



## Foundation Investigation Report

Highway 401 Eastbound Express and Collector Lanes between Victoria Park Avenue and Neilson Road - **Superstructure Replacement at Kennedy Road Overpass Eastbound Core and Collectors Structure (Site 37X-0214/B1 & B3)**

Assignment No. 2021-E-0018  
MTO Central Region  
Geocres Number: 30M14-552  
(Latitude: 43.774739, Longitude: -79.284516)

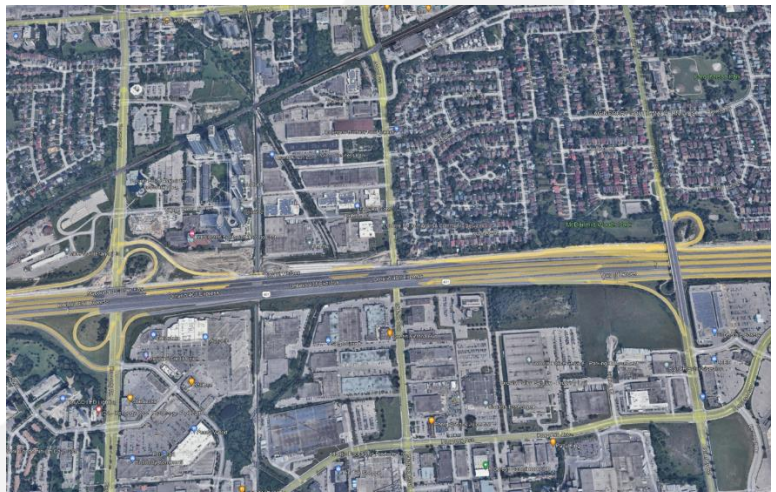
**Type of Document:**  
Foundation Investigation and Design Report

**Project Number:**  
ADM-22000797-A0

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**Date Submitted:**  
December 20, 2024



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## Issue and Revised Record

Rev.	Date	Format	Prepared by	Reviewed by	Approved by	Description
Rev. 0	September 19, 2024	pdf	E. Lu	T. Lardner T.C. Kim	S. Gonsalves	Report
Rev. 1	December 20, 2024	pdf	T. Lardner	T.C. Kim	S. Gonsalves	Report

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## Table of Contents

<b>Part I: Foundation Investigation Report .....</b>	<b>1</b>
<b>1.0 Introduction .....</b>	<b>2</b>
<b>2.0 Structure Description .....</b>	<b>2</b>
<b>3.0 Site Description and Geological Setting .....</b>	<b>3</b>
3.1 Site Description .....	3
3.2 Geological Setting .....	3
<b>4.0 Previous Geotechnical Investigation.....</b>	<b>3</b>
<b>5.0 Field Investigation and Laboratory Analyses .....</b>	<b>4</b>
5.1 Site Investigation and Field Testing .....	4
5.2 Laboratory Testing .....	5
<b>6.0 Subsurface Conditions .....</b>	<b>6</b>
6.1 Subsoils .....	6
6.1.1 Pavement Structure .....	6
6.1.2 Cohesionless Fill: Sand and Gravel to Gravelly Sand.....	6
6.1.3 Cohesionless Fill: Sand/Sandy Silt/Silty Sand .....	7
6.1.4 Cohesive Fill: Clayey Silt .....	9
6.1.5 Sandy Silt/Silt and Sand/Silty Sand/Silt .....	10
6.1.6 Silty Clay to Clayey Silt .....	11
6.1.7 Glacial Till: Mixture of Clayey Silt, Sand and Gravel.....	13
6.2 Groundwater Conditions.....	14
6.3 Chemical Analyses.....	14
<b>7.0 Closure .....</b>	<b>16</b>

## References

Appendix A – Limitations and Use of Report  
Appendix B – General Arrangement Drawings  
Appendix C – Borehole Location Plan and Stratigraphic Profile  
Appendix D – Borehole Logs  
Appendix E – Laboratory Data  
Appendix F – Previous Investigation - BH Logs

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## Part I: Foundation Investigation Report

Highway 401 Eastbound Express and Collector Lanes between Victoria Park Avenue and Neilson Road – Kennedy Road Overpass (Site 37X-0214/B1 & B3)

## 1.0 Introduction

EXP Services Inc. (EXP) was retained by AECOM on behalf of The Ministry of Transportation (MTO) to provide detailed foundation investigation and engineering services for the proposed Highway 401 Eastbound rehabilitation and construction project. The findings, analyses and recommendations are presented in a Foundation Investigation Design Report created for each structure along the proposed highway. The work was undertaken under Assignment No. 2021-E-0018. The terms of reference (TOR) and the scope of work for the foundation investigation are outlined in Ministry of Transportation Ontario's (MTO) Request for proposal, dated June 2021. The scope of this report is specifically limited to the proposed location of the Kennedy Road Overpass structure (Site 37X-0214/B1 & B3).

The General Arrangement drawings (GA) for the bridge structure were provided to EXP by AECOM. The purpose of the investigation was to evaluate the subsurface conditions along the structure alignment to permit a detailed design for the proposed superstructure replacement.

The site-specific geotechnical investigation consisted of borings, soil sampling, borehole logging, and field and laboratory testing. The field and laboratory work for this structure was performed by EXP. Based on collected geotechnical data, this report provides an assessment of the geotechnical issues, geotechnical design parameters, and geotechnical foundation design recommendations for the proposed structure. Geotechnical-related construction recommendations are also provided.

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.

## 2.0 Structure Description

The GA drawing titled *Hwy 401 EB Core & Collector Lane Kennedy Rd O/P Bridge Rehab.*, prepared by AECOM, dated May 2023, shows the preliminarily proposed configuration of the Kennedy Road Overpass structure. Foundation and Investigation Design Reports (FIDR) by Golder Associates Ltd., *"Bridge Widening and Replacement Highway 401 Rehabilitation from Warden Avenue to Brock Road, Toronto, Ontario, W.O.07-20012."*, dated March 2012 and *"Kennedy Road Overpass (Site No. 37-214) Rehabilitation and Northward Widening, Highway 401 Westbound Core and Collector Lanes, Neilson Road to Warden Avenue, City of Toronto, Ontario, G.W.P No. 2162-11-00."*, dated January 4, 2019. A summary of the proposed structure is as follows:

1. The existing structure is a 36.80 m long two-span bridge. It is understood that the existing abutments, piers and retaining wall foundations are supported on spread footings. The founding elevations of the spread footings are not known at the time of preparing this report. However, it is assumed that it is similar to the Westbound Core and Collectors Structure. Based on the previous FIDRs, the existing abutments supported on 3.4 m wide footings founded at about Elevation 167.6 m to 166.9 m and the centre piers are supported on 1.8 m wide footings founded at Elevation 167.5 m to 166.7 m. It is also noted that the existing north wingwalls/retaining walls are found on spread footings that are 4.3 m wide and 20.4 m long at Elevation 167.6 m.
2. The existing structure is proposed to undergo superstructure replacement, which includes replacement of the existing bridge deck and girders, conversion to semi-integral abutment and rehabilitation of wingwalls/retaining walls. The existing foundations will remain to support the abutments and retaining walls.
3. Initially, 0.5 m of widening on the south side of Highway 401 was proposed, however, it is understood that widening is now considered not within the proposed works.

The previous FIDRs and GA drawing by AECOM, in addition to contract package drawings titled *401 WB Core & Collector Lanes – Kennedy Rd. Overpass – Bridge Rehabilitation (Cont. No. 2019-2011, WP No. 2401/2402-15-01)*, produced by WSP Global Inc., dated February 2019, were reviewed as part of this report. These background documents were used for the initial context to

address the nature and scope of the investigation. It is understood that some changes might occur as a result of normal refinement or the findings of the geotechnical report.

## 3.0 Site Description and Geological Setting

### 3.1 Site Description

The site is located at the intersection of Highway 401 and Kennedy Road, approximately 5 km east of Highway 404 in the City of Toronto, Ontario. The site is adjacent to industrial zones to the south and northeast, and adjacent to residential zones to the northwest of the site. In general, the terrain in this area is relatively flat, with the natural ground surface sloping gently towards the south. The Highway 401 pavement grade ranges between about Elevation 176.2 m to 176.8 m while, the Kennedy Road pavement grade is at Elevation about 170 m at the structure site. Based on the FIDRs by Golder Associates Ltd., the fill thickness is assumed to be about 8 m.

A site location plan is presented as Drawing 1 in Appendix C.

### 3.2 Geological Setting

Based on a review of geological maps of Southern Ontario (Chapman and Putnam, 1984; 2007), the site is situated within the South Slope physiographic region where the predominate landforms are Till Plains (Drumlinized) and Drumlins. The South Slope represents the southern slope of the Oak Ridges Moraine but also includes a strip south of the Peel Plain, extending from the Niagara Escarpment to the Trent River. The South Slope gradually, fairly and uniformly slopes down towards Lake Ontario.

According to the Ministry of Northern Development and Mines, Map 2556 (Quaternary Geology of Ontario, Southern Sheet, 1991) the surface conditions in the vicinity of the project area consists of Halton Till predominately silt to silty clay matrix, high in matrix carbonate content and clast poor with occasional sand to silt zones. In addition, Map 2544 (Bedrock Geology of Ontario, Southern Sheet, 1991), the bedrock geology at the site consists of shale, limestone, dolostone and siltstone: Georgian Bay Formation, Blue Mountain Formation, Bilings Formation, Collingwood Member, Eastview Member.

## 4.0 Previous Geotechnical Investigation

During the tender design for the project, four (4) previous reports were issued which contain relevant information to the proposed Kennedy Road Overpass structure (Site 37X-0214/B1 & B3), as follows:

1. Geocres No. 30M14-69 *"Foundation Investigation Highway #401 at Kennedy Road"* by Department of Highways – Ontario, dated June 14, 1954.
2. Geocres No. 30M14-71 *"Foundation Investigation Report for The Proposed New Structure at Hwy. 401 and Kennedy Intersection, Scarborough Twp., York County, District No. 6 (Toronto), W.J. 66-F-33, W.P. 858-61."* by The Ministry of Transportation Ontario (MTO), Foundation Section, Materials and Testing Div., dated June 20, 1966.
3. Geocres No. 30M14-338 *"Bridge Widening and Replacement Highway 401 Rehabilitation from Warden Avenue to Brock Road, Toronto, Ontario, W.O.07-20012."* by Golder Associates Ltd., dated April 2012.
4. Geocres No. 30M14-486 *"Kennedy Road Overpass (Site No. 37-214) Rehabilitation and Northward Widening, Highway 401 Westbound Core and Collector Lanes, Neilson Road to Warden Avenue, City of Toronto, Ontario, G.W.P No. 2162-11-00."* by Golder Associates Ltd., dated January 4, 2019

The applicable previous MTO borehole logs are attached as Appendix F in this report. The details of the applicable boreholes completed by the MTO are also outlined in Table 1.1.

**Table 1.1: Summary of Applicable Borehole Completed by MTO**

Borehole No.	Borehole Location	Location (MTM NAD83 Zone 10)		Latitude	Longitude	Borehole Elevation (m)	Borehole Depth (m)
		Northing	Easting				
71-1	Eastbound Core East Approach	4848340.5	322165.4	43.774821	-79.284283	167.9	15.2
71-4	Eastbound Collector West Approach	4848307.8	322135.7	43.774528	-79.284653	170.4	14.2
71-5	Eastbound Collector East Approach	4848,322.1	322186.2	43.774655	-79.284025	168.2	18.7

## 5.0 Field Investigation and Laboratory Analyses

### 5.1 Site Investigation and Field Testing

A site-specific investigation was undertaken by EXP between October 21, 2022, and November 27, 2022, and it included the following:

1. A walkover site assessment was carried out by a Geotechnical Engineer from EXP.
2. Subsequent to the borehole layouts in the field, existing utilities were cleared by public utility companies.
3. At the time of this report, seven (7) boreholes have been completed for this structure (BH22-4-2 to BH22-4-7) as part of the additional investigation. A summary of boreholes completed by EXP is listed in Table 1.2 below. The borehole was drilled using a truck-mounted CME-75 machine (owned and operated by Drilltech drilling Ltd.) equipped with solid and hollow stem augers, mud rotary equipment, and fitted with capability for Standard Penetration Testing (SPT);
4. An obstruction was encountered in BH22-4-4A at about 4.6 m below ground surface. Therefore, a companion borehole (BH22-4-4B) was drilled about 2.8 m northeast to evaluate the subsurface in the adjacent area. It should be noted that since soil sampling was conducted to a depth of 4.6 m in BH22-4-4A, soil sampling in BH22-4-4B continued from 4.6 m below ground surface.
5. Soil samples in the boreholes were taken at frequent intervals of depth by the Standard Penetration Test method (SPT), in general accordance with ASTM D1586. The test consists of freely dropping a 63.5 kg hammer a vertical distance of 0.76 m to drive a 51 mm O.D. split barrel (SS-split-spoon) sampler into the ground. The number of blows of the hammer required to drive the sampler into the relatively undisturbed ground by a vertical distance of 0.30 m is recorded as the Standard Penetration Resistance, or the N-value, of the soil which is indicative of the compactness of granular (or cohesionless) soils (gravels, sands and silts) or the consistency of cohesive soils (clays and clayey soils).
6. 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.
7. All spoon samples obtained in the Standard Penetration Tests (SPT, ASTM D-1586) were placed in moisture proof bags after field classification. Samples were allocated from the spoon samples for moisture content testing without delay. They were subsequently re-examined under controlled laboratory conditions prior to assigning other laboratory tests.



8. Selected soil samples for corrosivity testing were sent to the Bureau Veritas Laboratories (formerly Maxxam Analytics), a CALA-certified and accredited laboratory in Mississauga, Ontario. The selected soil samples for the analytical testing were placed in a laboratory prepared glass jar, labelled, and stored in a secure cooler.
9. The borehole locations and their ground surface elevations were surveyed by EXP using a Trimble DA2 GNSS receiver with Trimble Catalyst GNSS positioning, having an accuracy of  $\pm 0.10$  m horizontal and vertical directions. MTM NAD83 Zone 10 coordinates and the geodetic elevation for the boreholes are listed in Table 1.2 below. It can also be found on the Record of Borehole Sheet (Appendix D); and
10. Upon completion of drilling and field testing, the boreholes were backfilled with a mixture of bentonite and auger cuttings. The borehole decommissioning was in general accordance with the Ministry of the Environment Regulation 903, as amended by Regulation 128/03 (the well regulation under the Ontario Water Resources Act).

**Table 1.2: Summary of boreholes completed by EXP**

Borehole No.	Borehole Location	Location (MTM NAD83 Zone 10)		Latitude	Longitude	Borehole Elevation (m)	Borehole Depth (m)
		Northing	Easting				
<b>BH22-4-2</b>	~12 m west of West Abutment, b/w EBL and WBL Express	4848340.9	322113.1	43.774826	-79.284933	176.7	15.8
<b>BH22-4-3</b>	~12 m east of East Abutment, b/w EBL and WBL Express	4848359.5	322170.8	43.774992	-79.284215	176.4	15.8
<b>BH22-4-4A</b>	~22 m east of East Abutment, South Side (EBL Collector)	4848331.9	322193.1	43.774743	-79.283939	176.2	4.3 <sup>1</sup>
<b>BH22-4-4B</b>	~25 m east of East Abutment, South Side (EBL Collector)	4848333.9	322194.2	43.774761	-79.283925	176.2	15.7
<b>BH22-4-5</b>	~22 m west of West Abutment, South Side (EBL Collector)	4848301.2	322111.2	43.774469	-79.284958	176.6	15.8
<b>BH22-4-6</b>	~45 m west of West Abutment, b/w EBL and WBL Express	4848330.0	322080.0	43.774729	-79.285344	176.8	14.2 <sup>2</sup>
<b>BH22-4-7</b>	~45 East Abutment, b/w EBL and WBL Express	4848370.0	322203.5	43.775086	-79.283809	176.2	15.3

Notes:

- 1.0 Terminated due to encountering an obstruction, BH22-4-4B drilled 2.8 m away to avoid this obstruction.
- 2.0 Terminated at refusal (N>100 blows over 1.5 m interval)

## 5.2 Laboratory Testing

All obtained samples were submitted for natural moisture content testing. Additionally, unit weight, Atterberg limits and grain size analysis (sieve and hydrometer) tests were performed on a minimum of 25% of all obtained soil samples (performed by EXP). Chemical analyses were also carried out on two soil samples selected by EXP. The samples were tested at the Bureau Veritas Laboratories (formerly Maxxam Analytics), a CALA-certified and accredited laboratory in Mississauga, Ontario. The results of the laboratory tests are shown in table 1.3.



**Table 1.3: List of Laboratory Test Completed by EXP**

Borehole No.	Moisture Content	Atterberg Limits	Sieve	Hydrometer	Unit Weight	Corrosivity
<b>BH22-4-2</b>	15	2	4	4	3	1
<b>BH22-4-3</b>	15	4	5	5	3	1
<b>BH22-4-4A</b>	5	2	2	2	1	-
<b>BH22-4-4B</b>	11	1	3	3	5	-
<b>BH22-4-5</b>	14	3	4	4	5	-
<b>BH22-4-6</b>	13	3	5	5	1	-
<b>BH22-4-7</b>	14	3	4	4	1	-

The laboratory test results are provided on the attached borehole log sheets in Appendix D as well as graphically in Appendix E.

## 6.0 Subsurface Conditions

The detailed subsurface conditions encountered in the boreholes advanced during this investigation are presented on the borehole log sheets in Appendix D. The “Explanation of Terms Used in Report” preceding the borehole logs in Appendix D forms an integral part of and should be read in conjunction with this report.

A borehole location plan and stratigraphic sections are provided in Appendix C. It should be noted that the stratigraphic boundaries indicated on the borehole log and stratigraphic sections are inferred from semi-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 interpreted as exact planes of geological change. Furthermore, subsurface conditions may vary between and beyond the borehole locations.

In general, the subsurface conditions below the roadway/pavement structure encountered within the depths of EXP’s geotechnical investigation consists of layers of cohesionless and cohesive fill followed by native layers of sand and silt/sandy silt/silty sand/silt, silty clay to clayey silt and glacial till (mixture of clayey silt, sand and gravel).

A detailed description of the stratigraphy encountered is discussed further in subsequent sections. It should be noted that the following sections are based on the geotechnical investigation conducted by EXP and MTO.

### 6.1 Subsoils

#### 6.1.1 Pavement Structure

A pavement structure consisting of asphalt and concrete was encountered at the surface of all boreholes. The thickness of the structure ranged between 300 mm and 460 mm.

#### 6.1.2 Cohesionless Fill: Sand and Gravel to Gravelly Sand

During EXP’s geotechnical investigation, sand and gravel/gravelly sand fill was encountered below the pavement structure (asphalt/concrete) in BH22-4-3, BH22-4-4A, BH22-4-5, BH22-4-6 and BH22-4-7. The approximate elevations of the surface and base of each fill layer, thickness, description and SPT “N” Values encountered in the boreholes are summarized in Table 1.4 below:

**Table 1.4: Summary of Cohesionless Fill: Sand and Gravel/Gravelly Sand Layers**

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Layer Description	SPT “N” Value Range
	Top	Bottom				
EXP (2022)						
BH22-4-3	175.9	175.6	0.5	0.3	Gravelly Sand	N/A <sup>1</sup>
BH22-4-4A	175.8	174.7	0.4	1.1	Gravelly Sand	33
BH22-4-5	176.3	175.8	0.3	0.5	Sand and Gravel	N/A <sup>1</sup>
BH22-4-6	176.5	176.0	0.3	0.5	Sand and Gravel	N/A <sup>1</sup>
BH22-4-7	175.9	175.4	0.3	0.5	Sand and Gravel	N/A <sup>1</sup>

Note:

1.0 No SPT sampling within layer, only auger samples retrieved.

This layer consists of mainly sand and gravel. The material was greyish brown to brown in colour and moist to wet. SPT "N" value obtained within this layer was 33 blows per 300 mm penetration, corresponding to dense in compactness.

Laboratory testing performed on selected samples consisted of moisture content tests. The test results are as follow:

Moisture Content: (EXP)

- 6% to 17%

The results of the moisture content performed by EXP are provided on the record of borehole sheets in Appendix D.

### 6.1.3 Cohesionless Fill: Sand/Sandy Silt/Silty Sand

During EXP's geotechnical investigation, sand/sandy silt/silty sand fill was encountered below the pavement structure (asphalt/concrete) in BH22-4-2, below the sand and gravel/gravelly sand fill in BH22-4-3, BH22-4-5, BH22-4-6 and BH22-4-7 and below the cohesive fill in BH22-4-4B. The approximate elevations of the surface and base of each fill layer, thickness, description and SPT "N" Values encountered in the boreholes are summarized in Table 1.5 below:

**Table 1.5: Summary of Cohesionless Fill: Sand/Sandy Silt/Silty Sand Layers**

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Layer Description	SPT “N” Value Range
	Top	Bottom				
EXP (2022)						
BH22-4-2	176.3	167.6	0.4	8.7 <sup>1</sup>	Sand/Silty Sand	17 – 49 <sup>2</sup>
BH22-4-3	175.6	175.2	0.8	0.4	Silty Sand	30
	168.8	167.3	7.6	1.5		7
BH22-4-4B	168.3	167.3	7.9	1.2	Sandy Silt	8
BH22-4-5	175.8	167.5	0.8	8.3	Silty Sand/Sand/Sandy Silt	7 – 51
BH22-4-6	176.0	174.5	0.8	1.5	Silty Sand	12
BH22-4-7	175.4	174.9	0.8	0.5	Silty Sand	21

**Notes:**

- 1.0 Includes cohesive fill layer within the overall cohesionless fill thickness (see Table 1.6).
- 2.0 Range for SPT "N" values only within cohesionless fill.

This layer consists of mainly sand and silt with varying amounts of trace to some gravel and trace to some clay. In addition, asphalt and trace organics were encountered within this material. The material was grey to brown in colour and moist to wet. The SPT "N" values within this layer ranged from 7 to 51 blows per 300 mm penetration, corresponding to loose to very dense, but generally compact to dense in compactness. Atterberg limits tests suggest that this layer was non-plastic.

Laboratory testing performed on selected samples consisted of moisture content, grain size distribution, Atterberg limits and unit weight tests. The test results are as follow:

**Moisture Content: (EXP)**

- 4% to 17%

**Grain Size Distribution: (EXP)**

- 1% to 3% gravel.
- 30% to 63% sand.
- 27% to 58% silt.
- 9% clay.

**Atterberg Limits: (EXP)**

- Non-plastic

**Unit Weight: (EXP)**

- 21.1 kN/m<sup>3</sup> to 22.9 kN/m<sup>3</sup>

The results of the moisture content, grain size distribution, Atterberg limits and unit weight tests performed by EXP are provided on the record of borehole sheets in Appendix D. The results of grain size distribution tests are also provided on Figure 1 in Appendix E.

#### 6.1.4 Cohesive Fill: Clayey Silt

During EXP's geotechnical investigation, a cohesive fill was encountered below the cohesionless fill layers in boreholes BH22-4-2, BH22-4-3, BH22-4-4A, BH22-4-6 and BH22-4-7. A cohesive fill layer was encountered at the surface in borehole 71-5 during MTO's geotechnical investigation in 1966. The approximate elevations of the surface and base of each fill layer, thickness, description and SPT (N Value) encountered in the boreholes are summarized in Table 1.6 below:

**Table 1.6: Summary of Cohesive Fill: Clayey Silt Layers**

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Layer Description	SPT “N” Value Range
	Top	Bottom				
EXP (2022)						
BH22-4-2	172.1	170.6	4.6	1.5	Clayey Silt	13
BH22-4-3	175.2	168.8	1.2	6.4	Clayey Silt	7 – 34
BH22-4-4A	174.7	171.9	1.5	2.8 <sup>1</sup>	Clayey Silt	10 – 13
BH22-4-4B	171.6	168.3	4.6	3.3	Clayey Silt	8 – 12
BH22-4-6	174.5	169.2	2.3	5.3	Clayey Silt	11 – 18
BH22-4-7	174.9	167.8	1.3	7.1	Clayey Silt	7 – 24
MTO (1966)						
71-5	168.2	166.7	0	1.5	Clayey Silt	14

Note:

1.0 End of borehole terminated within cohesive fill layer due to encountering an obstruction.

This layer predominately consists of silt and clay and can be considered sandy with trace to some gravel. The material was grey to brown in colour and slightly moist to wet. The SPT "N" value within this layer ranged between 7 to 34 blows per 300 mm penetration, corresponding to firm to hard, but generally stiff to very stiff in consistency. Atterberg limits tests suggest that this cohesive fill material was low plastic.

Laboratory testing performed on selected samples consisted of moisture content, grain size distribution, Atterberg limits and unit weight tests. The test results are as follow:

Moisture Content (EXP and MTO):

- 10% to 23%

Grain Size Distribution: (EXP and MTO)

- 0% to 7% gravel.
- 26% to 42% sand.

- 41% to 52% silt.
- 11% to 26% clay.

Atterberg Limits: (EXP and MTO)

- Liquid Limit: 16% to 24%.
- Plastic Limit: 11% to 13%.
- Plasticity Index: 4% to 12%

Unit Weight: (EXP)

- 19.5 kN/m<sup>3</sup> to 23.2 kN/m<sup>3</sup>

The results of the moisture content, grain size distribution, Atterberg limits and unit weight tests performed by EXP are provided on the record of borehole sheets in Appendix D. The results of grain size distribution and Atterberg limits tests are also provided on Figure 2 and 5 in Appendix E. The results of tests performed by MTO are shown on the borehole logs attached in Appendix F.

#### 6.1.5 Sandy Silt/Silt and Sand/Silty Sand/Silt

During EXP's geotechnical investigation, a native sandy silt/silt and sand/silty sand/silt deposit was encountered below fill layers in boreholes BH22-4-2, BH22-4-3, BH22-4-4B, BH22-4-5, BH22-4-6 and BH22-4-7. Sandy silt to silty sand was also encountered at the surface in boreholes 71-1 and 71-4 and below the fill layer in borehole 71-5 during MTO's geotechnical investigation in 1966. The approximate elevations of the surface and base of each layer, thickness, description and SPT (N Value) encountered in the boreholes are summarized in Table 1.7 below:

**Table 1.7: Summary of Sandy Silt/Silt and Sand/Silty Sand/Silt Layers**

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Layer Description	SPT “N” Value Range
	Top	Bottom				
EXP (2022)						
BH22-4-2	167.6	160.9	9.1	6.7 <sup>1</sup>	Sandy Silt to Sand and Silt	28 – 105
BH22-4-3	167.3	160.6	9.1	6.7 <sup>1</sup>	Sand and Silt/Sandy Silt/Silt	6 – 150
BH22-4-4B	167.1	160.5	9.1	6.6 <sup>1</sup>	Sandy Silt to Sand and Silt	35 – 105
BH22-4-5	167.5	162.9	9.1	4.6	Sandy Silt	71 – 124/230 mm
BH22-4-6	169.2	162.6	7.6	6.6 <sup>1</sup>	Silty Sand/Sandy Silt/Sand and Silt	38 – 157
BH22-4-7	167.8	160.9	8.4	6.9 <sup>1</sup>	Sandy Silt	34 – 170/228 mm
MTO (1966)						
71-1	167.9	158.8	0	9.1	Sandy Silt to Silty Sand	39 – 120
71-4	170.4	161.2	0	9.2	Sandy Silt to Silty Sand	12 – 170/200 mm

*Foundation Investigation and Design Report  
Highway 401 Eastbound from Victoria Park Avenue to Neilson Road  
Superstructure Replacement at Kennedy Road Overpass  
Eastbound Core and Collectors Structure (Site 37X-0214/B1 & B3)  
Assignment No. 2021-E-0018  
Date: December 20, 2024*

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Layer Description	SPT "N" Value Range
	Top	Bottom				
<b>71-5</b>	166.7	157.8	1.5	8.9	Sandy Silt to Silty Sand	28 – 189

Note:

1.0 The end of borehole terminated within this layer.

This native layer predominately consists of sand and silt with trace to some gravel, trace to some clay. Occasional clayey silt lenses were also encountered within the sandy silt/sand and silt/silty sand/silt layers. The material was grey to brown in colour and slightly moist to moist. The SPT "N" value within this layer ranged between 6 to 189 blows per 300 mm penetration, corresponding to loose to very dense, but generally dense to very dense in compactness. Atterberg limits tests suggest that this layer was non-plastic to low plastic (in one sample only).

Laboratory testing performed on selected samples consisted of moisture content, grain size distribution, Atterberg limits and unit weight tests. The test results are as follow:

Moisture Content (EXP and MTO):

- 5% to 21%

Grain Size Distribution: (EXP and MTO)

- 0% to 10% gravel.
- 8% to 54% sand.
- 32% to 82% silt.
- 2% to 12% clay

Atterberg Limits: (EXP)

- Liquid Limit: 18%.
- Plastic Limit: 10%.
- Plasticity Index: 8%

Five test results indicated non-plastic material.

Unit Weight: (EXP)

- 21.6 kN/m<sup>3</sup> to 23.6 kN/m<sup>3</sup>

The results of the moisture content, grain size distribution, Atterberg limits and unit weight tests performed by EXP are provided on the record of borehole sheets in Appendix D. The results of grain size distribution and Atterberg limits are also provided on Figures 3 and 6 in Appendix E. The results of tests performed by MTO are shown on the borehole logs attached in Appendix F.

#### 6.1.6 Silty Clay to Clayey Silt

During EXP's geotechnical investigation, a native silty clay layer was encountered below the cohesionless till in borehole BH22-4-5. Additionally, native clayey silt was encountered below the native sandy silt to silty sand in borehole 71-5 during MTO's

geotechnical investigation in 1966. The approximate elevations of the surface and base of each layer, thickness, description and SPT (N Value) encountered in the boreholes are summarized in Table 1.8 below:

**Table 1.8: Summary of Silty Clay to Clayey Silt Layers**

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Layer Description	SPT “N” Value Range
	Top	Bottom				
EXP (2022)						
BH22-4-5	162.9	160.8	13.7	2.1 <sup>1</sup>	Silty Clay	32 – 44
MTO (1966)						
71-5	157.8	154.8	10.4	3.0	Clayey Silt	100/125 mm – 100/150 mm

**Notes:**

1.0 End of borehole terminated within this layer.

This layer predominately consists of silt and clay with trace sand to sandy and trace gravel. The material was grey in colour and slightly moist to wet. The SPT "N" values within this layer ranged from 32 to 44 blows per 300 mm penetration and 100 blows per 125 mm to 150 mm penetration, corresponding to hard in consistency. Atterberg limits tests suggest that this native silty clay/clayey silt was low to high plasticity.

Laboratory testing performed on selected samples consisted of moisture content, grain size distribution, Atterberg limits and unit weight tests. The test results are as follow:

**Moisture Content (EXP and MTO):**

- 11% to 29%

**Grain Size Distribution: (EXP and MTO)**

- 1% gravel.
- 6% to 25% sand.
- 21% to 46% silt.
- 28% to 72% clay.

**Atterberg Limits: (EXP and MTO)**

- Liquid Limit: 22% to 53%.
- Plastic Limit: 13% to 20%.
- Plasticity Index: 9% to 33%

**Unit Weight: (EXP)**

- 19.1 kN/m<sup>3</sup>



The results of the moisture content, grain size distribution, Atterberg limits and unit weight tests performed by EXP are provided on the record of borehole sheets in Appendix D. The results of grain size distribution and Atterberg limits tests are also provided on Figures 4 and 7 in Appendix E. The results of tests performed by MTO are shown on the borehole logs attached in Appendix F.

### 6.1.7 Glacial Till: Mixture of Clayey Silt, Sand and Gravel

A glacial till (mixture of clayey silt, sand and gravel) layer was encountered below the native sandy silt to silty sand in boreholes 71-1 and 71-4 and below the native clayey silt in borehole 71-5 during MTO's geotechnical investigation in 1966. The approximate elevations of the surface and base of each layer, thickness, description and SPT (N Value) encountered in the boreholes are summarized in Table 1.9 below:

**Table 1.9: Summary of Glacial Till: Mixture of Clayey Silt, Sand and Gravel Layers**

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Layer Description	SPT “N” Value Range
	Top	Bottom				
MTO (1966)						
71-1	158.8	152.7	9.1	6.1 <sup>1</sup>	Clayey Silt	100/75 mm – 100/125 mm
71-4	162.2	156.2	9.1	5.0 <sup>1</sup>	Clayey Silt	100/100 mm – 136/275 mm
71-5	154.8	149.4	13.4	5.4 <sup>1</sup>	Clayey Silt	100/100 mm – 100/150 mm

*Note:*

*1.0 The end of borehole terminated within this layer.*

This layer was described as a heterogenous mixture of clayey silt, sand and gravel. Grain size analyses of this material suggest that this layer predominately consists of sand and silt (varying from some to main fraction) with trace clay to clayey and trace gravel. Refusal SPT "N" values (100+ blows for less than 300 mm penetration) were obtained within this layer corresponding to hard in consistency. Atterberg limits tests suggest that this native clayey silt till layer was low plasticity.

Laboratory testing performed on selected samples consisted of moisture content, grain size distribution and Atterberg limits. The test results are as follow:

Moisture Content (MTO):

- 9% to 14%

Grain Size Distribution: (MTO)

- 0% to 5% gravel.
- 21% to 85% sand.
- 52% to 58% silt.
- 9% to 22% clay.
- 15% silt and clay

Atterberg Limits: (MTO)

- Liquid Limit: 18% to 19%.
- Plastic Limit: 10% to 12%.
- Plasticity Index: 7% to 8%

The results of tests performed by MTO are shown on the borehole logs attached in Appendix F.

## 6.2 Groundwater Conditions

Groundwater levels were observed upon completion of some of the boreholes. Groundwater levels measured on completion of boreholes may not be considered stabilized and therefore may not represent the established long-term average groundwater table (phreatic surface).

A summary of the groundwater levels encountered during the investigations are summarized in Table 1.10 and are also presented on the Record of Borehole Sheets attached in Appendix D and Appendix F.

**Table 1.10: Summary of observed groundwater levels**

Borehole	Ground Surface Elevation (m)	Water level Depth/ Elevation (m)	Date
<b>EXP (2022)</b>			
<b>BH22-4-3</b>	176.4	11.8/164.6	October 25, 2022
<b>BH22-4-4B</b>	176.2	13.3/162.9	November 14, 2022
<b>BH22-4-6</b>	176.8	12.2/164.6 <sup>1</sup>	October 21, 2022
<b>BH22-4-7</b>	176.2	14.1/162.1	October 24, 2022
<b>MTO (1966)</b>			
<b>71-1</b>	167.9	1.7/166.2	April 4, 1966
<b>71-4</b>	170.4	4.3/166.1	April 12, 1966
<b>71-5</b>	168.2	3.7/164.5	December 6, 1966

Note:

1.0 Groundwater level inferred from split spoon observations.

It should be noted that fluctuations in the level of the groundwater may occur due to seasonal variations, (precipitation, snowmelt, rainfall), local soil permeability, construction remediation activities, and other related factors.

## 6.3 Chemical Analyses

Two (2) soil samples were selected for chemical analysis during current investigation. The soils samples collected by EXP were tested at the Bureau Veritas Laboratories (formerly Maxxam Analytics), a CALA-certified and accredited laboratory in Mississauga, Ontario.

*Foundation Investigation and Design Report*  
*Highway 401 Eastbound from Victoria Park Avenue to Neilson Road*  
*Superstructure Replacement at Kennedy Road Overpass*  
*Eastbound Core and Collectors Structure (Site 37X-0214/B1 & B3)*  
*Assignment No. 2021-E-0018*  
*Date: December 20, 2024*

The analytical results are summarized in Table 1.11 below and are presented in Appendix E.

**Table 1.11. Summary of chemical analysis results**

Sample Identification	pH (Unitless)	Soluble Chloride (ppm)	Soluble Sulphate (ppm)	Resistivity (ohm-cm)	Conductivity (umho/cm)	Redox Potential (mV)
BH22-4-2, SS11	7.91	470	77	970	1030	210
BH22-4-3, SS6	7.89	400	<20	1100	895	220

*Foundation Investigation and Design Report  
Highway 401 Eastbound from Victoria Park Avenue to Neilson Road  
Superstructure Replacement at Kennedy Road Overpass  
Eastbound Core and Collectors Structure (Site 37X-0214/B1 & B3)  
Assignment No. 2021-E-0018  
Date: December 20, 2024*

## 7.0 Closure

A subsurface investigation is a limited sampling of a site; the subsurface conditions have been established only at the test hole locations. Should conditions at the site be encountered which differ from those reported at the test locations, we require that we be notified immediately in order to assess this additional information and our recommendations, as appropriate. It may then be necessary to perform additional investigations and analyses.

Details of the limitations of this report are presented as Appendix A, "Limitations and Use of Report".

This Foundation Investigation Report has been prepared by Elvis Lu, M.Eng., EIT and Thomas Lardner, Ph.D., P.Eng. It was 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 supervised by Elvis Lu, M.Eng., and Osama Drbe P.H.D and Danial Mroz, M.E.Sc.

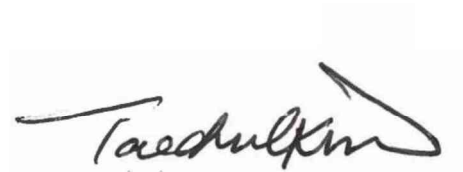
Yours truly,

EXP Services Inc.

Elvis Lu, M.Eng., EIT  
Technical Specialist



Thomas Lardner, Ph.D., P.Eng.  
Senior Geotechnical Engineer

TaeChul Kim, M.E.Sc., P.Eng.  
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Designated MTO Foundation Contact



Encl.

## References

- Barnett, P.J., Cowan, W.R., & Henry, A.P. 1991. *Quaternary geology of Ontario, southern sheet*; Ontario Geological Survey, Map 2556, scale 1:1 000 000.
- Canadian Geotechnical Society, 2006. *Canadian Foundation Engineering Manual*, 4th Edition. The Canadian Geotechnical Society, BiTech Publisher Ltd., British Columbia.
- Canadian Standards Association (CSA), 2019. *Canadian Highway Bridge Design Code and Commentary* on CAN/CSA-S6-19. CSA Special Publication.
- Chapman, L.J. and Putnam, D.F. 1984. *The physiography of Southern Ontario*. Ontario Geological Survey, Special volume 2, 3rd Edition. Ontario Ministry of Natural Resources.
- Chapman, L.J. and Putnam, D.F. 2007. *The Physiography of Southern Ontario*. Ontario Geological Survey, Miscellaneous Release-Data 228.
- Golder Associates Ltd., Preliminary Foundation Investigation and Design Report, Bridge Widening and Replacement, Highway 401 Rehabilitation from Warden Avenue to Brock Road, Toronto, Ontario, W.O. 07-20012, Report Number: 09-1111-6055-1, Geocres No. 30M14-338, dated April 2012.
- Golder Associates Ltd., Foundation Investigation and Design Report, Kennedy Road Overpass (Site No. 37-214) Rehabilitation and Northward Widening, Highway 401 Westbound Core and Collector Lanes, Neilson Road to Warden Avenue, City of Toronto, Ontario, Ministry of Transportation, Ontario, G.W.P. No. 2162-11-00, Geocres No. 30M14-486, dated January 4, 2019
- Ministry of Transportation, April 2014. MTO Gravity Pipe Design Guidelines. Circular Culverts and Storm Sewers.
- Ministry of Transportation, April 2022. Guideline for MTO Foundation Engineering Services, Version 03.
- Molinas, A., and Mommandi, A., 2009. Development of New Corrosion/Abrasion Guidelines for Selection of Culvert Pipe Materials, Report No. CDOT-2009-11. Colorado Department of Transportation, DTD Applied Research and Innovation Branch.
- Ontario Geological Survey. 1991. *Bedrock geology of Ontario, southern sheet*; Ontario Geological Survey, Map 2544, scale 1:1 000 000.
- Preliminary Foundation Investigation and Design Report, Bridge Widening and Replacement, Highway 401 Rehabilitation from Warden Avenue to Brock Road, Toronto, Ontario, W.O. 07-20012, Report Number: 09-1111-6055-1, Geocres No. 30M14-338, Golder Associates Ltd., dated April 2012.

## Appendix A – Limitations and Use of Report



## **LIMITATIONS AND USE OF REPORT**

### **BASIS OF REPORT**

This report ("Report") is based on site conditions known or inferred by the geotechnical investigation undertaken as of the date of the Report. Should changes occur which potentially impact the geotechnical condition of the site, or if construction is implemented more than one year following the date of the Report, the recommendations of exp may require re-evaluation.

The Report is provided solely for the guidance of design engineers and on the assumption that the design will be in accordance with applicable codes and standards. Any changes in the design features which potentially impact the geotechnical analyses or issues concerning the geotechnical aspects of applicable codes and standards will necessitate a review of the design by exp. Additional field work and reporting may also be required.

Where applicable, recommended field services are the minimum necessary to ascertain that construction is being carried out in general conformity with building code guidelines, generally accepted practices and exp's recommendations. Any reduction in the level of services recommended will result in exp providing qualified opinions regarding the adequacy of the work. exp can assist design professionals or contractors retained by the Client to review applicable plans, drawings, and specifications as they relate to the Report or to conduct field reviews during construction.

Contractors contemplating work on the site are responsible for conducting an independent investigation and interpretation of the borehole results contained in the Report. The number of boreholes necessary to determine the localized underground conditions as they impact construction costs, techniques, sequencing, equipment and scheduling may be greater than those carried out for the purpose of the Report.

Classification and identification of soils, rocks, geological units, contaminant materials, building envelopment assessments, and engineering estimates are based on investigations performed in accordance with the standard of care set out below and require the exercise of judgment. As a result, even comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations or building envelope descriptions involve an inherent risk that some conditions will not be detected. All documents or records summarizing investigations are based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated. Some conditions are subject to change over time. The Report presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, these should be disclosed to exp to allow for additional or special investigations to be undertaken not otherwise within the scope of investigation conducted for the purpose of the Report.

### **RELIANCE ON INFORMATION PROVIDED**

The evaluation and conclusions contained in the Report are based on conditions in evidence at the time of site inspections and information provided to exp by the Client and others. The Report has been prepared for the specific site, development, building, design or building assessment objectives and purpose as communicated by the Client. exp has relied in good faith upon such representations, information and instructions and accepts no responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of any misstatements, omissions, misrepresentation or fraudulent acts of persons providing information. Unless specifically stated otherwise, the applicability and reliability of the findings, recommendations, suggestions or opinions expressed in the Report are only valid to the extent that there has been no material alteration to or variation from any of the information provided to exp.

### **STANDARD OF CARE**

The Report has been prepared in a manner consistent with the degree of care and skill exercised by engineering consultants currently practicing under similar circumstances and locale. No other warranty, expressed or implied, is made. Unless specifically stated otherwise, the Report does not contain environmental consulting advice.

### **COMPLETE REPORT**

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment form part of the Report. This material includes, but is not limited to, the terms of reference given to exp by its client ("Client"), communications between exp and the Client, other reports, proposals or documents prepared by exp for the Client in connection with the site described in the Report. In order to properly understand the suggestions, recommendations and opinions expressed in the Report, reference must be made to the Report in its entirety. exp is not responsible for use by any party of portions of the Report.





## **USE OF REPORT**

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. No other party may use or rely upon the Report in whole or in part without the written consent of exp. Any use of the Report, or any portion of the Report, by a third party are the sole responsibility of such third party. exp is not responsible for damages suffered by any third party resulting from unauthorised use of the Report.

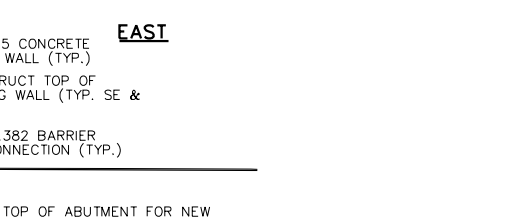
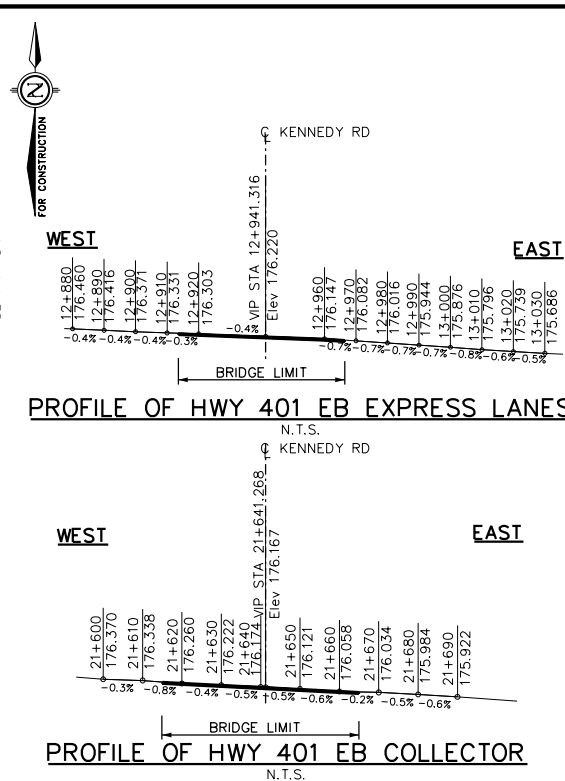
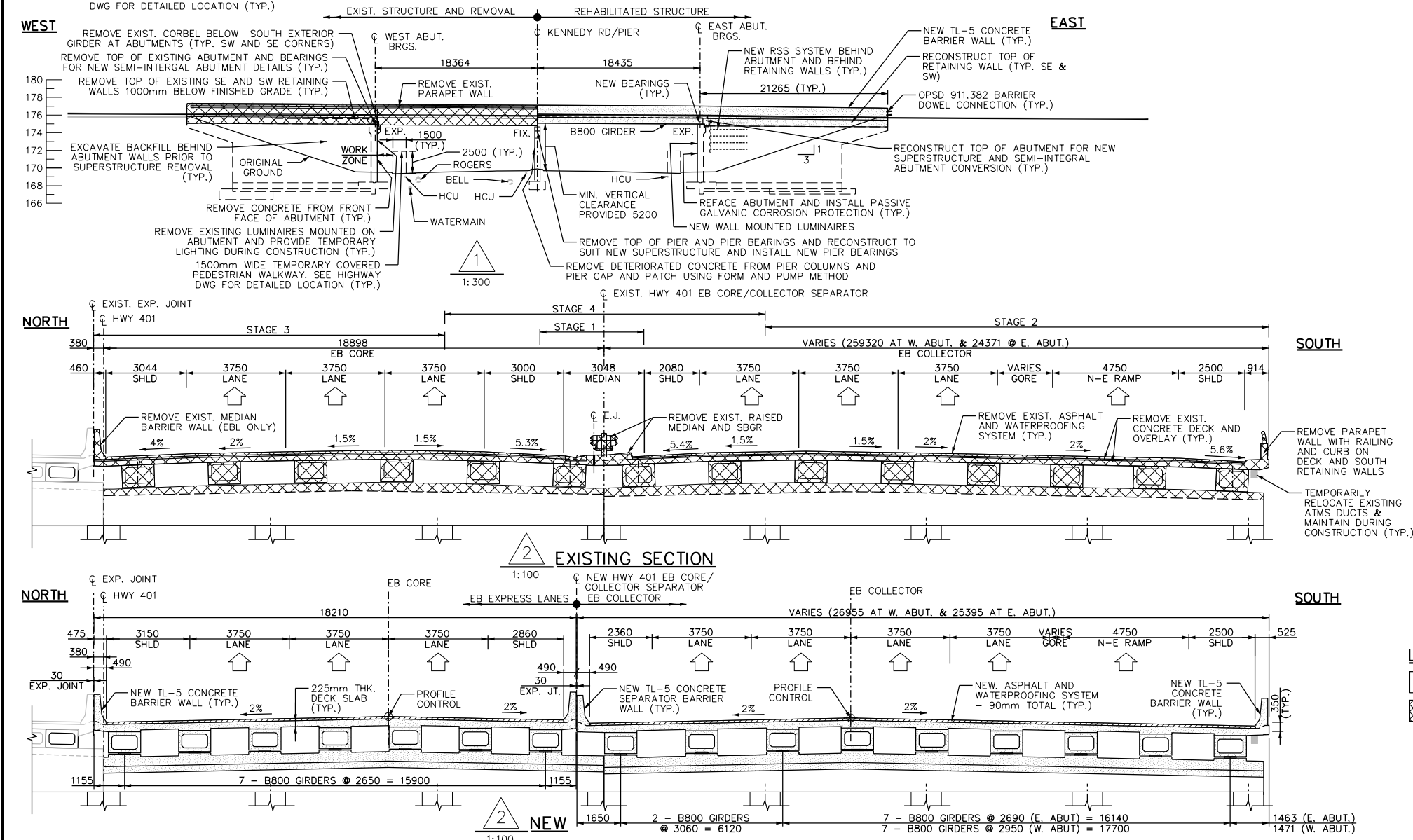
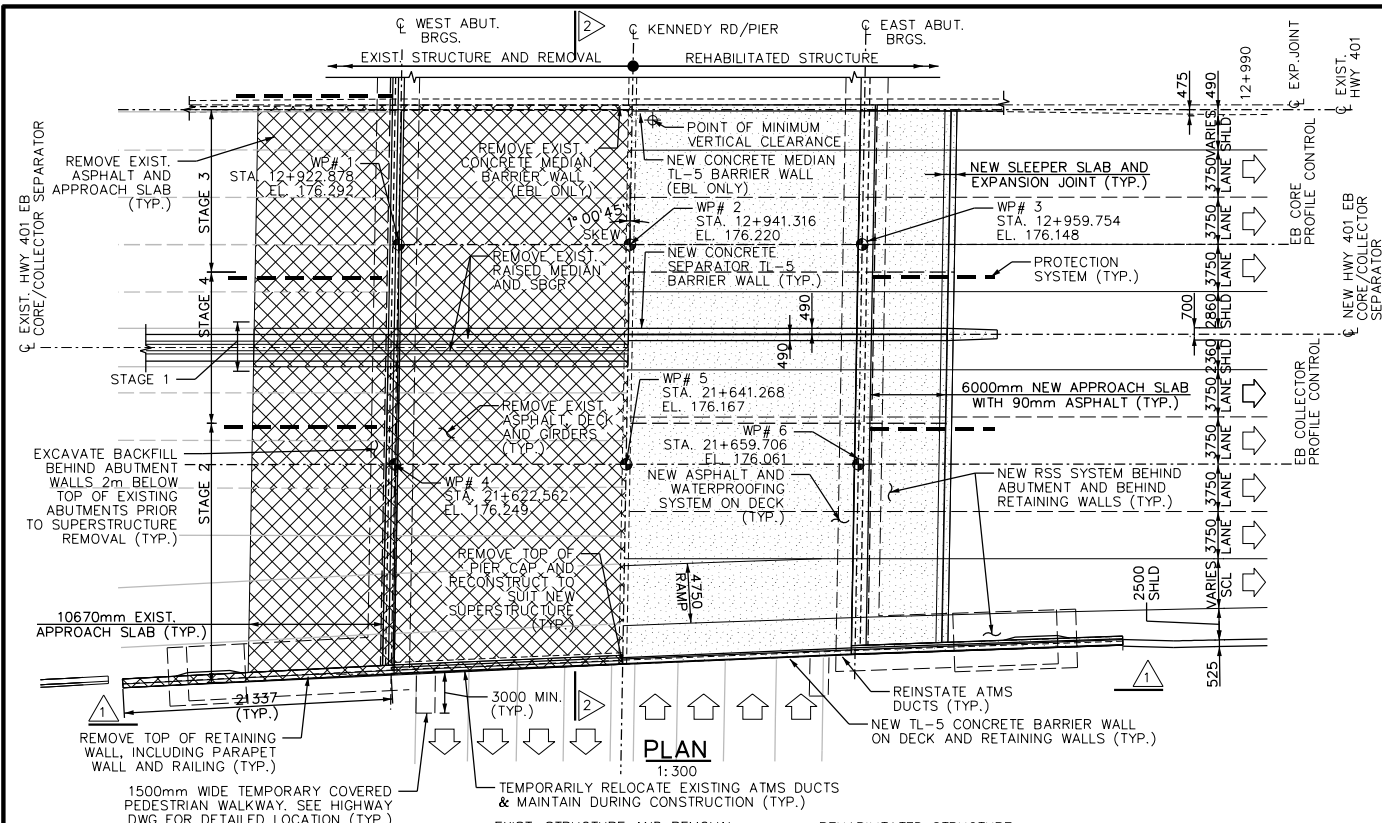
## **REPORT FORMAT**

Where exp has submitted both electronic file and a hard copy of the Report, or any document forming part of the Report, only the signed and sealed hard copy shall be the original documents for record and working purposes. In the event of a dispute or discrepancy, the hard copy shall govern. Electronic files transmitted by exp have utilize specific software and hardware systems. exp makes no representation about the compatibility of these files with the Client's current or future software and hardware systems. Regardless of format, the documents described herein are exp's instruments of professional service and shall not be altered without the written consent of exp.

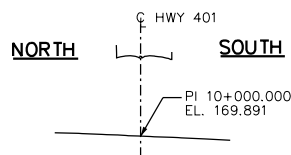
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Highway 401 Eastbound from Victoria Park Avenue to Neilson Road  
Superstructure Replacement at Kennedy Road Overpass  
Eastbound Core and Collectors Structure (Site 37X-0216/B1 & B3)  
Assignment No. 2021-E-0018  
Date: December 20, 2024*

## Appendix B – General Arrangement Drawings



METRIC  
DIMENSIONS ARE IN METRES AND/OR  
MILLIMETRES UNLESS OTHERWISE SHOWN  
DRAWING NOT TO BE SCALED  
100mm ON ORIGINAL DRAWING



PROFILE OF KENNEDY ROAD  
N.T.S.

LIST OF DRAWINGS:

- R3-1. GENERAL ARRANGEMENT
- R3-2. CONSTRUCTION STAGING I
- R3-3. CONSTRUCTION STAGING II
- R3-4. REMOVALS I
- R3-5. REMOVALS II
- R3-6. ABUTMENT REHABILITATION
- R3-7. PIER REHABILITATION
- R3-8. RETAINING WALL REHABILITATION AND DETAILS
- R3-9. PRESTRESSED BOX GIRDER LAYOUT
- R3-10. PRESTRESSED BOX GIRDERS AND BEARINGS I
- R3-11. PRESTRESSED BOX GIRDERS AND BEARINGS II
- R3-12. DECK LAYOUT
- R3-13. DECK DETAILS AND REINFORCEMENT I
- R3-14. DECK DETAILS AND REINFORCEMENT II
- R3-15. EXPANSION JOINT AND SLEEPER SLAB
- R3-16. STRIP SEAL EXPANSION JOINT TYPE 'C' DETAILS
- R3-17. SEQUENCE OF EXPANSION JOINT INSTALLATION
- R3-18. NORTH AND SOUTH BARRIER WALL  
WITHOUT RAILING TL-5
- R3-19. E.B. SEPARATOR BARRIER WALL WITHOUT  
RAILING TL-5
- R3-20. 6000mm APPROACH SLAB
- R3-21. DECK DRAIN DETAILS
- R3-22. MISCELLANEOUS DETAILS
- R3-23. ELECTRICAL EMBEDDED WORK


APPLICABLE STANDARD DRAWINGS:

OPSD 0911.382	GUIDE RAIL SYSTEM (CONCRETE BARRIER DOWEL CONNECTION DETAIL)
OPSD 3370.100	DECK, WATERPROOFING HOT APPLIED ASPHALT MEMBRANE WITH PROTECTION BOARD
OPSD 3370.101	DECK, WATERPROOFING HOT APPLIED ASPHALT MEMBRANE AT ACTIVE CRACKS GREATER THAN 2mm WIDE AND CONSTRUCTION JOINTS
OPSD 3390.150	FALSEWORK CLEARANCE TO TRAFFIC LANES
OPSD 3941.200	FIGURES IN CONCRETE SITE NUMBER AND DATE LAYOUT

LIST OF ABBREVIATIONS:

ABUT.	ABUTMENT
BRS.	BEARINGS
C.J.	CONSTRUCTION JOINT
DIA.	DIAMETER
EB	EASTBOUND
EBL	EASTBOUND LANE
E.J.	EXPANSION JOINT
EL.	ELEVATION
EQ. SP.	EQUALLY SPACED
EXIST.	EXISTING
EXP.	EXPANSION
REINF.	REINFORCEMENT
SCL	SPEED CHANGE LANE
SHLD	SHOULDER
T/P	TOP OF PAVEMENT
TYP.	TYPICAL
WB	WESTBOUND
WBL	WESTBOUND LANE
WP	WORKING POINT

LEGEND:

	CONCRETE TO REMAIN		NEW CONCRETE
	REMOVAL		NEW ASPHALT

REVISIONS					
	DATE	BY	DESCRIPTION		
	DESIGN J.C.	CHK U.P.	CODE CAN/CSA 56-19	LOAD CL 625-ONT	DATE OCT. 2024
	DRAWN V.A.	CHK J.C.	SITE 37x-0214/B14B3		DWG. R3-01

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*Foundation Investigation and Design Report  
Highway 401 Eastbound from Victoria Park Avenue to Neilson Road  
Superstructure Replacement at Kennedy Road Overpass  
Eastbound Core and Collectors Structure (Site 37X-0216/B1 & B3)  
Assignment No. 2021-E-0018  
Date: December 20, 2024*

## Appendix C – Borehole Location Plan and Stratigraphic Profile









SHEET

1

LEGEND

### LEGEND

- |   |  |
|---|--|
|  | New Borehole Location  |
|  | Existing Borehole Location   |
|  | Water Level Upon Completion of Drilling<br>( W. L. NOT STABILIZED) |
|  | Blows/0.3m (Std. Pen. Test, 475 J/blow)                            |

## SOIL STRATA SYMBOLS

- |   |   |   |   |
|---|---|---|---|
|  | PAVEMENT<br>STRUCTURE                   |  | MIXTURE OF CLAYEY SILT,<br>SAND AND GRAVEL (TILL) |
|  | FILL                                    |   |   |
|  | CLAYEY SILT                             |   |   |
|  | SILTY SAND/SANDY SILT/<br>SAND AND SILT |   |   |

BOREHOLE CO-ORDINATES/ NAD 83/ MTM ON-10

BH No.	ELEV.	NORTHING	EASTING
BH22-4-02	176.7	4848340.9	322113.1
BH22-4-03	176.4	4848359.5	322170.8
BH22-4-04A	176.2	4848331.9	322193.1
BH22-4-04B	176.2	4848333.9	322194.2
BH22-4-05	176.6	4848301.2	322111.2
BH22-4-06	176.8	4848330.0	322080.0
BH22-4-07	176.2	4848370.0	322203.5
71-1	167.9	4848340.5	322165.4
71-4	170.4	4848307.8	322135.7
71-5	168.2	4848322.1	322186.2

NOTES

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 boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

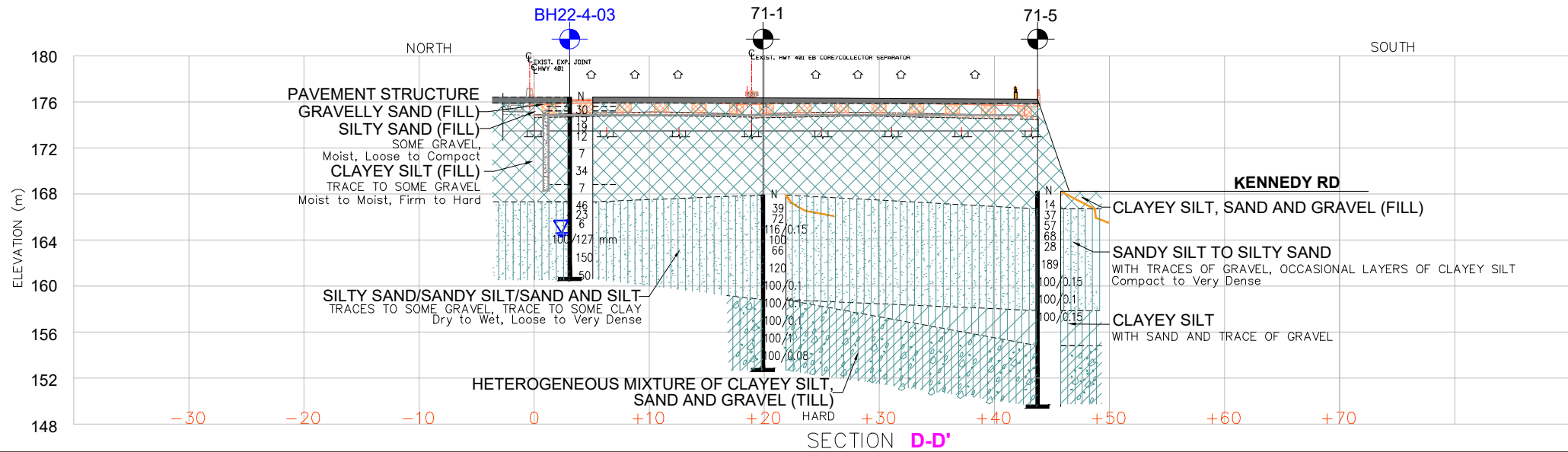
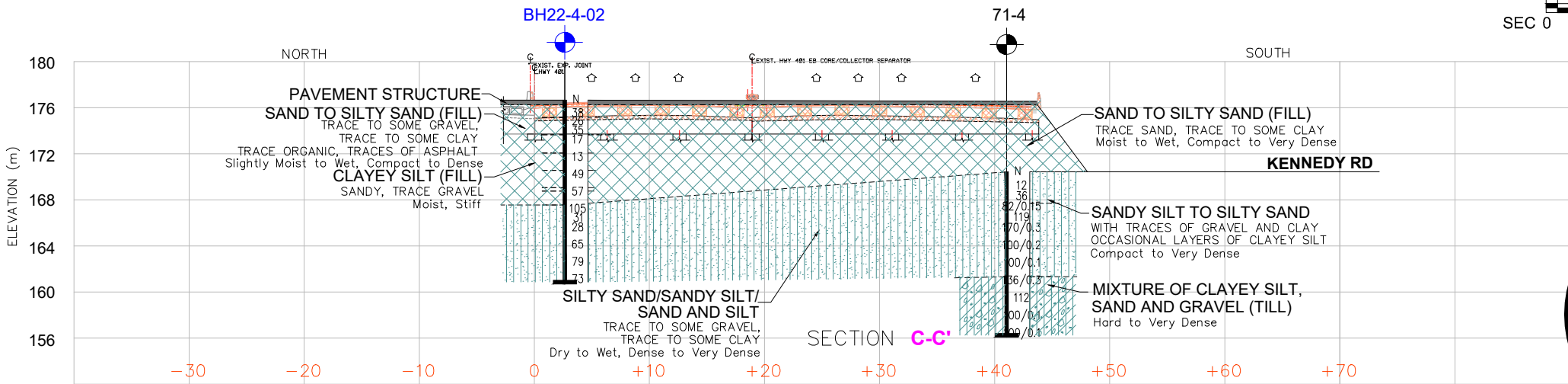
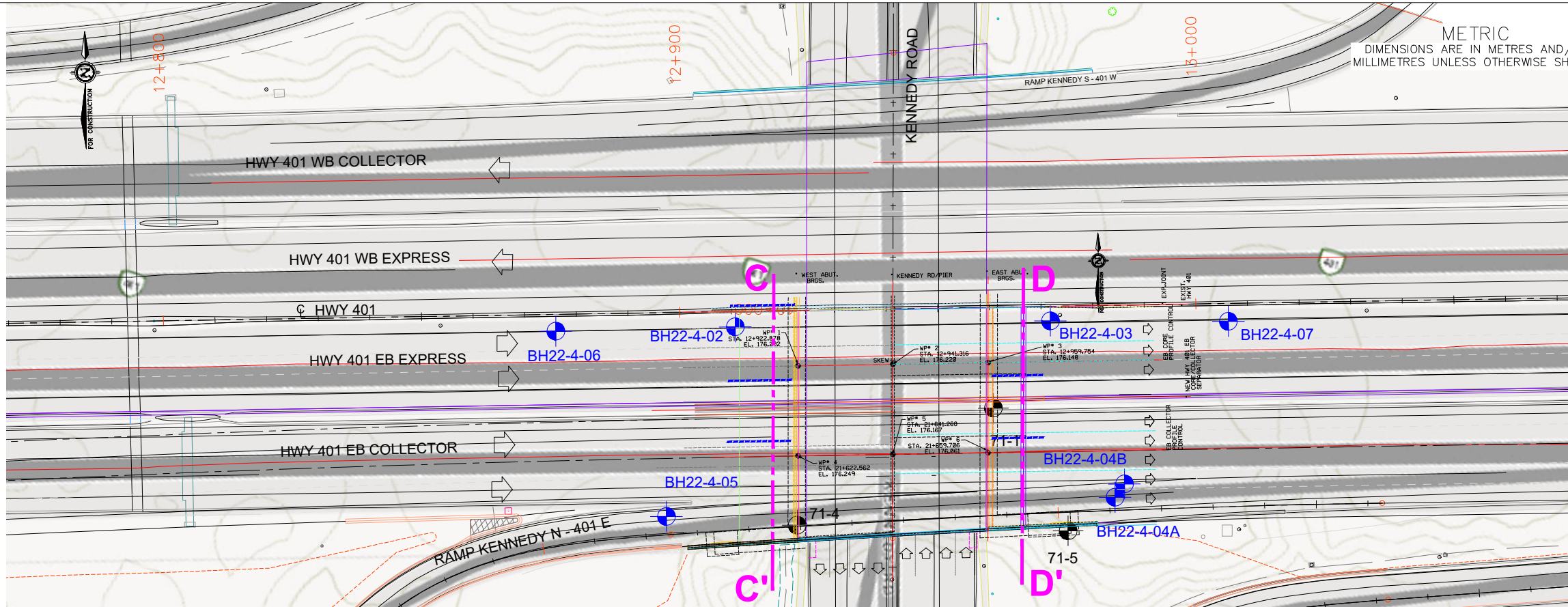
The complete foundation investigation and design report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in the report and related documents are specifically excluded in accordance with the conditions of Section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

REVISIONS				SUBMISSION FOR MTO REVIEW
	NO	DATE	BY	DESCRIPTION

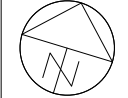
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DRAWN SH	CHKD. TC	APPRD SG	DWG 01



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MODIFIED: 2024-11-14 14:23



CONT No.  
ASSIG No. 2021-E-0018  
GWP No.  
Superstructure Replacement at Kennedy Road Overpass  
Eastbound Core and Collectors Structure  
Latitude: 43.774789; Longitude: -79.284548  
BOREHOLE LOCATION PLAN & SOIL STRATA

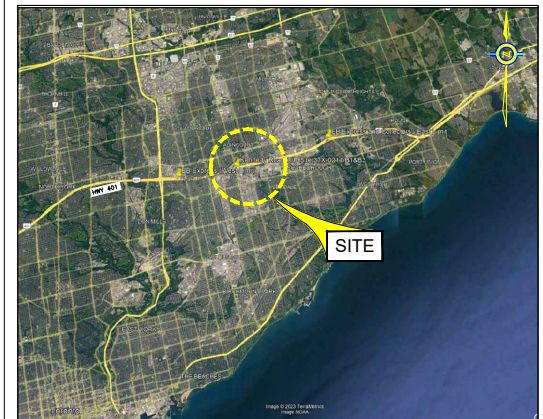


SHEET

2



EXP SERVICES INC.



KEY PLAN  
N.T.S.

LEGEND

- New Borehole Location
- Existing Borehole Location
- Water Level Upon Completion of Drilling  
( W. L. NOT STABILIZED)
- N Blows/0.3m (Std. Pen. Test, 475 J/blow)

SOIL STRATA SYMBOLS

- PAVEMENT STRUCTURE
- FILL
- CLAYEY SILT
- SILTY SAND/SANDY SILT/  
SAND AND SILT
- MIXTURE OF CLAYEY SILT,  
SAND AND GRAVEL (TILL)

BOREHOLE CO-ORDINATES/ NAD 83/ MTM ON-10

BH No.	ELEV.	NORTHING	EASTING
BH22-4-02	176.7	4848340.9	322113.1
BH22-4-03	176.4	4848359.5	322170.8
BH22-4-04A	176.2	4848331.9	322193.1
BH22-4-04B	176.2	4848333.9	322194.2
BH22-4-05	176.6	4848301.2	322111.2
BH22-4-06	176.8	4848330.0	322080.0
BH22-4-07	176.2	4848370.0	322203.5
71-1	167.9	4848340.5	322165.4
71-4	170.4	4848307.8	322135.7
71-5	168.2	4848322.1	322186.2

NOTES

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 boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

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 the OPS Gen. Cond.

SUBMISSION FOR MTO REVIEW			
NO	DATE	BY	DESCRIPTION
PROJECT No.	ADM-22000797-A0	GEOCRETS No.	30M14-552
SUBM'D SH	CHKD. SM	DATE	NOV. 14, 2024
DRAWN SH	CHKD. TC	APPRD SG	DWG 02

EXP Services Inc.

*Foundation Investigation and Design Report  
Highway 401 Eastbound from Victoria Park Avenue to Neilson Road  
Superstructure Replacement at Kennedy Road Overpass  
Eastbound Core and Collectors Structure (Site 37X-0216/B1 & B3)  
Assignment No. 2021-E-0018  
Date: December 20, 2024*

## Appendix D – 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.

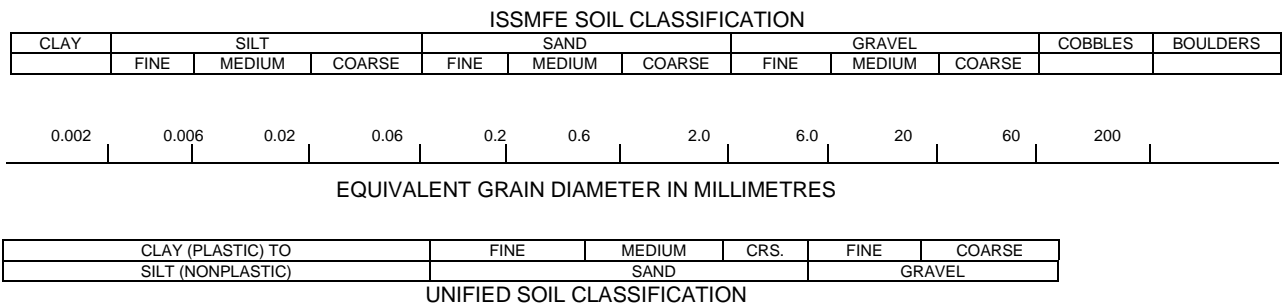
*Seam:* a thin, confined layer of soil having different particle size, texture, or color from materials above and below.

*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 generally the ASTM D2487-11 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) with some modification to reflect current MTO practices. 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 Canadian Foundation Engineering Manual (CFEM):

Table a: Percent or Proportion of Soil

Term	Description	Criteria
"trace"	trace gravel, trace sand, etc.	1% - 10%
"some"	some gravel, some sand, etc.	10% - 20%
Adjective	gravelly, sandy, silty and clayey	20% - 35%
"and"	and gravel, and sand, etc.	>35%
Noun	gravel, sand, silt, clay	>35% and main fraction

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≤N<10
Compact	10≤N<30
Dense	30≤N<50
Very Dense	50≤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:

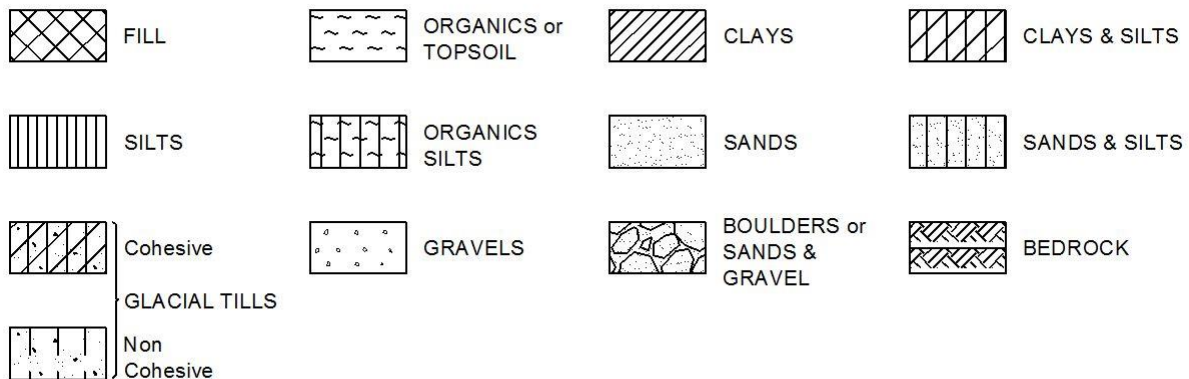
Table c: Consistency of Cohesive Soil

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
$\sigma$	kPa	Total normal stress
$\sigma'$	kPa	Effective normal stress
$\tau$	kPa	Shear stress
$\sigma_1, \sigma_2, \sigma_3$	kPa	Principal stresses
$\varepsilon$	%	Linear strain
$\varepsilon_1, \varepsilon_2, \varepsilon_3$	%	Principal strains
E	kPa	Modulus of linear deformation
G	kPa	Modulus of shear deformation
$\mu$	1	Coefficient of friction

### MECHANICAL PROPERTIES OF SOIL

$m_v$	kPa <sup>-1</sup>	Coefficient of volume change
$c_c$	1	Compression index
$c_s$	1	Swelling index
$c_r$	1	Recompression index
$c_v$	m <sup>2</sup> /s	Coefficient of consolidation
H	m	Drainage path
$T_v$	1	Time factor
U	%	Degree of consolidation
$\sigma'_{v0}$	kPa	Effective overburden pressure
$\sigma'_p$	kPa	Preconsolidation pressure
$\tau_f$	kPa	Shear strength
$c'$	kPa	Effective cohesion intercept
$\phi'$	—°	Effective angle of internal friction
$c_u$	kPa	Apparent cohesion intercept
$\phi_u$	—°	Apparent angle of internal friction
$\tau_R$	kPa	Residual shear strength
$\tau_r$	kPa	Remoulded shear strength
$S_t$	1	Sensitivity = $c_u/\tau_r$

### PHYSICAL PROPERTIES OF SOIL

$P_s$	kg/m <sup>3</sup>	Density of solid particles
$\gamma_s$	kN/m <sup>3</sup>	Unit weight of solid particles
$\rho_w$	kg/m <sup>3</sup>	Density of water
$\gamma_w$	kN/m <sup>3</sup>	Unit weight of water
$\rho$	kg/m <sup>3</sup>	Density of soil
$\gamma$	kN/m <sup>3</sup>	Unit weight of soil
$\rho_d$	kg/m <sup>3</sup>	Density of dry soil
$\gamma_d$	kN/m <sup>3</sup>	Unit weight of dry soil
$\rho_{sat}$	kg/m <sup>3</sup>	Density of saturated soil
$\gamma_{sat}$	kN/m <sup>3</sup>	Unit weight of saturated soil
$\rho'$	kg/m <sup>3</sup>	Density of submerged soil
$\gamma'$	kN/m <sup>3</sup>	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 <sup>3</sup> /s	Rate of discharge
v	m/s	Discharge velocity
i	1	Hydraulic gradient
k	m/s	Hydraulic conductivity
j	kN/m <sup>3</sup>	Seepage force

Brampton, Ontario

## RECORD OF BOREHOLE No BH22-4-02

1 OF 1

METRIC

W.P. Site 37X-0214/B1&B3 LOCATION Hwy 401 - Kennedy Road O/P, Toronto, ON, MTM ON-10 322113.1E 4848340.9N ORIGINATED BY OD  
 DIST Toronto HWY 401 BOREHOLE TYPE Truck Mount CME 75 / SSA COMPILED BY OD  
 DATUM Geodetic DATE 2022.10.26 - 2022.10.26 LATITUDE 43.774826 LONGITUDE -79.284933 CHECKED BY SM/TL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)								
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL P. PENETROMETER						WATER CONTENT (%)							
176.7								20	40	60	80	100									
0.0	PAVEMENT STRUCTURE - 150 mm of asphalt, and 250 mm of concrete																				
176.3																					
0.4	SAND (FILL) - some gravel, grey to brown, slightly moist, dense		AS1	AS			176														
			SS2	SS	38																
175.2																					
1.5	SILTY SAND (FILL) - trace gravel, trace clay, grey, moist to wet, compact to dense  - Traces of asphalt were encountered at a depth of 2.3 m		SS3	SS	26		175														
				SS4	SS	35															
173.7							174														
3.0	SAND (FILL) - some silt, trace to some clay, grey, moist, compact		SS5	SS	17																
								173													
172.1																					
4.6	CLAYEY SILT (FILL) - sandy, trace gravel, grey, slightly moist to moist, stiff		SS6	SS	13		172														
170.6							171														
6.1	SILTY SAND (FILL) - some gravel, trace clay, trace organic, grey, slightly moist, dense		SS7	SS	49		170														
168.8																					
	-clayey silt lens						169														
7.9	SAND (FILL) - trace gravel, some silt, some clay, grey to brown, slightly moist, very dense		SS8	SS	57																
								168													
167.6																					
9.1	SANDY SILT - trace gravel, trace to some clay, grey to brown, slightly moist, compact to very dense		SS9	SS	105		167														
				SS10	SS	31															
								166													
				SS11	SS	28															
							165														
			SS12	SS	65		164														
162.7							163														
14.0	SAND AND SILT - trace gravel, trace to some clay, grey, slightly moist to wet, very dense		SS13	SS	79																
								162													
161.5																					
15.2	SANDY SILT - trace gravel, trace to some clay, grey to brown, slightly moist, very dense		SS14	SS	73		161														
160.9																					
15.8	END OF BOREHOLE																				
	NOTES: 1) No groundwater was encountered in open borehole upon completion of drilling.																				

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MTO H401 - KENNEDY RD OVERPASS-090122023 GPJ ONTARIO MTO GDT 7/24/23

Brampton, Ontario

## RECORD OF BOREHOLE No BH22-4-03

1 OF 1

METRIC

W.P. Site 37X-0214/B1&B3 LOCATION Hwy 401 - Kennedy Road O/P, Toronto, ON, MTM ON-10 322170.9E 4848359.5N ORIGINATED BY OD  
 DIST Toronto HWY 401 BOREHOLE TYPE Truck Mount CME 75 / SSA COMPILED BY OD  
 DATUM Geodetic DATE 2022.10.25 - 2022.10.25 LATITUDE 43.774992 LONGITUDE -79.284215 CHECKED BY SM/TL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
								○ UNCONFINED + FIELD VANE								
● QUICK TRIAXIAL P. PENETROMETER																
								WATER CONTENT (%)								
								W <sub>P</sub> — W — W <sub>L</sub>								
								PLASTIC LIMIT — NATURAL MOISTURE CONTENT — LIQUID LIMIT								
176.4																
0.0	<b>PAVEMENT STRUCTURE</b> - 150 mm of asphalt, and 310 mm of concrete		AS1	AS			176							22.9	2 26 51 21	
175.9																
175.6																
0.8			<b>GRAVELLY SAND (FILL)</b> - brown, wet	SS2	SS	30		175								
175.2			- The sample is wet from coring process													
1.2			<b>SILTY SAND (FILL)</b> - some gravel, brown, moist, compact	SS3	SS	15		174								
			<b>CLAYEY SILT (FILL)</b> - sandy, trace to some gravel, brown to grey, slightly moist to moist, firm to hard	SS4	SS	19		173								
			- Becomes grey at a depth of 1.5 m													
			- Thin layer of sand were encountered between depths of 2.3 m and 2.7 m	SS5	SS	12		172								
				SS6	SS	7		171								
		SS7	SS	34		170										
168.8							169							7 32 42 20 Corrosivity Sample		
7.6	<b>SILTY SAND (FILL)</b> - some gravel, greyish brown, moist, loose	SS8	SS	7		168										
	- Thin layer of clayey silt were encountered below 8.0 m.															
167.3																
9.1	<b>SAND AND SILT</b> - trace to some gravel, trace to some clay, brown, moist, compact to dense	SS9	SS	46		167										
		SS10	SS	23		166										
165.7	- Becomes grey at a depth of 10.3 m															
10.7	<b>SANDY SILT</b> - trace gravel, some clay, greyish brown, moist, loose	SS11	SS	6		165										
164.2																
12.2	<b>SILT</b> - trace gravel, some sand, trace to some clay, grey, moist to wet, dense to very dense	SS12	SS	100/127 mm		164										
		SS13	SS	150		163										
						162										
160.6			SS14	SS	50		161						23.6	1 16 72 11 Non-Plastic		
15.8	<b>END OF BOREHOLE</b>															
	NOTES: 1) Groundwater level was encountered at a depth of 11.8 m upon completion of drilling															

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MTO H401 - KENNEDY RD OVERPASS-090122023.GPJ ONTARIO MTO.GDT 7/24/23

Brampton, Ontario

## RECORD OF BOREHOLE No BH22-4-04A

1 OF 1

METRIC

W.P. Site 37X-0214/B1&B3 LOCATION Hwy 401 - Kennedy Road O/P, Toronto, ON, MTM ON-10 322193.1E 4848331.9N ORIGINATED BY OD  
 DIST Toronto HWY 401 BOREHOLE TYPE Truck Mount CME 75 / SSA COMPILED BY OD  
 DATUM Geodetic DATE 2022.10.31 - 2022.10.31 LATITUDE 43.774743 LONGITUDE -79.283939 CHECKED BY SM/TL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT  $\gamma$ kN/m <sup>3</sup>	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						PLASTIC LIMIT W <sub>p</sub> NATURAL MOISTURE CONTENT W LIQUID LIMIT W <sub>L</sub> WATER CONTENT (%)	
176.2 0.0 175.8 0.4	<b>PAVEMENT STRUCTURE</b> - 200 mm of asphalt, and 150 mm of concrete  <b>GRAVELLY SAND (FILL)</b> - brown to greyish brown, moist, dense - Becomes dark grey to black at a depth of 1.3 m <b>CLAYEY SILT (FILL)</b> - trace gravel, grey, moist, stiff														
			AS1	AS											
				SS2	SS	33									
174.7 1.5				SS3	SS	13									
				SS4	SS	12									
				SS5	SS	10									
171.9 4.3	<b>END OF BOREHOLE</b>  NOTES: 1) Borehole terminated at 4.3 m due to encountering an obstruction at this depth. 2) A companion borehole (BH22-4-4B) was drilled 2.8 m northeast BH22-4-4A. 3) No groundwater was encountered in open borehole upon completion of drilling.														

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



Brampton, Ontario

## RECORD OF BOREHOLE No BH22-4-04B

1 OF 1

## METRIC

W.P. Site 37X-0214/B1&B3 LOCATION Hwy 401 - Kennedy Road O/P, Toronto, ON, MTM ON-10 322194.2E 4848333.9N ORIGINATED BY OD  
 DIST Toronto HWY 401 BOREHOLE TYPE Truck Mount CME 75 / SSA COMPILED BY OD  
 DATUM Geodetic DATE 2022.11.14 - 2022.11.14 LATITUDE 43.7747611 LONGITUDE -79.283925 CHECKED BY SM/TL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ  kN/m <sup>3</sup>	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									
176.2	<b>PAVEMENT STRUCTURE</b> - 200 mm of asphalt, and 150 mm of concrete - Continuation of BH 22-4-4A - Auger drilling to a depth of 4.6 m																		
0.0																			
175.8																			
0.4																			
171.6	<b>CLAYEY SILT (FILL)</b> - trace gravel, brown to grey, moist, stiff  - Becomes grey at a depth of 6.1 m		SS6	SS	12										23.2	3 36 42 19			
4.6																			
168.3	<b>SANDY SILT (FILL)</b> - some gravel, trace clay, brown to grey, moist, loose		SS7	SS	12										19.5				
7.9																			
167.1	<b>SANDY SILT</b> - trace gravel, trace to some clay, brown to grey, moist, dense to very dense  - Becomes grey at a depth of 10.7 m		SS8	SS	8														
9.1																			
164.0	<b>SAND AND SILT</b> - trace gravel, trace clay, grey, moist to wet, very dense		SS9	SS	35										22.3	1 31 59 9			
12.2																			
160.5			SS10	SS	54										23.1				
160.5			SS11	SS	49														
160.5			SS12	SS	54														
160.5			SS13	SS	60														
160.5			SS14	SS	105										22.8				
15.7	<b>END OF BOREHOLE</b>  NOTES: 1) Groundwater level was encountered at a depth of 13.3 m upon completion of drilling.																		

METRIC

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○<sup>3%</sup> STRAIN AT FAILURE

Brampton, Ontario

## RECORD OF BOREHOLE No BH22-4-06

1 OF 1

METRIC

W.P. Site 37X-0214/B1&B3 LOCATION Hwy 401 - Kennedy Road O/P, Toronto, ON, MTM ON-10 322080.0E 4848330.0N ORIGINATED BY OD  
 DIST Toronto HWY 401 BOREHOLE TYPE Truck Mount CME 75 / SSA COMPILED BY OD  
 DATUM Geodetic DATE 2022.10.21 - 2022.10.21 LATITUDE 43.774729 LONGITUDE -79.285344 CHECKED BY SM/TL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL & P. PENETROMETER									
176.8								20	40	60	80	100					
176.0	PAVEMENT STRUCTURE - 90 mm of asphalt and 230 mm of concrete		AS1	AS			176										
176.0	SAND AND GRAVEL (FILL) - brown, wet - The sample is wet from coring process		SS2	SS	12		175										
174.5	SILTY SAND (FILL) - some gravel, brown, moist, compact		SS3	SS	12		174										
2.3	CLAYEY SILT (FILL) - trace gravel, brown to grey, moist, stiff to very stiff		SS4	SS	11		173										
			SS5	SS	13		172										
			SS6	SS	18		171										
			SS7	SS	17		170										
169.2	SILTY SAND - trace to some gravel, trace to some clay, greyish brown to brown, dry to moist, dense to very dense		SS8	SS	38		169										
			SS9	SS	63		168										
167.7	SANDY SILT - some clay, brown to grey, moist, very dense		SS10	SS	81		167										
166.1	SAND AND SILT - trace clay, grey, moist to wet, very dense		SS11	SS	130		166										
10.7	- Becomes wet at a depth of 12.2 m		SS12	SS	138		165										
162.6			SS13	SS	157		164										
14.2	END OF BOREHOLE						163										
NOTES: 1) No groundwater measured upon completion of open borehole due to cave in. 2) Groundwater level inferred to be 12.2 m based on wet split spoon sampling during drilling.																	

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MTO H401 - KENNEDY RD OVERPASS-090122023.GPJ ONTARIO MTO.GDT 7/24/23

Brampton, Ontario

## RECORD OF BOREHOLE No BH22-4-07

1 OF 1

METRIC

W.P. Site 37X-0214/B1&B3 LOCATION Hwy 401 - Kennedy Road O/P, Toronto, ON, MTM ON-10 322203.5E 4848370.0N ORIGINATED BY OD  
 DIST Toronto HWY 401 BOREHOLE TYPE Truck Mount CME 75 / SSA COMPILED BY OD  
 DATUM Geodetic DATE 2022.10.24 - 2022.10.24 LATITUDE 43.775086 LONGITUDE -79.283809 CHECKED BY SM/TL

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			20 40 60 80 100	20 40 60	W <sub>P</sub> W W <sub>L</sub>	WATER CONTENT (%)	GR SA SI CL		
176.2														
175.9	PAVEMENT STRUCTURE - 100 mm of asphalt and 200 mm of concrete		AS1	AS			176							
175.4	SAND AND GRAVEL (FILL) - brown, wet		SS2	SS	21		175						21.8	
174.9	- The sample is wet from coring process		SS3	SS	12		174							2 39 43 17
	SILTY SAND (FILL) - some gravel, some clay, trace organic, brown to grey, moist, compact		SS4	SS	7		173							
	CLAYEY SILT (FILL) - trace to some gravel, brown to grey, moist to wet, firm to very stiff		SS5	SS	18		172							
	- Black inclusions were encountered at a depth of 1.5 m						171							
			SS6	SS	24		170							2 33 52 13
	- Asphalt inclusions were encountered at a depth of 5.0 m		SS7	SS	20		169							
							168							
	- Organic materials were encountered at a depth of 6.1 m		SS8	SS	11		167							2 29 62 7
			SS9	SS	34		166							
	SANDY SILT - trace to some gravel, trace to some clay, brown to grey, moist, dense to very dense		SS10	SS	36		165							
							164							
			SS11	SS	54		163							
							162							1 25 49 26
			SS12	SS	100/ 100 mm		161							
			SS13	SS	170/ 228 mm									
	-clayey silt seam													
160.9	END OF BOREHOLE		SS14	SS	100/ 76 mm									
15.3	NOTES: 1) Groundwater level was encountered at a depth of 14.1 m upon completion of drilling.													

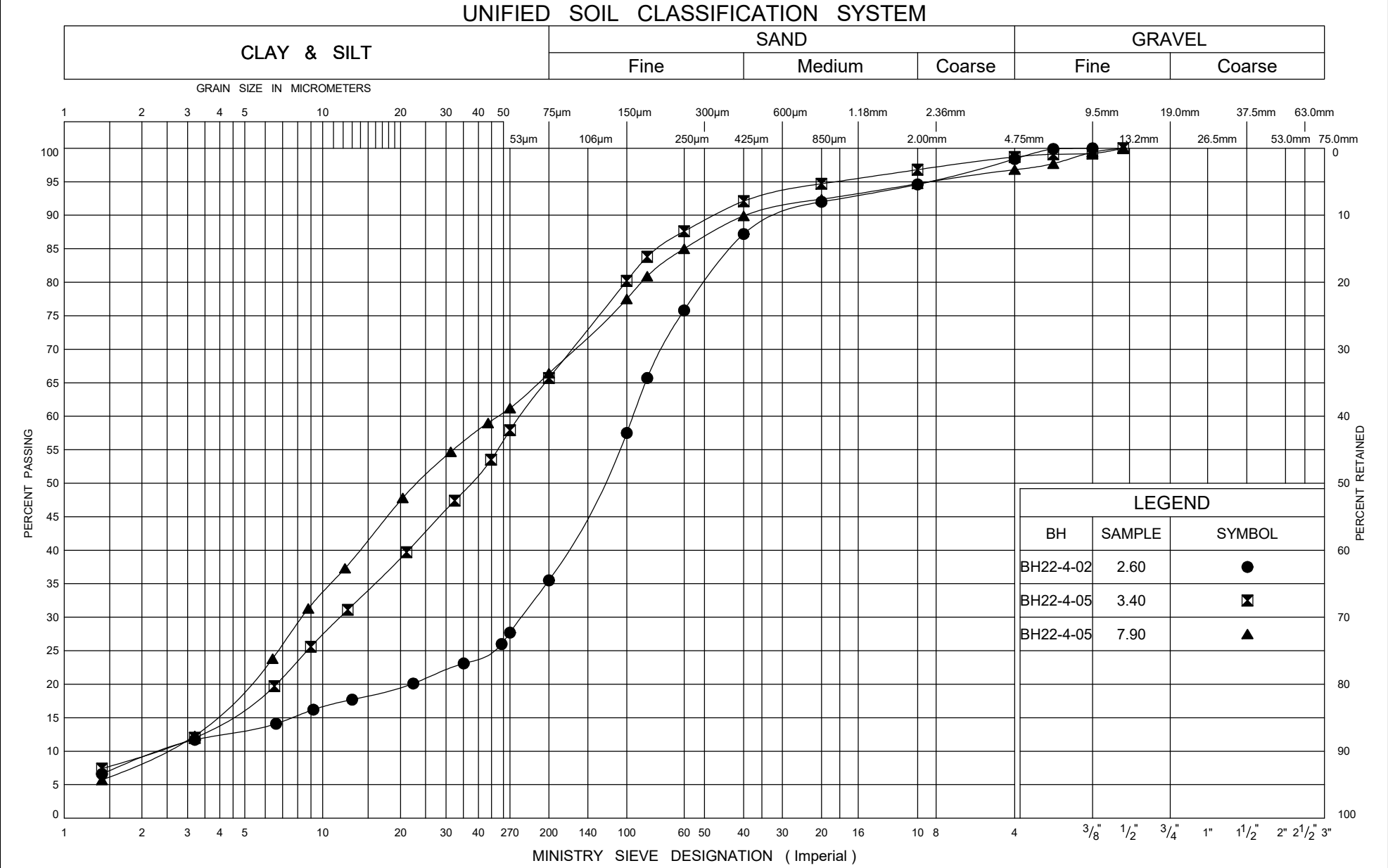
+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MTO H401 - KENNEDY RD OVERPASS-090122023.GPJ ONTARIO MTO.GDT 7/24/23

EXP Services Inc.

*Foundation Investigation and Design Report  
Highway 401 Eastbound from Victoria Park Avenue to Neilson Road  
Superstructure Replacement at Kennedy Road Overpass  
Eastbound Core and Collectors Structure (Site 37X-0216/B1 & B3)  
Assignment No. 2021-E-0018  
Date: December 20, 2024*

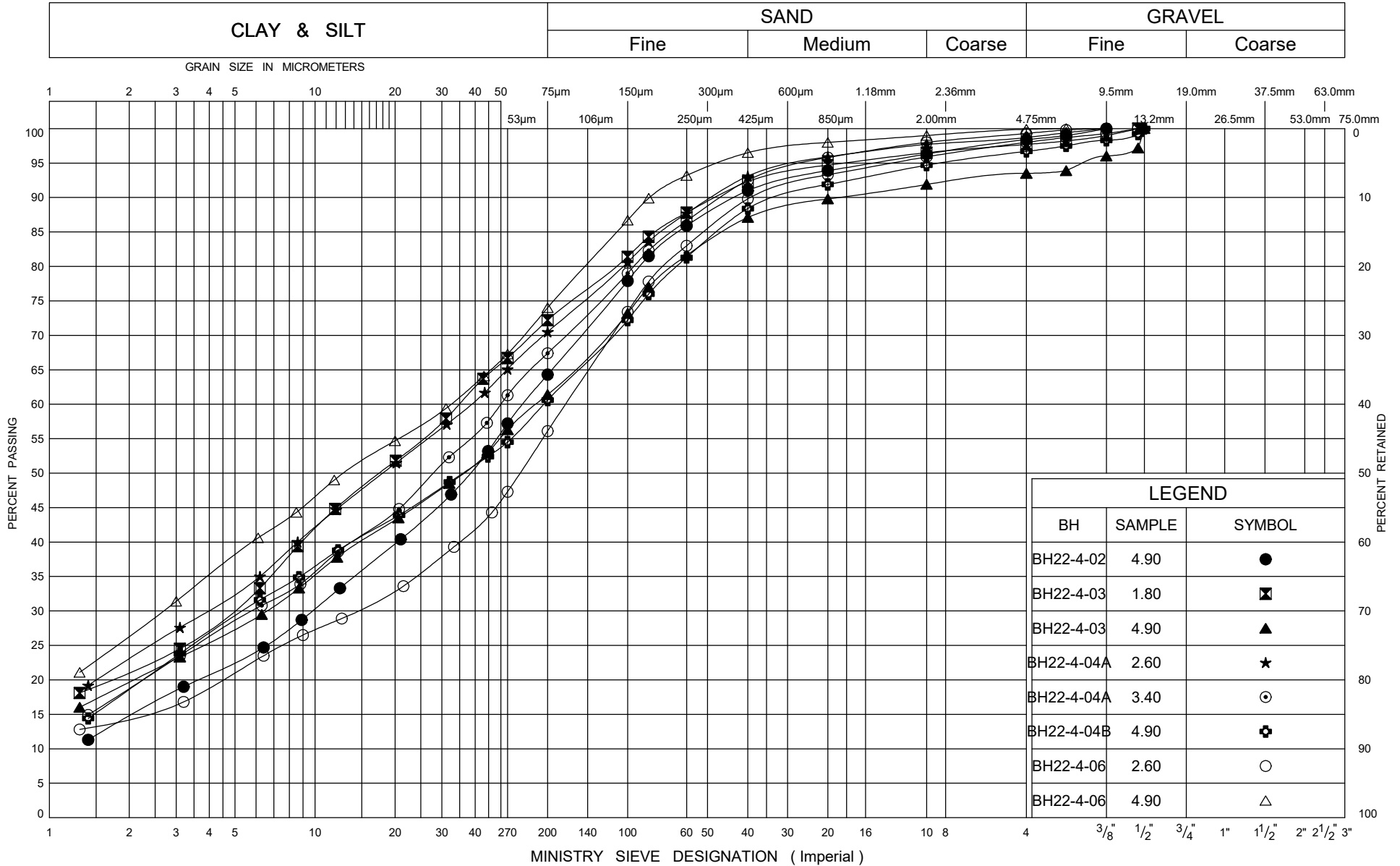
## Appendix E – Laboratory Data



**GRAIN SIZE DISTRIBUTION**  
Sand/Sandy Silt/Silty Sand Fill

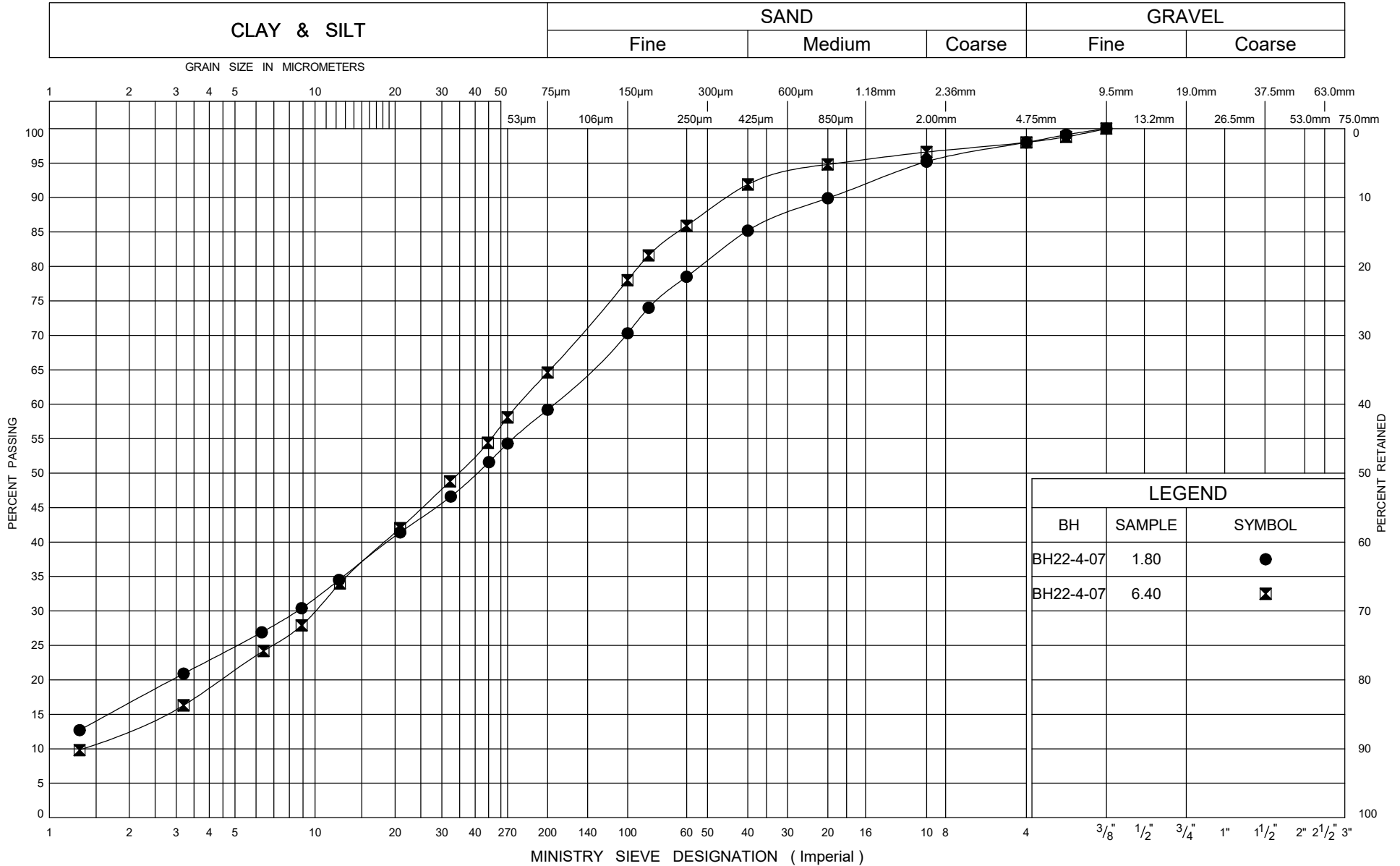
FIG No 1  
W P Site 37X-0214/B1&B3  
Hwy 401 - Kennedy Road O/P

# UNIFIED SOIL CLASSIFICATION SYSTEM

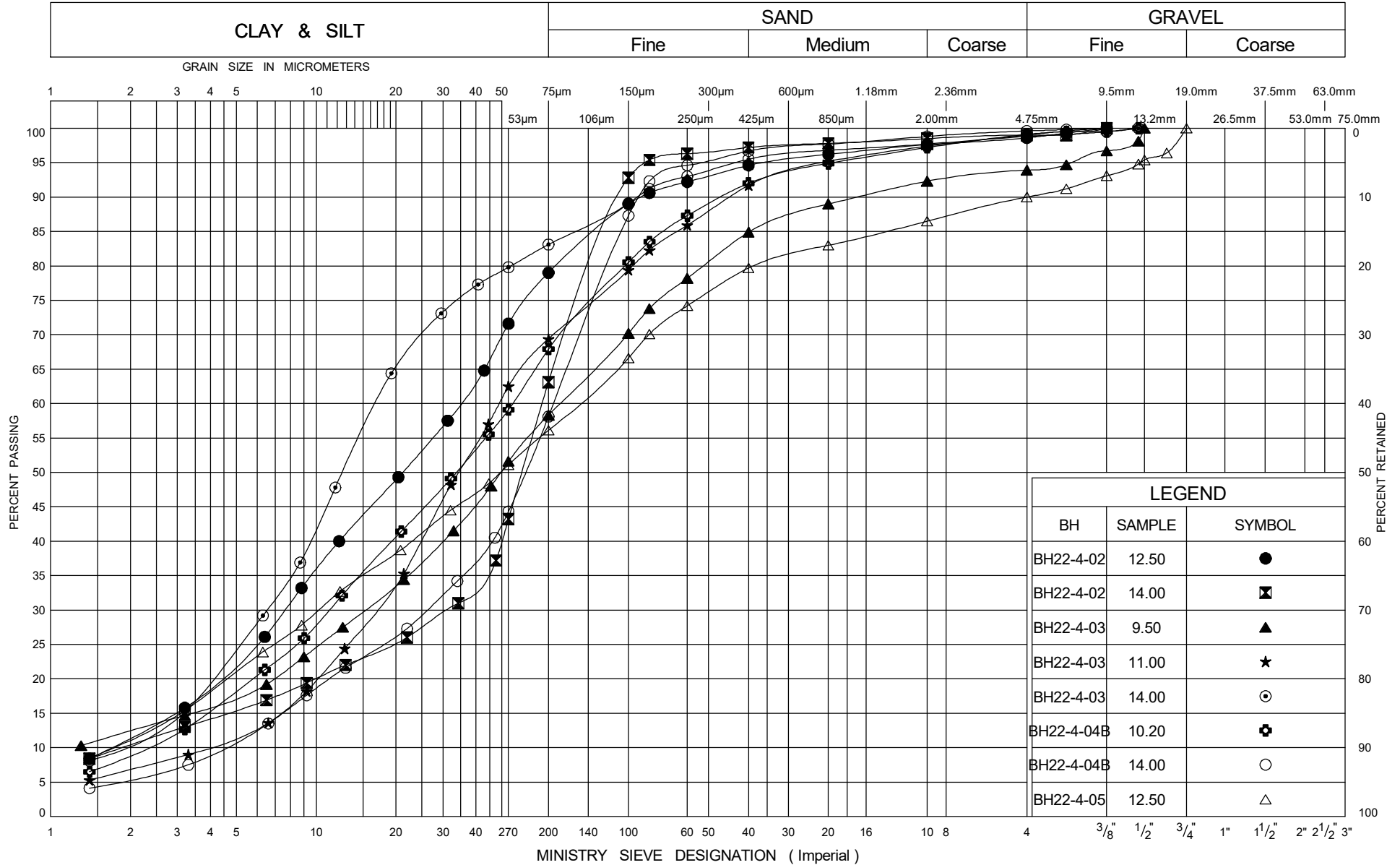




# UNIFIED SOIL CLASSIFICATION SYSTEM



# UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of  
Transportation

## GRAIN SIZE DISTRIBUTION

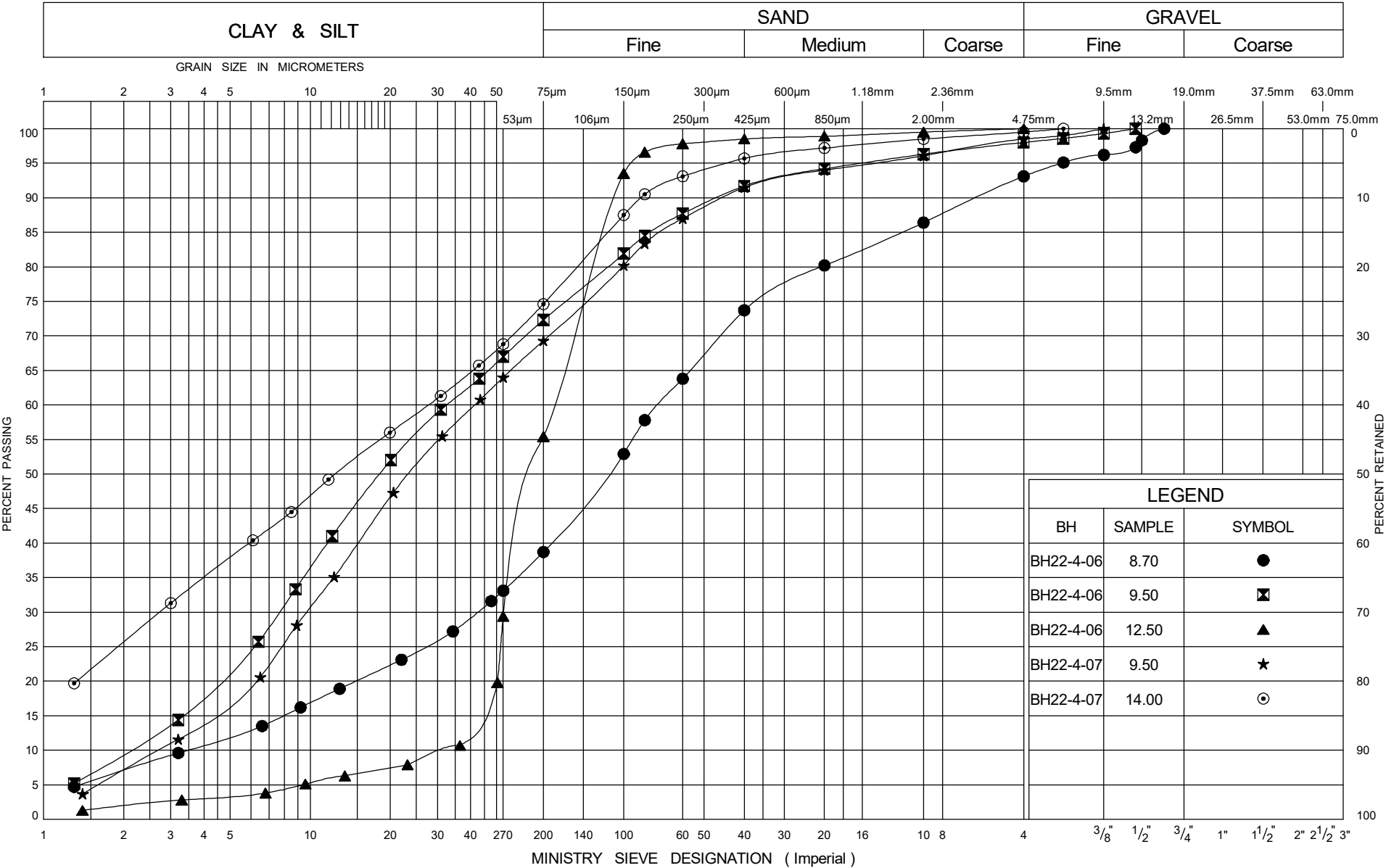
Sandy Silt/Sand and Silt/Silty Sand/Silt

FIG No 3a

W P Site 37X-0214/B1&B3

Hwy 401 - Kennedy Road O/P

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of  
Transportation

GRAIN SIZE DISTRIBUTION

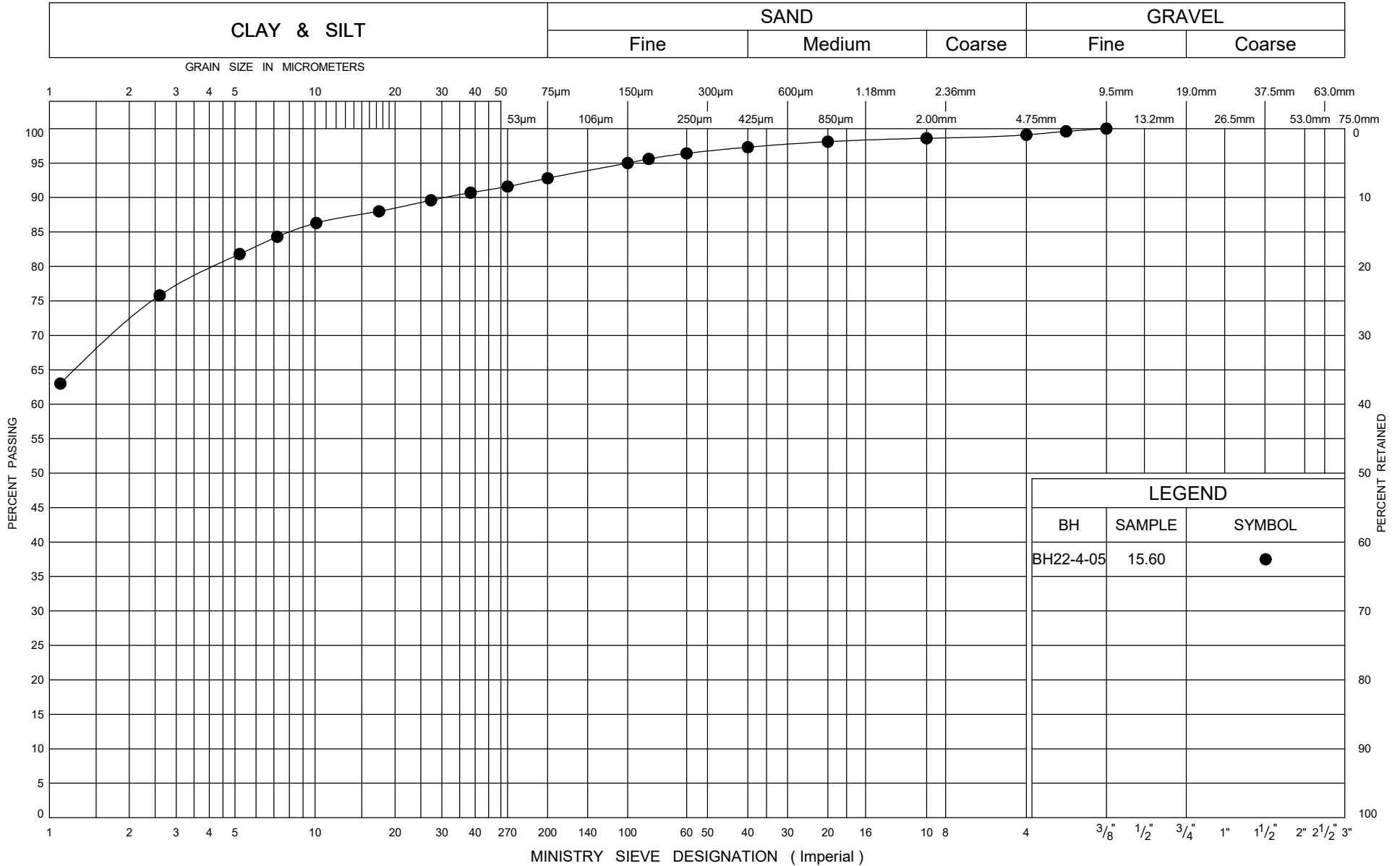
Sandy Silt/Sand and Silt/Silty Sand/Silt

FIG No 3b

W P Site 37X-0214/B1&B3

Hwy 401 - Kennedy Road O/P

# UNIFIED SOIL CLASSIFICATION SYSTEM



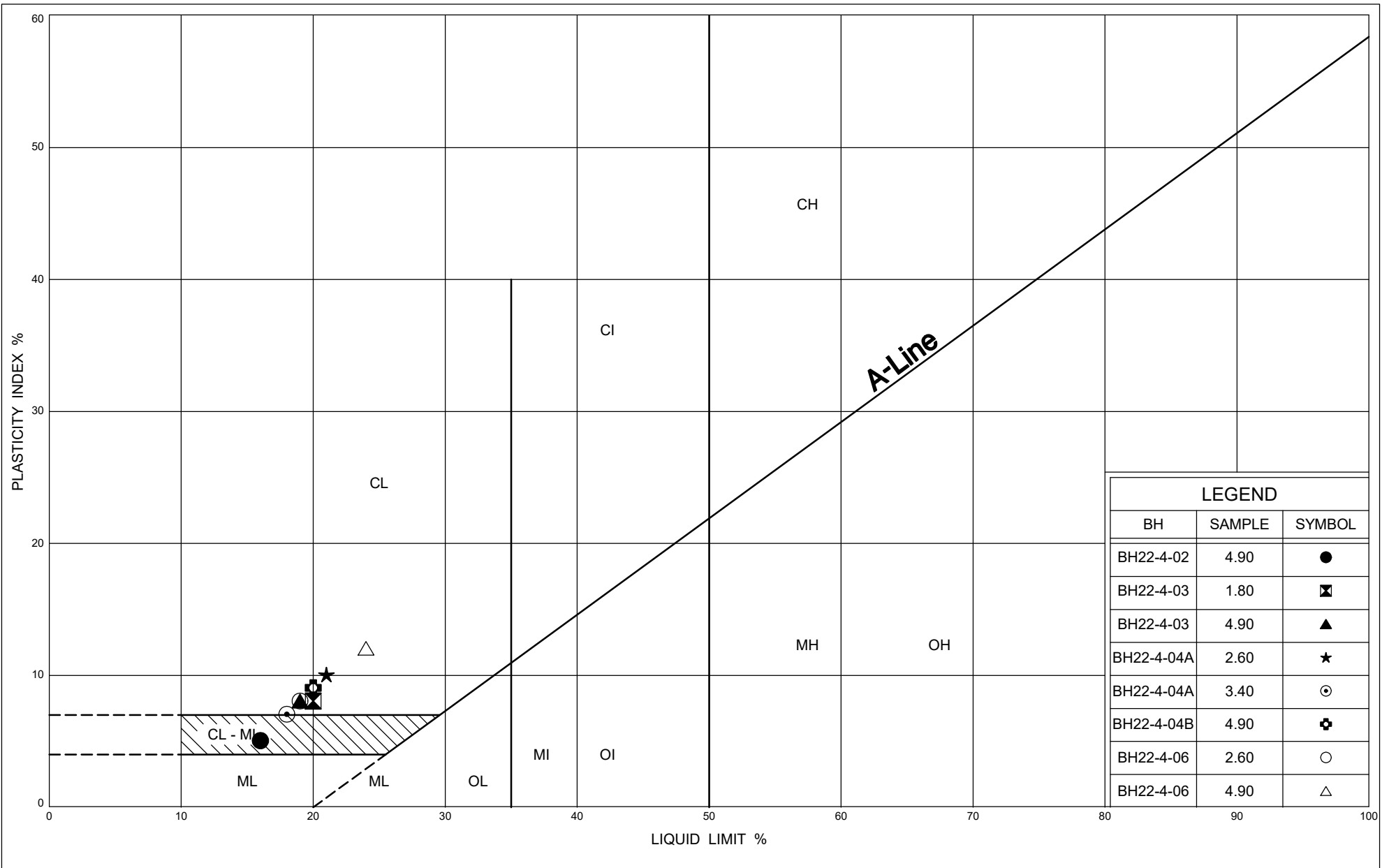
## GRAIN SIZE DISTRIBUTION

Silty Clay

FIG No 4

W P Site 37X-0214/B1&B3

Hwy 401 - Kennedy Road O/P



Ministry of  
Transportation

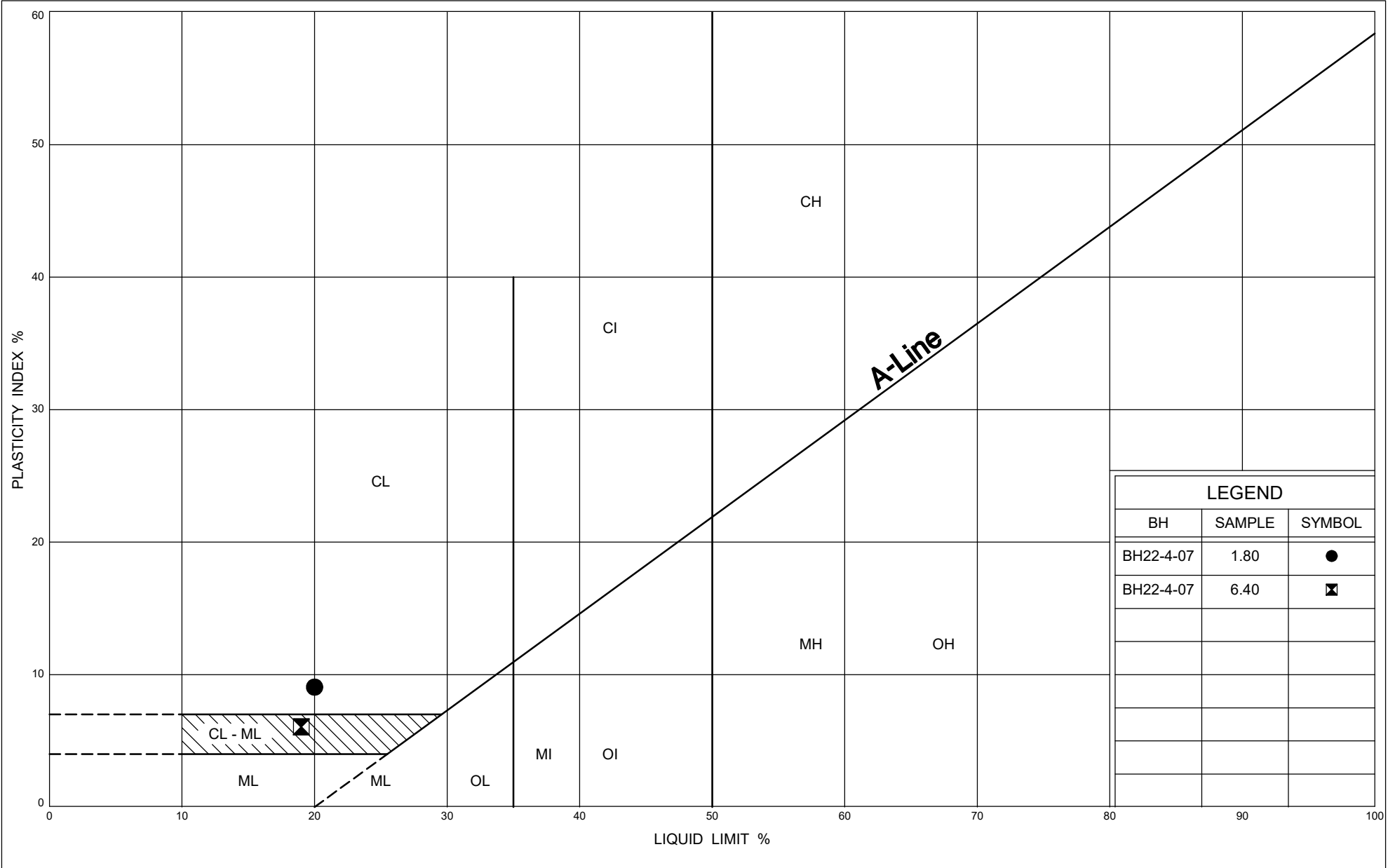
## PLASTICITY CHART

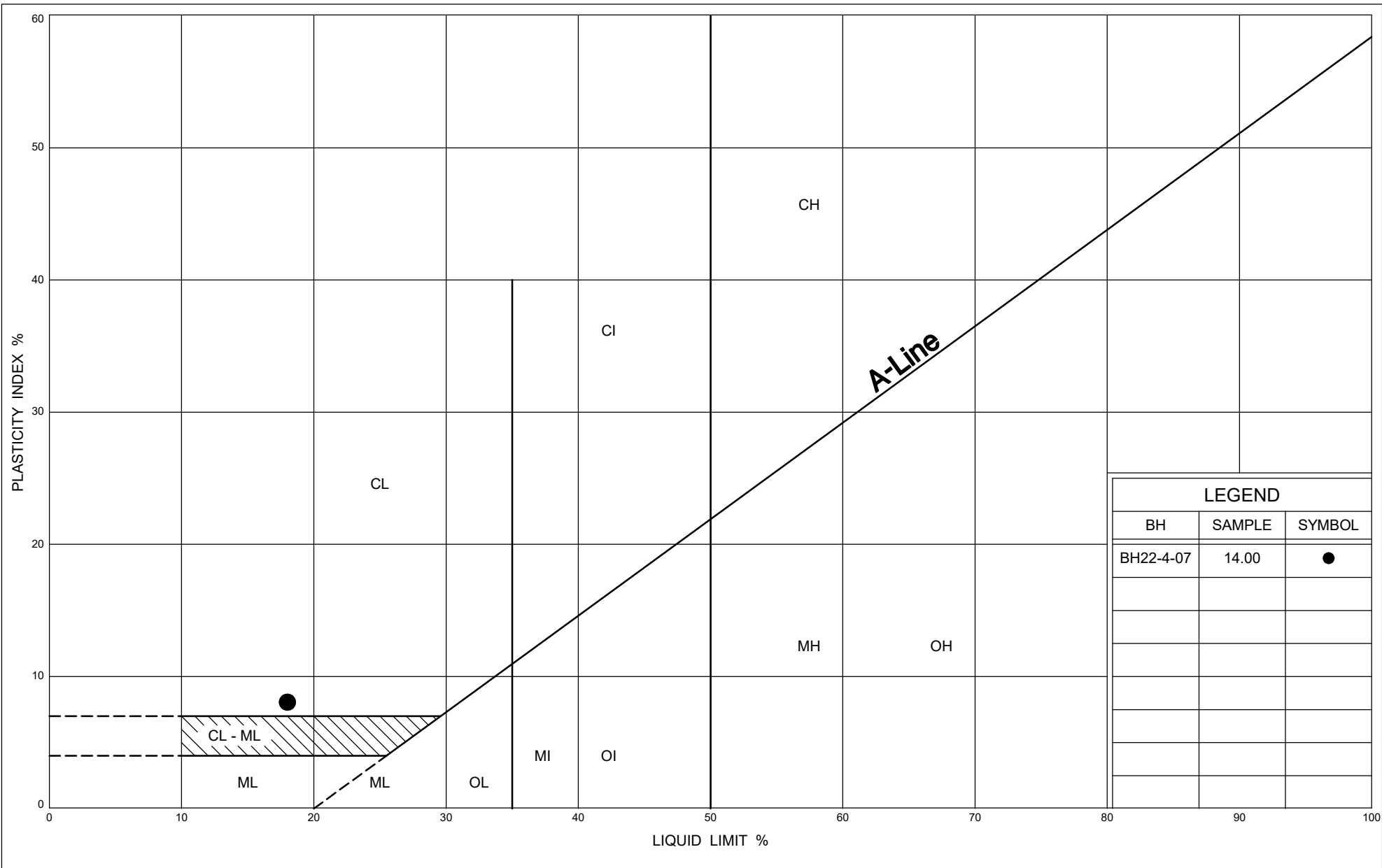
Cohesive Fill

FIG No 5a

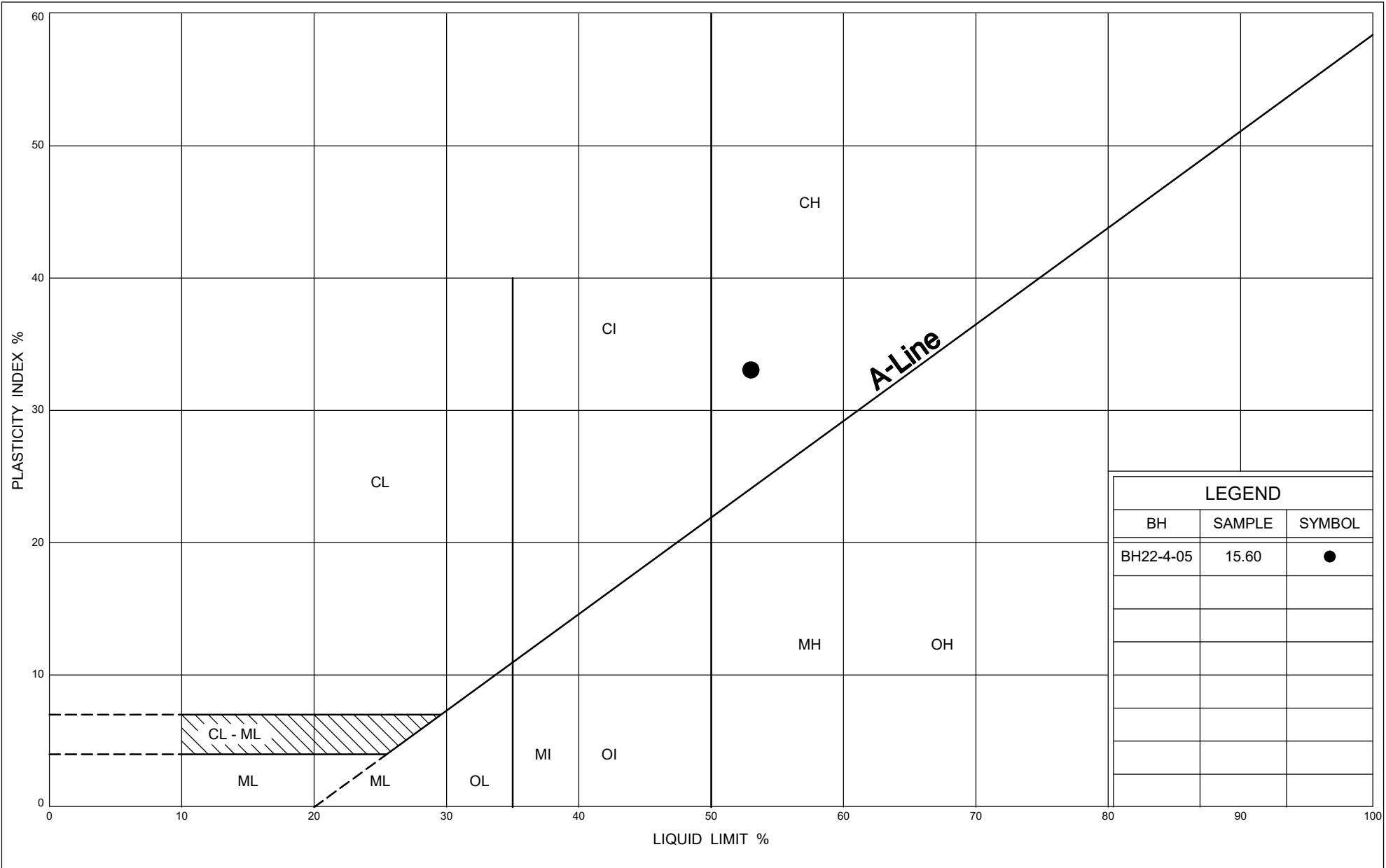
W P Site 37X-0214/B1&B3

Hwy 401 - Kennedy Road O/P











Your Project #: ADM-22000797-A0  
Your C.O.C. #: 903374-01-01

**Attention: Nimesh Tamrakar**

exp Services Inc  
Brampton Branch  
1595 Clark Blvd  
Brampton, ON  
CANADA L6T 4V1

**Report Date: 2022/11/08**  
Report #: R7378236  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BUREAU VERITAS JOB #: C2V5874**

**Received: 2022/10/28, 11:51**

Sample Matrix: Soil  
# Samples Received: 2

Analyses	Quantity	Date	Date	Laboratory Method	Analytical Method
		Extracted	Analyzed		
Chloride (20:1 extract)	2	2022/11/03	2022/11/04	CAM SOP-00463	SM 23 4500-Cl E m
Conductivity	2	2022/11/03	2022/11/03	CAM SOP-00414	OMOE E3530 v1 m
Moisture (Subcontracted) (1, 2)	2	N/A	2022/11/03	AB SOP-00002	CCME PHC-CWS m
Sulphide in Soil (1)	2	N/A	2022/11/02	AB SOP-00080	EPA9030B/SM4500S2-DF
pH CaCl2 EXTRACT	2	2022/11/03	2022/11/03	CAM SOP-00413	EPA 9045 D m
Redox Potential (3)	2	2022/11/03	2022/11/04	CAM SOP-00421	SM 2580 B
Resistivity of Soil	2	2022/10/28	2022/11/04	CAM SOP-00414	SM 23 2510 m
Sulphate (20:1 Extract)	2	2022/11/03	2022/11/07	CAM SOP-00464	EPA 375.4 m

**Remarks:**

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

\* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This test was performed by Bureau Veritas Calgary (19th), 4000 19th Street NE, Calgary, AB, T2E 6P8

(2) Offsite analysis requires that subcontracted moisture be reported.



Your Project #: ADM-22000797-A0  
Your C.O.C. #: 903374-01-01

**Attention: Nimesh Tamrakar**

exp Services Inc  
Brampton Branch  
1595 Clark Blvd  
Brampton, ON  
CANADA L6T 4V1

**Report Date: 2022/11/08**  
Report #: R7378236  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BUREAU VERITAS JOB #: C2V5874**

**Received: 2022/10/28, 11:51**

(3) Oxidation-Reduction Potential (ORP) values are determined using a Ag/AgCl reference electrode. The test is therefore, not SCC accredited for this matrix.

**Encryption Key**

Please direct all questions regarding this Certificate of Analysis to:

Patricia Legette, Project Manager

Email: Patricia.Legette@bureauveritas.com

Phone# (905)817-5799

=====

This report has been generated and distributed using a secure automated process.

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.

**SOIL CORROSIVITY PACKAGE (SOIL)**

Bureau Veritas ID		UDK776		UDK777			UDK777		
Sampling Date		2022/10/25 15:00		2022/10/23 15:00			2022/10/23 15:00		
COC Number		903374-01-01		903374-01-01			903374-01-01		
	<b>UNITS</b>	<b>22-4-2 SS11</b>	<b>QC Batch</b>	<b>22-4-3 SS6</b>	<b>RDL</b>	<b>QC Batch</b>	<b>22-4-3 SS6 Lab-Dup</b>	<b>RDL</b>	<b>QC Batch</b>

**Calculated Parameters**

Resistivity	ohm-cm	970	8313871	1100		8313871			
-------------	--------	-----	---------	------	--	---------	--	--	--

**CONVENTIONALS**

Redox Potential	mV	210	8325057	220	N/A	8325057			
-----------------	----	-----	---------	-----	-----	---------	--	--	--

**Inorganics**

Soluble (20:1) Chloride (Cl-)	ug/g	470	8324034	400	20	8324034			
Conductivity	umho/cm	1030	8325071	895	2	8325071	889	2	8325071
Available (CaCl2) pH	pH	7.91	8324644	7.89		8324213			
Soluble (20:1) Sulphate (SO4)	ug/g	77	8324043	<20	20	8324043			
Sulphide	mg/kg	<0.5 (1)	8331974	<0.5 (2)	0.5	8331974			

**Physical Testing**

Moisture-Subcontracted	%	8.6	8331973	12	0.30	8331973			
------------------------	---	-----	---------	----	------	---------	--	--	--

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate

N/A = Not Applicable

(1) Sample contained greater than 10% headspace at time of extraction. Sample extracted past method-specified hold time.  
Analyzed past method specified hold time(2) Sample contained greater than 10% headspace at time of extraction. Sample extracted past method-specified hold time.  
Analyzed past method specified hold time



**BUREAU  
VERITAS**

Bureau Veritas Job #: C2V5874

Report Date: 2022/11/08

exp Services Inc

Client Project #: ADM-22000797-A0

Sampler Initials: NT

## TEST SUMMARY

**Bureau Veritas ID:** UDK776  
**Sample ID:** 22-4-2 SS11  
**Matrix:** Soil

**Collected:** 2022/10/25  
**Shipped:**  
**Received:** 2022/10/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8324034	2022/11/03	2022/11/04	Samuel Law
Conductivity	AT	8325071	2022/11/03	2022/11/03	Surinder Rai
Moisture (Subcontracted)	BAL	8331973	N/A	2022/11/03	Winston Lee
Sulphide in Soil	SPEC	8331974	N/A	2022/11/02	Ly Vu
pH CaCl <sub>2</sub> EXTRACT	AT	8324644	2022/11/03	2022/11/03	Taslina Aktar
Redox Potential	COND	8325057	2022/11/03	2022/11/04	Surinder Rai
Resistivity of Soil		8313871	2022/11/04	2022/11/04	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8324043	2022/11/03	2022/11/07	Samuel Law

**Bureau Veritas ID:** UDK777  
**Sample ID:** 22-4-3 SS6  
**Matrix:** Soil

**Collected:** 2022/10/23  
**Shipped:**  
**Received:** 2022/10/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8324034	2022/11/03	2022/11/04	Samuel Law
Conductivity	AT	8325071	2022/11/03	2022/11/03	Surinder Rai
Moisture (Subcontracted)	BAL	8331973	N/A	2022/11/03	Winston Lee
Sulphide in Soil	SPEC	8331974	N/A	2022/11/02	Ly Vu
pH CaCl <sub>2</sub> EXTRACT	AT	8324213	2022/11/03	2022/11/03	Taslina Aktar
Redox Potential	COND	8325057	2022/11/03	2022/11/04	Surinder Rai
Resistivity of Soil		8313871	2022/11/04	2022/11/04	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8324043	2022/11/03	2022/11/07	Samuel Law

**Bureau Veritas ID:** UDK777 Dup  
**Sample ID:** 22-4-3 SS6  
**Matrix:** Soil

**Collected:** 2022/10/23  
**Shipped:**  
**Received:** 2022/10/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Conductivity	AT	8325071	2022/11/03	2022/11/03	Surinder Rai



### GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	0.3°C
-----------	-------

**Results relate only to the items tested.**



BUREAU  
VERITAS

Bureau Veritas Job #: C2V5874

Report Date: 2022/11/08

## QUALITY ASSURANCE REPORT

exp Services Inc

Client Project #: ADM-22000797-A0

Sampler Initials: NT

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
8324034	Soluble (20:1) Chloride (Cl <sup>-</sup> )	2022/11/04	111	70 - 130	108	70 - 130	<20	ug/g	NC	35
8324043	Soluble (20:1) Sulphate (SO <sub>4</sub> )	2022/11/07	119	70 - 130	109	70 - 130	<20	ug/g	NC	35
8324213	Available (CaCl <sub>2</sub> ) pH	2022/11/03			100	97 - 103			0.38	N/A
8324644	Available (CaCl <sub>2</sub> ) pH	2022/11/03			100	97 - 103			0.86	N/A
8325057	Redox Potential	2022/11/04			101	95 - 105			3.9	N/A
8325071	Conductivity	2022/11/03			104	90 - 110	<2	umho/cm	0.68	10
8331973	Moisture-Subcontracted	2022/11/03					<0.30	%		
8331974	Sulphide	2022/11/02	65 (1)	75 - 125	108	75 - 125	<0.5	mg/kg		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Matrix spike exceeds acceptance limits due to matrix interference.





BUREAU  
VERITAS

Bureau Veritas Job #: C2V5874

Report Date: 2022/11/08

exp Services Inc

Client Project #: ADM-22000797-A0

Sampler Initials: NT

### VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Anastassia Hamanov, Scientific Specialist

Veronica Falk, B.Sc., P.Chem., QP, Scientific Specialist, Organics

Suwan (Sze Yeung) Fock, B.Sc., Scientific Specialist

---

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Bureau Veritas  
6740 Campbell Road, Mississauga, Ontario Canada L5N 2L8 Tel: (905) 817-5700 Toll-free: 800-563-6266 Fax: (905) 817-5777 www.bvna.com

CHAIN OF

28-Oct-22 11:51

Patricia Legette  
C2V5874

AN4 ENV-778

903374

Project Manager:

Patricia Legette

INVOICE TO:			REPORT TO:			PROJECT INFORMATION:					
Company Name: #17488 exp Services Inc			Company Name: Nimesh Tamrakar			Quotation #: C20328					
Attention: Accounts Payable			Attention: Nimesh Tamrakar			P.O. #:					
Address: 1595 Clark Blvd			Address:			Project: ADM-22000797-A0					
Brampton ON L6T 4V1						Project Name:					
Tel: (905) 793-9800 Fax: (905) 793-0641			Tel: (905) 796-3200 Ext: 3026 Fax:			Site #:					
Email: AP@exp.com; Karen.Burke@exp.com			Email: Nimesh.Tamrakar@exp.com			Sampled By:					
MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BUREAU VERITAS DRINKING WATER CHAIN OF CUSTODY						ANALYSIS REQUESTED (PLEASE BE SPECIFIC)					
Regulation 153 (2011)		Other Regulations		Special Instructions		Field Filtered (please circle): Metals / Hg / Cr-VI					
<input type="checkbox"/> Table 1	<input type="checkbox"/> Res/Park	<input type="checkbox"/> Medium/Fine	<input type="checkbox"/> CCME	<input type="checkbox"/> Sanitary Sewer Bylaw		50.1 CONTAMINANT PACKAGE					
<input type="checkbox"/> Table 2	<input type="checkbox"/> Ind/Comm	<input type="checkbox"/> Coarse	<input type="checkbox"/> Reg 558	<input type="checkbox"/> Storm Sewer Bylaw							
<input type="checkbox"/> Table 3	<input type="checkbox"/> Agri/Other	<input type="checkbox"/> For RSC	<input type="checkbox"/> MISA	<input type="checkbox"/> Municipality							
<input type="checkbox"/> Table			<input type="checkbox"/> PWQO	<input type="checkbox"/> Reg 406 Table							
Include Criteria on Certificate of Analysis (Y/N)?											
Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix							
1	22-4-2 SS11	Oct 25/23	03:00 AM								
2	22-4-2 SS11	Oct 25/23	03:00 AM								
3	22-4-3 SS6	Oct 24/23	03:00 AM								
4	22-4-3 SS6	Oct 24/23	05:00 AM								
5											
6											
7											
8											
9											
10											
* RELINQUISHED BY: (Signature/Print)		Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)		Date: (YY/MM/DD)	Time	# jars used and not submitted		Laboratory Use Only	
										Time Sensitive	Temperature (°C) on Reel
										0/0/1	
										Custody Seal	Yes
										Present	No
										Intact	
* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BUREAU VERITAS'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVNA.COM/ENVIRONMENTAL-LABORATORIES/RESOURCES/COCS-TERMS-AND-CONDITIONS.										White: Bureau Veritas Yellow: Client	
* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.										SAMPLES MUST BE KEPT COOL ( < 10° C ) FROM TIME OF SAMPLING UNTIL DELIVERY TO BUREAU VERITAS	
** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT WWW.BVNA.COM/ENVIRONMENTAL-LABORATORIES/RESOURCES/CHAIN-CUSTODY-FORMS-COCS.											

Bureau Veritas Canada (2019) Inc.

## Appendix F – Previous Investigation - BH logs

DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS &amp; TESTING DIVISION

JOB 66-E-33

LOCATION  Hwy. 401 & Kennedy Rd. Sta. 344/11 64' Rt.

ORIGINATED BY V.K.

W. P. \_\_\_\_\_ BORING DATE April 4, 1966

COMPILED BY V.K.

DATUM Geodetic BOREHOLE TYPE Penn-Drill

CHECKED BY 2/5

## RECORD OF BOREHOLE NO. 1.

FOUNDATION SECTION

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W		BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		20 40 60 80 100	Wp ———— W ———— WL			
<b>167.9</b>	Ground Level										
521.0											
0.0						550					Gr-2 Sa-14 Si-78 Cl-6
	Bandy Silt to Silty Sand with traces of Gravel and Clay		1	SS	39						W.L. 545.5 5.5
			2	SS	72						
			3	SS	116/6"	540					
	Dense to V. Dense		4	SS	100						
			5	SS	66						Gr-2 Sa-8 Si-82 Cl-3
			6	SS	120	530					
			7	SS	100/4"						
<b>158.8</b>											
521.0											
30.0											Gr-5 Sa-21 Si-52 Cl-22
	Heterogeneous mixture of Clayey Silt, Sand and Gravel		8	SS	100/4"	520					
	GLACIAL TILL		9	SS	100/4"						
	Hard		10	SS	100/5"	510					
			11	SS	100/3"						
201.0											
50.0	End of Borehole					500					

FOUNDATION SECTION

MATERIALS &amp; TESTING DIVISION

JOB 66-F-33

LOCATION Hwy. 401 & Kennedy Rd. Sta. 342-84 140' Rt.

ORIGINATED BY V.K.

W. P. BORING DATE April 12, 1966

COMPILED BY \_\_\_\_\_ V.K.

DATUM Ordville SOREHOLE TYPE Penn - Drill

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— WL			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT					PLASTIC LIMIT ——— WP				
							20	40	60	80	100	WATER CONTENT ——— W				
							SHEAR STRENGTH P.S.F.					WP	W	WL		
559.0	Ground Level															
0.0																
	Fandy Silt to Silty Sand with traces of Gravel and Clay		1	SS	12	550									Gr-2 Sa-52	
			2	SS	36											Si-39 Cl-7
			3	SS	82/6"											Gr-1 Sa-30
			4	SS	119											Si-65 Cl-4
			5	SS	170/10"											W.L. = 545.0 14.0
	Compact to very Dense					540										
			6	SS	100/7"											
			7	SS	100/5"											
529.0						530										
30.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel		8	SS	136/11"											
			9	SS	112										Gr-5 Sa-28	
	GLACIAL TILL		10	SS	100/4"	520									Si-58 Cl-9	
512.5	Hard		11	SS	100/4"											
46.5																

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — WL		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	SHEAR STRENGTH P.S.F.	PLASTIC LIMIT — WP	WATER CONTENT — W		
551.8	GROUND LEVEL										
0.0	Clayey silt, sand & gravel (fill)	1	SS	14	550						Gr. 3, Sa. 35 Sl. 51, Cl. 11
546.8	(Brown)	2	SS	37							
5.0	Sandy silt to silty sand with traces of gravel and	3	SS	57							Gr. 0, Sa. 35 Sl. 59, WL. 12, Cl. 6
	(Grey)	4	SS	68	540						
	occasional layers of clayey silt.	5	SS	28							Gr. 1, Sa. 29 Sl. 66, Cl. 4
	Compact to very dense	6	SS	189	530						
		7	SS	100	6"						
		8	SS	100	4"	520					
517.8											
34.0	Clayey silt with sand and trace of gravel	9	SS	100	6"						Gr. 1, Sa. 25 Sl. 46, Cl. 28
	(Hard)	10	SS	100	5"	510					
507.8											
44.0	Glacial till Het mixture of clayey silt, sand and gravel.	11	SS	100	6"	500					Gr. 0, Sa. 85 Sl. & Cl. 15
	Hard or Very Dense	12	SS	100	4"						
490.3											
61.5	End of Borehole	13	SS	100	6"	490					