



**FOUNDATION INVESTIGATION REPORT
OVERHEAD SIGN SUPPORT STRUCTURES
HIGHWAY 401 – PARK ROAD SOUTH AND CUBERT STREET
CITY OF OSHAWA, ONTARIO
G.W.P. 2555-17-00
GEOCRES NO. 30M15-371**

Client Name: Egis Canada Ltd.
Date: March 13, 2025
File: 30915

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PART 1: FACTUAL INFORMATION

1. INTRODUCTION

This report presents the factual findings obtained from a foundation investigation carried out by Thurber Engineering Ltd. (Thurber) for the design of three overhead sign (OHS) support structures to be installed along Highway 401 from Park Road South to Cubert Street in the City of Oshawa, Ontario. The proposed OHS support structures will be installed at Stations 11+665, 12+110 and 12+225.

The purpose of the investigation was to explore the subsurface conditions at the proposed sign locations and, based on the data obtained, to provide a borehole location drawing, records of boreholes, laboratory test results, and a written description of the subsurface conditions.

Thurber was retained by Egis Canada Ltd. (Egis) to carry out this foundation investigation under the Ministry of Transportation Ontario (MTO) Agreement Number 2019-E-0076. The overall assignment includes replacement of the overpass structures on Highway 401 at Park Road South and Cubert Street, new and proposed retaining walls and noise barrier walls on both sides of the highway, and overhead signs.

It is a condition of this report that Thurber's performance of its professional services is subject to the attached Statement of Limitations and Conditions.

2. SITE DESCRIPTION

The site is located along Highway 401 from approximately 190 m west of Park Road South to about 55 m west of Cubert Steet in the City of Oshawa, Ontario.

Along the area of investigation, the Highway 401 grade varies from Elevations 110.8 to 112.6.

The overall surface topography in the vicinity of the site is relatively flat with the ground surface gently sloping towards the south. Beyond the highway right-of-way, the lands are currently occupied by residential and commercial developments.

Based on published geological information, the site area is located within the Iroquois Plain physiographic region. This region extends around the western shores of Lake Ontario and consists of lakebed and beaches of the former glacial Lake Iroquois. The subsoils in this area are typically comprised of glacial tills and glaciolacustrine clays, silts and sands. Limestone bedrock underlies the soil deposits.

3. SITE INVESTIGATION AND FIELD TESTING

The site investigation and field testing program completed for the OHS support structures were carried out on September 25, October 7 and 8, and November 12, 2024, and consisted of drilling and sampling six (6) boreholes, designated as Boreholes OHS1-01, OHS1-02, OHS2-01, OHS2-02, OHS3-01 and OHS3-02. Five of the boreholes were located on the Highway 401 westbound lane (WBL), and one borehole beyond the Highway 401 eastbound platform at the approximate Stations presented in Table 3.1.

Table 3.1: Borehole Locations

OHS/Station	Borehole	Station
OHS1 11+665 Highway 401 WBL	OHS1-01	11+657, Highway 401 WBL
	OHS1-02	11+657, Highway 401 WBL
OHS2 12+110 Highway 401 WBL	OHS2-01	12+108, Highway 401 WBL
	OHS2-02	12+109, Highway 401 WBL
OHS3 12+225 Highway 401 EBL	OHS3-01	12+226, Highway 401 WBL
	OHS3-02	12+225, (approx. 15 m south of Highway 401 EBL, approx. 7 m south of the existing noise barrier wall)

The boreholes were terminated at depths ranging from 7.7 m to 8.2 m (Elevations 102.6 to 105.1).

Approximate locations of the boreholes are shown on the Borehole Locations Plan Drawing in Appendix A.

The Record of Borehole sheets of the investigation are provided in Appendix B.

Thurber obtained the co-ordinates of the as-drilled borehole locations in the field using a Trimble R10 GPS survey equipment and forwarded them to Egis, who then provided the ground surface elevations. It is understood that the horizontal and vertical accuracy of the survey results meet the MTO terms of reference requirements. The coordinates and elevations of the boreholes are given on the drawing and Record of Borehole sheets in Appendices A and B, respectively.

Traffic control was implemented for drilling each borehole for the investigation. Prior to commencement of drilling, utility clearances were obtained for all borehole locations.

The boreholes were advanced using a truck-mounted drill rig using solid stem augers. Soil samples were obtained at selected depth intervals using a 50 mm outside diameter split-spoon sampler driven in conjunction with the Standard Penetration Test (SPT) which was performed in accordance with ASTM D1586.

The field investigation was supervised on a full-time basis by a member of Thurber's technical staff who marked/staked the boreholes in the field, directed the drilling, sampling and in-situ testing operations, logged the boreholes and processed the recovered soil samples for transport to Thurber's laboratory for further examination and testing.

All boreholes were backfilled upon completion of drilling in general accordance with O.Reg. 903.

The asphalt surface was reinstated as much as practicable in boreholes drilled on the road platform.

4. LABORATORY TESTING

The recovered soil samples were subjected to visual identification (VI) and natural moisture content determination. Selected soil samples were subjected to grain size distribution analyses (sieve and/or hydrometer), and Atterberg Limits testing. Geotechnical laboratory testing results of the current investigation are summarized on the Record of Borehole sheets in Appendix B and are presented on the figures in Appendix C.

5. DESCRIPTION OF SUBSURFACE CONDITIONS

Reference should be made to the Record of Borehole sheets in Appendix B and the “Borehole Locations Drawing” in Appendix A. An overall description of the stratigraphy is given in the following paragraphs. However, the factual data presented in the Record of Borehole Sheets governs any interpretation of the site conditions. It must be recognized and anticipated that soil conditions may vary between and beyond the borehole locations.

In general, the subsurface stratigraphy encountered at the site consists of pavement structure or topsoil overlying embankment fill within the highway platform. Below the embankment fill, the native soils consist of an extensive deposit of very stiff to hard clayey silt to silty clay till, with occasional firm to stiff zones. There are also layers of compact to very dense sand and silt till. The groundwater table was not encountered in all but two locations where short term groundwater levels of 3.6 m and 5.2 m depths were observed upon completion of drilling.

More detailed descriptions of the individual stratum are presented below.

5.1 Topsoil

Topsoil was encountered surficially in Borehole OHS3-02 that was drilled beyond the Highway 401 EBL platform. The thickness of the topsoil was 200 mm at this location.

The topsoil thickness may vary between and beyond the borehole locations, and the data is not intended for the purpose of estimating quantities.

5.2 Pavement Structure

A pavement structure consisting of approximately 100 mm to 250 mm of asphalt overlying granular (sand) road base was encountered in Boreholes OHS1-01, OHS1-02, OHS2-01, OHS2-02 and OHS3-01 drilled from the Highway 401 platform. The granular fill ranged in thickness from 0.6 m to 1.9 m.

SPT 'N' values recorded in the granular fill typically ranged from 24 to 50 blows per 0.3 m of penetration indicating a compact to dense condition. An SPT 'N' value of 72 blows per 0.3m of penetration was measured within the granular fill in Borehole OHS1-01 indicating a very dense state. The moisture contents measured on samples of the granular fill ranged approximately from 2 percent to 9 percent.

The results of grain size analyses conducted on a sample of the granular fill are provided on the Record of Borehole sheets in Appendix B and illustrated on Figure C1 in Appendix C. The results are summarized as follows:

Soil Particle	Cohesionless Fill (Percent)
Gravel	10
Sand	71
Silt	18
Clay	1

5.3 Fill

A 600 mm thick layer of brown to grey silty sand fill containing trace to some gravel and trace clay was contacted below the pavement structure at 0.8 m depth in Borehole OHS2-01.

The depth to the base of the silty sand fill was at 1.4 m (Elevation 111.1).

An SPT 'N' value recorded in the silty sand fill was 50 blows per 0.125 m indicating a very dense state. The natural moisture content measured on a sample of the cohesionless fill was 8 percent.

5.4 Sandy Silt

A layer of brown sandy silt containing trace clay was contacted below the silty sand fill, at 1.4 m depth, in Borehole OHS2-01. The thickness of the sandy silt was 1.5 m.

The depth to the base of the sandy silt was at 2.9 m (Elevation 109.6).

The SPT 'N' values recorded in the sandy silt were 90 blows per 0.3 m of penetration and 102 blows per 0.2 m of penetration, indicating a very dense state. The natural moisture contents measured on two samples of the sandy silt were 11 percent and 15 percent.

The results of grain size distribution analyses carried out on one sample of the sandy silt are shown on Figure C2 in Appendix C. The results are summarized as follows:

Soil Particle	Sandy Silt (Percent)
Gravel	0
Sand	22
Silt	70
Clay	8

5.5 Sand and Silt Till

A deposit of brown to grey sand and silt till containing trace to some gravel, trace clay and occasional cobbles was encountered below the topsoil, pavement structure, and sandy silt in all the boreholes. The thickness of the sand and silt till was 0.8 m in Boreholes OHS1-01 and OHS1-02, and varied from 2.7 m to 4.8 m in Boreholes OHS2-01, OHS2-02, OHS3-01 and OHS3-02.

Where fully penetrated, the depths to the base of the upper sand and silt till were at 3.0 m and 2.2 m (Elevation 108.6) in Boreholes OHS1-01 and OHS1-02, and ranged from 2.9 m to 7.1 m (Elevations 105.4 to 109.9) in Boreholes OHS2-01, OHS2-02, OHS3-01 and OHS3-02. Boreholes OHS1-01 and OHS1-02 were terminated within the lower sand and silt till at 8.2 m depth (Elevations 103.4 and 102.6).

The SPT 'N' values recorded in the cohesionless till ranged from 12 to 100 blows per 0.3 m of penetration, and greater than 100 blows for less than 0.3 m of penetration at some locations, indicating a compact to very dense state. Some of the higher "N" values may be attributed to the presence of cobbles and boulders. The natural moisture contents measured on samples of the cohesionless till ranged from 7 percent to 15 percent.

The results of grain size distribution analyses carried out on selected samples of the sand and silt till are shown on Figure C3 in Appendix C. The results are summarized as follows:

Soil Particle	Sand and Silt Till (Percent)
Gravel	0 to 7
Sand	34 to 53
Silt	39 to 53
Clay	5 to 12

The results of Atterberg Limits tests conducted on a sample of the sand and silt till are presented on the Record of Borehole sheets in Appendix B and illustrated in Figure C6 of Appendix C. The results are summarized as follows:

Index Property	Percentage (%)
Liquid Limit	13
Plasticity Index	3

The results of the Atterberg Limits testing indicate that the sand and silt till is considered non-plastic with a group symbol of ML.

Grinding of augers and split spoon sampler refusal were noted in the cohesionless till in Boreholes OHS1-02 and OHS3-02. These occurrences are an indication of possible obstructions such as cobbles or boulders.

Glacial tills inherently contain cobbles and boulders.

5.6 Clayey Silt to Silty Clay Till

A deposit of native brown to grey clayey silt till to silty clay till with sand, containing trace gravel and occasional cobbles, was encountered below the sand and silt till in all the boreholes, at depths ranging from 2.2 m to 7.1 m. Where fully penetrated, the thickness of the clayey silt to silty clay till was 2.6 m and 1.5 m in Boreholes OHS1-01 and OHS1-02.

Boreholes OHS2-01, OHS2-02, OHS3-01 and OHS3-02 were terminated within the clayey silt to silty clay till at depths ranging from 7.7 m to 7.9 m (Elevations 103.9 to 105.1).

SPT 'N' values measured in the cohesive till typically increased with depth from 13 blows per 0.3m penetration to greater than 100 blows for less than 0.3 m of penetration, indicating a stiff to predominantly hard consistency. Some of the higher "N" values may be attributed to the presence of cobbles and boulders. An SPT 'N' value of 5 blows per 0.3 m of penetration was measured in Borehole OHS1-01 at the top of the till, indicating a firm consistency.

Moisture contents measured in the cohesive till ranged approximately from 6 percent to 21 percent.

The results of grain size distribution analyses carried out on selected samples of the clayey silt till and silty clay till are presented on the Record of Borehole sheets included in Appendix B. Grain size distribution curves of samples tested are presented on Figures C4 and C5 in Appendix C. The results of the grain size distribution analyses are summarized below:

Soil Particle	Clayey Silt Till / Silty Clay Till (Percent)
Gravel	1 to 18
Sand	17 to 44
Silt	31 to 56
Clay	13 to 26

The results of Atterberg Limits tests conducted on samples of the clayey silt till and silty clay till are presented on the Record of Borehole sheets in Appendix B and illustrated in Figures C7 and C8 of Appendix C. The results are summarized as follows:

Index Property	Percentage (%)
Liquid Limit	15 to 24
Plasticity Index	5 to 11

The results of the Atterberg Limits testing indicate that the clayey silt to silty clay till is of low to slight plasticity with group symbols of CL to CL-ML.

Grinding of augers and/or split spoon sampler refusal were noted in the cohesive till in Boreholes OHS2-02 and OHS3-02. These occurrences are an indication of possible obstructions such as cobbles or boulders.

Glacial tills inherently contain cobbles and boulders.

5.7 Groundwater Conditions

Groundwater levels in the boreholes were observed during the drilling operations and upon completion of drilling. Water levels measured in open boreholes are presented in Table 5.1 below.

Table 5.1: Groundwater Level Measurements

Borehole	Date	Groundwater Level		Comments
		Depth (m)	Elevation (m)	
OHS1-02	September 25, 2024	5.2	105.6	Open borehole upon completion
OHS2-02	September 25, 2024	3.6	109.0	Open borehole upon completion

The other four boreholes were dry upon completion of drilling.

It is noted that the above groundwater levels are based on very short term observations. The groundwater levels may be at a higher elevation especially after periods of significant or prolonged precipitation such as rainstorms and snowmelts. Seasonal fluctuations of the groundwater levels are to be expected.

6. MISCELLANEOUS

Thurber staked and/or marked the borehole locations in the field and obtained utility clearances prior to drilling. Thurber surveyed the as-drilled boreholes in the field, and forwarded the borehole coordinates to Egis who provided the ground surface elevations.

Young's Drilling of Bowmanville, Ontario supplied and operated the drilling and sampling equipment for the field program.

Full time supervision of the field activities was carried out by Messrs. Joe Lin, Liam Scalena, EIT and Jaimin Patel, EIT of Thurber. Overall supervision of the field program was performed by Mr. Rod de Castro, P.Eng. of Thurber.

Interpretation of the field data and preparation of the report was carried out by Ms. Rocio Reyna, P.Eng. This report was reviewed by Messrs. Sydney Pang, P.Eng. and P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.

Thurber Engineering Ltd.



Rocio Palomeque Reyna, P. Eng.
Associate, Senior Geotechnical Engineer



Sydney Pang, P. Eng.
Senior Associate, Senior Foundation Engineer



P.K. Chatterji, P. Eng.
Review Principal, Designated MTO Contact

Date: **March 13, 2025**
File: **30915**

STATEMENT OF LIMITATIONS AND CONDITIONS

1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

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The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

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5. INTERPRETATION OF THE REPORT

- a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.
- b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.
- c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.
- d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

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The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.



APPENDIX A

Drawing 1 - Borehole Locations Plan Drawing

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

CONT No
WP No 2555-17-00

HIGHWAY 401
PARK RD. S & CUBERT ST.
OVERHEAD SIGNS
BOREHOLE LOCATIONS PLAN



KEYPLAN

LEGEND

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

NO	ELEVATION	NORTHING	EASTING
OHS1-01	111.6	4 859 998.7	355 334.2
OHS1-02	110.8	4 859 976.4	355 341.8
OHS2-01	112.5	4 860 138.6	355 762.3
OHS2-02	112.6	4 860 121.3	355 769.2
OHS3-01	111.8	4 860 159.5	355 880.6
OHS3-02	112.8	4 860 126.6	355 890.1

-NOTES-

- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.
- Coordinate system is MTM NAD 83 Zone 10.

GEOCRES No. 30M15-371



REVISIONS	DATE	BY	DESCRIPTION
DESIGN	RPR	CHK SKP	CODE
DRAWN	AN	CHK RPR	SITE
LOAD			
STRUCT			
DWG	1		
DATE	MAR 2025		



APPENDIX B

Record of Boreholes Sheets

SYMBOLS, ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES

1. TEXTURAL CLASSIFICATION OF SOILS

CLASSIFICATION	PARTICLE SIZE	VISUAL IDENTIFICATION
Boulders	Greater than 200mm	same
Cobbles	75 to 200mm	same
Gravel	4.75 to 75mm	5 to 75mm
Sand	0.075 to 4.75mm	Not visible particles to 5mm
Silt	0.002 to 0.075mm	Non-plastic particles, not visible to the naked eye
Clay	Less than 0.002mm	Plastic particles, not visible to the naked eye

2. COARSE GRAIN SOIL DESCRIPTION (50% greater than 0.075mm)

TERMINOLOGY	PROPORTION
Trace or Occasional	Less than 10%
Some	10 to 20%
Adjective (e.g. silty or sandy)	20 to 35%
And (e.g. sand and gravel)	35 to 50%

3. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

DESCRIPTIVE TERM	UNDRAINED SHEAR STRENGTH (kPa)	APPROXIMATE SPT ⁽¹⁾ 'N' VALUE
Very Soft	12 or less	Less than 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	Greater than 200	Greater than 30

NOTE: Hierarchy of Soil Strength Prediction

- 1) Laboratory Triaxial Testing
- 2) Field Insitu Vane Testing
- 3) Laboratory Vane Testing
- 4) SPT value
- 5) Pocket Penetrometer



4. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

DESCRIPTIVE TERM	SPT "N" VALUE
Very Loose	Less than 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	Greater than 50

5. LEGEND FOR RECORDS OF BOREHOLES

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

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


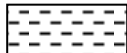



 Water Level
 Shear Strength Determination by Pocket Penetrometer

- (1) SPT 'N' Value Standard Penetration Test 'N' Value – refers to the number of blows from a 63.5kg hammer free falling a height of 0.76m to advance a standard 50 mm outside diameter split spoon sampler for 0.3 m depth into undisturbed ground.
- (2) DCPT Dynamic Cone Penetration Test – Continuous penetration of a 50 mm outside diameter, 60° conical steel point attached to "A" size rods driven by a 63.5 kg hammer free falling a height of 0.76 m. The resistance to cone penetration is the number of hammer blows required for each 0.3 m advance of the conical point into undisturbed ground.

UNIFIED SOILS CLASSIFICATION

MAJOR DIVISIONS		GROUP SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels or gravel-sand mixtures, little or no fines.
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines.
		GM	Silty gravels, gravel-sand-silt mixtures.
		GC	Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS	SW	Well-graded sands or gravelly sands, little or no fines.
		SP	Poorly-graded sands or gravelly sands, little or no fines.
		SM	Silty sands, sand-silt mixtures.
		SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS	SILTS AND CLAYS $W_L < 50\%$	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. ($W_L < 30\%$).
		CI	Inorganic clays of medium plasticity, silty clays. ($30\% < W_L < 50\%$).
		OL	Organic silts and organic silty-clays of low plasticity.
	SILTS AND CLAYS $W_L > 50\%$	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
		OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils.
CLAY SHALE			
SANDSTONE			
SILTSTONE			
CLAYSTONE			
COAL			

EXPLANATION OF ROCK LOGGING TERMS

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

<u>DISCONTINUITY SPACING</u>		<u>STRENGTH CLASSIFICATION</u>			
Bedding	Bedding Plane Spacing	Rock Strength	Approximate Uniaxial Compressive Strength		Field Estimation of Hardness*
			(MPa)	(psi)	
Very thickly bedded	Greater than 2m	Extremely Strong	Greater than 250	Greater than 36,000	Specimen can only be chipped with a geological hammer
Thickly bedded	0.6 to 2m				
Medium bedded	0.2 to 0.6m	Very Strong	100-250	15,000 to 36,000	Requires many blows of geological hammer to break
Thinly bedded	60mm to 0.2m				
Very thinly bedded	20 to 60mm	Strong	50-100	7,500 to 15,000	Requires more than one blow of geological hammer to break
Laminated	6 to 20mm				
Thinly Laminated	Less than 6mm	Medium Strong	25.0 to 50.0	3,500 to 7,500	Breaks under single blow of geological hammer.
		Weak	5.0 to 25.0	750 to 3,500	Can be peeled by a pocket knife with difficulty
		Very Weak	1.0 to 5.0	150 to 750	Can be peeled by a pocket knife, crumbles under firm blows of geological pick.
		Extremely Weak (Rock)	0.25 to 1.0	35 to 150	Indented by thumbnail

<u>TERMS</u>	
Total Core Recovery: (TCR)	Core recovered as a percentage of total core run length.
Solid Core Recovery: (SCR)	Percent Ratio of solid core of full cylindrical shape recovered. Expressed with respect to the total length of core run.
Rock Quality Designation: (RQD)	Total length of sound core recovered in pieces 0.1m in length or larger as a percentage of total core run length.
Uniaxial Compressive Strength (UCS)	Axial stress required to break the specimen
Fracture Index: (FI)	Frequency of natural fractures per 0.3m of core run.

RECORD OF BOREHOLE No OHS1-01 1 OF 1 METRIC

WP# 2555-17-00 LOCATION Overhead Signs, Sta. 11+657.1; MTM83-10: N 4 859 998.7 E 355 334.2 ORIGINATED BY LS
DIST HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2024.10.08 - 2024.10.08 LATITUDE 43.878231 LONGITUDE -78.871169 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE				WATER CONTENT (%) w _p w w _L				
111.6	GROUND SURFACE															
0.0 111.3	ASPHALT: (250mm)															
0.3	SAND, some gravel, some silt, trace clay Very Dense to Dense Brown Moist (FILL)		1	SS	72											
			2	SS	50											
			3	SS	24											
109.4	Compact Grey Moist															
2.2	SAND and SILT, some gravel, trace clay Compact Grey Moist to Wet (TILL)		4	SS	12											
108.6	Clayey SILT, with sand, trace gravel Firm Grey Wet (TILL)(CL)		5	SS	5											
3.0	Very Stiff Brown to Grey Wet to Moist															
			6	SS	24											
106.0	SAND and SILT, trace to some gravel, trace clay Very Dense to Dense Grey Moist to Wet (TILL)		7	SS	70											
5.6																
			8	SS	49											
103.4																
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE CAVED TO 7.3m. BOREHOLE DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CONCRETE TO GROUND SURFACE.															

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

RECORD OF BOREHOLE No OHS1-02

1 OF 1

METRIC

WP# 2555-17-00 LOCATION Overhead Signs, Sta. 11+657.4; MTM83-10: N 4 859 976.4 E 355 341.8 ORIGINATED BY JOE
DIST HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2024.09.25 - 2024.09.25 LATITUDE 43.878030 LONGITUDE -78.871076 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
110.8	GROUND SURFACE							20	40	60	80	100																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									</

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RECORD OF BOREHOLE No OHS2-01

1 OF 1

METRIC

WP# 2555-17-00 LOCATION Overhead Signs, Sta. 12+107.8; MTM83-10: N 4 860 138.6 E 355 762.3 ORIGINATED BY LS
DIST HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2024.10.07 - 2024.10.08 LATITUDE 43.879461 LONGITUDE -78.865828 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						WATER CONTENT (%)
112.5	GROUND SURFACE													
0.0	ASPHALT: (200mm)													
0.2	SAND, some gravel, trace silt, trace clay Dense Brown to Grey		1	SS	34		112							
111.7	Moist (FILL)		2	SS	50/ 0.125									
0.8	Silty SAND, some gravel, trace clay Very Dense Brown to Grey		3	SS	90		111							
111.1	Moist (FILL)		4	SS	102/ 0.200		110							0 22 70 8
1.4	Sandy SILT, trace clay Very Dense Brown Moist		5	SS	50/ 0.125		109							
109.6	Layer of gravel at 2.6m		6	SS	50/ 0.125		108							
2.9	SAND and SILT, trace gravel, trace clay, occasional cobbles Very Dense Brown to Grey Moist to Wet (TILL)		7	SS	100/ 0.275		107							
			8	SS	99/ 0.250		106							0 45 47 8
105.4	Clayey SILT, with sand, trace gravel Hard Grey Moist (TILL)						105							
7.1														
104.6														
7.9	END OF BOREHOLE AT 7.9m. BOREHOLE CAVED TO 5.2m. BOREHOLE DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CONCRETE TO GROUND SURFACE.													

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

RECORD OF BOREHOLE No OHS2-02 1 OF 1 METRIC

WP# 2555-17-00 LOCATION Overhead Signs, Sta. 12+109.0; MTM83-10: N 4 860 121.3 E 355 769.2 ORIGINATED BY JOE
DIST HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2024.09.25 - 2024.09.25 LATITUDE 43.879305 LONGITUDE -78.865744 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)							
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)						
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE							w _P w w _L						
112.6	GROUND SURFACE							20	40	60	80	100		20	40	60		GR	SA	SI	CL
0.0	ASPHALT: (100mm)																				
0.1	SAND, some gravel, some silt, trace clay Dense Brown Moist (FILL)		1	SS	36		112							○							
111.8																					
0.8	SAND and SILT, trace clay, occasional cobbles Dense to Very Dense Brown Moist (TILL)		2	SS	48									○							
			3	SS	100		111							○				0	49	45	6
			4	SS	97		110							○							
	Layer of sand (150mm) at 3.0m Brown to Grey Wet		5	SS	78		109							○							
			6	SS	100/ 0.150									○							
108.3																					
4.3	Clayey SILT, with sand, trace gravel, occasional cobbles Hard Grey Moist (TILL)(CL)		7	SS	100		108							○				7	40	36	17
			8	SS	100/ 0.125		107							○							
	Augers grinding from 6.2m to 6.5m																				

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

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METRIC

[illegible]

+³, ×³: Numbers refer to Sensitivity

RECORD OF BOREHOLE No OHS3-02

1 OF 1

METRIC

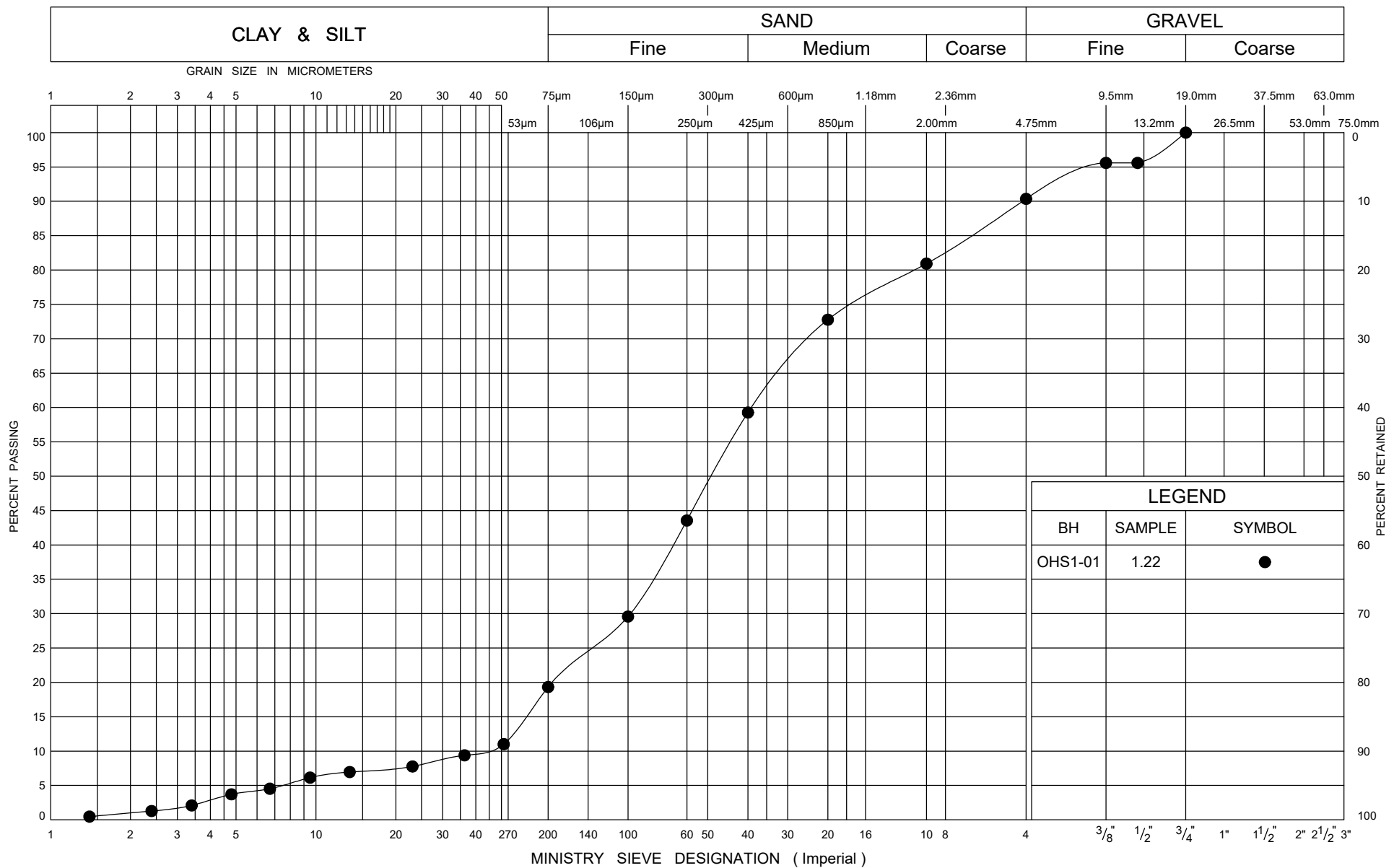
WP# 2555-17-00 LOCATION Overhead Signs, Sta. 12+225.6; MTM83-10: N 4 860 126.6 E 355 890.1 ORIGINATED BY JP
DIST HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2024.11.12 - 2024.11.12 LATITUDE 43.879344 LONGITUDE -78.864239 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					WATER CONTENT (%) w _P w w _L				
112.8	GROUND SURFACE							20	40	60	80	100					
0.0	TOPSOIL: (200mm)																
0.2	SAND and SILT, trace clay Compact to Very Dense Brown Moist (TILL) Augers grinding from 0.9m to 1.5m		1	SS	17		112										0 52 43 5
			2	SS	79/ 0.250												
	Augers grinding at 2.4m		3	SS	105/ 250		111										
			4	SS	50/ 0.075												
109.9	Silty CLAY to clayey SILT, with sand, trace gravel Hard Grey Moist (TILL)(CL) Occasional cobbles Augers grinding and spoon bouncing at 3.9m Augers grinding at 4.6m Augers grinding from 5.5m to 6.1m Augers grinding at 6.8m		5	SS	103/ 0.250		110									1 17 56 26	
			6	SS	60/ 0.100		109										
			7	SS	50/ 0.050		108										
			8	SS	60/ 0.100		107										
	Augers grinding at 6.8m						106									15 36 33 16	
105.1	END OF BOREHOLE AT 7.7m. BOREHOLE DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO GROUND SURFACE.		9	SS	60/ 0.100												
7.7																	

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

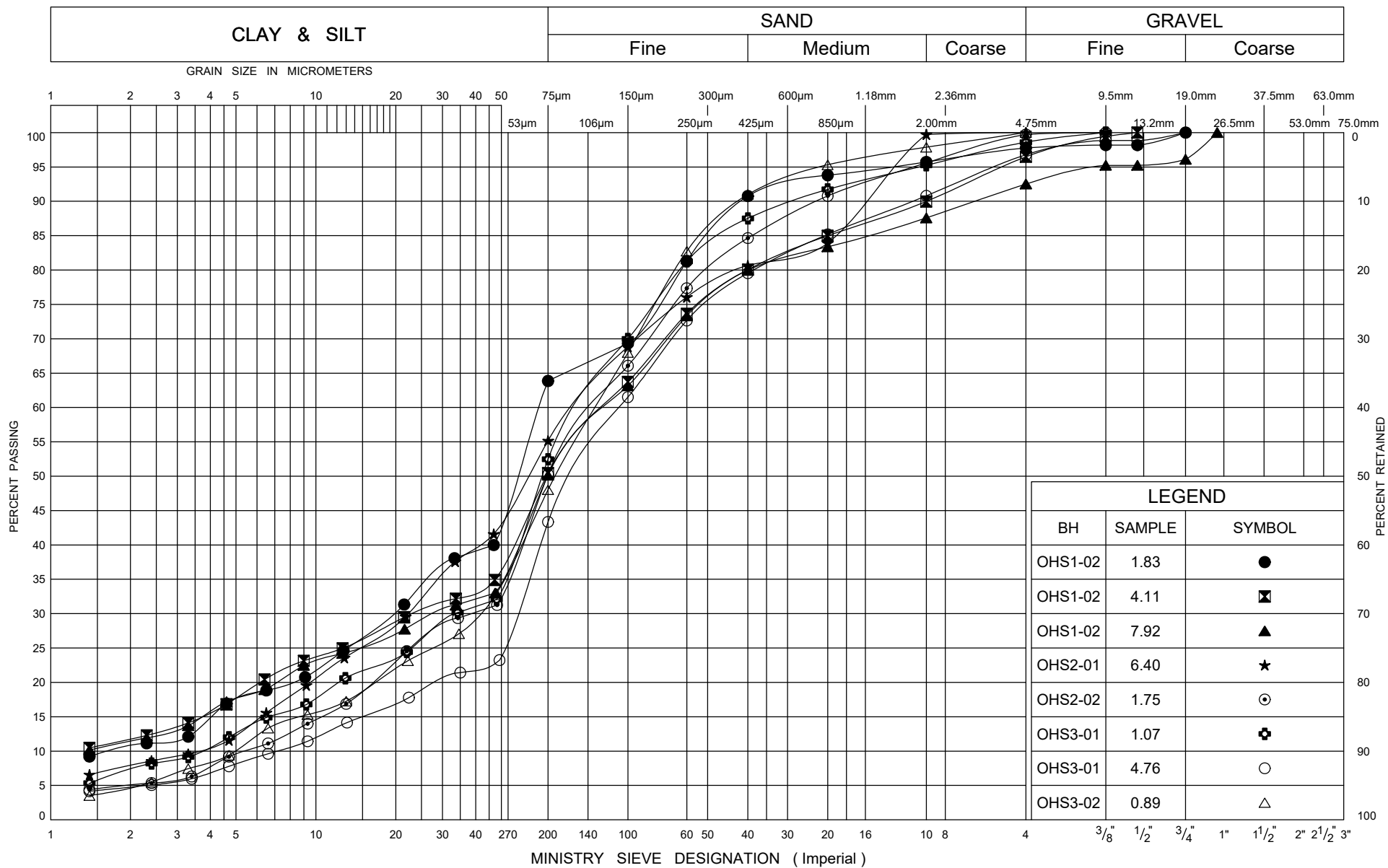
APPENDIX C

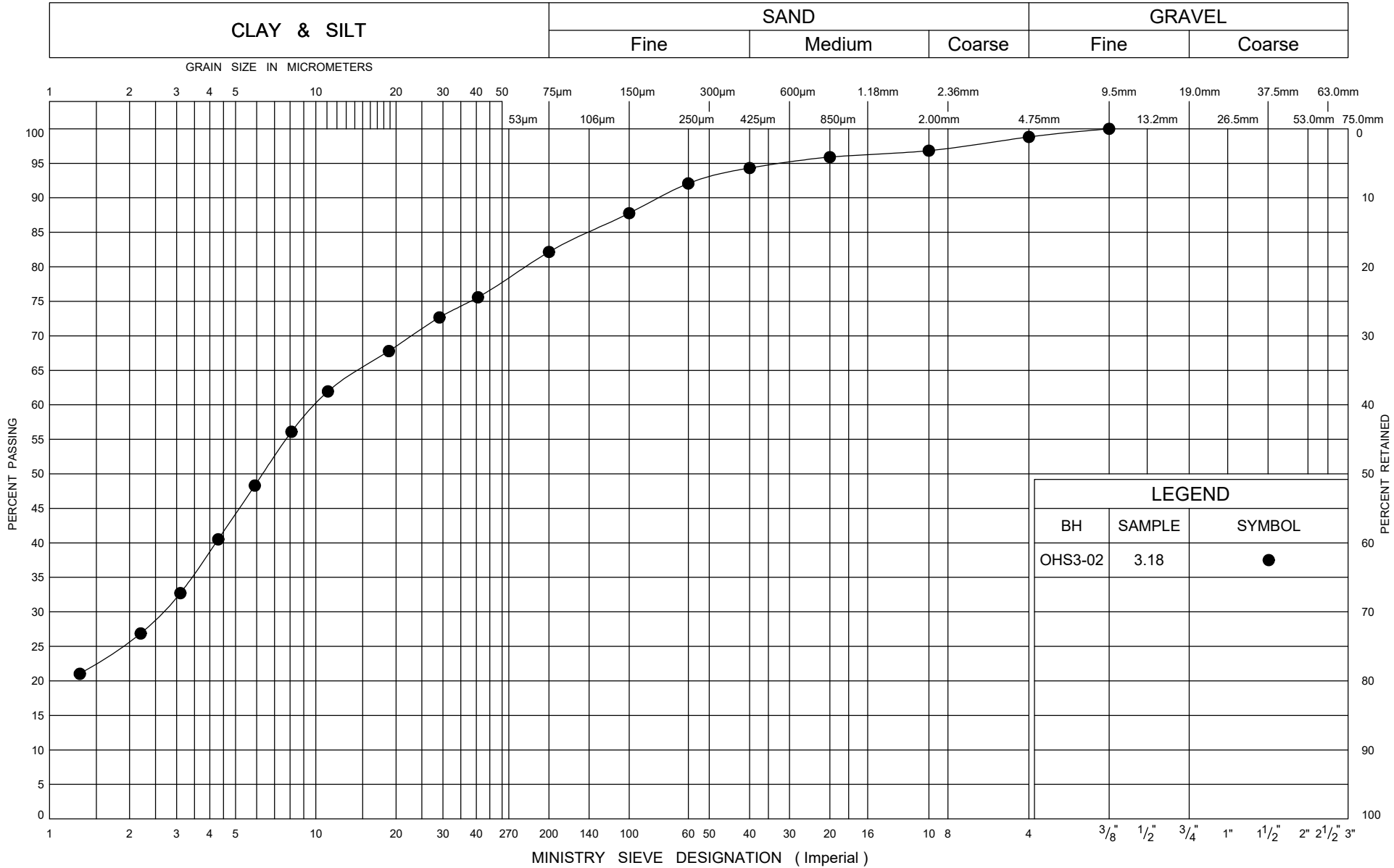
Geotechnical Laboratory Test Results

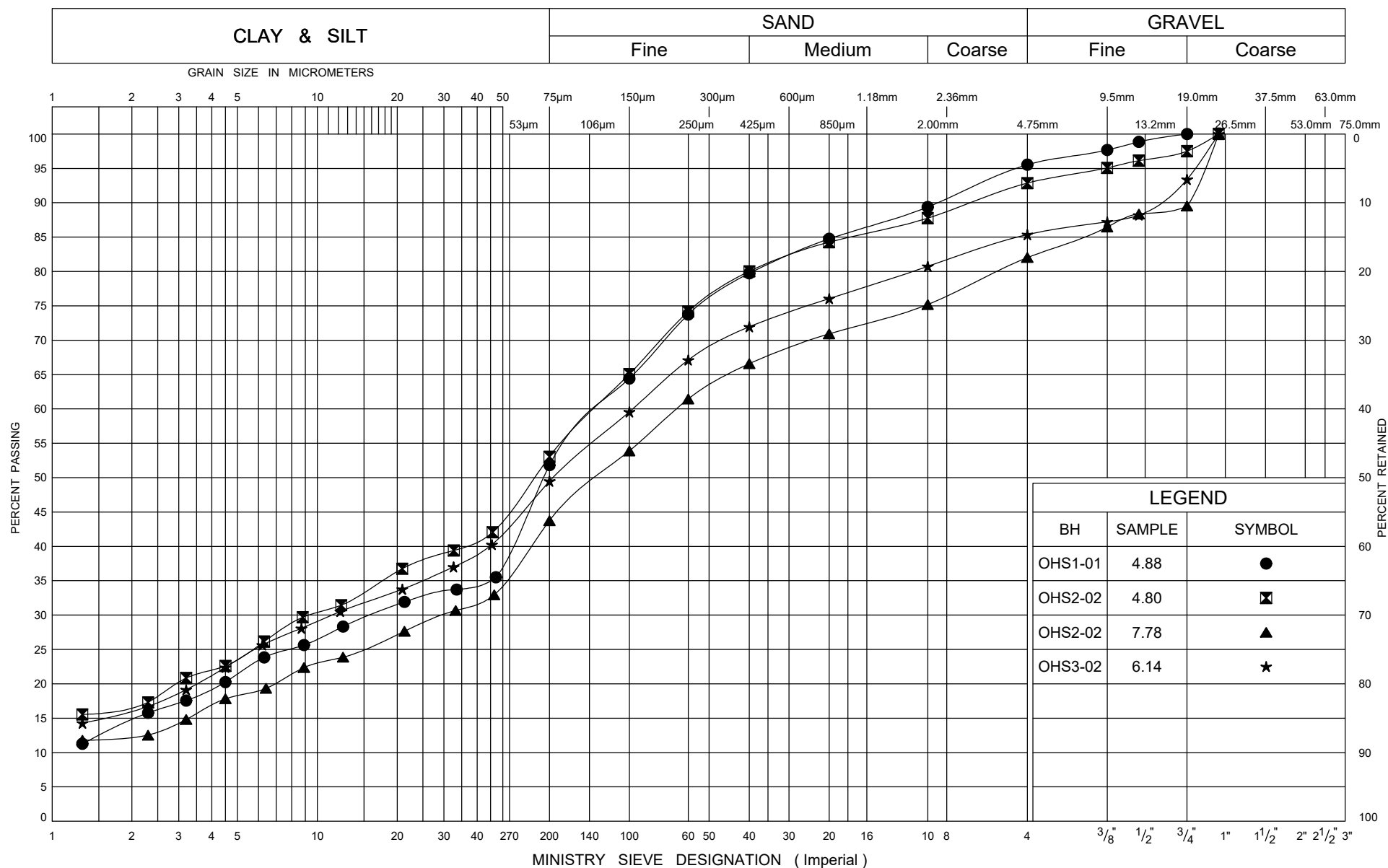


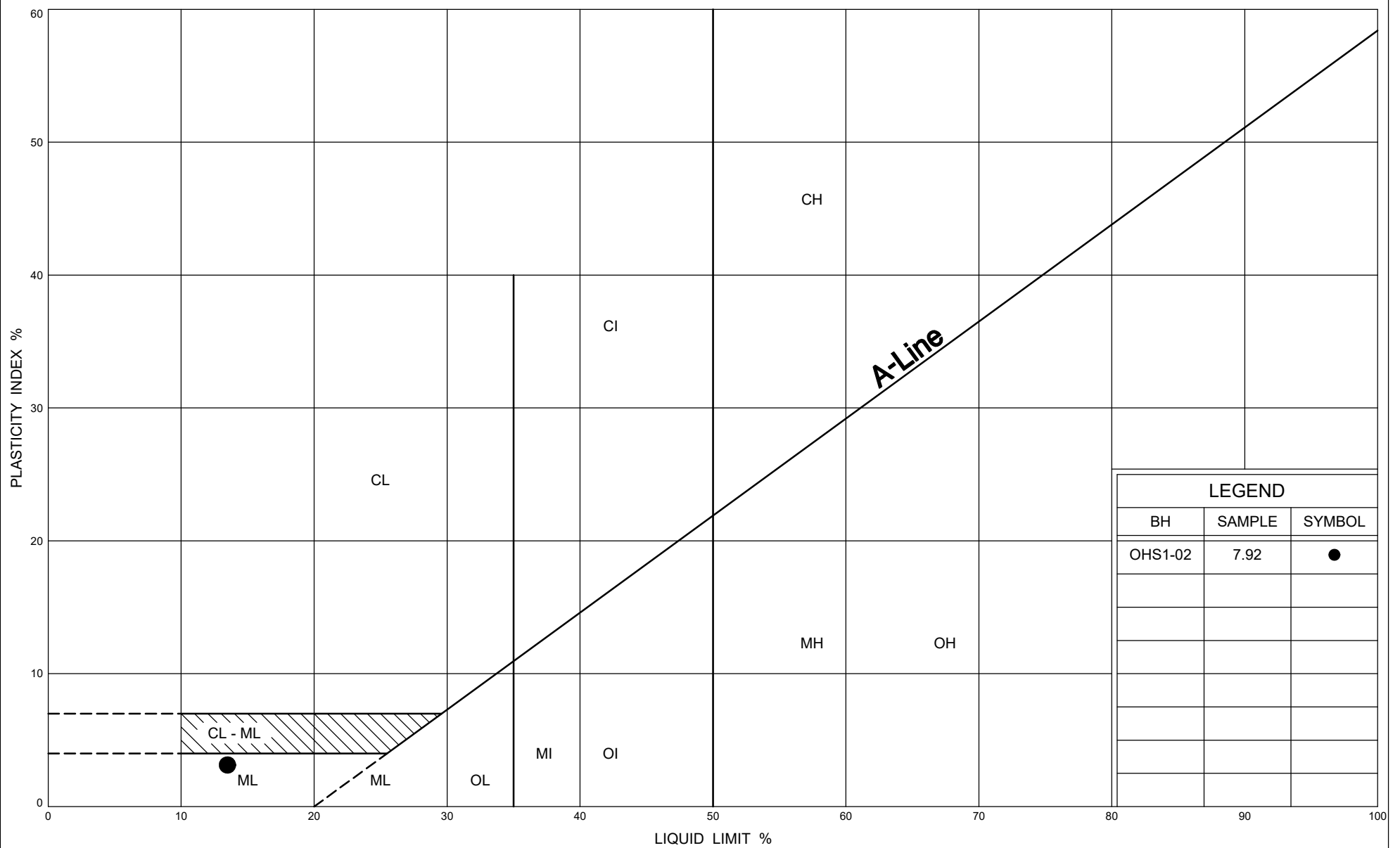


Overhead Signs









LEGEND		
BH	SAMPLE	SYMBOL
OHS1-02	7.92	●



