

# Foundation Investigation and Design Report

Bradford Bypass – West Contract, Simcoe County Road 4 Carpool Lot

Ministry of Transportation Ontario

60731727

April 2026

**GEOCRES No.: 31D04-034**

Latitude: 44.130559°

Longitude: -79.567640°

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# Table of Contents

**Part A – Foundation Investigation Report ..... 1**

**1. Introduction ..... 2**

**2. Site Description ..... 3**

**3. Investigation Procedures ..... 4**

    3.1 MTO GEOCRETS Library .....4

    3.2 Referenced Pavement Boreholes .....4

    3.3 Subsurface Investigation Procedures.....4

**4. Site Geology and Stratigraphy ..... 6**

    4.1 Regional Geological Conditions .....6

    4.2 Summarized Subsurface Conditions .....6

        4.2.1 Topsoil .....6

        4.2.2 Sand.....7

        4.2.3 Clayey Silt.....7

        4.2.4 Sandy Clayey Silt (Till).....8

        4.2.5 Clayey Silt (Till).....8

    4.3 Groundwater Conditions .....9

**5. Closure..... 10**

**Part B – Foundation Design Report ..... 11**

**6. Discussion and Engineering Recommendations..... 12**

    6.1 General.....12

    6.2 Project Understanding .....12

    6.3 Seismic Considerations .....12

        6.3.1 Seismic Site Classification.....13

        6.3.2 Spectral Response Values and Seismic Performance Category .....13

        6.3.3 Soil Liquefaction.....13

    6.4 Ground Characterization .....13

        6.4.1 Overview of Subsurface Conditions.....13

        6.4.2 Geotechnical Models .....14

    6.5 Analyses Results .....15

        6.5.1 Estimated Settlement.....15

        6.5.2 Global Slope Stability.....16

**7. Construction Considerations ..... 17**

    7.1 General.....17

    7.2 Site Preparation and Subgrade Protection .....17

    7.3 Embankment Fill Placement .....17

    7.4 Slope Protection / Erosion Control .....18

    7.5 Excess Soil Re-Use / Management.....18

**8. Construction Impacts ..... 19**

**9. Closure..... 20**

## Tables

Table 3-1: Borehole Locations .....	5
Table 4-1: Grain Size Analysis for Sand .....	7
Table 4-2: Grain Size Analysis for Clayey Silt.....	7
Table 4-3: Atterberg Limits Testing for Clayey Silt.....	7
Table 4-4: Grain Size Analysis for Sandy Clayey Silt Till.....	8
Table 4-5: Atterberg Limits Testing for Sandy Clayey Silt Till .....	8
Table 4-6: Atterberg Limits Testing for Clayey Silt Till .....	9
Table 6-1: Seismic Hazard Values for Site – Class ‘D’ (NBC 2025).....	13
Table 6-2: Parameters for Settlement Evaluation .....	14
Table 6-3: Parameters for Slope Stability Assessment.....	15
Table 6-4: Summary of Settlements Analysis Results .....	15
Table 6-5: Global Slope Stability Results .....	16

## Appendices

Appendix A.	Borehole Location Plans and Soil Stratigraphy
Appendix B.	Site Photographs
Appendix C.	Record of Borehole Logs
Appendix D.	Laboratory Test Results
Appendix E.	Geotechnical Modelling Results
Appendix F.	Non-Standard Special Provisions and Notice to Contractor

# Part A – Foundation Investigation Report

**Bradford Bypass – West Contract  
Simcoe County Road 4 Carpool Lot**

**For  
Ministry of Transportation Ontario**

**GEOCRES No.: 31D04-034**

Latitude: 44.130559°

Longitude: -79.567640°

# 1. Introduction

AECOM Canada ULC (AECOM) has been retained by the Ministry of Transportation Ontario (MTO) to undertake a foundation investigation for the proposed Bradford Bypass (BBP) project, West Contract, located in the County of Simcoe and Regional Municipality of York, Ontario. The entire new BBP is a 16.3 km rural controlled access highway connecting Highway 400 to Highway 404. The West Contract includes the western section of the project starting at Highway 400 and roughly ending 1.0 km east of County Road 4.

This Part A of this report provides a summary of the findings from the foundation investigation carried out for detailed design of the proposed Simcoe County Road 4 Carpool Lot. The location of the site and the locations of the boreholes completed for this report are shown on the drawings in **Appendix A**.

## 2. Site Description

The proposed Simcoe County Road 4 Carpool Lot is located within the southeast quadrant area of Bradford Bypass and Simcoe County Road 4 (Yonge St.) interchange and is in the Town of Bradford West Gwillimbury in Simcoe County, Ontario.

The land use within the reporting limits is generally agricultural fields. Currently the topography at the site is generally flat with the highest elevation being near borehole CR4-CP-03 at Elev. 249.9 metres above sea level (mASL) and lowest at Elev. 249.1 mASL at borehole CR4-CP-01 based on surveyed borehole data. The borehole location plan is provided in **Appendix A**. Site photographs captured during the field investigation are included in **Appendix B**.

The current design (CTS Contract Drawing submission, dated January 30, 2026) of the new carpool parking lot with 130 parking stalls is triangular (approximately 80 m x 96 m x 116 m) and will be constructed along the proposed S-E Ramp of the County Road 4 interchange. Approximately 0.0 m to 4.0 m high earth filling will be required in the parking areas while area. Approximately 6.2 m high earth filling will be required for the entrance road subgrade to fill in an existing drainage ditch.

As part of the pre-mobilization activities for this subsurface investigation, underground utility locate requests at each proposed borehole location were completed by AECOM. AECOM completed an Ontario 1 Call public utility locate request and retained a private utility locating subcontractor to clear all proposed borehole locations of buried utilities including Hydro One, Enbridge Gas, and other utilities. No utilities were found within the proposed Carpool Lot area.

## 3. Investigation Procedures

The foundation investigation for the proposed BBP West County Road 4 Carpool Lot consisted of a desktop study, reviewing the available historical data, and a field exploration program based on the findings from the desktop study in accordance with the MTO Guideline for Foundation Engineering Services, Version 3.0 (April 2022). The desktop study gathered available geotechnical and geological data from several publicly available databases, such as the Ministry of the Environment, Conservation and Parks (MECP) well records, MTO's GEOCREs database, and other geological databases.

### 3.1 MTO GEOCREs Library

A search of the GEOCREs library identified four (4) foundation investigation reports available near the project site.

- *Foundation Investigation and Design Report – Simcoe County Road 4 (Yonge Street) Temporary Protection System Highway 400 – Highway 404 Link (The Bradford Bypass), Bradford, Ontario, prepared by WSP (May 10, 2022), GEOCREs No. 31D-797.*
- *Foundation Investigation and Design Report – Bradford Bypass / Simcoe County Road 4 (Yonge Street) Underpass and High Fill Embankment Widening Hwy 400 - Hwy 404 Link (The Bradford Bypass), Bradford, Ontario prepared by Golder (March 2022), GEOCREs No. 31D-784*
- *Foundation Investigation and Design Report – Simcoe County Road 4 (Yonge Street) Culvert Replacement Highway 400 - Highway 404 Link (The Bradford Bypass), Bradford, Ontario prepared by Golder (January 18, 2022), GEOCREs No. 31D-787*
- *Preliminary Foundation Investigation and Design Report – Deep Cut and High Fill Areas Highway 400 to Highway 404 link (Bradford Bypass), Simcoe County, prepared by WSP (December 2023), GEOCREs No. 31D04-004*

The geotechnical data obtained from the Simcoe County Road 4 Culvert Replacement, GEOCREs No. 31D-787, report was used for support of analyses provided under a separate cover. The site conditions in the reference report are consistent with those in the current investigation. However, the other three referenced investigations were not utilized in the design for this report because of the distance from the location of the current assignment (greater than 200 m).

### 3.2 Referenced Pavement Boreholes

The geotechnical data from eighteen pavement boreholes obtained from the draft Pavement Design Report for the Bradford Bypass West – Highway 400 to County Road 4 dated February 2026 completed by Thurber Engineering were relevant to this site. Copies of the pavement borehole logs were included in **Appendix C**.

### 3.3 Subsurface Investigation Procedures

The fieldwork for the project was carried out between October 7 and 8, 2025. A total of four (4) boreholes, of which none included monitoring wells, were advanced at the site. The boreholes were drilled by utilizing a track-mounted drill rig outfitted with hollow stem continuous flight augers. The boreholes were advanced and terminated at depths ranging from 8.2 mBGS to 11.3 mBGS in the areas where the initial proposed grade raise was greater than 4 m (two boreholes at the entrance and two boreholes at the exit of the parking lot). Note that during the detailed design, the fill required for the parking lot and exit road was determined to be less than 4 m of fill, however the boreholes remained where planned. The remaining area of the parking lot where there is less than 4m of fill is covered under the pavement investigation for this project as referenced in section 3.2 of this report.

Soil samples were obtained at regular intervals using a 50 mm split spoon sampler driven with an automatic hammer in general accordance with the Standard Penetration Test (SPT) procedure (ASTM D1586). The split spoon samplers used in the investigation limit the maximum particle size that can be sampled and tested to about 35 mm. Therefore, particles that may exist within the soils that are larger than this dimension would not be sampled or represented in the grain size distributions. In-situ testing using the SPT was generally carried out at 0.75 m intervals until 6 mBGS, where the sampling interval was increased to every 1.5 m. The relative density of cohesionless soils were assessed by completing SPTs. The SPTs were also used to estimate the consistency of cohesive soils since performing Field Vane Test (FVT) procedures (ASTM D2573) was not applicable because the soils were too stiff for the use of FVTs.

The recovered samples from the borehole investigation were identified in the field, placed in labelled containers, and transported to AECOM's Etobicoke laboratory for further Visual Identification (VI) examination and testing. Selected soil samples were subjected to classification tests, including water content determinations, grain size distribution analyses and Atterberg limits determinations. Oedometer test results from the overall project were referenced for this site, specifically from borehole SR10-03A which is 3 km West from the Carpool Lot site, as reported in the *Foundation Investigation Report: Bradford Bypass Project – West Contract - 10<sup>th</sup> Sideroad Underpass, Site No. 30X-0870/B0* (March 2026) by AECOM. The results of the testing are shown on the Record of Borehole logs provided in **Appendix C**, and on the figures included in Laboratory Test Results, **Appendix D**.

The field work was supervised on a full-time basis by AECOM staff who marked and staked the location of boreholes in the field, supervised the clearance of underground utilities, directed the sampling and testing of all samples in the field, and logged the boreholes. All laboratory tests were carried out in general accordance with MTO and/or ASTM Standards, as applicable. In-situ groundwater levels were measured in the open boreholes prior to backfilling.

All boreholes were backfilled with a bentonite mixture upon completion of field work in general accordance with Ontario Regulation (O.Reg) 903 (as amended) and the ground surface was restored to near original condition as practicable.

The borehole locations were surveyed in the field by Callon-Dietz Surveyors, an Ontario Land Surveyor to Geodetic datum (CGVD28 datum), and positioned relative to MTM NAD 83 (Zone 10) northing and easting coordinates with the ground elevation.

The borehole IDs including their depths, geodetic coordinates and elevations are summarized below in the below table. The location of the boreholes is provided in **Appendix A** for reference.

**Table 3-1: Borehole Locations**

Borehole ID	Coordinates (MTM NAD 83 Zone 10)		Latitude (°)	Longitude (°)	Existing Ground Surface (mASL)	Depth (mBGS)
	Northing	Easting				
<b>CR4-CP-01</b>	4887878	299462	44.130876	-79.566703	249.1	8.2
<b>CR4-CP-02</b>	4887865	299437	44.130758	-79.567020	249.8	8.2
<b>CR4-CP-03</b>	4887774	299365	44.129941	-79.567921	249.9	8.2
<b>CR4-CP-04</b>	4887751	299340	44.129731	-79.568225	249.8	11.3

Notes: mASL – metres above mean sea level  
 mBGS – meters below existing ground surface

## 4. Site Geology and Stratigraphy

### 4.1 Regional Geological Conditions

The site is located within the Simcoe Lowlands physiographic region of southern Ontario, near the transition zone to the Peterborough Drumlin Field and the Schomberg Clay Plains (The Physiography of Southern Ontario, Chapman and Putnam, 3rd Edition, 1984). This region is characterized by streamlined, elongate hills composed of dense glacial till (drumlins), formed beneath a moving ice sheet. These drumlins are often overlain by stratified glaciolacustrine deposits, primarily associated with the post-glacial Lake Algonquin.

In low-lying areas between drumlins, fine-textured lacustrine silts, clays, and fine sands have been deposited, often reaching significant thicknesses. Although these soils typically contain a high proportion of clay-sized particles, the overall behaviour of the soil mass is more like a silt. When saturated, the soil becomes very slippery, while in a drier state it is powdery and friable. Organic deposits such as peat may also be present in depressions or former meltwater channels.

According to the Bedrock Geology of Ontario, Southern Sheet (Map 2544), published by the Ontario Ministry of Northern Development and Mines, the underlying bedrock along the site comprises Ordovician-age units, including the Shadow Lake Formation (sandstone, conglomerate, and shale) and various limestones and dolostones of the Simcoe Group (e.g., Gull River, Bobcaygeon, and Verulam formations). In parts of the corridor, younger shale-dominated units of the Blue Mountain and Collingwood formations may also be present.

Further, the Bedrock Topography of the Alliston Area (Map P.3213) indicates that the bedrock surface depth in the region varies from approximately 130 m to 160 m below the existing ground surface, confirming the presence of a thick overburden layer.

### 4.2 Summarized Subsurface Conditions

This section provides a general description of the major soil types encountered during AECOM's subsurface investigation carried out at the proposed Simcoe County Road 4 Carpool Lot within the reporting limits. It should be noted that the boundaries between the strata have been inferred from drilling observations and non-continuous samples. They generally represent a transition from one soil type to another and should not be inferred to represent exact planes of geological change. The subsurface conditions will vary between and beyond the borehole locations.

The pavement records of boreholes referenced from the project's pavement investigation are generally consistent with the foundation boreholes. Generally, the pavement boreholes at the Simcoe County Road 4 Carpool Lot consist of topsoil at the surface, underlain by sand and clayey silt layers. Details of the pavement borehole descriptions can be found in the draft *Pavement Design Report for Bradford Bypass West – Highway 400 to County Road 4* (February 2026). A copy of the pavement borehole data is included in **Appendix C** of this report.

#### 4.2.1 Topsoil

Topsoil was encountered at the ground surface in all the boreholes advanced at the proposed Simcoe County Road 4 Carpool Lot. The thickness of the topsoil ranged from 100 mm to 300 mm. It was generally brown in colour and recovered in a moist state. The topsoil thickness may differ beyond the areas where the boreholes were drilled. Some of the variations in topsoil thickness could be attributed to prior agricultural and/or earthwork activities conducted at the site.

## 4.2.2 Sand

A non-cohesive layer of sand, trace to some gravel, trace to some silt, and trace to some clay was encountered below the topsoil in boreholes CR4-CP-01, CR4-CP-02 and CR4-CP-03. This layer was encountered at depths ranging from 0.1 mBGS to 0.3 mBGS (Elev. 249.8 mASL to 249.0 mASL) and extending to a depth of 0.8 mBGS (Elev. 249.1 mASL to 248.3 mASL). This layer was brown in colour and recovered in a moist state with moisture content values near 3%.

The SPT N-values conducted within this layer ranged from 9 blows to 14 blows per 305 mm of penetration indicating a loose to compact relative density.

One (1) grain size distribution test was performed on a representative sample, and the test indicated the following grain size distribution value as shown in the table below.

**Table 4-1: Grain Size Analysis for Sand**

Borehole ID, Sample ID	Sample Depth (mBGS)	Gravel (%)	Sand (%)	Fines (Silts and Clays) (%)
CR4-CP-01, SS1	0.1 – 0.6	20	68	12

## 4.2.3 Clayey Silt

A cohesive layer of clayey silt, trace gravel, and trace to some sand was encountered below the sand in boreholes CR4-CP-01 and CR4-CP-03. This layer was encountered a depth of 0.8 mBGS (Elev. 249.1 mASL to 248.3 mASL) and extending to depths ranging from 1.5 mBGS to 2.3 mBGS (Elev. 248.4 mASL to 246.8 mASL) in these two boreholes.

This layer was brown to grey in colour and recovered in a moist state with moisture content values ranging from 17% to 20%.

The SPT N-values conducted within this layer ranged from 13 blows to 19 blows per 305 mm of penetration, indicating a stiff to very stiff consistency.

One (1) grain size distribution test was performed on a selected sample and the test indicated the following grain size distribution value as shown in the table below.

**Table 4-2: Grain Size Analysis for Clayey Silt**

Borehole ID, Sample ID	Sample Depth (mBGS)	Gravel (%)	Sand (%)	% Fines	
				Silt (%)	Clay (%)
CR4-CP-01, SS3	1.5 - 2.1	0	15	40	45

Two (2) Atterberg limits testing analyses were performed on selected samples, and the tests indicated the following limit values as shown in the table below.

**Table 4-3: Atterberg Limits Testing for Clayey Silt**

Borehole ID, Sample ID	Sample Depth (mBGS)	Atterberg Limits			Behaviour
		Liquid Limit (%)	Plastic Limit (%)	Plasticity Index	
CR4-CP-01, SS3	1.5 - 2.1	30	15	15	CL
CR4-CP-03, SS2	0.8 – 1.4	29	19	10	CL

## 4.2.4 Sandy Clayey Silt (Till)

A cohesive layer of sandy clayey silt till, trace to some gravel was encountered below the clayey silt in boreholes CR4-CP-01 and CR4-CP-03, below the sand in borehole CR4-CP-02, and below topsoil in borehole CR4-CP-04. This layer was encountered at a depth ranging from 0.3 mBGS to 2.3 mBGS (Elev. 249.5 mASL to 246.8 mASL) and extended to a depth of 10.7 mBGS (Elev. 239.1 mASL) in borehole CR4-CP-04 and extended to the borehole termination depth of 8.2 mBGS (Elev. 241.7 mASL to 240.8 mASL) in boreholes CR4-CP-01 to CR4-CP-03.

This layer was grey in colour and recovered in a moist state with moisture content values ranging from 9% to 21%.

The SPT N-value conducted within this layer ranged from 7 blows to 100 blows per 305 mm of penetration indicating a firm to hard consistency.

Nine (9) grain size distribution tests were performed on representative samples and the tests indicated the following grain size distribution values as shown in the table below.

**Table 4-4: Grain Size Analysis for Sandy Clayey Silt Till**

Borehole ID, Sample ID	Sample Depth (mBGS)	Gravel (%)	Sand (%)	% Fines	
				Silt (%)	Clay (%)
CR4-CP-01, SS7	4.6 – 5.2	5	22	45	28
CR4-CP-02, SS6	3.8 – 4.4	20	28	37	15
CR4-CP-02, SS8	5.3 – 5.9	6	31	43	20
CR4-CP-03, SS3	1.5 – 2.1	2	40	58	
CR4-CP-03, SS5	3.1 – 3.7	7	32	44	17
CR4-CP-03, SS7	4.6 – 5.2	6	31	47	16
CR4-CP-04, SS2	0.8 – 1.4	5	35	45	15
CR4-CP-04, SS8	5.3 – 5.9	19	28	39	14
CR4-CP-04, SS11	6.1 – 6.7	4	26	50	20

Eight (8) Atterberg limits testing analyses were performed on representative samples and the tests indicated the following limit values as shown in the table below.

**Table 4-5: Atterberg Limits Testing for Sandy Clayey Silt Till**

Borehole ID, Sample ID	Sample Depth (mBGS)	Atterberg Limits			Behaviour
		Liquid Limit (%)	Plastic Limit (%)	Plasticity Index	
CR4-CP-01, SS8	5.3 – 5.9	25	14	11	CL
CR4-CP-02, SS6	3.8 – 4.4	16	12	4	CL-ML
CR4-CP-02, SS8	5.3 – 5.9	16	11	5	CL-ML
CR4-CP-03, SS5	3.1 – 3.7	18	13	5	CL-ML
CR4-CP-03, SS7	4.6 – 5.2	17	12	5	CL-ML
CR4-CP-04, SS2	0.8 – 1.4	19	13	6	CL-ML
CR4-CP-04, SS8	5.3 – 5.9	17	12	5	CL-ML
CR4-CP-04, SS11	6.1 – 6.7	18	12	6	CL-ML

## 4.2.5 Clayey Silt (Till)

A cohesive layer of clayey silt till, trace sand was encountered below the sandy clayey silt till in borehole CR4-CP-04. This layer was encountered at a depth of 10.7 mBGS (Elev. 239.1 mASL) and extended to borehole termination depth of 11.3 mBGS (Elev. 238.5 mASL).

This layer was grey in colour and recovered in a moist state with a moisture content value near 14%.

The SPT N-value conducted within this layer was over 100 blows per 305 mm of penetration indicating a hard consistency.

One (1) Atterberg limits testing analyses were performed on a representative sample and the tests indicated the following limit values as shown in the table below.

**Table 4-6: Atterberg Limits Testing for Clayey Silt Till**

Borehole ID, Sample ID	Sample Depth (mBGS)	Atterberg Limits			Behaviour
		Liquid Limit (%)	Plastic Limit (%)	Plasticity Index	
CR4-CP-04, SS12	10.7 – 11.3	20	16	4	CL-ML

### 4.3 Groundwater Conditions

Water levels were observed in the boreholes during and upon completion of drilling. No standpipe piezometers were installed in boreholes after completion of the drilling within the proposed Simcoe County Road 4 Carpool Lot. Water observations in the open boreholes ranged from 7.0 mBGS to 7.9 mBGS (Elev. 241.8 mASL to 242.9 mASL). No artesian conditions were observed during and upon completion of drilling.

The groundwater conditions described in this report refer only to those observed at the place and the time of the observation noted in the report. These levels and conditions may vary locally due to seasonal fluctuations. Groundwater regimes encountered at the site during construction or as consequence of construction activities at the site or adjacent lands may also vary from the reported levels. Further discussion on groundwater conditions may be found in the hydrogeological report prepared for this project under a separate cover.

## 5. Closure

The geotechnical fieldwork for this project was carried out under the supervision of Mr. Abdelrahman Abouzaid and the boreholes were drilled by Pontil Drilling and Investigative Services (Pontil).

This Foundation Investigation Report was prepared by Curtis Simpson, P.Eng. Technical and quality review of this report was completed by Bruce Goddard, P.Eng., as Senior Geotechnical Engineer. An independent technical and quality review of this report was also carried out by Carlos Nascimento, P.Eng., as the Designated MTO Foundations Contact and Quality Control Auditor for this assignment. Quality verification of the report was completed by Taesang Ahn, Ph.D., P. Eng., as Senior Geotechnical Engineer and Lead for Ontario.

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# **Part B – Foundation Design Report**

**Bradford Bypass – West Contract  
Simcoe County Road 4 Carpool Lot**

**For  
Ministry of Transportation Ontario**

**GEOCRES No.: 31D04-034**

Latitude: 44.130559°

Longitude: -79.567640°

## 6. Discussion and Engineering Recommendations

### 6.1 General

This Part B of the report provides recommendations for the foundation aspects of the proposed Simcoe County Road 4 Carpool Lot design and construction of the high fill embankment as part of the proposed BBP interchange at Simcoe Country Road 4. For this specific project, a high fill embankment has been defined as any grade raise equal to, or greater than, 4.0 m above the existing ground surface. The recommendations are based on our understanding of the project and on the interpretation of factual data compiled from both field and laboratory investigations carried out by AECOM for this project.

The foundation recommendations provided herein are based on interpretation of subsurface information obtained from the current borehole investigation by AECOM, previous boreholes completed by others contained in the MTO GEOCRETS library and are prepared in accordance with the Canadian Highway Bridge Design Code (CHBDC), CSA S6:19 and MTO's Guideline for Foundation Engineering Services (April 2022).

This report has been prepared for the MTO and AECOM's design team. The recommendations and discussions herein are not intended for use by other parties, including contractors. Contractors should undertake their own assessment of the factual data provided in Part A – Foundation Investigation Report (FIR). The discussions and recommendations presented in this report are intended to assist the designers with sufficient information that would enable them to proceed with detailed design.

Construction comments made herein are based on geotechnical considerations only and should not be relied upon without further independent assessment and qualification in the selection of means and methods for construction. In addition, comments related to construction are provided solely to highlight considerations that may influence design and are not intended to be construed as construction methodology recommendations.

### 6.2 Project Understanding

The new Bradford Bypass (BBP) project is a 16.3 km rural controlled access highway connecting Highway 400 to Highway 404. As part of the West Contract, a foundation design report has been prepared concerning the design and construction of the high fill embankment within the Simcoe Country Road 4 Carpool Lot. Non-high fills and non-deep cut excavations for the parking lot are covered under the separate pavement report.

The current design (CTS Contract Drawing submission, dated January 30, 2026) of the new carpool parking lot with 130 parking stalls is triangular (approximately 80 m x 96 m x 116 m) and will be constructed along the proposed S-E Ramp of the County Road 4 interchange. Approximately 0.0 m to 4.0 m high earth filling will be required in the parking areas while area. Approximately 6.2 m high earth filling will be required for the entrance road subgrade to fill in an existing drainage ditch. The analysis for the Simcoe County Road 4 Ramp S-E was provided under separate cover.

### 6.3 Seismic Considerations

Seismic hazard values for this site have been derived from the 6th Generation Seismic Hazard Maps, developed by the Geological Survey of Canada (GSC) and referenced in the 2020 edition of the National Building Code of Canada (NBC 2020). These values form the basis for evaluating seismic loading in accordance with the requirements outlined in Clause 4.4.3.2 of the CHBDC CSA S6:19.

### 6.3.1 Seismic Site Classification

Based on available subsurface data, the deep borehole drilled at the site and in accordance with CHBDC Table 4.1 of CSA S6-19, the site is classified as Site Class ‘D’.

### 6.3.2 Spectral Response Values and Seismic Performance Category

In accordance with Section 4.4.3.1 of the CHBDC (2019), seismic design parameters were obtained using the 6th Generation Seismic Hazard Maps (NBC 2020) for Site Class ‘D’ conditions. This is based on the average SPT  $N_{60}$  values for the top 30 m of soil correspond to 32 blows per 305 mm of penetration.

These values represent 5% damped spectral acceleration values at various periods and are used in the evaluation of structural performance under seismic loading.

The Peak Ground Acceleration (PGA) for the 2,475-year return period is 0.155 g, indicating low to moderate seismicity at the site.

**Table 6-1** below summarizes the spectral acceleration values for use in structural analysis:

**Table 6-1: Seismic Hazard Values for Site – Class ‘D’ (NBC 2025)**

Return Period (Years)	PGA (g)	PGV (m/s)	Sa (0.2s) (g)	Sa (0.5s) (g)	Sa (1.0s) (g)	Sa (2.0s) (g)
<b>475 (10% in 50 yrs)</b>	0.0612	0.0609	0.109	0.110	0.0625	0.0280
<b>975 (5% in 50 yrs)</b>	0.096	0.100	0.170	0.170	0.0998	0.0465
<b>2,475 (2% in 50 yrs)</b>	0.155	0.175	0.273	0.275	0.167	0.0802

### 6.3.3 Soil Liquefaction

A liquefaction analysis was performed to assess whether the subsurface soils at the site have the potential to undergo liquefaction during the design earthquake under undrained conditions. For seismic loading conditions, the estimated permanent deformations of the embankment under the design seismic event were assessed using the procedure developed by Seed and Idriss (1971). In this procedure, pseudo-static analyses were performed to compute the yield acceleration that is defined as the maximum seismic coefficient resulting in a factor of safety of unity against slope failure, and the consequent embankment deformations were estimated from the ratio of the yield acceleration to the maximum design acceleration for the site.

Considering the subsurface stratigraphy and relatively low PGA for the site, it is considered that the potential for liquefaction is very low during a seismic event.

## 6.4 Ground Characterization

### 6.4.1 Overview of Subsurface Conditions

In summary, the subsurface conditions predominantly consisted of following soils from a foundation engineering perspective.

- Surficial topsoil with a thickness ranging from 100 mm to 300 mm.
- Sand, trace to some gravel, and trace to some silt encountered at depths ranging from 0.1 mBGS to 0.3 mBGS and extending to a depth of 0.8 mBGS with a thickness ranging from 0.5 m to 0.7 m. In this layer SPT-N values ranging from 9 blows to 14 blows per 305 mm of penetration, indicating a loose to compact relative density.

- Clayey Silt, trace gravel, and trace to some sand encountered at a depth of 0.8 mBGS and extending to depths ranging from 1.5 mBGS to 2.3 mBGS with a thickness of 0.7 m to 1.5m. SPT N-values ranging from 13 blows to 19 blows per 305 mm of penetration, indicating a stiff to very stiff consistency.
- Sandy Clayey Silt glacial till, trace to some gravel encountered at depths ranging from 0.3 mBGS to 2.3 mBGS and extended to depths ranging from 8.2 mBGS to 10.7 mBGS with a thickness of 5.9 m to 10.4 m. SPT N-values ranging from 7 blows to 100 blows per 305 mm of penetration indicating a firm to hard consistency.
- Clayey Silt till, trace sand encountered at a depth of 10.7 mBGS and extended a depth of 11.3 mBGS with a thickness of 0.6 m. SPT N-value over 100 blows per 305 mm of penetration indicating a hard consistency.

## 6.4.2 Geotechnical Models

Geotechnical models were developed for the proposed carpool lot based on the subsurface conditions discussed above. These models represent the average, or most representative, thicknesses and soil parameters for that location based on laboratory test results and well-established correlations.

The proposed grading illustrated in the profiles and cross sections shown in the CTS design drawings, dated January 2026, that have been used as the geometry and design of the settlement and slope stability analyses. The high fill embankment is located at the parking lot entrance road, immediately East of Simcoe Country Road 4 with the thickest part of the embankment being above the lowest part of the existing drainage ditch.

Settlement impacts associated with the high fill embankment was evaluated using SETTLE3, a commercial software by Rocscience®, while slope stability analyses were performed using SLOPE/W, a commercial software by Geostudio®.

The embankment for the carpool access road was modelled with the parameters provided in **Table 6-2** for settlement evaluation in SETTLE3 and modelled with the parameters provided in **Table 6-3** for the slope stability assessment in Slope/W. The parameters were estimated based on laboratory testing of the carpool lot borehole samples and the closest available consolidation laboratory test result from borehole SR10-03A which is 3 km West from the Carpool Lot site, as reported in the *Foundation Investigation Report: Bradford Bypass Project – West Contract - 10<sup>th</sup> Sideroad Underpass, Site No. 30X-0870/B0* (March 2026) by AECOM. The consolidation parameters for each layer were estimated based on the laboratory results from other corresponding soil layers with similar grain sizes, Atterberg limits and depths. The analysis within this FIDR is limited to the carpool lot and the access roads leading to and from this lot.

**Table 6-2: Parameters for Settlement Evaluation**

Location / Relevant BH	Material	Approx. Depth (mASL) / Thickness (m)	Unit Weight (kN/m <sup>3</sup> )	$\phi'$ (deg)	$E_s$ (kPa)	$K_o$	$C_c$	$C_r$	$e_0$	$p'_c$ (kPa)	$C_v$ (m <sup>2</sup> /y)
Parking Lot Entrance Road / CR4-CP-04	New Embankment Fill (Earth)	255.0 – 248.8 / 6.2	20	-	-	-	-	-	-	-	-
	Sandy Clayey Silt (Till)	248.8 – 239.1 / 9.7	19	30	30000	0.50	0.066	0.004	0.338	375	0.8
	Clayey Silt (Till)	239.1 – <238.5 / >0.6	20	32	50000	0.47	0.060	0.004	0.350	375	0.6

Notes:  $\phi'$ : Effective Friction Angle;  $E_s$ : Modulus of deformation;  $K_o$ : Earth Pressure Coefficient (at rest);  $C_c$ : Compressibility Index;  $C_r$ : Recompression Index;  $e_0$ : Initial Void Ratio;  $p'_c$ : Pre-consolidation pressure;  $C_v$ : Coefficient of consolidation

**Table 6-3: Parameters for Slope Stability Assessment**

Location & Relevant Borehole	Material	Depth (mASL) / Thickness (m)	Unit Weight (kN/m <sup>3</sup> )	$\phi'$ (°)	$C_u$ (kPa)	$E_s$ (MPa)	$c'$ (kPa)
Parking Lot Entrance Road / CR4-CP-04	Embankment Fill (Earth)	255.0 – 248.8 / 6.2	20	28	-	-	3
	Sandy Clayey Silt (Till) [Drained]	248.8 – 239.1 / 9.7	19	30	-	-	5
	Sandy Clayey Silt (Till) [Undrained]		19	0	90	-	-
	Clayey Silt (Till) [Drained]	239.1 – <236.0 / >3.1	20	32	-	-	10
	Clayey Silt (Till) [Undrained]		20	0	200	-	-

Notes:  $\phi'$ : Effective Friction Angle;  $C_u$ : Undrained Shear Strength;  $E_s$ : Modulus of deformation;  $c'$ : Effective cohesion

## 6.5 Analyses Results

Using the geotechnical models, assumptions, and analysis methods described in **Section 6.4.2**, global slope stability and settlement analysis was carried out for the assessed embankment. The results are summarized in the following sections.

### 6.5.1 Estimated Settlement

The settlement analysis simulated stress distribution beneath the embankment footprints, with the objective of meeting the post-construction settlement criteria for new embankments specified in the MTO Guideline for Foundation Engineering Services (April 2022), Appendix C, Embankment Settlement Criteria for Design (July 2010), Table 1.1 non-compressible soils.

For the carpool parking lot entrance road embankment, a 6.2 m high embankment was modelled in accordance with the CTS design drawings. The embankment geometry included 36.5 m wide crest and 3H:1V side slopes. For the purpose of the analyses only, this embankment height was used for the entirety of the embankment, even though the embankment of this height is only for a short, limited distance to fill in the existing drainage ditch. This analysis will provide the maximum expected settlement under this partial condition. Soil layers modelled were based on the interpolation from the closest boreholes.

Self-settlement of the newly placed fill material was not included in the analysis, as the embankment will be constructed using well-compacted earth fill obtained from other deep cuts on the BBP project, and the majority of settlement of the fill itself is expected to occur during construction.

A summary of the estimated immediate, consolidation, and post-construction settlements is provided in the **Table 6-4**.

**Table 6-4: Summary of Settlements Analysis Results**

Location & Relevant Borehole	Max. Embankment Height (m)	Estimated 15 Year Post Construction Total Settlement (mm)	MTO Post Construction Settlement Criteria (mm)	Comment
Parking Lot Entrance Road / CR4-CP-04	6.2	~7	200	Within the settlement criteria

The results indicate that the predicted post-construction consolidation settlements over a 15 year period at the assessed high fill embankment location is within the applicable MTO post-construction settlement criteria for non-freeways on compressible soils on MTO Settlement Criteria, New Embankments, Figure 1. The differential

settlement of 100:1 is considered not applicable to the performance of the parking lot surface and is also considered not applicable to the performance of the proposed parking lot entrance road embankment due to a low magnitude of settlement expected adjacent to the existing Simcoe County Road 4 embankment.

## 6.5.2 Global Slope Stability

Global slope stability analyses were carried out for the assessed carpool lot embankment using the limit equilibrium Morgenstern–Price method. Both long-term static and seismic (pseudo-static) stability conditions were evaluated in accordance with the requirements of CHBC S6-19, as well as temporary conditions.

The target minimum Factors of Safety (FoS) were adopted from Table 6.2 of CHBC S6-19, with a minimum FoS of 1.5 for long-term static conditions, a minimum FoS of 1.3 for short-term (temporary) conditions, and a minimum FoS of 1.1 was considered for pseudo-static conditions as specified in Clause 6.14.9.1 of CHBC S6-19. Seismic stability was assessed using a pseudo-static approach with a horizontal acceleration equal to half of the PGA, corresponding to 0.078.

For the parking lot access embankment, a side slope of 3H:1V was used. The analysis for the Simcoe County Road 4 Ramp S-E is provided under a separate cover.

A summary of the global slope stability results is presented in **Table 6-5**, and detailed analysis outputs are provided in **Appendix E**.

**Table 6-5: Global Slope Stability Results**

Soil Model	Specified Side Slope Angle (from 90% Design Drawings)	Calculated Factor of Safety			Comment
		Long-Term Static	Short-Term (Temporary)	Pseudo-static	
Parking Lot Entrance Road / CR4-CP-04	3H:1V	2.5	2.5	2.0	Satisfies required FoS

The result of the stability analysis for the parking lot entrance road meets the indicated required factors of safety.

## 7. Construction Considerations

### 7.1 General

During construction, the Contract Administrator should employ experienced geotechnical staff to review construction activities to confirm that foundation recommendations are carried out. Additional construction issues that need resolution depending on the contractors' means and methods may be warranted. Potential contractors should seek independent geotechnical advice regarding temporary works, excavation approaches, and dewatering strategies.

### 7.2 Site Preparation and Subgrade Protection

Prior to the placement of any fill, any existing topsoil, organic material, deleterious material, any disturbed material topsoil and/or unsuitable fill materials should be stripped in accordance with OPSS.PROV 206 and managed in accordance with OPSS.PROV 180.

The topsoil stripping should store the surficial topsoil cuttings into windrows where it is removed by scrapers to avoid excessive removal of organic contaminated soil caused by punching of scraper wheels into the subgrade.

Any soft, wet, or otherwise unsuitable material observed by proof rolling or inspection of the native subgrade should be sub-excavated as per Ontario Provincial Standard Drawing (OPSD) 203.010, removed, and replaced with suitable earth fill/granular material compacted as per OPSS.PROV 501. The subgrade preparation and any placement and compaction of the earth fill/granular material must be carried out in the dry.

All subgrade preparation and construction of high fill embankment should be completed under full time supervision and compaction testing overseen by a professional geotechnical engineer licensed to practice in Ontario.

### 7.3 Embankment Fill Placement

Fill embankments should be constructed with earth fill materials as per NSSP No. 1 in **Appendix F**, compacted as per OPSS.PROV 501, and constructed with side slopes inclined at 3H:1V or flatter. All fill materials must be free of organics, frozen soils, and any other deleterious materials. Medium and/or high plastic silts/clays shall not be used as Earth Fill embankment material. Earth fill will require careful selection and/or treatment prior to re-use. The engineered earth fill should consist of non-frost susceptible soils within 1.0 m of the pavement subgrade level for the access road, exit road and parking lot. Re-use of excavated earth from other sections for the BBP project shall be sampled and tested for plasticity and approved by the Geotechnical Engineer prior re-use and placement as part of embankment construction.

The embankment fill should be placed and compacted in accordance with OPSS.PROV 206 and OPSS.PROV 501 requirements.

If embankment fill is placed against existing embankments or earth cuts, benching of the existing slope should be carried out in accordance with OPSD 208.010.

Inspection and field density testing should be carried out by qualified geotechnical personnel during all engineered fill placement operations to ensure that appropriate materials are used, and that adequate levels of compaction have been achieved.

## 7.4 Slope Protection / Erosion Control

The side slopes of the constructed embankments and excavated side slope should be provided with adequate erosion protection against surface water runoff. Proper erosion control measures should be implemented both during construction and permanently in accordance with OPSS.PROV 803 and OPSS.PROV 804. Design and construction of erosion protection measures should include consideration of the surficial stability under heavy, prolonged rainfall and spring thaw conditions. Vegetation of the slopes must be adequately established before the onset of winter in accordance with OPSS.PROV 804.

Erosion control of the cut slope faces may also be accomplished with gravel sheeting (OPSS.PROV 1004). The placement of the granular sheeting should be selected during construction by examination of the conditions of the cut faces and groundwater emanating from the slopes. A contingency item may be carried in the tenders, as appropriate.

To prevent surface runoff from eroding and gullyng the embankment side slopes, consideration should be given to installing an asphalt barrier curb in accordance with OPSD 601.010.

## 7.5 Excess Soil Re-Use / Management

All excavated material shall be assessed for potential contamination in accordance with OPSS.PROV 180. Only clean, non-contaminated materials shall be reused on-site. Any excess excavated material (fill material) should be checked for contamination prior to removal/managed off-site, to determine which disposal option is best for excavated material. **Appendix F** includes a NSSP where the Earth Fill Material Specification is outlined.

## 8. Construction Impacts

Potential construction impacts include, but not limited to, the following:

- Topsoil, and any other organics deposits within the proposed embankment footprint must be stripped/sub-excavated and replaced with approved compacted material.
- The till deposits are generally hard and typically contain cobbles and boulders. The Contractor must be prepared to remove, penetrate, or otherwise handle these anticipated obstructions during construction.
- Construction equipment traffic may be difficult in areas of soft, loosened, and/or saturated subgrade. Disturbance of the subgrade by construction traffic should be minimized and adequate drainage constructed to maintain stable subgrade. Construction of windrows for topsoil stripping is recommended.
- Long term erosion protection should be effectively provided to the entire area of the final fill slopes.

Achieving the target design and performance is largely dependent on good contractor workmanship and quality control during construction. Subgrade inspections should be carried out by qualified foundation/geotechnical personnel to confirm subgrade conditions are consistent with the construction specifications and soils explored on site. Earth borrow material used as fill should be verified through rigorous quality control measures to verify its conformity with the material and construction specifications, respectively.

## 9. Closure

Preparation of the design report and engineering analysis was carried out by Curtis Simpson, P.Eng.. Technical and quality review of this report was completed by Bruce Goddard, P.Eng., a Senior Geotechnical Engineer. An independent technical and quality review of this report was also carried out by Carlos Nascimento, P.Eng., the Designated MTO Foundations Contact and Quality Control Auditor for this assignment. Quality verification of the report was completed by Taesang Ahn, Ph.D., P.Eng..

### AECOM Canada ULC

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#### Verified by

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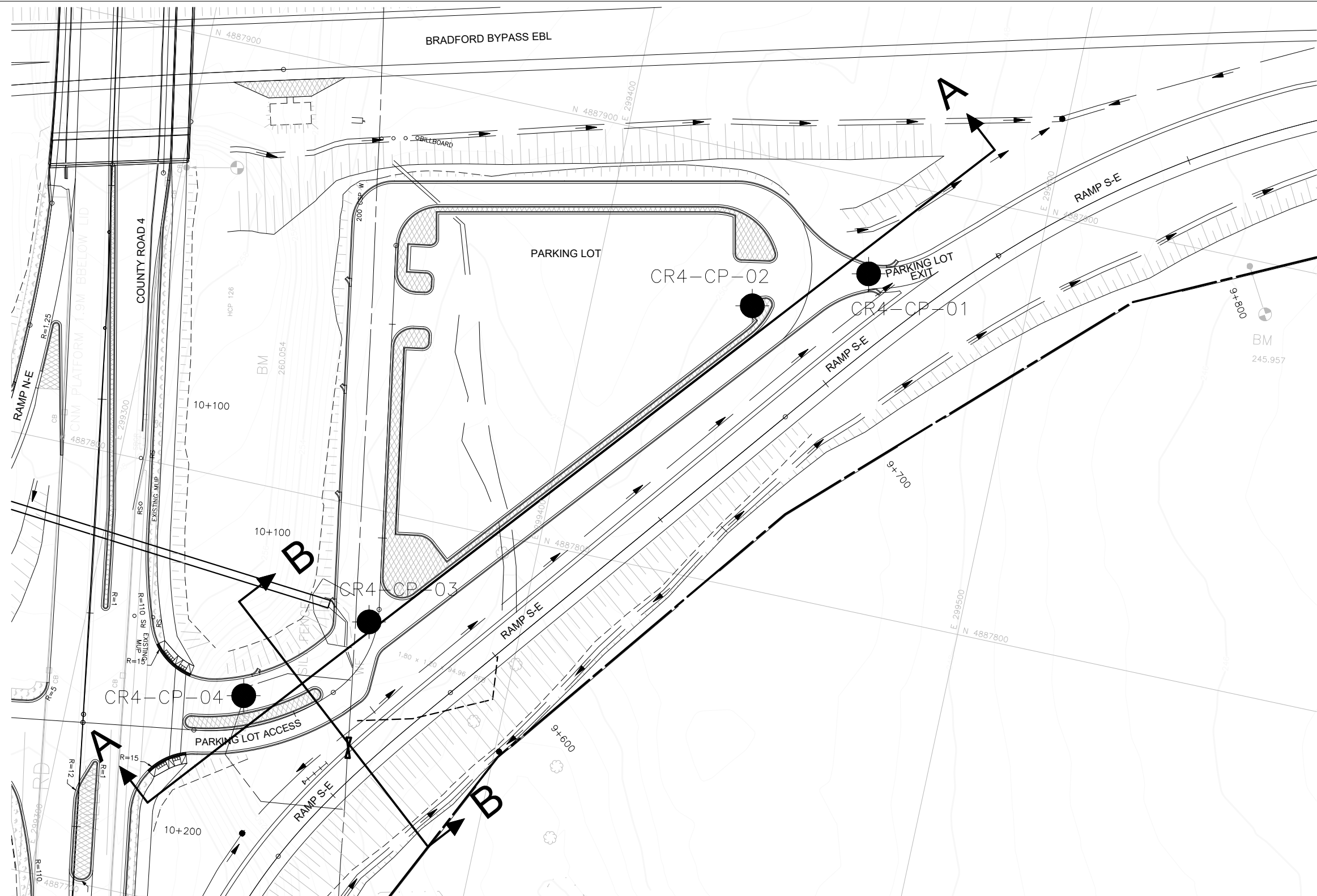


Taesang Ahn, Ph.D., P.Eng.  
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taesang.ahn@aecom.com

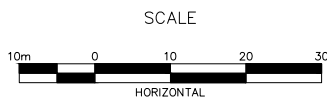
# Appendix **A**

## **Borehole Location Plans and Soil Stratigraphy**

JANUARY, 2026  
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 DRAWING NAME:  
 CREATED:



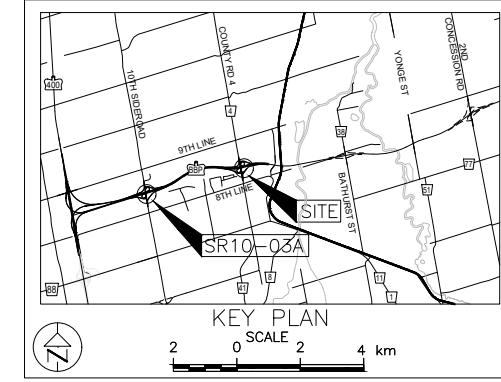
BOREHOLE LOCATION PLAN – PARKING LOT



NOTES:

- THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE TEXT OF REPORT AND RECORD OF BOREHOLE LOGS.
- 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.
- DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN.
- REFERENCE: BASE PLANS PROVIDED IN DIGITAL FORMAT BY AECOM FILES "Bradford Bypass\_base.dwg" RECEIVED OR DATED: NOVEMBER 13, 2025 AND "Bradford Bypass\_plan.dwg", RECEIVED OR DATED: JANUARY 22, 2026.
- REFER TO SHEET No. 02 FOR SECTION 'A - A', SECTION 'B - B'.

**Ontario** Ministry of Transportation  
 CONT No. 2026-2005  
 GWP No. 2026-23-00  
 GRADING DETAILS  
 BOREHOLE LOCATION PLAN  
 PARKING LOT  
**AECOM**



LEGEND

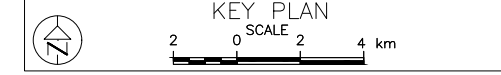
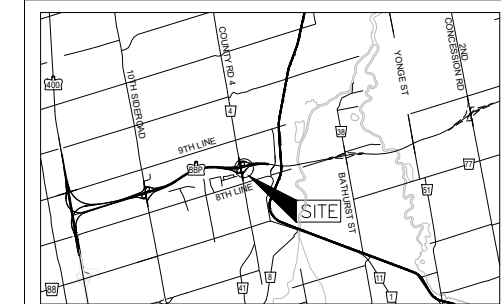
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- ⊥ SEAL (NOT INSTALLED)
- ⊥ PIEZOMETER (NOT INSTALLED)
- N STANDARD PENETRATION TEST VALUE
- 16 BLOWS/0.3M UNLESS OTHERWISE STATED (STD. PEN. TEST, 475 J/BLOW)
- 100% ROCK QUALITY DESIGNATION (RQD)
- ∇ WL IN PIEZOMETER, MEASURED ON YYYY/MM/DD
- ∇ WL UPON COMPLETION OF DRILLING

10TH SIDEROAD INTERCHANGE RAMP E-NS AND S-W			
BH No.	ELEVATION	MTM 10	
		NORTHING	EASTING
CR4-CP-01	249.10	4887878.0	299462.0
CR4-CP-02	249.80	4887865.0	299437.0
CR4-CP-03	249.90	4887774.0	299365.0
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SR10-03A	281.60	4887067.0	296268.0



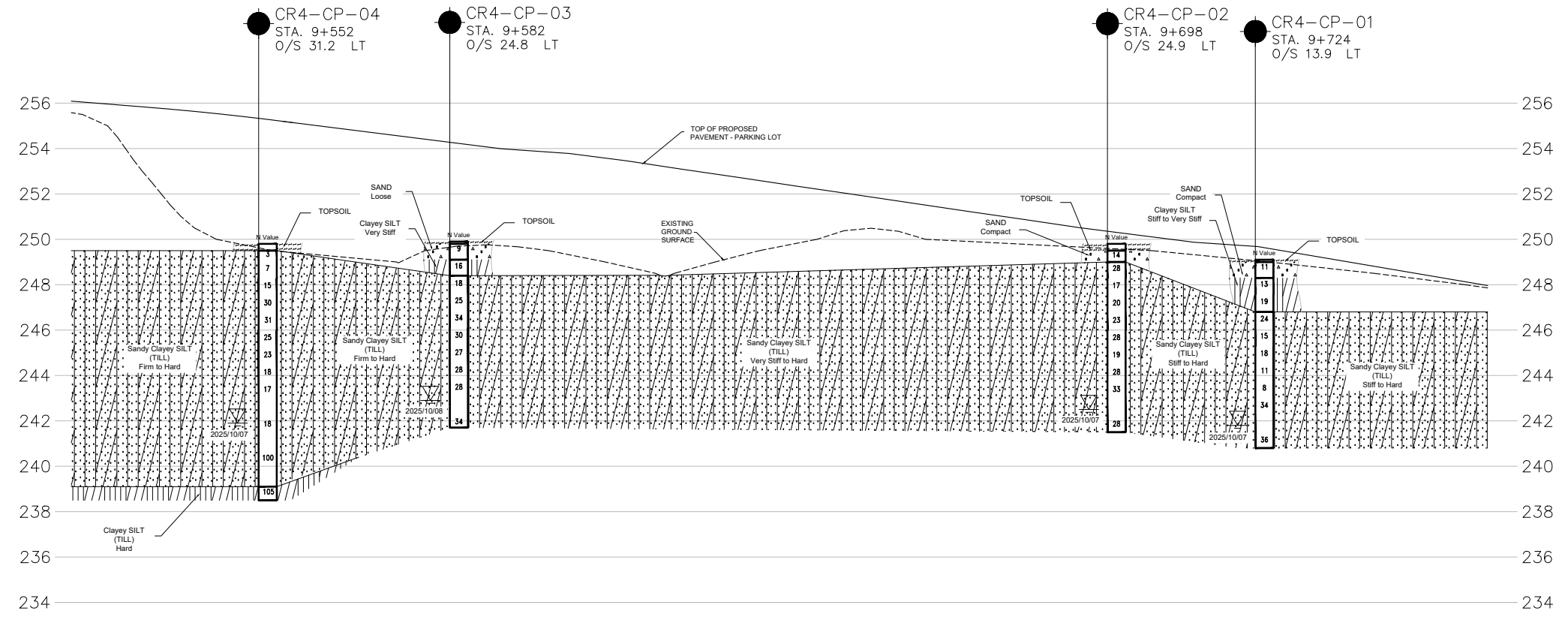
NO.	DATE	BY	REVISION
2	APR 9	SP	FINAL
1	JAN 26	JC	DRAFT

Geocres No. 31D04-034  
 HWY. BRADFORD BYPASS WEST PROJECT NO. 60731727 DIST. CENTRAL  
 SUBM'D. DATE: 01/28/2026 SITE:  
 DRAWN: JC CHKD. AR APPD. BG DWG. 01

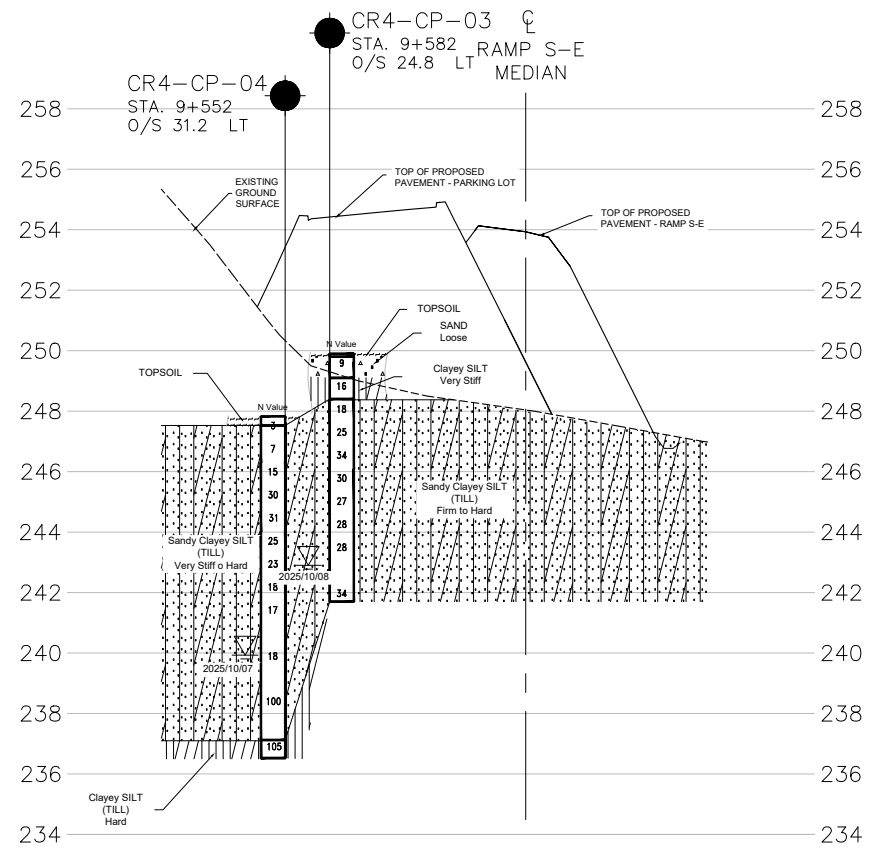


- LEGEND**
- BOREHOLE
  - ⊥ SEAL (NOT INSTALLED)
  - ⊥ PIEZOMETER (NOT INSTALLED)
  - N STANDARD PENETRATION TEST VALUE
  - 16 BLOWS/0.3M UNLESS OTHERWISE STATED (STD. PEN. TEST, 475 J/BLOW)
  - 100% ROCK QUALITY DESIGNATION (RQD)
  - W IN PIEZOMETER, MEASURED ON YYYY/MM/DD
  - ▽ WL UPON COMPLETION OF DRILLING
- REFER TO DRAWING No. 01 FOR BOREHOLE LIST AND COORDINATES.

- LEGEND - SOIL STRATA:**
- [Pattern] TOPSOIL
  - [Pattern] SAND
  - [Pattern] CLAYEY SILT
  - [Pattern] SANDY CLAYEY SILT (TILL)
  - [Pattern] CLAYEY SILT (TILL)



SECTION 'A - A'  
SECTIONS SCALE  
2 0 2 4m Hor  
1 0 1 2m Vert



SECTION 'B - B'  
SECTIONS SCALE  
2 0 2 4m Hor  
1 0 1 2m Vert

- NOTES:**
- LT (LEFT) AND RT (RIGHT) IN DIRECTION OF C/L MEDIAN CHAINAGE EQUATION OF RAMP S-E.
  - THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE TEXT OF REPORT AND RECORD OF BOREHOLE LOGS.
  - 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.
  - DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETRES AND METRES.
  - REFERENCE: BASE PLANS PROVIDED IN DIGITAL FORMAT BY AECOM FILES "Bradford Bypass\_base.dwg" RECEIVED OR DATED: NOVEMBER 13, 2025 AND "Bradford Bypass\_plan.dwg", RECEIVED OR DATED: JANUARY 22, 2026.
  - REFER TO DRAWINGS No. 01 FOR PLAN.

NO.	DATE	BY	REVISION
2	MAR 6	JC	FINAL
1	JAN 26	JC	DRAFT

Geocres No. 31D04-034  
HWY. BRADFORD BYPASS WEST PROJECT NO. 60731727 DIST. CENTRAL  
SUBM'D. \_ CHKD. \_ DATE: 01/28/2026 SITE:  
DRAWN: JC CHKD. CS APPD. BG DWG. 02

# Appendix **B**

## Site Photographs

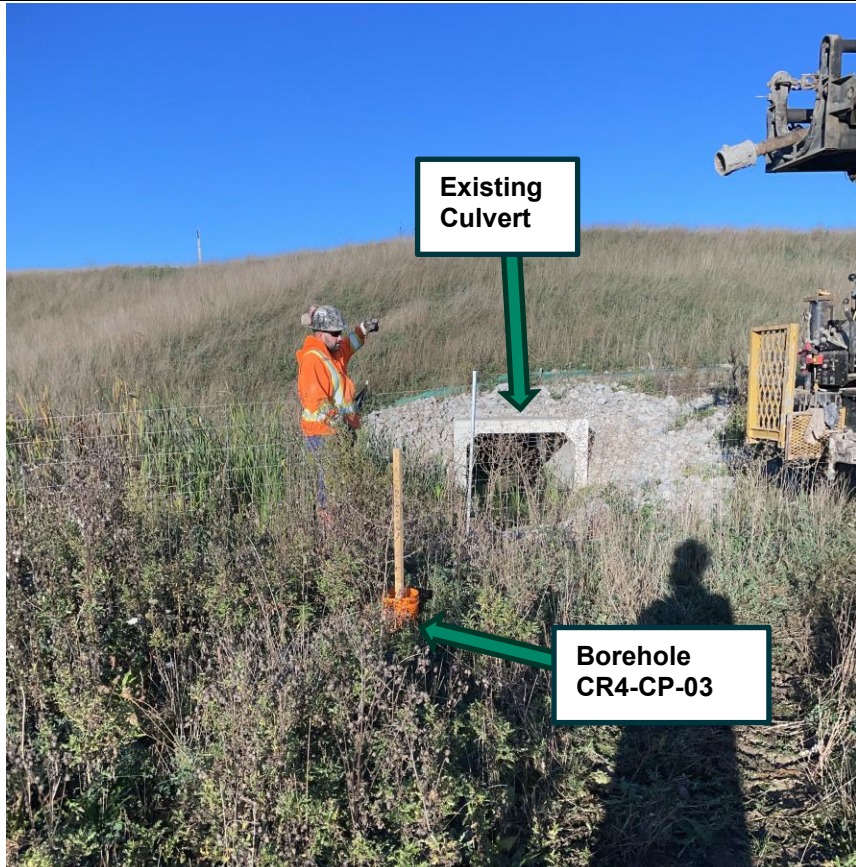
<b>Client Name:</b> MTO	<b>Report Name:</b> Foundation Investigation and Design Report BBP West - Simcoe County Road 4 Carpool Lot	<b>Street Name:</b> Simcoe County Road 4	<b>Project No.:</b> 60731727
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<b>Photo No.</b> <b>1</b>	<b>Date</b> 10/7/2025	
<b>Direction Photo Taken</b> North		
<b>Description</b> ■ Completion of drilling at borehole CR4-CP-01.		

<b>Photo No.</b> <b>2</b>	<b>Date</b> 10/7/2025	
<b>Direction Photo Taken</b> West		
<b>Description</b> ■ Completion of drilling at borehole CR4-CP-02		

<b>Client Name:</b> MTO	<b>Report Name:</b> Foundation Investigation and Design Report BBP West - Simcoe County Road 4 Carpool Lot	<b>Street Name:</b> Simcoe County Road 4	<b>Project No.:</b> 60731727
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<b>Photo No.</b> <b>3</b>	<b>Date</b> 10/8/2025
<b>Direction Photo Taken</b> West	
<b>Description</b> ■ Setting up for drilling at borehole CR4-CP-03.	



<b>Photo No.</b> <b>4</b>	<b>Date</b> 10/7/2025
<b>Direction Photo Taken</b> Southwest	
<b>Description</b> ■ Completion of drilling at borehole CR4-CP-04	



# Appendix **C**

## Record of Borehole Logs



## TERMINOLOGY USED IN BOREHOLE LOGS

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

*Peat:* A mass of organic matter usually fibrous in texture in various stages of decomposition, generally dark brown to black in colour and of spongy consistency.

*Fill:* The term fill has been used to describe materials which have been placed by non-natural processes. Fills can often be heterogeneous in nature and those relying on this report should expect them to contain deleterious materials. Such materials can include wood, bricks, slag, porcelain, organics, and obstructions such as scrap metal, storage tanks, and abandoned concrete/steel structures.

Due to the uncertainty of the placement method of the material, the boring samples obtained for this report are not expected to represent other materials at any horizontal or vertical distance from where the sample was obtained.

Fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill site. Unless specifically stated, the fill on this site has not been tested for contaminants that can be considered toxic or hazardous. Testing to determine the toxicity of fill materials can be conducted, if requested.

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

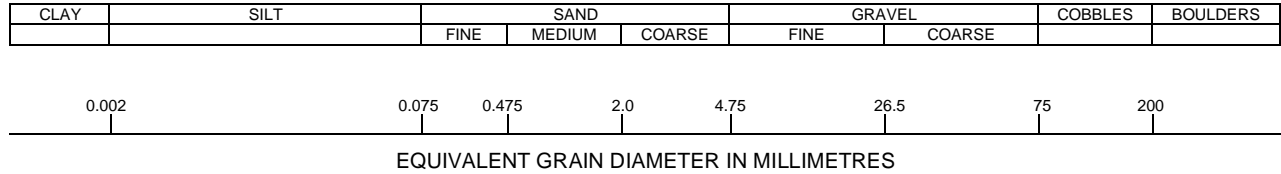
*Homogeneous:* same color and appearance throughout.

*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 generally follow the Canadian Foundations Engineering Manual and the Unified Soil Classification System. These systems follow the standard proposed by the International Society for Soil Mechanics and Foundation Engineering. Laboratory grain size analyses provided by AECOM follow the same system. Note that, with exception of those samples where a grain size distribution analysis has been completed, all samples have been classified by visual inspection. Visual inspection classification is not sufficient to provide exact grain sizing.

## ISSMFE / USCS SOIL CLASSIFICATION



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.

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

Cohesionless Soils		Cohesive Soils			Composition	
Compactness Condition	SPT N-Index (blows per 0.3 m)	Consistency	Undrained Shear Strength (kPa)	SPT N-Index (blows per 0.3 m)	Term	Criteria
Very loose	0 - 5	Very soft	< 12	< 2	Trace	1% - 10%
Loose	5 - 10	Soft	12 - 25	2 - 5	Some	10% - 20%
Compact	10 - 30	Firm	25 - 50	5 - 8	Adjective	20% - 35%
Dense	30 - 50	Stiff	50 - 100	8 - 15	And	> 35%
Very Dense	> 50	Very Stiff	100 - 200	15 - 30	Noun	> 35% & largest fraction
		Hard	> 200	> 30		

### Standard Penetration Test (SPT):

The number of blows required to drive a 50 mm (2 in.) open split spoon sampler from a depth of 150 mm (6 in.) to 450 mm (18 in.) in undisturbed soil. Each blow is driven by a 63.6 kg (140 lb.) hammer free falling a distance of 0.76 m (30 in.).

Sample & Soil Abbreviations		Laboratory Result Abbreviations		Strata/Graphic Plot					
CORE	Rock core sample	GR	Gravel		Fill		Asphalt		Cobbles
AS	Auger sample	SA	Sand		Topsoil		Concrete		Sandy Silt Till
PP	Pocket penetrometer	SI	Silt		Clay		Silty Clay		Silty Clay Till
SG	Specific gravity	CL	Clay		Silt		Clayey Silt		Clayey Silt Till
SS	Split spoon sample	PL	Plastic Limit		Sand		Silty Sand		Silty Gravel
TW	Thin wall sample (Shelby tube)	LL	Liquid limit		Gravel		Sand & Gravel		Clayey Gravel
VANE	Field vane	UW	Unit Weight (wet)		Clayey Sand		Shale		Limestone
WH	Weight of hammer	U	Unconfined Compressive Shear Strength						
		Q	Unconfined-Undrained Triaxle Shear Strength						
Plasticity Description		Liquid Limit (w <sub>l</sub> )							
Low		w <sub>l</sub> < 30							
Medium		30 < w <sub>l</sub> < 50							
High		50 < w <sub>l</sub>							

**RECORD OF BOREHOLE CR4-CP-01**

1 OF 1

**METRIC**

G.W.P. 2026-23-00 LOCATION Carpool Lot N 4887878.0; E 299462.0 / MTM Zone 10 ORIGINATED BY AA  
 DIST Central HWY BBP BOREHOLE TYPE Track Mount CME 75 / HSA COMPILED BY BH  
 DATUM Geodetic (CGVD28) DATE 2025.10.07 - 2025.10.07 LATITUDE 44.130876 LONGITUDE -79.566703 CHECKED BY BG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80					
											○ UNCONFINED	+	FIELD VANE			
											● QUICK TRIAXIAL	×	LAB VANE			
											WATER CONTENT (%)					
											20	40	60			
249.1	GROUND SURFACE															
248.9 0.1	<b>TOPSOIL</b> , brown, moist (100 mm) <b>SAND</b> , some gravel, trace silt, trace clay, brown, moist, compact		1	SS	11											20 68 (12)
248.3 0.8	<b>CLAYEY SILT</b> , some sand, brown to grey, moist, stiff to very stiff		2	SS	13											
			3	SS	19											0 15 40 45
246.8 2.3	<b>SANDY CLAYEY SILT</b> , trace gravel, grey, moist, stiff to hard (TILL)		4	SS	24											
			5	SS	15											
			6	SS	18											
			7	SS	11											5 22 45 28
			8	SS	8											
			9	SS	34											
			10	SS	36											
240.8 8.2	<b>END OF BOREHOLE</b> Notes: 1. This log is to be read in conjunction with the subject report and project number as presented above. 2. Interpretation assistance by AECOM is required for projects excluding the above mentioned project. 3. Groundwater measured at 7.3 mBGS in open borehole upon completion.															

AECOM MTO FOUNDATION LOG BBP WEST LOGS 12 23 25\_CS 20260108.GPJ AECOM OTTAWA DATA TEMPLATE.GDT 26-1-27



**RECORD OF BOREHOLE CR4-CP-03**

1 OF 1

**METRIC**

G.W.P. 2026-23-00 LOCATION Carpool Lot N 4887774.0; E 299365.0 / MTM Zone 10 ORIGINATED BY AA  
 DIST Central HWY BBP BOREHOLE TYPE Track Mount CME 75 / HSA COMPILED BY CS  
 DATUM Geodetic (CGVD28) DATE 2025.10.08 - 2025.10.08 LATITUDE 44.129941 LONGITUDE -79.567921 CHECKED BY BG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								
249.9	GROUND SURFACE															
249.8 0.1	<b>TOPSOIL</b> , brown, moist (125 mm) <b>SAND</b> , some silt, some clay, brown, moist to very moist, loose		1	SS	9											
249.1 0.8	<b>CLAYEY SILT</b> , trace gravel, trace sand, grey, moist, very stiff		2	SS	16											
248.4 1.5	<b>SANDY CLAYEY SILT</b> , trace gravel, grey, moist, very stiff to hard (TILL)		3	SS	18										2	40 (58)
			4	SS	25											
			5	SS	34										7	32 44 17
			6	SS	30											
			7	SS	27										6	31 47 16
			8	SS	28											
			9	SS	28											
241.7 8.2	<b>END OF BOREHOLE</b> Notes: 1. This log is to be read in conjunction with the subject report and project number as presented above. 2. Interpretation assistance by AECOM is required for projects excluding the above mentioned project. 3. Groundwater measured at 7.0 mBGS in open borehole upon completion.		10	SS	34											

AECOM MTO FOUNDATION LOG BBP WEST LOGS 12 23 25\_CS 20260108.GPJ AECOM OTTAWA DATA TEMPLATE.GDT 26-1-27



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

**RECORD OF BOREHOLE CR4-CP-04**

1 OF 1

**METRIC**

G.W.P. 2026-23-00 LOCATION Carpool Lot N 4887751.0; E 299340.0 / MTM Zone 10 ORIGINATED BY AA  
 DIST Central HWY BBP BOREHOLE TYPE Track Mount CME 75 / HSA COMPILED BY CS  
 DATUM Geodetic (CGVD28) DATE 2025.10.07 - 2025.10.07 LATITUDE 44.129731 LONGITUDE -79.568225 CHECKED BY BG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
										○ UNCONFINED	+ FIELD VANE					
										● QUICK TRIAXIAL	× LAB VANE					
										WATER CONTENT (%)						
										20	40	60				
249.8	GROUND SURFACE															
249.5	TOPSOIL, brown, moist (300 mm)															
0.3	SANDY CLAYEY SILT, trace to some gravel, grey, moist to very moist, firm to hard (TILL)	1	SS	3												
		2	SS	7											5 35 45 15	
		3	SS	15												
		4	SS	30												
		5	SS	31												
		6	SS	25												
		7	SS	23												
		8	SS	18												
		9	SS	17												
		10	SS	18												
		11	SS	100											19 28 39 14	
		12	SS	105											4 26 50 20	
239.1	CLAYEY SILT, trace sand, grey, moist, hard (TILL)															
10.7																
238.5	END OF BOREHOLE															
11.3	Notes: 1. This log is to be read in conjunction with the subject report and project number as presented above. 2. Interpretation assistance by AECOM is required for projects excluding the above mentioned project. 3. Groundwater measured at 7.9 mBGS in open borehole upon completion. 4. Borehole open to 8.2 mBGS prior to backfilling.															

AECOM MTO FOUNDATION LOG BBP WEST LOGS 12\_23\_25\_CS 20260108.GPJ AECOM OTTAWA DATA TEMPLATE.GDT 26-1-27



○ <sup>3</sup>% STRAIN AT FAILURE

+ <sup>3</sup>, × <sup>3</sup>: Numbers refer to Sensitivity

**RECORD OF BOREHOLE SR10-03A**

1 OF 1

**METRIC**

G.W.P. 2026-23-00 LOCATION 10th Sideroad Underpass N 4887067.0; E 296268.0 / MTM Zone 10 ORIGINATED BY CP  
 DIST Central HWY BBP BOREHOLE TYPE Truck Mount CME 75 / HSA COMPILED BY MF  
 DATUM Geodetic (CGVD28) DATE 2025.08.12 - 2025.08.12 LATITUDE 44.123551 LONGITUDE -79.606611 CHECKED BY BG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80						100	20
281.6	GROUND SURFACE																	
	<b>SILTY SAND</b> , trace gravel, brown, moist, loose to compact		1	SS	11													
280.8																		
0.8	<b>CLAYEY SILT</b> , trace sand, brownish grey, moist, stiff to very stiff		2	SS	9													0 6 59 35
			3	ST														
			VANE															
278.6																		
3.0	<b>SANDY CLAYEY SILT</b> , some gravel, some clay, grey, moist to wet, very stiff		4	SS	15													11 29 41 19
			5	ST														
			VANE															
277.0																		
4.6	<b>SILTY SAND</b> , trace gravel and cobbles, some clay, grey, wet, very dense (TILL)		6	SS	54													Corrosivity 6 43 34 17
			7	SS	58													
			VANE															
274.9																		
6.7	<b>END OF BOREHOLE</b>		8	SS	57													6 49 (45)
	Notes: 1. This log is to be read in conjunction with the subject report and project number as presented above. 2. Interpretation assistance by AECOM is required for projects excluding the above mentioned project. 3. Groundwater levels were recorded at 1.45 mBGS on 2025.04.04, 1.57 mBGS on 2025.04.14, 1.65 mBGS on 2025.06.06, 1.71 mBGS on 2025.03.27, 2.04 mBGS on 2024.11.30, 2.07 mBGS on 2025.01.15, 2.20 mBGS on 2025.07.04, 2.27 mBGS on 2025.02.02, and 2.81 mBGS on 2025.08.07. 4. No caving was observed.																	

AECOM MTO FOUNDATION LOG BBP WEST LOGS 12 23 25.GPJ AECOM OTTAWA DATA TEMPLATE.GDT 26-3-9



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

DRAWING NAME:  
CREATED:

NAME/DON  
CREATED

MODIFIED:

JANUARY, 2026 MCDTIME

MINISTRY OF TRANSPORTATION, ONTARIO

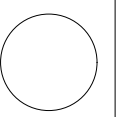
PH-D-302

89-10

METRIC  
DIMENSIONS ARE IN METRES AND/OR  
MILLIMETRES UNLESS OTHERWISE SHOWN  
N.T.S.

**Ontario** Ministry of  
Transportation

CONT No 2026-2025  
GWP No 2026-23-00



SOILS DATA

SHEET  
734



**AECOM**

**County Road 4 Carpool Lot**

**Station 10+200**  
0- 200 Tps  
200- 600 Br Sa(y) Si Tr Gr Tr Org M Moist  
600- 1.5 Br Sa Some Si Tr Gr Tr Cl Moist to Wet  
Fr Wat @ 1400mm

**Station 10+200 D 0**  
0- 200 Tps  
200- 800 Br Sa(y) Si Tr Gr Tr Org M Moist  
800- 1.5 Br Sa Some Si Tr Gr Tr Cl Moist


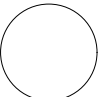

**Station 10+230**  
0- 200 Tps  
200- 1.5 Br Sa(y) Si Some Gr Tr Cl Moist

**Station 10+260**  
0- 300 Tps  
300- 600 Br Sa(y) Si W Gr Tr Cl Moist  
600- 1.5 Br Sa Some Si Tr Gr Tr Cl Moist  
1.5- 2.1 Br Si(y) Cl W Sa Tr Gr (V.Stiff) Moist  
Nvalue=15 blows / 300mm

REVISIONS	DATE	BY	DESCRIPTION
	XX/XX/XX		
XX/XX/XX			
XX/XX/XX			
XX/XX/XX			
25/06/19			

DRAWING NAME: COUNTY ROAD 4 CARPOOL LOT (RESTRICTED)     
 NAME/DON: COUNTY ROAD 4 CARPOOL LOT (RESTRICTED)     
 CREATED: JANUARY, 2026     
 MODIFIED:     
 MODTIME:     
 COUNTY ROAD 4 CARPOOL LOT (RESTRICTED)     
 PH-D-302     
 89-10     
 MINISTRY OF TRANSPORTATION, ONTARIO

METRIC  
 DIMENSIONS ARE IN METRES AND/OR  
 MILLIMETRES UNLESS OTHERWISE SHOWN  
 N.T.S.

	CONT No 2026-2025 GWP No 2026-23-00	
	SOILS DATA	
		

**AECOM**

**Station 10+090 D 0**

0- 50 Tps

50- 3 Br Si(y) Cl Tr Sa Tr Gr Moist

3- 3.6 Br Si(y) Cl Tr Sa Tr Gr (Stiff) Moist  
 Nvalue=15 blows / 300mm

3.6- 4.5 Br Si(y) Cl Some Sa Tr Gr Moist

4.5- 5.1 Br/Gry Si(y) Cl Some Sa Tr Gr Moist (Hard)  
 Nvalue=52 blows / 300mm

**Station 10+110 D 0**

0- 50 Tps

50- 1.5 Br Si(y) Cl Tr Sa Tr Gr Moist

1.5- 2.1 Br Si(y) Cl Tr Sa Tr Gr (V.Stiff) Moist  
 Nvalue=25 blows / 300mm

2.1- 3.6 Br/Gry Si(y) Cl Some Sa Tr Gr Moist

3.6- 4.2 Br/Gry Si(y) Cl Some Sa Tr Gr Moist (Hard)  
 Nvalue=31 blows / 300mm

**Station 10+140 D 0**

0- 100 Tps

100- 3.5 Br Si(y) Cl Tr Sa Moist

**Station 10+140 D 0**

0- 100 Tps

100- 1.5 Br Si(y) Cl Tr Sa Moist

**Station 10+160 D 0**

0- 100 Tps

100- 1.5 Br Si(y) Cl Tr Sa Moist

w @ 0.8m = 20%

Percent Passing 4.75 mm = 100%

75 µm = 92%

5 µm = 64%

2 µm = 45%

Frost Susceptibility = LSFH

Soil Erodibility = 0.21

W<sub>L</sub> = 32%

W<sub>p</sub> = 17%

P<sub>t</sub> = 15%

MTC Soil Classification = CL

1.5- 2.1 Br Si(y) Cl Tr Sa (V.Stiff) Moist  
 Nvalue=18 blows / 300mm

**Station 10+180 D 0**

0- 100 Tps

100- 1.5 Br Si(y) Cl Tr Sa Moist

**Station 10+230 D 0**

0- 100 Tps

100- 2.5 Br Si(y) Cl Tr Sa Moist

**County Road 4 Carpool Lot (Restricted)**

**Station 10+060 D 0**

0- 1.5 Br Si(y) Cl Tr Sa Moist

1.5- 2.1 Br Si(y) Cl Tr Sa (V.Stiff) Moist  
 Nvalue=15 blows / 300mm

2.1- 4.5 Br Si(y) Cl Tr Sa Tr Gr Moist

4.5- 5.1 Gry Si(y) Cl Tr Sa Tr Gr (Hard) Moist  
 Nvalue=48 blows / 300mm

5.1- 6 Gry Si(y) Cl Tr Sa Tr Gr Moist

6- 6.6 Gry Si(y) Cl Tr Sa Tr Gr (Hard) Moist to Wet  
 Nvalue=50 blows / 75mm

REVISIONS	DATE	BY	DESCRIPTION
XX/XX/XX			
XX/XX/XX			
XX/XX/XX			
XX/XX/XX			
25/06/19			



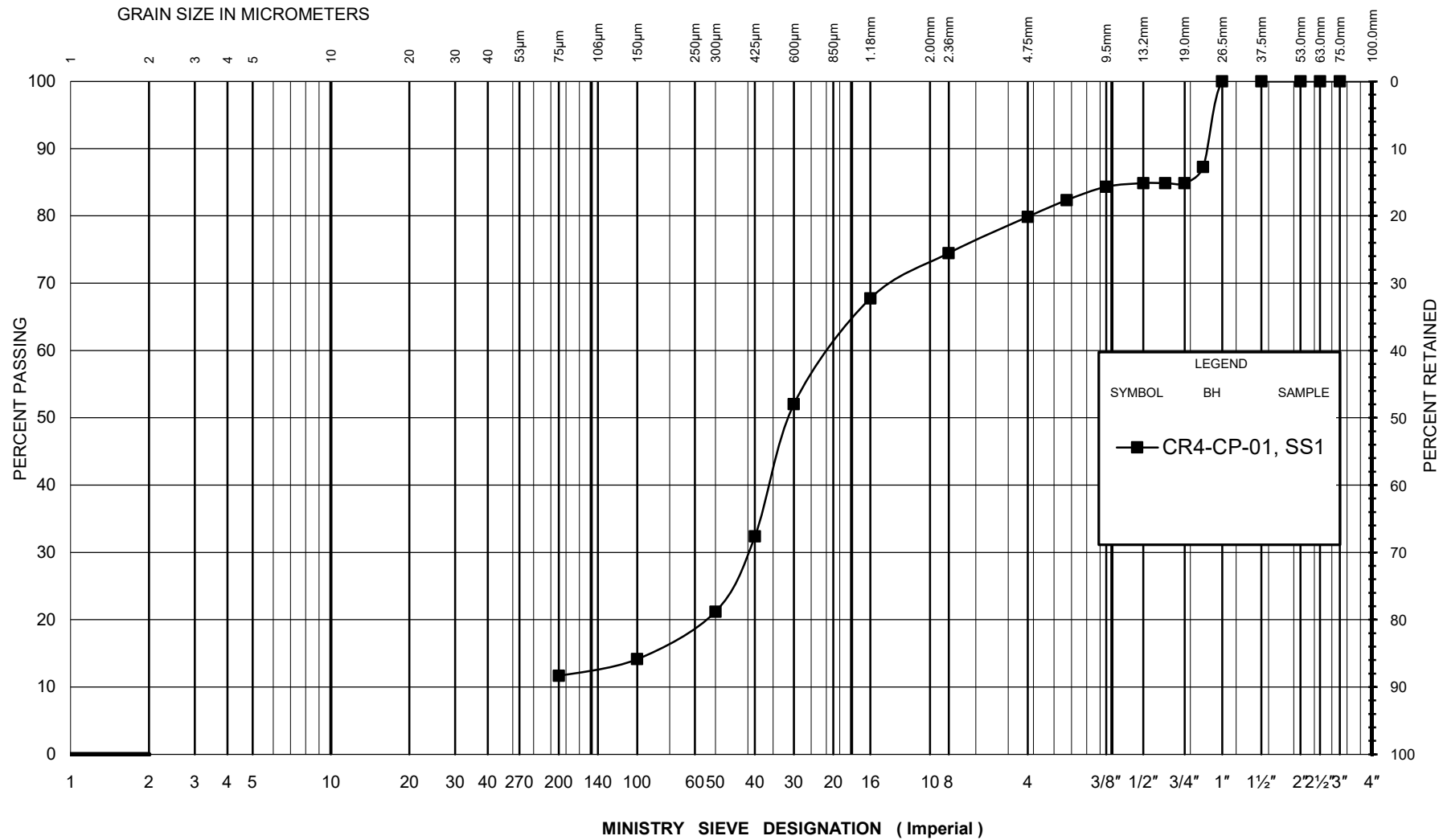
# Appendix **D**

## Laboratory Test Results



# UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT					SAND			Gravel		Cobbles
					Fine	Medium	Coarse	Fine	Coarse	



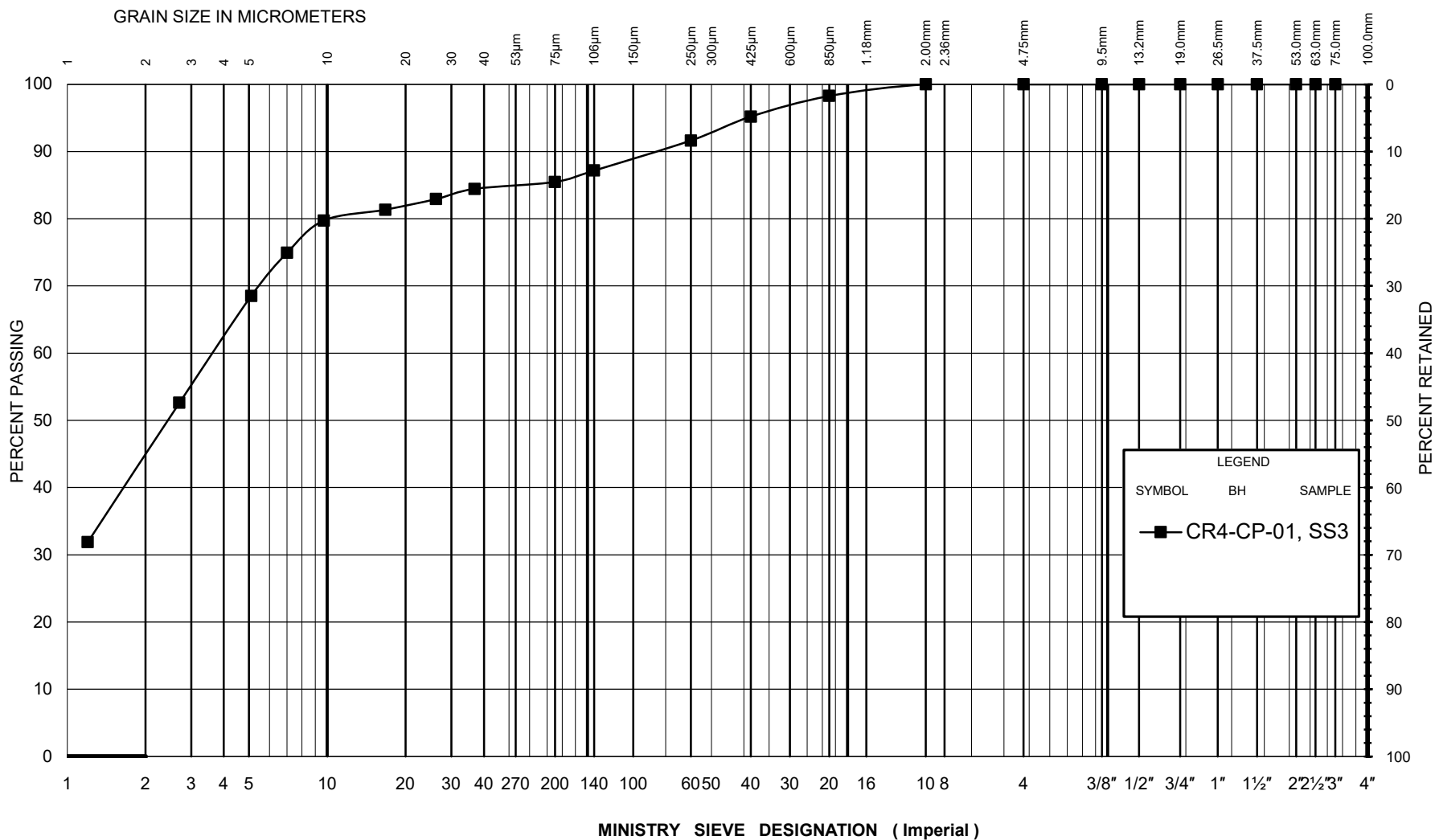
GRAIN SIZE DISTRIBUTION

**SAND**

Figure No.	1
Project No.	60731727
Project Name	BBP West CR4 Carpool Lot

# UNIFIED SOIL CLASSIFICATION SYSTEM

<b>CLAY &amp; SILT</b>	<b>SAND</b>			<b>Gravel</b>		<b>Cobbles</b>
	Fine	Medium	Coarse	Fine	Coarse	

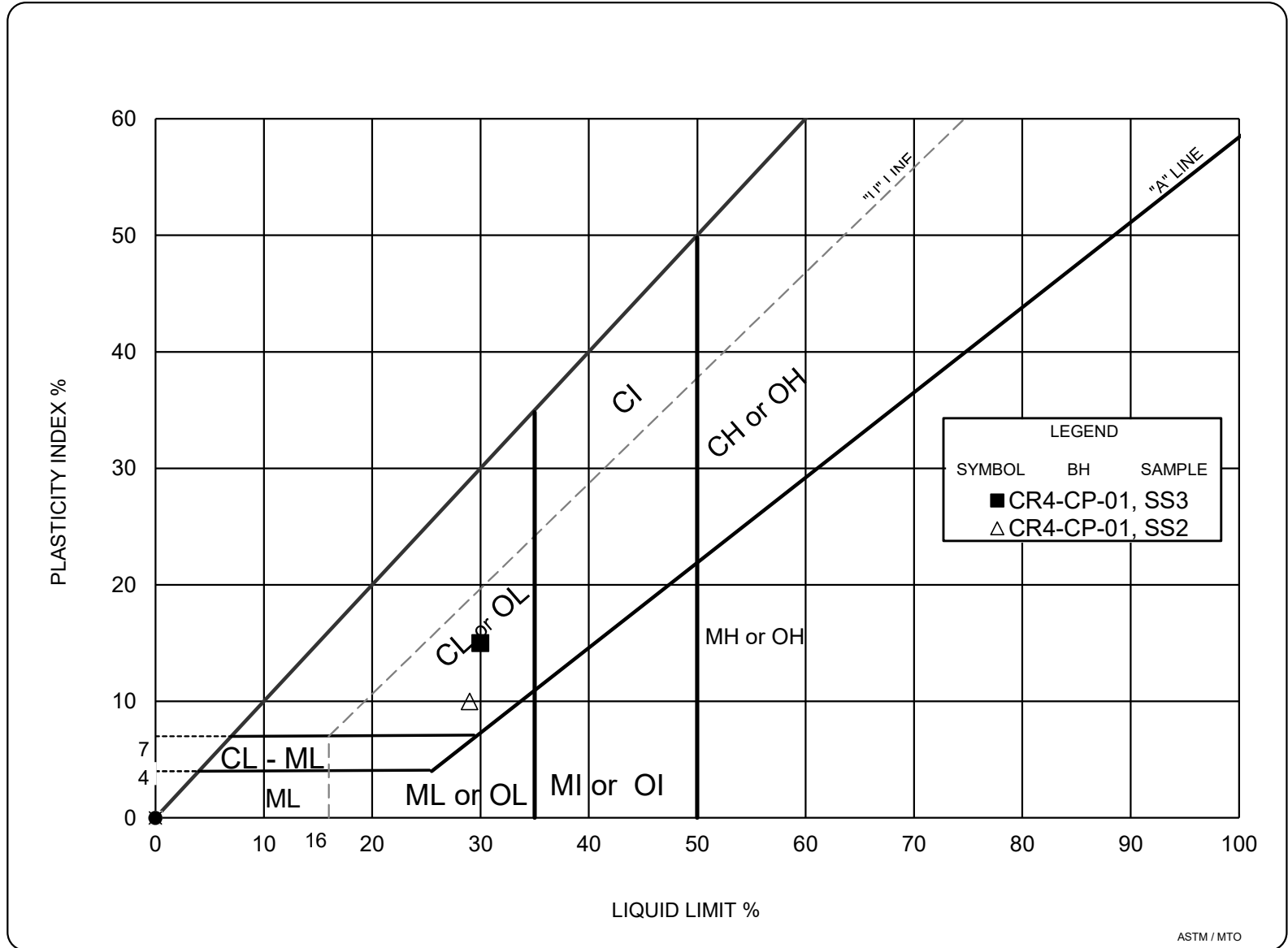


GRAIN SIZE DISTRIBUTION

**CLAYEY SILT**

Figure No.	2
Project No.	60731727
Project Name	BBP West CR4 Carpool Lot

# PLASTICITY CHART



Ministry of  
Transportation

PLASTICITY CHART

CLAYEY SILT

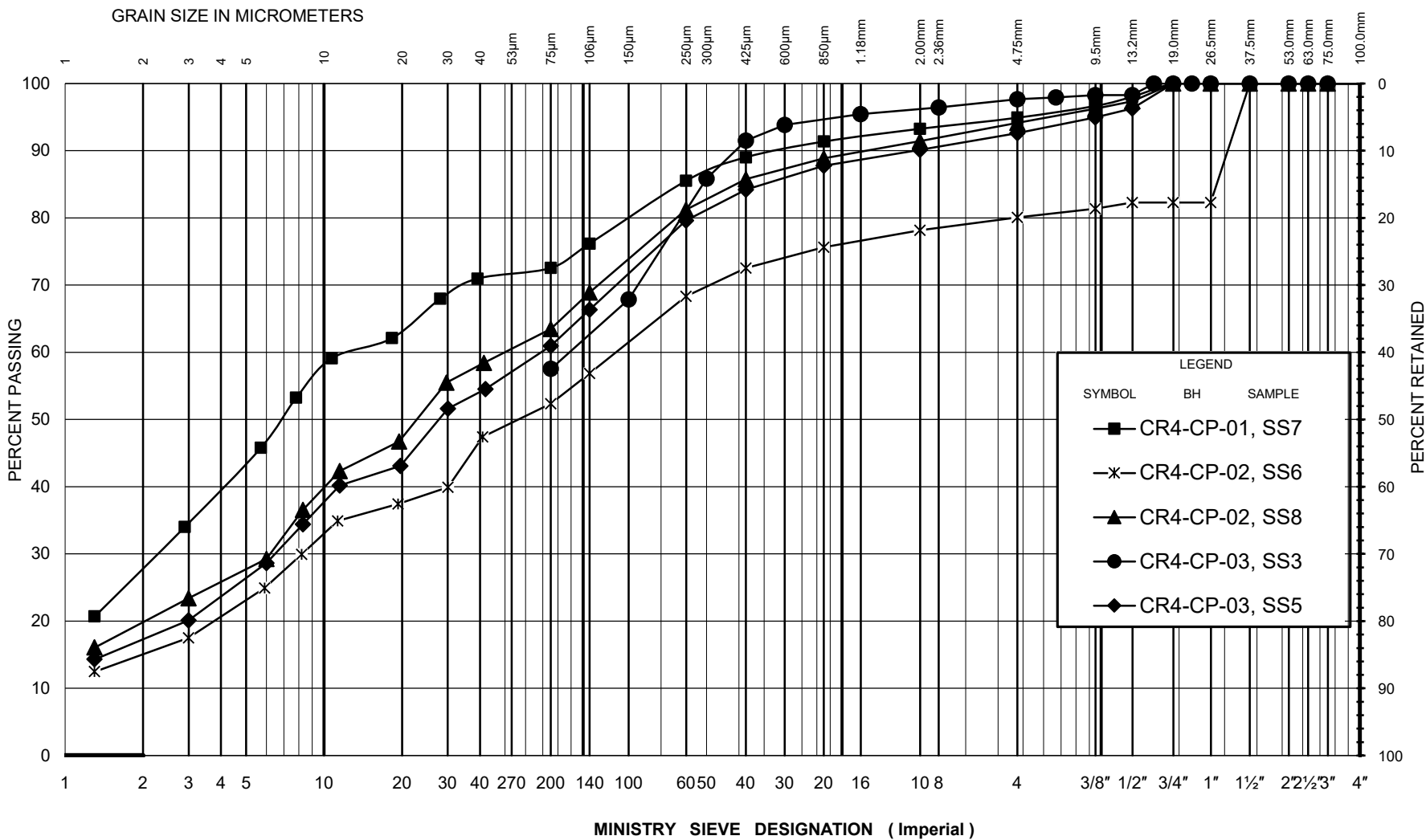
Figure No. 3

Project No. 60731727

Project Name BBP West  
CR4 Carpool Lot

# UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT	SAND			Gravel		Cobbles
	Fine	Medium	Coarse	Fine	Coarse	



Ministry of  
Transportation

GRAIN SIZE DISTRIBUTION

**SANDY CLAYEY SILT TILL**

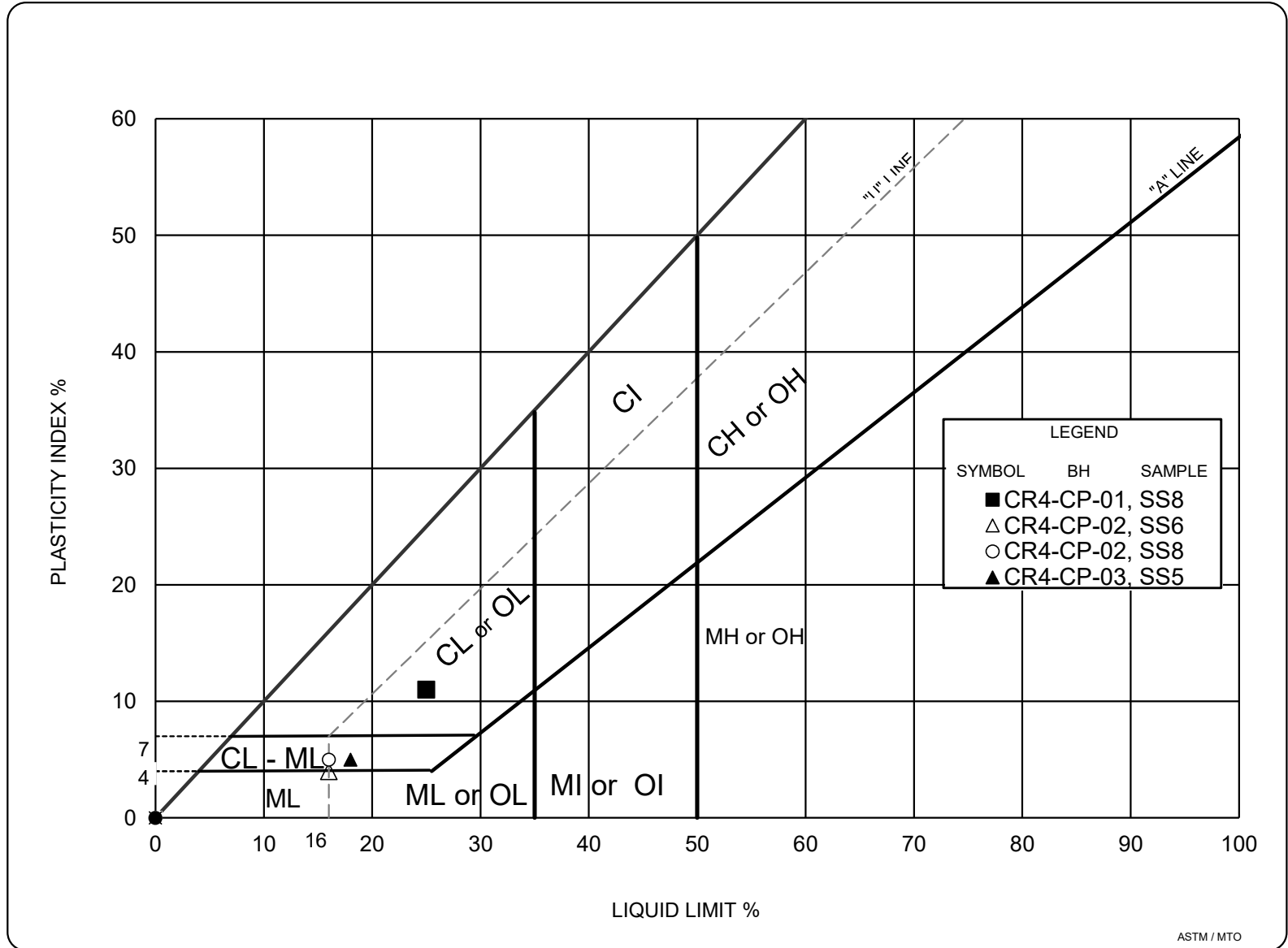
Figure No. 4

Project No. 60731727

Project Name BBP West  
CR4 Carpool Lot



# PLASTICITY CHART



Ministry of  
Transportation

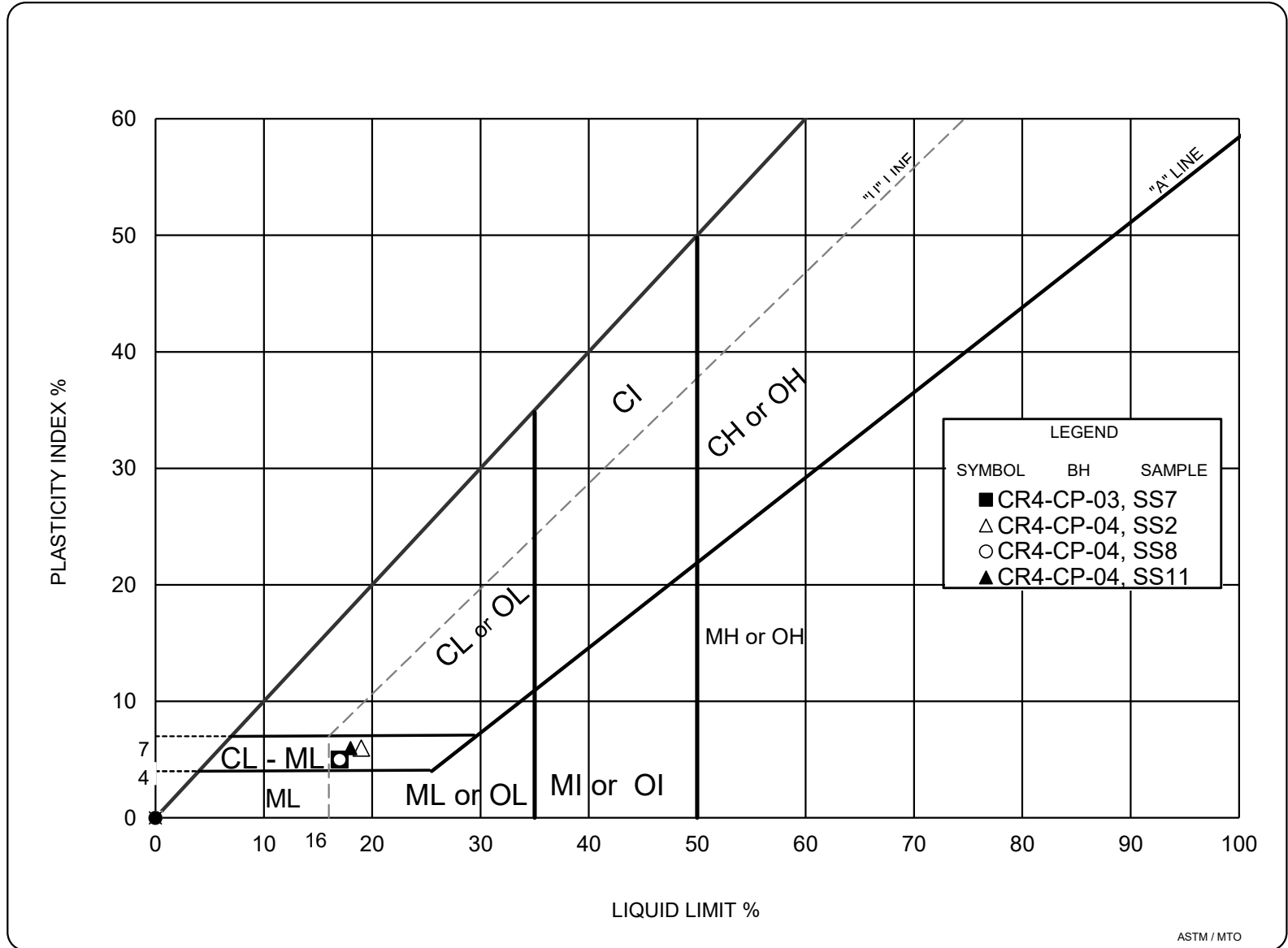
PLASTICITY CHART  
**SANDY CLAYEY SILT TILL**

Figure No. 6

Project No. 60731727

Project Name BBP West  
CR4 Carpool Lot

# PLASTICITY CHART



Ministry of  
Transportation

PLASTICITY CHART  
**SANDY CLAYEY SILT TILL**

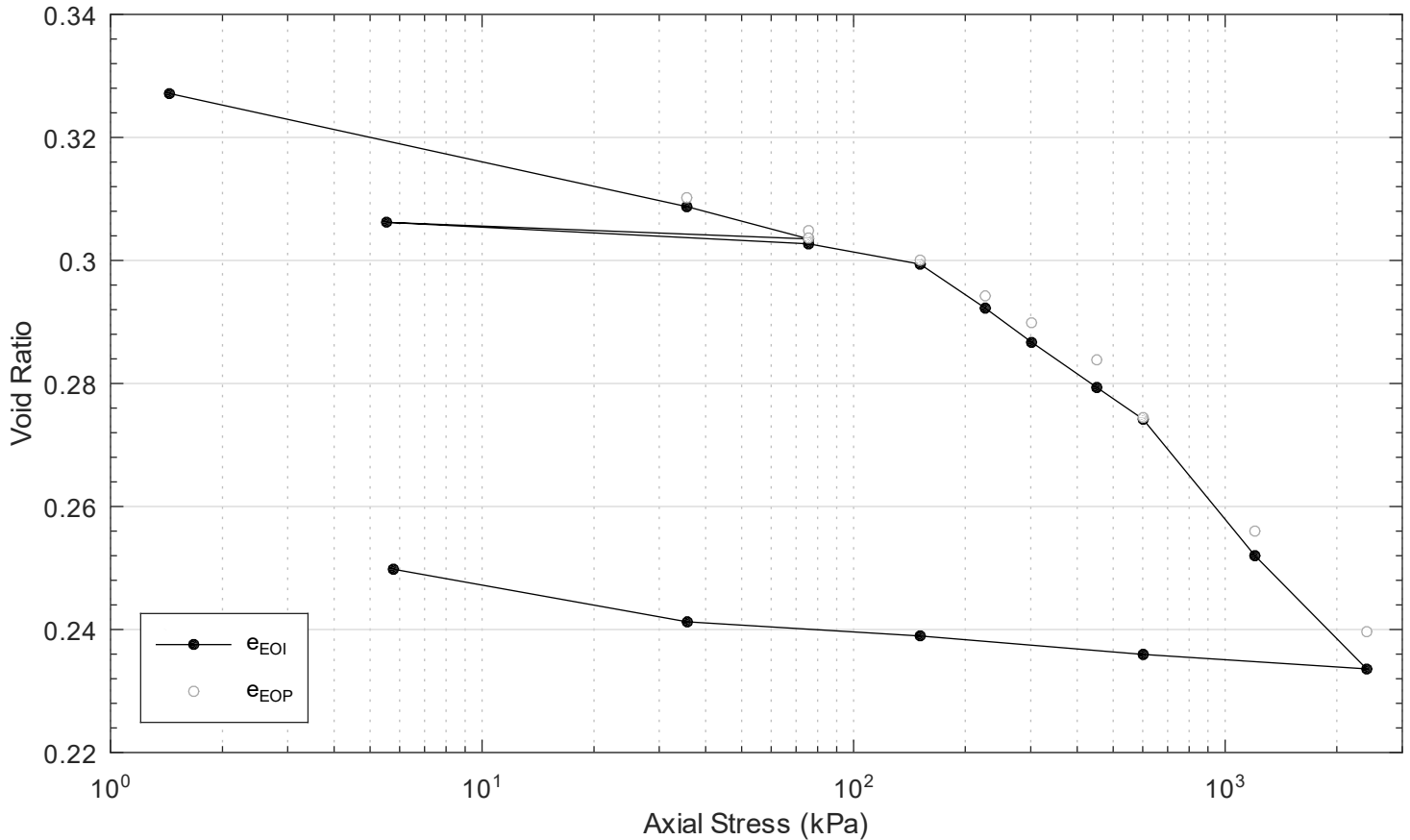
Figure No. 7

Project No. 60731727

Project Name BBP West  
CR4 Carpool Lot



Project: 60731727  
 BBP - West Contract  
 Borehole: SR10-03A  
 Sample: ST5  
 Depth: 3.6m  
 Client: AECOM



Start of Test		2025-09-16	
Diameter of Sample	cm	D	6.343
Height of Sample	cm	H <sub>o</sub>	2.538
Height of Solids	cm	H <sub>s</sub>	1.914
Water Content	%	w <sub>o</sub>	11.91
Dry Density	g/cm <sup>3</sup>	ρ <sub>d</sub>	2.04
Moist Unit Weight	kN/m <sup>3</sup>	γ	22.3
Void Ratio	-	e <sub>o</sub>	0.326
Degree of Saturation	-	S <sub>ro</sub>	0.99
Specific Gravity	-	G <sub>s</sub>	2.702

TRIMMING: the specimen was manually trimmed to the size of the consolidation ring, then mounted in a fixed ring consolidometer

LOADING: the consolidometer was flooded with water with the seating load adjusted to limit swelling

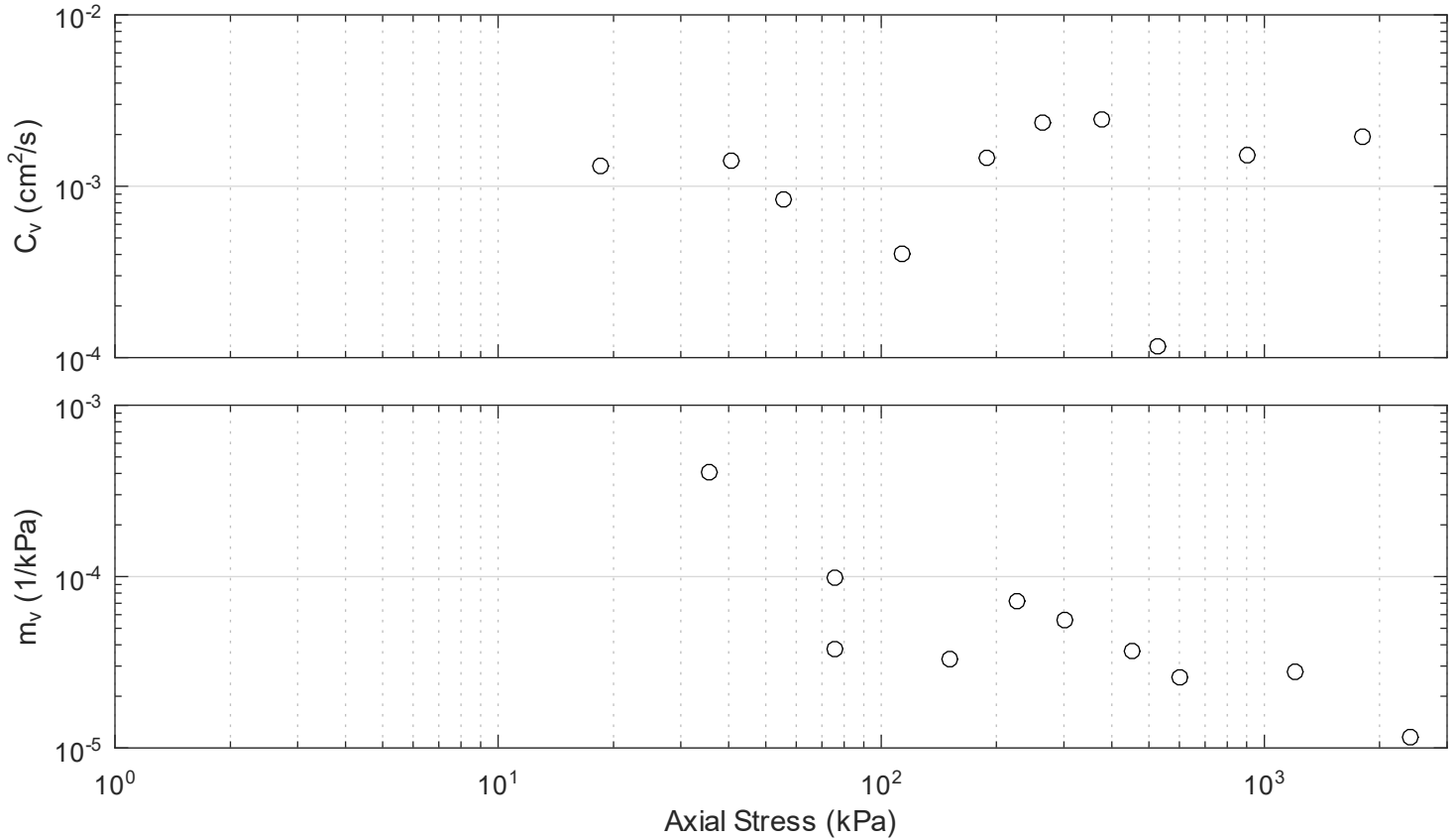
CALCULATIONS: coefficients of consolidation were calculated by the square root time method, secondary consolidation was calculated based on the available duration of the time step

End of Test		2025-10-01	
Height of Sample	cm	H <sub>f</sub>	2.392
Water Content	%	w <sub>f</sub>	9.76
Void Ratio	-	e <sub>f</sub>	0.250

Check: AO Review: SP/JL



Project: 60731727  
 BBP - West Contract  
 Borehole: SR10-03A  
 Sample: ST5  
 Depth: 3.6m  
 Client: AECOM



Load No.	Axial Stress kPa	Load Duration min	System Deflec. mm	Dial mm	Sample Height cm	Axial Strain %	Void Ratio (EOI)	Void Ratio (EOP)	Time U(0.99) min	C <sub>v</sub> cm <sup>2</sup> /s	k <sub>v</sub> cm/s	C <sub>ac</sub> -
0				10.000	2.538	0.00	0.326					
1	1.4	1440.1	0.012	10.001	2.540	-0.05	0.327					
2	35.6	1440.2	0.099	9.563	2.504	1.34	0.309	0.310	33.2	1.31e-03	5.23e-08	0.0005
3	75.7	1440.2	0.158	9.404	2.494	1.73	0.303	0.305	53.7	8.37e-04	8.09e-09	0.0007
4	5.5	1440.3	0.083	9.531	2.500	1.53	0.306					
5	75.7	1440.1	0.165	9.382	2.493	1.79	0.303	0.304	32.6	1.41e-03	5.22e-09	0.0004
6	151.1	1184.2	0.233	9.251	2.487	2.04	0.299	0.300	111.7	4.03e-04	1.31e-09	0.0535
7	226.2	1380.9	0.272	9.074	2.473	2.58	0.292	0.294	29.8	1.46e-03	1.03e-08	0.0009
8	301.4	1380.1	0.292	8.945	2.462	3.00	0.287	0.290	19.1	2.35e-03	1.29e-08	0.0014
9	451.7	1380.4	0.368	8.726	2.448	3.55	0.279	0.284	17.6	2.46e-03	8.86e-09	0.0019
10	602.0	1380.1	0.390	8.605	2.438	3.94	0.274	0.274	369.8	1.16e-04	2.95e-10	0.0004
11	1203.3	1380.1	0.488	8.082	2.396	5.61	0.252	0.256	26.7	1.52e-03	4.14e-09	0.0020
12	2405.8	1380.2	0.606	7.609	2.361	7.00	0.234	0.240	20.3	1.95e-03	2.20e-09	0.0024
13	602.0	1380.4	0.459	7.797	2.365	6.82	0.236					
14	151.1	225.4	0.372	7.940	2.371	6.60	0.239					
15	35.7	121.1	0.280	8.077	2.375	6.42	0.241					
16	5.8	2520.1	0.183	8.342	2.392	5.78	0.250					

Borehole SR10-03A, Sample ST5, Depth 3.6 m  
(sample width approximately equal to diameter of Thin-Walled sample tube, ~70 mm)

“Wet/Initial”



“Air Dried”



Borehole SR10-03A, Sample ST5, Depth 3.6 m

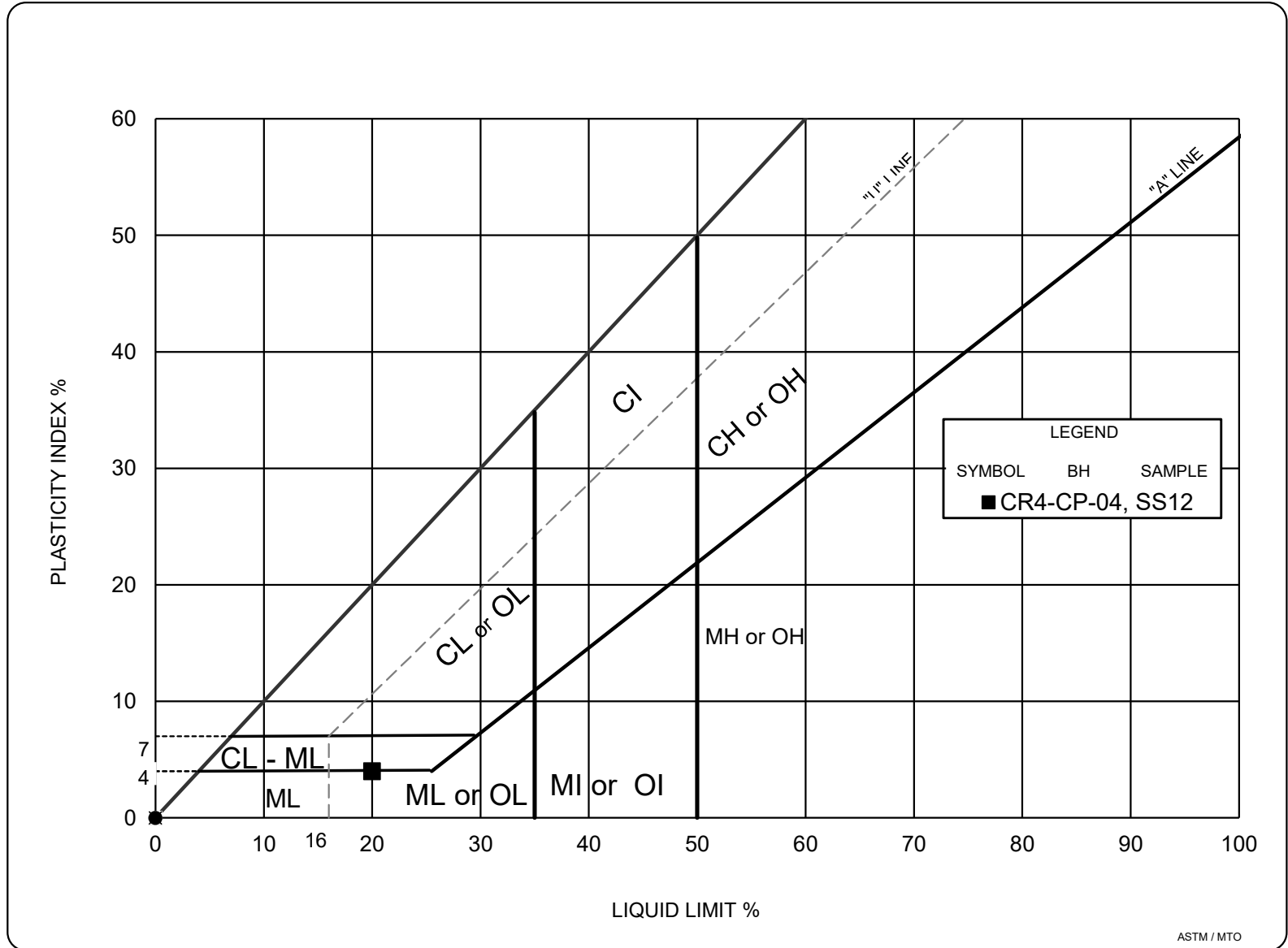
*(Coarser material within tested sample)*



*(Coarser material within duplicate sample)*



# PLASTICITY CHART



Ministry of  
Transportation

PLASTICITY CHART

CLAYEY SILT (TILL)

Figure No. 8

Project No. 60731727

Project Name  
BBP West  
CR4 Carpool Lot

# Appendix **E**

## Geotechnical Modelling Results



## **APPENDIX E: CALCULATION OUTPUTS**

### **SETTLEMENT ASSESSMENTS**

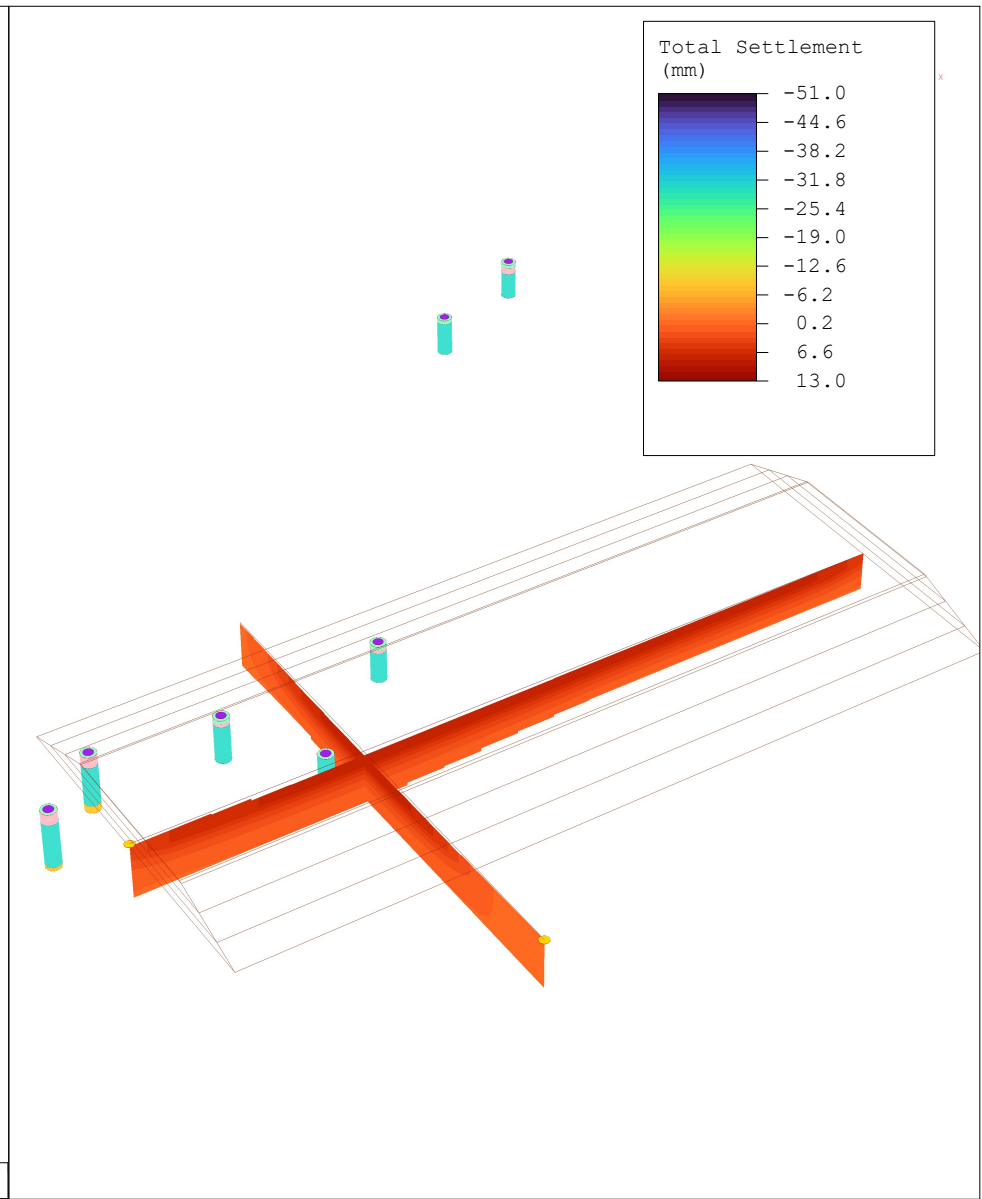
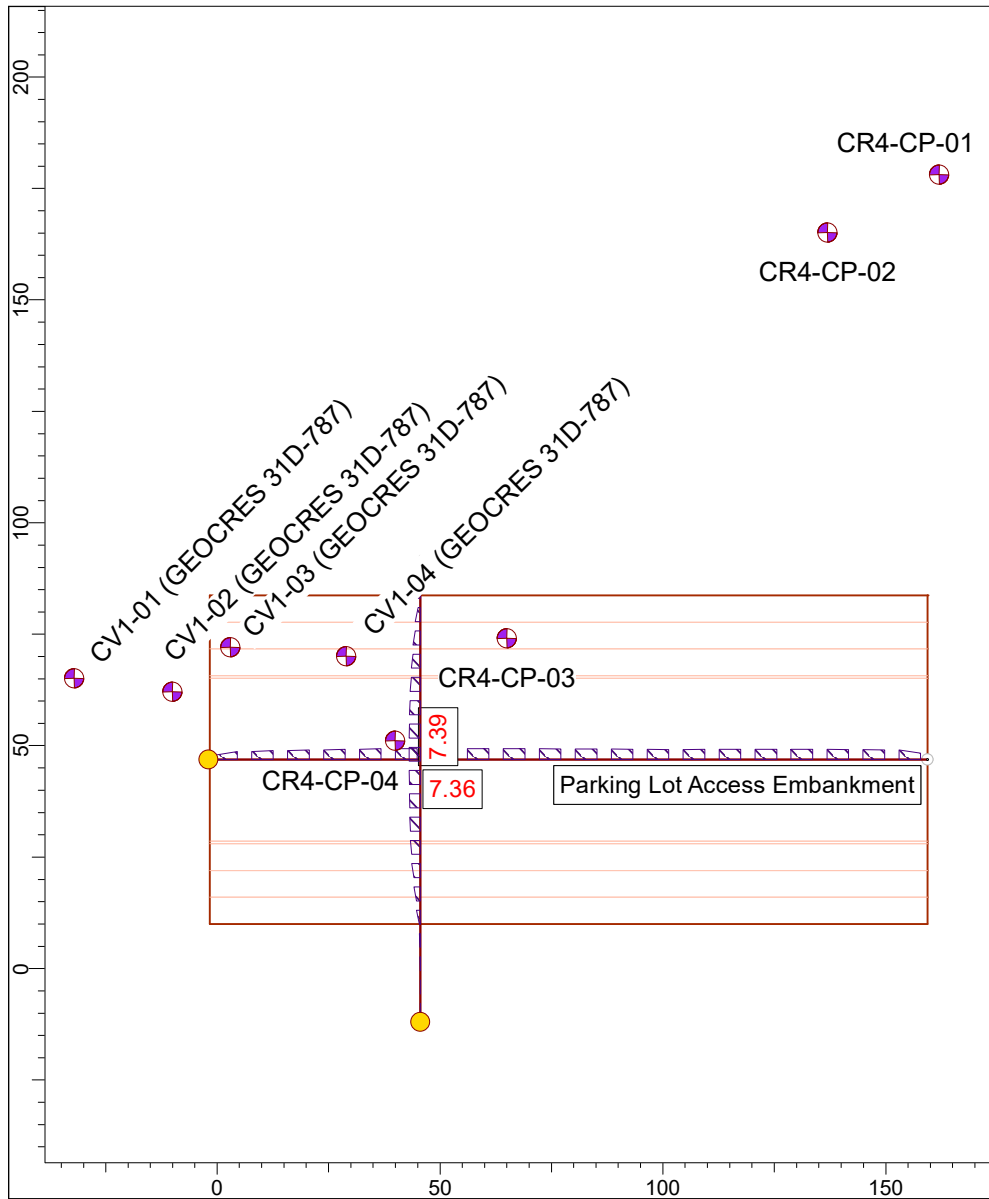
Figure 1: Parking Lot Entrance Road Embankment 15y Post Construction Total Settlement

### **SLOPE STABILITY ASSESSMENTS**

Figure 2: Parking Lot Entrance Road: Static Long-term Condition (Direction of movement: Right to Left)

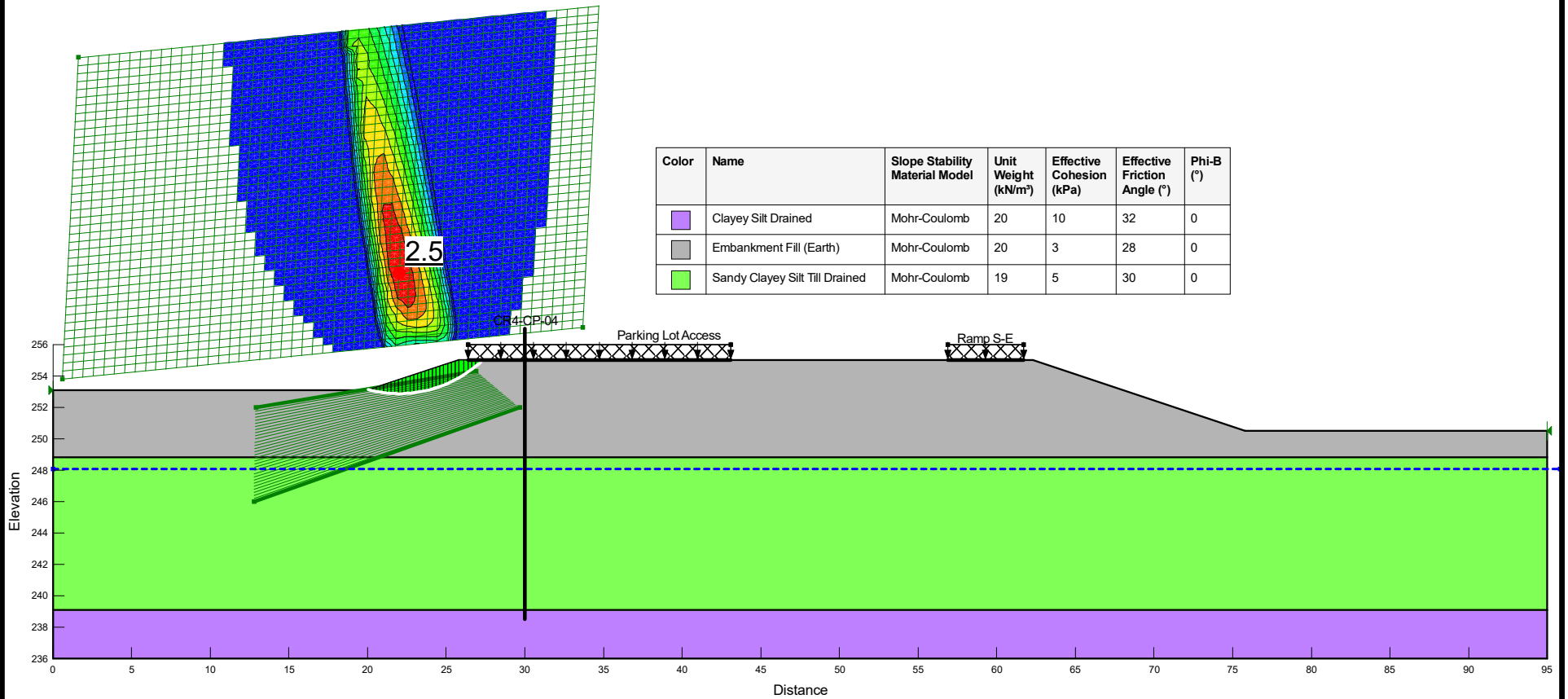
Figure 3: Parking Lot Entrance Road: Undrained Temporary Condition (Direction of movement: Right to Left)

Figure 4: Parking Lot Entrance Road: Pseudostatic Seismic Condition (Direction of movement: Right to Left)



<b>AECOM</b>	Project 60731727 Bradford Bypass West		Client MTO	
	Analysis Description Parking Lot Entrance Road Embankment 15y Post Construction Total Settlement			
	Drawn By CS		Date 2026.04.14	
	Date 2026.04.14		Figure No. 1	

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
Light Purple	Clayey Silt Drained	Mohr-Coulomb	20	10	32	0
Grey	Embankment Fill (Earth)	Mohr-Coulomb	20	3	28	0
Light Green	Sandy Clayey Silt Till Drained	Mohr-Coulomb	19	5	30	0



Client: MTO

Title: Parking Lot Entrance Road: Static Long-term Condition  
(Direction of movement: Right to Left)

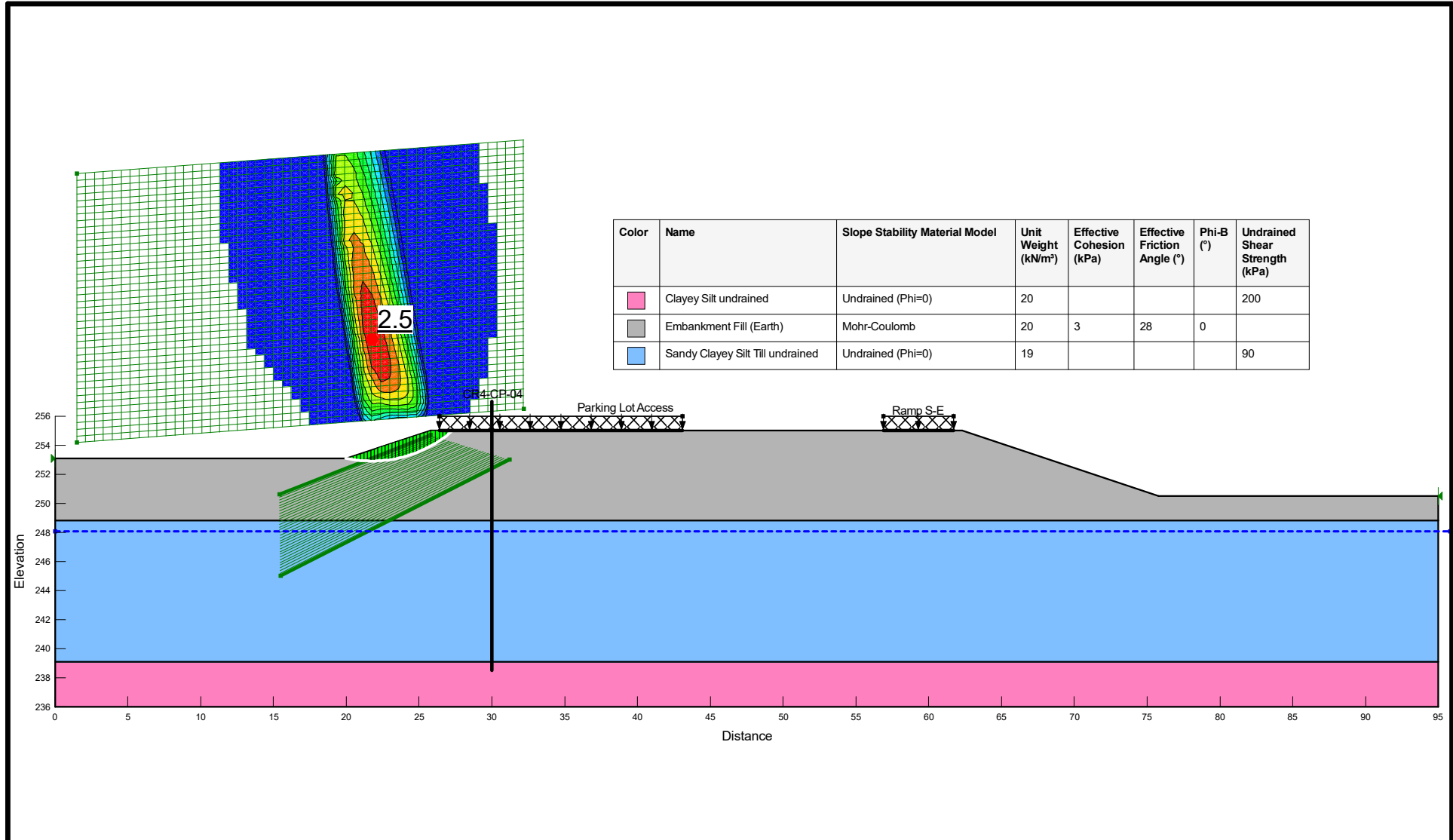
Project Number: 60731727

Figure Number: 2

Project Name: Bradford Bypass - West

Date: 2026.03.13

**AECOM**



Client: MTO

Project Number: 60731727

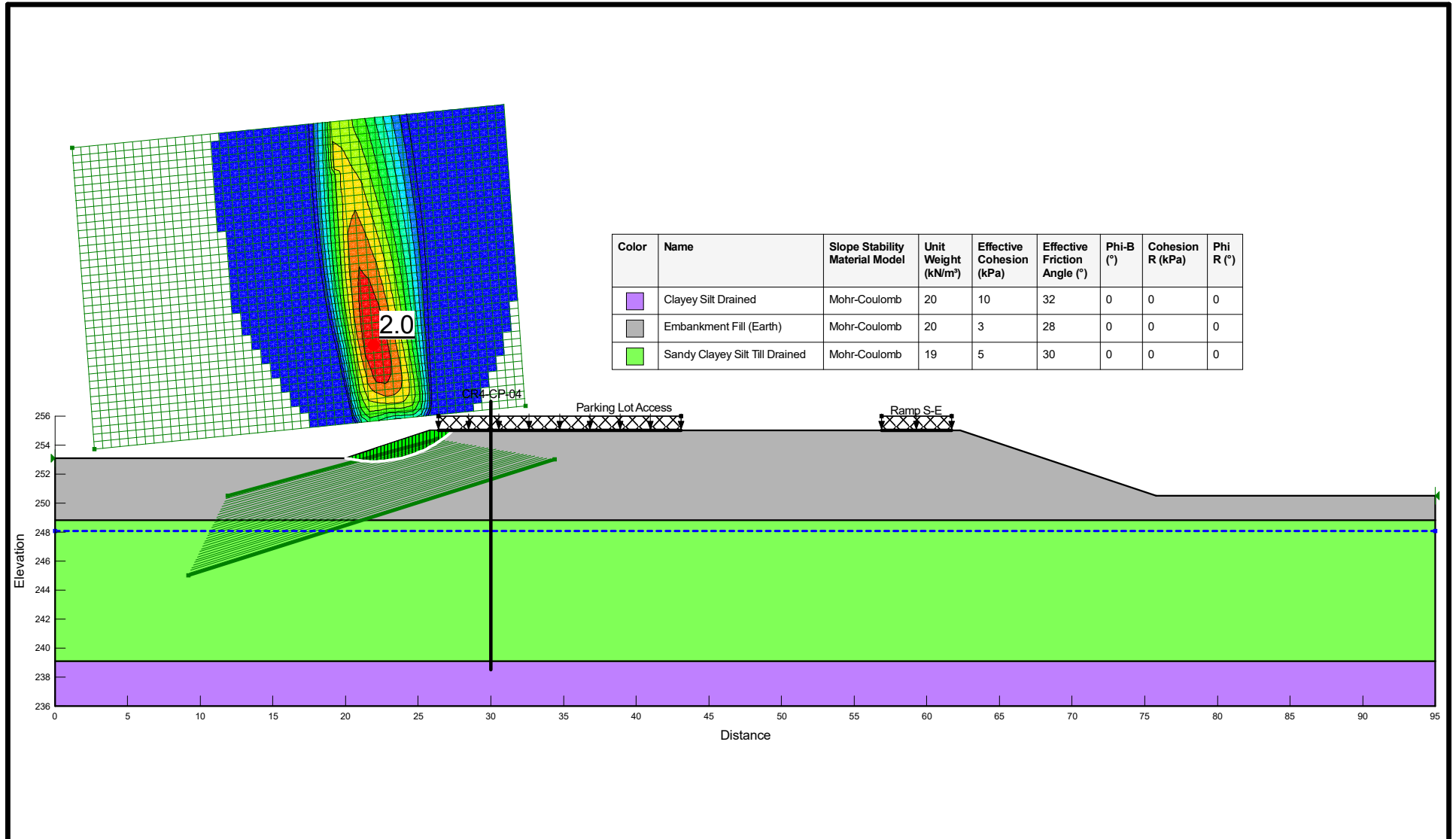
Project Name: Bradford Bypass - West

Date: 2026.03.13

Title: Parking Lot Entrance Road: Undrained Temporary Condition  
(Direction of movement: Right to Left)

Figure Number: 3

**AECOM**



Client: MTO

Project Number: 60731727

Project Name: Bradford Bypass - West

Date: 2026.03.13

Title: Parking Lot Entrance Road: Pseudostatic Seismic Condition  
(Direction of movement: Right to Left)

Figure Number: 4

**AECOM**

# Appendix **F**

## **Non-Standard Special Provisions and Notice to Contractor**

**EARTH EXCAVATION, GRADING - Item No. 9**

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Special Provision

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Embankment construction shall be carried out in accordance with OPSS.PROV 206. All earth and granular fills shall be compacted as per OPSS.PROV 501. Medium and/or high plastic silts/clays shall not be used as Earth Fill embankment material. Within one metre of the pavement subgrade level, the earth fill material shall consist of low frost susceptible soils.

## **PRESENCE OF COBBLES, BOULDERS, AND OTHER OBSTRUCTIONS**

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Notice to Contractor: No. 1

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The Contractor shall be alerted to the potential presence of cobbles and possibly boulders within the existing subgrade soils and/or the till deposits. Considerations of the presences of such obstructions must be made in the selection of appropriate equipment and procedures for removal of boulders and excavations. Contractor's equipment must be able to advance through any such obstructions. The Contractor shall select methods and equipment that can penetrate these obstructions to reach the required subgrade levels. The excavations shall be inspected periodically to confirm stability at all stages.

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