



Foundation Investigation Report

Highway 401 Eastbound Express and Collector Lanes between Victoria Park Avenue and Neilson Road - **Superstructure Replacement at Midland Avenue Overpass Eastbound Core and Collectors Structure (Site 37X-0216/B1 & B3)**

Assignment No. 2021-E-0018
MTO Central Region
Geocres Number: 30M14-553

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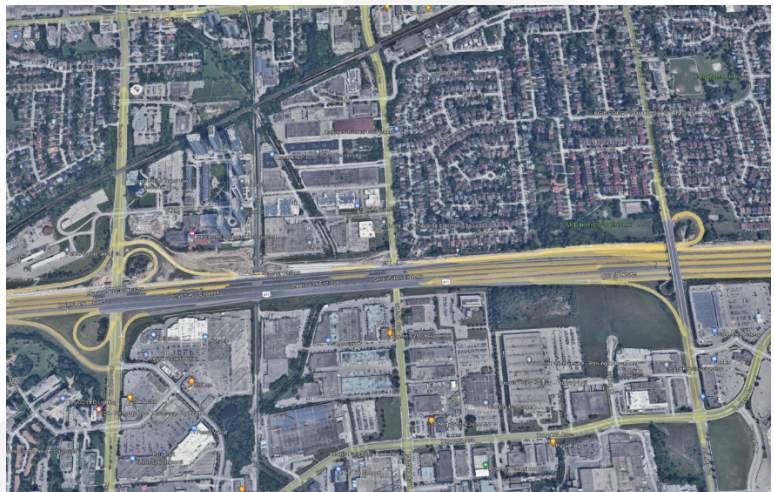
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Table of Contents

Part I: Foundation Investigation Report	iii
1.0 Introduction	4
2.0 Structure Description	4
3.0 Site Description and Geological Setting	5
3.1 Site Description	5
3.2 Geological Setting	5
4.0 Previous Geotechnical Investigation.....	5
5.0 Field Investigation and Laboratory Analyses	6
5.1 Site Investigation and Field Testing	6
5.2 Laboratory Testing	7
6.0 Subsurface Conditions	8
6.1 Subsoils	8
6.1.1 Pavement Structure.....	8
6.1.2 Cohesionless Fill: Sand and Gravel to Gravelly Sand	8
6.1.3 Cohesionless Fill: Sand/Sand and Silt/Silt	9
6.1.4 Cohesive Fill: Clayey Silt.....	10
6.1.5 Silty Clay	11
6.1.6 Sand/Silty Sand/Sand and Silt/Sandy Silt/Silt	12
6.2 Groundwater Conditions.....	14
6.3 Chemical Analyses.....	14
7.0 Closure	16

References

Appendix A – Limitations and Use of Report

Appendix B –General Arrangement Drawing

Appendix C – Borehole Location Plan and Stratigraphic Profile

Appendix D – Borehole Logs

Appendix E – Laboratory Data

Appendix F – Previous Investigation - BH logs

*Foundation Investigation Report
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Part I: Foundation Investigation Report

Highway 401 Eastbound Express and Collector Lanes between Victoria Park Avenue and Neilson Road – Midland Avenue Overpass (Site 37X-0216/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 Midland Avenue Overpass structure (Site 37X-0216/B1 & B3).

The General Arrangement (GA) drawing for the bridge structure was 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 "*Midland Ave. Overpass E.B. Core and Collectors*", prepared by AECOM, dated October 2024, shows the preliminarily proposed configuration of the Midland Avenue Overpass structure. Foundation Investigation and 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 "*Midland Avenue Overpass Rehabilitation and Northward Widening (Site No. 37-216), 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 21, 2019, were reviewed. A summary of the structure is as follows:

1. The existing structure is a 19.43 m long single span bridge. It is understood that the existing abutments and retaining wall foundations are supported on spread footings. However, it is assumed that they are similar to the Westbound Core and Collectors Structure. Based on the previous FIDRs, the existing abutments foundations are supported on 3.7 m wide footings founded at about Elevation 163.4 m.
2. The superstructure of the existing single-span bridge is proposed to be rehabilitated, which involves the 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. No widening of Highway 401 is proposed on the Eastbound side.

The previous FIDRs and GA drawing by AECOM, in addition to contract package drawings titled *Hwy 401 WB Core & Collector Lanes – Midland Avenue Overpass – Bridge Rehabilitation (Cont. No. 2019-2011, WP No. 2398/2399-15-01)*, produced by WSP Global Inc., dated February 2019, were reviewed as part of this report. These background documents are used for 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 Midland Avenue, 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 172 m to 173 m while, the Midland Avenue pavement grade is at Elevation about 166 m at the structure site. The fill thickness is assumed to be about 7 to 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, three (3) previous reports were issued which contain relevant information to the proposed Midland Avenue Overpass structure (Site 37X-0216/B1 & B3), as follows:

1. Foundation Investigation Report for The Proposed Extension of Hwy. #401 and Midland Ave. Crossing, Metropolitan Toronto, District #6, W.J. 66-P-87, W.P. 260-61, Geocres No. 30M14-74, The Ministry of Transportation Ontario (MTO), Foundation Section, Materials and Testing Div., dated December 8, 1966.
2. 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.
3. Geocres No. 30M14-495 "Midland Avenue Overpass Rehabilitation and Northward Widening (Site No. 37-216), 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 21, 2019.

The previous borehole logs are attached as Appendix F in this report. The details of the applicable boreholes completed by the MTO are 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				
74-1A	Eastbound Core East Approach	4848615.6	322957.3	43.777279	-79.274437	171.3	14.2
74-2A	Eastbound Core West Approach	4848601.5	322911.9	43.777153	-79.275001	170.9	15.7
74-3	Eastbound Collector West Approach	4848561.5	322923.5	43.776793	-79.274858	165.2	11.1
74-4	Eastbound Collector East Approach	4848573.7	322966.5	43.776901	-79.274324	166.1	11.1

5.0 Field Investigation and Laboratory Analyses

5.1 Site Investigation and Field Testing

A site-specific investigation was undertaken by EXP between August 29, 2022, and September 12, 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. Four boreholes were completed for this structure (BH22-5-1 to BH22-5-4) 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. 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 condition of granular (or cohesionless) soils (gravels, sands and silts) or the consistency of cohesive soils (clays and clayey soils);
5. 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.

6. 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.
7. 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.
8. 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 ± 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
9. 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				
BH22-5-1	~6 m west of West Abutment, South Side (EBL Collector)	4848566.0	322930.0	43.776833	-79.274778	172.7	8.4 ⁽¹⁾
BH22-5-2	~10 m west of West Abutment, b/w EBL and WBL Express	4848597.8	322914.9	43.777119	-79.274964	172.7	14.3 ⁽²⁾
BH22-5-3	~12 m east of East Abutment, b/w EBL and WBL Express	4848611.8	322958.3	43.777244	-79.274425	172.8	12.5 ⁽²⁾
BH22-5-4	~12 m east of East Abutment, South Side (EBL Collector)	4848578.1	322964.4	43.776941	-79.274350	172.7	9.7 ⁽³⁾

Notes:

1. Borehole terminated at 8.4 m depth, likely hit south wingwall footing.
2. Terminated at refusal ($N > 100$ blows for 1.5 m interval)

5.2 Laboratory Testing

Laboratory testing was conducted on a minimum of 25% of samples collected. Selected samples were submitted for natural moisture content testing. In addition, unit weight, Atterberg limits and grain size analysis (sieve and hydrometer) tests were performed on selected 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
BH22-5-1	9	1	2	1	-	-
BH22-5-2	15	2	4	2	2	1

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

Borehole No.	Moisture Content	Atterberg Limits	Sieve	Hydrometer	Unit Weight	Corrosivity
BH22-5-3	13	2	3	2	5	-
BH22-5-4	9	1	2	1	2	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.

The general stratigraphy encountered within the investigated depths of EXP’s geotechnical investigation indicates the following sub-surface sequence: cohesionless and cohesive fill overlaying native silty clay followed by sandy silt to sand.

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 EXP boreholes (BH22-5-1 to BH22-5-4). The thickness of the structure ranged between 375 mm and 550 mm.

6.1.2 Cohesionless Fill: Sand and Gravel to Gravelly Sand

During EXP’s geotechnical investigation, sand and gravel to gravelly sand fill was encountered below the pavement structure (asphalt/concrete) in boreholes BH22-5-1, BH22-5-2 and BH22-5-4. 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 1.4 below:

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

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Layer Description	SPT “N” Value Range
	Top	Bottom				
EXP (2022)						
BH22-5-1	172.2	171.2	0.5	1.0	Sand and Gravel	10
BH22-5-2	172.1	166.6	0.6	5.5	Gravelly Sand	19 – 32

Foundation Investigation Report
Highway 401 Eastbound from Victoria Park Avenue to Neilson Road
Superstructure Replacement at Midland Avenue Overpass
Eastbound Core and Collectors Structure (Site 37X-0216/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				
BH22-5-4	172.2	166.6	0.5	5.6	Gravelly Sand	25 – 38

This layer predominately consisted of sand and gravel with some silt and clay, occasional cobbles and asphalt inclusions. The material was grey to brown in colour and dry to moist. The SPT "N" values within this layer ranged from 10 to 38 blows per 300 mm penetration, corresponding to compact to dense in compactness.

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

Moisture Content: (EXP)

- 1% to 18%

Grain Size Distribution: (EXP)

- 25% to 27% gravel.
- 57% to 59% sand.
- 14% to 18% silt and clay

The results of the moisture content and grain size distribution 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.

6.1.3 Cohesionless Fill: Sand/Sand and Silt/Silt

During EXP's geotechnical investigation, sand to sand and silt fill was encountered below the pavement structure (asphalt/concrete) in borehole BH22-5-3 and below the upper cohesionless fill (sand and gravel/gravelly sand) layer in borehole BH22-5-1. In addition, sand and silt to silt fill was also encountered in boreholes 74-1A and 74-2A at ground surface (layer interpreted by EXP based on relative natural ground surface in the area) 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 1.5 below:

Table 1.5: Summary of Cohesionless Fill: Sand/Sand and Silt/Silt Layers

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Layer Description	SPT “N” Value Range
	Top	Bottom				
EXP (2022)						
BH22-5-1	171.2	164.8	1.5	6.4	Sand	9 – 31
BH22-5-3	172.4	165.9	0.4	6.5	Sand/Sand and Silt	5 – 26
MTO (1966)						
BH74-1A	171.3	166.1	0	5.2	Sand and Silt	8 – 42

*Foundation Investigation Report
 Highway 401 Eastbound from Victoria Park Avenue to Neilson Road
 Superstructure Replacement at Midland Avenue Overpass
 Eastbound Core and Collectors Structure (Site 37X-0216/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				
BH74-2A	170.9	165.7	0	5.2	Silt	13 – 22

This layer predominately consisted of sand and silt with trace to some gravel, trace to some clay and occasional cobbles. The material was greyish brown to brown and grey in colour and moist. The SPT "N" values within this layer ranged from 5 to 42 blows per 300 mm penetration, corresponding to loose to dense, but generally compact in compactness.

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

Moisture Content: (EXP and MTO)

- 5% to 23%

Grain Size Distribution: (EXP and MTO)

- 3% to 7% gravel.
- 44% to 80% sand.
- 42% silt.
- 11% clay.
- 17% to 48% silt and clay

Unit Weight: (EXP)

- 22.5 kN/m³ to 22.6 kN/m³

The results of the moisture content, grain size distribution 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 in Figure 2 in Appendix E. The results of tests performed by MTO are shown on the borehole logs attached in Appendix F.

6.1.4 Cohesive Fill: Clayey Silt

During EXP's geotechnical investigation, a cohesive fill layer was encountered below cohesionless fill layers in boreholes BH22-5-1, BH22-5-2 and BH22-5-4. 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 1.6 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)						
BH22-5-1	164.8	164.3	7.9	0.5	Clayey Silt	14
BH22-5-2	166.6	165.1	6.1	1.5	Clayey Silt	14

Foundation Investigation Report
Highway 401 Eastbound from Victoria Park Avenue to Neilson Road
Superstructure Replacement at Midland Avenue Overpass
Eastbound Core and Collectors Structure (Site 37X-0216/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				
BH22-5-4	166.6	166.0	6.1	0.6	Clayey Silt	16

Note:

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

This layer predominately consists of silt and clay with varying amounts of sand (trace to sandy), trace to some gravel and occasional cobbles. In addition, some organic rootlets were encountered within the layer in borehole BH22-5-4. The material was grey in color and moist to wet. The SPT "N" value within this layer ranged between 14 to 16 blows per 300 mm penetration, corresponding to stiff to very stiff in consistency. Results of the Atterberg limits test suggest that this layer was low plastic.

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

Moisture Content: (EXP)

- 11% to 15%

Grain Size Distribution: (EXP)

- 2% gravel.
- 32% sand.
- 53% silt.
- 13% clay

Atterberg Limits: (EXP)

- Liquid Limit: 20%.
- Plastic Limit: 12%.
- Plasticity Index: 8%

Unit Weight: (EXP)

- 23.2 kN/m³

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 3 and 6 in Appendix E.

6.1.5 Silty Clay

During EXP's geotechnical investigation, a native silty clay deposit was encountered below the fill layers in boreholes BH22-5-2, BH22-5-3 and BH22-5-4. 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 Silty Clay Layers

Foundation Investigation Report
Highway 401 Eastbound from Victoria Park Avenue to Neilson Road
Superstructure Replacement at Midland Avenue Overpass
Eastbound Core and Collectors Structure (Site 37X-0216/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				
EXP (2022)						
BH22-5-2	165.1	164.3	7.6	0.8	Silty Clay	17
BH22-5-3	165.9	163.7	6.9	2.2	Silty Clay	6 – 19
BH22-5-4	166.0	163.6	6.7	2.4	Silty Clay	7

This layer predominately consisted of silt and clay with trace to some sand and trace gravel. In addition, trace to some organic rootlets were encountered within the layer in boreholes BH22-5-2 and BH22-5-3. The material was moist to wet and brownish grey to grey with black inclusions in color. The SPT "N" values within this layer ranged from 6 to 19 blows per 300 mm penetration corresponding to firm to very stiff in consistency. Results of Atterberg limits tests suggest that the plasticity of this deposit was intermediate.

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)

- 12% to 23%

Grain Size Distribution: (EXP)

- 1% to 2% gravel.
- 7% to 22% sand.
- 36% to 46% silt.
- 35% to 46% clay

Atterberg Limits: (EXP)

- Liquid Limit: 39% to 46%.
- Plastic Limit: 17% to 19%.
- Plasticity Index: 22% to 27%

Unit Weight: (EXP)

- 19.3 kN/m³ to 21.2 kN/m³

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 4 and 7 in Appendix E.

6.1.6 Sand/Silty Sand/Sand and Silt/Sandy Silt/Silt

During EXP's geotechnical investigation, a native sand to sandy silt layer was encountered below the native silty clay in boreholes BH22-5-2, BH22-5-3 and BH22-5-4. In addition, sandy silt/silt/sand and silt/silty sand/sand was also encountered below the cohesionless fill in boreholes 74-1A and 74-2A and at the ground surface in boreholes 74-3 and 74-4 during MTO's geotechnical

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

Table 1.8: Summary of Sand/Silty Sand/Sand and Silt/Sandy Silt/Silt Layers

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Layer Description	SPT “N” Value Range
	Top	Bottom				
EXP (2022)						
BH22-5-2	164.3	158.4	8.4	5.9 ¹	Sandy Silt to Sand	18 – 140/250 mm
BH22-5-3	163.7	160.3	9.1	3.4 ¹	Sandy Silt	128 – 125/200 mm
BH22-5-4	163.6	163.0	9.1	0.6 ¹	Sandy Silt	6
MTO (1966)						
74-1A	166.1	157.1	5.2	9.0 ¹	Sand and Silt	16 – 100/125 mm
74-2A	165.7	155.2	5.2	10.5 ¹	Silt/Silty Sand/Sand	19 – 129
74-3	165.2	154.1	0	11.1 ¹	Silty Sand	14 – 170
74-4	166.1	155.0	0	11.1 ¹	Silty Sand	10 – 146

Note:

1.0 The end of borehole terminated within this layer.

This layer predominately consists of sand and silt with trace to some gravel and trace to some clay. The material was brown and grey in color and slightly moist to wet. The SPT "N" value within this layer ranged between 6 to 170 blows per 300 mm penetration, corresponding to loose to very dense, but generally compact to very dense in compactness. The results of the Atterberg limits test suggest this layer ranges from non-plastic to low plasticity.

Laboratory testing performed on selected sample 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 45%

Grain Size Distribution: (EXP and MTO)

- 0% to 21% gravel.
- 33% to 86% sand.
- 54% to 56% silt.
- 8% to 10% clay.
- 14% to 57% silt and clay

Atterberg Limits: (EXP)

- Liquid Limit: 16%.
- Plastic Limit: 10%.
- Plasticity Index: 6%.

One test result indicated a non-plastic material.

Unit Weight: (EXP)

- 22.8 kN/m³ to 23.7 kN/m³

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 5 and 8 in Appendix E. 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 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 observed during and after the investigations is summarized in Table 1.9 and are also presented on the Record of Borehole Sheets attached in Appendix D and Appendix F.

Table 1.9: Summary of observed groundwater levels

Borehole	Ground Surface Elevation (m)	Water level Depth/ Elevation (m)	Date
EXP (2022)			
BH22-5-1	172.7	7.0/165.7	August 31, 2022
BH22-5-2	172.7	12.2/160.5	September 7, 2022
BH22-5-3	172.8	6.6/166.2	September 8, 2022
MTO (1966)			
BH74-3	165.2	1.0/164.2	October 7, 1966
BH74-4	166.1	1.6/164.5	October 12, 1966

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

The analytical results are summarized in Table 1.10 below and are presented in Appendix D.

Table 1.10: Summary of chemical analysis results

Sample Identification	pH (Unitless)	Soluble Chloride (ppm)	Soluble Sulphate (ppm)	Resistivity (ohm-cm)	Conductivity (umho/cm)	Redox Potential (mV)
BH22-5-2, SS6	8.15	510	<20	1100	899	150
BH22-5-4, SS5	8.17	330	<20	1500	660	110

*Foundation Investigation Report
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Superstructure Replacement at Midland Avenue Overpass
Eastbound Core and Collectors Structure (Site 37X-0216/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 Stephen Fredericks, M.Eng., P.Eng., 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.


Yours truly,


EXP Services Inc.

Stephen Fredericks, M.Eng., P.Eng.
Geotechnical Engineer


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




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


Stan E. Gonsalves, M.Eng., P.Eng.
Executive Vice-President
Designated MTO Foundation Contact



Encl.

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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.



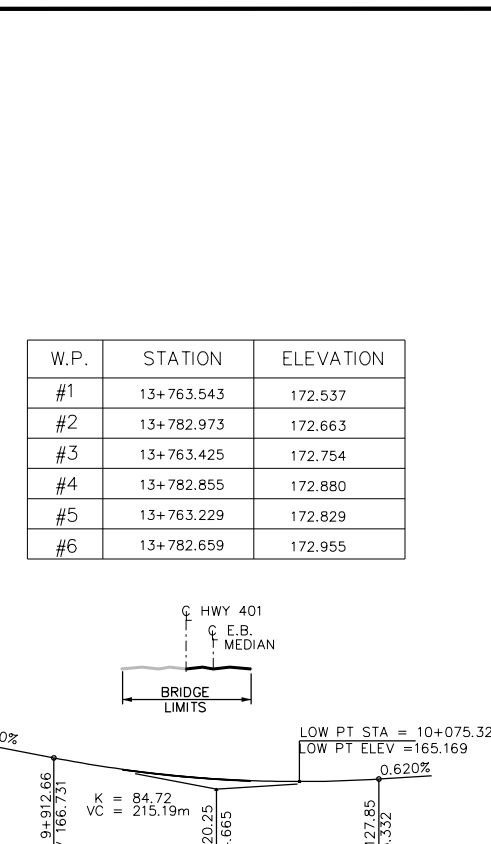
USE OF REPORT

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.

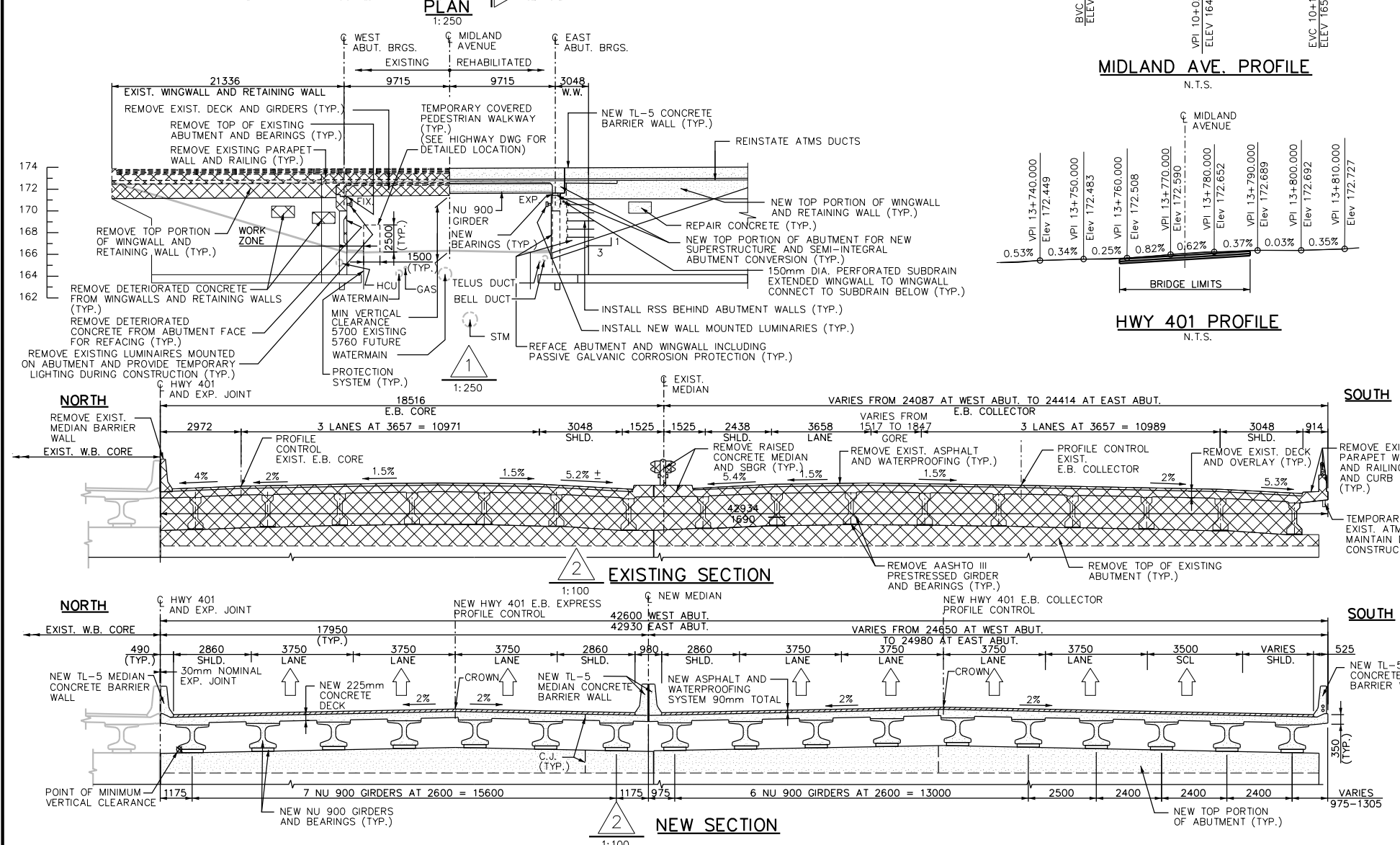
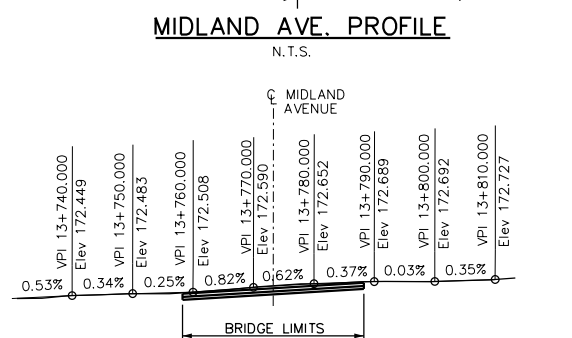
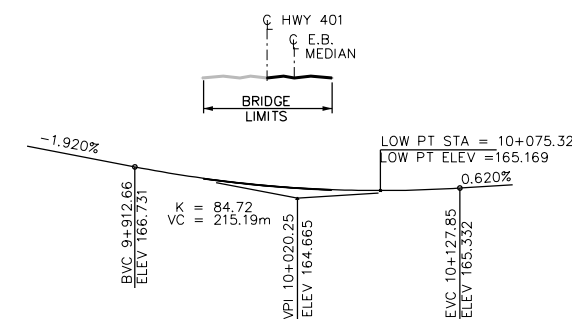
REPORT FORMAT




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.

Appendix B – General Arrangement Drawings



W.P.	STATION	ELEVATION
#1	13+763.543	172.537
#2	13+782.973	172.663
#3	13+763.425	172.754
#4	13+782.855	172.880
#5	13+763.229	172.829
#6	13+782.659	172.955



Ontario 	Ministry of Transportation	
CONT WP		
MIDLAND AVE. OVERPASS E.B. CORE AND COLLECTORS		SHEET S104
GENERAL ARRANGEMENT		
		

GENERAL NOTES:

1. SPECIFIED 28-DAY COMPRESSIVE STRENGTH.....30 MPa
UNLESS NOTED OTHERWISE.
SPECIFIED 28-DAY COMPRESSIVE STRENGTH FOR PRECAST
GIRDERS ARE GIVEN ON PRESTRESSED GIRDER DRAWINGS.
2. CLEAR COVER TO REINFORCING STEEL:
 -DECK : TOP.....70 * 20
 BOTTOM.....40 * 10
 -REMAINDER.....70 * 20
 UNLESS OTHERWISE NOTED.
3. REINFORCING STEEL:
 REINFORCING STEEL SHALL BE GRADE 500W UNLESS OTHERWISE
 SPECIFIED.
 STAINLESS REINFORCING STEEL BARS SHALL BE TYPE 316LN OR
 DUPLEX 2205 AND HAVE A MINIMUM YIELD STRENGTH OF 500 MPa,
 UNLESS OTHERWISE SPECIFIED.

BAR MARKS WITH PREFIX 'S' DENOTE STAINLESS STEEL BARS.
 UNLESS OTHERWISE SHOWN, TENSION LAP SPLICES SHALL CLASS B.

BAR HOOKS SHALL HAVE STANDARD HOOK DIMENSIONS USING
 MINIMUM BEND DIAMETERS, WHILE STIRRUPS AND TIES SHALL
 HAVE MINIMUM HOOK DIMENSIONS. ALL HOOKS SHALL BE IN
 ACCORDANCE WITH THE STRUCTURAL STANDARD DRAWINGS
 SS21-1 AND SS21-2 UNLESS INDICATED OTHERWISE.

- R5-1. GENERAL ARRANGEMENT
- R5-2. BOREHOLE LOCATIONS
- R5-3. SOIL STRATA
- R5-4. CONSTRUCTION STAGING I
- R5-5. CONSTRUCTION STAGING II
- R5-6. REMOVALS I
- R5-7. REMOVALS II
- R5-8. REHABILITATION DETAILS I
- R5-9. REHABILITATION DETAILS II
- R5-10. PRESTRESSED NU 900 GIRDERS AND BEARINGS
- R5-11. PRESTRESSED NU GIRDERS DETAILS
- R5-12. DECK LAYOUT AND SCREEN ELEVATIONS
- R5-13. DECK DETAILS I
- R5-14. DECK DETAILS II
- R5-15. SOUTH AND NORTH BARRIER WALLS WITHOUT RAILING
- R5-16. MEDIAN BARRIER WALL WITHOUT RAILING TL-5
- R5-17. 6000mm APPROACH SLAB
- R5-18. EXPANSION JOINT AND SLEEPER SLAB
- R5-19. STRIP SE EXPANSION JOINT - TYPE "C" DETAILS
- R5-20. SEQUENCE OF EXPANSION JOINT INSTALLATION
- R5-21. TEMPORARY DECK DRAIN DETAILS
- R5-22. MISCELLANEOUS DETAILS
- R5-23. ELECTRICAL EMBEDDED WORK




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

CONSTRUCTION NOTES:

1. THE CONTRACTOR SHALL VERIFY ALL RELEVANT DIMENSIONS, ELEVATIONS AND DETAILS ON SITE AND REPORT ANY DISCREPANCIES TO THE CONTRACT ADMINISTRATOR PRIOR TO PROCEEDING WITH REHABILITATION WORK.
2. TYPICAL AREAS OF REPAIRS ARE INDICATED ON THE DRAWINGS. WHERE REPAIR LIMITS ARE NOT SHOWN, LIMITS SHALL BE IDENTIFIED BY THE CONTRACT ADMINISTRATOR.
3. THE CONTRACTOR SHALL ADJUST THE BEARING SEAT ELEVATIONS AND REINFORCING STEEL TO SUIT THE ACTUAL HEIGHT OF THE BEARING SUPPLIED. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING FULL BEARING CONTACT TO GIRDER SOFFIT AND BEARING SEAT. ADDITIONAL COST DUE TO ANY CHANGES IN ELEVATIONS OF THE TOP OF BEARINGS BY THE CONTRACTOR SHALL BE AT THEIR OWN EXPENSE.
4. PROTECTION SYSTEM SHALL MEET REQUIREMENTS FOR PERFORMANCE LEVEL 2. EXACT LOCATIONS AND LIMITS OF PROTECTION SYSTEM SHALL BE DETERMINED BY CONTRACTOR.
5. BACKFILL SHALL NOT BE PLACED BEHIND THE NEW SEMI-INTEGRAL ABUTMENTS UNTIL THE NEW CONCRETE HAS ACHIEVED 75% OF DESIGN COMPRESSIVE STRENGTH.
6. SAWCUT IN CONCRETE, WHERE DESIGNATED, SHALL BE 25mm DEEP OR TO THE FIRST LAYER OF REINFORCING STEEL, WHICHEVER IS LESS.
7. ANY DAMAGE DURING CONSTRUCTION TO THE EXISTING STRUCTURES UTILITIES AND ADJACENT PROPERTIES NOT DESIGNATED FOR REPAIR SHALL BE REPAIRED GOOD BY THE CONTRACTOR TO THE SATISFACTION OF THE CONTRACT ADMINISTRATOR AND AT NO COST TO THE OWNER.
8. THE CONTRACTOR IS FULLY RESPONSIBLE FOR ADEQUATE PROTECTION OF ALL UTILITIES, SERVICES, ROADWAYS, ETC., DURING CONSTRUCTION OPERATIONS.
9. THE CONTRACTOR SHALL PROVIDE DEBRIS PLATFORMS AND NECESSARY CONTAINMENT MEASURES TO COLLECT FALLING CONCRETE AND CONSTRUCTION DEBRIS SUCH THAT NO DEBRIS OR MATERIALS RESULTING FROM THE REMOVAL WORK FALLS IN AREAS BELOW THE BRIDGE.
10. THE CONTRACTOR SHALL NOT REMOVE THE EXISTING SUPERSTRUCTURE WITHIN EACH STAGE UNTIL EXISTING APPROACH SLABS AND BACKFILL BEHIND BOTH ABUTMENTS ARE REMOVED TO THE SPECIFIED DEPTH. BACKFILL SHALL BE REMOVED SIMULTANEOUSLY BEHIND BOTH ABUTMENTS KEEPING THE HEIGHT OF BACKFILL APPROXIMATELY THE SAME. AT NO TIME SHALL THE DIFFERENCE IN ELEVATION BE GREATER THAN 300mm.
11. BACKFILL SHALL BE PLACED SIMULTANEOUSLY BEHIND BOTH DECK ENDS KEEPING THE HEIGHT OF THE BACKFILL APPROXIMATELY THE SAME. AT NO TIME SHALL THE DIFFERENCE IN ELEVATION BE GREATER THAN 300mm.

OPSD 0912.430	GUIDE RAIL SYSTEM, STEEL BEAMSTRUCTURE CONNECTION
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 3419.100	BARRIER AND RAILING, STEEL BEAM GUIDE RAIL AND CHANNEL ANCHORAGE
OPSD 3941.200	FIGURES IN CONCRETE, SITE NUMBER AND DATA LAYOUT

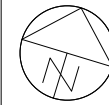
LEGEND:

	REMOVAL
	NEW CONCRETE
	NEW ASPHALT

REVISIONS						
	DATE	BY		DESCRIPTION		
DESIGN	D.M.	CHK	P.O.	CODE CAN/CSA 56-19	LOAD CL 625-ONT	DATE OCT. 2024
DRAWN	V.A.	CHK	D.M.	SITE 37X-0216/B1&B3		DWG R5-1

Appendix C – Borehole Location Plan and Stratigraphic Profile

CONT No.
ASSIG No. 2021-E-0018
GWP No.

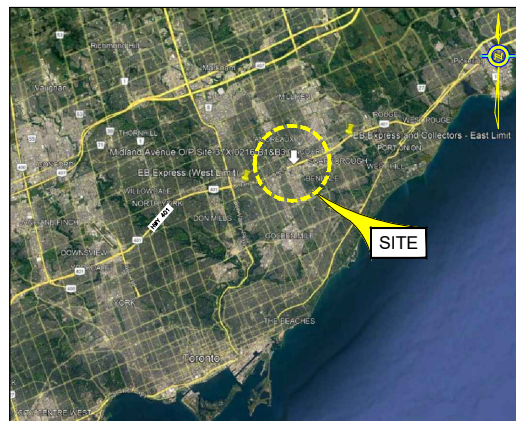


Superstructure Replacement at Midland Avenue Overpass
Eastbound Core and Collectors Structure
Latitude: 43.777075°; Longitude: -79.274687°
BOREHOLE LOCATION PLAN & SOIL STRATA

SHEET
1



EXP SERVICES INC.



KEY PLAN
N.T.S.

LEGEND

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

SOIL STRATA SYMBOLS

- PAVEMENT STRUCTURE
- FILL
- SILTY CLAY
- SANDY SILT TO SILT
- SILTY SAND TO SAND

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

BH No.	ELEV.	NORTHING	EASTING
BH22-5-1	172.7	4848566.0	322930.0
BH22-5-2	172.7	4848597.8	322914.9
BH22-5-3	172.8	4848611.8	322958.3
BH22-5-4	172.7	4848578.1	322964.4
74-1A	171.3	4848615.6	322957.3
74-2A	170.9	4848601.5	322911.9
74-3	165.2	4848561.5	322923.5
74-4	166.1	4848573.7	322966.5

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.

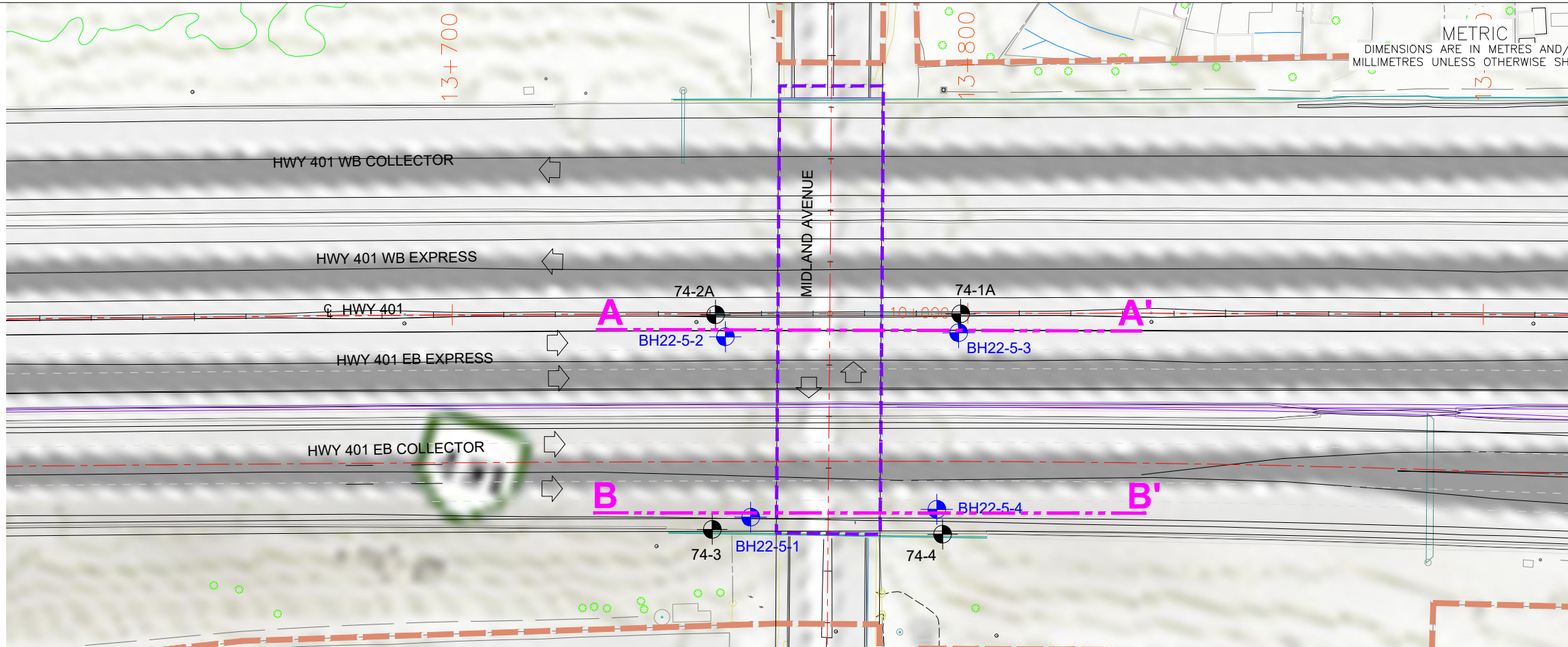
The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

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 O.P.S. Gen. Cond.

REVISIONS

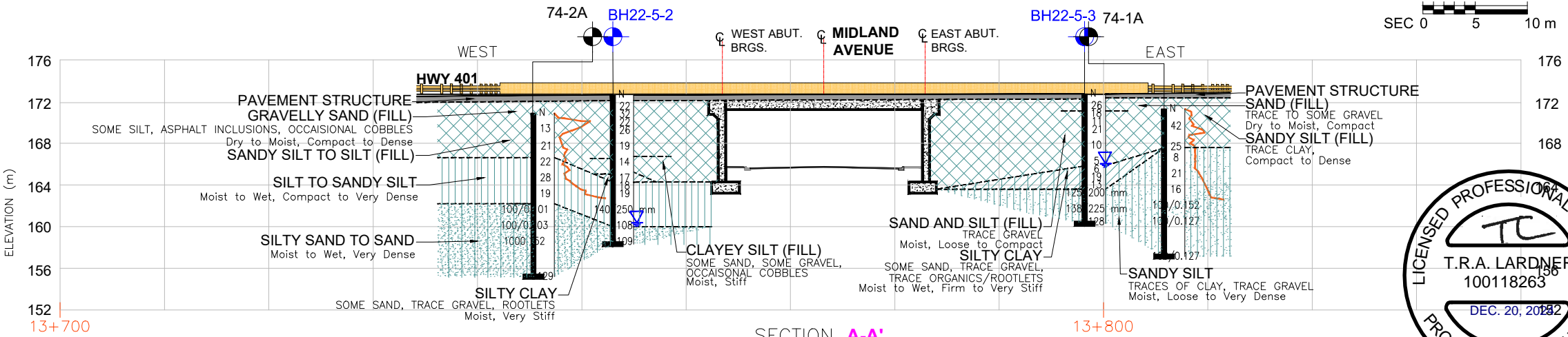
NO	DATE	BY	DESCRIPTION

PROJECT No.	ADM-22000797-A0	GEOCREs No.	30M14-553
SUBM'D SH	CHKD. SM	DATE	JUNE 30, 2023
DRAWN SH	CHKD. TC	APPRD SG	SITE 37X-0216/B1 & B3
			DWG 01

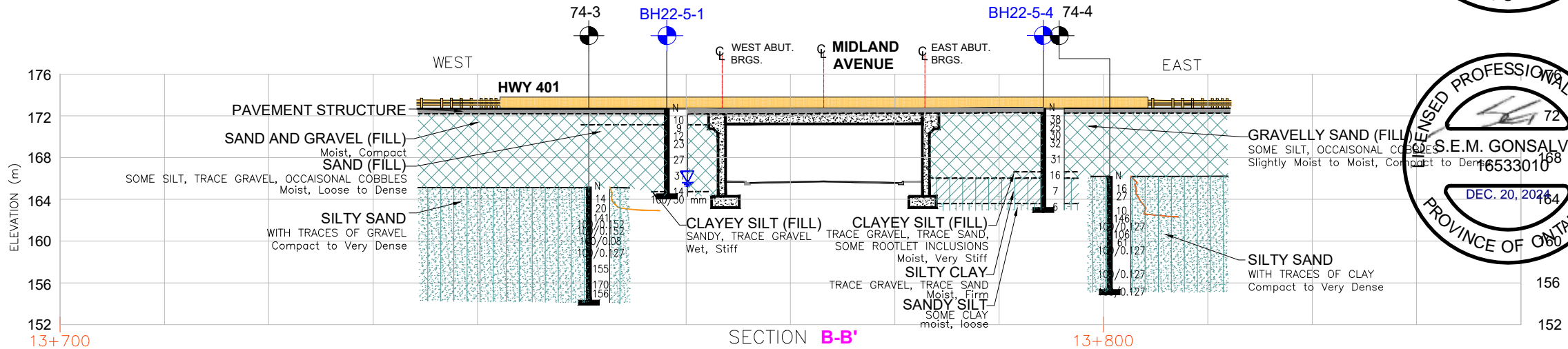


PLAN

PLN 0 10 20 m
SEC 0 5 10 m

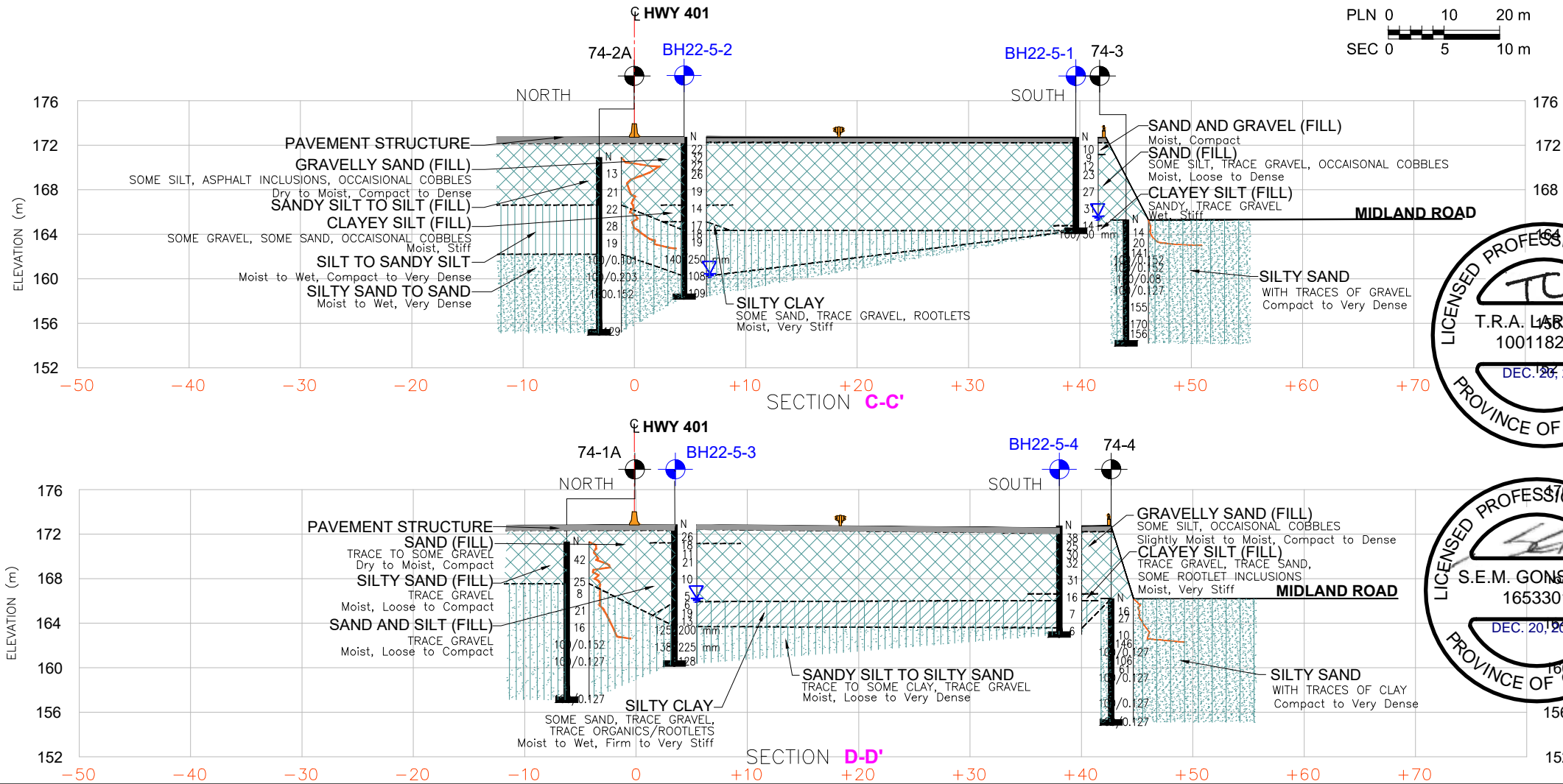
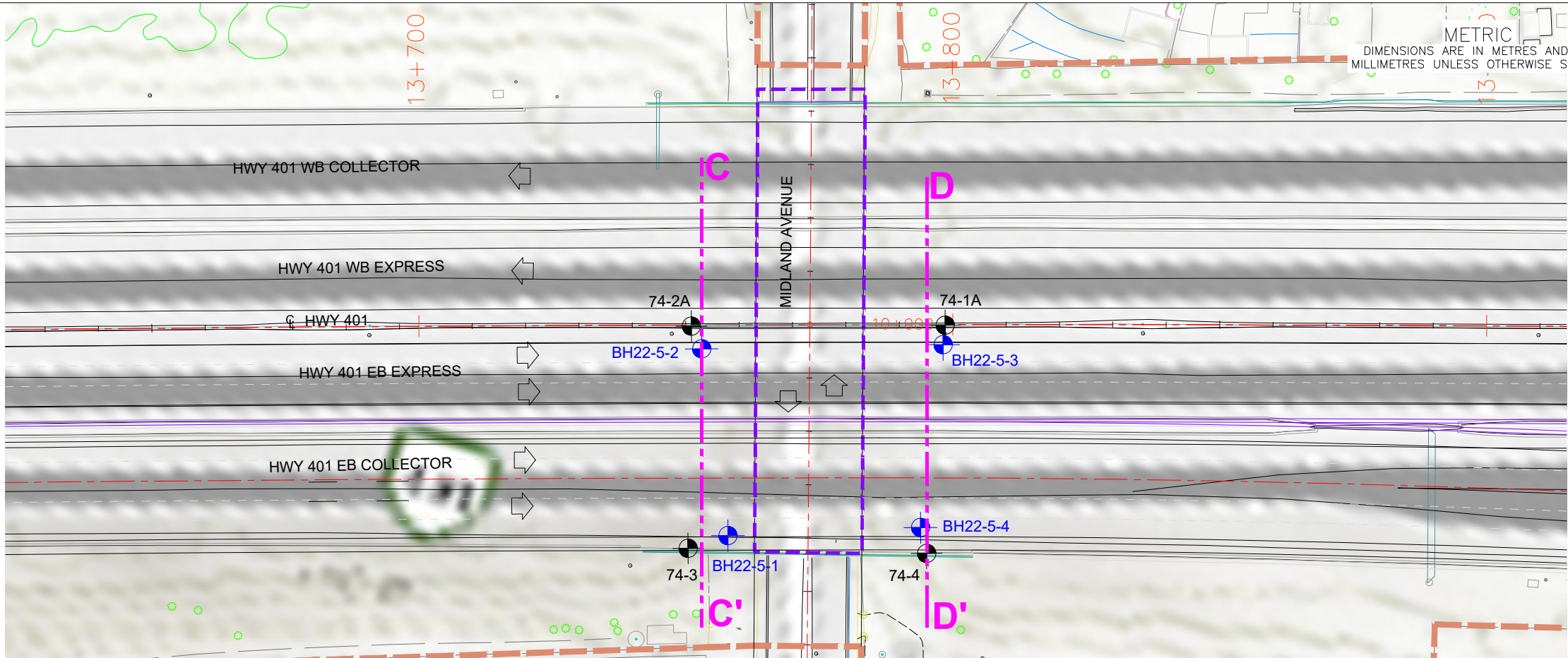


SECTION A-A'

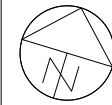


SECTION B-B'

FILE NAME: I:\2003-Brampton\Proposals\Proposals\International\Hwy 401 & Victoria Park Av. to Nelson\working drawings\Structure 5 - Midland Ave Overpass\Borehole location plan & soil strata.dwg
MODIFIED: 2023-06-28 13:11



CONT No.
ASSIG No. 2021-E-0018
GWP No.



Superstructure Replacement at Midland Avenue Overpass
Eastbound Core and Collectors Structure
Latitude: 43.777075°; Longitude: -79.274687°
BOREHOLE LOCATION PLAN & SOIL STRATA

SHEET
2



EXP SERVICES INC.



KEY PLAN
N.T.S.

LEGEND

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

SOIL STRATA SYMBOLS

- PAVEMENT STRUCTURE
- FILL
- SILTY CLAY
- SANDY SILT TO SILT
- SILTY SAND TO SAND

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

BH No.	ELEV.	NORTHING	EASTING
BH22-5-1	172.7	4848566.0	322930.0
BH22-5-2	172.7	4848597.8	322914.9
BH22-5-3	172.8	4848611.8	322958.3
BH22-5-4	172.7	4848578.1	322964.4
74-1A	171.3	4848615.6	322957.3
74-2A	170.9	4848601.5	322911.9
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REVISIONS

NO	DATE	BY	DESCRIPTION

PROJECT No.	ADM-22000797-A0	GEOCRETS No.	30M14-553
SUBM'D SH	CHKD. SM	DATE	JUNE 30, 2023
DRAWN SH	CHKD. TC	APPRD SG	SITE 37X-0216/B1 & B3
			DWG 02

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.

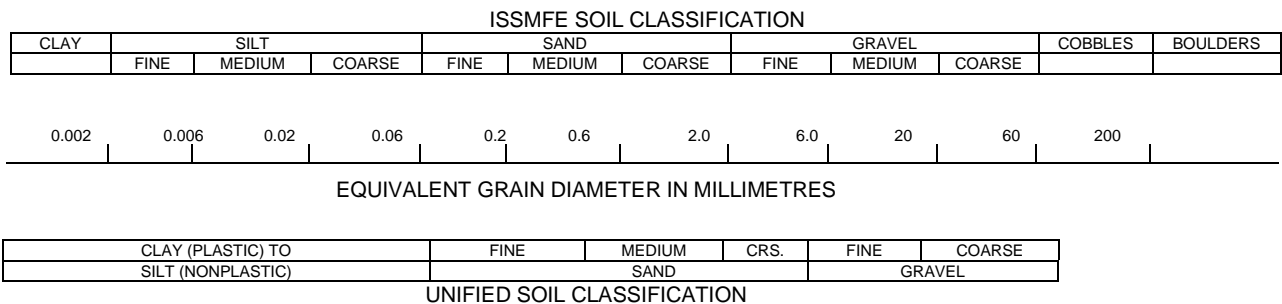
Seam: a thin, confined layer of soil having different particle size, texture, or color from materials above and below.

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:

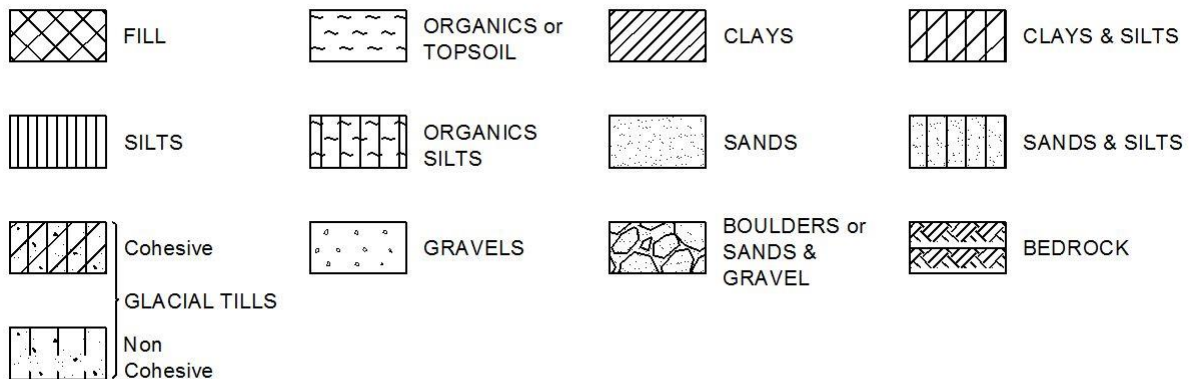
Table c: Consistency of Cohesive Soil

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

MECHANICAL PROPERTIES OF SOIL

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

PHYSICAL PROPERTIES OF SOIL

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

Brampton, Ontario

RECORD OF BOREHOLE No BH22-5-1

1 OF 1

METRIC

W.P. Site 37X-0216/B1 & B3 LOCATION Hwy 401 - Midland Ave O/P, Toronto, ON, MTM ON-10 322930.0E 4848566.0N ORIGINATED BY EL
 DIST Toronto HWY 401 BOREHOLE TYPE Truck Mount CME 75 / SSA COMPILED BY EL
 DATUM Geodetic DATE 2022.08.29 - 2022.08.31 LATITUDE 43.776833 LONGITUDE -79.274778 CHECKED BY TL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIALX P. PENETROMETER									WATER CONTENT (%)
172.7								20	40	60	80	100					
0.0	PAVEMENT STRUCTURE - 125 mm of asphalt and 350 mm of concrete																
172.2																	
0.5	SAND AND GRAVEL (FILL) - greyish brown, moist , compact		AS1	AS			172							○			
			SS2	SS	10									○			
171.2																	
1.5	SAND (FILL) - some silt, trace gravel, greyish brown, moist, loose to dense		SS3	SS	9		171							○			
			SS4	SS	12		170							○			
	- Occasional cobbles encountered																
			SS5	SS	23		169							○			
			SS6	SS	27		168							○			
	- Spoon bouncing, possible cobbles						167										
			SS7	SS	31		166							○			
							165										
164.8																	
7.9	CLAYEY SILT (FILL) - sandy, trace gravel, grey, wet, stiff		SS8	SS	14									○			2 32 53 13
164.3																	
8.4	END OF BOREHOLE		SS9	SS	100/ 50 mm									○			
	NOTES: 1) Borehole terminated at 8.4 m depth, likely hit south wing wall footing 2) Groundwater measured in open hole at 7.0 m depth below ground surface (Elev. 165.7 m)																

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

Brampton, Ontario

RECORD OF BOREHOLE No BH22-5-2

1 OF 1

METRIC

W.P. Site 37X-0216/B1 & B3 LOCATION Hwy 401 - Midland Ave O/P, Toronto, ON, MTM ON-10 322914.9E 4848597.8N ORIGINATED BY EL
 DIST Toronto HWY 401 BOREHOLE TYPE Truck Mount CME 75 / SSA COMPILED BY EL
 DATUM Geodetic DATE 2022.09.06 - 2022.09.07 LATITUDE 43.777119 LONGITUDE -79.274964 CHECKED BY TL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
172.7 0.0	PAVEMENT STRUCTURE - 200 mm of asphalt and 350 mm of concrete													
172.1 0.6	GRAVELLY SAND (FILL) - some silt, greyish brown, dry to moist, compact to dense		AS1	AS			172							
			SS2	SS	22									
	- Asphalt inclusions		SS3	SS	32		171							
	- Asphalt inclusions		SS4	SS	22		170							27 59 (14)
	- Occasional cobbles encountered		SS5	SS	26		169							
			SS6	SS	19		168							Corrosivity Sample
							167							
166.6 6.1	CLAYEY SILT (FILL) - some gravel, some sand, occasional cobbles, grey, moist, stiff		SS7	SS	14		166							
165.1 7.6	SILTY CLAY - some sand, trace gravel, rootlets, brownish grey with light brown, moist, very stiff		SS8	SS	17		165						20.2	2 22 41 35
164.3 8.4	SANDY SILT - some clay, trace gravel, grey, slightly moist to wet, compact to very dense		SS9	SS	18		164						22.8	
			SS10	SS	19		163							2 34 54 10
			SS11	SS	140/ 250 mm		162							
							161							
160.1 12.7	SAND - some silt, grey, moist to wet, very dense		SS12	SS	108		160							
							159							
158.4 14.3	END OF BOREHOLE		SS13	SS	109									0 86 (14)
	NOTES: 1) Borehole terminated at 14.3 m on refusal (N>100 blows over 1.5 m interval) 2) Groundwater measured in open hole at 12.2 m depth below ground surface (~Elev. 160.5 m)													

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

ONTARIO MTO H401 - MIDLAND GPJ ONTARIO MTO.GDT 6/26/23







Brampton, Ontario

RECORD OF BOREHOLE No BH22-5-3

1 OF 1

METRIC

W.P. Site 37X-0216/B1 & B3 LOCATION Hwy 401 - Midland Ave O/P, Toronto, ON, MTM ON-10 322958.3E 4848611.8N ORIGINATED BY EL
 DIST Toronto HWY 401 BOREHOLE TYPE Truck Mount CME 75 / SSA COMPILED BY EL
 DATUM Geodetic DATE 2022.09.08 - 2022.09.08 LATITUDE 43.777244 LONGITUDE -79.274425 CHECKED BY TL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X P. PENETROMETER								WATER CONTENT (%)		
172.8	PAVEMENT STRUCTURE - 200 mm of asphalt and 175 mm of concrete														GR SA SI CL			
0.0 172.4 0.4																		
	SAND (FILL) - trace to some gravel, brownish grey, dry to moist, compact		AS1	AS			172							○		22.6	7 45 (48)	
			SS2	SS	26									○				
171.1								171								○		22.5
1.7			SAND AND SILT (FILL) - trace gravel, greyish brown, moist, loose to compact		SS3		SS	18										○
	SS4	SS			11									○				
								170								○		
	SS5	SS			21									○				
								169										
			SS6	SS	10		168							○				
							167											
			SS7	SS	5								○					
165.9						166												
6.9	SILTY CLAY - some sand, trace gravel, trace organics/rootlets to 7.2 m, grey with black inclusions, moist to wet, firm to very stiff		SS8	SS	6								○	21.2	2 16 36 46			
							165							○				
			SS9	SS	19									○				
							164							○				
163.7			SS10	SS	13	163									23.7			
9.1	SANDY SILT - trace gravel, trace clay, grey, moist, very dense		SS11	SS	125/ 200 mm								○		23.2			
							162							○				
			SS12	SS	138/ 225 mm													
						161												
160.3			SS13	SS	128								○					
12.5	END OF BOREHOLE																	
	NOTES: 1) Borehole terminated at 12.5 m at refusal (N>100 blows over 1.5 m interval) 2) Groundwater measured in open hole at 6.6 m depth below ground surface (~Elev. 166.2 m)																	

+³, ×³: Numbers refer to
Sensitivity

○ 3% STRAIN AT FAILURE

ONTARIO MTO H401 - MIDLAND GPJ ONTARIO MTO.GDT 6/26/23

Brampton, Ontario

RECORD OF BOREHOLE No BH22-5-4

1 OF 1

METRIC

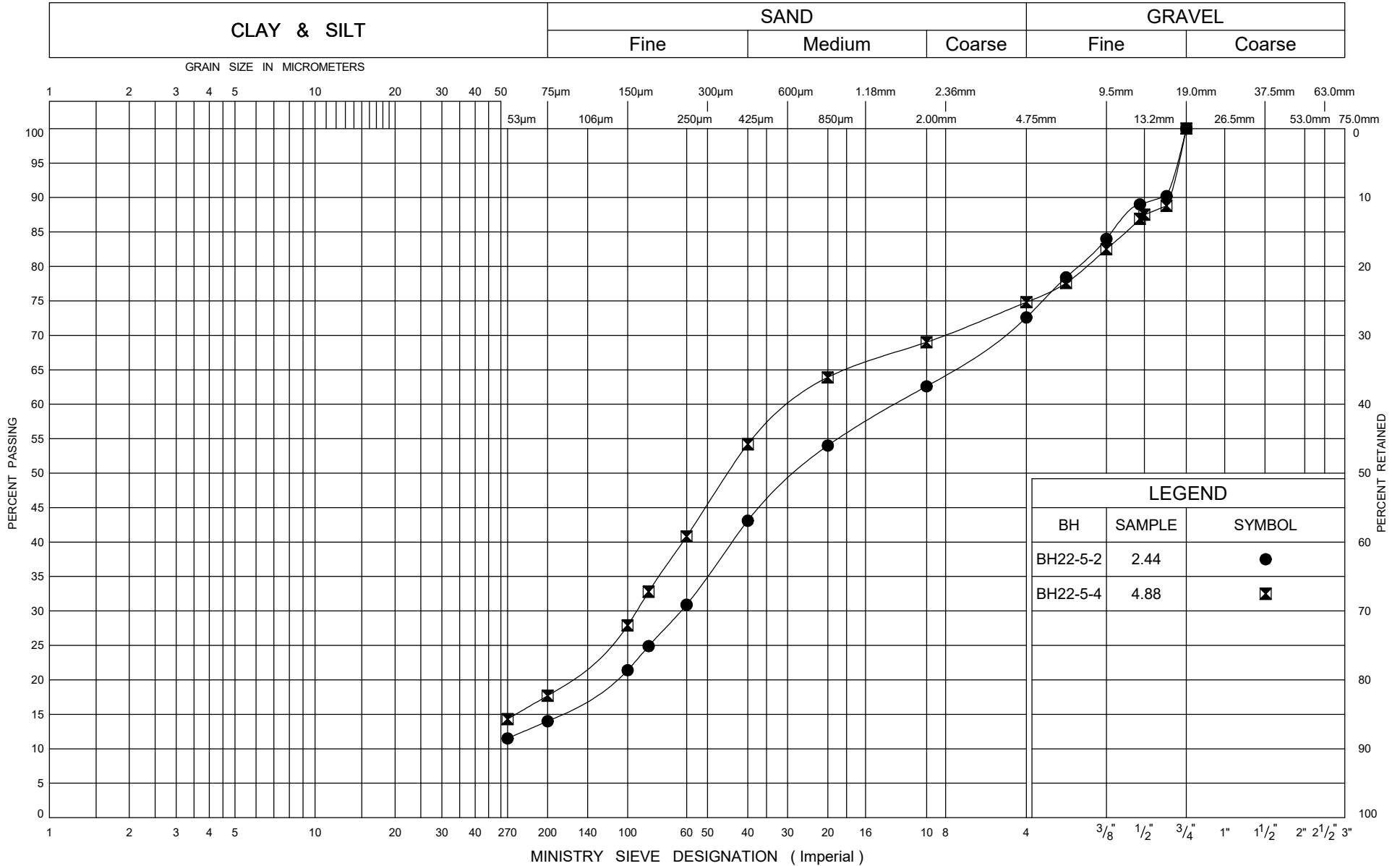
W.P. Site 37X-0216/B1 & B3 LOCATION Hwy 401 - Midland Ave O/P, Toronto, ON, MTM ON-10 322964.4E 4848578.1N ORIGINATED BY EL
 DIST Toronto HWY 401 BOREHOLE TYPE Truck Mount CME 75 / SSA COMPILED BY EL
 DATUM Geodetic DATE 2022.09.12 - 2022.09.12 LATITUDE 43.776941 LONGITUDE -79.27435 CHECKED BY TL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X P. PENETROMETER								WATER CONTENT (%)		
172.7								20	40	60	80	100						
0.0	PAVEMENT STRUCTURE - 175 mm of asphalt and 275 mm of concrete																	
172.2																		
0.5		GRAVELLY SAND (FILL) - some silt, greyish brown, slightly moist to moist, compact to dense		AS1	AS													
				SS2	SS	38												
				SS3	SS	25												
				SS4	SS	30												
				SS5	SS	32												
	- Occasional cobbles encountered		SS6	SS	31													
166.6																		
6.1	CLAYEY SILT (FILL) - trace gravel, trace sand, some rootlets inclusions, grey, moist, very stiff		SS7	SS	16													
166.0																		
6.7		SILTY CLAY - trace gravel, trace sand, grey, moist, firm																
			SS8	SS	7													
163.6																		
9.1	SANDY SILT - some clay, grey, moist, loose		SS9	SS	6													
163.0																		
9.7	END OF BOREHOLE																	
	NOTES: 1) Borehole terminated at 9.7 m depth within the top 3 m of native soils. 2) No groundwater encountered in open borehole upon completion of drilling.																	

ONTARIO MTO H401 - MIDLAND.GPJ ONTARIO MTO.GDT 6/26/23

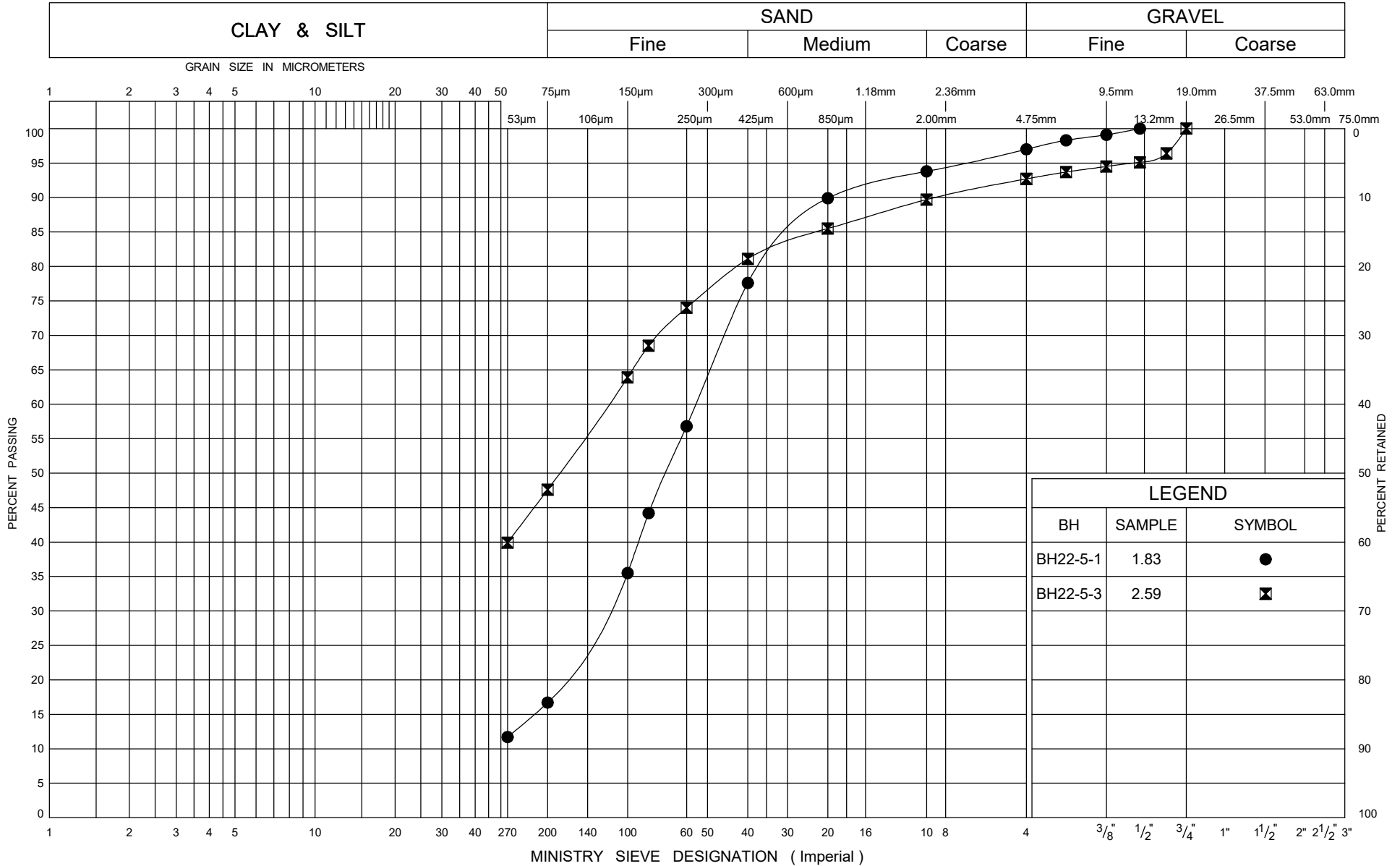
Appendix E – Laboratory Data

UNIFIED SOIL CLASSIFICATION SYSTEM

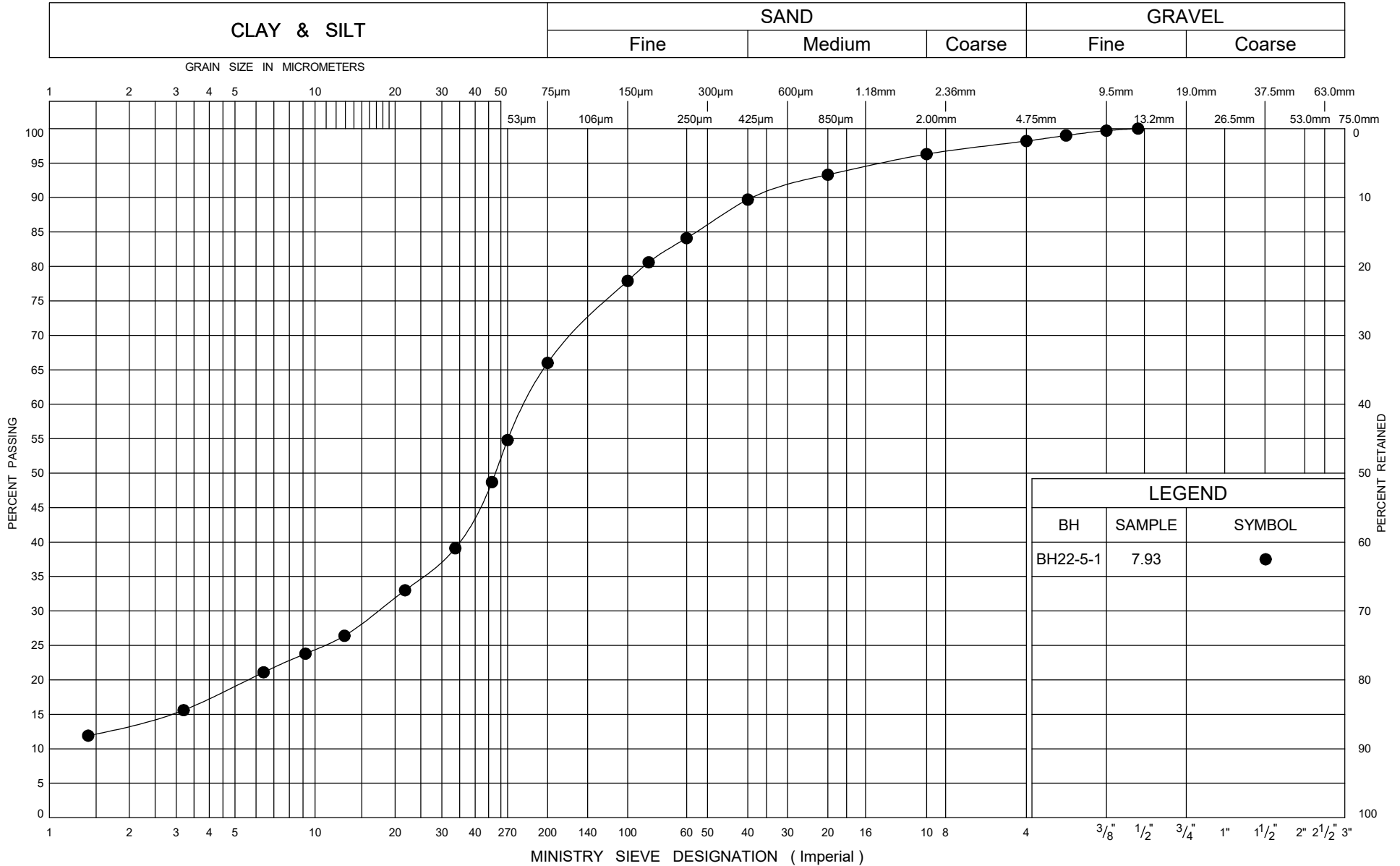


LEGEND		
BH	SAMPLE	SYMBOL
BH22-5-2	2.44	●
BH22-5-4	4.88	⊠

UNIFIED SOIL CLASSIFICATION SYSTEM



UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

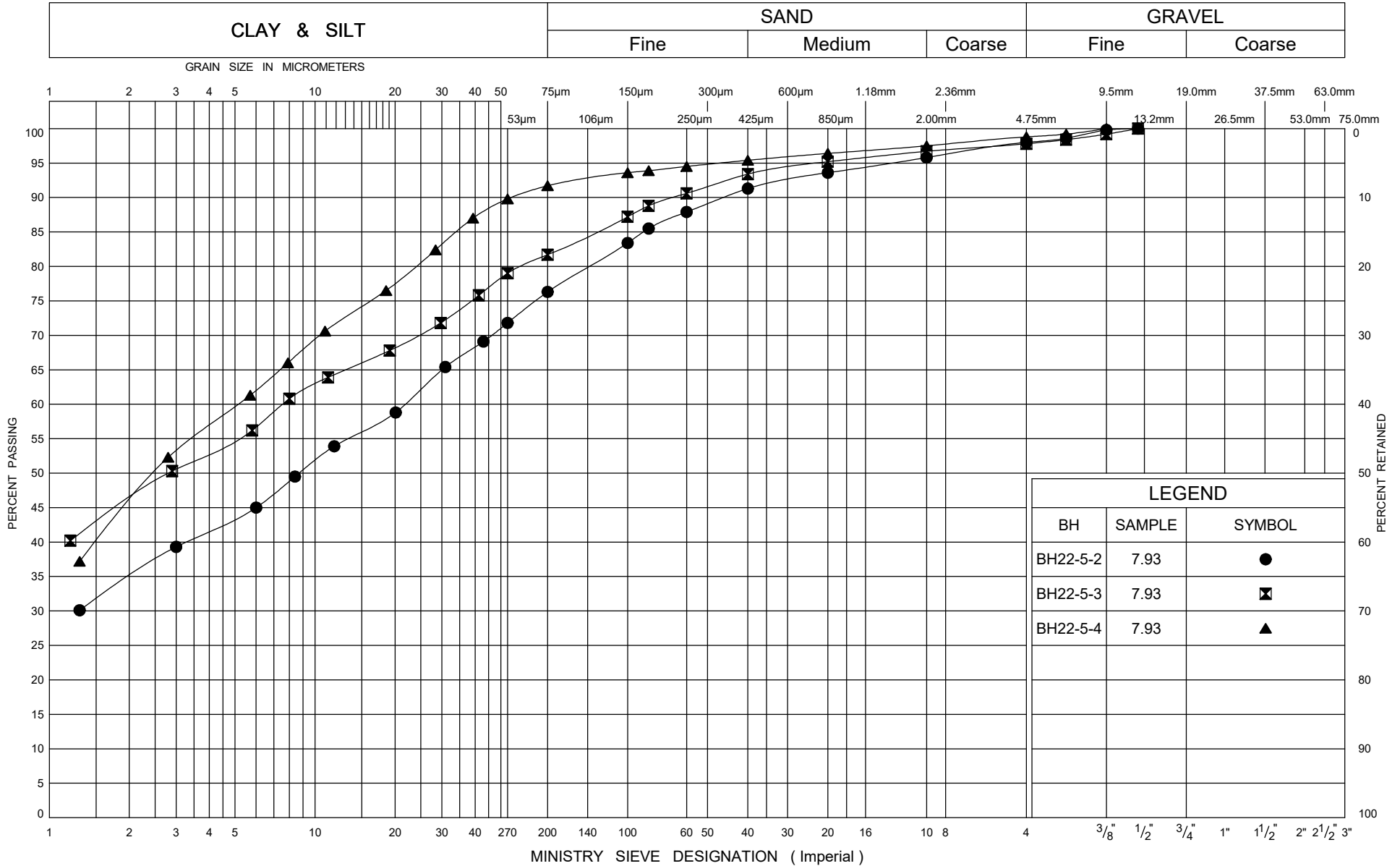
Cohesive Fill: Clayey Silt

FIG No 3

W P Site 37X-0216/B1 & B3

Hwy 401 - Midland Ave O/P

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

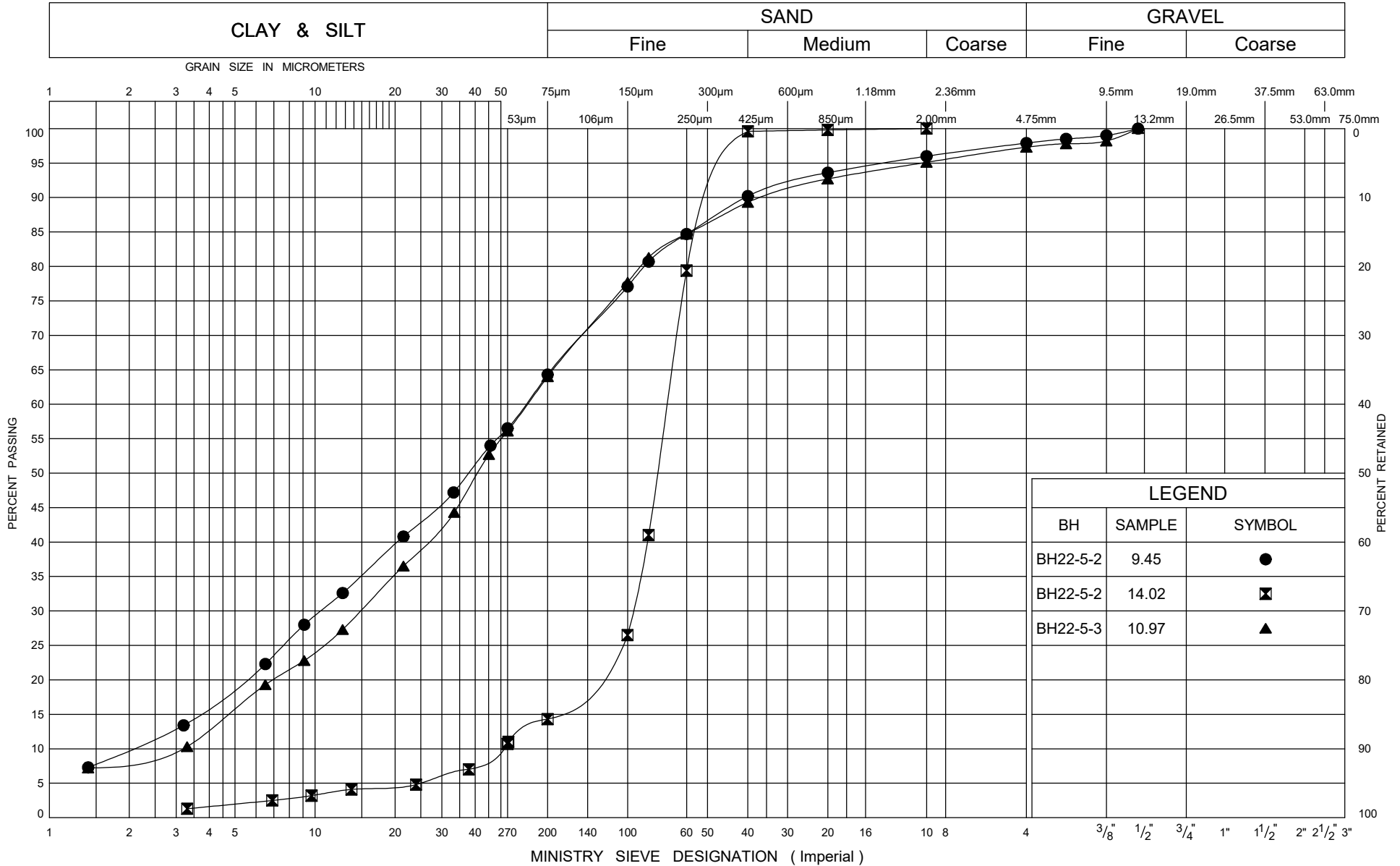
Silty Clay

FIG No 4

W P Site 37X-0216/B1 & B3

Hwy 401 - Midland Ave O/P

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation

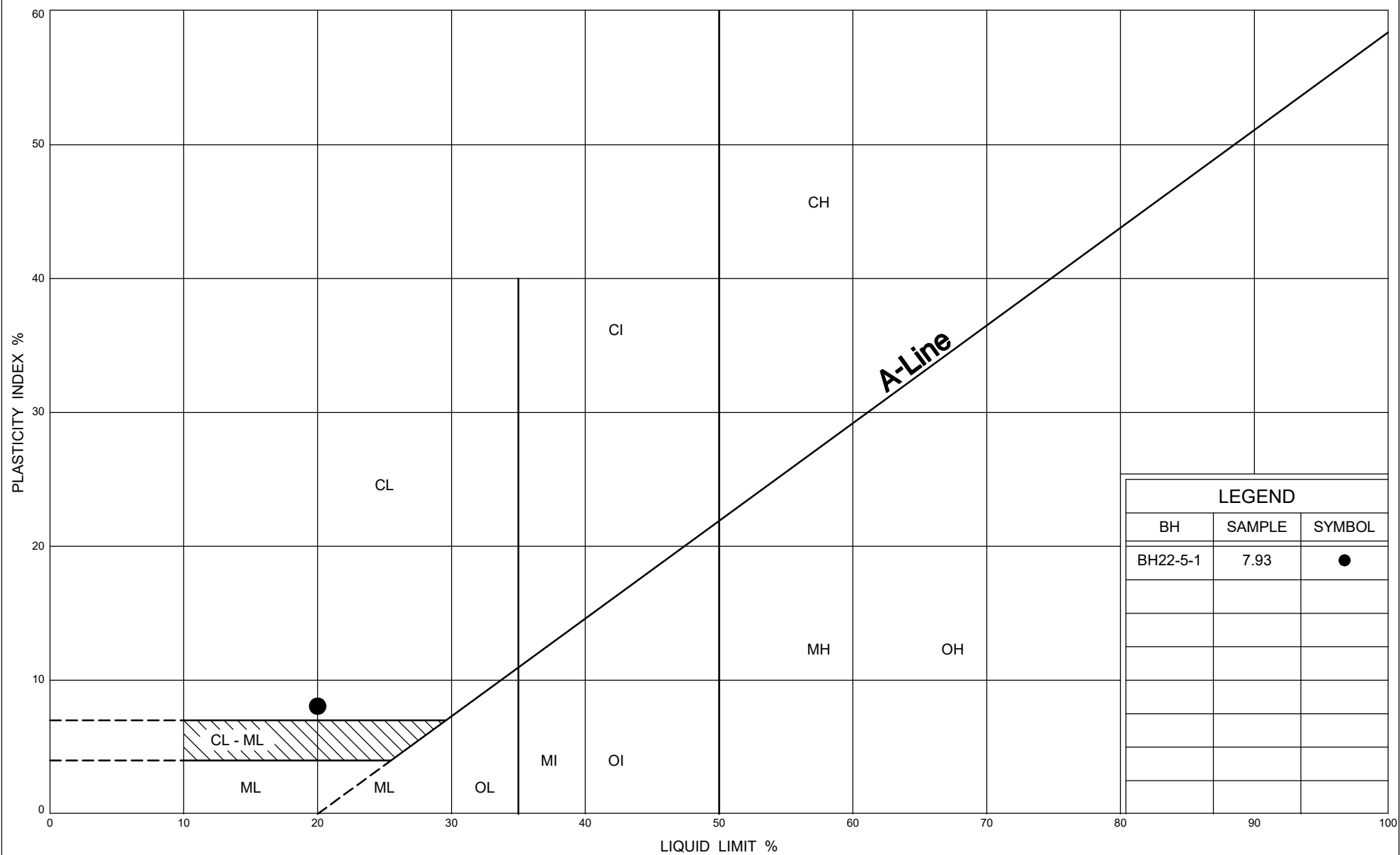
GRAIN SIZE DISTRIBUTION

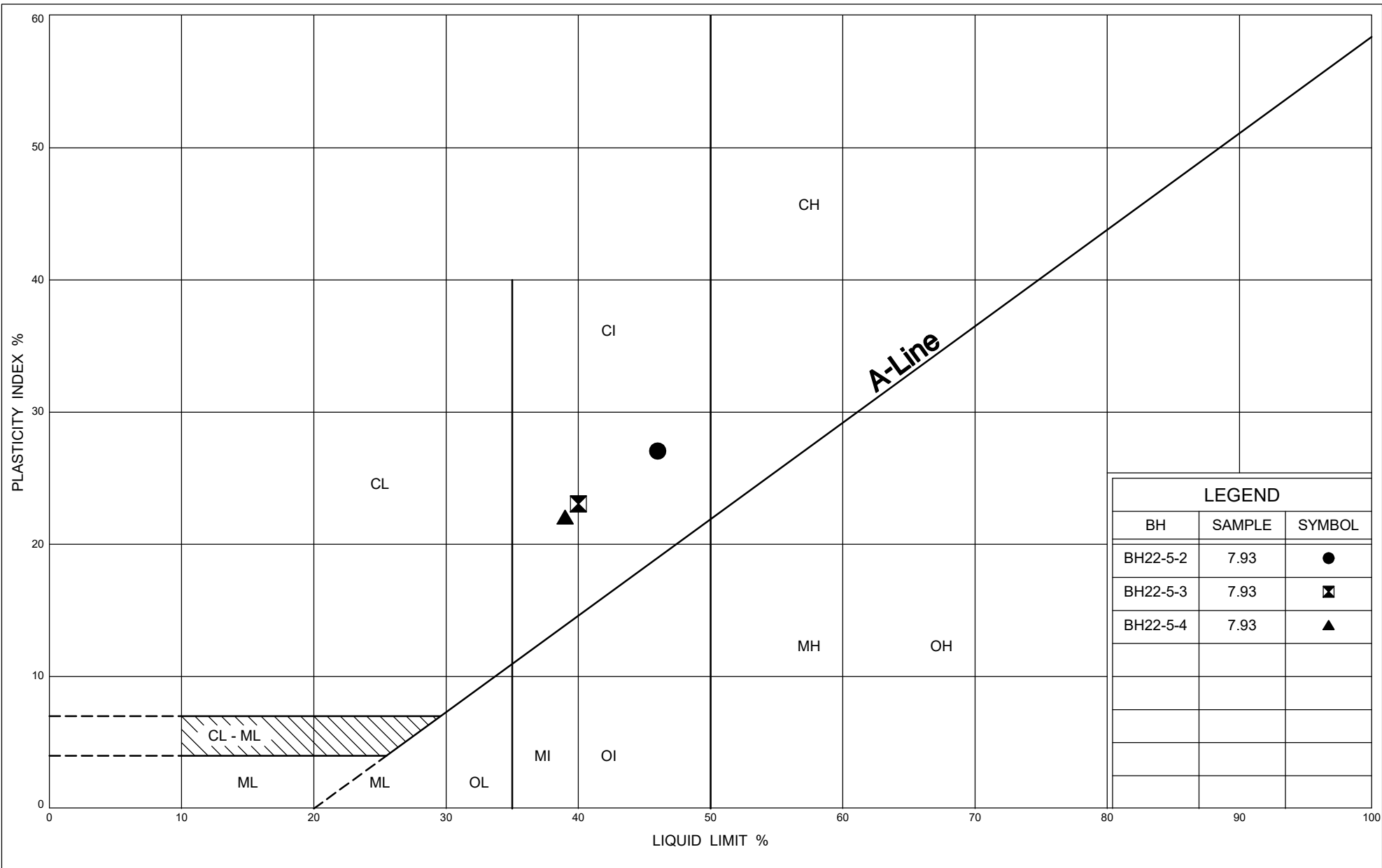
Sandy Silt to Sand

FIG No 5

W P Site 37X-0216/B1 & B3

Hwy 401 - Midland Ave O/P





Ministry of
Transportation

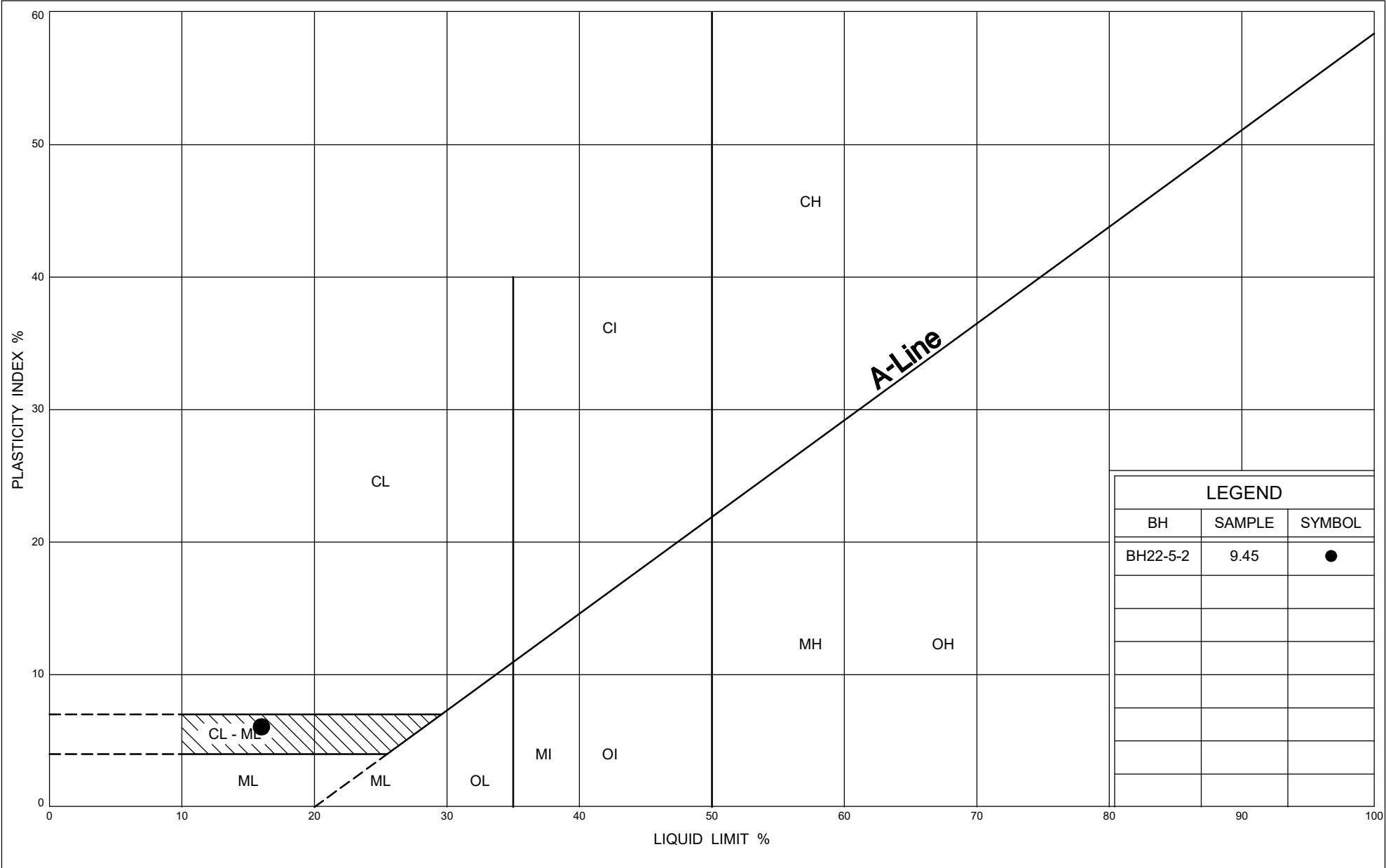
PLASTICITY CHART

Silty Clay

FIG No 7

W P Site 37X-0216/B1 & B3

Hwy 401 - Midland Ave O/P





Your Project #: ADM-22000797-A0
Site Location: Hwy 401 from Victoria to Nelson Ave, ON
Your C.O.C. #: 893860-01-01

Attention: Nimesh Tamrakar

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

Report Date: 2022/09/23
Report #: R7310677
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2Q5117

Received: 2022/09/14, 16:47

Sample Matrix: Soil
Samples Received: 1

Analyses	Quantity	Date	Date	Laboratory Method	Analytical Method
		Extracted	Analyzed		
Chloride (20:1 extract)	1	2022/09/19	2022/09/20	CAM SOP-00463	SM 23 4500-Cl E m
Conductivity	1	2022/09/20	2022/09/20	CAM SOP-00414	OMOE E3530 v1 m
Moisture (Subcontracted) (1, 2)	1	N/A	2022/09/20	AB SOP-00002	CCME PHC-CWS m
Sulphide in Soil (1)	1	N/A	2022/09/20	AB SOP-00080	EPA9030B/SM4500S2-DF
pH CaCl2 EXTRACT	1	2022/09/20	2022/09/20	CAM SOP-00413	EPA 9045 D m
Redox Potential (3)	1	2022/09/20	2022/09/20	CAM SOP-00421	SM 2580 B
Resistivity of Soil	1	2022/09/14	2022/09/20	CAM SOP-00414	SM 23 2510 m
Sulphate (20:1 Extract)	1	2022/09/19	2022/09/19	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.

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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
Site Location: Hwy 401 from Victoria to Nelson Ave, ON
Your C.O.C. #: 893860-01-01

Attention: Nimesh Tamrakar

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

Report Date: 2022/09/23
Report #: R7310677
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2Q5117

Received: 2022/09/14, 16:47

(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 your Project Manager.

Patricia Legette, Project Manager

Email: Patricia.Legette@bureauveritas.com

Phone# (905)817-5799

=====

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For Service Group specific validation please refer to the Validation Signature Page.



SOIL CORROSIVITY PACKAGE (SOIL)

Bureau Veritas ID		TST846		
Sampling Date		2022/09/08 01:00		
COC Number		893860-01-01		
	UNITS	BH22-5-2	RDL	QC Batch
Calculated Parameters				
Resistivity	ohm-cm	1100		8225586
CONVENTIONALS				
Redox Potential	mV	150	N/A	8234488
Inorganics				
Soluble (20:1) Chloride (Cl-)	ug/g	510	20	8232398
Conductivity	umho/cm	899	2	8235211
Available (CaCl2) pH	pH	8.15		8234842
Soluble (20:1) Sulphate (SO4)	ug/g	<20	20	8232412
Sulphide	mg/kg	0.8 (1)	0.5	8244503
Physical Testing				
Moisture-Subcontracted	%	7.1	0.30	8244502
RDL = Reportable Detection Limit QC Batch = Quality Control Batch N/A = Not Applicable (1) Sample extracted past method-specified hold time. Analyzed past method specified hold time				



BUREAU
VERITAS

Bureau Veritas Job #: C2Q5117

Report Date: 2022/09/23

exp Services Inc

Client Project #: ADM-22000797-A0

Site Location: Hwy 401 from Victoria to Nelson Ave, ON

Sampler Initials: NT

TEST SUMMARY

Bureau Veritas ID: TST846
Sample ID: BH22-5-2
Matrix: Soil

Collected: 2022/09/08
Shipped:
Received: 2022/09/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8232398	2022/09/19	2022/09/20	Alina Dobreanu
Conductivity	AT	8235211	2022/09/20	2022/09/20	Roya Fathitil
Moisture (Subcontracted)	BAL	8244502	N/A	2022/09/20	Ting Liu
Sulphide in Soil	SPEC	8244503	N/A	2022/09/20	Dafne Strozake Maximo
pH CaCl2 EXTRACT	AT	8234842	2022/09/20	2022/09/20	Taslima Aktar
Redox Potential	COND	8234488	2022/09/20	2022/09/20	Surinder Rai
Resistivity of Soil		8225586	2022/09/20	2022/09/20	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8232412	2022/09/19	2022/09/19	Samuel Law



GENERAL COMMENTS

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

Package 1	3.3°C
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Results relate only to the items tested.



BUREAU
VERITAS

Bureau Veritas Job #: C2Q5117

Report Date: 2022/09/23

QUALITY ASSURANCE REPORT

exp Services Inc

Client Project #: ADM-22000797-A0

Site Location: Hwy 401 from Victoria to Nelson Ave, ON

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
8232398	Soluble (20:1) Chloride (Cl ⁻)	2022/09/20	114	70 - 130	103	70 - 130	<20	ug/g	NC	35
8232412	Soluble (20:1) Sulphate (SO ₄)	2022/09/19	NC	70 - 130	102	70 - 130	<20	ug/g	19	35
8234488	Redox Potential	2022/09/20			100	95 - 105			21	N/A
8234842	Available (CaCl ₂) pH	2022/09/20			100	97 - 103			0.085	N/A
8235211	Conductivity	2022/09/20			101	90 - 110	<2	umho/cm	1.1	10
8244502	Moisture-Subcontracted	2022/09/20					<0.30	%		
8244503	Sulphide	2022/09/20	90	75 - 125	111	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 (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

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).



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		Page of	
INVOICE TO: Company Name: #17488 exp Services Inc Attention: Accounts Payable Address: 1595 Clark Blvd Brampton ON L6T 4V1 Tel: (905) 793-9800 Fax: (905) 793-0641 Email: AP@exp.com; Karen.Burke@exp.com		REPORT TO: Company Name: Attention: Nimesh Tamrakar Address: Tel: (905) 796-3200 Ext: 3026 Fax: Email: Nimesh.Tamrakar@exp.com	
PROJECT INFORMATION: Quotation #: C20328 P.O. #: ADM-22000797-A0 Project Name: Hwy 401 from Victoria to Nelso Site #: UK Sampled By:		14-Sep-22 16:47 Patricia Legette C2Q5117 ENV-640 C#893860-01-01	
MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BUREAU VERITAS DRINKING WATER CHAIN OF CUSTODY			
Regulation 153 (2011) <input type="checkbox"/> Table 1 <input type="checkbox"/> Res/Park <input type="checkbox"/> Medium/Fine <input type="checkbox"/> Table 2 <input type="checkbox"/> Ind/Comm <input type="checkbox"/> Coarse <input type="checkbox"/> Table 3 <input type="checkbox"/> Agri/Other <input type="checkbox"/> For RSC <input type="checkbox"/> Table		Other Regulations <input type="checkbox"/> CCME <input type="checkbox"/> Sanitary Sewer Bylaw <input type="checkbox"/> Reg 558 <input type="checkbox"/> Storm Sewer Bylaw <input type="checkbox"/> MISA Municipality <input type="checkbox"/> PWQO <input type="checkbox"/> Reg 406 Table <input type="checkbox"/> Other	
Special Instructions		ANALYSIS REQUESTED (PLEASE BE SPECIFIC)	
Include Criteria on Certificate of Analysis (Y/N)?		Field Filtered (please circle): Metals / Hg / Cr / V Soil Corrosivity Package	
Sample Barcode Label 1 BH 22-5-2	Sample (Location) Identification 356 (15'-17') midline	Date Sampled SEP 8, 2022	Time Sampled 1 AM
Matrix SOIL	Field Filtered (please circle): Metals / Hg / Cr / V Soil Corrosivity Package	ANALYSIS REQUESTED (PLEASE BE SPECIFIC)	
2			
3			
4			
5			
6			
7			
8			
9			
10			
* RELINQUISHED BY: (Signature/Print) Nimesh Tamrakar		Date: (YY/MM/DD) SEP 14, 2022	Time 1:00 PM
RECEIVED BY: (Signature/Print) Patricia Legette		Date: (YY/MM/DD) SEP 14, 2022	Time 1:00 PM
# jars used and not submitted		Laboratory Use Only Time Sensitive Temperature (°C) on Receipt 9/14/22	
* 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/TERMS-AND-CONDITIONS.		** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT WWW.BVNA.COM/RESOURCES/CHAIN-OF-CUSTODY-FORMS.	
* 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	
White: Bureau Veritas Yellow: Client		Signature: Patricia Legette	



Your Project #: Campobello job# C2Q5117

Attention: Patricia Legette

BUREAU VERITAS
CAMPOBELLO
6740 CAMPOBELLO ROAD
MISSISSAUGA, ON
CANADA L5N 2L8

Report Date: 2022/09/23

Report #: R3237165

Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C270521

Received: 2022/09/14, 21:08

Sample Matrix: Soil
Samples Received: 1

Analyses	Date		Date Analyzed	Laboratory Method	Analytical Method
	Quantity	Extracted			
Moisture	1	N/A	2022/09/20	AB SOP-00002	CCME PHC-CWS m
Sulphide	1	2022/09/19	2022/09/20	AB SOP-00080	EPA9030B/SM4500S2-DF

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.



Your Project #: Campobello job# C2Q5117

Attention: Patricia Legette

BUREAU VERITAS
CAMPOBELLO
6740 CAMPOBELLO ROAD
MISSISSAUGA, ON
CANADA L5N 2L8

Report Date: 2022/09/23

Report #: R3237165

Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C270521

Received: 2022/09/14, 21:08

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Customer Solutions, Western Canada Customer Experience Team

Email: customersolutionswest@bureauveritas.com

Phone# (403) 291-3077

=====

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RESULTS OF CHEMICAL ANALYSES OF SOIL

Bureau Veritas ID		BBW213		
Sampling Date		2022/09/08 01:00		
	UNITS	BH22-5-2	RDL	QC Batch
Misc. Inorganics				
Sulphide	mg/kg	0.8 (1)	0.5	A720754
RDL = Reportable Detection Limit				
(1) Sample extracted past method-specified hold time. Analyzed past method specified hold time				



BUREAU
VERITAS

Bureau Veritas Job #: C270521

Report Date: 2022/09/23

BUREAU VERITAS

Client Project #: Campobello job# C2Q5117

Sampler Initials: NT

PHYSICAL TESTING (SOIL)

Bureau Veritas ID		BBW213		
Sampling Date		2022/09/08 01:00		
	UNITS	BH22-5-2	RDL	QC Batch
Physical Properties				
Moisture	%	7.1	0.30	A721816
RDL = Reportable Detection Limit				



BUREAU
VERITAS

Bureau Veritas Job #: C270521
Report Date: 2022/09/23

BUREAU VERITAS
Client Project #: Campobello job# C2Q5117
Sampler Initials: NT

TEST SUMMARY

Bureau Veritas ID: BBW213
Sample ID: BH22-5-2
Matrix: Soil

Collected: 2022/09/08
Shipped:
Received: 2022/09/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	A721816	N/A	2022/09/20	Ting Liu
Sulphide	SPEC	A720754	2022/09/19	2022/09/20	Dafne Strozake Maximo



GENERAL COMMENTS

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

Package 1	4.4°C
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Results relate only to the items tested.



BUREAU
VERITAS

Bureau Veritas Job #: C270521

Report Date: 2022/09/23

QUALITY ASSURANCE REPORT

BUREAU VERITAS

Client Project #: Campobello job# C2Q5117

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
A720754	Sulphide	2022/09/20	90	75 - 125	111	75 - 125	<0.5	mg/kg	6.9	30
A721816	Moisture	2022/09/20					<0.30	%	4.7	20

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.



BUREAU
VERITAS

Bureau Veritas Job #: C270521

Report Date: 2022/09/23

BUREAU VERITAS

Client Project #: Campobello job# C2Q5117

Sampler Initials: NT

VALIDATION SIGNATURE PAGE

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

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

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

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Your Project #: ADM-22000797-A0
Site Location: MIDLAND/MARKHAM - 401 HWY
Your C.O.C. #: n/a

Attention: Silvana Micic

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

Report Date: 2022/09/22
Report #: R7308420
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2Q5822

Received: 2022/09/15, 10:29

Sample Matrix: Soil
Samples Received: 2

Analyses	Quantity	Date	Date	Laboratory Method	Analytical Method
		Extracted	Analyzed		
Chloride (20:1 extract)	2	2022/09/20	2022/09/21	CAM SOP-00463	SM 23 4500-Cl E m
Conductivity	2	2022/09/20	2022/09/20	CAM SOP-00414	OMOE E3530 v1 m
Moisture (Subcontracted) (1, 2)	2	N/A	2022/09/21	AB SOP-00002	CCME PHC-CWS m
Sulphide in Soil (1)	2	N/A	2022/09/21	AB SOP-00080	EPA9030B/SM4500S2-DF
pH CaCl2 EXTRACT	2	2022/09/21	2022/09/21	CAM SOP-00413	EPA 9045 D m
Redox Potential (3)	2	2022/09/20	2022/09/20	CAM SOP-00421	SM 2580 B
Resistivity of Soil	2	2022/09/16	2022/09/20	CAM SOP-00414	SM 23 2510 m
Sulphate (20:1 Extract)	2	2022/09/20	2022/09/20	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.

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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
Site Location: MIDLAND/MARKHAM - 401 HWY
Your C.O.C. #: n/a

Attention: Silvana Micic

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

Report Date: 2022/09/22
Report #: R7308420
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2Q5822

Received: 2022/09/15, 10:29

(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 your Project Manager.

Patricia Legette, Project Manager

Email: Patricia.Legette@bureauveritas.com

Phone# (905)817-5799

=====

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BUREAU
VERITAS

Bureau Veritas Job #: C2Q5822
Report Date: 2022/09/22

exp Services Inc
Client Project #: ADM-22000797-A0
Site Location: MIDLAND/MARKHAM - 401 HWY
Sampler Initials: EL

SOIL CORROSIVITY PACKAGE (SOIL)

Bureau Veritas ID		TSY134			TSY134			TSY135		
Sampling Date		2022/09/12 13:00			2022/09/12 13:00			2022/09/13 13:00		
COC Number		n/a			n/a			n/a		
	UNITS	BH22-5-4 SS5	RDL	QC Batch	BH22-5-4 SS5 Lab-Dup	RDL	QC Batch	BH22-6-1 SS5	RDL	QC Batch
Calculated Parameters										
Resistivity	ohm-cm	1500		8229384				540		8229384
CONVENTIONALS										
Redox Potential	mV	110	N/A	8234488				180	N/A	8234488
Inorganics										
Soluble (20:1) Chloride (Cl ⁻)	ug/g	330	20	8234709				1000	40	8234709
Conductivity	umho/cm	660	2	8235211				1870	2	8235211
Available (CaCl ₂) pH	pH	8.17		8237272				7.24		8237272
Soluble (20:1) Sulphate (SO ₄)	ug/g	<20	20	8234714				<20	20	8234714
Sulphide	mg/kg	2.0 (1)	0.5	8241140	2.6	0.5	8241140	<0.5 (1)	0.5	8241140
Physical Testing										
Moisture-Subcontracted	%	5.6	0.30	8241139				15	0.30	8241139
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate N/A = Not Applicable (1) Sample extracted past method-specified hold time. Sample contained greater than 10% headspace at time of extraction. Analyzed past method specified hold time										

Bureau Veritas ID		TSY135		
Sampling Date		2022/09/13 13:00		
COC Number		n/a		
	UNITS	BH22-6-1 SS5 Lab-Dup	RDL	QC Batch
Inorganics				
Conductivity	umho/cm	1850	2	8235211
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate				



BUREAU
VERITAS

Bureau Veritas Job #: C2Q5822
Report Date: 2022/09/22

exp Services Inc
Client Project #: ADM-22000797-A0
Site Location: MIDLAND/MARKHAM - 401 HWY
Sampler Initials: EL

TEST SUMMARY

Bureau Veritas ID: TSY134
Sample ID: BH22-5-4 SS5
Matrix: Soil

Collected: 2022/09/12
Shipped:
Received: 2022/09/15

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8234709	2022/09/20	2022/09/21	Samuel Law
Conductivity	AT	8235211	2022/09/20	2022/09/20	Roya Fathitil
Moisture (Subcontracted)	BAL	8241139	N/A	2022/09/21	Eric Tse
Sulphide in Soil	SPEC	8241140	N/A	2022/09/21	Ly Vu
pH CaCl2 EXTRACT	AT	8237272	2022/09/21	2022/09/21	Taslina Aktar
Redox Potential	COND	8234488	2022/09/20	2022/09/20	Surinder Rai
Resistivity of Soil		8229384	2022/09/20	2022/09/20	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8234714	2022/09/20	2022/09/20	Samuel Law

Bureau Veritas ID: TSY134 Dup
Sample ID: BH22-5-4 SS5
Matrix: Soil

Collected: 2022/09/12
Shipped:
Received: 2022/09/15

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sulphide in Soil	SPEC	8241140	N/A	2022/09/21	Ly Vu

Bureau Veritas ID: TSY135
Sample ID: BH22-6-1 SS5
Matrix: Soil

Collected: 2022/09/13
Shipped:
Received: 2022/09/15

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8234709	2022/09/20	2022/09/21	Samuel Law
Conductivity	AT	8235211	2022/09/20	2022/09/20	Roya Fathitil
Moisture (Subcontracted)	BAL	8241139	N/A	2022/09/21	Eric Tse
Sulphide in Soil	SPEC	8241140	N/A	2022/09/21	Ly Vu
pH CaCl2 EXTRACT	AT	8237272	2022/09/21	2022/09/21	Taslina Aktar
Redox Potential	COND	8234488	2022/09/20	2022/09/20	Surinder Rai
Resistivity of Soil		8229384	2022/09/20	2022/09/20	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8234714	2022/09/20	2022/09/20	Samuel Law

Bureau Veritas ID: TSY135 Dup
Sample ID: BH22-6-1 SS5
Matrix: Soil

Collected: 2022/09/13
Shipped:
Received: 2022/09/15

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Conductivity	AT	8235211	2022/09/20	2022/09/20	Roya Fathitil



GENERAL COMMENTS

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

Package 1	1.3°C
-----------	-------

Results relate only to the items tested.

BUREAU
VERITAS

Bureau Veritas Job #: C2Q5822

Report Date: 2022/09/22

QUALITY ASSURANCE REPORT

exp Services Inc

Client Project #: ADM-22000797-A0

Site Location: MIDLAND/MARKHAM - 401 HWY

Sampler Initials: EL

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
8234488	Redox Potential	2022/09/20			100	95 - 105			21	N/A
8234709	Soluble (20:1) Chloride (Cl-)	2022/09/21	116	70 - 130	108	70 - 130	<20	ug/g	NC	35
8234714	Soluble (20:1) Sulphate (SO4)	2022/09/20	NC	70 - 130	99	70 - 130	<20	ug/g	NC (1)	35
8235211	Conductivity	2022/09/20			101	90 - 110	<2	umho/cm	1.1	10
8237272	Available (CaCl2) pH	2022/09/21			100	97 - 103			1.1	N/A
8241139	Moisture-Subcontracted	2022/09/21					<0.30	%		
8241140	Sulphide	2022/09/21	113	75 - 125	114	75 - 125	<0.5	mg/kg	25	30

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 (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

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) Due to colour interferences, sample required dilution. Detection limit was adjusted accordingly.



BUREAU
VERITAS

Bureau Veritas Job #: C2Q5822

Report Date: 2022/09/22

exp Services Inc

Client Project #: ADM-22000797-A0

Site Location: MIDLAND/MARKHAM - 401 HWY

Sampler Initials: EL

VALIDATION SIGNATURE PAGE

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

Cristina Carriere, Senior Scientific Specialist

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

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

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 Signature Page.



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6740 Campobello Road, Mississauga, Ontario L5N 2L8
Phone: 905-817-5700 Fax: 905-817-5779 Toll Free: 800-563-6266CHAIN OF CUSTODY RECORD
ENV COC - 00014v3

Page 1 of 1

Invoice Information				Report Information (if differs from invoice)				Project Information			
Company: EXP Services				Company: EXP SERVICES				Quotation #:			
Contact Name: ELVIS LU				Contact Name: ELVIS LU				P.O. #/ A/E/R:			
Street Address: 1595 CLOAK BLVD				Street Address:				Project #: ADH-22000797-A0			
City: BROMPTON		Prov: ON		City:		Prov:		Site #:		Site Location: 401 HWY 4	
Phone: 519 870 4510		Postal Code: L6T 4M1		City:		Postal Code:		Site Location:		Province: ON	
Email: Elvis.Lu@EXP.COM				Email:				Sampled By: ELVIS LU			
Copies:				Copies:							

Regulatory Criteria				Regular Turnaround Time (TAT)																																					
REG 153 <input type="checkbox"/> Table 1 <input type="checkbox"/> Table 2 <input type="checkbox"/> Table 3 <input type="checkbox"/> Table				Res/Park <input type="checkbox"/> Ind/Comm <input type="checkbox"/> Agri/other				Med/Fine <input type="checkbox"/> Course <input type="checkbox"/> For RSC				OTHER <input type="checkbox"/> CMCE <input type="checkbox"/> Reg 558* <input type="checkbox"/> *min 3 day TAT <input type="checkbox"/> MISA <input type="checkbox"/> PWQO <input type="checkbox"/> Other:				Reg 406, Table: <input type="checkbox"/> Sanitary Sewer Bylaw <input type="checkbox"/> Storm Sewer Bylaw <input type="checkbox"/> Municipality				<input type="checkbox"/> 5 to 7 Day <input type="checkbox"/> 10 Day <input type="checkbox"/> Rush Turnaround Time (TAT) Surcharges apply <input type="checkbox"/> Same Day <input type="checkbox"/> 1 Day <input type="checkbox"/> 2 Day <input type="checkbox"/> 3 Day <input type="checkbox"/> 4 Day																					
Include Criteria on Certificate of Analysis (check if yes): <input type="checkbox"/>																																									
SAMPLES MUST BE KEPT COOL (<10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BUREAU VERITAS																																									
Sample Identification			Date Sampled			Time (24hr)		Matrix																																	
YY	MM	DD	HH	MM																																					
1	22	09	12																																						
2	22	09	12																																						
3	22	09	13																																						
4	22	09	13																																						
5																																									
6																																									
7																																									
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11																																									
12																																									

*UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BUREAU VERITAS STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS AND CONDITIONS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVNA.COM/TERMS-AND-CONDITIONS OR BY CALLING THE LABORATORY LISTED ABOVE TO OBTAIN A COPY.

LAB USE ONLY				LAB USE ONLY				LAB USE ONLY				Temperature reading by:			
Seal present	Yes	No		Seal present	Yes	No		Seal present	Yes	No					
Seal intact	Yes	No		Seal intact	Yes	No		Seal intact	Yes	No					
Cooling media present	Yes	No		Cooling media present	Yes	No		Cooling media present	Yes	No					

Relinquished by: (Signature/Print)				Date				Time				Received by: (Signature/Print)				Date				Time				Special Instructions				
YY	MM	DD	HH	MM		YY	MM	DD	HH	MM	YY	MM	DD	HH	MM	YY	MM	DD	HH	MM								
1	22	09	15	10	24	1	22	09	15	10	24	22	09	15	10	24												
2						2																						

Appendix F – Previous Investigation - BH logs

BH 74-1A

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

JOB 66-F-87

W.P. 260-61

DATUM Geodetic

RECORD OF BOREHOLE NO. 1A

FOUNDATION SECTION

LOCATION Sta. 371 +59.5; 1.5' Int. 2

BORING DATE Oct. 31, 1966

BOREHOLE TYPE Washboring, BX Casing

ORIGINATED BY J.K.B.

COMPILED BY A.K.B.

CHECKED BY *AKB*

SOIL PROFILE		SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT SHEAR STRENGTH P.S.F.	LIQUID LIMIT PLASTIC LIMIT WATER CONTENT % W.P. — W.L. — W.P. — W.L. —	BULK DENSITY P.C.F.	REMARKS
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE					
171.3	562.0 GROUND LEVEL							
0.0								
	Brown & Grey	1	SS 42					
	Sandy Silt with traces of clay	2	SS 25					
		3	SS 8					
	Loose to very dense	4	SS 21					Gr. 3% Sa. 44% Sl. 42% Cl. 11%
		5	SS 16					Gr. 4% Sa. 39% Sl. & Cl. 57%
		6	SS 100/6"					
		7	SS 100/5"					
		8	SS 100/5"					
157.1	515.5							
14.2	46.5							

MATERIALS & TESTING DIVISION

JOB 66-F-87

W.P. 260-61

DATUM Geodetic

RECORD OF BOREHOLE NO. 2A

LOCATION Sta. 370 #03.5; 1' Rt. of E

BORING DATE November 2, 1966

BOREHOLE TYPE Washboring, BX Casing

FOUNDATION SECTION

ORIGINATED BY AKB

COMPILED BY AKB

CHECKED BY *AKB*

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	NUMBER	TYPE					
560.7	GROUND LEVEL							
0.0								
	Brown & Grey	1	SS 13					
	Silt with occ. layers of clayey silt.	2	SS 21					
		3	SS 22					
	Compact	4	SS 28					
		5	SS 19					
		6	SS 100/4"					
		7	SS 100/3"					
	Silty Sand to Sand.	8	SS 100/5"					
	Very Dense							
509.2		9	SS 129					
51.5	End of Borehole							

WATER CONTENT %

10 20 30

W P WL

Org. 2.6%

N.P.

1709

15.7

155.2

BH 74-3

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

JOB 66-F-87

W.P. 260-61

DATUM Geodetic

RECORD OF BOREHOLE NO. 3

FOUNDATION SECTION

LOCATION Sta. 370 & 05; 139' Rt. of C

BORING DATE Oct. 7, 1966

BOREHOLE TYPE Washboring, BX Casing

ORIGINATED BY AKB

COMPILED BY AKB

CHECKED BY *AKB*

SOIL PROFILE		SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W		BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	NUMBER	TYPE		BLOWS / FOOT	SHEAR STRENGTH P.S.F.	WP	WL		
542.0	GROUND LEVEL									
0.0				540						
	Brown & Grey	1	SS	14						
		2	SS	20						
	Silty Sand with traces of gravel.	3	SS	141						
		4	SS	100/6"						
		5	SS	100/6"						
		6	SS	100/3"						
	Compact to very dense.	7	SS	100/5"	520					
		8	SS	155						
		9	SS	170	510					
		10	SS	156						
505.5										
36.5	End of Borehole									

$$\frac{W.L.}{W.P.} = \frac{538.5}{51.538.5}$$

Gr. 21%
Sa. 47%
Si. & Cl. 32%

BH 74-4

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

JOB 66-P-87

W.P. 260-63

DATUM Geodetic

RECORD OF BOREHOLE NO. 4

FOUNDATION SECTION

LOCATION Sta. 371 + 50; 139' Ht. of ϕ

BORING DATE Oct. 12, 1963

BOREHOLE TYPE Washboring, BX Casing

ORIGINATED BY AKB

COMPILED BY AKB

CHECKED BY *AKB*

(in)	SOIL PROFILE		SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W		BULK DENSITY γ P.C.F.	REMARKS
	ELEV. DEPTH	DESCRIPTION	NUMBER	TYPE		BLOWS / FOOT	SHEAR STRENGTH P.S.F.	WP	WL		
166.1	545.1	GROUND LEVEL									
	0.0		1	SS 16	540						
		Brown & Grey	2	SS 27							
		Silty sand with traces of clay	3	SS 10							
			4	SS 146							
			5	SS 100/5"	530						
		Compact to very dense	6	SS 106							
			7	SS 61							
			8	SS 100/5"	520						
			9	SS 100/5"							
			10	SS 100/5"	510						
155.0	508.6										
111	36.5	End of Borehole									

 $\frac{\Delta W.L.}{\Delta E.L.} = \frac{540.0}{540.0}$

 Gr. 1%
 Sa. 70%
 Si. & Cl. 29%