisture Content Range (%)		SPT 'N' Value Range		Undrained Shear Strength (kPa)		
									Vane Test	Pocket Penetrometer Test	
	Top	Bottom			Min.	Max.	Min.	Max.		Min.	Max.
17-24	180.0	178.0	2.3	2.0	29	32	4	5	-	156	192
17-23	180.9	178.9	2.3	2.0	17	25	8	20	-	156	192
17-21	182.1	180.1	2.3	2.0	14	28	5	11	-	60	144
17-20	181.7	179.2	1.7	2.6	17	33	5	16	-	156	192
17-19	182.3	179.8	1.8	2.5	13	27	12	16	-	132	192
17-18	183.8	181.0	1.5	2.8	15	24	9	25	-	168	215
17-17	183.6	181.6	2.3	2.0	19	21	8	18	-	144	215

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Moisture Content Range (%)		SPT 'N' Value Range		Undrained Shear Strength (kPa)		
									Vane Test	Pocket Penetrometer Test	
	Top	Bottom			Min.	Max.	Min.	Max.		Min.	Max.
17-16	185.6	182.9	1.5	2.8	19	25	7	22	-	72	215

Laboratory testing performed on selected samples from this silty clay/clayey silt layer are summarized on Table 1.17 below:

Table 1.17. Laboratory test results for selected samples from silty clay/clayey silt layer

Borehole	Sample	Depth (m)	Atterberg Limits			Grain Size Distribution			
			W _L	W _P	I _P	Gravel	Sand	Silt	Clay
17-24	5	3.81-4.27	46	21	25	0	2	40	58
17-23	4	3.05-3.51	34	18	16	3	23	45	29
17-21	3	2.28-2.74	44	19	25	0	2	66	32
17-21	5	3.81-4.27	42	19	13	3	10	40	46
17-20	3	2.28-2.74	52	22	30	0	2	35	63
17-19	4	3.05-3.51	30	16	14	2	25	46	27
17-18	4	3.05-3.51	33	16	17	2	20	48	30
17-17	4	3.05-3.51	40	21	19	2	13	50	35
17-16	5	3.81-4.27	38	17	21	2	13	41	43

W_L= Liquid Limit; W_P= Plastic Limit; I_P= Plasticity Index

The results of the moisture content, grain size distribution and Atterberg Limit tests are provided on the record of borehole sheets in Appendix C. The results of the grain size distribution test and Atterberg Limit tests performed are also provided on Figure 12-13 and 14-15, respectively, in Appendix D.

1.4.3.5 Silty Sand

A native silt sand layer was encountered below silty clay fill only in BH 17-22 within this segment. The approximate elevations of the surface and base, thickness, SPT 'N' value and moisture content of the fill as encountered in this borehole are summarized in Table 1.18 below:

Table 1.18. Summary of silty sand layer

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Moisture Content Range (%)		SPT 'N' Value Range	
	Top	Bottom			Min.	Max.	Min.	Max.
17-22	179.7	179.2	3.8	0.5	32	-	21	-

The result of the moisture content is provided on the record of borehole sheets in Appendix C.

1.4.4 Segment 4 - Harwich Rd. to Scane Rd.

A total of ten (11) boreholes were drilled within the segment Harwich Rd. to Scane Rd. (BH17-15 to BH17-05) along median slope of Hwy 401.

The general stratigraphy encountered within the investigated depths of boreholes indicate the following sub-surface sequence: sand and gravel fill underlain by sand/silty clay/clayey silt fill followed by native silty clay/ clayey silt. A detailed description of the stratigraphy encountered in the boreholes is discussed further in subsequent sections.

1.4.4.1 Fill: Sand and Gravel

A sand and gravel fill layer was encountered at the surface of all boreholes drilled within this segment. The fill layer extended to depth ranged from 0.8 to 1.5 m below ground surface with elevations ranging between 187.3 m to 189.1 m. The explored thickness of this layer ranged from 0.8 to 1.5 m.

The composition of this fill layer is sand and gravel and trace recycled asphalt inclusions. The SPT "N" value from one sample taken within this layer was 11 blows per 0.3 m penetration, suggesting compact relative density. The water content performed on selected sample (BH17-05, SS1), which shown 4%. The grain size distribution test also performed on this sample, which shown 64% gravel, 28% sand and 8% silt and clay. The result of the moisture content is provided on the record of borehole sheets in Appendix C. The result of the grain size distribution test performed are also provided on Figure 16 in Appendix D.

1.4.4.2 Fill: Silty Sand/Sandy Silt/Sand

A silty sand/sandy/sand silt fill layer was encountered below sand and gravel fill in BH17-15 and BH17-05. The approximate elevations of the surface and base, thickness, SPT 'N' value and moisture content of the fill as encountered in boreholes are summarized in Table 1.19 below:

Table 1.19. Summary of silty sand/sandy silt/sand fill layer

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Moisture Content Range (%)		SPT 'N' Value Range	
	Top	Bottom			Min.	Max.	Min.	Max.
17-15	187.6	186.7	0.8	0.9	12	-	13	-
17-05	188.7	187.9	1.5	0.8	25	-	11	-

The results of the moisture content are provided on the record of borehole sheets in Appendix C.

1.4.4.3 Fill: Silty Clay/Clayey Silt

A silty clay/clayey silt fill layer was encountered below sand and gravel/silty sand/sandy silt fill in all drilled boreholes except for BH17-05 within this segment. The approximate elevations of the surface and base, thickness, moisture content, SPT 'N' value and undrained shear strength of the fill as encountered in these boreholes are summarized in Table 1.20 below:

Table 1.20. Summary of silty clay/clay silt fill layer

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Moisture Content Range (%)		SPT 'N' Value Range		Undrained Shear Strength (kPa)		
									Vane Test	Pocket Penetrometer Test	
	Top	Bottom			Min.	Max.	Min.	Max.			Min.
17-15	186.7	186.1	1.7	0.6	22	-	7	-	-	105	-
17-14	187.9	186.4	0.8	1.5	18	22	8	-	-	96	144
17-13	187.6	186.0	0.8	1.6	21	24	5	12	-	72	96
17-12	188.5	187.8	0.8	0.7	24	-	5	-	-	84	192
17-11	189.1	187.6	0.8	1.5	19	23	10	14	-	120	215
17-10	187.8	186.4	0.9	1.4	17	21	7	12	-	144	180
17-09	187.3	186.6	0.8	0.7	22	-	9	-	-	168	-
17-08	187.6	186.1	0.8	1.5	21	23	11	-	-	144	168
17-07	187.9	187.2	0.8	0.7	13	-	11	-	-	-	-
17-06	187.9	186.4	0.8	1.5	21	25	8	9	-	108	168

Laboratory testing performed on selected sample from this fill layer are summarized on Table 1.21 below:

Table 1.21. Laboratory test results for selected samples from silty clay/clay silt fill layer

Borehole	Sample	Depth (m)	Atterberg Limits			Grain Size Distribution			
			W _L	W _P	I _P	Gravel	Sand	Silt	Clay
17-06	1	0.76-1.22	-	-	-	2	28	70	

W_L= Liquid Limit; W_P= Plastic Limit; I_P= Plasticity Index

The results of the moisture content and grain size distribution are provided on the record of borehole sheets in Appendix C. The result of the grain size distribution test performed is also provided on Figure 17 in Appendix D.

1.4.4.4 Silty Clay/Clayey Silt

A native silty clay/clayey silt layer was encountered below silty clay/clayey silt/sand fill layer in all boreholes drilled within this segment. The approximate elevations of the surface and base, thickness, moisture content, SPT 'N' value and undrained shear strength of the fill as encountered in boreholes are summarized in Table 1.22 below:

Table 1.22. Summary of silty clay/clay silt layer

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Moisture Content Range (%)		SPT 'N' Value Range		Undrained Shear Strength (kPa)		
									Vane Test	Pocket Penetrometer Test	
	Top	Bottom			Min.	Max.	Min.	Max.		Min.	Max.
17-15	186.1	184.1	2.3	2.0	19	20	17	23	-	192	215
17-14	186.4	184.4	2.3	2.0	19	20	8	23	-	120	215

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Moisture Content Range (%)		SPT 'N' Value Range		Undrained Shear Strength (kPa)		
									Vane Test	Pocket Penetrometer Test	
	Top	Bottom			Min.	Max.	Min.	Max.		Min.	Max.
17-13	186.0	184.1	2.4	1.9	19	29	11	19	-	84	192
17-12	187.8	185.0	1.5	2.8	18	19	15	25	-	192	215
17-11	187.6	185.6	2.3	2.0	29	35	5	14	-	72	156
17-10	186.4	184.3	2.3	2.1	25	31	5	8	111.7	36	168
17-09	186.6	183.8	1.5	2.8	15	22	10	15	-	144	192
17-08	186.1	184.0	2.3	2.1	16	28	6	11	140	96	192
17-07	187.2	184.4	1.5	2.8	16	21	12	18	-	156	215
17-06	186.4	184.4	2.3	2.0	16	28	9	14	-	120	156
17-05	187.9	185.9	2.3	2.0	22	35	3	8	-	48	72

Laboratory testing performed on selected samples from this silty clay/clayey silt layer are summarized on Table 1.23 below:

Table 1.23. Laboratory test results for selected samples from silty clay/clayey silt layer

Borehole	Sample	Depth (m)	Atterberg Limits			Grain Size Distribution			
			W _L	W _P	I _P	Gravel	Sand	Silt	Clay
17-15	4	3.05-3.51	43	20	23	1	13	40	46
17-14	3	2.28-2.74	55	20	35	0	9	39	52
17-13	3	2.28-2.74	58	23	35	0	6	40	54
17-13	5	3.81-4.27	37	18	19	1	15	52	32
17-12	2	1.52-1.98	47	22	25	1	7	29	63
17-10	3	2.28-2.74	45	21	24	0	3	44	53
17-09	5	3.81-4.27	29	16	13	2	24	39	35
17-07	2	2.28-2.74	45	21	24	0	5	38	57
17-05	4	3.05-3.51	38	19	19	1	3	35	61

W_L= Liquid Limit; W_P= Plastic Limit; I_P= Plasticity Index

The results of the moisture content, grain size distribution and Atterberg Limit tests are provided on the record of borehole sheets in Appendix C. The results of the grain size distribution test and Atterberg Limit tests performed are also provided on Figure 18-19 and 20-21, respectively, in Appendix D.

1.4.5 Segment 5 - Scane Rd. to Victoria Rd.

A total of four (4) boreholes were drilled within the segment Scane Rd. to Victoria Rd. (BH17-04 to BH17-01) along median slope of Hwy 401.

The general stratigraphy encountered within the investigated depths of boreholes indicate the following sub-surface sequence: granular fill followed by silty sand/sand fill underlain by silty clay/clayey silt fill followed by native silty clay/clayey silt/silty sand. A detailed description of the stratigraphy encountered in the boreholes is discussed further in subsequent sections.

1.4.5.1 Fill: Sand and Gravel

A sand and gravel fill layer was encountered at the surface of all boreholes drilled within this segment. The fill layer extended to depth ranged from 0.8 to 0.9 m below ground surface with elevations ranging between 190.6 m to 193.6 m. The explored thickness of this layer ranged from 0.8 to 0.9 m.

The composition of this fill layer is sand and gravel, some stone and trace recycled asphalt inclusions.

1.4.5.2 Fill: Silty Sand/Sand

A silty sand/sand fill layer was encountered below sand and gravel fill in all boreholes drilled within this segment. The approximate elevations of the surface and base, thickness, SPT 'N' value and moisture content of the fill as encountered in boreholes are summarized in Table 1.24 below:

Table 1.24. Summary of silty sand/sand fill layer

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m) Min.	Moisture Content Range (%)		SPT 'N' Value Range	
	Top	Bottom			Min.	Min.	Min.	Max.
17-04	190.7	189.2	0.8	13	12	22	13	16
17-03	190.6	188.3	0.8	11	7	20	11	20
17-02	193.6	192.2	0.9	8	20	33	8	14
17-01	192.7	192.0	0.8	12	19	-	12	-

The results of the moisture content is provided on the record of borehole sheets in Appendix C.

1.4.5.3 Fill: Silty Clay

A silty clay fill layer was encountered below silty sand fill in BH17-04 and BH17-01 within this segment. The approximate elevations of the surface and base, thickness, moisture content, SPT 'N' value and undrained shear strength of the fill as encountered in these boreholes are summarized in Table 1.25 below:

Table 1.25. Summary of silty clay fill layer

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Moisture Content Range (%)		SPT 'N' Value Range		Undrained Shear Strength (kPa)		
									Vane Test	Pocket Penetrometer Test	
	Top	Bottom			Min.	Max.	Min.	Max.		Min.	Max.
17-04	189.2	188.2	2.3	1.1	17	27	8	11	-	168	-
17-01	192.0	190.4	1.5	1.6	17	28	7	13	-	48	215

The results of the moisture content are provided on the record of borehole sheets in Appendix C.

1.4.5.4 Topsoil

A topsoil layer was encountered below sand/silty clay fill in BH17-04 and BH17-03 within this segment. The composition of this layer is topsoil mixed with some sand, some silt and trace clay. The approximate elevations of the surface and base, thickness, SPT 'N' value and moisture content of the fill as encountered in these boreholes are summarized in Table 1.26 below:

Table 1.26. Summary of topsoil layer

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Moisture Content Range (%)		SPT 'N' Value Range	
	Top	Bottom			Min.	Max.	Min.	Max.
17-04	188.2	187.7	3.4	0.4	-	-	-	-
17-03	188.3	187.6	3.1	0.7	25	-	5	-

The result of the moisture content is provided on the record of borehole sheets in Appendix C.

1.4.5.5 Silty Clay/Clayey Silt

A native silty clay/clayey silt layer was encountered below topsoil/silty clay fill layer in BH17-04, BH17-03 and BH17-01 drilled within this segment. The approximate elevations of the surface and base, thickness, moisture content, SPT 'N' value and undrained shear strength of the fill as encountered in boreholes are summarized in Table 1.27 below:

Table 1.27. Summary of silty clay/clayey silt layer

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Moisture Content Range (%)		SPT 'N' Value Range		Undrained Shear Strength (kPa)		
									Vane Test	Pocket Penetrometer Test	
	Top	Bottom			Min.	Max.	Min.	Max.		Min.	Max.
17-04	187.7	187.2	3.8	0.5	24	-	9	-	-	192	215
17-03	187.6	187.1	3.8	0.5	21	-	12	-	-	96	-
17-01	190.4	189.2	3.1	1.2	20	21	18	20	-	72	-

Laboratory testing performed on selected samples from silty clay/clayey silt layer are summarized on Table 1.28 below:

Table 1.28. Laboratory test results for selected samples from silty clay/clayey silt layer

Borehole	Sample	Depth (m)	Atterberg Limits			Grain Size Distribution			
			W _L	W _P	I _P	Gravel	Sand	Silt	Clay
17-04	5	3.81-4.27	35	19	26	0	3	50	48
17-01	4	3.05-3.51	42	20	22	0	6	32	62

W_L= Liquid Limit; W_P= Plastic Limit; I_P= Plasticity Index

The results of the moisture content, grain size distribution and Atterberg Limit tests are provided on the record of borehole sheets in Appendix C. The results of the grain size distribution test and Atterberg Limit tests performed are also provided on Figure 22 and 23, respectively, in Appendix D.

1.4.5.6 Silty Sand

A native silty sand layer was encountered below the silty sand fill layer only in BH17-02. The approximate elevations of the surface and base, thickness, SPT 'N' value and moisture content of the fill as encountered in boreholes are summarized in Table 1.27 below:

Table 1.29. Summary of silty sand layer

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	SPT 'N' Value Range		Moisture Content Range (%)	
	Top	Bottom			Min.	Max.	Min.	Max.
17-02	192.2	190.2	2.3	2.0	19	26	15	23

Laboratory testing performed on selected samples from this silty sand layer are summarized on Table 1.30 below:

Table 1.30. Laboratory test results for selected samples from silty sand layer

Borehole	Sample	Depth (m)	Atterberg Limits			Grain Size Distribution			
			W _L	W _P	I _P	Gravel	Sand	Silt	Clay
17-02	3	2.28-2.74	-	-	-	0	50	50	

W_L= Liquid Limit; W_P= Plastic Limit; I_P= Plasticity Index

The results of the moisture content, grain size distribution and Atterberg Limit tests are provided on the record of borehole sheets in Appendix C. The result of the grain size distribution test performed are also provided on Figure 24 in Appendix D.

1.5 Groundwater Conditions

Information on groundwater levels at the site was obtained by measuring the water levels in the open boreholes after completion of drilling. The groundwater levels encountered in the boreholes are shown on the borehole logs and presented below in Table 1.31.

Table 1.31. Groundwater data

Borehole	Date Completed and Measured	Ground Surface Elevation (m)	Groundwater Elevation (m)	Groundwater Depth (m)
BH17-52	Nov 21, 2017	178.6	Dry in the open hole	
BH17-51	Nov 21, 2017	177.4	Dry in the open hole	
BH17-50	Nov 21, 2017	177.6	Dry in the open hole	
BH17-49	Nov 21, 2017	177.7	Dry in the open hole	
BH17-48	Nov 21, 2017	177.7	176.2	1.5

Borehole	Date Completed and Measured	Ground Surface Elevation (m)	Groundwater Elevation (m)	Groundwater Depth (m)
BH17-47	Nov 21, 2017	179.3	Dry in the open hole	
BH17-46	Nov 21, 2017	179.1	Dry in the open hole	
BH17-45	Nov 21, 2017	179.2	Dry in the open hole	
BH17-44	Nov 20, 2017	179.1	Dry in the open hole	
BH17-43	Nov 20, 2017	179.3	Dry in the open hole	
BH17-42	Nov 20, 2017	178.0	Dry in the open hole	
BH17-41	Nov 20, 2017	177.8	Dry in the open hole	
BH17-40	Nov 20, 2017	178.8	Dry in the open hole	
BH17-39	Nov 20, 2017	178.4	Dry in the open hole	
BH17-38	Nov 20, 2017	178.4	Dry in the open hole	
BH17-37	Nov 20, 2017	178.1	Dry in the open hole	
BH17-36	Nov 20, 2017	178.7	Not measured since borehole was caved	
BH17-35	Nov 20, 2017	178.4	Dry in the open hole	
BH17-34	Nov 19, 2017	179.8	Dry in the open hole	
BH17-33	Nov 19, 2017	179.8	Dry in the open hole	
BH17-32	Nov 19, 2017	179.8	Dry in the open hole	
BH17-31	Nov 19, 2017	179.2	Dry in the open hole	
BH17-30	Nov 19, 2017	179.2	Dry in the open hole	
BH17-29	Nov 19, 2017	180.1	Dry in the open hole	
BH17-28	Nov 19, 2017	181.4	Dry in the open hole	
BH17-27	Nov 19, 2017	180.1	Dry in the open hole	
BH17-26	Dec 21, 2017	181.4	Dry in the open hole	
BH17-25	Dec 21, 2017	182.0	Dry in the open hole	
BH17-24	Dec 21, 2017	182.3	Dry in the open hole	
BH17-23	Dec 21, 2017	183.2	Dry in the open hole	
BH17-22	Dec 21, 2017	183.5	Dry in the open hole	
BH17-21	Dec 21, 2017	184.4	Dry in the open hole	
BH17-20	Dec 20, 2017	183.5	Dry in the open hole	
BH17-19	Dec 20, 2017	184.1	Dry in the open hole	
BH17-18	Dec 20, 2017	185.3	Dry in the open hole	
BH17-17	Dec 20, 2017	185.9	Dry in the open hole	
BH17-16	Dec 20, 2017	187.2	Dry in the open hole	
BH17-15	Dec 20, 2017	188.4	Dry in the open hole	
BH17-14	Dec 20, 2017	188.7	Dry in the open hole	
BH17-13	Dec 20, 2017	188.4	Dry in the open hole	
BH17-12	Dec 18, 2017	189.3	Dry in the open hole	
BH17-11	Dec 18, 2017	189.9	Dry in the open hole	
BH17-10	Dec 18, 2017	188.7	Dry in the open hole	
BH17-9	Dec 18, 2017	188.1	Dry in the open hole	

Borehole	Date Completed and Measured	Ground Surface Elevation (m)	Groundwater Elevation (m)	Groundwater Depth (m)
BH17-8	Dec 18, 2017	188.4	Dry in the open hole	
BH17-7	Dec 18, 2017	188.7	Dry in the open hole	
BH17-6	Dec 18, 2017	188.7	Dry in the open hole	
BH17-5	Dec 18, 2017	190.2	Dry in the open hole	
BH17-4	Dec 11, 2017	191.5	Dry in the open hole	
BH17-3	Dec 11, 2017	191.4	189.0	2.4
BH17-2	Dec 11, 2017	194.5	Dry in the open hole	
BH17-1	Dec 11, 2017	193.5	Dry in the open hole	

Note that water levels measured in open boreholes might not be stabilized due to short term observation.

Seasonal variations in the water table should be expected, with higher levels occurring during wetter periods of the year and lower levels during drier periods. Some perched water could exist in the granular fill as well.

2 DISCUSSIONS AND ENGINEERING RECOMMENATIONS

2.1 General

This section of the report provides geotechnical design recommendations for installation of High Tension Cable Median Barrier (HTCMB) at Hwy 401 from Windsor to London, Southern Ontario; in particular, from the interchange of Essex Rd. 42 (Sta. 16+200 Tilbury W) to the interchange of Victoria Rd. (Sta. 11+200 Howard Twp.), a distance of approximately 52 km. The recommendations are based on interpretation of the factual data obtained from the boreholes advanced during the current investigation at the site and presented in **Part I-Foundation Investigation Report**. The interpretation and recommendations provided are intended solely to permit designers to assess foundation alternatives and design the proposed structure. Comments on construction are only provided to highlight issues that could affect the design. Contractors bidding on the works should make their own assessments of the factual data and how it might affect construction means and methods, scheduling and the like.

Based on information included in the TOR and correspondence with MTO it is understood that the objective of this geotechnical investigation is to obtain information on soil type, soil strength, and water table elevation such that the manufacturer of the end terminals for HTCMB can adequately design their end terminals and anchor systems for use in Southern Ontario. Some typical drawings of how the system will be installed in the median are provided by MTO (i.e. DCSOD 200.041, DCSOD 200.046, DCSOD 200.065, DCSOD 913.260, DCSOD 913.264, OPSD 912.315, OPSD 991.131 and OPSD 3419.100). However, we understand that there is not a typical drawing of the end terminals yet but they are essentially flared out similar to Steel Beam Guiderail and placed on 6:1 slopes instead of standard 4:1 slopes. Based on OPSS 1504 and OPSD 912.104 the steel post of the steel beam guiderail is a W150 x 14 beam. It is understood that high tension cables are individually connected to line posts and/or end terminal posts (anchors) that are placed in sockets in concrete foundations or sockets driven into the ground depending on the soil condition, manufacturer's specification and recommendations of MTO.

This report addresses the geotechnical design of foundations for the high tension cable median barrier by providing geotechnical design parameters at the Ultimate Limit State (ULS) and Serviceability Limit States (SLS) as well as other geotechnical parameters that may be required in accordance with MTO Roadside Design Manual (published December 2017) and the latest edition of the *Canadian Highway Bridge Design Code (CHBDC)* (CAN/CSA-S6-14), the *Guideline for Professional Engineers Providing Geotechnical Engineering Service* (1992), the *Canadian Foundation Engineering Manual (CFEM)* (2006), the *provisions in the TOR* and good practice.

2.2 Geotechnical Design Data for Line Post and End Terminal Post Foundations

Generally, line posts and terminal posts for the HTCMB can be supported on concrete caisson foundations. The depth of the caisson would vary depending upon the design of HTCMB posts.

Based on the borehole information and a requirement for adequate protection against frost penetration in the project area (i.e. a minimum 1.2 m below the lowest surrounding area, see Section 2.2.5), the recommended soil parameters for the design of HTCMB post foundations are given in Table 2.1.

As noted before, the groundwater were measured in open boreholes, but they were not stabilized due to short term observation and low permeable soils. However, beside the measured water levels, the groundwater levels listed in Table 2.1 are estimated based on observed color and measured water content of collected soil samples. Seasonal variations in the water table should be expected, with higher levels occurring during wetter periods of the year and lower levels during drier periods. Some perched water could exist in the granular fill material above the low permeable native cohesive soils as well.

Table 2.1. Recommended soil parameters for HTCMB posts

Strata	Depth (m)	Type of Soil	N _{SPT}	γ kN/m ³	S _u kPa	φ degree	δ degree	K _p	GW Depth (m)
Segment 1 - Essex Rd. 42 to Drake Rd. (BH17-52 to BH17-49)									
Fill: Silty Clay, Firm to Very Stiff	1.2-4.1	cohesive	5 -17 Avr. 8	19	60	-	19	1.0	>3.5 (>Elev.174.5)
Silty Clay/Clayey Silt, Firm to Very Stiff	2.3-4.3	cohesive	8-20 Avr. 14	19	90	-	20	1.0	
Segment 1 - Essex Rd. 42 to Drake Rd. (BH17-48)									
Fill: Silty Clay, Stiff	1.2-2.3	cohesive	10-11	19	90	-	19	1.0	>1.5 (>Elev.176.2)
Silty Clay/Clayey Silt, stiff to very stiff	2.3-4.3	cohesive	9-16 Avr. 14	19	100	-	20	1.0	
Segment 1 - Essex Rd. 42 to Drake Rd. (BH17-47 to BH17-36)									
Fill: Silty Clay, Firm to Stiff	1.2-3.1	cohesive	5-12 Avr. 8	19	70	-	19	1.0	>4.0 (>Elev.175.5)
Silty	1.5-	cohesive	6-24	19	80	-	20	1.0	

Clay/Clayey Silt, firm to very stiff	4.3		Avr. 13						
Segment 2 - Drake Rd. to Charing Cross Rd (BH17-35 to BH17-27)									
Fill: Silty Clay/ Clayey Silt, Firm to Very Stiff	1.2-3.8	cohesive	5-18 Avr. 9	19	80	-	19	1.0	>4.0 (>Elev.177)
Silty Clay/Clayey Silt, Soft to Very Stiff	1.5-4.3	cohesive	4-21 Avr. 10	19	80	-	20	1.0	
Segment 2 - Drake Rd. Charing Cross Rd. (BH17-26 to BH17-25)									
Fill: Sandy Silt, Compact	1.2-1.5	non-cohesive	13-16	20	-	28	19	2.8	>2.5 (>Elev.179)
Fill: Silty Clay/Clayey Silt, Firm (BH17-25)	1.5-3.1	cohesive	6-8 Avr. 7	19	50	-	19	1.0	
Silty Clay/Clayey Silt, Very Soft to Firm	1.5-4.3	cohesive	WH-6 Avr. 4	19	30	-	20	1.0	
Segment 3 - Charing Cross Rd. to Harwich Rd. (BH17-24 to BH17-23)									
Fill: Silty Clay/Clayey Silt, Stiff to Very Stiff	1.2-2.3	cohesive	11-16 Avr. 13	19	100	-	19	1.0	>3.5 (>Elev.179.5)
Silty Clay/Clayey Silt, Firm to Very Stiff	2.3-4.3	cohesive	4-20 Avr. 9	19	75	-	20	1.0	
Segment 3 - Charing Cross Rd. to Harwich Rd. (BH17-22)									
Fill: Clayey Silt, Stiff	1.2-1.5	cohesive	10	19	80	-	19	1.0	>3.0 (>Elev.180.5)
Fill: Silt, Compact	1.5-3.1	non-cohesive	12-15	20	-	32	17	3.2	
Fill: Silty Clay. Stiff	3.1-3.8	cohesive	9	19	80	-	19	1.0	

Silty Sand, Compact	3.8-4.3	non-cohesive	21	21	-	34	19	3.5	
Segment 3 - Charing Cross Rd. to Harwich Rd. (BH17-21 to BH17-16)									
Fill: Clayey Silt, Firm to Stiff	1.2-2.3	cohesive	7-13 Avr. 9	19	70	-	19	1.0	>4.0 (Elev. varies)
Silty Clay/Clayey Silt, Firm to Very Stiff	1.5-4.3	cohesive	5-25 Avr. 12	19	90	-	20	1.0	
Segment 4 - Harwich Rd. to Scane Rd. (BH17-15)									
Fill: Silty Sand/Sandy Silt, Compact	1.2-1.7	non-cohesive	13	21	-	32	19	3.2	>4.0 (>Elev.185)
Fill: Clayey Silt, Firm	1.7-2.3	cohesive	7	19	50	-	19	1.0	
Silty Clay/Clayey Silt, Very Stiff	2.3-4.3	cohesive	17-23 Avr. 21	19	120	-	20	1.0	
Segment 4 - Harwich Rd. to Scane Rd. (BH17-14 to BH17-6)									
Fill: Silty Clay/Clayey Silt, Firm to Stiff	1.2-2.4	cohesive	5-14 Avr. 9	19	70	-	19	1.0	For BH17-14 to BH17-12: >4.0 (>Elev.185)
Silty Clay /Clayey Silt, Firm to Very Stiff	1.5-4.3	cohesive	5-25 Avr. 13	19	90	-	20	1.0	For BH17-11 to BH17-6: >3.0 (>Elev.185.5)
Segment 4 - Harwich Rd. to Scane Rd. (BH17-5)									
Fill: Sand and Gravel, Compact	1.2-1.5	non-cohesive	11	21	-	34	19	3.5	>2.3 (>Elev.188)
Fill: Sand, Compact	1.5-2.3	non-cohesive	11	21	-	32	19	3.2	
Silty Clay/Clayey Silt, Soft to stiff	2.3-4.3	cohesive	3-8 Avr. 5	19	35	-	20	1.0	

Segment 5 - Scane Rd. Victoria Rd. (BH17-4)									
Fill: Silty Sand, Compact	1.2-2.3	non-cohesive	12-22 Avr. 17	21	-	32	19	3.2	>3.4 (>Elev.188)
Fill: Silty Clay, Stiff	2.3-3.4	cohesive	8-11 Avr. 9	19	60	-	19	1.0	
Top Soil	3.4-3.8	-	-	-	-	-	-	-	
Silty Clay/Clayey Silt, Stiff	3.8-4.3	cohesive	9	19	70	-	20	1.0	
Segment 5 - Scane Rd. Victoria Rd. (BH17-3)									
Fill: Sand, Compact	1.2-3.1	non-cohesive	7-20 Avr. 13	21	-	32	19	3.2	>2.4 (>Elev.189)
Top Soil	3.1-3.8	-	-	-	-	-	-	-	
Silty Clay, Stiff	3.8-4.3	cohesive	12	19	90	-	20	1.0	
Segment 5 - Scane Rd. Victoria Rd. (BH17-2)									
Fill: Silty Sand, Compact to Dense	1.2-2.3	non-cohesive	20-33	21	-	32	19	3.2	>3.5 (>Elev.191)
Silty Sand, Compact	2.3-4.3	non-cohesive	15-23 Avr, 17	21	-	34	19	3.5	
Segment 5 - Scane Rd. Victoria Rd. (BH17-1)									
Fill: Silty Sand, Compact	1.2-1.5	non-cohesive	19	21	-	32	19	3.2	>4.3 (>Elev.189)
Fill: Silty Clay, firm to Stiff	1.5-3.1	cohesive	7-13 Avr. 10	19	50	-	19	1.0	
Silty Clay, Very Stiff	3.1-4.3	cohesive	18-20	19	120	-	20	1.0	

The notations used in the table are defined below:

N_{SPT} Standard Penetration Test, N-value

γ bulk unit weight

s_u	undrained shear strength of cohesive soils
ϕ	internal friction angle
δ	friction angle between mass concrete and soils (based on Table 24.4 of CFEM, 4E)
K_p	coefficient of passive earth pressure

The calculation of unfactored lateral geotechnical resistance at ULS can be carried out using commercial computer programs, e.g. LPILE and M.FAD, for pile foundations.

The standard foundation design may be checked using the following equations to calculate the unfactored passive lateral earth pressure, P_p , distributed along the depth of the caisson foundation.

$$P_p = K_p \gamma d \quad \text{above the groundwater table}$$

$$P_p = K_p \gamma d_w + K_p \gamma' (d - d_w) \quad \text{below the groundwater table}$$

where P_p = passive lateral earth pressure in kPa acting at depth d

K_p = passive earth pressure coefficient

γ = unit weight in kN/m³

d = depth to point of interest in m

d_w = depth to the groundwater level in m

γ' = effective unit weight below the groundwater level in kN/m³

In the design of the foundations, the passive resistance within the upper 1.2 m below ground surface should be neglected to account for frost action. The unfactored lateral resistance should be calculated assuming an equivalent width equal to three times the caisson diameter. A resistance factor of 0.5 should be applied to the unfactored lateral resistance to obtain the factored lateral geotechnical resistance at Ultimate Limit States (ULS).

For this purpose, the factored ULS skin friction capacity of the soil at any depth may be estimated to be:

For non-cohesive soils

$$q_s = \phi \beta \sigma'_v$$

where q_s = unit shaft friction in kPa

ϕ = resistance factor = 0.4 (based on Tables 8.1 and 8.2 of CFEM, 4E)

β = combined shaft resistance factor = 0.6 (based on Table 18.1 of CFEM, 4E)

σ'_v = vertical effective stress adjacent to the foundation employing the unit weights and groundwater levels presented in Table 2.1

For cohesive soil

$$q_s = \alpha s_u$$

where q_s = unit shaft resistance in kPa
 α = adhesion coefficient ($\alpha=0.5$ as per CFEM, 4E)
 s_u = undrained shear strength of cohesive soils in kPa given in Table 2.1

The factored SLS skin friction should be taken as two thirds of the factored ULS value.

2.3 Construction Considerations

In general, the soils encountered at the site are considered to be competent and is expected to be self-supporting in the immediate short-term. Due to the relatively low permeability of the cohesive soils water seepage into the caisson excavations is expected to be minor even below the groundwater table. However, sloughing may occur within the more pervious non-cohesive fill soils and interlayers due to groundwater seepage. It is therefore recommended that temporary liner be used to support the caisson sidewalls and to provide seepage cut-off as and where required.

The concrete should be poured expeditiously on completion of the caisson hole. A 150 mm slump concrete is recommended for use to prevent the concrete from having a honeycombed structure and to avoid bridging in the liner upon its withdrawal. It is recommended that the concrete be placed by the tremie method in accordance with OPSS PROV 904 – Construction Specification for Concrete Structures as soon as the hole reaches its desired depth. The liner should be withdrawn as concrete is placed. During liner withdrawal, the level of concrete in the caisson hole must always be at least 0.6 m above the bottom of the temporary liner.

Construction of foundations for the HTCMB should be monitored by qualified geotechnical personnel to verify the soil conditions and to confirm that those conditions consistent with the design assumptions in this report. The HTCMB should be constructed in accordance with OPSS.PROV 721 – Construction Specification for Steel Beam Guide Rail and Cable Guide Rail, and excavation should be undertaken in accordance with OPSS 902 – Construction Specification for Excavation and Backfill – Structures. The backfill around posts should be compacted according to OPSS 501 – Construction Specification for Compaction.

January 24, 2018

3 CLOSURE

The comments given in this report are intended only for the guidance of design engineers. The number of boreholes required to determine the localized underground conditions between boreholes affecting construction costs, techniques, sequencing, equipment, scheduling, etc. could be greater than has been carried out for design purposes. Contractors bidding on or undertaking the works should, in this light, decide on their own investigations, as well as their own interpretations of the factual borehole results, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

This Foundation Investigation and Design Report has been prepared by Silvana Micic, Ph.D., P.Eng. and Jia He, M.Eng., E.I.T. and reviewed by TaeChul Kim, M.E.Sc., P.Eng. and Stan E. Gonsalves, M.Eng., P.Eng., Designated MTO Foundation Contact. The field investigation was conducted by Natasha Ungerer and Mona Ungerer.

We trust that these comments provide you with sufficient information to proceed with design. Should you have any questions, please do not hesitate to contact this office.

Yours truly,

exp Services Inc.



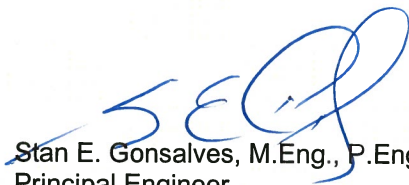
Jia He, M.Eng., E.I.T.
Technical Specialist



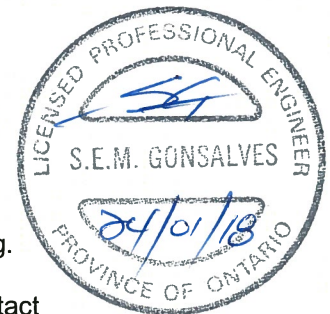
Silvana Micic, Ph.D, P.Eng.
Senior Geotechnical Engineer



TaeChul Kim, M.E.Sc., P.Eng.
Senior Geotechnical/Foundation Engineer



Stan E. Gonsalves, M.Eng., P.Eng.
Principal Engineer
Designated MTO Foundation Contact



Encl.

Appendix A – Photographs



Photo 1. Drilling BH17-20 at Hwy 401, facing west



Photo 2. Drilling BH17-20 at Hwy 401, facing east

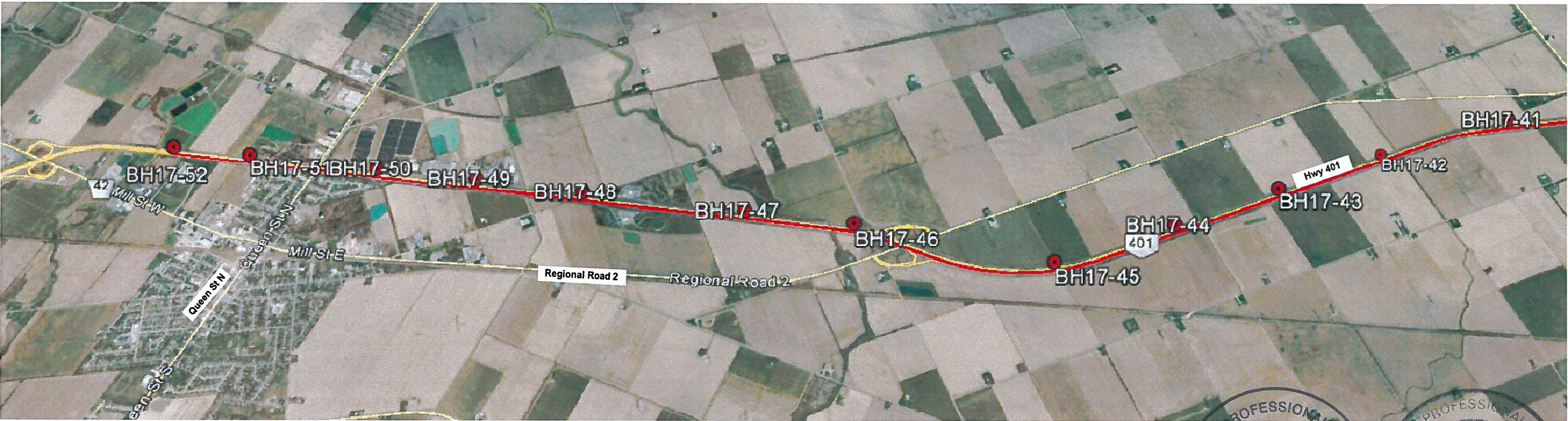


Photo 3. Drilling BH17-33t Hwy 401, facing east

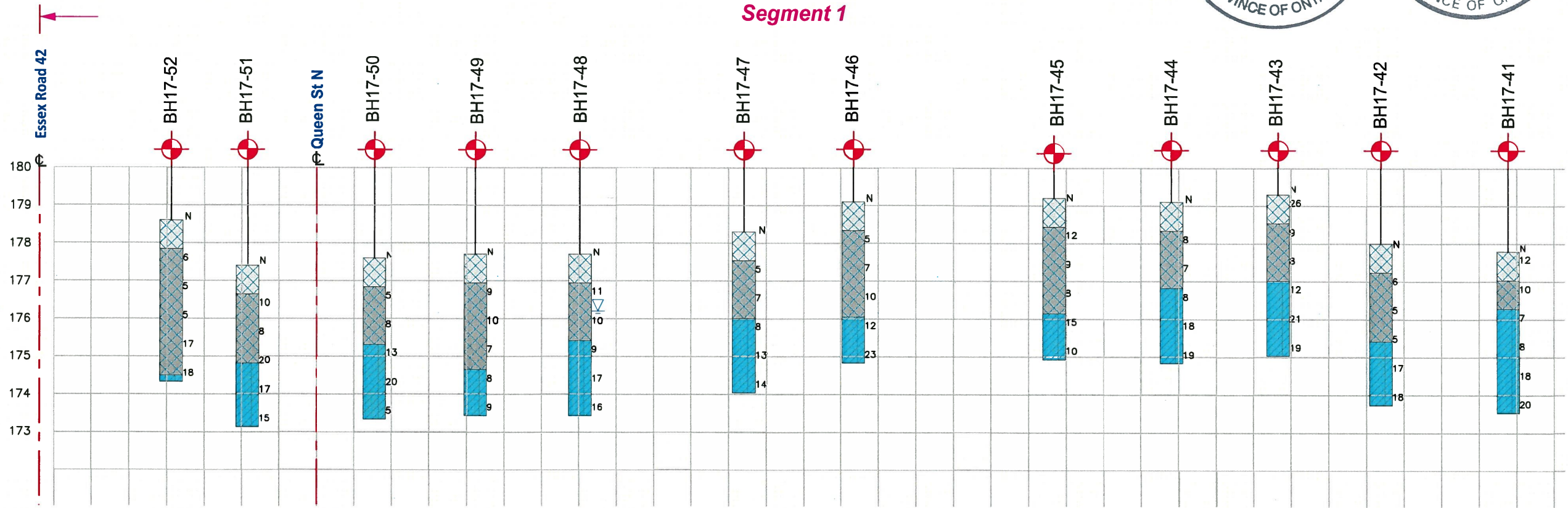


Photo 3. Rig used for drilling at Hwy 401, facing east

Appendix B – Drawings



PLAN



PROFILE ALONG HWY 401



LEGEND

- Location of New Boreholes Drilled by EXP
- N Standard Penetration Test (Blows/0.3 m)
- Groundwater level measured in open hole (Note: All other boreholes were dry)

SOIL STRATA

- FILL: SAND AND GRAVEL
- FILL: SILTY SAND/ SANDY SILT
- FILL: SILTY CLAY/ CLAYEY SILT
- SILT/ SAND/ SILT
- TOPSOIL

BH No.	APPROX. ELEV.	MTM CO-ORDINATES	
		NORTHING	EASTING
BH17-52	178.6	4680908.6	309283.0
BH17-51	177.4	4681240.1	352688.7
BH17-50	177.6	4681316.3	310948.2
BH17-49	177.7	4681512.4	311741.2
BH17-48	177.7	4681701.7	312603.2
BH17-47	178.3	4682000.1	313882.8
BH17-46	179.1	4682201.5	314741.6
BH17-45	179.2	4682420.9	316307.6
BH17-44	179.1	4683081.2	317107.5
BH17-43	179.3	4683713.3	317805.7
BH17-42	178.0	4684348.1	318513.4
BH 17-41	177.8	4685056.5	319449.6

NOTE

This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

The complete foundation investigation and design report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in the report and related documents are specifically excluded in accordance with the conditions of Section GC 2.01 of OPS Gen. Cond.



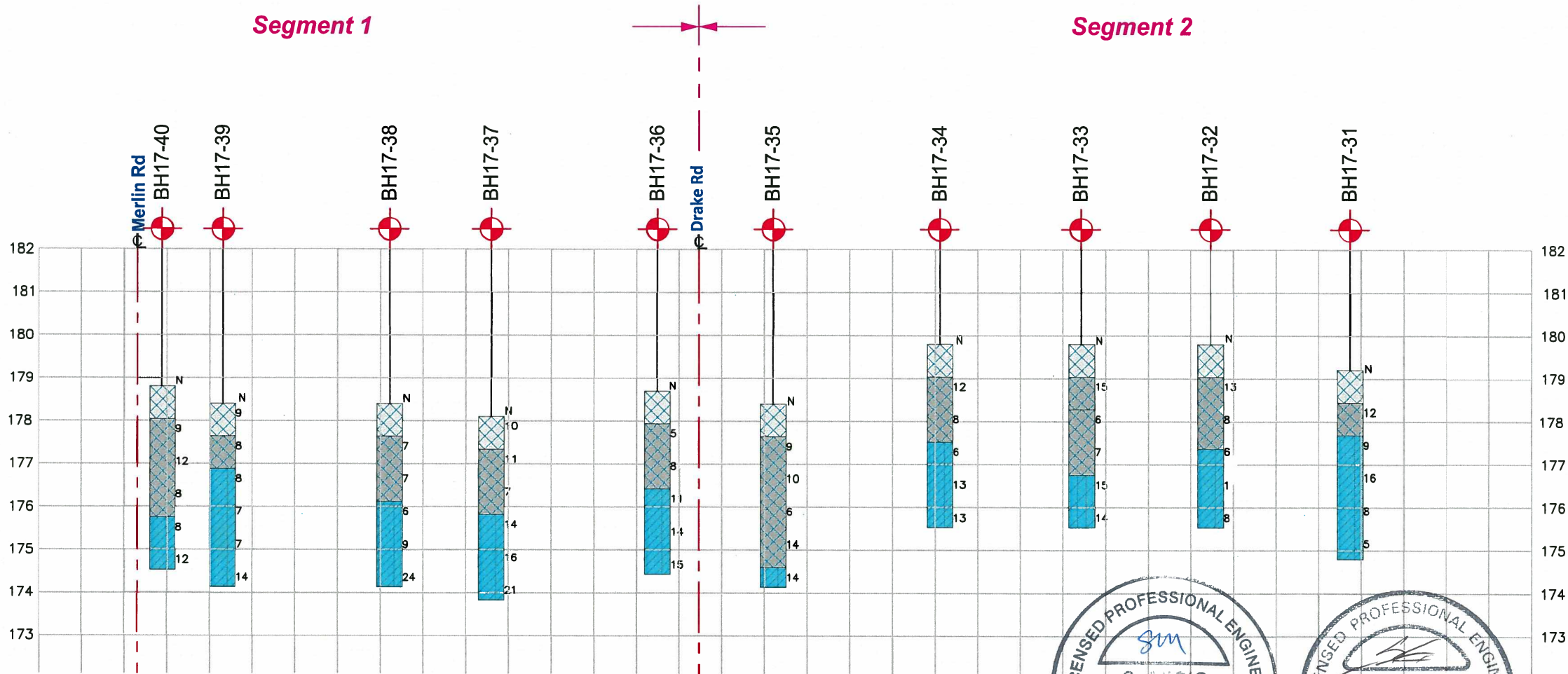
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	BY	DESCRIPTION	
		GEOCRE NO. 4018-69	
		PROJECT NO. ADM-00235197-L0	
SUBM'D SM	CHECKED SM	DATE	Jan. 24, 18
DRAWN SH	CHECKED SM	APPROVED SG	DWG. 1



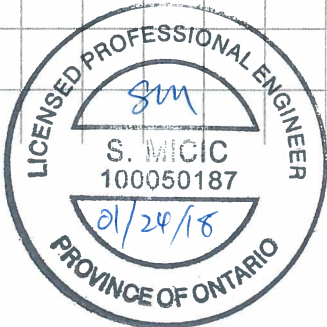
PLAN

Segment 1

Segment 2



PROFILE ALONG HWY 401



Agreement No. 3015-E-0017
Assignment No. 8
WP 3102-15-00

Installation of High Tension Cable Median Barrier at Hwy 401,
Windsor to London-
Interchanges of Essex Rd. 42 (Sta. 16+200 Tibury W) and
Victoria Rd. (Sta. 11+200 Howard Twp.)

BOREHOLE LOCATION PLAN AND SOIL STRATA

exp Services Inc.

KEY PLAN

LEGEND

Location of New Boreholes Drilled by EXP

N Standard Penetration Test (Blows/0.3 m)

Groundwater level measured in open hole
(Note: All other boreholes were dry)

Fill: Sand and Gravel

Fill: Silty Sand/Sandy Silt

Fill: Silty Clay/Clayey Silt

Silty Clay/Clayey Silt

Silty Sand

Topsoil

BH No.	APPROX. ELEV.	MTM CO-ORDINATES	
		NORTHING	EASTING
BH17-40	178.8	4685561.1	320374.2
BH17-39	178.4	4685763.2	320746.7
BH17-38	178.4	4686302.7	321827.7
BH17-37	178.1	4686382.5	322626.4
BH17-36	178.7	4686491.9	323905.9
BH17-35	178.4	4686803.3	324678.8
BH17-34	179.8	4687233.2	325780.2
BH17-33	179.8	4687618.7	326723.7
BH17-32	179.8	4687973.3	327589.4
BH17-31	179.2	4688352.4	328509.4

NOTE

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SCALE

HOR 0 200 1000 m

VERT 0 1 4 m

SM	SUBMISSION FOR MTO REVIEW
BY	DESCRIPTION
GEOCRES NO. 4018-69	
PROJECT NO. ADM-00235197-L0	
SUBMD SM	CHECKED SM
DATE	Jan. 24, 18
DRAWN SH	CHECKED SM
APPROVED SG	DWG. 2

METRIC
DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN.

Agreement No. 3015-E-0017
Assignment No. 8
WP 3102-15-00
Installation of High Tension Cable Median Barrier at Hwy 401,
Windsor to London-
Interchanges of Essex Rd. 42 (Sta. 16+200 Tibury W) and
Victoria Rd. (Sta. 11+200 Howard Twp.)
BOREHOLE LOCATION PLAN AND SOIL STRATA



exp Services Inc.



- LEGEND
- Location of New Boreholes Drilled by EXP
 - N Standard Penetration Test (Blows/0.3 m)
 - Groundwater level measured in open hole (Note: All other boreholes were dry)

- SOIL STRATA
- FILL: SAND AND GRAVEL
 - FILL: SILTY SAND/ SANDY SILT/ SAND/ SILT
 - FILL: SILTY CLAY/ CLAYEY SILT
 - SILT/ CLAY/ CLAYEY SILT
 - SILT/ SAND
 - TOPSOIL

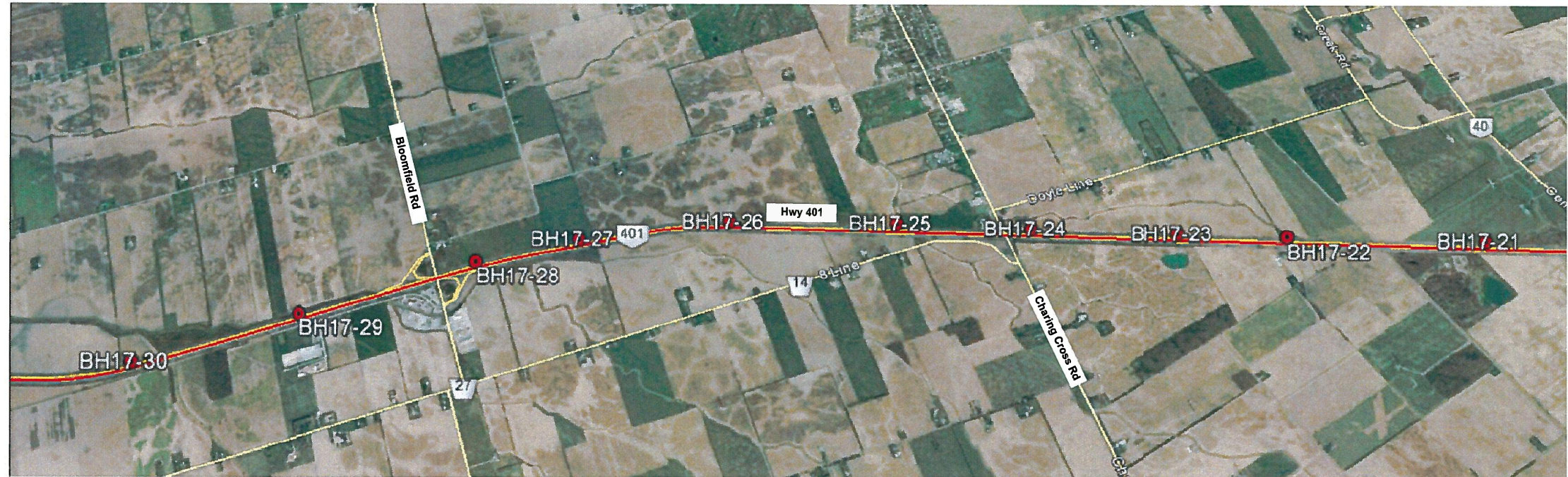
BH No.	APPROX. ELEV.	MTM CO-ORDINATES	
		NORTHING	EASTING
BH17-30	179.2	4688779.9	329301.9
BH17-29	180.1	4689539.8	330125.8
BH17-28	181.4	469719.4	373966.7
BH17-27	180.1	4690835.9	331606.9
BH17-26	181.4	4691389.9	332514.9
BH17-25	182.0	4691848.8	333617.7
BH17-24	182.3	4692184.2	334512.9
BH17-23	183.2	4692559.7	335483.9
BH17-22	183.5	4692840.1	336197.5
BH17-21	184.4	4695060.5	337493.9

NOTE

This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

The complete foundation investigation and design report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in the report and related documents are specifically excluded in accordance with the conditions of Section GC 2.01 of OPS Gen. Cond.

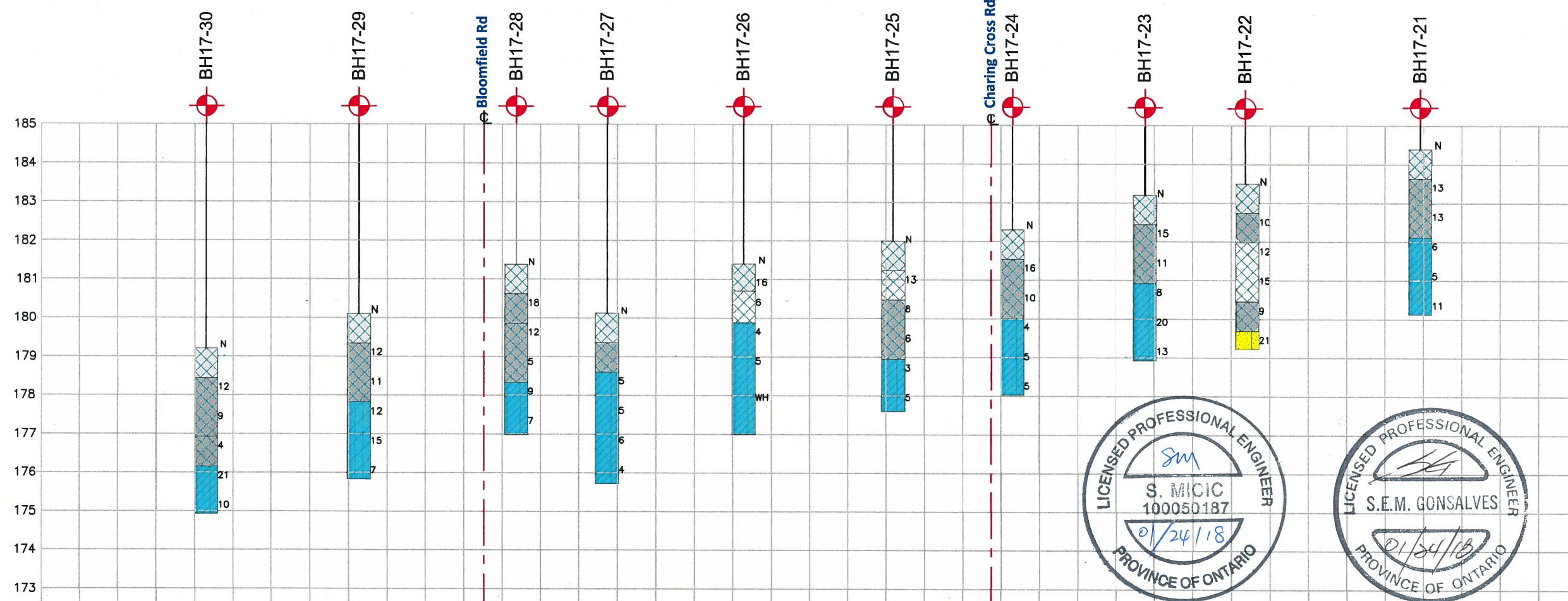
SCALE			
HOR		0 200 1000 m	
VERT		0 1 4 m	
DATE		SUBMISSION FOR MTO REVIEW	
DATE		DESCRIPTION	
		GEOCRES NO. 4018-69	
		PROJECT NO. ADM-00235197-L0	
SUBMD SM	CHECKED SM	DATE	Jan. 24, 18
DRAWN SH	CHECKED SM	APPROVED SG	DWG. 3



PLAN

Segment 2

Segment 3

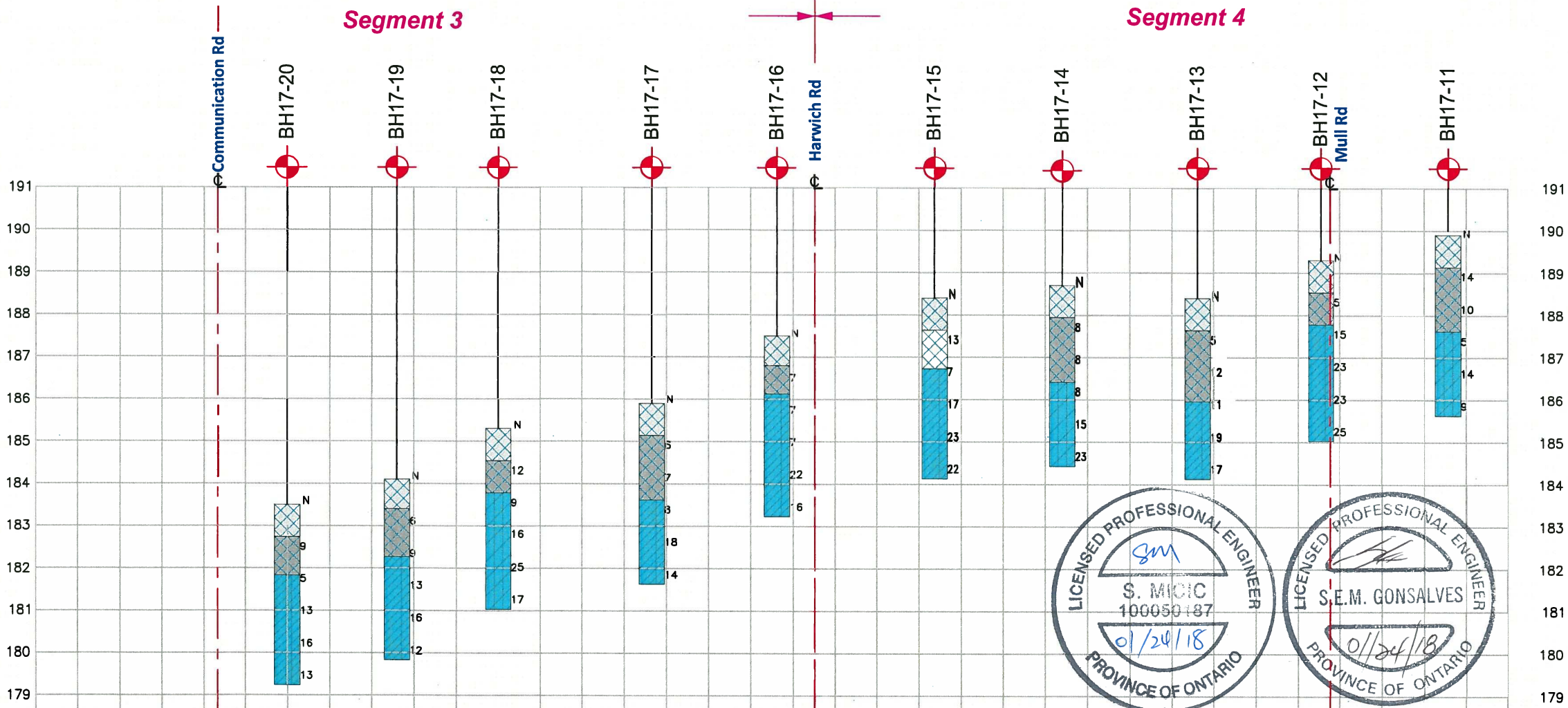


PROFILE ALONG HWY 401





PLAN



PROFILE ALONG HWY 401



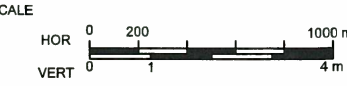
- Location of New Boreholes Drilled by EXP
- N Standard Penetration Test (Blows/0.3 m)
- Groundwater level measured in open hole (Note: All other boreholes were dry)

- FILL SAND AND GRAVEL
- FILL SILTY SAND/ SANDY SILT/ SAND/ SILT
- FILL SILTY CLAY/ CLAYEY SILT
- SILT CLAY/ CLAYEY SILT
- SILT SAND
- TOPSOIL

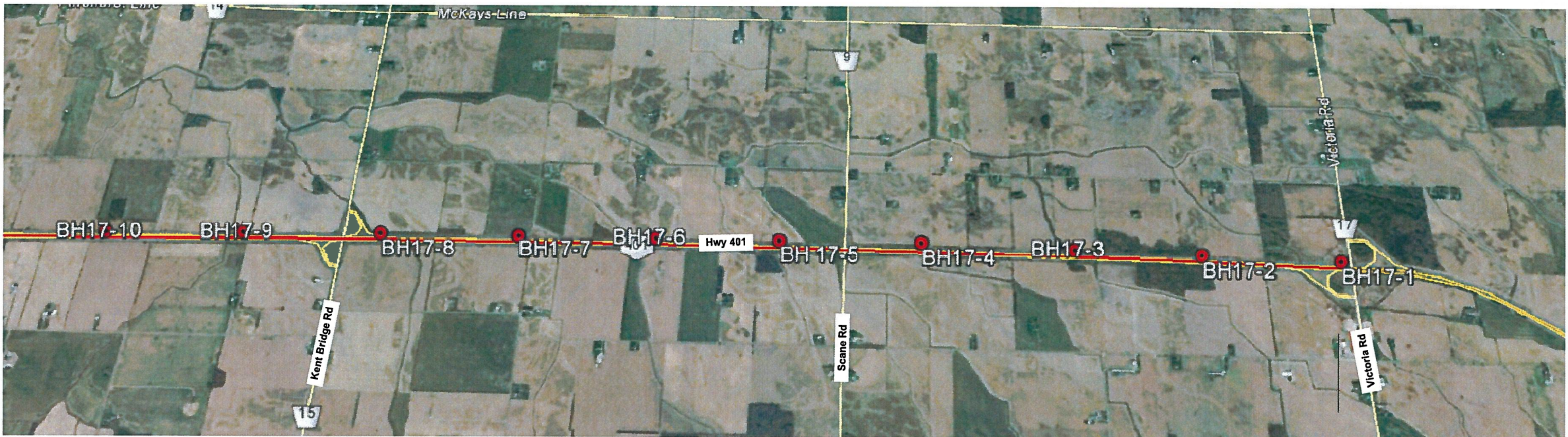
BH No.	APPROX. ELEV.	MTM CO-ORDINATES	
		NORTHING	EASTING
BH17-20	183.5	4693884.5	338856.8
BH17-19	184.1	4694146.7	339602.7
BH17-18	185.3	4694388.1	340287.1
BH17-17	185.9	4694761.5	341335.0
BH17-16	187.2	4695060.5	342159.2
BH17-15	188.4	4695462.6	343176.7
BH17-14	188.7	4696058.1	343832.7
BH17-13	188.4	4696744.7	344561.1
BH17-12	189.3	4697510.3	345368.0
BH17-11	189.9	4698101.9	345967.9

This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

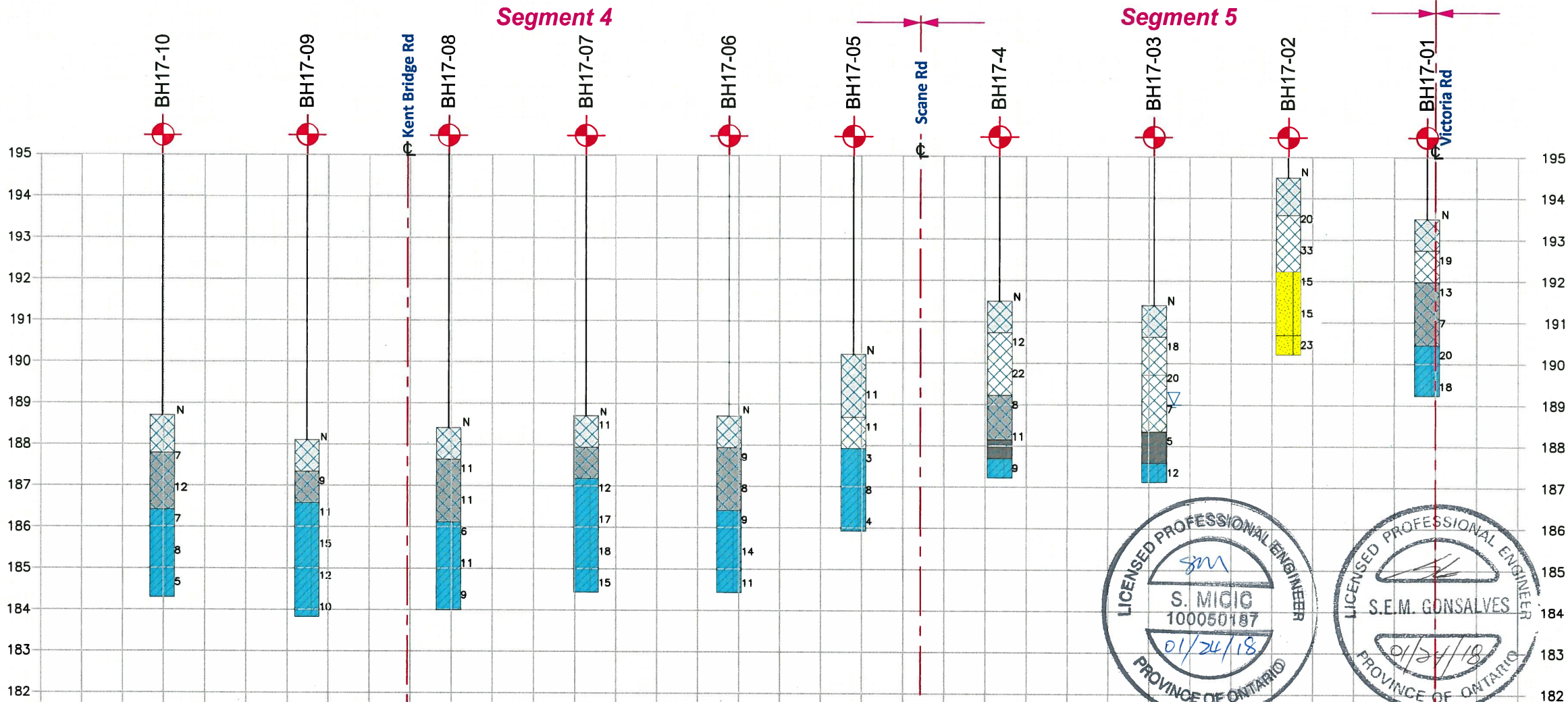
The complete foundation investigation and design report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in the report and related documents are specifically excluded in accordance with the conditions of Section GC 2.01 of OPS Gen. Cond.



SUBMITTAL		SUBMISSION FOR MTO REVIEW	
DATE	BY	DESCRIPTION	
		GEOCRE NO. 4018-69	
		PROJECT NO. ADM-00235197-L0	
SUBMD	SM	CHECKED	SM
DRAWN	SH	CHECKED	SM
DATE	Jan. 24, 18	APPROVED	SG
DWG.	4		



PLAN



LEGEND

- Location of New Boreholes Drilled by EXP
- N Standard Penetration Test (Blows/0.3 m)
- Groundwater level measured in open hole (Note: All other boreholes were dry)

SOIL STRATA

- FILL: SAND AND GRAVEL
- FILL: SILTY SAND/ SANDY SILT
- FILL: SILTY CLAY/ CLAYEY SILT
- SILT SAND
- TOPSOIL
- SILT CLAY/ CLAYEY SILT

BH No.	APPROX. ELEV.	MTM CO-ORDINATES	
		NORTHING	EASTING
BH17-10	188.7	4698794.2	346681.5
BH17-09	188.1	4699534.9	347432.6
BH17-08	188.4	4700163.4	348093.3
BH17-07	188.7	4700897.8	348858.2
BH17-06	188.7	4701567.3	349567.1
BH17-05	190.2	4702144.1	350185.4
BH17-04	191.5	4702855.4	350925.4
BH17-03	191.4	4703594.7	351747.4
BH17-02	194.5	4704205.8	352427.6
BH17-01	193.5	4704875.8	353168.9

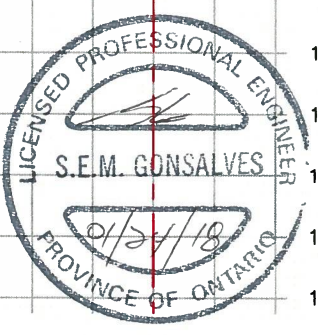
NOTE

This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

The complete foundation investigation and design report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in the report and related documents are specifically excluded in accordance with the conditions of Section GC 2.01 of OPS Gen. Cond.



SM	SUBMISSION FOR MTO REVIEW		
BY	DESCRIPTION		
	GEOCRES NO. 4018-69		
	PROJECT NO. ADM-00235197-L0		
SUBMD SM	CHECKED SM	DATE	Jan. 24, 18
DRAWN SH	CHECKED SM	APPROVED SG	DWG. 5



Appendix C – Borehole Logs

Explanation of Terms Used on Borehole Records

SOIL DESCRIPTION

Terminology describing common soil genesis:

Topsoil: mixture of soil and humus capable of supporting good vegetative growth.

Peat: fibrous fragments of visible and invisible decayed organic matter.

Fill: where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc.; none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional geotechnical site investigation.

Till: the term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

Terminology describing soil structure:

Desiccated: having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.

Stratified: alternating layers of varying material or color with the layers greater than 6 mm thick.

Laminated: alternating layers of varying material or color with the layers less than 6 mm thick.

Fissured: material breaks along plane of fracture.

Varved: composed of regular alternating layers of silt and clay.

Slickensided: fracture planes appear polished or glossy, sometimes striated.

Blocky: cohesive soil that can be broken down into small angular lumps which resist further breakdown.

Lensed: inclusion of small pockets of different soil, such as small lenses of sand scattered through a mass of clay; not thickness.

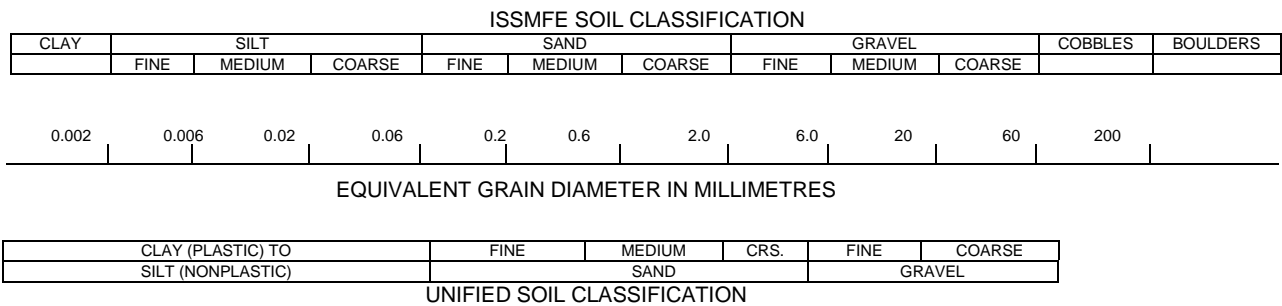
Seam: a thin, confined layer of soil having different particle size, texture, or color from materials above and below.

Homogeneous: same color and appearance throughout.

Well Graded: having wide range in grain sized and substantial amounts of all predominantly on grain size.

Uniformly Graded: predominantly on grain size.

All soil sample descriptions included in this report follow the ASTM D2487-11 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System). The system divides soils into three major categories: (1) coarse grained, (2) fine-grained, and (3) highly organic. The soil is then subdivided based on either gradation or plasticity characteristics. The system provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification. The classification excludes particles larger than 76 mm. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually in accordance with ASTM D2488-09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems. Others may use different classification systems; one such system is the ISSMFE Soil Classification.



Terminology describing materials outside the USCS, (e.g. particles larger than 76 mm, visible organic matter, construction debris) is based upon the proportion of these materials present and as described below in accordance with Note 16 in ASTM D2488-09a:

Table a: Percent or Proportion of Soil, Pp

	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	$5 \leq P_p \leq 10\%$
Little	$15 \leq P_p \leq 25\%$
Some	$30 \leq P_p \leq 45\%$
Mostly	$50 \leq P_p \leq 100\%$

The standard terminology to describe cohesionless soils includes the compactness as determined by the Standard Penetration Test 'N' value:

Table b: Apparent Density of Cohesionless Soil

	'N' Value (blows/0.3 m)
Very Loose	$N < 5$
Loose	$5 \leq N < 10$
Compact	$10 \leq N < 30$
Dense	$30 \leq N < 50$
Very Dense	$50 \leq N$

The standard terminology to describe cohesive soils includes consistency, which is based on undrained shear strength as measured by insitu vane tests, penetrometer tests, unconfined compression tests or similar field and laboratory analysis, Standard Penetration Test 'N' values can also be used to provide an approximate indication of the consistency and shear strength of fine grained, cohesive soils:

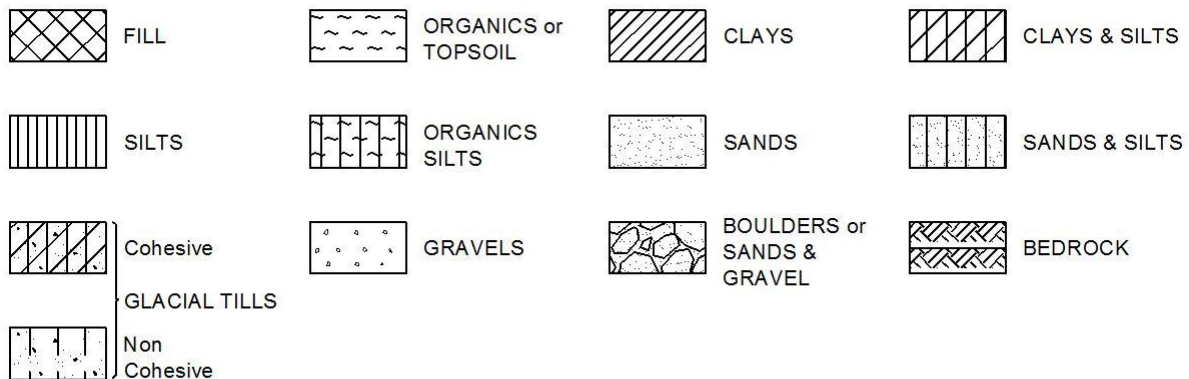
Table c: Consistency of Cohesive Soil

Consistency	Vane Shear Measurement (kPa)	'N' Value
Very Soft	<12.5	<2
Soft	12.5-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

Note: 'N' Value - The Standard Penetration Test records the number of blows of a 140 pound (64kg) hammer falling 30 inches (760mm), required to drive a 2 inch (50.8mm) O.D. split spoon sampler 1 foot (305mm). For split spoon samples where full penetration is not achieved, the number of blows is reported over the sampler penetration in meters (e.g. 50/0.15).

STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols:



WATER LEVEL MEASUREMENT



Open Borehole or Test Pit



Monitoring Well, Piezometer or Standpipe

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

SS	Split spoon sample (obtained from the Standard Penetration Test)
WS	Wash sample
BS	Bulk sample
TW	Thin wall sample or Shelby tube
PS	Piston sample
AS	Auger sample
VT	Vane test
GS	Grab sample
HQ, NQ, etc.	Rock core samples obtained with the use of standard size diamond drilling bits

STRESS AND STRAIN

u_w	kPa	Pore water pressure
r_u	1	Pore pressure ratio
σ	kPa	Total normal stress
σ'	kPa	Effective normal stress
τ	kPa	Shear stress
$\sigma_1, \sigma_2, \sigma_3$	kPa	Principal stresses
ε	%	Linear strain
$\varepsilon_1, \varepsilon_2, \varepsilon_3$	%	Principal strains
E	kPa	Modulus of linear deformation
G	kPa	Modulus of shear deformation
μ	1	Coefficient of friction

MECHANICAL PROPERTIES OF SOIL

m_v	kPa^{-1}	Coefficient of volume change
c_c	1	Compression index
c_s	1	Swelling index
c_r	1	Recompression index
c_v	m^2/s	Coefficient of consolidation
H	m	Drainage path
T_v	1	Time factor
U	%	Degree of consolidation
σ'_{v0}	kPa	Effective overburden pressure
σ'_p	kPa	Preconsolidation pressure
τ_f	kPa	Shear strength
c'	kPa	Effective cohesion intercept
ϕ'	$-\circ$	Effective angle of internal friction
c_u	kPa	Apparent cohesion intercept
ϕ_u	$-\circ$	Apparent angle of internal friction
τ_R	kPa	Residual shear strength
τ_r	kPa	Remoulded shear strength
S_t	1	Sensitivity = c_u/τ_r

PHYSICAL PROPERTIES OF SOIL

P_s	kg/m^3	Density of solid particles
γ_s	kN/m^3	Unit weight of solid particles
ρ_w	kg/m^3	Density of water
γ_w	kN/m^3	Unit weight of water
ρ	kg/m^3	Density of soil
γ	kN/m^3	Unit weight of soil
ρ_d	kg/m^3	Density of dry soil
γ_d	kN/m^3	Unit weight of dry soil
ρ_{sat}	kg/m^3	Density of saturated soil
γ_{sat}	kN/m^3	Unit weight of saturated soil
ρ'	kg/m^3	Density of submerged soil
γ'	kN/m^3	Unit weight of submerged soil
e	1, %	Void ratio
n	1, %	Porosity
w	1, %	Water content
S_r	%	Degree of saturation
W_L	%	Liquid limit
W_P	%	Plastic limit
W_s	%	Shrinkage limit
I_p	%	Plasticity index = $(W_L - W_P)$
I_L	%	Liquidity index = $(W - W_P)/I_p$
I_C	%	Consistency index = $(W_L - W)/I_p$
e_{max}	1, %	Void ratio in loosest state
e_{min}	1, %	Void ratio in densest state
I_D	1	Density index = $(e_{max} - e)/(e_{max} - e_{min})$
D	mm	Grain diameter
D_n	mm	N percent - diameter
C_u	1	Uniformity coefficient
h	m	Hydraulic head or potential
q	m^3/s	Rate of discharge
v	m/s	Discharge velocity
i	1	Hydraulic gradient
k	m/s	Hydraulic conductivity
j	kN/m^3	Seepage force

Brampton, Ontario

RECORD OF BOREHOLE No 17-52

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4680908.58N, 309283.01E ORIGINATED BY MU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.11.21 - 2017.11.21 LATITUDE 42.2677306 LONGITUDE -82.4456567 CHECKED BY SM

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 X P. PENETROMETER						
178.6 0.0	Ground Surface FILL: SAND AND GRAVEL trace silt													
177.8 0.8	FILL: SILTY CLAY trace gravel, little sand, brown and grey mottled, moist, firm to very stiff		1	SS	6									
			2	SS	5									
			3	SS	5									
			4	SS	17									
			5	SS	18									
174.5 4.3	SILTY CLAY/CLAYEY SILT - trace gravel, trace sand, brown and grey mottled, moist, very stiff End of Borehole at 4.27 m below ground surface. Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 2.44 m below ground surface. 3. Borehole was dry in open hole.													

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-51

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 468124.10N, 352688.66E ORIGINATED BY MU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.11.21 - 2017.11.21 LATITUDE 42.267876 LONGITUDE -82.43801 CHECKED BY SM

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 X P. PENETROMETER																
177.4	Ground Surface						20	40	60	80	100					
0.0	FILL: SAND AND GRAVEL trace silt															
176.6																
0.8	FILL: SILTY CLAY trace gravel, little sand, brown and grey mottled, moist, stiff		1	SS	10							>>X	○			
			2	SS	8							>>X	○			
174.8			3	SS	20							>>X	○			
2.6	SILTY CLAY/CLAYEY SILT trace gravel, trace to some sand, brown, moist, very stiff															
			4	SS	17							>>X	○			
			5	SS	15							>>X	○			
173.1																
4.3	End of Borehole at 4.27 m below ground surface.															
	Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 2.74 m below ground surface. 3. Borehole was dry in open hole.															

+ ³, X ³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-50

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4681316.32N, 310948.21E ORIGINATED BY MU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.11.21 - 2017.11.21 LATITUDE 42.2713903 LONGITUDE -82.4254668 CHECKED BY SM

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 X P. PENETROMETER																
177.6 0.0	Ground Surface FILL: SAND AND GRAVEL trace silt						20	40	60	80	100					
176.8 0.8	FILL: SILTY CLAY trace gravel, trace to little sand, brown and grey mottled, moist, firm		1	SS	5							>>X		○		
												>>X		○		
175.3 2.3	SILTY CLAY/CLAYEY SILT trace gravel, trace to little sand, brown to grey, moist, firm to very stiff		3	SS	13							>>X		○		
												>>X		○		
173.3 4.3	End of Borehole at 4.27 m below ground surface. Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 2.44 m below ground surface. 3. Borehole was dry in open hole.		5	SS	5		X							○		

+³, X³: Numbers refer to Sensitivity O 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-49

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4681512.44N, 311741.18E ORIGINATED BY MU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.11.21 - 2017.11.21 LATITUDE 42.2731494 LONGITUDE -82.4158515 CHECKED BY SM

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										
								20 40 60 80 100										
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X P. PENETROMETER				WATER CONTENT (%)							
177.7 0.0	Ground Surface FILL: SAND AND GRAVEL trace silt																	
176.9 0.8	FILL: SILTY CLAY trace gravel, little sand, brown and grey mottled, moist, stiff		1	SS	9							>>X	○			1 17 37 45		
			2	SS	10							>>X	○					
			3	SS	7							>>X	○					
174.6 3.1	SILTY CLAY/CLAYEY SILT trace gravel, few to little sand, brown to grey, moist, stiff		4	SS	8							>>X	○					
			5	SS	9							>>X	┌─┐			1 14 42 41		
173.4 4.3	End of Borehole at 4.27 m below ground surface. Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 3.05 m below ground surface. 3. Borehole was dry in open hole.																	

+³, X³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-48

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4681701.67N, 312603.2E ORIGINATED BY MU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.11.21 - 2017.11.21 LATITUDE 42.274845 LONGITUDE -82.4053986 CHECKED BY SM

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 X P. PENETROMETER																
177.7	Ground Surface						20	40	60	80	100					
0.0	FILL: SAND AND GRAVEL trace silt															
176.9																
0.8	FILL: SILTY CLAY trace gravel, trace to little sand, brown and grey mottled, moist, stiff		1	SS	11											
			2	SS	10											
175.4																
2.3	SILTY CLAY/CLAYEY SILT trace gravel, trace to little sand, brown to grey, moist, stiff to very stiff		3	SS	9											
			4	SS	17											
			5	SS	16											
173.4																
4.3	End of Borehole at 4.27 m below ground surface.															
	Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 3.05 m below ground surface. 3. Groundwater level was measured in open hole upon completion of drilling at 1.52 m below ground surface.															

+³, X³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-47

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4682000.09N, 313882.82E ORIGINATED BY MU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.11.21 - 2017.11.21 LATITUDE 42.277518 LONGITUDE -82.3898806 CHECKED BY SM

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 TRIAXIALX P. PENETROMETER										
178.3	Ground Surface						20	40	60	80	100							
0.0	FILL: SAND AND GRAVEL trace asphalt, trace silt																	
177.5																		
0.8	FILL: SILTY CLAY trace gravel, trace to little sand, brown and grey mottled, moist, firm		1	SS	5							X	○					
			2	SS	7				X				○					
176.0																		
2.3	SILTY CLAY/CLAYEY SILT trace gravel, little sand, brown to grey, moist, stiff		3	SS	8							>>X	○					
			4	SS	13							>>X	○					
													10	11		2 24 42 32		
			5	SS	14							>>X	○					
174.0																		
4.3	End of Borehole at 4.27 m below ground surface.																	
	Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 3.05 m below ground surface. 3. Borehole was dry in open hole.																	

+³, X³: Numbers refer to Sensitivity o 3% STRAIN AT FAILURE

ONTARIO MTO ADM-00235197-L0 - ASSIGN8.GPJ ONTARIO.MTO.GDT 1/12/18

Brampton, Ontario

RECORD OF BOREHOLE No 17-46

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4682201.47N, 314741.62E ORIGINATED BY MU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.11.21 - 2017.11.21 LATITUDE 42.2793207 LONGITUDE -82.3794651 CHECKED BY SM

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 X P. PENETROMETER										
179.1 0.0	Ground Surface FILL: SAND AND GRAVEL trace silt, trace asphalt, trace topsoil						179											
178.3 0.8	FILL: SILTY CLAY trace gravel, trace to little sand, brown and grey mottled, moist, firm to stiff		1	SS	5		178					X		○				
			2	SS	7							X		○				
			3	SS	10		177						>>X		○			
176.0 3.1			SILTY CLAY/CLAYEY SILT trace gravel, trace to little sand, brown to grey, moist, stiff to very stiff	4	SS		12	176					>>X		○			
	5	SS		23						>>X		○						
174.8 4.3	End of Borehole at 4.27 m below ground surface. Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 3.05 m below ground surface. 3. Borehole was dry in open hole.					175												

+³, X³: Numbers refer to Sensitivity O 3% STRAIN AT FAILURE

ONTARIO MTO ADM-00235197-L0 - ASSIGN8.GPJ ONTARIO.MTO.GDT 1/12/18

Brampton, Ontario

RECORD OF BOREHOLE No 17-45

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4682420.92N, 316307.63E ORIGINATED BY MU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.11.21 - 2017.11.21 LATITUDE 42.281275 LONGITUDE -82.3604741 CHECKED BY SM

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 X P. PENETROMETER																
179.2 0.0	Ground Surface FILL: SAND AND GRAVEL trace silt, trace asphalt, trace topsoil						20	40	60	80	100					
178.4 0.8	FILL: SILTY CLAY - trace gravel, trace to little sand, brown and grey mottled, moist, stiff		1	SS	12							>>X	○			
			2	SS	9							>>X	○			
			3	SS	8				X				○			
176.1 3.1	SILTY CLAY/CLAYEY SILT trace gravel, trace to some sand, brown to grey, moist, stiff to very stiff		4	SS	15							>>X	○			2 20 (78)
			5	SS	10				X				○			
174.9 4.3	End of Borehole at 4.27 m below ground surface. Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 3.05 m below ground surface. 3. Borehole was dry in open hole.															

+³, X³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-44

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4683081.20N, 317107.54E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.11.20 - 2017.11.20 LATITUDE 42.2872076 LONGITUDE -82.3507615 CHECKED BY SM

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
179.1	Ground Surface							20 40 60 80 100						
0.0	FILL: SAND AND GRAVEL trace silt, trace asphalt, trace topsoil						179							
178.3														
0.8	FILL: SILTY CLAY trace organics, trace gravel, trace to little sand, dark brown to grey, moist, firm to stiff		1	SS	8		178			X	o			
			2	SS	7				X		o			
							177							
176.8										X				
2.3	SILTY CLAY/CLAYEY SILT occassional cobbles, trace gravel, little sand, brown to grey, moist, stiff to very stiff		3	SS	8						o			
			4	SS	18		176				o			
			5	SS	19					>>X				
174.8							175				o			
4.3	End of Borehole at 4.27 m below ground surface.													
	Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 3.66 m below ground surface. 3. Borehole was dry in open hole.													1 19 35 35

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-43

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 44683713.29N, 317805.72E ORIGINATED BY MU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.11.20 - 2017.11.20 LATITUDE 42.2928873 LONGITUDE -82.3422813 CHECKED BY SM

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X P. PENETROMETER								WATER CONTENT (%)		
179.3	Ground Surface							20	40	60	80	100						
0.0	FILL: SAND AND GRAVEL trace silt, trace asphalt, trace topsoil, compact		1	SS	26		179											
178.5																		
0.8	FILL: SILTY CLAY trace gravel, few to little sand, brown to grey, moist, stiff		2	SS	9		178											
			3	SS	8													
177.0							177											
2.3	SILTY CLAY/CLAYEY SILT trace gravel, trace to little sand, brown to grey, moist, stiff to very stiff		4	SS	12													
			5	SS	21		176											
			6	SS	19													
175.0																		
4.3	End of Borehole at 4.27 m below ground surface.																	
	Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 4.1 m below ground surface. 3. Borehole was dry in open hole.																	

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-42

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4684348.05N, 318513.36E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.11.20 - 2017.11.20 LATITUDE 42.2985902 LONGITUDE -82.3336849 CHECKED BY SM

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 X P. PENETROMETER									
178.0	Ground Surface						20	40	60	80	100						
0.0	FILL: SAND AND GRAVEL trace silt, trace asphalt, trace topsoil																
177.2																	
0.8	FILL: SILTY CLAY trace gravel, few to little sand, trace organics, brown to grey, moist, firm		1	SS	6	177											
			2	SS	5	176											
175.4			3	SS	5												
2.6	SILTY CLAY/CLAYEY SILT trace gravel, few to little sand seams, brown to grey, moist, firm to very stiff					175											
			4	SS	17												
			5	SS	18	174											
173.7																	
4.3	End of Borehole at 4.27 m below ground surface.																
	Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 3.35 m below ground surface. 3. Borehole was dry in open hole.																

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE




Brampton, Ontario

RECORD OF BOREHOLE No 17-41

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4685056.47N, 319449.57E ORIGINATED BY MU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.11.20 - 2017.11.20 LATITUDE 42.3049514 LONGITUDE -82.3223127 CHECKED BY SM

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 (%)		
								20 40 60 80 100	20 40 60								
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X P. PENETROMETER										
177.8	Ground Surface		1	SS	12		177							2 19 39 40			
0.0	FILL: SAND AND GRAVEL trace silt, trace asphalt, trace topsoil																
177.0			2	SS	10			176									
0.8	FILL: SILTY CLAY trace topsoil, trace gravel, trace sand, brown, moist, stiff																
176.3			3	SS	7				175								
1.5	SILTY CLAY/CLAYEY SILT trace gravel, little sand seams, brown to grey, moist, firm to very stiff																
			4	SS	8												
		5	SS	18													
			6	SS	20	174											
173.5																	
4.3	End of Borehole at 4.27 m below ground surface.																
Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 4.27 m below ground surface. 3. Borehole was dry in open hole.																	

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-40

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4685561.12N, 320374.16E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.11.20 - 2017.11.20 LATITUDE 42.309477 LONGITUDE -82.3110846 CHECKED BY SM

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 TRIAXIALX P. PENETROMETER											
178.8 0.0	Ground Surface FILL: SAND AND GRAVEL trace silt, trace asphalt, trace topsoil							20	40	60	80	100		20	40	60			
178.0 0.8	FILL: SILTY CLAY trace topsoil, little gravel, some sand, dark brown, moist, stiff		1	SS	9		178							○				19 30 (51)	
				2	SS	12		177							>>X	○			
			3	SS	8					X					○				
175.7 3.1	SILTY CLAY/CLAYEY SILT trace gravel, occassional sand seams, brown to grey, moist, stiff		4	SS	8		176												
																○			
174.5 4.3	End of Borehole at 4.27 m below ground surface. Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 3.35 m below ground surface. 3. Borehole was dry in open hole.		5	SS	12		175							X	○				

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE



Brampton, Ontario

RECORD OF BOREHOLE No 17-39

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4685763.16N, 320746.72E ORIGINATED BY MU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.11.20 - 2017.11.20 LATITUDE 42.3112885 LONGITUDE -82.3065599 CHECKED BY SM

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 X P. PENETROMETER											
178.4 0.0	Ground Surface FILL: SAND AND GRAVEL trace silt, trace asphalt, loose		1	SS	9	178													
177.6 0.8	FILL: SILTY CLAY trace organics, trace gravel, brown, moist, stiff		2	SS	8							>>X							
176.9 1.5	SILTY CLAY/CLAYEY SILT trace gravel, occassional sand seams, brown to grey, moist, firm to stiff		3	SS	8	177				X									
			4	SS	7	176					X								
			5	SS	7	175				X									
174.1 4.3	End of Borehole at 4.27 m below ground surface. Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 3.81 m below ground surface. 3. Borehole was dry in open hole.		6	SS	14						>>X								

+³, X³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-38

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4686302.67N, 321827.66E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.11.20 - 2017.11.20 LATITUDE 42.3161231 LONGITUDE -82.2934319 CHECKED BY SM

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 X P. PENETROMETER							
178.4	Ground Surface						20	40	60	80	100					
0.0	FILL: SAND AND GRAVEL trace silt, trace asphalt															
177.6																
0.8	FILL: SILTY CLAY trace organics, trace gravel, brown, moist, firm		1	SS	7											
			2	SS	7											
176.1																
2.3	SILTY CLAY/CLAYEY SILT trace gravel, little sand seams, brown to grey, moist, firm to very stiff		3	SS	6											
			4	SS	9											
174.1			5	SS	24											
4.3	End of Borehole at 4.27 m below ground surface.															
	Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 3.35 m below ground surface. 3. Borehole was dry in open hole.															

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-37

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4686382.47N, 322626.41E ORIGINATED BY MU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.11.20 - 2017.11.20 LATITUDE 42.3168237 LONGITUDE -82.2837396 CHECKED BY SM

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)					
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIALX P. PENETROMETER													
178.1	Ground Surface						20	40	60	80	100	20	40	60	kN/m ³	GR	SA	SI	CL		
0.0	FILL: SAND AND GRAVEL trace silt, trace asphalt, compact		1	SS	10													41	50	(9)	
177.3																					
0.8	FILL: SILTY CLAY trace organics, trace gravel, brown to black, moist, firm to stiff		2	SS	11																
			3	SS	7																
175.8																					
2.3	SILTY CLAY/CLAYEY SILT trace gravel, few to little sand seams, brown to grey, moist, firm to very stiff		4	SS	14													1	13	39	44
			5	SS	16																
			6	SS	21																
173.8																					
4.3	End of Borehole at 4.27 m below ground surface.																				
	Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 3.67 m below ground surface. 3. Borehole was dry in open hole.																				

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-36

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4686491.85N, 323905.99E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.11.20 - 2017.11.20 LATITUDE 42.3177782 LONGITUDE -82.2682129 CHECKED BY SM

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	○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL						× P. PENETROMETER			
178.7 0.0	Ground Surface FILL: SAND AND GRAVEL trace silt, trace asphalt																			
177.9 0.8	FILL: SILTY CLAY trace organics, trace gravel, brown to black, moist, firm to stiff		1	SS	5						>>×		○							
										×										
			2	SS	8								○							
176.4 2.3	SILTY CLAY/CLAYEY SILT few gravel, little sand seams, brown to grey, moist, stiff to very stiff		3	SS	11						>>×		○							
										×			○			5 21 (74)				
			4	SS	14															
											>>×		○							
174.4 4.3	End of Borehole at 4.27 m below ground surface. Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Since, borehole was caved upto top after auger pullout, groundwater level was not measured in open hole upon completion of drilling.		5	SS	15															

+³, X³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-35

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4686803.27N, 324678.76E ORIGINATED BY MU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.11.20 - 2017.11.20 LATITUDE 42.3205627 LONGITUDE -82.2588273 CHECKED BY SM

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)	
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X P. PENETROMETER										
178.4	Ground Surface						20	40	60	80	100							
0.0	FILL: SAND AND GRAVEL trace silt, trace asphalt, trace topsoil																	
177.6																		
0.8	FILL: SILTY CLAY few sand, dark brown to grey, moist, firm to stiff		1	SS	9							>>X	○					
			2	SS	10							>>X	○					
			3	SS	6					X			○					
			4	SS	14							>>X	○					
174.6																		
3.8	SILTY CLAY/CLAYEY SILT trace gravel, occassional sand seams, brown to grey, moist, stiff		5	SS	14							>>X	○					
174.1																		
4.3	End of Borehole at 4.27 m below ground surface.																	
	Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 3.58 m below ground surface. 3. Borehole was dry in open hole.																	

+³, X³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-34

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4687233.23N, 325780.24E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.19 - 2017.12.19 LATITUDE 42.32440489 LONGITUDE -82.24544843 CHECKED BY SM

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 TRIAXIALX P. PENETROMETER															
179.8 0.0	Ground Surface FILL: SAND AND GRAVEL						20 40 60 80 100								
179.0 0.8	FILL: CLAYEY SILT trace gravel, trace organics, brown, moist, stiff		1	SS	12					>>X					
			2	SS	8					X					
177.5 2.3	SILTY CLAY/CLAYEY SILT few wet sand seams, brown to grey mottled, moist, firm to stiff		3	SS	6			X							
			4	SS	13					>>X					
			5	SS	13				X						
175.5 4.3	End of Borehole at 4.27 m below ground surface. Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 4.27 m below ground surface. 3. Borehole was dry in open hole.														
	</														

+ 3, X 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-33

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4687618.69N, 326723.66E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.19 - 2017.12.19 LATITUDE 42.32784931 LONGITUDE -82.23398749 CHECKED BY SM

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 X P. PENETROMETER																
179.8 0.0	Ground Surface FILL: SAND AND GRAVEL						20	40	60	80	100					
179.0 0.8	FILL: CLAYEY SILT trace gravel, trace to little sand, brown to grey, moist, firm to very stiff		1	SS	15											
			2	SS	6											
			3	SS	7											
176.8 3.1	SILTY CLAY/CLAYEY SILT trace gravel, trace sand, brown, moist, stiff to very stiff		4	SS	15											
			5	SS	14											
175.5 4.3	End of Borehole at 4.27 m below ground surface. Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 4.27 m below ground surface. 3. Borehole was dry in open hole.															

+³, X³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MTO ADM-00235197-L0 - ASSIGN8.GPJ ONTARIO.MTO.GDT 1/12/18

Brampton, Ontario

RECORD OF BOREHOLE No 17-32

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4687973.27N, 327589.40E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.19 - 2017.12.19 LATITUDE 42.33101686 LONGITUDE -82.22346909 CHECKED BY SM

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X P. PENETROMETER										
179.8 0.0	Ground Surface FILL: SAND AND GRAVEL							20	40	60	80	100						
179.0 0.8	FILL: CLAYEY SILT trace to some organics, trace gravel, brown to grey, moist, firm to stiff		1	SS	13		179											
			2	SS	8		178											
177.4 2.4	SILT CLAY/CLAYEY SILT trace gravel, trace sand, brown to grey, moist, firm to stiff		3	SS	6		177											
			4	SS	11													
175.5 4.3	End of Borehole at 4.27 m below ground surface. Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 4.27 m below ground surface. 3. Borehole was dry in open hole.		5	SS	8		176											

+³, X³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-31

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4688352.41N, 328509.43E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.19 - 2017.12.19 LATITUDE 42.33440297 LONGITUDE -82.21228988 CHECKED BY SM

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
○ UNCONFINED + FIELD VANE ● QUICK TRIAXIALX P. PENETROMETER																
179.2	Ground Surface						20	40	60	80	100					
0.0	FILL: SAND AND GRAVEL															
178.4	FILL: CLAYEY SILT trace organics, trace gravel, grey/ brown, moist, stiff		1	SS	12							>>X	○			
0.8																
177.7	SILTY CLAY/CLAYEY SILT trace gravel, little wet sand seams, brown to grey, moist to very moist, firm to very stiff		2	SS	9							>>X	○			
1.5																
			3	SS	16							>>X	○			
	-becoming wet sandy seams		4	SS	8				X				○			
			5	SS	5			X					○			
174.8	End of Borehole at 4.4 m below ground surface.			VANE												1 15 51 33
4.4	Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 4.27 m below ground surface. 3. Borehole was dry in open hole.															

+³, X³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-30

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4688779.93N, 329301.86E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.19 - 2017.12.19 LATITUDE 42.33822749 LONGITUDE -82.20265582 CHECKED BY SM

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X P. PENETROMETER									
179.2 0.0	Ground Surface FILL: SAND AND GRAVEL						20	40	60	80	100						GR SA SI CL
178.4 0.8	FILL: CLAYEY SILT trace organics, trace gravel, brown to grey/black, moist, firm to stiff		1	SS	12							>>X	○				
			2	SS	9							X	○				
	-becoming with wet sand seams		3	SS	4				X				○				
176.1 3.1	SILTY CLAY/CLAYEY SILT trace gravel, little sand, moist, brown to grey, stiff to very stiff		4	SS	21							>>X	○	—			0 16 52 32
			5	SS	10				X				○				
174.9 4.3	End of Borehole at 4.27 m below ground surface. Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 4.27 m below ground surface. 3. Borehole was dry in open hole.																

+³, X³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-29

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4689539.81N, 330125.75E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.19 - 2017.12.19 LATITUDE 42.34504261 LONGITUDE -82.19262431 CHECKED BY SM

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 TRIAXIALX P. PENETROMETER																
180.1	Ground Surface						20	40	60	80	100					
0.0	FILL: SAND AND GRAVEL															
179.3																
0.8	FILL: CLAYEY SILT trace organics, trace gravel, trace sand, brown/black, moist, stiff		1	SS	12							>>X	○			
			2	SS	11							>>X	○			
177.8																
2.3	SILTY CLAY/CLAYEY SILT trace gravel, little sand, brown to grey, moist, firm to very stiff		3	SS	12							>>X	○			
			4	SS	15							>>X	○			
			5	SS	7					X			○			
175.8																
4.3	End of Borehole at 4.27 m below ground surface.															
	Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 4.27 m below ground surface. 3. Borehole was dry in open hole.															

+³, X³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

1 OF 1

METRIC

DATUM	Geodetic	DATE	2017.12.19 - 2017.12.19	LATITUDE	42.3526316	LONGITUDE	-82.1816035	CHECKED BY	SM
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+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE

1 OF 1

METRIC

DATUM	Geodetic	DATE	2017.12.19 - 2017.12.19	LATITUDE	42.35666276	LONGITUDE	-82.17458775	CHECKED BY	SM
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+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-26

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4691389.89N, 332514.86E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.21 - 2017.12.21 LATITUDE 42.36161791 LONGITUDE -82.16353962 CHECKED BY SM

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 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X P. PENETROMETER		W _P W W _L WATER CONTENT (%)							
181.4	Ground Surface							20	40	60	80	100					
0.0	FILL: SAND AND GRAVEL						181										
180.6																	
0.8	FILL: SANDY SILT trace gravel, brown, moist, compact		1	SS	16		180						○				
179.9																	
1.5	SILTY CLAY/CLAYEY SILT trace sand seams, brown to grey, moist to wet, firm		2	SS	6			X					○				
			3	SS	4		179	X					○				
			4	SS	5		178	X					○				
	- becoming wet, very soft		5	SS	WH								○				
177.0																	
4.4	End of Borehole at 4.4 m below ground surface.						177										
	Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 4.27 m below ground surface. 3. Borehole was dry in open hole.																

+³, X³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-25

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4691848.80N, 333617.65E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.21 - 2017.12.21 LATITUDE 42.36570954 LONGITUDE -82.15012891 CHECKED BY SM

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIALX P. PENETROMETER									
182.0	Ground Surface						20	40	60	80	100						
0.0	FILL: SAND AND GRAVEL																
181.2																	
0.8	FILL: SANDY SILT some organics, brown/black, moist, compact		1	SS	13	181											
180.5																	
1.5	FILL: SILTY CLAY/CLAYEY SILT trace organics, few sand seams, brown/black to brown/grey, moist, firm		2	SS	8	180											
			3	SS	6												
178.9						179											
3.1	SILTY CLAY/CLAYEY SILT trace sand seams, brown to grey, moist, soft to firm		4	SS	3												
			5	SS	5	178											
177.6																	
4.4	End of Borehole at 4.4 m below ground surface.																
	Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 4.27 m below ground surface. 3. Borehole was dry in open hole.																

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-24

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4692184.21N, 334512.96E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.21 - 2017.12.21 LATITUDE 42.36869563 LONGITUDE -82.13924208 CHECKED BY SM

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			
								20 40 60 80 100	20 40 60								
182.3	Ground Surface							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL P. PENETROMETER									
0.0	FILL: SAND AND GRAVEL						182										
181.5	FILL: SILTY CLAY trace gravel, trace to little sand, trace organics, brown, moist, stiff to very stiff		1	SS	16		181			>>X	○						
0.8			2	SS	10				>>X		○						
180.0			3	SS	4		180			>>X		○					
2.3	SILTY CLAY/CLAYEY SILT trace sand seams, brown to grey, moist, firm		4	SS	5		179			>>X		○					
			5	SS	5				>>X			○					
178.0													┌─○─┐				0 2 40 58
4.3	End of Borehole at 4.27 m below ground surface.																
	Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 4.27 m below ground surface. 3. Borehole was dry in open hole.																

+³, X³: Numbers refer to Sensitivity o 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-23

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4692559.68N, 335483.98E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.21 - 2017.12.21 LATITUDE 42.3720383 LONGITUDE -82.12743269 CHECKED BY SM

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIALX P. PENETROMETER									
183.2	Ground Surface						20	40	60	80	100						
0.0	FILL: SAND AND GRAVEL																
182.4	FILL: CLAYEY SILT trace organics, trace gravel, trace to little sand, brown to grey, moist, stiff to very stiff		1	SS	15							>>X	○				
0.8			2	SS	11							>>X	○				
180.9	SILTY CLAY/CLAYEY SILT trace gravel, few sand, brown to grey, moist, stiff to very stiff		3	SS	8							>>X	○				
2.3			4	SS	20							>>X	4	1			
			5	SS	13							>>X	○				
178.9	End of Borehole at 4.27 m below ground surface.																
4.3	Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 4.27 m below ground surface. 3. Borehole was dry in open hole.																
						</											

+³, X³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-22

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4692840.06N, 336197.49E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.21 - 2017.12.21 LATITUDE 42.37453421 LONGITUDE -82.11875409 CHECKED BY SM

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 X P. PENETROMETER								
183.5	Ground Surface						20	40	60	80	100					
0.0	FILL: SAND AND GRAVEL															
182.7																
0.8	FILL: CLAYEY SILT trace organics, trace to some gravel, trace sand, brown, moist, stiff		1	SS	10							>>X	○			
182.0																
1.5	FILL: SILT trace organics, trace sand, few clay, brown/black, moist, compact		2	SS	12								○			
			3	SS	15								○			
180.4																
3.1	FILL: SILTY CLAY some organics, trace sand, grey/black, moist, stiff		4	SS	9			X					○			
179.7																
3.8	SILTY SAND trace gravel, grey, wet, compact		5	SS	21								○			
179.2																
4.3	End of Borehole at 4.27 m below ground surface. Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 3.05 m below ground surface. 3. Borehole was dry in open hole.															

Non Plastic
0 2 85 13+ ³, X ³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MTO ADM-00235197-L0 - ASSIGN8.GPJ ONTARIO MTO.GDT 1/12/18

Brampton, Ontario

RECORD OF BOREHOLE No 17-21

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4693358.72N, 337493.92E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.21 - 2017.12.21 LATITUDE 42.37915037 LONGITUDE -82.10298313 CHECKED BY SM

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 X P. PENETROMETER							
184.4	Ground Surface						20 40 60 80 100									
0.0	FILL: SAND AND GRAVEL															
183.6	FILL: CLAYEY SILT - trace gravel, trace sand, trace organics, brown, moist, stiff		1	SS	13					>>X	○					
0.8			2	SS	13					>>X	○					
182.1			3	SS	6				X			○	—		0 2 66 32	
2.3	SILTY CLAY/CLAYEY SILT trace organics, trace gravel, trace to few sand seams, brown to grey, moist. firm to stiff		4	SS	5				X		○					
			5	SS	11					>>X	○	—		3 10 40 46		
180.1																
4.3	End of Borehole at 4.27 m below ground surface.															
Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 4.27 m below ground surface. 3. Borehole was dry in open hole.																

+³, X³: Numbers refer to Sensitivity O 3% STRAIN AT FAILURE

ONTARIO MTO ADM-00235197-L0 - ASSIGN8.GPJ ONTARIO.MTO.GDT 1/12/18

Brampton, Ontario

RECORD OF BOREHOLE No 17-20

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4693884.46N, 338856.84E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.20 - 2017.12.20 LATITUDE 42.38382517 LONGITUDE -82.08640184 CHECKED BY SM

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 X P. PENETROMETER						
183.5	Ground Surface													
0.0	FILL: SAND AND GRAVEL													
182.7														
0.8	FILL: CLAYEY SILT trace gravel, trace to some sand, trace topsoil, brown, moist, stiff		1	SS	9									
181.8	- becoming sandy silt, trace clay, brown, very moist @ 1.3 m below ground surface													
1.7	SILTY CLAY/CLAYEY SILT trace gravel, trace sand, brown to grey, moist, firm to very stiff		2	SS	5									
			3	SS	13									0 2 35 63
			4	SS	16									
			5	SS	13									
179.2														
4.3	End of Borehole at 4.27 m below ground surface.													
	Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 4.27 m below ground surface. 3. Borehole was dry in open hole.													

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-19

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4694146.72N, 339602.69E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.20 - 2017.12.20 LATITUDE 42.38615327 LONGITUDE -82.07732837 CHECKED BY SM

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIALX P. PENETROMETER										
184.1	Ground Surface						20	40	60	80	100	20	40	60	kN/m ³	GR SA SI CL		
0.0	FILL: SAND AND GRAVEL																	
183.3																		
0.8	FILL:CLAYEY SILT trace topsoil, trace gravel, trace to little sand, brown moist, firm		1	SS	6							>>X	○					
182.3			2	SS	9				X				○					
1.8	SLITY CLAY/CLAYEY SILT trace gravel, little sand, moist, stiff to very stiff																	
												>>X						
			3	SS	13								○					
			4	SS	16							>>X	○	—		2 25 46 27		
												>>X						
			5	SS	12								○					
179.8																		
4.3	End of Borehole at 4.27 m below ground surface.																	
	Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 4.27m below ground surface. 3. Borehole was dry in open hole.																	

+³, X³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-18

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4694388.09N, 340287.09E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.20 - 2017.12.20 LATITUDE 42.38829538 LONGITUDE -82.06900186 CHECKED BY SM

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 TRIAXIALX P. PENETROMETER								
185.3	Ground Surface						20	40	60	80	100					
0.0	FILL: SAND AND GRAVEL															
184.5																
0.8	FILL: CLAYEY SILT trace organics, trace to little sand, brown/black, moist, stiff		1	SS	12							>>X	○			
183.8																
1.5	SILTY CLAY/CLAYEY SILT trace gravel, little sand, brown to grey, moist, stiff to very stiff		2	SS	9							>>X	○			1 6 (93)
			3	SS	16							>>X	○			
			4	SS	25							>>X	▬			2 20 48 30
			5	SS	17							>>X	○			
181.0																
4.3	End of Borehole at 4.27 m below ground surface.															
	Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 4.27 m below ground surface. 3. Borehole was dry in open hole.															

+³, X³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-17

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4694761.52N, 341335.00E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.20 - 2017.12.20 LATITUDE 42.39160887 LONGITUDE -82.05625151 CHECKED BY SM

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 TRIAXIALX P. PENETROMETER						
185.9 0.0	Ground Surface FILL: SAND AND GRAVEL													
185.1 0.8	FILL: CLAYEY SILT trace organics and topsoil inclusion, little sand, brown to greyish black, moist, firm		1	SS	6									
			2	SS	7									0 19 (81)
183.6 2.3	SILTYCLAY/CLAYEY SILT trace gravel, little sand, brown to grey, moist, stiff to very stiff		3	SS	8					>>X				
			4	SS	18					>>X				2 13 50 35
			5	SS	14					>>X				
181.6 4.3	End of Borehole at 4.27 m below ground surface. Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 4.27 m below ground surface. 3. Borehole was dry in open hole.													

+ 3, X 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-16

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4695060.58N, 342159.23E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.20 - 2017.12.20 LATITUDE 42.3942621 LONGITUDE -82.0462214 CHECKED BY SM

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	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 TRIAXIALX P. PENETROMETER												
187.2	Ground Surface							20	40	60	80	100	20	40	60	kN/m ³	GR SA SI CL	
0.0	FILL: SAND AND GRAVEL						187											
186.4																		
0.8	FILL: CLAYEY SILT some organics, trace sand, greyish black, moist, firm		1	SS	7		186											
185.6																		
1.5	SILTY CLAY/CLAYEY SILT trace organics, trace gravel, few sand seams, brown to grey, moist, firm to very stiff		2	SS	7		185											
			3	SS	7		184											
			4	SS	22		183											
			5	SS	16													
182.9																		
4.3	End of Borehole at 4.27 m below ground surface.																	
<div>Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 4.27 m below ground surface. 3. Borehole was dry in open hole.</div>																		

+ 3, X 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-15

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4695462.59N, 343176.73E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.20 - 2017.12.20 LATITUDE 42.3978319 LONGITUDE -82.0338361 CHECKED BY SM

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	× P. PENETROMETER						
188.4	Ground Surface						20	40	60	80	100					
0.0	FILL: SAND AND GRAVEL															
187.6																
0.8	FILL: SILTY SAND/SANDY SILT trace gravel, brown , moist, compact		1	SS	13								○			
186.7																
1.7	FILL: CLAYEY SILT trace gravel, trace sand, moist, firm		2	SS	7					×			○			
186.1																
2.3	SILTY CLAY/CLAYEY SILT trace gravel, few sand, brown to grey, moist, very stiff		3	SS	17								○			
			4	SS	23								○	—	—	
			5	SS	22								○			
184.1																
4.3	End of Borehole at 4.27 m below ground surface.															
	Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 4.27 m below ground surface. 3. Borehole was dry in open hole.															

+ 3, X 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-14

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4696058.1N, 343832.67E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.20 - 2017.12.20 LATITUDE 42.4031605 LONGITUDE -82.0258282 CHECKED BY SM

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 TRIAXIALX P. PENETROMETER															
188.7 0.0	Ground Surface FILL: SAND AND GRAVEL						20 40 60 80 100								
187.9 0.8	FILL: SILTY CLAY trace organics, trace gravel, trace to few sand, brown to grey , moist, stiff		1	SS	8					>>X	○				
									X						
				2	SS	8						○			
186.4 2.3	SILTY CLAY/CLAYEY SILT trace gravel, trace sand, brown to grey, moist, firm to very stiff		3	SS	8					X	●	—————			0 9 39 52
										>>X	○				
				4	SS	15					>>X				
184.4 4.3	End of Borehole at 4.27 m below ground surface. Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 4.27 m below ground surface. 3. Borehole was dry in open hole.		5	SS	23					>>X	○				

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-13

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4696744.72N, 344561.13E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.20 - 2017.12.20 LATITUDE 42.4093053 LONGITUDE -82.0169317 CHECKED BY SM

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL						
188.4 0.0	Ground Surface FILL: SAND AND GRAVEL						20	40	60	80	100				kN/m ³	GR SA SI CL
187.6 0.8	FILL: SILTY CLAY trace to some organics, trace gravel, trace to few sand, brown to grey , moist, firm to stiff		1	SS	5											
			2	SS	12											
186.0 2.4	SILTY CLAY/CLAYEY SILT trace gravel, little wet sand seams, brown, moist, stiff to very stiff		3	SS	11											
			4	SS	19											
			5	SS	17											
184.1 4.3	End of Borehole at 4.27 m below ground surface. Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 4.27 m below ground surface. 3. Borehole was dry in open hole.															

+³, X³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-12

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4697510.26N, 345368.04E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.18 - 2017.12.18 LATITUDE 42.41615574 LONGITUDE -82.00707483 CHECKED BY SM

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X P. PENETROMETER							WATER CONTENT (%)			
189.3	Ground Surface							20	40	60	80	100						
0.0	FILL: SAND AND GRAVEL recycled asphalt over sand and gravel						189											
188.5																		
0.8	FILL: CLAYEY SILT trace gravel, trace sand, brown , very moist, firm		1	SS	5		188											
187.8																		
1.5	SILTY CLAY/CLAYEY SILT trace gravel, few sand, brown, moist, very stiff		2	SS	15					>>X								
			3	SS	23		187			>>X								
			4	SS	23		186			>>X								
			5	SS	25					>>X								
185.0																		
4.3	End of Borehole at 4.27 m below ground surface.																	
	Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 4.27 m below ground surface. 3. Borehole was dry in open hole.																	

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-11

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4698101.89N, 345967.93E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.18 - 2017.12.18 LATITUDE 42.4214505 LONGITUDE -81.9997437 CHECKED BY SM

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	× P. PENETROMETER										
189.9 0.0	Ground Surface FILL: SAND AND GRAVEL recycled asphalt over sand and gravel																			
189.1 0.8	FILL: CLAYEY SILT with sand and gravel, trace organics, brown/grey , moist, stiff		1	SS	14						>>×									
												○								
			2	SS	10						×		○							
	-becoming trace gravel, some sand																			
187.6 2.3	SILTY CLAY/CLAYEY SILT trace gravel, brown to grey, moist, firm to stiff		3	SS	5			×					○							
			4	SS	14						>>×		○							
			5	SS	9			×					○							
185.6 4.3	End of Borehole at 4.27 m below ground surface. Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 4.27 m below ground surface. 3. Borehole was dry in open hole.																			

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

1 OF 1

METRIC

DATUM	Geodetic	DATE	2017.12.18 - 2017.12.18	LATITUDE	42.42764485	LONGITUDE	-81.99102279	CHECKED BY	SM
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+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-09

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4699534.92N, 347432.60E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.18 - 2017.12.18 LATITUDE 42.43427294 LONGITUDE -81.98184005 CHECKED BY SM

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 TRIAXIALX P. PENETROMETER								
188.1	Ground Surface						20	40	60	80	100					
0.0	FILL: SAND AND GRAVEL recycled asphalt over sand and gravel															
187.3																
0.8	FILL: CLAYEY SILT trace sand, brown, moist, stiff		1	SS	9							>>X				
186.6																
1.5	SILTY CLAY/CLAYEY SILT trace gravel, little sand, brown to grey, moist, stiff		2	SS	11							>>X				
			3	SS	15							>>X				
			4	SS	12							>>X				
			5	SS	10							>>X				
183.8																
4.3	End of Borehole at 4.27 m below ground surface.															
	Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 4.27 m below ground surface. 3. Borehole was dry in open hole.															

+³, X³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-08

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4700163.44N, 348093.27E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.18 - 2017.12.18 LATITUDE 42.43989486 LONGITUDE -81.97376328 CHECKED BY SM

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 X P. PENETROMETER																
188.4	Ground Surface						20	40	60	80	100					
0.0	FILL: SAND AND GRAVEL recycled asphalt over sand and gravel															
187.6																
0.8	FILL: CLAYEY SILT trace organics, trace gravel, trace sand, brown, moist, stiff		1	SS	11							>>X	○			
			2	SS	11							>>X	○			
186.1																
2.3	SILTY CLAY/CLAYEY SILT trace gravel, some thin sand/silt layers, brown to grey, moist, firm to stiff		3	SS	6					X			○			
			4	SS	11							>>X	○			
			5	SS	9					X			○			
184.0																
4.4	End of Borehole at 4.4 m below ground surface.			VANE								140				
	Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 4.27m below ground surface. 3. Borehole was dry in open hole.															

+³, X³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-07

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4700897.84N, 348858.20E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.18 - 2017.12.18 LATITUDE 42.44646356 LONGITUDE -81.96440945 CHECKED BY SM

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 TRIAXIALX P. PENETROMETER						
188.7 0.0	Ground Surface FILL: SAND AND GRAVEL recycled asphalt over sand and gravel					188								
187.9 0.8	FILL: CLAYEY SILT with sand and gravel, brown, moist, stiff		1	SS	11									
187.2 1.5	SILTY CLAY/CLAYEY SILT trace sand, brown to grey, moist, stiff to very stiff		2	SS	12	187				>>X			0 5 38 57	
			3	SS	17	186				>>X				
			4	SS	18	185				>>X				
184.4 4.3	End of Borehole at 4.27 m below ground surface. Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 4.27 m below ground surface. 3. Borehole was dry in open hole.								>>X					

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-06

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4701567.34N, 349567.06E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.18 - 2017.12.18 LATITUDE 42.45245031 LONGITUDE -81.95574044 CHECKED BY SM

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 X P. PENETROMETER																	
188.7 0.0	Ground Surface FILL: SAND AND GRAVEL trace recycled asphalt						20	40	60	80	100		20	40	60		
187.9 0.8	FILL: CLAYEY SILT organics with depth, trace gravel, little to some sand, brown/grey, moist, stiff		1	SS	9							>>X	○				2 28 (70)
												X		○			
			2	SS	8									○			
186.4 2.3	SILTY CLAY/CLAYEY SILT trace gravel, trace sand, brown to grey, moist, stiff		3	SS	9							>>X	○				
			4	SS	14							>>X	○				
184.4 4.3	End of Borehole at 4.27 m below ground surface. Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 4.27 m below ground surface. 3. Borehole was dry in open hole.		5	SS	11							X	○				

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-05

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4702144.09N, 350185.42E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.18 - 2017.12.18 LATITUDE 42.45760683 LONGITUDE -81.94817741 CHECKED BY SM

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X P. PENETROMETER										
190.2	Ground Surface						20	40	60	80	100	20	40	60	kN/m ³	GR SA SI CL		
0.0	FILL: SAND AND GRAVEL thin recycled asphalt over sand and gravel, grey, moist, compact																	
	-becoming sandy gravel, few silt and clay		1	SS	11							○				64 28 (8)		
188.7																		
1.5	FILL: SAND trace gravel, trace silt, brown, wet, compact		2	SS	11							○						
187.9																		
2.3	SILTY CLAY/CLAYEY SILT trace gravel, trace sand, grey, moist, soft to stiff		3	SS	3			X				○						
			4	SS	8				X			○				1 3 35 61		
			5	SS	4			X				○						
185.9																		
4.3	End of Borehole at 4.27 m below ground surface.																	
	Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 4.27 m below ground surface. 3. Borehole was dry in open hole.																	

+ 3, X 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-04

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4702855.36N, 350925.36E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.11 - 2017.12.11 LATITUDE 42.463966 LONGITUDE -81.939124 CHECKED BY SM

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 TRIAXIALX P. PENETROMETER																
191.5	Ground Surface						20	40	60	80	100					
0.0	FILL: SAND AND GRAVEL trace recycled asphalt															
190.7																
0.8	FILL: SILTY SAND trace organics, trace gravel, brown to black, moist, compact		1	SS	12											
			2	SS	22											
189.2																
2.3	FILL: SILTY CLAY trace gravel, brown, moist, stiff		3	SS	8											
188.2			4	SS	11											
3.4	TOPSOIL some sand, some silt, trace clay, brown/black, moist, compact															
187.7																
3.8	SILTY CLAY/CLAYEY SILT trace sand, grey, moist, stiff		5	SS	9				X							0 3 50 48
187.2																
4.3	End of Borehole at 4.27 m below ground surface.															
	Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 3.05 m below ground surface. 3. Borehole was dry in open hole.															

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-03

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4703594.69N, 351747.43E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.11 - 2017.12.11 LATITUDE 42.470573 LONGITUDE -81.929067 CHECKED BY SM

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					W _p	W	W _L		
191.4	Ground Surface						20	40	60	80	100					
0.0	FILL: SAND AND GRAVEL trace recycled asphalt					191										
190.6																
0.8	FILL: SAND medium to coarse sand, few gravel, little silt, brown to grey, moist to very moist, compact		1	SS	18							o				
			2	SS	20	190						o				5 67 23 5
			3	SS	7	189						o				
188.3																
3.1	TOPSOIL some silt, some sand, black, moist, loose		4	SS	5	188						o				
187.6																
3.8	SILTY CLAY trace gravel, brown, moist, stiff		5	SS	12					X		o				
187.1																
4.3	End of Borehole at 4.27 m below ground surface. Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 2.74 m below ground surface. 3. Groundwater level measured at 2.43 m depth below ground surface in an open hole.															

+³, X³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

RECORD OF BOREHOLE No 17-02

1 OF 1

METRIC

W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4704205.76N, 352427.61E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.11 - 2017.12.11 LATITUDE 42.476033 LONGITUDE -81.920745 CHECKED BY SM

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 X P. PENETROMETER																	
194.5	Ground Surface							20	40	60	80	100					
0.0	FILL: SAND AND GRAVEL trace recycled asphalt						194										
193.6																	
0.9	FILL: SILTY SAND fine sand, trace organics, trace gravel, brown/black , moist, compact to dense		1	SS	20								○				
	-becoming trace organics, fine to medium gravel, brown/black, moist, dense		2	SS	33		193						○				
192.2																	
2.3	SILTY SAND trace organics, brown to grey, moist to wet, compact		3	SS	15		192						○				0 50 (50)
			4	SS	15								○				
							191										
			5	SS	23								○				
190.2																	
4.3	End of Borehole at 4.27 m below ground surface. Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 3.05 m below ground surface. 3. Borehole was dry in open hole.																

+ ³, × ³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MTO ADM-00235197-L0 - ASSIGN8.GPJ ONTARIO.MTO.GDT 1/12/18

Brampton, Ontario

RECORD OF BOREHOLE No 17-01

1 OF 1

METRIC

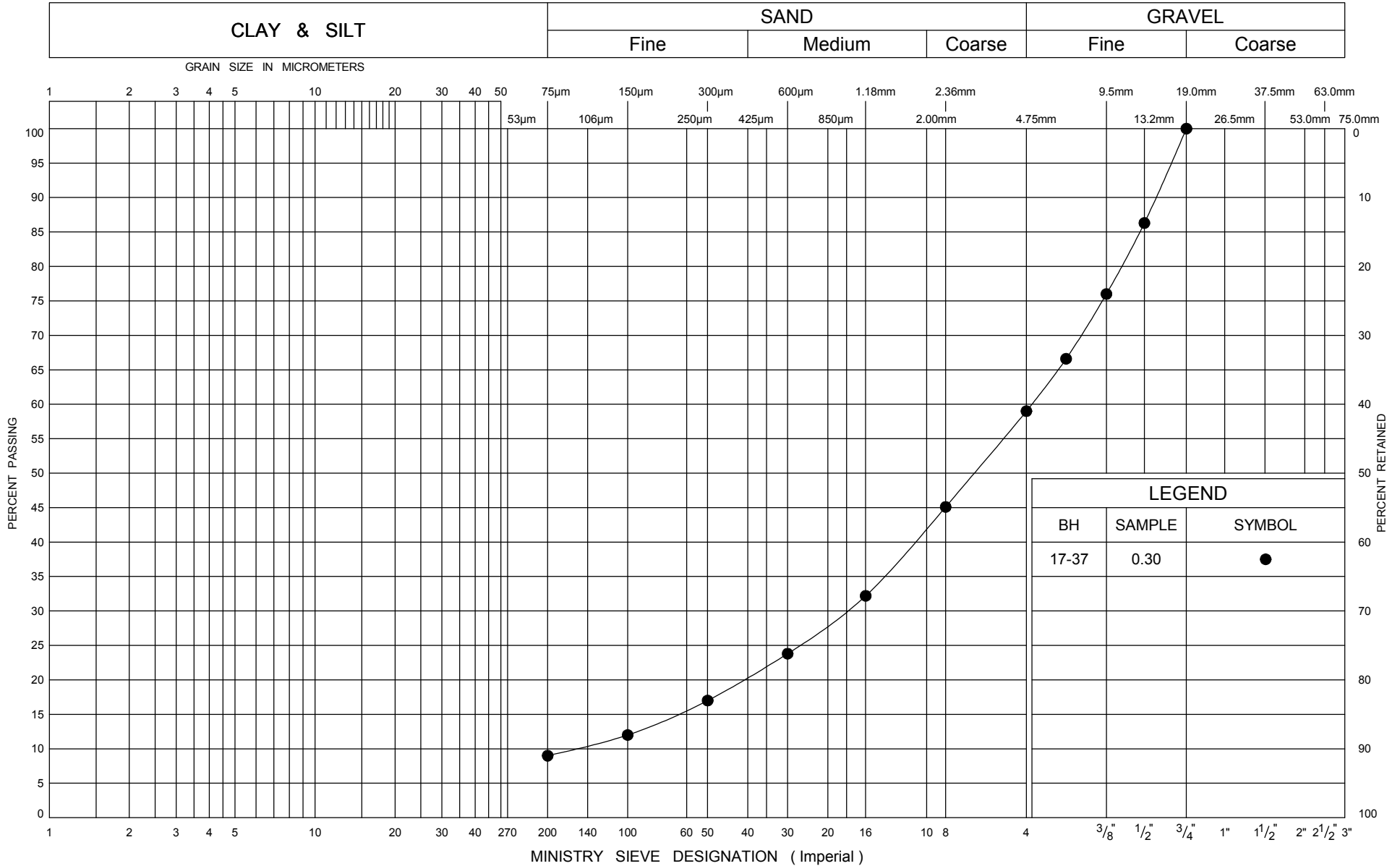
W.P. WP 3102-15-00 LOCATION Along Hwy 401 Centre Line, Essex Rd 42 to Victoria Rd, ON, 4704875.85N, 353168.97E ORIGINATED BY NU
 DIST Chatham-Kent HWY 401 BOREHOLE TYPE Geoprobe Truck Mount, HSA, Cased COMPILED BY NT
 DATUM Geodetic DATE 2017.12.11 - 2017.12.11 LATITUDE 42.48201971 LONGITUDE -81.91167317 CHECKED BY SM

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 X P. PENETROMETER																
193.5	Ground Surface						20	40	60	80	100					
0.0	FILL: SAND AND GRAVEL some stone															
192.7																
0.8	FILL: SILTY SAND trace topsoil, little gravel, brown , moist, compact		1	SS	19											16 32 (52)
192.0																
1.5	FILL: SILTY CLAY brown/grey, mottled, moist to wet, firm to stiff		2	SS	13											
			3	SS	7											
190.4																
3.1	SILTY CLAY/CLAYEY SILT few sand, brown, moist, very stiff		4	SS	20											0 6 32 62
			5	SS	18											
189.2																
4.3	End of Borehole at 4.27 m below ground surface.															
	Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole open up to 2.13 m below ground surface. 3. Borehole was dry in open hole.															

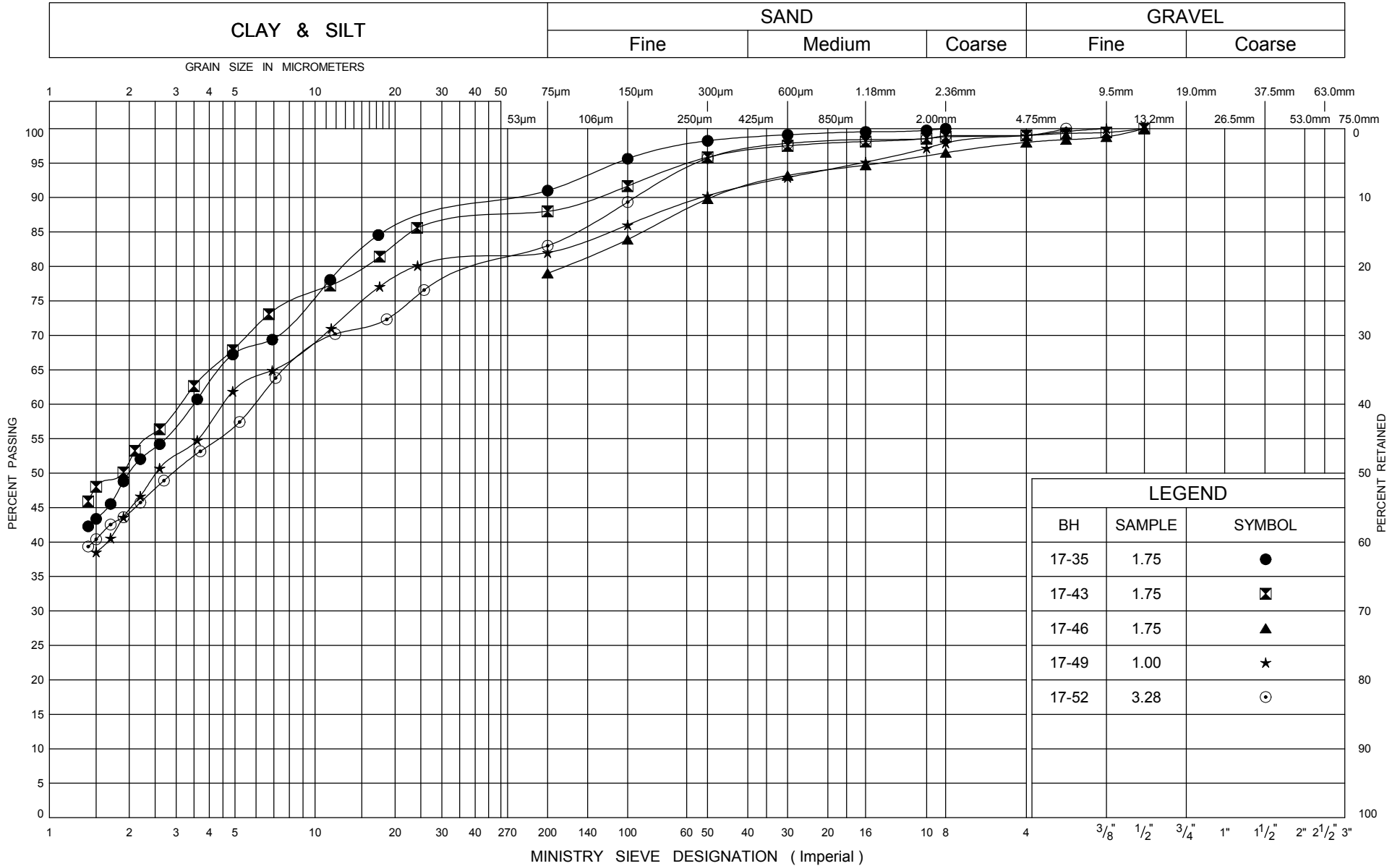
+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

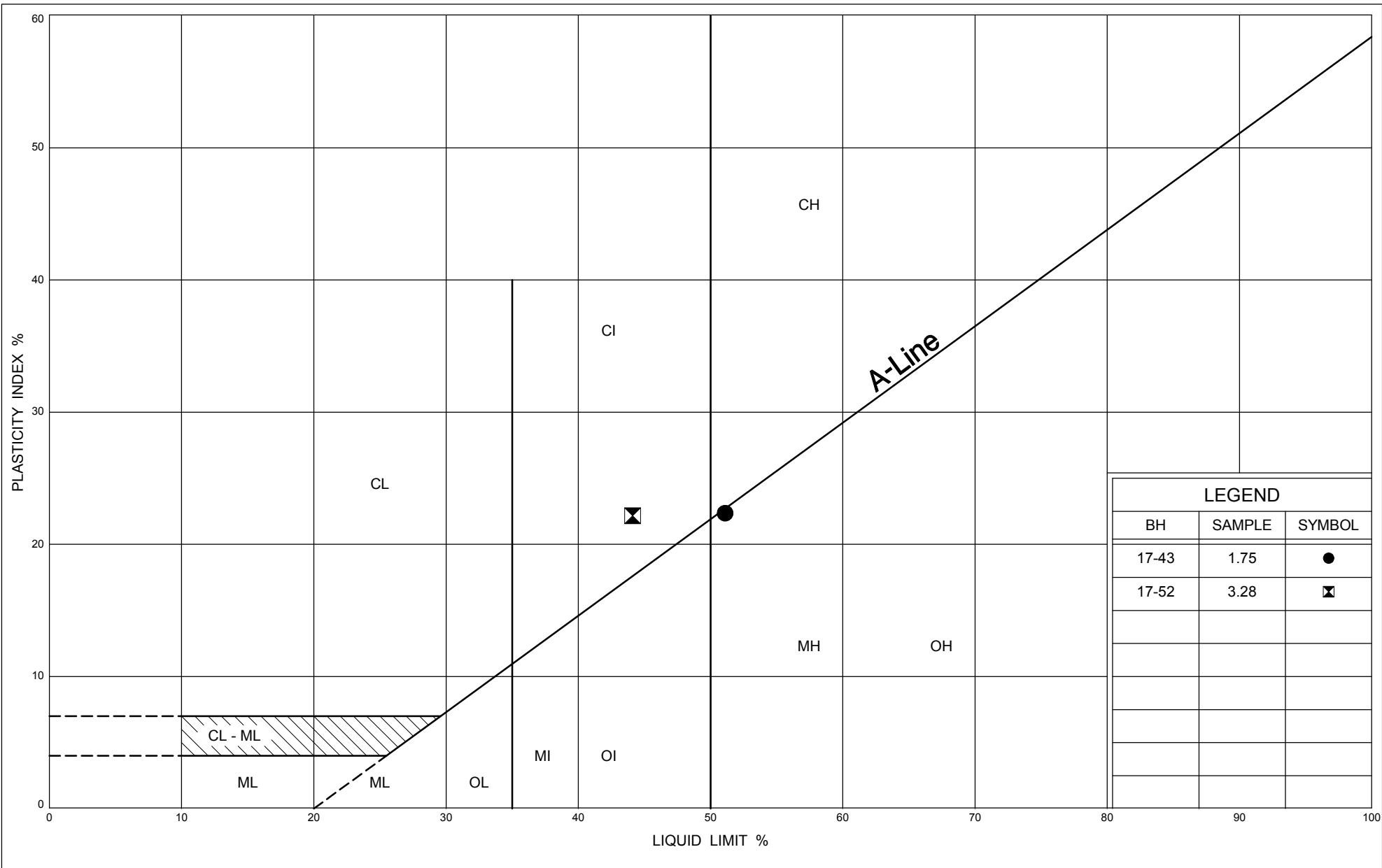
Appendix D – Laboratory Data

UNIFIED SOIL CLASSIFICATION SYSTEM

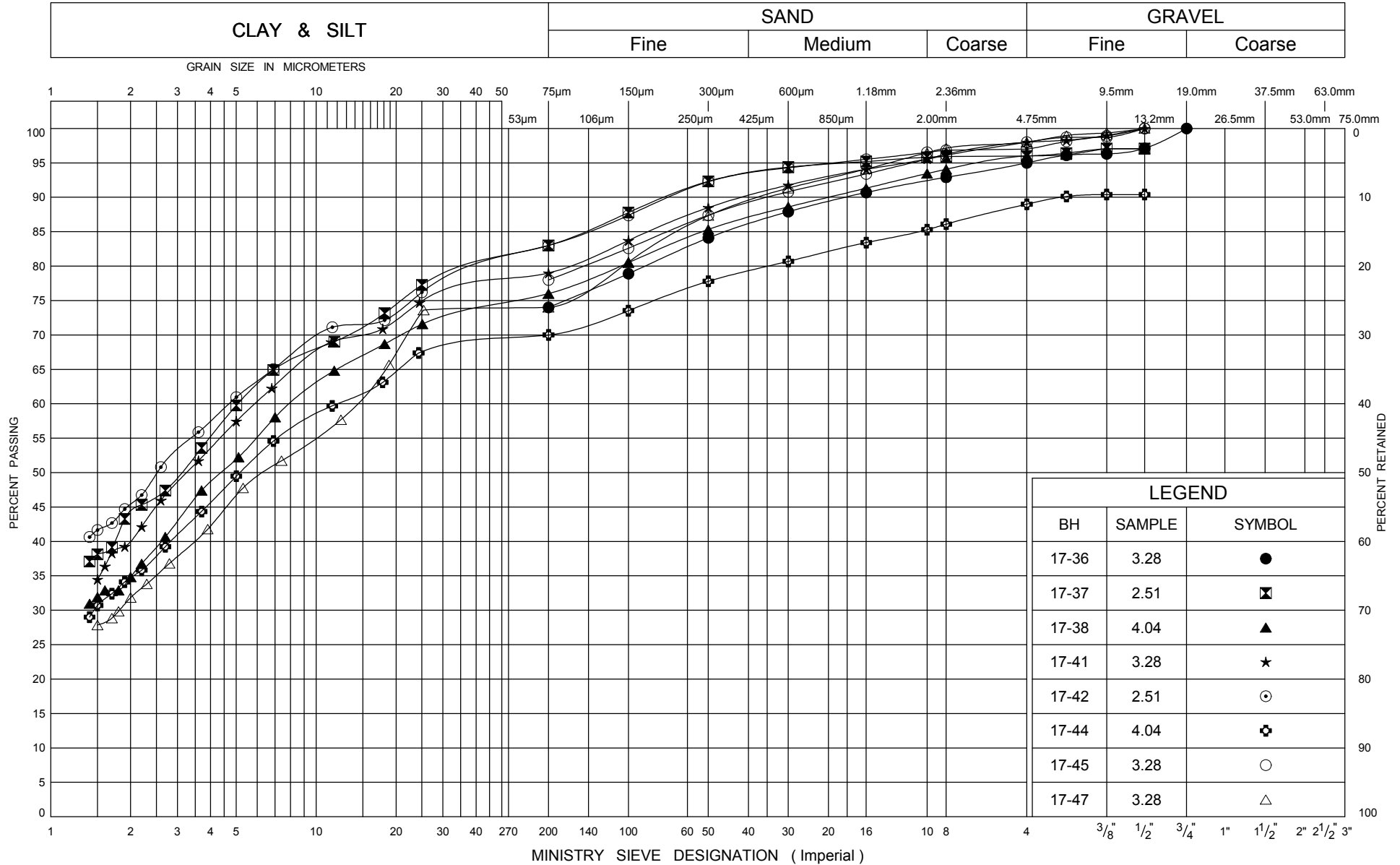


UNIFIED SOIL CLASSIFICATION SYSTEM

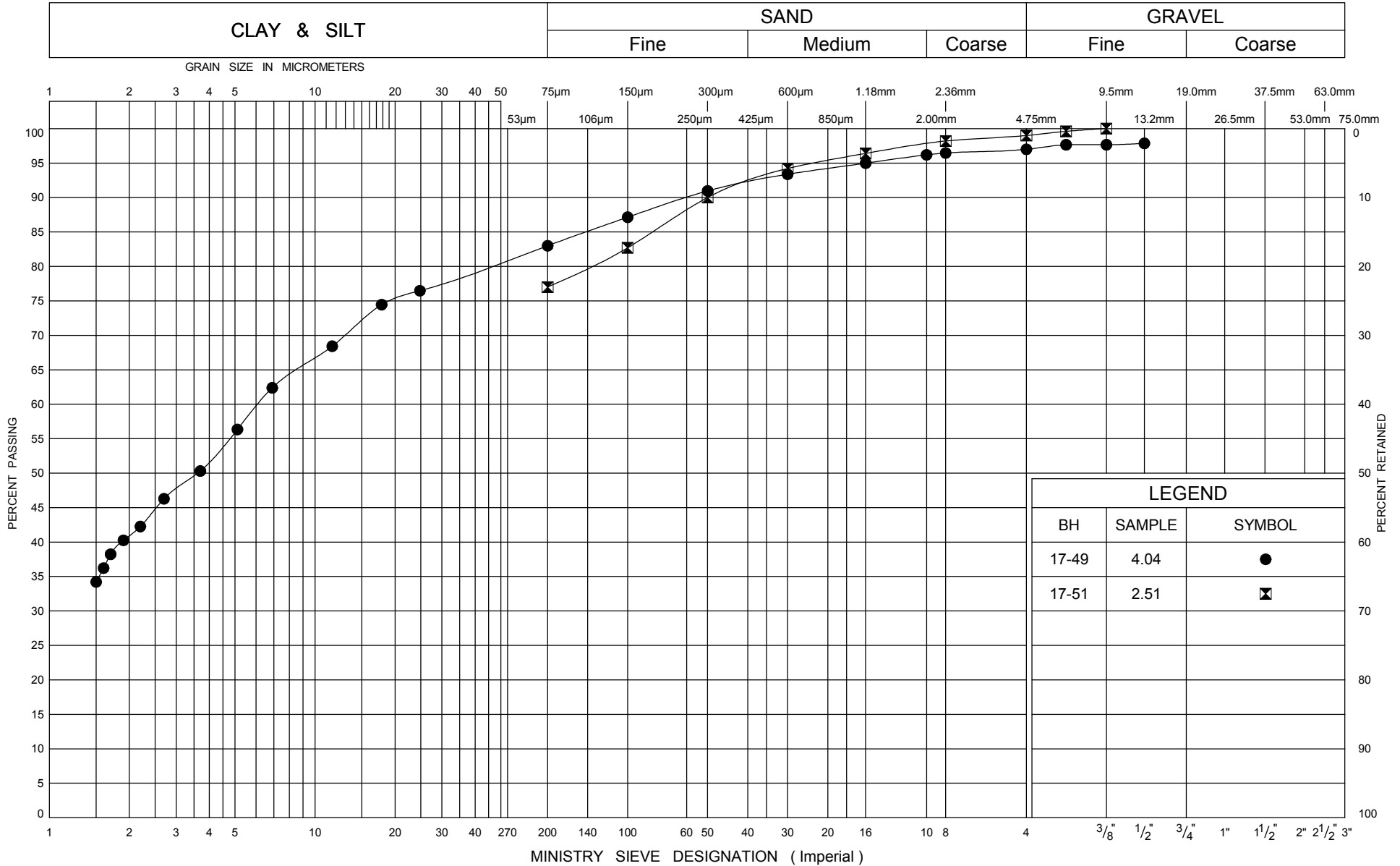


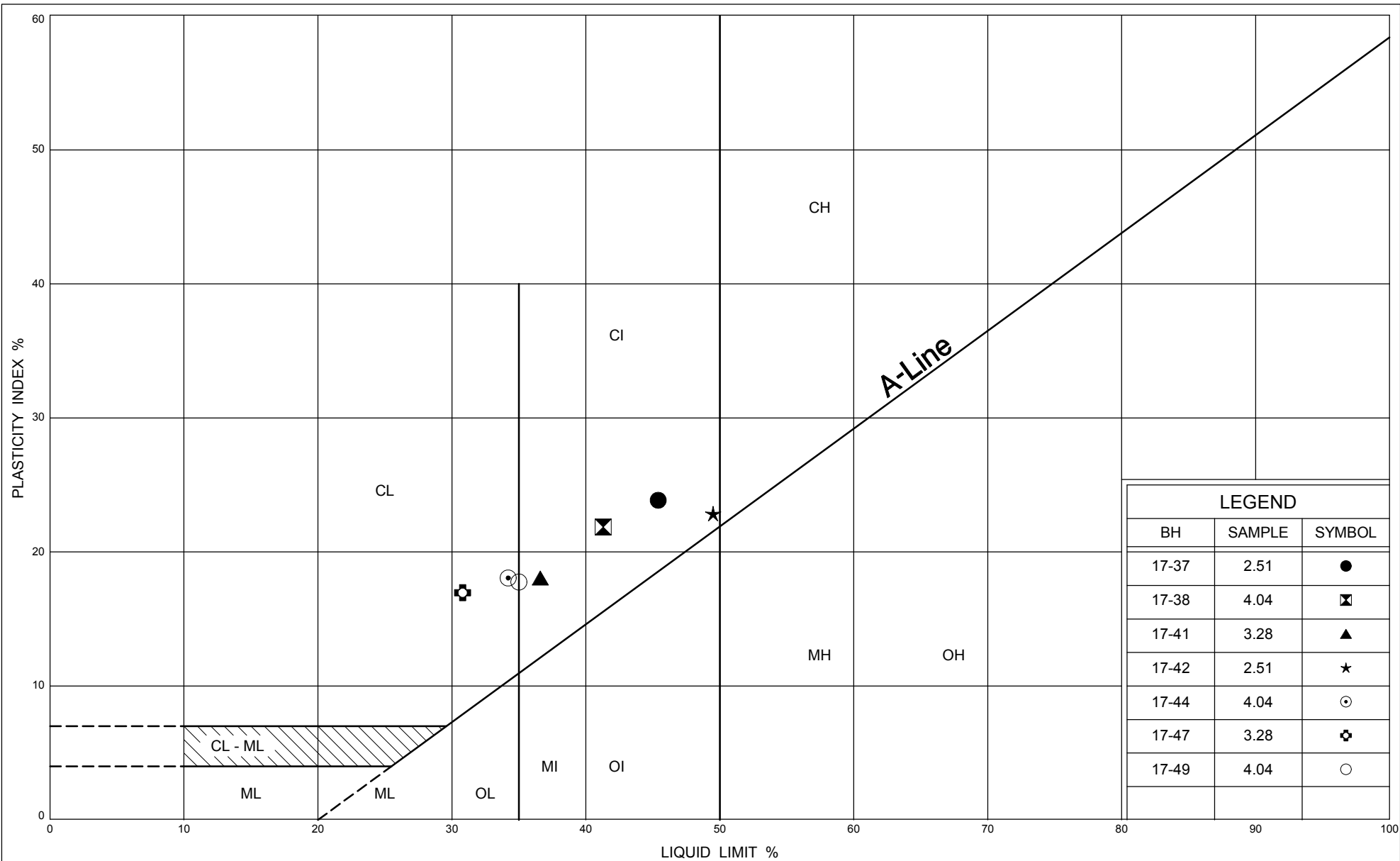


UNIFIED SOIL CLASSIFICATION SYSTEM



UNIFIED SOIL CLASSIFICATION SYSTEM





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Transportation

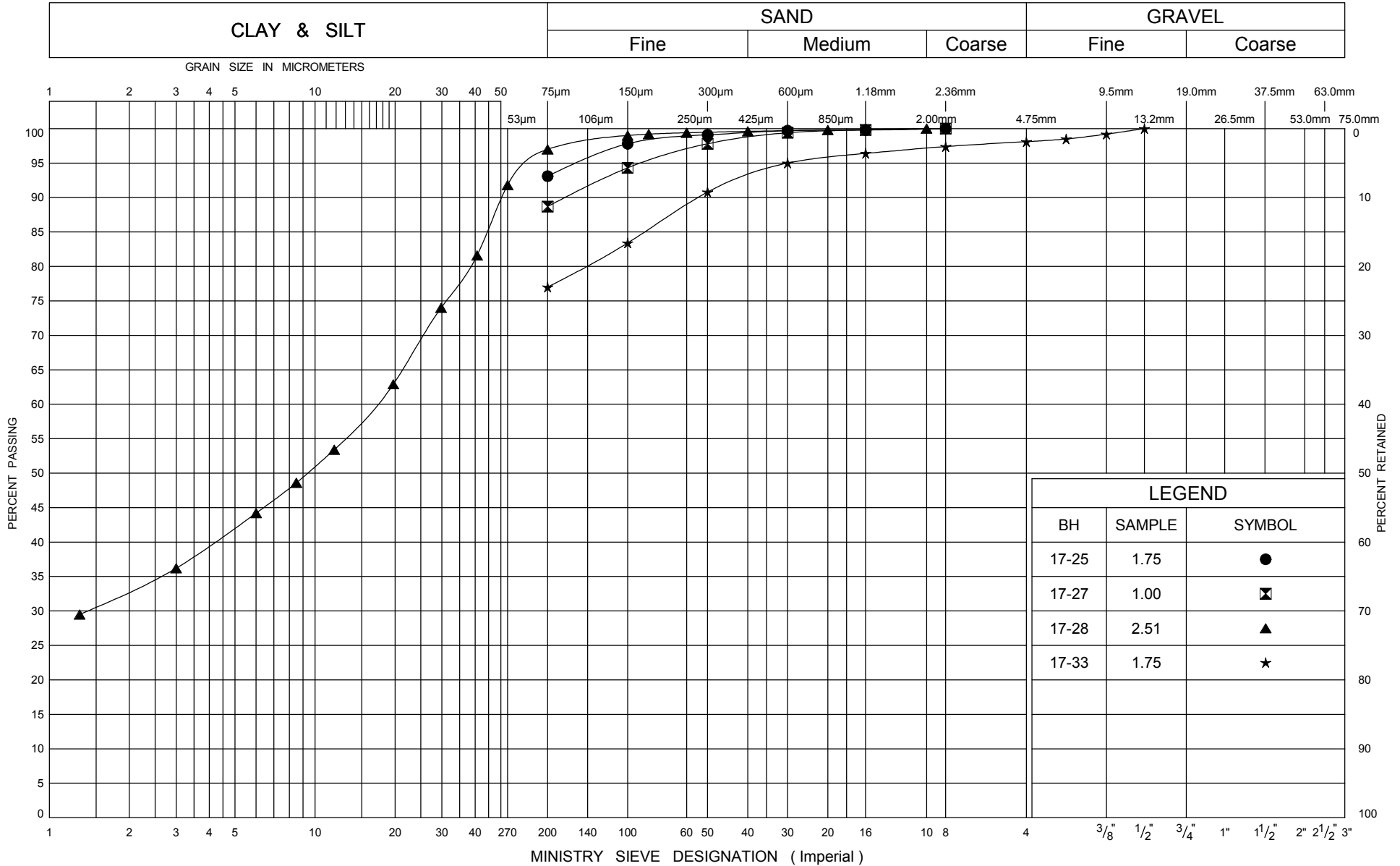
PLASTICITY CHART Silty Clay/Clayey Silt

FIG No 6

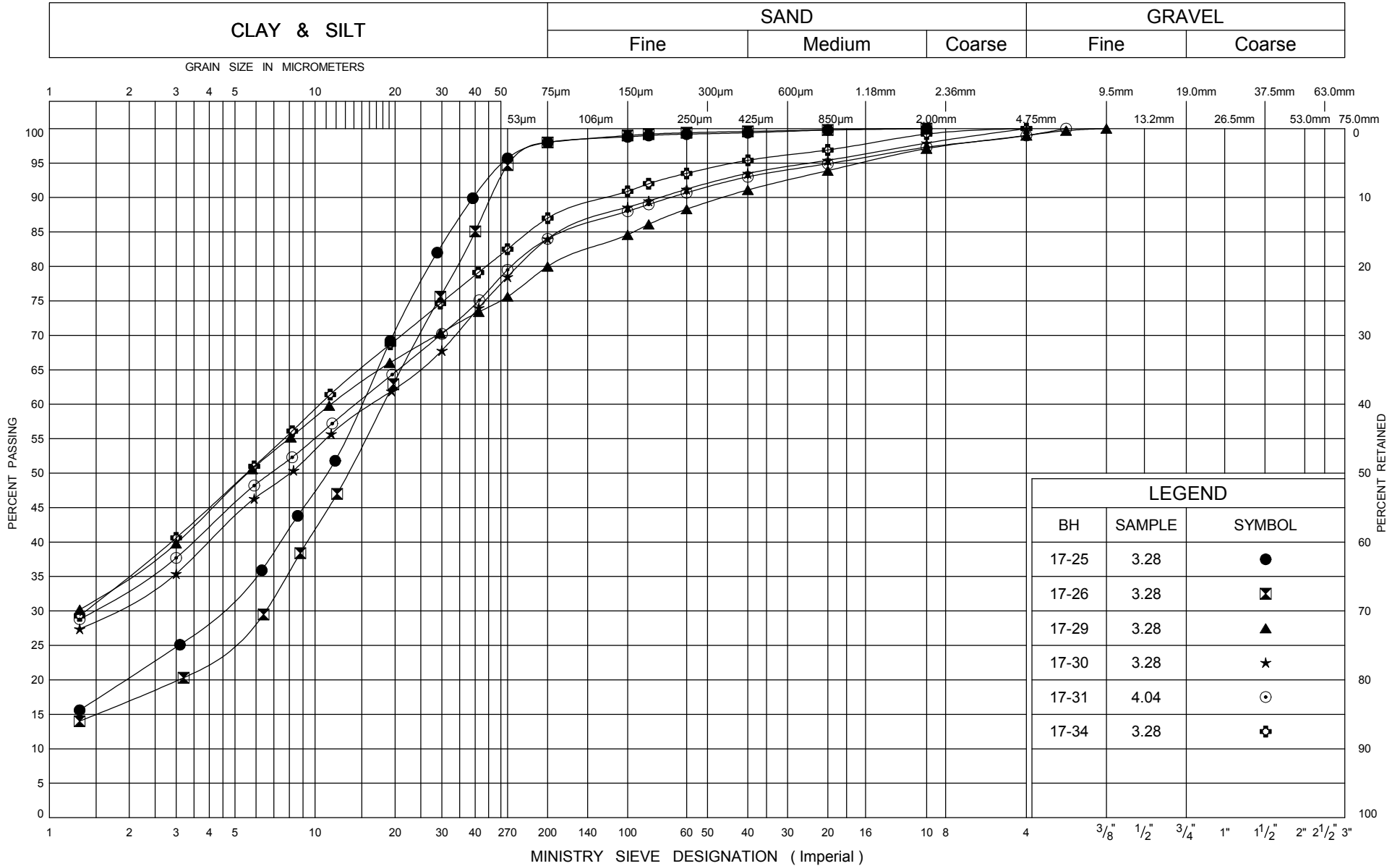
W PWP 3102-15-00

3015-E-0017, Assignment 8

UNIFIED SOIL CLASSIFICATION SYSTEM



UNIFIED SOIL CLASSIFICATION SYSTEM



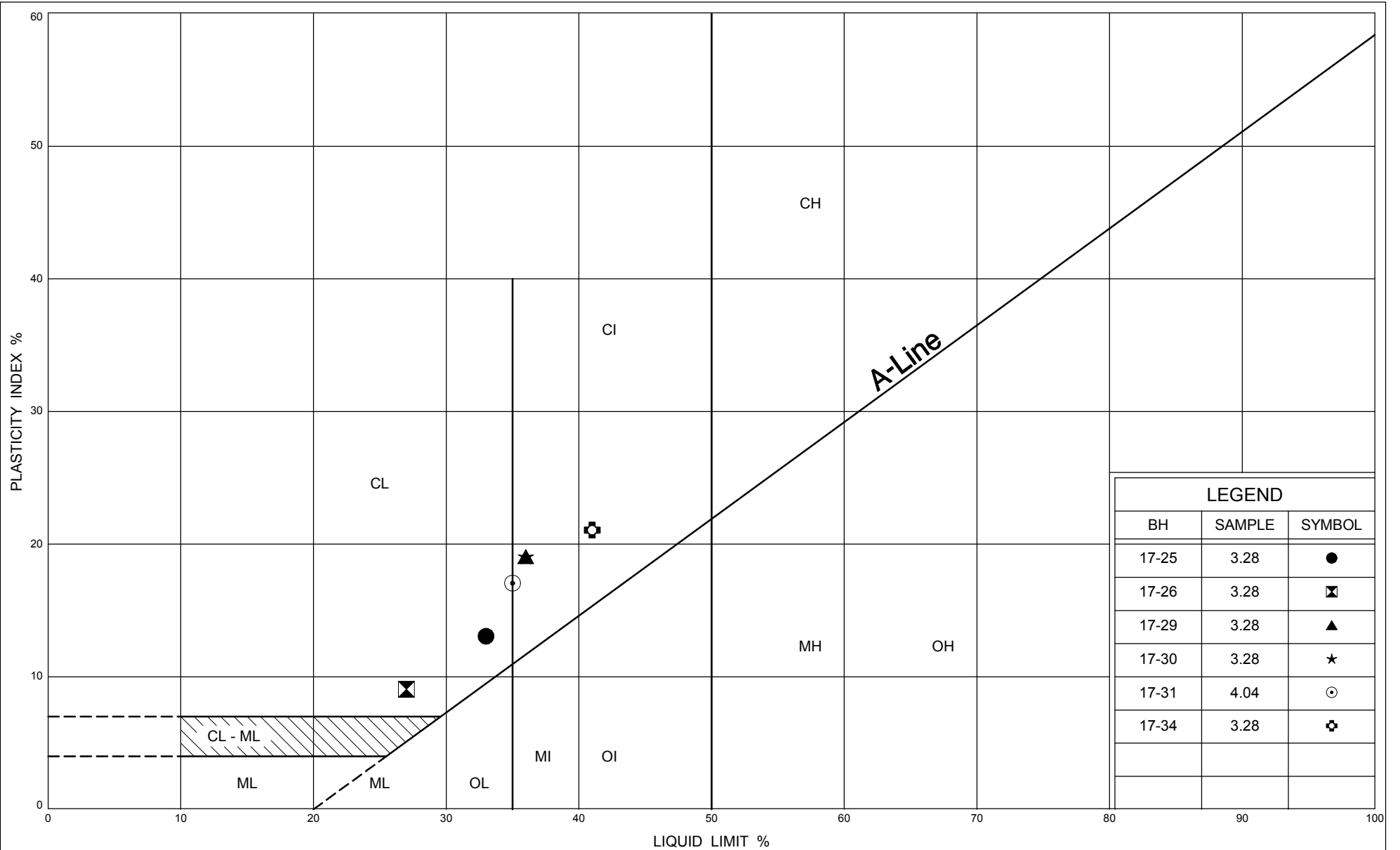
Ministry of
Transportation

GRAIN SIZE DISTRIBUTION
Silty Clay/Clayey Silt

FIG No 8

W PWP 3102-15-00

3015-E-0017, Assignment 8



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Transportation

PLASTICITY CHART **Silty Clay/Clayey Silt**

FIG No 9

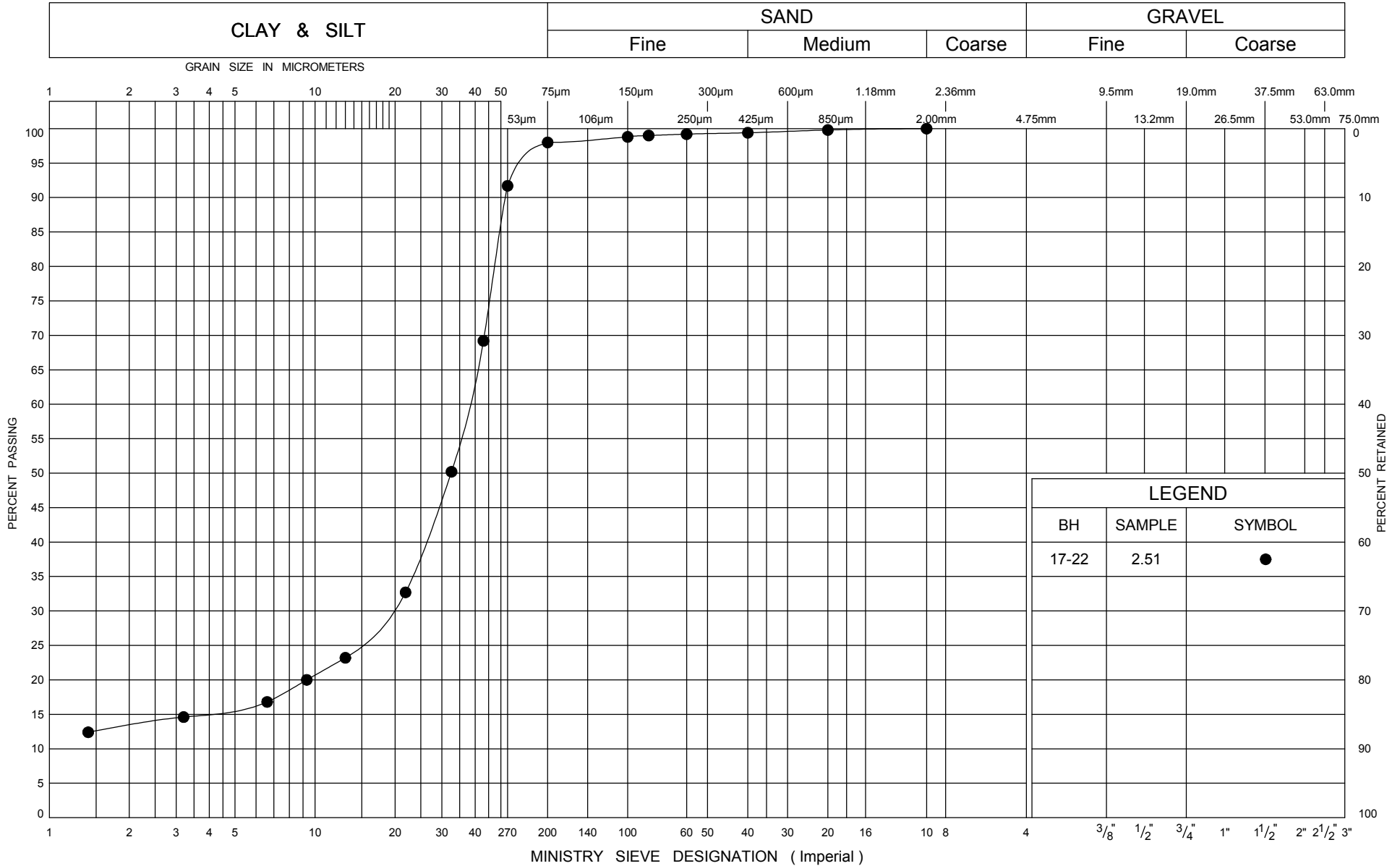
W PWP 3102-15-00

3015-E-0017, Assignment 8

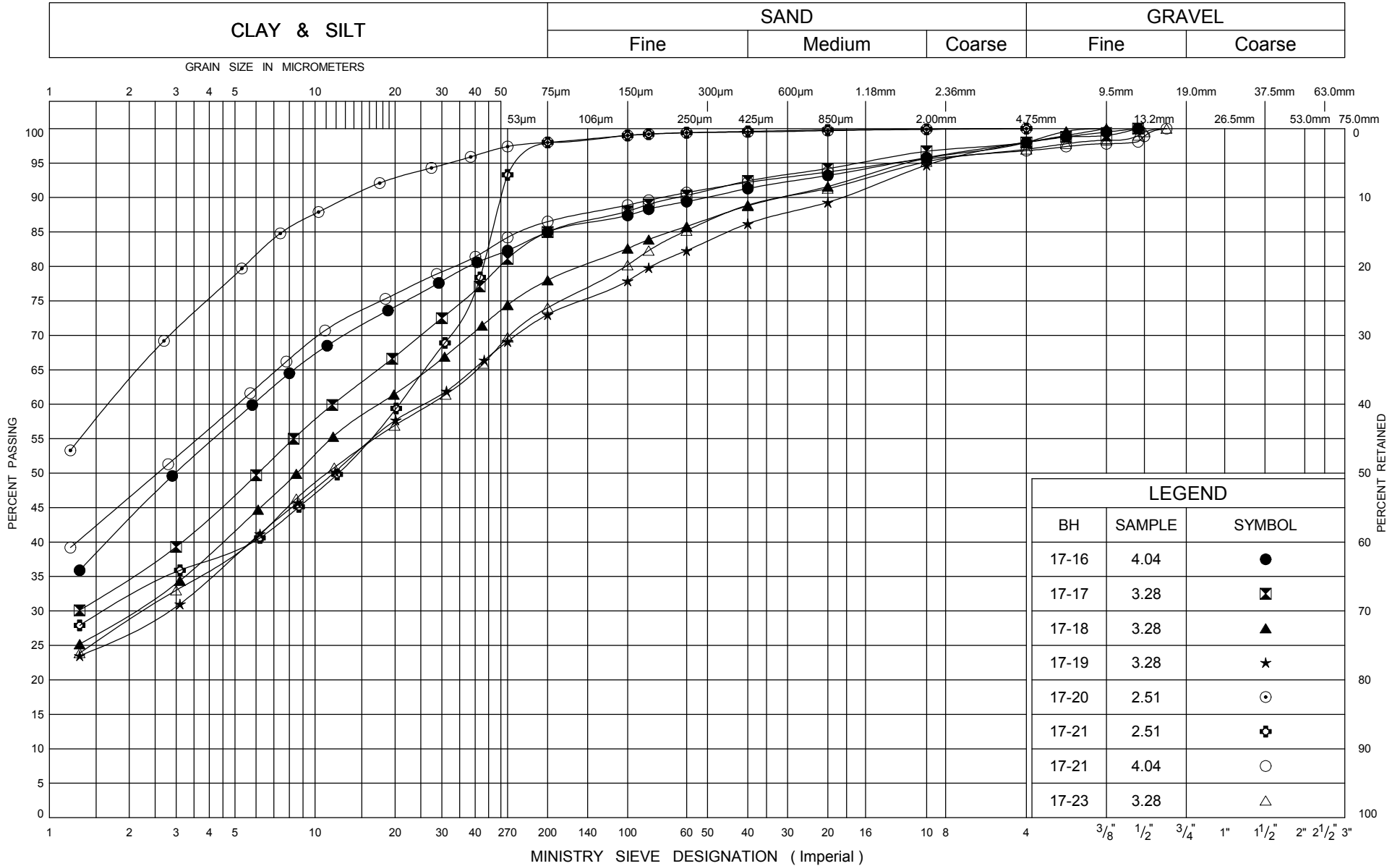


FIG No 10
W PWP 3102-15-00
3015-E-0017, Assignment 8

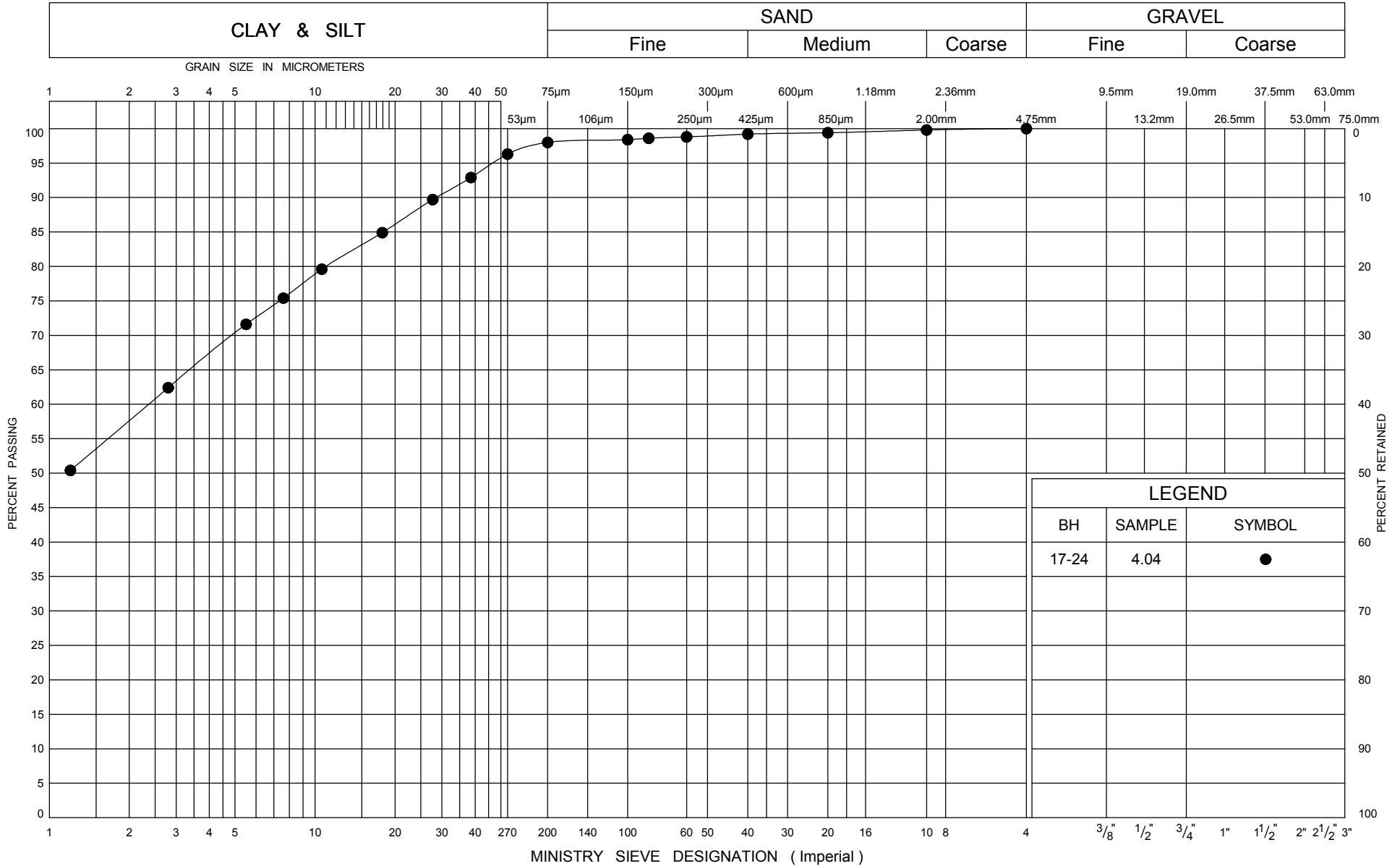
UNIFIED SOIL CLASSIFICATION SYSTEM

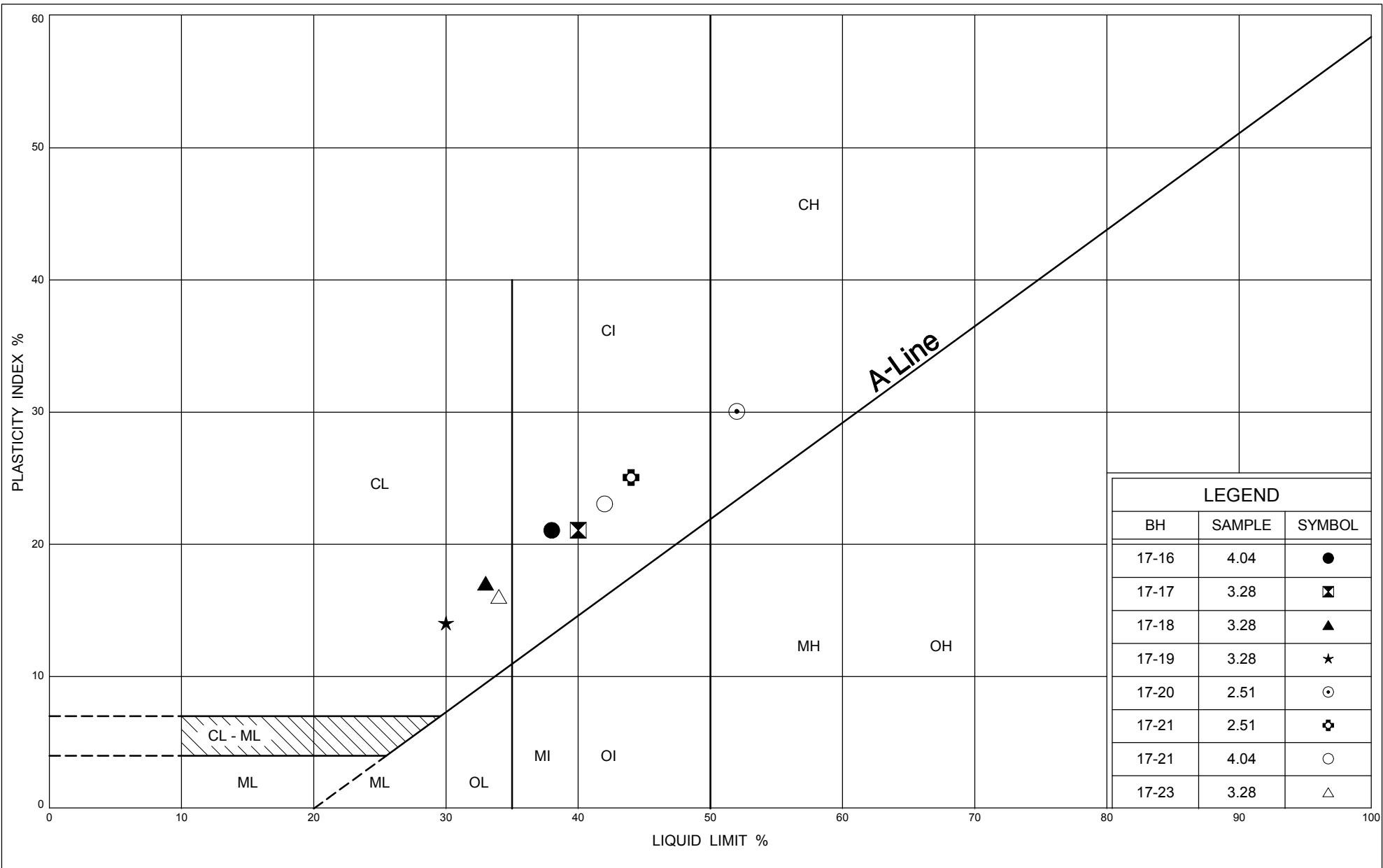


UNIFIED SOIL CLASSIFICATION SYSTEM



UNIFIED SOIL CLASSIFICATION SYSTEM





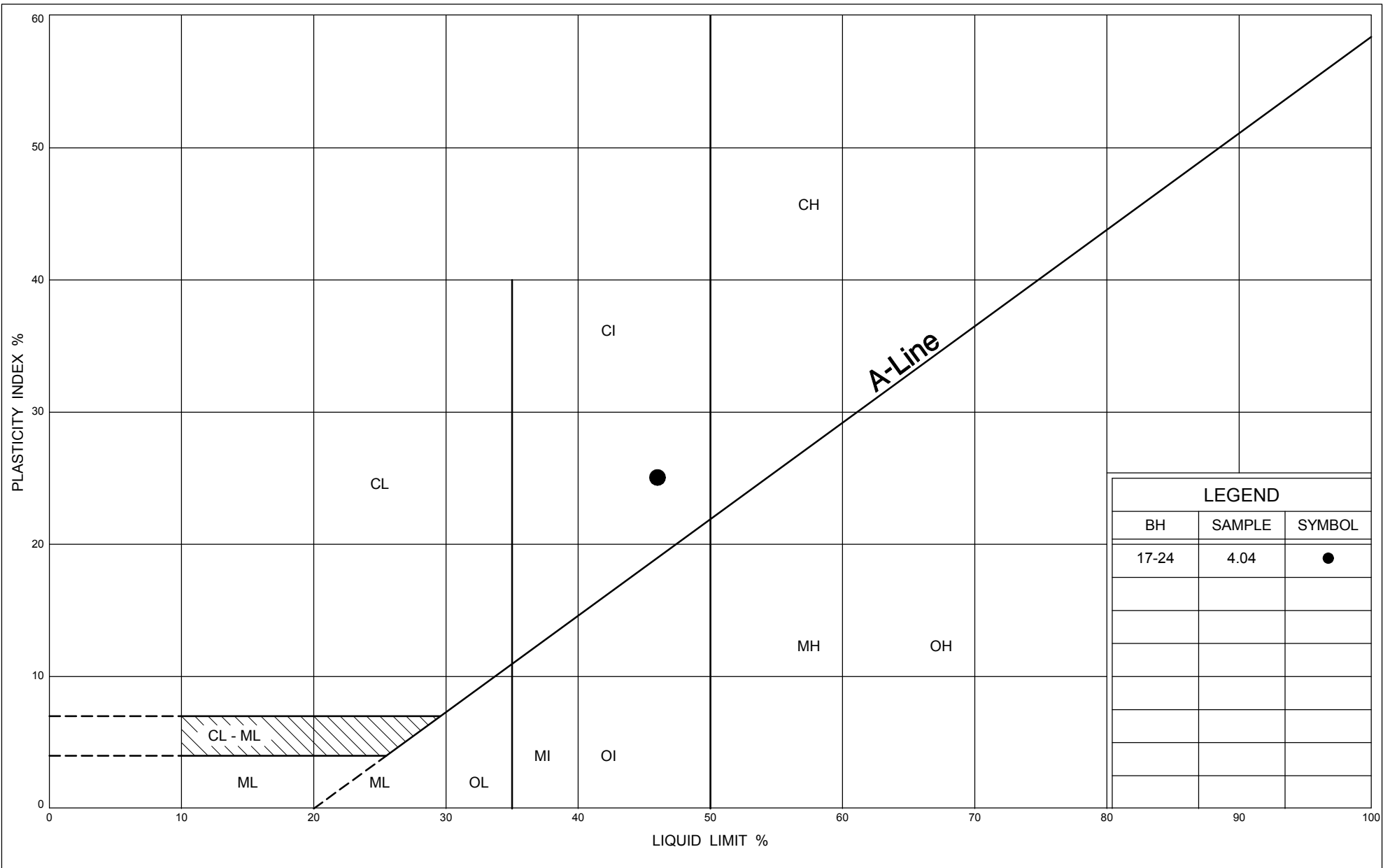
Ministry of
Transportation

PLASTICITY CHART Silty Clay/Clayey Silt

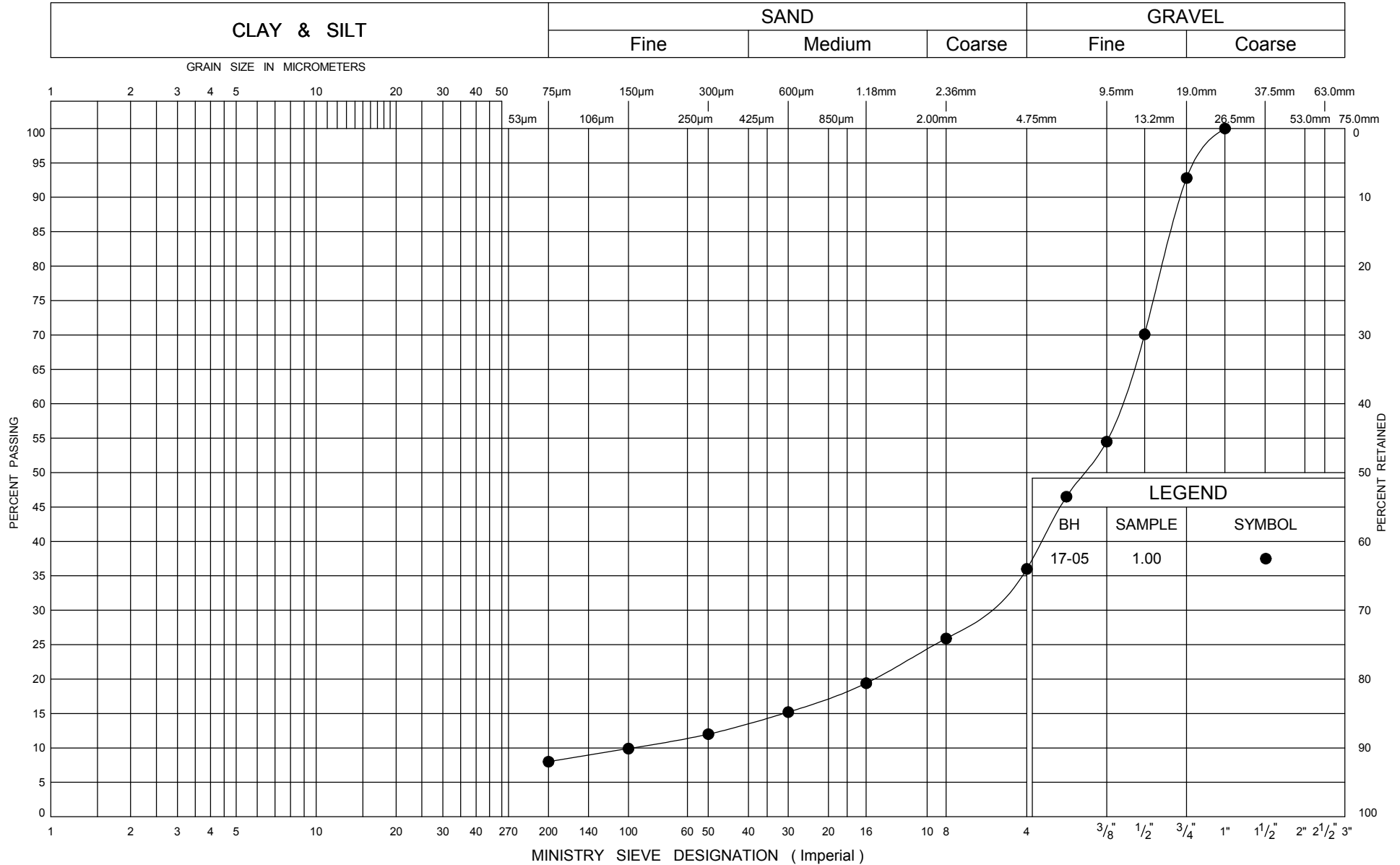
FIG No 14

W PWP 3102-15-00

3015-E-0017, Assignment 8



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GRAIN SIZE DISTRIBUTION

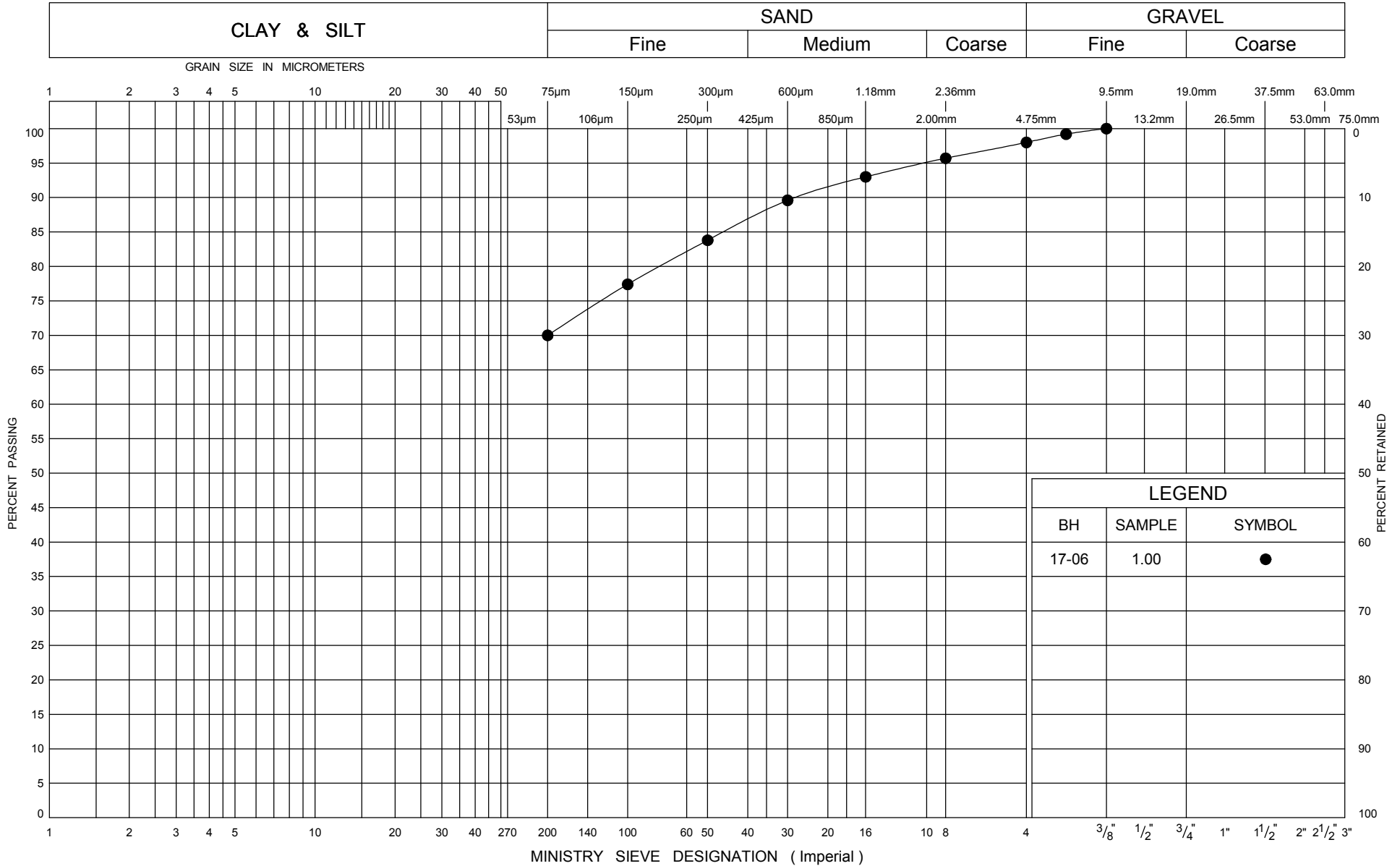
Fill: Sand and Gravel

FIG No 16

W PWP 3102-15-00

3015-E-0017, Assignment 8

UNIFIED SOIL CLASSIFICATION SYSTEM



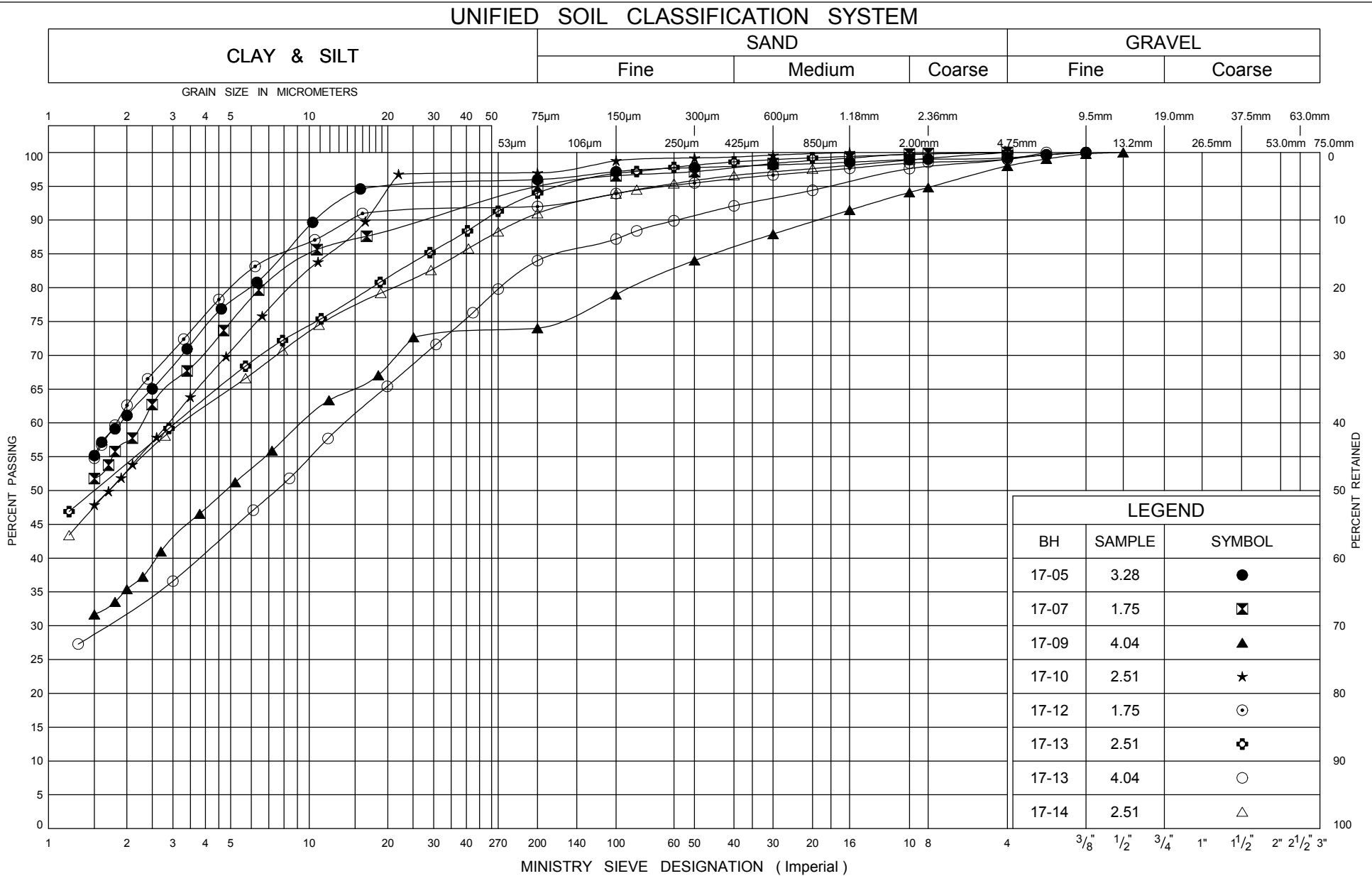
Ministry of
Transportation

GRAIN SIZE DISTRIBUTION
Fill: Silty Clay/Clayey Silt

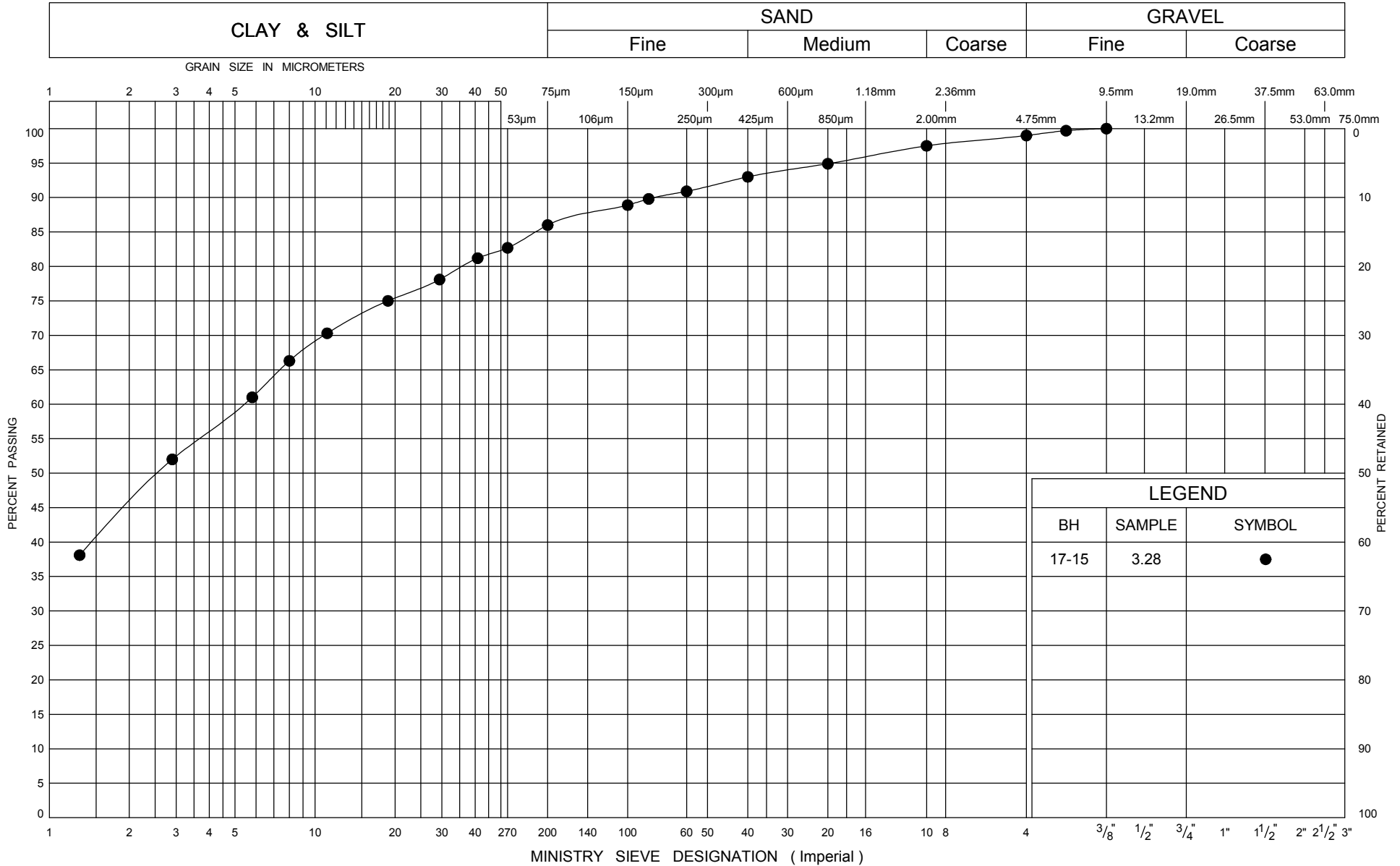
FIG No 17

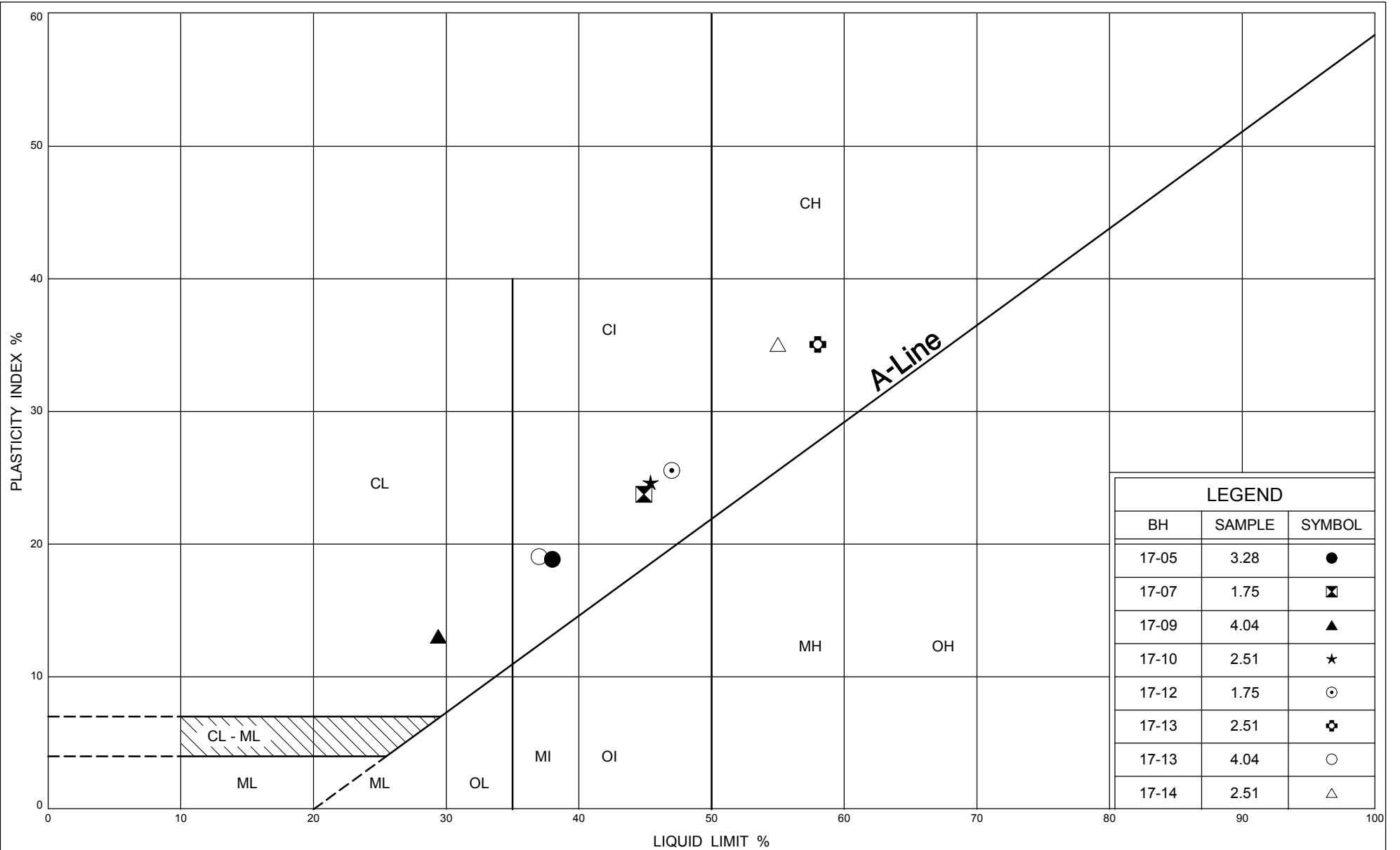
W PWP 3102-15-00

3015-E-0017, Assignment 8



UNIFIED SOIL CLASSIFICATION SYSTEM





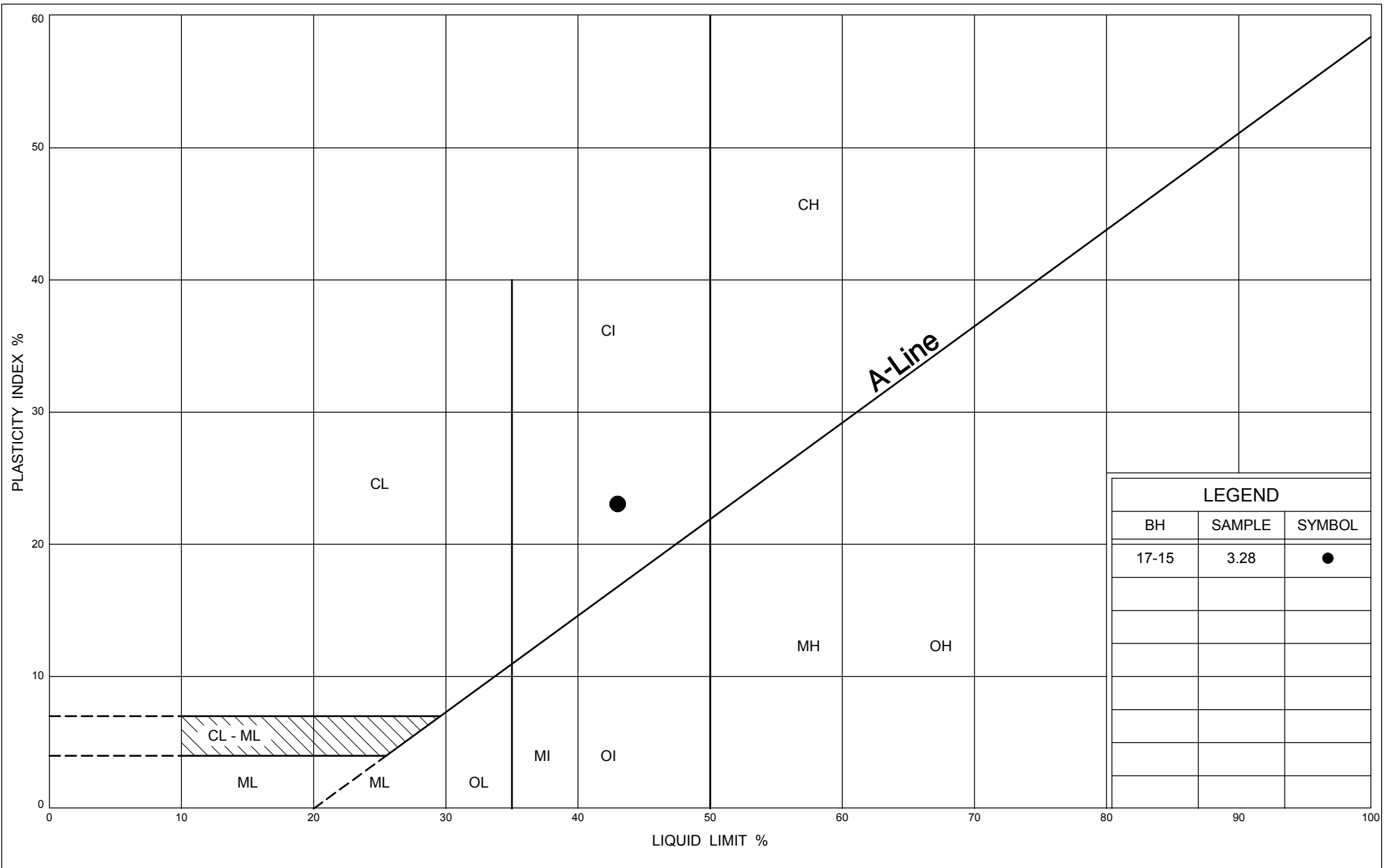
Ministry of
Transportation

PLASTICITY CHART Silty Clay/Clayey Silt

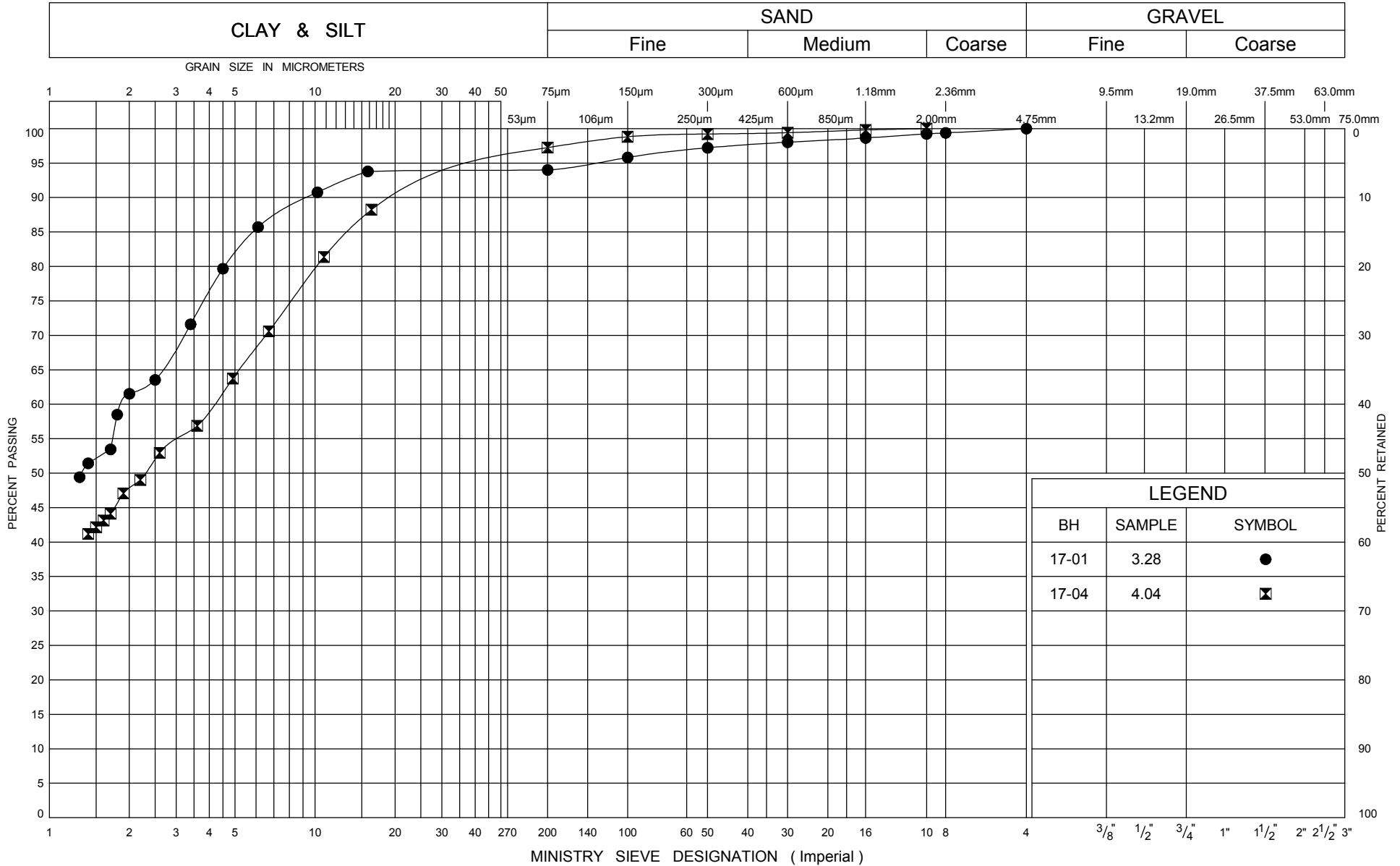
FIG No 20

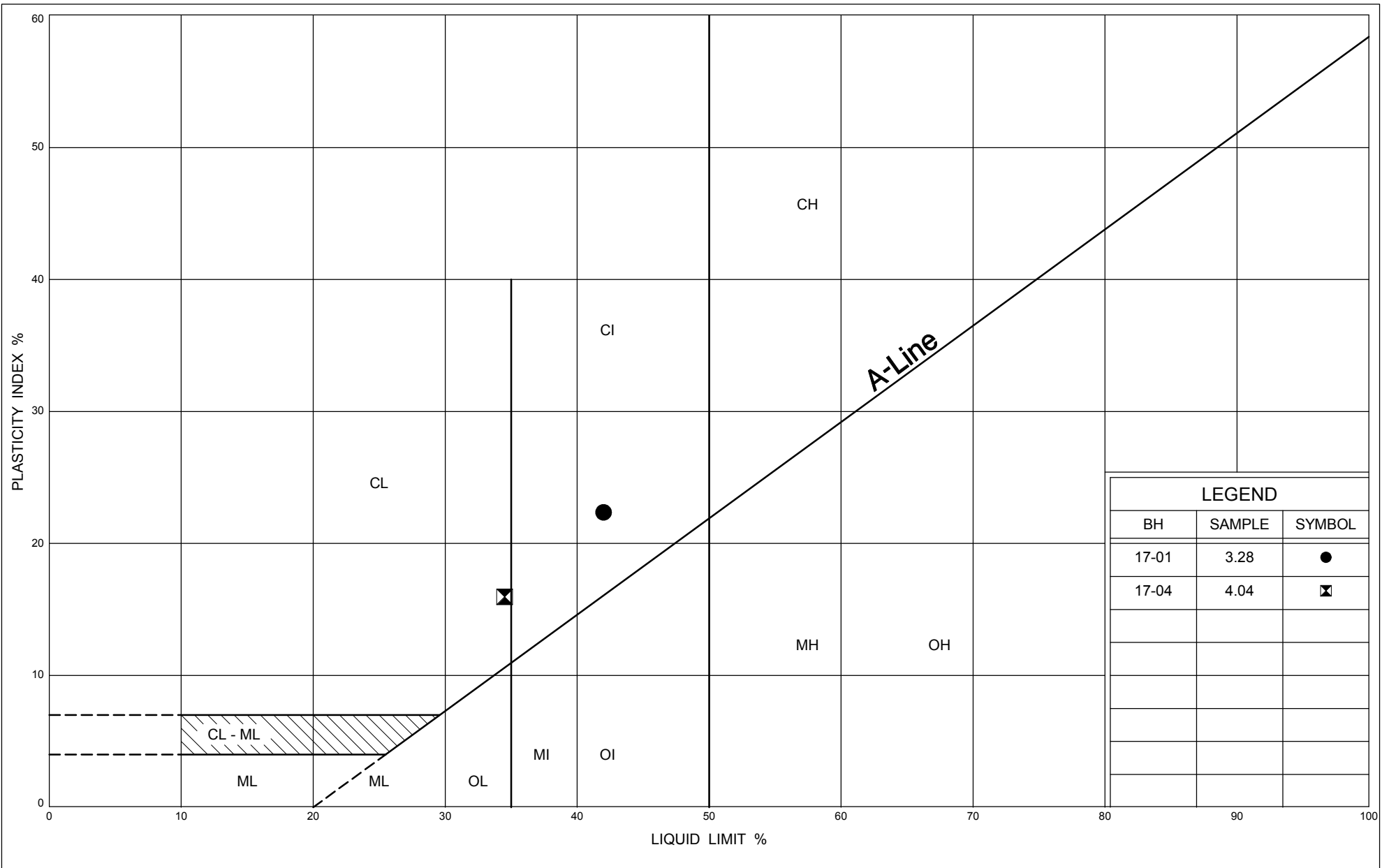
W PWP 3102-15-00

3015-E-0017, Assignment 8

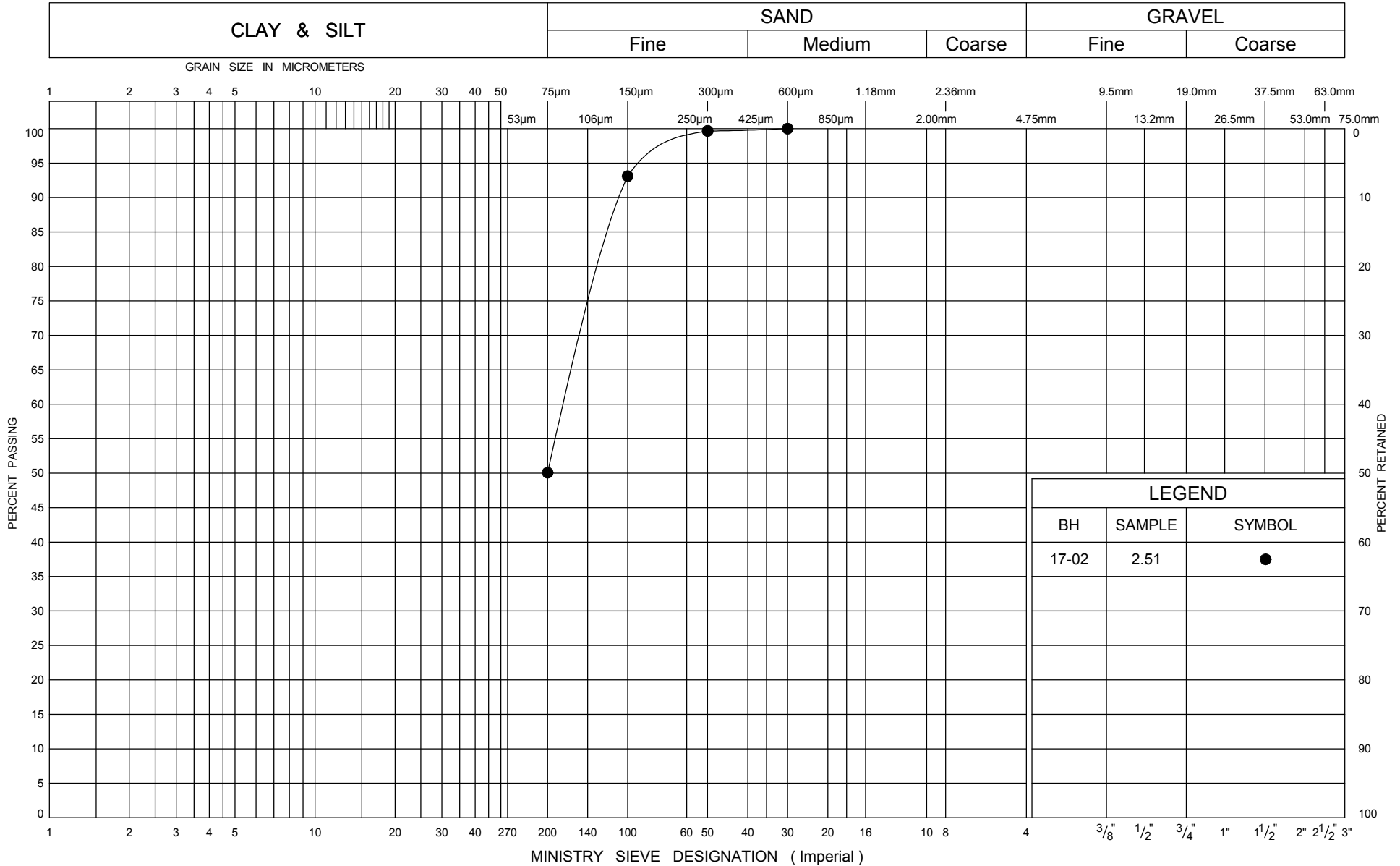


UNIFIED SOIL CLASSIFICATION SYSTEM





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GRAIN SIZE DISTRIBUTION

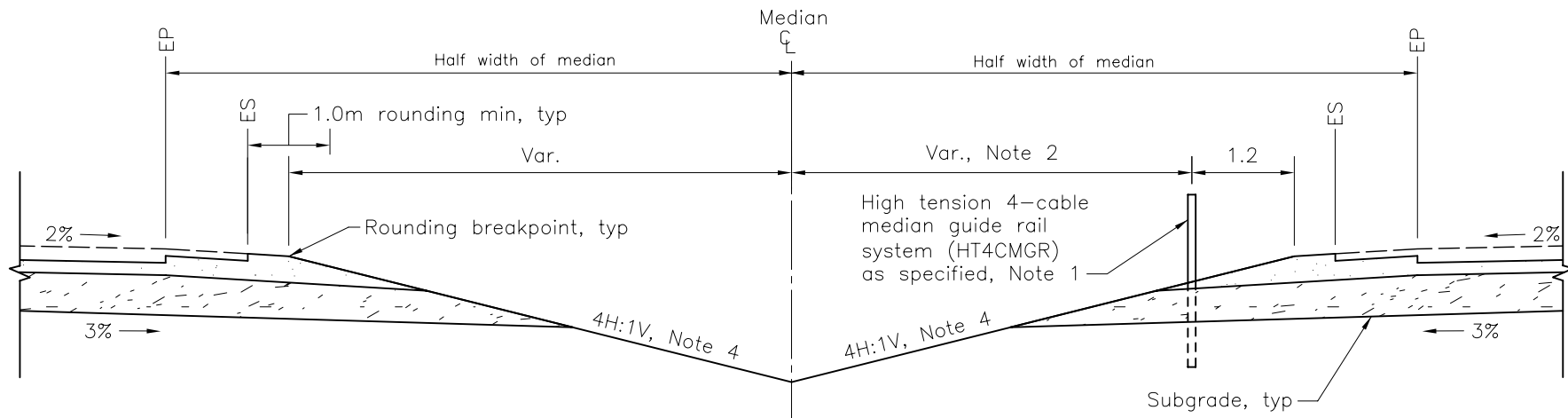
Silty Sand

FIG No 24

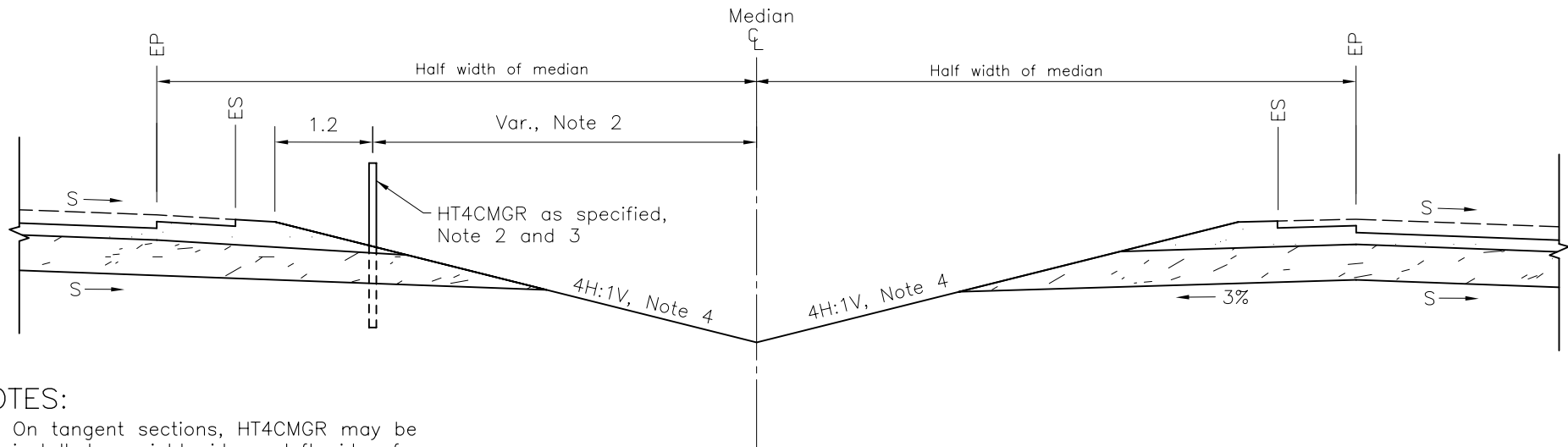
W PWP 3102-15-00

3015-E-0017, Assignment 8

**Appendix E –
Draft DCSOD Provide by MTO**



TANGENT SECTION

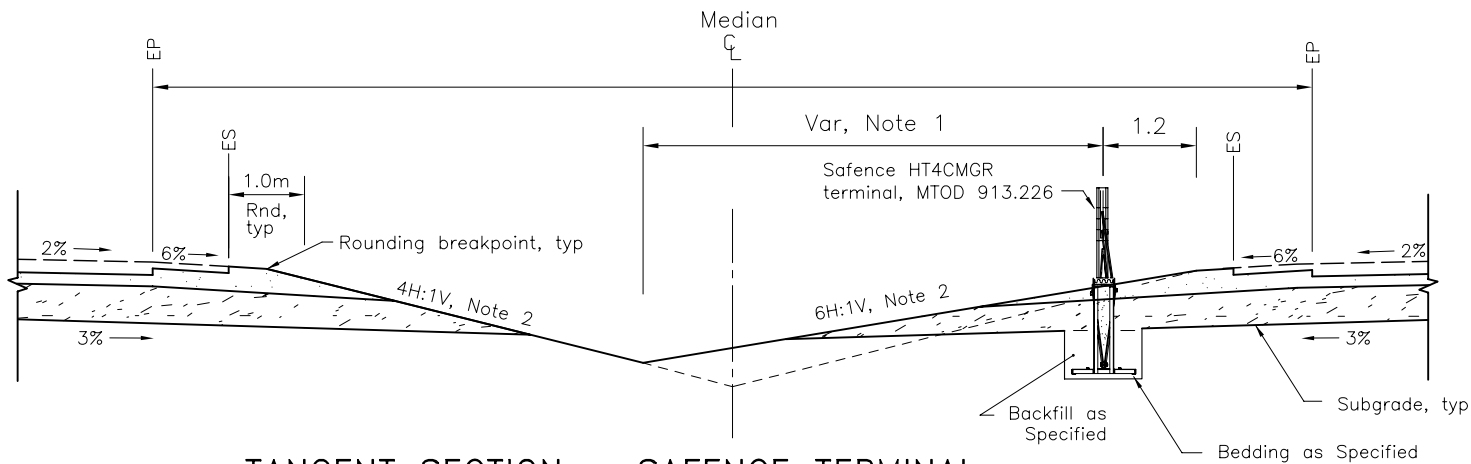


SUPERELEVATED SECTION
(HORIZONTAL RIGHT CURVE DEPICTED)

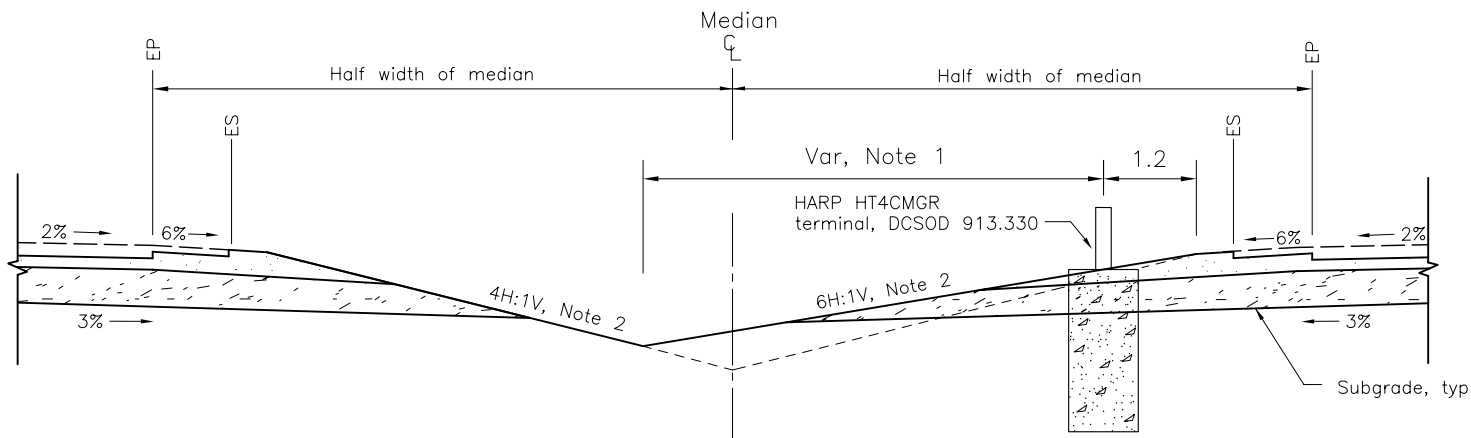
NOTES:

1. On tangent sections, HT4CMGR may be installed on right side or left side of median ditch.
2. Offset from centreline of median ditch to HT4CMGR shall not be less than 2.44m.
3. For horizontal right curves, HT4CMGR shall be installed on left side of median ditch, and for horizontal left curves, HT4CMGR shall be installed on right side of median ditch.
4. Slope shall be flatter when specified.
- A. This DCSOD shall be read in conjunction with OPSD 206.020.
- B. All dimensions are in metres unless otherwise shown.

DESIGN & CONTRACT STANDARDS OFFICE DRAWING	January 18, 2018	Rev	0
4H:1V MEDIAN GRADING WITH HT4CMGR RURAL FREEWAY		WP 3102-15-00 Hwy 401 East of Chatham	
		DCSOD 200.041	



TANGENT SECTION – SAFENCE TERMINAL



TANGENT SECTION – CASS HARP TERMINAL

NOTES:

1. Offset from centreline of median ditch to HT4CMGR terminal shall not be less than 2.44m.
 2. Slope shall be flatter when specified.
- A. This DCSOD shall be read in conjunction with OPSD 206.020.
- B. All dimensions are in metres unless otherwise shown.

DESIGN & CONTRACT STANDARDS OFFICE DRAWING

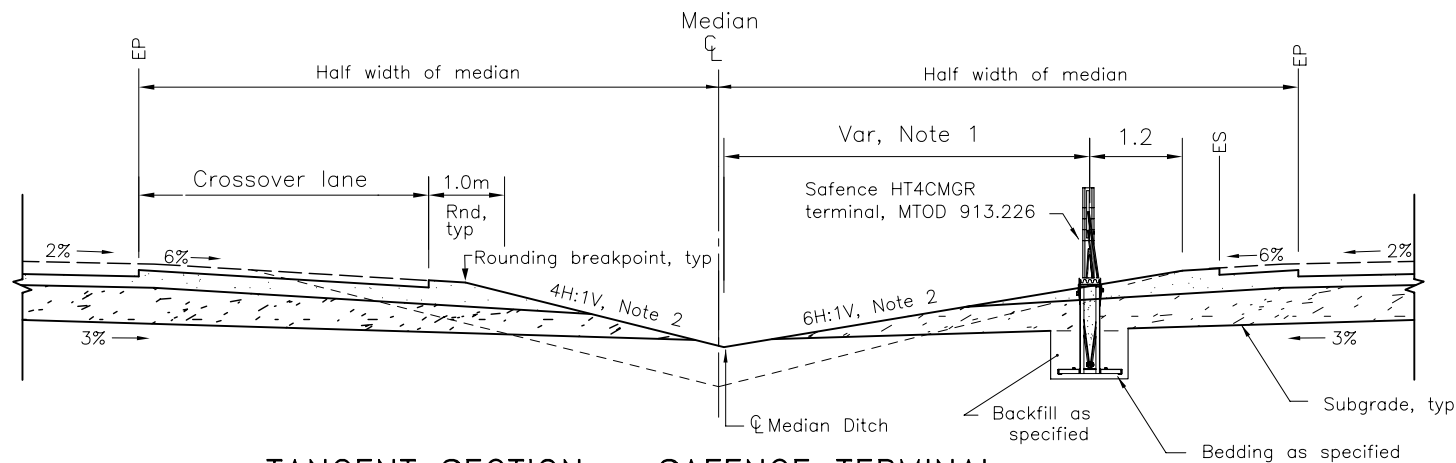
January 18, 2018

Rev 0

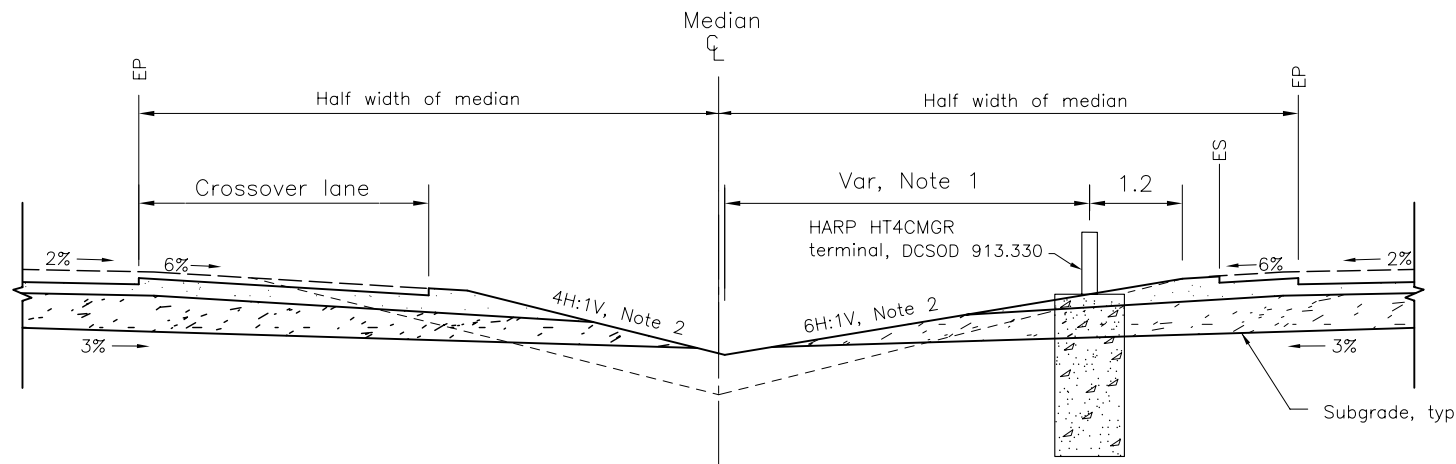
**MEDIAN GRADING
WITH HT4CMGR TERMINAL
RURAL FREEWAY**

WP 3102-15-00
Hwy 401 East of Chatham

DCSOD 200.045



TANGENT SECTION – SAFENCE TERMINAL

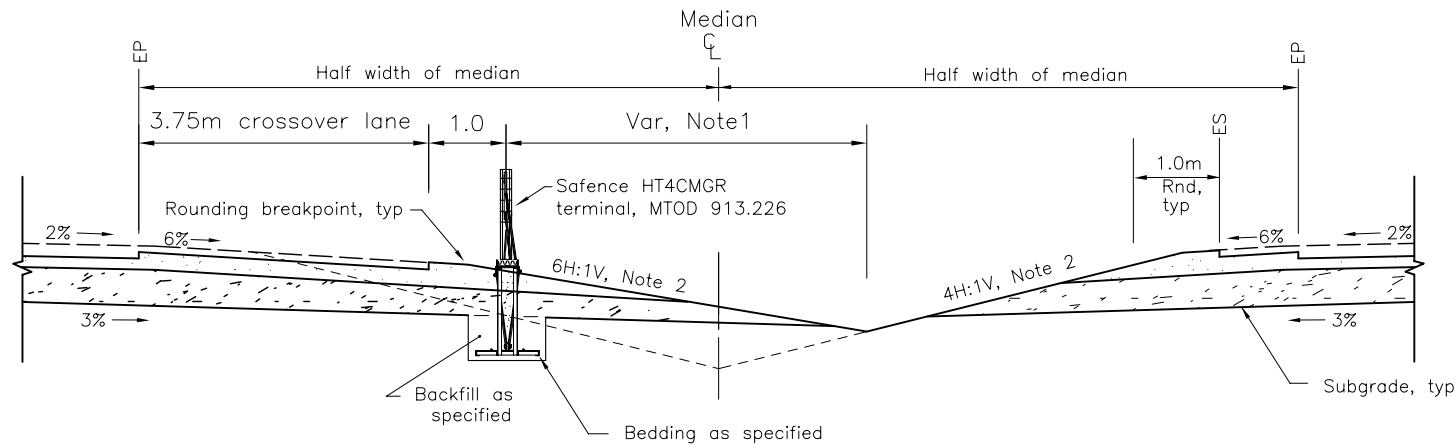


TANGENT SECTION – CASS HARP TERMINAL

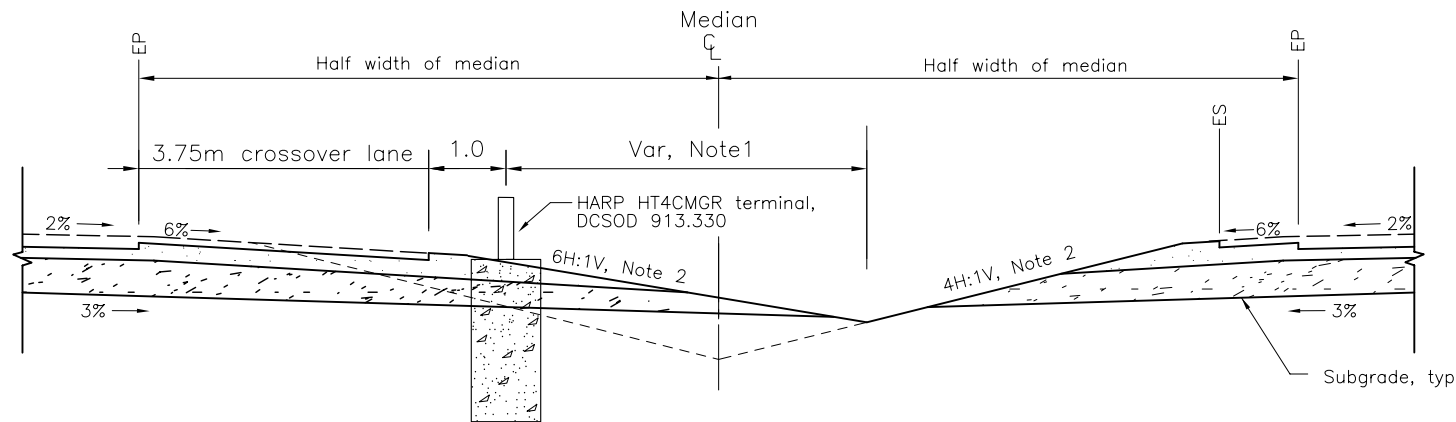
NOTES:

- Offset from centreline of median ditch to HT4CMGR terminal shall not be less than 2.44m.
 - Slope shall be flatter when specified.
- A. This DCSOD shall be read in conjunction with OPSD 206.020.
- B. All dimensions are in metres unless otherwise shown.

DESIGN & CONTRACT STANDARDS OFFICE DRAWING	January 18, 2018	Rev	0
<p>MEDIAN GRADING</p> <p>WITH HT4CMGR TERMINAL OPPOSITE TO CROSSOVER</p> <p>RURAL FREEWAY</p>			
<p>WP 3102-15-00</p> <p>Hwy 401 East of Chatham</p> <p>DCSOD 200.046</p>			



TANGENT SECTION - SAFENCE TERMINAL

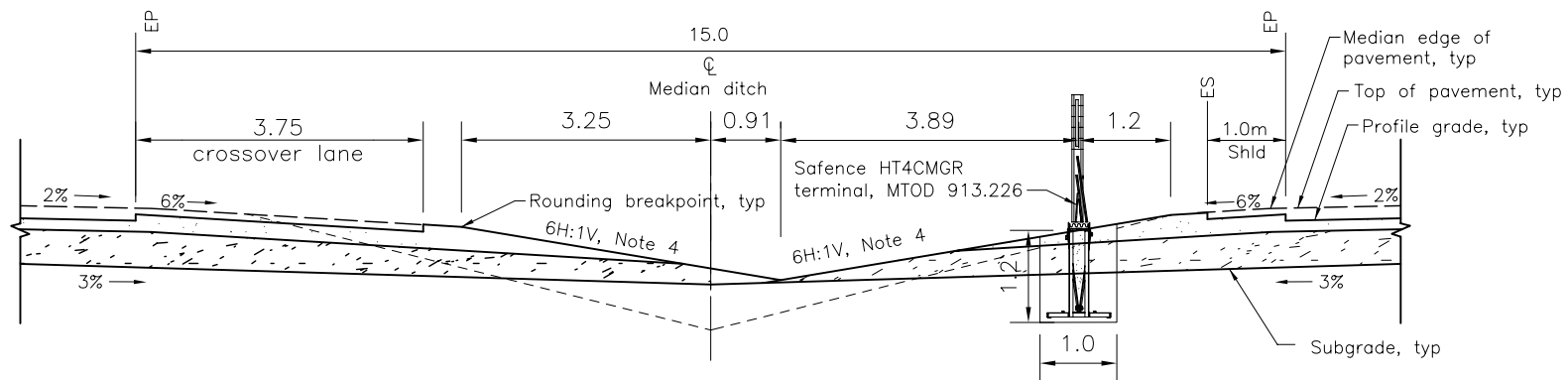


TANGENT SECTION - CASS HARP TERMINAL

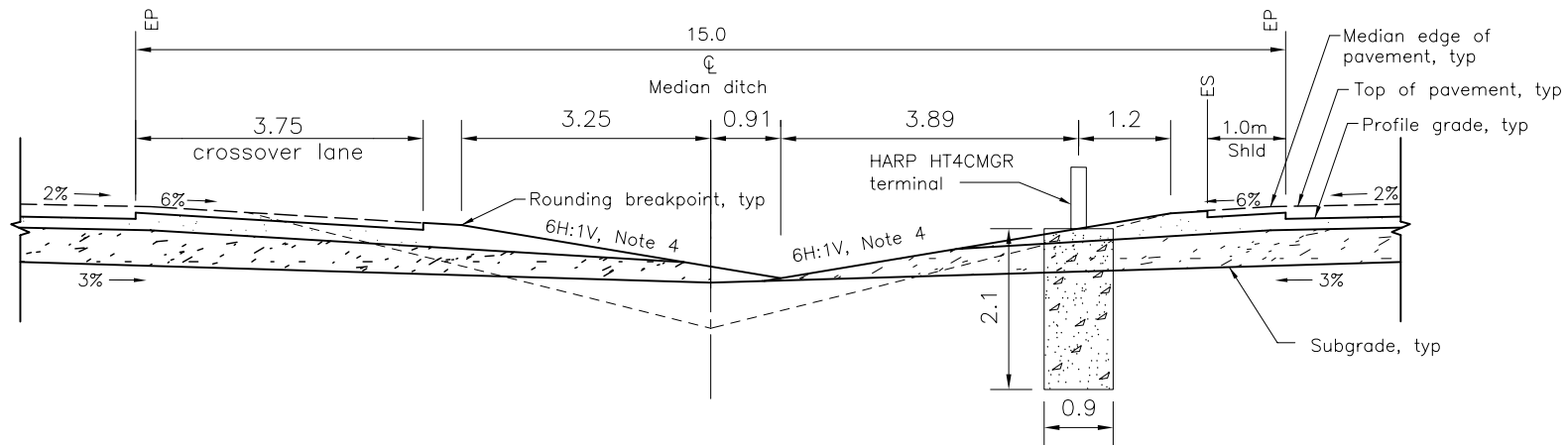
NOTES:

1. Offset from centreline of median ditch to HT4CMGR terminal shall not be less than 2.44m.
2. Slope shall be flatter when specified.
- A. This DCSOD shall be read in conjunction with OPSD 206.020.
- B. All dimensions are in metres unless otherwise shown.

DESIGN & CONTRACT STANDARDS OFFICE DRAWING	January 18, 2018	Rev	0
<p>MEDIAN GRADING</p> <p>WITH HT4CMGR TERMINAL ADJACENT TO CROSSOVER</p> <p>RURAL FREEWAY</p>			
<p>WP 3102-15-00</p> <p>Hwy 401 East of Chatham</p> <p>DCSOD 200.047</p>			



TANGENT SECTION AT CROSSOVER – SAFENCE TERMINAL



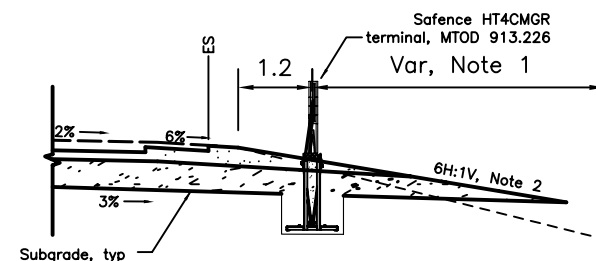
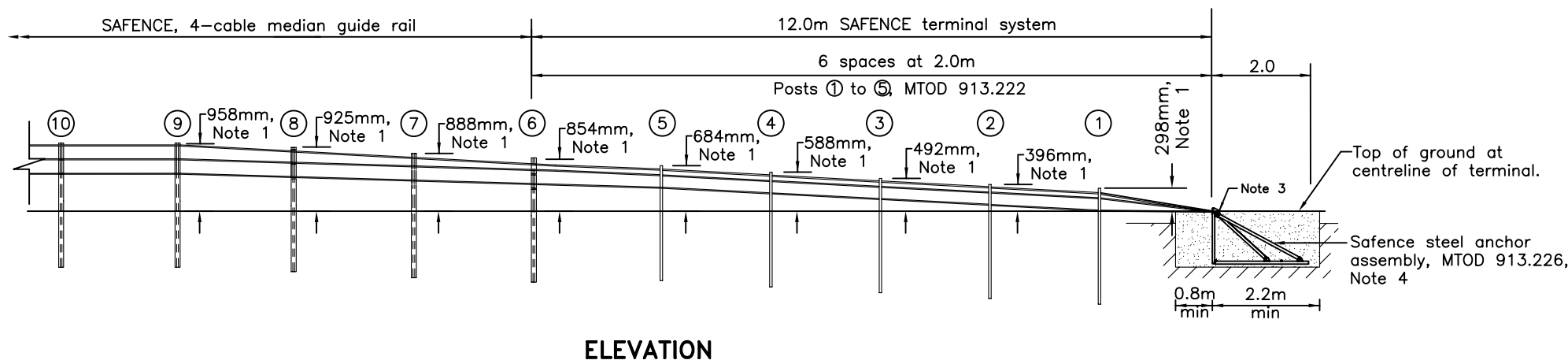
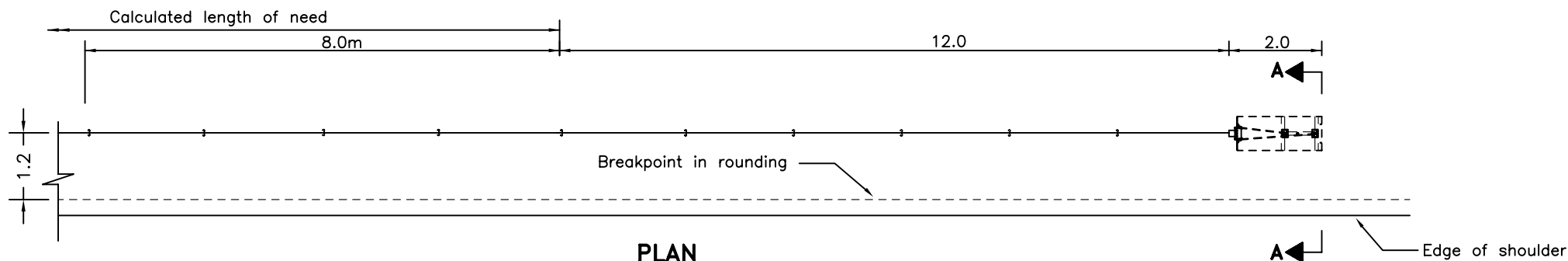
TANGENT SECTION AT CROSSOVER – CASS HARP TERMINAL

DRAFT

NOTES:

A. All dimensions are in metres unless otherwise shown.

DESIGN & CONTRACT STANDARDS OFFICE DRAWING	Nov 9, 2017	Rev	0
6H:1V MEDIAN GRADING WITH HT4CMGR AT CROSSOVER RURAL FREEWAY		WP 3102-15-00 Hwy 401 East of Chatham	
		DCSOD 200.065	



NOTES:

- 1 Height from ground to top of post is measured at face of post.
- 2 Slope shall be flatter when specified.
- 3 Top of steel anchor shall project 25mm to 75mm above top of shoulder.
- 4 The longitudinal slope of the steel bottom plate shall match the gradient of the roadway.
- 5 Offset from centreline of median ditch to HT4CMGR terminal shall not be less than 2.44m.
- 6 Offset from breakpoint to HT4CMGR terminal shall not be greater than 1.2m.

- A The system depicted here is a proprietary product.
- B System configuration meets NCHRP Report 350, TL-3
- C All dimensions are in metres unless otherwise shown.

DESIGN AND CONTRACT STANDARD DRAWING

GUIDE RAIL SYSTEM, HIGH TENSION CABLE
SAFENCE TERMINAL, 3-CABLE
 SLOPE INSTALLATION

Nov 23, 2017

Rev 0

WP 3102-15-00
 Hwy 401 East of Chatham

DCSOD - 913.230

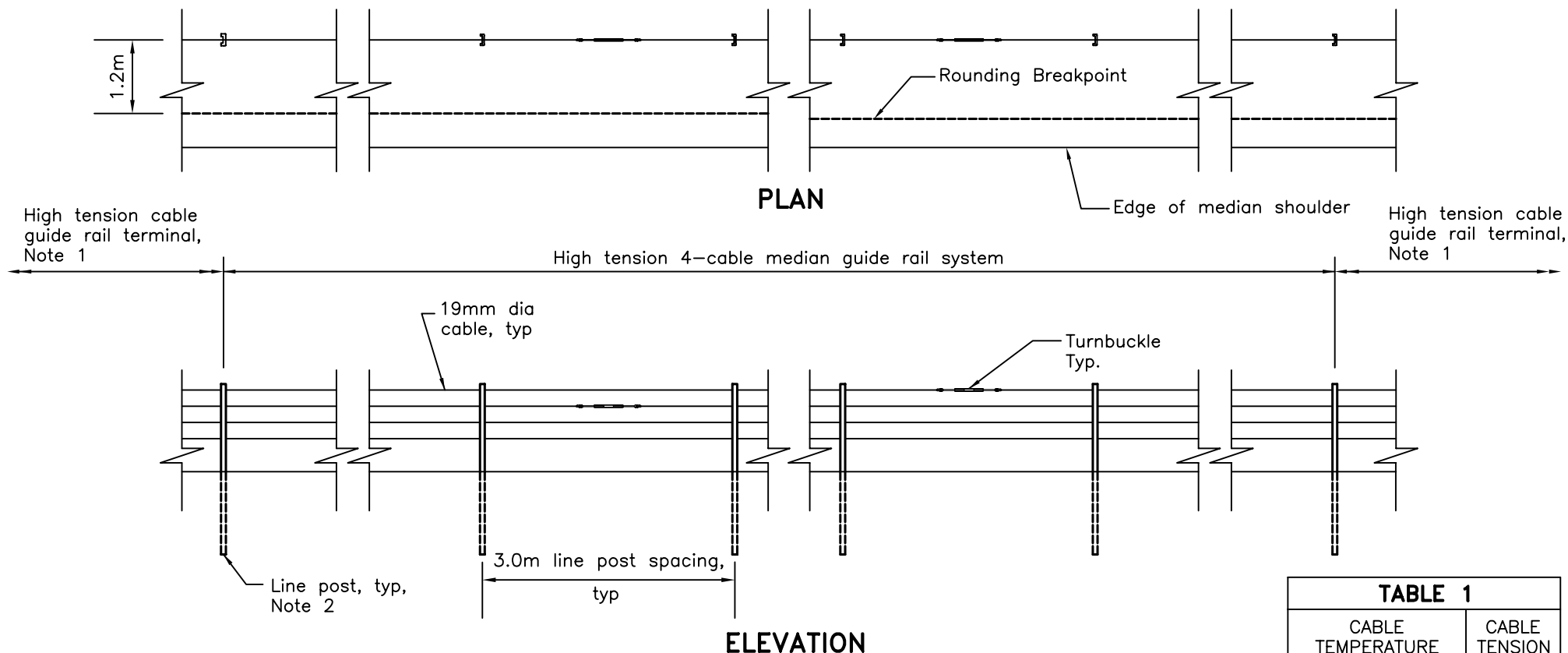
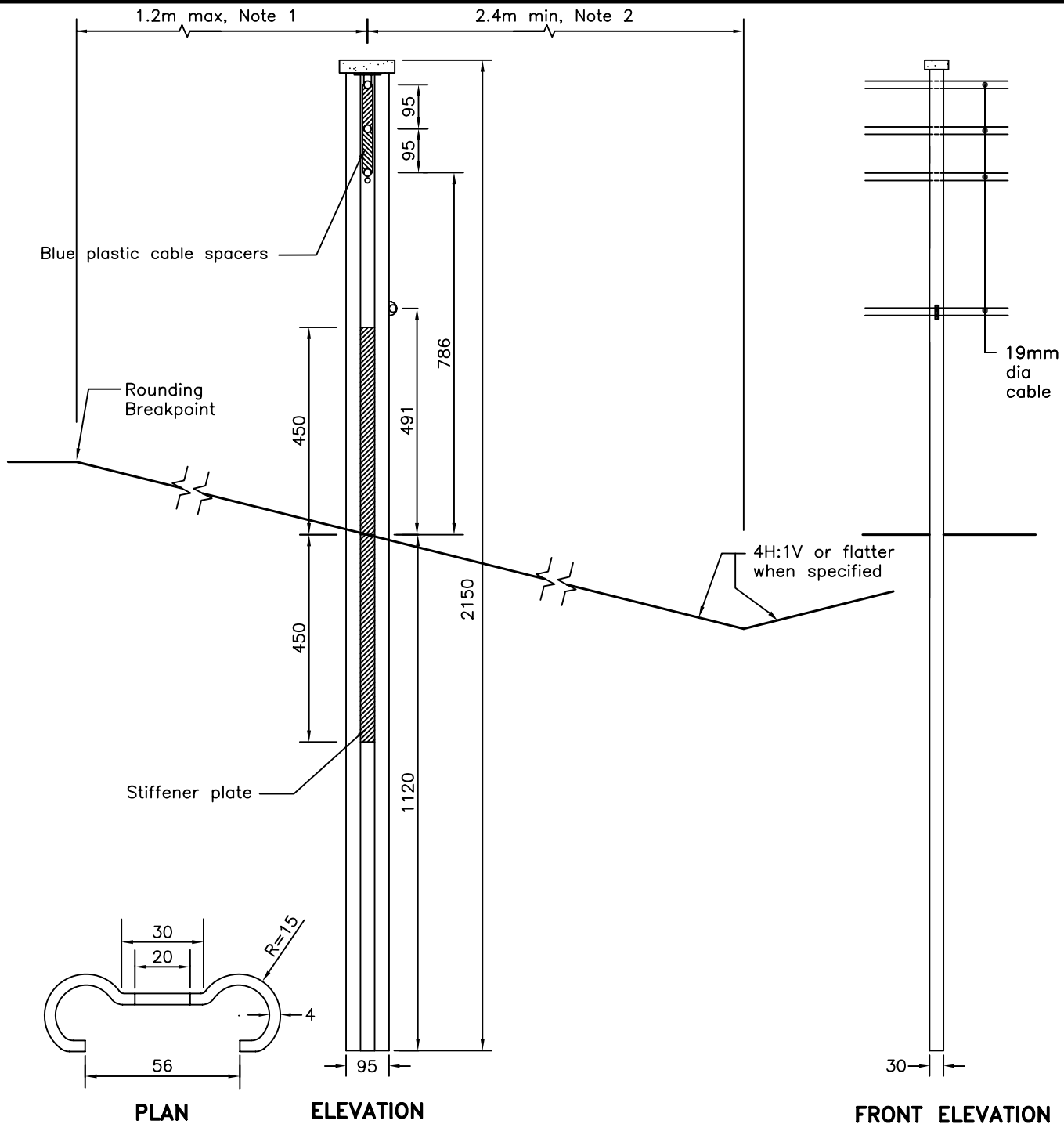


TABLE 1	
CABLE TEMPERATURE (°C)	CABLE TENSION (kN)
-40	31.4
-30	28.4
-20	25.5
-10	22.5
0	19.6
+10	16.7
+20	13.7
+30	10.8
+40	7.8

NOTES:

- 1 Each end of the installation to be anchored by a high tension cable guide rail terminal according to DCSOD 913.226.
- 2 Line posts and grading shall be according to DCSOD 200.041 and DCSOD 913.264.
- A Tension in 19mm dia. cables shall be according to Table 1.
- B The system depicted is proprietary.
- C System configuration meets AASHTO MASH TL-3.
- D All dimensions are in millimetres unless otherwise shown.

DESIGN & CONTRACT STANDARDS OFFICE	Nov 23, 2017	Rev	0
GUIDE RAIL SYSTEM, HIGH TENSION CABLE	WP 3102-15-00		
SAFENCE, 4-CABLE	Hwy 401 East of Chatham		
4H:1V MEDIAN INSTALLATION	DCSOD 913.260		



NOTES:

- 1 System shall not be offset more than 1.2m beyond the rounding breakpoint on 4H:1V slope.
- 2 System shall not be offset less than 2.44m from centre line of median ditch with 4H:1V slopes.
- A The components depicted here are proprietary.
- B ASTM-A1011 Grade 60 steel post hot dip galvanized according to ASTM - F1043
- C All dimensions are in millimetres unless otherwise shown.

DESIGN & CONTRACT STANDARD OFFICE DRAWING

GUIDE RAIL SYSTEM, HIGH TENSION CABLE

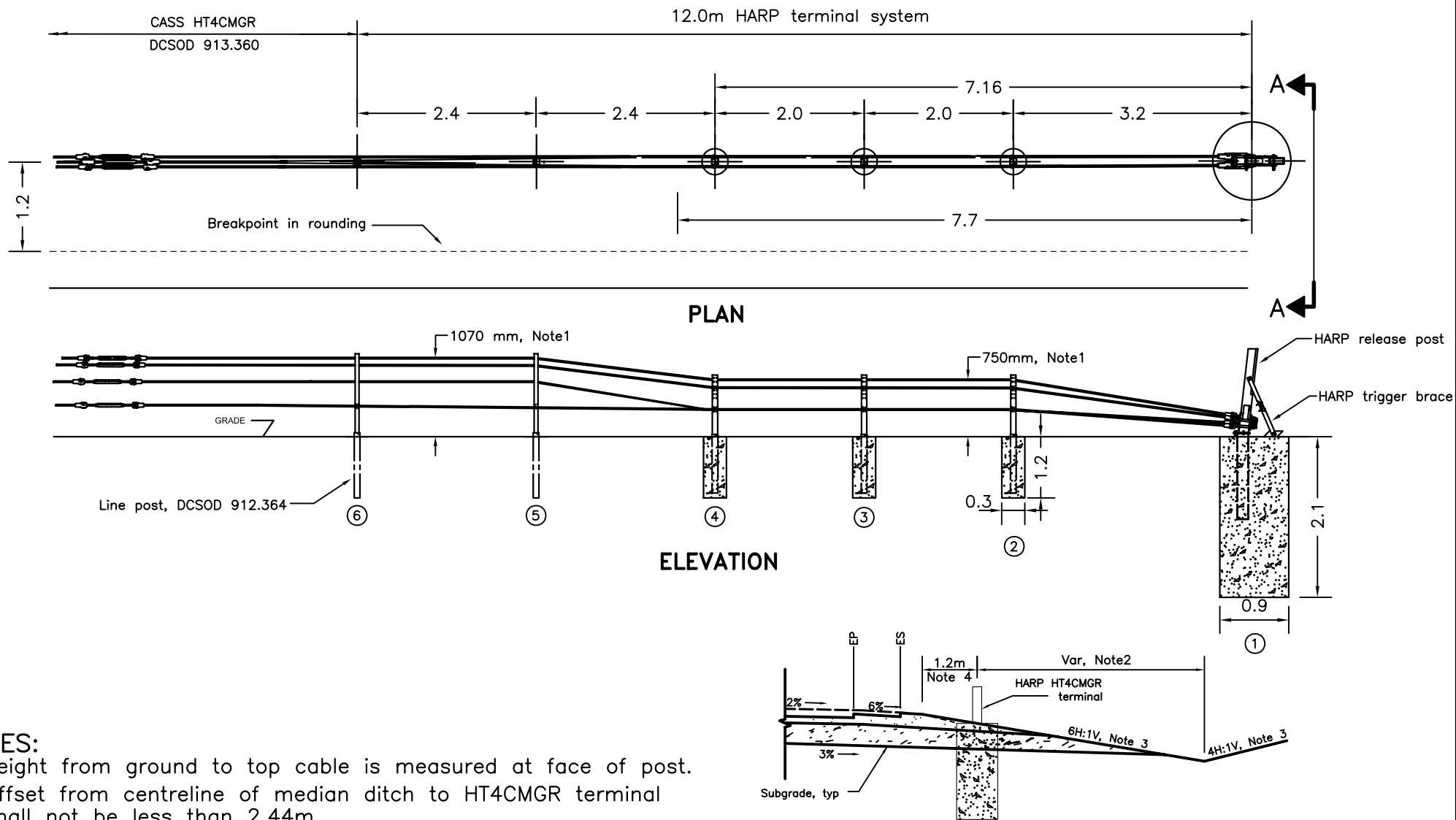
SAFENCE, 4-CABLE

4H:1V MEDIAN INSTALLATION LINE POST - COMPONENT

DATE Nov 23, 2017 Rev 0

WP 3102-15-00 _
Hwy 401 East of Chatham

DCSOD 913.264



NOTES:

- 1 Height from ground to top cable is measured at face of post.
- 2 Offset from centreline of median ditch to HT4CMGR terminal shall not be less than 2.44m.
- 3 Slope shall be flatter when specified.
- 4 Offset from breakpoint to HT4CMGR terminal shall not be greater than 1.2m.

- A The system depicted here is a proprietary product.
- B System configuration meets NCHRP Report 350, TL-3.
- C All dimensions are in metres unless otherwise shown.

DESIGN AND CONTRACT STANDARD DRAWING

November 23 2017 Rev 1

GUIDE RAIL SYSTEM, HIGH TENSION CABLE
HARP TERMINAL, 4-CABLE
 MEDIAN INSTALLATION

WP 3102-15-00
 Hwy 401 East of Chatham
DCSOD - 913.330

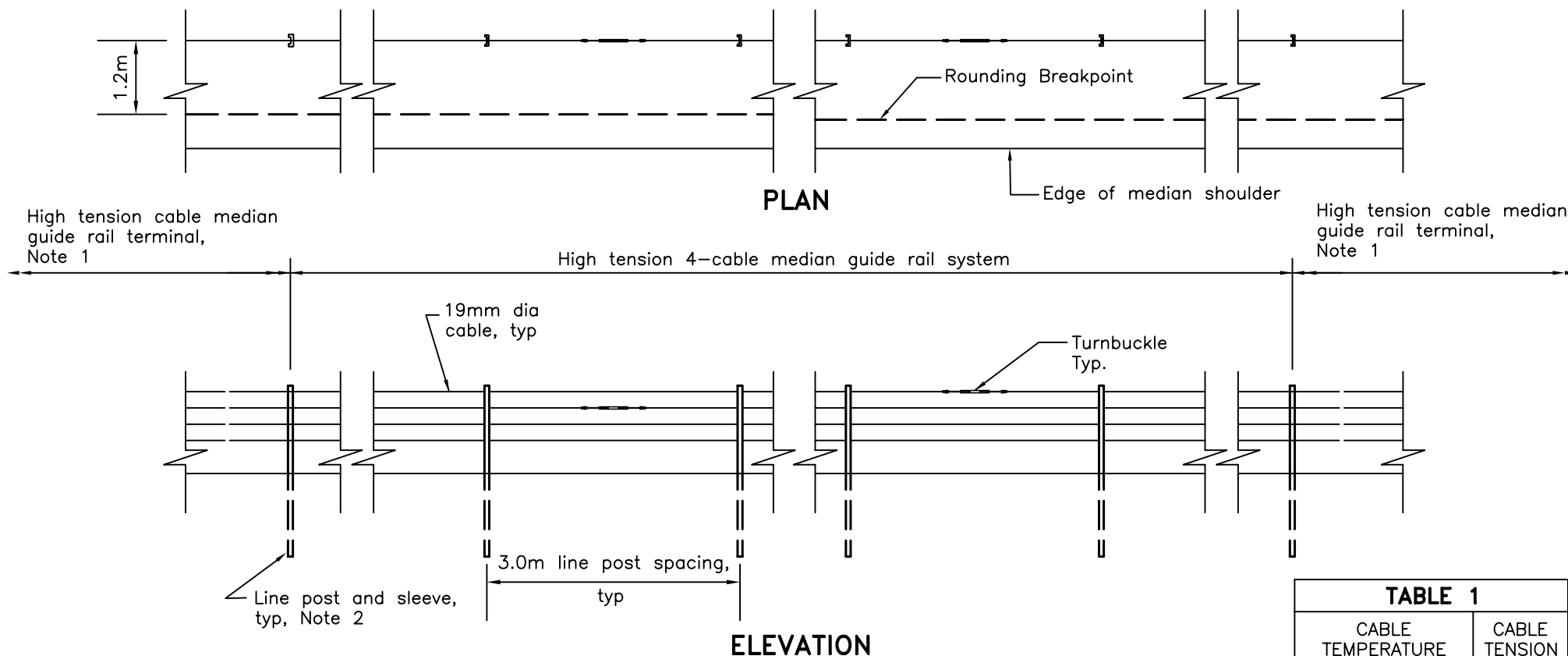


TABLE 1	
CABLE TEMPERATURE (°C)	CABLE TENSION (kN)
-40	31.4
-30	28.4
-20	25.5
-10	22.5
0	19.6
+10	16.7
+20	13.7
+30	10.8
+40	7.8

NOTES:

- 1 Each end of the installation to be anchored by a high tension cable guide rail terminal according to DCSOD 913.226.
- 2 Line posts, sleeves, and grading shall be according to DCSOD 200.041 and DCSOD 913.364.
- A Tension in 19mm dia. cables shall be according to Table 1.
- B The system depicted is proprietary.
- C System configuration meets AASHTO MASH TL-3.
- D All dimensions are in millimetres unless otherwise shown.

DESIGN & CONTRACT STANDARDS OFFICE DRAWING

Nov 23, 2017

Rev 0

GUIDE RAIL SYSTEM, HIGH TENSION CABLE

CASS, 4-CABLE

4H:1V MEDIAN INSTALLATION

WP 3102-15-00

Hwy 401 East of Chatham

DCSOD 913.360



- DESIGN & CONTRACT STANDARD OFFICE DRAWING

DATE	Nov.23 2017	Rev	0
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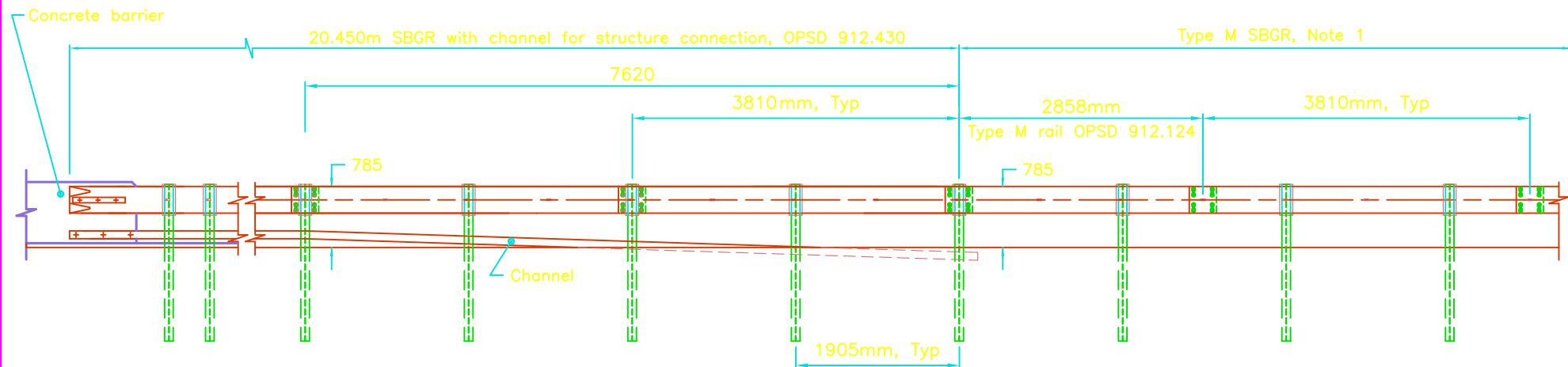
GUIDE RAIL SYSTEM, HIGH TENSION CABLE

WP 3102-15-00 _
Hwy 401 East of Chatham

CASS, 4-CABLE

4H:1V MEDIAN INSTALLATION LINE POST – COMPONENT

DCSOD 913.364



ELEVATION

NOTES:

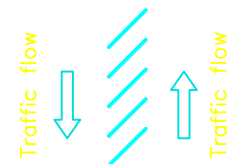
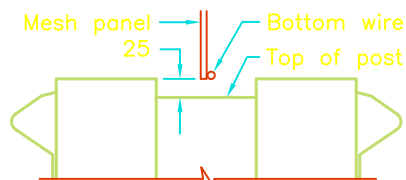
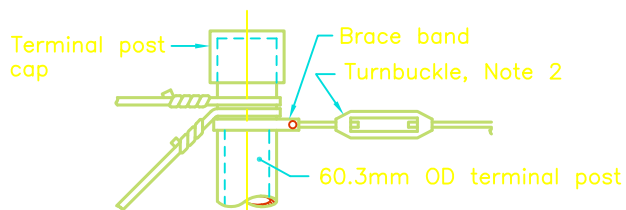
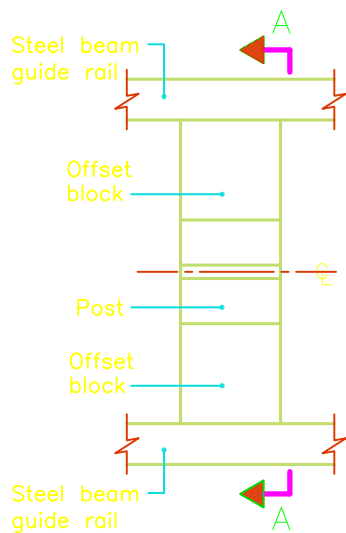
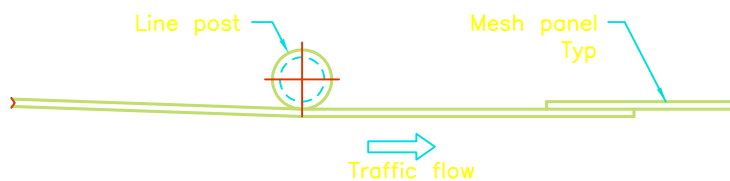
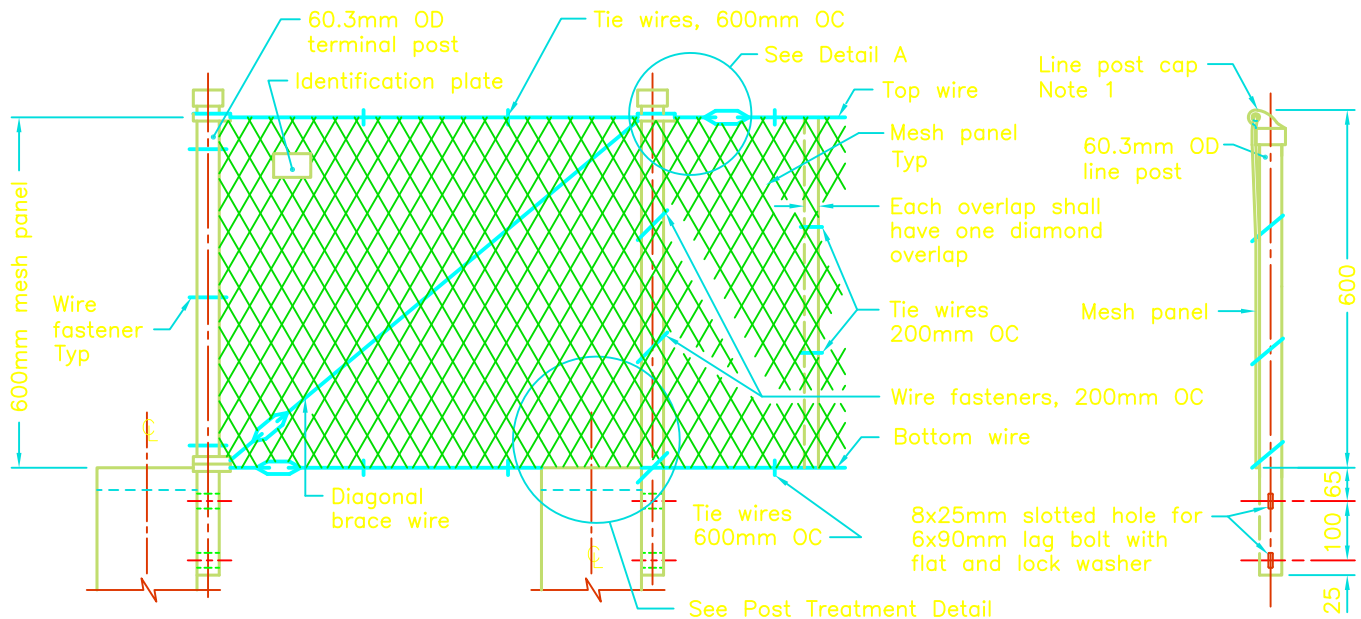
- 1 Type M SBGR includes Type M20 and Type M30.
- A Mounting height to top of steel beam shall be measured vertically at face of rail.
- B All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING GUIDE RAIL SYSTEM, STEEL BEAM TRANSITION FROM TYPE M TO STEEL BEAM GUIDE RAIL WITH CHANNEL FOR STRUCTURE CONNECTION-INSTALLATION

Nov 2016 Rev 0

OPSD 912.315





NOTES:

- 1 For line post cap detail refer to OPSD 972.132.
- 2 Turnbuckles shall be installed on diagonal brace wires and top and bottom wires, at intervals of 150m maximum and at terminal posts.
- A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING

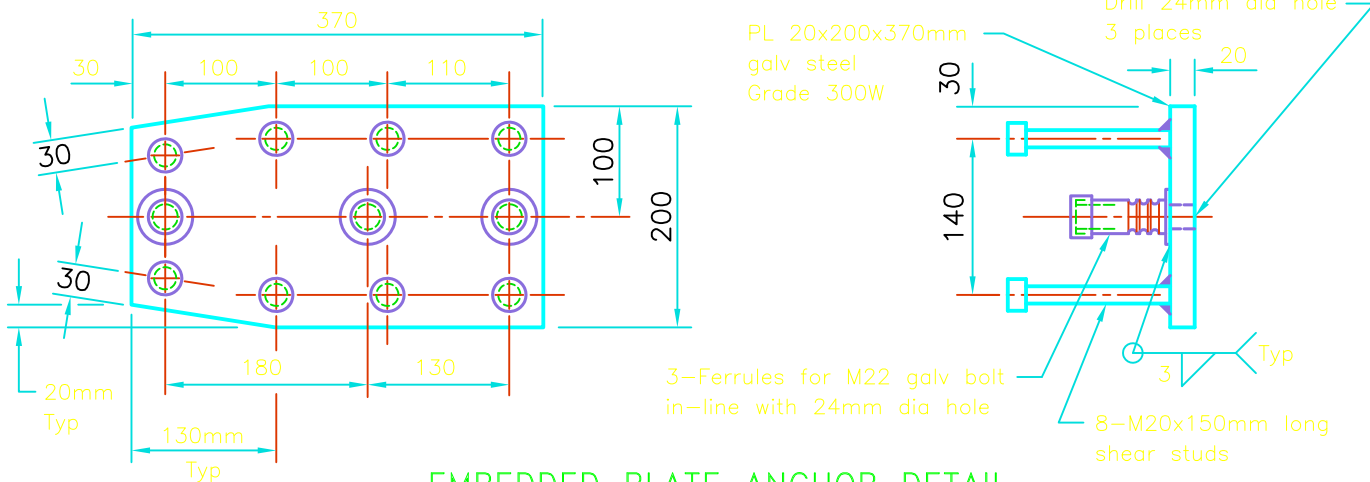
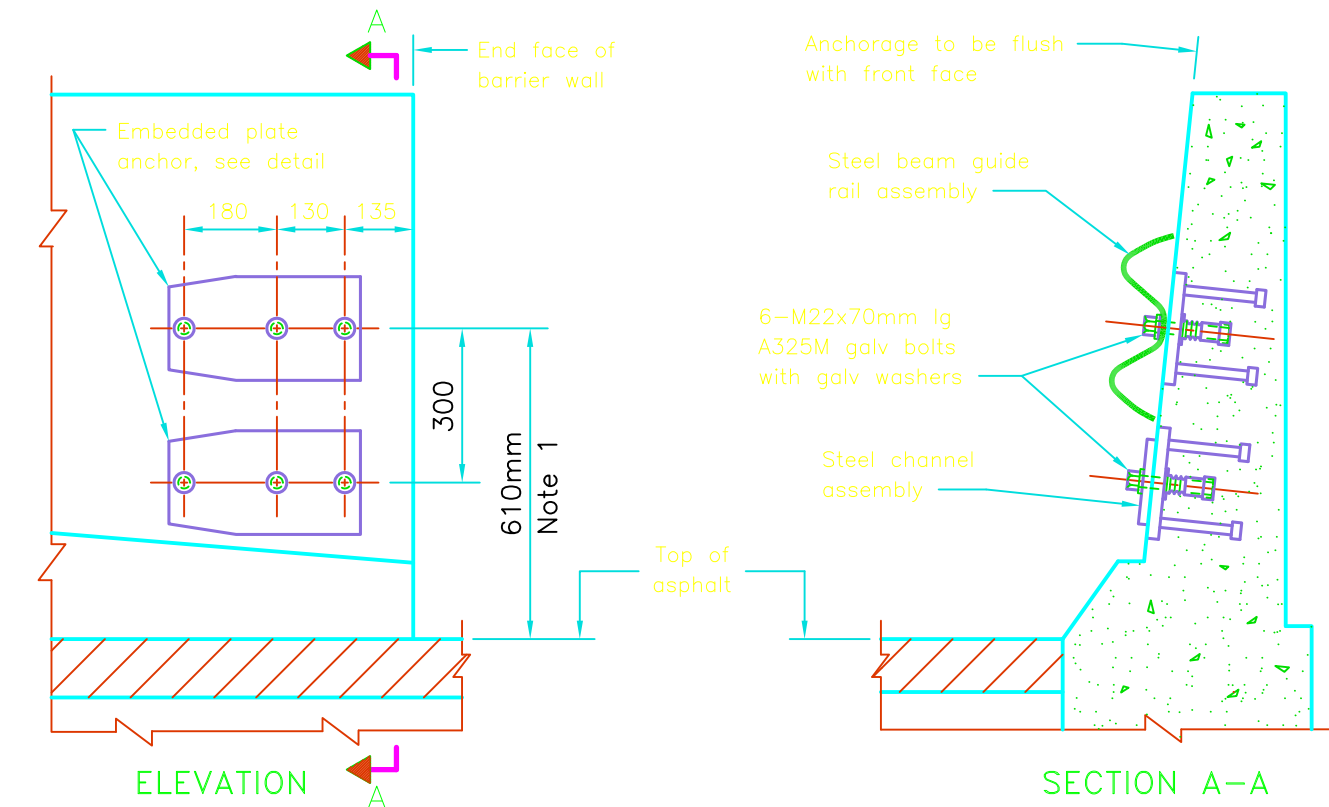
Nov 2014

Rev 3

**EXPANDED METAL ANTI-GLARE SCREEN
INSTALLATION – STEEL BEAM GUIDE RAIL
WITH WOODEN POST**

OPSD 991.131





NOTES:

- 1 If curb or sidewalk in front of the barrier wall is 300mm or greater in width, the mounting height shall be measured vertically to the top of the concrete surface.
- A This OPSD to be read in conjunction with OPSD 912.401 and 912.430.
- B Steel according to CSA G40.21, Grade 300W.
- C Studs to be welded using fusion weld process.
- D Welding shall be of a low hydrogen classification according to CSA W59 with E480xx electrodes.
- E Anchor to be hot dip galvanized after fabrication according to CAN/CSA G164.
- F All bolts shall be liberally coated with antiseize compound meeting US Military Specification MIL-A-907D.
- G All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING

Nov 2010 Rev 1



**BARRIERS AND RAILINGS
STEEL BEAM
GUIDE RAIL AND CHANNEL ANCHORAGE**

OPSD 3419.100

