Foundation Investigation Report

Highway 401 Eastbound Express and Collector Lanes between Victoria Park Avenue and Neilson Road – **Rehabilitation of Consilium Place Underpass Structure (Site 37X-1145/B0)**

Assignment No. 2021-E-0018
MTO Central Region
Geocres Number: 30M14-670

(Latitude: 43.779860, Longitude: -79.253592)

Type of Document:
Foundation Investigation Report

Project Number:
ADM-22000797-A0

Prepared For:
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Date Submitted:
March 13, 2026

AECOM Canada Ltd.

Foundation Investigation Report

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Issue and Revised Record

Rev.	Date	Format	Prepared by	Reviewed by	Approved by	Description
Rev. 0	January 7, 2026	pdf	B. Bhujel N. Tamrakar	T. Lardner T.C. Kim	S. Gonsalves	Draft Report
Rev. 1	March 13, 2026	pdf	B. Bhujel N. Tamrakar	T. Lardner T.C. Kim	S. Gonsalves	Final Report

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References

Part I: Foundation Investigation Report

Highway 401 Eastbound Express and Collector Lanes between Victoria Park Avenue and Neilson Road – Rehabilitation of Consilium Place Underpass Structure (Site 37X-1145/B0)

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 the additional scope to Assignment No. 2021-E-0018 as defined by AECOM on September 27, 2024. The scope of this report is specific to the proposed rehabilitation of the Consilium Place Overpass structure (Site 37X-1145/B0).

The General Arrangement (GA) drawing for the proposed rehabilitation of the Consilium Place Overpass structure was provided to EXP by AECOM. The purpose of the investigation was to evaluate the subsurface conditions along the structure alignment to support the detailed design for the proposed rehabilitation of the structure.

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

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

2.0 Structure Description

The GA drawing titled "*Hwy 401 EB Core & Collector Lane S-E McCowan Ramp Consilium Place Underpass",* prepared by AECOM, dated August 2024, shows the preliminarily proposed rehabilitation work of the structure. A summary of the structure is as follows:

1. The existing structure is about 13.38 m long single span bridge. It is understood that the existing abutments and retaining wall foundations are supported on spread footings founded at about Elevation 158 m.
2. The superstructure of the existing single-span bridge is proposed to be rehabilitated, which involves:
    - replacement of approach slabs, and concrete raised median on deck and approaches, and asphalt and waterproofing system on deck;
    - excavation behind abutment walls, removal of existing ballast walls, reconstruction of ballast walls, new semi-integral abutment deck extensions and backfill;
    - removal of deteriorated concrete from deck top surface, deck ends, deck soffit, barrier walls, sidewalk, abutment walls, wingwalls and repair of concrete;
    - replacement of abutment bearings and replacement of expansion joint assemblies with new sleeper slabs and expansion joints
3. The existing foundations will remain to support the abutments and retaining walls.
4. No widening of the existing overpass structure is proposed.

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 EB Core & Collector Lane S-E McCowan Ramp and Consilium Place, approximately 6.9 km east of Highway 404 in the City of Toronto, Ontario. The site is located south the Highway 401 and east of McCowan Road. In general, the terrain in this area is relatively flat, with the natural ground surface sloping gently towards the south. The Consilium Place pavement grade ranges between about Elevation 165.4 m to 166.7 m while Highway 401 EB Core & Collector Lane S-E McCowan Ramp pavement grade is at about Elevation 159.5 m at the structure site.

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 consist 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

No Previous geotechnical investigation report was identified at this structure location.

5.0 Field Investigation and Laboratory Analyses

5.1 Site Investigation and Field Testing

A site-specific investigation was undertaken by EXP between December 12, 2025, and December 13, 2025, 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. Two boreholes were completed for this structure (BH25-CV-01 and BH25-CV-02) as part of the field investigation. A summary of boreholes completed by EXP is listed in Table 1.1 below. The boreholes were 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 1.1 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 1.1: 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				
BH25-CV-01	~7.4 m west of West Abutment, (Left Lane of EBL Consilium Pl)	4848892.91	324619.07	43.779732	-79.253783	166.4	6.7
BH25-CV-02	~7.6 m east of East Abutment, (Left Lane of EBL Consilium Pl)	4848918.35	324650.57	43.77996	-79.253391	166.5	6.7

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, grain size analysis (sieve and hydrometer) tests were performed on selected soil samples. Chemical analyses were also carried out on two soil samples. The samples were tested at the Bureau Veritas Laboratories (formerly Maxxam Analytics), a CALA-certified and accredited laboratory in Mississauga, Ontario. The laboratory tests performed at this site are summarized in table 1.2.

Table 1.2: List of Laboratory Test Completed by EXP

Borehole No.	Moisture Content	Atterberg Limits	Sieve	Hydrometer	Corrosivity
BH25-CV-01	8	-	2	2	1

Borehole No.	Moisture Content	Atterberg Limits	Sieve	Hydrometer	Corrosivity
BH25-CV-02	6	1	2	2	1

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 depths investigated of EXP's geotechnical investigation indicates the following sub-surface sequence: cohesionless fill overlaying native silty sand to sandy silt till.

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.

6.1 Subsoils

6.1.1 Pavement Structure

A pavement structure consisting of asphalt and concrete was encountered at the surface of borehole BH25-CV-01, while only asphalt was encountered at the surface of borehole BH25-CV-02. The thickness of asphalt was about 178 mm in both boreholes & the thickness of concrete layer in BH25-CV-01 was about 178 mm.

6.1.2 Cohesionless Fill: Sand and Gravel to Gravelly Sand

Sand and Gravel to Gravelly Sand fill was encountered below the asphalt/concrete layer in both boreholes. 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 1.3 below:

Table 1.3: 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				
BH25-CV-01	165.9	160.4	0.6	5.5	Sand and Gravel to Gravelly Sand	21-49
BH25-CV-02	166.3	160.4	0.2	5.9	Sand and Gravel to Gravelly Sand	20-64

This layer predominately consisted of sand and gravel with trace to some silt and occasionally encountered sandy silt with trace clay and trace organics, trace oxidized layer. The material was brown to brownish grey in colour and damp to moist. The SPT "N" values within this layer ranged from 20 to 64 blows per 300 mm penetration, corresponding to compact to very dense but generally compact to dense in compactness condition.

Laboratory testing performed on selected samples consisting of Eleven (11) moisture content and Three (3) grain size distribution tests. The test results are as follows:

Moisture Content:

- 3.2% to 11.9%

Grain Size Distribution:

- 20% to 34% gravel;
- 50% to 60% sand;
- 15% to 19% silt
- 1% to 3% clay

The results of the moisture content and grain size distribution tests 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 Native: Silty sand / Sandy silt TILL

A native silty sand to sandy silt till deposit was encountered below cohesionless fill layer in both boreholes 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 1.5: Summary of Silty Sand/Sandy Silt Till

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Layer Description	SPT "N" Value Range
	Top	Bottom				
BH25-CV-01	160.4	159.7	6.1	0.6	Silty Sand	22
BH25-CV-02	160.4	159.8	6.1	0.6	Sandy Silt	23

This layer predominately consists of sand and silt with trace to some gravel, trace to some clay, trace oxidized layer. The material was grey in color and moist. The SPT "N" value within this layer ranged between 22 to 23 blows per 300 mm penetration, corresponding to compact in compactness condition.

Laboratory testing performed on selected sample consisted of Three (3) moisture content, One (1) grain size distribution and One(1) Atterberg Limit tests. The test results are as follows:

Moisture Content:

- 8.3% to 16.6%

Grain Size Distribution:

- 5% gravel;

- 43% sand.
- 41% silt.
- 11% clay

Atterberg Limits:

- Liquid Limit: 18%.
- Plastic Limit: 12%.
- Plasticity Index: 6%

The results of the moisture content, grain size distribution and Atterberg limits are provided on the record of borehole sheets in Appendix D. The results of grain size distribution and Atterberg limits tests are also provided on Figure 2 and 3 in Appendix E.

6.2 Groundwater Conditions

Groundwater levels were not encountered upon completion of the boreholes; both the boreholes were dry up to investigated depths upon completion of 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).

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 were tested at the Bureau Veritas Laboratories (formerly Maxxam Analytics), a CALA-certified and accredited laboratory in Mississauga, Ontario.

The analytical results are summarized in Table 1.6 below and are presented in Appendix D.

Table 1.6: Summary of chemical analysis results

Sample Identification	pH (Unitless)	Soluble Chloride (ppm)	Soluble Sulphate (ppm)	Resistivity (ohm-cm)	Conductivity (umho/cm)	Redox Potential (mV)
BH25-CV-01**, SS6**	7.88	400	130	870	1160	160
BH25-CV-02**, SS6**	7.78	230	170	1200	816	160

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 Bijaya Bhujel, Nimesh Tamrakar, 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 Bijaya Bhujel.

Yours truly,

EXP Services Inc.

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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.

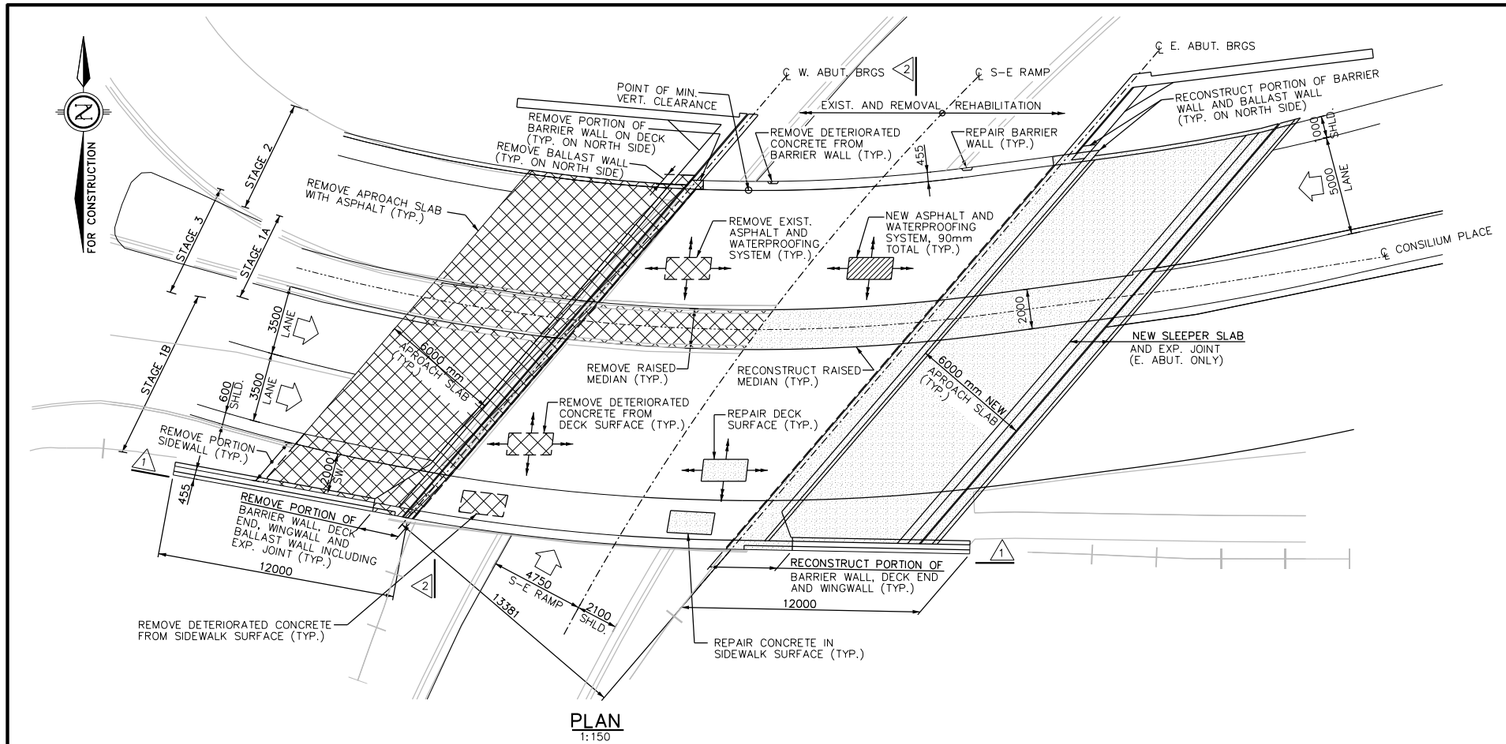
USE OF REPORT

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.

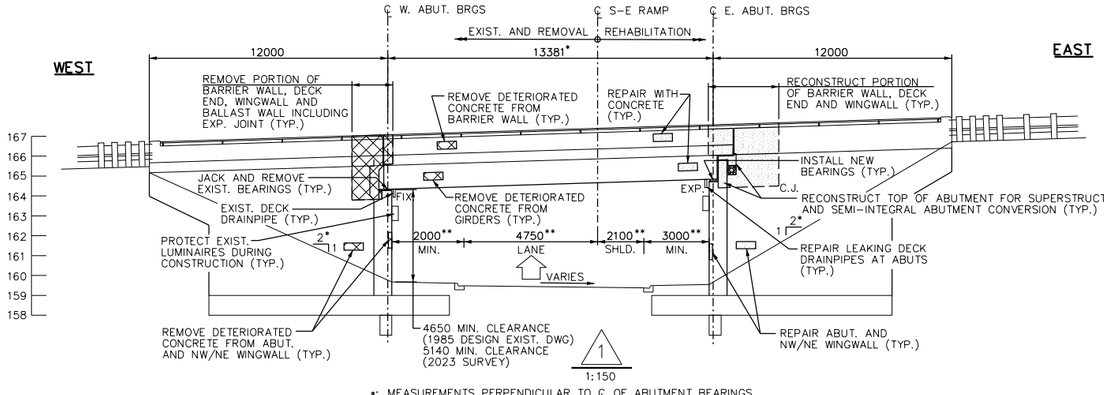
REPORT FORMAT

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

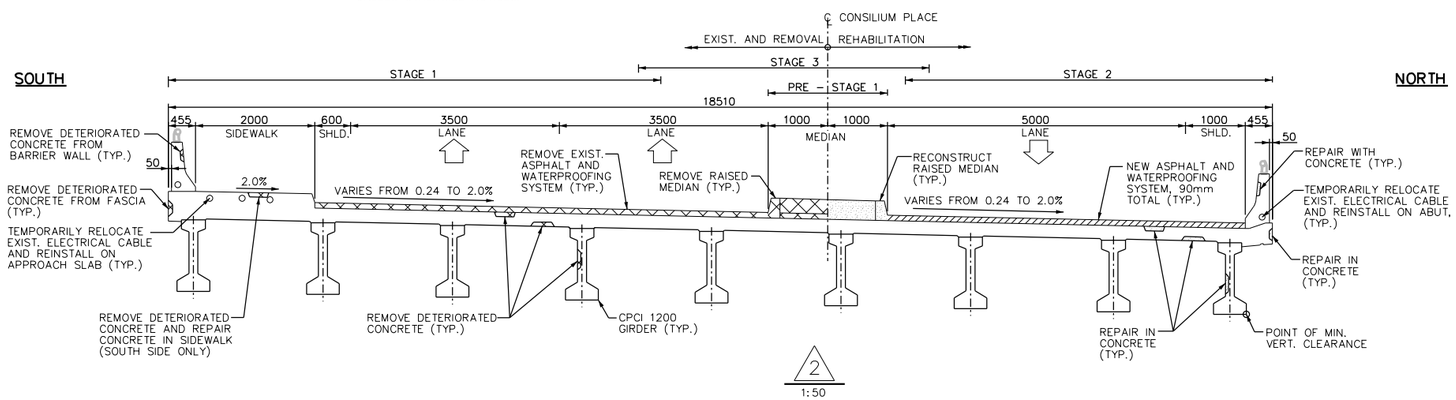


PLAN
1:150



1:150

*: MEASUREMENTS PERPENDICULAR TO ℄ OF ABUTMENT BEARINGS
**: MEASUREMENTS PERPENDICULAR TO ℄ OF S-E RAMP.
UNLESS OTHERWISE NOTICES.



1:50

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

Ontario Ministry of Transportation

CONT
WP

HWY 401 EB CORE & COLLECTOR LANE
S-E McCOWAN RAMP CONSILIUM PLACE UNDERPASS
GENERAL ARRANGEMENT

SHEET S21

AECOM

GENERAL NOTES:

1. CLASS OF CONCRETE: ..... 30 MPa
2. CLEAR COVER TO REINFORCEMENT:
   DECK: TOP ..... 70±20
   BOTTOM ..... 50±10
   REMAINDER ..... 70±20
   UNLESS NOTED OTHERWISE.
3. REINFORCING STEEL:
   - REINFORCING STEEL SHALL BE GRADE 500W UNLESS OTHERWISE SPECIFIED.
   - BAR MARKS WITH PREFIX 'S' DENOTE STAINLESS STEEL BARS.
   - STAINLESS REINFORCING STEEL SHALL BE TYPE 316LN OR DUPLEX 2205 AND HAVE MINIMUM YIELD STRENGTH OF 500 MPa.
   - 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 SS12-1 UNLESS INDICATED OTHERWISE.
   - UNLESS SHOWN OTHERWISE TENSION LAP SPLICES SHALL BE CLASS B.

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. SAW CUT IN CONCRETE, WHERE DESIGNATED, SHALL BE 25mm DEEP OR TO THE FIRST LAYER OF REINFORCING STEEL, WHICHEVER IS LESS.
4. LOCATIONS OF THE EXISTING UTILITY DUCTS SHOWN ON THE DRAWINGS ARE APPROXIMATE AND SHALL BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO START OF CONSTRUCTION.
5. 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.
6. 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 INTO ROADWAYS AND OTHER AREAS BELOW THE BRIDGE.
7. THE CONTRACTOR IS FULLY RESPONSIBLE FOR ADEQUATE PROTECTION OF ALL UTILITIES, SERVICES, ROADWAYS ETC. DURING CONSTRUCTION OPERATIONS.

LIST OF ABBREVIATIONS:

ABUT.	DENOTES ABUTMENT
BRGS.	DENOTES BEARINGS
E	DENOTES EAST
EXIST.	DENOTES EXISTING
EXP.	DENOTES EXPANSION
HWY	DENOTES HIGHWAY
S-E	DENOTES SOUTH TO EAST
SHLD	DENOTES SHOULDER
SW	DENOTES SIDEWALK
TYP.	DENOTES TYPICAL
W	DENOTES WEST

LEGEND:

- CONCRETE TO REMAIN
- REMOVAL
- NEW CONCRETE
- NEW ASPHALT

LIST OF DRAWINGS:

APPLICABLE STANDARD DRAWINGS

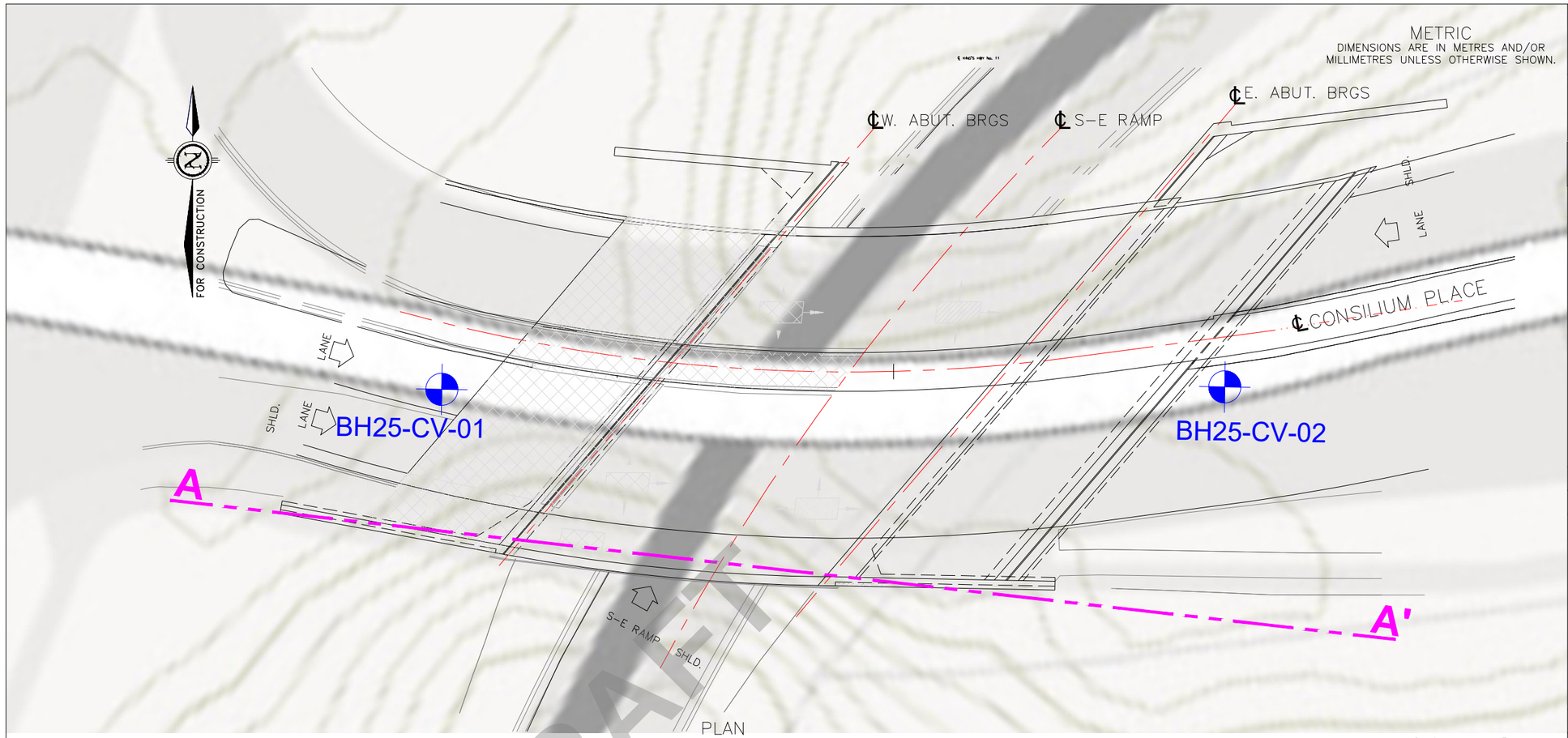
OPSD 3349.101	DRAINAGE OF EXISTING DECK BELOW ASPHALT WEARING SURFACE
OPSD 3370.100	DECK WATERPROOFING, HOT APPLIED ASPHALT MEMBRANE WITH PROTECTION BOARD DETAILS
OPSD 3370.101	DECK WATERPROOFING, HOT APPLIED ASPHALT MEMBRANE AT ACTIVE CRACKS GREATER THAN 2mm WIDE AND CONSTRUCTION JOINTS
OPSD 3390.100	DECK DRIP CHANNEL
OPSD 3950.100	JOINTS, CONCRETE EXPANSION AND CONSTRUCTION ON STRUCTURE

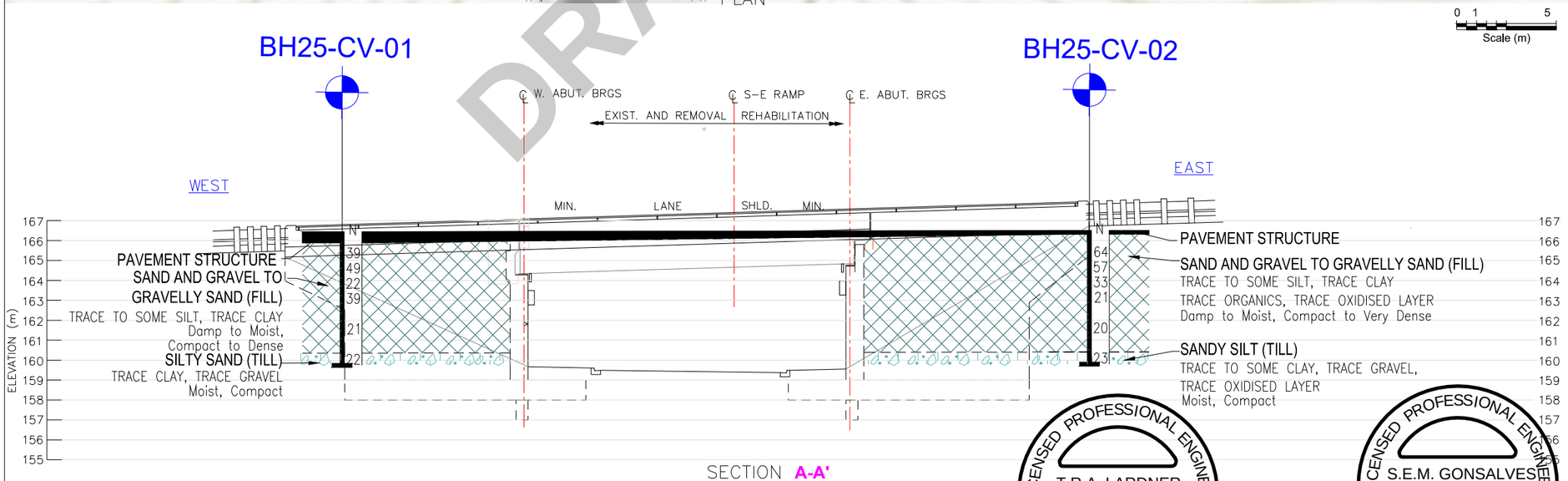
REVISIONS

DATE	BY	DESCRIPTION

DESIGN S.S.	CHK J.J.	CODE CAN/CSA S6-19	LOAD CL 625-ONT	DATE AUG. 2024	
DRAWN Q.Z.	CHK S.S.	SITE 37X-1145/B0		DWG R1-01	

Appendix C – Borehole Location Plan and Stratigraphic Profile





SECTION **A-A'**

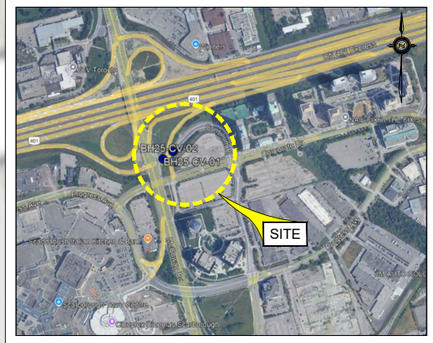
0 1 5
Scale (m)

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

Highway 401 Eastbound Expresss and Collector Rehabilitation of Consilium Place Underpass Structure
Latitude: 43.779837°, Longitude: -79.253617°
BOREHOLE LOCATION PLAN & SOIL STRATA

SHEET 1

exp. **EXP SERVICES INC.**



KEY PLAN
N.T.S.

LEGEND

Borehole

N Blows/0.3m (Std. Pen. Test, 475 J/blow)

SOIL STRATA SYMBOLS

PAVEMENT STRUCTURE
FILL
SANDY SILT TO SILTY SAND (TILL)

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

BH No.	ELEV.	NORTHING	EASTING
BH25-CV-01	166.4	4848892.91	324619.07
BH25-CV-02	166.5	4848918.35	324650.57

NOTES

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

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

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

LICENSED PROFESSIONAL ENGINEER
T.R.A. LARDNER
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MAR. 13, 2026
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LICENSED PROFESSIONAL ENGINEER
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REVISIONS				
				SUBMISSION FOR MTO REVIEW
01	13/MAR/2026	TL	ISSUED FOR USE	
NO	DATE	BY	DESCRIPTION	

PROJECT No.	ADM-22000797-A0		GEOCRES No.	-	
SUBM'D SH	CHKD. NT		DATE Dec. 23, 2025	SITE 37X-1145/B0	
DRAWN SH	CHKD. TL		APPRD SG	DWG 01	

FILE NAME: \\PBRMFSC001\Data_Zeus\2103-Brampton\Proposals\Projects\International\Hwy 401 & Victoria Park Av. to Nelson\Reports\CONSILIUM PLACE UNDERPASS\Autocad\GA_S-E McCowan Ramp, Consilium Place Underpass.dwg
MODIFIED: 2025-12-23 14:28

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.

ISSMFE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE		

0.002	0.006	0.02	0.06	0.2	0.6	2.0	6.0	20	60	200

EQUIVALENT GRAIN DIAMETER IN MILLIMETRES

CLAY (PLASTIC) TO	FINE	MEDIUM	CRS.	FINE	COARSE
SILT (NONPLASTIC)	SAND			GRAVEL	

UNIFIED 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:

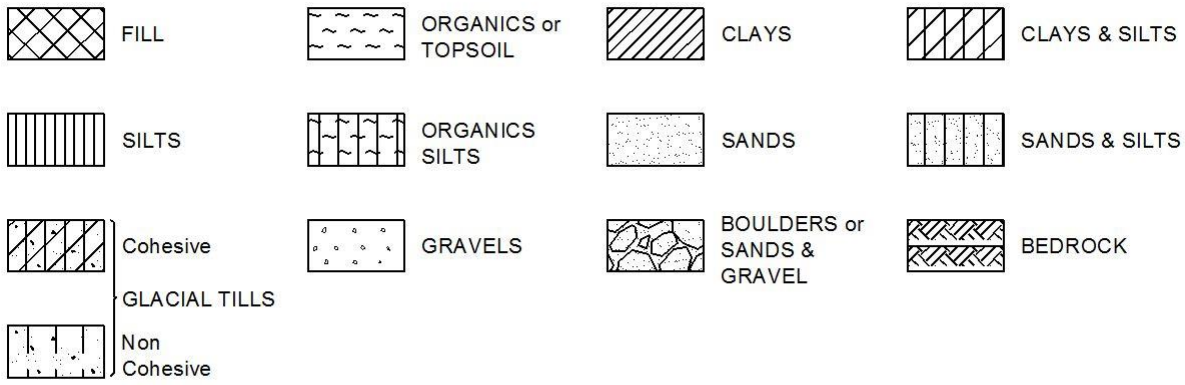
Table c: Consistency of Cohesive Soil

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

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

MECHANICALL PROPERIES 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

RECORD OF BOREHOLE No BH25-CV-01 1 OF 1 METRIC

W.P. ADM-22000797-A0 LOCATION **Hwy 401-Consilium Pl, Toronto, ON, MTM ON-10, 324619.07 E, 4848892.91 N** ORIGINATED BY BB

DIST Toronto HWY 401 BOREHOLE TYPE Truck Mount CME75/ SSA COMPILED BY BB

DATUM Geodetic DATE 2025.12.12 - 2025.12.12 LATITUDE 43.779732 LONGITUDE -79.253783 CHECKED BY NT

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × P. PENETROMETER 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
166.4	GROUND SURFACE									
0.0 / 165.9	**PAVEMENT STRUCTURE**, 178 mm of asphalt, and 178 mm of concrete						166			
0.6	**SAND AND GRAVEL TO GRAVELLY SAND (FILL)**, trace to some silt, brown to brownish grey, damp to moist, compact to dense		AS1	AS	-					
			SS2	SS	39					
			SS3	SS	49		165			34 50 15 1
	-100mm grey sandy silt, trace clay, trace organics layer at ~2.64 m.		SS4	SS	22		164			
			SS5	SS	39		163			
			SS6	SS	21		162			Corrosivity Sample 23 56 18 3
160.4							161			
6.1 / 159.7	**SILTY SAND (TILL)**, trace clay, trace gravel, grey, moist, compact		SS7	SS	22		160			
6.7	**END OF BOREHOLE**									

NOTE:
1) Borehole open to 5.6 m below grade upon completion of drilling.
2) No groundwater was encountered in open borehole.

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

ONTARIO MTO CONSILIUM PLACE UNDERPASS -V2.GPJ ONTARIO MTO.GDT 12/23/25

RECORD OF BOREHOLE No BH25-CV-02 1 OF 1 METRIC

W.P. ADM-22000797-A0 LOCATION **Hwy 401-Consilium Pl,Toronto, ON, MTM ON-10, 324650.57 E, 4848918.35N** ORIGINATED BY BB

DIST Toronto HWY 401 BOREHOLE TYPE Truck Mount CME75/ SSA COMPILED BY BB

DATUM Geodetic DATE 2025.12.12 - 2025.12.13 LATITUDE 43.77996 LONGITUDE -79.253391 CHECKED BY NT

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × P. PENETROMETER (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
166.5	GROUND SURFACE										
166.3	**PAVEMENT STRUCTURE**, 178 mm of asphalt										
0.2	**SAND AND GRAVEL TO GRAVELLY SAND (FILL)**, trace to some silt, trace clay, trace organics, trace oxidised layer, brown, damp to moist, compact to very dense		AS1	AS	-		166		○		
			SS2	SS	64				○		
			SS3	SS	57		165				
			SS4	SS	33		164		○		20 60 19 1
			SS5	SS	21				○		
	- trace organics at a depth ~3.4 m depth.						163				
			SS6	SS	20		162		○		Corrosivity Sample
160.4							161				
6.1	**SANDY SILT (TILL)**trace gravel, trace to some clay, trace oxidised layer, grey, moist, compact		SS7	SS	23		160		○		5 43 41 11
159.8											
6.7	**END OF BOREHOLE**										

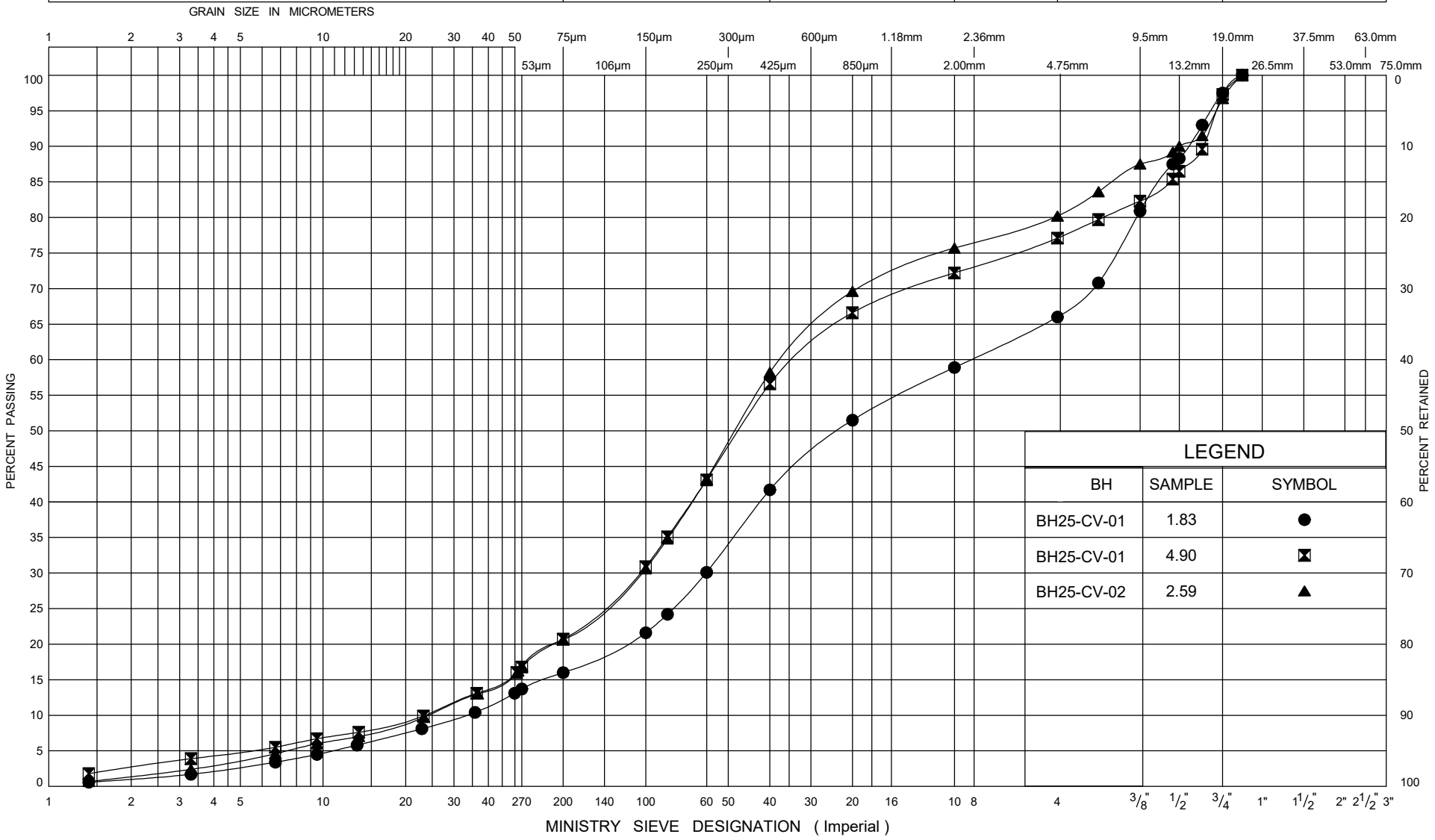
NOTE:
1) Borehole open to 5.5 m below grade upon completion of drilling.
2) No groundwater was encountered in open borehole.

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

ONTARIO MTO CONSILIUM PLACE UNDERPASS -V2.GPJ ONTARIO MTO.GDT 12/23/25

Appendix E – Laboratory Data

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of Transportation
Ontario

GRAIN SIZE DISTRIBUTION

SAND AND GRAVEL TO GRAVELLY SAND (FILL)

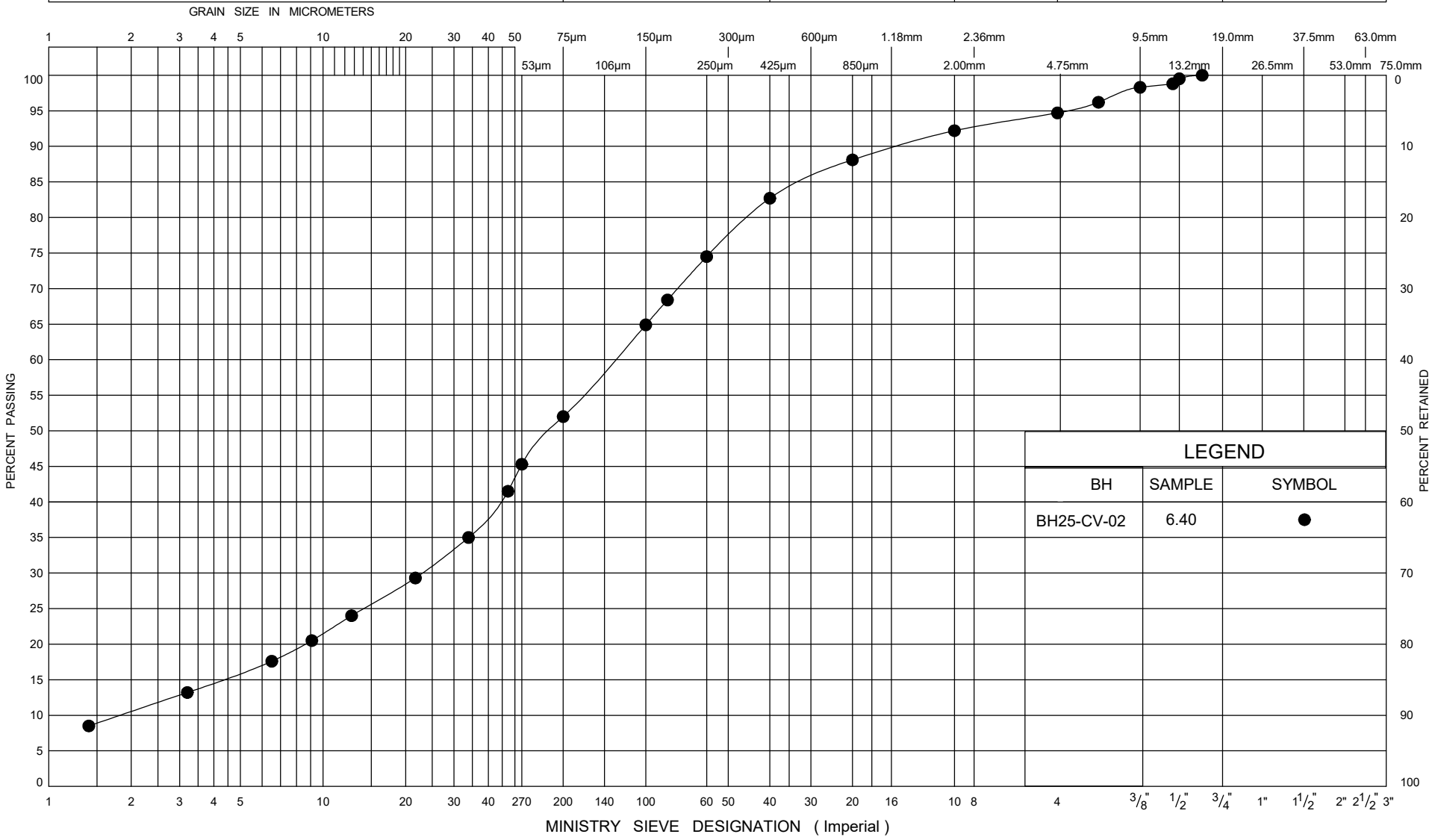
FIG No 1

W P ADM-22000797-A0

Hwy. 401 EB Express and Collector

ONTARIO MOT GRAIN SIZE CONSILIUM PLACE UNDERPASS -V2.GPJ ONTARIO MOT.GDT 12/23/25

UNIFIED SOIL CLASSIFICATION SYSTEM



ONTARIO MOT GRAIN SIZE CONSILIUM PLACE UNDERPASS -V2.GPJ ONTARIO MOT.GDT 12/23/25

Ministry of Transportation
Ontario

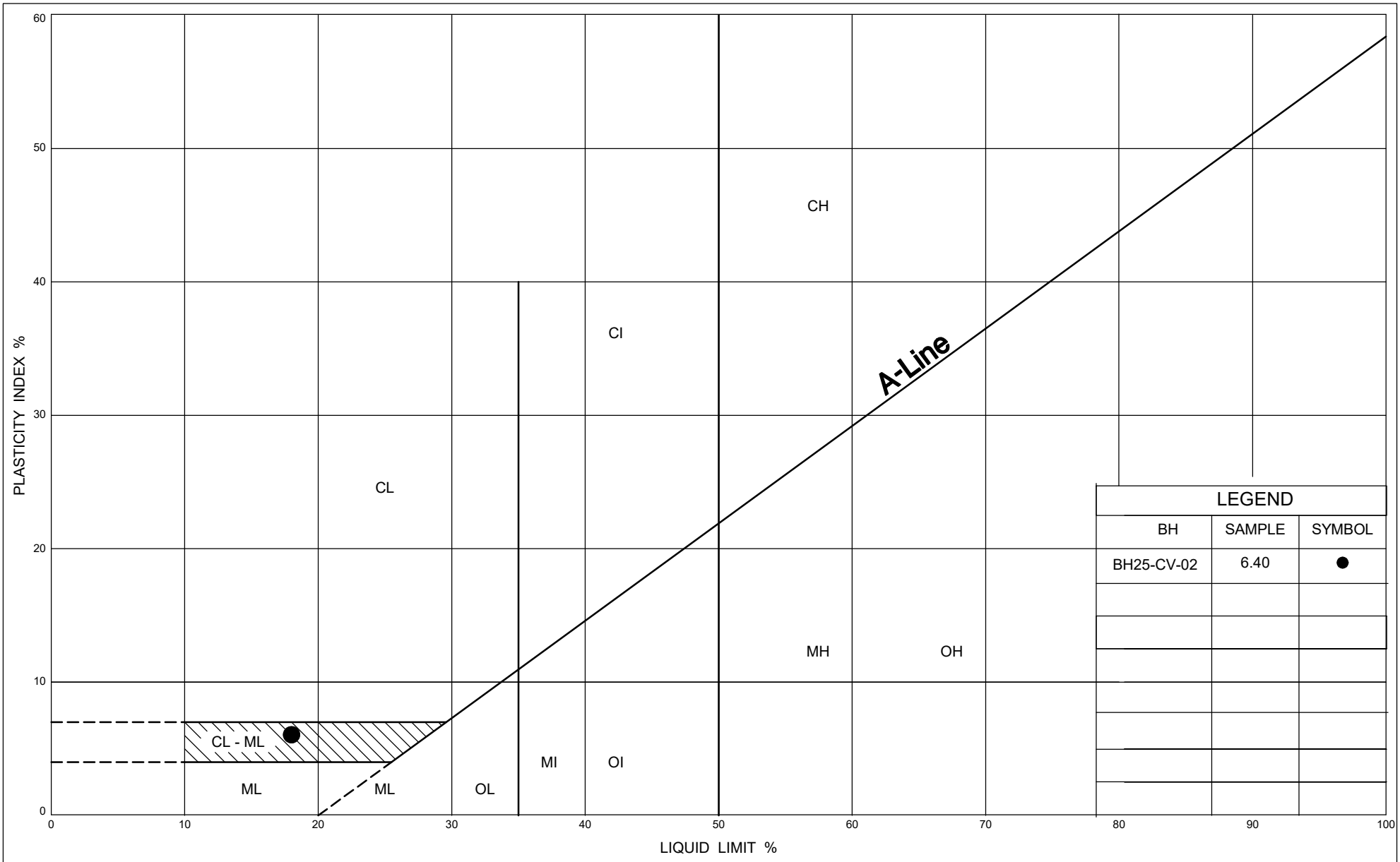
GRAIN SIZE DISTRIBUTION

SILTY SAND TO SANDY SILT (TILL)

FIG No 2

W P ADM-22000797-A0

Hwy. 401 EB Express and Collector



ONTARIO MOT PLASTICITY CHART CONSILIUM PLACE UNDERPASS -V2.GPJ ONTARIO MOT.GDT 12/23/25

Ministry of Transportation
Ontario

PLASTICITY CHART
SILTY SAND TO SANDY SILT (TILL)

FIG No 3

W P ADM-22000797-A0

Hwy. 401 EB Express and Collector