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GEOTECHNICAL DESIGN REPORT
INTERSTATE 95 OVER BROADWAY BRIDGE NO. 5789
BANGOR, MAINE

Prepared for:
Maine Department of Transportation
Augusta, Maine

April 2023
09.0025990.02

Prepared by:
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VIA EMAIL

April 14, 2023
File No. 09.0025990.02

Ms. Laura Krusinski
Maine Department of Transportation
16 State House Station
Augusta, Maine 04333-0016

Re: Geotechnical Design Report
Interstate 95 over Broadway Bridge No. 5789
WIN 22276.00
Bangor, Maine

Dear Laura:

We are pleased to provide this Geotechnical Design Report, which includes geotechnical design recommendations for the replacement of Interstate 95 Bridge No. 5789 over Broadway in Bangor, Maine. Our work was completed under GZA GeoEnvironmental, Inc.'s (GZA's) June 3, 2020 General Consulting Agreement (GCA CTM20200603000000000709) with the Maine Department of Transportation (MaineDOT) Bridge Program, and incorporates GZA's Proposal No. 09.P000131.22, dated June 3, 2022, and the *Limitations* Included in **Appendix A** of this report.

It has been a pleasure serving MaineDOT on this phase of the project, and we look forward to our continued work with you through project completion. If you have any questions regarding the report, or if we can provide further assistance, please do not hesitate to contact the undersigned.

Very truly yours,

GZA GEOENVIRONMENTAL, INC.

Blaine M. Cardali, P.E.
Project Manager

STATE OF MAINE
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1.0 INTRODUCTION

This report presents the results of the geotechnical evaluation by GZA GeoEnvironmental, Inc. (GZA) for the replacement of Interstate 95 Bridge No. 5789 over Broadway in Bangor, Maine. Our work was completed under GZA's June 3, 2020 General Consulting Agreement (GCA CTM20200603000000000709) with the Maine Department of Transportation (MaineDOT) Bridge Program, and incorporates GZA's Proposal No. 09.P000131.22, dated June 3, 2022, and the *Limitations* Included in **Appendix A** of this report. McFarland Johnson Inc. (MJ) is serving as the bridge designer for MaineDOT.

1.1 BACKGROUND

The project includes replacement of the Interstate 95 Bridge No. 5789 over Broadway in Bangor, Maine. The project location is shown on **Figure 1**. The existing 153-foot-long, three-span, simple span bridge was constructed in 1960 and consists of dual 44-foot-wide (southbound) and 48-foot-wide (northbound) bridges that span west-to-east over Broadway (Route 15). The bridges are supported independently by concrete piers and stub abutments with cast-in-place (CIP) concrete pile foundations. Each abutment has a front row of battered piles and a back row of plumb piles, and the piers are supported by two rows of battered piles. The Interstate embankments were constructed approximately 15 and 25 feet above pre-existing grades using fill material at the west and east abutments, respectively. An approximately 1,140-foot-long soldier beam and timber lagging soundwall was built in 1998 east of the northbound approach.

A full bridge replacement is planned for the project. The replacement consists of an on-alignment alternative including two approximately 102.5-foot-long, single-span bridges. The vertical clearance is to be increased, which will be achieved by raising the bridge decks and mainline approaches by about 3 feet. The superstructure is anticipated to consist of 13 steel plate girders with a composite deck. The proposed abutments will be cast-in-place concrete, full-height abutments supported by driven piles. The new abutments will be located between the existing abutments and adjacent piers, resulting large fills immediately behind the proposed abutments. Maximum fill heights in these areas are approximately 17 feet. This on-alignment replacement will widen the interstate by approximately 5 feet and require a temporary bridge and embankments for maintenance of traffic during construction and a new 486-foot permanent retaining wall along the northbound shoulder adjacent to the existing soundwall to retain approximately 6 feet of fill.

Phased construction is planned. Phase 1 will include construction of a southbound diversion embankment and temporary bridge to the north of the existing bridge. Phase 2 will shift southbound traffic to the temporary roadway and shift northbound traffic to the existing southbound lanes. Phase 2 will include demolition of the northbound bridge, construction of the new northbound bridge and the permanent retaining wall. Phase 3 will move northbound traffic to the new bridge and includes the demolition of the existing southbound bridge superstructure and construction of the proposed southbound bridge. The final Phase will move southbound traffic to the new southbound bridge and remove the temporary roadway.

1.2 OBJECTIVES AND SCOPE OF SERVICES

The objectives of our work were to evaluate subsurface conditions and to provide geotechnical design recommendations for the proposed bridge and approach modifications. To meet these objectives, GZA completed the following Scope of Services:

- Conducted site visits to observe surficial conditions during final design and reviewed mapped surficial and bedrock geology of the site;
- Reviewed existing subsurface data;
- Coordinated and observed subsurface explorations, consisting of four test borings in 2018 and nine test borings in 2022, to evaluate subsurface conditions;
- Conducted a laboratory testing program to evaluate engineering and index properties of the site soils;
- Conducted geotechnical engineering analyses for soil and bedrock properties; stability and settlement of raised and widened embankments; frost susceptibility; AASHTO LRFD load and resistance factors associated with geotechnical design elements; nominal resistance of pile foundations; lateral pile design considerations; pile drivability; and permanent retaining wall design; axial and lateral design parameters for OHSS foundations; lateral earth pressures on abutments and seismic design considerations;
- Developed geotechnical engineering recommendations including foundation design recommendations for driven piles; Permanent retaining walls; lateral earth pressures; seismic design parameters; embankment settlement mitigation; geotechnical construction considerations; and
- Prepared this report summarizing our findings and design recommendations.

2.0 SUBSURFACE EXPLORATIONS

2.1 PREVIOUS (1957) BORINGS AND PROBES

In 1957, MaineDOT conducted six test borings, designated as B-102, -104, -106, -109, -110, and -111, and four rod probes, designated as PB-103, -105, -107, and -108, to explore subsurface conditions for the current bridge. The borings encountered marine clay in all borings and ranged in thickness from 5 to 17 feet located directly below topsoil. Glacial Till was encountered in all borings below the clay. The borings were terminated 3 to 10 feet into a compact gravelly sand layer; therefore, no bedrock data was provided. Borings were advanced using drive-and-wash drilling techniques into sand and gravel to depths ranging from approximately 36 to 45 feet below grade. The 1957 boring data sheets were incorporated in the 1959 Bridge Plan Set and are included as **Appendix B**.

2.2 PREVIOUS (1998) BORINGS AND PROBES

In 1998, MaineDOT conducted two rod soundings designated as S-1 and S-6, and four power auger borings designated as B-2, B-3, B-4, and B-5, to explore subsurface conditions for the current soundwall located south of the northbound bridge approach. The borings encountered Fill between 1 to 4 feet thick and sandy Clay Silt in all borings that ranged in thickness from 14 to 18 feet. Cobbles were encountered within the clay layer. No bedrock data was provided. Borings were advanced to depths ranging from approximately 16 to 19 feet below grade. The 1998 boring data sheets were incorporated in the 1998 Noise Barrier Project Plan Set and are included as **Appendix B**.

2.3 RECENT TEST BORINGS

GZA completed an exploration program in 2018 consisting of four test borings, and a supplemental exploration program in 2022 consisting of nine borings. The as-drilled boring locations and elevations were surveyed by MaineDOT, provided to GZA, and are shown on the logs in **Appendix C** and in **Figures 2 and 3.** Elevations referenced in this report are in feet and refer to North American Vertical Datum of 1988 (NAVD 88).

Borings were drilled using 3- and 4-inch casing, and drive- or spin-and-wash drilling techniques or hollow-stem augers, as noted on the boring logs. Standard penetration testing (SPT) and split spoon sampling were performed continuously in the upper portion of some borings and generally at 5-foot typical intervals using a 24-inch-long, 1-3/8-inch inside diameter sampler. The borings were backfilled with ¾-inch crushed stone and/or soil cuttings and topped with asphalt cold patch in roadway areas. GZA personnel monitored the drilling work and prepared logs of each boring that are included in **Appendix C**. Additional details of each program are described below.

Borings BB-BI95-101 through BB-BI95-104 were drilled between October 2 and October 15, 2018 by New England Boring Contractors (NEBC) and borings BB-BI95-201 and HB-BI95-201 through HB-BI95-208 were drilled between July 6 and July 12, 2022. The borings were drilled using a track-mounted Mobile B-53 drill rig and were drilled to depths of approximately 20 to 107 feet and terminated approximately 0 to 12.7 feet into bedrock. The -100 series SPTs were conducted using automatic hammer NEBC No. D-20, which had a rated hammer efficiency factor at the time of drilling of 0.931 (2018). The -200 series SPTs were conducted using automatic hammer NEBC No. D-1, which had a rated hammer efficiency factor at the time of drilling of 0.860 (2022). Field vane shear tests were taken in pairs at 5- to 10-foot typical intervals within the low to moderate strength silt and clay layers using a Geonor 55x110 mm or 65x130 mm rectangular vane and procedures and rods in accordance with MaineDOT guidelines. Vane types used for each test are documented on the logs. Peak and residual torque values were measured and correlated to undrained shear strength values. Two thin-walled tube samples were taken from boring BB-BI95-201 by NEBC and submitted by GZA for laboratory consolidation testing.

3.0 LABORATORY TESTING

GZA retained two laboratories to complete laboratory soil testing: Thielsch Engineering of Cranston, Rhode Island, who assessed the gradation and index properties of the soil, and Soil Metrics of Cape Elizabeth, Maine who assessed compressibility of cohesive soils. The testing program included:

- Twenty (20) gradation analyses;
- Two (2) hydrometer tests;
- Twenty-seven (27) MaineDOT Frost Classification / Unified Soil Classification System (USCS) assessments;
- Thirty-six (36) moisture content tests;
- Nineteen (19) Atterberg limits analyses; and
- Two (2) incremental one-dimensional consolidation tests.

Results of the testing are included in **Appendix D**.

4.0 SUBSURFACE CONDITIONS

4.1 SURFICIAL AND BEDROCK GEOLOGY

Based on available surficial geology mapping[1], the surficial soil unit in the vicinity of the bridge consists of Till, described as loose to very compact, poorly sorted, massive to weakly stratified mixture of sand, silt, and gravel-sized rock debris. Glaciomarine silt, clay and sand of the Presumpscot Formation were also mapped in the area of the bridge.

Bedrock in the vicinity of the site is mapped[2] as the Bangor formation of the Vassalboro group, consisting of the Penobscot River and Lover's Leap Members. The Penobscot River Member consists of very fine to medium grained feldspathic metawacke, with siltstone and claystone slate as minor lithologies. The Lover's Leap Member consists of siltstone slate with laminae and very thin beds of very fine grained quartz-rich sandstone.

4.2 SUBSURFACE PROFILE

Three soil units were encountered in the test borings overlying bedrock: Fill, Marine Clay, and Glacial Till, beneath either pavement or topsoil. The thicknesses and generalized descriptions of the soil units are presented in the following table, in descending order from existing ground surface. Detailed descriptions of the materials encountered at specific locations are provided in the boring logs in **Appendix C**.

[1] Syverson, Kent M., and Thompson, Andrew H., 2010, Surficial geology of the Bangor quadrangle, Maine: Maine Geological Survey, Open-File Map 10-2 (Superseded by Syverson and Olson, 2011, Maine Geological Survey Open-file Map 11-6), map, scale 1:24,000. Maine Geological Survey Maps. 2096. https://digitalmaine.com/mgs_maps/2096

[2] Pollock, Stephen G., 2011, Bedrock geology of the Bangor quadrangle, Maine: Maine Geological Survey, Open-File Map 11-57, color map, scale 1:24,000. Maine Geological Survey Maps. 53. http://digitalmaine.com/mgs_maps/53

GENERALIZED SUBSURFACE CONDITIONS		
Soil Unit	**Approximate Encountered Thickness (ft)**	**Generalized Description**
Fill	4 to 6	Variable, ranging from: Grey, medium dense, GRAVEL, some fine to coarse Sand, trace Silt; to: brown, medium dense, SILT, some fine to coarse Sand, little Gravel. (USCS: SM, ML, GP-GM). MaineDOT Frost Classification: I-III *Encountered in all borings*
Marine Clay	8 to 20	Olive, medium stiff to very stiff, Silty CLAY, occasionally with trace fine Sand. (USCS: CL). The upper 5-10 feet is very stiff to medium stiff (crust), and the unit becomes softer with depth. MaineDOT Frost Classification: III-IV *Encountered in all borings.*
Glacial Till	28 to 85	Variable, ranging from: Grey, very stiff to hard, Clayey SILT, some fine to coarse Sand, trace Gravel; to: grey to brown, medium dense to very dense, fine to coarse SAND, some Gravel, trace Silt. (USCS: SM, CL, ML). The lower 15 feet in BB-BI95-101 and the lower 48 feet in BB-BI95-102 appear water-worked with weathered rock fragments. MaineDOT Frost Classification: II-III *Encountered in all borings*
Top of Bedrock Elevation	Encountered Top of Rock:	Abutment 1: Approximate El. 42 to El. 73 Abutment 2: Approximate El. 81 to El. 88

Additional index and engineering properties of the Marine Clay determined from the laboratory test data are summarized below:

- Twenty-one (21) water content tests: w_n = 17 percent to 31 percent;
- Nineteen (19) Atterberg limits tests: LL = 23 to 38, PI=8 to 18;
- Two (2) in-situ field vanes and two (2) laboratory shear strengths; Peak Shear Strength = 650 to 1,630 pounds per square foot (psf), Residual Shear Strength = 110 to 140 psf;
- Two consolidation tests:
  - Preconsolidation Pressure = 4,400 to 6,800 psf;
  - Virgin Compression Ratio (CR) = 0.1 to 0.118;
  - Recompression Ratio (RR) = 0.009 to 0.01; and
  - Coefficient of Consolidation (Cv) = 0.033 to 0.45 ft^2/day.

4.2.1 Bedrock

Bedrock was cored in the four bridge borings and two retaining wall borings and was described as hard, fresh to slightly weathered, aphanitic, grey, SLATE with few calcite stringers, veins and seams noted. In general, the joints are described as very close to moderately spaced, low to high angle, rough to smooth, planar to undulating, discolored to fresh, tight to open, with occasional silt infilling. The Rock Quality Designation (RQD)

in the core runs ranged from 0 to 100 percent with an average of 53 percent indicating poor to fair rock quality. Photographic logs of the recovered rock core specimens are included in **Appendix E**.

4.2.2 Groundwater

The groundwater level was measured in the completed borings after drilling at depths of 2 to 12.9 feet below existing grade, corresponding approximately to El. 120.4 to 135.7. Water levels measured in the borings were likely influenced by the addition of drill water during rotary wash drilling. In general, the data indicate that groundwater was encountered approximately 2 to 13 feet below grade outside of the existing embankment footprint.

Fluctuations in groundwater levels will occur due to variations in season, precipitation, and construction activity in the area. Consequently, water levels during and after construction are likely to vary from those encountered in the borings at the time the observations were made.

5.0 ENGINEERING EVALUATIONS

5.1 GENERAL

GZA conducted geotechnical engineering evaluations in accordance with *2020 AASHTO LRFD Bridge Design Specifications, 9th Edition* (herein designated as AASHTO LRFD) and the *MaineDOT Bridge Design Guide, 2003 Edition*, with updates through 2018 (MaineDOT BDG). The sections that follow describe the evaluations and the geotechnical basis for each element. Supporting calculations are included in **Appendix F**.

5.2 APPROACH EMBANKMENTS

The bridge replacement project includes widening the mainline embankments approximately 5 feet laterally with new fill heights of approximately 6 feet in the widened portions, raising the overall approach grade by 3 feet along the mainline, and raising the grade between the existing and new abutments by up to 17 feet.

Approach embankment side slopes will be typically constructed with an inclination of 2 horizontal to 1 vertical (2H:1V) or less, except where steepened to 1.5H:1V between Sta. 9+25 and Sta. 10+25, and at the vertical retaining wall proposed between Sta. 251+25 and Sta.255+00 south of the northbound Abutment 1 approach. 1.5H:1V over-steepened slopes are proposed to have a surface treatment of riprap.

The existing sound wall on the northbound Abutment 1 approach is to remain in place as part of the project. A permanent, vertical, cantilever sheet pile retaining wall is proposed to extend approximately 486 feet and terminate at the Abutment 1 southern wingwall. The typical roadway fills behind the wall extend approximately 5 to 7 feet above existing grade with the portion adjacent to the Abutment 1 wingwall having fills up to 8 feet tall.

5.2.1 Embankment Performance Criteria

We understand that the settlement criteria that has been adopted by MaineDOT in recent projects includes a maximum of 2 inches of pavement settlement within 100 feet of the abutment in the first 5 years

post-construction (after final paving), and additional 2 inches in the following 5 years (total 4 inches in the first 10 years).

The basis for acceptable global stability for embankments is specified in AASHTO LRFD Article 11.6.2.3 and is summarized as follows:

- Resistance factor of 0.75 (corresponding to a safety factor of 1.3) for slopes that do not support structures, considered for the cross-section analyses; and
- Resistance factor of 0.65 (corresponding to a safety factor of 1.5) for slopes that support structures, considered for the abutment/profile analyses.

5.2.2 Soil Profile and Properties

The profiles considered with respect to bridge approach embankment design included new fill, existing fill, riprap, marine clay, and glacial till overlying bedrock. The design parameters for these deposits are described below.

5.2.2.1 Strength

GZA developed the marine clay shear strength profile using the results of field vane shear testing. Friction angles for granular soil strata were developed using correlations between corrected SPT N-values and friction angle.

Based on the subsurface data, laboratory and in-situ testing results, and our experience with similar deposits in the area, GZA interpreted the strength properties at the controlling design profile located near Abutment 2 (southeast corner) as tabulated below.

DESIGN SOIL PROFILES – ABUTMENT 2 Worst Case Scenario			
Soil Unit	**Total Unit Weight (pcf)**	**Southeast Approach/NB Abutment 2**	
		Effective Friction Angle (deg) / Undrained Shear Strength (psf)	**Estimated Thickness (feet)**
Proposed Fill (Common Borrow, Sand, Gravel)	125	34	0 - 3
Riprap	140	44	1-4
Existing Fill	120	30	20-24
Marine Clay (crust)	115	S_u = 1,500 psf	10
Marine Clay	115	S_u = 750 psf	9
Glacial Till	130	34	28 - 30

5.2.2.2 Compressibility

Two one-dimensional incremental consolidation tests were completed on samples taken from boring BB-BI95-201 outside of the current embankment where less or minimal embankment fill has been placed over historic original grades.

The results from the consolidation tests indicate that the maximum past pressure of the crust is approximately 6,700 psf and of the lower portion of the clay is approximately 4,400 psf. The results show that the marine clay crust layer is overconsolidated (by approximately 5,000 psf) and will remain so under the proposed additional embankment loads. The underlying marine clay is shown to be moderately overconsolidated (by approximately 2,000 to 3,000 psf) outside the current embankment footprint; we anticipate that the conditions interpreted from the laboratory testing outside of the current embankment footprint would apply to the larger fills between the new and existing abutments. As such, we estimate that the clay is overconsolidated by approximately 1,000 psf under the stress of the full height of the present roadway embankment. Future settlement of overconsolidated deposits is anticipated to occur rapidly and be of small magnitude.

Based on the laboratory and in-situ testing results and our experience with similar Presumpscot clay deposits, GZA interpreted the index and compressibility properties as follows:

Soil Properties for Settlement Analyses		
Material Property	**Soil Layers**	
	Marine Clay Crust	**Marine Clay**
Modified Recompression Ratio (RR)	0.01	0.01
Modified Compression Ratio (CR)	0.118	0.1
Maximum past Pressure	6,700 psf	4,400 psf
Consolidation Coefficient (Cv)	0.4 ft^2/day	0.1 ft^2/day
Secondary Compression Coefficient (Cαe)	0.0004	0.0004
Unit Weight	118 pcf	118 pcf

5.2.3 Analysis of Future Settlement

The design intent is to limit post-construction settlement to 2 inches or less over each successive five-year period for the first 10 years. The results of the settlement calculations indicate that up to 0.5 inches of settlement is expected to occur under the 17-foot fills between the existing and proposed abutments. It is anticipated that the settlement will likely occur during or shortly following the end of construction. Mainline settlement under the proposed grade raises of 3 feet or less is expected to be negligible (less than 0.25 inches). Considering the results of the settlement are less than the criteria that have been set by MaineDOT, no settlement mitigation is required for the project.

Considering the abutment piles will be installed prior to the fills being placed behind the abutment, and the estimated settlement is greater than 0.4 inches, downdrag loading should be included in the design of the piles.

5.2.4 Embankment Slope Stability

GZA evaluated stability at the locations we judged to be the controlling cross-sections near proposed Abutment 2 in the transverse and longitudinal directions using the cross-sections and properties shown in **Appendix E**. The northbound Abutment 2 location was judged to have the controlling transverse and longitudinal sections due to the largest fills and the thickest stratum of marine clay.

Evaluations were conducted using the computer analytical software Slope/W 2022 (Slope/W), developed by Geo-Slope International, based on the Morgenstern-Price method. A grid and radius search technique was used to identify the slip surface with the lowest factor of safety. A 250-psf surcharge load was also included within the limits of the proposed travelway. Slope/W output figures showing the minimum factor of safety for each analysis are presented in **Appendix E**. The plotted contours above the slope indicate relative factors of safety associated with center points of the analyzed circular surfaces. Additional details of the analyses and results are presented below.

5.2.4.1 Longitudinal Profiles

Static Analysis

The analyzed profiles considered the interpreted subsurface conditions along the project baseline. The beneficial reinforcing effect of the new HP14x89 piles of the proposed abutments was not included in the Slope/W model but would be expected to add further resistance to the slopes in the longitudinal direction.

The results indicate a minimum factor of safety of 1.6 for the Abutment 2 profile without reinforcement piles. Therefore, the global stability is considered acceptable in the longitudinal direction.

5.2.4.2 Cross-Sections

Static Analysis

A Slope/W model was developed for the proposed travelway with design side slopes of 1.5H:1V slopes with 3-foot-thick riprap placed at the surface. The cross-section was selected for analysis due to the higher embankment in proximity to each abutment and the steeper side slopes. The controlling section was judged to be located at Sta. 257+00, Abutment 2 Approach and included a 24-foot-high embankment, with a maximum 3-foot grade raise. Left to right analyses were conducted with the proposed 3-foot-thick riprap section. The resulting factor of safety was 1.2, which resulted from a surficial instability directly behind the riprap, and therefore did not meet the required 1.3 safety factor for embankment slopes. To achieve the required factor of safety, a modified riprap section was developed. The modified section includes an 18-inch-thick layer of riprap with a riprap keyway at the slope break between the 1.5H:1V and 2H:1V slopes. The results showed that a mid-slope riprap buttress 4 feet deep by 3 feet wide would result in a factor of safety of 1.3 as shown in **Appendix F**. Since the factor of safety meets the required minimum, the calculated resistance to rotational failure is considered acceptable.

5.3 PERMANENT NORTHBOUND RETAINING WALL

An existing soundwall parallels the northbound approach to Abutment 1 on the right. Proposed mainline I-95 grade raises, a new ramp, and a southward widening of the roadway for this project will result in grade raises over the existing side slope. Since the soundwall was not designed for lateral earth loads, a retaining wall is proposed between the soundwall and the roadway to allow continued use of the soundwall there.

Two feasible alternatives for the retaining wall were considered: a Precast Modular Retaining Wall (T-wall) and a cantilever sheet pile wall. During the preliminary design phase, it was determined that a T-wall design required temporary sheeting to complete the excavation without impeding the phased construction work limits. In addition, the base excavation level would be controlled by the frost penetration depth requirement and could undermine the existing sound wall. Therefore, to limit footprint and avoid undermining the sound wall, the cantilever sheet pile wall option was selected as the preferred alternative. As the design progressed and based on discussions with MaineDOT, the durability of steel sheet piling was judged undesirable due to the potential for rapid corrosion, given the likelihood of snow and salt build-up between the proposed wall and the existing sound wall. A Fiber Reinforced Polymer (FRP) Sheet pile wall was proposed for the project due to its superior corrosion resistance.

The FRP Sheet Pile wall was analyzed using the SupportIT software program. The design cross-section and final grade elevations were developed from the MJ plan and profile drawings. The required top-of-wall elevations for the FRP sheetpile range from approximately EL. 144 feet to EL 158 feet, representing 4 to 8 feet of new fill. GZA performed design evaluations for four sections along the cantilevered FRP sheetpile wall with varying subsurface conditions and proposed fill heights using the analytical software package SupportIT. The subsurface profile was based on borings HB-BI95-202, HB-BI95-204, and BB-BI95-102. Groundwater level behind the wall was set to provide a 2-foot differential head. MJ provided the existing ground slope adjacent to the sound wall to be incorporated in each section. The soil properties used for the design are presented in **Section 5.2.1** of this report. The following table summarizes the inputs used for the evaluations.

SupportIT Retaining Wall Input Parameters					
Wall Station	**Existing Ground Slope in Front of Wall**	**Proposed Grade Raise (New Fill Thickness)**	**Existing Fill Thickness**	**Marine Clay Thickness**	**Glacial Till Thickness**
Sta. 1+65	2.3H:1V	5 feet	6 feet	14 feet	13 feet
Sta. 2+50	1.9H:1V	7.5 feet	8 feet	17 feet	13 feet
Sta. 3+50	2.9H:1V	5 feet	11 feet	17 feet	14 feet
Sta. 4+85	3.7H:1V	8 feet	14.5 feet	8 feet	21 feet

GZA reviewed commercially available FRP sheet pile sections and their published properties. The evaluations considered various sections and resulted in a technically feasible section that had a modulus of elasticity of 4,660 ksi, a section modulus of 30 in^3/ft and an ultimate bending moment capacity of 74,165 ft-lb per foot. The corresponding maximum allowable bending moment is 29,666 ft-lb per foot, based on a factor of safety of 2.5. GZA evaluated the sheet penetration for a factor of safety equal to 1.0 and extended the recommended length by 40 percent to provide a safety factor against toe failure. The results of the FRP sheet pile evaluation are summarized in the table below:

FRP Sheetpile Results Summary					
Wall Station	**Maximum Bending Moment (ft-lbs/ft)**	**Maximum Deflection (in)**	**Toe Embedment FS=1 (feet)**	**Toe Embedment Recommended + 40% (feet)**	**Tip Elevation (ft)**
Sta. 1+65	10,357	1.0	10.5	15	128
Sta. 2+50	28,443	5.4	14.9	21	123
Sta. 3+50	11,188	1.8	14.9	21	122
Sta. 4+85	26,783	8.1	19.6	28	122

The calculated wall top deflections ranged from approximately 1 to 8.1 inches. The largest anticipated deflection was calculated at Station 4+85 where the FRP wall will be restrained by the Abutment 1 Wing Wall. Since our modelling did not include this beneficial restraint, we anticipate that the top deflection will be less than the calculated magnitude. It is also noted that the deflection will occur as the wall is backfilled; therefore, it will not affect the performance of the roadway behind it.

The analysis results indicate that an FRP sheet pile wall with a section modulus of 30 in^3/ft and an allowable bending moment of 29,666 ft-lb per foot would provide sufficient support with typical deflections of 6 inches or less. In order to provide a uniform tip bearing stratum, the entire wall may be detailed with a minimum tip elevation of EL. 122.

5.4 SEISMIC DESIGN CONSIDERATIONS

The subsurface profile for seismic design includes the approach fills (including backfill behind abutments), Marine Clay, and Glacial Till overlying bedrock. Seismic site class was determined in general accordance with LRFD Table C3.10.3.1, considering the average standard penetration resistance encountered in the borings. The average standard penetration resistance for encountered soils is 47 blows per foot. Therefore, the bridge is assigned to Site Class D.

The available subsurface data indicate that the natural materials encountered at the site are sufficiently cohesive or dense that the potential for liquefaction is low.

5.5 EVALUATION OF FOUNDATIONS

5.5.1 Foundation Type Assessment

H-piles driven to refusal on or near bedrock are the preferred foundation type for the proposed abutments.

5.5.2 Pile Design Considerations

Bedrock was encountered at depths of approximately 60 to 90 feet below the bottom of proposed pile cap at Abutment 1 and 40 to 50 feet below the bottom of pile cap at Abutment 2. Based on our experience within similar soils, we anticipate that the proposed H-piles will need to be driven to refusal on or near the top of rock to achieve the required axial geotechnical resistance. The soil profile will consist of stiff to medium stiff marine clay that is sensitive and will lose most of its strength temporarily during pile driving, underlain by

medium dense to dense glacial till. For these profiles, we estimate friction resistance on the order of 20 to 50 percent of the required nominal resistance during driving.

Since the piles will gain support largely in end bearing, there is no reduction for group interaction in axial compression. Axial tensile geotechnical (uplift) resistance was not evaluated because the structural loads provided by MJ do not include uplift loading on the piles.

By utilizing steel H-piles for support of the abutments, total and differential settlement will be limited to elastic compression of the piles and should be less than ½ inch. Additional settlement on the order of 1/4 inch or less may occur over time due to downdrag loading.

5.5.3 Load and Resistance Factors

In GZA's experience with piles gaining a significant portion of their geotechnical resistance in very dense soil or on bedrock, which are verified using dynamic pile analysis methods, the drivability resistance generally controls the geotechnical and nominal pile resistance. For this condition, the piles will be driven to a nominal resistance calculated by dividing the maximum factored pile load (Strength load case) by a resistance factor of 0.65, per AASHTO LRFD Table 10.5.5.2.3-1. Resistance factors for service and extreme limit state design should be taken as 1.0. A load factor of 1.0 is recommended for downdrag loads for strength limit state design based on local practice.

Structural resistance of the piles should be checked at the strength limit state considering a resistance factor of ϕ_c=0.50, per AASHTO LRFD Article 10.7.3.2.3 for hard driving condition. Since the piles will be subject to lateral loading, the piles should also be checked for resistance to combined axial compression and flexure per AASHTO LRFD Articles 6.9.2.2 and 6.15.2. Per AASHTO LRFD Article 6.5.4.2, the axial resistance factor ϕ_{cc}=0.75 and the flexural resistance factor ϕ_f=1.0 should be applied to assess the combined axial and flexural resistance of the pile in the interaction equation (AASHTO LRFD Eq. 6.9.2.2-1).

AASHTO LRFD load factors should be applied to horizontal earth pressure (EH), vertical earth pressure (EV), earth surcharge (ES), live load surcharge (LS) loads, and components and attachments (DC) loads using the load factors for permanent loads (γ_p) provided in AASHTO LRFD Table 3.4.1-2 for strength limit state foundation design.

5.5.4 Pile Type

The abutments are planned to be supported on ASTM A572, Grade 50 (fy=50 kips per square inch [ksi]) steel HP14x89 piles, oriented for strong-axis bending parallel to the bridge beams. Each abutment will include two rows of plumb piles. The front row and back row piles will be spaced at 4.5 and 10 feet on center, respectively. The front and back rows will be spaced 11 feet on-center.

5.5.5 Downdrag

As discussed previously, the estimated settlement behind the proposed abutments is on the order of 0.5 inch and will likely occur after the piles are installed. Therefore, the piles should be designed to resist downdrag loading. Based on the subsurface stratification and anticipated settlement, we estimate an unfactored

downdrag load of approximately 14 kips will occur on piles at Abutment 2, which is the maximum value for the project because of the thicker clay in this area.

Side friction contributing to downdrag load was estimated using the β-method in accordance with NAVFAC DM 7.2-211, and as recommended by Sandford et al, "Bitumen Coatings Reduce Downdrag on Piles for Route 1 Interchange Bridges." Beta values were assumed to be 0.35 and 0.26 for the Fill and the Marine Clay, respectively, with the maximum friction limited to the shear strength of the clay. Based on past practice, a load factor of 1.0 was applied to the calculated downdrag, which was added to the maximum factored load provided by MJ.

5.5.6 Lateral Pile Analysis

GZA developed a soil profile and engineering properties for MJ's use in lateral pile group evaluations using FB MultiPier. The subsurface strata encountered near the top of the piles include primarily Marine Clay and Glacial Till. Considering the thicker Marine clay profile located in the southwest corner of the bridge, GZA developed a single soil profile for MJ to evaluate as the controlling design profile. The table below summarizes the soil profile developed for abutment evaluations.

Recommended Design Soil Profile for Lateral Pile Analysis Abutment 2 Pile Length = 45 ft					
Stratum	**Soil Model**	**Top of Layer Elevation (NAVD88 ft)**	**k (pci)/E50**	**ϕ' (deg)/ s_u (psf)**	**γ_e (pcf)**
Fill	Reese Sand	144.5	k = 83	32	125
Marine Clay	Clay	129	E50 = 0.008	700	56
Glacial Till	Reese Sand	116.4	K = 120	38	68
Top of Rock	--	87.7	--	--	--

Notes:
1. Soil strata interfaces were developed from BB-BI95-102.
2. Recommended modulus and unit weight values assume groundwater level at El. 129.
3. pci = pounds per cubic inch, deg = degrees, psf = pounds per square foot,
   a. γ_T = total unit weight (used above anticipated groundwater level),
   b. γ_e = effective unit weight (used below anticipated groundwater), pcf = pounds per cubic foot.
4. These parameters do not include reductions for group interaction. Reduction Factors should be applied in accordance with AASHTO 10.7.2.4 for spacing of 3 to 5 pile diameters.

We understand that MJ completed lateral analyses for abutment piles to evaluate pile fixity, combined stresses, and maximum factored axial loads in conjunction with the structural design. GZA reviewed the results of MJ's lateral pile analyses and found that the input parameters were applied in accordance with our recommendations.

5.5.7 Pile Loads

MJ provided a maximum factored axial load for abutment piles of 343 kips per pile for the strength condition, and the factored downdrag load is 14 kips; therefore, piles should be installed to a nominal axial resistance of at least 549 kips, calculated by dividing the maximum factored axial load of 357 kips by a geotechnical

resistance factor of 0.65. The resistance factor assumes that dynamic pile testing with signal matching analysis will be conducted on one pile per substructure during construction in accordance with AASHTO LRFD requirements, to assess nominal geotechnical pile resistance.

5.5.8 Design-Phase Pile Drivability Analysis

GZA completed wave equation analyses to assess the drivability of the HP 14x89 (abutments) pile with a nominal geotechnical resistance of 549 kips. The goal of the analyses was to evaluate the range of rated energy necessary to install the piles to a nominal resistance without exceeding the allowable driving stress.

The analyzed pile lengths were selected assuming that the piles would be driven close to the top-of-rock elevations encountered in the borings nearest the abutments. Estimated side resistance during pile installation was used as an input in wave equation analyses, including a range of 20 to 50 percent contribution of skin friction resistance to the maximum factored pile resistance. Analyses for the abutment piles were completed using an APE D30-42 diesel hammer with a ram weight of 6,618 pounds and a rated energy of approximately 74,419 ft-lb. The results are summarized below.

DESIGN-PHASE WAVE EQUATION ANALYSIS RESULTS						
Pile Location and Type	**Embedded Pile Length**	**Fuel Setting**	**Driving System Rated Energy (ft-lbs)**	**Required Nominal Geotechnical Resistance (kips)**	**Max Driving Stress (ksi)**	**Final Penetration Resistance (blows per inch)**
Abutment 1 HP 14x89	90 feet	Fuel setting 4 (maximum)	74,419	549	31	5
Abutment 2 HP 14x89	45 feet	Fuel Setting 3 (1 below maximum)	66,977	549	41	5

Since the driving stresses did not exceed the limiting driving stress of 45 ksi for ASTM A572 steel (50 ksi yield stress), and the calculated penetration resistance was within the MaineDOT preferred range of 3 to 15 blows per inch, the analyzed hammer system type and rated energy are judged acceptable to install the piles to the required nominal resistance noted. A number of commonly available diesel pile hammers are available in the noted rated energy ranges. Construction-phase drivability analyses should be conducted for the hammer(s) proposed by the contractor.

5.5.9 Lateral Earth Pressures

Article 3.6.4 of the BDG states that abutments with a height of 5 feet or more should be assumed to experience sufficient horizontal movement of the top of the wall to develop active conditions due to structural deformation of the stem and rotation of the foundation. For the proposed approximately 28-foot abutment height (measured above the pile cap), this would correspond to about ¼ to ½ inch of lateral movement of the top of the abutment. The structural engineer should confirm that this amount of deflection is anticipated.

Based on Article 3.6.4 of the BDG, we conclude active earth pressure is appropriate for design of the abutments. Based on Figure C3.11.5.3-1 of LRFD, the abutment is considered to be a short-heeled wall. Therefore, Coulomb theory should be used to calculate active earth pressures. The material properties will be

controlled by the backfill material, which is anticipated to consist of BDG Type 4 soil. Soil properties for Type 4 soil are provided in **Section 6.4** of this report.

AASHTO LRFD Commentary C3.10.9.1 specifies that bridges in Seismic Zone 1 are not required to include acceleration-augmented (earthquake-induced) soil pressures for design.

5.5.10 Overhead Sign Structure Foundations

A new overhead sign structure is proposed approximately 100 feet south of the existing structure over the southerly approach to the bridges at Sta. 250+87.5. Bedrock is estimated to be present at those foundations at a depth of approximately 18 to 35 feet below the proposed tops of foundations. Drilled shafts are the preferred foundation type for the two supports. GZA developed soil profiles and estimated unit side friction resistances for MJ's use in shaft design. The recommended soil profiles and parameters are summarized for each foundation in the tables below.

Left Foundation - Station 250+87.5, 51.5' Left (HB-BI95-201)						
Stratum	**Soil Model**	**Top of Layer Elevation (NAVD88 ft)**	**k (pci) / E50 / krm**	**ϕ' (deg) / Su (psf) / UCS (psi)**	**Nominal Unit Side Resistance (ksf)**	**γ_e (pcf)**
Existing Fill*	Reese Sand	144.7	50	30	0.7	120
Marine Clay**	Clay	119.2	0.008	900	0.1	55.6
Glacial Till	Reese Sand	116.1	75	34	1.6	67.6
Top of Rock	Weak Rock	110.4	0.0005	2000	23	87.6

Right Foundation - Station 250+87.5, 52.75' Right (HB-BI95-202)						
Stratum	**Soil Model**	**Top of Layer Elevation (NAVD88 ft)**	**k (pci) / E50**	**ϕ' (deg) / Su (psf) / UCS (psi)**	**Nominal Unit Side Resistance (ksf)**	**γ_e (pcf)**
Existing Fill*	Reese Sand	142.3	50	30	0.7	120
Marine Clay**	Clay	134.5	0.008	900	0.1	55.6
Top of Rock	Weak Rock	123.4	0.0005	2000	23	87.6

Notes:

1. *Indicates the top of foundation elevation per plans.
2. **Indicates the top of the layer is the approximate ground water elevation based on borings.
3. pci = pounds per cubic inch, deg = degrees, psf = pounds per square foot,
4. γ_T = total unit weight (used above anticipated groundwater level),
5. γ_e = effective unit weight (used below anticipated groundwater), pcf = pounds per cubic foot.
6. Factored side resistance may be calculated using a resistance factor ϕ = 0.55 for compression and ϕ = 0.40 for tension with no testing, per AASHTO Table 10.5.5.2.4-1
7. The weak rock model uses the following input parameters per the table: Effective Unit weight, Uniaxial Compressive strength, and krm; and also requires: RQD (use 40 percent), and intial Rock Mass Modulus (use 10 ksi).

5.5.11 Frost Protection

Fill soils are anticipated to be present at the abutments and embankments, either as existing fill or imported granular borrow backfill. Based on the MaineDOT BDG, Section 5.2.1, the Freezing Index for the site is 1,730, and with low-moisture content (20 percent) soils, the estimated depth of frost penetration is approximately 6.1 feet.

6.0 RECOMMENDATIONS

6.1 EMBANKMENT DESIGN

Embankment side slopes should be designed with MaineDOT-typical slope angles of 2H:1V or flatter, except at locations near the northbound off-ramp between Sta. 2+18 and 2+55 Right, where the slope angle will be 1.5H:1V. As discussed in **Section 5.2.4.2**, riprap slope protection is required to achieve the minimum factor of safety for global stability. The section should be an 18-inch-thick section of plain and hand-laid riprap (MaineDOT Item 703.26) along the surface of the slope. At the toe of the 1.5H:1V slope, a minimum 3-foot-long and 4-foot-deep riprap buttress should be embedded below the surface. A layer of non-woven geotextile (MaineDOT 722.04) should be placed as a separator between the riprap and underlying soil.

6.2 SEISMIC DESIGN

The peak ground acceleration coefficient, short- and long-period spectral acceleration coefficients were interpolated from the AASHTO LRFD design guide maps (3.10.2.1-1 through -21 as appropriate). Based on the site coordinates, the recommended AASHTO LRFD Response Spectra (Site Class D) for a 7 percent probability of exceedance in 75 years are summarized for the site are as follows:

SITE CLASS D SEISMIC DESIGN PARAMETERS	
Parameter	**Design Value**
Fpga	1.6
Fa	1.6
Fv	2.4
As (Period = 0.0 sec)	0.11 g
SDs (Period = 0.2 sec)	0.23 g
SD1 (Period = 1.0 sec)	0.10 g

6.3 PERMANENT NORTHBOUND RETAINING WALL DESIGN

- The proposed FRP sheet pile wall should consist of an FRP sheetpile section with an allowable bending moment of at least 29,666 ft-lb per foot and providing a factor of safety of at least 2.5 on nominal moment.
- FRP sheets should be installed using the manufacturer's recommendations. We anticipate that a vibratory hammer will be used. The existing fill soils may include cobbles or boulders that will likely require the use of spud piles or a mandrel system to advance the FRP sheets.
- The minimum tip elevation for the length of the wall is EL. 122 feet.

- In order to enhance drainage, the fill material placed directly behind the wall should consist of MaineDOT 703.19 Granular Borrow for Underwater Backfill, MaineDOT BDG Type 4 soil.
- We recommend the use of weep holes or a French drain system on the uphill side of the wall to provide positive drainage behind the wall. For the weep hole alternative, the weep holes should be drilled on the neutral axis of the sheets, be 1.5-inch-diameter, and spaced every 4 feet along the wall.

6.4 ABUTMENT AND WINGWALL DESIGN

- Backfill between new abutments and wingwalls and a 1.5H:1V plane extending up from the bottom of the abutment to the pavement subgrade should consist of MaineDOT 703.19 Granular Borrow Backfill, MaineDOT BDG Type 4 soil. Recommended soil properties for backfill material are as follows:
  - Internal Friction Angle of Soil (Type 4) = 32°;
  - Soil Total Unit Weight (Type 4) = 125 pcf; and
  - Coefficient of Active Earth Pressure, K_a = 0.28 (use for design of abutment and wingwalls).
- Live load surcharge should be applied as a uniform lateral surcharge pressure using the equivalent fill height (H_{eq}) values developed in accordance with AASHTO LRFD Section 3.11.6.4, based on the abutment/wingwall height and distance from the wall backface to the edge of traffic. A minimum H_{eq} of 2 feet is recommended.
- Foundation drainage should be provided in accordance with Section 5.4.1.9 of the MaineDOT BDG. We recommend the use of French drains on the uphill side of abutments and wing walls to prevent buildup of differential hydrostatic pressure. The drains should be sloped to drain by gravity and should outlet through a series of 4-inch-diameter weep holes, spaced approximately 10 feet center-to-center. Alternatively, prefabricated drainage geocomposite material can be placed against the uphill side of abutments, after holes have been created through the backing material at the weep hole locations.

6.5 PILE DESIGN

- The proposed abutments may be supported on HP 14x89 ASTM A572, Grade 50 steel (50 ksi yield stress) H-piles. Piles should be driven to the required nominal resistance, anticipated to be developed through a combination of side friction and end-bearing on or near the bedrock surface.
- The abutment piles should be driven to a nominal resistance of 549 kips, calculated by dividing the maximum factored pile load of 357 kips (343 kips Strength limit state plus 14 kips downdrag) by a resistance factor of 0.65.
- Preliminary wave equation analyses indicate that the abutment piles can be driven to the required nominal resistance using a diesel hammer with a rated energy of about 74,419 ft-lb for the anticipated 60- to 100-foot-long, ASTM A572 Grade 50 HP14x89 piles without exceeding the allowable driving stress of 45 ksi (0.9Fy for 50 ksi steel), and with a final penetration resistance within the MaineDOT range of 3 to 15 blows per inch.
- The pile tip elevations used in the drawings should correspond to the bedrock elevations encountered in the borings (approximately El. 42 to 73 at Abutment 1 and approximately El. 81 to 88 at Abutment 2). A provision is included in the drawings for extra pile length to account for variability in the top-of-rock surface and the potential for piles to penetrate a short distance into the bedrock.

- To limit pile damage during driving, cast steel pile points should be provided in accordance with *MaineDOT Standard Specification Section 501.10 – Pile Tips.*
- Pile installation should be controlled using wave equation analysis and field logging of the pile installation with final penetration resistance based on dynamic pile testing with signal matching analysis.
- We recommend that one pile at each abutment, per construction phase, be dynamically tested at the end of initial drive and at beginning of restrike after an approximately 24-hour hold, to assess driving stress and establish the penetration resistance criteria to achieve the required nominal resistance for the production piles.
- Piles shall be spliced in accordance with MaineDOT Section 501.047.
- Abutment piles should be checked for resistance to combined axial compression and flexure per AASHTO LRFD Articles 6.9.2.2 and 6.15.2. Per AASHTO LRFD Article 6.5.4.2, the axial resistance factor ϕ_{cc}=0.7 and the flexural resistance factor ϕ_f=1.0 should be applied to the combined axial and flexural resistance of the pile in the interaction equation (AASHTO LRFD Eq. 6.9.2.2-1).
- Approach slabs should be constructed at each abutment to smooth the transition from the approach embankment to the bridge. The slabs should be positively connected to the backwalls.

7.0 CONSTRUCTION CONSIDERATIONS

This section provides guidance regarding quality control during pile installation, excavation, dewatering, and foundation subgrade preparation and protection. These items are discussed in the paragraphs that follow.

7.1 PILE INSTALLATION CONTROL

We recommend that the H-pile installation be controlled using wave equation analysis of the contractor's proposed driving system, field logging of the pile installation, and determination of final penetration resistance based on dynamic pile testing with signal matching analysis. As previously noted, the piles should be driven to a nominal resistance calculated by dividing the maximum factored pile load by a resistance factor of 0.65, per AASHTO LRFD Table 10.5.5.2.3-1.

AASHTO LRFD Table 10.5.5.2.3-1 requires that at least one dynamic load test with signal matching be performed per substructure in conjunction with the resistance factor of 0.65. We recommend that one Pile Driving Analyzer (PDA) test with Signal Matching be completed at each abutment per construction phase, including a restrike test at least 24 hours after initial drive for each tested pile, resulting in a total of four PDA tests.

7.2 EXCAVATION, TEMPORARY LATERAL SUPPORT AND DEWATERING

We anticipate that temporary support of excavation may be necessary to maintain portions of the existing or temporary relocated roadway. It is anticipated that sheet pile walls will be used in the vicinity of the bridge in areas where grade separations exceed approximately 4 feet during different construction phases.

Temporary dewatering is not anticipated to be necessary to control groundwater inflow in excavations. It is anticipated that any inflow of surface water or runoff to excavations can be handled by open pumping from sumps installed at the bottoms of excavations. Sumps should be fitted with geotextile or sand filters to prevent loss of subgrade fines during pumping. Dewatering discharge should be managed in accordance with the contractor's Stormwater Pollution Prevention Plan and MaineDOT Best Management Practices.

7.3 REUSE OF ON-SITE MATERIALS

Based on the test boring results, one of the eleven upper fill samples tested had less than 10 percent passing the No. 200 sieve, indicating a significant proportion of the fill will likely not meet MaineDOT specifications for Granular Borrow for Underwater Backfill, but that the material is considered suitable for use as Granular Borrow.

If the contractor wishes to consider reuse of excavated material as Granular Borrow for Underwater Backfill, we recommend that the proposed material be stockpiled and tested for grain size distribution. Stockpiled materials meeting the appropriate MaineDOT specifications may be reused on the project.

7.4 FRP SHEET PILE INSTALLATION

Considering that the proposed FRP Sheet pile wall will be installed through existing fill and glacial till in an area outside the core of the embankment, materials there may contain cobbles, boulders or debris that could create difficult driving conditions. We anticipate that predrilling, spudding or use of a mandrel system may be necessary to advance the FRP sheets to limit damage potential. We recommend that the FRP sheets be installed based on an approved installation plan that is consistent with the manufacturer's recommendations and a project specific special provision.

7.5 VIBRATION MONTIROING

The plans indicate that several structures are located within 150 feet of potential construction vibration generating activities, particularly abutment pile and FRP sheet pile installation. These include commercial and residential properties along Broadway, Lemist Street, Fowler Avenue, Princeton Street, and Alden Street. We anticipate the vibrations from the impact hammers for driving abutment piles and the vibratory hammers used to install the FRP sheets may generate vibrations perceptible to the tenants. In our experience the vibrations are likely to be less than the accelerations sufficient to cause damage to plaster finishes, typically assumed to be 0.5 inches per second or greater.

In our opinion, the structures within this zone should have pre-construction and post-construction condition surveys completed, and vibrations monitored during construction. The proposed survey and vibration monitoring should be performed by MaineDOT or their representatives in accordance with a project-specific special provision.

TABLES

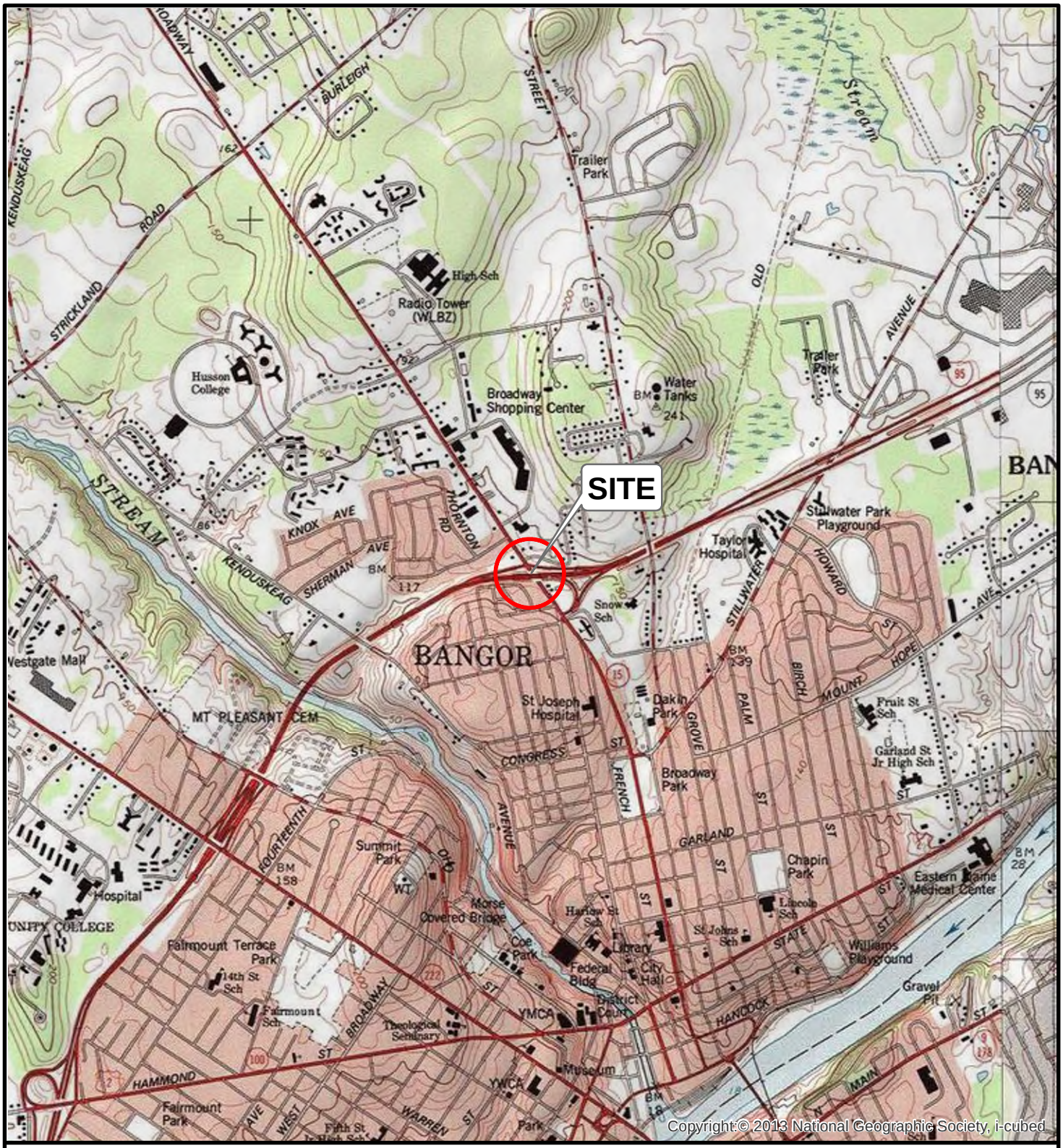
TABLE 1
Summary of Subsurface Explorations
Broadway Bridge Replacement
Bangor, Maine
GZA job#: 09.0025990.02

Boring ID	Station	Offset		Northing	Easting	Ground Surface El. (ft)	Top of Stratum Elevation					Stratum Thickness				Depth to Bedrock (ft)	Top of Rock Elevation (ft)	Bottom of Boring Depth (ft)	Bottom of Boring El. (ft)	Groundwater	
							Topsoil	Fill	Marine Clay	Glacial Till	Bedrock	Topsoil	Fill	Marine Clay	Glacial Till					El. (ft)	Depth (ft)
BB-BI95-101	254+22.3	94.4	L	1731004.3	481230.2	132.5	132.5	132.0	127.5	119.5	72.7	0.5	4.5	8.0	46.8	59.8	72.7	69.9	62.6	121.3	11.2
BB-BI95-102	255+28.6	63.5	R	1731117.8	481077.4	138.8	138.8	138.4	133.8	125.8	41.3	0.4	4.6	8.0	84.5	97.5	41.3	107.2	31.6	126.2	12.6
BB-BI95-103	255+43.8	63.4	L	1731127.1	481204.8	134.5	134.5	134.0	128.5	119.5	80.7	0.5	5.5	9.0	38.8	53.8	80.7	66.5	68.0	123.6	10.9
BB-BI95-104	256+21.4	62.3	R	1731210.4	481082.8	140.1	NE	140.1	135.1	115.8	87.1	NE	5.0	19.3	28.7	53.0	87.1	63.8	76.3	127.2	12.9
BB-BI95-201	256+15.4	56.3	R	1731204.2	481088.6	139.4	139.4	139.2	134.9	NE	NE	0.2	4.3	>15.5	NE	NE	NE	20.0	119.4	--	NM
HB-BI95-201	250+85.5	79.6	L	1730667.4	481199.2	132.2	132.2	132.0	119.4	116.1	110.4	0.2	12.8	3.1	5.7	21.8	110.4	28.0	104.2	120.4	11.8
HB-BI95-202	250+98.0	85.4	R	1730688.6	481035.2	138.5	138.5	138.3	132.9	NE	123.3	0.2	5.6	11.1	NE	15.2	123.3	20.7	117.8	--	NM
HB-BI95-203	252+78.1	109.7	L	1730859.6	481238.9	125.7	125.7	125.5	125.5	122.7	NE	0.2	NE	2.8	26.0	NE	NE	29.0	96.7	123.7	2
HB-BI95-204	253+72.0	108.3	R	1730963.4	481025.5	138.6	138.6	NE	138.1	121.8	NE	0.5	NE	16.3	14.2	NE	NE	31.0	107.6	134.6	4
HB-BI95-205	256+18.3	107.6	L	1731199.6	481252.3	130.5	130.5	NE	130.4	110.5	NE	0.1	NE	19.9	11.5	NE	NE	32.0	98.5	120.7	9.8
HB-BI95-206	257+94.3	90.9	L	1731376.1	481243.8	138.0	138.0	137.6	135.8	119.0	NE	0.4	2.2	16.4	13	NE	NE	32.0	106.0	--	NM
HB-BI95-207	259+53.6	78.7	R	1731535.6	481239.0	143.5	143.5	143.3	137.5	131.0	122.4	0.2	5.8	6.5	8.6	21.1	122.4	21.1	122.4	135.7	7.8
HB-BI95-208	261+53.7	64.7	L	1731727.7	481239.0	150.1	150.1	149.9	142.1	128.1	NE	0.2	7.8	14.0	15	NE	NE	37.0	113.1	--	NM

El. = Elevation, NE = Not Encountered, NM = Not Measured, NP = Not Penetrated, > = Boring Terminated in Stratum

Notes:
1. Refer to the boring logs in Appendix C for additional information.
2. Project elevation datum is North American Vertical Datum (NAVD 88), unless noted otherwise.
3. As-drilled locations and elevations were surveyed by MaineDOT and provided to GZA.
4. Stratum depths, thickness and elevations are rounded to the nearest 0.1 foot as interpreted on the boring logs, but this does not represent the precision of the data.

FIGURES



USGS QUADRANGLE LOCATION

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SOURCE : THIS MAP CONTAINS THE ESRI ARCGIS ONLINE USA TOPOGRAPHIC MAP SERVICE, PUBLISHED DECEMBER 12, 2009 BY ESRI ARCIMS SERVICES AND UPDATED AS NEEDED. THIS SERVICE USES UNIFORM NATIONALLY RECOGNIZED DATUM AND CARTOGRAPHY STANDARDS AND A VARIETY OF AVAILABLE SOURCES FROM SEVERAL DATA PROVIDERS. THIS MAP ALSO CONTAINS THE ESRI ARCGIS ONLINE USA COUNTIES WHICH PROVIDES DETAILED BOUNDARIES THAT ARE CONSISTENT WITH THE TRACT, BLOCK GROUP, AND STATE DATA SETS AND ARE EFFECTIVE AT REGIONAL AND STATE LEVELS.

0 1,000 2,000 4,000 6,000

SCALE IN FEET

Data Supplied by :

esri

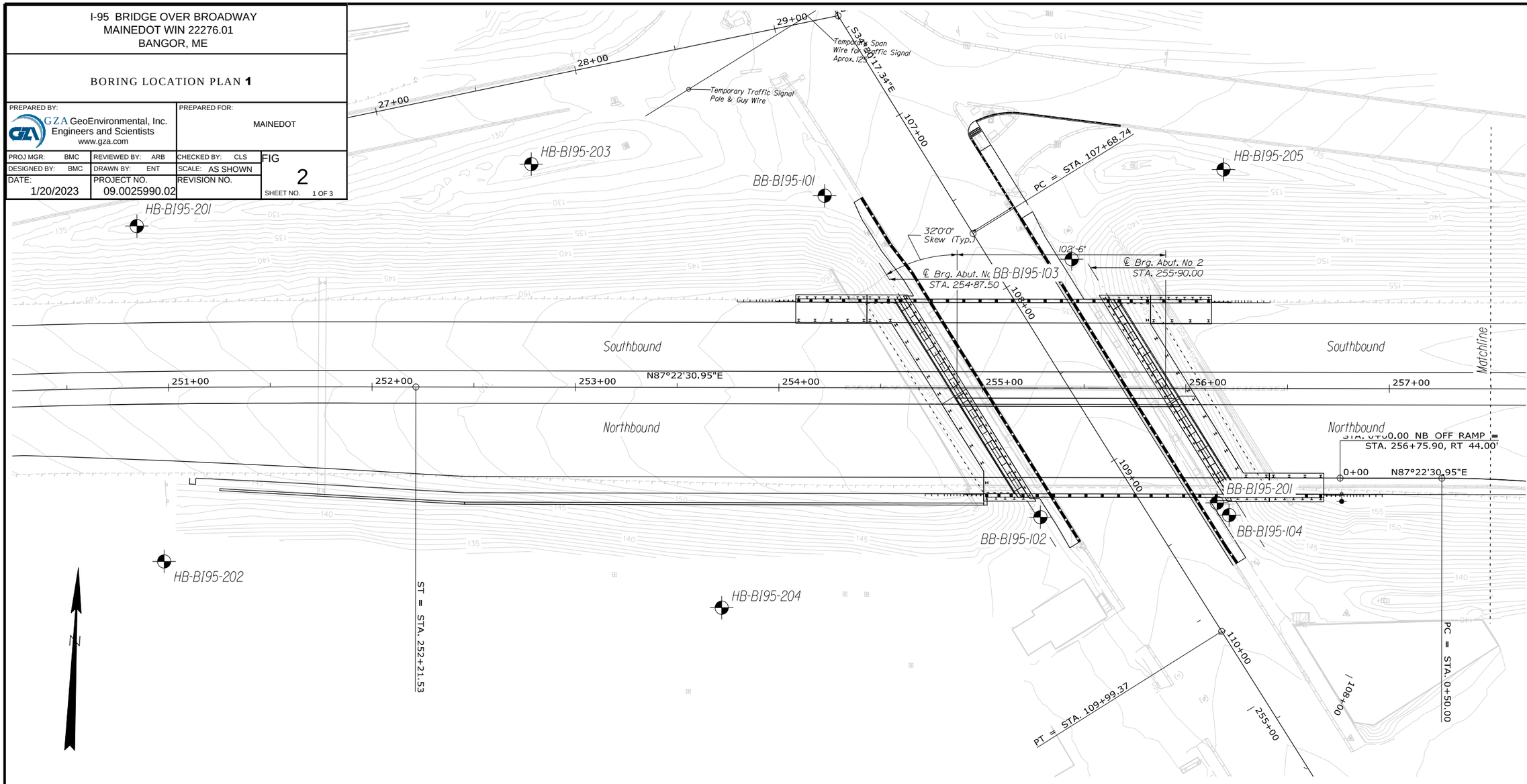
USGS science for a changing world

GZA	PROJ. MGR.: BMC DESIGNED BY: MRJ REVIEWED BY: BMC OPERATOR: MRJ DATE: 04-14-2023	**LOCUS PLAN**	JOB NO. 09.0025990.02
		INTERSTATE 95 BRIDGE OVER BROADWAY BANGOR, MAINE	FIGURE NO. **1**

I-95 BRIDGE OVER BROADWAY
MAINEDOT WIN 22276.01
BANGOR, ME

BORING LOCATION PLAN 1

PREPARED BY:		PREPARED FOR:	
GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com		MAINEDOT	
PROJ MGR: BMC	REVIEWED BY: ARB	CHECKED BY: CLS	FIG 2
DESIGNED BY: BMC	DRAWN BY: ENT	SCALE: AS SHOWN	SHEET NO. 1 OF 3
DATE: 1/20/2023	PROJECT NO. 09.0025990.02	REVISION NO.	



NOTES

1) Base map developed from electronic files (Topo.dgn, alignments.dgn, Bridge.dgn, and contours.dgn) provided by McFarland Johnson on November 8, 2022.

2) The as-drilled locations of the BB-BI95-100 and -200 series bridge borings and the HB-BI95-200 series highway borings were surveyed and provided by MaineDOT in an electronic file (Borings.dgn).

BORING LOCATION PLAN LEGEND

- BB-BI95-104 — Indicates -100 series bridge borings performed by New England Boring Contractors of Hermon, Maine between October 2 and October 15, 2018 and observed by GZA personnel.
- BB-BI95-201 — Indicates -200 series bridge boring performed by New England Boring Contractors of Hermon, Maine on July 7, 2022 and observed by GZA personnel.
- HB-BI95-205 — Indicates -200 series highway borings performed by New England Boring Contractors of Hermon, Maine between July 6 and July 12, 2022 and observed by GZA personnel.

PLAN

25 0 25 50
Scale in Feet

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

022276.01

WIN 22276.01

BRIDGE PLANS

Bridge No. 5789

PROJ. MANAGER	A. Lothel	DATE
DESIGN-DETAILED	M. Johnescu	BY B. Cardoli
CHECKED-REVIEWED	C. Snow	A. Blaisdell
DESIGN2-DETAILED2		
DESIGN3-DETAILED3		
REVISIONS 1		
REVISIONS 2		
REVISIONS 3		
REVISIONS 4		
FIELD CHANGES		

SIGNATURE

P.E. NUMBER

DATE

I-95\BROADWAY BRIDGE
STATE ROUTE 15 (BROADWAY)
BANGOR, ME PENOBSCOT COUNTY

BORING LOCATION PLAN 1

PREPARED BY: GZA

SHEET NUMBER 17 OF 180

Filename: ...\BLP\Broadway - BLP 1.dgn Division: HIGHWAY Username: common Date:1/20/2023

I-95 BRIDGE OVER BROADWAY
MAINEDOT WIN 22276.01
BANGOR, ME

BORING LOCATION PLAN **2**

PREPARED BY: GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com		PREPARED FOR: MAINEDOT	
PROJ MGR: BMC	REVIEWED BY: ARB	CHECKED BY: CLS	FIG 3
DESIGNED BY: BMC	DRAWN BY: ENT	SCALE: AS SHOWN	
DATE: 1/20/2023	PROJECT NO. 09.0025990.02	REVISION NO.	SHEET NO. 2 OF 3

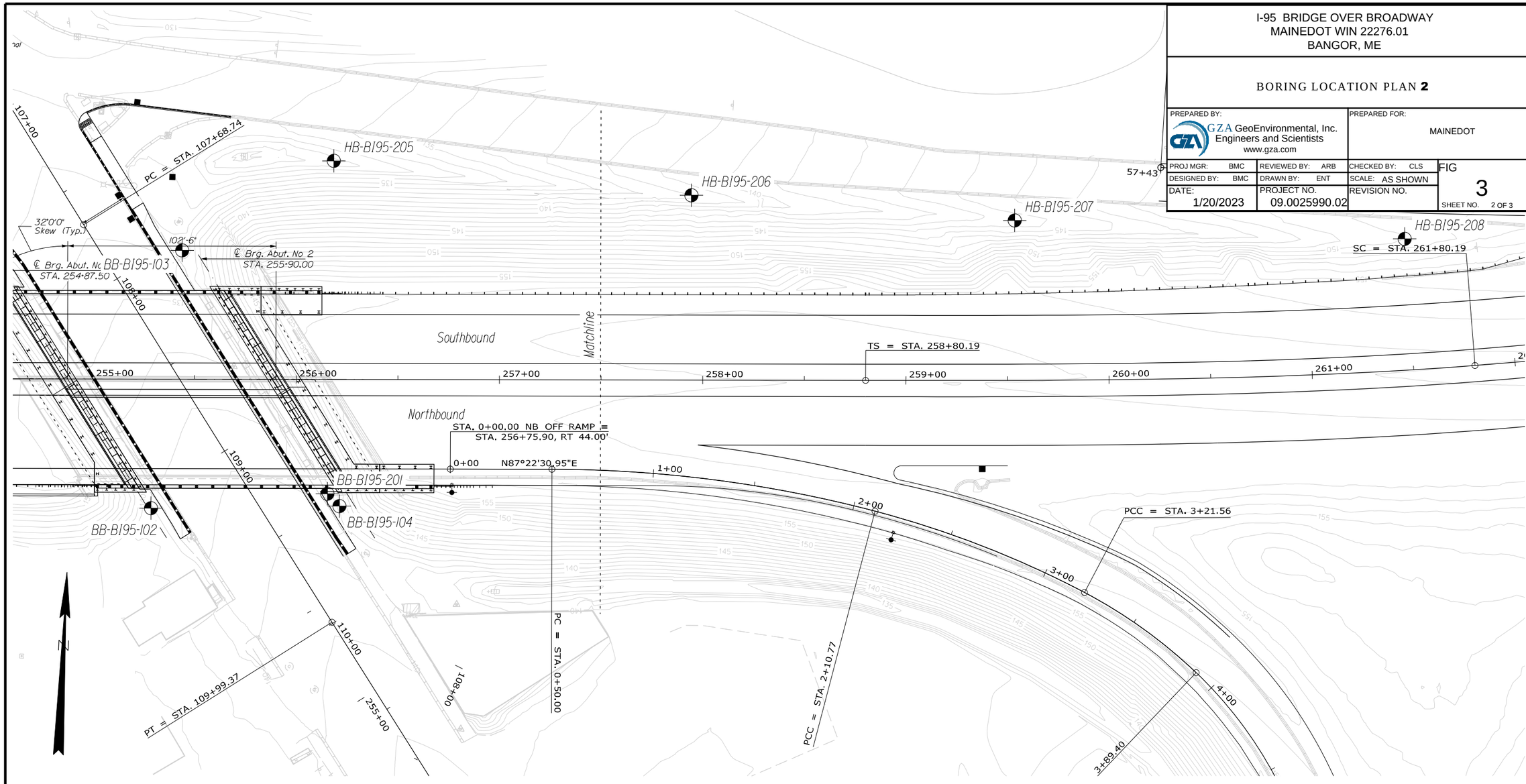
STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

022276.01

WIN 22276.01

BRIDGE PLANS

Bridge No. 5789



NOTES

1) Base map developed from electronic files (Topo.dgn, alignments.dgn, Bridge.dgn, and contours.dgn) provided by McFarland Johnson on November 8, 2022.

2) The as-drilled locations of the BB-BI95-100 and -200 series bridge borings and the HB-BI95-200 series highway borings were surveyed and provided by MaineDOT in an electronic file (Borings.dgn).

BORING LOCATION PLAN LEGEND

- BB-BI95-104 — *Indicates borings performed by New England Boring Contractors of Hermon, Maine between October 2 and October 15, 2018 and observed by GZA personnel.*
- BB-BI95-201 — *Indicates -200 series bridge boring performed by New England Boring Contractors of Hermon, Maine on July 7, 2022 and observed by GZA personnel.*
- HB-BI95-208 — *Indicates -200 series highway borings performed by New England Boring Contractors of Hermon, Maine between July 6 and July 12, 2022 and observed by GZA personnel.*

PLAN

25 0 25 50
Scale in Feet

PROJ. MANAGER	A. Lothel		
DESIGN-DETAILED	M. Johnescu	B. Cardoli	
CHECKED-REVIEWED	C. Snow	A. Blaisdell	
DESIGN2-DETAILED2			
DESIGN3-DETAILED3			
REVISIONS 1			
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			

DATE | BY | SIGNATURE

P.E. NUMBER

DATE

I-95\BROADWAY BRIDGE
STATE ROUTE 15 (BROADWAY)
BANGOR, ME PENOBSCOT COUNTY

BORING LOCATION PLAN 2

PREPARED BY:

SHEET NUMBER
18
OF 180

Filename: ...\BLP\Broadway - BLP 2.dgn Division: HIGHWAY Username: common Date:1/20/2023

I-95 BRIDGE OVER BROADWAY
MAINEDOT WIN 22276.01
BANGOR, ME

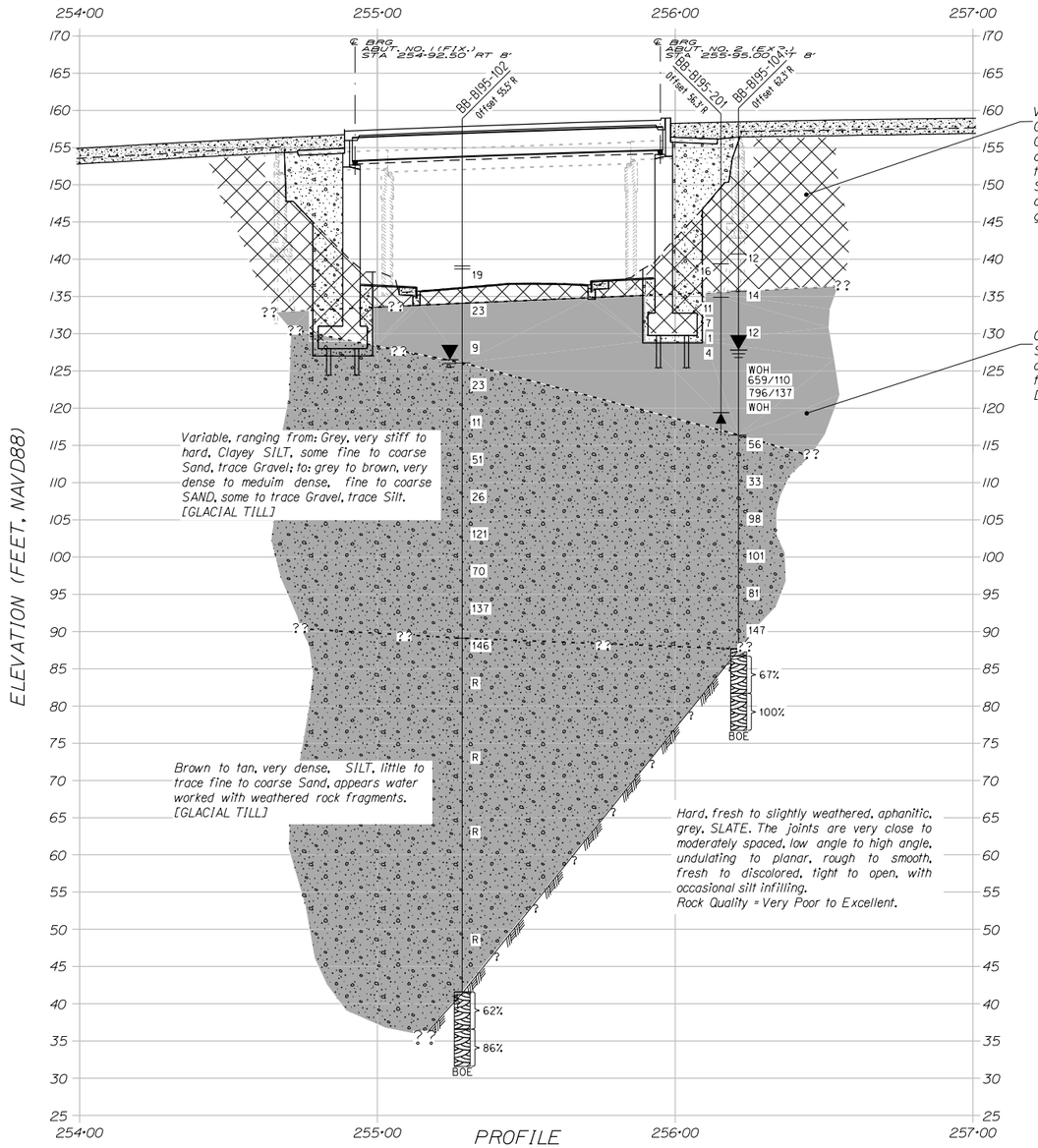
INTERPRETIVE SUBSURFACE PROFILE

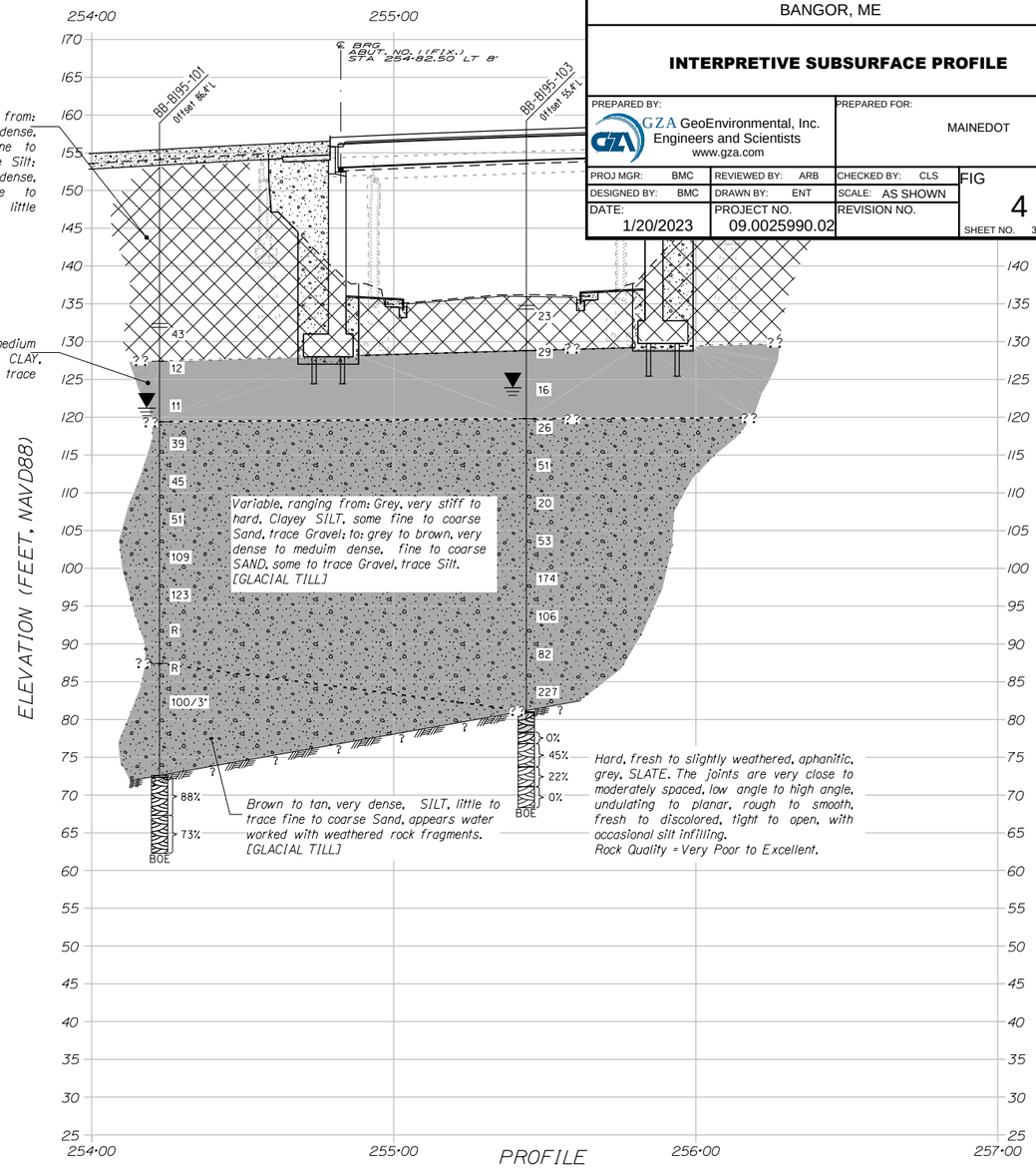
PREPARED BY: GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com

PREPARED FOR: MAINEDOT

PROJ MGR: BMC	REVIEWED BY: ARB	CHECKED BY: CLS	FIG 4
DESIGNED BY: BMC	DRAWN BY: ENT	SCALE: AS SHOWN	
DATE: 1/20/2023	PROJECT NO. 09.0025990.02	REVISION NO.	SHEET NO. 3 OF 3

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
022276.01
WIN 22276.01
BRIDGE PLANS
Bridge No. 5789





Horiz. 25 0 25 50
Vert. 10 0 10 20
Scale of Feet

NOTES

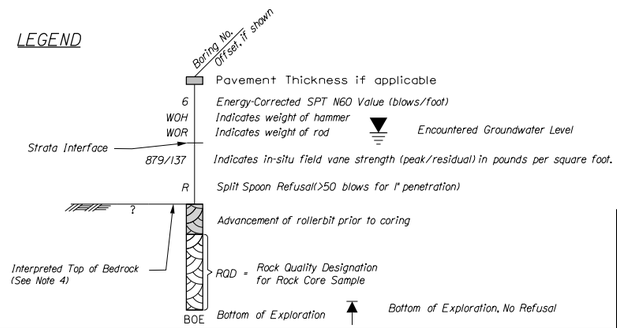
1) Base map developed from electronic files provided by McFarland Johnson Inc. on November 8, 2022 (Profile.dgn)

2) The as-drilled boring locations were surveyed by a MaineDOT survey crew and provided to GZA in an electronic file (Borings.dgn).

3) BB-B195-100 series bridge borings were performed by New England Boring Contractors and observed by GZA personnel between October 2 and 15, 2018.

4) This generalized interpretive soil profile is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized, and have been developed by interpretations of widely spaced explorations and samples. Actual soil and rock transitions may vary and are probably more erratic. Boring data are shown for borings drilled off alignment, but interpreted strata are based on the borings drilled closest to the project baseline. For more specific information refer to the exploration logs.

LEGEND



PREPARED BY: GZA

SHEET NUMBER 19 OF 180

I-95\BROADWAY BRIDGE
STATE ROUTE 15 (BROADWAY)
BANGOR, ME PENOBSCOT COUNTY
INTERPRETIVE SUBSURFACE PROFILE

BY	DATE	
B. Cardoli	--	SIGNATURE
A. Blasdell	--	
		P.E. NUMBER
		DATE

PROJ. MANAGER	M. Johnescu
DESIGN-DETAILED	B. Cardoli
CHECKED-REVIEWED	C. Snow
DESIGN2-DETAILED2	A. Blasdell
DESIGN3-DETAILED3	
REVISIONS 1	
REVISIONS 2	
REVISIONS 3	
REVISIONS 4	
FIELD CHANGES	

Division: Bridge
Filename: ...\ISP\Broadway_ISP.dgn
Date:1/20/2023
Username: BMC

APPENDIX A – LIMITATIONS

GEOTECHNICAL LIMITATIONS

Use of Report

1. GZA GeoEnvironmental, Inc. (GZA) prepared this report on behalf of, and for the exclusive use of our Client for the stated purpose(s) and location(s) identified in the Proposal for Services and/or Report. Use of this report, in whole or in part, at other locations, or for other purposes, may lead to inappropriate conclusions; and we do not accept any responsibility for the consequences of such use(s). Further, reliance by any party not expressly identified in the contract documents, for any use, without our prior written permission, shall be at that party's sole risk, and without any liability to GZA.

Standard of Care

2. GZA's findings and conclusions are based on the work conducted as part of the Scope of Services set forth in Proposal for Services and/or Report, and reflect our professional judgment. These findings and conclusions must be considered not as scientific or engineering certainties, but rather as our professional opinions concerning the limited data gathered during the course of our work. If conditions other than those described in this report are found at the subject location(s), or the design has been altered in any way, GZA shall be so notified and afforded the opportunity to revise the report, as appropriate, to reflect the unanticipated changed conditions.

3. GZA's services were performed using the degree of skill and care ordinarily exercised by qualified professionals performing the same type of services, at the same time, under similar conditions, at the same or a similar property. No warranty, expressed or implied, is made.

4. In conducting our work, GZA relied upon certain information made available by public agencies, Client and/or others. GZA did not attempt to independently verify the accuracy or completeness of that information. Inconsistencies in this information which we have noted, if any, are discussed in the Report.

Subsurface Conditions

5. The generalized soil profile(s) provided in our Report are based on widely-spaced subsurface explorations and are intended only to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized, and were based on our assessment of subsurface conditions. The composition of strata, and the transitions between strata, may be more variable and more complex than indicated. For more specific information on soil conditions at a specific location refer to the exploration logs. The nature and extent of variations between these explorations may not become evident until further exploration or construction. If variations or other latent conditions then become evident, it will be necessary to reevaluate the conclusions and recommendations of this report.

6. In preparing this report, GZA relied on certain information provided by the Client, state and local officials, and other parties referenced therein which were made available to GZA at the time of our evaluation. GZA did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this evaluation.

7. Water level readings have been made in test holes (as described in this Report) and monitoring wells at the specified times and under the stated conditions. These data have been reviewed and interpretations

have been made in this Report. Fluctuations in the level of the groundwater however occur due to temporal or spatial variations in areal recharge rates, soil heterogeneities, the presence of subsurface utilities, and/or natural or artificially induced perturbations. The water table encountered in the course of the work may differ from that indicated in the Report.

8. GZA's services did not include an assessment of the presence of oil or hazardous materials at the property. Consequently, we did not consider the potential impacts (if any) that contaminants in soil or groundwater may have on construction activities, or the use of structures on the property.

9. Recommendations for foundation drainage, waterproofing, and moisture control address the conventional geotechnical engineering aspects of seepage control. These recommendations may not preclude an environment that allows the infestation of mold or other biological pollutants.

Compliance with Codes and Regulations

10. We used reasonable care in identifying and interpreting applicable codes and regulations. These codes and regulations are subject to various, and possibly contradictory, interpretations. Compliance with codes and regulations by other parties is beyond our control.

Cost Estimates

11. Unless otherwise stated, our cost estimates are only for comparative and general planning purposes. These estimates may involve approximate quantity evaluations. Note that these quantity estimates are not intended to be sufficiently accurate to develop construction bids, or to predict the actual cost of work addressed in this Report. Further, since we have no control over either when the work will take place or the labor and material costs required to plan and execute the anticipated work, our cost estimates were made by relying on our experience, the experience of others, and other sources of readily available information. Actual costs may vary over time and could be significantly more, or less, than stated in the Report.

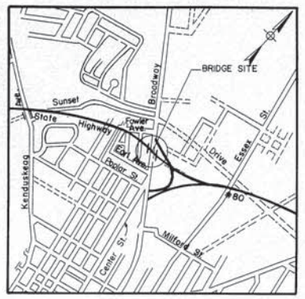
Additional Services

12. GZA recommends that we be retained to provide services during any future: site observations, design, implementation activities, construction and/or property development/redevelopment. This will allow us the opportunity to: i) observe conditions and compliance with our design concepts and opinions; ii) allow for changes in the event that conditions are other than anticipated; iii) provide modifications to our design; and iv) assess the consequences of changes in technologies and/or regulations.

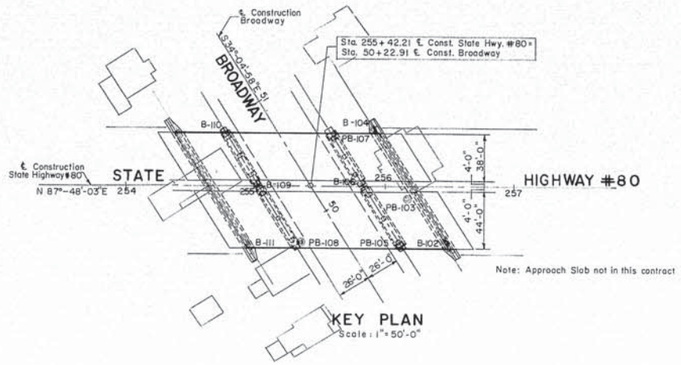
APPENDIX B –1957 AND 1998 TEST BORING LOG SHEETS

B.P.R. REG. NO.	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS
1	MAINE	I-080-8(4)	7	15

BANGOR INTERSTATE



LOCATION MAP
No Scale



KEY PLAN
Scale: 1"=50'-0"

GENERAL NOTES

FOUNDATIONS:
Foundations may be altered, if necessary, to suit conditions encountered in construction.

DESIGN:
In accordance with the specifications of the American Association of State Highway Officials for H20-S16-44 loading (1953 Edition) modified for military requirements.

Design Stresses: Structural Steel 18,000 p.s.i.
Reinforcing Steel 18,000 p.s.i.
Concrete (n=10) 1,200 p.s.i.

CONSTRUCTION:
State of Maine Standard Specifications to be followed except as noted in Special Provisions.

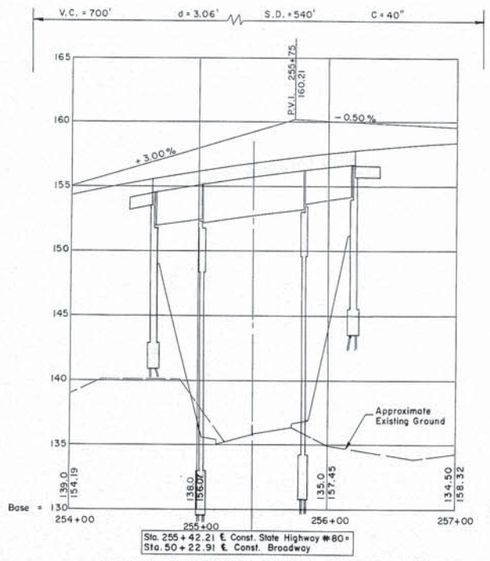
REINFORCEMENT:
All bars shall have deformations conforming to A.S.T.M. Designation A 305.
Unless otherwise shown on plans, reinforcing bars shall be lapped 20 diameters to make a splice, except that main reinforcing bars near the top of slabs and beams having more than 12" of concrete under the bars shall be lapped 35 diameters to make a splice.

STRUCTURAL STEEL:
Wherever cover plates and/or shear connectors are welded to beams, beams and plates shall be structural weldable steel A.S.T.M. designation A-373.

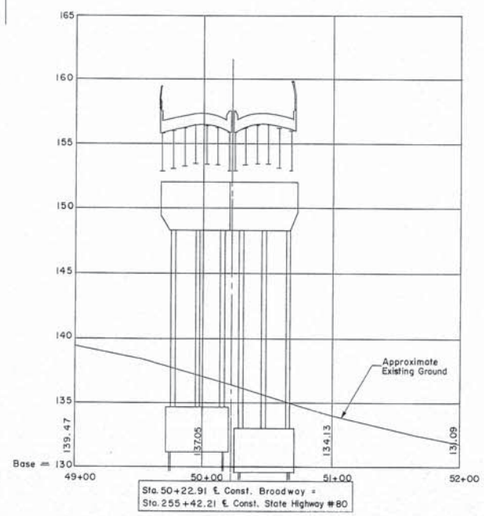
BENCH MARK:
B.M. S-18 Chiseled square in S.E. Corner of east concrete post base – Whitley's Garage. 0.6 miles west of Stillwater Ave. and Broadway. Garage at intersection of Broadway, Center St., and Earl Ave. Elevation 144.65. U.S.G.S. Datum

ESTIMATED QUANTITIES
(NOT GUARANTEED)

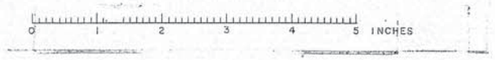
STRUCTURAL EARTH EXCAVATION, PIERS	550	CU.YDS
GRAVEL BASE COURSE-IN PLACE MEASUREMENT	420	CU.YDS
Not in this contract — BITUMINOUS CONCRETE SURFACE COURSE, TYPE "A"	170	TONS
MEMBRANE WATERPROOFING (3 PLY)	1430	SQ.YDS
PORTLAND CEMENT CONCRETE, ABUTMENTS AND RETAINING WALLS	410	CU.YDS
PORTLAND CEMENT CONCRETE, PIERS	370	CU.YDS
PORTLAND CEMENT CONCRETE, ROADWAY AND SIDEWALK SLABS ON STEEL BRIDGES	420	CU.YDS
PORTLAND CEMENT	1800	BBLS
BRIDGE DRAINAGE	1	LUMP SUM
STRUCTURAL STEEL, FABRICATED AND DELIVERED	487600	LBS
STRUCTURAL STEEL, ERECTION	487600	LBS
BRONZE OR COPPER-ALLOY BEARING AND EXPANSION PLATES, DELIVERED	760	LBS
BRONZE OR COPPER-ALLOY BEARING AND EXPANSION PLATES, PLACING	760	LBS
REINFORCING STEEL, DELIVERED	202300	LBS
REINFORCING STEEL, PLACING	202300	LBS
SHEAR CONNECTORS, DELIVERED AND PLACED	1	LUMP SUM
PILE LOADING TEST	1	EACH
CAST IN PLACE CONCRETE PILES	6220	LIN.FT.
FRENCH DRAINS	230	CU.YDS
ALUMINUM RAILING	310	LIN. FT.
SLOPED GRANITE CURB (6"x 7")	310	LIN. FT.
SLOPED PAVING FOR BRIDGES	840	SQ.YDS
GUARD RAIL-TYPE "E"-DOUBLE FACE	150	LIN. FT.



PROFILE ALONG STATE HIGHWAY #80
Scale: Hor. 1"=50'-0" Vert. 1"= 5'-0"



PROFILE ALONG BROADWAY
Scale Hor. 1"=50'-0" Vert. 1"= 5'-0"



APPROVED BY John Clarkeson DATE 1/13/58
THE CLARKESON ENGINEERING CO., INC.
CONSULTING ENGINEERS
BOSTON MASSACHUSETTS

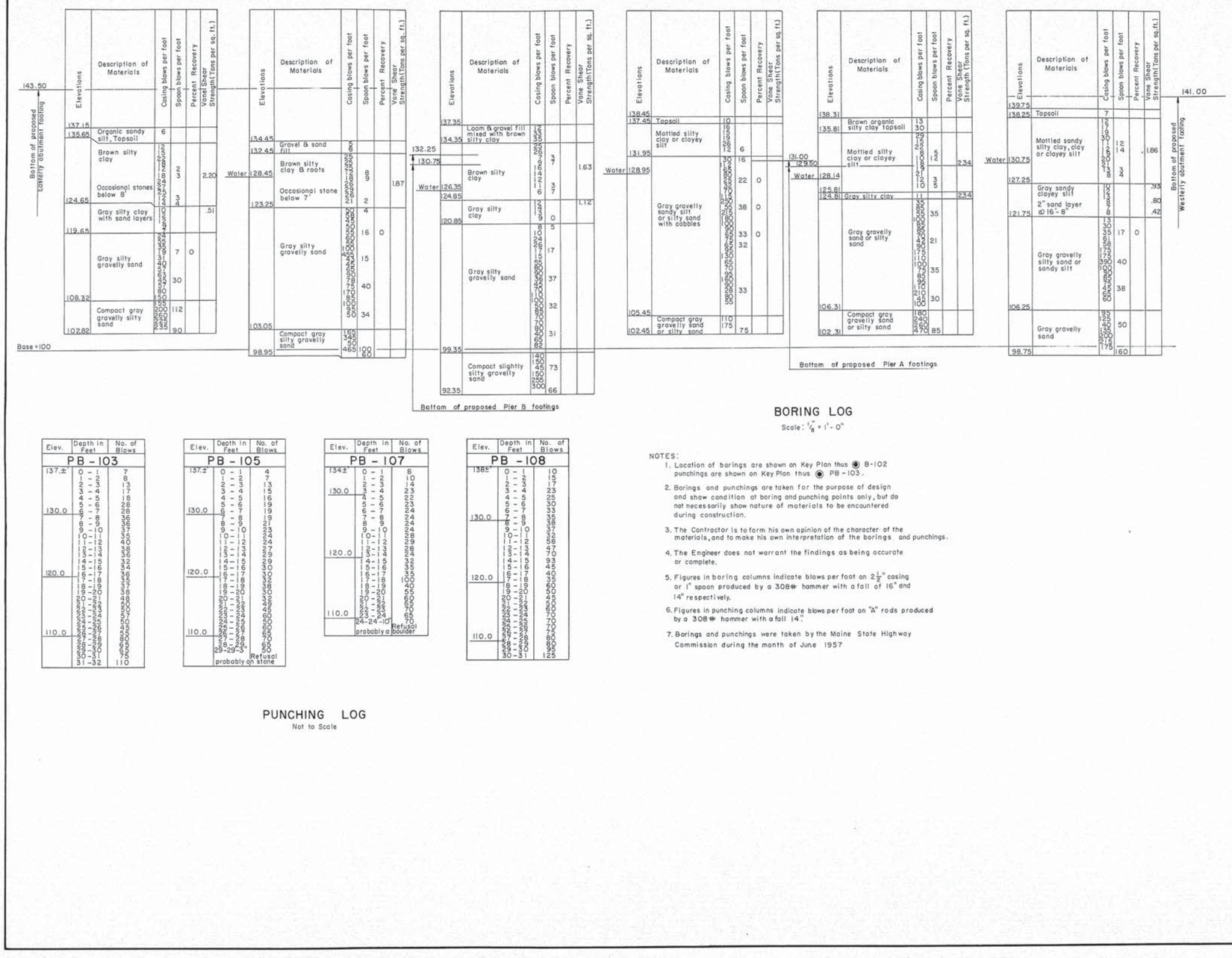
DESIGN	CHECK H.P.	BRIDGE NO.
DRAWN D.A.T., P.W.G.	APPROVED WAH JJM	SURVEY
		PLOT

STATE HIGHWAY COMMISSION
STATE HIGHWAY # 80
OVER
BROADWAY
IN THE CITY OF
BANGOR
PENOBSCOT COUNTY
KEY PLAN & PROFILES
SHEET 1 OF 8 AUGUSTA, MAINE

73-56

B.P.R. REG. NO.	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS
1	MAINE	I-080-8(4)	8	15

BANGOR INTERSTATE



BORING LOG

Scale: 1/8" = 1'-0"

PB-103

Elev.	Depth in Feet	No. of Blows
137.±	0 - 1	7
	1 - 2	8
	2 - 3	13
	3 - 4	17
	4 - 5	18
	5 - 6	28
130.0	6 - 7	28
	7 - 8	36
	8 - 9	36
	9 - 10	37
	10 - 11	35
	11 - 12	40
	12 - 13	38
	13 - 14	36
	14 - 15	32
	15 - 16	34
120.0	16 - 17	36
	17 - 18	35
	18 - 19	37
	19 - 20	38
	20 - 21	48
	21 - 22	45
	22 - 23	50
	23 - 24	50
	24 - 25	50
	25 - 26	50
	26 - 27	50
	27 - 28	60
	28 - 29	65
	29 - 30	70
	30 - 31	75
	31 - 32	110

PB-105

Elev.	Depth in Feet	No. of Blows
137.±	0 - 1	4
	1 - 2	7
	2 - 3	13
	3 - 4	15
	4 - 5	16
	5 - 6	19
130.0	6 - 7	19
	7 - 8	19
	8 - 9	21
	9 - 10	23
	10 - 11	24
	11 - 12	24
	12 - 13	27
	13 - 14	29
	14 - 15	29
	15 - 16	30
120.0	16 - 17	30
	17 - 18	32
	18 - 19	38
	19 - 20	30
	20 - 21	32
	21 - 22	38
	22 - 23	45
	23 - 24	65
	24 - 25	60
	25 - 26	60
	26 - 27	55
110.0	27 - 28	70
	28 - 29	55
	29-29-3	50
		Refusal probably on stone

PB-107

Elev.	Depth in Feet	No. of Blows
134±	0 - 1	8
	1 - 2	10
	2 - 3	14
130.0	3 - 4	23
	4 - 5	22
	5 - 6	23
	6 - 7	24
	7 - 8	24
	8 - 9	24
	9 - 10	24
	10 - 11	28
	11 - 12	29
	12 - 13	28
120.0	13 - 14	24
	14 - 15	32
	15 - 16	35
	16 - 17	35
	17 - 18	100
	18 - 19	40
	19 - 20	55
	20 - 21	60
	21 - 22	60
	22 - 23	70
	23 - 24	65
110.0	24-24-10	70
		Refusal probably a boulder

PB-108

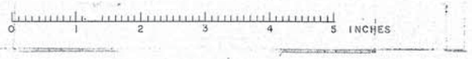
Elev.	Depth in Feet	No. of Blows
138±	0 - 1	10
	1 - 2	15
	2 - 3	17
	3 - 4	23
	4 - 5	25
	5 - 6	30
	6 - 7	33
130.0	7 - 8	35
	8 - 9	38
	9 - 10	37
	10 - 11	32
	11 - 12	56
	12 - 13	47
	13 - 14	70
	14 - 15	93
	15 - 16	45
120.0	16 - 17	40
	17 - 18	35
	18 - 19	60
	19 - 20	50
	20 - 21	45
	21 - 22	50
	22 - 23	60
	23 - 24	70
	24 - 25	70
	25 - 26	70
	26 - 27	75
	27 - 28	80
	28 - 29	80
	29 - 30	95
	30 - 31	125

PUNCHING LOG

Not to Scale

NOTES:

1. Location of borings are shown on Key Plan thus ◉ B-102 punchings are shown on Key Plan thus ◉ PB-103.
2. Borings and punchings are taken for the purpose of design and show condition at boring and punching points only, but do not necessarily show nature of materials to be encountered during construction.
3. The Contractor is to form his own opinion of the character of the materials, and to make his own interpretation of the borings and punchings.
4. The Engineer does not warrant the findings as being accurate or complete.
5. Figures in boring columns indicate blows per foot on 2½" casing or 1" spoon produced by a 308# hammer with a fall of 16" and 14" respectively.
6. Figures in punching columns indicate blows per foot on "A" rods produced by a 308# hammer with a fall 14".
7. Borings and punchings were taken by the Maine State Highway Commission during the month of June 1957



THE CLARKESON ENGINEERING CO., INC.

DESIGN	CHECK H.P.	BRIDGE NO.
DRAWN V.C.S.	APPROVED W.A.H. C.J.M.	SURVEY PLOT

STATE HIGHWAY COMMISSION

STATE HIGHWAY #80

OVER

BROADWAY

IN THE CITY OF

BANGOR

PENOBSCOT COUNTY

BORING DATA

SHEET 2 OF 8 AUGUSTA, MAINE

73-57

ESTIMATE

F.A.P. NO.	STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
1	MAINE	IM-95-8465(00)E	2	8

PIN NO. 8465.00

ESTIMATED QUANTITIES

ITEM NO.	DESCRIPTION	QUANTITY	UNIT
607.243	REMOVE CHAIN LINK FENCE	1000	LF
607.422	TIMBER NOISE BARRIER	1	LS
639.19	FIELD OFFICE TYPE B	1	EA
652.30	FLASHING ARROW BOARD	1	EA
652.33	DRUM	30	EA
652.34	CONE	25	EA
652.35	CONSTRUCTION SIGNS	120	SF
652.361	MAINTENANCE OF TRAFFIC CONTROL DEVICES	1	LS
652.38	FLAGGER	500	MH
659.10	MOBILIZATION	1	LS

GENERAL NOTES

1. CONCRETE SHALL BE CLASS "A" IN CONFORMANCE WITH SPECIAL PROVISION 502.

2. LUMBER & POLES
ALL LUMBER SHALL BE NO. 1 KD OR BETTER SOUTHERN YELLOW PINE OR DOUGLAS FIR SURFACED FOUR SIDES. ALL LUMBER AND POLES SHALL BE COMMERCIALLY INSPECTED BY AN INDEPENDENT COMPANY. ALL CCA TREATED LUMBER AND POLES SHALL BE KILN DRIED TO 15% MOISTURE CONTENT AFTER TREATMENT. POLES TO BE STRAIGHT SOUTHERN YELLOW PINE OR DOUGLAS FIR CONFORMING TO ANSI 05.1-1987. (ANSI--AMERICAN NATIONAL STANDARDS INSTITUTE)

3. TREATING SPECIFICATIONS
TWO TYPES OF TREATMENT ARE ACCEPTABLE:
A: CCA IN ACCORDANCE WITH AWPA P-5 (AWPA--AMERICAN WOOD PRESERVERS ASSOCIATION)
B: PENTACHLOROPHENOL IN ACCORDANCE WITH AWPA P-9,TYPE B (L.P.G.)
ALL MATERIAL SHALL HAVE A MINIMUM TREATMENT AS FOLLOWS:

PENTACHLOROPHENOL	0.50 LBS. PER CU. FT.
CCA	0.40 LBS. PER CU. FT.
CCA (POLES)	0.60 LBS. PER CU. FT.

TREATMENT TO CONFORM TO AWPA C-2 FOR PLANK, PANELS, BATTENS AND AWPA C-4 FOR POLES. ALL MATERIAL SHALL BE PROTECTED FROM WEATHER UNTIL INSTALLED.

4. THE PLANK ENDS SHALL BE IN A VERTICAL STRAIGHT LINE AND ALL PLANKS SHALL FIT TIGHTLY AT THE TIME OF INSTALLATION. ANY PLANK WHICH DOES NOT FIT TIGHTLY SHALL BE REJECTED.

5. FIELD CUTS AND HOLES SHALL BE TREATED IN ACCORDANCE WITH AWPA M4.

6. ALL METAL SHALL BE STAINLESS STEEL TYPE 304 OR 316. 20D NAILS SHALL BE A MINIMUM DIAMETER OF .190 INCHES AND SHALL BE A MINIMUM OF 4 INCHES LONG. 10D NAILS SHALL HAVE A MINIMUM DIAMETER OF .145 INCHES AND SHALL BE A MINIMUM OF 2 3/4 " INCHES LONG. ALL NAILS SHALL BE RINGSHANKED. LAG BOLTS SHALL BE 1/4 " DIAMETER X 4" LONG. INSTALLED NAILS SHALL BE SET SO THAT HEADS ARE FLUSH WITH FACE OF PLANKS.

7. THE CRUSHED STONE SHALL CONFORM TO ARTICLE 703.31 OF THE STANDARD SPECIFICATIONS AND PLACED TO A MIN. DEPTH OF 2" ABOVE THE BOTTOM OF THE PLANKS. STONE DITCH PROTECTION CONFORMING TO ARTICLE 703.29 OF THE STANDARD SPECIFICATIONS SHALL BE REQUIRED IN LIEU OF CRUSHED STONE BETWEEN STATIONS 9+50 AND 44+50. "S" SHALL BE A MIN. OF 2" AND SHALL BE INCIDENTAL TO ITEM 607.422 TIMBER NOISE BARRIER.

8. CLEARING SHALL BE KEPT TO A MINIMUM AS DIRECTED BY THE ENGINEER. ONLY VEGETATION WITHIN THE EXISTING RIGHT OF WAY SHALL BE CLEARED FOR CONSTRUCTION OF THE NOISE BARRIER. OVERHANGING TREE LIMBS MAY BE PRUNED AS REQUIRED FOR CONSTRUCTION. CLEARING SHALL BE CONSIDERED INCIDENTAL TO ITEM 607.422 TIMBER NOISE BARRIER.

9. SEED AND MULCH SHALL BE APPLIED TO ALL AREAS OF DISTURBED SOIL UPON COMPLETION OF THE TIMBER NOISE BARRIER PROJECT (WORK SHALL BE INCIDENTAL TO ITEM 607.422 TIMBER NOISE BARRIER).

10. ACCESS FOR BUILDING THE BARRIER SHALL BE FROM THE NORTHBOUND LANES OF INTERSTATE 95. IF NECESSARY, TEMPORARY ACCESS RIGHTS ARE ALSO AVAILABLE FROM NOWELL ROAD -- HOWEVER, THE AREA USED FOR TEMPORARY ACCESS SHALL BE RESTORED UPON COMPLETION OF THE NOISE BARRIER. RESTORATION SHALL INCLUDE: ANY GRADING AS REQUIRED; PLACING LOAM, SEED, AND MULCH; AND REPLACING ANY DAMAGED TREES, SHRUBS, OR FLOWER GARDENS AS DIRECTED BY THE ENGINEER. (THIS WORK SHALL BE CONSIDERED INCIDENTAL TO ITEM 607.422 TIMBER NOISE BARRIER.)

11. ALL WORK INVOLVING CONSTRUCTION OF THE TIMBER NOISE BARRIER AND REMOVAL OF THE CHAIN LINK RIGHT OF WAY FENCE SHALL BE CONDUCTED FROM WITHIN THE EXISTING RIGHT OF WAY.

12. AS DIRECTED BY THE ENGINEER, PORTIONS OF THE EXISTING CHAIN LINK RIGHT OF WAY FENCE MAY NEED TO BE REMOVED PRIOR TO CONSTRUCTION OF THE TIMBER NOISE BARRIER SO AS TO ALLOW WORK TO BE CONDUCTED ENTIRELY FROM WITHIN THE RIGHT OF WAY. UPON COMPLETION OF THE TIMBER NOISE BARRIER, THE REMAINDER OF THE EXISTING CHAIN LINK FENCE SHALL BE REMOVED EXCEPT ADJACENT TO THE DETOUR PROPERTY (38 PRINCETON STREET). THE EXISTING CHAIN LINK FENCE WILL ALSO REMAIN BEYOND BOTH ENDS OF THE NOISE BARRIER. IT SHALL BE ATTACHED TO THE BARRIER AT BOTH ENDS BY FASTENING STEEL FENCE POSTS WITH STAINLESS STEEL U-BOLTS AS DIRECTED BY THE ENGINEER. THIS WORK SHALL BE CONSIDERED INCIDENTAL TO ITEM 607.243 REMOVE CHAIN LINK FENCE.

13. THE NEIGHBORHOOD SIDE OF THE BARRIER SHALL BE STAINED WITH A SOLID COLOR STAIN ADJACENT TO THE DETOUR PROPERTY (38 PRINCETON STREET--BETWEEN PRINCETON AND WARWICK STREETS) AS PER SPECIAL PROVISION 607 TIMBER NOISE BARRIER. STAIN SHALL BE PENETRATING EXTERIOR OIL BASE COMPATIBLE WITH THE PRESERVATIVE TREATMENT. COLOR SHALL BE WHITE.

SOILS INFORMATION

		DEPTH	
S-1	ROD SOUNDING	0 - 16 FT.	NO REFUSAL
B-2	POWER AUGER BORING	0 - 4.0 FT. 4.0 - 19.5 FT.	SILTY SANDY GRAVEL (FILL) SANDY CLAY SILT WITH COBBLES (AASHTO CLASSIFICATION A-4)
B-3	POWER AUGER BORING	0 - 2.5 FT. 2.5 - 16.0 FT. 2.5 - 16.0 FT.	SILTY SANDY GRAVEL (FILL) SANDY CLAY SILT WITH COBBLES (AASHTO CLASSIFICATION A-4) SANDY CLAY SILT WITH COBBLES (AASHTO CLASSIFICATION A-4) VERY FIRM AT DEPTH OF 16.4 FT. SOIL INCREASINGLY MOIST WITH DEPTH, HOWEVER WATER TABLE IS BELOW 19.5 FT.
B-4	POWER AUGER BORING	0 - 1.0 FT. 1.0 - 15.0 FT. 15.0 - 19.0 FT.	SILTY SANDY GRAVEL (FILL) SANDY CLAY SILT (AASHTO CLASSIFICATION A-6) SANDY CLAY SILT WITH COBBLES
B-5	POWER AUGER BORING	0-1.9 FT. 1.9 - 19 FT.	SILTY SANDY GRAVEL (FILL) SANDY CLAY SILT (AASHTO CLASSIFICATION A-6)
S-6	ROD SOUNDING	0 -12 FT.	NO REFUSAL (MATERIAL IS BLASTED LEDGE FILL)

1. LOCATIONS OF BORINGS AND ROD SOUNDINGS ARE AS INDICATED ON THE PLAN VIEW. SOILS INVESTIGATION WAS CONDUCTED FOR PURPOSES OF DESIGN AND SHOWS CONDITIONS AT INVESTIGATION POINTS ONLY. IT DOES NOT NECESSARILY SHOW THE NATURE OF MATERIALS TO BE ENCOUNTERED DURING CONSTRUCTION.

2. THE CONTRACTOR IS TO FORM HIS OWN OPINION OF THE CHARACTER OF THE MATERIAL AND TO MAKE HIS OWN INTERPRETATION OF THE RESULTS.

3. THE ENGINEER DOES NOT WARRANT THE FINDINGS AS BEING ACCURATE OR COMPLETE.

4. SOILS INVESTIGATION WAS CONDUCTED BY THE MAINE DEPARTMENT OF TRANSPORTATION DURING THE MONTH OF JULY 1998.

TABLE - PIER DEPTH - "D" - FT.

WALL HIGHT "H"	POLE DIAMETER OF PIER AT TOP	MIN. ALLOWABLE DIAMETER AT TOP OF POLE	PIER DEPTH "D"
11.5' - 14'	11"	7.5"	10.5'
20'	14"	9"	12.5'

PROJECT DESIGN ENGINEER	BY	DATE
	J. BRYAN	6/98
DESIGN-DETAILED	J. BRYAN	6/98
CHECKED	B. CHURCH	6/98
REVISIONS		
FIELD CHANGES		

PLANS

22SEP98:0100.00

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

ESTIMATED QUANTITIES & GENERAL NOTES

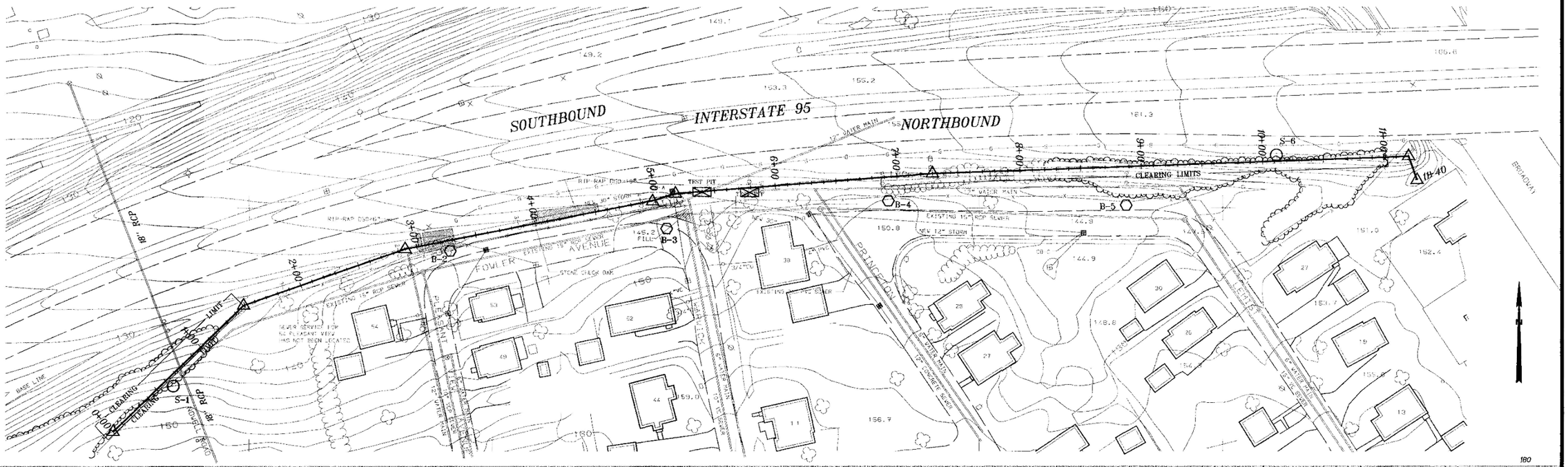
SHEET 1 OF 1 AUGUSTA, MAINE

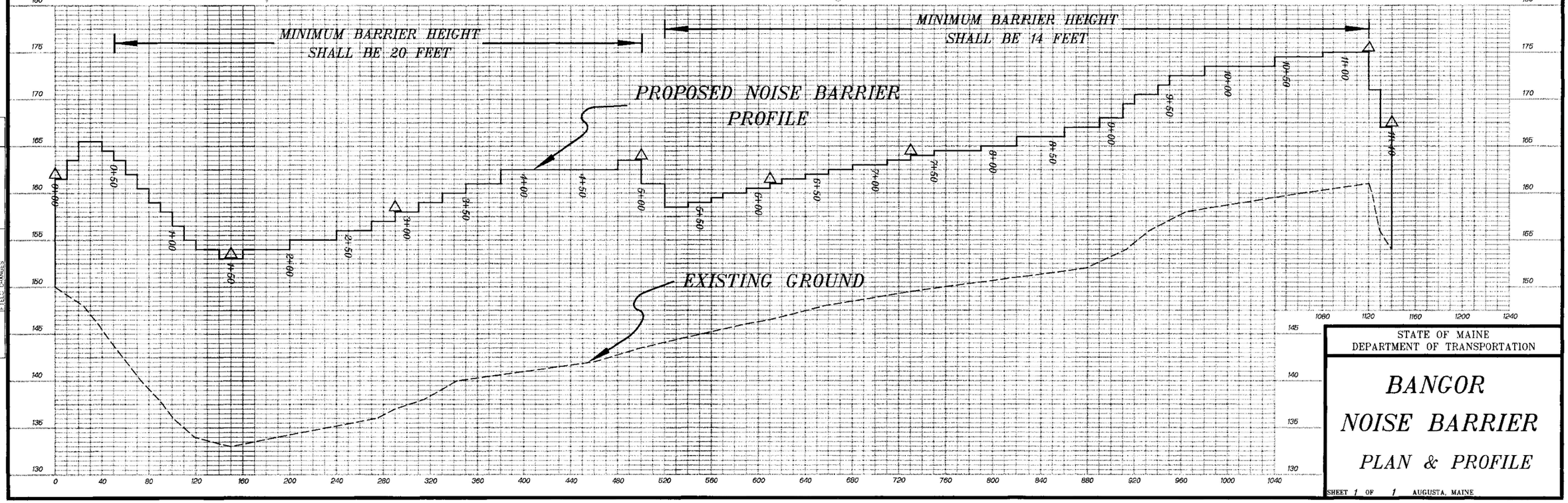
BANGOR I 95 NORTHBOUND

BANGOR

F.H.W.A. REG. NO.	STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
1	MAINE	IM-95-8465(00)X	3	3

PIN NO. 8465.00





PROJECT DESIGN ENGINEER	BY	DATE
DESIGN-DETAILED	I. DEVIN	8/98
CHECKED	D. CRIMSON	
REVISIONS		
FIELD CHANGES		

PLANS

14FE896-010000

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

BANGOR
NOISE BARRIER
PLAN & PROFILE

SHEET 1 OF 1 AUGUSTA, MAINE

BANGOR I – 95 NORTHBOUND

APPENDIX C – RECENT TEST BORING LOGS

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE-GRAINED SOILS (more than half of material is larger than No. 4 sieve size)	GRAVELS (more than half of coarse fraction is larger than No. 4 sieve size)	CLEAN GRAVELS (little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly-graded gravels, gravel sand mixtures, little or no fines.
		GRAVEL WITH FINES (Appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (more than half of coarse fraction is smaller than No. 4 sieve size)	CLEAN SANDS (little or no fines)	SW	Well-graded sands, Gravelly sands, little or no fines
			SP	Poorly-graded sands, Gravelly sand, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures.
FINE-GRAINED SOILS (more than half of material is smaller than No. 200 sieve size)	SILTS AND CLAYS (liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, Silty or Clayey fine sands, or Clayey silts with slight plasticity.
			CL	Inorganic clays of low to medium plasticity, Gravelly clays, Sandy clays, Silty clays, lean clays.
			OL	Organic silts and organic Silty clays of low plasticity.
	SILTS AND CLAYS (liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine Sandy or Silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
	HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils.

Desired Soil Observations (in this order, if applicable):

Color (Munsell color chart)
Moisture (dry, damp, moist, wet)
Density/Consistency (from above right hand side)
Texture (fine, medium, coarse, etc.)
Name (Sand, Silty Sand, Clay, etc., including portions - trace, little, etc.)
Gradation (well-graded, poorly-graded, uniform, etc.)
Plasticity (non-plastic, slightly plastic, moderately plastic, highly plastic)
Structure (layering, fractures, cracks, etc.)
Bonding (well, moderately, loosely, etc.,)
Cementation (weak, moderate, or strong)
Geologic Origin (till, marine clay, alluvium, etc.)
Groundwater level

MODIFIED BURMISTER SYSTEM

Descriptive Term	Portion of Total (%)
trace	0 - 10
little	11 - 20
some	21 - 35
adjective (e.g. Sandy, Clayey)	36 - 50

TERMS DESCRIBING DENSITY/CONSISTENCY

Coarse-grained soils (more than half of material is larger than No. 200 sieve): Includes (1) clean gravels; (2) Silty or Clayey gravels; and (3) Silty, Clayey or Gravelly sands. Density is rated according to standard penetration resistance (N-value).

Density of Cohesionless Soils	Standard Penetration Resistance N-Value (blows per foot)
Very loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

Fine-grained soils (more than half of material is smaller than No. 200 sieve): Includes (1) inorganic and organic silts and clays; (2) Gravelly, Sandy or Silty clays; and (3) Clayey silts. Consistency is rated according to undrained shear strength as indicated.

Consistency of Cohesive soils	SPT N-Value (blows per foot)	Approximate Undrained Shear Strength (psf)	Field Guidelines
Very Soft	WOH, WOR, WOP, <2	0 - 250	Fist easily penetrates
Soft	2 - 4	250 - 500	Thumb easily penetrates
Medium Stiff	5 - 8	500 - 1000	Thumb penetrates with moderate effort
Stiff	9 - 15	1000 - 2000	Indented by thumb with great effort
Very Stiff	16 - 30	2000 - 4000	Indented by thumbnail
Hard	>30	over 4000	Indented by thumbnail with difficulty

Rock Quality Designation (RQD):

$$\text{RQD (\%)} = \frac{\text{sum of the lengths of intact pieces of core* > 4 inches}}{\text{length of core advance}}$$

*Minimum NQ rock core (1.88 in. OD of core)

Rock Quality Based on RQD

Rock Quality	RQD (%)
Very Poor	≤25
Poor	26 - 50
Fair	51 - 75
Good	76 - 90
Excellent	91 - 100

Desired Rock Observations (in this order, if applicable):

Color (Munsell color chart)
Texture (aphanitic, fine-grained, etc.)
Rock Type (granite, schist, sandstone, etc.)
Hardness (very hard, hard, mod. hard, etc.)
Weathering (fresh, very slight, slight, moderate, mod. severe, severe, etc.)
Geologic discontinuities/jointing:
- -dip (horiz - 0-5 deg., low angle - 5-35 deg., mod. dipping - 35-55 deg., steep - 55-85 deg., vertical - 85-90 deg.)
- -spacing (very close - <2 inch, close - 2-12 inch, mod. close - 1-3 feet, wide - 3-10 feet, very wide >10 feet)
- -tightness (tight, open, or healed)
- -infilling (grain size, color, etc.)

Formation (Waterville, Ellsworth, Cape Elizabeth, etc.)
RQD and correlation to rock quality (very poor, poor, etc.)
ref: ASTM D6032 and FHWA NHI-16-072 GEC 5 - Geotechnical Site Characterization, Table 4-12
Recovery (inch/inch and percentage)
Rock Core Rate (X.X ft - Y.Y ft (min:sec))

Maine Department of Transportation
Geotechnical Section
Key to Soil and Rock Descriptions and Terms
Field Identification Information

Sample Container Labeling Requirements:

WIN
Bridge Name / Town
Boring Number
Sample Number
Sample Depth
Blow Counts
Sample Recovery
Date
Personnel Initials

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: I-95 Bridge over Broadway No. 5789
Location: Bangor, Maine

Boring No.: BB-BI95-101
WIN: 22276.01

Driller:	New England Boring Contractors	**Elevation (ft.)**	132.5	**Auger ID/OD:**	4.25" OD SSA
Operator:	Mike Porter	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	B. Woodman	**Rig Type:**	Track B-53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/02/18 - 10/02/18	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NX
Boring Location:	Sta. 254+22.3, Offset 94.4 L	**Casing ID/OD:**	4"	**Water Level*:**	11.2
Hammer Efficiency Factor:	0.931	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample Attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample Attempt
V = Field Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Field Vane Shear Test Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	24/14	0.5 - 2.5	3-10-18-13	28	43	SSA	132.0		0'-0.5': Topsoil.	
										0.5	G#7
										Brown, dry, dense, fine to coarse SAND, some silt, some gravel, (Fill).	A-2-4(0) (SM)
											WC=8.5
5								127.5		5.0	
	2D	24/24	5.0 - 7.0	3-4-4-6	8	12	29			Olive, dry, stiff, Silty CLAY, mottled throughout, (Marine Clay).	LL=36
							33				PL=22
							35				PI=14
							33				WC=28.7
							39				
10	3D	24/14	10.0 - 12.0	3-2-5-9	7	11	29			Olive, wet, stiff, Silty CLAY, little fine to medium sand, trace gravel, (Marine Clay).	
							46				
							65				
							80	119.5		13.0	
							97			Increased roller bit resistance at 13.0', probable transition to Glacial Till.	
15	4D	24/10	15.0 - 17.0	19-14-11-13	25	39	58			Brown, wet, dense, fine to coarse SAND, little gravel, little silt, (Glacial Till).	
							59				
							55				
							64				
							62				
20	5D	24/7	20.0 - 22.0	19-13-16-14	29	45	42			Brown, wet, dense, fine to coarse SAND, little gravel, trace silt, (Glacial Till).	
							80				
							69				
							62				
25							80				

Remarks:

1. NEBC drill # D-20 automatic hammer energy transfer rate = 0.931.
2. Water levels measured approximately 20 minutes after completion of drilling after casing removal.
3. Coordinates: N1731004.3, E481230.3

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: I-95 Bridge over Broadway No. 5789
Location: Bangor, Maine

Boring No.: BB-BI95-101
WIN: 22276.01

Driller:	New England Boring Contractors	**Elevation (ft.)**	132.5	**Auger ID/OD:**	4.25" OD SSA
Operator:	Mike Porter	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	B. Woodman	**Rig Type:**	Track B-53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/02/18 - 10/02/18	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NX
Boring Location:	Sta. 254+22.3, Offset 94.4 L	**Casing ID/OD:**	4"	**Water Level*:**	11.2
Hammer Efficiency Factor: 0.931		**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
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SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140 lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
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N-uncorrected = Raw Field SPT N-value
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N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25	6D	24/24	25.0 - 27.0	16-17-16-25	33	51	58			Grey, wet, very dense, Silty fine to coarse SAND, little gravel, little silt, (Glacial Till).	G#8 A-4(0) (SM) WC=9.6
							78				
							106				
							91				
							148				
30	7D	24/16	30.0 - 32.0	28-33-37-60	70	109	91			Grey, wet, very dense, fine to coarse SAND, little gravel, little silt, (Glacial Till).	
							190				
							224				
							230				
							203				
35	8D	24/16	35.0 - 37.0	36-34-45-59	79	123	RC			Grey, wet, very dense, fine to coarse SAND, some fine to coarse gravel, some silt, (Glacial Till).	G#9 A-1-b (SM) WC=7.0
							AHEAD				
40	9D	5/4	40.5 - 40.9	50/3"	R					Grey, wet, very dense, fine to coarse SAND, some gravel, little silt, (Glacial Till).	
45								87.5		45.0	
	10D	17/17	45.0 - 46.4	27-40-86/3"	R					Brown, moist, very dense, SILT, appears water worked with weathered rock fragments, (Glacial Till).	
50											

Remarks:

1. NEBC drill # D-20 automatic hammer energy transfer rate = 0.931.
2. Water levels measured approximately 20 minutes after completion of drilling after casing removal.
3. Coordinates: N1731004.3, E481230.3

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: I-95 Bridge over Broadway No. 5789

Location: Bangor, Maine

Boring No.: BB-BI95-101

WIN: 22276.01

Driller:	New England Boring Contractors	**Elevation (ft.)**	132.5	**Auger ID/OD:**	4.25" OD SSA
Operator:	Mike Porter	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	B. Woodman	**Rig Type:**	Track B-53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/02/18 - 10/02/18	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NX
Boring Location:	Sta. 254+22.3, Offset 94.4 L	**Casing ID/OD:**	4"	**Water Level*:**	11.2
Hammer Efficiency Factor: 0.931		**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
50	11D	5/4	50.0 - 50.4	100/3"						Brown, moist, very dense, SILT, trace fine sand, appears water worked with weathered rock fragments, (Glacial Till).	
55											
60	R1	60/57	59.9 - 64.9	RQD = 88%			NX2	72.7		59.8 Increased roller bit resistance at 59.8', advanced to 59.9' and set up to core. R1: Hard, fresh, aphanitic, grey, SLATE. Joints are close to moderately spaced, high angle, planar to undulating, rough, fresh, tight to partially open. Rock Quality = Good Recovery = 95% Rock Core Times (min:sec): 59.9-60.9' (3:39), 60.9-61.9' (2:57), 61.9-62.9' (2:01), 62.9-63.9' (2:15), 63.9-64.9' (3:29)	
65	R2	60/58	64.9 - 69.9	RQD = 73%						R2: Hard, fresh, aphanitic, grey, SLATE with calcite stringers. Joints are very close to close, high angle, planar to undulating, rough, fresh, tight to partially open. Rock Quality = Fair Recovery = 97% Rock Core Times (min:sec): 64.9-65.9' (2:29), 65.9-66.9' (2:34), 66.9-67.9' (2:41), 67.9-68.9' (1:51), 68.9-69.9' (1:57)	
70								62.6		69.9 **Bottom of Exploration at 69.9 feet below ground surface.**	
75											

Remarks:

1. NEBC drill # D-20 automatic hammer energy transfer rate = 0.931.
2. Water levels measured approximately 20 minutes after completion of drilling after casing removal.
3. Coordinates: N1731004.3, E481230.3

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: I-95 Bridge over Broadway No. 5789
Location: Bangor, Maine

Boring No.: BB-BI95-102
WIN: 22276.01

Driller:	New England Boring Contractors	**Elevation (ft.)**	138.8	**Auger ID/OD:**	4.25" OD SSA
Operator:	Mike Porter	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	B. Woodman	**Rig Type:**	Track B-53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/07/18 - 10/11/18	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NX
Boring Location:	Sta. 255+28, Offset 63.5 R	**Casing ID/OD:**	4"	**Water Level*:**	12.6'
Hammer Efficiency Factor:	0.931	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
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U = Thin Wall Tube Sample
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MV = Unsuccessful Field Vane Shear Test Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	19/19	0.4 - 2.0	2-6-6-5	12	19	SSA	138.4		0'-0.4': Topsoil.	
										0.4	
										Brown, dry, medium dense, fine to coarse SAND, some gravel, little silt, (Fill).	
5	2D	24/24	5.0 - 7.0	6-7-8-10	15	23	29	133.8		5.0	
							44			Olive, moist, very stiff, Silty CLAY, mottling throughout, (Marine Clay).	
							52				
							51				
							57				
10	3D	24/24	10.0 - 12.0	2-3-3-6	6	9	29			Olive, wet, stiff, Silty CLAY, (Marine Clay).	LL=28 PL=19 PI=9 WC=23.2
							42				
							73				
							106	125.8		13.0	
							91			Increased roller bit resistance from 13. 0'-15.0' bgs. Possible Cobbles.	
15	4D	24/14	15.0 - 17.0	15-10-5-9	15	23	57	123.8		15.0	
							52			Grey, moist, medium dense, Silty fine to coarse SAND, little gravel, (Glacial Till).	
							81				
							111				
							59				
20	5D	24/15	20.0 - 22.0	4-4-3-5	7	11	44			Grey, moist, medium dense, fine to medium SAND, little silt, little gravel, (Glacial Till).	
							55				
							68				
							71				
25							69				

Remarks:

1. NEBC drill # D-20 automatic hammer energy transfer rate = 0.931.
2. Water levels measured approximately 20 minutes after completion of drilling after casing removal.
3. Coordinates: N1731117.8, E481077.4

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: I-95 Bridge over Broadway No. 5789
Location: Bangor, Maine

Boring No.: BB-BI95-102
WIN: 22276.01

Driller:	New England Boring Contractors	**Elevation (ft.)**	138.8	**Auger ID/OD:**	4.25" OD SSA
Operator:	Mike Porter	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	B. Woodman	**Rig Type:**	Track B-53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/07/18 - 10/11/18	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NX
Boring Location:	Sta. 255+28, Offset 63.5 R	**Casing ID/OD:**	4"	**Water Level*:**	12.6'
Hammer Efficiency Factor: 0.931		**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample Attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample Attempt
V = Field Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Field Vane Shear Test Attempt
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SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140 lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25	6D	24/4	25.0 - 27.0	12-14-19-18	33	51	37			Grey, moist, very dense, fine to coarse SAND, some silt, little gravel, (Glacial Till).	
							39				
							61				
							65				
							96				
30	7D	24/11	30.0 - 32.0	9-9-8-8	17	26	44			Grey, moist, medium dense, fine to coarse SAND, some silt, little gravel, (Glacial Till).	
							50				
							95				
							167				
							184				
35	8D	19/11	35.0 - 36.6	13-19-59-50/1"	78	121	RC			Grey, moist, very dense, fine to coarse SAND, some silt, little gravel, (Glacial Till).	
								102.3		36.5	
										Increased roller bit resistance from 36.5'-39.0', probable Cobble/ Boulder.	
								99.8		39.0	
40	9D	24/16	40.0 - 42.0	21-24-21-15	45	70				Grey, moist, very dense, fine to coarse SAND, some silt, little gravel, (Glacial Till).	
45	10D	24/24	45.0 - 47.0	56-38-50-65	88	137				Grey, moist, hard, Clayey SILT, some fine to coarse sand, trace gravel, (Glacial Till).	G#10 A-4(0) (ML) WC=9.9
50											

Remarks:

1. NEBC drill # D-20 automatic hammer energy transfer rate = 0.931.
2. Water levels measured approximately 20 minutes after completion of drilling after casing removal.
3. Coordinates: N1731117.8, E481077.4

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: I-95 Bridge over Broadway No. 5789

Location: Bangor, Maine

Boring No.: BB-BI95-102

WIN: 22276.01

Driller:	New England Boring Contractors	**Elevation (ft.)**	138.8	**Auger ID/OD:**	4.25" OD SSA
Operator:	Mike Porter	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	B. Woodman	**Rig Type:**	Track B-53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/07/18 - 10/11/18	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NX
Boring Location:	Sta. 255+28, Offset 63.5 R	**Casing ID/OD:**	4"	**Water Level*:**	12.6'
Hammer Efficiency Factor: 0.931		**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
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SSA = Solid Stem Auger
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WOR/C = Weight of Rods or Casing
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$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
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N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
50	11D	24/24	50.0 - 52.0	23-52-42-39	94	146		88.8		50.0 Tan, wet, very dense, SILT, appears water worked with weathered rock fragments, (Glacial Till).	
55	12D	15/15	55.0 - 56.3	33-60-53/2"	R					Tan, wet, very dense, SILT, trace fine sand, appears water worked with weathered rock fragments, (Glacial Till) .	
60											
65	13D	4/4	65.0 - 65.3	107/4"	R					Tan, wet, very dense, SILT, little fine sand, appears water worked with weathered rock fragments, (Glacial Till).	
70											
75											

Remarks:

1. NEBC drill # D-20 automatic hammer energy transfer rate = 0.931.
2. Water levels measured approximately 20 minutes after completion of drilling after casing removal.
3. Coordinates: N1731117.8, E481077.4

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: I-95 Bridge over Broadway No. 5789
Location: Bangor, Maine

Boring No.: BB-BI95-102
WIN: 22276.01

Driller:	New England Boring Contractors	**Elevation (ft.)**	138.8	**Auger ID/OD:**	4.25" OD SSA
Operator:	Mike Porter	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	B. Woodman	**Rig Type:**	Track B-53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/07/18 - 10/11/18	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NX
Boring Location:	Sta. 255+28, Offset 63.5 R	**Casing ID/OD:**	4"	**Water Level*:**	12.6'
Hammer Efficiency Factor: 0.931		**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
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MV = Unsuccessful Field Vane Shear Test Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140 lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
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N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
75	14D	2/2	75.0 - 75.2	57/2"	R		39			Brown, moist, very dense, SILT, little fine to coarse sand, appears water worked with weathered rock fragments, (Glacial Till).	
							55				
							64				
							308				
							RC				
80											
85											
	15D	3/3	89.5 - 89.8	100/1"	R					Brown, moist, very dense, SILT, little fine to coarse sand, appears water worked with weathered rock fragments, (Glacial Till).	
90											
95											
	R1	60/54	97.5 - 102.5	RQD = 62%			NX2	41.3		97.5 R1: Hard, fresh, aphanitic, grey, SLATE with calcite veins and seams. Joints are very close to close, low angle, undulating, rough, partially open, fresh. One high angle planar joint. Rock Quality = Fair Recovery: 90%	
100											

Remarks:

1. NEBC drill # D-20 automatic hammer energy transfer rate = 0.931.
2. Water levels measured approximately 20 minutes after completion of drilling after casing removal.
3. Coordinates: N1731117.8, E481077.4

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: I-95 Bridge over Broadway No. 5789
Location: Bangor, Maine

Boring No.: BB-BI95-102
WIN: 22276.01

Driller:	New England Boring Contractors	**Elevation (ft.)**	138.8	**Auger ID/OD:**	4.25" OD SSA
Operator:	Mike Porter	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	B. Woodman	**Rig Type:**	Track B-53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/07/18 - 10/11/18	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NX
Boring Location:	Sta. 255+28, Offset 63.5 R	**Casing ID/OD:**	4"	**Water Level*:**	12.6'
Hammer Efficiency Factor: 0.931		**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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RC = Roller Cone
WOH = Weight of 140 lb. Hammer
WOR/C = Weight of Rods or Casing
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N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
100										Rock Core Times (min:sec): 97.5-98.5' (3:51), 98.5-99.5' (2:52), 99.5-100.5' (4:07), 100.5-101.5' (3:28), 101.5-102.5' (3:21)	
	R2	58/58	102.5 - 107.3	RQD = 86%						R2: Hard, fresh, aphanitic, grey, SLATE with calcite veins and seams. Joints are very close to moderately spaced, high angle, planar, rough to smooth, tight to partially open, fresh. Rock Quality = Good Recovery = 100% Rock Core Times (min:sec): 102.5-103.5' (3:22), 103.5-104.5' (2:36), 104.5-105.5' (2:46), 105.5-106.5' (2:40), 106.5-107.2' (2:08)	
105								31.6		107.2 **Bottom of Exploration at 107.2 feet below ground surface.**	
110											
115											
120											
125											

Remarks:

1. NEBC drill # D-20 automatic hammer energy transfer rate = 0.931.
2. Water levels measured approximately 20 minutes after completion of drilling after casing removal.
3. Coordinates: N1731117.8, E481077.4

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: I-95 Bridge over Broadway No. 5789
Location: Bangor, Maine

Boring No.: BB-BI95-103
WIN: 22276.01

Driller:	New England Boring Contractors	**Elevation (ft.)**	134.5	**Auger ID/OD:**	4.25" OD SSA
Operator:	Mike Porter	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	B. Woodman	**Rig Type:**	Track B-53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/03/18 - 10/04/18	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NX
Boring Location:	Sta. 255+43.8, Offset 63.4 L	**Casing ID/OD:**	4"	**Water Level*:**	10.9'
Hammer Efficiency Factor:	0.931	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
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V = Field Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Field Vane Shear Test Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
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N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	18/20	0.5 - 2.0	4-5-10-13	15	23	SSA	134.0		0'-0.5': Topsoil.	
										0.5	G#11 A-4(0) (ML) WC=12.1
										Brown, dry, very stiff, SILT, some fine to coarse sand, little gravel, (Fill).	
5	2D	24/24	5.0 - 7.0	4-10-9-7	19	29	31			Top 12": Brown/grey, dry, medium dense, Silty fine to medium SAND, trace gravel, (Fill).	
								128.5		6.0	
							41			Bottom 12": Olive, wet, Silty CLAY, little fine sand. Brown and black mottling throughout, (Marine Clay).	
							41				
							46				
							39				
10	3D	24/24	10.0 - 12.0	1-5-5-8	10	16	29			Olive, wet, very stiff, Silty CLAY, trace fine sand, (Marine Clay).	LL=26 PL=18 PI=8 WC=23.8
							31				
							32				
							35				
							47				
15	4D	24/9	15.0 - 17.0	11-8-9-11	17	26	50	119.5		15.0	G#12 A-4(0) (ML) WC=57.6
										Grey, wet, medium dense, Clayey SILT, some fine to coarse sand, little gravel, (Glacial Till).	
							59				
							61				
							60				
							61				
20	5D	24/9	20.0 - 22.0	13-16-17-13	33	51	67			Grey, wet, very dense, fine to coarse SAND, little silt, little gravel, (Glacial Till).	
							74				
							80				
							55				
25							55				

Remarks:

1. NEBC drill # D-20 automatic hammer energy transfer rate = 0.931.
2. Water levels measured approximately 20 minutes after completion of drilling after casing removal.
3. Coordinates: N1731127.1, E481204.8

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: I-95 Bridge over Broadway No. 5789
Location: Bangor, Maine

Boring No.: BB-BI95-103
WIN: 22276.01

Driller:	New England Boring Contractors	**Elevation (ft.)**	134.5	**Auger ID/OD:**	4.25" OD SSA
Operator:	Mike Porter	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	B. Woodman	**Rig Type:**	Track B-53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/03/18 - 10/04/18	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NX
Boring Location:	Sta. 255+43.8, Offset 63.4 L	**Casing ID/OD:**	4"	**Water Level*:**	10.9'
Hammer Efficiency Factor: 0.931		**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
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N-uncorrected = Raw Field SPT N-value
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Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25	6D	24/11	25.0 - 27.0	6-6-7-10	13	20	37			Grey, wet, medium dense, fine to coarse SAND, little silt, trace gravel, (Glacial Till).	
							66				
							68				
							91				
							60				
30	7D	24/14	30.0 - 32.0	10-17-17-24	34	53	66			Grey, wet, very dense, Silty fine to coarse SAND, some gravel, (Glacial Till).	G#13 A-4(0) (SM) WC=8.6
							84				
							89				
							172				
							130				
35	8D	24/20	35.0 - 37.0	36-54-58-73	112	174	103			Grey, wet, very dense, fine to coarse SAND, some gravel, little silt, (Glacial Till).	
							137				
							303				
							RC				
40	9D	24/14	40.0 - 42.0	20-26-42-50	68	106				Grey, wet, very dense, fine to coarse SAND, little silt, trace gravel, (Glacial Till).	
								92.0		42.5	
										Increased roller bit resistance from 42. 5'-43.5', probable Cobbles.	
								91.0		43.5	
45	10D	24/15	45.0 - 47.0	25-33-20-34	53	82				Grey, wet, very dense, fine to coarse SAND, some gravel, little silt, (Glacial Till).	
50											

Remarks:

1. NEBC drill # D-20 automatic hammer energy transfer rate = 0.931.
2. Water levels measured approximately 20 minutes after completion of drilling after casing removal.
3. Coordinates: N1731127.1, E481204.8

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: I-95 Bridge over Broadway No. 5789

Location: Bangor, Maine

Boring No.: BB-BI95-103

WIN: 22276.01

Driller:	New England Boring Contractors	**Elevation (ft.)**	134.5	**Auger ID/OD:**	4.25" OD SSA
Operator:	Mike Porter	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	B. Woodman	**Rig Type:**	Track B-53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/03/18 - 10/04/18	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NX
Boring Location:	Sta. 255+43.8, Offset 63.4 L	**Casing ID/OD:**	4"	**Water Level*:**	10.9'
Hammer Efficiency Factor: 0.931		**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample Attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample Attempt
V = Field Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Field Vane Shear Test Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140 lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows		Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
				Sample Information								
50	11D	18/18	50.0 - 51.5	34-57-89-50/1"	146	227					Grey, wet, very dense, fine to coarse SAND, little silt, little gravel.	
									80.7		53.8	
55											Increased roller bit resistance at 53.8' bgs, apparent top of rock. Advanced roller bit to 56.5' and set up to core.	
	R1	18/12	56.5 - 58.0	RQD = 0%							R1: Hard, fresh to slightly weathered, aphanitic, grey, SLATE. Joints are very close, low angle, planar to undulating rough to smooth, fresh, open. Rock Quality = Very Poor Recovery = 67% Rock Core Times (min:sec): 56.5-57.5' (3:17), 57.5-58.0' (2:07)	
	R2	37/37	58.0 - 61.1	RQD = 45%							R2: Hard, fresh to slightly weathered, aphanitic, grey, SLATE. Joints are very close to close, low angle, undulating to planar, rough, discolored to fresh, open. Rock Quality = Very Poor Recovery = 100% Rock Core Times (min:sec): 58.0-58.5' (1:92), 58.5-59.5' (2:22), 59.5-60.5' (2:12), 60.5-61.1' (1:51)	
60	R3	31/22	61.1 - 63.7	RQD = 22%							R3: Hard, fresh to slightly weathered, aphanitic, grey, SLATE. Joints are very close to close, low angle, undulating to planar, rough, discolored to fresh, open. Rock Quality = Very Poor Recovery = 69% Rock Core Times (min:sec): 61.1-62.1' (2:47), 62.1-63.1' (2:58), 63.1-63.7' (1:48)	
	R4	33/30	63.7 - 66.5	RQD = 0%							R4: Hard, fresh to slightly weathered, aphanitic, grey, SLATE. Joints are very close to close, low angle, undulating to planar, rough, discolored to fresh, open, with silt infilling. One high angle joint. Rock Quality = Very Poor Recovery = 91% Rock Core Times (min:sec): 63.7-64.1' (0:46), 64.1-65.1' (2:37), 65.1-66.1' (2:08), 66.1-66.5' (0:50)	
65									68.0		66.5	
											Bottom of Exploration at 66.5 feet below ground surface.	
70												
75												

Remarks:

1. NEBC drill # D-20 automatic hammer energy transfer rate = 0.931.
2. Water levels measured approximately 20 minutes after completion of drilling after casing removal.
3. Coordinates: N1731127.1, E481204.8

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: I-95 Bridge over Broadway No. 5789
Location: Bangor, Maine

Boring No.: BB-BI95-104
WIN: 22276.01

Driller:	New England Boring Contractors	**Elevation (ft.)**	140.1	**Auger ID/OD:**	4.25" OD SSA
Operator:	Mike Porter	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	B. Woodman	**Rig Type:**	Track B-53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/11/18 - 10/15/18	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NX
Boring Location:	Sta. 256+21.4, Offset 62.3 R	**Casing ID/OD:**	4"	**Water Level*:**	12.9'
Hammer Efficiency Factor:	0.931	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
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MU = Unsuccessful Thin Wall Tube Sample Attempt
V = Field Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Field Vane Shear Test Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	24/15	0.0 - 2.0	1-3-5-7	8	12	SSA			Grey, dry, medium dense, GRAVEL, some fine to coarse sand, trace silt, (Fill).	G#14 A-1-a (GP-GM) WC=4.1
5	2D	24/24	5.0 - 7.0	2-4-5-4	9	14	35	135.1		-5.0- Olive, moist, stiff, Silty CLAY, mottling throughout, (Marine Clay).	LL=30 PL=20 PI=10 WC=20.7
							32				
							32				
							31				
							36				
10	3D	24/24	10.0 - 12.0	2-4-4-7	8	12	8			Olive, wet, stiff, Silty CLAY, trace fine sand, (Marine Clay).	
							12				
							15				
							24				
							27				
15	4D	24/24	15.0 - 17.0	WOH-WOH-WOH-WOH						Olive, wet, medium stiff, Silty CLAY, (Marine Clay).	LL=34 PL=21 PI=13 WC=31.2
	V1	6/6	17.6 - 18.1	S_u=659/110 psf			24			24/4.0 ft lbs 65 x 130 mm	
	V2	6/6	18.6 - 19.1	S_u=796/137 psf			25			29/5.0 ft lbs 65 x 130 mm	
							26				
20	MU1 5D	6/0 24/24	20.0 - 20.5 20.0 - 22.0	WOH-WOH-WOH-3			30			Olive, wet, medium stiff, Silty CLAY, (Marine Clay).	LL=31 PL=19 PI=12 WC=28.3
							28				
							26				
							34				
25							70	115.8		-24.3- Increased roller bit resistance, probable transition.	

Remarks:

1. NEBC drill # D-20 automatic hammer energy transfer rate = 0.931.
2. Water levels measured approximately 20 minutes after completion of drilling after casing removal.
3. Coordinates: N1731210.5, E481082.8

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: I-95 Bridge over Broadway No. 5789
Location: Bangor, Maine

Boring No.: BB-BI95-104
WIN: 22276.01

Driller:	New England Boring Contractors	**Elevation (ft.)**	140.1	**Auger ID/OD:**	4.25" OD SSA
Operator:	Mike Porter	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	B. Woodman	**Rig Type:**	Track B-53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/11/18 - 10/15/18	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NX
Boring Location:	Sta. 256+21.4, Offset 62.3 R	**Casing ID/OD:**	4"	**Water Level*:**	12.9'
Hammer Efficiency Factor: 0.931		**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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MV = Unsuccessful Field Vane Shear Test Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140 lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25	6D	24/0	25.0 - 27.0	20-18-18-18	36	56	116			No recovery.	
							76				
							88				
							95				
							97				
30	7D	24/12	30.0 - 32.0	12-11-10-14	21	33	75			Grey, moist, dense, Clayey SILT, some fine to coarse sand, trace gravel, (Glacial Till).	G#15 A-4(0) (ML) WC=12.1
							73				
							67				
							72				
							117				
35	8D	24/10	35.0 - 37.0	12-32-31-19	63	98	37			Grey, moist, very dense, fine to coarse SAND, some silt, some gravel, (Glacial Till).	
							139				
							163				
							155				
							214				
40	9D	24/12	40.5 - 42.5	14-21-44-35	65	101	R/C			Grey, moist, very dense, fine to coarse SAND, little silt, little gravel, (Glacial Till).	
45	10D	24/8	45.0 - 47.0	30-21-31-29	52	81				Grey, moist, hard, Clayey SILT, some fine to coarse sand, some gravel, (Glacial Till) .	G#16 A-4(0) (ML) WC=9.2
50											

Remarks:

1. NEBC drill # D-20 automatic hammer energy transfer rate = 0.931.
2. Water levels measured approximately 20 minutes after completion of drilling after casing removal.
3. Coordinates: N1731210.5, E481082.8

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: I-95 Bridge over Broadway No. 5789

Location: Bangor, Maine

Boring No.: BB-BI95-104

WIN: 22276.01

Driller:	New England Boring Contractors	**Elevation (ft.)**	140.1	**Auger ID/OD:**	4.25" OD SSA
Operator:	Mike Porter	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	B. Woodman	**Rig Type:**	Track B-53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/11/18 - 10/15/18	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NX
Boring Location:	Sta. 256+21.4, Offset 62.3 R	**Casing ID/OD:**	4"	**Water Level*:**	12.9'
Hammer Efficiency Factor: 0.931		**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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N-uncorrected = Raw Field SPT N-value
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N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
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LL = Liquid Limit
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C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
50	11D	24/22	50.0 - 52.0	20-43-52-62/4"	95	147				Grey-brown, moist, very dense, fine to coarse SAND, little silt, little gravel, (Glacial Till).	
								87.1		53.0	
										Increased roller bit resistance at 53.0' bgs, probable top of rock. Advanced roller bit to 54.0' and set up to core.	
	R1	60/52	54.0 - 59.0	RQD = 67%						R1: Hard, fresh, aphanitic, grey, SLATE with calcite stringers and veins. Joints are very close to close, low angle, rough to smooth, undulating, fresh, partially open. One high angle joint. Rock Quality = Fair Recovery = 87% Rock Core Times (min:sec): 54.0-55.0' (3:08), 55.0-56.0' (2:28), 56.0-57.0' (2:30), 57.0-58.0' (2:10), 58.0-59.0' (2:10)	
55											
	R2	58/55	59.0 - 63.8	RQD = 100%						R2: Hard, fresh, aphanitic, grey, SLATE with calcite stringers and veins. Joints are close to moderately spaced, moderate to high angle, planar, rough to smooth, fresh, tight to partially open. Rock Quality = Excellent Recovery = 93% Rock Core Times (min:sec): 58.3-59.0' (0:10), 59.0-60.0' (2:33), 60.0-61.0' (3:30), 61.0-62.0' (3:17), 62.0-63.0' (2:59), 63.0-63.8' (2:14)	
60											
								76.3		63.8	
										Bottom of Exploration at 63.8 feet below ground surface.	
65											
70											
75											

Remarks:

1. NEBC drill # D-20 automatic hammer energy transfer rate = 0.931.
2. Water levels measured approximately 20 minutes after completion of drilling after casing removal.
3. Coordinates: N1731210.5, E481082.8

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: I-95 Bridge over Broadway No. 5789
Location: Bangor, Maine

Boring No.: BB-B195-201
WIN: 22276.01

Driller:	New England Boring Company	**Elevation (ft.)**	139.2	**Auger ID/OD:**	2.0/4.0"
Operator:	T. Schaefer	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	E. Tome	**Rig Type:**	ATV-Mounted Mobile Drill B-53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	7/7/22-7/7/22	**Drilling Method:**	Drive & Wash	**Core Barrel:**	--
Boring Location:	Sta. 256+15.4, Offset 56.3 R	**Casing ID/OD:**	--	**Water Level*:**	Not Measured
Hammer Efficiency Factor:	0.86	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
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SSA = Solid Stem Auger
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RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
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WC = Water Content, percent
LL = Liquid Limit
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PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	24/11	0.0 - 2.0	3-5-6-8	11	16	PUSH	139.0		0'-0.2': Brown, dry, Silty fine to medium SAND, with roots, (Topsoil). 0.2	G#S-2916 A-1-b, SM WC=3.7
										0.2'-0.9': Brown, dry, medium dense, fine to coarse SAND, some gravel, little silt, (Fill).	
								134.7		4.5	
5	2D	24/20	5.0 - 7.0	4-4-4-4	8	11				Clay observed on auger flights at 4.5' bgs. Blue/grey, moist, medium stiff, Silty CLAY, (Marine Clay).	A-6, CL LL=29 PI=14 WC=20.8
	3D	24/24	7.0 - 9.0	1-3-2-2	5	7				Blue/grey, moist, medium stiff, Silty CLAY, (Marine Clay). Advanced 4" casing to 9.0'.	
	4D	24/24	9.0 - 11.0	WOH-WOH-1-3	1	1				Blue/grey, wet, very soft, Silty CLAY, (Marine Clay).	
10	5D	24/23	11.0 - 13.0	1-1-2-2	3	4				Olive/grey, wet, soft, Silty CLAY, (Marine Clay).	A-6, CL LL=37 PI=18 WC=29.3
	U1	24/20	13.0 - 15.0	PUSH						Olive, wet, Silty CLAY, (Marine Clay). Gravel piece on top of sample. Advanced 4" casing to 18.0'.	
15											
	U2	24/19	18.0 - 20.0	PUSH						Olive, wet, Silty CLAY.	
20								119.2		20.0	
										Bottom of Exploration at 20.0 feet below ground surface.	
25											

Remarks:

1. NEBC Drill #D-1 automatic hammer energy transfer rate = 0.86.
2. Coordinates: N1731204.2, E481088.6

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: I-95 Bridge over Broadway No. 5789
Location: Bangor, Maine

Boring No.: HB-B195-201
WIN: 22276.01

Driller:	New England Boring Company	**Elevation (ft.)**	132.2	**Auger ID/OD:**	4.25" OD SSA
Operator:	T. Schaefer	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	E. Tome/E. Tombaugh	**Rig Type:**	ATV-Mounted Mobile Drill B-53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	7/8/22-7/11/22	**Drilling Method:**	Drive & Wash	**Core Barrel:**	
Boring Location:	Sta. 250+85.5, Offset 79.6 L	**Casing ID/OD:**	4.0/4.5"	**Water Level*:**	11.8'
Hammer Efficiency Factor:	0.86	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	24/16	0.0 - 2.0	WOH-4-12-8	16	23	SSA	132.0		Top 2": Brown, dry, SILT, with roots, (Topsoil).	G#S-2919 A-4(0), SM
										0.2	
										Bottom 14": Brown, dry, medium dense, fine to coarse SAND and Silt, some gravel, (Fill).	
	2D	24/12	2.0 - 4.0	4-7-14-12	21	30				Top 6": Grey/blue, moist, very stiff, Clayey Sandy SILT, (Fill). Bottom 6": Brown, moist, gravelly fine to coarse SAND, little silt, (Fill).	
	3D	24/23	4.0 - 6.0	7-14-16-18	30	43				Top 4": Brown, moist, gravelly fine to coarse SAND, little silt, (Fill). Middle 17": Grey/brown, SILT & CLAY, little gravel, (Fill). Bottom 2": Brown/grey, moist, GRAVEL, some fine to coarse sand, trace silt, (Fill).	G#S-2920 A-4(8), ML
5											
	4D	9/9	6.0 - 6.8	11-50/3"	R		R/C			Olive, moist, SILT, some fine to coarse sand, little gravel, (Fill). Advanced 4" casing to 7.0' bgs and railed ahead to 8.0'; till in wash return.	
	5D	21/15	8.0 - 9.8	19-14-11-7	25	36				Olive, wet, very stiff, SILT & CLAY, little fine to medium sand, (Fill). Advanced 4" casing to 10.0'; increase in roller cone resistance during advancement from 12.5'-13.0'. Drill rig action indicates probable cobble from 12.5'-13.0'.	G#S-2921 A-4(7), ML
10											
								119.2		13.0	
15	6D	24/17	15.0 - 17.0	3-4-10-27	14	20				Top 13": Olive, wet, Silty CLAY, (Marine Clay).	
								116.1		16.1	
										Bottom 4": Olive-brown, wet, SILT, little fine to coarse sand, trace gravel, (Glacial Till).	
20	7D	21/13	20.0 - 21.8	22-17-17-50/4"	34	49				Olive, wet, hard, fine to coarse SAND, some silt & clay, some gravel, (Glacial Till).	G#S-2922 A-2-4(0), SM
								110.4		21.8	
										Roller cone resistance at 22.2'; possible bedrock. Advanced roller cone to 23.0' refusal, and set up to core. Splitspoon refusal at 21.8', probable top of rock.	
	R1	60/60	23.0 - 28.0	RQD = 72%			NX			R1: Hard, fresh, aphanitic, grey, SLATE, with white veins. Primary joints are moderately spaced to wide, high angle, planar, smooth, fresh, tight to partially open. Secondary joints are close to moderately	
25											

Remarks:

1. NEBC Drill #D-1 automatic hammer energy transfer rate = 0.86.
2. Coordinates: N1730667.4, E481199.2

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: I-95 Bridge over Broadway No. 5789

Location: Bangor, Maine

Boring No.: HB-B195-201

WIN: 22276.01

Driller:	New England Boring Company	**Elevation (ft.)**	132.2	**Auger ID/OD:**	4.25" OD SSA
Operator:	T. Schaefer	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	E. Tome/E. Tombaugh	**Rig Type:**	ATV-Mounted Mobile Drill B-53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	7/8/22-7/11/22	**Drilling Method:**	Drive & Wash	**Core Barrel:**	
Boring Location:	Sta. 250+85.5, Offset 79.6 L	**Casing ID/OD:**	4.0/4.5"	**Water Level*:**	11.8'
Hammer Efficiency Factor: 0.86		**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample Attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample Attempt
V = Field Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Field Vane Shear Test Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140 lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25										spaced, low angle to moderately dipping, planar, smooth, fresh to decomposed, tight to open. Recovery = 100% Rock Quality = Fair Rock Core Times (min:sec): 23.0-24.0' (2:42), 24.0-25.0' (2:48), 25.0-26.0' (2:29), 26.0-27.0' (2:47), 27.0-28.0' (2:55)	
								104.2		28.0 **Bottom of Exploration at 28.0 feet below ground surface.**	
30											
35											
40											
45											
50											

Remarks:

1. NEBC Drill #D-1 automatic hammer energy transfer rate = 0.86.
2. Coordinates: N1730667.4, E481199.2

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: I-95 Bridge over Broadway No. 5789
Location: Bangor, Maine

Boring No.: HB-B195-202
WIN: 22276.01

Driller:	New England Boring Company	**Elevation (ft.)**	138.5	**Auger ID/OD:**	4.25" OD SSA
Operator:	T. Schaefer	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	E. Tome	**Rig Type:**	ATV-Mounted Mobile Drill B-53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	7/6/22-7/6/22	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NX
Boring Location:	Sta. 250+98.0, Offset 85.4 R	**Casing ID/OD:**	4/4.5"	**Water Level*:**	Not Measured
Hammer Efficiency Factor: 0.86		**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
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MD = Unsuccessful Split Spoon Sample Attempt
U = Thin Wall Tube Sample
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MV = Unsuccessful Field Vane Shear Test Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	24/9	0.0 - 2.0	1-5-8-12	13	19	PUSH	138.3		Top 2": Brown, moist, Silty fine to coarse SAND, with organics, (Topsoil).	
										0.2	
										Bottom 7": Light brown, dry, medium dense, gravelly fine to coarse SAND, some silt, (Fill).	
	2D	24/14	2.0 - 4.0	10-10-9-12	19	27				Light brown, dry, medium dense, sandy GRAVEL, little silt, glacial till in spoon tip, (Fill).	G#S-2923 A-1-a, GM WC=2.3
								134.5		4.0	
	3D	24/14	4.0 - 6.0	14-8-10-10	19	27	6			Olive-brown/grey, dry, very stiff, Silty CLAY, (Marine Clay).	
5											
	4D	24/24	6.0 - 8.0	7-8-7-8	15	22				Olive-brown/grey, moist, very stiff, Silty CLAY, (Marine Clay).	
	5D	24/24	8.0 - 10.0	3-4-3-4	7	10				Olive-brown, moist, stiff, Silty CLAY, trace fine sand, (Marine Clay). Advanced 4" casing to 10.0' bgs. Advanced roller cone to 15.0' bgs. Increased resistance of roller cone at 14.9'.	A-6, CL LL=38 PI=18 WC=24.4
10							R/C				G#S-2925 A-4(10), ML
15	6D	1/1	15.0 - 15.1	50/1"	R			123.4		Olive-brown, wet, Silty CLAY, with fractured rock in tip of spoon, (Marine Clay). Splitspoon refusal at 15.1', advanced roller bit to 16.0' and set up to core.	
										15.1	
	R1	56/56	16.0 - 20.7	RQD = 7%						R1: Hard, fresh to slightly weathered, aphanitic, grey, SLATE, with quartz from 16.3'-16.4' and 18.8'-18.9'. Primary joints are extremely close to close, moderately dipping, smooth, planar, fresh, tight to partially open. Secondary joints are vertical. Recovery = 100% Rock Quality = Very Poor Rock Core Times (min:sec): 16.0-17.0' (2:53), 17.0-18.0' (2:30), 18.0-19.0' (2:32), 19.0-20.0' (3:06), 20.0-20.7' (1:33)	
20								117.8		20.7	
										Bottom of Exploration at 20.7 feet below ground surface.	
25											

Remarks:

1. NEBC Drill #D-1 automatic hammer energy transfer rate = 0.86.
2. Coordinates: N1730688.6, E481035.2

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: I-95 Bridge over Broadway No. 5789
Location: Bangor, Maine

Boring No.: HB-B195-203
WIN: 22276.01

Driller:	New England Boring Company	**Elevation (ft.)**	125.7	**Auger ID/OD:**	2.25/6.25" HSA
Operator:	T. Schaefer	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	E. Tome	**Rig Type:**	ATV-Mounted Mobile Drill B-53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	7/8/22-7/8/22	**Drilling Method:**	HSA	**Core Barrel:**	--
Boring Location:	Sta. 252+78.1, Offset 109.7 L	**Casing ID/OD:**	--	**Water Level*:**	2.0'
Hammer Efficiency Factor:	0.86	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
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MU = Unsuccessful Thin Wall Tube Sample Attempt
V = Field Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Field Vane Shear Test Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	24/9	0.0 - 2.0	WOH-WOH-2-2	2	3	HSA	125.5		Top 2": Dark brown, wet, SILT, with organics, (Topsoil).	CL LL=23 PI=8 WC=18.1
										0.2 Bottom 7": Grey/blue, wet, SILT & CLAY (Marine Clay).	
	2D	24/12	2.0 - 4.0	1-8-14-4	21	30				Top 6": Grey/blue, wet, Silty CLAY, (Marine Clay).	
								122.7		3.0 Bottom 6": Olive/grey, wet, sandy GRAVEL, little silt, wood in spoon tip, (Glacial Till).	
	3D	24/13	4.0 - 6.0	6-9-13-13	22	32				Top 2": Olive/grey, wet, sandy GRAVEL, little silt, (Glacial Till). Bottom 11": Olive/tan, wet, dense, fine to coarse SAND, some silt & clay, some gravel, (Glacial Till).	G#S-2927 A-2-4(0), SM WC=9.6
5	4D	24/1	6.0 - 8.0	11-22-19-20	41	59				Olive/tan, wet, GRAVEL, some fine to coarse sand, some silt. Spoon likely pushed rock, (Glacial Till)	
	5D	24/8	8.0 - 10.0	5-6-7-6	13	19				Olive/tan, wet, medium dense, Silty fine to coarse SAND, some gravel, (Glacial Till).	
10	6D	24/10	10.0 - 12.0	11-10-26-14	36	52				Olive, wet, very dense, Silty fine to coarse SAND, some gravel, (Glacial Till).	
15	7D	24/14	15.0 - 17.0	4-9-17-11	26	37				Olive, wet, dense, fine to coarse SAND, some gravel, some silt, (Glacial Till).	G#S-2928 A-2-4(0), SM
20	8D	24/10	20.0 - 22.0	19-19-17-24	36	52				Olive, wet, hard, SILT, little fine to coarse sand, trace gravel, (Glacial Till).	
25											

Remarks:

1. NEBC Drill #D-1 automatic hammer energy transfer rate = 0.86.
2. Coordinates: N1730859.6, E481238.9

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: I-95 Bridge over Broadway No. 5789
Location: Bangor, Maine

Boring No.: HB-B195-203
WIN: 22276.01

Driller:	New England Boring Company	**Elevation (ft.)**	125.7	**Auger ID/OD:**	2.25/6.25" HSA
Operator:	T. Schaefer	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	E. Tome	**Rig Type:**	ATV-Mounted Mobile Drill B-53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	7/8/22-7/8/22	**Drilling Method:**	HSA	**Core Barrel:**	--
Boring Location:	Sta. 252+78.1, Offset 109.7 L	**Casing ID/OD:**	--	**Water Level*:**	2.0'
Hammer Efficiency Factor: 0.86		**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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V = Field Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Field Vane Shear Test Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140 lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25	9D	24/14	25.0 - 27.0	6-9-19-59	28	40		96.7		Olive, wet, dense, fine to coarse SAND, some gravel, some silt, (Glacial Till). Fractured slate from 26.6'-26.8'. Auger refusal at 29.0'.	G#S-2929 A-2-4(0), SM
										29.0 **Bottom of Exploration at 29.0 feet below ground surface.**	
30											
35											
40											
45											
50											

Remarks:

1. NEBC Drill #D-1 automatic hammer energy transfer rate = 0.86.
2. Coordinates: N1730859.6, E481238.9

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: I-95 Bridge over Broadway No. 5789
Location: Bangor, Maine

Boring No.: HB-B195-204
WIN: 22276.01

Driller:	New England Boring Company	**Elevation (ft.)**	138.6	**Auger ID/OD:**	--
Operator:	T. Schaefer	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	E. Tome	**Rig Type:**	ATV-Mounted Mobile Drill B-53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	7/6/22-7/6/22	**Drilling Method:**	Drive & Wash	**Core Barrel:**	
Boring Location:	Sta. 253+72.0, Offset 108.3 R	**Casing ID/OD:**	4/4.5"	**Water Level*:**	4.0'
Hammer Efficiency Factor:	0.86	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
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MD = Unsuccessful Split Spoon Sample Attempt
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MU = Unsuccessful Thin Wall Tube Sample Attempt
V = Field Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Field Vane Shear Test Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	24/16	0.0 - 2.0	WOH-WOH-2-4	2	3	PUSH	138.1		Top 6": Brown, moist, SILT, with roots, (Topsoil).	
										0.5	
										Bottom 10": Olive-brown/grey, moist, Silty CLAY, (Marine Clay).	
	2D	24/22	2.0 - 4.0	1-3-3-4	6	9				Olive-brown/grey/rust, moist, stiff, Silty CLAY, with rust staining, (Marine Clay).	A-6, CL LL=33 PI=16 WC=23.8
	3D	24/24	4.0 - 6.0	2-3-4-5	7	10				Olive-brown/grey/rust, wet, stiff, Silty CLAY, with rust staining, (Marine Clay).	
5	4D	24/24	6.0 - 8.0	2-2-4-5	6	9				Olive-brown/rust, wet, stiff, Silty CLAY, (Marine Clay).	A-6, CL LL=34 PI=16 WC=24.3
	5D	24/24	8.0 - 10.0	2-3-3-4	6	9				Olive-brown/rust, wet, stiff, Silty CLAY, (Marine Clay). Advanced 4" casing to 10.0' bgs.	
10							R/C				
15	6D	24/24	15.0 - 17.0	1-WOH-1-5	2	3				Top 21": Grey, wet, Silty CLAY, (Marine Clay).	CL LL=27 PI=12 WC=24.2
								121.8		16.8	
										Bottom 3": Grey, wet, Silty fine to coarse SAND, little gravel, (Glacial Till). Increase in drill chatter and roller cone advancement at 17.8' bgs.	
20	7D	24/10	20.0 - 22.0	11-8-8-7	16	23				Grey, wet, stiff, Sandy SILT, trace gravel, (Glacial Till).	G#S-2933 A-4(2), ML
25											

Remarks:

1. NEBC Drill #D-1 automatic hammer energy transfer rate = 0.86.
2. Coordinates: N1730963.4, E481025.5

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Boring No.: HB-B195-204

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: I-95 Bridge over Broadway No. 5789

Location: Bangor, Maine

Boring No.: HB-B195-204

WIN: 22276.01

Driller:	New England Boring Company	**Elevation (ft.)**	138.6	**Auger ID/OD:**	--
Operator:	T. Schaefer	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	E. Tome	**Rig Type:**	ATV-Mounted Mobile Drill B-53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	7/6/22-7/6/22	**Drilling Method:**	Drive & Wash	**Core Barrel:**	
Boring Location:	Sta. 253+72.0, Offset 108.3 R	**Casing ID/OD:**	4/4.5"	**Water Level*:**	4.0'
Hammer Efficiency Factor:	0.86	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample Attempt
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MU = Unsuccessful Thin Wall Tube Sample Attempt
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MV = Unsuccessful Field Vane Shear Test Attempt
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SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140 lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25	8D	24/10	25.0 - 27.0	6-7-8-10	15	22				Grey, wet, medium dense, Silty fine to coarse SAND, little gravel, 2 rounded rocks in bottom 1", (Glacial Till).	
	9D	24/6	29.0 - 31.0	6-8-13-14	21	30				Grey, wet, dense, silty fine SAND, trace gravel, (Glacial Till).	
30								107.6		31.0 **Bottom of Exploration at 31.0 feet below ground surface.**	
35											
40											
45											
50											

Remarks:

1. NEBC Drill #D-1 automatic hammer energy transfer rate = 0.86.
2. Coordinates: N1730963.4, E481025.5

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: I-95 Bridge over Broadway No. 5789
Location: Bangor, Maine

Boring No.: HB-B195-205
WIN: 22276.01

Driller:	New England Boring Company	**Elevation (ft.)**	130.5	**Auger ID/OD:**	2.25/6.25" HSA
Operator:	T. Schaefer	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	E. Tombaugh	**Rig Type:**	ATV-Mounted Mobile Drill B-53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	7/12/22-7/12/22	**Drilling Method:**	HSA	**Core Barrel:**	--
Boring Location:	Sta. 256+18.3, Offset 107.6 L	**Casing ID/OD:**	--	**Water Level*:**	9.8'
Hammer Efficiency Factor:	0.86	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample Attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample Attempt
V = Field Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Field Vane Shear Test Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	24/21	0.0 - 2.0	4-2-2-1	4	6	SSA	130.4		Top 1": Brown, dry, SILT, with roots, (Topsoil). 0.1	
										Bottom 20": Brown, moist, soft, Clayey SILT, trace gravel, (Marine Clay). Iron staining.	
	2D	24/24	2.0 - 4.0	WOH-1-1-2	2	3				Olive, moist, Silty CLAY, (Marine Clay). Iron staining.	A-6, CL LL=35 PI=17 WC=28.3
	3D	24/24	4.0 - 6.0	WOH-WOH-1-2	1	1				Olive, moist, Silty CLAY, (Marine Clay).	
5	4D	24/24	6.0 - 8.0	WOH-WOH-WOH-WOH	--					Olive, moist, Silty CLAY, (Marine Clay).	
	5D	24/24	8.0 - 10.0	WOH-WOH-WOH-WOH	--		HSA			Grey, wet, Silty CLAY, (Marine Clay).	
10											
15	6D	24/24	15.0 - 17.0	WOH-WOH-WOH-WOH	--					Grey, wet, Silty CLAY, (Marine Clay).	A-6, CL LL=30 PI=13 WC=26.2
20	7D	24/12	20.0 - 22.0	WOH-5-7-8	12	17		110.5		20.0 Grey, wet, medium dense, silty fine to coarse SAND, little gravel, (Glacial Till).	
25											

Remarks:

1. NEBC Drill #D-1 automatic hammer energy transfer rate = 0.86.
2. Coordinates: N1731199.6, E481252.3

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: I-95 Bridge over Broadway No. 5789

Location: Bangor, Maine

Boring No.: HB-B195-205

WIN: 22276.01

Driller:	New England Boring Company	**Elevation (ft.)**	130.5	**Auger ID/OD:**	2.25/6.25" HSA
Operator:	T. Schaefer	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	E. Tombaugh	**Rig Type:**	ATV-Mounted Mobile Drill B-53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	7/12/22-7/12/22	**Drilling Method:**	HSA	**Core Barrel:**	--
Boring Location:	Sta. 256+18.3, Offset 107.6 L	**Casing ID/OD:**	--	**Water Level*:**	9.8'
Hammer Efficiency Factor: 0.86		**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample Attempt
U = Thin Wall Tube Sample
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V = Field Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Field Vane Shear Test Attempt
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SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140 lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25	8D	24/15	25.0 - 27.0	6-9-11-12	20	29				Grey, wet, hard, SILT, some fine to coarse sand, some gravel, (Glacial Till).	G#S-2936 A-4(3), ML
30	9D	24/16	30.0 - 32.0	9-12-15-17	27	39				Grey, wet, dense, silty fine to coarse SAND, some gravel, (Glacial Till).	
								98.5		32.0	
										Bottom of Exploration at 32.0 feet below ground surface.	
35											
40											
45											
50											

Remarks:

1. NEBC Drill #D-1 automatic hammer energy transfer rate = 0.86.
2. Coordinates: N1731199.6, E481252.3

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: I-95 Bridge over Broadway No. 5789
Location: Bangor, Maine

Boring No.: HB-B195-206
WIN: 22276.01

Driller:	New England Boring Company	**Elevation (ft.)**	138.0	**Auger ID/OD:**	2.25/6.25" HSA
Operator:	T. Schaefer	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	E. Tombaugh	**Rig Type:**	ATV-Mounted Mobile Drill B-53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	7/12/22-7/12/22	**Drilling Method:**	HSA	**Core Barrel:**	--
Boring Location:	Sta. 257+94.3, Offset 90.9 L	**Casing ID/OD:**	--	**Water Level*:**	See Remark 2.
Hammer Efficiency Factor: 0.86		**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample Attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample Attempt
V = Field Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Field Vane Shear Test Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	24/16	0.0 - 2.0	8-7-9-6	16	23	SSA	137.6		Top 5": Dark brown, dry, SILT, with roots, (Topsoil). 0.4	G#S-2937 A-4(3), ML
										Bottom 11": Brown, dry, medium dense, SILT & CLAY, some fine to coarse sand, little gravel, (Fill).	
	2D	24/19	2.0 - 4.0	1-2-2-3	4	6		135.4		Top 7": Brown, moist, loose, fine to coarse Silty SAND, trace gravel, (Fill). 2.6	WC=17.3
										Bottom 12": Olive, moist, Silty CLAY, (Marine Clay).	
	3D	24/24	4.0 - 6.0	1-2-9-5	11	16				Grey, moist, very stiff, Silty CLAY, (Marine Clay).	WC=17.3
5											
	4D	24/24	6.0 - 8.0	4-4-5-5	9	13				Olive, moist, stiff, Silty CLAY, (Marine Clay). Fine sand seams at 6.6', 7.4', 7.7'.	
	5D	24/24	8.0 - 10.0	2-2-3-3	5	7				Olive, moist, medium stiff, Silty CLAY, (Marine Clay).	
10							HSA				
15	6D	24/24	15.0 - 17.0	WOH-WOH-WOH-WOH	--					Grey, wet, Silty CLAY, (Marine Clay).	CL LL=24 PI=10 WC=28
								119.0		19.0	
20	7D	24/6	20.0 - 22.0	4-5-3-6	8	11				Increase in auger resistance during advancement at 19.0' bgs indicates probable strata change. Grey, wet, medium dense, fine to coarse Silty SAND, trace gravel, (Glacial Till).	
25											

Remarks:

1. NEBC Drill #D-1 automatic hammer energy transfer rate = 0.86.
2. Cave-in at 8.0'; no water above 8.0'.
3. Coordinates: N1731376.1, E481243.8

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Boring No.: HB-B195-206

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: I-95 Bridge over Broadway No. 5789
Location: Bangor, Maine

Boring No.: HB-B195-206
WIN: 22276.01

Driller:	New England Boring Company	**Elevation (ft.)**	138.0	**Auger ID/OD:**	2.25/6.25" HSA
Operator:	T. Schaefer	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	E. Tombaugh	**Rig Type:**	ATV-Mounted Mobile Drill B-53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	7/12/22-7/12/22	**Drilling Method:**	HSA	**Core Barrel:**	--
Boring Location:	Sta. 257+94.3, Offset 90.9 L	**Casing ID/OD:**	--	**Water Level*:**	See Remark 2.
Hammer Efficiency Factor: 0.86		**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample Attempt
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MU = Unsuccessful Thin Wall Tube Sample Attempt
V = Field Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Field Vane Shear Test Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140 lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25	8D	24/18	25.0 - 27.0	4-7-10-10	17	24				Grey, wet, medium dense, SILT, some fine to coarse sand, trace gravel, (Glacial Till).	G#S-2940 A-4(3), ML
30	9D	24/24	30.0 - 32.0	7-8-10-10	18	26		106.0		Grey, wet, medium dense, fine to coarse SAND, little gravel, (Glacial Till). 32.0 **Bottom of Exploration at 32.0 feet below ground surface.**	
35											
40											
45											
50											

Remarks:

1. NEBC Drill #D-1 automatic hammer energy transfer rate = 0.86.
2. Cave-in at 8.0'; no water above 8.0'.
3. Coordinates: N1731376.1, E481243.8

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: I-95 Bridge over Broadway No. 5789
Location: Bangor, Maine

Boring No.: HB-B195-207
WIN: 22276.01

Driller:	New England Boring Company	**Elevation (ft.)**	143.5	**Auger ID/OD:**	2.25/6.25" HSA
Operator:	T. Schaefer	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	E. Tombaugh	**Rig Type:**	ATV-Mounted Mobile Drill B-53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	7/12/22-7/12/22	**Drilling Method:**	HSA	**Core Barrel:**	--
Boring Location:	Sta. 259+53.6, Offset 78.7 R	**Casing ID/OD:**	--	**Water Level*:**	7.8'
Hammer Efficiency Factor:	0.86	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample Attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample Attempt
V = Field Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Field Vane Shear Test Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	24/19	0.0 - 2.0	2-3-9-12	12	17	SSA	143.3		Top 2": Brown, dry, SILT, with roots, (Topsoil). 0.2 Bottom 17": Brown, dry, medium dense, fine to coarse SAND, some silt, trace gravel, (Fill).	
	2D	24/20	2.0 - 4.0	5-15-6-4	21	30				Top 4": Brown, dry, fine to coarse Silty SAND, (Fill). Bottom 16": Grey, dry, Silty GRAVEL, some fine to coarse sand, (Fill).	G#S-2941 A-4(0), GM WC=7.9
	3D	24/24	4.0 - 6.0	1-3-3-4	6	9		139.5		4.0 Top 7": Olive, moist, SILT, (Marine Clay). Bottom 14": Olive, moist, stiff, Silty CLAY, (Marine Clay).	
5	4D	24/24	6.0 - 8.0	3-4-5-4	9	13				Olive, moist, stiff, Silty CLAY, (Marine Clay).	WC=23.1
	5D	24/24	8.0 - 10.0	2-4-4-4	8	11				Olive, moist, medium stiff, Silty CLAY, (Marine Clay).	
10							HSA				
								131.0		12.5	
15	6D	24/4	15.0 - 17.0	16-15-12-10	27	39				Olive, moist, dense, Silty fine to coarse SAND, trace gravel, (Glacial Till). Sand coming up into hole at 17.0'.	
20	7D	13/8	20.0 - 21.1	10-14-25/1"	R			122.4		Grey, wet, very dense, fine to coarse SAND, little silt, little gravel, (Glacial Till). Weathered rock in tip of spoon. 21.1 **Bottom of Exploration at 21.1 feet below ground surface.**	
25											

Remarks:

1. NEBC Drill #D-1 automatic hammer energy transfer rate = 0.86.
2. Coordinates: N1731535.6, E481239.0

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Boring No.: HB-B195-207

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: I-95 Bridge over Broadway No. 5789
Location: Bangor, Maine

Boring No.: HB-B195-208
WIN: 22276.01

Driller:	New England Boring Company	**Elevation (ft.)**	150.1	**Auger ID/OD:**	2.25/6.25" HSA
Operator:	T. Schaefer	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	E. Tombaugh	**Rig Type:**	ATV-Mounted Mobile Drill B-53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	7/12/22-7/12/22	**Drilling Method:**	HSA	**Core Barrel:**	--
Boring Location:	Sta. 261+53.7, Offset 64.7 L	**Casing ID/OD:**	--	**Water Level*:**	See Remark 2.
Hammer Efficiency Factor:	0.86	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
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MD = Unsuccessful Split Spoon Sample Attempt
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SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	24/15	0.0 - 2.0	2-4-5-7	9	13	SSA	149.9		Top 2": Brown, dry, SILT, with roots (Topsoil). 0.2	G#S-2943 A-4(0), SM WC=9.3
										Bottom 13": Brown, dry, medium dense, Silty fine to coarse SAND, some gravel, (Fill) .	
	2D	24/10	2.0 - 4.0	5-4-2-7	6	9				Brown, moist, loose, fine to medium SAND, little silt, trace gravel, (Fill).	
	3D	24/6	4.0 - 6.0	1-5-11-11	16	23				Brown, moist, hard, SILT, some fine to coarse sand, little gravel, (Fill).	G#S-2944 A-4(5), ML
5							HSA				
	4D	24/17	6.0 - 8.0	5-8-18-10	26	37				Brown, moist, dense, fine to coarse SAND, some silt, little gravel, (Fill).	
	5D	24/9	8.0 - 10.0	10-14-9-7	23	33		142.1		8.0 Grey, moist, hard, Silty CLAY, (Marine Clay).	
10											
15	6D	24/24	15.0 - 17.0	2-2-2-2	4	6				Olive, wet, medium stiff, Silty CLAY, (Marine Clay).	A-6, CL LL=30 PI=14 WC=24.6
20	7D	24/21	20.0 - 22.0	WOH-WOH-2-4	2	3				Grey, wet, Silty CLAY, some fine to coarse sand, 1" piece of gravel in spoon tip, (Marine Clay).	
								128.1		22.0	
25											

Remarks:

1. NEBC Drill #D-1 automatic hammer energy transfer rate = 0.86.
2. Cave-in at 8.5'; no water above 8.5'.
3. Coordinates: N1731727.7, E481239.0

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
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Boring No.: HB-B195-208

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: I-95 Bridge over Broadway No. 5789
Location: Bangor, Maine

Boring No.: HB-B195-208
WIN: 22276.01

Driller:	New England Boring Company	**Elevation (ft.)**	150.1	**Auger ID/OD:**	2.25/6.25" HSA
Operator:	T. Schaefer	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	E. Tombaugh	**Rig Type:**	ATV-Mounted Mobile Drill B-53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	7/12/22-7/12/22	**Drilling Method:**	HSA	**Core Barrel:**	--
Boring Location:	Sta. 261+53.7, Offset 64.7 L	**Casing ID/OD:**	--	**Water Level*:**	See Remark 2.
Hammer Efficiency Factor: 0.86		**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
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U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample Attempt
V = Field Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Field Vane Shear Test Attempt
R = Rock Core Sample
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S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
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WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25	8D	24/0	25.0 - 27.0	8-13-16-17	29	42				No recovery.	
30	9D	24/7	30.0 - 32.0	48-47-45-39	92	132				Grey, wet, very dense, silty SAND, some gravel, gravel piece in tip of spoon, (Glacial Till). Increased auger resistance at 34.0'.	
35	10D	24/2	35.0 - 37.0	16-26-38-26	64	92				Grey, wet, very dense, Silty fine to coarse SAND, little gravel, (Glacial Till).	
								113.1		37.0 **Bottom of Exploration at 37.0 feet below ground surface.**	
40											
45											
50											

Remarks:

1. NEBC Drill #D-1 automatic hammer energy transfer rate = 0.86.
2. Cave-in at 8.5'; no water above 8.5'.
3. Coordinates: N1731727.7, E481239.0

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

APPENDIX D – LABORATORY TEST RESULTS

-100 Series Borings
Laboratory Test Results

THIELSCH ENGINEERING

195 Frances Avenue
Cranston RI, 02910
Phone: (401)-467-6454
Fax: (401)-467-2398
thielsch.com
Let's Build a Solid Foundation

Client Information:
GZA GeoEnvironmental
Portland, ME
PM: B. Cardali
Assigned By: B. Cardali
Collected By: B. Cardali

Project Information:
Broadway Bridge #5789, WIN 22276.00
Bangor, ME
GZA Project Number: 09.0025990.00
Summary Page: 1 of 2
Report Date: 12.12.18

LABORATORY TESTING DATA SHEET

Boring ID	Sample No.	Depth (ft)	Laboratory No.	Identification Tests						Corrosivity Tests								Laboratory Log and Soil Description
				Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	Sulfate (mg/kg)	Chloride (mg/kg)	Sulfide (mg/kg)	Redox Potential (mv)	Electrical Resist. As Received Ohm-cm	Electrial Resist. Saturated Ohm-cm	pH	
				D2216	D4318		D6913			D2874	EPA				G57		G51	
BB-BI95-101	2D	5-7	S-1	28.7	36	22												Olive CLAY & SILT
BB-BI95-102	3D	10-12	S-2	23.2	28	19												Olive SILT & CLAY
BB-BI95-103	3D	10-12	S-3	23.8	26	18												Olive SILT & CLAY
BB-BI95-104	2D	5-7	S-4	20.7	30	20												Olive SILT & CLAY
BB-BI95-104	4D	15-17	S-5	31.2	34	21												Olive CLAY & SILT
BB-BI95-104	5D	20-22	S-6	28.3	31	19												Olive CLAY & SILT
BB-BI95-101	1D	0.5-2.5	S-7	8.5			28.0	39.1	32.9									Brown f-c SAND, some Silt, some fine Gravel
BB-BI95-101	6D	25-27	S-8	9.6			10.9	49.2	39.9									Grey Silty fine to coarse SAND, little fine Gravel
BB-BI95-101	8D	35-37	S-9	7.0			28.9	49.4	21.7									Grey f-c SAND, some f-c Gravel, some Silt
BB-BI95-102	10D	45-47	S-10	9.9			6.2	30.5	63.3									Grey SILT & CLAY, some f-c Sand, trace fine Gravel
BB-BI95-103	1D	0.5-2.5	S-11	12.1			17.7	34.7	47.6									Brown SILT, some f-c Sand, little fine Gravel

Reviewed By _____ *12.12.2018*

THIELSCH ENGINEERING	195 Frances Avenue Cranston RI, 02910 Phone: (401)-467-6454 Fax: (401)-467-2398 thielsch.com *Let's Build a Solid Foundation*	Client Information: GZA GeoEnvironmental Portland, ME PM: B. Cardali Assigned By: B. Cardali Collected By: B. Cardali	Project Information: **Broadway Bridge #5789, WIN 22276.00** **Bangor, ME** GZA Project Number: 09.0025990.00 Summary Page: 1 of 2 Report Date: 12.12.18

Boring ID	Sample No.	Depth (ft)	Laboratory No.	Identification Tests						Corrosivity Tests								Laboratory Log and Soil Description
				Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	Sulfate (mg/kg)	Chloride (mg/kg)	Sulfide (mg/kg)	Redox Potential (mv)	Electrical Resist. As Received Ohm-cm	Electrial Resist. Saturated Ohm-cm	pH	
				D2216	D4318		D6913			D2874	EPA				G57		G51	
BB-BI95-103	4D	15-17	S-12	57.6			15.1	38.0	46.9									Grey CLAYEY SILT, some f-c Sand, little fine Gravel
BB-BI95-103	7D	30-32	S-13	8.6			22.9	40.0	37.1									Grey Silty fine to coarse SAND, some fine Gravel
BB-BI95-104	1D	0-2	S-14	4.1			58.4	34.8	6.8									Grey f-c GRAVEL, some f-c Sand, trace Silt
BB-BI95-104	7D	30-32	S-15	12.1			8.3	32.6	59.1									Grey CLAYEY SILT, some f-c Sand, trace fine Gravel
BB-BI95-104	10D	45-47	S-16	9.2			21.3	24.5	54.2									Grey CLAYEY SILT, some f-c Sand, some fine Gravel

Reviewed By _____ 12.12.2018

THIELSCH ENGINEERING

State of Maine - Department of Transportation
Laboratory Testing Summary Sheet

Broadway Bridge #5789

MDOT Project Number:

GZA Project Number: 09.0025990.00

Town(s): Bangor, ME

Boring & Sample Identification Number	Station (Feet)	Sample No.	Depth (Feet)	Lab Number	Organic %	W.C.	L.L.	P.I.	Classification		
									Unified	AASHTO	Frost
BB-BI95-101		2D	5-7	S-1		28.7	36	22	CL	A-6	III
BB-BI95-102		3D	10-12	S-2		23.2	28	19	CL	A-6	IV
BB-BI95-103		3D	10-12	S-3		23.8	26	18	CL	A-4(0)	IV
BB-BI95-104		2D	5-7	S-4		20.7	30	20	CL	A-4(0)	IV
BB-BI95-104		4D	15-17	S-5		31.2	34	21	CL	A-6	III
BB-BI95-104		5D	20-22	S-6		28.3	31	19	CL	A-6	III
BB-BI95-101		1D	0.5-2.5	S-7		8.5			SM	A-2-4(0)	III
BB-BI95-101		6D	25-27	S-8		9.6			SM	A-4(0)	III
BB-BI95-101		8D	35-37	S-9		7.0			SM	A-1-b	II
BB-BI95-102		10D	45-47	S-10		9.9			CL	A-4(0)	III
BB-BI95-103		1D	0.5-2.5	S-11		12.1			SM	A-4(0)	III
BB-BI95-103		4D	15-17	S-12		57.6			ML	A-4(0)	III
BB-BI95-103		7D	30-32	S-13		8.6			SM	A-4(0)	III
BB-BI95-104		1D	0-2	S-14		4.1			GP-GM	A-1-a	I
BB-BI95-104		7D	30-32	S-15		12.1			ML	A-4(0)	III
BB-BI95-104		10D	45-47	S-16		9.2			ML	A-4(0)	III

Classification of these soil samples is in accordance with AASHTO Classification System M-145-40. This classification is followed by the "Frost Susceptibility Rating" from zero (non-frost susceptible) to Class IV (highly frost susceptible). The "Frost Susceptibility Rating" is based upon the MDOT and Corps of Engineers Classification Systems.

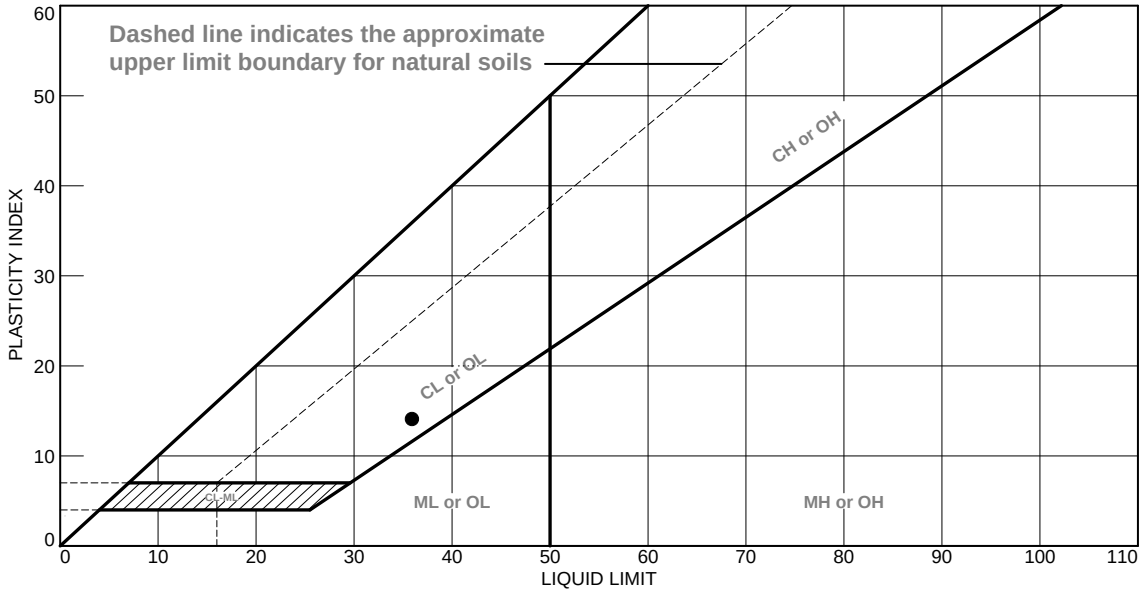
GSDC = Grain Size Distribution Curve as determined by AASHTO T 88-93 (1996) and/or ASTM D 422-63 (Reapproved 1998)

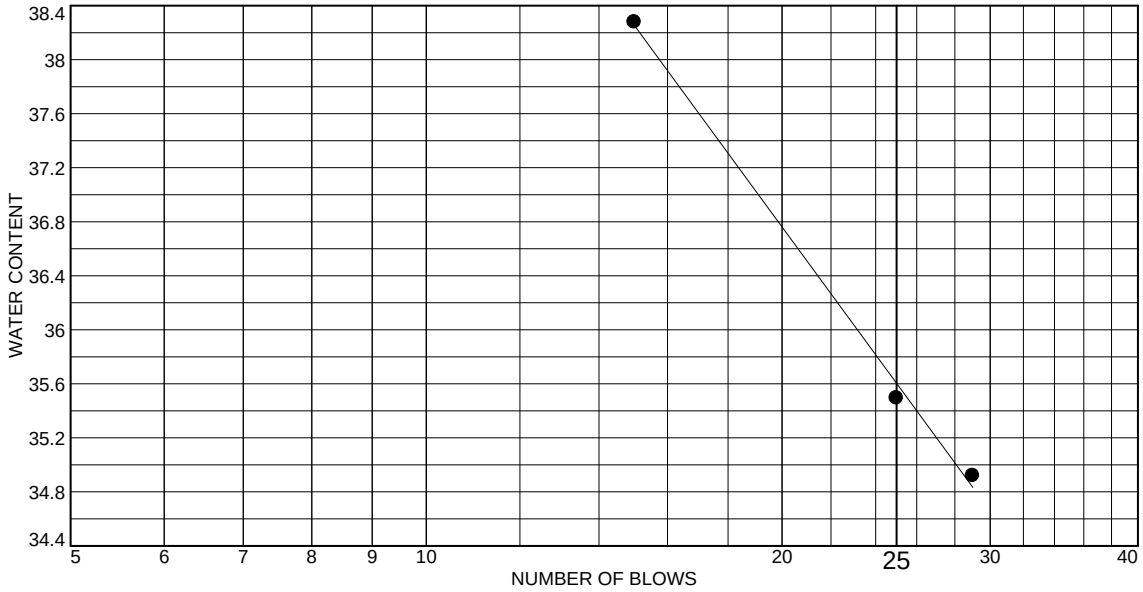
WC = water content as determined by AASHTO T 265-93 and/or ASTM D 2216-98

LL = Liquid limit as determined by AASHTO T 89-96 and/or ASTM D 4318-98

PI = Plasticity Index as determined by AASHTO 90-96 and/or ASTM D4318-98

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Olive CLAY & SILT	36	22	14			

Project No. 09.0025990.00 **Client:** GZA GeoEnvironmental

Project: Broadway Brige #5789, WIN 22276.00

Bangor, ME

Source of Sample: BB-BI95- **Depth:** 5-7'

Sample Number: 101 / 2D

Thielsch Engineering Inc.

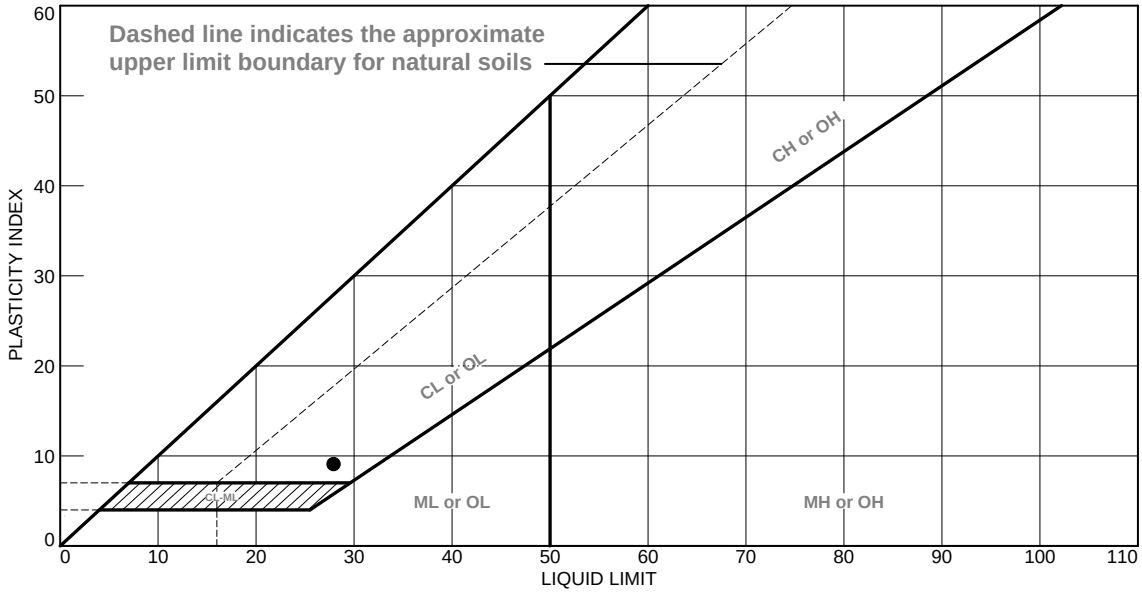
Cranston, RI

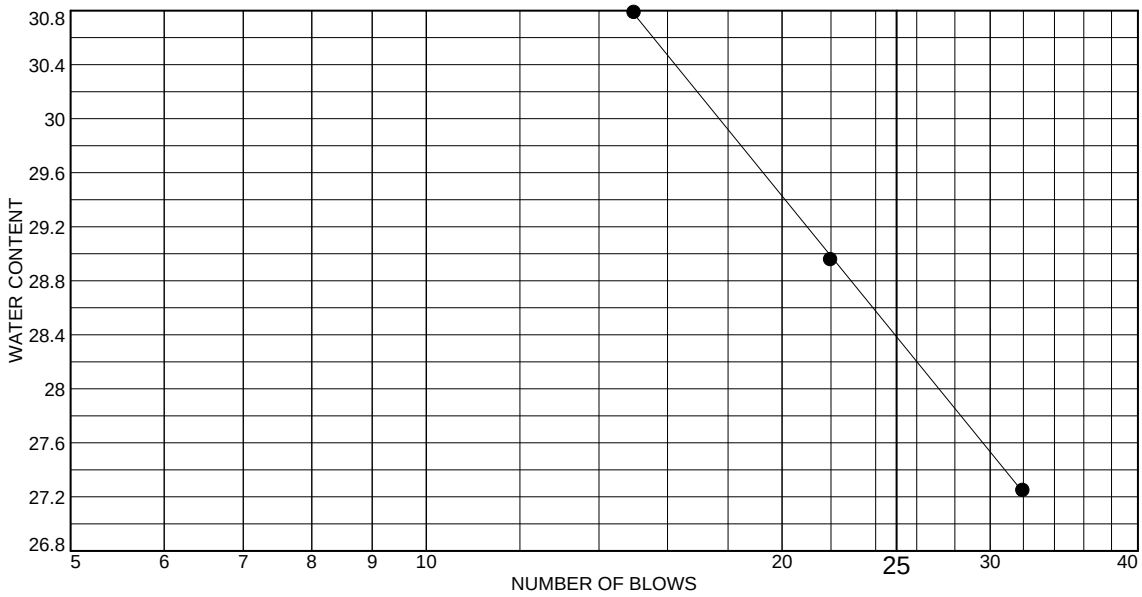
Remarks:

Figure L-1

Tested By: RR **Checked By:** sa

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Olive SILT & CLAY	28	19	9			

Project No. 09.0025990.00 **Client:** GZA GeoEnvironmental

Project: Broadway Brige #5789, WIN 22276.00

Bangor, ME

Source of Sample: BB-BI95- **Depth:** 10-12'

Sample Number: 102 / 3D

Remarks:

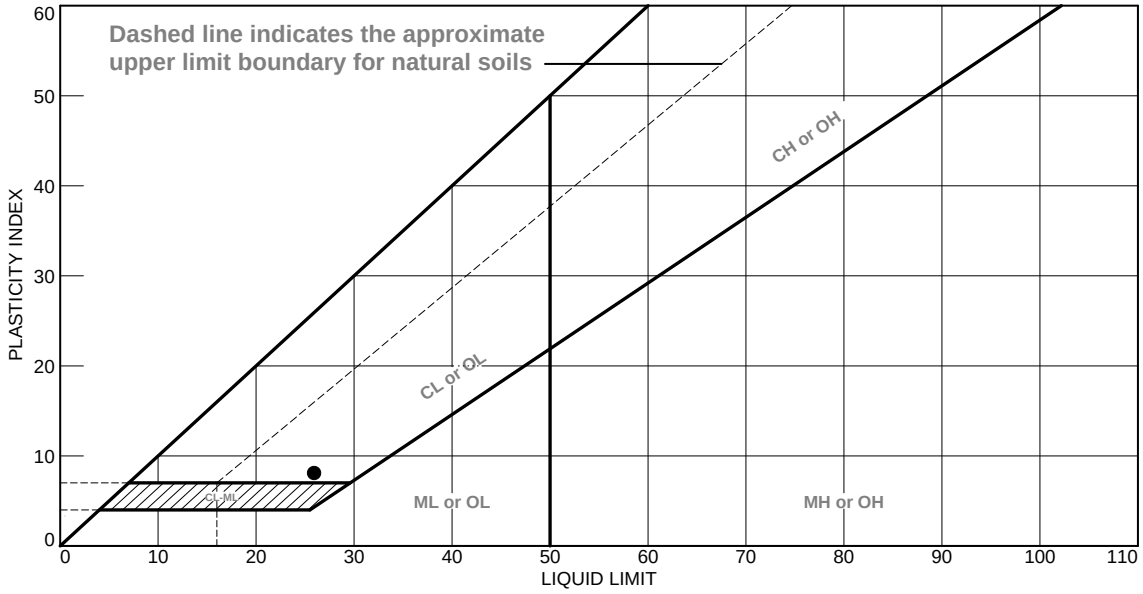
Thielsch Engineering Inc.

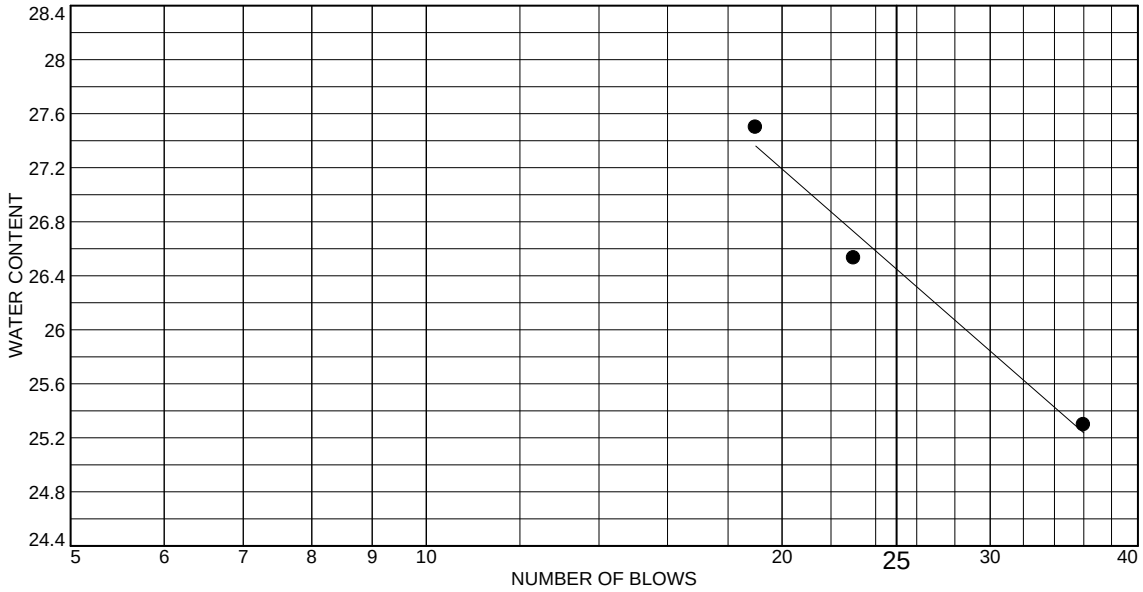
Cranston, RI

Figure L-2

Tested By: RR **Checked By:** sa

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Olive SILT & CLAY	26	18	8			

Project No. 09.0025990.00 **Client:** GZA GeoEnvironmental

Project: Broadway Brige #5789, WIN 22276.00

Bangor, ME

Source of Sample: BB-BI95- **Depth:** 10-12'

Sample Number: 103 / 3D

Remarks:

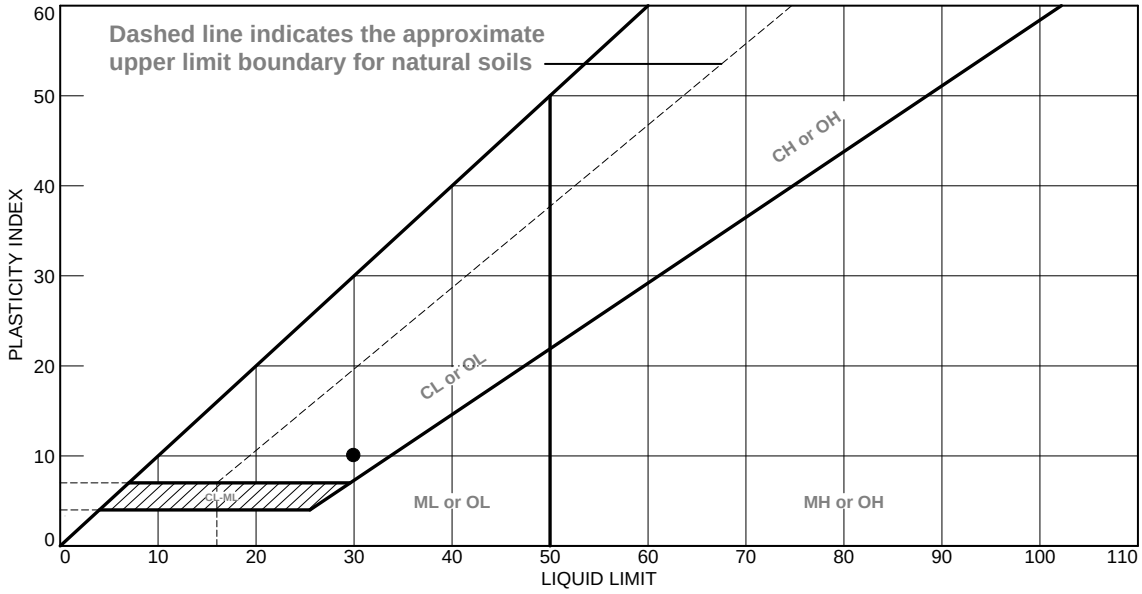
Thielsch Engineering Inc.

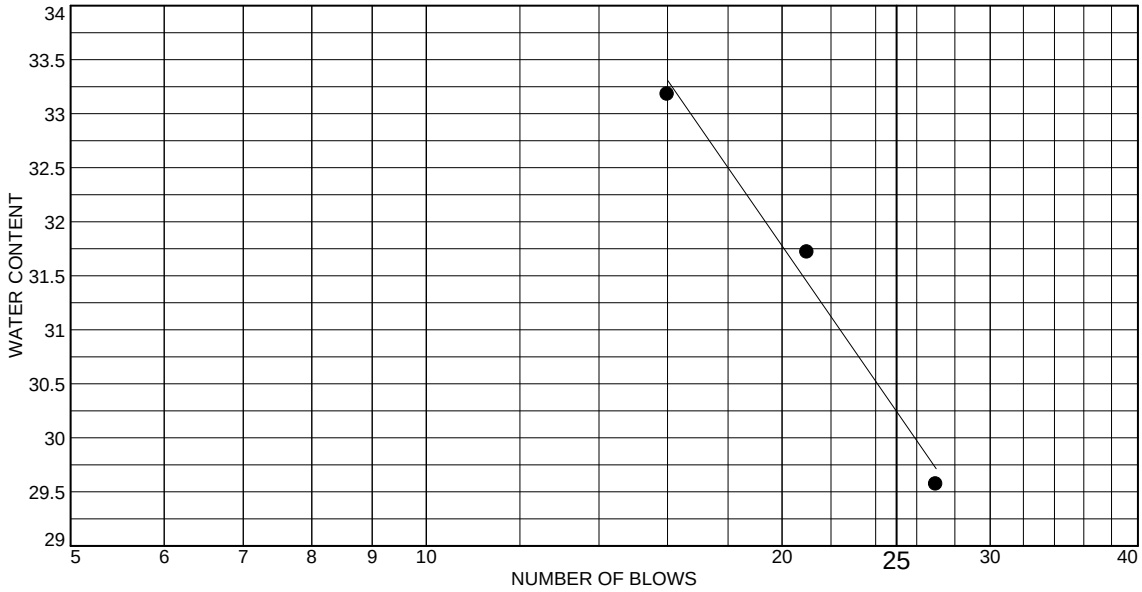
Cranston, RI

Figure L-3

Tested By: RR **Checked By:** sa

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Olive SILT & CLAY	30	20	10			

Project No. 09.0025990.00 **Client:** GZA GeoEnvironmental

Project: Broadway Brige #5789, WIN 22276.00

Bangor, ME

Source of Sample: BB-BI95- **Depth:** 5-7'

Sample Number: 104 / 2D

Remarks:

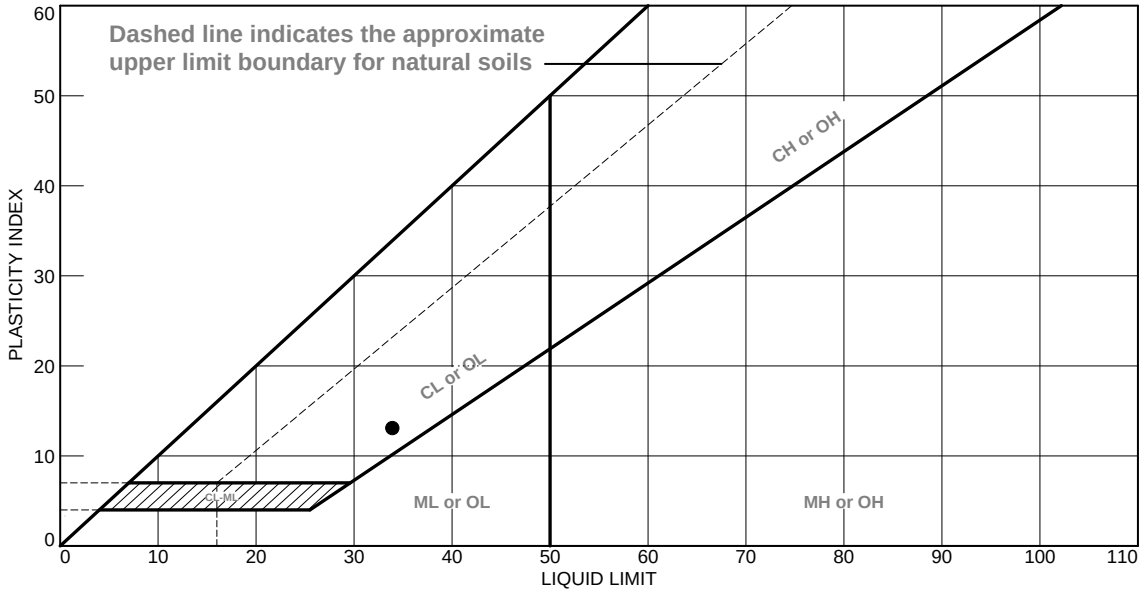
Thielsch Engineering Inc.

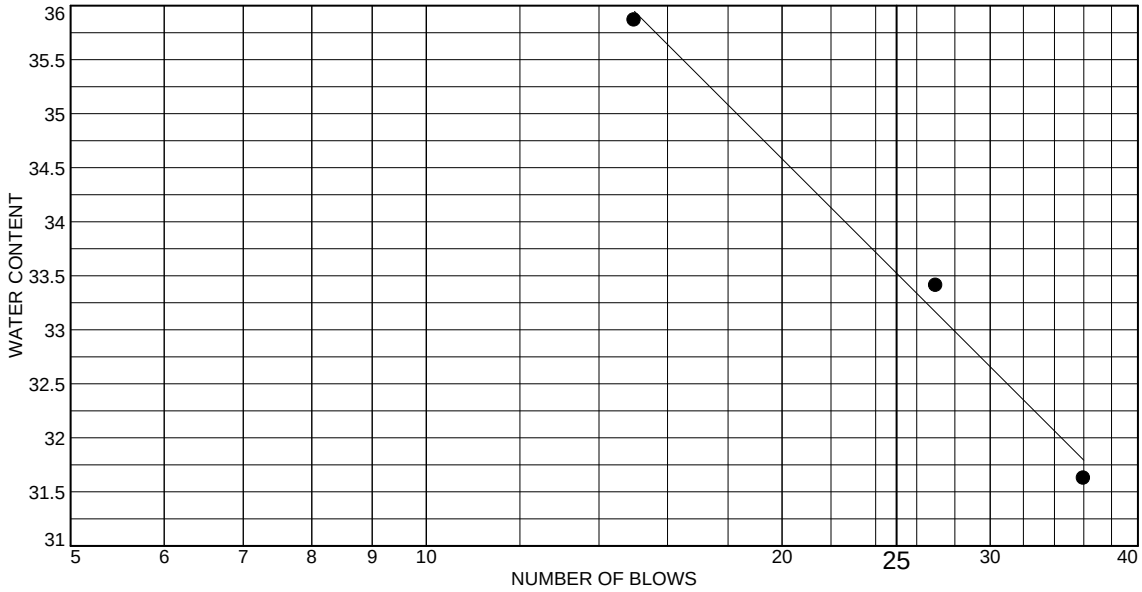
Cranston, RI

Figure L-4

Tested By: RR **Checked By:** sa

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Grey CLAY & SILT	34	21	13			

Project No. 09.0025990.00 **Client:** GZA GeoEnvironmental

Project: Broadway Brige #5789, WIN 22276.00

Bangor, ME

Source of Sample: BB-BI95- **Depth:** 15-17'

Sample Number: 104 / 4D

Thielsch Engineering Inc.

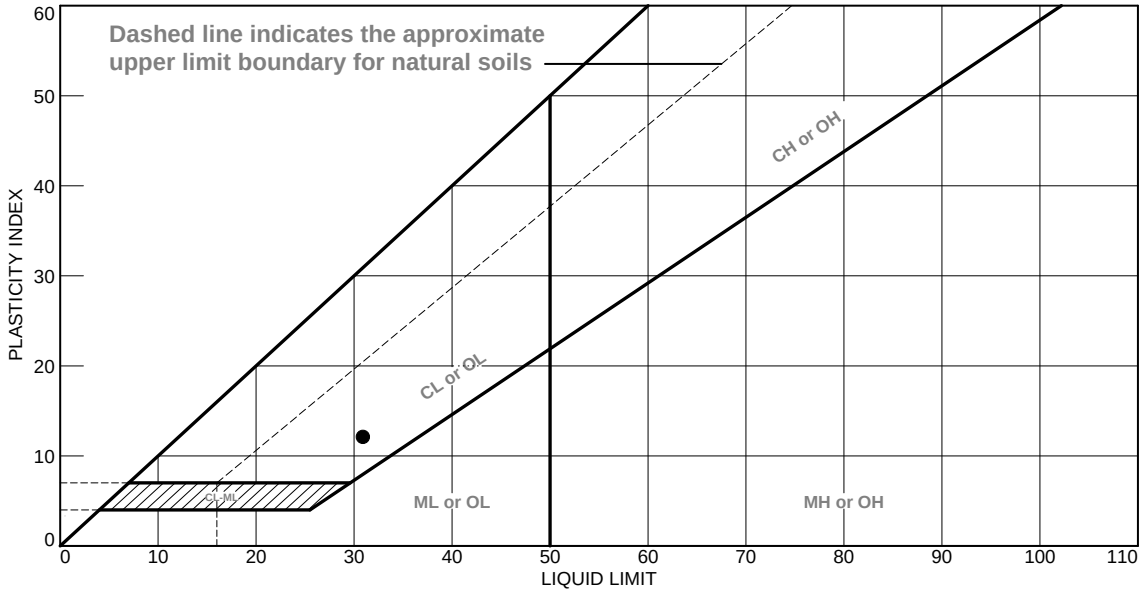
Cranston, RI

Remarks:

Figure L-5

Tested By: RR **Checked By:** sa

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Grey CLAY & SILT	31	19	12			

Project No. 09.0025990.00 **Client:** GZA GeoEnvironmental

Project: Broadway Brige #5789, WIN 22276.00

Bangor, ME

Source of Sample: BB-BI95- **Depth:** 20-22'

Sample Number: 104 / 5D

Thielsch Engineering Inc.

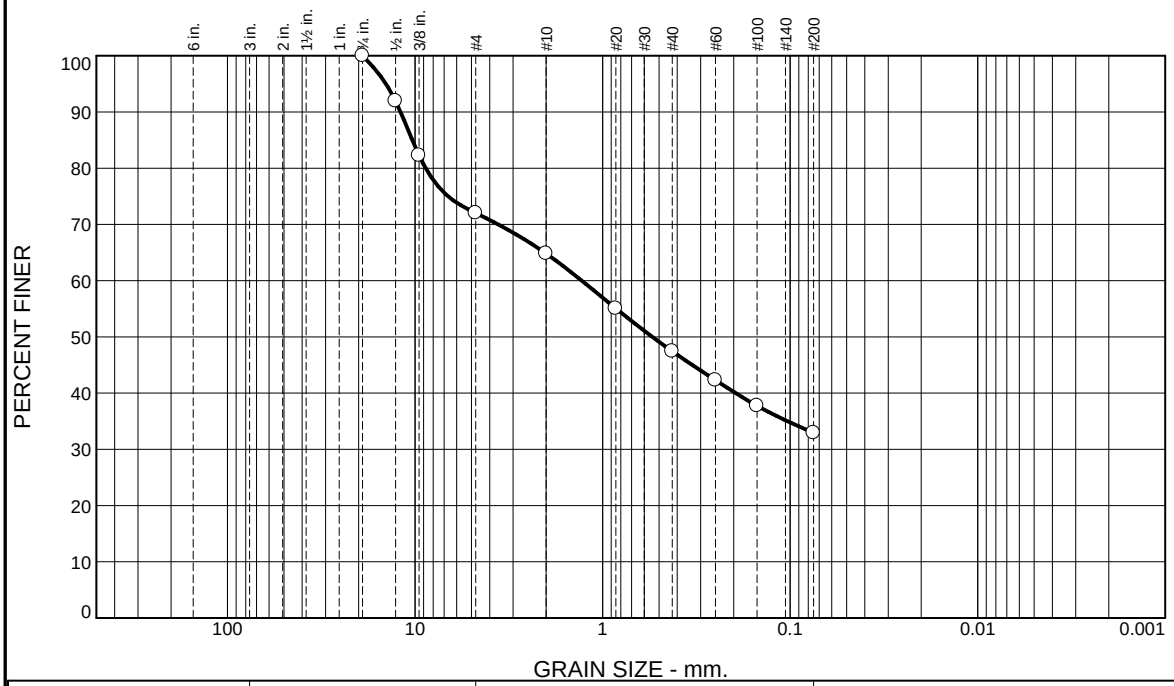
Cranston, RI

Remarks:

Figure L-6

Tested By: RR **Checked By:** sa

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	28.0	7.2	17.4	14.5	32.9	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	91.9		
0.375"	82.3		
#4	72.0		
#10	64.8		
#20	55.1		
#40	47.4		
#60	42.3		
#100	37.7		
#200	32.9		

* (no specification provided)

Material Description

Brown f-c SAND, some Silt, some fine Gravel

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-2-4(0)

Coefficients

D_{90}= 11.9506 D_{85}= 10.3506 D_{60}= 1.2916
D_{50}= 0.5427 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Sample visually classified as non-plastic.

Date Received: 12.05.18 **Date Tested:** 12.11.18

Tested By: mn

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: BB-BI95-101 / 1D **Depth:** 0.5-2.5' **Date Sampled:**

Sample Number:

Thielsch Engineering Inc.

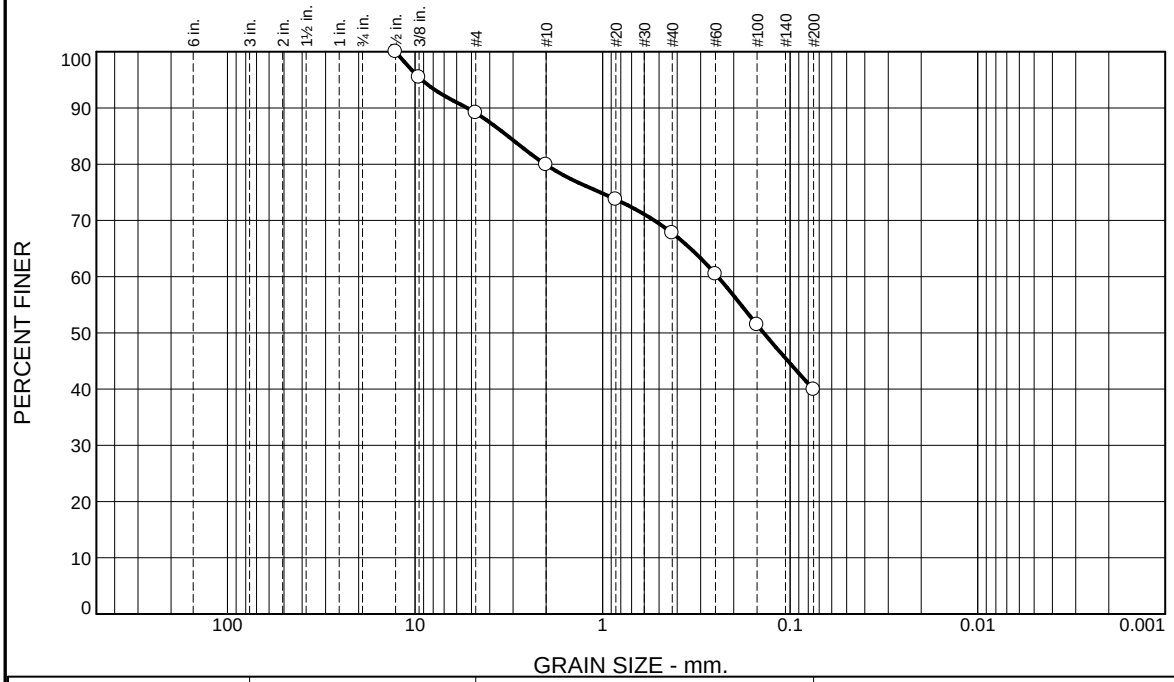
Cranston, RI

Client: GZA GeoEnvironmental

Project: Broadway Brige #5789, WIN 22276.00
Bangor, ME

Project No: 09.0025990.00 **Figure** S-7

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	10.9	9.2	12.2	27.8	39.9	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.5"	100.0		
0.375"	95.4		
#4	89.1		
#10	79.9		
#20	73.7		
#40	67.7		
#60	60.5		
#100	51.4		
#200	39.9		

* (no specification provided)

Material Description

Grey Silty fine to coarse SAND, little fine Gravel

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-4(0)

Coefficients

D_{90}= 5.2716 D_{85}= 3.1992 D_{60}= 0.2430
D_{50}= 0.1383 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Sample visually classified as non-plastic.

Date Received: 12.05.18 **Date Tested:** 12.11.18

Tested By: MN

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: BB-BI95- **Depth:** 25-27' **Date Sampled:**
Sample Number: 101 / 6D

Thielsch Engineering Inc.

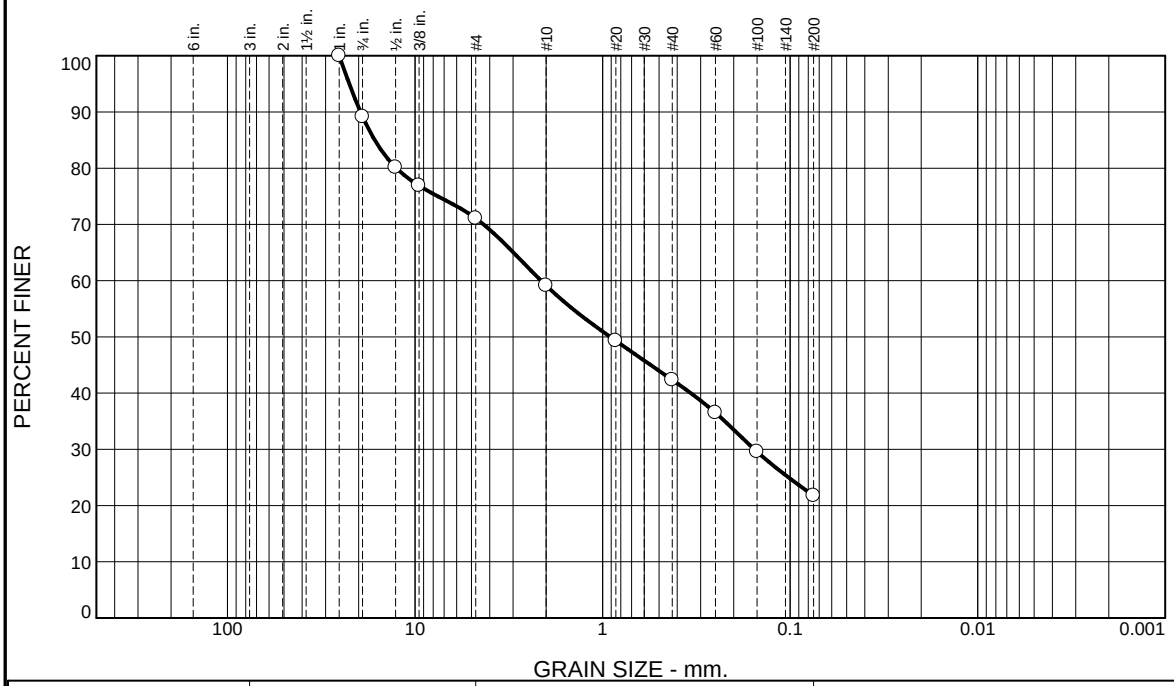
Cranston, RI

Client: GZA GeoEnvironmental

Project: Broadway Brige #5789, WIN 22276.00
Bangor, ME

Project No: 09.0025990.00 **Figure** S-8

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	10.8	18.1	12.0	16.8	20.6	21.7	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
0.75"	89.2		
0.5"	80.2		
0.375"	76.9		
#4	71.1		
#10	59.1		
#20	49.3		
#40	42.3		
#60	36.5		
#100	29.6		
#200	21.7		

* (no specification provided)

Material Description

Grey f-c SAND, some f-c Gravel, some Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 19.5440 D_{85}= 16.4139 D_{60}= 2.1284
D_{50}= 0.9112 D_{30}= 0.1550 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 12.05.18 **Date Tested:** 12.11.18

Tested By: MN

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: BB-BI95- **Depth:** 35-37' **Date Sampled:**
Sample Number: 101 / 8D

Thielsch Engineering Inc.

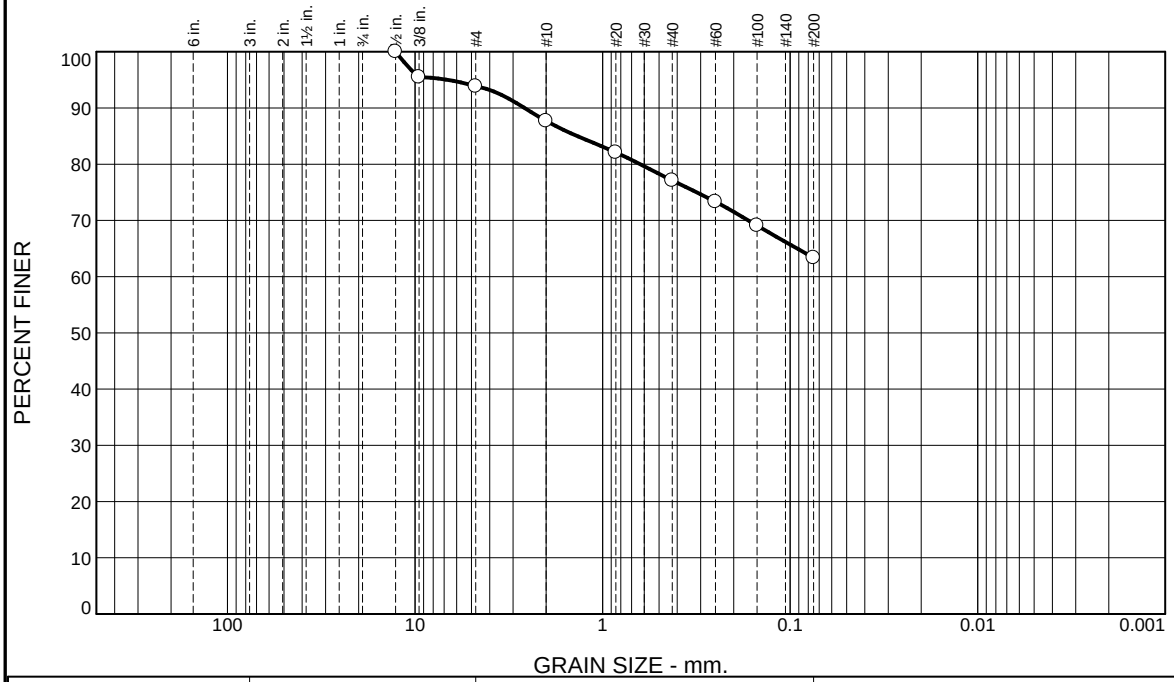
Cranston, RI

Client: GZA GeoEnvironmental

Project: Broadway Brige #5789, WIN 22276.00
Bangor, ME

Project No: 09.0025990.00 **Figure** S-9

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	6.2	6.1	10.6	13.8	63.3	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.5"	100.0		
0.375"	95.5		
#4	93.8		
#10	87.7		
#20	82.1		
#40	77.1		
#60	73.3		
#100	69.1		
#200	63.3		

* (no specification provided)

Material Description

Grey SILT & CLAY, some f-c Sand, trace fine Gravel

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=** A-4(0)

Coefficients

D_{90}= 2.6057 D_{85}= 1.3621 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Sample visually classified as plastic. Sample rolled to 1/8".

Date Received: 12.05.18 **Date Tested:** 12.11.18

Tested By: MN

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: BB-BI95- **Depth:** 45-47' **Date Sampled:**
Sample Number: 102 / 10D

Thielsch Engineering Inc.

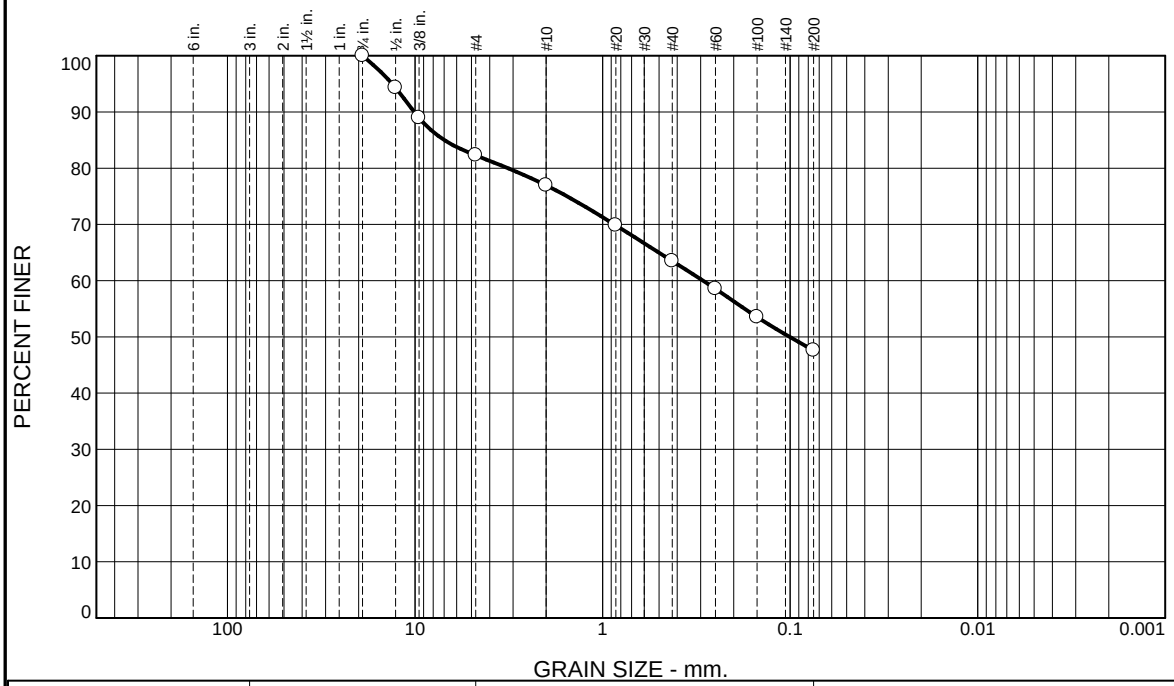
Cranston, RI

Client: GZA GeoEnvironmental

Project: Broadway Brige #5789, WIN 22276.00
Bangor, ME

Project No: 09.0025990.00 **Figure** S-10

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	17.7	5.3	13.5	15.9	47.6	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	94.3		
0.375"	89.0		
#4	82.3		
#10	77.0		
#20	69.8		
#40	63.5		
#60	58.6		
#100	53.5		
#200	47.6		

* (no specification provided)

Material Description

Brown SILT, some f-c Sand, little fine Gravel

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-4(0)

Coefficients

D_{90}= 10.0999 D_{85}= 6.9749 D_{60}= 0.2910
D_{50}= 0.1006 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Sample visually classified as non-plastic.

Date Received: 12.05.18 **Date Tested:** 12.11.18

Tested By: MN

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: BB-BI95- **Depth:** 0.5-2.5' **Date Sampled:**
Sample Number: 103 / 1D

Thielsch Engineering Inc.

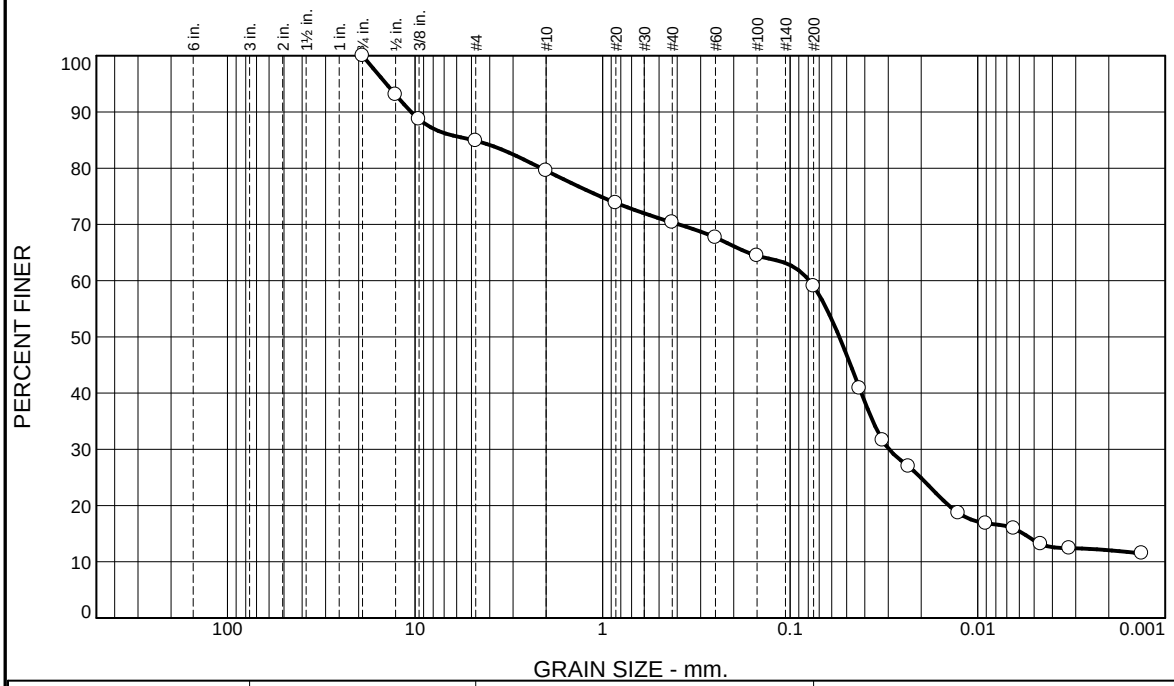
Cranston, RI

Client: GZA GeoEnvironmental

Project: Broadway Brige #5789, WIN 22276.00
Bangor, ME

Project No: 09.0025990.00 **Figure** S-11

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	15.1	5.3	9.2	11.4	46.9	12.1

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75	100.0		
0.5"	93.1		
0.375"	88.7		
#4	84.9		
#10	79.6		
#20	73.8		
#40	70.4		
#60	67.7		
#100	64.4		
#200	59.0		
0.0426 mm.	40.8		
0.0321 mm.	31.6		
0.0234 mm.	27.0		
0.0127 mm.	18.7		
0.0091 mm.	16.8		
0.0064 mm.	15.9		
0.0046 mm.	13.2		
0.0032 mm.	12.4		
0.0013 mm.	11.5		

* (no specification provided)

Material Description

Grey CLAYEY SILT, some f-c Sand, little fine Gravel

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= ML **AASHTO (M 145)=** A-4(0)

Coefficients

D_{90}= 10.4902 D_{85}= 4.8883 D_{60}= 0.0789
D_{50}= 0.0547 D_{30}= 0.0297 D_{15}= 0.0057
D_{10}= C_u= C_c=

Remarks

Sample visually classified as plastic. Sample rolled to 1/4".

Date Received: 12.05.18 **Date Tested:** 12.12.18

Tested By: MN

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: BB-BI95- **Depth:** 15-17' **Date Sampled:**
Sample Number: 103 / 4D

Thielsch Engineering Inc.

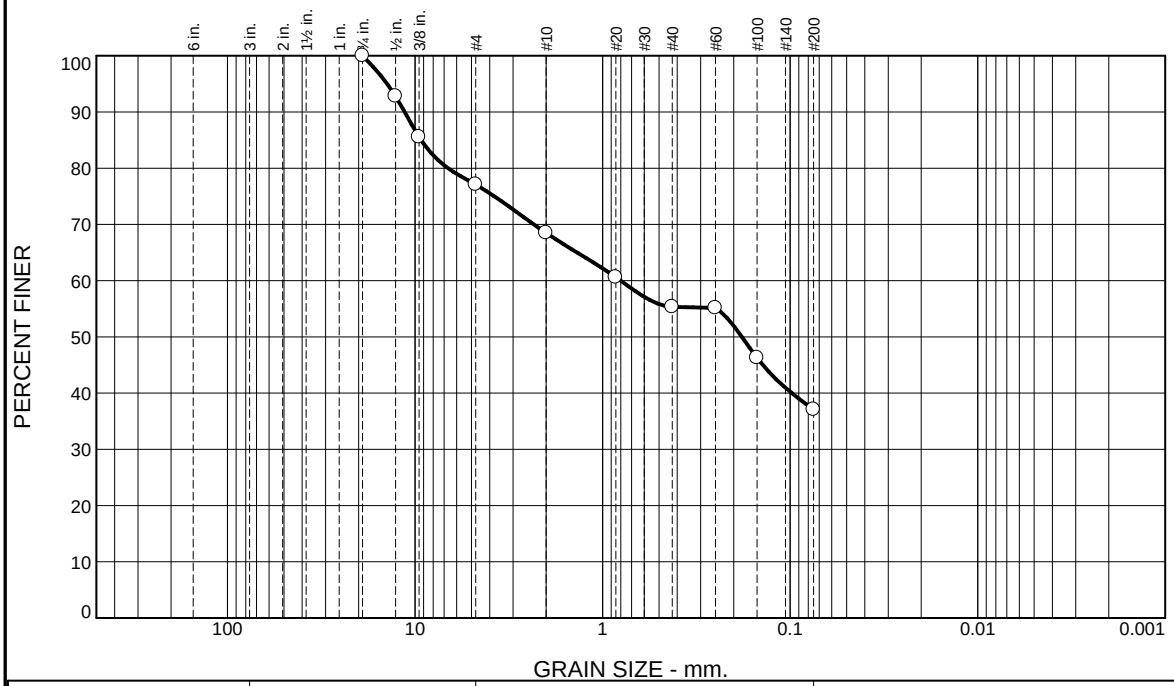
Cranston, RI

Client: GZA GeoEnvironmental

Project: Broadway Brige #5789, WIN 22276.00
Bangor, ME

Project No: 09.0025990.00 **Figure** S-12

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	22.9	8.6	13.2	18.2	37.1	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	92.8		
0.375"	85.6		
#4	77.1		
#10	68.5		
#20	60.6		
#40	55.3		
#60	55.2		
#100	46.3		
#200	37.1		

* (no specification provided)

Material Description

Grey Silty fine to coarse SAND, some fine Gravel

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-4(0)

Coefficients

D_{90}= 11.3658 D_{85}= 9.2860 D_{60}= 0.8014
D_{50}= 0.1808 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Sample visually classified as plastic. Sample rolled to 1/4".

Date Received: 12.05.18 **Date Tested:** 12.11.18

Tested By: MN

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: BB-BI95- **Depth:** 30-32' **Date Sampled:**
Sample Number: 103 / 7D

Thielsch Engineering Inc.

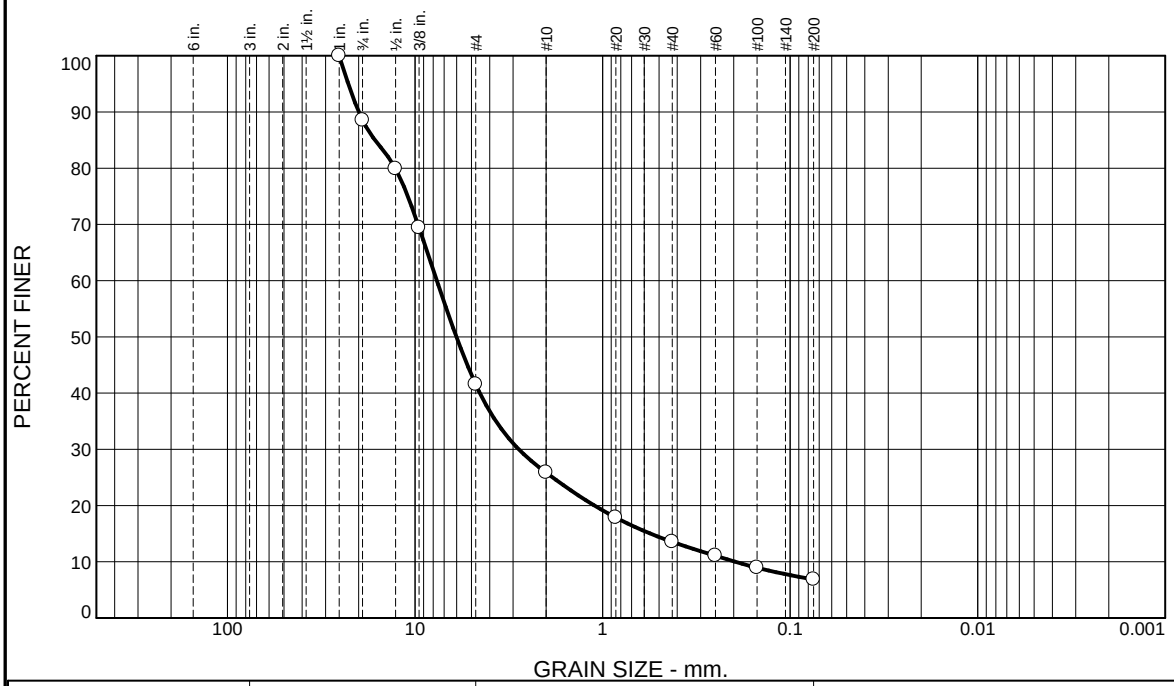
Cranston, RI

Client: GZA GeoEnvironmental

Project: Broadway Brige #5789, WIN 22276.00
Bangor, ME

Project No: 09.0025990.00 **Figure** S-13

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	11.5	46.9	15.7	12.4	6.7	6.8	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
0.75"	88.5		
0.5"	79.9		
0.375"	69.4		
#4	41.6		
#10	25.9		
#20	17.9		
#40	13.5		
#60	11.1		
#100	8.9		
#200	6.8		

* (no specification provided)

Material Description

Grey f-c GRAVEL, some f-c Sand, trace Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= GP-GM **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 19.9523 D_{85}= 16.3623 D_{60}= 7.6472
D_{50}= 6.0153 D_{30}= 2.7995 D_{15}= 0.5546
D_{10}= 0.1957 C_u= 39.08 C_c= 5.24

Remarks

Date Received: 12.05.18 **Date Tested:** 12.11.18

Tested By: MN

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: BB-BI95- **Depth:** 0-2' **Date Sampled:**
Sample Number: 104 / 1D

Thielsch Engineering Inc.

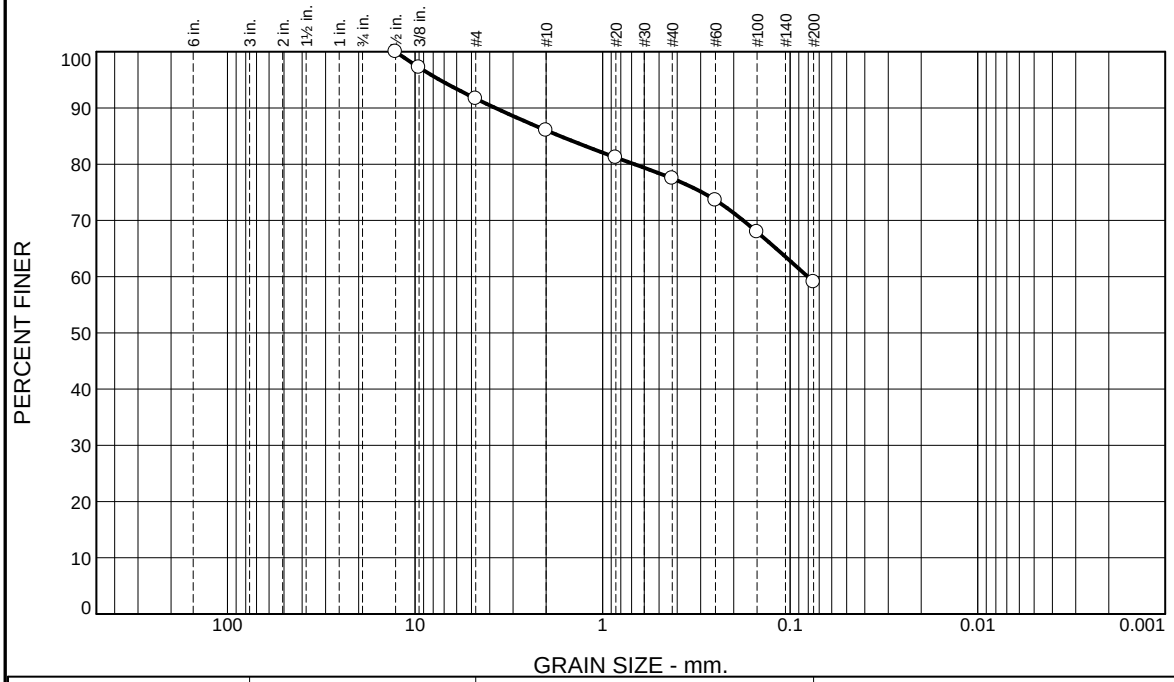
Cranston, RI

Client: GZA GeoEnvironmental

Project: Broadway Brige #5789, WIN 22276.00
Bangor, ME

Project No: 09.0025990.00 **Figure** S-14

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	8.3	5.7	8.5	18.4	59.1	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.5"	100.0		
0.375"	97.2		
#4	91.7		
#10	86.0		
#20	81.2		
#40	77.5		
#60	73.6		
#100	67.9		
#200	59.1		

* (no specification provided)

Material Description

Grey CLAYEY SILT, some f-c Sand, trace fine Gravel

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= ML **AASHTO (M 145)=** A-4(0)

Coefficients

D_{90}= 3.7235 D_{85}= 1.6816 D_{60}= 0.0806
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Sample visually classified as plastic. Sample rolled to 1/4".

Date Received: 12.05.18 **Date Tested:** 12.11.18

Tested By: MN

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: BB-BI95- **Depth:** 30-32' **Date Sampled:**
Sample Number: 104 / 7D

Thielsch Engineering Inc.

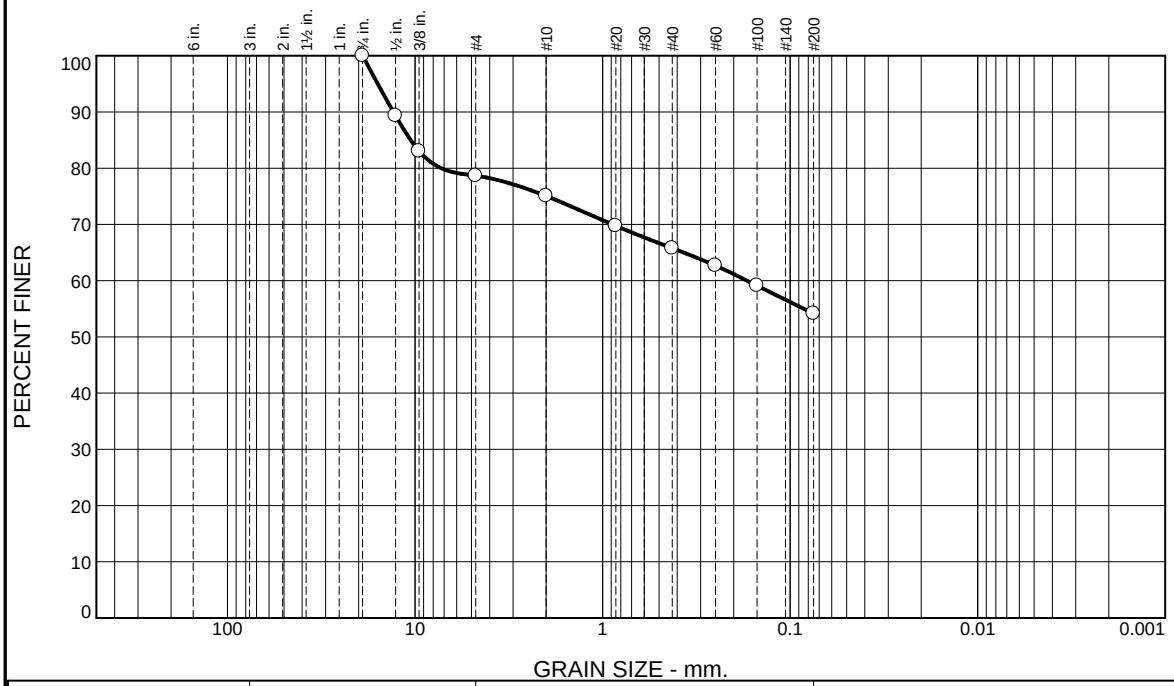
Cranston, RI

Client: GZA GeoEnvironmental

Project: Broadway Brige #5789, WIN 22276.00
Bangor, ME

Project No: 09.0025990.00 **Figure** S-15

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	21.3	3.6	9.3	11.6	54.2	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	89.3		
0.375"	83.0		
#4	78.7		
#10	75.1		
#20	69.8		
#40	65.8		
#60	62.7		
#100	59.1		
#200	54.2		

* (no specification provided)

Material Description

Grey CLAYEY SILT, some f-c Sand, some fine Gravel

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= ML **AASHTO (M 145)=** A-4(0)

Coefficients

D_{90}= 13.0408 D_{85}= 10.5568 D_{60}= 0.1697
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Sample visually classified as plastic. Sample rolled to 1/4".

Date Received: 12.05.18 **Date Tested:** 12.11.18

Tested By: MN

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: BB-BI95-104 / 10D **Depth:** 45-47' **Sample Number:** **Date Sampled:**

Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental

Project: Broadway Brige #5789, WIN 22276.00
Bangor, ME

Project No: 09.0025990.00 **Figure** S-16

-200 Series Borings
Laboratory Test Results

THIELSCH ENGINEERING

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Fax: (401)-467-2398
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Let's Build a Solid Foundation

Client Information:
GZA GeoEnvironmental, Inc.
South Portland, ME
PM: Blaine Cardali
Assigned By: Blaine Cardali
Collected By: Emma Tombaugh

Project Information:
Broadway Bridge No. 5789 Replacement WIN 22276.01
Bangor, ME
GZA Project Number: 09.0025990.02
Summary Page: 1 of 3
Report Date: 08.15.22

LABORATORY TESTING DATA SHEET, Report No.: 7422-H-106

Boring No.	Sample No.	Depth (ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				As Received Moisture Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	pH	Dry unit wt. (pcf)	Test Moisture Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Permeability cm/sec	
				D2216	D4318		D6913			D2974	D4792			D1557						
BB-BI95-201	1D	0-2	22-S-2916	3.7			33.8	53.8	12.4											Brown f-c SAND, some f-c Gravel, little Silt
BB-BI95-201	2D	5-7	22-S-2917	20.8	29	15														Brown CLAY & SILT
BB-BI95-201	5D	11-13	22-S-2918	29.3	37	19														Brown CLAY & SILT
HB-BI95-201	1D	0-2	22-S-2919				26.0	37.9	36.1											Brown f-c SAND and SILT, some f-c Gravel
HB-BI95-201	3D middle 17"	4-6	22-S-2920				1.9	6.3	91.8											Brown SILT & CLAY
HB-BI95-201	5D	8-10	22-S-2921				0.0	17.1	82.9											Gray SILT & CLAY, little f-m Sand
HB-BI95-201	7D	20-21.6	22-S-2922				31.1	35.0	33.9											Olive f-c SAND, some Silt & Clay, some f-c Gravel
HB-BI95-202	2D	2-4	22-S-2923	2.3			50.0	36.5	13.5											Olive f-c GRAVEL and f-c SAND, little Silt
HB-BI95-202	4D	6-8	22-S-2924	24.4	38	20														Brown CLAY & SILT
HB-BI95-202	5D	8-10	22-S-2925				0.0	0.8	99.2											Brown SILT & CLAY, trace fine Sand
HB-BI95-203	1D	0-2	22-S-2926	18.1	23	15														Olive SILT & CLAY
HB-BI95-203	3D bottom 11"	4-6	22-S-2927	9.6			24.2	50.5	25.3											Olive f-c SAND, some Silt & Clay, some f-c Gravel

Date Received: *08.02.22*

Reviewed By:

Date Reviewed: *08.16.22*

THIELSCH ENGINEERING
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Let's Build a Solid Foundation

Client Information:
GZA GeoEnvironmental, Inc.
South Portland, ME
PM: Blaine Cardali
Assigned By: Blaine Cardali
Collected By: Emma Tombaugh

Project Information:
Broadway Bridge No. 5789 Replacement WIN 22276.01
Bangor, ME
GZA Project Number: 09.0025990.02
Summary Page: 2 of 3
Report Date: 08.15.22

LABORATORY TESTING DATA SHEET, Report No.: 7422-H-106

Boring No.	Sample No.	Depth (ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				As Received Moisture Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	pH	Dry unit wt. (pcf)	Test Moisture Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Permeability cm/sec	
				D2216	D4318		D6913			D2974	D4792			D1557						
HB-BI95-203	7D	15-17	22-S-2928				33.6	35.9	30.5											Olive f-c SAND, some f-c GRAVEL, some Silt & Clay
HB-BI95-203	9D	25-27	22-S-2929				27.8	48.0	24.2											Olive f-c SAND, some f-c Gravel, some Silt & Clay
HB-BI95-204	2D	2-4	22-S-2930	23.8	33	17														Olive CLAY & SILT
HB-BI95-204	4D	6-8	22-S-2931	24.3	34	18														Olive CLAY & SILT
HB-BI95-204	6D	15-17	22-S-2932	24.2	27	15														Olive CLAY & SILT
HB-BI95-204	7D	20-22	22-S-2933				7.9	40.7	51.4											Gray SILT & CLAY and f-c SAND, trace fine Gravel
HB-BI95-205	2D	2-4	22-S-2934	28.3	35	18														Olive CLAY & SILT
HB-BI95-205	6D	15-17	22-S-2935	26.2	30	17														Olive CLAY & SILT
HB-BI95-205	8D	25-27	22-S-2936				22.1	24.0	53.9											Gray SILT & CLAY, some f-c Sand, some f-c Gravel
HB-BI95-206	1D	0-2	22-S-2937				14.4	31.5	54.1											Brown SILT & CLAY, some f-c Sand, little fine Gravel
HB-BI95-206	3D	4-6	22-S-2938	17.3																Moisture Content Only
HB-BI95-206	6D	15-17	22-S-2939	28.0	24	14														Gray CLAY & SILT

Date Received: *08.02.22*

Reviewed By:

Date Reviewed: *08.16.22*

THIELSCH ENGINEERING

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Let's Build a Solid Foundation

Client Information:
GZA GeoEnvironmental, Inc.
South Portland, ME
PM: Blaine Cardali
Assigned By: Blaine Cardali
Collected By: Emma Tombaugh

Project Information:
Broadway Bridge No. 5789 Replacement WIN 22276.01
Bangor, ME
GZA Project Number: 09.0025990.02
Summary Page: 3 of 3
Report Date: 08.15.22

LABORATORY TESTING DATA SHEET, Report No.: 7422-H-106

Boring No.	Sample No.	Depth (ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				As Received Moisture Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	pH	Dry unit wt. (pcf)	Test Moisture Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Permeability cm/sec	
				D2216	D4318		D6913			D2974	D4792			D1557						
HB-BI95-206	8D	25-27	22-S-2940				7.5	32.5	60.0											Gray SILT & CLAY, some f-c Sand, trace fine Gravel
HB-BI95-207	2D lower 16"	2.3-4	22-S-2941	7.9			33.9	25.9	40.2											Gray SILT, some f-c Gravel, some f-c Sand
HB-BI95-207	4D	6-8	22-S-2942	23.1																Moisture Content Only
HB-BI95-208	1D	0-2	22-S-2943	9.3			20.2	43.4	36.4											Brown f-c SAND and SILT, some f-c Gravel
HB-BI95-208	3D	4-6	22-S-2944				10.2	22.6	67.2											Olive SILT & CLAY, some f-c Sand, little fine Gravel
HB-BI95-208	6D	15-17	22-S-2945	24.6	30	16														Olive CLAY & SILT

Moisture Content testing completed by SL on 08.04.22

Date Received: *08.02.22*

Reviewed By:

Date Reviewed: *08.16.22*

THIELSCH ENGINEERING

State of Maine - Department of Transportation
Laboratory Testing Summary Sheet

Broadway Bridge Replacement #5789

MDOT Project Number: WIN 2276.01

GZA Project Number: 0 09.0025990.02

Town(s): Bangor, ME

Boring & Sample Identification Number	Station (Feet)	Sample No.	Depth (Feet)	Lab Number	Organic %	W.C.	L.L.	P.I.	Classification		
									Unified	AASHTO	Frost
BB-BI95-201		1D	0-2	S-2916		3.7			SM	A-1-b	
BB-BI95-201		2D	5-7	S-2917		20.8	29	14	CL	A-6	IV
BB-BI95-201		5D	11-13	S-2918		29.3	37	18	CL	A-6	IV
HB-BI95-201		1D	0-2	S-2919					SM	A-4(0)	
HB-BI95-201		3D middle 17"	4-6	S-2920					ML	A-4(8)	III
HB-BI95-201		5D	8-10	S-2921					ML	A-4(7)	
HB-BI95-201		7D	20-21.6	S-2922					SM	A-2-4(0)	
HB-BI95-202		2D	2-4	S-2923		2.3			GM	A-1-a	
HB-BI95-202		4D	6-8	S-2924		24.4	38	18	CL	A-6	IV
HB-BI95-202		5D	8-10	S-2925					ML	A-4(10)	III
HB-BI95-203		1D	0-2	S-2926		18.1	23	8	CL		
HB-BI95-203		3D bottom 11"	4-6	S-2927		9.6			SM	A-2-4(0)	
HB-BI95-203		7D	15-17	S-2928					SM	A-2-4(0)	
HB-BI95-203		9D	25-27	S-2929					SM	A-2-4(0)	
HB-BI95-204		2D	2-4	S-2930		23.8	33	16	CL	A-6	IV
HB-BI95-204		4D	6-8	S-2931		24.3	34	16	CL	A-6	IV
HB-BI95-204		6D	15-17	S-2932		24.2	27	12	CL		
HB-BI95-204		7D	20-22	S-2933					ML	A-4(2)	
HB-BI95-205		2D	2-4	S-2934		28.3	35	17	CL	A-6	IV
HB-BI95-205		6D	15-17	S-2935		26.2	30	13	CL	A-6	IV
HB-BI95-205		8D	25-27	S-2936					ML	A-4(3)	
HB-BI95-206		1D	0-2	S-2937					ML	A-4(3)	
HB-BI95-206		3D	4-6	S-2938		17.3					
HB-BI95-206		6D	15-17	S-2939		28	24	10	CL		
HB-BI95-206		8D	25-27	S-2940					ML	A-4(3)	
HB-BI95-207		2D lower 16"	2.3-4	S-2941		7.9			GM	A-4(0)	
HB-BI95-207		4D	6-8	S-2942		23.1					
HB-BI95-208		1D	0-2	S-2943		9.3			SM	A-4(0)	
HB-BI95-208		3D	4-6	S-2944					ML	A-4(5)	
HB-BI95-208		6D	15-17	S-2945		24.6	30	14	CL	A-6	IV

Classification of these soil samples is in accordance with AASHTO Classification System M-145-40. This classification is followed by the "Frost Susceptibility Rating" from zero (non-frost susceptible) to Class IV (highly frost susceptible). The "Frost Susceptibility Rating" is based upon the MDOT and Corps of Engineers Classification Systems.

GSDC = Grain Size Distribution Curve as determined by AASHTO T 88-93 (1996) and/or ASTM D 422-63 (Reapproved 1998)

WC = water content as determined by AASHTO T 265-93 and/or ASTM D 2216-98

LL = Liquid limit as determined by AASHTO T 89-96 and/or ASTM D 4318-98

PI = Plasticity Index as determined by AASHTO 90-96 and/or ASTM D4318-98

Particle Size Distribution Report

ASTM D6913

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	13.8	20.0	15.6	26.5	11.7	12.4	

Test Results (ASTM D6913)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
1 1/2"	100.0			
1"	88.7			
3/4"	86.2			
1/2"	81.2			
3/8"	78.2			
#4	66.2			
#10	50.6			
#20	34.2			
#40	24.1			
#60	19.1			
#100	15.8			
#200	12.4			

* (no specification provided)

Material Description

Brown f-c SAND, some f-c Gravel, little Silt

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 27.0058 D_{85}= 17.1997 D_{60}= 3.3454
D_{50}= 1.9355 D_{30}= 0.6559 D_{15}= 0.1289
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-1-b

Test Remarks

Source of Sample: BB-BI95 Depth: 0-2'
Sample Number: 201 / 1D Sample Date: 08.05.22

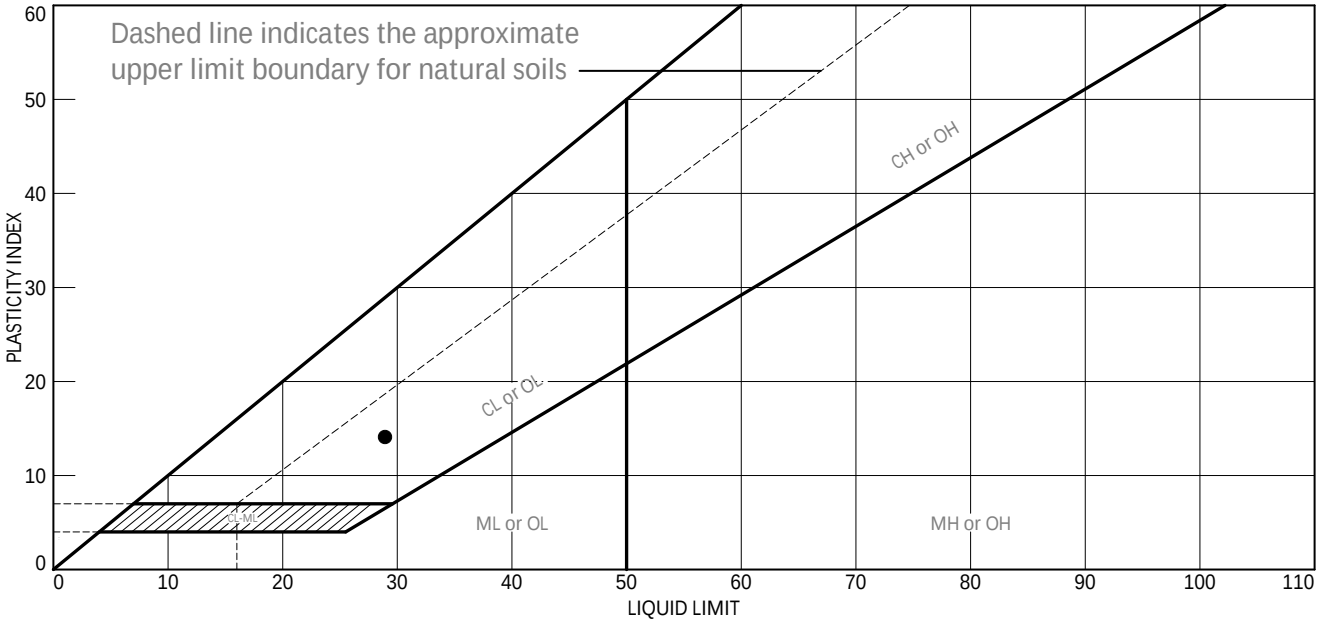
Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental
Project: Broadway Bridge No. 5789 Replacement
Bangor, ME
Project No: 09.0025990.02 Figure 22-S-2916

Tested By: JB Checked By:

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown CLAY & SILT	29	15	14			

Project No. 09.0025990.02 Client: GZA GeoEnvironmental

Project: Broadway Bridge No. 5789 Replacement

Bangor, ME

Source of Sample: BB-BI95 Depth: 5-7'

Sample Number: 201 / 2D

Remarks:

Thielsch Engineering Inc.

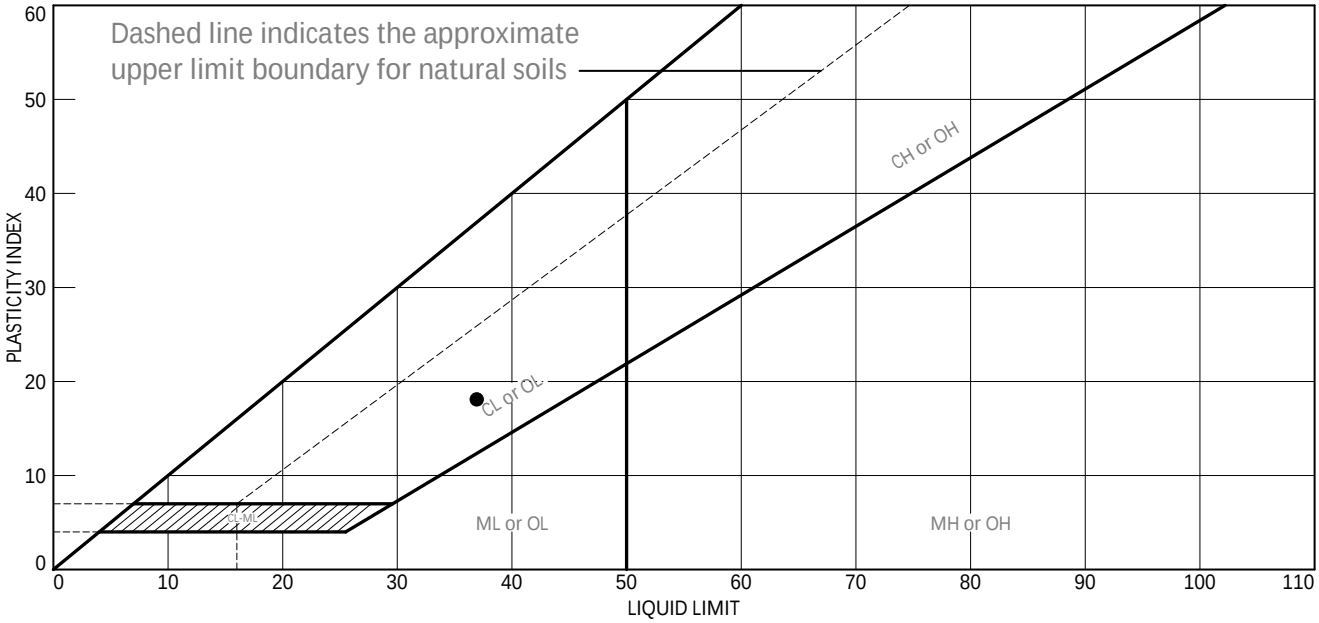
Cranston, RI

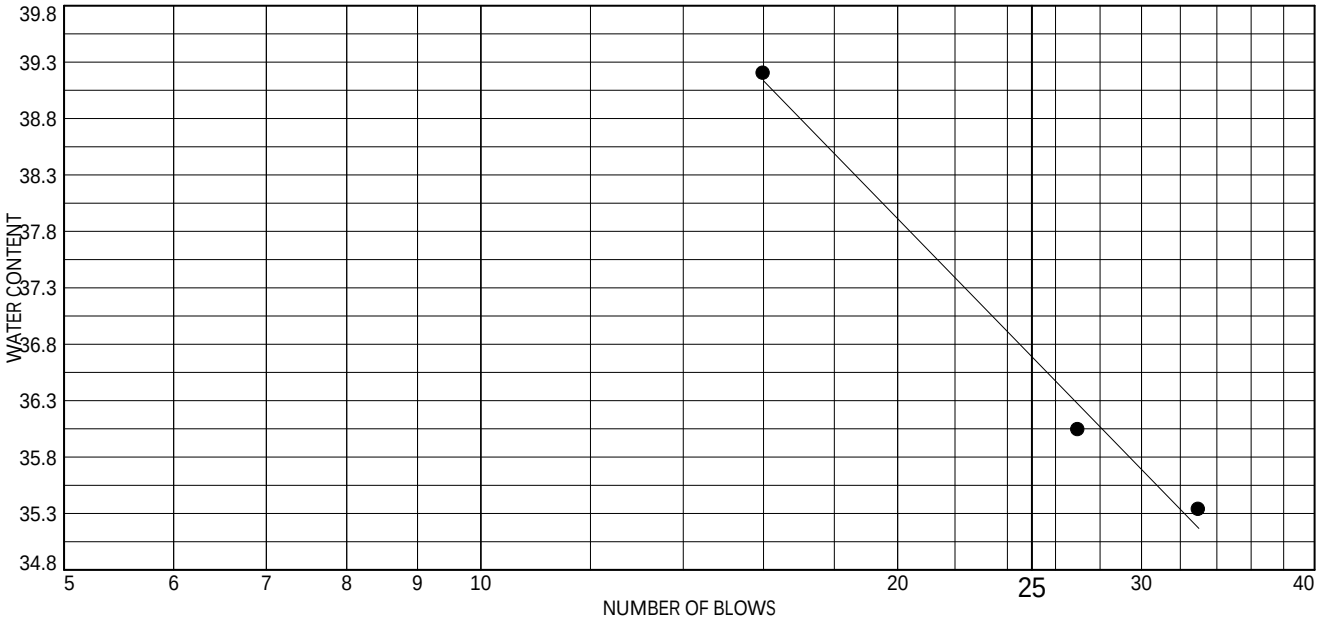
Figure 22-L-2917

Tested By: FR Checked By:

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown CLAY & SILT	37	19	18			

Project No. 09.0025990.02 Client: GZA GeoEnvironmental

Project: Broadway Bridge No. 5789 Replacement

Bangor, ME

Source of Sample: BB-BI95 Depth: 11-13'

Sample Number: 201 / 5D

Remarks:

Thielsch Engineering Inc.

Cranston, RI

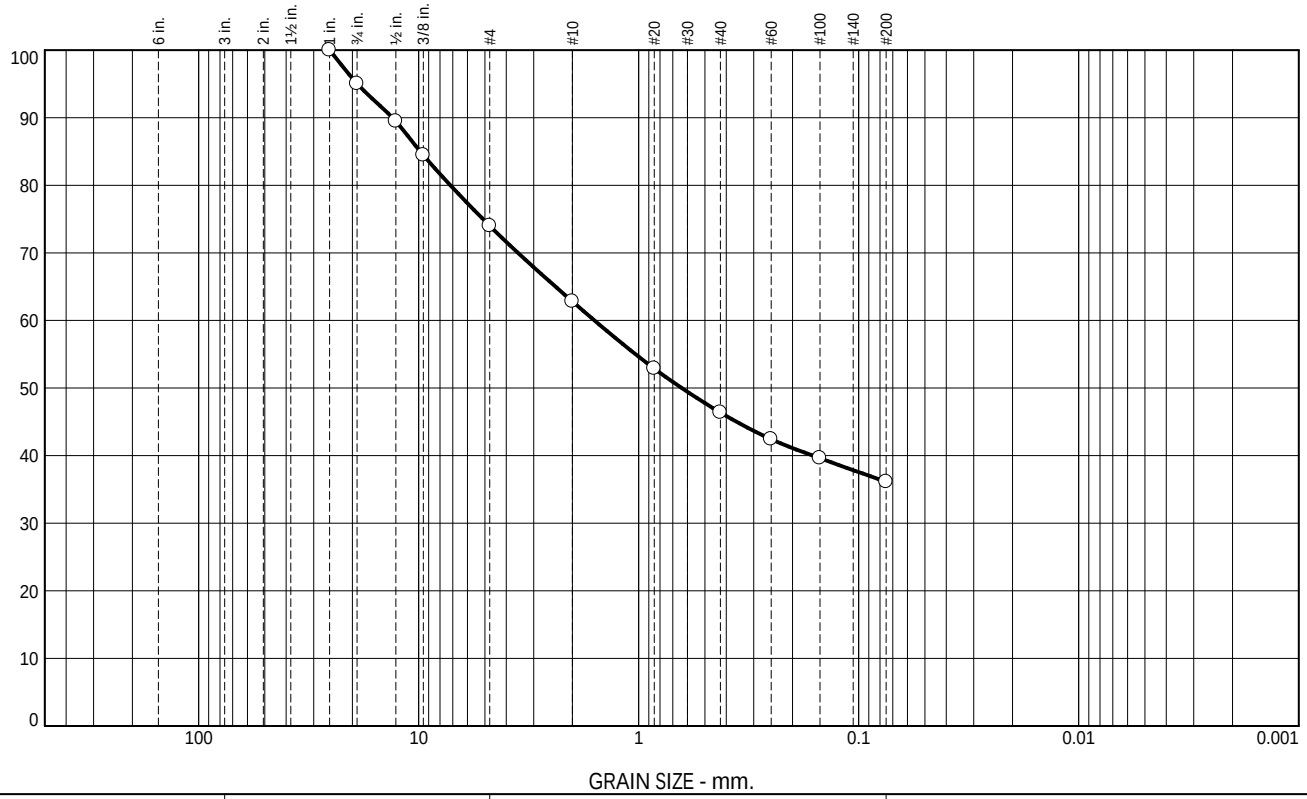
Figure 22-L-2918

Tested By: FR Checked By:

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

Particle Size Distribution Report

ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	5.0	21.0	11.2	16.4	10.3	36.1	

Test Results (ASTM D6913)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
1"	100.0			
3/4"	95.0			
1/2"	89.5			
3/8"	84.5			
#4	74.0			
#10	62.8			
#20	52.9			
#40	46.4			
#60	42.4			
#100	39.6			
#200	36.1			

* (no specification provided)

Material Description

Brown f-c SAND and SILT, some f-c Gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 13.1600 D_{85}= 9.8434 D_{60}= 1.5875
D_{50}= 0.6370 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Test Remarks

Sample visually classified as non-plastic.

Source of Sample: HB-BI95 Depth: 0-2'
Sample Number: 201 / 1D Sample Date: 08.05.22

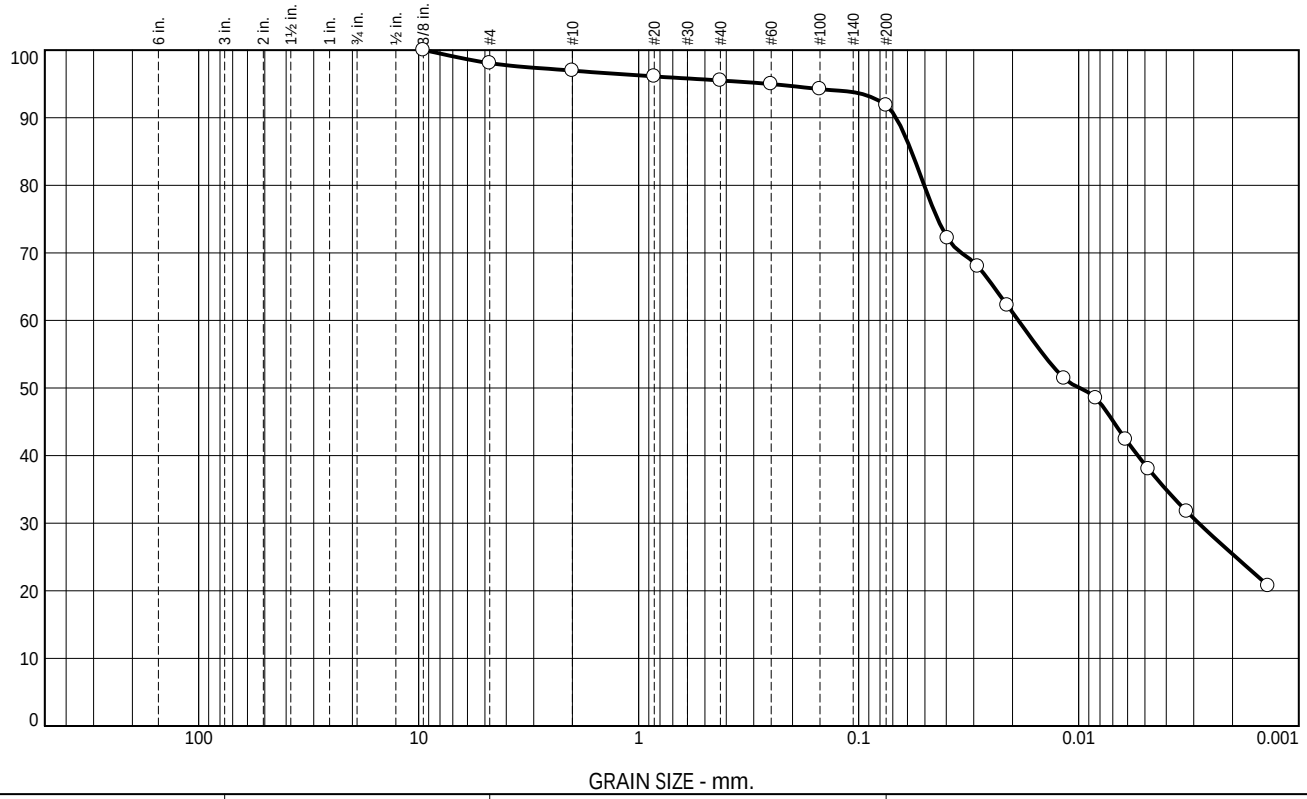
Thielsch Engineering Inc.
Cranston, RI

Client: GZA GeoEnvironmental
Project: Broadway Bridge No. 5789 Replacement
Bangor, ME
Project No: 09.0025990.02 Figure 22-S-2919

Tested By: JB Checked By:

Particle Size Distribution Report

ASTM D6913 and ASTM D7928



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.9	1.1	1.5	3.7	66.4	25.4

Test Results (ASTM D6913 and ASTM D7928)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
3/8"	100.0			
#4	98.1			
#10	97.0			
#20	96.1			
#40	95.5			
#60	95.0			
#100	94.2			
#200	91.8			
0.0395 mm.	72.2			
0.0287 mm.	68.0			
0.0211 mm.	62.2			
0.0116 mm.	51.4			
0.0084 mm.	48.5			
0.0061 mm.	42.4			
0.0048 mm.	38.0			
0.0032 mm.	31.8			
0.0014 mm.	20.7			

* (no specification provided)

Material Description

Brown SILT & CLAY

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.0676 D_{85}= 0.0575 D_{60}= 0.0188
D_{50}= 0.0099 D_{30}= 0.0028 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO= A-4(8)

Test Remarks

Sample visually classified as plastic. Sample rolled to 1/8".

Source of Sample: HB-BI95 Depth: 4-6'
Sample Number: 201 / 3D middle 17"

Sample Date: 08.05.22

Thielsch Engineering Inc.

Cranston, RI

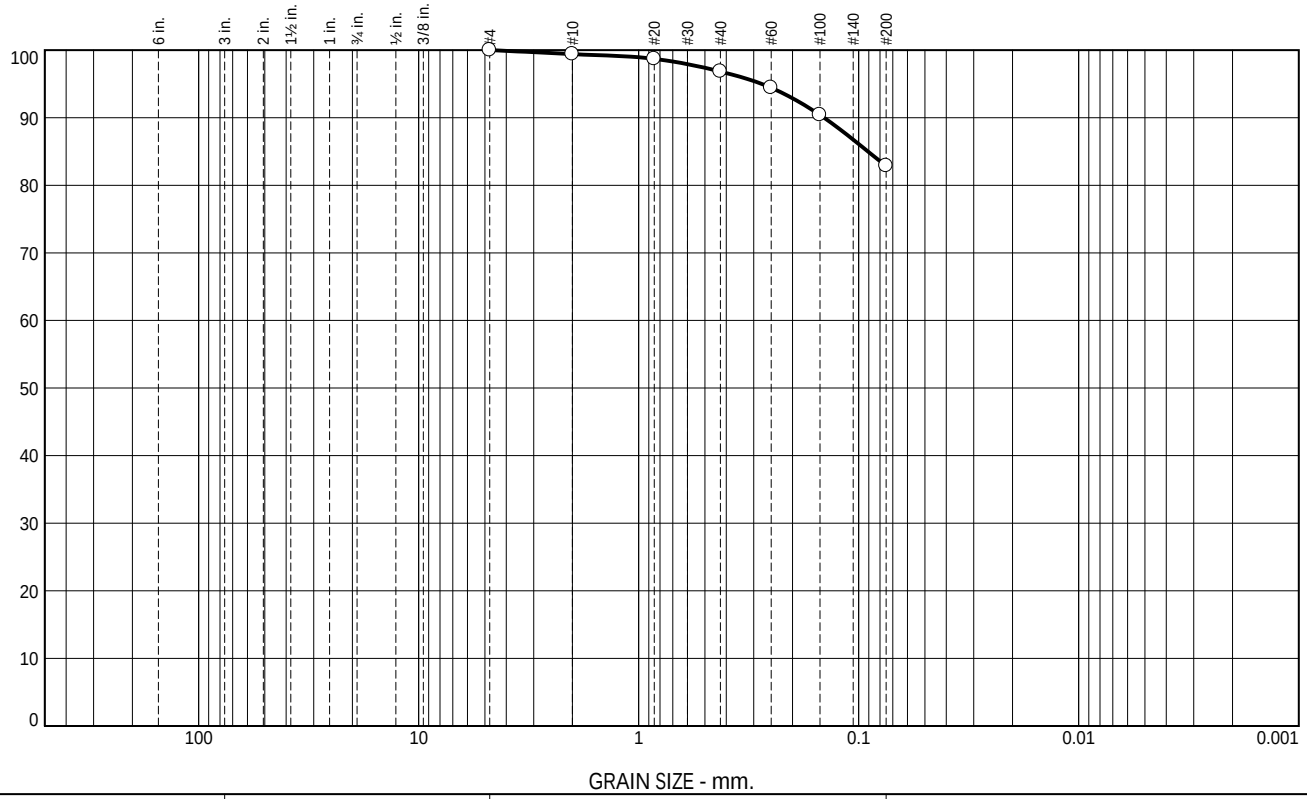
Client: GZA GeoEnvironmental
Project: Broadway Bridge No. 5789 Replacement
Bangor, ME
Project No: 09.0025990.02

Figure 22-S-2920

Tested By: JB / SL Checked By:

Particle Size Distribution Report

ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.6	2.6	13.9	82.9	

Test Results (ASTM D6913)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
#4	100.0			
#10	99.4			
#20	98.7			
#40	96.8			
#60	94.4			
#100	90.4			
#200	82.9			

* (no specification provided)

Material Description

Gray SILT & CLAY, little f-m Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1437 D_{85}= 0.0908 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO= A-4(7)

Test Remarks

Sample visually classified as plastic. Sample rolled to 1/8".

Source of Sample: HB-BI95 Depth: 8-10'
Sample Number: 201 / 5D

Sample Date: 08.08.22

Thielsch Engineering Inc.

Cranston, RI

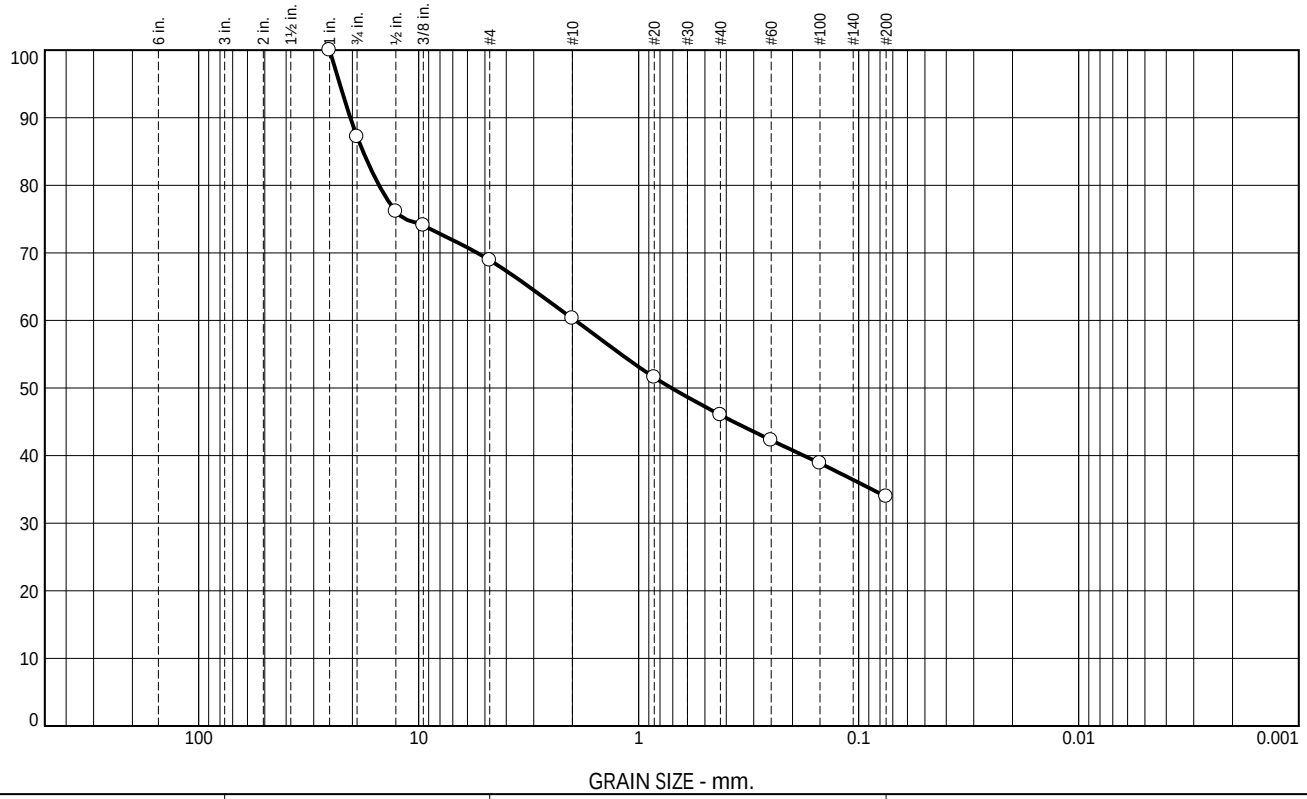
Client: GZA GeoEnvironmental
Project: Broadway Bridge No. 5789 Replacement
Bangor, ME
Project No: 09.0025990.02

Figure 22-S-2921

Tested By: JB Checked By:

Particle Size Distribution Report

ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	12.8	18.3	8.6	14.3	12.1	33.9	

Test Results (ASTM D6913)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
1"	100.0			
3/4"	87.2			
1/2"	76.1			
3/8"	74.1			
#4	68.9			
#10	60.3			
#20	51.6			
#40	46.0			
#60	42.3			
#100	38.9			
#200	33.9			

* (no specification provided)

Material Description

Olive f-c SAND, some Silt & Clay, some f-c Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 20.4543 D_{85}= 17.8915 D_{60}= 1.9413
D_{50}= 0.7088 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Test Remarks

Sample visually classified as plastic. Sample rolled to 1/8".

Source of Sample: HB-BI95 Depth: 20-21.6'
Sample Number: 201 / 7D Sample Date: 08.05.22

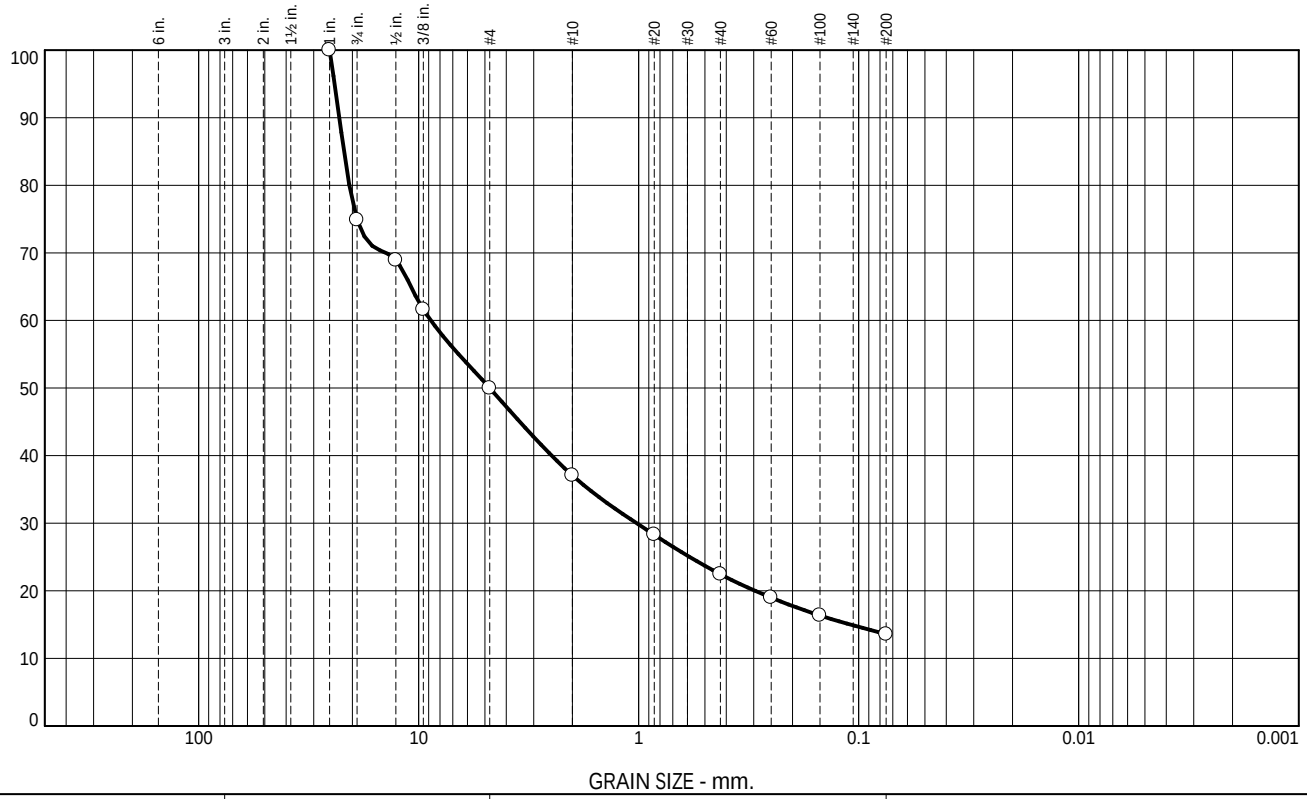
Thielsch Engineering Inc.
Cranston, RI

Client: GZA GeoEnvironmental
Project: Broadway Bridge No. 5789 Replacement
Bangor, ME
Project No: 09.0025990.02 Figure 22-S-2922

Tested By: JB Checked By:

Particle Size Distribution Report

ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	25.1	24.9	12.9	14.7	8.9	13.5	

Test Results (ASTM D6913)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
1"	100.0			
3/4"	74.9			
1/2"	68.9			
3/8"	61.6			
#4	50.0			
#10	37.1			
#20	28.3			
#40	22.4			
#60	19.0			
#100	16.3			
#200	13.5			

* (no specification provided)

Material Description

Olive f-c GRAVEL and f-c SAND, little Silt

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 22.9341 D_{85}= 21.8241 D_{60}= 8.7982
D_{50}= 4.7548 D_{30}= 1.0211 D_{15}= 0.1088
D_{10}= C_u= C_c=

Classification

USCS= GM AASHTO= A-1-a

Test Remarks

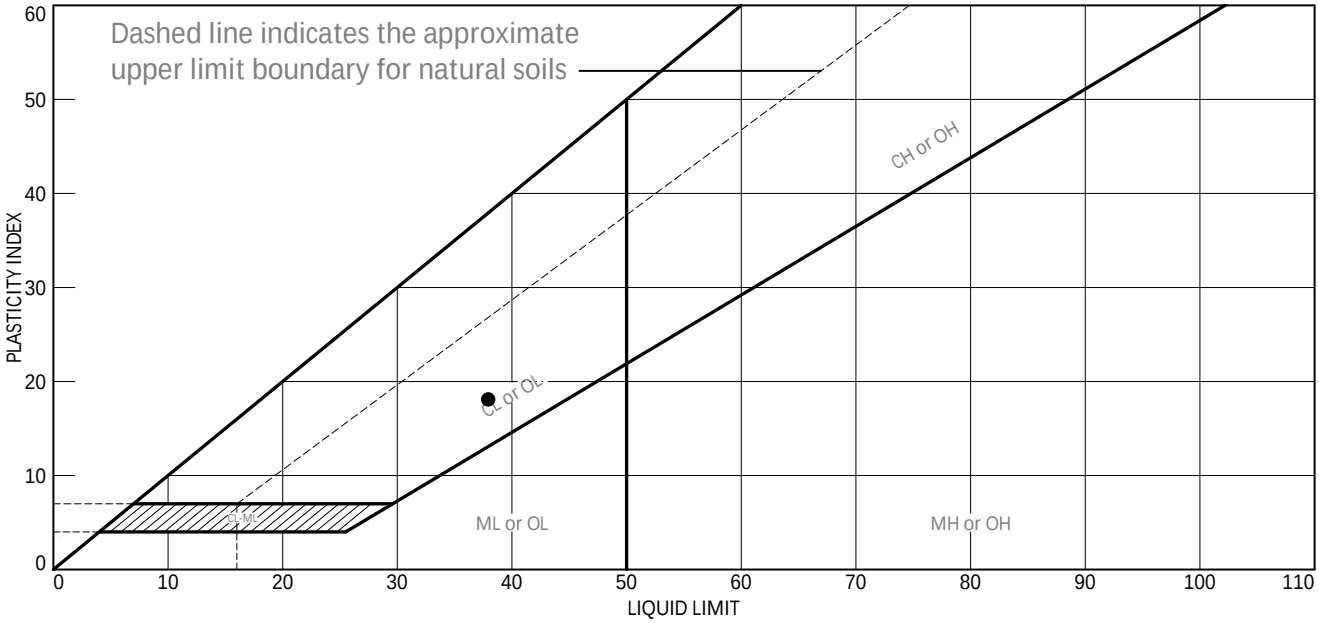
Source of Sample: HB-BI95 Depth: 2-4'
Sample Number: 202 / 2D Sample Date: 08.05.22

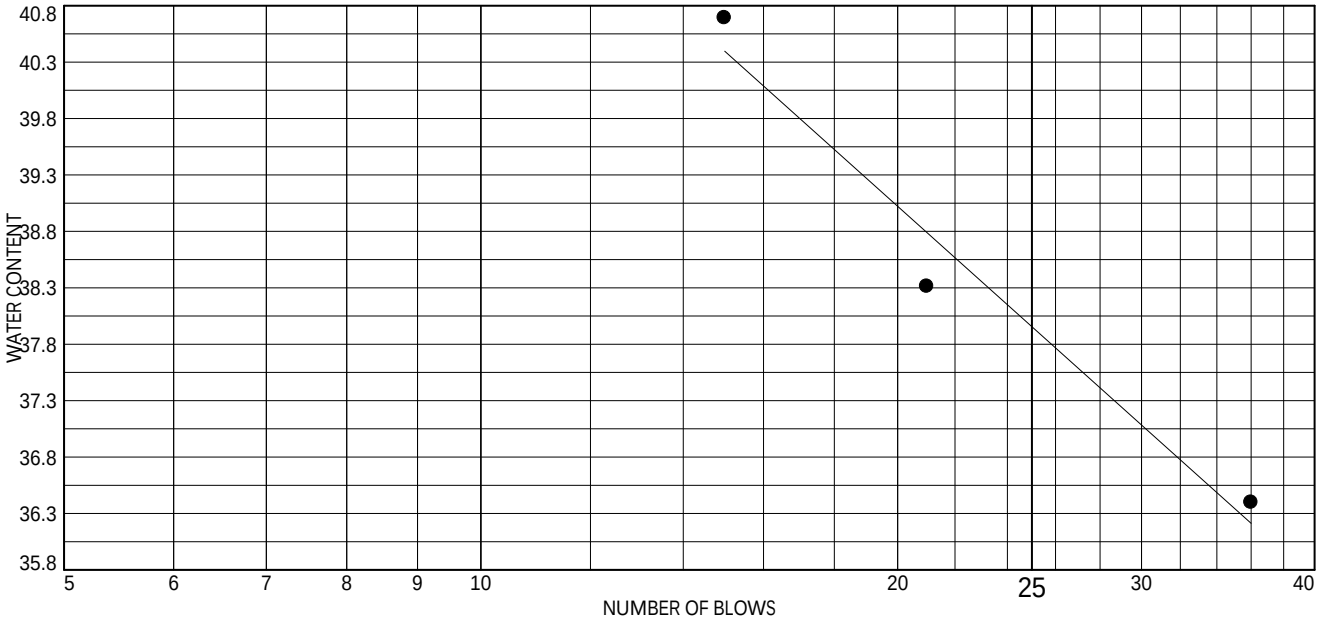
Thielsch Engineering Inc.
Cranston, RI

Client: GZA GeoEnvironmental
Project: Broadway Bridge No. 5789 Replacement
Bangor, ME
Project No: 09.0025990.02 Figure 22-S-2923

Tested By: JB Checked By:

LIQUID AND PLASTIC LIMITS TEST REPORT





MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
● Brown CLAY & SILT	38	20	18			

Project No. 09.0025990.02 Client: GZA GeoEnvironmental

Project: Broadway Bridge No. 5789 Replacement

Bangor, ME

Source of Sample: HB-BI95 Depth: 6-8'

Sample Number: 202 / 4D

Remarks:

Thielsch Engineering Inc.

Cranston, RI

Figure 22-L-2924

Tested By: FR Checked By:

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

Particle Size Distribution Report

ASTM D6913 and ASTM D7928

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	0.7	76.9	22.3

Test Results (ASTM D6913 and ASTM D7928)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
#4	100.0			
#10	100.0			
#20	100.0			
#40	99.9			
#60	99.8			
#100	99.6			
#200	99.2			
0.0408 mm.	76.9			
0.0307 mm.	65.6			
0.0225 mm.	59.0			
0.0122 mm.	48.5			
0.0088 mm.	44.6			
0.0064 mm.	37.6			
0.0049 mm.	33.2			
0.0033 mm.	28.2			
0.0014 mm.	18.3			

* (no specification provided)

Material Description

Brown SILT & CLAY, trace fine Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.0543 D_{85}= 0.0489 D_{60}= 0.0237
D_{50}= 0.0135 D_{30}= 0.0039 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO= A-4(10)

Test Remarks

Sample visually classified as plastic. Sample rolled to 1/8".

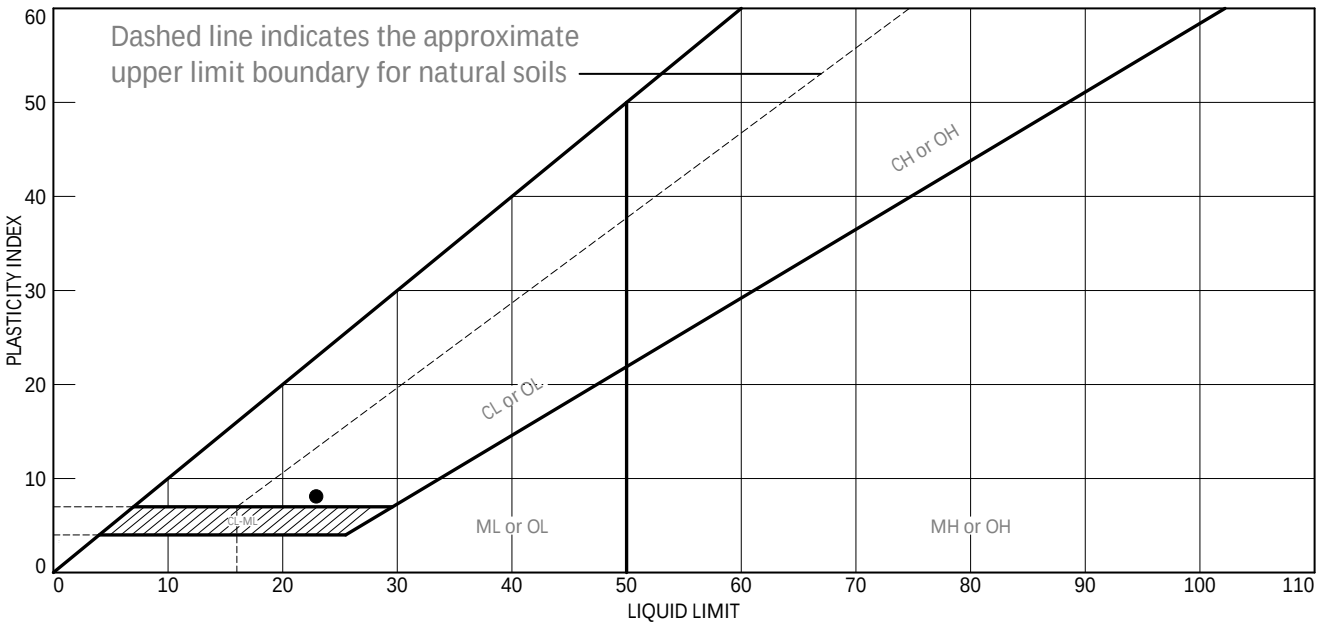
Source of Sample: HB-BI95 Depth: 8-10'
Sample Number: 202 / 5D Sample Date: 08.05.22

Thielsch Engineering Inc.
Cranston, RI

Client: GZA GeoEnvironmental
Project: Broadway Bridge No. 5789 Replacement
Bangor, ME
Project No: 09.0025990.02 Figure 22-S-2925

Tested By: JB / SL Checked By:

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Olive SILT & CLAY	23	15	8			

Project No. 09.0025990.02 Client: GZA GeoEnvironmental

Project: Broadway Bridge No. 5789 Replacement

Bangor, ME

Source of Sample: HB-BI95 Depth: 0-2'

Sample Number: 203 / 1D

Remarks:

Thielsch Engineering Inc.

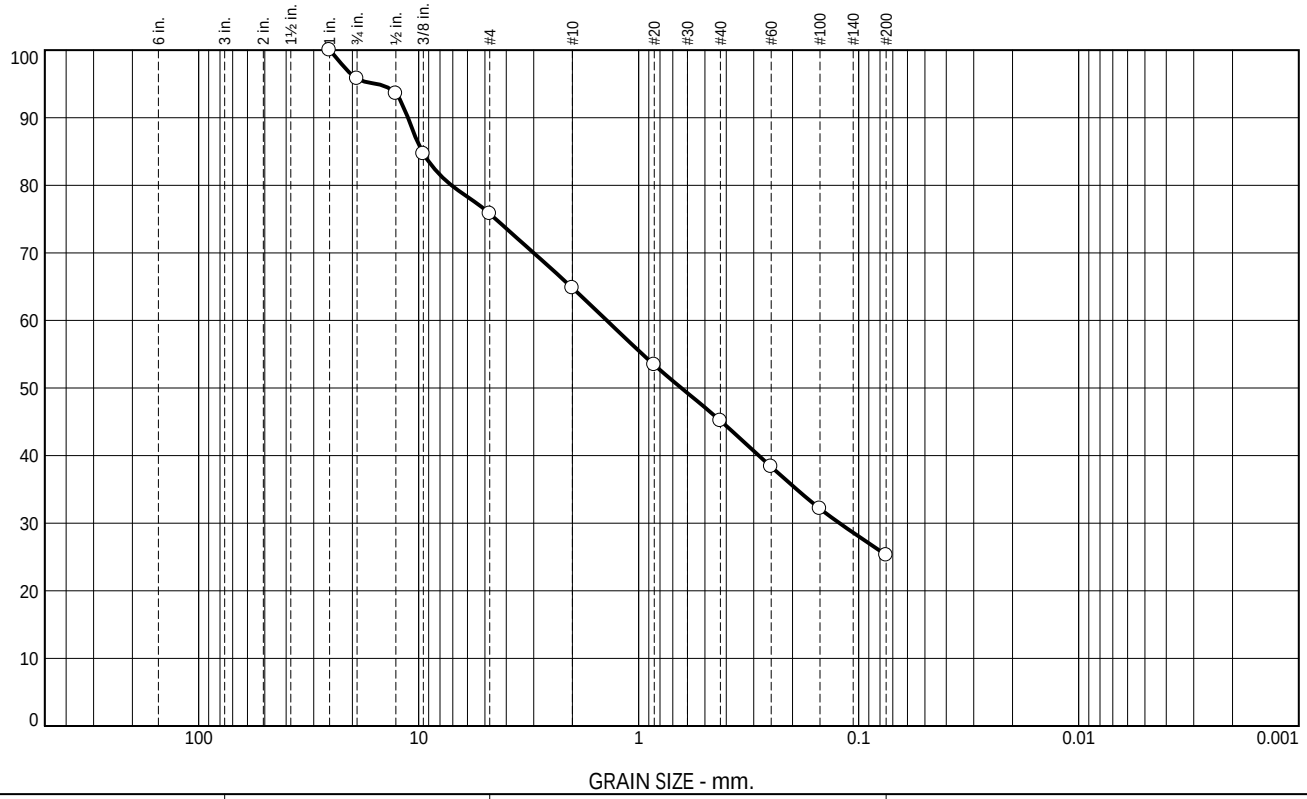
Cranston, RI

Figure 22-L-2926

Tested By: SL Checked By:

Particle Size Distribution Report

ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.2	20.0	11.0	19.6	19.9	25.3	

Test Results (ASTM D6913)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
1"	100.0			
3/4"	95.8			
1/2"	93.6			
3/8"	84.7			
#4	75.8			
#10	64.8			
#20	53.4			
#40	45.2			
#60	38.4			
#100	32.2			
#200	25.3			

* (no specification provided)

Material Description

Olive f-c SAND, some Silt & Clay, some f-c Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 11.1797 D_{85}= 9.6635 D_{60}= 1.3959
D_{50}= 0.6398 D_{30}= 0.1221 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Test Remarks

Sample visually classified as plastic. Sample rolled to 1/8".

Source of Sample: HB-BI95 Depth: 4-6'
Sample Number: 203 / 3D bottom 11" Sample Date: 08.05.22

Thielsch Engineering Inc.

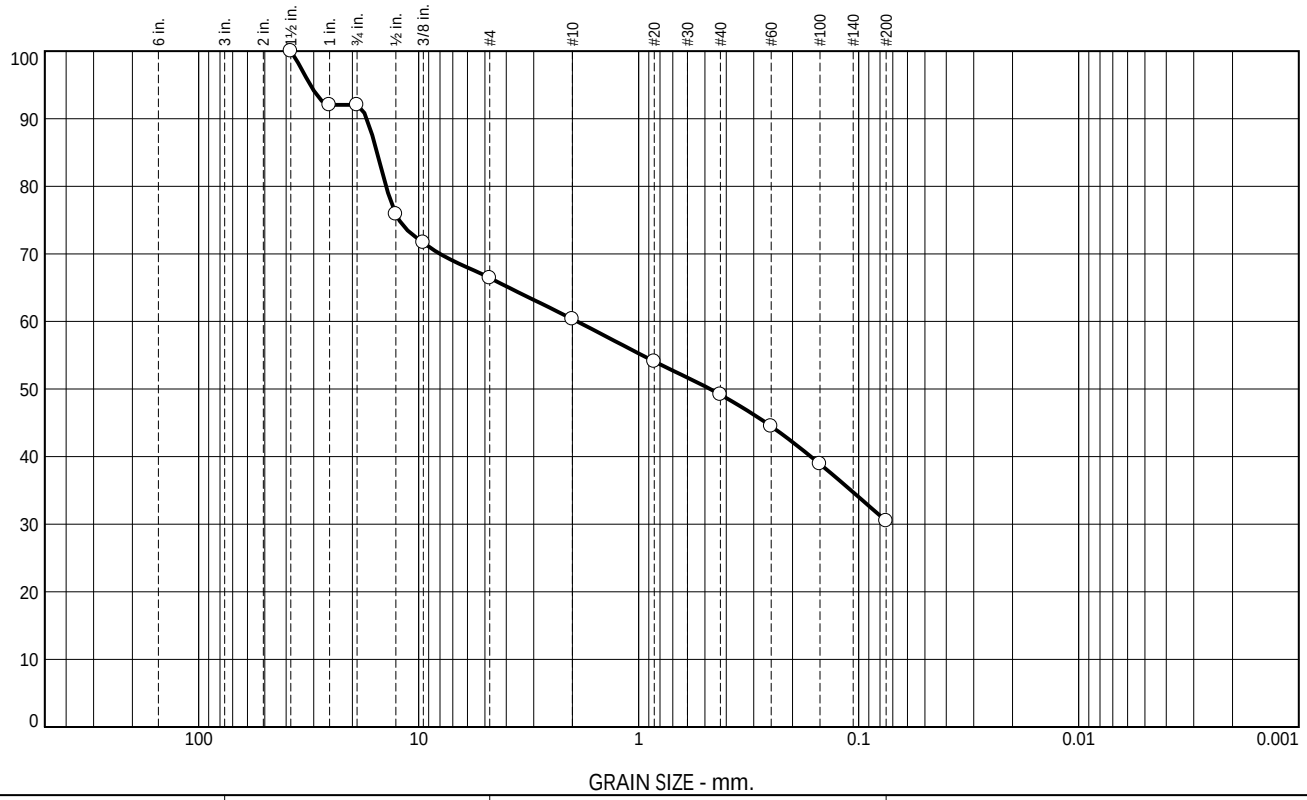
Cranston, RI

Client: GZA GeoEnvironmental
Project: Broadway Bridge No. 5789 Replacement
Bangor, ME
Project No: 09.0025990.02 Figure 22-S-2927

Tested By: JB Checked By:

Particle Size Distribution Report

ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	8.0	25.6	6.0	11.2	18.7	30.5	

Test Results (ASTM D6913)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
1 1/2"	100.0			
1"	92.0			
3/4"	92.0			
1/2"	75.9			
3/8"	71.7			
#4	66.4			
#10	60.4			
#20	54.1			
#40	49.2			
#60	44.5			
#100	38.9			
#200	30.5			

* (no specification provided)

Material Description

Olive f-c SAND, some f-c GRAVEL, some Silt & Clay

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 17.1974 D_{85}= 15.4558 D_{60}= 1.9044
D_{50}= 0.4736 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Test Remarks

Sample visually classified as plastic. Sample rolled to 1/8".

Source of Sample: HB-BI95 Depth: 15-17'
Sample Number: 203 / 7D Sample Date: 08.08.22

Thielsch Engineering Inc.

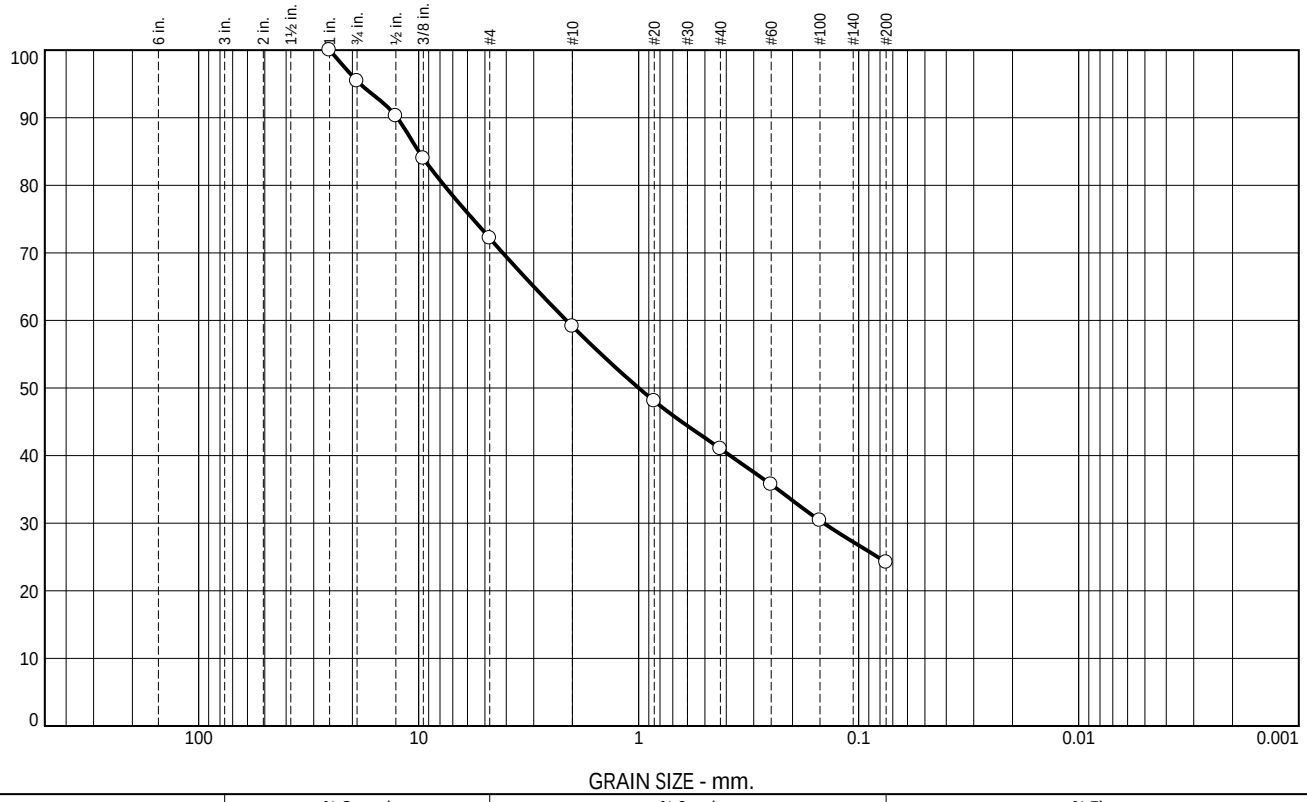
Cranston, RI

Client: GZA GeoEnvironmental
Project: Broadway Bridge No. 5789 Replacement
Bangor, ME
Project No: 09.0025990.02 Figure 22-S-2928

Tested By: JB Checked By:

Particle Size Distribution Report

ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.6	23.2	13.1	18.1	16.8	24.2	

Test Results (ASTM D6913)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
1"	100.0			
3/4"	95.4			
1/2"	90.3			
3/8"	84.0			
#4	72.2			
#10	59.1			
#20	48.1			
#40	41.0			
#60	35.7			
#100	30.4			
#200	24.2			

* (no specification provided)

Material Description

Olive f-c SAND, some f-c Gravel, some Silt & Clay

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 12.5149 D_{85}= 9.9990 D_{60}= 2.1277
D_{50}= 0.9991 D_{30}= 0.1441 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Test Remarks

Sample visually classified as plastic. Sample rolled to 1/8".

Source of Sample: HB-BI95 Depth: 25-27'
Sample Number: 203 / 9D Sample Date: 08.05.22

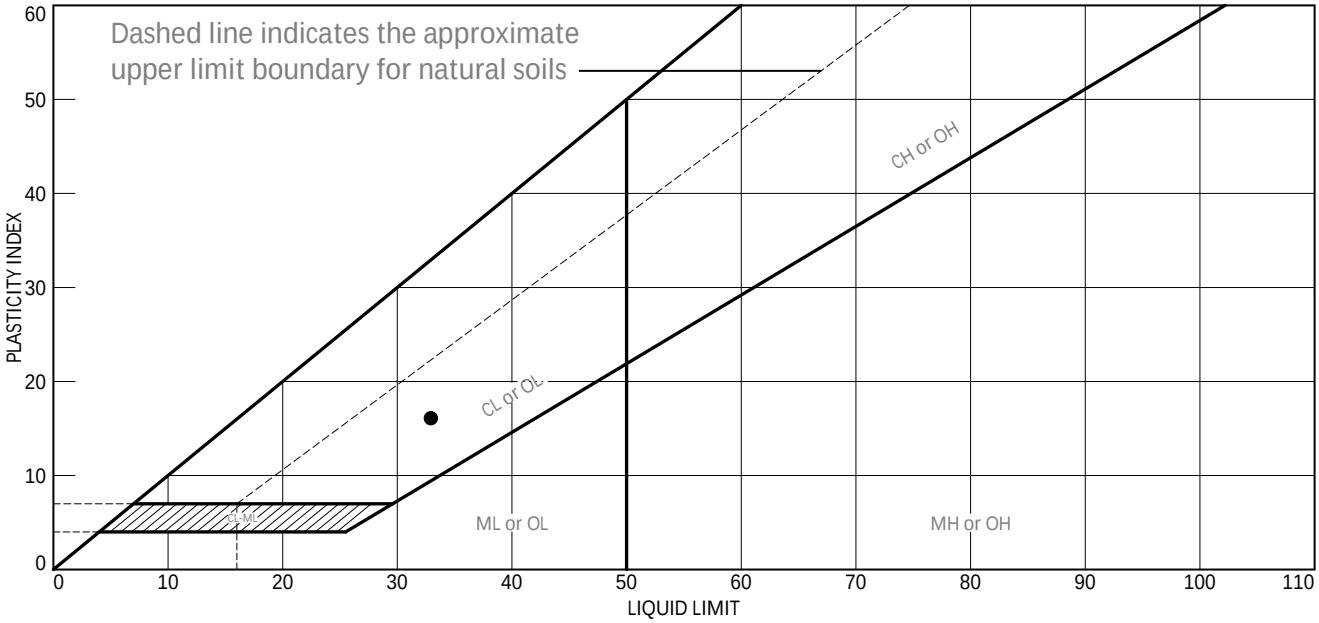
Thielsch Engineering Inc.

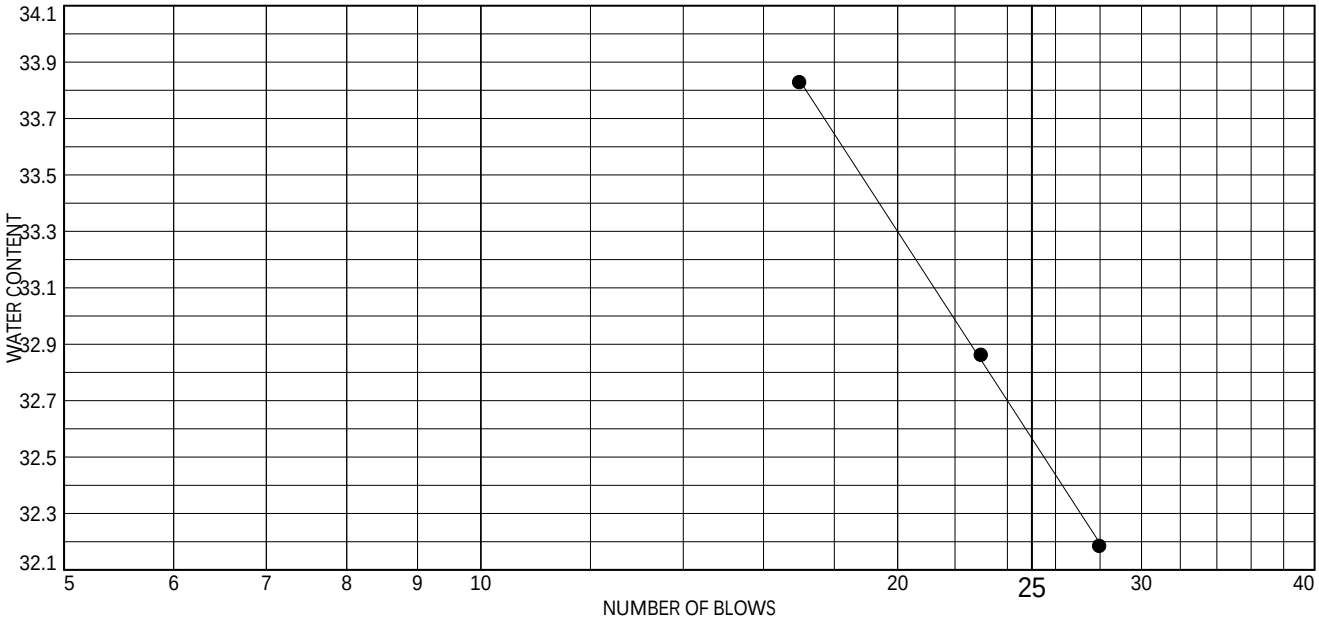
Cranston, RI

Client: GZA GeoEnvironmental
Project: Broadway Bridge No. 5789 Replacement
Bangor, ME
Project No: 09.0025990.02 Figure 22-S-2929

Tested By: JB Checked By:

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Olive CLAY & SILT	33	17	16			

Project No. 09.0025990.02 Client: GZA GeoEnvironmental

Project: Broadway Bridge No. 5789 Replacement

Bangor, ME

Source of Sample: HB-BI95 Depth: 2-4'

Sample Number: 204 / 2D

Remarks:

Thielsch Engineering Inc.

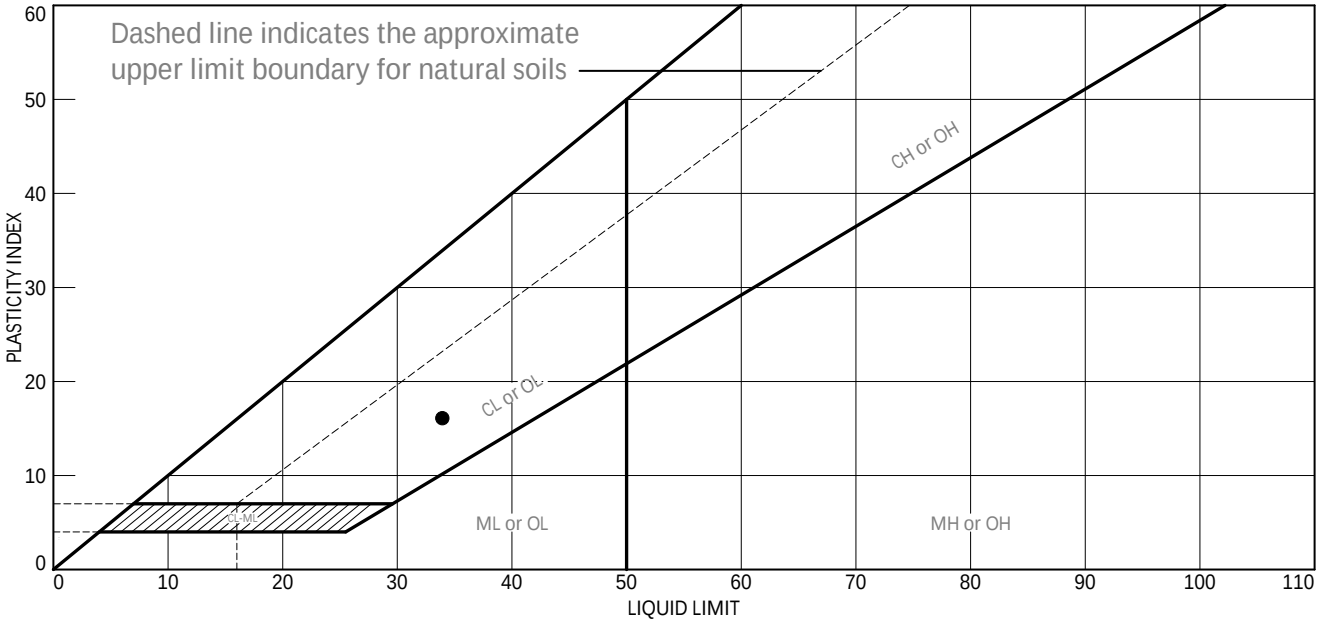
Cranston, RI

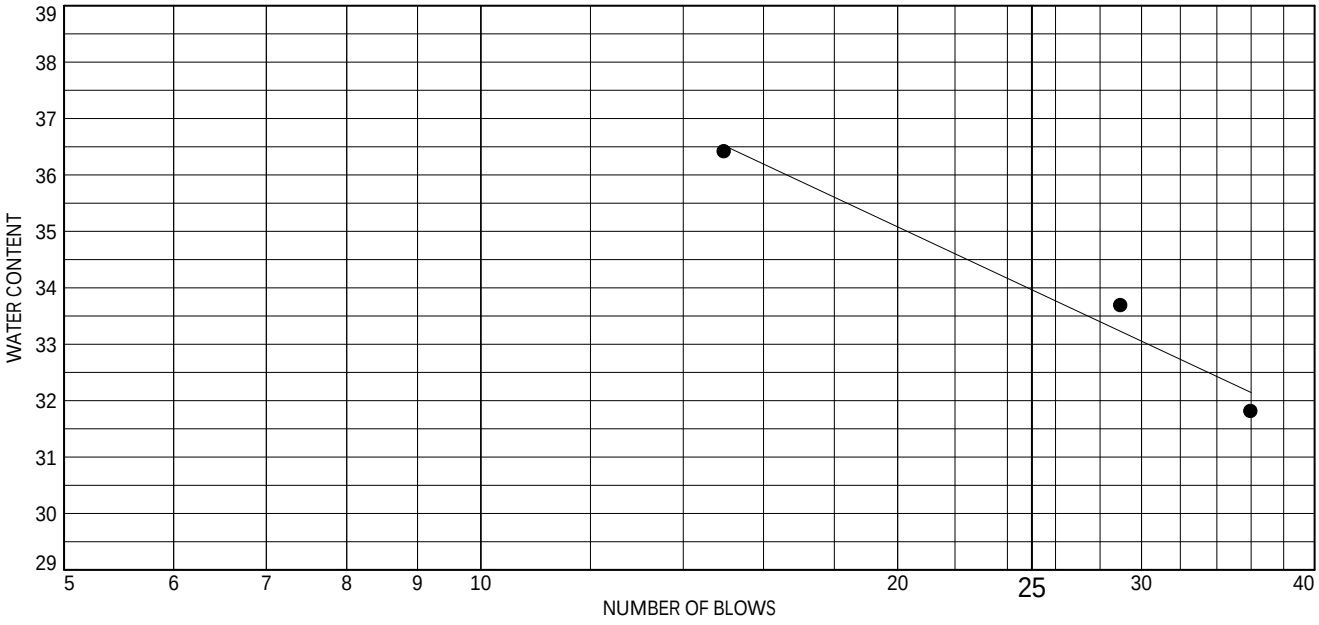
Figure 22-L-2930

Tested By: JB Checked By:

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Olive CLAY & SILT	34	18	16			

Project No. 09.0025990.02 Client: GZA GeoEnvironmental

Project: Broadway Bridge No. 5789 Replacement

Bangor, ME

Source of Sample: HB-BI95 Depth: 6-8'

Sample Number: 204 / 4D

Remarks:

Thielsch Engineering Inc.

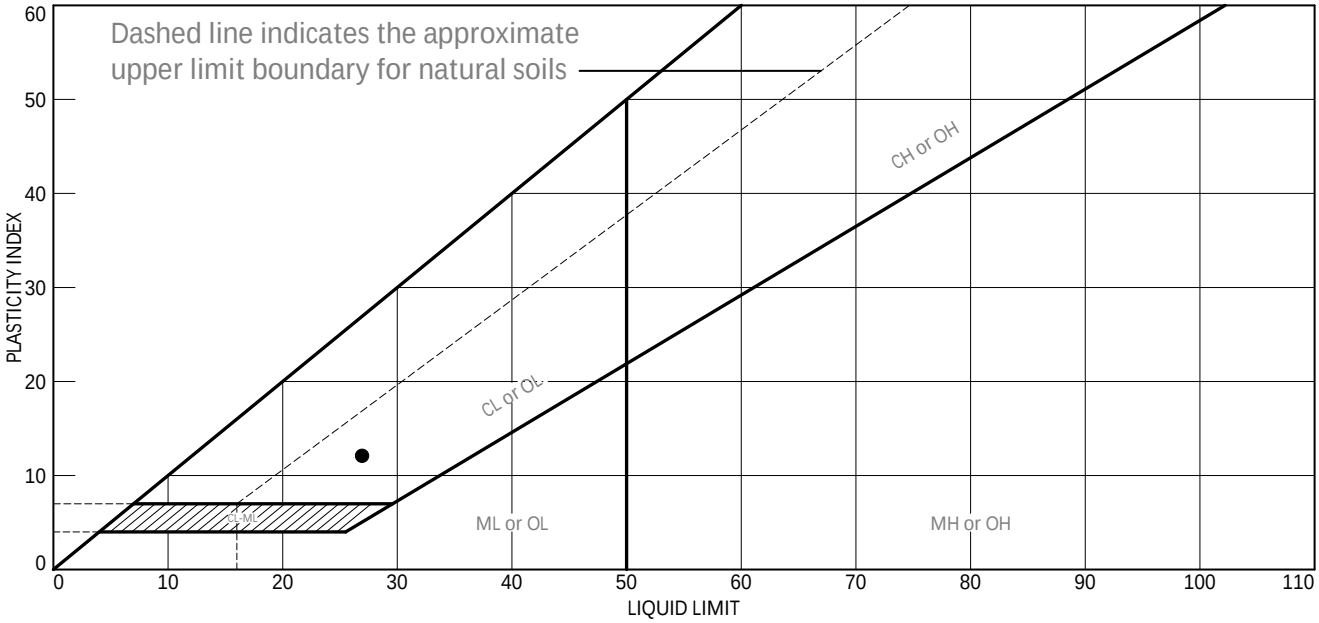
Cranston, RI

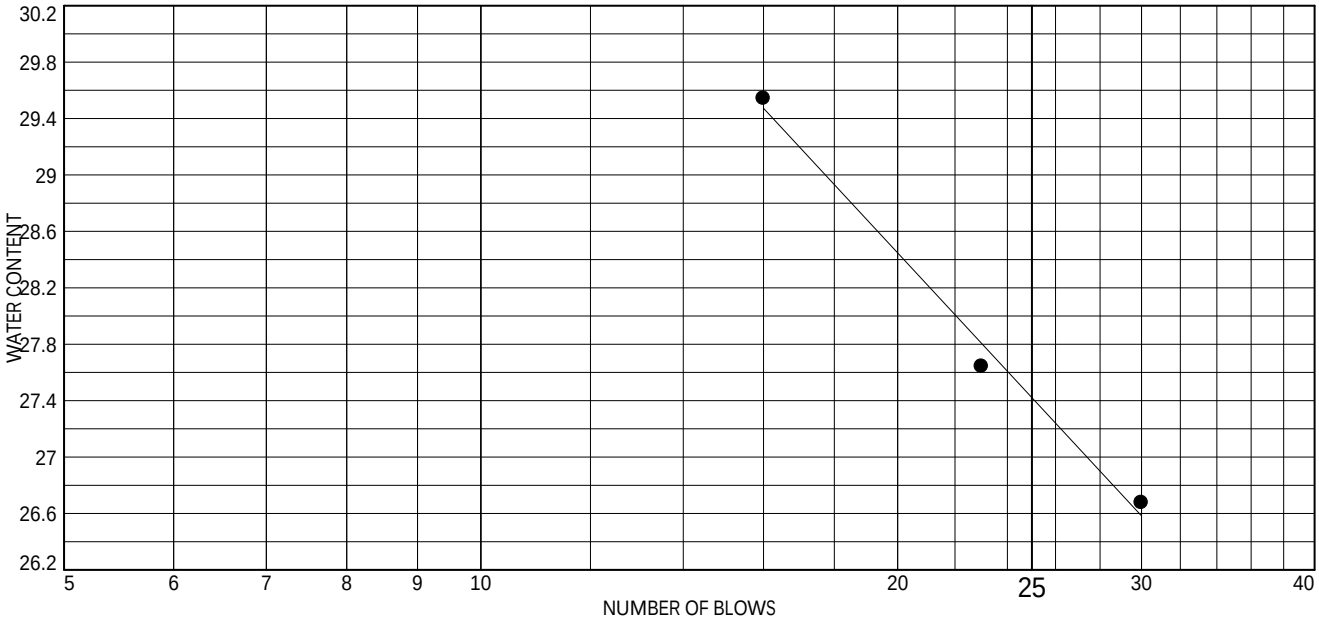
Figure 22-L-2931

Tested By: FR Checked By:

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Olive CLAY & SILT	27	15	12			

Project No. 09.0025990.02 Client: GZA GeoEnvironmental

Project: Broadway Bridge No. 5789 Replacement

Bangor, ME

Source of Sample: HB-BI95 Depth: 15-17'

Sample Number: 204 / 6D

Remarks:

Thielsch Engineering Inc.

Cranston, RI

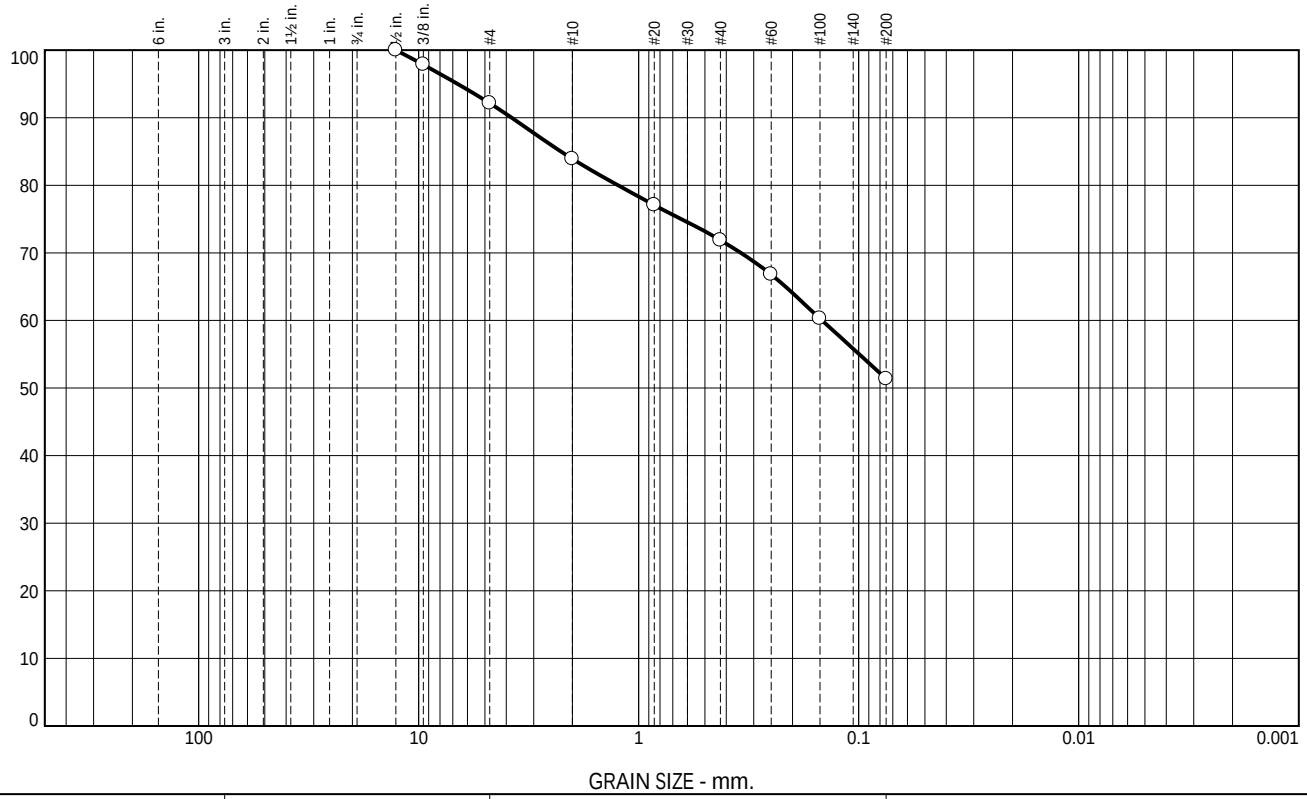
Figure 22-L-2932

Tested By: SL Checked By:

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

Particle Size Distribution Report

ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	7.9	8.2	12.0	20.5	51.4	

Test Results (ASTM D6913)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
1/2"	100.0			
3/8"	97.9			
#4	92.1			
#10	83.9			
#20	77.1			
#40	71.9			
#60	66.8			
#100	60.3			
#200	51.4			

* (no specification provided)

Material Description

Gray SILT & CLAY and f-c SAND, trace fine Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 3.7778 D_{85}= 2.2582 D_{60}= 0.1467
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO= A-4(2)

Test Remarks

Sample visually classified as plastic. Sample rolled to 1/8".

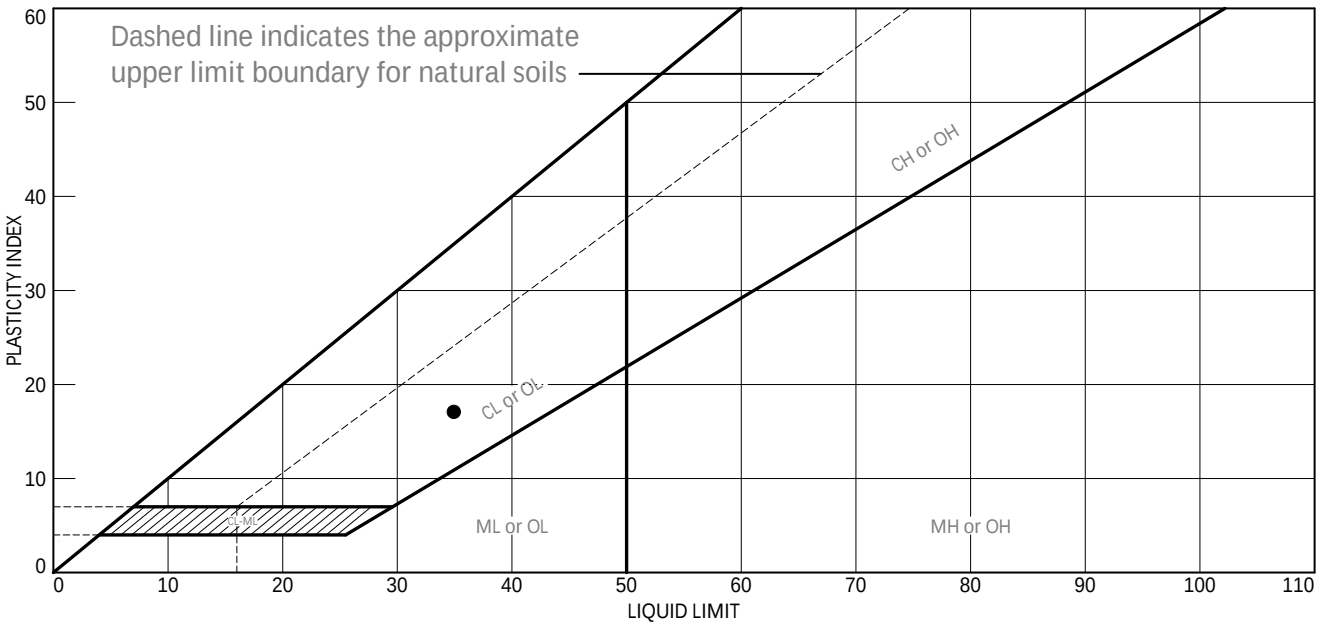
Source of Sample: HB-BI95 Depth: 20-22'
Sample Number: 204 / 7D Sample Date: 08.05.22

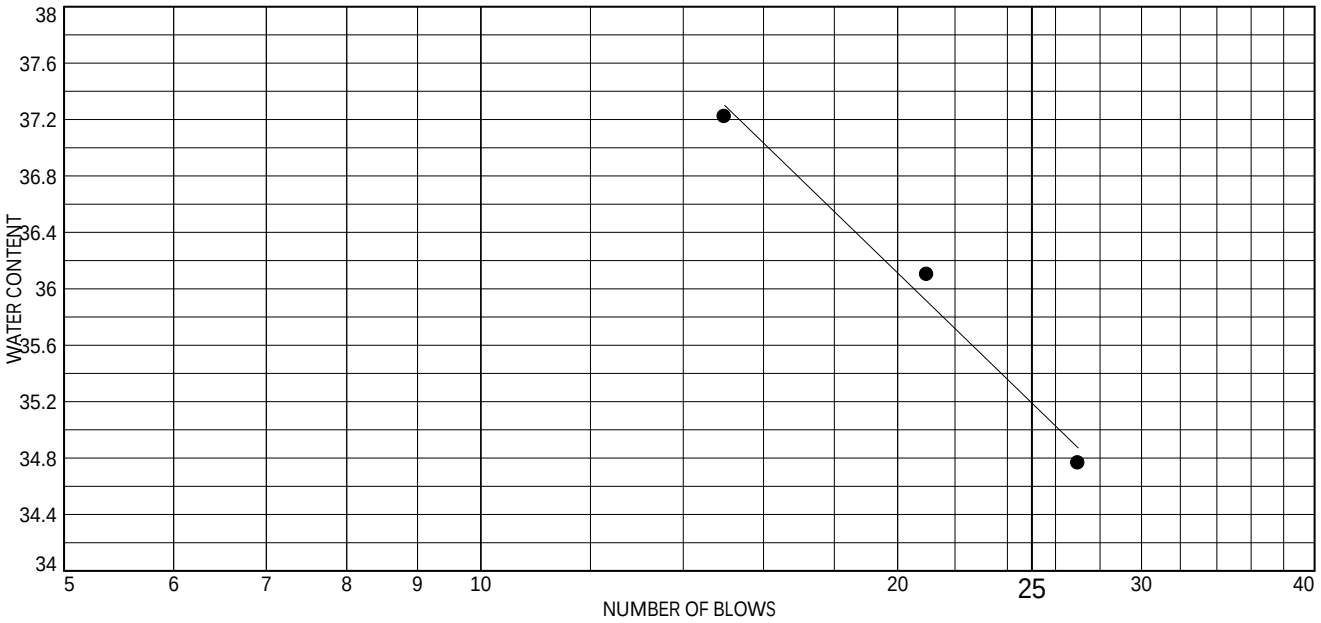
Thielsch Engineering Inc.
Cranston, RI

Client: GZA GeoEnvironmental
Project: Broadway Bridge No. 5789 Replacement
Bangor, ME
Project No: 09.0025990.02 Figure 22-S-2933

Tested By: JB Checked By:

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Olive CLAY & SILT	35	18	17			

Project No. 09.0025990.02 Client: GZA GeoEnvironmental

Project: Broadway Bridge No. 5789 Replacement

Bangor, ME

Source of Sample: HB-BI95 Depth: 2-4'

Sample Number: 205 / 2D

Remarks:

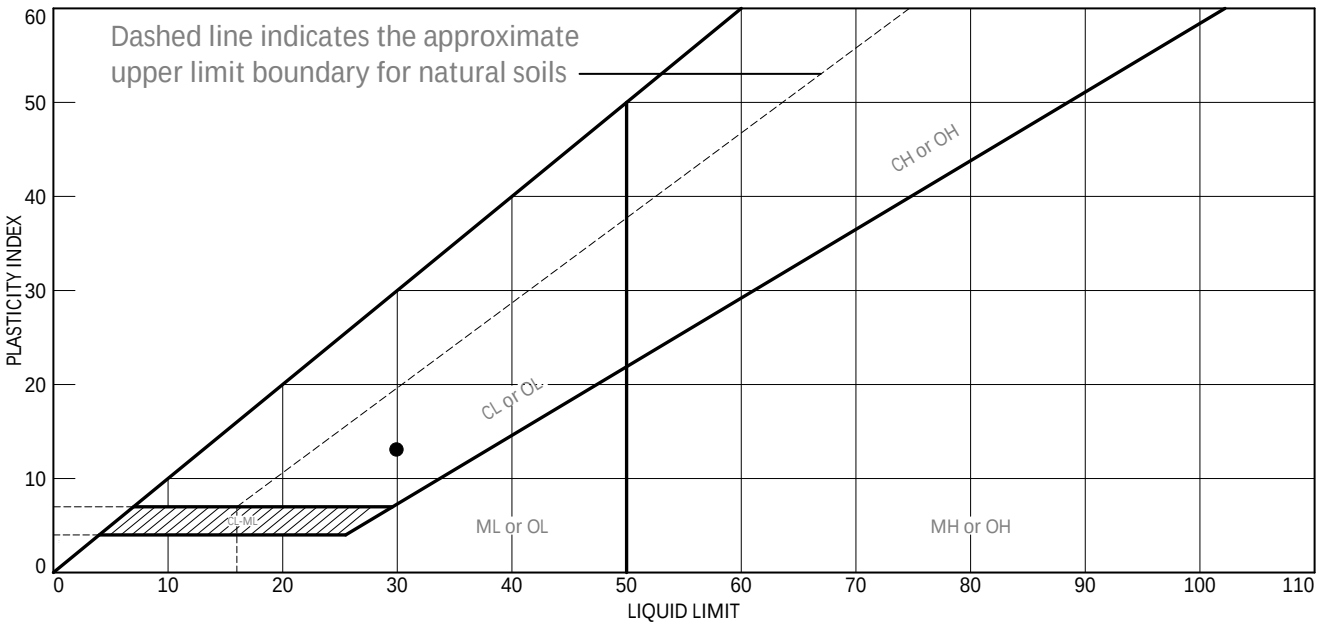
Thielsch Engineering Inc.

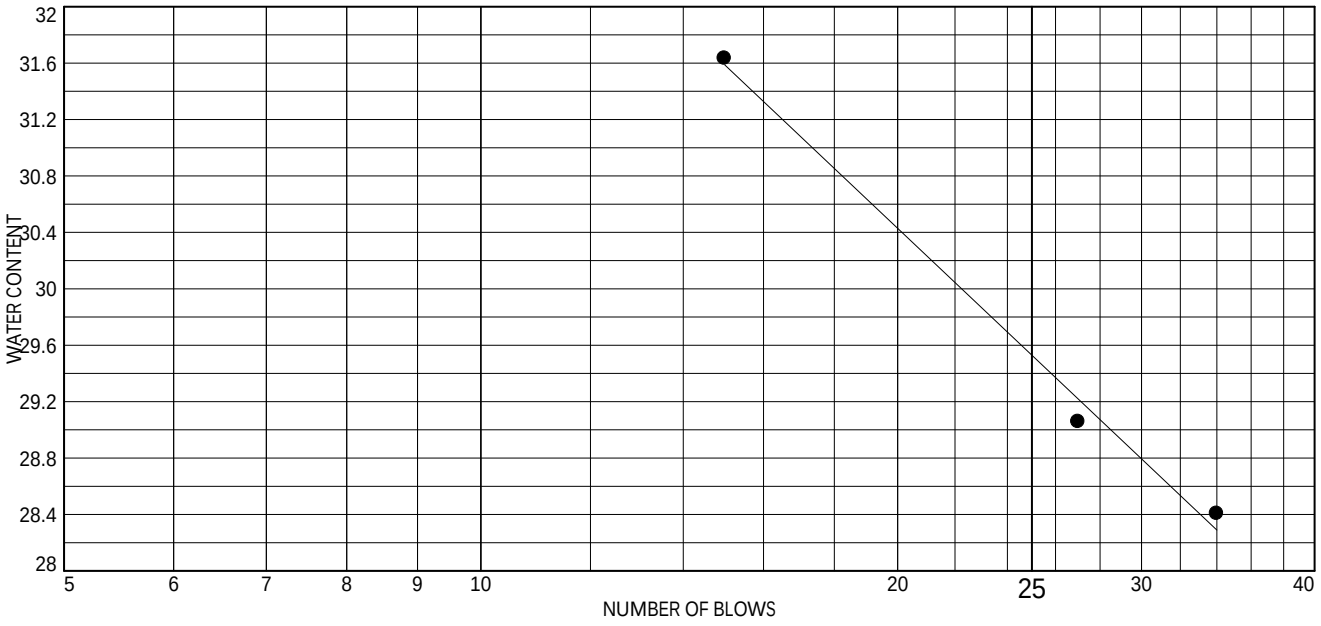
Cranston, RI

Figure 22-L-2934

Tested By: JB Checked By:

LIQUID AND PLASTIC LIMITS TEST REPORT





MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
● Olive CLAY & SILT	30	17	13			

Project No. 09.0025990.02 Client: GZA GeoEnvironmental

Project: Broadway Bridge No. 5789 Replacement

Bangor, ME

Source of Sample: HB-BI95 Depth: 15-17'

Sample Number: 205 / 6D

Remarks:

Thielsch Engineering Inc.

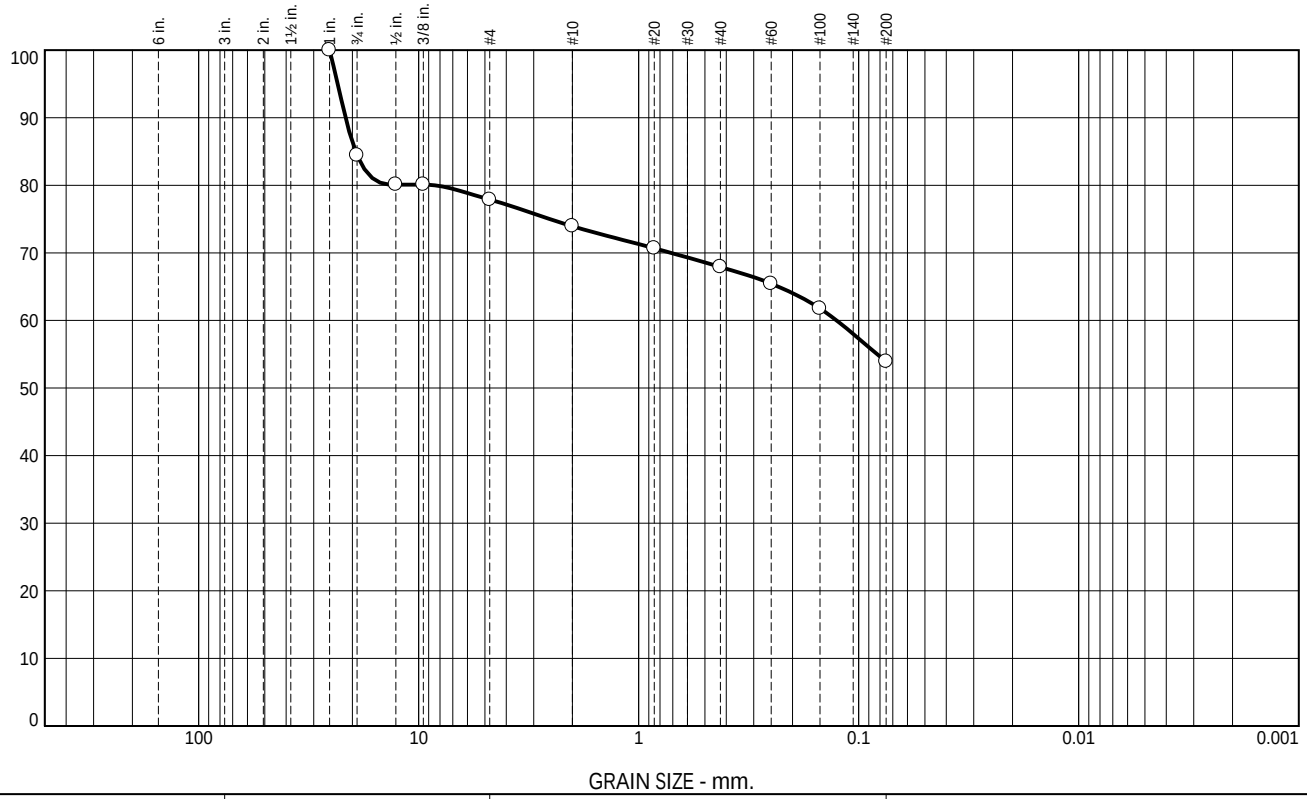
Cranston, RI

Figure 22-L-2935

Tested By: FR Checked By:

Particle Size Distribution Report

ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	15.6	6.5	4.0	6.0	14.0	53.9	

Test Results (ASTM D6913)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
1"	100.0			
3/4"	84.4			
1/2"	80.1			
3/8"	80.1			
#4	77.9			
#10	73.9			
#20	70.7			
#40	67.9			
#60	65.4			
#100	61.8			
#200	53.9			

* (no specification provided)

Material Description

Gray SILT & CLAY, some f-c Sand, some f-c Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 21.4696 D_{85}= 19.3670 D_{60}= 0.1260
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO= A-4(3)

Test Remarks

Sample visually classified as plastic. Sample rolled to 1/8".

Source of Sample: HB-BI95 Depth: 25-27'
Sample Number: 205 / 8D Sample Date: 08.05.22

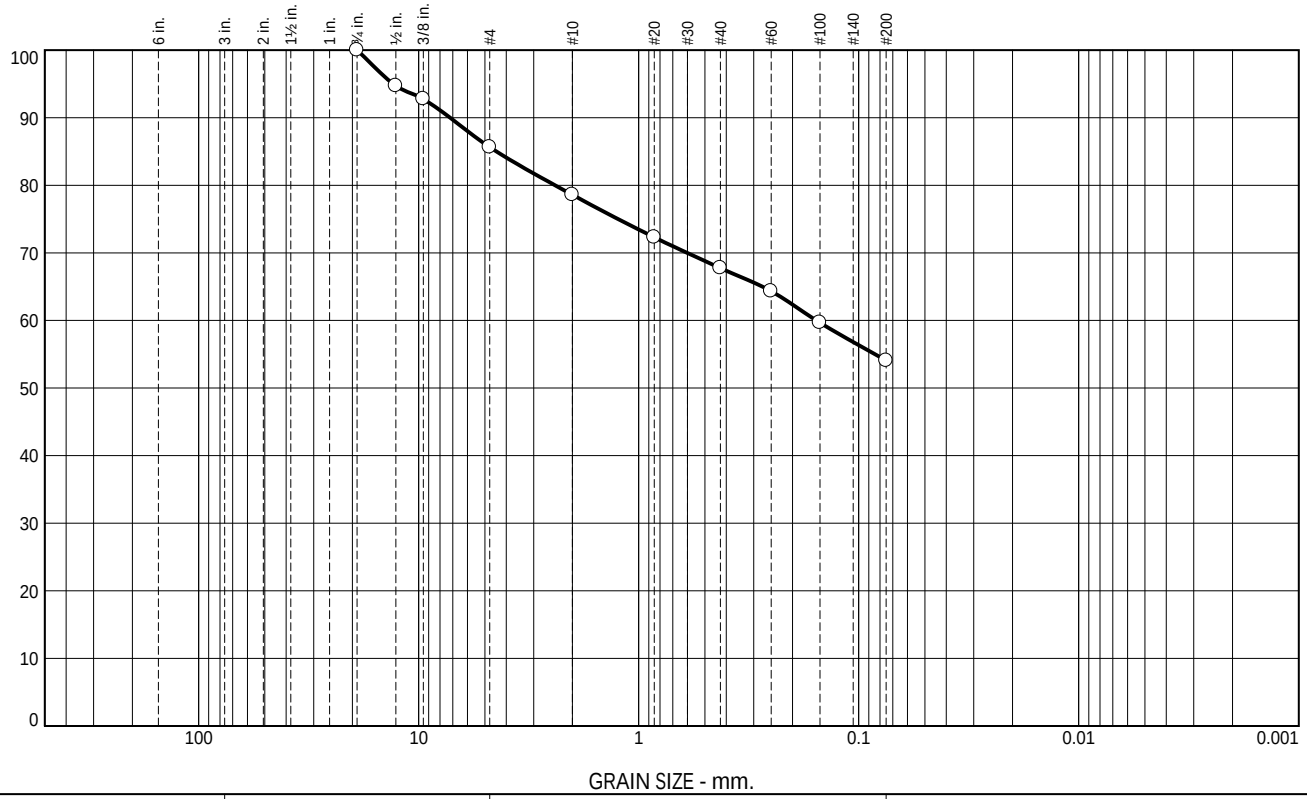
Thielsch Engineering Inc.
Cranston, RI

Client: GZA GeoEnvironmental
Project: Broadway Bridge No. 5789 Replacement
Bangor, ME
Project No: 09.0025990.02 Figure 22-S-2936

Tested By: JB Checked By:

Particle Size Distribution Report

ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	14.4	7.0	10.9	13.6	54.1	

Test Results (ASTM D6913)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
3/4"	100.0			
1/2"	94.7			
3/8"	92.8			
#4	85.6			
#10	78.6			
#20	72.3			
#40	67.7			
#60	64.3			
#100	59.7			
#200	54.1			

* (no specification provided)

Material Description

Brown SILT & CLAY, some f-c Sand, little fine Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 7.1987 D_{85}= 4.4254 D_{60}= 0.1558
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO= A-4(3)

Test Remarks

Sample visually classified as plastic. Sample rolled to 1/8".

Source of Sample: HB-BI95 Depth: 0-2'
Sample Number: 206 / 1D Sample Date: 08.08.22

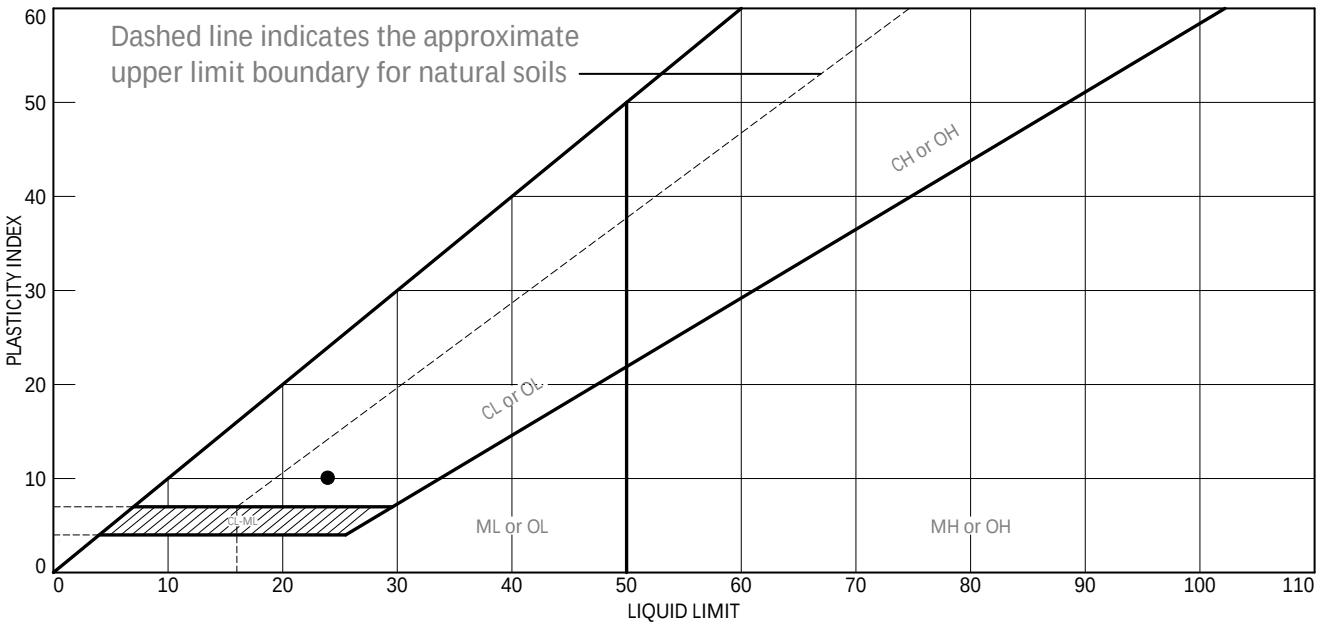
Thielsch Engineering Inc.

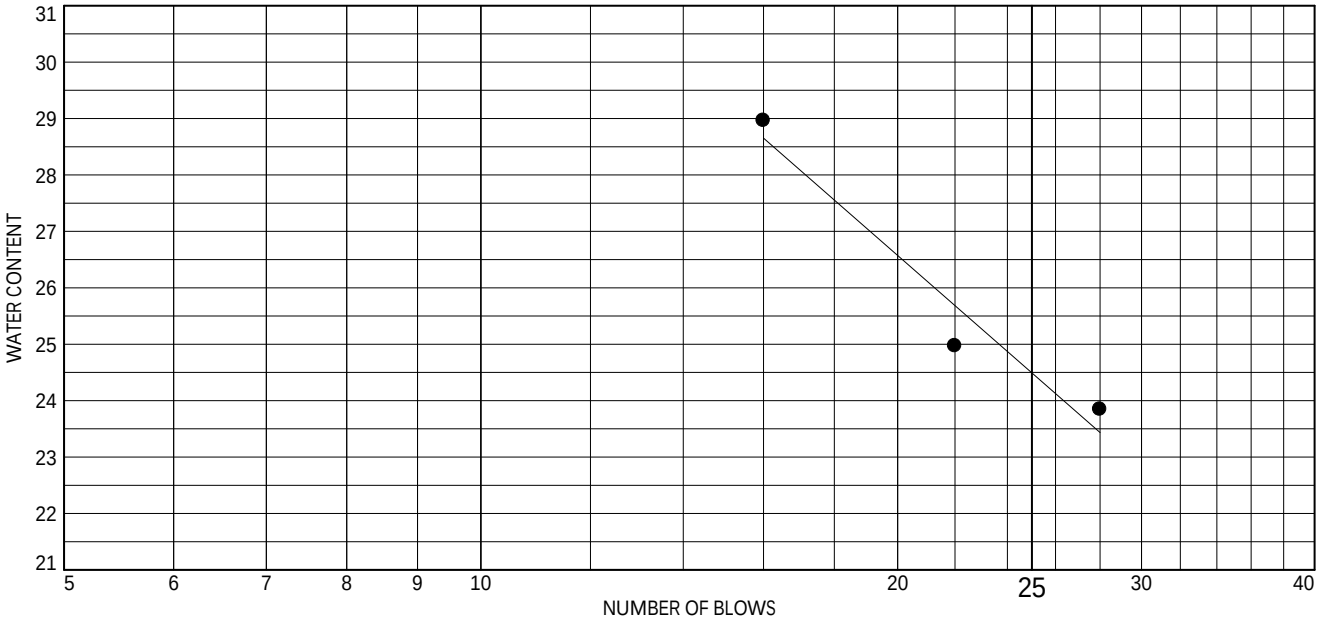
Cranston, RI

Client: GZA GeoEnvironmental
Project: Broadway Bridge No. 5789 Replacement
Bangor, ME
Project No: 09.0025990.02 Figure 22-S-2937

Tested By: JB Checked By:

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray CLAY & SILT	24	14	10			

Project No. 09.0025990.02 Client: GZA GeoEnvironmental

Project: Broadway Bridge No. 5789 Replacement

Bangor, ME

Source of Sample: HB-BI95 Depth: 15-17'

Sample Number: 206 / 6D

Remarks:

Thielsch Engineering Inc.

Cranston, RI

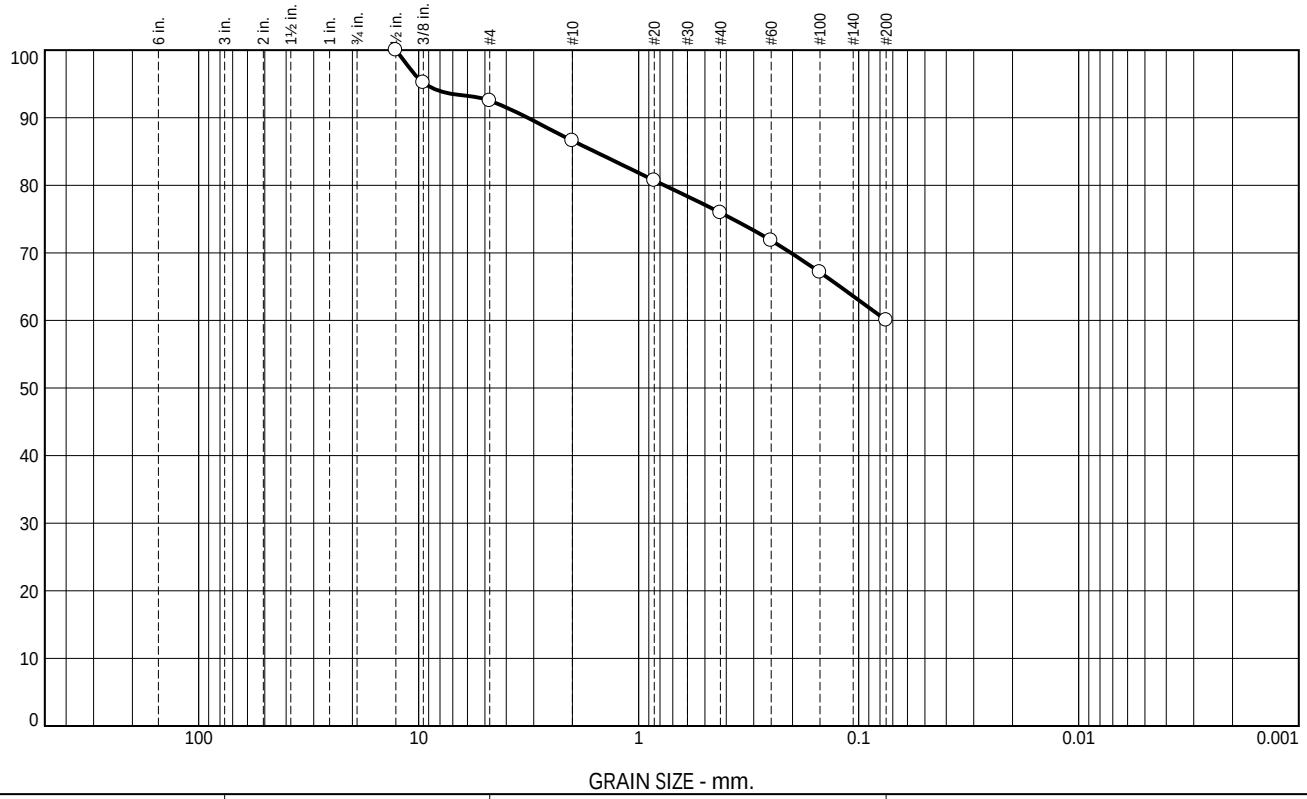
Figure 22-L-2939

Tested By: JB Checked By:

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

Particle Size Distribution Report

ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	7.5	5.9	10.7	15.9	60.0	

Test Results (ASTM D6913)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
1/2"	100.0			
3/8"	95.2			
#4	92.5			
#10	86.6			
#20	80.7			
#40	75.9			
#60	71.8			
#100	67.1			
#200	60.0			

* (no specification provided)

Material Description

Gray SILT & CLAY, some f-c Sand, trace fine Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 3.2005 D_{85}= 1.5848 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO= A-4(3)

Test Remarks

Sample visually classified as plastic. Sample rolled to 1/8".

Source of Sample: HB-BI95 Depth: 25-27'
Sample Number: 206 / 8D Sample Date: 08.08.22

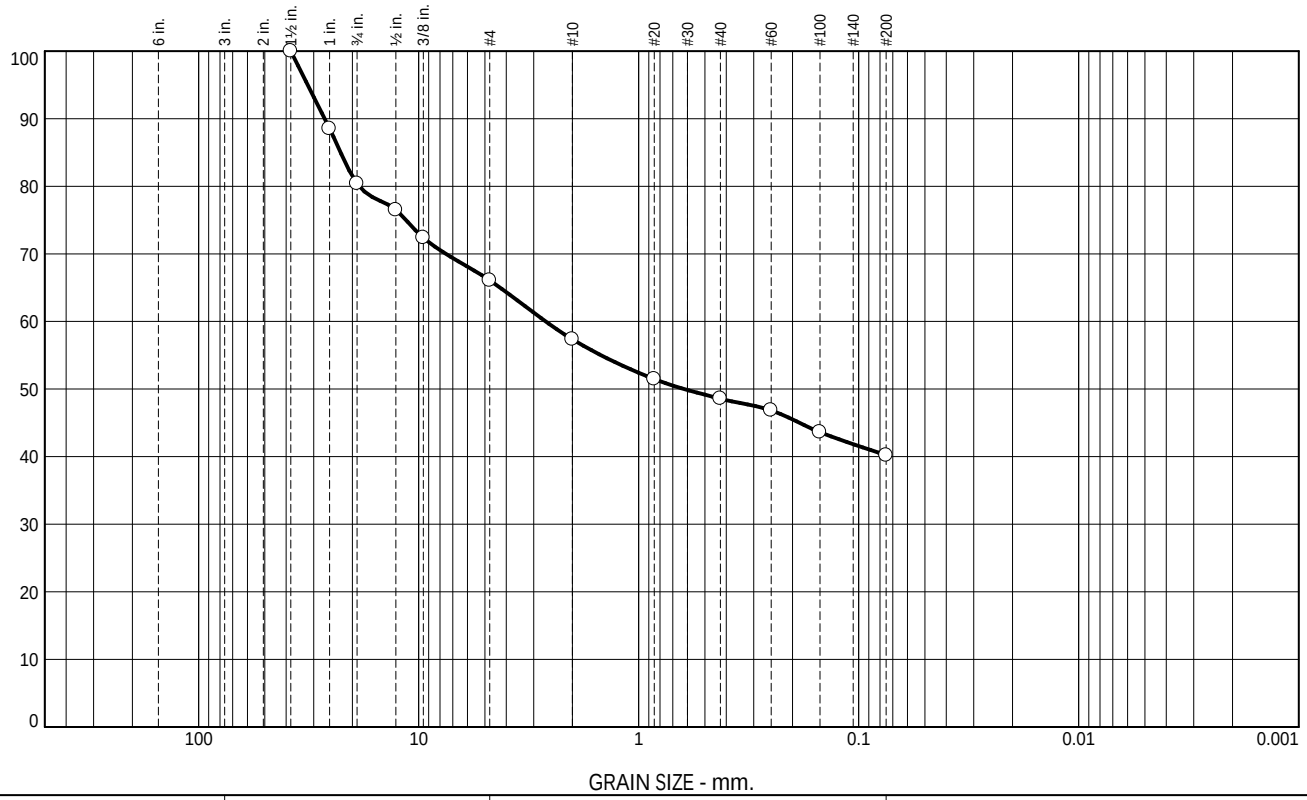
Thielsch Engineering Inc.
Cranston, RI

Client: GZA GeoEnvironmental
Project: Broadway Bridge No. 5789 Replacement
Bangor, ME
Project No: 09.0025990.02 Figure 22-S-2940

Tested By: JB Checked By:

Particle Size Distribution Report

ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	19.6	14.3	8.7	8.8	8.4	40.2	

Test Results (ASTM D6913)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
1 1/2"	100.0			
1"	88.5			
3/4"	80.4			
1/2"	76.5			
3/8"	72.4			
#4	66.1			
#10	57.4			
#20	51.5			
#40	48.6			
#60	46.8			
#100	43.6			
#200	40.2			

* (no specification provided)

Material Description

Gray SILT, some f-c Gravel, some f-c Sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 26.7534 D_{85}= 22.6238 D_{60}= 2.6456
D_{50}= 0.6213 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= GM AASHTO= A-4(0)

Test Remarks

Sample visually classified as non-plastic.

Source of Sample: HB-BI95 Depth: 2.3-4'
Sample Number: 207 / 2D lower 16" Sample Date: 08.05.22

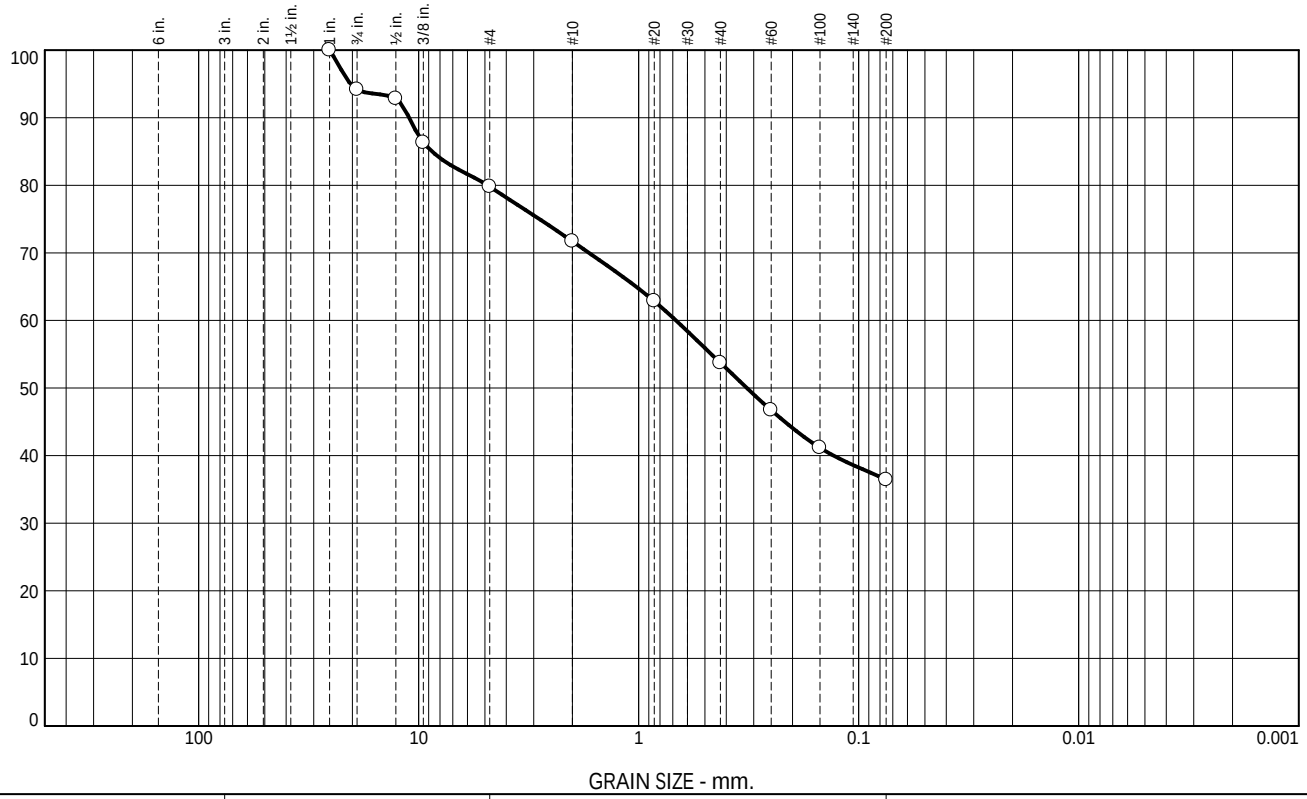
Thielsch Engineering Inc.
Cranston, RI

Client: GZA GeoEnvironmental
Project: Broadway Bridge No. 5789 Replacement
Bangor, ME
Project No: 09.0025990.02 Figure 22-S-2941

Tested By: JB Checked By:

Particle Size Distribution Report

ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	5.9	14.3	8.1	18.0	17.3	36.4	

Test Results (ASTM D6913)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
1"	100.0			
3/4"	94.1			
1/2"	92.8			
3/8"	86.3			
#4	79.8			
#10	71.7			
#20	62.9			
#40	53.7			
#60	46.7			
#100	41.2			
#200	36.4			

* (no specification provided)

Material Description

Brown f-c SAND and SILT, some f-c Gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 11.0435 D_{85}= 8.6864 D_{60}= 0.6768
D_{50}= 0.3223 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Test Remarks

Sample visually classified as non-plastic.

Source of Sample: HB-BI95 Depth: 0-2'
Sample Number: 208 / 1D Sample Date: 08.08.22

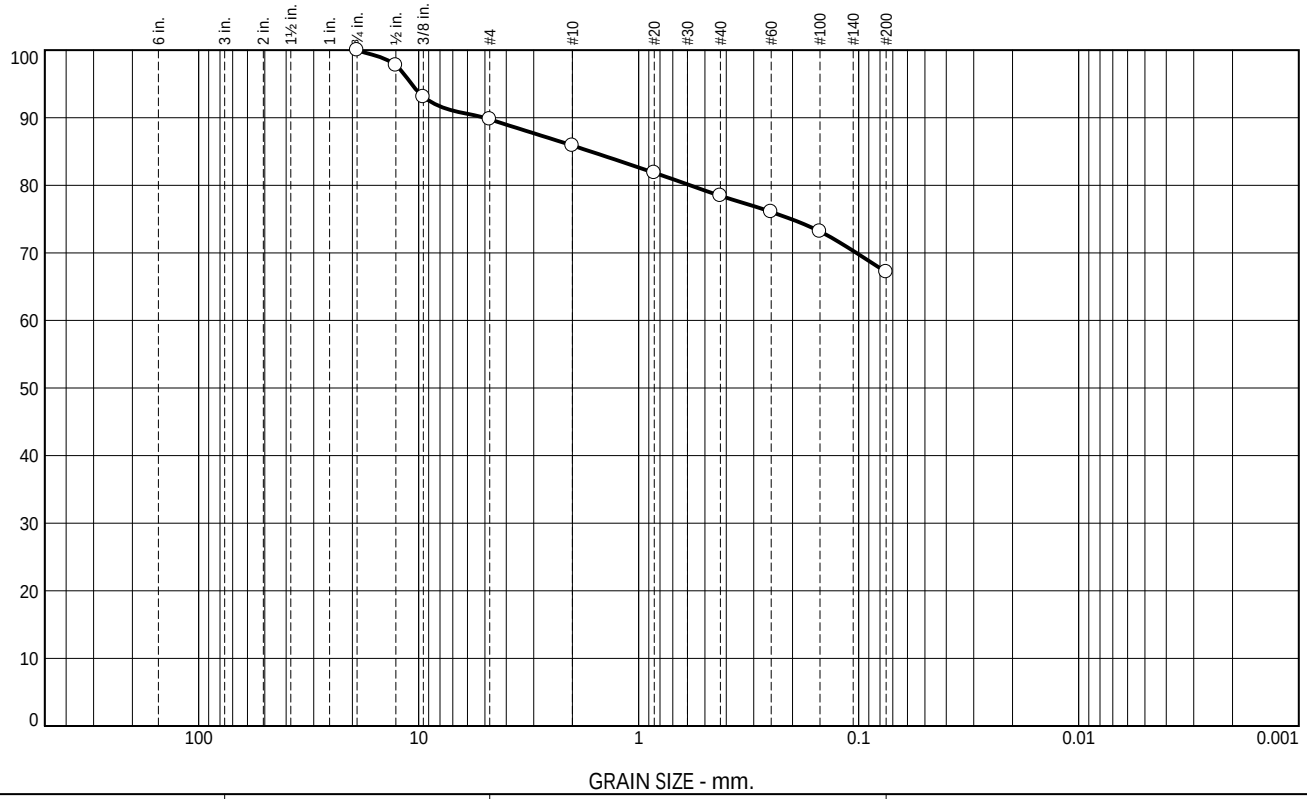
Thielsch Engineering Inc.
Cranston, RI

Client: GZA GeoEnvironmental
Project: Broadway Bridge No. 5789 Replacement
Bangor, ME
Project No: 09.0025990.02 Figure 22-S-2943

Tested By: JB Checked By:

Particle Size Distribution Report

ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	10.2	3.9	7.5	11.2	67.2	

Test Results (ASTM D6913)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
3/4"	100.0			
1/2"	97.7			
3/8"	93.1			
#4	89.8			
#10	85.9			
#20	81.9			
#40	78.4			
#60	76.1			
#100	73.2			
#200	67.2			

* (no specification provided)

Material Description

Olive SILT & CLAY, some f-c Sand, little fine Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 5.0252 D_{85}= 1.6525 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO= A-4(5)

Test Remarks

Sample visually classified as plastic. Sample rolled to 1/8".

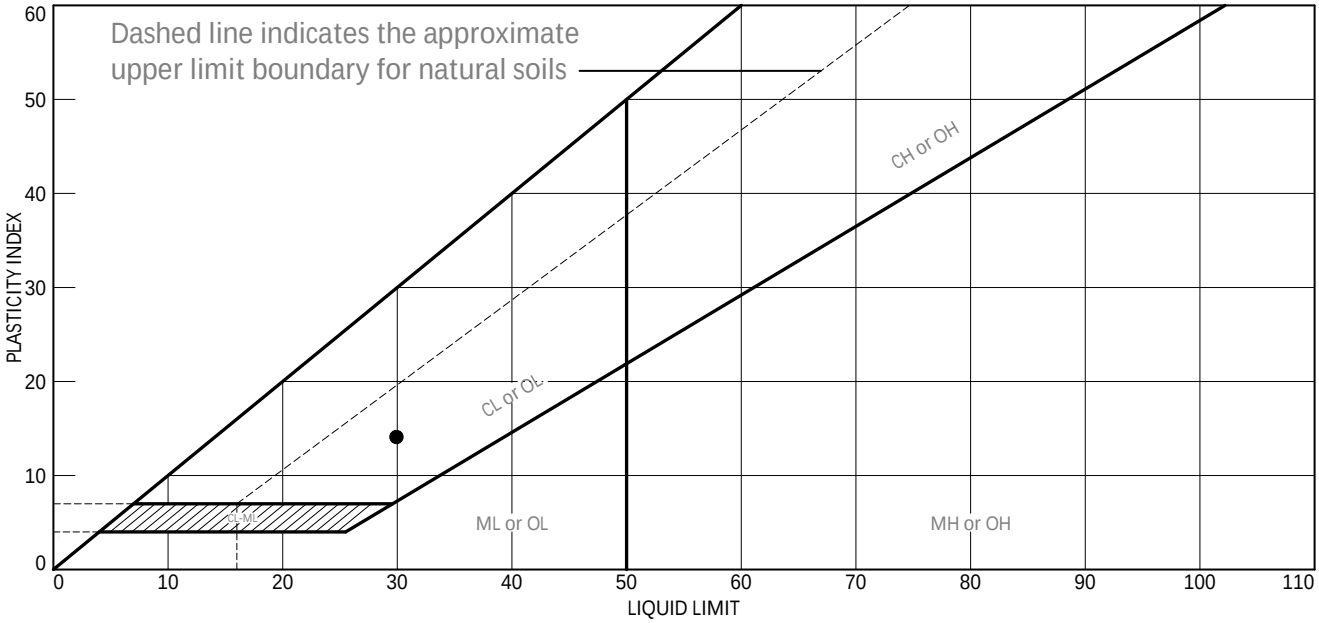
Source of Sample: HB-BI95 Depth: 4-6'
Sample Number: 208 / 3D Sample Date: 08.08.22

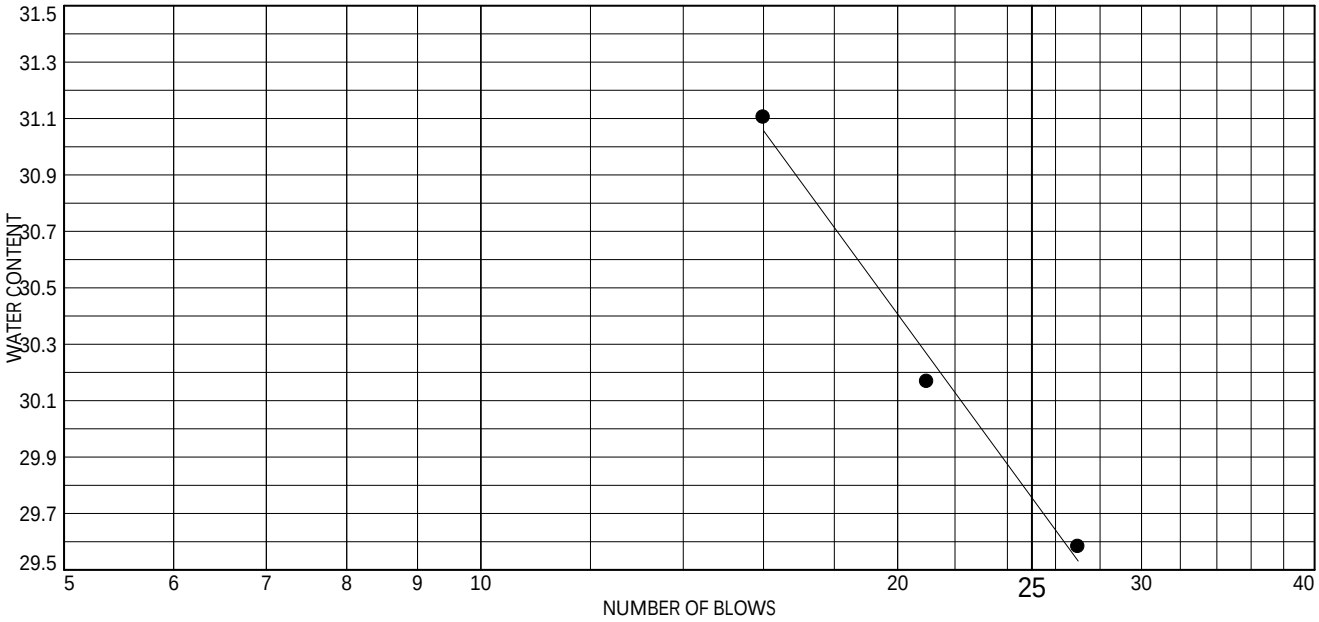
Thielsch Engineering Inc.
Cranston, RI

Client: GZA GeoEnvironmental
Project: Broadway Bridge No. 5789 Replacement
Bangor, ME
Project No: 09.0025990.02 Figure 22-S-2944

Tested By: JB Checked By:

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Olive CLAY & SILT	30	16	14			

Project No. 09.0025990.02 Client: GZA GeoEnvironmental

Project: Broadway Bridge No. 5789 Replacement

Bangor, ME

Source of Sample: HB-BI95 Depth: 15-17'

Sample Number: 208 / 6D

Remarks:

Thielsch Engineering Inc.

Cranston, RI

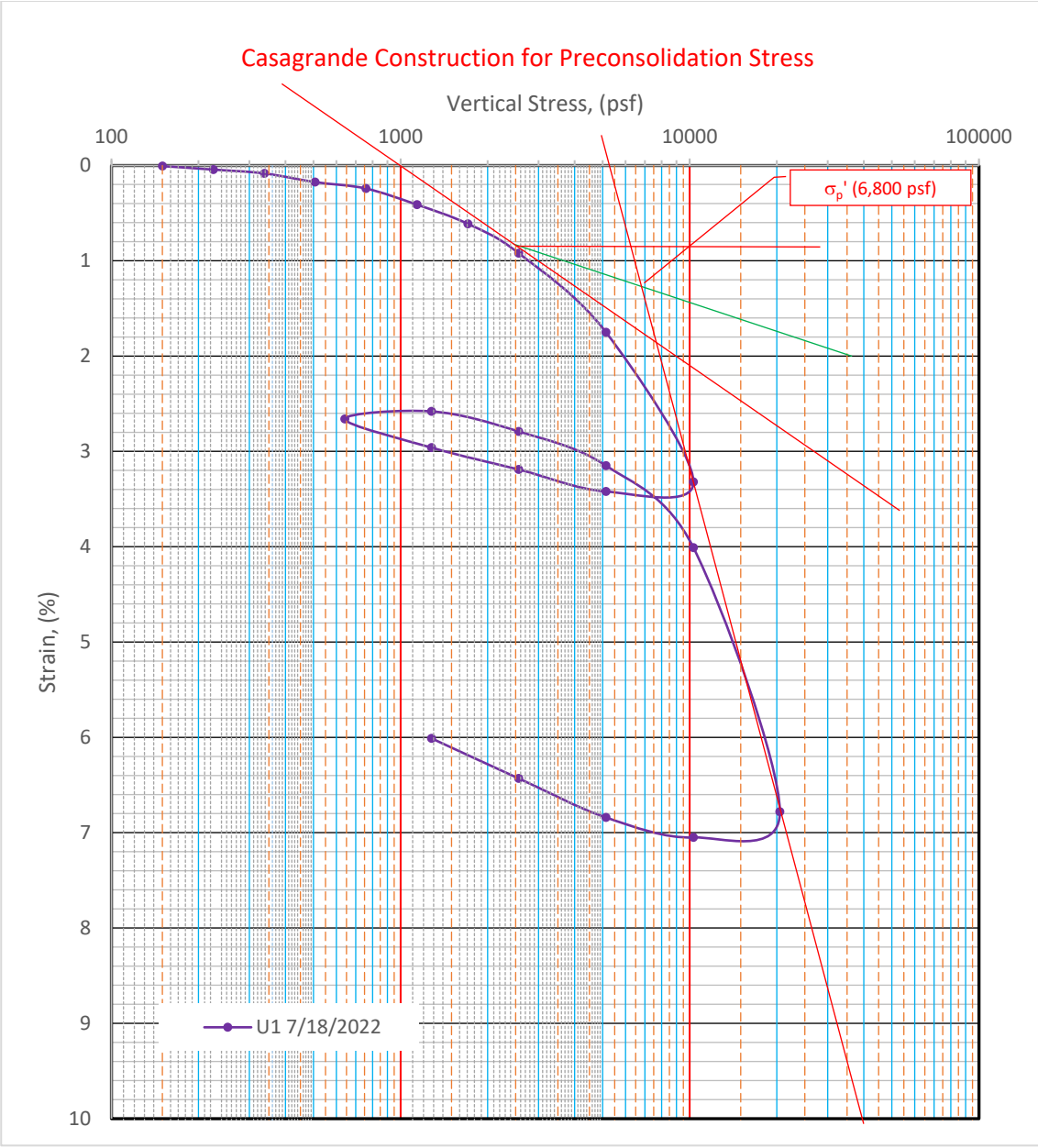
Figure 22-S-2945

Tested By: JB Checked By:

Consolidation Test Data
Summary Report

Project Name:	I95 Bridge Over Broadway
Project Number:	166-28
Project Location:	Bangor, ME
Client:	GZA
Sample Description:	Brown Silty Clay
Preparation:	Trimmed Shelby Tube

Lab Test No:	ICON 68-408			
Boring No.	BB-I95-201			
Sample No:	U1			
Boring Elevation (ft).	--			
Sample Depth (ft):	13 - 15			
Test Specimen Depth (Ft):	14.7			
Test Specimen Elevation:	---			
Water Content (%):	30.3			
Dry Unit Weight (pcf):	93.6			
Wet Unit Weight (pcf):	122.0			
Saturation Before (%):	96.3			
Saturation After (%):	100			
Void Ratio Before:	0.89			
Void Ratio After:	0.78			
Overburden Pressure (psf):	--			
Max Previous stress (psf):	6,800			
Max Prev. stress (Work) (psf):	6,700			
OCR:	--			
Compression Index (C_{CE}):	0.118			
Recompression Index (C_{RE}):	0.009			
Liquid Limit:	34.6			
Plastic Limit:	20.6			
Plasticity Index:	14.0			
Liquidity Index:	0.60			
Lab Vane Su at 14.9 ft. (psf)	1,629			
Tested By:	sjr			
Date Tested:	7/18/2022			
Checked By:	sjr			

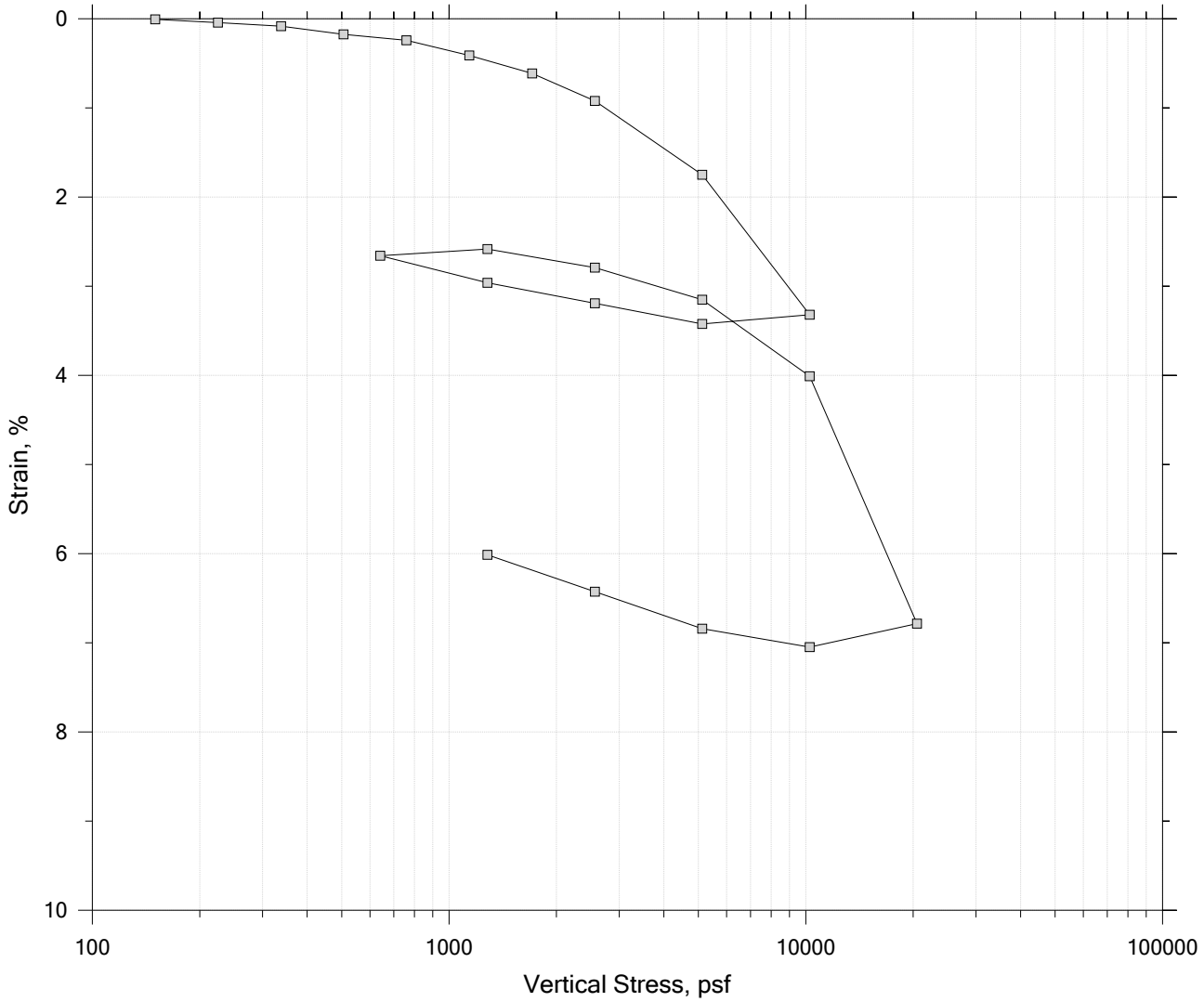


Note 1: The calculations for the Max Previous Stress, the Compression Index and the Recompression Index are provided for the convienience of the Specifier. The Specifier should make their own independent assessment of Maximum Previous stress, Cce and Cre for use in any engineering analyses.

Soil Metrics LLC Geotechnical Engineering

One-Dimensional Consolidation by ASTM D2435 - Method B

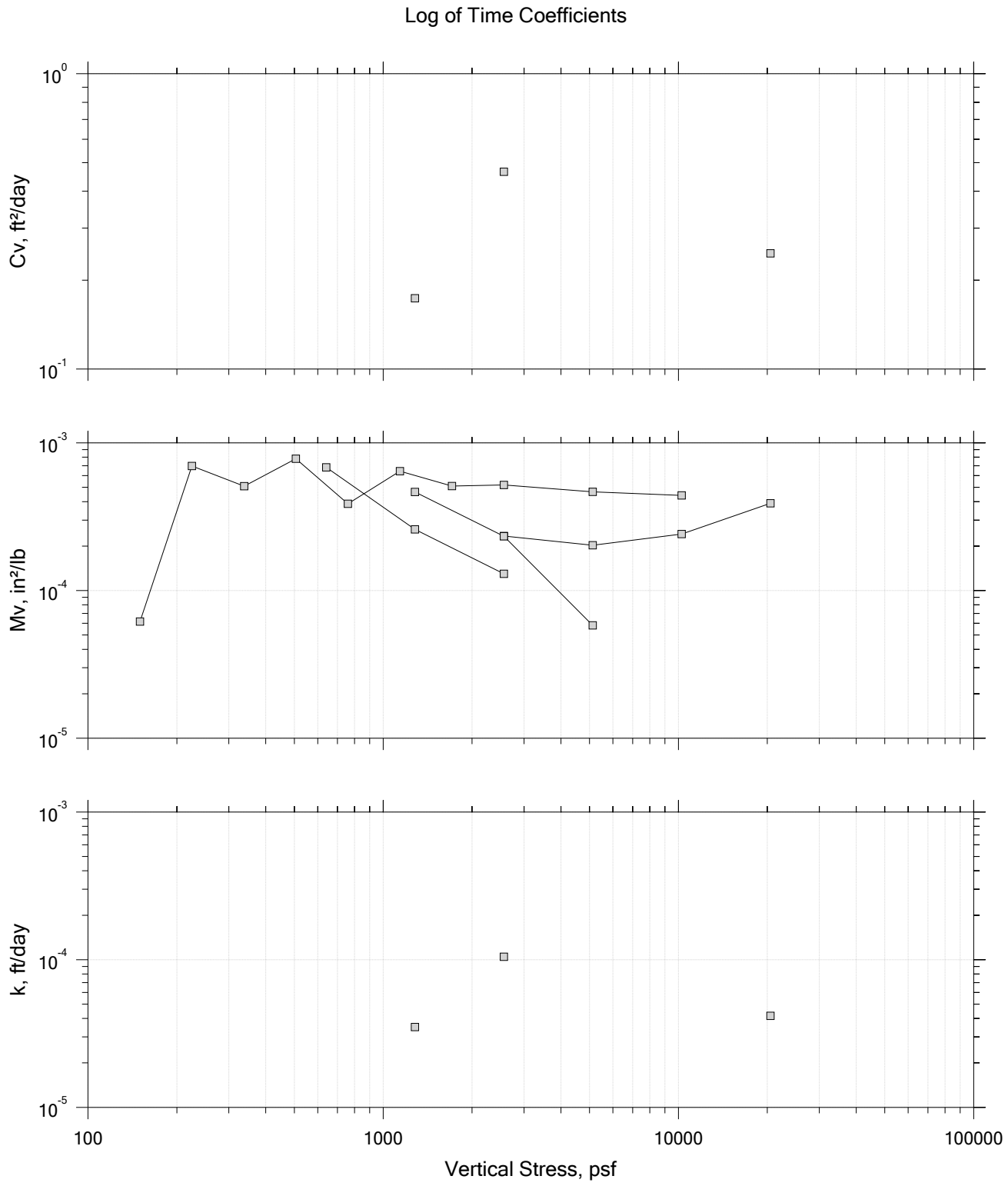
Summary Report



				Before Test	After Test
Current Vertical Effective Stress: 0 psf				Water Content, %	30.31	27.47
Preconsolidation Stress: 0 psf				Dry Unit Weight, pcf	93.6	99.568
Compression Ratio: 0				Saturation, %	96.32	100.00
Diameter: 2.5 in		Height: 1.001 in		Void Ratio	0.89	0.78
LL: 35	PL: 21	PI: 14	GS: 2.84			

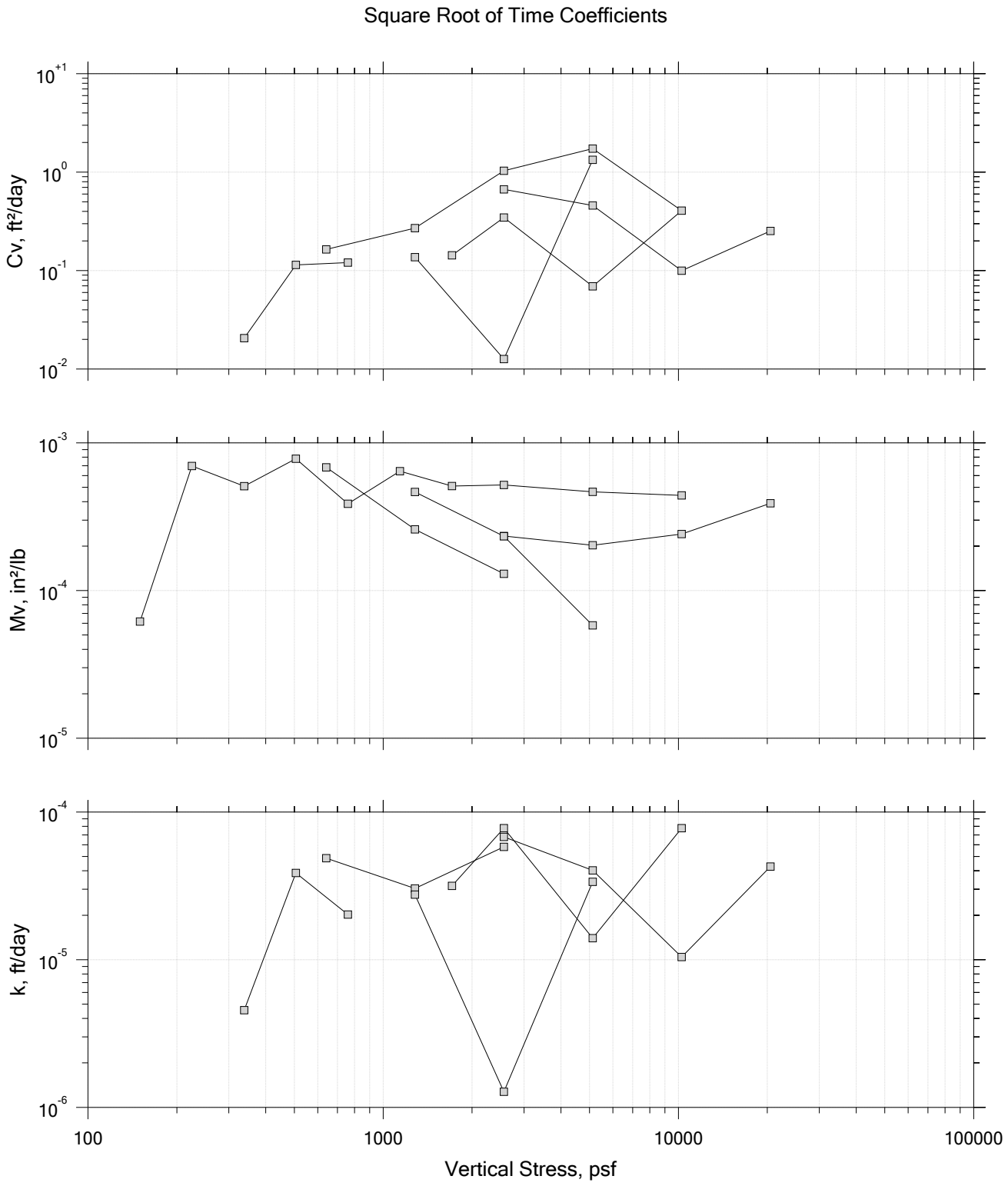
Soil Metrics LLC	Project: I95 Bridge over Broadway	Location: Bangor, ME	Project No.: 166-28
	Boring No.: BB-B195-201	Tested By: sjr	Checked By: sjr
	Sample No.: U1	Test Date: 7/18/2022	Depth: 14.7
	Test No.: ICONP-68-408	Sample Type: wet	Elevation: --
	Description: Brown silty clay		
	Remarks:		
	Displacement at End of Primary		

One-Dimensional Consolidation by ASTM D2435 - Method B



Soil Metrics LLC	Project: I95 Bridge over Broadway	Location: Bangor, ME	Project No.: 166-28
	Boring No.: BB-B195-201	Tested By: sjr	Checked By: sjr
	Sample No.: U1	Test Date: 7/18/2022	Depth: 14.7
	Test No.: ICONP-68-408	Sample Type: wet	Elevation: --
	Description: Brown silty clay		
	Remarks:		

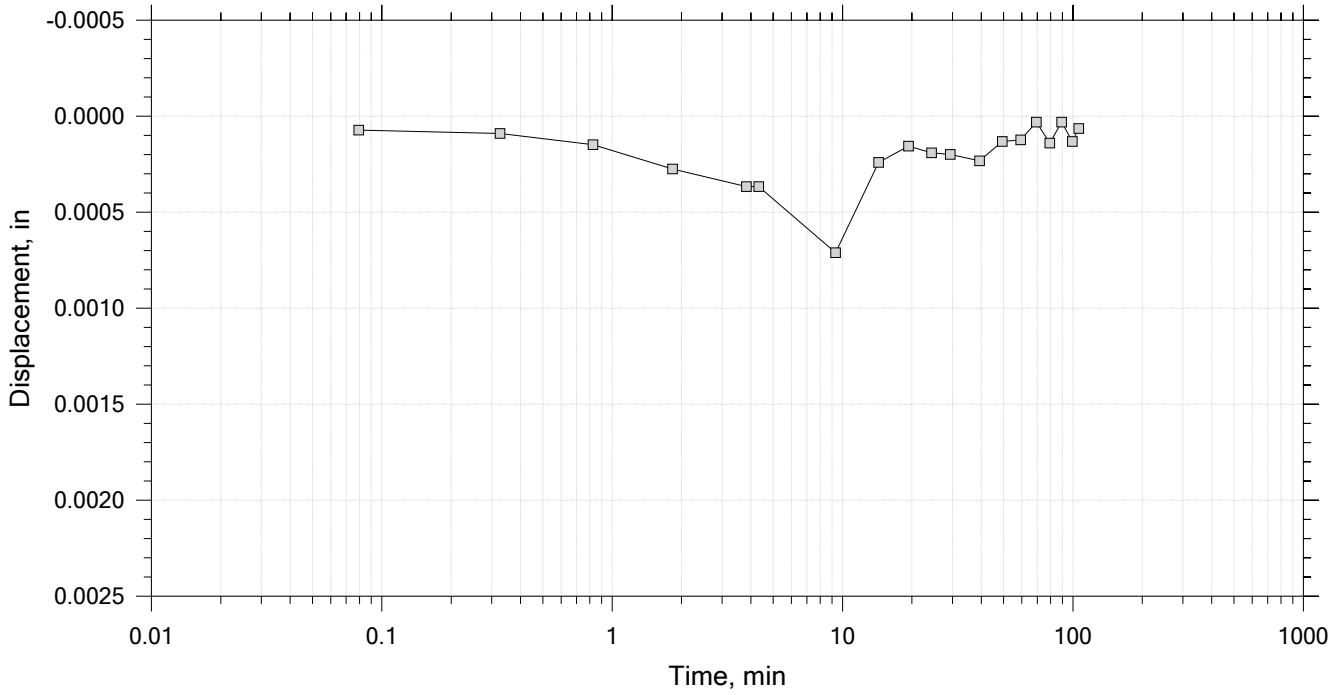
One-Dimensional Consolidation by ASTM D2435 - Method B

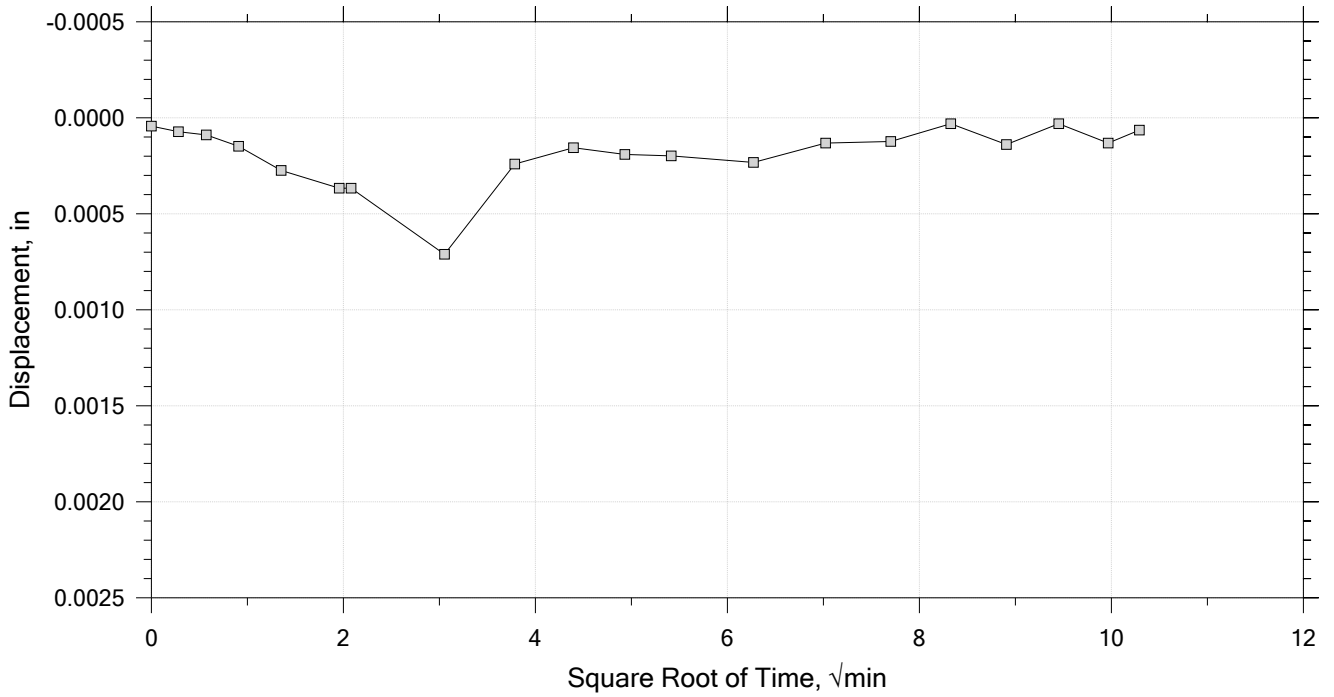


Soil Metrics LLC	Project: I95 Bridge over Broadway	Location: Bangor, ME	Project No.: 166-28
	Boring No.: BB-B195-201	Tested By: sjr	Checked By: sjr
	Sample No.: U1	Test Date: 7/18/2022	Depth: 14.7
	Test No.: ICONP-68-408	Sample Type: wet	Elevation: --
	Description: Brown silty clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 1 of 23
Constant Load Step
Stress: 150 psf

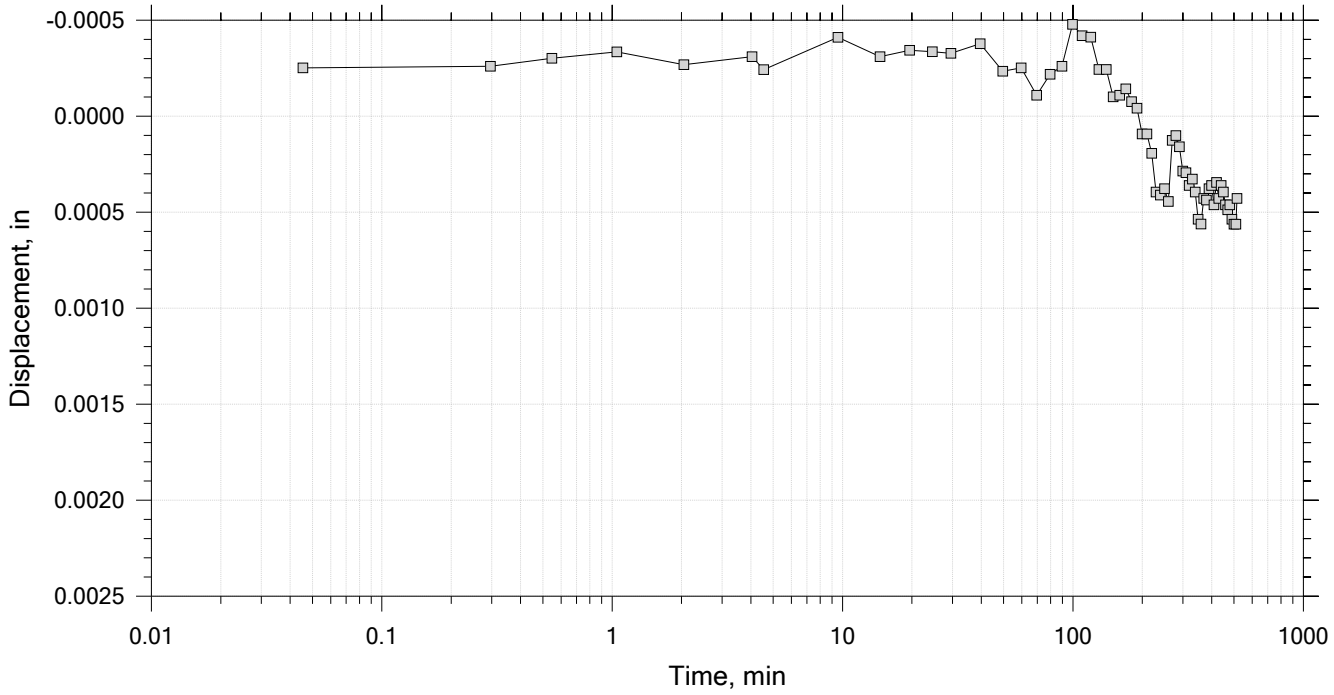


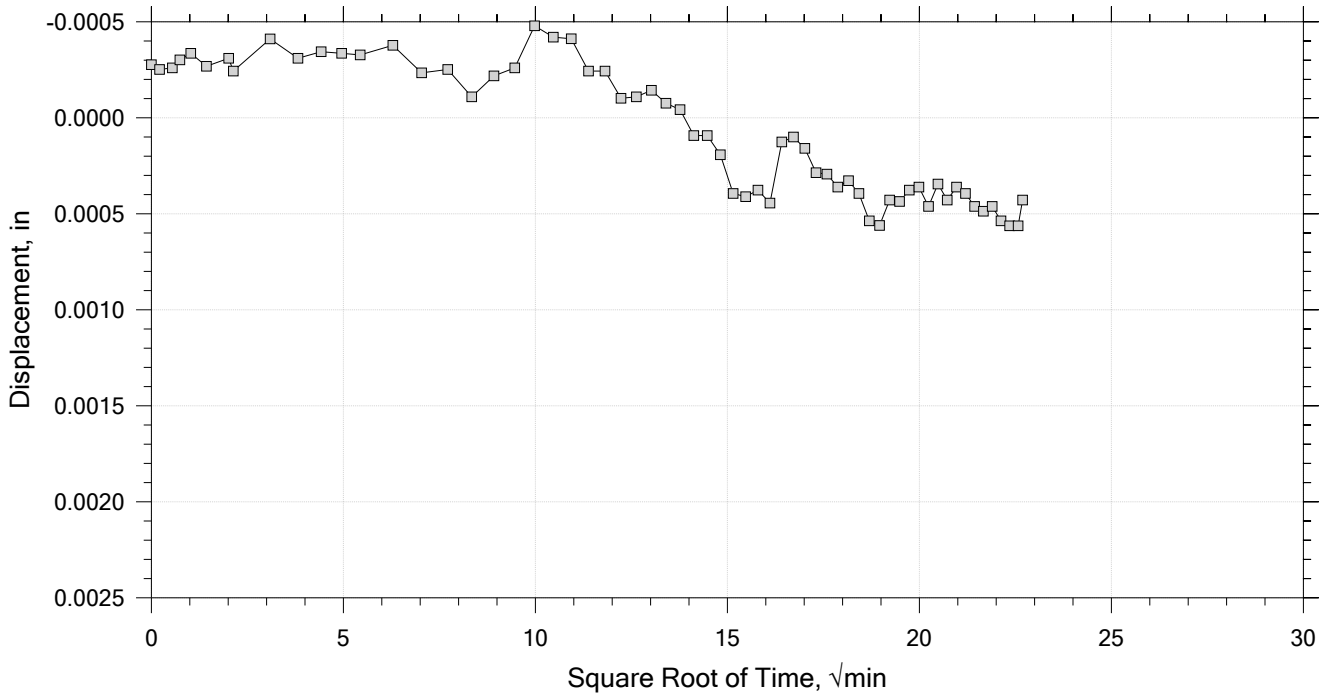


Project: I95 Bridge over Broadway	Location: Bangor, ME	Project No.: 166-28
Boring No.: BB-B195-201	Tested By: sjr	Checked By: sjr
Sample No.: U1	Test Date: 7/18/2022	Depth: 14.7
Test No.: ICONP-68-408	Sample Type: wet	Elevation: --
Description: Brown silty clay		
Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 2 of 23
Constant Load Step
Stress: 225 psf

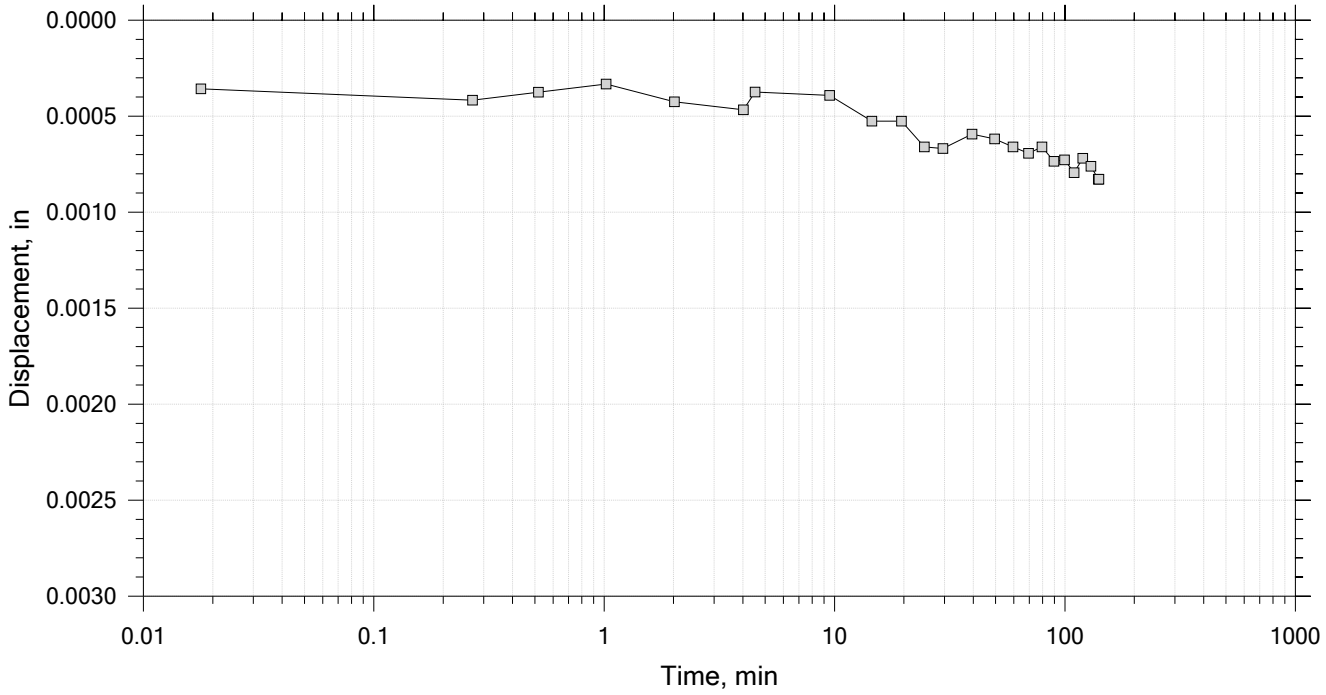


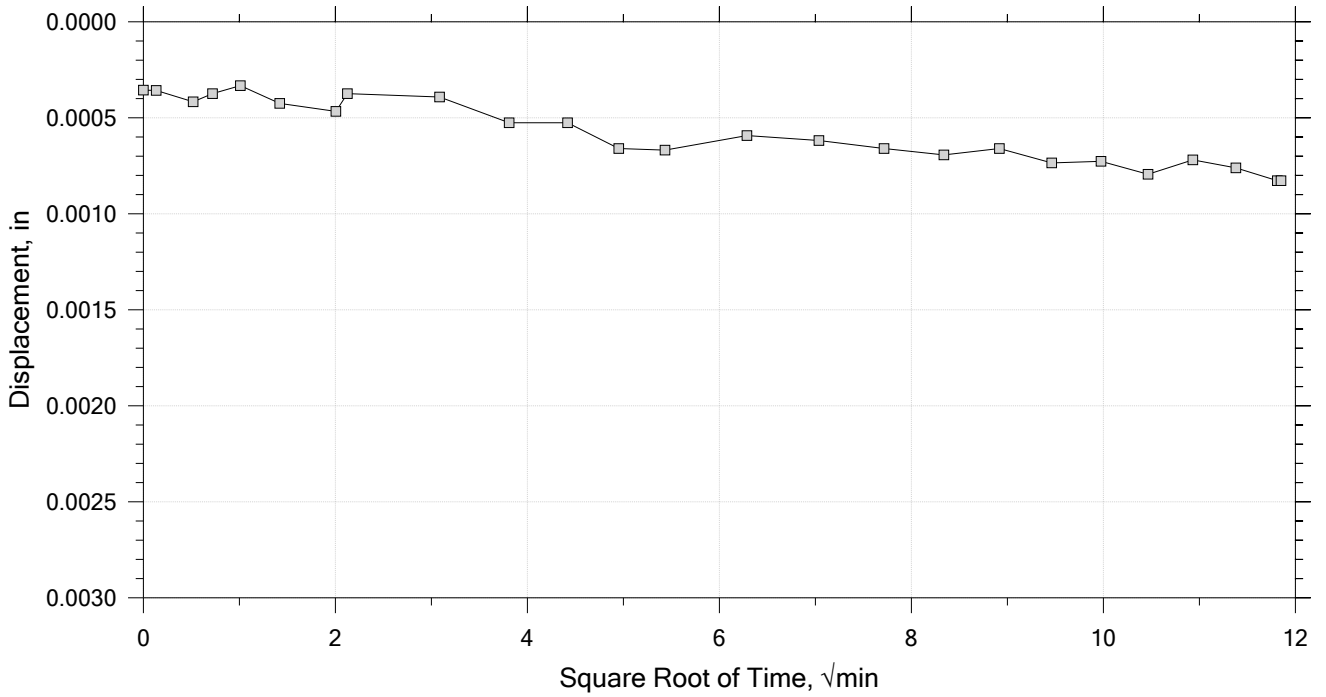


Soil Metrics LLC	Project: I95 Bridge over Broadway	Location: Bangor, ME	Project No.: 166-28
	Boring No.: BB-B195-201	Tested By: sjr	Checked By: sjr
	Sample No.: U1	Test Date: 7/18/2022	Depth: 14.7
	Test No.: ICONP-68-408	Sample Type: wet	Elevation: --
	Description: Brown silty clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 3 of 23
Constant Load Step
Stress: 338 psf





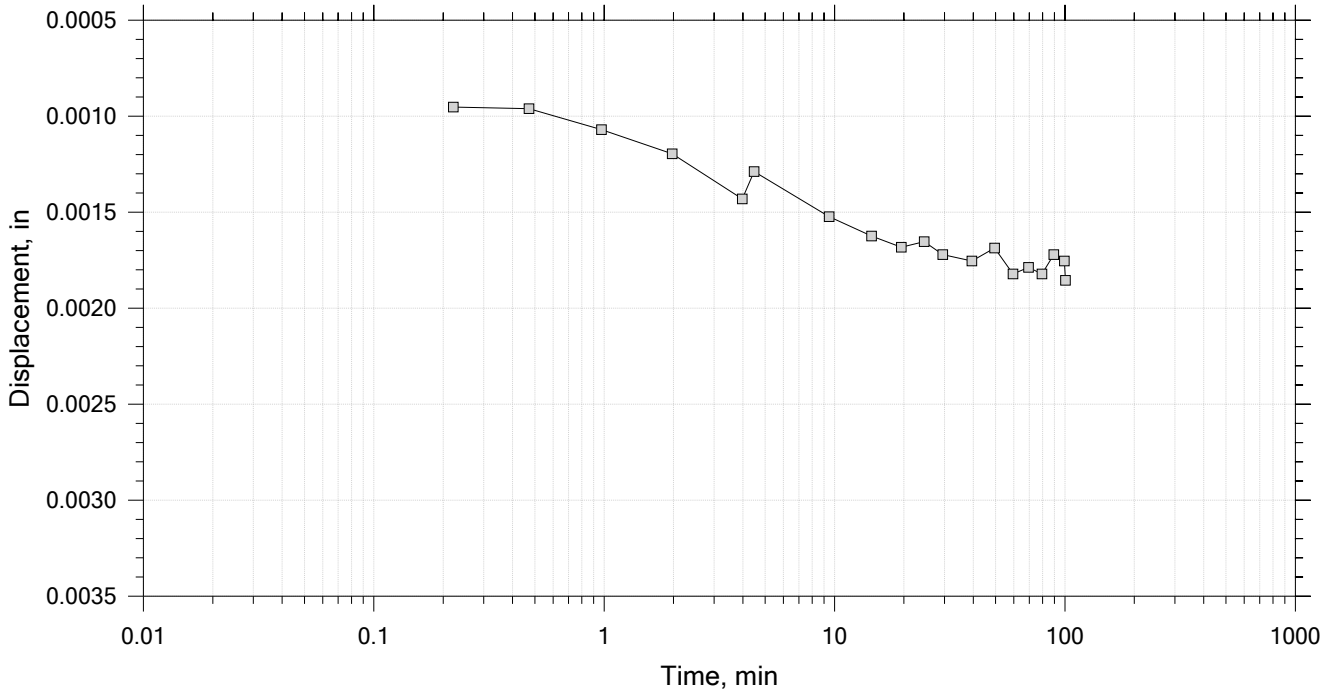
Project: I95 Bridge over Broadway	Location: Bangor, ME	Project No.: 166-28
Boring No.: BB-B195-201	Tested By: sjr	Checked By: sjr
Sample No.: U1	Test Date: 7/18/2022	Depth: 14.7
Test No.: ICONP-68-408	Sample Type: wet	Elevation: --
Description: Brown silty clay		
Remarks:		

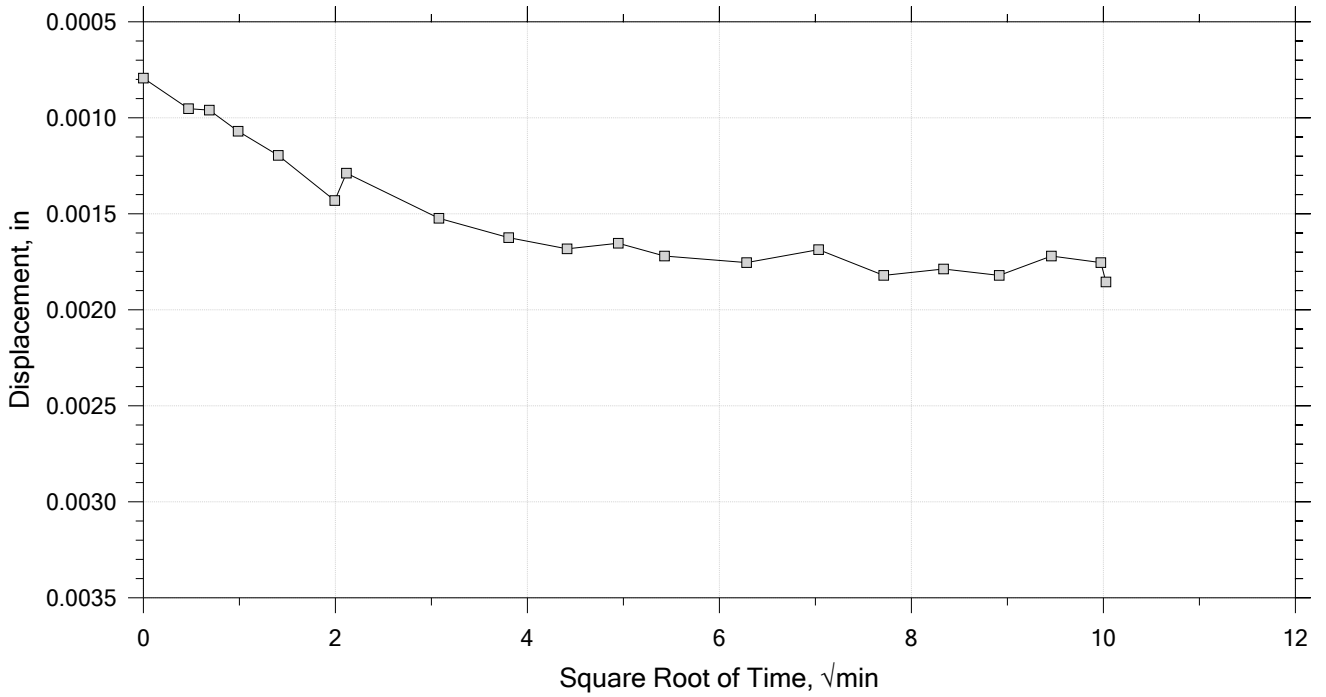
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 4 of 23

Constant Load Step

Stress: 506 psf

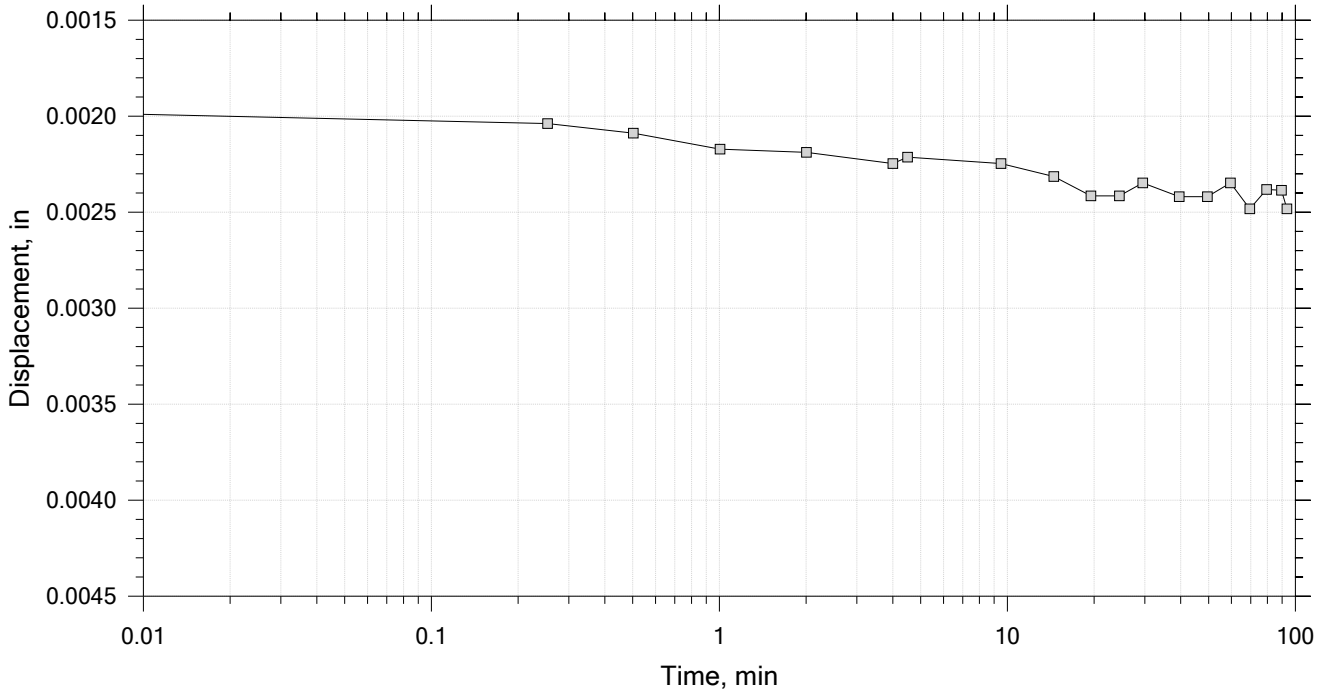


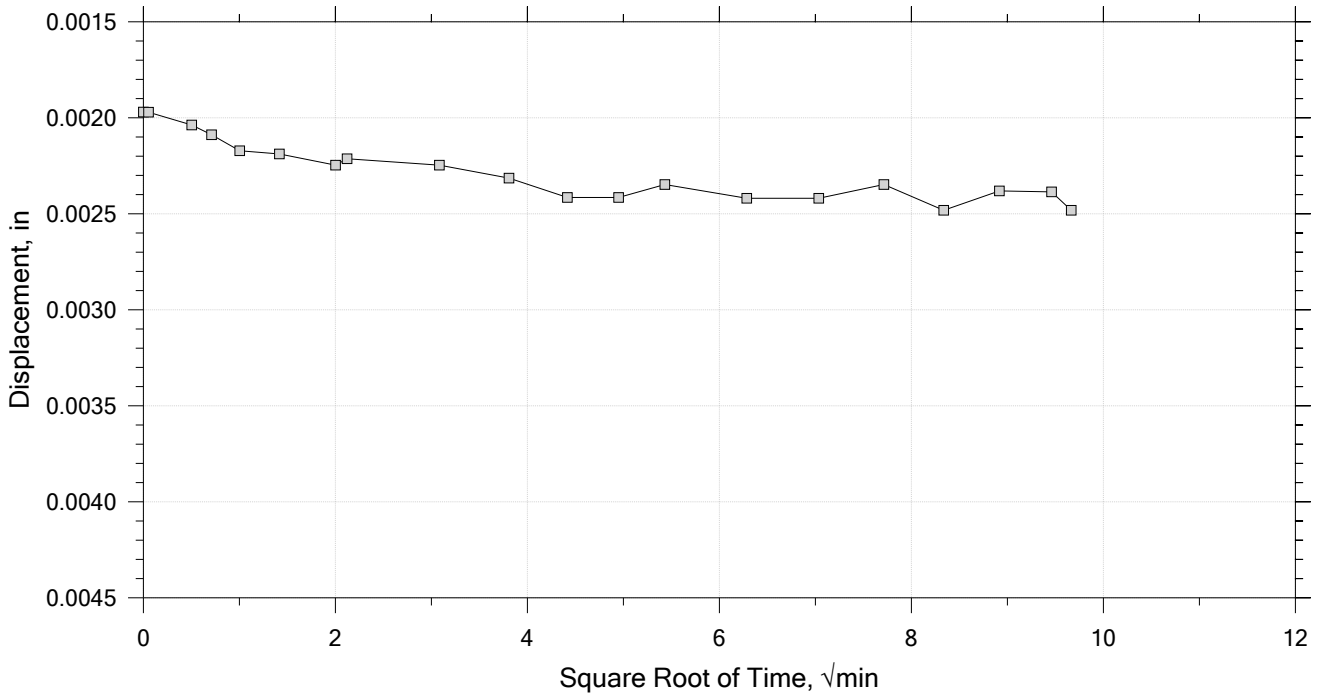


Soil Metrics LLC	Project: I95 Bridge over Broadway	Location: Bangor, ME	Project No.: 166-28
	Boring No.: BB-B195-201	Tested By: sjr	Checked By: sjr
	Sample No.: U1	Test Date: 7/18/2022	Depth: 14.7
	Test No.: ICONP-68-408	Sample Type: wet	Elevation: --
	Description: Brown silty clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 5 of 23
Constant Load Step
Stress: 759 psf





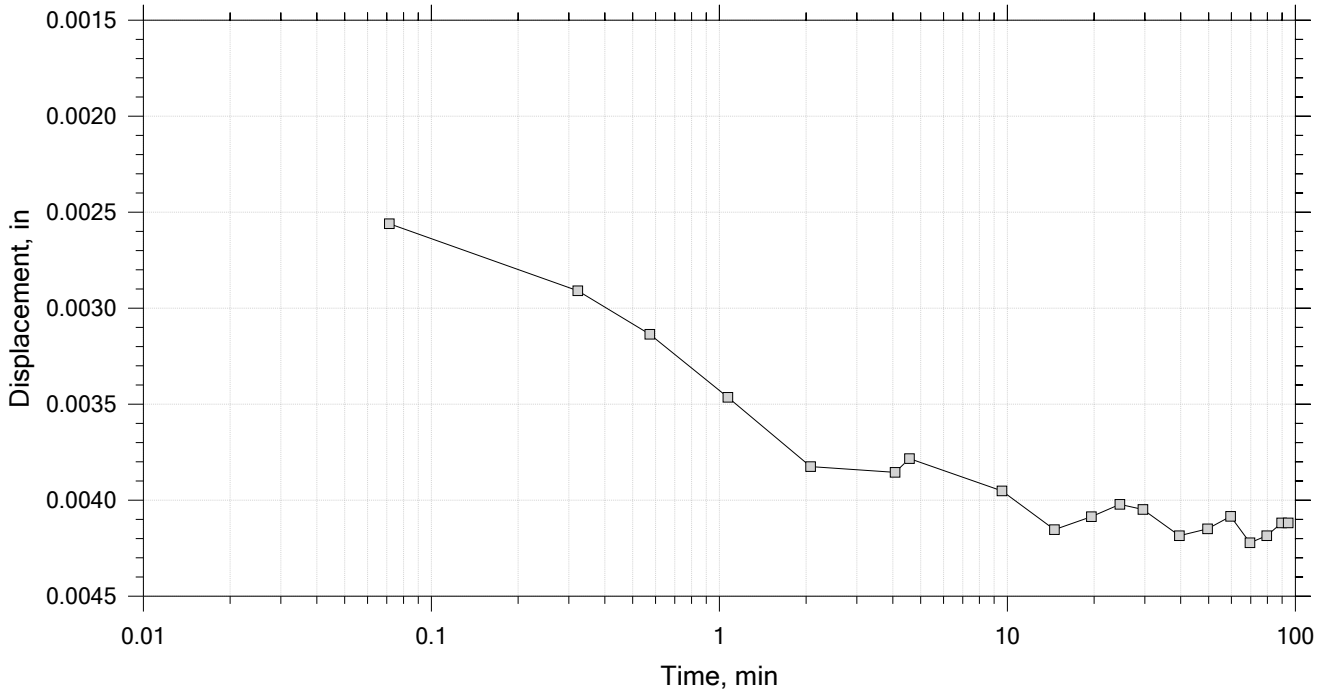
Project: I95 Bridge over Broadway	Location: Bangor, ME	Project No.: 166-28
Boring No.: BB-B195-201	Tested By: sjr	Checked By: sjr
Sample No.: U1	Test Date: 7/18/2022	Depth: 14.7
Test No.: ICONP-68-408	Sample Type: wet	Elevation: --
Description: Brown silty clay		
Remarks:		

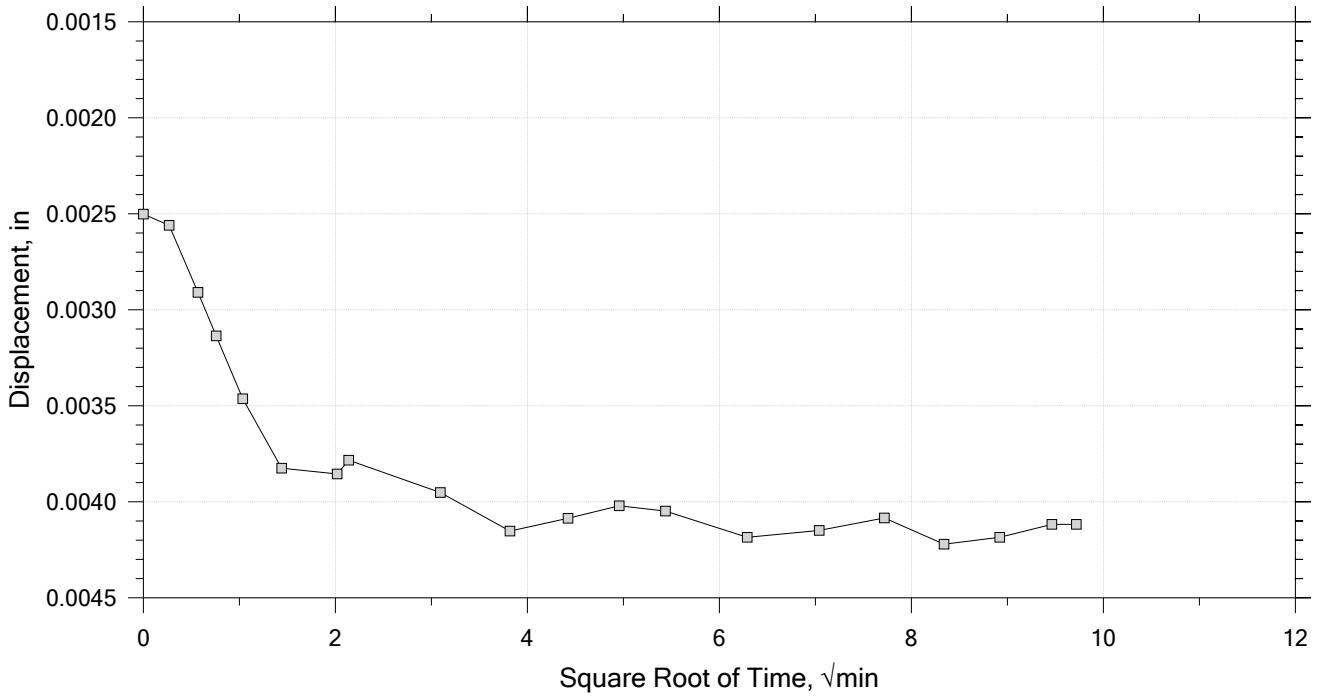
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 6 of 23

Constant Load Step

Stress: 1.14e+03 psf





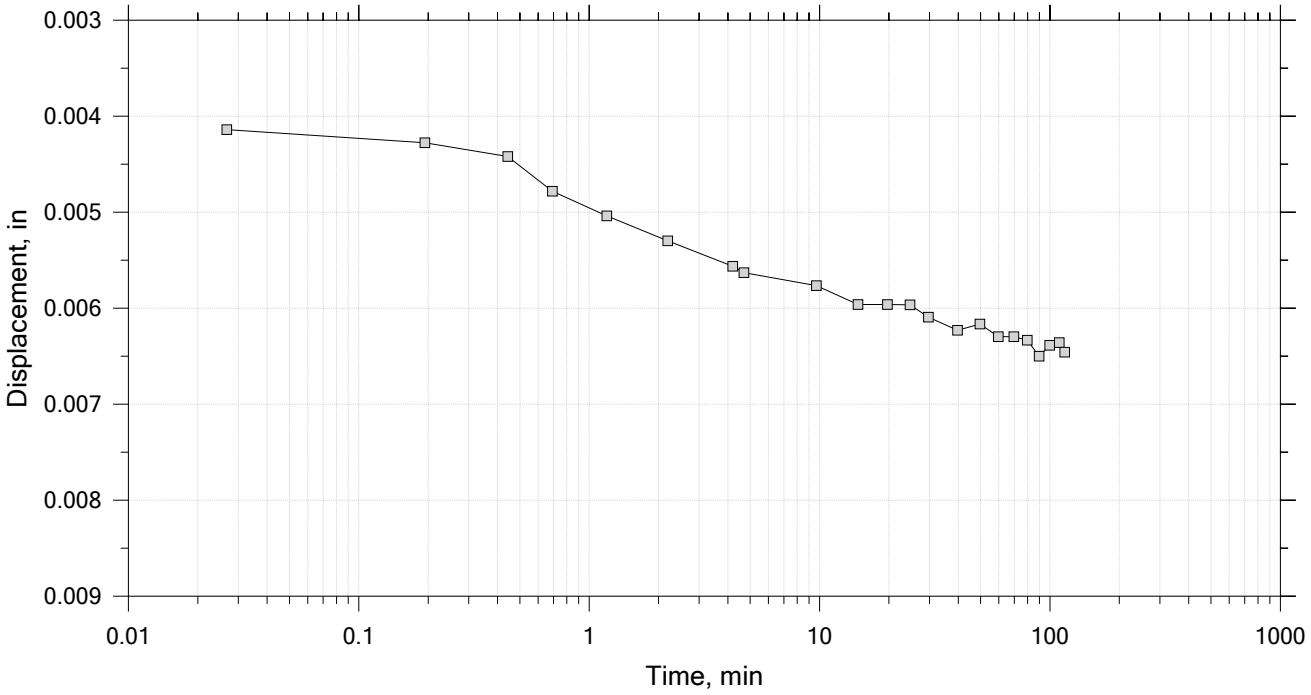
Project: I95 Bridge over Broadway	Location: Bangor, ME	Project No.: 166-28
Boring No.: BB-B195-201	Tested By: sjr	Checked By: sjr
Sample No.: U1	Test Date: 7/18/2022	Depth: 14.7
Test No.: ICONP-68-408	Sample Type: wet	Elevation: --
Description: Brown silty clay		
Remarks:		

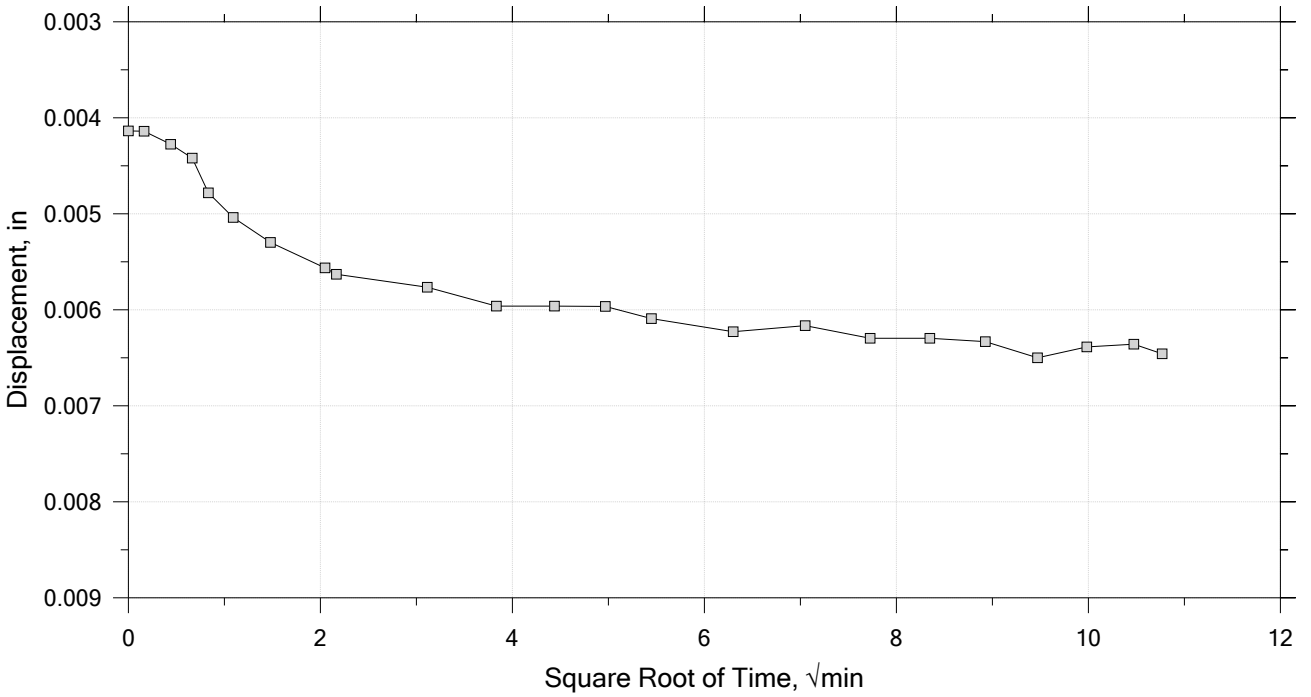
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 7 of 23

Constant Load Step

Stress: 1.71e+03 psf





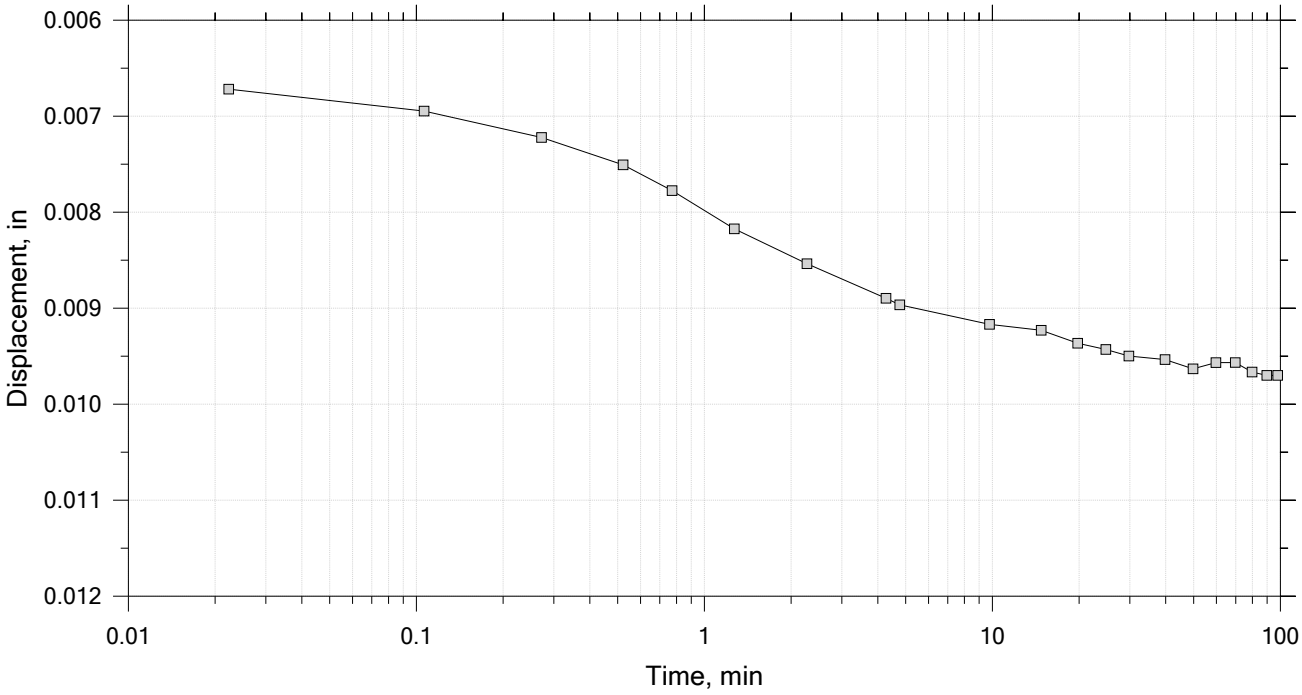
Soil Metrics LLC	Project: I95 Bridge over Broadway	Location: Bangor, ME	Project No.: 166-28
	Boring No.: BB-B195-201	Tested By: sjr	Checked By: sjr
	Sample No.: U1	Test Date: 7/18/2022	Depth: 14.7
	Test No.: ICONP-68-408	Sample Type: wet	Elevation: --
	Description: Brown silty clay		
	Remarks:		

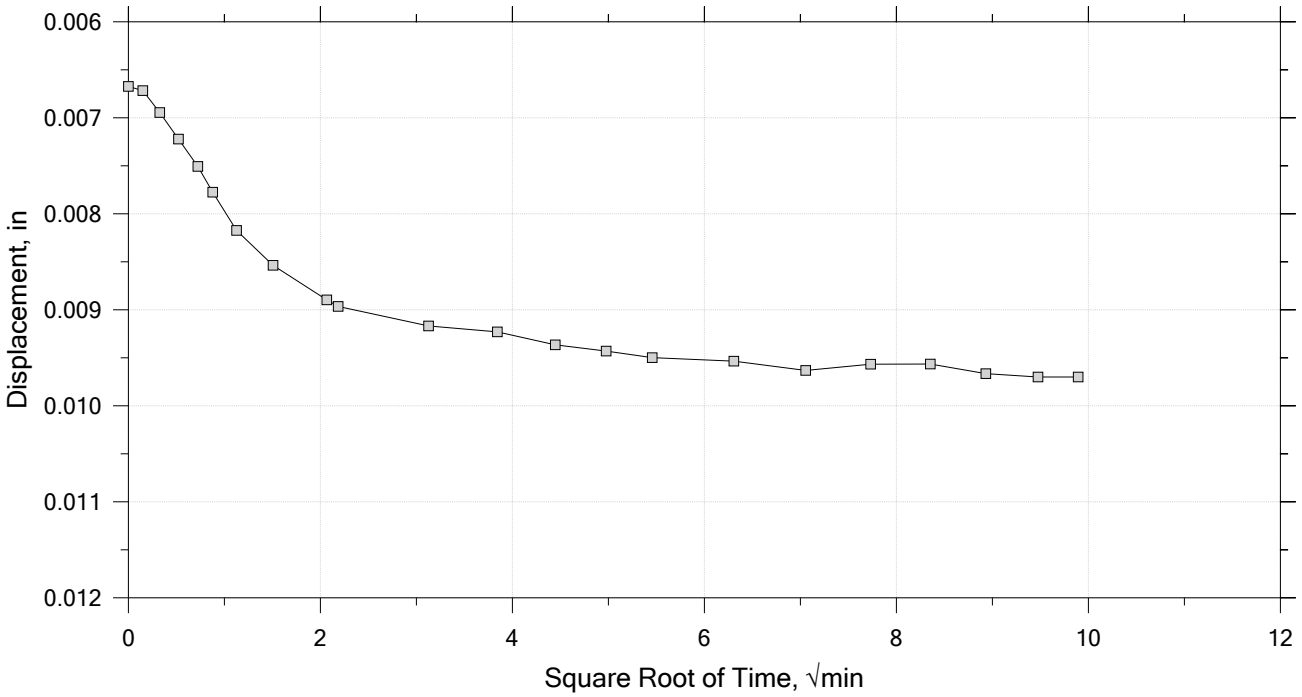
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 8 of 23

Constant Load Step

Stress: 2.56e+03 psf





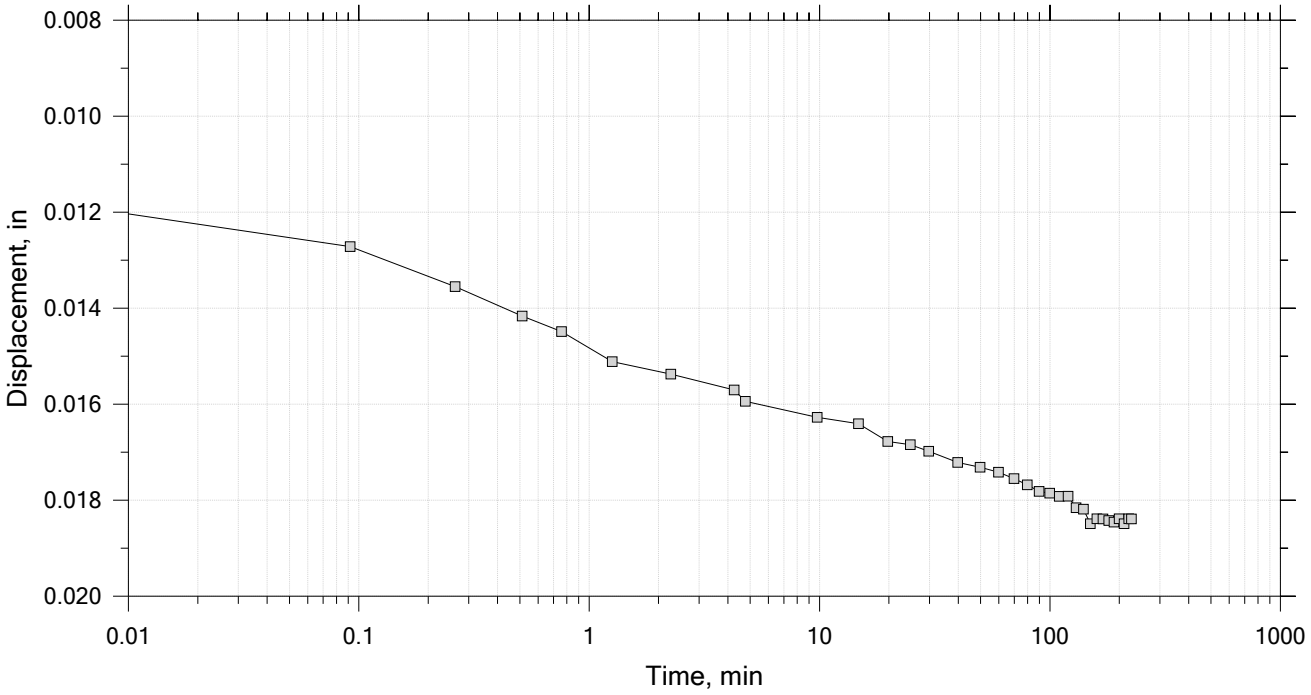
Soil Metrics LLC	Project: I95 Bridge over Broadway	Location: Bangor, ME	Project No.: 166-28
	Boring No.: BB-B195-201	Tested By: sjr	Checked By: sjr
	Sample No.: U1	Test Date: 7/18/2022	Depth: 14.7
	Test No.: ICONP-68-408	Sample Type: wet	Elevation: --
	Description: Brown silty clay		
	Remarks:		

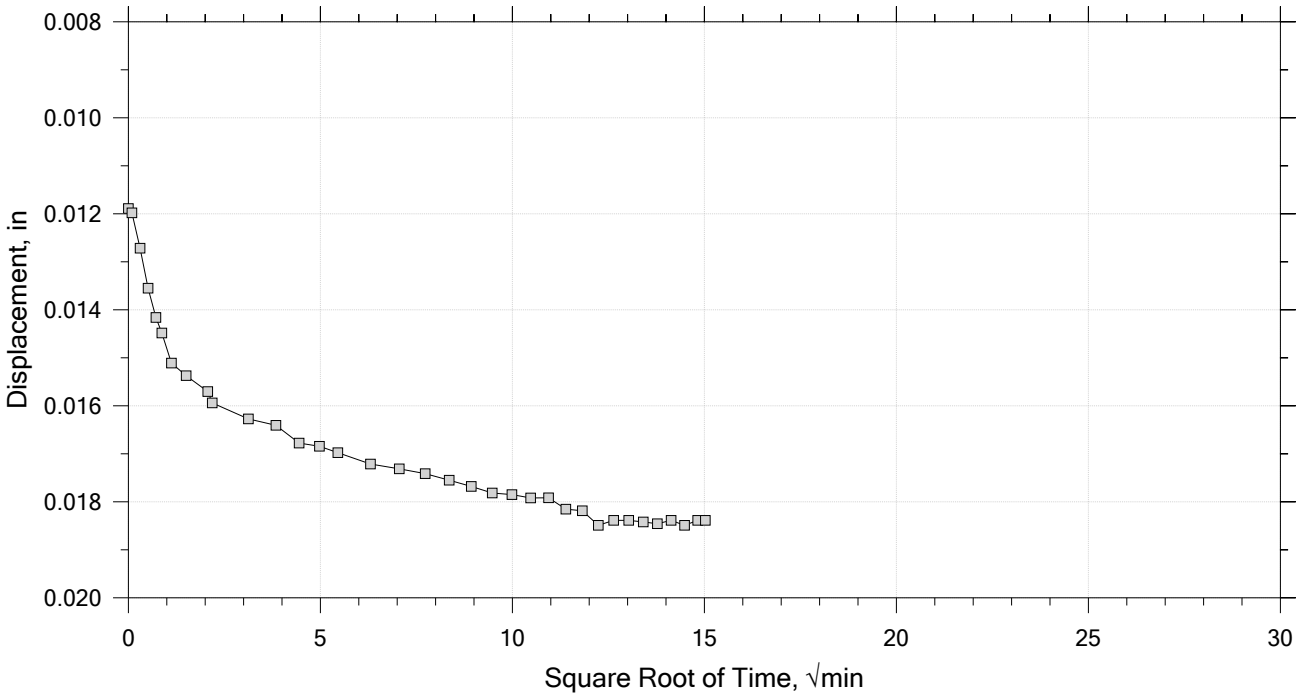
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 9 of 23

Constant Load Step

Stress: 5.13e+03 psf

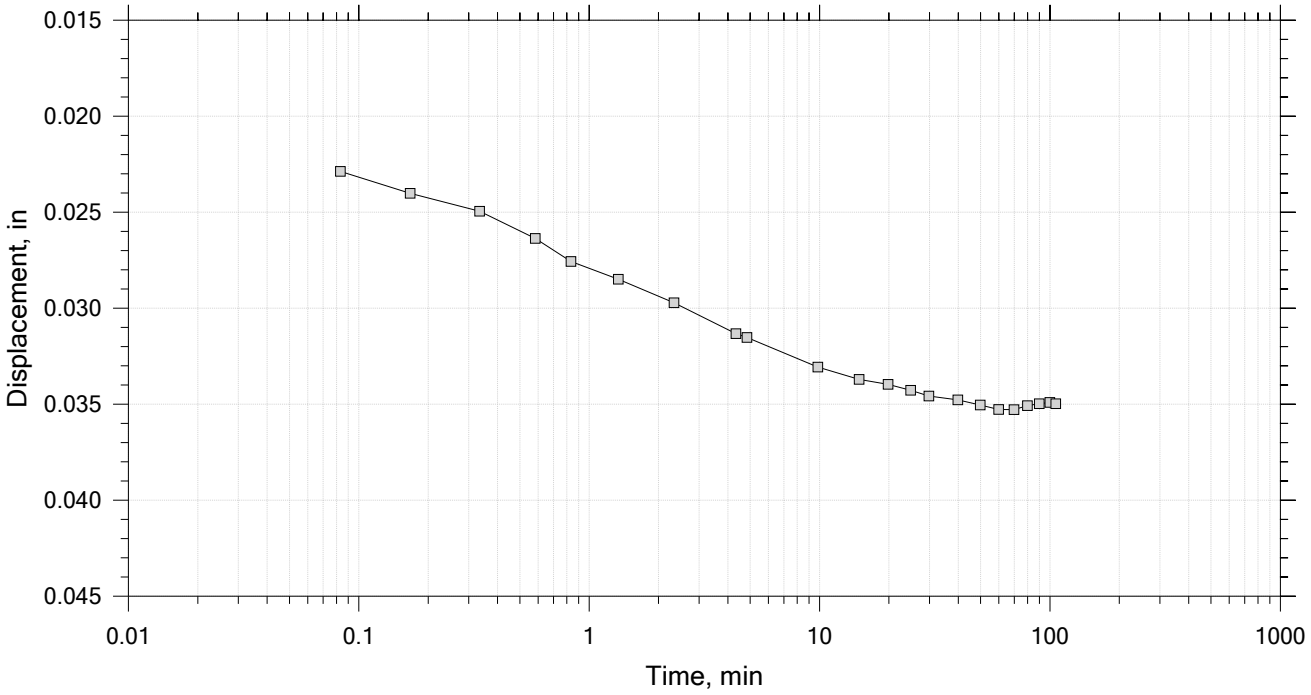


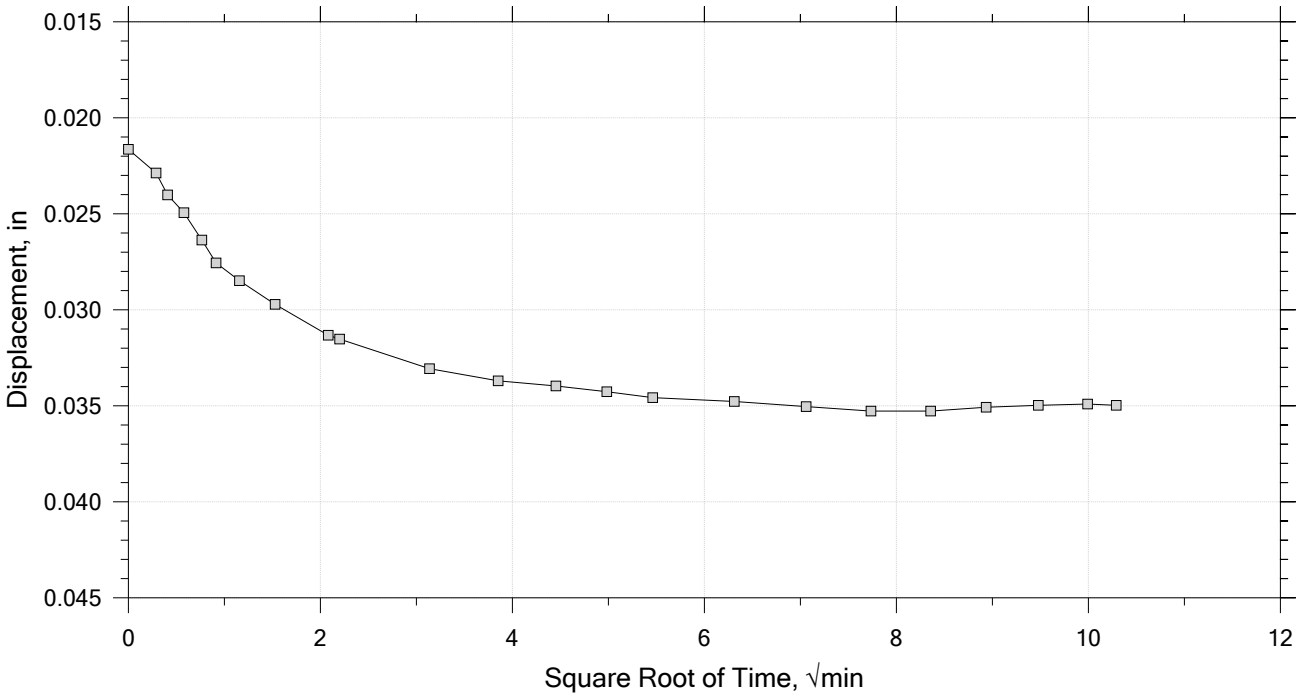


Soil Metrics LLC	Project: I95 Bridge over Broadway	Location: Bangor, ME	Project No.: 166-28
	Boring No.: BB-B195-201	Tested By: sjr	Checked By: sjr
	Sample No.: U1	Test Date: 7/18/2022	Depth: 14.7
	Test No.: ICONP-68-408	Sample Type: wet	Elevation: --
	Description: Brown silty clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 10 of 23
Constant Load Step
Stress: 1.03e+04 psf

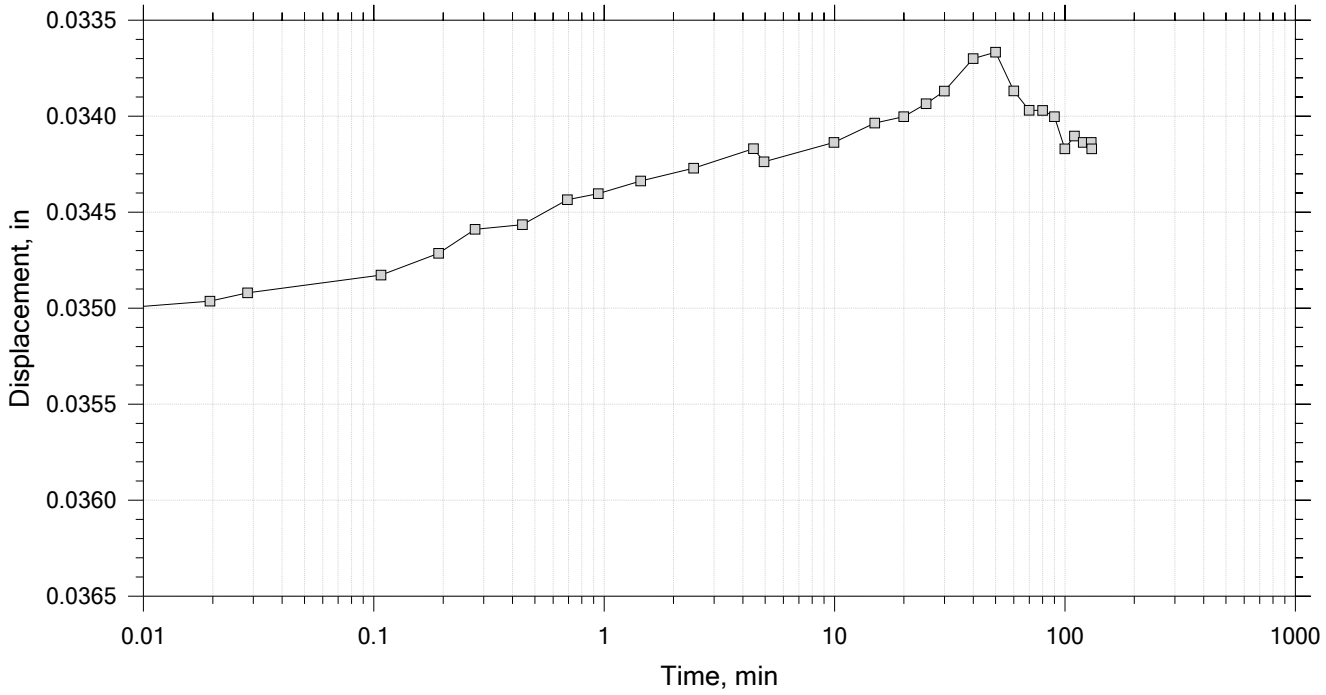


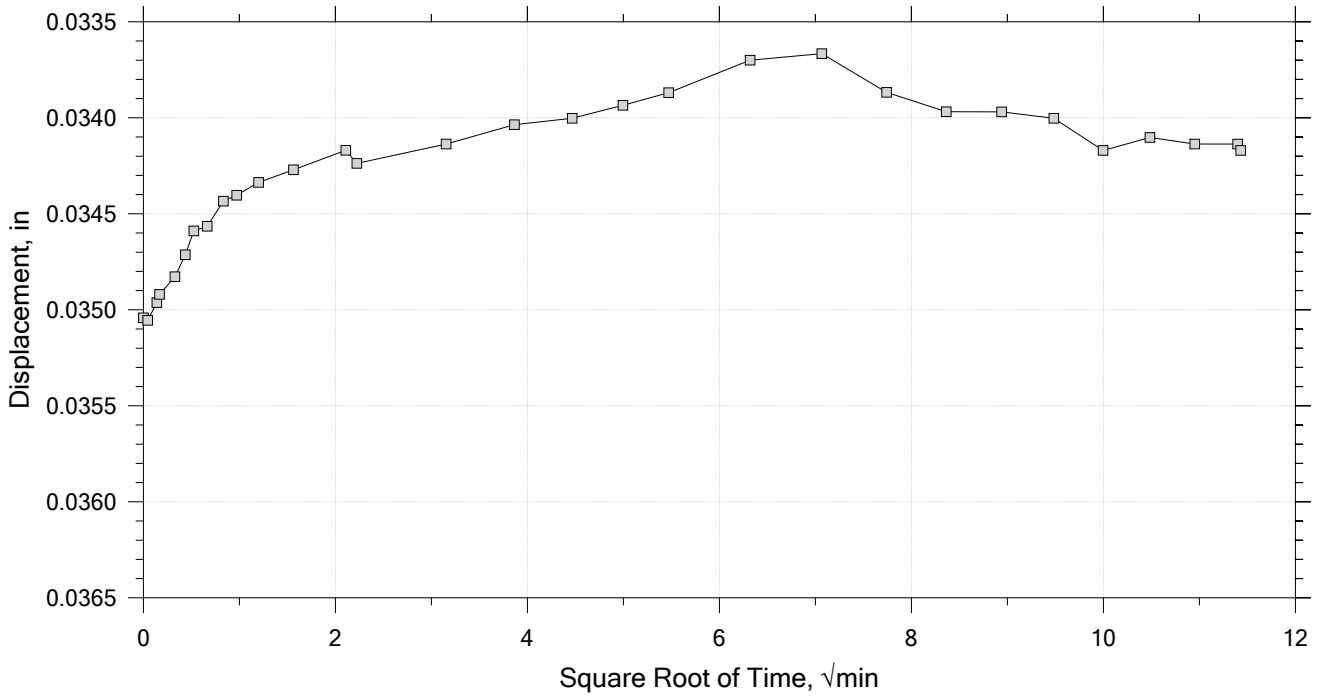


Soil Metrics LLC	Project: I95 Bridge over Broadway	Location: Bangor, ME	Project No.: 166-28
	Boring No.: BB-B195-201	Tested By: sjr	Checked By: sjr
	Sample No.: U1	Test Date: 7/18/2022	Depth: 14.7
	Test No.: ICONP-68-408	Sample Type: wet	Elevation: --
	Description: Brown silty clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 11 of 23
Constant Load Step
Stress: 5.13e+03 psf

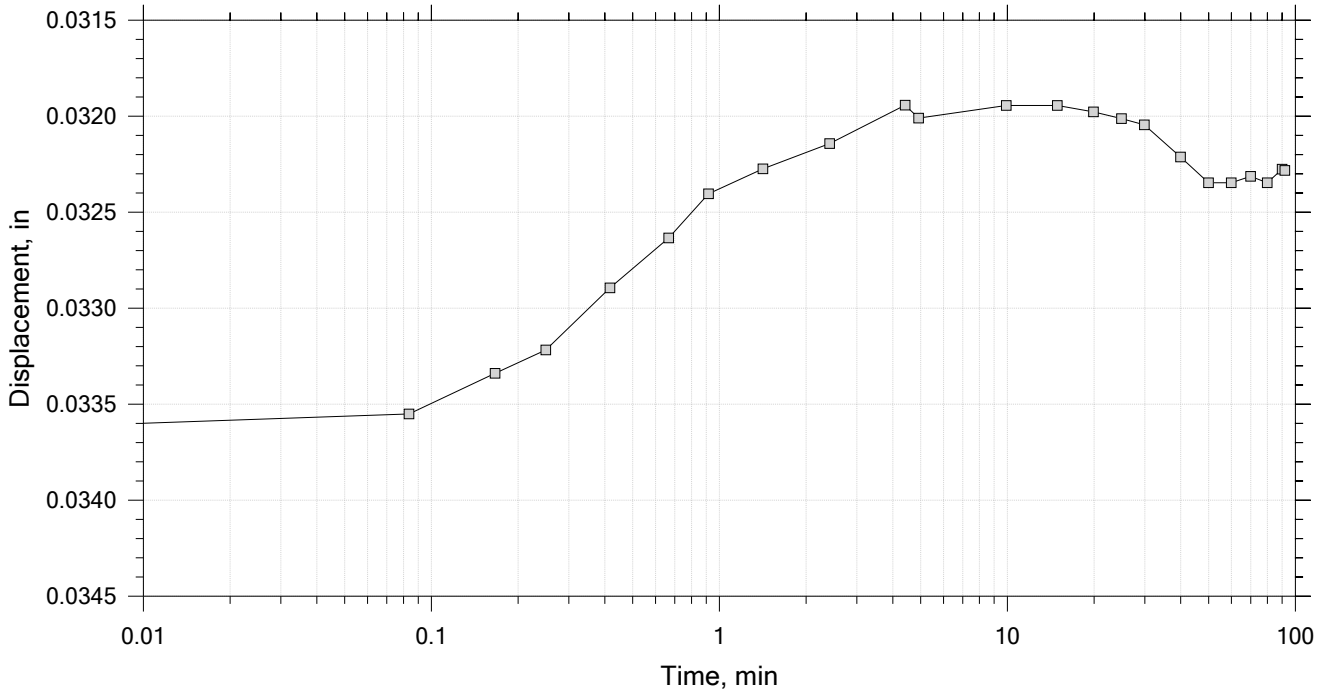


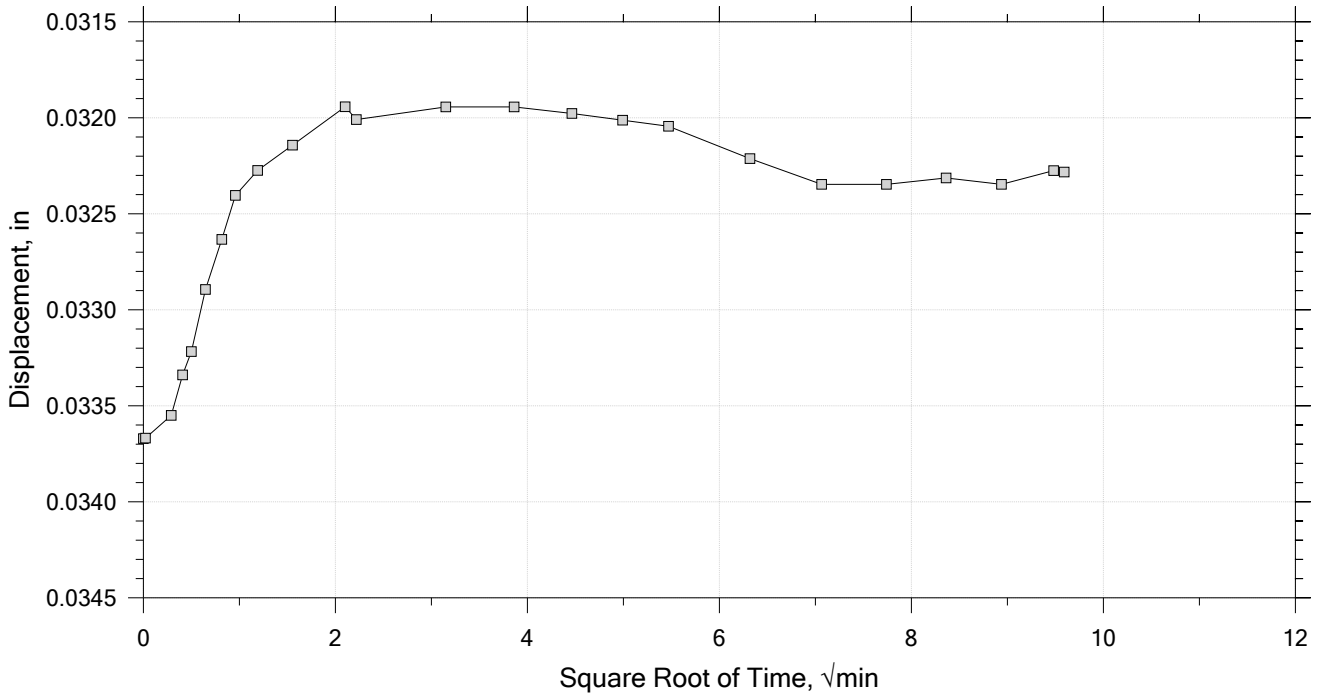


Soil Metrics LLC	Project: I95 Bridge over Broadway	Location: Bangor, ME	Project No.: 166-28
	Boring No.: BB-B195-201	Tested By: sjr	Checked By: sjr
	Sample No.: U1	Test Date: 7/18/2022	Depth: 14.7
	Test No.: ICONP-68-408	Sample Type: wet	Elevation: --
	Description: Brown silty clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 12 of 23
Constant Load Step
Stress: 2.56e+03 psf

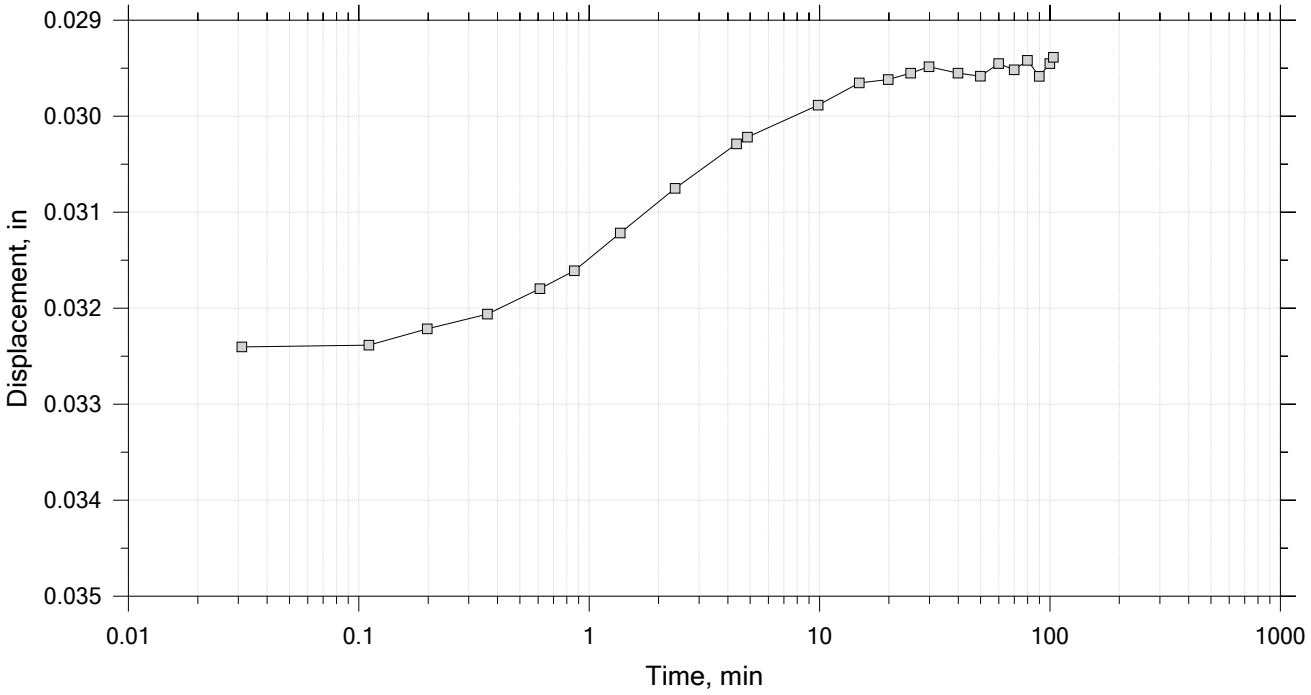


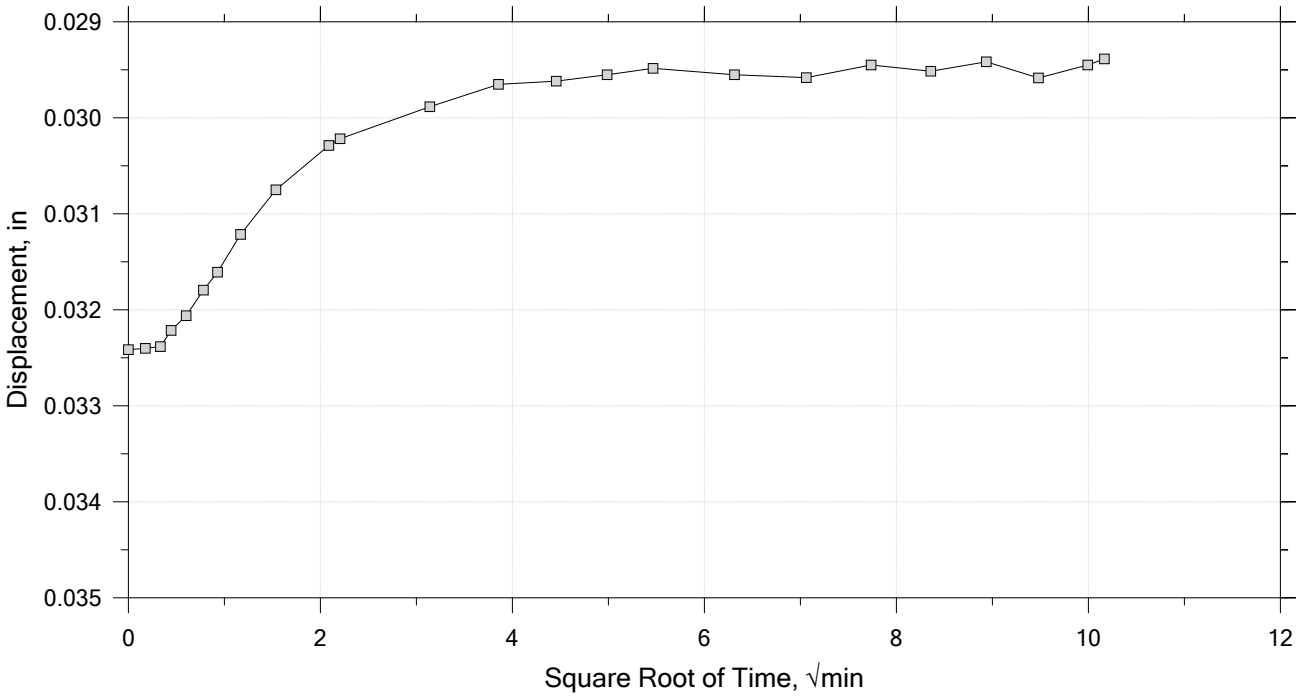


Project: I95 Bridge over Broadway	Location: Bangor, ME	Project No.: 166-28
Boring No.: BB-B195-201	Tested By: sjr	Checked By: sjr
Sample No.: U1	Test Date: 7/18/2022	Depth: 14.7
Test No.: ICONP-68-408	Sample Type: wet	Elevation: --
Description: Brown silty clay		
Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 13 of 23
Constant Load Step
Stress: 1.28e+03 psf

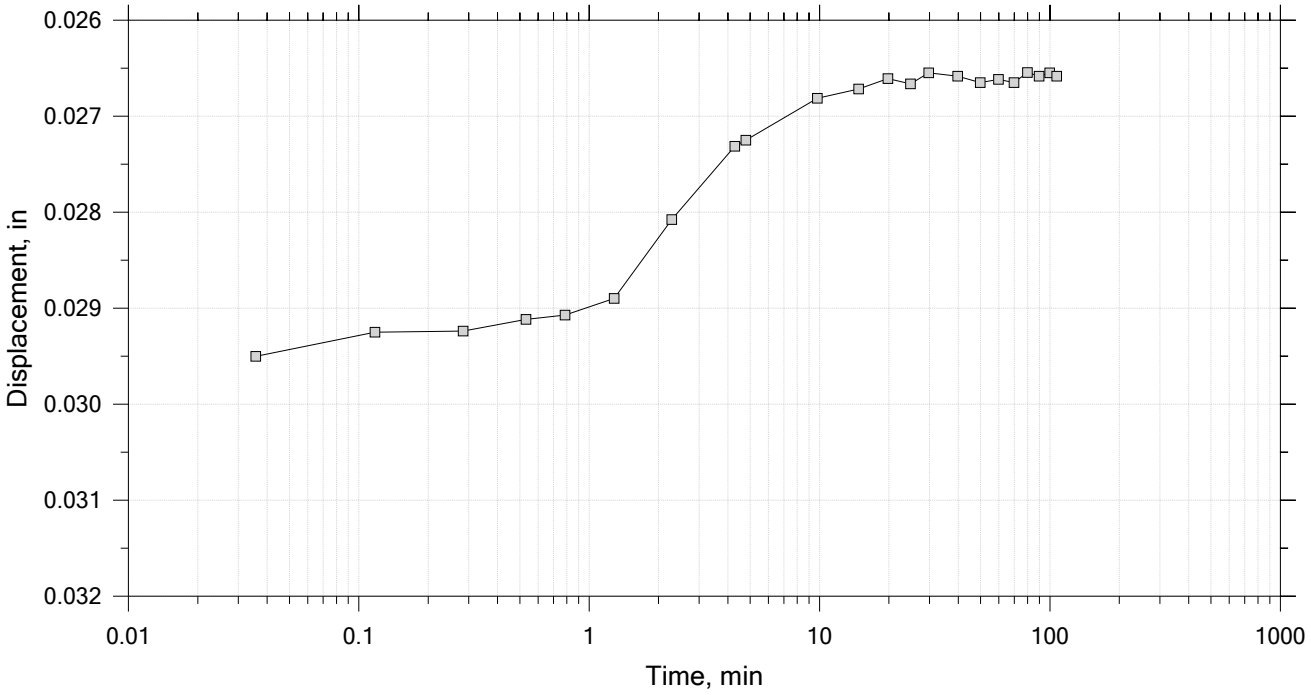


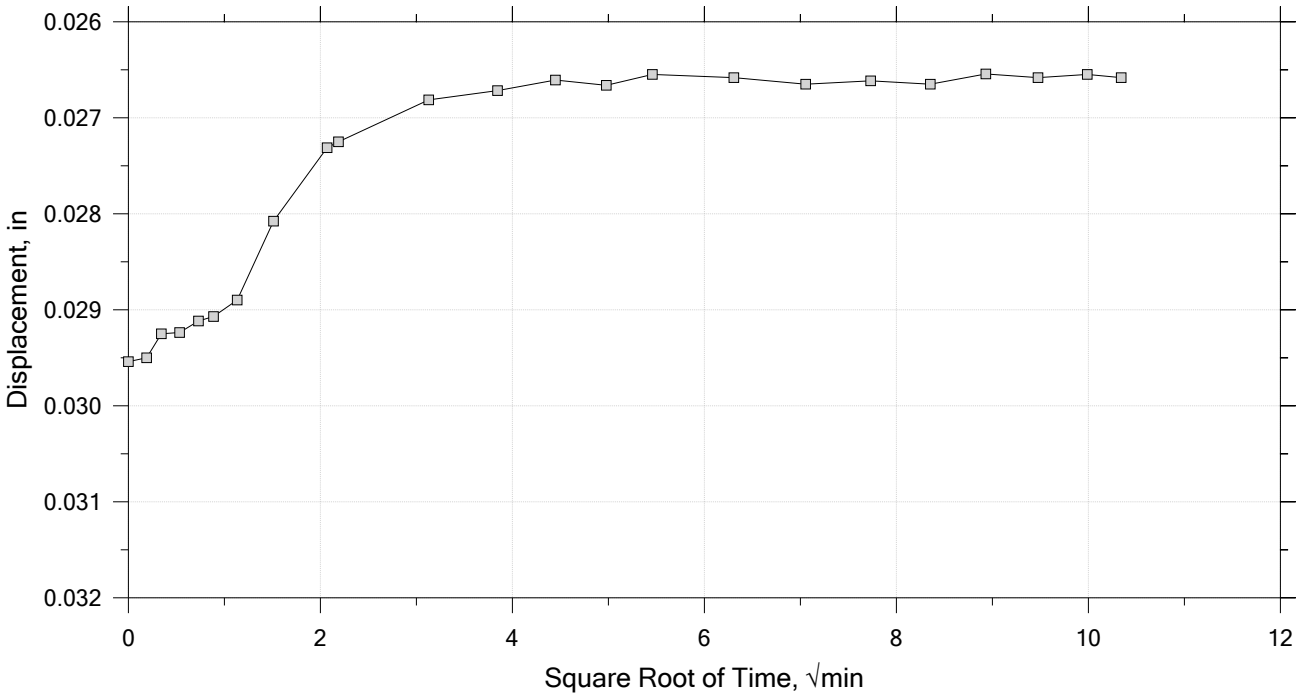


Soil Metrics LLC	Project: I95 Bridge over Broadway	Location: Bangor, ME	Project No.: 166-28
	Boring No.: BB-B195-201	Tested By: sjr	Checked By: sjr
	Sample No.: U1	Test Date: 7/18/2022	Depth: 14.7
	Test No.: ICONP-68-408	Sample Type: wet	Elevation: --
	Description: Brown silty clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 14 of 23
Constant Load Step
Stress: 641 psf

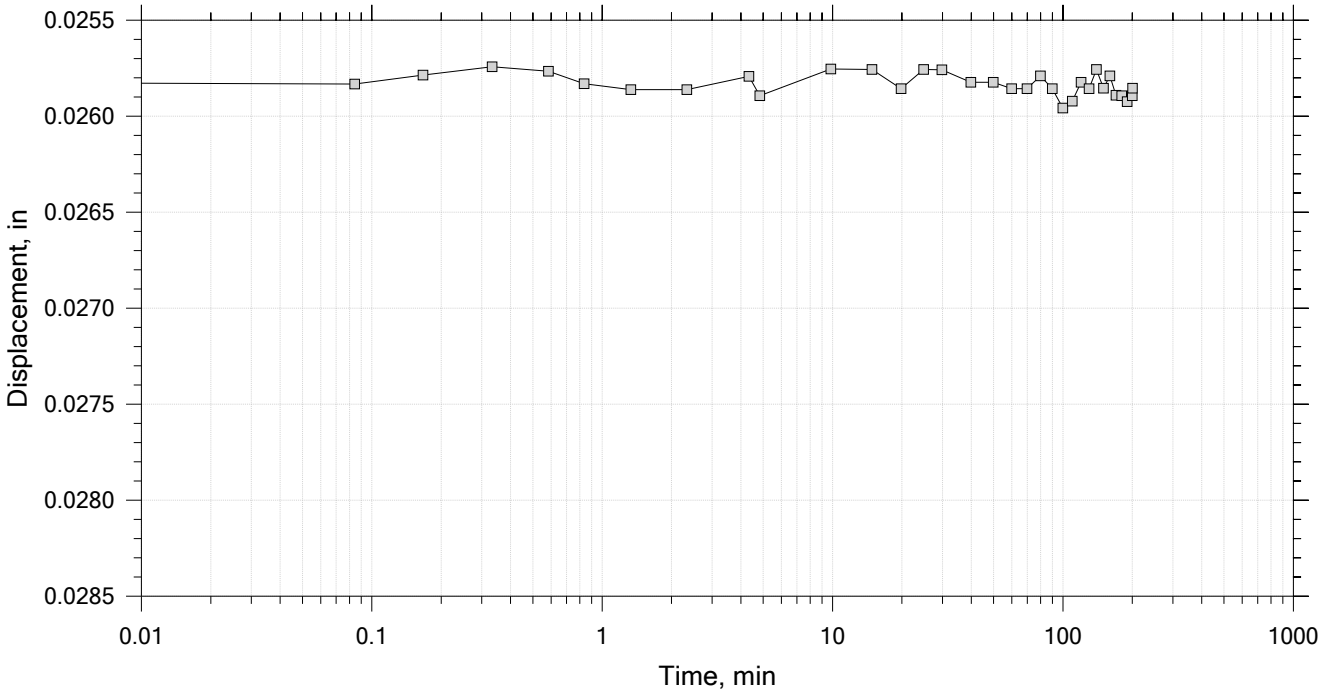


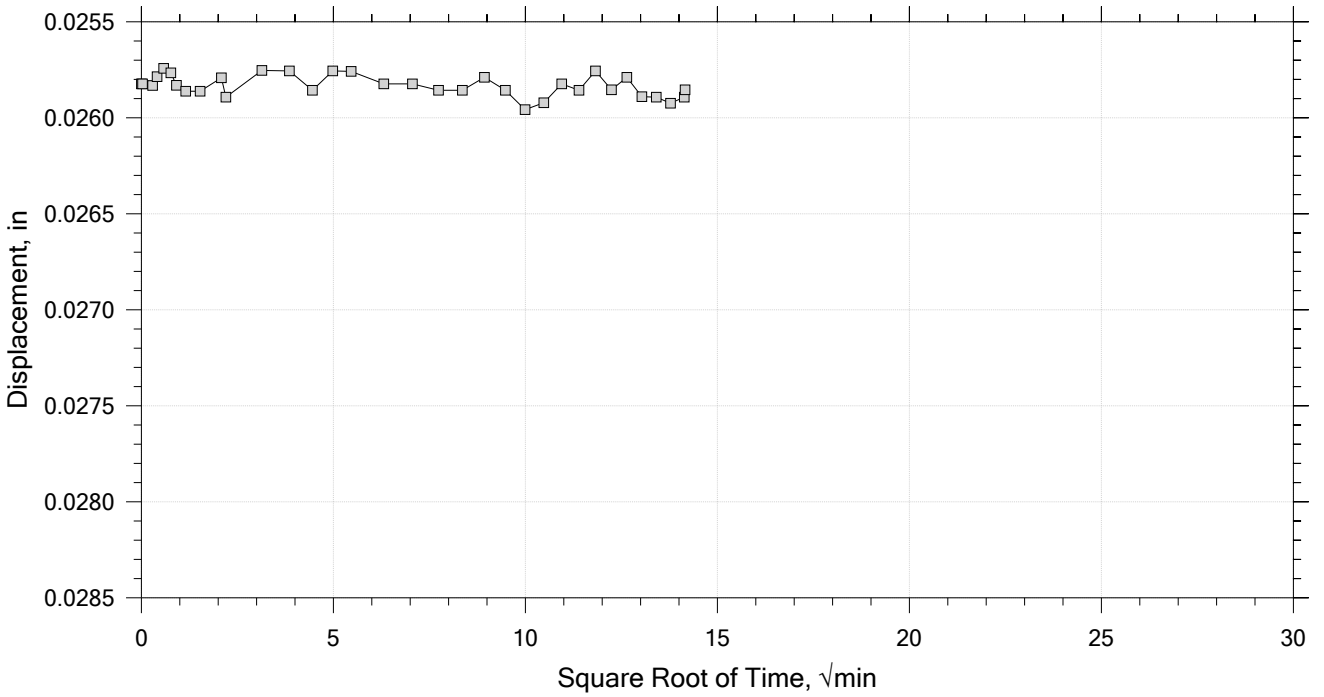


Soil Metrics LLC	Project: I95 Bridge over Broadway	Location: Bangor, ME	Project No.: 166-28
	Boring No.: BB-B195-201	Tested By: sjr	Checked By: sjr
	Sample No.: U1	Test Date: 7/18/2022	Depth: 14.7
	Test No.: ICONP-68-408	Sample Type: wet	Elevation: --
	Description: Brown silty clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 15 of 23
Constant Load Step
Stress: 1.28e+03 psf

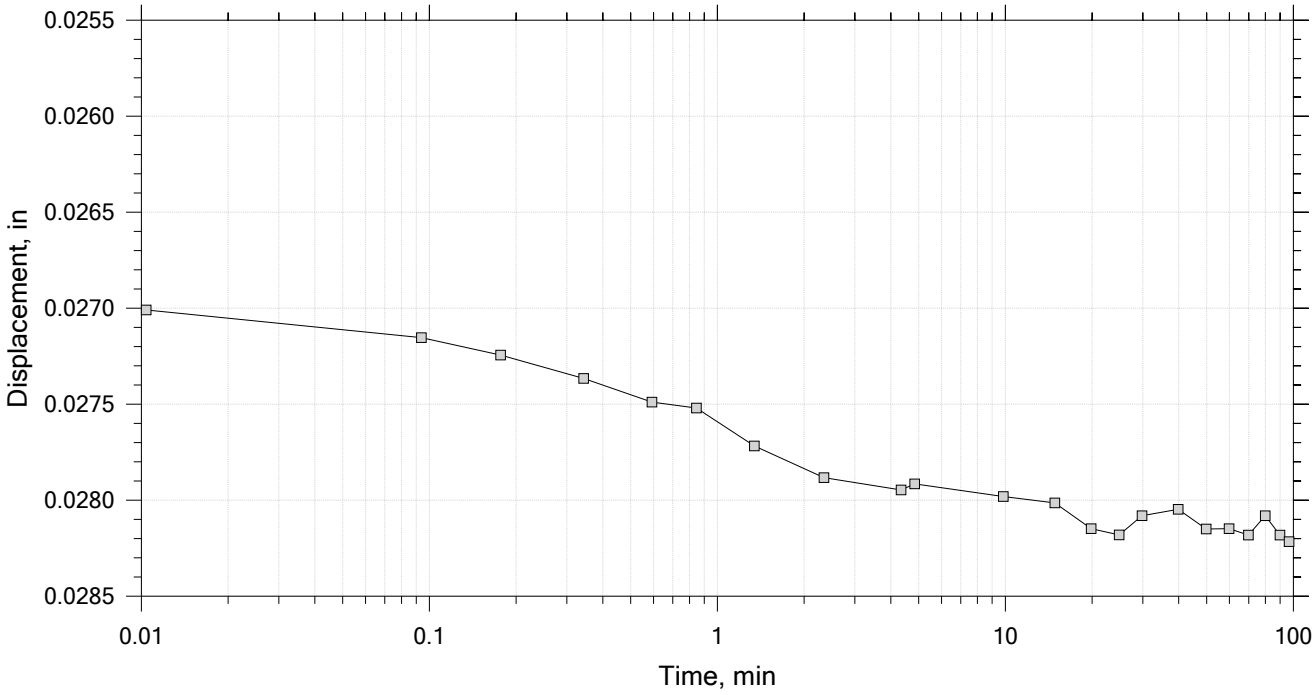


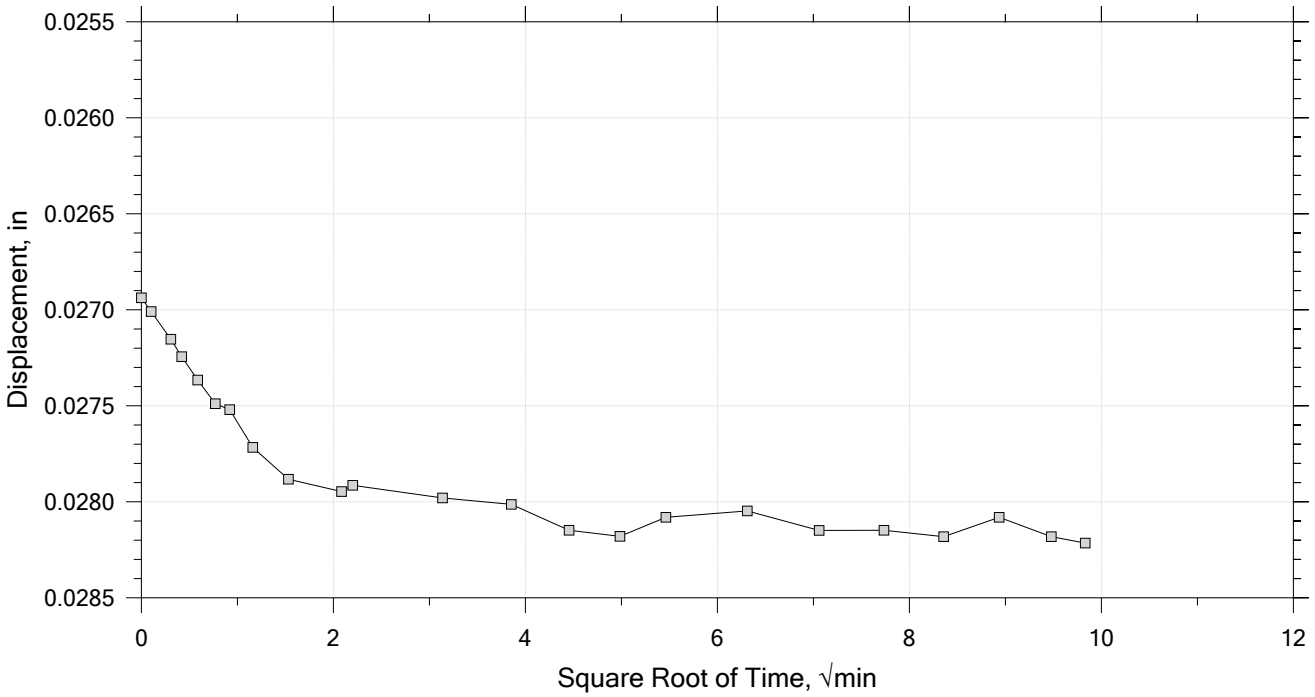


Soil Metrics LLC	Project: I95 Bridge over Broadway	Location: Bangor, ME	Project No.: 166-28
	Boring No.: BB-B195-201	Tested By: sjr	Checked By: sjr
	Sample No.: U1	Test Date: 7/18/2022	Depth: 14.7
	Test No.: ICONP-68-408	Sample Type: wet	Elevation: --
	Description: Brown silty clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 16 of 23
Constant Load Step
Stress: 2.56e+03 psf

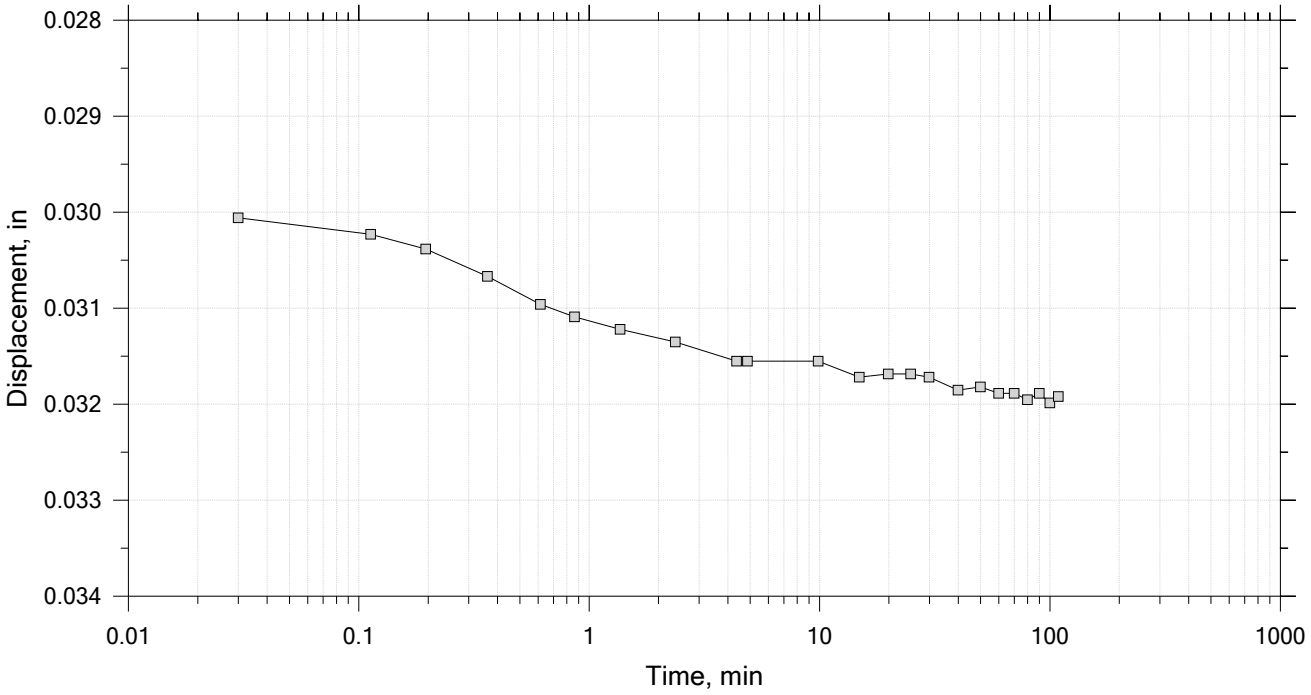


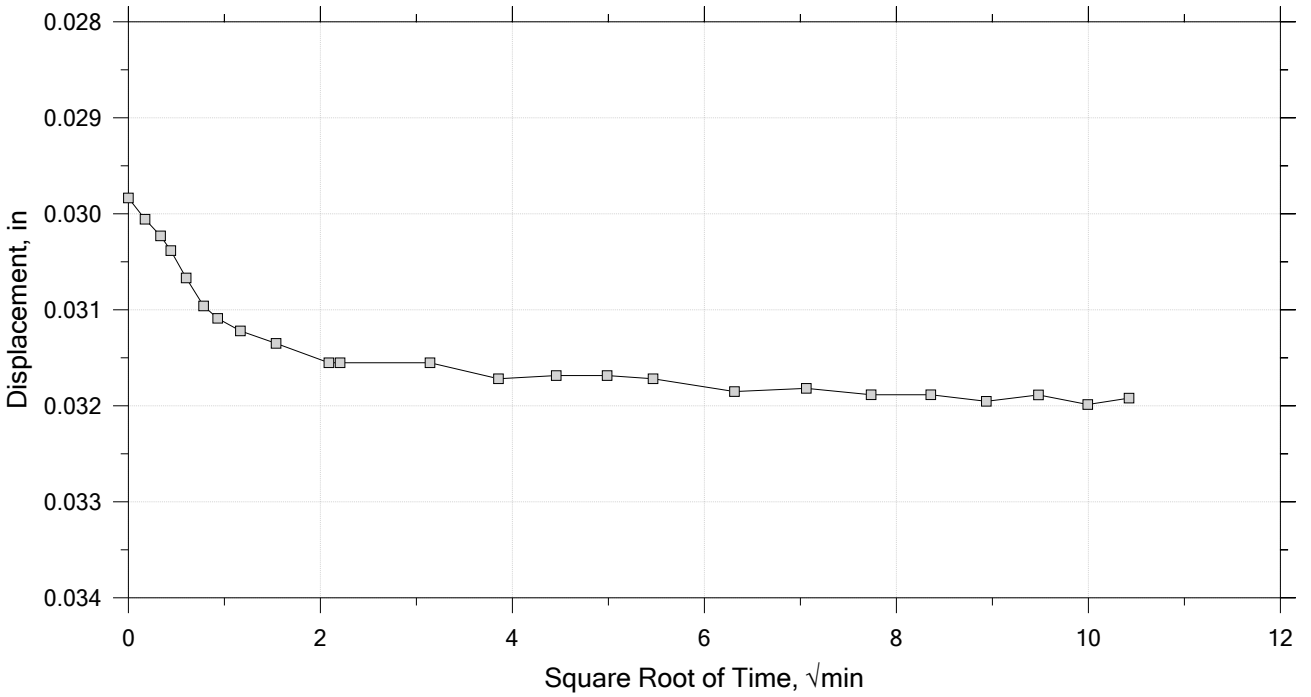


Soil Metrics LLC	Project: I95 Bridge over Broadway	Location: Bangor, ME	Project No.: 166-28
	Boring No.: BB-B195-201	Tested By: sjr	Checked By: sjr
	Sample No.: U1	Test Date: 7/18/2022	Depth: 14.7
	Test No.: ICONP-68-408	Sample Type: wet	Elevation: --
	Description: Brown silty clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 17 of 23
Constant Load Step
Stress: 5.13e+03 psf

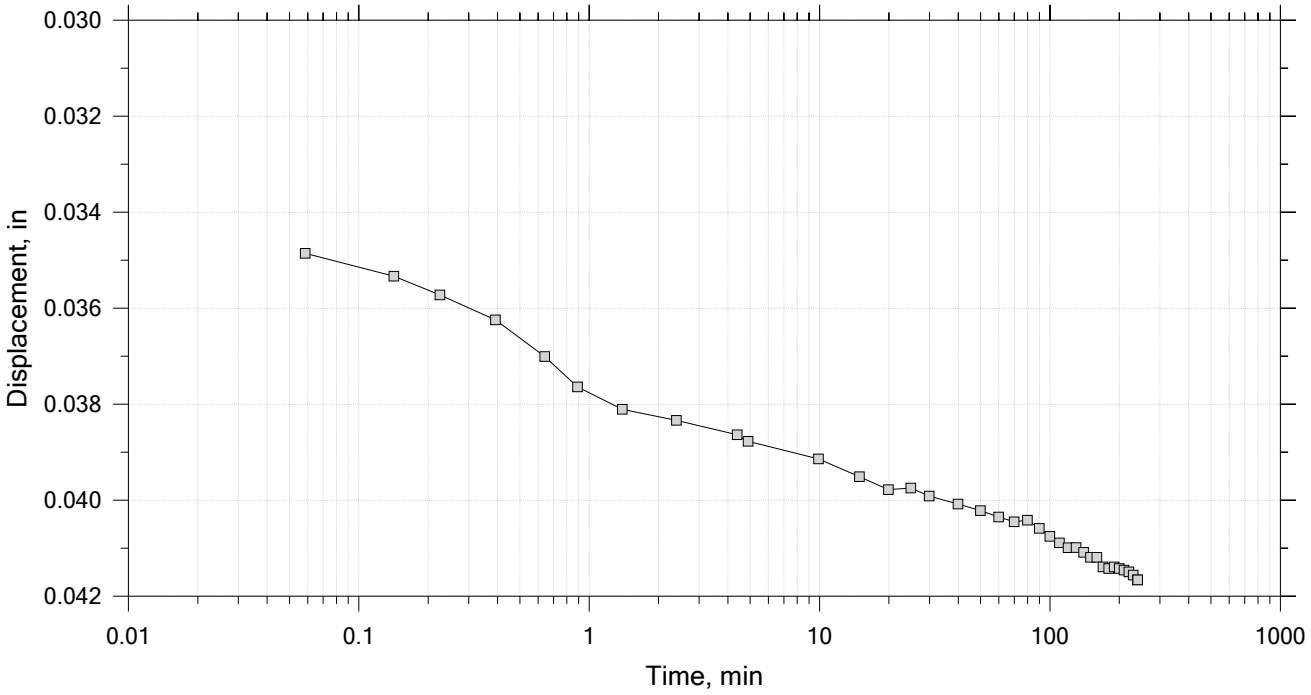


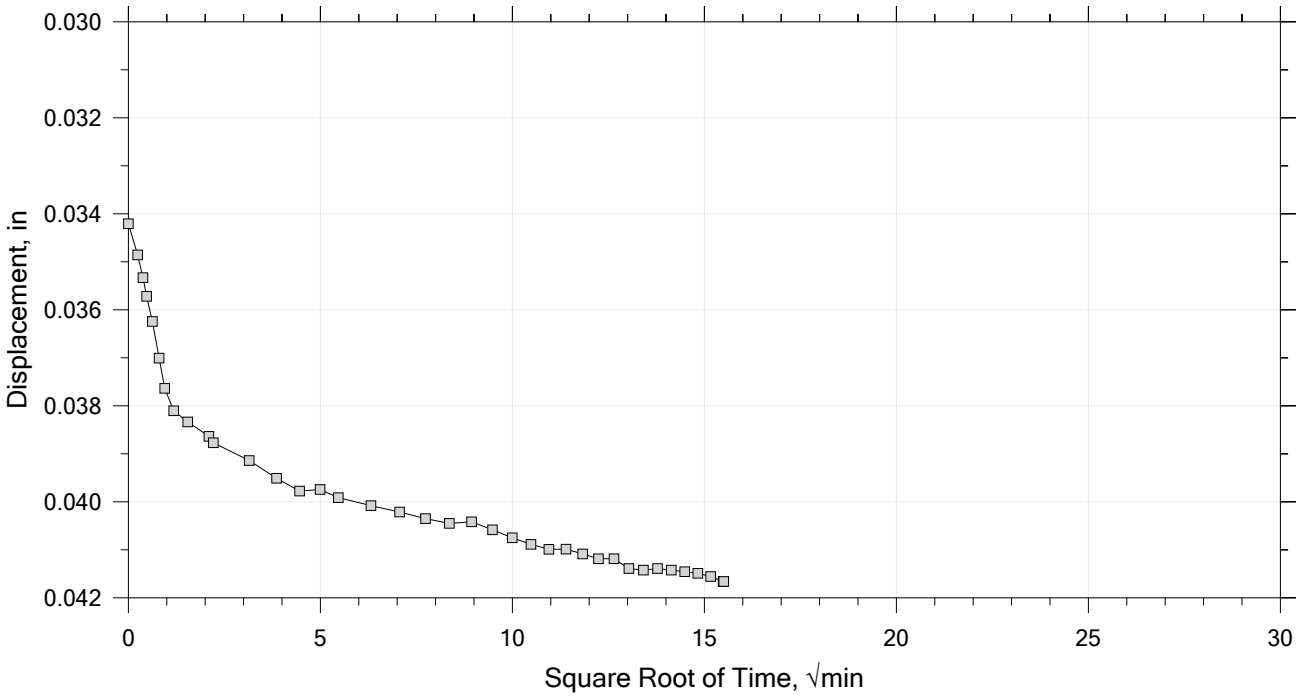


Soil Metrics LLC	Project: I95 Bridge over Broadway	Location: Bangor, ME	Project No.: 166-28
	Boring No.: BB-B195-201	Tested By: sjr	Checked By: sjr
	Sample No.: U1	Test Date: 7/18/2022	Depth: 14.7
	Test No.: ICONP-68-408	Sample Type: wet	Elevation: --
	Description: Brown silty clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 18 of 23
Constant Load Step
Stress: 1.03e+04 psf

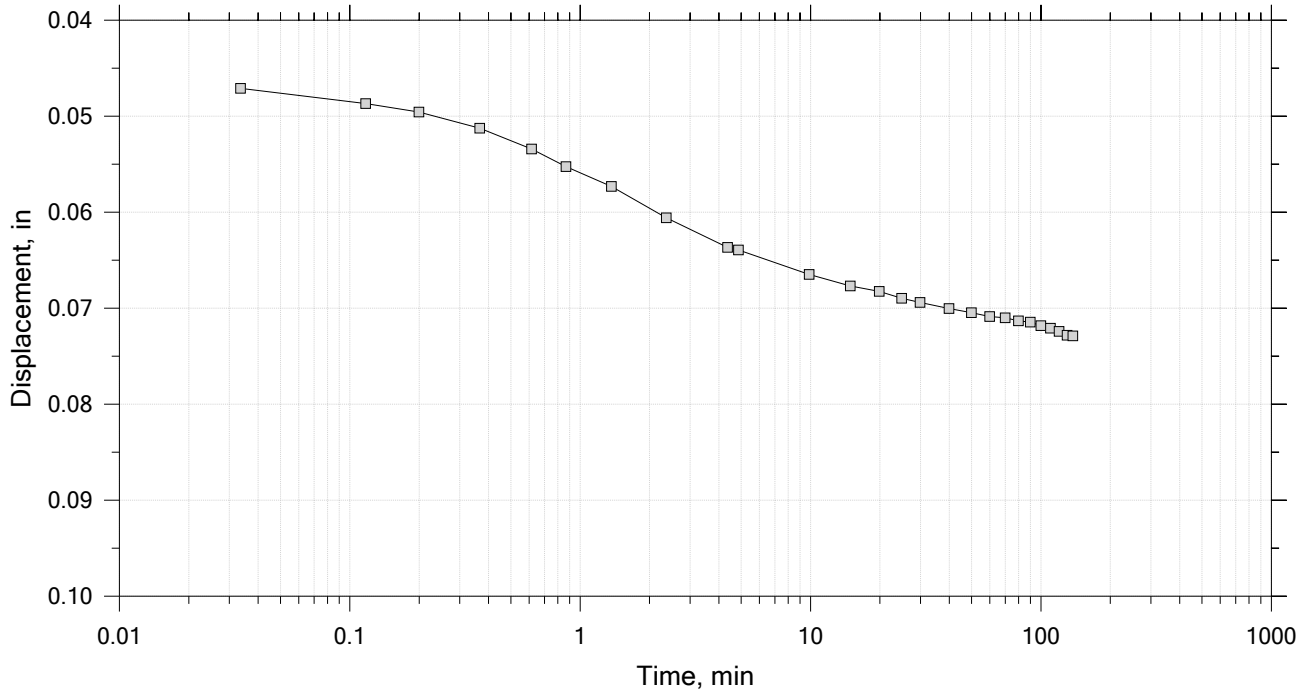


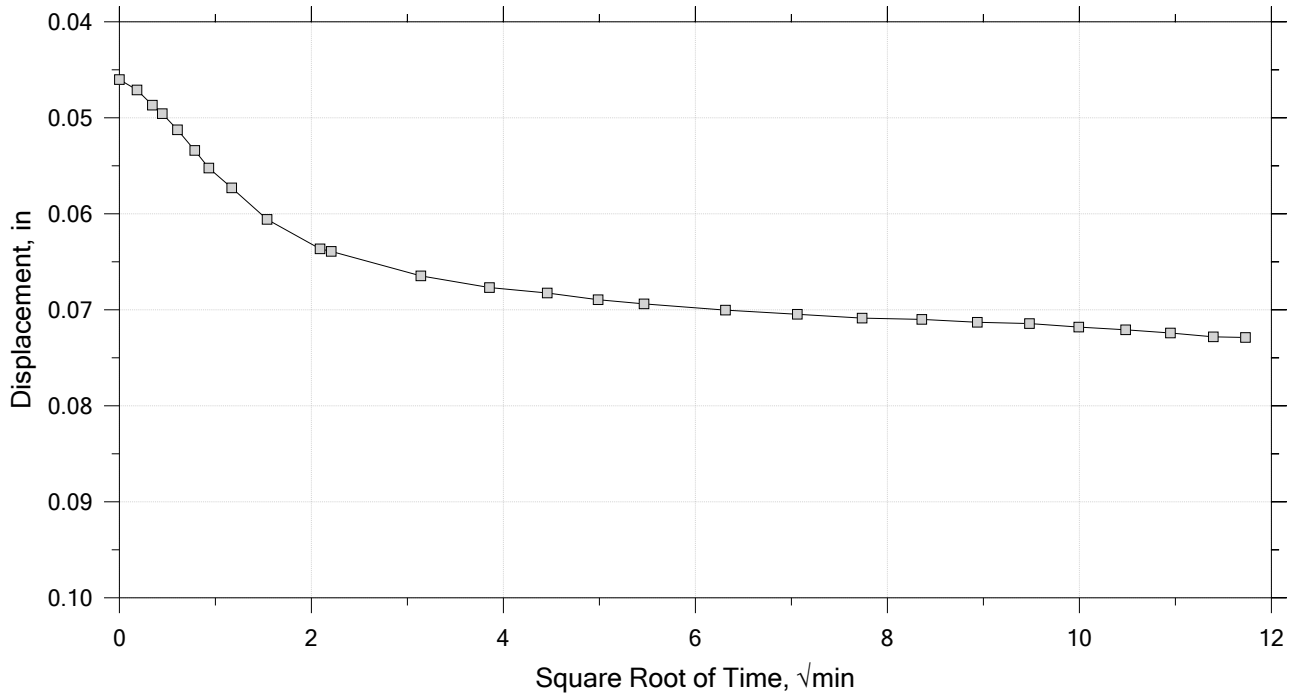


Soil Metrics LLC	Project: I95 Bridge over Broadway	Location: Bangor, ME	Project No.: 166-28
	Boring No.: BB-B195-201	Tested By: sjr	Checked By: sjr
	Sample No.: U1	Test Date: 7/18/2022	Depth: 14.7
	Test No.: ICONP-68-408	Sample Type: wet	Elevation: --
	Description: Brown silty clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 19 of 23
Constant Load Step
Stress: 2.05e+04 psf

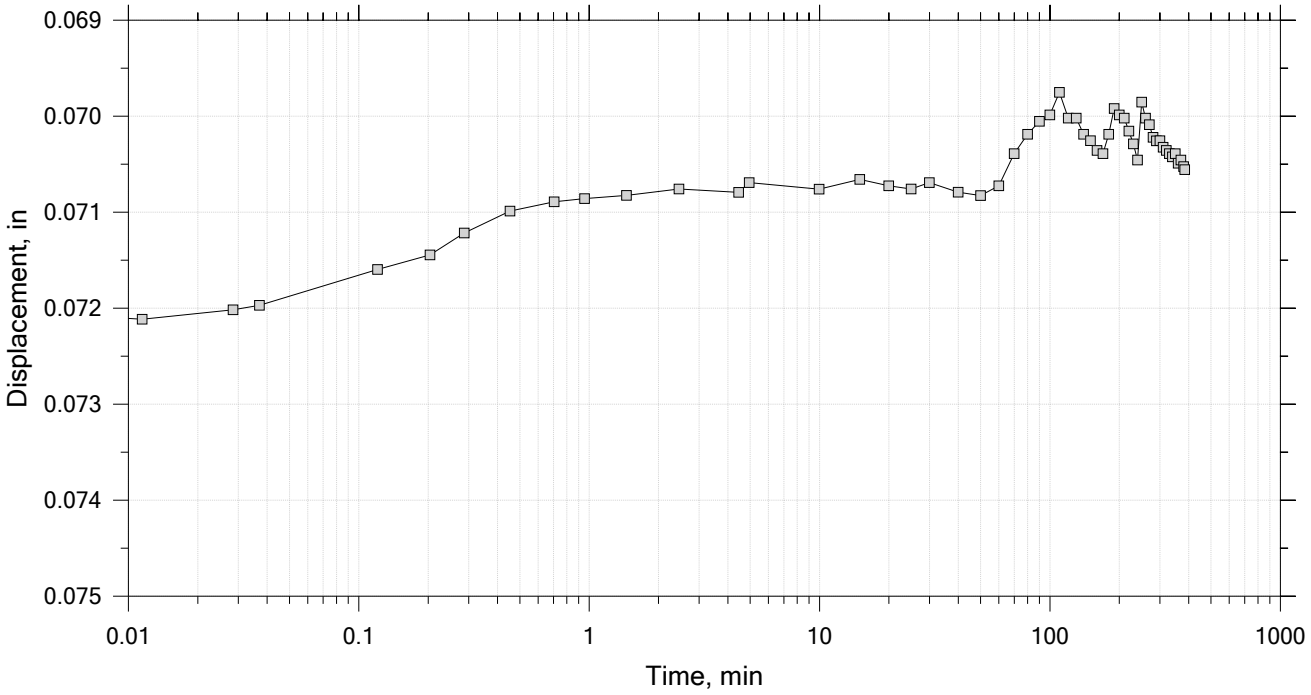


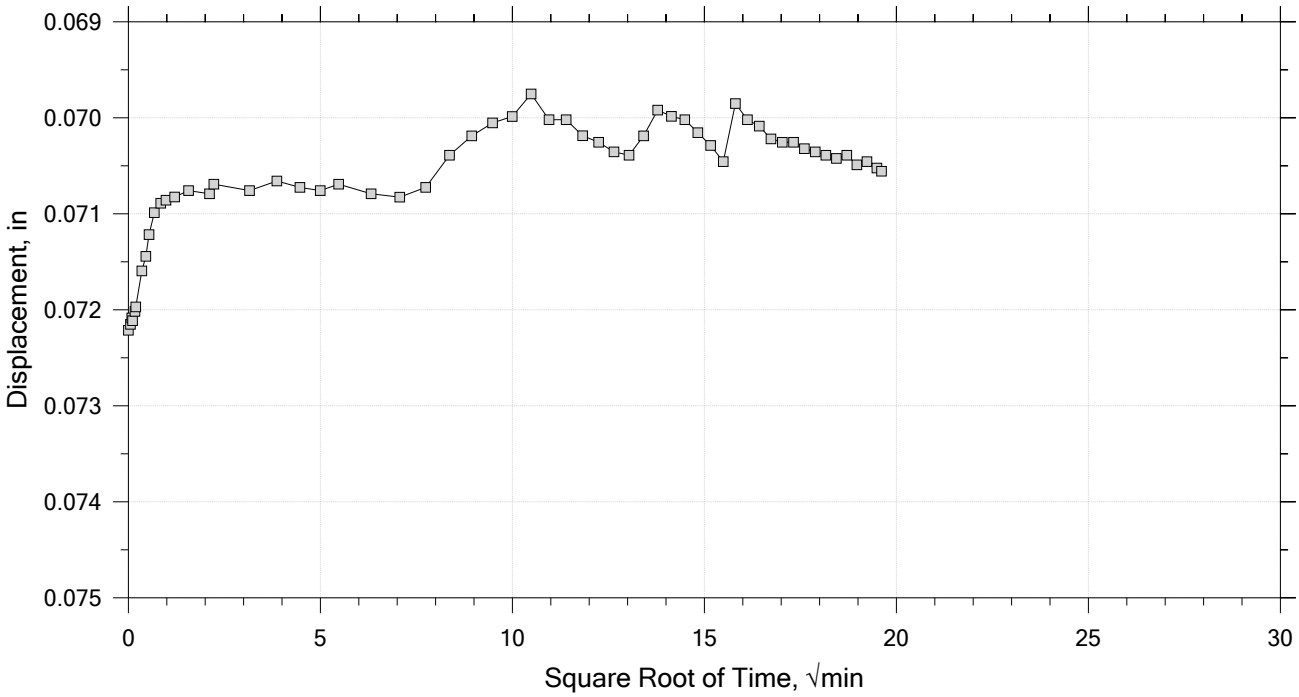


Soil Metrics LLC	Project: I95 Bridge over Broadway	Location: Bangor, ME	Project No.: 166-28
	Boring No.: BB-B195-201	Tested By: sjr	Checked By: sjr
	Sample No.: U1	Test Date: 7/18/2022	Depth: 14.7
	Test No.: ICONP-68-408	Sample Type: wet	Elevation: --
	Description: Brown silty clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 20 of 23
Constant Load Step
Stress: 1.03e+04 psf

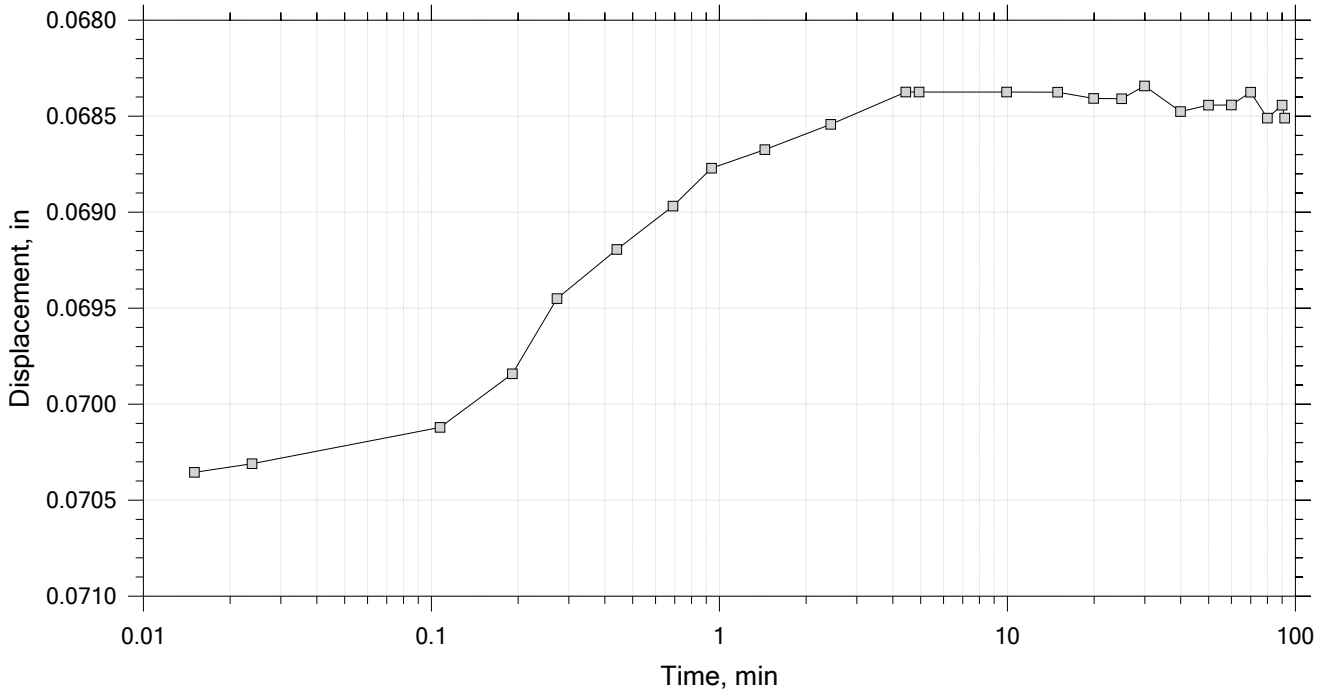


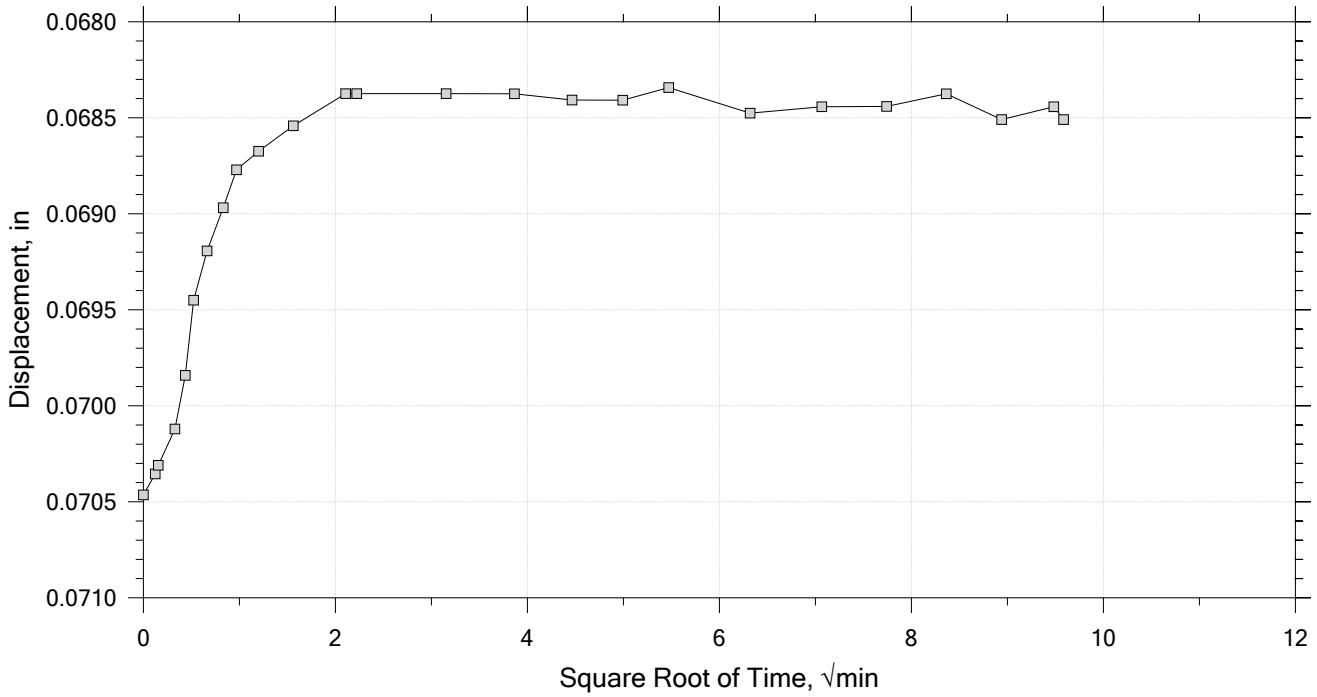


Project: I95 Bridge over Broadway	Location: Bangor, ME	Project No.: 166-28
Boring No.: BB-B195-201	Tested By: sjr	Checked By: sjr
Sample No.: U1	Test Date: 7/18/2022	Depth: 14.7
Test No.: ICONP-68-408	Sample Type: wet	Elevation: --
Description: Brown silty clay		
Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 21 of 23
Constant Load Step
Stress: 5.13e+03 psf

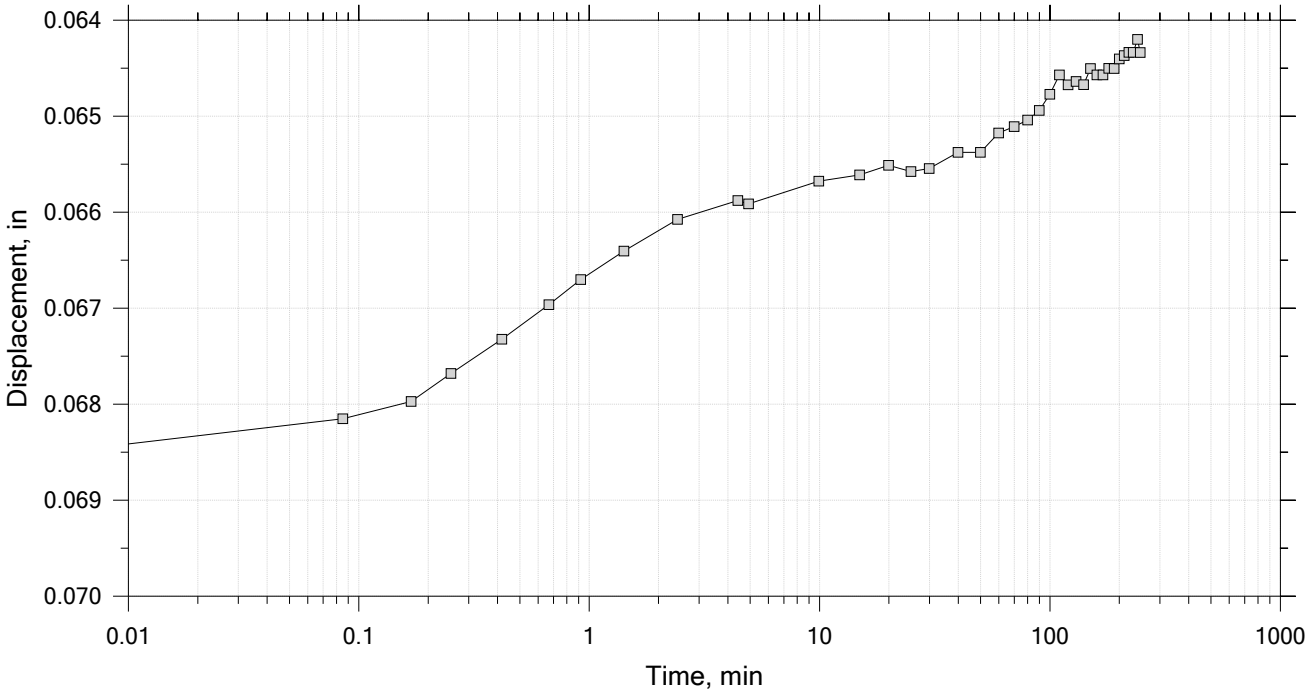


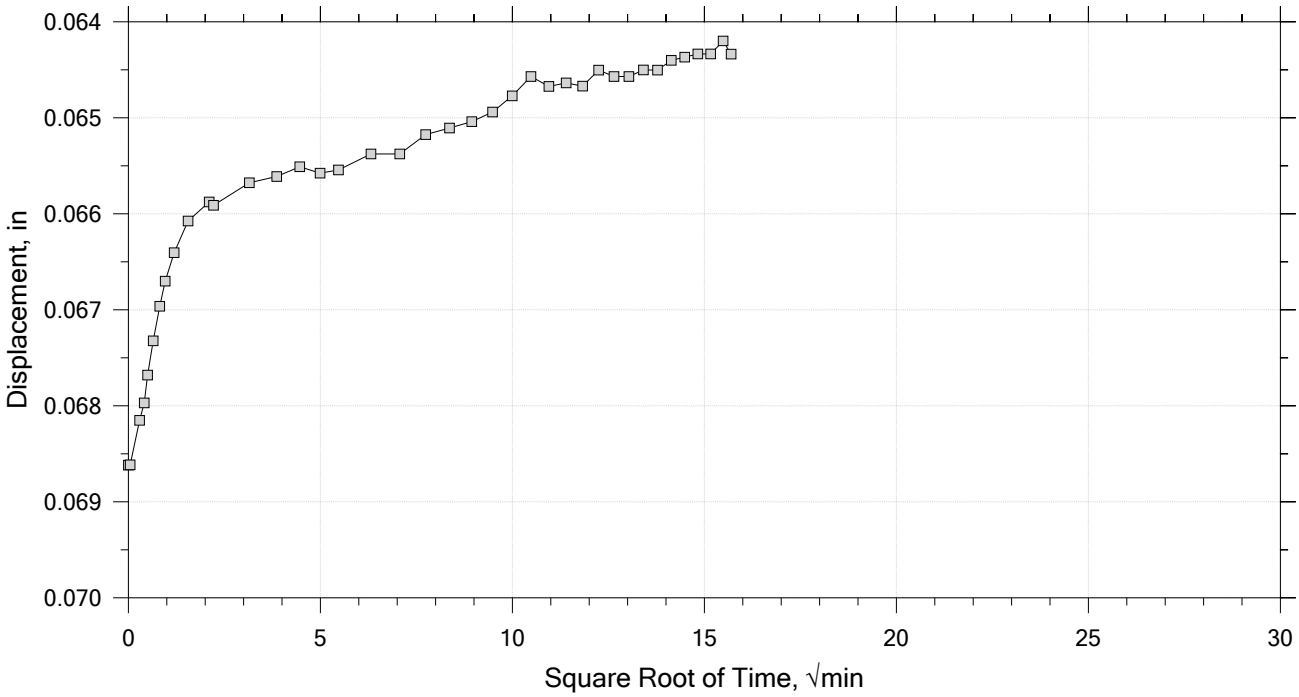


Soil Metrics LLC	Project: I95 Bridge over Broadway	Location: Bangor, ME	Project No.: 166-28
	Boring No.: BB-B195-201	Tested By: sjr	Checked By: sjr
	Sample No.: U1	Test Date: 7/18/2022	Depth: 14.7
	Test No.: ICONP-68-408	Sample Type: wet	Elevation: --
	Description: Brown silty clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 22 of 23
Constant Load Step
Stress: 2.56e+03 psf

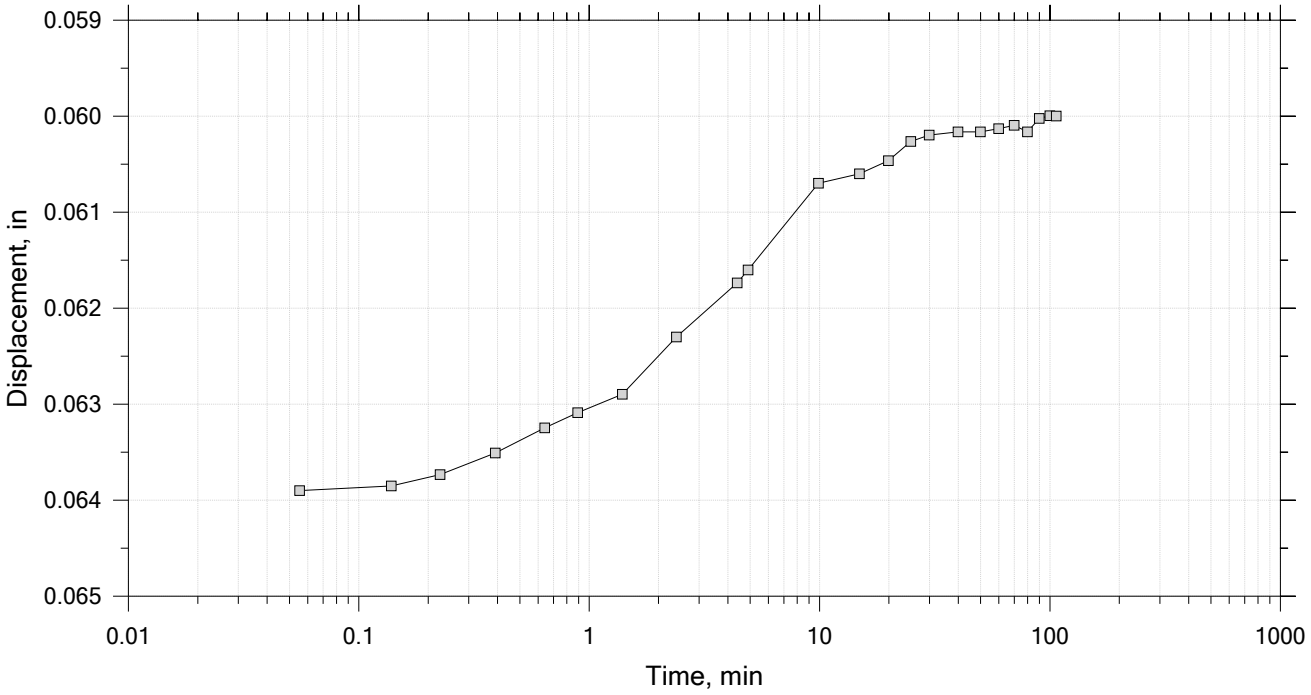


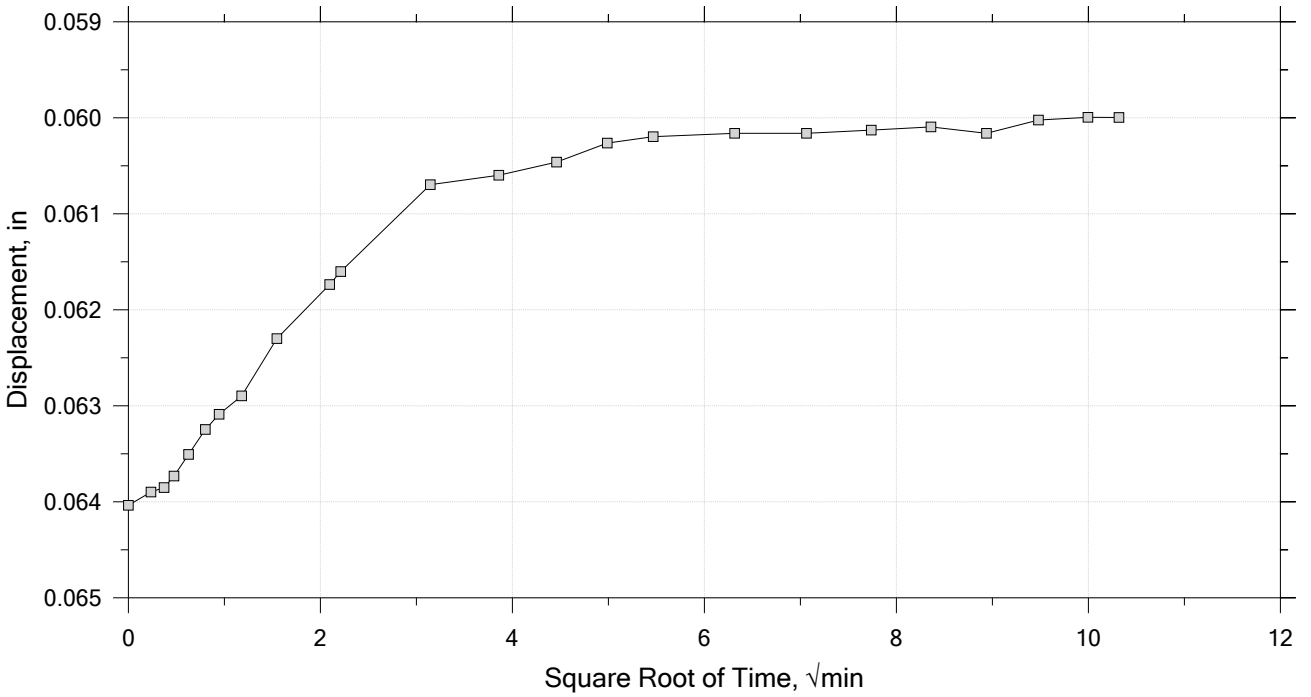


Soil Metrics LLC	Project: I95 Bridge over Broadway	Location: Bangor, ME	Project No.: 166-28
	Boring No.: BB-B195-201	Tested By: sjr	Checked By: sjr
	Sample No.: U1	Test Date: 7/18/2022	Depth: 14.7
	Test No.: ICONP-68-408	Sample Type: wet	Elevation: --
	Description: Brown silty clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 23 of 23
Constant Load Step
Stress: 1.28e+03 psf





Soil Metrics LLC	Project: I95 Bridge over Broadway	Location: Bangor, ME	Project No.: 166-28
	Boring No.: BB-B195-201	Tested By: sjr	Checked By: sjr
	Sample No.: U1	Test Date: 7/18/2022	Depth: 14.7
	Test No.: ICONP-68-408	Sample Type: wet	Elevation: --
	Description: Brown silty clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Specimen Diameter: 2.50 in	Implied Specific Gravity: 2.84	Liquid Limit: 35
Initial Height: 1.00 in	Initial Void Ratio: 0.893	Plastic Limit: 21
Final Height: 0.94 in	Final Void Ratio: 0.78	Plasticity Index: 14

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	205	RING	"ring"	318
Mass Container, gm	36.96	109.53	109.53	60.52
Mass Container + Wet Soil, gm	177.96	266.85	263.42	214.07
Mass Container + Dry Soil, gm	146.42	230.26	230.26	180.98
Mass Dry Soil, gm	109.46	120.73	120.73	120.46
Water Content, %	28.81	30.31	27.47	27.47
Void Ratio	---	0.89	0.78	---
Degree of Saturation, %	---	96.32	100.00	---
Dry Unit Weight, pcf	---	93.6	99.568	---

Note: Specific Gravity and Void Ratios are calculated assuming the degree of saturation equals 100% at the end of the test. Therefore, values may not represent actual values for the specimen.

Soil Metrics LLC

Project: I95 Bridge over Broadway	Location: Bangor, ME	Project No.: 166-28
Boring No.: BB-B195-201	Tested By: sjr	Checked By: sjr
Sample No.: U1	Test Date: 7/18/2022	Depth: 14.7
Test No.: ICONP-68-408	Sample Type: wet	Elevation: --
Description: Brown silty clay		
Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Log of Time Coefficients

Step	Applied Stress psf	Final Displacement in	Void Ratio	Strain at End %	Log T50 min	Cv ft²/day	Mv 1/psf	k ft/day	Ca %
1	150.	6.432e-05	0.893	0.00643	0.000	0.00e+00	4.28e-07	0.00e+00	0.00e+00
2	225.	0.0004280	0.892	0.0428	0.000	0.00e+00	4.84e-06	0.00e+00	0.00e+00
3	338.	0.0008278	0.892	0.0827	0.000	0.00e+00	3.53e-06	0.00e+00	0.00e+00
4	506.	0.001739	0.890	0.174	0.000	0.00e+00	5.42e-06	0.00e+00	0.00e+00
5	759.	0.002419	0.889	0.242	0.000	0.00e+00	2.68e-06	0.00e+00	0.00e+00
6	1.14e+03	0.004118	0.885	0.411	0.000	0.00e+00	4.47e-06	0.00e+00	0.00e+00
7	1.71e+03	0.006138	0.882	0.613	0.000	0.00e+00	3.54e-06	0.00e+00	0.00e+00
8	2.56e+03	0.009216	0.876	0.921	1.044	4.65e-01	3.60e-06	1.05e-04	0.00e+00
9	5.13e+03	0.01752	0.860	1.75	0.000	0.00e+00	3.24e-06	0.00e+00	0.00e+00
10	1.03e+04	0.03324	0.830	3.32	0.000	0.00e+00	3.06e-06	0.00e+00	0.00e+00
11	5.13e+03	0.03426	0.828	3.42	0.000	0.00e+00	-2.00e-07	-0.00e+00	0.00e+00
12	2.56e+03	0.03195	0.833	3.19	0.000	0.00e+00	9.01e-07	0.00e+00	0.00e+00
13	1.28e+03	0.02964	0.837	2.96	0.000	0.00e+00	1.80e-06	0.00e+00	0.00e+00
14	641.	0.02660	0.843	2.66	0.000	0.00e+00	4.74e-06	0.00e+00	0.00e+00
15	1.28e+03	0.02585	0.844	2.58	0.000	0.00e+00	-1.17e-06	-0.00e+00	0.00e+00
16	2.56e+03	0.02794	0.840	2.79	0.000	0.00e+00	1.63e-06	0.00e+00	0.00e+00
17	5.13e+03	0.03155	0.834	3.15	0.000	0.00e+00	1.41e-06	0.00e+00	0.00e+00
18	1.03e+04	0.04014	0.817	4.01	0.000	0.00e+00	1.67e-06	0.00e+00	0.00e+00
19	2.05e+04	0.06792	0.765	6.78	1.793	2.46e-01	2.71e-06	4.16e-05	0.00e+00
20	1.03e+04	0.07056	0.760	7.05	0.000	0.00e+00	-2.57e-07	-0.00e+00	0.00e+00
21	5.13e+03	0.06849	0.764	6.84	0.000	0.00e+00	4.03e-07	0.00e+00	0.00e+00
22	2.56e+03	0.06434	0.772	6.43	0.000	0.00e+00	1.62e-06	0.00e+00	0.00e+00
23	1.28e+03	0.06019	0.779	6.01	2.499	1.74e-01	3.23e-06	3.50e-05	0.00e+00

Soil Metrics LLC	Project: I95 Bridge over Broadway	Location: Bangor, ME	Project No.: 166-28
	Boring No.: BB-B195-201	Tested By: sjr	Checked By: sjr
	Sample No.: U1	Test Date: 7/18/2022	Depth: 14.7
	Test No.: ICONP-68-408	Sample Type: wet	Elevation: --
	Description: Brown silty clay		
	Remarks:		
	Displacement at End of Primary		

One-Dimensional Consolidation by ASTM D2435 - Method B

Square Root of Time Coefficients

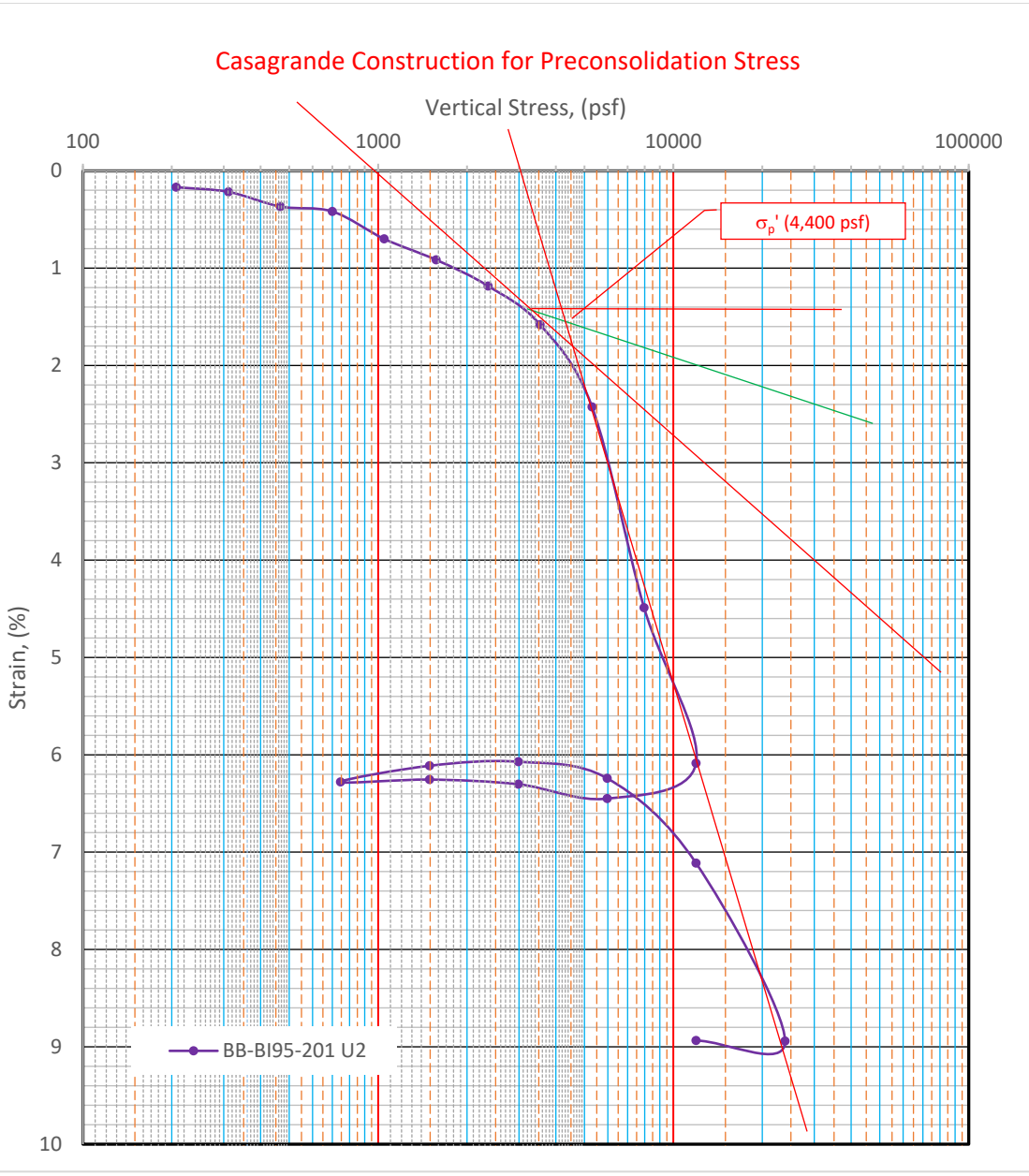
Step	Applied Stress psf	Final Displacement in	Void Ratio	Strain at End %	Sq.Rt. T90 min	Cv ft²/day	Mv 1/psf	k ft/day
1	150.	6.432e-05	0.893	0.00643	0.000	0.00e+00	4.28e-07	0.00e+00
2	225.	0.0004280	0.892	0.0428	0.000	0.00e+00	4.84e-06	0.00e+00
3	338.	0.0008278	0.892	0.0827	102.846	2.06e-02	3.53e-06	4.55e-06
4	506.	0.001739	0.890	0.174	18.536	1.14e-01	5.42e-06	3.87e-05
5	759.	0.002419	0.889	0.242	17.549	1.21e-01	2.68e-06	2.02e-05
6	1.14e+03	0.004118	0.885	0.411	0.000	0.00e+00	4.47e-06	0.00e+00
7	1.71e+03	0.006138	0.882	0.613	14.692	1.43e-01	3.54e-06	3.16e-05
8	2.56e+03	0.009216	0.876	0.921	6.048	3.46e-01	3.60e-06	7.77e-05
9	5.13e+03	0.01752	0.860	1.75	29.875	6.92e-02	3.24e-06	1.40e-05
10	1.03e+04	0.03324	0.830	3.32	4.965	4.06e-01	3.06e-06	7.77e-05
11	5.13e+03	0.03426	0.828	3.42	1.145	1.73e+00	-2.00e-07	-2.17e-05
12	2.56e+03	0.03195	0.833	3.19	1.922	1.03e+00	9.01e-07	5.81e-05
13	1.28e+03	0.02964	0.837	2.96	7.390	2.70e-01	1.80e-06	3.04e-05
14	641.	0.02660	0.843	2.66	12.208	1.64e-01	4.74e-06	4.87e-05
15	1.28e+03	0.02585	0.844	2.58	0.000	0.00e+00	-1.17e-06	-0.00e+00
16	2.56e+03	0.02794	0.840	2.79	3.009	6.69e-01	1.63e-06	6.78e-05
17	5.13e+03	0.03155	0.834	3.15	4.361	4.59e-01	1.41e-06	4.03e-05
18	1.03e+04	0.04014	0.817	4.01	19.786	9.98e-02	1.67e-06	1.04e-05
19	2.05e+04	0.06792	0.765	6.78	7.522	2.53e-01	2.71e-06	4.27e-05
20	1.03e+04	0.07056	0.760	7.05	0.000	0.00e+00	-2.57e-07	-0.00e+00
21	5.13e+03	0.06849	0.764	6.84	1.377	1.34e+00	4.03e-07	3.37e-05
22	2.56e+03	0.06434	0.772	6.43	146.602	1.26e-02	1.62e-06	1.28e-06
23	1.28e+03	0.06019	0.779	6.01	13.638	1.37e-01	3.23e-06	2.76e-05

Soil Metrics LLC	Project: I95 Bridge over Broadway	Location: Bangor, ME	Project No.: 166-28
	Boring No.: BB-B195-201	Tested By: sjr	Checked By: sjr
	Sample No.: U1	Test Date: 7/18/2022	Depth: 14.7
	Test No.: ICONP-68-408	Sample Type: wet	Elevation: --
	Description: Brown silty clay		
	Remarks:		
	Displacement at End of Primary		

Consolidation Test Data
Summary Report

Project Name:	I95 Bridge Over Broadway
Project Number:	166-28
Project Location:	Bangor, ME
Client:	GZA
Sample Description:	Gray Silty Clay/Clayey Silt
Preparation:	Trimmed Shelby Tube

Lab Test No:	ICON 65-406
Boring No.	BB-I95-201
Sample No:	U2
Boring Elevation (ft).	--
Sample Depth (ft):	18 - 20
Test Specimen Depth (Ft):	19.35
Test Specimen Elevation:	---
Water Content (%):	29.0
Dry Unit Weight (pcf):	95.4
Wet Unit Weight (pcf):	123.1
Saturation Before (%):	99.0
Saturation After (%):	100
Void Ratio Before:	0.81
Void Ratio After:	0.65
Overburden Pressure (psf):	--
Max Previous stress (psf):	4,400
Max Prev. stress (Work) (psf):	4,500
OCR:	--
Compression Index (C_{CE}):	0.1
Recompression Index (C_{RE}):	0.01
Liquid Limit:	24.5
Plastic Limit:	16.8
Plasticity Index:	7.7
Liquidity Index:	1.00
Lab Vane Su at 19.85 ft. (psf)	680
Tested By:	sjr
Date Tested:	7/18/2022
Checked By:	sjr

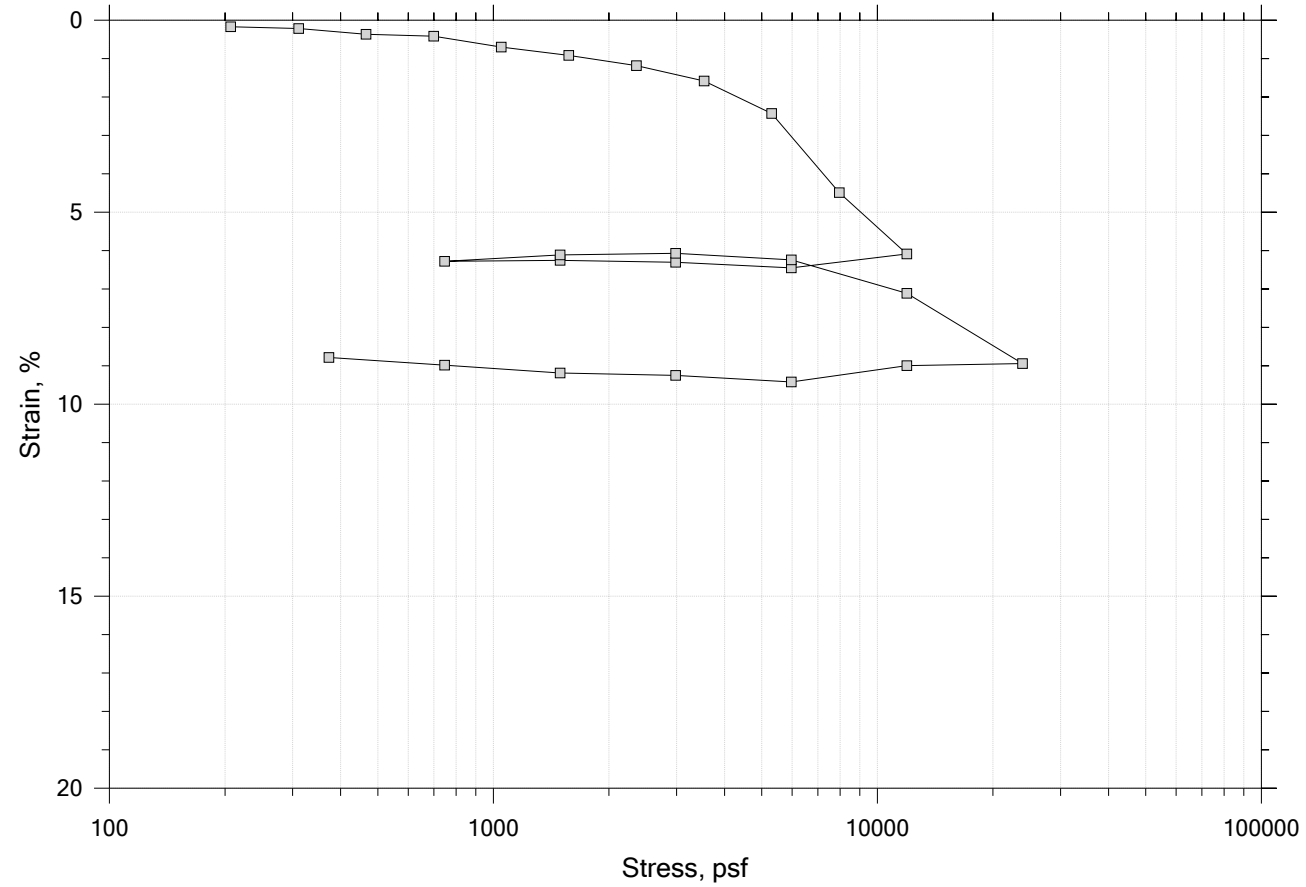


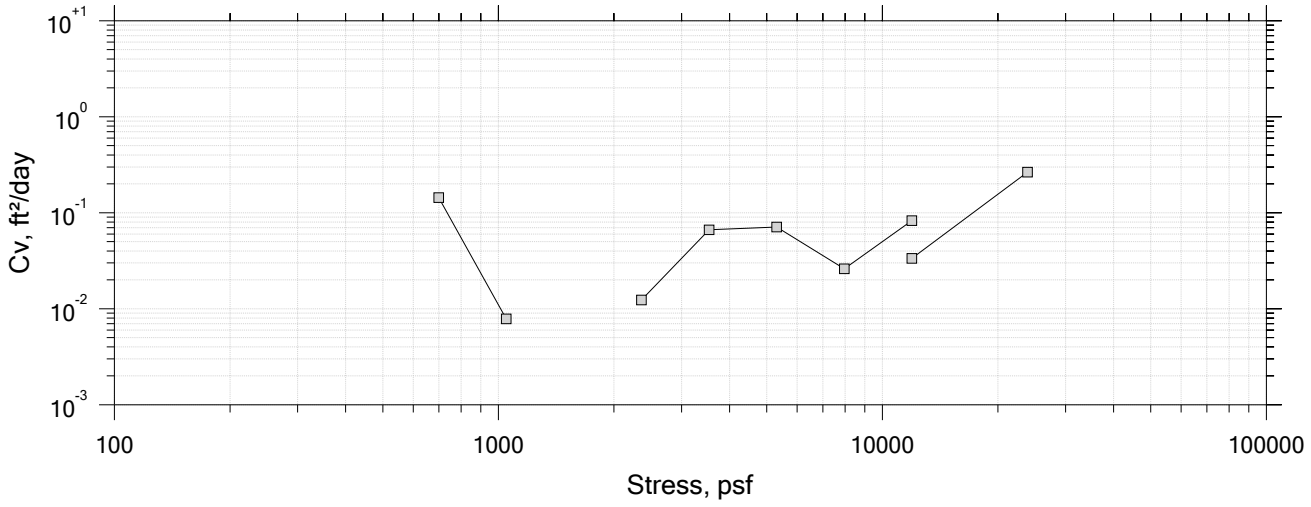
Note 1: The calculations for the Max Previous Stress, the Compression Index and the Recompression Index are provided for the convienience of the Specifier. The Specifier should make their own independent assessment of Maximum Previous stress, Cce and Cre for use in any engineering analyses.

Soil Metrics LLC Geotechnical Engineering

One-Dimensional Consolidation by ASTM D2435 - Method B

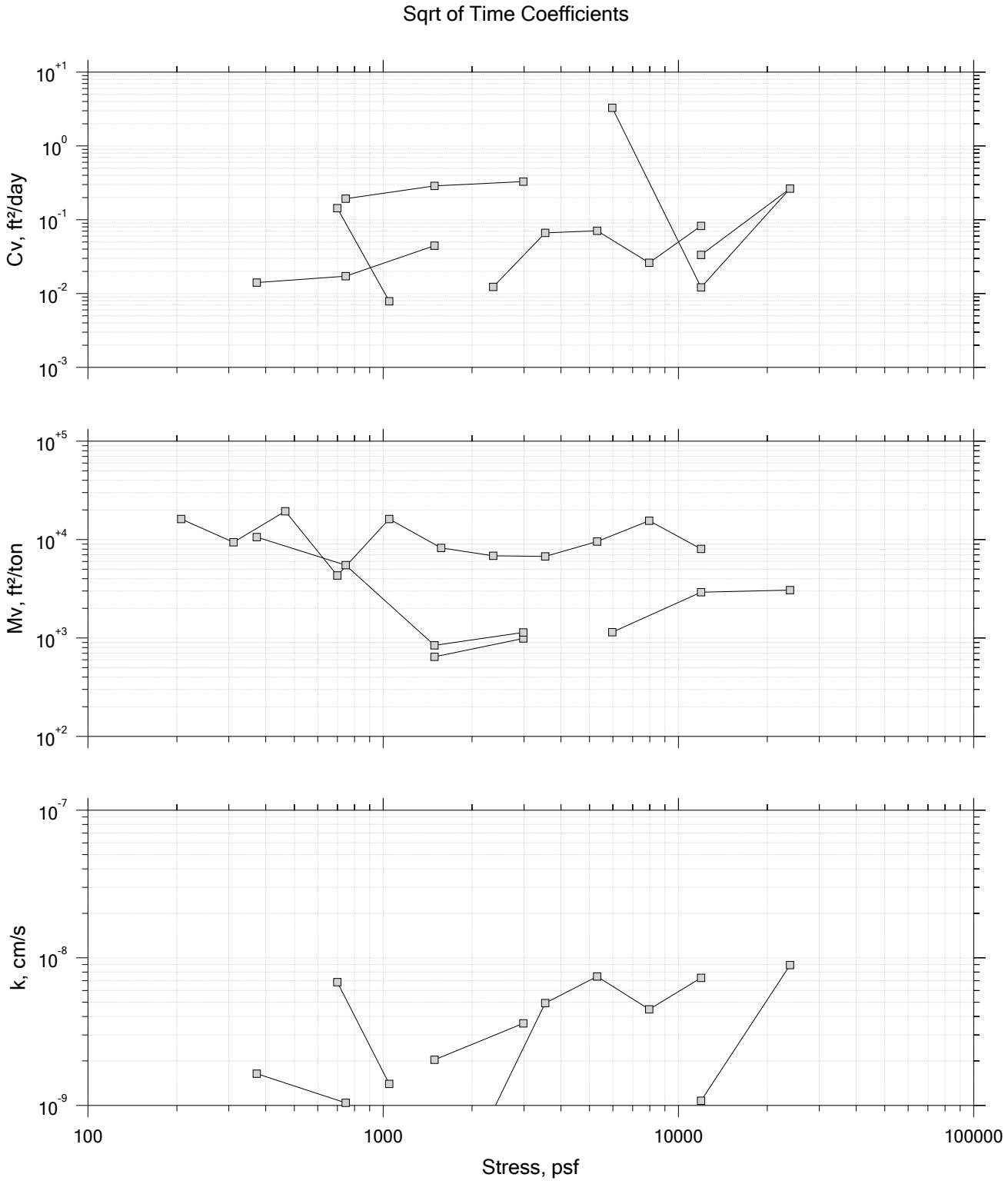
Summary Report





Soil Metrics LLC	Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
	Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
	Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
	Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
	Description: Gray Silty clay with thin sand layers		
	Remarks:		
	Displacement at End of Primary		

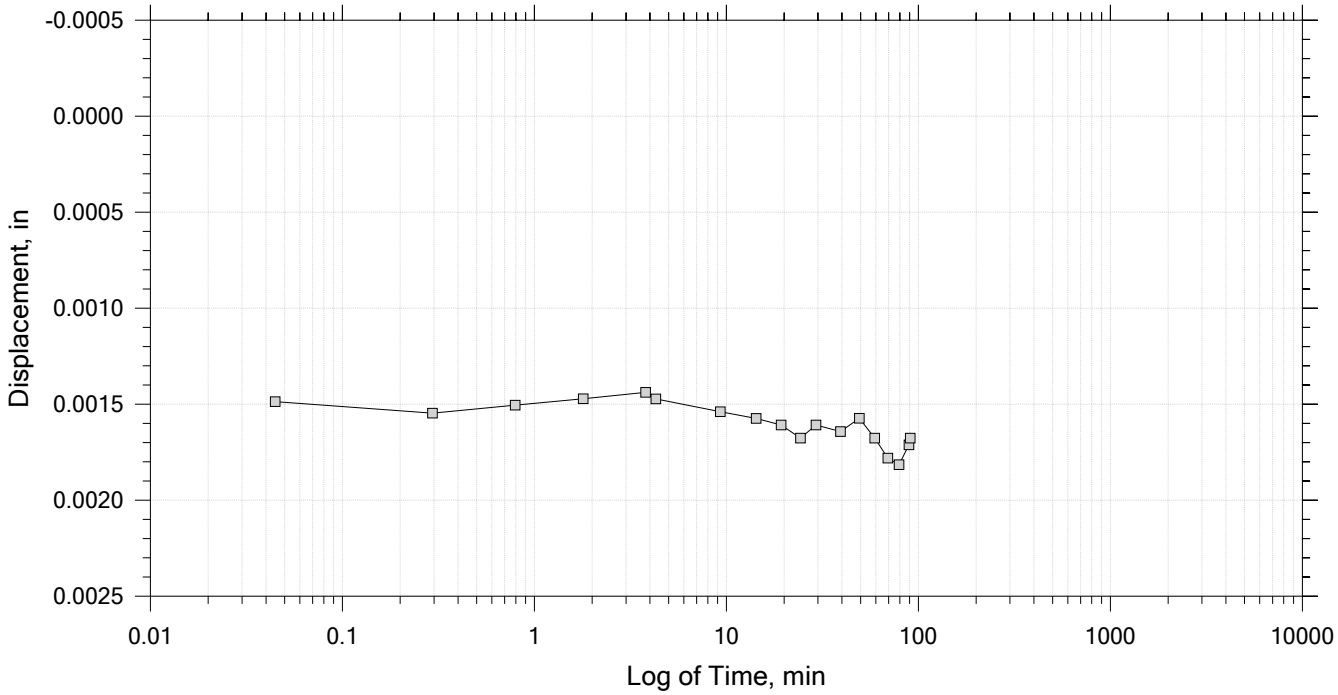
One-Dimensional Consolidation by ASTM D2435 - Method B

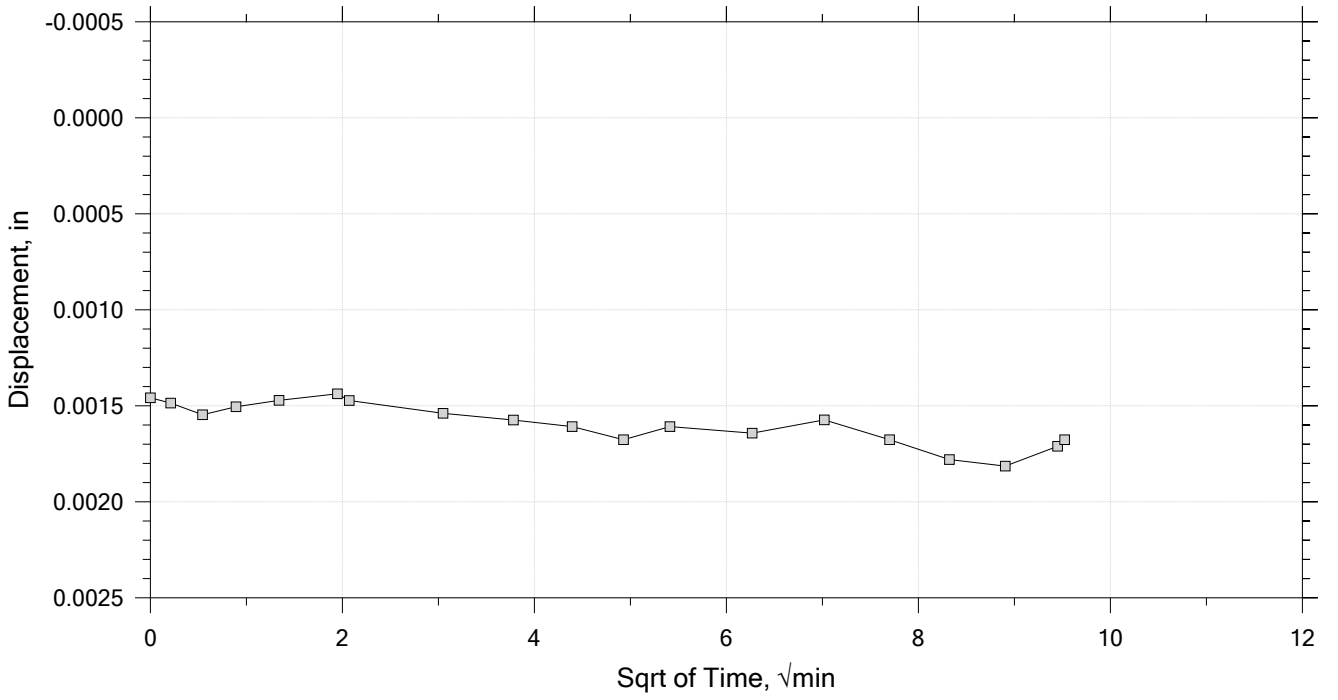


Soil Metrics LLC	Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
	Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
	Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
	Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
	Description: Gray Silty clay with thin sand layers		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 1 of 26
Constant Load Step
Stress: 207 psf

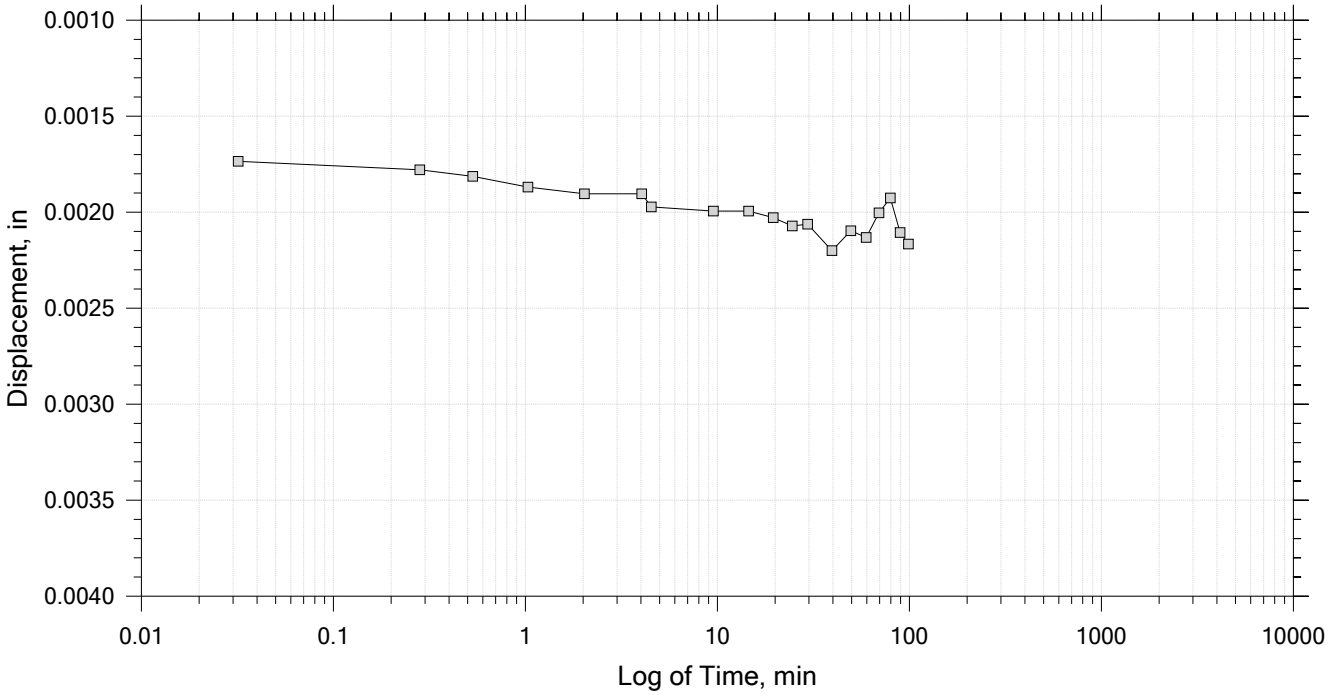


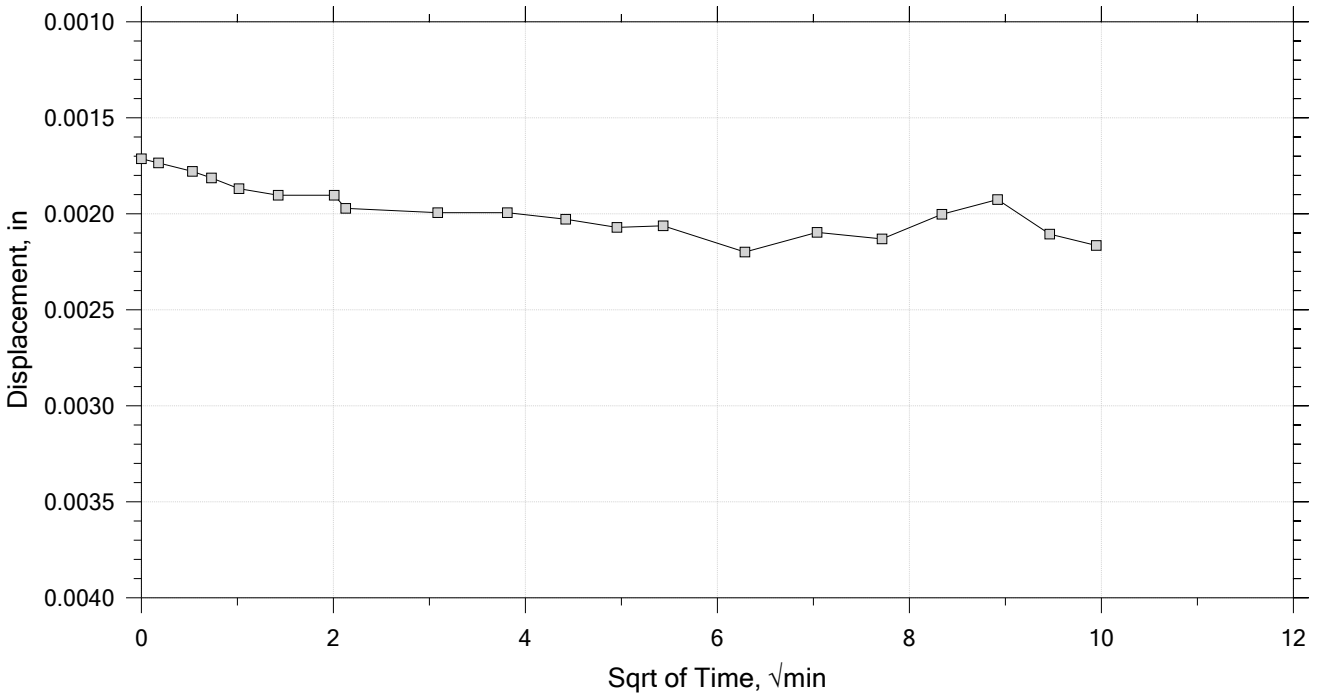


Soil Metrics LLC	Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
	Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
	Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
	Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
	Description: Gray Silty clay with thin sand layers		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 2 of 26
Constant Load Step
Stress: 311 psf

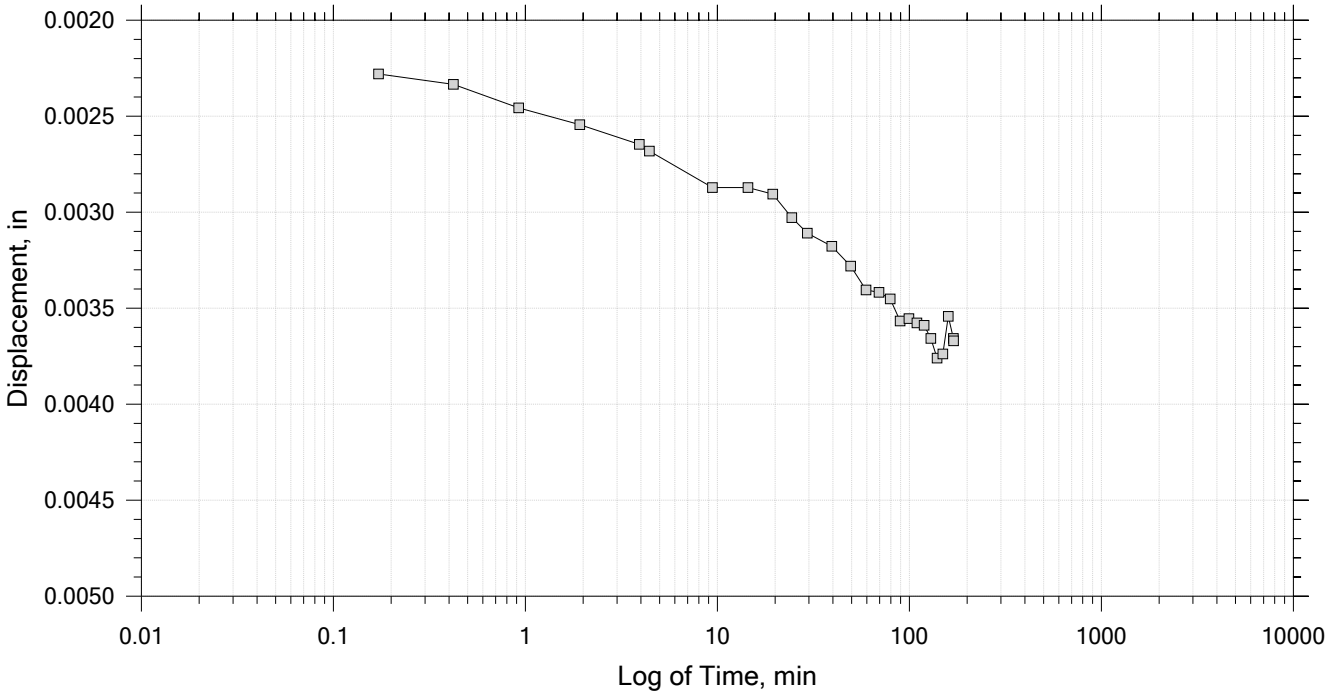


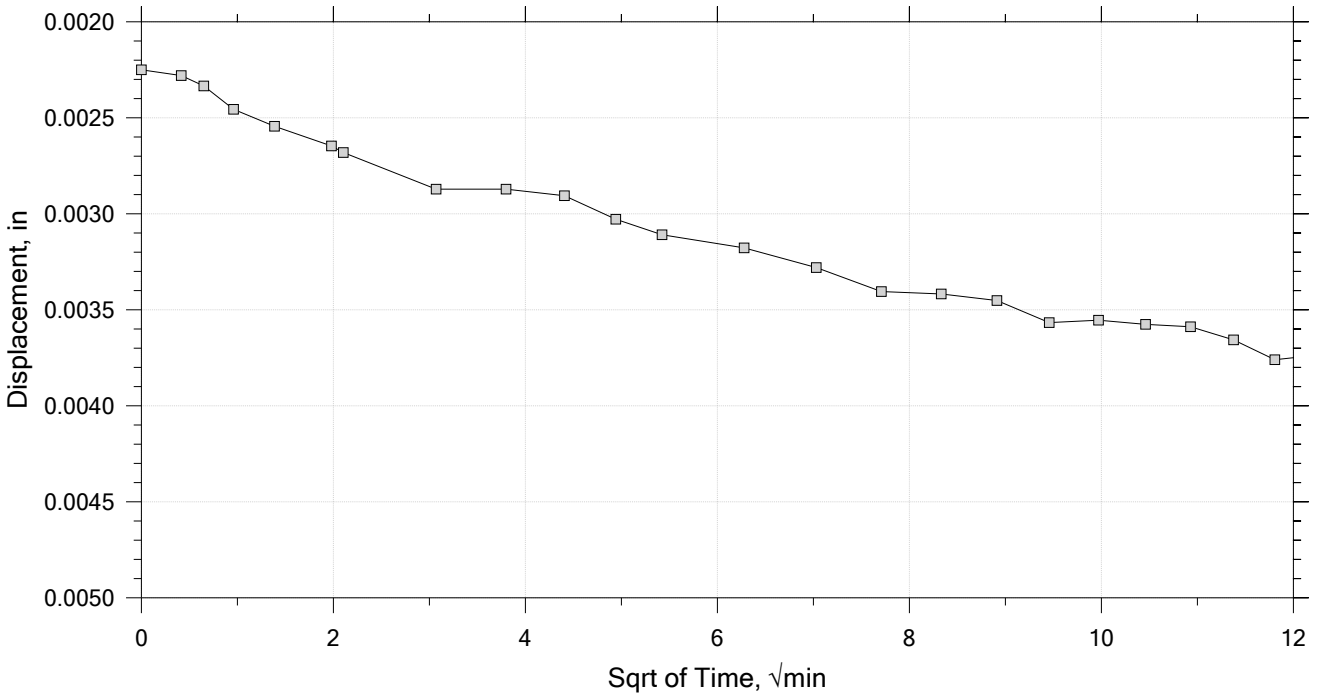


Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
Description: Gray Silty clay with thin sand layers		
Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 3 of 26
Constant Load Step
Stress: 466 psf

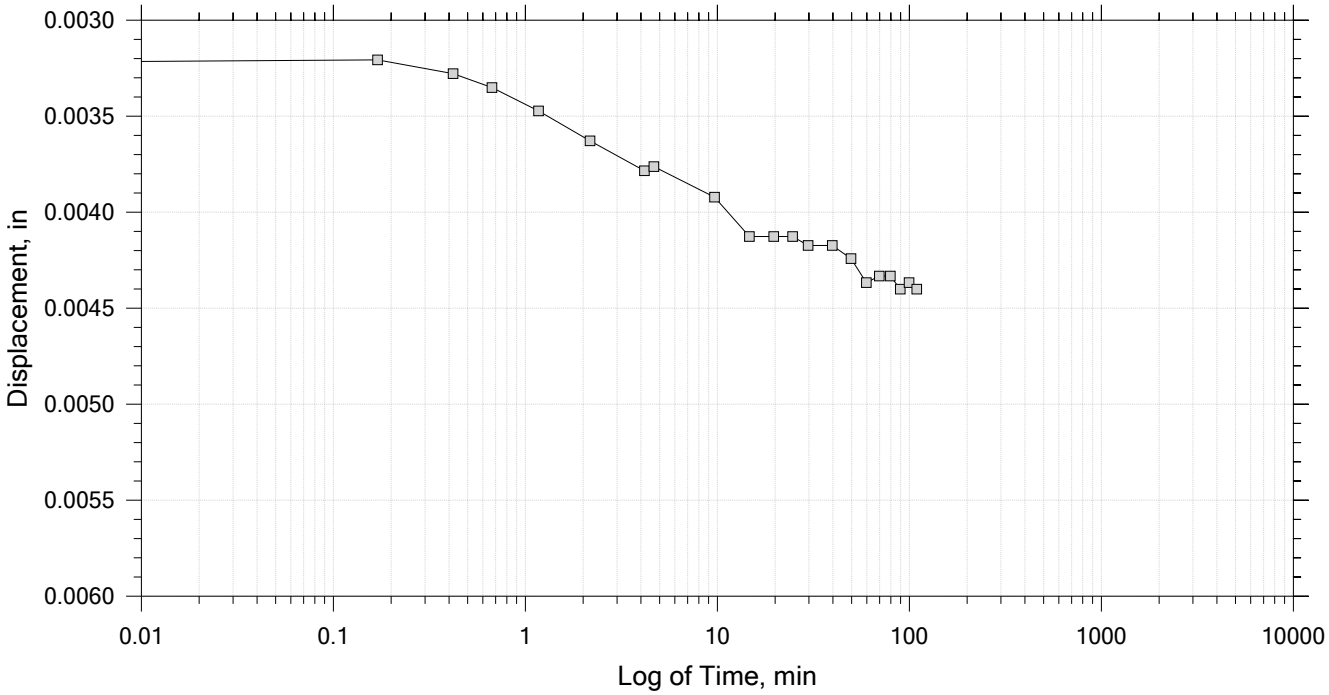


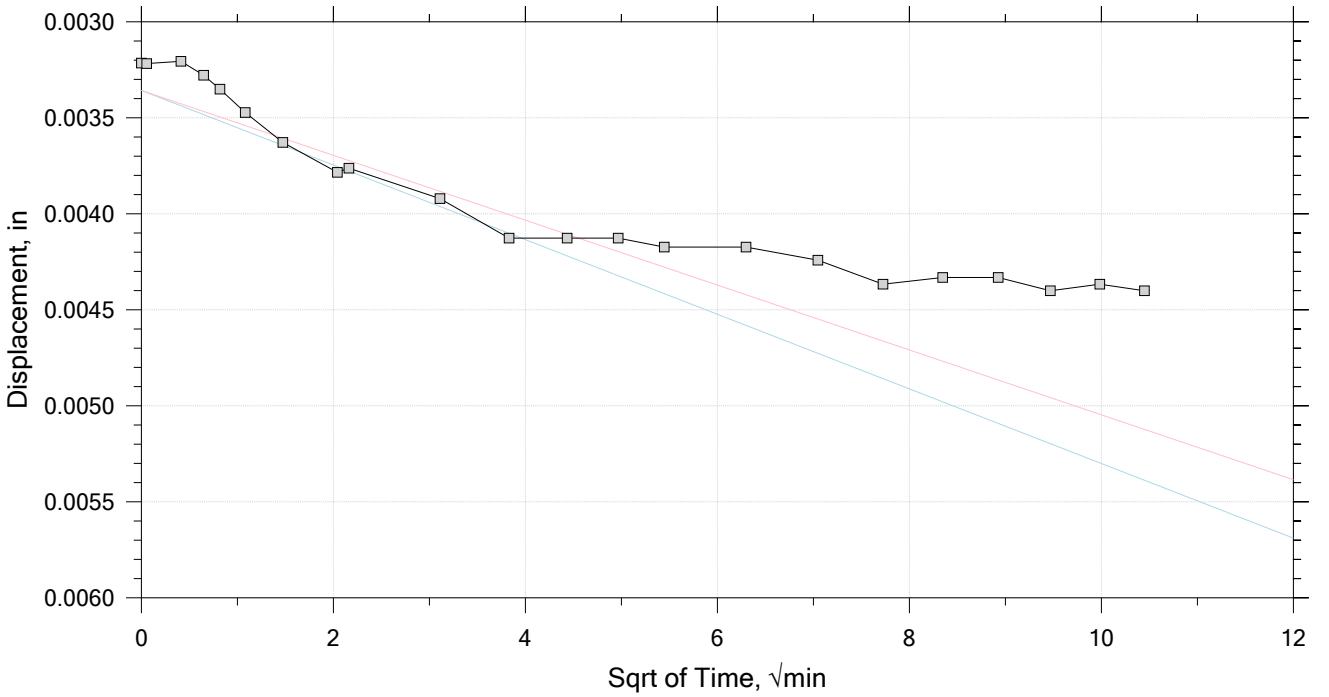


Soil Metrics LLC	Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
	Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
	Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
	Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
	Description: Gray Silty clay with thin sand layers		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 4 of 26
Constant Load Step
Stress: 699 psf





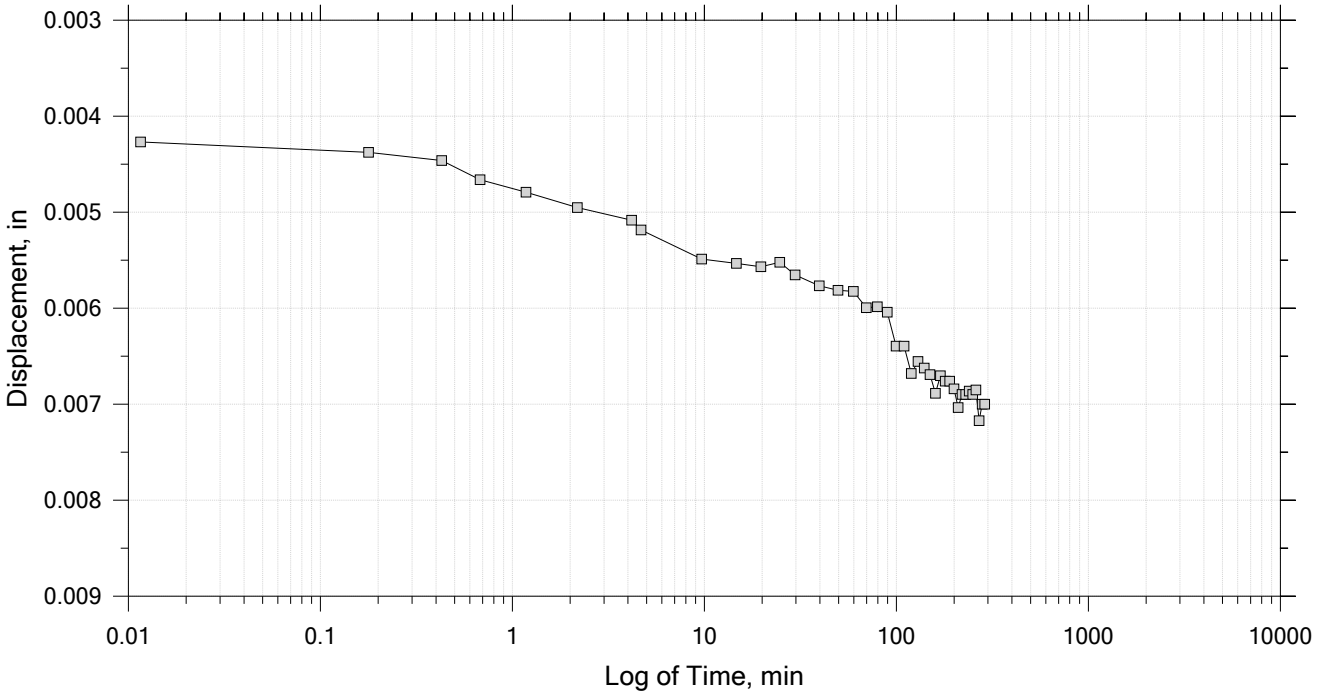
Soil Metrics LLC	Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
	Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
	Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
	Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
	Description: Gray Silty clay with thin sand layers		
	Remarks:		

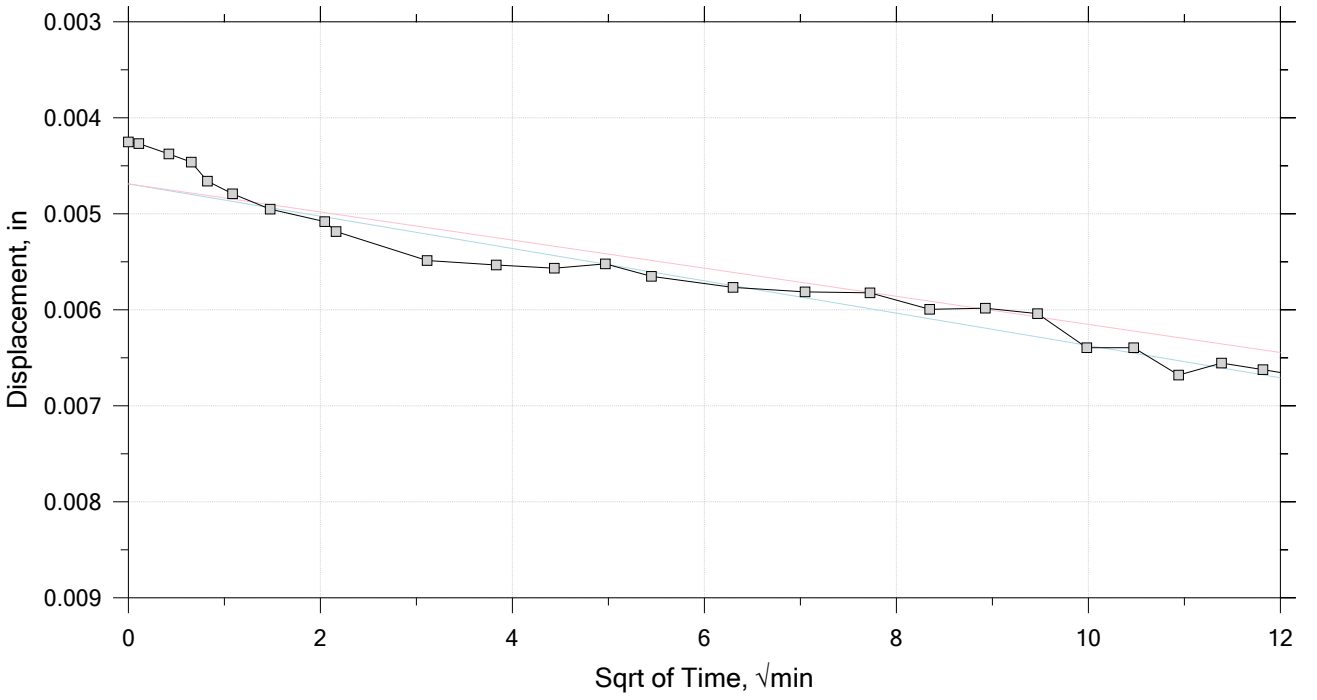
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 5 of 26

Constant Load Step

Stress: 1.05e+03 psf





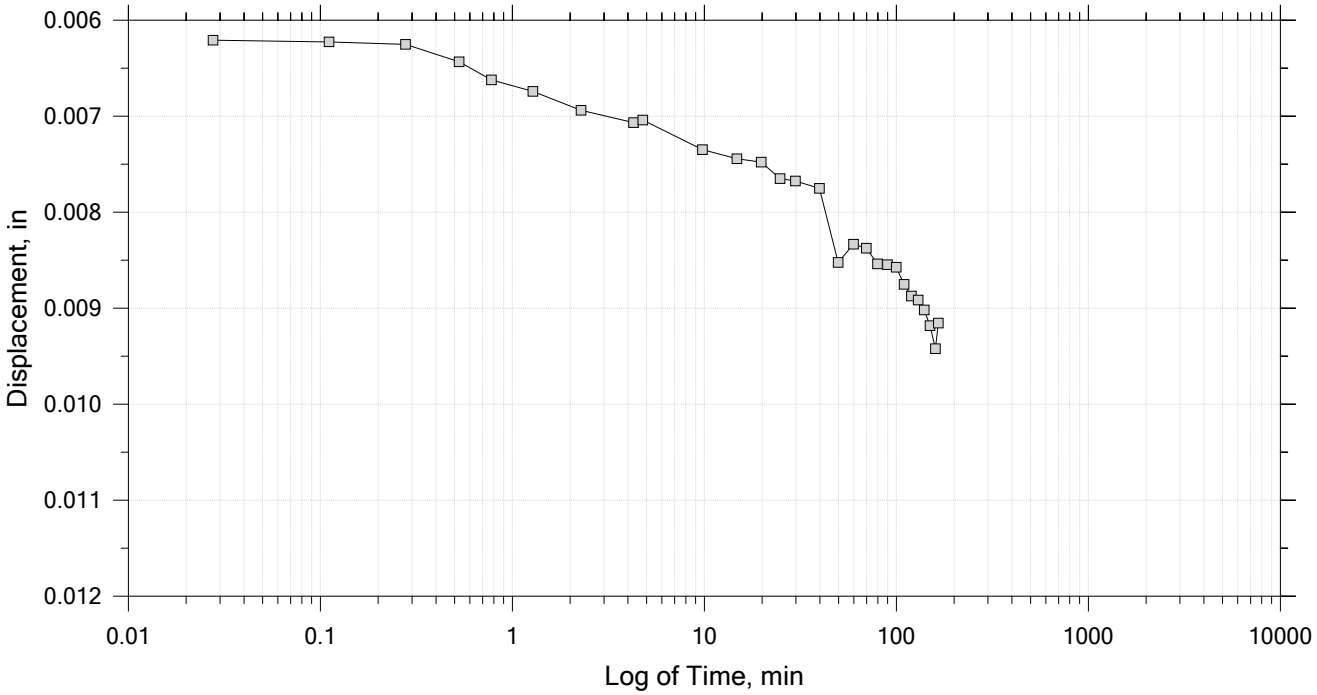
Soil Metrics LLC	Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
	Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
	Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
	Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
	Description: Gray Silty clay with thin sand layers		
	Remarks:		

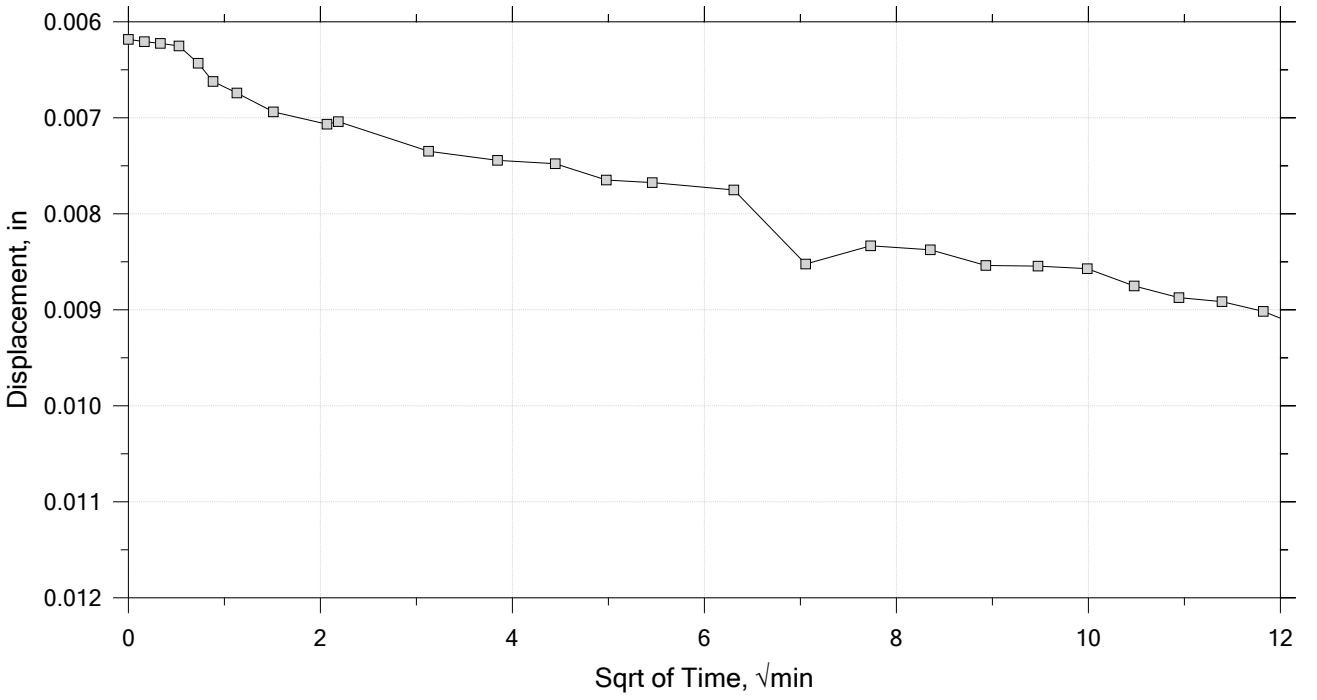
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 6 of 26

Constant Load Step

Stress: 1.57e+03 psf

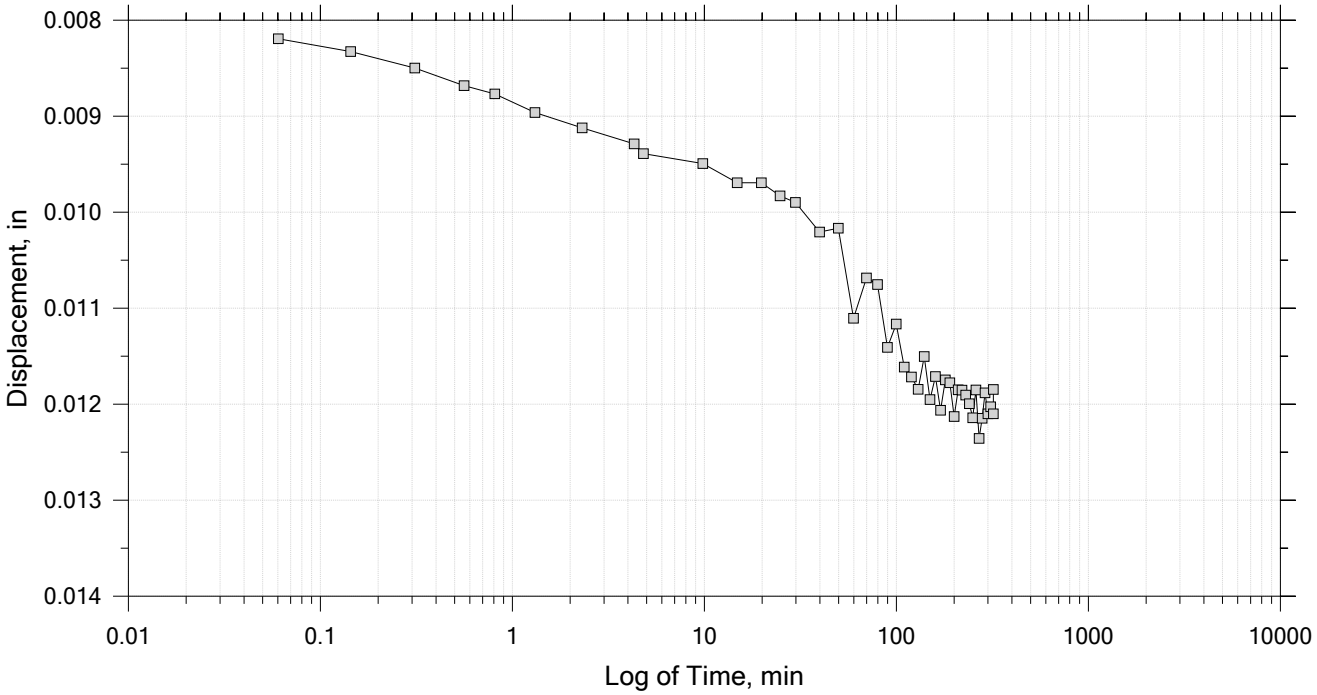


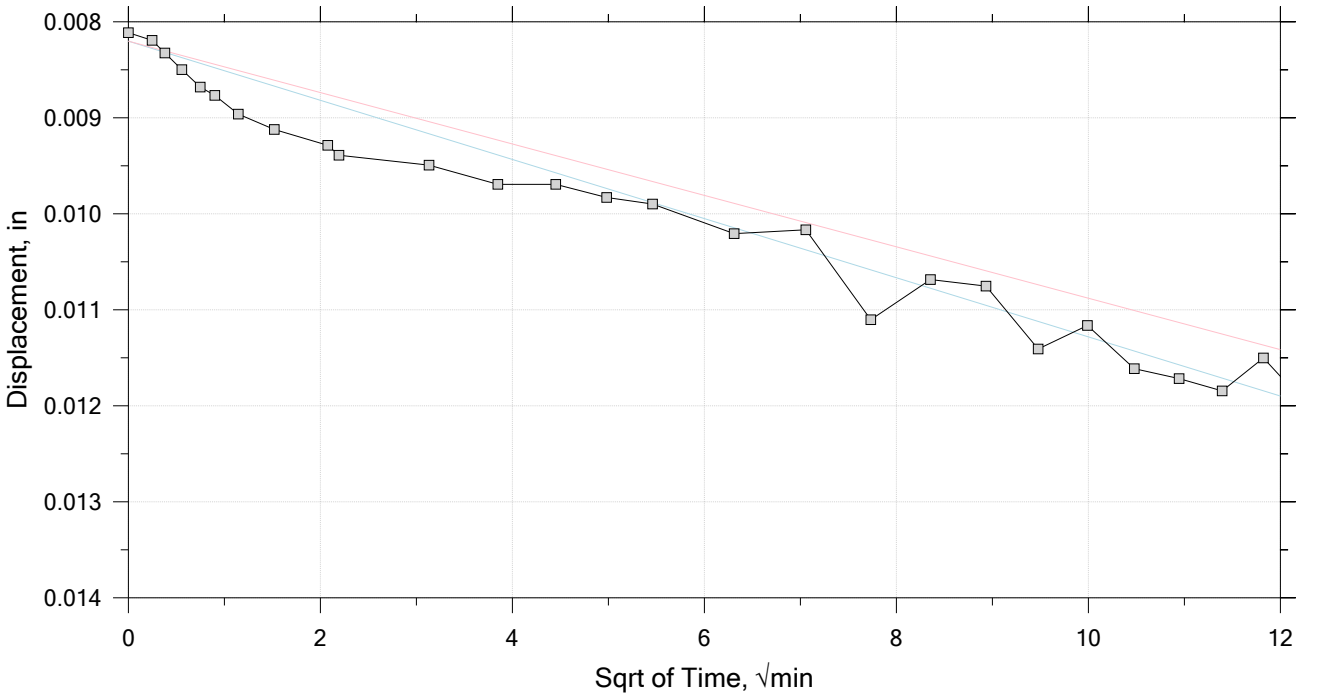


Soil Metrics LLC	Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
	Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
	Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
	Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
	Description: Gray Silty clay with thin sand layers		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 7 of 26
Constant Load Step
Stress: 2.36e+03 psf

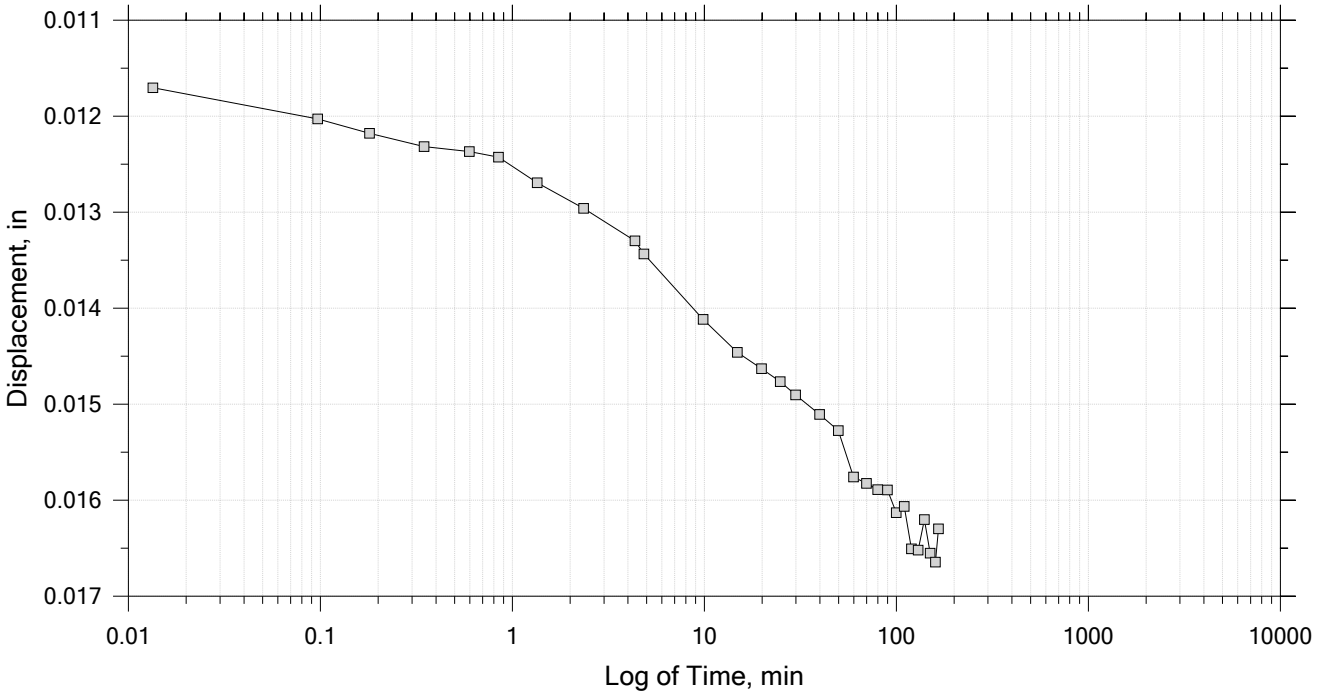


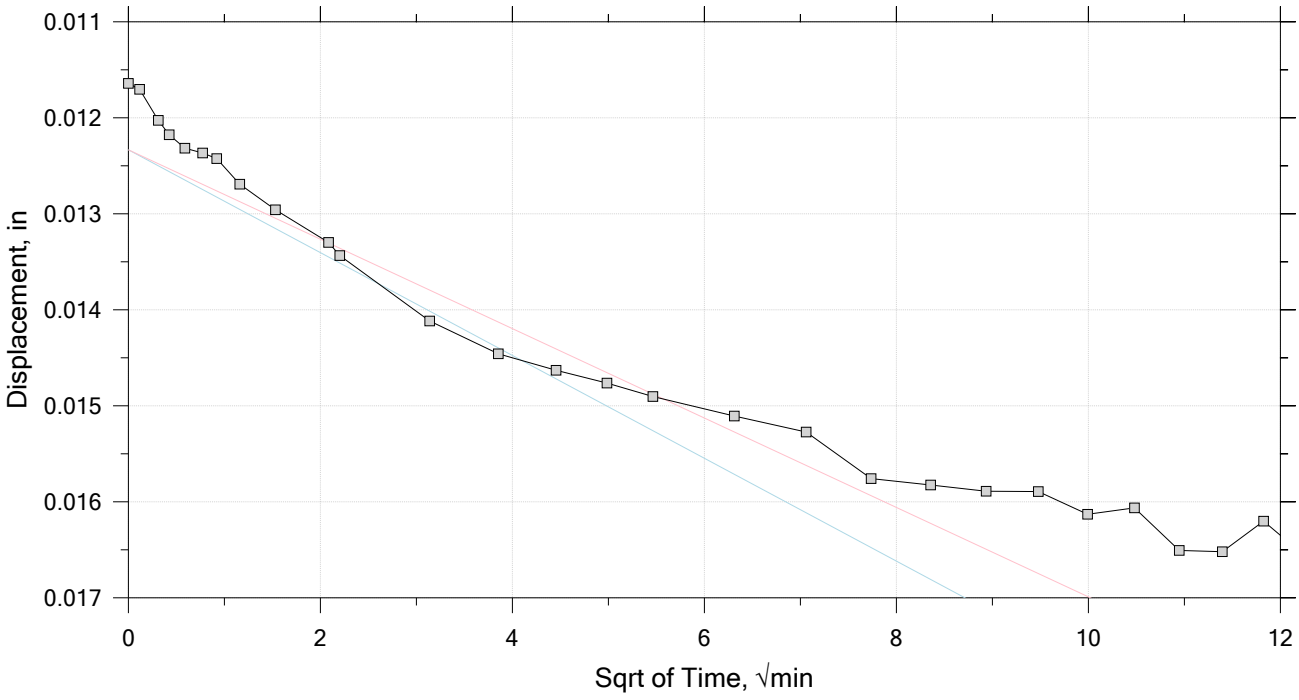


Soil Metrics LLC	Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
	Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
	Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
	Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
	Description: Gray Silty clay with thin sand layers		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 8 of 26
Constant Load Step
Stress: 3.54e+03 psf

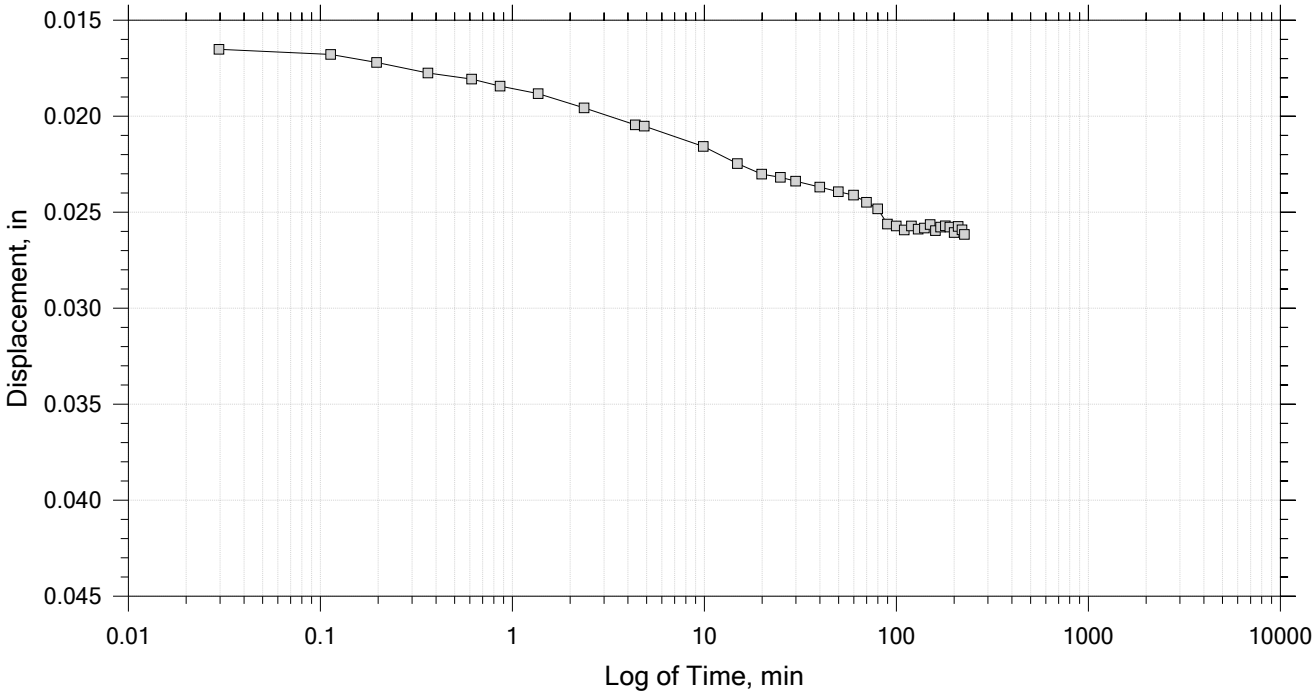


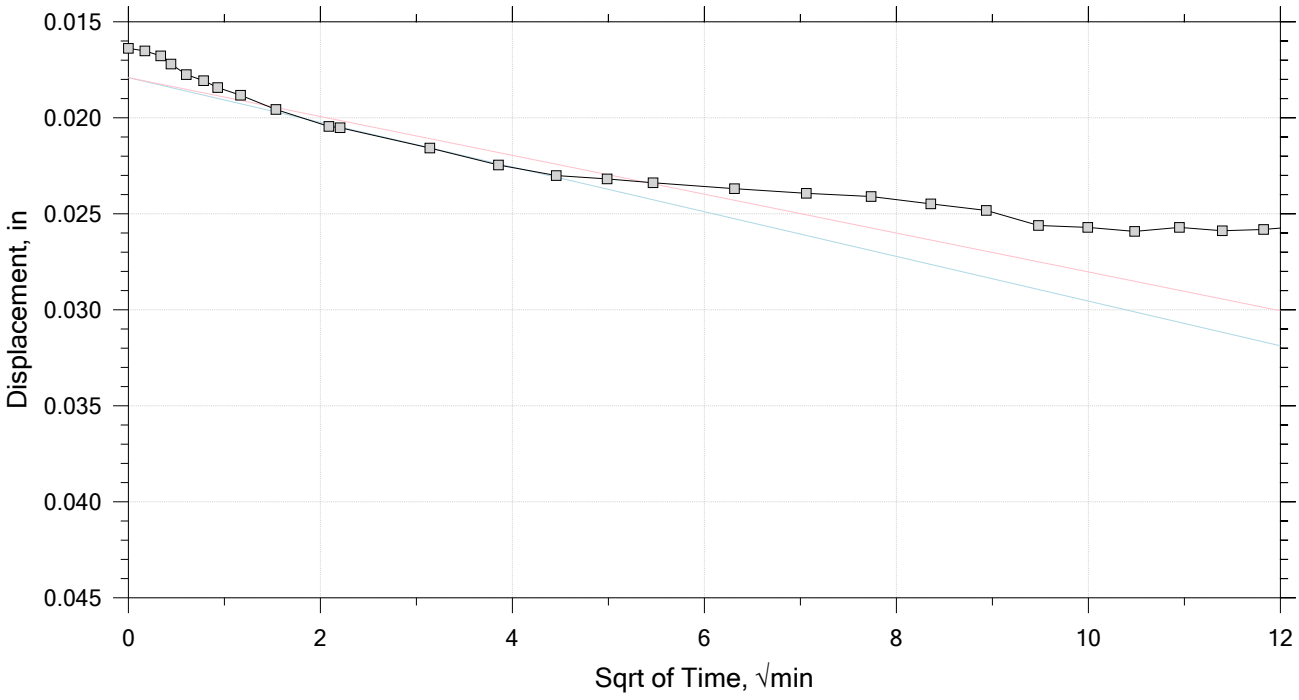


Soil Metrics LLC	Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
	Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
	Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
	Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
	Description: Gray Silty clay with thin sand layers		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 9 of 26
Constant Load Step
Stress: 5.3e+03 psf

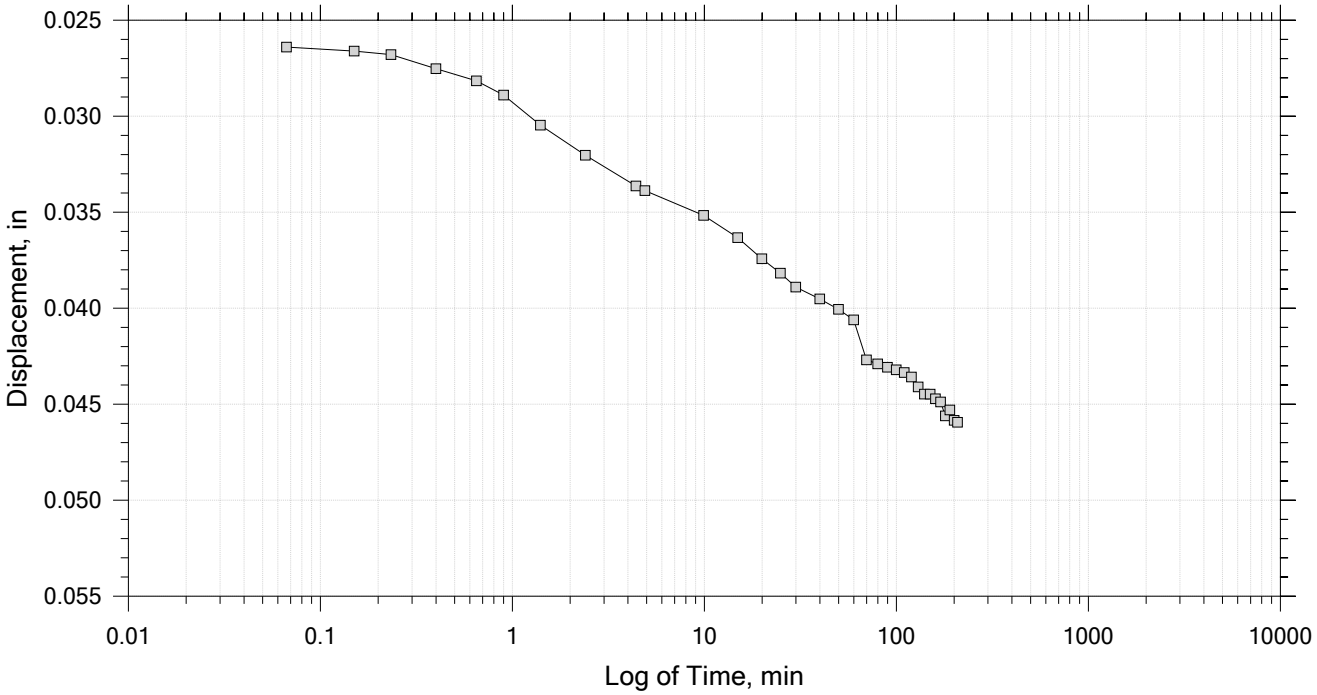


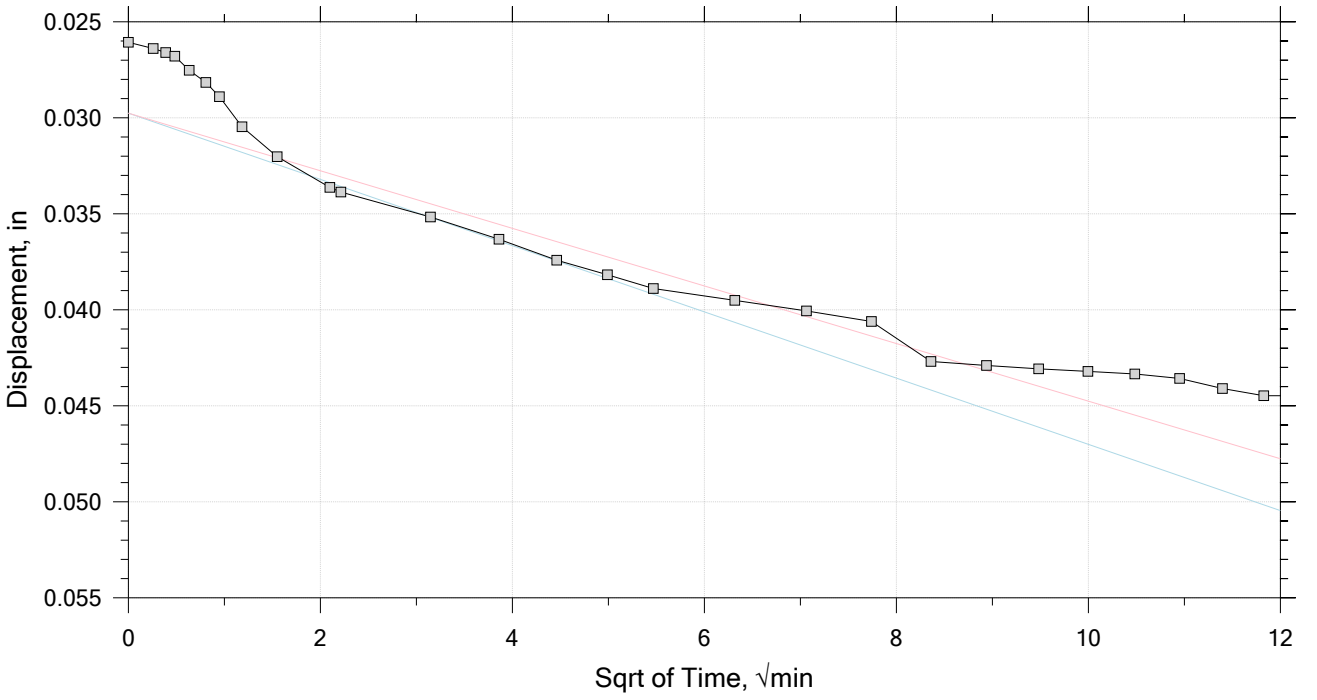


Soil Metrics LLC	Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
	Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
	Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
	Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
	Description: Gray Silty clay with thin sand layers		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 10 of 26
Constant Load Step
Stress: 7.96e+03 psf

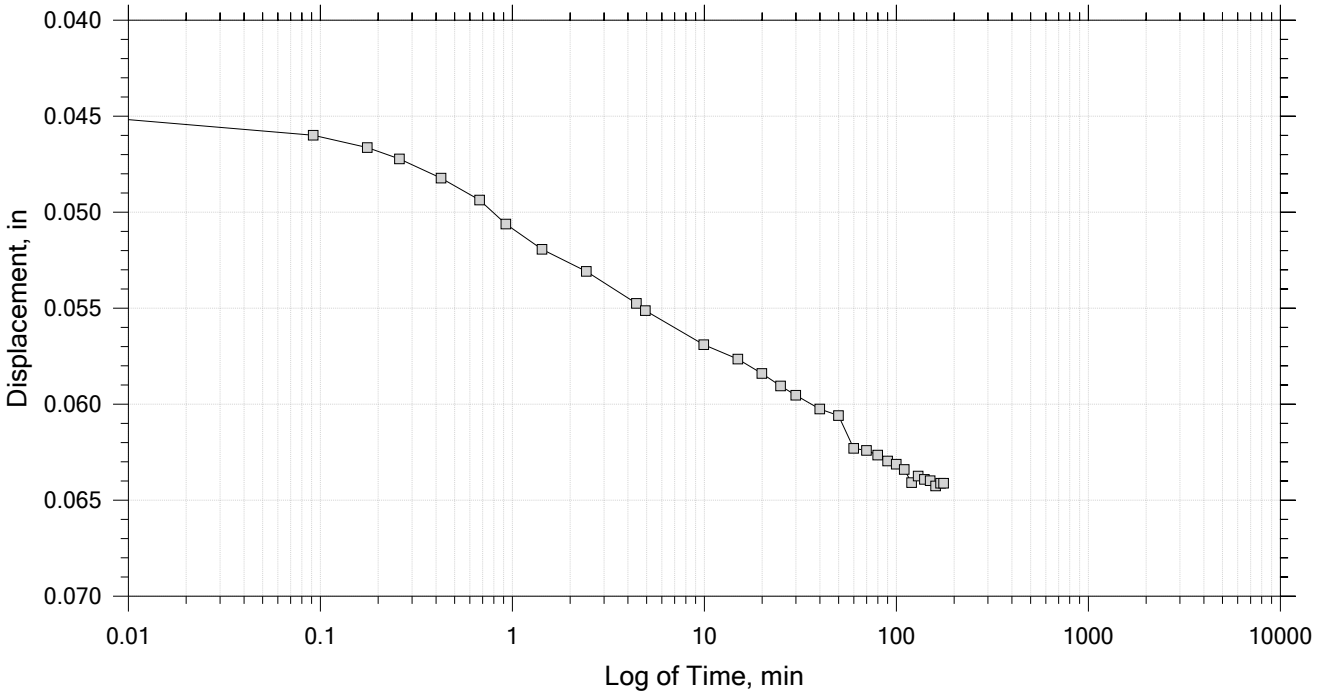


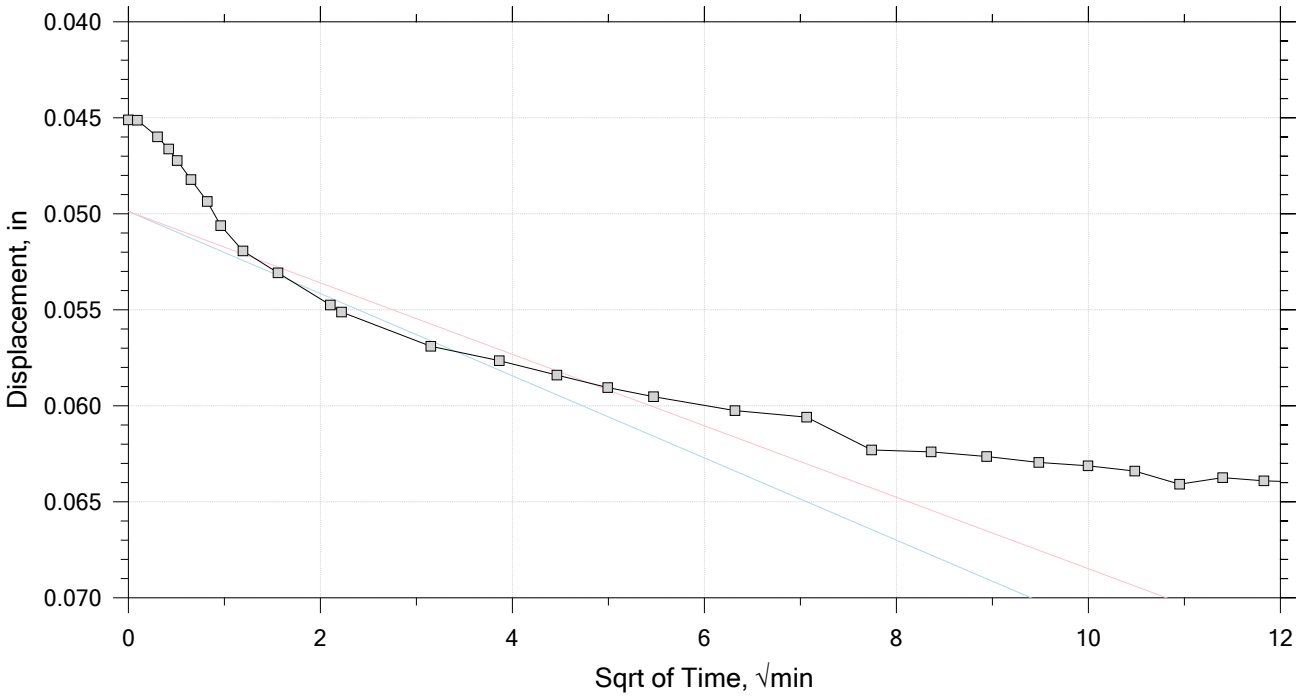


Soil Metrics LLC	Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
	Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
	Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
	Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
	Description: Gray Silty clay with thin sand layers		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 11 of 26
Constant Load Step
Stress: 1.19e+04 psf

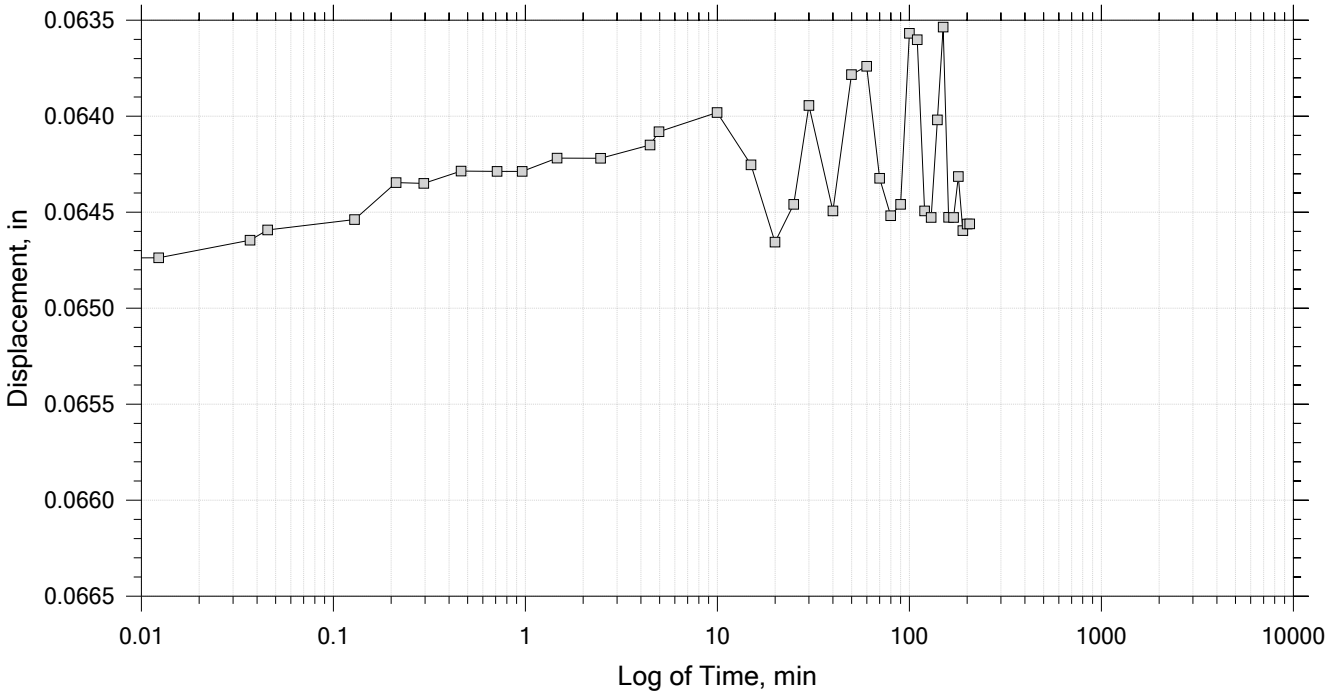


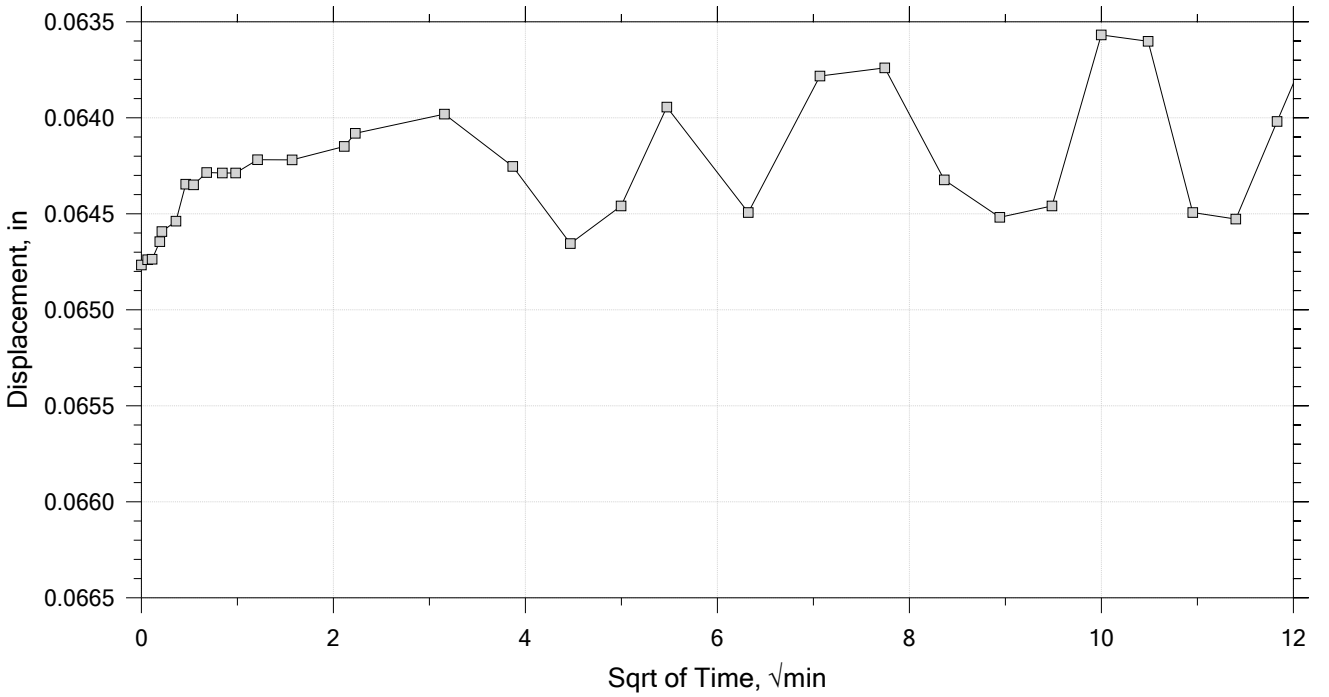


Soil Metrics LLC	Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
	Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
	Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
	Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
	Description: Gray Silty clay with thin sand layers		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 12 of 26
Constant Load Step
Stress: 5.97e+03 psf

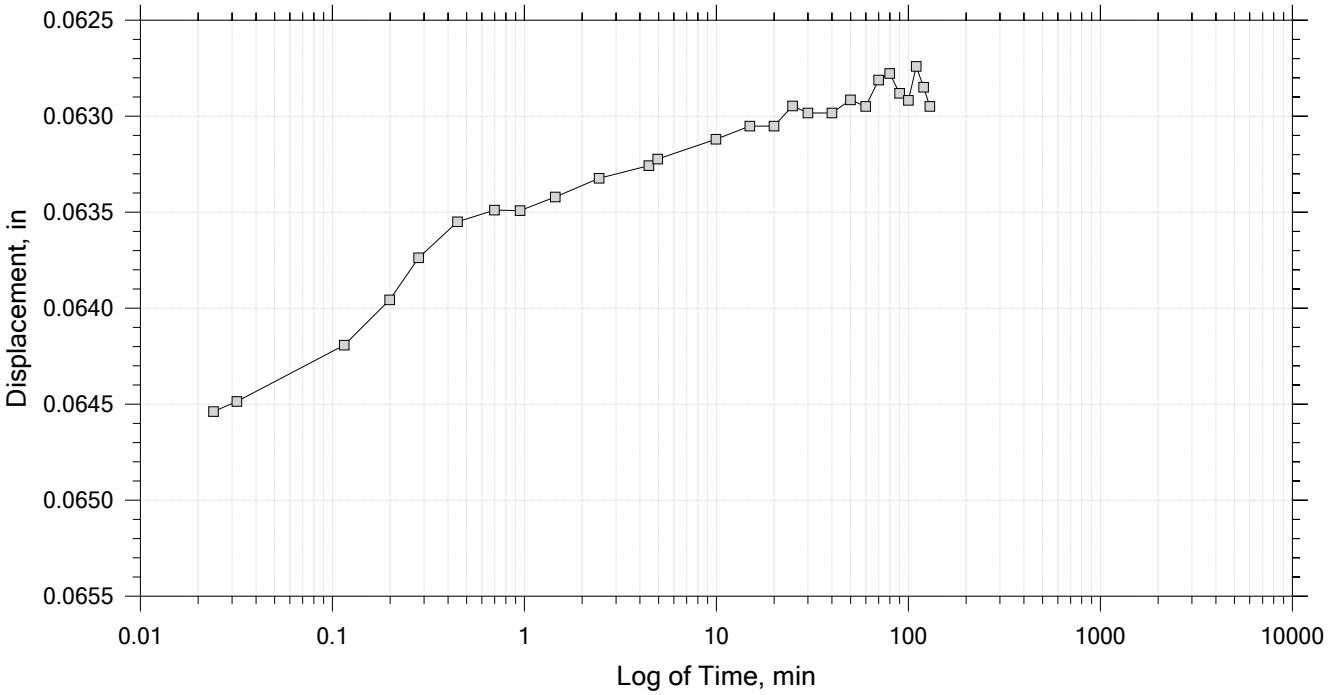


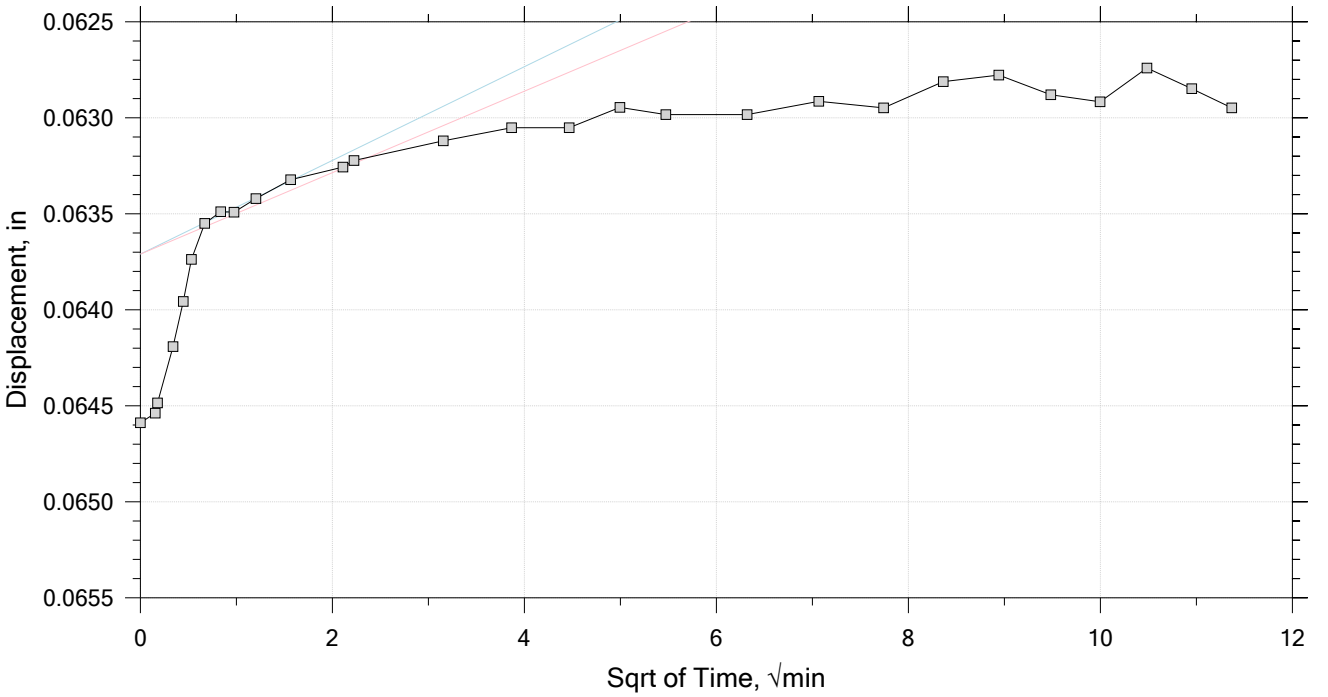


Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
Description: Gray Silty clay with thin sand layers		
Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 13 of 26
Constant Load Step
Stress: 2.98e+03 psf

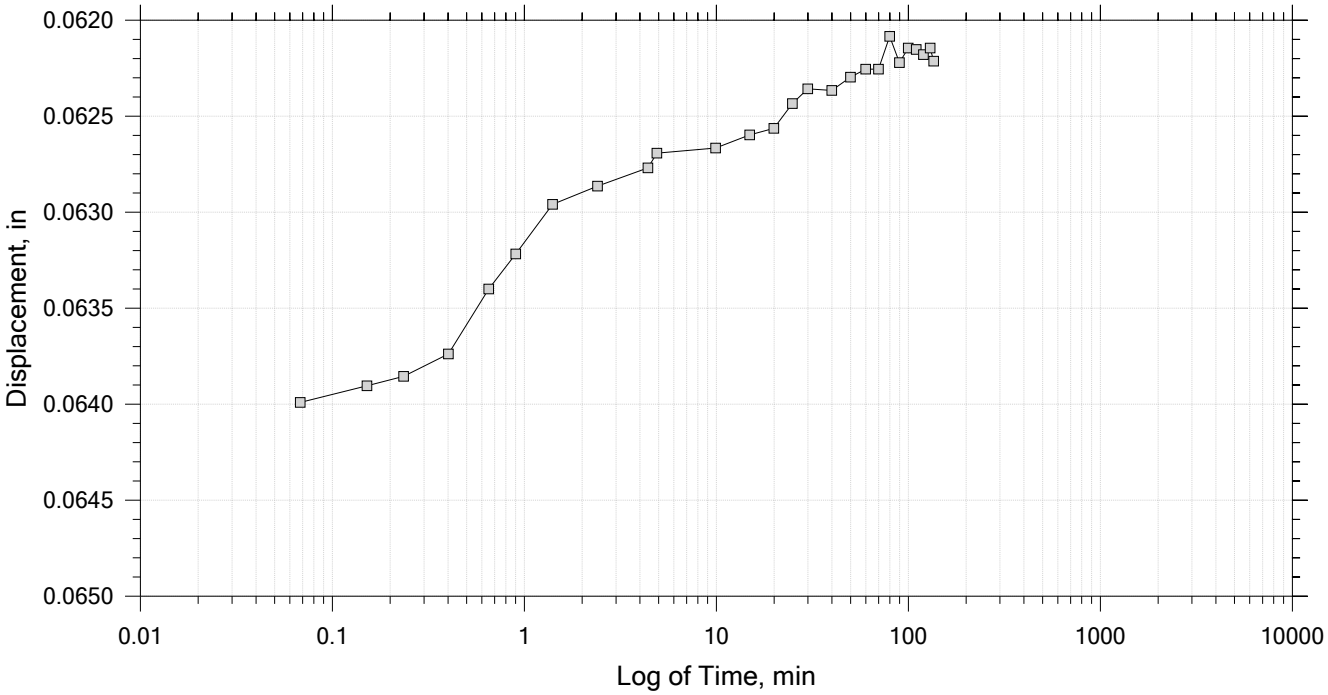


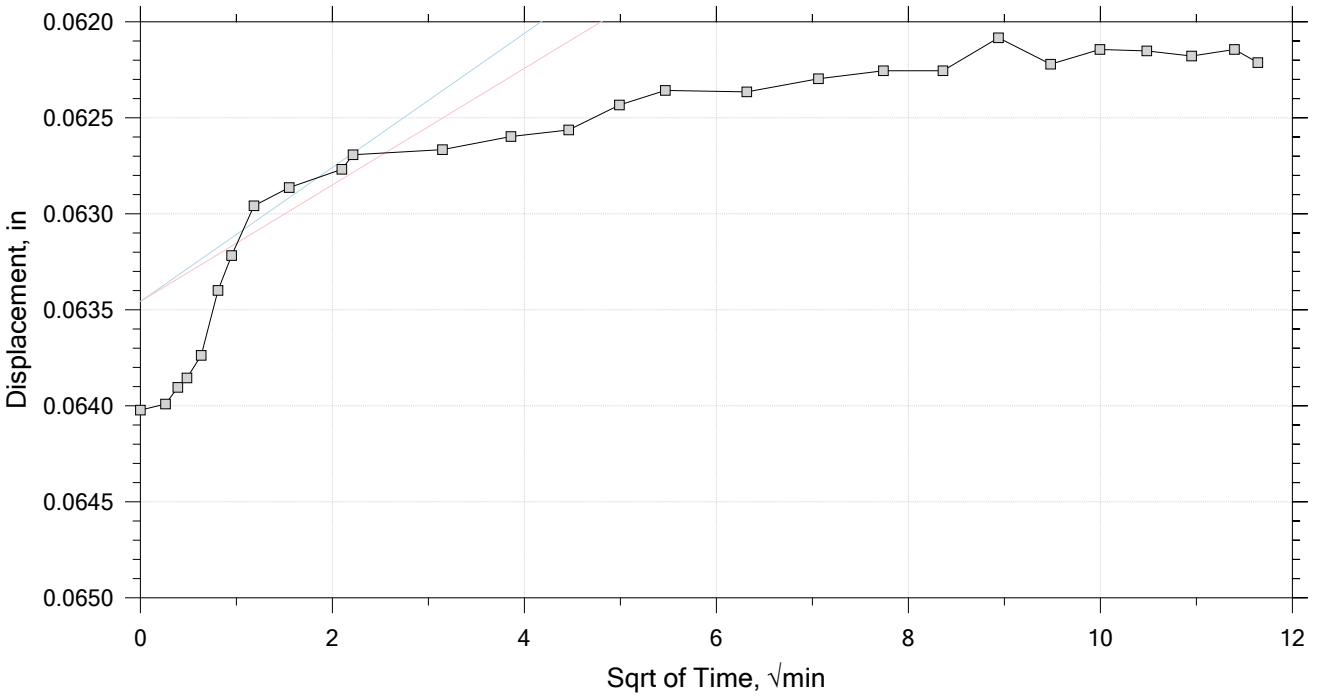


Soil Metrics LLC	Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
	Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
	Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
	Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
	Description: Gray Silty clay with thin sand layers		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 14 of 26
Constant Load Step
Stress: 1.49e+03 psf

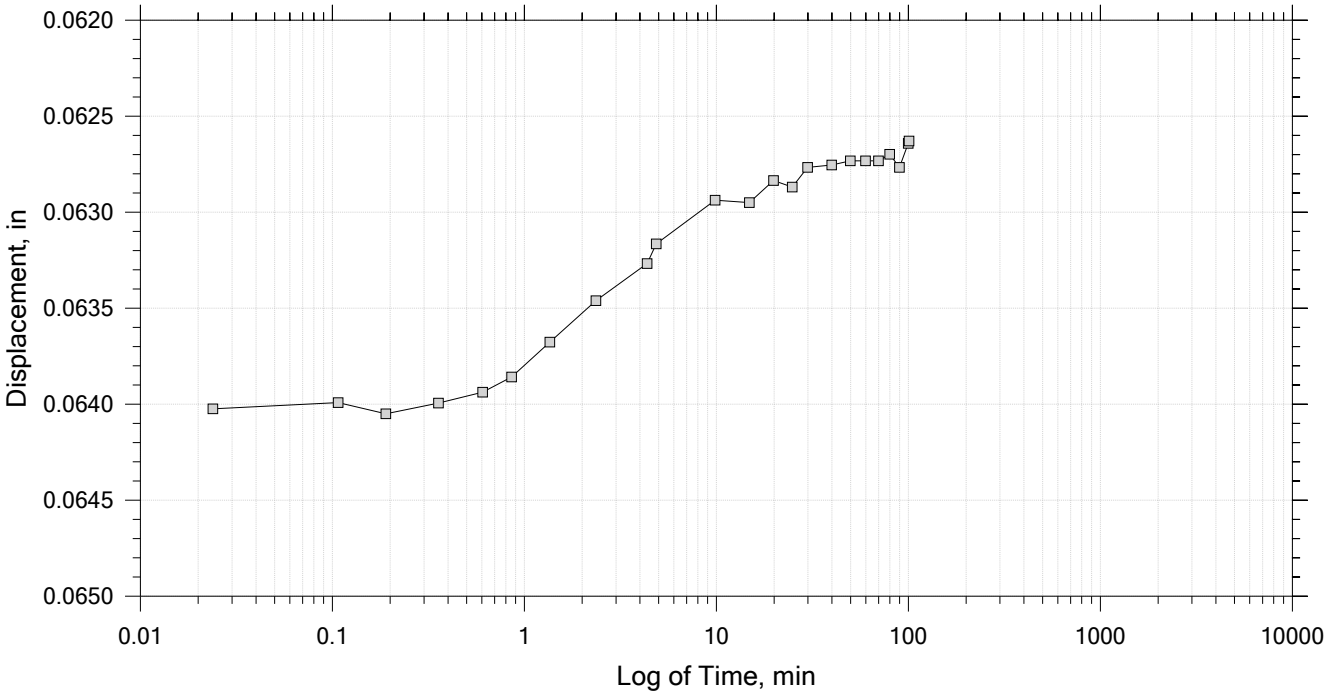


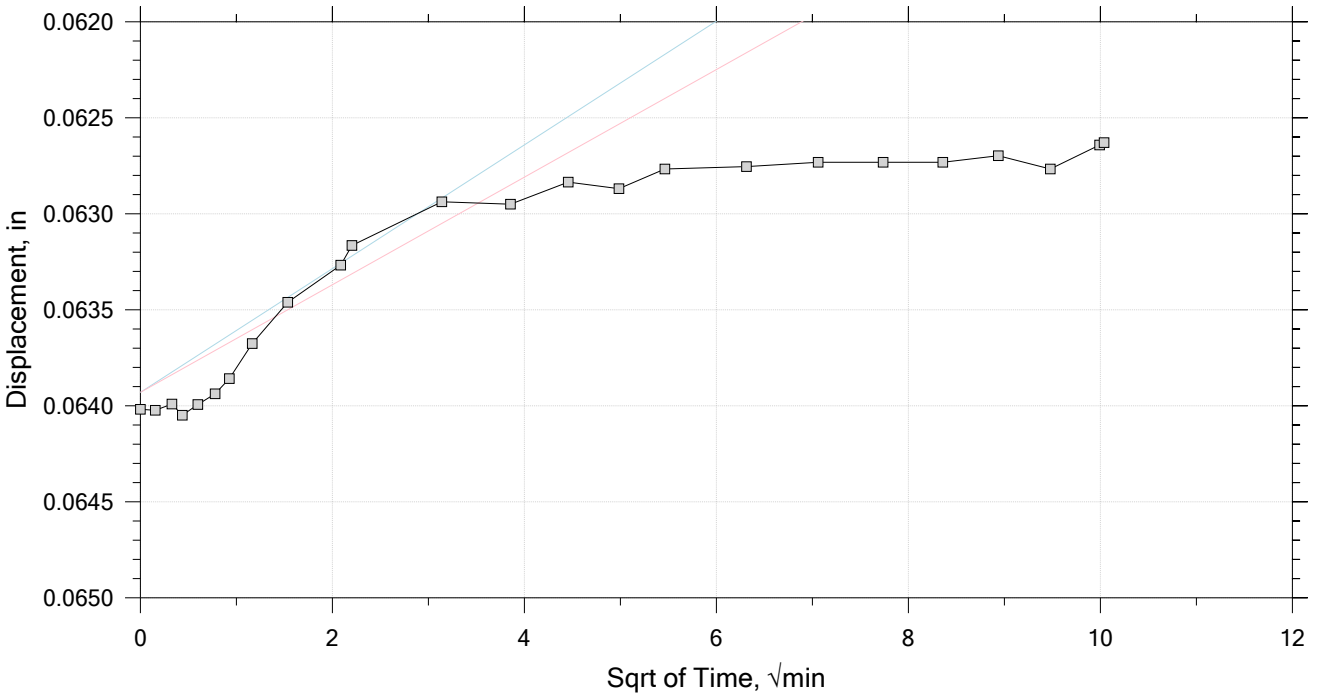


Soil Metrics LLC	Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
	Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
	Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
	Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
	Description: Gray Silty clay with thin sand layers		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 15 of 26
Constant Load Step
Stress: 746 psf

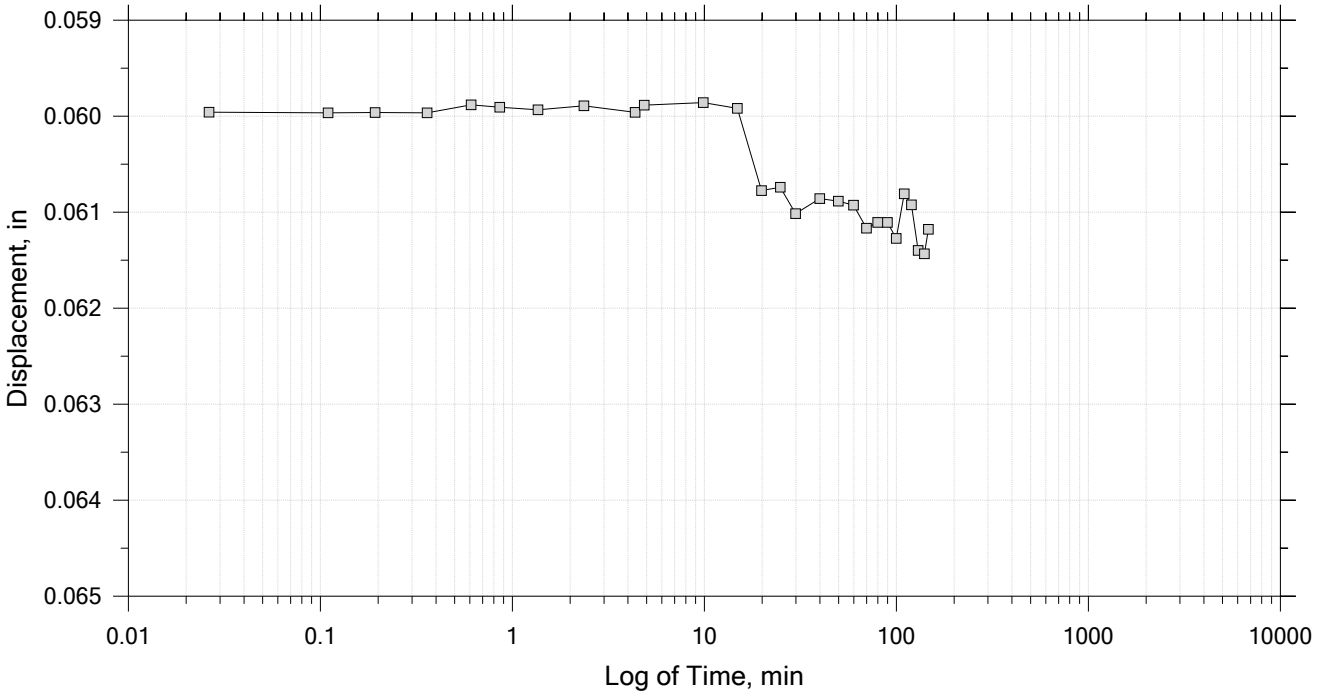


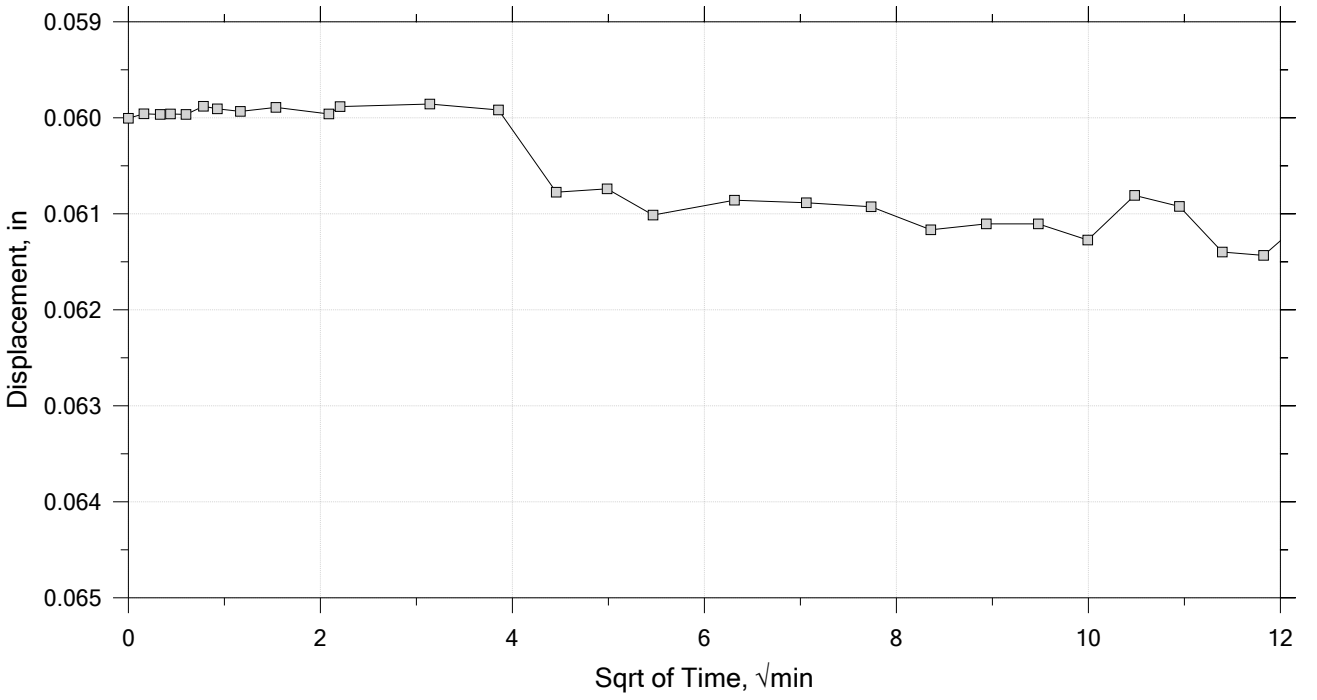


Soil Metrics LLC	Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
	Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
	Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
	Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
	Description: Gray Silty clay with thin sand layers		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 16 of 26
Constant Load Step
Stress: 1.49e+03 psf

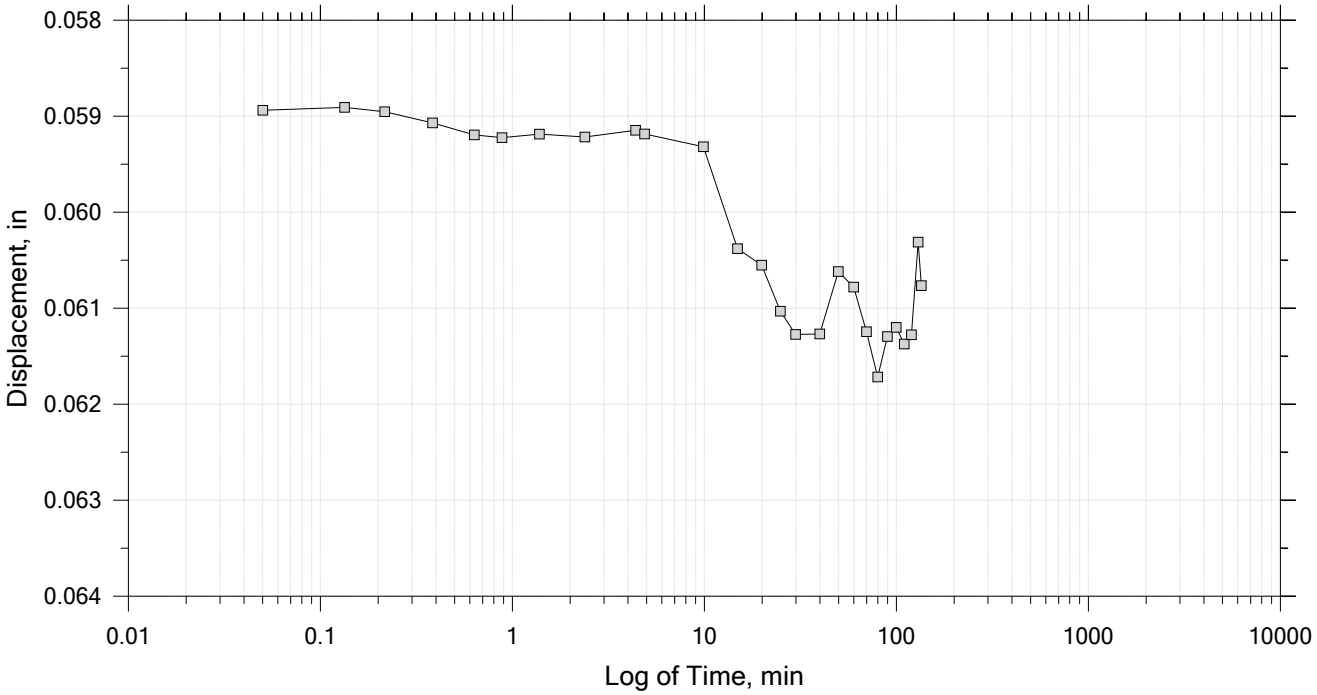


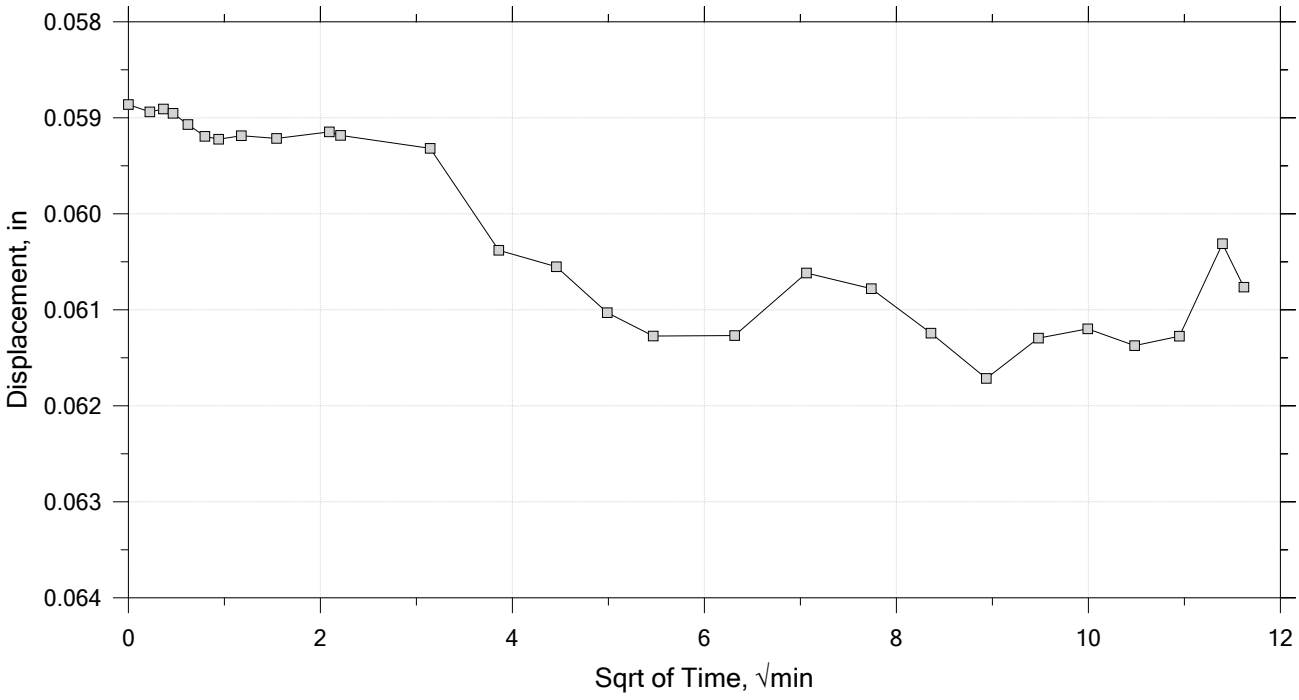


Soil Metrics LLC	Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
	Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
	Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
	Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
	Description: Gray Silty clay with thin sand layers		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 17 of 26
Constant Load Step
Stress: 2.98e+03 psf

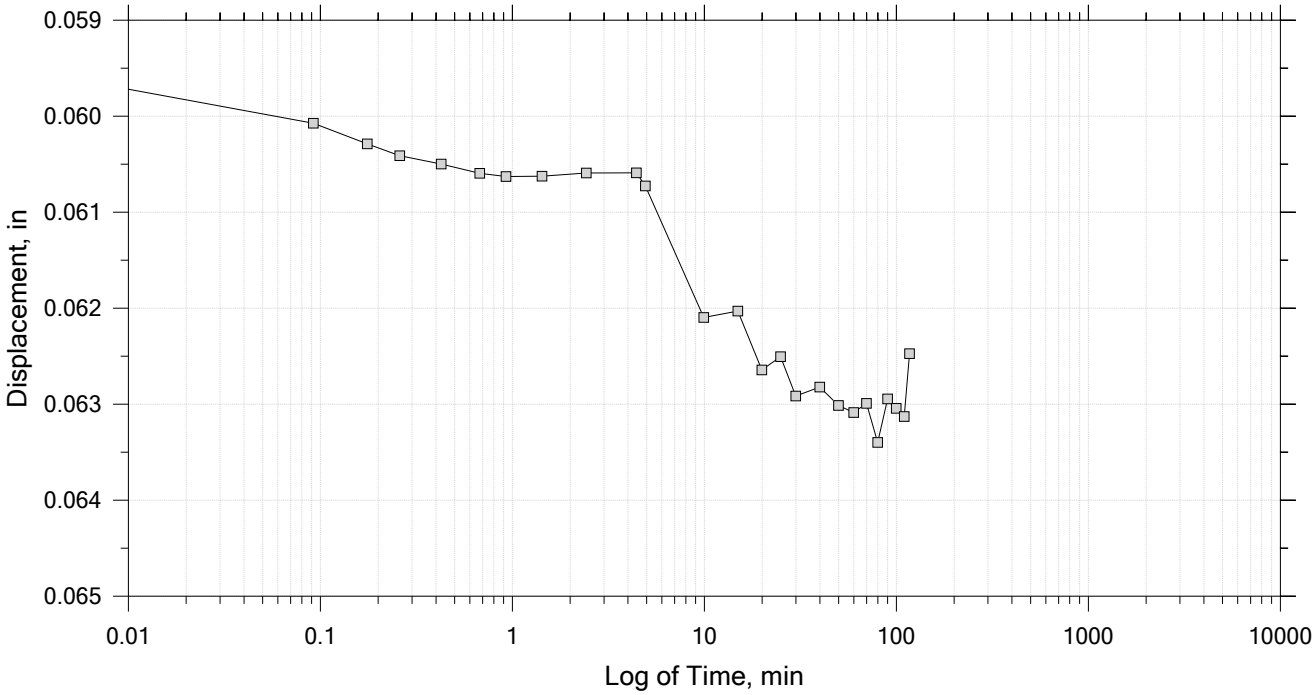


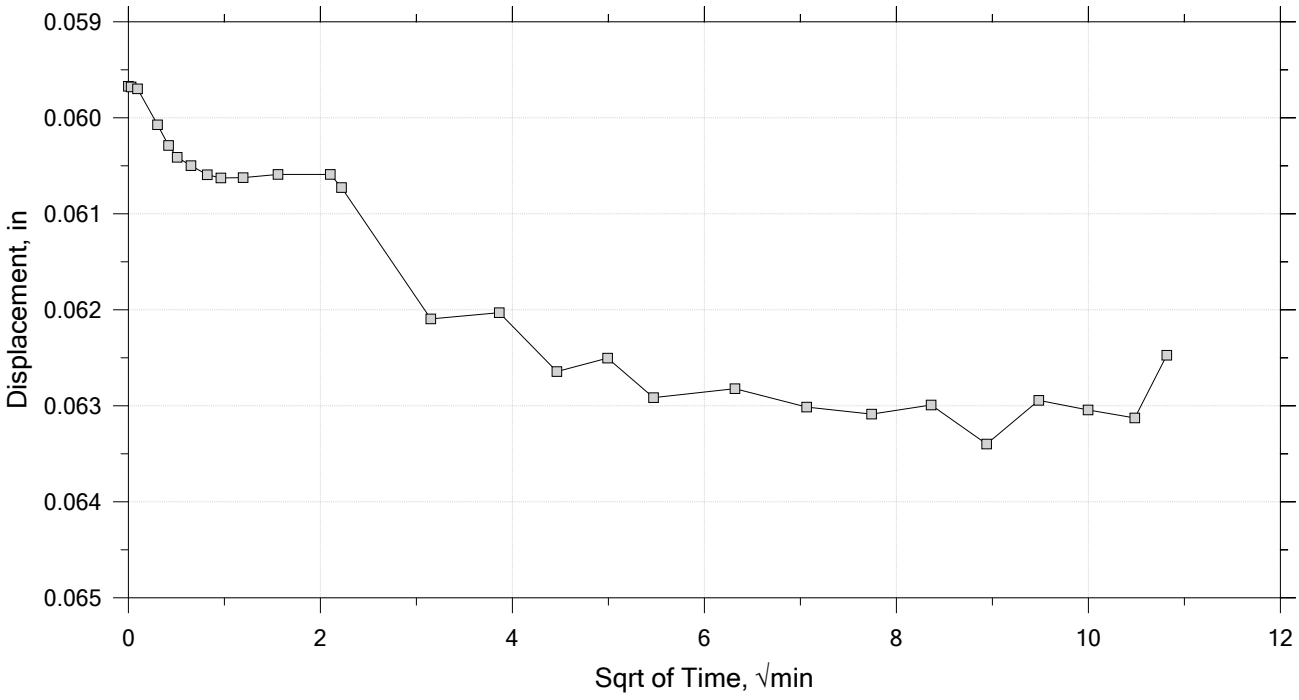


Soil Metrics LLC	Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
	Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
	Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
	Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
	Description: Gray Silty clay with thin sand layers		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 18 of 26
Constant Load Step
Stress: 5.97e+03 psf

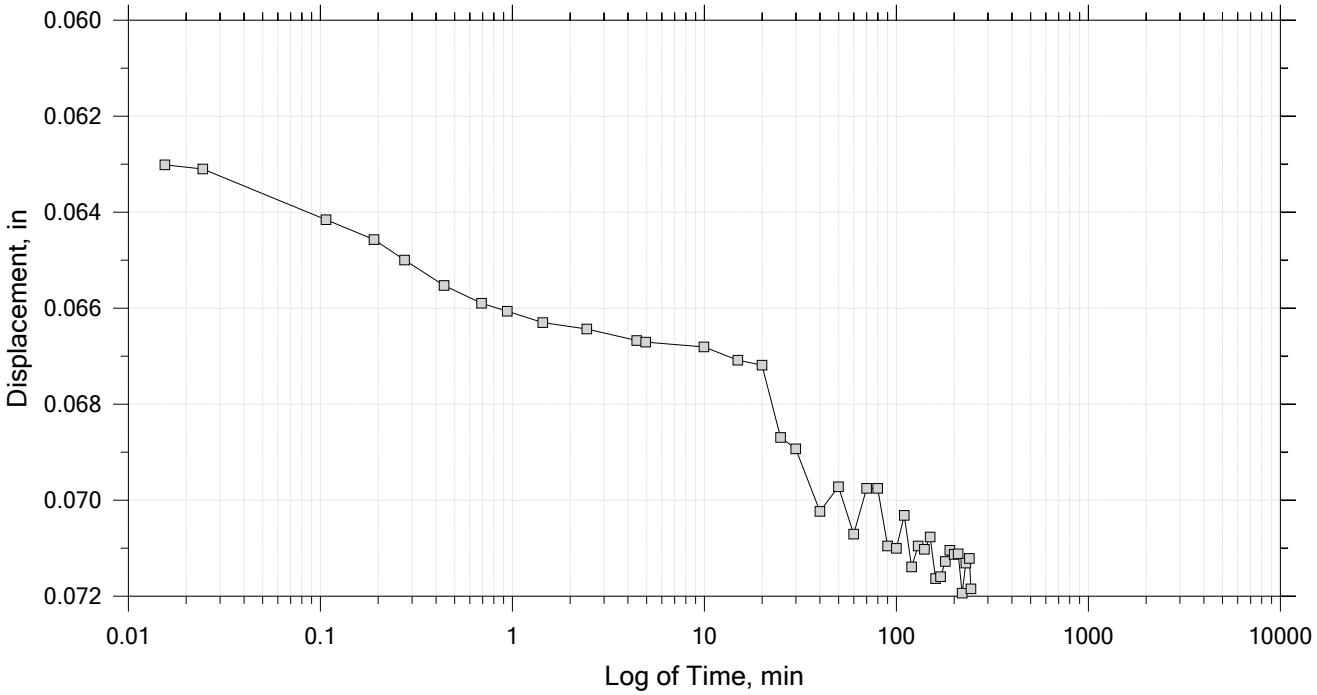


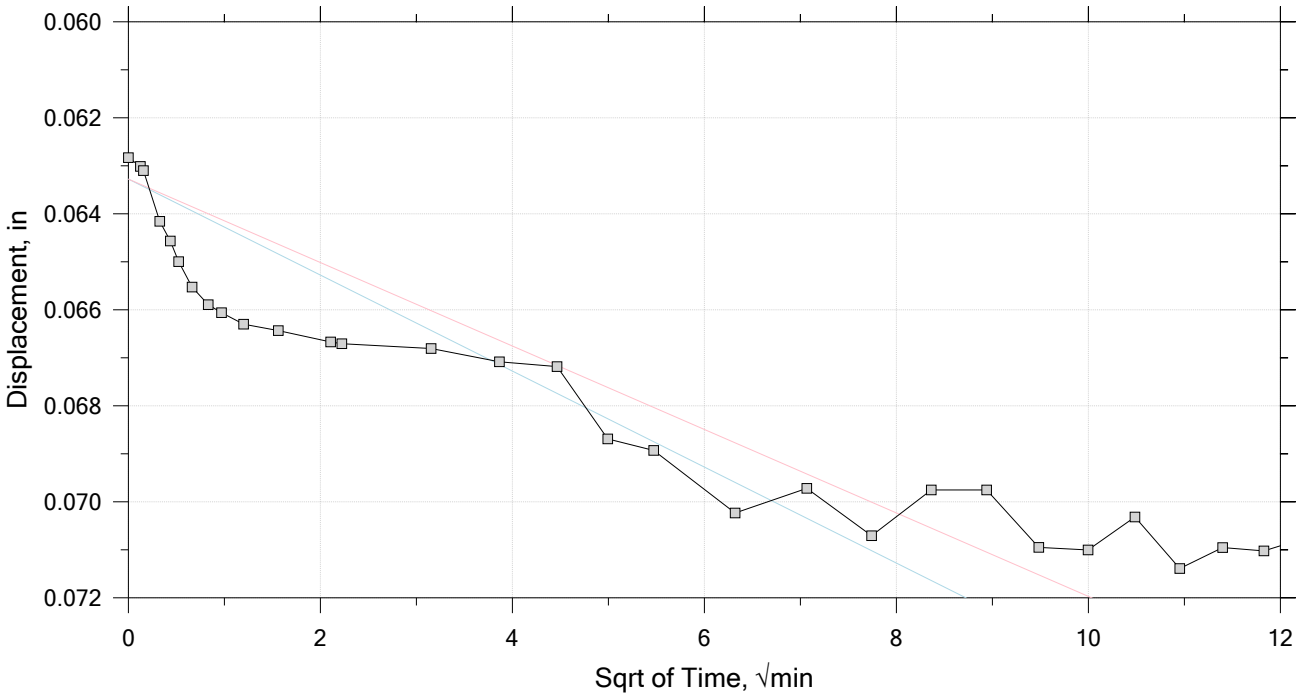


Soil Metrics LLC	Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
	Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
	Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
	Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
	Description: Gray Silty clay with thin sand layers		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 19 of 26
Constant Load Step
Stress: 1.19e+04 psf

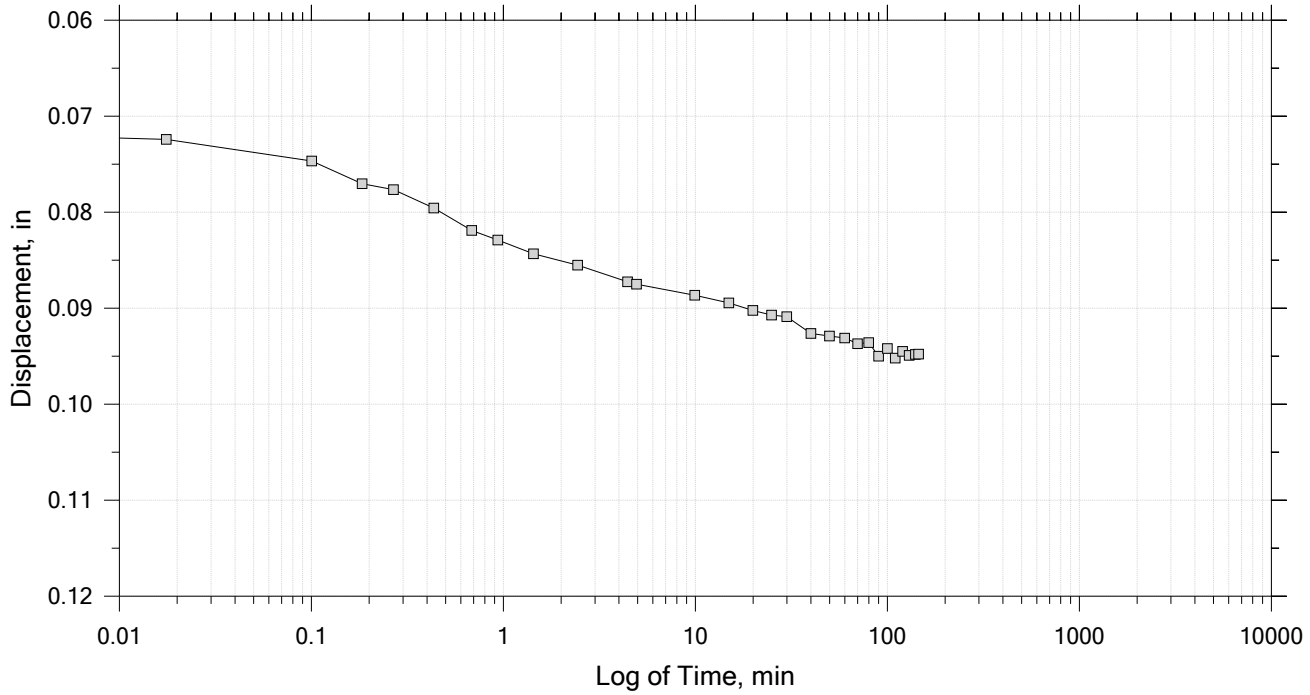


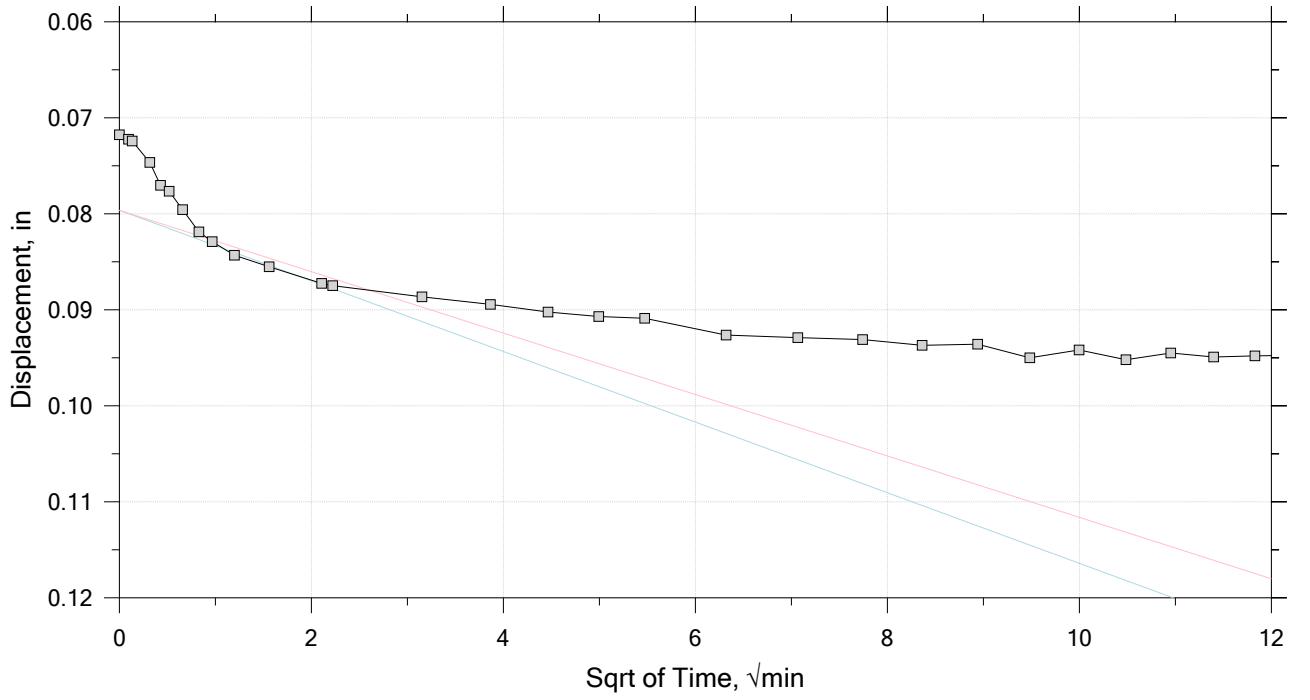


Soil Metrics LLC	Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
	Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
	Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
	Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
	Description: Gray Silty clay with thin sand layers		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 20 of 26
Constant Load Step
Stress: 2.39e+04 psf

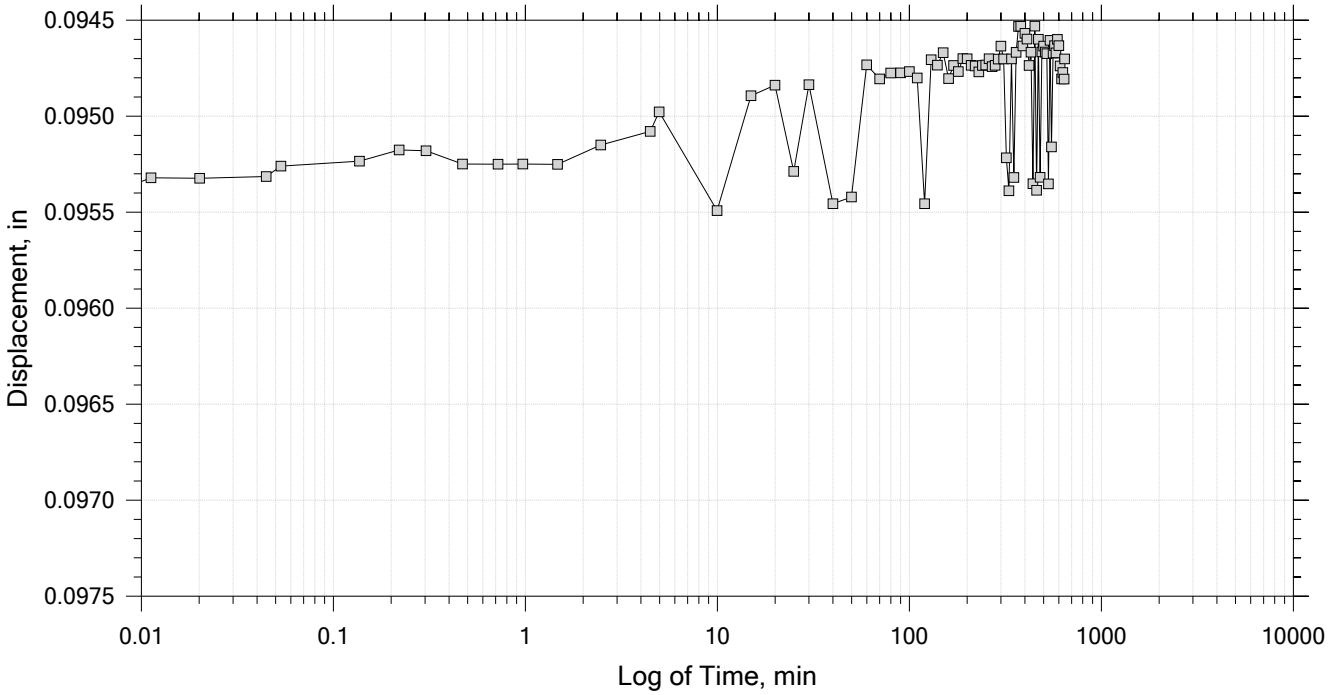


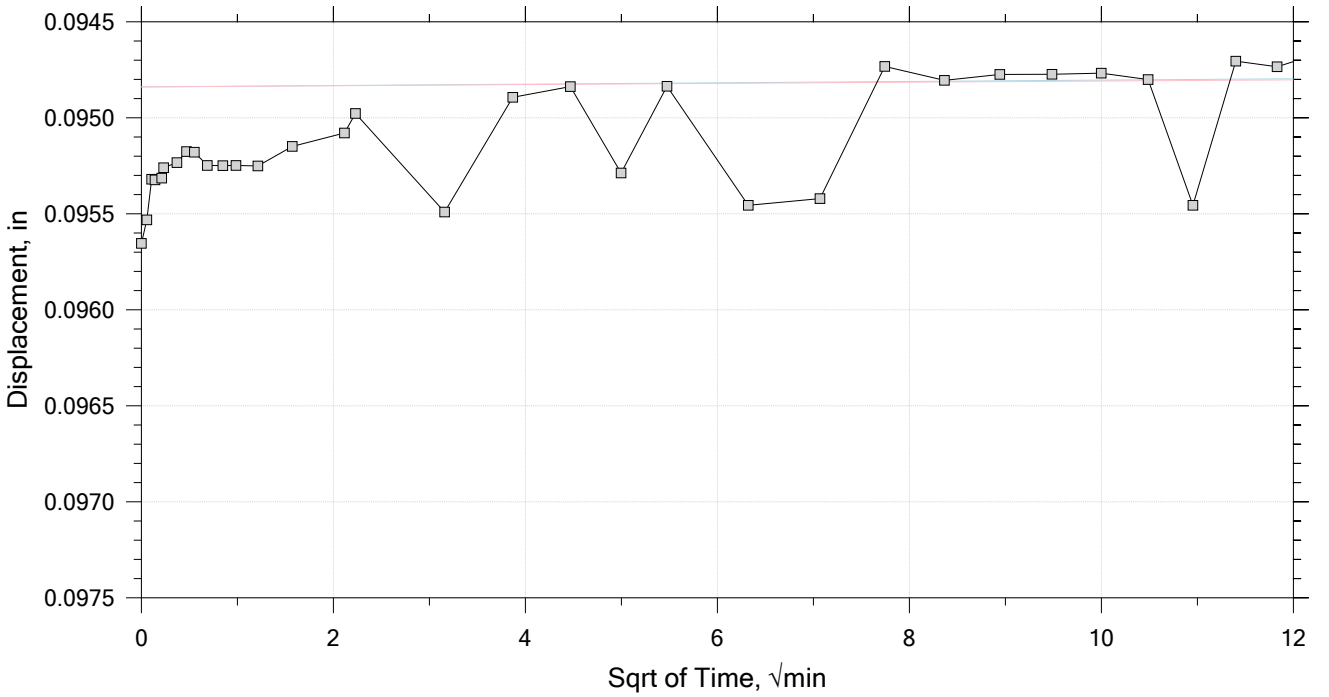


Soil Metrics LLC	Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
	Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
	Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
	Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
	Description: Gray Silty clay with thin sand layers		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 21 of 26
Constant Load Step
Stress: 1.19e+04 psf

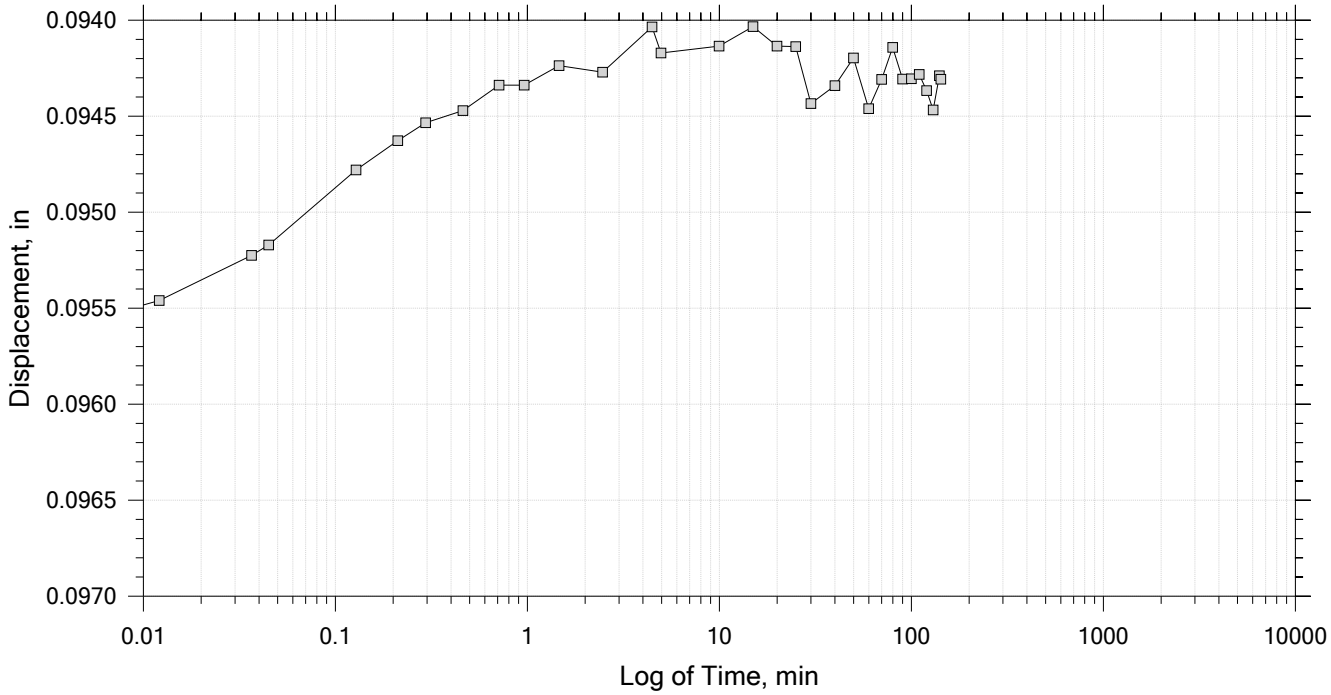


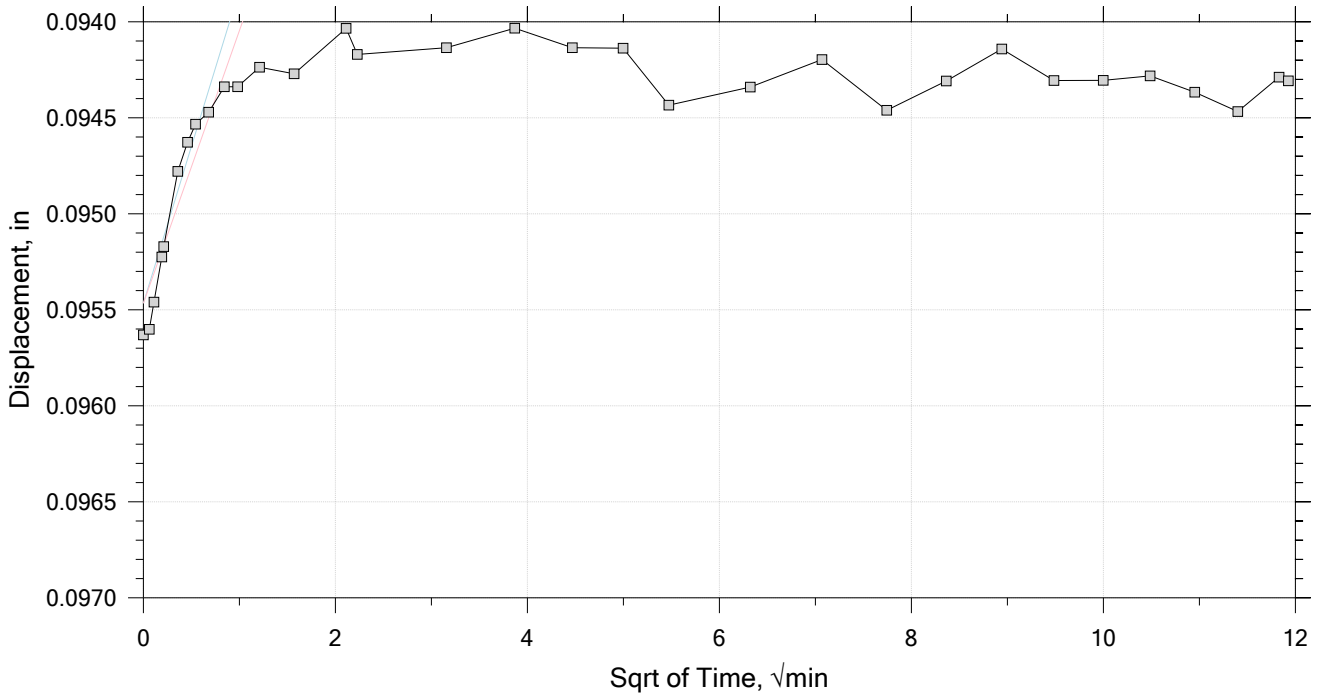


Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
Description: Gray Silty clay with thin sand layers		
Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 22 of 26
Constant Load Step
Stress: 5.97e+03 psf

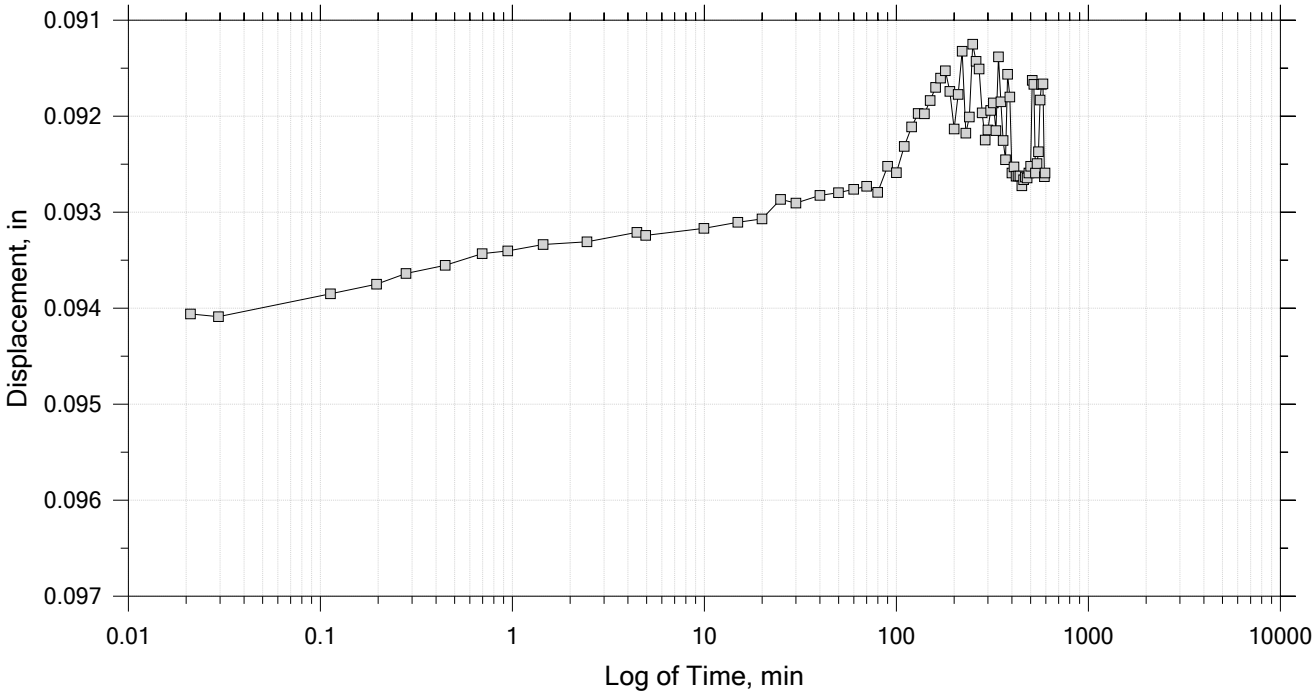


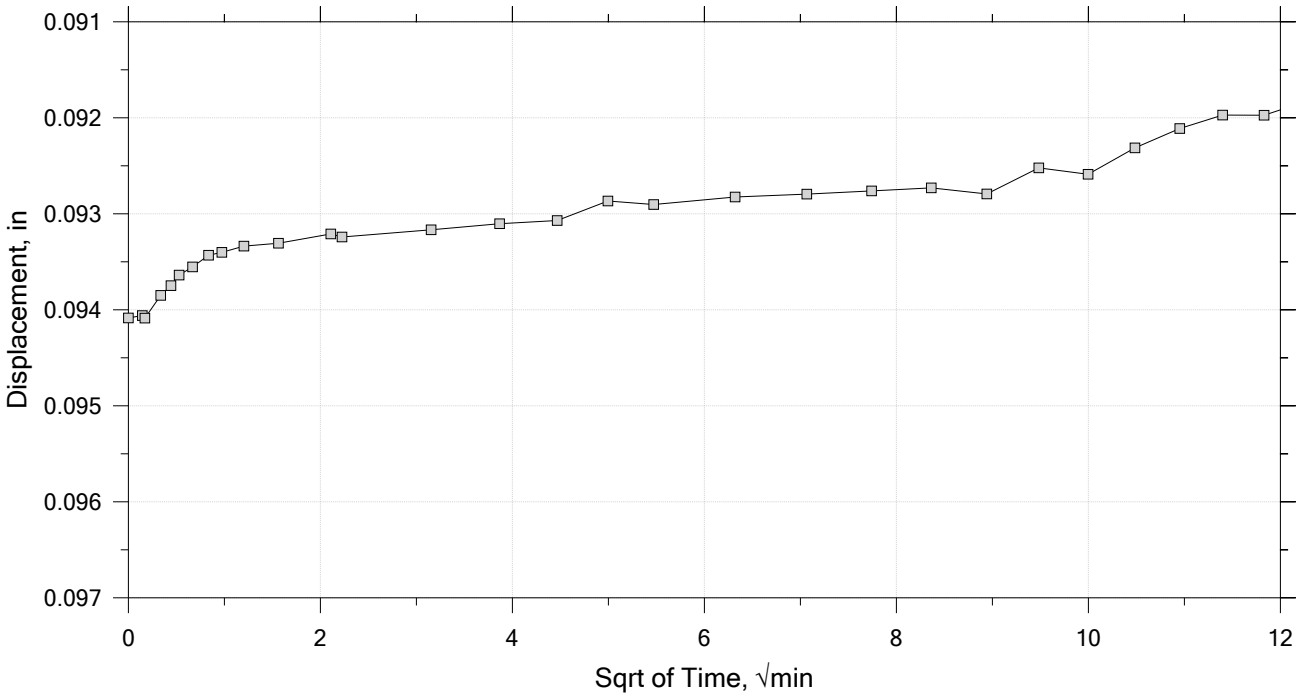


Soil Metrics LLC	Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
	Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
	Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
	Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
	Description: Gray Silty clay with thin sand layers		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 23 of 26
Constant Load Step
Stress: 2.98e+03 psf

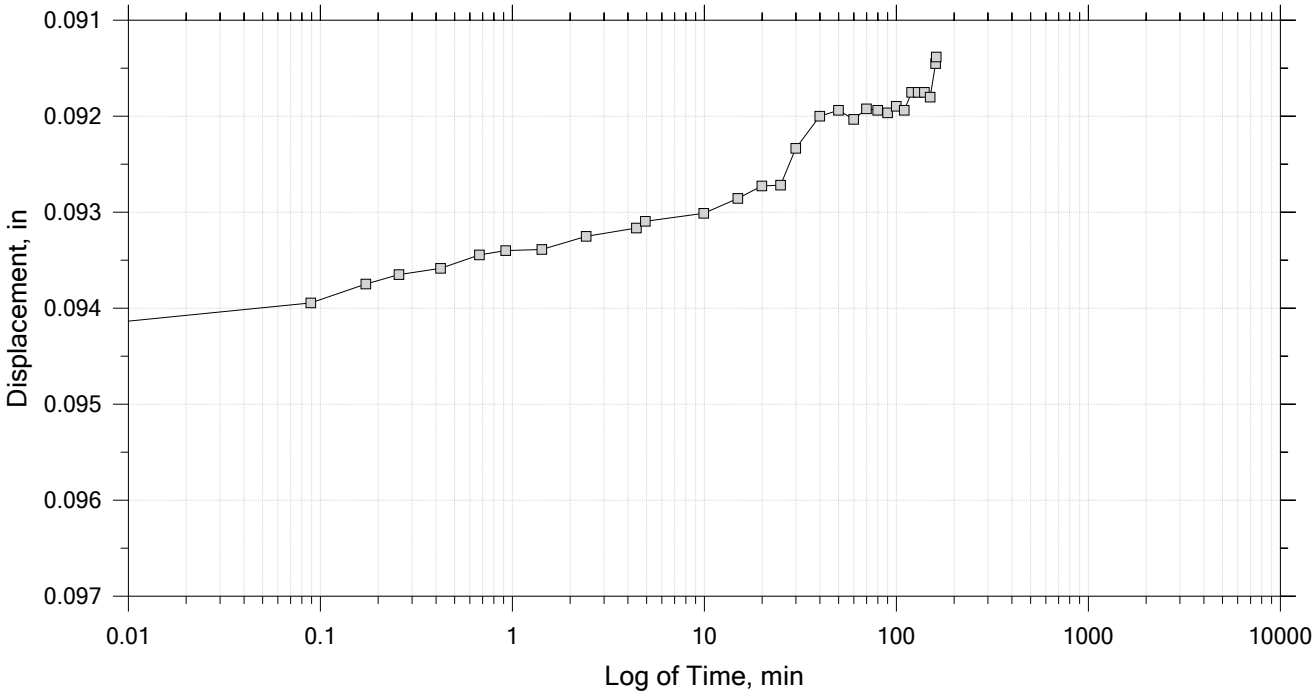


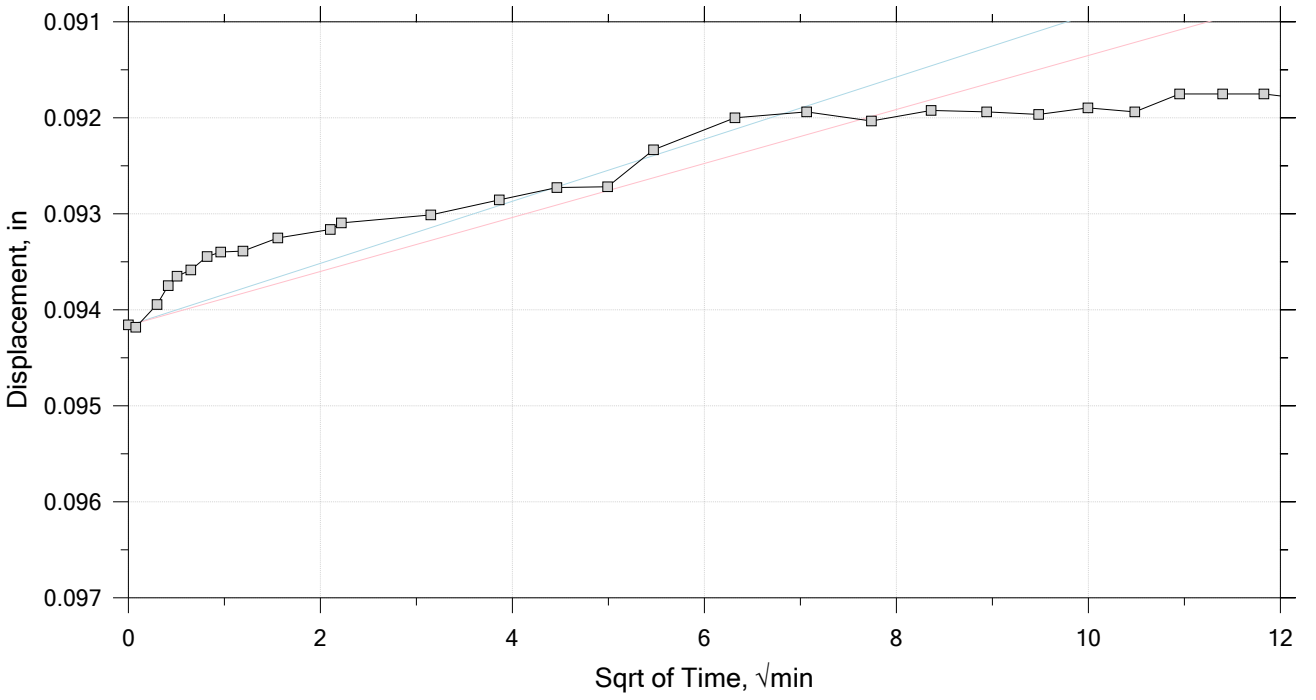


Soil Metrics LLC	Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
	Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
	Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
	Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
	Description: Gray Silty clay with thin sand layers		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 24 of 26
Constant Load Step
Stress: 1.49e+03 psf

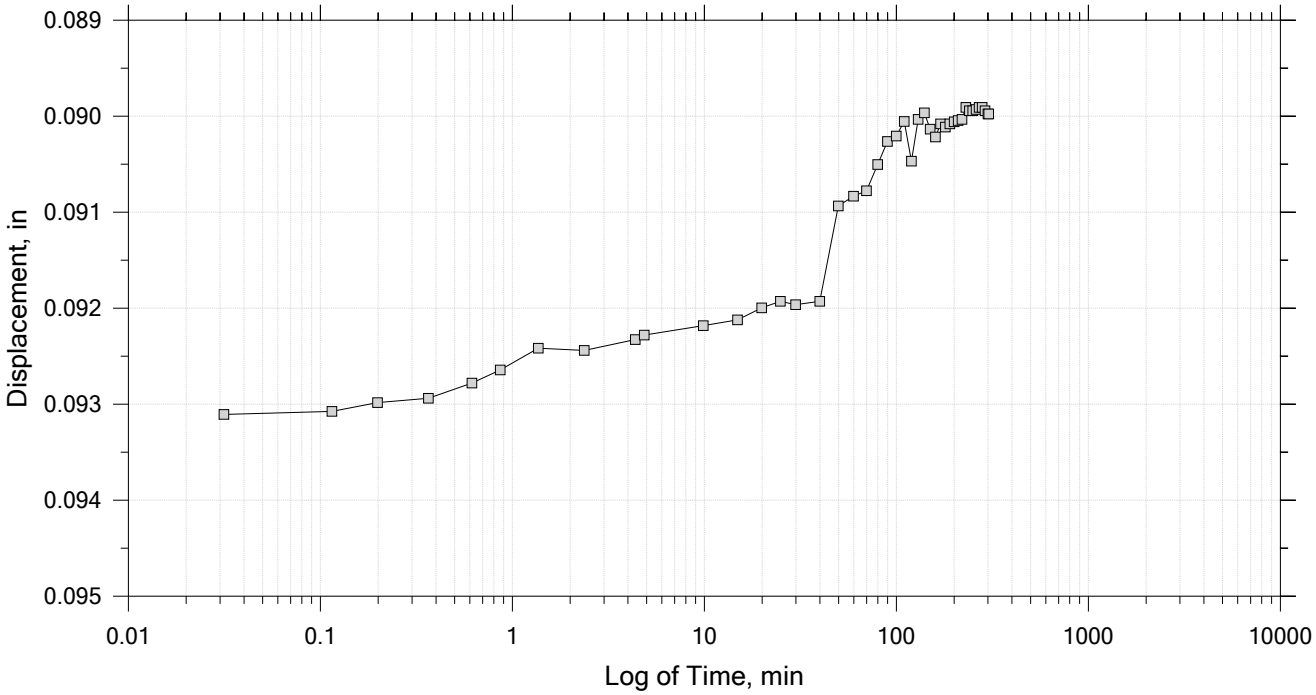


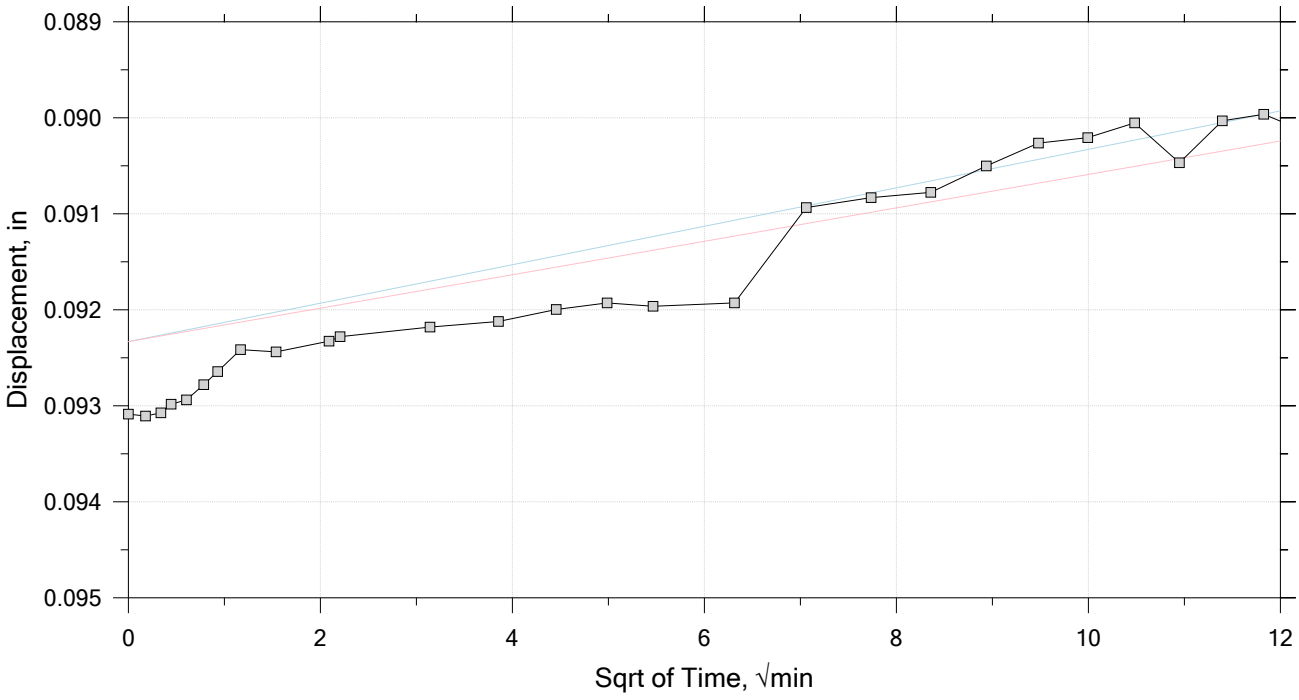


Soil Metrics LLC	Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
	Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
	Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
	Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
	Description: Gray Silty clay with thin sand layers		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 25 of 26
Constant Load Step
Stress: 746 psf

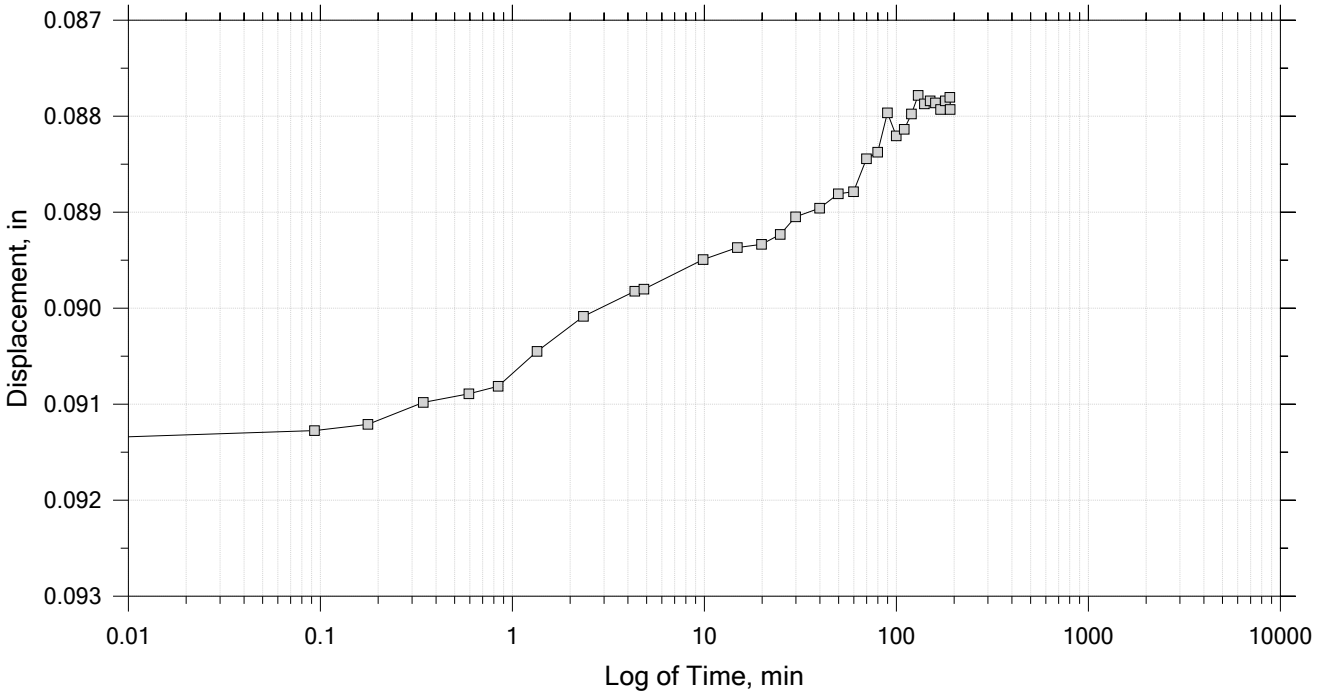


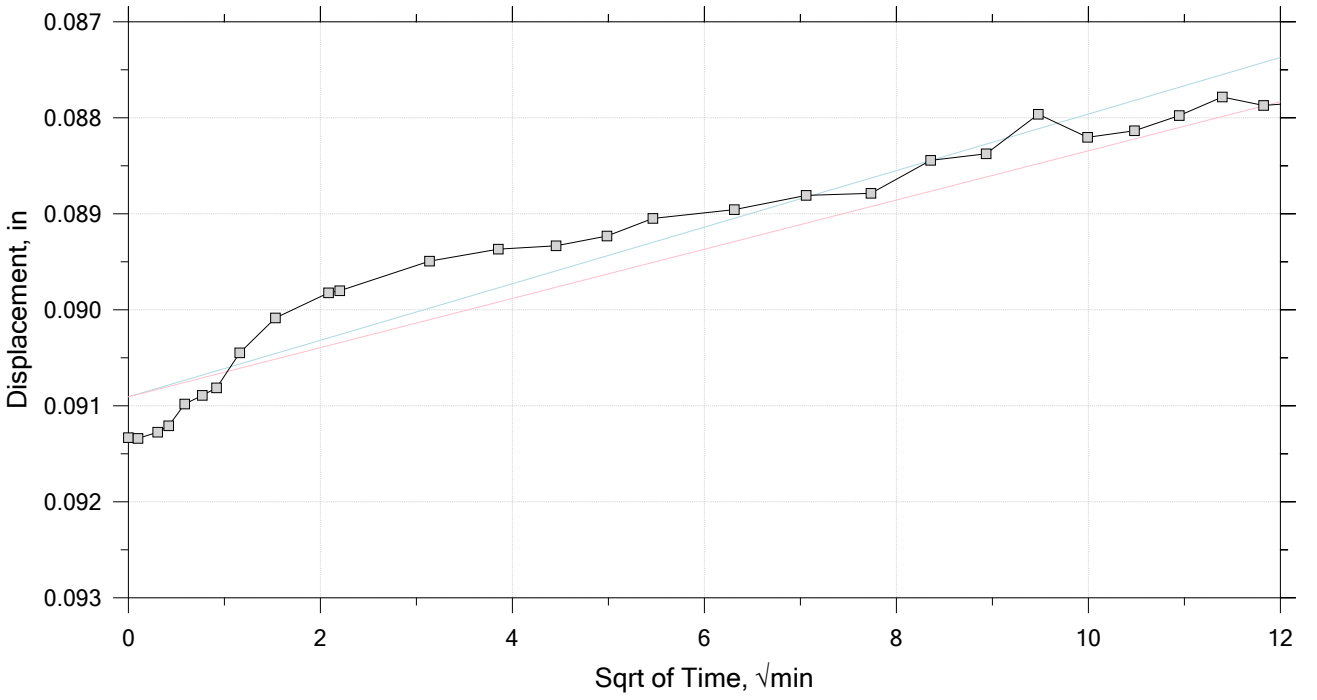


Soil Metrics LLC	Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
	Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
	Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
	Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
	Description: Gray Silty clay with thin sand layers		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 26 of 26
Constant Load Step
Stress: 373 psf





Soil Metrics LLC	Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
	Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
	Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
	Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
	Description: Gray Silty clay with thin sand layers		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Specimen Diameter, in: 2.50	Specific Gravity: 2.77 (Implied)	Liquid Limit: 25
Specimen Height, in: 1.00	Initial Void Ratio: 0.81	Plastic Limit: 17
Final Height, in: 0.91	Final Void Ratio: 0.651	Plasticity Index: 8

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	220	---	"ring"	301
Mass Container, gm	36.72	110.26	110.26	60.57
Mass Container + Wet Soil, gm	174.74	269.02	262.3	212.29
Mass Container + Dry Soil, gm	146.42	233.34	233.34	183.39
Mass Dry Soil, gm	109.7	123.08	123.08	122.82
Water Content, %	25.82	28.99	23.53	23.53
Void Ratio	---	0.81	0.65	---
Degree of Saturation, %	---	99.02	100.00	---
Dry Unit Weight, pcf	---	95.424	104.61	---

Preconsolidation Stress, psf	---
Compression Ratio	0
Rebound Ratio	0
Compression Index	0
Rebound Index	0

Note: Specific Gravity and Void Ratios are calculated assuming the degree of saturation equals 100% at the end of the test. Therefore, values may not represent actual values for the specimen.

Soil Metrics LLC	Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
	Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
	Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
	Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
	Description: Gray Silty clay with thin sand layers		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Log of Time Coefficients

Step	Applied Stress psf	EOP Displacement in	Void Ratio	Strain at End %	Log T50 min	Cv ft²/day	Mv ft²/ton	k cm/s	Ca %
1	207.	0.001677	0.807	0.168	0.000	0.00e+00	1.62e+04	0.00e+00	0.00e+00
2	311.	0.002165	0.806	0.216	0.000	0.00e+00	9.38e+03	0.00e+00	0.00e+00
3	466.	0.003669	0.803	0.367	0.000	0.00e+00	1.94e+04	0.00e+00	0.00e+00
4	699.	0.004173	0.802	0.417	0.000	0.00e+00	4.32e+03	0.00e+00	0.00e+00
5	1.05e+03	0.007000	0.797	0.699	0.000	0.00e+00	1.62e+04	0.00e+00	0.00e+00
6	1.57e+03	0.009155	0.793	0.915	0.000	0.00e+00	8.22e+03	0.00e+00	0.00e+00
7	2.36e+03	0.01185	0.789	1.18	0.000	0.00e+00	6.84e+03	0.00e+00	0.00e+00
8	3.54e+03	0.01583	0.781	1.58	0.000	0.00e+00	6.74e+03	0.00e+00	0.00e+00
9	5.30e+03	0.02429	0.766	2.43	0.000	0.00e+00	9.56e+03	0.00e+00	0.00e+00
10	7.96e+03	0.04493	0.729	4.49	0.000	0.00e+00	1.55e+04	0.00e+00	0.00e+00
11	1.19e+04	0.06092	0.700	6.09	0.000	0.00e+00	8.03e+03	0.00e+00	0.00e+00
12	5.97e+03	0.06456	0.693	6.45	0.000	0.00e+00	-1.22e+03	-0.00e+00	0.00e+00
13	2.98e+03	0.06308	0.696	6.30	0.000	0.00e+00	9.90e+02	0.00e+00	0.00e+00
14	1.49e+03	0.06260	0.697	6.25	0.000	0.00e+00	6.44e+02	0.00e+00	0.00e+00
15	746.	0.06285	0.696	6.28	0.000	0.00e+00	-6.61e+02	-0.00e+00	0.00e+00
16	1.49e+03	0.06118	0.699	6.11	0.000	0.00e+00	-4.47e+03	-0.00e+00	0.00e+00
17	2.98e+03	0.06076	0.700	6.07	0.000	0.00e+00	-5.53e+02	-0.00e+00	0.00e+00
18	5.97e+03	0.06247	0.697	6.24	0.000	0.00e+00	1.14e+03	0.00e+00	0.00e+00
19	1.19e+04	0.07119	0.681	7.11	0.000	0.00e+00	2.92e+03	0.00e+00	0.00e+00
20	2.39e+04	0.08950	0.648	8.94	0.000	0.00e+00	3.06e+03	0.00e+00	0.00e+00
21	1.19e+04	0.09005	0.647	9.00	0.000	0.00e+00	-9.17e+01	-0.00e+00	0.00e+00
22	5.97e+03	0.09429	0.640	9.42	0.000	0.00e+00	-1.42e+03	-0.00e+00	0.00e+00
23	2.98e+03	0.09259	0.643	9.25	0.000	0.00e+00	1.14e+03	0.00e+00	0.00e+00
24	1.49e+03	0.09196	0.644	9.19	0.000	0.00e+00	8.43e+02	0.00e+00	0.00e+00
25	746.	0.08991	0.647	8.98	0.000	0.00e+00	5.50e+03	0.00e+00	0.00e+00
26	373.	0.08793	0.651	8.78	0.000	0.00e+00	1.06e+04	0.00e+00	0.00e+00

Soil Metrics LLC	Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
	Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
	Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
	Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
	Description: Gray Silty clay with thin sand layers		
	Remarks:		
	Displacement at End of Primary		

One-Dimensional Consolidation by ASTM D2435 - Method B

Sqrt of Time Coefficients

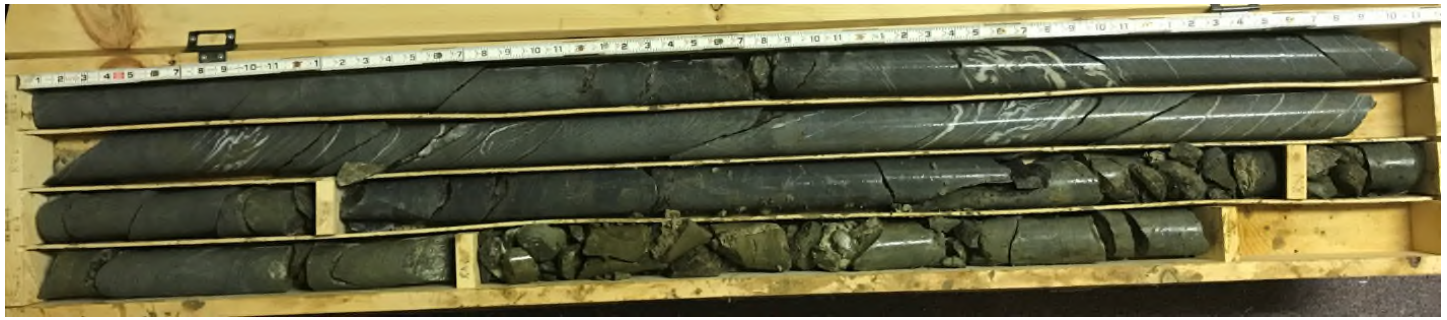
Step	Applied Stress psf	EOP Displacement in	Void Ratio	Strain at End %	Sq.Rt. T90 min	Cv ft²/day	Mv ft²/ton	k cm/s
1	207.	0.001677	0.807	0.168	0.000	0.00e+00	1.62e+04	0.00e+00
2	311.	0.002165	0.806	0.216	0.000	0.00e+00	9.38e+03	0.00e+00
3	466.	0.003669	0.803	0.367	0.000	0.00e+00	1.94e+04	0.00e+00
4	699.	0.004173	0.802	0.417	14.669	1.44e-01	4.32e+03	6.84e-09
5	1.05e+03	0.007000	0.797	0.699	267.710	7.85e-03	1.62e+04	1.40e-09
6	1.57e+03	0.009155	0.793	0.915	0.000	0.00e+00	8.22e+03	0.00e+00
7	2.36e+03	0.01185	0.789	1.18	168.655	1.23e-02	6.84e+03	9.29e-10
8	3.54e+03	0.01583	0.781	1.58	31.115	6.64e-02	6.74e+03	4.93e-09
9	5.30e+03	0.02429	0.766	2.43	28.772	7.09e-02	9.56e+03	7.47e-09
10	7.96e+03	0.04493	0.729	4.49	75.794	2.61e-02	1.55e+04	4.47e-09
11	1.19e+04	0.06092	0.700	6.09	23.053	8.27e-02	8.03e+03	7.31e-09
12	5.97e+03	0.06456	0.693	6.45	0.000	0.00e+00	-1.22e+03	-0.00e+00
13	2.98e+03	0.06308	0.696	6.30	5.652	3.29e-01	9.90e+02	3.59e-09
14	1.49e+03	0.06260	0.697	6.25	6.497	2.87e-01	6.44e+02	2.04e-09
15	746.	0.06285	0.696	6.28	9.687	1.93e-01	-6.61e+02	-1.40e-09
16	1.49e+03	0.06118	0.699	6.11	0.000	0.00e+00	-4.47e+03	-0.00e+00
17	2.98e+03	0.06076	0.700	6.07	0.000	0.00e+00	-5.53e+02	-0.00e+00
18	5.97e+03	0.06247	0.697	6.24	0.000	0.00e+00	1.14e+03	0.00e+00
19	1.19e+04	0.07119	0.681	7.11	55.310	3.34e-02	2.92e+03	1.08e-09
20	2.39e+04	0.08950	0.648	8.94	6.794	2.64e-01	3.06e+03	8.92e-09
21	1.19e+04	0.09005	0.647	9.00	144.927	1.21e-02	-9.17e+01	-1.23e-11
22	5.97e+03	0.09429	0.640	9.42	0.532	3.29e+00	-1.42e+03	-5.14e-08
23	2.98e+03	0.09259	0.643	9.25	0.000	0.00e+00	1.14e+03	0.00e+00
24	1.49e+03	0.09196	0.644	9.19	39.338	4.45e-02	8.43e+02	4.13e-10
25	746.	0.08991	0.647	8.98	102.225	1.72e-02	5.50e+03	1.04e-09
26	373.	0.08793	0.651	8.78	125.395	1.41e-02	1.06e+04	1.64e-09

Soil Metrics LLC	Project Name: I95 Bridge over Broadway	Location: Bangor, Maine	Project Number: 166.28
	Boring Number: BB-BI95-201	Tester: SJR	Checker: SJR
	Sample Number: U2	Test Date: 7/18/22	Depth: 19.35
	Test Number: ICON 65-406	Preparation: Shelby Tube	Elevation:
	Description: Gray Silty clay with thin sand layers		
	Remarks:		
	Displacement at End of Primary		

APPENDIX E – ROCK CORE PHOTOGRAPHS

Maine Department of Transportation – Broadway Bridge
Bridge #5789, Interstate 95 over Broadway
Bangor, ME
Rock Core Photographs

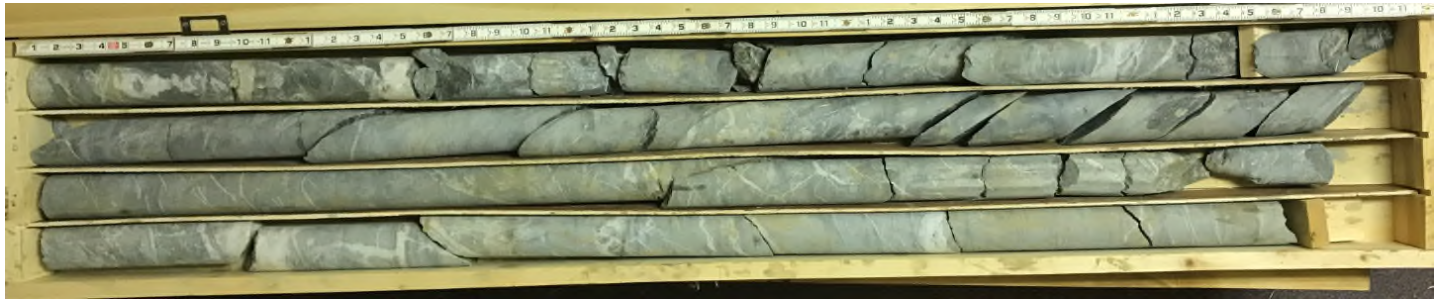
Boring No.	Run	Depth (ft)	Recovery (in)	Recovery (%)	RQD (in)	RQD (%)	Rock Type	Box Row
BB-BI95-101	R1	59.9 - 64.9	57	95%	53	88%	SLATE	1
BB-BI95-101	R2	64.9 - 69.9	58	97%	44	73%	SLATE	2
BB-BI95-103	R1	56.5 - 58.0	12	67%	0	0%	SLATE	3
BB-BI95-103	R2	58.0 - 61.1	37	100%	17	45%	SLATE	3
BB-BI95-103	R3	61.1 - 63.7	22	69%	7	22%	SLATE	3/4
BB-BI95-103	R4	63.7 - 66.5	30	91%	0	0%	SLATE	4

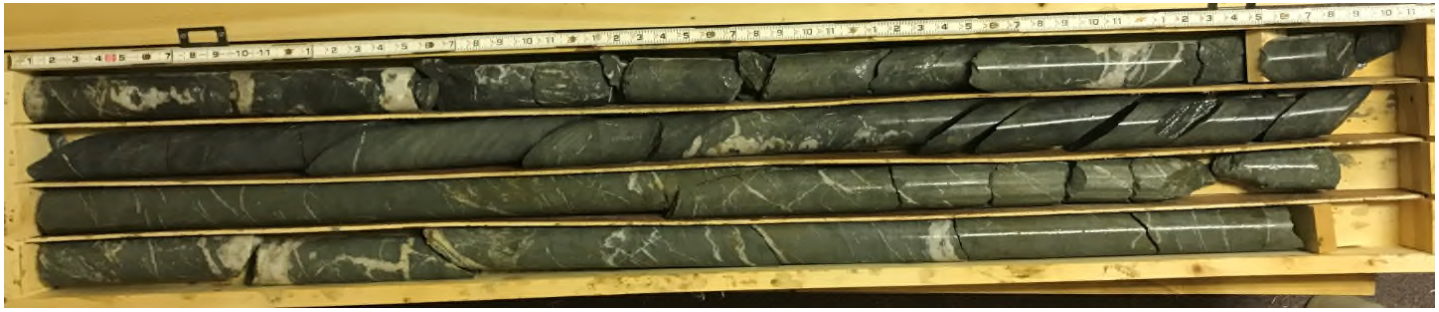


Notes:
1. Box row corresponds to the core box section in which the rock core sample is contained; Row 1=Top, Row 4=Bottom.
2. Top photo is dry, bottom photo is wet.
3. Transition between core runs within a row are marked by wood separators.

Maine Department of Transportation – Broadway Bridge
Bridge #5789, Interstate 95 over Broadway
Bangor, ME
Rock Core Photographs

Boring No.	Run	Depth (ft)	Recovery (in)	Recovery (%)	RQD (in)	RQD (%)	Rock Type	Box Row
BB-BI95-102	R1	97.5 - 102.5	54	90%	37	62%	SLATE	1
BB-BI95-102	R2	102.5 - 107.3	58	100%	50	86%	SLATE	2
BB-BI95-104	R1	54.0 - 59.0	52	87%	40	67%	SLATE	3
BB-BI95-104	R2	59.0 - 63.8	55	95%	55	100%	SLATE	4

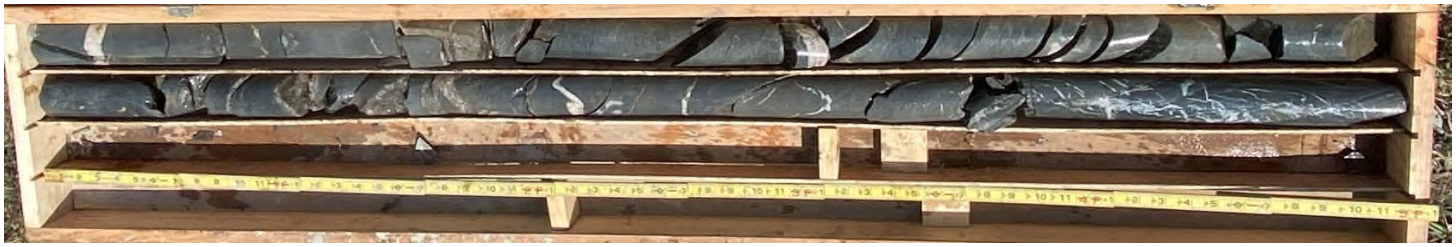




Notes:
1. Box row corresponds to the core box section in which the rock core sample is contained; Row 1=Top, Row 4=Bottom.
2. Top photo is dry, bottom photo is wet.
3. Transition between core runs within a row are marked by wood separators.

Maine Department of Transportation – Broadway Bridge
Bridge #5789, Interstate 95 over Broadway
Bangor, ME
Rock Core Photographs

Boring No.	Run	Depth (ft)	Recovery (in)	Recovery (%)	RQD (in)	RQD (%)	Rock Type	Box Row
HB-BI95-202	R1	16.0 - 20.7	56	100%	4	7%	SLATE	1
HB-BI95-201	R1	23.0 - 28.0	60	100%	50	86%	SLATE	2



Notes:
1. Box row corresponds to the core box section in which the rock core sample is contained; Row 1=Top, Row 4=Bottom.
2. Top photo is dry, bottom photo is wet.
3. Transition between core runs within a row are marked by wood separators.

APPENDIX F – ENGINEERING CALCULATIONS

Global Stability

GZA
GeoEnvironmental, Inc
707 Sable Oaks Drive, Suite 150
South Portland, Maine 04106
207-879-9190
Fax 207-879-0099
http://www.gza.com

Engineers and Scientists

JOB: 09.0025990.02
SUBJECT: 1-95 Bridge over Broadway
SHEET: 1 OF 6
CALCULATED BY ENT 01/06/2023
CHECKED BY B. Cardali 02/13/2023

Objective

Evaluate global stability of the proposed approach embankment at critical sections near the proposed abutment 2 using the profile shown in the Interpretive Subsurface Profile for the replacement of the I-95 bridge over Broadway. The northbound Abutment 2 cross sections and longitudinal sections include the largest fills and the thickest strata of marine clay and are considered the worst case scenarios for the project. Additionally, GZA was requested to evaluate the 1.5:1 riprap slopes near the northbound off-ramp.

References

1. American Association of State Highway and Transportation Officials, AASHTO LRFD Bridge Design Specifications: Customary U.S. Units, 9th edition, 2020. (AASHTO LRFD)

Analysis

Soil Properties

Friction angles were developed for granular materials based on corrected N60 blow counts of existing materials or anticipated/Maine DOT BDG design properties of new fills. Shear strengths and unit weights of marine clay were developed based on laboratory testing and field vane testing. Design soil properties are shown on the Slope/W output.

Stability Calculation and Performance Criteria

To consider the longitudinal and cross-section analyses, the minimum factor of safety for global stability is selected as 1.5 and 1.3, respectively. These correspond to approximate resistance factors of 0.65 and 0.75, for a slope that supports structures and for a slope that does not contain or support a structural element, as specified in AASHTO LRFD Article 11.6.2.3.

GZA evaluated the stability of the proposed approach embankments using the computer analytical software *Slope/W 2022*, developed by Geo-Slope International, based on the Morgenstern-Price method.

Longitudinal Analysis

The analyzed profiles considered the interpreted typical subsurface conditions along the project baseline without the beneficial "reinforcing" effects of new abutment HP 14x89 piles. The proposed embankment at the abutments consist of the travelway with a traffic surcharge placed over the existing fill with a proposed slope of 2H:1V.

The attached Slope/W outputs show that the proposed embankment provides the following minimum global factors of safety in the longitudinal direction:

Abutment	Analysis	Factor of Safety Against Rotation	Required Factor of safety
2	Static (no reinforcement)	1.6	1.5

Based on these results, the longitudinal global stability is sufficient without pile reinforcement. With reinforcements, the factor of safety would likely increase.

Cross Section Analysis

The highest embankment, thickest clay profile, and/or steepest side slope is at the Abutment 2 approach. The analyzed section considers the typical subsurface conditions at the respective locations, the borings that the stratification are based on are identified in the respective Slope/W outputs. A Slope/W model was developed for the proposed 36 foot wide travelway and auxiliary lane with a traffic surcharge load placed over the travelway and side slopes of 2H:1V typically, with 1.5H:1V in area with riprap. The proposed riprap section includes a thickness of 3 feet from top to bottom of the 1.5:1 slope. Initial analyses show that the proposed riprap section did not achieve the required factor of safety. Therefore, GZA developed a riprap section of 1.5 feet thick, with a minimum key way of 3 feet wide by 4 feet thick as shown on the Slope/W output.

GZA
GeoEnvironmental, Inc
707 Sable Oaks Drive, Suite 150
South Portland, Maine 04106
207-879-9190
Fax 207-879-0099
http://www.gza.com

Engineers and Scientists

The attached Slope/W outputs show that the proposed embankment provides the following minimum global factors of safety :

Station	Analysis	Factor of Safety Against Rotation	Required Factor of safety
257+00 Left to Right	Static (Proposed Riprap)	1.2	1.3
257+00 Left to Right	Static (Modified Riprap)	1.3	1.3

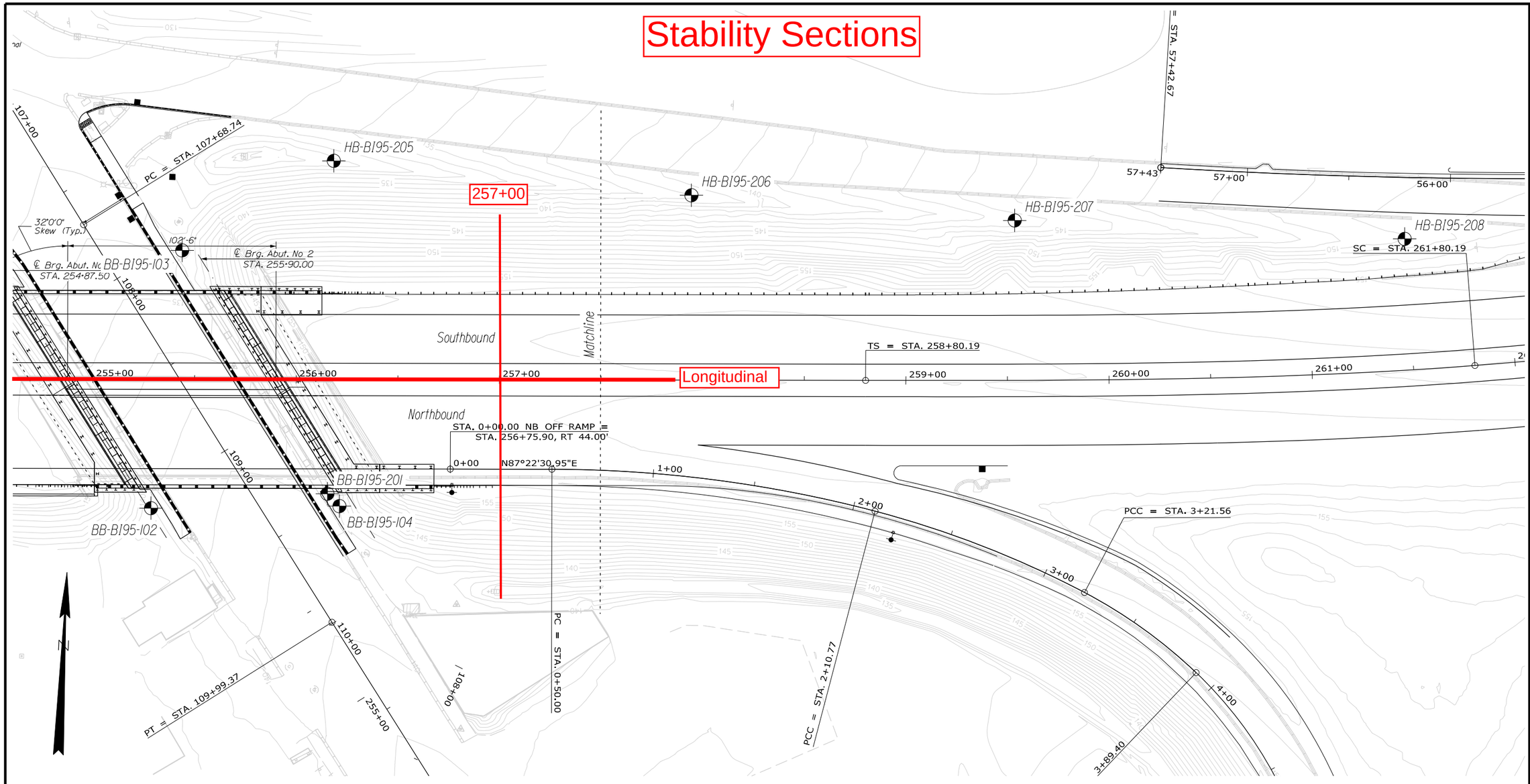
Based on these results, global stability is suitable for both approach embankments.

Conclusion

1. Longitudinal: The global stability meets the minimum required criteria for static conditions.

2. Abutment 2 Cross Section: The global stability meets the minimum required criteria for static conditions with the modified riprap section.

Stability Sections



NOTES

1) Base map developed from electronic files (Topo.dgn, alignments.dgn, Bridge.dgn, and contours.dgn) provided by McFarland Johnson on November 8, 2022.

2) The as-drilled locations of the BB-BI95-100 and -200 series bridge borings and the HB-BI95-200 series highway borings were surveyed and provided by MaineDOT in an electronic file (Borings.dgn).

BORING LOCATION PLAN LEGEND

- BB-BI95-104 — Indicates borings performed by New England Boring Contractors of Hermon, Maine between October 2 and October 15, 2018 and observed by GZA personnel.
- BB-BI95-201 — Indicates -200 series bridge boring performed by New England Boring Contractors of Hermon, Maine on July 7, 2022 and observed by GZA personnel.
- HB-BI95-208 — Indicates -200 series highway borings performed by New England Boring Contractors of Hermon, Maine between July 6 and July 12, 2022 and observed by GZA personnel.

PLAN

25 0 25 50

Scale in Feet

PREPARED BY:

GZA

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

022276.01

WIN 22276.01

BRIDGE PLANS

Bridge No. 5789

	BY	DATE
PROJ. MANAGER	A. Lothel	
DESIGN-DETAILED	M. Johnescu	B. Cardoli
CHECKED-REVIEWED	C. Snow	A. Blasdell
DESIGN2-DETAILED2		
DESIGN3-DETAILED3		
REVISIONS 1		
REVISIONS 2		
REVISIONS 3		
REVISIONS 4		
FIELD CHANGES		

SIGNATURE

P.E. NUMBER

DATE

I-95\BROADWAY BRIDGE
STATE ROUTE 15 (BROADWAY)
BANGOR, ME PENOBSCOT COUNTY

BORING LOCATION PLAN 2

SHEET NUMBER

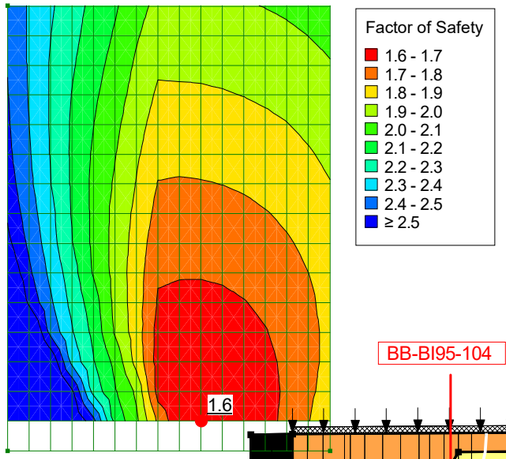
2

OF 7

Filename: ...\BLP\Broadway - BLP 3.dgn Division: HIGHWAY Username: common Date:11/14/2022

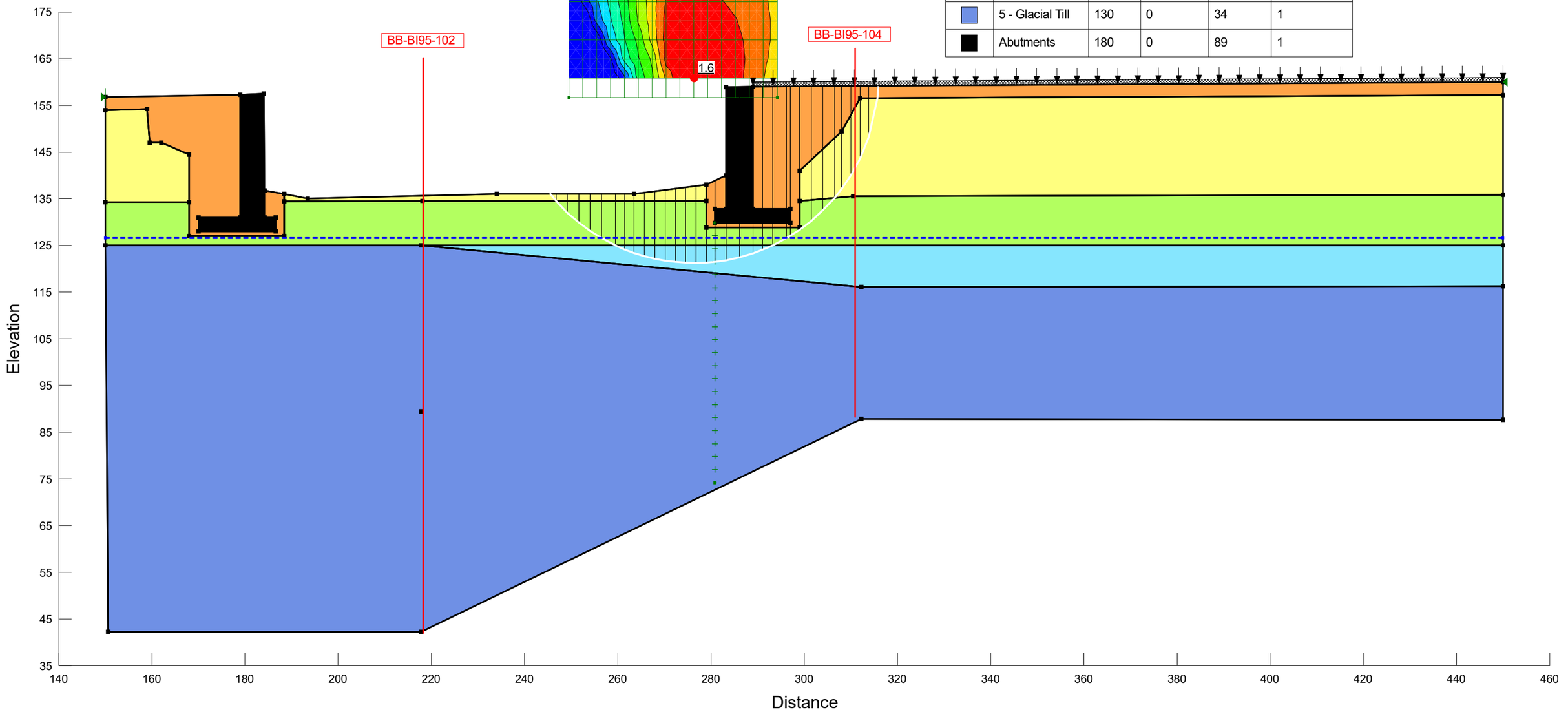
File Name: Sta. 257+00.gsz
Name: Abutment 2 Longitudinal
Date: 02/15/2023
P:\09 Jobs\0025900s\09.0025990.00 - MEDOT - I-95 Bridge over Broadway\09.0025990.02 - Final Design\Work\Calcs\Stability\

Method: Morgenstern-Price
Surcharge (Unit Weight): 250 pcf (1 ft thick)



Factor of Safety
- 1.6 - 1.7
- 1.7 - 1.8
- 1.8 - 1.9
- 1.9 - 2.0
- 2.0 - 2.1
- 2.1 - 2.2
- 2.2 - 2.3
- 2.3 - 2.4
- 2.4 - 2.5
- ≥ 2.5

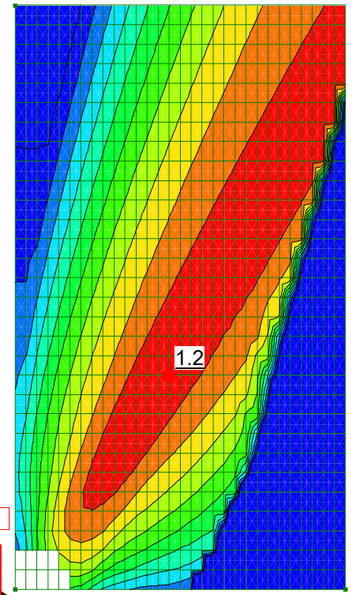
Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface
	1 - New Fill	125	0	34	1
	2 - Existing Fill	120	0	30	1
	3 - Marine Clay Crust	115	1,500	0	1
	4 - Marine Clay	115	750	0	1
	5 - Glacial Till	130	0	34	1
	Abutments	180	0	89	1

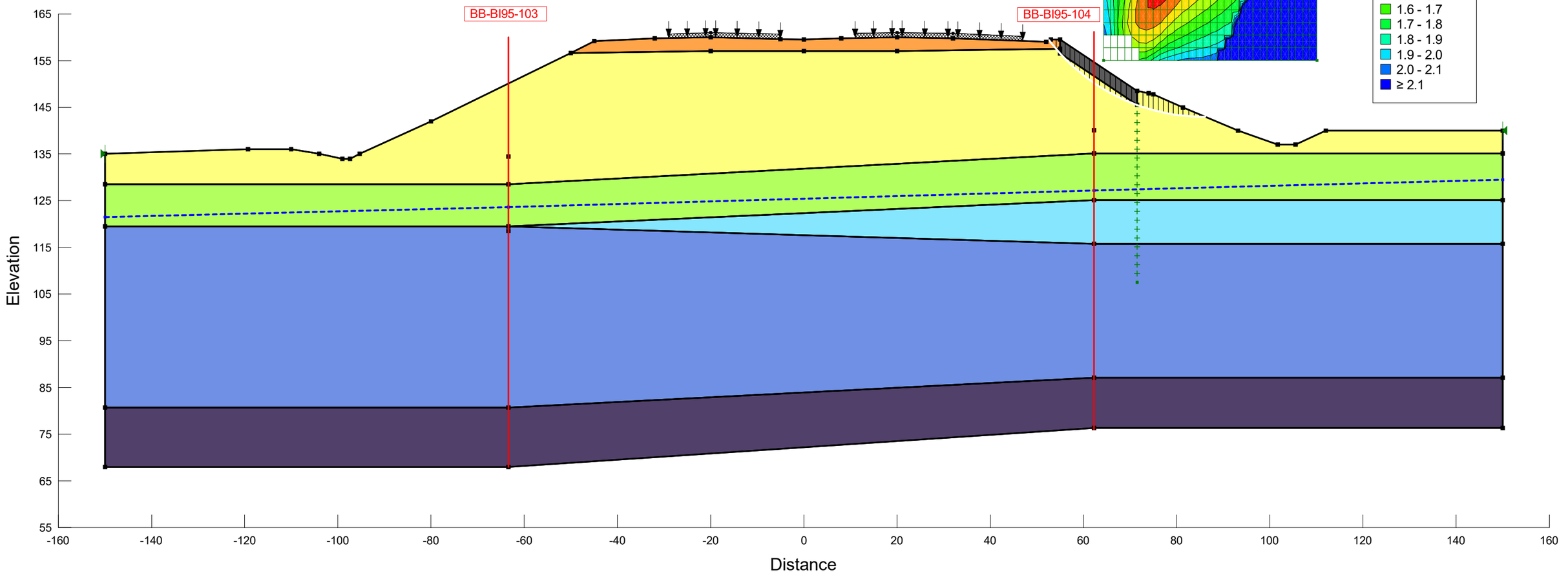


File Name: Sta. 257+00.gsz
Name: Sta. 257+00 Proposed Riprap Design
Date: 02/16/2023
P:\09 Jobs\0025900s\09.0025990.00 - MEDOT - I-95 Bridge over Broadway\09.0025990.02 - Final Design\Work\Calcs\Stability\

Method: Morgenstern-Price
Surcharge (Unit Weight): 250 pcf (1 ft thick)

Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface
	1 - New Fill	125	0	34	1
	2 - Existing Fill	120	0	30	1
	3 - Marine Clay Crust	115	1,500	0	1
	4 - Marine Clay	115	750	0	1
	5 - Glacial Till	130	0	34	1
	6 - Bedrock				1
	7 - RipRap	140	0	44	1

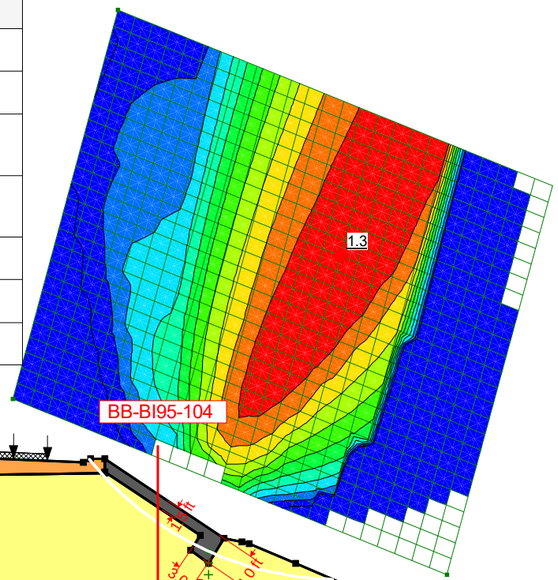


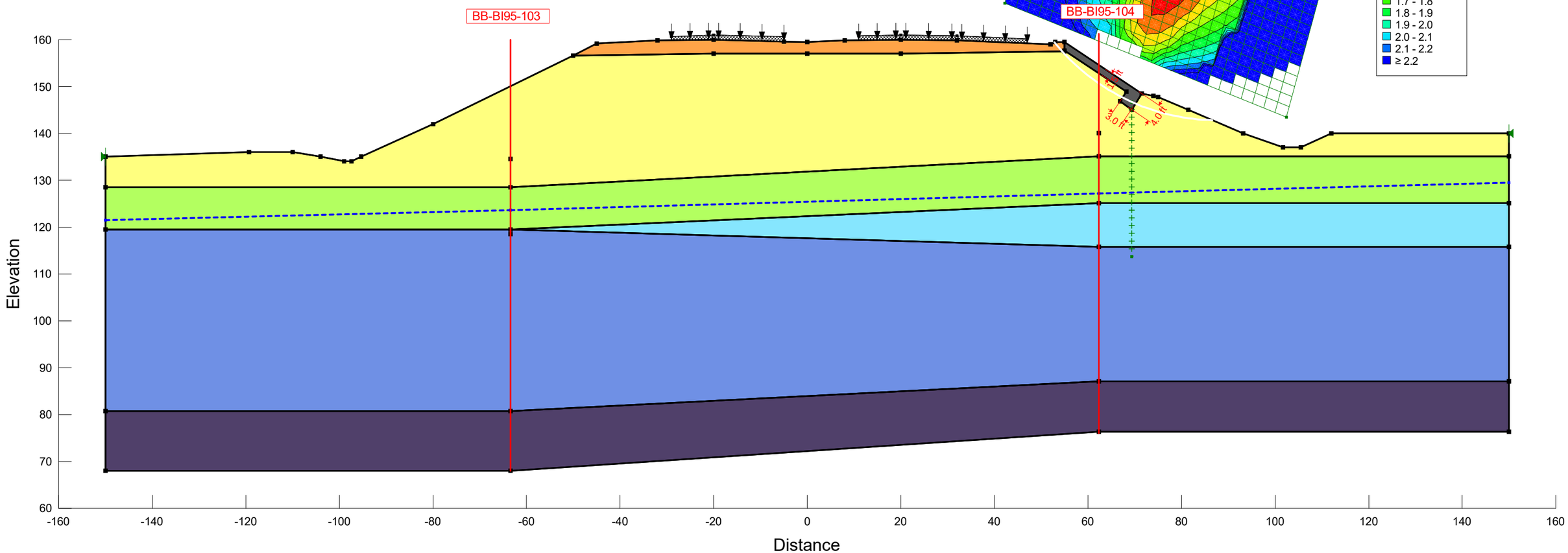


File Name: Sta. 257+00.gsz
Name: Sta. 257+00 Modified Riprap Design
Date: 02/15/2023
P:\09 Jobs\0025900s\09.0025990.00 - MEDOT - I-95 Bridge over Broadway\09.0025990.02 - Final Design\Work\Calcs\Stability\

Method: Morgenstern-Price
Surcharge (Unit Weight): 250 pcf (1 ft thick)

Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface
	1 - New Fill	125	0	34	1
	2 - Existing Fill	120	0	30	1
	3 - Marine Clay Crust	115	1,500	0	1
	4 - Marine Clay	115	750	0	1
	5 - Glacial Till	130	0	34	1
	6 - Bedrock				1
	7 - RipRap	140	0	44	1





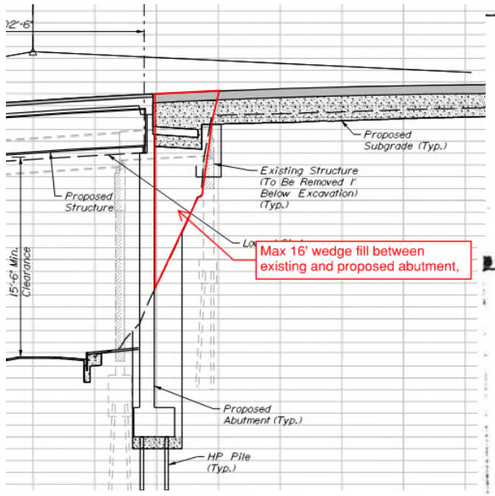
Seismic

Broadway Bridge		Embankment Increase	
SETTLEMENT OF EMBANKMENT			
Interstate 95 Bridge over Broadway		max height	16
		unit wt	125
GZA File No. 09.0025990.02		stress (psf)	2000
Calc By:	B.Cardali		
Check By:	C.Snow		

SETTLEMENT ESTIMATE Based on Borings BB-BI95-104/-201				
Location:	Center of Bridge	**Scenario: East Abutment**		
Existing Grade:		141.5		
Design GWT Depth		6		
Stress Estimate by:		Boussinesq Est		

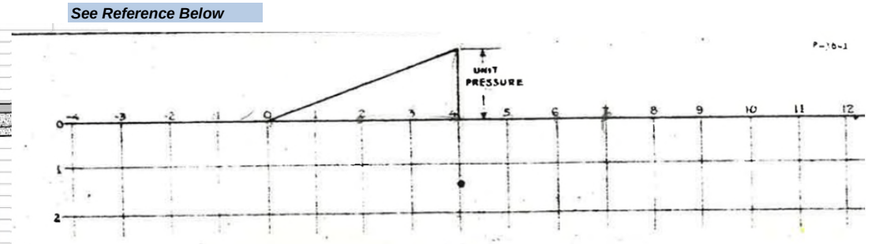
Fill		**Till**		
γ moist (pcf)	120	γ moist (pcf)	130	
γ Buoyant (pcf)	57.6	γ Buoyant (pcf)	67.6	
Silty Clay				
γ moist (pcf)	112		t90	0.848
γ Buoyant (pcf)	49.6			

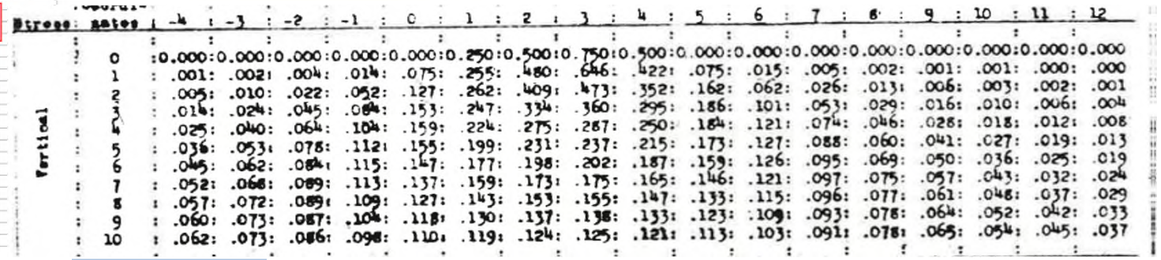
Layer	Depth (ft) top/mid/bot (below bot of load)	Thick. (ft)	In-Situ Stress (psf)	Influence Factor	Embankment Stress Increase (psf)	Total Stress Increase (psf)	Final Stress (psf)	Max. Prev. Stress (psf)	RR	CR	RECOMPRESSION SETTLEMENT RR H log(Po+dP/Po) (in)	VIRGIN COMPR. SETTLEMENT CR H log(Po+dP/Pmax) (in)	TOTAL CONSOL SETTLEMENT (in)	Stress Ratio	Calpha	Second Settlement (in)	Cumulative Total Settlement from Bottom (in)	Notes
Fill	0																	
	3	6	360	0.65	1292	1293	1653	1	0	0	0.00	0.00	0.00	1652.646	0	0		
	6																	
Silty Clay	6																	
	8.5	5	1000	0.47	946	946	1946	6700	0.009	0.118	0.16	0.00	0.16	0.29	0.0004	0.024	0.50	The top 5 feet will move enough to initiate downdrag
	11																	
Silty Clay	11																	
	13.5	5	1092	0.36	720	720	1812	6700	0.009	0.118	0.12	0.00	0.12	0.27	0.0004	0.024	0.32	
	16																	
Silty Clay	16																	
	20.5	9	1439	0.24	474	474	1913	4400	0.01	0.1	0.13	0.00	0.13	0.43	0.0004	0.04	0.18	
	25																	
TOTAL		25									0.41	0.00	0.41			0.09	0.50	



HORIZ SCALE 1 square = 4 feet+-
VERT SCALE same

See Reference Below

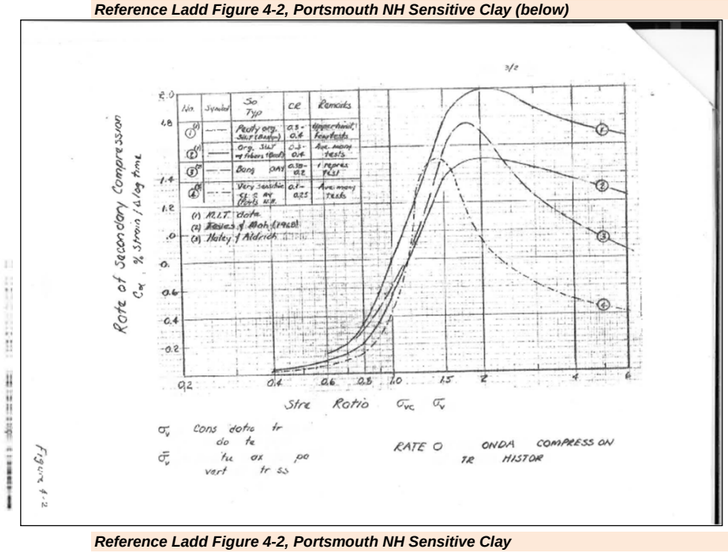




Stress ratios	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12
Vertical 0	0.000	0.000	0.000	0.000	0.000	0.250	0.500	0.750	0.500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1	.001	.002	.004	.014	.075	.255	.480	.646	.422	.075	.015	.005	.002	.001	.001	.000	.000
2	.005	.010	.022	.052	.127	.262	.409	.473	.352	.162	.062	.026	.013	.006	.003	.002	.001
3	.014	.024	.045	.084	.153	.247	.334	.360	.295	.186	.101	.053	.029	.016	.010	.006	.004
4	.025	.040	.064	.104	.159	.224	.275	.287	.250	.184	.121	.074	.046	.028	.018	.012	.008
5	.036	.053	.078	.112	.155	.199	.231	.237	.215	.173	.127	.088	.060	.041	.027	.019	.013
6	.045	.062	.084	.115	.147	.177	.198	.202	.187	.159	.126	.095	.069	.050	.036	.025	.019
7	.052	.068	.089	.113	.137	.159	.173	.175	.165	.146	.121	.097	.075	.057	.043	.032	.024
8	.057	.072	.089	.109	.127	.143	.153	.155	.147	.133	.115	.096	.077	.061	.048	.037	.029
9	.060	.073	.087	.104	.118	.130	.137	.138	.133	.123	.109	.093	.078	.064	.052	.042	.033
10	.062	.073	.086	.098	.110	.119	.124	.125	.121	.113	.103	.091	.078	.065	.054	.045	.037

Reference NAVFAQ DM.7

Reference Ladd Figure 4-2, Portsmouth NH Sensitive Clay (below)



Reference Ladd Figure 4-2, Portsmouth NH Sensitive Clay

Notes:
1. Ignore beneficial supportive effects of the pile cap.

GZA
GeoEnvironmental, Inc.
707 Sable Oaks Drive Suite 150
South Portland, Maine 04106
207-879-9190
Fax 207-879-0099
http://www.gza.com

JOB: **I-95 Bridge #5789 over Broadway Bangor, ME**
GZA PROJECT NO: **09.0025990.02**
SUBJECT: **Downdrag Calculation, Abutment 2**
SHEET:
CALCULATED BY: **B.Cardali 11/10/2022, REV 1/20/23**
CHECKED BY: **C.Snow 11/10/2022**

Type of Pile	**HP14x89**	
Diameter of Pile	14.5	in
Perimeter of Pile	4.67	ft
Maximum Factored Pile Load	399	kips

No of HP14x89 Piles per Abutment	Maximum Factored Axial Load per Pile ($\Sigma\gamma i$ Qi)	Factored Load from Downdrag (γ_p DD)	Total Factored Load ($\Sigma\gamma i$ Qi + γ_p DD)	Resistance Factor for Dynamic Pile Analysis (ϕ_{dyn})	Nominal Driving Resistance Required (Rn=Rndr)
60	343	14	357	0.65	549

NOTES:
1. Downdrag load calculated using β method as shown on attached sheet. Load factor γ_p=1.0 applied to calculated downdrag load.
2. Maximum settlement and downdrag occurs at Abutment 2 because of thicker clay profile; Abutment 2 used as design basis.
3. Maximum factored axial load provided by McFarland Johnson.

Reference from AASHTO LRFD, 9th Edition, Article 10.7.3.7:

Pile design for downdrag is illustrated in Figure C10.7.3.7-1.

where:

R_{Sdd} = side resistance which must be overcome during driving through downdrag zone (kips)
$Q_p = \Sigma\gamma_i Q_i$ = factored load per pile, excluding downdrag load (kips)
DD = downdrag load per pile (kips)
$D_{est.}$ = estimated pile length needed to obtain desired nominal resistance per pile (ft)
φ_{dyn} = resistance factor, assuming that a dynamic method is used to estimate nominal pile resistance during installation of the pile (if a static analysis method is used instead, use φ_{stat})
γ_p = load factor for downdrag

The summation of the factored loads ($\Sigma\gamma_i Q_i$) should be less than or equal to the factored resistance ($\varphi_{dyn} R_n$). Therefore, the nominal resistance R_n should be greater than or equal to the sum of the factored loads divided by the resistance factor φ_{dyn}. The nominal bearing resistance (kips) of the pile needed to resist the factored loads, including downdrag, is therefore taken as:

$$R_n = \frac{(\Sigma\gamma_i Q_i)}{\varphi_{dyn}} + \frac{\gamma_p DD}{\varphi_{dyn}} \qquad \text{(C10.7.3.7-1)}$$

The total nominal driving resistance, R_{ndr} (kips), needed to obtain R_n, accounting for the side resistance that must be overcome during pile driving that does not contribute to the nominal resistance of the pile, is taken as:

$$R_{ndr} = R_{Sdd} + R_n \qquad \text{(C10.7.3.7-2)}$$

GZA
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B.Cardali 11/10/2022, REV 1/20/22

JOB:	I-95 Bridge #5789 over Broadway Bangor, ME
GZA PROJECT NO:	09.0025990.02
SUBJECT:	Downdrag Calculation, Abutment 2
SHEET:	
CALCULATED BY:	B.Cardali 11/10/2022, REV 1/20/23
CHECKED BY:	C.Snow 11/10/2022

Type of Pile		**HP14x89**		
Finish Ground Surface Elevation		159.0	ft	
Pile Embedment below Ex. Grade		11.0	ft	
Elevation of Water Table		146.1	ft	
Depth of Water Table		12.9	ft	
Diameter of Pile	399.4	14.0	in	
Perimeter of Pile		4.67	ft	
Depth of Critical Effective Stress		23.3	ft	(20 times pile diameter)
Critical Total Stress		2917	psf	
Critical Effective Stress		2266	psf	
Unit Weight of Water		62.4	pcf	

Soil	Thickness (ft)	Bottom Elev. (ft)	Bottom Depth. (ft)	Midpoint Elev. (ft)	Depth to Midpoint of Layer (ft)	Soil Unit Weight (pcf)	Total Stress (psf)	Effective Stress (psf)	Limiting Effective Stress (psf)	Beta (β)	Beta Unit Skin Friction, fs (psf)	Clay Su, Max Unit Skin Friction, fs,m (psf)	Max Nominal Load from Downdrag (DD) (kip)	Settlement of Layer (inches)	Nominal Load from Downdrag (DD) (kip)
Fill	29	131.0	28	145.0	14	125	1750	1681	1681	0.35	588	--	--	--	--
Marine Clay Crust	5	126.0	33	128.5	30.5	118	3599	2501	2266	0.26	589	--	14	0.5	14
Marine Clay	9	117.0	42	121.5	37.5	118	4621	3086	2266	0.26	589	--	25	0.32	0
Glacial Till	28.7	88.3	70.7	102.7	56.4	130	6822	4110	2266	0.35	793	--	--	--	--
												TOTAL	**38**		**14**

NOTES:

1. Stress influence calculated based on elastic theory.
2. Beta values were selected based on NAVFAC DM 7.2-211.
3. Yellow cells are input, white are calculated.
4. Settlement is caused by widening and raise of grade at proposed bridge
5. Maximum settlement occurs at Abutment 2 because of thicker clay profile; Abutment 2 used as design basis.

Profile:
Sand Fill, 0-5
Marine Clay Crust, 5-15
Marine Clay, 15-24.3
Glacial Till, 24.3-53

Settlement and Downdrag

Seismic Site Class Calculation Summary

Project: Broadway Bridge Over Interstate-95 **Project No.:** 09.0025990.02
Location: Bangor, ME
Evaluated By/Date: E. Tombaugh **Date** 7/25/2022
Checked By/Date: B.Cardali **Date** 1/20/2023

Objective:
Determine seismic site class by performing calculations in accordance with the MaineDOT Bridge Manual 2003 Edition with updates in 2018, which references the AASHTO LRFD Seismic Bridge Design Specifications, 9th Edition.

Subsurface Data: Borings BB-BI95-101, -102, -103 and -104 were drilled by NEBC of Hermon, Maine between October 2 and October 15 , 2018. Boring BB-BI95-201 was drilled by New England Boring Contractors, of Hermon, Maine on July 7, 2022.

Assumptions: Soil borings extended to depths between 63 and 107 feet below the roadway level and bedrock was encountered in the soil borings.

Approach: 1) Evaluate if the procedure in AASHTO LRFD Seismic Section 3.10.2.1 for classifying a site is appropriate for the site. Sites with highly variable subsurface conditions or very large sites may require multiple site class determinations or a site-specific seismic response analysis. Furthermore, classifying a site based on the 100 feet of soil and rock beneath the ground surface may be inappropriate if deep deposits of weak soils are present below 100 feet, or if foundation structures are supported on firm soil or rock below soft soils which can be justified as having little effect on the structure's seismic response.

2) Evaluate if soil properties are known in sufficient detail to determine site class. If data is not known in sufficient detail, AASHTO permits the use of Site Class D, unless conditions for Site Class E or Site Class F are likely to be present.

3) Check for the four categories of Site Class F requiring site-specific evaluation:
- Soils vulnerable to potential failure (liquefiable soils, sensitive clays, weakly cemented soils)
- Peats or highly organic clays greater than 10 feet in thickness
- Thick layers (greater than 25 feet) of highly plastic clay (PI > 75)
- Very thick soft/medium stiff clays (greater than 125 feet)

4) Check for existence of greater than 10 feet of soft clay (where s_u < 500 psf, w > 40%, and PI > 20). If these conditions are met, classify as Site Class E.

5) Categorize the site using one of the following three methods in AASHTO C3.10.3.1-1:
- $\overline{v}_s$ (Method A) - $\overline{N}$ (Method B) - $\overline{N}_{ch}$ *and* $\overline{s_u}$ (Method C)

If shear wave velocity data are available, they should be used to classify the site. The N and s_u methods should only be used if shear wave velocity data is not available, as the correlation between site amplification and these geotechnical parameters is more uncertain (and therefore more conservative) than the correlation with $\overline{v}_s$.

Results: Calculations of the Seismic Site Class based on Method B as described in section 3.10.3.1 of the LRFD Seismic Bridge Design Specifications are attached. Calculations results are summarized in the table below.

Boring ID	BB-BI95-101	BB-BI95-102	BB-BI95-103	BB-BI95-104	Average
N-Value	39	33	61	55	47.0

Conclusions: Based on the procedure outlined in section 3.10.3.1 and table 3.10.3.1-1 of the LRFD Seismic Bridge Design Specifications, we recommend that Site Class "D" be used for design.

Interstate 95 Bridge over Broadway
Bangor, ME

Calculated By: E. Tombaugh Date: 7/25/2022
Checked By: B.Cardali Date: 1/20/2023

INPUT

Exploration ID: **BB-BI95-101** Ground Surface Elevation: 132.5 ft Depth of Boring: 69.9 ft

Depth to Bedrock: 59.8 ft

EQUATIONS

$$\overline{N}_{ch} = \frac{\sum_{i=1}^{m} d_i}{\sum_{i=1}^{m} \frac{d_i}{N_i}}$$

where: m = number of layers

d_i = the thickness of all layers between 0 and 100 feet.

d_c = the thickness of any clay layers between 0 and 100 feet.

N_i = the Standard Penetration Resistance (ASTM D 1586) of cohesionless soil layers not to exceed 100 blows/ft, corrected for hammer energy for calibrated auto hammers (i.e., N_{60}).

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise)

CALCULATION

$\overline{N}$ = 38.8

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	d_i	d_i / N_i	Comment
Fill	1.0	3.0	130.5	43	4.0	0.09	
Silty Clay	5.0	7.0	126.5	12	4.5	0.38	
	10.0	12.0	121.5	11	5.0	0.45	
Glacial Till	15.0	17.0	116.5	39	5.0	0.13	
	20.0	22.0	111.5	45	5.0	0.11	
	25.0	27.0	106.5	51	5.0	0.10	
	30.0	32.0	101.5	109	5.0	0.05	
	35.0	37.0	96.5	123	5.0	0.04	
	40.0	40.4	92.3	50	4.2	0.08	
Weathered Bedrock	45.0	46.4	86.8	50	5.5	0.11	
	50.0	50.4	82.3	50	51.8	1.04	
Top of Rock	59.8						

100.00

Interstate 95 Bridge over Broadway
Bangor, ME

Calculated By: E. Tombaugh Date: 7/25/2022
Checked By: B.Cardali Date: 1/20/2023

INPUT

Exploration ID: **BB-BI95-102** Ground Surface Elevation: 138.8 ft Depth of Boring: 107.2 ft

Depth to Bedrock: 97.5 ft

EQUATIONS

$$\overline{N}_{ch} = \frac{\sum_{i=1}^{m} d_i}{\sum_{i=1}^{m} \frac{d_i}{N_i}}$$

where: m = number of layers

d_i = the thickness of all layers between 0 and 100 feet.

d_c = the thickness of any clay layers between 0 and 100 feet.

N_i = the Standard Penetration Resistance (ASTM D 1586) of cohesionless soil layers not to exceed 100 blows/ft, corrected for hammer energy for calibrated auto hammers (i.e., N_{60}).

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise)

CALCULATION

$\overline{N}$ = 33.0

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	d_i	d_i / N_i	Comment
Fill	0.4	2.0	137.6	19	3.5	0.18	
Silty Clay	5.0	7.0	132.8	23	5.0	0.22	
	10.0	12.0	127.8	9	5.0	0.56	
Glacial Till	15.0	17.0	122.8	23	5.0	0.22	
	20.0	22.0	117.8	11	5.0	0.45	
	25.0	27.0	112.8	51	5.0	0.10	
	30.0	32.0	107.8	26	5.0	0.19	
	35.0	36.6	103.0	121	4.8	0.04	
	40.0	42.0	97.8	70	5.2	0.07	
	45.0	47.0	92.8	137	5.0	0.04	
Weathered Bedrock	50.0	52.0	87.8	146	5.0	0.03	
	55.0	56.3	83.2	50	7.2	0.14	
	65.0	65.3	73.7	50	9.5	0.19	
	75.0	75.2	63.7	50	12.2	0.24	
	89.5	89.8	49.2	50	17.7	0.35	
Top of Rock	97.5						
					100.00		

Interstate 95 Bridge over Broadway
Bangor, ME

Calculated By: E. Tombaugh Date: 7/25/2022
Checked By: B.Cardali Date: 1/20/2023

INPUT

Exploration ID: **BB-BI95-103** Ground Surface Elevation: 134.5 ft Depth of Boring: 66.5 ft

Depth to Bedrock: 53.8 ft

EQUATIONS

$$\overline{N}_{ch} = \frac{\sum_{i=1}^{m} d_i}{\sum_{i=1}^{m} \frac{d_i}{N_i}}$$

where: m = number of layers

d_i = the thickness of all layers between 0 and 100 feet.

d_c = the thickness of any clay layers between 0 and 100 feet.

N_i = the Standard Penetration Resistance (ASTM D 1586) of cohesionless soil layers not to exceed 100 blows/ft, corrected for hammer energy for calibrated auto hammers (i.e., N_{60}).

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise)

CALCULATION

$\overline{N}$ = 61.1

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	d_i	d_i / N_i	Comment
Fill	0.5	2.0	133.3	23	3.5	0.15	
	5.0	7.0	128.5	29	5.0	0.17	
Silty Clay	10.0	12.0	123.5	16	5.0	0.31	
Glacial Till	15.0	17.0	118.5	26	5.0	0.19	
	20.0	22.0	113.5	51	5.0	0.10	
	25.0	27.0	108.5	20	5.0	0.25	
	30.0	32.0	103.5	53	5.0	0.09	
	35.0	37.0	98.5	174	5.0	0.03	
	40.0	42.0	93.5	106	5.0	0.05	
	45.0	47.0	88.5	82	5.0	0.06	
	50.0	51.5	83.8	227	51.5	0.23	
Top of Rock	53.8						

100.00

Interstate 95 Bridge over Broadway
Bangor, ME

Calculated By: E. Tombaugh Date: 7/25/2022
Checked By: B.Cardali Date: 1/20/2023

INPUT

Exploration ID: **BB-BI95-104** Ground Surface Elevation: 140.1 ft Depth of Boring: 63.8 ft

Depth to Bedrock: 53.0 ft

EQUATIONS

$$\overline{N}_{ch} = \frac{\sum_{i=1}^{m} d_i}{\sum_{i=1}^{m} \frac{d_i}{N_i}}$$

where: m = number of layers

d_i = the thickness of all layers between 0 and 100 feet.

d_c = the thickness of any clay layers between 0 and 100 feet.

N_i = the Standard Penetration Resistance (ASTM D 1586) of cohesionless soil layers not to exceed 100 blows/ft, corrected for hammer energy for calibrated auto hammers (i.e., N_{60}).

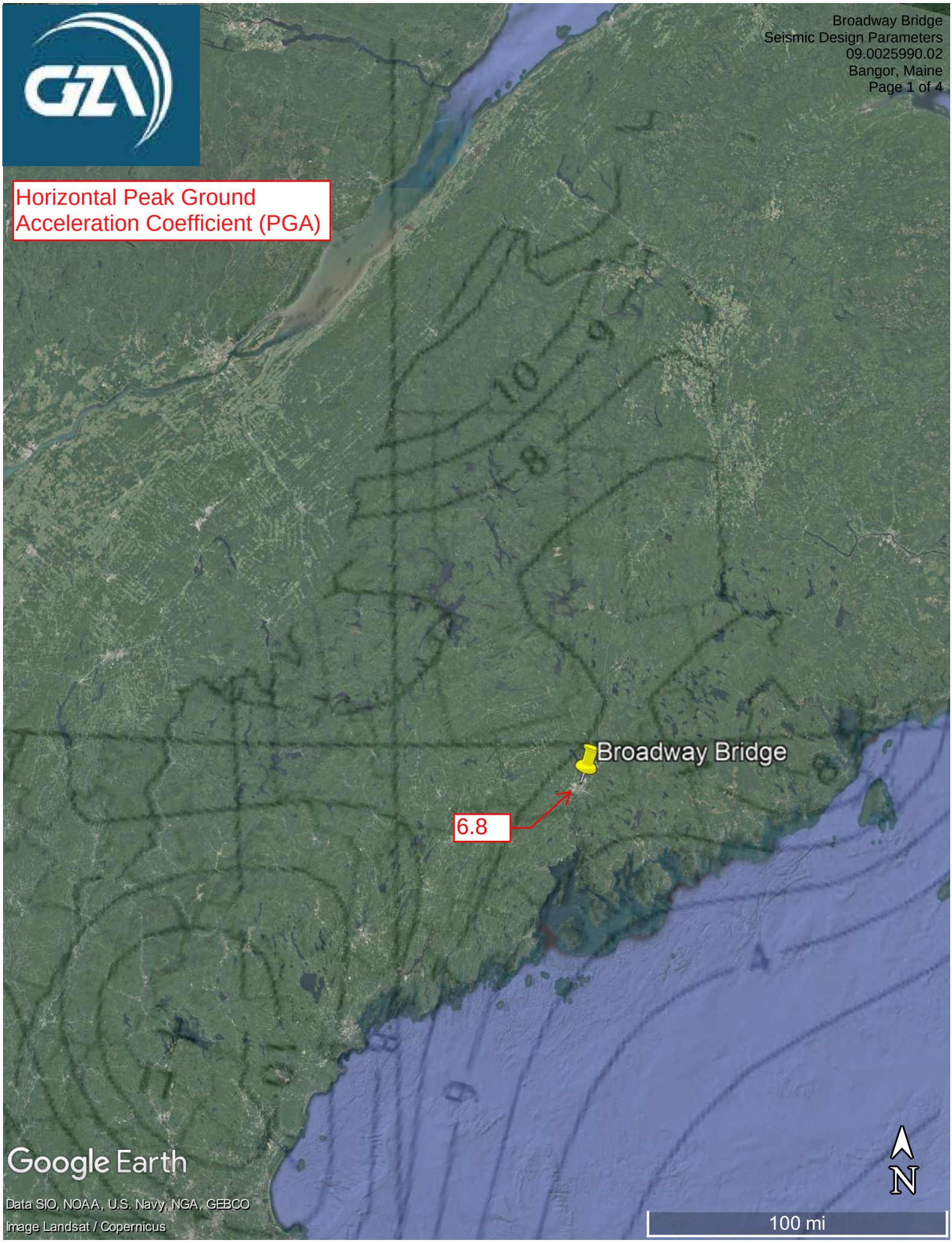
Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise)

CALCULATION

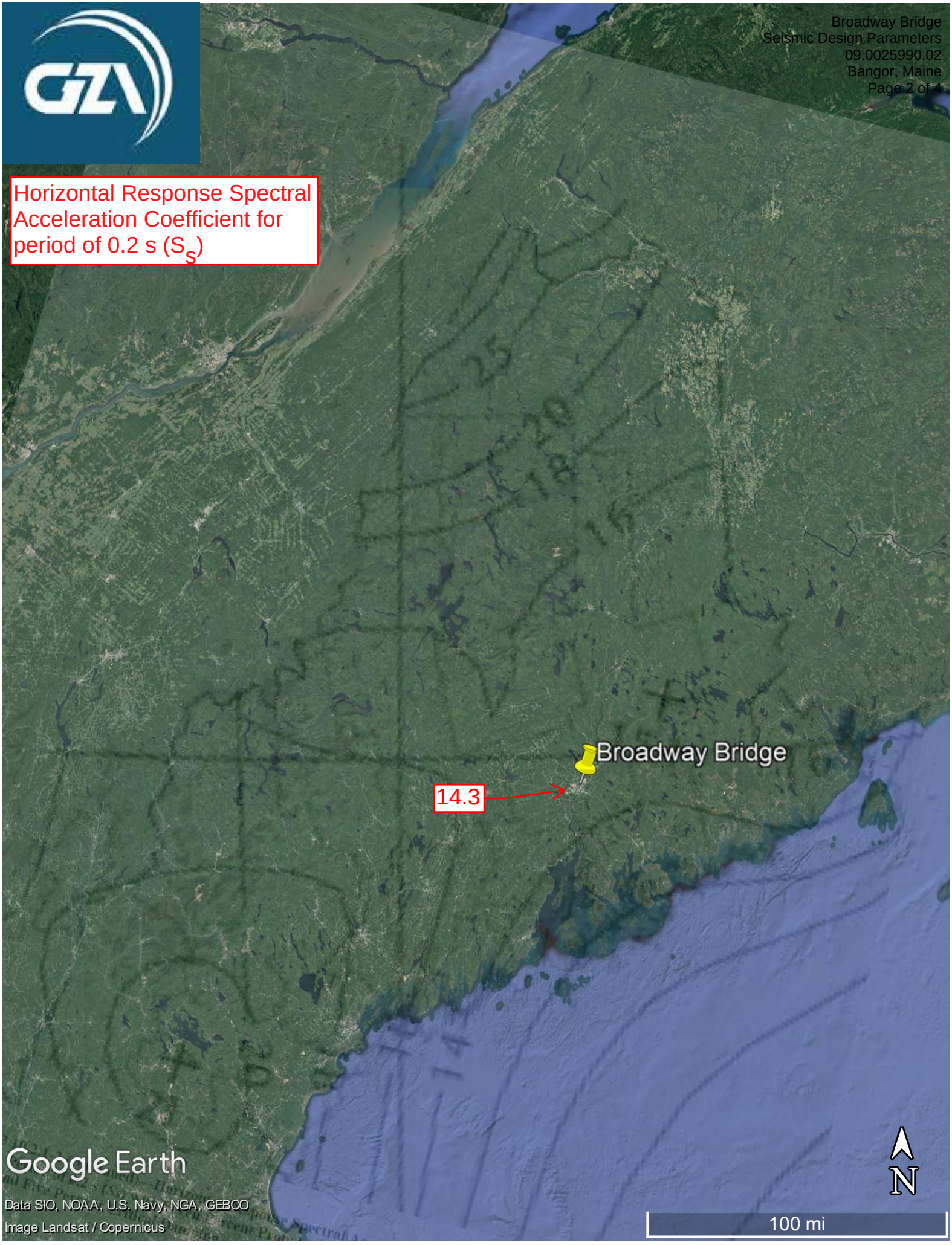
$\overline{N}$ = 55.0

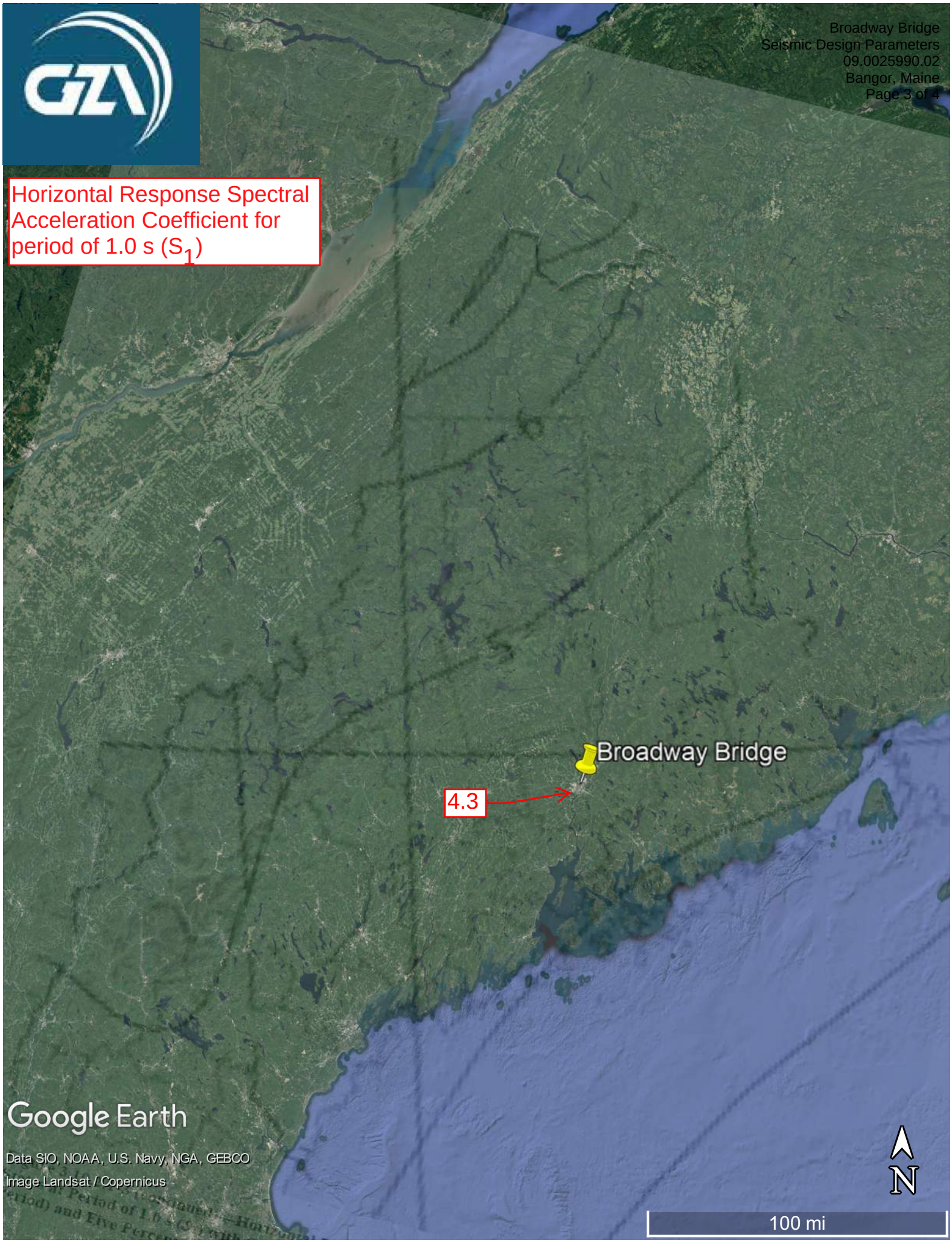
Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	d_i	d_i / N_i	Comment
Fill	0.0	2.0	139.1	12	3.5	0.29	
Silty Clay	5.0	7.0	134.1	14	5.0	0.36	
	10.0	12.0	129.1	12	5.0	0.42	
	15.0	17.0	124.1	0	5.0	0.00	
	20.0	22.0	119.1	0	5.0	0.00	
Glacial Till	25.0	27.0	114.1	56	5.0	0.09	
	30.0	32.0	109.1	33	5.0	0.15	
	35.0	37.0	104.1	98	5.3	0.05	
	40.5	42.5	98.6	101	5.0	0.05	
	45.0	47.0	94.1	81	4.8	0.06	
	50.0	52.0	89.1	147	51.5	0.35	
Top of Rock	53.0						

100.00


Horizontal Peak Ground Acceleration Coefficient (PGA)
10
9
8
Broadway Bridge
6.8
Google Earth
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus
N
100 mi

Horizontal Response Spectral Acceleration Coefficient for period of 0.2 s (S_S)




Horizontal Response Spectral Acceleration Coefficient for period of 1.0 s (S_1)
Broadway Bridge
4.3
Google Earth
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus
N
100 mi

Broadway Bridge Seismic Interpolation for Coefficients		
Seismic Parameter	**Interpolated Value from Maps[1]**	**Design Parameter**
Horizontal Peak ground Acceleration Coefficient	6.8	$PGA = .068$
Horizontal Response Spectral Acceleration Coefficient for Period of 0.2s	14.3	$S_s = 0.143$
Horizontal Response Spectral Acceleration Coefficient for Period of 1.0s	4.3	$S_1 = .043$

Notes: 1. AASHTO Figures 3.10.2.1-1,-2, and -3 were overlaid within the Google Earth software. Coefficients were interpolated between lines on these figures as presented in pages 1 through 3 of this calculation.

For Class D, values of F_{PGA} and F_a = 1.6, and F_v = 2.4

Therefore:

$$A_s = F_{PGA} \times PGA = 1.6 \times 0.068 = 0.11\ g$$

$$S_{DS} = F_a \times S_s = 1.6 \times 0.143 = 0.23\ g$$

$$S_{D1} = F_v \times S_1 = 2.4 \times 0.043 = 0.10\ g$$

Summary:

SITE CLASS D SEISMIC DESIGN PARAMETERS	
Parameter	**Design Value**
Fpga	1.6
Fa	1.6
Fv	2.4
As (Period = 0.0 sec)	0.11 g
SDs (Period = 0.2 sec)	0.23 g
SD1 (Period = 1.0 sec)	0.10 g

Lateral Earth Pressures

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Engineers and Scientists

JOB: 09.0025990.02 Broadway Bridge
SUBJECT: Lateral Earth Pressures
SHEET: 1 OF 1
CALCULATED BY E. Tome 9/1/22
CHECKED BY B. Cardali 1/20/23

Subject:

Evaluate lateral earth pressure coefficients for Abutments

References:

1. MaineDOT Bridge Design Guide, Chapter 3
2. AASHTO LRFD Bridge Design Specifications, 9th Edition (2020)
3. U.S. Army Corps of Engineers Engineer Manual 1110-2-2502, Retaining and Flood Walls

Input Parameters:

$\phi := 32\text{deg}$ Effective angle of internal friction *(Granular borrow, Soil Type 4, BDG Table 3-3)*

$\delta_f := 19.5\text{deg}$ Average value, precast concrete against clean sand/silty sand-gravel mixture *(AASHTO LRFD Table 3.11.5.3-1)*

$\beta := 0\text{deg}$ Angle of backfill to the horizontal

$\theta := 90 \cdot \text{deg}$ Angle of back face of wall to the horizontal

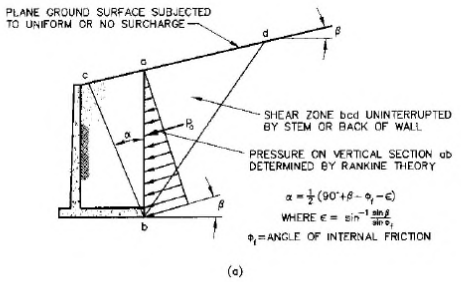
Earth Pressure Coefficients:

Active Earth Pressure (Abutments and Wingwalls)

Article 3.6.4 of the BDG states that abutments with a height of 5 feet or more should be assumed to experience sufficient horizontal movement of the top of the wall to develop active conditions due to structural deformation of the stem and rotation of the foundation.

$$\alpha := \frac{(90 \cdot \text{deg} + \beta - \phi)}{2} = 29 \cdot \text{deg}$$

Based on Figure C3.11.5.3-1 of LRFD, the abutment is considered to be a short-heeled wall. Therefore, Coulomb theory should be used to calculate active earth pressures.



Coloumb Active Earth Pressure Coefficient (Short-Heeled Wall)

$$\Gamma := \left[1 + \sqrt{\left[\frac{\sin(\phi + \delta_f) \cdot (\sin(\phi - \beta))}{\sin(\theta - \delta_f) \cdot \sin(\theta + \beta)}\right]}\right]^2 = 2.77$$

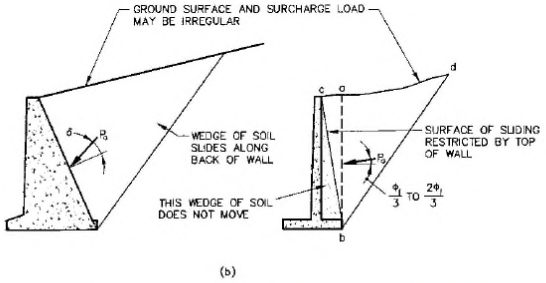


Figure C3.11.5.3-1—Application of (a) Rankine and (b) Coulomb Earth Pressure Theories in Retaining Wall Design

$$K_{ac} := \frac{(\sin(\theta + \phi))^2}{\Gamma \cdot \left[(\sin(\theta))^2 \cdot \sin(\theta - \delta_f)\right]}$$

$K_{ac} = 0.28$

Drivability

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JOB: 09.0025990.02 Broadway Bridge
SUBJECT: Axial Pile Resistance
SHEET: 1 OF 4
CALCULATED BY E. Tome, 2/3/23
REVIEWED BY CLS, 4/13/23

Objective

Evaluate the axial geotechnical resistance of the abutments for the I-95 Bridge over Broadway in Bangor, ME. Evaluations were conducted to assess a suitable driving system to install piles to the required geotechnical nominal resistance of 549 kips for for the HP 14X89 at the Abutment piles.

Methodology

Evaluate proposed pile section for governing factored axial compression resistance as follows.

1. Nominal Compressive Resistance
2. Factored Structural Compressive Resistance - Strength Limit State
3. Factored Structural Compressive Resistance - Extreme/Service Limit State
4. Geotechnical Resistance (Static Analysis)
5. Geotechnical Resistance (Drivability Analysis)
6. Factored Geotechnical Resistance - Strength Limit State
7. Factored Geotechnical Resistance - Extreme/Service Limit State

References

1. American Association of State Highway and Transportation Officials, AASHTO LRFD Bridge Design Specifications: Customary U.S. Units, 9th edition. (AASHTO LRFD)

Soil Properties

Consider Broadway Bridge Interpretive Subsurface Profile (see Figure 3), subsurface layering and properties relative to pile design are presented in the Apile outputs attached.

Structural Properties

HP14x89, ASTM A572, Gr. 50

Yield Strength of Steel $F_y := 50ksi$

Area of section $A_s := 26.1in^2$

Young's Modulus of Steel $E_s := 30000 \cdot ksi$

Radius of gyration (weak axis) $r_x := 5.88in$

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JOB: 09.0025990.02 Broadway Bridge
SUBJECT: Axial Pile Resistance
SHEET: 2 OF 4
CALCULATED BY E. Tome, 2/3/23
REVIEWED BY CLS, 4/13/23

1. Nominal Structural Compressive Resistance P_n

Nominal Compressive Resistance: $P_n := 0.66 \cdot F_y \cdot A_s$ AASHTO Eq. 6.9.5.1-1

Determine normalized column slenderness factor λ

$$:= \left(\frac{K \cdot l}{r_s \cdot}\right)^2 \cdot \frac{F_y}{E}$$ AASHTO Eq. 6.9.4.1-3 pg. 6-74

$:= 0$ Where the pile is fully embedded, AASHTO 10.7.3.13.1.

Giving: $P_n := 0.66 \cdot F_y \cdot A_s$ $P_n = 1305 \cdot kip$

2. Factored Structural Compressive Resistance - Strength Limit State:

Factor for piles in compression under hard driving conditions:

From Article 6.5.4.2 $_c := 0.5$

Factored Compressive Resistance for Strength Limit State:

$P_r := {}_c \cdot P_n$ AASHTO Eq. 6.9.2.1-1 pg. 6-71

$P_r = 653 \cdot kip$

Note: This is the maximum structural resistance assuming no unbraced length, actual structural resistance should be checked by the structural engineer.

3. Factored Structural Compressive Resistance - Service/Extreme Limit State:

Resistance Factors for Extreme Limit States:

From Article 10.5.5.1 and 10.5.5.3 $:= 1$

Factored Compressive Resistance for Service/Extreme Limit State:

$P_r := \cdot P_n$ AASHTO Eq. 6.9.2.1-1 pg. 6-71

$P_r = 1305 \cdot kip$

4. Geotechnical Axial Resistance - Static Analysis

AASHTO Article 10.7.3.2.3 states that the nominal resistance of piles driven to point bearing on hard rock is controlled by the structural limit state or potential for driving damage to occur during hard driving.

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Required nominal resistance of 549 kips for the pile configuration based on a maximum factored pile loads of 357 kips and a 0.65 resistance factor.

The estimated % skin friction resistance is 50% for the Abutment 1 piles and 20% at the Abutment 2 piles at the required nominal pile resistance, based on the estimated friction resistance. A-pile is higher, but we anticipate driving resistance in the Marine Clay and Glacial Till may be lower than the calculated static resistance.

5. Geotechnical Axial Resistance - Drivability Analysis

$dr := 0.9 \cdot da \cdot f_y$ AASHTO Eq. 10.7.8.1

$f_y := 50ksi$ yield Strength of steel

$da := 1.0$ AASHTO Table 10.5.5.2.3-1 Refers to Article 6.5.4.2, Pg. 6-28

$dr := 0.9 \cdot da \cdot f_y$ $dr = 45 \cdot ksi$ Driving Stress in pile cannot exceed 45 ksi

Abutment 1 Piles - Drive pile plumb through 90 feet of soil to rock with toe quake representative of tip resistance in soil (0.10 in) and no plug and representative of tip resistance in soil. Model pile length as 100 feet (10 foot stickup at end of drive).

Abutment 2 Piles - Drive pile plumb through 50 feet of soil to rock with toe quake representative of tip resistance in soil (0.04 in) and no plug and representative of tip resistance on rock, to evaluate range of driving conditions. Model pile length as 60 feet (10 foot stickup at end of drive).

Drive piles with a APE D 30-42 open-ended diesel hammer with a rated energy of 74,419 ft-lbs (fuel setting 3, 1 below maximum or 4, maximum). **The proposed hammer is sized to achieve the required nominal pile resistance for each of the potential driving scenarios; not the maximum driveability resistance for the pile section and profile.**

GRLWEAP Output is attached for the Abutment piles.

$R_{ndr1} := 549kip$ Estimated penetration criteria for required nominal geotechnical resistance:
Abutment 1 - Toe quake 0.10 inch (fuel setting 4) - pile driving stress=31 ksi, final penetration resistance= 5 bpi.
Abutment 2- Toe quake 0.04 inch (fuel setting 3) - pile driving stress=40 ksi, final penetration resistance= 5 bpi.

6. Factored Drivability Resistance - Strength Limit State:

Strength Limit State Factored Drivability Resistance:

PDA, WEAP and CAPWAP used to establishing driving criteria $dyn := 0.65$ AASHTO Table 10.5.5.2.3-1

$R_{ndr1\_factored} := R_{ndr1} \cdot dyn$

$R_{ndr1\_factored} = 357 \cdot kip$

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7. Factored Drivability Resistance - Service/Extreme Limit States:

Service and Extreme Limit State Factored Drivability Resistance:

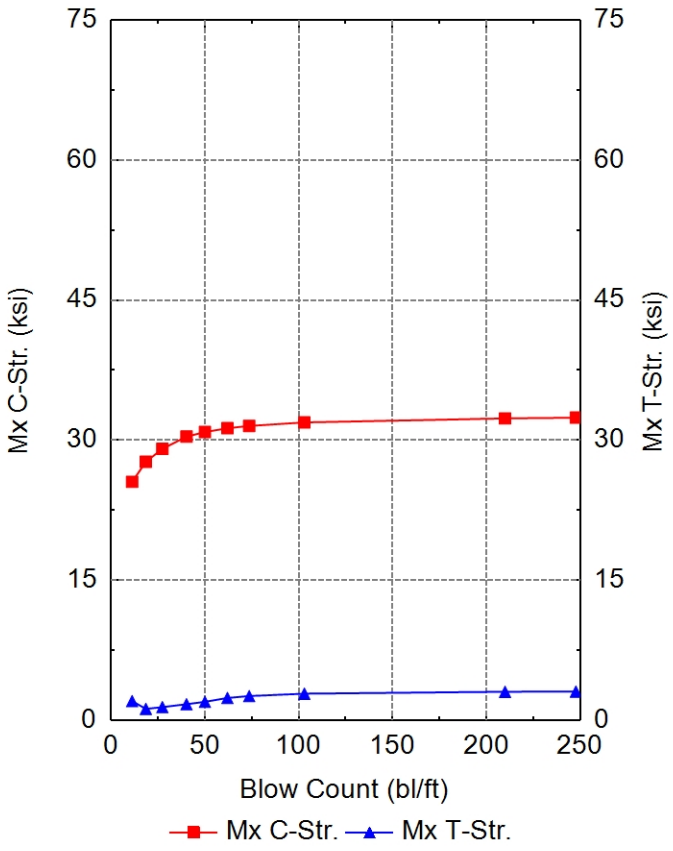
Resistance Factors for Extreme Limit States: $serv\_ext := 1$

From Article 10.5.5.1 and 10.5.5.3

Abutments: $R_{ndr1\_serv\_ext} := R_{ndr1} \cdot serv\_ext$

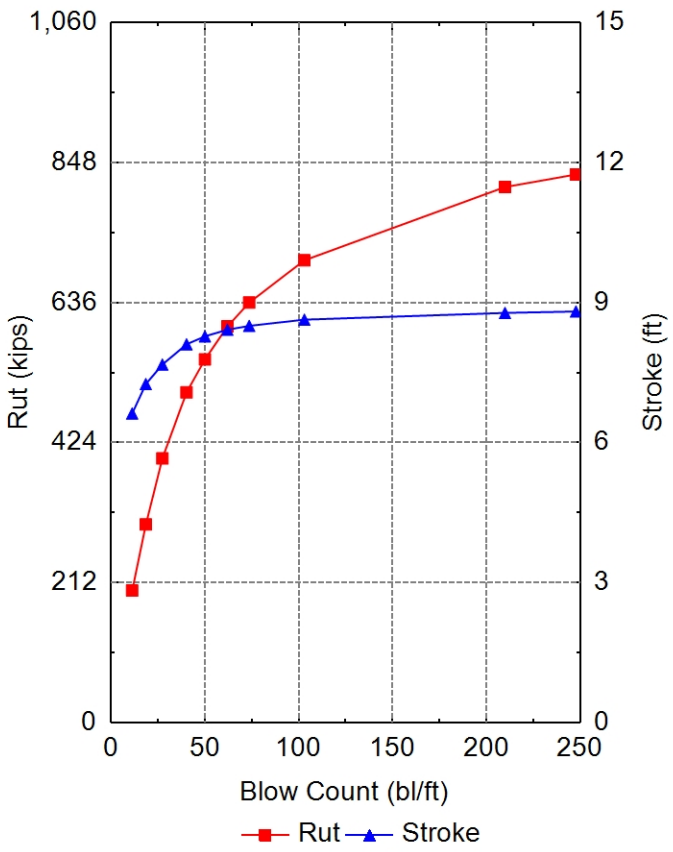
$R_{ndr1\_serv\_ext} = 549 \cdot kip$

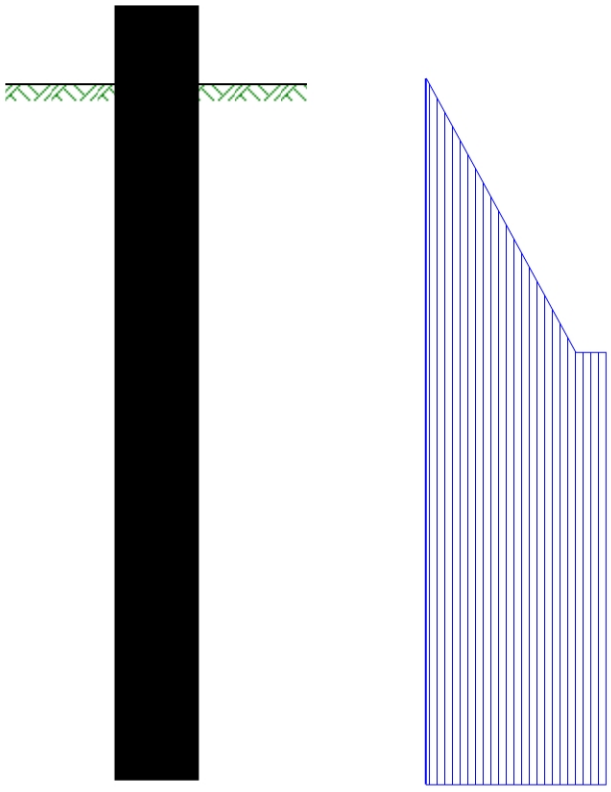
Since the driving stresses do not exceed the limiting driving stress of 45 ksi for ASTM A572 steel (50 ksi yield stress), and the calculated penetration resistance for the abutment piles is within the MaineDOT preferred range of 4 to 15 blows per inch, the analyzed hammer system is judged acceptable to install the piles to the required nominal resistances. The selected hammer system is large enough for the all abutment piles.



APE D 30-42

Ram Weight	6.62	kips
Efficiency	0.800	
Pressure	1425.0 (100%)	psi
Helmet Weight	3.500	kips
Hammer Cushion	115396.1	kips/in
COR of H.C.	0.800	
Skin Quake	0.100	in
Toe Quake	0.100	in
Skin Damping	0.050	s/ft
Toe Damping	0.150	s/ft
Pile Length	100.00	ft
Pile Penetration	90.00	ft
Pile Top Area	26.10	in²
RSA	No	



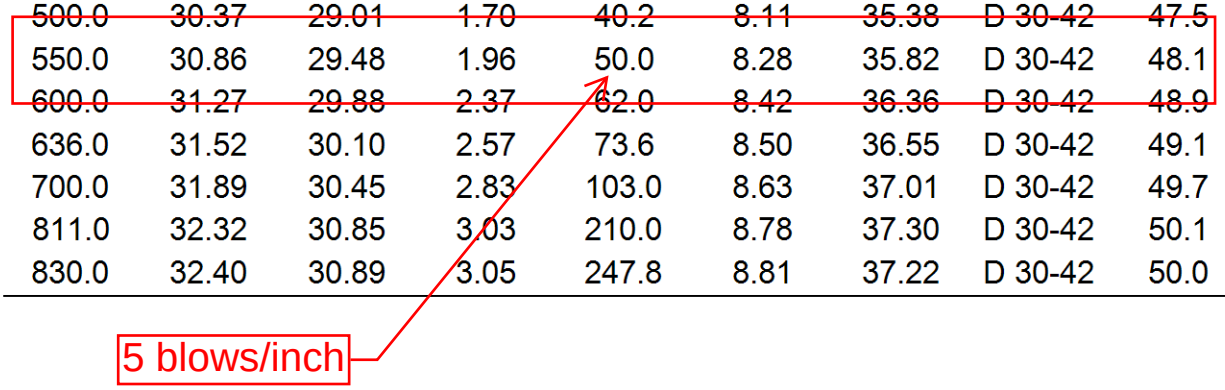


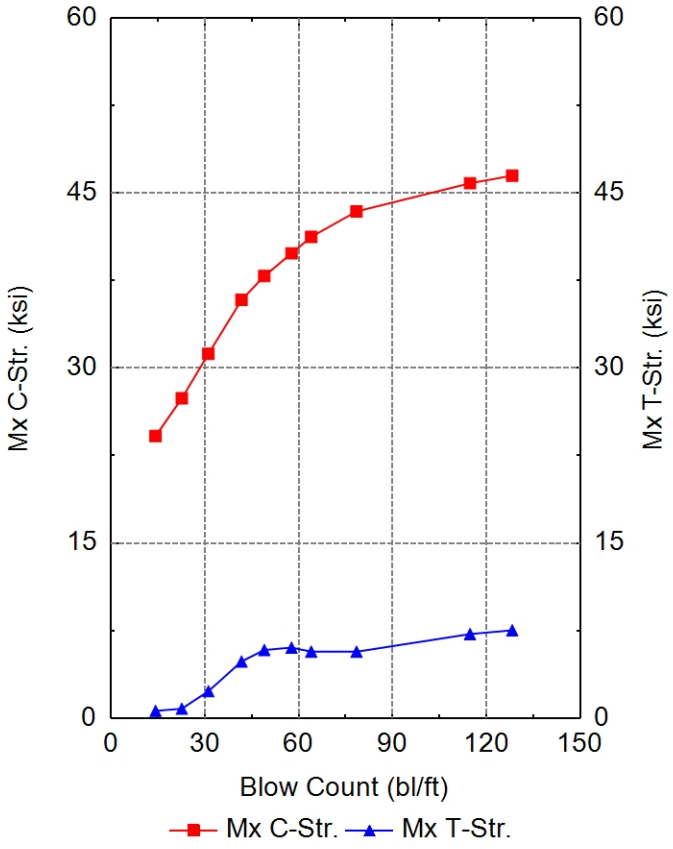
Pile Model

Shaft=50% (Prop.)

Bearing Graph Summary — APE D 30-42

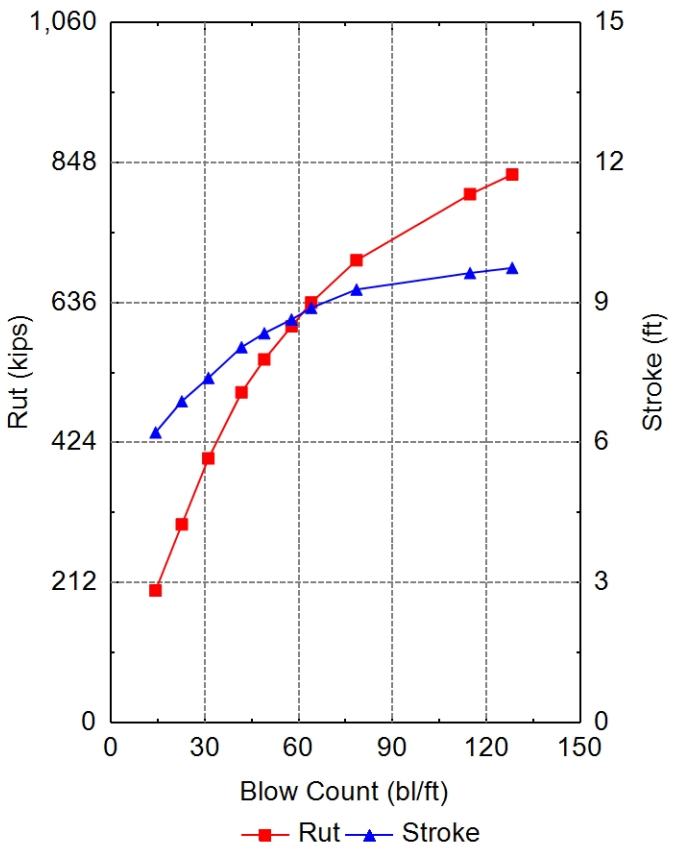
Rut	Mx C-Str.	Top Str.	Mx T-Str.	Blow Ct	Stroke	ENTHRU	Ham.	Pow. Trfr. R.
kips	ksi	ksi	ksi	bl/ft	ft	kip-ft	APE	%
200.0	25.52	24.42	2.04	11.2	6.62	33.76	D 30-42	45.4
300.0	27.68	26.46	1.20	18.5	7.26	33.21	D 30-42	44.6
400.0	29.06	27.78	1.39	27.3	7.67	33.98	D 30-42	45.7
500.0	30.37	29.01	1.70	40.2	8.11	35.38	D 30-42	47.5
550.0	30.86	29.48	1.96	50.0	8.28	35.82	D 30-42	48.1
600.0	31.27	29.88	2.37	62.0	8.42	36.36	D 30-42	48.9
636.0	31.52	30.10	2.57	73.6	8.50	36.55	D 30-42	49.1
700.0	31.89	30.45	2.83	103.0	8.63	37.01	D 30-42	49.7
811.0	32.32	30.85	3.03	210.0	8.78	37.30	D 30-42	50.1
830.0	32.40	30.89	3.05	247.8	8.81	37.22	D 30-42	50.0

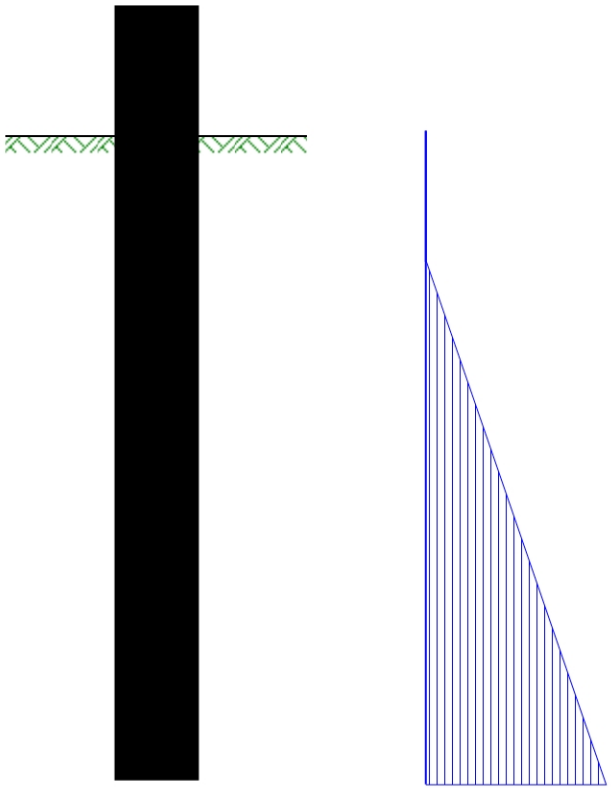




APE D 30-42

Ram Weight	6.62	kips
Efficiency	0.800	
Pressure	1282.0 (90%)	psi
Helmet Weight	3.500	kips
Hammer Cushion	115396.1	kips/in
COR of H.C.	0.800	
Skin Quake	0.100	in
Toe Quake	0.040	in
Skin Damping	0.050	s/ft
Toe Damping	0.150	s/ft
Pile Length	60.00	ft
Pile Penetration	50.00	ft
Pile Top Area	26.10	in²
RSA	No	





Pile Model

Shaft=20%
(Prop.)

Bearing Graph Summary — APE D 30-42

Rut	Mx C-Str.	Top Str.	Mx T-Str.	Blow Ct	Stroke	ENTHRU	Ham.	Pow. Trfr. R.
kips	ksi	ksi	ksi	bl/ft	ft	kip-ft	APE	%
200.0	24.17	22.97	0.62	14.2	6.22	28.05	D 30-42	37.7
300.0	27.41	24.97	0.80	22.6	6.88	28.11	D 30-42	37.8
400.0	31.22	26.38	2.30	31.1	7.39	29.33	D 30-42	39.4
500.0	35.84	28.09	4.86	41.7	8.04	31.58	D 30-42	42.4
550.0	37.89	29.68	5.83	49.0	8.35	32.57	D 30-42	43.8
600.0	39.83	32.28	6.04	57.7	8.64	33.73	D 30-42	45.3
636.0	41.25	34.07	5.70	64.0	8.89	34.87	D 30-42	46.9
700.0	43.43	36.95	5.69	78.5	9.28	36.51	D 30-42	49.1
800.0	45.84	40.49	7.20	114.8	9.63	38.14	D 30-42	51.2
830.0	46.49	41.45	7.53	128.3	9.74	38.56	D 30-42	51.8

5 blows/inch

Frost

March 2014

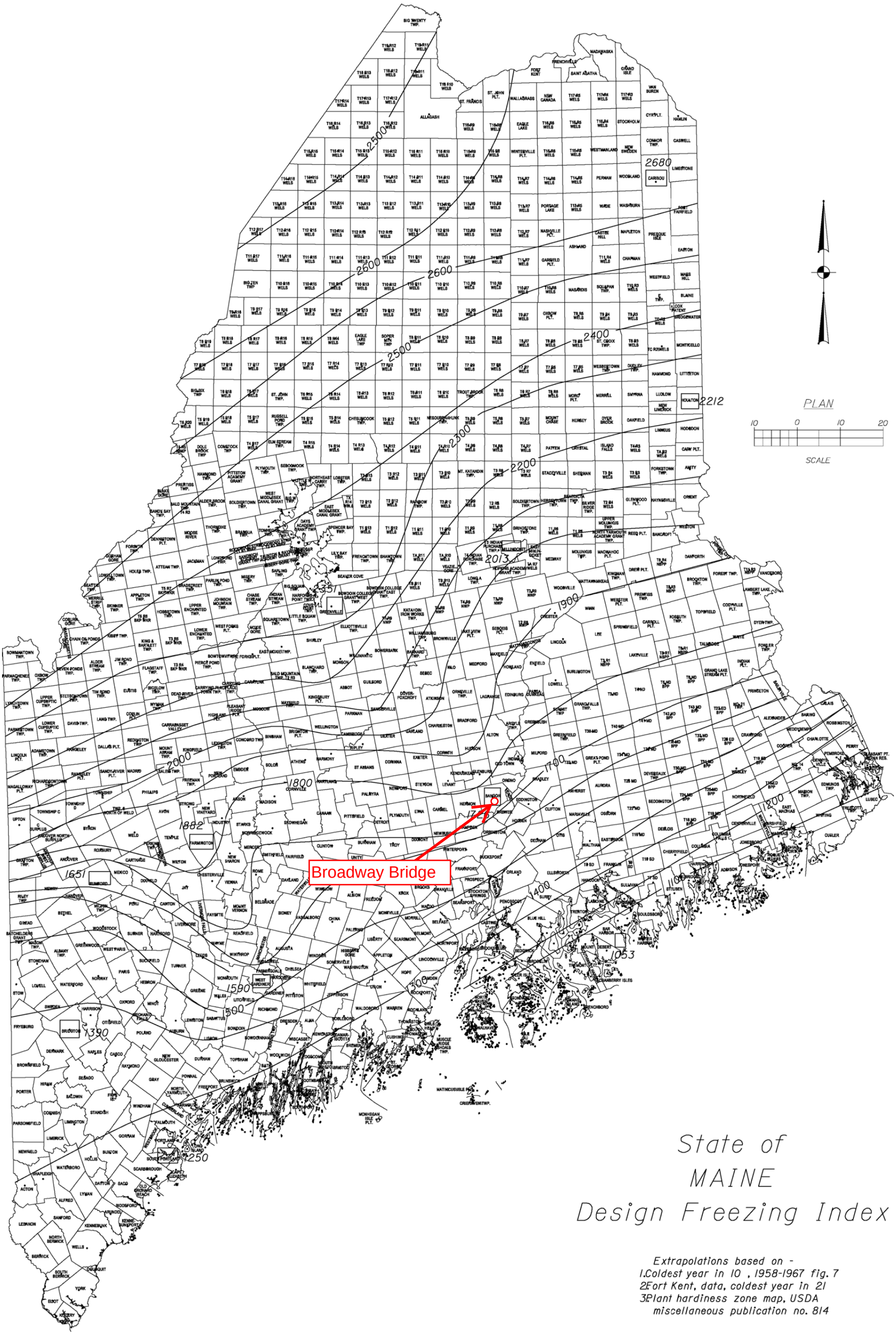


Figure 5-1 Maine Design Freezing Index Map

Table 5-1 Depth of Frost Penetration

Design Freezing Index	Frost Penetration (in)					
	Coarse Grained			Fine Grained		
	w=10%	w=20%	w=30%	w=10%	w=20%	w=30%
1000	66.3	55.0	47.5	47.1	40.7	36.9
1100	69.8	57.8	49.8	49.6	42.7	38.7
1200	73.1	60.4	52.0	51.9	44.7	40.5
1300	76.3	63.0	54.3	54.2	46.6	42.2
1400	79.2	65.5	56.4	56.3	48.5	43.9
1500	82.1	67.9	58.4	58.3	50.2	45.4
1600	84.8	70.2	60.3	60.2	51.9	46.9
1700	87.5	72.4	62.2	62.2	53.5	48.4
1800	90.1	74.5	64.0	64.0	55.1	49.8
1900	92.6	76.6	65.7	65.8	56.7	51.1
2000	95.1	78.7	67.5	67.6	58.2	52.5
2100	97.6	80.7	69.2	69.3	59.7	53.8
2200	100.0	82.6	70.9	70.0	61.1	55.1
2300	102.3	84.5	72.4	72.7	62.5	56.4
2400	104.6	86.4	74.0	74.3	63.9	57.6
2500	106.9	88.2	75.6	75.9	65.2	58.8
2600	109.1	89.9	77.1	77.5	66.5	60.0

1730

6.1' for Abutment fill

Notes: 1. w = water content
2. Where the Freezing Index and/or water content is between the presented values, linear interpretation may be used to determine the frost penetration.

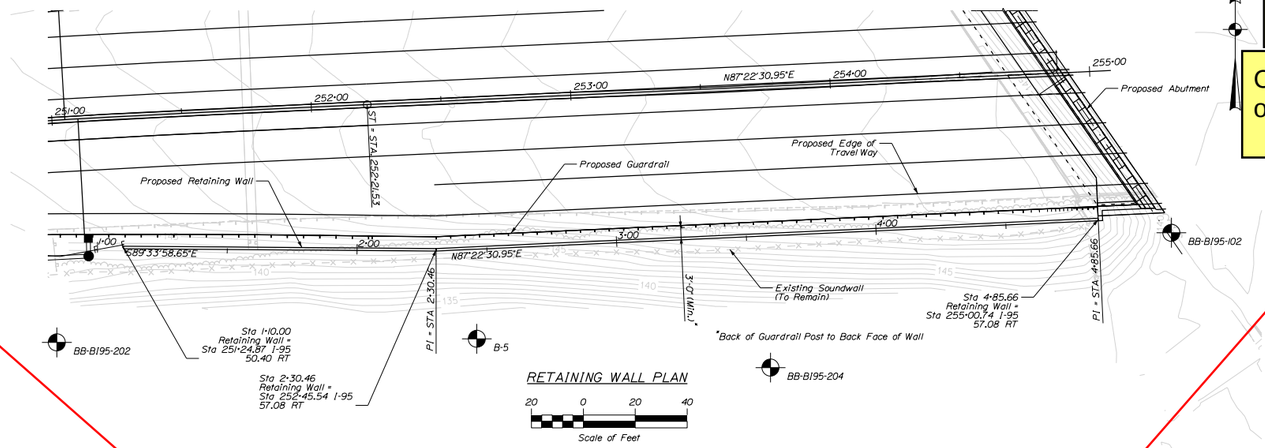
Abutments: Marine clay deposit soils are anticipated to be present near the elevation of the abutments, but granular fill is anticipated to be placed adjacent to the abutments. The granular material controls, therefore material is coarse-grained with water contents of approximately 20%. Based on the MaineDOT BDG, Section 5.2.1 and a Freezing Index of 1730 the estimated depth of frost penetration is 6.1 feet.

Permanent
Retaining Wall

Retaining wall evaluations

FRP Sheetpile Requirements
S = 30 in^3/ft
Mult = 74,165 ft-lb / ft
FS = 2.5
Mall = 29,666 ft-lb / ft

Creative Composites Series 1432
or CMI UC-75



1+65 to 3+50, base on 2+50
Tip el = GS-L = 152-29 = 123,
use 122 min tip penetration

Maximum	d (ft)
○ 445.8 psf	7.55
□ 28443.0 ftlb/ft	16.70
● 5.4 in	0.00

3+50 to 4+65 base on 3+50
use 122 min tip penetration

Maximum	d (ft)
○ 367.2 psf	5.04
□ 11188.0 ftlb/ft	13.53
● 1.8 in	0.00

4+65 to end base on 4+85
use 122 min tip penetration

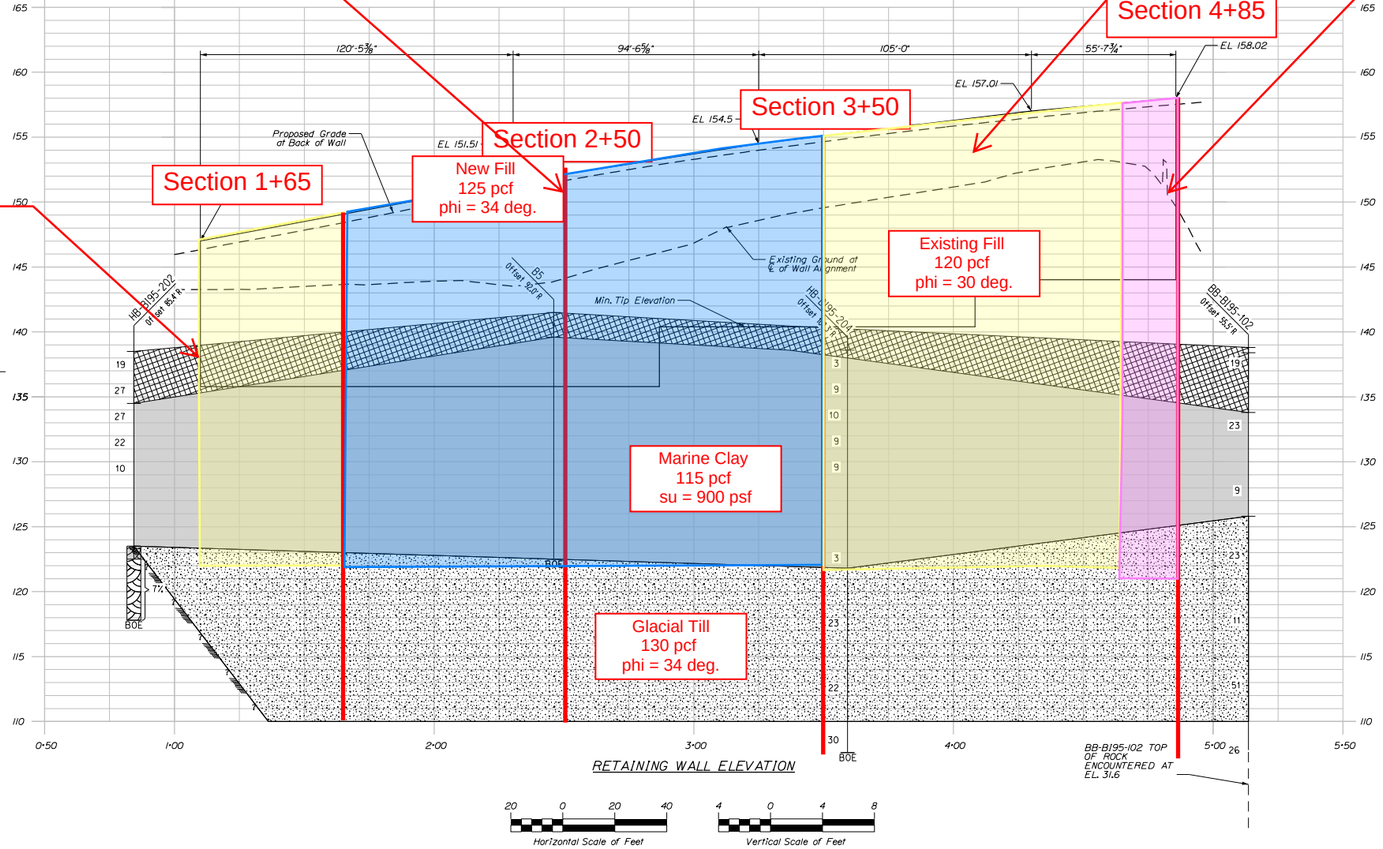
Maximum	d (ft)
○ 457.0 psf	8.05
□ 26782.9 ftlb/ft	18.71
● 8.1 in	0.00

This end will be restrained at the abutment - likely less than 8-in deflection estimated in analysis

end to 1+65, base on 1+65
Tip el = 148-20 = 128, for practicality min tip elevation at top of glacial till EL. 122.

Maximum	d (ft)
○ 371.3 psf	5.00
□ 10356.9 ftlb/ft	11.54
● 1.0 in	0.00

Section 1+65
Section 2+50
Section 3+50
Section 4+85



BB-B195-102 TOP OF ROCK ENCOUNTERED AT EL. 31.6

Wall Station / Existing Ground Slope in Front of Wall
1+10/2.9:1
1+35/2.6:1
1+60/2.4:1
1+85/2.1:1
2+10/2.0:1
2+35/1.8:1
2+60/2.0:1
2+85/2.1:1
3+10/2.0:1
3+35/2.8:1
3+60/2.9:1
3+85/2.7:1
4+10/3.8:1
4+35/4.2:1
4+60/3.7:1
4+85/Level:1

(From McFarland Johnson)

PREPARED BY:

GZA

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
022276.01
WIN 22276.01
BRIDGE PLANS
Bridge No. 5789

SIGNATURE
P.E. NUMBER
DATE

BY	DATE
PROJ. MANAGER	
M. Johnescu	--
DESIGN-DETAILED	B. Cardoli
C. Snow	--
CHECKED-REVIEWED	A. Blasdell
DESIGN2-DETAILED2	
DESIGN3-DETAILED3	
REVISIONS 1	
REVISIONS 2	
REVISIONS 3	
REVISIONS 4	
FIELD CHANGES	

I-95\BROADWAY BRIDGE
STATE ROUTE 15 (BROADWAY)
BANGOR, ME PENOBSCOT COUNTY

RETAINING WALL ISP

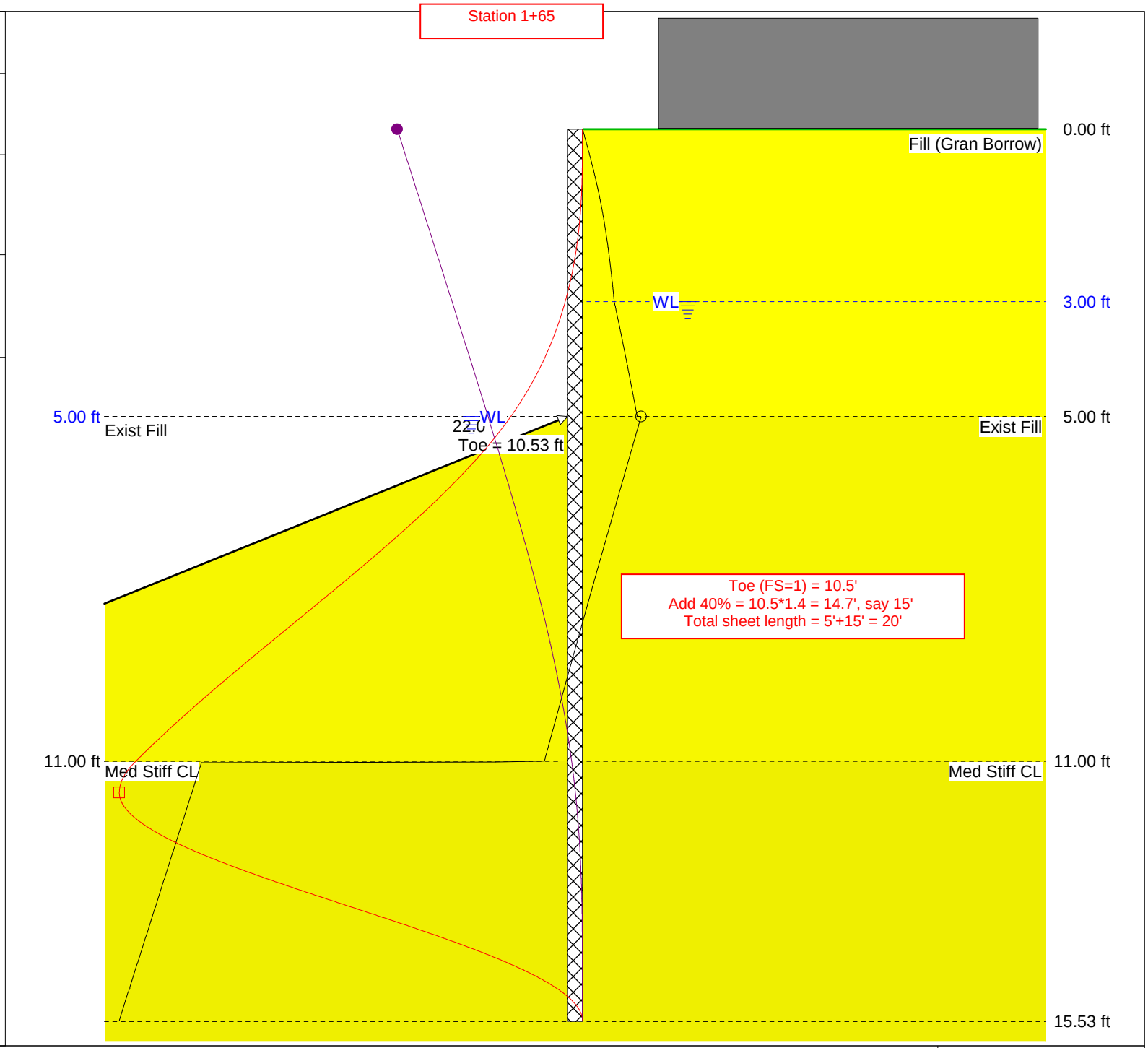
Division: Bridge
Filename: ...\z_Retaining_Wall.dgn
Date:11/28/2022
Username: BMC

Client: I-95 over Broadway East
Retaining Wall
Site: Bangor

Title: Station 1+65 Ret.Wall
Designer: B.Cardali
Page: 1
Date: 12.7.22

Sheet: Creative Composite Series 1432
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure
Toe: Cantilever

Maximum	d (ft)
○ 371.3 psf	5.00
□ 10356.9 ftlb/ft	11.54
● 1.0 in	0.00



GZA GeoEnvironmental, Inc.

707 Sable Oaks Drive
South Portland, Maine

SupportIT, v2.39

Tel/Fax: +44 (0)1292 477754
Email: GTSoftLtd@aol.com
Web: www.GTSoft.org

Client: I-95 over Broadway East Retaining Wall
Site: Bangor

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Designer: B.Cardali
Page: 2
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Input Data

Depth Of Excavation = 5.00ft
Surcharge = 0.0psf

Depth Of Active Water = 3.00ft
Depth Of Passive Water = 5.00ft
Slope (passive) = 22.0degrees

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile — Active Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Fill (Gran Borrow)	125.00	62.60	0.0	0.0	34.0	0.0	0.28	0.00	3.54	0.00
5.00	Exist Fill	120.00	57.60	0.0	0.0	30.0	0.0	0.33	0.00	3.00	0.00
11.00	Med Stiff CL	115.00	52.60	900.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
32.00	Glacial Till	115.82	68.73	0.0	0.0	36.0	0.0	0.26	0.00	3.85	0.00

Soil Profile — Passive Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Fill (Gran Borrow)	125.00	62.60	0.0	0.0	34.0	0.0	0.35	0.00	2.43	0.00
5.00	Exist Fill	120.00	57.60	0.0	0.0	30.0	0.0	0.44	0.00	1.96	0.00
11.00	Med Stiff CL	115.00	52.60	900.0	0.0	0.0	0.0	0.99	1.99	1.01	2.01
24.00	Glacial Till	115.82	68.73	0.0	0.0	36.0	0.0	0.32	0.00	2.70	0.00

Surcharges

Position (ft)	Width (ft)	Length (ft)	Depth (ft)	Magnitude	Type
2.00	10.00		0.00	250.0psf	Strip

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
Creative Composite Series 1432	4.66E+06	240.50	62960.0	30.50	74165.0	32.00	8.28	18.0	0.00	10.53	15.53

Pressure Model: Rankine; Assume full hydrostatic pressure to 5.00ft in cohesive soils on active side

Maxima

	Maximum	Depth (ft)
Pressure	371.3 psf	5.00
Bending Moment	10356.9 ftlb/ft	11.54
Deflection	1.0 in	0.00
Shear Force	1570.5 lb/ft	8.58

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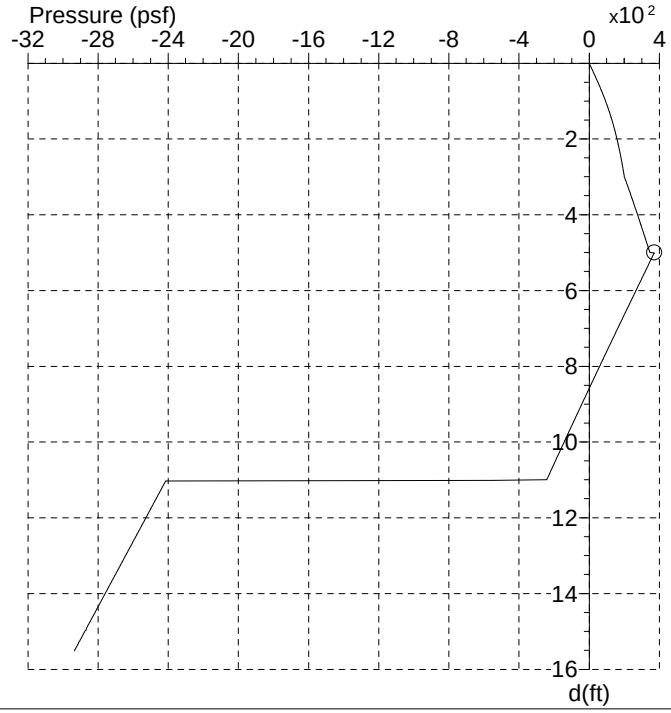
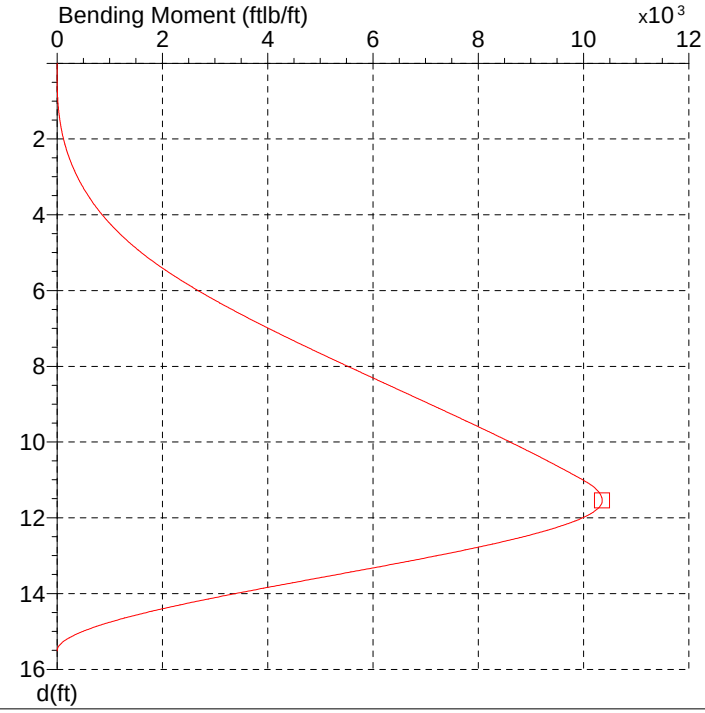
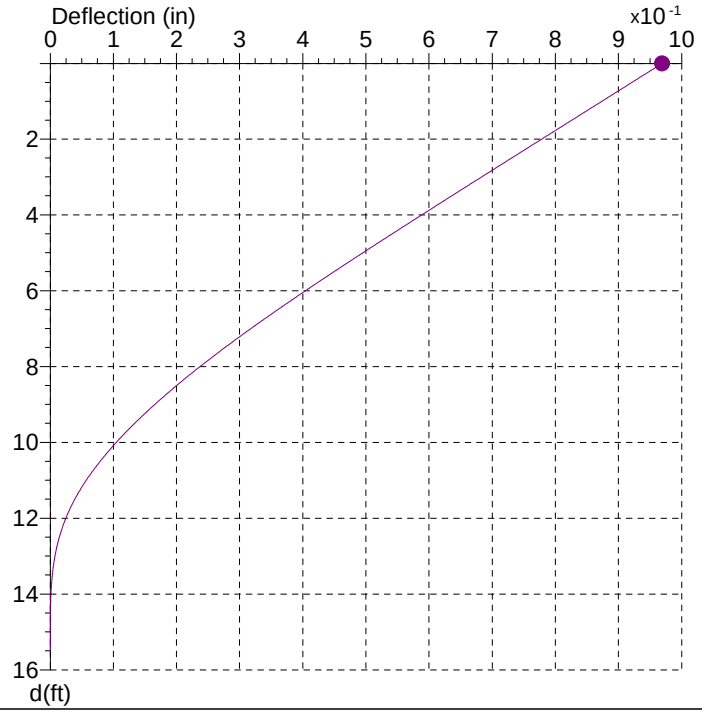
Page: 3
Date: 12.7.22

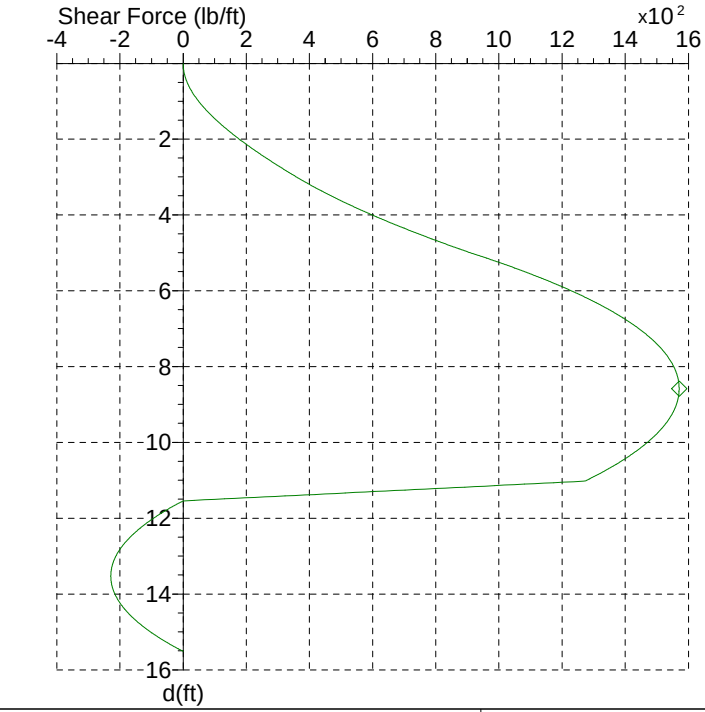
Sheet: Creative Composite Series 1432
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure
Toe: Cantilever

Maximum	d (ft)
○ 371.3 psf	5.00
□ 10356.9 ftlb/ft	11.54
◇ 1570.5 lb/ft	8.58
● 1.0 in	0.00









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Toe: Cantilever

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	0.0	0.0	1.0	0.0
0.11	10.5	0.0	1.0	0.6
0.21	20.9	0.1	0.9	2.3
0.32	32.5	0.6	0.9	5.5
0.43	42.6	1.3	0.9	9.4
0.53	52.5	2.5	0.9	14.4
0.64	62.1	4.3	0.9	20.4
0.74	72.6	7.0	0.9	28.3
0.85	81.6	10.3	0.9	36.4
0.96	90.2	14.5	0.9	45.3
1.06	98.5	19.6	0.9	55.1
1.17	106.4	25.8	0.9	65.8
1.28	115.0	34.1	0.8	78.8
1.38	122.2	42.7	0.8	91.1
1.49	129.1	52.7	0.8	104.1
1.60	135.6	64.1	0.8	117.9
1.70	142.6	78.7	0.8	134.1
1.81	148.5	93.2	0.8	149.2
1.91	154.2	109.3	0.8	164.9
2.02	159.6	127.1	0.8	181.2
2.13	164.7	146.6	0.8	198.0
2.23	170.2	170.6	0.8	217.6
2.34	174.9	193.9	0.7	235.5
2.45	179.4	219.0	0.7	253.9
2.55	183.7	246.1	0.7	272.7
2.66	187.8	275.1	0.7	291.9
2.77	192.3	310.2	0.7	314.1
2.87	196.1	343.6	0.7	334.2
2.98	199.8	379.0	0.7	354.7
3.08	206.8	416.6	0.7	375.8
3.19	215.9	461.6	0.7	400.5
3.30	223.9	504.0	0.7	423.3
3.40	231.8	548.8	0.6	446.9
3.51	239.6	596.0	0.6	471.4
3.62	247.4	645.9	0.6	496.6
3.72	256.0	705.1	0.6	526.0
3.83	263.6	760.7	0.6	552.9
3.94	271.1	819.0	0.6	580.7
4.04	278.6	880.3	0.6	609.2
4.15	287.0	952.8	0.6	642.1
4.25	294.3	1020.5	0.6	672.3
4.36	301.7	1091.4	0.6	703.2
4.47	309.0	1165.4	0.5	734.8
4.57	316.3	1242.8	0.5	767.2
4.68	324.5	1333.9	0.5	804.6
4.79	331.7	1418.6	0.5	838.6
4.89	339.0	1506.8	0.5	873.4
5.00	346.3	1598.6	0.5	908.9
5.10	359.6	1706.5	0.5	951.4
5.21	348.8	1806.5	0.5	988.0
5.32	338.0	1910.2	0.5	1023.5
5.42	327.2	2017.5	0.5	1057.9
5.53	316.4	2128.3	0.4	1091.1
5.64	304.2	2257.0	0.4	1127.2
5.74	293.4	2374.8	0.4	1158.0
5.85	282.6	2495.8	0.4	1187.8
5.96	271.7	2619.9	0.4	1216.4
6.06	260.9	2746.8	0.4	1243.9
6.17	248.8	2892.9	0.4	1273.5
6.27	238.0	3025.6	0.4	1298.6
6.38	227.2	3160.9	0.4	1322.6
6.49	216.4	3298.6	0.4	1345.5
6.59	204.3	3456.3	0.4	1369.9
6.70	193.5	3598.7	0.3	1390.4
6.81	182.7	3743.3	0.3	1409.8
6.91	172.0	3889.8	0.3	1428.1
7.02	161.3	4038.1	0.3	1445.3
7.13	149.2	4207.1	0.3	1463.3
7.23	138.5	4358.9	0.3	1478.1
7.34	127.8	4512.3	0.3	1491.8
7.44	117.1	4667.0	0.3	1504.5
7.55	105.1	4842.5	0.3	1517.3
7.66	94.4	4999.8	0.3	1527.6
7.76	83.8	5158.0	0.3	1536.7
7.87	73.2	5317.2	0.2	1544.8
7.98	62.6	5477.1	0.2	1551.7
8.08	50.6	5657.8	0.2	1558.3
8.19	40.0	5819.0	0.2	1562.9
8.30	29.5	5980.7	0.2	1566.4
8.40	18.9	6142.6	0.2	1568.8
8.51	7.0	6325.1	0.2	1570.3
8.61	-3.5	6487.3	0.2	1570.4
8.72	-14.0	6649.6	0.2	1569.6
8.83	-24.5	6811.7	0.2	1567.7
8.93	-35.0	6973.5	0.2	1564.7
9.04	-46.8	7155.1	0.2	1560.0
9.15	-57.2	7316.1	0.2	1554.7
9.25	-67.7	7476.4	0.1	1548.3
9.36	-78.1	7636.1	0.1	1540.8
9.47	-89.8	7814.7	0.1	1531.1
9.57	-100.3	7972.4	0.1	1521.3
9.68	-110.7	8129.1	0.1	1510.5
9.78	-121.0	8284.6	0.1	1498.5
9.89	-131.4	8438.9	0.1	1485.5
10.00	-143.1	8610.7	0.1	1469.6
10.10	-153.4	8761.9	0.1	1454.3
10.21	-163.7	8911.4	0.1	1438.0
10.32	-174.1	9059.2	0.1	1420.6
10.42	-184.4	9205.2	0.1	1402.1
10.53	-196.0	9367.0	0.1	1380.0
10.64	-206.2	9508.7	0.1	1359.3
10.74	-216.5	9648.1	0.1	1337.5
10.85	-226.8	9785.3	0.1	1314.6
10.95	-238.3	9936.7	0.1	1287.6
11.06	-2419.1	10067.4	0.1	1174.2
11.17	-2431.1	10177.4	0.1	923.3
11.27	-2443.1	10261.4	0.0	671.1
11.38	-2455.1	10319.2	0.0	417.6
11.49	-2468.6	10353.0	0.0	131.0
11.59	-2480.7	10352.9	0.0	-11.8
11.70	-2492.7	10314.4	0.0	-34.4
11.81	-2504.7	10236.9	0.0	-55.8
11.91	-2518.2	10105.7	0.0	-78.4
12.02	-2530.2	9952.5	0.0	-97.1
12.12	-2542.2	9767.1	0.0	-114.6
12.23	-2554.3	9551.8	0.0	-130.8
12.34	-2566.3	9308.7	0.0	-145.8
12.44	-2579.8	9004.7	0.0	-161.2
12.55	-2591.8	8709.9	0.0	-173.6
12.66	-2603.8	8394.2	0.0	-184.7
12.76	-2615.9	8059.8	0.0	-194.6
12.87	-2629.4	7664.0	0.0	-204.2
12.97	-2641.4	7297.2	0.0	-211.4
13.08	-2653.4	6918.5	0.0	-217.4
13.19	-2665.4	6530.3	0.0	-222.2
13.29	-2677.5	6134.6	0.0	-225.7
13.40	-2691.0	5683.3	0.0	-228.1
13.51	-2703.0	5279.2	0.0	-229.0
13.61	-2715.0	4874.5	0.0	-228.6
13.72	-2727.0	4471.5	0.0	-226.9
13.83	-2739.1	4072.3	0.0	-224.1
13.93	-2752.6	3630.5	0.0	-219.3
14.04	-2764.6	3246.9	0.0	-213.8
14.14	-2776.6	2873.9	0.0	-207.0
14.25	-2788.6	2513.9	0.0	-199.0
14.36	-2802.2	2127.0	0.0	-188.5
14.46	-2814.2	1801.8	0.0	-177.9
14.57	-2826.2	1496.3	0.0	-166.0
14.68	-2838.2	1212.9	0.0	-152.8
14.78	-2850.2	953.7	0.0	-138.4
14.89	-2863.8	693.7	0.0	-120.8
15.00	-2875.8	493.1	0.0	-103.8
15.10	-2887.8	323.5	0.0	-85.5
15.21	-2899.8	187.2	0.0	-66.0
15.31	-2913.3	76.4	0.0	-42.6
15.42	-2925.4	18.1	0.0	-20.4
15.53	-2934.4	0.0	0.0	0.0

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Page: 5
Date: 12.7.22

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Works: Temporary
Pressure: Rankine
Analysis: Net Pressure
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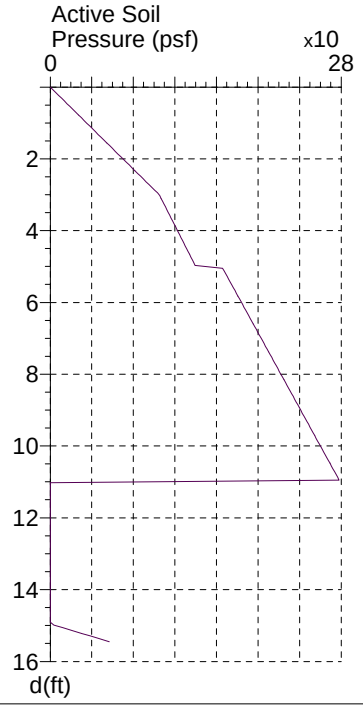

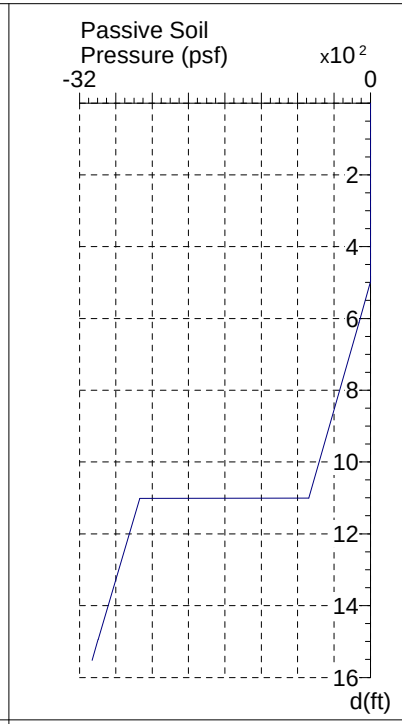

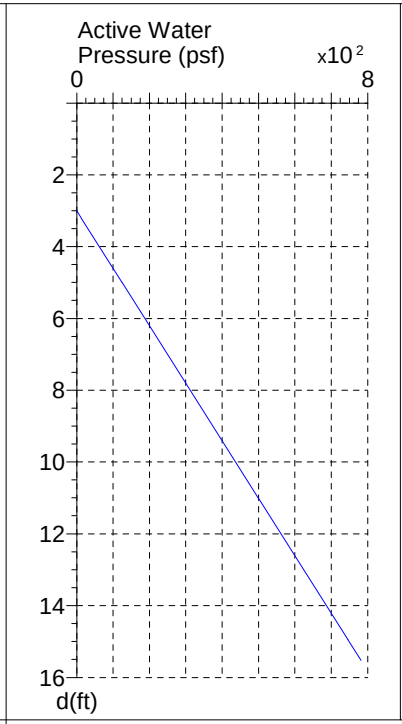

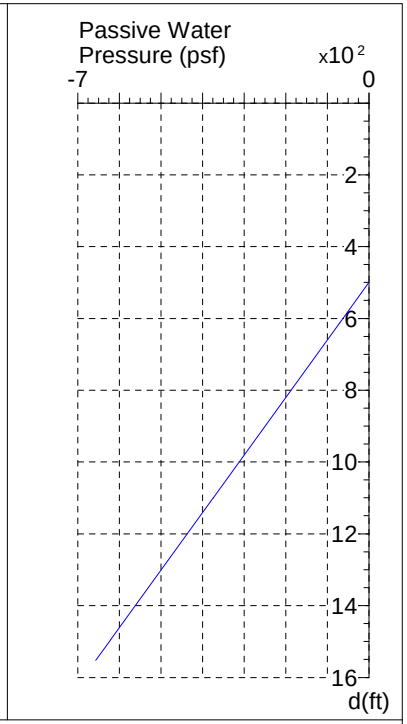

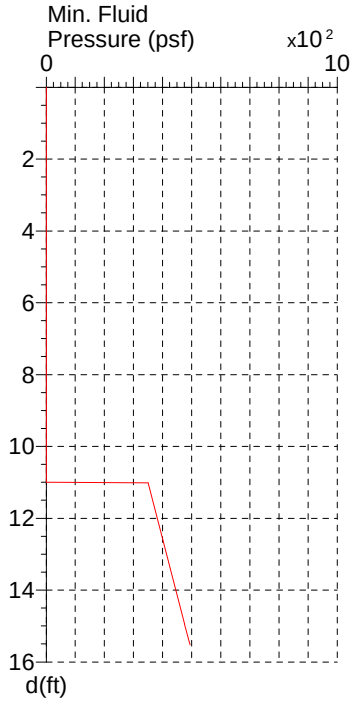

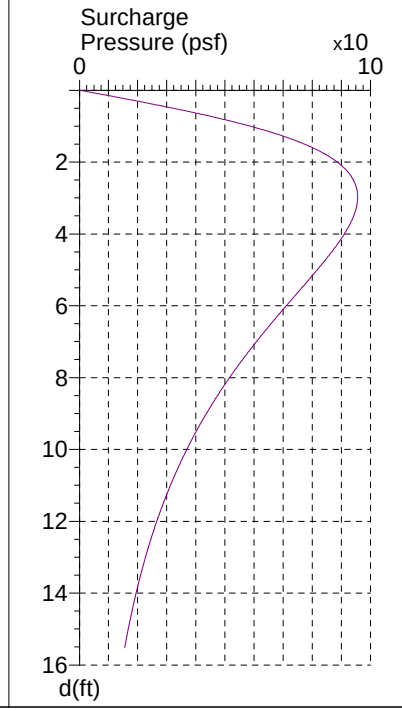

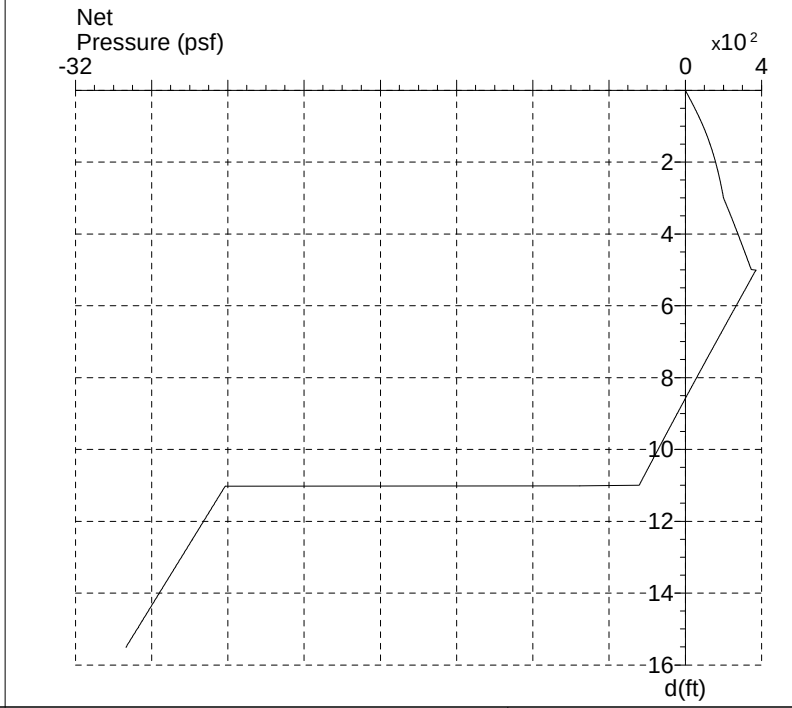

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Page: 7
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Sheet: Creative Composite Series 1432
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure
Toe: Cantilever

Design Report

1. The standard surcharge is 0.0psf. The Piling Handbook recommends a minimum surcharge of 200.0psf. Other surcharges have been defined, but ensure that this is sufficient.

2. Hydrostatic pressure is switched ON in passive side cohesive soils below excavation depth. This can be switched OFF in the 'Pressure' page. A greater toe, or 'no solution' may result.

3. Total stress values are being used (i.e. C > 0). Note that the Piling Handbook and CIRIA SP95 recommend that effective stress values be used in 'long term' excavations.

4. Maximum bending moment = 10356.9ftlb/ft and f = 62960.0psi. MINIMUM required sheet section modulus is: Z = 1.97in³/ft (= M/f). Sheet section modulus in this design is Z = 30.50in³/ft, and is satisfactory.

5. FOS = 1.00 (Net Pressure)
   This is the factor of safety against rotation about the toe.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

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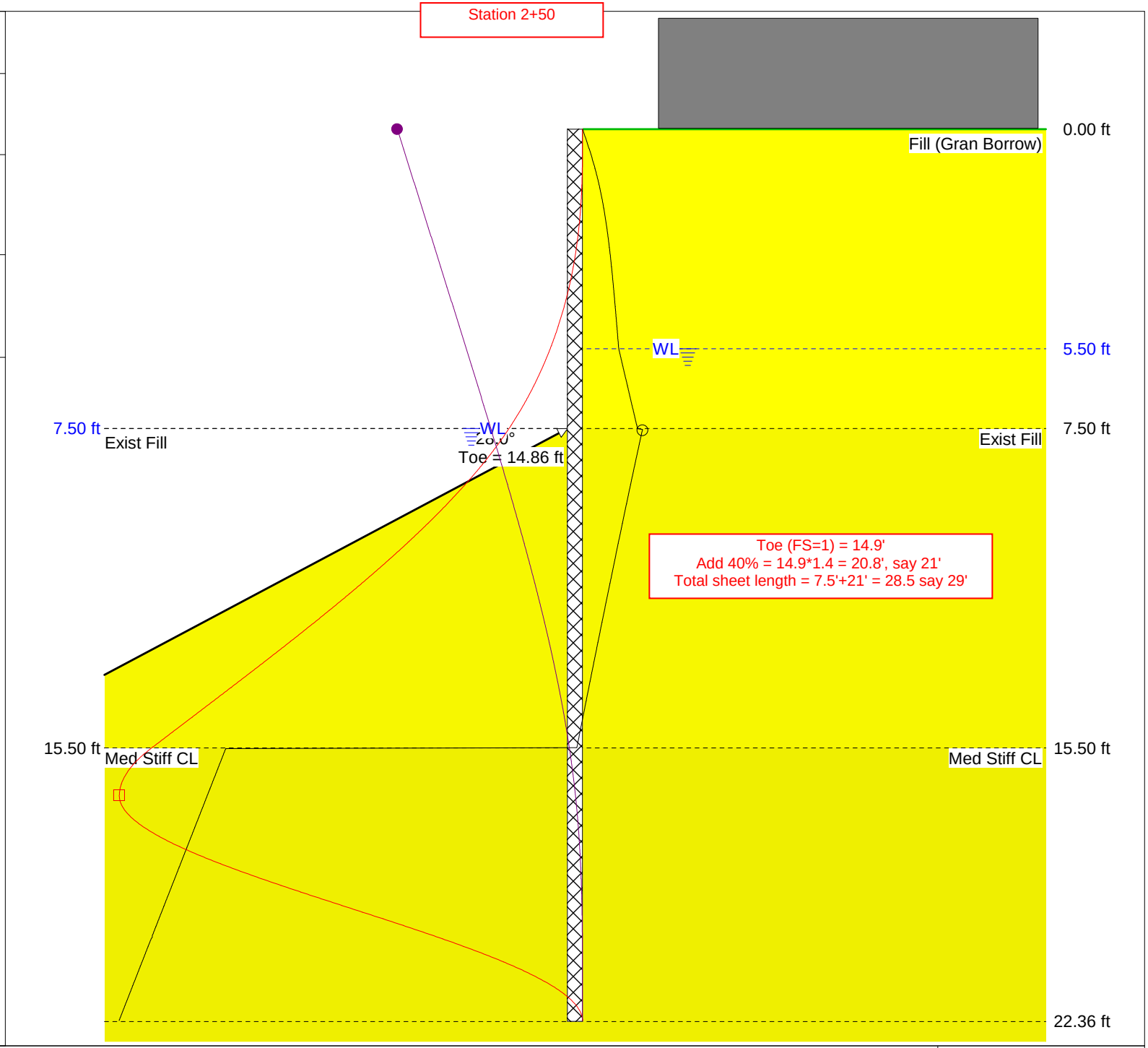
Retaining Wall
Site: Bangor

Title: Station 2+50 Ret.Wall
Designer: B.Cardali
Page: 1
Date: 11.16.22

Sheet: Creative Composite Series 1432
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure
Toe: Cantilever

Maximum	d (ft)
○ 445.8 psf	7.55
□ 28443.0 ftlb/ft	16.70
● 5.4 in	0.00



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Title: Station 2+50 Ret.Wall
Designer: B.Cardali
Page: 2
Date: 11.16.22

Sheet: Creative Composite Series 1432
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure
Toe: Cantilever

Input Data

Depth Of Excavation = 7.50ft
Surcharge = 0.0psf

Depth Of Active Water = 5.50ft
Depth Of Passive Water = 7.50ft
Slope (passive) = 28.0degrees

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile — Active Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Fill (Gran Borrow)	125.00	62.60	0.0	0.0	34.0	0.0	0.28	0.00	3.54	0.00
7.50	Exist Fill	120.00	57.60	0.0	0.0	30.0	0.0	0.33	0.00	3.00	0.00
15.50	Med Stiff CL	115.00	52.60	900.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
29.50	Glacial Till	115.82	68.73	0.0	0.0	36.0	0.0	0.26	0.00	3.85	0.00

Soil Profile — Passive Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Fill (Gran Borrow)	125.00	62.60	0.0	0.0	34.0	0.0	0.43	0.00	1.81	0.00
7.50	Exist Fill	120.00	57.60	0.0	0.0	30.0	0.0	0.59	0.00	1.31	0.00
15.50	Med Stiff CL	115.00	52.60	900.0	0.0	0.0	0.0	0.99	1.99	1.01	2.01
29.50	Glacial Till	115.82	68.73	0.0	0.0	36.0	0.0	0.38	0.00	2.06	0.00

Surcharges

Position (ft)	Width (ft)	Length (ft)	Depth (ft)	Magnitude	Type
2.00	10.00		0.00	250.0psf	Strip

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
Creative Composite Series 1432	4.66E+06	240.50	62960.0	30.50	74165.0	32.00	8.28	18.0	0.00	14.86	22.36

Pressure Model: Rankine; Assume full hydrostatic pressure to 7.50ft in cohesive soils on active side

Maxima

	Maximum	Depth (ft)
Pressure	445.8 psf	7.55
Bending Moment	28443.0 ftlb/ft	16.70
Deflection	5.4 in	0.00
Shear Force	3229.5 lb/ft	14.78

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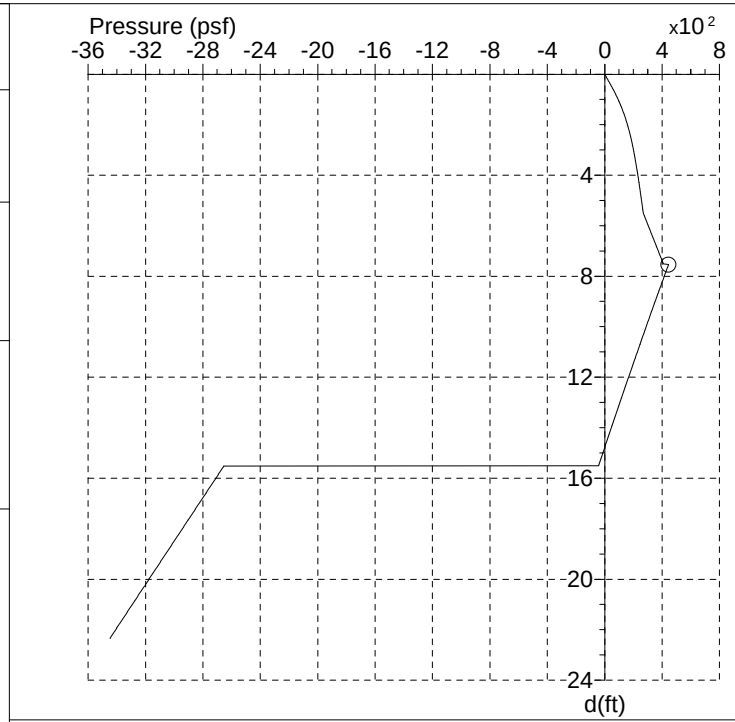
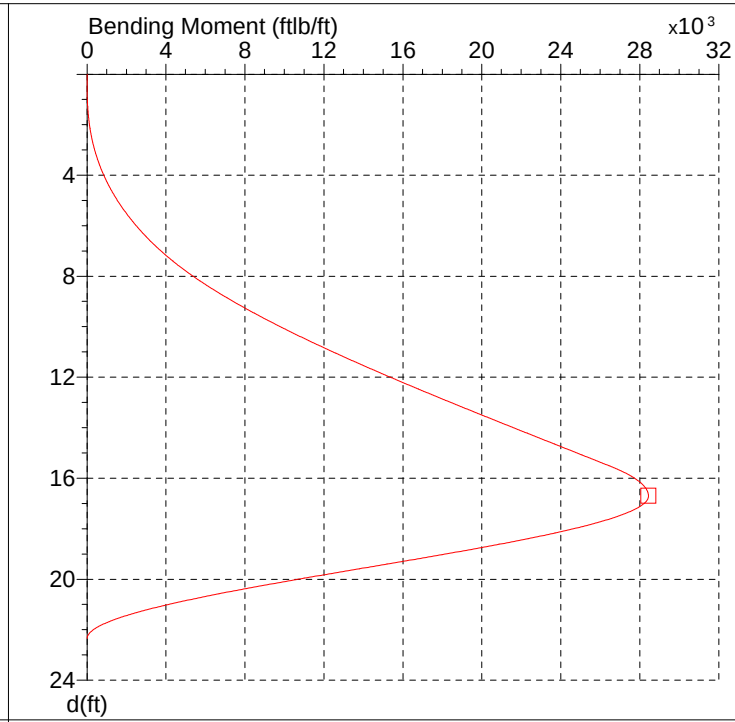
Client: I-95 over Broadway East Retaining Wall
Site: Bangor

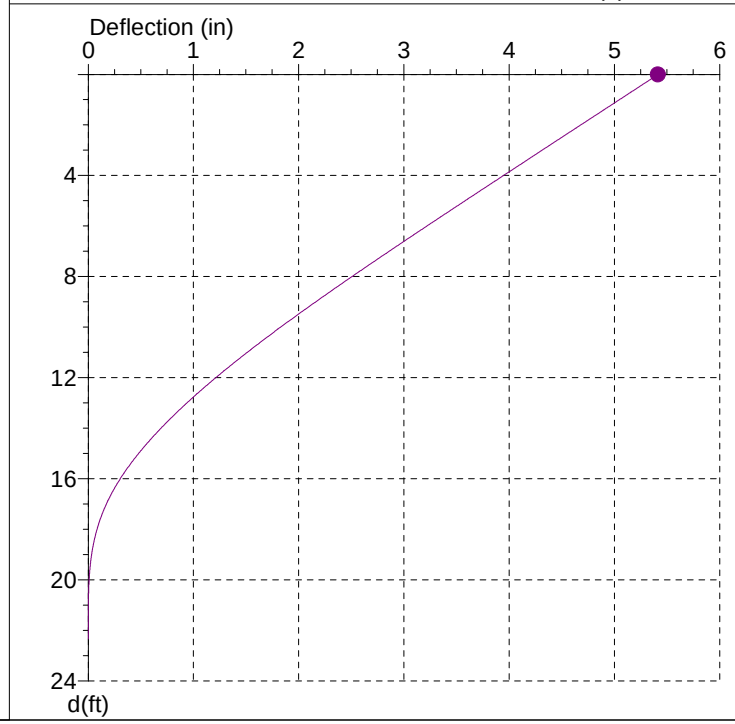
Title: Station 2+50 Ret.Wall
Designer: B.Cardali
Page: 3
Date: 11.16.22

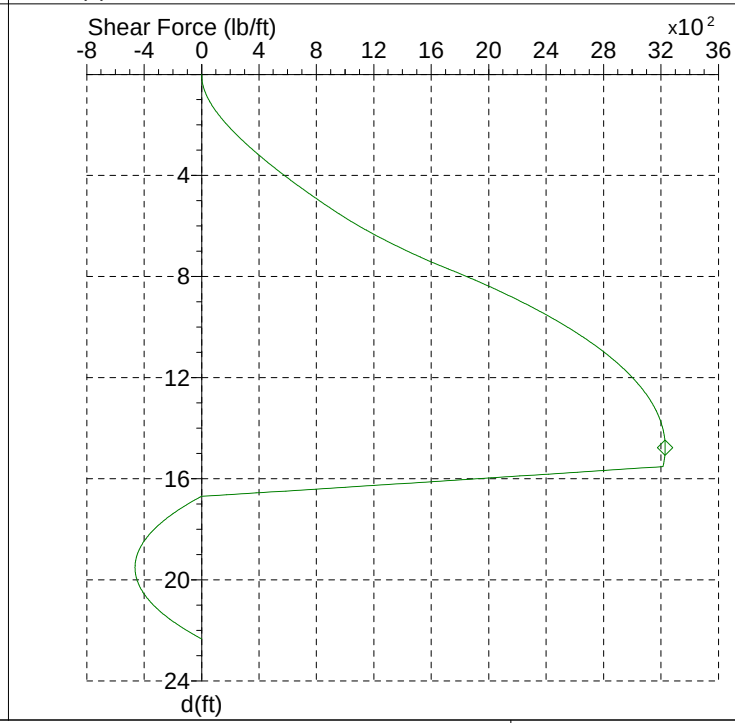
Sheet: Creative Composite Series 1432
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure
Toe: Cantilever

Maximum	d (ft)
○ 445.8 psf	7.55
□ 28443.0 ftlb/ft	16.70
◇ 3229.5 lb/ft	14.78
● 5.4 in	0.00









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depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	0.0	0.0	5.4	0.0	7.50	408.0	4525.7	2.7	1635.1	15.01	-13.1	24828.0	0.5	3228.1
0.15	15.1	0.1	5.4	1.3	7.66	437.2	4773.2	2.6	1700.9	15.16	-23.0	25368.0	0.4	3225.2
0.31	30.0	0.4	5.3	4.8	7.81	427.5	5030.4	2.6	1765.2	15.31	-31.8	25847.5	0.4	3221.2
0.46	46.3	1.7	5.2	11.3	7.96	417.9	5297.1	2.5	1828.2	15.47	-40.6	26326.4	0.4	3215.9
0.61	60.3	3.9	5.2	19.4	8.12	407.1	5608.2	2.5	1897.2	15.62	-2665.7	26795.3	0.4	2965.8
0.77	73.8	7.4	5.1	29.5	8.27	397.5	5894.4	2.4	1957.1	15.77	-2685.3	27258.3	0.3	2517.4
0.92	86.5	12.6	5.1	41.6	8.42	388.0	6189.3	2.4	2015.6	15.93	-2702.6	27606.7	0.3	2115.9
1.07	100.0	20.7	5.0	57.4	8.58	378.5	6492.9	2.3	2072.6	16.08	-2720.0	27895.2	0.3	1712.0
1.23	111.3	30.2	5.0	73.3	8.73	369.0	6804.8	2.3	2128.2	16.23	-2737.3	28123.4	0.3	1305.4
1.38	121.8	42.2	4.9	90.7	8.88	358.3	7165.5	2.2	2189.1	16.39	-2754.7	28291.0	0.2	896.2
1.53	131.6	56.9	4.9	109.7	9.04	348.9	7494.6	2.1	2241.7	16.54	-2774.2	28406.6	0.2	432.8
1.68	140.8	74.6	4.8	130.1	9.19	339.5	7831.5	2.1	2292.9	16.69	-2791.6	28443.0	0.2	0.0
1.84	150.4	98.2	4.7	154.6	9.34	330.1	8175.8	2.0	2342.8	16.85	-2809.0	28391.8	0.2	-47.7
1.99	158.3	122.6	4.7	177.7	9.50	319.6	8571.9	2.0	2397.1	17.00	-2826.3	28227.5	0.2	-92.8
2.14	165.7	150.6	4.6	201.9	9.65	310.3	8931.6	1.9	2444.0	17.15	-2845.8	27915.2	0.2	-140.4
2.30	172.7	182.3	4.6	227.2	9.80	301.0	9298.1	1.9	2489.5	17.31	-2863.2	27531.4	0.1	-180.0
2.45	180.0	222.5	4.5	256.9	9.95	291.8	9671.4	1.8	2533.6	17.46	-2880.6	27054.1	0.1	-217.1
2.60	186.1	262.5	4.5	284.2	10.11	282.5	10051.0	1.8	2576.3	17.61	-2897.9	26489.6	0.1	-251.5
2.76	191.9	306.6	4.4	312.5	10.26	272.2	10485.7	1.7	2622.7	17.77	-2915.3	25844.2	0.1	-283.3
2.91	197.3	355.0	4.3	341.5	10.41	263.0	10878.4	1.7	2662.5	17.92	-2934.8	25029.2	0.1	-316.1
3.06	202.6	407.7	4.3	371.4	10.57	253.8	11277.0	1.6	2700.9	18.07	-2952.2	24232.8	0.1	-342.4
3.22	208.1	472.4	4.2	405.9	10.72	244.7	11681.2	1.6	2738.0	18.22	-2969.5	23375.1	0.1	-366.2
3.37	212.9	534.8	4.2	437.3	10.87	234.4	12142.4	1.5	2778.1	18.38	-2986.9	22462.4	0.1	-387.3
3.52	217.4	602.0	4.1	469.4	11.03	225.3	12558.0	1.5	2812.3	18.53	-3006.4	21377.8	0.1	-408.0
3.68	221.8	673.9	4.1	502.2	11.18	216.2	12978.4	1.5	2845.1	18.68	-3023.8	20369.3	0.0	-423.7
3.83	226.1	750.8	4.0	535.6	11.33	207.1	13403.7	1.4	2876.6	18.84	-3041.2	19325.4	0.0	-436.8
3.98	230.7	843.3	4.0	574.0	11.49	198.0	13833.6	1.4	2906.7	18.99	-3058.5	18252.5	0.0	-447.3
4.13	234.7	930.9	3.9	608.7	11.64	187.7	14322.5	1.3	2938.9	19.14	-3075.9	17156.8	0.0	-455.2
4.29	238.7	1023.8	3.8	644.0	11.79	178.6	14761.5	1.3	2966.2	19.30	-3095.4	15904.8	0.0	-461.0
4.44	242.6	1121.9	3.8	679.9	11.95	169.6	15204.4	1.2	2992.0	19.45	-3112.8	14781.7	0.0	-463.4
4.59	246.8	1238.7	3.7	721.0	12.10	160.5	15651.1	1.2	3016.5	19.60	-3130.1	13655.5	0.0	-463.2
4.75	250.6	1348.4	3.7	758.1	12.25	150.3	16157.9	1.1	3042.5	19.76	-3147.5	12532.5	0.0	-460.4
4.90	254.3	1463.6	3.6	795.8	12.40	141.3	16611.9	1.1	3064.2	19.91	-3164.8	11419.0	0.0	-455.1
5.05	258.0	1584.4	3.6	834.0	12.56	132.3	17069.1	1.1	3084.5	20.06	-3184.4	10185.4	0.0	-446.0
5.21	261.6	1711.0	3.5	872.7	12.71	123.3	17529.2	1.0	3103.5	20.22	-3201.7	9112.9	0.0	-435.1
5.36	265.7	1860.4	3.4	917.0	12.86	114.4	17992.0	1.0	3121.1	20.37	-3219.1	8069.2	0.0	-421.8
5.51	270.2	1999.4	3.4	956.9	13.02	104.3	18515.7	0.9	3139.3	20.52	-3236.4	7060.9	0.0	-405.8
5.67	280.5	2144.4	3.3	998.1	13.17	95.3	18983.7	0.9	3154.1	20.67	-3255.9	5976.6	0.0	-384.7
5.82	290.9	2295.6	3.3	1040.7	13.32	86.4	19453.8	0.9	3167.6	20.83	-3273.2	5064.3	0.0	-363.2
5.97	302.5	2473.4	3.2	1090.6	13.48	77.5	19925.8	0.8	3179.7	20.98	-3290.5	4207.0	0.0	-339.1
6.13	312.8	2638.7	3.2	1136.6	13.63	67.5	20458.8	0.8	3191.8	21.13	-3307.8	3411.0	0.0	-312.4
6.28	323.2	2810.8	3.1	1184.1	13.78	58.6	20934.2	0.7	3201.1	21.29	-3325.2	2682.5	0.0	-283.2
6.43	333.5	2990.1	3.1	1233.1	13.94	49.7	21411.0	0.7	3209.1	21.44	-3344.6	1951.6	0.0	-247.2
6.59	343.9	3176.8	3.0	1283.7	14.09	40.9	21888.8	0.7	3215.8	21.59	-3362.0	1387.5	0.0	-212.4
6.74	355.6	3396.0	3.0	1342.4	14.24	32.0	22367.5	0.6	3221.1	21.75	-3379.3	910.6	0.0	-175.1
6.89	366.0	3599.2	2.9	1396.3	14.40	22.1	22906.9	0.6	3225.6	21.90	-3396.6	527.1	0.0	-135.2
7.04	376.5	3810.5	2.8	1451.8	14.55	13.3	23386.9	0.6	3228.1	22.05	-3416.1	215.2	0.0	-87.2
7.20	387.0	4030.1	2.8	1508.8	14.70	4.5	23867.2	0.5	3229.4	22.21	-3433.4	51.1	0.0	-41.8
7.35	398.8	4287.5	2.7	1574.8	14.86	-4.4	24347.7	0.5	3229.3	22.36	-3446.4	0.0	0.0	0.0

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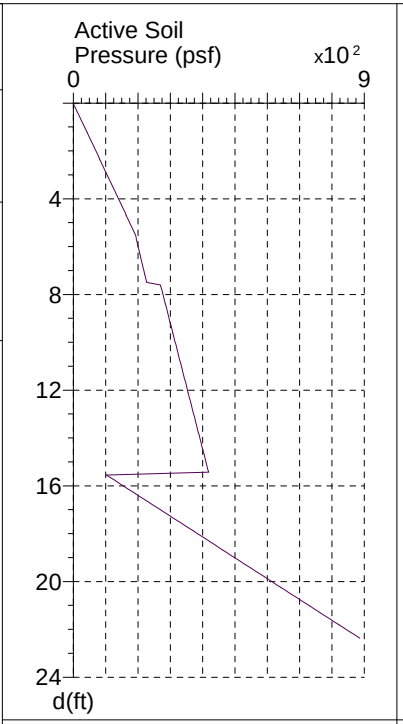

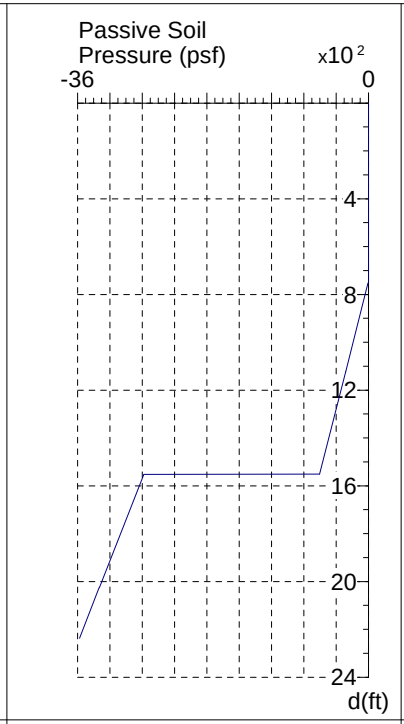

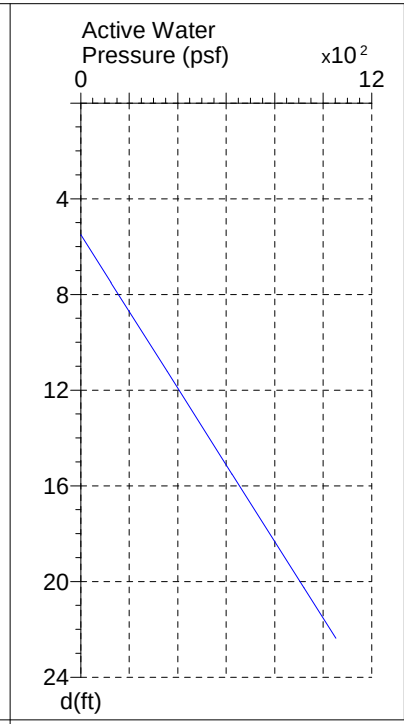

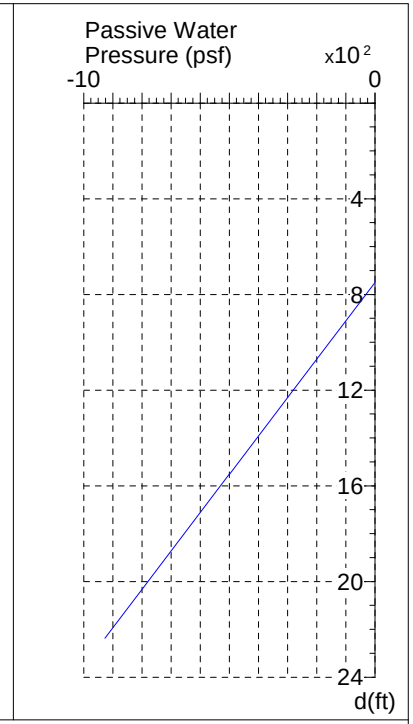

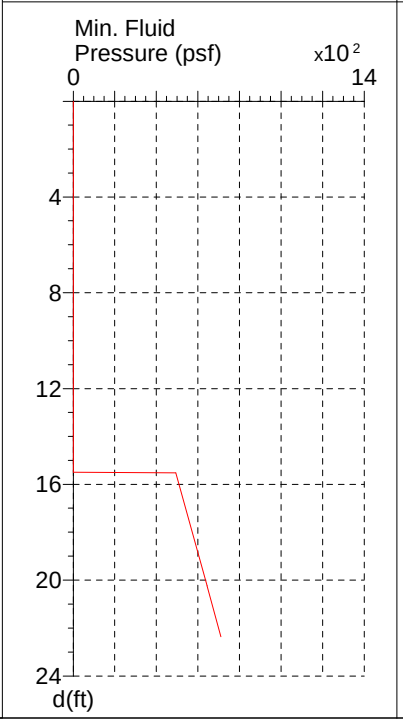

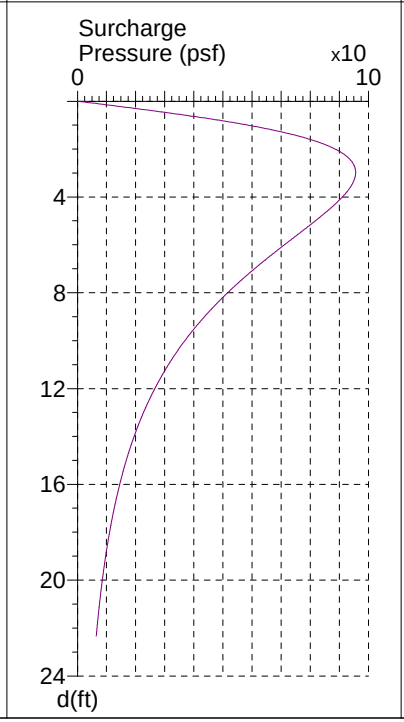

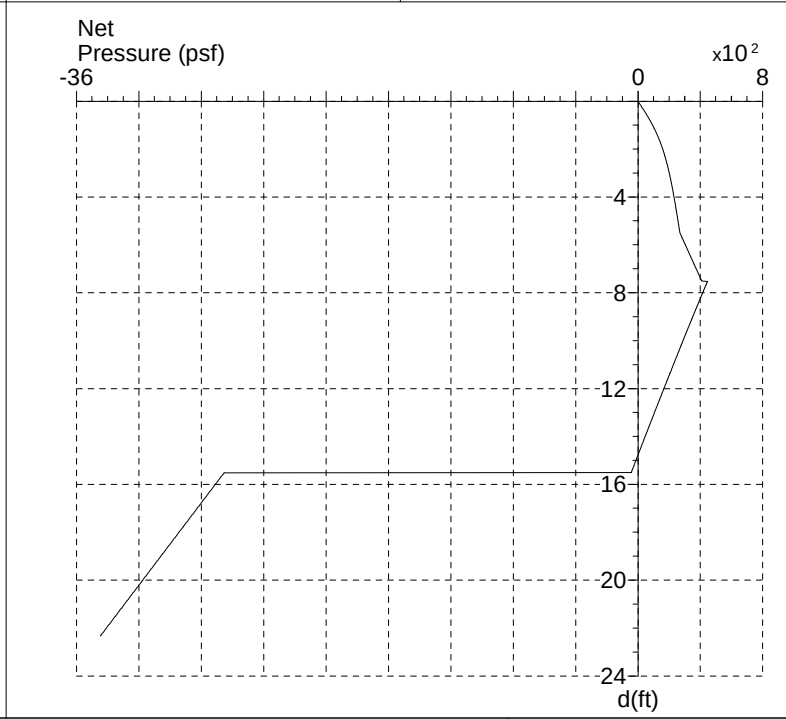

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Designer:	B.Cardali
Page:	7
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Works:	Temporary
Pressure:	Rankine
Analysis:	Net Pressure
Toe:	Cantilever

Design Report

1. The standard surcharge is 0.0psf. The Piling Handbook recommends a minimum surcharge of 200.0psf. Other surcharges have been defined, but ensure that this is sufficient.

2. Hydrostatic pressure is switched ON in passive side cohesive soils below excavation depth. This can be switched OFF in the 'Pressure' page. A greater toe, or 'no solution' may result.

3. Total stress values are being used (i.e. C > 0). Note that the Piling Handbook and CIRIA SP95 recommend that effective stress values be used in 'long term' excavations.

4. Maximum bending moment = 28443.0ftlb/ft and f = 62960.0psi. MINIMUM required sheet section modulus is: Z = 5.42in³/ft (= M/f). Sheet section modulus in this design is Z = 30.50in³/ft, and is satisfactory.

5. FOS = 1.01 (Net Pressure)
   This is the factor of safety against rotation about the toe.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

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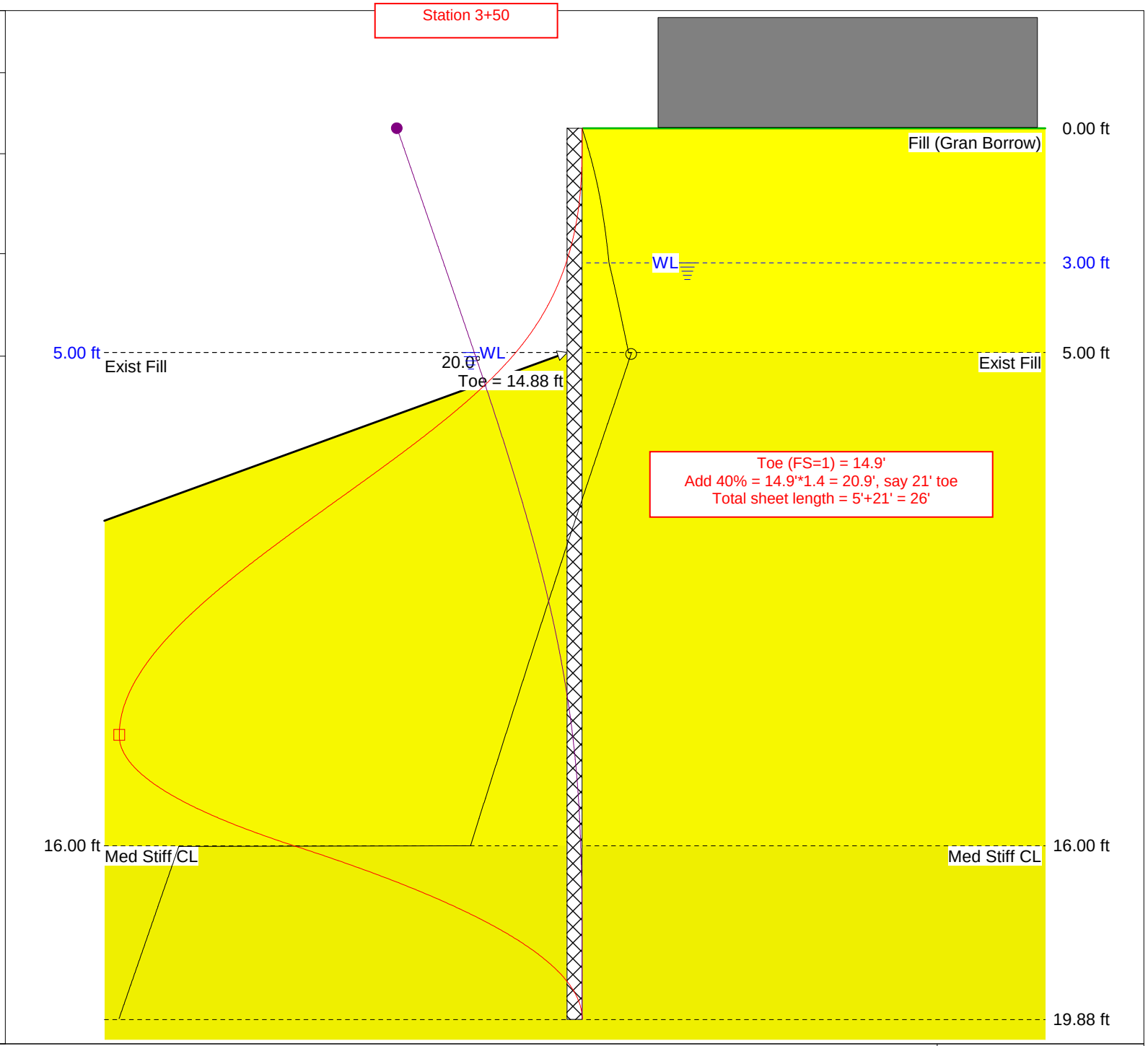
Maximum	d (ft)
○ 367.2 psf	5.04
□ 11188.0 ftlb/ft	13.53
● 1.8 in	0.00

2.75:1 Slope



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Toe: Cantilever

2.75:1 Slope

Input Data

Depth Of Excavation = 5.00ft
Surcharge = 0.0psf

Depth Of Active Water = 3.00ft
Depth Of Passive Water = 5.00ft
Slope (passive) = 20.0degrees

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile — Active Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Fill (Gran Borrow)	125.00	62.60	0.0	0.0	34.0	0.0	0.28	0.00	3.54	0.00
5.00	Exist Fill	120.00	57.60	0.0	0.0	30.0	0.0	0.33	0.00	3.00	0.00
16.00	Med Stiff CL	115.00	52.60	900.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
33.00	Glacial Till	115.82	68.73	0.0	0.0	36.0	0.0	0.26	0.00	3.85	0.00

Soil Profile — Passive Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Fill (Gran Borrow)	125.00	62.60	0.0	0.0	34.0	0.0	0.34	0.00	2.61	0.00
5.00	Exist Fill	120.00	57.60	0.0	0.0	30.0	0.0	0.41	0.00	2.13	0.00
16.00	Med Stiff CL	115.00	52.60	900.0	0.0	0.0	0.0	0.99	1.99	1.01	2.01
33.00	Glacial Till	115.82	68.73	0.0	0.0	36.0	0.0	0.31	0.00	2.89	0.00

Surcharges

Position (ft)	Width (ft)	Length (ft)	Depth (ft)	Magnitude	Type
2.00	10.00		0.00	250.0psf	Strip

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
Creative Composite Series 1432	4.66E+06	240.50	62960.0	30.50	74165.0	32.00	8.28	18.0	0.00	14.88	19.88

Pressure Model: Rankine; Assume full hydrostatic pressure to 5.00ft in cohesive soils on active side

Maxima

	Maximum	Depth (ft)
Pressure	367.2 psf	5.04
Bending Moment	11188.0 ftlb/ft	13.53
Deflection	1.8 in	0.00
Shear Force	3818.0 lb/ft	16.00

GZA GeoEnvironmental, Inc.

707 Sable Oaks Drive
South Portland, Maine

SupportIT, v2.39

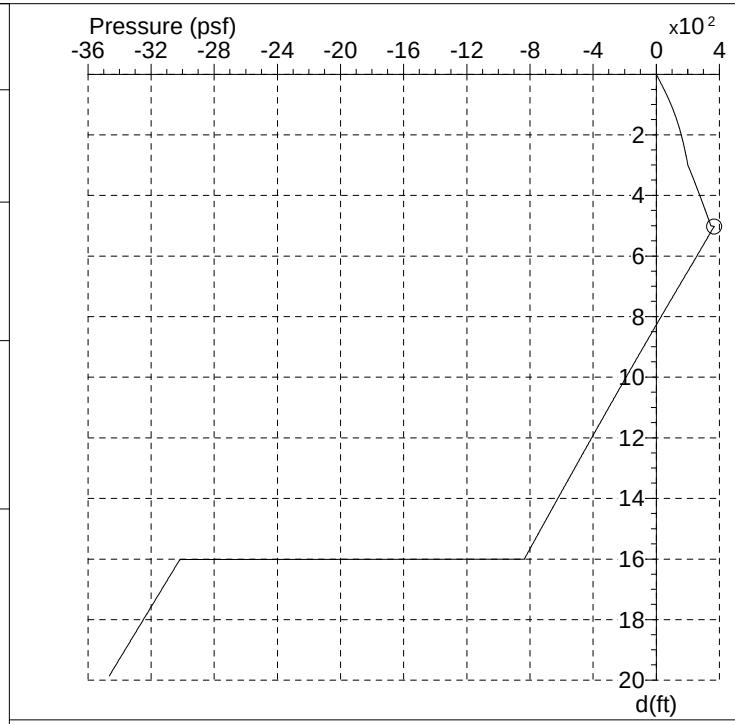
Client: I-95 over Broadway East Retaining Wall
Site: Bangor

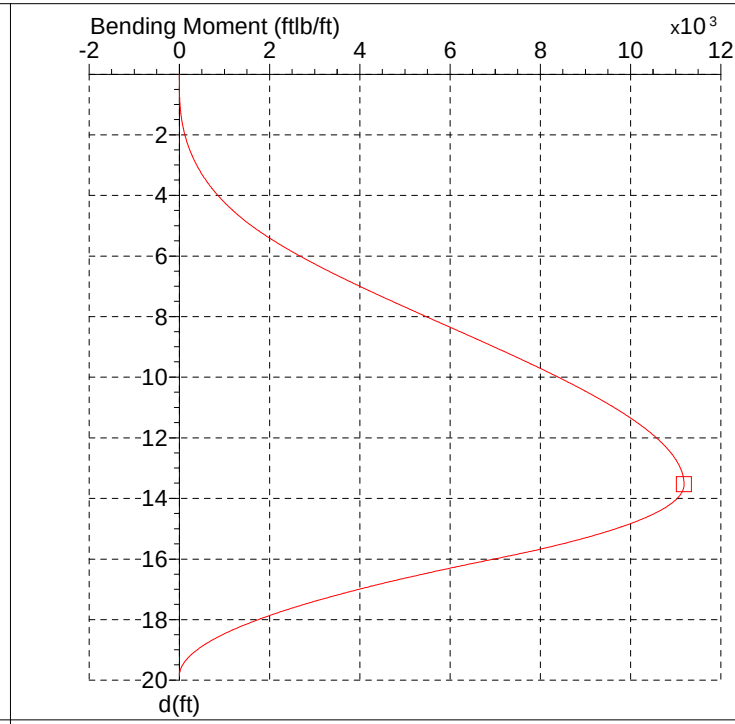
Title: Station 3+50 Ret.Wall
Designer: B.Cardali
Page: 3
Date: 11.16.22

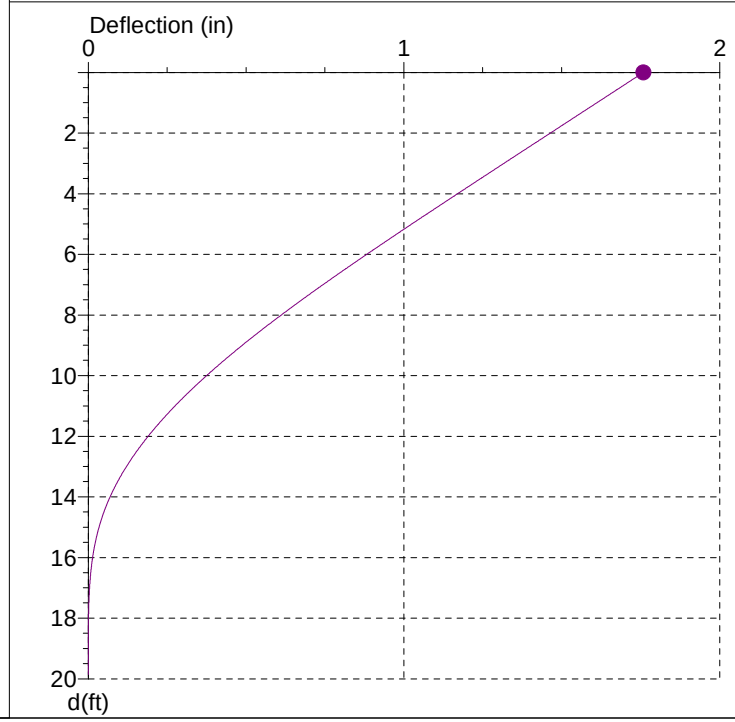
Sheet: Creative Composite Series 1432
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure
Toe: Cantilever

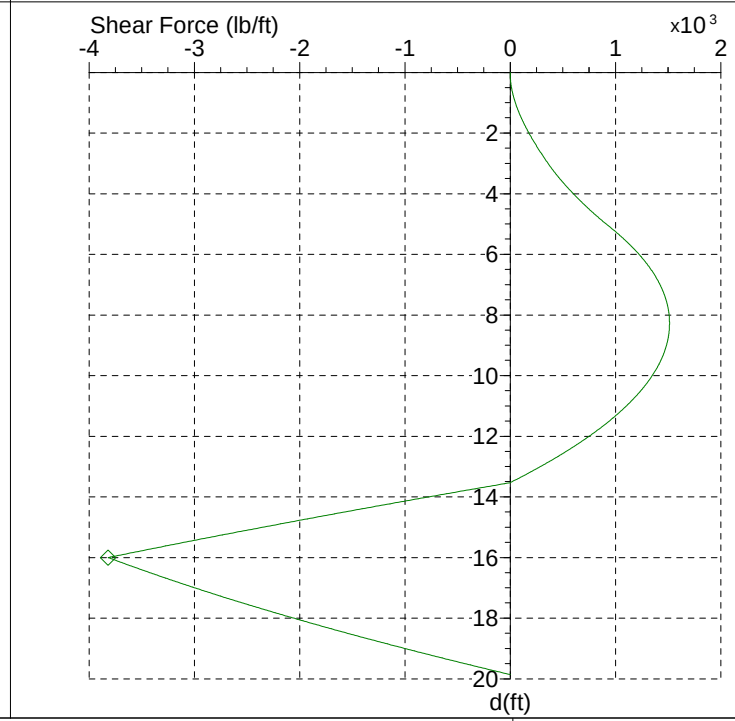
Maximum	d (ft)
○ 367.2 psf	5.04
□ 11188.0 ftlb/ft	13.53
◇ 3818.0 lb/ft	16.00
● 1.8 in	0.00

2.75:1 Slope









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Toe: Cantilever

2.75:1 Slope

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	0.0	0.0	1.8	0.0
0.14	13.4	0.0	1.7	1.0
0.27	26.7	0.3	1.7	3.8
0.41	41.3	1.2	1.7	9.0
0.54	54.0	2.7	1.7	15.4
0.68	66.2	5.2	1.7	23.5
0.82	77.9	8.9	1.6	33.1
0.95	90.5	14.6	1.6	45.8
1.09	101.0	21.4	1.6	58.6
1.23	111.0	29.9	1.6	72.7
1.36	120.4	40.4	1.6	88.1
1.50	129.2	53.0	1.5	104.7
1.63	138.6	69.9	1.5	124.8
1.77	146.3	87.5	1.5	143.7
1.91	153.6	107.6	1.5	163.6
2.04	160.5	130.4	1.5	184.5
2.18	167.8	159.5	1.4	209.1
2.31	173.9	188.4	1.4	231.8
2.45	179.7	220.4	1.4	255.2
2.59	185.1	255.6	1.4	279.4
2.72	190.3	294.0	1.4	304.4
2.86	195.9	341.1	1.3	333.2
3.00	200.6	386.7	1.3	359.5
3.13	211.1	435.8	1.3	386.9
3.27	221.3	488.6	1.3	415.6
3.40	231.5	545.3	1.3	445.7
3.54	242.7	613.9	1.2	481.1
3.68	252.6	679.4	1.2	514.0
3.81	262.3	749.3	1.2	548.2
3.95	272.0	823.8	1.2	583.7
4.08	282.7	913.4	1.2	625.1
4.22	292.2	998.2	1.1	663.3
4.36	301.6	1088.2	1.1	702.7
4.49	311.0	1183.4	1.1	743.4
4.63	320.3	1284.1	1.1	785.3
4.76	330.7	1404.1	1.1	833.9
4.90	340.0	1516.9	1.0	878.4
5.04	367.2	1635.7	1.0	924.8
5.17	350.4	1760.7	1.0	972.0
5.31	333.8	1908.7	1.0	1022.9
5.45	318.9	2046.5	1.0	1066.0
5.58	304.1	2189.8	0.9	1107.2
5.72	289.3	2338.5	0.9	1146.4
5.85	274.4	2492.2	0.9	1183.6
5.99	257.7	2670.9	0.9	1223.1
6.13	244.1	2834.6	0.9	1256.2
6.26	227.8	3002.5	0.8	1287.3
6.40	212.6	3174.4	0.8	1316.3
6.53	195.6	3372.2	0.8	1346.6

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
6.67	180.5	3551.7	0.8	1371.4
6.81	165.5	3734.4	0.8	1394.2
6.94	150.4	3919.9	0.8	1415.0
7.08	135.4	4108.1	0.7	1433.8
7.22	118.5	4322.7	0.7	1452.6
7.35	103.5	4515.6	0.7	1467.2
7.49	88.5	4710.3	0.7	1479.8
7.62	73.5	4906.6	0.7	1490.4
7.76	58.6	5104.2	0.6	1499.0
7.90	41.8	5327.7	0.6	1506.4
8.03	26.9	5527.1	0.6	1510.8
8.17	12.1	5727.0	0.6	1513.2
8.30	-2.8	5927.1	0.6	1513.8
8.44	-19.4	6152.2	0.6	1512.3
8.58	-34.2	6352.0	0.5	1508.8
8.71	-49.0	6551.2	0.5	1503.4
8.85	-63.7	6749.6	0.5	1496.1
8.99	-78.5	6946.8	0.5	1486.8
9.12	-95.0	7167.2	0.5	1474.0
9.26	-109.7	7361.3	0.5	1460.6
9.39	-124.4	7553.5	0.4	1445.2
9.53	-139.0	7743.6	0.4	1427.8
9.67	-155.4	7954.6	0.4	1406.0
9.80	-170.0	8139.3	0.4	1384.6
9.94	-184.6	8321.0	0.4	1361.2
10.07	-199.2	8499.5	0.4	1335.9
10.21	-213.7	8674.6	0.4	1308.7
10.35	-230.0	8867.1	0.3	1275.7
10.48	-244.5	9034.0	0.3	1244.4
10.62	-259.0	9196.6	0.3	1211.2
10.75	-273.5	9354.8	0.3	1176.0
10.89	-289.7	9526.9	0.3	1134.2
11.03	-304.1	9674.6	0.3	1094.9
11.16	-318.6	9817.1	0.3	1053.8
11.30	-332.9	9953.9	0.2	1010.8
11.44	-347.3	10085.0	0.2	965.8
11.57	-363.5	10225.2	0.2	913.0
11.71	-377.8	10343.1	0.2	864.0
11.84	-392.2	10454.4	0.2	813.1
11.98	-406.5	10558.8	0.2	760.3
12.12	-422.6	10667.9	0.2	698.6
12.25	-436.8	10757.0	0.2	641.8
12.39	-451.1	10838.4	0.2	583.1
12.52	-465.4	10912.1	0.2	522.5
12.66	-479.6	10977.5	0.1	460.0
12.80	-495.6	11041.2	0.1	387.4
12.93	-509.9	11088.6	0.1	320.9
13.07	-524.1	11127.1	0.1	252.5
13.21	-538.3	11156.4	0.1	182.3

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
13.34	-552.5	11176.4	0.1	110.1
13.48	-568.4	11187.3	0.1	26.7
13.61	-582.6	11183.9	0.1	-138.6
13.75	-596.7	11156.6	0.1	-358.9
13.89	-610.9	11103.9	0.1	-577.3
14.02	-626.8	11014.3	0.1	-820.8
14.16	-640.9	10908.1	0.1	-1035.3
14.29	-655.0	10777.1	0.1	-1247.8
14.43	-669.1	10621.5	0.1	-1458.5
14.57	-683.2	10441.5	0.0	-1667.3
14.70	-699.1	10210.2	0.0	-1900.0
14.84	-713.1	9979.2	0.0	-2104.9
14.98	-727.2	9724.5	0.0	-2307.9
15.11	-741.3	9446.3	0.0	-2509.0
15.25	-757.1	9105.6	0.0	-2733.1
15.38	-771.1	8778.3	0.0	-2930.2
15.52	-785.2	8428.2	0.0	-3125.5
15.66	-799.2	8055.4	0.0	-3319.0
15.79	-813.2	7660.4	0.0	-3510.6
15.93	-829.0	7189.4	0.0	-3723.9
16.06	-3024.4	6750.7	0.0	-3767.1
16.20	-3039.8	6318.6	0.0	-3663.7
16.34	-3055.2	5898.6	0.0	-3558.3
16.47	-3072.6	5440.8	0.0	-3437.3
16.61	-3088.0	5047.3	0.0	-3327.5
16.75	-3103.4	4666.7	0.0	-3215.7
16.88	-3118.9	4299.1	0.0	-3101.9
17.02	-3134.3	3944.8	0.0	-2986.0
17.15	-3151.7	3562.5	0.0	-2853.2
17.29	-3167.1	3237.4	0.0	-2732.9
17.43	-3182.5	2926.3	0.0	-2610.7
17.56	-3197.9	2629.5	0.0	-2486.3
17.70	-3213.4	2347.2	0.0	-2360.0
17.83	-3230.7	2047.3	0.0	-2215.4
17.97	-3246.1	1796.7	0.0	-2084.7
18.11	-3261.6	1561.4	0.0	-1951.9
18.24	-3277.0	1341.7	0.0	-1817.1
18.38	-3294.3	1113.2	0.0	-1663.0
18.51	-3309.8	927.2	0.0	-1523.9
18.65	-3325.2	757.5	0.0	-1382.7
18.79	-3340.6	604.2	0.0	-1239.5
18.92	-3356.0	467.6	0.0	-1094.2
19.06	-3373.4	334.3	0.0	-928.3
19.20	-3388.8	234.1	0.0	-778.7
19.33	-3404.3	151.4	0.0	-627.1
19.47	-3419.7	86.4	0.0	-473.3
19.60	-3437.0	34.7	0.0	-298.0
19.74	-3452.5	8.1	0.0	-139.9
19.88	-3464.0	0.0	0.0	0.0

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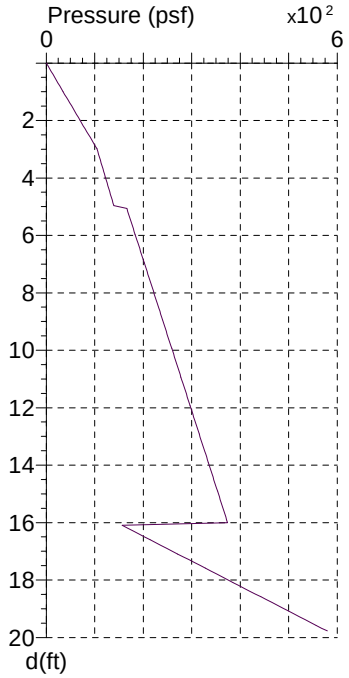
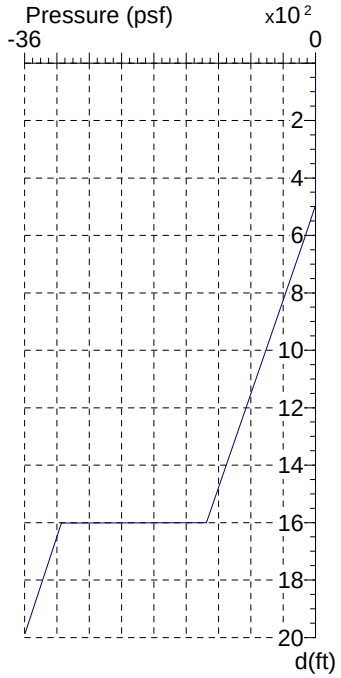
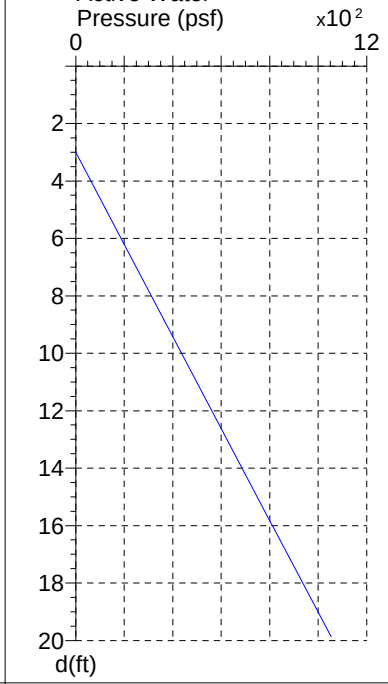
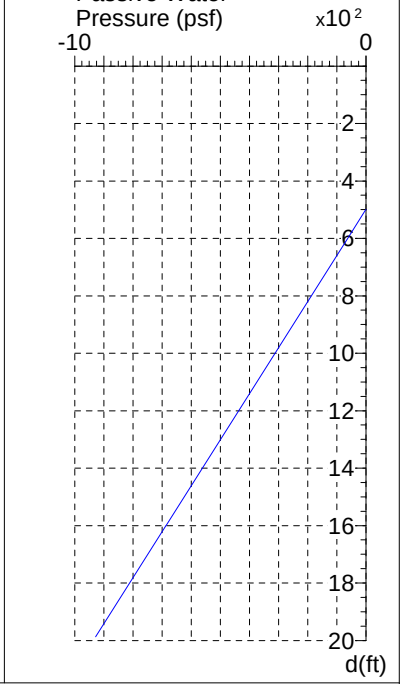
Sheet: Creative Composite Series 1432
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure
Toe: Cantilever

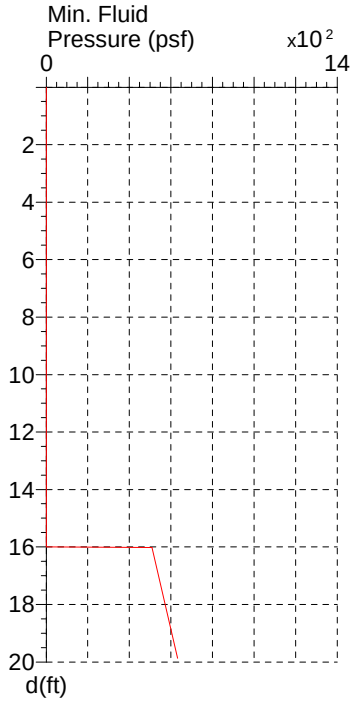
2.75:1 Slope

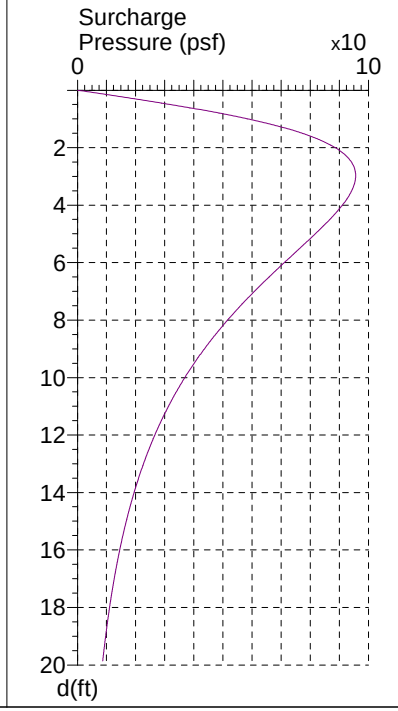


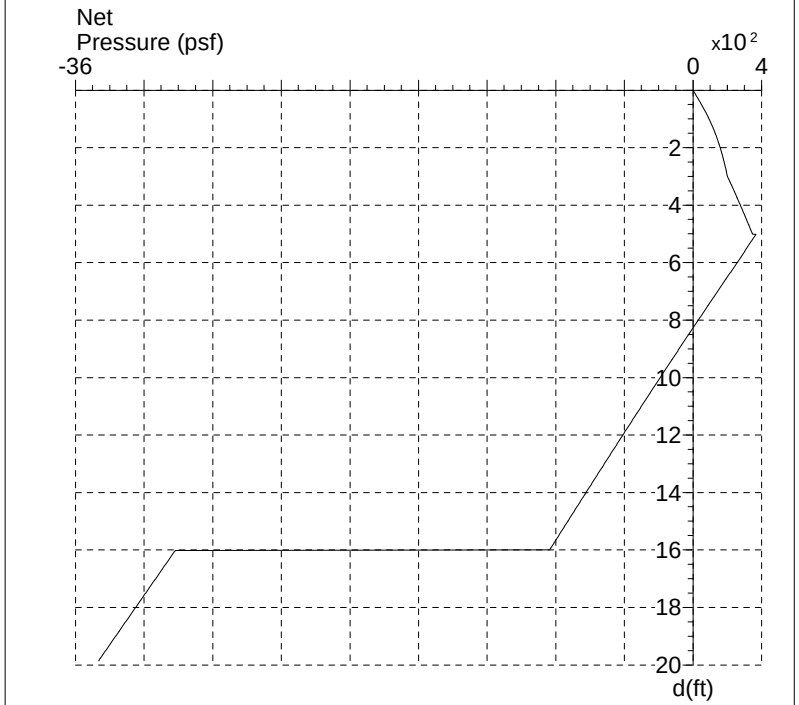












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2.75:1 Slope

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2.75:1 Slope

Design Report

1. The standard surcharge is 0.0psf. The Piling Handbook recommends a minimum surcharge of 200.0psf. Other surcharges have been defined, but ensure that this is sufficient.

2. Hydrostatic pressure is switched ON in passive side cohesive soils below excavation depth. This can be switched OFF in the 'Pressure' page. A greater toe, or 'no solution' may result.

3. Total stress values are being used (i.e. C > 0). Note that the Piling Handbook and CIRIA SP95 recommend that effective stress values be used in 'long term' excavations.

4. Maximum bending moment = 11188.0ftlb/ft and f = 62960.0psi. MINIMUM required sheet section modulus is: Z = 2.13in³/ft (= M/f). Sheet section modulus in this design is Z = 30.50in³/ft, and is satisfactory.

5. FOS = 1.01 (Net Pressure)
   This is the factor of safety against rotation about the toe.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

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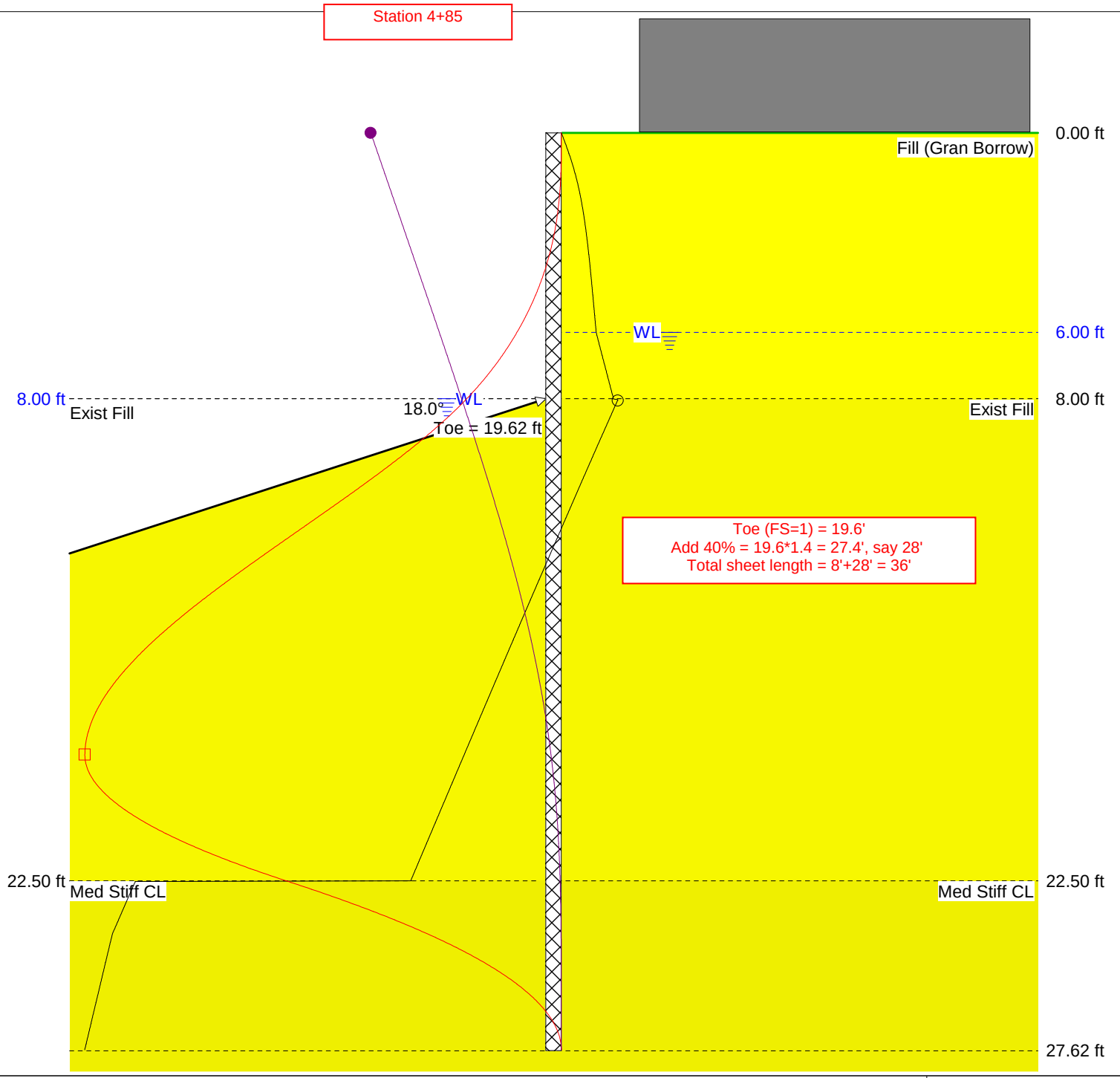
Client: I-95 over Broadway East
Retaining Wall
Site: Bangor

Title: Station 4+85 Ret.Wall
Designer: B.Cardali
Page: 1
Date: 11.16.22

Sheet: Creative Composite Series 1432
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure
Toe: Cantilever

Maximum	d (ft)
○ 457.0 psf	8.05
□ 26782.9 ftlb/ft	18.71
● 8.1 in	0.00



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Input Data

Depth Of Excavation = 8.00ft
Surcharge = 0.0psf

Depth Of Active Water = 6.00ft
Depth Of Passive Water = 8.00ft
Slope (passive) = 18.0degrees

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile — Active Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Fill (Gran Borrow)	125.00	62.60	0.0	0.0	34.0	0.0	0.28	0.00	3.54	0.00
8.00	Exist Fill	120.00	57.60	0.0	0.0	30.0	0.0	0.33	0.00	3.00	0.00
22.50	Med Stiff CL	115.00	52.60	900.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
31.50	Glacial Till	115.82	68.73	0.0	0.0	36.0	0.0	0.26	0.00	3.85	0.00

Soil Profile — Passive Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Fill (Gran Borrow)	125.00	62.60	0.0	0.0	34.0	0.0	0.33	0.00	2.78	0.00
8.00	Exist Fill	120.00	57.60	0.0	0.0	30.0	0.0	0.39	0.00	2.29	0.00
22.50	Med Stiff CL	115.00	52.60	900.0	0.0	0.0	0.0	0.99	1.99	1.01	2.01
31.50	Glacial Till	115.82	68.73	0.0	0.0	36.0	0.0	0.30	0.00	3.06	0.00

Surcharges

Position (ft)	Width (ft)	Length (ft)	Depth (ft)	Magnitude	Type
2.00	10.00		0.00	250.0psf	Strip

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
Creative Composite Series 1432	4.66E+06	240.50	62960.0	30.50	74165.0	32.00	8.28	18.0	0.00	19.62	27.62

Pressure Model: Rankine; Assume full hydrostatic pressure to 8.00ft in cohesive soils on active side

Maxima

	Maximum	Depth (ft)
Pressure	457.0 psf	8.05
Bending Moment	26782.9 ftlb/ft	18.71
Deflection	8.1 in	0.00
Shear Force	5812.2 lb/ft	22.51

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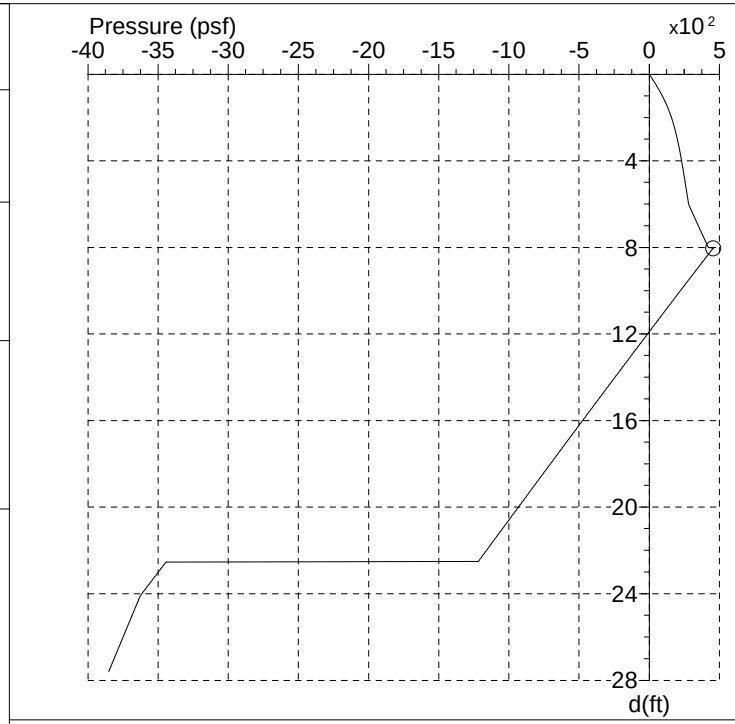
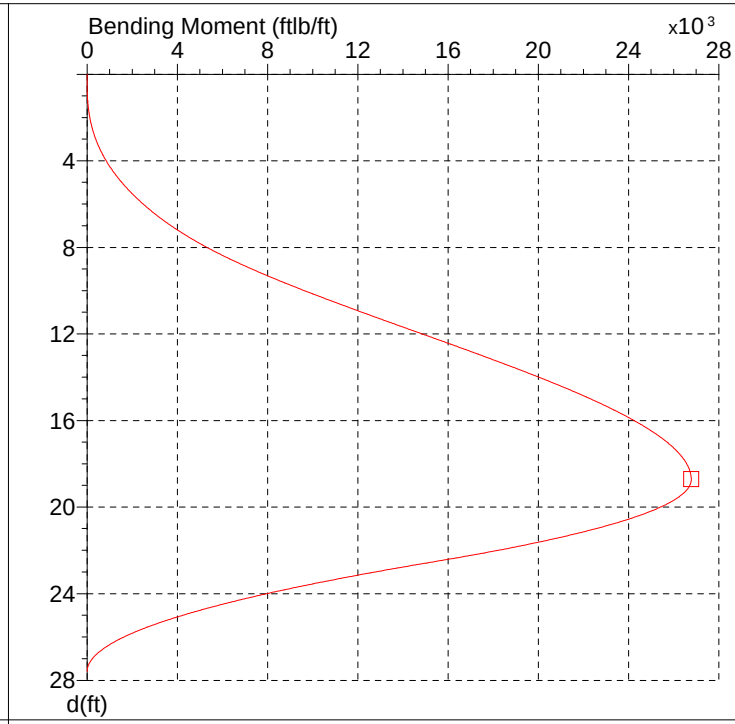
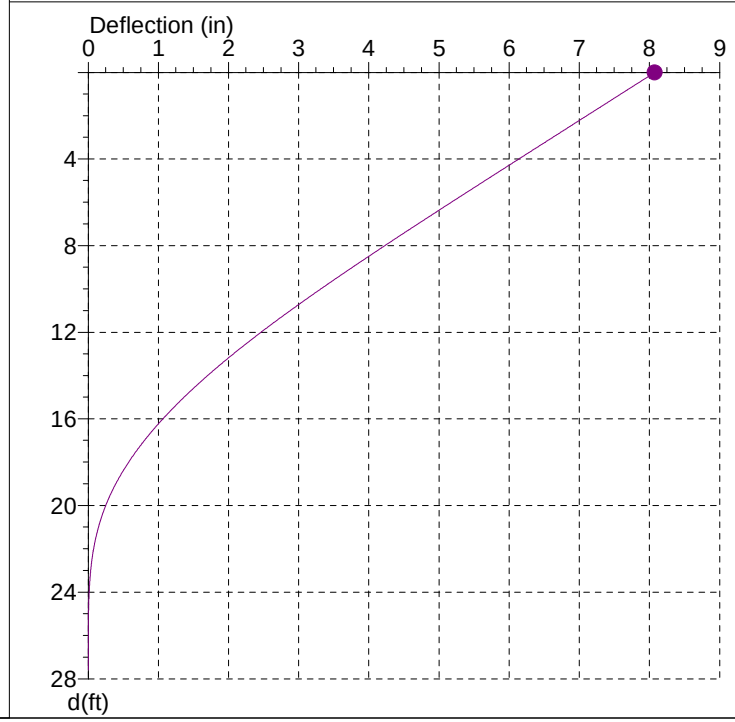
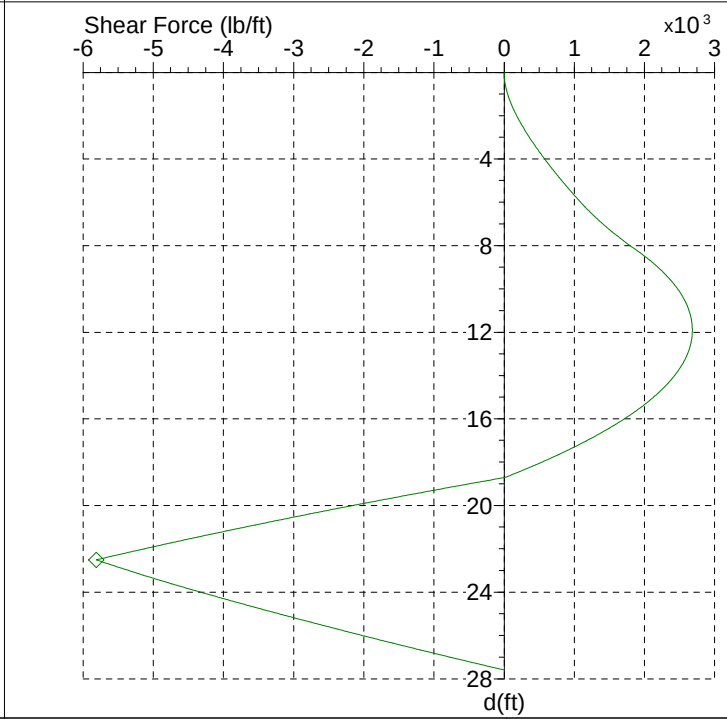
Maximum	d (ft)
○ 457.0 psf	8.05
□ 26782.9 ftlb/ft	18.71
◇ 5812.2 lb/ft	22.51
● 8.1 in	0.00









GZA GeoEnvironmental, Inc.

707 Sable Oaks Drive
South Portland, Maine

SupportIT, v2.39

Client: I-95 over Broadway East Retaining Wall
Site: Bangor

Title: Station 4+85 Ret.Wall
Designer: B.Cardali
Page: 4
Date: 11.16.22

Sheet: Creative Composite Series 1432
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure
Toe: Cantilever

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	0.0	0.0	8.1	0.0
0.19	18.6	0.1	8.0	1.9
0.38	36.9	0.8	7.9	7.3
0.57	56.7	3.2	7.8	17.2
0.76	73.4	7.3	7.7	29.4
0.95	89.1	13.8	7.6	44.5
1.13	103.7	23.4	7.5	62.4
1.32	118.8	38.4	7.4	85.7
1.51	131.0	56.0	7.3	108.8
1.70	142.3	78.0	7.3	134.1
1.89	152.7	104.8	7.2	161.4
2.08	162.2	136.7	7.1	190.5
2.27	172.1	179.3	7.0	225.3
2.46	180.1	223.2	6.9	257.8
2.65	187.6	273.3	6.8	291.8
2.84	194.6	329.7	6.7	327.0
3.03	201.9	401.0	6.6	368.2
3.22	208.1	471.7	6.5	406.0
3.40	213.9	549.4	6.4	444.9
3.59	219.5	634.3	6.3	484.9
3.78	224.8	726.7	6.2	525.8
3.97	230.6	839.6	6.1	573.1
4.16	235.5	948.4	6.1	616.0
4.35	240.4	1065.0	6.0	659.9
4.54	245.1	1189.8	5.9	704.6
4.73	249.7	1322.9	5.8	750.2
4.92	254.9	1482.8	5.7	802.6
5.11	259.4	1634.0	5.6	850.0
5.30	263.9	1794.0	5.5	898.2
5.49	268.4	1962.9	5.4	947.2
5.67	273.4	2163.8	5.3	1003.4
5.86	277.9	2352.2	5.2	1054.2
6.05	284.3	2550.0	5.1	1105.9
6.24	297.1	2757.4	5.1	1159.6
6.43	309.9	2974.9	5.0	1215.6
6.62	324.4	3232.1	4.9	1281.5
6.81	337.2	3472.4	4.8	1342.5
7.00	350.1	3724.0	4.7	1405.9
7.19	363.1	3987.6	4.6	1471.7
7.38	377.7	4298.7	4.5	1548.6
7.57	390.7	4588.9	4.4	1619.5
7.76	403.7	4892.2	4.3	1692.8
7.94	416.9	5209.2	4.3	1768.5
8.13	445.7	5540.5	4.2	1849.4
8.32	420.8	5931.0	4.1	1938.9
8.51	398.7	6293.2	4.0	2014.1
8.70	376.7	6669.0	3.9	2085.2
8.89	354.7	7057.5	3.8	2152.3
9.08	330.1	7508.8	3.7	2222.9
9.27	308.2	7921.9	3.6	2281.4
9.46	286.4	8345.5	3.6	2335.9
9.65	264.5	8778.7	3.5	2386.4
9.84	242.8	9220.8	3.4	2432.8
10.03	218.4	9728.0	3.3	2480.3
10.21	196.7	10186.8	3.2	2518.2
10.40	175.0	10652.1	3.1	2552.2
10.59	153.4	11123.4	3.1	2582.2
10.78	131.8	11599.9	3.0	2608.2
10.97	107.6	12141.3	2.9	2632.7
11.16	86.1	12626.3	2.8	2650.3
11.35	64.6	13114.3	2.7	2663.9
11.54	43.2	13604.5	2.7	2673.6
11.73	19.1	14157.7	2.6	2679.8
11.92	-2.3	14650.1	2.5	2681.1
12.11	-23.7	15142.5	2.4	2678.9
12.30	-45.0	15634.2	2.3	2672.9
12.48	-66.6	16124.4	2.3	2662.9
12.67	-90.7	16673.4	2.2	2646.8
12.86	-112.2	17158.1	2.1	2628.4
13.05	-133.7	17639.2	2.0	2606.0
13.24	-155.1	18115.9	2.0	2579.7
13.43	-179.2	18645.9	1.9	2545.3
13.62	-200.5	19110.8	1.8	2510.6
13.81	-221.9	19568.9	1.8	2472.0
14.00	-243.2	20019.6	1.7	2429.4
14.19	-264.5	20462.2	1.6	2382.9
14.38	-288.5	20949.5	1.6	2325.9
14.56	-309.8	21372.5	1.5	2271.1
14.75	-331.1	21785.0	1.4	2212.3
14.94	-352.3	22186.4	1.4	2149.7
15.13	-376.2	22623.8	1.3	2074.5
15.32	-397.4	22999.3	1.3	2003.5
15.51	-418.6	23361.3	1.2	1928.7
15.70	-439.8	23709.3	1.2	1849.9
15.89	-461.0	24042.6	1.1	1767.2
16.08	-484.8	24398.9	1.0	1669.5
16.27	-506.0	24698.3	1.0	1578.5
16.46	-527.1	24980.7	0.9	1483.7
16.65	-548.3	25245.4	0.9	1384.9
16.83	-572.0	25521.0	0.8	1269.2
17.02	-593.1	25745.6	0.8	1162.2
17.21	-614.2	25950.3	0.7	1051.3
17.40	-635.3	26134.2	0.7	936.5
17.59	-656.4	26296.8	0.7	817.8
17.78	-680.1	26453.2	0.6	679.7
17.97	-701.2	26567.9	0.6	552.8
18.16	-722.2	26659.0	0.5	422.0
18.35	-743.3	26725.7	0.5	287.3
18.54	-764.3	26767.4	0.5	148.8
18.73	-788.0	26782.9	0.4	-40.2
18.92	-809.0	26750.2	0.4	-359.4
19.10	-830.0	26659.9	0.4	-674.8
19.29	-851.0	26512.7	0.3	-986.2
19.48	-874.6	26279.9	0.3	-1332.0
19.67	-895.6	26014.0	0.3	-1635.3
19.86	-916.6	25693.4	0.3	-1934.7
20.05	-937.6	25318.8	0.2	-2230.3
20.24	-958.6	24890.9	0.2	-2521.9
20.43	-982.2	24346.6	0.2	-2845.5
20.62	-1003.1	23807.7	0.2	-3128.9
20.81	-1024.1	23217.6	0.2	-3408.5
21.00	-1045.1	22577.1	0.1	-3684.3
21.19	-1068.6	21797.1	0.1	-3989.9
21.37	-1089.6	21051.8	0.1	-4257.5
21.56	-1110.5	20258.2	0.1	-4521.2
21.75	-1131.5	19417.0	0.1	-4781.0
21.94	-1152.4	18529.0	0.1	-5037.0
22.13	-1175.9	17474.9	0.1	-5320.4
22.32	-1196.9	16489.7	0.1	-5568.2
22.51	-1215.2	15459.8	0.1	-5812.2
22.70	-3462.6	14418.4	0.0	-5643.0
22.89	-3486.9	13284.0	0.0	-5447.8
23.08	-3508.4	12309.4	0.0	-5270.0
23.27	-3530.0	11367.4	0.0	-5088.3
23.46	-3551.6	10458.7	0.0	-4902.7
23.64	-3573.2	9584.0	0.0	-4713.0
23.83	-3597.5	8641.6	0.0	-4494.9
24.02	-3619.1	7841.5	0.0	-4296.8
24.21	-3635.0	7077.8	0.0	-4095.1
24.40	-3646.8	6350.8	0.0	-3891.1
24.59	-3658.6	5661.0	0.0	-3685.0
24.78	-3671.9	4929.9	0.0	-3450.4
24.97	-3683.7	4320.5	0.0	-3239.6
25.16	-3695.5	3749.5	0.0	-3026.7
25.35	-3707.3	3217.2	0.0	-2811.5
25.54	-3720.6	2665.4	0.0	-2566.9
25.73	-3732.4	2217.0	0.0	-2347.2
25.91	-3744.2	1808.6	0.0	-2125.3
26.10	-3756.0	1440.7	0.0	-1901.2
26.29	-3767.8	1113.6	0.0	-1674.9
26.48	-3781.0	795.0	0.0	-1417.8
26.67	-3792.8	556.0	0.0	-1186.9
26.86	-3804.6	359.1	0.0	-953.8
27.05	-3816.4	204.6	0.0	-718.6
27.24	-3829.6	82.1	0.0	-451.4
27.43	-3841.4	19.2	0.0	-211.6
27.62	-3850.2	0.0	0.0	0.0

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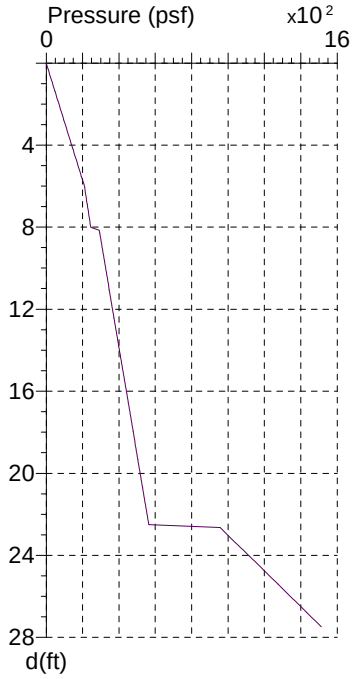

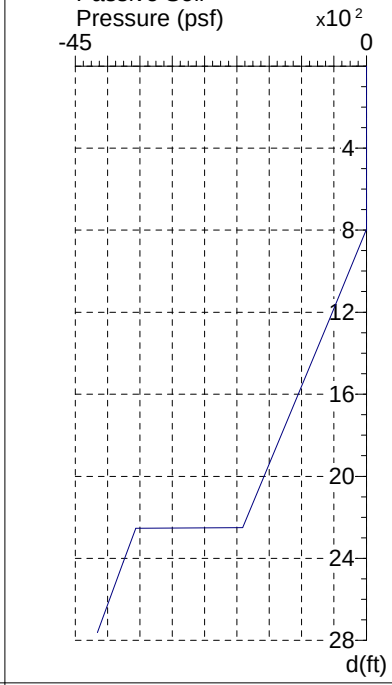

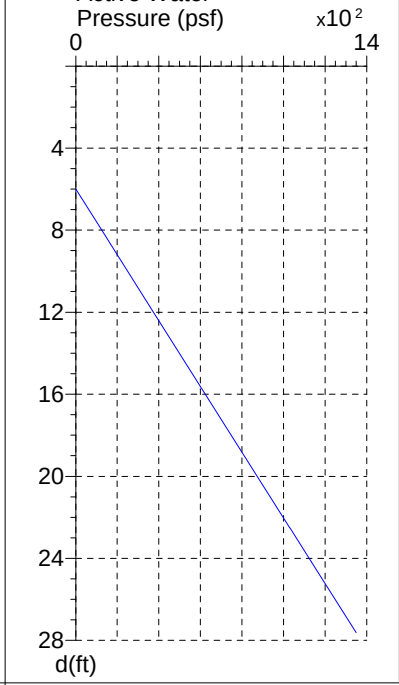

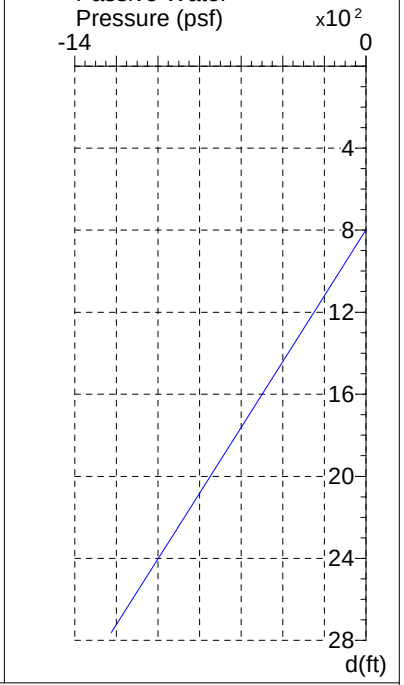

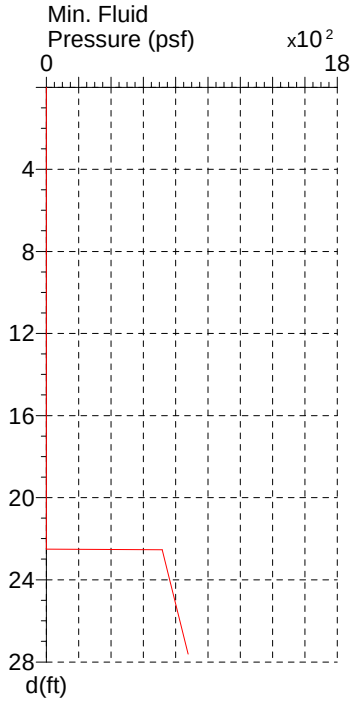

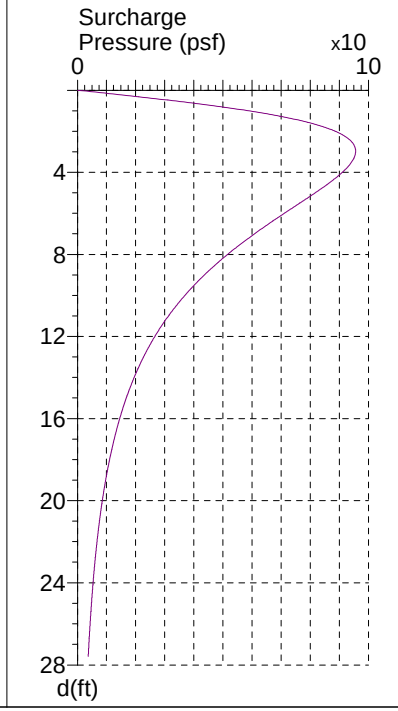

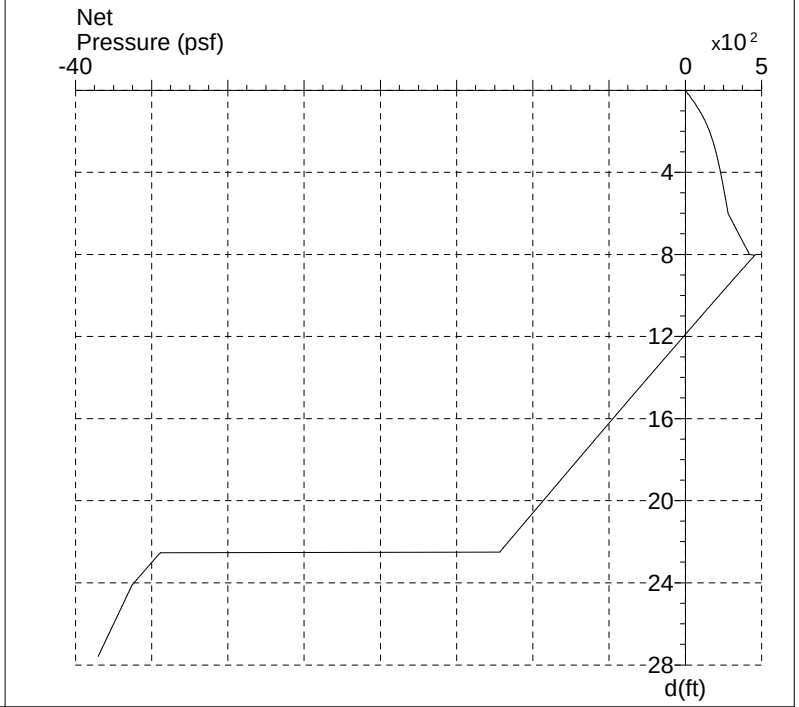

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Design Report

1. The standard surcharge is 0.0psf. The Piling Handbook recommends a minimum surcharge of 200.0psf. Other surcharges have been defined, but ensure that this is sufficient.

2. Hydrostatic pressure is switched ON in passive side cohesive soils below excavation depth. This can be switched OFF in the 'Pressure' page. A greater toe, or 'no solution' may result.

3. Total stress values are being used (i.e. C > 0). Note that the Piling Handbook and CIRIA SP95 recommend that effective stress values be used in 'long term' excavations.

4. Maximum bending moment = 26782.9ftlb/ft and f = 62960.0psi. MINIMUM required sheet section modulus is: Z = 5.10in³/ft (= M/f). Sheet section modulus in this design is Z = 30.50in³/ft, and is satisfactory.

5. FOS = 1.01 (Net Pressure)
   This is the factor of safety against rotation about the toe.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

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