Known for excellence.
Built on trust.

GEOTECHNICAL DESIGN REPORT
BUCKNAM ROAD BRIDGE NO. 5830
OVER INTERSTATE 295
FALMOUTH, MAINE

Prepared for:
Maine Department of Transportation
Augusta, Maine

March 2022
09.0026023.00

Prepared by:
GZA GeoEnvironmental, Inc.
707 Sable Oaks Drive | Suite 150 | South Portland, Maine 04106
207.879.9190

31 Offices Nationwide
www.gza.com

Known for excellence.
Built on trust.

GEOTECHNICAL
ENVIRONMENTAL
ECOLOGICAL
WATER
CONSTRUCTION MANAGEMENT

707 Sable Oaks Drive
Suite 150
South Portland, ME 04106
T: 207.879.9190
F: 207.536.1173
www.gza.com

VIA EMAIL

March 10, 2022
File No. 09.0026023.00

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

Re: Geotechnical Design Report
Replacement of Bucknam Road Bridge No. 5830 over Interstate 295
MaineDOT WIN 21720.00
Falmouth, Maine

Dear Laura:

We are pleased to provide this Geotechnical Design Report, which includes geotechnical design recommendations for the replacement of Bucknam Road Bridge No. 5830 in Falmouth, Maine. Our work was completed under GZA GeoEnvironmental, Inc.'s (GZA's) June 8, 2015 General Consulting Agreement (GCA CTM20150608000000000793) with the Maine Department of Transportation (MaineDOT) Bridge Program, and incorporates GZA's Proposal No. 09.P000017.20, dated May 7, 2019, 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.
Assistant Project Manager

STATE OF MAINE
Andrew R. Blaisdell
10957
LICENSED
PROFESSIONAL ENGINEER
03/10/2022

Christopher L. Snow, P.E.
Consultant Reviewer

Andrew R. Blaisdell, P.E.
Associate Principal

BMC/ARB/CLS:erc
p:\09 jobs\0026000s\09.0026023.00 - medot - bucknam rd - falmouth\report\final 26023.00 bucknam rd gdr 03102022.docx

Attachment: Geotechnical Design Report

TABLE OF CONTENTS

TABLE OF CONTENTS (*continued*)

TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

This report presents the results of the geotechnical evaluation by GZA GeoEnvironmental, Inc. (GZA) for the replacement of Bucknam Road Bridge No. 5830 in Falmouth, Maine. Our services were completed in accordance with GZA's June 8, 2015 General Consulting Agreement (GCA CTM20150608000000000793) with the Maine Department of Transportation (MaineDOT) Bridge Program, and incorporates GZA's Proposal No. 09.P000017.20, dated May 7, 2019, and the *Limitations* Included in **Appendix A** of this report. Hoyle, Tanner Associates, Inc. (Hoyle, Tanner) is serving as the bridge designer for MaineDOT.

1.1 BACKGROUND

The project includes replacement of the Bucknam Road Bridge No. 5830 over Interstate 295 in Falmouth, Maine. The project location is shown on **Figure 1**. The existing bridge has four spans with a continuous superstructure with a total length of approximately 225 feet. The bridge was built in 1960 and consists of steel stringers with a concrete bridge deck and bituminous overlay. The abutments are composed of reinforced concrete stub abutments founded on H-piles, and all three piers are three-column bents with concrete caps supported on H-piles. The total bridge width is 33 feet.

The existing approach embankments are at approximately El. 57 to 62.5 at the west and east, respectively, which is approximately 15 to 20 feet above adjacent grades. The existing bridge plans show that stabilization berms were constructed along all four sides of the approach embankments, which were observed to be present by GZA during our site visits.

It is GZA's understanding that a full bridge replacement is planned for the project. The replacement bridge is planned to consist of a two-span bridge with integral abutments and a center pier in the I-295 median, all supported by driven H-piles. The replacement bridge will be approximately 242 feet long and 52 feet wide. The roadway will be raised approximately 2 to 3.5 feet above existing pavement grades within about 100 feet of the bridge, up to approximately El. 60.5 to 65 at the west and east approaches, respectively. The embankments will be widened to facilitate a full-width sidewalk and improved access to on- and off-ramps. The top of the embankment will extend approximately 17 feet south of the current roadway near the bridge approaches, approx. Sta 3+00 to 4+35 and 6+77 to 10+00 with a maximum fill height of 14 feet above grade and a slope inclination of 2 horizontal to 1 vertical (2H:1V), except between Sta. 9+25 and 10+25 where a 1.5:1 slope inclination with a Turf Reinforced Mat (TRM) is proposed. Additional details of the proposed embankments are presented later in this report.

Staged construction is planned. Stage 1 will include demolition of the southerly pier columns and approximately 8 feet of the bridge superstructure and construction of the southerly approximate 29 feet of the proposed bridge. Stage 2 will include demolition of the remainder of the existing bridge, completion of the pier, and construction of the northerly approximately 21 feet of the proposed superstructure, including all of the bridge girders. Stage 3 will be a deck closure pour.

A roadway improvement project along Bucknam Road, east of the limits of the bridge project and including on- and off-ramp improvements, will be conducted in conjunction with the bridge project (WIN 22672.00). GZA's role in the roadway improvement project was limited to evaluations and recommendations for an over-steepened embankment fill slope.

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 preliminary design and reviewed mapped surficial and bedrock geology of the site;
- Reviewed existing subsurface data;
- Coordinated and observed subsurface explorations, consisting of eight test borings and five piezocone penetration tests (CPTs), 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; lateral earth pressures on abutments and seismic design considerations;
- Developed geotechnical engineering recommendations including foundation design recommendations for driven piles; 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 TEST BORINGS

GZA completed an exploration program in 2019 consisting of six test borings and a supplemental exploration program in 2020 consisting of two borings. The as-drilled boring locations and elevations were surveyed by MaineDOT and provided to GZA and are shown on the logs in **Appendix B** and in **Figure 2.** 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, 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 generally 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 B**. Additional details of each program are described below.

Borings BB-FBR-101 and -105 were conducted by Summit Geoengineering between May 22 and 23, 2019 and were drilled adjacent to CPT locations to compare shear strengths as determined by field vane shear testing for evaluation of site-specific coefficients necessary for CPT data interpretation. Summit conducted field vane shear tests in pairs, continuously within the clay layer.

Borings BB-FBR-102 through BB-FBR-104 and BB-FBR-106 were drilled between May 22 and June 25, 2019 by New England Boring Contractors (NEBC) and borings BB-FBR-201 and BB-FBR-202 were drilled between September 1 and September 2, 2020. The borings were drilled using a track-mounted Mobile B-53 drill rig and were drilled to depths of approximately 36 to 114 feet and terminated approximately 0 to 13.5 feet into bedrock. The -100 series and -200 series SPTs were conducted using automatic hammer NEBC No. D23, which had a rated hammer efficiency factor at the time of drilling of 0.895 (2019) and 0.818 (2020). Field vane shear tests were taken in pairs at approximately 5- to 10-foot typical intervals within the silt and clay layers. Field vane shear tests were conducted with Geonor 55x110 mm or 65x130 mm rectangular vanes using 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 using the MaineDOT correlation charts. A total of 17 thin-walled tube samples were taken from the borings drilled by NEBC and logged by GZA for laboratory consolidation and shear strength testing.

2.2 CONE PENETRATION TESTING

GZA retained Summit Geoengineering Services (SGS) to complete five CPTs, designated CPT-FBR-101 through CPT-FBR-105, between May 21 to May 23, 2019. The as-drilled CPT locations and elevations were surveyed by MaineDOT and provided to GZA as shown on **Figure 3**.

The CPTs were performed in accordance with ASTM D5778. CPT-FBR-101 through -105 were advanced using a truck-mounted PowerProbe 9500 VTR with a Vertek digital cone to depths ranging from approximately 43.8 to 84.7 feet, where refusal was observed. CPTs were advanced to depths ranging from approximately 43.8 to 84.7 feet, where refusal was encountered. Parameters obtained include cone resistance (qc), sleeve friction (fs), and piezocone pore pressure (u2). Dissipation tests were conducted at CPT-FBR-101, -102, and -103. Downhole shear wave velocity testing was conducted in each CPT (i.e., sCPTs) at 1-meter intervals throughout the CPT depths.

The data report submitted to GZA by SGS dated June 7, 2019 containing the raw CPT results is included in **Appendix C**. SGS also provided GZA with Excel files containing the raw data collected from the CPTs for use in our engineering evaluations.

GZA utilized the analytical software CPetIT by Geologismiki to develop reports of correlated soil types and engineering properties based on the raw data provided by SGS. These reports and a summary of empirical correlations associated with different properties are included in **Appendix C**.

3.0 LABORATORY TESTING

GZA retained three laboratories to complete a soil laboratory testing program, including Thielsch Engineering of Cranston, Rhode Island, to assess the gradation and index properties of the soil and bedrock, and Soil Metrics of Cape Elizabeth, Maine and Geotesting Express of Acton, Massachusetts to assess shear strength and compressibility of cohesive soils. The testing program included:

- Fourteen (14) gradation analyses;
- Twenty-five (25) MaineDOT Frost Classification / Unified Soil Classification System (USCS) assessments;
- Thirty-one (31) moisture content tests;
- Sixteen (16) Atterberg limits analyses;
- Nine (9) incremental consolidation tests;
- Six (6) Constant Rate-of-Strain (CRS) consolidation tests;
- Ten (10) K_o-consolidated undrained direct simple shear (CKoUDSS) tests; and
- Four (4) hydrometer tests.

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

4.0 SUBSURFACE CONDITIONS

4.1 SURFICIAL AND BEDROCK GEOLOGY

Based on available geologic mapping[1], the surficial unit in the vicinity of the bridges consists of the Presumpscot Formation, described as gray-blue, silty clay. Marine sand and gravel deposits and glacial till deposits were also mapped in the area of the bridge.

Bedrock in the vicinity of the site is mapped[2] as the Hutchins Corner Formation, consisting primarily of fine to medium grained, medium gray quartz-plagioclase-biotite granofels or gneiss, heavily intruded by pegmatite.

4.2 SUBSURFACE PROFILE

Up to five soil units were encountered in the test borings and CPTs overlying bedrock: Fill, Upper Marine Sand, Marine Clay Crust, Marine Clay, and Lower Marine Sand. Approximately 1 to 1.3 feet of asphalt pavement was encountered in the roadway borings. The thicknesses and generalized descriptions of the soil units are presented in the following table, in descending order from existing ground surface. Soil descriptions are based on GZA borings and CPTs. Detailed descriptions and interpretations of the materials encountered at specific locations are provided in the boring logs and CPTs in **Appendices B and D**. An interpretive subsurface profile was developed representing generalized stratification along the proposed bridge alignment and is presented on **Figure 3**. The strata thicknesses and elevations of the borings are summarized in **Table 1**.

[1] Bernotavicz, Alexa, 1999, Surficial geology of the Portland East quadrangle, Maine: Maine Geological Survey, Open-File Map 99-95, map, scale 1:24,000. Maine Geological Survey Maps. 996. http://digitalmaine.com/mgs_maps/996

[2] Hussey, Arthur M., II, 2003, Bedrock geology of the Portland East quadrangle, Maine: Maine Geological Survey, Open-File Map 03-90, 12 p. report, 21 figures, 1 plate, photographs, color map, cross section, scale 1:24,000. Maine Geological Survey Maps. 33. http://digitalmaine.com/mgs_maps/33

GENERALIZED SUBSURFACE CONDITIONS		
Subsurface Unit	**Approximate Encountered Thickness (ft)**	**Generalized Description**
Fill	4 to 20	Varies from brown, loose to medium dense, fine to coarse SAND, trace to little Gravel, trace Silt to medium stiff Clayey SILT, some fine to coarse Sand. (USCS: SP-SM, SM, SP, ML). MaineDOT Frost Classification: 0-IV *Encountered in borings BB-FBR-102 through -104, and BB-FBR-106.*
Upper Maine Sand	4 to 11	Brown, loose to dense, fine to coarse SAND, trace to some Silt, trace Gravel. (USCS: SW, SM) MaineDOT Frost Classification: I-II *Encountered in all borings.*
Marine Clay Crust	3 to 8	Grey, stiff to medium stiff, Silty CLAY, trace Sand. (USCS: CL) MaineDOT Frost Classification: III-IV *Encountered in all borings except BB-FBR-106.*
Marine Clay	24 to 53	Grey, soft to stiff, Silty CLAY, trace to little Sand. (USCS: CL) MaineDOT Frost Classification: III-IV *Encountered in all borings.*
Lower Marine Sand	5 to 30	Brown/grey, medium dense to very dense, fine to coarse SAND, trace to little Silt, trace Gravel. (USCS: SM, SP-SM) MaineDOT Frost Classification: II-IV *Encountered in all borings.*
Top of Bedrock Elevation	Encountered Top of Rock:	Abutment 1: Approximate El. -11.1 Center Pier: Approximate El. -39.0 Abutment 2: Approximate El. -37.8

Additional index and engineering properties of the Marine Clay determined from the laboratory test data are summarized below and plotted on **Figure 4 and 5**:

- Twenty-two (22) water content tests: 52 percent to 30 percent (generally decreases with depth);
- Sixteen (16) Atterberg limits tests: LL=50-31, PI=24-18 (generally decreases with depth);
- 127 in-situ field vanes and 10 laboratory shear strengths; Peak Shear Strength=275 to 1,800 pounds per square foot (psf), Residual Shear Strength=14 to 300 psf;
  - Peak Undrained shear strength S_u=275-900 psf (outside of existing embankment);
  - Undrained shear strength S_u=500-1,800 psf (under existing embankment);
- Fifteen consolidation tests:
  - Preconsolidation Pressure=3,200-6,800 psf;
  - Virgin Compression Ratio (CR)=0.18-0.25;
  - Recompression Ratio (RR)=0.012-0.022; and
  - Coefficient of Consolidation (Cv)=0.016-0.23 ft^2/day.

4.2.1 Bedrock

Bedrock was cored in borings BB-FBR-102, -103A and -104. Bedrock was described as hard, fresh to moderately weathered, medium to coarse grained, gray and white Schist/Gneiss with some pegmatite intrusions. In general, the joints are described as extremely close to moderately spaced, low angle to moderately dipping, smooth to rough, planar to undulating, fresh to discolored, and tight to open. The Rock Quality Designation (RQD) in the core runs ranged from 0 to 100 percent.

4.2.2 Groundwater

The groundwater level was measured in the completed borings after drilling at depths of 5.7 to 30.0 feet below existing grade, corresponding approximately to El. 10 to 50.2. Water levels measured in the borings were likely influenced by the addition of drill water during rotary wash drilling. The groundwater level was also interpreted from the CPTs to be at depths of 2.5 to 6.3 feet, corresponding approximately to El. 36.1 to El. 44.4. The CPT measurements are considered more representative of in-situ groundwater conditions. In general, the data indicate that groundwater was encountered approximately 2 to 7 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 E**.

5.2 APPROACH EMBANKMENTS

The new bridge will be shifted approximately 6 feet to the south of the existing alignment and widened approximately 21 feet south to accommodate an additional turning lane and a new sidewalk. The roadway profile will be raised approximately 3.5 feet above existing roadway grade at the west (Abutment 1) approach (approximately Sta. 4+30) and 2.5 feet above grade at the east (Abutment 2) approach (approximately Sta. 6+75), resulting in total embankment heights of approximately 17 to 24 feet above adjacent grades. The raise in grade tapers to about 1 foot above existing roadway grade within about 150 feet of each abutment. The widened embankments will extend approximately 20 to 30 feet south of the current embankment limits at the bridge approaches and are planned to have maximum new fill heights up to 14 feet above existing site grades.

Approach embankment side slopes will be typically constructed with an inclination of 2 horizontal to 1 vertical (2H:1V) or less, except for a portion of slope between Sta. 9+25 and 10+25 where the inclination will be

1.5H:1V to limit impacts outside of the right-of-way, and between Sta. 8+75 to 9+25 and 10+25 to 10+75 where the inclination will transition between 2H:1V and 1.5H:1V. The over-steepened slopes are proposed to have a surface treatment of a Turf Reinforced Mat (TRM).

5.2.1 Embankment Performance Criteria

We understand that the settlement criteria that have been adopted by MaineDOT for this project include 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.

Pseudostatic analyses were also conducted, which are interpreted to indicate a low likelihood of significant slope movement if the factor of safety is greater than 1.

5.2.2 Soil Profile and Properties

The profiles considered for bridge approach embankment design considerations included new engineered fill, existing fill, upper marine sand, marine clay, and lower marine sand overlying bedrock. The strength and compressibility properties of the marine clay deposit are the primary contributors to the performance of the embankments. Development of the design parameters for this deposit is described below.

5.2.2.1 Strength

GZA developed marine clay shear strength profiles using the results of field vane shear testing, CKoUDSS testing, and correlation to CPT side friction measurements. The individual undrained shear strength, S_u, data points/profiles and interpreted design values are plotted versus elevation on **Figures 4 and 5** for both abutments. The primary profiles (bold black) were developed to be consistent with S_u outside the footprint of the embankments (including data from borings BB-FBR-101, -103, -105, -106, -201 and -202, and CPT-FBR-101, -102, -103, -104 and -105). Since consolidation of the clay under existing embankment loads is known to result in increased undrained shear strengths, the plot also shows the higher interpreted S_u beneath the embankment from borings conducted through the existing roadway (including borings BB-FBR-102 and -104). The data also indicate that S_u is higher beneath the Abutment 1 approach (**Figure 4**) than the Abutment 2 approach (**Figure 5**), with a thinner and stronger low-strength zone at Abutment 1.

Friction angles for granular soil strata were developed using correlations between corrected SPT N-values and friction angle.

Based on the subsurface data and laboratory and in-situ testing results, and our experience with similar deposits in the area, GZA interpreted the strength properties as follows:

DESIGN SOIL PROFILES – ABUTMENTS					
Soil Unit	**Total Unit Weight (pcf)**	**West Approach/ Abutment 1**		**East Approach/ Abutment 2**	
		Effective Friction Angle (deg) / Undrained Shear Strength (psf)	**Estimated Thickness[1] (feet)**	**Effective Friction Angle (deg) / Undrained Shear Strength (psf)**	**Estimated Thickness[1] (feet)**
Proposed Fill (Common Borrow, Sand, Gravel)	125	34	0 - 3.5	34	0 – 3.5
Proposed Lightweight Fill	20	40	2 - 4	40	2 - 5
Existing Fill	125	31	15	31	6 - 23
Upper Marine Sand	120	32	7 - 11	32	4 - 10
Marine Clay (crust)	118	S_u = 1,000 psf	7	S_u = 870 - 750 psf	0 -8
Marine Clay (under Embankment)	115	S_u = 640 - 900 psf	33	S_u = 620 - 1000 psf	39
Marine Clay (outside Embankment)	115	S_u = 500 - 900 psf	30 - 37	S_u = 400 - 900 psf	37 - 53
Lower Marine Sand	125	33	4 - 5	33	12 - 28
Depth to Bedrock below Existing Pavement Grade	--	68		100	

Note:
1. Estimated thicknesses of fill strata are measured from existing approach embankment pavement grades.

5.2.2.2 Compressibility

Fifteen one-dimensional consolidation tests (nine incremental and six CRS) were completed on samples taken at the site beneath the current roadway embankment (seven tests) and outside of the current embankment (eight tests) where less or minimal embankment fill has been placed over historic original grades.

The maximum past pressure results from the consolidation tests were compared to values derived using the Stress History and Normalized Soil Engineering Properties (SHANSEP) concept based on the design undrained shear strength profiles in **Figures 4 and 5**, utilizing a ratio of undrained shear strength to effective stress (S_u/P) of 0.23 for normally consolidated clay, which was estimated from comparison of laboratory strength and consolidation test results that indicated normally consolidated to lightly overconsolidated clay. The stress history profiles are generally consistent with the laboratory test data and the SHANSEP-based values outside of the existing embankment footprint. The profiles suggest that the clay in the area adjacent to the Abutment 1 approach is more overconsolidated (less compressible) than the Abutment 2 approach, especially at the bottom of the deposit.

We interpreted the combined results to show that the marine clay crust layer is overconsolidated and will remain so under additional embankment loads. The underlying marine clay is shown to be lightly to moderately overconsolidated (by approximately 900 to 1,500 psf) outside the current embankment footprint, and approximately normally consolidated under the present roadway embankment. We anticipate that the conditions interpreted outside of the current embankment footprint would apply to the entire site prior to the circa-1960 construction.

Future settlement of overconsolidated deposits is anticipated to occur rapidly and be of moderate magnitude. Normally consolidated deposits tend to be more compressible and the settlement is expected to occur more slowly.

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

Soil Properties for Settlement Analyses				
Material Property	**Soil Layers**			
	Marine Clay Crust	**Upper Marine Clay (AB 1)**	**Lower Marine Clay (AB 1)**	**Marine Clay (AB 2)**
Modified Recompression Ratio (RR)	0.02	0.02	0.02	0.02
Modified Compression Ratio (CR)	0.23	0.23	0.23	0.23
Consolidation Coefficient (Cv)	0.15 ft^2/day	0.15 ft^2/day	0.15 ft^2/day	0.15 ft^2/day
Secondary Compression Coefficient (Cαe)	0.002	0.007	0.007	0.007
Unit Weight	118 pcf	115 pcf	115 pcf	115 pcf

It is noted that the Cv value selected for design is in the upper range of values interpreted from the laboratory test results. Considering the time-based settlement criteria presented below, a higher Cv results in greater settlement within the 5- and 10-year evaluation periods and therefore is conservative. Considering the granular marine sands above and below the marine clay, GZA considered the marine clay to have double drainage.

5.2.3 Settlement Modelling and Historic Embankment Construction

GZA modeled the settlement using Settle3™, starting with a relatively flat pre-construction ground surface at approximately El. 40 to 42. Initial embankment construction occurred in the early 1960s. GZA utilized historic drawings to estimate the original embankment top elevation and dimensions.

Subsurface stratification and soil properties were developed and utilized as previously described. The preconsolidation profile developed outside of the embankment footprint was utilized as the initial condition for the model, using the values specific to each approach beneath the embankments as shown on **Figures 4 and 5**. This is the preferred modeling approach in Settle3™ because it creates a more realistic effective stress profile considering differential loading at the time of the proposed construction. Where necessary, the subsurface conditions beyond the limits of the test borings were extrapolated to provide a complete subsurface model in the areas of interest for Settle 3™.

Our results predict approximately 9 to 17 inches of total settlement under the existing embankments, which is generally consistent with the pavement thicknesses found in the borings.

5.2.4 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 currently proposed raised and widened embankments were modeled as being constructed approximately 62 years after initial embankment construction, with final paving being completed six months after fill placement. Therefore, the initial five-year settlement values correspond to six to 66 months after completion of fill placement. GZA developed the three-dimensional model for analysis of future settlement using proposed grading supplied by Hoyle, Tanner.

Initially, GZA evaluated three alternatives including no-mitigation (base analysis), lightweight fill mitigation, and a vertical drainage wick/surcharge mitigation scheme. As the design progressed and contractor input was provided as part of the Contractor Input During Design (CID) process, the vertical drainage wick and surcharge mitigation was eliminated from the mitigation alternatives due to schedule considerations regarding the typical minimum six-month duration, during which bridge construction would not be practical. Therefore, vertical drainage wicks were not evaluated further. The remaining schemes are described in more detail in the following section. If final pavement is placed within six months after fill placement, additional primary consolidation settlement should be anticipated.

5.2.4.1 Settlement Mitigation Alternatives

No Mitigation

GZA evaluated a base model where filling is completed to design grade without lightweight materials, vertical drains or surcharge. The results indicate estimated total settlement (combined primary and secondary settlement) ranging from approximately 1.5 to 2.1 inches within five years at the approaches. During the 75-year life of the bridge, we anticipate up to approximately 5 to 7 inches of total settlement.

The “No Mitigation” results indicate that predicted settlements are very close to the project criteria. However, the settlement would be greater near the sidewalk to the south than at the north side of the road, which could affect the superelevation. In addition, settlement variability would be more likely to result from local variations in clay thickness, the timeline of new fill placement, and soil properties. Therefore, the lightweight fill scheme was evaluated.

Lightweight Fill

GZA evaluated ultra-lightweight foamed glass aggregate (ULFGA) material placed beneath the roadway section within 100 feet of the bridge abutments to limit stress increase and associated settlement. The thickness of the approximately 20-pounds-per-cubic-foot material was selected such that there would be a slight stress increase, generally equivalent to about 1 foot or less of standard-weight fill, beneath the paved portion of the roadway, and a reduced but still significant stress increase beneath the widened portion of the embankment, which is generally beneath the sidewalk. Based on our Settle3™ analyses, we predict post-construction settlements of approximately 0.5 to 1 inch in the first five years and an additional 1 to 1.5 in the following five years within the limits of the roadway, which are well within the settlement criteria provided by MaineDOT. Therefore, the use of lightweight fill is considered the preferred alternative for settlement mitigation. The maximum settlement predicted beneath the sidewalk occurs at the outer (southerly) edge and is approximately 1.5 inch in the first five years and 2 inches in the following five years. During the 75-year life of the bridge, we anticipate up to approximately 4 to 6 inches of total settlement.

The calculations included in **Appendix E** provide additional details and plotted results of the settlement analyses.

5.2.5 Embankment Slope Stability

GZA evaluated the stability of both approaches at critical cross-sections near the proposed abutments and in the longitudinal direction beneath each abutment using the cross-sections and properties shown in **Appendix E**.

Evaluations were conducted using the computer analytical software Slope/W 2020 (Slope/W), developed by Geo-Slope International, based on the Modified Bishop 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. The strength profiles presented in **Section 5.2.2** were used for these analyses.

5.2.5.1 Longitudinal Profiles

Static Analysis

The analyzed profiles considered the interpreted typical subsurface conditions along the project baseline, including the proposed presence of ULFGA. The beneficial reinforcing effect of the proposed HP 14x117 piles supporting the abutments was included in the Slope/W model. The Brom's method was used to calculate the available resistance from the piles, which is based on the stiffness of the embedded pile and the strength of the soil. Seven HP14x117 piles were modeled beneath each abutment, corresponding to a center-to-center spacing of about 8.2 feet, oriented for weak-axis bending. Brom's method pile resistance calculations are presented in **Appendix E**. The calculated lateral pile resistance was entered in Slope/W using a resistance value per pile and a pile spacing.

The results indicate a minimum factor of safety of 1.9 for the Abutment 1 profile and 1.6 for the Abutment 2 profile. Therefore, the global stability is acceptable in the longitudinal direction.

5.2.5.2 Cross-Sections

Static Analysis

A Slope/W model was developed for the proposed travelway with a 250-psf traffic surcharge pressure placed over the travel lanes and side slopes generally of 2H:1V. Three cross-sections were selected for analysis, consisting of the highest embankment in proximity to each abutment and one section at 9+25 at the proposed steepened 1.5H:1V slope, which is protected by TRM surface treatment. Type D subbase gravel was modeled beneath the TRM. The evaluations are summarized as follows:

- *Sta. 4+00, Abutment 1 Approach:* 19-foot-high embankment, widened to the right (south) and a maximum 3.5-foot grade raise. Left to right and right to left analyses. Proposed ULFGA section included in model.

- *Sta. 7+00, Abutment 2 Approach:* 25-foot-high embankment, widened to the right (south) and a maximum 3.5-foot grade raise. Left to right and right to left analyses. Proposed ULFGA section included in model.
- *Sta. 9+25, Abutment 2 Approach:* 13- to 14-foot-high embankment, minimal raise in grade, 1.5H:1V with TRM surface treatment. Left to right analysis only.

The results are summarized in the table below.

SUMMARY OF GLOBAL STABILITY EVALUATION	
Analysis Case	**Minimum Factor of Safety (Static)**
Sta. 4+00, Right to Left	1.7
Sta. 4+00, Left to Right	1.5
Sta. 7+00, Right to Left	1.4
Sta. 7+00, Left to Right	1.3
Sta. 9+25, Left to Right	1.6

The results show that the calculated resistance to rotational failure is acceptable for all planned embankment sections.

Seismic Analysis

A pseudostatic analysis was conducted at Abutment 2 including earthquake loading based on the Newmark method by incorporating a horizontal seismic coefficient, k_h, defined as half of the maximum peak ground acceleration at the ground surface (0.085 g). This value is justified by the likely development of some degree of deformation of the overall soil mass above the slip surface, in accordance with AASHTO LRFD Article 11.6.5.2.2. For this analysis, the stability is evaluated for the slip surface that is shown to have the lowest safety factor in the static analysis. The calculated pseudostatic factor of safety against rotational failure is predicted to be approximately 1.1 for the critical slip surface beneath Abutment 2 approach, which corresponds to the lowest static factor of safety for the project, indicating that significant slope deformations are not likely.

5.3 SEISMIC DESIGN CONSIDERATIONS

The subsurface profile for seismic design includes the approach fills (including backfill behind abutments), Marine Sand, Marine Clay and underlying Sand overlying bedrock. Seismic site class was determined in general accordance with AASHTO LRFD Table C3.10.3.1, considering the measured shear wave velocities in the sCPTs, which ranged from 615 to 730 feet per second. These averages consider the soil profile only, which ranged from 44 to 85 feet deep at the sCPTs. These sCPTs were not conducted through the approach embankments, which would likely be higher velocity material and would increase the average. Site Class D is defined as an average shear wave velocity between 600 and 1,200 feet per second. Based on the shear wave velocity criterion, the bridge can be assigned to Site Class D.

We also evaluated the Site Class E criterion of a profile with more than 10 feet of soft clay, defined as S_u less than 500 psf. The maximum thickness of soft clay encountered in the explorations and represented in the design profiles is less than 10 feet. Therefore, the soft clay criterion does not apply.

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

5.4 EVALUATION OF FOUNDATIONS

5.4.1 Foundation Type Assessment

H-piles driven to refusal on or near bedrock are the preferred foundation type for the proposed integral abutments and central pier. Probable bedrock was encountered at depths of approximately 59, 90, and 72 feet below the bottom of abutment/pile cap level at Abutments 1 and 2 and the central pier, respectively.

5.4.2 Pile Design Considerations

Based on our experience within similar soils, we anticipate that the proposed H-piles will be driven to refusal on or near the top of rock to achieve the required axial geotechnical resistance. The soil profile will primarily consist of medium stiff marine clay that is sensitive and will lose most of its strength temporarily during pile driving, underlain by medium dense fine sand which will also have limited friction resistance during driving. Therefore, we estimate friction resistance on the order of 5 to 20 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 Hoyle, Tanner do not include uplift loading on the piles.

By utilizing steel H-piles for support of the abutments and pier, 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 ½ inch or less may occur over time due to downdrag loading.

5.4.3 Load and Resistance Factors

Piles should be designed for the controlling nominal resistance of the piles, which could be structural or geotechnical. 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 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 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 ASSHTO LRFD Table 3.4.1-2 for strength limit state foundation design.

5.4.4 Pile Type

The abutments are planned to be supported on ASTM A572, Grade 50 (fy=50 kips per square inch [ksi]) steel HP14x117 piles, oriented for weak-axis bending parallel to the bridge beams. Each abutment will include seven piles. The central pier will be supported by 21 HP14x89 piles, comprised of three rows of seven plumb piles, oriented with the strong axis parallel to the length of the pier, which is skewed approximately 19 degrees from the longitudinal axis of the bridge. The piles will be spaced 3 feet on-center longitudinally and 7 feet on-center laterally.

5.4.5 Downdrag

As discussed previously, the proposed settlement mitigation scheme will not mitigate all of the settlement over the 75-year design life of the bridge relative to the abutment piles, during which several inches of settlement may occur. Therefore, the piles should be designed to resist downdrag loading. Based on the subsurface stratification and estimated settlement, we estimate an unfactored downdrag load of approximately 131 kips will occur on piles at Abutment 2, which is the maximum value for the project because of the thicker clay in this area. Considering the limited filling at the central pier, downdrag is not anticipated on the pier piles.

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, 0.25, and 0.23 for the Fill, Marine Clay Crust, 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 resistance, which was added to the maximum factored load provided by Hoyle, Tanner.

5.4.6 Pile Loads

Hoyle, Tanner provided a maximum factored axial load for abutment piles of 385 kips per pile for the strength condition, and the factored downdrag load is 131 kips; therefore, piles should be installed to a nominal axial resistance of at least 794 kips, calculated by dividing the maximum factored axial load of 516 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.

Hoyle, Tanner provided a maximum factored loads and moments applied at the center of the pile cap at the pier and the proposed pile and cap configuration for GZA's use in the pile group analyses. The maximum factored axial load per pile was calculated from these analyses, as presented in **Section 5.4.7**.

5.4.7 Lateral Pile Analysis

Abutments

GZA conducted lateral pile analyses using L-Pile 2019® (L-Pile). Hoyle, Tanner provide a maximum thermal deflection of 1.375 inches and a factored axial load of 385 kips. Downdrag was not included in the axial load as it will act below the pile head and will not contribute to the maximum pile stress. We assumed a fixed-head condition (zero rotation) and imposed the estimated thermal deflection at the pile head. The ground surface was assumed at the bottom-of-abutment/top-of-pile for thermal contraction. The analysis used ASTM A572 Grade 50, HP 14x117 piles aligned for weak-axis bending parallel to the bridge centerline. GZA's lateral pile analysis for the integral abutments was conducted in accordance with Section 5.4.2.4 of the MaineDOT BDG and the recommendations included in the "Integral Abutment Bridge Design Guidelines" by the Vermont Department of Transportation (VTrans).

GZA developed the soil profiles tabulated below based on the soil conditions encountered in the test borings and laboratory testing results. Considering the similarity of the upper 50 feet of the soil profile, Abutment 1 results are considered representative for both abutments.

L-PILE® INPUT PARAMETERS
Abutment 1, Typical Shortest Pile Length Approx. 59 ft

Stratum	Soil Model	Top of Layer Elevation (ft-NAVD 88)	Layer Thickness (ft)	k (pci) / E50	ϕ' (deg)/ Su (psf)	γ_t, γ_e (pcf)
Existing Fill	Reese Sand	48	6.4	65	31	125
Upper Marine Sand	Reese Sand	41.6	7	85	32	120
Marine Clay Crust**	Matlock Clay	34.6	7	E_{50} = 0.007	800	53
Marine Clay	Matlock Clay	27.6	33.5	E_{50} = 0.008	600	53
Lower Marine Sand	Reese Sand	-5.9	5.1	65	33	73
Top of Rock	--	-11	--	--	--	--

Notes:
1. Soil strata were modelled after boring BB-FBR-102.
2. ** indicates the top of layer is the approximate ground water elevation based on the boring logs and/or CPTs.
3. pci = pounds per cubic inch, deg = degrees, psf = pounds per square foot, γ_t = total unit weight (used above anticipated groundwater level), γ_e = effective unit weight (used below anticipated groundwater), pcf = pounds per square foot.

The initial lateral pile analysis resulted in a combined axial and bending stress of 81.9 ksi, which is beyond the elastic range of the pile. Therefore, GZA conducted a plastic hinge analysis.

The initial analysis using VTrans methodology considered pile head boundary conditions including a thermal deflection of 1.375 inches and a fixed-head condition (zero slope condition). The plastic moment resistance of the pile was calculated using the comparison of factored axial pile load and resistance, unbraced lengths, and effective length factors resulting from the initial L-Pile analysis. The structural capacity of the pile was checked to determine if a plastic hinge was formed for the specified displacement and specified axial thrust load under combined flexure based on the provisions of Article 6 of AASHTO LRFD and as per the recommendations of Section 5.4.2.4 of the MaineDOT BDG. This involves comparing the ratios of nominal and maximum factored axial load and moment in the pile using the interaction equation presented in AASHTO

LRFD 6.9.2.2. This calculation indicates that the combined stress resulting from an axial load of 385 kips and calculated pile head moment of 351 ft-kip results in formation of a plastic hinge.

The hinge allows the pile head to rotate with a constant moment (i.e., the plastic moment). The pile head transforms from a fixed connection to a pinned connection, thereby changing the effective length and design end condition parameter (K-value) of the top segment for stability checks in accordance with AASHTO LRFD Table C4.6.2.5-1. The structural resistance of the top segment of the pile is enhanced since the plastic hinge condition is anticipated to occur.

Since the resulting moment from the initial L-Pile iteration exceeded the calculated plastic hinge moment, a second L-Pile analysis was performed using the original specified pile head displacement and the plastic moment. This change results in a reduction of the axial buckling resistance of the upper segment of the pile (Segment 1) where the plastic hinge occurs.

The results of the second analysis indicate that the axial structural resistance including bending is adequate, and the demand ratio for combined bending is less than 1.0 in Segment 2. Therefore, with the exception of the plastic hinge location within the upper 1 foot of the pile below the abutment, the pile remains within the elastic range over the remainder of its length and is stable against buckling. The results also indicate that the nominal structural resistance in Segment 1 is adequate to support the design loads. Therefore, the proposed HP14x117 pile type and weak-axis configuration is suitable for support of the integral abutment deformation and axial loads. The integral abutment pile calculations are included in **Appendix E**.

Central Pier

GZA conducted lateral pile group analyses using GROUP 2015® (Group). We developed design subsurface profiles for use in Group that included new fill, marine clay, and marine sand. The soil profiles and recommended design properties are summarized in the following tables, and pier cap geometry, pile sizes, and load combinations provided by Hoyle, Tanner are presented in **Appendix E**. Load combinations were provided for multiple strength and service cases, and Hoyle, Tanner recommended using the largest factored loads for axial and moments applied to the bottom of column from different Strength load combinations. The Group model considered pile lateral resistance reduction factors (i.e., p-multipliers) in the direction of primary loading. The p-multipliers were developed based on the loading directions, pile diameter and pile spacing. These p-multipliers ranged from 1.0 to 0.6 and are summarized per pile in the results presented in **Appendix E**.

GROUP INPUT PARAMETERS Central Pier						
Stratum	**Soil Model**	**Top of Layer Elevation (ft- NAVD 88)**	**Layer Thickness (ft)**	**k (pci) / E50**	**ϕ' (deg)/ Su (psf)**	**γ_e (pcf)**
New Fill	Reese Sand	35.5	4	45	32	63
Marine Clay (Crust)	Stiff Clay w/o Free Water	31.5	0.2	E_{50} = 0.007	750 psf	53
Marine Clay	Soft Clay	31.3	40.2	E_{50} = 0.008	500 psf	53
Lower Marine Sand	Reese Sand	-8.9	30.1	65	33	73
Top of Rock	--	-39	--	--	--	--

Notes:
1. Recommended modulus and unit weight values assume groundwater level at El. 35.5.
2. pci = pounds per cubic inch, deg = degrees, psf = pounds per square foot,
3. γ_e = effective unit weight (used below anticipated groundwater), pcf = pounds per square foot.
4. Top of pile/Bottom of pile cap at EL. 31.5, Fill soils modeled from bottom of cap to EL. 35 (top of Cap).

Ultimate unit side friction, unit tip resistance, axial-load-displacement curves and torque-rotation curves were automatically generated by Group using the soil models above for the analysis.

GZA conducted analyses for the pier using pile group configurations developed by Hoyle, Tanner, which were iteratively modified based on interim Group analyses. The pier piles will consist of ASTM A572, Grade 50 (fy=50 ksi) HP14x89 steel H-piles. GZA's final analysis geometry includes three rows of seven plumb piles (21 total). GZA provided the analysis results to Hoyle, Tanner who evaluated the modelled foundation performance as part of the overall structural design and found it to be adequate

The pile stresses and loads from the Group results indicate a maximum combined stress of 15.9 ksi and a maximum factored axial pile demand of 284 kips. The maximum stresses in the table are combined stresses including axial and bending components. Pile cap movement is predicted to be approximately 0.4 inches vertically (down), 0.3 inches laterally (in the longitudinal direction), and 0.1 inches laterally (in the transverse direction). The results show that piles will not be in tension under the applied loads. The required nominal pile resistance of 436 kips was calculated by dividing the maximum factored axial load by the driven pile resistance factor for the strength condition of 0.65. The results indicate that the pier piles are capable of achieving fixity and remaining elastic under the proposed loads.

5.4.8 Design-Phase Pile Drivability Analysis

GZA completed wave equation analyses to assess the drivability of the HP 14x117 (abutments) and HP 14x89 (pier) pile with nominal geotechnical resistances of 794 and 436 kips, respectively. The goal of the analysis 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 to the deepest top-of-rock elevations encountered at the abutments and pier. Estimated side resistance during pile installation was used as an input in wave equation analyses, including a range of 5 to 15 percent contribution of skin friction resistance to the maximum factored pile resistance. Analyses for the abutment piles were completed using a Delmag D46-32 diesel hammer with a ram weight of 10,140 pounds and a rated energy of approximately 126,750 foot-pounds (ft-lbs). Analyses for the pier piles were completed using a Delmag D25-32 diesel hammer with a ram weight of 5,500 pounds and a rated energy of approximately 58,245 ft-lbs. The results are summarized below.

DESIGN-PHASE WAVE EQUATION ANALYSIS RESULTS					
Pile Location and Type	**Embedded Pile Length**	**Driving System Rated Energy (ft-lbs)**	**Required Nominal Geotechnical Resistance (kips)**	**Max Driving Stress (ksi)**	**Final Penetration Resistance (blows per inch)**
Abutment 2 HP 14x117	90 feet	126,750	794	41	7
Pier HP 14x89	72 feet	58,245	436	25	7

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 is within the MaineDOT preferred range of 6 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.

5.4.9 Lateral Earth Pressures

Thermal expansion of the bridge will cause the backwalls and wingwalls of the integral abutment to move toward the backfill, which will result in earth pressures ranging from at-rest to passive earth pressure. The material properties will be controlled by the backfill material, which is proposed to consist of BDG Type 4 soil.

Hoyle, Tanner provided a thermal expansion for use in abutment design of 0.725 inches. The abutment height is approximately 11.25 feet resulting in a calculated abutment rotation of 0.0054 feet/foot. Considering the calculated rotation exceeds the threshold of 0.005 for use of a Rankine passive coefficients, GZA recommends using the MassDOT methodology, which results in a passive earth pressure coefficient of 4.08 for design of backwalls and wingwalls. A range of 4.08 to 4.5 is appropriate for a passive earth pressure coefficient for lightweight fill considering the MassDOT Methodology and the possible higher friction angle. The coefficient that generates the largest load scenario should be used for design. Design lateral earth pressure recommendations were developed based on this equation, as presented in **Appendix E**, and are provided in **Section 6.3** 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.

5.4.10 Frost Protection

Fill soils are anticipated to be present at the abutments and embankments, either as existing fill or imported backfill. Based on the MaineDOT BDG, Section 5.2.1, the Freezing Index for the site is 1,275, and with low-moisture content (10-20 percent) soils, the estimated depth of frost penetration is approximately 5.75 feet. The soils in the vicinity of the pier pile cap consist of marine clay and new fill soils and are anticipated to have a moisture content of around 20 percent. Therefore, the frost depth at the pier location is approximately 4.5 feet.

6.0 RECOMMENDATIONS

6.1 EMBANKMENT DESIGN AND SETTLEMENT MITIGATION

We recommend the use of ULFGA to reduce the stress increase in the marine clay resulting from new embankment fills in the vicinity of the new abutments. The basic limits of the ULFGA should extend vertically from the base of the new pavement section, and from the back of the new abutments to a distance of 100 feet from the back of the abutments. The limits of the ULFGA consistent with GZA's settlement evaluations and predictions are as follows:

Station	**ULFGA Thickness**		
	16' Lt. to 0'	**0' to 27' Rt.**	**27' Rt. to 46' Rt.**
3+35 to 4+35	2'	2'	4'
6+77 to 7+77	2'	3'	5'

The thicknesses recommended above should be considered the minimum within the offsets listed, including irregularities in the cross-sections around guardrails and underdrains.

The ULFGA should be completely encapsulated with non-woven separation geotextile (MaineDOT Standard Specification 722.04). Installation of the ULFGA should be completed in accordance with *Special Provision Section 203, Excavation and Embankment (Ultra-Lightweight Foamed Glass Aggregate)*.

Embankment side slopes should be designed with MaineDOT-typical slope angles of 2H:1V or flatter, except between Sta. 9+25 and 10+25 Right, where the slope angle will be 1.5H:1V. Slopes should be provided with loam and seed for permanent erosion protection. Where slopes steeper than 1.75H:1V are planned, a TRM should be employed to promote vegetation growth and limit surface erosion. Beneath the TRM and extending through areas with inclinations steeper than 2H:1V, we recommend utilizing MaineDOT Type D Aggregate for Subbase compacted to 95 percent relative compaction according to AASHTO LRFD T-180 (Modified Proctor). The TRM should be underlain by a 2-inch-thick compost blanket (Special Provision 615) and hydraulically seeded with a special seed mix (Special Provision 717.03). The TRM should be installed in accordance with Special Provision 613 and any manufacturer-specific or system-specific components (e.g., anchoring).

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)	0.14 g
SDs (Period = 0.2 sec)	0.27 g
SD1 (Period = 1.0 sec)	0.11 g

6.3 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 for Underwater Backfill, MaineDOT BDG Type 4 soil, except in areas where ULFGA is proposed 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;
  - Internal Friction Angle of Soil (ULFGA) = 40°;
  - Soil Total Unit Weight (ULFGA) = 20 pcf; and
  - Coefficient of Passive Earth Pressure, K_p = 4.08 for granular fills and 4.08 – 4.50 for ULFGA (use for design of backwalls 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.

6.4 PILE DESIGN

6.4.1 Abutments

- The proposed abutments may be supported on HP 14x117 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 794 kips, calculated by dividing the maximum factored pile load of 516 kips (385 kips Strength I plus 131 kips downdrag) by a resistance factor of 0.65.
- The piles should be oriented for weak-axis bending consistent with the lateral pile analyses presented herein.
- 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 127,000 ft-lbs for the anticipated 80- to 90-foot-long, ASTM A572 Grade 50 HP14x117 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 6 to 15 blows per inch.

6.4.2 Pier

- The proposed pier substructure 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 pier piles should be driven to a nominal resistance of 436 kips, calculated by dividing the maximum factored pile load of 284 kips (Strength I) by a resistance factor of 0.65.
- The pier piles should be oriented for strong-axis bending consistent with the lateral pile analyses presented herein.
- Preliminary wave equation analyses indicate that the pier piles can be driven to the required nominal resistance using a diesel hammer with a rated energy of about 58,000 ft-lbs for the anticipated 70- to 75-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 6 to 15 blows per inch.

6.4.3 All Piles

- The pile tip elevations used in the drawings should correspond to the bedrock elevations encountered in the borings (approximately El. -11 at Abutment 1, approximately El. -38 at Pier 1, and approximately El. -39 at Abutment 2). A provision is recommended 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 and one pier pile be dynamically tested at the end of initial drive to assess driving stress and establish the penetration resistance criteria to achieve the required nominal resistance for the production piles. The plans should also require a restrike test on each test pile.

- Piles may be installed through the marine clay stratum by vibratory methods. Vibratory installation should be terminated when an increase in resistance is detected, and the pile should be monitored dynamically throughout the remainder of the driving.
- Piles shall be spliced in accordance with MaineDOT Section 501.047. Considering the predicted formation of a plastic hinge at the base of the abutment, splices should not be allowed within 15 feet of the bottom of the abutment.
- Integral 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). GZA completed this analysis for the integral abutment piles as documented herein.
- 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 load test with signal matching be performed per substructure in conjunction with the resistance factor of 0.65. We recommend that one PDA test with Signal Matching be completed at each abutment and at a pier pile, including a restrike test at least 24 hours after initial drive for each tested pile, resulting in a total of three 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 required in the vicinity of the bridge in areas where grade separations exceed approximately 4 feet during different construction phases. An approximately 7-foot-deep sheet pile cofferdam will likely be required for construction of the pier in the I-295 median.

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 Prevention Plan and MaineDOT Best Management Practices.

7.3 REUSE OF ON-SITE MATERIALS

Based on the test boring results, three of the seven 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 and/or Granular Borrow Backfill, and would not be suitable for use as structural backfill. The material is considered suitable for use as Common Borrow.

If the contractor wishes to reuse excavated material as embankment fill or in other areas, 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 ULTRA-LIGHT WEIGHT FILL PLACEMENT

Based on our experience, the ULFGA material can be handled and placed similarly to granular borrow, but a unique aspect that affects construction is that densification must take place in a controlled fashion with careful attention to avoid crushing of the particles. This involves utilization of vibratory plate compaction equipment to place and compact the material in lifts and avoiding direct traffic on the material with heavy construction equipment. We recommend that GZA provide submittal review and field engineering to observe and provide input into material-specific aspects of construction sequencing, placement methodology, compaction equipment and compaction procedures.

We recommend that a nonwoven geotextile fabric be placed as a separator between the ULFGA and all other differing materials above, below or adjacent to the material. This will involve a combination of placing the geotextile along prepared subgrade surfaces, wrapping it around the edges of placed ULFGA, and wrapping it around irregularities in the surface as required due to the presence of underdrain piping, catch basins, and guardrails. In areas where the ULFGA is placed against the temporary sheets, additional ULFGA should be placed in the "bellies" to reduce subsidence upon sheetpile extraction.

Equipment travel on placed ULFGA should be strictly prohibited. Construction equipment other than for placement and compaction of ULFGA should not operate on the exposed ULFGA surface until a minimum 12-inch layer of granular cover material is placed over the ULFGA. The cover material should be placed and compacted within 48 hours of placing and compacting the final lift(s) of ULFGA in an area. Until that time, operation of construction equipment directly on the ULFGA shall be limited to light-duty equipment with rubber tires. The contractor should be required to submit a proposed plan for protecting exposed ULFGA.

The ULFGA will be placed in two stages consistent with the planned staged bridge construction. The contractor should be required to submit a description of their methodology to provide a continuous ULFGA fill layer considering phased bridge construction.

The ULFGA should be transported, placed and compacted in accordance with the project-specific Special Provision 203.

TABLES

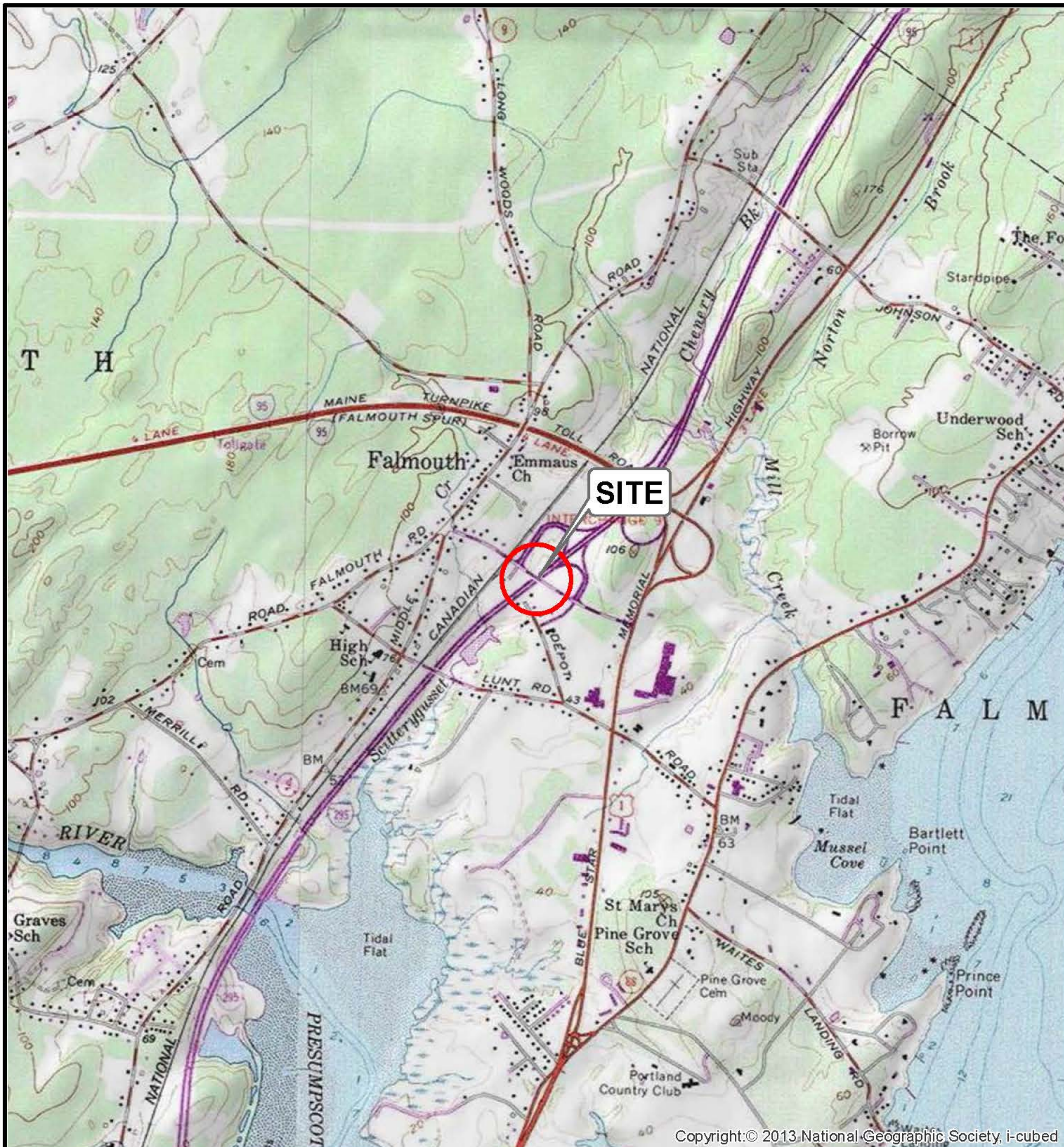
TABLE 1
Summary of Subsurface Explorations
Bucknam Road Bridge #5830 over I-295
Falmouth, ME
WIN 21720.00

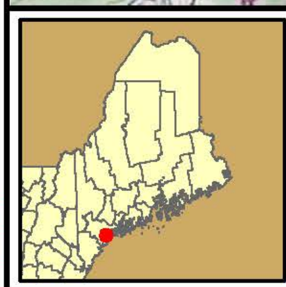
Boring ID	Station	Offset (ft)	Ground Surface El. (ft)	Top of Stratum Elevation						Stratum Thickness					Depth to Bedrock (ft)	Bottom of Boring Depth (ft)	Bottom of Boring El. (ft)	Groundwater	
				Fill	Upper Marine Sands	Marine Clay Crust	Marine Clay	Lower Marine Sands	Bedrock	Fill	Upper Marine Sands	Marine Clay Crust	Marine Clay	Lower Marine Sands				El. (ft)	Depth (ft)
BB-FBR-102	4+29.3	2.8 R	56.6	56.6	41.6	34.6	27.6	-5.9	-11.1	15.0	7.0	7.0	33.5	5.2	67.7	78.0	-21.4	26.6	30.0
BB-FBR-103	5+42.5	2.8 R	40.0	40.0	NE	36.0	31.0	NE	NE	4.0	NE	5.0	27.0	NE	NE	36.0	4.0	39.0	1.0
BB-FBR-103A	5+58.0	2.7 R	40.3	40.3	NE	36.3	31.3	-8.9	-39.0	4.0	NE	5.0	40.2	30.1	79.3	89.5	-49.2	39.3	1.0
BB-FBR-104	6+80.8	2.7 R	62.4	62.4	39.8	35.5	28.4	-10.1	-37.8	22.6	4.3	7.1	38.5	27.7	100.2	113.7	-51.3	50.2	12.2
BB-FBR-106	6+86.6	58.7 R	47.0	47.0	41.0	NE	33.0	-20.0	-37.5	6.0	8.0	NE	53.0	17.5	84.5	86.0	-39.0	31.8	15.2
CPT-FBR-101	4+07.6	87.6 R	39.0	39.0	34.0	29.0	25.0	-1.5	NE	5.0	5.0	4.0	26.5	3.3	NE	43.8	-4.8	36.5	2.5
CPT-FBR-102	4+19.7	51.0 R	42.4	42.4	40.4	29.4	22.4	-7.6	NE	2.0	11.0	7.0	30.0	5.6	NE	55.6	-13.2	36.1	6.3
CPT-FBR-103	6+84.5	85.2 R	42.8	42.8	40.8	34.8	31.8	-15.2	NE	2.0	6.0	3.0	47.0	14.0	NE	73.0	-30.2	38.9	3.9
CPT-FBR-104	6+98.0	46.4 R	48.7	48.7	42.7	32.7	28.2	-23.3	NE	6.0	10.0	4.5	51.5	12.7	NE	84.7	-36.0	44.4	4.3
CPT-FBR-105	7+96.0	59.3 R	47.1	47.1	45.1	37.1	32.1	1.6	NE	2.0	8.0	5.0	30.5	8.1	NE	54.6	-7.5	41.7	5.4
BB-FBR-201	4+15.4	68.9 L	39.6	39.6	33.3	32.5	24.9	0.5	-3.6	6.3	0.8	7.6	24.4	4.1	43.5	45.2	-5.6	33.9	5.7
BB-FBR-202	7+55.5	68.5 L	43.6	43.6	39.0	37.0	34.0	-3.4	-15.8	4.6	2.0	3.0	37.4	12.4	59.4	59.4	-15.8	37.9	5.7

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

Notes:
1. Refer to the boring logs in Appendix B for additional information.
2. Project elevation datum is North American Vertical Datum (NAVD 88), unless noted otherwise.
3. As-drilled locations 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

N W E S

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.

Data Supplied by :

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

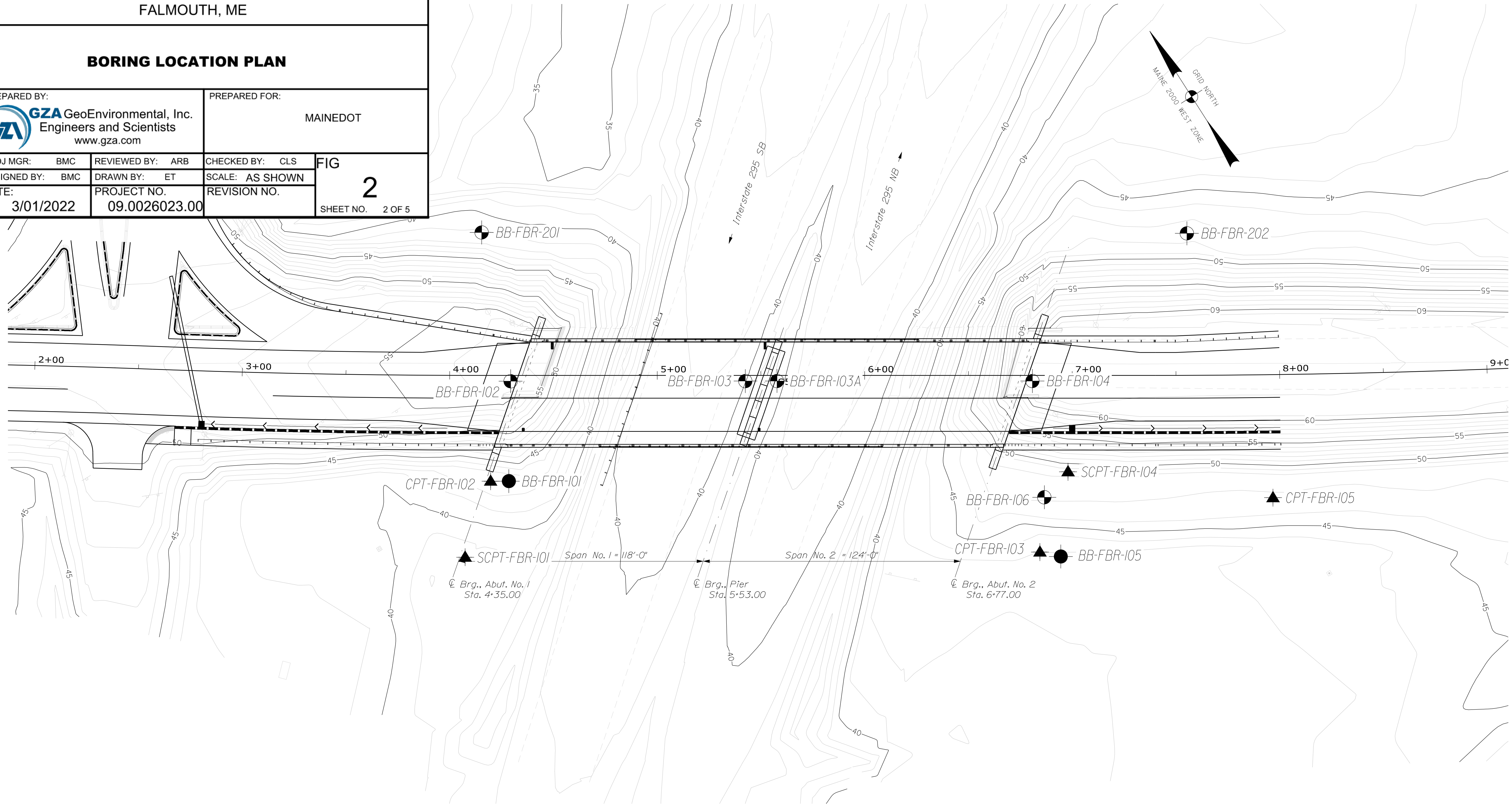
SCALE IN FEET

PROJ. MGR.: BMC DESIGNED BY: LCN REVIEWED BY: CLS OPERATOR: LCN DATE: 01-31-2022	**LOCUS PLAN**	JOB NO. 09.0026023.00
	BUCKNAM ROAD BRIDGE OVER I-295 FALMOUTH, ME	FIGURE NO. **1**

BUCKNAM ROAD BRIDGE
MAINEDOT WIN 21720.00
FALMOUTH, ME

BORING LOCATION PLAN

PREPARED BY: GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com		PREPARED FOR: MAINEDOT	
PROJ MGR: BMC	REVIEWED BY: ARB	CHECKED BY: CLS	FIG 2
DESIGNED BY: BMC	DRAWN BY: ET	SCALE: AS SHOWN	
DATE: 3/01/2022	PROJECT NO. 09.0026023.00	REVISION NO.	SHEET NO. 2 OF 5



NOTES

1) Base map developed from electronic files (Files included Alignments.dgn, Bridge.dgn Points.dgn, text.dgn, topo.dgn, and contours.dgn) provided by Hoyle, Tanner & Associates, Inc February 28, 2022.

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

LEGEND

BB-FBR-106 — Indicates -100 series borings performed by New England Boring Contractors of Hermon, Maine between June 16, and June 26, 2019 and observed by GZA personnel.

BB-FBR-202 — Indicates -200 series borings performed by New England Boring Contractors of Hermon, Maine from September 1 to 2, 2020 and observed by GZA personnel.

BB-FBR-105 — Indicates borings performed by Summit Geoengineering Services, Inc. of Rockland, Maine between May 22, and May 23, 2019 and observed by GZA personnel.

CPT-FBR-105 — Indicates cone penetration tests (CPTs) performed by Summit Geoengineering Services, Inc. of Rockland, Maine between May 21, and May 23, 2019 ("S" indicates seismic testing was performed).

PLAN

25 0 25 50
Scale

PREPARED BY: GZA

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
021720.00
WIN 21720.00
BRIDGE PLANS
BRIDGE NO. 5830

SIGNATURE | P.E. NUMBER | DATE

BY | DATE
PROJ. MANAGER
DESIGN-DETAILED
CHECKED-REVIEWED
DESIGN2-DETAILED2
DESIGN3-DETAILED3
REVISIONS 1
REVISIONS 2
REVISIONS 3
REVISIONS 4
FIELD CHANGES

BUCKNAM ROAD BRIDGE
INTERSTATE 295
FALMOUTH CUMBERLAND COUNTY
BORING LOCATION PLAN

SHEET NUMBER
7
OF 51

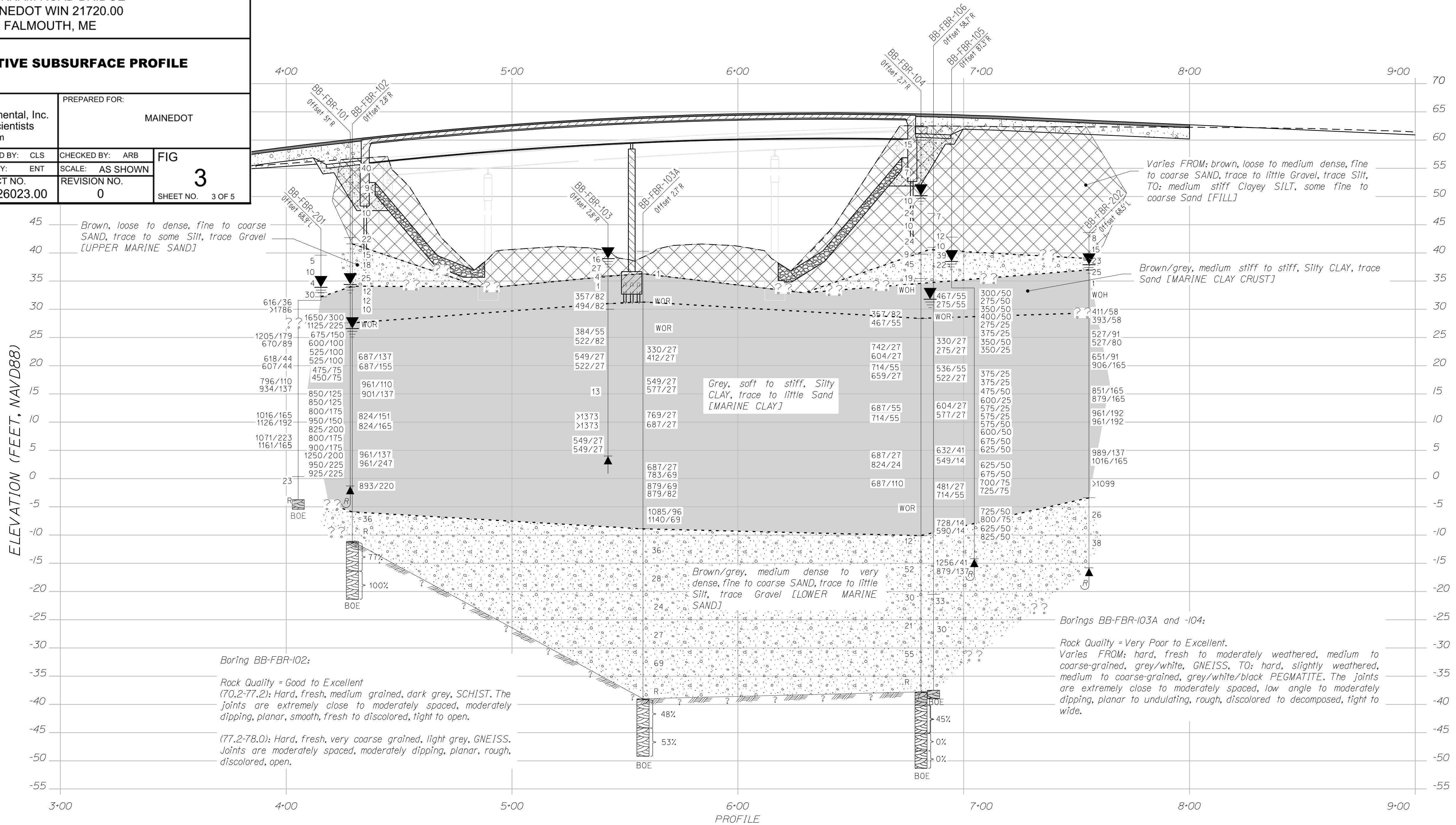
Division: Bridge
Filename: ...\BLP\Bucknam BLP.dgn
Date:3/1/2022
Username: BMC

BUCKNAM ROAD BRIDGE
MAINEDOT WIN 21720.00
FALMOUTH, ME

INTERPRETIVE SUBSURFACE PROFILE

PREPARED BY: GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com	PREPARED FOR: MAINEDOT	
PROJ MGR: BMC	REVIEWED BY: CLS	CHECKED BY: ARB
DESIGNED BY: ENT	DRAWN BY: ENT	SCALE: AS SHOWN
DATE: 2/1/2022	PROJECT NO. 09.0026023.00	REVISION NO. 0

FIG 3
SHEET NO. 3 OF 5



Division: Bridge
Filename: ...\ISP\Bucknam_ISP.dgn
Date:1/31/2022
Username: BMC

NOTES

1) Base map developed from electronic files provided or downloaded from MaineDOT ftp site by Hoyle, Tanner & Associates, Inc. on January 28, 2022 (File included 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-FBR-100 series bridge borings were performed by New England Boring Contractors and Summit Geoengineering Services, Inc and observed by GZA personnel between May 22 and June 25, 2019.

4) BB-FBR-200 series bridge borings were performed by New England Boring Contractors and observed by GZA personnel from September 1 to 2, 2020.

4) This generalized interpretive soil and rock 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 transitions may vary and are probably more erratic. Boring data are shown for borings drilled off alignment, but interpreted strata are based on the three borings drilled closest to the project baseline. For more specific information refer to the exploration logs.

LEGEND

Boring No. Offset, if shown

Pavement Thickness if applicable
6 — Energy-Corrected SPT N60 Value (blows/foot)
WOH — Indicates weight of hammer
WOR — Indicates weight of rod
Encountered Groundwater Level
Strata Interface
879/137 — Indicates In-situ field vane strength (peak/residual) in pounds per square foot.
R — Split Spoon Refusal(>50 blows for 1" penetration)
Advancement of rollerbit
Interpreted Top of Bedrock (See Note 4)
RQD = Rock Quality Designation for Rock Core Sample
BOE — Bottom of Exploration
Bottom of Exploration, No Refusal
Bottom of Exploration, Refusal

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

PREPARED BY: GZA

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

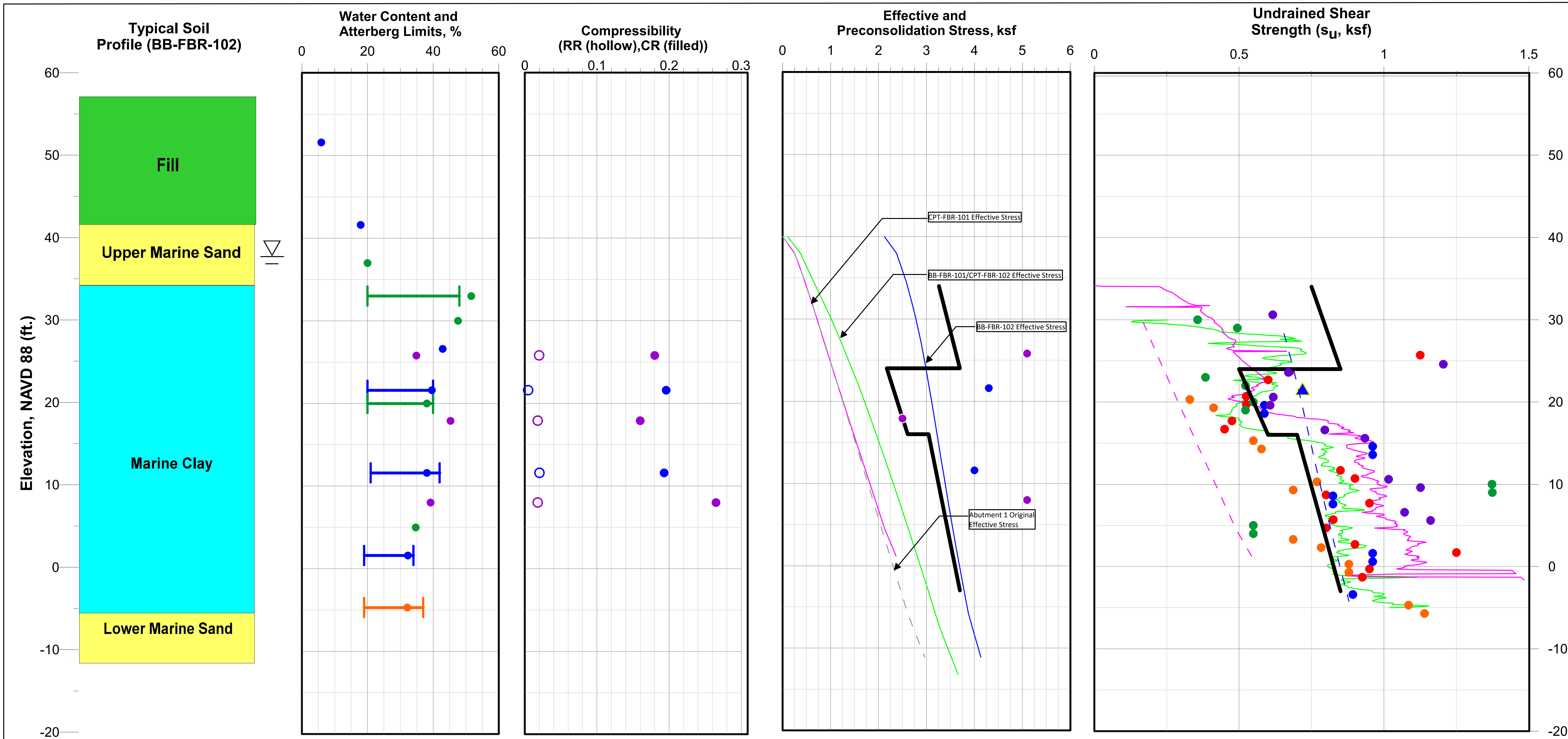
021720.00
WIN 21720.00
BRIDGE PLANS
Bridge No. 5830

	SIGNATURE	P.E. NUMBER	DATE
PROJ. MANAGER			
DESIGN-DETAILED			
CHECKED-REVIEWED			
DESIGN2-DETAILED2			
DESIGN3-DETAILED3			
REVISIONS 1			
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			

BUCKNAM ROAD BRIDGE
INTERSTATE 295
FALMOUTH CUMBERLAND COUNTY

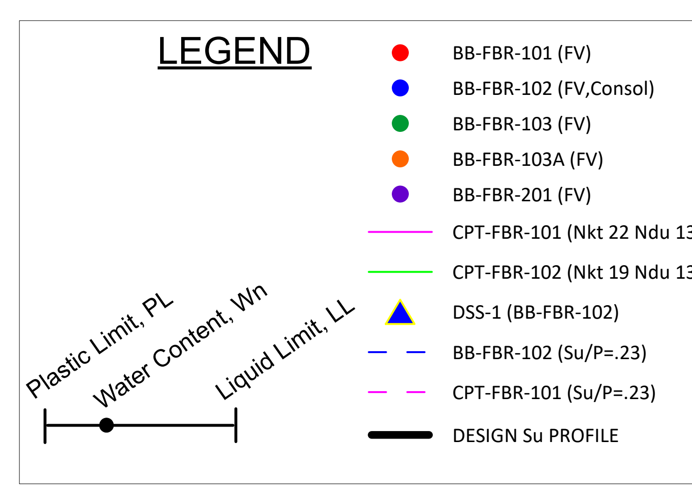
INTERPRETIVE SUBSURFACE PROFILE

SHEET NUMBER
8
OF 51



NOTES:

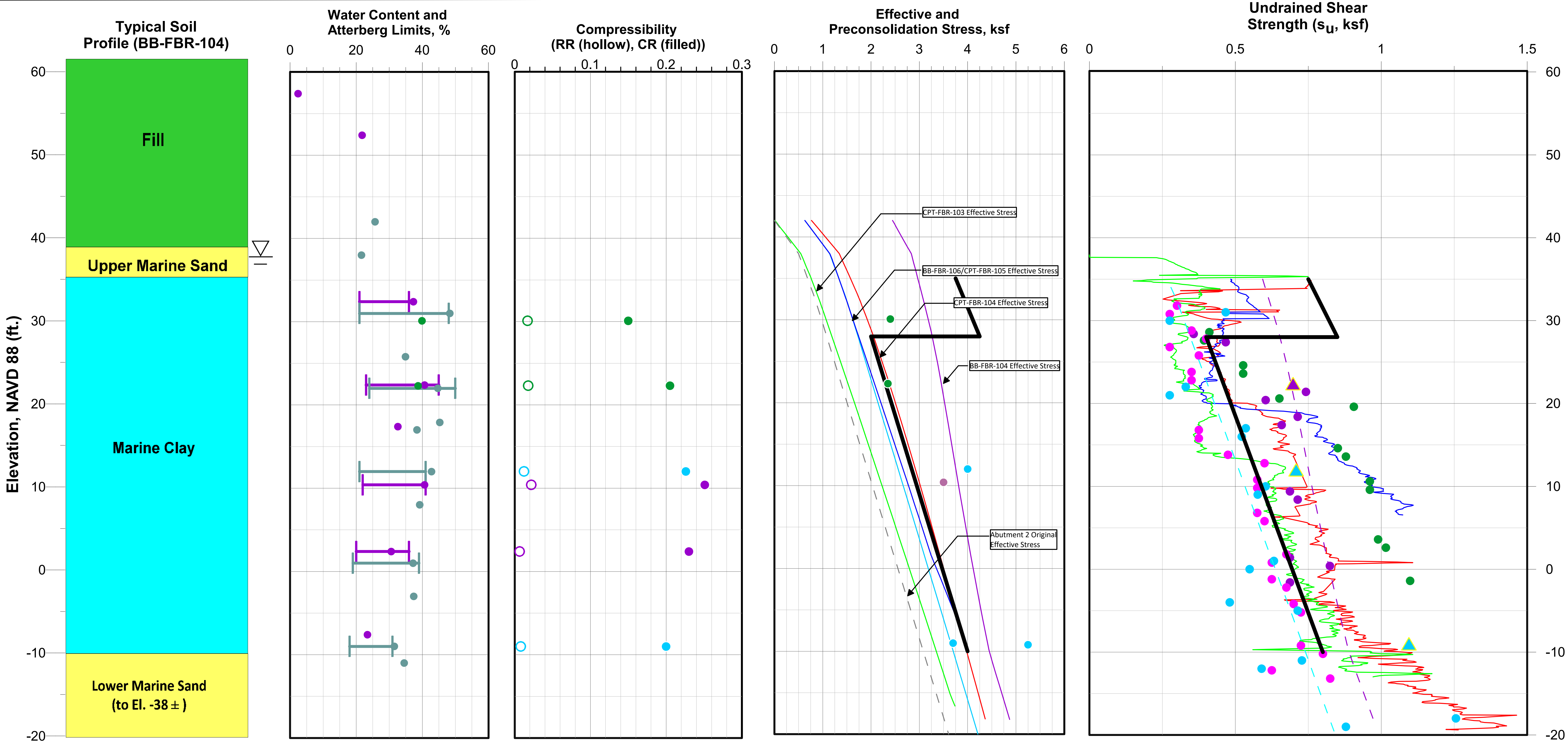
1. DATA BASED ON TEST BORINGS (BB-FBR-102, -103, AND -103A) PERFORMED BY NEW ENGLAND BORING CONTRACTORS OF HERMON, MAINE BETWEEN JUNE 16 AND JUNE 17, 2019 AND TEST BORING BB-FBR-101 PERFORMED BY SUMMIT GEOENGINEERING OF ROCKLAND, MAINE ON MAY 23, 2019. BORINGS PERFORMED BY NEW ENGLAND BORING CONTRACOTRS WERE OBSERVED AND LOGGED BY GZA PERSONNEL.
2. CPT EXPLORATIONS (CPT-FBR-101 AND -102) PERFORMED BY SUMMIT GEOENGINEERING OF ROCKLAND, MAINE BETWEEN MAY 22 AND 23, 2019.
3. TYPICAL SOIL PROFILE BASED ON BORING BB-FBR-102.
4. WATER CONTENTS BASED ON LABORATORY TESTS PERFORMED ON SAMPLES TAKEN FROM RECENT BORINGS.
5. EFFECTIVE STRESS BASED ON INITIAL EFFECTIVE STRESS CALCULATED BY SETTLE3D BY ROCSCIENCE. EXISTING EMBANKMENT (FILL) MODELED AS AN EMBANKMENT LOAD OVER ORIGINAL GRADE. THEREFORE, EFFECTIVE STRESS ONLY CALCULATED BELOW EL. 40'.
6. PRECONSOLIDATION PRESSURE CALCULATED FROM CONSOLIDATION TESTS USING THE WORK METHOD.
7. CORRELATED UNDRAINED SHEAR STRENGTH FROM CPT DATA IS BASED ON N_{KT} = 28 (CPT-FBR-101) AND N_{KT} =22 (CPT-FBR-102).
8. IN LEGEND, FV=UNDRAINED SHEAR STRENGTH FROM IN-SITU FIELD VANE, CONSOL=LAB DATA FROM CONSOLIDATION TEST.



BUCKNAM ROAD BRIDGE REPLACEMENT
FALMOUTH, ME

IN-SITU SOIL CONDITIONS VS. ELEVATION
Abutment 1 Approach

PREPARED BY:		PREPARED FOR:	
GZA GeoEnvironmental, Inc. Engineers & Scientists www.gza.com		MAINE DEPARTMENT OF TRANSPORTATION	
PROJ MGR: BMC	REVIEWED BY: ARB	CHECKED BY: CLS	FIGURE 4
DESIGNED BY: BMC	DRAWN BY: BMC	SCALE: N/A	
DATE: 1/31/2022	PROJECT NUMBER: 09.0026023.00	REVISION NUMBER: 0	



NOTES:

1. DATA BASED ON TEST BORINGS (BB-FBR-104, AND -106) PERFORMED BY NEW ENGLAND BORING CONTRACTORS OF HERMON, MAINE BETWEEN JUNE 16 AND JUNE 26, 2019 AND TEST BORING BB-FBR-105 PERFORMED BY SUMMIT GEOENGINEERING OF ROCKLAND, MAINE ON MAY 22, 2019. BORINGS OBSERVED AND LOGGED BY GZA PERSONNEL.
2. CPT EXPLORATIONS (CPT-FBR-103, -104 AND -105) PERFORMED BY SUMMIT GEOENGINEERING OF ROCKLAND, MAINE BETWEEN MAY 21 AND 22, 2019.
3. TYPICAL SOIL PROFILE BASED ON BORING BB-FBR-104.
4. WATER CONTENTS BASED ON LABORATORY TESTS PERFORMED ON SAMPLES TAKEN FROM RECENT BORINGS.
5. EFFECTIVE STRESS BASED ON INITIAL EFFECTIVE STRESS CALCULATED BY SETTLE3D BY ROCSCIENCE. EXISTING EMBANKMENT (FILL) MODELED AS AN EMBANKMENT LOAD OVER ORIGINSL GRADE. THEREFORE, EFFECTIVE STRESS ONLY CALCULATED BELOW EL. 40'.
6. PRECONSOLIDATION PRESSURE CALCULATED FROM CONSOLIDATION TESTS USING THE WORK METHOD .
7. CORRELATED UNDRAINED SHEAR STRENGTH FROM CPT DATA IS BASED ON N_{KT} = 16 (CPT-FBR-104) AND N_{KT}=22 (CPT-FBR-103 AND -105).
8. IN LEGEND, FV=UNDRAINED SHEAR STRENGTH FROM IN-SITU FIELD VANE, CONSOL=LAB DATA FROM CONSOLIDATION TEST.

LEGEND

Plastic Limit, PL
Water Content, Wn
Liquid Limit, LL

- BB-FBR-202 (FV)
- BB-FBR-104 (FV, Consol)
- BB-FBR-105 (CPT-103) (FV)
- BB-FBR-106 (FV,Consol)
- CPT-FBR-103 (Nkt 22 Ndu 18)
- CPT-FBR-104 (Nkt 16 Ndu 13)
- CPT-FBR-105 (Nkt 22 Ndu 18)
- DSS-2 (BB-FBR-104)
- DSS-3/4 (BB-FBR-106)
- BB-FBR-106 (Su/P=.2)
- BB-FBR-104 (Su/P=.2)
- DESIGN Su PROFILE

BUCKNAM ROAD BRIDGE REPLACEMENT
FALMOUTH, ME

IN-SITU SOIL CONDITIONS VS. ELEVATION
Abutment 2 Approach

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

PREPARED FOR:
MAINE DEPARTMENT OF TRANSPORTATION

PROJ MGR: BMC	REVIEWED BY: ARB	CHECKED BY: CLS	FIGURE 5
DESIGNED BY: BMC	DRAWN BY: BMC	SCALE: N/A	
DATE: 1/31/2022	PROJECT NUMBER: 09.0026023.00	REVISION NUMBER: 0	

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 –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. 200 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

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

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))

Sample Container Labeling Requirements:

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

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Bucknam Road Bridge #5830 over I-295
Location: Falmouth, Maine
Boring No.: BB-FBR-101
WIN: 21720.00

Driller:	Summit Geoengineering, Inc.	**Elevation (ft.)**	42.7	**Auger ID/OD:**	
Operator:	S. Anderson, S. Floyd	**Datum:**	NAVD 88	**Sampler:**	-
Logged By:	C. Coolidge	**Rig Type:**	AMS 9500 VTR	**Hammer Wt./Fall:**	-
Date Start/Finish:	5/23/19-5/23/19	**Drilling Method:**	Hydraulic Push Casing	**Core Barrel:**	
Boring Location:	Sta. 4+28.5, 51.0' Rt	**Casing ID/OD:**	1.5"/2.0"	**Water Level*:**	8.3'
Hammer Efficiency Factor:	--	**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							HYD			Advanced boring to 15' and began conducting field vanes in clay based on the results of CPT-FBR-102. No split spoon samples were taken.	
5											
10											
15	V1		15.6 - 16.0	S_u=1,650/300 psf						55x110 mm vane raw torque readings: V1: 34/6 ft-lbs	
	V2		16.6 - 17.0	S_u=1,125/225 psf						V2: 23/4.5 ft-lbs	
	V3		18.6 - 19.0	S_u=675/150 psf						55x110 mm vane raw torque readings: V3: 14/3 ft-lbs	
	V4		19.6 - 20.0	S_u=600/100 psf						V4: 12.5/1.5 ft-lbs	
20											
	V5		21.6 - 22.0	S_u=525/100 psf						55x110 mm vane raw torque readings: V5: 11/2 ft-lbs	
	V6		22.6 - 23.0	S_u=525/100 psf						V6: 11/2 ft-lbs	
	V7		24.6 - 25.0	S_u=475/75 psf						55x110 mm vane raw torque readings:	
25											

Remarks:

1. Boring was completed by Summit Geoengineering, GZA prepared log using information included in Summit's report dated 6/7/19.
2. 2" casing advanced by pushing, with central plug in place.
3. Field vanes consisted of Geonor rectangular vanes. Raw torque readings were converted to undrained shear strength by Summit and were rounded to the nearest 25 psf.

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: Bucknam Road Bridge #5830 over I-295
Location: Falmouth, Maine

Boring No.: BB-FBR-101
WIN: 21720.00

Driller:	Summit Geoengineering, Inc.	**Elevation (ft.)**	42.7	**Auger ID/OD:**	
Operator:	S. Anderson, S. Floyd	**Datum:**	NAVD 88	**Sampler:**	-
Logged By:	C. Coolidge	**Rig Type:**	AMS 9500 VTR	**Hammer Wt./Fall:**	-
Date Start/Finish:	5/23/19-5/23/19	**Drilling Method:**	Hydraulic Push Casing	**Core Barrel:**	
Boring Location:	Sta. 4+28.5, 51.0' Rt	**Casing ID/OD:**	1.5"/2.0"	**Water Level*:**	8.3'
Hammer Efficiency Factor: --		**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.
25	V8		25.6 - 26.0	S_u=450/75 psf						V7: 10/1.5 ft-lbs 55x110 mm vane raw torque readings: V8: 9.5/1.5 ft-lbs	
30	V9		30.6 - 31.0	S_u=850/125 psf						V9: 29/4 ft-lbs	
	V10		31.6 - 32.0	S_u=850.125 psf						V10: 30/4.5 ft-lbs	
	V11		33.6 - 34.0	S_u=800/175 psf						V11: 27/6 ft-lbs	
	V12		34.6 - 35.0	S_u=950/150 psf						V12: 32/5 ft-lbs	
35											
	V13		36.6 - 37.0	S_u=825/200 psf						V13: 28/7 ft-lbs	
	V14		37.6 - 38.0	S_u=800/175 psf						V14: 27/6 ft-lbs	
	V15		39.6 - 40.0	S_u= 900/175 psf						V15: 30/6 ft-lbs	
40	V16		40.6 - 41.0	S_u=1,250/200 psf						V16: 42/6.5 ft-lbs	
	V17		42.6 - 43.0	S_u= 950/225 psf						V17: 32/7.5 ft-lbs	
	V18		43.6 - 44.0	S_u=925/225 psf				-1.3		V18: 31/7.5 ft-lbs 44.0 **Bottom of Exploration at 44.0 feet below ground surface.**	
45											
50											

Remarks:

1. Boring was completed by Summit Geoengineering, GZA prepared log using information included in Summit's report dated 6/7/19.
2. 2" casing advanced by pushing, with central plug in place.
3. Field vanes consisted of Geonor rectangular vanes. Raw torque readings were converted to undrained shear strength by Summit and were rounded to the nearest 25 psf.

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: Bucknam Road Bridge #5830 over I-295		**Boring No.:**	BB-FBR-102
Location: Falmouth, Maine		**WIN:**	21720.00

Driller:	New England Boring Contractors	**Elevation (ft.)**	56.6	**Auger ID/OD:**	2.5" SSA
Operator:	B. Enos	**Datum:**	NAVD 88	**Sampler:**	Standard Splitspoon
Logged By:	B. Woodman	**Rig Type:**	ATV Mobile B53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	6/16/19-6/17/19	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NX
Boring Location:	Sta. 4+29.3, 2.8' Rt	**Casing ID/OD:**	4/4.5", 3/3.5"	**Water Level*:**	30'
Hammer Efficiency Factor:	.895	**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							SSA			-ASPHALT-	
	1D	24/12	1.0 - 3.0	16-14-13-12	27	40		55.6		1.0 Brown, dry, dense, fine to coarse SAND, little gravel, trace silt, (Fill).	
	2D	24/12	4.0 - 6.0	5-4-2-2	6	9				Brown, dry, loose, fine to coarse SAND, little gravel, little silt, (Fill).	G#S-1 A-1-b, SM WC=5.9
5											
							37				
							83				
10	3D	24/24	10.0 - 12.0	2-3-4-42	7	10	58			Top 12": Brown, dry, loose, Sandy SILT, (Fill). Bottom 12": Grey, dry, Sandy SILT, (Fill).	
							31				
							39				
							RC				
	4D	24/12	14.0 - 16.0	8-9-6-10	15	22				Brown, wet, medium dense, fine to coarse SAND, some clayey silt, little gravel, (Fill).	G#S-2 A-1-4(0), SM WC=17.9
15								41.6		15.0	
	5D	24/7	16.0 - 18.0	8-6-4-7	10	15				Brown, wet, loose, fine to coarse SAND, (Upper Marine Sand).	
	6D	24/7	18.0 - 20.0	6-7-5-6	12	18				Brown, wet, medium dense, fine to coarse SAND, trace gravel, trace silt, (Upper Marine Sand).	G#S-3 A-1-b, SW
20	7D	24/7	20.0 - 22.0	7-10-7-11	17	25				Brown, wet, medium dense, fine to coarse SAND, (Upper Marine Sand).	
	8D	24/24	22.0 - 24.0	2-3-5-8	8	12		34.6 34.1		22.0 Top 6": Dark brown, wet, fine SAND, some silt, organic matter present. 22.5 Bottom 18": Grey, moist, stiff, Silty CLAY, trace fine sand, (Marine Clay Crust). Brown mottling present.	
	9D	24/24	24.0 - 26.0	2-4-4-5	8	12				Grey, wet, stiff, Silty CLAY, (Marine Clay Crust).	
25											

Remarks:

1. Fine-Grained Soil Descriptions on this log are based on plasticity estimated using visual-manual classification techniques or laboratory Atterberg Limit tests if available, rather than the MaineDOT Standard based percentages passing specific grain sizes.
2. Automatic Hammer NEBC #D19 Energy Transfer Ratio = 0.895.
3. Water level measurements were taken immediately after removal of casing.

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: Bucknam Road Bridge #5830 over I-295
Location: Falmouth, Maine

Boring No.: BB-FBR-102
WIN: 21720.00

Driller:	New England Boring Contractors	**Elevation (ft.)**	56.6	**Auger ID/OD:**	2.5" SSA
Operator:	B. Enos	**Datum:**	NAVD 88	**Sampler:**	Standard Splitspoon
Logged By:	B. Woodman	**Rig Type:**	ATV Mobile B53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	6/16/19-6/17/19	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NX
Boring Location:	Sta. 4+29.3, 2.8' Rt	**Casing ID/OD:**	4/4.5", 3/3.5"	**Water Level*:**	30'
Hammer Efficiency Factor:	.895	**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.
25											
	10D	24/7	26.0 - 28.0	2-3-4-4	7	10				Grey, wet, stiff, Silty CLAY, (Marine Clay Crust).	
	11D	24/24	29.0 - 31.0	WOR-WOR-WOR-WOH	-			27.1		Grey, wet, soft to medium stiff, Silty CLAY, (Marine Clay). 29.5	WC=42.9
30											
	1U	24/15	34.0 - 36.0	PUSH						Grey, wet, Silty CLAY,(Marine Clay).	LL=40 PL=20 PI=20 WC=39.6
35											
	V1		36.6 - 37.0	S_u=687/137 psf						65x130mm vane raw torque readings: V1: 25/<5 ft-lbs	
	V2		37.6 - 38.0	S_u=687/55 psf						V2: 25/2 ft-lbs	
40											
	V3		41.6 - 42.0	S_u=961/110 psf						65x130mm vane raw torque readings: V3: 35/4 ft-lbs	
	V4		42.6 - 43.0	S_u=901/137 psf						V4: 35/5 ft-lbs	
	2U	24/22	44.0 - 46.0	PUSH						Grey, wet, Silty CLAY, (Marine Clay).	LL=42 PL=21 PI=21 WC=38.1
45											
	12D	24/24	47.0 - 49.0	Push thru vane	-					Grey, wet, medium stiff, Silty CLAY, (Marine Clay).	
	V5		47.6 - 48.0	S_u=824/151 psf						65x130mm vane raw torque readings: V5: 30/5.5 ft-lbs	
	V6		48.6 - 49.0	S_u=824/165 psf						V6: 30/6 ft-lbs	
50											

Remarks:

1. Fine-Grained Soil Descriptions on this log are based on plasticity estimated using visual-manual classification techniques or laboratory Atterberg Limit tests if available, rather than the MaineDOT Standard based percentages passing specific grain sizes.
2. Automatic Hammer NEBC #D19 Energy Transfer Ratio = 0.895.
3. Water level measurements were taken immediately after removal of casing.

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: Bucknam Road Bridge #5830 over I-295 Location: Falmouth, Maine	Boring No.: BB-FBR-102 WIN: 21720.00

Driller:	New England Boring Contractors	**Elevation (ft.)**	56.6	**Auger ID/OD:**	2.5" SSA
Operator:	B. Enos	**Datum:**	NAVD 88	**Sampler:**	Standard Splitspoon
Logged By:	B. Woodman	**Rig Type:**	ATV Mobile B53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	6/16/19-6/17/19	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NX
Boring Location:	Sta. 4+29.3, 2.8' Rt	**Casing ID/OD:**	4/4.5", 3/3.5"	**Water Level*:**	30'
Hammer Efficiency Factor:	.895	**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.
50											
	13D	24/24	54.0 - 56.0	Push thru vane	-					Grey, wet, medium stiff, Silty CLAY, (Marine Clay). V7: 35/5 ft-lbs V8: 35/9 ft-lbs	A-6, CL LL=34 PL=19 PI=15 WC=32.3
55	V7		55.6 - 56.0	S_u=961/137 psf							
	V8		56.6 - 57.0	S_u=961/247 psf							
	14D V9	24/24	59.0 - 61.0 59.6 - 60.0	Push thru vane S_u=893/220 psf	-					Grey, wet, medium stiff, Silty CLAY, trace fine sand, (Marine Clay). 65x130mm vane raw torque readings: V9: 32.5/8 ft-lbs Could not advance vane to 60.6' due to refusal, possible sand seam.	
60	MV										
								-5.9		62.5	
	15D	24/9	64.0 - 66.0	10-11-13-14	24	36				Brown, wet, dense, fine to medium SAND, some silt, trace gravel, (Lower Marine Sand).	G#S-6 A-2-4 (0), SM
65							135				
							175/R				
							RC NX	-11.1		67.7 Casing refusal at 67.7'; apparent top of rock. Advance roller cone to 68' and core. R1: 68'-70.2': Hard, fresh, very coarse grained, light grey and black, PEGMATITE. Joints are close to moderately spaced, low angle, planar, fresh to discolored (dull), open.	
	R1	60/60	68.0 - 73.0	RQD = 77%							
70								-13.6		70.2 R1: 70.2'-73': Hard, fresh, medium grained, dark grey, SCHIST. Joints are extremely close to moderately spaced, moderately dipping, planar, smooth, discolored, partially open, pitted near joints. Rock Quality = Good Recovery = 100% Rock Core Times (min:ft): 68.0-69.0' (1:16), 69.0-70.0' (1:19), 70.0-71.0' (1:26), 71.0-72.0' (1:28), 72.0-73.0' (1:32)	
	R2	60/60	73.0 - 78.0	RQD = 100%						R2: 73'-77.2': Hard, fresh, medium grained, dark grey, SCHIST. Joints are moderately spaced, moderately dipping, planar, smooth, fresh to	
75											

Remarks:

1. Fine-Grained Soil Descriptions on this log are based on plasticity estimated using visual-manual classification techniques or laboratory Atterberg Limit tests if available, rather than the MaineDOT Standard based percentages passing specific grain sizes.
2. Automatic Hammer NEBC #D19 Energy Transfer Ratio = 0.895.
3. Water level measurements were taken immediately after removal of casing.

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:** Bucknam Road Bridge #5830 over I-295 **Location:** Falmouth, Maine	**Boring No.:** BB-FBR-102 **WIN:** 21720.00

Driller:	New England Boring Contractors	**Elevation (ft.)**	56.6	**Auger ID/OD:**	2.5" SSA
Operator:	B. Enos	**Datum:**	NAVD 88	**Sampler:**	Standard Splitspoon
Logged By:	B. Woodman	**Rig Type:**	ATV Mobile B53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	6/16/19-6/17/19	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NX
Boring Location:	Sta. 4+29.3, 2.8' Rt	**Casing ID/OD:**	4/4.5", 3/3.5"	**Water Level*:**	30'
Hammer Efficiency Factor: .895		**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.
75										discolored, tight, pitted near joints.	
								-20.6		77.2	
								-21.4		R2: 77.2'-78': Hard, fresh, very coarse grained, light grey, GNEISS. Joints are moderately spaced, moderately dipping, planar, rough, discolored, open. Rock Quality = Excellent Recovery = 100% Rock Core Times (min:ft): 73.0-74.0' (1:31), 74.0-75.0' (1:20), 75.0-76.0' (1:32), 76.0-77.0' (1:09), 77.0-78.0' (2:27)	
80										78.0 **Bottom of Exploration at 78.0 feet below ground surface.**	
85											
90											
95											
100											

Remarks:

1. Fine-Grained Soil Descriptions on this log are based on plasticity estimated using visual-manual classification techniques or laboratory Atterberg Limit tests if available, rather than the MaineDOT Standard based percentages passing specific grain sizes.
2. Automatic Hammer NEBC #D19 Energy Transfer Ratio = 0.895.
3. Water level measurements were taken immediately after removal of casing.

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: Bucknam Road Bridge #5830 over I-295
Location: Falmouth, Maine
Boring No.: BB-FBR-103
WIN: 21720.00

Driller:	New England Boring Contractors	**Elevation (ft.)**	40.0	**Auger ID/OD:**	2.5" SSA
Operator:	B. Enos	**Datum:**	NAVD 88	**Sampler:**	Standard Splitspoon
Logged By:	B. Woodman	**Rig Type:**	ATV Mobile B53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	6/19/19-6/20/19	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NX
Boring Location:	Sta. 5+42.5, 2.8' Rt	**Casing ID/OD:**	4/4.5"	**Water Level*:**	1'
Hammer Efficiency Factor:	.895	**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	24/6	0.0 - 2.0	2-6-5-6	11	16	RC			Brown, dry, medium dense, fine to coarse SAND, little gravel, (Fill).	
	2D	24/13	2.0 - 4.0	6-9-9-7	18	27				Brown, dry, medium dense, fine SAND, trace silt, (Fill).	G#S-7 A-3, SP-SM WC=20
								36.0		4.0	
	3D	24/23	4.0 - 6.0	1-2-1-WOH	3	4				Brown, wet, medium stiff, Silty CLAY, (Marine Clay Crust).	
5											
	4D	24/24	6.0 - 8.0	1-1-WOH-WOR	1	1				Grey, wet, Silty CLAY, (Marine Clay Crust).	A-7, CL LL=48 PL=20 PI=28 WC=51.6
								31.0		9.0	
	5D	24/24	9.0 - 11.0	Push thru vane	-					Grey, wet, soft, Silty CLAY, (Marine Clay). 65x130mm vane raw torque readings: V1: 13/3 ft-lbs V2: 18/3 ft-lbs	WC=47.6
10	V1		9.6 - 10.0	S_u=357/82 psf							
	V2		10.6 - 11.0	S_u=494/82 psf							
	1U		14.0 - 16.0	PUSH						Grey, wet, Silty CLAY.	
15											
	V3		16.6 - 17.0	S_u=384/55 psf						65x130mm vane raw torque readings: V3: 14/2 ft-lbs V4: 19/3 ft-lbs	
	V4		17.6 - 18.0	S_u=522/82 psf							
	6D	24/24	19.0 - 21.0	Push thru vane	-					Grey, wet, medium stiff, Silty CLAY, (Marine Clay). 65x130mm vane raw torque readings: V5: 20/1/ft-lbs V6: 19/1 ft-lbs	A-6, CL LL=40 PL=20 PI=20 WC=38.1
20	V5		19.6 - 20.0	S_u=549/27 psf							
	V6		20.6 - 21.0	S_u=522/27 psf							
	2U	24/4	24.0 - 26.0	PUSH							
25											

Remarks:

1. Fine-Grained Soil Descriptions on this log are based on plasticity estimated using visual-manual classification techniques or laboratory Atterberg Limit tests if available, rather than the MaineDOT Standard based percentages passing specific grain sizes.
2. Automatic Hammer NEBC #D19 Energy Transfer Ratio = 0.895.
3. Cored through 0.8' of bridge deck with 4" spin shoe. Ground level 19.9' below top of bridge deck.
4. Casing broke during advancement to 40' on possible boulder. Boring terminated. Refer to boring BB-FBR-103A.
5. Water level measurements were taken immediately after removal of casing.

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:	Bucknam Road Bridge #5830 over I-295	**Location:**	Falmouth, Maine	**Boring No.:**	BB-FBR-103
				WIN:	21720.00

Driller:	New England Boring Contractors	**Elevation (ft.)**	40.0	**Auger ID/OD:**	2.5" SSA
Operator:	B. Enos	**Datum:**	NAVD 88	**Sampler:**	Standard Splitspoon
Logged By:	B. Woodman	**Rig Type:**	ATV Mobile B53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	6/19/19-6/20/19	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NX
Boring Location:	Sta. 5+42.5, 2.8' Rt	**Casing ID/OD:**	4/4.5"	**Water Level*:**	1'
Hammer Efficiency Factor:	.895	**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.
25											
	7D	24/24	26.0 - 28.0	3-4-5-6	9	13				Grey, wet, stiff, Silty CLAY, (Marine Clay).	
	8D	24/24	29.0 - 31.0	Drive thru vane						Grey, wet, stiff, Silty CLAY, (Marine Clay).	
30	V7		29.6 - 30.0	S_u>1373 psf						65x130mm vane, could not rotate V7 or V8 at 50 ft-lbs. Wrench was sticking during rotation; ft-lbs reading was not confirmed and clay did not shear.	
	V8		30.6 - 31.0	S_u>1373 psf							
	9D	24/24	34.0 - 36.0	Push thru vane	-					Grey, wet, medium stiff, Silty CLAY, (Marine Clay). 65x130mm vane raw torque readings:	WC=34.7
35	V9		34.6 - 35.0	S_u=549/27 psf						V9: 20/1 ft-lbs	
	V10		35.6 - 36.0	S_u=549/27 psf				4.0		V10: 19/1 ft-lbs	
										36.0	
										Bottom of Exploration at 36.0 feet below ground surface.	
40											
45											
50											

Remarks:

1. Fine-Grained Soil Descriptions on this log are based on plasticity estimated using visual-manual classification techniques or laboratory Atterberg Limit tests if available, rather than the MaineDOT Standard based percentages passing specific grain sizes.
2. Automatic Hammer NEBC #D19 Energy Transfer Ratio = 0.895.
3. Cored through 0.8' of bridge deck with 4" spin shoe. Ground level 19.9' below top of bridge deck.
4. Casing broke during advancement to 40' on possible boulder. Boring terminated. Refer to boring BB-FBR-103A.
5. Water level measurements were taken immediately after removal of casing.

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: Bucknam Road Bridge #5830 over I-295 Location: Falmouth, Maine	Boring No.: BB-FBR-103A WIN: 21720.00

Driller:	New England Boring Contractors	**Elevation (ft.)**	40.3	**Auger ID/OD:**	2.5" SSA
Operator:	B. Enos	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	B. Woodman/M. Walsh	**Rig Type:**	ATV Mobile B53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	6/20/19-6/25/19	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NX
Boring Location:	Sta. 5+42.5, 2.8' Rt	**Casing ID/OD:**	4/4.5", 3/3.5"	**Water Level*:**	Not measured
Hammer Efficiency Factor:	.895	**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							CASED			0'-4': Assumed Fill based on BB-FBR-103.	
	1D	24/4	4.0 - 6.0	1-1-WOH-2	1	1		36.3		4.0 Brown/grey, moist, medium stiff, Sandy CLAY, (Marine Clay Crust).	
5											
	2D	24/24	9.0 - 11.0	WOR-WOR-WOR-WOR	-			31.3		9.0 Grey, wet, soft, Silty CLAY, (Marine Clay).	
10											
	3D	24/24	14.0 - 16.0	WOR-WOR-WOR-WOR	-		RC			Grey, wet, soft, Silty CLAY, (Marine Clay).	
15											
	V1		19.6 - 20.0	S_u=330/27 psf						65x130mm vane raw torque readings: V1: 12/1 ft-lbs V2: 15/1 ft-lbs	
20	V2		20.6 - 21.0	S_u=412/27 psf							
	4D	24/24	24.0 - 26.0	Push thru vane	-					Grey, wet, medium stiff, Silty CLAY, (Marine Clay). 65x130mm vane raw torque readings:	
25											

Remarks:

1. Fine-Grained Soil Descriptions on this log are based on plasticity estimated using visual-manual classification techniques or laboratory Atterberg Limit tests if available, rather than the MaineDOT Standard based percentages passing specific grain sizes.
2. Automatic Hammer NEBC #D19 Energy Transfer Ratio = 0.895.
3. Cored through 0.8' of bridge deck with 4" spin shoe. Ground level 20.1' below top of bridge deck.
4. 4" casing advanced to 14' bgs, then the boring was advanced using open hole techniques utilizing bentonite slurry. 3" casing advanced to 79.3' bgs after drilling open hole to ____.
5. Water level measurements were taken immediately after removal of casing.

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: Bucknam Road Bridge #5830 over I-295 Location: Falmouth, Maine	Boring No.: BB-FBR-103A WIN: 21720.00

Driller:	New England Boring Contractors	Elevation (ft.)	40.3	Auger ID/OD:	2.5" SSA
Operator:	B. Enos	Datum:	NAVD88	Sampler:	Standard Splitspoon
Logged By:	B. Woodman/M. Walsh	Rig Type:	ATV Mobile B53	Hammer Wt./Fall:	140#/30"
Date Start/Finish:	6/20/19-6/25/19	Drilling Method:	Drive & Wash	Core Barrel:	NX
Boring Location:	Sta. 5+42.5, 2.8' Rt	Casing ID/OD:	4/4.5", 3/3.5"	Water Level*:	Not measured
Hammer Efficiency Factor:	.895	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.
25	V3 V4		24.6 - 25.0 25.6 - 26.0	S_u=549/27 psf S_u=577/27 psf						V3: 20/1 ft-lbs V4: 21/1 ft-lbs	
	V5		29.6 - 30.0	S_u=769/27 psf			2				
30	V6		30.6 - 31.0	S_u=687/27 psf			19			65x130mm vane raw torque readings: V5: 28/1 ft-lbs V6: 25/1 ft-lbs	
							25				
							25				
							26				
	1U	24/23	34.0 - 36.0	PUSH			RC				
35											
	5D ~~V7~~	24/0	36.0 - 38.0 ~~36.6 - 37.0~~	Push thru vane ~~S_u=687/55 psf~~						No recovery in 5D. 65x130mm vane raw torque readings: V7: 25/2 ft-lbs V8: 28.5/2.5 ft-lbs	
	V8		37.6 - 38.0	S_u=783/69 psf							
	6D ~~V9~~	24/24	39.0 - 41.0 ~~39.6 - 40.0~~	Push thru vane ~~S_u=879/69 psf~~	-					Grey, wet, medium stiff, Silty CLAY, (Marine Clay). 65x130mm vane raw torque readings: V9: 32/2.5 ft-lbs V10: 32/3 ft-lbs	
40	V10		40.6 - 41.0	S_u=879/82 psf							
	7D ~~V11~~	24/24	44.0 - 46.0 ~~44.6 - 45.0~~	Push thru vane ~~S_u=1085/96 psf~~	-					Grey, wet, stiff, Silty CLAY, little fine sand, (Marine Clay). 65x130mm vane raw torque readings: V11: 39.5/3.5 ft-lbs V12: 41.5/2.5 ft-lbs	G#S-12 A-6(16), CL LL=37 PL=19 PI=18 WC=32.1
45	V12		45.6 - 46.0	S_u=1140/69 psf							
50	8D	24/12	49.0 - 51.0	4-8-17-18	25	37		-8.9		Top 3": Grey, wet, Silty CLAY, trace fine sand, (Marine Clay). 49.2	

Remarks:

1. Fine-Grained Soil Descriptions on this log are based on plasticity estimated using visual-manual classification techniques or laboratory Atterberg Limit tests if available, rather than the MaineDOT Standard based percentages passing specific grain sizes.
2. Automatic Hammer NEBC #D19 Energy Transfer Ratio = 0.895.
3. Cored through 0.8' of bridge deck with 4" spin shoe. Ground level 20.1' below top of bridge deck.
4. 4" casing advanced to 14' bgs, then the boring was advanced using open hole techniques utilizing bentonite slurry. 3" casing advanced to 79.3' bgs after drilling open hole to ____.
5. Water level measurements were taken immediately after removal of casing.

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:** Bucknam Road Bridge #5830 over I-295 **Location:** Falmouth, Maine	**Boring No.:** BB-FBR-103A **WIN:** 21720.00

Driller:	New England Boring Contractors	**Elevation (ft.)**	40.3	**Auger ID/OD:**	2.5" SSA
Operator:	B. Enos	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	B. Woodman/M. Walsh	**Rig Type:**	ATV Mobile B53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	6/20/19-6/25/19	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NX
Boring Location:	Sta. 5+42.5, 2.8' Rt	**Casing ID/OD:**	4/4.5", 3/3.5"	**Water Level*:**	Not measured
Hammer Efficiency Factor:	.895	**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.
50										Bottom 9": Grey/brown, dense, fine to medium SAND, some silt, trace gravel, (Lower Marine Sand).	
	9D	24/6	54.0 - 56.0	16-13-11-12	24	36				Brown/grey, wet, dense, fine to coarse SAND, little gravel, trace silt, (Lower Marine Sand).	G#S-13 A-1-b, SM-SM
55											
	10D	24/5	59.0 - 61.0	10-9-10-9	19	28				Brown/grey, wet, medium dense, fine to medium SAND, little silt, (Lower Marine Sand).	
60											
	11D	24/13	64.0 - 66.0	8-7-9-10	16	24				Brown/grey, wet, medium dense, fine to medium SAND, little gravel, trace silt, (Lower Marine Sand).	G#S-14 A-1-b, SP-SM
65											
	12D	24/11	69.0 - 71.0	9-8-10-12	18	27				Brown/grey, wet, medium dense, fine to medium SAND, little silt, (Lower Marine Sand).	
70											
	13D	24/15	74.0 - 76.0	12-19-27-29	46	69	34			Grey/brown, wet, very dense, fine SAND, little silt, (Lower Marine Sand).	
75											

Remarks:

1. Fine-Grained Soil Descriptions on this log are based on plasticity estimated using visual-manual classification techniques or laboratory Atterberg Limit tests if available, rather than the MaineDOT Standard based percentages passing specific grain sizes.
2. Automatic Hammer NEBC #D19 Energy Transfer Ratio = 0.895.
3. Cored through 0.8' of bridge deck with 4" spin shoe. Ground level 20.1' below top of bridge deck.
4. 4" casing advanced to 14' bgs, then the boring was advanced using open hole techniques utilizing bentonite slurry. 3" casing advanced to 79.3' bgs after drilling open hole to ____.
5. Water level measurements were taken immediately after removal of casing.

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: Bucknam Road Bridge #5830 over I-295
Location: Falmouth, Maine

Boring No.: BB-FBR-103A
WIN: 21720.00

Driller:	New England Boring Contractors	**Elevation (ft.)**	40.3	**Auger ID/OD:**	2.5" SSA
Operator:	B. Enos	**Datum:**	NAVD88	**Sampler:**	Standard Splitspoon
Logged By:	B. Woodman/M. Walsh	**Rig Type:**	ATV Mobile B53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	6/20/19-6/25/19	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NX
Boring Location:	Sta. 5+42.5, 2.8' Rt	**Casing ID/OD:**	4/4.5", 3/3.5"	**Water Level*:**	Not measured
Hammer Efficiency Factor:	.895	**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.
75							91				
							148				
							158				
							145				
	14D	3/3	79.0 - 79.3	50/3"	R		139	-39.0		Grey, wet, very dense, fine SAND, little silt, (Lower Marine Sand). 79.3	
80	R1	60/60	79.5 - 84.5	RQD = 48%			NX			Casing refusal at 79.3', apparent top of rock. Advance roller cone to 79.5' and core. R1: Hard, slightly weathered, medium to very coarse grained, white/ grey/black PEGMATITE. Joints are very close to moderately spaced, low angle to moderately dipping, undulating, rough, discolored, open, grey silt infilling. Rock Quality = Poor Recovery = 100% Rock Core Times (min:ft): 79.5-80.5' (1:12), 80.5-81.5' (1:24), 81.5-82.5' (1:56), 82.5-83.5' (1:42), 83.5-84.5' (1:46)	
	R2	60/60	84.5 - 89.5	RQD = 53%						R2: 84.5'-87.4': Hard, slightly weathered, medium to very coarse grained, white/grey/black PEGMATITE. Joints are close to moderately spaced, Moderately dipping, undulating, rough, discolored, open to moderately wide.	
85											
								-47.1		87.4	
										R2: 87.4'-89.5: Hard, slightly weathered, medium grained, grey/white, GNEISS. Joints are close to moderately spaced, low angle to moderately dipping, planar, rough, discolored to decomposed, partially open to open. Rock Quality = Fair Recovery = 100% Rock Core Times (min:ft): 84.5-85.5' (1:28), 85.5-86.5' (1:29), 86.5-87.5' (1:36), 87.5-88.5' (1:51), 88.5-89.5' (1:31)	
								-49.2		89.5	
90										**Bottom of Exploration at 89.5 feet below ground surface.**	
95											
100											

Remarks:

1. Fine-Grained Soil Descriptions on this log are based on plasticity estimated using visual-manual classification techniques or laboratory Atterberg Limit tests if available, rather than the MaineDOT Standard based percentages passing specific grain sizes.
2. Automatic Hammer NEBC #D19 Energy Transfer Ratio = 0.895.
3. Cored through 0.8' of bridge deck with 4" spin shoe. Ground level 20.1' below top of bridge deck.
4. 4" casing advanced to 14' bgs, then the boring was advanced using open hole techniques utilizing bentonite slurry. 3" casing advanced to 79.3' bgs after drilling open hole to ____.
5. Water level measurements were taken immediately after removal of casing.

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: Bucknam Road Bridge #5830 over I-295 Location: Falmouth, Maine	Boring No.: BB-FBR-104 WIN: 21720.00

Driller:	New England Boring Contractors	**Elevation (ft.)**	62.4	**Auger ID/OD:**	2.5" SSA
Operator:	B. Enos	**Datum:**	NAVD 88	**Sampler:**	Standard Splitspoon
Logged By:	B. Woodman/M. Walsh	**Rig Type:**	ATV Mobile B53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	6/18/19-6/18/19	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NX
Boring Location:	Sta. 6+80.8, 2.7' Rt	**Casing ID/OD:**	4/4.5", 3/3.5"	**Water Level*:**	12.2*
Hammer Efficiency Factor:	.895	**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							SSA			-ASPHALT-	
								61.1		1.3 -CONCRETE-	
								60.0		2.4	
							SPIN				
5	1D	24/13	4.0 - 6.0	2-8-2-1	10	15				Brown, dry, medium dense, fine to coarse SAND, little gravel, trace silt, (Fill).	G#S-15 A-1-b, SP WC=2.4
							16				
							18				
							20				
10	2D	24/2	9.0 - 11.0	3-3-2-3	5	7	19			Brown, moist, stiff, Clayey SILT, some fine to coarse sand, (Fill).	G#S-16 A-4(3), CL WC=21.8
							19				
							21				
							30				
							RC				
15	3D	24/8	14.0 - 16.0	4-4-3-7	7	10				Brown, moist, loose, fine to coarse SAND, trace silt, trace gravel, (Fill).	
	4D	24/9	16.0 - 18.0	10-9-7-6	16	24				Brown, moist, medium dense, fine to coarse SAND, trace silt, trace gravel, (Fill).	
	5D	24/9	18.0 - 20.0	4-4-3-6	7	10				Brown, moist, loose, fine to coarse SAND, trace silt, trace gravel, (Fill).	G#S-17 A-1-b, SP-SM
20	6D	24/11	20.0 - 22.0	7-7-9-10	16	24				Brown, moist, medium dense, fine to coarse SAND, trace silt, trace gravel, (Fill).	
	7D	24/12	22.0 - 24.0	4-4-2-4	6	9		39.8		Top 7": Brown, moist, fine to coarse SAND, (Fill). 22.6 Bottom 5": Brown, moist, Silty SAND, (Upper Marine Sand).	
25	8D	24/14	24.0 - 26.0	16-16-14-13	30	45				Brown, wet, dense, fine SAND, some silt, (Upper Marine Sand).	G#S-18 A-2-4(0), SM

Remarks:

1. Fine-Grained Soil Descriptions on this log are based on plasticity estimated using visual-manual classification techniques or laboratory Atterberg Limit tests if available, rather than the MaineDOT Standard based percentages passing specific grain sizes.
2. Automatic Hammer NEBC #D19 Energy Transfer Ratio = 0.895.
3. Cored through 0.8' of bridge deck with 4" spin shoe. Ground level 20.1' below top of bridge deck. * indicates water level taken 15 minutes after drilling and within casing.
4. 4" casing advanced to 14' bgs, then the boring was advanced using open hole techniques utilizing bentonite slurry. 3" casing advanced to 79.3' bgs after drilling open hole to 79.0'.
5. Water level measurements were taken immediately after removal of casing.

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: Bucknam Road Bridge #5830 over I-295		**Boring No.:**	BB-FBR-104
Location: Falmouth, Maine		**WIN:**	21720.00

Driller:	New England Boring Contractors	**Elevation (ft.)**	62.4	**Auger ID/OD:**	2.5" SSA
Operator:	B. Enos	**Datum:**	NAVD 88	**Sampler:**	Standard Splitspoon
Logged By:	B. Woodman/M. Walsh	**Rig Type:**	ATV Mobile B53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	6/18/19-6/18/19	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NX
Boring Location:	Sta. 6+80.8, 2.7' Rt	**Casing ID/OD:**	4/4.5", 3/3.5"	**Water Level*:**	12.2*
Hammer Efficiency Factor:	.895	**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.
25											
	9D	24/13	26.0 - 28.0	6-7-6-5	13	19		35.5		Top 11": Brown, wet, medium dense, fine SAND, some silt, (Upper Marine Sand). 26.9 Bottom 2": Grey, wet, Silty CLAY, (Marine Clay Crust).	
30	10D	24/13	29.0 - 31.0	WOH-WOH-WOH-WOH	--					Grey, wet, Silty CLAY, (Marine Clay Crust).	A-6, CL LL=36 PL=21 PI=15 WC=37.3
35	11D V1 V2	24/24	34.0 - 36.0 34.6 - 35.0 35.6 - 36.0	Push thru vane S_u=357/82 psf S_u=467/55 psf				28.4		34.0 Grey, wet, soft, Silty CLAY, (Marine Clay). 65x130mm vane raw torque readings: V1: 13/3 ft-lbs V2: 17/2 ft-lbs	
40	1U	24/24	39.0 - 41.0							Grey, wet, medium stiff, Silty CLAY, (Marine Clay). 65x130mm vane raw torque readings: V3: 27/1 ft-lbs V4: 22/1 ft-lbs	LL=45 PL=23 PI=22 WC=40.7
	V3		41.6 - 42.0	S_u=742/27 psf							
	V4		42.6 - 43.0	S_u=604/27 psf							
45	12D V5 V6	24/24	44.0 - 46.0 44.6 - 45.0 45.6 - 46.0	Push thru vane S_u=714/55 psf S_u=659/27 psf						Grey, wet, medium stiff, Silty CLAY, (Marine Clay). 65x130mm vane raw torque readings: V5: 26/2 ft-lbs V6: 24/1 ft-lbs	WC=32.6
50	MV	24/0	49.5 - 51.5							No recovery.	

Remarks:

1. Fine-Grained Soil Descriptions on this log are based on plasticity estimated using visual-manual classification techniques or laboratory Atterberg Limit tests if available, rather than the MaineDOT Standard based percentages passing specific grain sizes.
2. Automatic Hammer NEBC #D19 Energy Transfer Ratio = 0.895.
3. Cored through 0.8' of bridge deck with 4" spin shoe. Ground level 20.1' below top of bridge deck. * indicates water level taken 15 minutes after drilling and within casing.
4. 4" casing advanced to 14' bgs, then the boring was advanced using open hole techniques utilizing bentonite slurry. 3" casing advanced to 79.3' bgs after drilling open hole to 79.0'.
5. Water level measurements were taken immediately after removal of casing.

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: Bucknam Road Bridge #5830 over I-295 Location: Falmouth, Maine	Boring No.: BB-FBR-104 WIN: 21720.00

Driller:	New England Boring Contractors	Elevation (ft.)	62.4	Auger ID/OD:	2.5" SSA
Operator:	B. Enos	Datum:	NAVD 88	Sampler:	Standard Splitspoon
Logged By:	B. Woodman/M. Walsh	Rig Type:	ATV Mobile B53	Hammer Wt./Fall:	140#/30"
Date Start/Finish:	6/18/19-6/18/19	Drilling Method:	Drive & Wash	Core Barrel:	NX
Boring Location:	Sta. 6+80.8, 2.7' Rt	Casing ID/OD:	4/4.5", 3/3.5"	Water Level*:	12.2*
Hammer Efficiency Factor:	.895	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.
50											
	2U	24/24	51.0 - 53.0	PUSH						Grey, wet, medium stiff, Silty CLAY, (Marine Clay).	LL=41 PL=22 PI=19 WC=40.9
	V7		53.6 - 54.0	S_u=687/55 psf						65x130mm vane raw torque readings: V7: 25/2 ft-lbs V8: 26/2 ft-lbs	
	V8		54.6 - 55.0	S_u=714/55 psf							
55											
	3U	24/24	59.0 - 61.0	PUSH						Grey, wet, medium stiff, Silty CLAY, trace fine sand, (Marine Clay).	LL=36 PL=20 PI=16 WC=30.6
60											
	V9		61.6 - 62.0	S_u=687/27 psf						65x130mm vane raw torque readings: V9: 25/1 ft-lbs V10: 30/1 ft-lbs	
	V10		62.6 - 63.0	S_u=824/24 psf							
	13D	24/24	64.0 - 66.0	Push thru vane						Grey, wet, medium stiff, Silty CLAY, (Marine Clay). 65x130mm vane raw torque readings: V11: 25/4 ft-lbs	
65	V11		64.6 - 65.0	S_u=687/110 psf							
	MV										
	14D	24/24	69.0 - 71.0	WOR-WOR-WOR-WOH	--					Grey, wet, medium stiff, Silty CLAY, trace fine sand, (Marine Clay).	WC=23.4
70											
								-10.1		72.5 Increased resistance indicating possible transition to Marine Sand.	
	15D	24/21	74.0 - 76.0	2-4-4-8	8	12				Top 16": Grey, wet, medium dense, Silty fine SAND, (Lower Marine Sand).	G#S-22 A-4(0), SM
75											

Remarks:

1. Fine-Grained Soil Descriptions on this log are based on plasticity estimated using visual-manual classification techniques or laboratory Atterberg Limit tests if available, rather than the MaineDOT Standard based percentages passing specific grain sizes.
2. Automatic Hammer NEBC #D19 Energy Transfer Ratio = 0.895.
3. Cored through 0.8' of bridge deck with 4" spin shoe. Ground level 20.1' below top of bridge deck. * indicates water level taken 15 minutes after drilling and within casing.
4. 4" casing advanced to 14' bgs, then the boring was advanced using open hole techniques utilizing bentonite slurry. 3" casing advanced to 79.3' bgs after drilling open hole to 79.0'.
5. Water level measurements were taken immediately after removal of casing.

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:	Bucknam Road Bridge #5830 over I-295	**Boring No.:**	BB-FBR-104		
Location:	Falmouth, Maine	**WIN:**	21720.00		
Driller:	New England Boring Contractors	**Elevation (ft.)**	62.4	**Auger ID/OD:**	2.5" SSA
Operator:	B. Enos	**Datum:**	NAVD 88	**Sampler:**	Standard Splitspoon
Logged By:	B. Woodman/M. Walsh	**Rig Type:**	ATV Mobile B53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	6/18/19-6/18/19	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NX
Boring Location:	Sta. 6+80.8, 2.7' Rt	**Casing ID/OD:**	4/4.5", 3/3.5"	**Water Level*:**	12.2*
Hammer Efficiency Factor:	.895	**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.
75										Bottom 5": Brown/grey, wet, fine SAND, little silt, (Lower Marine Sand).	
	16D	24/14	79.0 - 81.0	10-17-18-14	35	52				Brown/grey, wet, very dense, fine to coarse SAND, little silt, trace gravel, (Lower Marine Sand).	
80											
	17D	24/10	84.0 - 86.0	8-9-11-11	20	30				Grey/brown, wet, medium dense, fine to medium SAND, little silt, (Lower Marine Sand).	
85											
	18D	24/12	89.0 - 91.0	6-6-8-10	14	21				Grey/brown, wet, medium dense, fine to medium SAND, trace silt, (Lower Marine Sand).	G#S-23 A-3, SP-SM
90											
	19D	24/13	94.0 - 96.0	13-18-19-21	37	55				Grey/brown, wet, very dense, fine to medium SAND, trace silt, (Lower Marine Sand).	
95											
	20D	24/10	99.0 - 101.0	17-18-51/2"	R					Top 9": Grey/brown, wet, very dense, fine to medium SAND, trace silt.	
100											

Remarks:

1. Fine-Grained Soil Descriptions on this log are based on plasticity estimated using visual-manual classification techniques or laboratory Atterberg Limit tests if available, rather than the MaineDOT Standard based percentages passing specific grain sizes.
2. Automatic Hammer NEBC #D19 Energy Transfer Ratio = 0.895.
3. Cored through 0.8' of bridge deck with 4" spin shoe. Ground level 20.1' below top of bridge deck. * indicates water level taken 15 minutes after drilling and within casing.
4. 4" casing advanced to 14' bgs, then the boring was advanced using open hole techniques utilizing bentonite slurry. 3" casing advanced to 79.3' bgs after drilling open hole to 79.0'.
5. Water level measurements were taken immediately after removal of casing.

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: Bucknam Road Bridge #5830 over I-295 Location: Falmouth, Maine	Boring No.: BB-FBR-104 WIN: 21720.00

Driller:	New England Boring Contractors	Elevation (ft.)	62.4	Auger ID/OD:	2.5" SSA
Operator:	B. Enos	Datum:	NAVD 88	Sampler:	Standard Splitspoon
Logged By:	B. Woodman/M. Walsh	Rig Type:	ATV Mobile B53	Hammer Wt./Fall:	140#/30"
Date Start/Finish:	6/18/19-6/18/19	Drilling Method:	Drive & Wash	Core Barrel:	NX
Boring Location:	Sta. 6+80.8, 2.7' Rt	Casing ID/OD:	4/4.5", 3/3.5"	Water Level*:	12.2*
Hammer Efficiency Factor:	.895	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.
100								-37.8		Bottom 1": Possible weathered rock. 100.2	
										Splitspoon refusal. Fractured rock 100.2'-102.5'. Set up to core upon increased roller cone resistance.	
	R1	60/50	102.5 - 107.5	RQD = 45%						R1: Hard, slightly to moderately weathered, medium to coarse grained, grey and dark grey, GNEISS. Joints are very close to close, log angle, undulating, rough, discolored to decomposed, tight to wide. Rock Quality = Poor Recovery = 83% Rock Core Times (min:ft): 102.5-103.5' (1:42), 103.5-104.5' (1:35), 104.5-105.5' (1:25), 105.5-106.5' (1:23), 106.5-107.5' (1:00)	
105											
	R2	37/37	107.5 - 110.6	RQD = 0%				-45.1		107.5 R2: Hard, slightly weathered, medium to coarse grained, light grey, PEGMATITE. Joints are extremely close to close, moderately dipping to high angle, planar, rough, discolored, tight to wide, grey silt infilling. Rock Quality = Very Poor Recovery = 100% Rock Core Times (min:ft): 107.5-108.5' (1:20), 108.5-109.5' (1:22), 109.5-110.6' (1:45)	
110	R3	37/27	110.6 - 113.7	RQD = 0%						R3: Hard, slightly weathered, medium to coarse grained, light grey, PEGMATITE. Joints are extremely close to close, low angle to moderately dipping, undulating, rough, tight to wide, grey silt infilling. Rock Quality = Very Poor Recovery = 73% Rock Core Times (min:ft): 110.6-111.6' (2:22), 111.6-112.6' (1:39), 112.6-113.7' (1:40)	
								-51.3		113.7 **Bottom of Exploration at 113.7 feet below ground surface.**	
115											
120											
125											

Remarks:

1. Fine-Grained Soil Descriptions on this log are based on plasticity estimated using visual-manual classification techniques or laboratory Atterberg Limit tests if available, rather than the MaineDOT Standard based percentages passing specific grain sizes.
2. Automatic Hammer NEBC #D19 Energy Transfer Ratio = 0.895.
3. Cored through 0.8' of bridge deck with 4" spin shoe. Ground level 20.1' below top of bridge deck. * indicates water level taken 15 minutes after drilling and within casing.
4. 4" casing advanced to 14' bgs, then the boring was advanced using open hole techniques utilizing bentonite slurry. 3" casing advanced to 79.3' bgs after drilling open hole to 79.0'.
5. Water level measurements were taken immediately after removal of casing.

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: Bucknam Road Bridge #5830 over I-295
Location: Falmouth, Maine

Boring No.: BB-FBR-105
WIN: 21720.00

Driller:	Summit Geoengineering, Inc.	**Elevation (ft.)**	42.8	**Auger ID/OD:**	
Operator:	S. Anderson, S. Floyd	**Datum:**	NAVD 88	**Sampler:**	--
Logged By:	C. Coolidge	**Rig Type:**	AMS 9500 VTR	**Hammer Wt./Fall:**	--
Date Start/Finish:	5/22/19-5/22/19	**Drilling Method:**	Hydraulic Push Casing	**Core Barrel:**	
Boring Location:	Sta. 6+86.6, 58.7' Rt	**Casing ID/OD:**	1.5"/2.0"	**Water Level*:**	4.3'
Hammer Efficiency Factor: --		**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							HYD			Advanced boring to 10' and began conducting field vanes in clay based on the results of CPT-FBR-103. No split spoon samples were taken.	
5											
10	V1		10.6 - 11.0	S_u=300/50 psf						55x110 mm vane raw torque readings: V1: 6/1 ft-lbs	
	V2		11.6 - 12.0	S_u=275/50 psf						V2: 5.5/1 ft-lbs	
	V3		13.6 - 14.0	S_u=350/50 psf						55x110 mm vane raw torque readings: V3: 7/1 ft-lbs	
	V4		14.6 - 15.0	S_u=400/50 psf						V4: 8/1 ft-lbs	
15	V5		15.6 - 16.0	S_u=275/25 psf						55x110 mm vane raw torque readings: V5: 9/1 ft-lbs	
	V6		16.6 - 17.0	S_u=375/25 psf						V6: 13/1 ft-lbs	
	V7		18.6 - 19.0	S_u=350/50 psf						65x130 mm vane raw torque readings: V7: 11.5/1.5 ft-lbs	
	V8		19.6 - 20.0	S_u=350/25 psf						V8: 11.5/1.25 ft-lbs	
20											
25											

Remarks:

1. Boring was completed by Summit Geoengineering, GZA prepared log using information included in Summit's report dated 6/7/19.
2. 2" casing advanced by pushing, with central plug in place.
3. Field vanes consisted of Geonor rectangular vanes. Raw torque readings were converted to undrained shear strength by Summit and were rounded to the nearest 25 psf.

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: Bucknam Road Bridge #5830 over I-295 Location: Falmouth, Maine	Boring No.: BB-FBR-105 WIN: 21720.00

Driller:	Summit Geoengineering, Inc.	**Elevation (ft.)**	42.8	**Auger ID/OD:**	
Operator:	S. Anderson, S. Floyd	**Datum:**	NAVD 88	**Sampler:**	--
Logged By:	C. Coolidge	**Rig Type:**	AMS 9500 VTR	**Hammer Wt./Fall:**	--
Date Start/Finish:	5/22/19-5/22/19	**Drilling Method:**	Hydraulic Push Casing	**Core Barrel:**	
Boring Location:	Sta. 6+86.6, 58.7' Rt	**Casing ID/OD:**	1.5"/2.0"	**Water Level*:**	4.3'
Hammer Efficiency Factor: --		**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.
25	V9		25.6 - 26.0	S_u=375/25 psf						65x130 mm vane raw torque readings: V9: 12.5/1 ft-lbs V10: 13/0.5 ft-lbs	
	V10		26.6 - 27.0	S_u=375/25 psf							
	V11		28.6 - 29.0	S_u=475/50 psf						65x130 mm vane raw torque readings: V11: 16/1.5 ft/lbs V12: 20/1 ft-lbs	
	V12		29.6 - 30.0	S_u=600/25 psf							
30											
	V13		31.6 - 32.0	S_u=575/25 psf						65x130 mm vane raw torque readings: V13: 19.5/1 ft-lbs V14: 19/1 ft-lbs	
	V14		32.6 - 33.0	S_u=575/25 psf							
35	V15		35.6 - 36.0	S_u=575/50 psf						55x110 mm vane raw torque readings: V15: 12/1 ft-lbs V16: 12.5/1 ft-lbs	
	V16		36.6 - 37.0	S_u= 600/50 psf							
40	V17		40.6 - 41.0	S_u=675/50 psf						55x110 mm vane raw torque readings: V17: 14/1 ft-lbs V18: 13/1 ft-lbs	
	V18		41.6 - 42.0	S_u=625/50 psf							
	V19		43.6 - 44.0	S_u=625/50 psf						55x110 mm vane raw torque readings:: V19: 13/1 ft-lbs V20: 14/1 ft-lbs	
	V20		44.6 - 45.0	S_u=675/50 psf							
45											
	V21		46.6 - 47.0	S_u=700/75 psf						55x110 mm vane raw torque readings:: V21: 14.5/1.5 ft-lbs V22: 15/1.5 ft-lbs	
	V22		47.6 - 48.0	S_u=725/75 psf							
50											

Remarks:

1. Boring was completed by Summit Geoengineering, GZA prepared log using information included in Summit's report dated 6/7/19.
2. 2" casing advanced by pushing, with central plug in place.
3. Field vanes consisted of Geonor rectangular vanes. Raw torque readings were converted to undrained shear strength by Summit and were rounded to the nearest 25 psf.

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: Bucknam Road Bridge #5830 over I-295
Location: Falmouth, Maine

Boring No.: BB-FBR-105
WIN: 21720.00

Driller:	Summit Geoengineering, Inc.	**Elevation (ft.)**	42.8	**Auger ID/OD:**	
Operator:	S. Anderson, S. Floyd	**Datum:**	NAVD 88	**Sampler:**	--
Logged By:	C. Coolidge	**Rig Type:**	AMS 9500 VTR	**Hammer Wt./Fall:**	--
Date Start/Finish:	5/22/19-5/22/19	**Drilling Method:**	Hydraulic Push Casing	**Core Barrel:**	
Boring Location:	Sta. 6+86.6, 58.7' Rt	**Casing ID/OD:**	1.5"/2.0"	**Water Level*:**	4.3'
Hammer Efficiency Factor: --		**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.
50											
	V23		51.6 - 52.0	S_u=725/50 psf						55x110 mm vane raw torque readings: V23: 15/1 ft-lbs V24: 16.5/1.5 ft-lbs	
	V24		52.6 - 53.0	S_u=800/75 psf							
	V25		54.6 - 55.0	S_u=625/50 psf						55x110 mm vane raw torque readings: V25: 13/1 ft-lbs V26: 17/1 ft-lbs	
55	V26		55.6 - 56.0	S_u=825/50 psf							
								-14.2		57.0 **Bottom of Exploration at 57.0 feet below ground surface.**	
60											
65											
70											
75											

Remarks:

1. Boring was completed by Summit Geoengineering, GZA prepared log using information included in Summit's report dated 6/7/19.
2. 2" casing advanced by pushing, with central plug in place.
3. Field vanes consisted of Geonor rectangular vanes. Raw torque readings were converted to undrained shear strength by Summit and were rounded to the nearest 25 psf.

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: Bucknam Road Bridge #5830 over I-295 Location: Falmouth, Maine	Boring No.: BB-FBR-106 WIN: 21720.00

Driller:	New England Boring Contractors	**Elevation (ft.)**	47.0	**Auger ID/OD:**	2.5" SSA
Operator:	B. Enos	**Datum:**	NAVD 88	**Sampler:**	Standard Splitspoon
Logged By:	B. Woodman/M. Walsh	**Rig Type:**	ATV Mobile B53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	6/25/19-6/25/19	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NA
Boring Location:	Sta. 6+86.6, 58.7' Rt	**Casing ID/OD:**	4/4.5"	**Water Level*:**	15.2
Hammer Efficiency Factor:	.895	**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	1-2-3-5	5	7	SSA			Brown, dry, medium stiff, Sandy SILT, with organics/roots, (Fill).	
	2D	24/23	4.0 - 6.0	3-3-5-3	8	12				Brown, dry, medium dense, Clayey SILT some fine to coarse sand, trace gravel, (Fill).	G#S-24 A-4, CL WC=25.7
5							35				
	3D	24/18	6.0 - 8.0	4-3-4-10	7	10	38	41.0		6.0 Light brown, dry, loose, fine SAND, some silt, (Marine Sand).	
							95				
	4D	24/23	8.0 - 10.0	16-15-11-15	26	39	113			Brown, moist, dense, fine SAND, some silt, (Upper Marine Sand).	G#S-25 A-2-4(0), SM WC=21.6
							117				
10	5D	24/16	10.0 - 12.0	5-8-7-7	15	22	50			Brown, wet, medium dense, Clayey fine SAND, (Upper Marine Sand).	
							59				
							55				
							60				
							RC	33.0		14.0	
15	6D V1 V2	24/24	15.0 - 17.0 15.6 - 16.0 16.6 - 17.0	Push thru vane S_u=467/55 psf S_u=275/55 psf	--					Grey, wet, soft, Silty CLAY, (Marine Clay). 65x130mm vane raw torque readings: V1: 17/2 ft-lbs V2: 10/2 ft-lbs	A-7, CL LL=48 PL=21 PI=27 WC=48.3
	7D	24/24	19.0 - 21.0	WOR-WOR-WOR-WOR	--					Grey, wet, soft, Silty CLAY, (Marine Clay).	
20											
25	8D	24/24	24.0 - 26.0	Push thru vane	--					Grey, wet, soft, Silty CLAY, (Marine Clay). 65x130mm vane raw torque readings:	A-7, CL LL=50

Remarks:

1. Fine-Grained Soil Descriptions on this log are based on plasticity estimated using visual-manual classification techniques or laboratory Atterberg Limit tests if available, rather than the MaineDOT Standard based percentages passing specific grain sizes.
2. Automatic Hammer NEBC #D19 Energy Transfer Ratio = 0.895.
3. Water level measurements were taken immediately after removal of casing.

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: Bucknam Road Bridge #5830 over I-295 Location: Falmouth, Maine	Boring No.: BB-FBR-106 WIN: 21720.00

Driller:	New England Boring Contractors	Elevation (ft.)	47.0	Auger ID/OD:	2.5" SSA
Operator:	B. Enos	Datum:	NAVD 88	Sampler:	Standard Splitspoon
Logged By:	B. Woodman/M. Walsh	Rig Type:	ATV Mobile B53	Hammer Wt./Fall:	140#/30"
Date Start/Finish:	6/25/19-6/25/19	Drilling Method:	Drive & Wash	Core Barrel:	NA
Boring Location:	Sta. 6+86.6, 58.7' Rt	Casing ID/OD:	4/4.5"	Water Level*:	15.2
Hammer Efficiency Factor:	.895	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.
25	V3 V4		24.6 - 25.0 25.6 - 26.0	S_u=330/27 psf S_u=275/27 psf						V3: 12/1 ft-lbs V4: 10/1 ft-lbs	PL-24 PI=26 WC=44.7
30	9D ~~V5~~ V6	24/24	29.0 - 31.0 ~~29.6 - 30.0~~ 30.6 - 31.0	Push thru vane ~~S_u=536/55 psf~~ S_u=522/27 psf	--					Grey, wet, medium stiff, Silty CLAY, (Marine Clay). 65x130mm vane raw torque readings: V5: 19.5/2 ft-lbs V6: 19.0/1 ft-lbs	WC=38.4
35	1U	24/24	34.0 - 36.0	PUSH							LL=41 PL=21 PI=20 WC=42.8
	V7		36.6 - 37.0	S_u=604/27 psf						65x130mm vane raw torque readings: V7: 22/1 ft-lbs	
	V8		37.6 - 38.0	S_u=577/27 psf						V8: 21/1 ft-lbs	
40											
45	10D ~~V9~~ V10	24/24	45.0 - 47.0 ~~45.6 - 46.0~~ 46.6 - 47.0	Push thru vane ~~S_u=632/41 psf~~ S_u=549/14 psf	--					Grey, wet, medium stiff, Silty CLAY, (Marine Clay). 65x130mm vane raw torque readings: V9: 23/1.5 ft-lbs V10: 20/.5 ft-lbs	A-6, CL LL=39 PL=19 PI=20 WC=37.2
50											

Remarks:

1. Fine-Grained Soil Descriptions on this log are based on plasticity estimated using visual-manual classification techniques or laboratory Atterberg Limit tests if available, rather than the MaineDOT Standard based percentages passing specific grain sizes.
2. Automatic Hammer NEBC #D19 Energy Transfer Ratio = 0.895.
3. Water level measurements were taken immediately after removal of casing.

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:	Bucknam Road Bridge #5830 over I-295	**Location:**	Falmouth, Maine	**Boring No.:**	BB-FBR-106
				WIN:	21720.00

Driller:	New England Boring Contractors	**Elevation (ft.)**	47.0	**Auger ID/OD:**	2.5" SSA
Operator:	B. Enos	**Datum:**	NAVD 88	**Sampler:**	Standard Splitspoon
Logged By:	B. Woodman/M. Walsh	**Rig Type:**	ATV Mobile B53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	6/25/19-6/25/19	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NA
Boring Location:	Sta. 6+86.6, 58.7' Rt	**Casing ID/OD:**	4/4.5"	**Water Level*:**	15.2
Hammer Efficiency Factor:	.895	**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.
50	11D	24/24	50.0 - 52.0	Push thru vane	--					Grey, wet, medium stiff, Silty CLAY, (Marine Clay). 65x130mm vane raw torque readings: V11: 17.5/1 ft-lbs V12: 26.0/2 ft-lbs	WC=37.4
	V11		50.6 - 51.0	S_u=481/27 psf							
	V12		51.6 - 52.0	S_u=714/55 psf							
55	2U	24/24	55.0 - 57.0	PUSH							LL=31 PL=18 PI=13 W31.5
	12D	24/24	57.0 - 59.0	Push thru vane	--					Grey, wet, medium stiff, Silty CLAY, (Marine Clay). 65x130mm vane raw torque readings: V13: 26.5/.5 ft-lbs V14: 21.5/.5 ft-lbs	WC=34.5
	V13		57.6 - 58.0	S_u=728/14 psf							
	V14		58.6 - 59.0	S_u=590/14 psf							
60											
	13D	24/24	64.0 - 66.0	Push thru vane	--					Grey, wet, medium stiff, Sandy CLAY, (Marine Clay). 65x130mm vane raw torque readings: V15: 46.5/1.5 ft-lbs V16: 32.0/5 ft-lbs	
65	V15		64.6 - 65.0	S_u=1256/41 psf							
	V16		65.6 - 66.0	S_u=879/137 psf							
								-20.0		67.0	
	14D	24/19	69.0 - 71.0	15-12-10-14	22	33				Grey/brown, wet, dense, Sandy, Clayey SILT, (Lower Marine Sand).	G#S-32 A-4(0), CL WC=21.6
70											
75	15D	24/13	74.0 - 76.0	9-9-11-12	20	30				Grey/brown, wet, medium dense, fine to medium SAND, little silt, (Lower Marine Sand).	

Remarks:

1. Fine-Grained Soil Descriptions on this log are based on plasticity estimated using visual-manual classification techniques or laboratory Atterberg Limit tests if available, rather than the MaineDOT Standard based percentages passing specific grain sizes.
2. Automatic Hammer NEBC #D19 Energy Transfer Ratio = 0.895.
3. Water level measurements were taken immediately after removal of casing.

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: Bucknam Road Bridge #5830 over I-295
Location: Falmouth, Maine

Boring No.: BB-FBR-106
WIN: 21720.00

Driller:	New England Boring Contractors	**Elevation (ft.)**	47.0	**Auger ID/OD:**	2.5" SSA
Operator:	B. Enos	**Datum:**	NAVD 88	**Sampler:**	Standard Splitspoon
Logged By:	B. Woodman/M. Walsh	**Rig Type:**	ATV Mobile B53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	6/25/19-6/25/19	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NA
Boring Location:	Sta. 6+86.6, 58.7' Rt	**Casing ID/OD:**	4/4.5"	**Water Level*:**	15.2
Hammer Efficiency Factor:	.895	**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.
75											
	16D	24/12	79.0 - 81.0	10-14-17-17	31	46				Grey/brown, wet, dense, fine to coarse SAND, trace silt, (Lower Marine Sand). Advanced roller bit without sampling.	G#S-33 A-3, SP-SM WC=15.7
80											
								-37.5		84.5	
85										Increased resistance at 84.5' bgs, possible bedrock. Advanced roller bit to 86.0' and terminated boring.	
								-39.0		86.0	
										Bottom of Exploration at 86.0 feet below ground surface.	
90											
95											
100											

Remarks:

1. Fine-Grained Soil Descriptions on this log are based on plasticity estimated using visual-manual classification techniques or laboratory Atterberg Limit tests if available, rather than the MaineDOT Standard based percentages passing specific grain sizes.
2. Automatic Hammer NEBC #D19 Energy Transfer Ratio = 0.895.
3. Water level measurements were taken immediately after removal of casing.

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:	Bucknam Road Bridge #5830 over I-295	**Location:**	Falmouth, Maine	**Boring No.:**	BB-FBR-201
				WIN:	21720.00
Driller:	New England Boring Contractors	**Elevation (ft.)**	39.6	**Auger ID/OD:**	4.25" OD SSA
Operator:	B. Enos	**Datum:**	NAVD 88	**Sampler:**	Standard Splitspoon
Logged By:	E. Tome	**Rig Type:**	ATV Mobile B53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	9/2/20-9/2/20	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NA
Boring Location:	Sta. 4+15.4, 68.9' Lt	**Casing ID/OD:**	4/4.5"	**Water Level*:**	5.7
Hammer Efficiency Factor:	0.818	**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	24/15	0.0 - 2.0	1-2-2-5	4	5	SSA	39.3		0'-0.3': Topsoil 0.3 Brown, dry, medium stiff, SILT, trace sand, with organics, (Fill).	
	2D	24/12	2.0 - 4.0	2-3-4-4	7	10				Grey/brown, moist, stiff, Clayey SILT, trace sand, with organics, (Fill).	
5	3D	24/12	4.0 - 6.0	2-1-2-2	3	4				Grey/brown, moist, soft to medium stiff, SILT, trace fine sand, with organics, (Fill).	
	4D	24/21	6.0 - 8.0	3-10-12-7	22	30	RC	33.0 32.2		Top 7": Grey/brown, moist, SILT, trace sand, with organics, (Fill). 6.6 4D: Middle 10": Grey, wet, Silty fine SAND, (Upper Marine Sand). 7.4 4D: Bottom 4": Grey, wet, Silty CLAY, trace sand, (Marine Clay Crust).	
	5D V1 V2	24/20	8.0 - 10.0 8.6 - 9.0 9.6 - 10.0	1-3-3-3 S_u=616/36 psf S_u>1786 psf	--					Grey, wet, medium stiff to stiff, Silty CLAY, trace sand, (Marine Clay Crust). 55x110 mm vane raw torque readings: V1: 165/10 in-lbs V2: >40 ft-lbs	
10											
	1U	24/24	12.0 - 14.0	PUSH						Grey, wet, Silty CLAY, (Marine Clay Crust).	
15	6D V3 V4	24/24	14.0 - 16.0 14.6 - 15.0 15.6 - 16.0	Push Thru Vane S_u=1205/179 psf S_u=670/89 psf				24.6		Grey, wet, medium stiff to stiff, Silty CLAY, (Marine Clay Crust). 55x110 mm vane raw torque readings: V3: 27/4 ft-lbs 15.0 V4: 15/2 ft-lbs	
	7D V5 V6	24/17	18.0 - 20.0 18.6 - 19.0 19.6 - 20.0	Push Thru Vane S_u=618/44 psf S_u=607/44 psf						Grey, wet, medium stiff, Silty CLAY, (Marine Clay). 65x130 mm vane raw torque readings: V5: 270/20 in-lbs V6: 265/20 in-lbs	
20	2U	24/24	20.0 - 22.0	PUSH						Grey, wet, Silty CLAY, (Marine Clay).	
	8D V7 V8	24/24	22.0 - 24.0 22.6 - 23.0 23.6 - 24.0	Push Thru Vane S_u=796/110 psf S_u=934/137 psf						Grey, wet, medium stiff, Silty CLAY, (Marine Clay). 65x130 mm vane raw torque readings: V7: 29/4 ft-lbs V8: 34/5 ft-lbs	
25											

Remarks:

1. Fine-Grained Soil Descriptions on this log are based on plasticity estimated using visual-manual classification techniques or laboratory Atterberg Limit tests if available, rather than the MaineDOT Standard based on percentages passing specific grain sizes.
2. Automatic Hammer NEBC #D23 Energy Transfer Ratio = 0.818
3. Water level measured in open hole after removal of SSA clean out to 8 feet bgs.
4. Could not advance vane at 39.4'.

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: Bucknam Road Bridge #5830 over I-295
Location: Falmouth, Maine

Boring No.: BB-FBR-201
WIN: 21720.00

Driller:	New England Boring Contractors	**Elevation (ft.)**	39.6	**Auger ID/OD:**	4.25" OD SSA
Operator:	B. Enos	**Datum:**	NAVD 88	**Sampler:**	Standard Splitspoon
Logged By:	E. Tome	**Rig Type:**	ATV Mobile B53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	9/2/20-9/2/20	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NA
Boring Location:	Sta. 4+15.4, 68.9' Lt	**Casing ID/OD:**	4/4.5"	**Water Level*:**	5.7
Hammer Efficiency Factor:	0.818	**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.
25											
	9D	24/17	28.0 - 30.0	Push Thru Vane						Grey, wet, stiff, Silty CLAY, (Marine Clay).	
	V9		28.6 - 29.0	S_u=1016/165 psf						65x130 mm vane raw torque readings: V9: 37/6 ft-lbs	
	V10		29.6 - 30.0	S_u=1126/192 psf						V10: 41/7 ft-lbs	
30	3U	24/24	30.0 - 32.0	PUSH						Grey, wet, Silty CLAY, (Marine Clay).	
	10D	24/24	32.0 - 34.0	Push Thru Vane						Grey, wet, stiff, Silty CLAY, trace fine sand, (Marine Clay).	
	V11		32.6 - 33.0	S_u=1071/223 psf						55x110 mm vane raw torque readings: V11: 24/5 ft-lbs	
	V12		33.6 - 34.0	S_u=1161/165 psf						V12: 26/6 ft-lbs	
35											
	11D	24/24	39.0 - 41.0	5-7-10-10	17	23		0.2		Top 5": Grey, wet, Silty CLAY, trace fine sand, (Marine Clay). 39.4	
40	MV		39.6 - 40.0							Bottom 16": Brown, wet, medium dense, fine to coarse SAND, little silt, trace gravel, (Lower Marine Sand).	
	12D	6/0	43.0 - 43.5	5-50/0"	R			-3.9		43.5 Increased roller bit resistance at 43.0' bgs. splitspoon refusal at 43.5', probable top of rock. Advanced roller bit from 43.5'-45.2', increased resistance and consistent drilling from 44.0'-45.2' bgs.	
45								-5.6		45.2 **Bottom of Exploration at 45.2 feet below ground surface.**	
50											

Remarks:

1. Fine-Grained Soil Descriptions on this log are based on plasticity estimated using visual-manual classification techniques or laboratory Atterberg Limit tests if available, rather than the MaineDOT Standard based on percentages passing specific grain sizes.
2. Automatic Hammer NEBC #D23 Energy Transfer Ratio = 0.818
3. Water level measured in open hole after removal of SSA clean out to 8 feet bgs.
4. Could not advance vane at 39.4'.

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: Bucknam Road Bridge #5830 over I-295
Location: Falmouth, Maine

Boring No.: BB-FBR-202
WIN: 21720.00

Driller:	New England Boring Contractors	**Elevation (ft.)**	43.6	**Auger ID/OD:**	4.25" OD SSA
Operator:	B. Enos	**Datum:**	NAVD 88	**Sampler:**	Standard Splitspoon
Logged By:	E. Tome	**Rig Type:**	ATV Mobile B53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	9/1/20-9/1/20	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NA
Boring Location:	Sta. 7+55.5, 68.5' Lt	**Casing ID/OD:**	4/4.5"	**Water Level*:**	5.7
Hammer Efficiency Factor:	0.818	**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	24/15	0.0 - 2.0	1-2-4-4	6	8	SSA			Brown, dry, medium stiff, SILT, trace fine sand, with organics, (Fill).	
	2D	24/15	2.0 - 4.0	3-5-6-8	11	15				Brown, dry, stiff to very stiff, SILT, trace fine sand, with organics, (Fill).	
	3D	24/17	4.0 - 6.0	6-7-10-11	17	23		39.0		Top 7": Brown, dry, stiff, SILT, little fine sand, (Fill). 4.6	
5										Bottom 10": Light brown, moist, medium dense, fine SAND, trace silt (Upper Marine Sand).	
	4D	24/17	6.0 - 8.0	9-10-8-9	18	25		37.0		Top 7": Light brown, damp, fine SAND, trace silt, (Upper Marine Sand). 6.6 Bottom 10": Grey, moist, very stiff, Silty CLAY, (Marine Clay Crust).	
	5D	24/24	8.0 - 10.0	1-WOH-1-WOH	1	1				Grey, wet, Silty CLAY, (Marine Clay Crust).	
10	6D	24/24	10.0 - 12.0	WOH-WOH-WOH-WOH			RC	33.1		Top 6": Grey, wet, soft, Silty CLAY, (Marine Clay Crust). 10.5	
	MV		10.6 - 11.0					32.6		6D: Middle 6": Grey, wet, Silty fine SAND. 11.0	
										6D: Bottom 12": Grey, wet, Silty CLAY, (Marine Clay Crust).	
	1U	24/24	12.0 - 14.0	PUSH							
								29.6		14.0	
	7D	24/24	14.0 - 16.0	Push Thru Vane						Grey, wet, soft, Silty CLAY, (Marine Clay).	
15	V1		14.6 - 15.0	S_u=411/58 psf						55x110 mm vane raw torque readings: V1: 110/15 in-lbs	
	V2		15.6 - 16.0	S_u=393/58 psf						V2: 105/15 in-lbs	
	2U	24/22	16.0 - 18.0	PUSH							
	8D	24/24	18.0 - 20.0	Push Thru Vane						Grey, wet, medium stiff, Silty CLAY, (Marine Clay).	
	V3		18.6 - 19.0	S_u=527/91 psf						65x130 mm vane raw torque readings: V3: 230/40 in-lbs	
	V4		19.6 - 20.0	S_u=527/80 psf						V4: 230/55 in-lbs	
20	3U			PUSH							
	9D	24/24	22.0 - 24.0	Push Thru Vane						Grey, wet, medium stiff, Silty CLAY, (Marine Clay).	
	V5		22.6 - 23.0	S_u=651/91 psf						65x130 mm vane raw torque readings: V5: 285/40 in-lbs	
	V6		23.6 - 24.0	S_u=906/165 psf						V6: 33/6 ft-lbs	
25											

Remarks:

1. Fine-Grained Soil Descriptions on this log are based on plasticity estimated using visual-manual classification techniques or laboratory Atterberg Limit tests if available, rather than the MaineDOT Standard based on percentages passing specific grain sizes.
2. Automatic Hammer NEBC #D239 Energy Transfer Ratio = 0.818
3. Water level measured in open hole after removal of SSA clean out to 10 feet bgs.
4. MV at 10.6' bgs could not be advanced due to a 6" sand seam identified from 10.5-11.0' bgs

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: Bucknam Road Bridge #5830 over I-295 Location: Falmouth, Maine	Boring No.: BB-FBR-202 WIN: 21720.00

Driller:	New England Boring Contractors	Elevation (ft.)	43.6	Auger ID/OD:	4.25" OD SSA
Operator:	B. Enos	Datum:	NAVD 88	Sampler:	Standard Splitspoon
Logged By:	E. Tome	Rig Type:	ATV Mobile B53	Hammer Wt./Fall:	140#/30"
Date Start/Finish:	9/1/20-9/1/20	Drilling Method:	Drive & Wash	Core Barrel:	NA
Boring Location:	Sta. 7+55.5, 68.5' Lt	Casing ID/OD:	4/4.5"	Water Level*:	5.7
Hammer Efficiency Factor:	0.818	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.
25											
	10D	24/24	28.0 - 30.0	Push Thru Vane						Grey, wet, medium stiff, Silty CLAY, trace fine sand, (Marine Clay).	
	V7		28.6 - 29.0	S_u=851/165 psf						65x130 mm vane raw torque readings: V7: 31/6 ft-lbs	
	V8		29.6 - 30.0	S_u=879/165 psf						V8: 32/6 ft-lbs	
30											
	11D	24/24	32.0 - 34.0	Push Thru Vane						Grey, wet, medium stiff, Silty CLAY, trace fine sand, (Marine Clay).	
	V9		32.6 - 33.0	S_u=961/192 psf						65x130 mm vane raw torque readings: V9: 35/7 ft-lbs	
	V10		33.6 - 34.0	S_u=961/192 psf						V10: 35/7 ft-lbs	
35											
	12D	24/24	39.0 - 41.0	Push Thru Vane						Grey, wet, medium stiff to stiff, Silty CLAY, trace fine sand, (Marine Clay).	
40	V11		39.6 - 40.0	S_u=989/137 psf						65x130 mm vane raw torque readings: V11: 36/5 ft-lbs	
	V12		40.6 - 41.0	S_u=1016/165 psf						V12: 37/6 ft-lbs	
	4U	24/22	42.0 - 44.0	PUSH							
	13D	24/24	44.0 - 46.0	Push Thru Vane						Grey, wet, stiff, Silty CLAY, trace fine sand, (Marine Clay). Rock in tip of spoon.	
45	V13		44.6 - 45.0	S_u>1099 psf						65x130 mm vane raw torque readings: V13: >40 ft-lbs	
								-3.4		47.0	
50	14D	24/21	49.0 - 51.0	1-6-13-15	19	26				Top 13": Grey/brown, wet, medium dense, Silty fine SAND, (Lower Marine Sand).	

Remarks:

1. Fine-Grained Soil Descriptions on this log are based on plasticity estimated using visual-manual classification techniques or laboratory Atterberg Limit tests if available, rather than the MaineDOT Standard based on percentages passing specific grain sizes.
2. Automatic Hammer NEBC #D239 Energy Transfer Ratio = 0.818
3. Water level measured in open hole after removal of SSA clean out to 10 feet bgs.
4. MV at 10.6' bgs could not be advanced due to a 6" sand seam identified from 10.5-11.0' bgs

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: Bucknam Road Bridge #5830 over I-295
Location: Falmouth, Maine

Boring No.: BB-FBR-202
WIN: 21720.00

Driller:	New England Boring Contractors	**Elevation (ft.)**	43.6	**Auger ID/OD:**	4.25" OD SSA
Operator:	B. Enos	**Datum:**	NAVD 88	**Sampler:**	Standard Splitspoon
Logged By:	E. Tome	**Rig Type:**	ATV Mobile B53	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	9/1/20-9/1/20	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NA
Boring Location:	Sta. 7+55.5, 68.5' Lt	**Casing ID/OD:**	4/4.5"	**Water Level*:**	5.7
Hammer Efficiency Factor:	0.818	**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.
50										Bottom 8": Grey, wet, fine to medium SAND, trace silt, trace gravel, (Lower Marine Sand).	
	15D	24/11	54.0 - 56.0	11-13-15-17	28	38				Grey, wet, medium dense, fine to SAND, trace silt, (Lower Marine Sand).	
55											
	16D	5/4	59.0 - 59.4	130/5"	R			-15.8		Grey, wet, fine to medium SAND, little gravel, trace silt, (Lower Marine Sand). Splitspoon refusal at 59.4', possible top of rock. 59.4	
60										**Bottom of Exploration at 59.4 feet below ground surface.**	
65											
70											
75											

Remarks:

1. Fine-Grained Soil Descriptions on this log are based on plasticity estimated using visual-manual classification techniques or laboratory Atterberg Limit tests if available, rather than the MaineDOT Standard based on percentages passing specific grain sizes.
2. Automatic Hammer NEBC #D239 Energy Transfer Ratio = 0.818
3. Water level measured in open hole after removal of SSA clean out to 10 feet bgs.
4. MV at 10.6' bgs could not be advanced due to a 6" sand seam identified from 10.5-11.0' bgs

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 C – CONE PENETRATION TEST REPORTS

APPENDIX C.1 – CPT DATA REPORT BY SUMMIT GEOENGINGEERING SERVICES

The key to success starts with a solid foundation.
ENGINEERING | EXPLORATION | EXPERIENCE

Exploration Report

MDOT I-295 Bridge
Bucknam Road, Falmouth, Maine

Client

GZA GeoEnvironmntal, Inc.
477 Congress Street, Suite 700
Portland, Maine 04101

Project #: 19120
Date: 6/7/19

SUMMIT
GEOENGINEERING SERVICES

145 Lisbon Street (PO Box 7216) Lewiston, Maine 04243 | (207) 576-3313
173 Pleasant Street Rockland, Maine 04841 | (207) 318-7761
www.summitgeoeng.com

June 7, 2019
Summit #19120

Andrew R. Blaisdell, PE
GZA GeoEnvironmntal, Inc.
477 Congress Street, Suite 700
Portland, Maine 04101

Reference: Geotechnical Exploration Services
Piezocone Penetration Testing – Bucknam Road Falmouth, Maine

Dear Mr. Blaisdell;

We have completed exploration services for a planned bridge project on Bucknam Road in Falmouth, Maine. Summit Geoengineering Services (SGS) was asked to perform piezocone penetration testing (CPT) and prepare this data report summarizing results.

Work Description

The project site is located at Bucknam Road Bridge over Interstate I-295 in Falmouth, Maine. Explorations were performed along the southern edge of the existing bridge abutments within wooded or field areas, as shown on Figure 1 Exploration Location Plan included at the end of this report. Work performed includes the following:

- 5 piezocone penetration tests with shear wave velocity
- 4 dissipation tests within soft clay
- 2 test borings with field vane shear tests

Explorations

Summit Geoengineering Services (SGS) performed 5 piezocone penetration tests (CPT) to include shear wave velocity on May 21 to 23, 2019. CPT was performed in accordance with ASTM D5778. Shear wave velocity was performed at rod break intervals of 3.3 feet in accordance with ASTM D7400. Field vane shear tests were conducted within 2 test borings in accordance with ASTM D2573. Logs of the explorations are included at the end of this report.

CPT was advanced using a rubber track mounted PowerProbe 9500 VTR with a Vertek digital cone having a cross sectional area of 10 cm^2. CPT was performed to a depth of push refusal or anchor failure ranging from 43.8 to 84.7 feet below ground surface. Anchoring was conducting using a single point hollow anchor with start of test depth at 5 feet. Parameters obtained include cone resistance (q_c), sleeve friction (f_s), piezocone pore pressure (u_2), and shear wave velocity (V_s). Dissipation tests were conducted at CPT-FBR-101, CPT-FBR-102, and CPT-FBR-103.

Soil Behavior Type

Soil Behavior Type (SBT_N) profiling based on normalized cone penetration resistance (Robertson 1990, B_q method) indicates the following soil types generalized as follows:

CPT-FBR-101
- ***5 to 10 feet*** - Type 5 (silty sand to sandy silt) to Type 6 (clean sand to silty sand)
- ***10 to 12.5 feet*** - Type 4 (clayey silt to silty clay)
- ***12.5 to 40.5 feet*** - Type 3 (clay to silty clay)
- ***40.5 to 43.8 feet*** - Type 6 (clean sand to silty sand)

CPT-FBR-102
- ***5 to 13 feet*** - Type 4 (clayey silt to silty clay) to Type 6 (clean sand to silty sand)
- ***13 to 15 feet*** - Type 4 (clayey silt to silty clay)
- ***15 to 50 feet*** - Type 3 (clay to silty clay)
- ***50 to 55.6 feet*** - Type 6 (clean sand to silty sand)

CPT-FBR-103
- ***5 to 8 feet*** - Type 5 (silty sand to sandy silt) to Type 7 (gravelly sand to sand)
- ***8 to 10 feet*** - Type 4 (clayey silt to silty clay)
- ***10 to 59 feet*** - Type 3 (clay to silty clay)
- ***59 to 73 feet*** - Type 6 (clean sand to silty sand)

CPT-FBR-104
- ***5 to 16 feet*** - Type 5 (silty sand to sandy silt) to Type 7 (gravelly sand to sand)
- ***16 to 18 feet*** - Type 4 (clayey silt to silty clay)
- ***18 to 72 feet*** - Type 3 (clay to silty clay)
- ***72 to 84.7 feet*** - Type 6 (clean sand to silty sand)

CPT-FBR-105
- ***5 to 11 feet*** - Type 5 (silty sand to sandy silt) to Type 6 (clean sand to silty sand)
- ***11 to 13 feet*** - Type 4 (clayey silt to silty clay)
- ***13 to 46.5 feet*** - Type 3 (clay to silty clay)
- ***46.5 to 54.6 feet*** - Type 6 (gravelly sand to sand)

Soil behavior type 5 to type 7 are typical of granular fill and/or alluvium consisting of sand with variable silt and gravel. Type 3 to type 4 is typical of Presumpscot Formation consisting of silty clay with minor sand. Type 4 is commonly associated with upper firm clay and type 3 is commonly associated with lower soft clay. Details of the SBT_N profiling is shown on the attached CPT logs.

Shear Wave Velocity Tests

Shear wave velocity tests were conducted during performed of the cone penetration tests during rod break intervals. Waterfall plots showing details of the shear wave velocity results are included at the end of this report. Summary of the results are provided below:

SHEAR WAVE VELOCITY TEST SUMMARY									
CPT-FBR-101		CPT-FBR-102		CPT-FBR-103		CPT-FBR-104		CPT-FBR-105	
D (ft)	V_s (ft/s)	D (ft)	V_s (ft/s)	D (ft)	V_s (ft/s)	D (ft)	V_s (ft/s)	D (ft)	V_s (ft/s)
10.8	740	10.6	575	10.8	490	11.7	640	10.7	1040
12.7	285	13.6	625	14.4	445	15.1	985	14.1	595
16.1	465	17.1	620	17.7	400	18.5	700	17.5	565
19.3	440	20.6	575	20.2	435	22.0	530	20.9	565
22.8	465	24.0	485	22.2	260	25.5	470	24.2	540
26.1	605	27.3	470	25.5	320	28.6	475	27.6	485
29.5	700	30.6	615	28.9	460	32.2	470	31.0	600
32.9	765	34.0	605	32.3	800	35.6	605	34.3	615
36.4	665	37.2	605	35.7	620	38.9	540	37.8	790
39.7	740	40.7	650	39.1	525	42.4	630	41.1	755
43.0	620	44.0	765	42.5	665	45.9	620	44.6	775
43.8	1170	47.2	670	45.7	510	49.1	700	47.9	695
--	--	50.7	710	49.1	1090	52.5	615	51.3	1185
--	--	54.0	960	52.4	570	56.0	720	54.6	1180
--	--	55.6	2305	55.8	440	59.4	695	--	--
--	--	--	--	59.2	765	62.8	645	--	--
--	--	--	--	62.4	880	66.2	955	--	--
--	--	--	--	66.0	650	69.6	650	--	--
--	--	--	--	69.4	1185	73.3	1110	--	--
--	--	--	--	72.7	1260	76.6	915	--	--
--	--	--	--	--	--	80.0	810	--	--
--	--	--	--	--	--	83.3	1085	--	--
Ave	640	**Ave**	750	**Ave**	640	**Ave**	710	**Ave**	740

Dissipation Tests

Dissipation tests were performed at CPT-FBR-101, CPT-FBR-102, and CPT-FBR-103. The horizontal coefficient of consolidation (C_h) can be estimated using a T_{50} determined for time for piezocone pore pressure to dissipate to 50 percent (U_{50}). Piezocone pore pressure is measured at the u_2 position located behind the cone tip. Graphic results of the dissipation tests are included at the end of this report. Summary of the results are provided below:

DISSIPATION TEST SUMMARY						
Location	**Depth (ft)**	**U_0 (psi)**	**U_{100} (psi)**	**U_{50} (psi)**	**T_{50} (min)**	**C_h (cm^2/min)**
CPT-FBR-101 GW = 2.5 ft	34.3	96.7	13.8	55.2	42.8	0.29
CPT-FBR-102 GW = 6.3 ft	19.6	53.8	5.8	29.8	39.5	0.31
	32.3	81.7	11.3	46.5	50.3	0.25
CPT-FBR-103 GW = 3.9 ft	21.1	51.7	7.5	29.6	49.2	0.25

Rigidity Index = 250, Cross Sectional Area = 10 cm^2, Pore Pressure Location = U_2

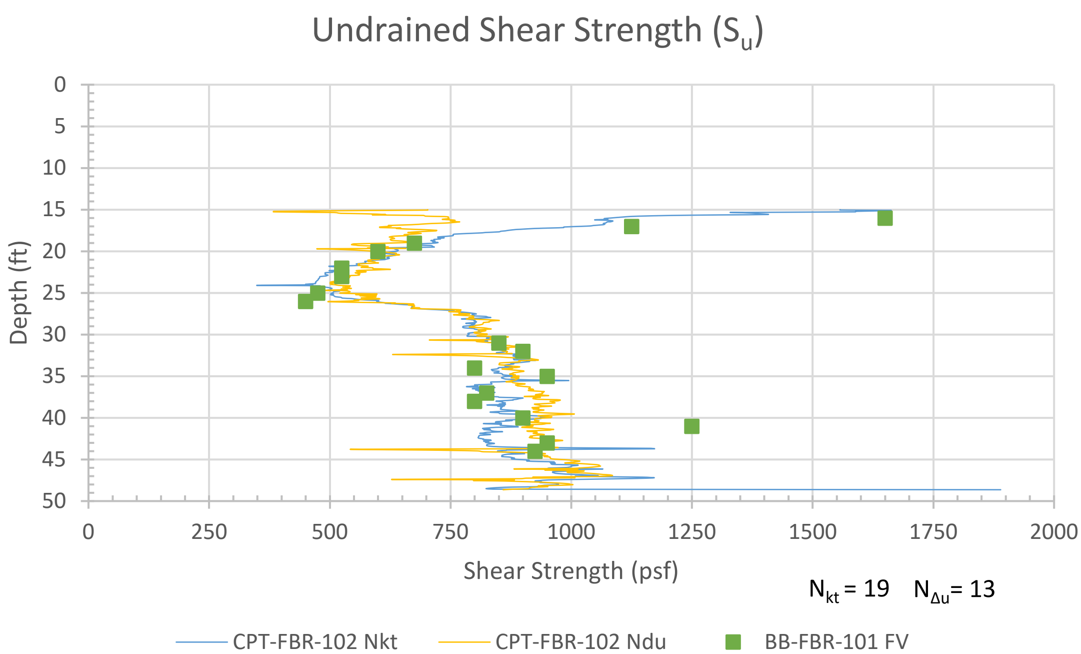
Groundwater was measured within open boreholes upon completion of explorations as follows:

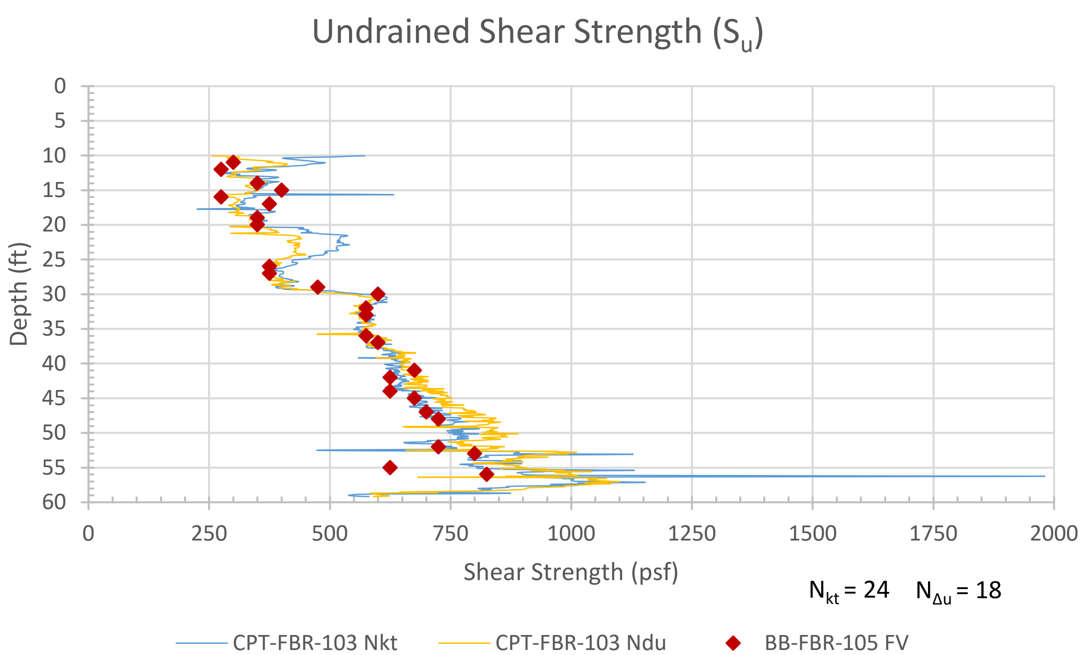
GROUNDWATER SUMMARY	
Location	**Depth (ft)**
CPT-FBR-101	2.5
CPT-FBR-102	6.3
CPT-FBR-103	3.9
CPT-FBR-104	4.3
CPT-FBR-105	5.4
BB-FBR-101	8.3
BB-FBR-105	4.3

Field Vane Shear Tests

The undrained shear strength (S_u) for soft clay is estimated from cone penetration resistance using N_{kt} and $N_{\Delta u}$ correction factors and field vane shear tests performed at adjacent test borings. Field vane shear tests were conducted at BB-FBR-101 from a depth of 16 to 44 feet below ground surface and at BB-FBR-105 from a depth of 10 to 56 feet at BB-FBR-105. Results of the field vane shear tests are shown on the test boring logs included at the end of this report.

Results indicate an average undrained shear strength of approximately 800 psf with a range from 450 to 1,650 psf at CPT-FBR-102/BB-FBR-101. Results indicate an average undrained shear strength of approximately 585 psf with a range from 275 to 1,100 psf at CPT-FBR-103/BB-FBR-105. Spikes typically represent silt or sand seams or layers. Graphic results of undrained shear strength (S_u) for soft clay are presented below:





145 Lisbon Street (PO Box 7216) Lewiston, Maine 04243 | (207) 576-3313
173 Pleasant Street Rockland, Maine 04841 | (207) 318-7761
www.summitgeoeng.com

Closure

Evaluation for soil profiling, shear wave velocity, coefficient of consolidation, and undrained shear strength is based on professional judgment and generally accepted principles of geotechnical engineering. Changes in subsurface conditions from those presented in this report may occur between the exploration locations.

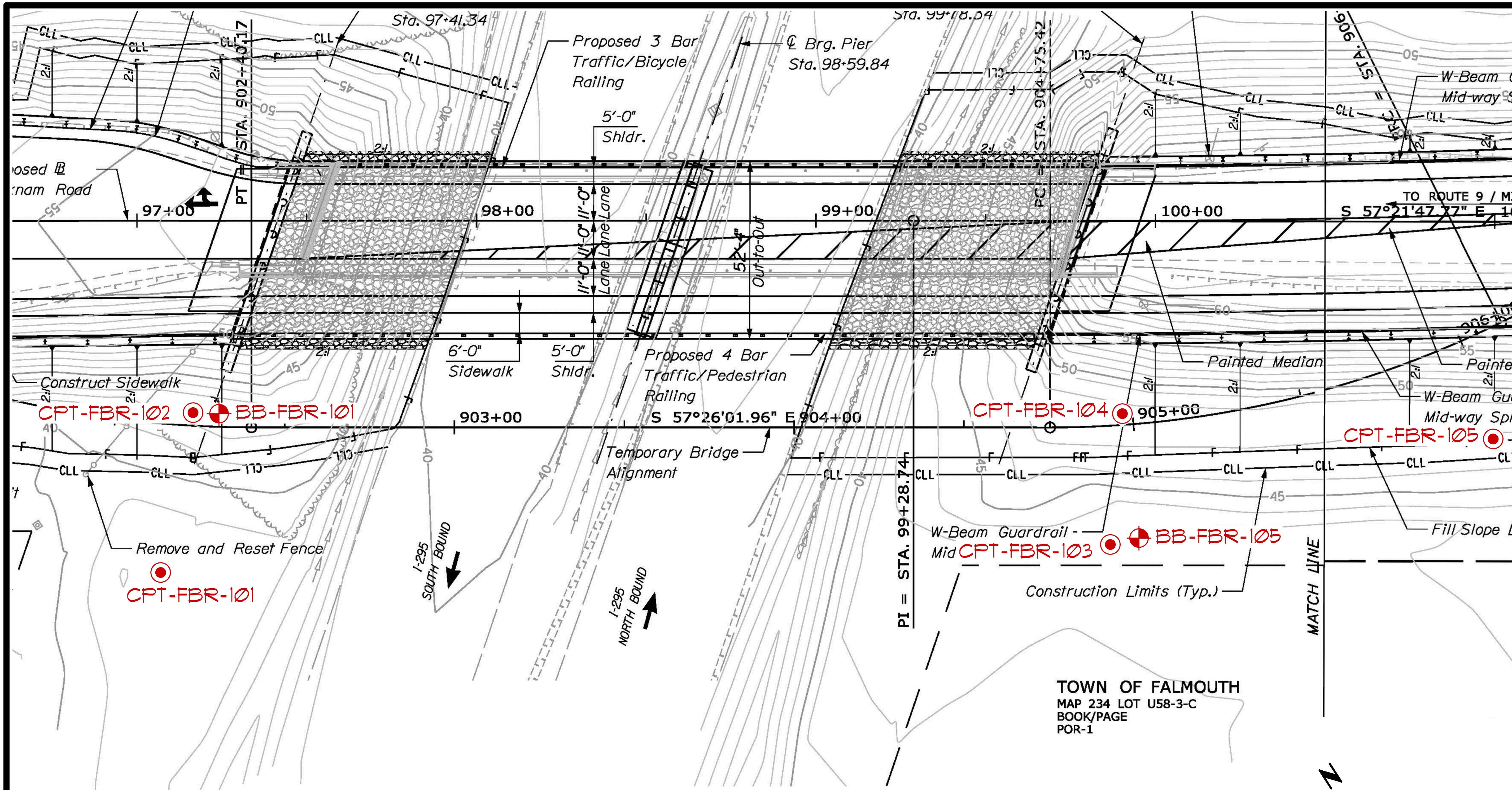
We appreciate the opportunity to serve you during this phase of your project. If there are any questions or additional information is required, please do not hesitate to call.

Sincerely yours,
Summit Geoengineering Services

Craig W. Coolidge, P.E.
Vice President
Principal Engineer

Attachments: EXPLORATION LOCATION PLAN, LOGS, WATERFALL PLOTS, DISSIPATION GRAPHS

145 Lisbon Street (PO Box 7216) Lewiston, Maine 04243 | (207) 576-3313
173 Pleasant Street Rockland, Maine 04841 | (207) 318-7761
www.summitgeoeng.com



SCALE: 1" = 30'

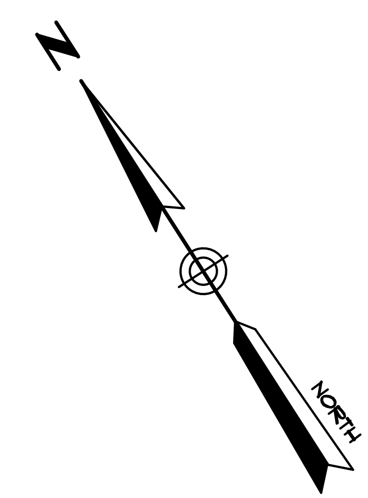
0 15 30 60 90

LEGEND

BB-FBR-105	SUMMIT TEST BORING WITH FIELD VANES (MAY 21-23, 2019)
CPT-FBR-106	SUMMIT CONE PENETRATION TEST (MAY 21-23, 2019)

PLAN REFERENCE

"BUCKNAM ROAD BRIDGE, INTERSTATE 295, PRELIMINARY PLAN" (2 SHEETS), DATED SEPTEMBER 2018, PREPARED BY STATE OF MAINE, DEPARTMENT OF TRANSPORTATION".



PROJECT: MAINE D.O.T. BRIDGE PROJECT
BUCKMAN RD - INTERSTATE 295 - FALMOUTH, ME

CLIENT: GZA GEOENVIRONMENTAL, INC.

TITLE: EXPLORATION LOCATION PLAN

DRAWN BY: KRF
APPR. BY: CWC
SCALE: 1" = 30'
DATE: JUNE 5, 2019

145 LISBON ST. - SUITE 101
LEWISTON, ME 04240
Tel.: (207) 576-3313

173 PLEASANT STREET
ROCKLAND, ME 04841
Tel.: (207) 318-7761

SUMMIT GEOENGINEERING SERVICES

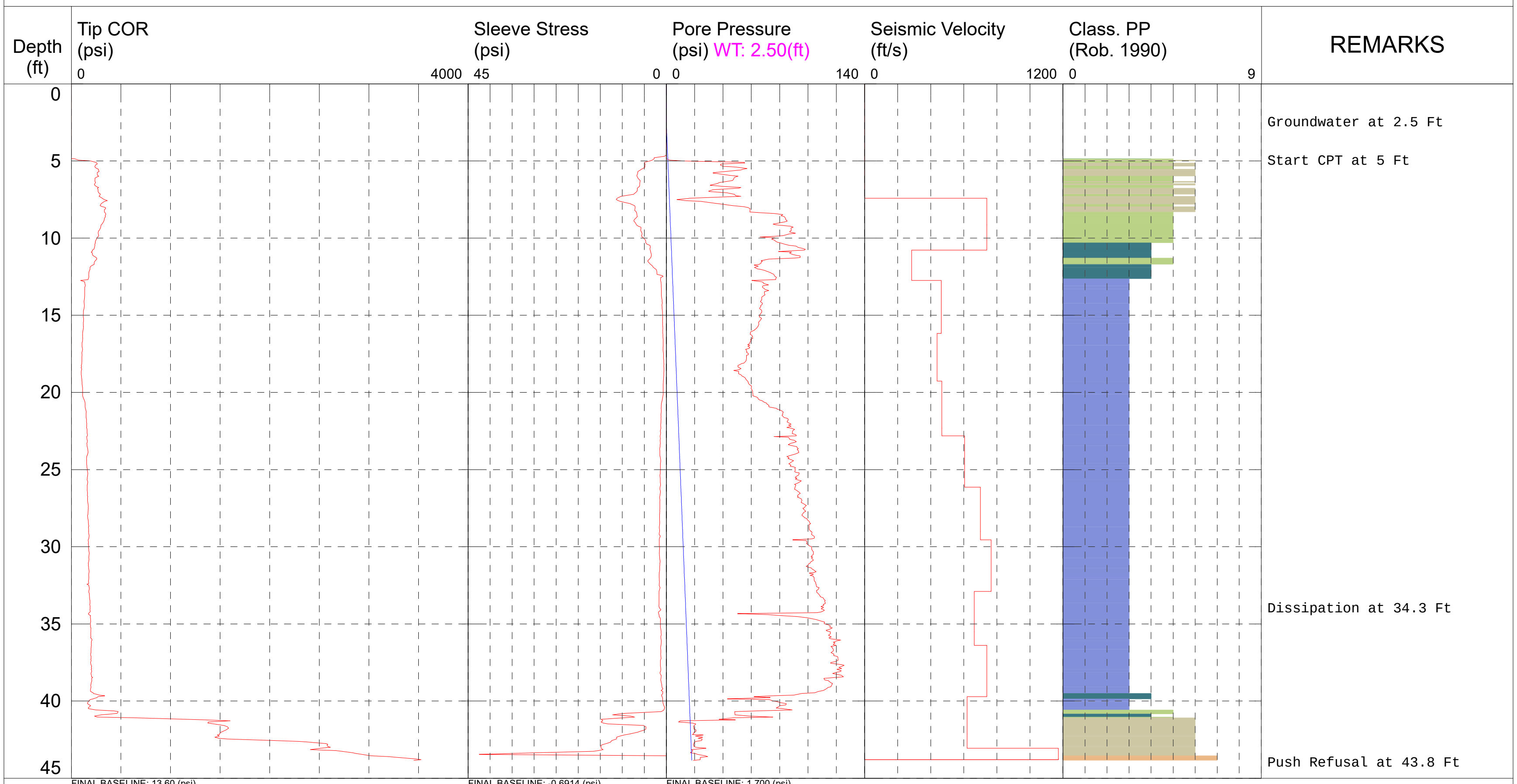
PROJ.#: 19120

FIGURE: 1

CPT-FBR-101

COMPANY: Summit Geoengineering Services
OPERATOR: C. Coolidge, P.E.
CREW: S. Anderson, S. Floyd
CLIENT: GZA
CLIENT REP: Blaine Cardali, P.E.

TEST DATE: Wed 22/May/2019
TEST ID: CPT-FBR-101
PROJECT: 19120
SITE: Bucknam Road
LOCATION: West Abutment



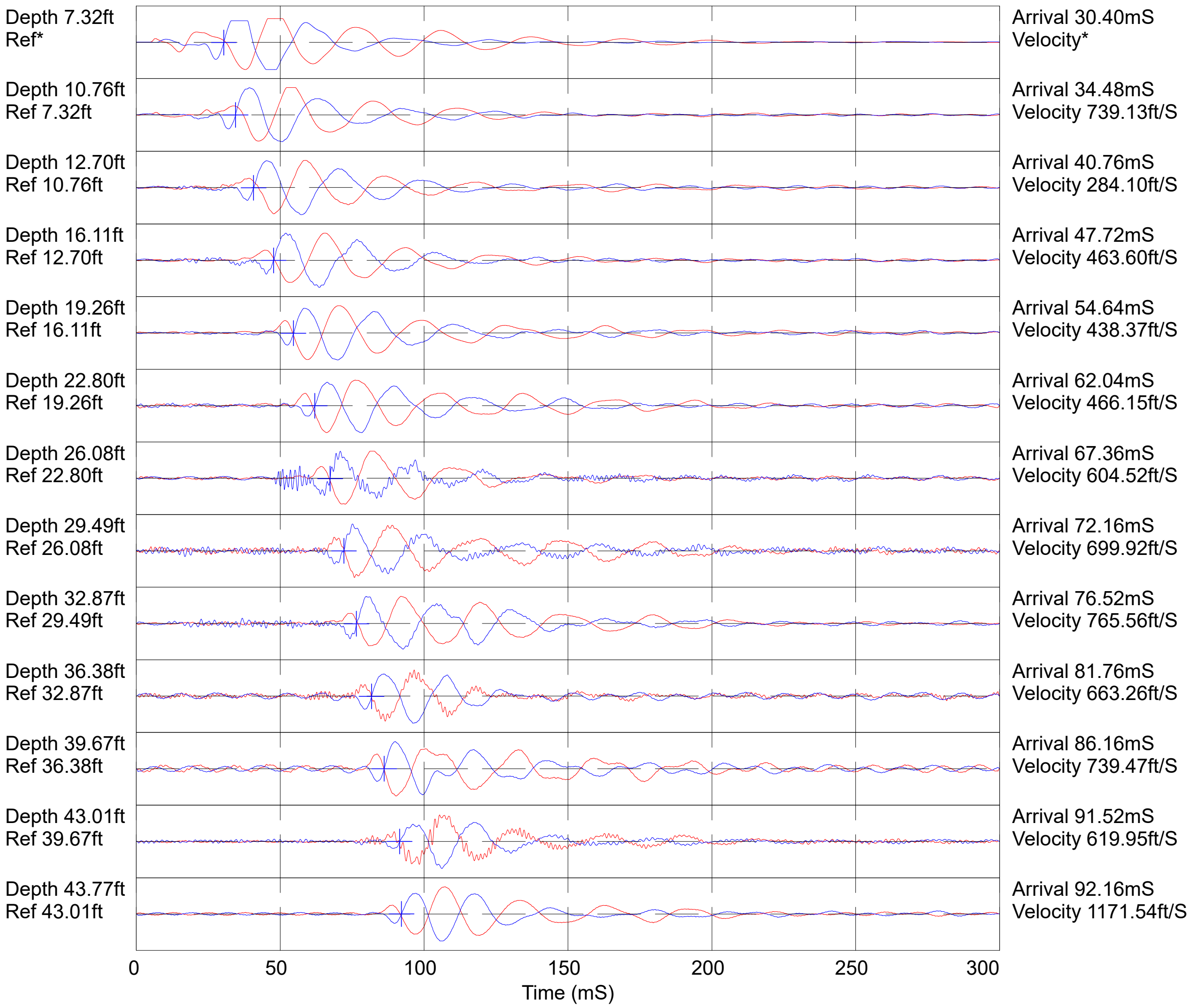
TOTAL DEPTH: 43.836 ft

PROBE ID: 4544.104.A

1 Sensitive, fine grained	4 Silt mixtures - clayey silt to silty clay	7 Gravelly sand to sand
2 Organic soils - peats	5 Sand mixtures - silty sand to sandy silt	8 Very stiff sand to clayey sand **
3 Clays - clay to silty clay	6 Sands - clean sand to silty sand	9 Very stiff, fine grained **

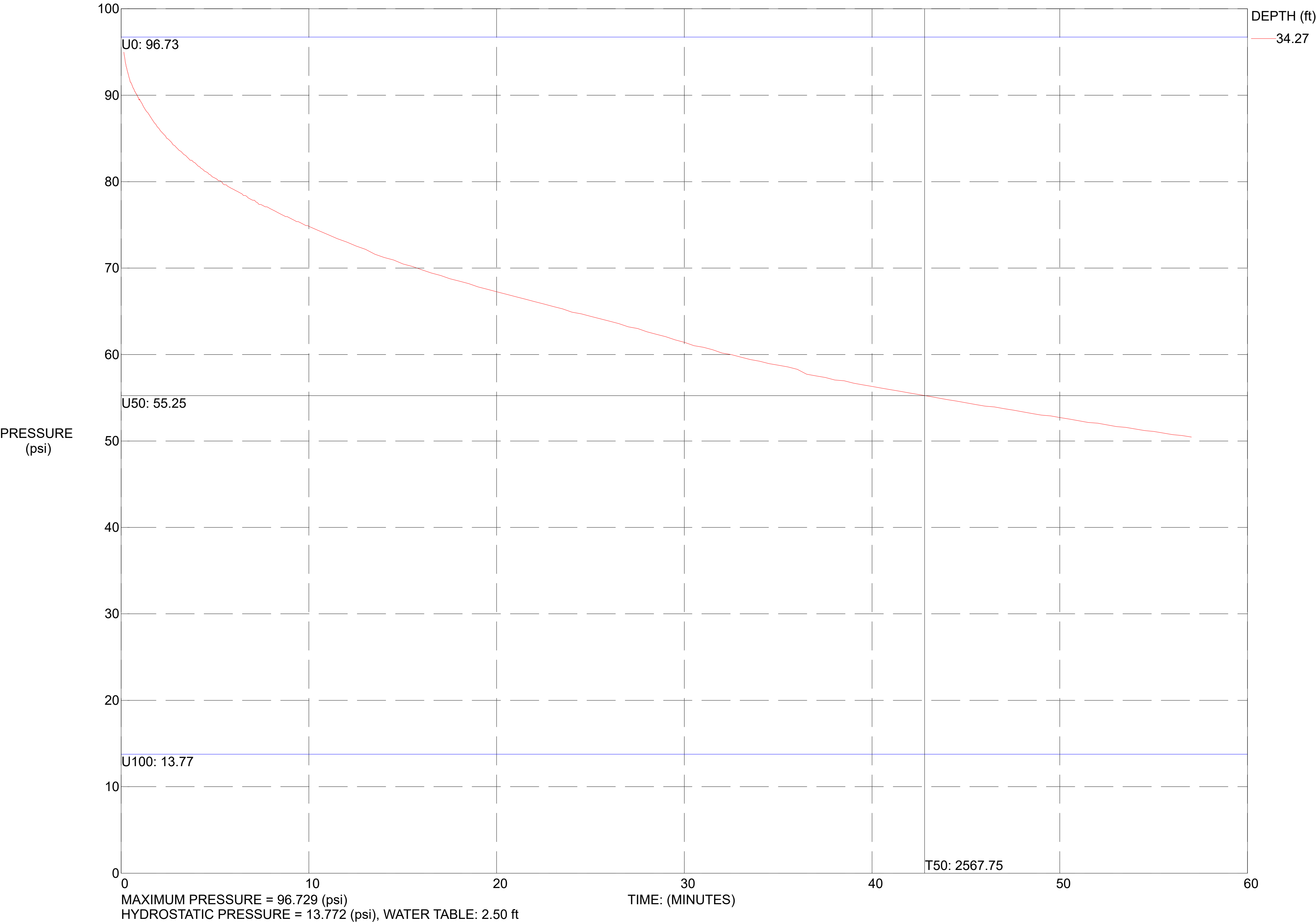
*SBT: Robertson 1990; **Overconsolidated or Cemented; *SBT/SPT CORRELATION: UBC-1983

TEST ID: CPT-FBR-101



Hammer to Rod String Distance (ft): 4.92
* = Not Determined

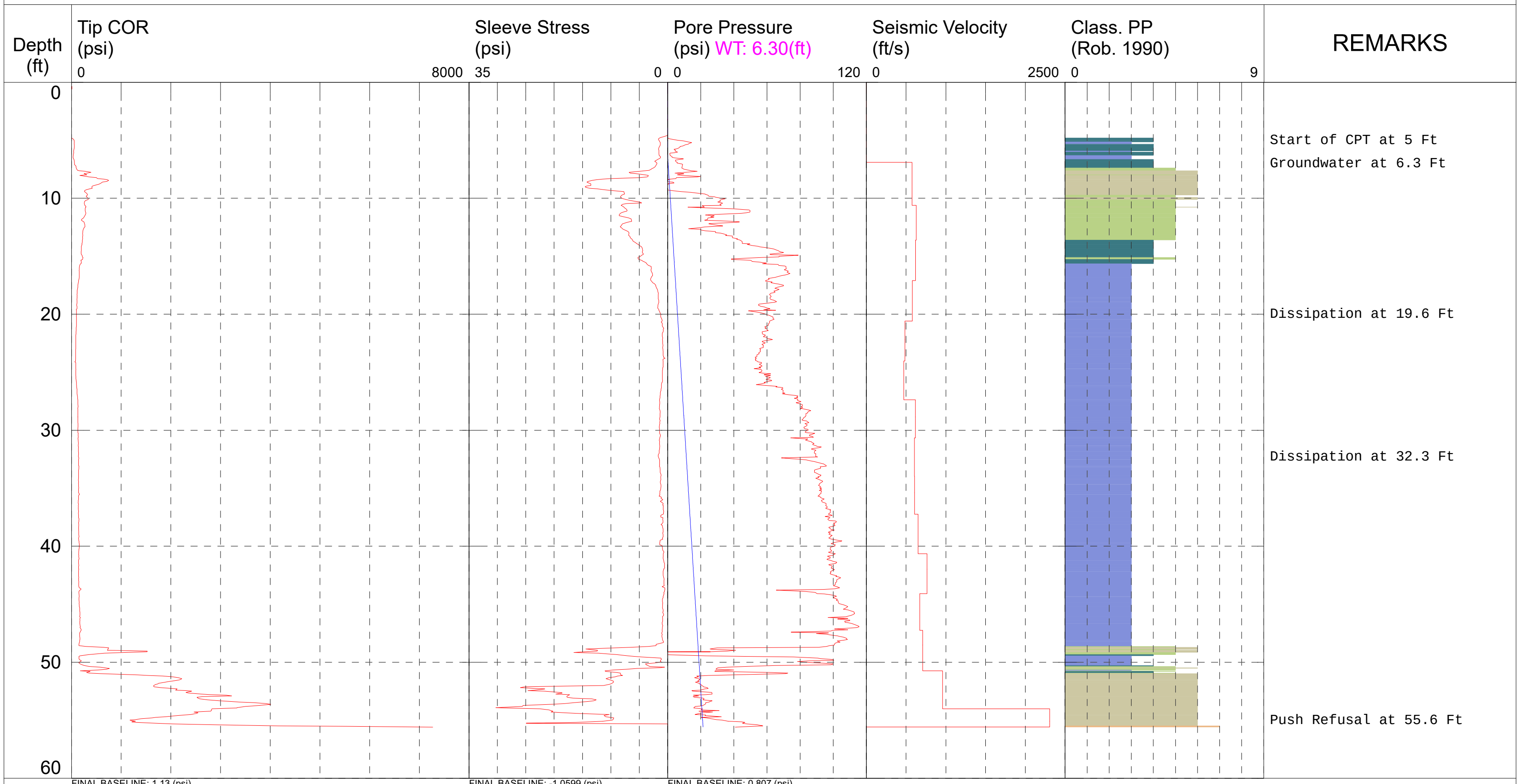
PROBE ID: 4544.104.A


SUMMIT
GEOENGINEERING SERVICES
100
90
80
70
60
50
40
30
20
10
0
U0: 96.73
U50: 55.25
U100: 13.77
PRESSURE
(psi)
DEPTH (ft)
34.27
T50: 2567.75
0
10
20
30
40
50
60
TIME: (MINUTES)
MAXIMUM PRESSURE = 96.729 (psi)
HYDROSTATIC PRESSURE = 13.772 (psi), WATER TABLE: 2.50 ft

CPT-FBR-102

COMPANY: Summit Geoengineering Services
OPERATOR: C. Coolidge, P.E.
CREW: S. Anderson, S. Floyd
CLIENT: GZA
CLIENT REP: Blaine Cardali, P.E.

TEST DATE: Thu 23/May/2019
TEST ID: CPT-FBR-102
PROJECT: 19120
SITE: Bucknam Road
LOCATION: West Abutment



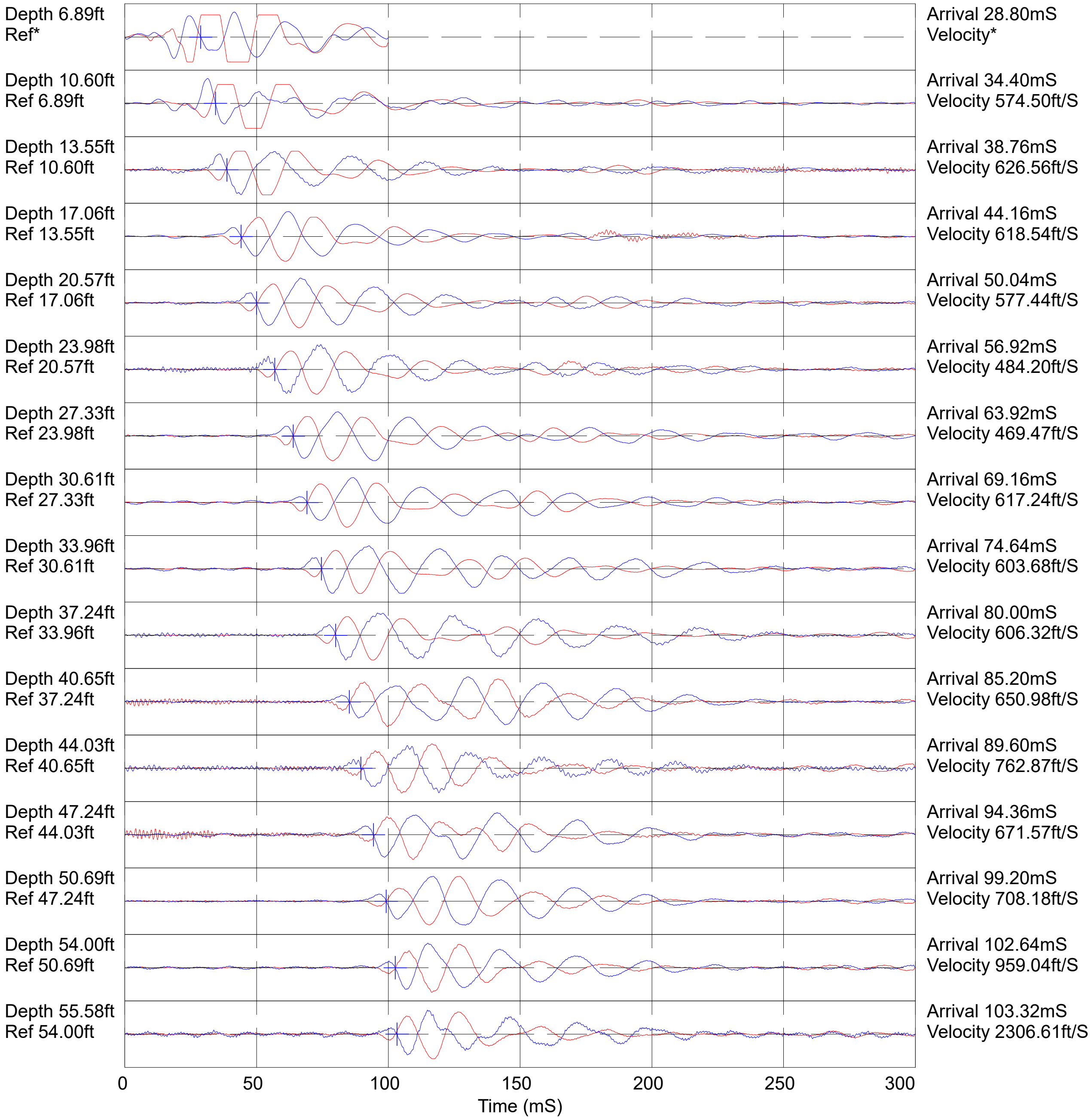
TOTAL DEPTH: 55.590 ft

PROBE ID: 4544.104.A

1	Sensitive, fine grained
2	Organic soils - peats
3	Clays - clay to silty clay
4	Silt mixtures - clayey silt to silty clay
5	Sand mixtures - silty sand to sandy silt
6	Sands - clean sand to silty sand
7	Gravelly sand to sand
8	Very stiff sand to clayey sand **
9	Very stiff, fine grained **

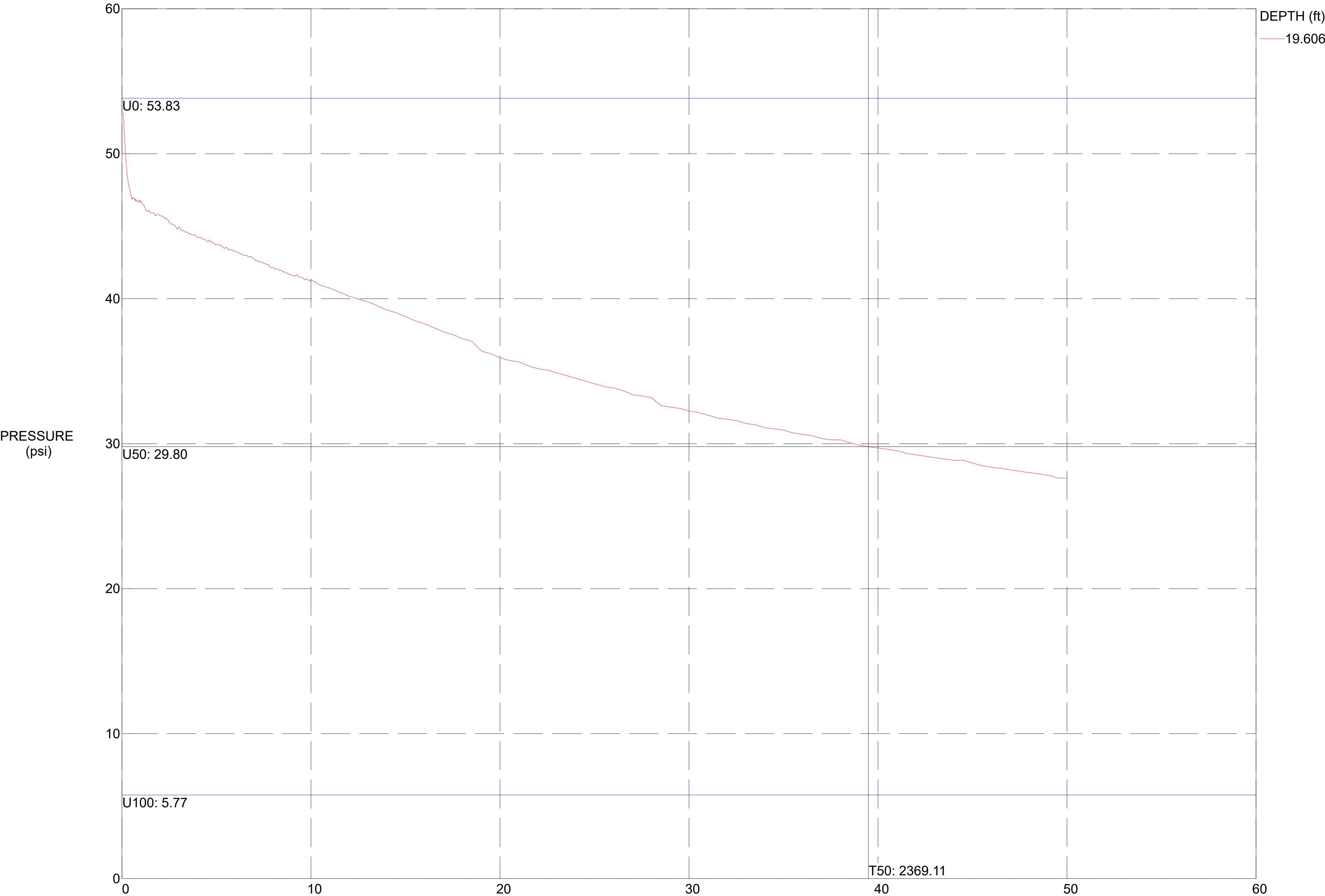
*SBT: Robertson 1990; **Overconsolidated or Cemented; *SBT/SPT CORRELATION: UBC-1983

TEST ID: CPT-FBR-102

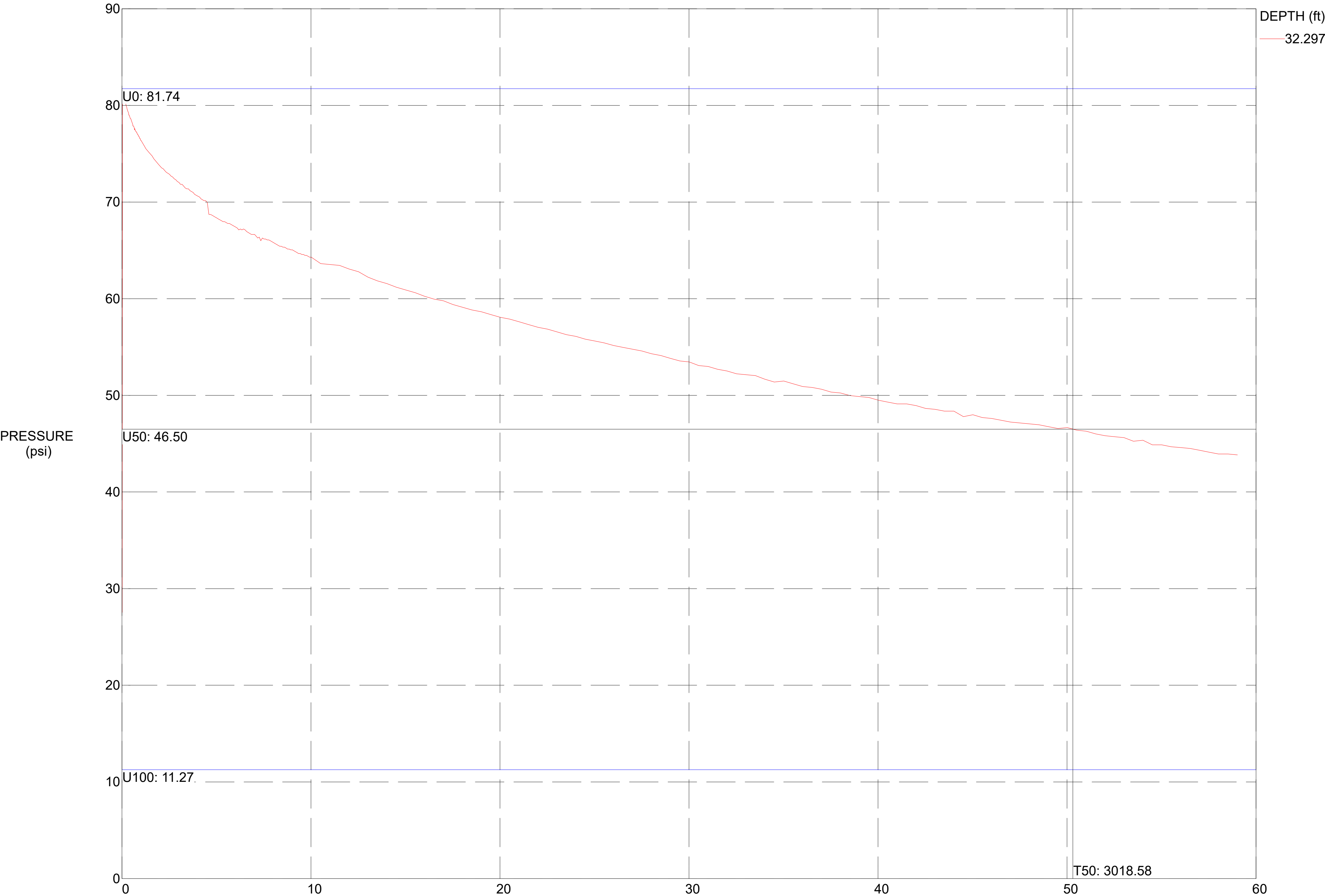


Hammer to Rod String Distance (ft): 4.92
* = Not Determined

PROBE ID: 4544.104.A



MAXIMUM PRESSURE = 53.833 (psi)
HYDROSTATIC PRESSURE = 5.768 (psi), WATER TABLE: 6.30 ft

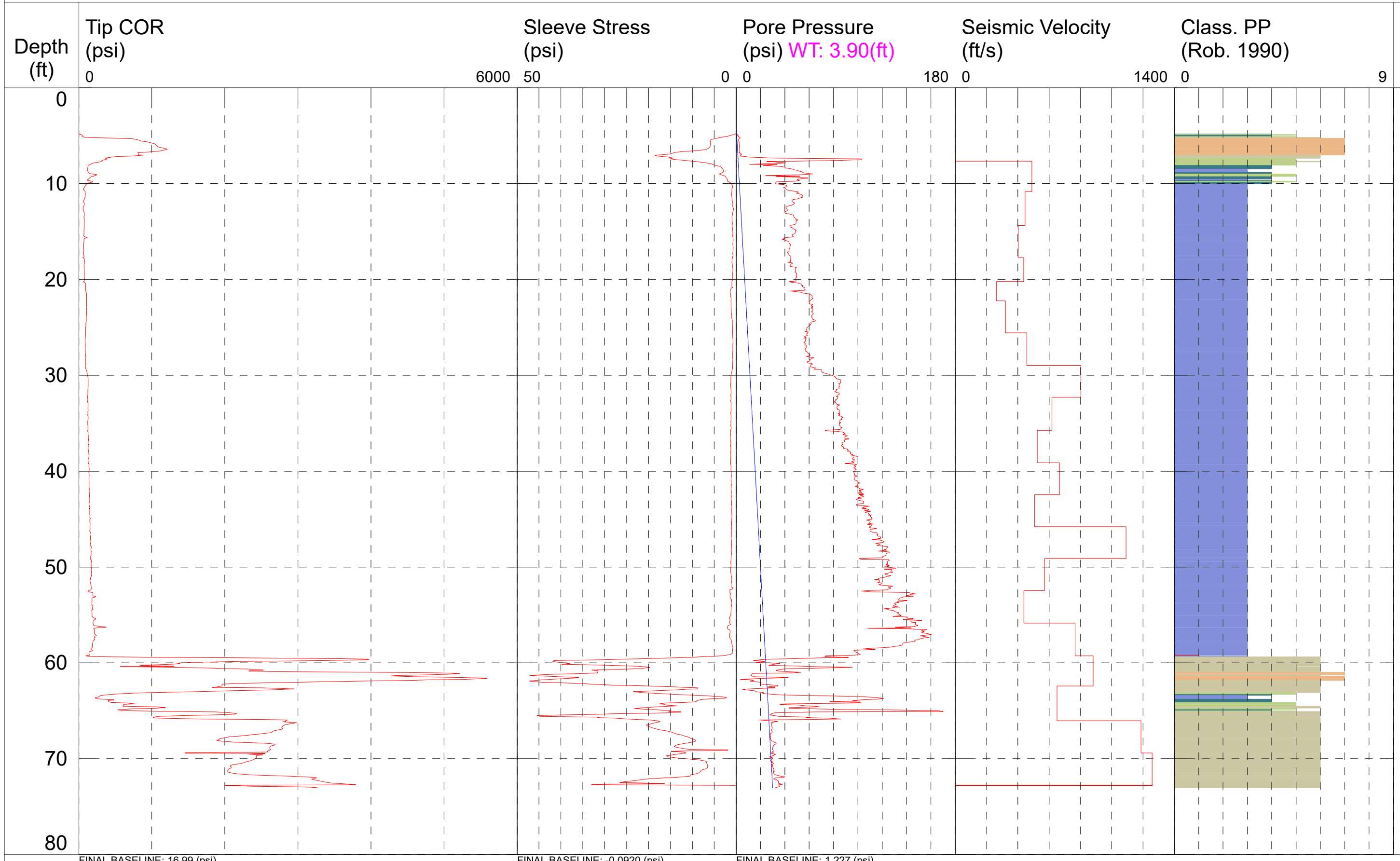


MAXIMUM PRESSURE = 81.739 (psi)
HYDROSTATIC PRESSURE = 11.27 (psi), WATER TABLE: 6.30 ft

CPT-FBR-103

COMPANY: Summit Geoengineering Services
OPERATOR: C. Coolidge, P.E.
CREW: S. Anderson, S. Floyd
CLIENT: GZA
CLIENT REP: Blaine Cardali, P.E.

TEST DATE: Tue 21/May/2019
TEST ID: CPT-FBR-103
PROJECT: 19120
SITE: Bucknam Road
LOCATION: East Abutment



REMARKS

Groundwater at 3.9 Ft
Start of CPT at 5 Ft
Dissipation at 21 Ft
Push Refusal at 73 Ft

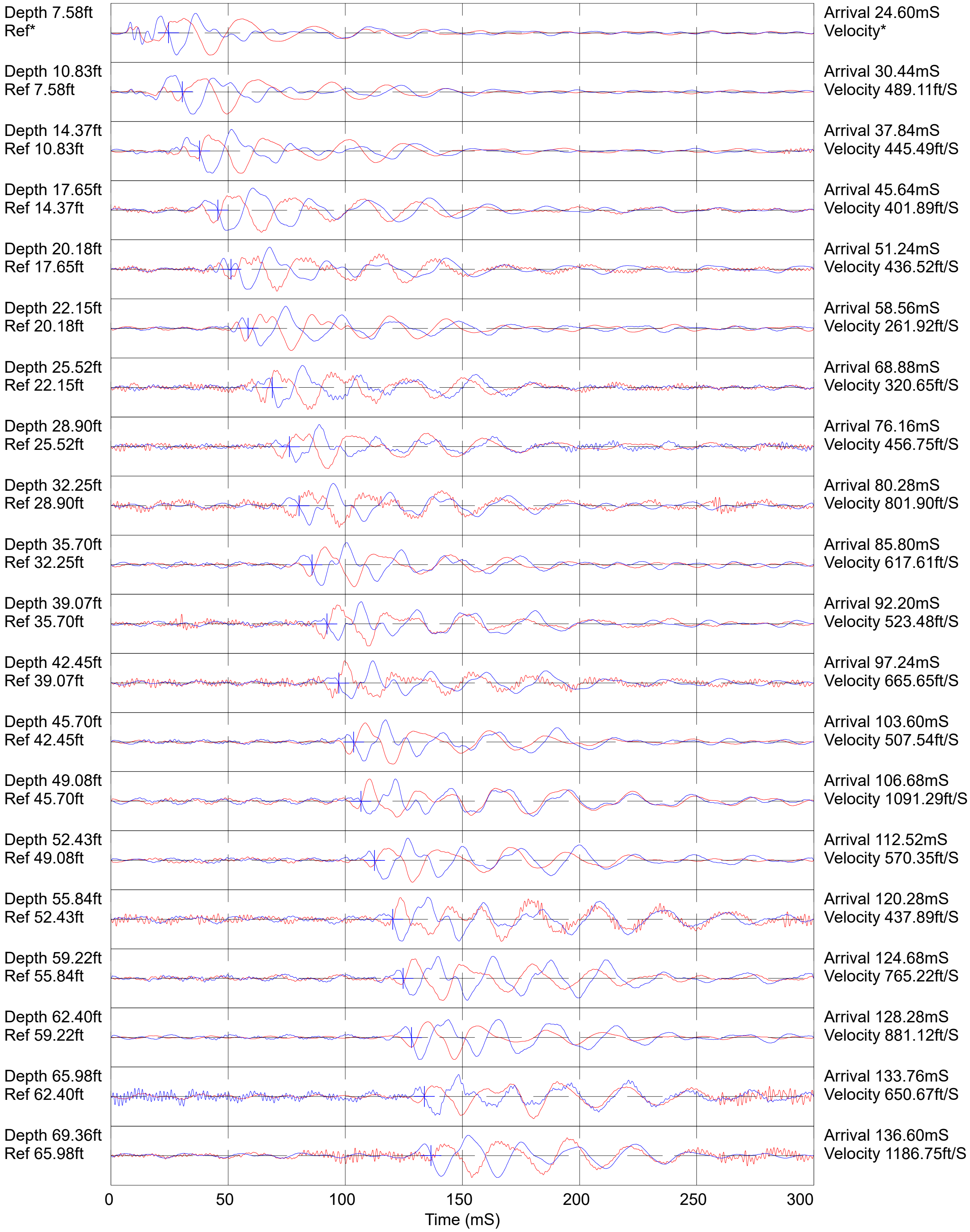
TOTAL DEPTH: 73.041 ft

PROBE ID: 4544.104.A

1 Sensitive, fine grained	4 Silt mixtures - clayey silt to silty clay	7 Gravelly sand to sand
2 Organic soils - peats	5 Sand mixtures - silty sand to sandy silt	8 Very stiff sand to clayey sand **
3 Clays - clay to silty clay	6 Sands - clean sand to silty sand	9 Very stiff, fine grained **

*SBT: Robertson 1990; **Overconsolidated or Cemented; *SBT/SPT CORRELATION: UBC-1983

TEST ID: CPT-FBR-103

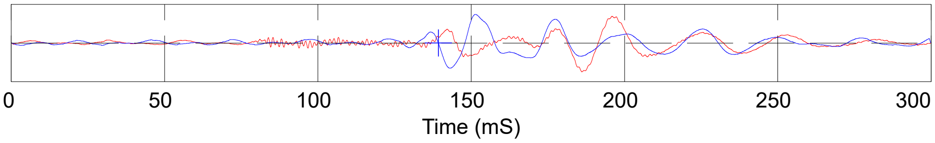


Hammer to Rod String Distance (ft): 4.92
* = Not Determined

PROBE ID: 4544.104.A

TEST ID: CPT-FBR-103

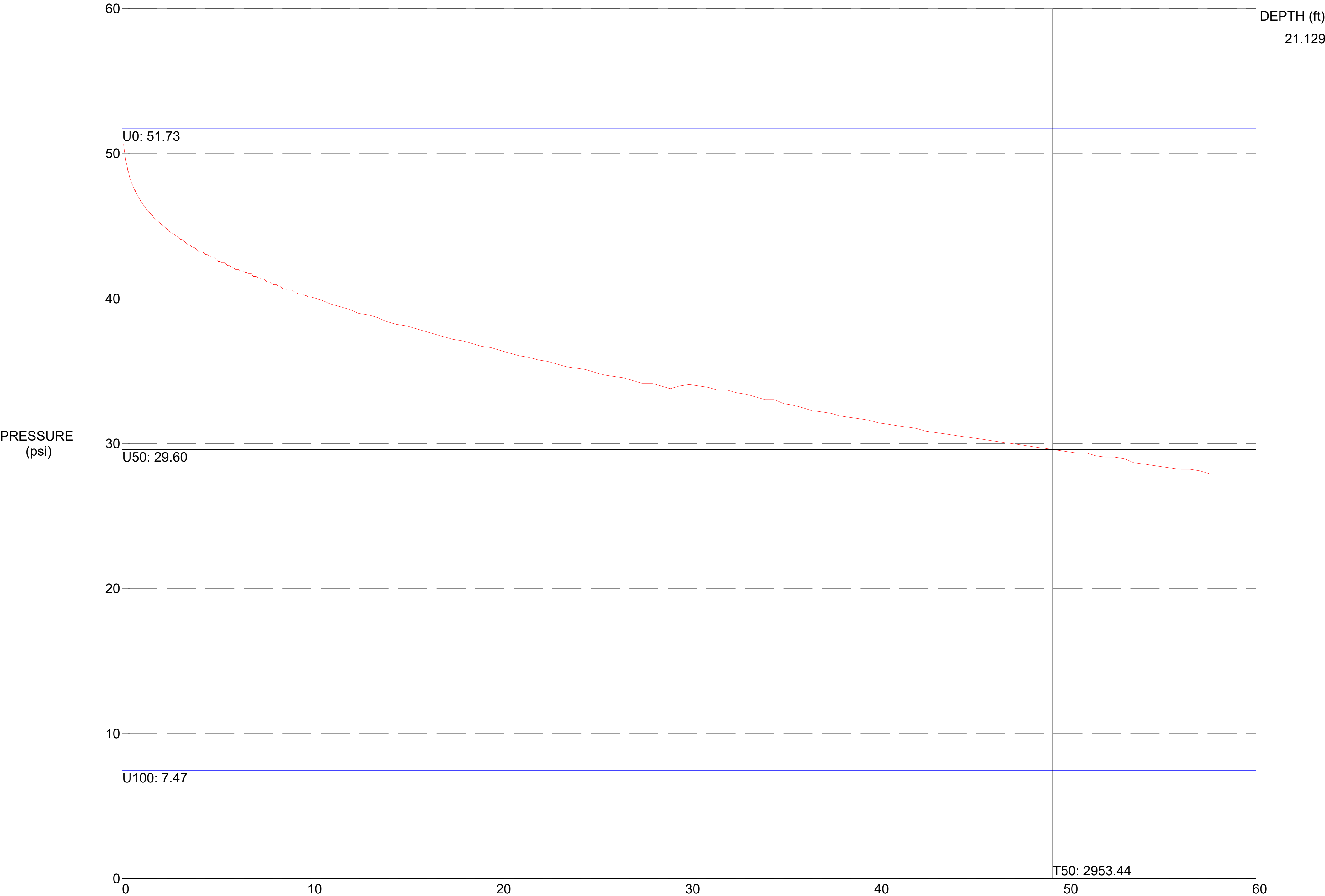
Depth 72.74ft
Ref 69.36ft



Arrival 139.28mS
Velocity 1257.90ft/S

Hammer to Rod String Distance (ft): 4.92
* = Not Determined

PROBE ID: 4544.104.A

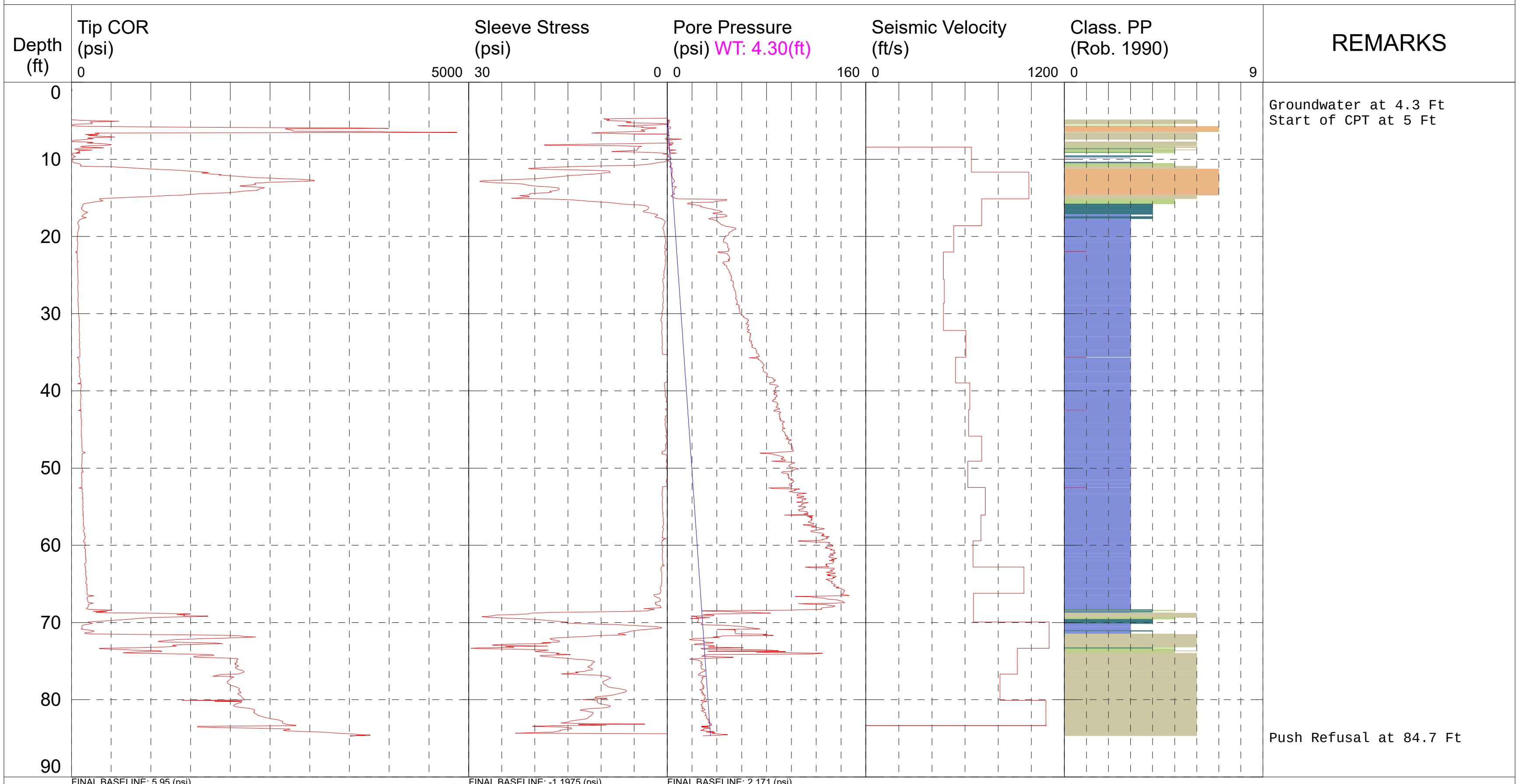


MAXIMUM PRESSURE = 51.727 (psi)
HYDROSTATIC PRESSURE = 7.469 (psi), WATER TABLE: 3.90 ft

CPT-FBR-104

COMPANY: Summit Geoengineering Services
OPERATOR: C. Coolidge, P.E.
CREW: S. Anderson, S. Floyd
CLIENT: GZA
CLIENT REP: Blaine Cardali, P.E.

TEST DATE: Tue 21/May/2019
TEST ID: CPT-FBR-104
PROJECT: 19120
SITE: Bucknam Road
LOCATION: East Abutment



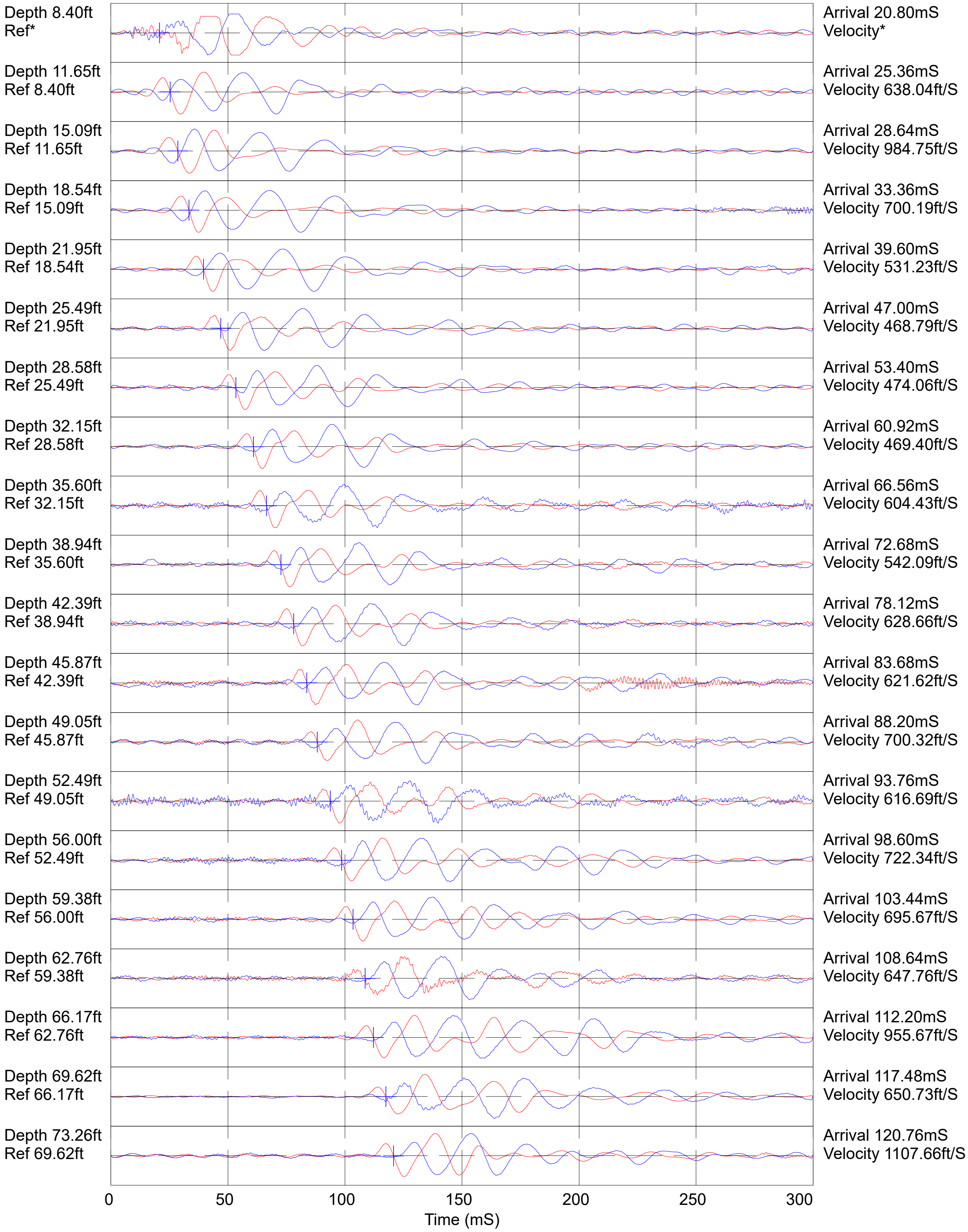
TOTAL DEPTH: 84.674 ft

PROBE ID: 4544.104.A

1 Sensitive, fine grained
2 Organic soils - peats
3 Clays - clay to silty clay
4 Silt mixtures - clayey silt to silty clay
5 Sand mixtures - silty sand to sandy silt
6 Sands - clean sand to silty sand
7 Gravelly sand to sand
8 Very stiff sand to clayey sand **
9 Very stiff, fine grained **

*SBT: Robertson 1990; **Overconsolidated or Cemented; *SBT/SPT CORRELATION: UBC-1983

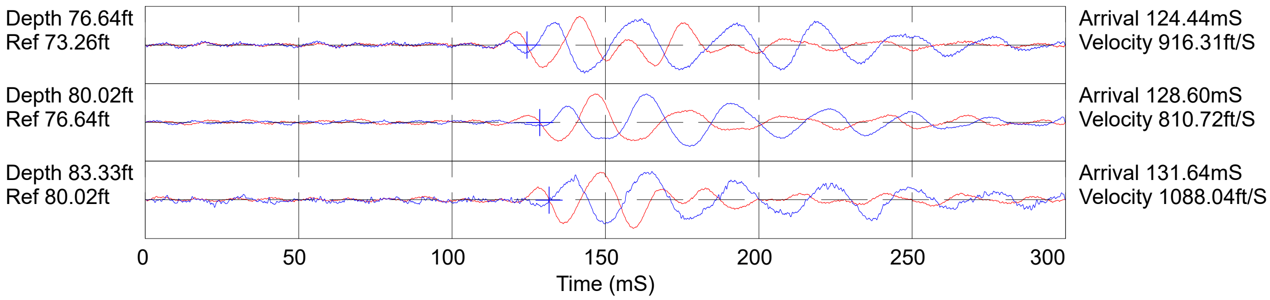
TEST ID: CPT-FBR-104



Hammer to Rod String Distance (ft): 4.92
* = Not Determined

PROBE ID: 4544.104.A

TEST ID: CPT-FBR-104



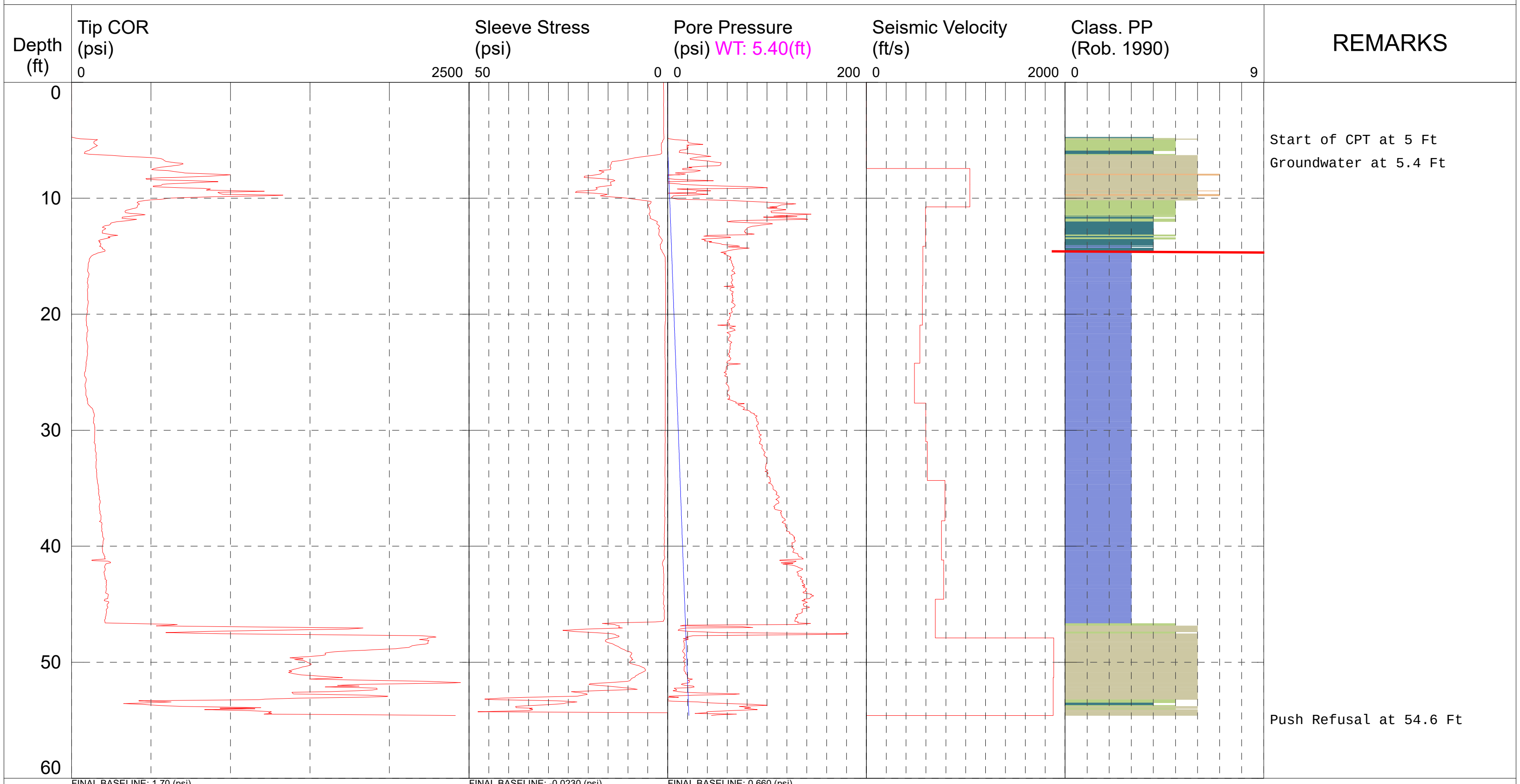
Hammer to Rod String Distance (ft): 4.92
* = Not Determined

PROBE ID: 4544.104.A

CPT-FBR-105

COMPANY: Summit Geoengineering Services
OPERATOR: C. Coolidge, P.E.
CREW: S. Anderson, S. Floyd
CLIENT: GZA
CLIENT REP: Blaine Cardali, P.E.

TEST DATE: Tue 21/May/2019
TEST ID: CPT-FBR-105
PROJECT: 19120
SITE: Bucknam Road
LOCATION: East Abutment



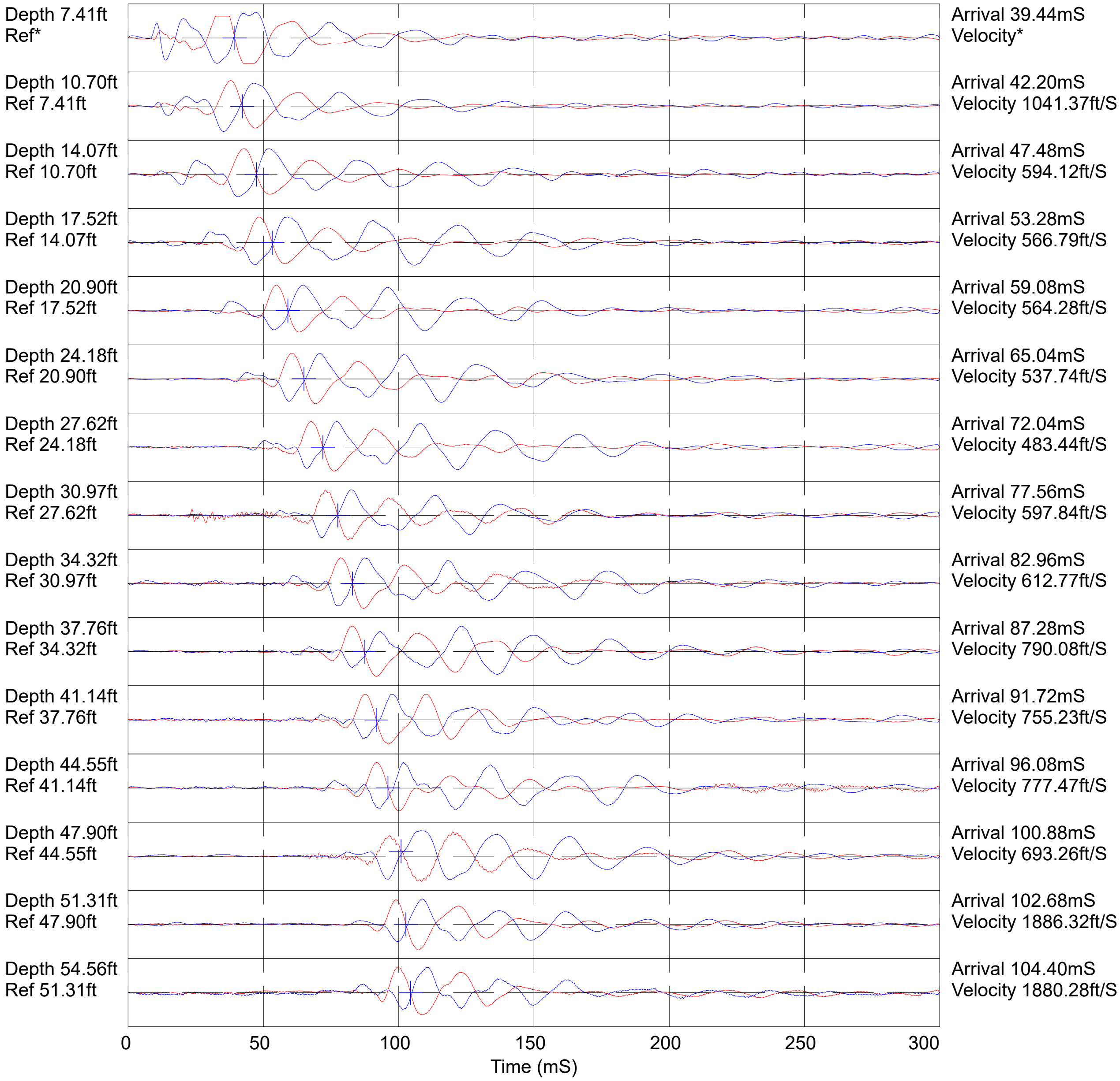
TOTAL DEPTH: 54.596 ft

PROBE ID: 4544.104.A

1	Sensitive, fine grained
2	Organic soils - peats
3	Clays - clay to silty clay
4	Silt mixtures - clayey silt to silty clay
5	Sand mixtures - silty sand to sandy silt
6	Sands - clean sand to silty sand
7	Gravelly sand to sand
8	Very stiff sand to clayey sand **
9	Very stiff, fine grained **

*SBT: Robertson 1990; **Overconsolidated or Cemented; *SBT/SPT CORRELATION: UBC-1983

TEST ID: CPT-FBR-105



Hammer to Rod String Distance (ft): 4.92
* = Not Determined

PROBE ID: 4544.104.A

SUMMIT GEOENGINEERING SERVICES

SOIL BORING LOG

Project:	CPT for Bridge Replacement	Boring #:	BB-FBR-101
Location:	Bucknam Road	Project #:	19120
City, State:	Falmouth, ME	Sheet:	1 of 2
		Chkd by:	CWC

Drilling Co:	Summit Geoengineering, Inc.	Boring Elevation:	43 feet +/-
Driller:	C. Coolidge, P.E.	Reference:	Preliminary Plan, Sheet 2 - Bucknam Rd Bridge provided by State of Maine DOT
Summit Staff:	S. Anderson, S. Floyd	Date started: 5/23/2019	Date Completed: 5/23/2019

DRILLING METHOD		SAMPLER	
Vehicle:	AMS	Length:	24" SS
Model:	9500 VTR	Diameter:	2"OD/1.5"ID
Method:	3-inch Casing	Hammer:	140 lb
Hammer Style:	Auto	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
5/23/2019	8.3 ft	34.7 ft	Measured in open borehole

Depth (ft.)			Depth (ft.)		Elev. (ft.)	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
1								
2								
3								
4								
5								
6								
7								
8								
9							Water at 8.3'	
10								
11								
12								
13								
14								
15								
	FIELD VANES							
16			Tip of Vane					
	FV-1		16		27'+/-	S_U = 1,650 psf, $S_{U(r)}$ = 300 psf (34 ft-lb, 6 ft-lb)	SMALL VANE↓	
17								
	FV-2		17		26'+/-	S_U = 1,125 psf, $S_{U(r)}$ = 225 psf (23 ft-lb, 4.5 ft-lb)		
18								
19								
	FV-3		19		24'+/-	S_U = 675psf, $S_{U(r)}$ = 150 psf (14 ft-lb, 3 ft-lb)		
20								
	FV-4		20		23'+/-	S_U = 600 psf, $S_{U(r)}$ = 75 psf (12.5 ft-lb, 1.5 ft-lb)		
21								
22								
	FV-5		22		21'+/-	S_U = 525 psf, $S_{U(r)}$ = 100 psf (11 ft-lb, 2 ft-lb)		

Granular Soils		Cohesive Soils		% Composition	Soil Moisture Condition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D2487	Dry: S = 0%
0-4	V. Loose	<2	V. soft		Humid: S = 1 to 25%
5-10	Loose	2-4	Soft	< 5% Trace	Damp: S = 26 to 50%
11-30	Compact	5-8	Firm	5-15% Little	Moist: S = 51 to 75%
31-50	Dense	9-15	Stiff	15-30% Some	Wet: S = 76 to 99%
>50	V. Dense	16-30	V. Stiff	> 30% With	Saturated: S = 100%
		>30	Hard		

NOTES: PP = Pocket Penetrometer, MC = Moisture Content
LL = Liquid Limit, PI = Plastic Index, FV = Field Vane Test
Su = Undrained Shear Strength, Su(r) = Remolded Shear Strength

Bedrock Joints
Shallow = 0 to 35 degrees
Dipping = 35 to 55 degrees
Steep = 55 to 90 degrees

Boulders = diameter > 12 inches, Cobbles = diameter < 12 inches and > 3 inches
Gravel = < 3 inch and > No 4, Sand = < No 4 and >No 200, Silt/Clay = < No 200

SUMMIT GEOENGINEERING SERVICES	**SOIL BORING LOG**	Boring #:	**BB-FBR-101**
	Project: CPT for Bridge Replacement	Project #:	19120
	Location: Bucknam Road	Sheet:	2 of 2
	City, State: Falmouth, ME	Chkd by:	CWC

Drilling Co:	Summit Geoengineering, Inc.	Boring Elevation:	43 feet +/-
Driller:	C. Coolidge, P.E.	Reference:	Preliminary Plan, Sheet 2 - Bucknam Rd Bridge provided by State of Maine DOT
Summit Staff:	S. Anderson, S. Floyd	Date started: 5/23/2019	Date Completed: 5/23/2019

DRILLING METHOD		SAMPLER		ESTIMATED GROUND WATER DEPTH			
Vehicle:	AMS	Length:	24" SS	Date	Depth	Elevation	Reference
Model:	9500 VTR	Diameter:	2"OD/1.5"ID	5/23/2019	8.3 ft	34.7 ft	Measured in open borehole
Method:	3-inch Casing	Hammer:	140 lb				
Hammer Style:	Auto	Method:	ASTM D1586				

Depth (ft.)	FIELD VANES		Depth (ft.) Tip of Vane		Elev. (ft.)	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
23							SMALL VANE↓	
	FV-6		23		20'+/-	S_U = 525 psf, $S_{U(r)}$ = 100 psf		
24						(11 ft-lb, 2 ft-lb)		
25								
	FV-7		25		18'+/-	S_U = 475 psf, $S_{U(r)}$ = 75 psf		
26						(10 ft-lb, 1.5 ft-lb)		
	FV-8		26		17'+/-	S_U = 450 psf, $S_{U(r)}$ = 75 psf		
27						(9.5 ft-lb, 1.5 ft-lb)		
28								
29								
30								
31								
	FV-9		31		12'+/-	S_U = 850 psf, $S_{U(r)}$ = 125 psf	LARGE VANE↓	
32						(29 ft-lb, 4 ft-lb)		
	FV-10		32		11'+/-	S_U = 900 psf, $S_{U(r)}$ = 125 psf		
33						(30 ft-lb, 4.5 ft-lb)		
34								
	FV-11		34		9'+/-	S_U = 800 psf, $S_{U(r)}$ = 175 psf		
35						(27 ft-lb, 6 ft-lb)		
	FV-12		35		8'+/-	S_U = 950 psf, $S_{U(r)}$ = 150 psf		
36						(32 ft-lb, 5 ft-lb)		
37								
	FV-13		37		6'+/-	S_U = 825 psf, $S_{U(r)}$ = 200 psf		
38						(28 ft-lb, 7 ft-lb)		
	FV-14		38		5'+/-	S_U = 800 psf, $S_{U(r)}$ = 175 psf		
39						(27 ft-lb, 6 ft-lb)		
40								
	FV-15		40		3'+/-	S_U = 900 psf, $S_{U(r)}$ = 175 psf		
41						(30 ft-lb, 6 ft-lb)		
	FV-16		41		2'+/-	S_U = 1,250 psf, $S_{U(r)}$ = 200 psf		
42						(42 ft-lb, 6.5 ft-lb)		
43								
	FV-17		43		0'+/-	S_U = 950 psf, $S_{U(r)}$ = 225 psf		
44						(32 ft-lb, 7.5 ft-lb)		
	FV-18		44		-1'+/-	S_U = 925 psf, $S_{U(r)}$ = 225 psf (31 ft-lb, 7.5 ft-lb)		
						End of Exploration at 44'		44'

Granular Soils		Cohesive Soils		% Composition	NOTES:	Soil Moisture Condition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D2487	PP = Pocket Penetrometer, MC = Moisture Content	
					LL = Liquid Limit, PI = Plastic Index, FV = Field Vane Test	Dry: S = 0%
0-4	V. Loose	<2	V. soft		Bedrock Joints — Su = Undrained Shear Strength, Su(r) = Remolded Shear Strength	Humid: S = 1 to 25%
5-10	Loose	2-4	Soft	< 5% Trace	Shallow = 0 to 35 degrees	Damp: S = 26 to 50%
11-30	Compact	5-8	Firm	5-15% Little	Dipping = 35 to 55 degrees	Moist: S = 51 to 75%
31-50	Dense	9-15	Stiff	15-30% Some	Steep = 55 to 90 degrees	Wet: S = 76 to 99%
>50	V. Dense	16-30	V. Stiff	> 30% With		Saturated: S = 100%
		>30	Hard		Boulders = diameter > 12 inches, Cobbles = diameter < 12 inches and > 3 inches	
					Gravel = < 3 inch and > No 4, Sand = < No 4 and >No 200, Silt/Clay = < No 200	

SUMMIT GEOENGINEERING SERVICES	SOIL BORING LOG		Boring #:	BB-FBR-105
	Project:	CPT for Bridge Replacement	Project #:	19120
	Location:	Bucknam Road	Sheet:	1 of 3
	City, State:	Falmouth, ME	Chkd by:	CWC

Drilling Co:	Summit Geoengineering, Inc.	Boring Elevation:	43 feet +/-
Driller:	C. Coolidge, P.E.	Reference:	Preliminary Plan, Sheet 2 - Bucknam Rd Bridge provided by State of Maine DOT
Summit Staff:	S. Anderson, S. Floyd	Date started: 5/22/2019	Date Completed: 5/22/2019

DRILLING METHOD		SAMPLER		ESTIMATED GROUND WATER DEPTH			
Vehicle:	AMS	Length:	24" SS	Date	Depth	Elevation	Reference
Model:	9500 VTR	Diameter:	2"OD/1.5"ID	5/22/2019	4.3 ft	38.7 ft	Measured in open borehole
Method:	3-inch Casing	Hammer:	140 lb				
Hammer Style:	Auto	Method:	ASTM D1586				

Depth (ft.)			Depth (ft.)		Elev. (ft.)	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
1								
2								
3								
4							Water at 4.3'	
5								
6								
7								
8								
9								
10								
	FIELD VANES							
11			Tip of Vane					
	FV-1		11		32'+/-	S_U = 300 psf, $S_{U(r)}$ = 50 psf	SMALL VANE↓	
12						(6 ft-lb, 1 ft-lb)		
	FV-2		12		31'+/-	S_U = 275 psf, $S_{U(r)}$ = 50 psf		
13						(5.5 ft-lb, 1 ft-lb)		
14								
	FV-3		14		29'+/-	S_U = 350 psf, $S_{U(r)}$ = 50 psf		
15						(7 ft-lb, 1 ft-lb)		
	FV-4		15		28'+/-	S_U = 400 psf, $S_{U(r)}$ = 50 psf		
16						(8 ft-lb, 1 ft-lb)		
	FV-5		16		27'+/-	S_U = 275 psf, $S_{U(r)}$ = 25 psf	LARGE VANE↓	
17						(9 ft-lb, 1 ft-lb)		
	FV-6		17		26'+/-	S_U = 375 psf, $S_{U(r)}$ = 25 psf		
18						(13 ft-lb, 1 ft-lb)		
19								
	FV-7		19		24'+/-	S_U = 350 psf, $S_{U(r)}$ = 50 psf		
20						(11.5 ft-lb, 1.5 ft-lb)		
	FV-8		20		23'+/-	S_U = 350 psf, $S_{U(r)}$ = 25 psf		
21						(11.5 ft-lb, 1.25 ft-lb)		
22								

Granular Soils		Cohesive Soils		% Composition	NOTES:	Soil Moisture Condition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D2487	PP = Pocket Penetrometer, MC = Moisture Content LL = Liquid Limit, PI = Plastic Index, FV = Field Vane Test	Dry: S = 0%
0-4	V. Loose	<2	V. soft		Bedrock Joints: Su = Undrained Shear Strength, Su(r) = Remolded Shear Strength	Humid: S = 1 to 25%
5-10	Loose	2-4	Soft	< 5% Trace	Shallow = 0 to 35 degrees	Damp: S = 26 to 50%
11-30	Compact	5-8	Firm	5-15% Little	Dipping = 35 to 55 degrees	Moist: S = 51 to 75%
31-50	Dense	9-15	Stiff	15-30% Some	Steep = 55 to 90 degrees	Wet: S = 76 to 99%
>50	V. Dense	16-30	V. Stiff	> 30% With		Saturated: S = 100%
		>30	Hard		Boulders = diameter > 12 inches, Cobbles = diameter < 12 inches and > 3 inches Gravel = < 3 inch and > No 4, Sand = < No 4 and >No 200, Silt/Clay = < No 200	

SUMMIT GEOENGINEERING SERVICES	**SOIL BORING LOG**	Boring #:	**BB-FBR-105**
	Project: CPT for Bridge Replacement	Project #:	19120
	Location: Bucknam Road	Sheet:	2 of 3
	City, State: Falmouth, ME	Chkd by:	CWC

Drilling Co:	Summit Geoengineering, Inc.	Boring Elevation:	43 feet +/-
Driller:	C. Coolidge, P.E.	Reference:	Preliminary Plan, Sheet 2 - Bucknam Rd Bridge provided by State of Maine DOT
Summit Staff:	S. Anderson, S. Floyd	Date started: 5/22/2019	Date Completed: 5/22/2019

DRILLING METHOD		SAMPLER		ESTIMATED GROUND WATER DEPTH			
Vehicle:	AMS	Length:	24" SS	Date	Depth	Elevation	Reference
Model:	9500 VTR	Diameter:	2"OD/1.5"ID	5/22/2019	4.3 ft	38.7 ft	Measured in open borehole
Method:	3-inch Casing	Hammer:	140 lb				
Hammer Style:	Auto	Method:	ASTM D1586				

Depth (ft.)		Depth (ft.)		Elev. (ft.)	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
23							
24							
25							
	FIELD VANES						
26		Tip of Vane				LARGE VANE↓	
	FV-9	26		17'+/-	S_U = 375 psf, $S_{U(r)}$ = 25 psf		
27					(12.5 ft-lb, 1 ft-lb)		
	FV-10	27		16'+/-	S_U = 375 psf, $S_{U(r)}$ = 25 psf		
28					(13 ft-lb, 0.5 ft-lb)		
29							
	FV-11	29		14'+/-	S_U = 475 psf, $S_{U(r)}$ = 50 psf		
30					(16 ft-lb, 1.5 ft-lb)		
	FV-12	30		13'+/-	S_U = 600 psf, $S_{U(r)}$ = 25 psf		
31					(20 ft-lb, 1 ft-lb)		
32							
	FV-13	32		11'+/-	S_U = 575 psf, $S_{U(r)}$ = 25 psf		
33					(19.5 ft-lb, 1 ft-lb)		
	FV-14	33		10'+/-	S_U = 575 psf, $S_{U(r)}$ = 25 psf		
34					(19 ft-lb, 1 ft-lb)		
35							
36							
	FV-15	36		7'+/-	S_U = 575 psf, $S_{U(r)}$ = 50 psf	SMALL VANE↓	
37					(12 ft-lb, 1 ft-lb)		
	FV-16	37		6'+/-	S_U = 600 psf, $S_{U(r)}$ = 50 psf		
38					(12.5 ft-lb, 1 ft-lb)		
39							
40							
41							
	FV-17	41		2'+/-	S_U = 675 psf, $S_{U(r)}$ = 50 psf		
42					(14 ft-lb, 1 ft-lb)		
	FV-18	42		1'+/-	S_U = 625 psf, $S_{U(r)}$ = 50 psf		
43					(13 ft-lb, 1 ft-lb)		
44							
	FV-19	44		-1'+/-	S_U = 625 psf, $S_{U(r)}$ = 50 psf		
					(13 ft-lb, 1 ft-lb)		

Granular Soils		Cohesive Soils		% Composition	NOTES:	Soil Moisture Condition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D2487	PP = Pocket Penetrometer, MC = Moisture Content	
					LL = Liquid Limit, PI = Plastic Index, FV = Field Vane Test	Dry: S = 0%
0-4	V. Loose	<2	V. soft		Bedrock Joints Su = Undrained Shear Strength, Su(r) = Remolded Shear Strength	Humid: S = 1 to 25%
5-10	Loose	2-4	Soft	< 5% Trace	Shallow = 0 to 35 degrees	Damp: S = 26 to 50%
11-30	Compact	5-8	Firm	5-15% Little	Dipping = 35 to 55 degrees	Moist: S = 51 to 75%
31-50	Dense	9-15	Stiff	15-30% Some	Steep = 55 to 90 degrees	Wet: S = 76 to 99%
>50	V. Dense	16-30	V. Stiff	> 30% With		Saturated: S = 100%
		>30	Hard		Boulders = diameter > 12 inches, Cobbles = diameter < 12 inches and > 3 inches	
					Gravel = < 3 inch and > No 4, Sand = < No 4 and >No 200, Silt/Clay = < No 200	

SUMMIT GEOENGINEERING SERVICES

SOIL BORING LOG

Boring #:	BB-FBR-105		
Project:	CPT for Bridge Replacement	Project #:	19120
Location:	Bucknam Road	Sheet:	3 of 3
City, State:	Falmouth, ME	Chkd by:	CWC

Drilling Co:	Summit Geoengineering, Inc.	Boring Elevation:	43 feet +/-
Driller:	C. Coolidge, P.E.	Reference:	Preliminary Plan, Sheet 2 - Bucknam Rd Bridge provided by State of Maine DOT
Summit Staff:	S. Anderson, S. Floyd	Date started: 5/22/2019	Date Completed: 5/22/2019

DRILLING METHOD		SAMPLER	
Vehicle:	AMS	Length:	24" SS
Model:	9500 VTR	Diameter:	2"OD/1.5"ID
Method:	3-inch Casing	Hammer:	140 lb
Hammer Style:	Auto	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
5/22/2019	4.3 ft	38.7 ft	Measured in open borehole

Depth (ft.)	FIELD VANES		Depth (ft.) Tip of Vane		Elev. (ft.)	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
45							SMALL VANE↓	
	FV-20		45		-2'+/-	S_U = 675 psf, $S_{U(r)}$ = 50 psf		
46						(14 ft-lb, 1 ft-lb)		
47								
	FV-21		47		-4'+/-	S_U = 700 psf, $S_{U(r)}$ = 75 psf		
48						(14.5 ft-lb, 1.5 ft-lb)		
	FV-22		48		-5'+/-	S_U = 725 psf, $S_{U(r)}$ = 75 psf		
49						(15 ft-lb, 1.5 ft-lb)		
50								
51								
52								
	FV-23		52		-9'+/-	S_U = 725 psf, $S_{U(r)}$ = 50 psf		
53						(15 ft-lb, 1 ft-lb)		
	FV-24		53		-10'+/-	S_U = 800 psf, $S_{U(r)}$ = 75 psf		
54						(16.5 ft-lb, 1.5 ft-lb)		
55								
	FV-25		55		-12'+/-	S_U = 625 psf, $S_{U(r)}$ = 50 psf		
56						(13 ft-lb, 1 ft-lb)		
	FV-26		56		-13'+/-	S_U = 825 psf, $S_{U(r)}$ = 50 psf		
57						(17 ft-lb, 1 ft-lb)		
					-14'+/-	End of Exploration at 57', Vane push refusal in sand seam		57'
58								
59								
60								
61								
62								
63								
64								
65								
66								

Granular Soils		Cohesive Soils		% Composition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D2487
0-4	V. Loose	<2	V. soft	
5-10	Loose	2-4	Soft	< 5% Trace
11-30	Compact	5-8	Firm	5-15% Little
31-50	Dense	9-15	Stiff	15-30% Some
>50	V. Dense	16-30	V. Stiff	> 30% With
		>30	Hard	

NOTES: PP = Pocket Penetrometer, MC = Moisture Content
LL = Liquid Limit, PI = Plastic Index, FV = Field Vane Test
Su = Undrained Shear Strength, Su(r) = Remolded Shear Strength

Bedrock Joints
Shallow = 0 to 35 degrees
Dipping = 35 to 55 degrees
Steep = 55 to 90 degrees

Boulders = diameter > 12 inches, Cobbles = diameter < 12 inches and > 3 inches
Gravel = < 3 inch and > No 4, Sand = < No 4 and >No 200, Silt/Clay = < No 200

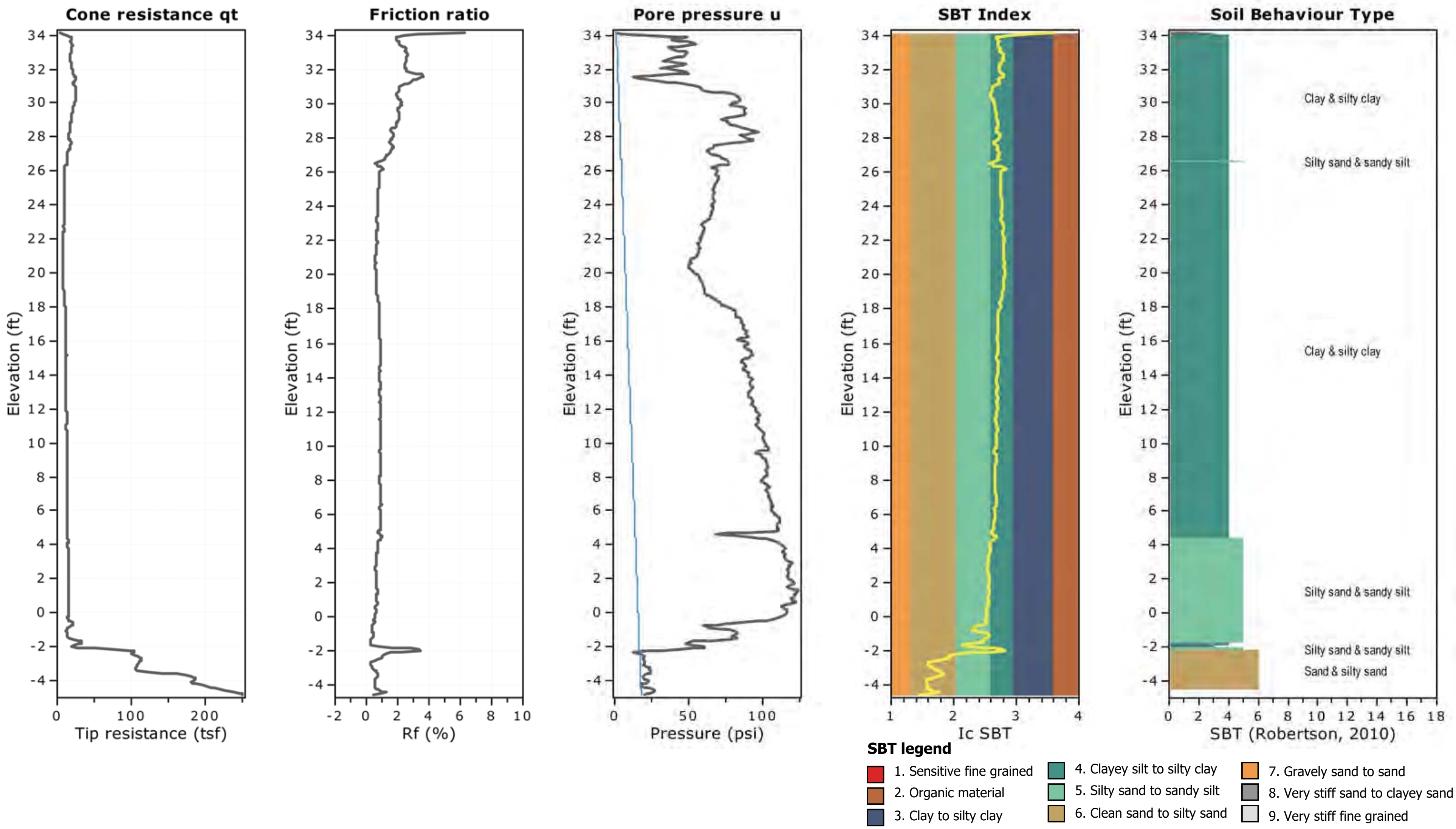
Soil Moisture Condition
Dry: S = 0%
Humid: S = 1 to 25%
Damp: S = 26 to 50%
Moist: S = 51 to 75%
Wet: S = 76 to 99%
Saturated: S = 100%

APPENDIX C.2 – CPT INTERPRETATION REPORT BY GZA

GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

CPT: CPT-FBR-101
Total depth: 43.84 ft, Date: 7/2/2019
Surface Elevation: 39.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services

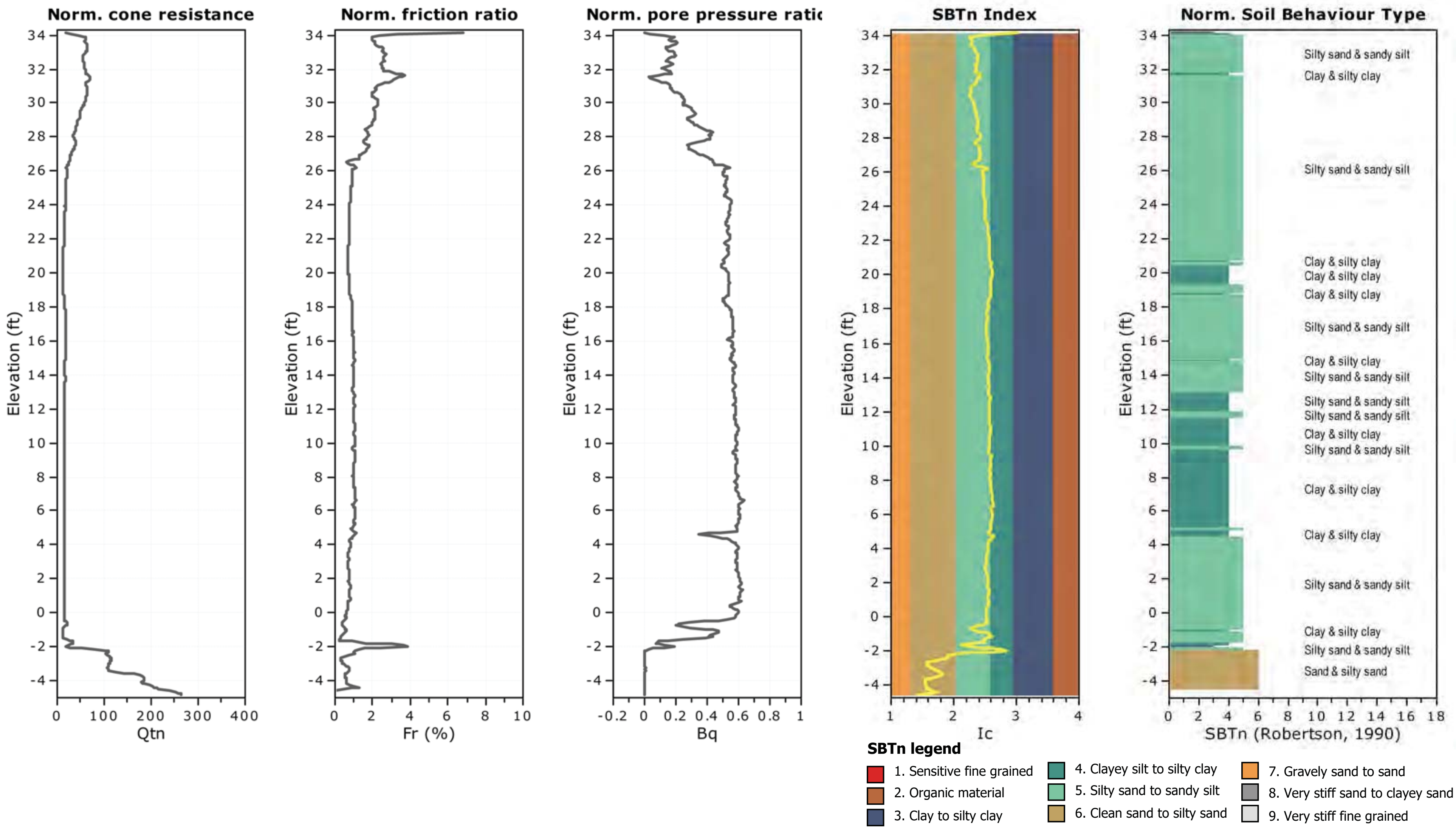
Project: **Bucknam Road Bridge**
Location: **Falmouth, Maine**



GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

CPT: CPT-FBR-101
Total depth: 43.84 ft, Date: 7/2/2019
Surface Elevation: 39.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services

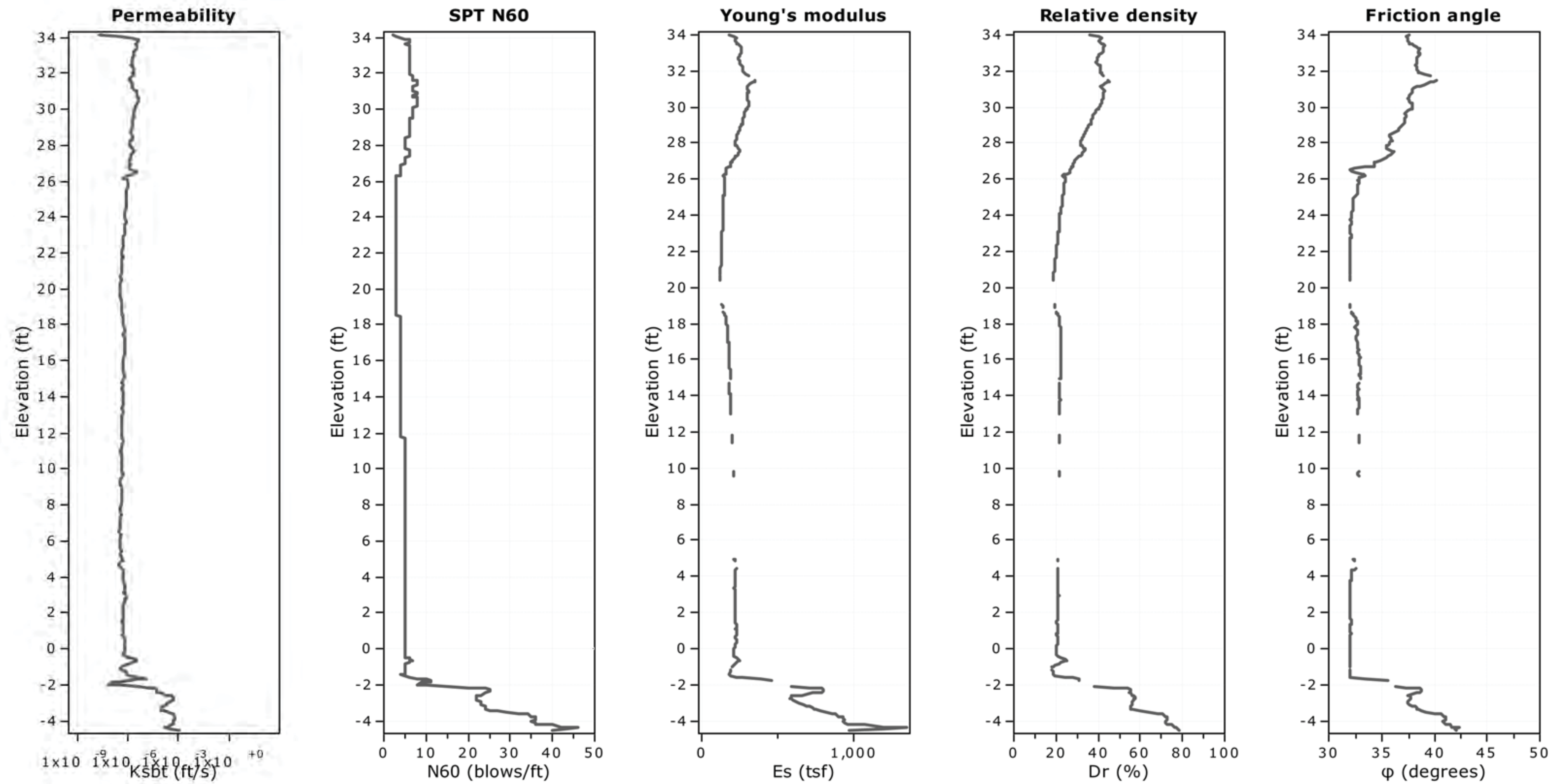
Project: **Bucknam Road Bridge**
Location: **Falmouth, Maine**



GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

CPT: CPT-FBR-101
Total depth: 43.84 ft, Date: 7/2/2019
Surface Elevation: 39.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services

Project: **Bucknam Road Bridge**
Location: **Falmouth, Maine**

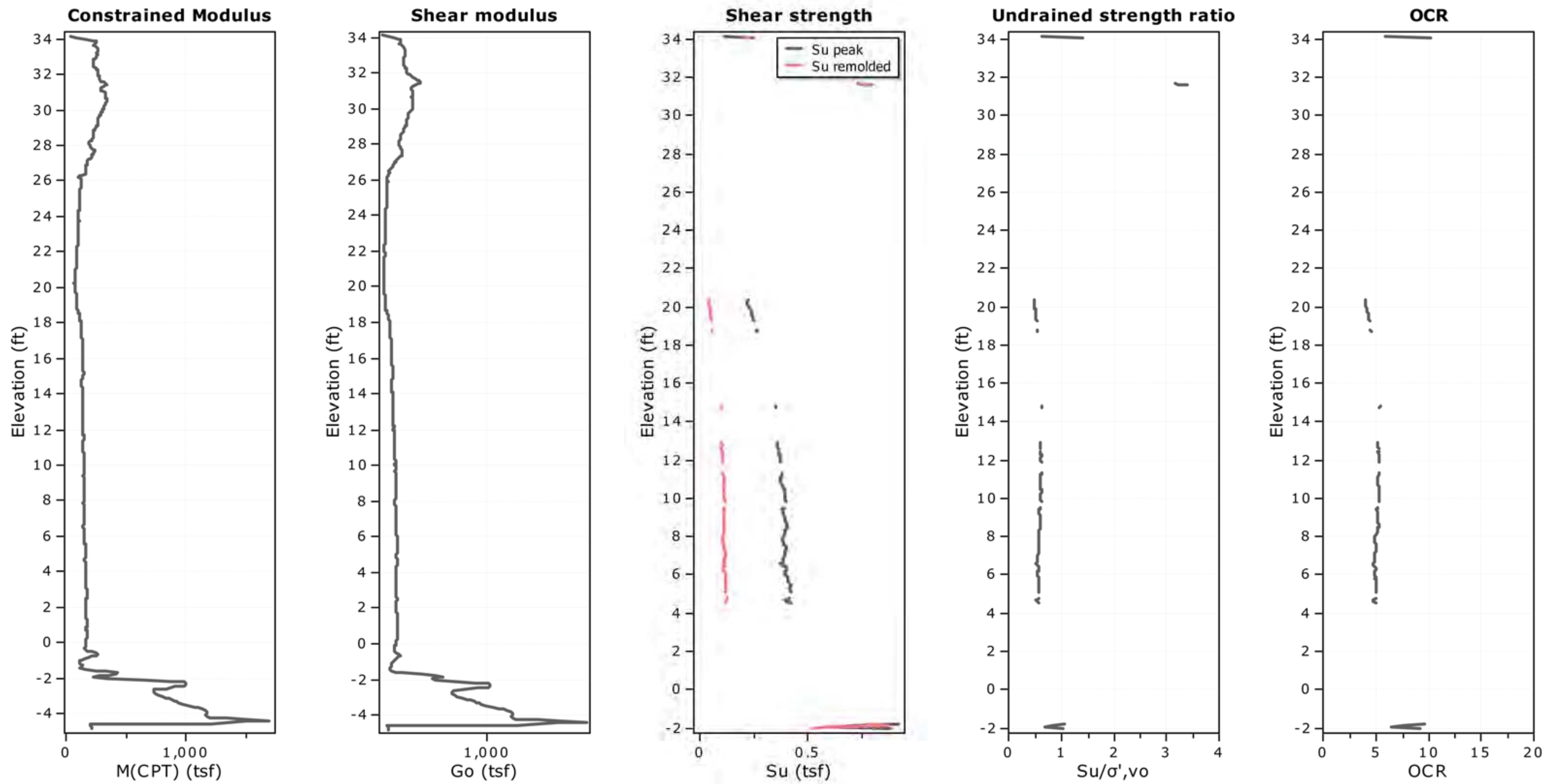


Calculation parameters
Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

CPT: CPT-FBR-101
Total depth: 43.84 ft, Date: 7/2/2019
Surface Elevation: 39.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services

Project: **Bucknam Road Bridge**
Location: **Falmouth, Maine**



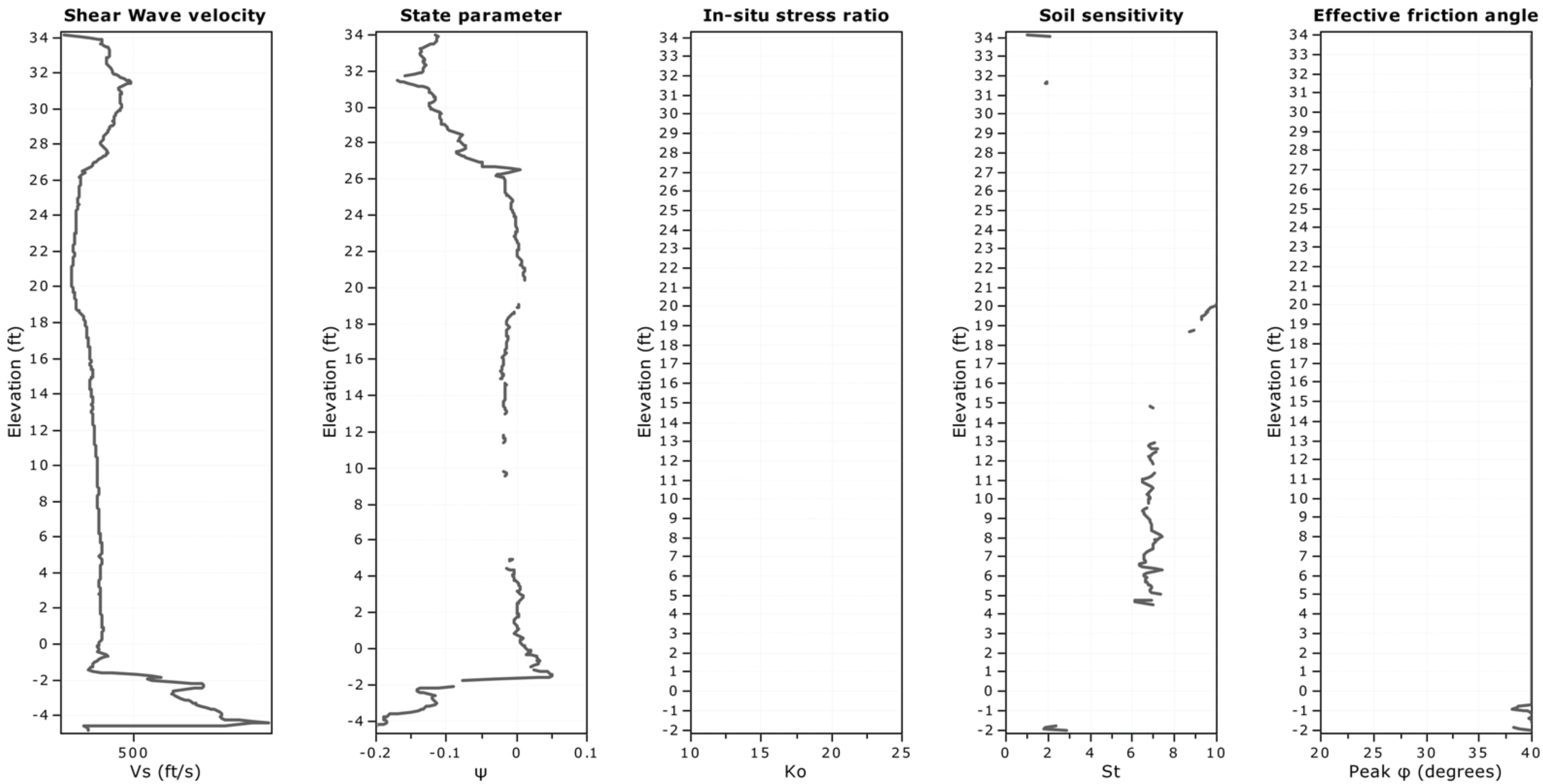
Calculation parameters

Constrained modulus: Based on variable alpha using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable alpha using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 28
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

CPT: CPT-FBR-101
Total depth: 43.84 ft, Date: 7/2/2019
Surface Elevation: 39.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services

Project: **Bucknam Road Bridge**
Location: **Falmouth, Maine**



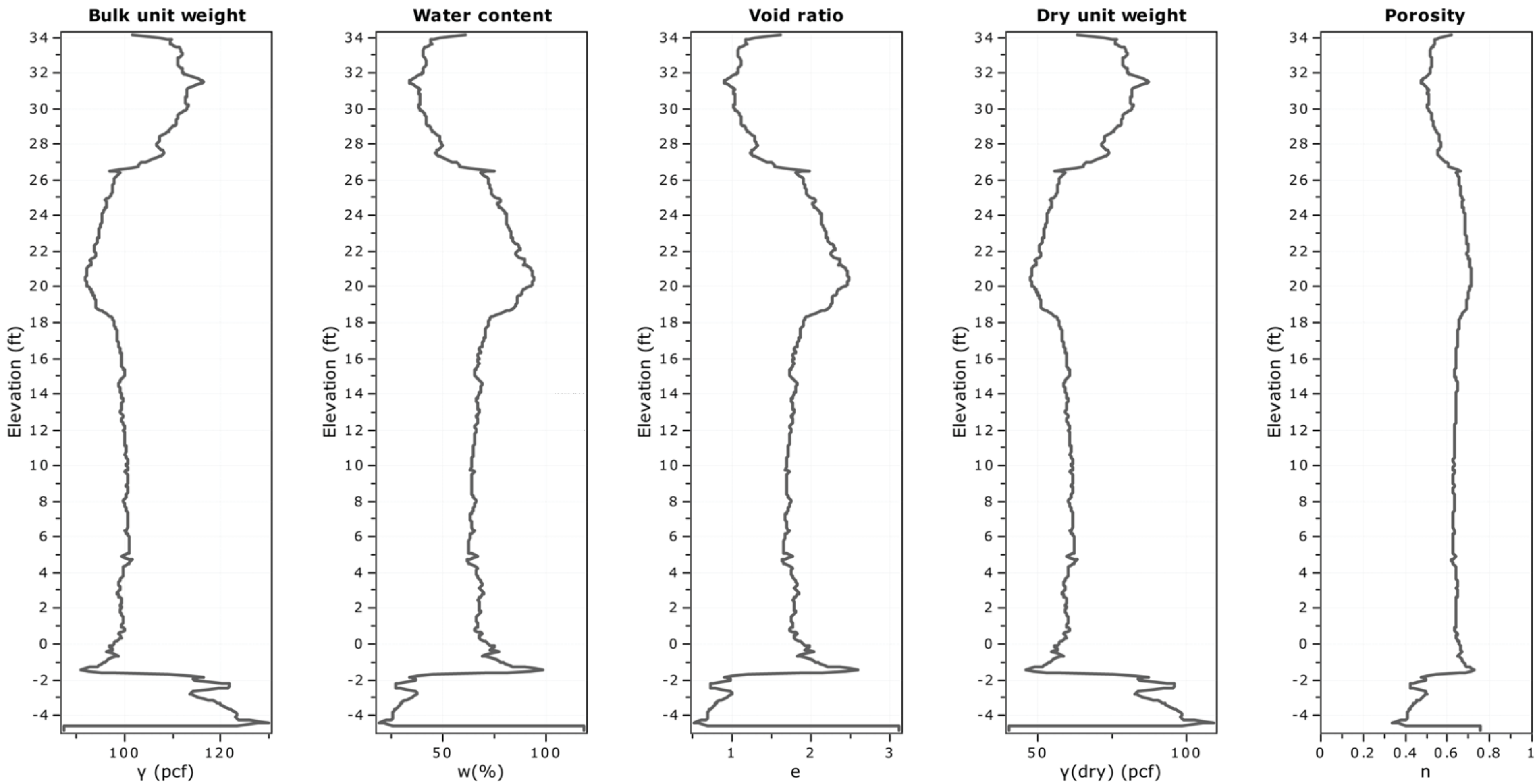
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

CPT: CPT-FBR-101
Total depth: 43.84 ft, Date: 7/2/2019
Surface Elevation: 39.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services

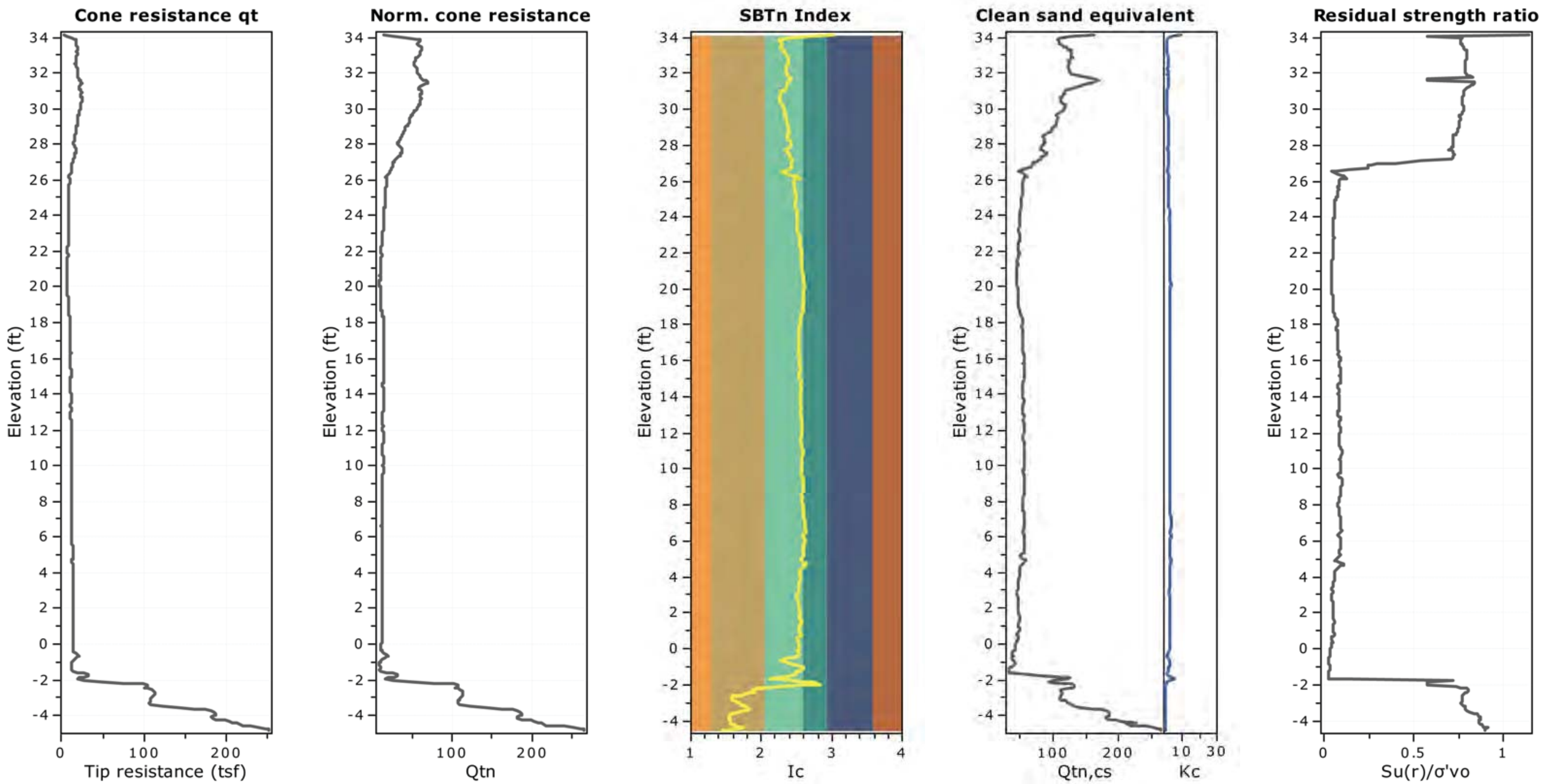
Project: **Bucknam Road Bridge**
Location: **Falmouth, Maine**



GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

Project: Bucknam Road Bridge
Location: Falmouth, Maine

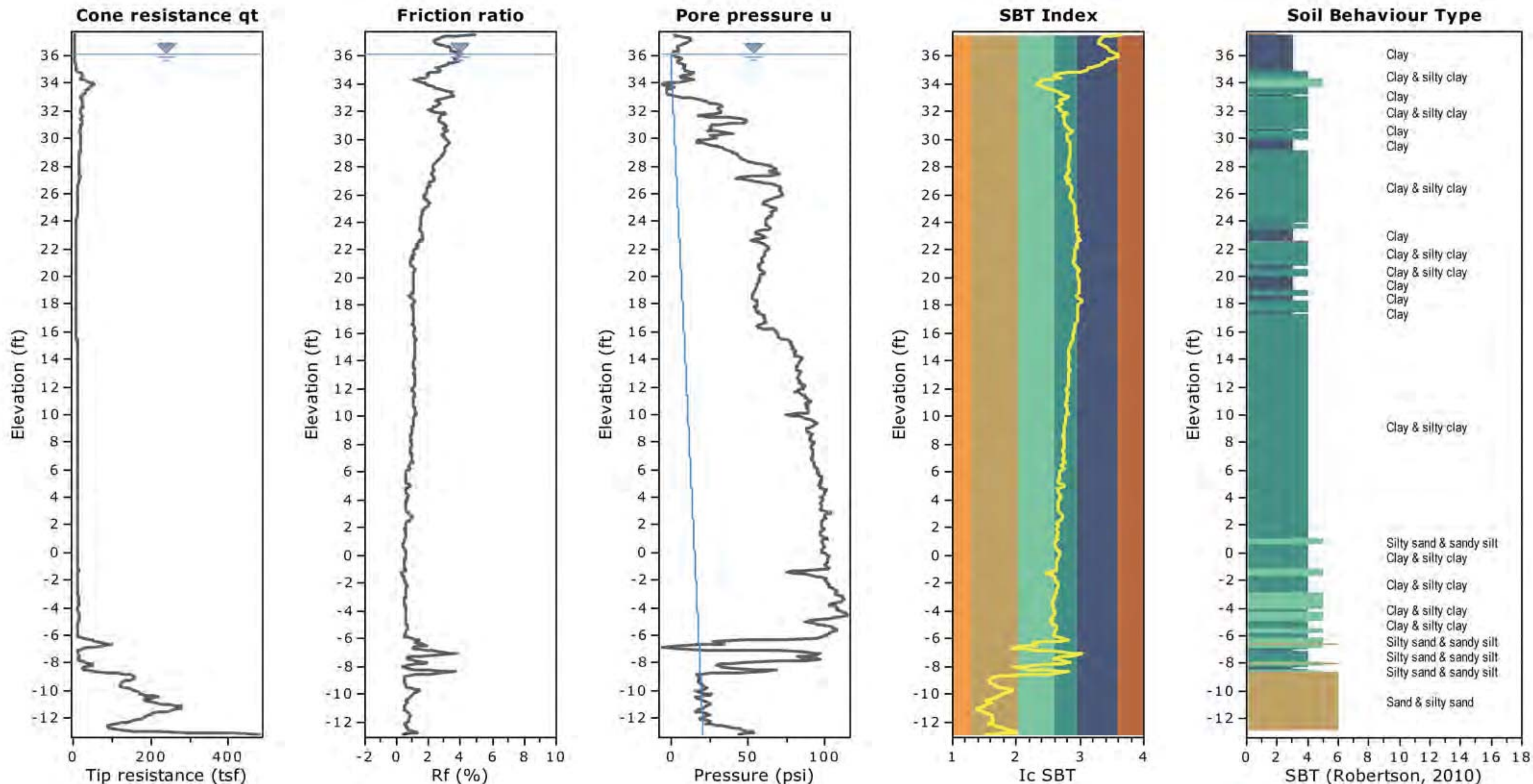
CPT: CPT-FBR-101
Total depth: 43.84 ft, Date: 7/2/2019
Surface Elevation: 39.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services



GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

Project: Bucknam Road Bridge
Location: Falmouth, Maine

CPT: CPT-FBR-102
Total depth: 55.59 ft, Date: 7/2/2019
Surface Elevation: 42.40 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services



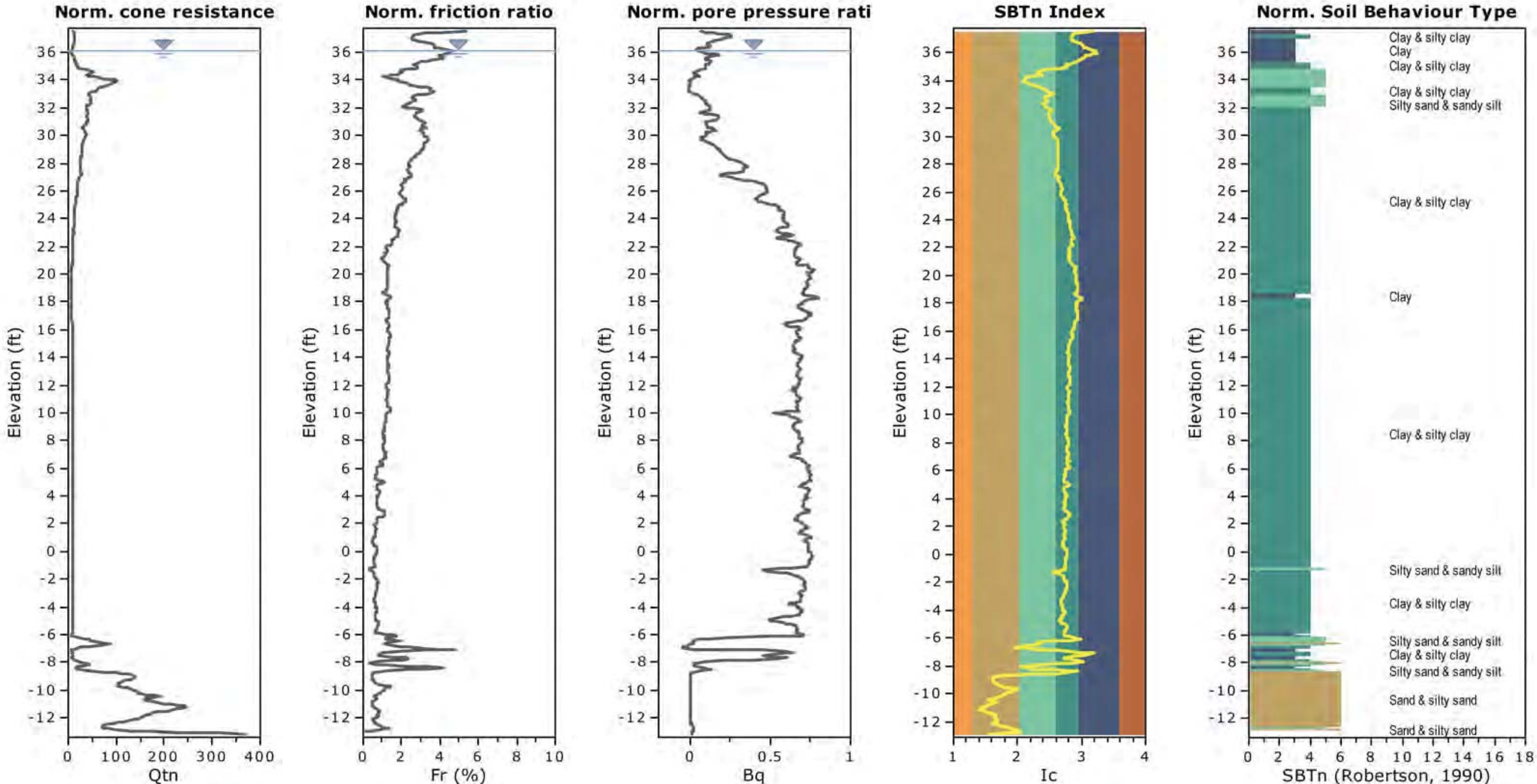
SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty clay
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to clayey sand
9. Very stiff fine grained

GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

CPT: CPT-FBR-102
Total depth: 55.59 ft, Date: 7/2/2019
Surface Elevation: 42.40 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services

Project: **Bucknam Road Bridge**
Location: **Falmouth, Maine**



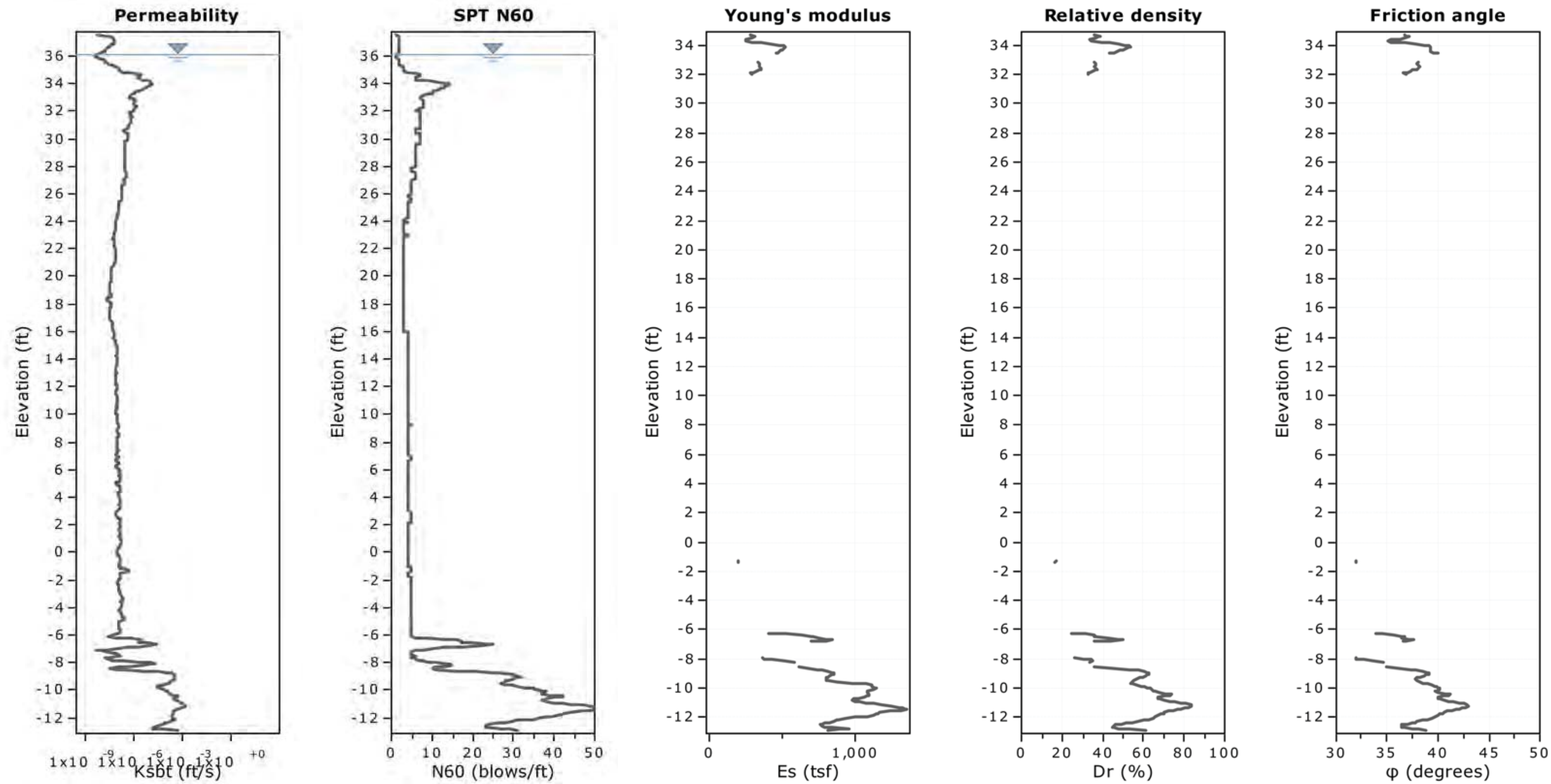
SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty clay
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to clayey sand
9. Very stiff fine grained

GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

CPT: CPT-FBR-102
Total depth: 55.59 ft, Date: 7/2/2019
Surface Elevation: 42.40 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services

Project: **Bucknam Road Bridge**
Location: **Falmouth, Maine**



Calculation parameters

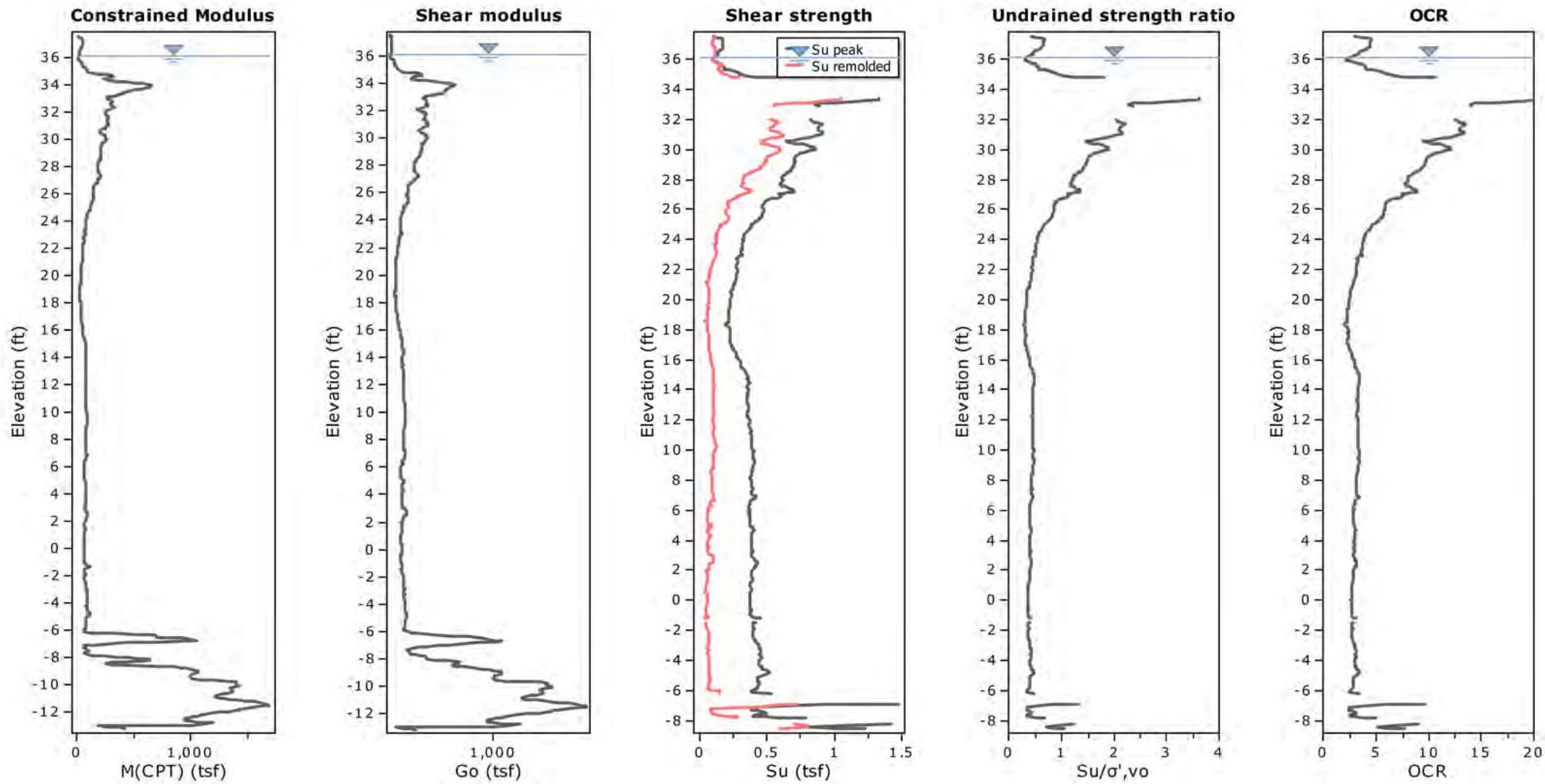
Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)

Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

CPT: CPT-FBR-102
Total depth: 55.59 ft, Date: 7/2/2019
Surface Elevation: 42.40 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services

Project: **Bucknam Road Bridge**
Location: **Falmouth, Maine**

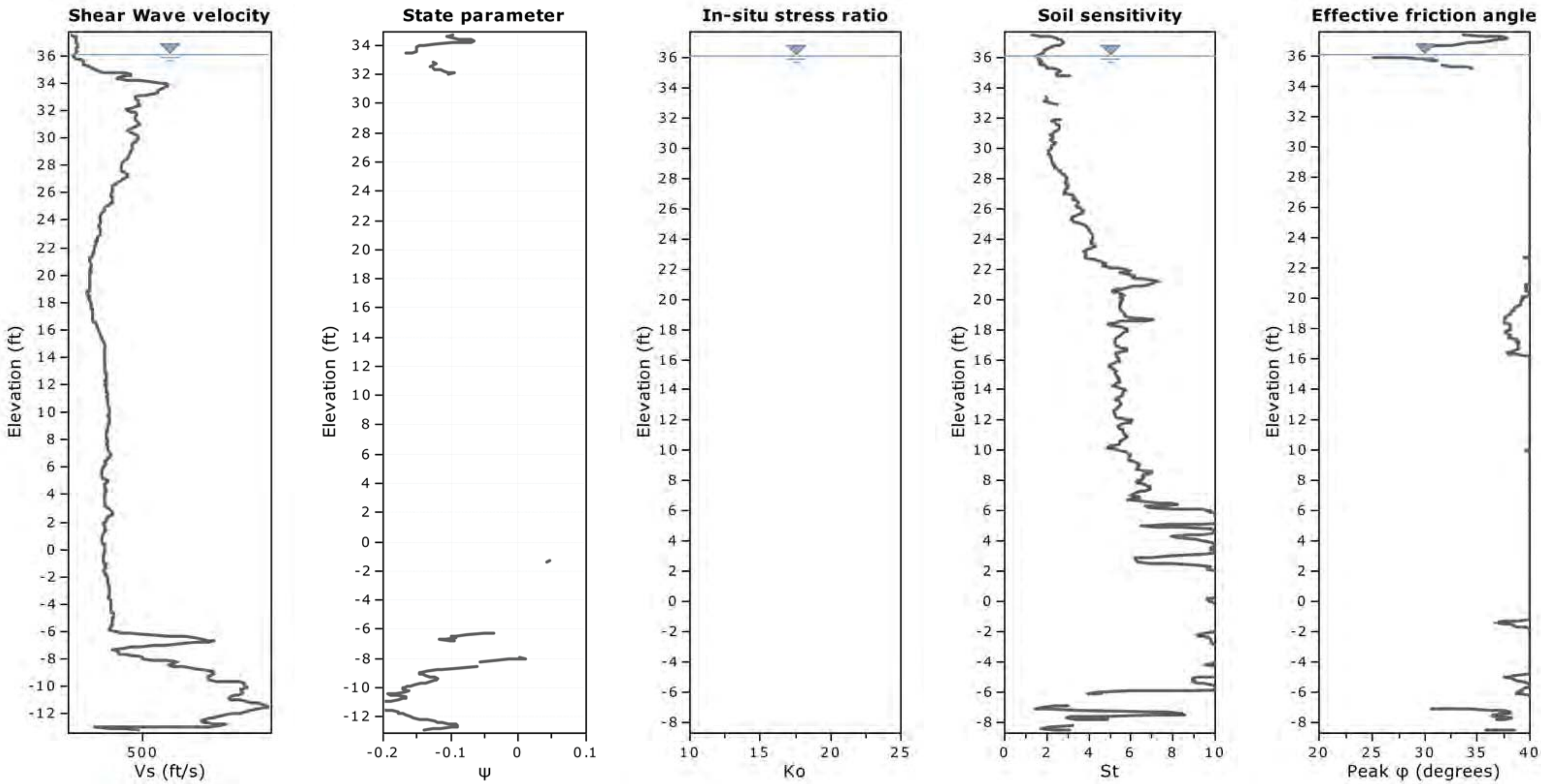


Calculation parameters
Constrained modulus: Based on variable alpha using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable alpha using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 22
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

CPT: CPT-FBR-102
Total depth: 55.59 ft, Date: 7/2/2019
Surface Elevation: 42.40 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services

Project: **Bucknam Road Bridge**
Location: **Falmouth, Maine**



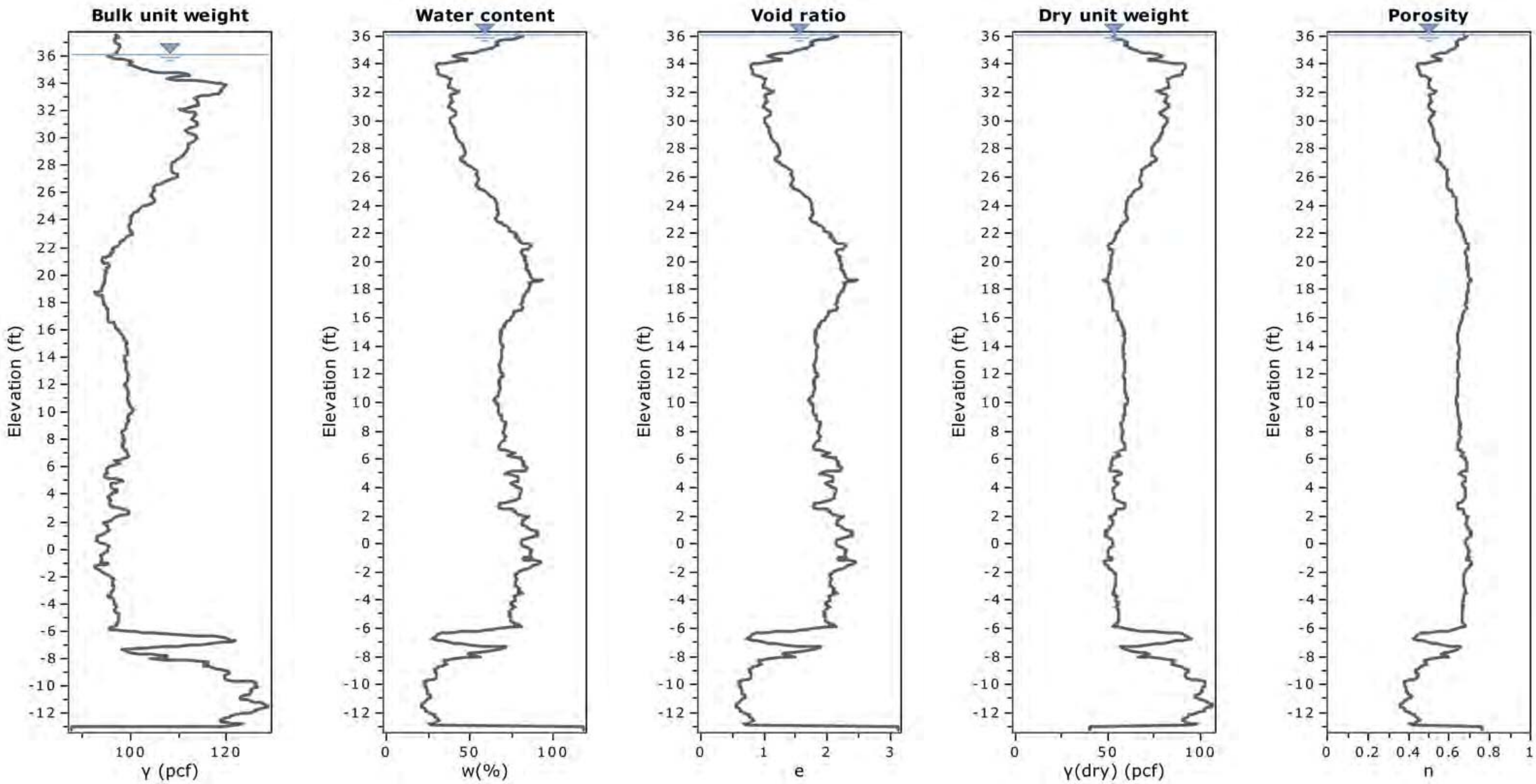
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

CPT: CPT-FBR-102
Total depth: 55.59 ft, Date: 7/2/2019
Surface Elevation: 42.40 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services

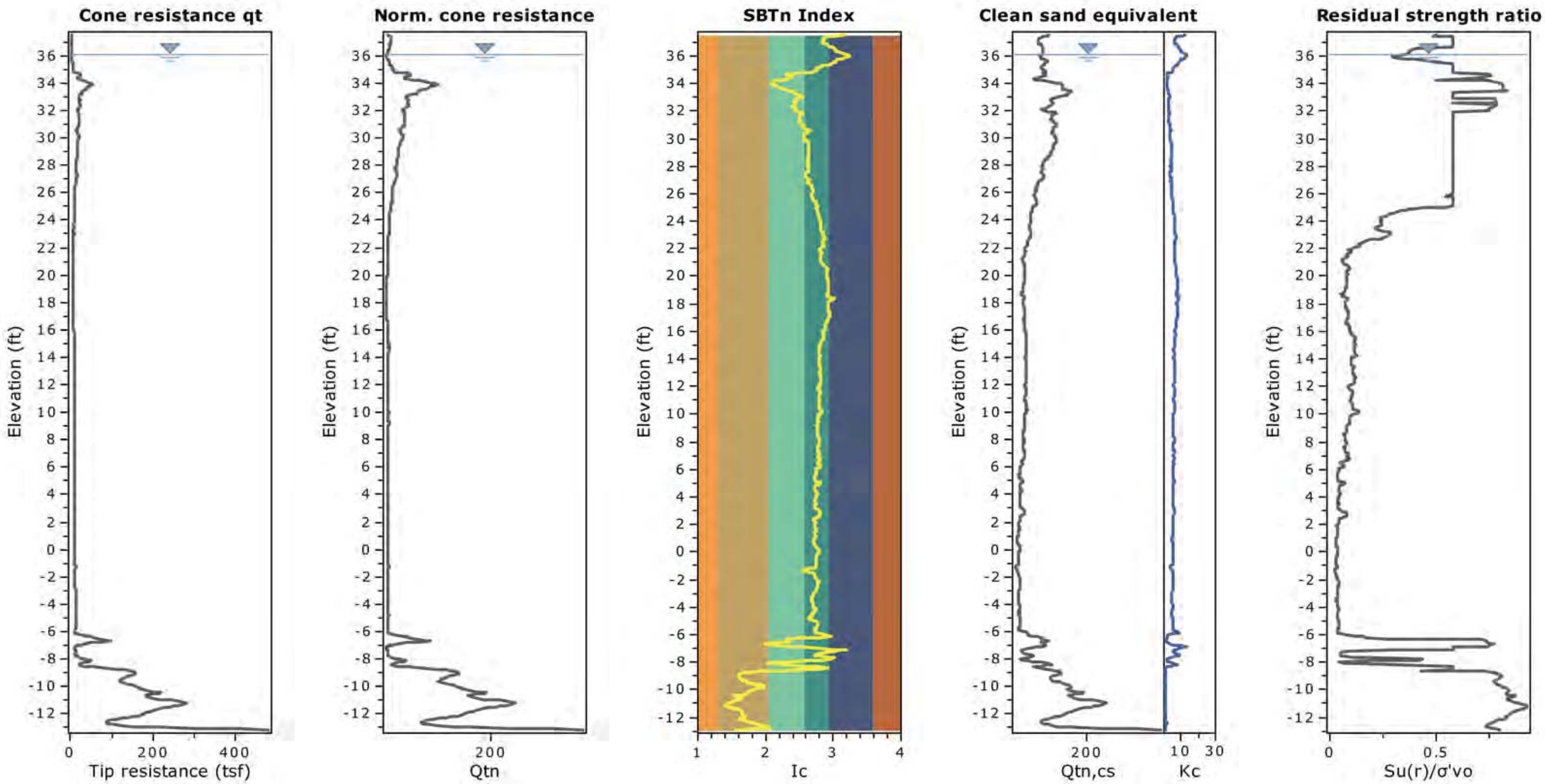
Project: **Bucknam Road Bridge**
Location: **Falmouth, Maine**



GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

CPT: CPT-FBR-102
Total depth: 55.59 ft, Date: 7/2/2019
Surface Elevation: 42.40 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services

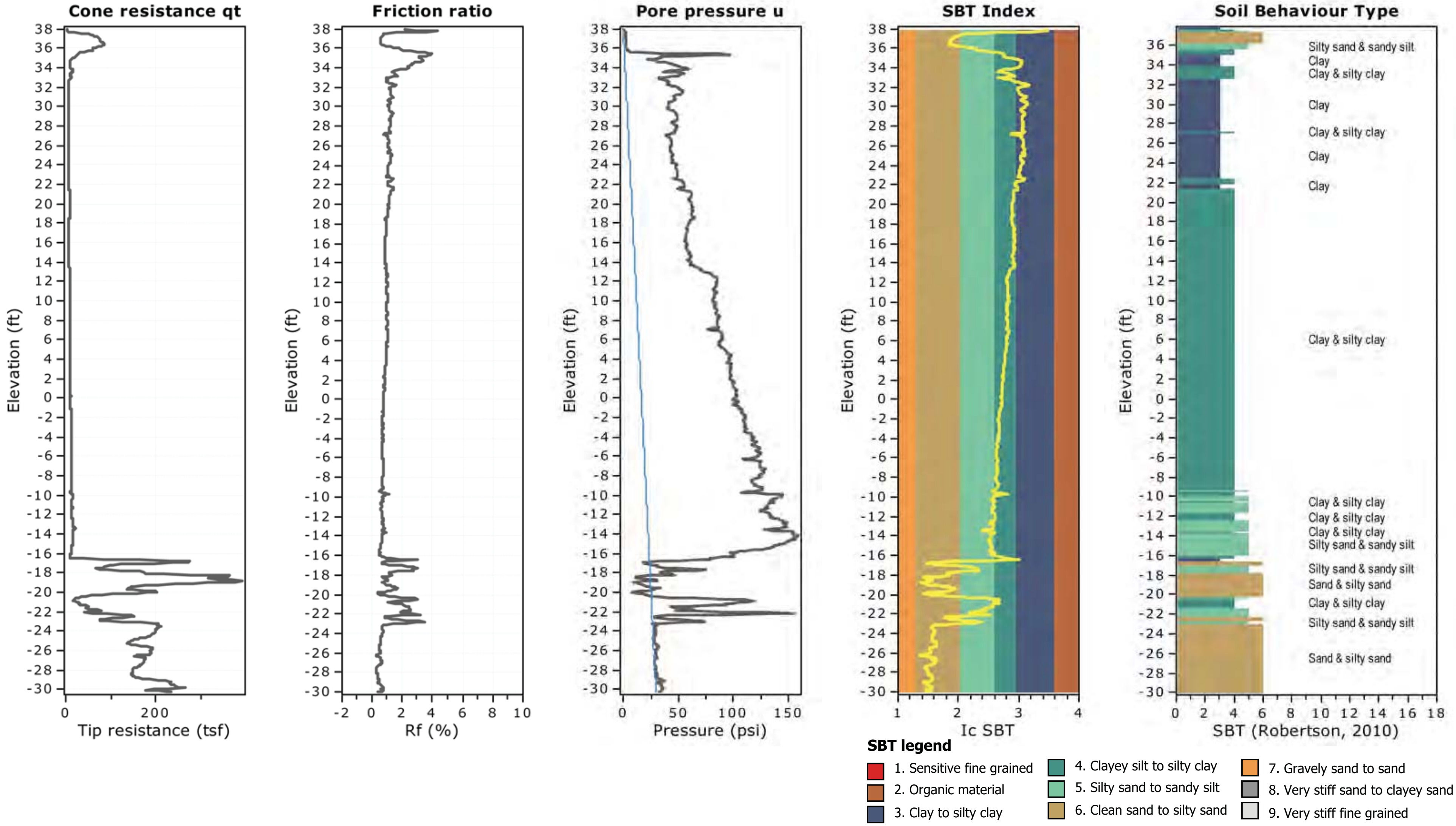
Project: **Bucknam Road Bridge**
Location: **Falmouth, Maine**



GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

Project: **Bucknam Road Bridge**
Location: **Falmouth, Maine**

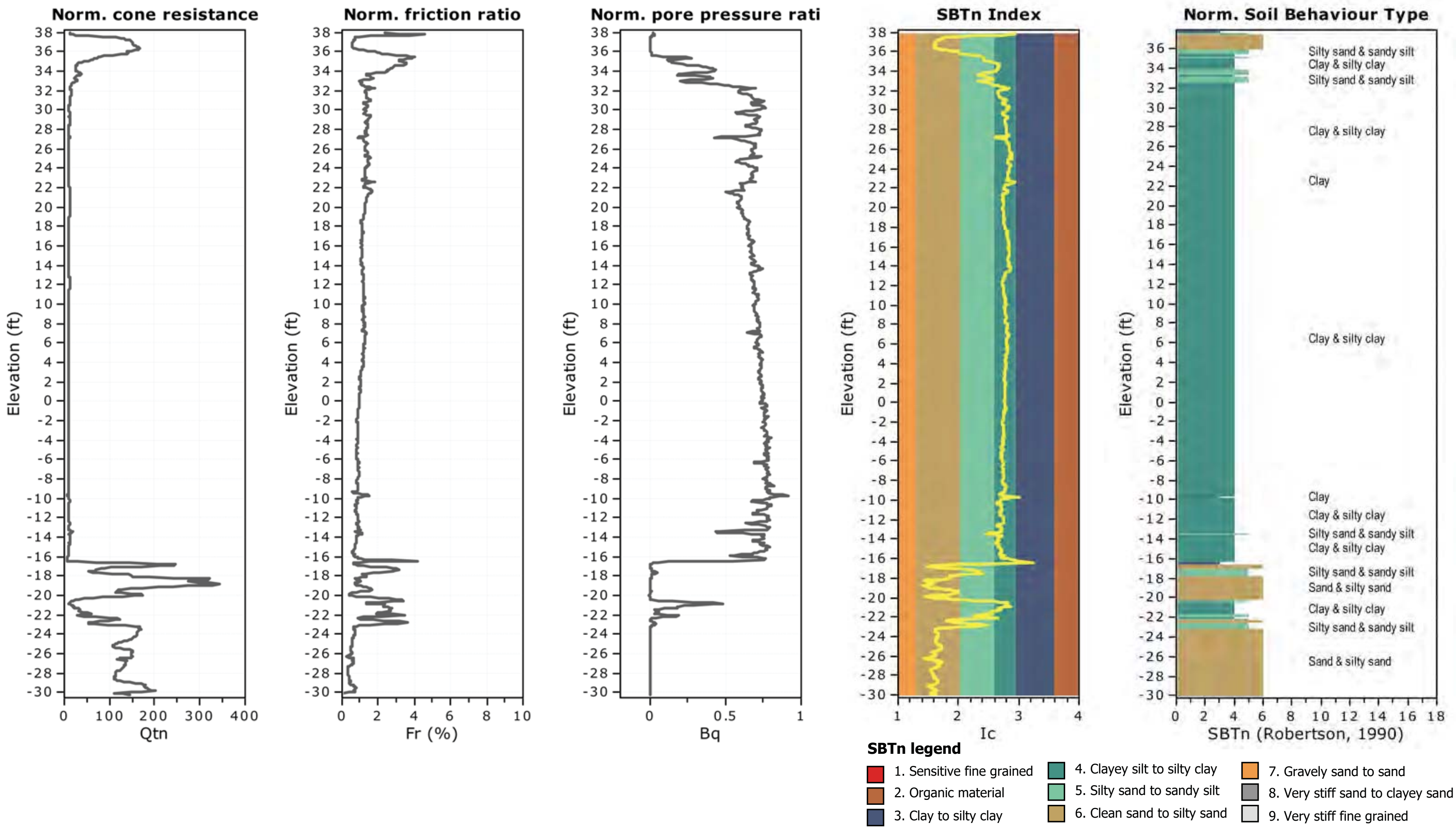
CPT: CPT-FBR-103
Total depth: 73.04 ft, Date: 7/2/2019
Surface Elevation: 42.80 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services



GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

Project: Bucknam Road Bridge
Location: Falmouth, Maine

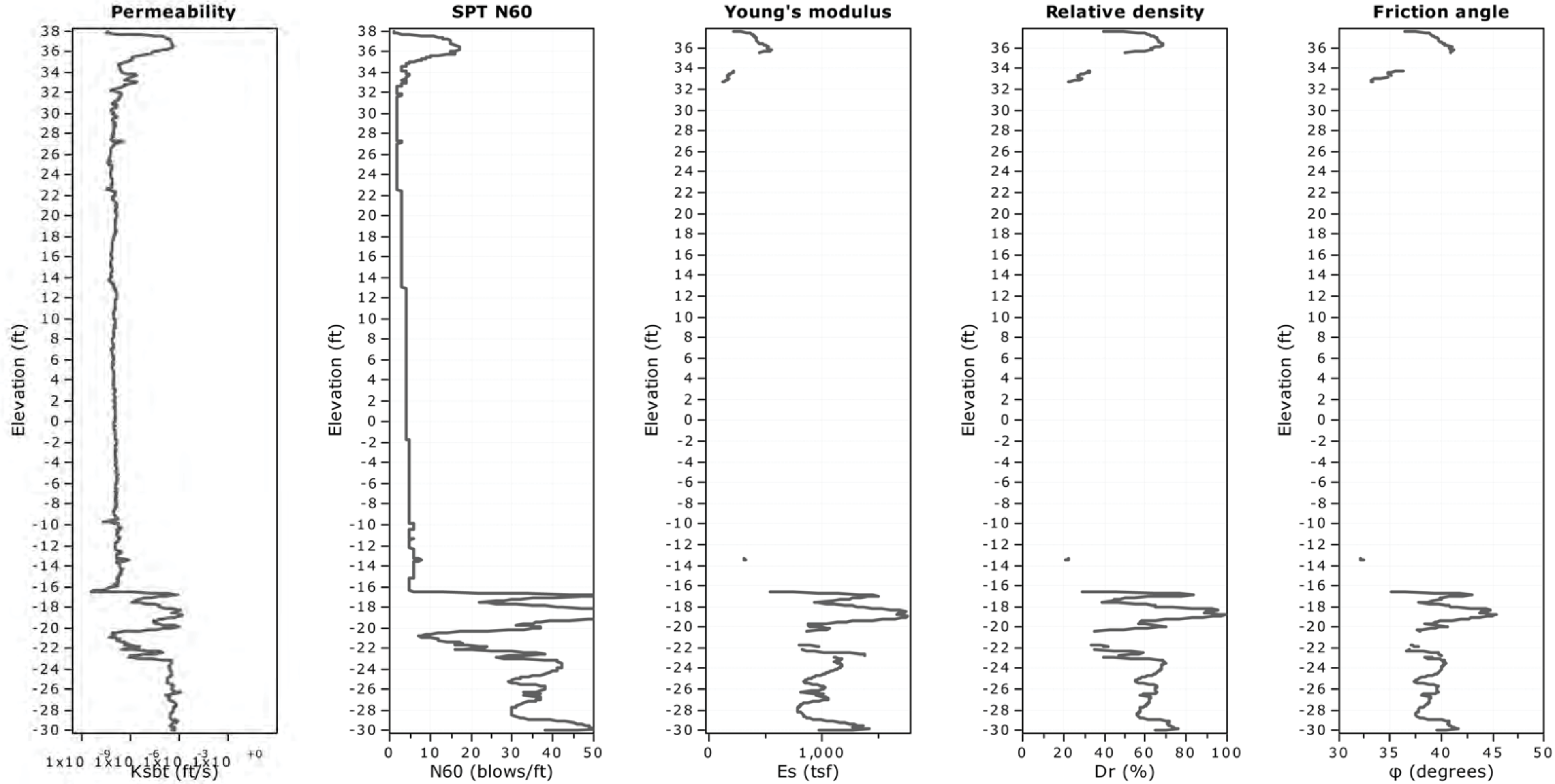
CPT: CPT-FBR-103
Total depth: 73.04 ft, Date: 7/2/2019
Surface Elevation: 42.80 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services



GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

CPT: CPT-FBR-103
Total depth: 73.04 ft, Date: 7/2/2019
Surface Elevation: 42.80 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services

Project: **Bucknam Road Bridge**
Location: **Falmouth, Maine**

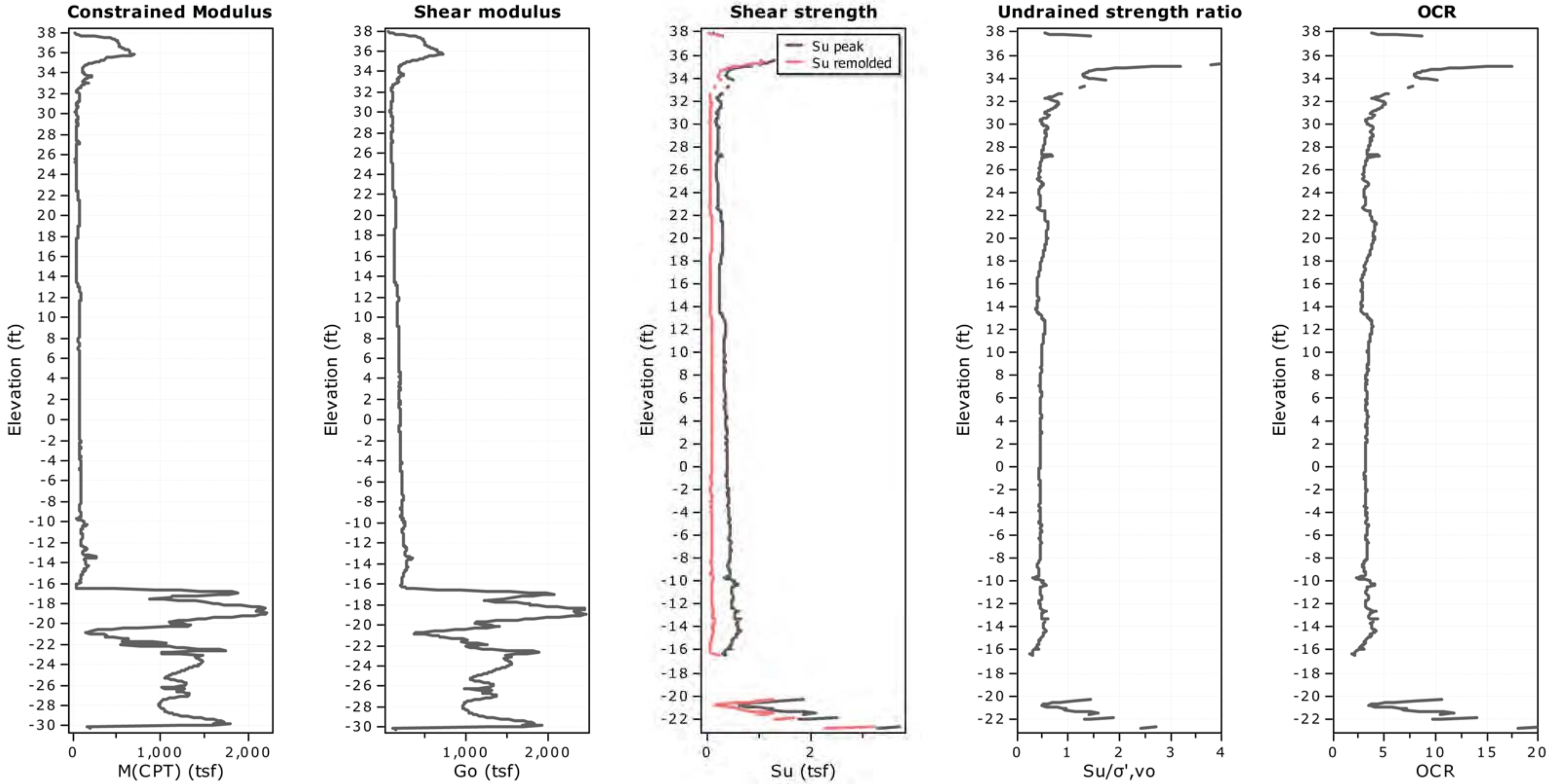


Calculation parameters
Permeability: Based on SBT $_n$
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

CPT: CPT-FBR-103
Total depth: 73.04 ft, Date: 7/2/2019
Surface Elevation: 42.80 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services

Project: **Bucknam Road Bridge**
Location: **Falmouth, Maine**

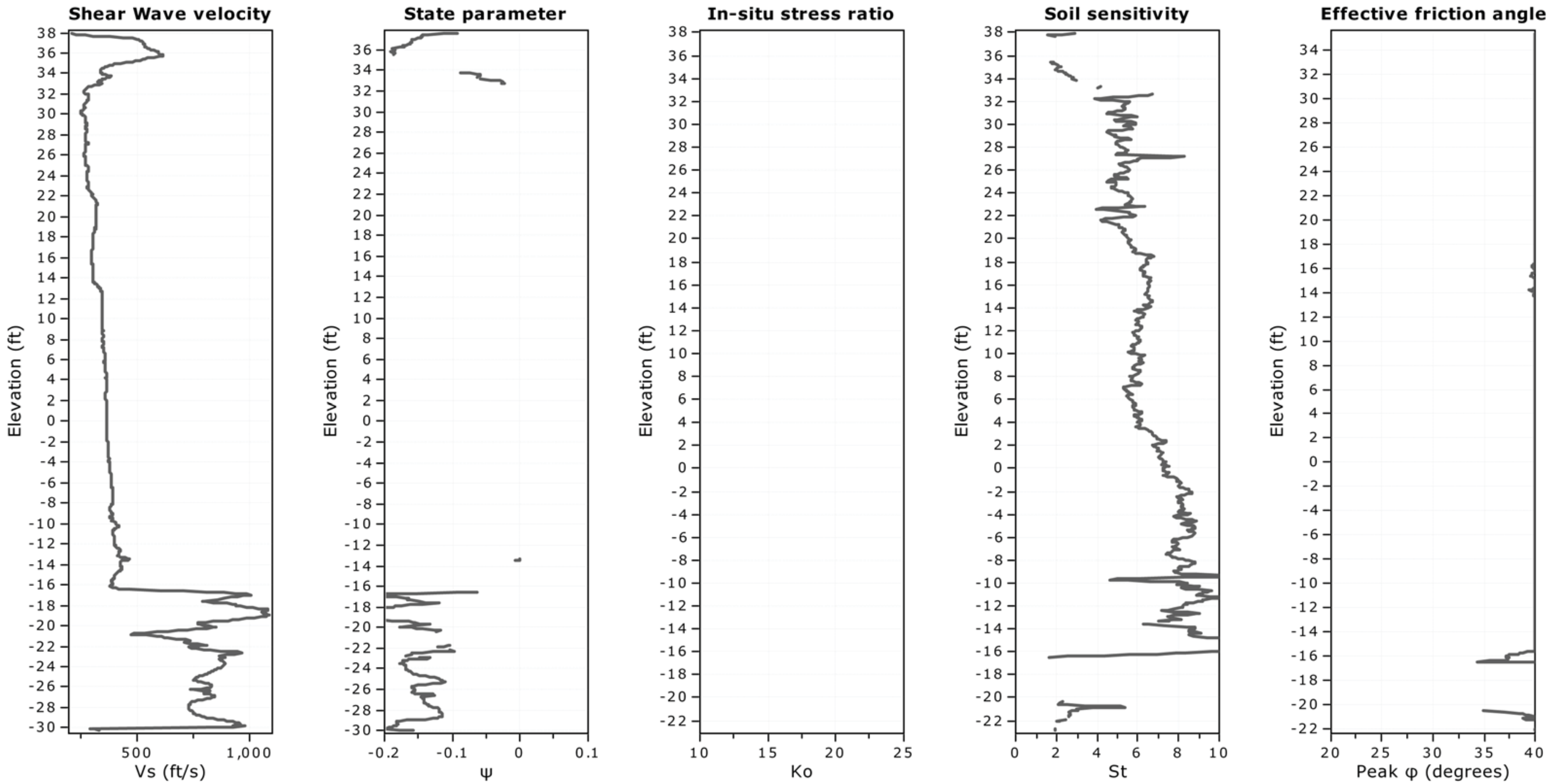


Calculation parameters
Constrained modulus: Based on variable alpha using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable alpha using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 22
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

CPT: CPT-FBR-103
Total depth: 73.04 ft, Date: 7/2/2019
Surface Elevation: 42.80 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services

Project: **Bucknam Road Bridge**
Location: **Falmouth, Maine**



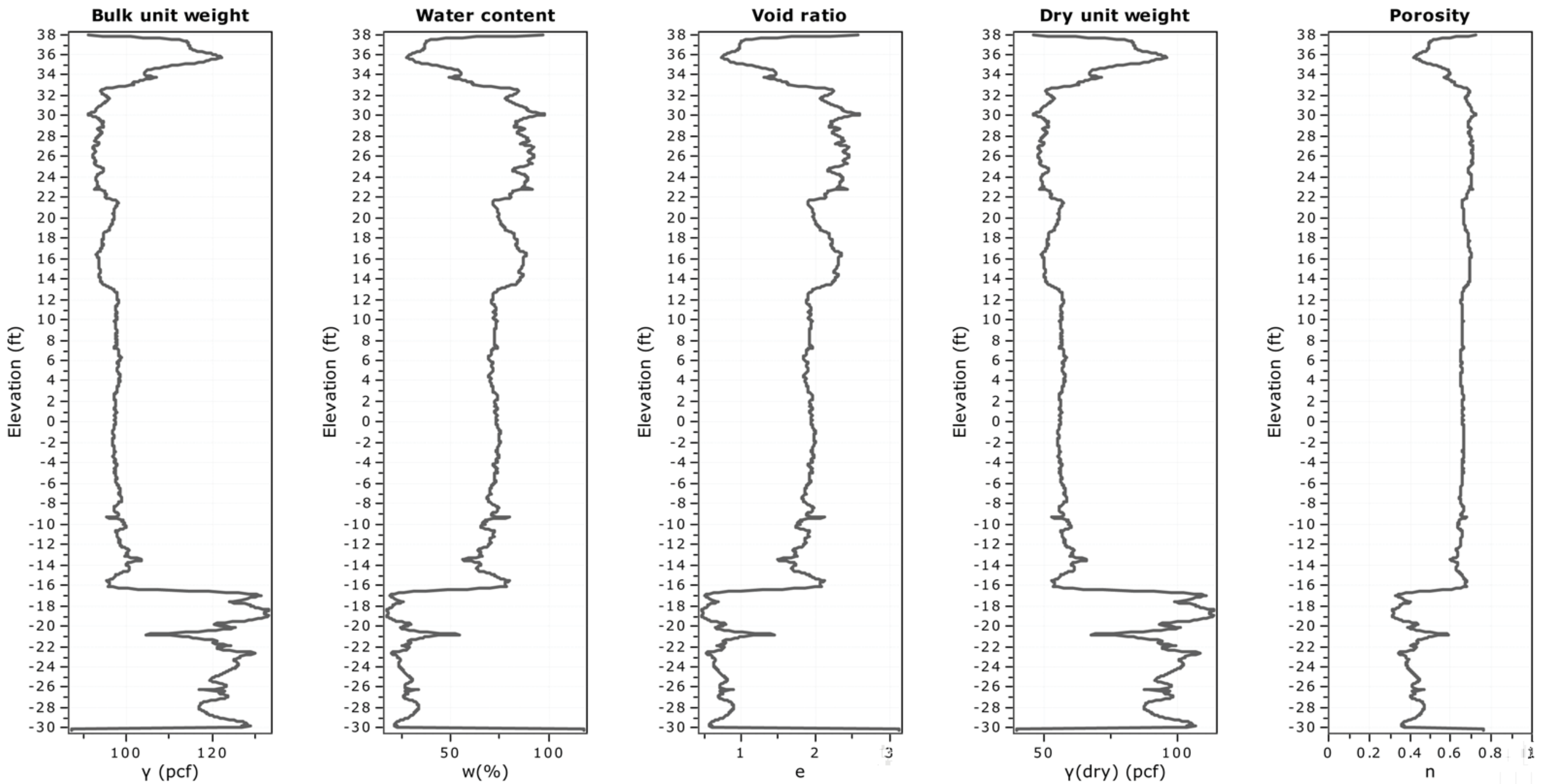
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

Project: **Bucknam Road Bridge**
Location: **Falmouth, Maine**

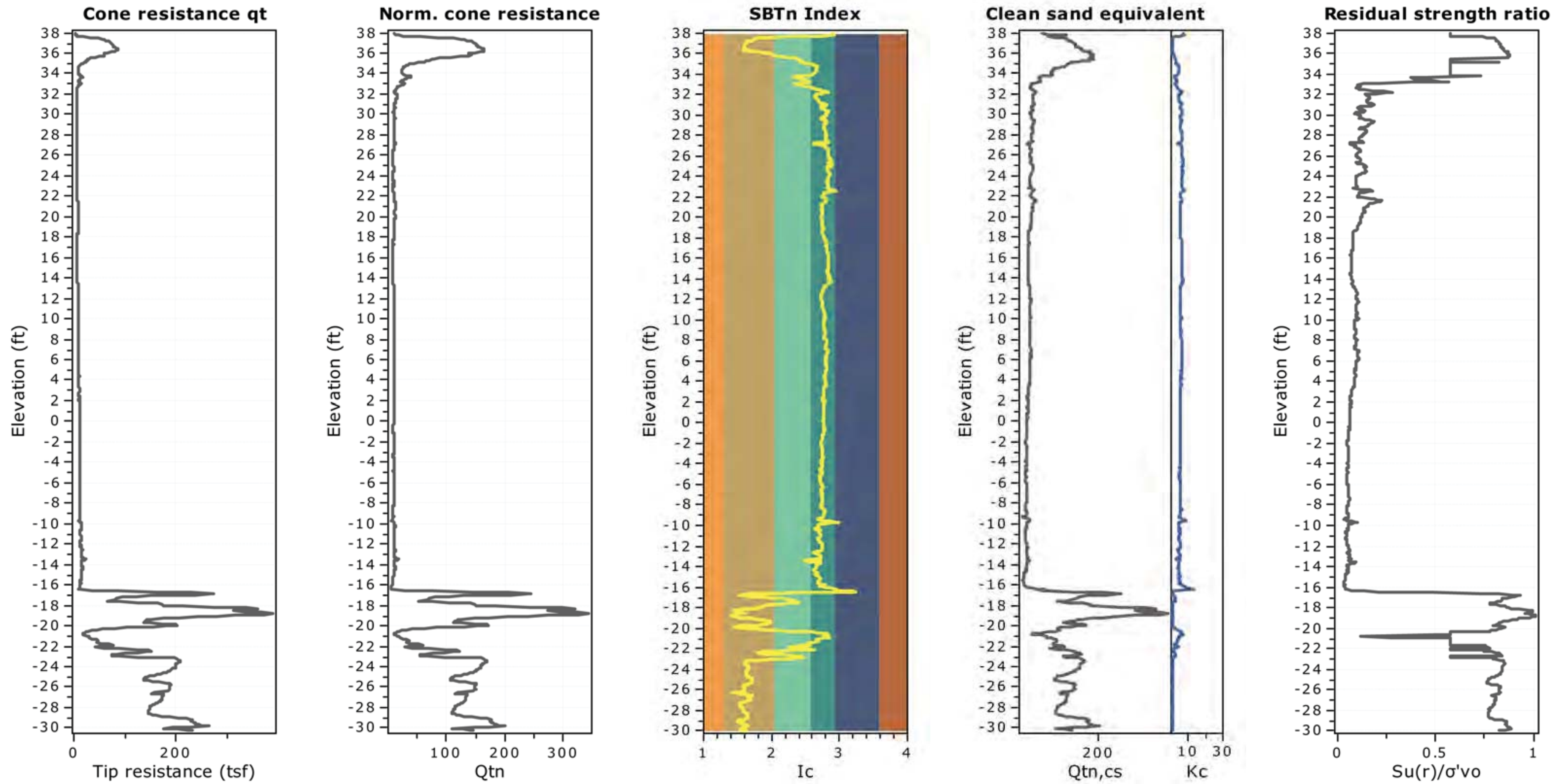
CPT: CPT-FBR-103
Total depth: 73.04 ft, Date: 7/2/2019
Surface Elevation: 42.80 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services



GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

CPT: CPT-FBR-103
Total depth: 73.04 ft, Date: 7/2/2019
Surface Elevation: 42.80 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services

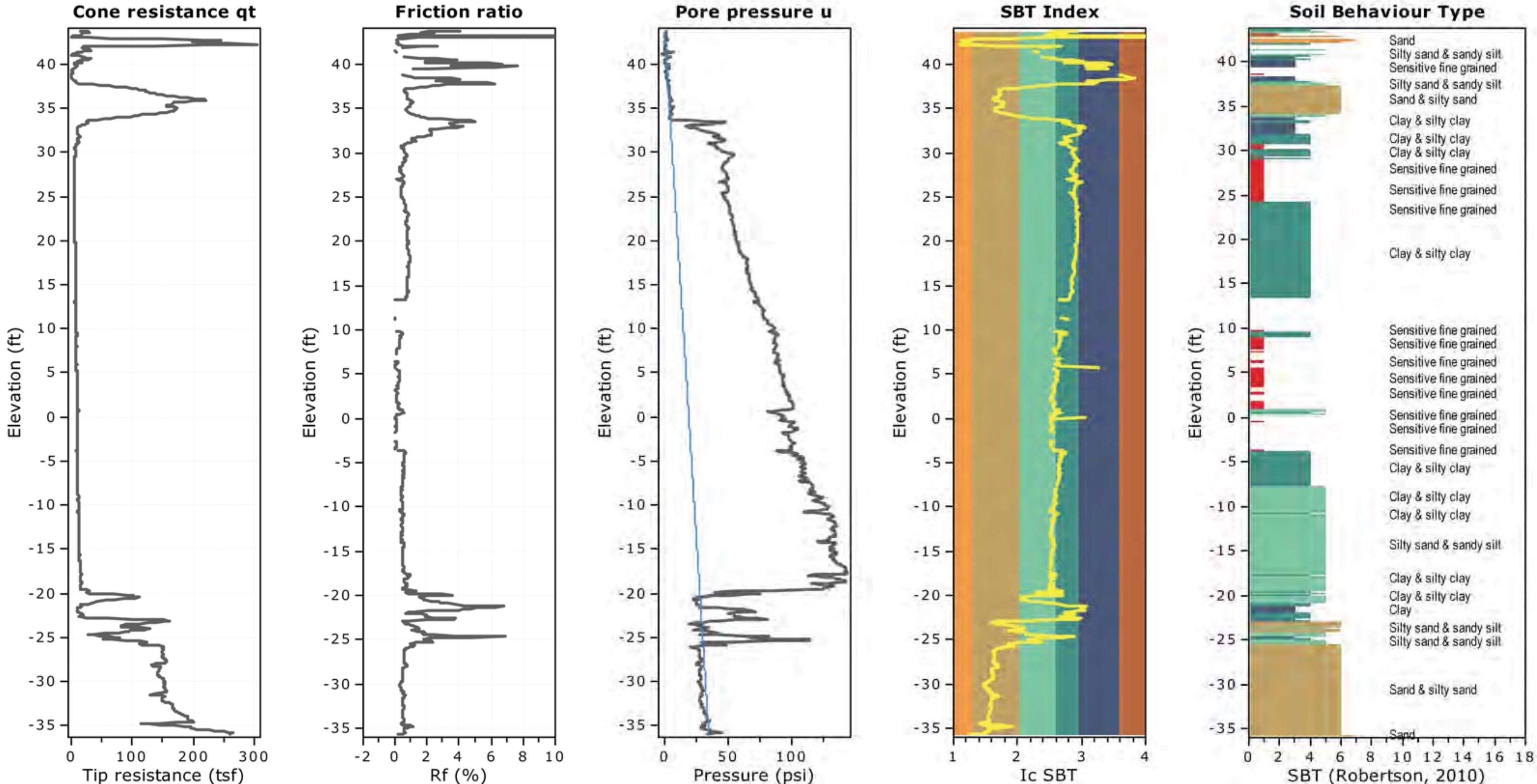
Project: **Bucknam Road Bridge**
Location: **Falmouth, Maine**



GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

Project: Bucknam Road Bridge
Location: Falmouth, Maine

CPT: CPT-FBR-104
Total depth: 84.67 ft, Date: 7/2/2019
Surface Elevation: 48.70 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services



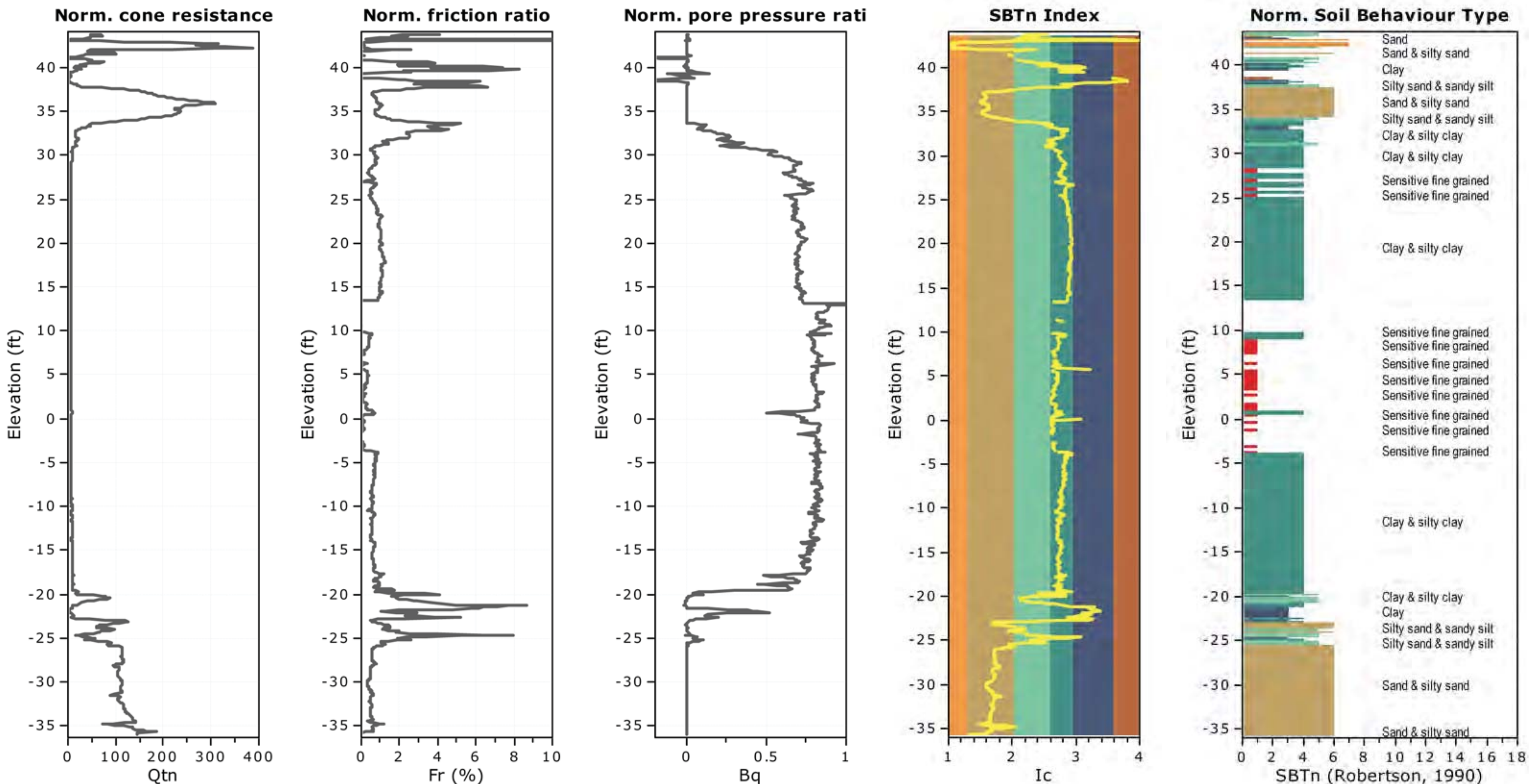
SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty clay
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to clayey sand
9. Very stiff fine grained

GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

CPT: CPT-FBR-104
Total depth: 84.67 ft, Date: 7/2/2019
Surface Elevation: 48.70 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services

Project: **Bucknam Road Bridge**
Location: **Falmouth, Maine**



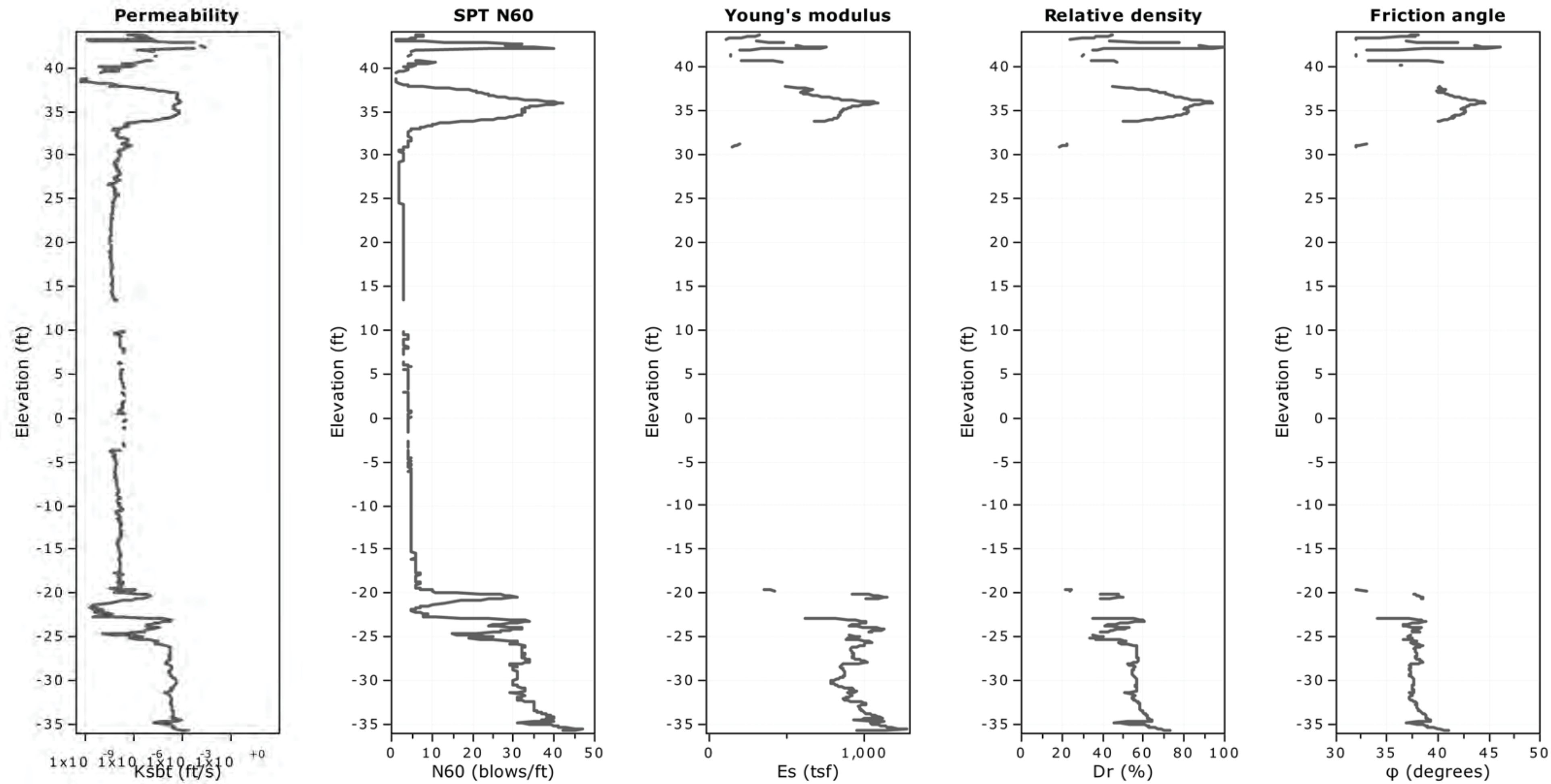
SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty clay
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to clayey sand
9. Very stiff fine grained

GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

Project: **Bucknam Road Bridge**
Location: **Falmouth, Maine**

CPT: CPT-FBR-104
Total depth: 84.67 ft, Date: 7/2/2019
Surface Elevation: 48.70 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services



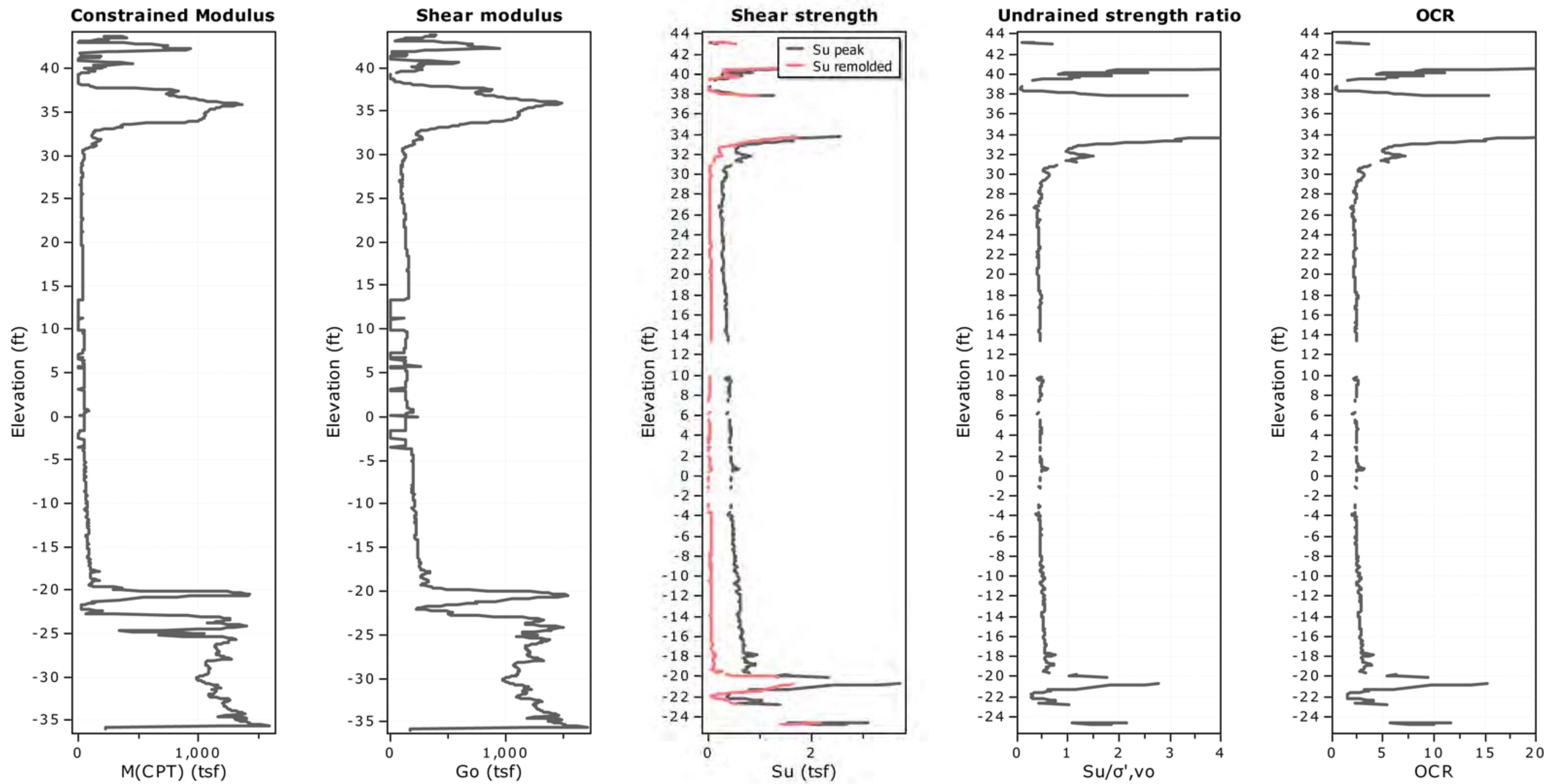
Calculation parameters
Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)

Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

CPT: CPT-FBR-104
Total depth: 84.67 ft, Date: 7/2/2019
Surface Elevation: 48.70 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services

Project: **Bucknam Road Bridge**
Location: **Falmouth, Maine**



Calculation parameters

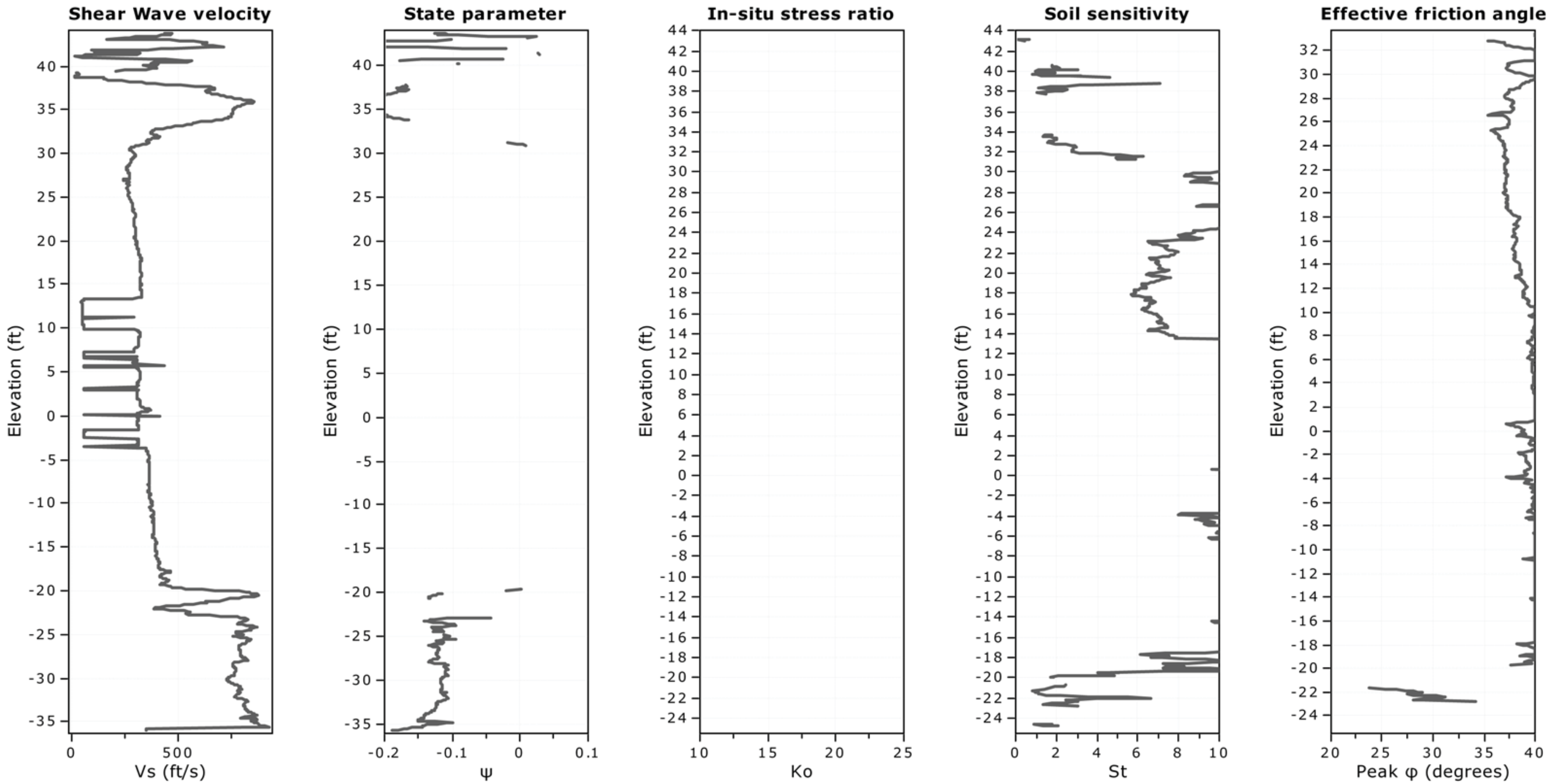
Constrained modulus: Based on variable alpha using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable alpha using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 16

OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

CPT: CPT-FBR-104
Total depth: 84.67 ft, Date: 7/2/2019
Surface Elevation: 48.70 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services

Project: **Bucknam Road Bridge**
Location: **Falmouth, Maine**



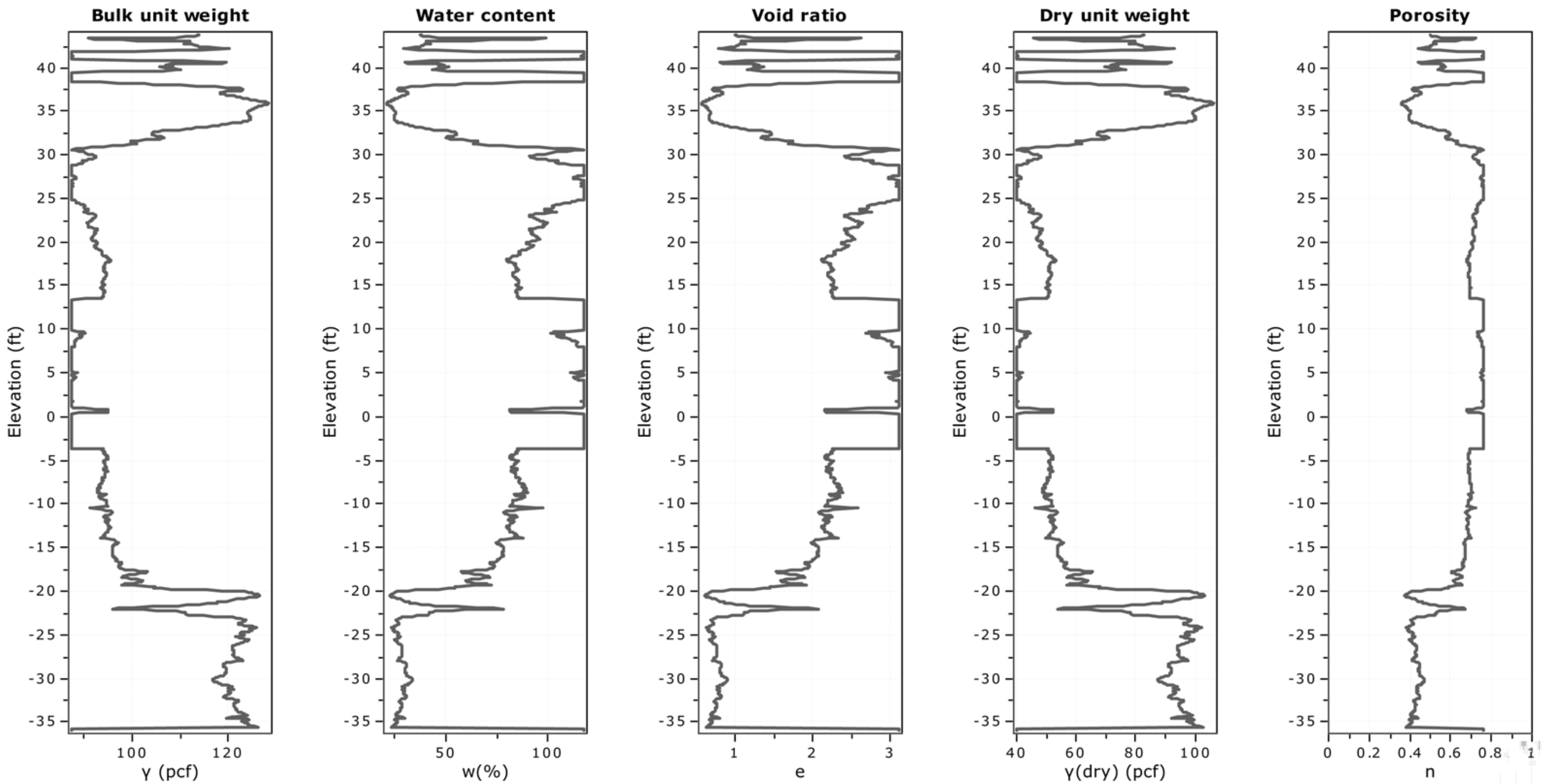
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

Project: Bucknam Road Bridge
Location: Falmouth, Maine

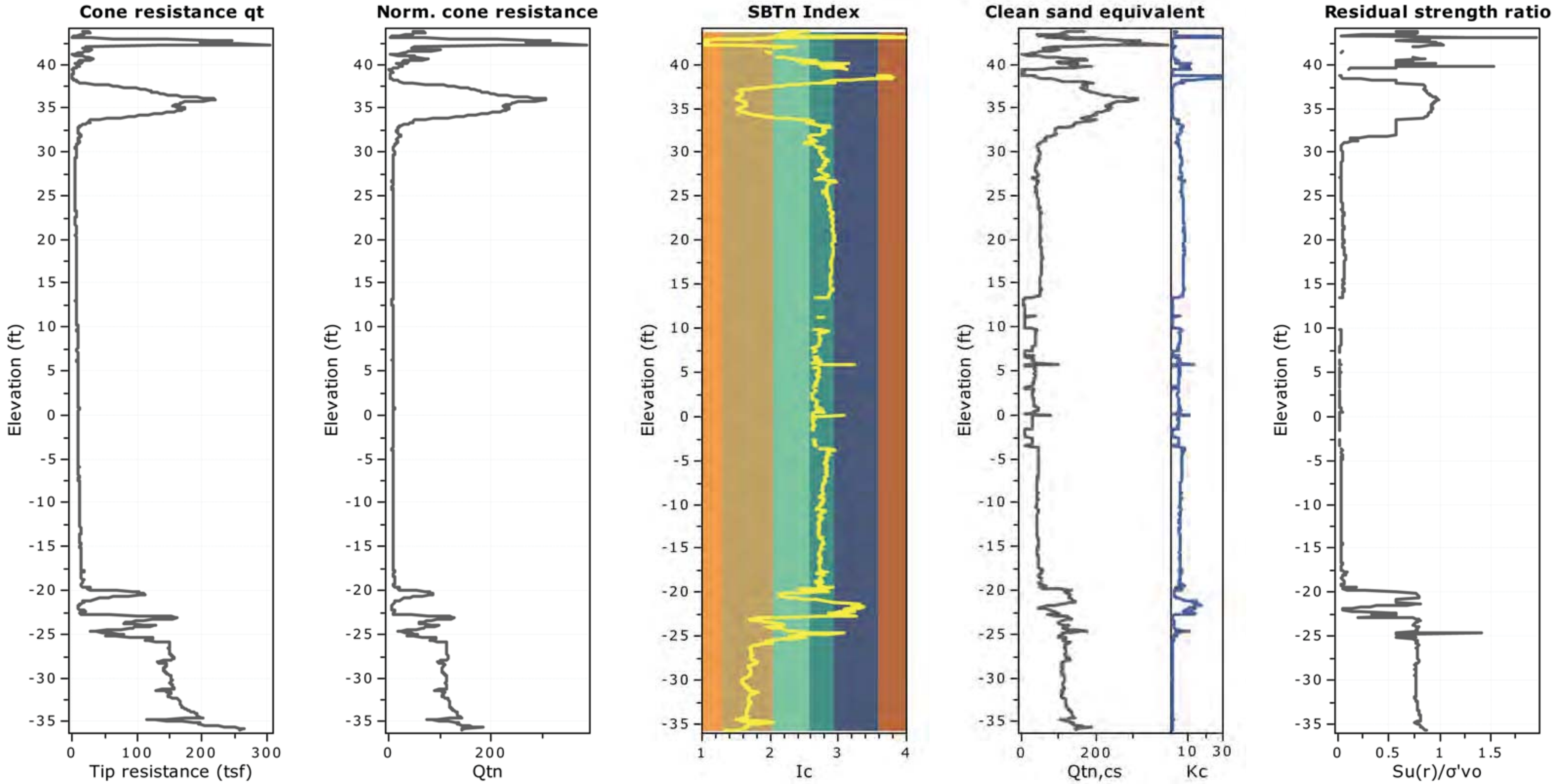
CPT: CPT-FBR-104
Total depth: 84.67 ft, Date: 7/2/2019
Surface Elevation: 48.70 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services



GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

CPT: CPT-FBR-104
Total depth: 84.67 ft, Date: 7/2/2019
Surface Elevation: 48.70 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services

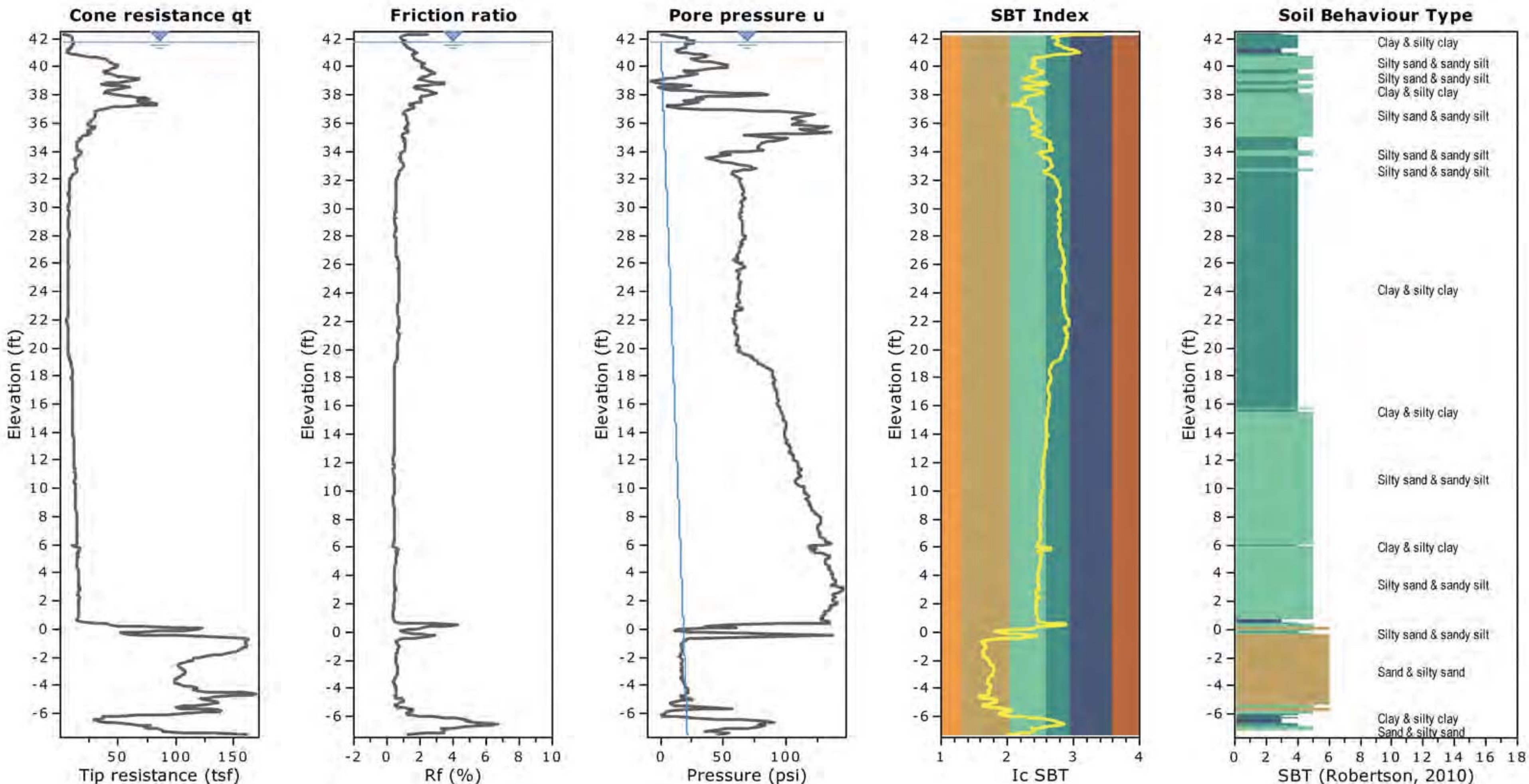
Project: **Bucknam Road Bridge**
Location: **Falmouth, Maine**



GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

CPT: CPT-FBR-105
Total depth: 54.60 ft, Date: 7/2/2019
Surface Elevation: 47.10 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services

Project: **Bucknam Road Bridge**
Location: **Falmouth, Maine**



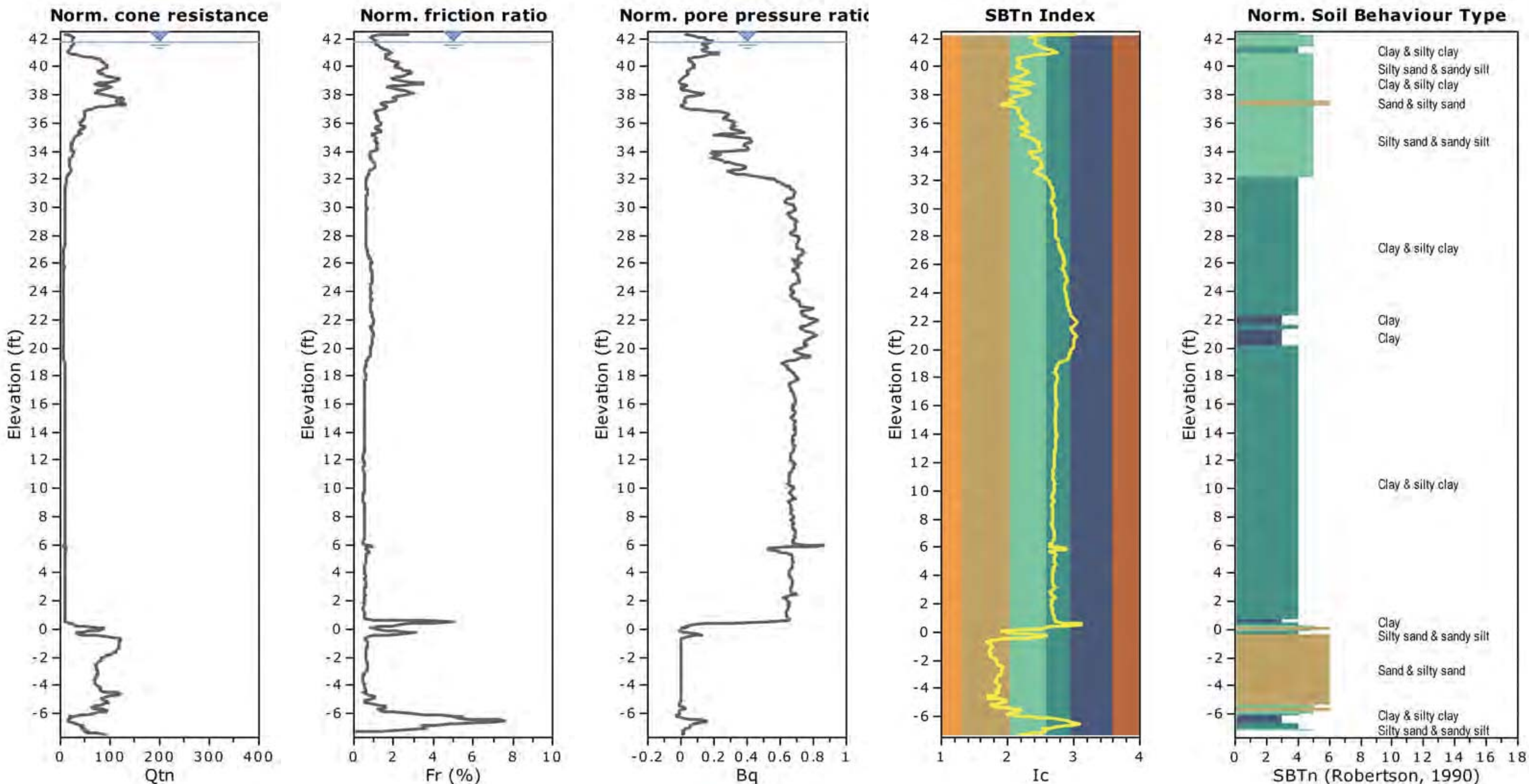
SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty clay
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to clayey sand
9. Very stiff fine grained

GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

CPT: CPT-FBR-105
Total depth: 54.60 ft, Date: 7/2/2019
Surface Elevation: 47.10 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services

Project: **Bucknam Road Bridge**
Location: **Falmouth, Maine**



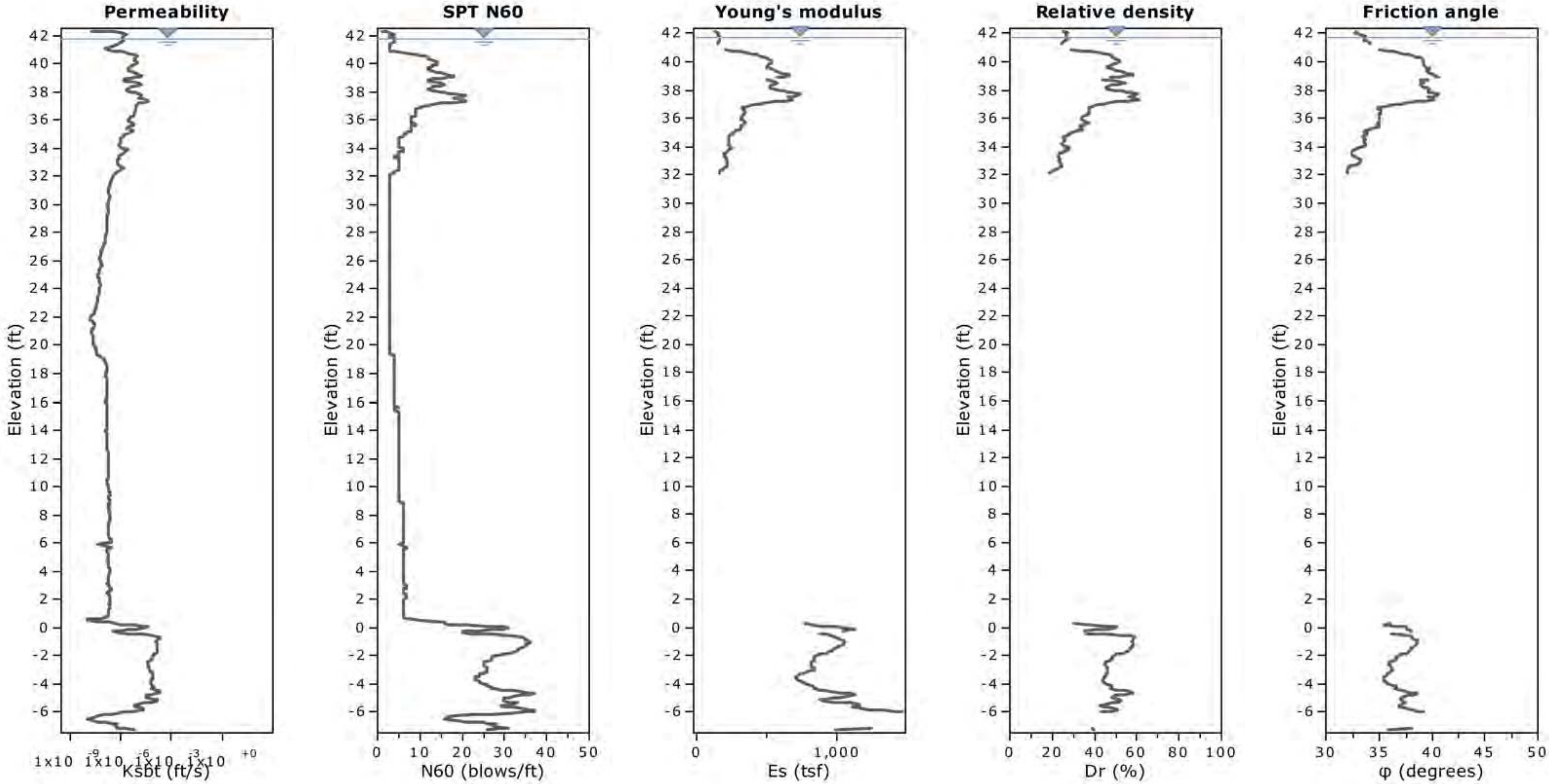
SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty clay
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to clayey sand
9. Very stiff fine grained

GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

CPT: CPT-FBR-105
Total depth: 54.60 ft, Date: 7/2/2019
Surface Elevation: 47.10 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services

Project: **Bucknam Road Bridge**
Location: **Falmouth, Maine**

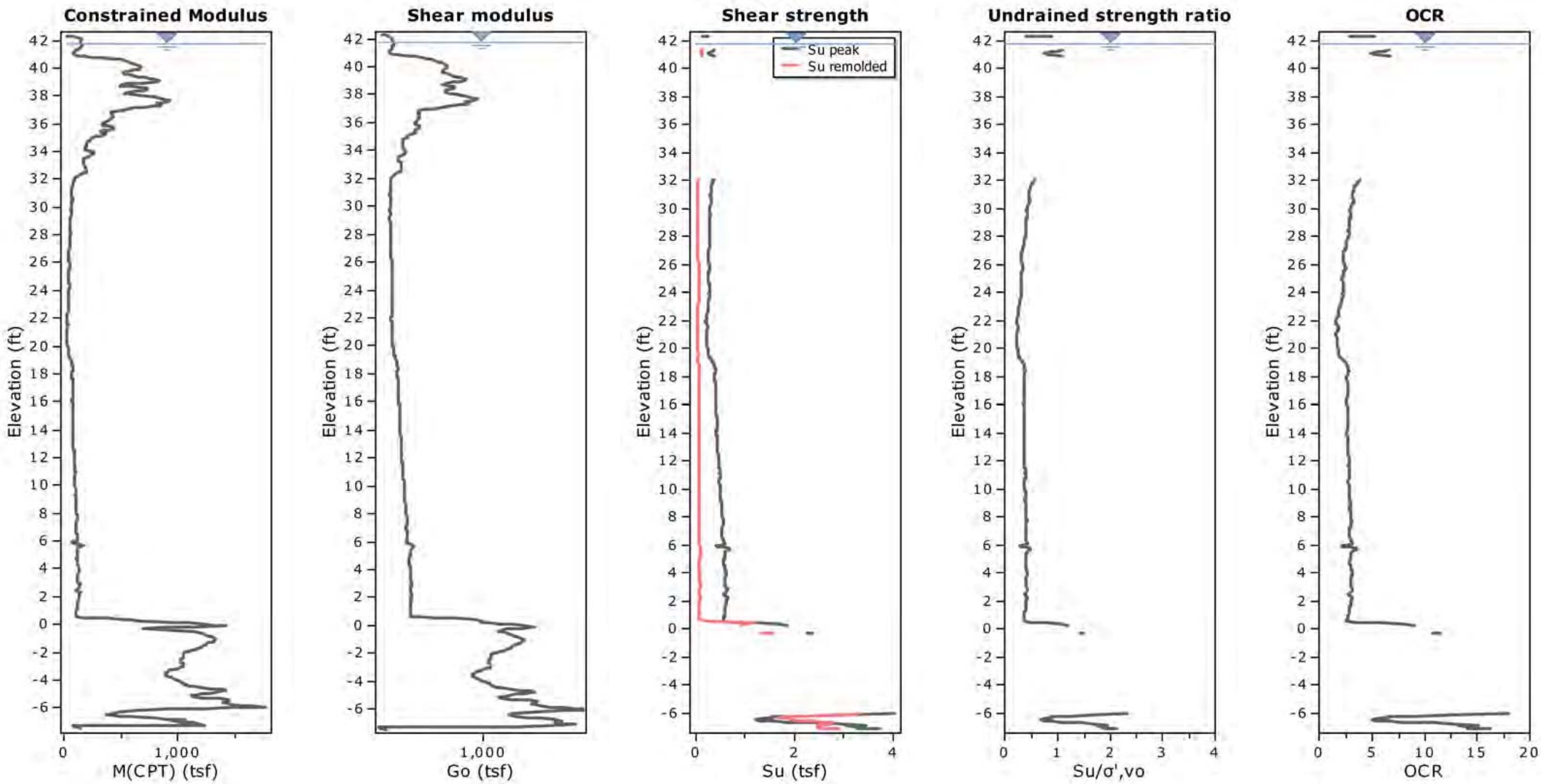


Calculation parameters
Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

CPT: CPT-FBR-105
Total depth: 54.60 ft, Date: 7/2/2019
Surface Elevation: 47.10 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services

Project: **Bucknam Road Bridge**
Location: **Falmouth, Maine**

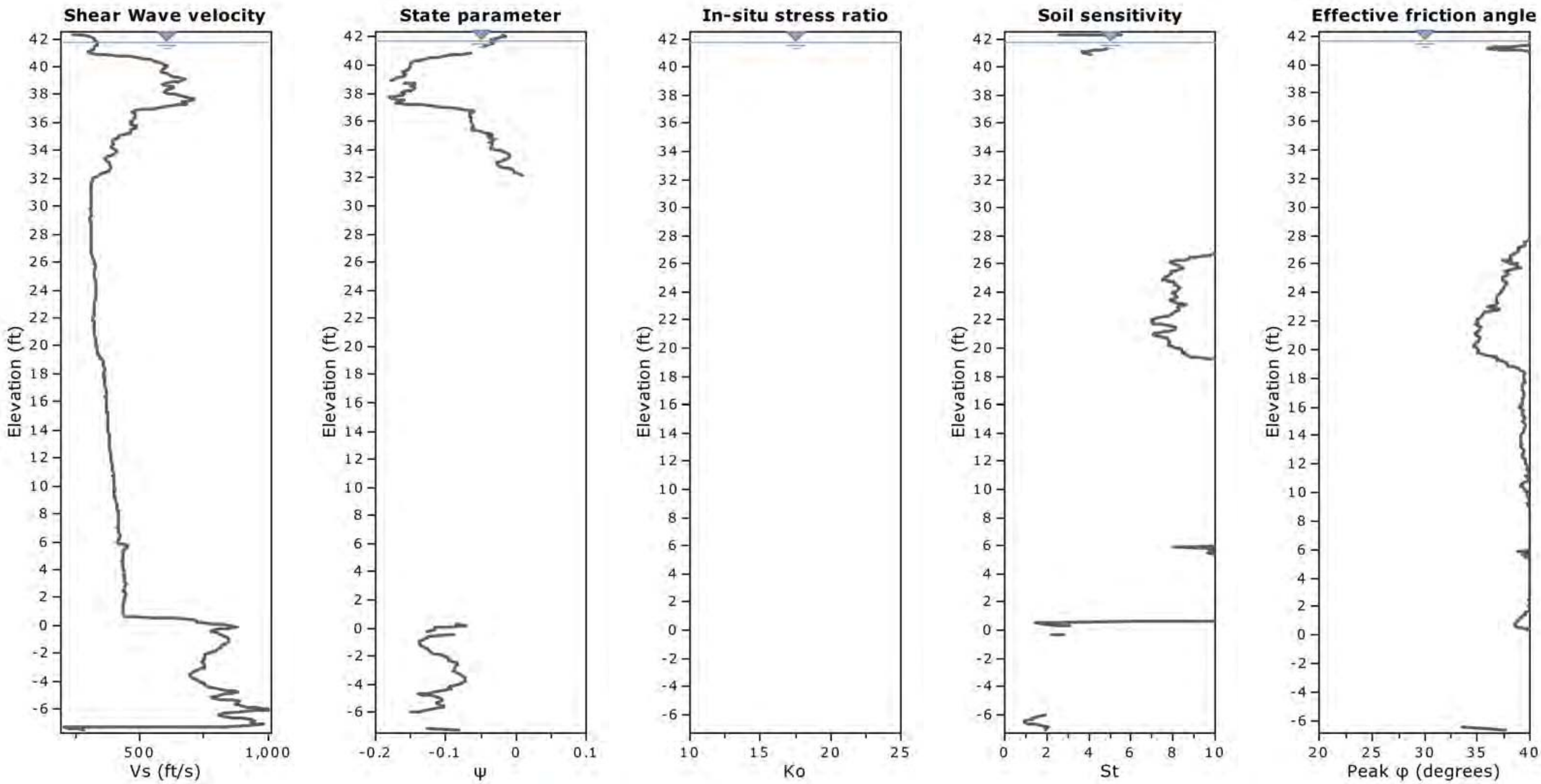


Calculation parameters
Constrained modulus: Based on variable alpha using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable alpha using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 22
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

Project: **Bucknam Road Bridge**
Location: **Falmouth, Maine**

CPT: CPT-FBR-105
Total depth: 54.60 ft, Date: 7/2/2019
Surface Elevation: 47.10 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services



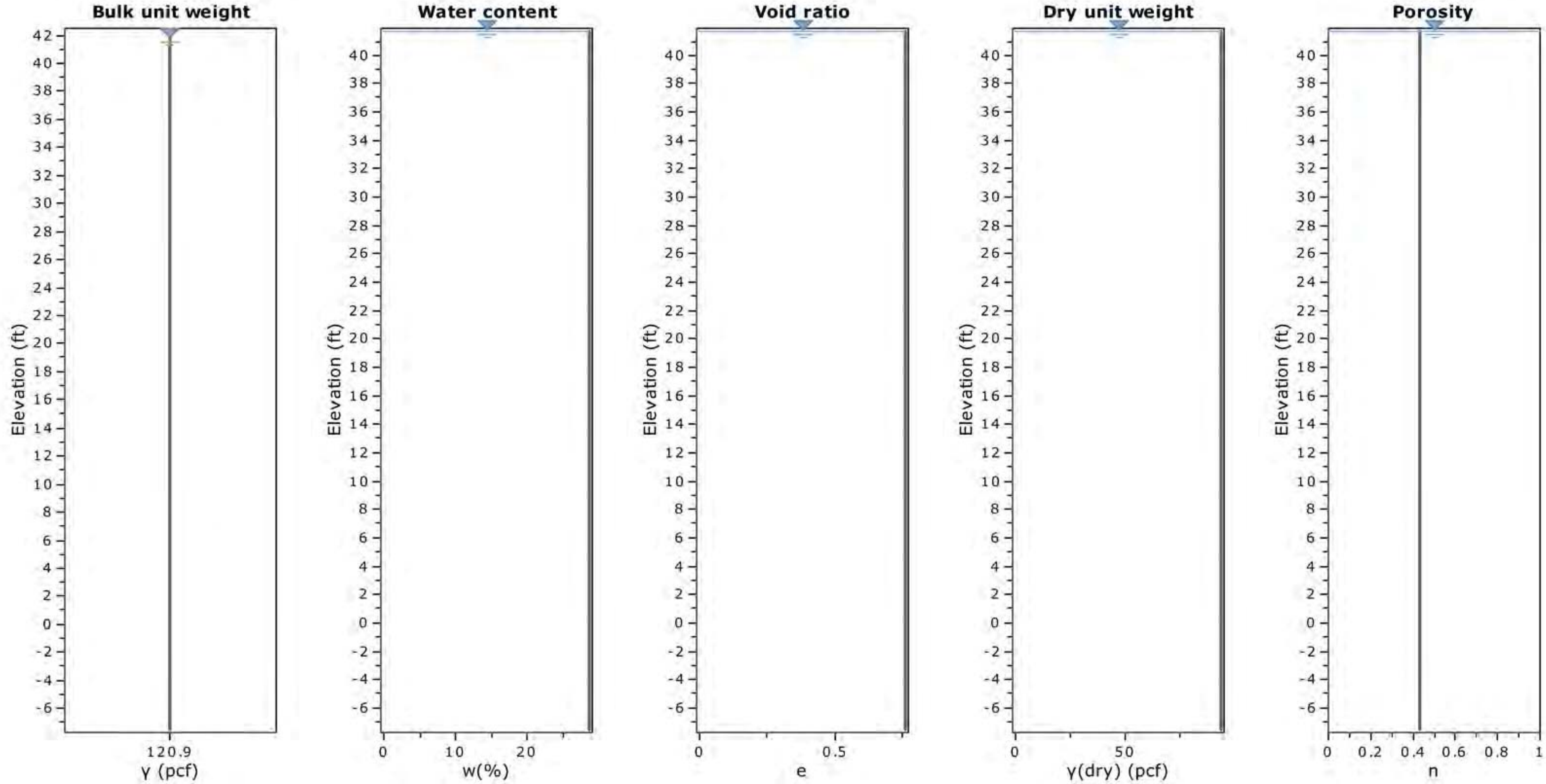
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

CPT: CPT-FBR-105
Total depth: 54.60 ft, Date: 7/2/2019
Surface Elevation: 47.10 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services

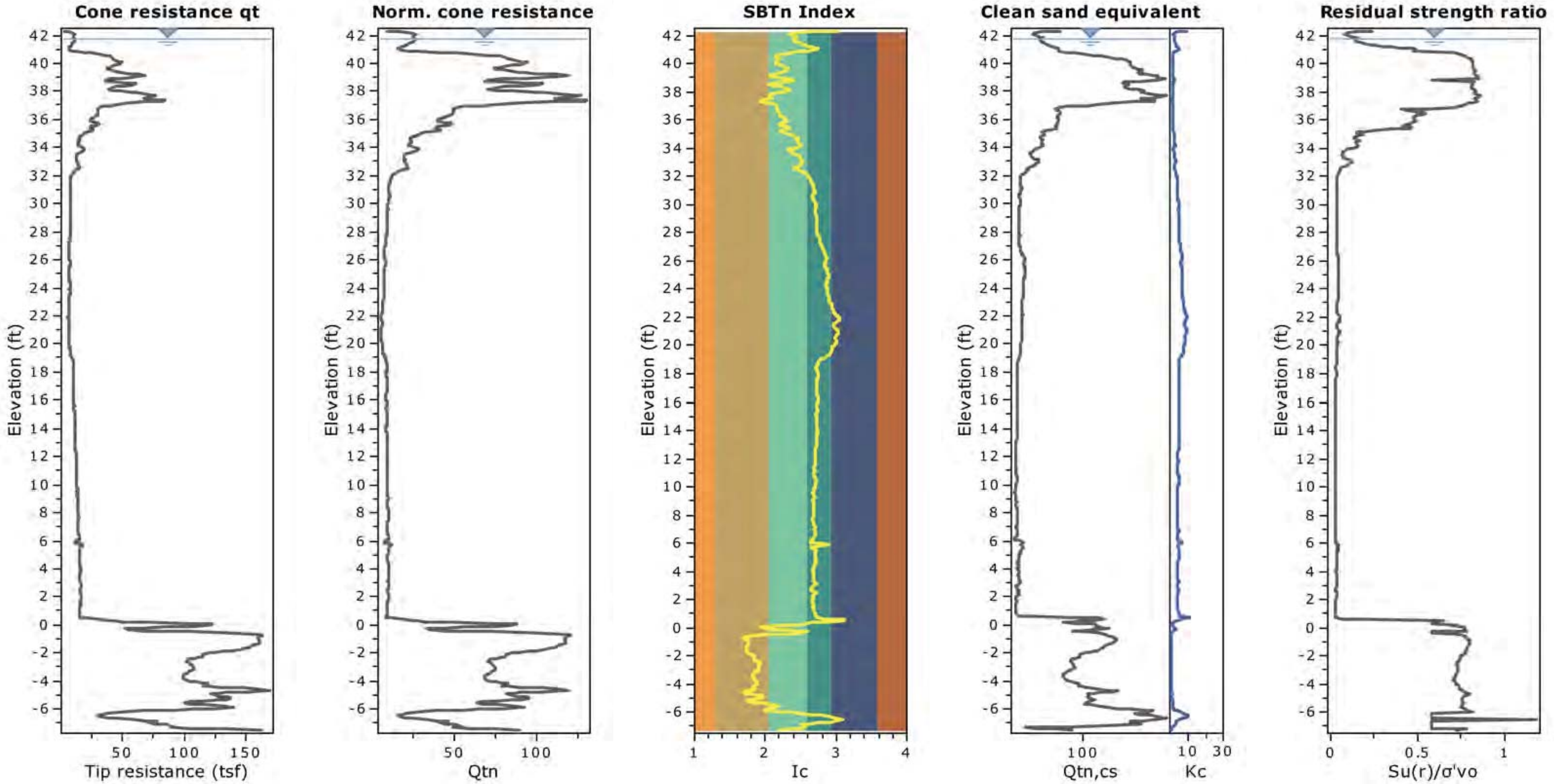
Project: **Bucknam Road Bridge**
Location: **Falmouth, Maine**



GZA GeoEnvironmental Inc.
707 Sable Oaks Drive
South Portland, Maine

CPT: CPT-FBR-105
Total depth: 54.60 ft, Date: 7/2/2019
Surface Elevation: 47.10 ft
Coords: X:0.00, Y:0.00
Cone Type: Vertek Digital Cone
Cone Operator: Summit Geoengineering Services

Project: **Bucknam Road Bridge**
Location: **Falmouth, Maine**



Presented below is a list of formulas used for the estimation of various soil properties. The formulas are presented in SI unit system and assume that all components are expressed in the same units.

:: Unit Weight, g (kN/m³) ::

$$g = g_w \cdot \left(0.27 \cdot \log(R_f) + 0.36 \cdot \log(\frac{q_t}{p_a}) + 1.236 \right)$$

where g_w = water unit weight

:: Permeability, k (m/s) ::

$I_c < 3.27$ and $I_c > 1.00$ then $k = 10^{0.952-3.04 \cdot I_c}$

$I_c \le 4.00$ and $I_c > 3.27$ then $k = 10^{-4.52-1.37 \cdot I_c}$

:: N_{SPT} (blows per 30 cm) ::

$$N_{60} = \left(\frac{q_c}{P_a} \right) \cdot \frac{1}{10^{1.1268-0.2817 \cdot I_c}}$$

$$N_{1(60)} = Q_{tn} \cdot \frac{1}{10^{1.1268-0.2817 \cdot I_c}}$$

:: Young's Modulus, Es (MPa) ::

$$(q_t - \sigma_v) \cdot 0.015 \cdot 10^{0.55 \cdot I_c + 1.68}$$

(applicable only to $I_c < I_{c\_cutoff}$)

:: Relative Density, Dr (%) ::

$$100 \cdot \sqrt{\frac{Q_{tn}}{k_{DR}}}$$

(applicable only to SBT_n: 5, 6, 7 and 8 or $I_c < I_{c\_cutoff}$)

:: State Parameter, ψ ::

$$\psi = 0.56 - 0.33 \cdot \log(Q_{tn,cs})$$

:: Drained Friction Angle, φ (°) ::

(applicable only to SBT_n: 5, 6, 7 and 8 or $I_c < I_{c\_cutoff}$)

:: 1-D constrained modulus, M (MPa) ::

If $I_c > 2.20$
$\alpha = 14$ for $Q_{tn} > 14$
$\alpha = Q_{tn}$ for $Q_{tn} \le 14$
$M_{CPT} = \alpha \cdot (q_t - \sigma_v)$

If $I_c \ge 2.20$

:: Small strain shear Modulus, Go (MPa) ::

$$G_0 = (q_t - \sigma_v) \cdot 0.0188 \cdot 10^{0.55 \cdot I_c + 1.68}$$

:: Shear Wave Velocity, Vs (m/s) ::

$$V_s = \left(\frac{G_0}{\rho} \right)^{0.50}$$

:: Undrained peak shear strength, Su (kPa) ::

$N_{kt} = 10.50 + 7 \cdot \log(F_r)$ or user defined

$$S_u = \frac{(q_t - \sigma_v)}{N_{kt}}$$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c\_cutoff}$)

:: Remolded undrained shear strength, Su(rem) (kPa) ::

$S_{u(rem)} = f_s$ (applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c\_cutoff}$)

:: Overconsolidation Ratio, OCR ::

$$k_{OCR} = \left[\frac{Q_{tn}^{0.20}}{0.25 \cdot (10.50 \cdot +7 \cdot \log(F_r))} \right]^{1.25}$$ or user defined

$$OCR = k_{OCR} \cdot Q_{tn}$$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c\_cutoff}$)

:: In situ Stress Ratio, Ko ::

$$K_O = (1 - \sin\varphi') \cdot OCR^{\sin\varphi'}$$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c\_cutoff}$)

:: Soil Sensitivity, S_t ::

$$S_t = \frac{N_S}{F_r}$$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c\_cutoff}$)

:: Peak Friction Angle, φ' (°) ::

$$\varphi' = 29.5° \cdot B_q^{0.121} \cdot (0.256 + 0.336 \cdot B_q + \log Q_t)$$

(applicable for $0.10 < B_q < 1.00$)

References

• Robertson, P.K., Cabal K.L., Guide to Cone Penetration Testing for Geotechnical Engineering, Gregg Drilling & Testing, Inc., 5th Edition, November 2012

• Robertson, P.K., Interpretation of Cone Penetration Tests - a unified approach., Can. Geotech. J. 46(11): 1337–1355 (2009)

• N Barounis, J Philpot, Estimation of in-situ water content, void ratio, dry unit weight and porosity using CPT for saturated sands, Proc. 20th NZGS Geotechnical Symposium

APPENDIX D – 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: M. Walsh	Project Information: **Bucknam Road Bridge No. 5830, MEDOT** **Falmouth, ME** GZA Project Number: 09.0026023.00 Summary Page: 1 of 5 Report Date: 07.25.19

LABORATORY TESTING DATA SHEET

Boring ID	Sample No.	Depth (ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				As Received Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Water 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"	Perme-ability cm/sec	
				D2216	D4318		D6913			D2874	D854			D1557						
BB-FBR-102	2D	4-6	S-1	5.9			19.7	64.2	16.1											Dark Brown f-c SAND, little fine Gravel, little Silt
BB-FBR-102	4D	14-16	S-2	17.9			12.2	61.3	26.5											Gray f-c SAND, some Clayey Silt, little fine Gravel
BB-FBR-102	6D	18-20	S-3				5.6	90.3	4.1											Dark Brown f-c SAND, trace fine Gravel, trace Silt
BB-FBR-102	11D	29-31	S-4	42.9																Water Content Only
BB-FBR-102	13D	54-56	S-5	32.3	34	19														Gray SILTY CLAY
BB-FBR-102	15D	64-66	S-6				2.8	64.4	32.8											Brown f-m SAND, some Silt, trace fine Gravel

Date Received: *07.17.19*

Reviewed By: Sth Bo

Date Reviewed: *07.26.19*

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: M. Walsh	Project Information: **Bucknam Road Bridge No. 5830, MEDOT** **Falmouth, ME** GZA Project Number: 09.0026023.00 Summary Page: 2 of 5 Report Date: 07.25.19

LABORATORY TESTING DATA SHEET

Boring ID	Sample No.	Depth (ft)	Laboratory No.	Identification Tests									Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				As Received Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Water 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"	Perme-ability cm/sec	
				D2216	D4318		D6913			D2874	D854			D1557						
BB-FBR-103	2D	2-4	S-7	20.0			0.0	90.2	9.8											Brown fine SAND, trace Silt
BB-FBR-103	4D	6-8	S-8	51.6	48	20														Gray SILTY CLAY
BB-FBR-103	5D	9-11	S-9	47.6																Water Content Only
BB-FBR-103	6D	19-21	S-10	38.1	40	20														Gray SILTY CLAY
BB-FBR-103	9D	34-36	S-11	34.7																Water Content Only

Date Received: *07.17.19*   Reviewed By: ________   Date Reviewed: *07.26.19*

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: M. Walsh	Project Information: **Bucknam Road Bridge No. 5830, MEDOT** **Falmouth, ME** GZA Project Number: 09.0026023.00 Summary Page: 3 of 5 Report Date: 07.25.19

LABORATORY TESTING DATA SHEET

Boring ID	Sample No.	Depth (ft)	Laboratory No.	Identification Tests									Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				As Received Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s		Dry unit wt. pcf	Test Water 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"	Perme-ability cm/sec	
				D2216	D4318		D6913			D2874	D854				D1557						
BB-FBR-103A	7D	44-46	S-12	32.1	37	19	0.0	10.2	89.8												Gray SILTY CLAY, little fine Sand
BB-FBR-103A	9D	54-56	S-13				17.6	73.2	9.2												Brown f-c SAND, little f-c Gravel, trace Silt
BB-FBR-103A	11D	64-66	S-14				15.4	79.1	5.5												Brown f-m SAND, little f-c Gravel, trace Silt

Date Received: *07.17.19*   Reviewed By: [signature]   Date Reviewed: *07.26.19*

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: M. Walsh	Project Information: **Bucknam Road Bridge No. 5830, MEDOT** **Falmouth, ME** GZA Project Number: 09.0026023.00 Summary Page: 4 of 5 Report Date: 07.25.19

LABORATORY TESTING DATA SHEET

Boring ID	Sample No.	Depth (ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				As Received Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Water 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"	Perme-ability cm/sec	
				D2216	D4318		D6913			D2874	D854			D1557						
BB-FBR-104	1D	4-6	S-15	2.4			14.2	83.8	2.0											Brown f-c SAND, little fine Gravel, trace Silt
BB-FBR-104	2D	9-11	S-16	21.8			0.0	36.2	63.8											Brown SANDY CLAYEY SILT
BB-FBR-104	5D	18-20	S-17				5.6	88.6	5.8											Brown f-c SAND, trace Silt, trace fine Gravel
BB-FBR-104	8D	24-26	S-18				0.0	78.8	21.2											Dark Brown fine SAND, some Silt
BB-FBR-104	10D	29-31	S-19	37.3	36	21														Gray SILTY CLAY
BB-FBR-104	12D	44-46	S-20	32.6																Water Content Only
BB-FBR-104	14D	69-71	S-21	23.4																Water Content Only
BB-FBR-104	15D	74-76	S-22				0.0	58.3	41.7											Grey SILTY fine SAND
BB-FBR-104	18D	89-91	S-23				0.0	92.7	7.3											Light Brown f-m SAND, trace Silt

Date Received: *07.17.19*

Reviewed By:

Date Reviewed: *07.26.19*

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: M. Walsh	Project Information: **Bucknam Road Bridge No. 5830, MEDOT** **Falmouth, ME** GZA Project Number: 09.0026023.00 Summary Page: 5 of 5 Report Date: 07.25.19

LABORATORY TESTING DATA SHEET

Boring ID	Sample No.	Depth (ft)	Laboratory No.	Identification Tests: As Received Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Proctor / CBR / Permeability Tests: Dry unit wt. pcf	Test Water 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"	Perme-ability cm/sec	Laboratory Log and Soil Description
				D2216	D4318		D6913			D2874	D854			D1557						
BB-FBR-106	2D	4-6	S-24	25.7			0.7	36.6	62.7											Brown SANDY, CLAYEY SILT, trace fine Gravel
BB-FBR-106	4D	8-10	S-25	21.6			0.0	79.2	20.8											Brown fine SAND, some Silt
BB-FBR-106	6D	15-17	S-26	48.3	48	21														Gray Silty CLAY
BB-FBR-106	8D	24-26	S-27	44.7	50	24														Gray Silty CLAY
BB-FBR-106	9D	29-31	S-28	38.4																Water Content Only
BB-FBR-106	10D	45-47	S-29	37.2	39	19														Gray SILTY CLAY
BB-FBR-106	11D	50-52	S-30	37.4																Water Content Only
BB-FBR-106	12D	57-59	S-31	34.5																Water Content Only
BB-FBR-106	14D	69-71	S-32	21.6			0.0	42.0	58.0											Gray SANDY, CLAYEY SILT
BB-FBR-106	16D	79-81	S-33	15.7			0.0	92.8	7.2											Gray f-c SAND, trace Silt

Date Received: *07.17.19*   Reviewed By: Sth Aw   Date Reviewed: *07.26.19*

THIELSCH ENGINEERING

State of Maine - Department of Transportation

Laboratory Testing Summary Sheet

Bucknam Road Bridge No. 5830

MDOT Project Number: WIN 21720.00

GZA Project Number: 09.0026023.00

Town: Falmouth, ME

Boring Identification Number	Station (Feet)	Sample No.	Depth (Feet)	Lab Number	Organic %	W.C.	L.L.	P.I.	Classification		
									Unified	AASHTO	Frost
BB-FBR-102		2D	4-6	S-1		5.9			SM	A-1-b	II
BB-FBR-102		4D	14-16	S-2		17.9			SM	A-2-4(0)	III
BB-FBR-102		6D	18-20	S-3					SW	A-1-b	I
BB-FBR-102		11D	29-31	S-4		42.9					
BB-FBR-102		13D	54-56	S-5		32.3	34	15	CL	A-6	III
BB-FBR-102		15D	64-66	S-6					SM	A-2-4(0)	III
BB-FBR-103		2D	2-4	S-7		20.0			SP-SM	A-3	II
BB-FBR-103		4D	6-8	S-8		51.6	48	28	CL	A-7	III
BB-FBR-103		5D	9-11	S-9		47.6					
BB-FBR-103		6D	19-21	S-10		38.1	40	20	CL	A-6	III
BB-FBR-103		9D	34-36	S-11		34.7					
BB-FBR-103A		7D	44-46	S-12		32.1	31	18	CL	A-6(16)	IV
BB-FBR-103A		9D	54-56	S-13					SW-SM	A-1-b	II
BB-FBR-103A		11D	64-66	S-14					SP-SM	A-1-b	II
BB-FBR-104		1D	4-6	S-15		2.4			SP	A-1-b	0
BB-FBR-104		2D	9-11	S-16		21.8			CL	A-4(3)	IV
BB-FBR-104		5D	18-20	S-17					SP-SM	A-1-b	II
BB-FBR-104		8D	24-26	S-18					SM	A-2-4(0)	II
BB-FBR-104		10D	29-31	S-19		37.3	36	15	CL	A-6	III
BB-FBR-104		12D	44-46	S-20		32.6					
BB-FBR-104		14D	69-71	S-21		23.4					
BB-FBR-104		15D	74-76	S-22					SM	A-4(0)	IV
BB-FBR-104		18D	89-91	S-23					SP-SM	A-3	II
BB-FBR-106		2D	4-6	S-24		25.7			CL	A-4	IV
BB-FBR-106		4D	8-10	S-25		21.6			SM	A-2-4(0)	II
BB-FBR-106		6D	15-17	S-26		48.3	48	27	CL	A-7	III
BB-FBR-106		8D	24-26	S-27		44.7	50	26	CL	A-7	III
BB-FBR-106		10D	45-47	S-29		37.2	39	20	CL	A-6	III
BB-FBR-106		11D	50-52	S-30		37.4					
BB-FBR-106		12D	57-59	S-31		34.5					
BB-FBR-106		14D	69-71	S-32		21.6			CL	A-4(0)	IV
BB-FBR-106		16D	79-81	S-33		15.7			SP-SM	A-3	II

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

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	19.7	8.1	34.9	21.2	16.1	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	86.7		
0.375"	85.2		
#4	80.3		
#10	72.2		
#20	53.2		
#40	37.3		
#60	24.9		
#100	19.3		
#200	16.1		

* (no specification provided)

Material Description

Dark Brown f-c SAND, little fine Gravel, little 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}= 14.6226 D_{85}= 8.7126 D_{60}= 1.1244
D_{50}= 0.7390 D_{30}= 0.3171 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 07.17.19 **Date Tested:** 07.22.19

Tested By: MN / JM

Checked By: Rebecca Roth

Title: Laboratory Coordinator

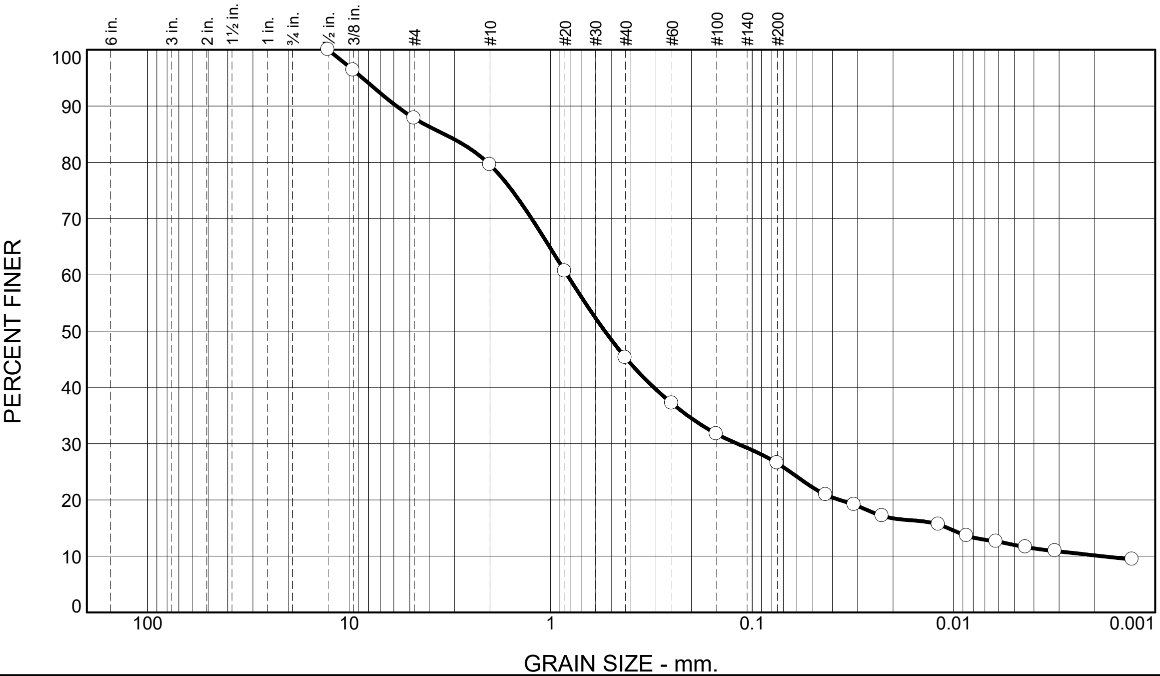
Source of Sample: BB-FBR-102 **Depth:** 4-6' **Date Sampled:**
Sample Number: 2D

Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental
Project: Bucknam Road Bridge No. 5830, MEDOT WIN 21720.00
Falmouth, ME
Project No: 09.0026023.00 **Figure** S-1

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	12.2	8.2	34.3	18.8	16.4	10.1

Test Results (D7928 & ASTM D 1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.5"	100.0		
0.375"	96.4		
#4	87.8		
#10	79.6		
#20	60.7		
#40	45.3		
#60	37.2		
#100	31.7		
#200	26.5		
0.0430 mm.	20.9		
0.0311 mm.	19.1		
0.0226 mm.	17.1		
0.0119 mm.	15.6		
0.0086 mm.	13.6		
0.0061 mm.	12.6		
0.0044 mm.	11.6		
0.0031 mm.	10.9		
0.0013 mm.	9.4		

* (no specification provided)

Material Description

Gray f-c SAND, some Clayey Silt, little fine Gravel

Atterberg Limits (ASTM D 4318)

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

Classification

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

Coefficients

D_{90}= 5.8135 D_{85}= 3.3702 D_{60}= 0.8276
D_{50}= 0.5380 D_{30}= 0.1185 D_{15}= 0.0107
D_{10}= 0.0018 C_u= 450.65 C_c= 9.25

Remarks

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

Date Received: 07.17.19 **Date Tested:** 07.25.19

Tested By: IA / MN

Checked By: Rebecca Roth

Title: Laboratory Coordinator

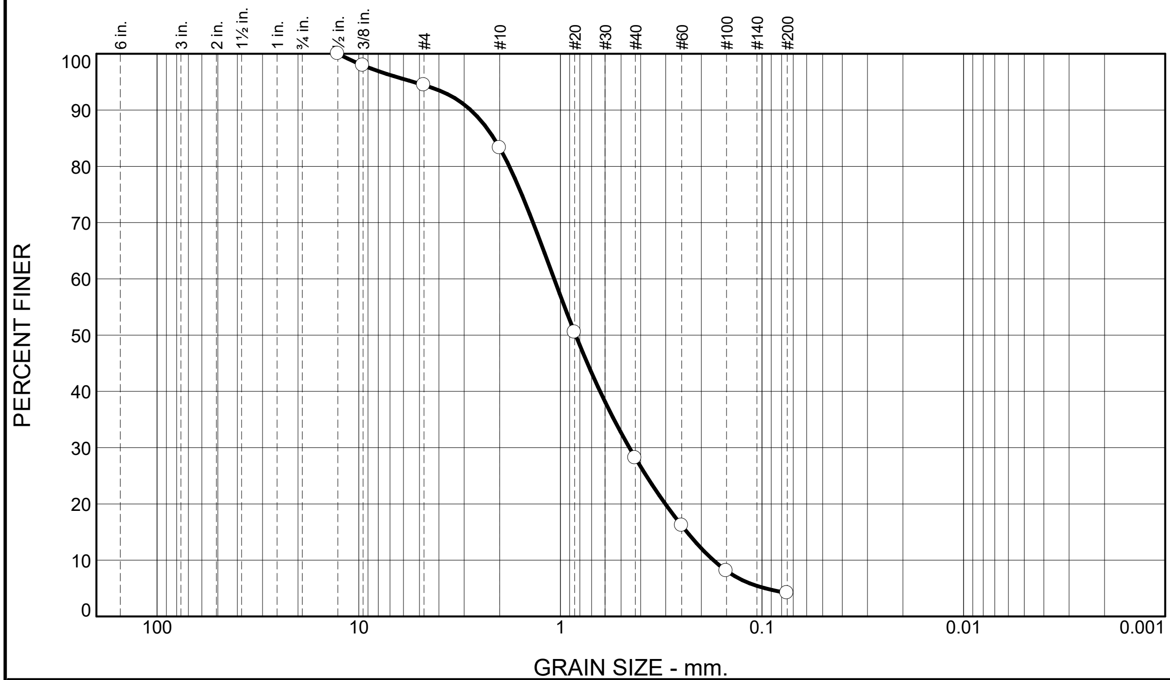
Source of Sample: BB-FBR-102 **Depth:** 14-16' **Date Sampled:**
Sample Number: 4D

Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental
Project: Bucknam Road Bridge No. 5830, MEDOT WIN 21720.00
Falmouth, ME
Project No: 09.0026023.00 **Figure** S-2

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	5.6	11.1	55.1	24.1	4.1	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.5"	100.0		
0.375"	97.9		
#4	94.4		
#10	83.3		
#20	50.5		
#40	28.2		
#60	16.1		
#100	8.1		
#200	4.1		

* (no specification provided)

Material Description

Dark Brown f-c SAND, trace fine Gravel, trace Silt

Atterberg Limits (ASTM D 4318)

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

Classification

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

Coefficients

$D_{90}=$ 2.7804 $D_{85}=$ 2.1367 $D_{60}=$ 1.0732
$D_{50}=$ 0.8397 $D_{30}=$ 0.4551 $D_{15}=$ 0.2354
$D_{10}=$ 0.1744 $C_u=$ 6.16 $C_c=$ 1.11

Remarks

Date Received: 07.17.19 **Date Tested:** 07.22.19

Tested By: MN / JM

Checked By: Rebecca Roth

Title: Laboratory Coordinator

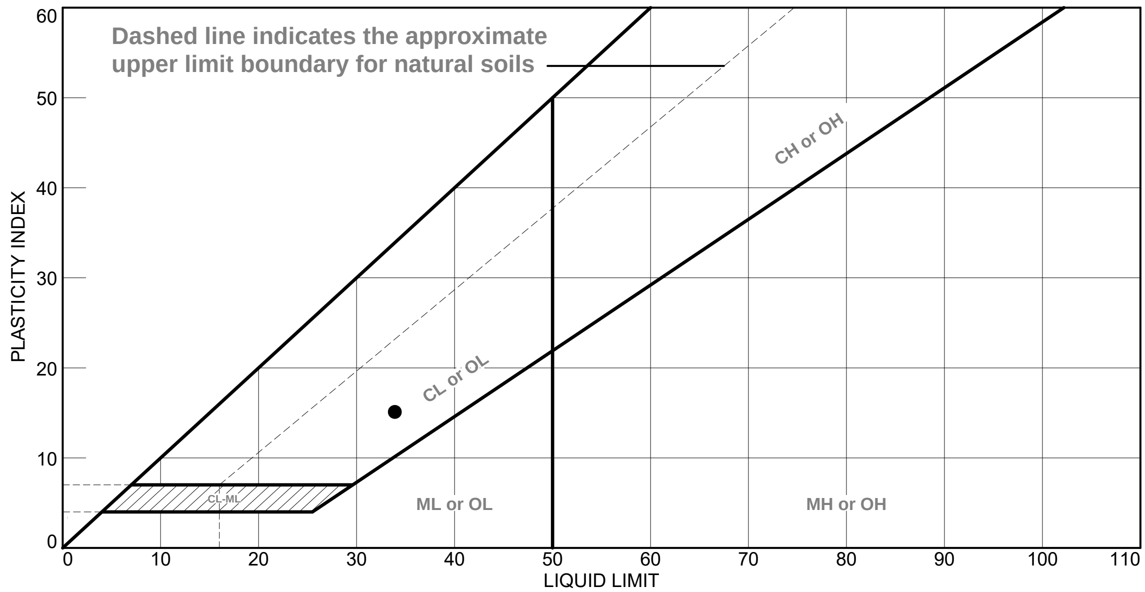
Source of Sample: BB-FBR-102 **Depth:** 18-20'
Sample Number: 6D
Date Sampled:

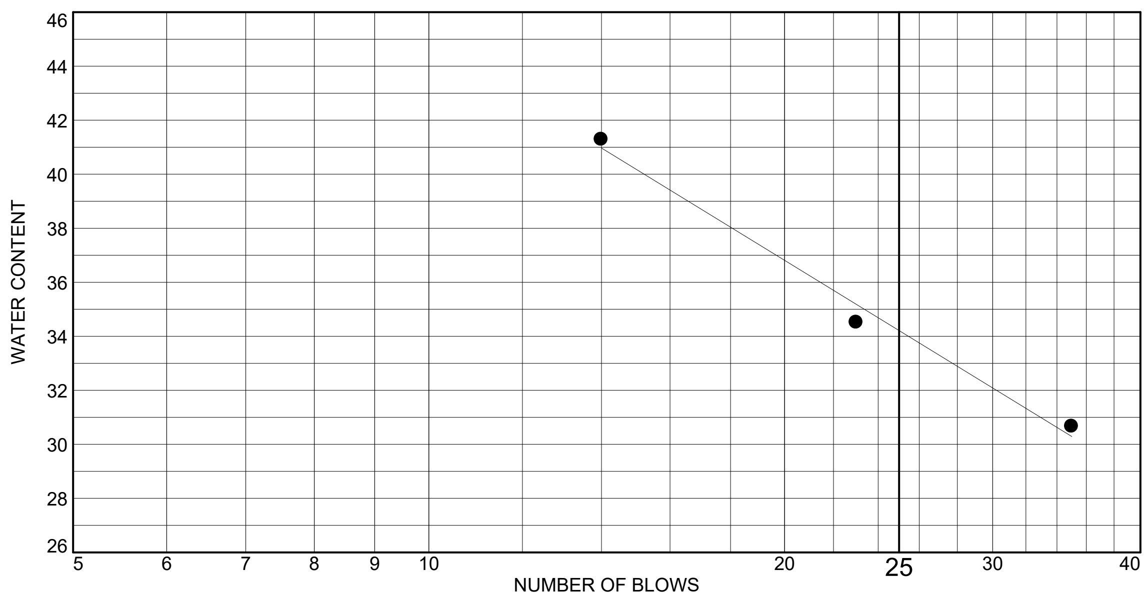
Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental
Project: Bucknam Road Bridge No. 5830, MEDOT WIN 21720.00
Falmouth, ME
Project No: 09.0026023.00 **Figure** S-3

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray SILTY CLAY	34	19	15			CL

Project No. 09.0026023.00 **Client:** GZA GeoEnvironmental

Project: Bucknam Road Bridge No. 5830, MEDOT WIN 21720.00

Falmouth, ME

Source of Sample: BB-FBR-102 **Depth:** 54-56'

Sample Number: 13D

Thielsch Engineering Inc.

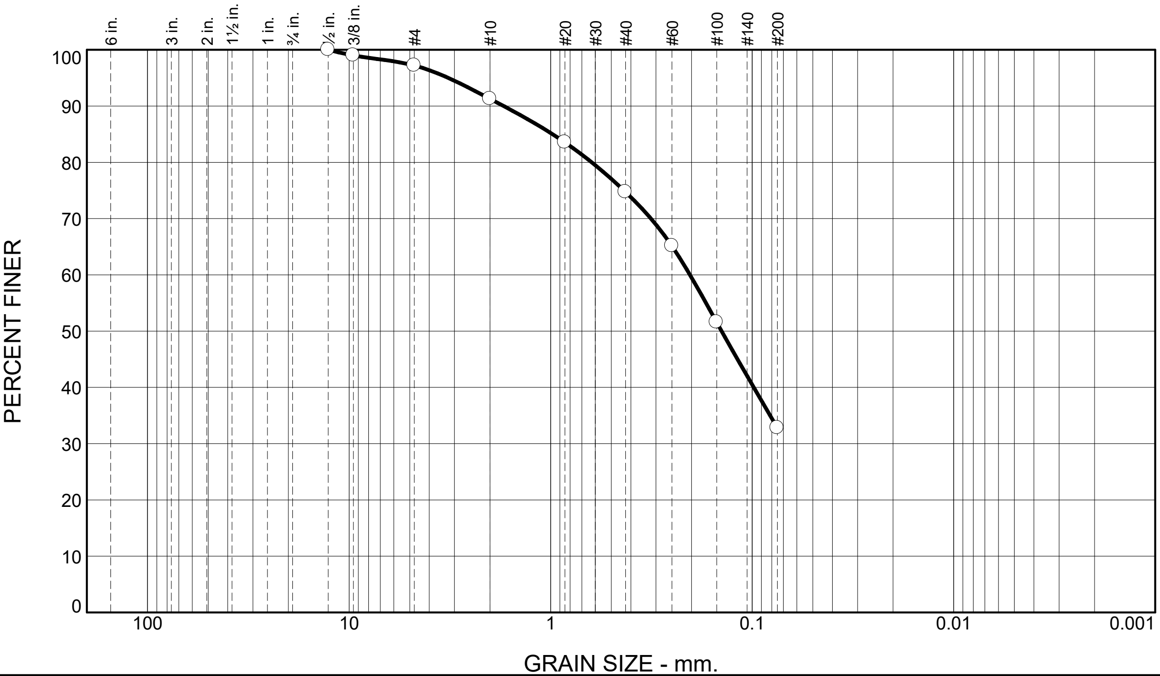
Cranston, RI

Remarks:

Figure L-5

Tested By: MN **Checked By:** RR

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.8	5.9	16.6	41.9	32.8	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.5"	100.0		
0.375"	99.0		
#4	97.2		
#10	91.3		
#20	83.6		
#40	74.7		
#60	65.1		
#100	51.6		
#200	32.8		

* (no specification provided)

Material Description

Brown f-m SAND, some Silt, trace 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}= 1.7088 D_{85}= 0.9773 D_{60}= 0.2035
D_{50}= 0.1418 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 07.17.19 **Date Tested:** 07.22.19

Tested By: MN / JM

Checked By: Rebecca Roth

Title: Laboratory Coordinator

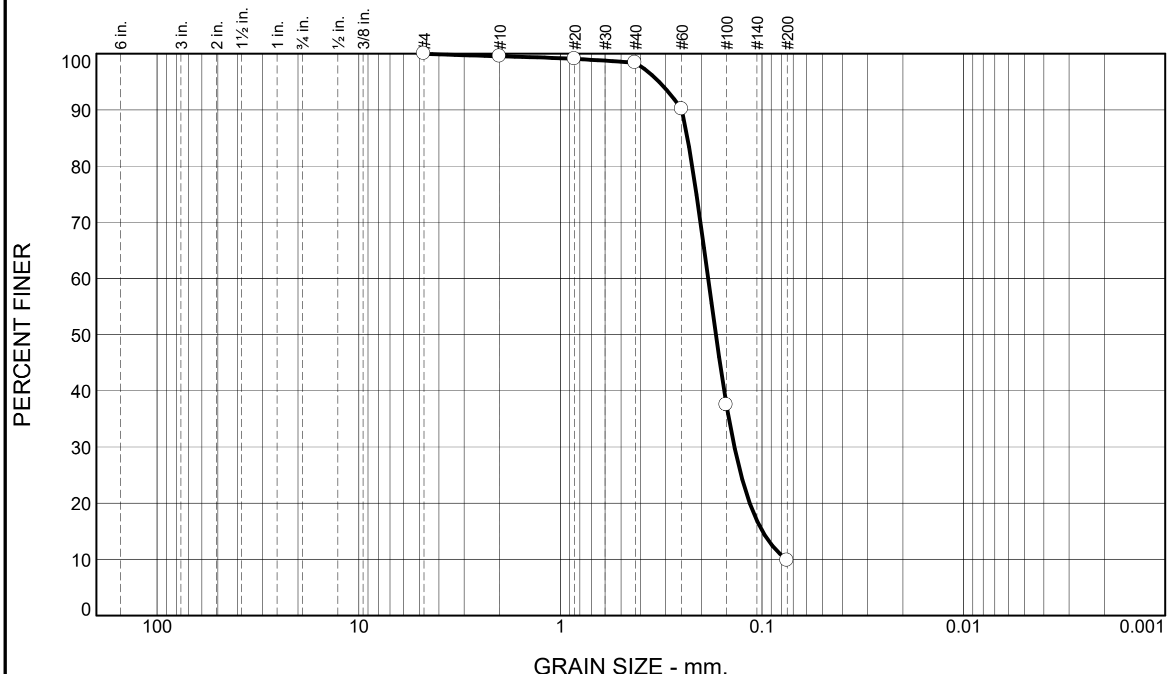
Source of Sample: BB-FBR-102 **Depth:** 64-66' **Date Sampled:**
Sample Number: 15D

Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental
Project: Bucknam Road Bridge No. 5830, MEDOT WIN 21720.00
Falmouth, ME
Project No: 09.0026023.00 **Figure** S-6

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.5	1.1	88.6	9.8	

Test Results (D6913 & ASTM D 1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.5		
#20	99.1		
#40	98.4		
#60	90.1		
#100	37.5		
#200	9.8		

* (no specification provided)

Material Description

Brown fine SAND, trace Silt

Atterberg Limits (ASTM D 4318)

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

Classification

USCS (D 2487)= SP-SM **AASHTO (M 145)=** A-3

Coefficients

D_{90}= 0.2495 D_{85}= 0.2341 D_{60}= 0.1849
D_{50}= 0.1694 D_{30}= 0.1369 D_{15}= 0.0996
D_{10}= 0.0761 C_u= 2.43 C_c= 1.33

Remarks

Date Received: 07.17.19 **Date Tested:** 07.22.19

Tested By: MN / JM

Checked By: Rebecca Roth

Title: Laboratory Coordinator

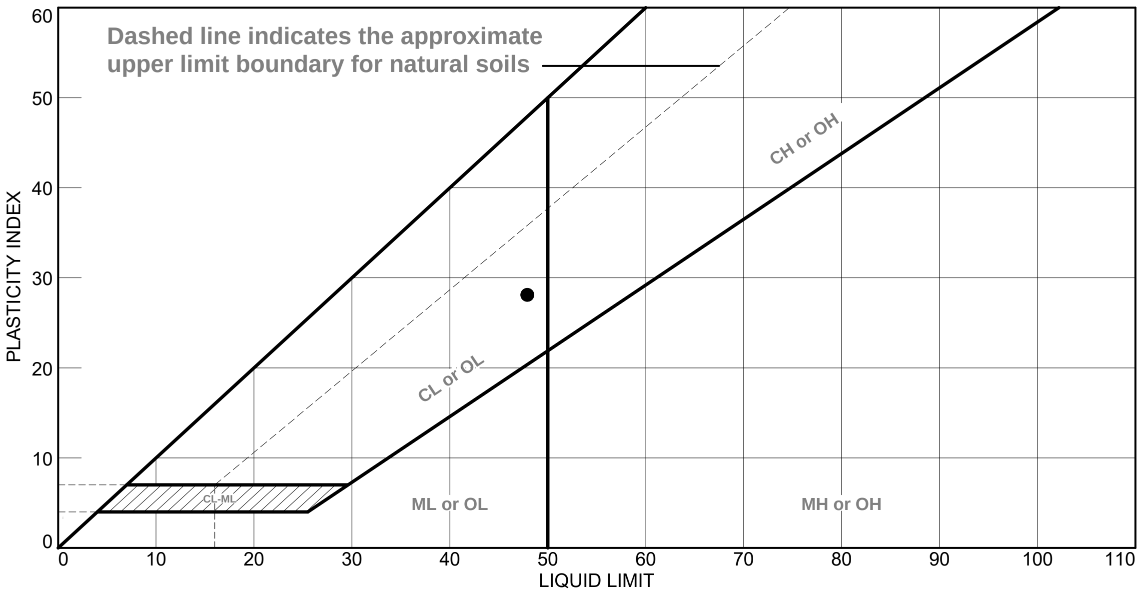
Source of Sample: BB-FBR-103 **Depth:** 2-4' **Date Sampled:**
Sample Number: 2D

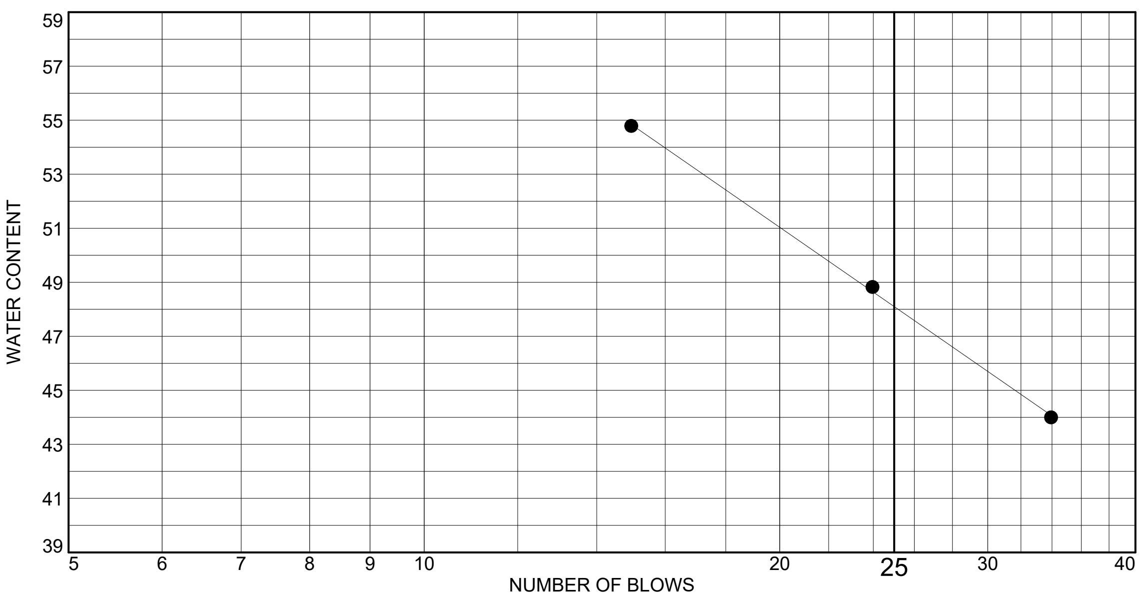
Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental
Project: Bucknam Road Bridge No. 5830, MEDOT WIN 21720.00
Falmouth, ME
Project No: 09.0026023.00 **Figure** S-7

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray SILTY CLAY	48	20	28			CL

Project No. 09.0026023.00 **Client:** GZA GeoEnvironmental

Project: Bucknam Road Bridge No. 5830, MEDOT WIN 21720.00

Falmouth, ME

Source of Sample: BB-FBR-103 **Depth:** 6-8'

Sample Number: 4D

Remarks:

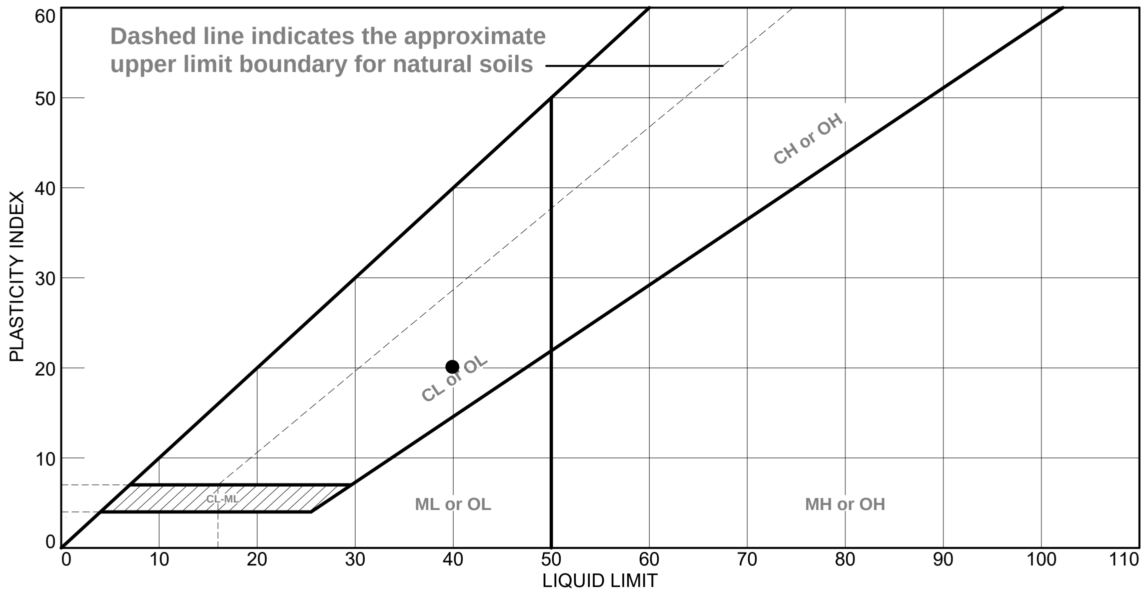
Thielsch Engineering Inc.

Cranston, RI

Figure L-8

Tested By: MN **Checked By:** RR

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray SILTY CLAY	40	20	20			CL

Project No. 09.0026023.00 **Client:** GZA GeoEnvironmental

Project: Bucknam Road Bridge No. 5830, MEDOT WIN 21720.00

Falmouth, ME

Source of Sample: BB-FBR-103 **Depth:** 19-21'

Sample Number: 6D

Remarks:

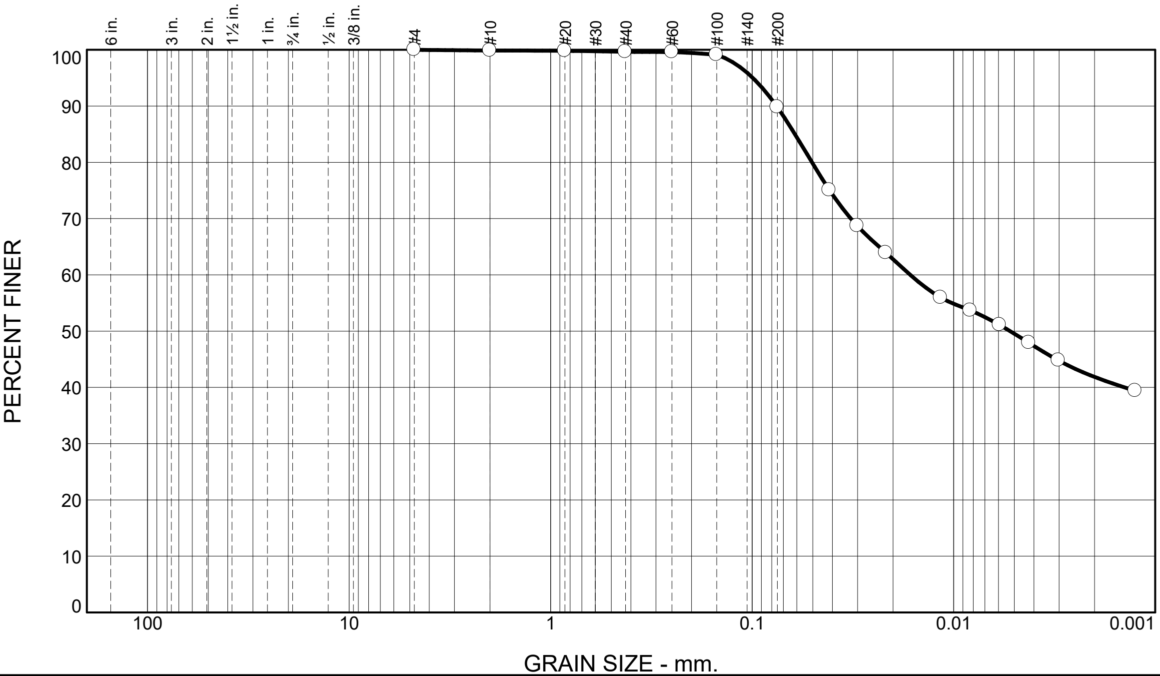
Thielsch Engineering Inc.

Cranston, RI

Figure L-10

Tested By: MN **Checked By:** RR

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.3	9.8	47.9	41.9

Test Results (D7928 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.9		
#20	99.8		
#40	99.6		
#60	99.6		
#100	99.1		
#200	89.8		
0.0414 mm.	75.1		
0.0301 mm.	68.7		
0.0217 mm.	63.9		
0.0116 mm.	55.9		
0.0083 mm.	53.7		
0.0059 mm.	51.1		
0.0042 mm.	47.9		
0.0030 mm.	44.8		
0.0013 mm.	39.4		

* (no specification provided)

Material Description

Gray SILTY CLAY, little fine Sand

Atterberg Limits (ASTM D 4318)

PL= 19 **LL=** 37 **PI=** 18

Classification

USCS (D 2487)= CL **AASHTO (M 145)=** A-6(16)

Coefficients

D_{90}= 0.0757 D_{85}= 0.0613 D_{60}= 0.0164
D_{50}= 0.0052 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 07.17.19 **Date Tested:** 07.25.19

Tested By: IA / MN

Checked By: Rebecca Roth

Title: Laboratory Coordinator

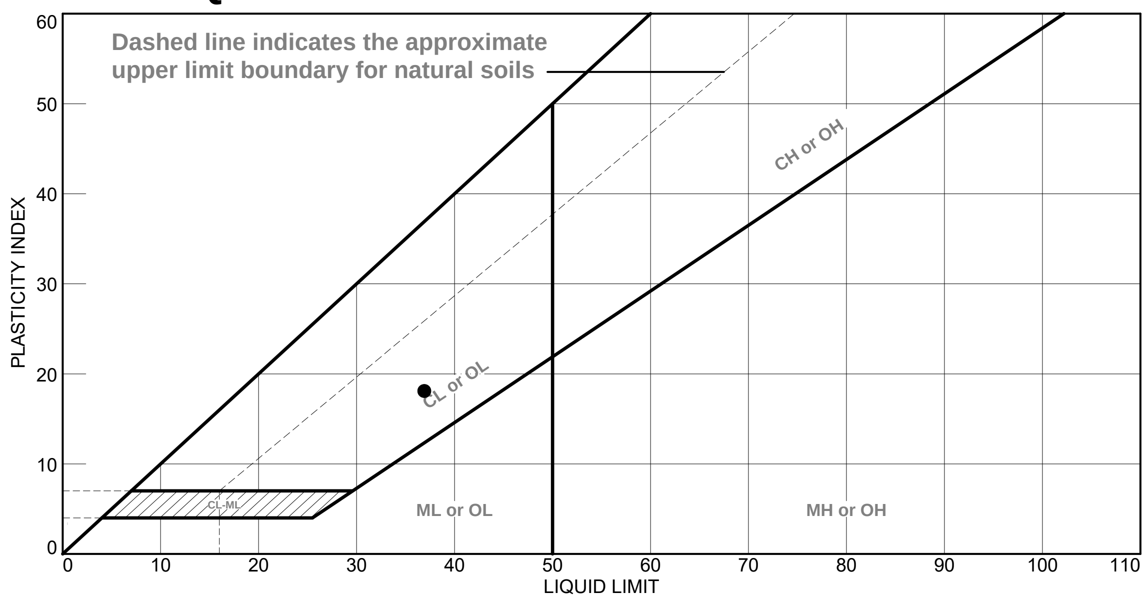
Source of Sample: BB-FBR-103A **Depth:** 44-46' **Date Sampled:**
Sample Number: 7D

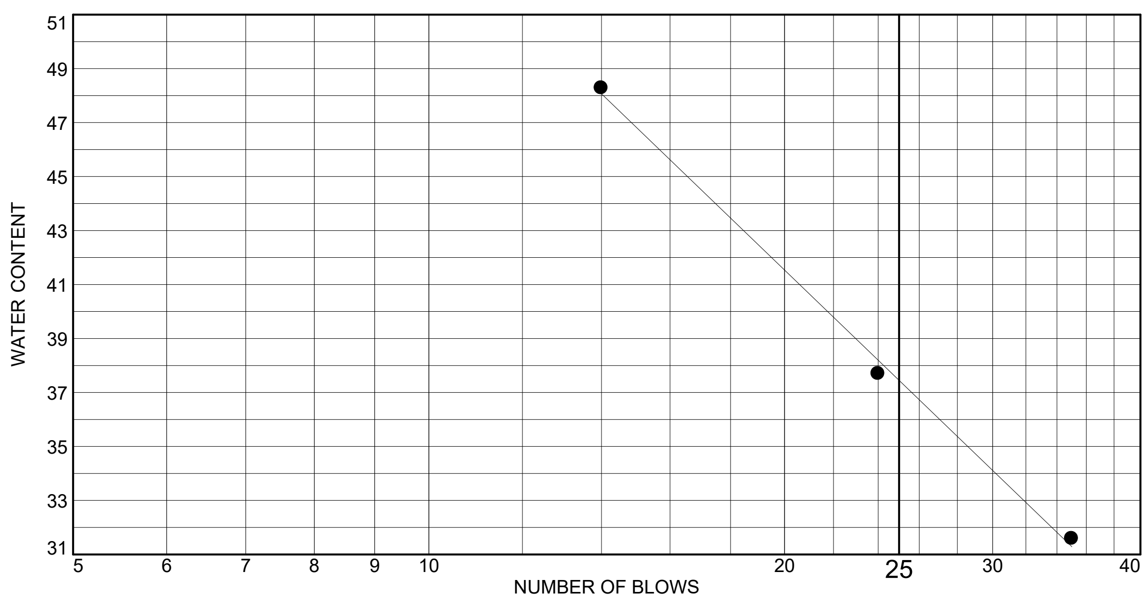
Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental
Project: Bucknam Road Bridge No. 5830, MEDOT WIN 21720.00
Falmouth, ME
Project No: 09.0026023.00 **Figure** S-12

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray SILTY CLAY, little fine Sand	37	19	18	99.6	89.8	CL

Project No. 09.0026023.00 **Client:** GZA GeoEnvironmental

Project: Bucknam Road Bridge No. 5830, MEDOT WIN 21720.00

Falmouth, ME

Source of Sample: BB-FBR-103A **Depth:** 44-46'

Sample Number: 7D

Thielsch Engineering Inc.

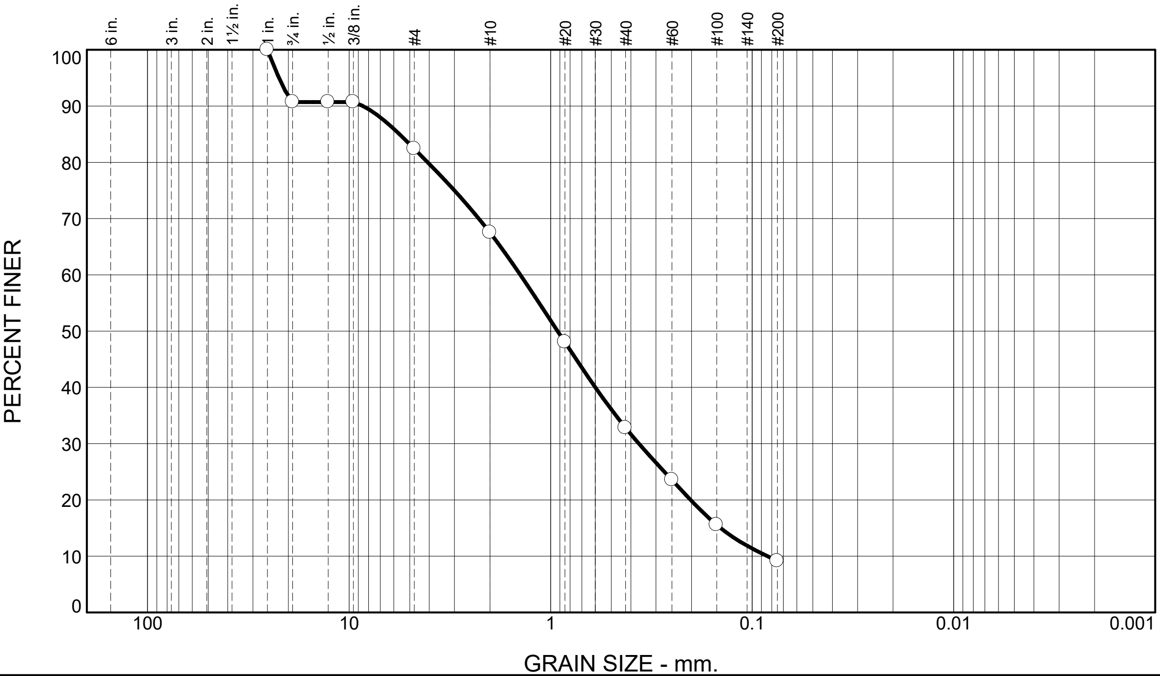
Cranston, RI

Remarks:

Figure L-12

Tested By: MN **Checked By:** RR

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	9.3	8.3	14.9	34.7	23.6	9.2	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
0.75"	90.7		
0.5"	90.7		
0.375"	90.7		
#4	82.4		
#10	67.5		
#20	48.1		
#40	32.8		
#60	23.6		
#100	15.6		
#200	9.2		

* (no specification provided)

Material Description

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

Atterberg Limits (ASTM D 4318)

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

Classification

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

Coefficients

D_{90}= 8.5196 D_{85}= 5.6218 D_{60}= 1.4128
D_{50}= 0.9228 D_{30}= 0.3649 D_{15}= 0.1435
D_{10}= 0.0841 C_u= 16.81 C_c= 1.12

Remarks

Date Received: 07.17.19 **Date Tested:** 07.22.19
Tested By: MN / JM
Checked By: Rebecca Roth
Title: Laboratory Coordinator

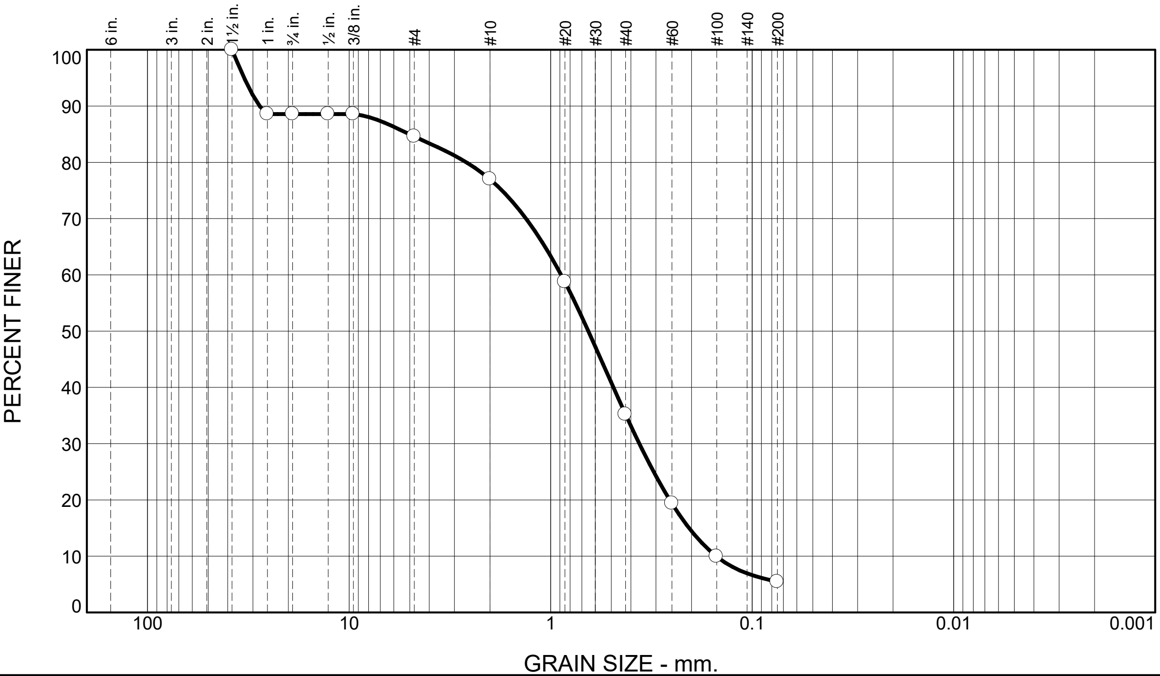
Source of Sample: BB-FBR-103A **Depth:** 54-56' **Date Sampled:**
Sample Number: 9D

Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental
Project: Bucknam Road Bridge No. 5830, MEDOT WIN 21720.00
Falmouth, ME
Project No: 09.0026023.00 **Figure** S-13

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	11.4	4.0	7.6	41.8	29.7	5.5	

Test Results (D6913 & ASTM D 1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1-1/2"	100.0		
1"	88.6		
3/4"	88.6		
1/2"	88.6		
3/8"	88.6		
#4	84.6		
#10	77.0		
#20	58.8		
#40	35.2		
#60	19.4		
#100	9.9		
#200	5.5		

* (no specification provided)

Material Description

Brown f-m SAND, little f-c Gravel, trace Silt

Atterberg Limits (ASTM D 4318)

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

Classification

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

Coefficients

D_{90}= 27.7583 D_{85}= 5.0179 D_{60}= 0.8866
D_{50}= 0.6496 D_{30}= 0.3630 D_{15}= 0.2055
D_{10}= 0.1507 C_u= 5.88 C_c= 0.99

Remarks

Date Received: 07.17.19 **Date Tested:** 07.22.19

Tested By: MN / JM

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: BB-FBR-103A **Depth:** 64-66' **Date Sampled:**
Sample Number: 11D

Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental
Project: Bucknam Road Bridge No. 5830, MEDOT WIN 21720.00
Falmouth, ME
Project No: 09.0026023.00 **Figure** S-14

Particle Size Distribution Report

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	14.2	12.6	49.8	21.4	2.0	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	98.1		
0.375"	92.9		
#4	85.8		
#10	73.2		
#20	46.2		
#40	23.4		
#60	8.4		
#100	3.5		
#200	2.0		

* (no specification provided)

Material Description

Brown f-c SAND, little fine Gravel, trace Silt

Atterberg Limits (ASTM D 4318)

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

Classification

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

Coefficients

D_{90}= 7.7869	D_{85}= 4.3232	D_{60}= 1.2764
D_{50}= 0.9512	D_{30}= 0.5204	D_{15}= 0.3254
D_{10}= 0.2693	C_u= 4.74	C_c= 0.79

Remarks

Date Received: 07.17.19 **Date Tested:** 07.22.19

Tested By: MN / JM

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: BB-FBR-104 **Depth:** 4-6' **Date Sampled:**

Sample Number: 1D

Thielsch Engineering Inc.

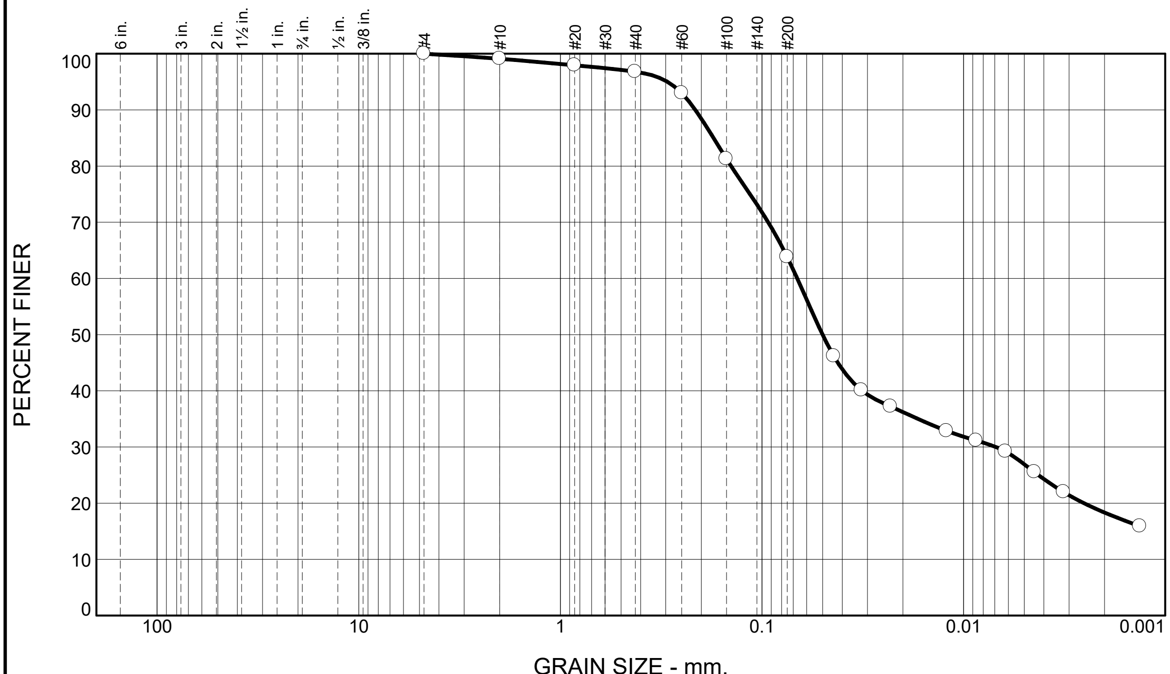
Cranston, RI

Client: GZA GeoEnvironmental

Project: Bucknam Road Bridge No. 5830, MEDOT WIN 21720.00
Falmouth, ME

Project No: 09.0026023.00 **Figure** S-15

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.9	2.3	33.0	45.5	18.3

Test Results (D7928 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.1		
#20	97.9		
#40	96.8		
#60	93.0		
#100	81.3		
#200	63.8		
0.0440 mm.	46.2		
0.0321 mm.	40.1		
0.0230 mm.	37.2		
0.0121 mm.	32.9		
0.0087 mm.	31.1		
0.0062 mm.	29.2		
0.0044 mm.	25.5		
0.0032 mm.	22.0		
0.0013 mm.	15.9		

* (no specification provided)

Material Description

Brown SANDY CLAYEY SILT

Atterberg Limits (ASTM D 4318)

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

Classification

USCS (D 2487)= CL **AASHTO (M 145)=** A-4(3)

Coefficients

D_{90}= 0.2140 D_{85}= 0.1739 D_{60}= 0.0668
D_{50}= 0.0501 D_{30}= 0.0069 D_{15}=
D_{10}= C_u= C_c=

Remarks

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

Date Received: 07.17.19 **Date Tested:** 07.25.19

Tested By: IA / MN

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: BB-FBR-104 **Depth:** 9-11' **Date Sampled:**
Sample Number: 2D

Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental
Project: Bucknam Road Bridge No. 5830, MEDOT WIN 21720.00
Falmouth, ME
Project No: 09.0026023.00 **Figure** S-16

Particle Size Distribution Report

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	5.6	13.0	43.8	31.8	5.8	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.5"	100.0		
0.375"	98.8		
#4	94.4		
#10	81.4		
#20	54.5		
#40	37.6		
#60	20.7		
#100	10.6		
#200	5.8		

* (no specification provided)

Material Description

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

Atterberg Limits (ASTM D 4318)

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

Classification

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

Coefficients

D_{90}= 3.1114 D_{85}= 2.3275 D_{60}= 1.0215
D_{50}= 0.7110 D_{30}= 0.3347 D_{15}= 0.1972
D_{10}= 0.1423 C_u= 7.18 C_c= 0.77

Remarks

Date Received: 07.17.19 **Date Tested:** 07.22.19

Tested By: MN / JM

Checked By: Rebecca Roth

Title: Laboratory Coordinator

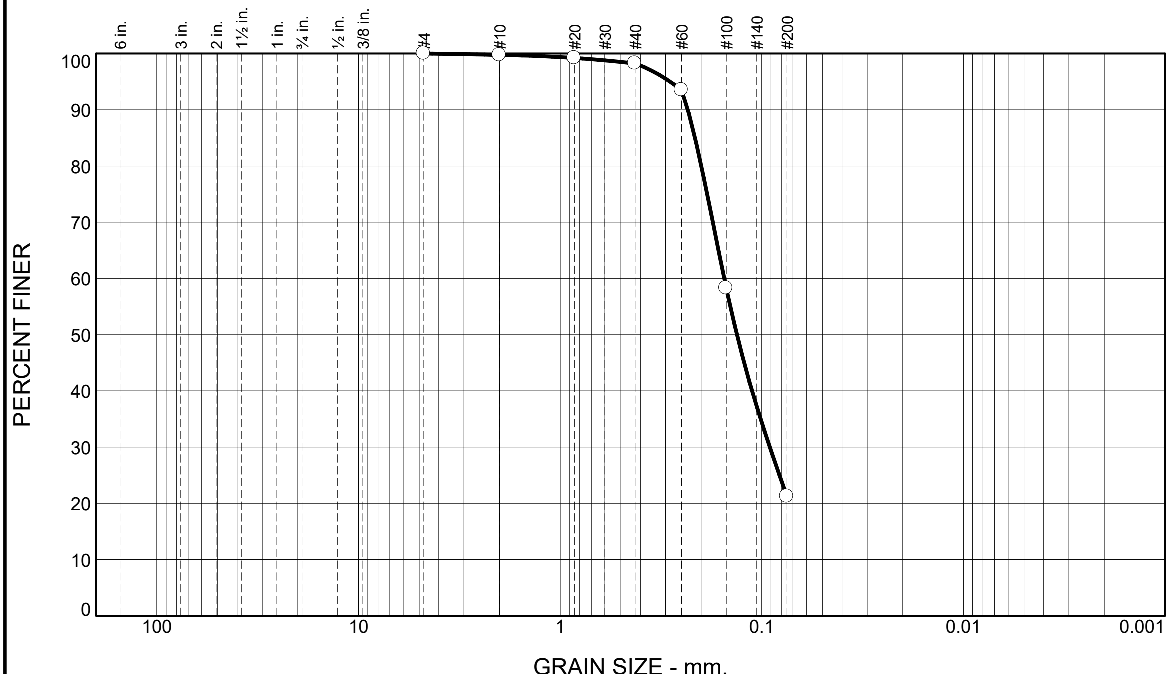
Source of Sample: BB-FBR-104 **Depth:** 18-20' **Date Sampled:**
Sample Number: 5D

Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental
Project: Bucknam Road Bridge No. 5830, MEDOT WIN 21720.00
Falmouth, ME
Project No: 09.0026023.00 **Figure** S-17

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.3	1.5	77.0	21.2	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.7		
#20	99.2		
#40	98.2		
#60	93.5		
#100	58.3		
#200	21.2		

* (no specification provided)

Material Description

Dark Brown fine SAND, some Silt

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}= 0.2325 D_{85}= 0.2142 D_{60}= 0.1536
D_{50}= 0.1327 D_{30}= 0.0912 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 07.17.19 **Date Tested:** 07.22.19

Tested By: IA / JM

Checked By: Rebecca Roth

Title: Laboratory Coordinator

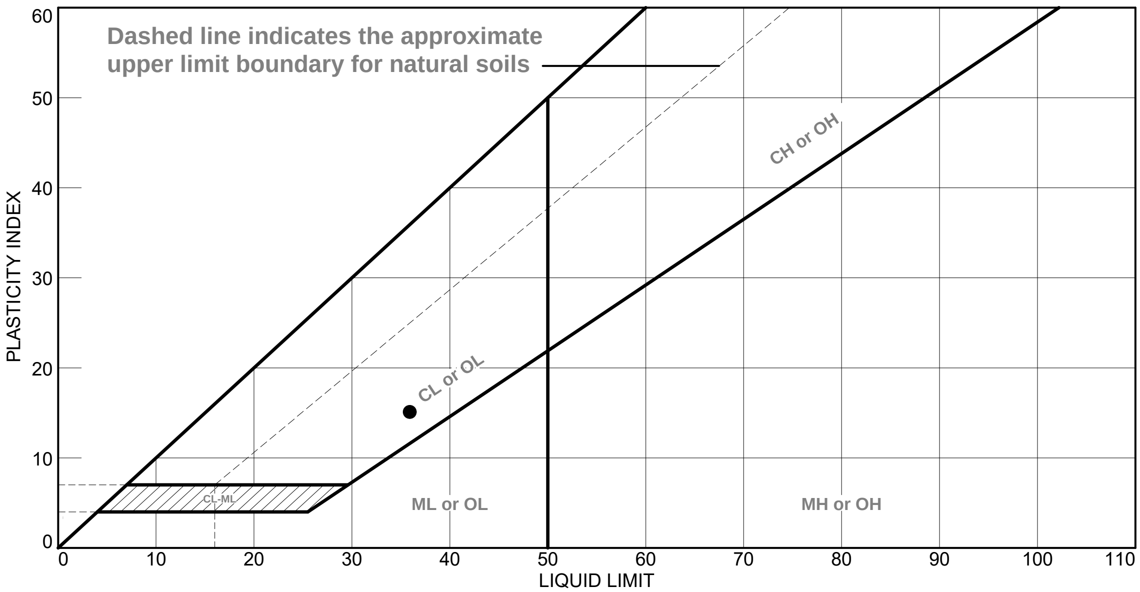
Source of Sample: BB-FBR-104 **Depth:** 24-26' **Date Sampled:**
Sample Number: 8D

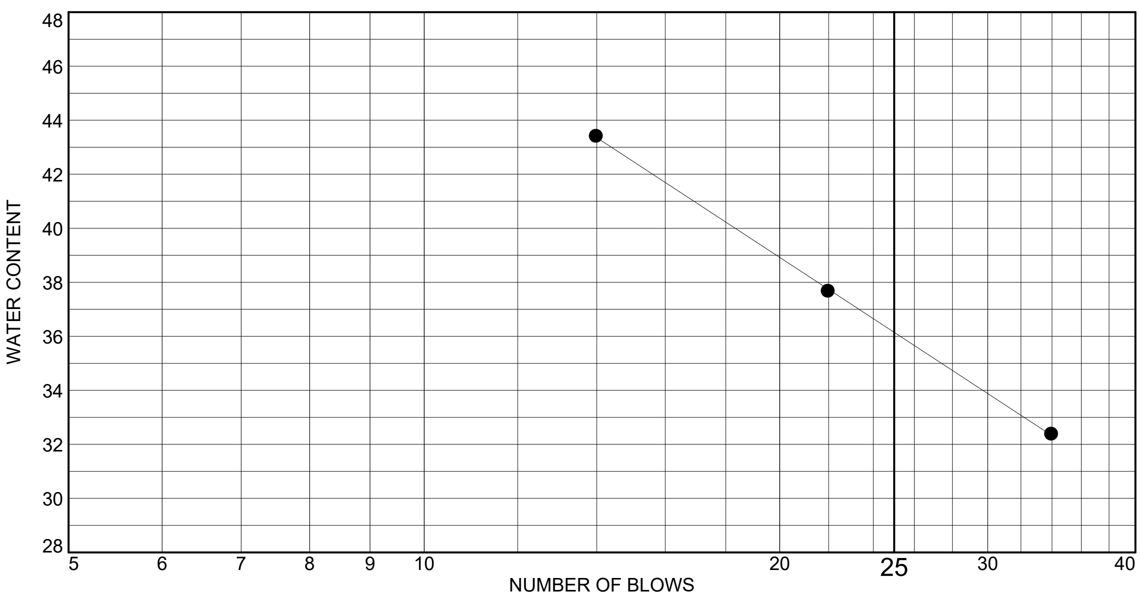
Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental
Project: Bucknam Road Bridge No. 5830, MEDOT WIN 21720.00
Falmouth, ME
Project No: 09.0026023.00 **Figure** S-18

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray SILTY CLAY	36	21	15			CL

Project No. 09.0026023.00 **Client:** GZA GeoEnvironmental

Project: Bucknam Road Bridge No. 5830, MEDOT WIN 21720.00

Falmouth, ME

Source of Sample: BB-FBR-104 **Depth:** 29-31'

Sample Number: 10D

Thielsch Engineering Inc.

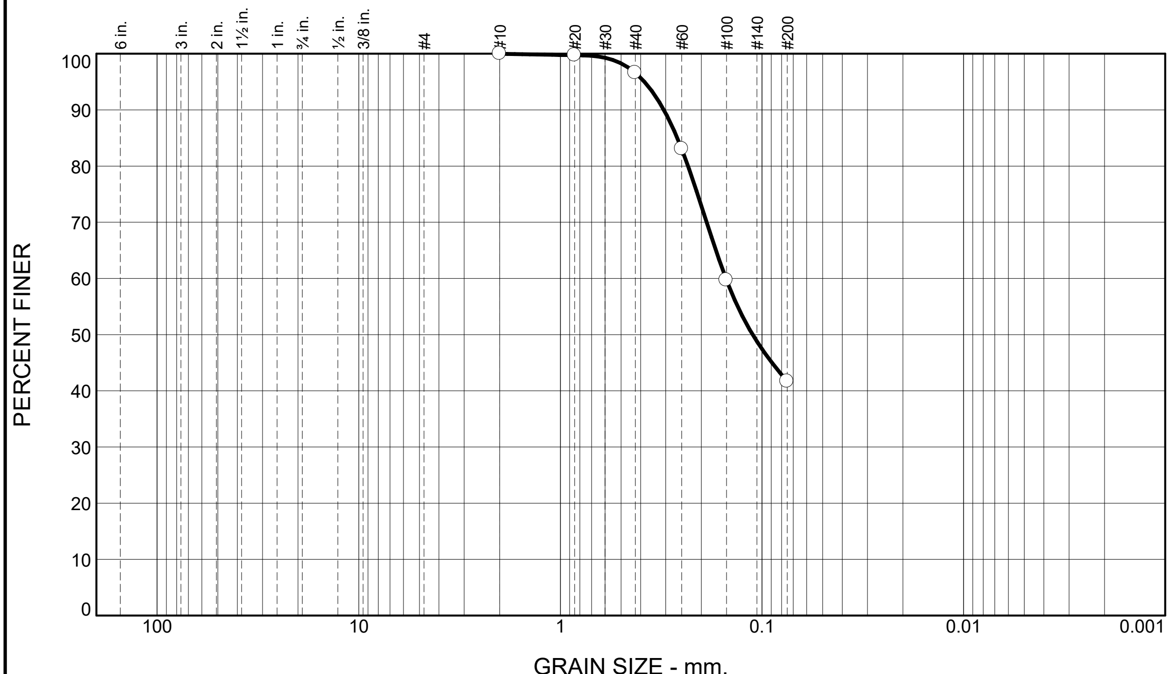
Cranston, RI

Remarks:

Figure L-19

Tested By: MN **Checked By:** RR

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	3.4	54.9	41.7	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#10	100.0		
#20	99.7		
#40	96.6		
#60	83.1		
#100	59.7		
#200	41.7		

* (no specification provided)

Material Description

Grey SILTY fine SAND

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}= 0.3067 D_{85}= 0.2629 D_{60}= 0.1511
D_{50}= 0.1112 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Sample visually classified as non-plastic.

Date Received: 07.17.19 **Date Tested:** 07.22.19

Tested By: MN / JM

Checked By: Rebecca Roth

Title: Laboratory Coordinator

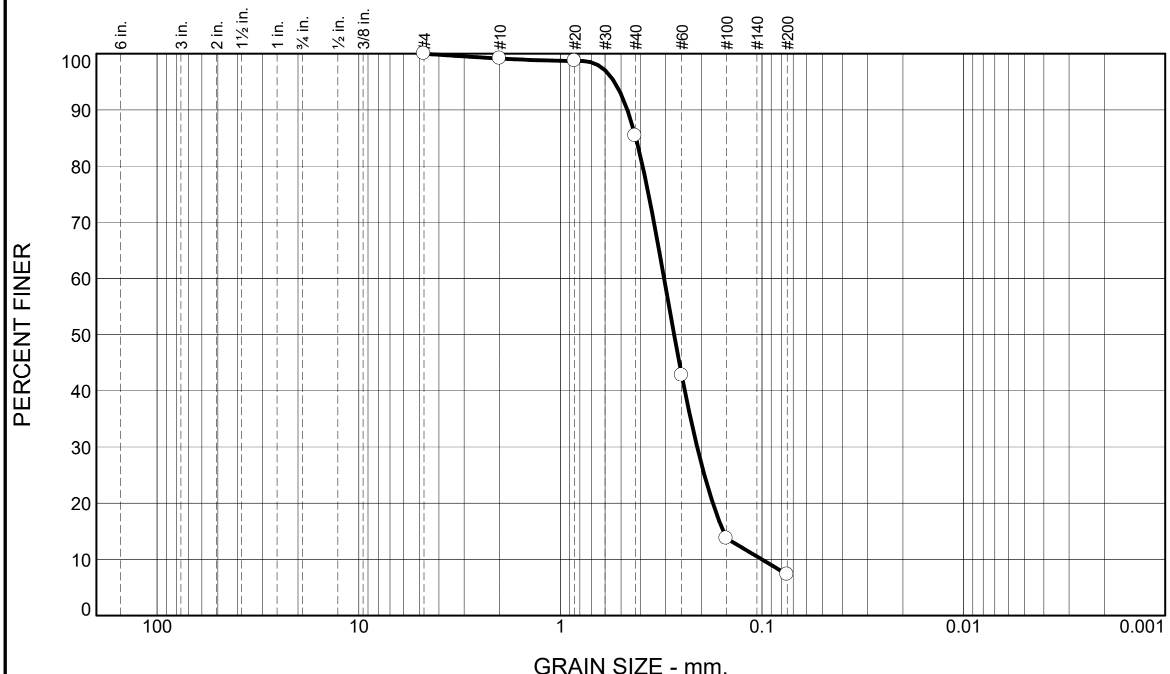
Source of Sample: BB-FBR-104 **Depth:** 74-76' **Date Sampled:**
Sample Number: 15D

Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental
Project: Bucknam Road Bridge No. 5830, MEDOT WIN 21720.00
Falmouth, ME
Project No: 09.0026023.00 **Figure** S-22

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.8	13.8	78.1	7.3	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.2		
#20	98.7		
#40	85.4		
#60	42.8		
#100	13.7		
#200	7.3		

* (no specification provided)

Material Description

Light Brown f-m SAND, trace Silt

Atterberg Limits (ASTM D 4318)

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

Classification

USCS (D 2487)= SP-SM **AASHTO (M 145)=** A-3

Coefficients

D_{90}= 0.4653 D_{85}= 0.4221 D_{60}= 0.3059
D_{50}= 0.2727 D_{30}= 0.2095 D_{15}= 0.1556
D_{10}= 0.1002 C_u= 3.05 C_c= 1.43

Remarks

Date Received: 07.17.19 **Date Tested:** 07.22.19

Tested By: MN / JM

Checked By: Rebecca Roth

Title: Laboratory Coordinator

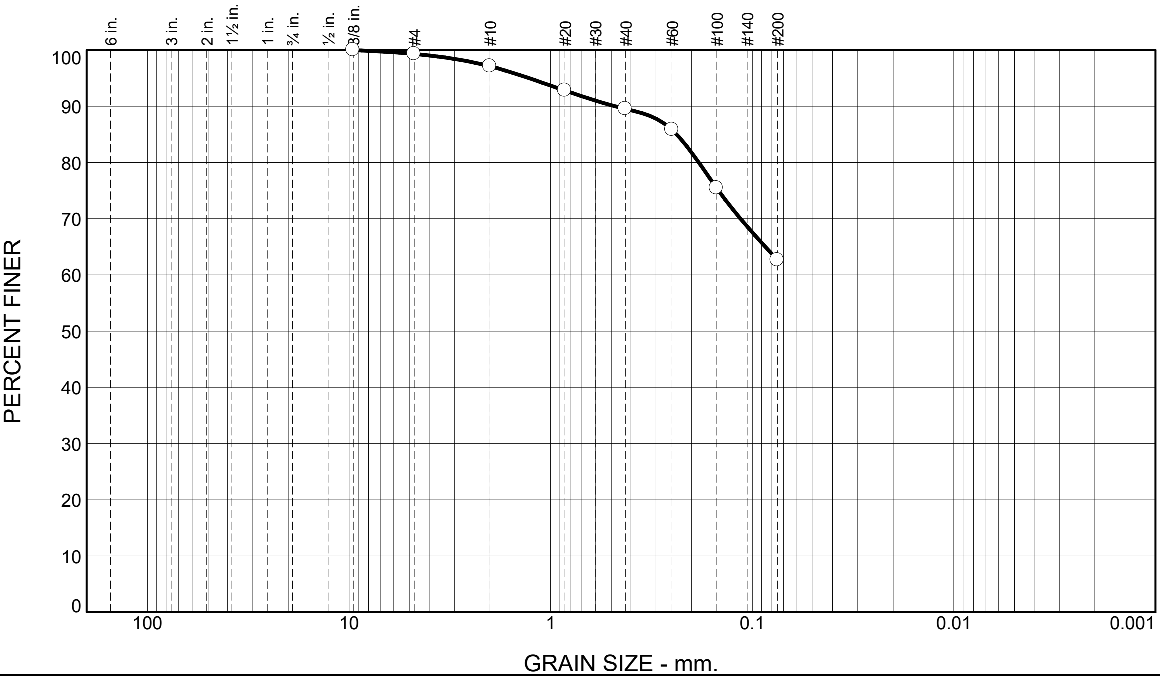
Source of Sample: BB-FBR-104 **Depth:** 89-91' **Date Sampled:**
Sample Number: 18D

Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental
Project: Bucknam Road Bridge No. 5830, MEDOT WIN 21720.00
Falmouth, ME
Project No: 09.0026023.00 **Figure** S-23

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.7	2.2	7.6	26.8	62.7	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.375"	100.0		
#4	99.3		
#10	97.1		
#20	92.8		
#40	89.5		
#60	85.8		
#100	75.4		
#200	62.7		

* (no specification provided)

Material Description

Brown SANDY, CLAYEY SILT, trace fine Gravel

Atterberg Limits (ASTM D 4318)

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

Classification

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

Coefficients

D_{90}= 0.4782 D_{85}= 0.2370 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: 07.17.19 **Date Tested:** 07.22.19

Tested By: MN / JM

Checked By: Rebecca Roth

Title: Laboratory Coordinator

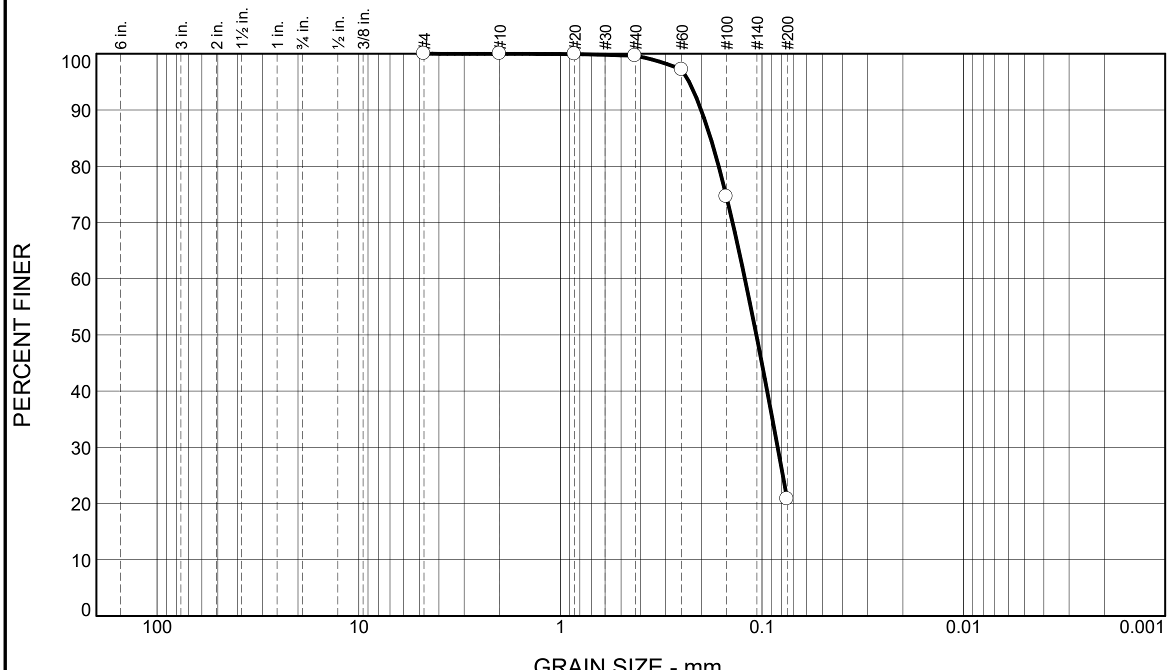
Source of Sample: BB-FBR-106 **Depth:** 4-6' **Date Sampled:**
Sample Number: 2D

Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental
Project: Bucknam Road Bridge No. 5830, MEDOT WIN 21720.00
Falmouth, ME
Project No: 09.0026023.00 **Figure** S-24

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.4	78.8	20.8	

Test Results (D6913 & ASTM D 1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	100.0		
#20	99.9		
#40	99.6		
#60	97.2		
#100	74.6		
#200	20.8		

* (no specification provided)

Material Description

Brown fine SAND, some Silt

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}= 0.2002 D_{85}= 0.1799 D_{60}= 0.1215
D_{50}= 0.1067 D_{30}= 0.0836 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 07.17.19 **Date Tested:** 07.22.19

Tested By: MN / JM

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: BB-FBR-106 **Depth:** 8-10' **Date Sampled:**
Sample Number: 4D

Thielsch Engineering Inc.

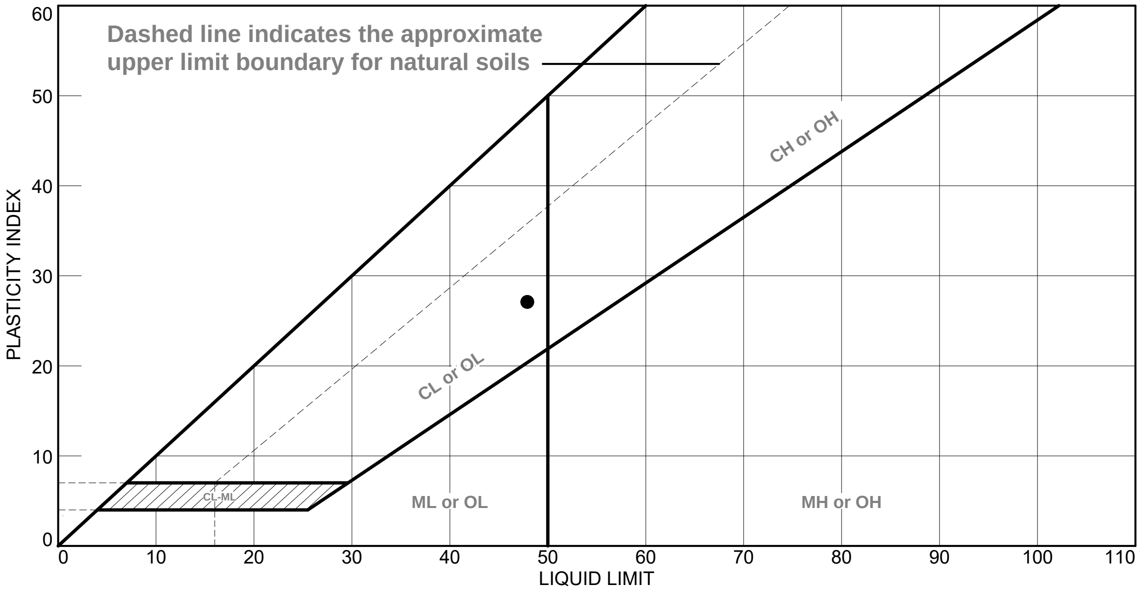
Cranston, RI

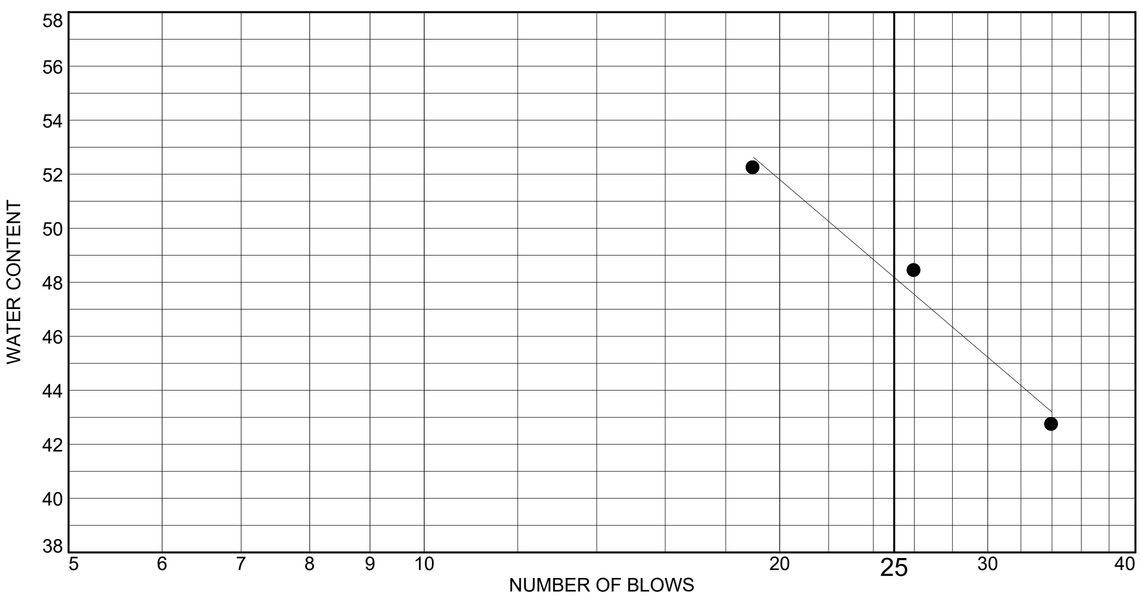
Client: GZA GeoEnvironmental

Project: Bucknam Road Bridge No. 5830, MEDOT WIN 21720.00
Falmouth, ME

Project No: 09.0026023.00 **Figure** S-25

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray Silty CLAY	48	21	27			CL

Project No. 09.0026023.00 **Client:** GZA GeoEnvironmental

Project: Bucknam Road Bridge No. 5830, MEDOT WIN 21720.00

Falmouth, ME

Source of Sample: BB-FBR-106 **Depth:** 15-17'

Sample Number: 6D

Thielsch Engineering Inc.

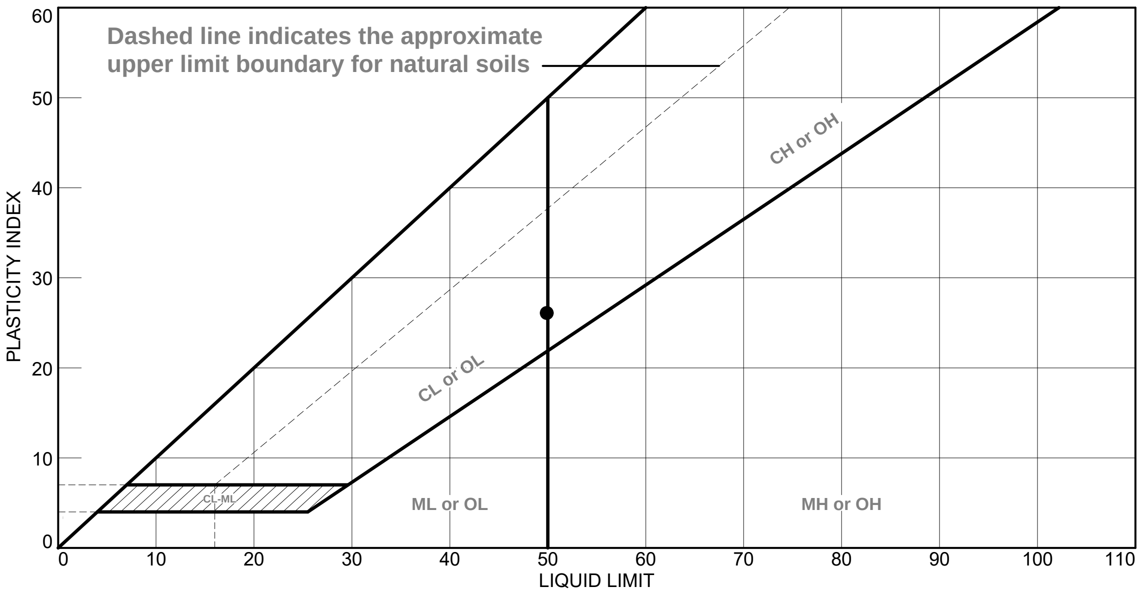
Cranston, RI

Remarks:

Figure L-26

Tested By: MN **Checked By:** RR

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray Silty CLAY	50	24	26			CL

Project No. 09.0026023.00 **Client:** GZA GeoEnvironmental

Project: Bucknam Road Bridge No. 5830, MEDOT WIN 21720.00

Falmouth, ME

Source of Sample: BB-FBR-106 **Depth:** 24-26'

Sample Number: 8D

Thielsch Engineering Inc.

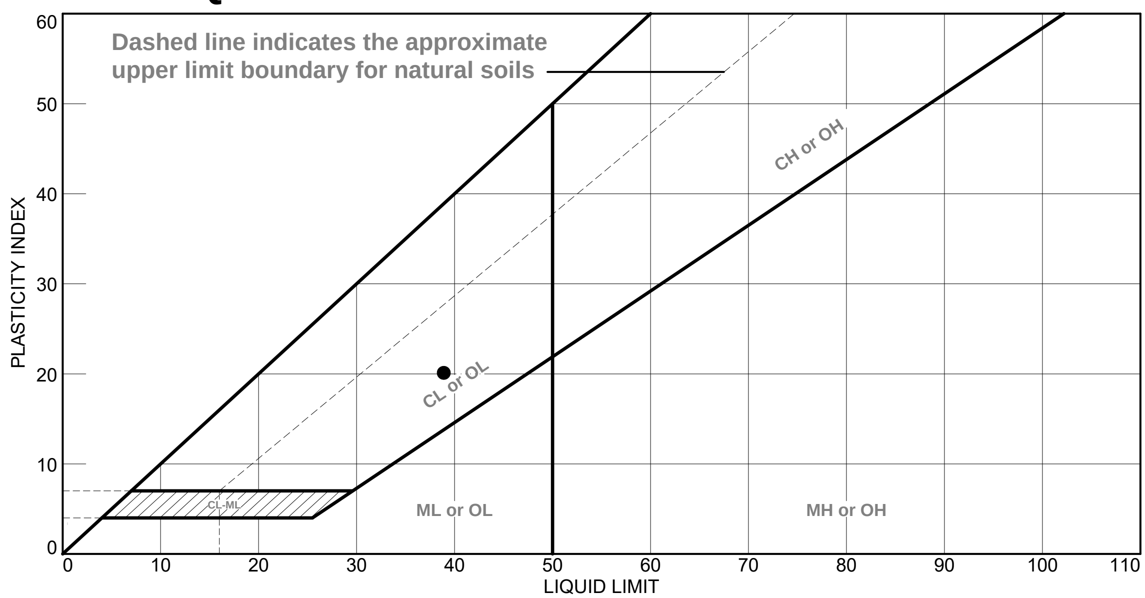
Cranston, RI

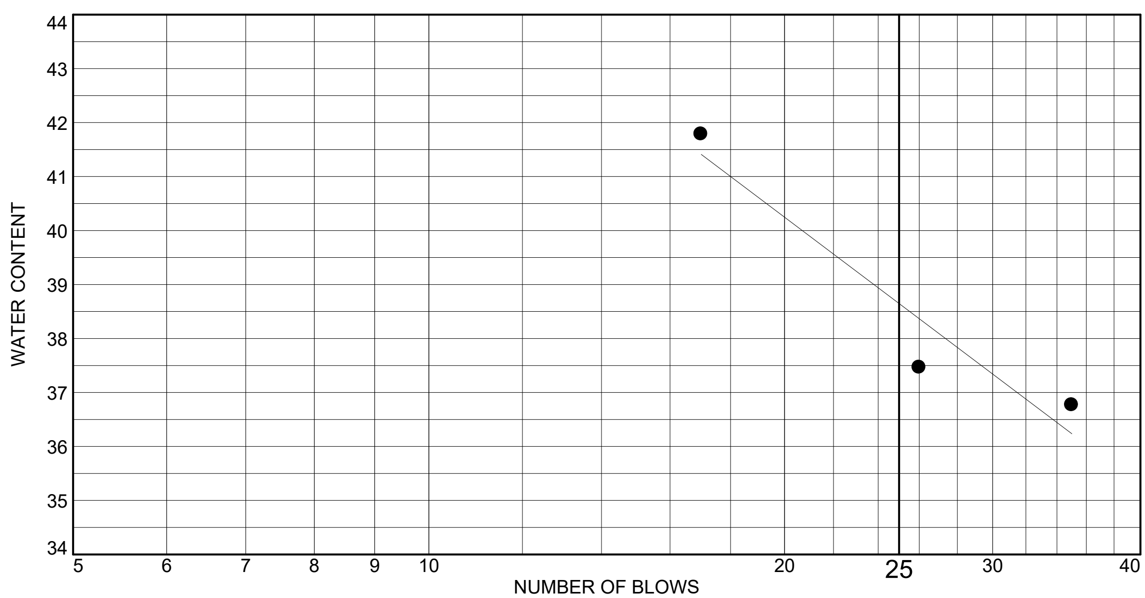
Remarks:

Figure L-27

Tested By: MN **Checked By:** RR

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray SILTY CLAY	39	19	20			CL

Project No. 09.0026023.00 **Client:** GZA GeoEnvironmental

Project: Bucknam Road Bridge No. 5830, MEDOT WIN 21720.00

Falmouth, ME

Source of Sample: BB-FBR-106 **Depth:** 45-47'

Sample Number: 10D

Remarks:

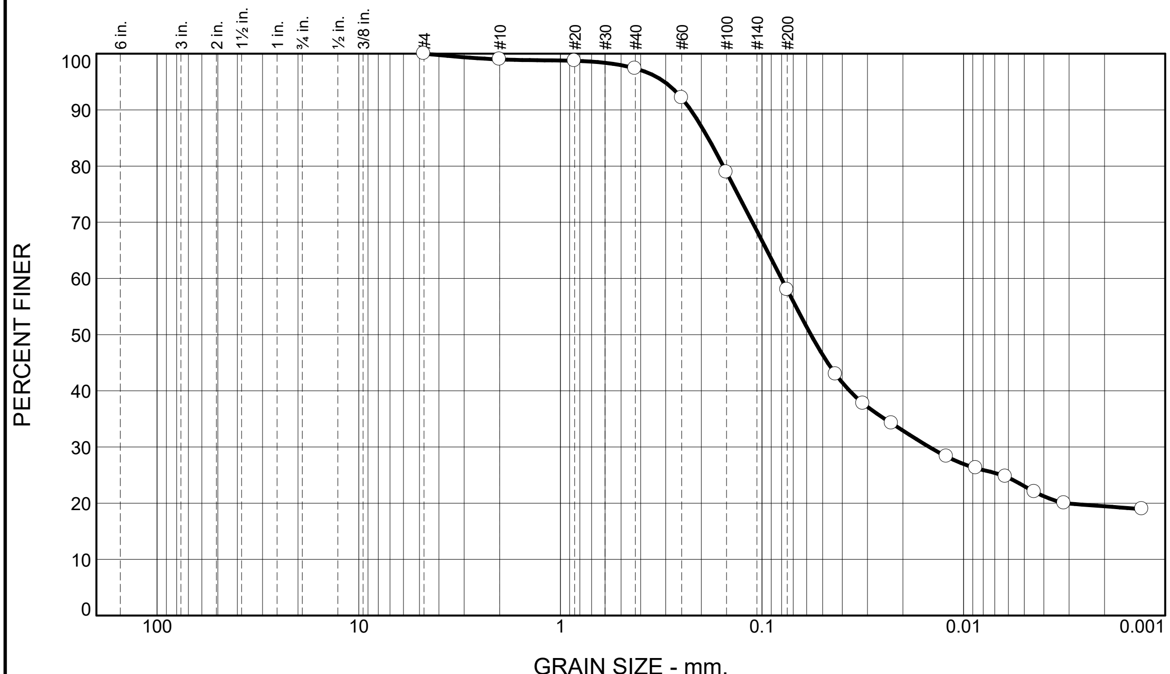
Thielsch Engineering Inc.

Cranston, RI

Figure L-29

Tested By: MN **Checked By:** RR

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	1.0	1.6	39.4	38.6	19.4

Test Results (D7928 & ASTM D 1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.0		
#20	98.7		
#40	97.4		
#60	92.1		
#100	78.9		
#200	58.0		
0.0431 mm.	43.0		
0.0315 mm.	37.8		
0.0227 mm.	34.2		
0.0122 mm.	28.3		
0.0087 mm.	26.2		
0.0062 mm.	24.7		
0.0044 mm.	22.0		
0.0032 mm.	20.0		
0.0013 mm.	18.9		

* (no specification provided)

Material Description

Gray SANDY, CLAYEY SILT

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

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

Coefficients

D_{90}= 0.2254 D_{85}= 0.1851 D_{60}= 0.0801
D_{50}= 0.0572 D_{30}= 0.0148 D_{15}=
D_{10}= C_u= C_c=

Remarks

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

Date Received: 07.17.19 **Date Tested:** 07.25.19

Tested By: IA / MN

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: BB-FBR-106 **Depth:** 69-71' **Date Sampled:**
Sample Number: 14D

Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental
Project: Bucknam Road Bridge No. 5830, MEDOT WIN 21720.00
Falmouth, ME
Project No: 09.0026023.00 **Figure** S-32

Particle Size Distribution Report

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.9	36.5	55.4	7.2	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.1		
#20	90.3		
#40	62.6		
#60	34.4		
#100	14.2		
#200	7.2		

* (no specification provided)

Material Description

Gray f-c SAND, trace Silt

Atterberg Limits (ASTM D 4318)

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

Classification

USCS (D 2487)= SP-SM **AASHTO (M 145)=** A-3

Coefficients

D_{90}= 0.8385 D_{85}= 0.7104 D_{60}= 0.4042
D_{50}= 0.3355 D_{30}= 0.2283 D_{15}= 0.1545
D_{10}= 0.1203 C_u= 3.36 C_c= 1.07

Remarks

Date Received: 07.17.19 **Date Tested:** 07.22.19

Tested By: IA / JM

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: BB-FBR-106 **Depth:** 79-81' **Date Sampled:**
Sample Number: 16D

Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental
Project: Bucknam Road Bridge No. 5830, MEDOT WIN 21720.00
Falmouth, ME
Project No: 09.0026023.00 **Figure** S-33

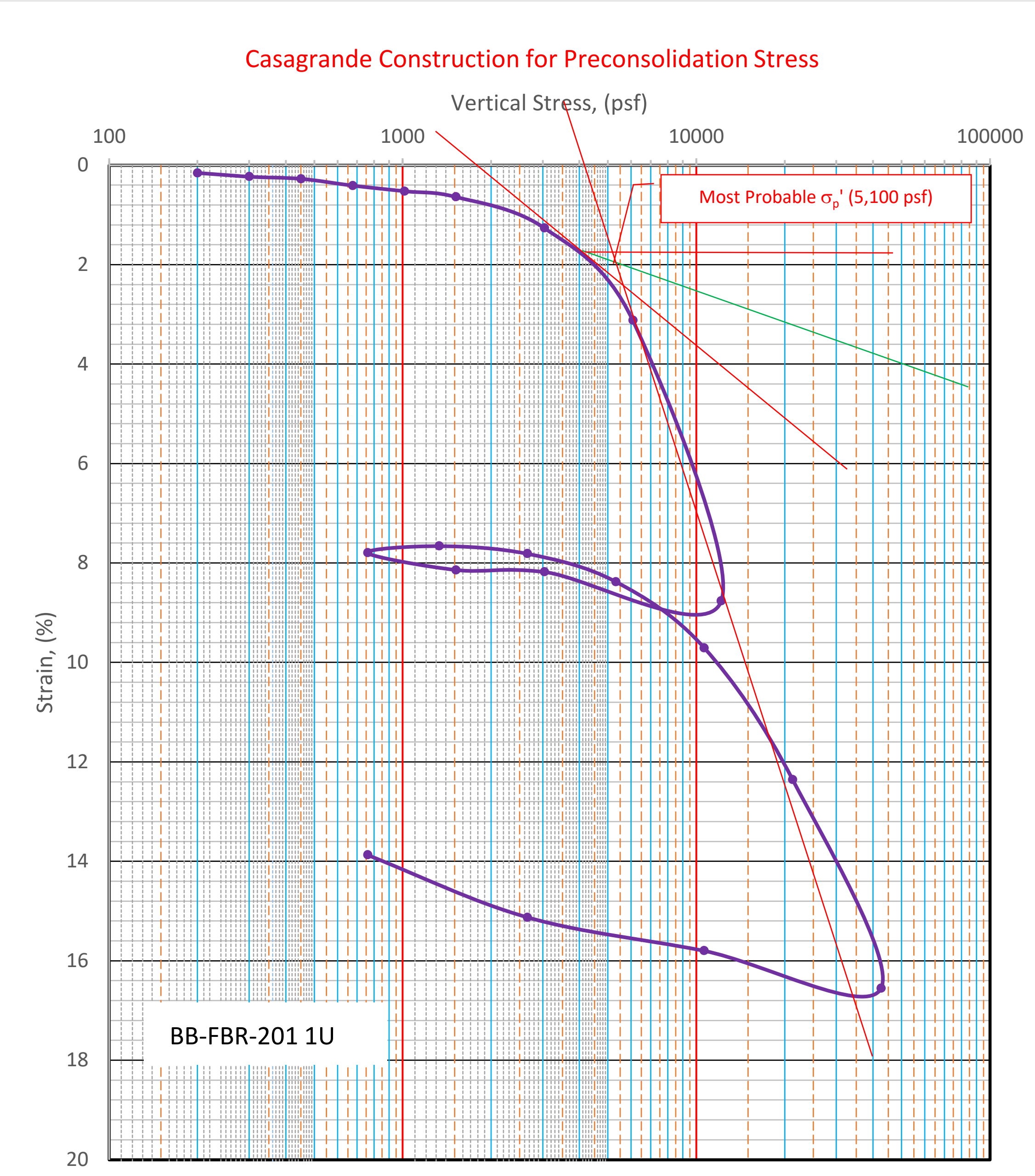
INCREMENTAL CONSOLIDATION

BB-FBR 201 1U

Consolidation Test Data
Summary Report

Project Name:	Bucknam Road Bridge
Project Number:	166-14
Project Location:	Falmouth, Maine
Client:	GZA
Sample Description:	Gray Silty Clay
Preparation:	Trimmed Shelby Tube

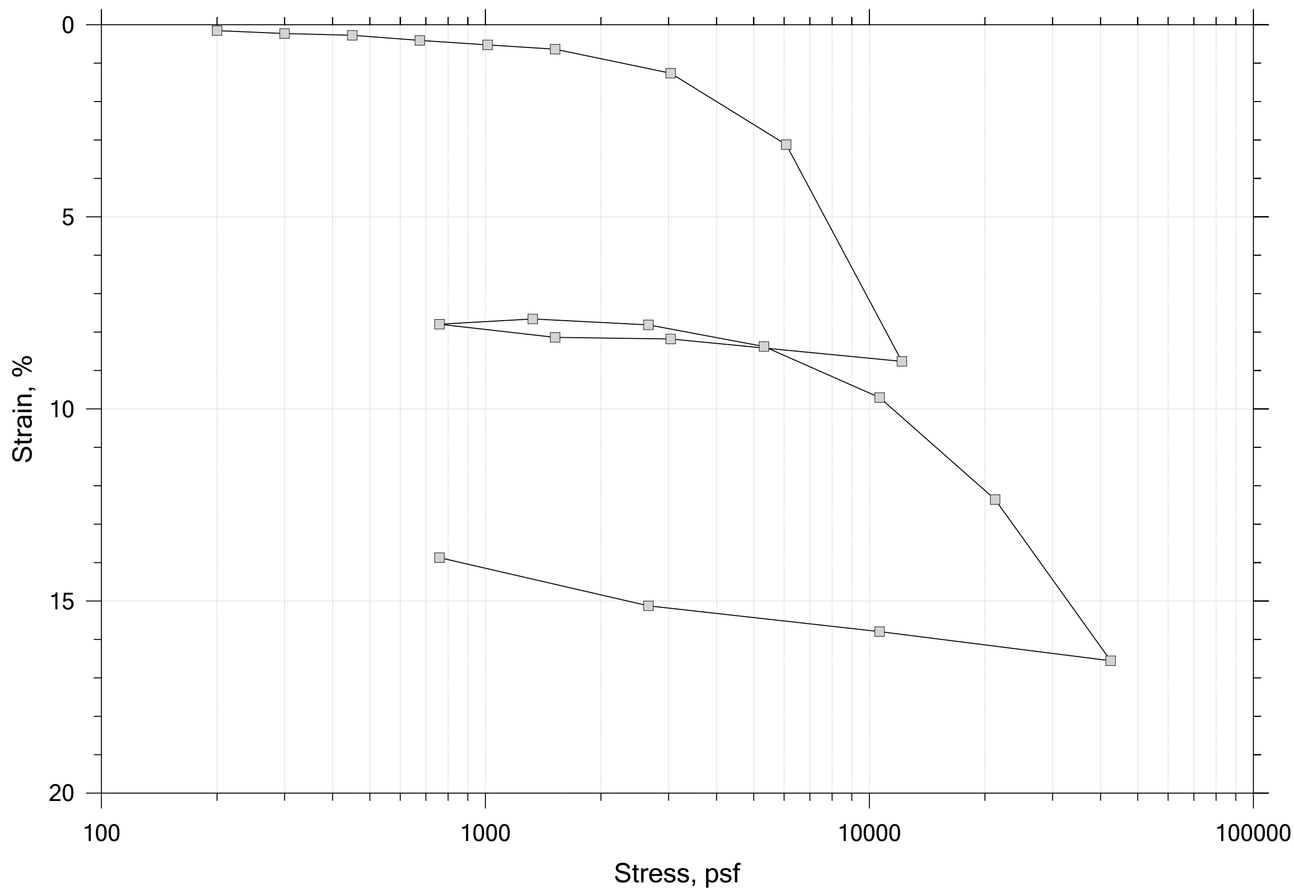
Lab Test No:	ICON 331			
Boring No.	BB-FBR-201			
Sample No:	1U			
Boring Elevation (ft).	39.6			
Sample Depth (ft):	12-14			
Test Specimen Depth (Ft):	13.75			
Test Specimen Elevation:	25.85			
Water Content (%):	34.9			
Dry Unit Weight (pcf):	86.5			
Wet Unit Weight (pcf):	116.7			
Saturation Before (%):	96.7			
Saturation After (%):	100			
Void Ratio Before:	1.06			
Void Ratio After:	0.77			
Overburden Pressure (psf):	--			
Max Previous stress (psf):	5,100			
Max Prev. stress (Work) (psf):	5,050			
OCR:	--			
Compression Index (C_{CE}):	0.18			
Recompression Index (C_{RE}):	0.02			
Liquid Limit:				
Plastic Limit:				
Plasticity Index:				
Liquidity Index:				
Specific Gravity (implied)	2.85			
Lab Vane Su at 13.9 ft. (psf)	841			
Tested By:	sjr			
Date Tested:	9/22/2020			
Checked By:	sjr			

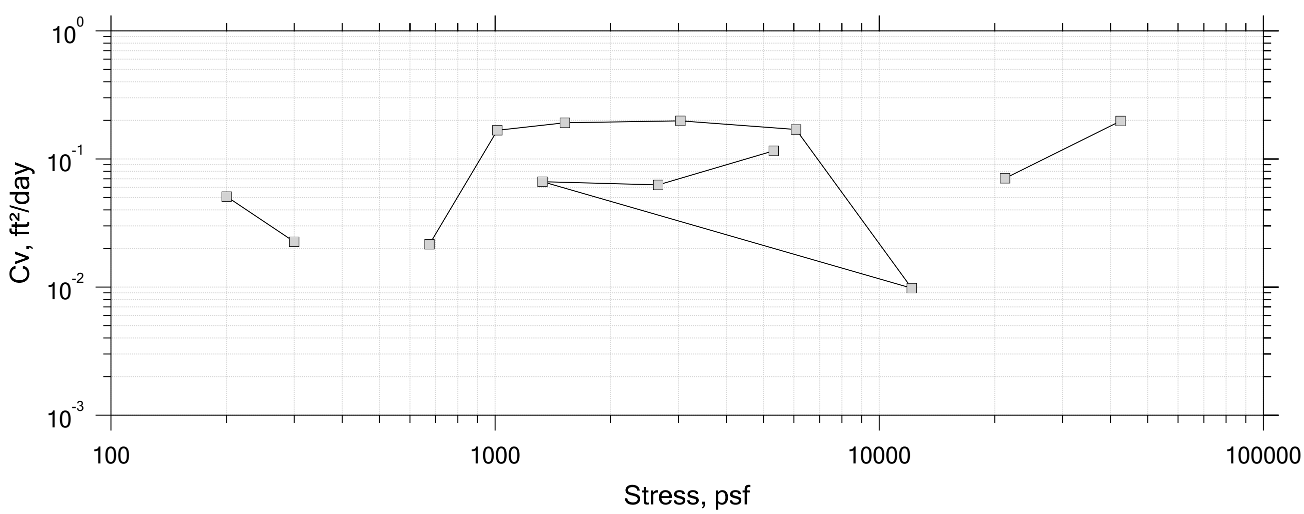


Soil Metrics LLC Geotechnical Engineering

One-Dimensional Consolidation by ASTM D2435 - Method B

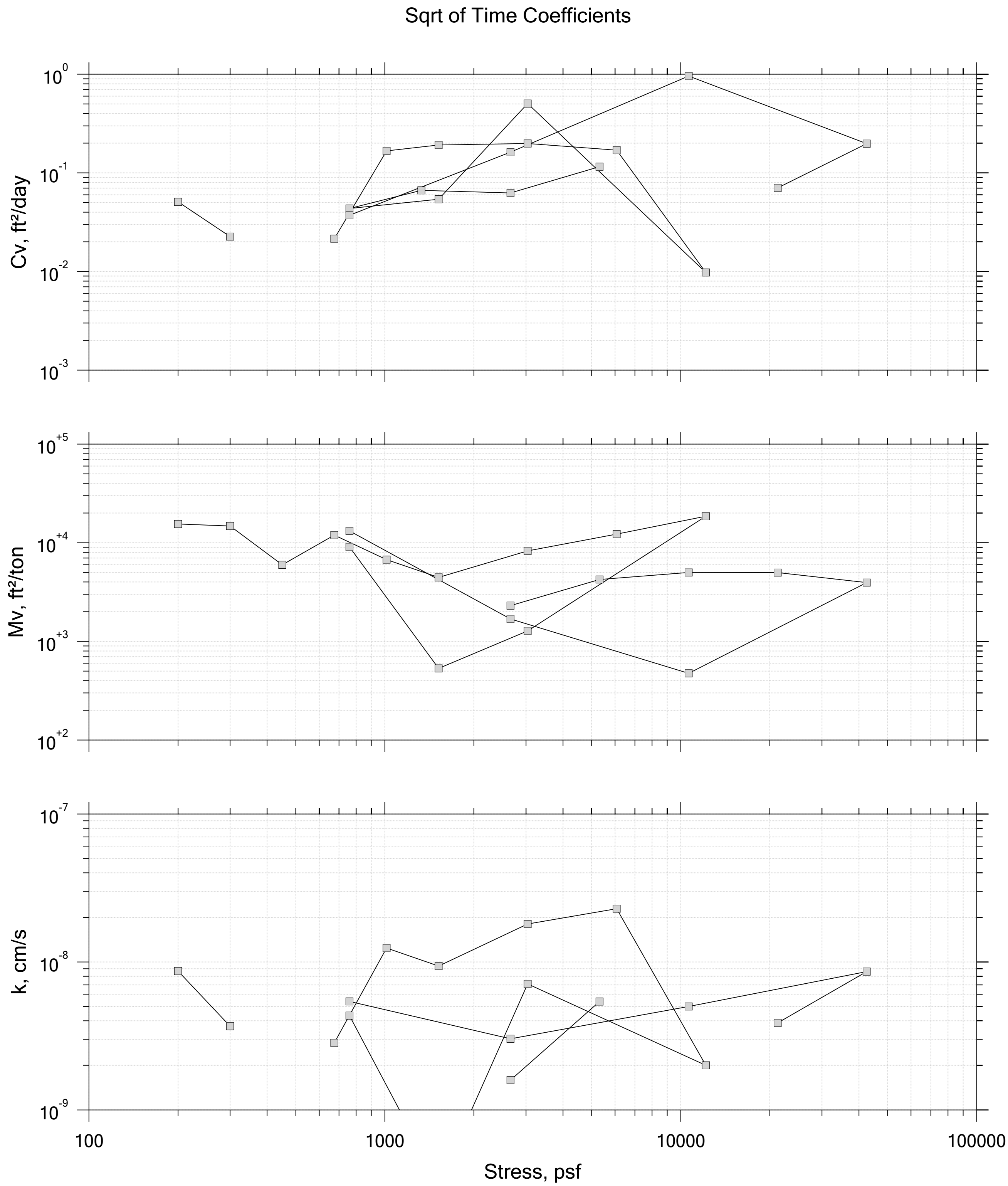
Summary Report





Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 9/22/22020	Depth: 13.75
	Test Number: ICON 331	Preparation: Shelby Tube	Elevation: 25.85
	Description: Gray Silty Clay		
	Remarks:		
	Displacement at End of Primary		

One-Dimensional Consolidation by ASTM D2435 - Method B



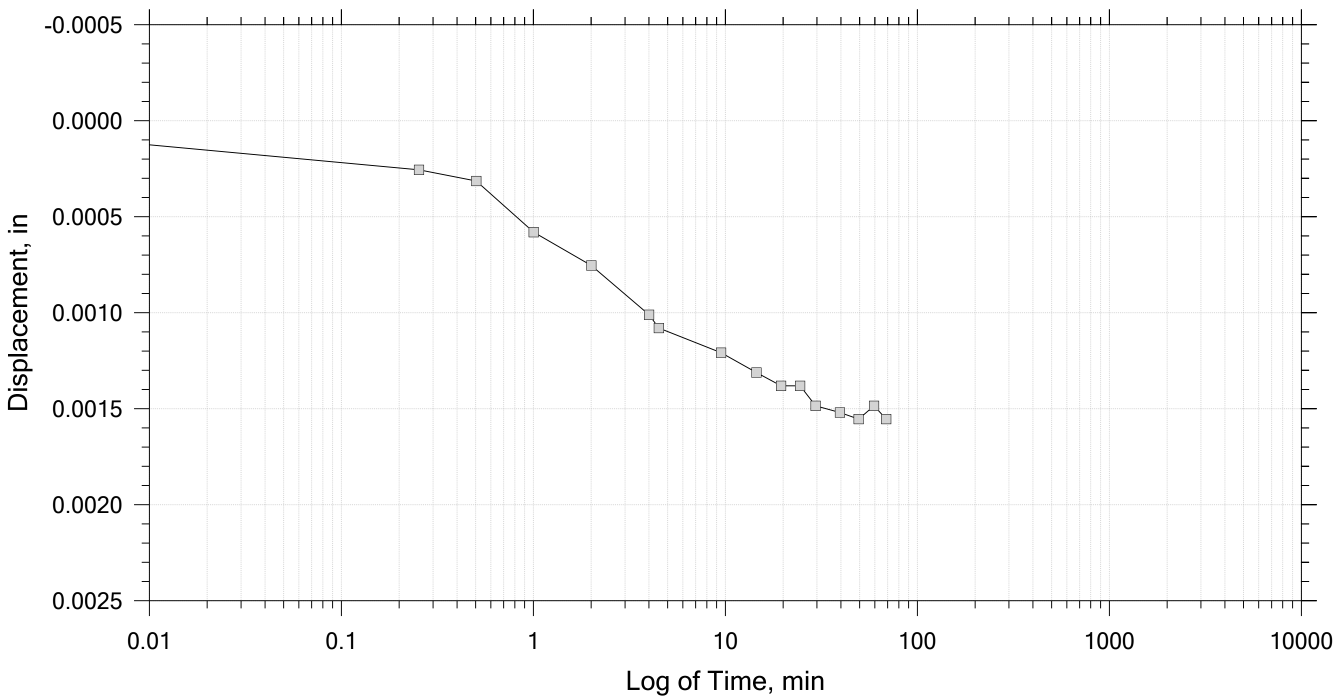
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 9/22/22020	Depth: 13.75
	Test Number: ICON 331	Preparation: Shelby Tube	Elevation: 25.85
	Description: Gray Silty Clay		
	Remarks:		

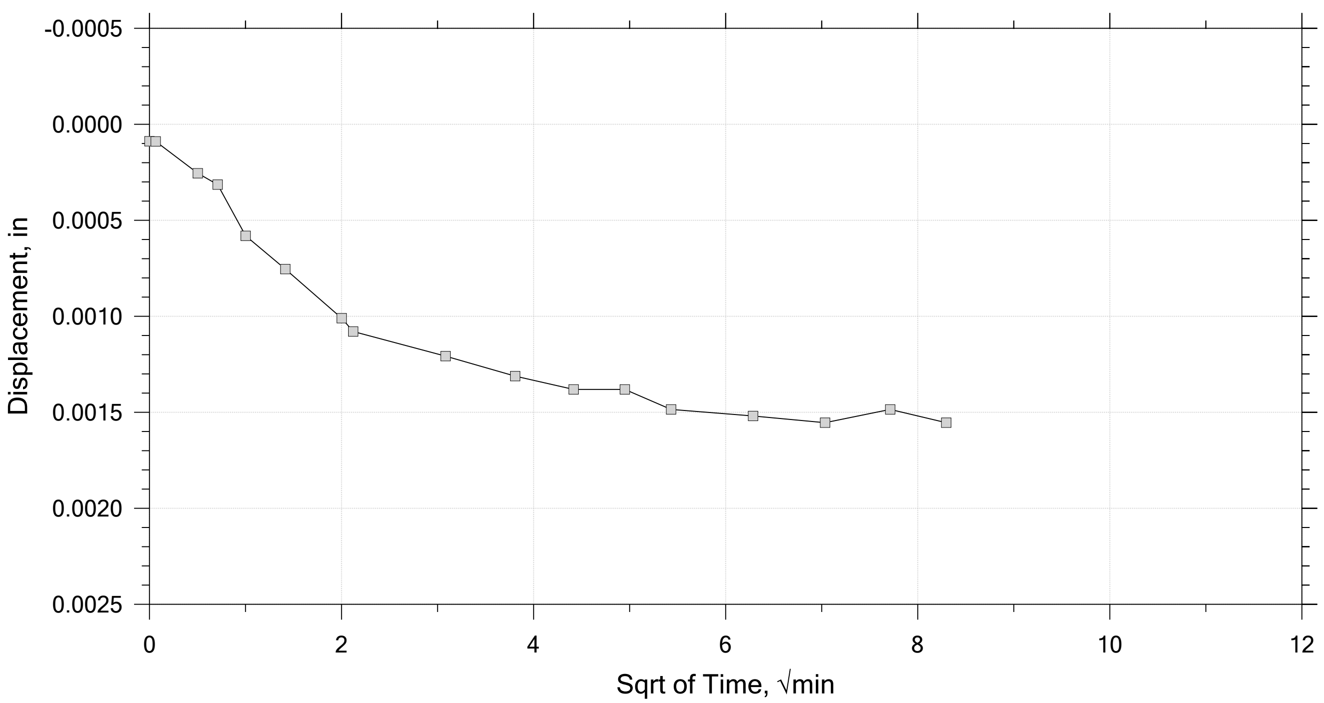
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 1 of 21

Constant Load Step

Stress: 200 psf

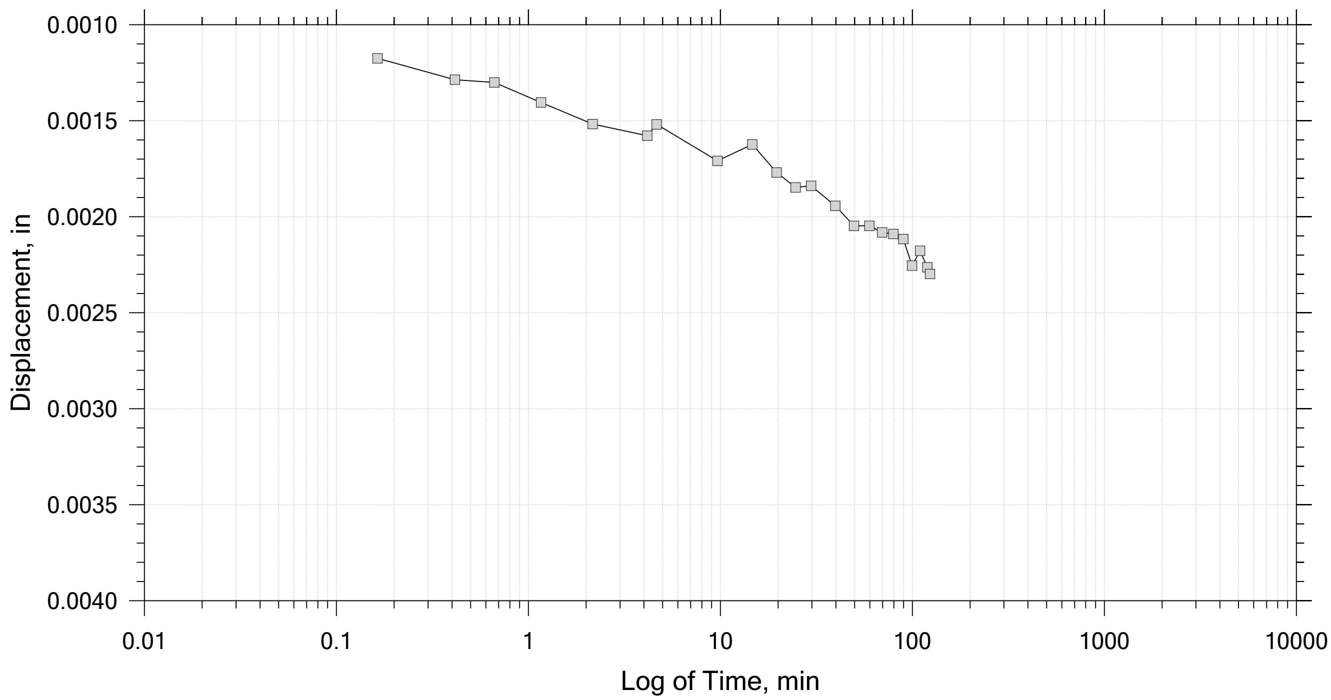


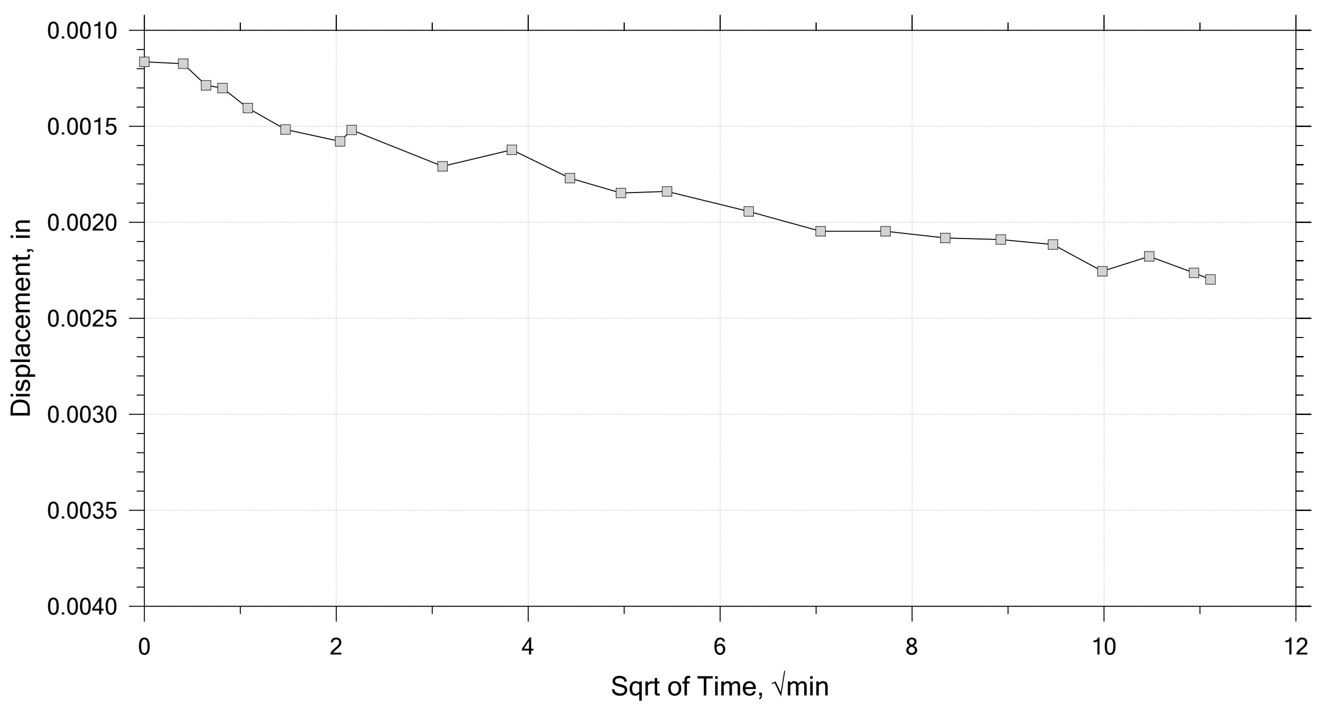


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 9/22/22020	Depth: 13.75
	Test Number: ICON 331	Preparation: Shelby Tube	Elevation: 25.85
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 2 of 21
Constant Load Step
Stress: 300 psf

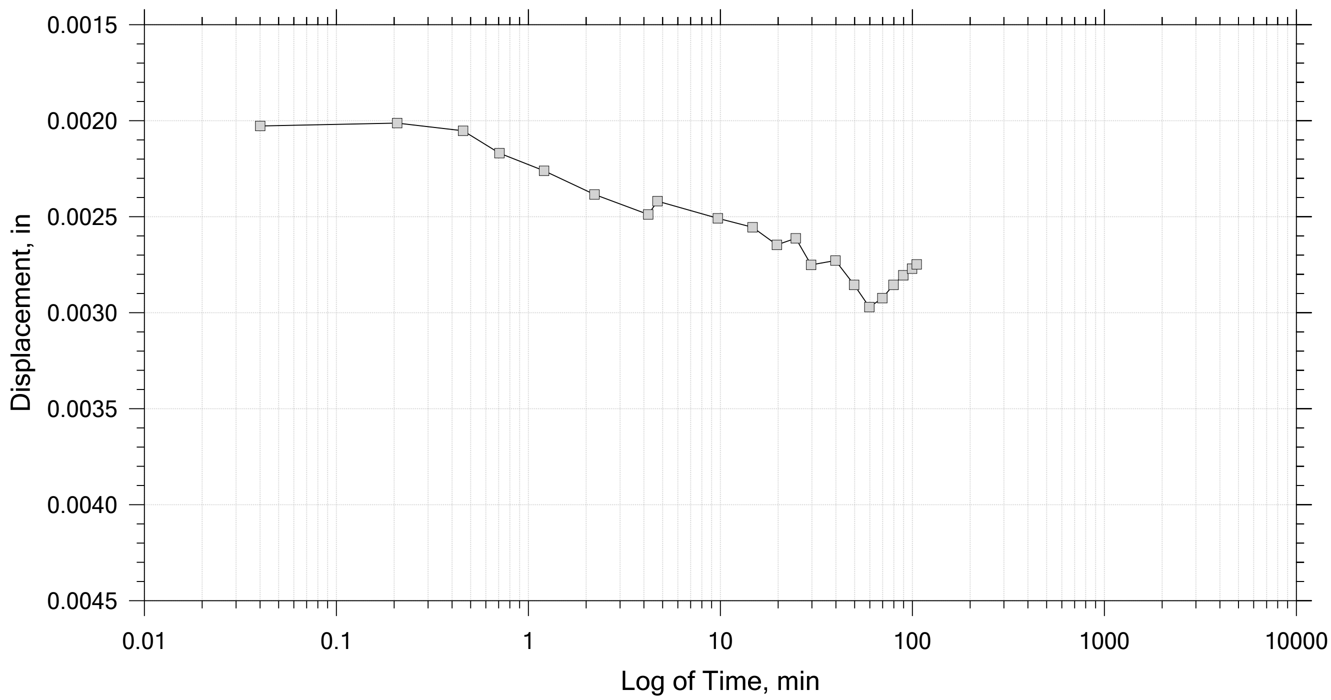


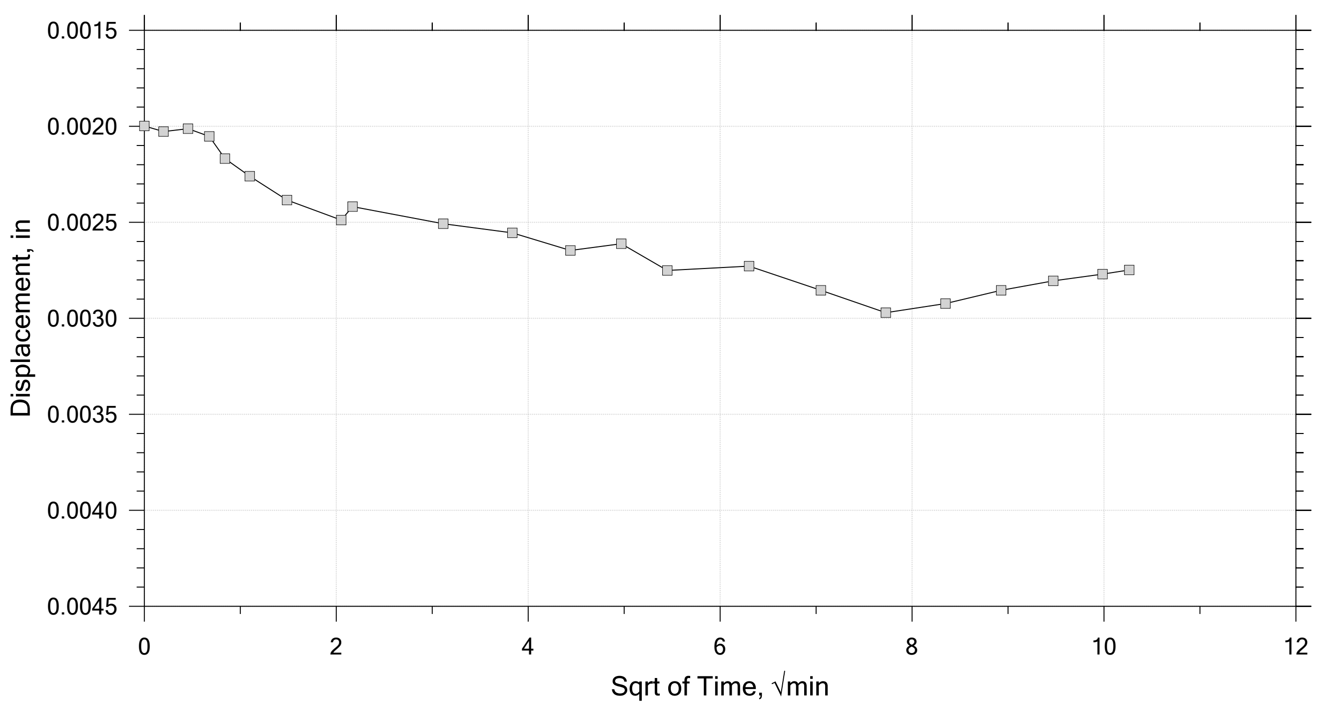


Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 9/22/22020	Depth: 13.75
	Test Number: ICON 331	Preparation: Shelby Tube	Elevation: 25.85
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 3 of 21
Constant Load Step
Stress: 450 psf





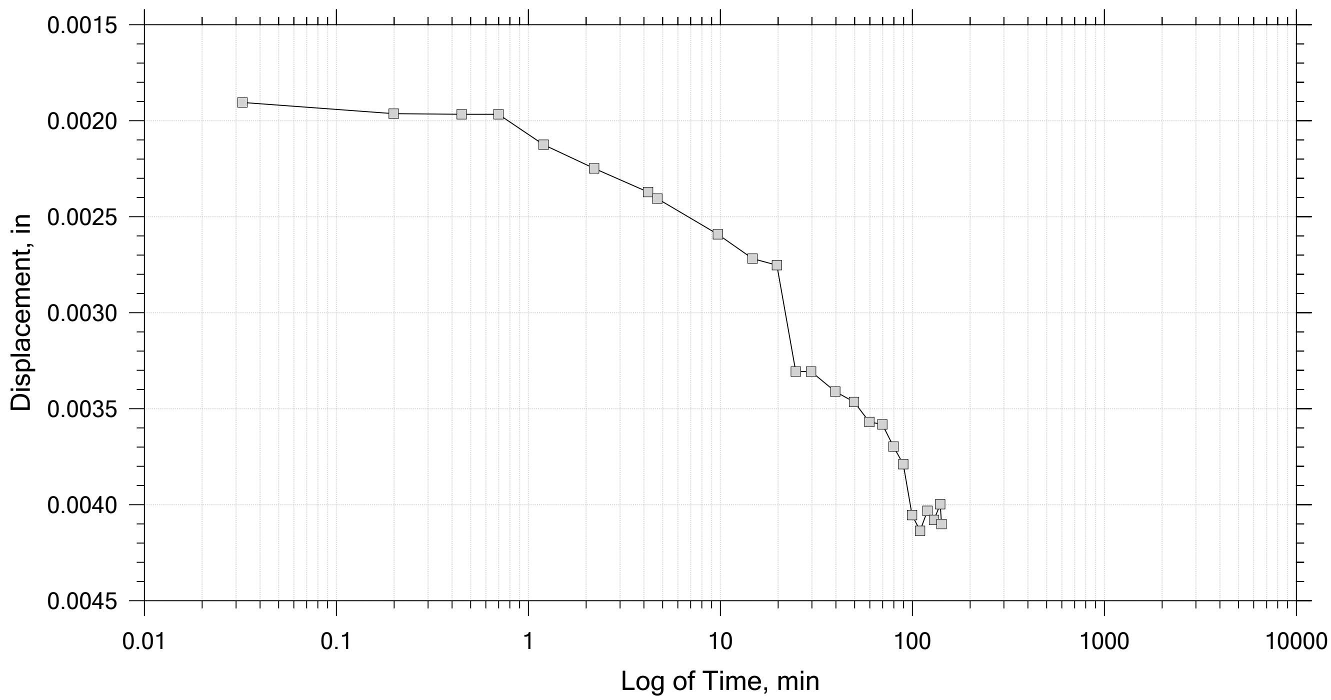
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 9/22/22020	Depth: 13.75
	Test Number: ICON 331	Preparation: Shelby Tube	Elevation: 25.85
	Description: Gray Silty Clay		
	Remarks:		

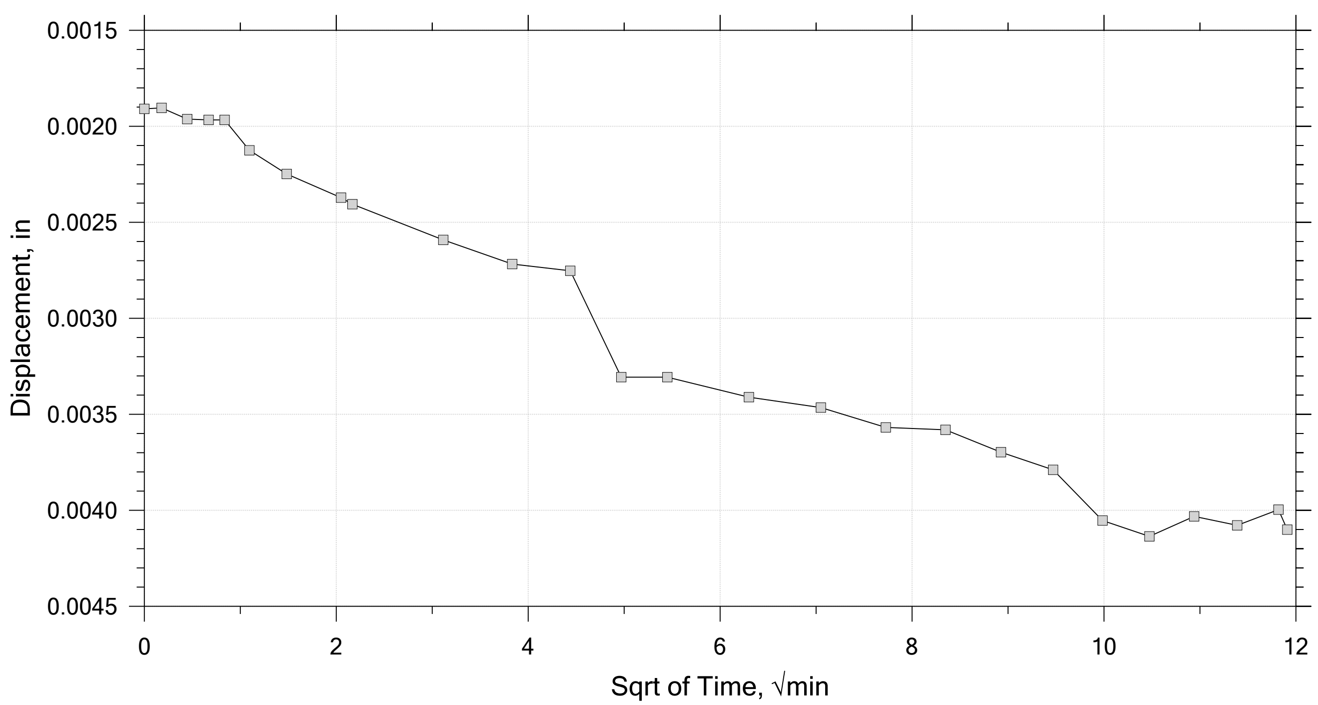
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 4 of 21

Constant Load Step

Stress: 675 psf





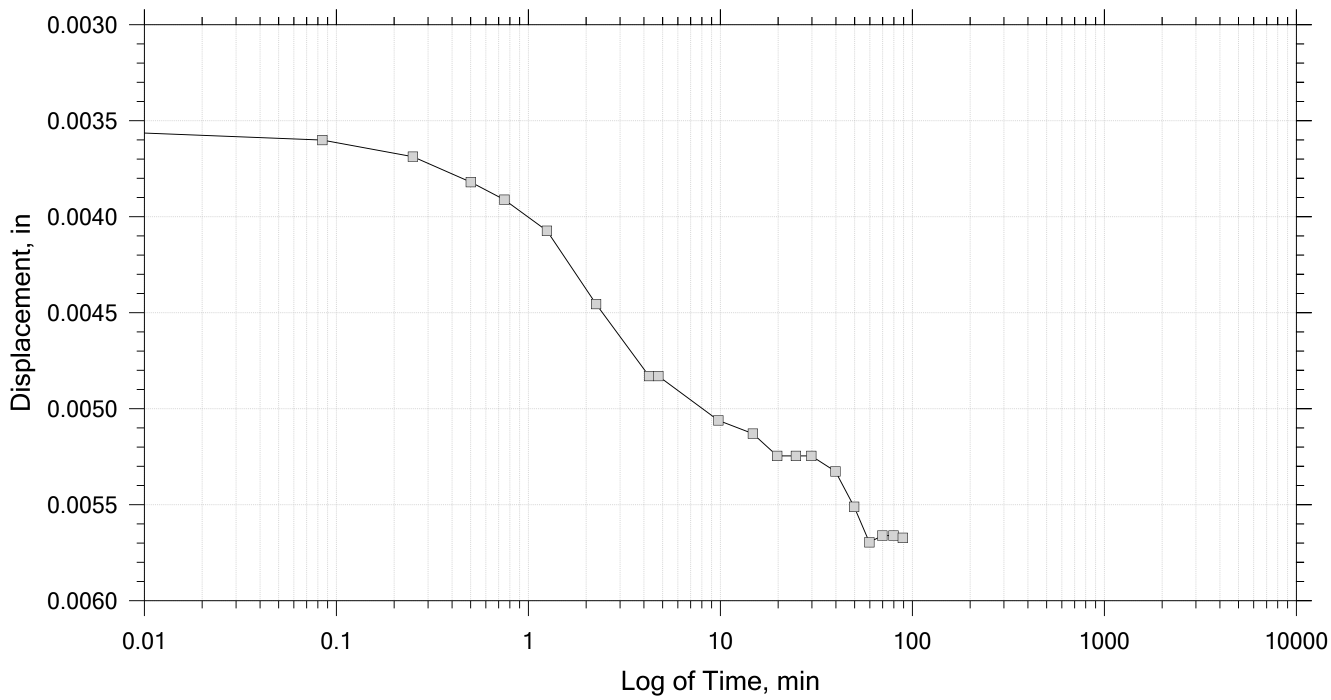
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 9/22/22020	Depth: 13.75
	Test Number: ICON 331	Preparation: Shelby Tube	Elevation: 25.85
	Description: Gray Silty Clay		
	Remarks:		

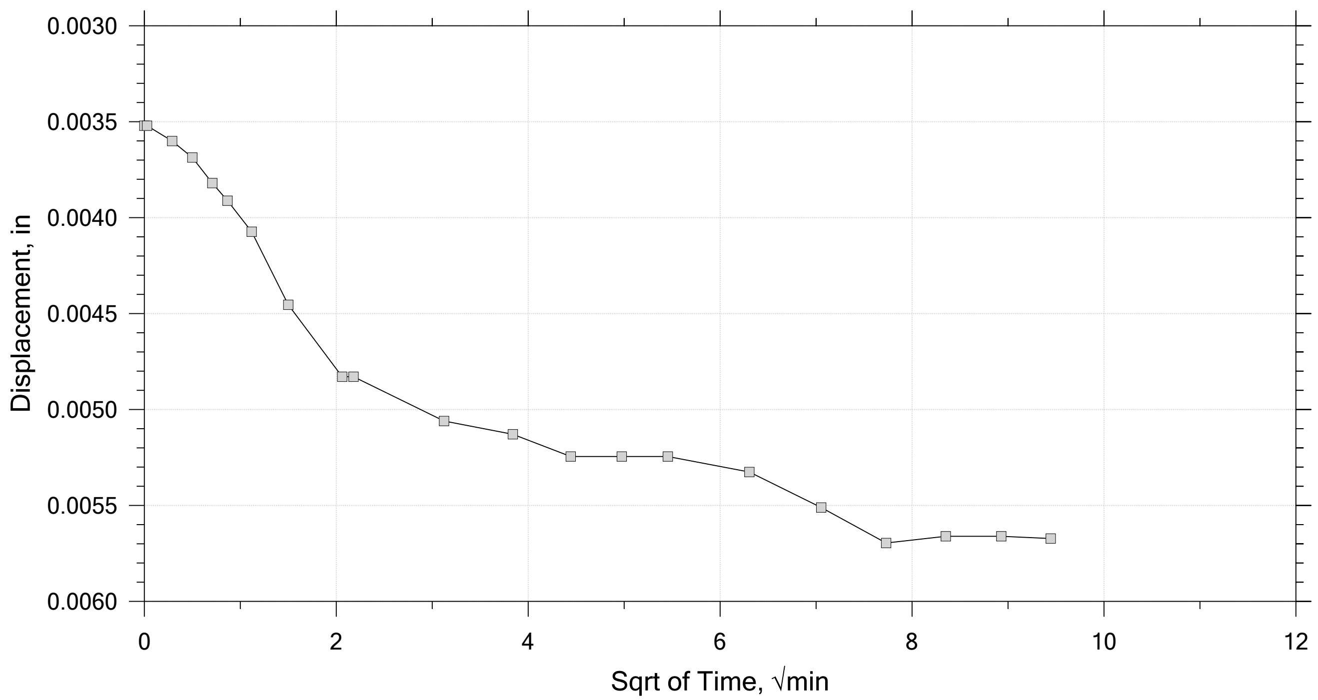
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 5 of 21

Constant Load Step

Stress: 1.01e+03 psf





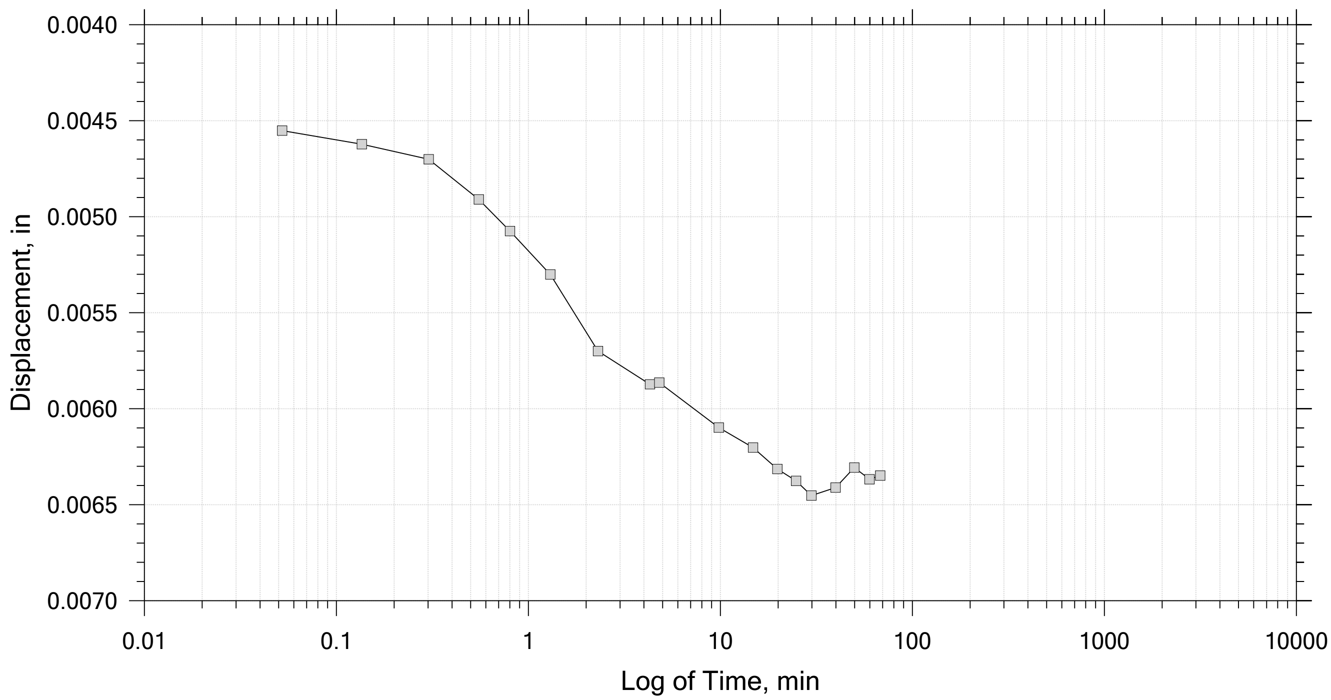
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 9/22/22020	Depth: 13.75
	Test Number: ICON 331	Preparation: Shelby Tube	Elevation: 25.85
	Description: Gray Silty Clay		
	Remarks:		

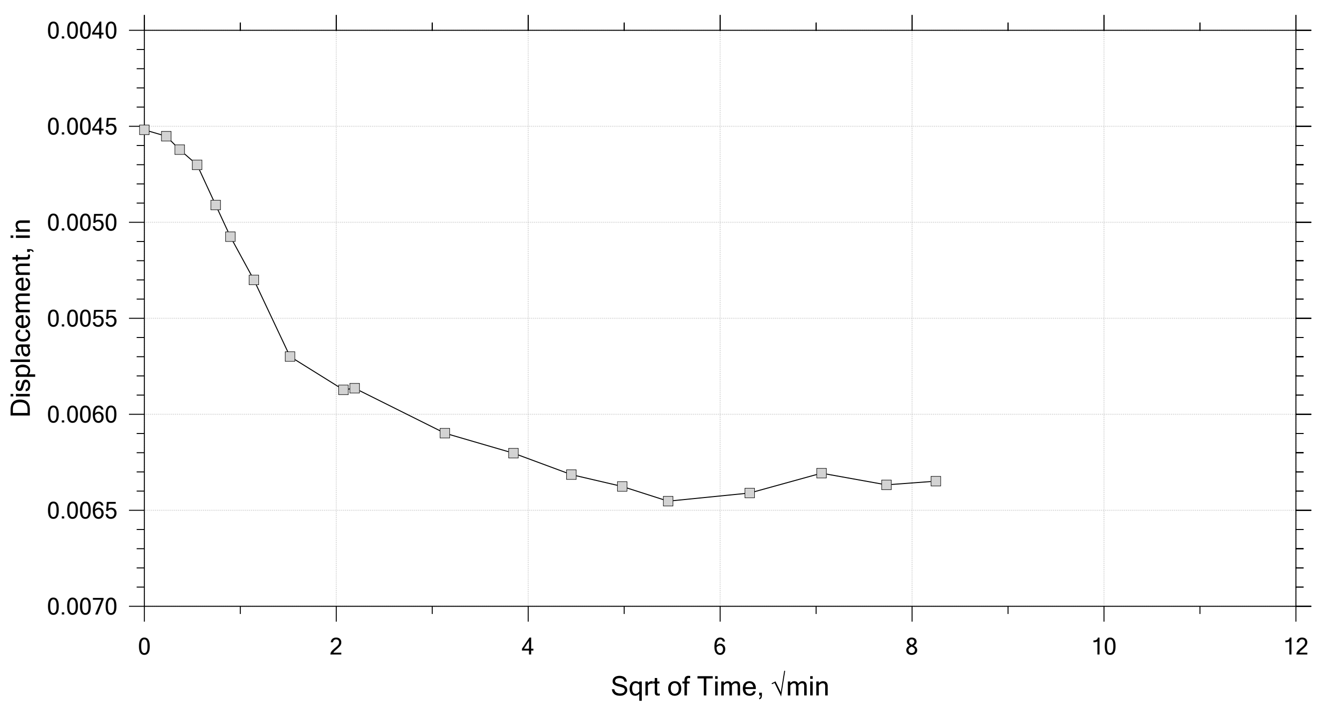
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 6 of 21

Constant Load Step

Stress: 1.52e+03 psf

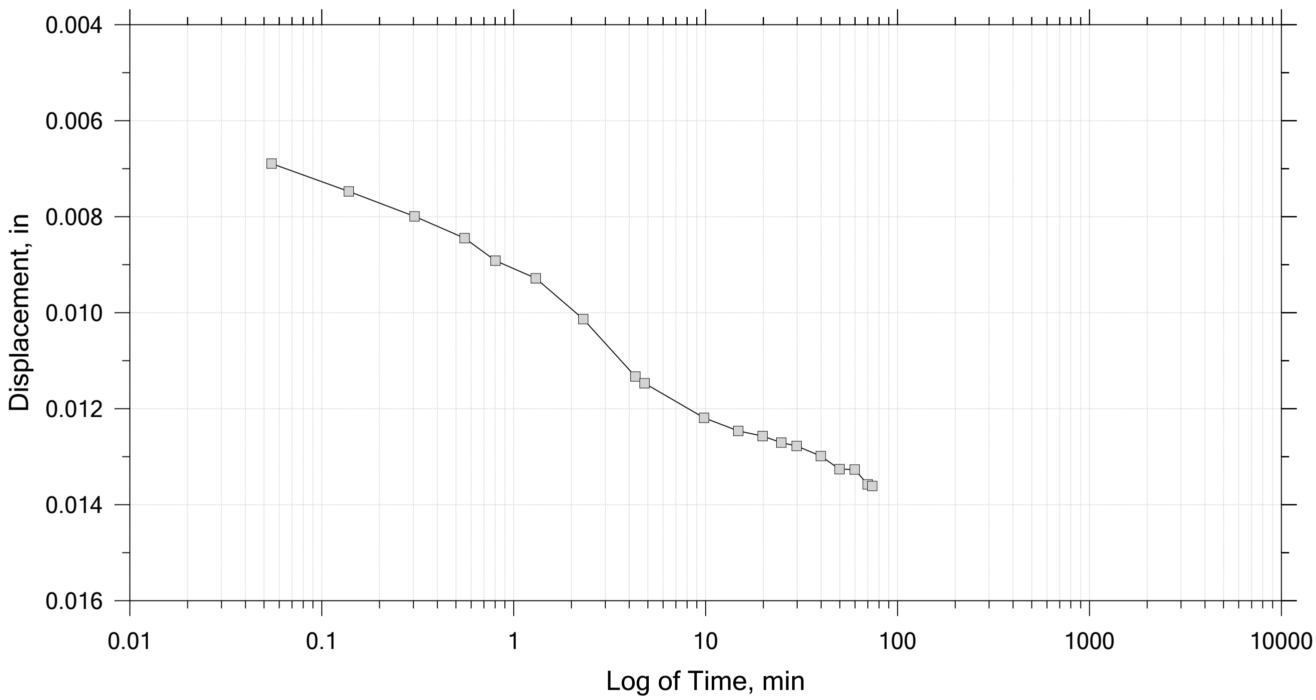


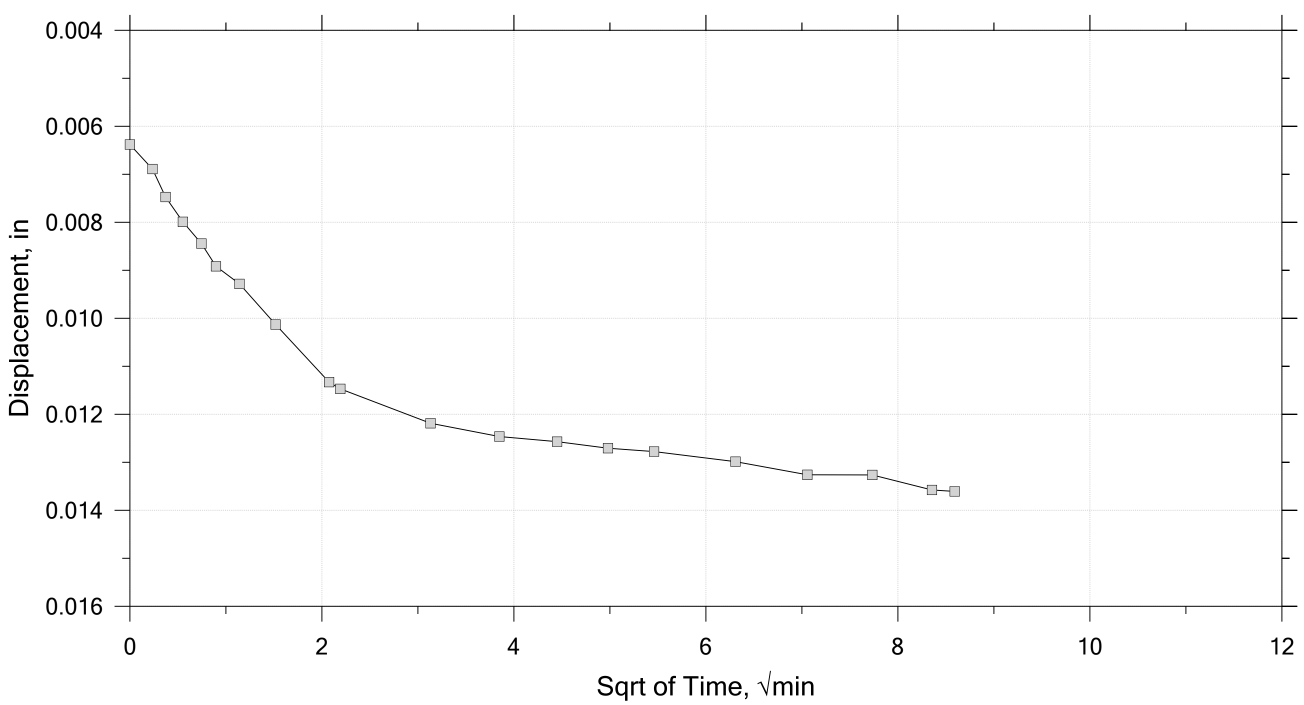


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 9/22/22020	Depth: 13.75
	Test Number: ICON 331	Preparation: Shelby Tube	Elevation: 25.85
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 7 of 21
Constant Load Step
Stress: 3.04e+03 psf





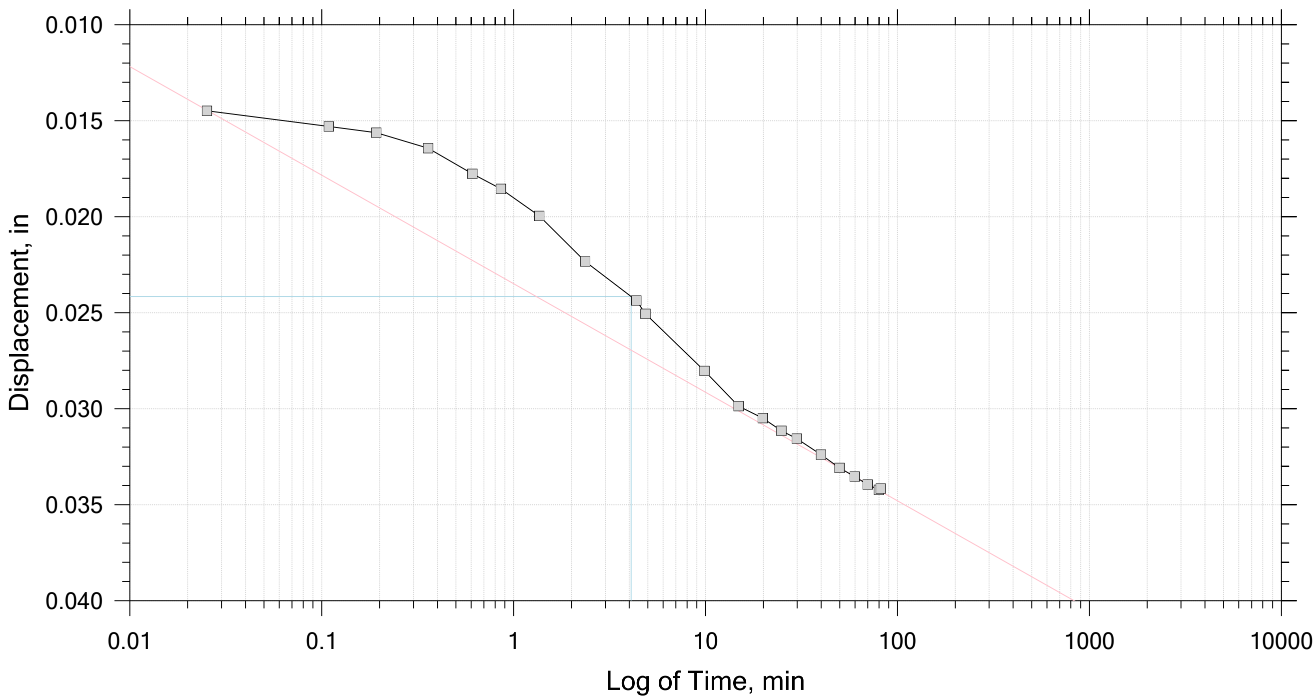
Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 9/22/22020	Depth: 13.75
	Test Number: ICON 331	Preparation: Shelby Tube	Elevation: 25.85
	Description: Gray Silty Clay		
	Remarks:		

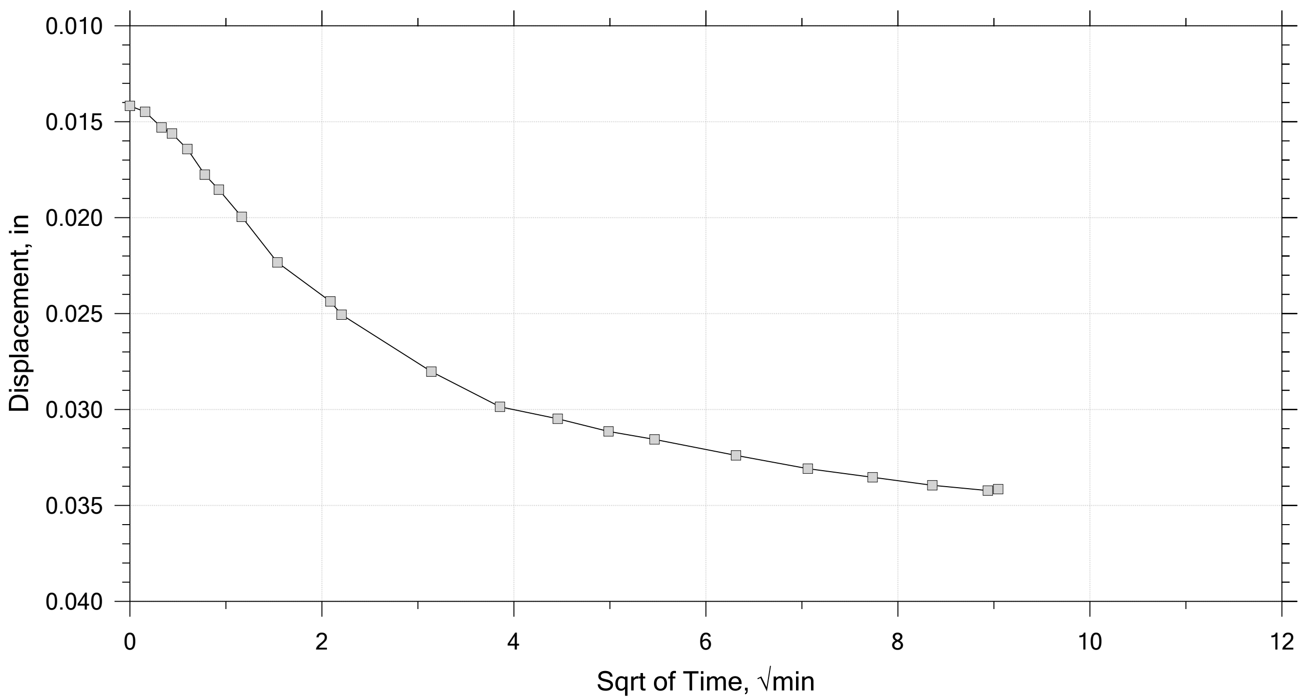
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 8 of 21

Constant Load Step

Stress: 6.08e+03 psf

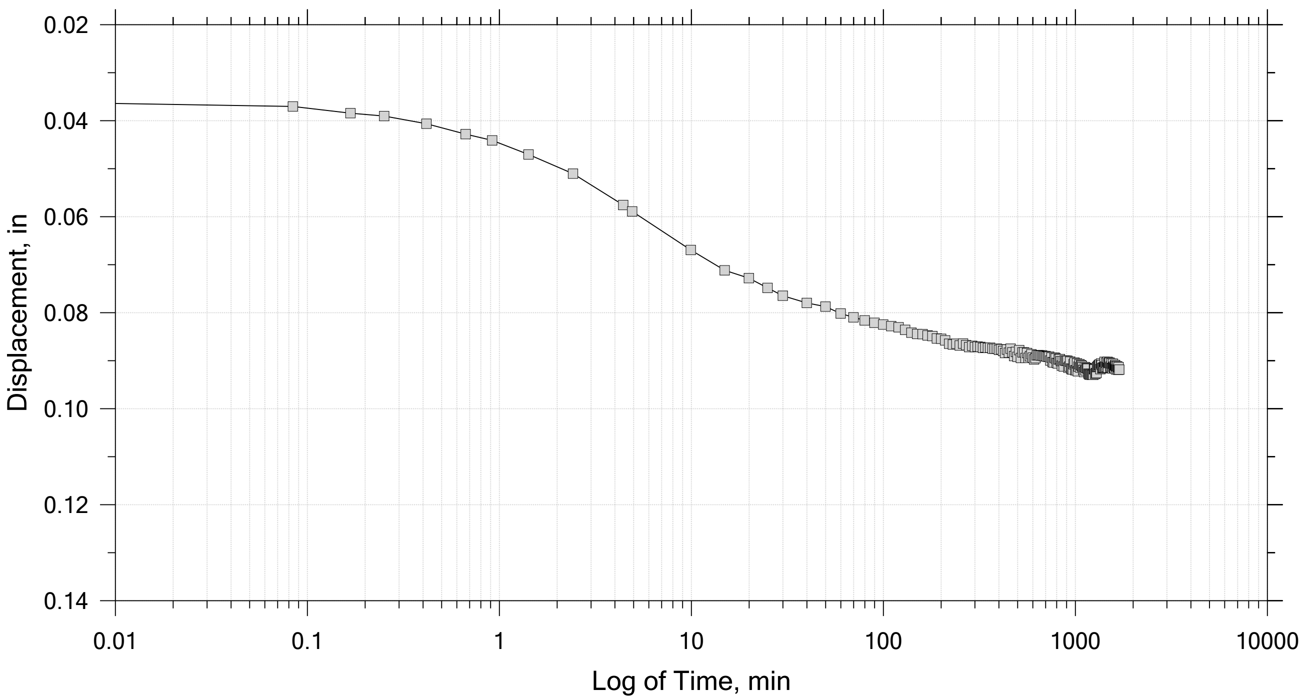


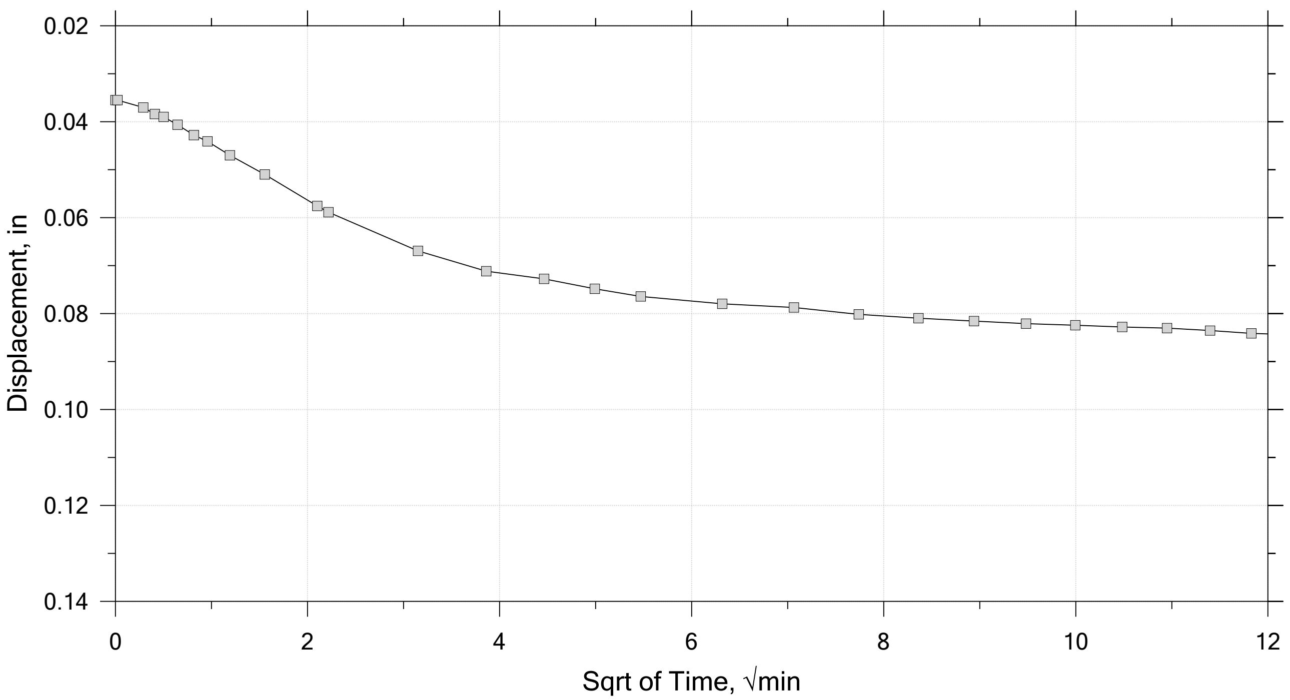


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 9/22/22020	Depth: 13.75
	Test Number: ICON 331	Preparation: Shelby Tube	Elevation: 25.85
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 9 of 21
Constant Load Step
Stress: 1.22e+04 psf





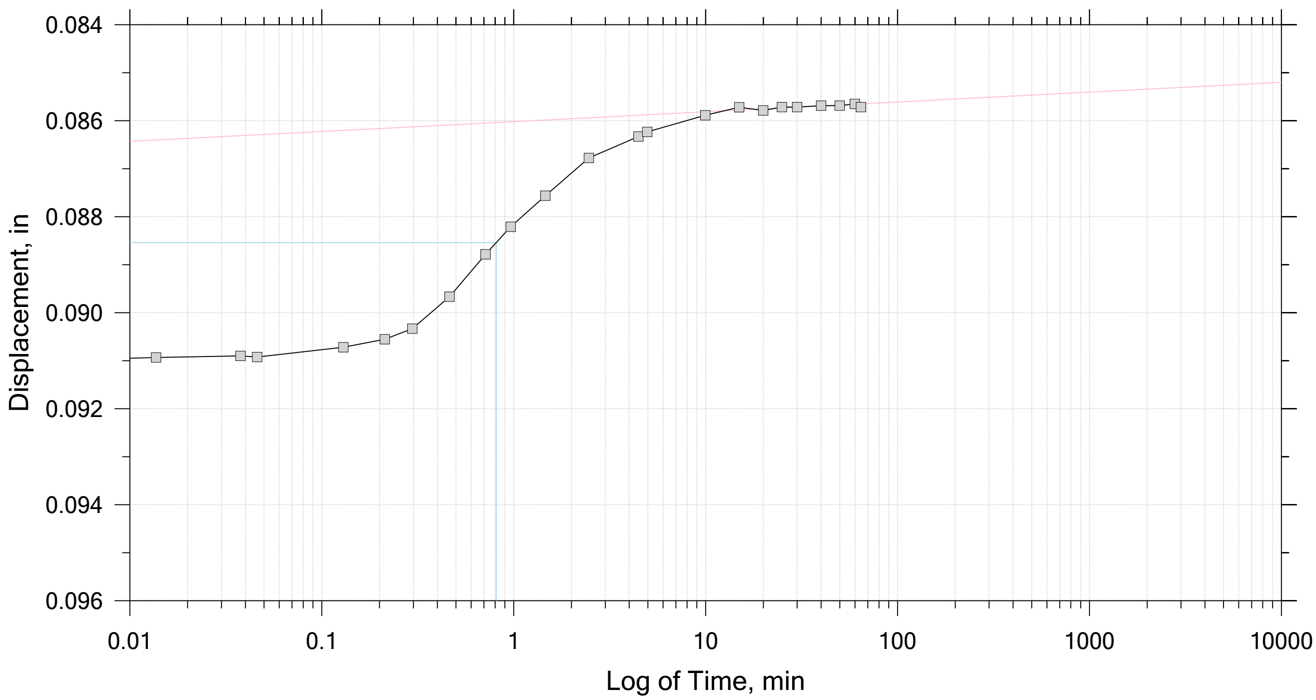
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 9/22/22020	Depth: 13.75
	Test Number: ICON 331	Preparation: Shelby Tube	Elevation: 25.85
	Description: Gray Silty Clay		
	Remarks:		

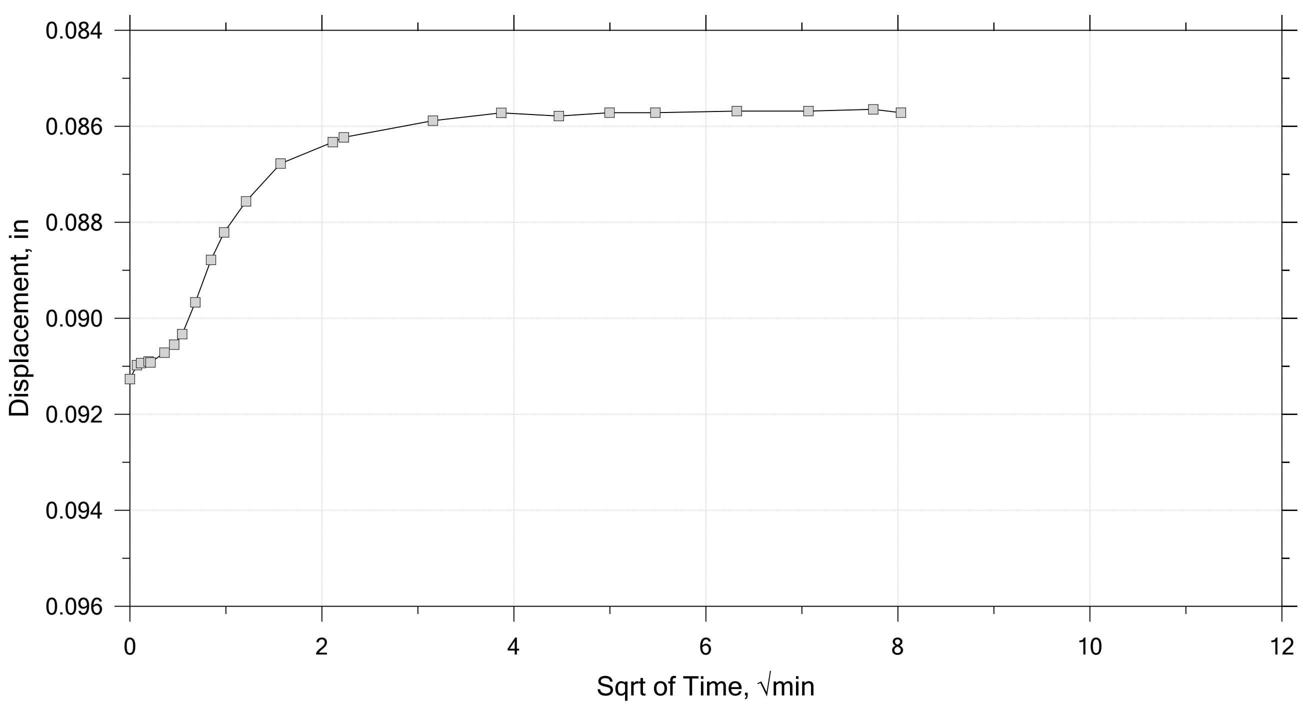
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 10 of 21

Constant Load Step

Stress: 3.04e+03 psf

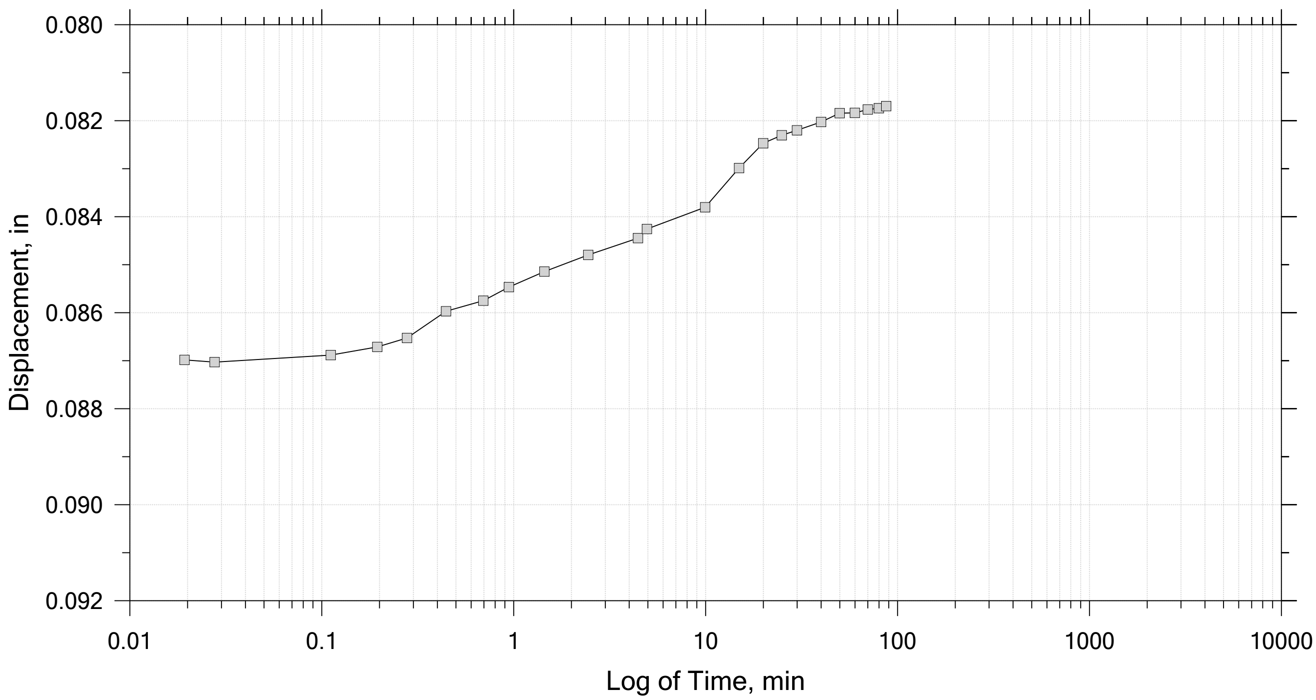


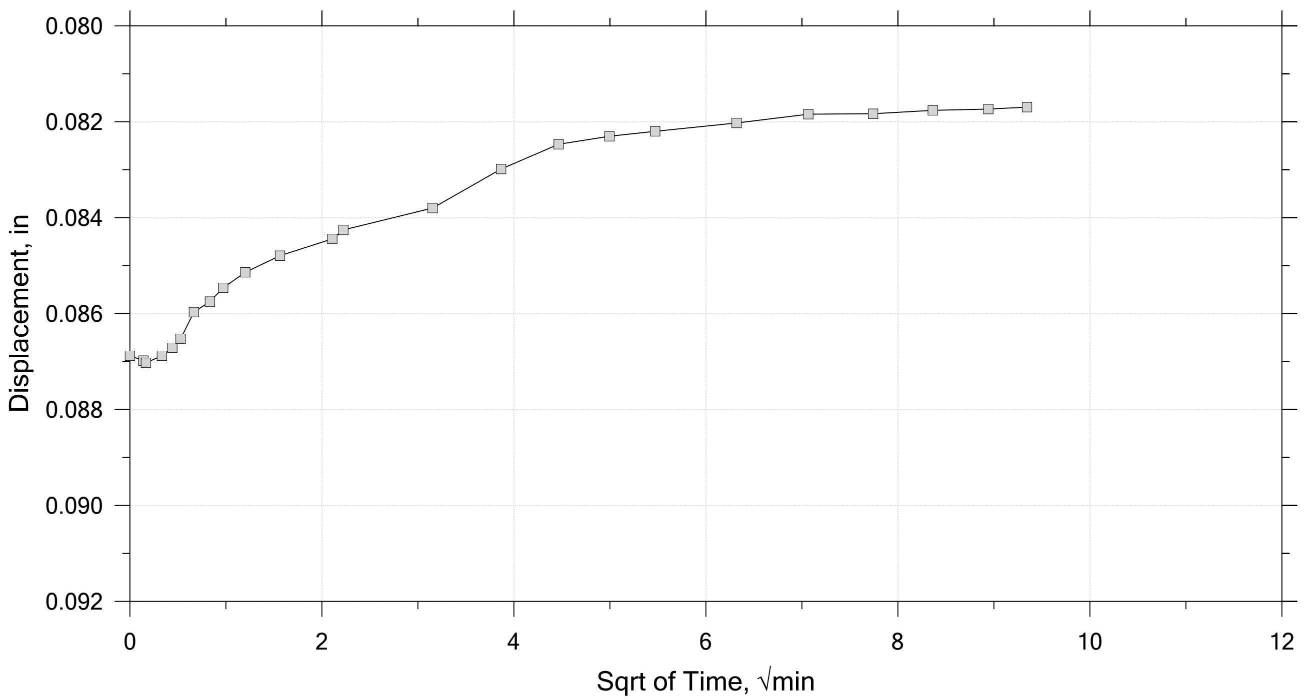


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 9/22/22020	Depth: 13.75
	Test Number: ICON 331	Preparation: Shelby Tube	Elevation: 25.85
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 11 of 21
Constant Load Step
Stress: 1.52e+03 psf





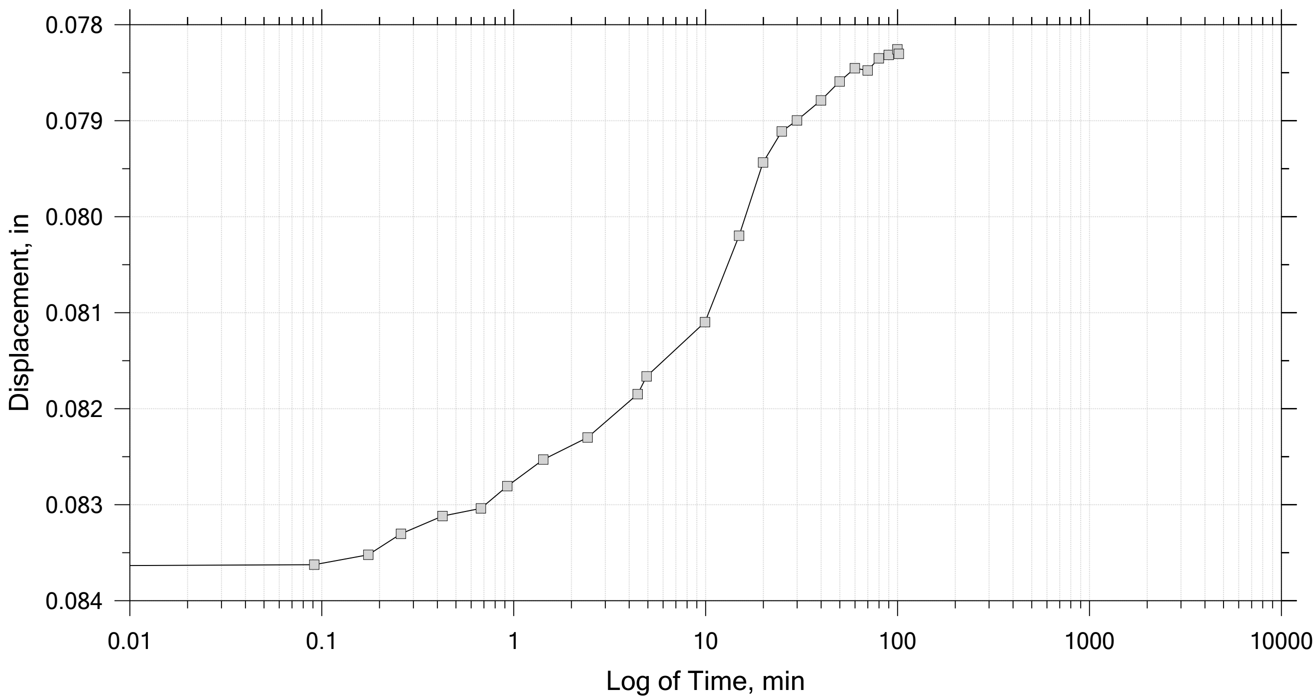
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 9/22/22020	Depth: 13.75
	Test Number: ICON 331	Preparation: Shelby Tube	Elevation: 25.85
	Description: Gray Silty Clay		
	Remarks:		

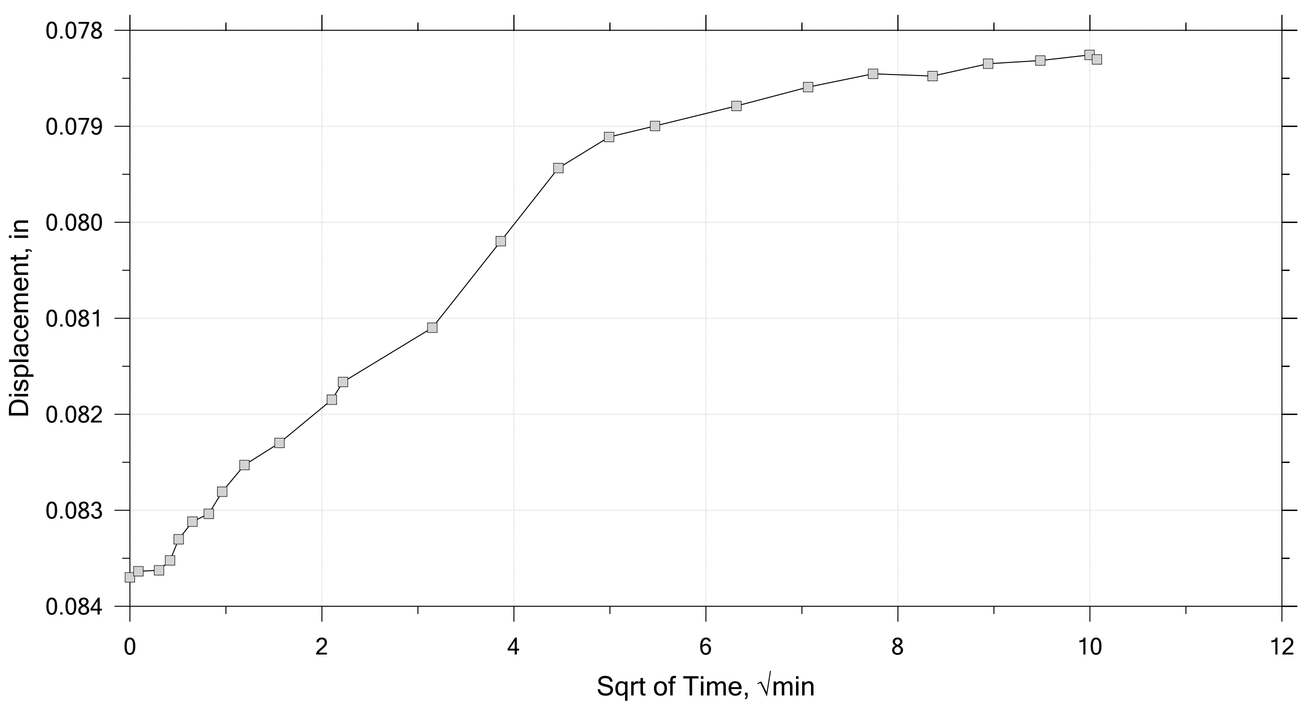
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 12 of 21

Constant Load Step

Stress: 759 psf





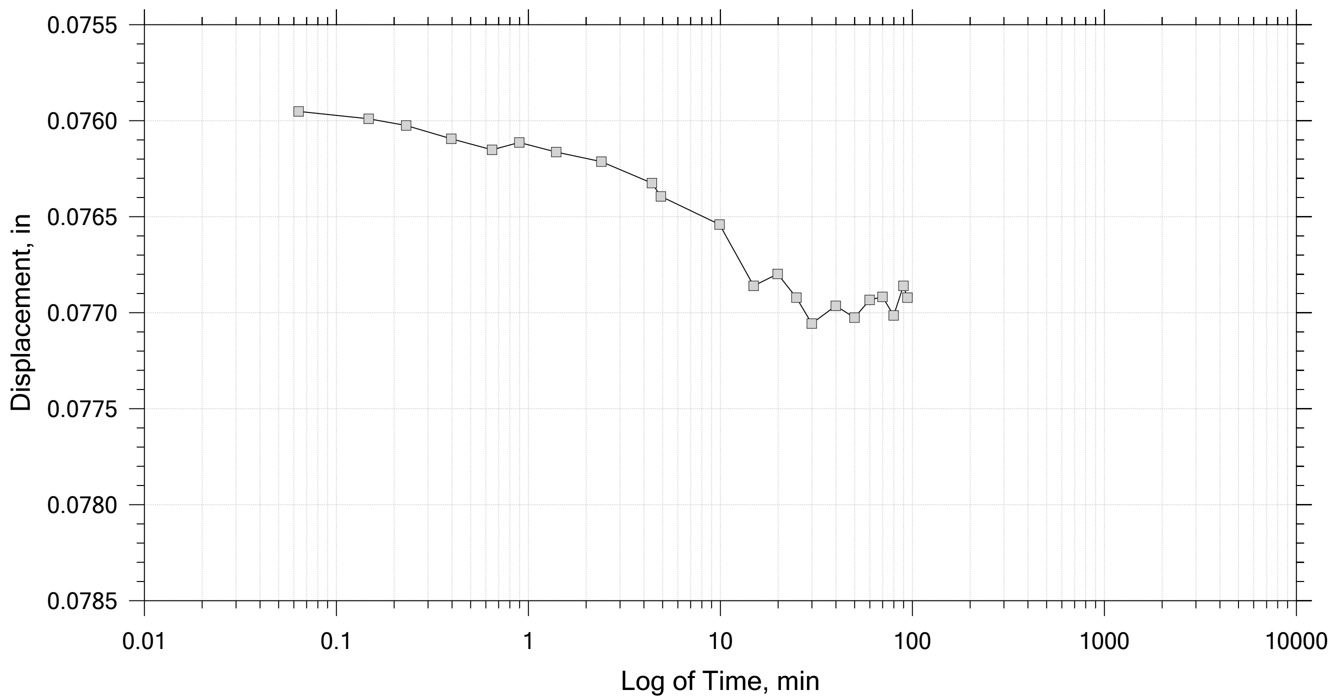
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 9/22/22020	Depth: 13.75
	Test Number: ICON 331	Preparation: Shelby Tube	Elevation: 25.85
	Description: Gray Silty Clay		
	Remarks:		

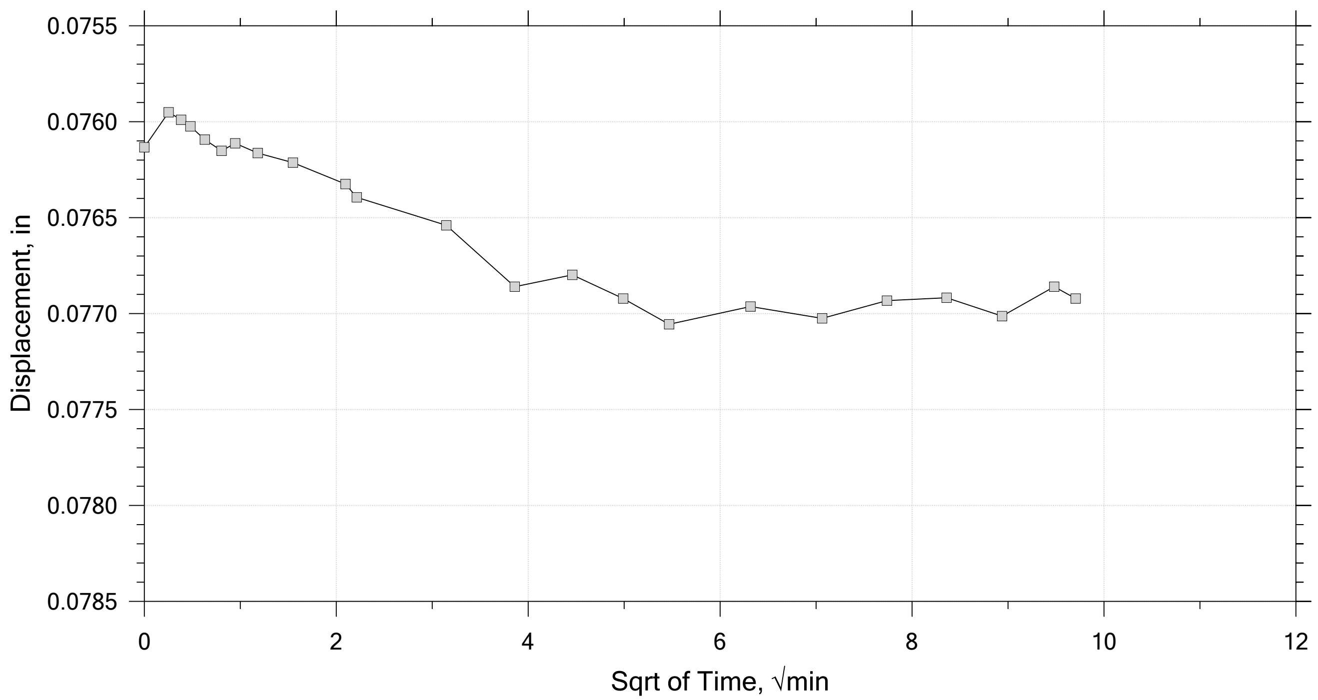
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 13 of 21

Constant Load Step

Stress: 1.33e+03 psf





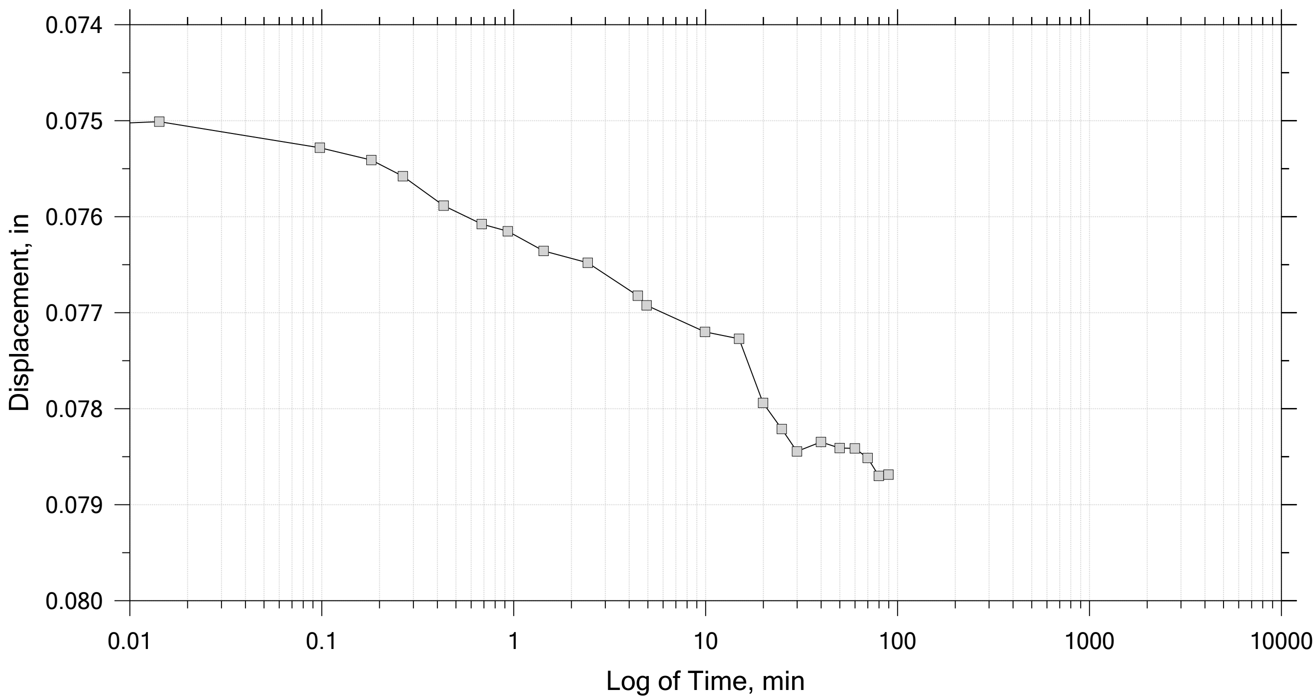
Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 9/22/22020	Depth: 13.75
	Test Number: ICON 331	Preparation: Shelby Tube	Elevation: 25.85
	Description: Gray Silty Clay		
	Remarks:		

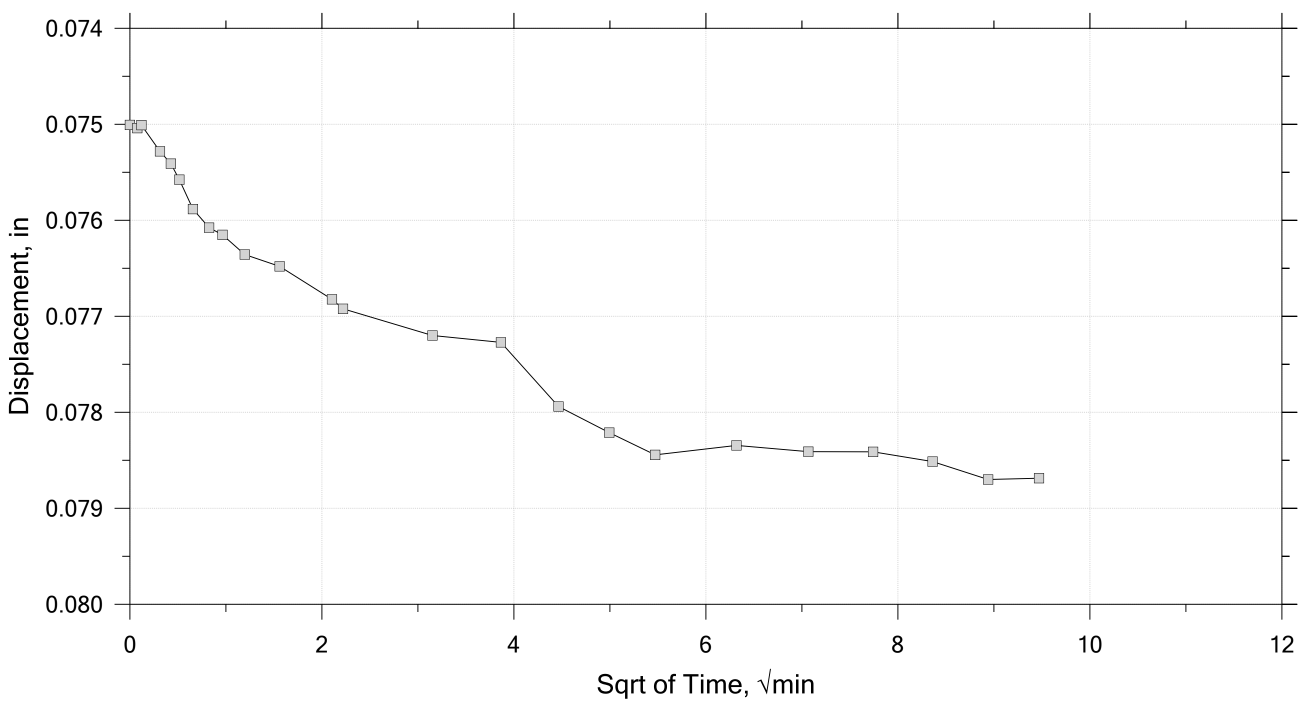
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 14 of 21

Constant Load Step

Stress: 2.66e+03 psf

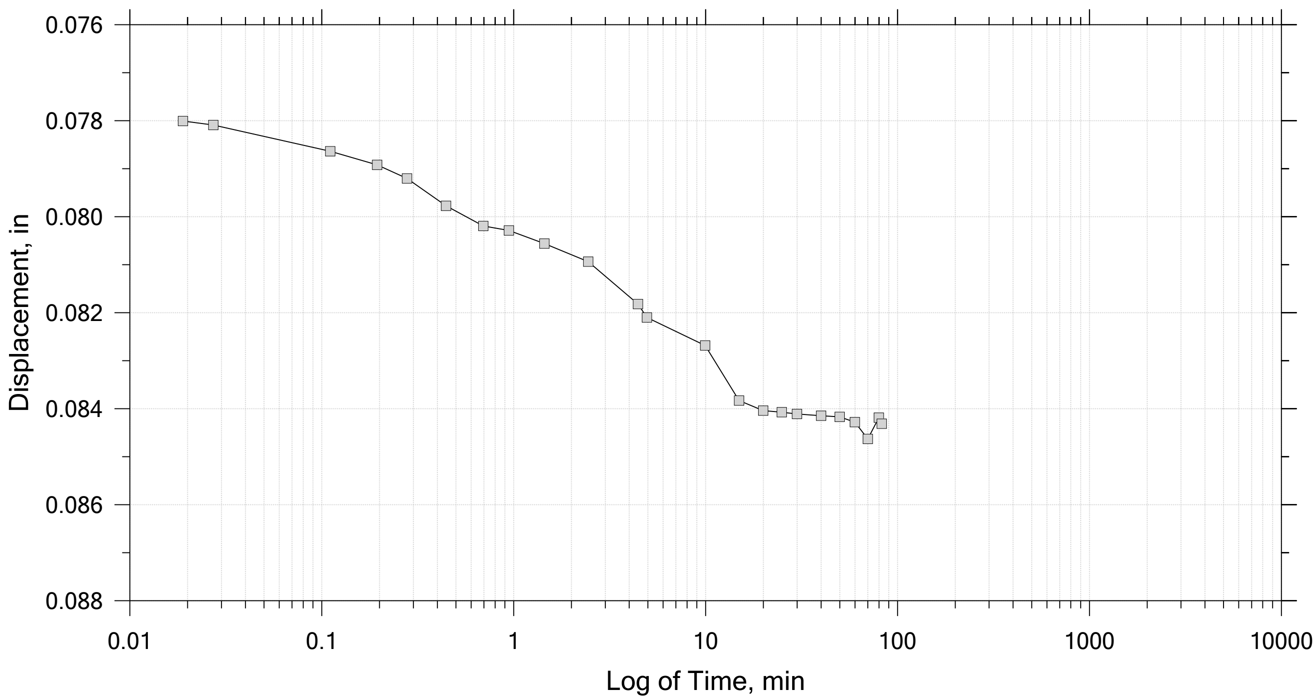


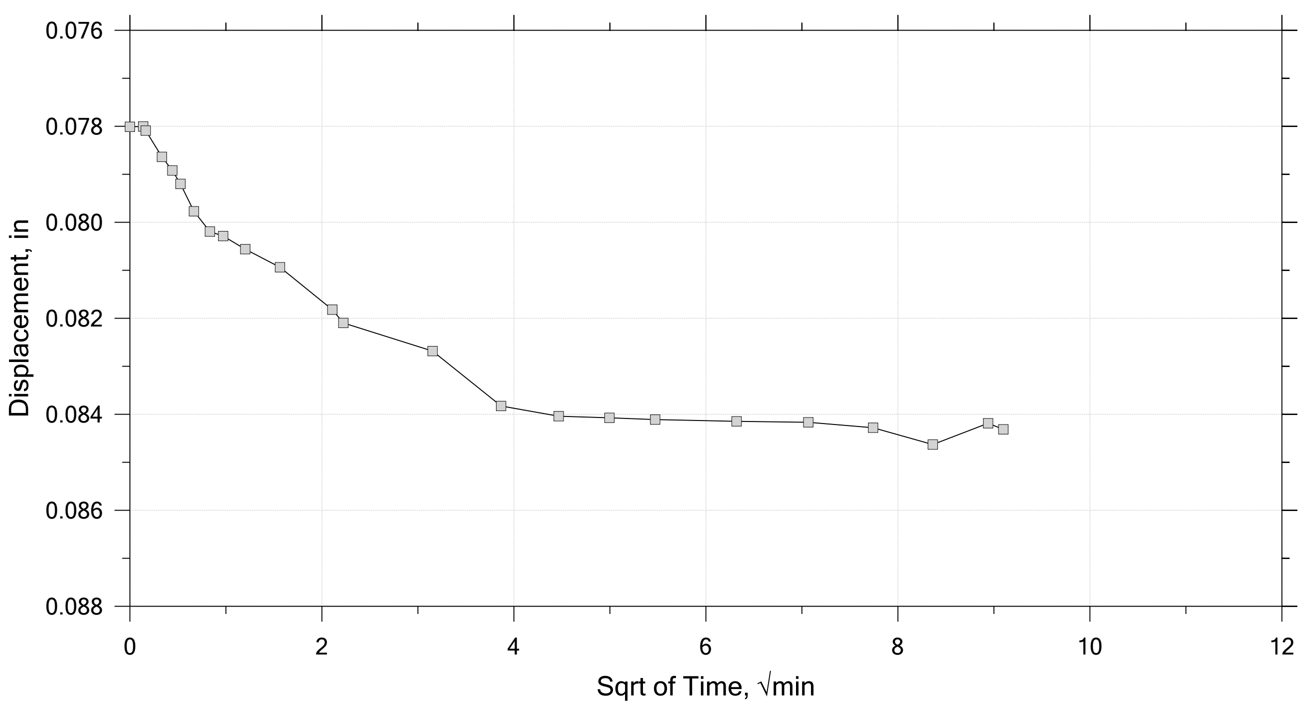


Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 9/22/22020	Depth: 13.75
	Test Number: ICON 331	Preparation: Shelby Tube	Elevation: 25.85
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 15 of 21
Constant Load Step
Stress: 5.32e+03 psf

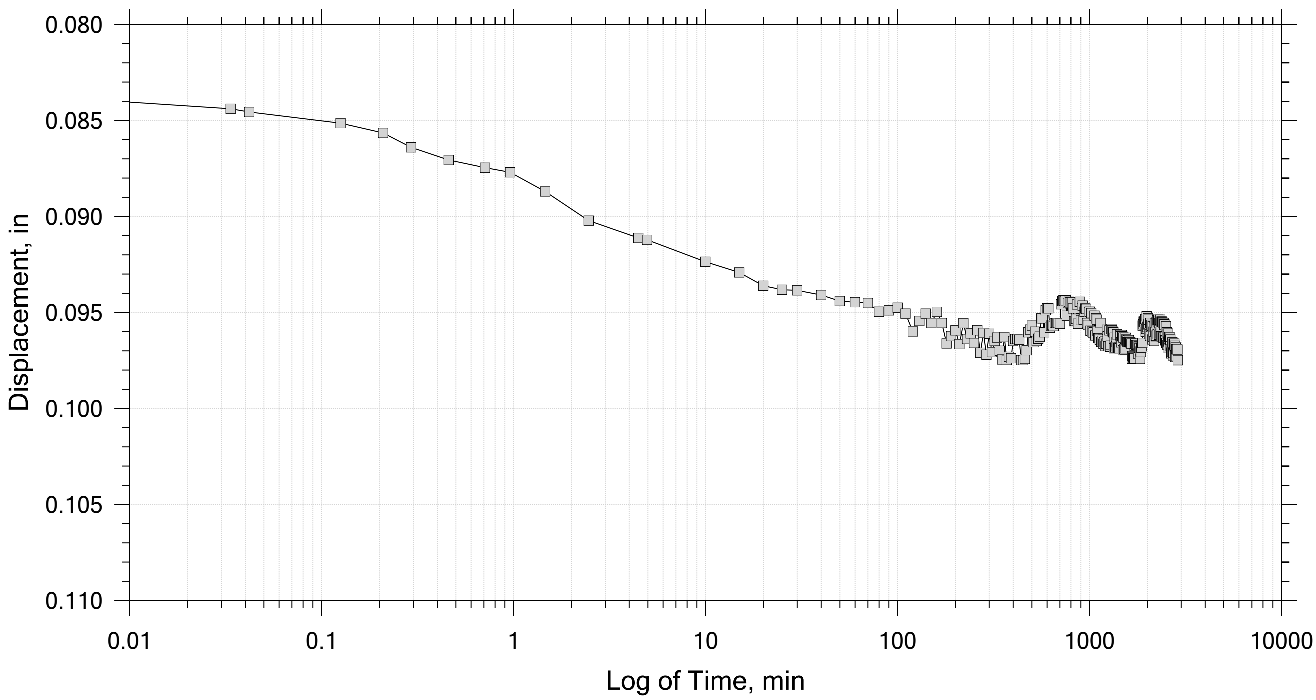


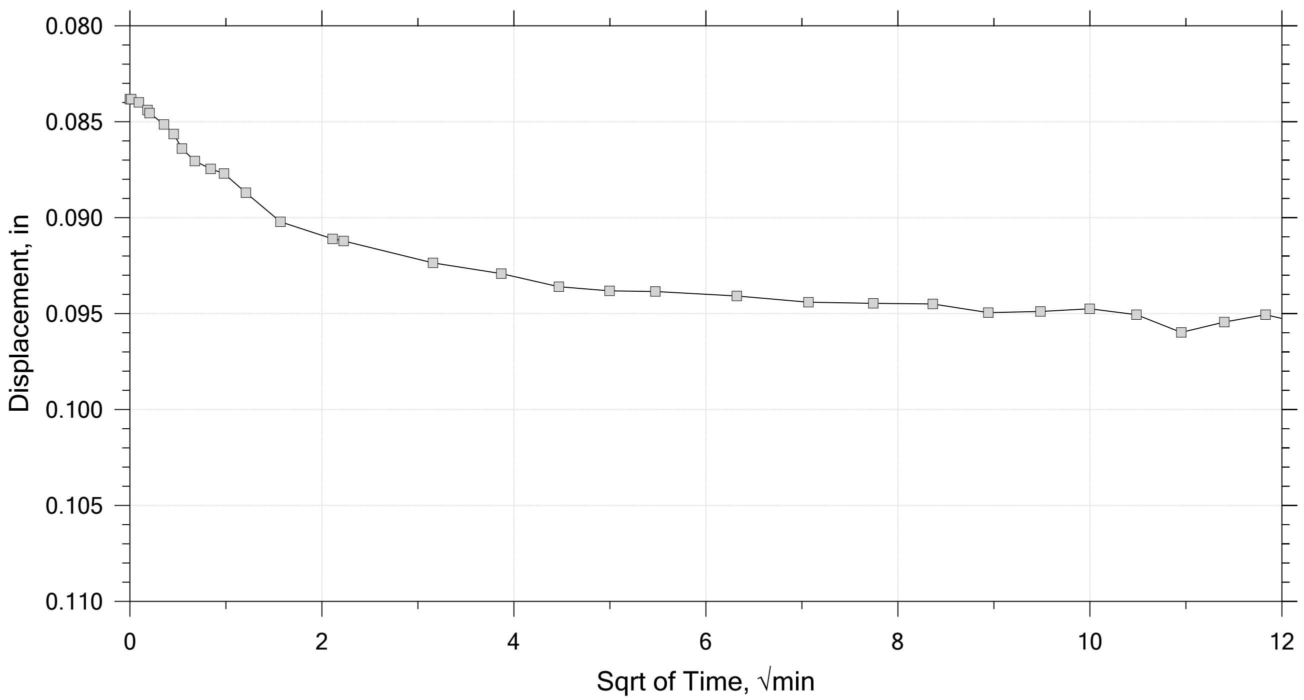


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 9/22/22020	Depth: 13.75
	Test Number: ICON 331	Preparation: Shelby Tube	Elevation: 25.85
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 16 of 21
Constant Load Step
Stress: 1.06e+04 psf

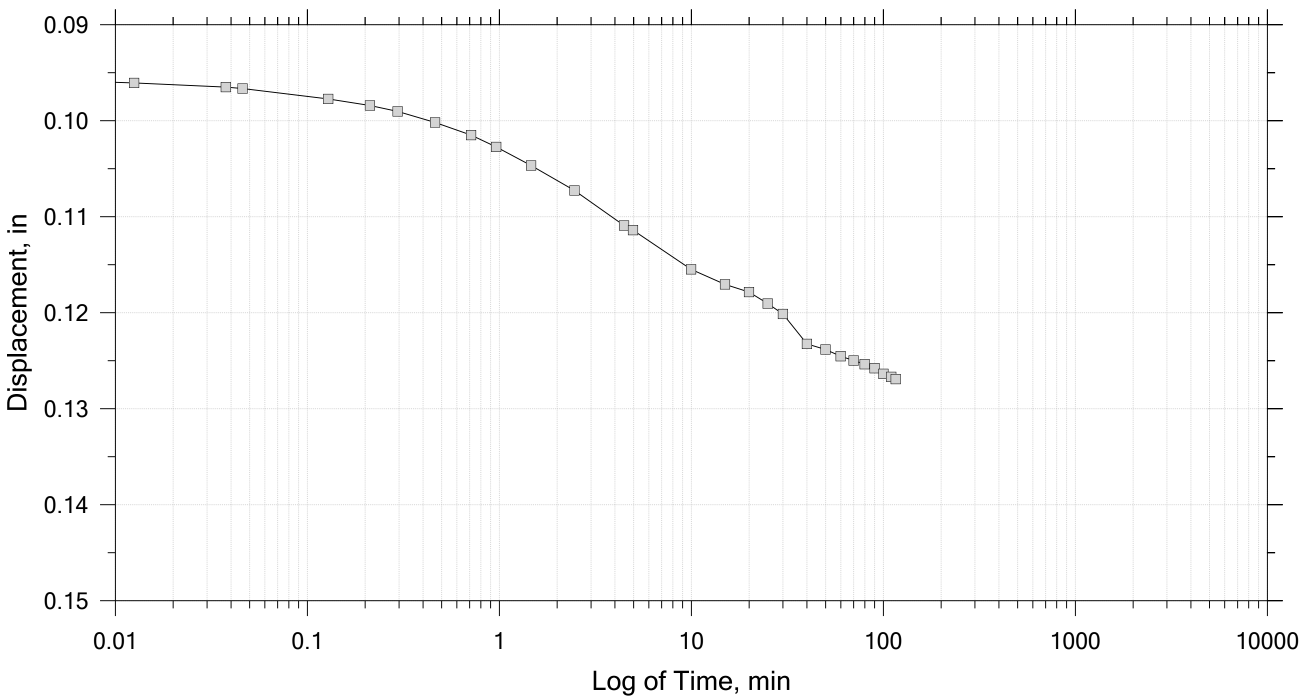


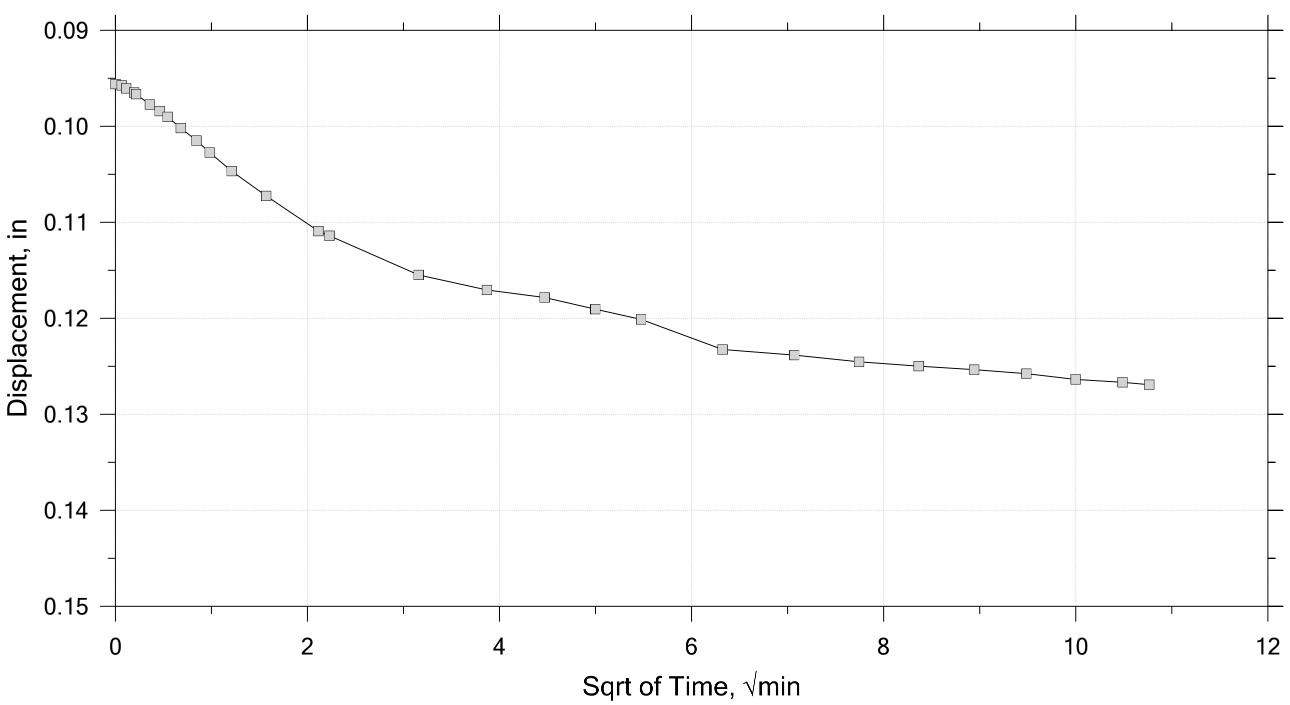


Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 9/22/22020	Depth: 13.75
	Test Number: ICON 331	Preparation: Shelby Tube	Elevation: 25.85
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 17 of 21
Constant Load Step
Stress: 2.13e+04 psf

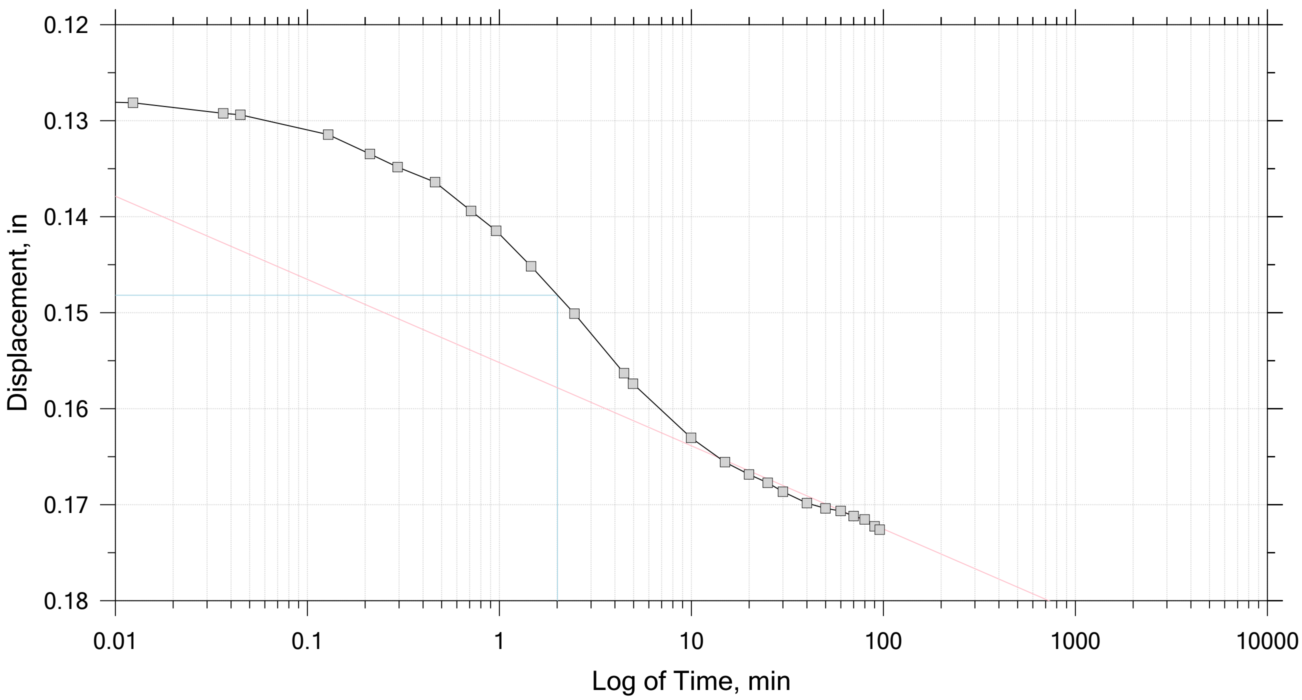


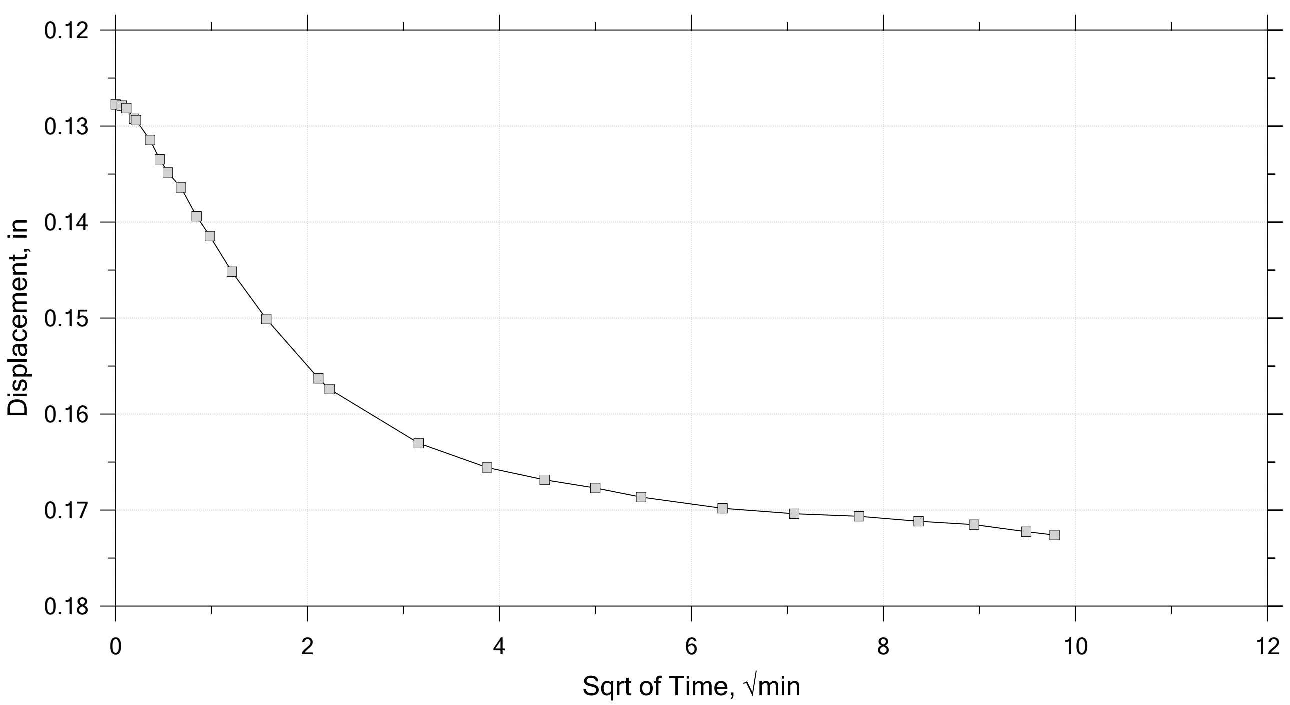


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 9/22/22020	Depth: 13.75
	Test Number: ICON 331	Preparation: Shelby Tube	Elevation: 25.85
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 18 of 21
Constant Load Step
Stress: 4.25e+04 psf





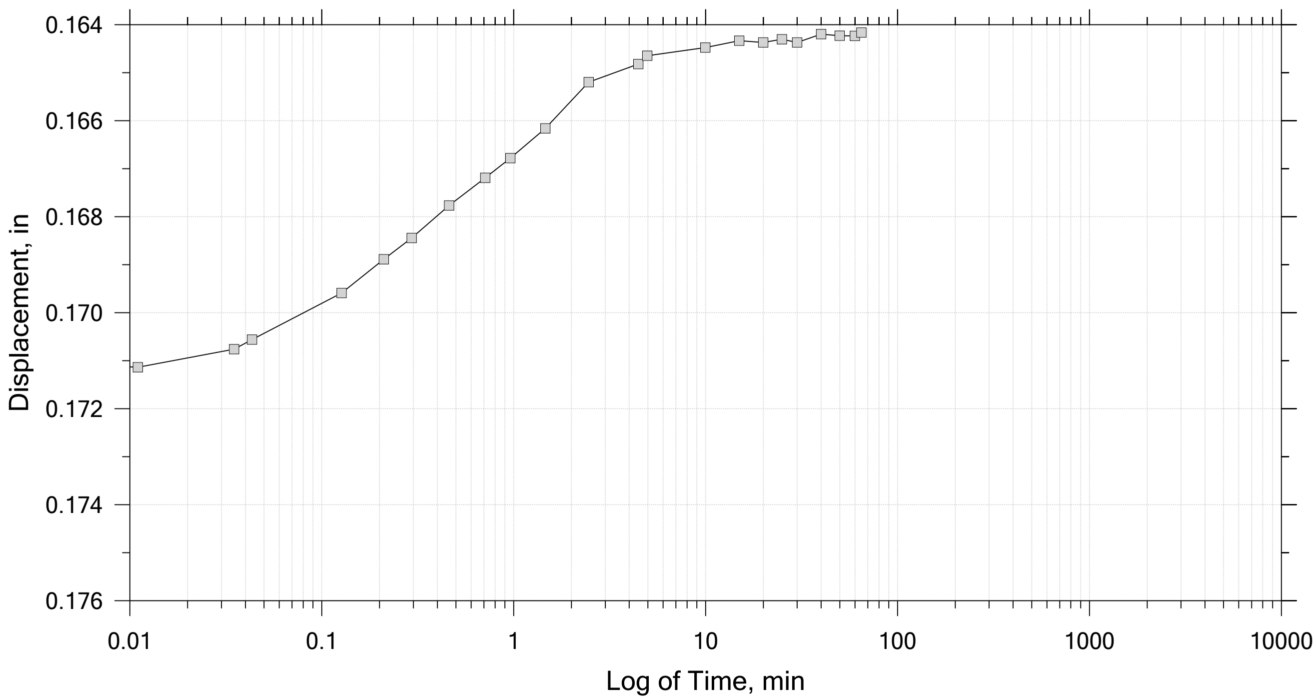
Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 9/22/22020	Depth: 13.75
	Test Number: ICON 331	Preparation: Shelby Tube	Elevation: 25.85
	Description: Gray Silty Clay		
	Remarks:		

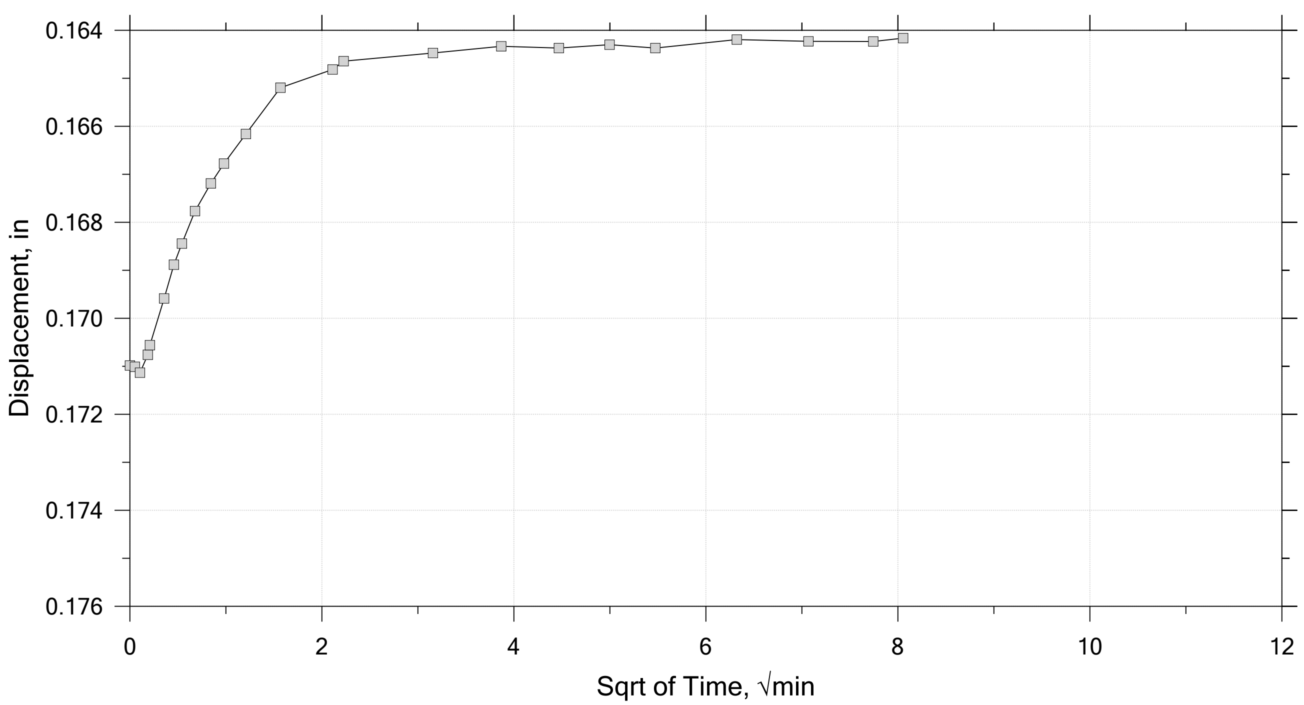
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 19 of 21

Constant Load Step

Stress: 1.06e+04 psf





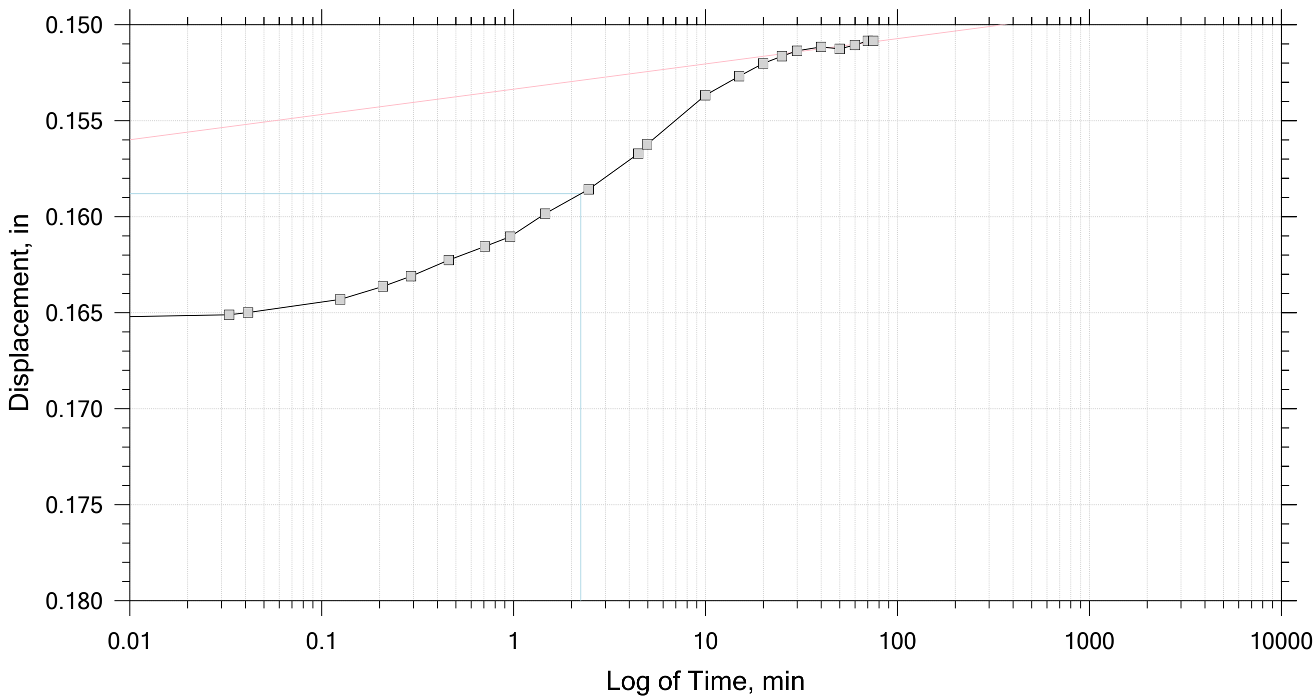
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 9/22/22020	Depth: 13.75
	Test Number: ICON 331	Preparation: Shelby Tube	Elevation: 25.85
	Description: Gray Silty Clay		
	Remarks:		

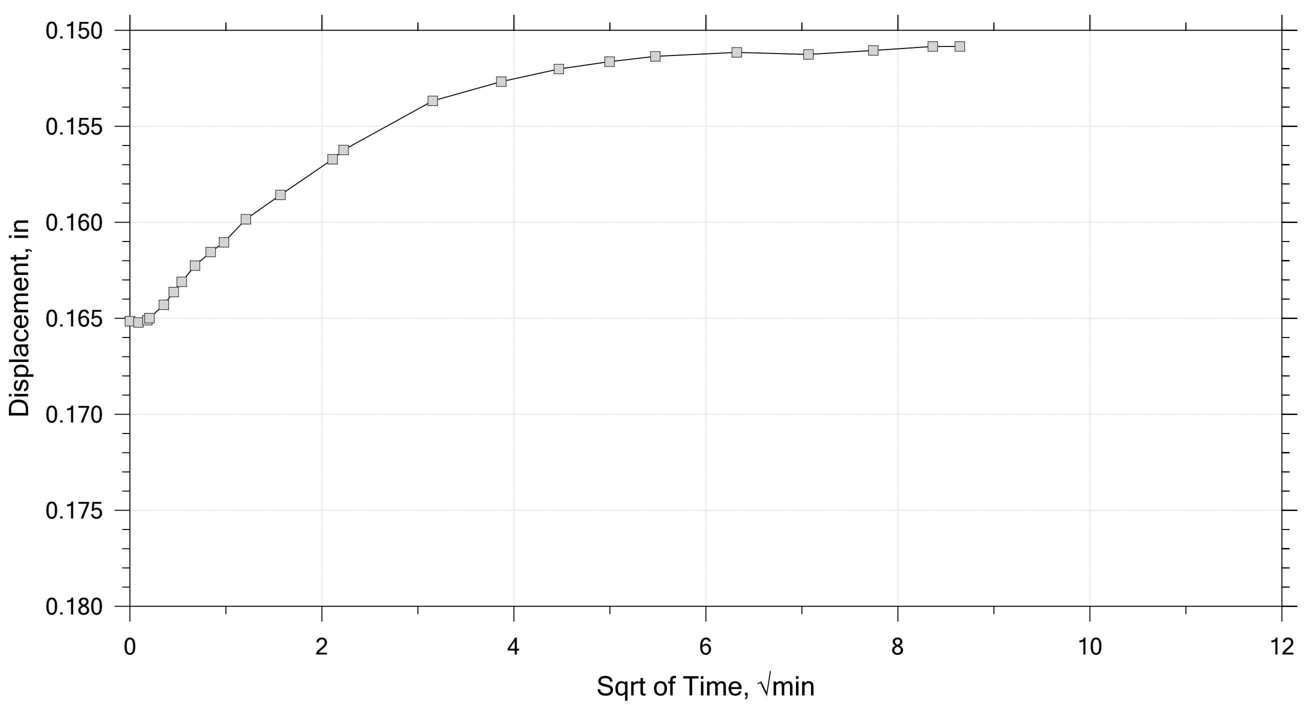
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 20 of 21

Constant Load Step

Stress: 2.66e+03 psf

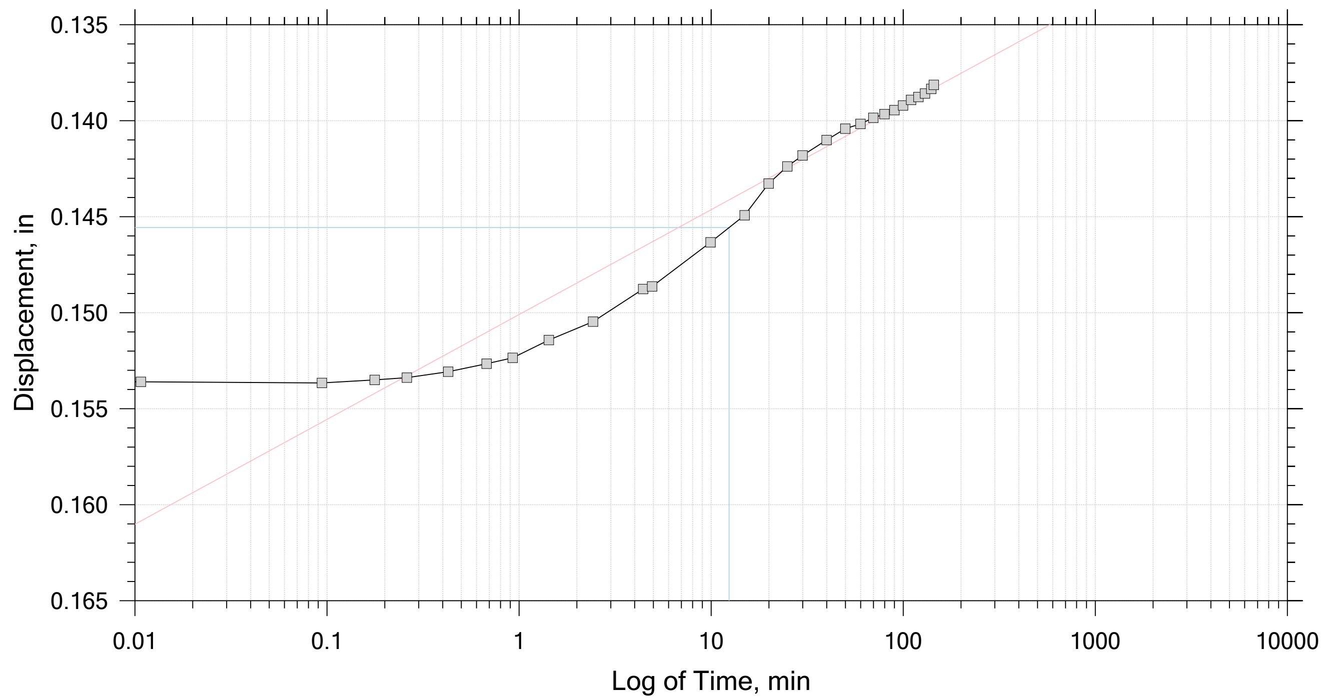


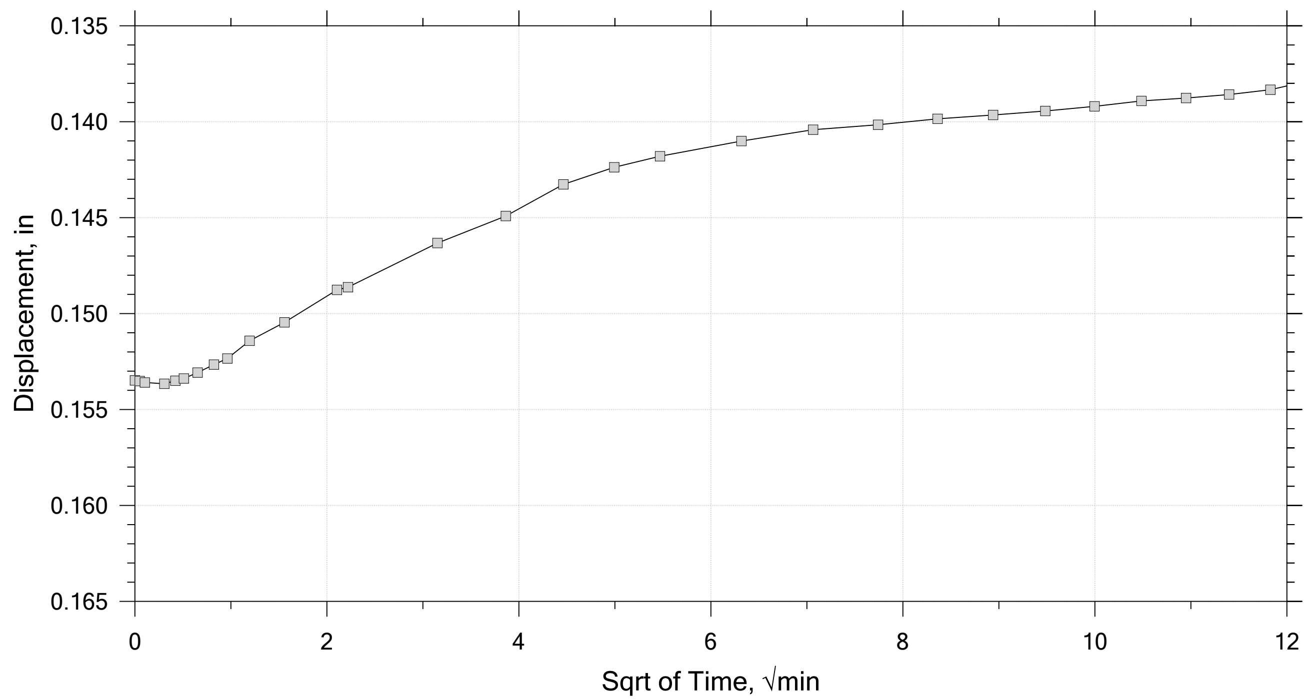


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 9/22/22020	Depth: 13.75
	Test Number: ICON 331	Preparation: Shelby Tube	Elevation: 25.85
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 21 of 21
Constant Load Step
Stress: 759 psf





Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 9/22/22020	Depth: 13.75
	Test Number: ICON 331	Preparation: Shelby Tube	Elevation: 25.85
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Specimen Diameter, in: 2.50	Specific Gravity: 2.85 (Implied)	Liquid Limit: 0
Specimen Height, in: 1.00	Initial Void Ratio: 1.06	Plastic Limit: 0
Final Height, in: 0.87	Final Void Ratio: 0.773	Plasticity Index: 0

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	219	---	"ring"	320
Mass Container, gm	36.98	111.09	111.09	60.46
Mass Container + Wet Soil, gm	122.55	263.23	253.48	202.7
Mass Container + Dry Soil, gm	100.42	223.09	223.09	172.34
Mass Dry Soil, gm	63.44	112	112	111.88
Water Content, %	34.88	35.84	27.14	27.14
Void Ratio	---	1.06	0.77	---
Degree of Saturation, %	---	96.72	100.00	---
Dry Unit Weight, pcf	---	86.53	100.33	---

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: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 9/22/22020	Depth: 13.75
	Test Number: ICON 331	Preparation: Shelby Tube	Elevation: 25.85
	Description: Gray Silty Clay		
	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	200.	0.001554	1.05	0.155	0.000	0.00e+00	1.55e+04	0.00e+00	0.00e+00
2	300.	0.002298	1.05	0.229	0.000	0.00e+00	1.48e+04	0.00e+00	0.00e+00
3	450.	0.002748	1.05	0.274	0.000	0.00e+00	5.98e+03	0.00e+00	0.00e+00
4	675.	0.004101	1.05	0.408	0.000	0.00e+00	1.20e+04	0.00e+00	0.00e+00
5	1.01e+03	0.005245	1.05	0.522	0.000	0.00e+00	6.74e+03	0.00e+00	0.00e+00
6	1.52e+03	0.006376	1.04	0.635	0.000	0.00e+00	4.45e+03	0.00e+00	0.00e+00
7	3.04e+03	0.01268	1.03	1.26	0.000	0.00e+00	8.26e+03	0.00e+00	0.00e+00
8	6.08e+03	0.03133	0.992	3.12	4.092	1.16e-01	1.22e+04	1.56e-08	0.00e+00
9	1.22e+04	0.08801	0.876	8.76	0.000	0.00e+00	1.86e+04	0.00e+00	0.00e+00
10	3.04e+03	0.08216	0.888	8.18	0.811	5.13e-01	1.28e+03	7.23e-09	0.00e+00
11	1.52e+03	0.08175	0.889	8.14	0.000	0.00e+00	5.33e+02	0.00e+00	0.00e+00
12	759.	0.07829	0.896	7.79	0.000	0.00e+00	9.06e+03	0.00e+00	0.00e+00
13	1.33e+03	0.07693	0.899	7.66	0.000	0.00e+00	-4.76e+03	-0.00e+00	0.00e+00
14	2.66e+03	0.07847	0.895	7.81	0.000	0.00e+00	2.30e+03	0.00e+00	0.00e+00
15	5.32e+03	0.08413	0.884	8.38	0.000	0.00e+00	4.24e+03	0.00e+00	0.00e+00
16	1.06e+04	0.09748	0.857	9.70	0.000	0.00e+00	5.00e+03	0.00e+00	0.00e+00
17	2.13e+04	0.1241	0.802	12.4	0.000	0.00e+00	4.99e+03	0.00e+00	0.00e+00
18	4.25e+04	0.1663	0.716	16.6	2.008	1.81e-01	3.95e+03	7.88e-09	0.00e+00
19	1.06e+04	0.1587	0.731	15.8	0.000	0.00e+00	4.75e+02	0.00e+00	0.00e+00
20	2.66e+03	0.1519	0.745	15.1	2.240	1.59e-01	1.69e+03	2.95e-09	0.00e+00
21	759.	0.1393	0.771	13.9	12.400	2.93e-02	1.32e+04	4.26e-09	0.00e+00

Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 9/22/22020	Depth: 13.75
	Test Number: ICON 331	Preparation: Shelby Tube	Elevation: 25.85
	Description: Gray Silty Clay		
	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	200.	0.001554	1.05	0.155	41.974	5.09e-02	1.55e+04	8.67e-09
2	300.	0.002298	1.05	0.229	94.419	2.26e-02	1.48e+04	3.68e-09
3	450.	0.002748	1.05	0.274	0.000	0.00e+00	5.98e+03	0.00e+00
4	675.	0.004101	1.05	0.408	98.628	2.15e-02	1.20e+04	2.84e-09
5	1.01e+03	0.005245	1.05	0.522	12.672	1.67e-01	6.74e+03	1.24e-08
6	1.52e+03	0.006376	1.04	0.635	11.037	1.92e-01	4.45e+03	9.39e-09
7	3.04e+03	0.01268	1.03	1.26	10.569	1.99e-01	8.26e+03	1.81e-08
8	6.08e+03	0.03133	0.992	3.12	12.040	1.70e-01	1.22e+04	2.29e-08
9	1.22e+04	0.08801	0.876	8.76	193.466	9.78e-03	1.86e+04	2.00e-09
10	3.04e+03	0.08216	0.888	8.18	3.548	5.05e-01	1.28e+03	7.11e-09
11	1.52e+03	0.08175	0.889	8.14	33.426	5.40e-02	5.33e+02	3.17e-10
12	759.	0.07829	0.896	7.79	41.645	4.35e-02	9.06e+03	4.34e-09
13	1.33e+03	0.07693	0.899	7.66	27.409	6.65e-02	-4.76e+03	-3.48e-09
14	2.66e+03	0.07847	0.895	7.81	29.049	6.27e-02	2.30e+03	1.59e-09
15	5.32e+03	0.08413	0.884	8.38	15.630	1.16e-01	4.24e+03	5.40e-09
16	1.06e+04	0.09748	0.857	9.70	0.000	0.00e+00	5.00e+03	0.00e+00
17	2.13e+04	0.1241	0.802	12.4	24.008	7.05e-02	4.99e+03	3.87e-09
18	4.25e+04	0.1663	0.716	16.6	7.909	1.98e-01	3.95e+03	8.61e-09
19	1.06e+04	0.1587	0.731	15.8	1.570	9.57e-01	4.75e+02	5.00e-09
20	2.66e+03	0.1519	0.745	15.1	9.407	1.63e-01	1.69e+03	3.02e-09
21	759.	0.1393	0.771	13.9	42.000	3.72e-02	1.32e+04	5.41e-09

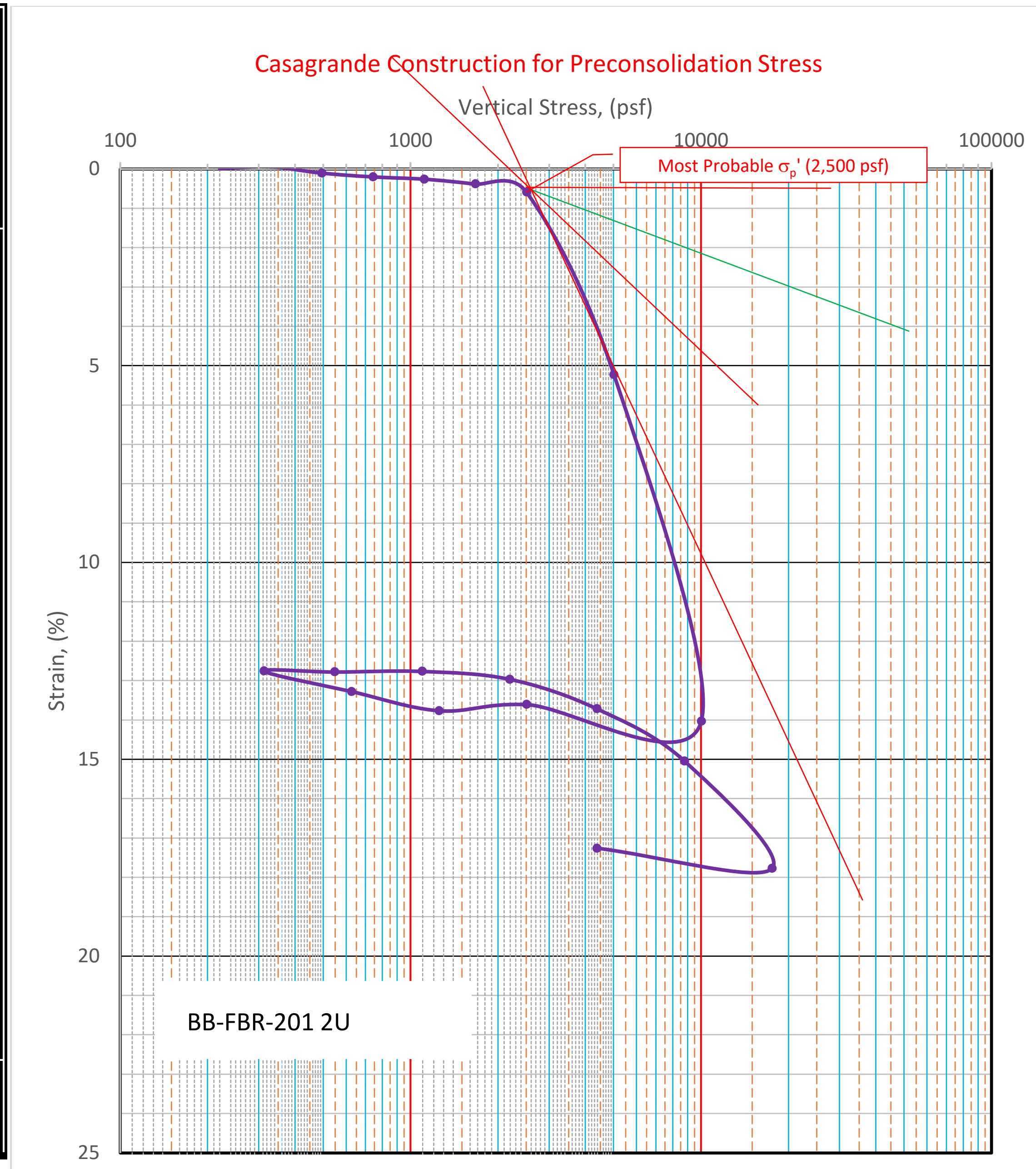
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 9/22/22020	Depth: 13.75
	Test Number: ICON 331	Preparation: Shelby Tube	Elevation: 25.85
	Description: Gray Silty Clay		
	Remarks:		
	Displacement at End of Primary		

BB-FBR-201 2U

Consolidation Test Data
Summary Report

Project Name:	Bucknam Road Bridge
Project Number:	166-14
Project Location:	Falmouth, Maine
Client:	GZA
Sample Description:	Gray Silty Clay
Preparation:	Trimmed Shelby Tube

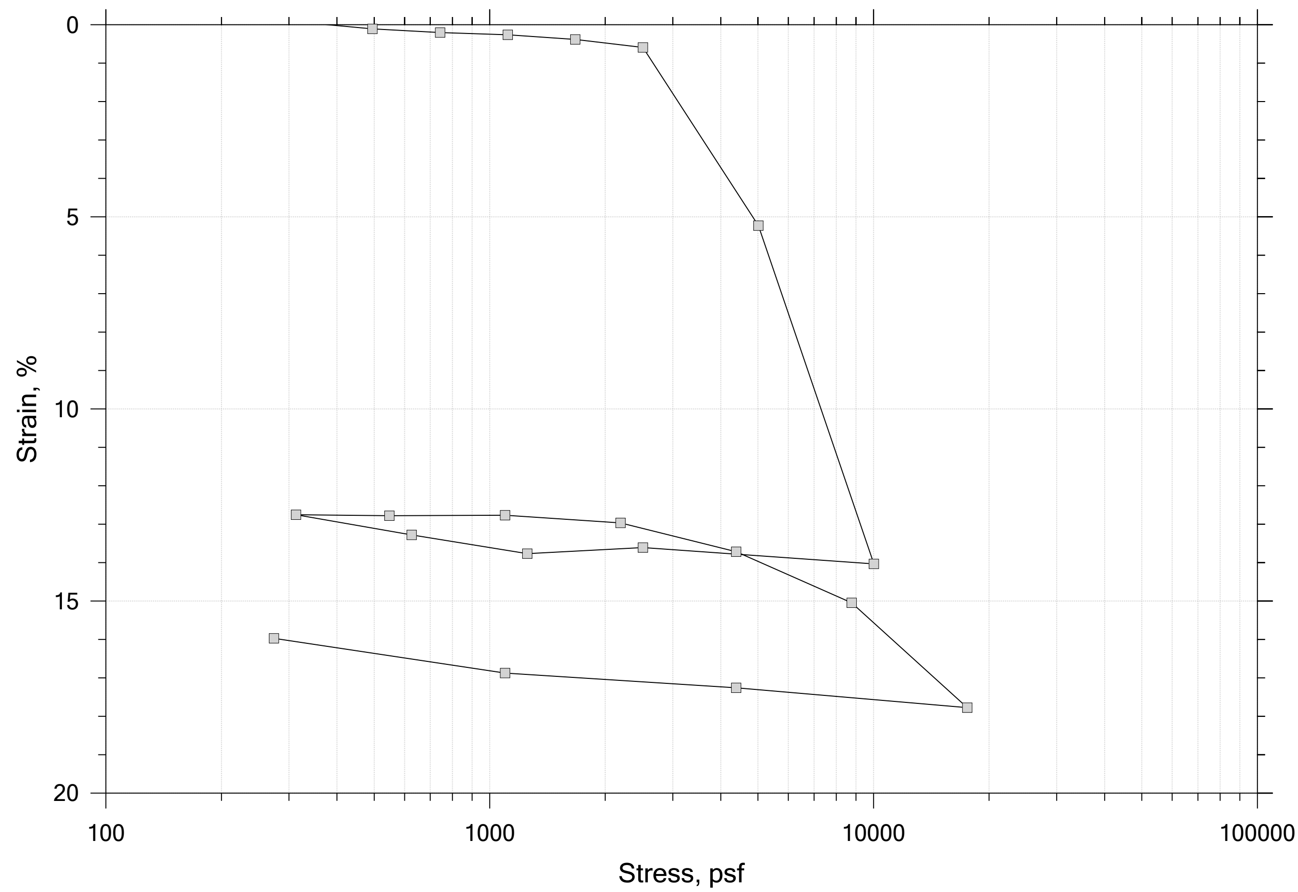
Lab Test No:	ICON 334			
Boring No.	BB-FBR-201			
Sample No:	2U			
Boring Elevation (ft).	39.6			
Sample Depth (ft):	20-22			
Test Specimen Depth (Ft):	21.65			
Test Specimen Elevation:	18.0			
Water Content (%):	45.3			
Dry Unit Weight (pcf):	76.1			
Wet Unit Weight (pcf):	110.5			
Saturation Before (%):	98.9			
Saturation After (%):	100.0			
Void Ratio Before:	1.3			
Void Ratio After:	1.0			
Overburden Pressure (psf):	--			
Max Previous stress (psf):	2,500			
Max Prev. stress (Work) (psf):	2,500			
OCR:	--			
Compression Index (C_{CE}):	0.16			
Recompression Index (C_{RE}):	0.018			
Liquid Limit:				
Plastic Limit:				
Plasticity Index:				
Liquidity Index:				
Specific Gravity (implied)	__			
Lab Vane Su at 21.85 ft. (psf)	632			
Tested By:	sjr			
Date Tested:	10/3/2020			
Checked By:	sjr			

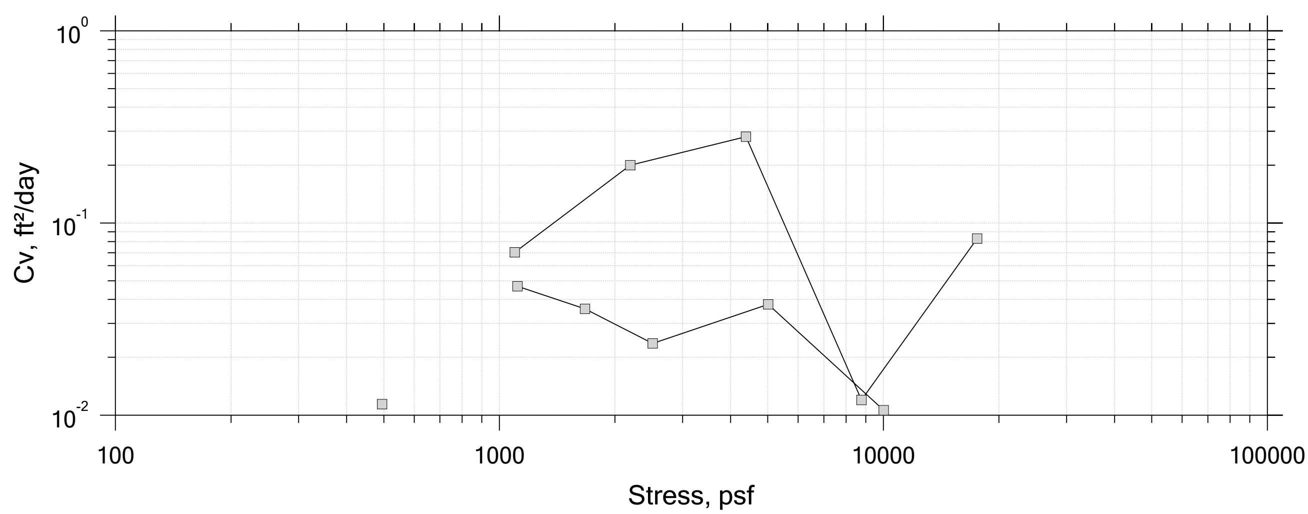


Soil Metrics LLC Geotechnical Engineering

One-Dimensional Consolidation by ASTM D2435 - Method B

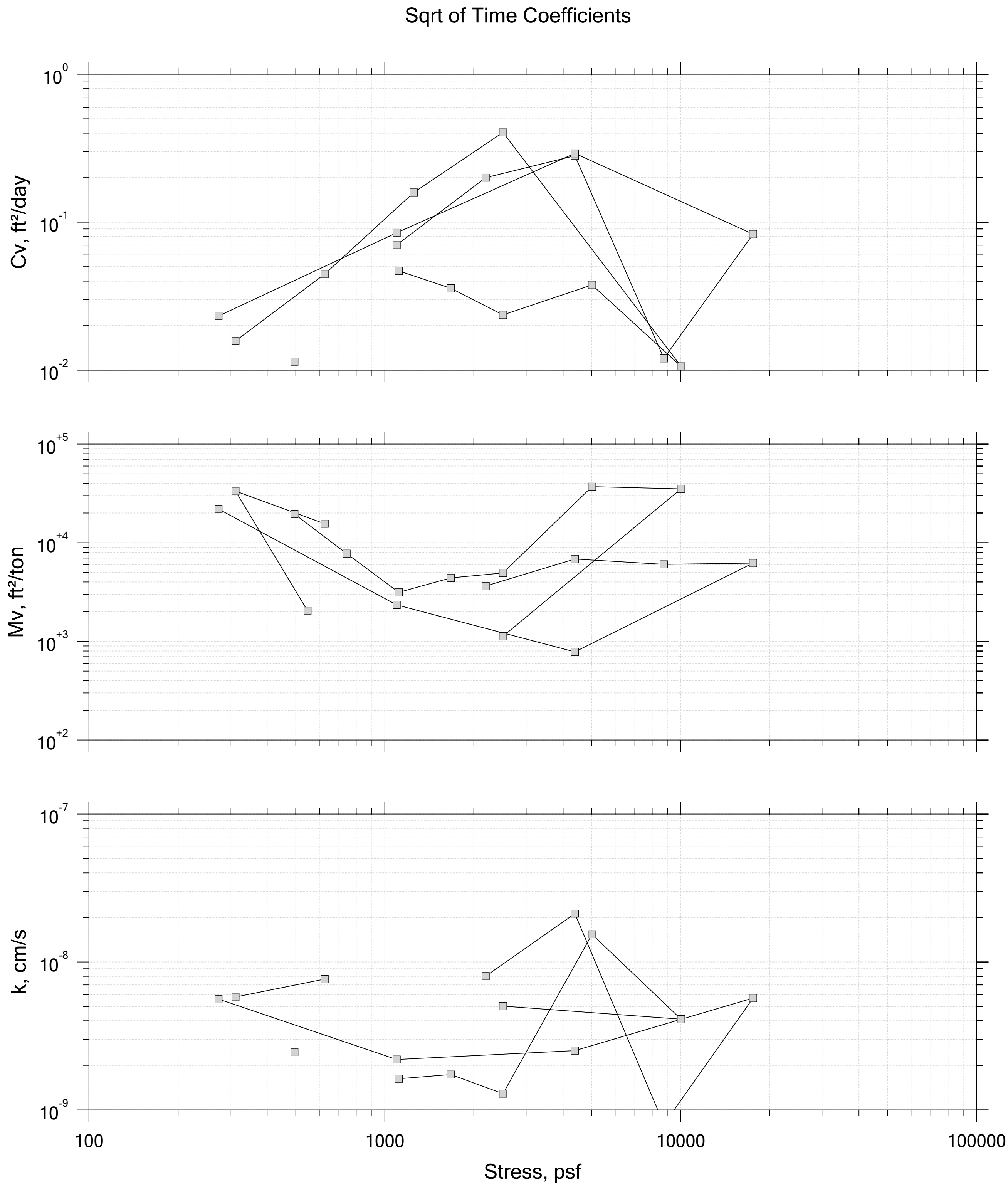
Summary Report





Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 2U	Test Date: 10/9/2020	Depth: 21.65
	Test Number: ICON 334	Preparation: Shelby Tube	Elevation: 17.95
	Description: Gray Silty Clay		
	Remarks:		
	Displacement at End of Primary		

One-Dimensional Consolidation by ASTM D2435 - Method B



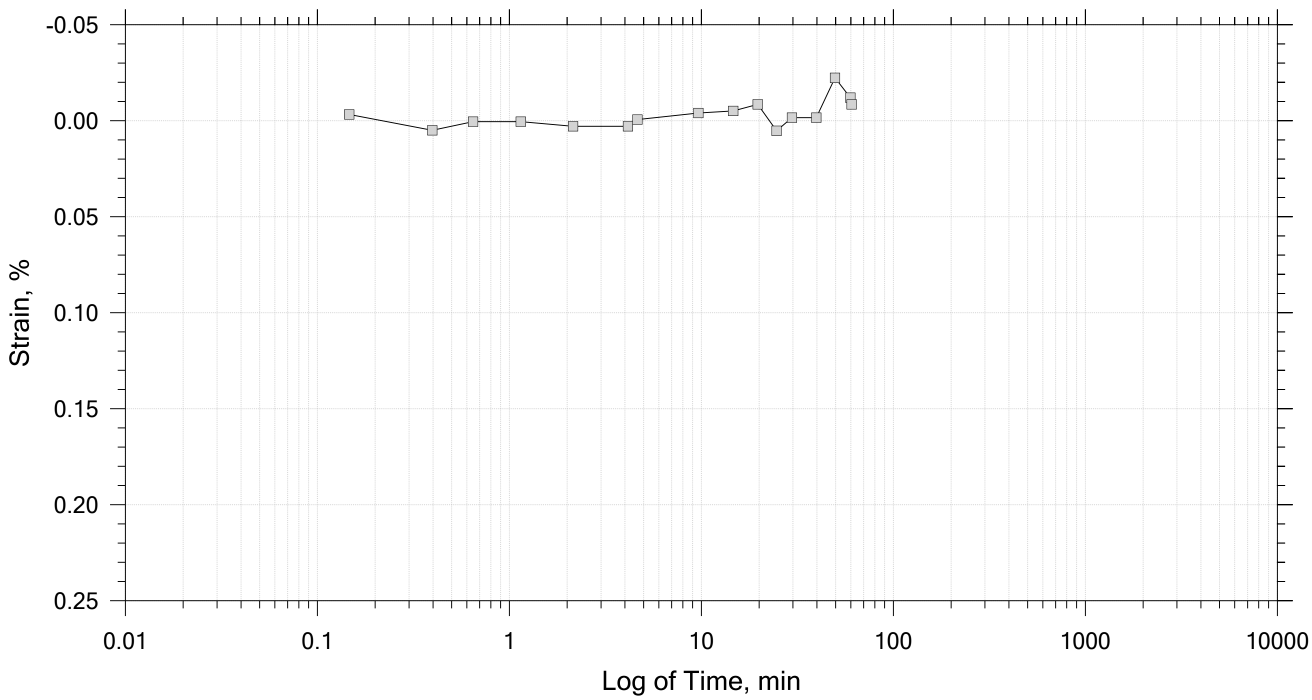
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 2U	Test Date: 10/9/2020	Depth: 21.65
	Test Number: ICON 334	Preparation: Shelby Tube	Elevation: 17.95
	Description: Gray Silty Clay		
	Remarks:		

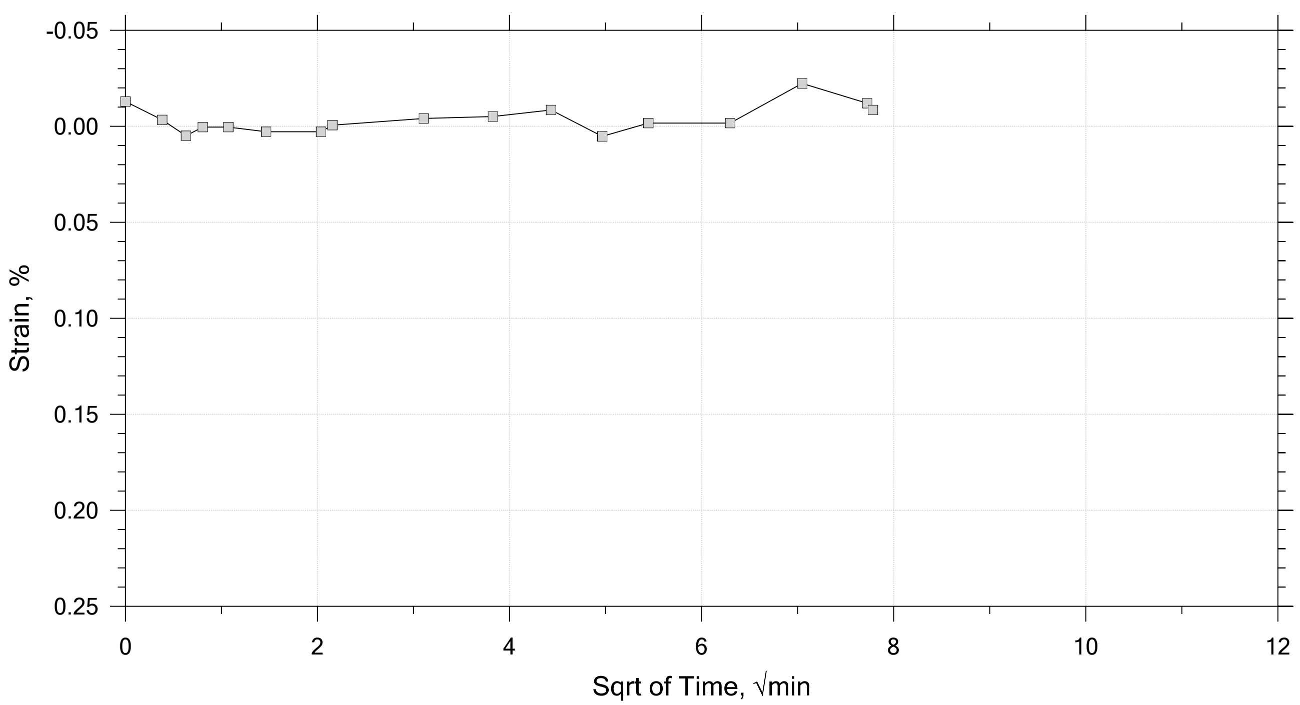
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 1 of 22

Constant Load Step

Stress: 220 psf

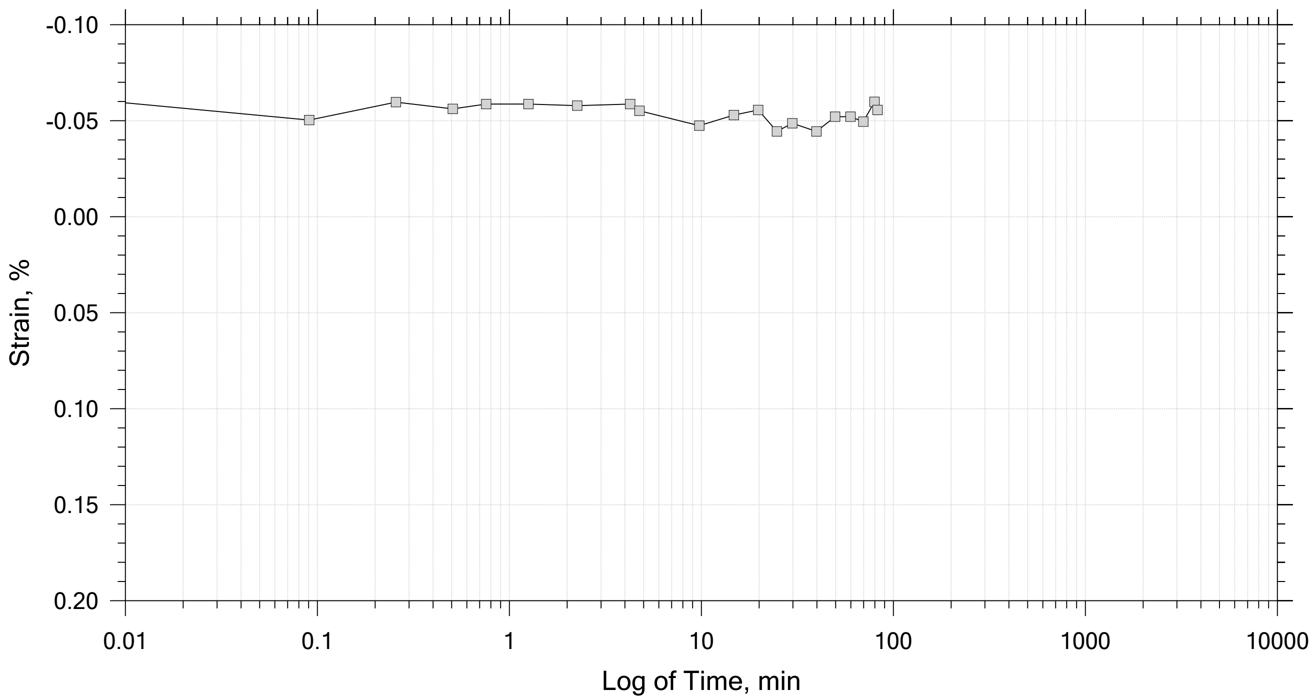


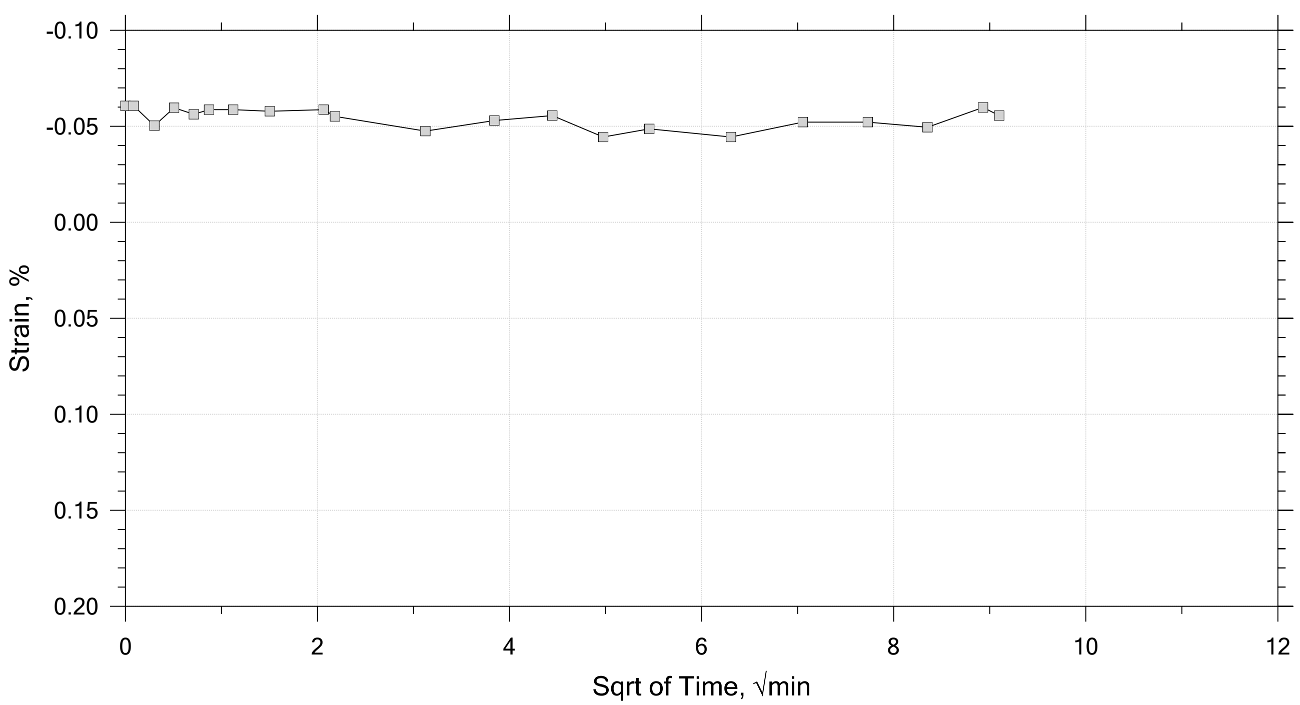


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 2U	Test Date: 10/9/2020	Depth: 21.65
	Test Number: ICON 334	Preparation: Shelby Tube	Elevation: 17.95
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 2 of 22
Constant Load Step
Stress: 330 psf





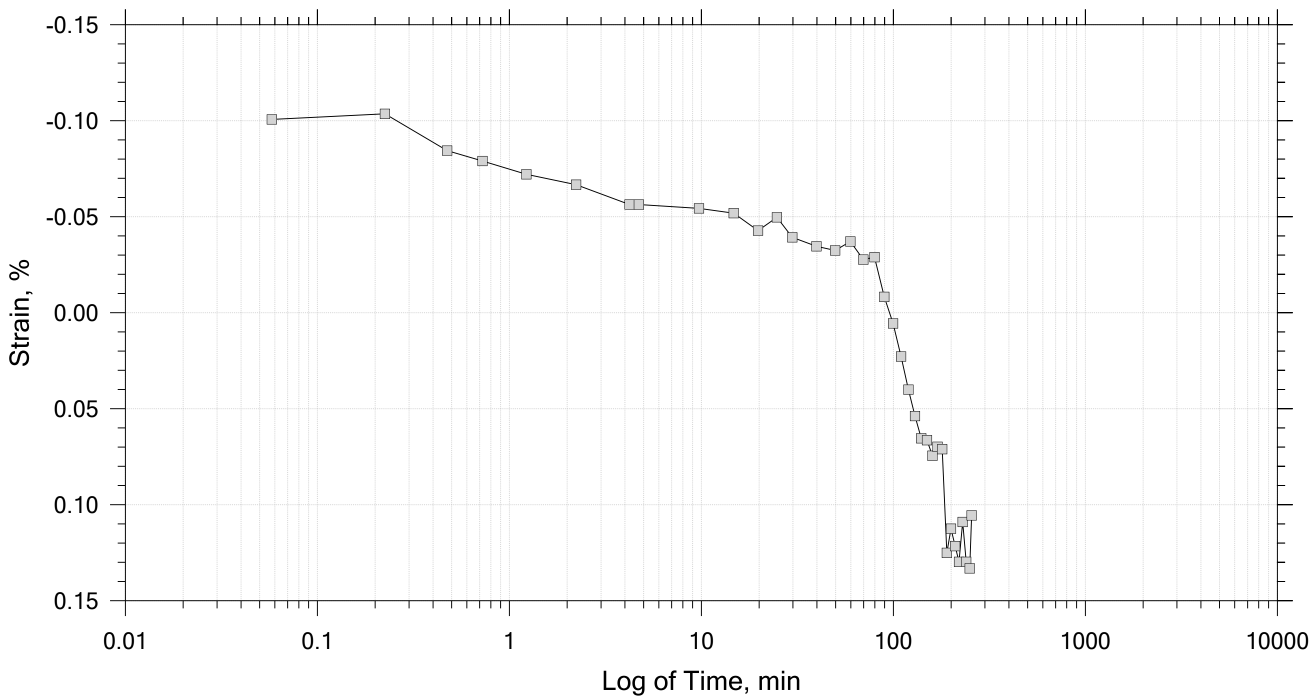
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 2U	Test Date: 10/9/2020	Depth: 21.65
	Test Number: ICON 334	Preparation: Shelby Tube	Elevation: 17.95
	Description: Gray Silty Clay		
	Remarks:		

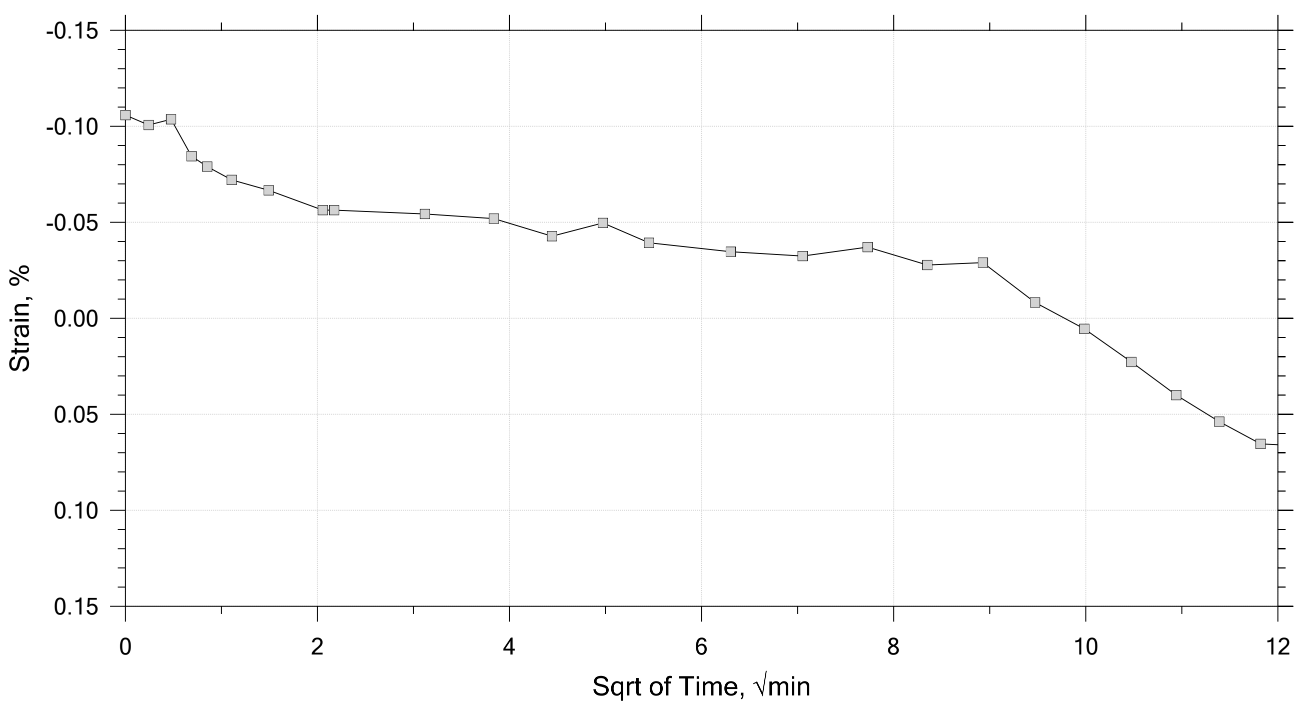
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 3 of 22

Constant Load Step

Stress: 495 psf





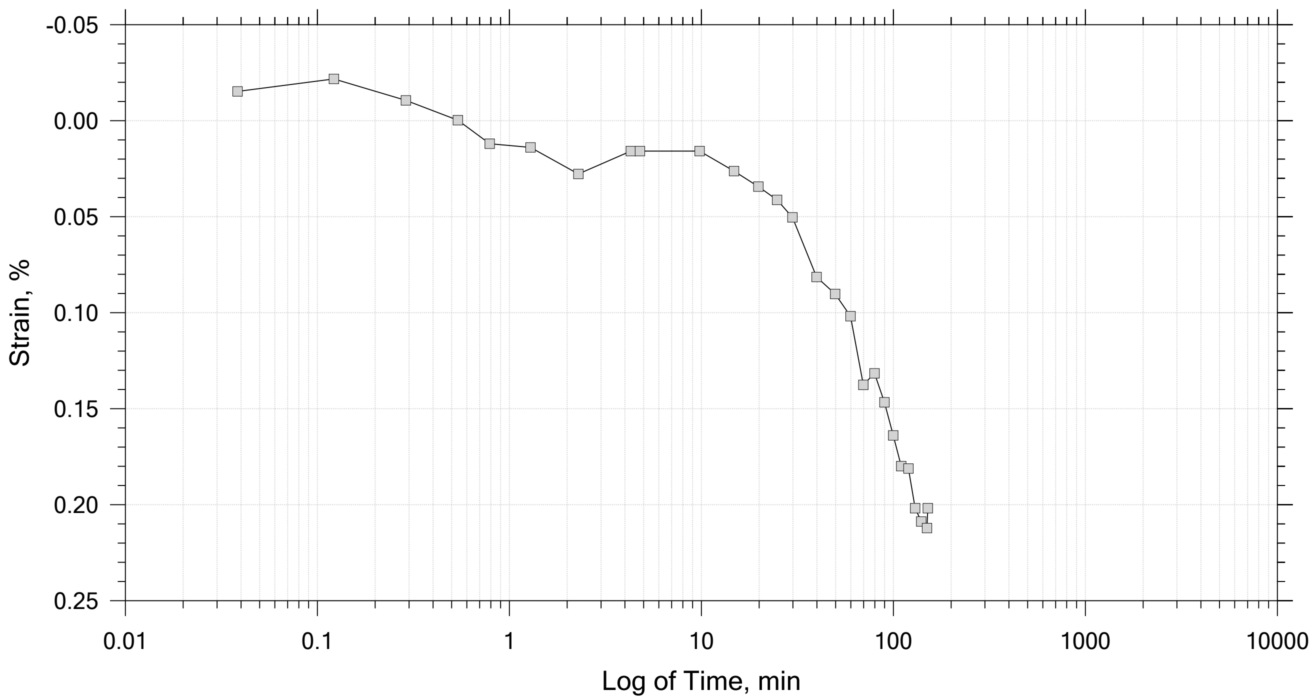
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 2U	Test Date: 10/9/2020	Depth: 21.65
	Test Number: ICON 334	Preparation: Shelby Tube	Elevation: 17.95
	Description: Gray Silty Clay		
	Remarks:		

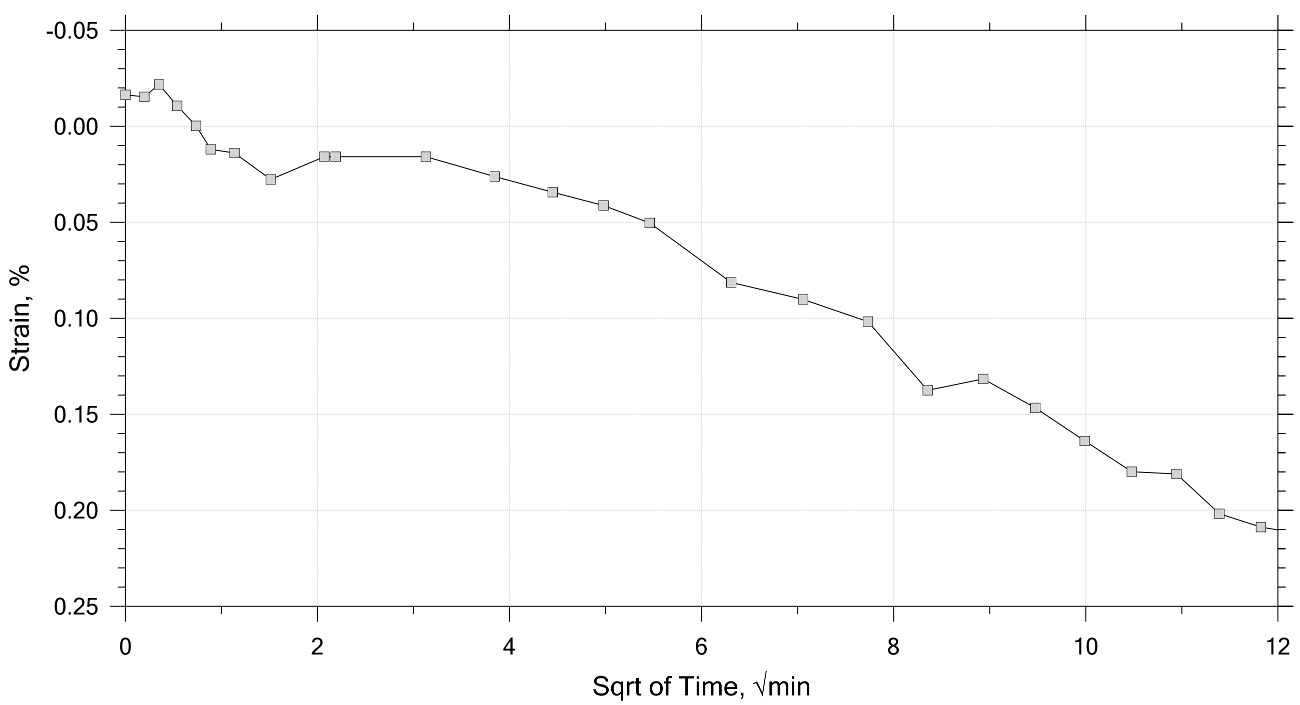
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 4 of 22

Constant Load Step

Stress: 743 psf

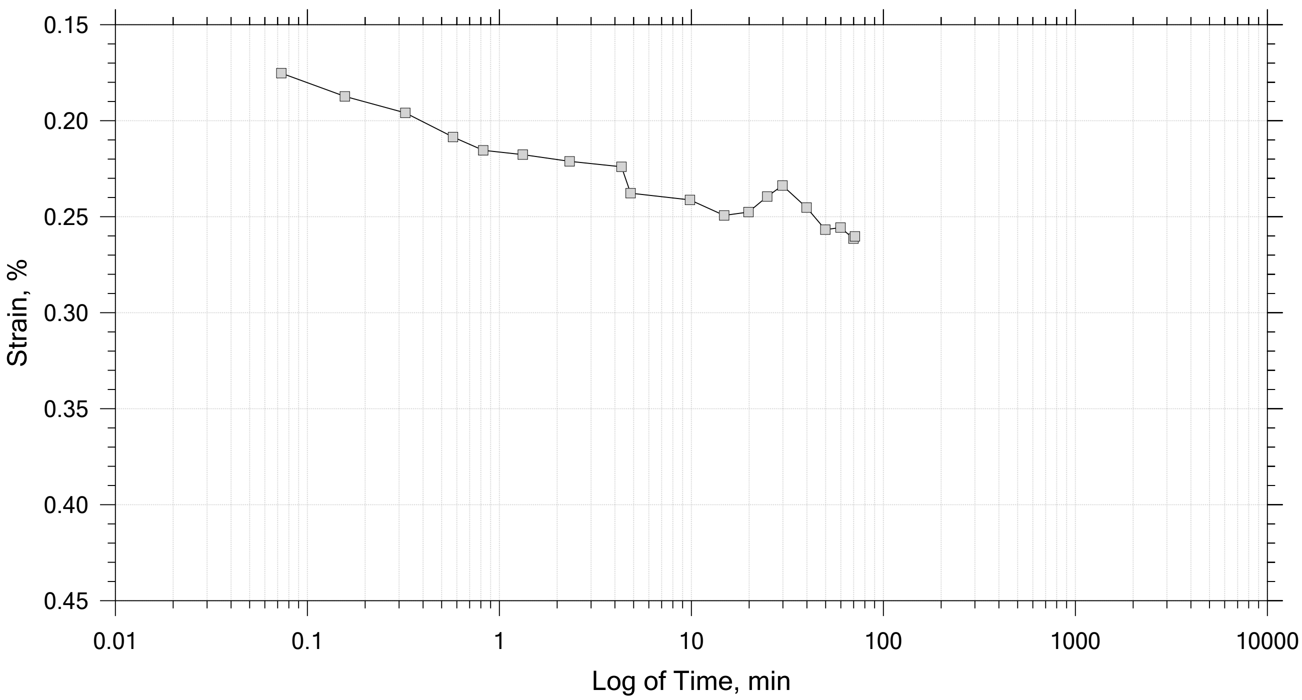


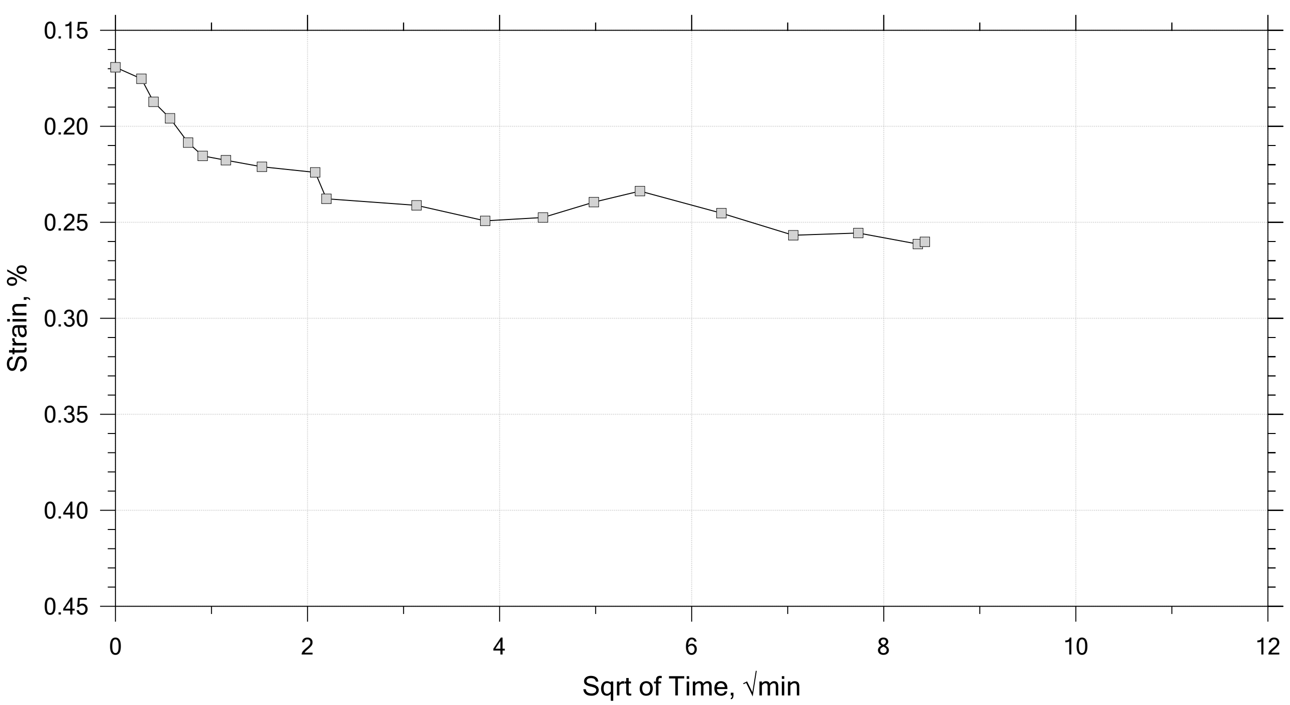


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 2U	Test Date: 10/9/2020	Depth: 21.65
	Test Number: ICON 334	Preparation: Shelby Tube	Elevation: 17.95
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 5 of 22
Constant Load Step
Stress: 1.11e+03 psf





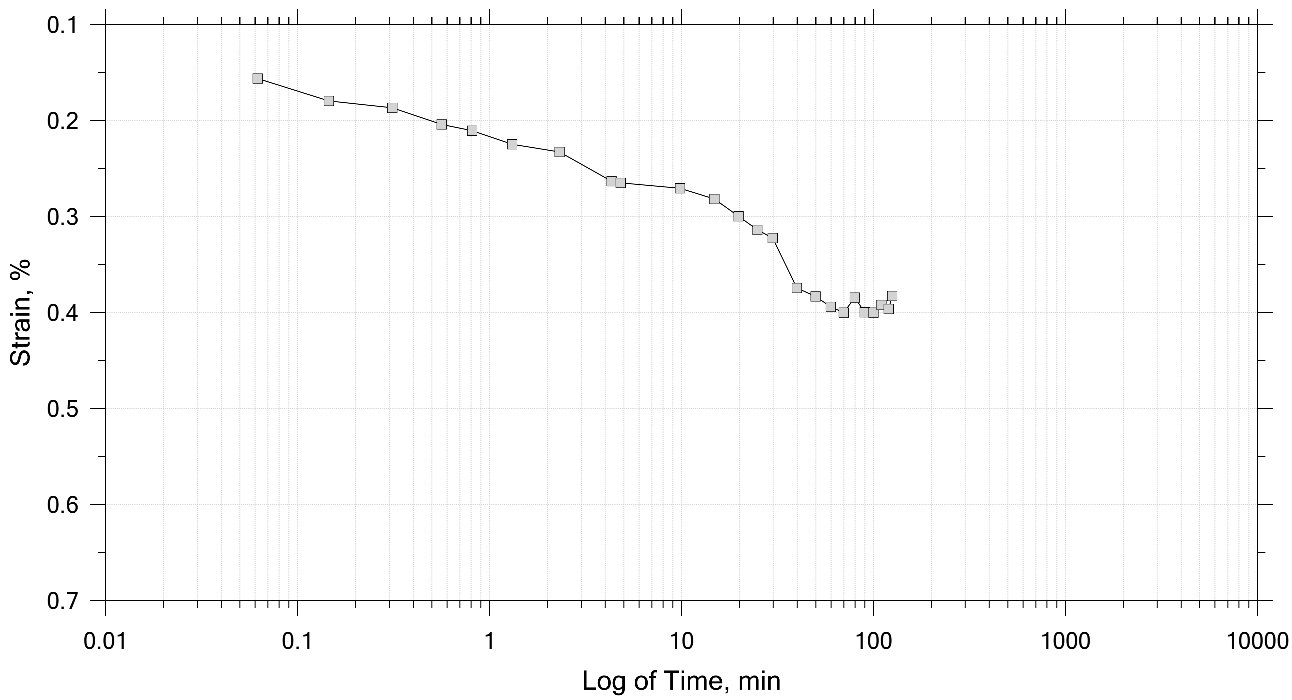
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 2U	Test Date: 10/9/2020	Depth: 21.65
	Test Number: ICON 334	Preparation: Shelby Tube	Elevation: 17.95
	Description: Gray Silty Clay		
	Remarks:		

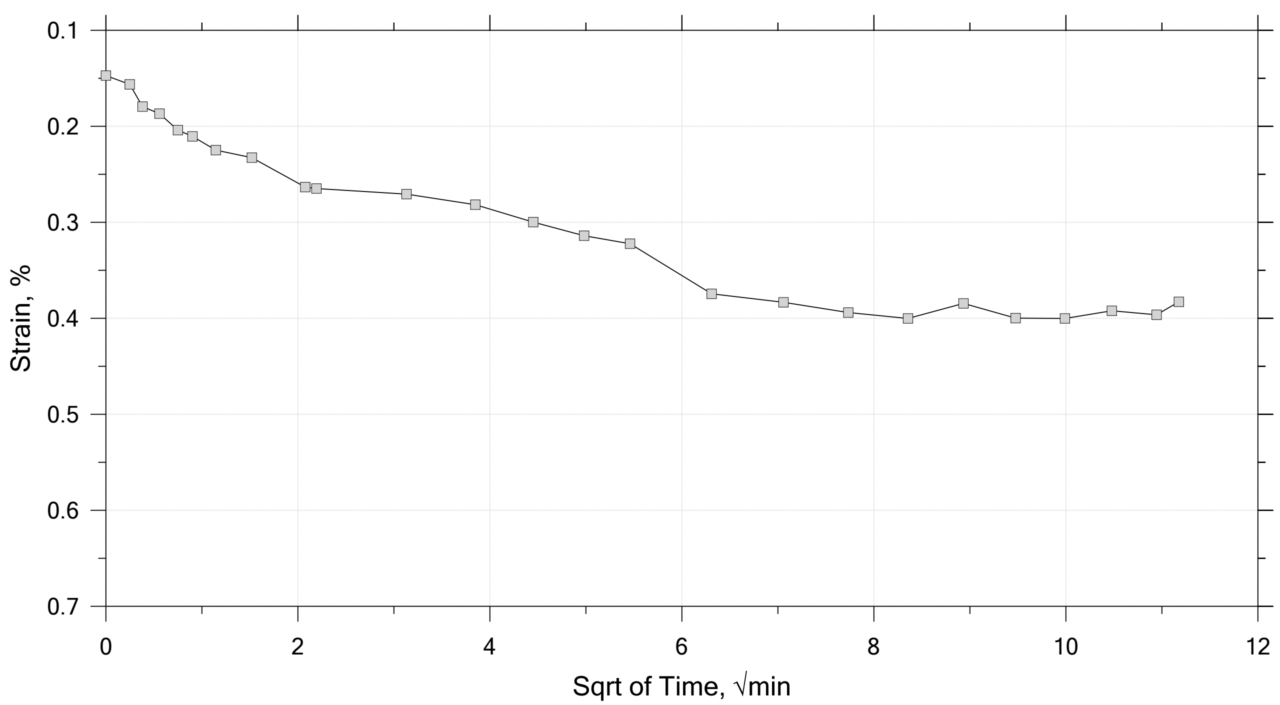
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 6 of 22

Constant Load Step

Stress: 1.67e+03 psf





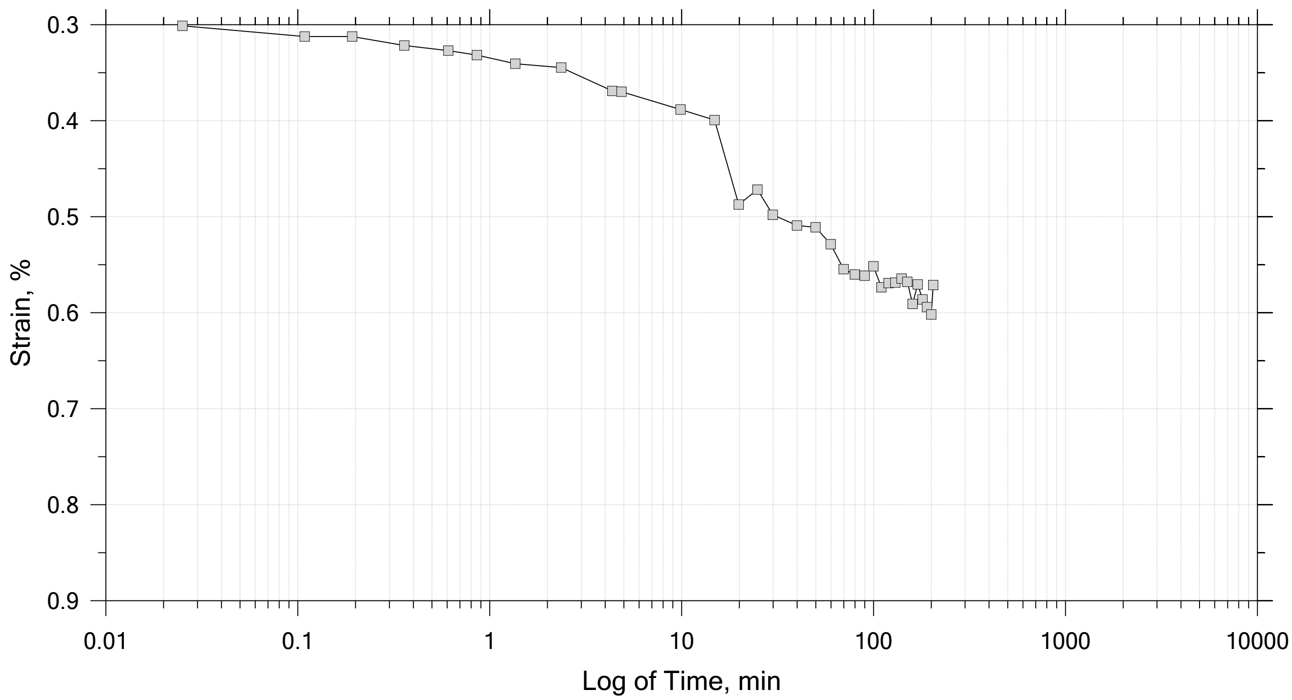
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 2U	Test Date: 10/9/2020	Depth: 21.65
	Test Number: ICON 334	Preparation: Shelby Tube	Elevation: 17.95
	Description: Gray Silty Clay		
	Remarks:		

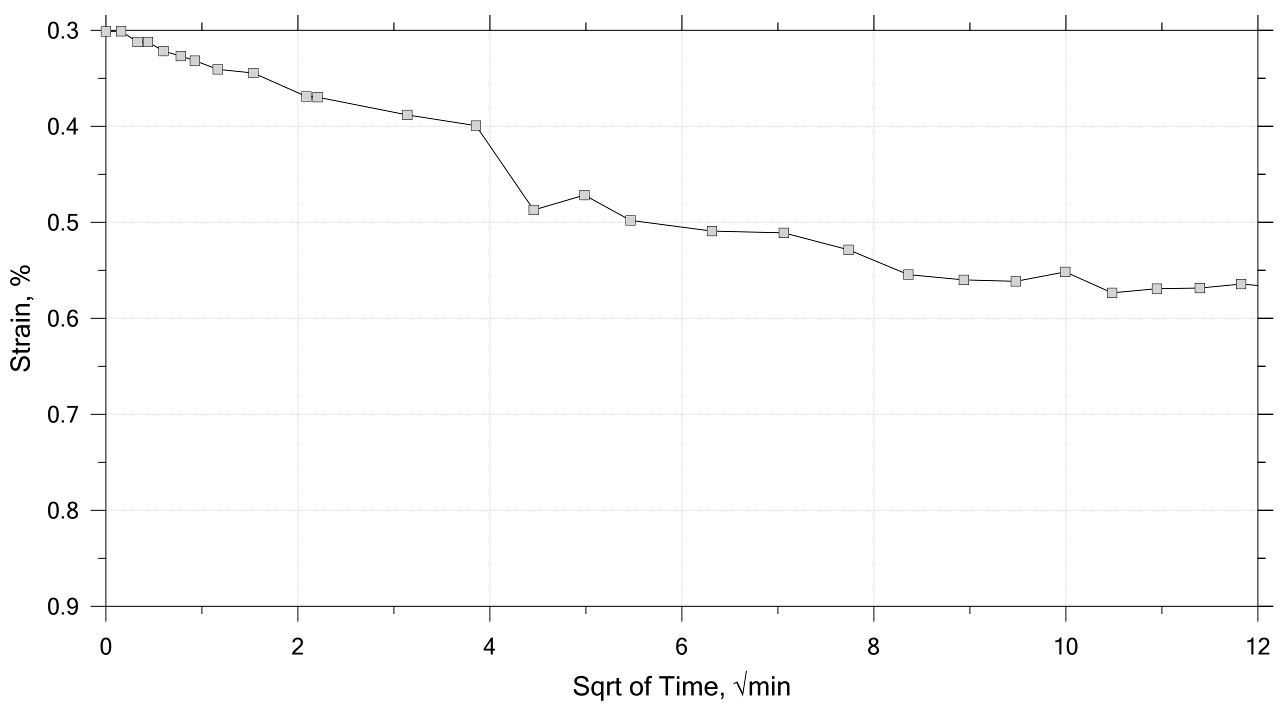
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 7 of 22

Constant Load Step

Stress: 2.51e+03 psf

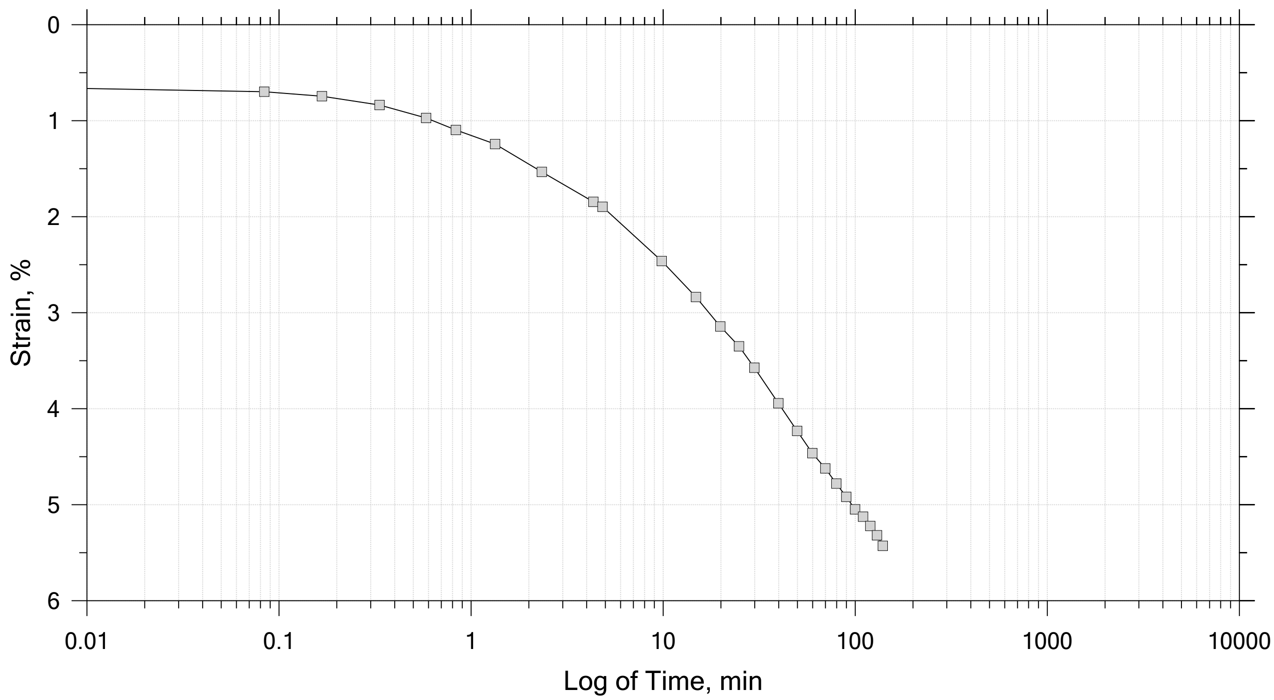


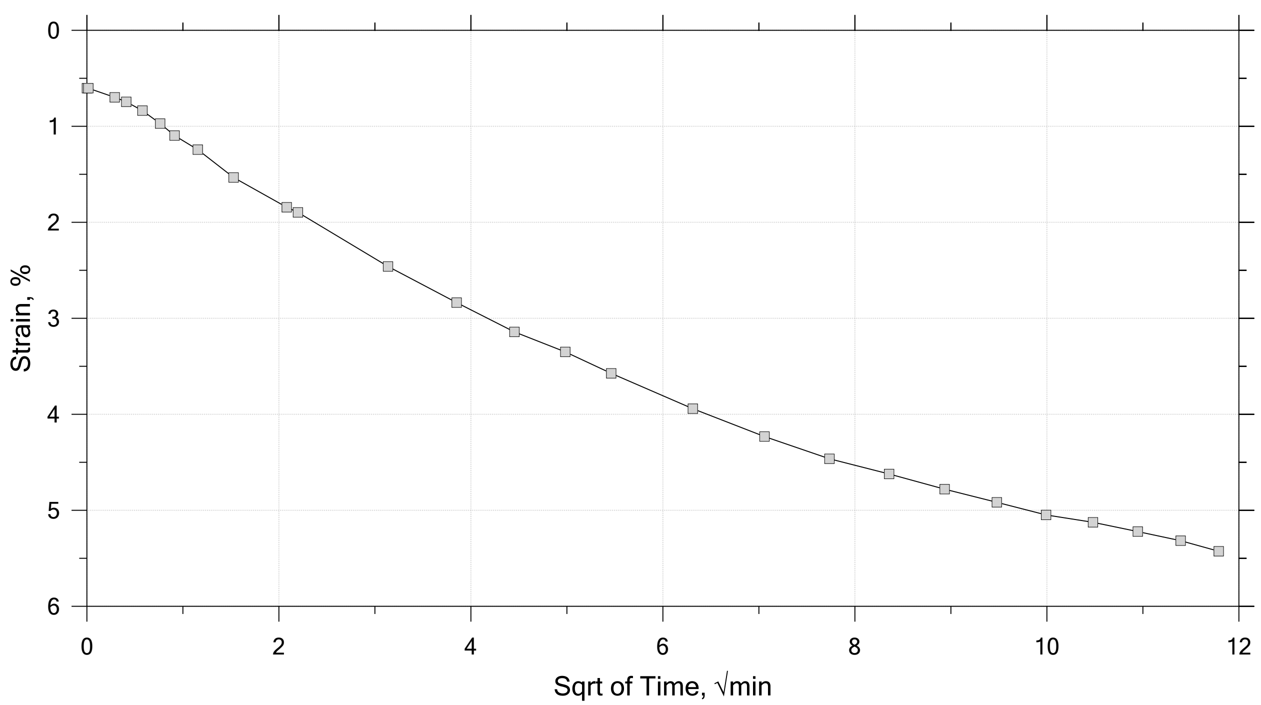


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 2U	Test Date: 10/9/2020	Depth: 21.65
	Test Number: ICON 334	Preparation: Shelby Tube	Elevation: 17.95
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 8 of 22
Constant Load Step
Stress: 5.01e+03 psf





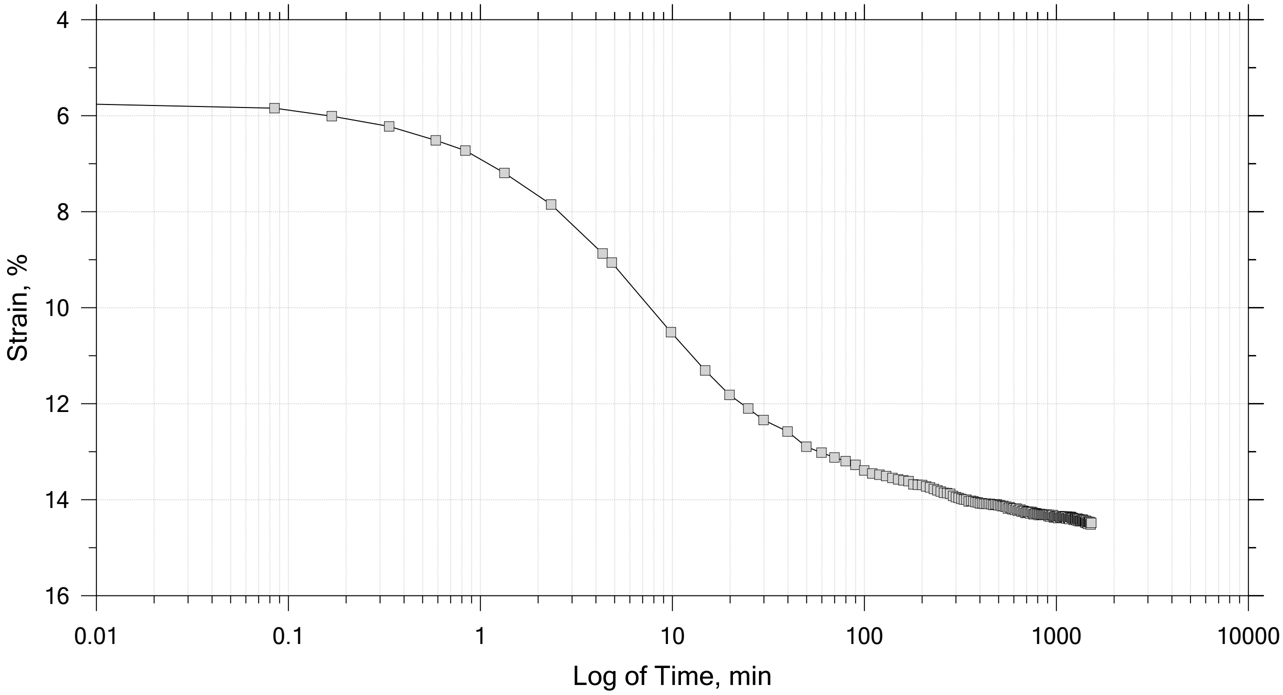
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 2U	Test Date: 10/9/2020	Depth: 21.65
	Test Number: ICON 334	Preparation: Shelby Tube	Elevation: 17.95
	Description: Gray Silty Clay		
	Remarks:		

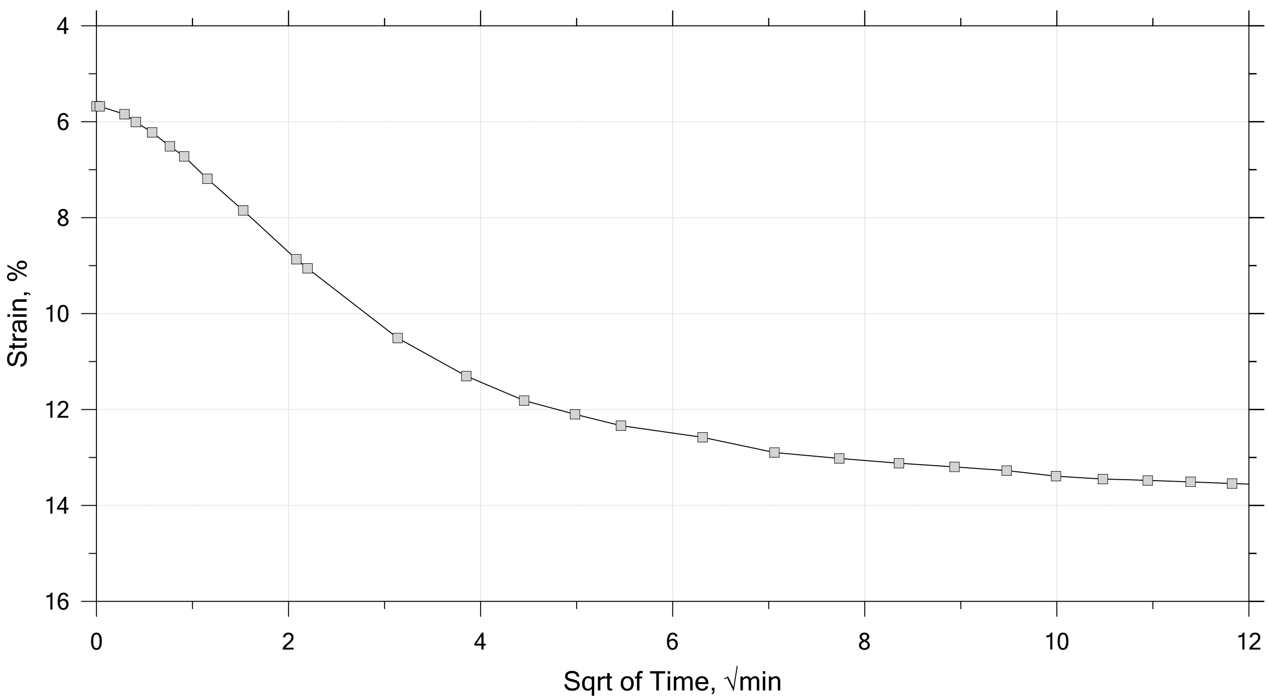
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 9 of 22

Constant Load Step

Stress: 1e+04 psf

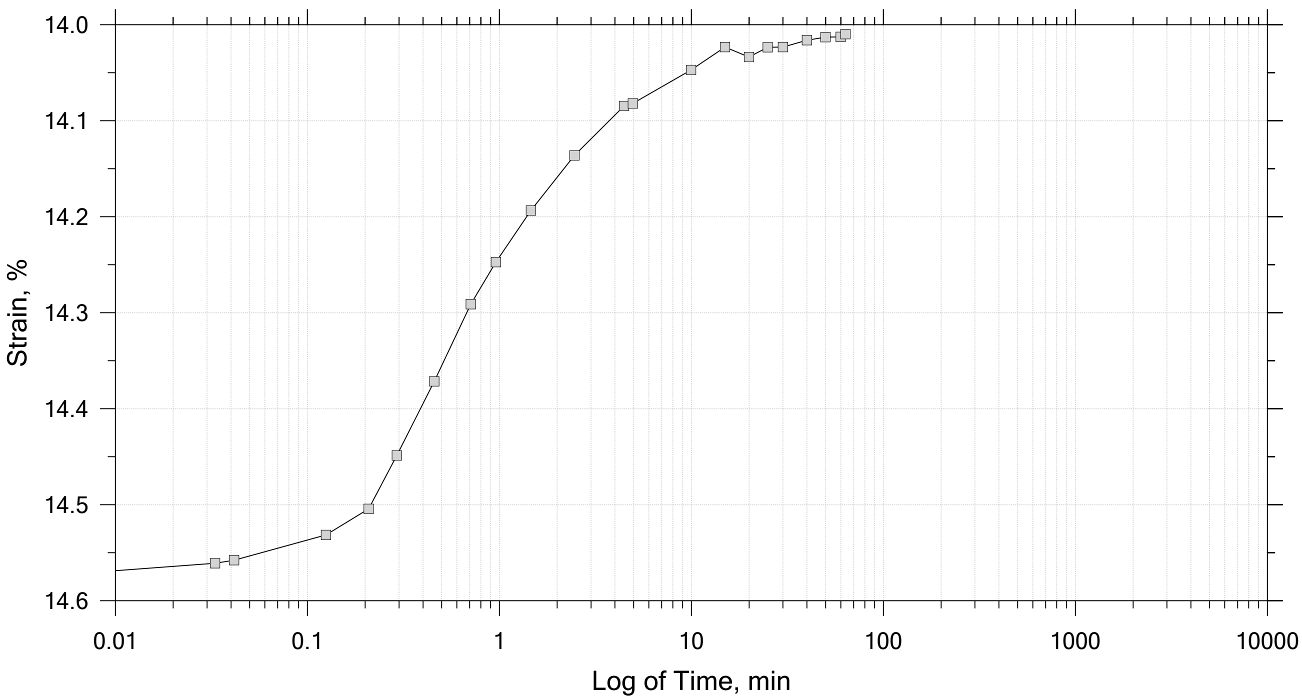


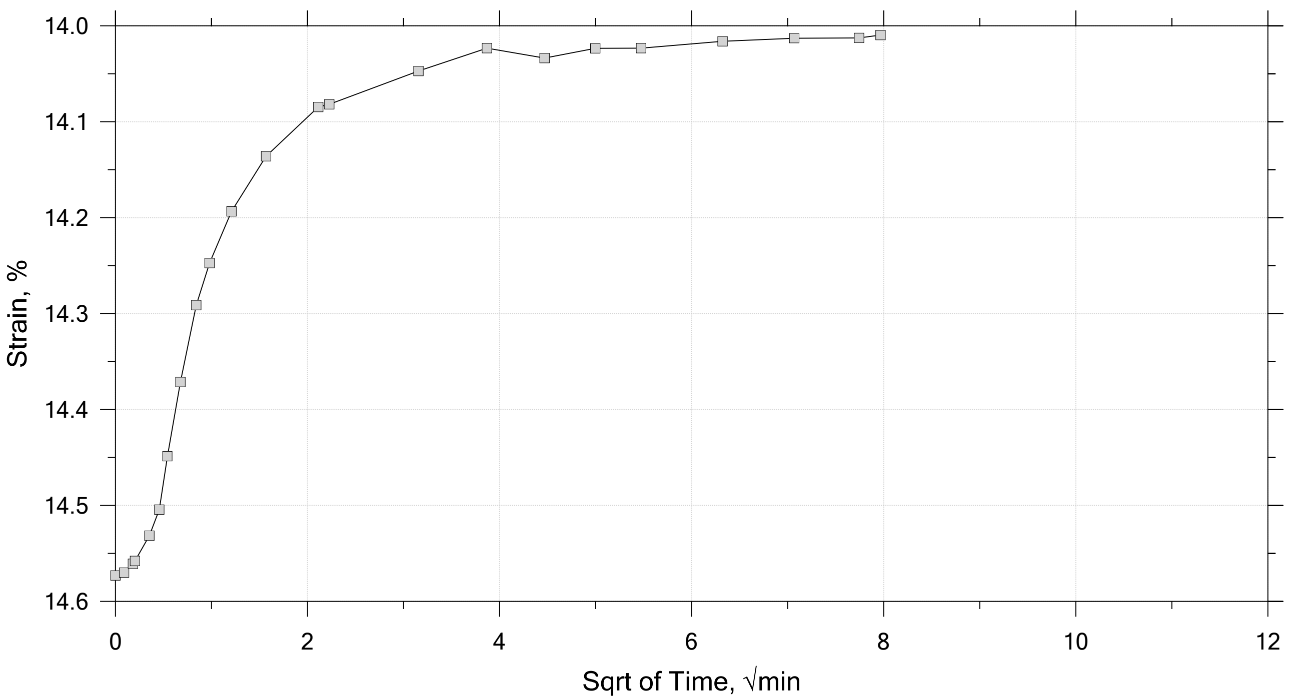


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 2U	Test Date: 10/9/2020	Depth: 21.65
	Test Number: ICON 334	Preparation: Shelby Tube	Elevation: 17.95
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 10 of 22
Constant Load Step
Stress: 2.51e+03 psf





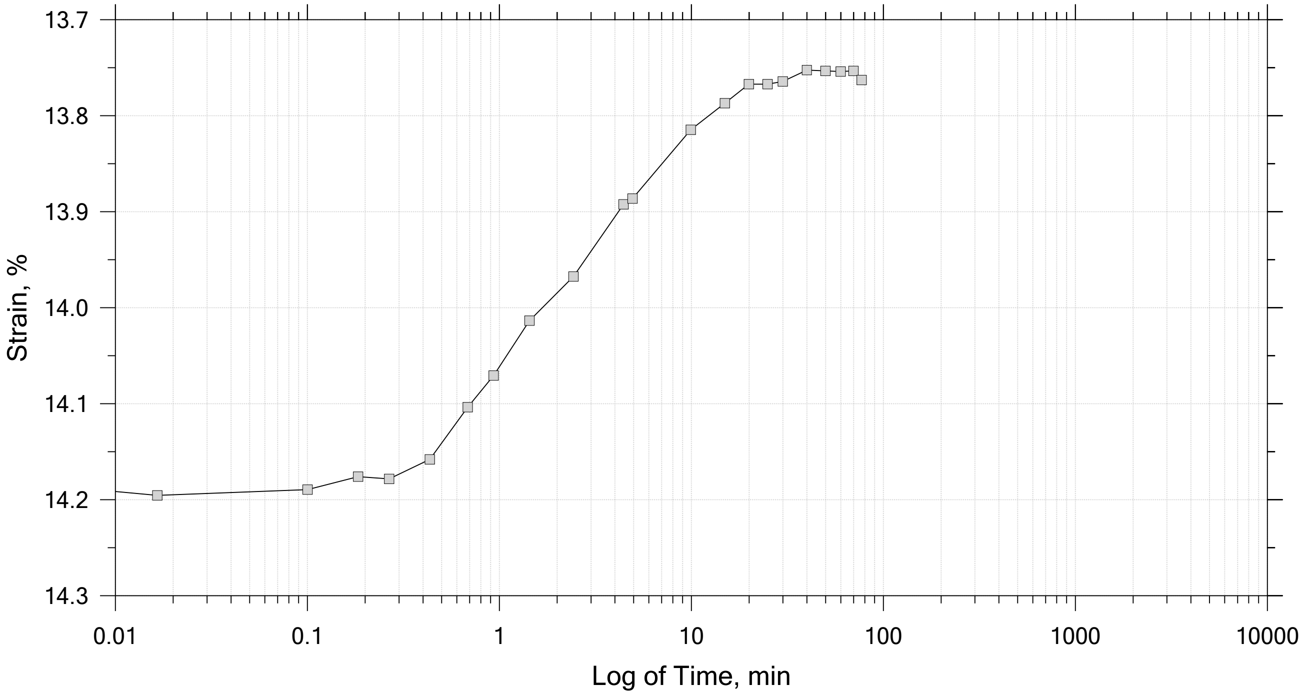
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 2U	Test Date: 10/9/2020	Depth: 21.65
	Test Number: ICON 334	Preparation: Shelby Tube	Elevation: 17.95
	Description: Gray Silty Clay		
	Remarks:		

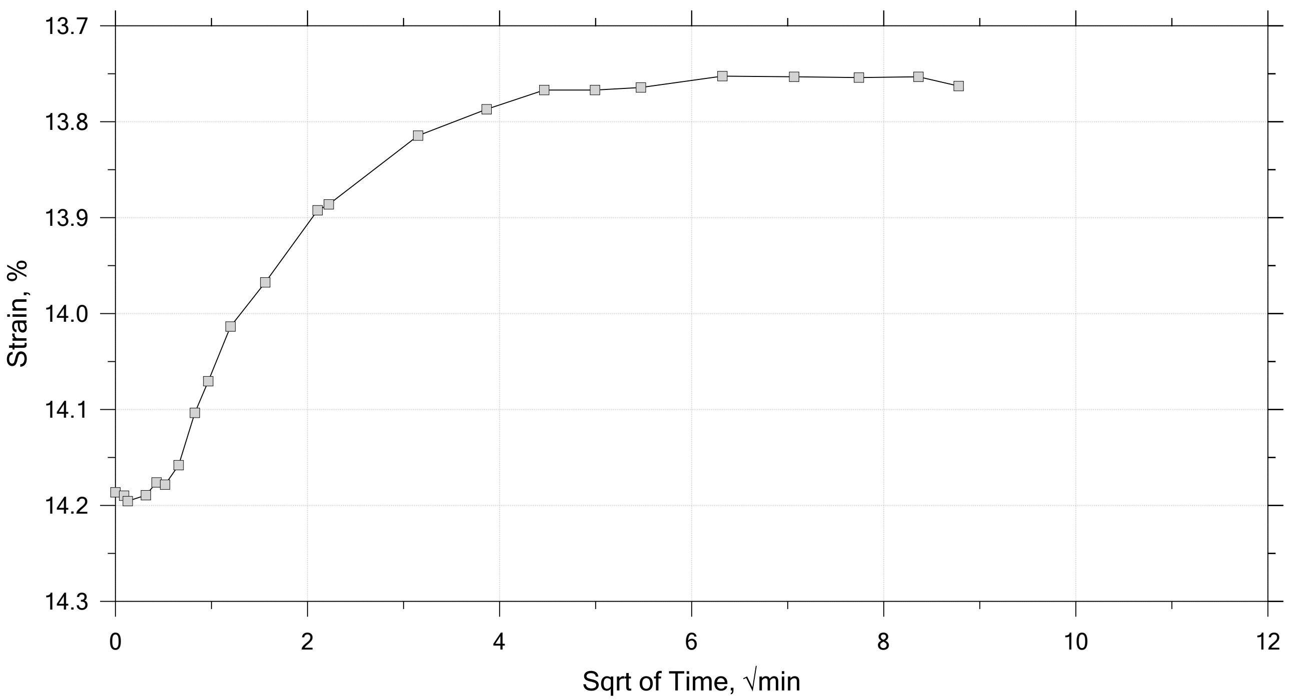
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 11 of 22

Constant Load Step

Stress: 1.25e+03 psf

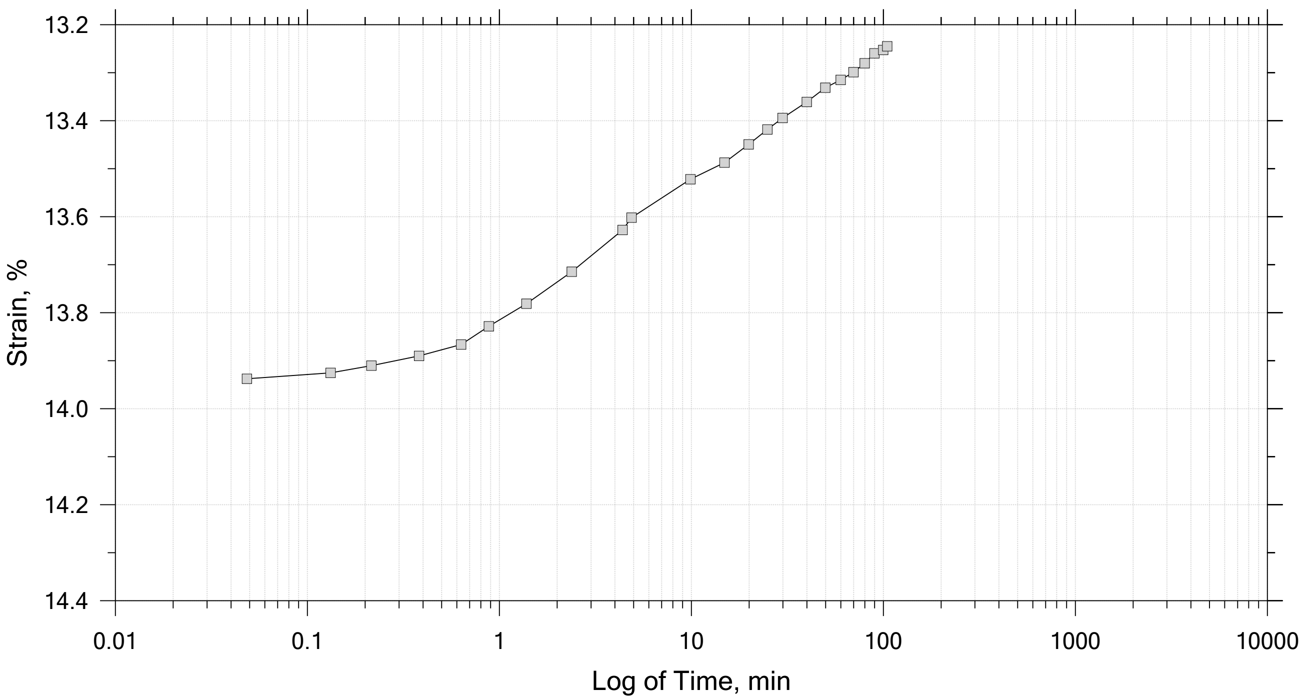


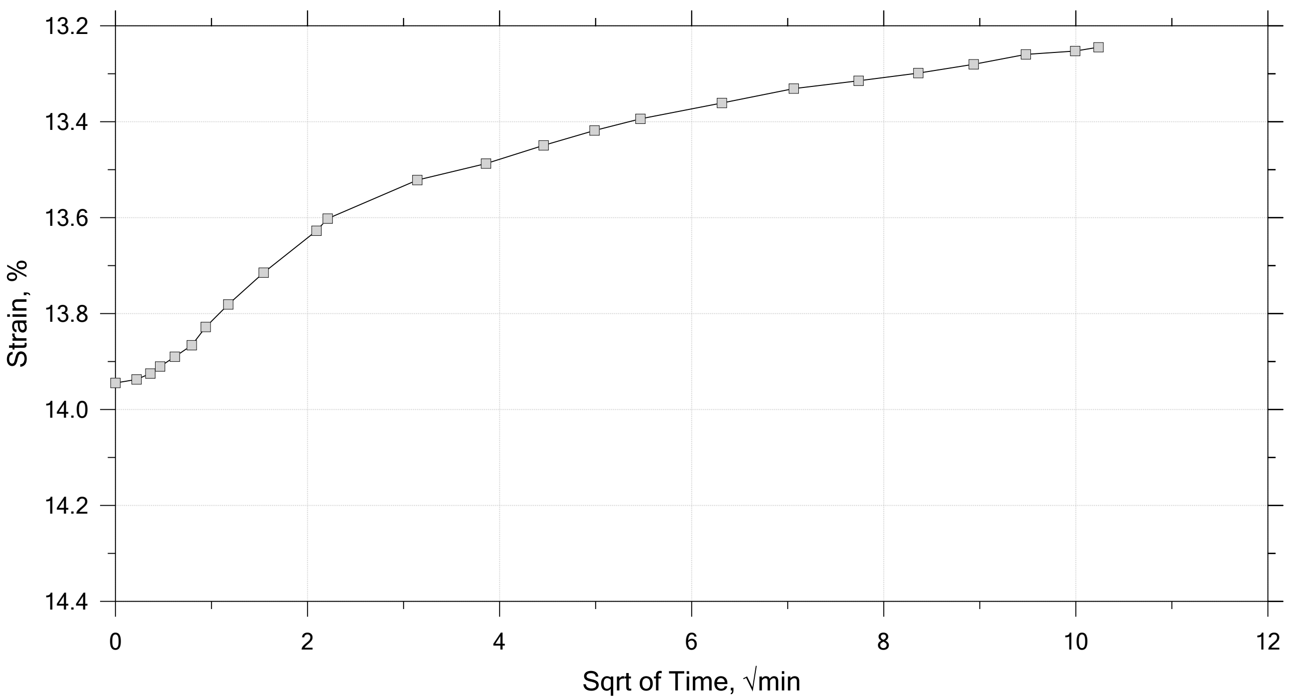


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 2U	Test Date: 10/9/2020	Depth: 21.65
	Test Number: ICON 334	Preparation: Shelby Tube	Elevation: 17.95
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 12 of 22
Constant Load Step
Stress: 626 psf





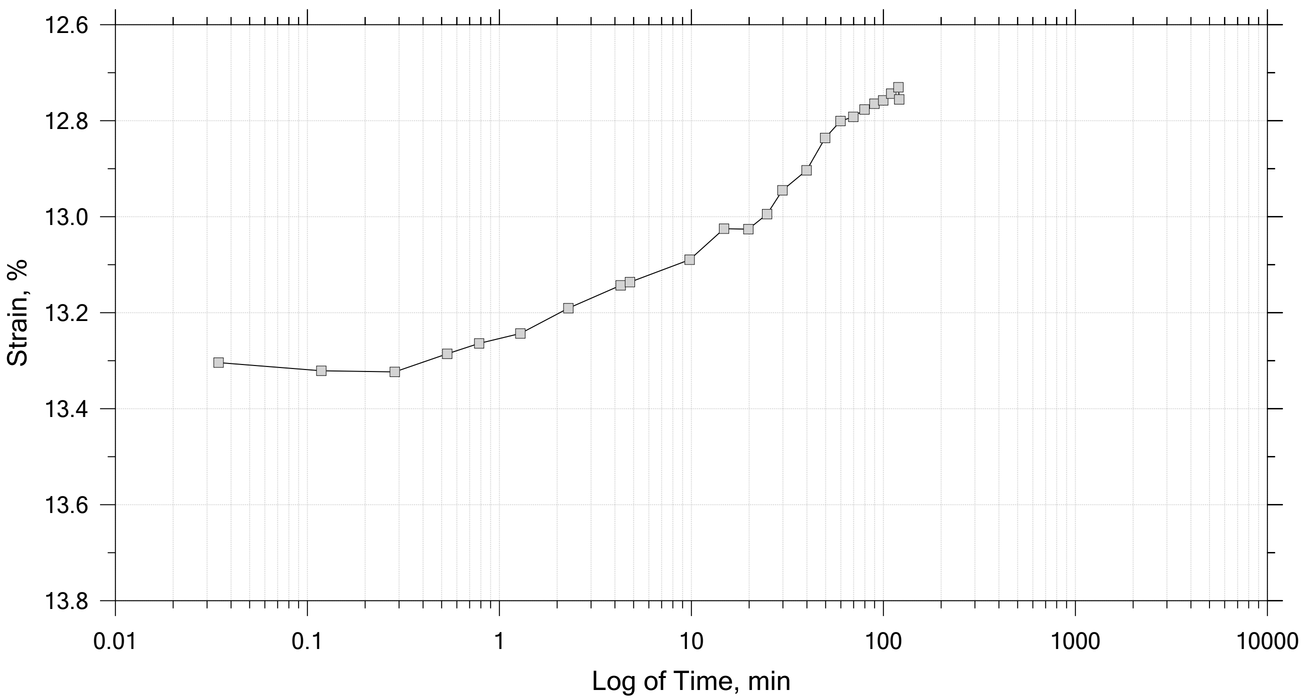
Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 2U	Test Date: 10/9/2020	Depth: 21.65
	Test Number: ICON 334	Preparation: Shelby Tube	Elevation: 17.95
	Description: Gray Silty Clay		
	Remarks:		

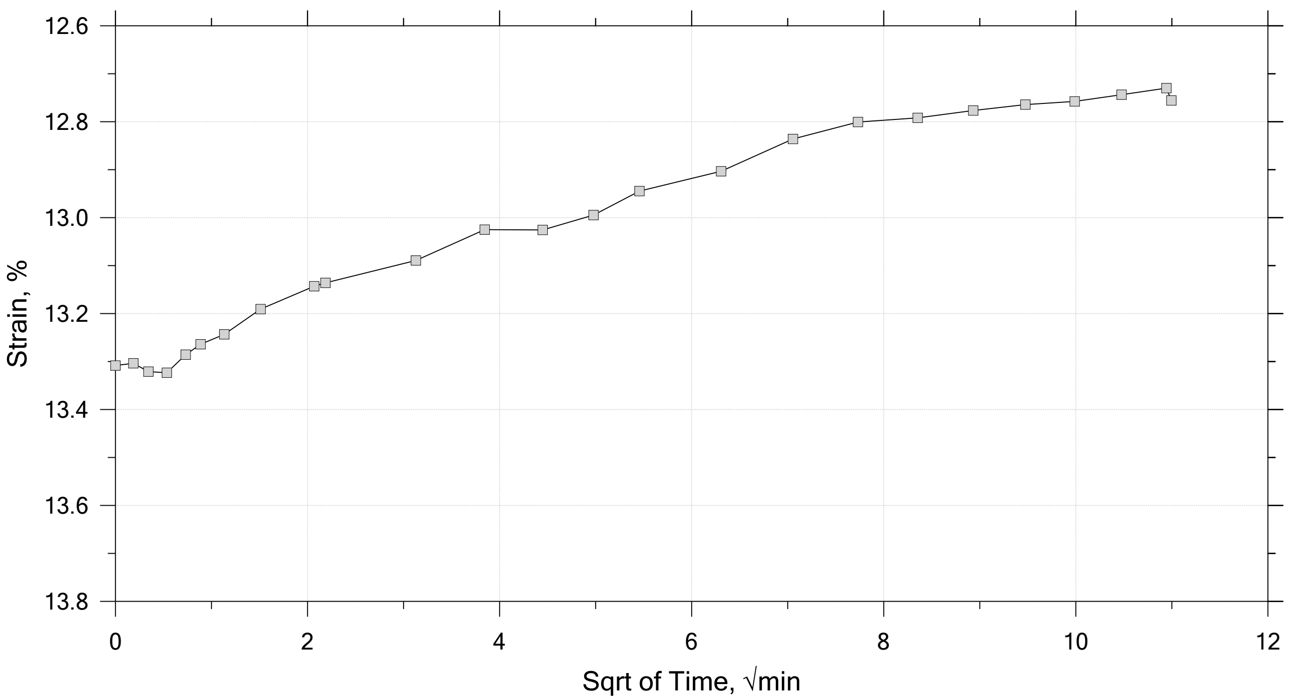
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 13 of 22

Constant Load Step

Stress: 313 psf





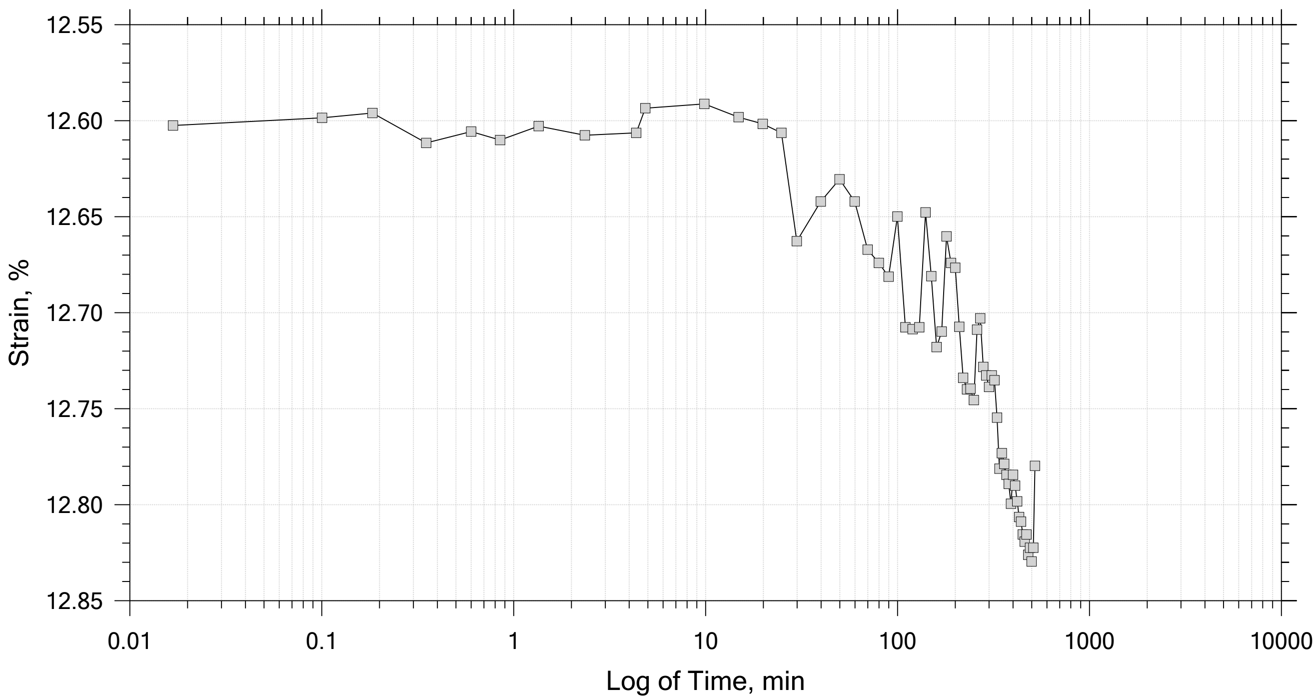
Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 2U	Test Date: 10/9/2020	Depth: 21.65
	Test Number: ICON 334	Preparation: Shelby Tube	Elevation: 17.95
	Description: Gray Silty Clay		
	Remarks:		

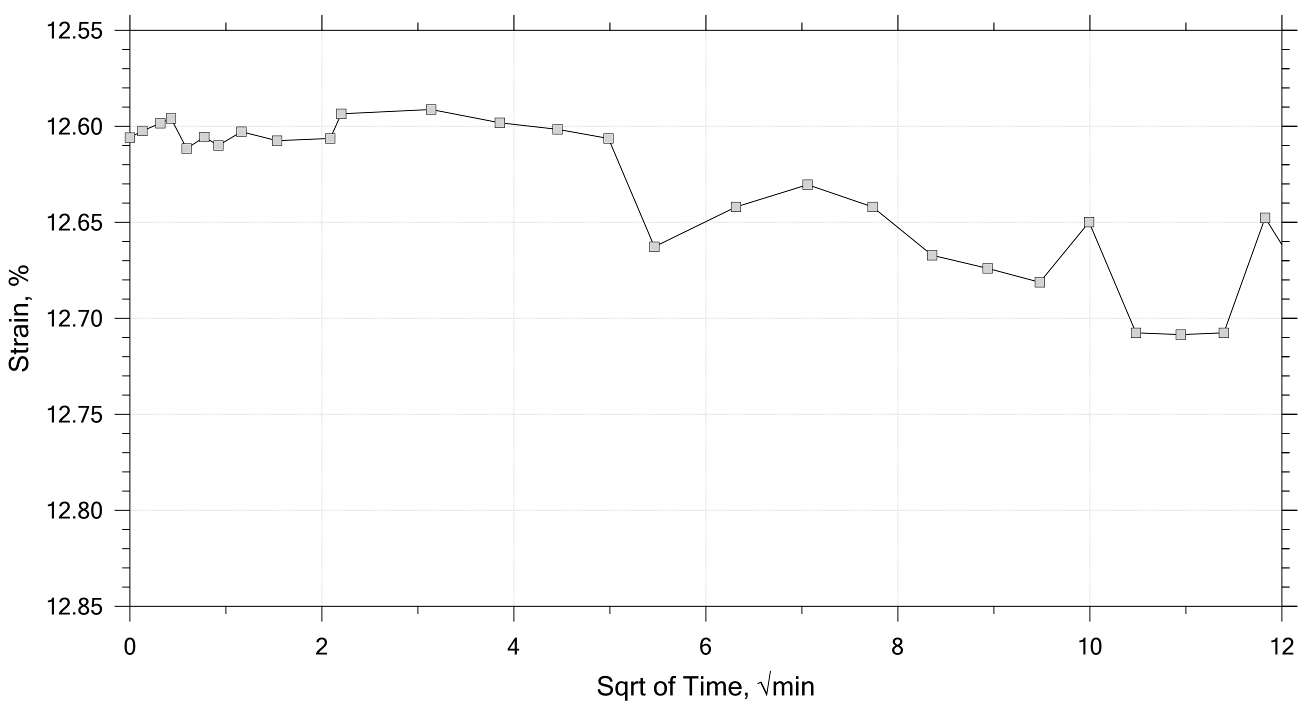
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 14 of 22

Constant Load Step

Stress: 548 psf





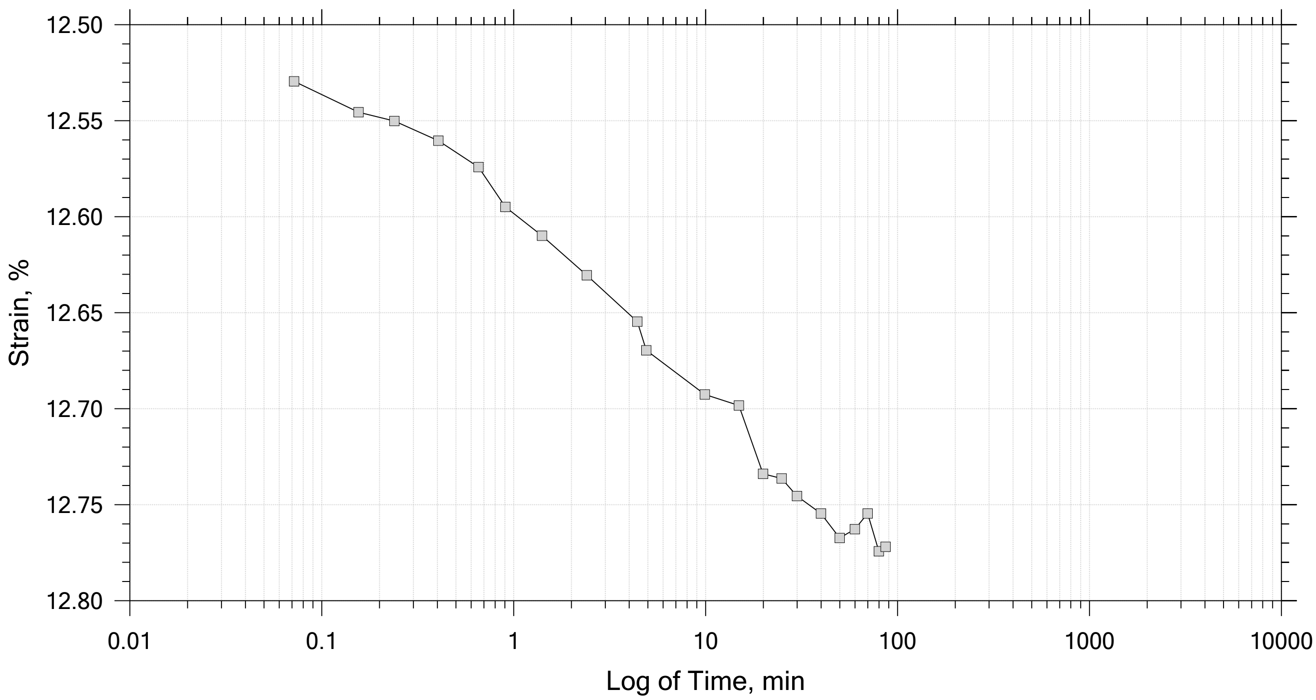
Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 2U	Test Date: 10/9/2020	Depth: 21.65
	Test Number: ICON 334	Preparation: Shelby Tube	Elevation: 17.95
	Description: Gray Silty Clay		
	Remarks:		

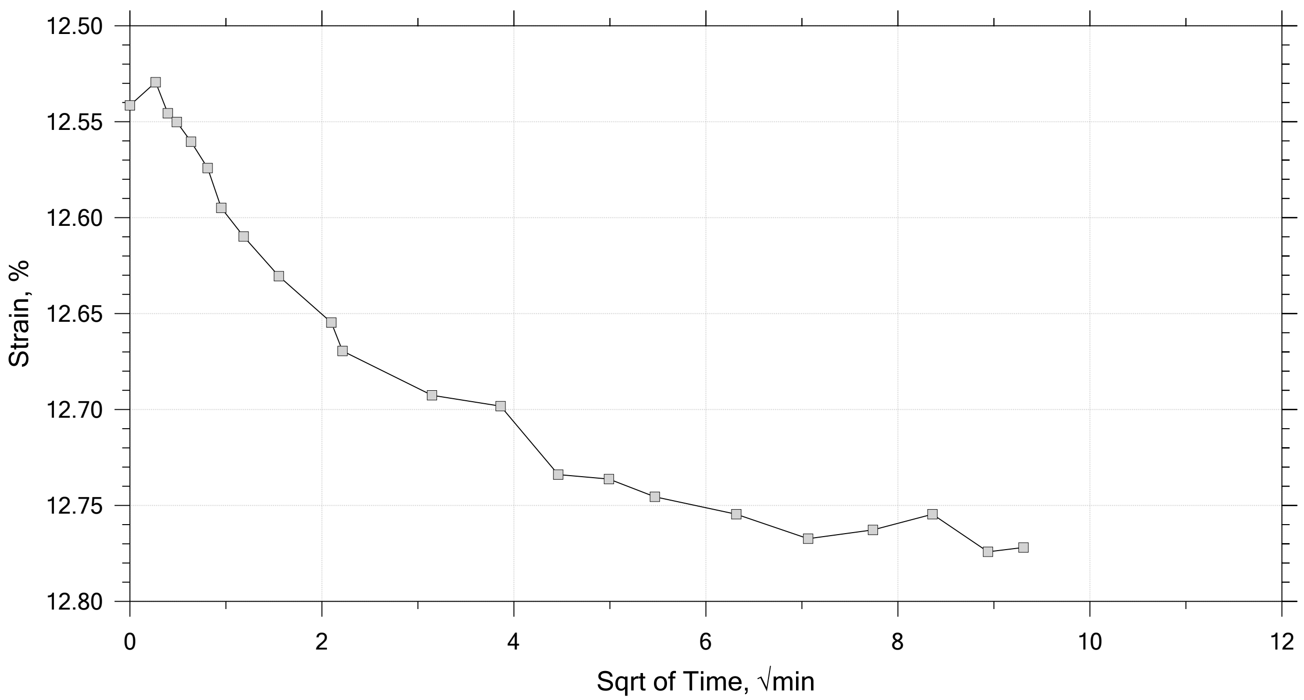
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 15 of 22

Constant Load Step

Stress: 1.1e+03 psf

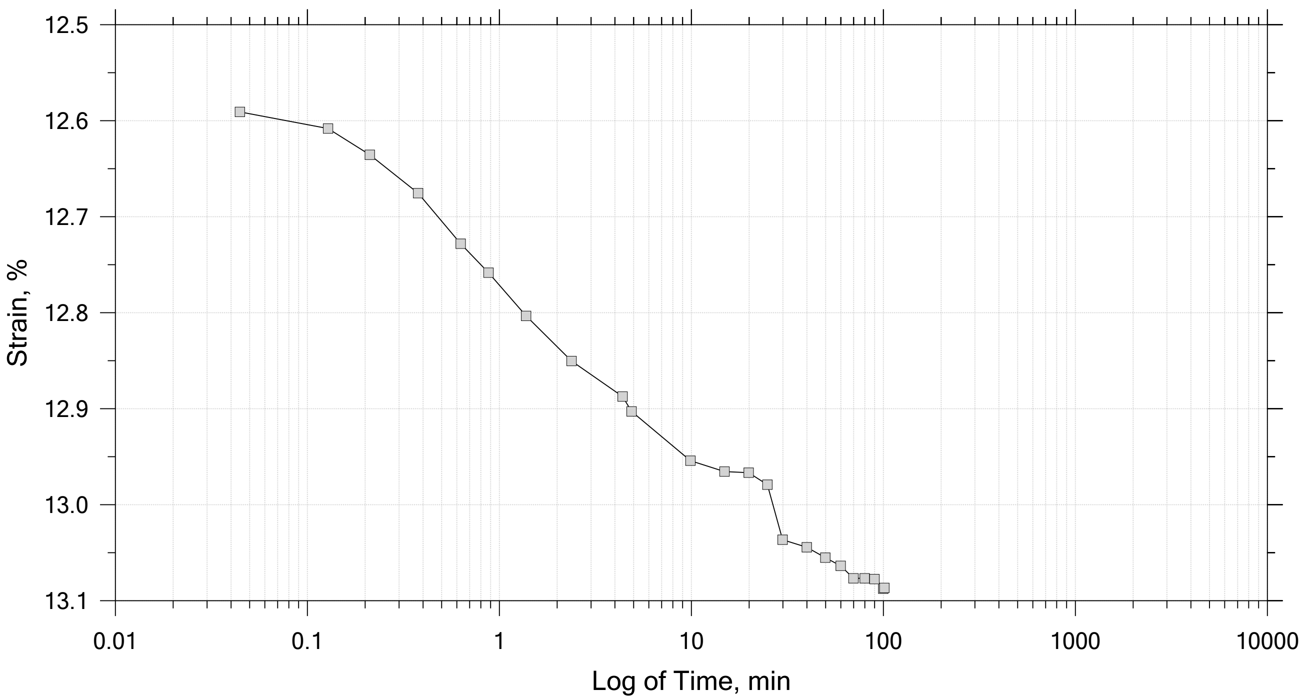


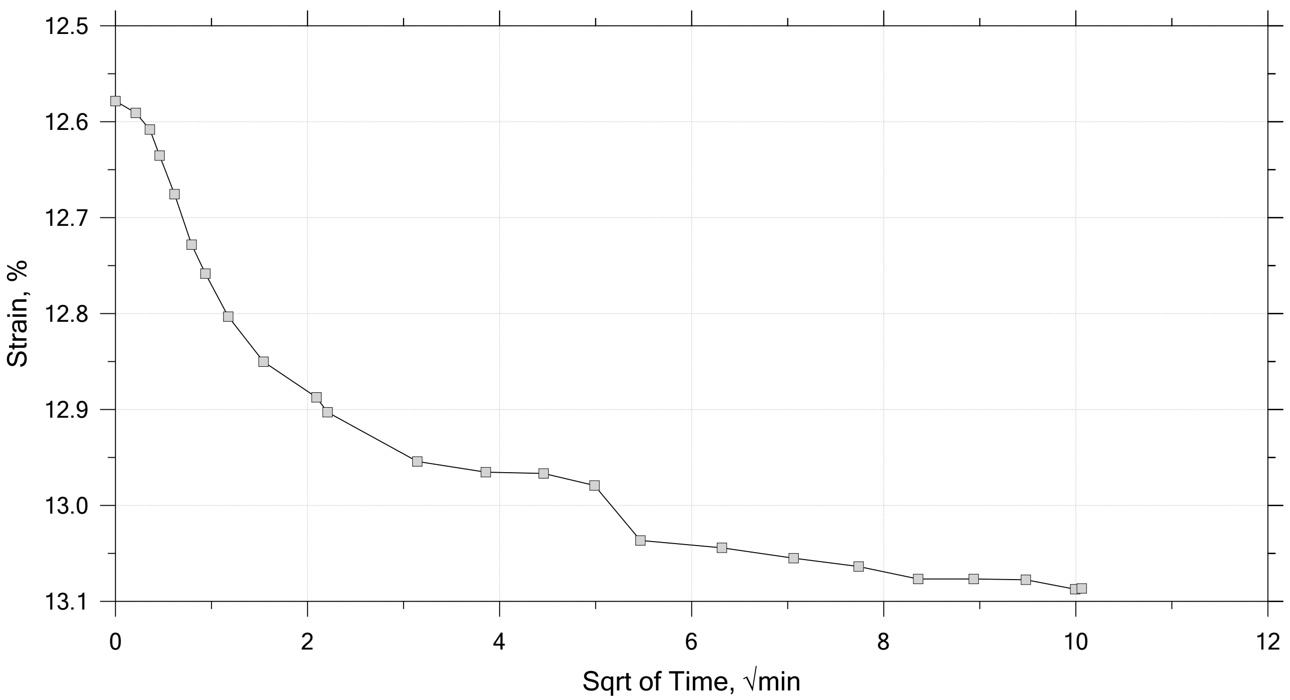


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 2U	Test Date: 10/9/2020	Depth: 21.65
	Test Number: ICON 334	Preparation: Shelby Tube	Elevation: 17.95
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 16 of 22
Constant Load Step
Stress: 2.19e+03 psf





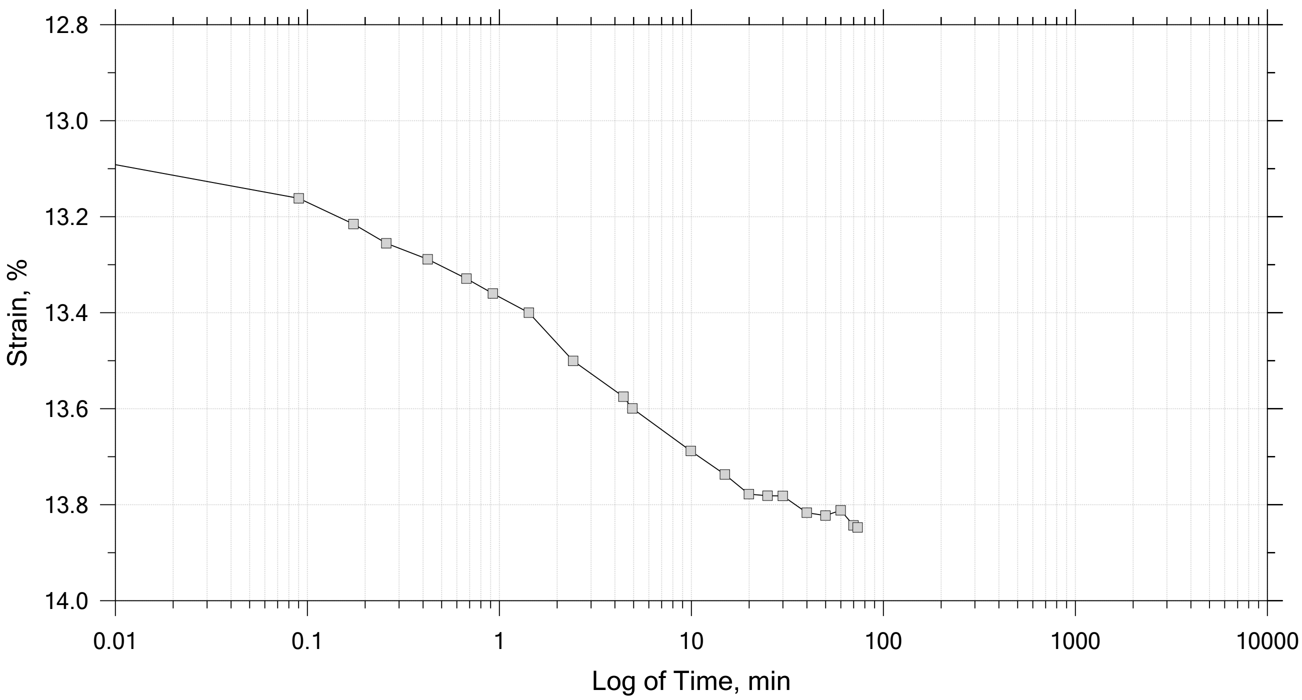
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 2U	Test Date: 10/9/2020	Depth: 21.65
	Test Number: ICON 334	Preparation: Shelby Tube	Elevation: 17.95
	Description: Gray Silty Clay		
	Remarks:		

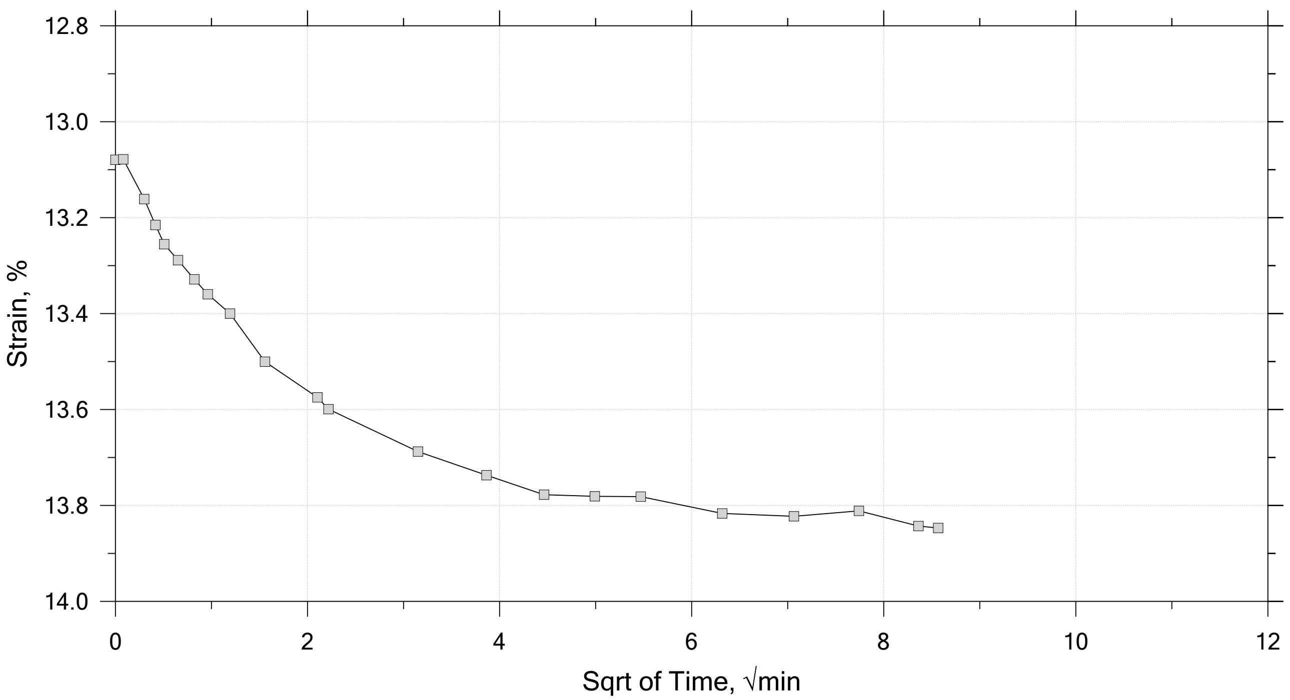
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 17 of 22

Constant Load Step

Stress: 4.39e+03 psf

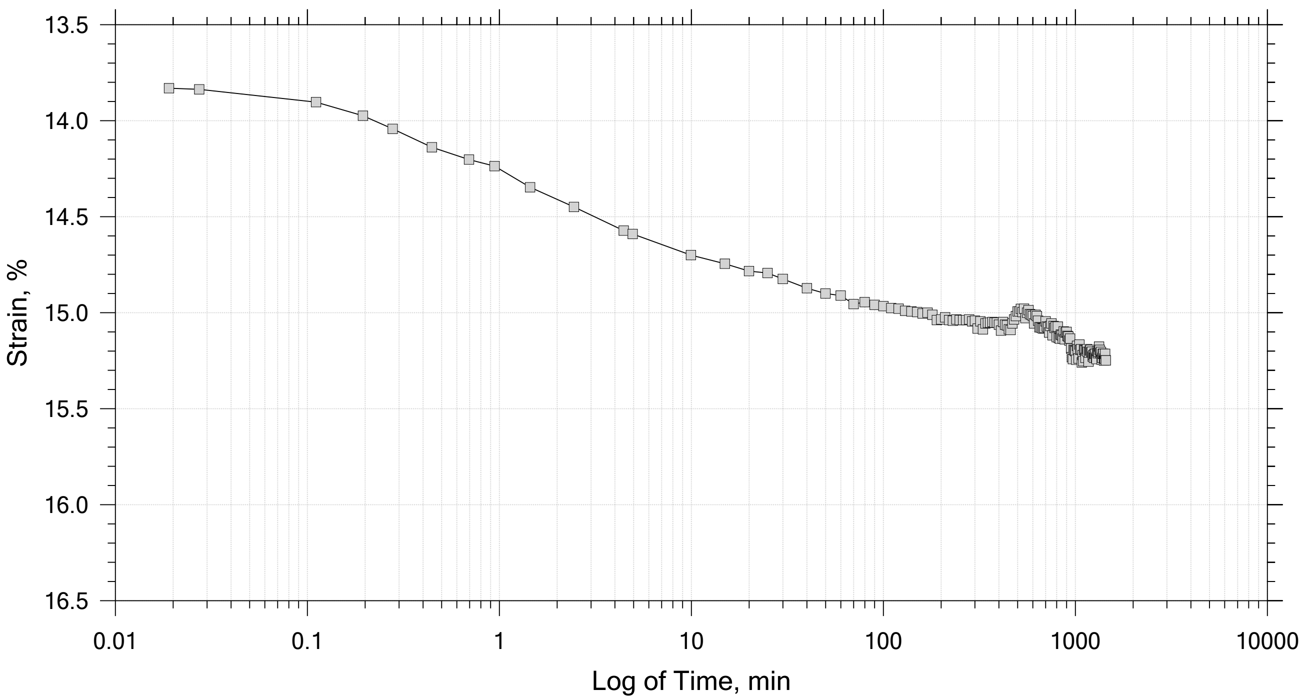


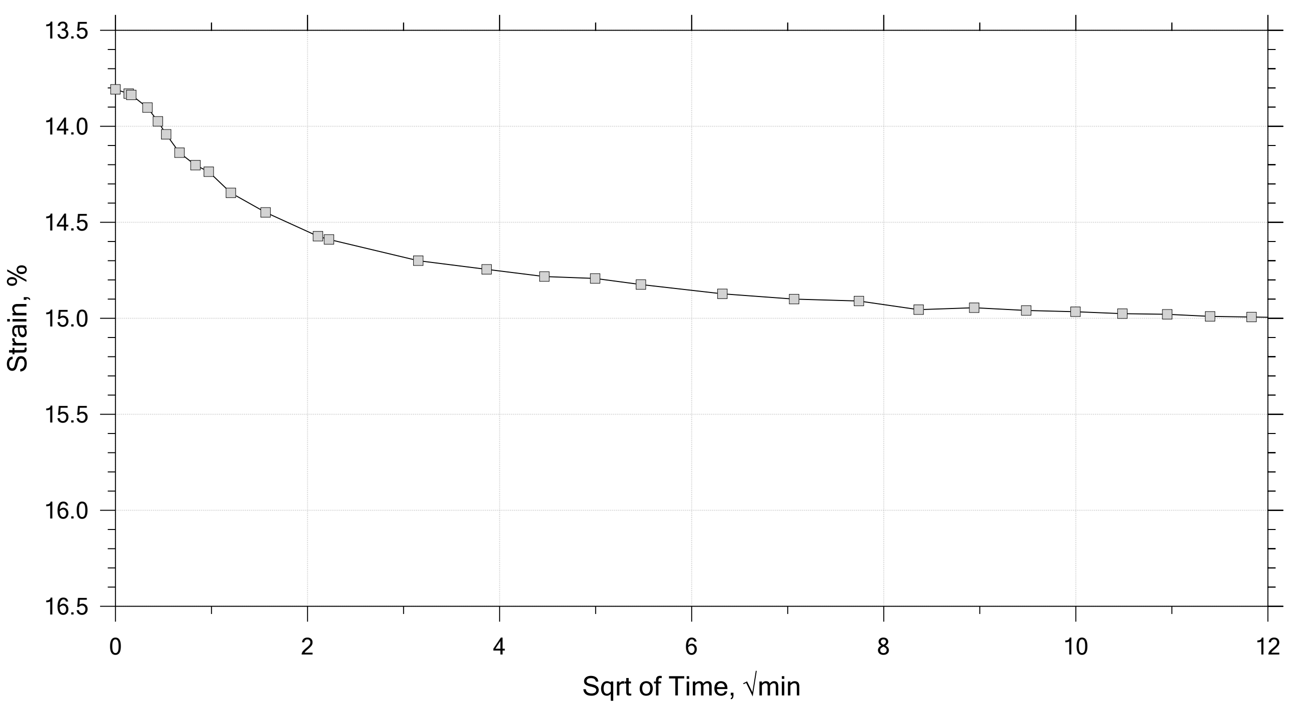


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 2U	Test Date: 10/9/2020	Depth: 21.65
	Test Number: ICON 334	Preparation: Shelby Tube	Elevation: 17.95
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 18 of 22
Constant Load Step
Stress: 8.77e+03 psf





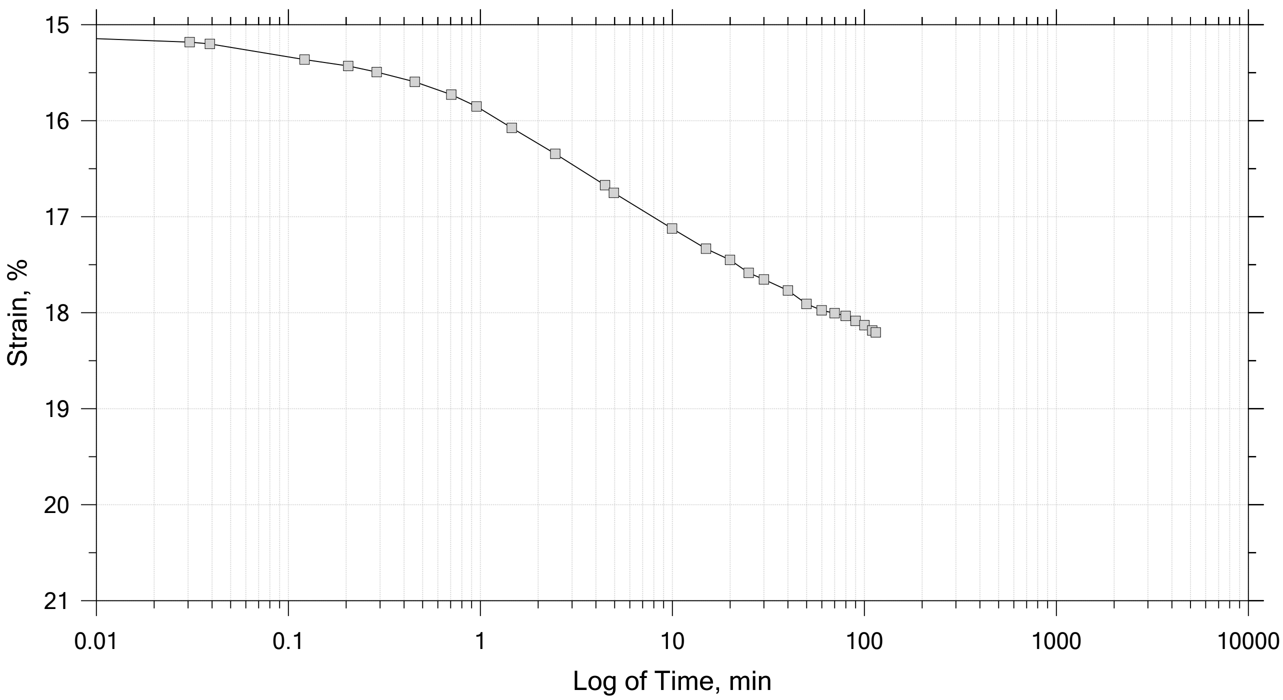
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 2U	Test Date: 10/9/2020	Depth: 21.65
	Test Number: ICON 334	Preparation: Shelby Tube	Elevation: 17.95
	Description: Gray Silty Clay		
	Remarks:		

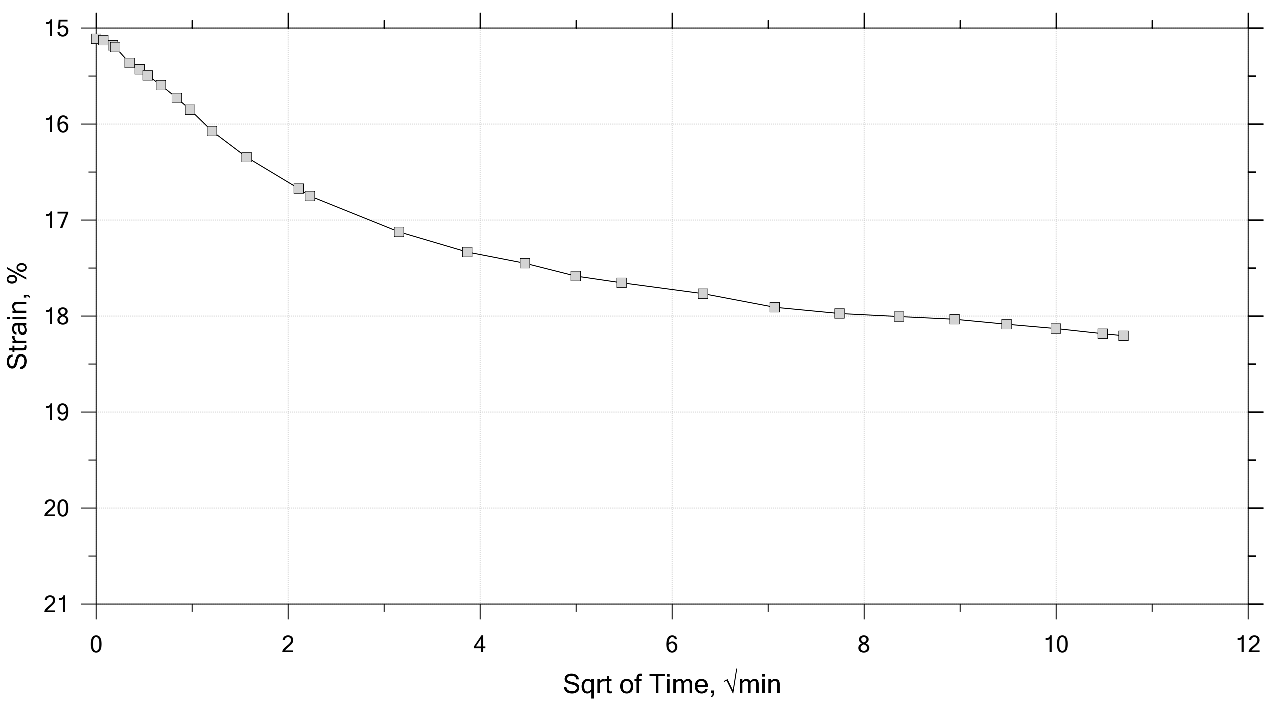
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 19 of 22

Constant Load Step

Stress: 1.75e+04 psf

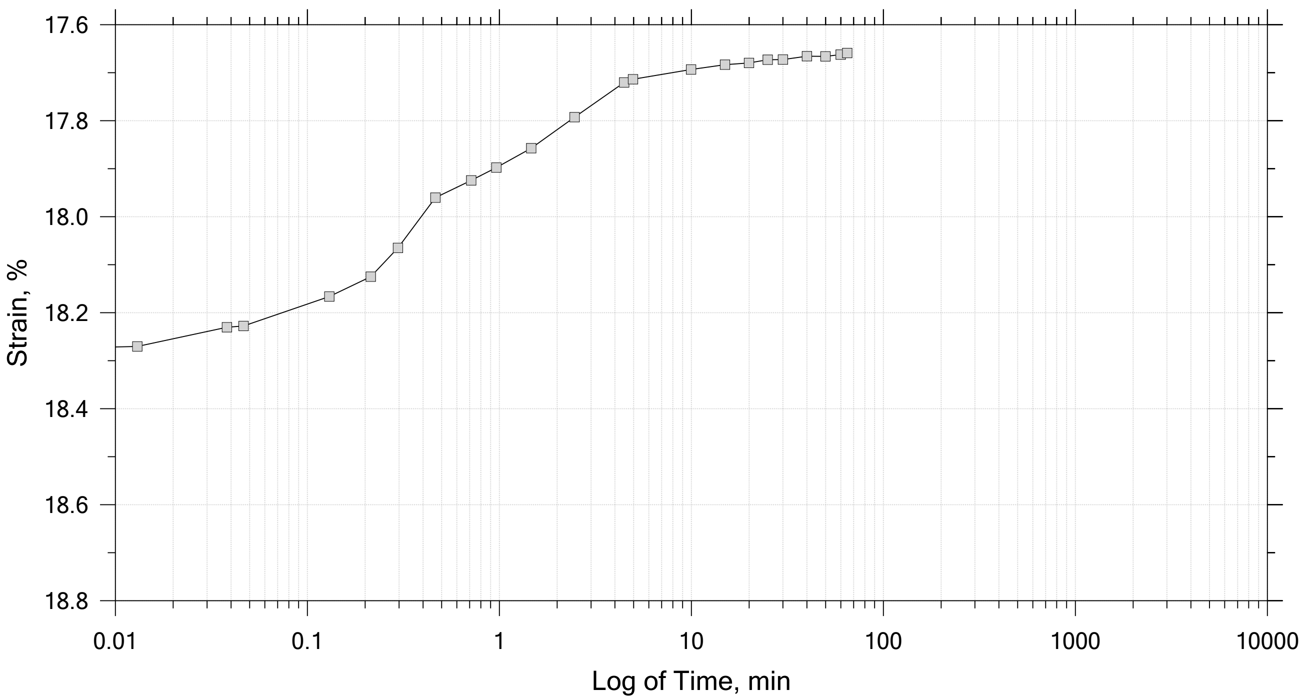


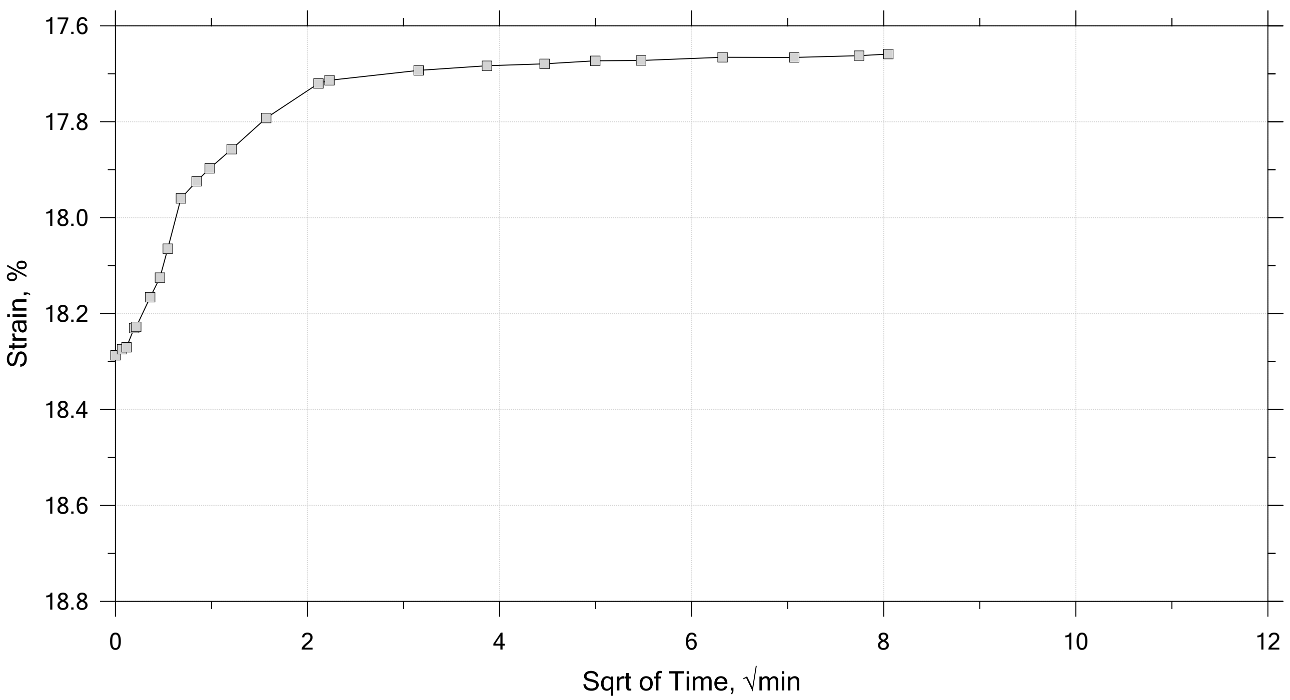


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 2U	Test Date: 10/9/2020	Depth: 21.65
	Test Number: ICON 334	Preparation: Shelby Tube	Elevation: 17.95
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 20 of 22
Constant Load Step
Stress: 4.39e+03 psf





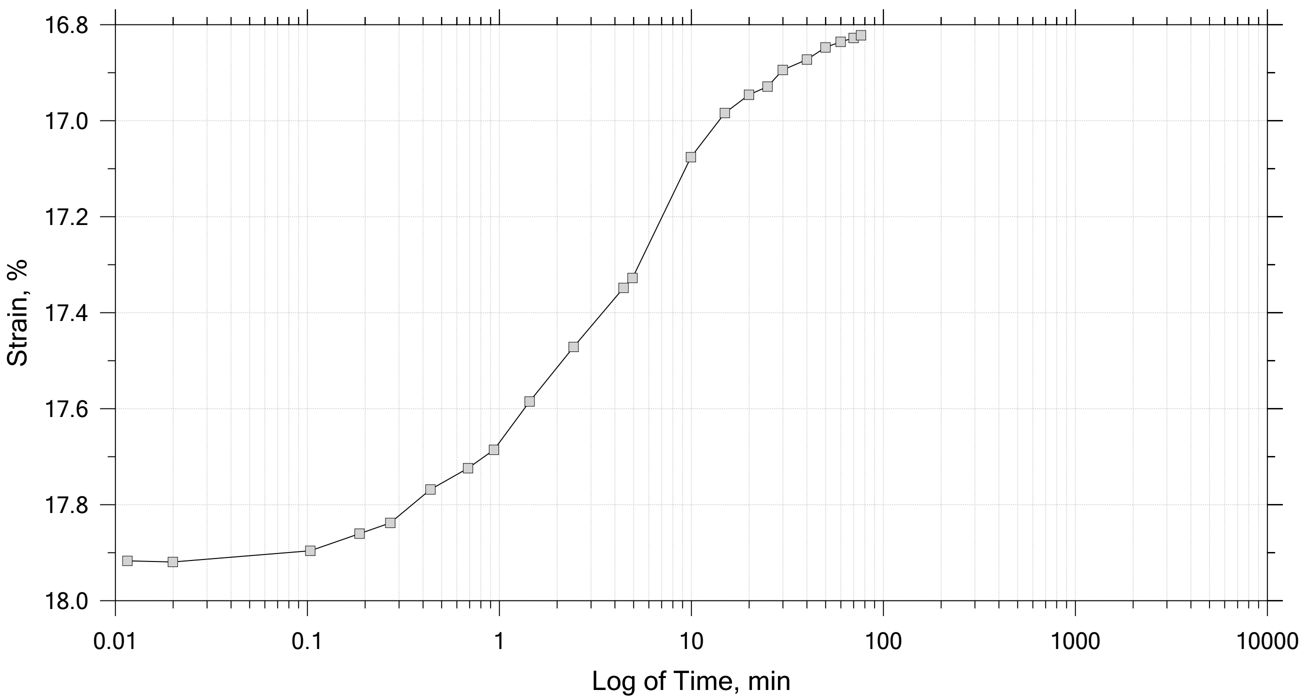
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 2U	Test Date: 10/9/2020	Depth: 21.65
	Test Number: ICON 334	Preparation: Shelby Tube	Elevation: 17.95
	Description: Gray Silty Clay		
	Remarks:		

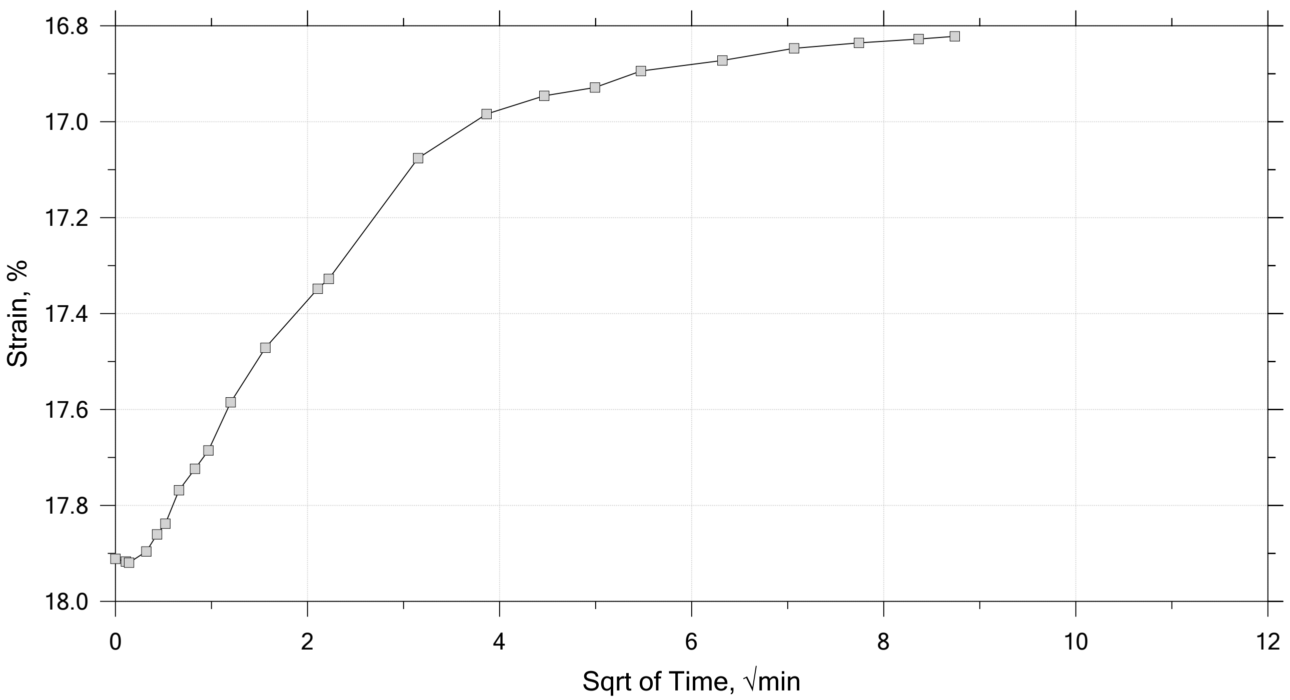
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 21 of 22

Constant Load Step

Stress: 1.1e+03 psf





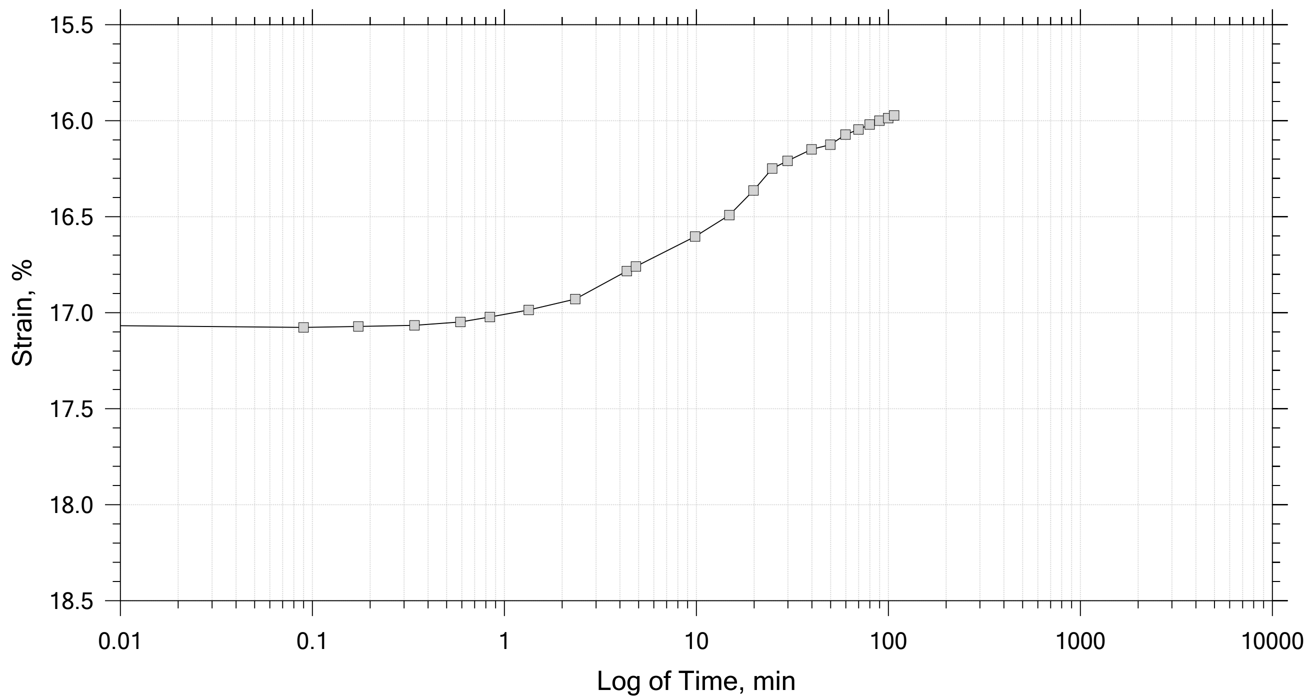
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 2U	Test Date: 10/9/2020	Depth: 21.65
	Test Number: ICON 334	Preparation: Shelby Tube	Elevation: 17.95
	Description: Gray Silty Clay		
	Remarks:		

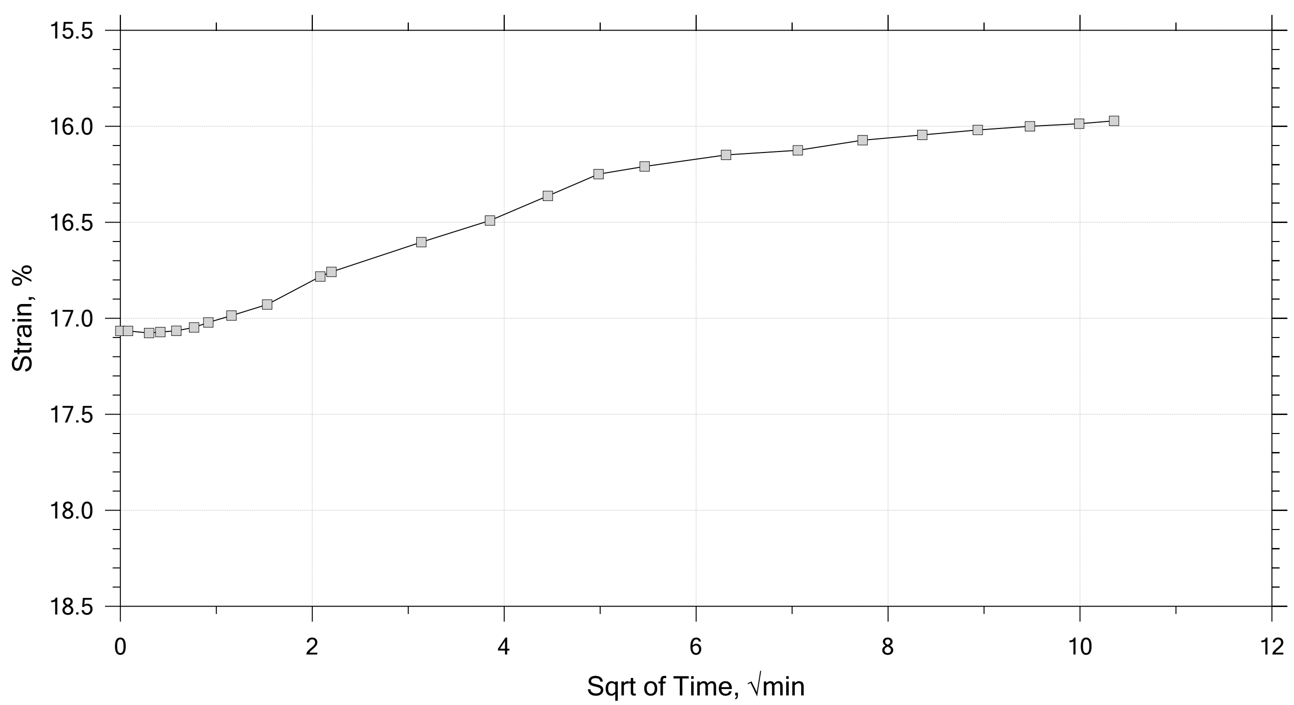
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 22 of 22

Constant Load Step

Stress: 274 psf





Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 2U	Test Date: 10/9/2020	Depth: 21.65
	Test Number: ICON 334	Preparation: Shelby Tube	Elevation: 17.95
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Specimen Diameter, in: 2.50	Specific Gravity: 2.82 (Implied)	Liquid Limit: 0
Specimen Height, in: 1.00	Initial Void Ratio: 1.32	Plastic Limit: 0
Final Height, in: 0.84	Final Void Ratio: 0.948	Plasticity Index: 0

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	210	---	"ring"	313
Mass Container, gm	37.02	111.09	111.09	60.86
Mass Container + Wet Soil, gm	163.36	254.97	242.57	192.16
Mass Container + Dry Soil, gm	123.99	209.52	209.52	159.16
Mass Dry Soil, gm	86.97	98.435	98.435	98.3
Water Content, %	45.27	46.17	33.57	33.57
Void Ratio	---	1.32	0.95	---
Degree of Saturation, %	---	98.90	100.00	---
Dry Unit Weight, pcf	---	76.051	90.507	---

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: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 2U	Test Date: 10/9/2020	Depth: 21.65
	Test Number: ICON 334	Preparation: Shelby Tube	Elevation: 17.95
	Description: Gray Silty Clay		
	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	220.	-8.573e-05	1.32	-0.00853	0.000	0.00e+00	-7.76e+02	-0.00e+00	0.00e+00
2	330.	-0.0005584	1.32	-0.0556	0.000	0.00e+00	-8.56e+03	-0.00e+00	0.00e+00
3	495.	0.001060	1.32	0.106	0.000	0.00e+00	1.95e+04	0.00e+00	0.00e+00
4	743.	0.002027	1.31	0.202	0.000	0.00e+00	7.76e+03	0.00e+00	0.00e+00
5	1.11e+03	0.002614	1.31	0.260	0.000	0.00e+00	3.15e+03	0.00e+00	0.00e+00
6	1.67e+03	0.003845	1.31	0.383	0.000	0.00e+00	4.40e+03	0.00e+00	0.00e+00
7	2.51e+03	0.005920	1.30	0.589	0.000	0.00e+00	4.95e+03	0.00e+00	0.00e+00
8	5.01e+03	0.05251	1.20	5.23	0.000	0.00e+00	3.70e+04	0.00e+00	0.00e+00
9	1.00e+04	0.1410	0.993	14.0	0.000	0.00e+00	3.51e+04	0.00e+00	0.00e+00
10	2.51e+03	0.1367	1.00	13.6	0.545	6.78e-01	1.13e+03	8.42e-09	0.00e+00
11	1.25e+03	0.1383	0.999	13.8	0.000	0.00e+00	-2.54e+03	-0.00e+00	0.00e+00
12	626.	0.1334	1.01	13.3	0.000	0.00e+00	1.56e+04	0.00e+00	0.00e+00
13	313.	0.1281	1.02	12.8	20.980	1.79e-02	3.34e+04	6.59e-09	0.00e+00
14	548.	0.1284	1.02	12.8	0.000	0.00e+00	2.04e+03	0.00e+00	0.00e+00
15	1.10e+03	0.1282	1.02	12.8	0.000	0.00e+00	-4.89e+02	-0.00e+00	0.00e+00
16	2.19e+03	0.1302	1.02	13.0	0.000	0.00e+00	3.65e+03	0.00e+00	0.00e+00
17	4.39e+03	0.1378	1.00	13.7	1.695	2.20e-01	6.85e+03	1.66e-08	0.00e+00
18	8.77e+03	0.1511	0.970	15.0	0.000	0.00e+00	6.05e+03	0.00e+00	0.00e+00
19	1.75e+04	0.1786	0.906	17.8	3.582	9.69e-02	6.23e+03	6.65e-09	0.00e+00
20	4.39e+03	0.1734	0.918	17.3	0.353	9.59e-01	7.82e+02	8.26e-09	0.00e+00
21	1.10e+03	0.1695	0.927	16.9	0.000	0.00e+00	2.35e+03	0.00e+00	0.00e+00
22	274.	0.1604	0.948	16.0	0.000	0.00e+00	2.20e+04	0.00e+00	0.00e+00

Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 2U	Test Date: 10/9/2020	Depth: 21.65
	Test Number: ICON 334	Preparation: Shelby Tube	Elevation: 17.95
	Description: Gray Silty Clay		
	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	220.	-8.573e-05	1.32	-0.00853	0.000	0.00e+00	-7.76e+02	-0.00e+00
2	330.	-0.0005584	1.32	-0.0556	0.000	0.00e+00	-8.56e+03	-0.00e+00
3	495.	0.001060	1.32	0.106	187.362	1.14e-02	1.95e+04	2.45e-09
4	743.	0.002027	1.31	0.202	0.000	0.00e+00	7.76e+03	0.00e+00
5	1.11e+03	0.002614	1.31	0.260	45.459	4.68e-02	3.15e+03	1.62e-09
6	1.67e+03	0.003845	1.31	0.383	59.452	3.57e-02	4.40e+03	1.73e-09
7	2.51e+03	0.005920	1.30	0.589	89.705	2.36e-02	4.95e+03	1.29e-09
8	5.01e+03	0.05251	1.20	5.23	53.514	3.77e-02	3.70e+04	1.54e-08
9	1.00e+04	0.1410	0.993	14.0	164.617	1.06e-02	3.51e+04	4.11e-09
10	2.51e+03	0.1367	1.00	13.6	3.929	4.04e-01	1.13e+03	5.03e-09
11	1.25e+03	0.1383	0.999	13.8	10.037	1.59e-01	-2.54e+03	-4.43e-09
12	626.	0.1334	1.01	13.3	35.888	4.46e-02	1.56e+04	7.65e-09
13	313.	0.1281	1.02	12.8	102.746	1.58e-02	3.34e+04	5.79e-09
14	548.	0.1284	1.02	12.8	0.000	0.00e+00	2.04e+03	0.00e+00
15	1.10e+03	0.1282	1.02	12.8	23.137	7.03e-02	-4.89e+02	-3.79e-10
16	2.19e+03	0.1302	1.02	13.0	8.127	2.00e-01	3.65e+03	8.02e-09
17	4.39e+03	0.1378	1.00	13.7	5.713	2.81e-01	6.85e+03	2.12e-08
18	8.77e+03	0.1511	0.970	15.0	130.764	1.20e-02	6.05e+03	7.99e-10
19	1.75e+04	0.1786	0.906	17.8	17.998	8.30e-02	6.23e+03	5.70e-09
20	4.39e+03	0.1734	0.918	17.3	4.986	2.92e-01	7.82e+02	2.51e-09
21	1.10e+03	0.1695	0.927	16.9	17.336	8.49e-02	2.35e+03	2.19e-09
22	274.	0.1604	0.948	16.0	64.363	2.32e-02	2.20e+04	5.61e-09

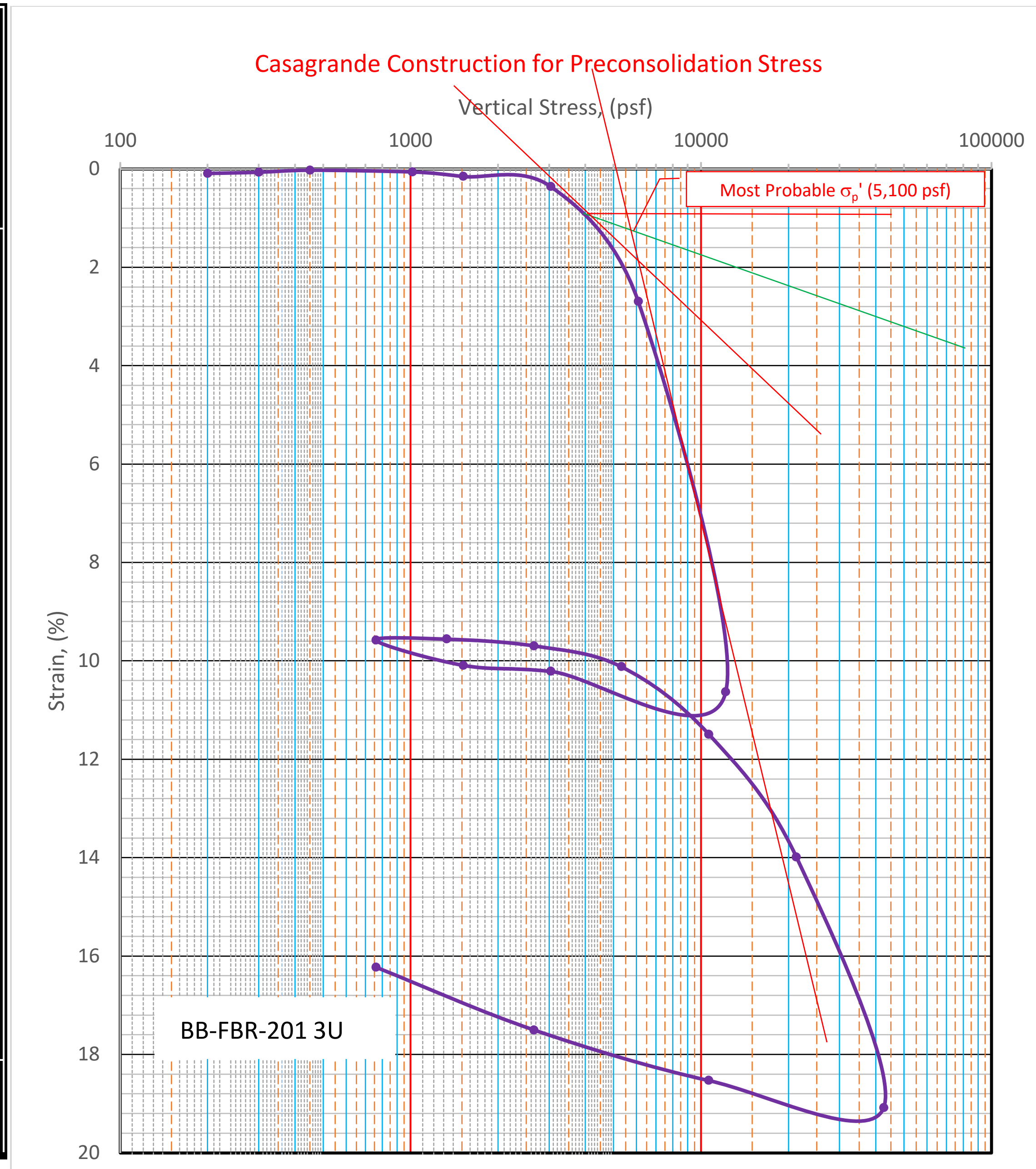
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 2U	Test Date: 10/9/2020	Depth: 21.65
	Test Number: ICON 334	Preparation: Shelby Tube	Elevation: 17.95
	Description: Gray Silty Clay		
	Remarks:		
	Displacement at End of Primary		

BB-FBR-201 3U

Consolidation Test Data
Summary Report

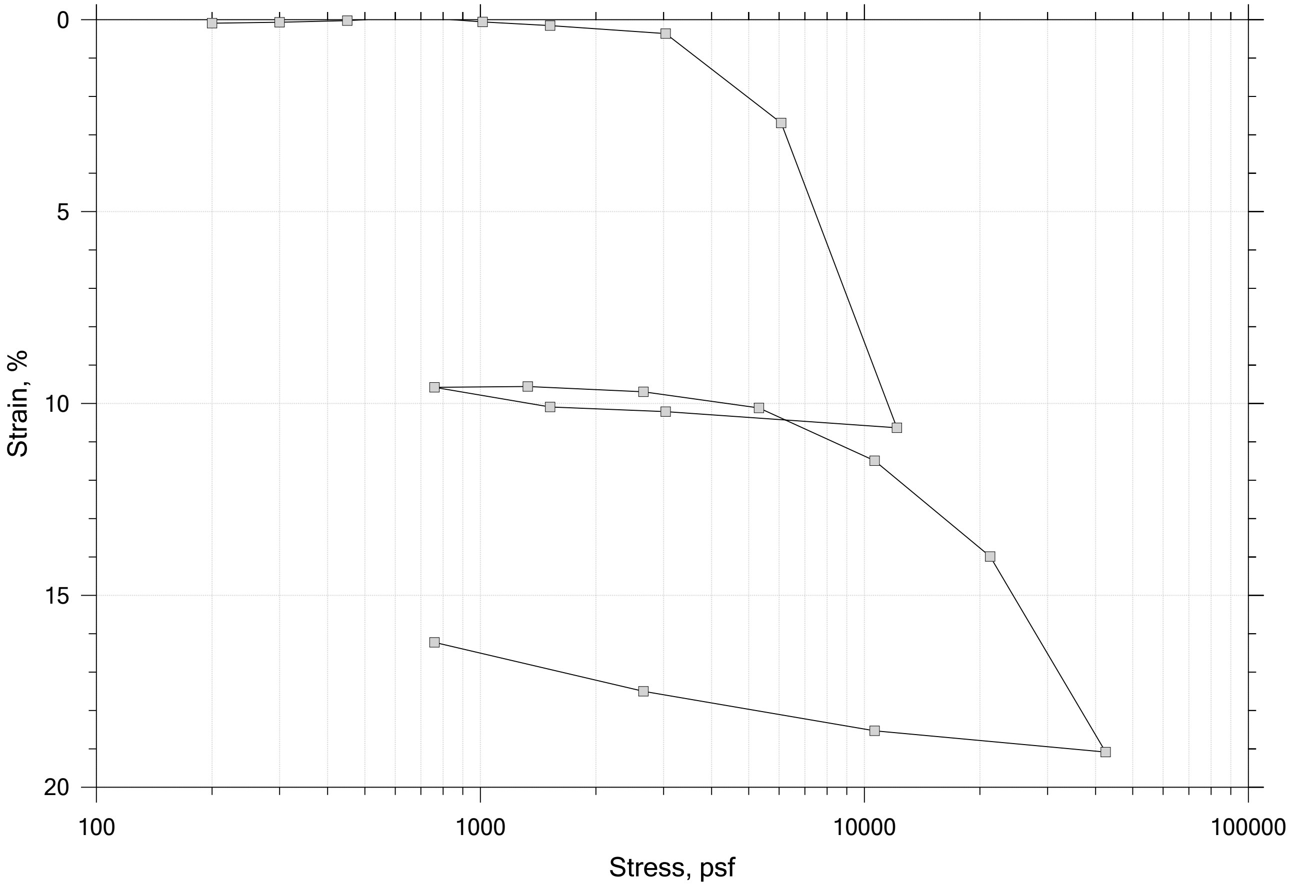
Project Name:	Bucknam Road Bridge
Project Number:	166-14
Project Location:	Falmouth, Maine
Client:	GZA
Sample Description:	Gray Silty Clay
Preparation:	Trimmed Shelby Tube

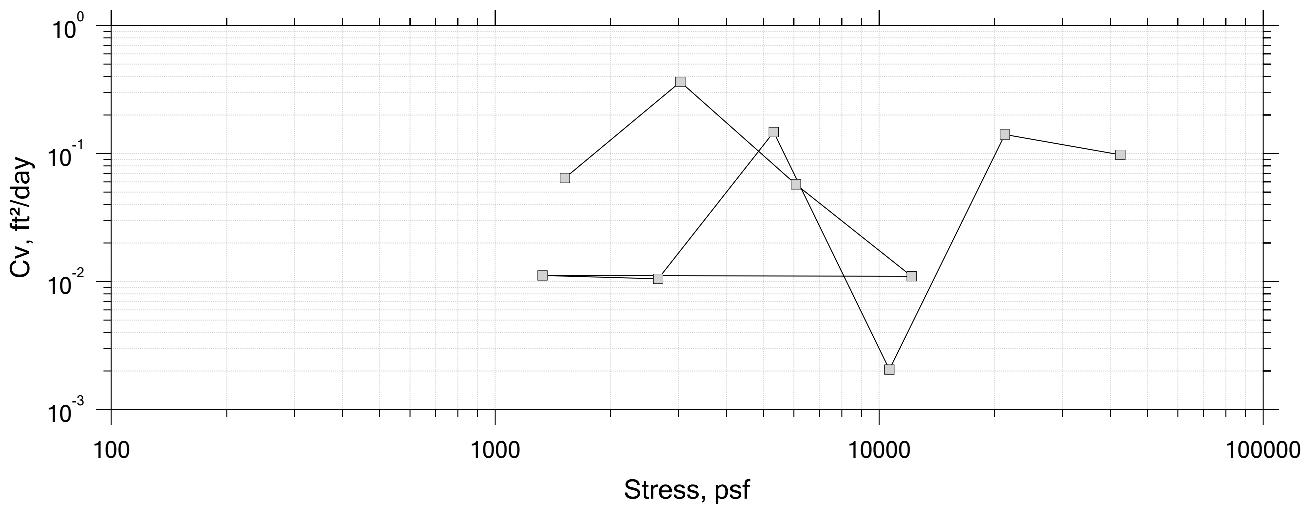
Lab Test No:	ICON 332			
Boring No.	BB-FBR-201			
Sample No:	3U			
Boring Elevation (ft).	39.6			
Sample Depth (ft):	30-32			
Test Specimen Depth (Ft):	31.6			
Test Specimen Elevation:	8.0			
Water Content (%):	39.2			
Dry Unit Weight (pcf):	79.9			
Wet Unit Weight (pcf):	111.2			
Saturation Before (%):	99.5			
Saturation After (%):	100			
Void Ratio Before:	1.18			
Void Ratio After:	0.77			
Overburden Pressure (psf):	--			
Max Previous stress (psf):	5,100			
Max Prev. stress (Work) (psf):	5,050			
OCR:	--			
Compression Index (C_{CE}):	0.265			
Recompression Index (C_{RE}):	0.018			
Liquid Limit:				
Plastic Limit:				
Plasticity Index:				
Liquidity Index:				
Specific Gravity (implied)	2.79			
Lab Vane Su at 31.85 ft. (psf)	794			
Tested By:	sjr			
Date Tested:	9/27/2020			
Checked By:	sjr			



One-Dimensional Consolidation by ASTM D2435 - Method B

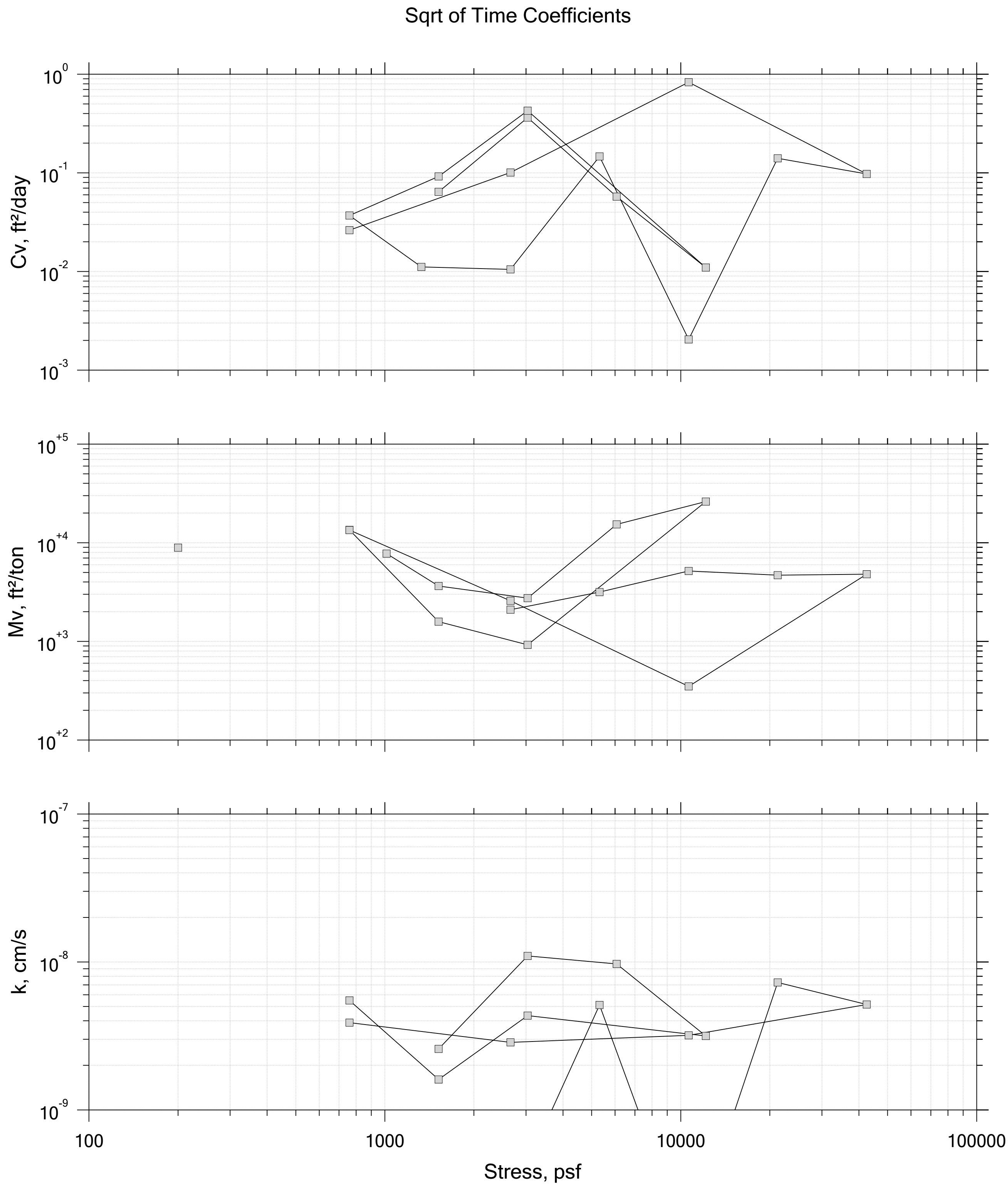
Summary Report





Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 9/27/22020	Depth: 31.6
	Test Number: ICON 332	Preparation: Shelby Tube	Elevation: 8.0
	Description: Gray Silty Clay		
	Remarks:		
	Displacement at End of Primary		

One-Dimensional Consolidation by ASTM D2435 - Method B



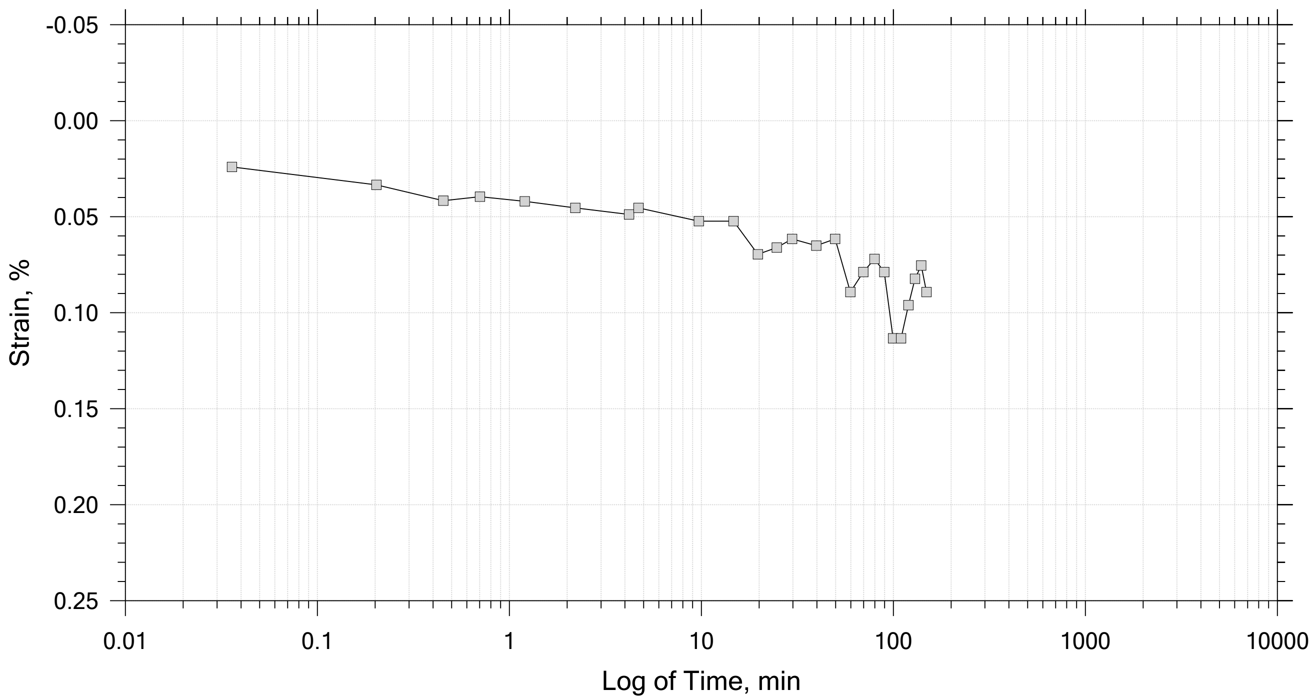
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 9/27/22020	Depth: 31.6
	Test Number: ICON 332	Preparation: Shelby Tube	Elevation: 8.0
	Description: Gray Silty Clay		
	Remarks:		

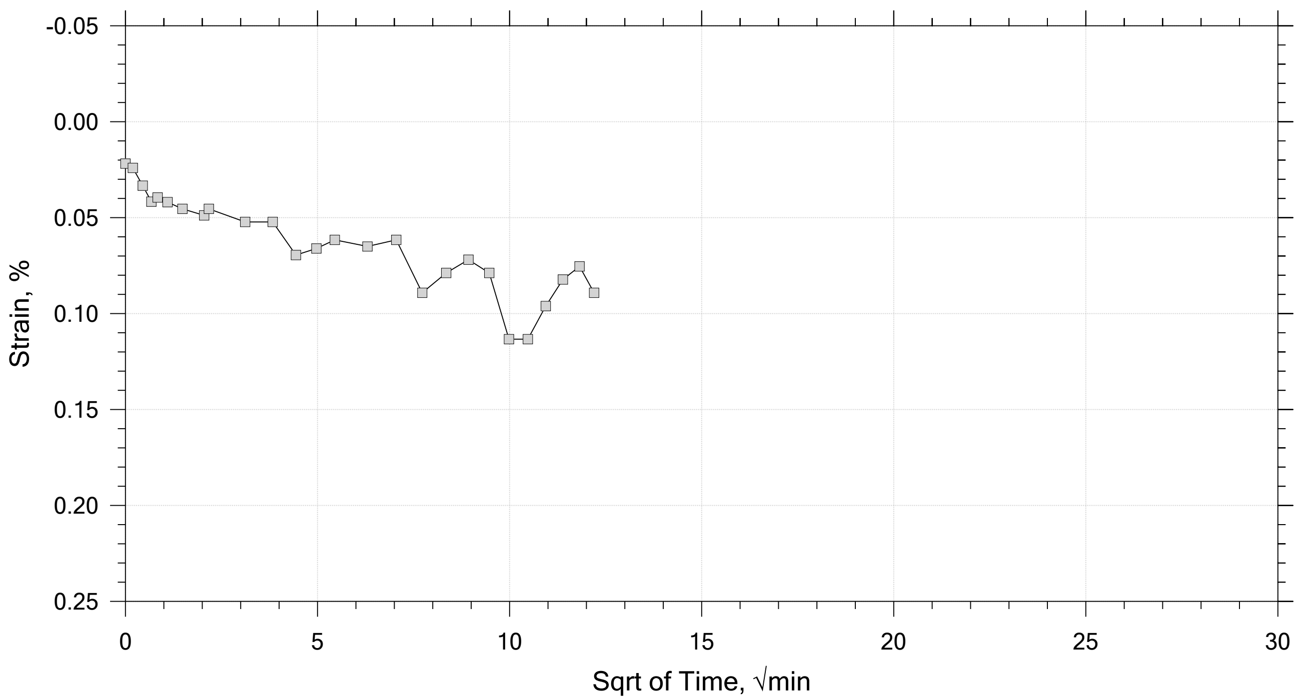
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 1 of 21

Constant Load Step

Stress: 200 psf





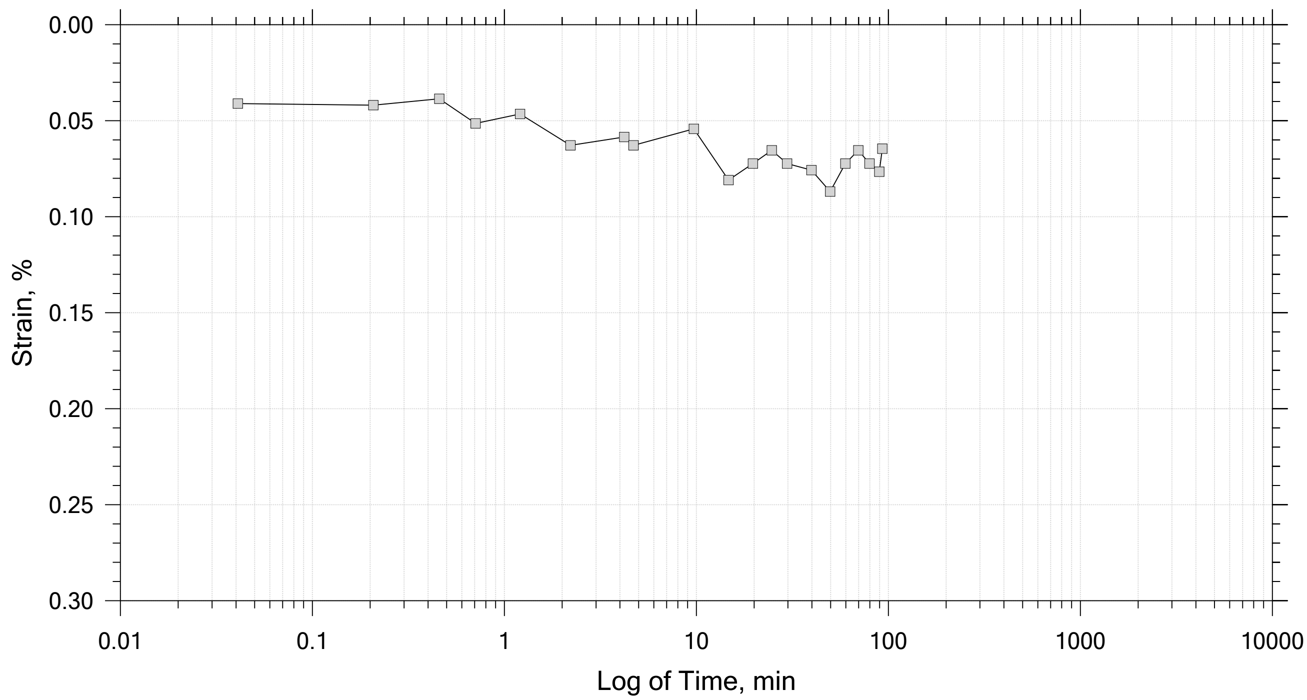
Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 9/27/22020	Depth: 31.6
	Test Number: ICON 332	Preparation: Shelby Tube	Elevation: 8.0
	Description: Gray Silty Clay		
	Remarks:		

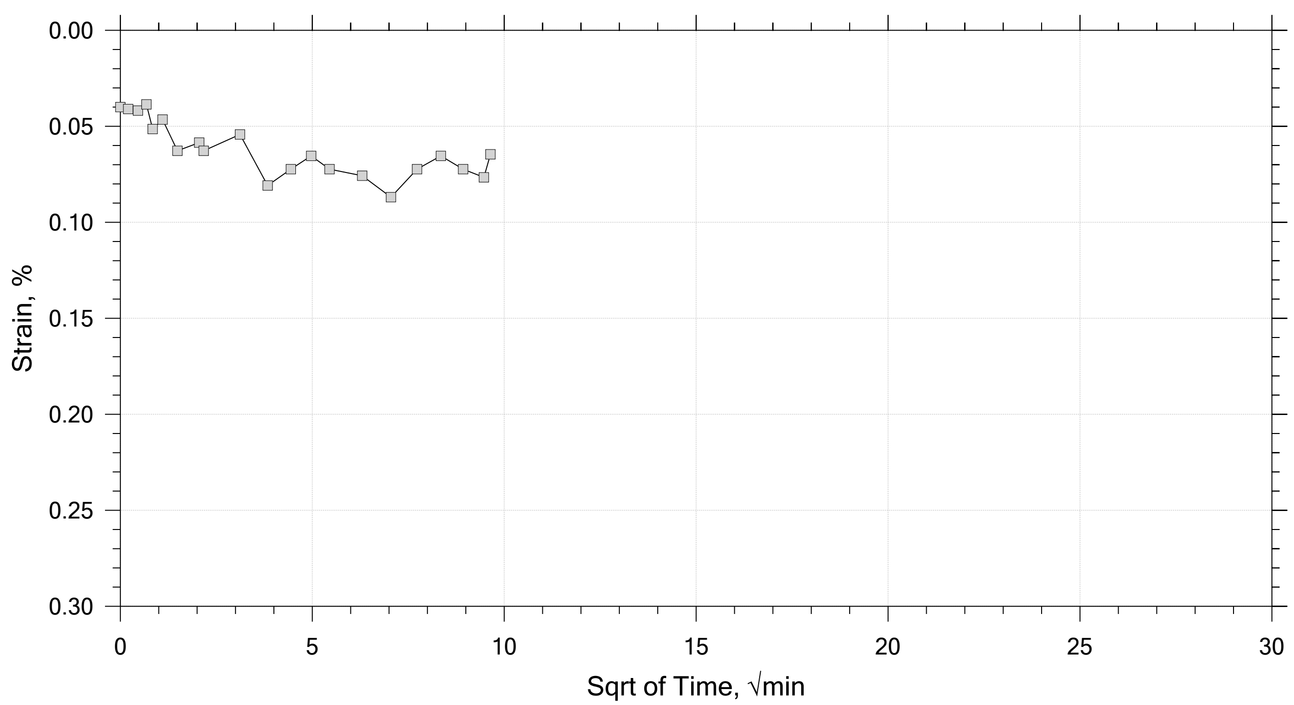
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 2 of 21

Constant Load Step

Stress: 300 psf





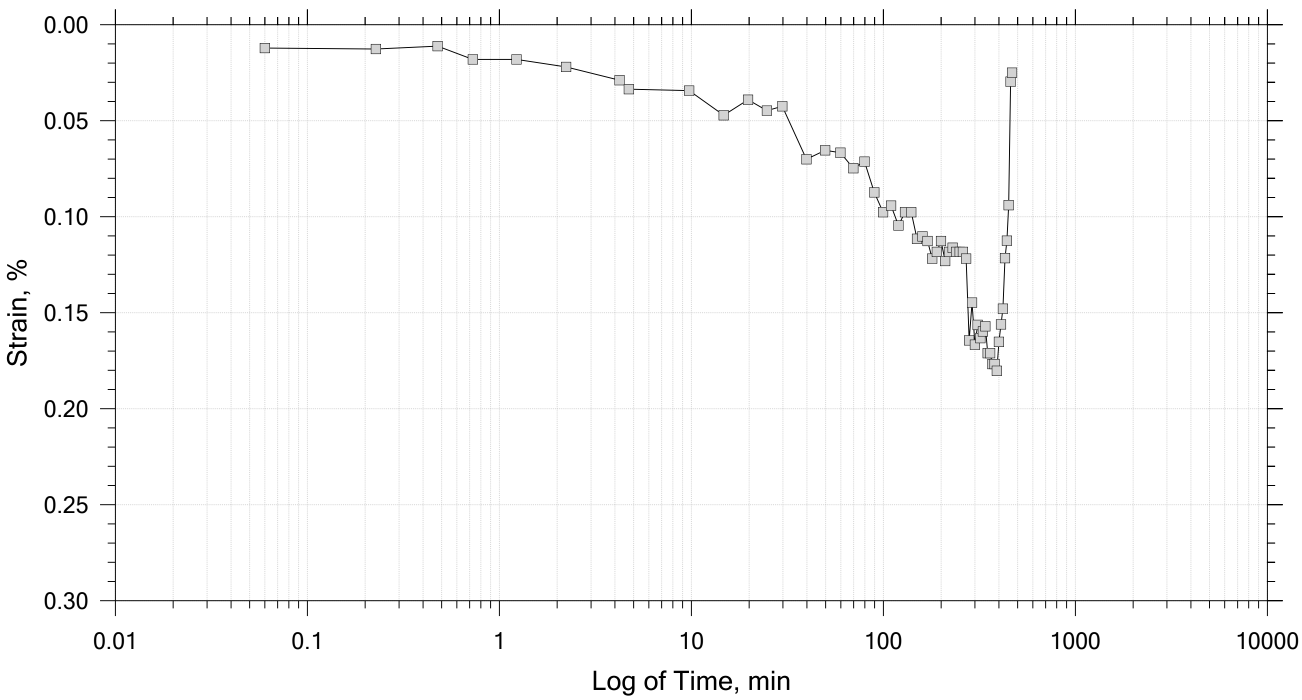
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 9/27/22020	Depth: 31.6
	Test Number: ICON 332	Preparation: Shelby Tube	Elevation: 8.0
	Description: Gray Silty Clay		
	Remarks:		

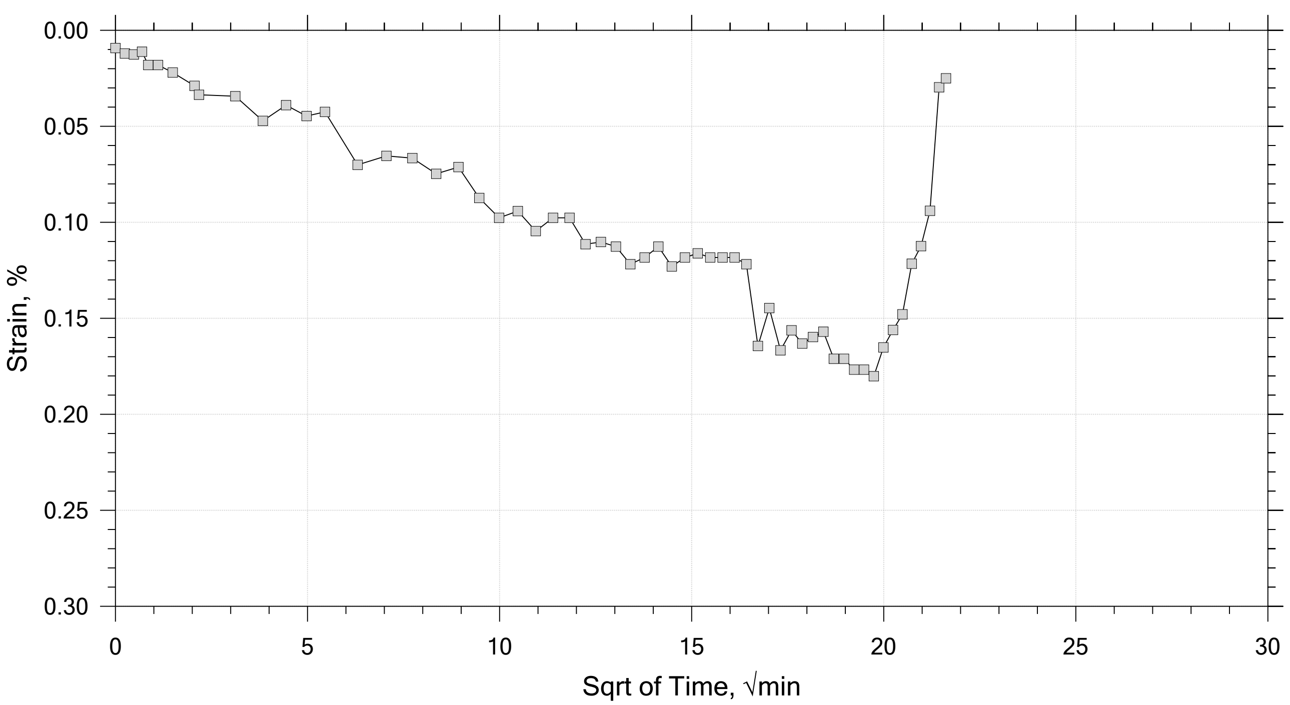
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 3 of 21

Constant Load Step

Stress: 450 psf

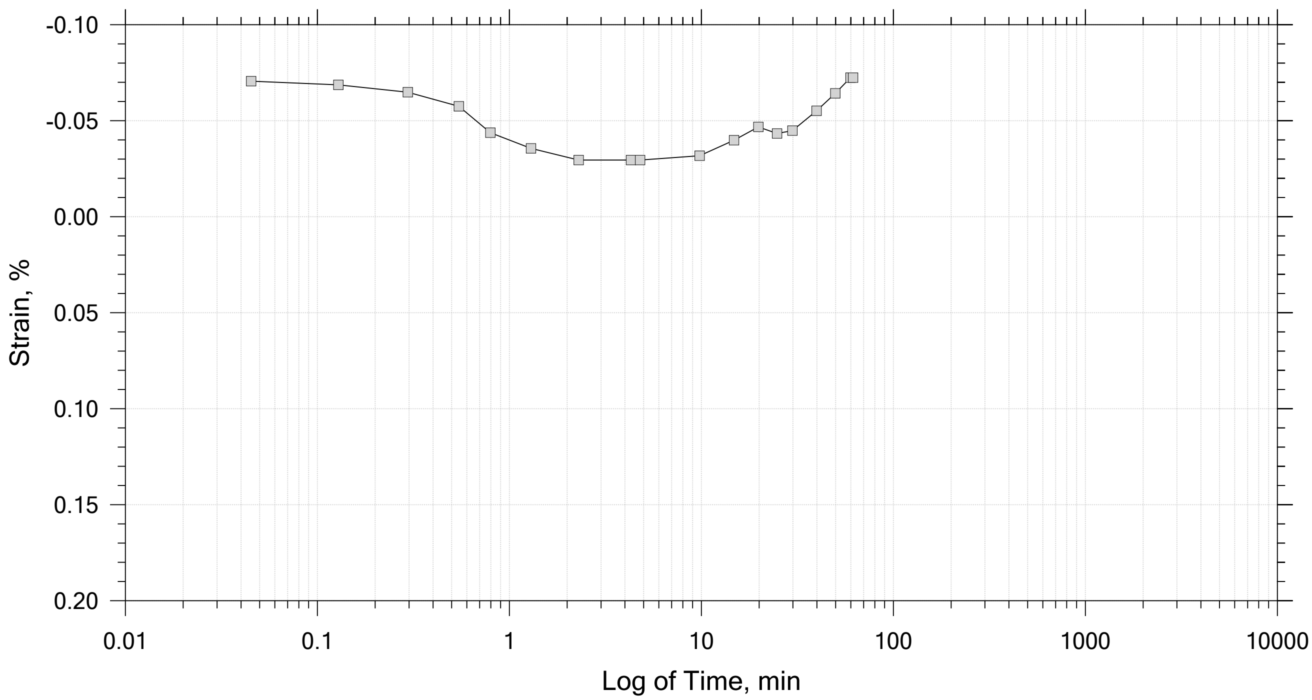


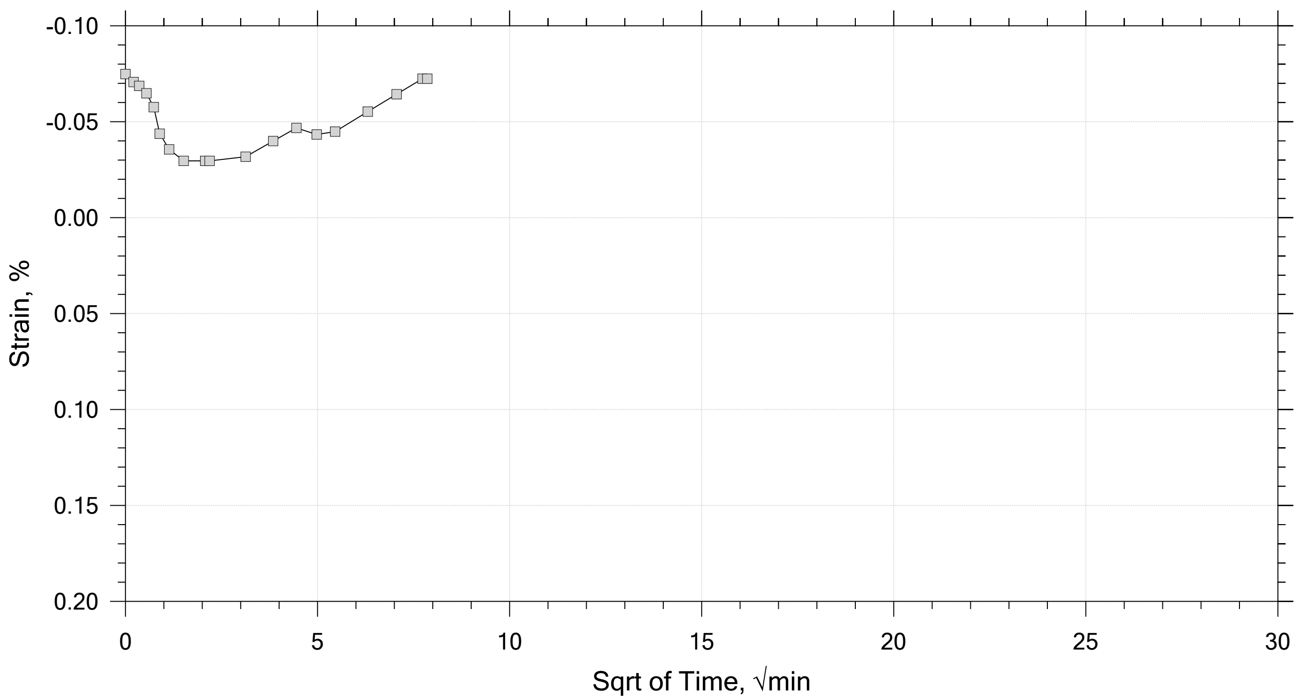


Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 9/27/22020	Depth: 31.6
	Test Number: ICON 332	Preparation: Shelby Tube	Elevation: 8.0
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 4 of 21
Constant Load Step
Stress: 675 psf





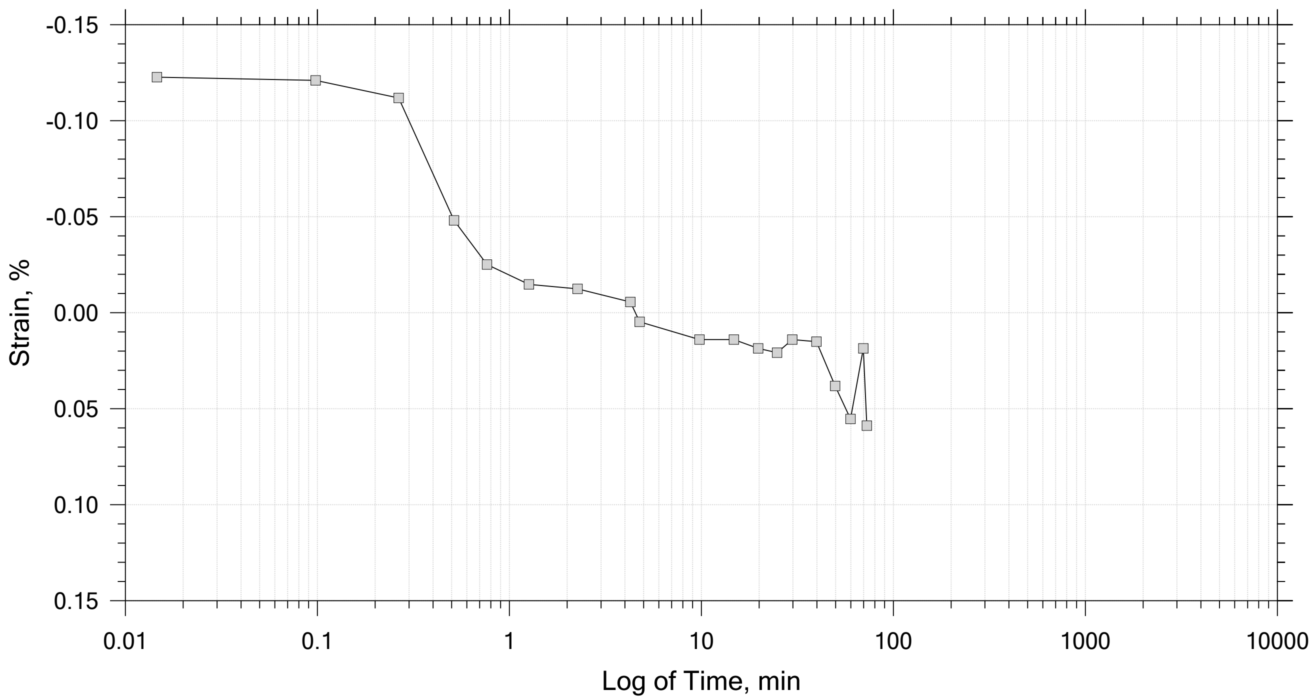
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 9/27/22020	Depth: 31.6
	Test Number: ICON 332	Preparation: Shelby Tube	Elevation: 8.0
	Description: Gray Silty Clay		
	Remarks:		

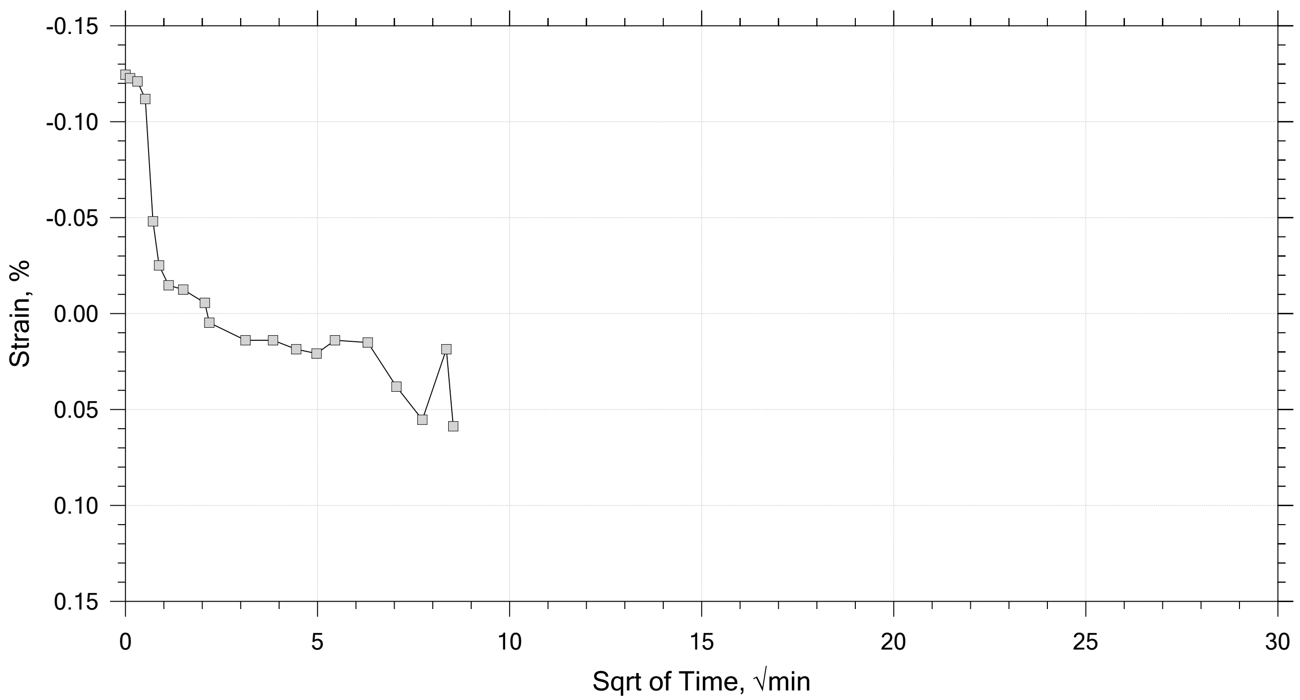
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 5 of 21

Constant Load Step

Stress: 1.01e+03 psf





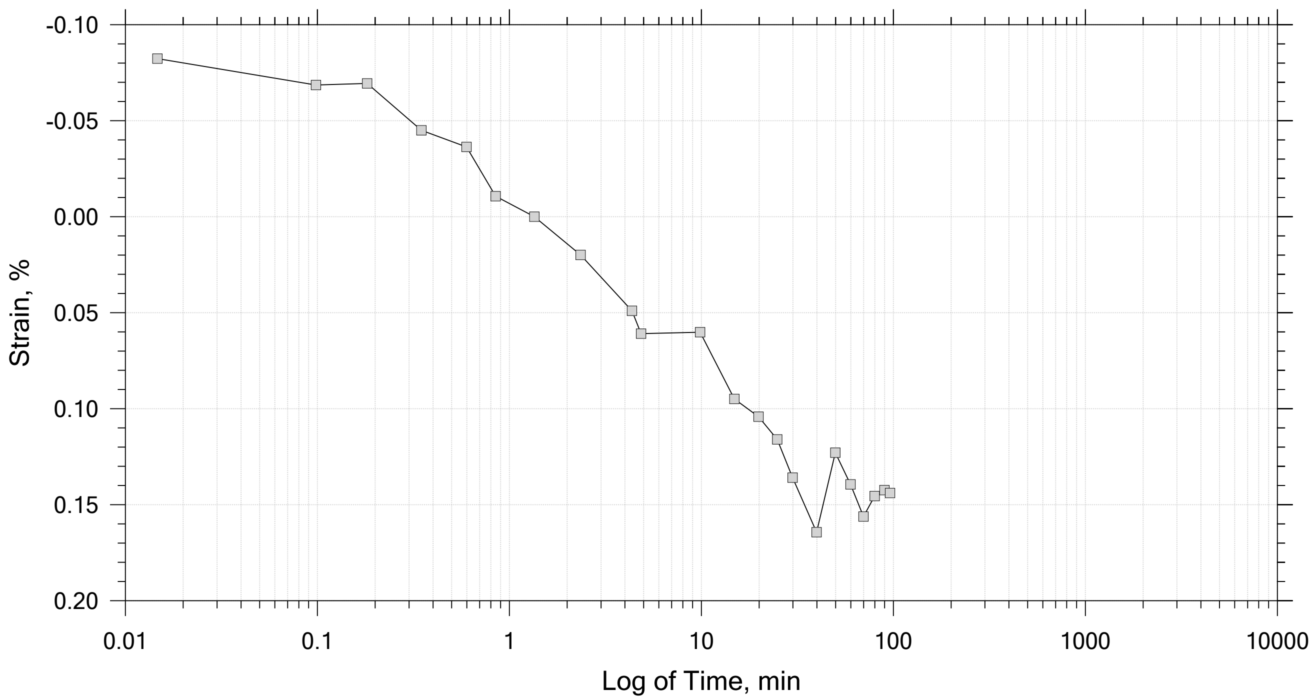
Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 9/27/22020	Depth: 31.6
	Test Number: ICON 332	Preparation: Shelby Tube	Elevation: 8.0
	Description: Gray Silty Clay		
	Remarks:		

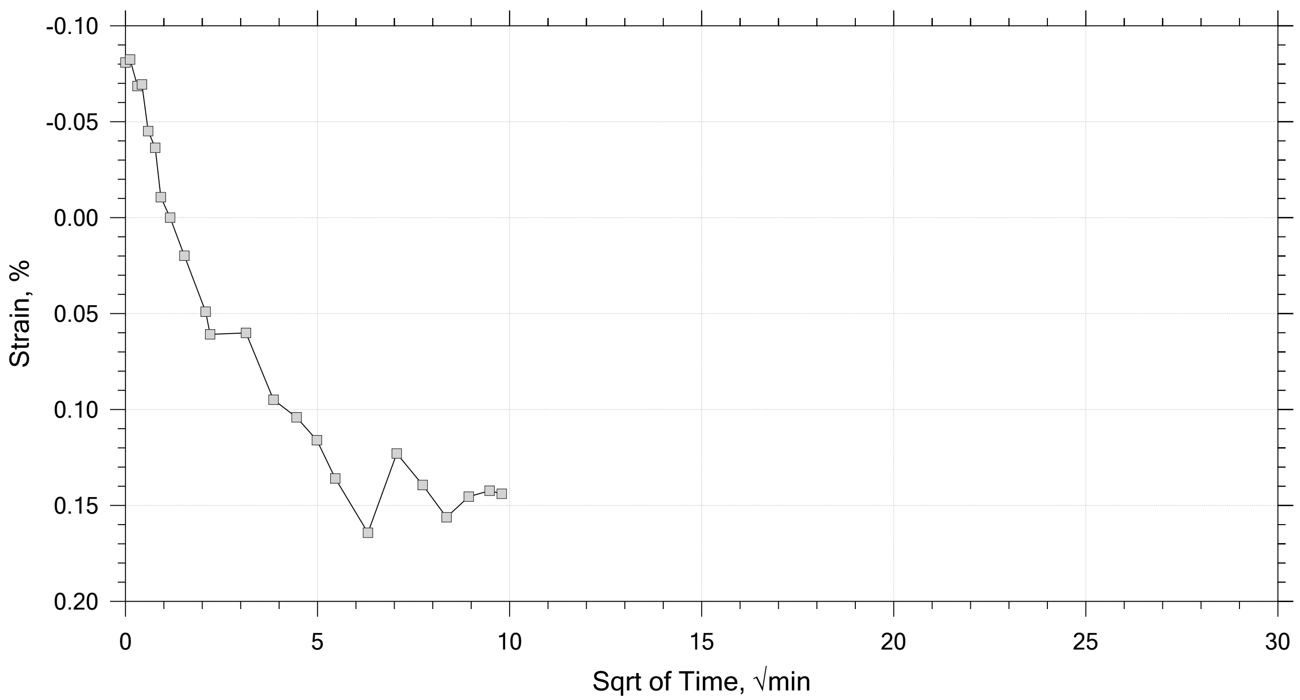
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 6 of 21

Constant Load Step

Stress: 1.52e+03 psf





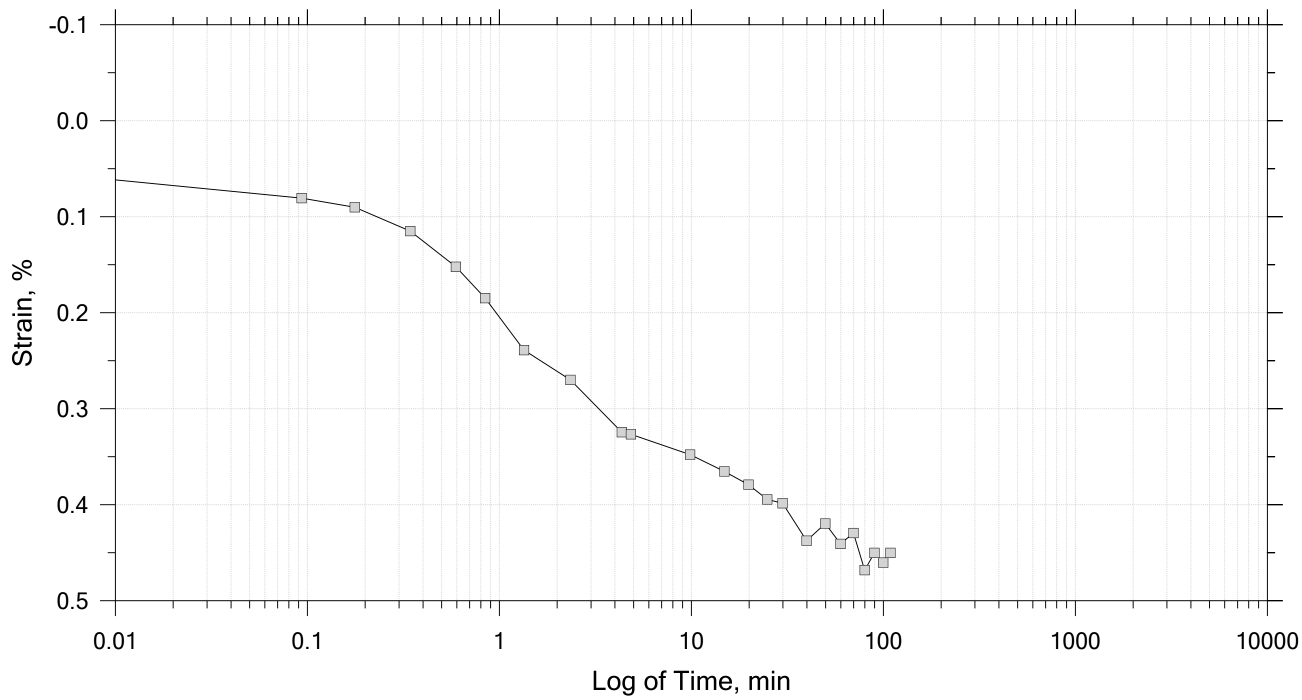
Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 9/27/22020	Depth: 31.6
	Test Number: ICON 332	Preparation: Shelby Tube	Elevation: 8.0
	Description: Gray Silty Clay		
	Remarks:		

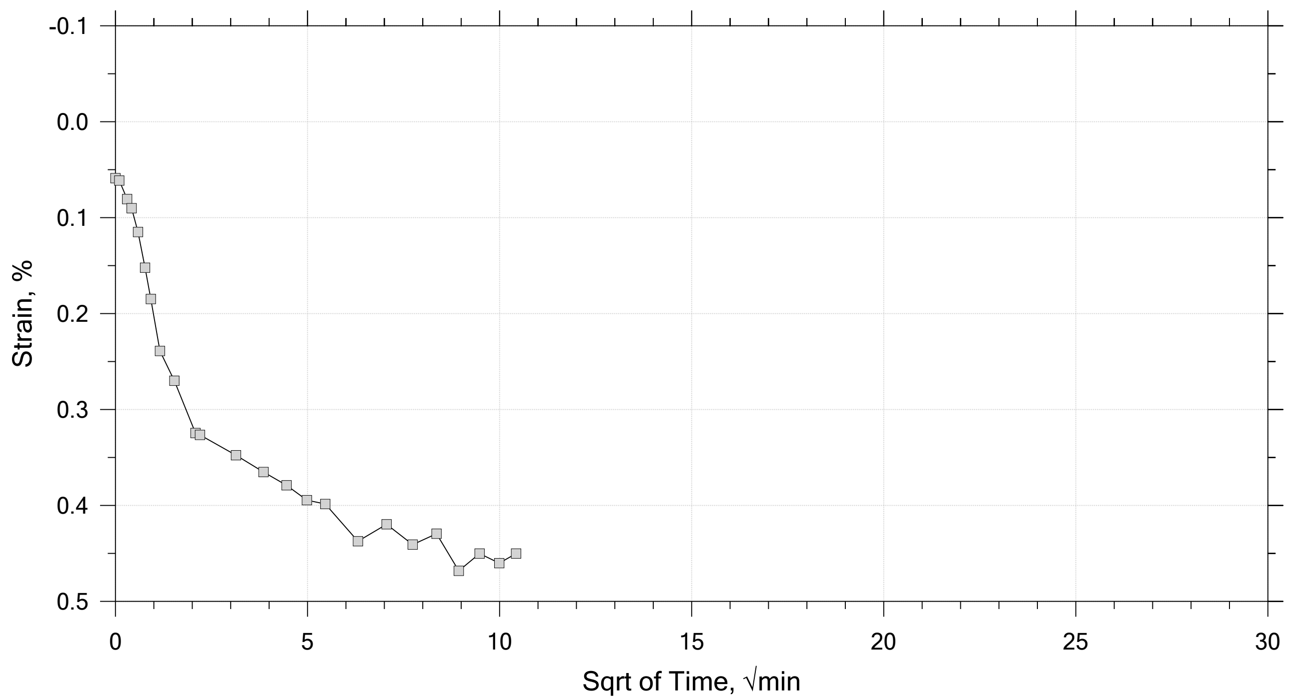
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 7 of 21

Constant Load Step

Stress: 3.04e+03 psf





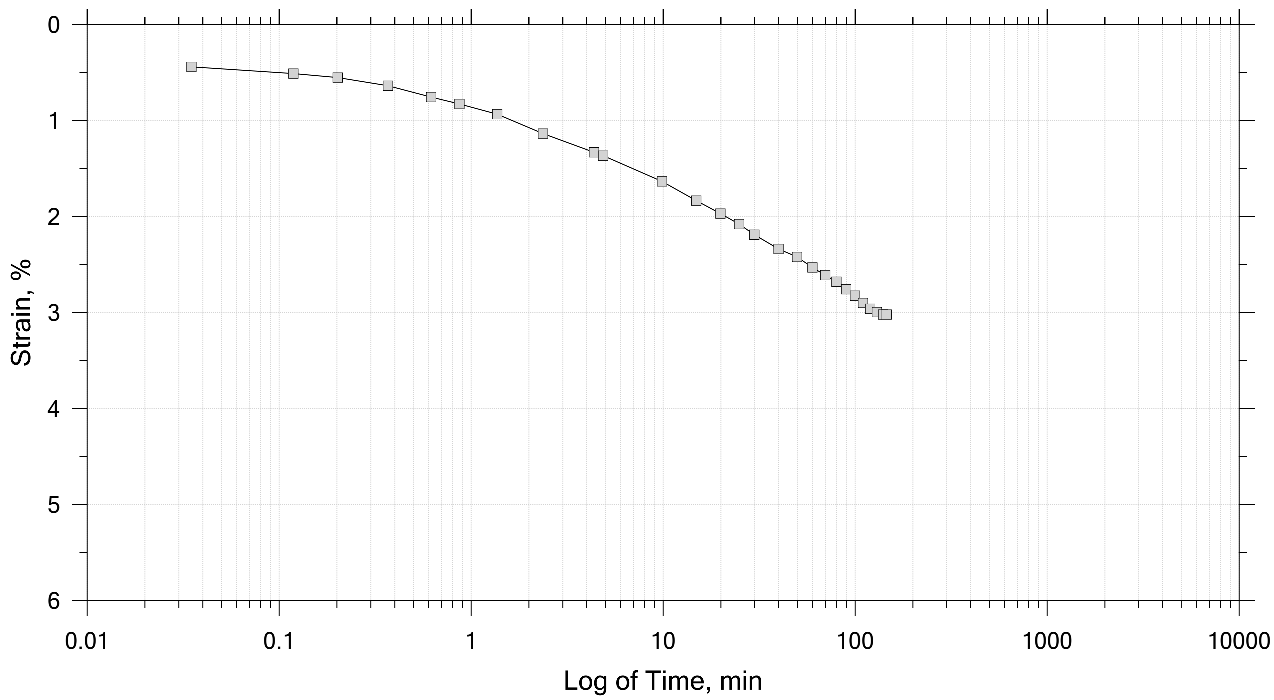
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 9/27/22020	Depth: 31.6
	Test Number: ICON 332	Preparation: Shelby Tube	Elevation: 8.0
	Description: Gray Silty Clay		
	Remarks:		

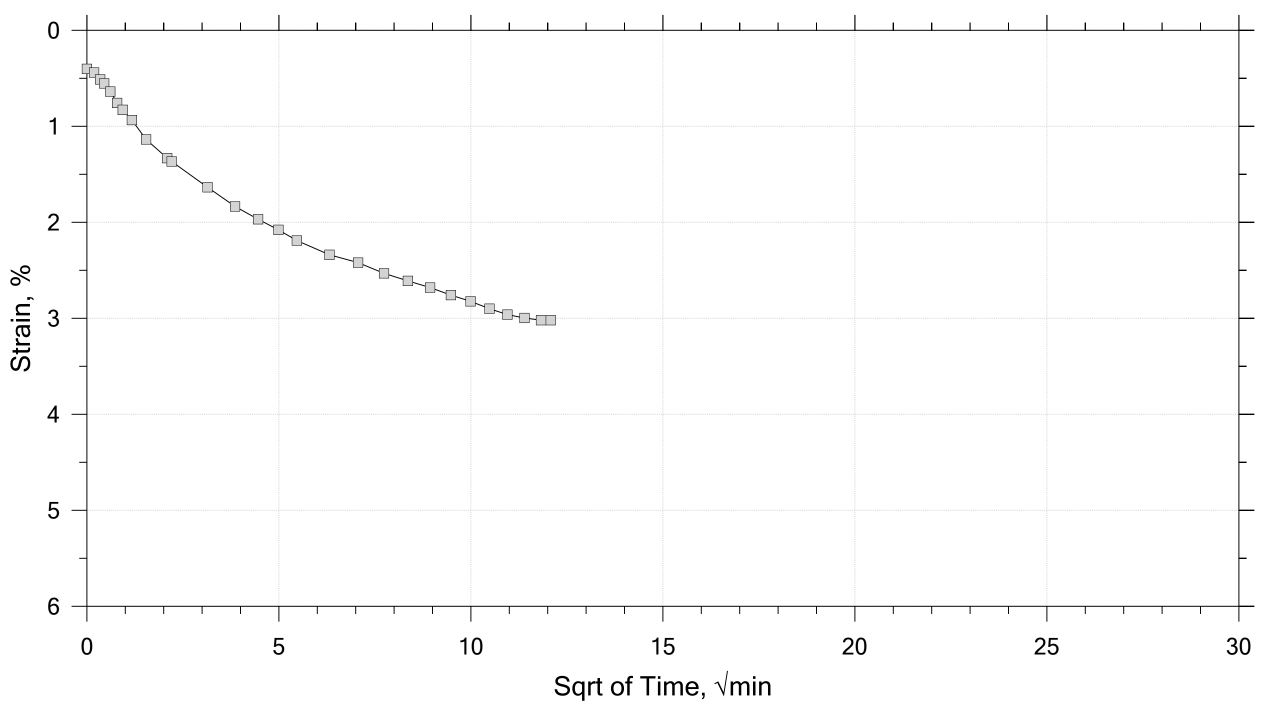
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 8 of 21

Constant Load Step

Stress: 6.08e+03 psf





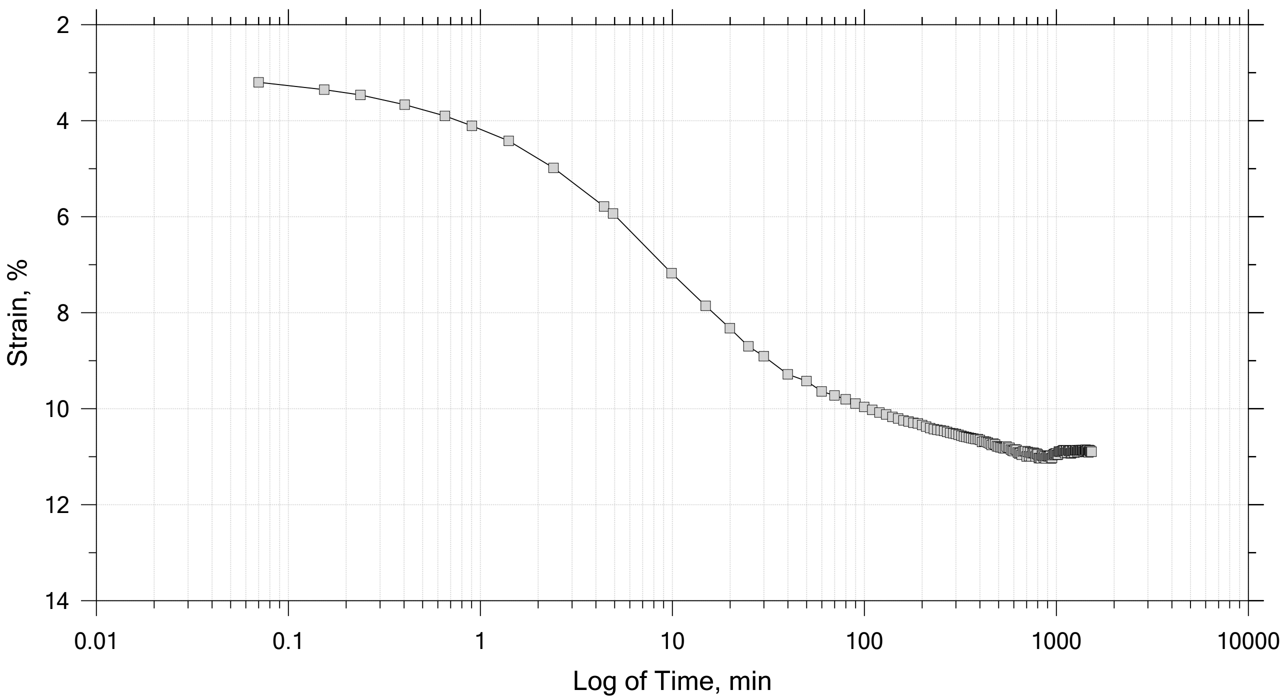
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 9/27/22020	Depth: 31.6
	Test Number: ICON 332	Preparation: Shelby Tube	Elevation: 8.0
	Description: Gray Silty Clay		
	Remarks:		

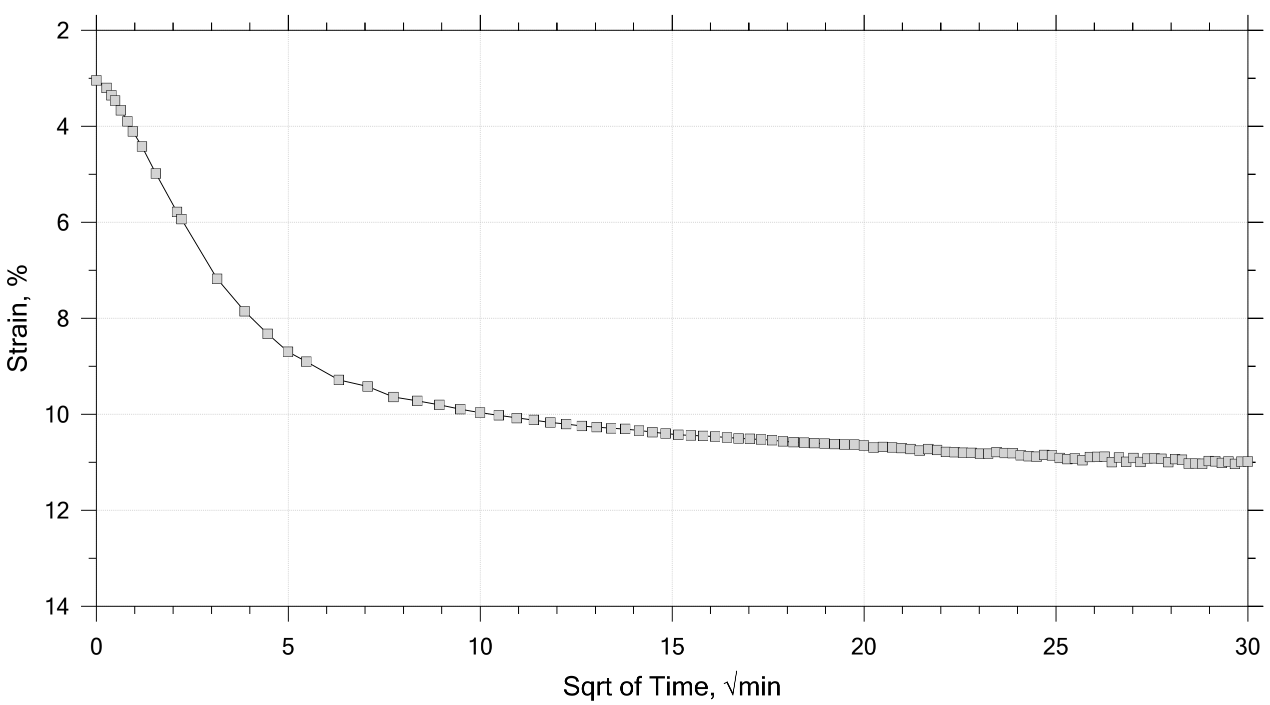
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 9 of 21

Constant Load Step

Stress: 1.22e+04 psf

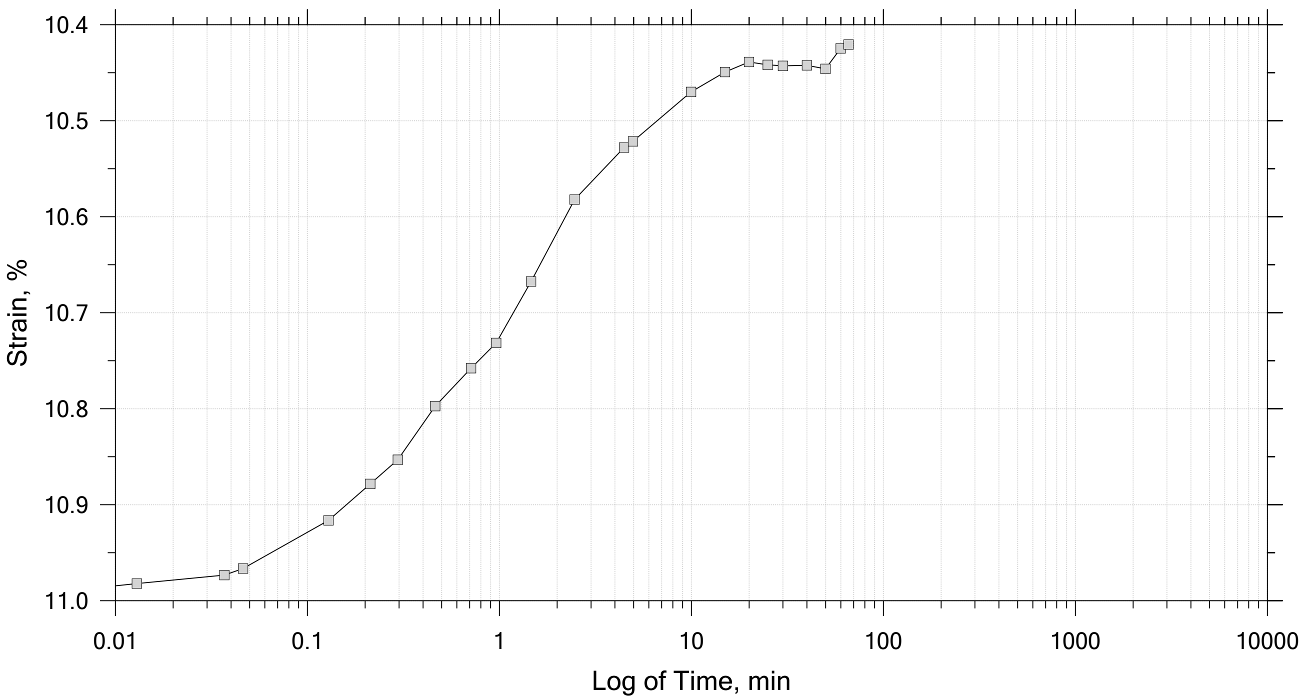


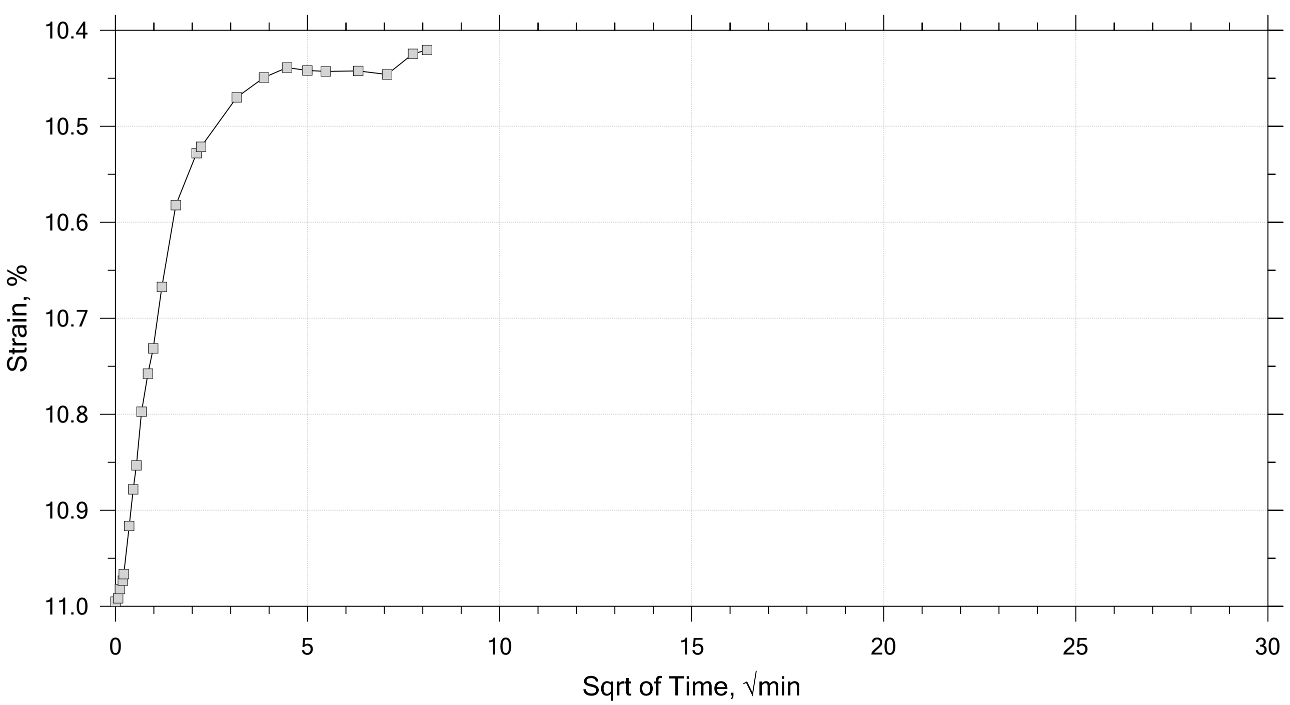


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 9/27/22020	Depth: 31.6
	Test Number: ICON 332	Preparation: Shelby Tube	Elevation: 8.0
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 10 of 21
Constant Load Step
Stress: 3.04e+03 psf

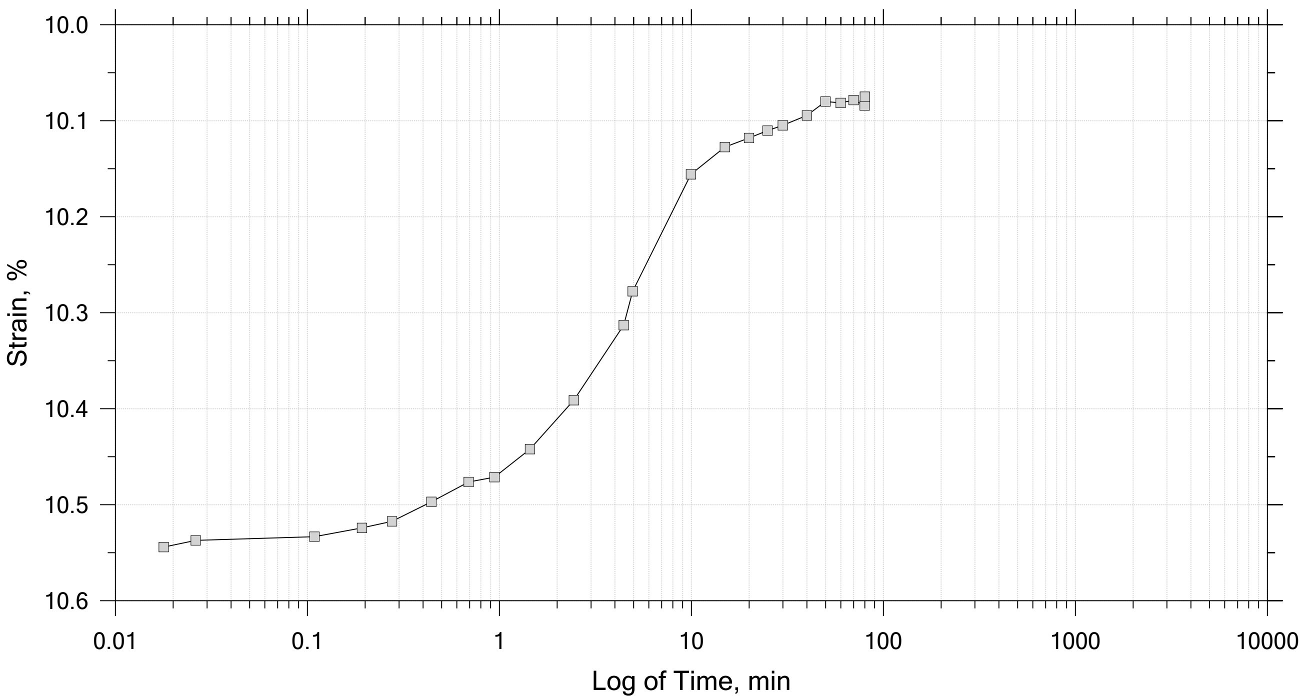


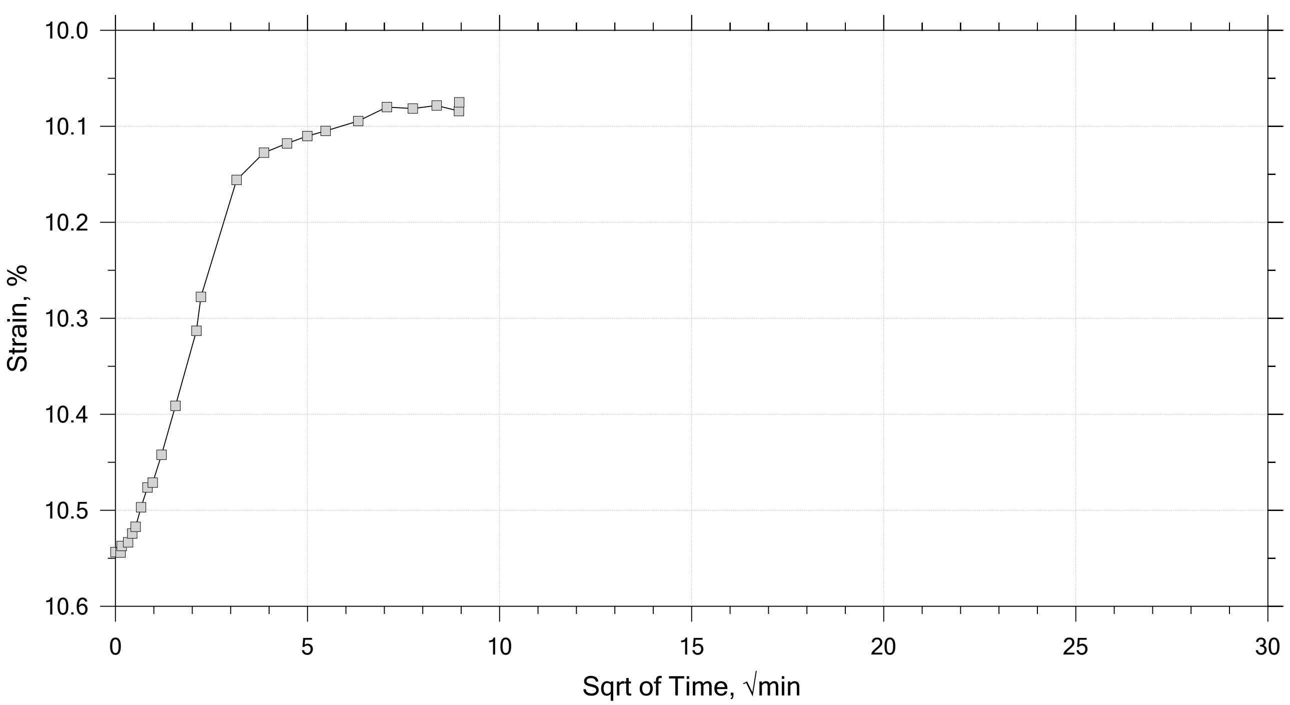


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 9/27/22020	Depth: 31.6
	Test Number: ICON 332	Preparation: Shelby Tube	Elevation: 8.0
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 11 of 21
Constant Load Step
Stress: 1.52e+03 psf

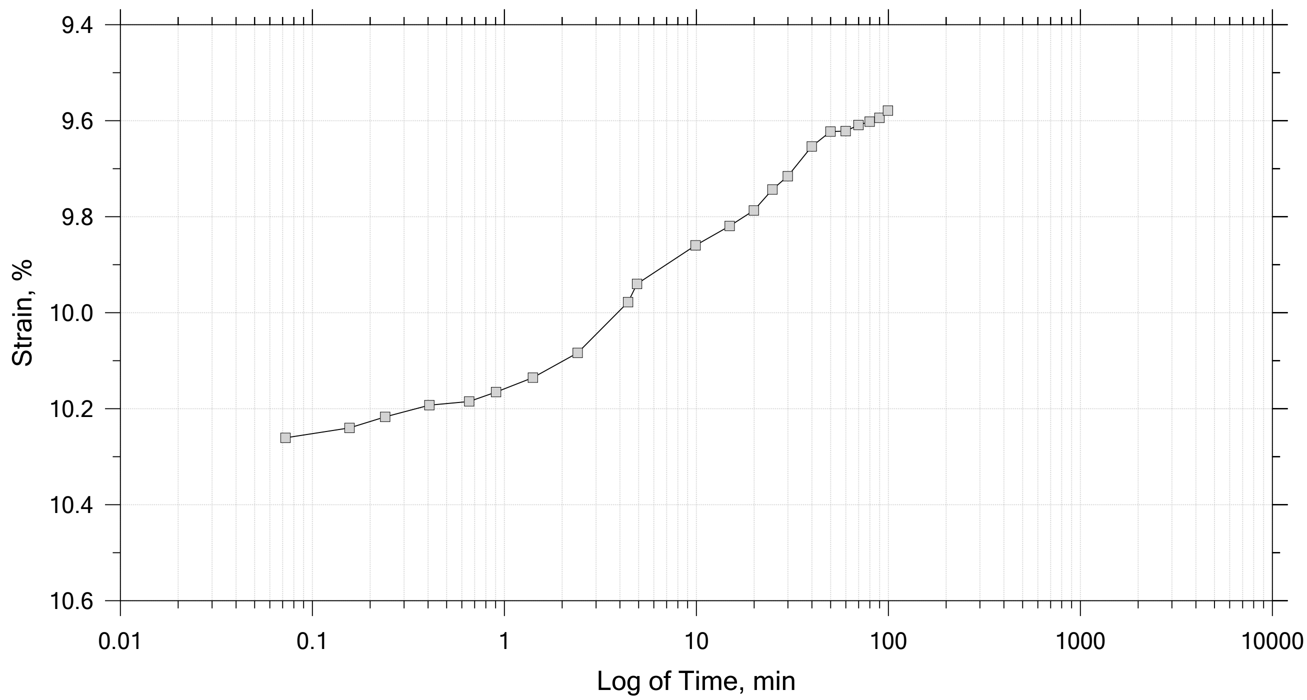


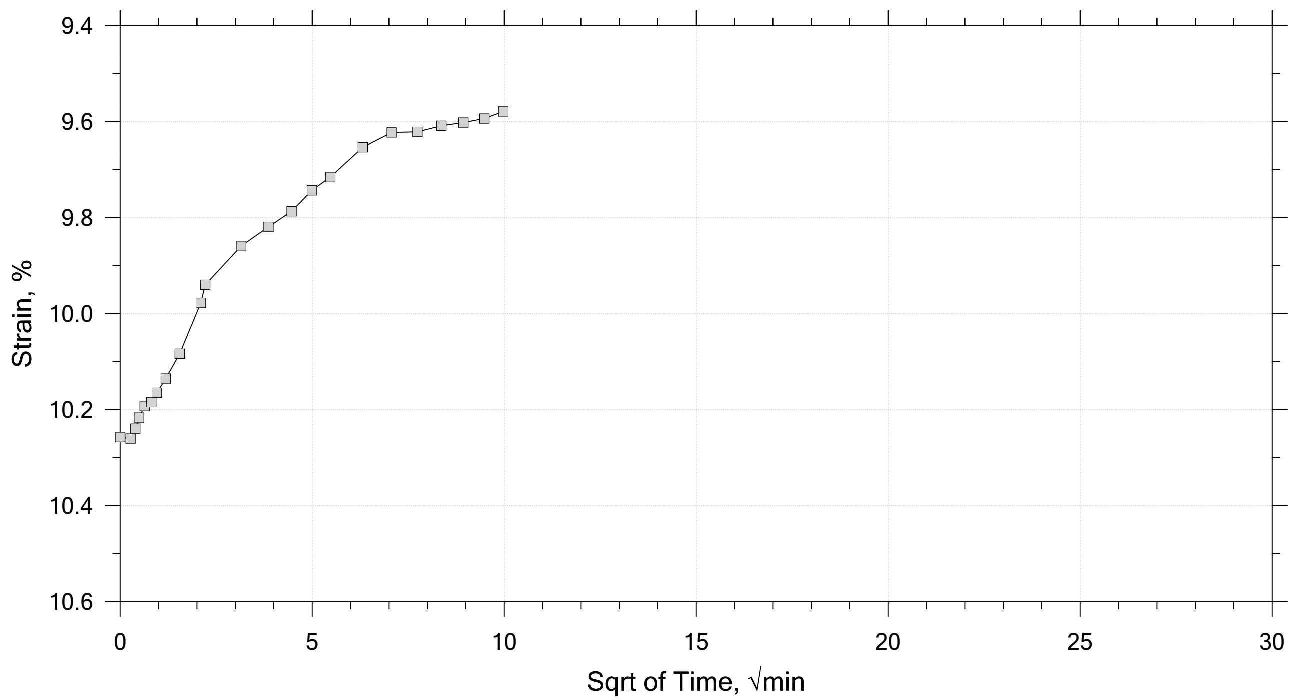


	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 9/27/22020	Depth: 31.6
	Test Number: ICON 332	Preparation: Shelby Tube	Elevation: 8.0
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 12 of 21
Constant Load Step
Stress: 759 psf





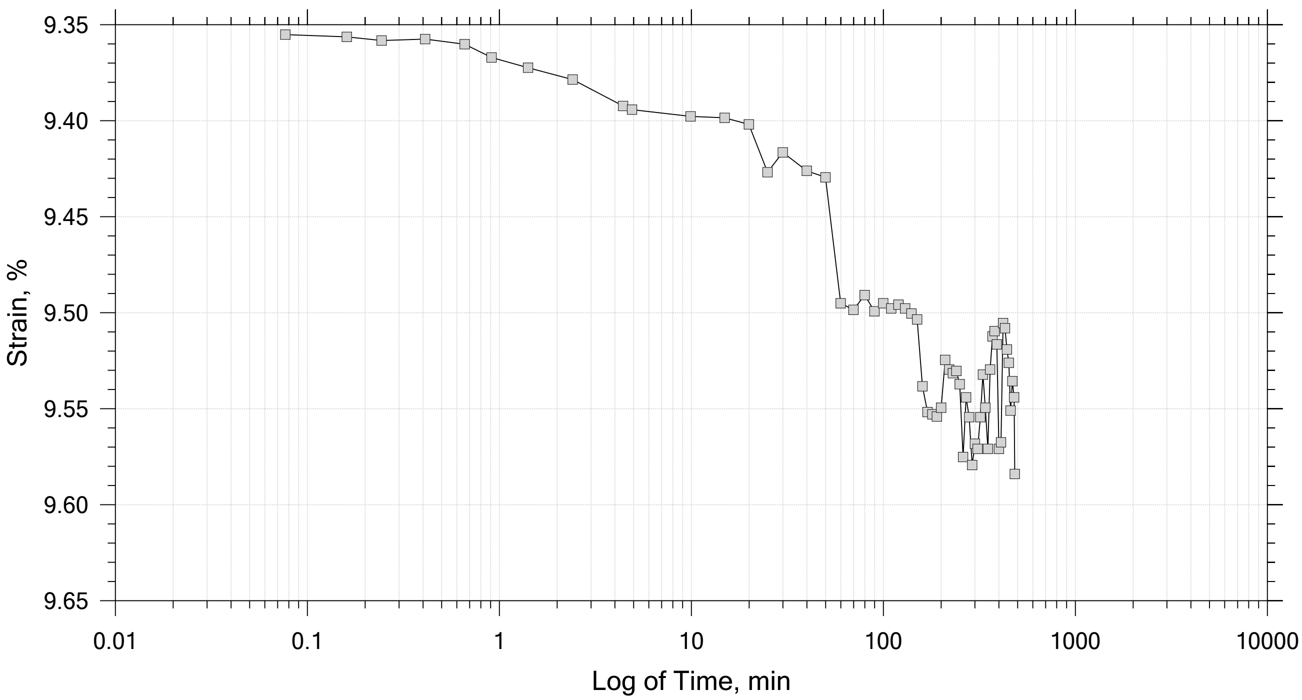
Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 9/27/22020	Depth: 31.6
	Test Number: ICON 332	Preparation: Shelby Tube	Elevation: 8.0
	Description: Gray Silty Clay		
	Remarks:		

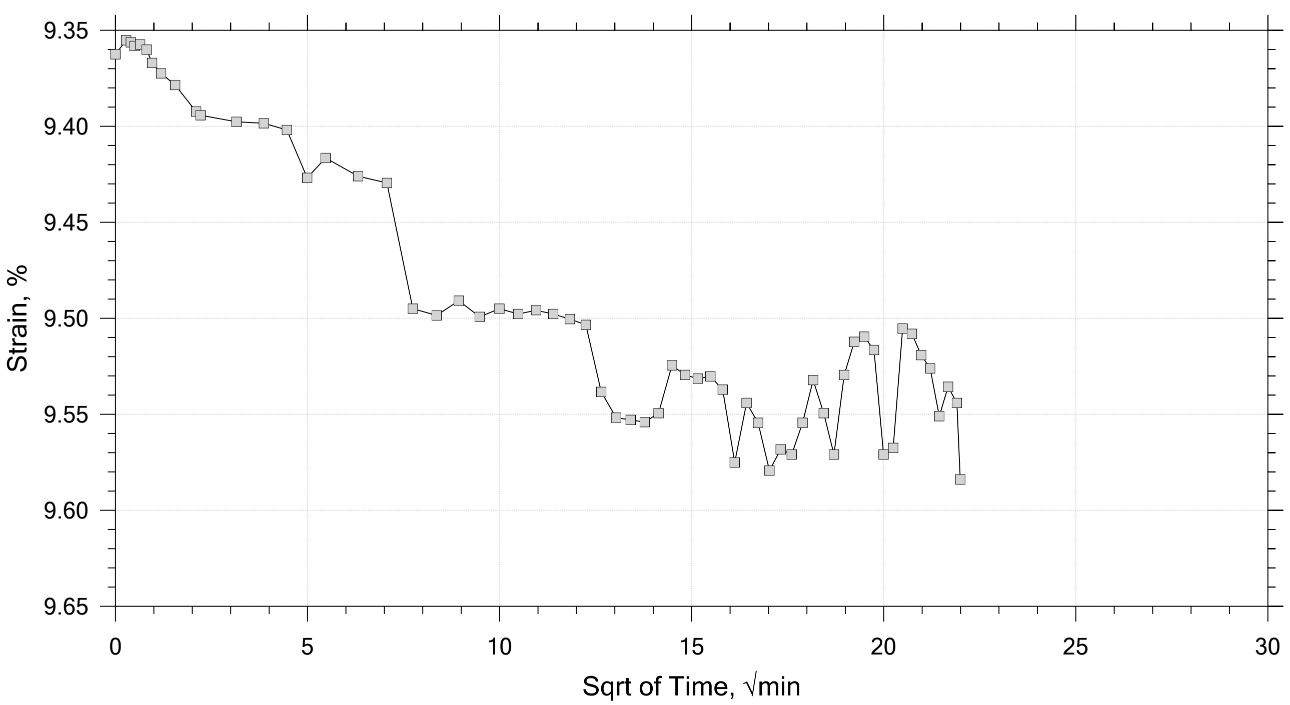
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 13 of 21

Constant Load Step

Stress: 1.33e+03 psf





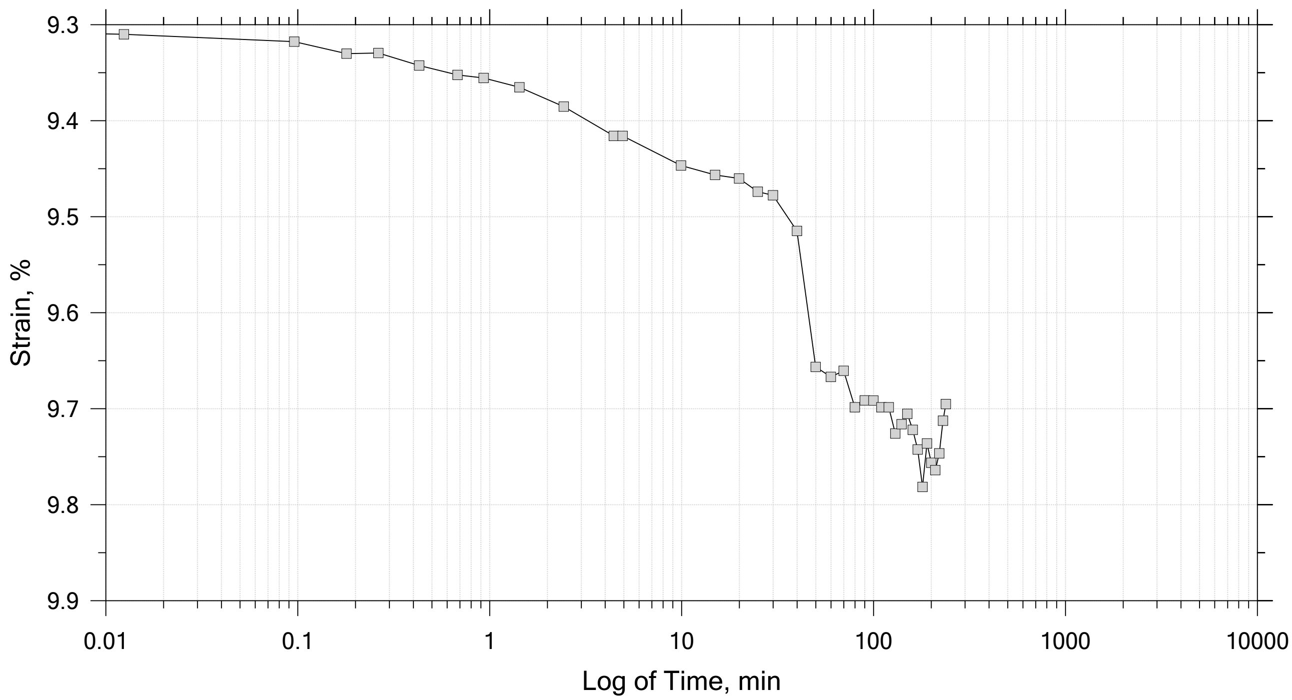
Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 9/27/22020	Depth: 31.6
	Test Number: ICON 332	Preparation: Shelby Tube	Elevation: 8.0
	Description: Gray Silty Clay		
	Remarks:		

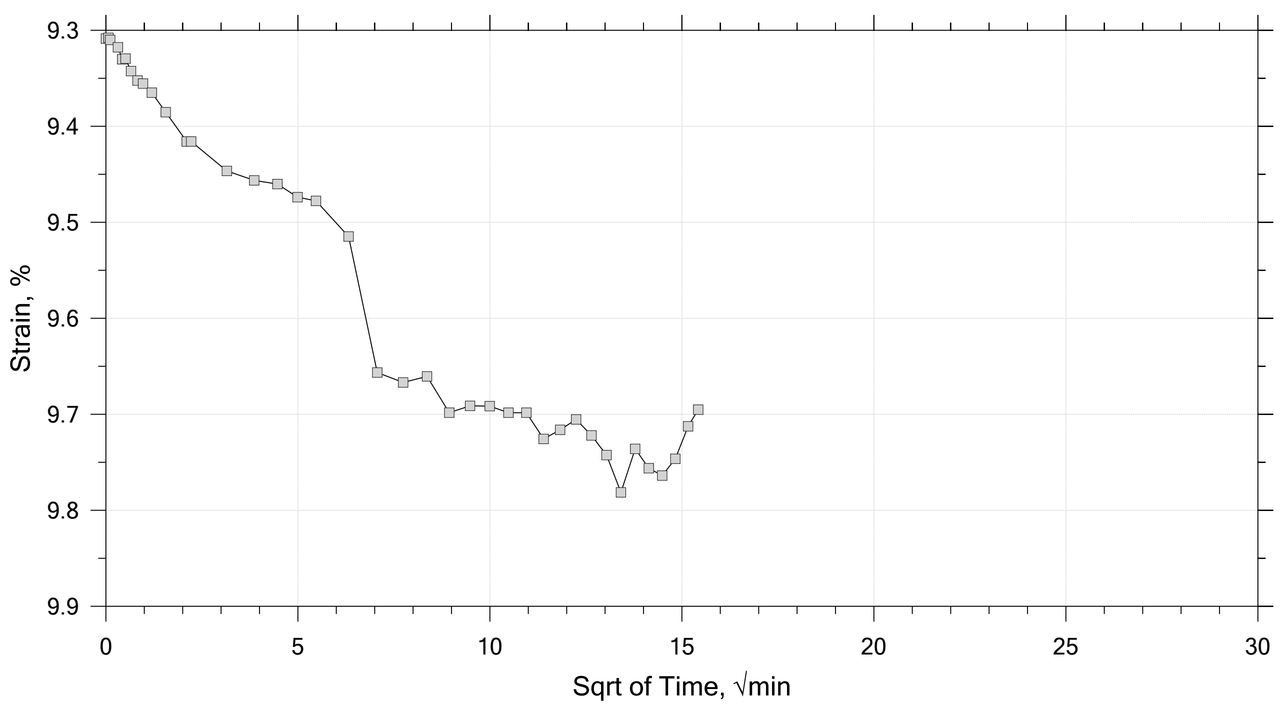
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 14 of 21

Constant Load Step

Stress: 2.66e+03 psf





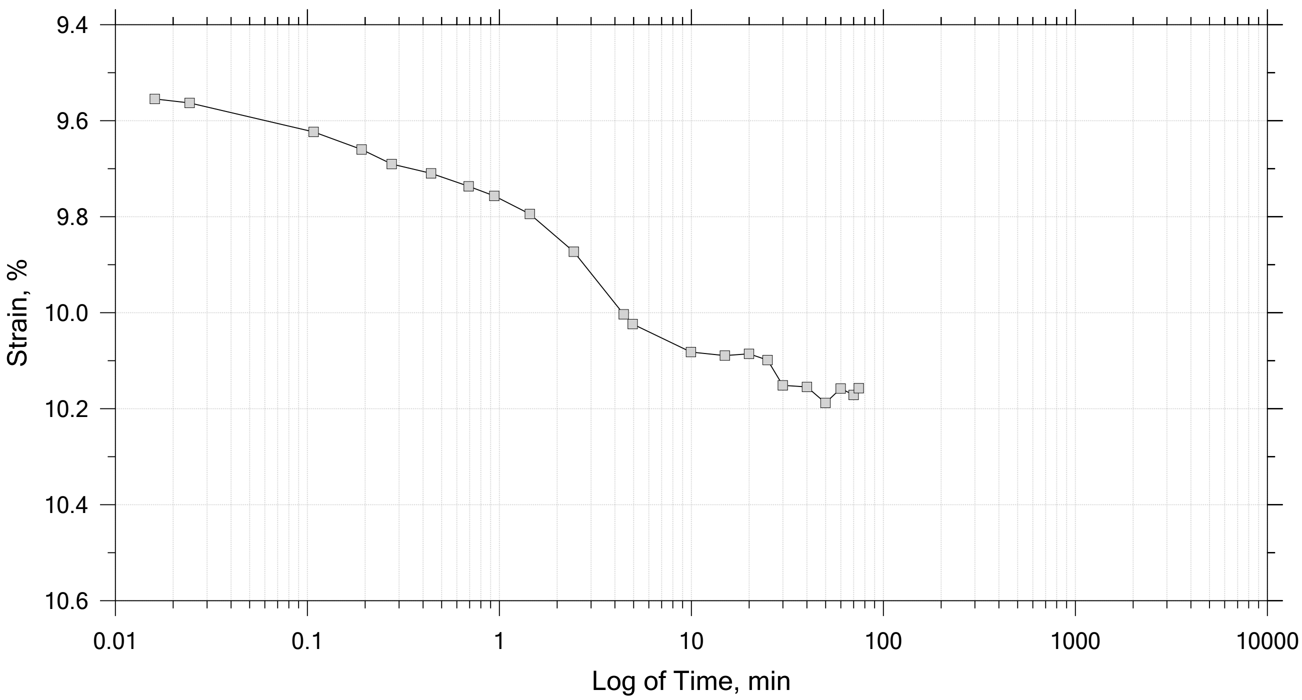
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 9/27/22020	Depth: 31.6
	Test Number: ICON 332	Preparation: Shelby Tube	Elevation: 8.0
	Description: Gray Silty Clay		
	Remarks:		

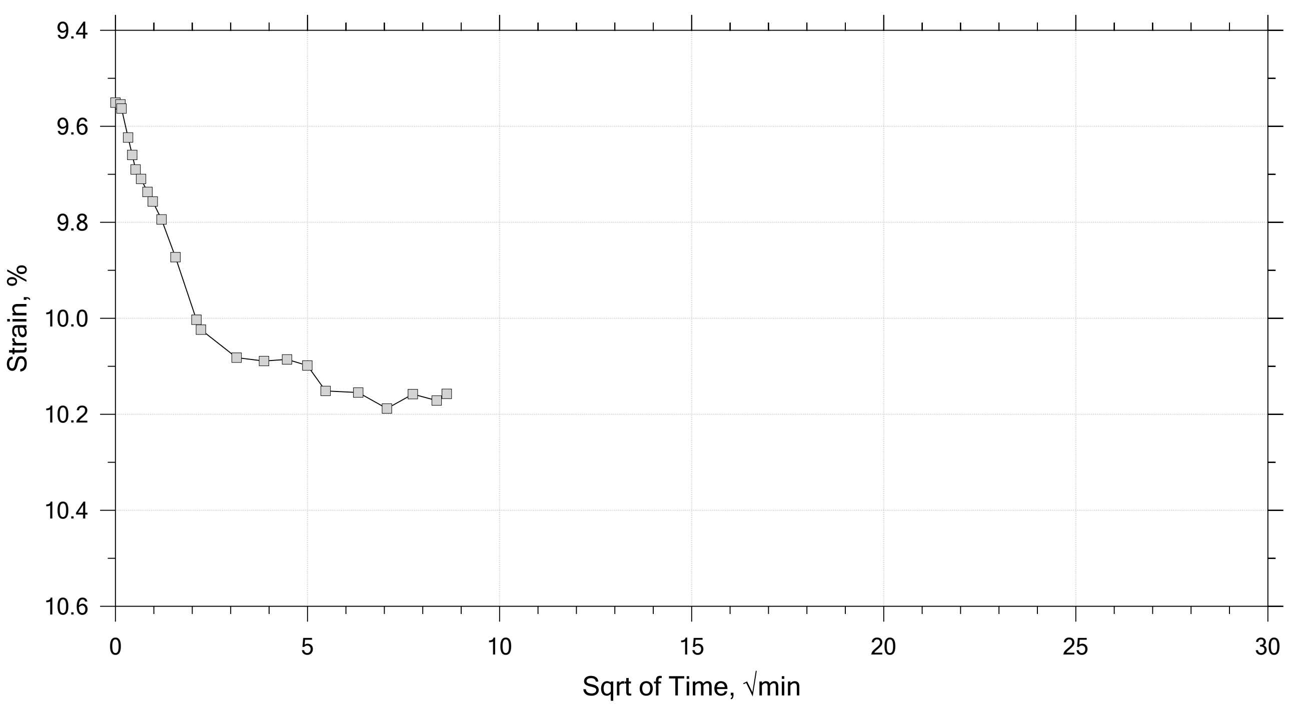
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 15 of 21

Constant Load Step

Stress: 5.32e+03 psf





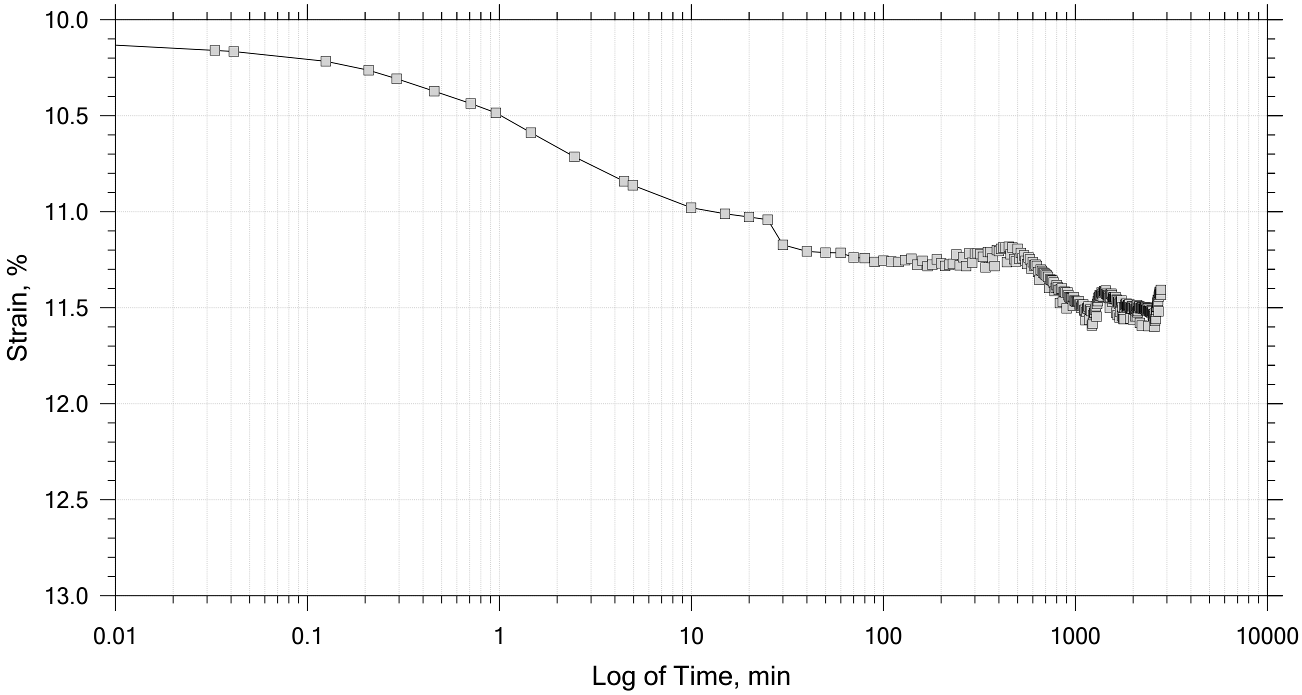
Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 9/27/22020	Depth: 31.6
	Test Number: ICON 332	Preparation: Shelby Tube	Elevation: 8.0
	Description: Gray Silty Clay		
	Remarks:		

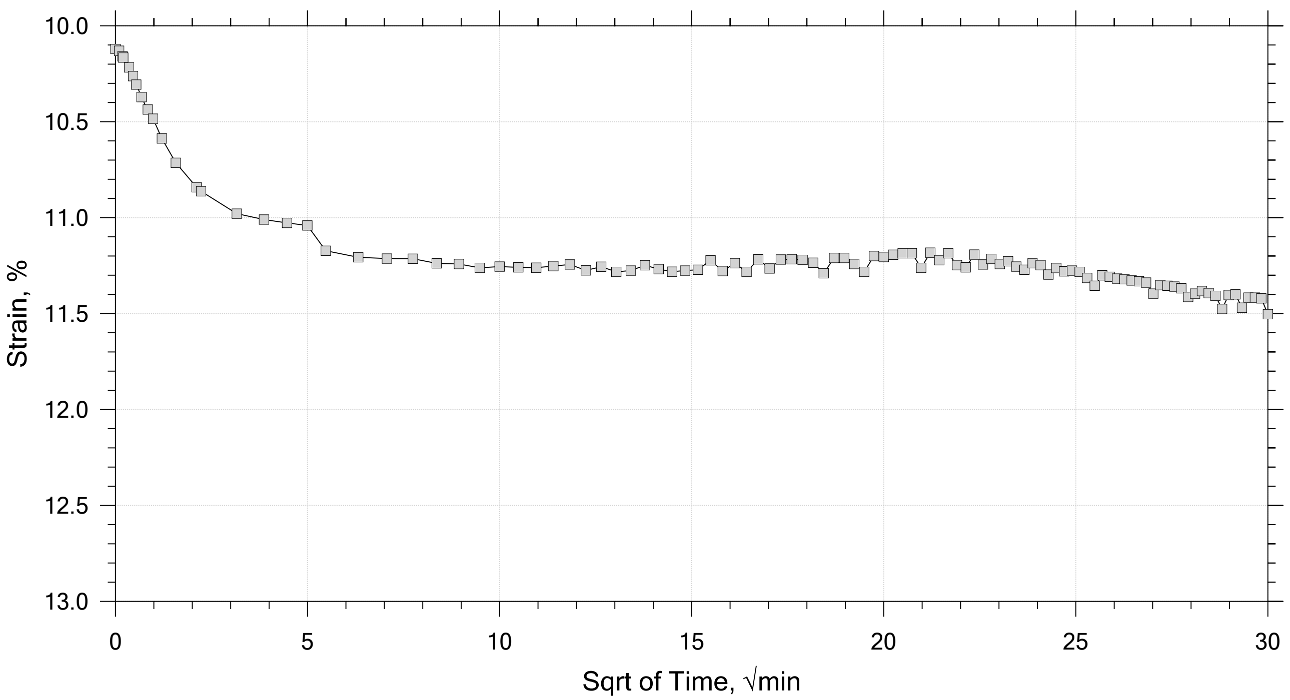
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 16 of 21

Constant Load Step

Stress: 1.06e+04 psf





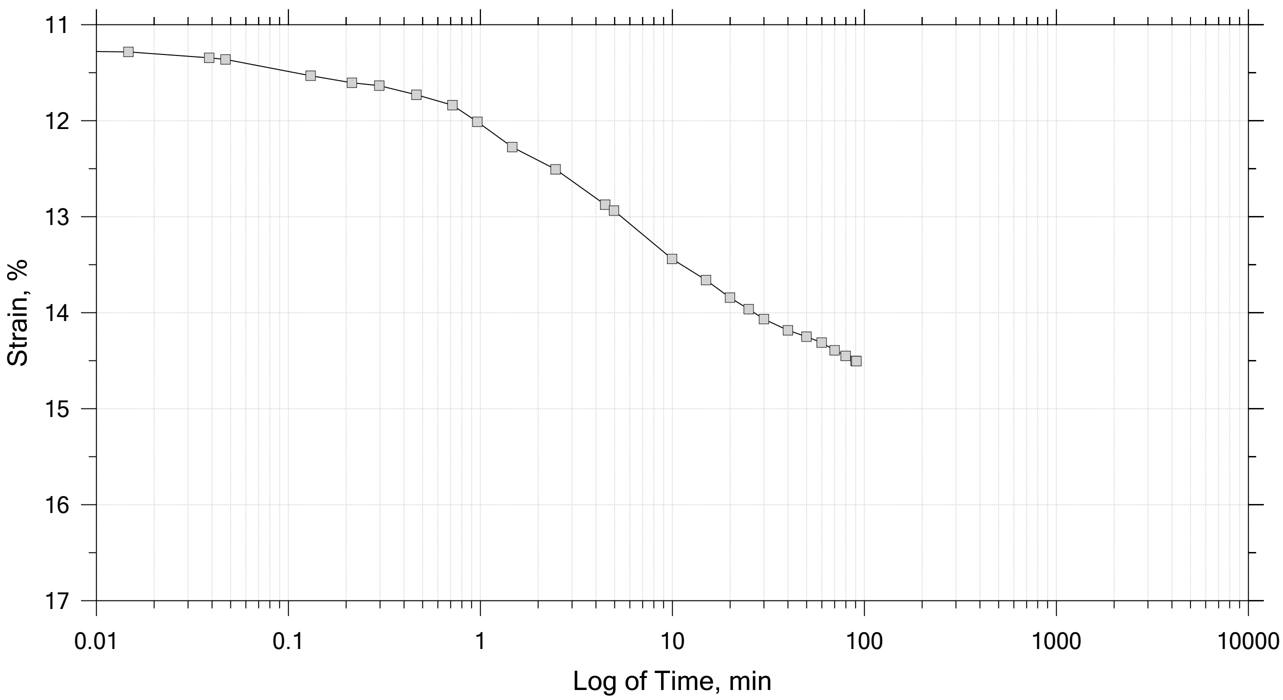
Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 9/27/22020	Depth: 31.6
	Test Number: ICON 332	Preparation: Shelby Tube	Elevation: 8.0
	Description: Gray Silty Clay		
	Remarks:		

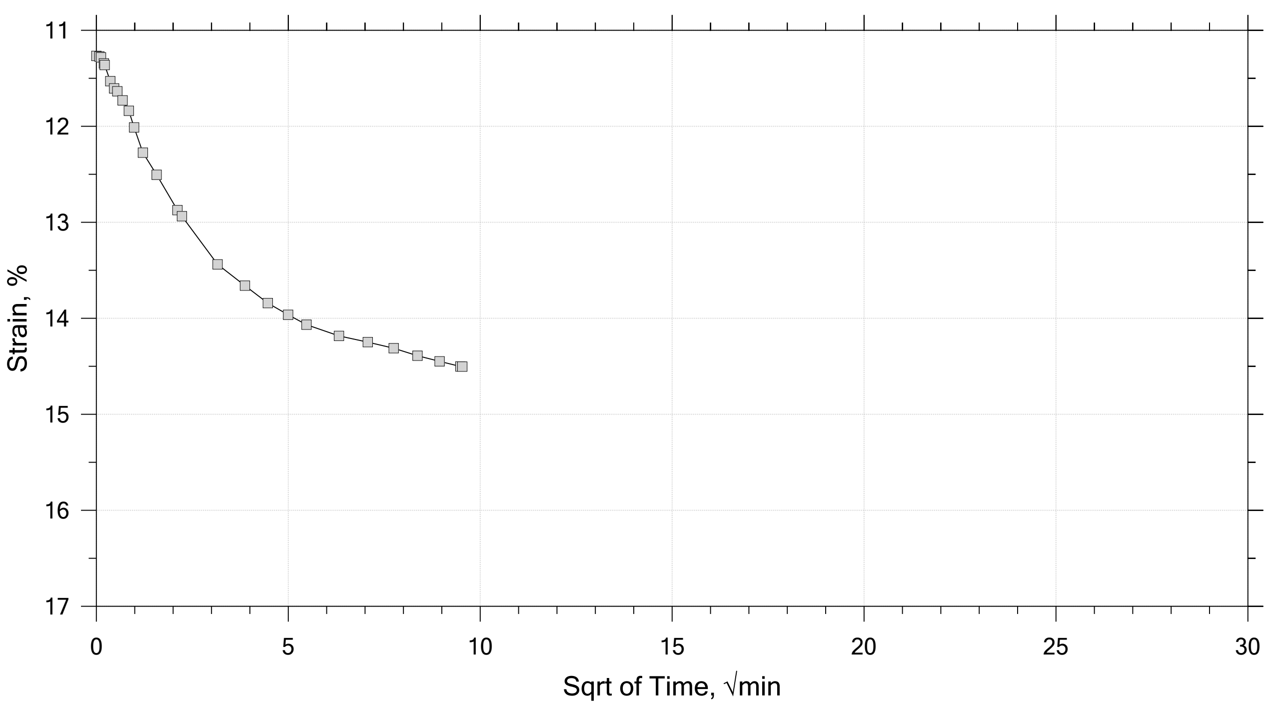
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 17 of 21

Constant Load Step

Stress: 2.13e+04 psf





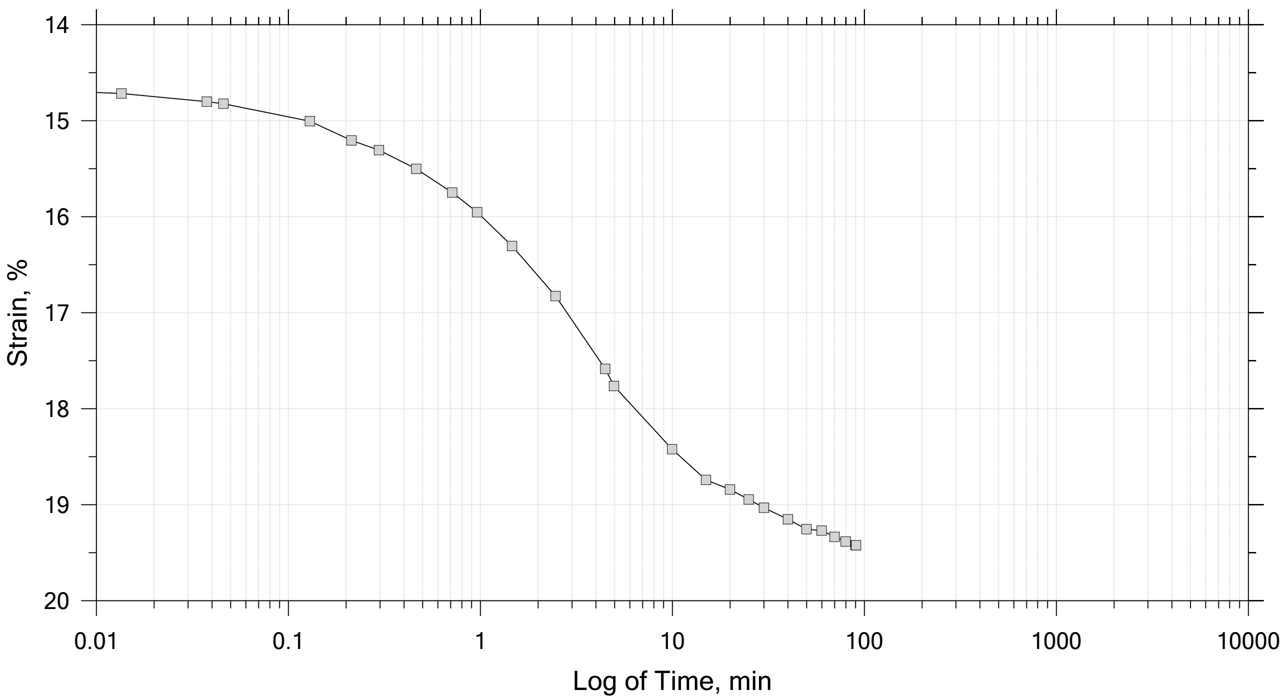
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 9/27/22020	Depth: 31.6
	Test Number: ICON 332	Preparation: Shelby Tube	Elevation: 8.0
	Description: Gray Silty Clay		
	Remarks:		

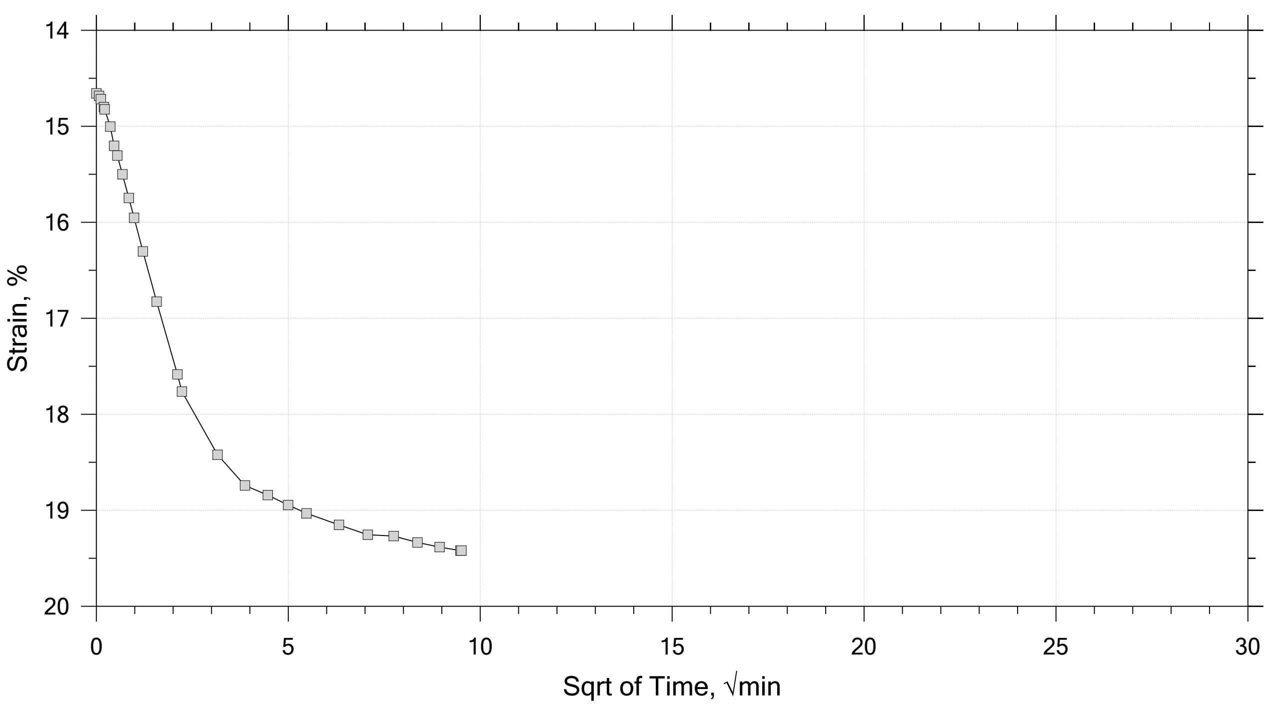
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 18 of 21

Constant Load Step

Stress: 4.25e+04 psf





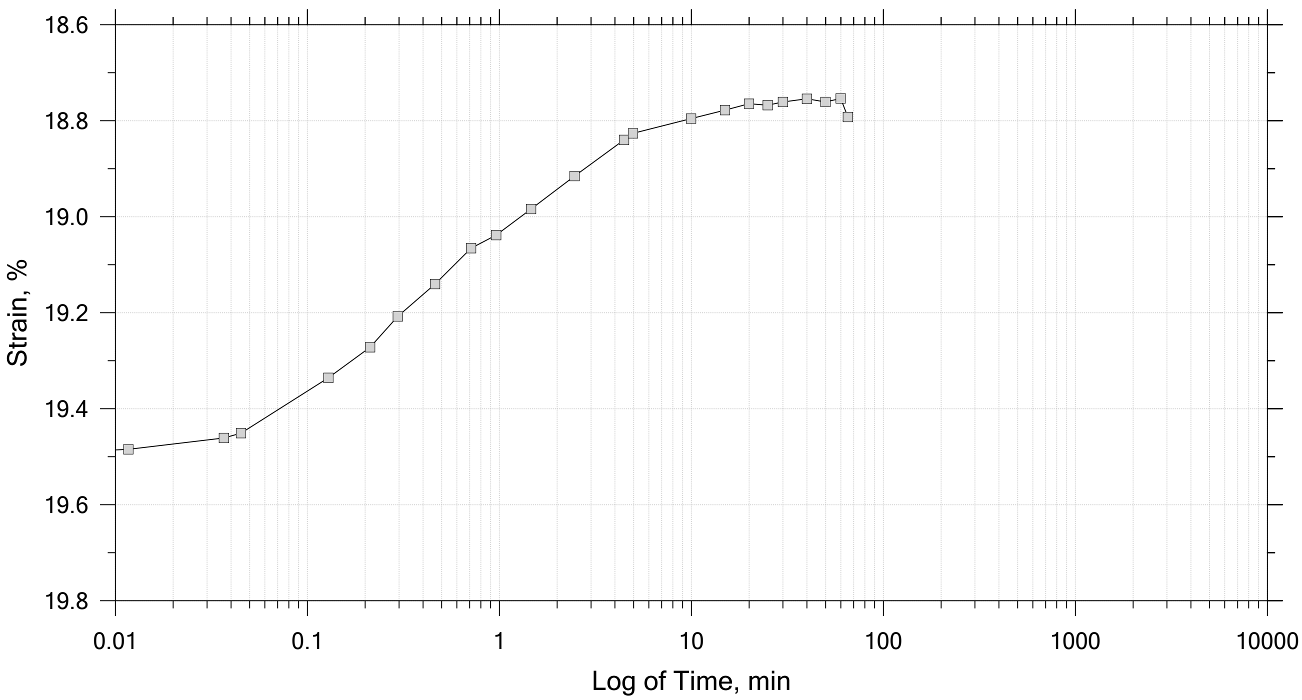
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 9/27/22020	Depth: 31.6
	Test Number: ICON 332	Preparation: Shelby Tube	Elevation: 8.0
	Description: Gray Silty Clay		
	Remarks:		

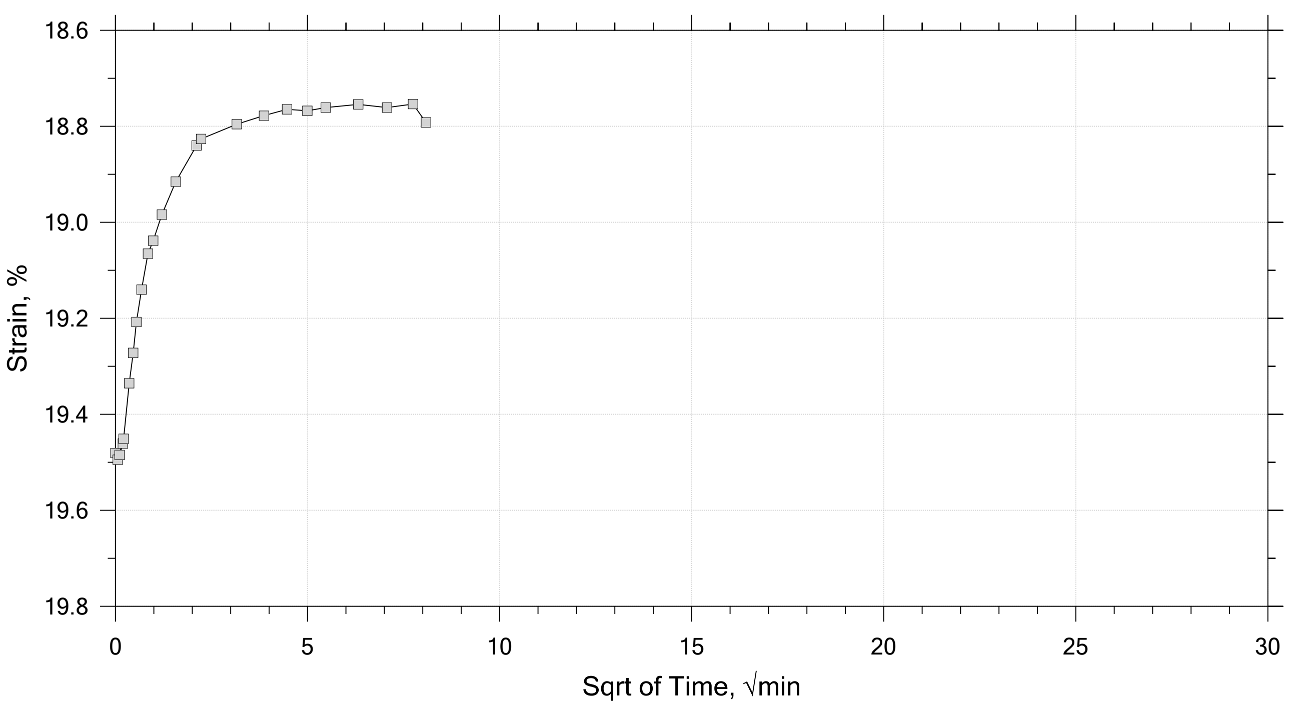
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 19 of 21

Constant Load Step

Stress: 1.06e+04 psf

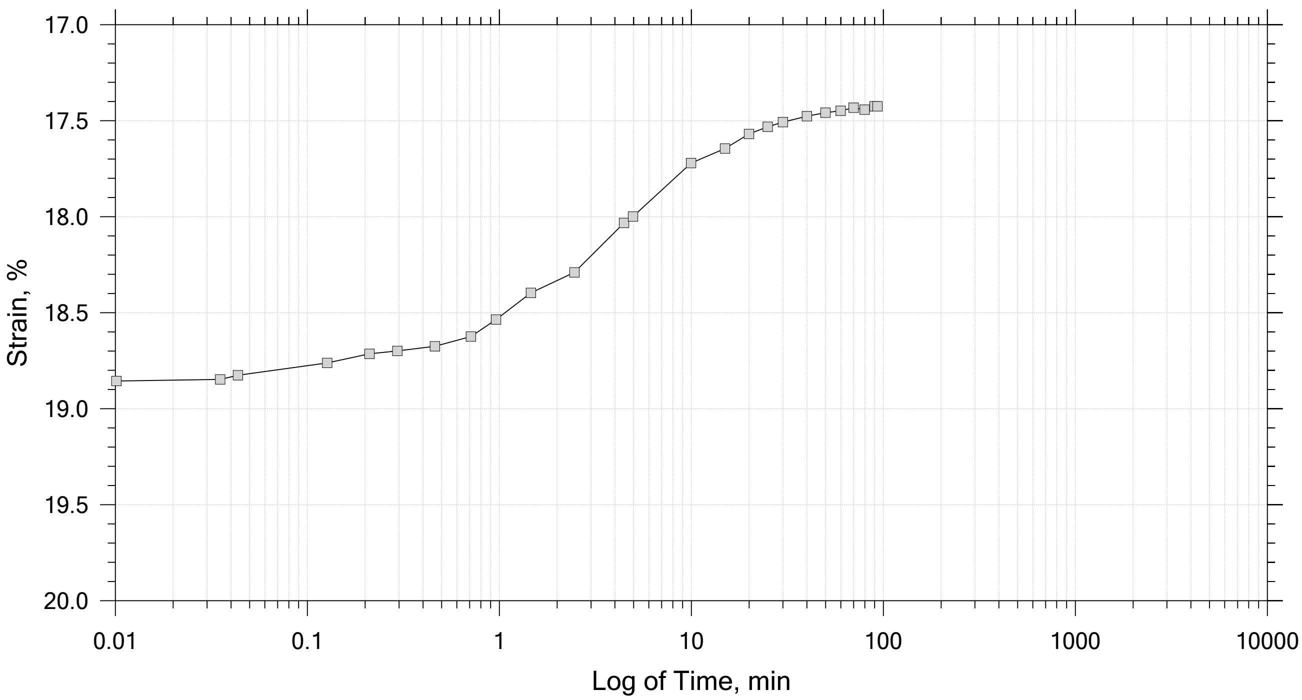


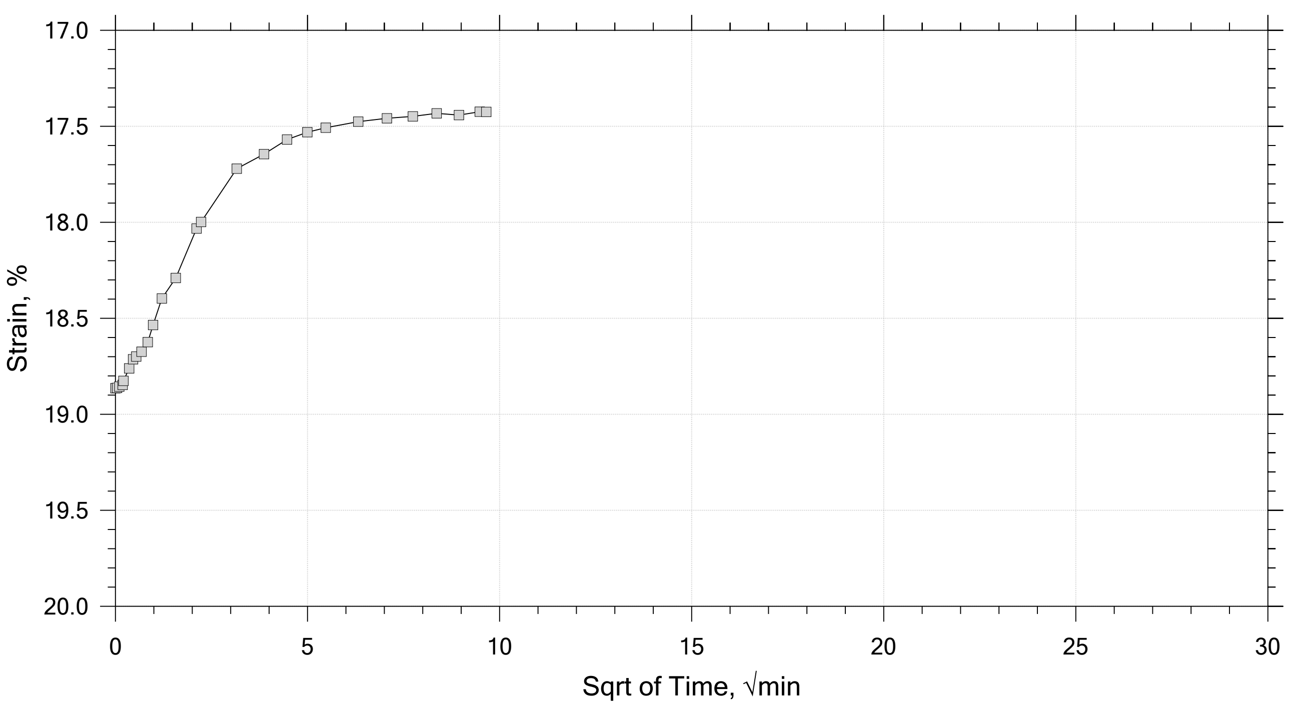


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 9/27/22020	Depth: 31.6
	Test Number: ICON 332	Preparation: Shelby Tube	Elevation: 8.0
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 20 of 21
Constant Load Step
Stress: 2.66e+03 psf

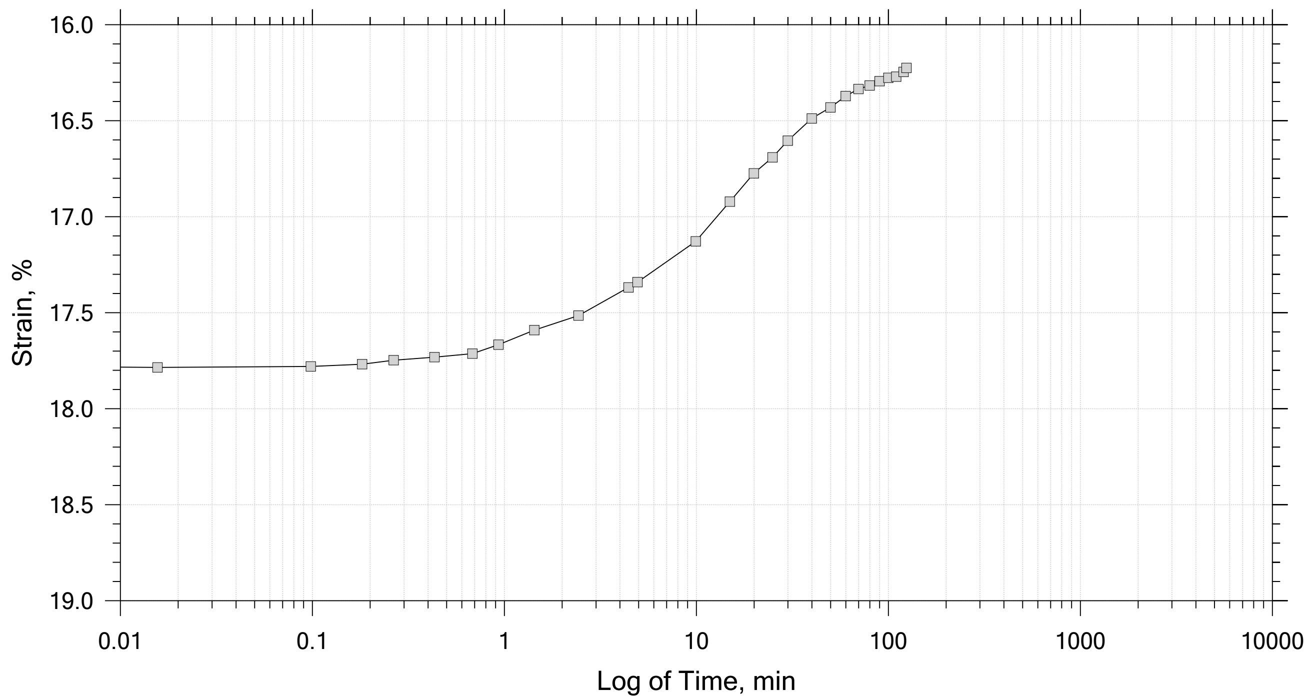


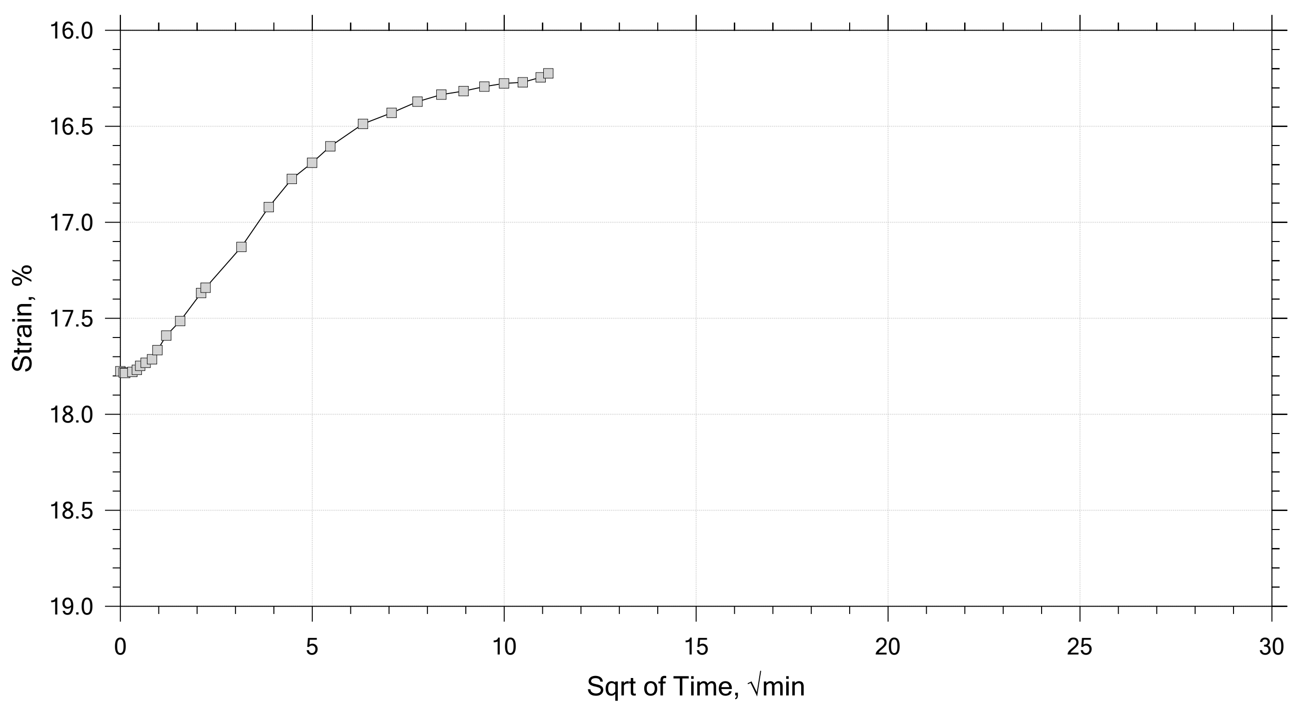


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 9/27/22020	Depth: 31.6
	Test Number: ICON 332	Preparation: Shelby Tube	Elevation: 8.0
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 21 of 21
Constant Load Step
Stress: 759 psf





Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 9/27/22020	Depth: 31.6
	Test Number: ICON 332	Preparation: Shelby Tube	Elevation: 8.0
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Specimen Diameter, in: 2.50	Specific Gravity: 2.79 (Implied)	Liquid Limit: 0
Specimen Height, in: 1.00	Initial Void Ratio: 1.18	Plastic Limit: 0
Final Height, in: 0.84	Final Void Ratio: 0.826	Plasticity Index: 0

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	211	---	"ring"	312
Mass Container, gm	36.98	111.09	111.09	60.67
Mass Container + Wet Soil, gm	157.6	258.06	245.15	194.61
Mass Container + Dry Soil, gm	123.65	214.52	214.52	164.01
Mass Dry Soil, gm	86.67	103.43	103.43	103.34
Water Content, %	39.17	42.09	29.61	29.61
Void Ratio	---	1.18	0.83	---
Degree of Saturation, %	---	99.54	100.00	---
Dry Unit Weight, pcf	---	79.913	95.389	---

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: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 9/27/22020	Depth: 31.6
	Test Number: ICON 332	Preparation: Shelby Tube	Elevation: 8.0
	Description: Gray Silty Clay		
	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	200.	0.0008959	1.18	0.0892	0.000	0.00e+00	8.92e+03	0.00e+00	0.00e+00
2	300.	0.0006487	1.18	0.0646	0.000	0.00e+00	-4.92e+03	-0.00e+00	0.00e+00
3	450.	0.0002509	1.18	0.0250	0.000	0.00e+00	-5.28e+03	-0.00e+00	0.00e+00
4	675.	-0.0007278	1.18	-0.0725	0.000	0.00e+00	-8.66e+03	-0.00e+00	0.00e+00
5	1.01e+03	0.0005905	1.18	0.0588	0.000	0.00e+00	7.77e+03	0.00e+00	0.00e+00
6	1.52e+03	0.001517	1.18	0.151	0.000	0.00e+00	3.65e+03	0.00e+00	0.00e+00
7	3.04e+03	0.003611	1.17	0.359	0.000	0.00e+00	2.74e+03	0.00e+00	0.00e+00
8	6.08e+03	0.02704	1.12	2.69	0.000	0.00e+00	1.54e+04	0.00e+00	0.00e+00
9	1.22e+04	0.1068	0.948	10.6	0.000	0.00e+00	2.61e+04	0.00e+00	0.00e+00
10	3.04e+03	0.1026	0.957	10.2	0.000	0.00e+00	9.23e+02	0.00e+00	0.00e+00
11	1.52e+03	0.1014	0.960	10.1	0.000	0.00e+00	1.58e+03	0.00e+00	0.00e+00
12	759.	0.09622	0.971	9.58	0.000	0.00e+00	1.35e+04	0.00e+00	0.00e+00
13	1.33e+03	0.09599	0.972	9.56	55.004	7.39e-03	-8.01e+02	-6.52e-11	0.00e+00
14	2.66e+03	0.09739	0.969	9.70	0.000	0.00e+00	2.09e+03	0.00e+00	0.00e+00
15	5.32e+03	0.1016	0.959	10.1	0.000	0.00e+00	3.17e+03	0.00e+00	0.00e+00
16	1.06e+04	0.1154	0.929	11.5	0.000	0.00e+00	5.18e+03	0.00e+00	0.00e+00
17	2.13e+04	0.1405	0.875	14.0	4.095	9.24e-02	4.69e+03	4.77e-09	0.00e+00
18	4.25e+04	0.1917	0.764	19.1	2.294	1.51e-01	4.80e+03	7.97e-09	0.00e+00
19	1.06e+04	0.1861	0.776	18.5	0.337	9.73e-01	3.49e+02	3.74e-09	0.00e+00
20	2.66e+03	0.1758	0.799	17.5	2.727	1.22e-01	2.58e+03	3.47e-09	0.00e+00
21	759.	0.1630	0.826	16.2	11.309	3.04e-02	1.34e+04	4.50e-09	0.00e+00

Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 9/27/22020	Depth: 31.6
	Test Number: ICON 332	Preparation: Shelby Tube	Elevation: 8.0
	Description: Gray Silty Clay		
	Remarks:		
	Displacement at End of Primary		

One-Dimensional Consolidation by ASTM D2435 - Method B

Sqrt of Time Coefficients

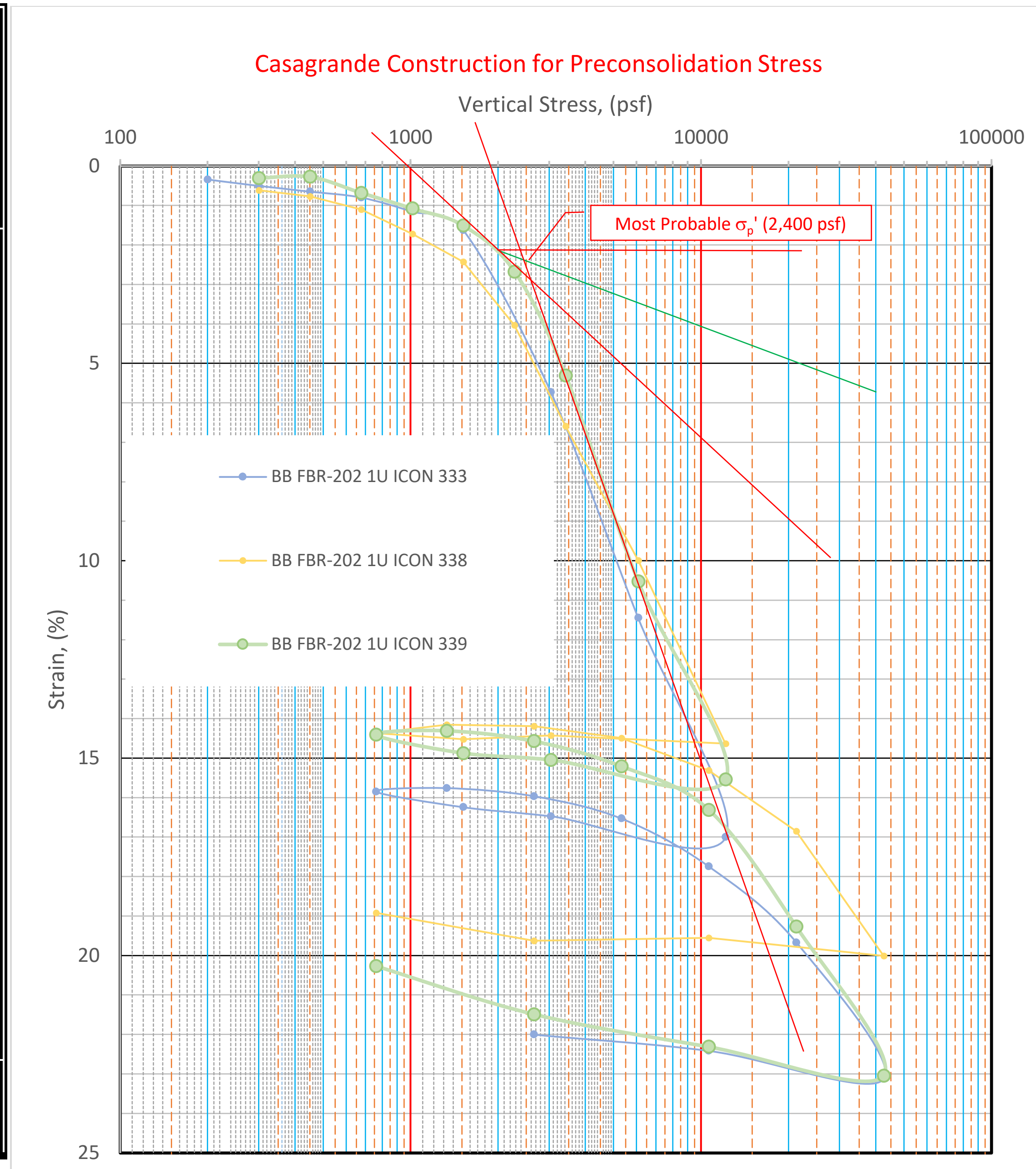
Step	Applied Stress psf	EOP Displacement in	Void Ratio	Strain at End %	Sq.Rt. T90 min	Cv ft²/day	Mv ft²/ton	k cm/s
1	200.	0.0008959	1.18	0.0892	0.000	0.00e+00	8.92e+03	0.00e+00
2	300.	0.0006487	1.18	0.0646	0.000	0.00e+00	-4.92e+03	-0.00e+00
3	450.	0.0002509	1.18	0.0250	0.000	0.00e+00	-5.28e+03	-0.00e+00
4	675.	-0.0007278	1.18	-0.0725	0.000	0.00e+00	-8.66e+03	-0.00e+00
5	1.01e+03	0.0005905	1.18	0.0588	0.000	0.00e+00	7.77e+03	0.00e+00
6	1.52e+03	0.001517	1.18	0.151	33.185	6.43e-02	3.65e+03	2.58e-09
7	3.04e+03	0.003611	1.17	0.359	5.860	3.63e-01	2.74e+03	1.10e-08
8	6.08e+03	0.02704	1.12	2.69	36.164	5.74e-02	1.54e+04	9.70e-09
9	1.22e+04	0.1068	0.948	10.6	169.727	1.10e-02	2.61e+04	3.16e-09
10	3.04e+03	0.1026	0.957	10.2	4.020	4.27e-01	9.23e+02	4.34e-09
11	1.52e+03	0.1014	0.960	10.1	18.778	9.20e-02	1.58e+03	1.60e-09
12	759.	0.09622	0.971	9.58	47.001	3.70e-02	1.35e+04	5.49e-09
13	1.33e+03	0.09599	0.972	9.56	157.108	1.11e-02	-8.01e+02	-9.82e-11
14	2.66e+03	0.09739	0.969	9.70	166.248	1.05e-02	2.09e+03	2.42e-10
15	5.32e+03	0.1016	0.959	10.1	11.822	1.47e-01	3.17e+03	5.12e-09
16	1.06e+04	0.1154	0.929	11.5	829.675	2.05e-03	5.18e+03	1.17e-10
17	2.13e+04	0.1405	0.875	14.0	11.578	1.41e-01	4.69e+03	7.27e-09
18	4.25e+04	0.1917	0.764	19.1	15.269	9.76e-02	4.80e+03	5.15e-09
19	1.06e+04	0.1861	0.776	18.5	1.701	8.29e-01	3.49e+02	3.19e-09
20	2.66e+03	0.1758	0.799	17.5	14.247	1.01e-01	2.58e+03	2.86e-09
21	759.	0.1630	0.826	16.2	56.270	2.63e-02	1.34e+04	3.89e-09

Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-201	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 9/27/22020	Depth: 31.6
	Test Number: ICON 332	Preparation: Shelby Tube	Elevation: 8.0
	Description: Gray Silty Clay		
	Remarks:		
	Displacement at End of Primary		

BB-FBR-202-1U

Consolidation Test Data
Summary Report

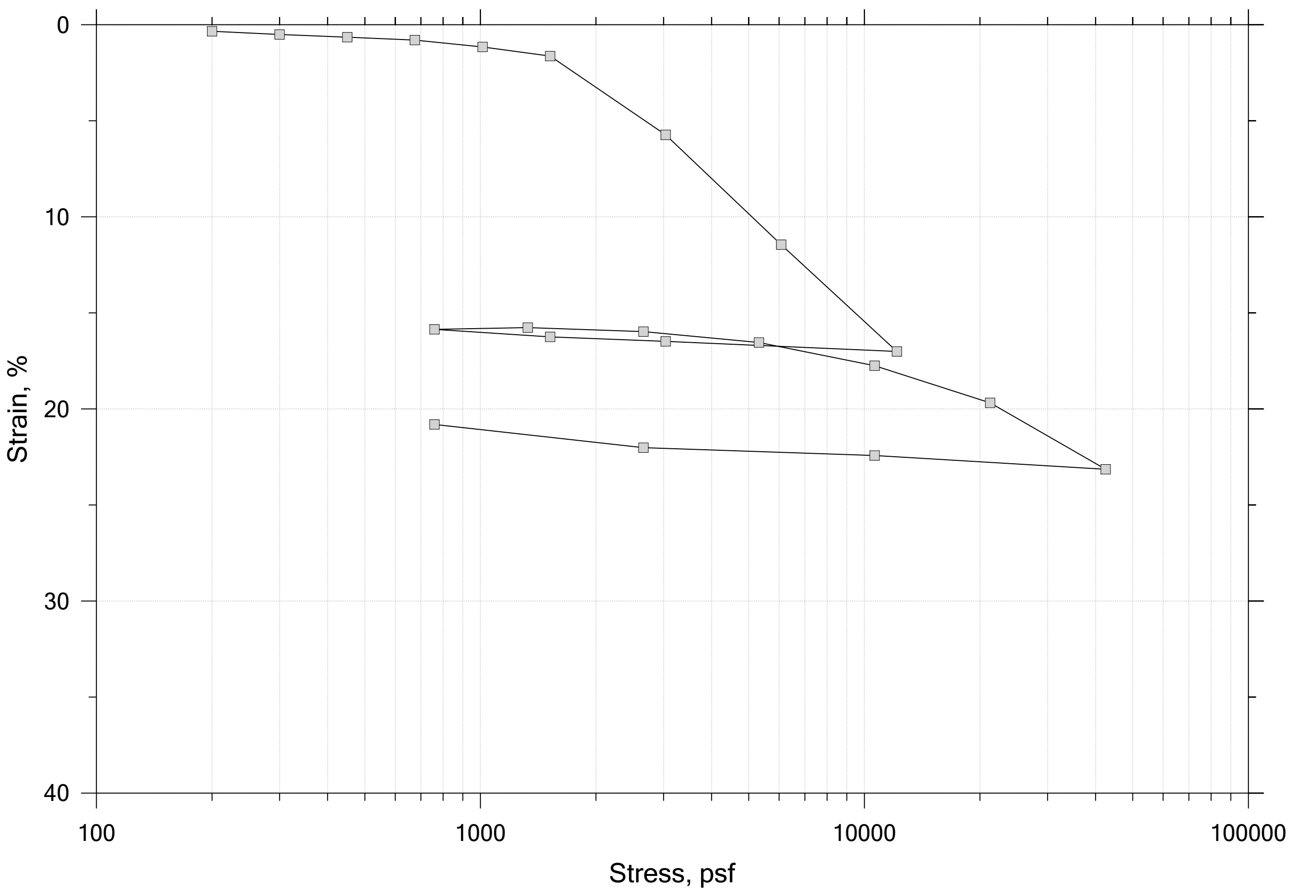
Project Name:	Bucknam Road Bridge			
Project Number:	166-14			
Project Location:	Falmouth, Maine			
Client:	GZA			
Sample Description:	Gray Silty Clay			
Preparation:	Trimmed Shelby Tube			
Lab Test No:	ICON 333	ICON 338	ICON 339	
Boring No.	BB-FBR-202	BB-FBR-202	BB-FBR-202	
Sample No:	1U	1U	1U	
Boring Elevation (ft).	43.6	43.6	43.6	
Sample Depth (ft):	12-14	12-14	12-14	
Test Specimen Depth (Ft):	13.45	13.1	12.75	
Test Specimen Elevation:	30.2	30.5	30.9	
Water Content (%):	39.9	36.8	41.0	
Dry Unit Weight (pcf):	79.8	92.1	75.7	
Wet Unit Weight (pcf):	111.7	126.0	106.8	
Saturation Before (%):	95.5	99.2	99.2	
Saturation After (%):	100	100.0	100.0	
Void Ratio Before:	1.22	1.1	1.14	
Void Ratio After:	0.76	0.7	0.74	
Overburden Pressure (psf):	--			
Max Previous stress (psf):	1,550	1,800	2,400	
Max Prev. stress (Work) (psf):	1,500	1,800	2,450	
OCR:	--			
Compression Index (C_{CE}):	0.185	0.2	0.2	
Recompression Index (C_{RE}):	0.017	0.008	0.017	
Liquid Limit:				
Plastic Limit:				
Plasticity Index:				
Liquidity Index:				
Specific Gravity (implied)	2.84	3.16	2.79	
Lab Vane Su at 13.85 ft. (psf)	355			
Tested By:	sjr	sjr	sjr	
Date Tested:	10/3/2020	11/5/2020	11/9/2020	
Checked By:	sjr	sjr	sjr	

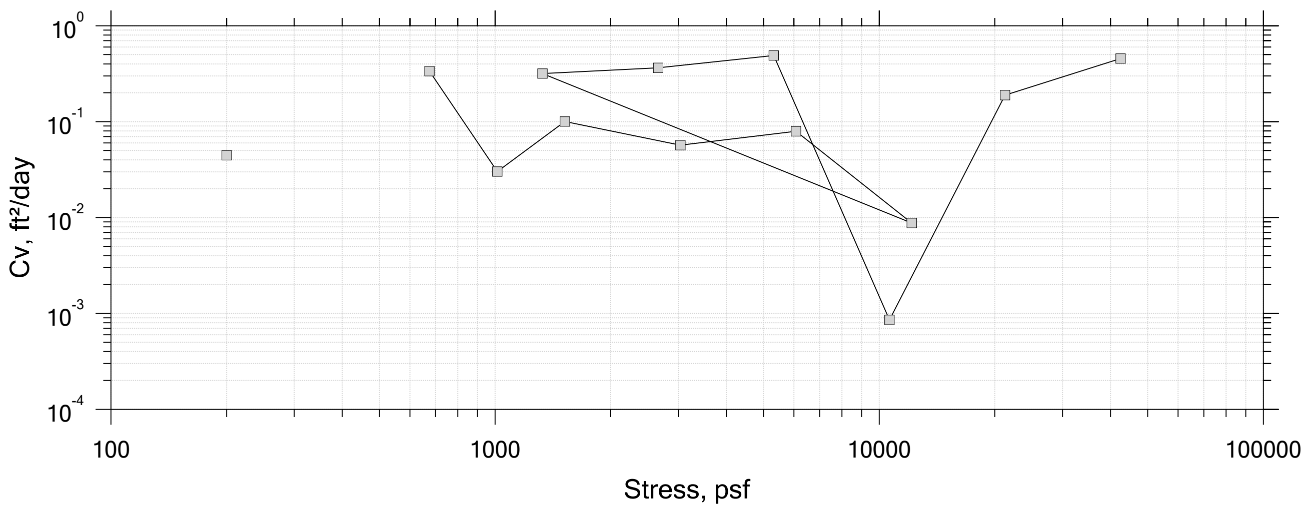


Soil Metrics LLC Geotechnical Engineering

One-Dimensional Consolidation by ASTM D2435 - Method B

Summary Report

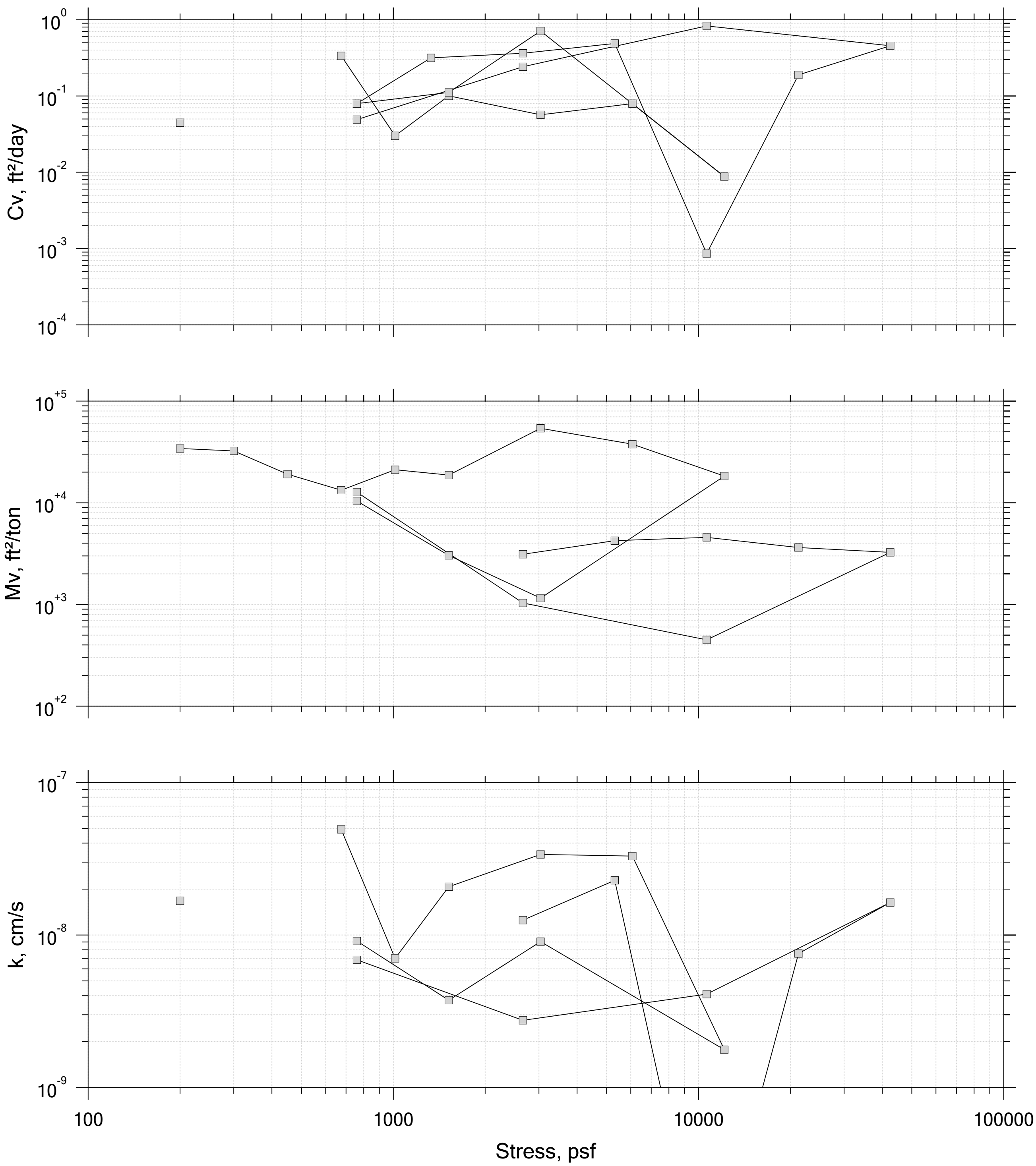




Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 10/3/2020	Depth: 13.45
	Test Number: ICON 333	Preparation: Shelby Tube	Elevation: 30.15
	Description: Gray Silty Clay		
	Remarks:		
	Displacement at End of Primary		

One-Dimensional Consolidation by ASTM D2435 - Method B

Sqrt of Time Coefficients



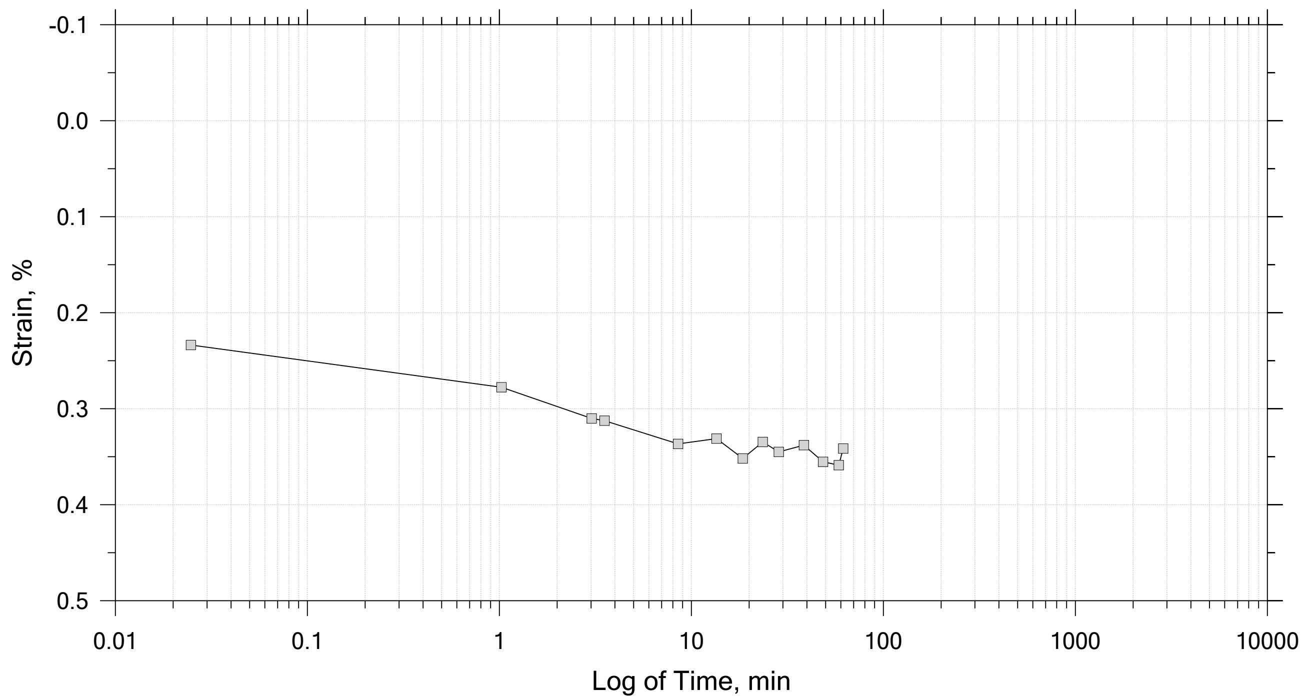
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 10/3/2020	Depth: 13.45
	Test Number: ICON 333	Preparation: Shelby Tube	Elevation: 30.15
	Description: Gray Silty Clay		
	Remarks:		

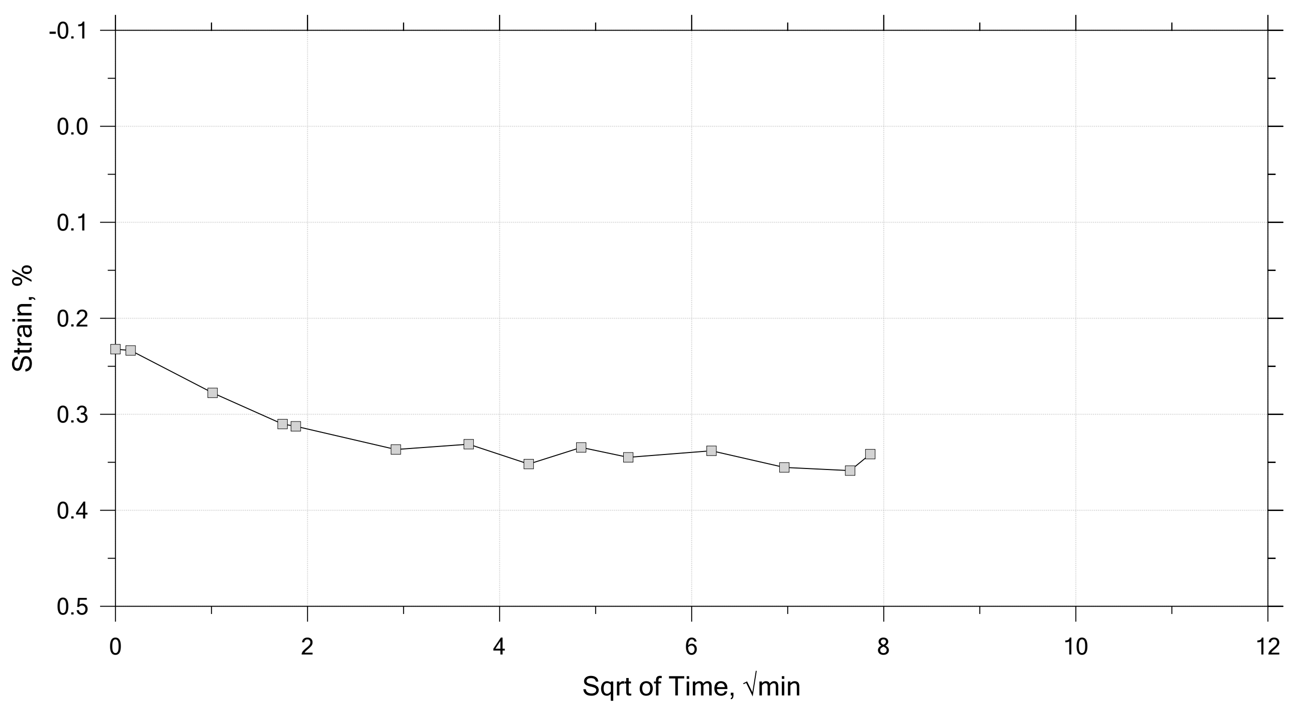
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 1 of 21

Constant Load Step

Stress: 200 psf





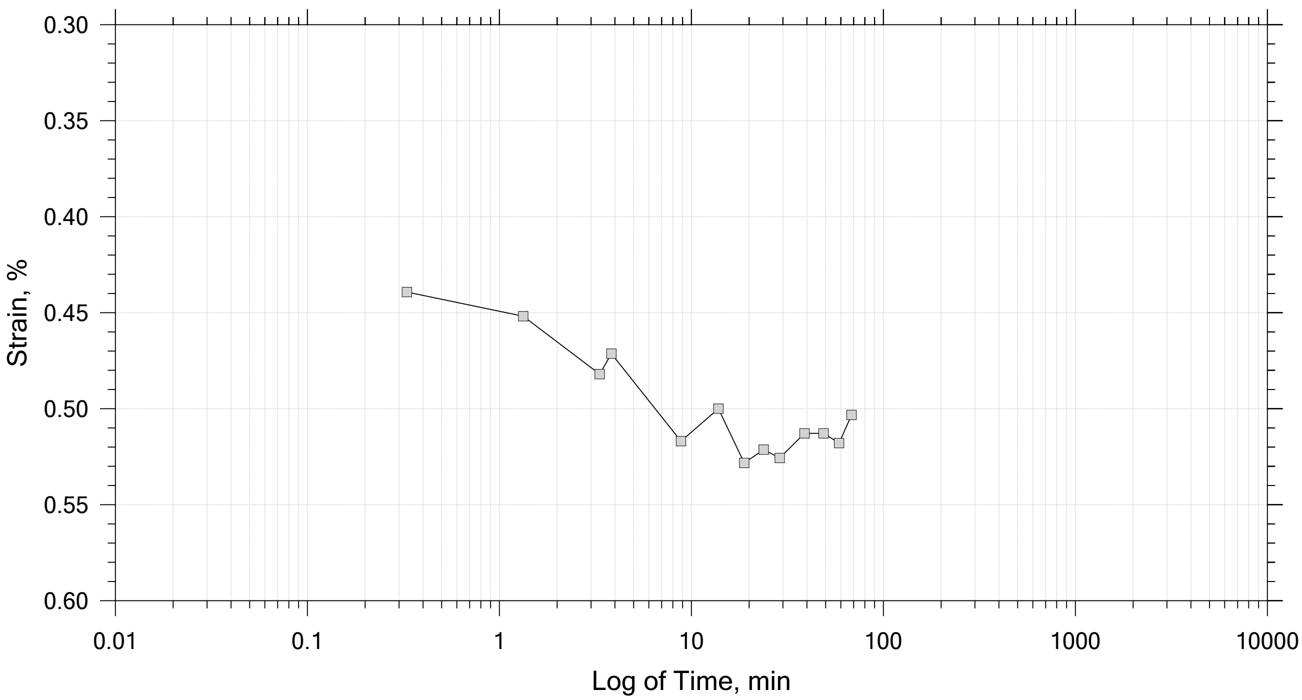
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 10/3/2020	Depth: 13.45
	Test Number: ICON 333	Preparation: Shelby Tube	Elevation: 30.15
	Description: Gray Silty Clay		
	Remarks:		

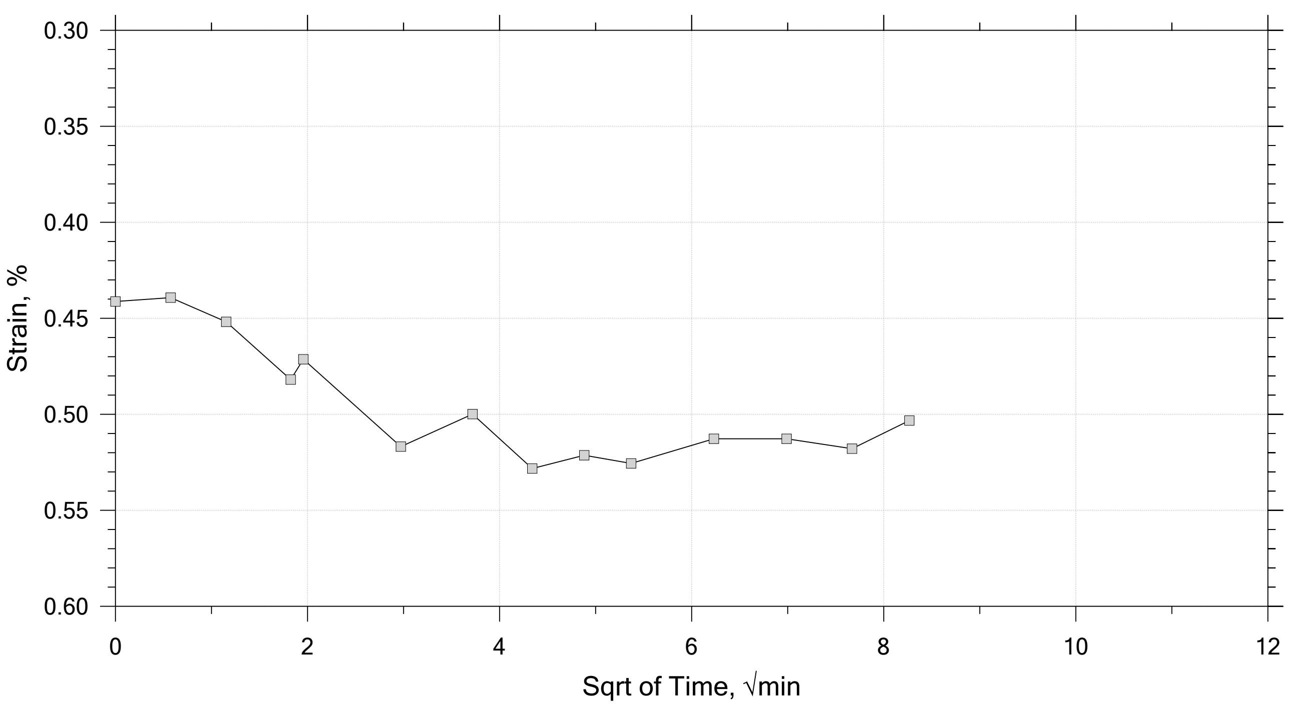
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 2 of 21

Constant Load Step

Stress: 300 psf





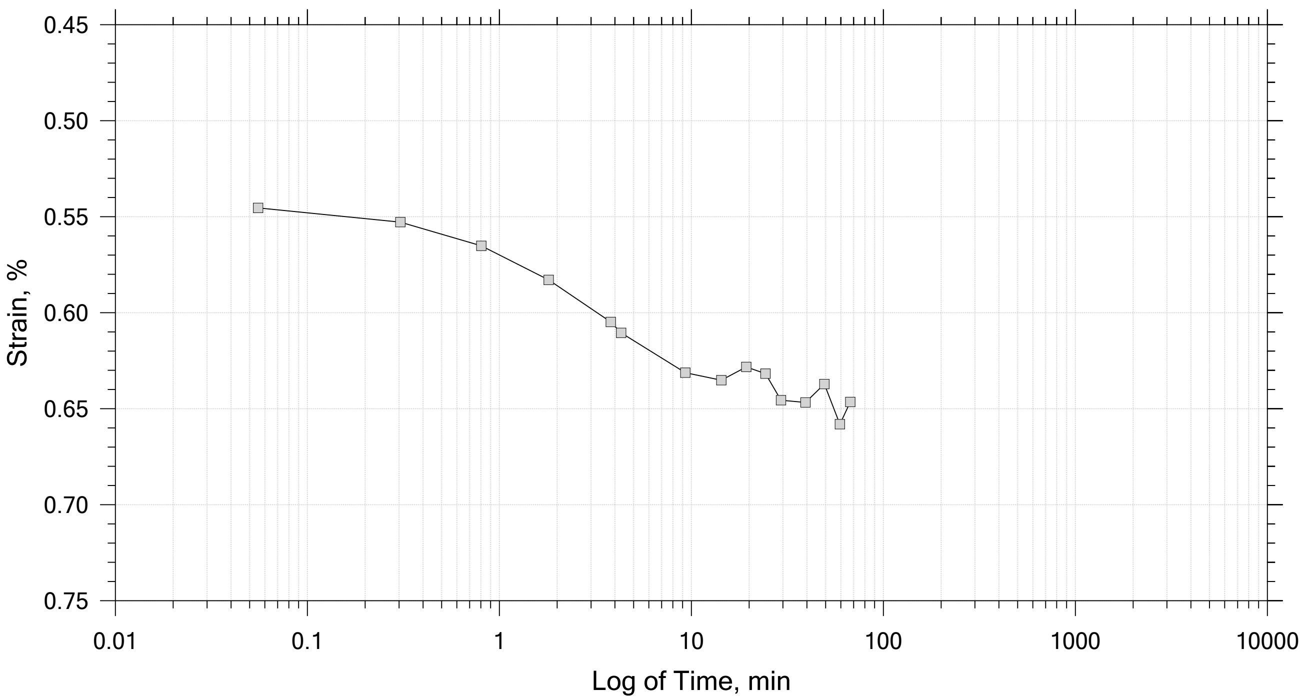
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 10/3/2020	Depth: 13.45
	Test Number: ICON 333	Preparation: Shelby Tube	Elevation: 30.15
	Description: Gray Silty Clay		
	Remarks:		

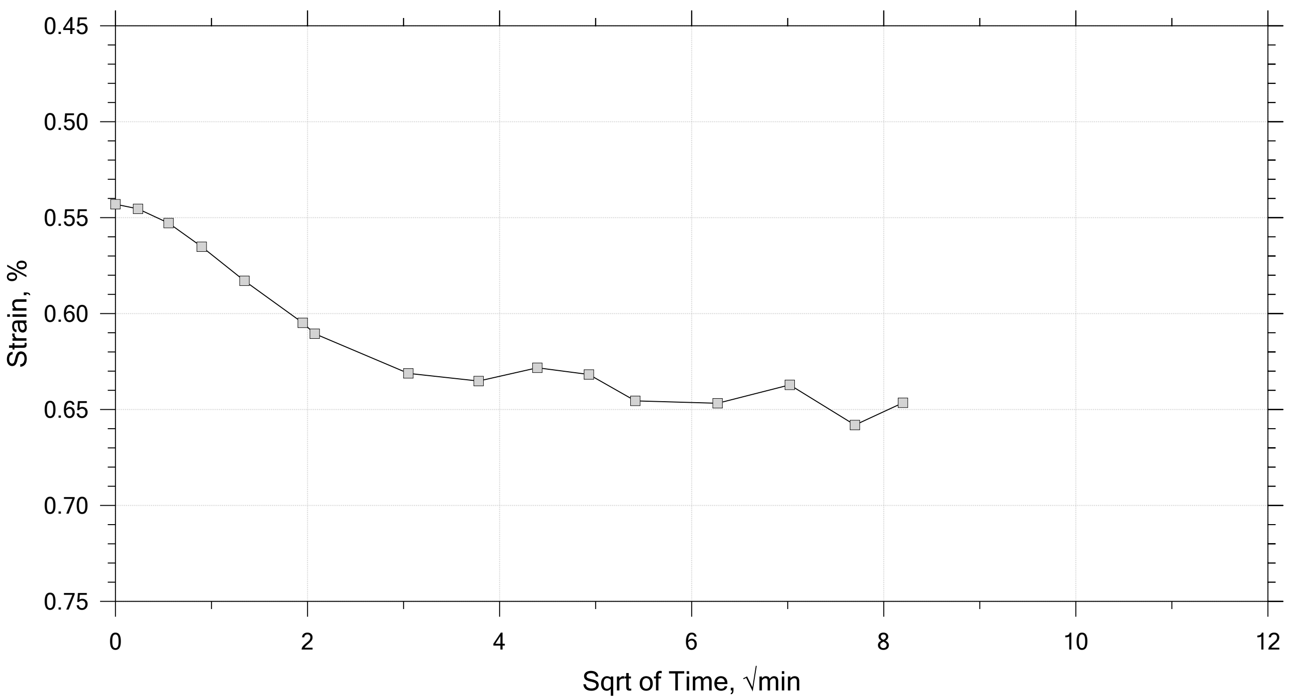
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 3 of 21

Constant Load Step

Stress: 450 psf

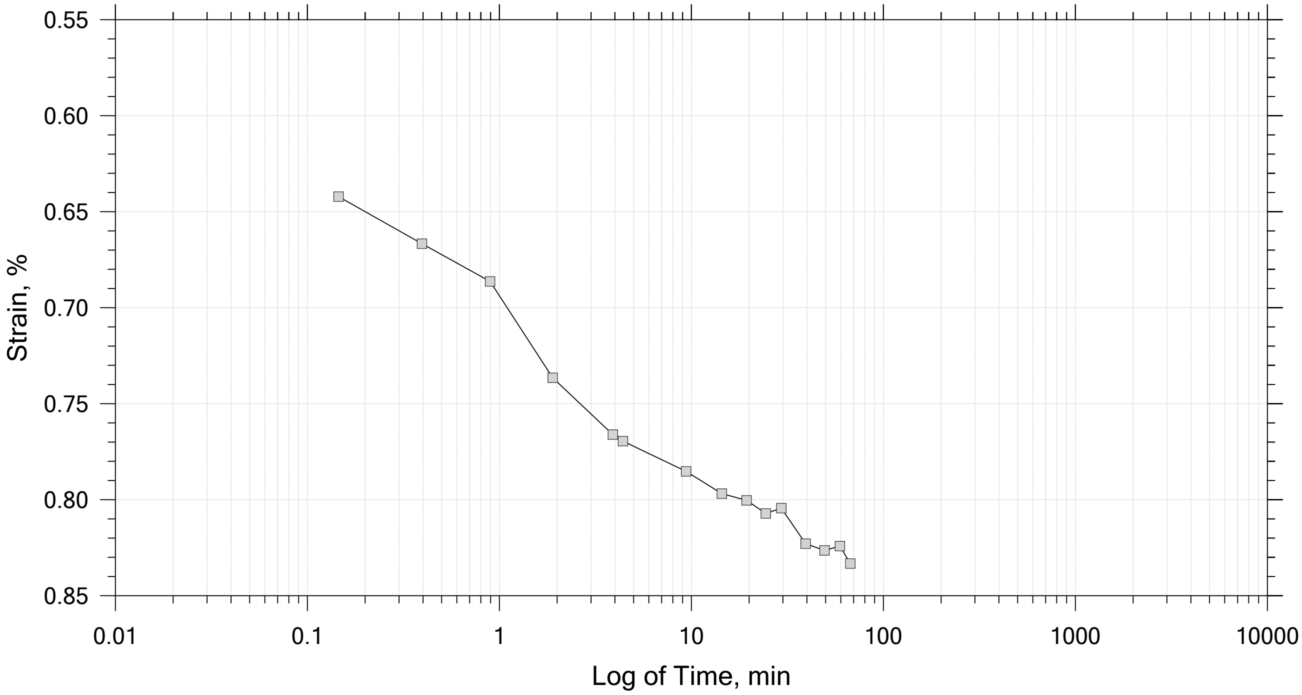


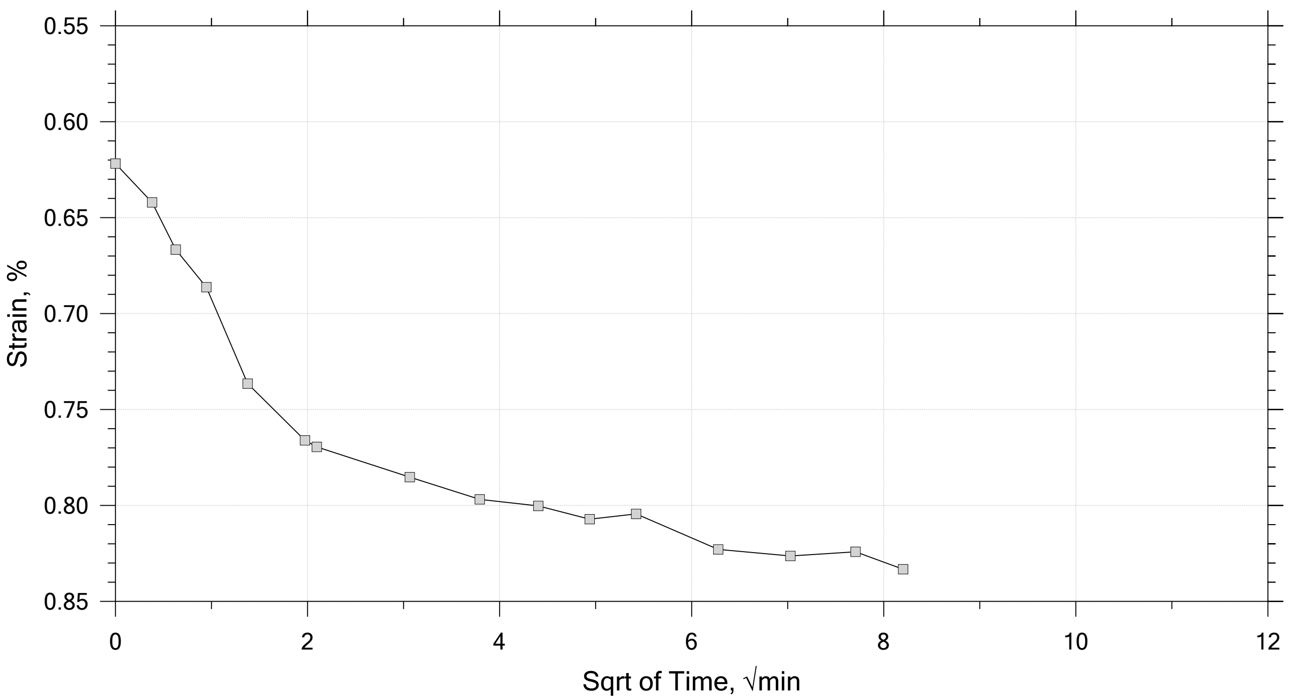


Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 10/3/2020	Depth: 13.45
	Test Number: ICON 333	Preparation: Shelby Tube	Elevation: 30.15
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 4 of 21
Constant Load Step
Stress: 675 psf





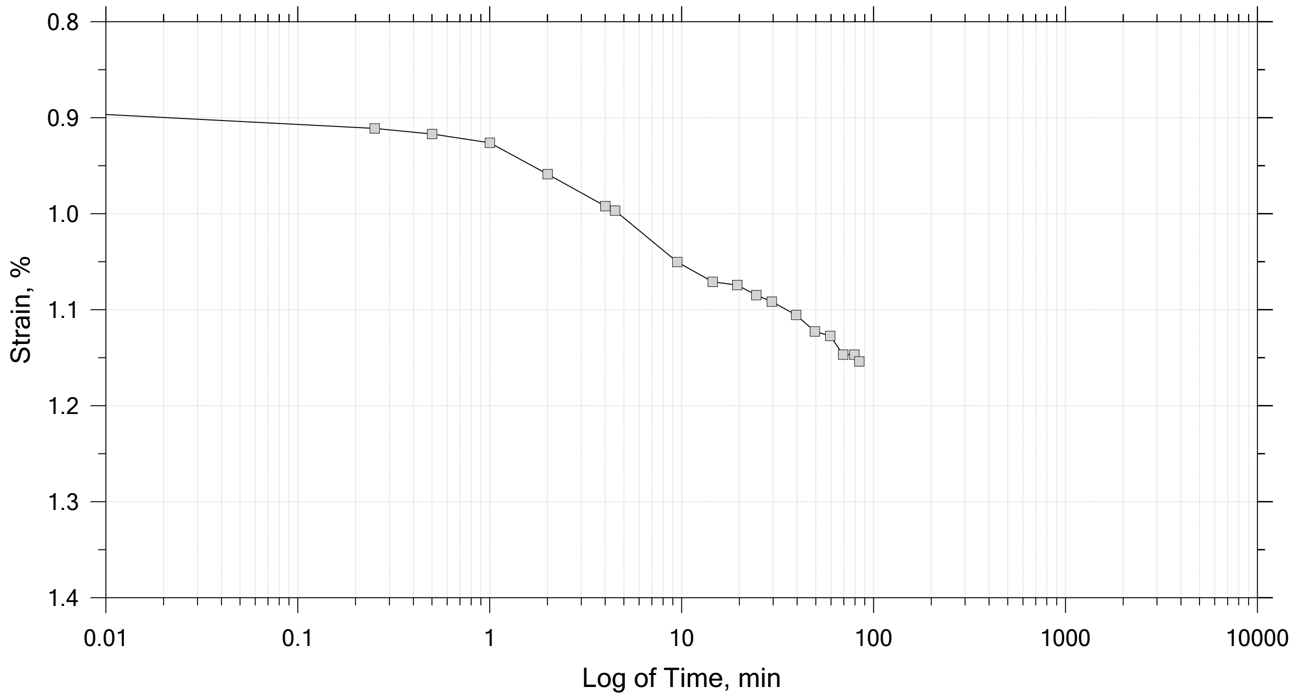
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 10/3/2020	Depth: 13.45
	Test Number: ICON 333	Preparation: Shelby Tube	Elevation: 30.15
	Description: Gray Silty Clay		
	Remarks:		

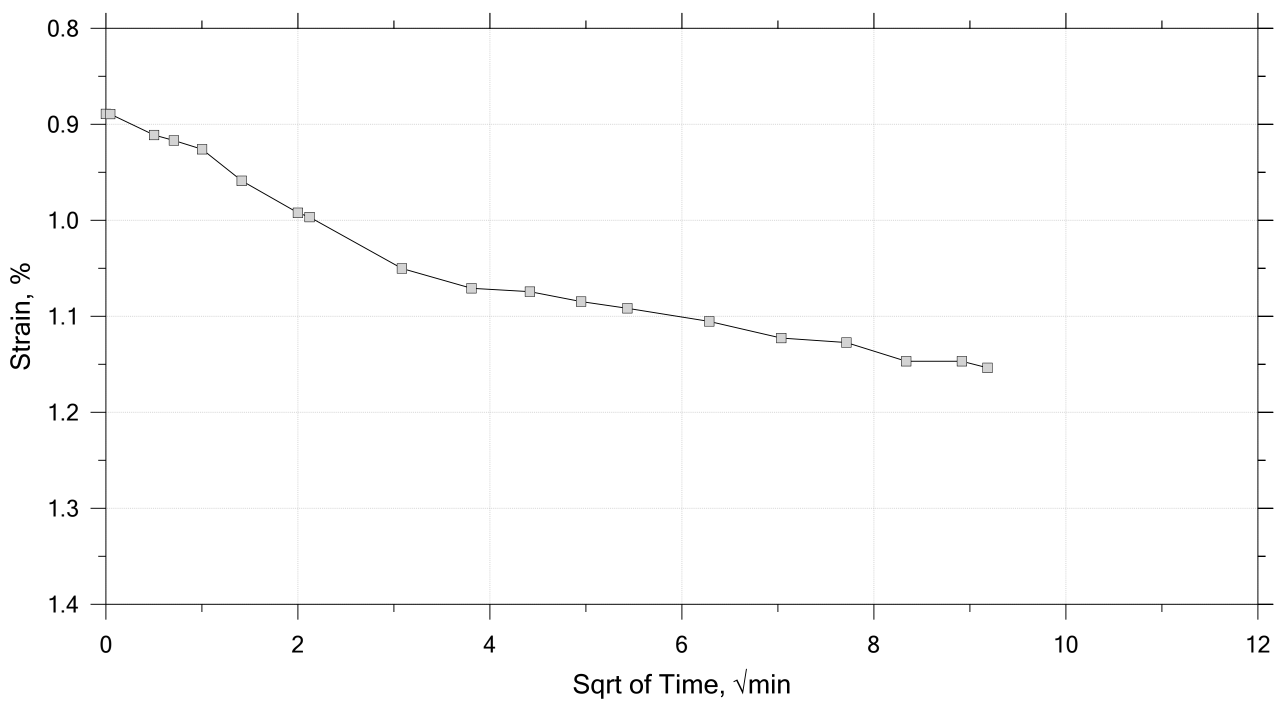
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 5 of 21

Constant Load Step

Stress: 1.01e+03 psf





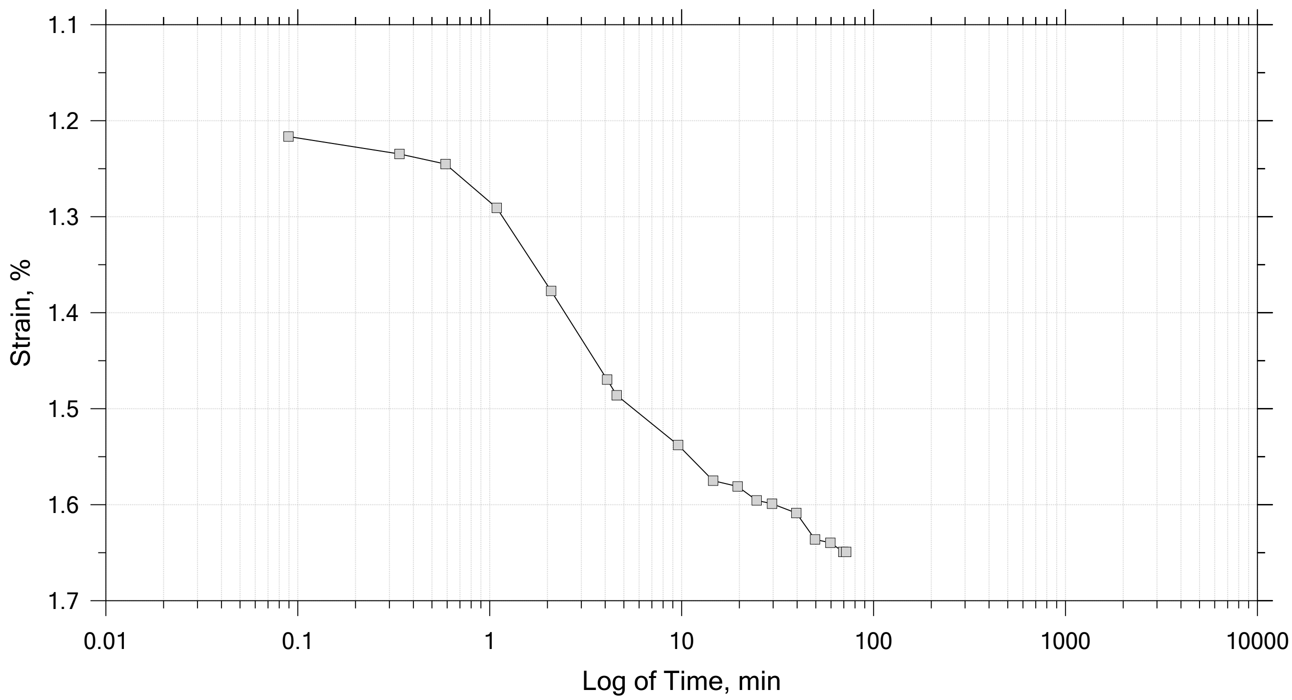
Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 10/3/2020	Depth: 13.45
	Test Number: ICON 333	Preparation: Shelby Tube	Elevation: 30.15
	Description: Gray Silty Clay		
	Remarks:		

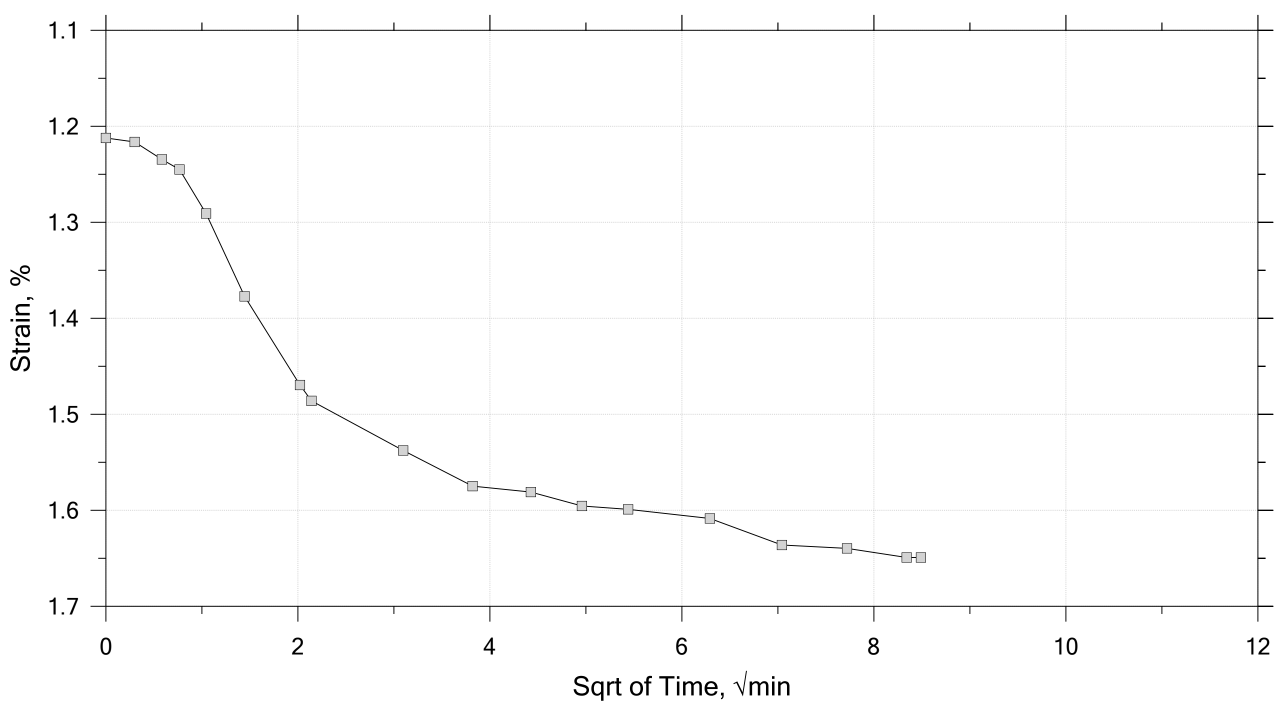
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 6 of 21

Constant Load Step

Stress: 1.52e+03 psf





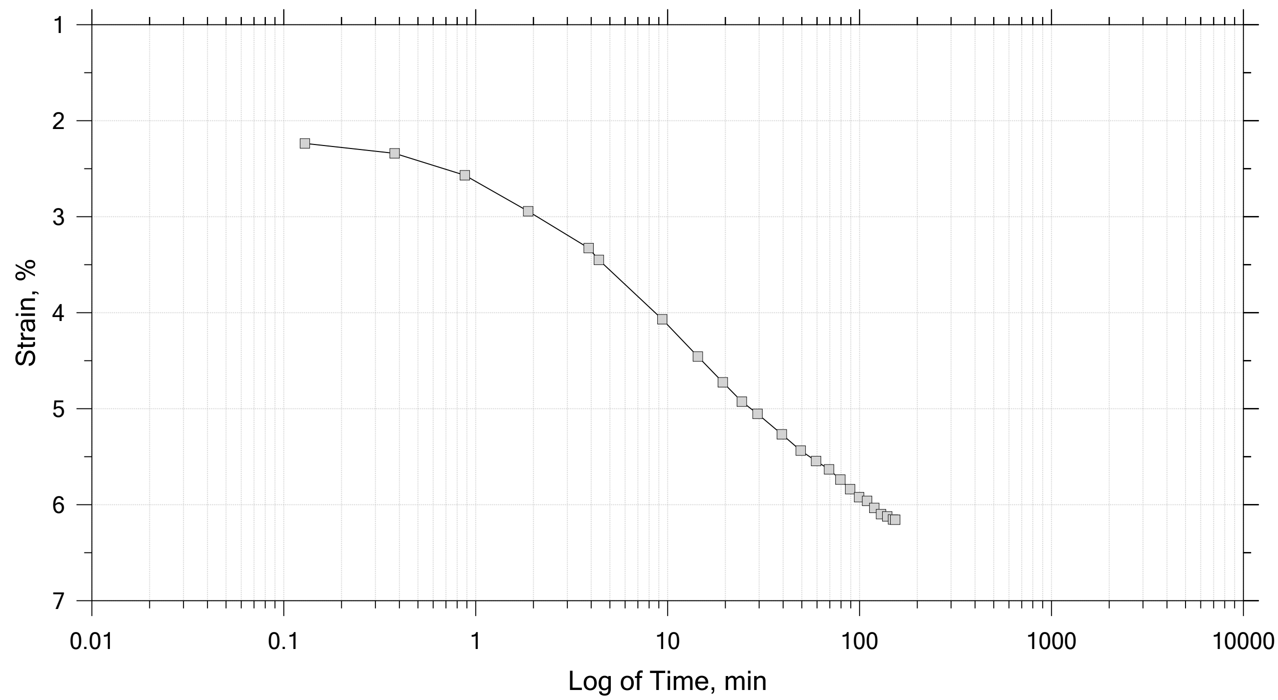
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 10/3/2020	Depth: 13.45
	Test Number: ICON 333	Preparation: Shelby Tube	Elevation: 30.15
	Description: Gray Silty Clay		
	Remarks:		

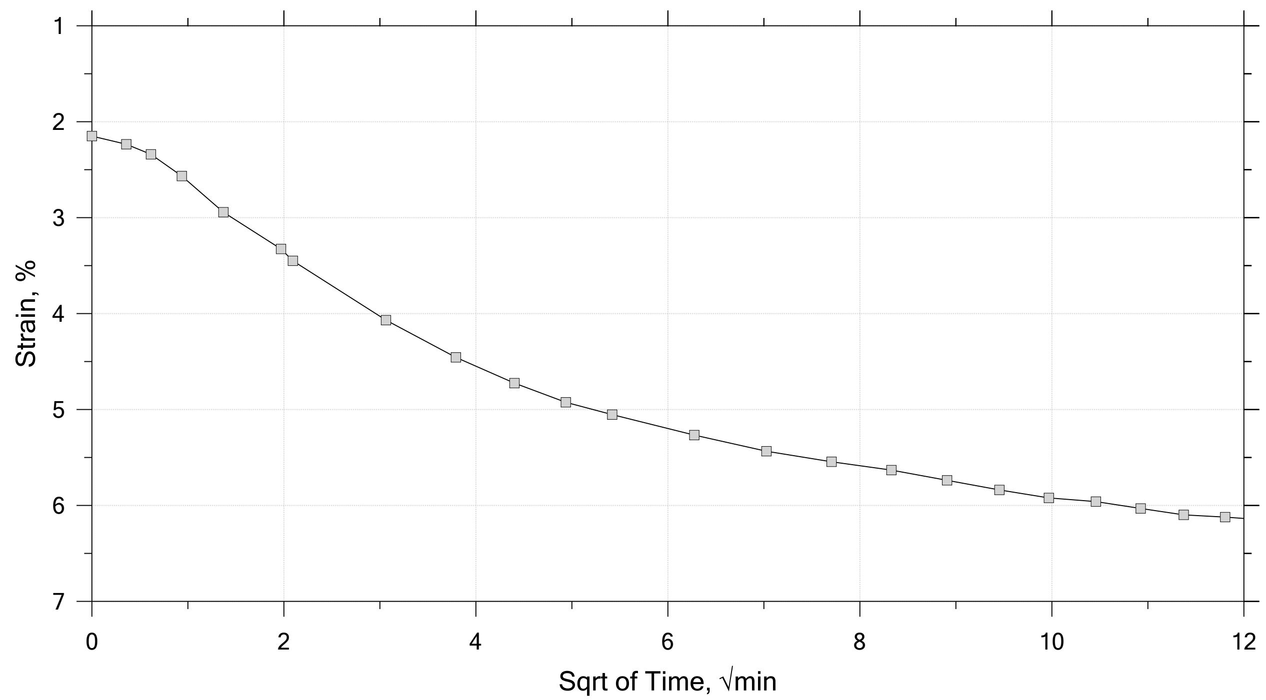
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 7 of 21

Constant Load Step

Stress: 3.04e+03 psf

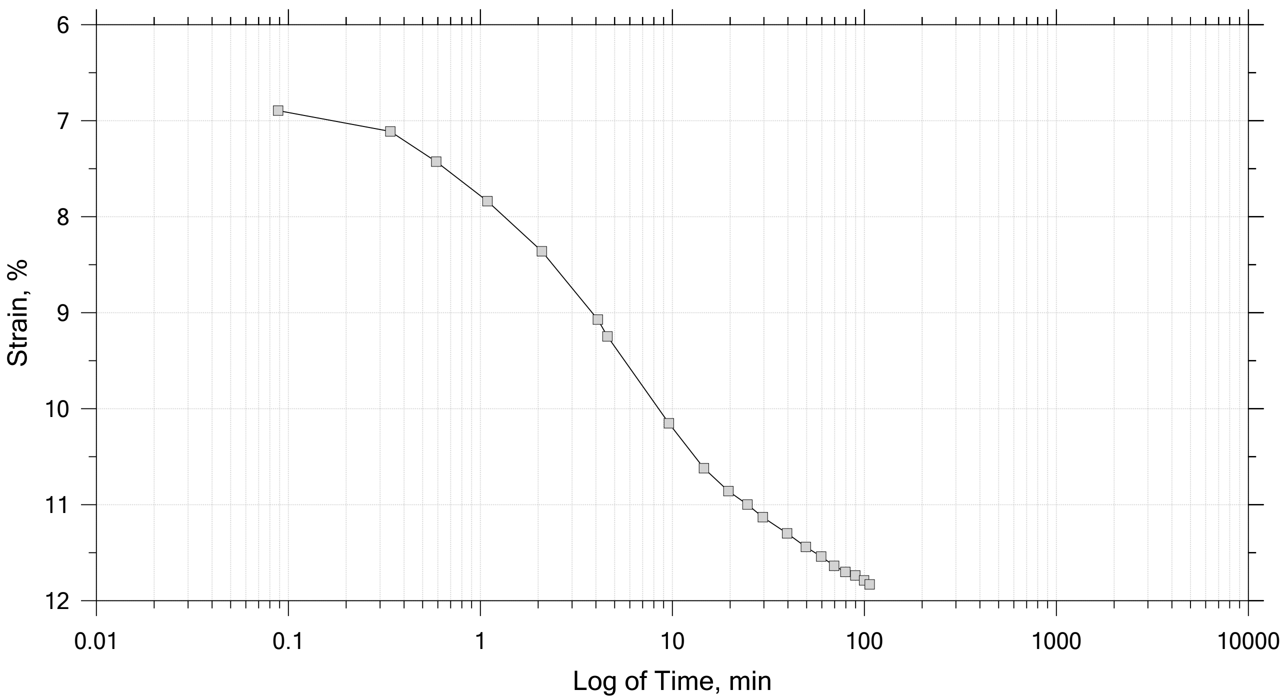


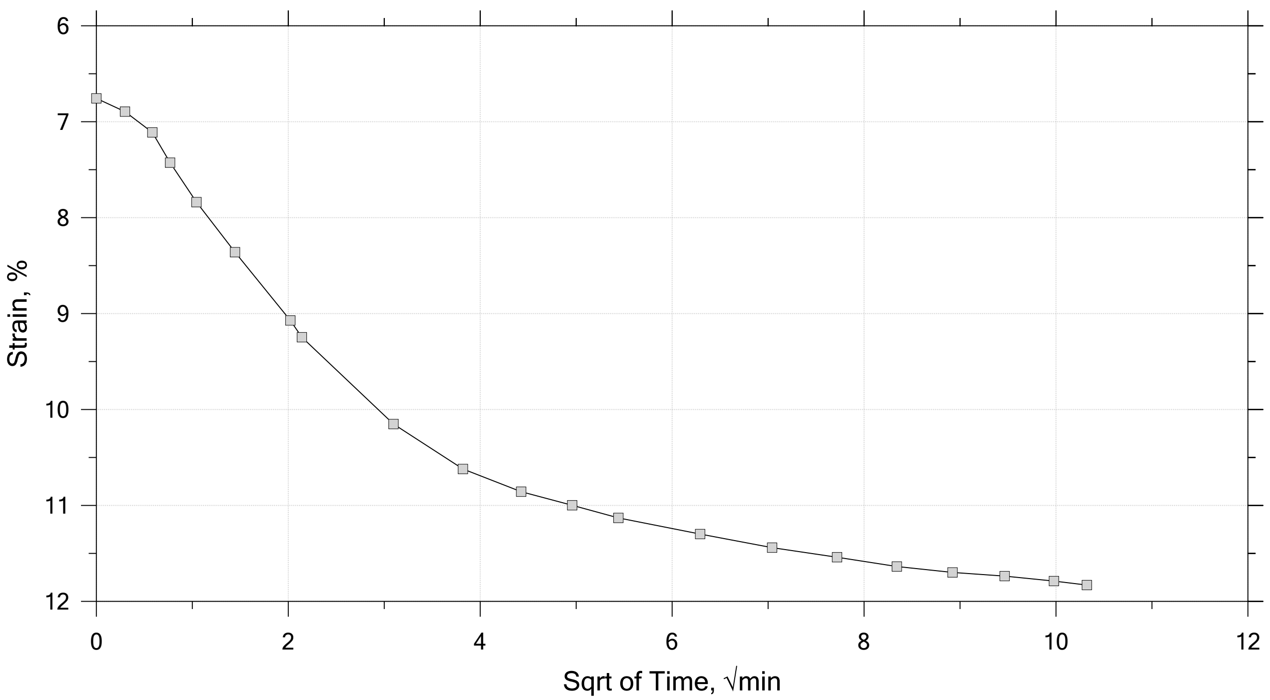


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 10/3/2020	Depth: 13.45
	Test Number: ICON 333	Preparation: Shelby Tube	Elevation: 30.15
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 8 of 21
Constant Load Step
Stress: 6.08e+03 psf





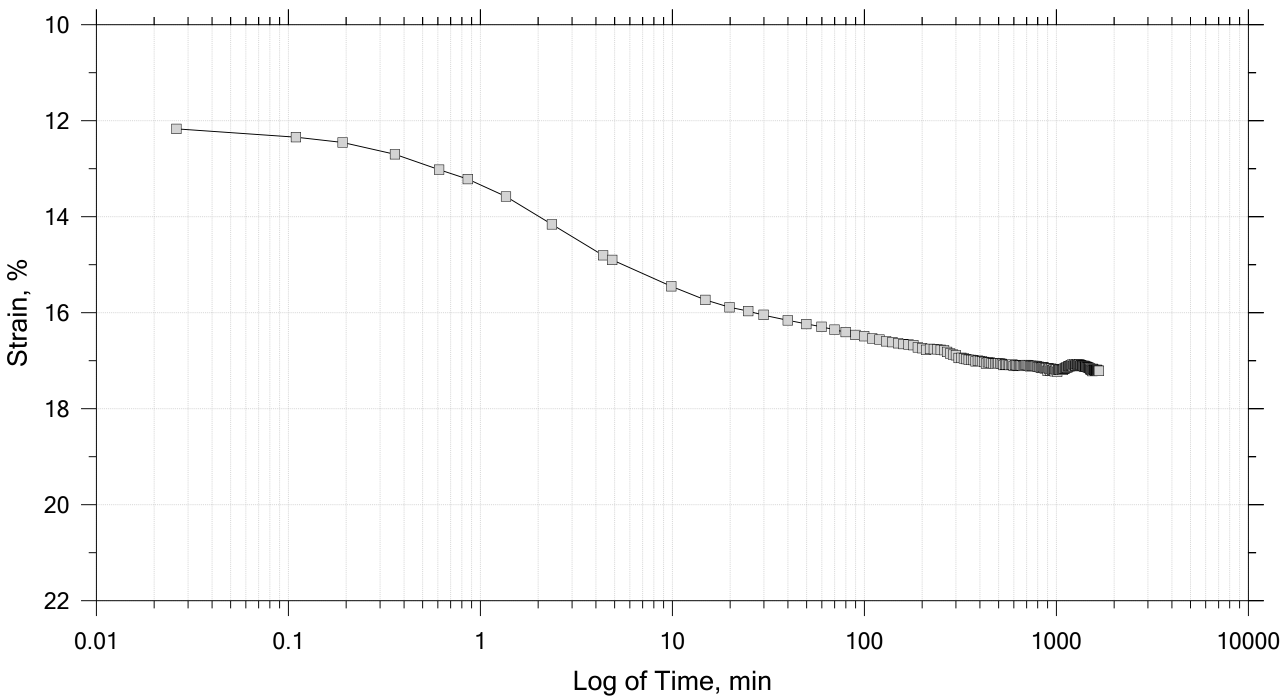
Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 10/3/2020	Depth: 13.45
	Test Number: ICON 333	Preparation: Shelby Tube	Elevation: 30.15
	Description: Gray Silty Clay		
	Remarks:		

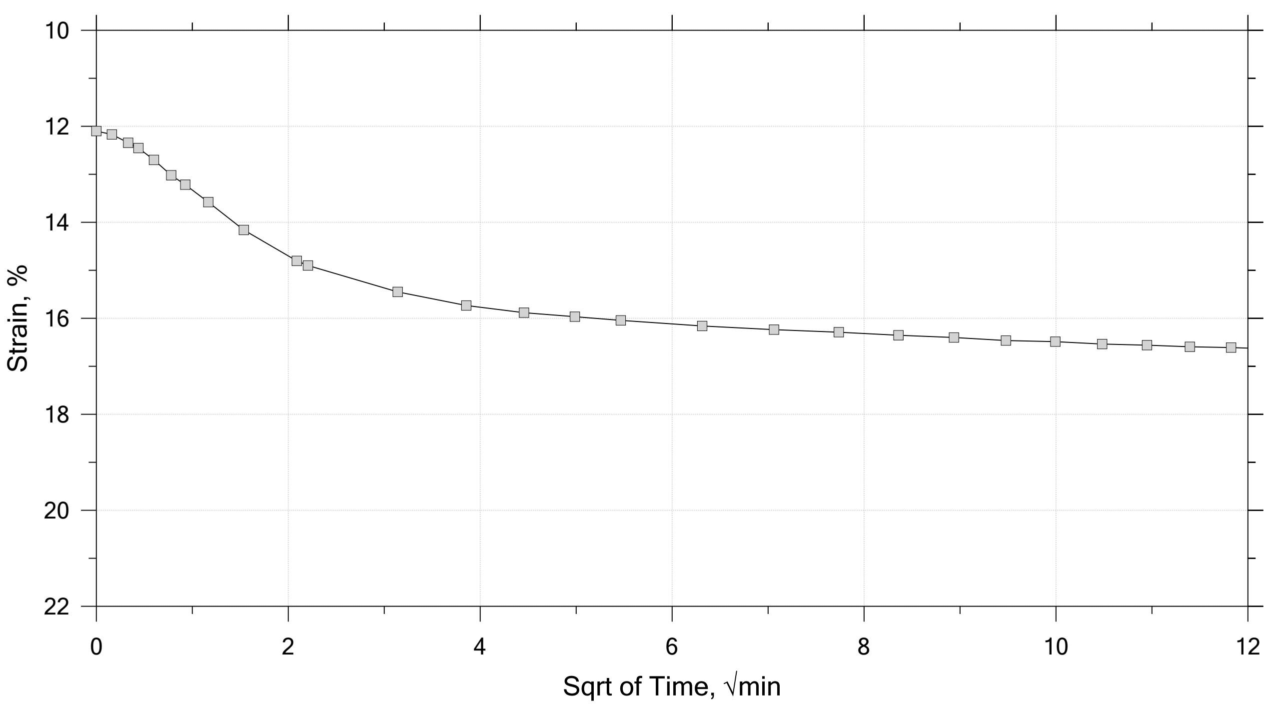
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 9 of 21

Constant Load Step

Stress: 1.22e+04 psf





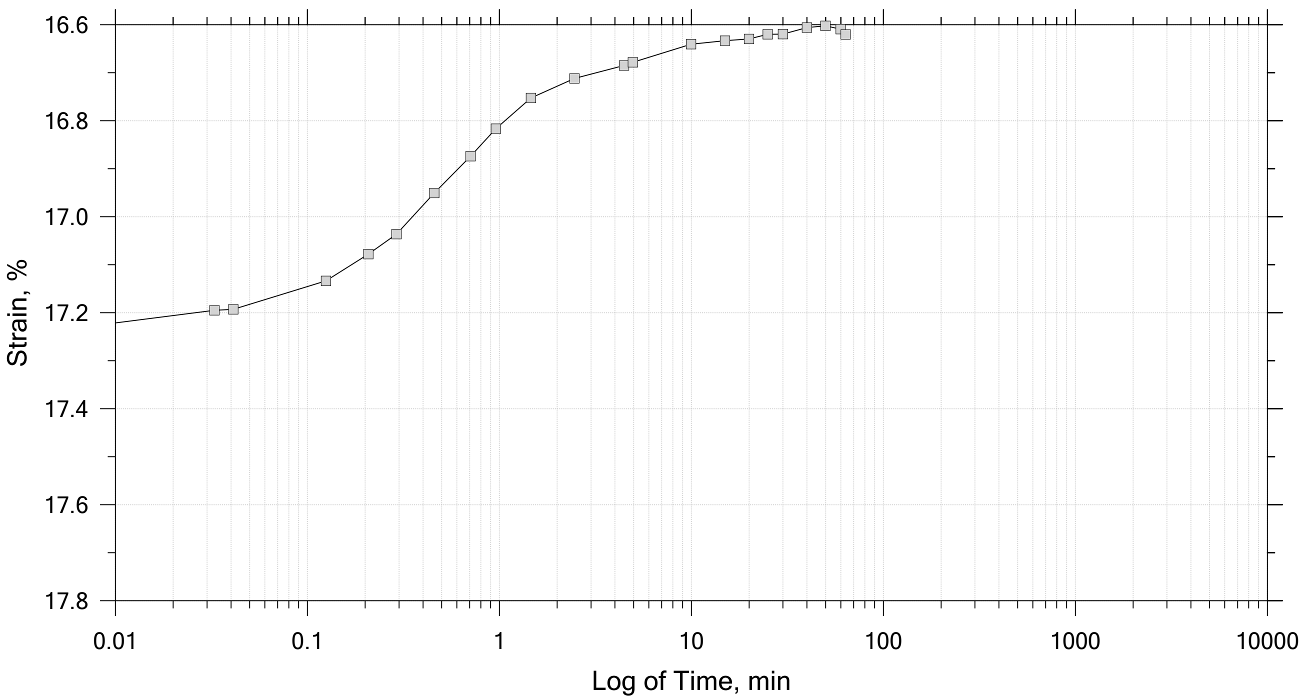
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 10/3/2020	Depth: 13.45
	Test Number: ICON 333	Preparation: Shelby Tube	Elevation: 30.15
	Description: Gray Silty Clay		
	Remarks:		

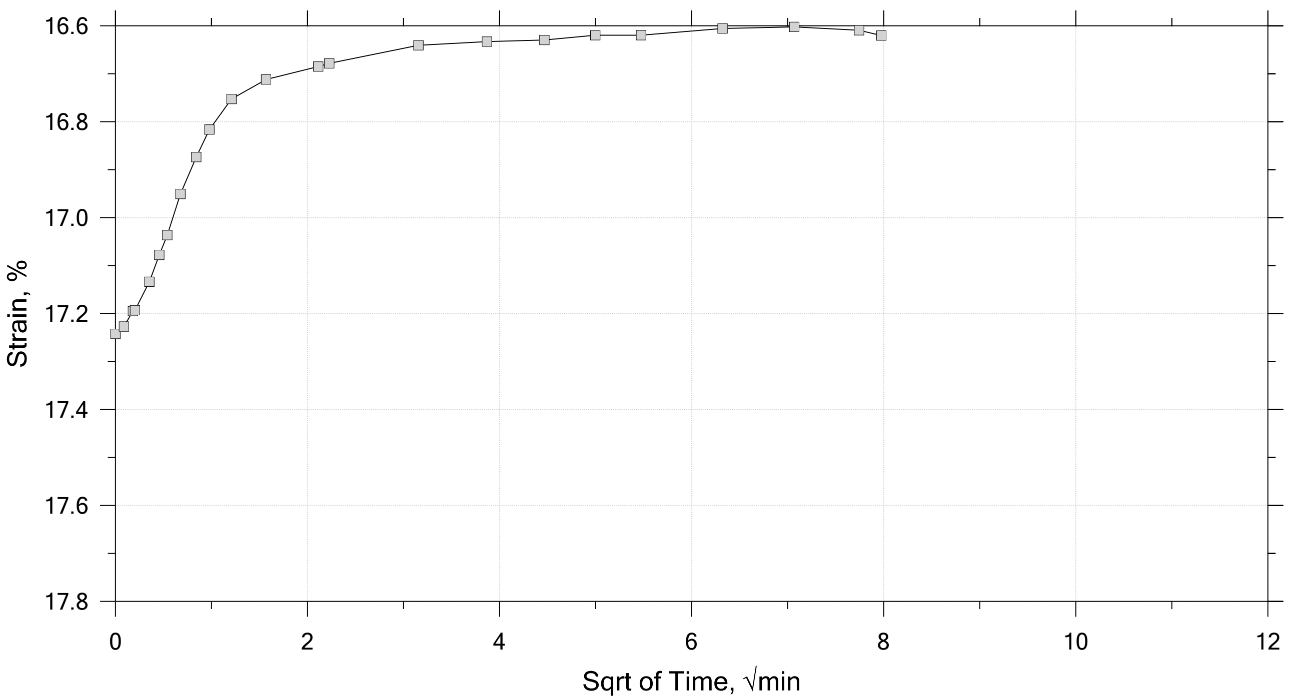
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 10 of 21

Constant Load Step

Stress: 3.04e+03 psf

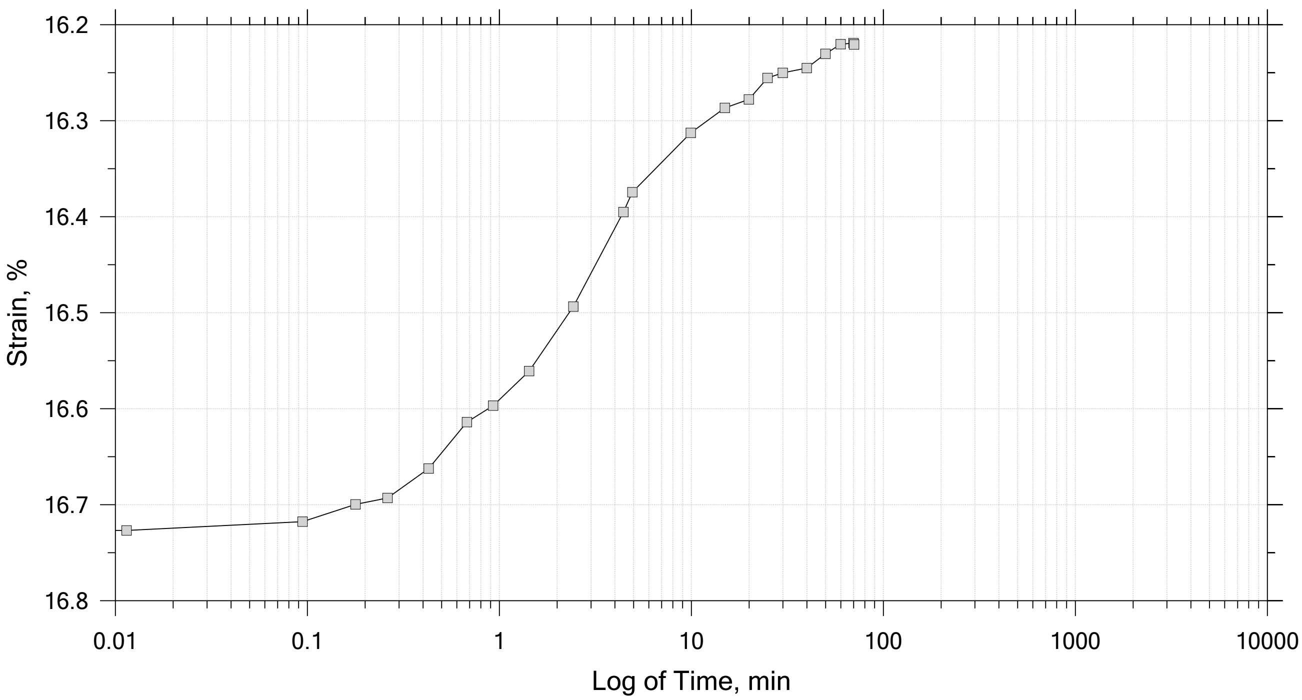


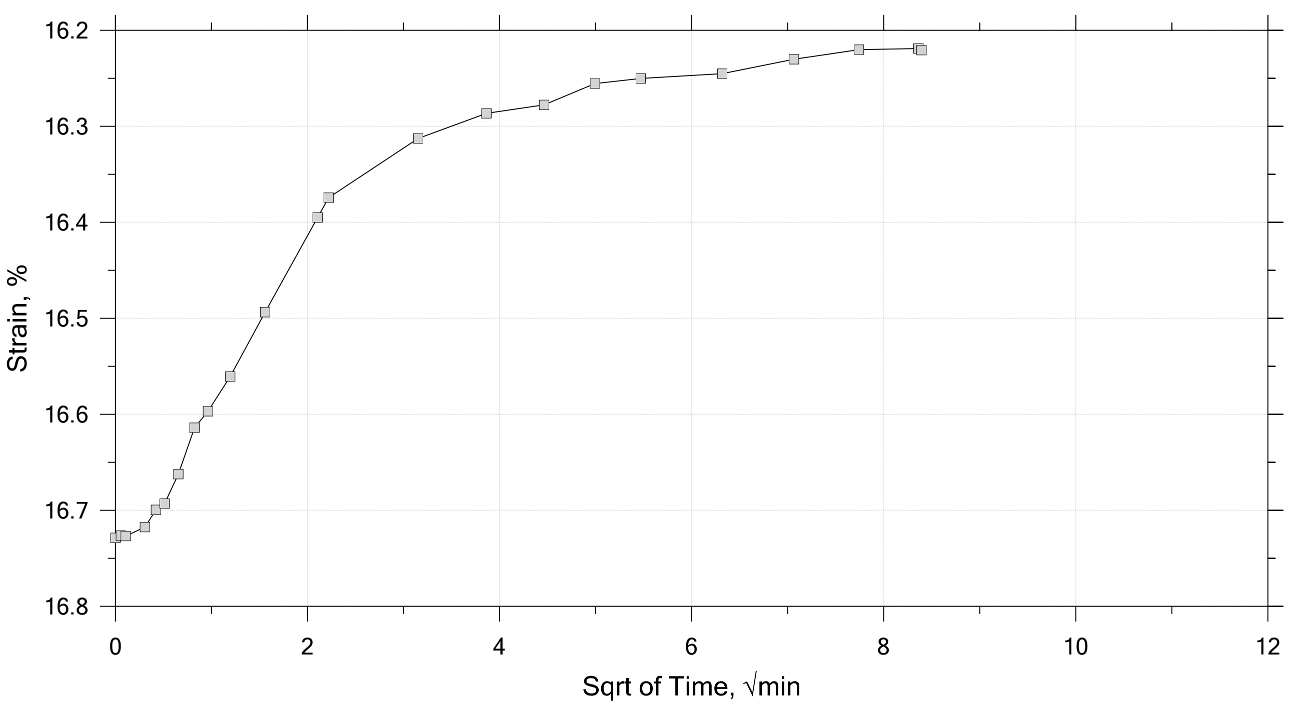


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 10/3/2020	Depth: 13.45
	Test Number: ICON 333	Preparation: Shelby Tube	Elevation: 30.15
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 11 of 21
Constant Load Step
Stress: 1.52e+03 psf





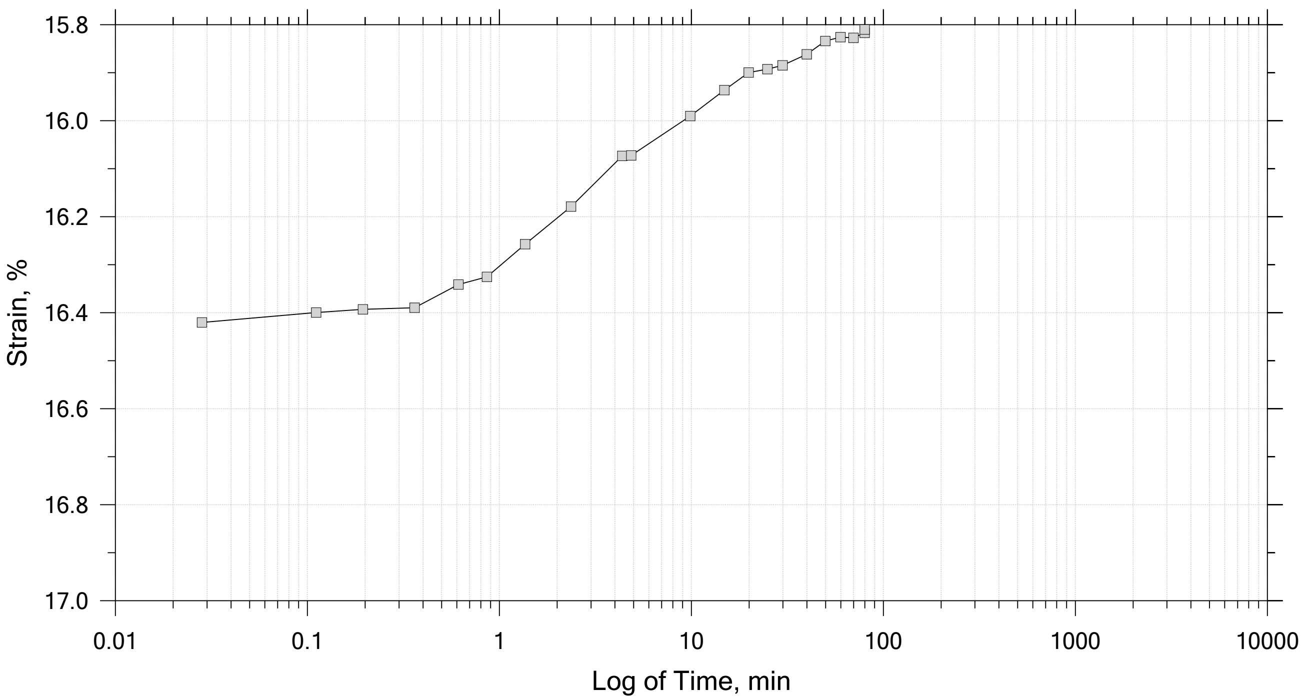
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 10/3/2020	Depth: 13.45
	Test Number: ICON 333	Preparation: Shelby Tube	Elevation: 30.15
	Description: Gray Silty Clay		
	Remarks:		

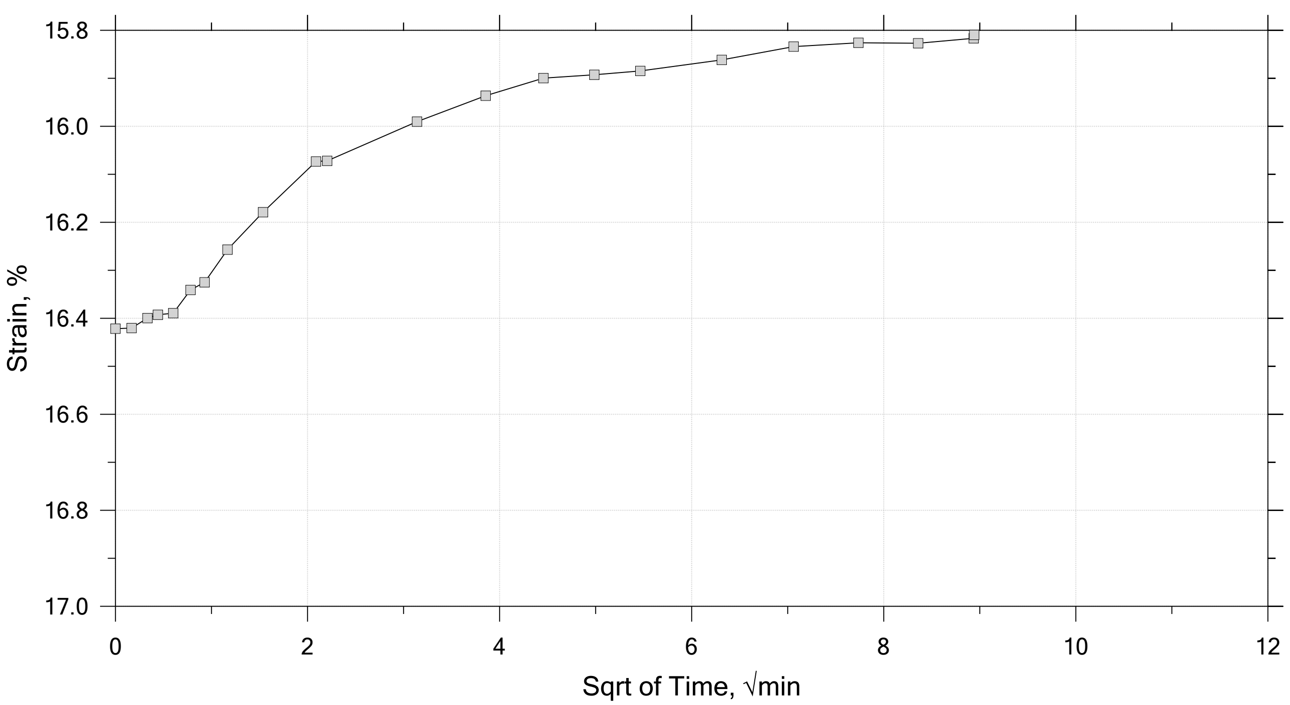
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 12 of 21

Constant Load Step

Stress: 759 psf

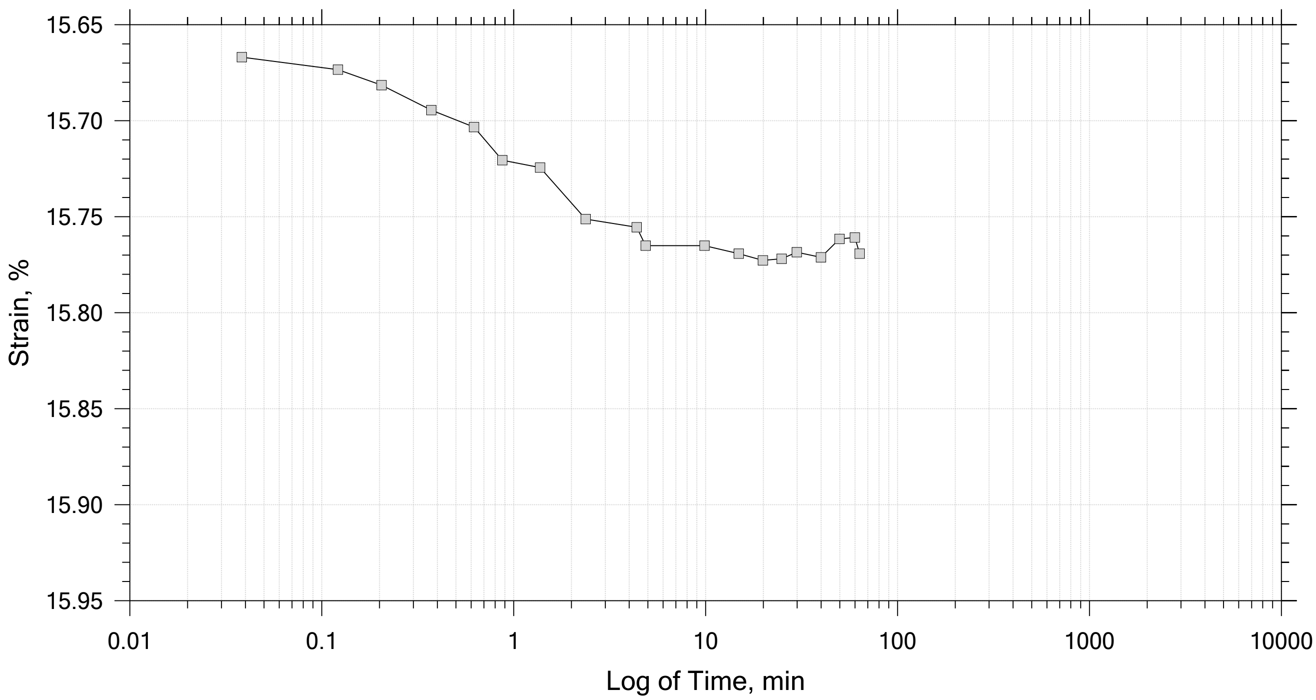


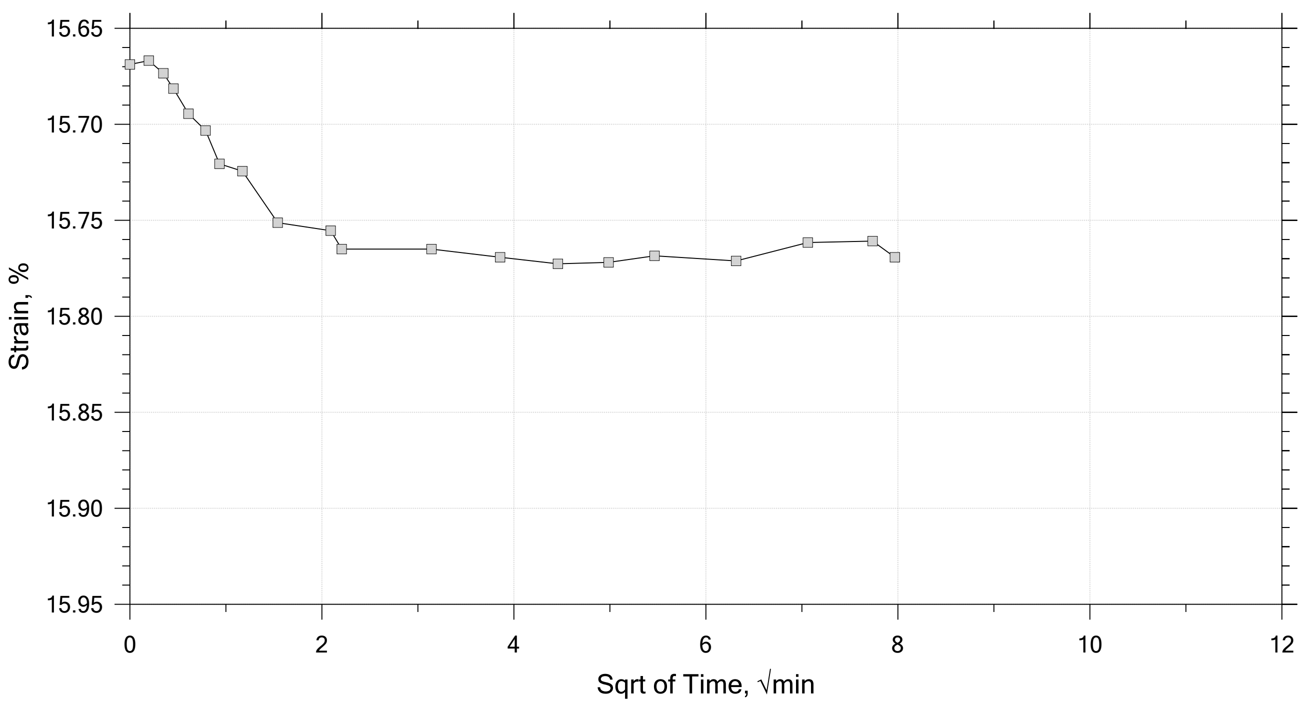


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 10/3/2020	Depth: 13.45
	Test Number: ICON 333	Preparation: Shelby Tube	Elevation: 30.15
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 13 of 21
Constant Load Step
Stress: 1.33e+03 psf

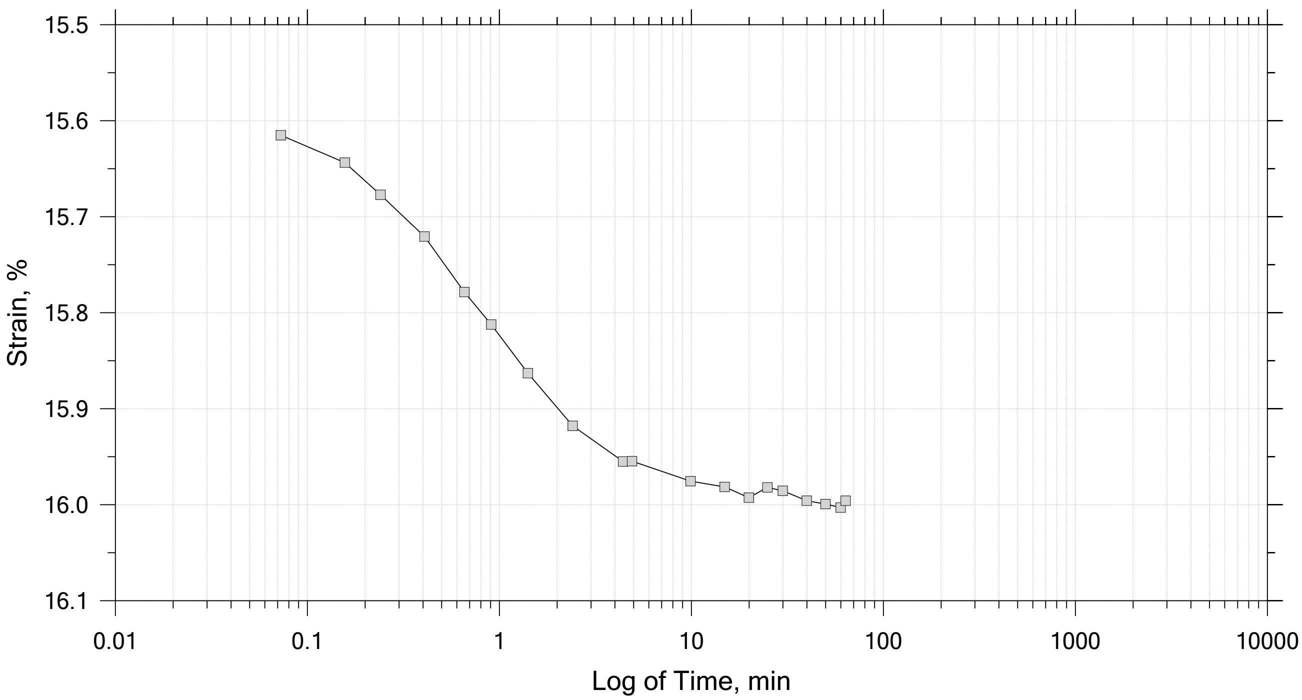


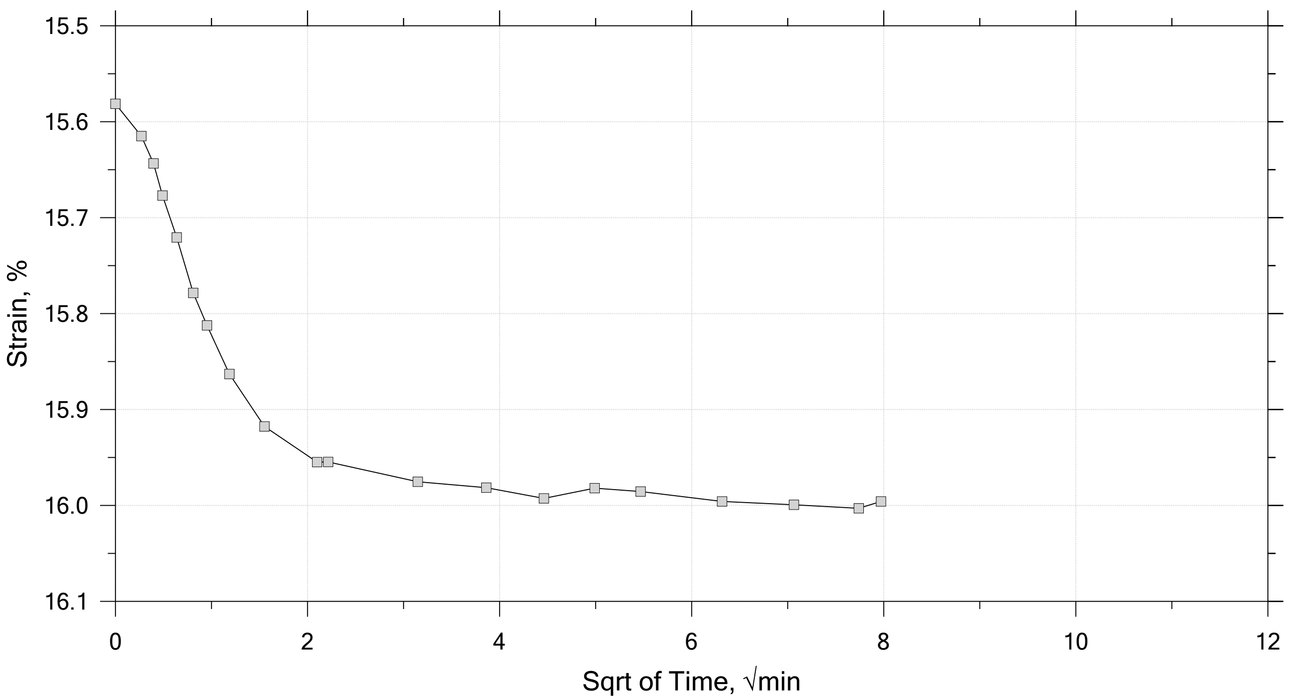


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 10/3/2020	Depth: 13.45
	Test Number: ICON 333	Preparation: Shelby Tube	Elevation: 30.15
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 14 of 21
Constant Load Step
Stress: 2.66e+03 psf





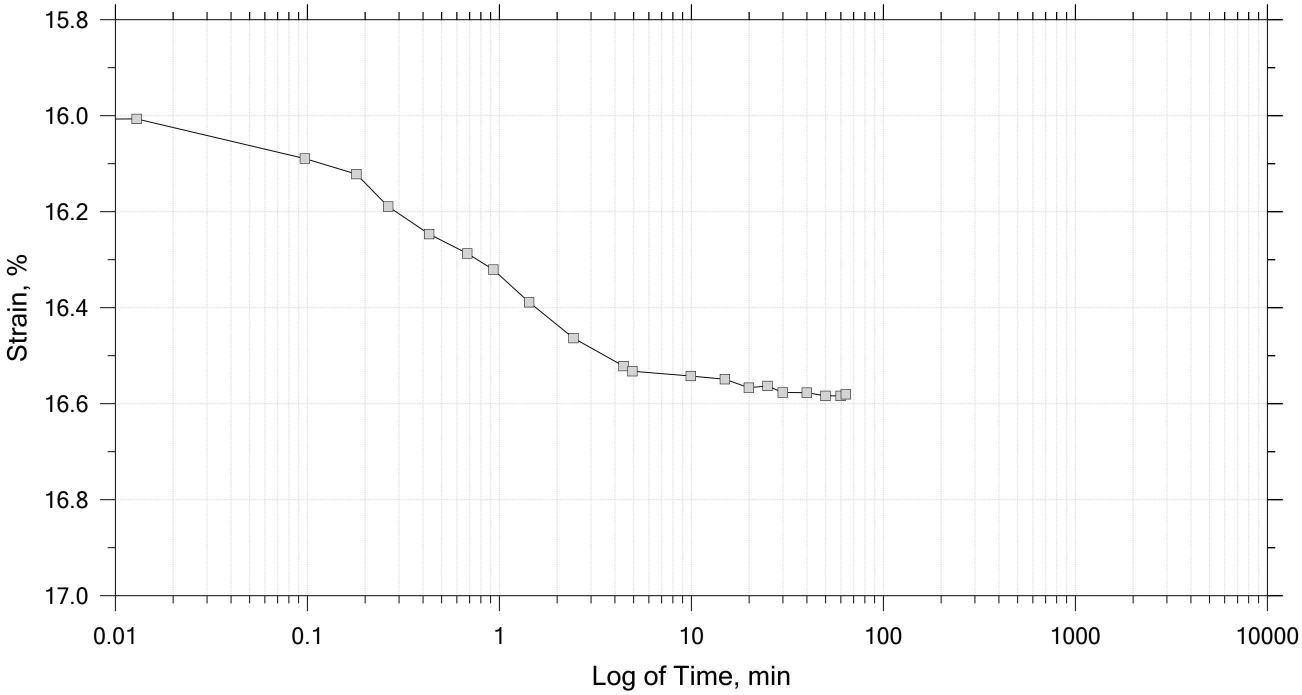
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 10/3/2020	Depth: 13.45
	Test Number: ICON 333	Preparation: Shelby Tube	Elevation: 30.15
	Description: Gray Silty Clay		
	Remarks:		

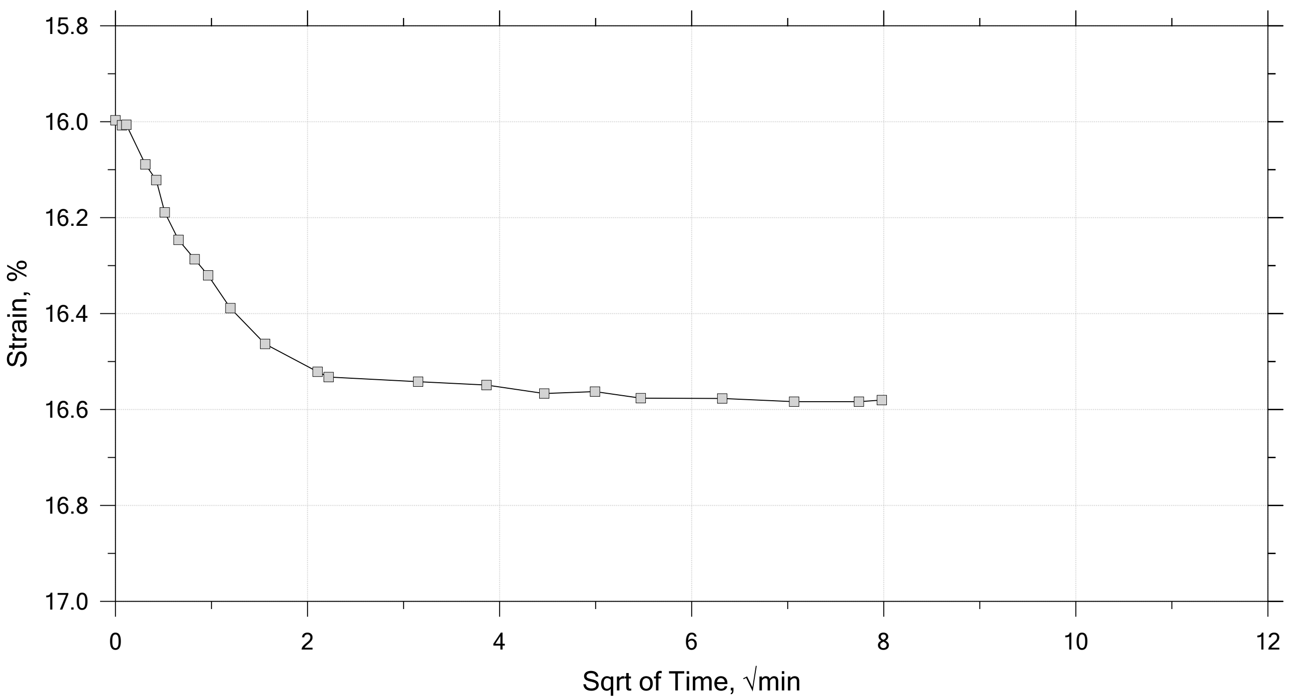
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 15 of 21

Constant Load Step

Stress: 5.32e+03 psf

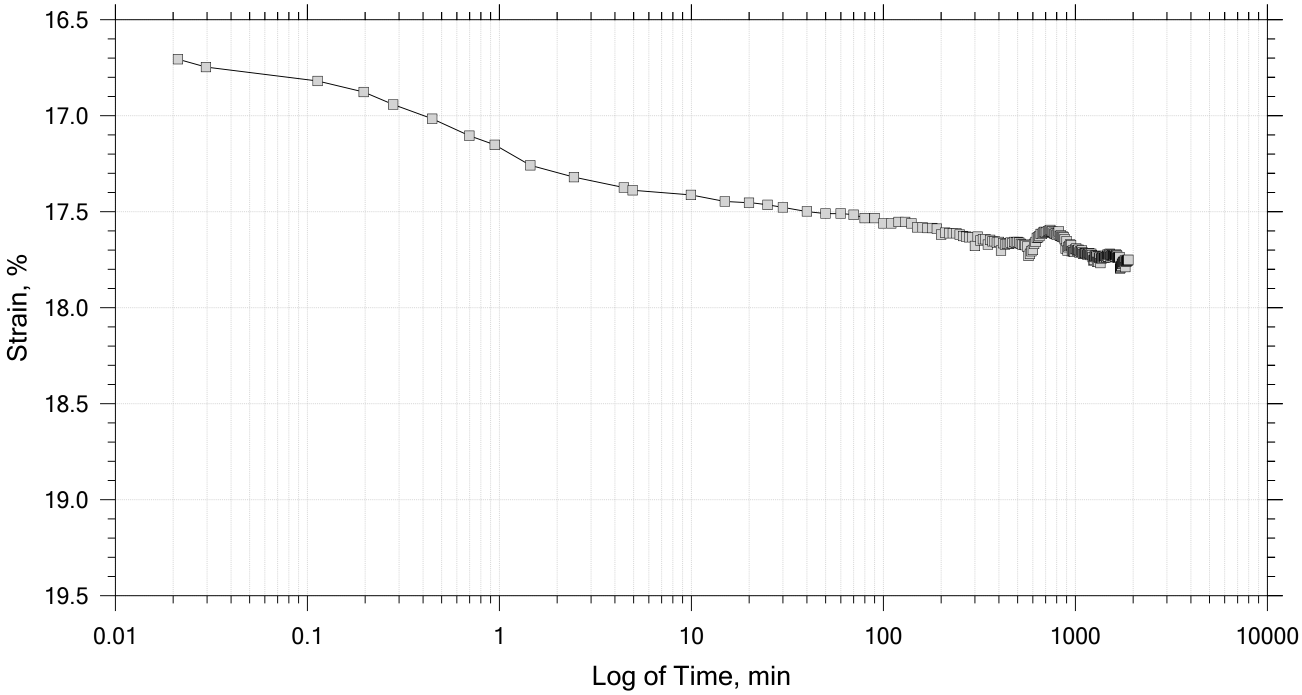


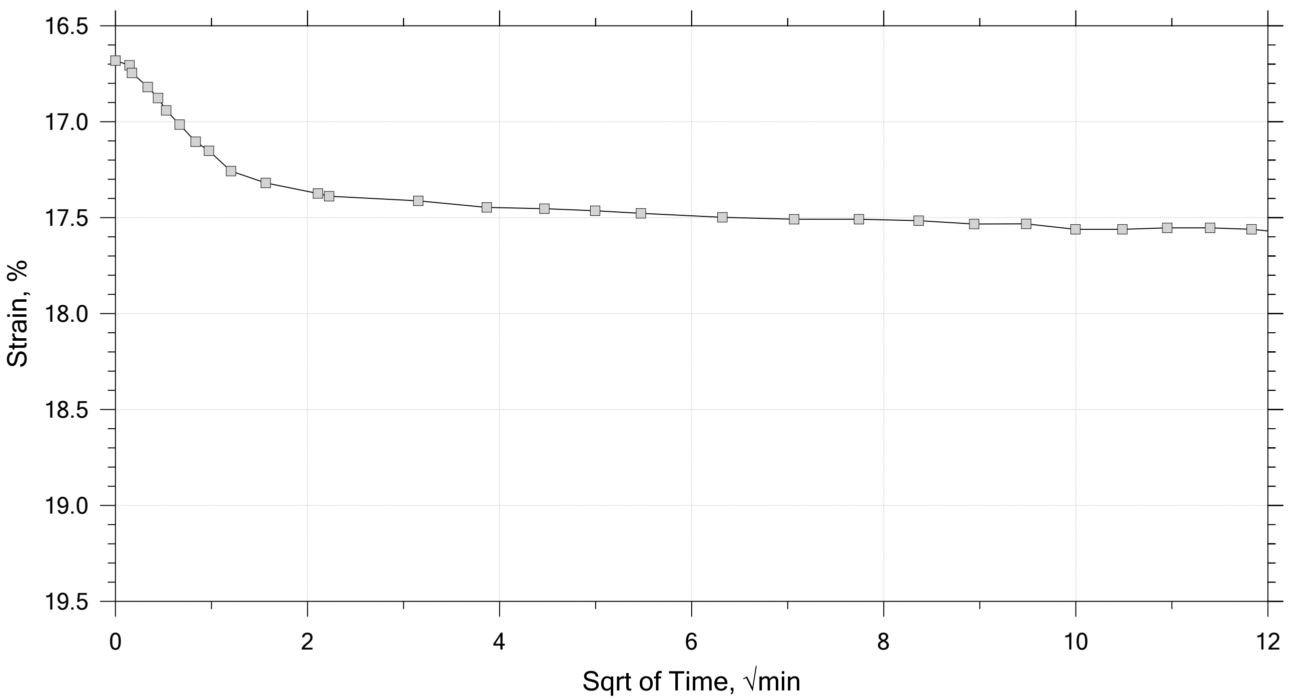


Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 10/3/2020	Depth: 13.45
	Test Number: ICON 333	Preparation: Shelby Tube	Elevation: 30.15
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 16 of 21
Constant Load Step
Stress: 1.06e+04 psf





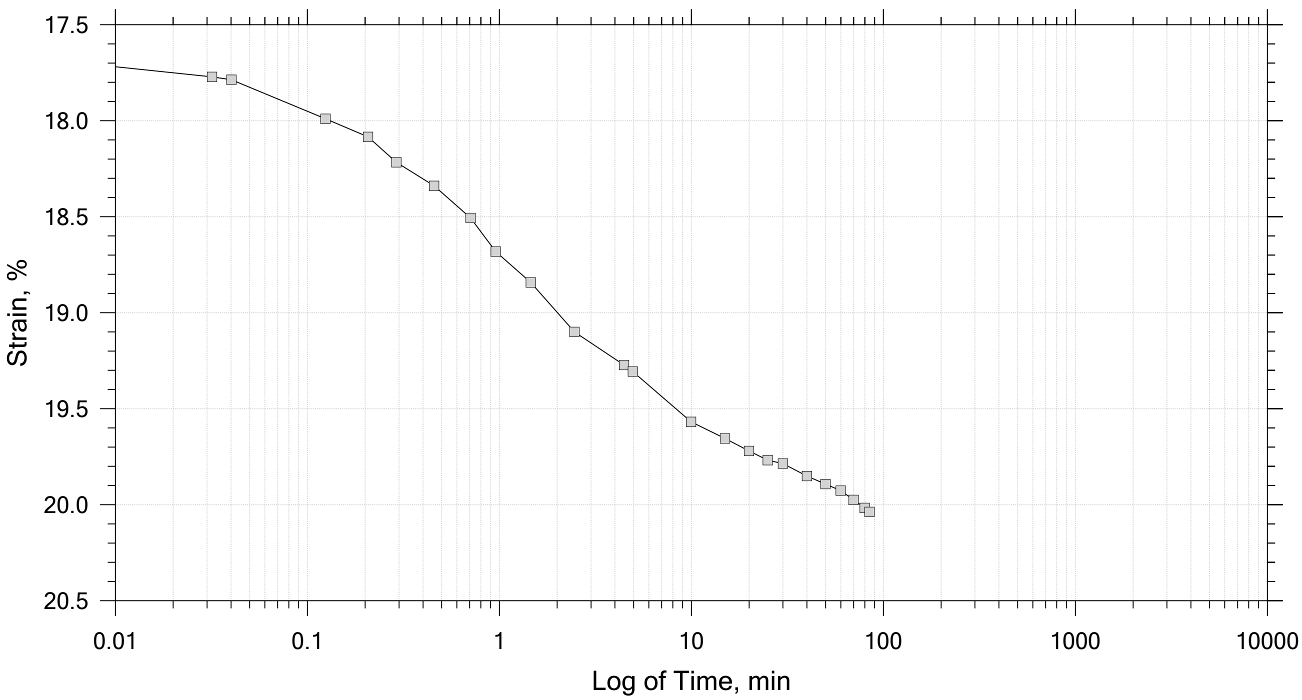
Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 10/3/2020	Depth: 13.45
	Test Number: ICON 333	Preparation: Shelby Tube	Elevation: 30.15
	Description: Gray Silty Clay		
	Remarks:		

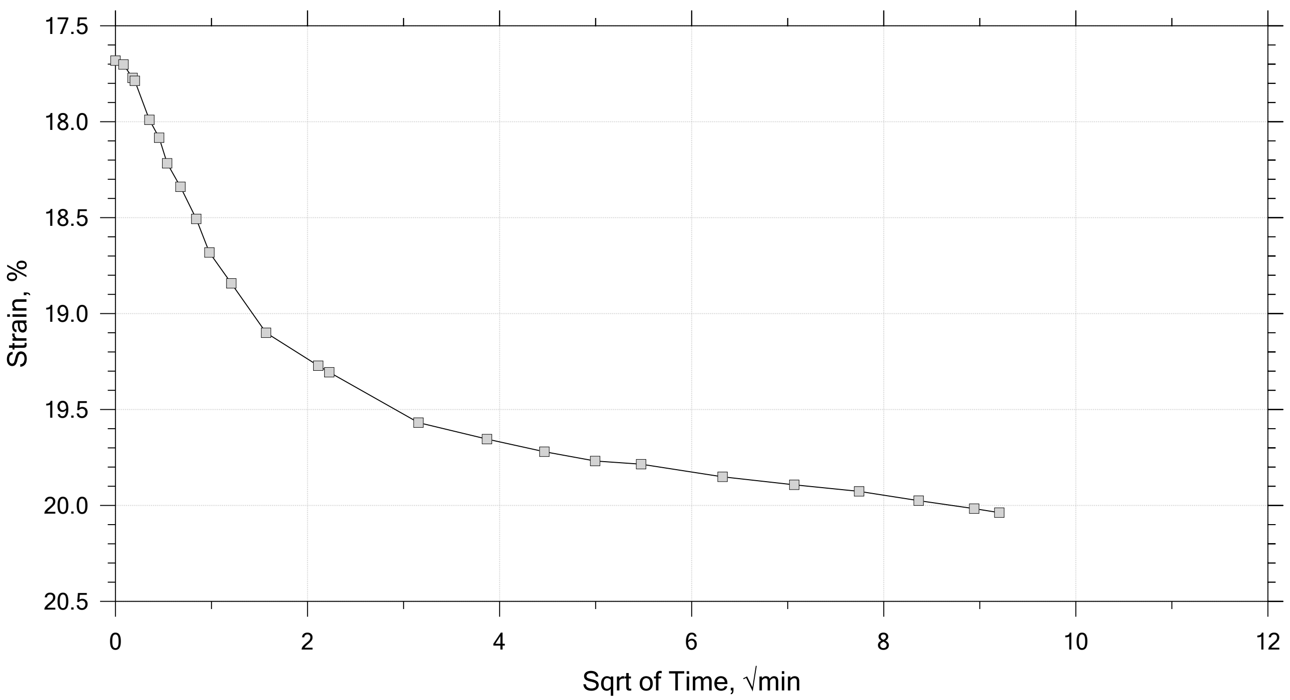
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 17 of 21

Constant Load Step

Stress: 2.13e+04 psf

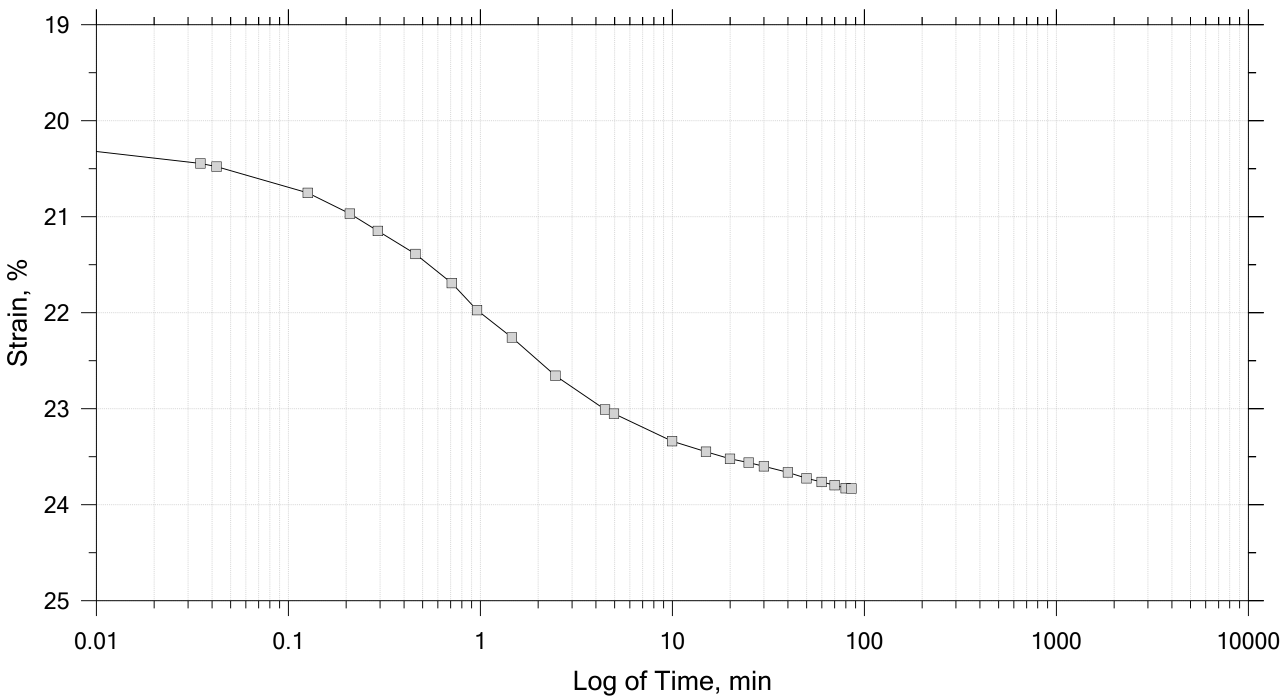


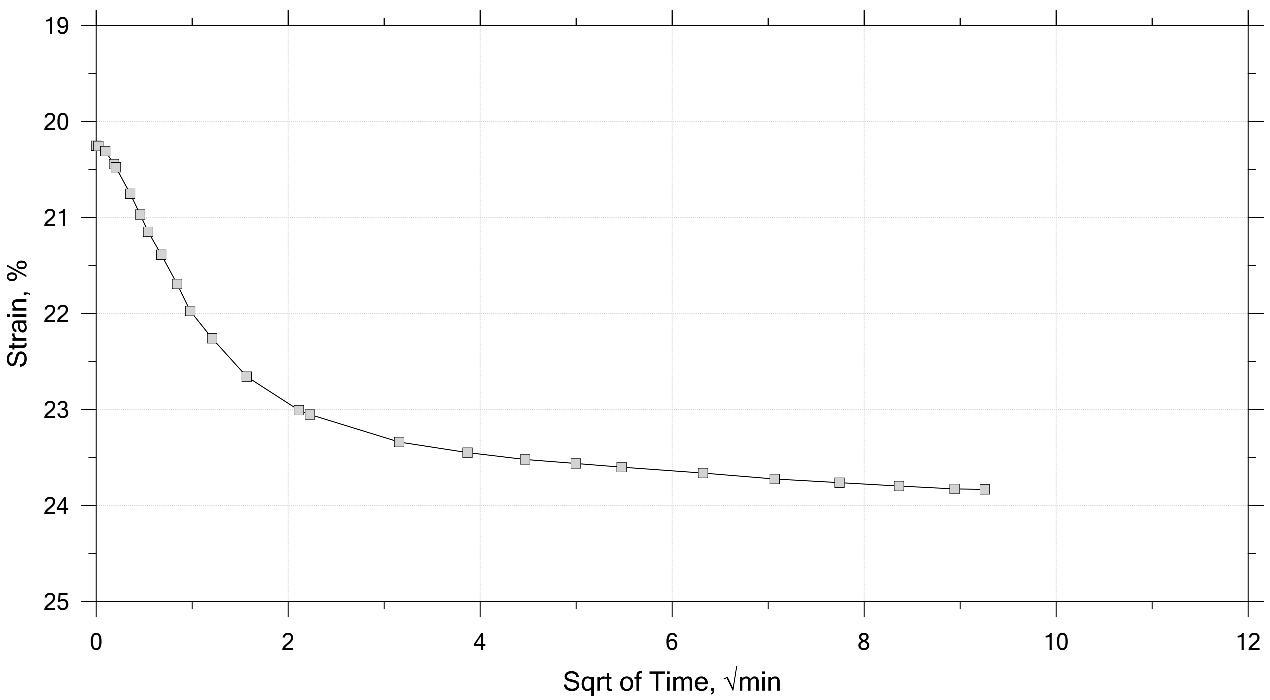


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 10/3/2020	Depth: 13.45
	Test Number: ICON 333	Preparation: Shelby Tube	Elevation: 30.15
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 18 of 21
Constant Load Step
Stress: 4.25e+04 psf

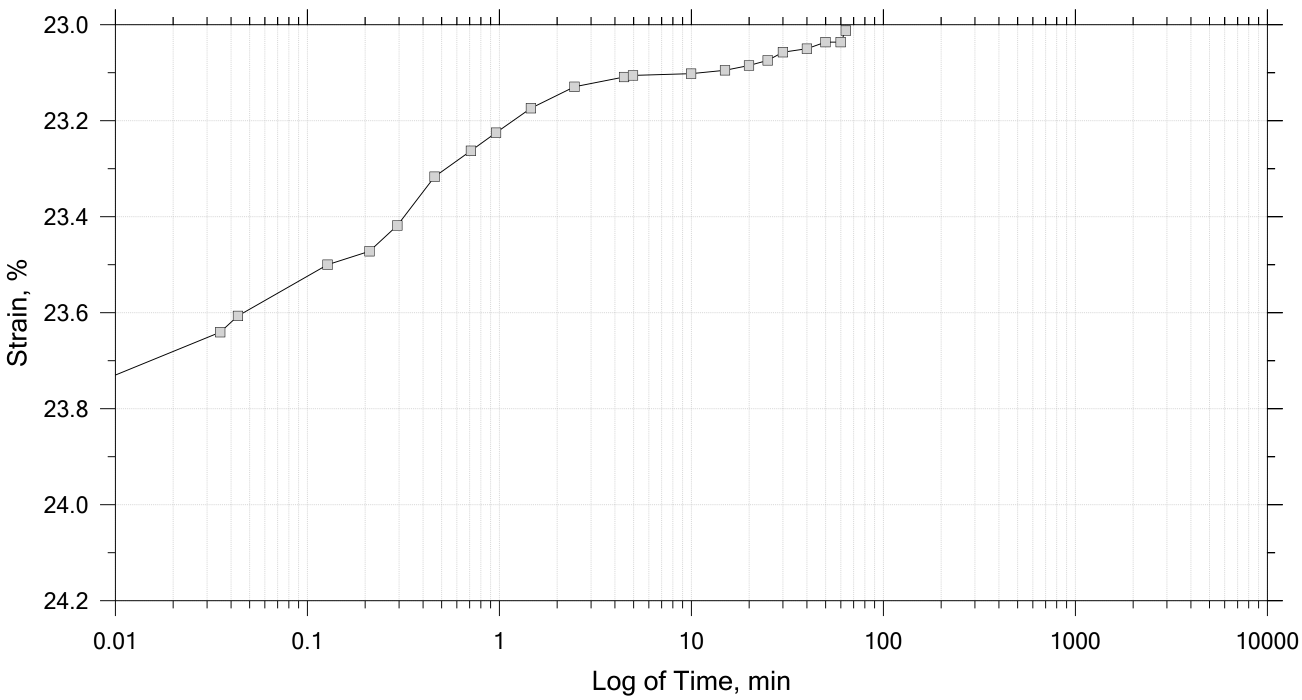


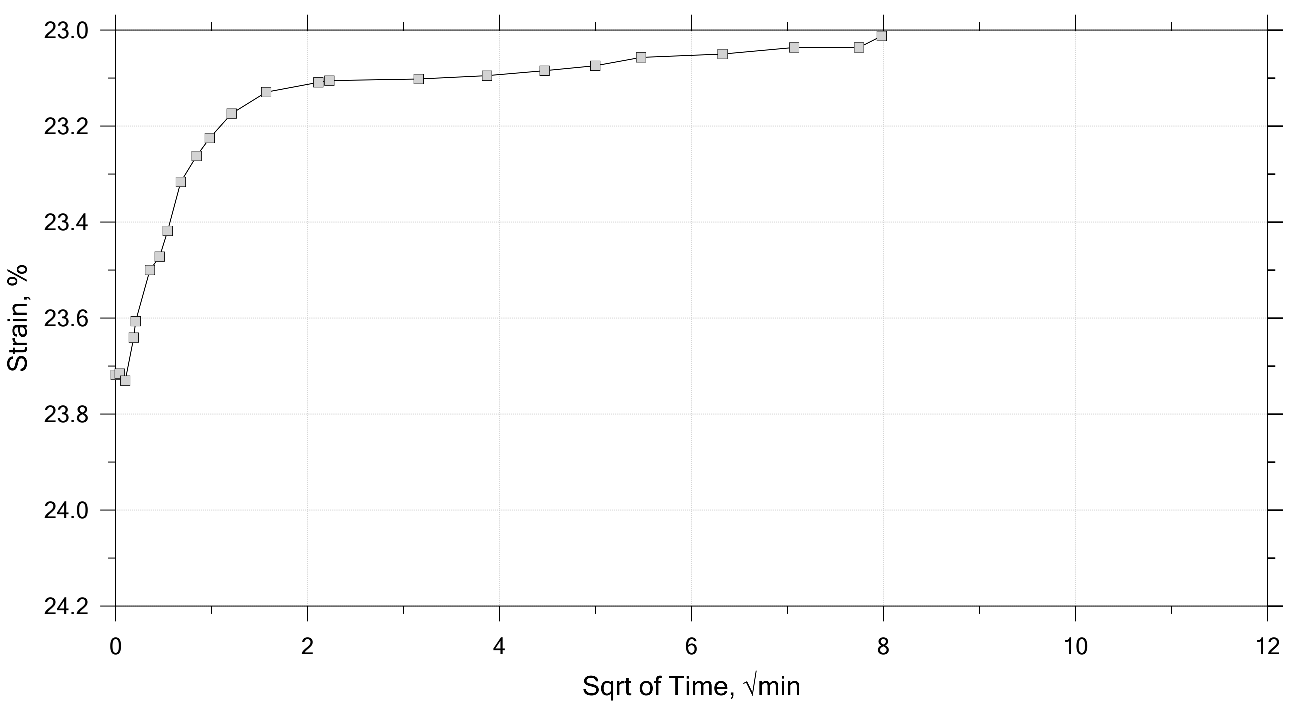


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 10/3/2020	Depth: 13.45
	Test Number: ICON 333	Preparation: Shelby Tube	Elevation: 30.15
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 19 of 21
Constant Load Step
Stress: 1.06e+04 psf





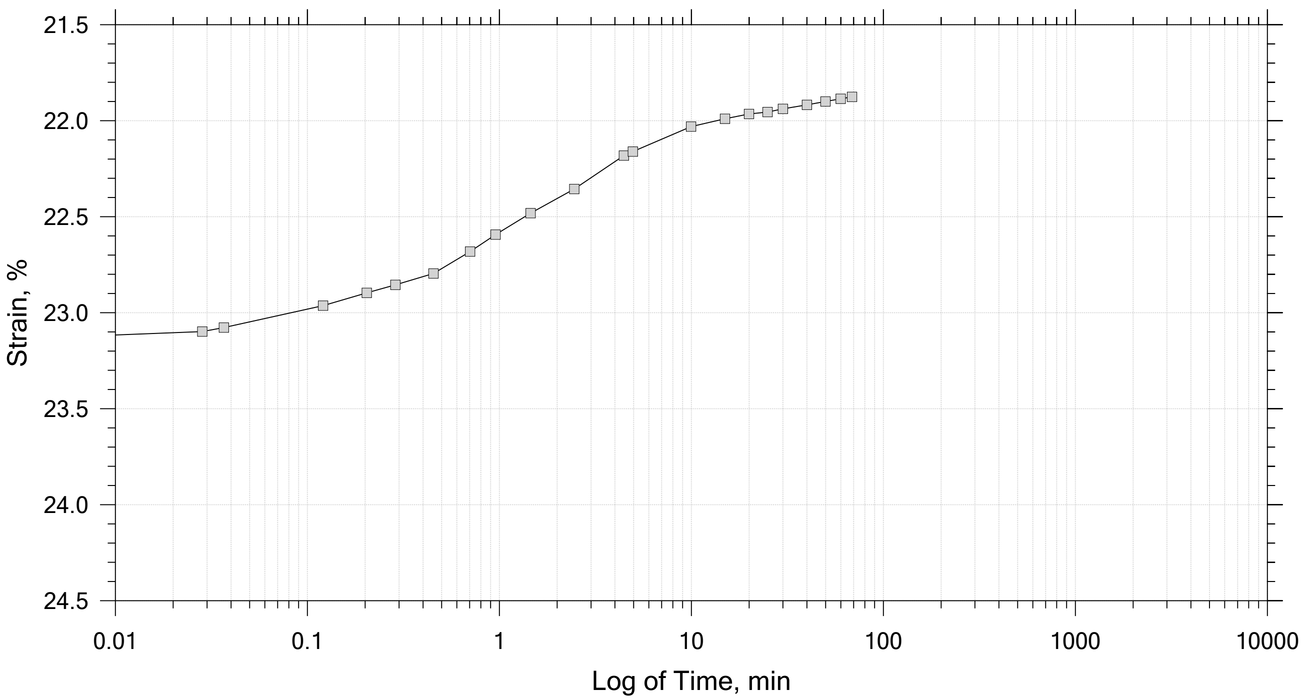
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 10/3/2020	Depth: 13.45
	Test Number: ICON 333	Preparation: Shelby Tube	Elevation: 30.15
	Description: Gray Silty Clay		
	Remarks:		

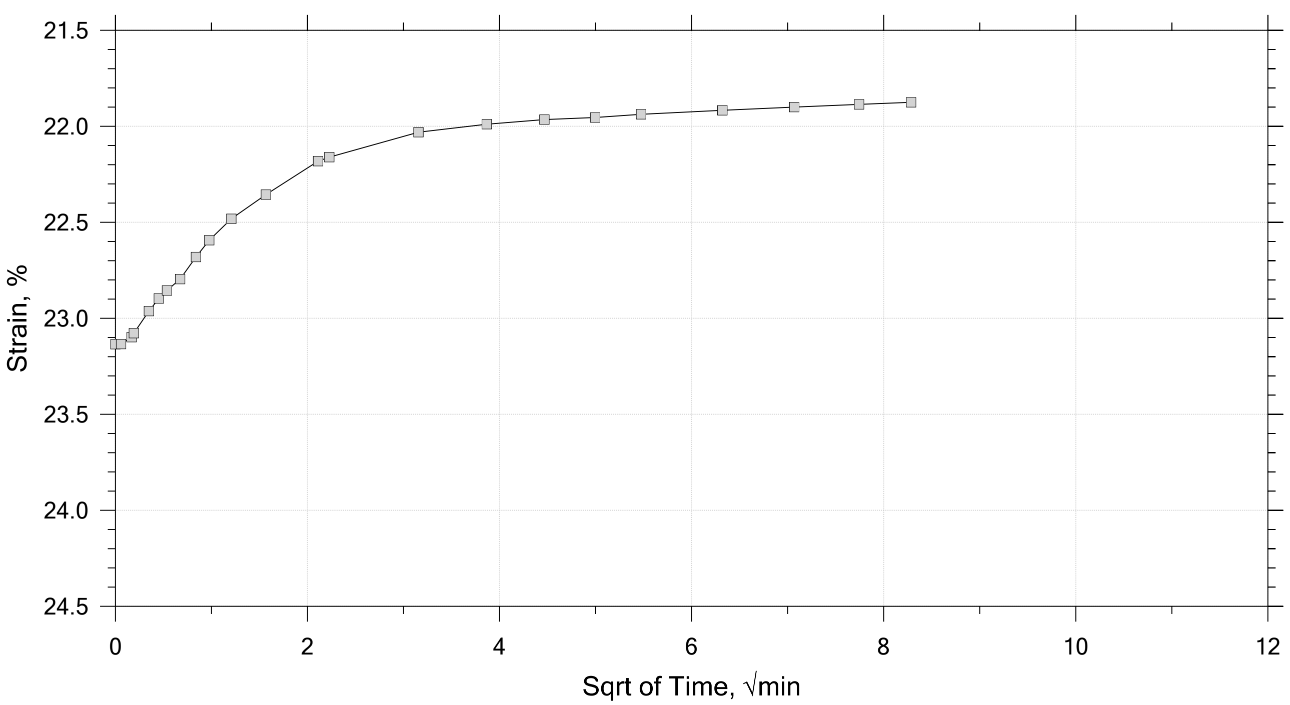
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 20 of 21

Constant Load Step

Stress: 2.66e+03 psf

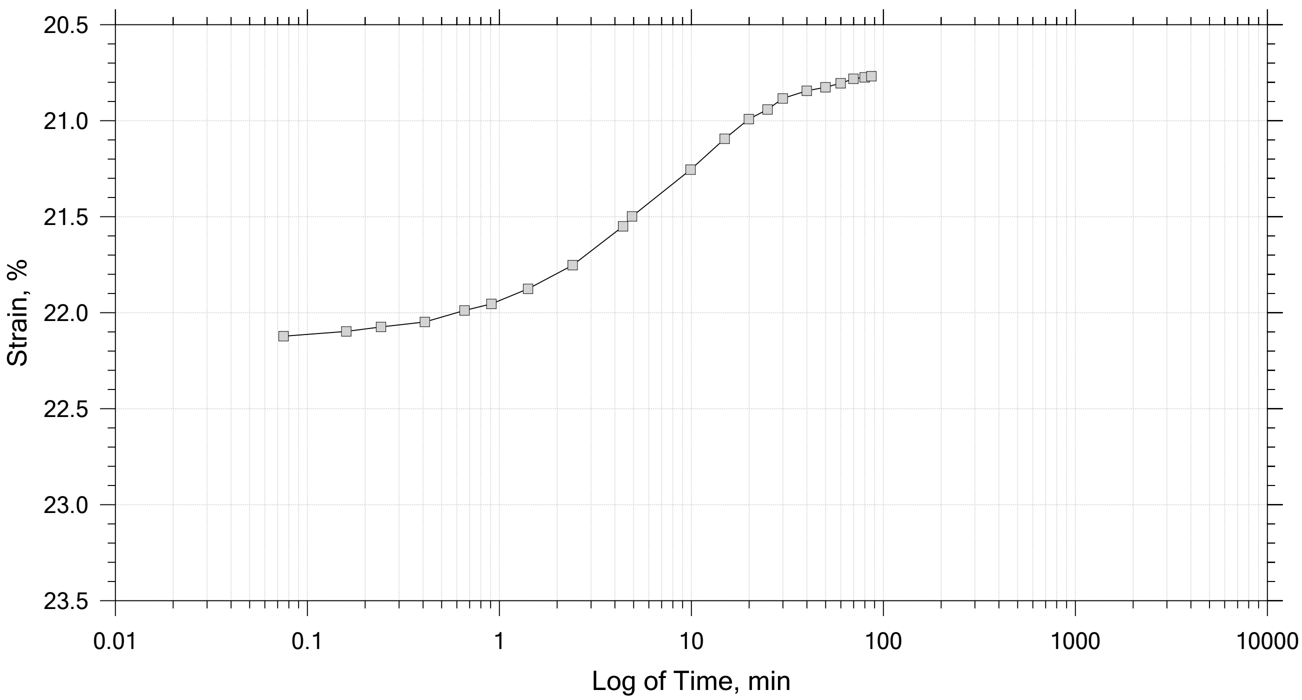


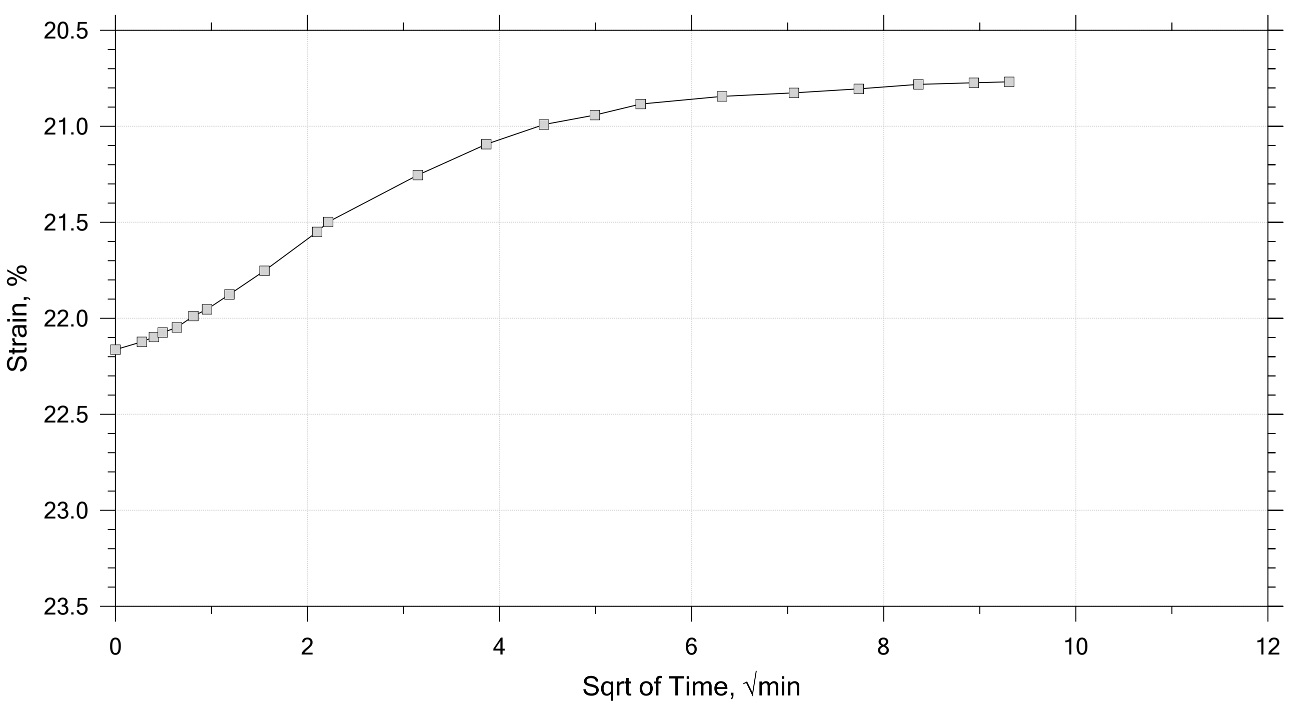


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 10/3/2020	Depth: 13.45
	Test Number: ICON 333	Preparation: Shelby Tube	Elevation: 30.15
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 21 of 21
Constant Load Step
Stress: 759 psf





Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 10/3/2020	Depth: 13.45
	Test Number: ICON 333	Preparation: Shelby Tube	Elevation: 30.15
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Specimen Diameter, in: 2.50	Specific Gravity: 2.78 (Implied)	Liquid Limit: 0
Specimen Height, in: 1.00	Initial Void Ratio: 1.2	Plastic Limit: 0
Final Height, in: 0.80	Final Void Ratio: 0.744	Plasticity Index: 0

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	220	---	"ring"	304
Mass Container, gm	36.71	111.09	111.09	60.7
Mass Container + Wet Soil, gm	139.47	256.86	240.42	189.9
Mass Container + Dry Soil, gm	110.18	213.11	213.11	162.62
Mass Dry Soil, gm	73.47	102.02	102.02	101.92
Water Content, %	39.87	42.88	26.77	26.77
Void Ratio	---	1.20	0.74	---
Degree of Saturation, %	---	99.25	100.00	---
Dry Unit Weight, pcf	---	78.863	99.534	---

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: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 10/3/2020	Depth: 13.45
	Test Number: ICON 333	Preparation: Shelby Tube	Elevation: 30.15
	Description: Gray Silty Clay		
	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	200.	0.003429	1.19	0.341	0.000	0.00e+00	3.41e+04	0.00e+00	0.00e+00
2	300.	0.005053	1.19	0.503	0.000	0.00e+00	3.24e+04	0.00e+00	0.00e+00
3	450.	0.006491	1.19	0.647	0.000	0.00e+00	1.91e+04	0.00e+00	0.00e+00
4	675.	0.007993	1.18	0.796	0.000	0.00e+00	1.33e+04	0.00e+00	0.00e+00
5	1.01e+03	0.01158	1.18	1.15	0.000	0.00e+00	2.12e+04	0.00e+00	0.00e+00
6	1.52e+03	0.01634	1.17	1.63	2.631	1.83e-01	1.87e+04	3.79e-08	0.00e+00
7	3.04e+03	0.05753	1.08	5.73	8.772	5.25e-02	5.40e+04	3.12e-08	0.00e+00
8	6.08e+03	0.1150	0.950	11.5	4.512	9.19e-02	3.77e+04	3.81e-08	0.00e+00
9	1.22e+04	0.1708	0.827	17.0	0.000	0.00e+00	1.83e+04	0.00e+00	0.00e+00
10	3.04e+03	0.1655	0.839	16.5	0.403	8.54e-01	1.16e+03	1.09e-08	0.00e+00
11	1.52e+03	0.1632	0.844	16.3	2.486	1.40e-01	3.04e+03	4.67e-09	0.00e+00
12	759.	0.1592	0.853	15.9	2.455	1.43e-01	1.04e+04	1.64e-08	0.00e+00
13	1.33e+03	0.1583	0.855	15.8	0.000	0.00e+00	-3.10e+03	-0.00e+00	0.00e+00
14	2.66e+03	0.1604	0.850	16.0	0.000	0.00e+00	3.12e+03	0.00e+00	0.00e+00
15	5.32e+03	0.1660	0.838	16.5	0.627	5.55e-01	4.24e+03	2.59e-08	0.00e+00
16	1.06e+04	0.1782	0.811	17.8	0.000	0.00e+00	4.57e+03	0.00e+00	0.00e+00
17	2.13e+04	0.1976	0.768	19.7	1.007	3.26e-01	3.63e+03	1.30e-08	0.00e+00
18	4.25e+04	0.2323	0.692	23.1	0.704	4.36e-01	3.26e+03	1.56e-08	0.00e+00
19	1.06e+04	0.2252	0.708	22.4	0.272	1.09e+00	4.49e+02	5.37e-09	0.00e+00
20	2.66e+03	0.2210	0.717	22.0	0.000	0.00e+00	1.03e+03	0.00e+00	0.00e+00
21	759.	0.2089	0.744	20.8	4.867	6.30e-02	1.27e+04	8.85e-09	0.00e+00

Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 10/3/2020	Depth: 13.45
	Test Number: ICON 333	Preparation: Shelby Tube	Elevation: 30.15
	Description: Gray Silty Clay		
	Remarks:		
	Displacement at End of Primary		

One-Dimensional Consolidation by ASTM D2435 - Method B

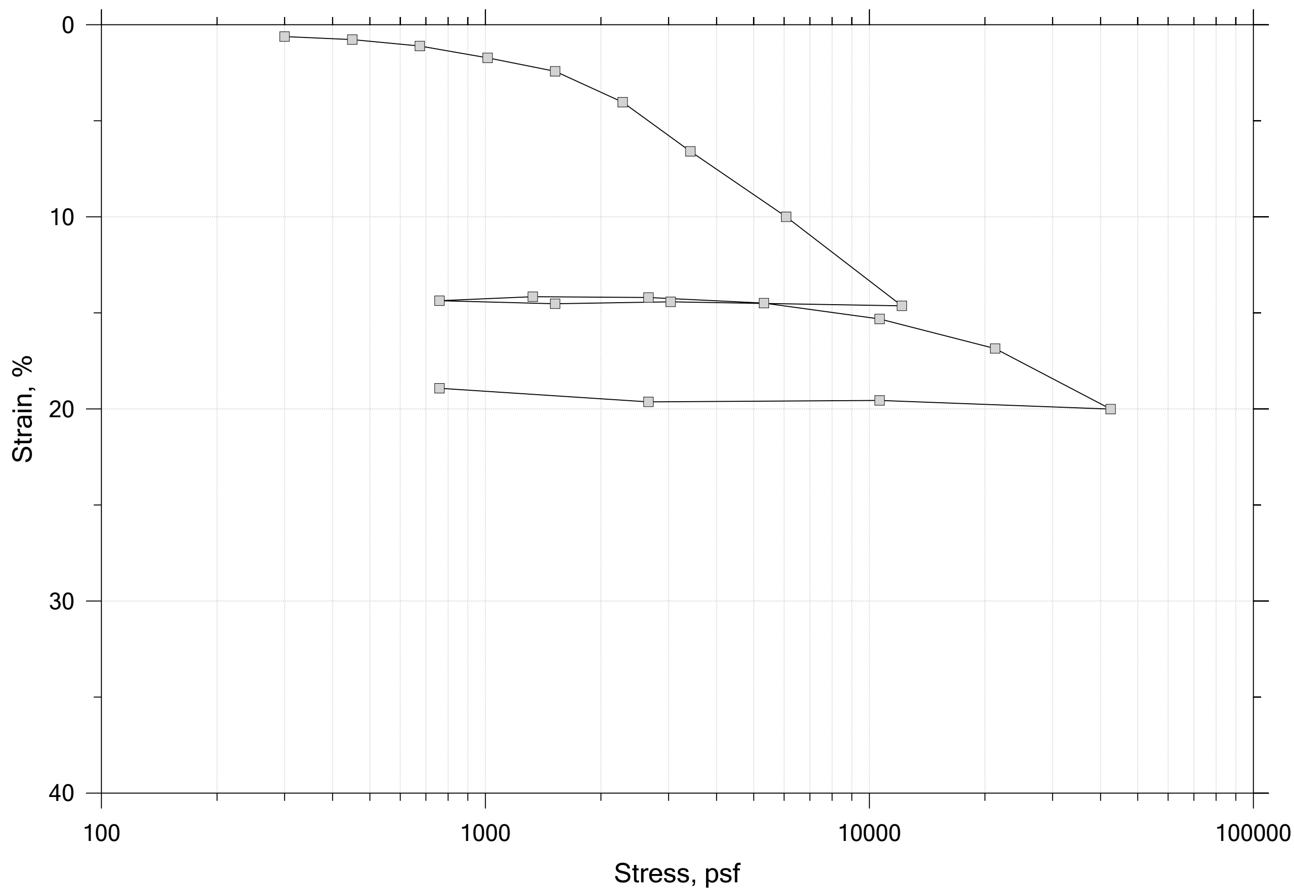
Sqrt of Time Coefficients

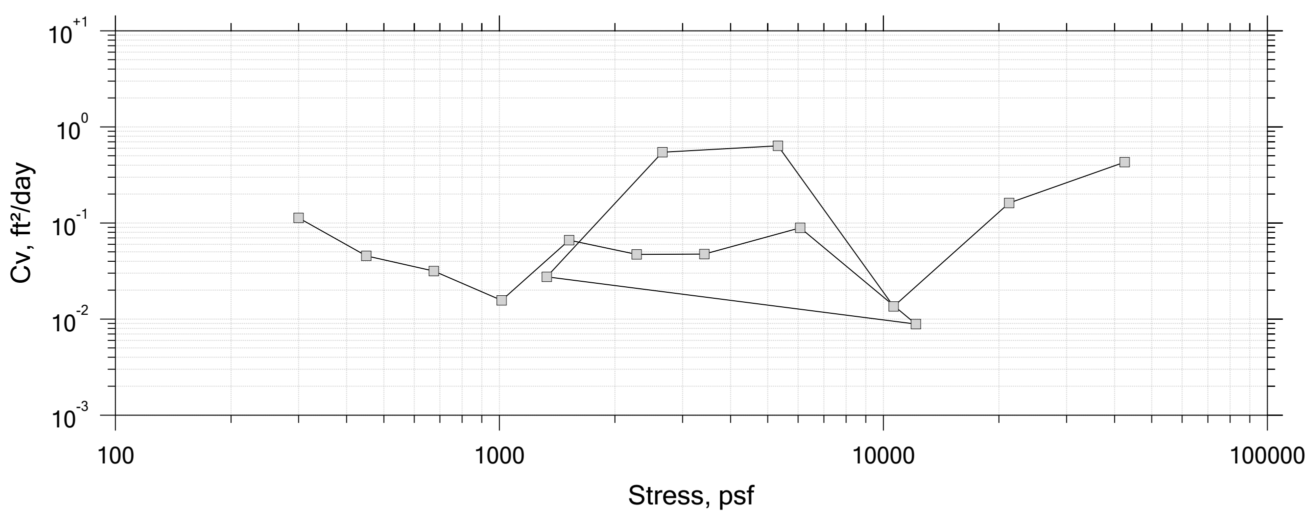
Step	Applied Stress psf	EOP Displacement in	Void Ratio	Strain at End %	Sq.Rt. T90 min	Cv ft²/day	Mv ft²/ton	k cm/s
1	200.	0.003429	1.19	0.341	47.713	4.46e-02	3.41e+04	1.68e-08
2	300.	0.005053	1.19	0.503	0.000	0.00e+00	3.24e+04	0.00e+00
3	450.	0.006491	1.19	0.647	0.000	0.00e+00	1.91e+04	0.00e+00
4	675.	0.007993	1.18	0.796	6.266	3.36e-01	1.33e+04	4.92e-08
5	1.01e+03	0.01158	1.18	1.15	69.501	3.02e-02	2.12e+04	7.03e-09
6	1.52e+03	0.01634	1.17	1.63	20.678	1.00e-01	1.87e+04	2.07e-08
7	3.04e+03	0.05753	1.08	5.73	34.933	5.68e-02	5.40e+04	3.38e-08
8	6.08e+03	0.1150	0.950	11.5	22.481	7.94e-02	3.77e+04	3.29e-08
9	1.22e+04	0.1708	0.827	17.0	178.962	8.78e-03	1.83e+04	1.77e-09
10	3.04e+03	0.1655	0.839	16.5	2.084	7.11e-01	1.16e+03	9.05e-09
11	1.52e+03	0.1632	0.844	16.3	13.399	1.12e-01	3.04e+03	3.73e-09
12	759.	0.1592	0.853	15.9	18.915	7.96e-02	1.04e+04	9.13e-09
13	1.33e+03	0.1583	0.855	15.8	4.778	3.17e-01	-3.10e+03	-1.08e-08
14	2.66e+03	0.1604	0.850	16.0	4.153	3.64e-01	3.12e+03	1.25e-08
15	5.32e+03	0.1660	0.838	16.5	3.065	4.89e-01	4.24e+03	2.28e-08
16	1.06e+04	0.1782	0.811	17.8	1708.939	8.58e-04	4.57e+03	4.32e-11
17	2.13e+04	0.1976	0.768	19.7	7.467	1.89e-01	3.63e+03	7.55e-09
18	4.25e+04	0.2323	0.692	23.1	2.898	4.55e-01	3.26e+03	1.63e-08
19	1.06e+04	0.2252	0.708	22.4	1.537	8.29e-01	4.49e+02	4.10e-09
20	2.66e+03	0.2210	0.717	22.0	5.334	2.42e-01	1.03e+03	2.76e-09
21	759.	0.2089	0.744	20.8	26.949	4.90e-02	1.27e+04	6.88e-09

Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 10/3/2020	Depth: 13.45
	Test Number: ICON 333	Preparation: Shelby Tube	Elevation: 30.15
	Description: Gray Silty Clay		
	Remarks:		
	Displacement at End of Primary		

One-Dimensional Consolidation by ASTM D2435 - Method B

Summary Report

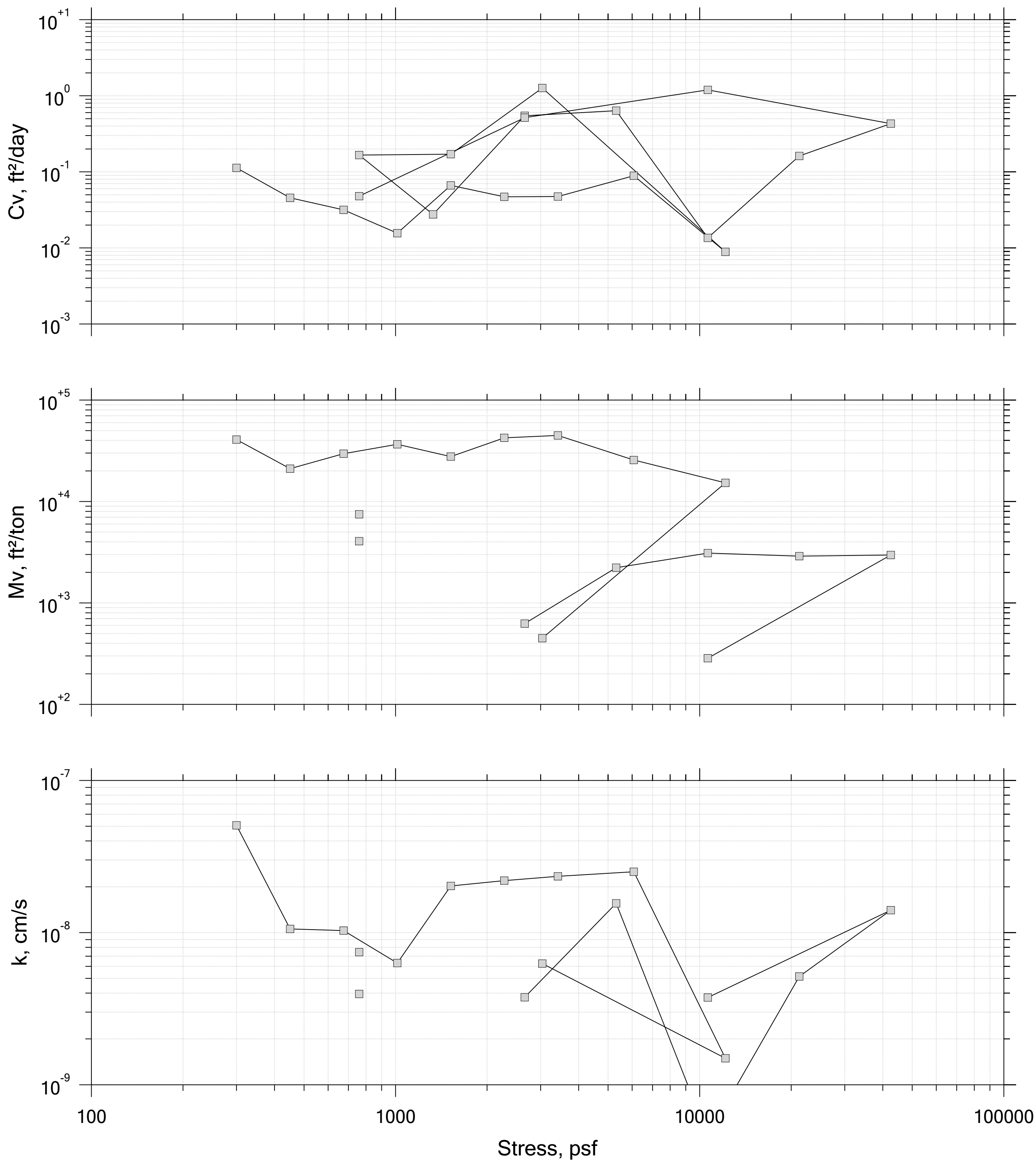




Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/5/2020	Depth: 13.2
	Test Number: ICON 338	Preparation: Shelby Tube	Elevation: 30.4
	Description: Gray Silty Clay		
	Remarks: second test		
	Displacement at End of Primary		

One-Dimensional Consolidation by ASTM D2435 - Method B

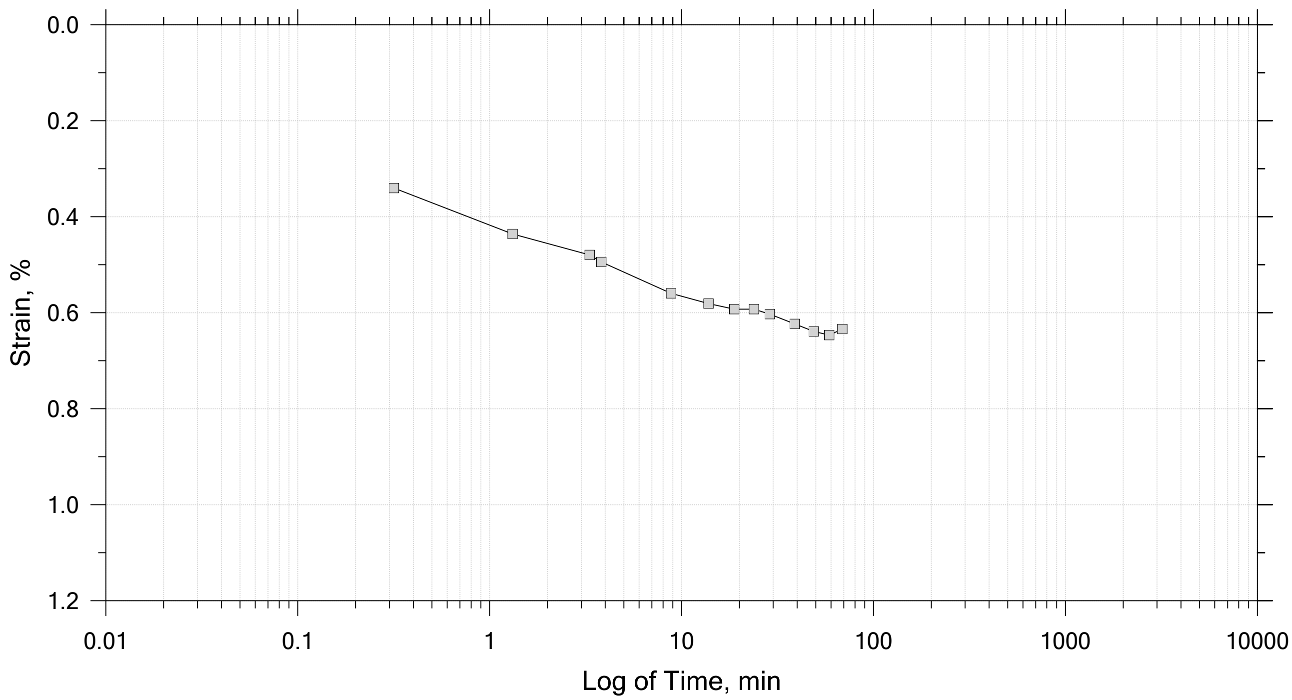
Sqrt of Time Coefficients

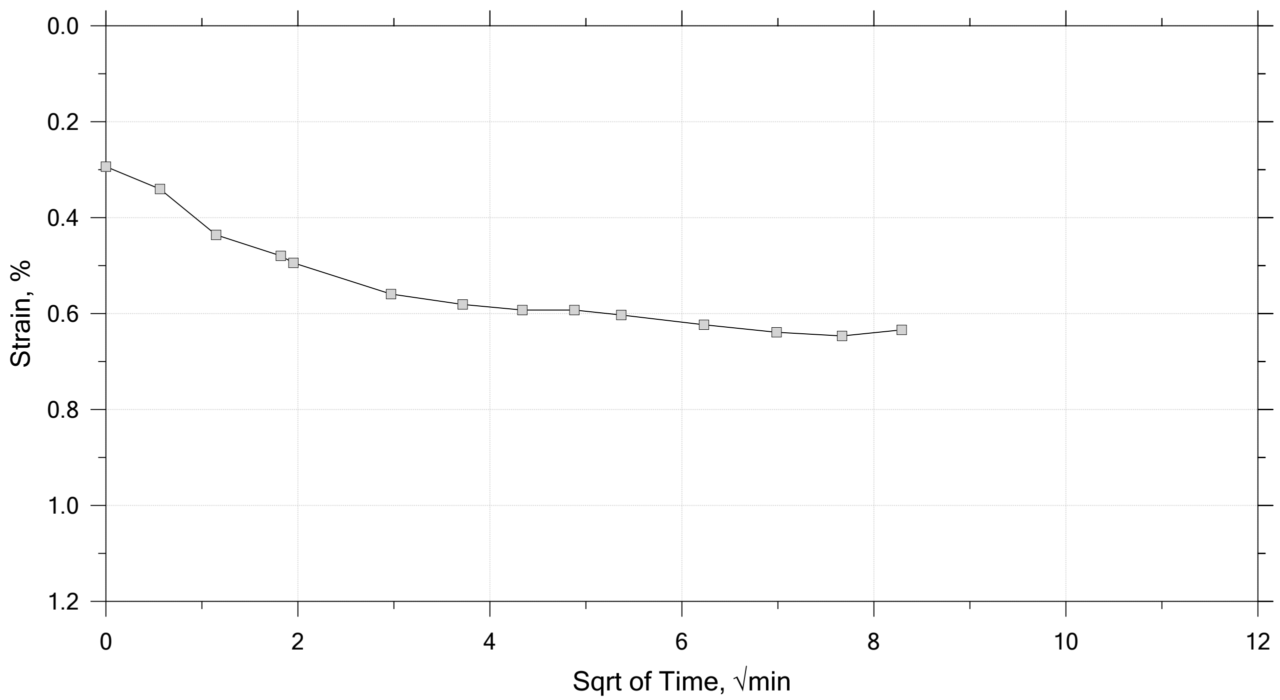


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/5/2020	Depth: 13.2
	Test Number: ICON 338	Preparation: Shelby Tube	Elevation: 30.4
	Description: Gray Silty Clay		
	Remarks: second test		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 1 of 21
Constant Load Step
Stress: 300 psf

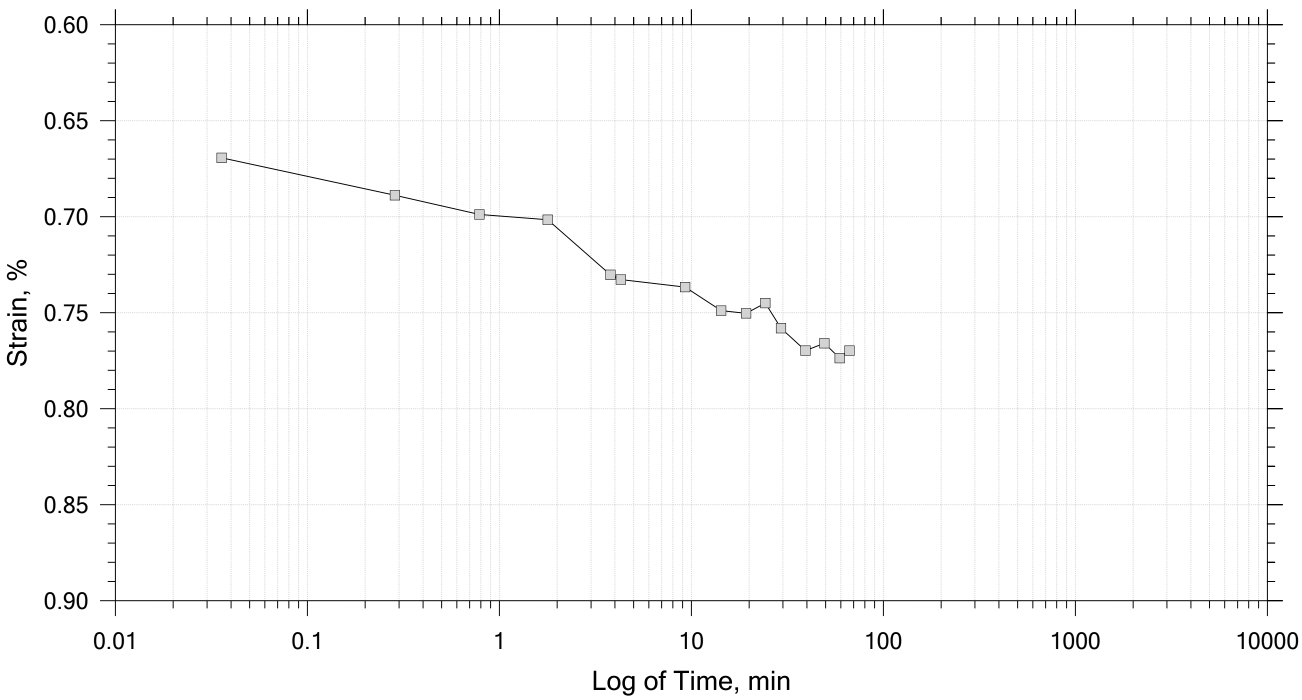


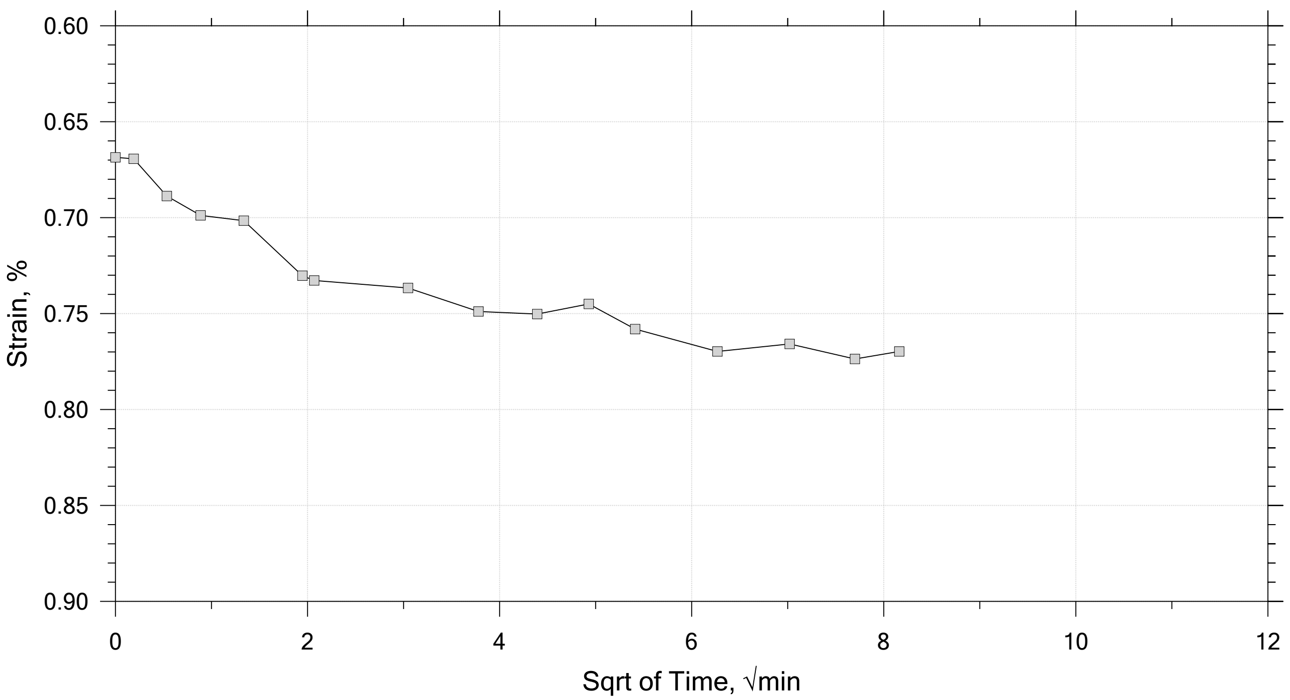


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/5/2020	Depth: 13.2
	Test Number: ICON 338	Preparation: Shelby Tube	Elevation: 30.4
	Description: Gray Silty Clay		
	Remarks: second test		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 2 of 21
Constant Load Step
Stress: 450 psf

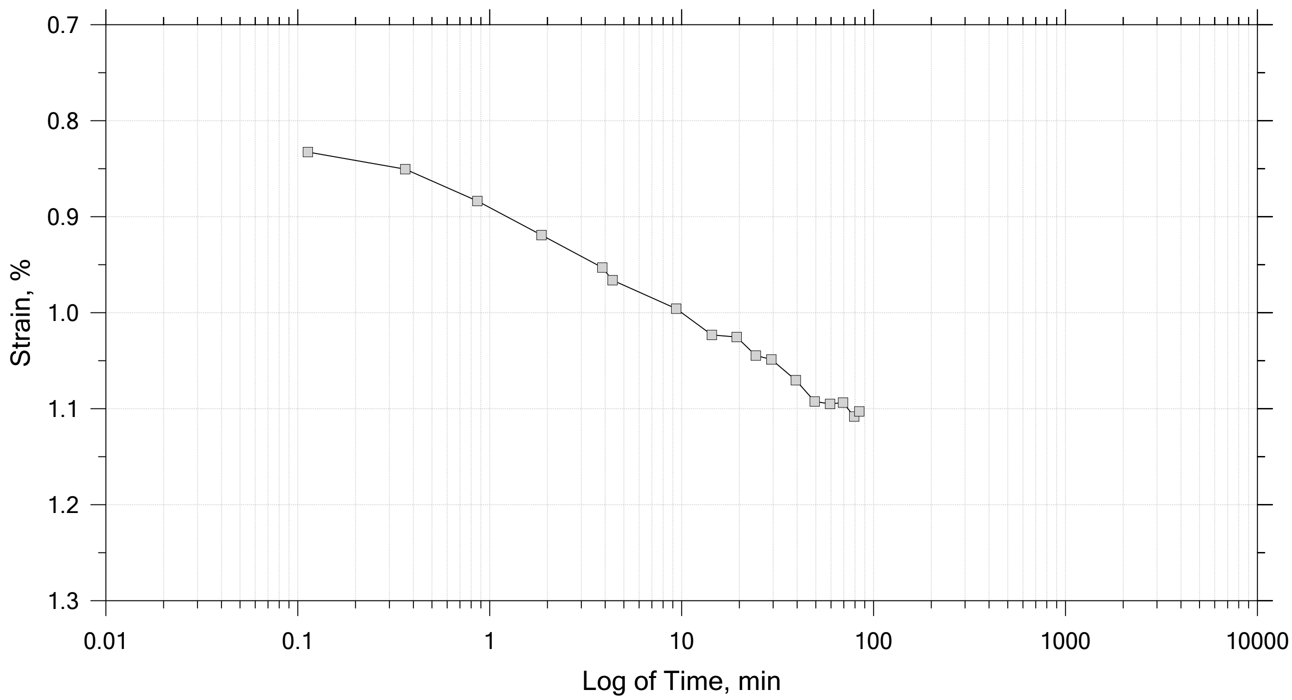


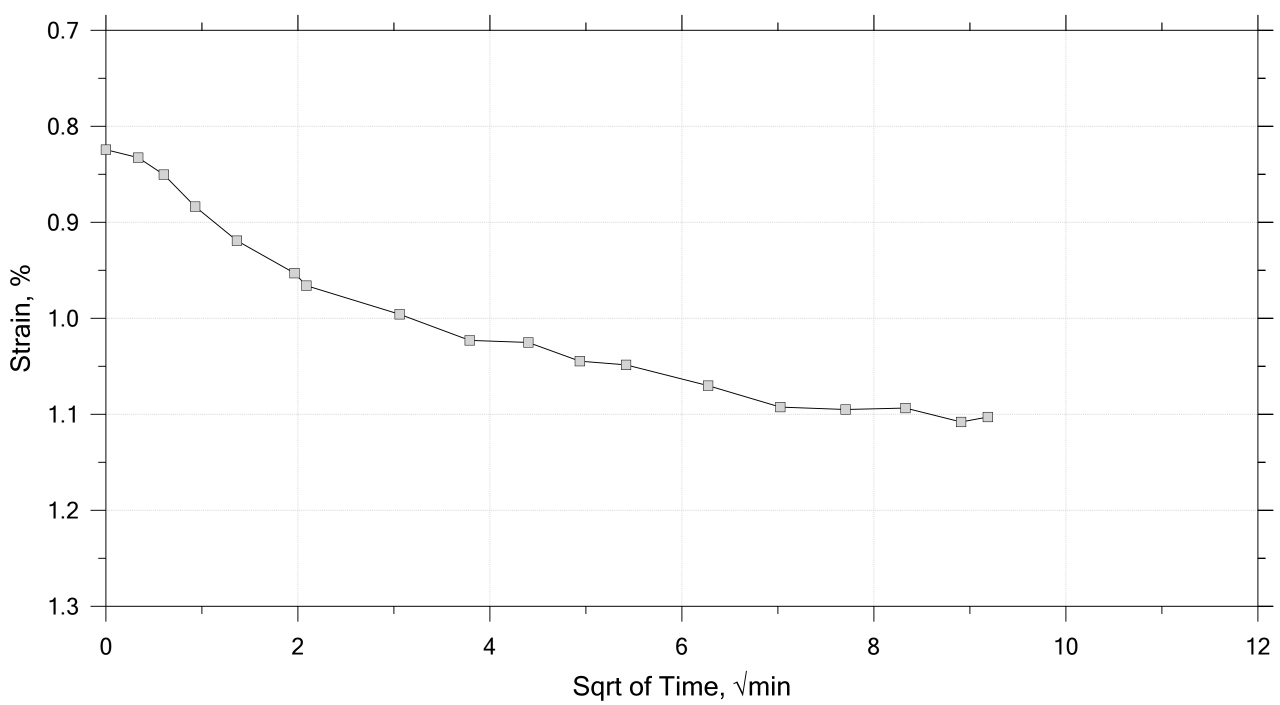


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/5/2020	Depth: 13.2
	Test Number: ICON 338	Preparation: Shelby Tube	Elevation: 30.4
	Description: Gray Silty Clay		
	Remarks: second test		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 3 of 21
Constant Load Step
Stress: 675 psf





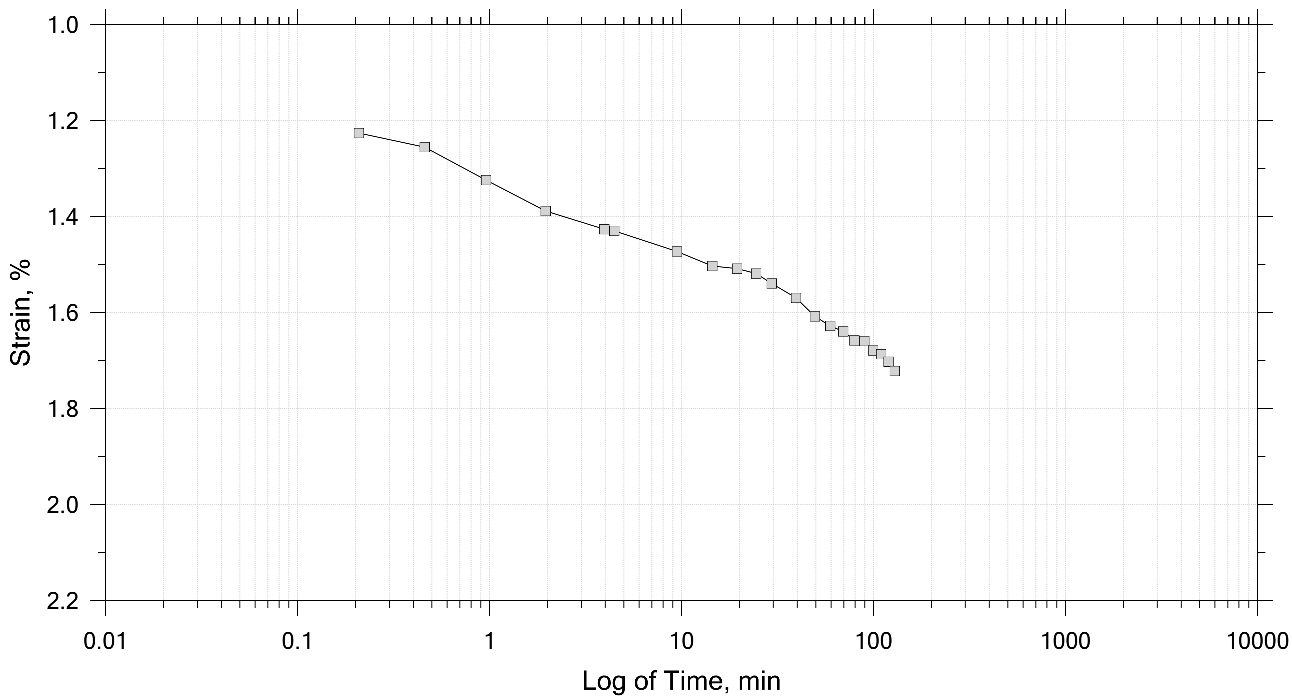
Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/5/2020	Depth: 13.2
	Test Number: ICON 338	Preparation: Shelby Tube	Elevation: 30.4
	Description: Gray Silty Clay		
	Remarks: second test		

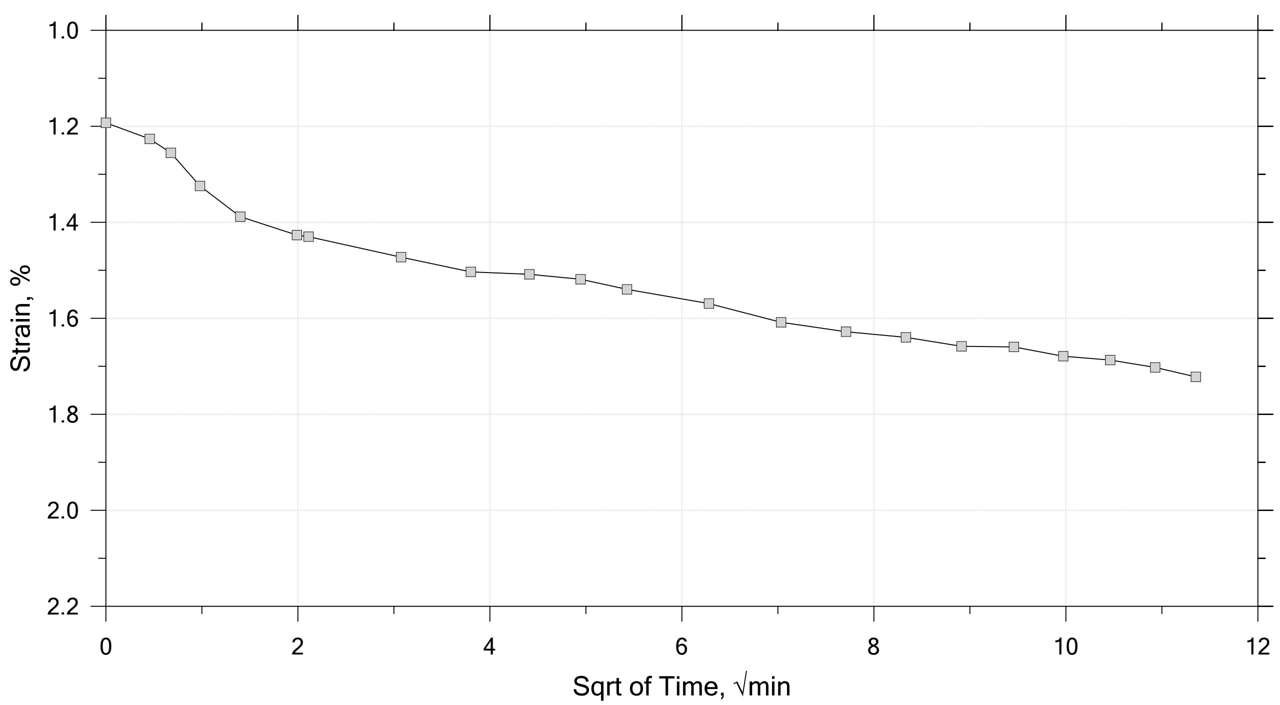
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 4 of 21

Constant Load Step

Stress: 1.01e+03 psf





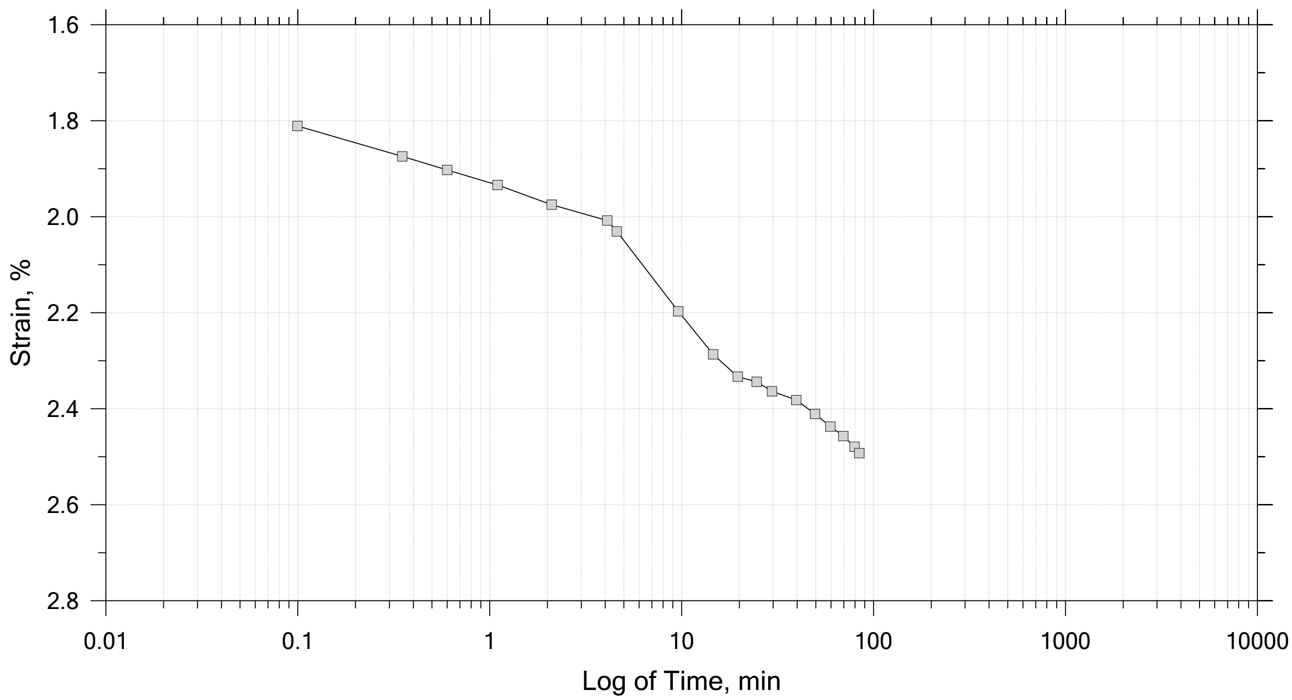
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/5/2020	Depth: 13.2
	Test Number: ICON 338	Preparation: Shelby Tube	Elevation: 30.4
	Description: Gray Silty Clay		
	Remarks: second test		

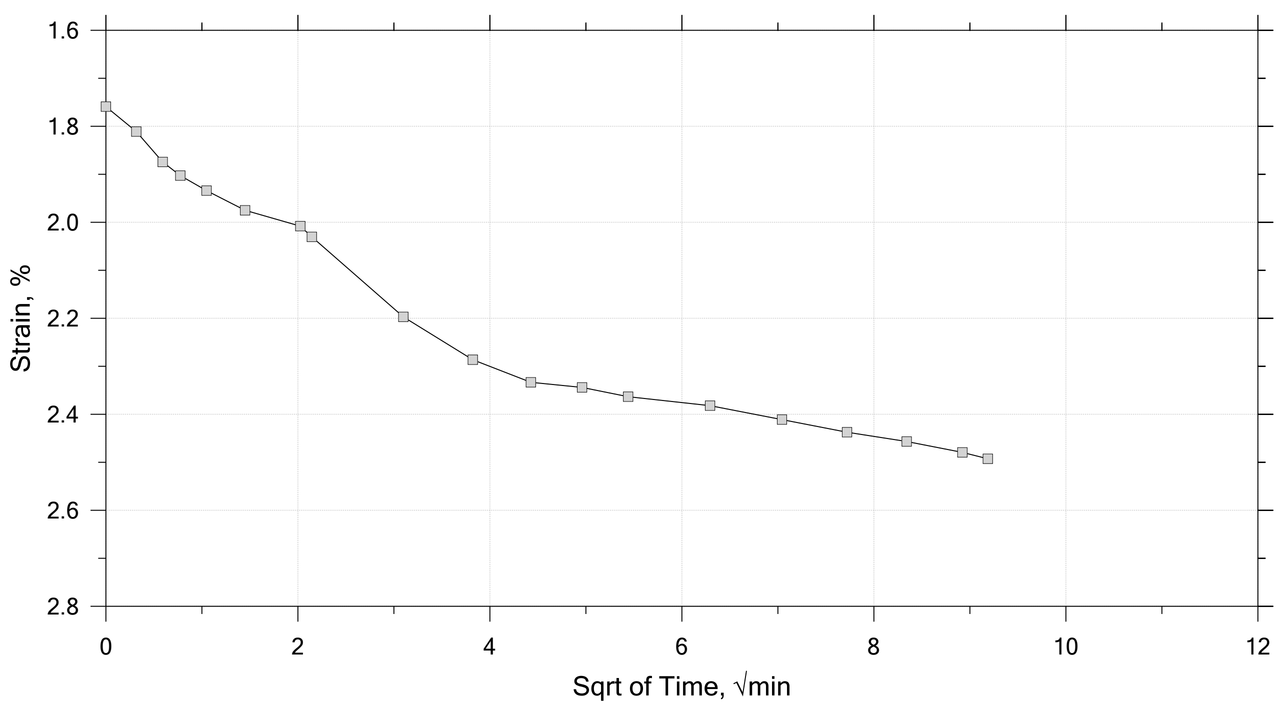
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 5 of 21

Constant Load Step

Stress: 1.52e+03 psf





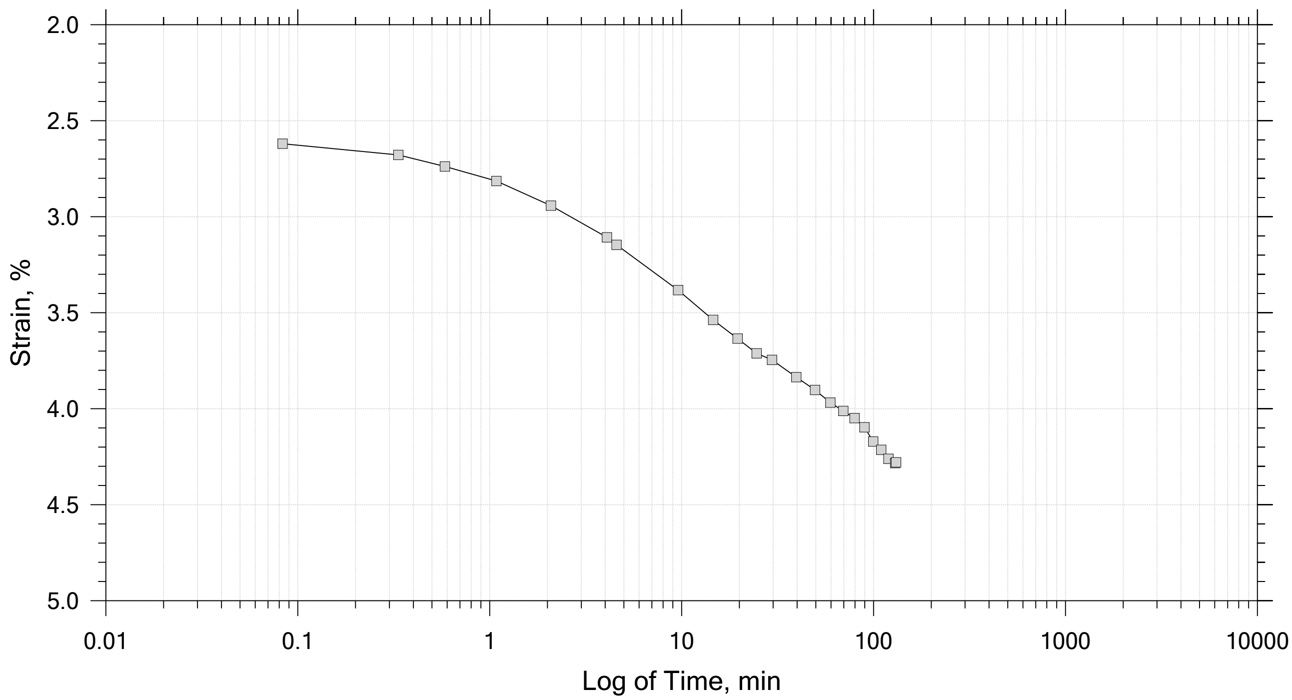
Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/5/2020	Depth: 13.2
	Test Number: ICON 338	Preparation: Shelby Tube	Elevation: 30.4
	Description: Gray Silty Clay		
	Remarks: second test		

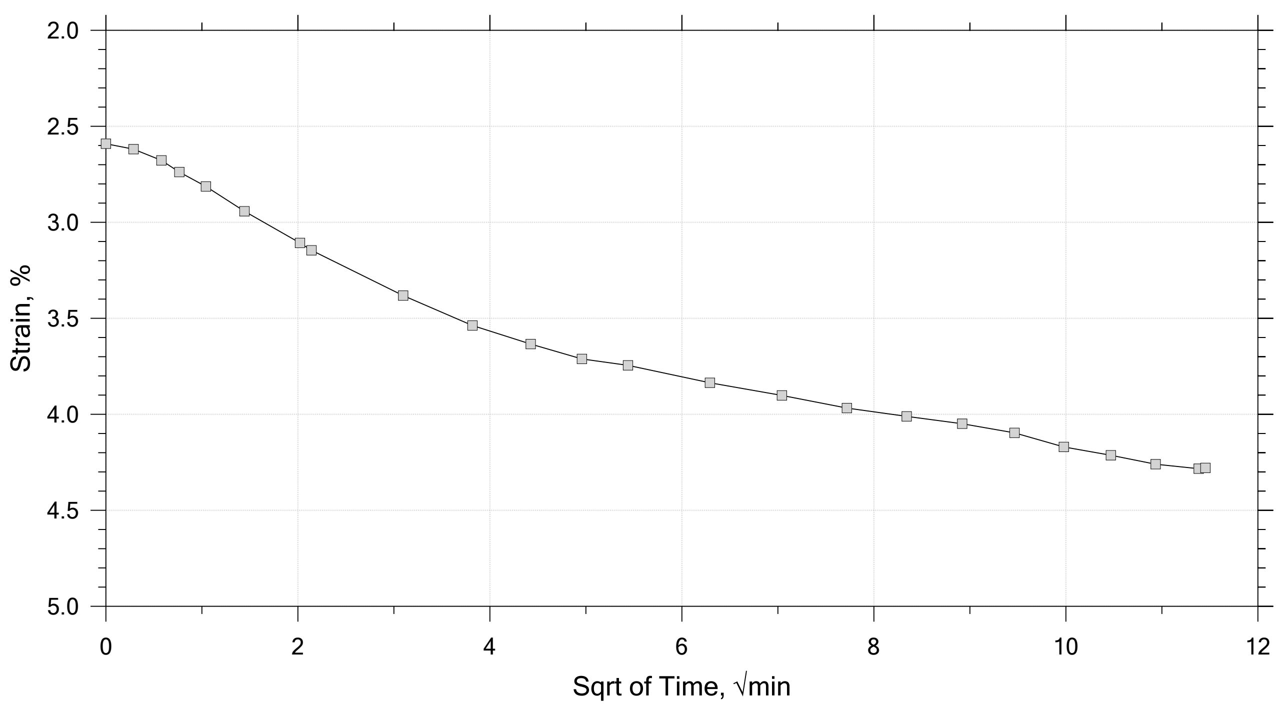
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 6 of 21

Constant Load Step

Stress: 2.28e+03 psf





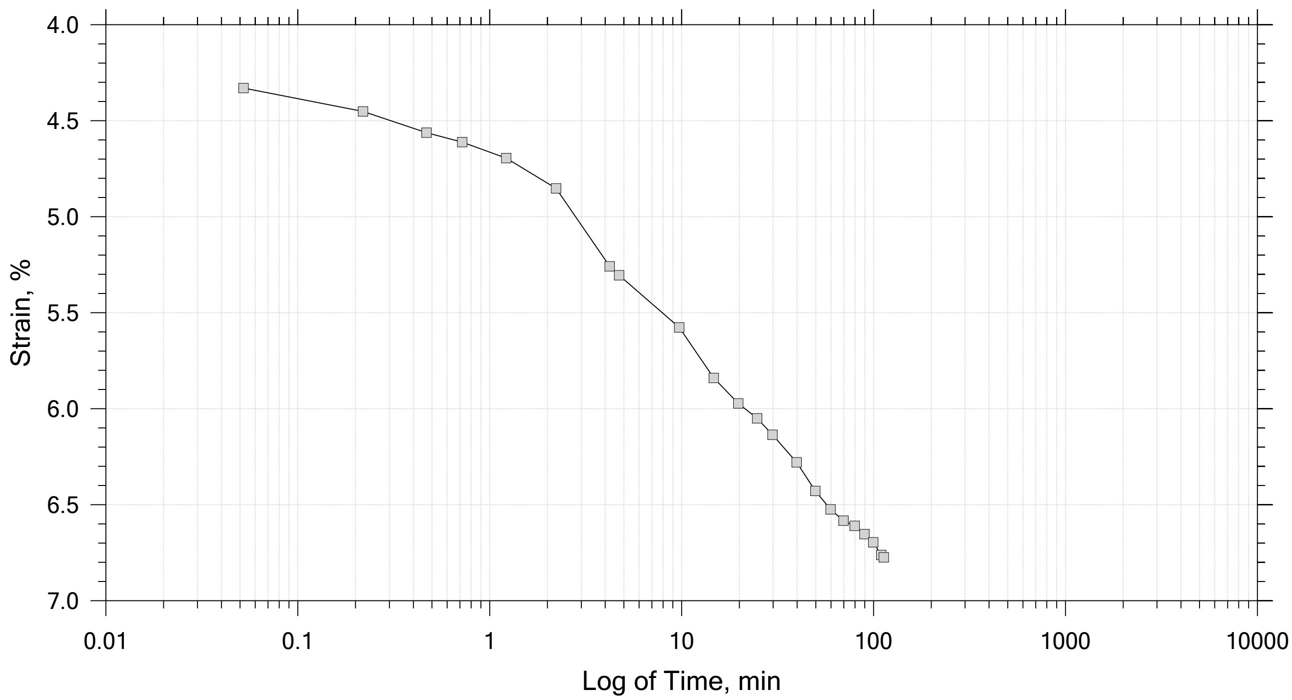
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/5/2020	Depth: 13.2
	Test Number: ICON 338	Preparation: Shelby Tube	Elevation: 30.4
	Description: Gray Silty Clay		
	Remarks: second test		

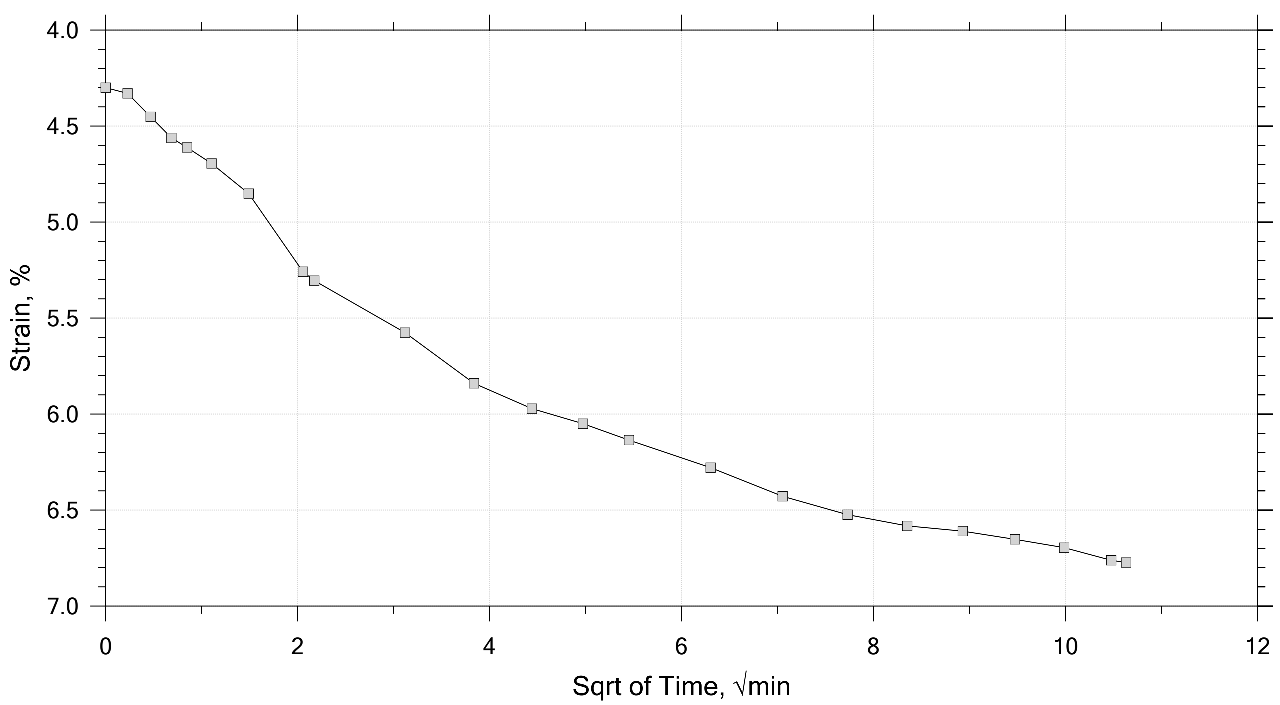
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 7 of 21

Constant Load Step

Stress: 3.42e+03 psf





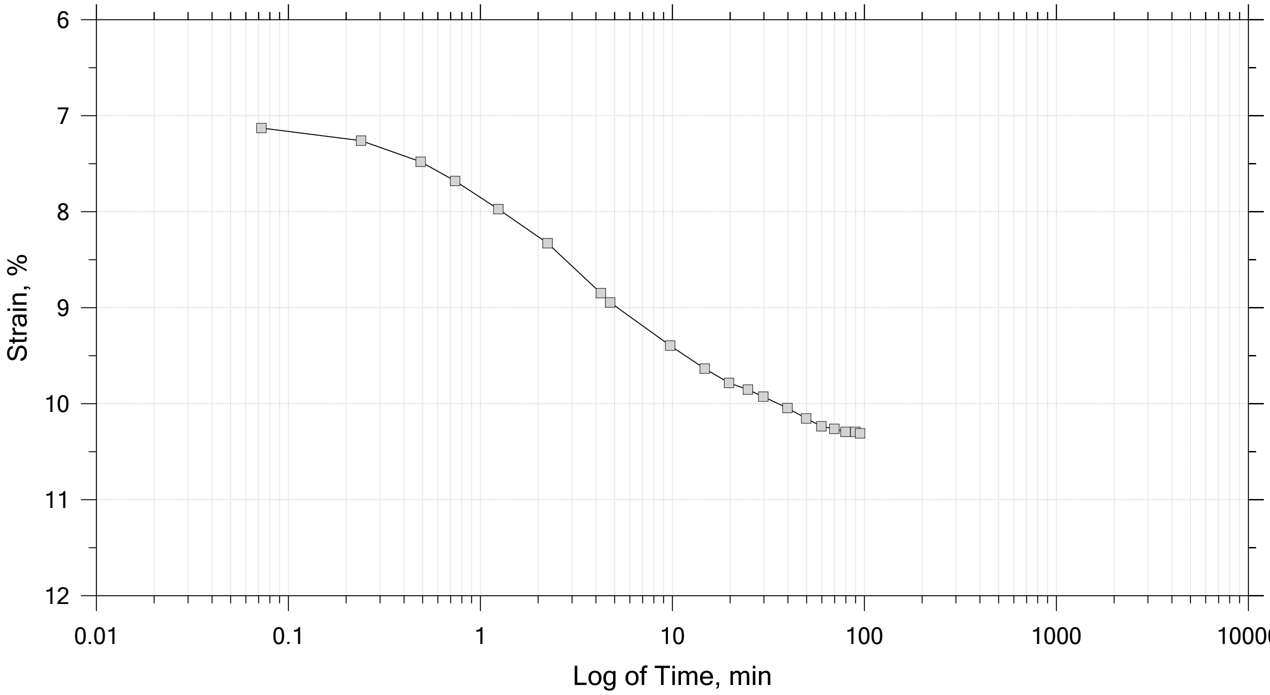
Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/5/2020	Depth: 13.2
	Test Number: ICON 338	Preparation: Shelby Tube	Elevation: 30.4
	Description: Gray Silty Clay		
	Remarks: second test		

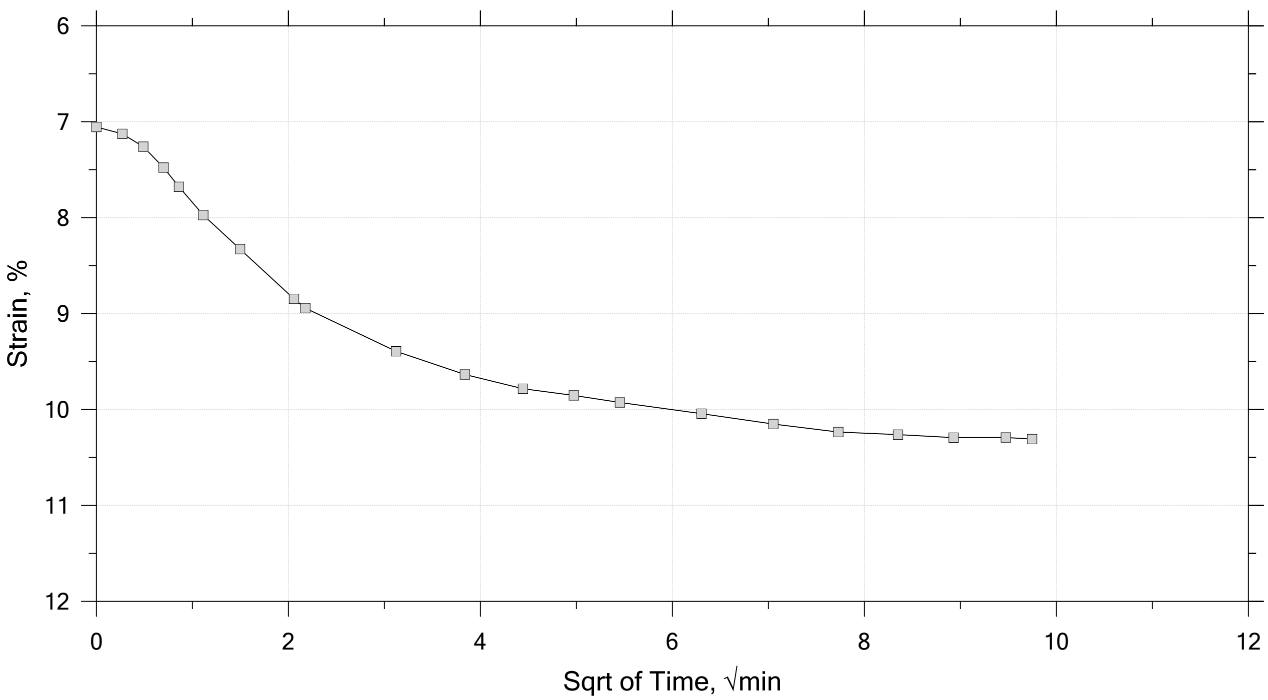
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 8 of 21

Constant Load Step

Stress: 6.08e+03 psf





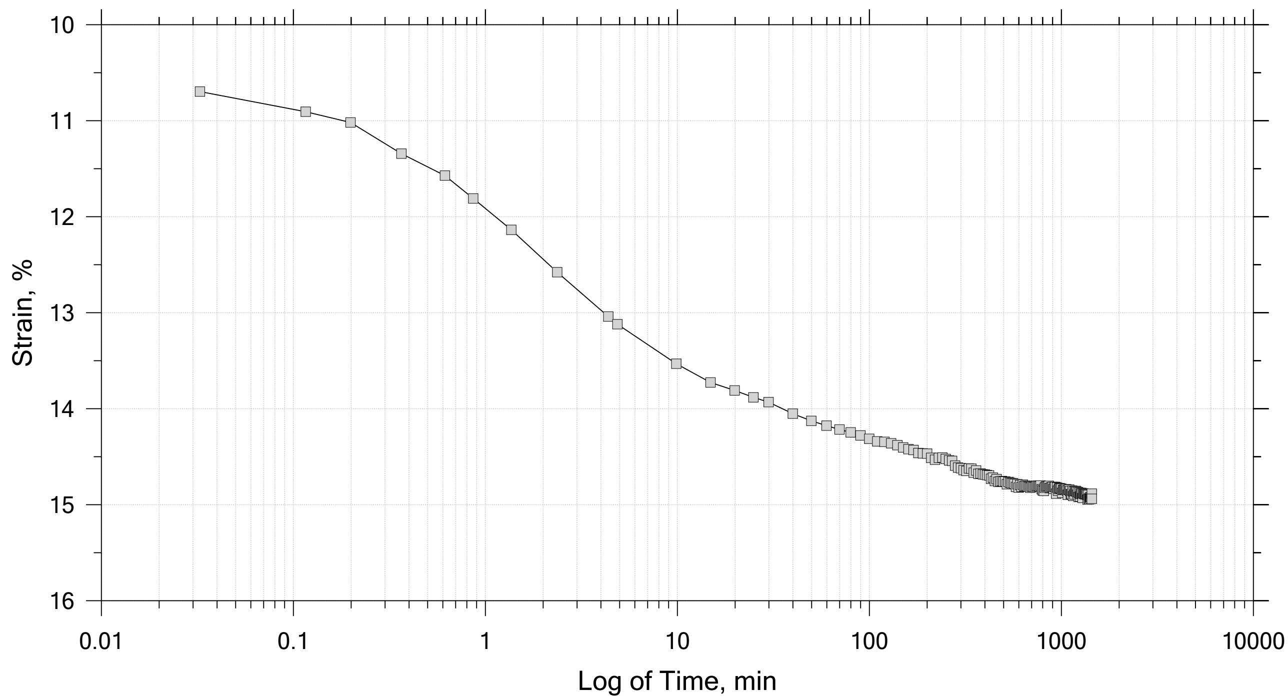
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/5/2020	Depth: 13.2
	Test Number: ICON 338	Preparation: Shelby Tube	Elevation: 30.4
	Description: Gray Silty Clay		
	Remarks: second test		

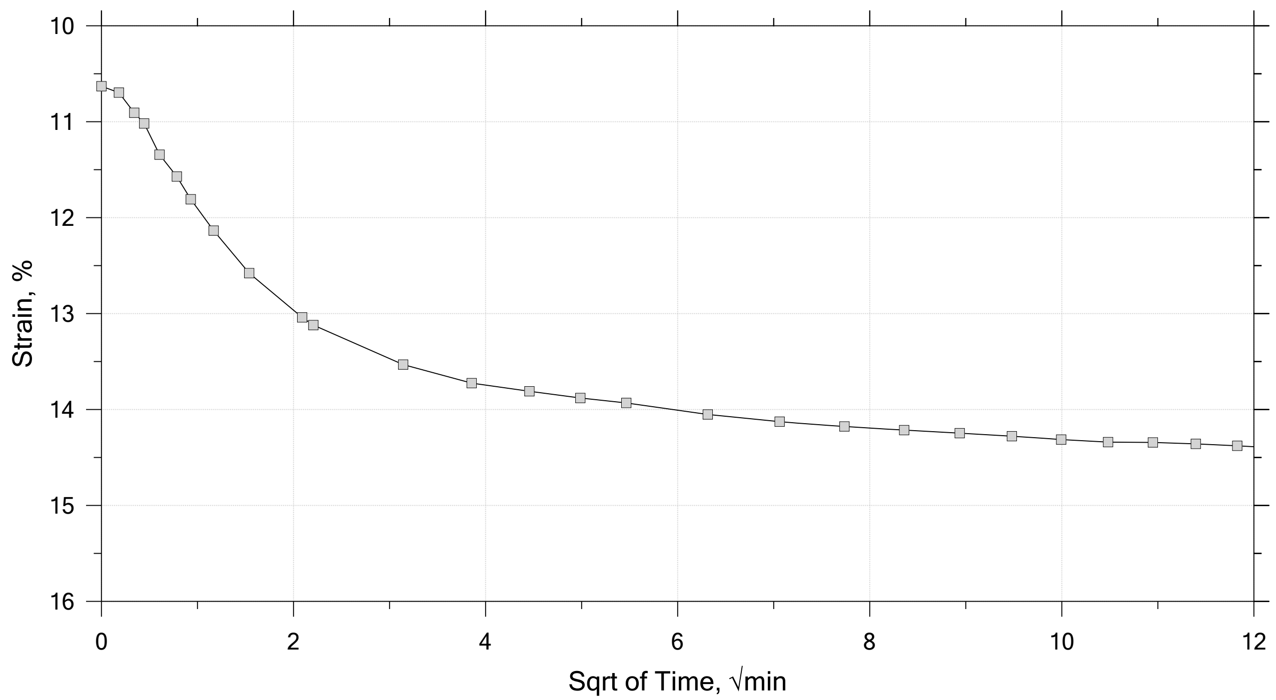
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 9 of 21

Constant Load Step

Stress: 1.22e+04 psf

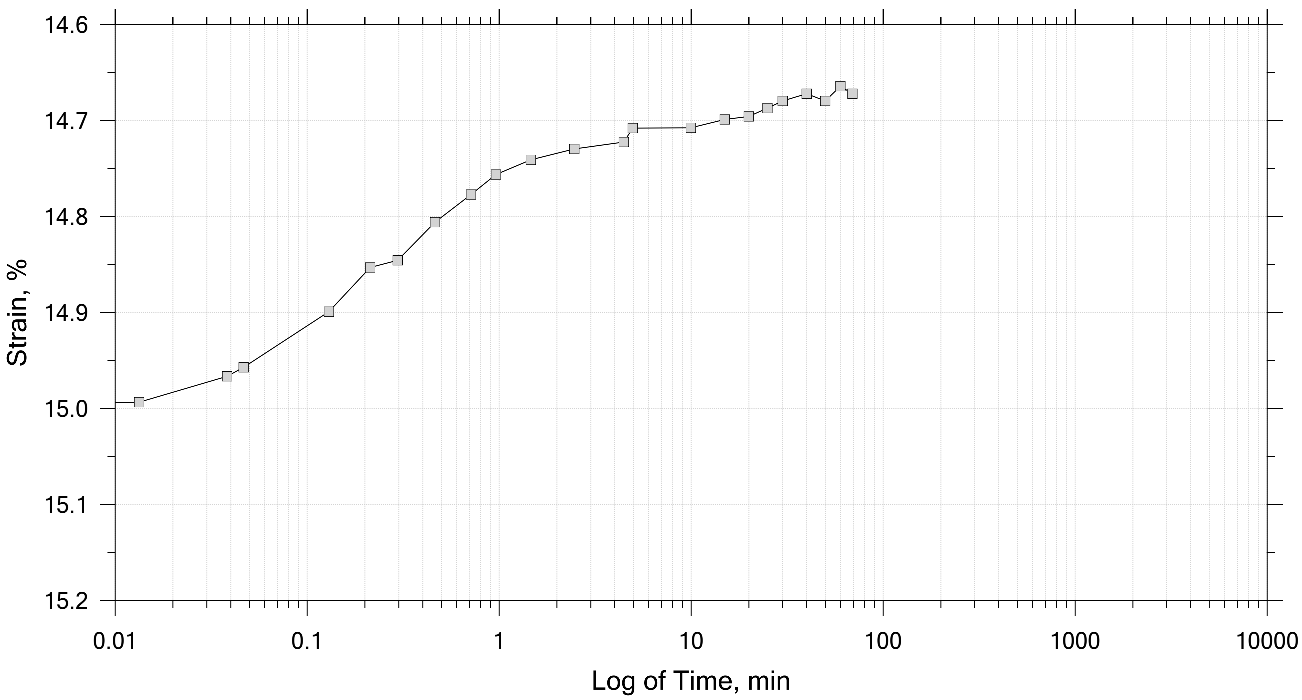


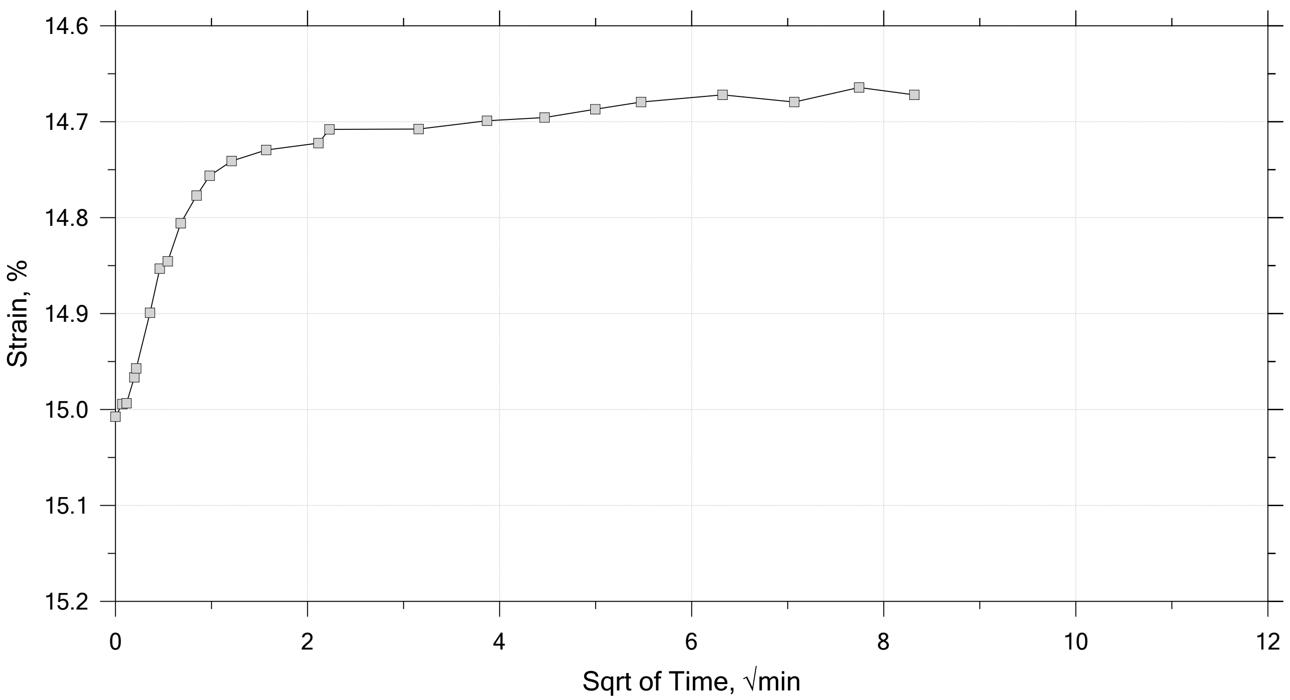


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/5/2020	Depth: 13.2
	Test Number: ICON 338	Preparation: Shelby Tube	Elevation: 30.4
	Description: Gray Silty Clay		
	Remarks: second test		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 10 of 21
Constant Load Step
Stress: 3.04e+03 psf





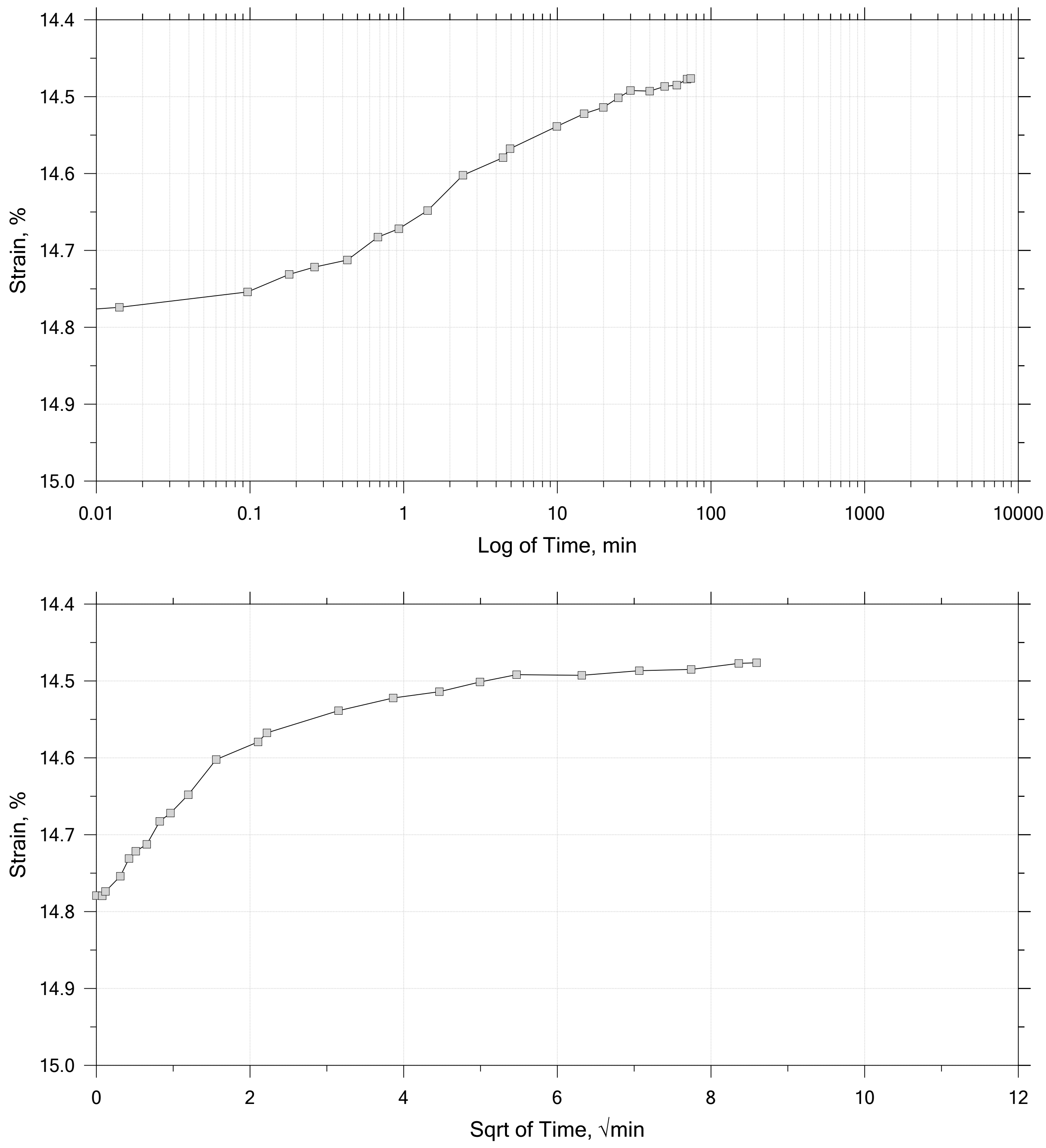
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
Soil Metrics LLC	Sample Number: 1U	Test Date: 11/5/2020	Depth: 13.2
	Test Number: ICON 338	Preparation: Shelby Tube	Elevation: 30.4
	Description: Gray Silty Clay		
	Remarks: second test		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 11 of 21

Constant Load Step

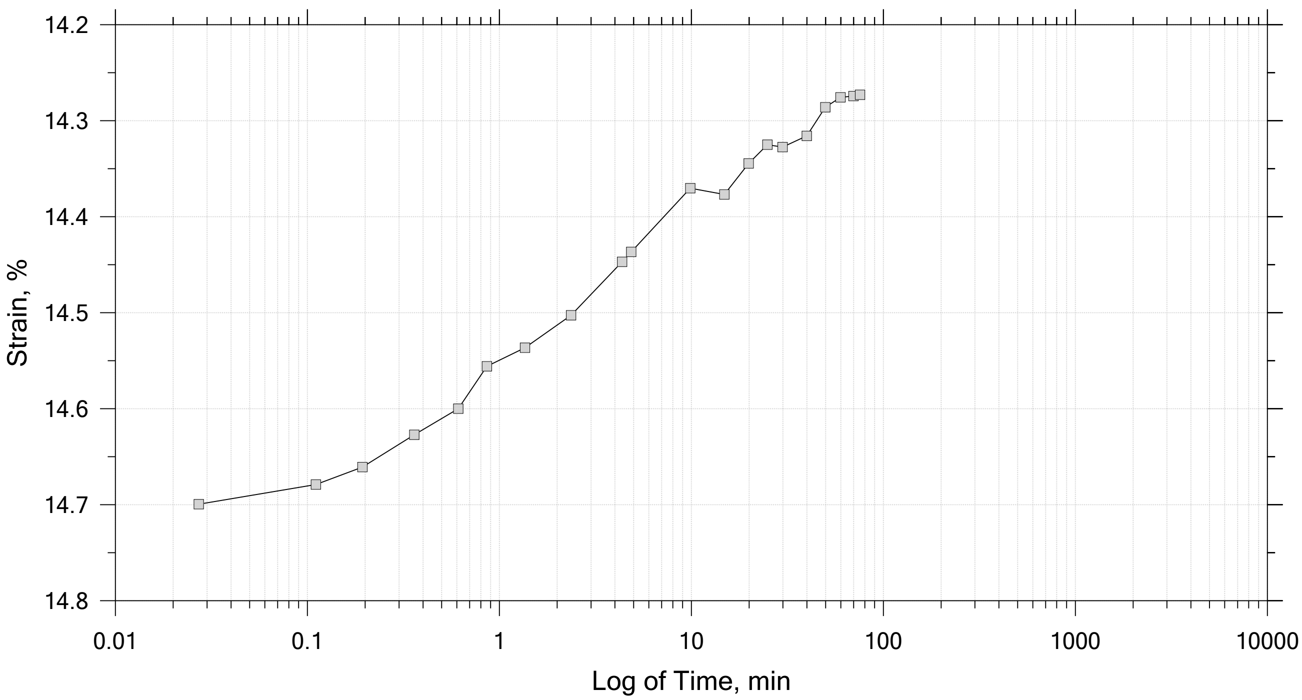
Stress: 1.52e+03 psf

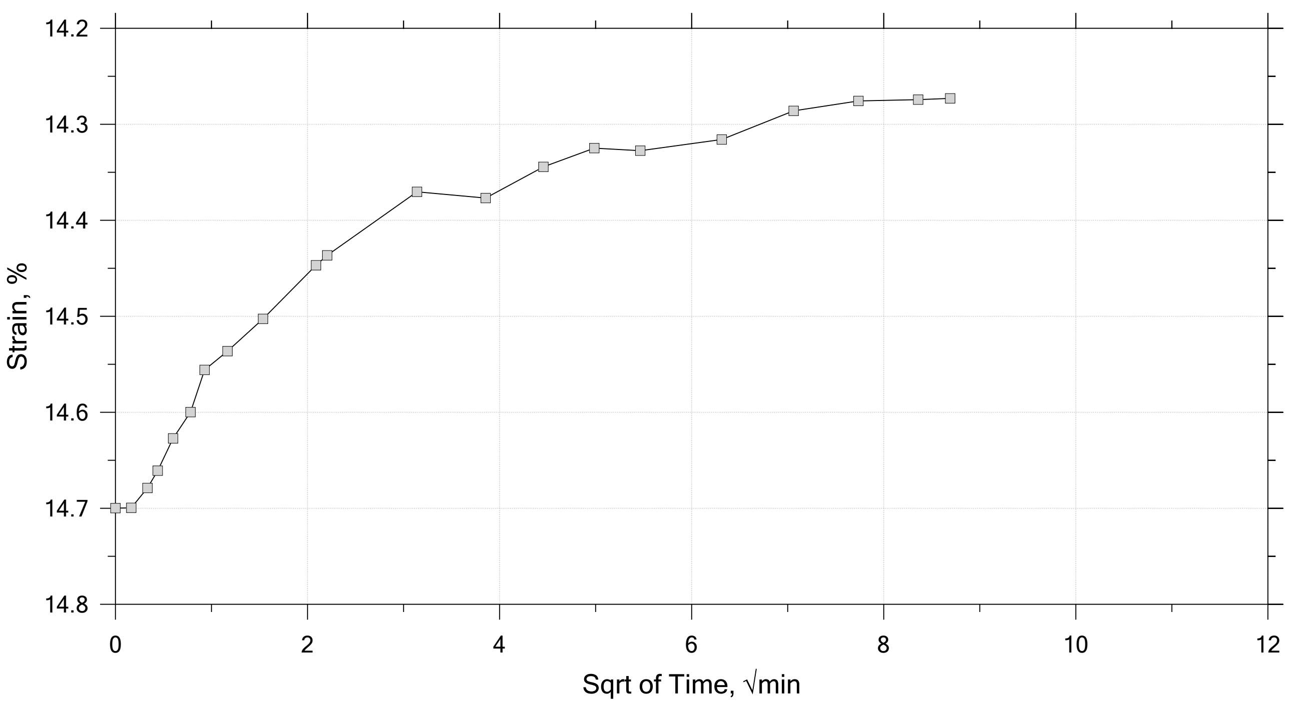


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/5/2020	Depth: 13.2
	Test Number: ICON 338	Preparation: Shelby Tube	Elevation: 30.4
	Description: Gray Silty Clay		
	Remarks: second test		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 12 of 21
Constant Load Step
Stress: 759 psf

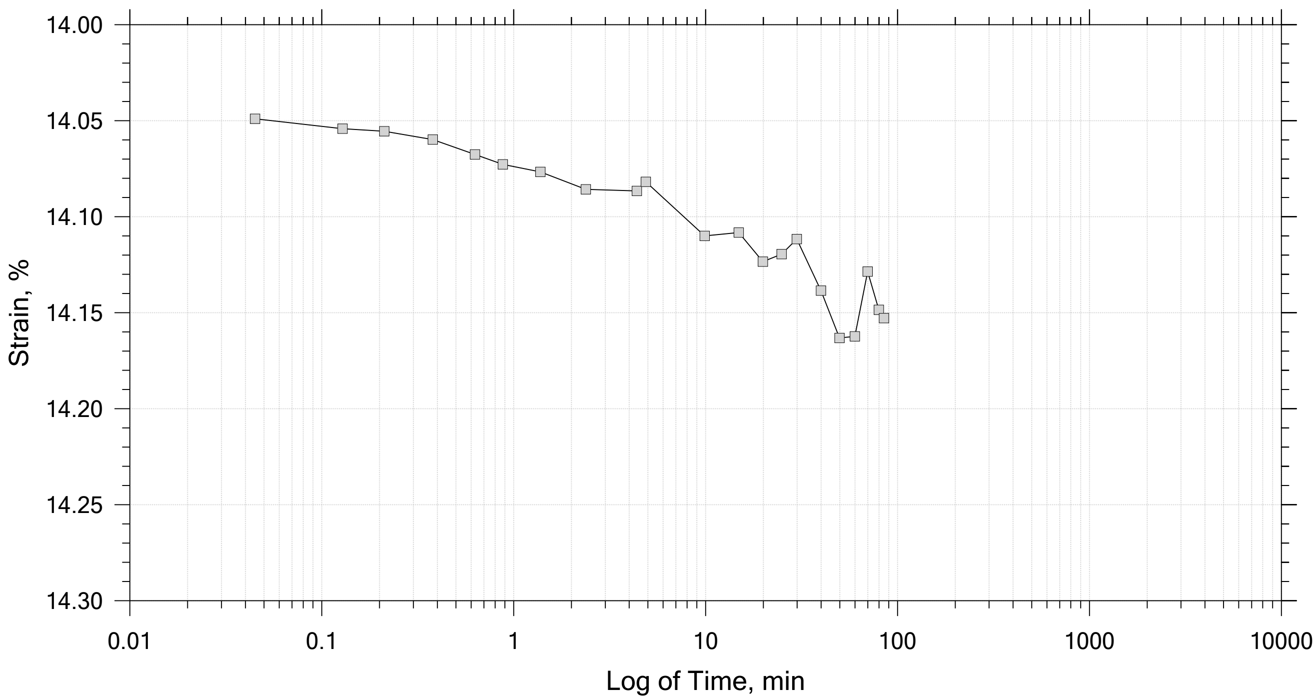


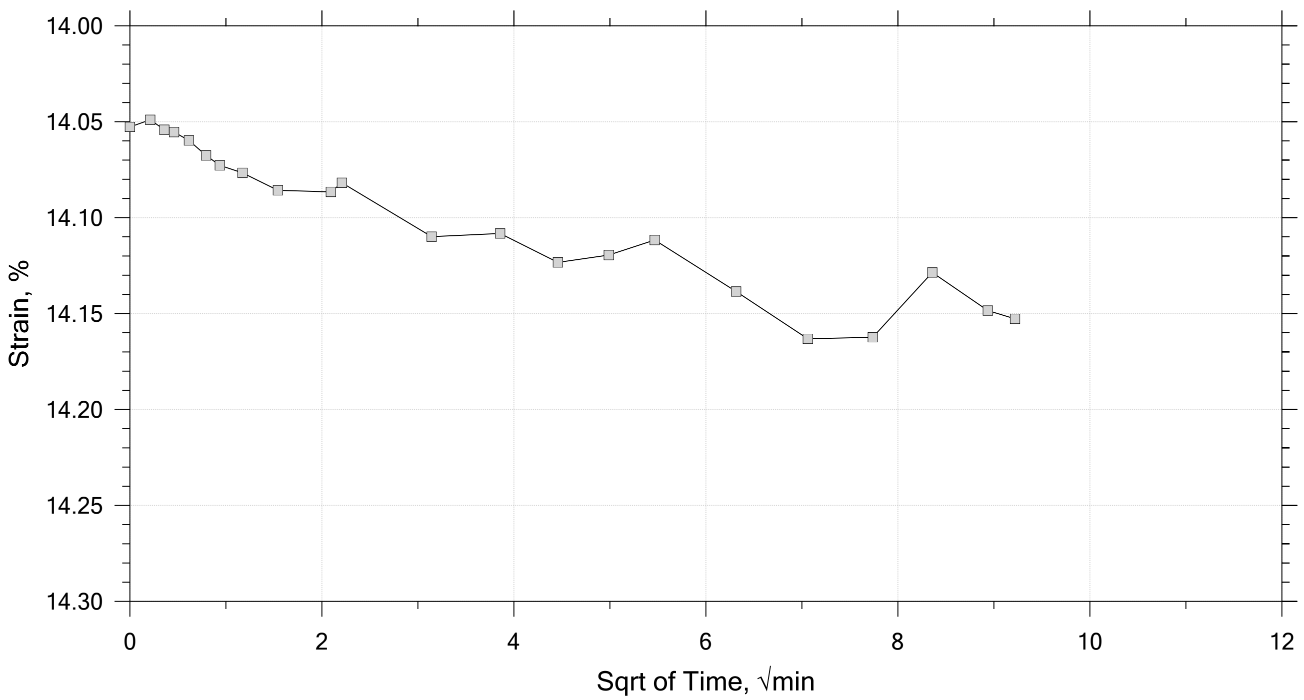


Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/5/2020	Depth: 13.2
	Test Number: ICON 338	Preparation: Shelby Tube	Elevation: 30.4
	Description: Gray Silty Clay		
	Remarks: second test		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 13 of 21
Constant Load Step
Stress: 1.33e+03 psf

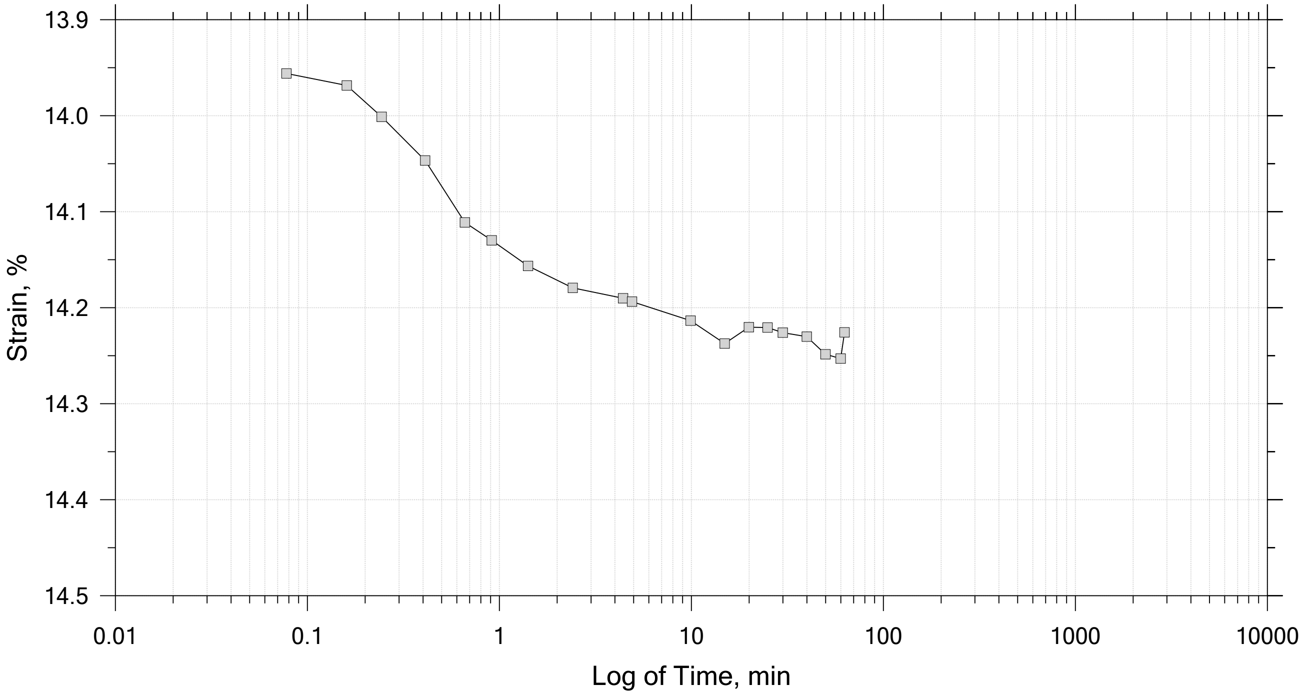


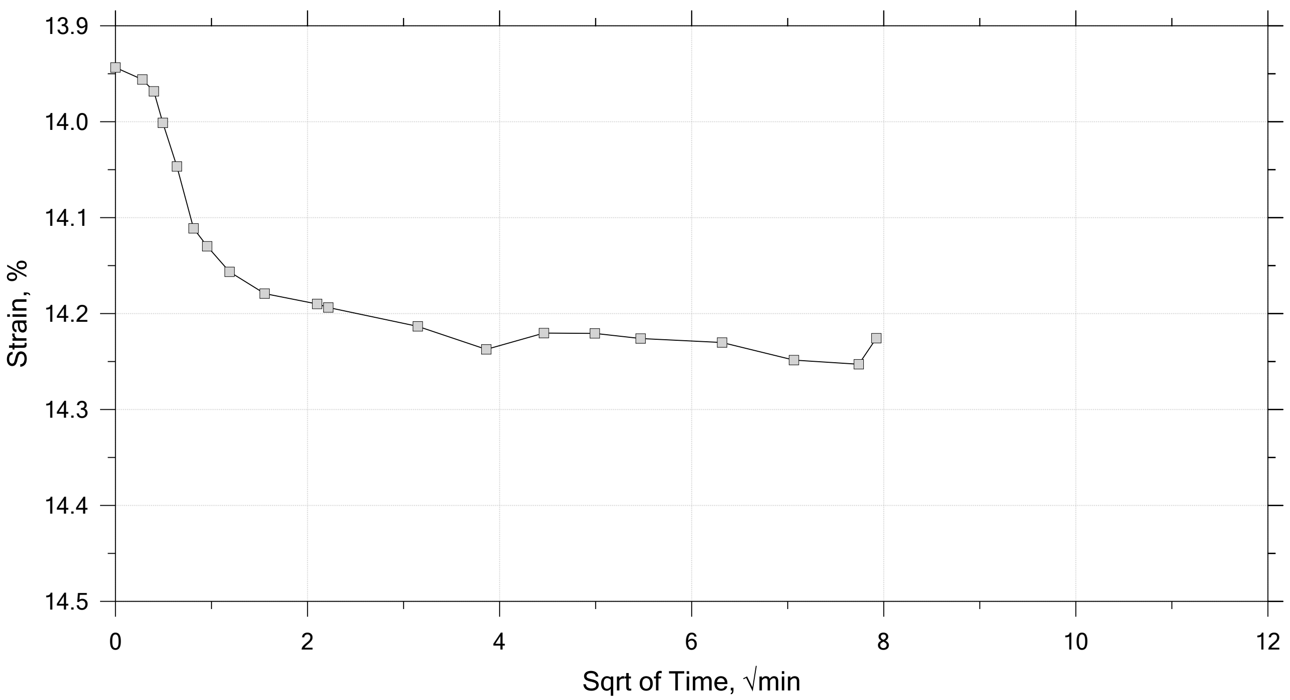


Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/5/2020	Depth: 13.2
	Test Number: ICON 338	Preparation: Shelby Tube	Elevation: 30.4
	Description: Gray Silty Clay		
	Remarks: second test		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 14 of 21
Constant Load Step
Stress: 2.66e+03 psf





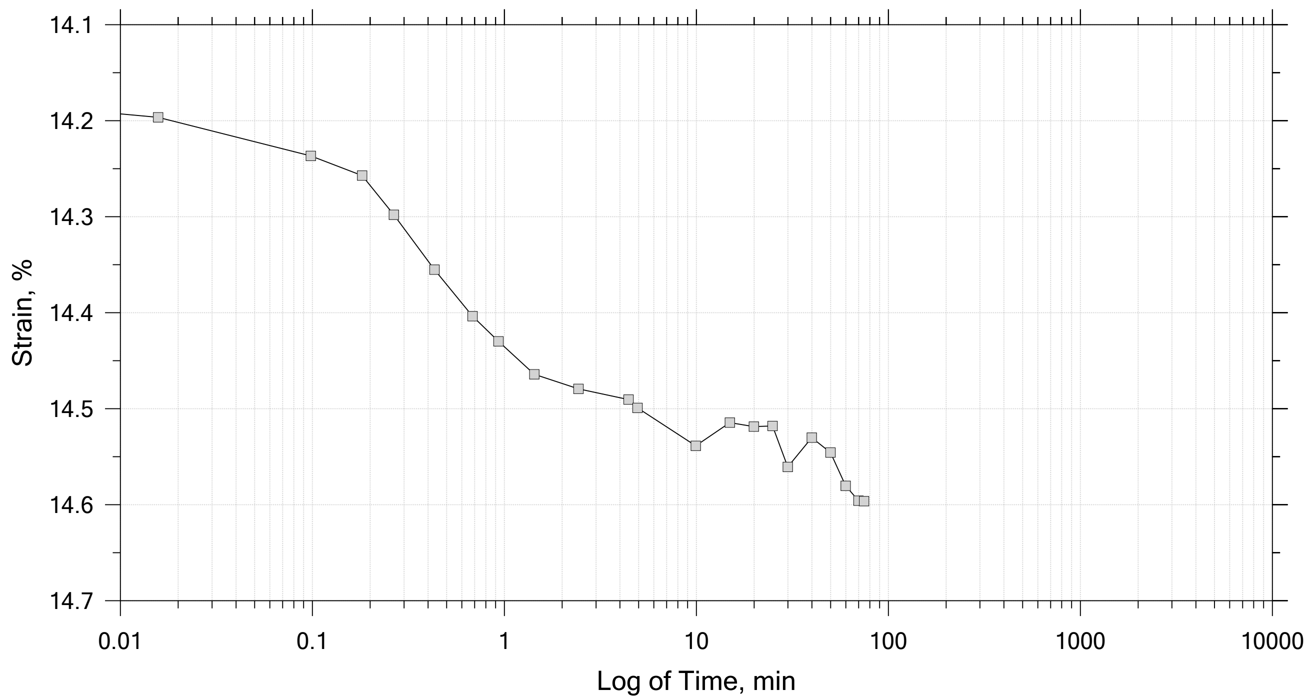
Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/5/2020	Depth: 13.2
	Test Number: ICON 338	Preparation: Shelby Tube	Elevation: 30.4
	Description: Gray Silty Clay		
	Remarks: second test		

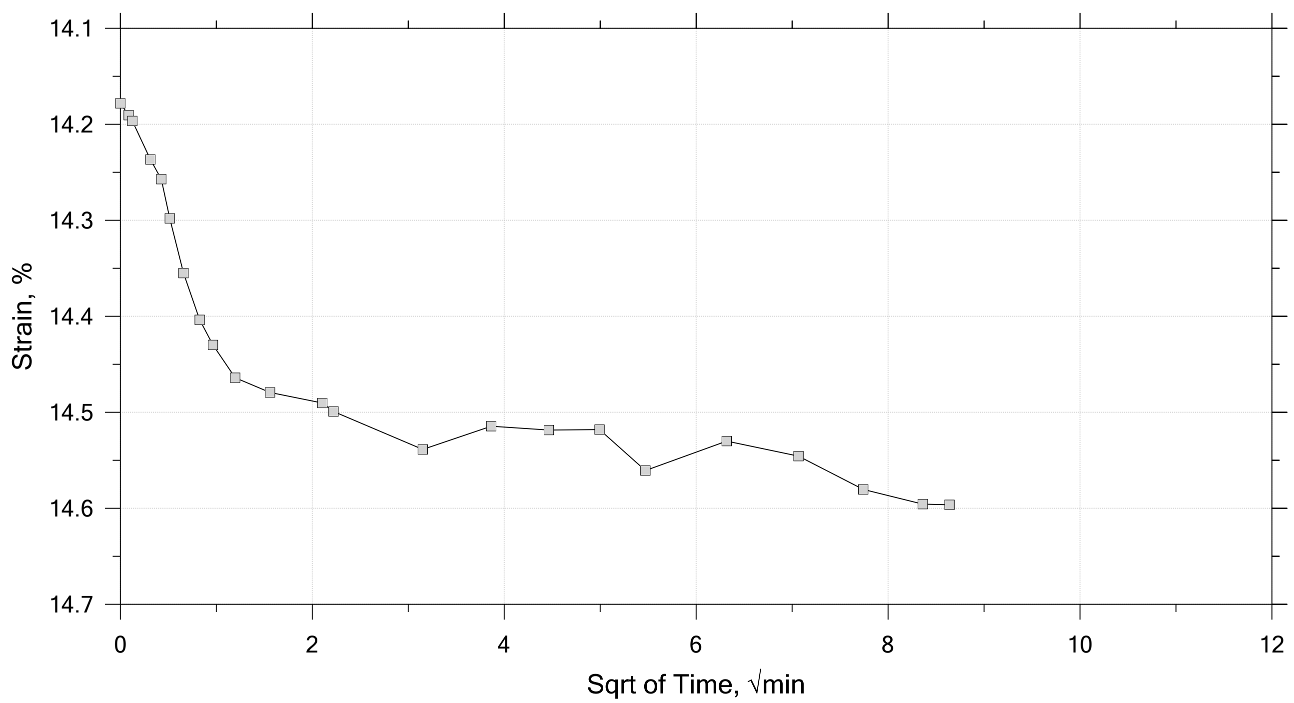
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 15 of 21

Constant Load Step

Stress: 5.32e+03 psf





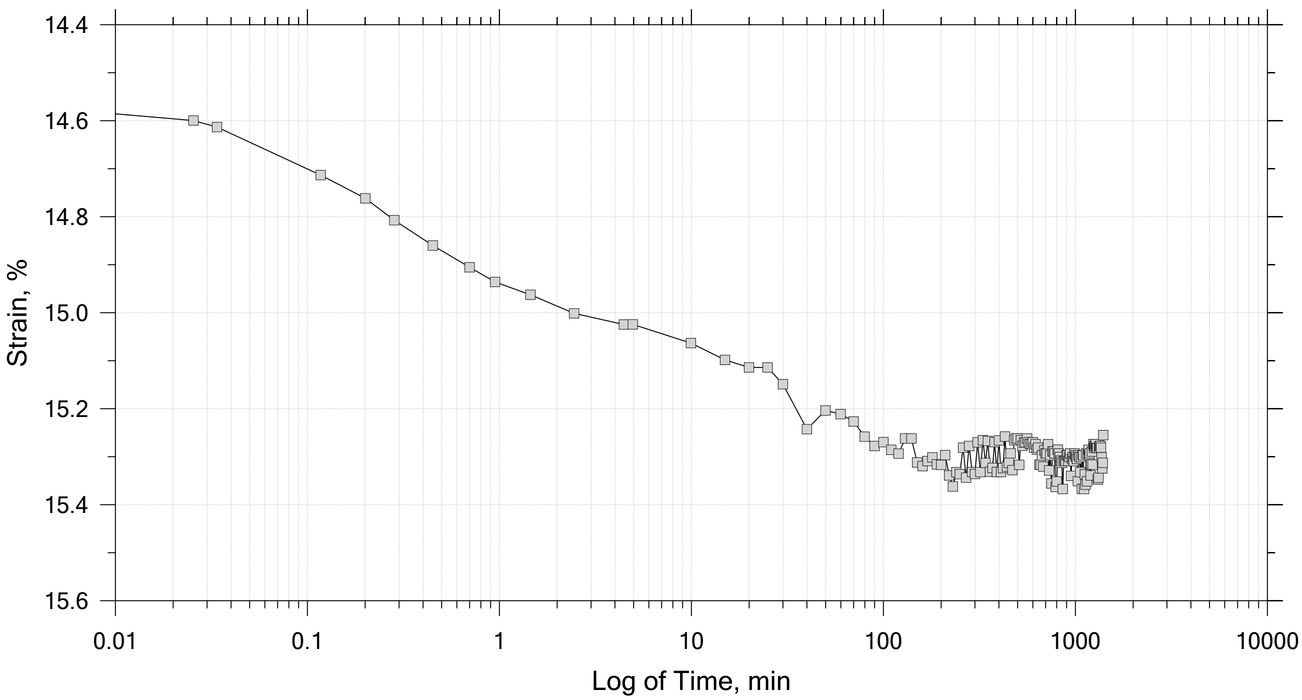
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/5/2020	Depth: 13.2
	Test Number: ICON 338	Preparation: Shelby Tube	Elevation: 30.4
	Description: Gray Silty Clay		
	Remarks: second test		

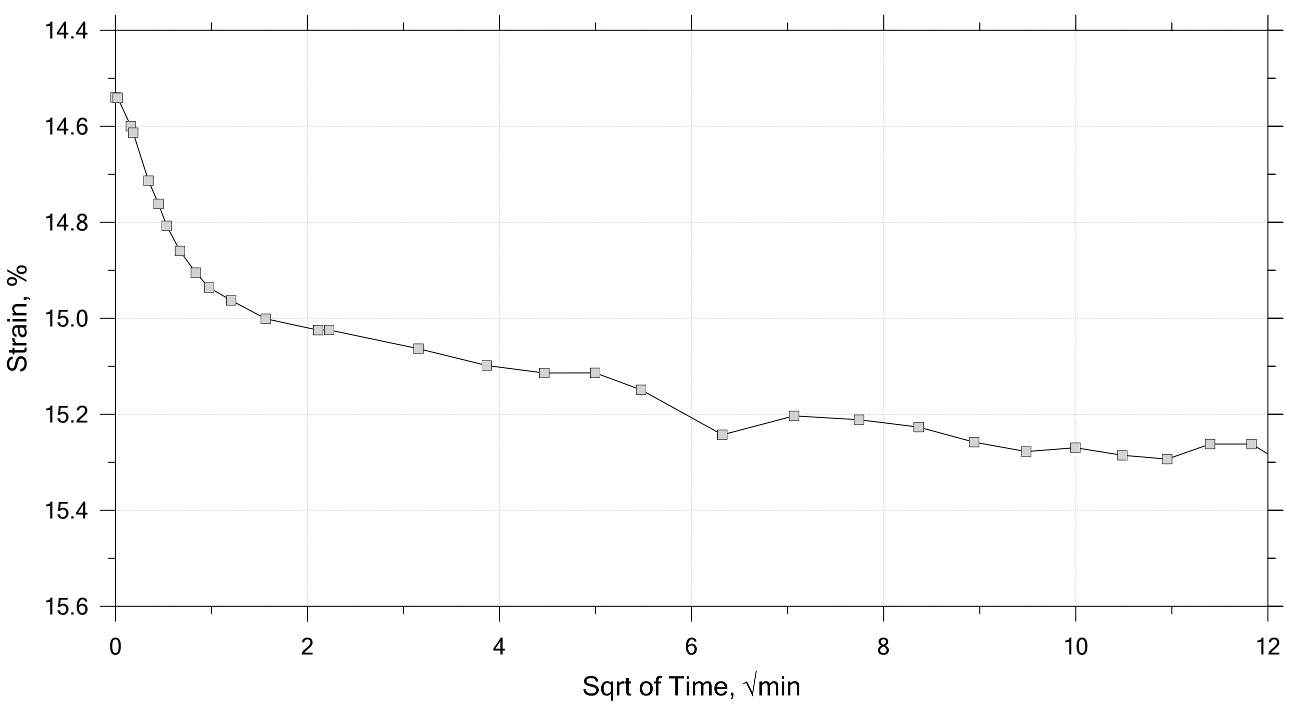
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 16 of 21

Constant Load Step

Stress: 1.06e+04 psf





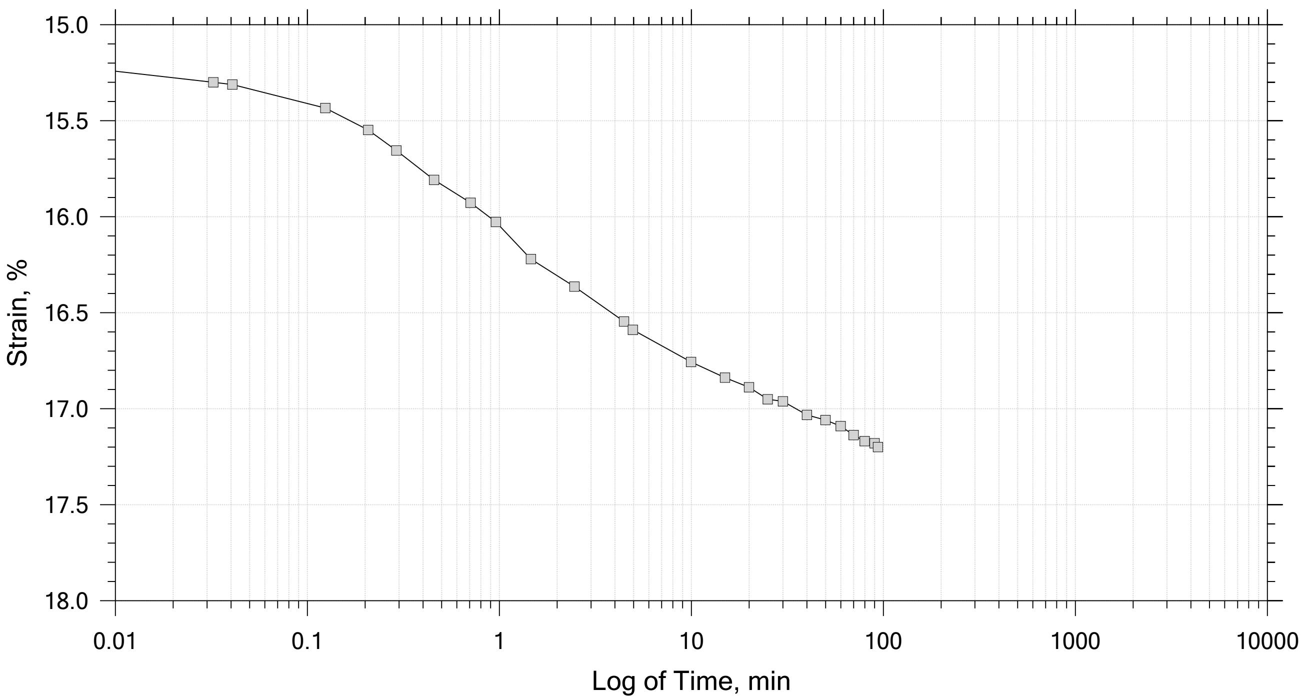
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/5/2020	Depth: 13.2
	Test Number: ICON 338	Preparation: Shelby Tube	Elevation: 30.4
	Description: Gray Silty Clay		
	Remarks: second test		

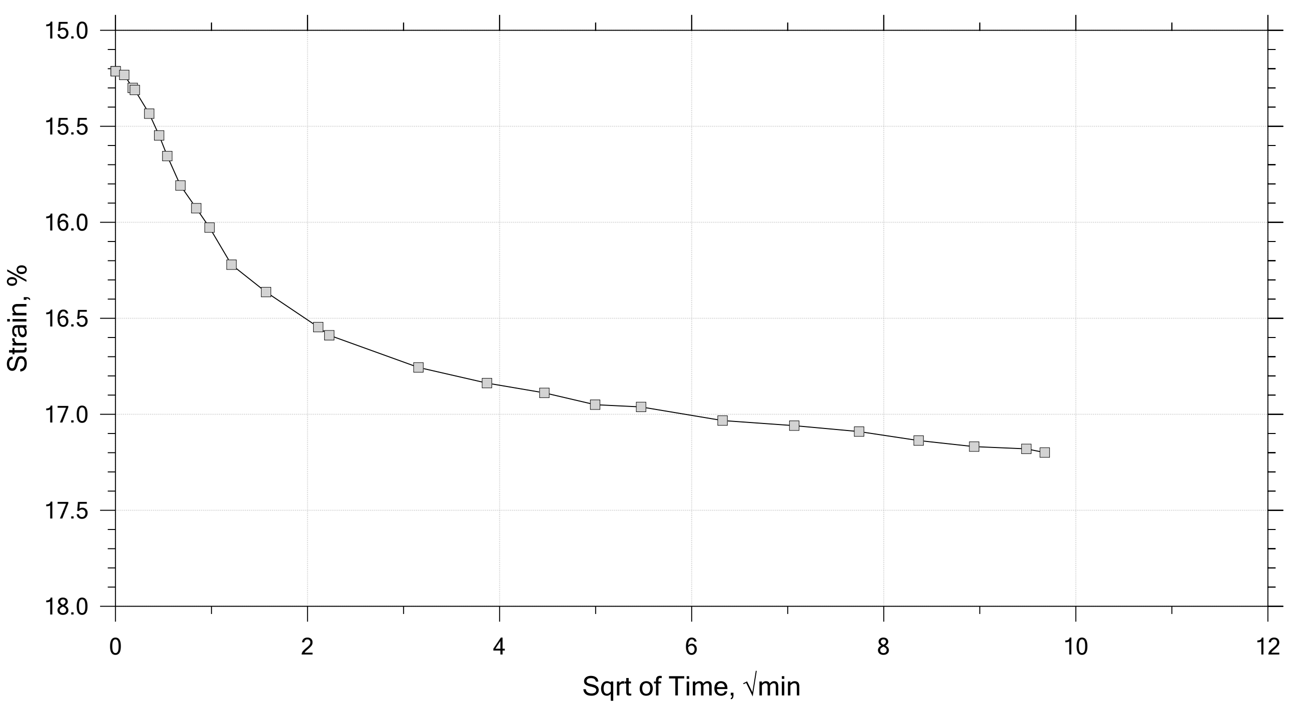
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 17 of 21

Constant Load Step

Stress: 2.13e+04 psf

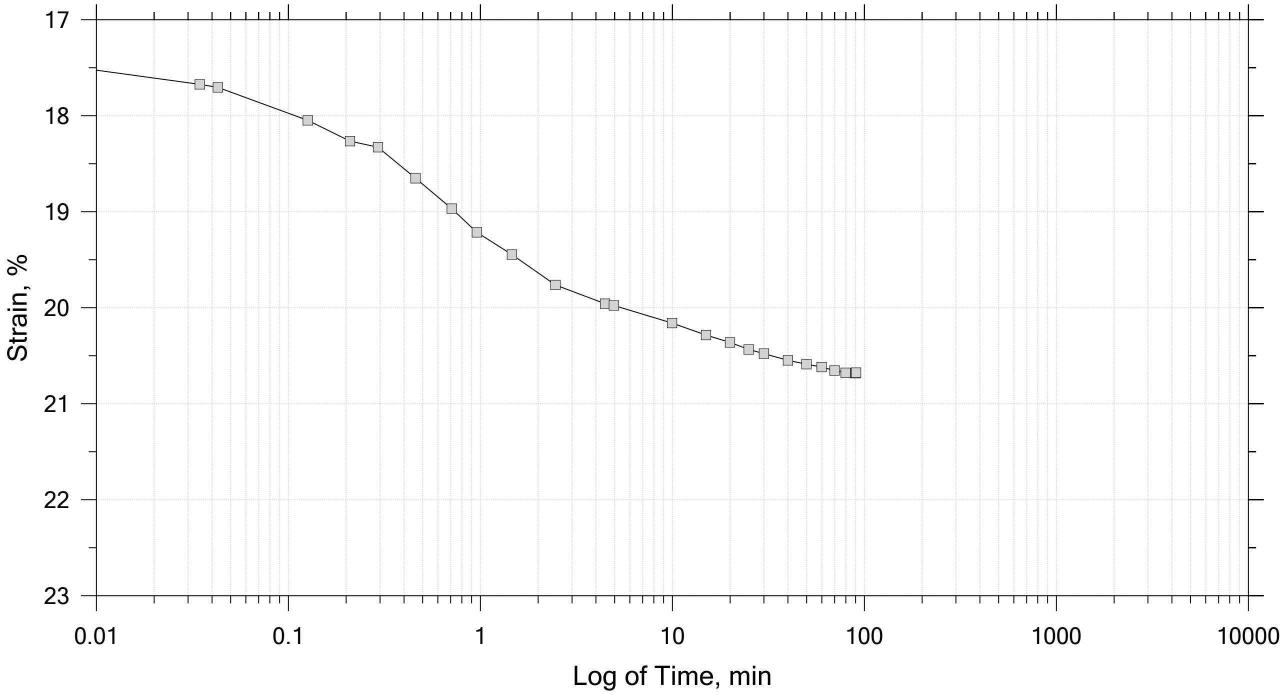


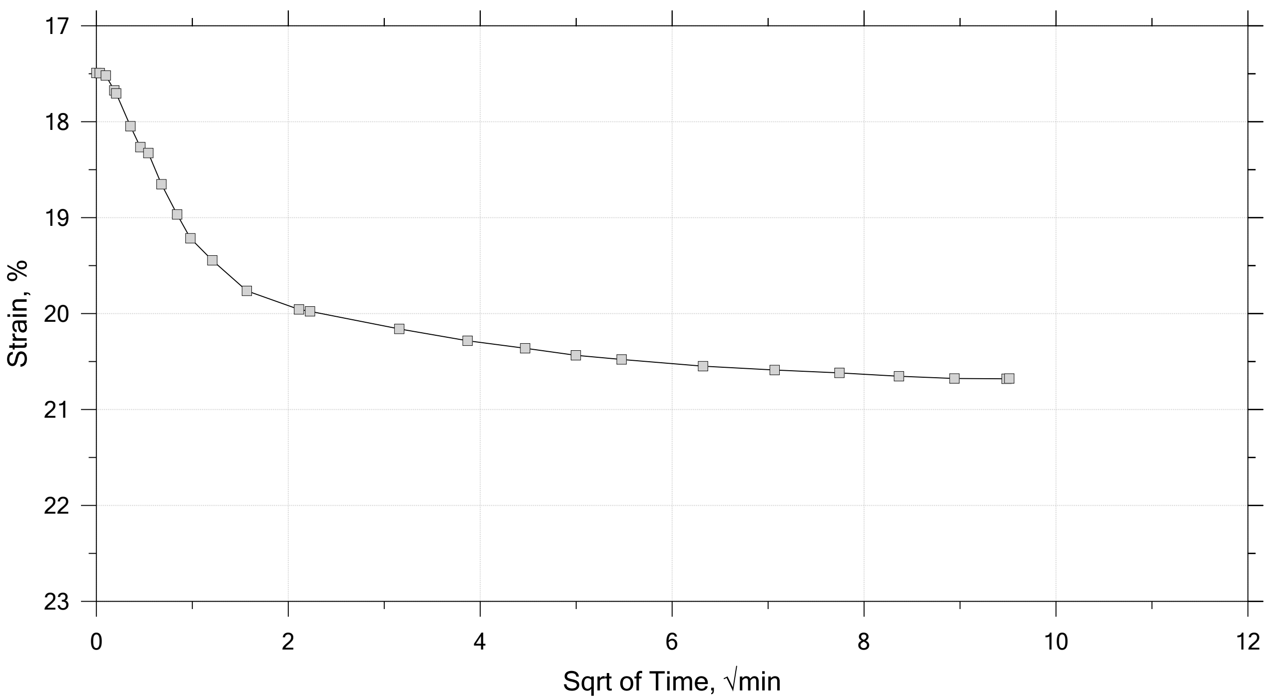


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/5/2020	Depth: 13.2
	Test Number: ICON 338	Preparation: Shelby Tube	Elevation: 30.4
	Description: Gray Silty Clay		
	Remarks: second test		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 18 of 21
Constant Load Step
Stress: 4.25e+04 psf

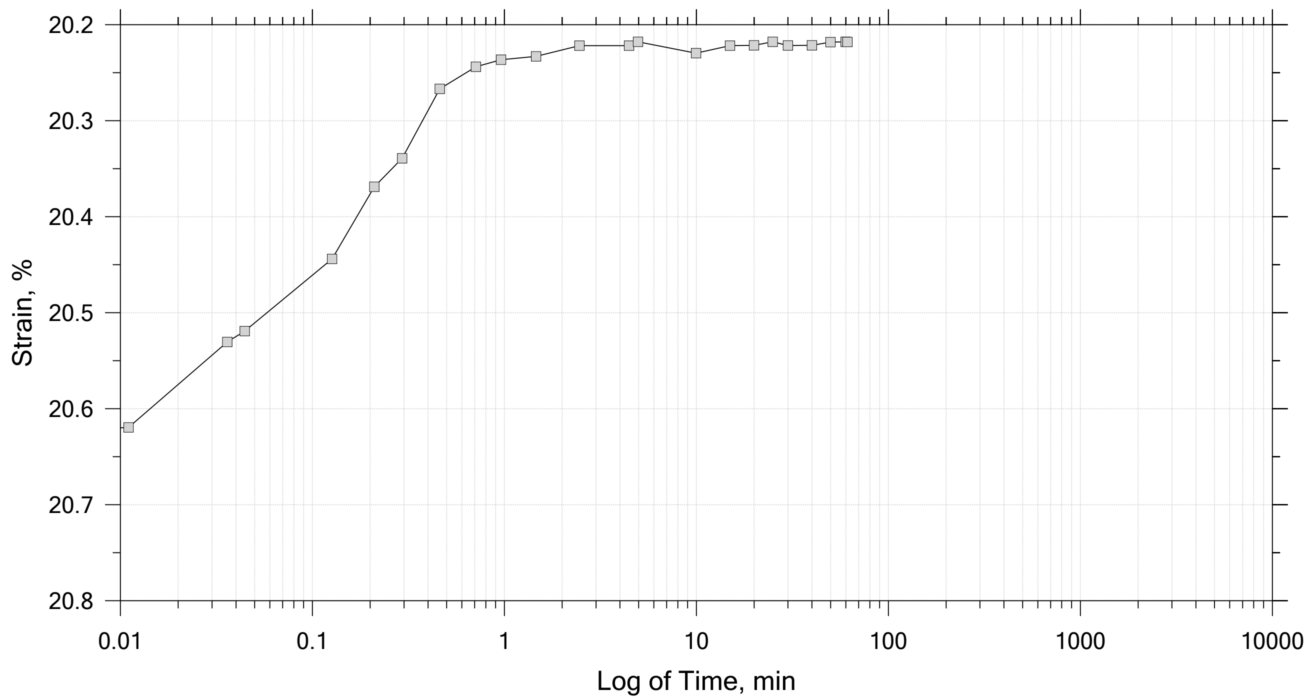


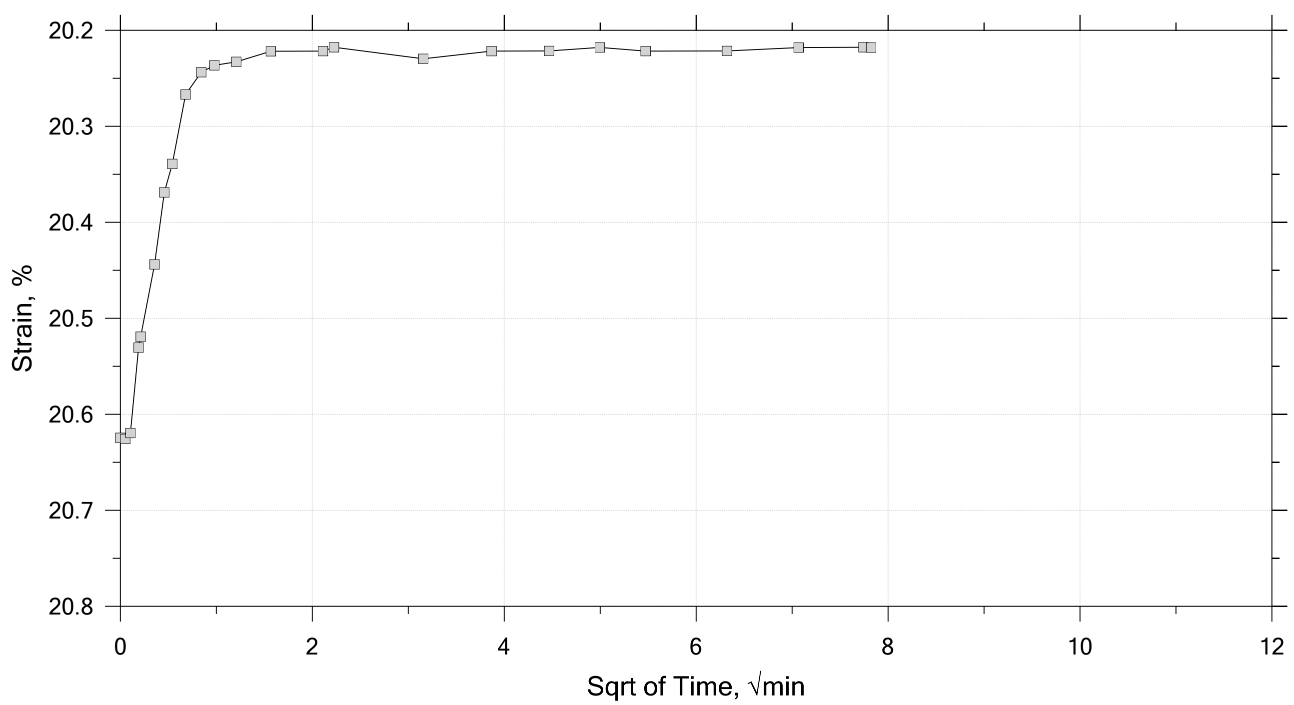


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/5/2020	Depth: 13.2
	Test Number: ICON 338	Preparation: Shelby Tube	Elevation: 30.4
	Description: Gray Silty Clay		
	Remarks: second test		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 19 of 21
Constant Load Step
Stress: 1.06e+04 psf

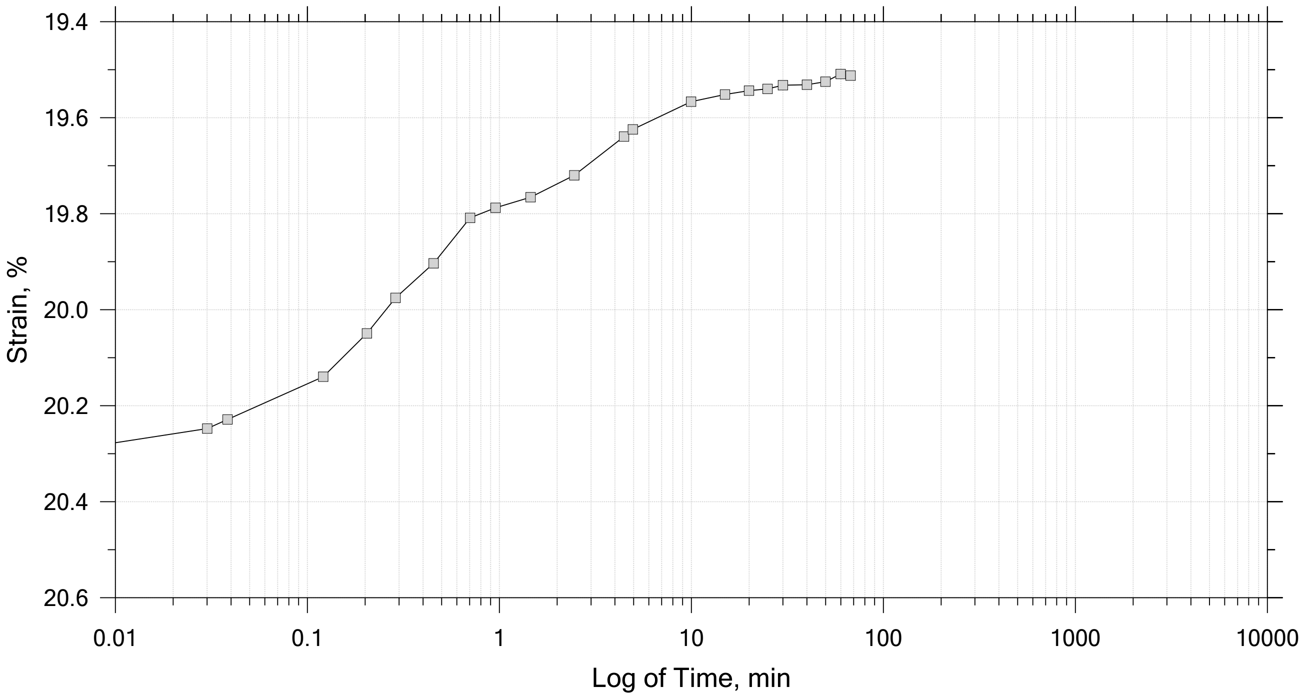


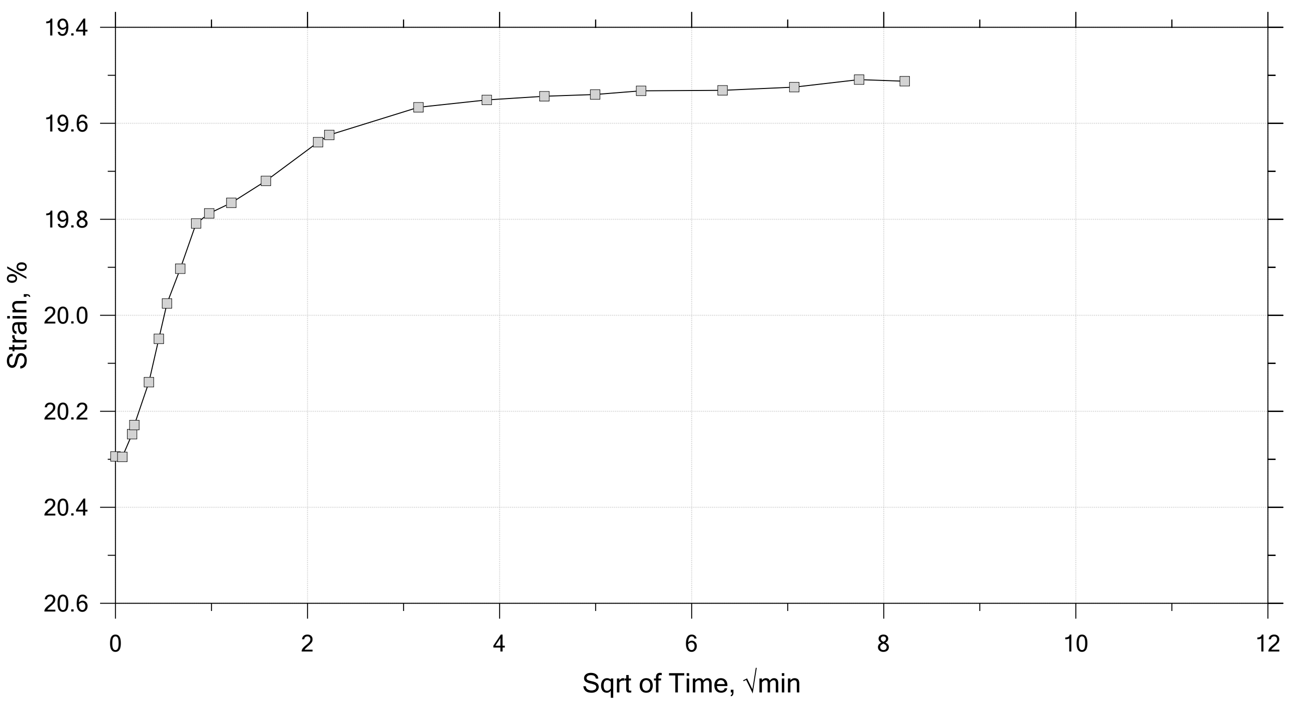


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/5/2020	Depth: 13.2
	Test Number: ICON 338	Preparation: Shelby Tube	Elevation: 30.4
	Description: Gray Silty Clay		
	Remarks: second test		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 20 of 21
Constant Load Step
Stress: 2.66e+03 psf





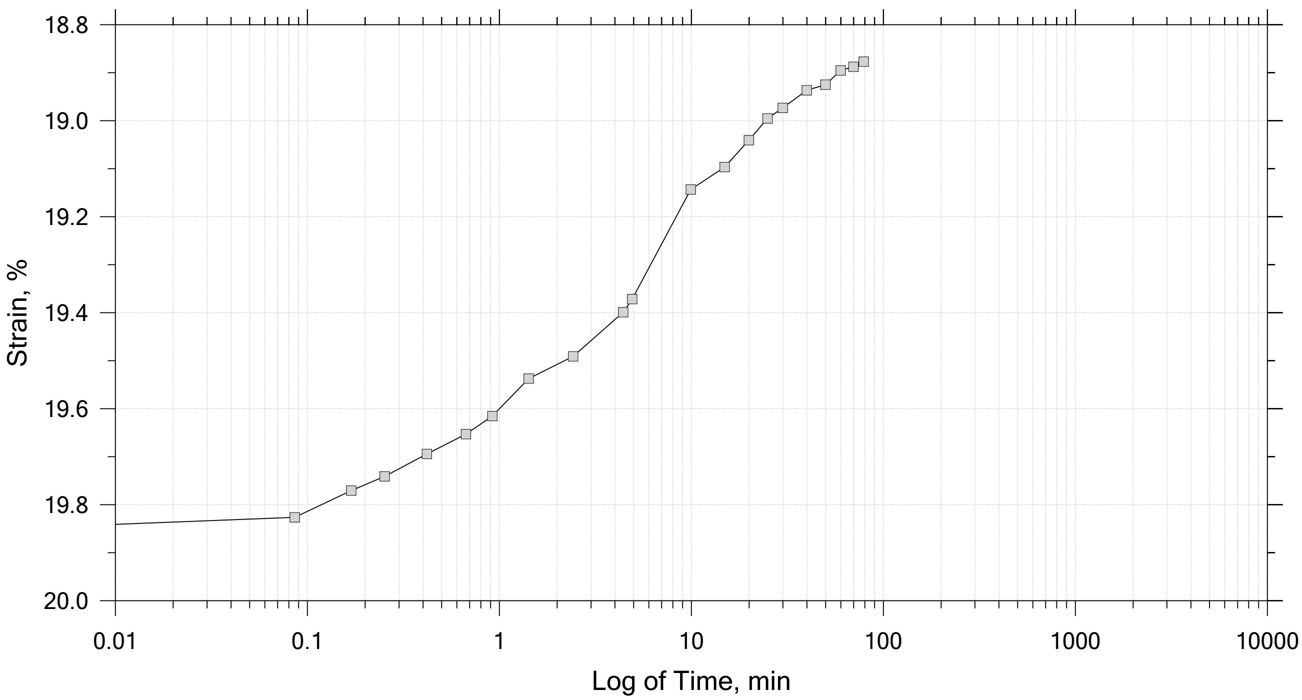
Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/5/2020	Depth: 13.2
	Test Number: ICON 338	Preparation: Shelby Tube	Elevation: 30.4
	Description: Gray Silty Clay		
	Remarks: second test		

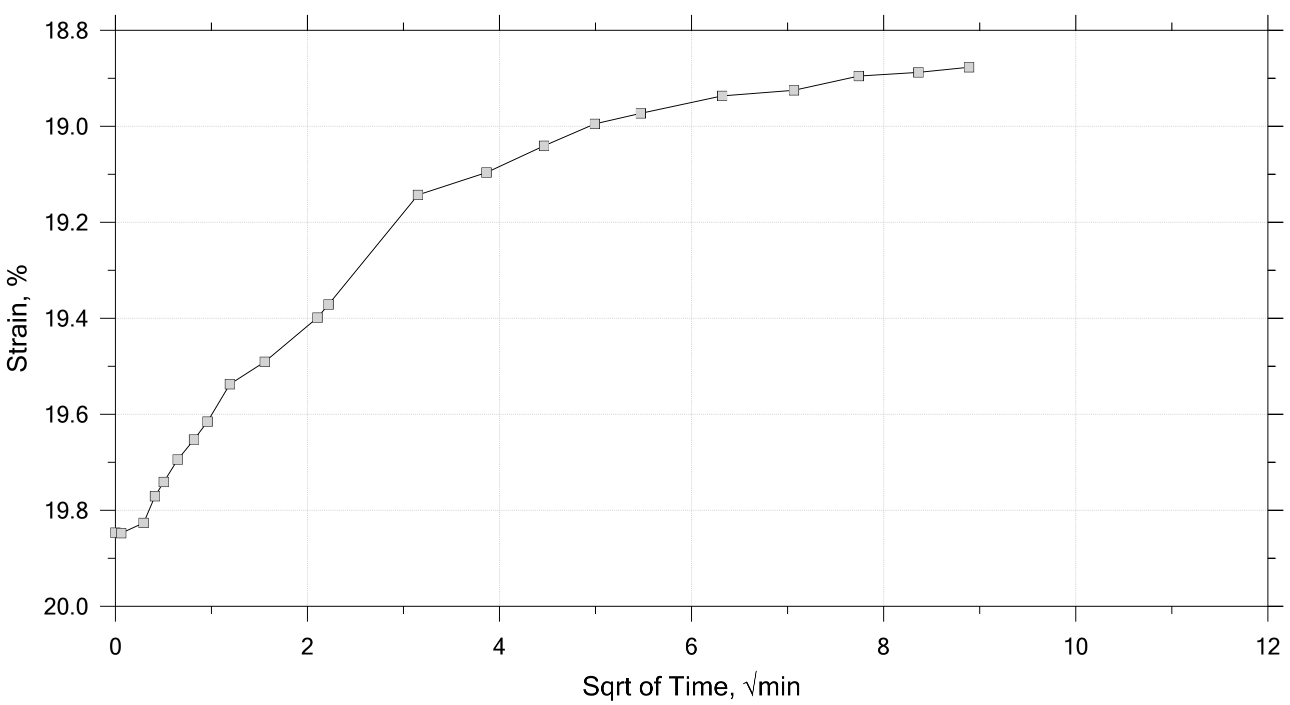
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 21 of 21

Constant Load Step

Stress: 759 psf





Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/5/2020	Depth: 13.2
	Test Number: ICON 338	Preparation: Shelby Tube	Elevation: 30.4
	Description: Gray Silty Clay		
	Remarks: second test		

One-Dimensional Consolidation by ASTM D2435 - Method B

Specimen Diameter, in: 2.50	Specific Gravity: 3.16 (Implied)	Liquid Limit: 0
Specimen Height, in: 0.89	Initial Void Ratio: 1.14	Plastic Limit: 0
Final Height, in: 0.72	Final Void Ratio: 0.74	Plasticity Index: 0

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	221	---	"ring"	319
Mass Container, gm	36.97	111.1	111.1	60.59
Mass Container + Wet Soil, gm	166.6	254.59	241.22	190.22
Mass Container + Dry Soil, gm	131.76	216.57	216.57	165.66
Mass Dry Soil, gm	94.79	105.47	105.47	105.07
Water Content, %	36.75	36.05	23.37	23.37
Void Ratio	---	1.14	0.74	---
Degree of Saturation, %	---	99.68	100.00	---
Dry Unit Weight, pcf	---	92.113	113.55	---

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: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/5/2020	Depth: 13.2
	Test Number: ICON 338	Preparation: Shelby Tube	Elevation: 30.4
	Description: Gray Silty Clay		
	Remarks: second test		

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	300.	0.005437	1.13	0.612	0.000	0.00e+00	4.08e+04	0.00e+00	0.00e+00
2	450.	0.006840	1.13	0.770	0.000	0.00e+00	2.11e+04	0.00e+00	0.00e+00
3	675.	0.009799	1.12	1.10	0.000	0.00e+00	2.96e+04	0.00e+00	0.00e+00
4	1.01e+03	0.01530	1.11	1.72	0.000	0.00e+00	3.66e+04	0.00e+00	0.00e+00
5	1.52e+03	0.02154	1.09	2.42	5.896	6.32e-02	2.77e+04	1.93e-08	0.00e+00
6	2.28e+03	0.03583	1.06	4.03	0.000	0.00e+00	4.24e+04	0.00e+00	0.00e+00
7	3.42e+03	0.05853	1.00	6.59	0.000	0.00e+00	4.49e+04	0.00e+00	0.00e+00
8	6.08e+03	0.08882	0.930	10.0	2.317	1.41e-01	2.56e+04	3.99e-08	0.00e+00
9	1.22e+04	0.1300	0.831	14.6	0.000	0.00e+00	1.53e+04	0.00e+00	0.00e+00
10	3.04e+03	0.1282	0.835	14.4	0.319	8.92e-01	4.49e+02	4.41e-09	0.00e+00
11	1.52e+03	0.1290	0.833	14.5	1.312	2.17e-01	-1.24e+03	-2.97e-09	0.00e+00
12	759.	0.1277	0.836	14.4	2.038	1.40e-01	4.06e+03	6.25e-09	0.00e+00
13	1.33e+03	0.1258	0.841	14.2	0.000	0.00e+00	-7.47e+03	-0.00e+00	0.00e+00
14	2.66e+03	0.1261	0.840	14.2	0.000	0.00e+00	6.26e+02	0.00e+00	0.00e+00
15	5.32e+03	0.1288	0.834	14.5	0.000	0.00e+00	2.22e+03	0.00e+00	0.00e+00
16	1.06e+04	0.1361	0.816	15.3	0.000	0.00e+00	3.10e+03	0.00e+00	0.00e+00
17	2.13e+04	0.1498	0.783	16.9	0.975	2.81e-01	2.90e+03	8.96e-09	0.00e+00
18	4.25e+04	0.1778	0.715	20.0	0.507	5.10e-01	2.97e+03	1.67e-08	0.00e+00
19	1.06e+04	0.1738	0.725	19.6	0.000	0.00e+00	2.85e+02	0.00e+00	0.00e+00
20	2.66e+03	0.1744	0.723	19.6	0.343	7.34e-01	-1.93e+02	-1.56e-09	0.00e+00
21	759.	0.1681	0.739	18.9	5.345	4.74e-02	7.48e+03	3.90e-09	0.00e+00

Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/5/2020	Depth: 13.2
	Test Number: ICON 338	Preparation: Shelby Tube	Elevation: 30.4
	Description: Gray Silty Clay		
	Remarks: second test		
	Displacement at End of Primary		

One-Dimensional Consolidation by ASTM D2435 - Method B

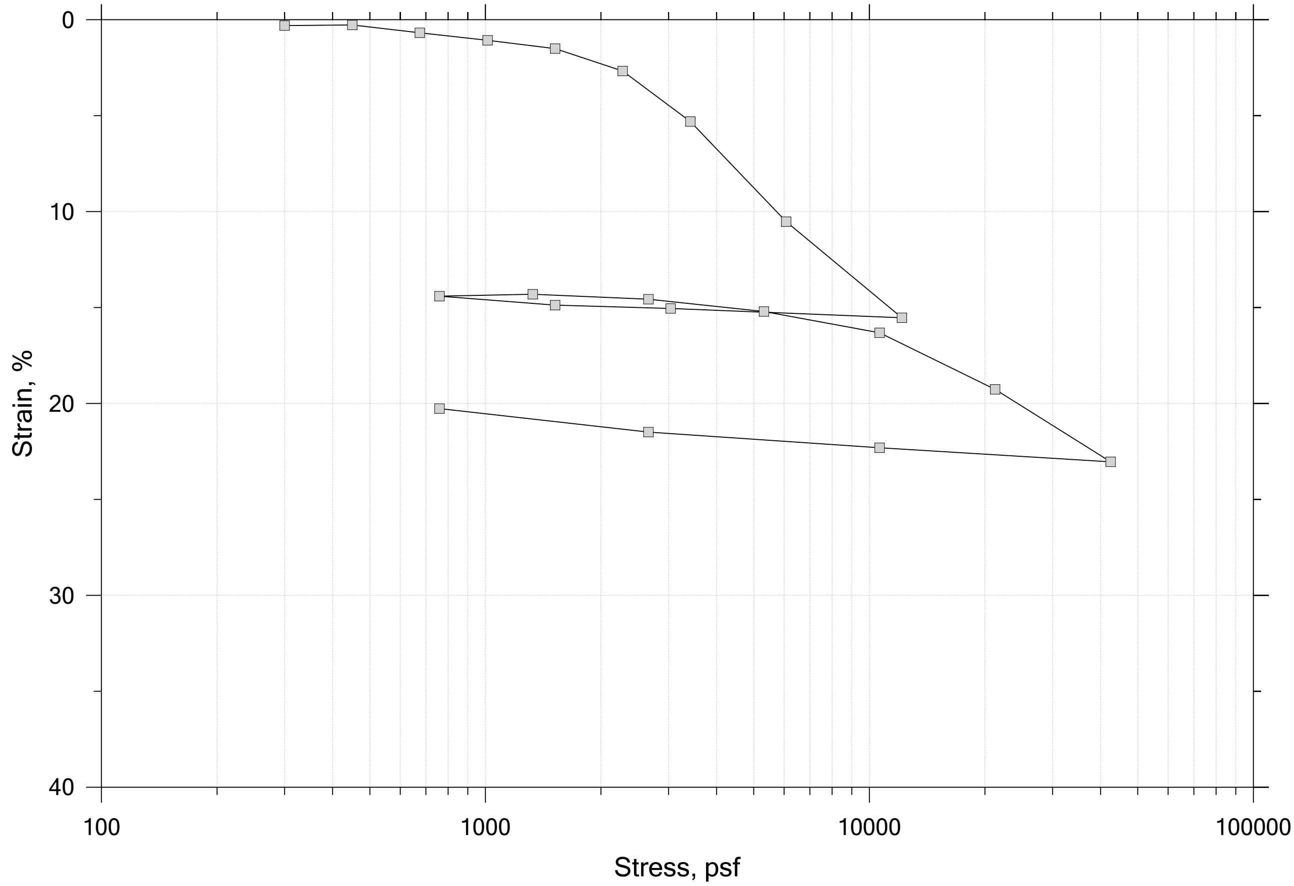
Sqrt of Time Coefficients

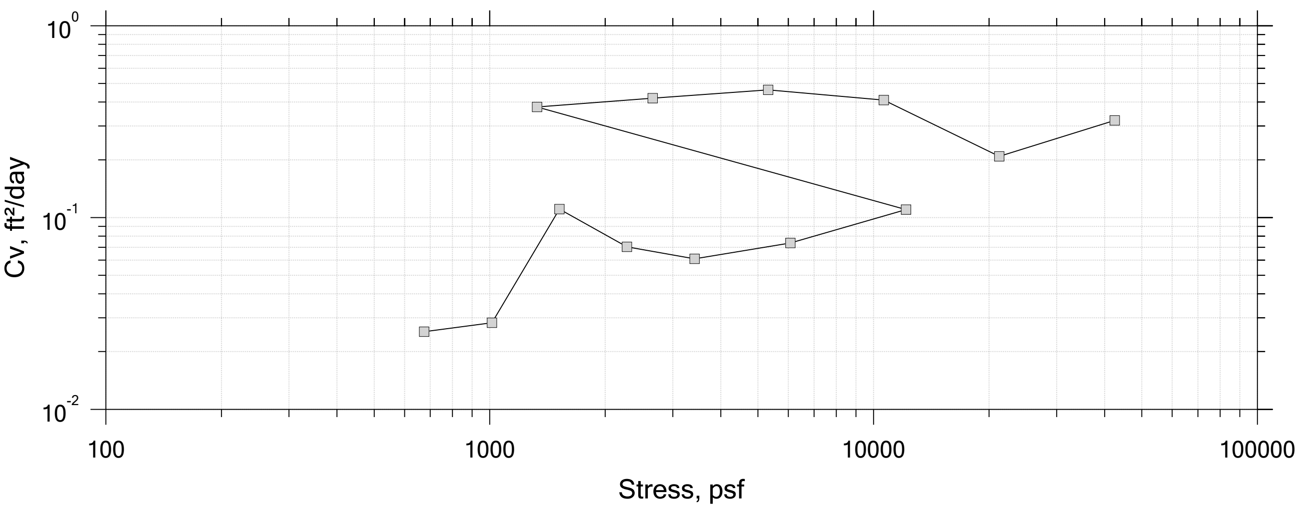
Step	Applied Stress psf	EOP Displacement in	Void Ratio	Strain at End %	Sq.Rt. T90 min	Cv ft²/day	Mv ft²/ton	k cm/s
1	300.	0.005437	1.13	0.612	14.753	1.13e-01	4.08e+04	5.07e-08
2	450.	0.006840	1.13	0.770	36.236	4.56e-02	2.11e+04	1.06e-08
3	675.	0.009799	1.12	1.10	51.987	3.16e-02	2.96e+04	1.03e-08
4	1.01e+03	0.01530	1.11	1.72	104.063	1.56e-02	3.66e+04	6.31e-09
5	1.52e+03	0.02154	1.09	2.42	24.205	6.63e-02	2.77e+04	2.03e-08
6	2.28e+03	0.03583	1.06	4.03	33.309	4.71e-02	4.24e+04	2.20e-08
7	3.42e+03	0.05853	1.00	6.59	31.653	4.74e-02	4.49e+04	2.34e-08
8	6.08e+03	0.08882	0.930	10.0	15.821	8.90e-02	2.56e+04	2.51e-08
9	1.22e+04	0.1300	0.831	14.6	145.030	8.87e-03	1.53e+04	1.49e-09
10	3.04e+03	0.1282	0.835	14.4	0.966	1.27e+00	4.49e+02	6.26e-09
11	1.52e+03	0.1290	0.833	14.5	7.186	1.70e-01	-1.24e+03	-2.33e-09
12	759.	0.1277	0.836	14.4	7.369	1.66e-01	4.06e+03	7.44e-09
13	1.33e+03	0.1258	0.841	14.2	44.683	2.75e-02	-7.47e+03	-2.27e-09
14	2.66e+03	0.1261	0.840	14.2	2.261	5.45e-01	6.26e+02	3.76e-09
15	5.32e+03	0.1288	0.834	14.5	1.931	6.36e-01	2.22e+03	1.56e-08
16	1.06e+04	0.1361	0.816	15.3	89.578	1.35e-02	3.10e+03	4.62e-10
17	2.13e+04	0.1498	0.783	16.9	7.302	1.61e-01	2.90e+03	5.15e-09
18	4.25e+04	0.1778	0.715	20.0	2.592	4.30e-01	2.97e+03	1.40e-08
19	1.06e+04	0.1738	0.725	19.6	0.903	1.19e+00	2.85e+02	3.74e-09
20	2.66e+03	0.1744	0.723	19.6	2.100	5.15e-01	-1.93e+02	-1.09e-09
21	759.	0.1681	0.739	18.9	22.760	4.79e-02	7.48e+03	3.95e-09

Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/5/2020	Depth: 13.2
	Test Number: ICON 338	Preparation: Shelby Tube	Elevation: 30.4
	Description: Gray Silty Clay		
	Remarks: second test		
	Displacement at End of Primary		

One-Dimensional Consolidation by ASTM D2435 - Method B

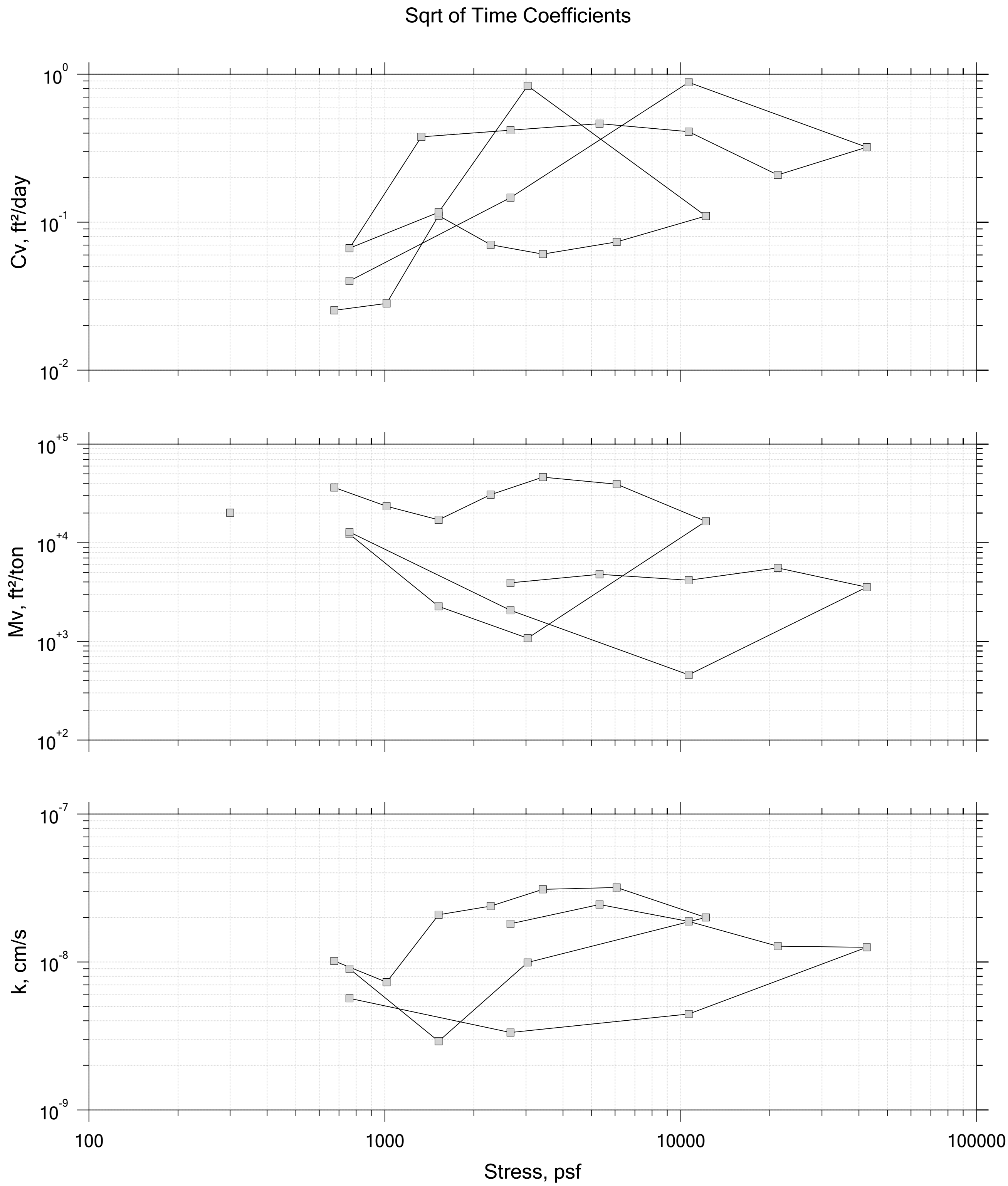
Summary Report





Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/9/2020	Depth: 12.75
	Test Number: ICON 339	Preparation: Shelby Tube	Elevation: 30.85
	Description: Gray Silty Clay		
	Remarks: third test		
	Displacement at End of Primary		

One-Dimensional Consolidation by ASTM D2435 - Method B



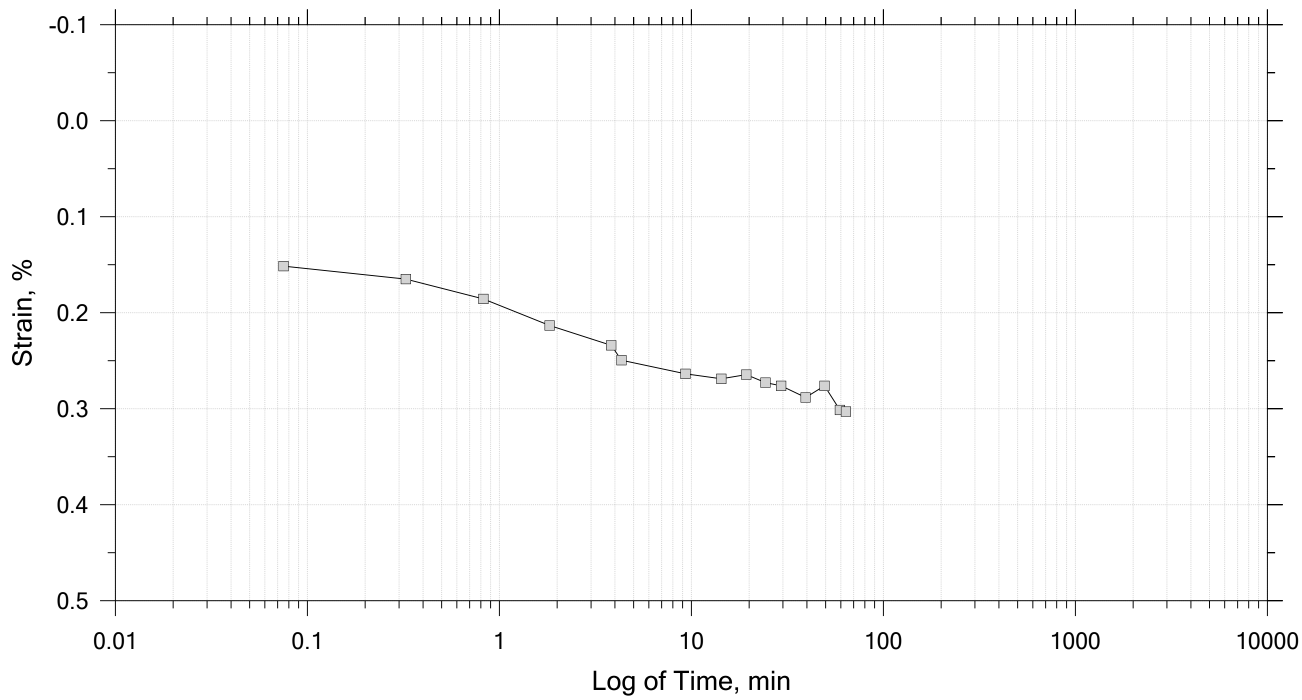
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/9/2020	Depth: 12.75
	Test Number: ICON 339	Preparation: Shelby Tube	Elevation: 30.85
	Description: Gray Silty Clay		
	Remarks: third test		

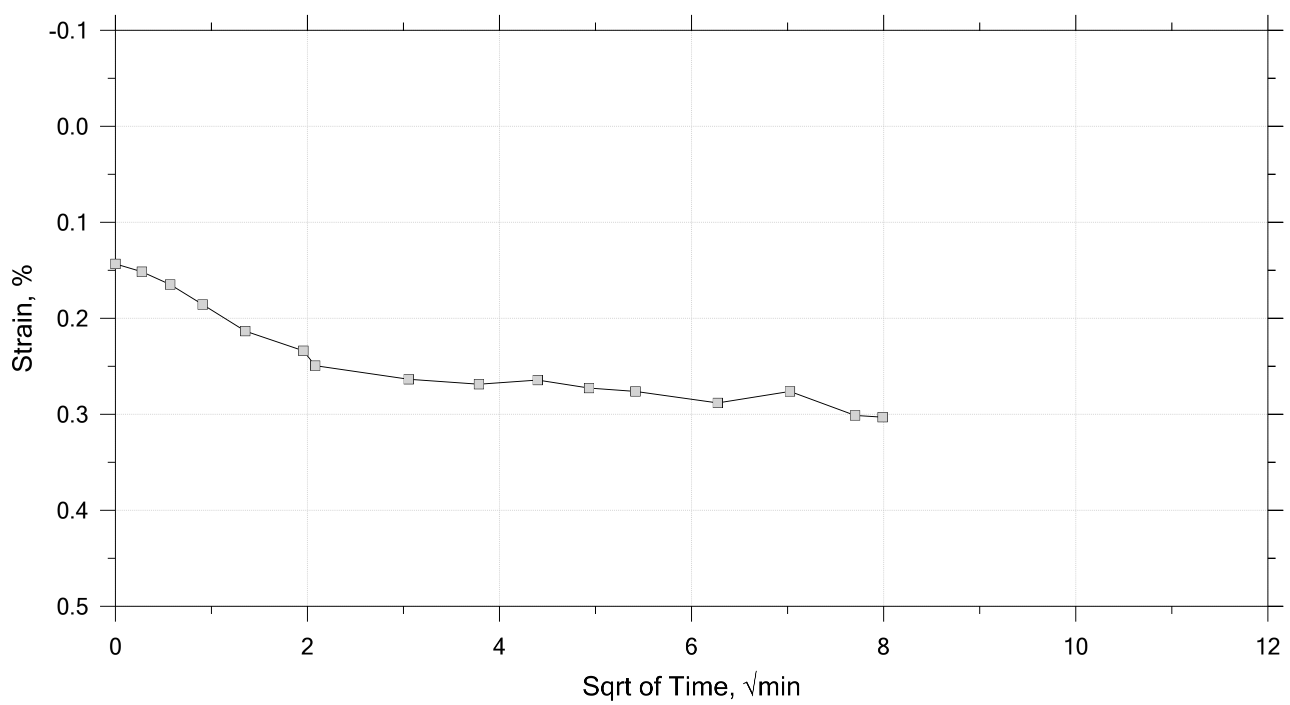
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 1 of 21

Constant Load Step

Stress: 300 psf

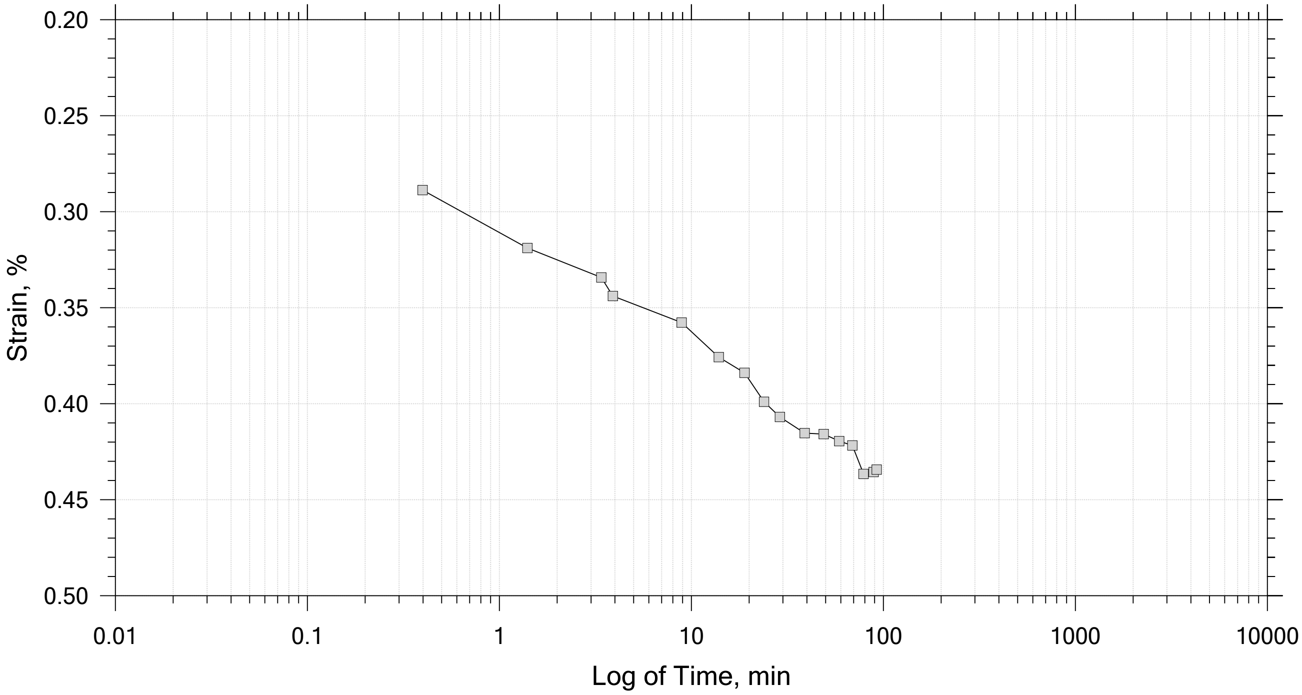


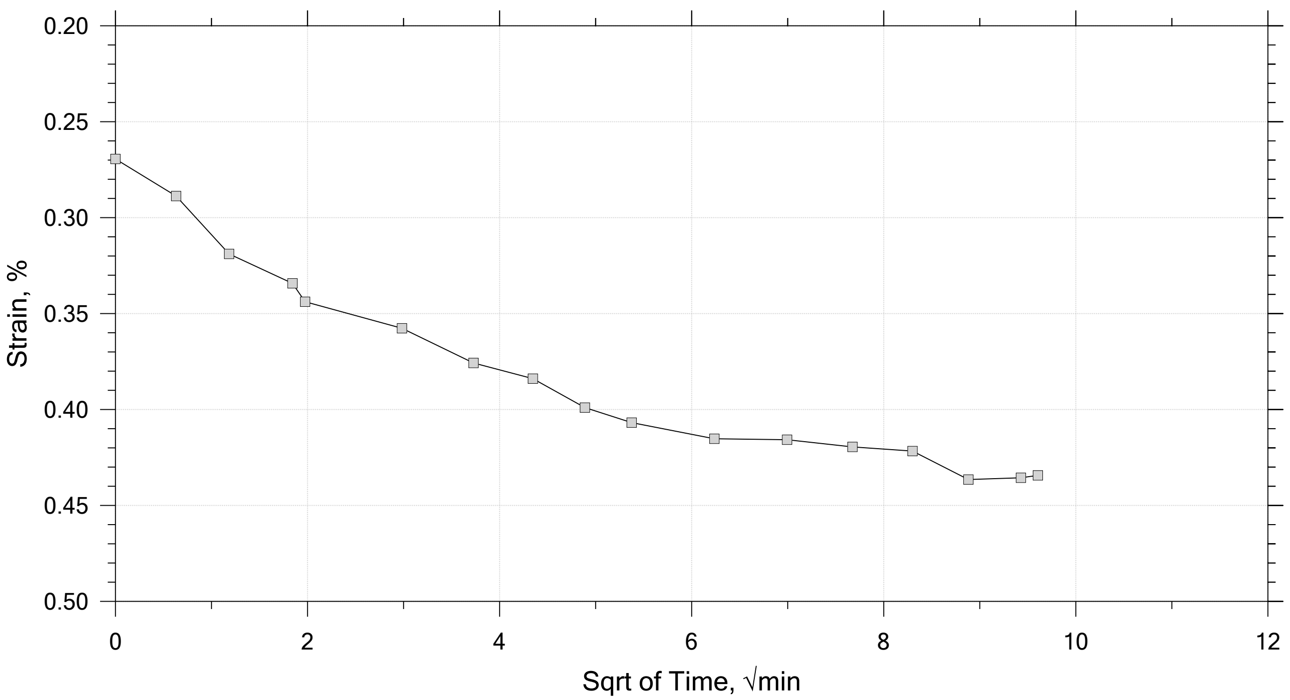


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/9/2020	Depth: 12.75
	Test Number: ICON 339	Preparation: Shelby Tube	Elevation: 30.85
	Description: Gray Silty Clay		
	Remarks: third test		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 2 of 21
Constant Load Step
Stress: 450 psf





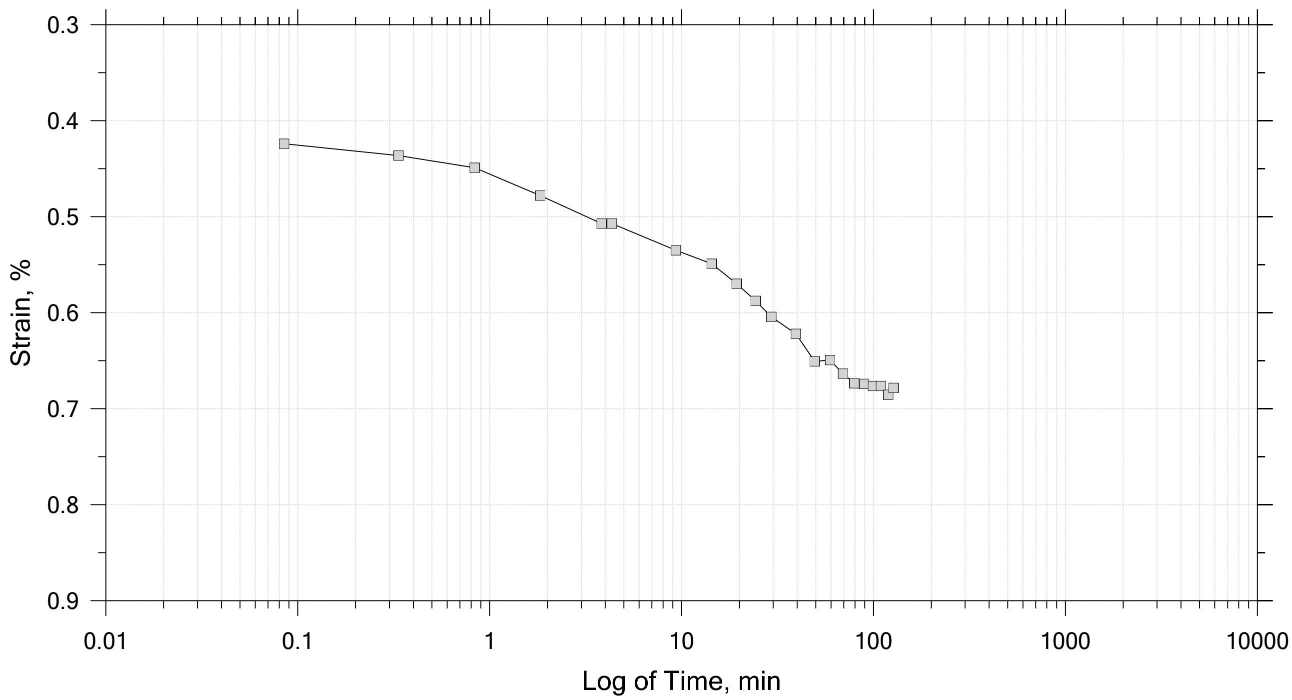
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/9/2020	Depth: 12.75
	Test Number: ICON 339	Preparation: Shelby Tube	Elevation: 30.85
	Description: Gray Silty Clay		
	Remarks: third test		

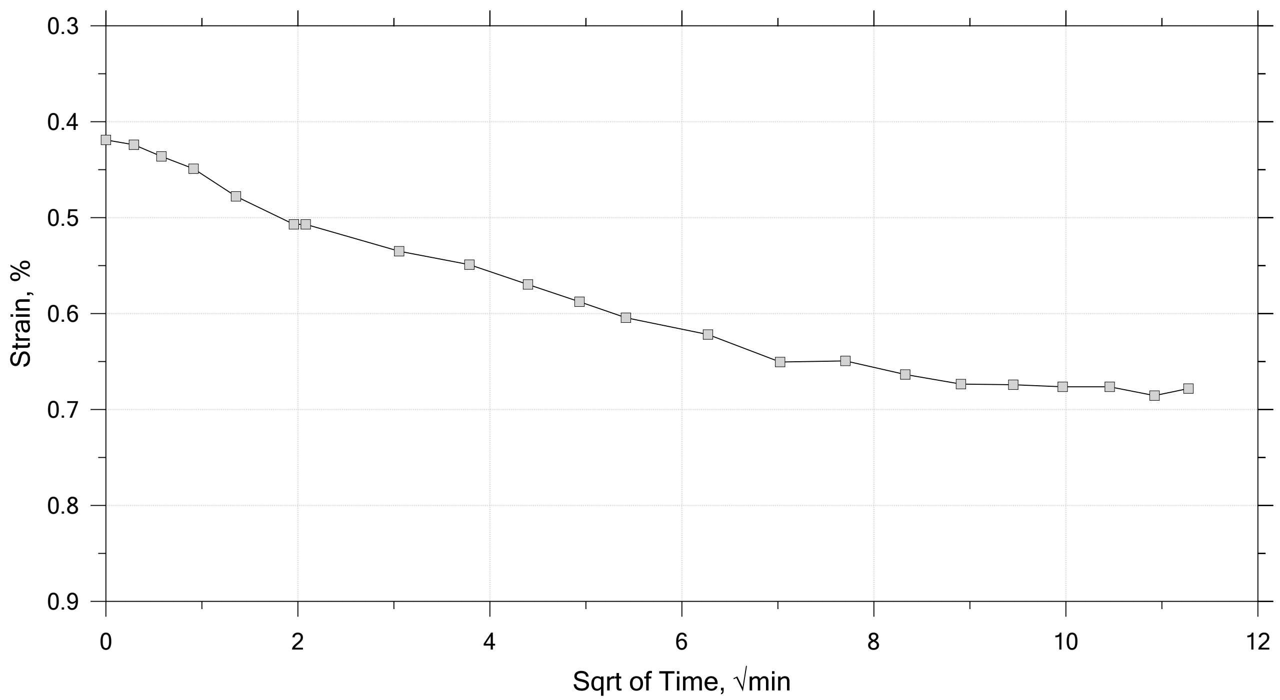
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 3 of 21

Constant Load Step

Stress: 675 psf





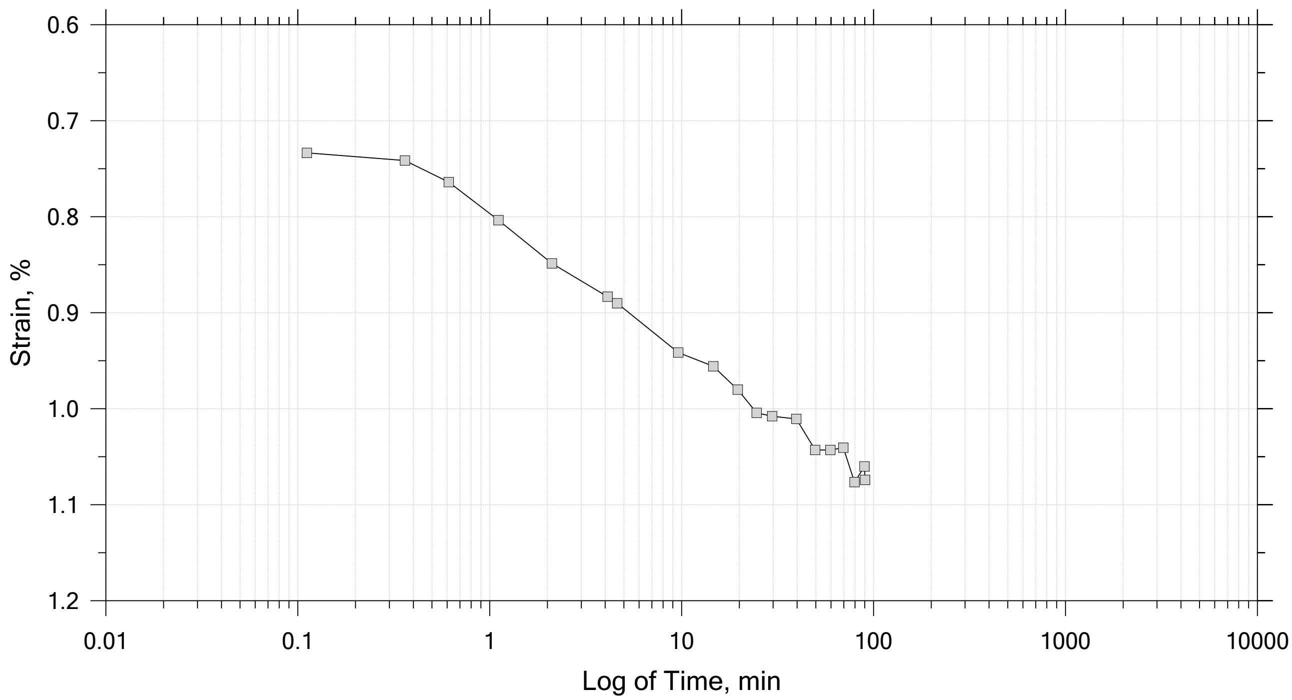
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/9/2020	Depth: 12.75
	Test Number: ICON 339	Preparation: Shelby Tube	Elevation: 30.85
	Description: Gray Silty Clay		
	Remarks: third test		

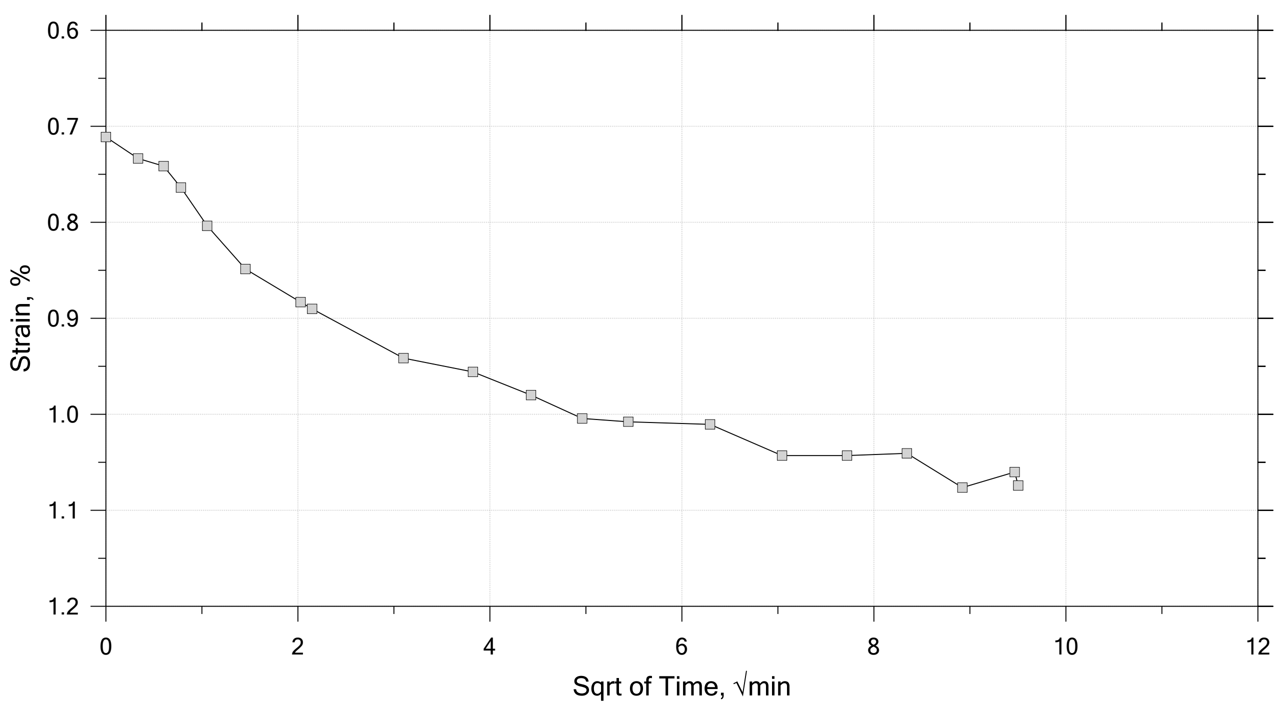
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 4 of 21

Constant Load Step

Stress: 1.01e+03 psf





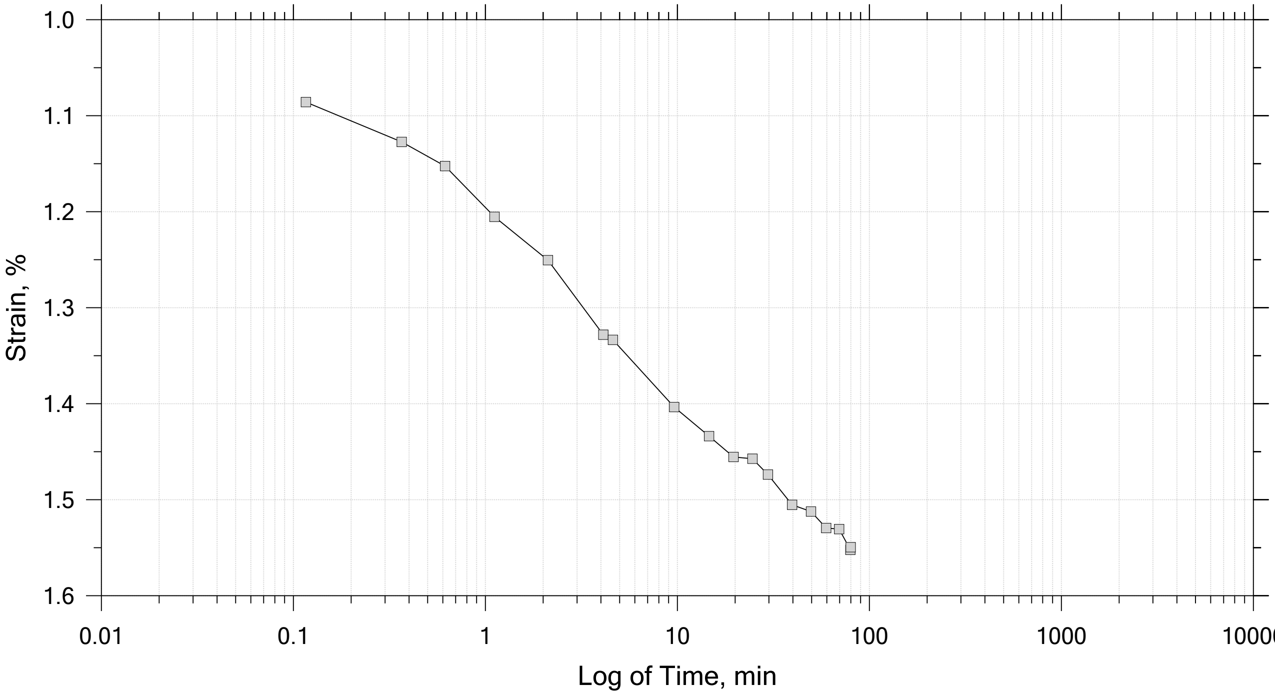
Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/9/2020	Depth: 12.75
	Test Number: ICON 339	Preparation: Shelby Tube	Elevation: 30.85
	Description: Gray Silty Clay		
	Remarks: third test		

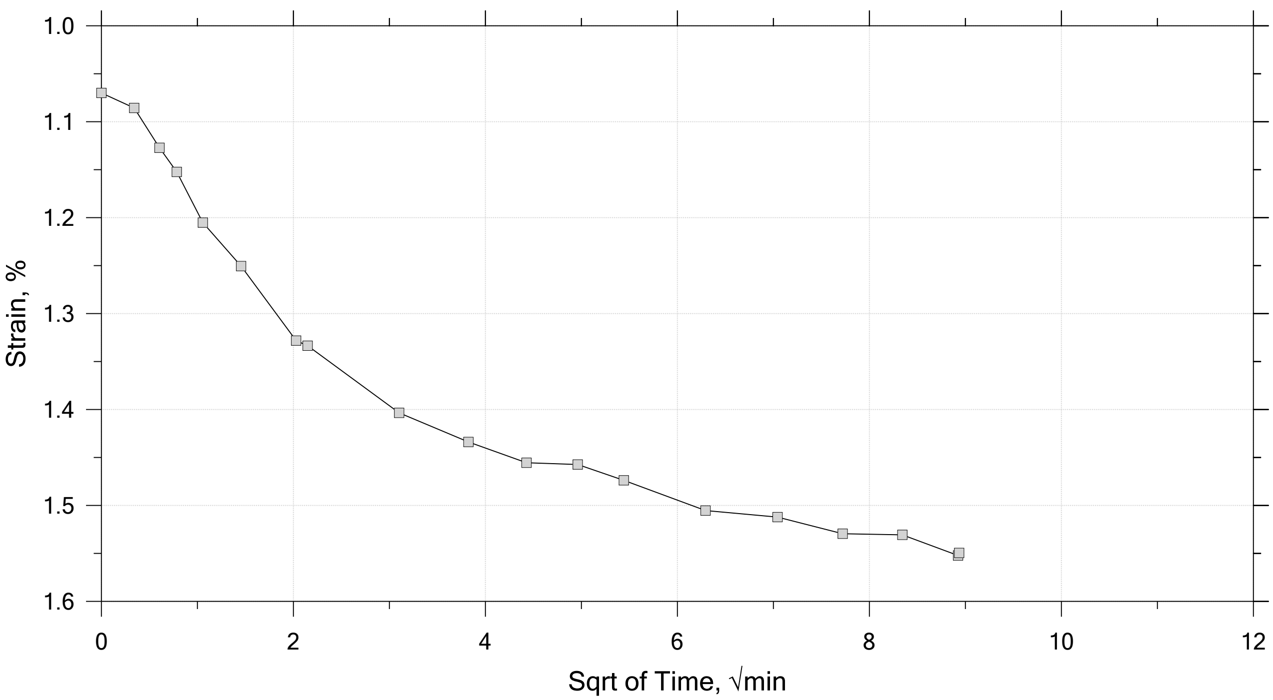
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 5 of 21

Constant Load Step

Stress: 1.52e+03 psf





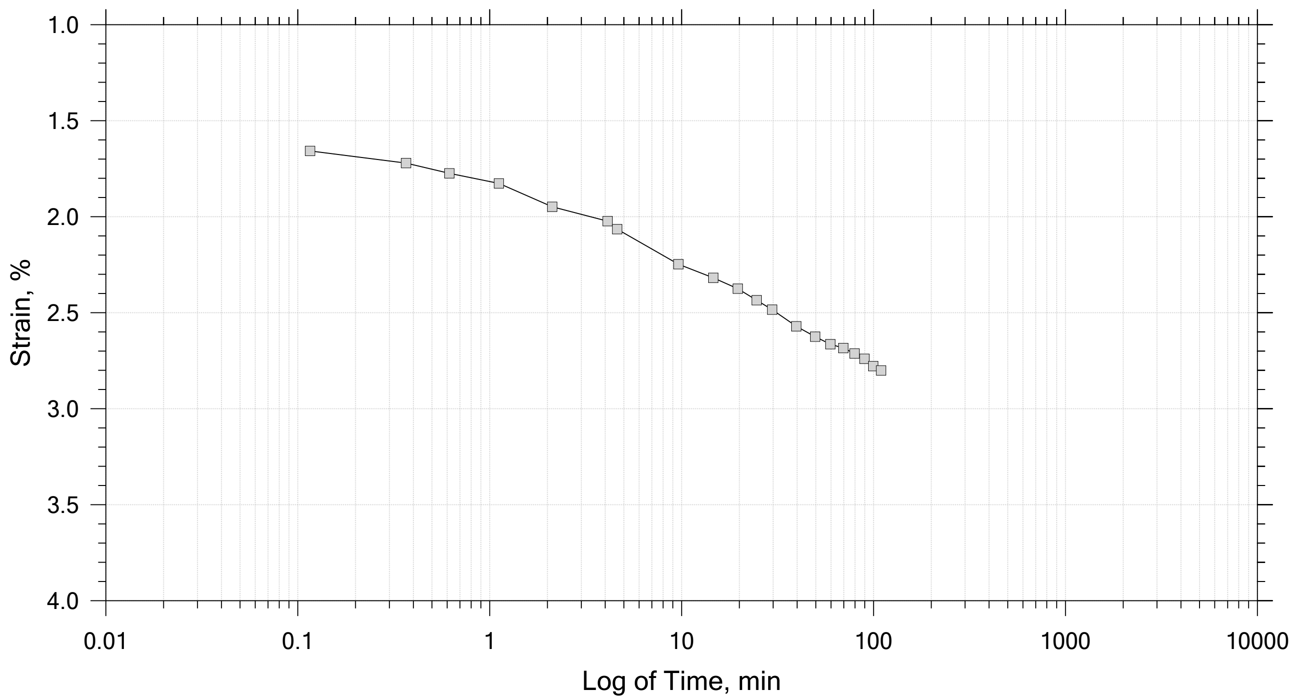
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/9/2020	Depth: 12.75
	Test Number: ICON 339	Preparation: Shelby Tube	Elevation: 30.85
	Description: Gray Silty Clay		
	Remarks: third test		

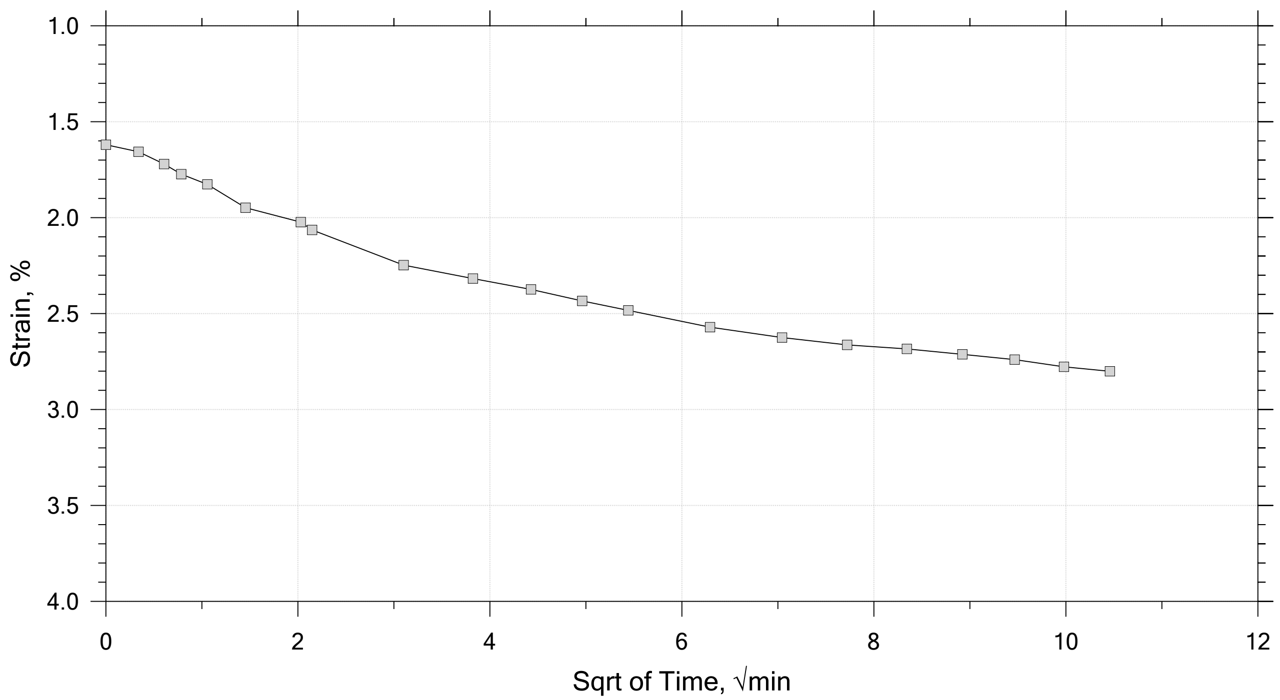
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 6 of 21

Constant Load Step

Stress: 2.28e+03 psf





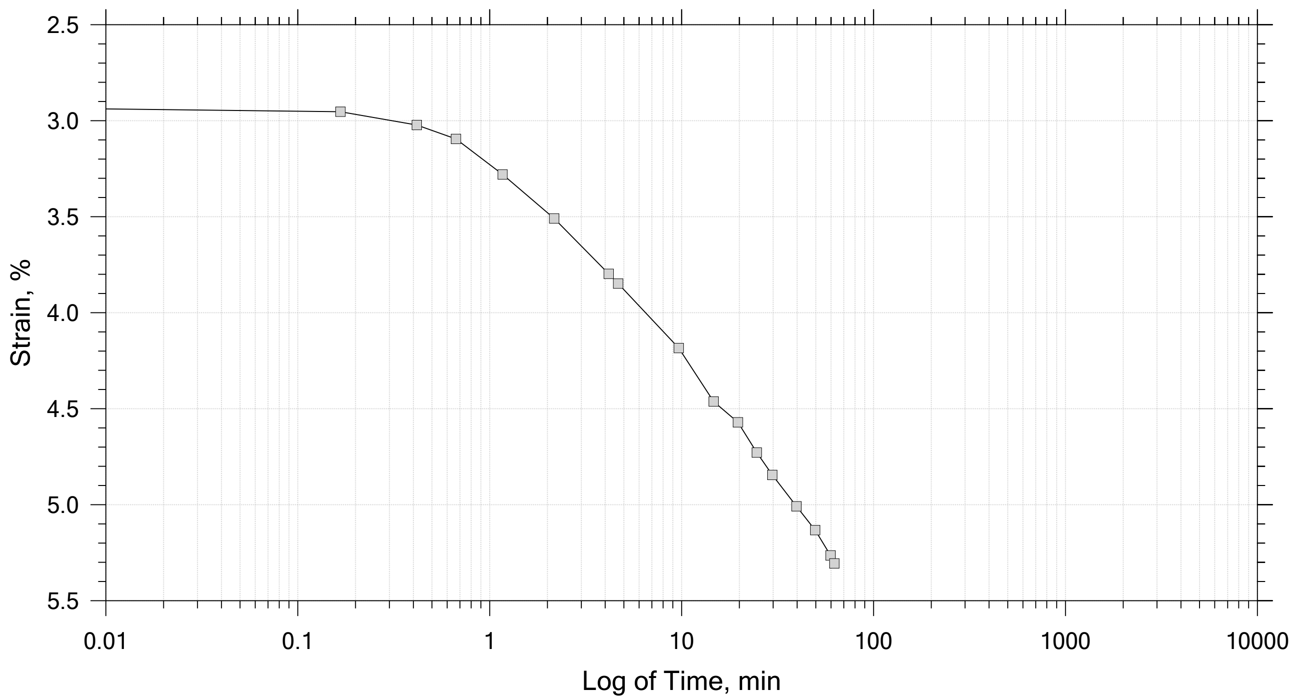
Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
Sample Number: 1U	Test Date: 11/9/2020	Depth: 12.75
Test Number: ICON 339	Preparation: Shelby Tube	Elevation: 30.85
Description: Gray Silty Clay		
Remarks: third test		

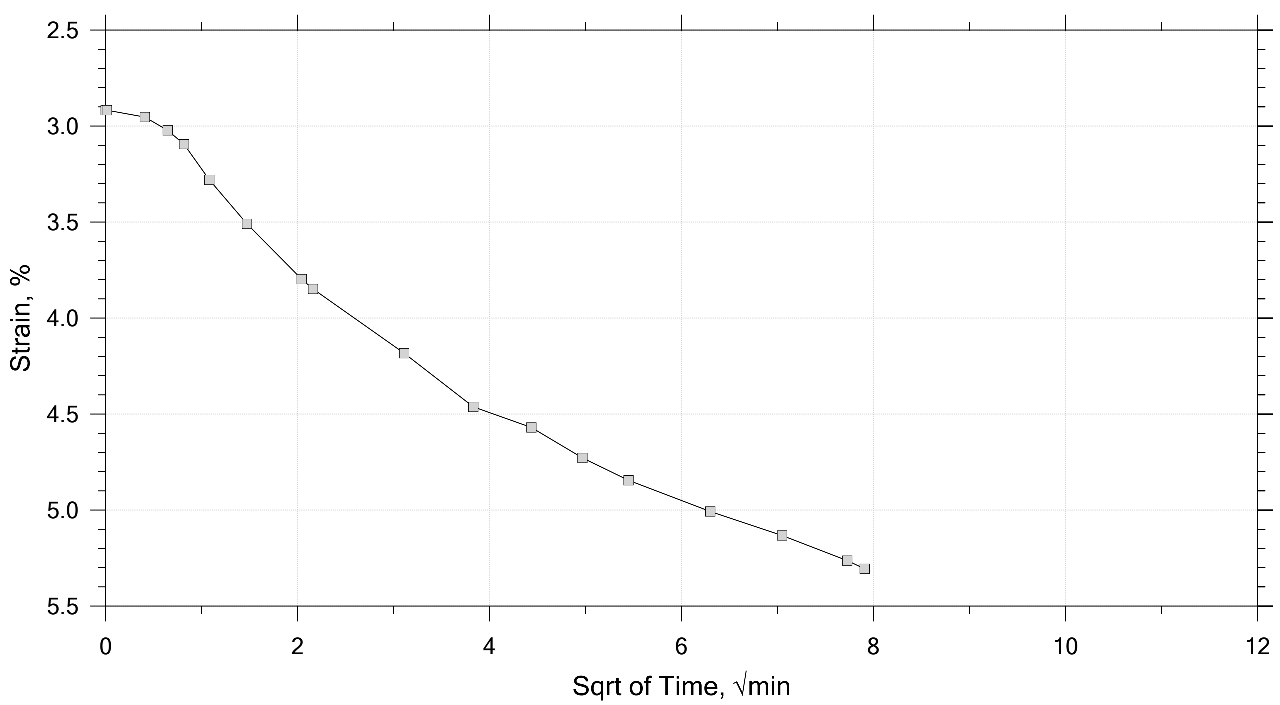
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 7 of 21

Constant Load Step

Stress: 3.42e+03 psf





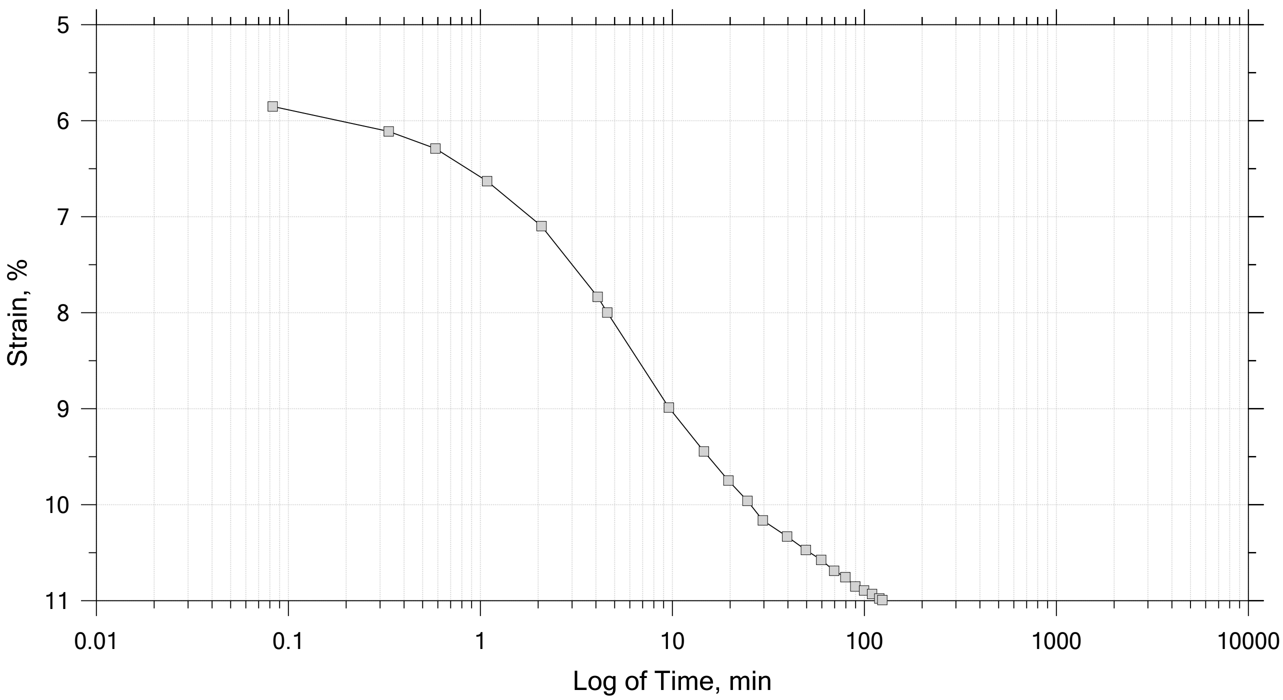
Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/9/2020	Depth: 12.75
	Test Number: ICON 339	Preparation: Shelby Tube	Elevation: 30.85
	Description: Gray Silty Clay		
	Remarks: third test		

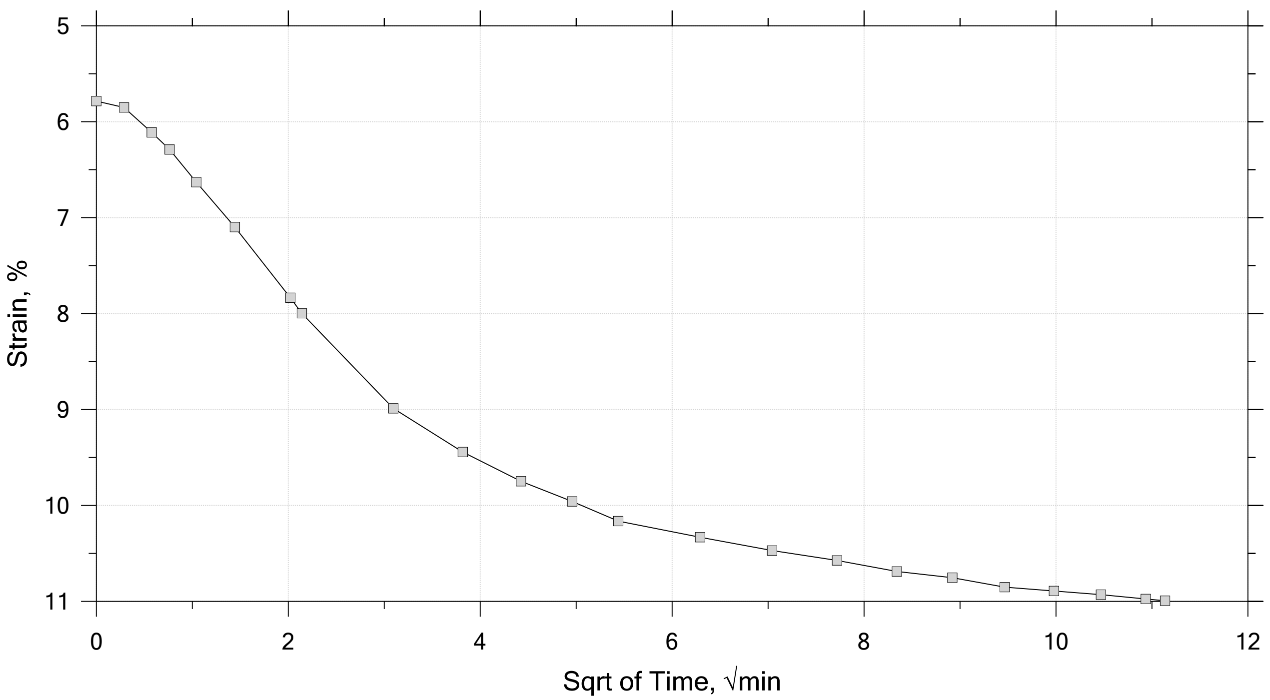
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 8 of 21

Constant Load Step

Stress: 6.08e+03 psf





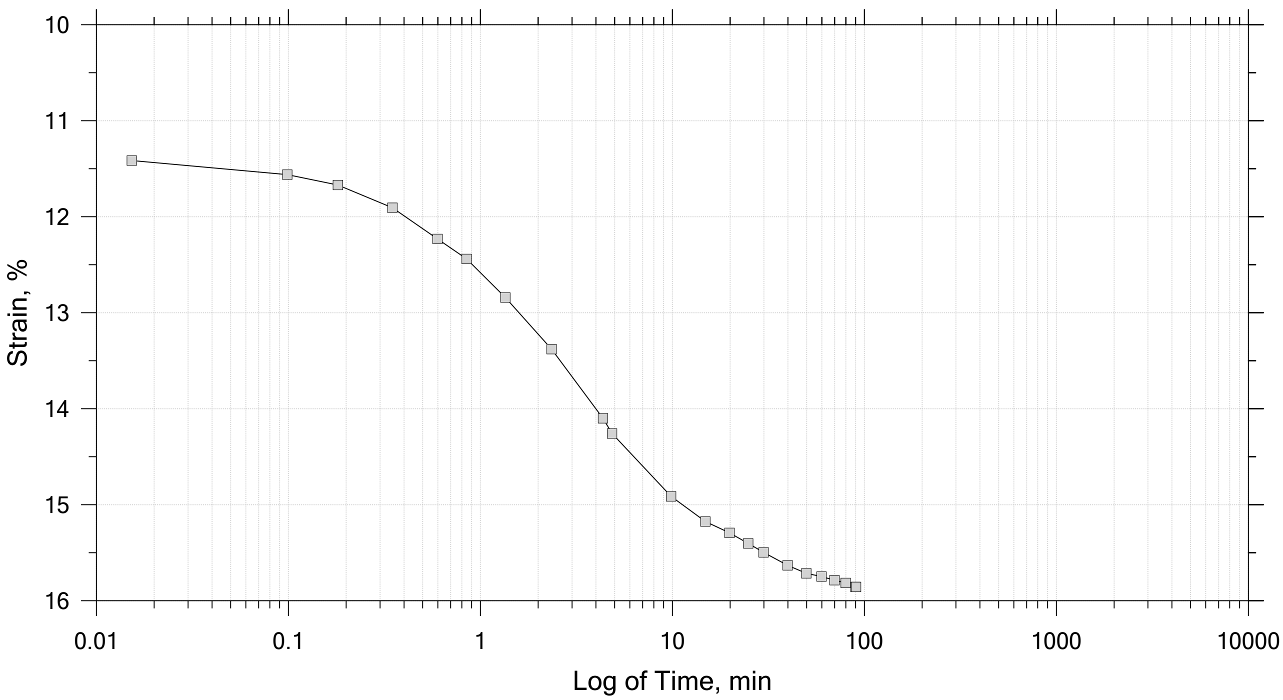
Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/9/2020	Depth: 12.75
	Test Number: ICON 339	Preparation: Shelby Tube	Elevation: 30.85
	Description: Gray Silty Clay		
	Remarks: third test		

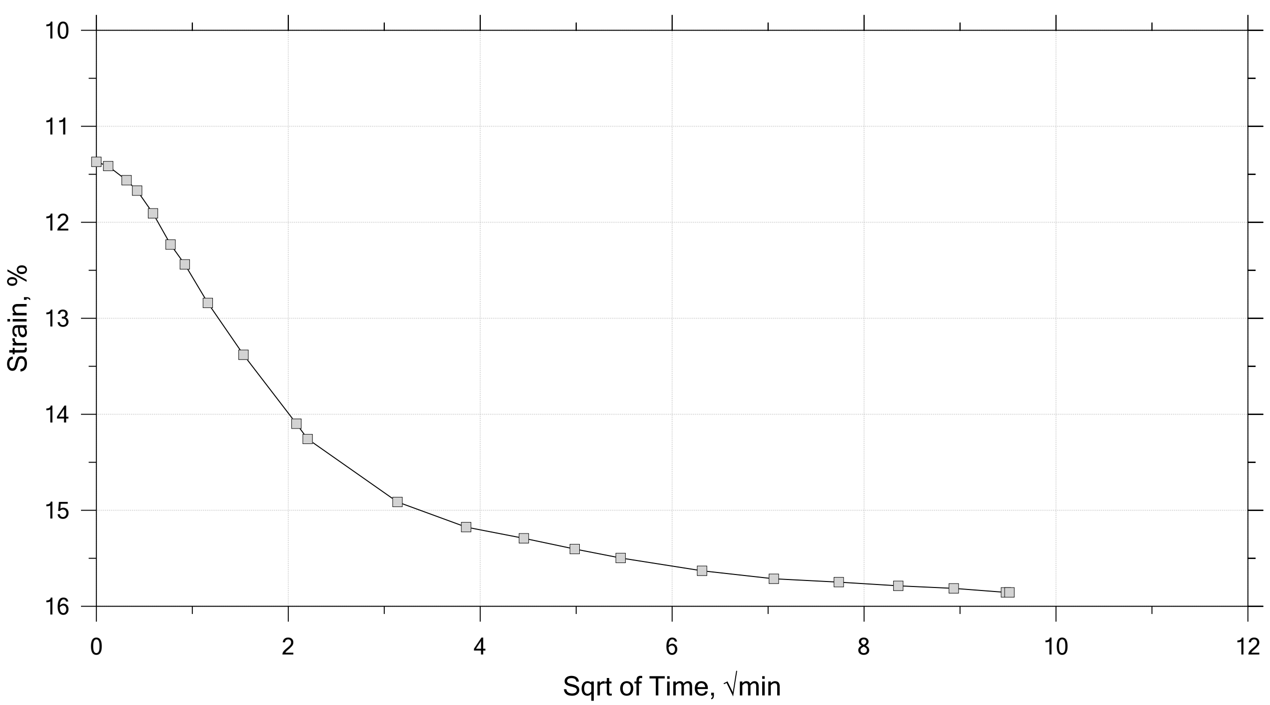
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 9 of 21

Constant Load Step

Stress: 1.22e+04 psf





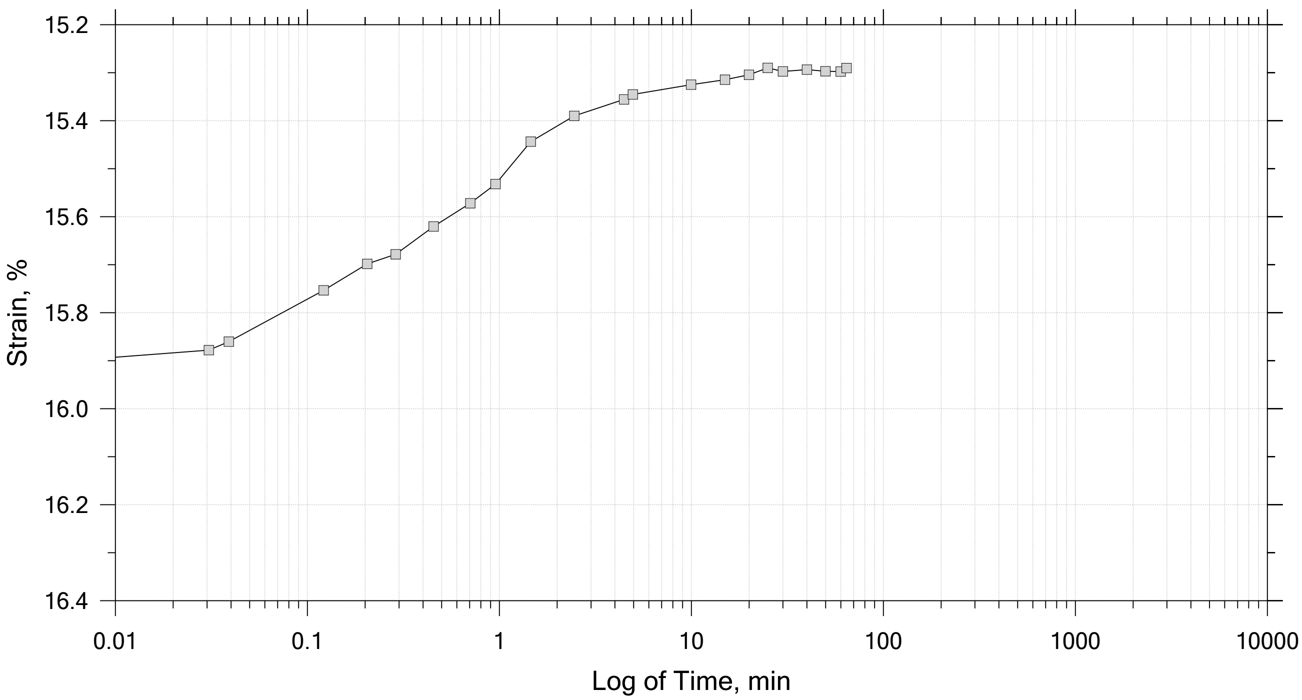
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/9/2020	Depth: 12.75
	Test Number: ICON 339	Preparation: Shelby Tube	Elevation: 30.85
	Description: Gray Silty Clay		
	Remarks: third test		

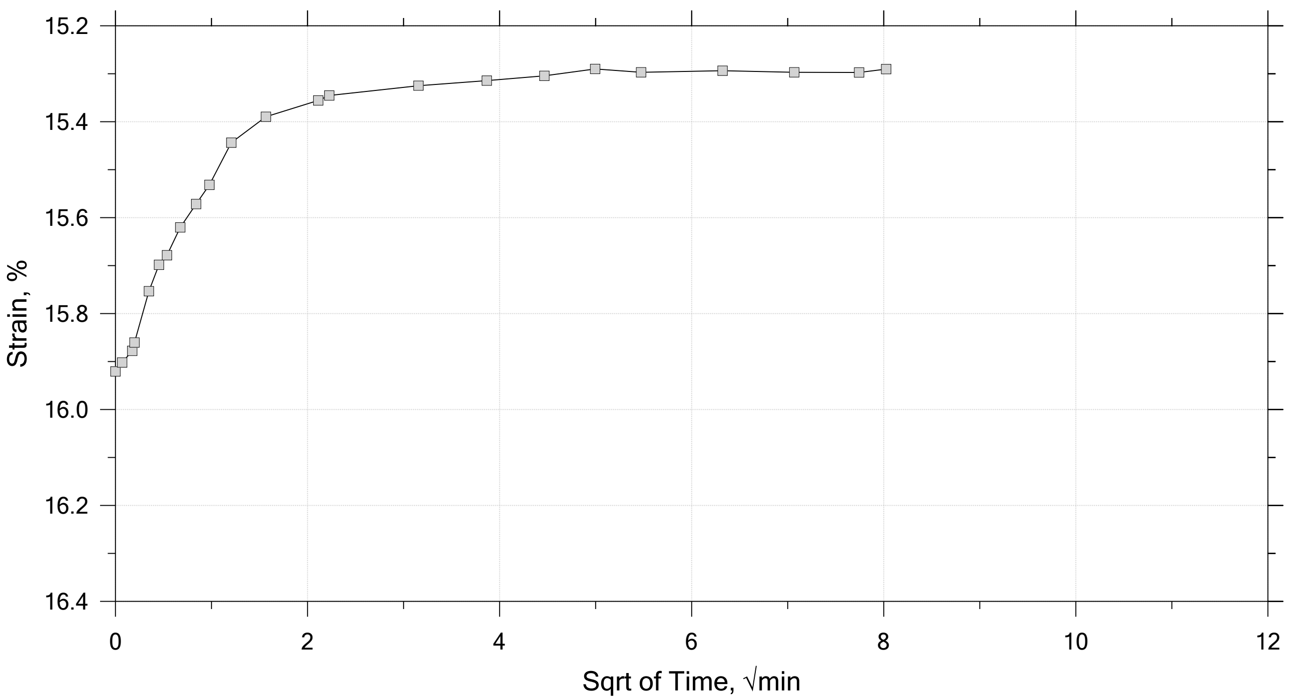
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 10 of 21

Constant Load Step

Stress: 3.04e+03 psf





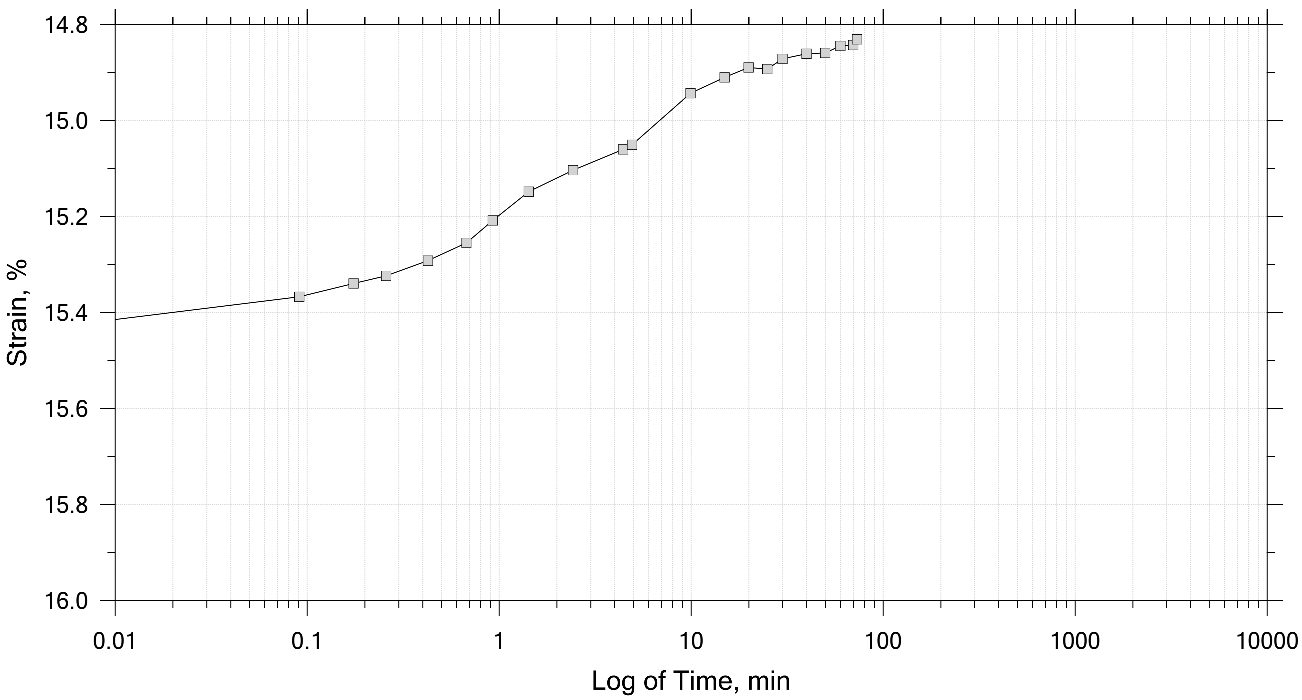
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/9/2020	Depth: 12.75
	Test Number: ICON 339	Preparation: Shelby Tube	Elevation: 30.85
	Description: Gray Silty Clay		
	Remarks: third test		

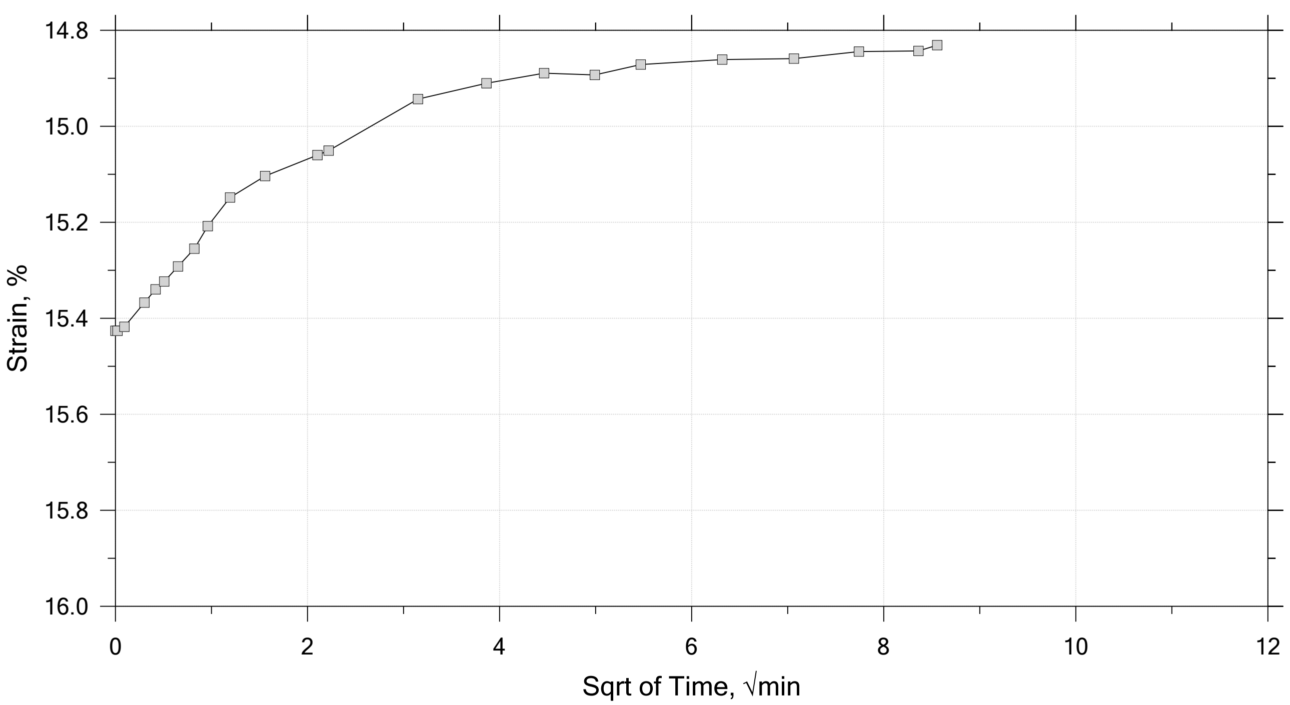
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 11 of 21

Constant Load Step

Stress: 1.52e+03 psf

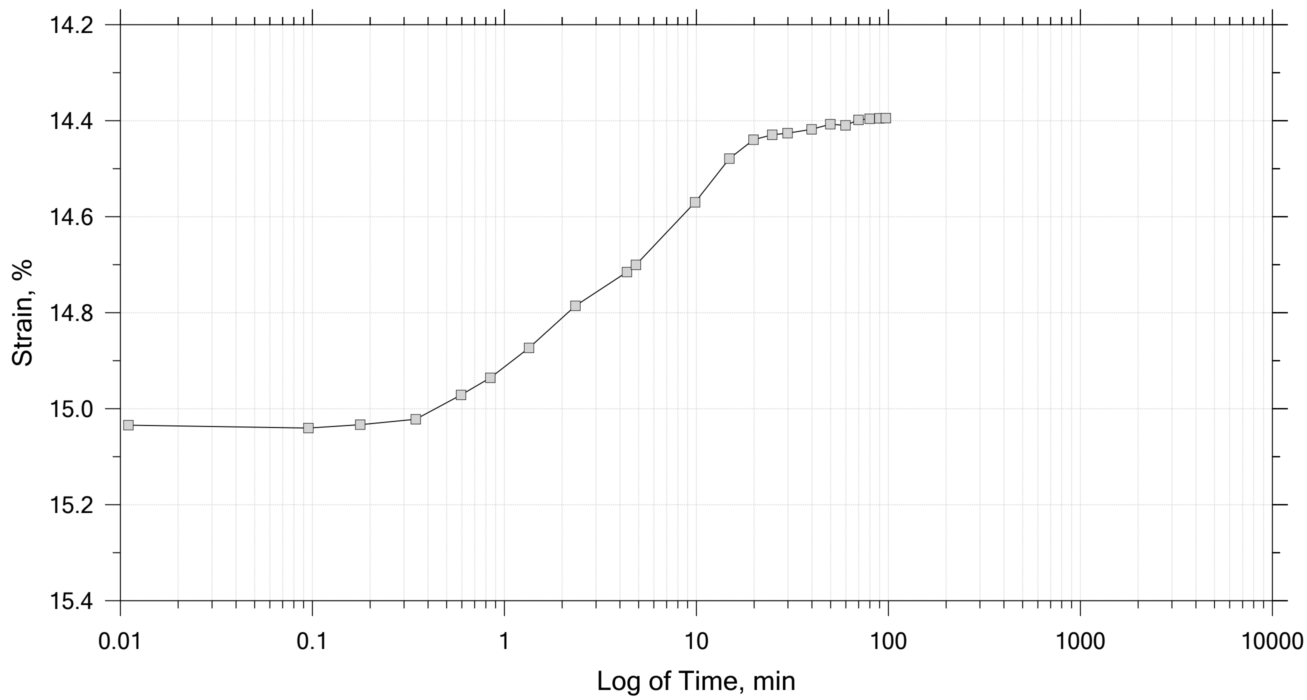


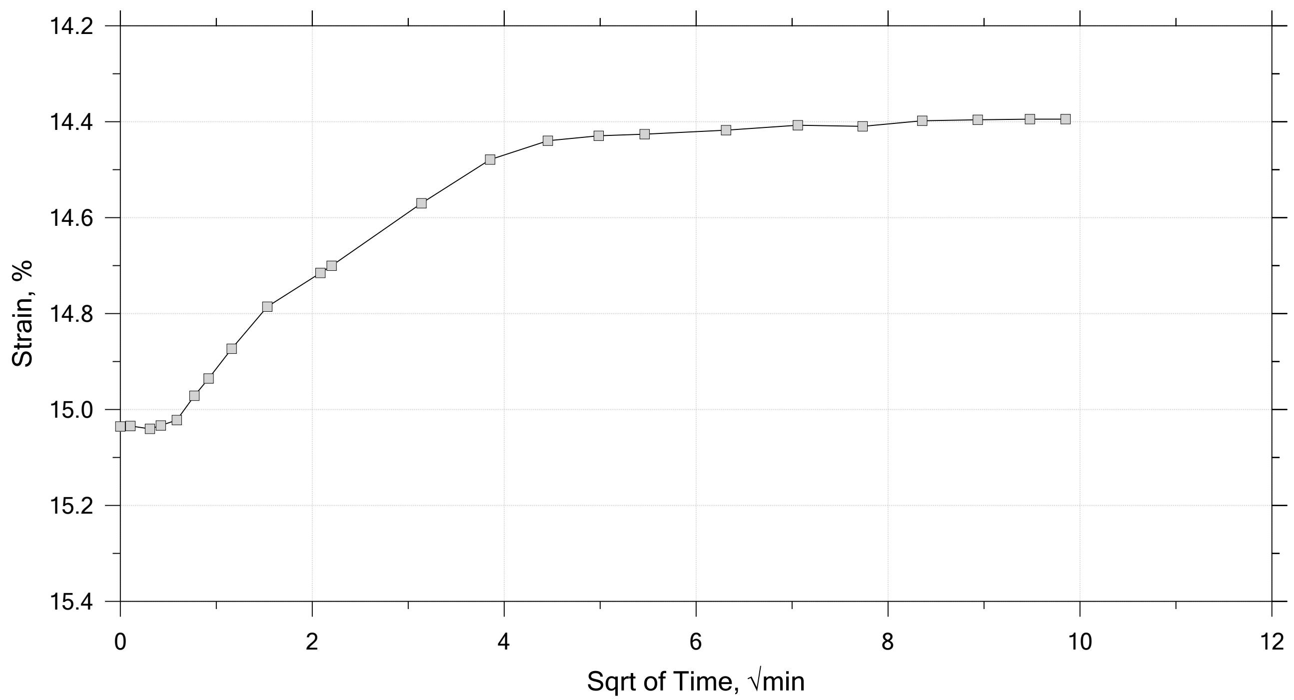


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/9/2020	Depth: 12.75
	Test Number: ICON 339	Preparation: Shelby Tube	Elevation: 30.85
	Description: Gray Silty Clay		
	Remarks: third test		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 12 of 21
Constant Load Step
Stress: 759 psf





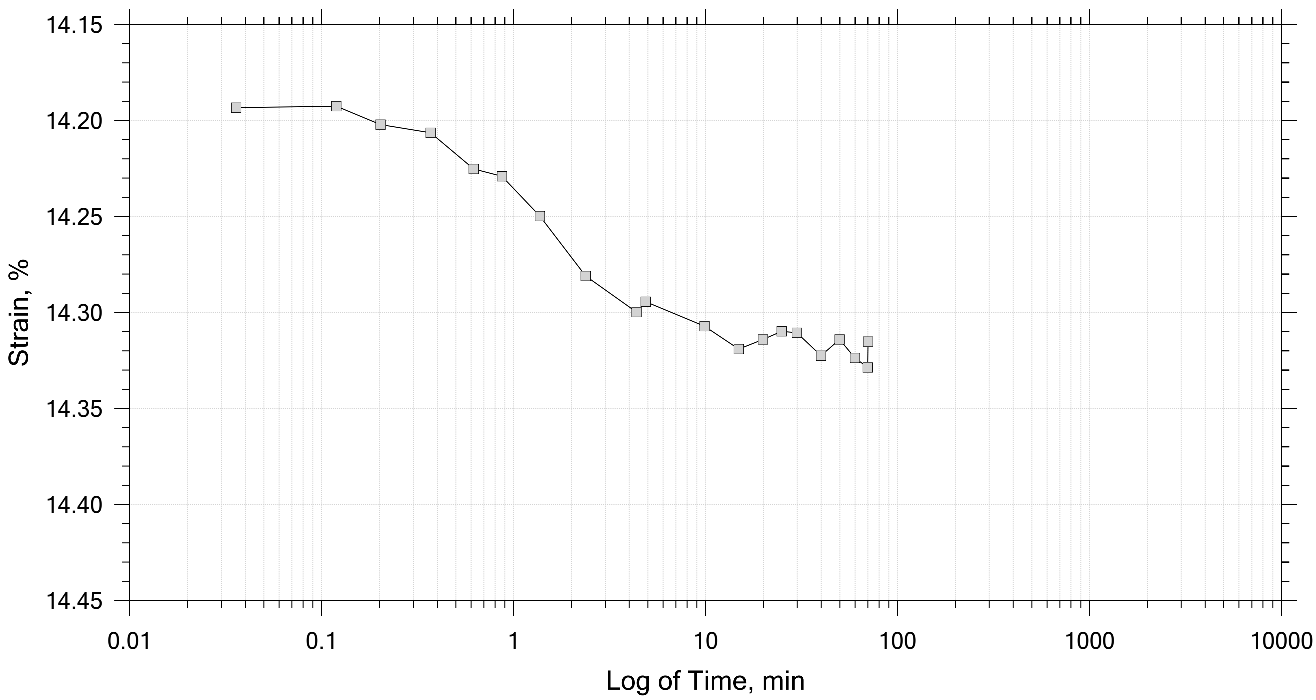
Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
Sample Number: 1U	Test Date: 11/9/2020	Depth: 12.75
Test Number: ICON 339	Preparation: Shelby Tube	Elevation: 30.85
Description: Gray Silty Clay		
Remarks: third test		

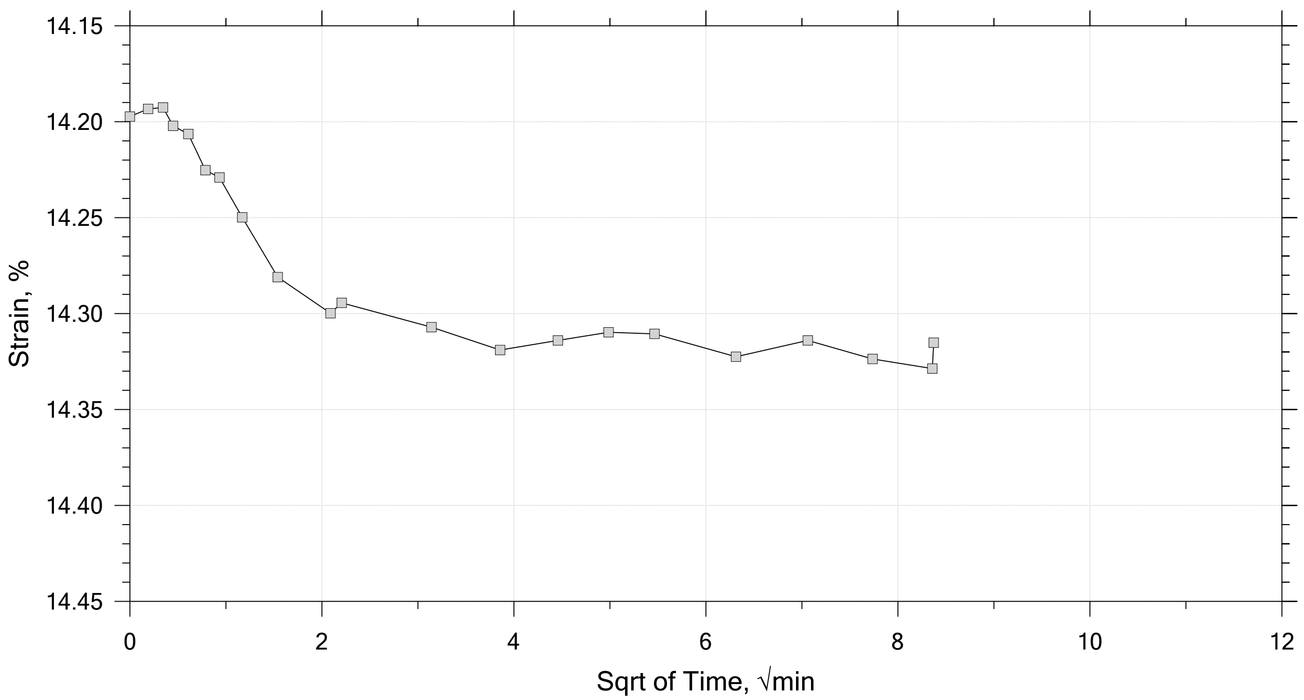
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 13 of 21

Constant Load Step

Stress: 1.33e+03 psf

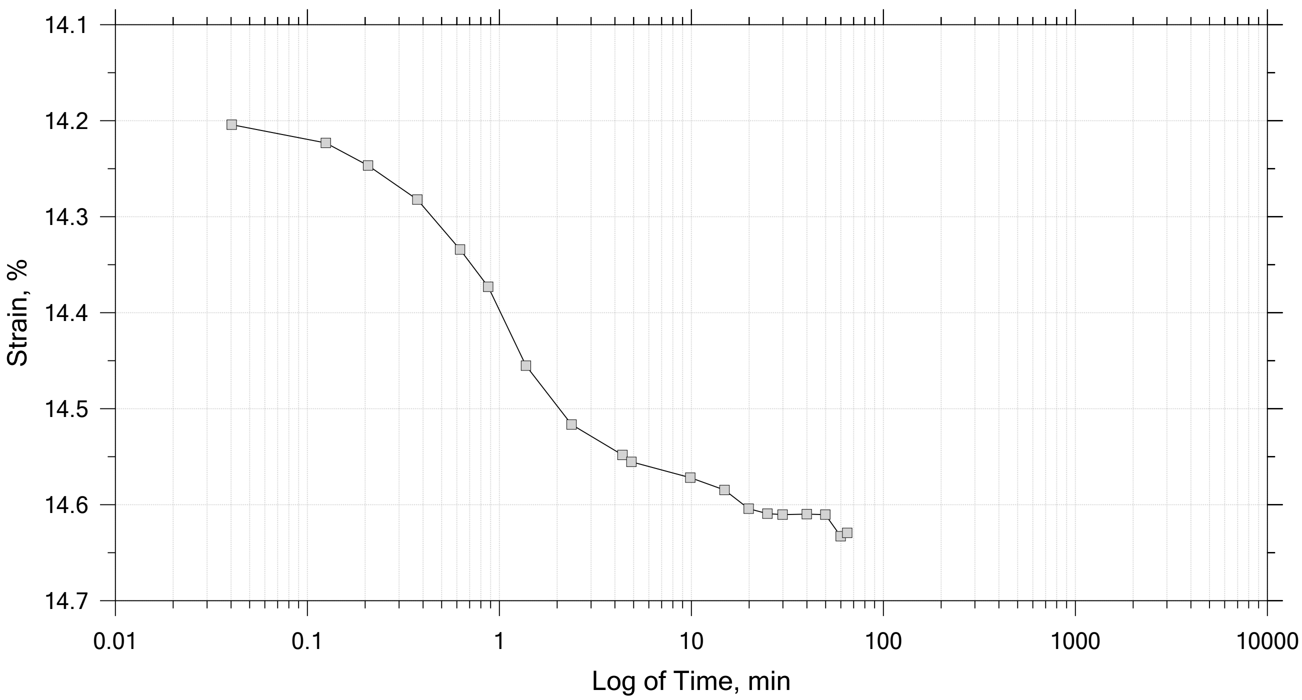


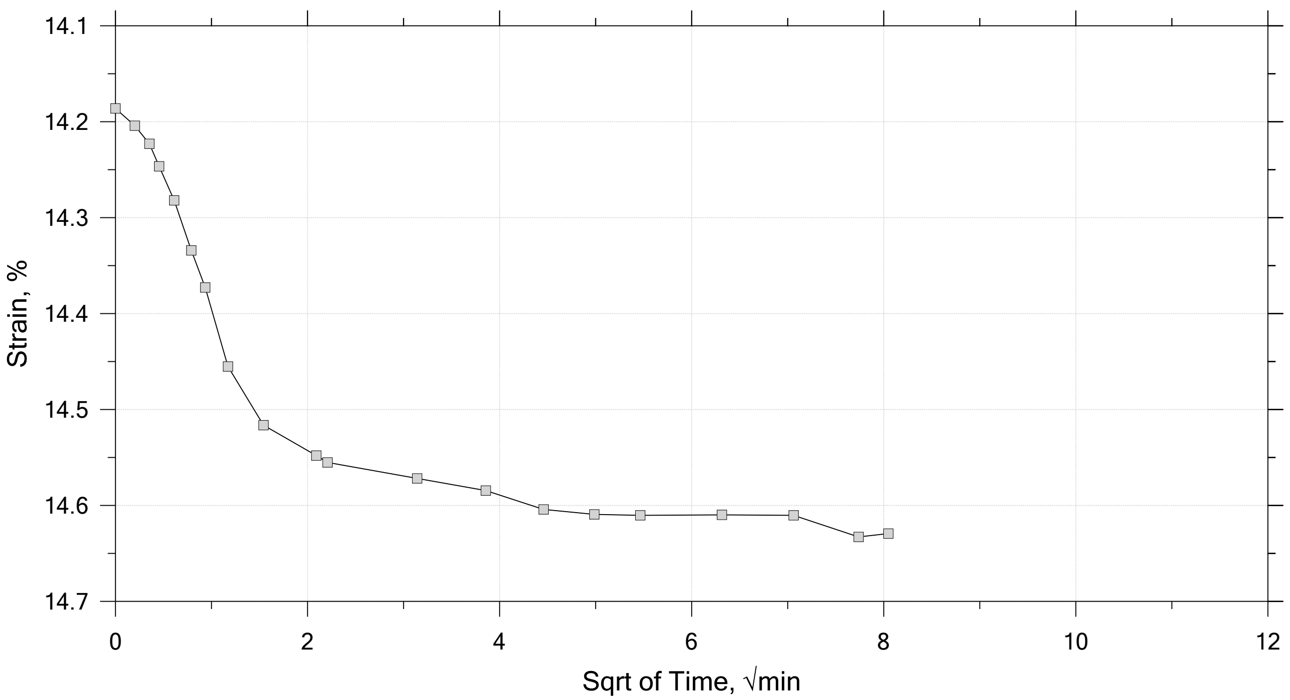


Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/9/2020	Depth: 12.75
	Test Number: ICON 339	Preparation: Shelby Tube	Elevation: 30.85
	Description: Gray Silty Clay		
	Remarks: third test		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 14 of 21
Constant Load Step
Stress: 2.66e+03 psf

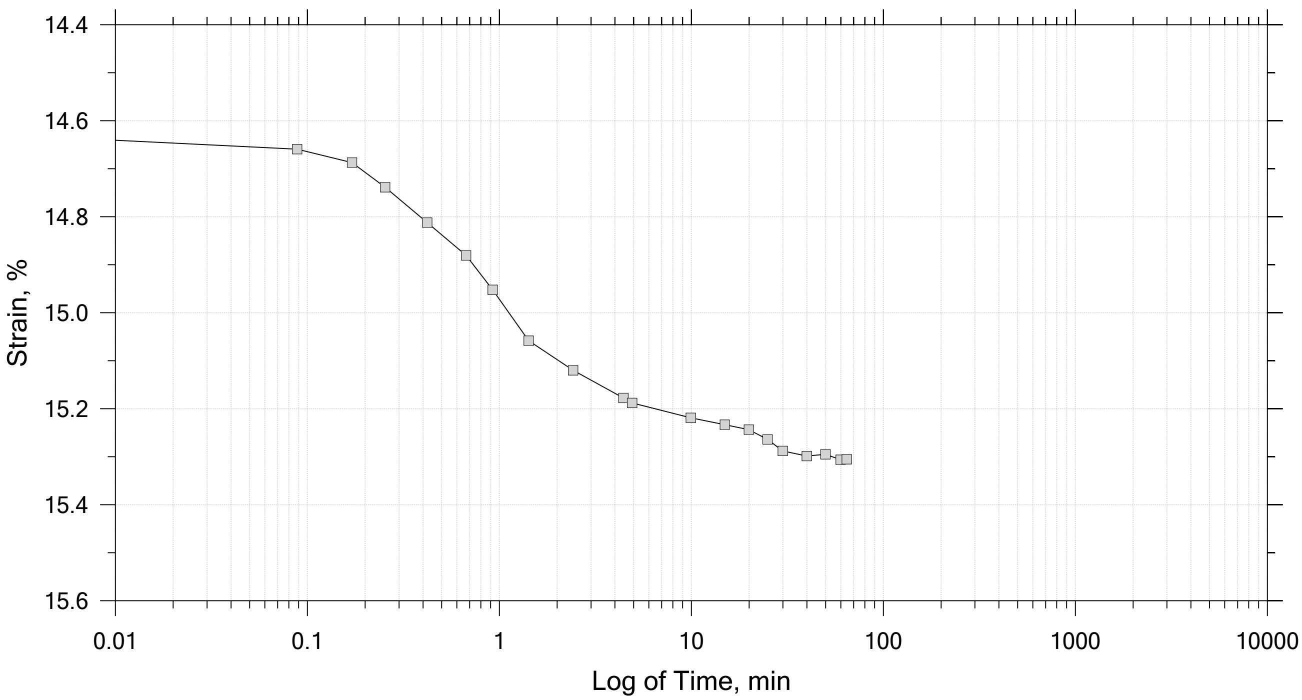


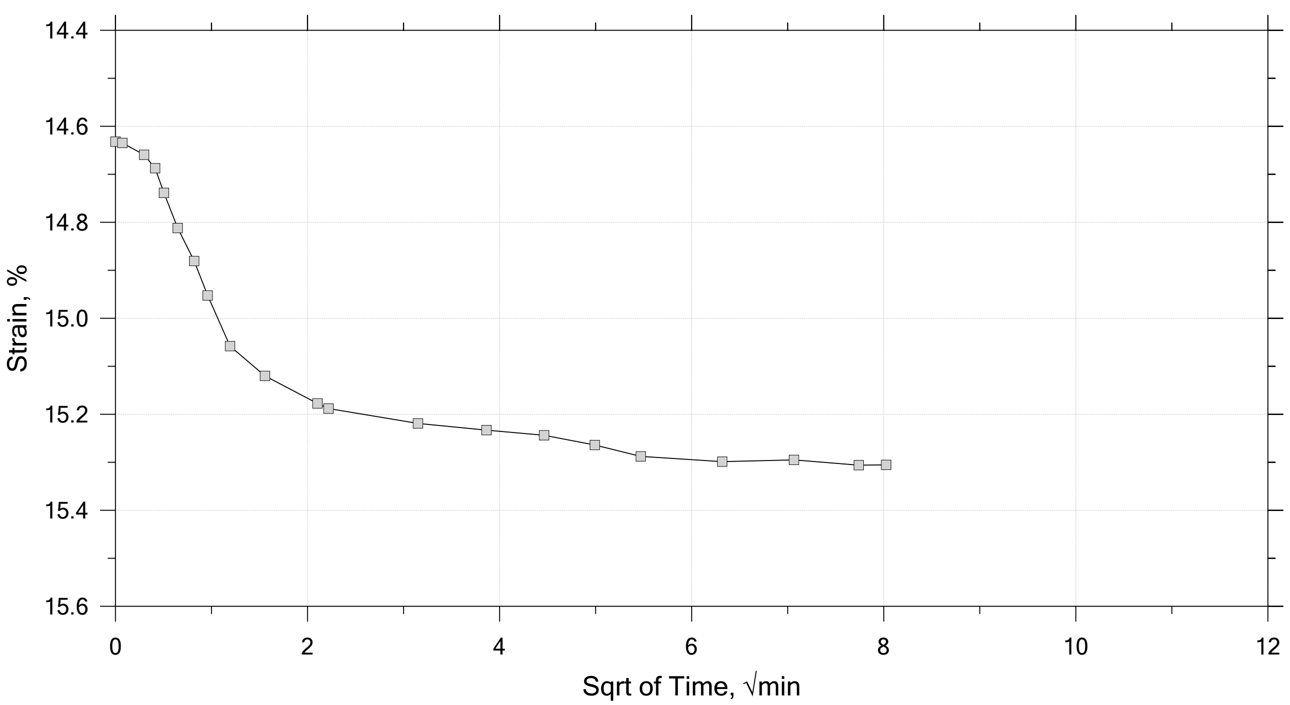


Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/9/2020	Depth: 12.75
	Test Number: ICON 339	Preparation: Shelby Tube	Elevation: 30.85
	Description: Gray Silty Clay		
	Remarks: third test		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 15 of 21
Constant Load Step
Stress: 5.32e+03 psf

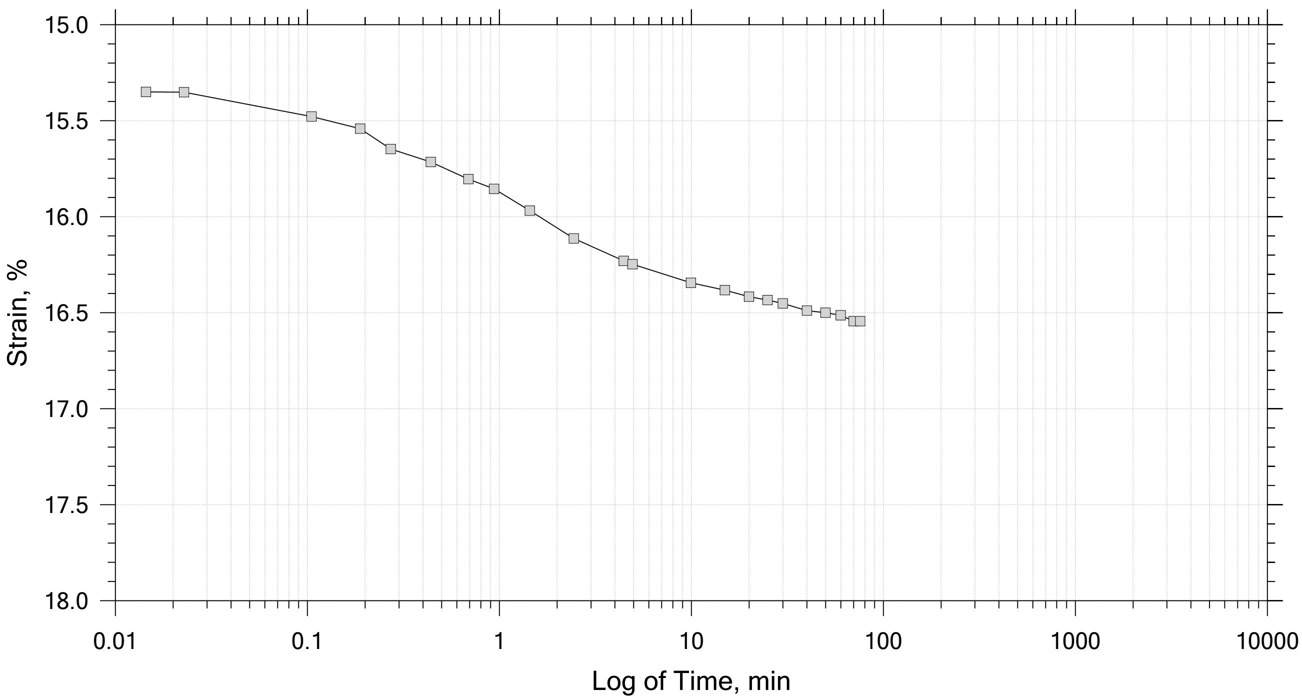


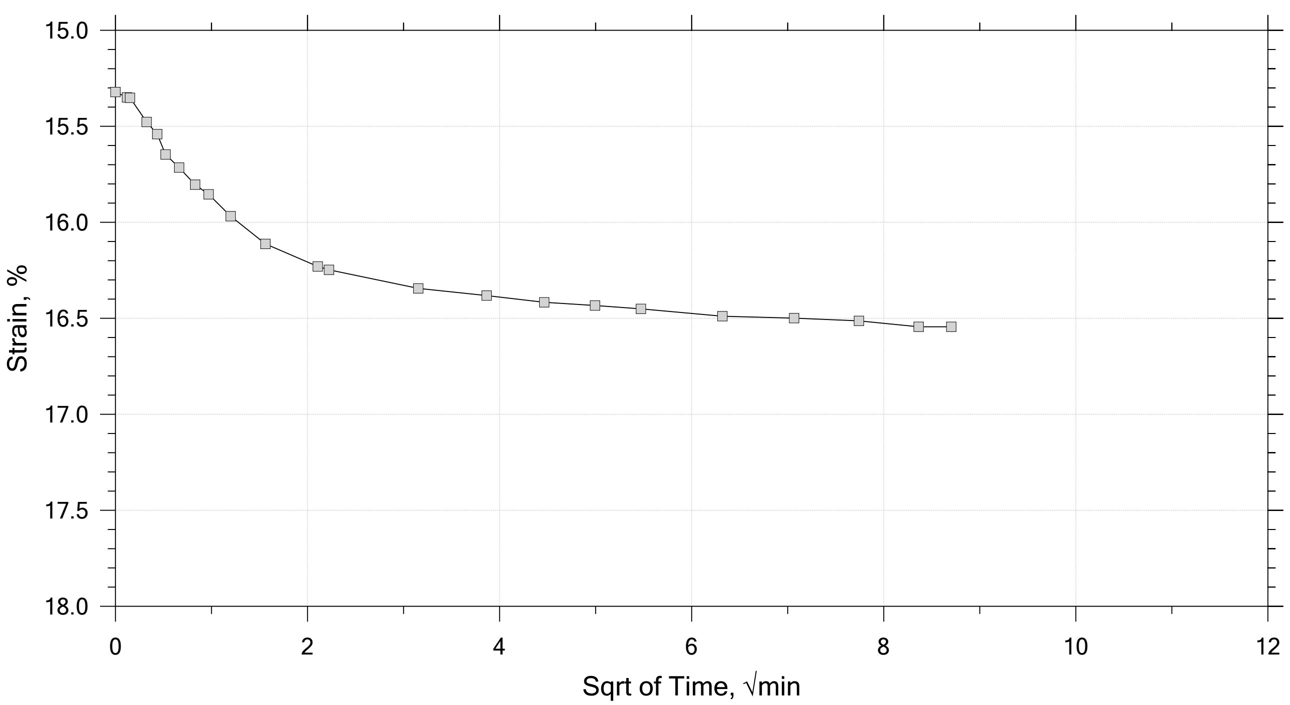


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/9/2020	Depth: 12.75
	Test Number: ICON 339	Preparation: Shelby Tube	Elevation: 30.85
	Description: Gray Silty Clay		
	Remarks: third test		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 16 of 21
Constant Load Step
Stress: 1.06e+04 psf

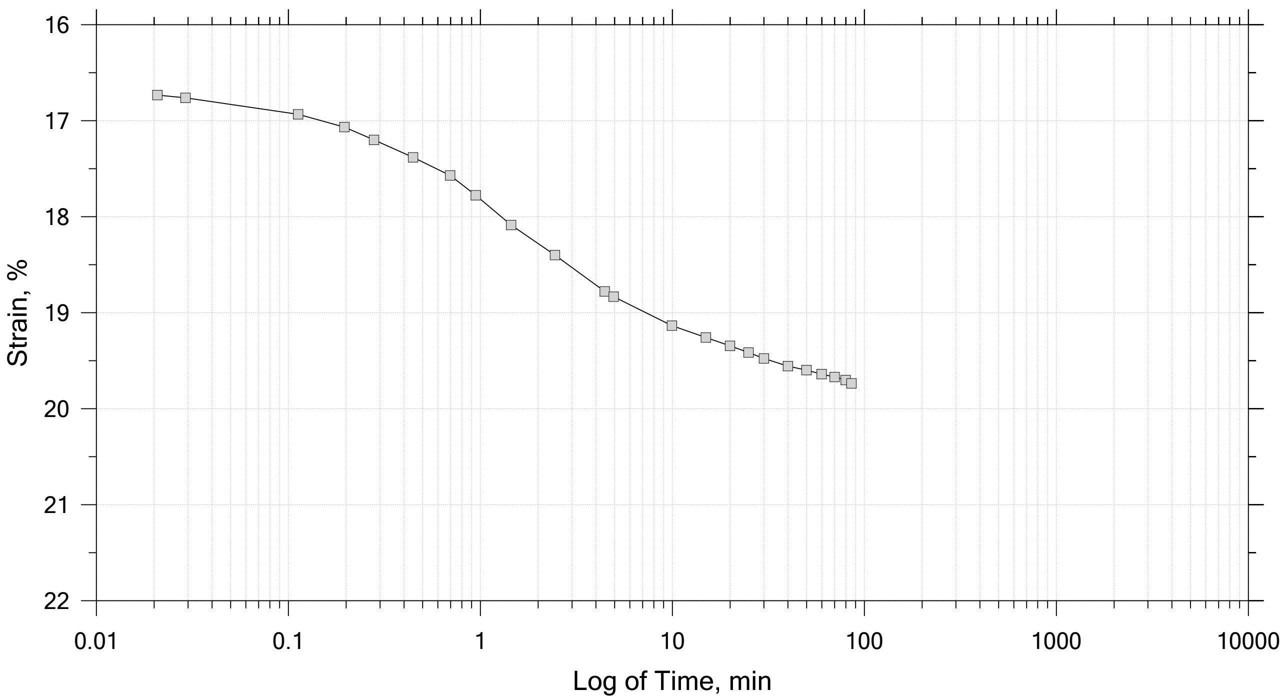


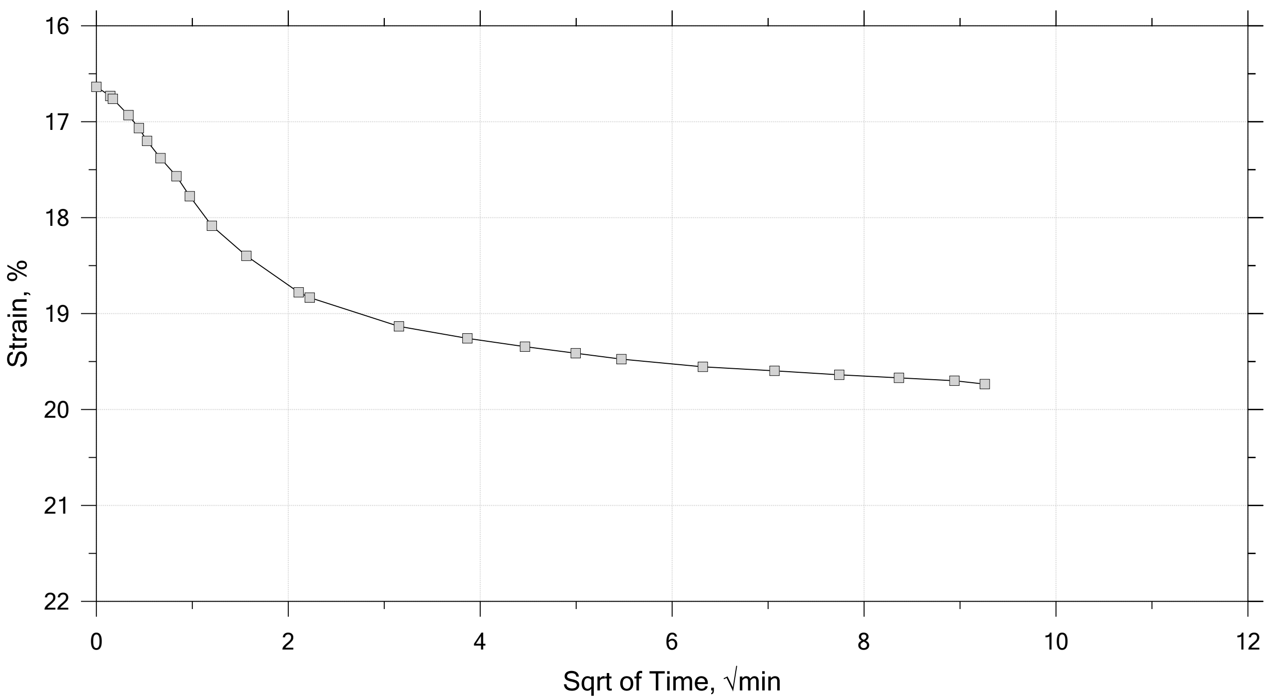


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/9/2020	Depth: 12.75
	Test Number: ICON 339	Preparation: Shelby Tube	Elevation: 30.85
	Description: Gray Silty Clay		
	Remarks: third test		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 17 of 21
Constant Load Step
Stress: 2.13e+04 psf

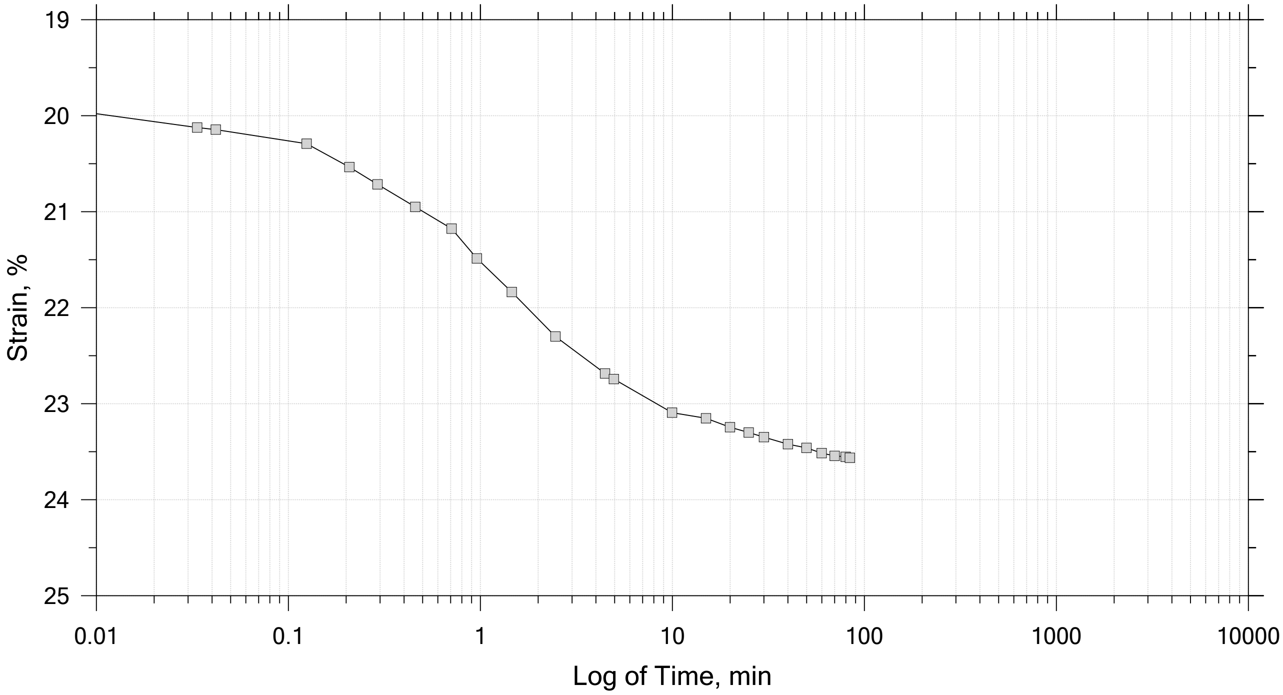


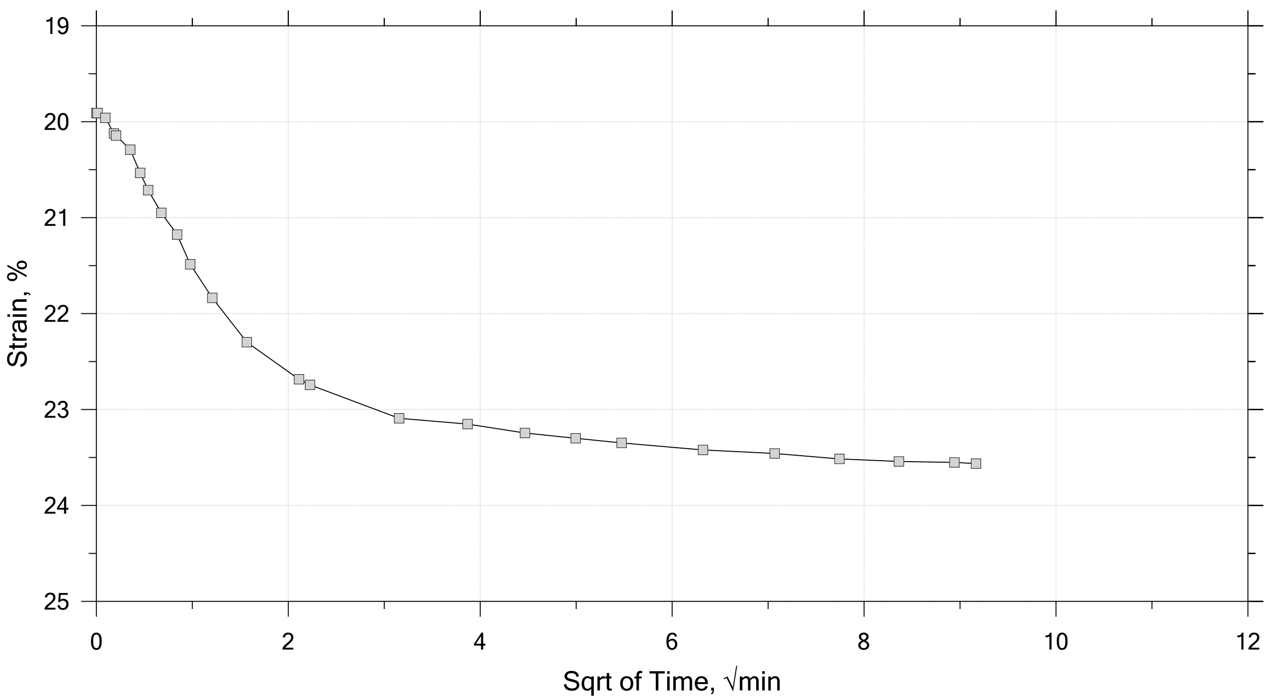


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/9/2020	Depth: 12.75
	Test Number: ICON 339	Preparation: Shelby Tube	Elevation: 30.85
	Description: Gray Silty Clay		
	Remarks: third test		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 18 of 21
Constant Load Step
Stress: 4.25e+04 psf

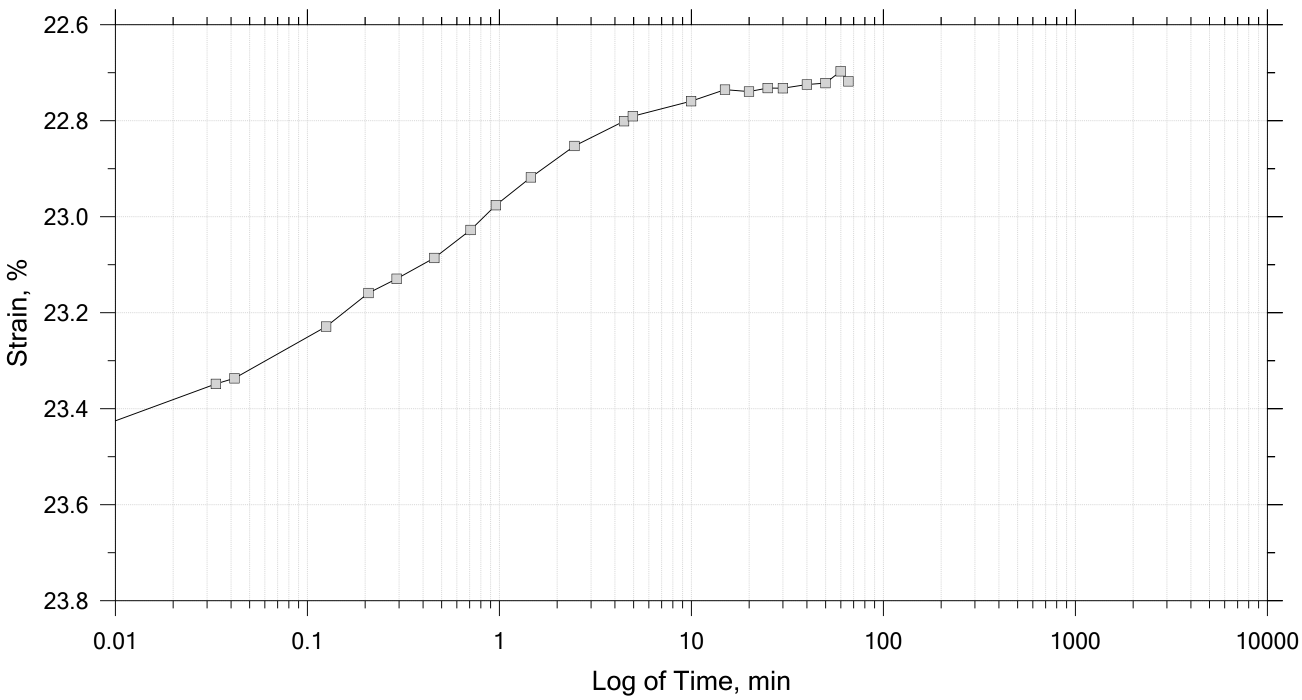


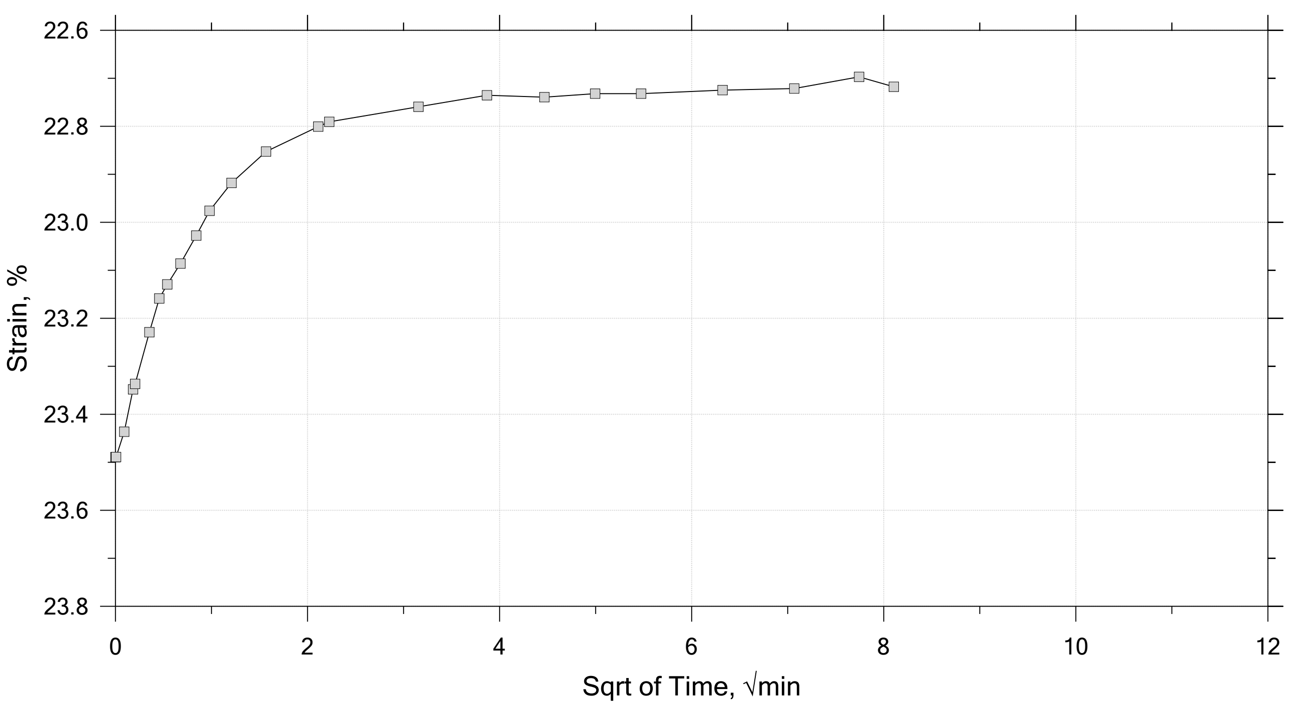


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/9/2020	Depth: 12.75
	Test Number: ICON 339	Preparation: Shelby Tube	Elevation: 30.85
	Description: Gray Silty Clay		
	Remarks: third test		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 19 of 21
Constant Load Step
Stress: 1.06e+04 psf





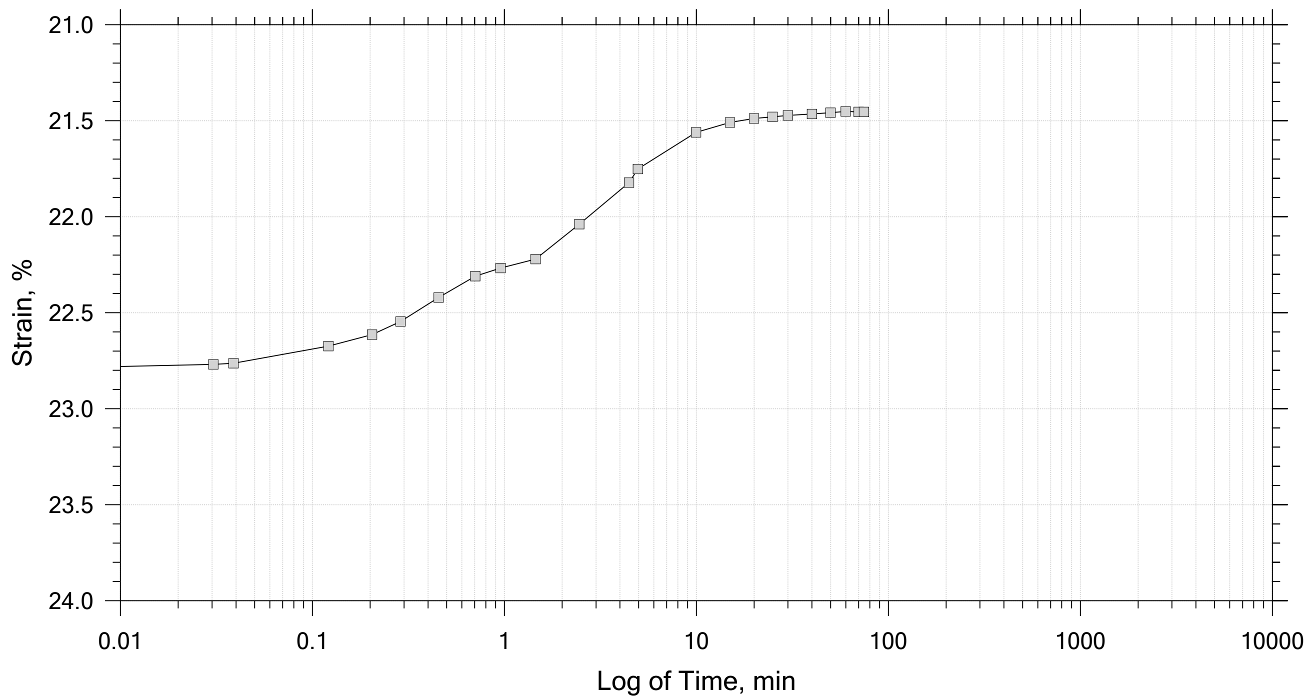
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/9/2020	Depth: 12.75
	Test Number: ICON 339	Preparation: Shelby Tube	Elevation: 30.85
	Description: Gray Silty Clay		
	Remarks: third test		

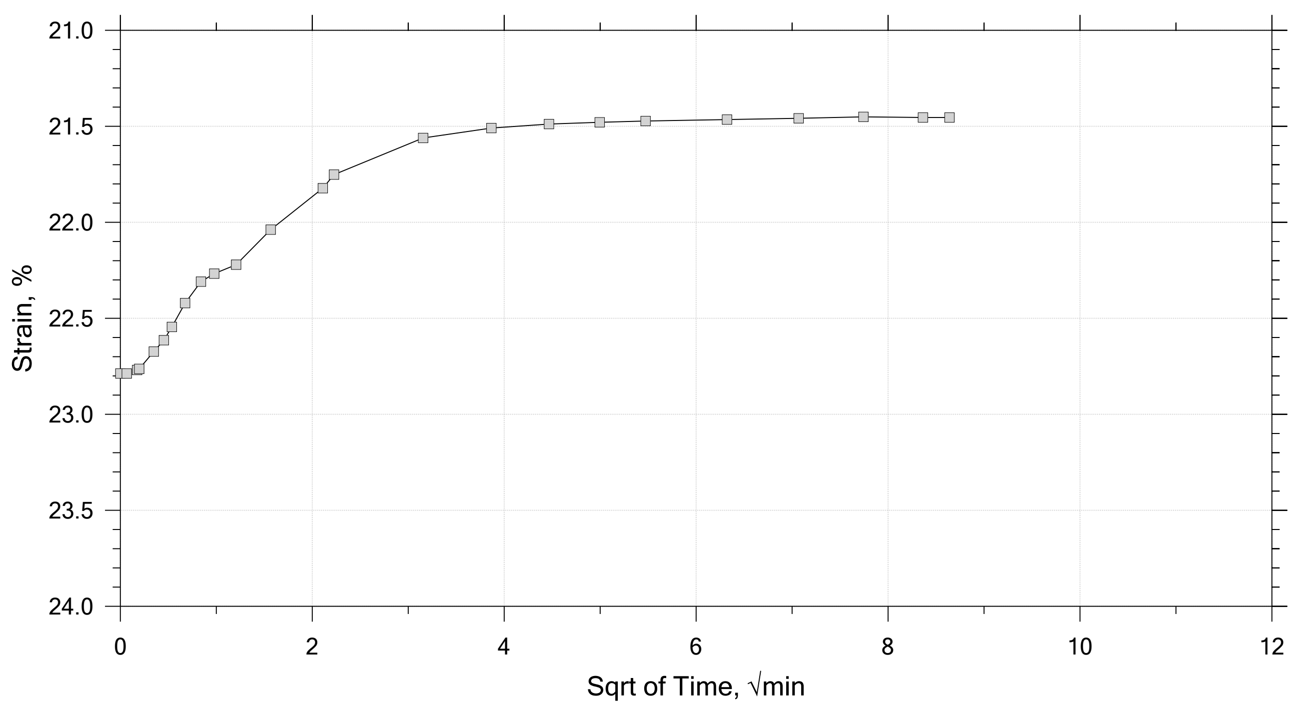
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 20 of 21

Constant Load Step

Stress: 2.66e+03 psf





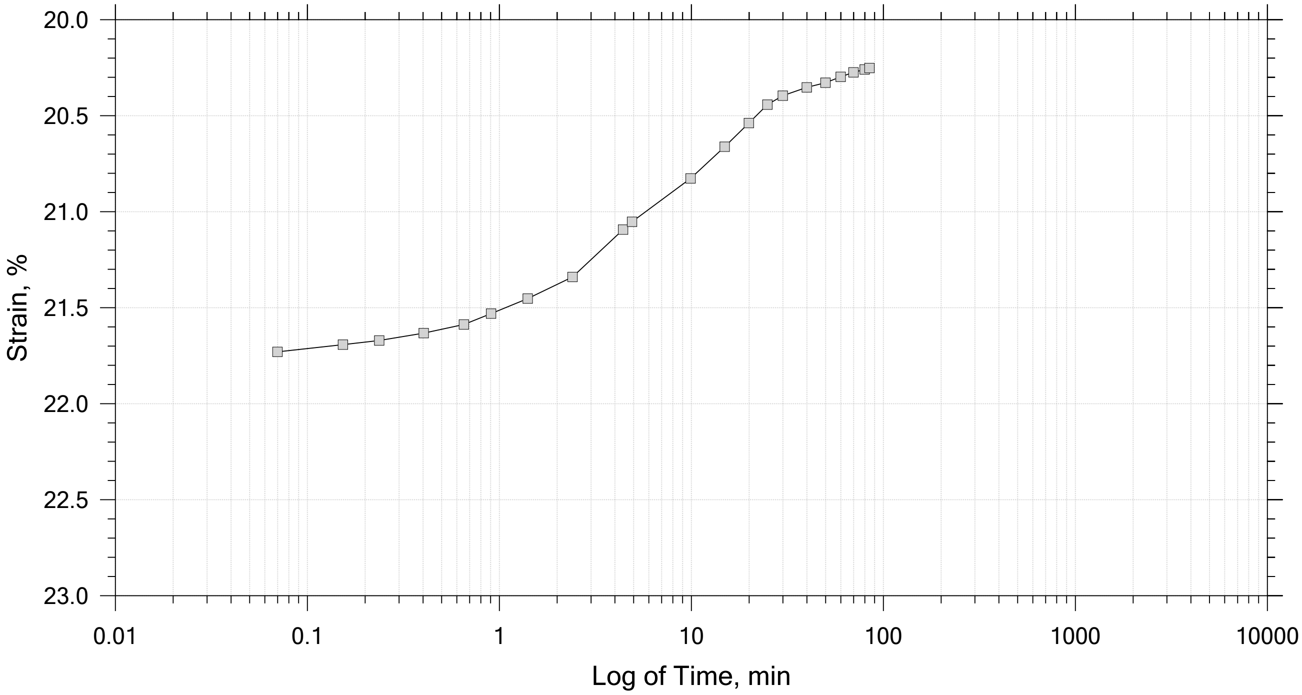
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/9/2020	Depth: 12.75
	Test Number: ICON 339	Preparation: Shelby Tube	Elevation: 30.85
	Description: Gray Silty Clay		
	Remarks: third test		

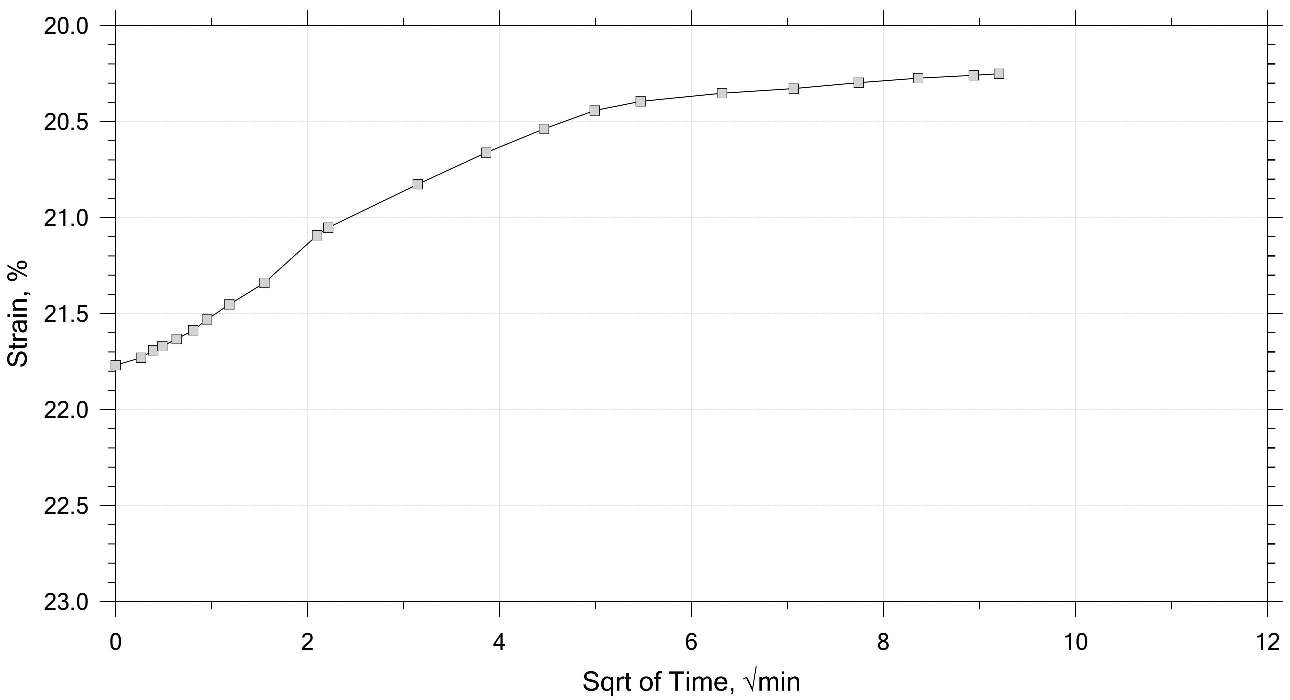
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 21 of 21

Constant Load Step

Stress: 759 psf





Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/9/2020	Depth: 12.75
	Test Number: ICON 339	Preparation: Shelby Tube	Elevation: 30.85
	Description: Gray Silty Clay		
	Remarks: third test		

One-Dimensional Consolidation by ASTM D2435 - Method B

Specimen Diameter, in: 2.50	Specific Gravity: 2.79 (Implied)	Liquid Limit: 0
Specimen Height, in: 1.00	Initial Void Ratio: 1.3	Plastic Limit: 0
Final Height, in: 0.80	Final Void Ratio: 0.835	Plasticity Index: 0

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	212	---	"ring"	309
Mass Container, gm	36.71	111.1	111.1	60.83
Mass Container + Wet Soil, gm	129.82	254.18	237.87	187.52
Mass Container + Dry Soil, gm	102.75	208.68	208.68	158.35
Mass Dry Soil, gm	66.04	97.582	97.582	97.52
Water Content, %	40.99	46.63	29.91	29.91
Void Ratio	---	1.30	0.83	---
Degree of Saturation, %	---	100.04	100.00	---
Dry Unit Weight, pcf	---	75.731	94.962	---

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: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/9/2020	Depth: 12.75
	Test Number: ICON 339	Preparation: Shelby Tube	Elevation: 30.85
	Description: Gray Silty Clay		
	Remarks: third test		

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	300.	0.003030	1.29	0.303	0.000	0.00e+00	2.02e+04	0.00e+00	0.00e+00
2	450.	0.002694	1.29	0.269	0.000	0.00e+00	-4.47e+03	-0.00e+00	0.00e+00
3	675.	0.006783	1.29	0.678	0.000	0.00e+00	3.63e+04	0.00e+00	0.00e+00
4	1.01e+03	0.01074	1.28	1.07	0.000	0.00e+00	2.34e+04	0.00e+00	0.00e+00
5	1.52e+03	0.01507	1.27	1.51	0.000	0.00e+00	1.71e+04	0.00e+00	0.00e+00
6	2.28e+03	0.02675	1.24	2.67	9.621	4.91e-02	3.08e+04	1.66e-08	0.00e+00
7	3.42e+03	0.05306	1.18	5.31	0.000	0.00e+00	4.62e+04	0.00e+00	0.00e+00
8	6.08e+03	0.1053	1.06	10.5	4.917	8.49e-02	3.93e+04	3.67e-08	0.00e+00
9	1.22e+04	0.1554	0.943	15.5	2.236	1.67e-01	1.65e+04	3.03e-08	0.00e+00
10	3.04e+03	0.1505	0.955	15.0	0.000	0.00e+00	1.08e+03	0.00e+00	0.00e+00
11	1.52e+03	0.1487	0.959	14.9	0.000	0.00e+00	2.27e+03	0.00e+00	0.00e+00
12	759.	0.1441	0.969	14.4	4.764	7.53e-02	1.22e+04	1.02e-08	0.00e+00
13	1.33e+03	0.1431	0.972	14.3	0.000	0.00e+00	-3.59e+03	-0.00e+00	0.00e+00
14	2.66e+03	0.1457	0.966	14.6	0.000	0.00e+00	3.93e+03	0.00e+00	0.00e+00
15	5.32e+03	0.1520	0.951	15.2	0.862	4.14e-01	4.79e+03	2.18e-08	0.00e+00
16	1.06e+04	0.1631	0.926	16.3	1.092	3.20e-01	4.17e+03	1.47e-08	0.00e+00
17	2.13e+04	0.1927	0.858	19.3	1.156	2.88e-01	5.56e+03	1.76e-08	0.00e+00
18	4.25e+04	0.2304	0.771	23.0	1.120	2.73e-01	3.55e+03	1.07e-08	0.00e+00
19	1.06e+04	0.2231	0.787	22.3	0.312	9.42e-01	4.58e+02	4.75e-09	0.00e+00
20	2.66e+03	0.2149	0.806	21.5	2.069	1.45e-01	2.06e+03	3.30e-09	0.00e+00
21	759.	0.2027	0.835	20.3	0.000	0.00e+00	1.29e+04	0.00e+00	0.00e+00

Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/9/2020	Depth: 12.75
	Test Number: ICON 339	Preparation: Shelby Tube	Elevation: 30.85
	Description: Gray Silty Clay		
	Remarks: third test		
	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	300.	0.003030	1.29	0.303	0.000	0.00e+00	2.02e+04	0.00e+00
2	450.	0.002694	1.29	0.269	0.000	0.00e+00	-4.47e+03	-0.00e+00
3	675.	0.006783	1.29	0.678	82.717	2.54e-02	3.63e+04	1.02e-08
4	1.01e+03	0.01074	1.28	1.07	73.673	2.83e-02	2.34e+04	7.29e-09
5	1.52e+03	0.01507	1.27	1.51	18.665	1.11e-01	1.71e+04	2.08e-08
6	2.28e+03	0.02675	1.24	2.67	28.860	7.04e-02	3.08e+04	2.39e-08
7	3.42e+03	0.05306	1.18	5.31	32.104	6.09e-02	4.62e+04	3.10e-08
8	6.08e+03	0.1053	1.06	10.5	24.402	7.37e-02	3.93e+04	3.19e-08
9	1.22e+04	0.1554	0.943	15.5	14.564	1.10e-01	1.65e+04	2.00e-08
10	3.04e+03	0.1505	0.955	15.0	1.819	8.36e-01	1.08e+03	9.92e-09
11	1.52e+03	0.1487	0.959	14.9	13.139	1.17e-01	2.27e+03	2.91e-09
12	759.	0.1441	0.969	14.4	23.128	6.68e-02	1.22e+04	9.00e-09
13	1.33e+03	0.1431	0.972	14.3	4.119	3.78e-01	-3.59e+03	-1.49e-08
14	2.66e+03	0.1457	0.966	14.6	3.706	4.19e-01	3.93e+03	1.81e-08
15	5.32e+03	0.1520	0.951	15.2	3.314	4.63e-01	4.79e+03	2.45e-08
16	1.06e+04	0.1631	0.926	16.3	3.676	4.09e-01	4.17e+03	1.88e-08
17	2.13e+04	0.1927	0.858	19.3	6.867	2.09e-01	5.56e+03	1.28e-08
18	4.25e+04	0.2304	0.771	23.0	4.103	3.21e-01	3.55e+03	1.26e-08
19	1.06e+04	0.2231	0.787	22.3	1.438	8.81e-01	4.58e+02	4.45e-09
20	2.66e+03	0.2149	0.806	21.5	8.818	1.47e-01	2.06e+03	3.33e-09
21	759.	0.2027	0.835	20.3	33.117	4.01e-02	1.29e+04	5.68e-09

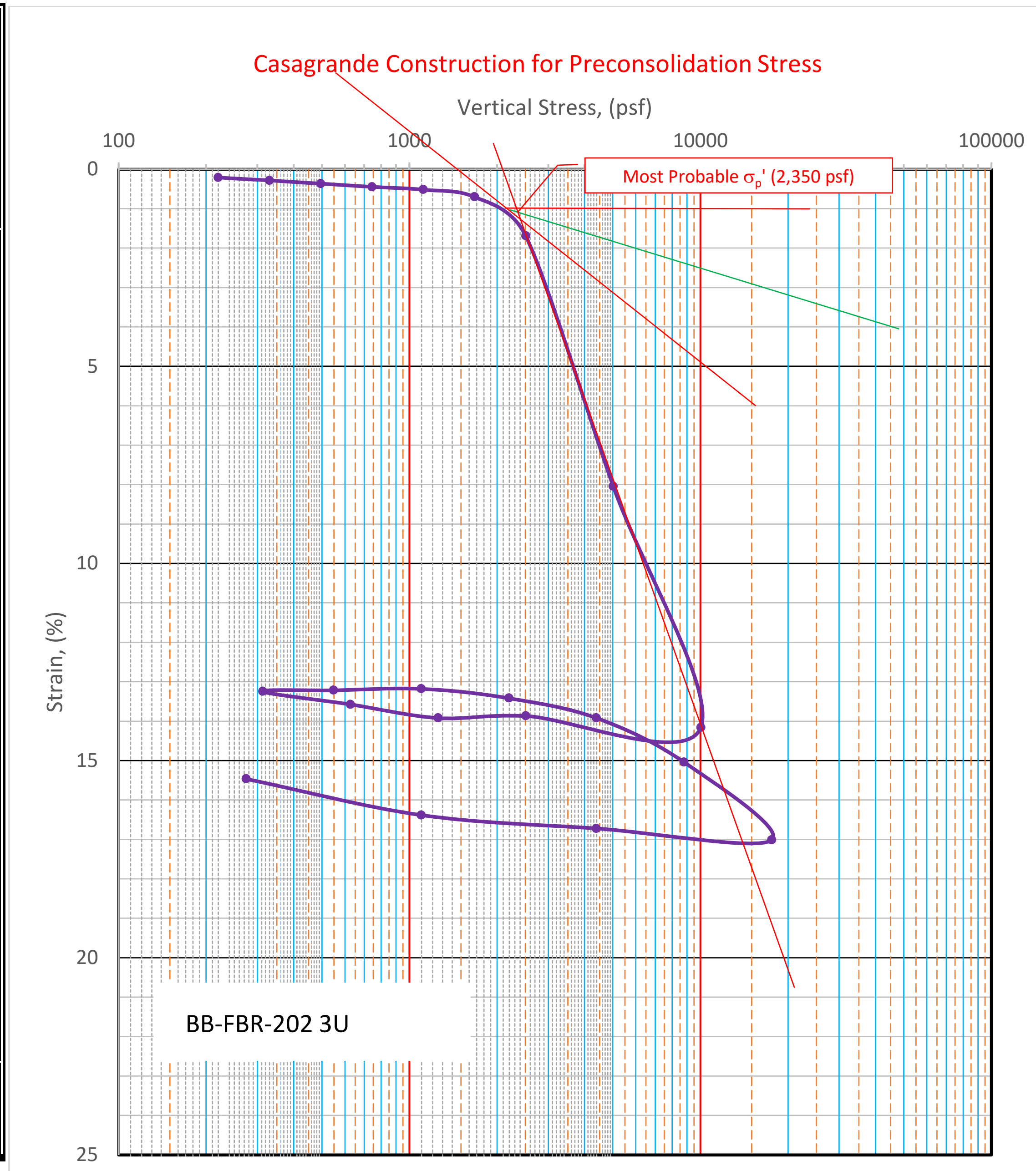
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 1U	Test Date: 11/9/2020	Depth: 12.75
	Test Number: ICON 339	Preparation: Shelby Tube	Elevation: 30.85
	Description: Gray Silty Clay		
	Remarks: third test		
	Displacement at End of Primary		

BB-FBR-202-3U

Consolidation Test Data
Summary Report

Project Name:	Bucknam Road Bridge
Project Number:	166-14
Project Location:	Falmouth, Maine
Client:	GZA
Sample Description:	Gray Silty Clay
Preparation:	Trimmed Shelby Tube

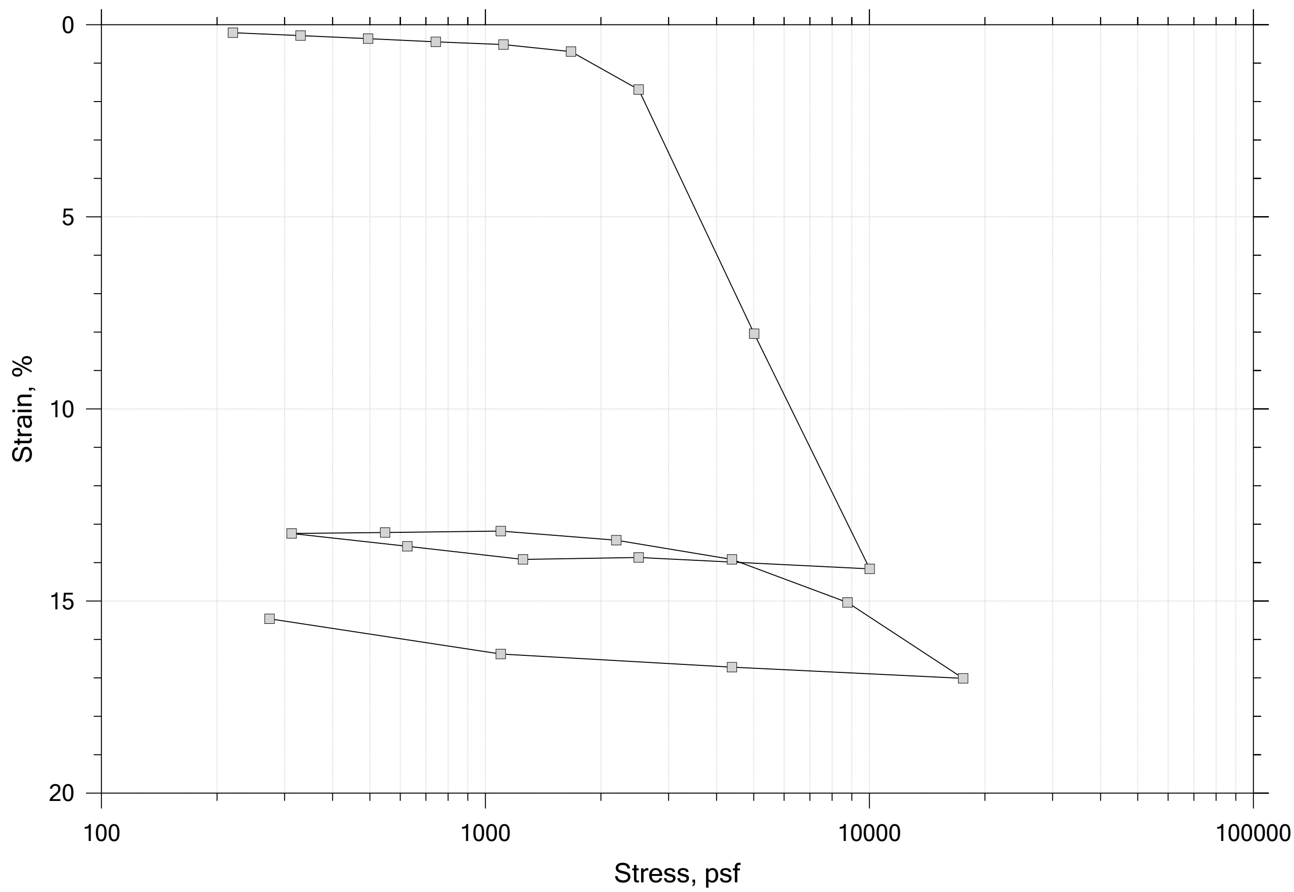
Lab Test No:	ICON 335			
Boring No.	BB-FBR-202			
Sample No:	3U			
Boring Elevation (ft).	43.6			
Sample Depth (ft):	20-22			
Test Specimen Depth (Ft):	21.25			
Test Specimen Elevation:	22.4			
Water Content (%):	38.7			
Dry Unit Weight (pcf):	81.5			
Wet Unit Weight (pcf):	113.1			
Saturation Before (%):	99.3			
Saturation After (%):	100.0			
Void Ratio Before:	1.14			
Void Ratio After:	0.81			
Overburden Pressure (psf):	--			
Max Previous stress (psf):	2,350			
Max Prev. stress (Work) (psf):	2,350			
OCR:	--			
Compression Index (C_{CE}):	0.205			
Recompression Index (C_{RE}):	0.018			
Liquid Limit:				
Plastic Limit:				
Plasticity Index:				
Liquidity Index:				
Specific Gravity (implied)	2.8			
Lab Vane Su at 21.85 ft. (psf)	439			
Tested By:	sjr			
Date Tested:	10/16/2020			
Checked By:	sjr			

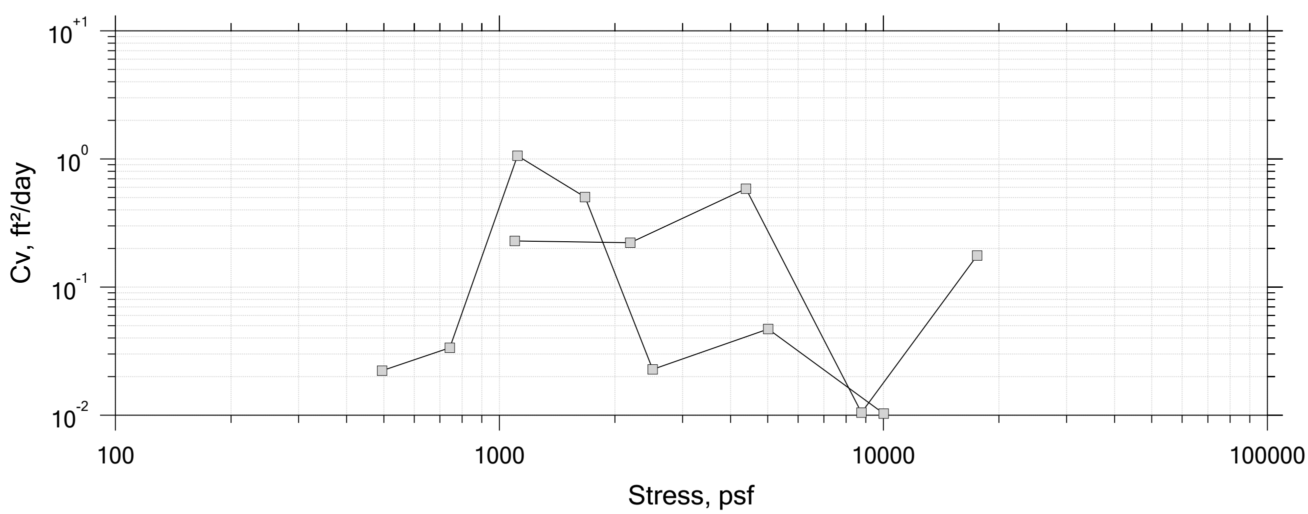


Soil Metrics LLC Geotechnical Engineering

One-Dimensional Consolidation by ASTM D2435 - Method B

Summary Report

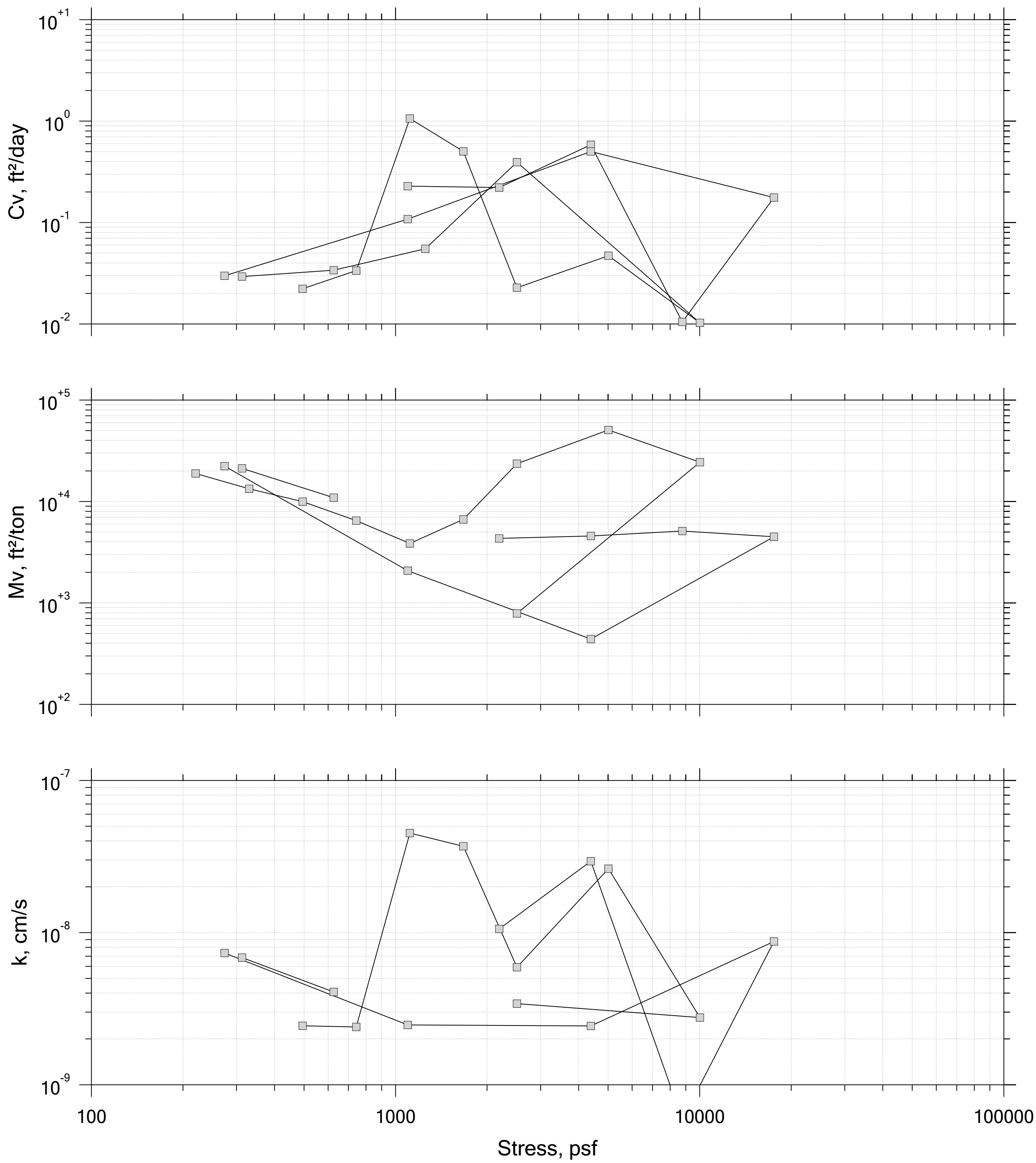




Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 10/16/2020	Depth: 21.35
	Test Number: ICON 335	Preparation: Shelby Tube	Elevation: 22.25
	Description: Gray Silty Clay		
	Remarks:		
	Displacement at End of Primary		

One-Dimensional Consolidation by ASTM D2435 - Method B

Sqrt of Time Coefficients



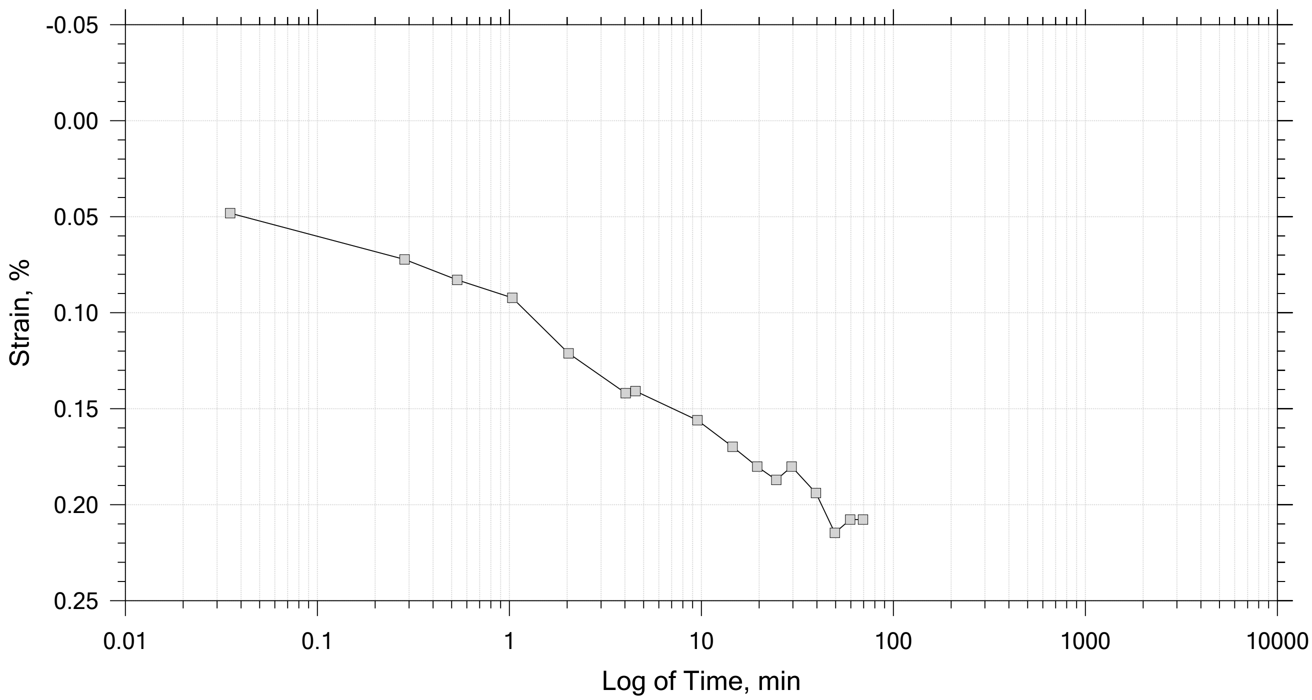
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 10/16/2020	Depth: 21.35
	Test Number: ICON 335	Preparation: Shelby Tube	Elevation: 22.25
	Description: Gray Silty Clay		
	Remarks:		

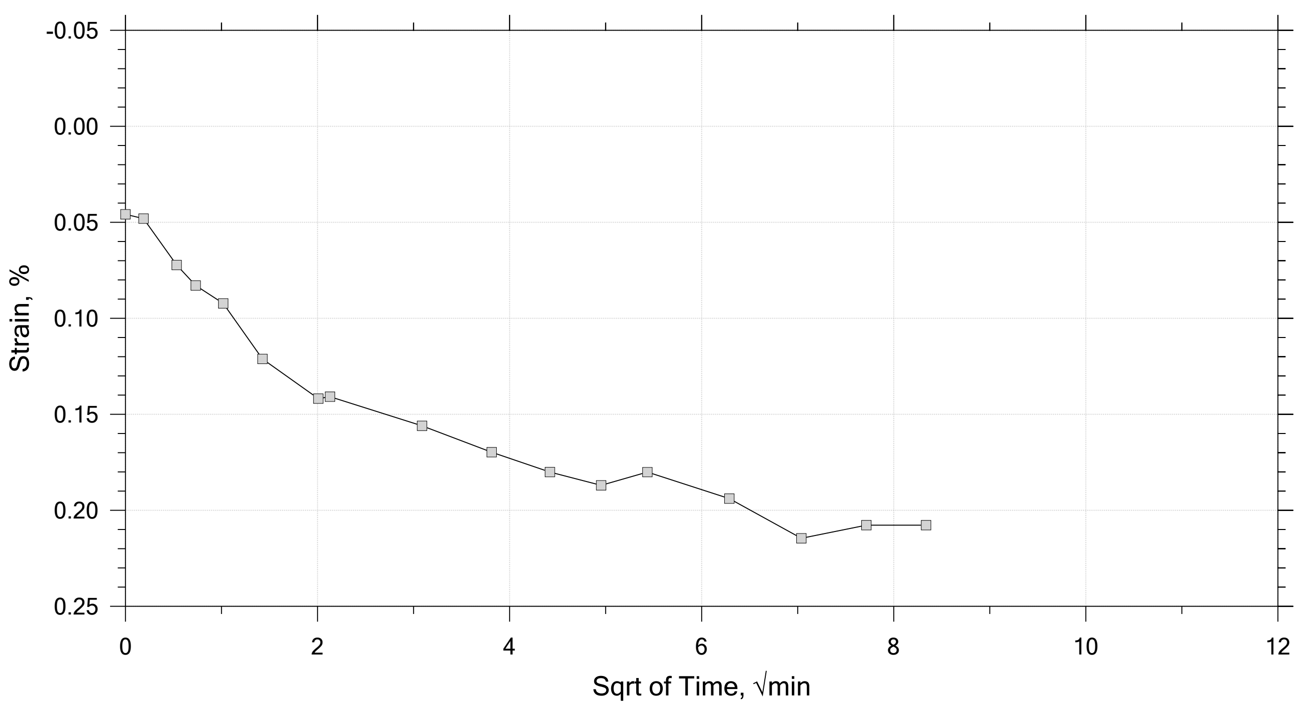
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 1 of 22

Constant Load Step

Stress: 220 psf

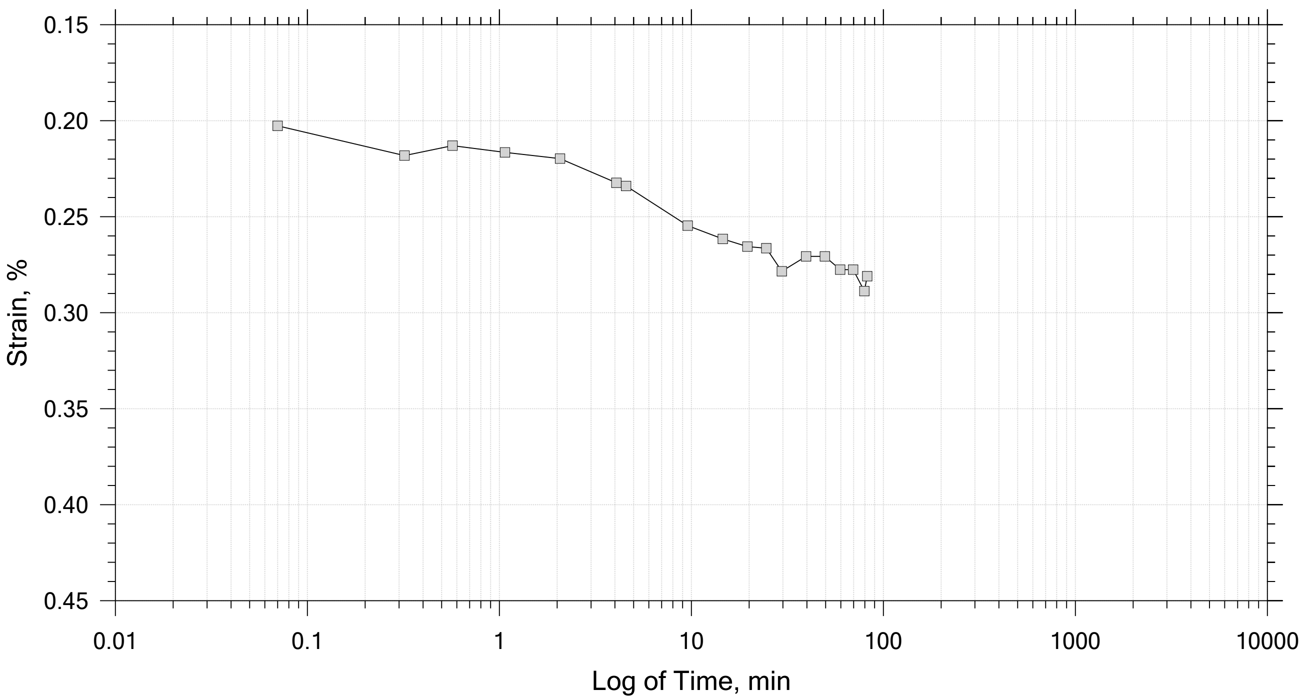


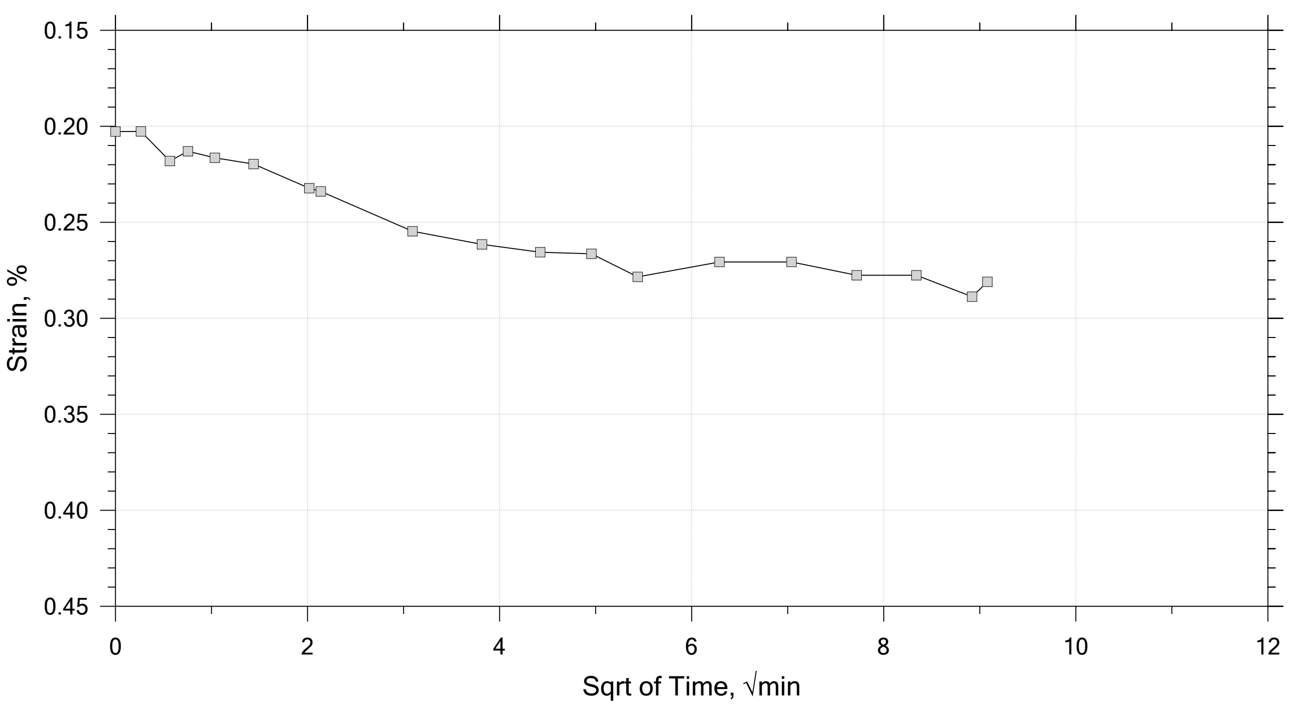


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 10/16/2020	Depth: 21.35
	Test Number: ICON 335	Preparation: Shelby Tube	Elevation: 22.25
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 2 of 22
Constant Load Step
Stress: 330 psf





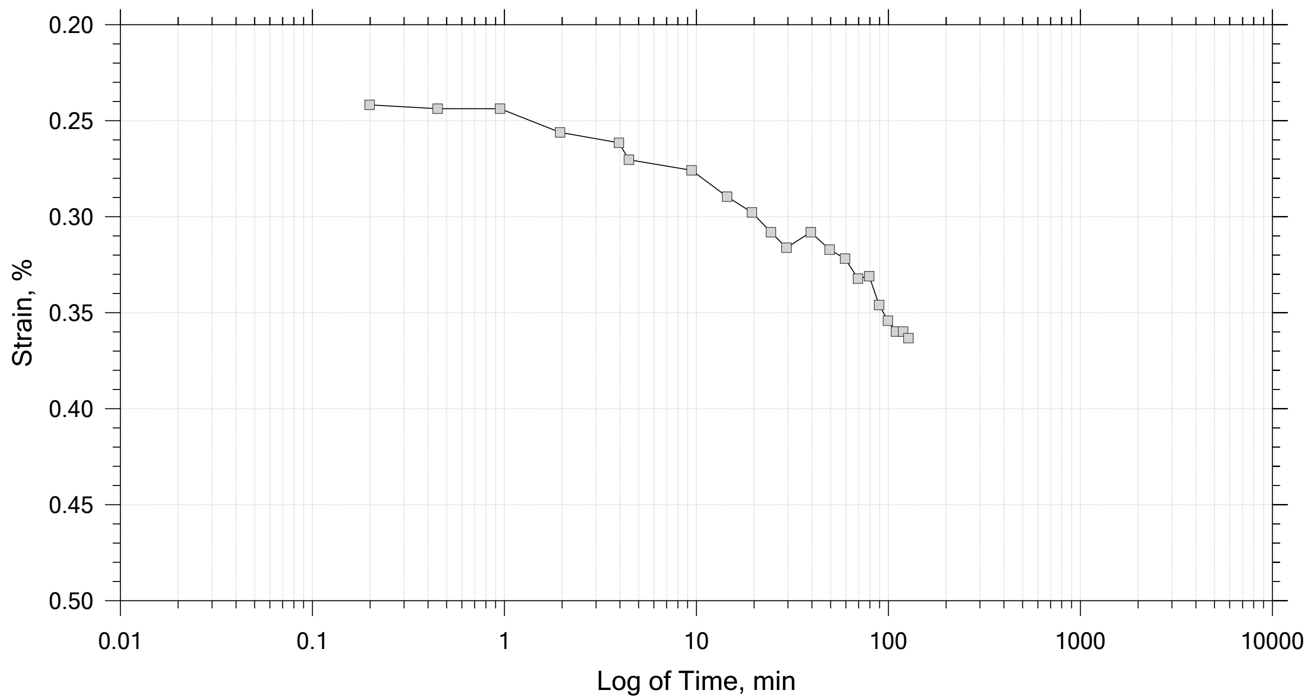
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 10/16/2020	Depth: 21.35
	Test Number: ICON 335	Preparation: Shelby Tube	Elevation: 22.25
	Description: Gray Silty Clay		
	Remarks:		

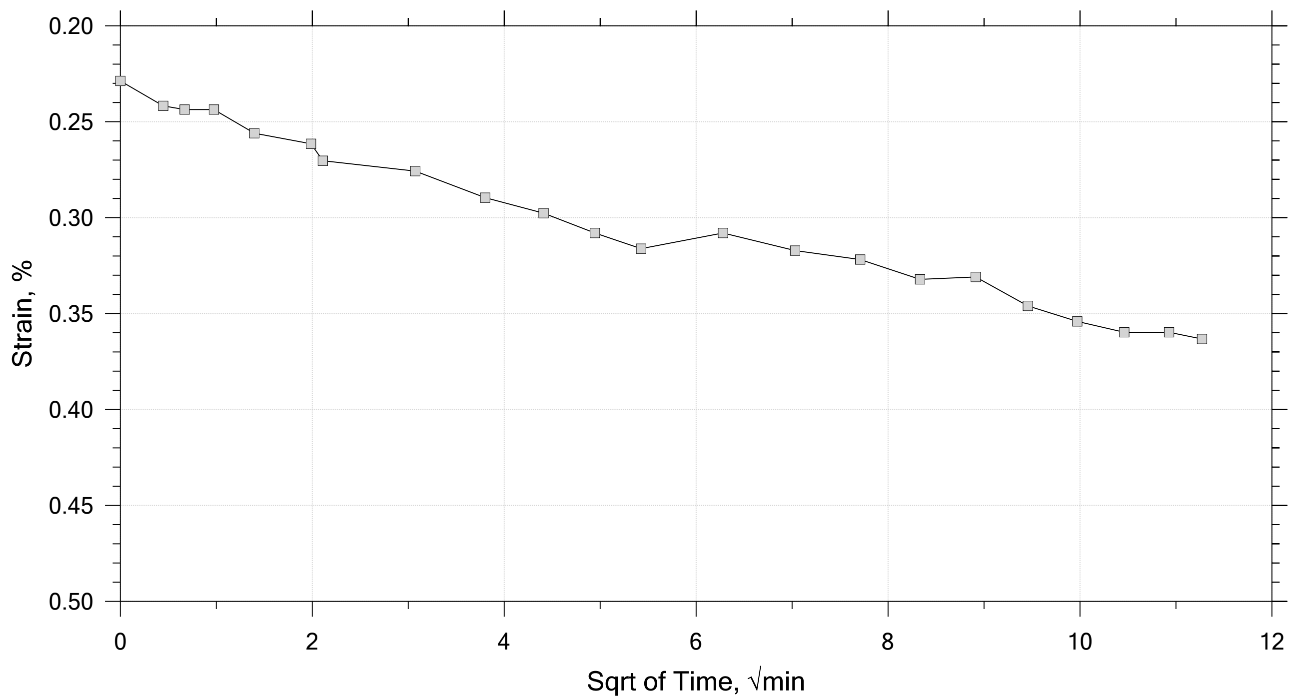
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 3 of 22

Constant Load Step

Stress: 495 psf

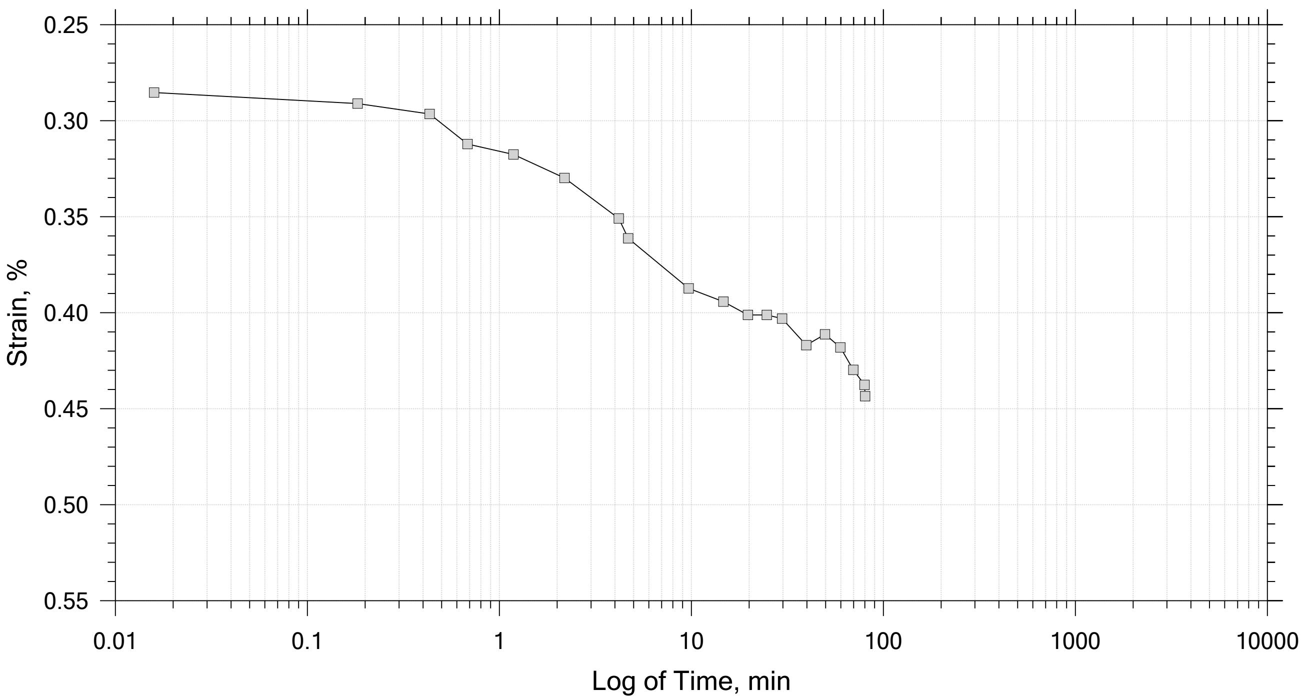


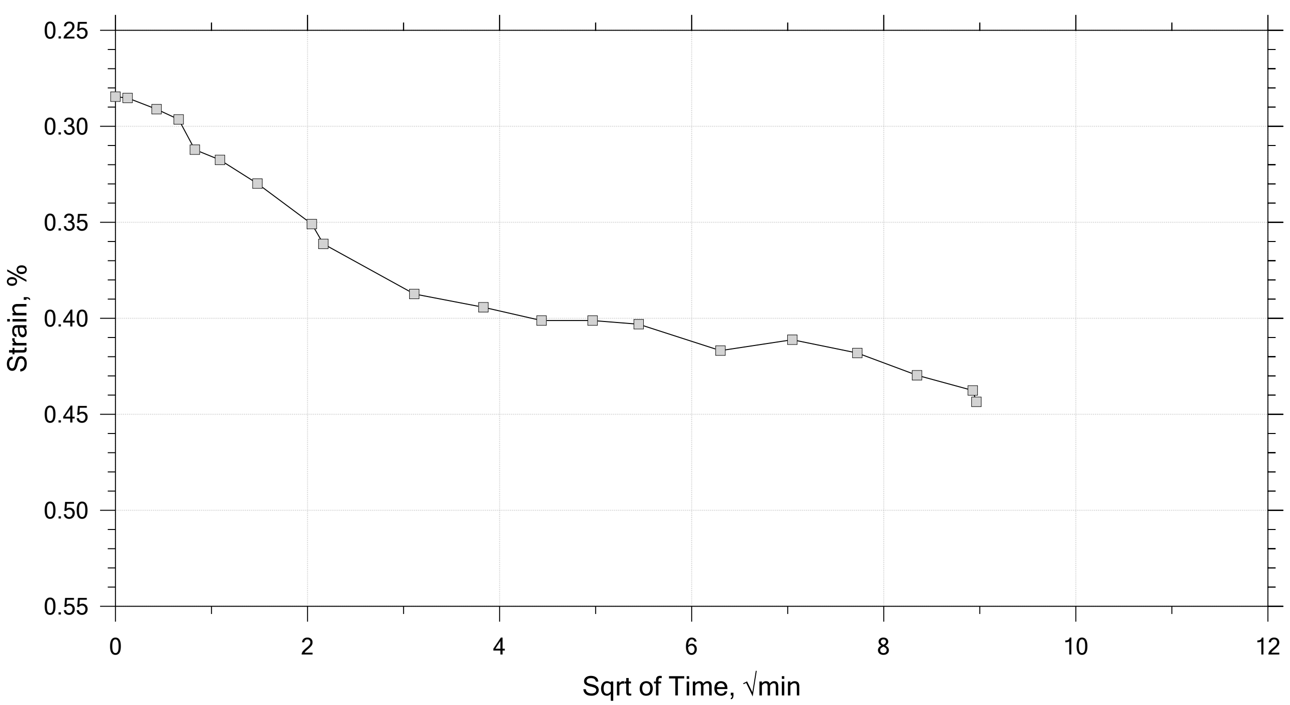


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 10/16/2020	Depth: 21.35
	Test Number: ICON 335	Preparation: Shelby Tube	Elevation: 22.25
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 4 of 22
Constant Load Step
Stress: 743 psf





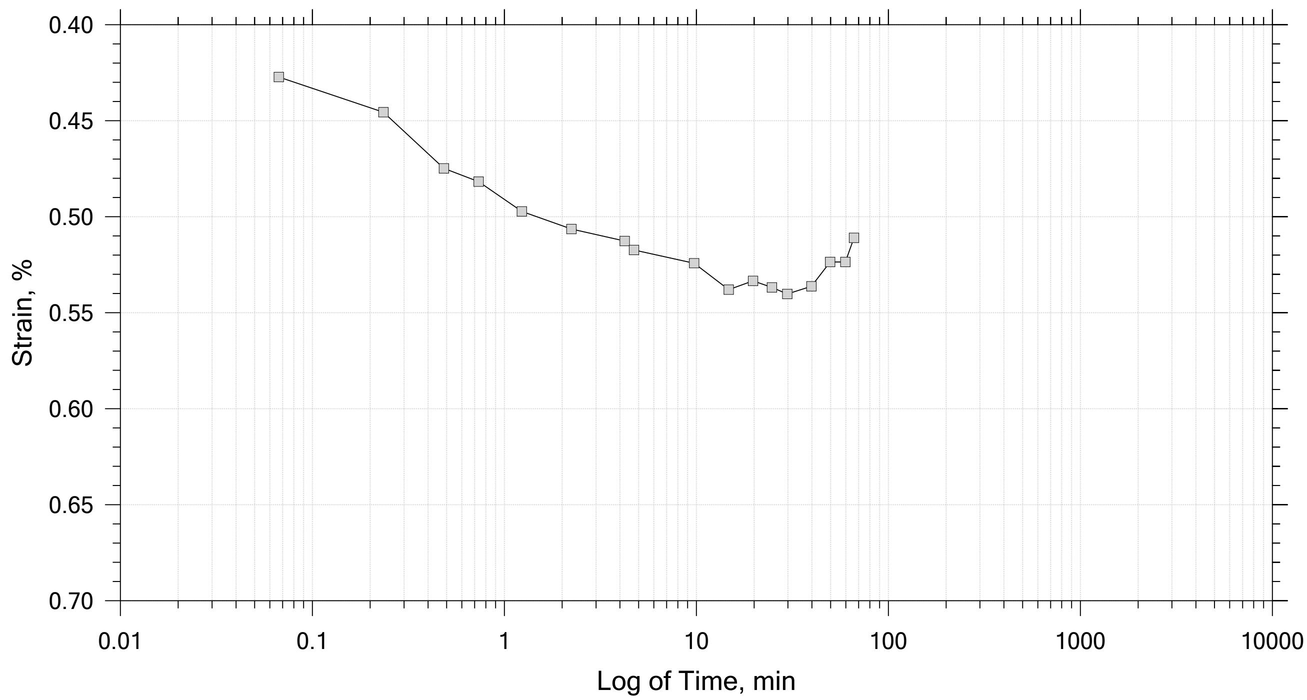
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 10/16/2020	Depth: 21.35
	Test Number: ICON 335	Preparation: Shelby Tube	Elevation: 22.25
	Description: Gray Silty Clay		
	Remarks:		

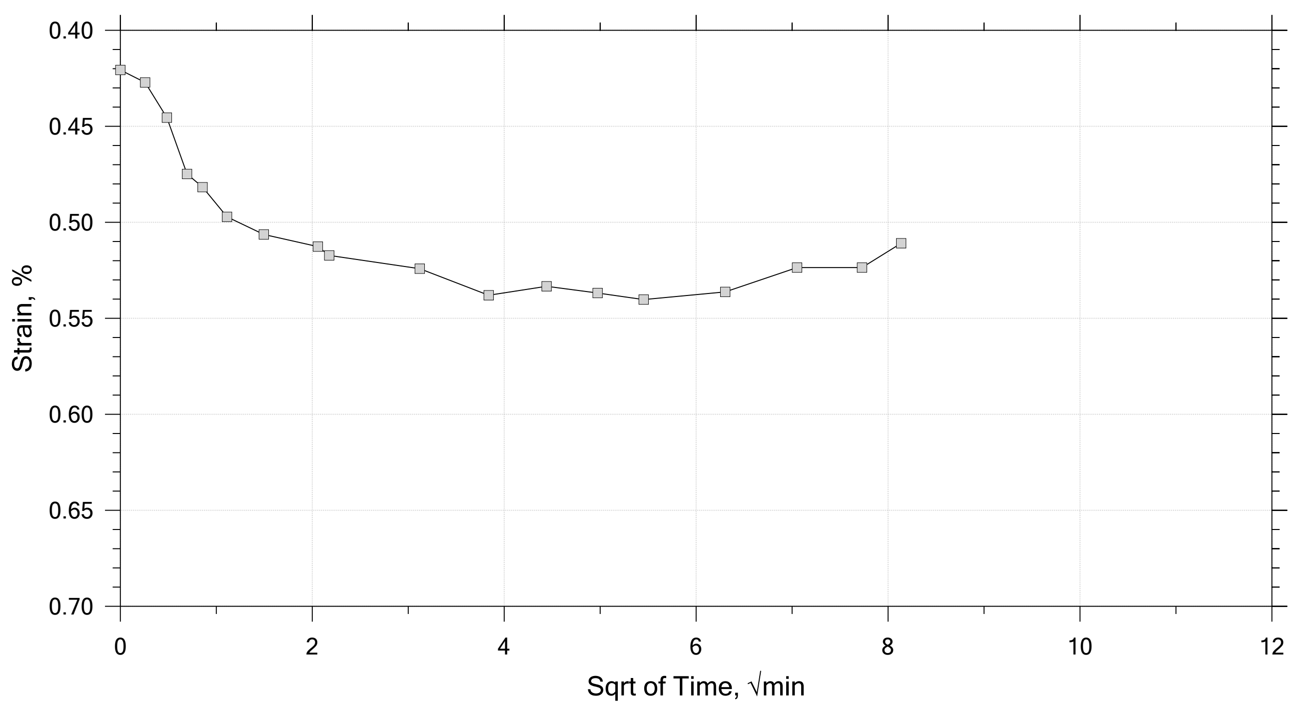
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 5 of 22

Constant Load Step

Stress: 1.11e+03 psf

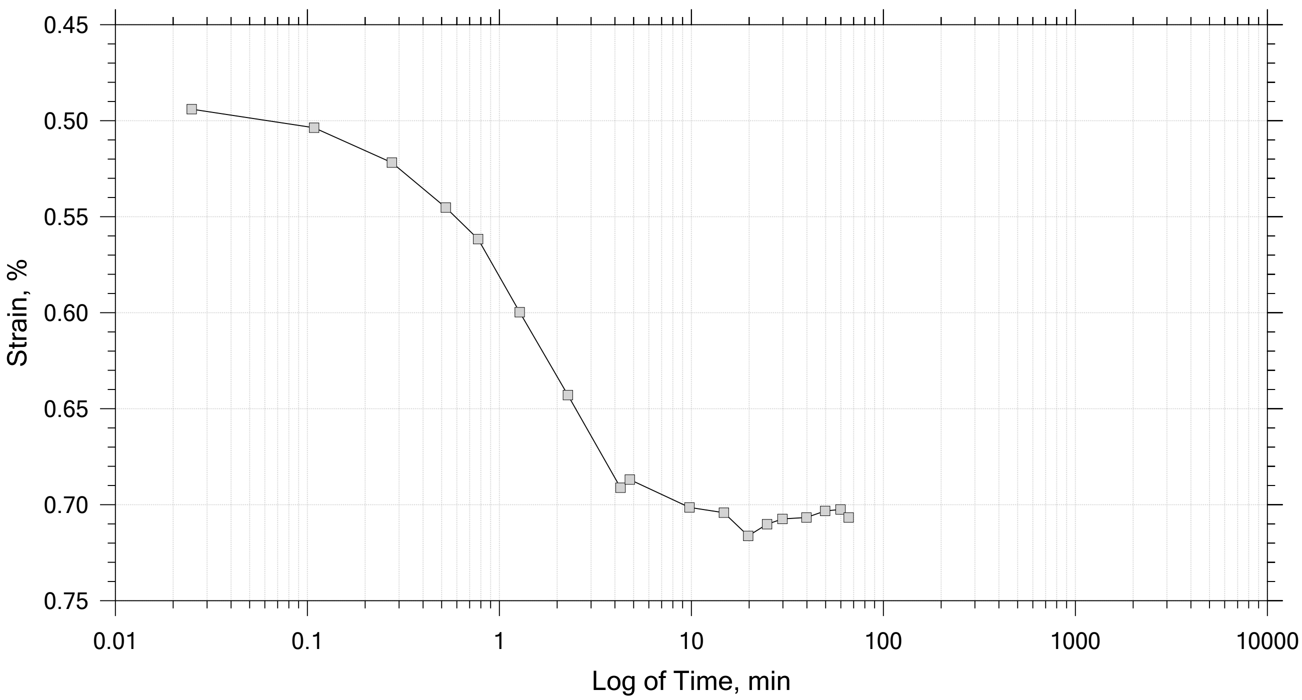


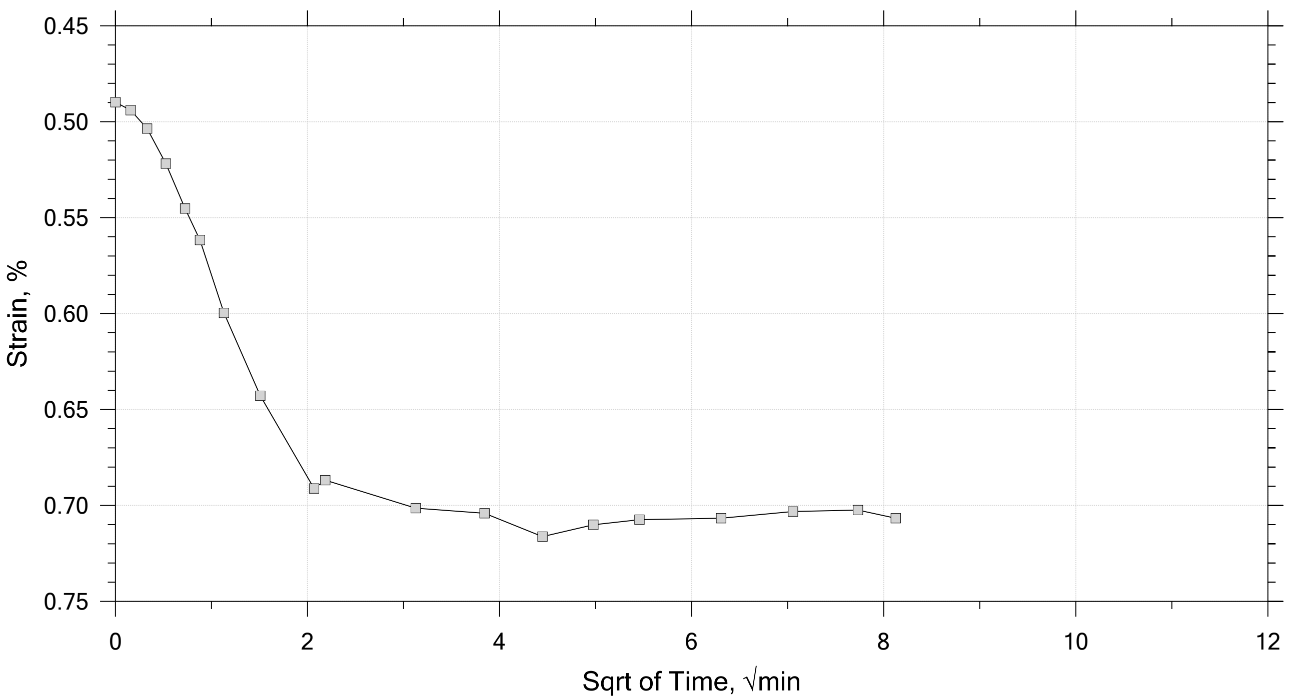


Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
Sample Number: 3U	Test Date: 10/16/2020	Depth: 21.35
Test Number: ICON 335	Preparation: Shelby Tube	Elevation: 22.25
Description: Gray Silty Clay		
Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 6 of 22
Constant Load Step
Stress: 1.67e+03 psf





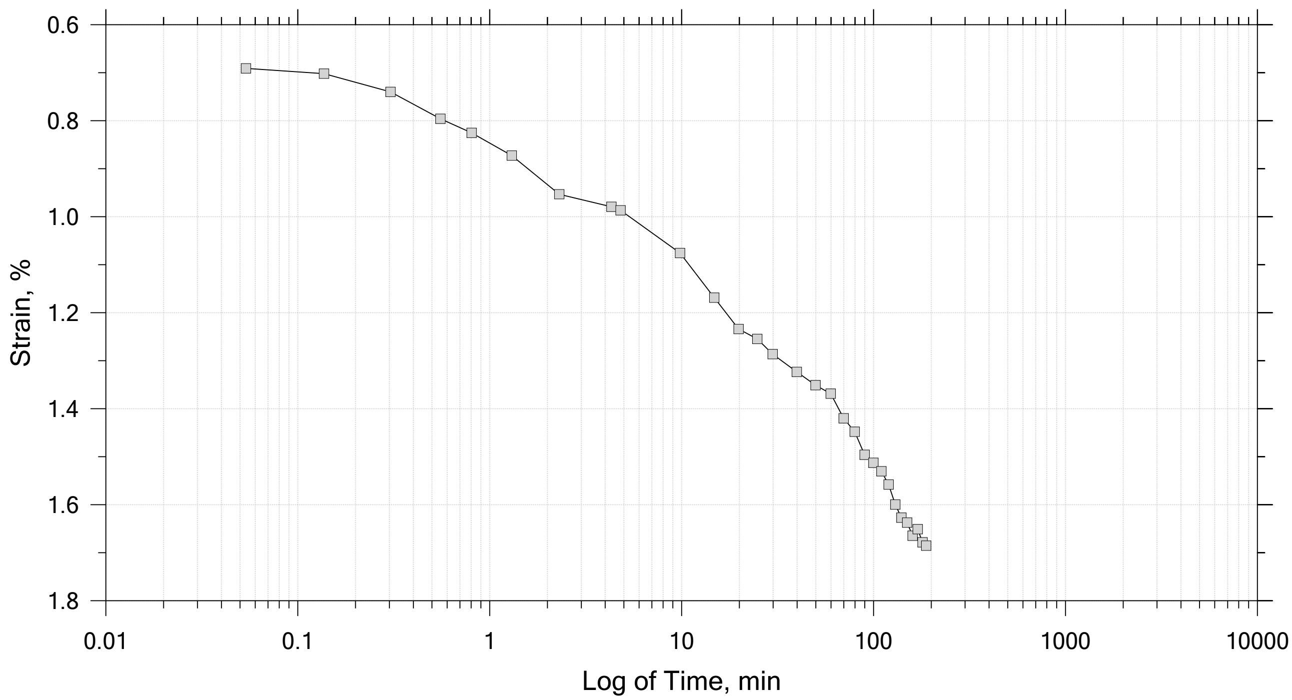
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 10/16/2020	Depth: 21.35
	Test Number: ICON 335	Preparation: Shelby Tube	Elevation: 22.25
	Description: Gray Silty Clay		
	Remarks:		

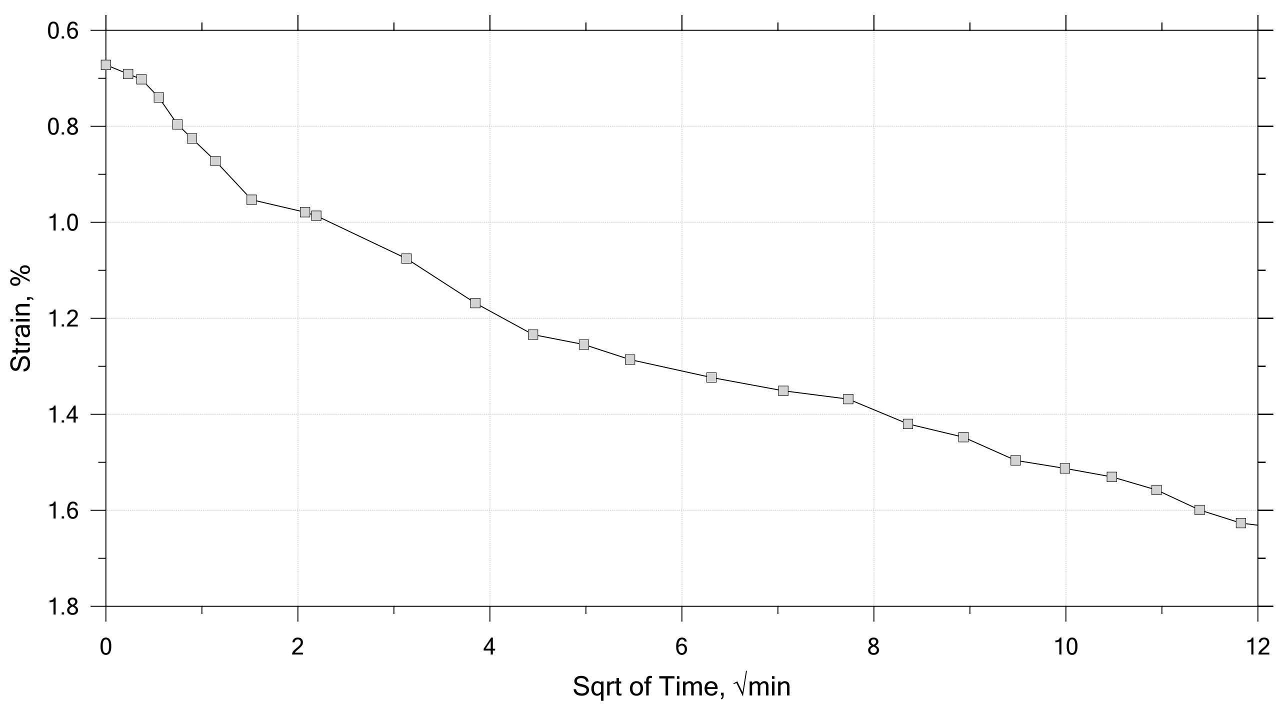
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 7 of 22

Constant Load Step

Stress: 2.51e+03 psf

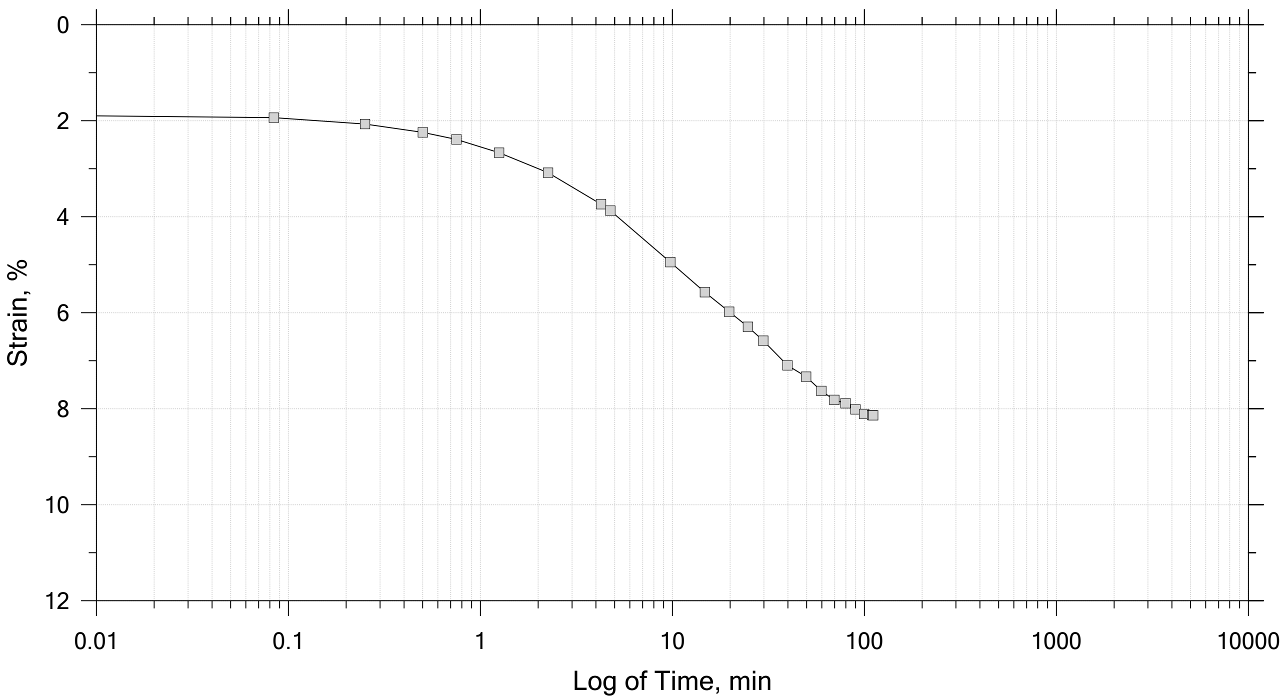


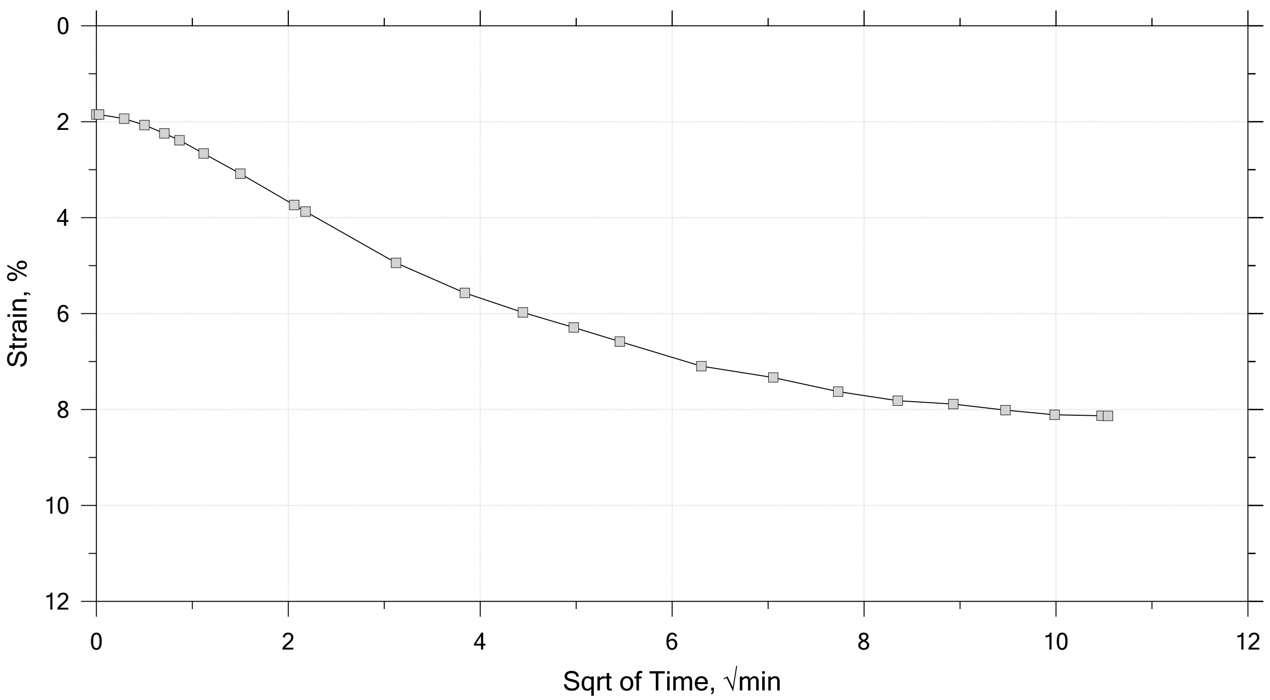


Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 10/16/2020	Depth: 21.35
	Test Number: ICON 335	Preparation: Shelby Tube	Elevation: 22.25
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 8 of 22
Constant Load Step
Stress: 5.01e+03 psf





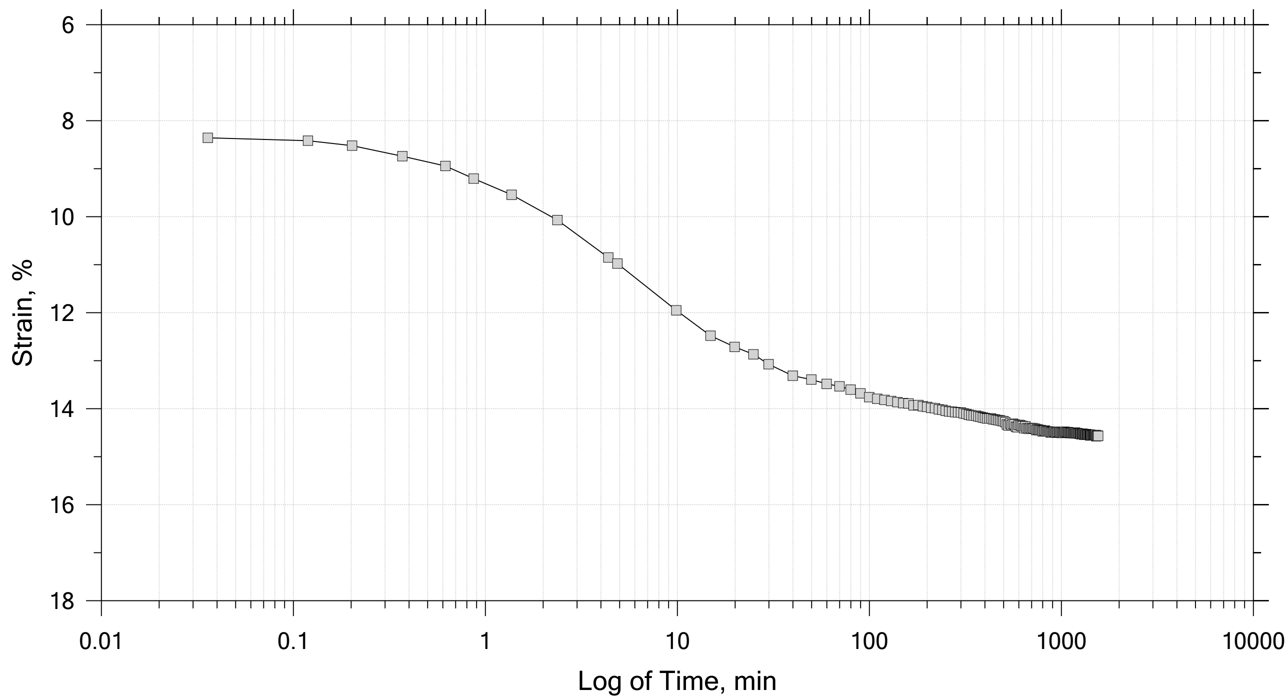
Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 10/16/2020	Depth: 21.35
	Test Number: ICON 335	Preparation: Shelby Tube	Elevation: 22.25
	Description: Gray Silty Clay		
	Remarks:		

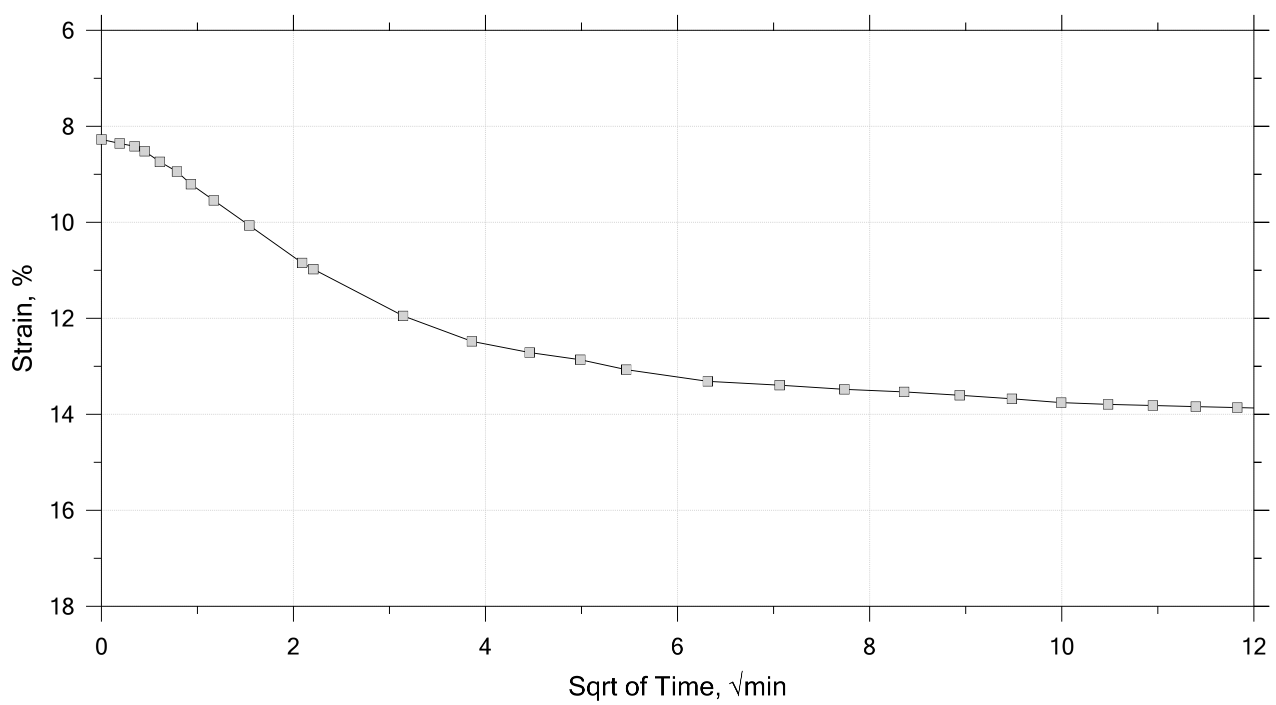
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 9 of 22

Constant Load Step

Stress: 1e+04 psf





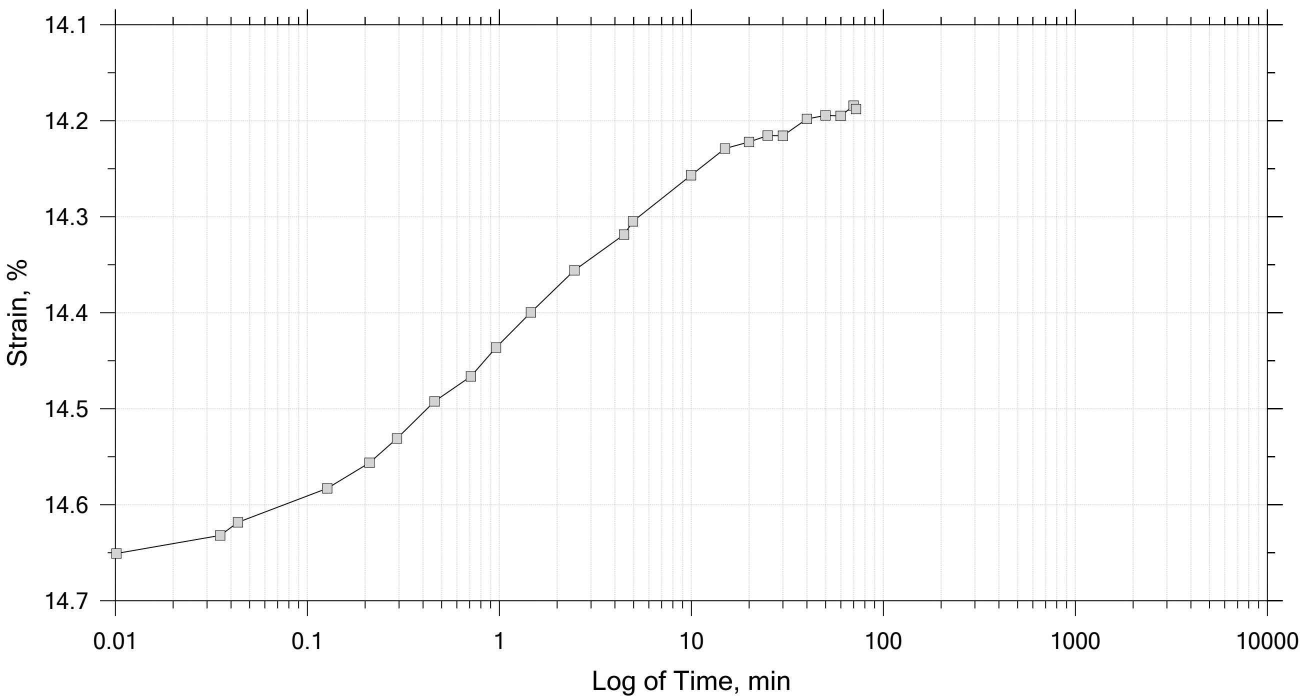
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 10/16/2020	Depth: 21.35
	Test Number: ICON 335	Preparation: Shelby Tube	Elevation: 22.25
	Description: Gray Silty Clay		
	Remarks:		

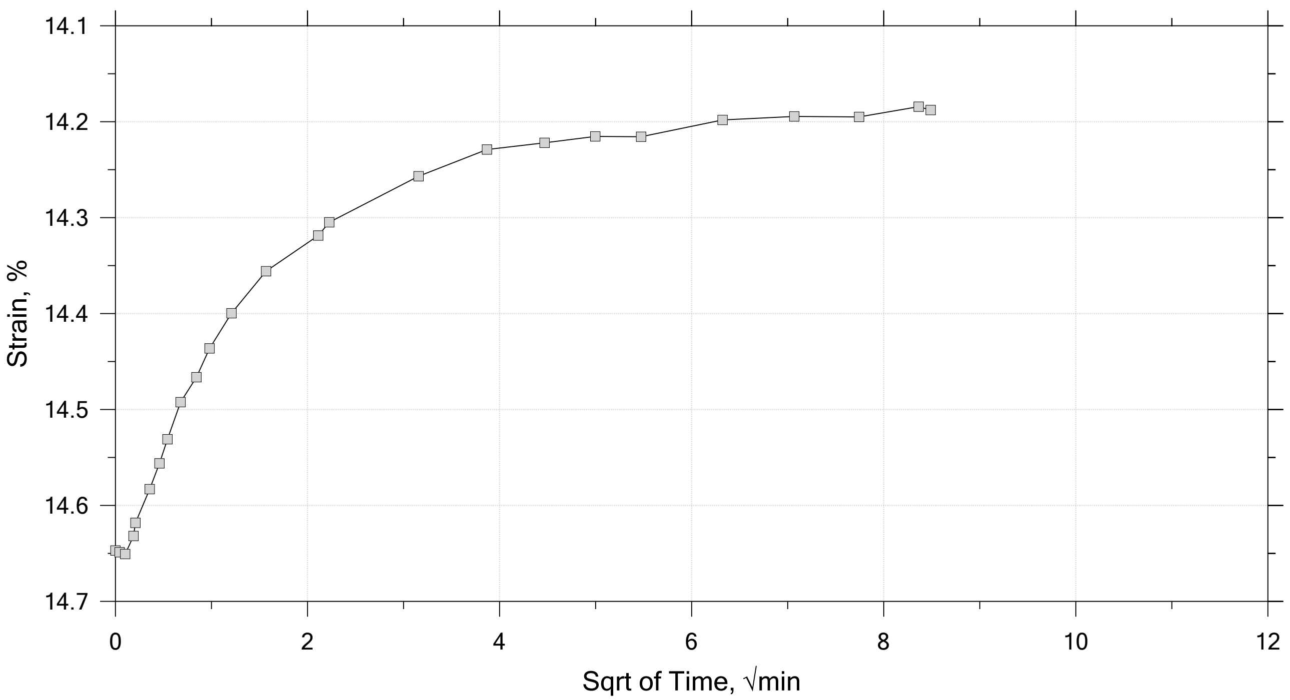
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 10 of 22

Constant Load Step

Stress: 2.51e+03 psf

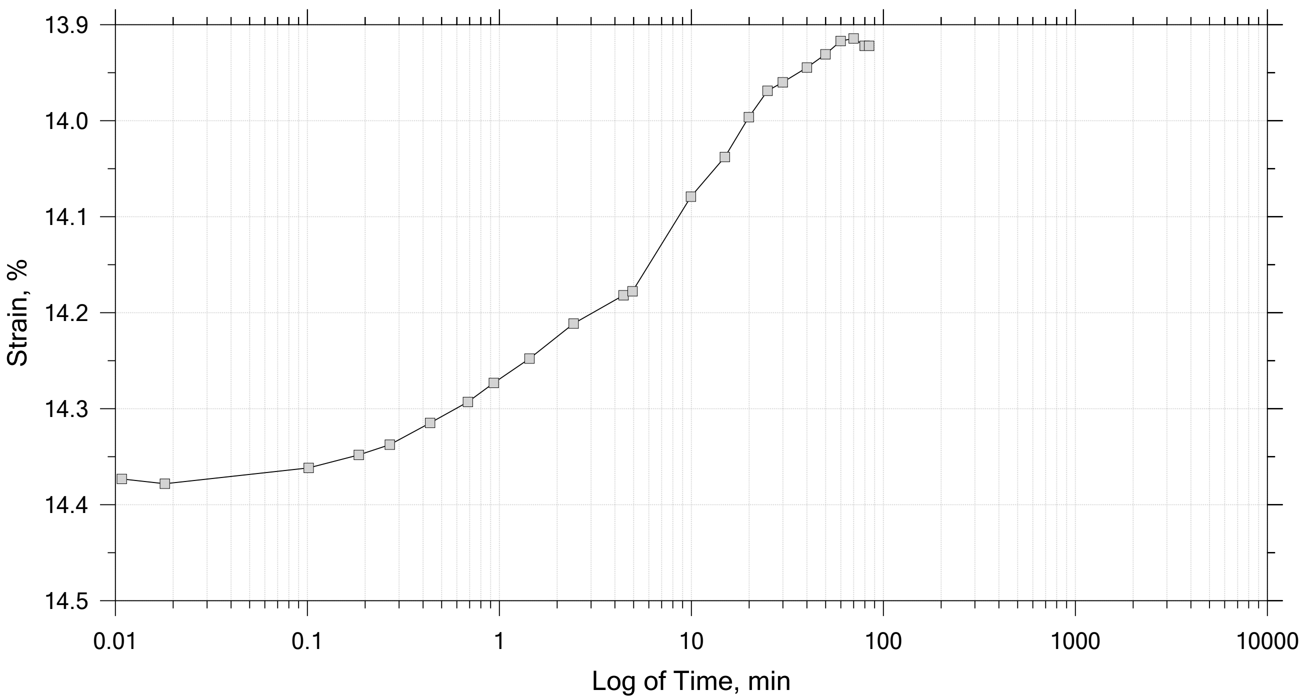


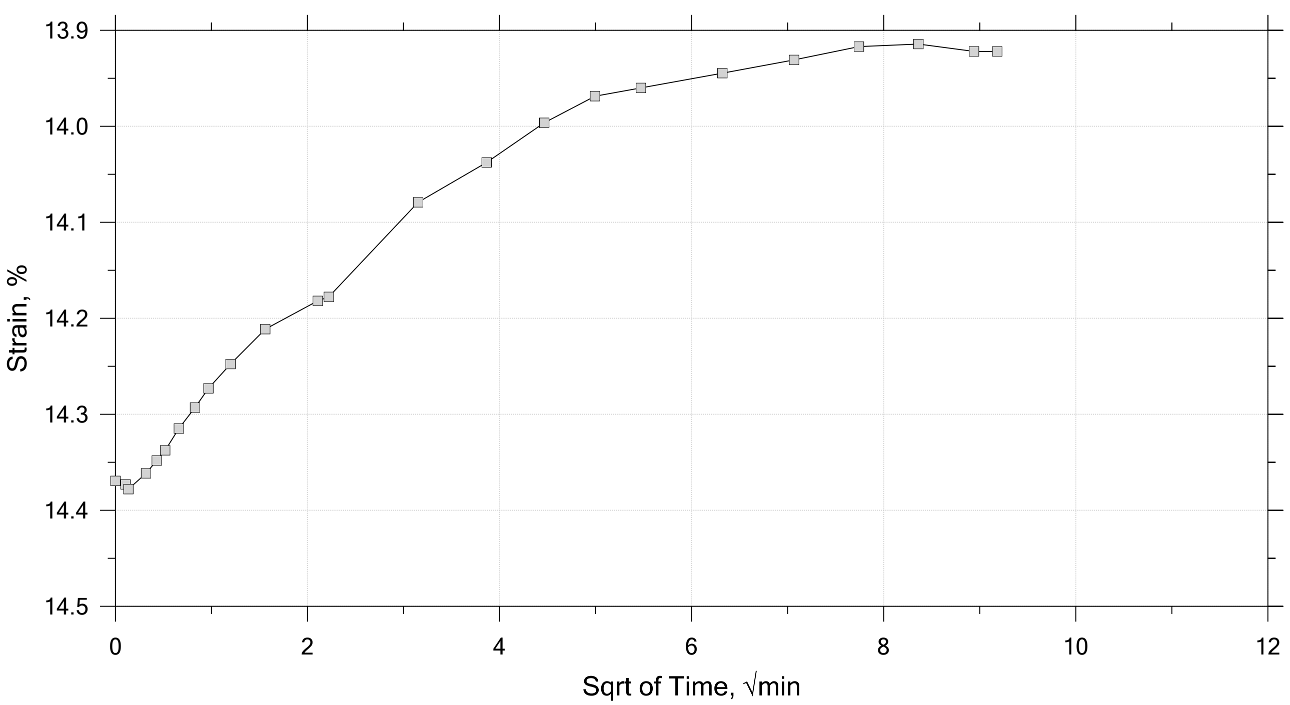


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 10/16/2020	Depth: 21.35
	Test Number: ICON 335	Preparation: Shelby Tube	Elevation: 22.25
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 11 of 22
Constant Load Step
Stress: 1.25e+03 psf

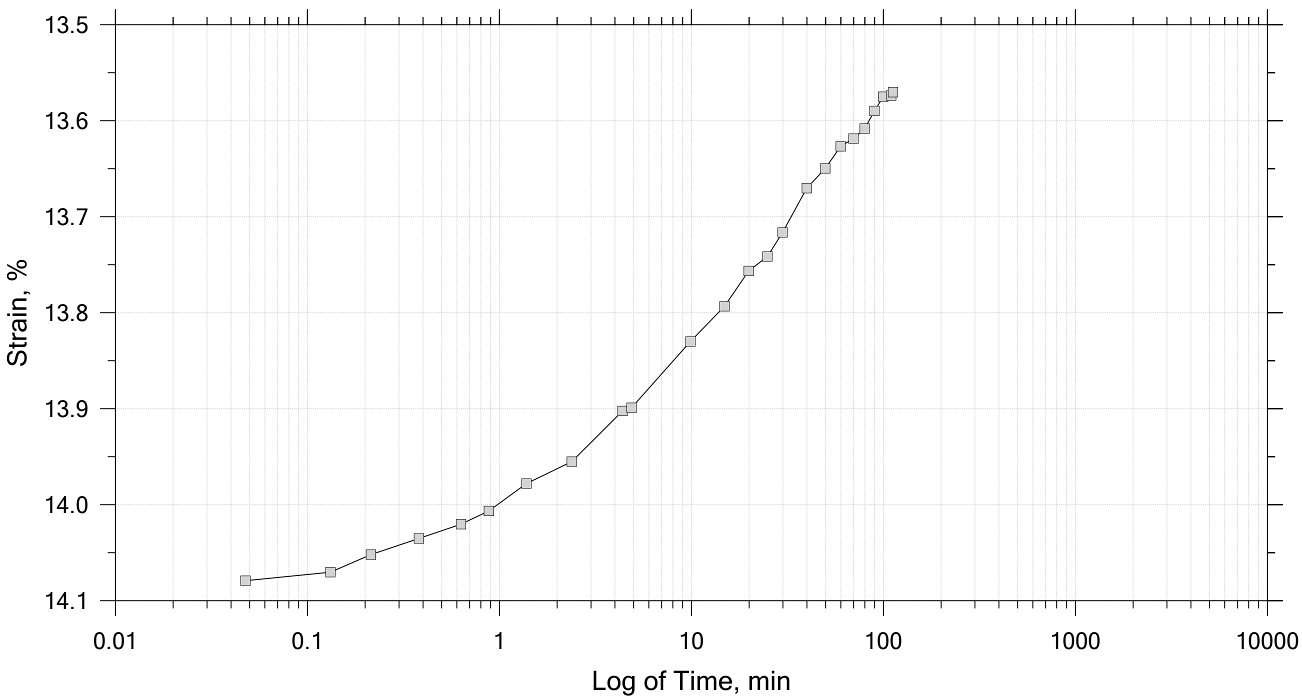


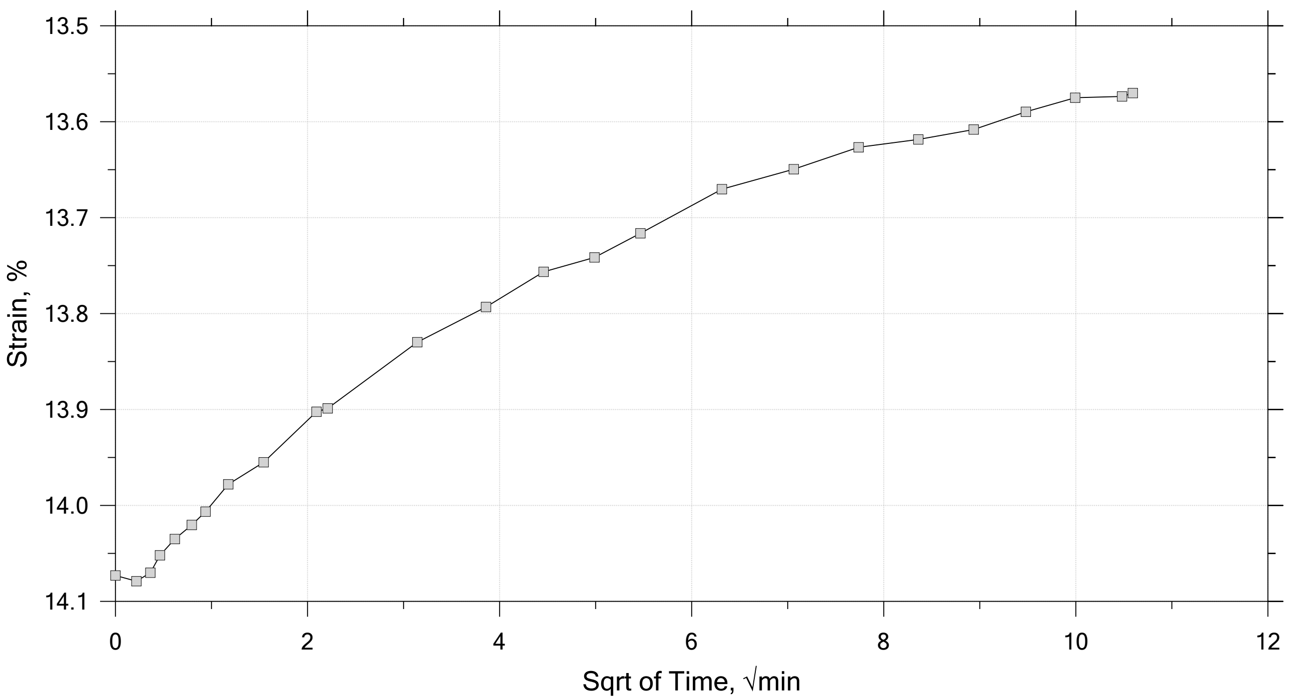


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 10/16/2020	Depth: 21.35
	Test Number: ICON 335	Preparation: Shelby Tube	Elevation: 22.25
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 12 of 22
Constant Load Step
Stress: 626 psf





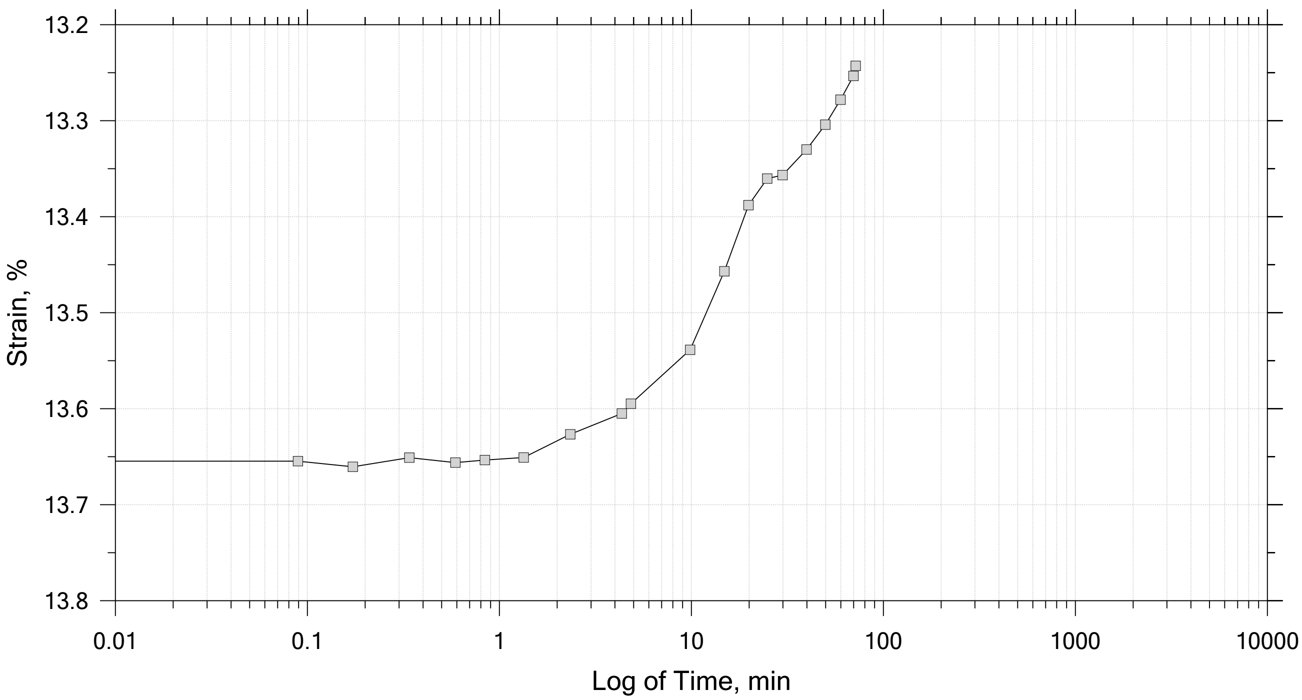
Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 10/16/2020	Depth: 21.35
	Test Number: ICON 335	Preparation: Shelby Tube	Elevation: 22.25
	Description: Gray Silty Clay		
	Remarks:		

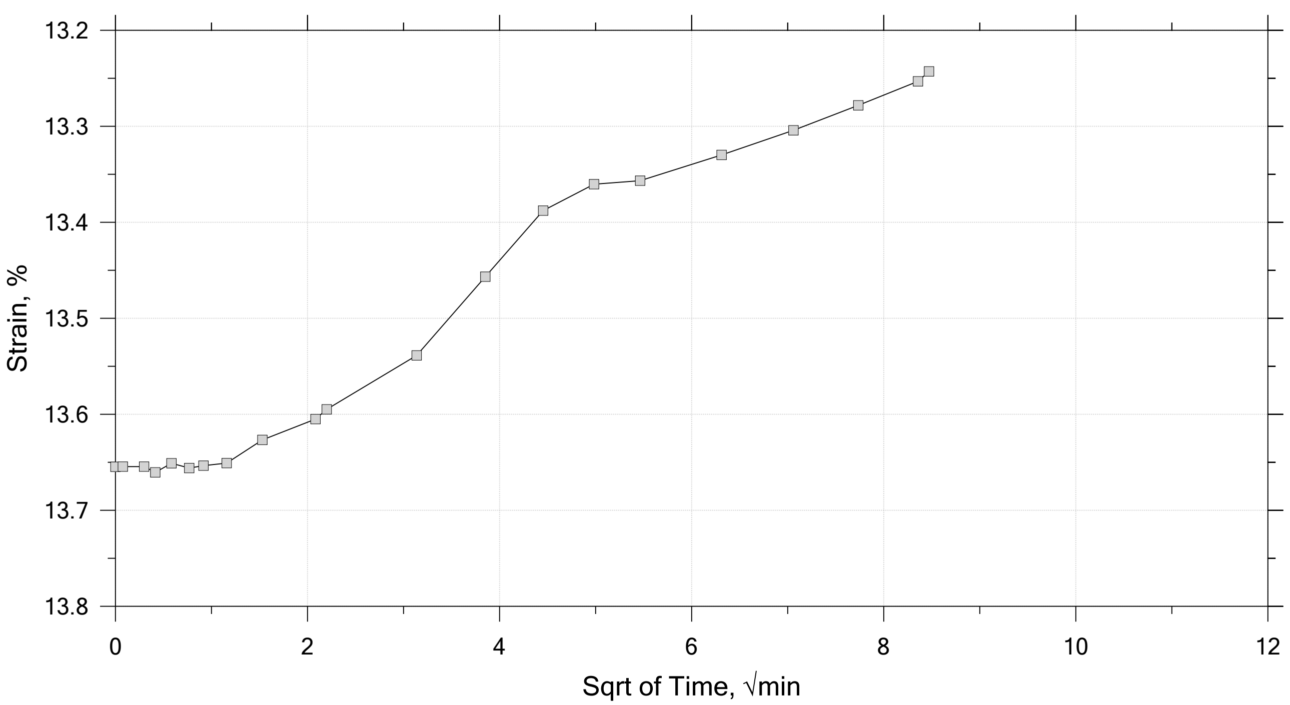
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 13 of 22

Constant Load Step

Stress: 313 psf





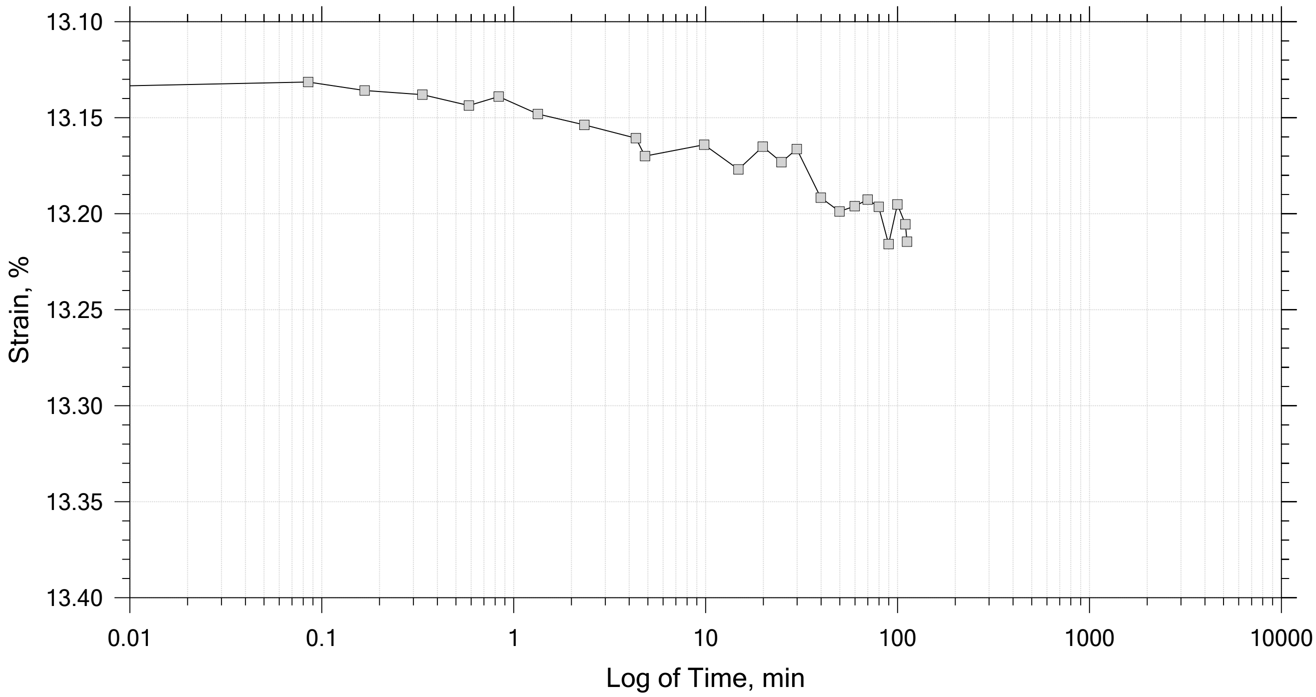
Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 10/16/2020	Depth: 21.35
	Test Number: ICON 335	Preparation: Shelby Tube	Elevation: 22.25
	Description: Gray Silty Clay		
	Remarks:		

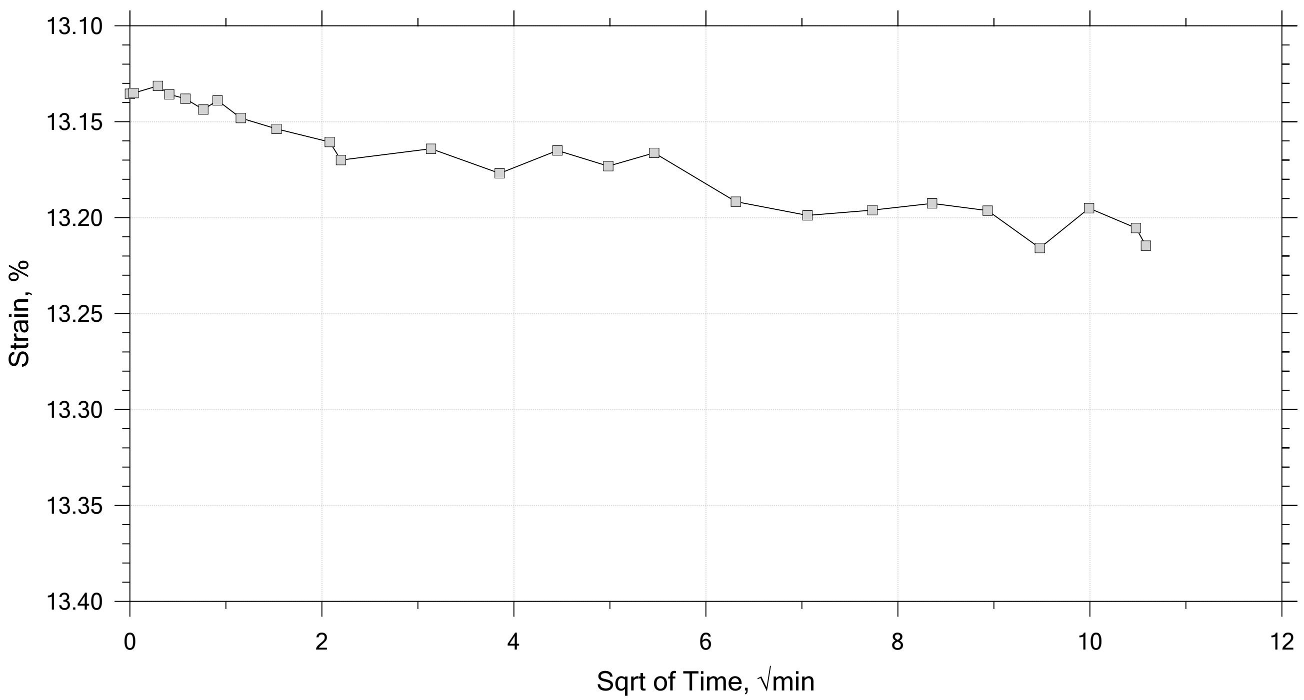
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 14 of 22

Constant Load Step

Stress: 548 psf





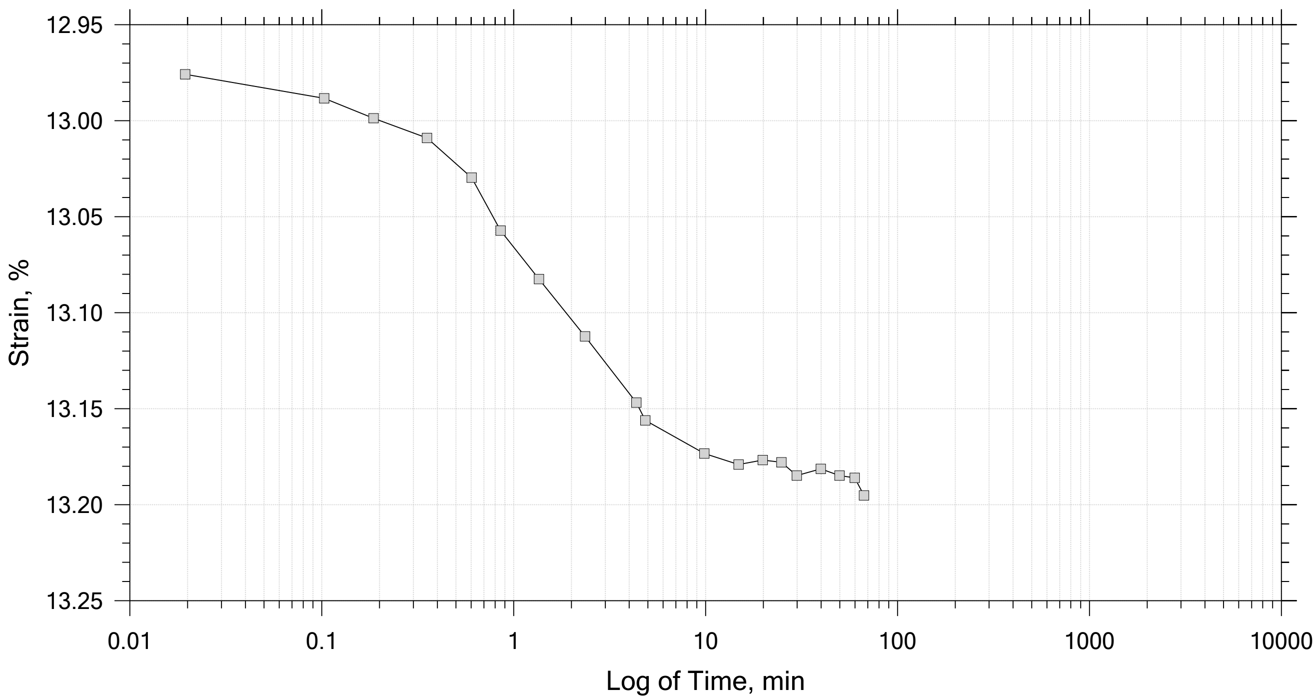
Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 10/16/2020	Depth: 21.35
	Test Number: ICON 335	Preparation: Shelby Tube	Elevation: 22.25
	Description: Gray Silty Clay		
	Remarks:		

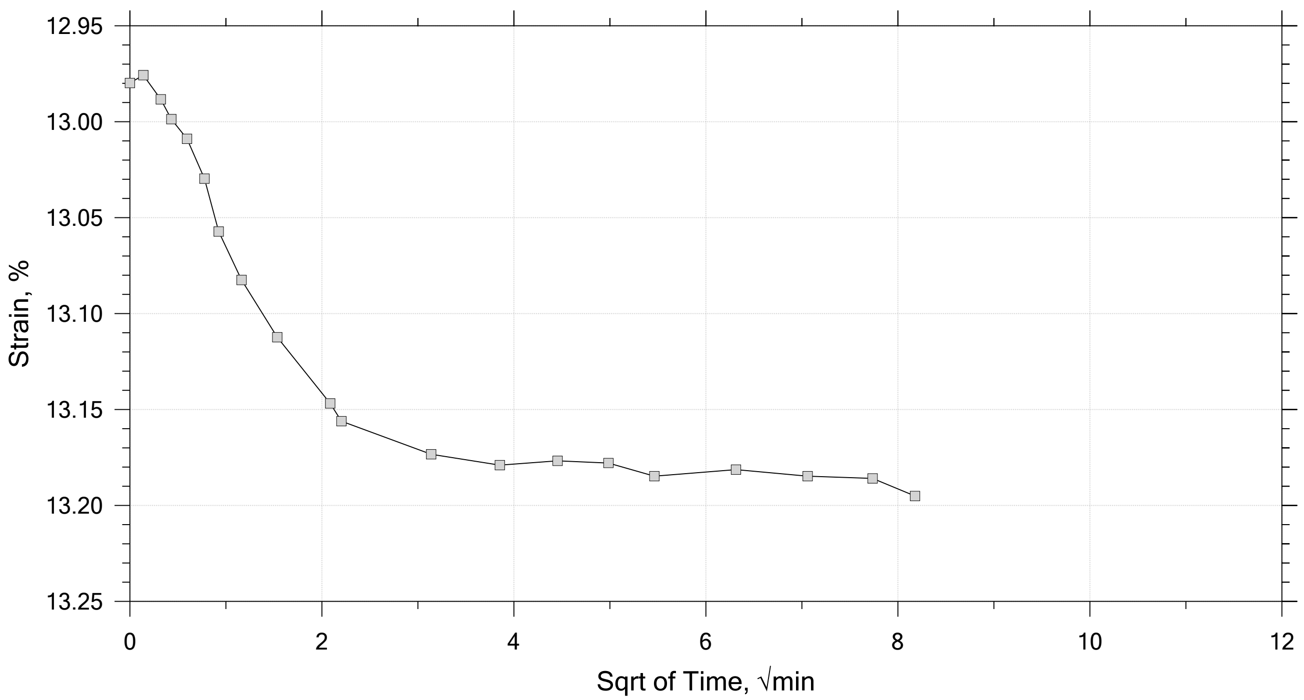
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 15 of 22

Constant Load Step

Stress: 1.1e+03 psf

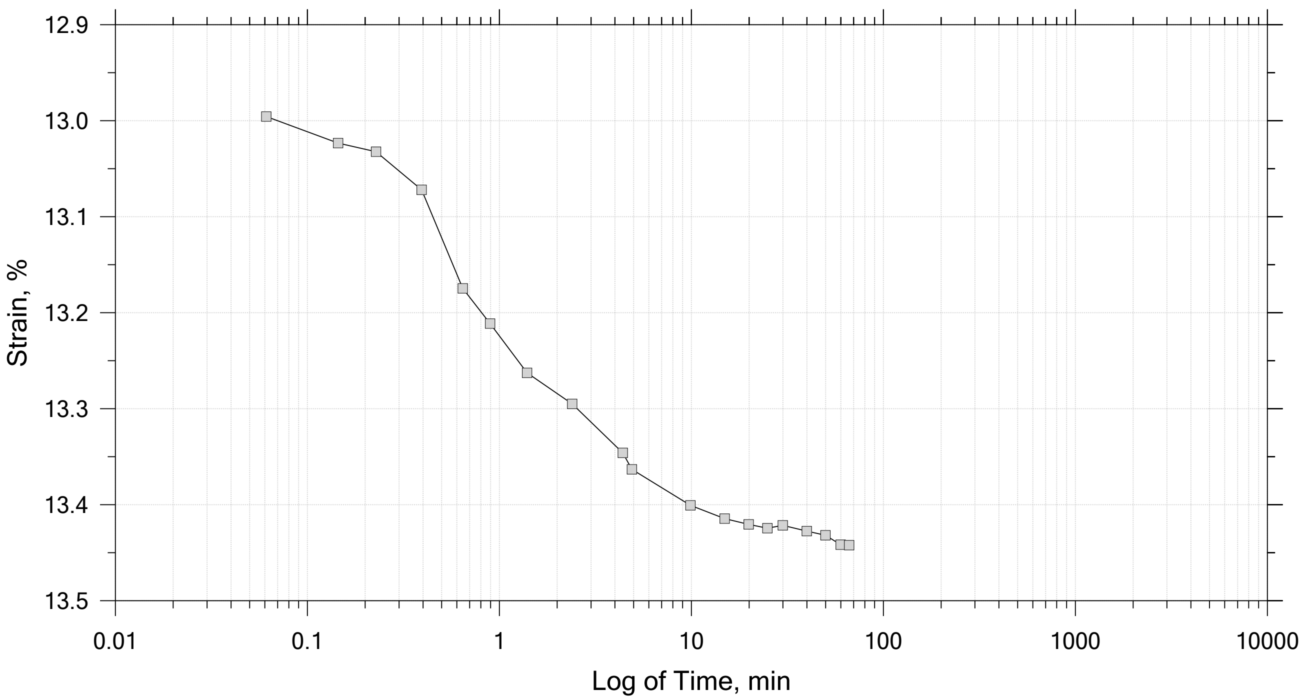


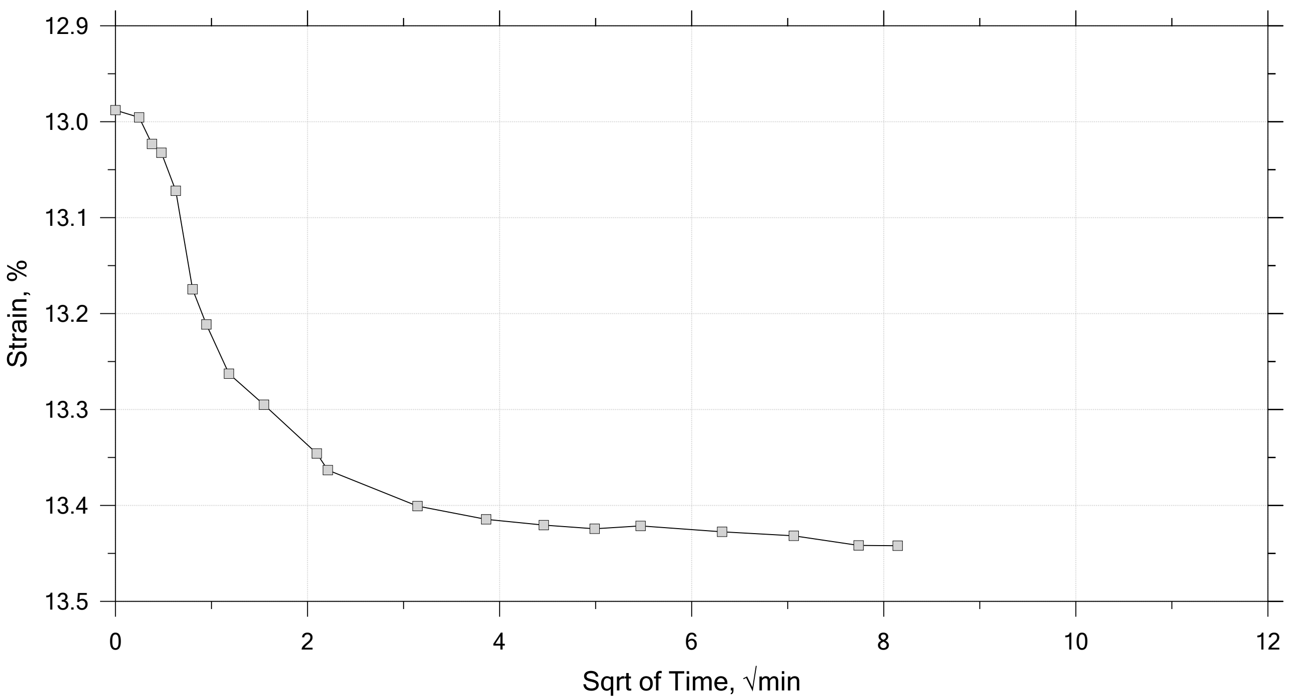


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 10/16/2020	Depth: 21.35
	Test Number: ICON 335	Preparation: Shelby Tube	Elevation: 22.25
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 16 of 22
Constant Load Step
Stress: 2.19e+03 psf

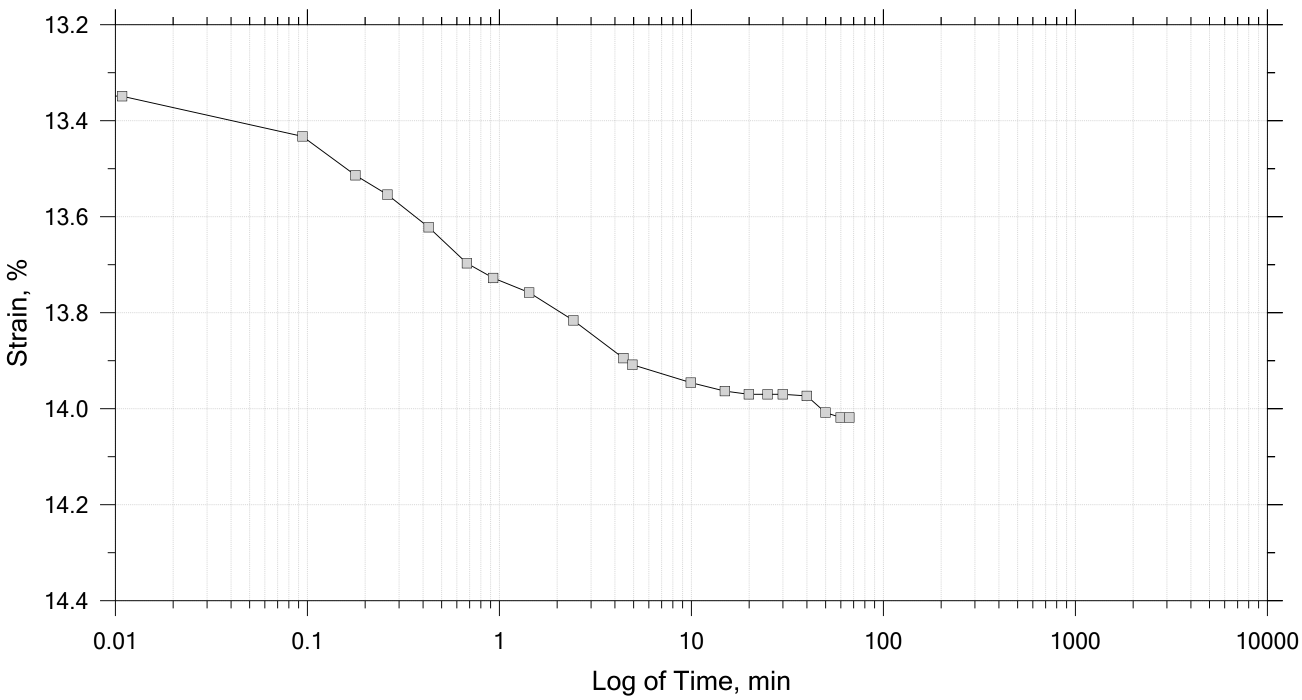


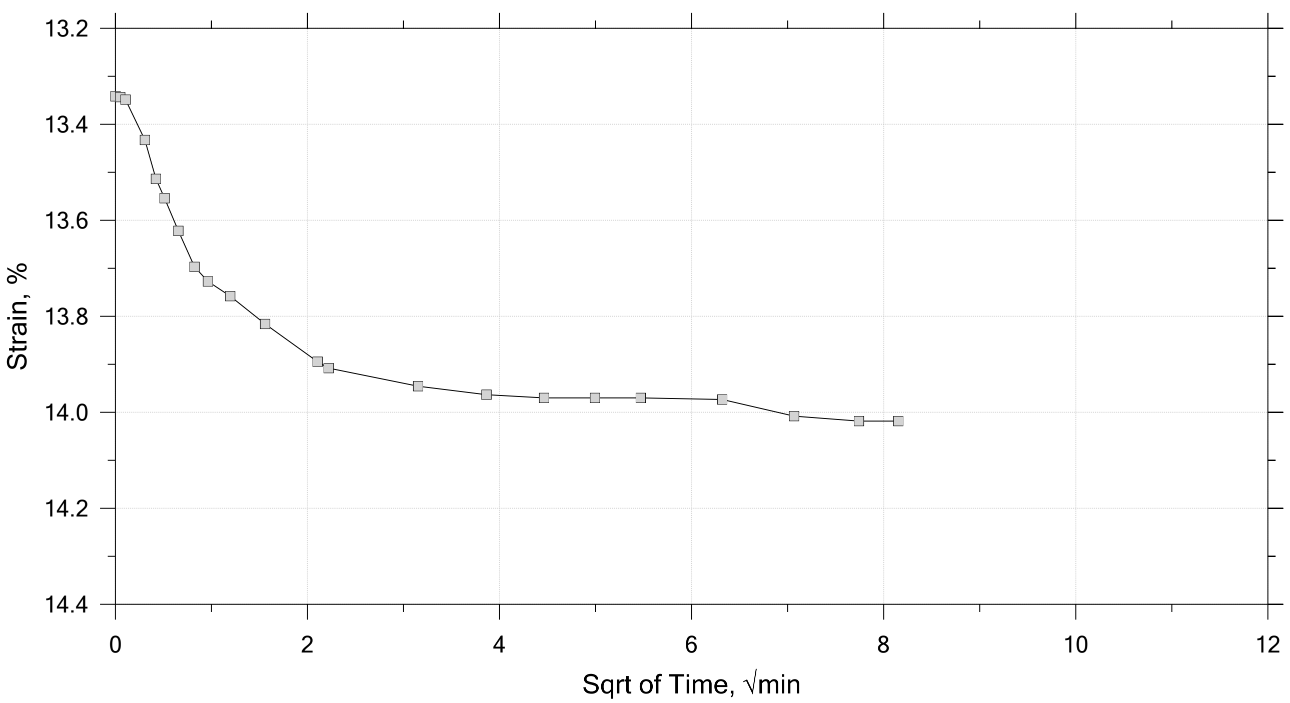


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 10/16/2020	Depth: 21.35
	Test Number: ICON 335	Preparation: Shelby Tube	Elevation: 22.25
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 17 of 22
Constant Load Step
Stress: 4.39e+03 psf

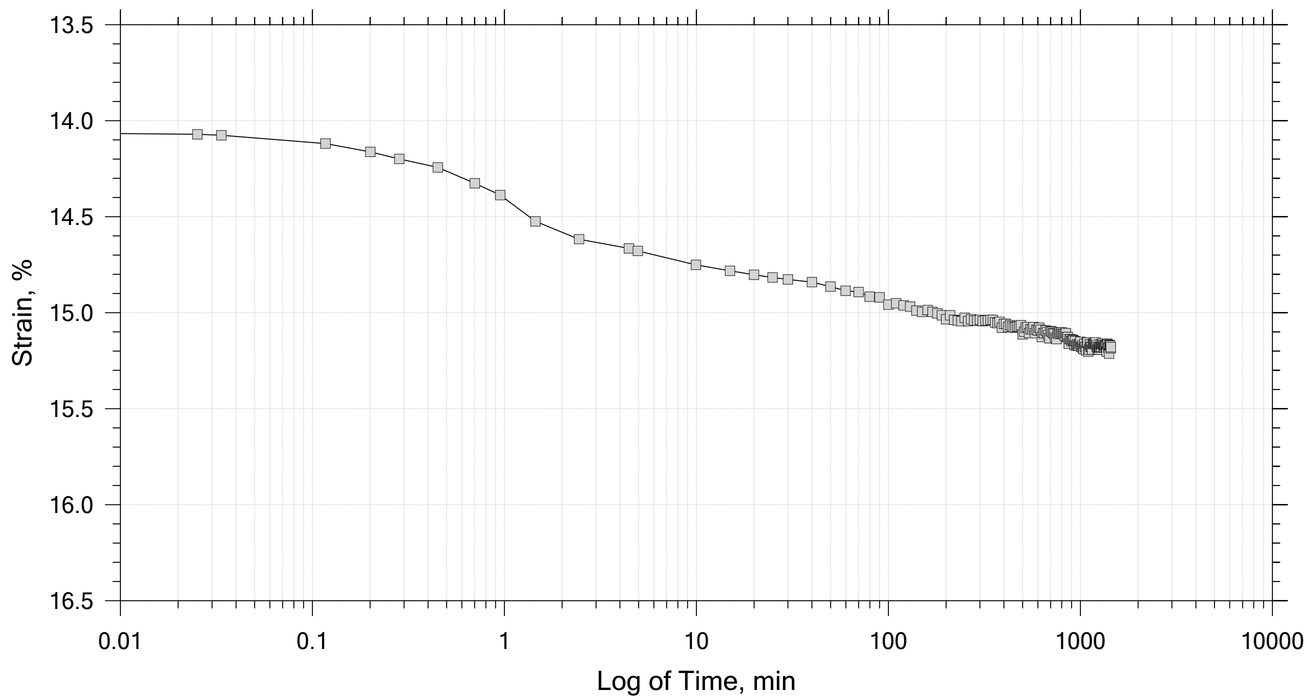


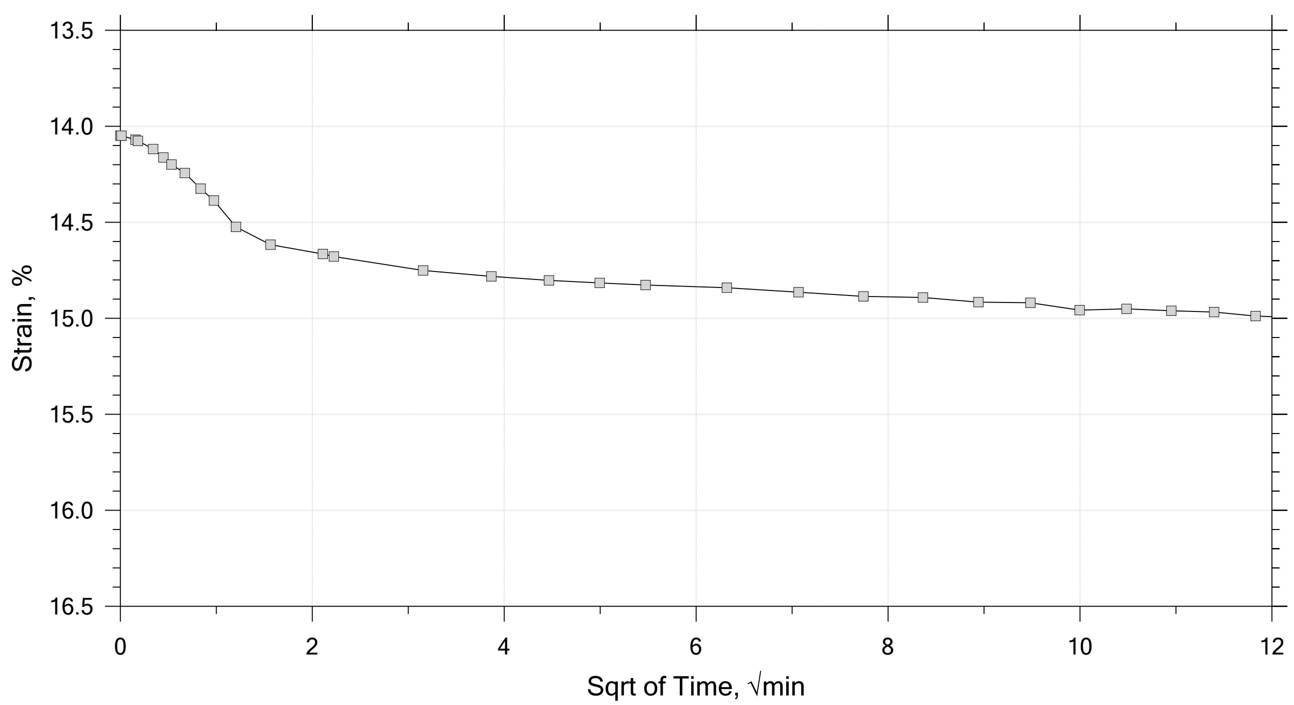


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 10/16/2020	Depth: 21.35
	Test Number: ICON 335	Preparation: Shelby Tube	Elevation: 22.25
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 18 of 22
Constant Load Step
Stress: 8.77e+03 psf

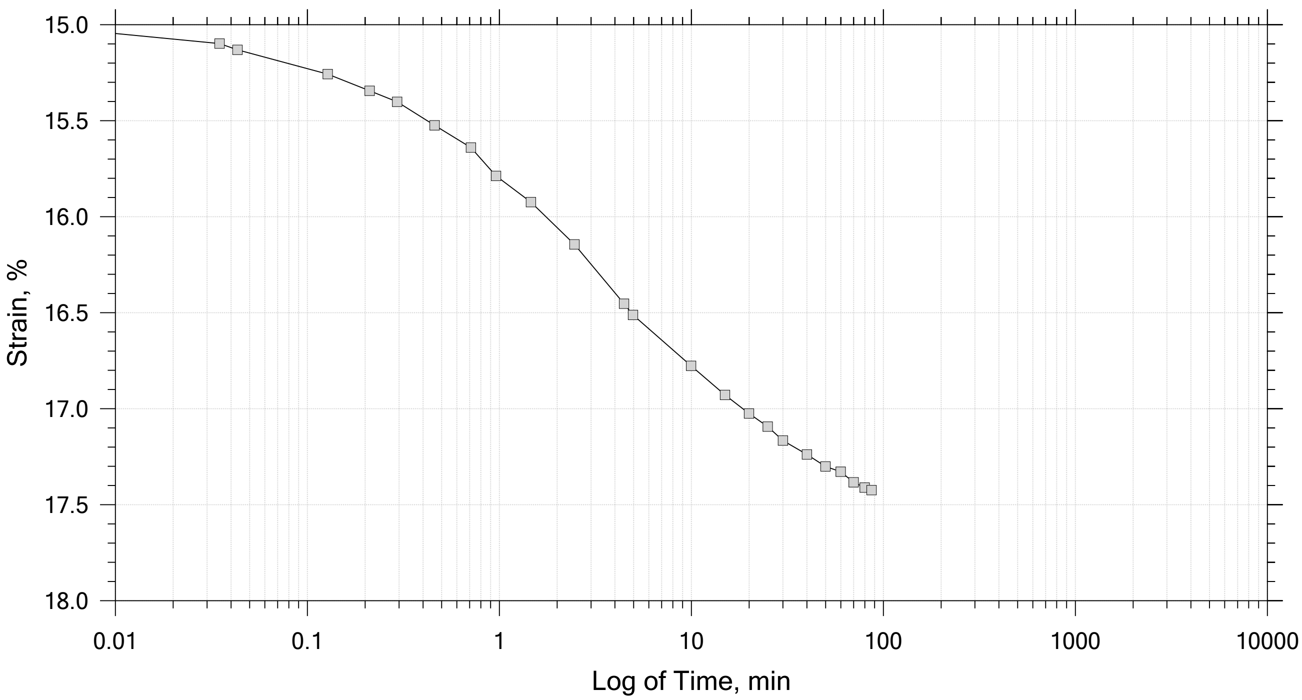


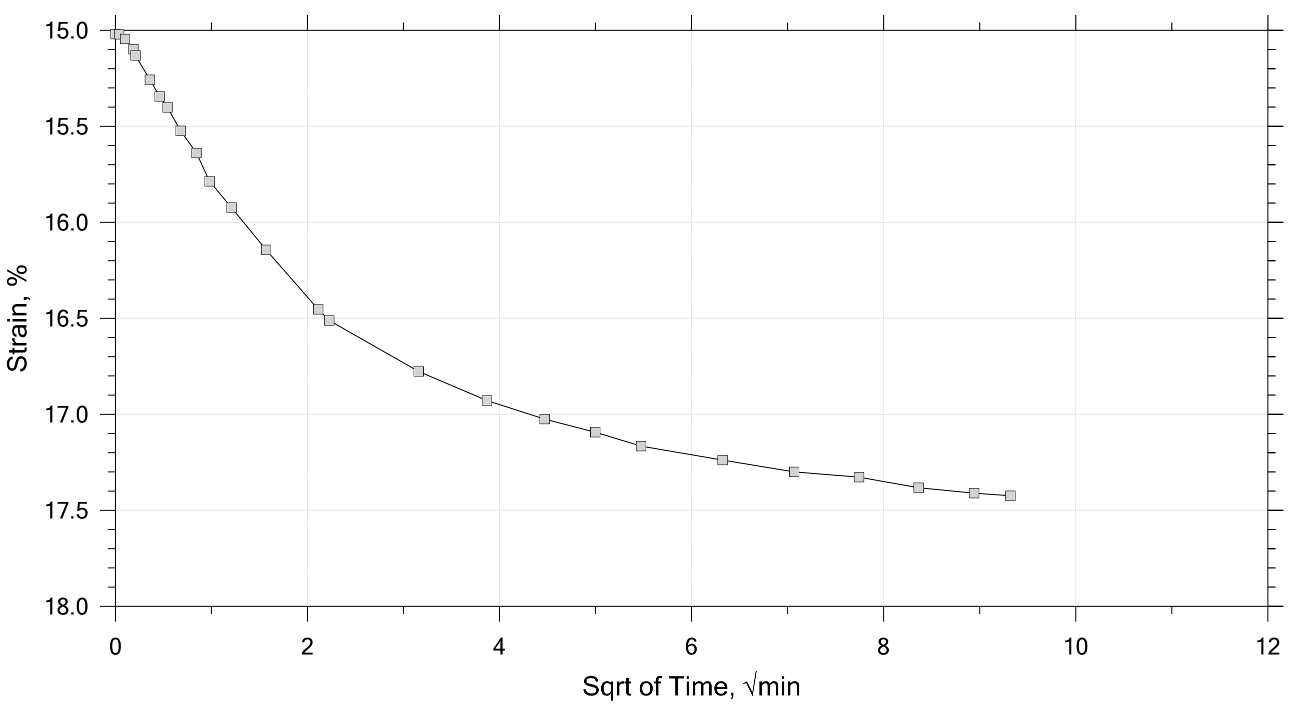


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 10/16/2020	Depth: 21.35
	Test Number: ICON 335	Preparation: Shelby Tube	Elevation: 22.25
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 19 of 22
Constant Load Step
Stress: 1.75e+04 psf

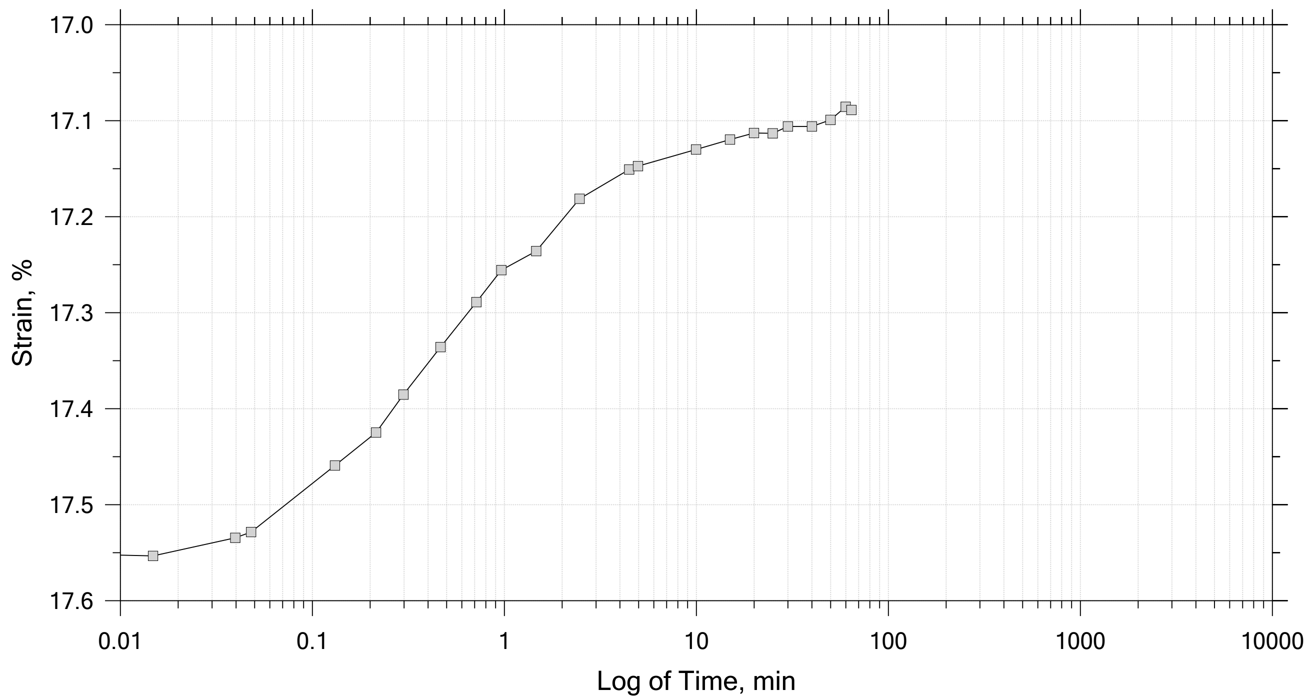


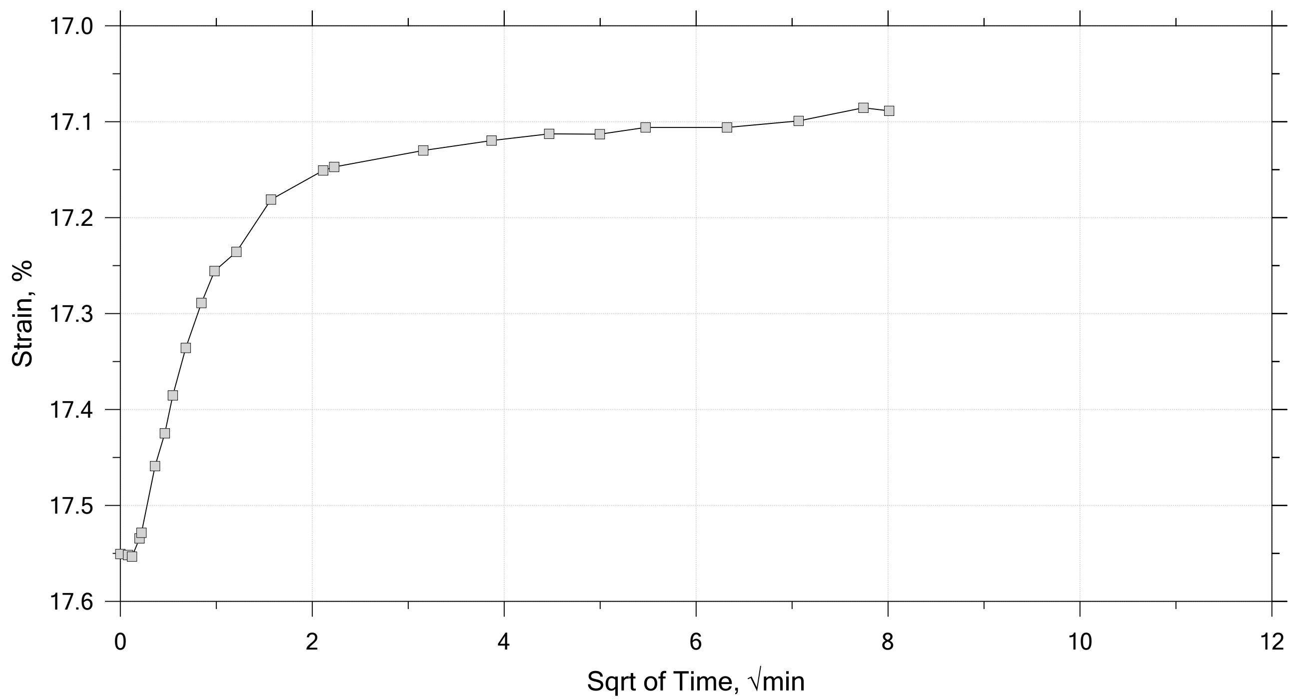


Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 10/16/2020	Depth: 21.35
	Test Number: ICON 335	Preparation: Shelby Tube	Elevation: 22.25
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 20 of 22
Constant Load Step
Stress: 4.39e+03 psf

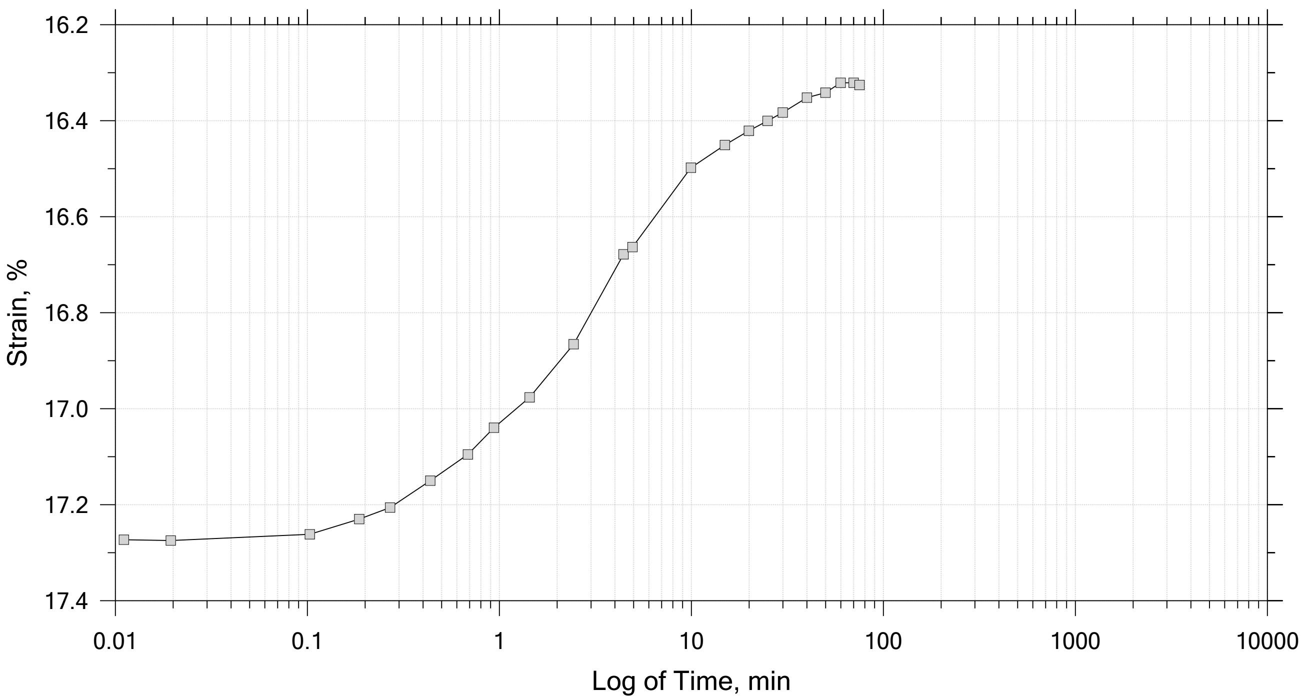


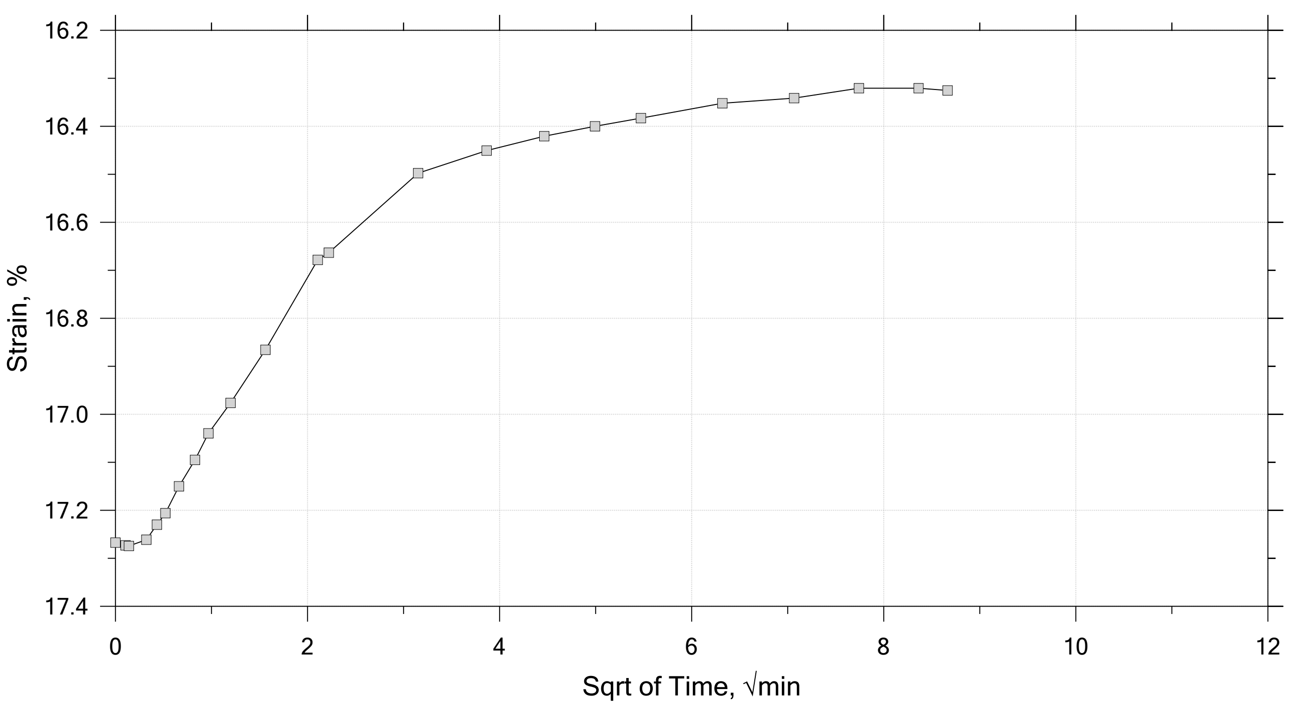


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 10/16/2020	Depth: 21.35
	Test Number: ICON 335	Preparation: Shelby Tube	Elevation: 22.25
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 21 of 22
Constant Load Step
Stress: 1.1e+03 psf

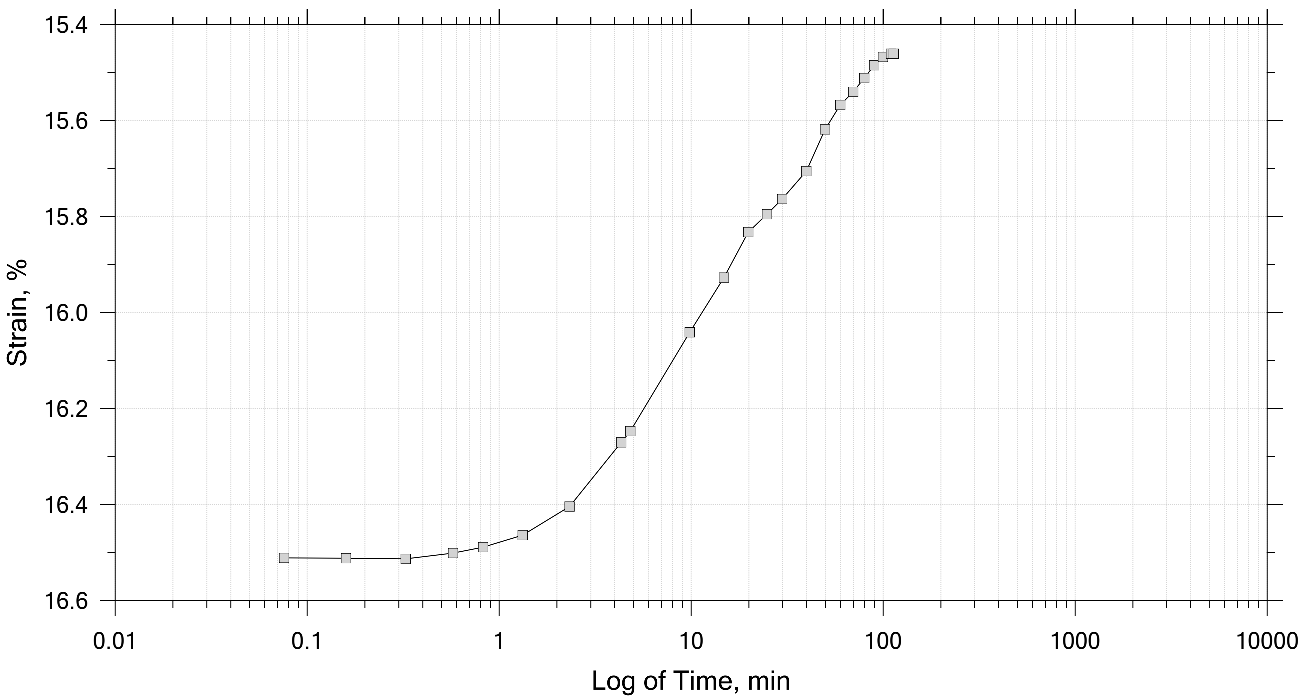


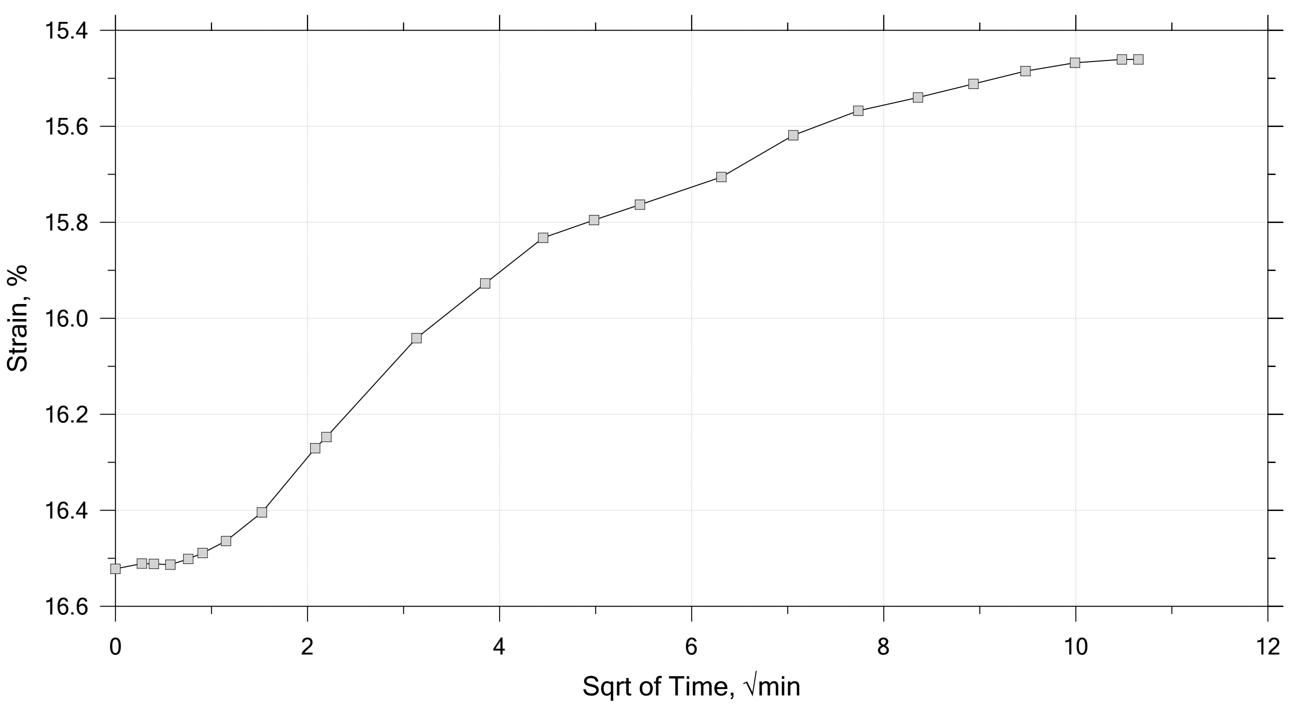


Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 10/16/2020	Depth: 21.35
	Test Number: ICON 335	Preparation: Shelby Tube	Elevation: 22.25
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 22 of 22
Constant Load Step
Stress: 274 psf





Soil Metrics LLC			
	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 10/16/2020	Depth: 21.35
	Test Number: ICON 335	Preparation: Shelby Tube	Elevation: 22.25
	Description: Gray Silty Clay		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Specimen Diameter, in: 2.50	Specific Gravity: 2.80 (Implied)	Liquid Limit: 0
Specimen Height, in: 1.00	Initial Void Ratio: 1.14	Plastic Limit: 0
Final Height, in: 0.85	Final Void Ratio: 0.81	Plasticity Index: 0

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	201	---	"ring"	308
Mass Container, gm	37.07	111.09	111.09	60.71
Mass Container + Wet Soil, gm	149.1	259.37	247.18	196.67
Mass Container + Dry Soil, gm	117.85	216.61	216.61	166.13
Mass Dry Soil, gm	80.78	105.52	105.52	105.42
Water Content, %	38.69	40.52	28.97	28.97
Void Ratio	---	1.14	0.81	---
Degree of Saturation, %	---	99.30	100.00	---
Dry Unit Weight, pcf	---	81.526	96.436	---

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: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 10/16/2020	Depth: 21.35
	Test Number: ICON 335	Preparation: Shelby Tube	Elevation: 22.25
	Description: Gray Silty Clay		
	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	220.	0.002087	1.14	0.208	0.000	0.00e+00	1.89e+04	0.00e+00	0.00e+00
2	330.	0.002823	1.13	0.281	0.000	0.00e+00	1.33e+04	0.00e+00	0.00e+00
3	495.	0.003649	1.13	0.363	0.000	0.00e+00	9.97e+03	0.00e+00	0.00e+00
4	743.	0.004455	1.13	0.443	0.000	0.00e+00	6.47e+03	0.00e+00	0.00e+00
5	1.11e+03	0.005174	1.13	0.515	0.000	0.00e+00	3.86e+03	0.00e+00	0.00e+00
6	1.67e+03	0.007036	1.13	0.700	0.000	0.00e+00	6.66e+03	0.00e+00	0.00e+00
7	2.51e+03	0.01693	1.10	1.69	0.000	0.00e+00	2.36e+04	0.00e+00	0.00e+00
8	5.01e+03	0.08078	0.969	8.04	0.000	0.00e+00	5.07e+04	0.00e+00	0.00e+00
9	1.00e+04	0.1423	0.838	14.2	0.000	0.00e+00	2.44e+04	0.00e+00	0.00e+00
10	2.51e+03	0.1393	0.844	13.9	0.658	5.58e-01	7.86e+02	4.83e-09	0.00e+00
11	1.25e+03	0.1398	0.843	13.9	0.000	0.00e+00	-7.97e+02	-0.00e+00	0.00e+00
12	626.	0.1364	0.850	13.6	0.000	0.00e+00	1.09e+04	0.00e+00	0.00e+00
13	313.	0.1330	0.857	13.2	14.302	2.61e-02	2.12e+04	6.07e-09	0.00e+00
14	548.	0.1327	0.858	13.2	0.000	0.00e+00	-2.41e+03	-0.00e+00	0.00e+00
15	1.10e+03	0.1324	0.859	13.2	0.000	0.00e+00	-1.31e+03	-0.00e+00	0.00e+00
16	2.19e+03	0.1348	0.854	13.4	0.000	0.00e+00	4.33e+03	0.00e+00	0.00e+00
17	4.39e+03	0.1398	0.843	13.9	0.000	0.00e+00	4.57e+03	0.00e+00	0.00e+00
18	8.77e+03	0.1511	0.819	15.0	0.000	0.00e+00	5.11e+03	0.00e+00	0.00e+00
19	1.75e+04	0.1709	0.777	17.0	1.942	1.80e-01	4.50e+03	8.94e-09	0.00e+00
20	4.39e+03	0.1680	0.783	16.7	0.361	9.52e-01	4.41e+02	4.62e-09	0.00e+00
21	1.10e+03	0.1645	0.790	16.4	2.576	1.34e-01	2.08e+03	3.07e-09	0.00e+00
22	274.	0.1553	0.810	15.5	0.000	0.00e+00	2.24e+04	0.00e+00	0.00e+00

Soil Metrics LLC

Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
Sample Number: 3U	Test Date: 10/16/2020	Depth: 21.35
Test Number: ICON 335	Preparation: Shelby Tube	Elevation: 22.25
Description: Gray Silty Clay		
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	220.	0.002087	1.14	0.208	0.000	0.00e+00	1.89e+04	0.00e+00
2	330.	0.002823	1.13	0.281	0.000	0.00e+00	1.33e+04	0.00e+00
3	495.	0.003649	1.13	0.363	95.572	2.22e-02	9.97e+03	2.44e-09
4	743.	0.004455	1.13	0.443	63.129	3.36e-02	6.47e+03	2.40e-09
5	1.11e+03	0.005174	1.13	0.515	1.999	1.06e+00	3.86e+03	4.51e-08
6	1.67e+03	0.007036	1.13	0.700	4.197	5.04e-01	6.66e+03	3.69e-08
7	2.51e+03	0.01693	1.10	1.69	91.649	2.28e-02	2.36e+04	5.92e-09
8	5.01e+03	0.08078	0.969	8.04	41.170	4.70e-02	5.07e+04	2.63e-08
9	1.00e+04	0.1423	0.838	14.2	164.576	1.03e-02	2.44e+04	2.76e-09
10	2.51e+03	0.1393	0.844	13.9	4.015	3.94e-01	7.86e+02	3.41e-09
11	1.25e+03	0.1398	0.843	13.9	28.724	5.52e-02	-7.97e+02	-4.84e-10
12	626.	0.1364	0.850	13.6	46.899	3.39e-02	1.09e+04	4.07e-09
13	313.	0.1330	0.857	13.2	54.652	2.93e-02	2.12e+04	6.84e-09
14	548.	0.1327	0.858	13.2	0.000	0.00e+00	-2.41e+03	-0.00e+00
15	1.10e+03	0.1324	0.859	13.2	7.043	2.29e-01	-1.31e+03	-3.31e-09
16	2.19e+03	0.1348	0.854	13.4	7.259	2.22e-01	4.33e+03	1.06e-08
17	4.39e+03	0.1398	0.843	13.9	2.726	5.85e-01	4.57e+03	2.94e-08
18	8.77e+03	0.1511	0.819	15.0	149.359	1.05e-02	5.11e+03	5.90e-10
19	1.75e+04	0.1709	0.777	17.0	8.554	1.76e-01	4.50e+03	8.73e-09
20	4.39e+03	0.1680	0.783	16.7	2.944	5.02e-01	4.41e+02	2.44e-09
21	1.10e+03	0.1645	0.790	16.4	13.789	1.08e-01	2.08e+03	2.47e-09
22	274.	0.1553	0.810	15.5	50.688	2.98e-02	2.24e+04	7.34e-09

Soil Metrics LLC	Project Name: Bucknam Road Bridge	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB FBR-202	Tester: SJR	Checker: SJR
	Sample Number: 3U	Test Date: 10/16/2020	Depth: 21.35
	Test Number: ICON 335	Preparation: Shelby Tube	Elevation: 22.25
	Description: Gray Silty Clay		
	Remarks:		
	Displacement at End of Primary		

DIRECT SIMPLE SHEAR

BB-FBR-201 2U

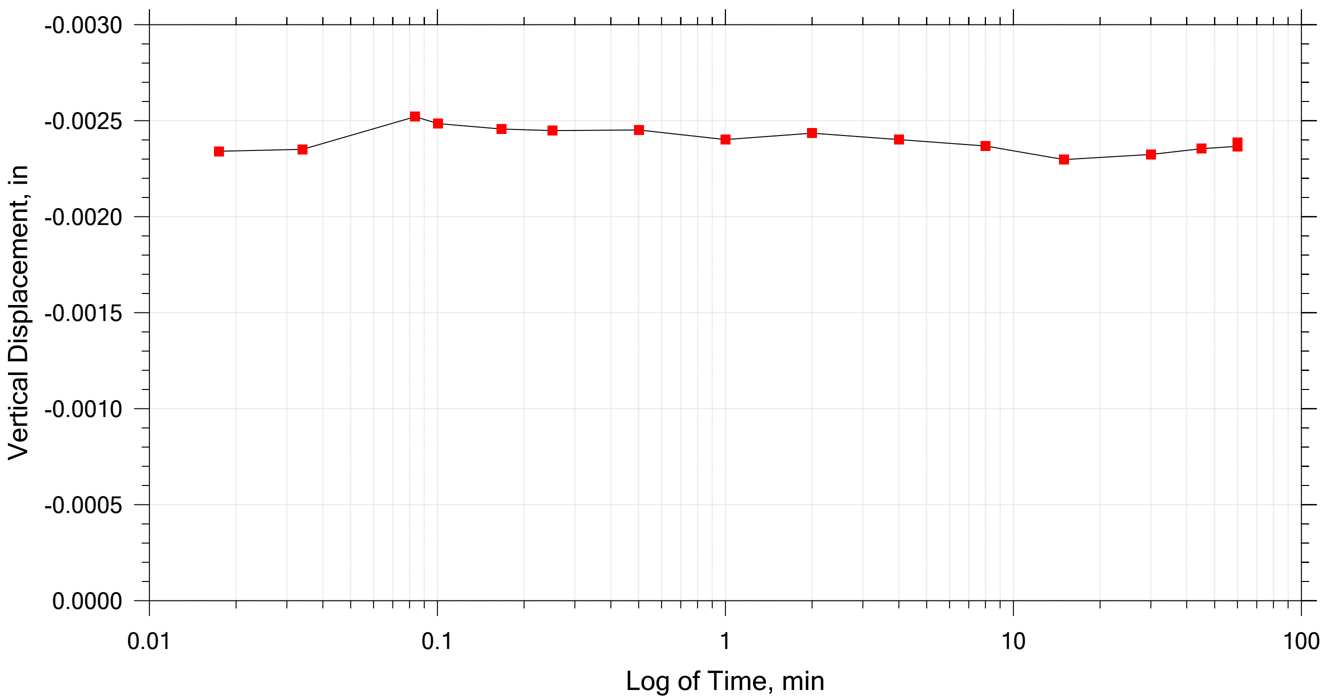
DSS-119

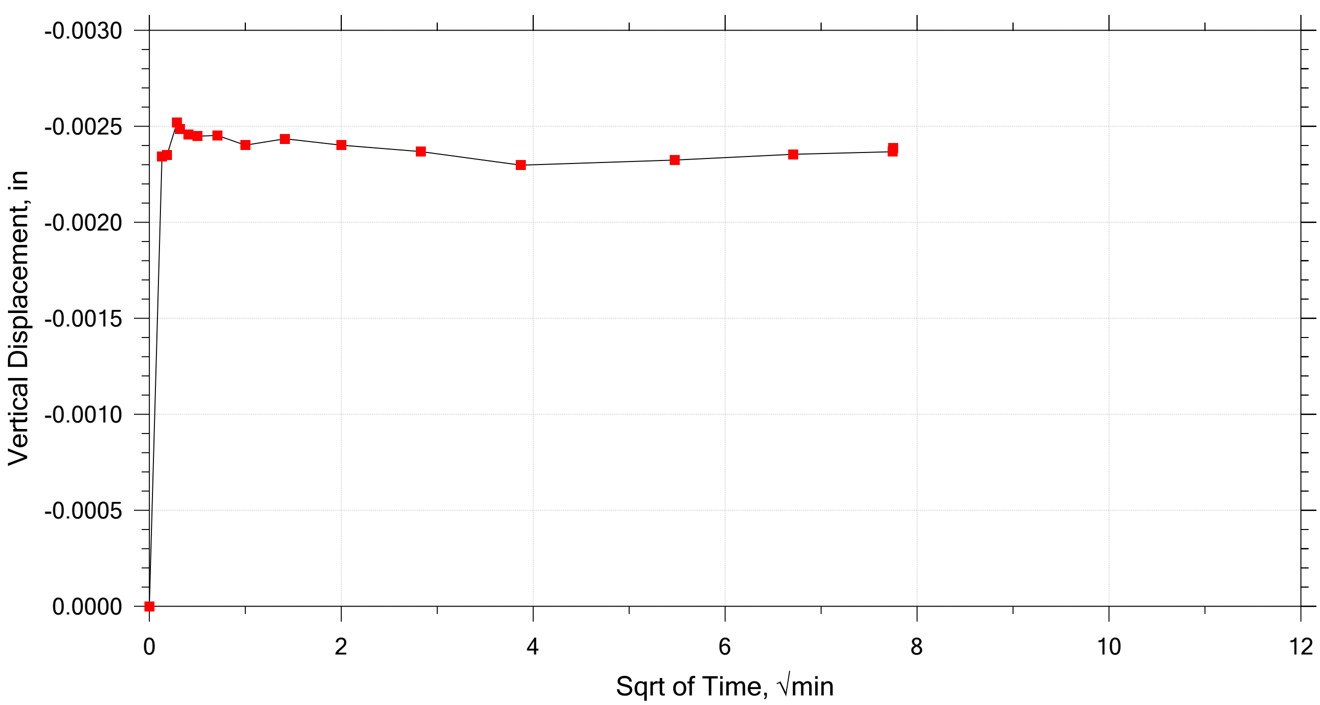
Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 1 of 7

Constant Load Step

Stress: 220 psf





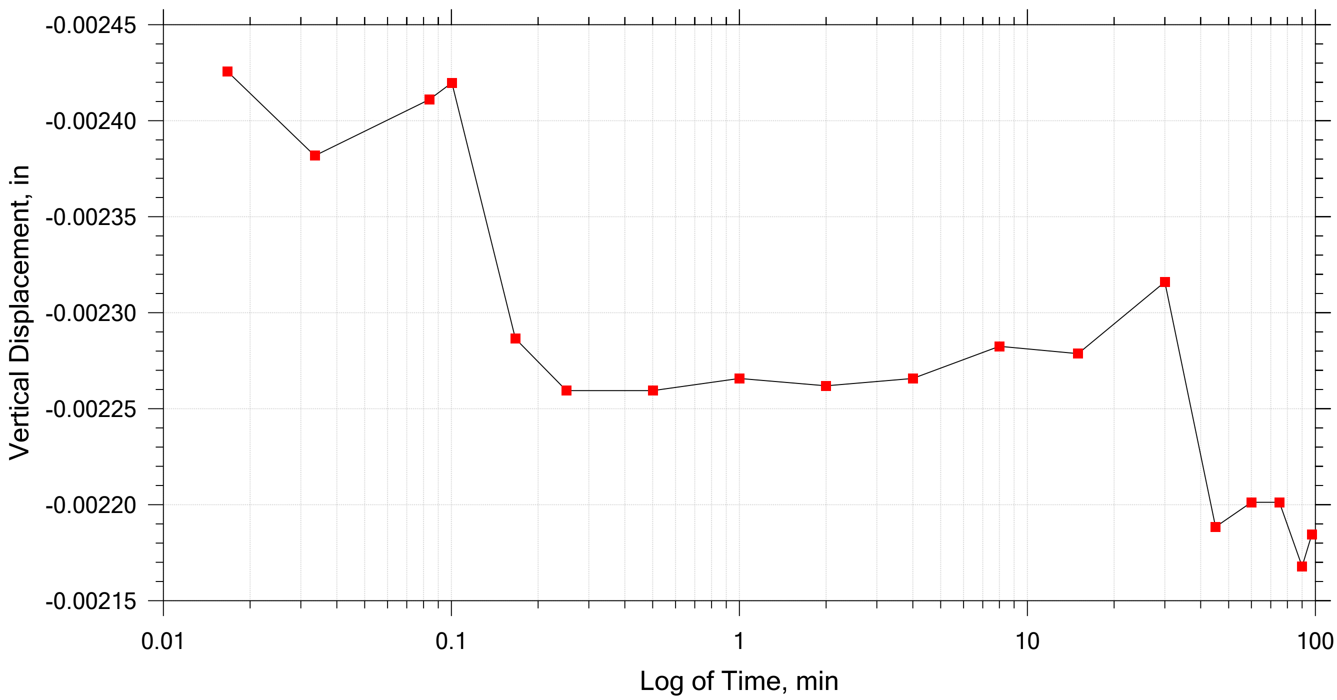
Soil Metrics LLC			
	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-201	Tester: SJR	Checker: sjr
	Sample Number: 2U	Test Date: 11/2/2020	Depth: 21.3
	Test Number: DSS 119	Preparation: wet	Elevation: 18.3
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2500 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

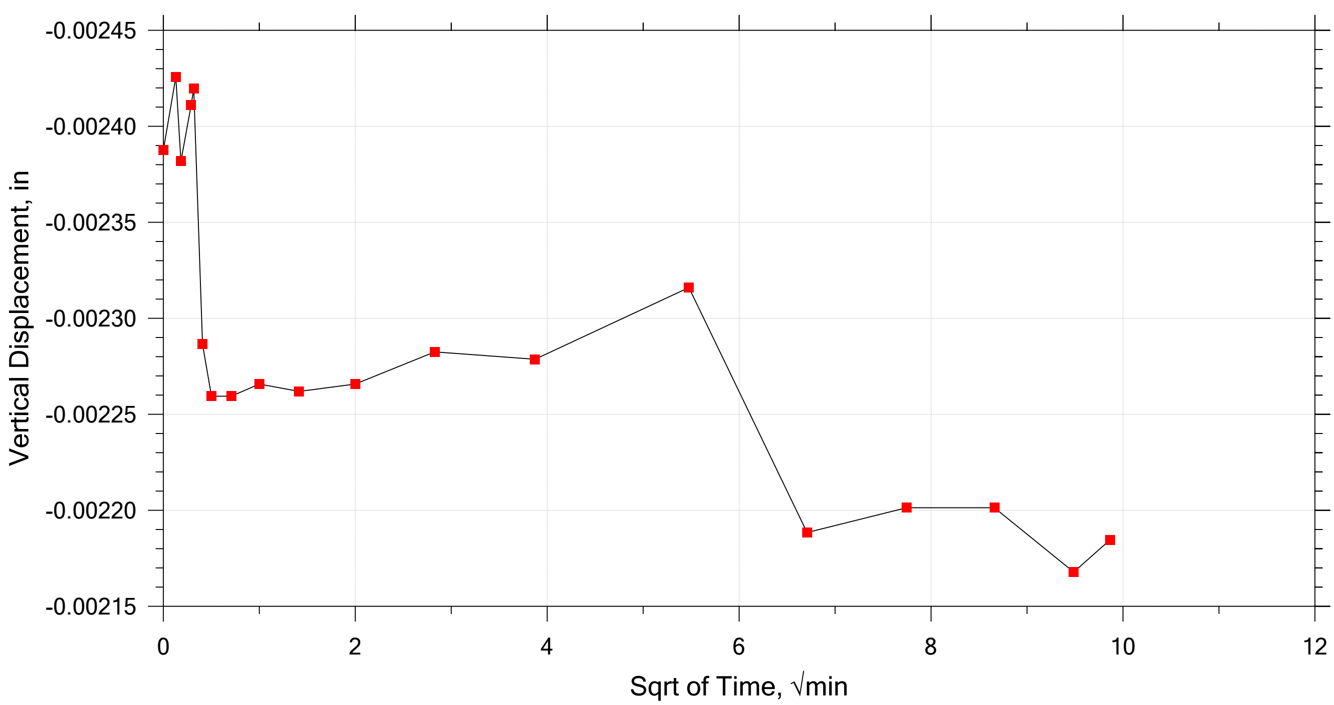
Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 2 of 7

Constant Load Step

Stress: 330 psf





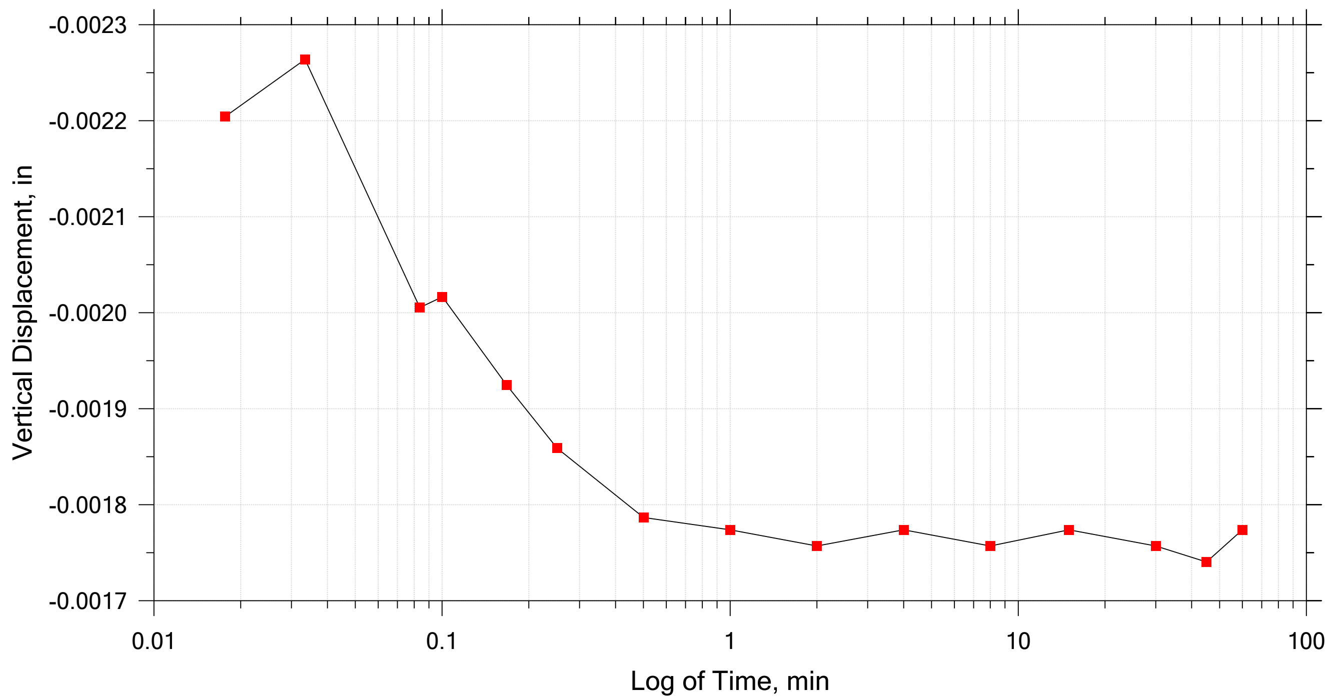
Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-201	Tester: SJR	Checker: sjr
	Sample Number: 2U	Test Date: 11/2/2020	Depth: 21.3
	Test Number: DSS 119	Preparation: wet	Elevation: 18.3
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2500 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

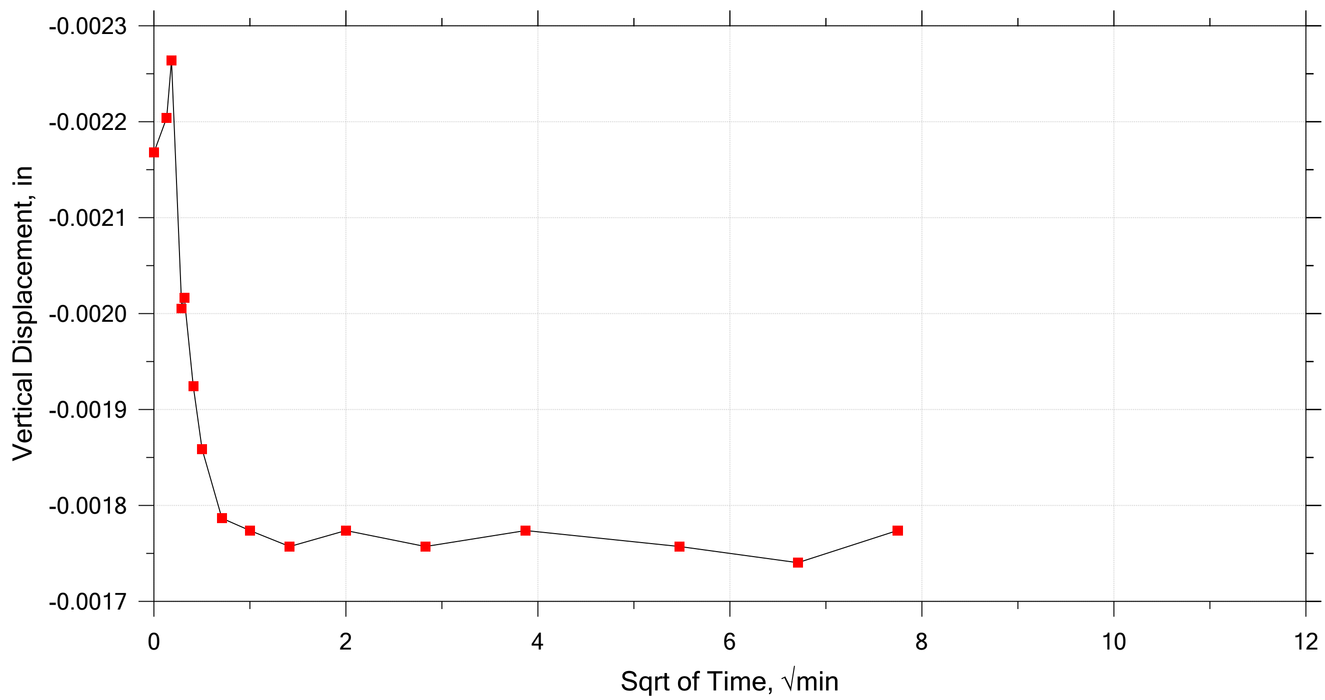
Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 3 of 7

Constant Load Step

Stress: 495 psf





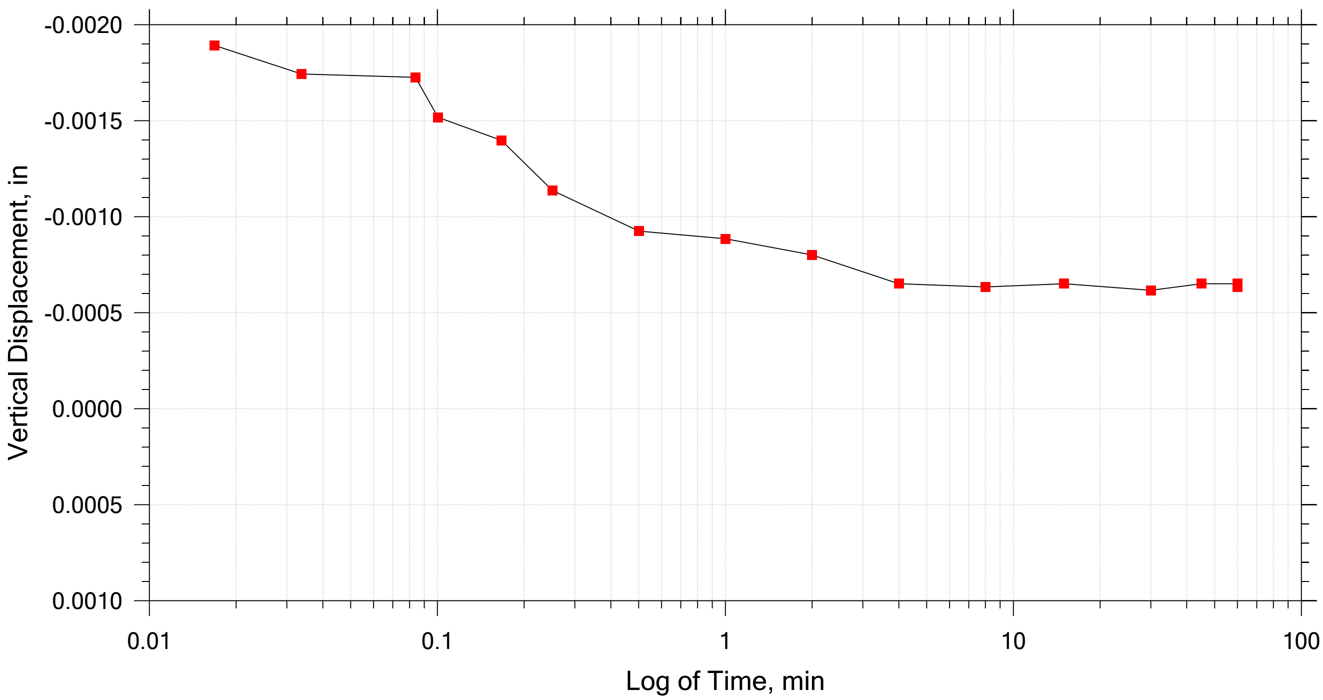
Soil Metrics LLC			
	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-201	Tester: SJR	Checker: sjr
	Sample Number: 2U	Test Date: 11/2/2020	Depth: 21.3
	Test Number: DSS 119	Preparation: wet	Elevation: 18.3
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2500 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

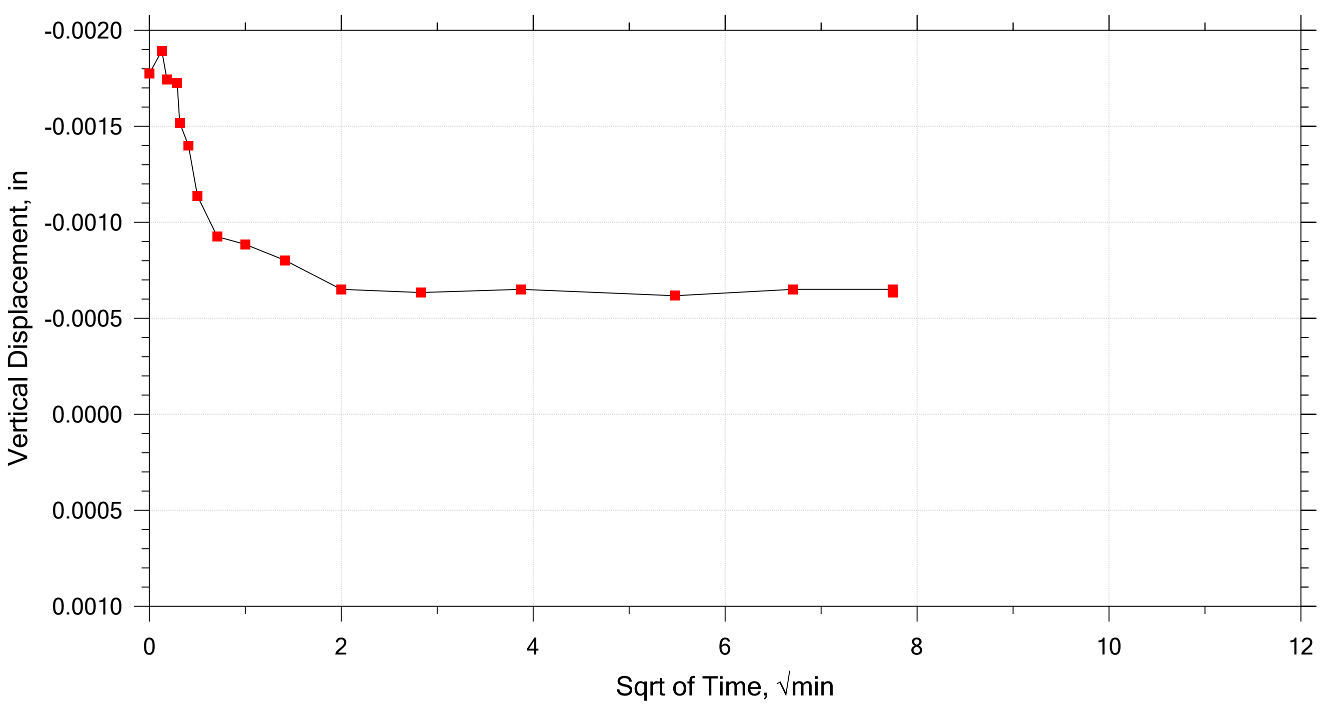
Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 4 of 7

Constant Load Step

Stress: 743 psf





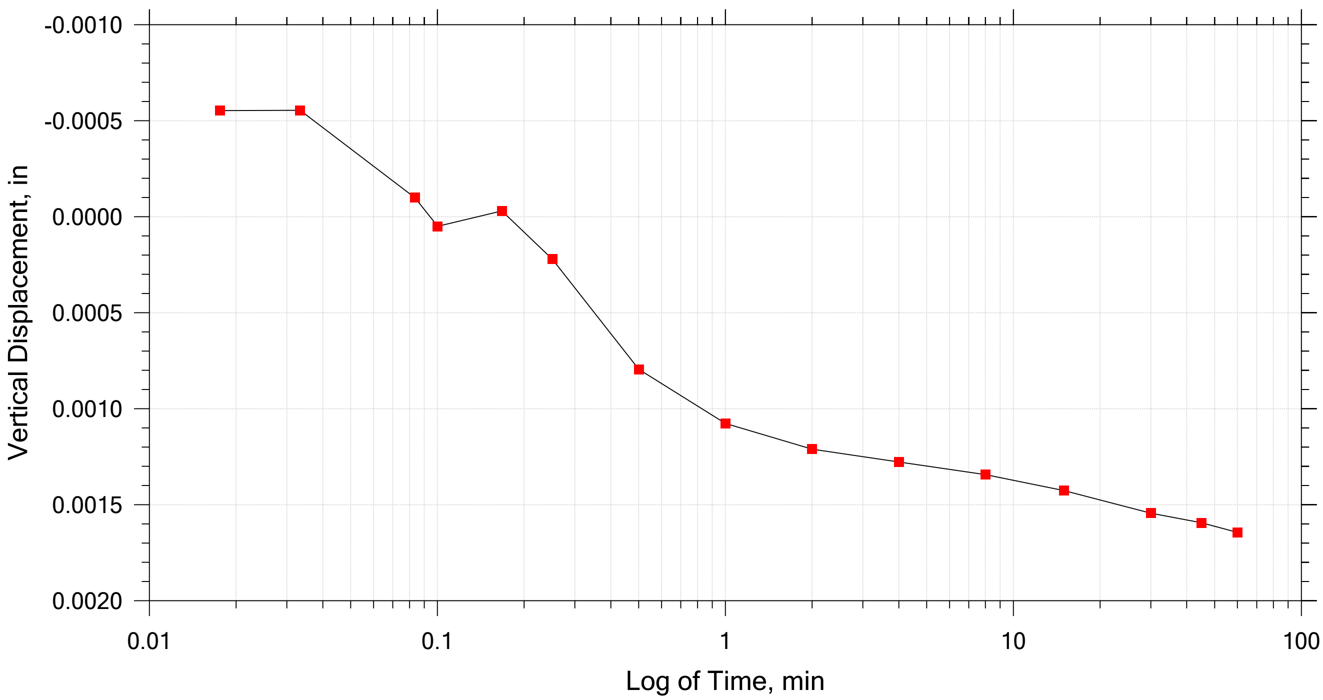
Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-201	Tester: SJR	Checker: sjr
	Sample Number: 2U	Test Date: 11/2/2020	Depth: 21.3
	Test Number: DSS 119	Preparation: wet	Elevation: 18.3
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2500 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

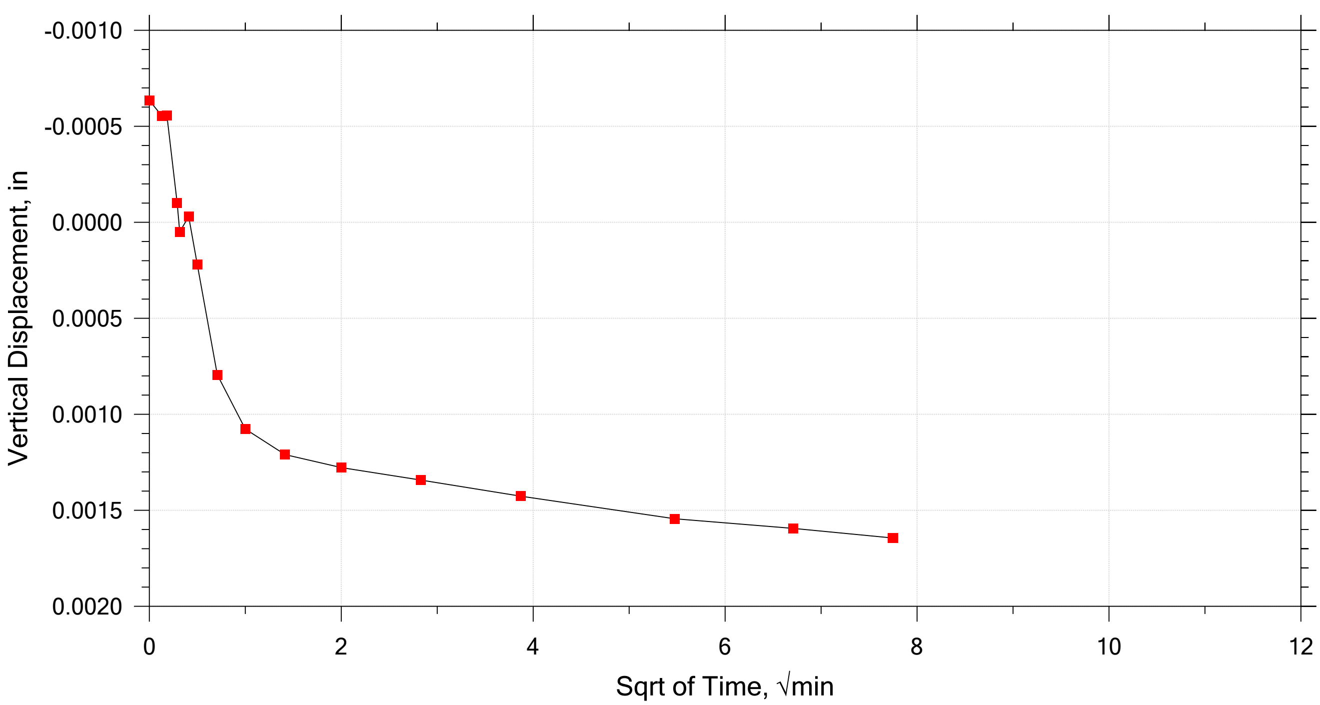
Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 5 of 7

Constant Load Step

Stress: 1.11e+03 psf





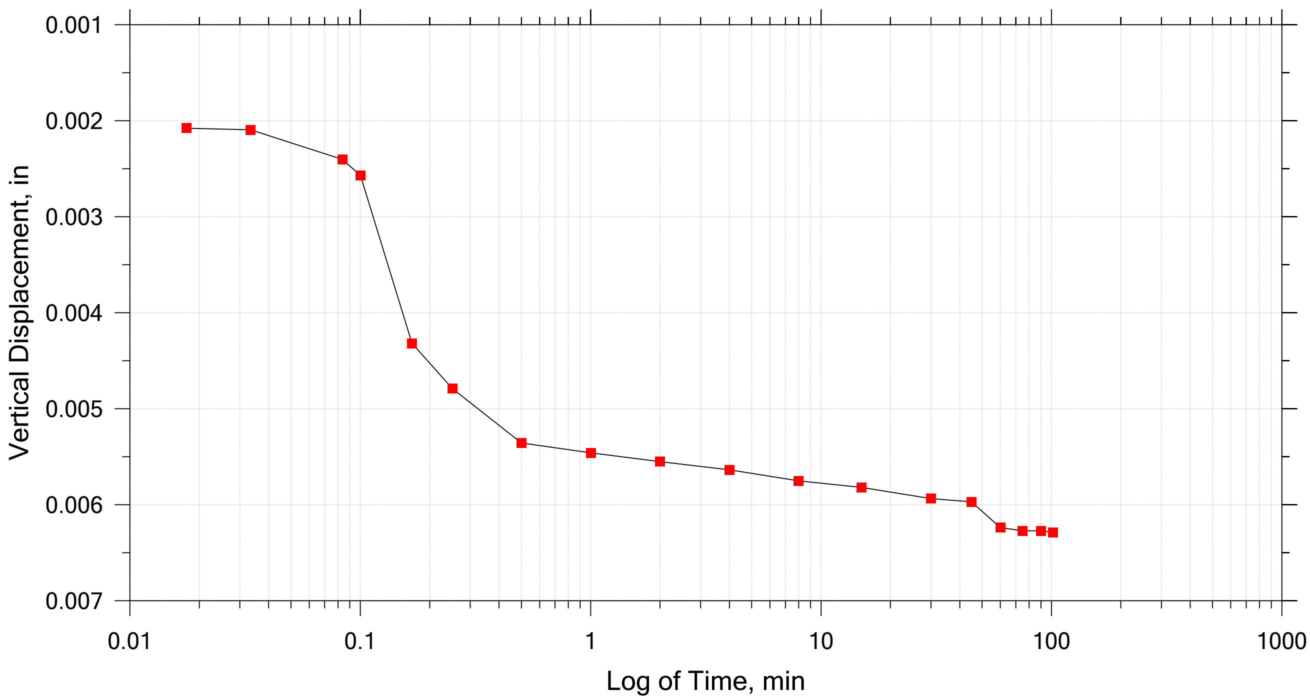
Soil Metrics LLC			
	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-201	Tester: SJR	Checker: sjr
	Sample Number: 2U	Test Date: 11/2/2020	Depth: 21.3
	Test Number: DSS 119	Preparation: wet	Elevation: 18.3
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2500 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

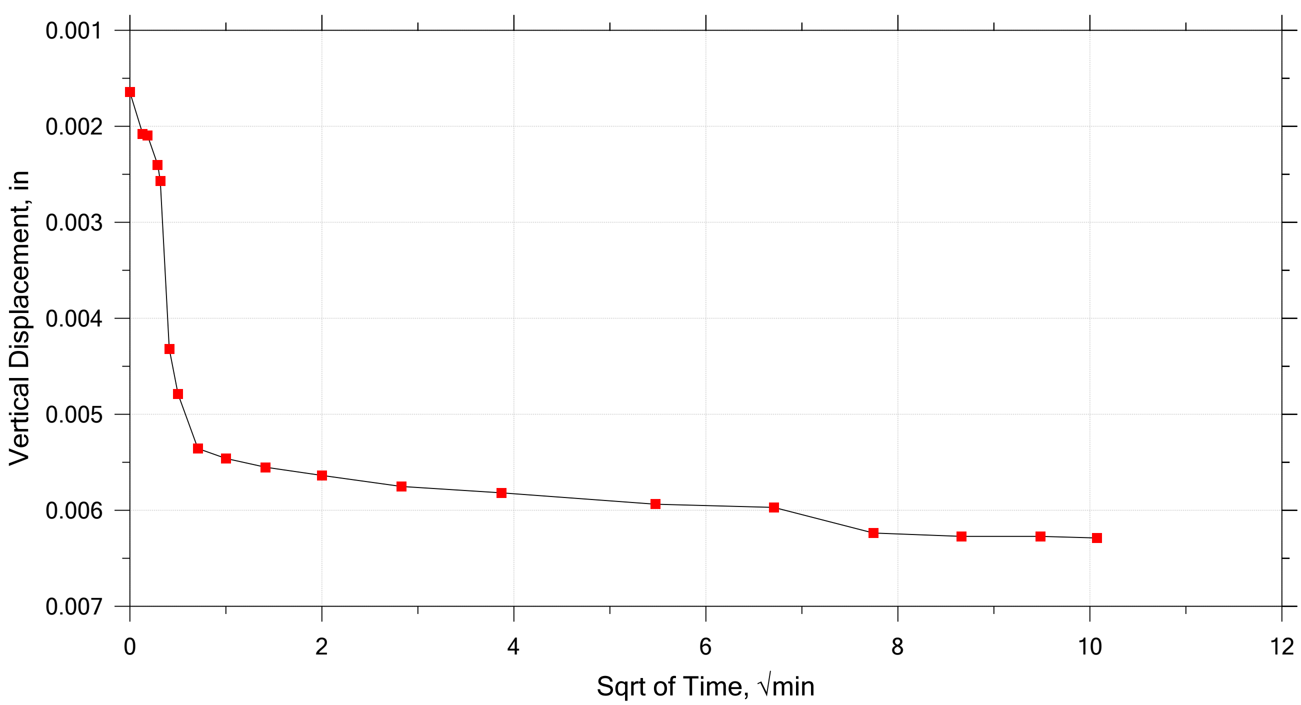
Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 6 of 7

Constant Load Step

Stress: 1.67e+03 psf





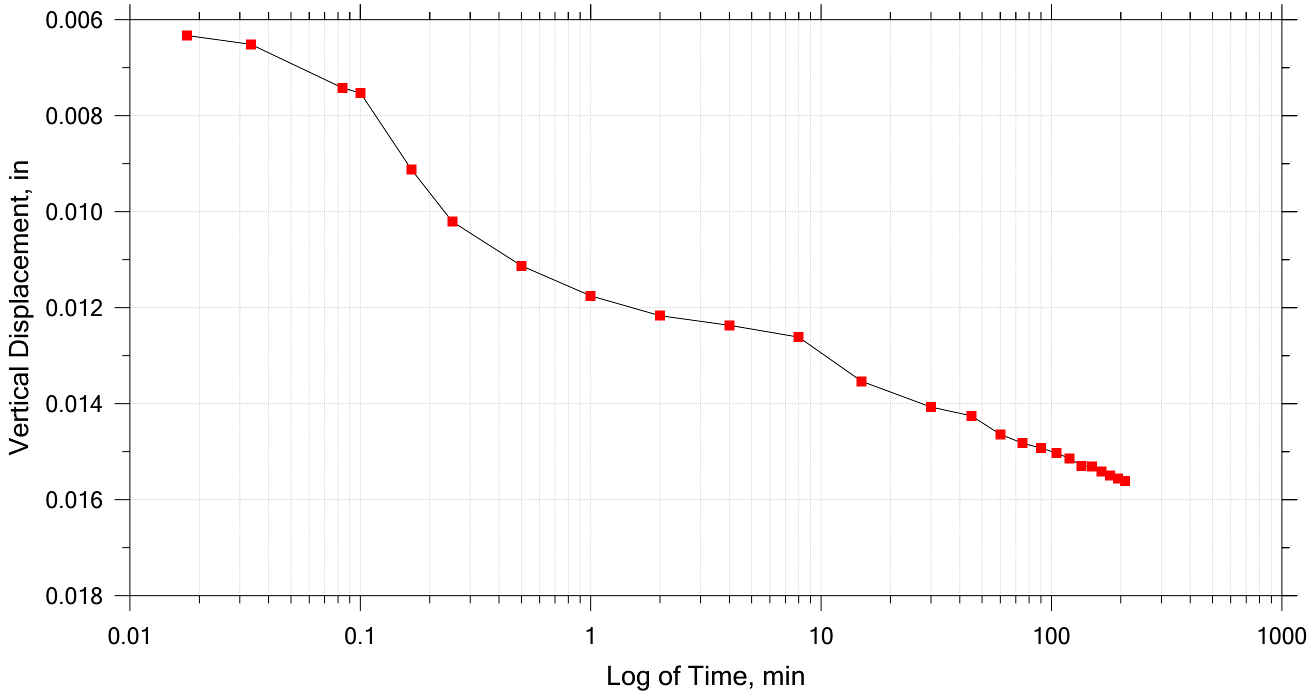
Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-201	Tester: SJR	Checker: sjr
	Sample Number: 2U	Test Date: 11/2/2020	Depth: 21.3
	Test Number: DSS 119	Preparation: wet	Elevation: 18.3
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2500 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

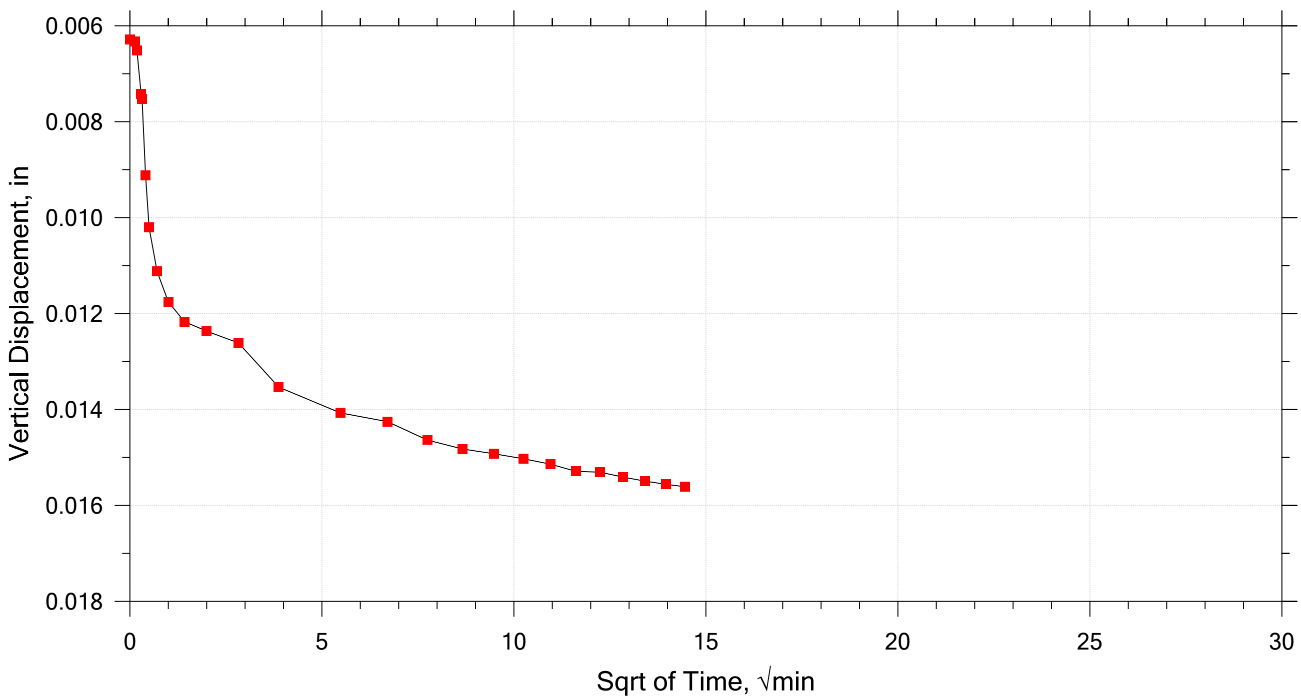
Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 7 of 7

Constant Load Step

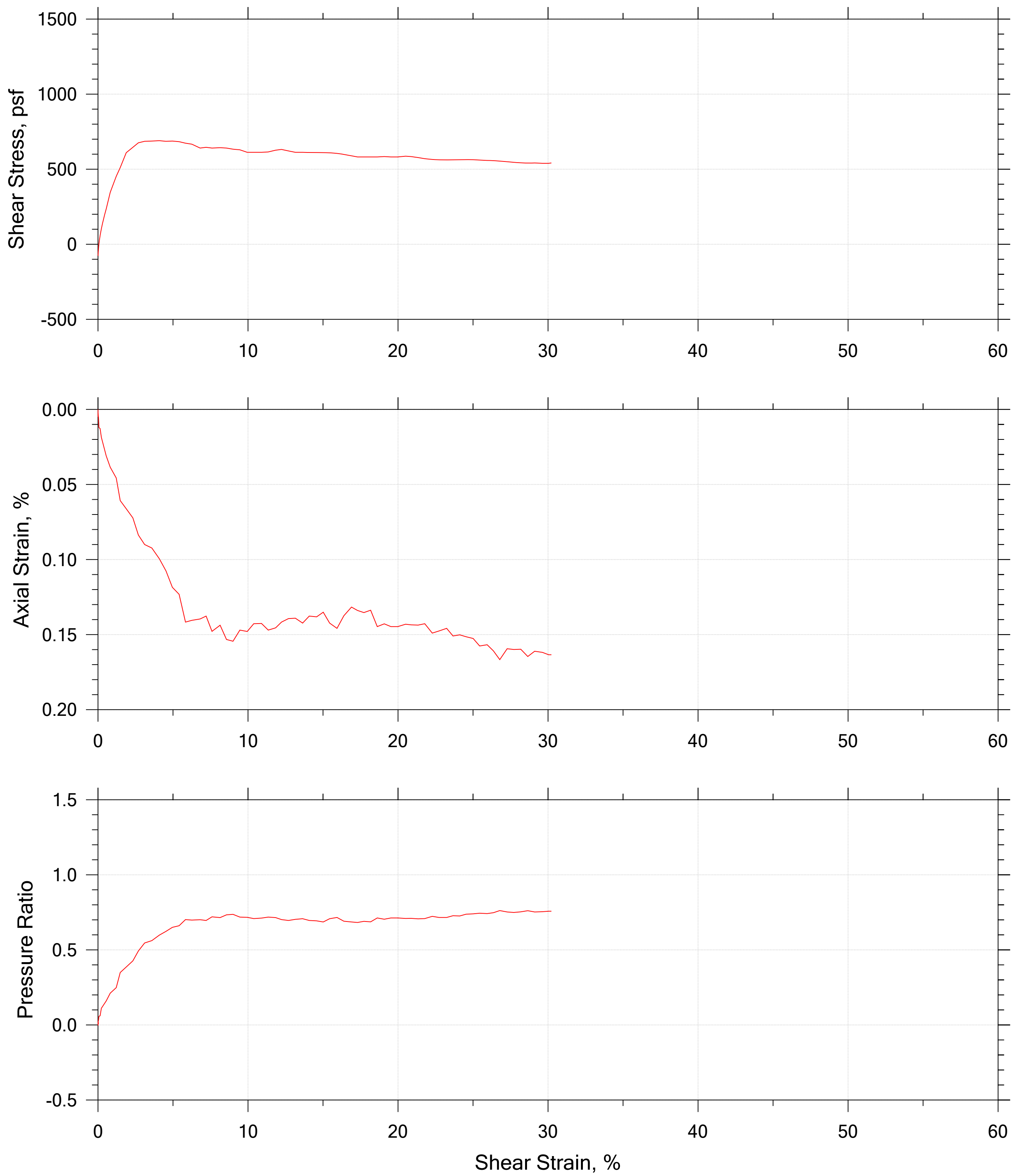
Stress: 2.51e+03 psf





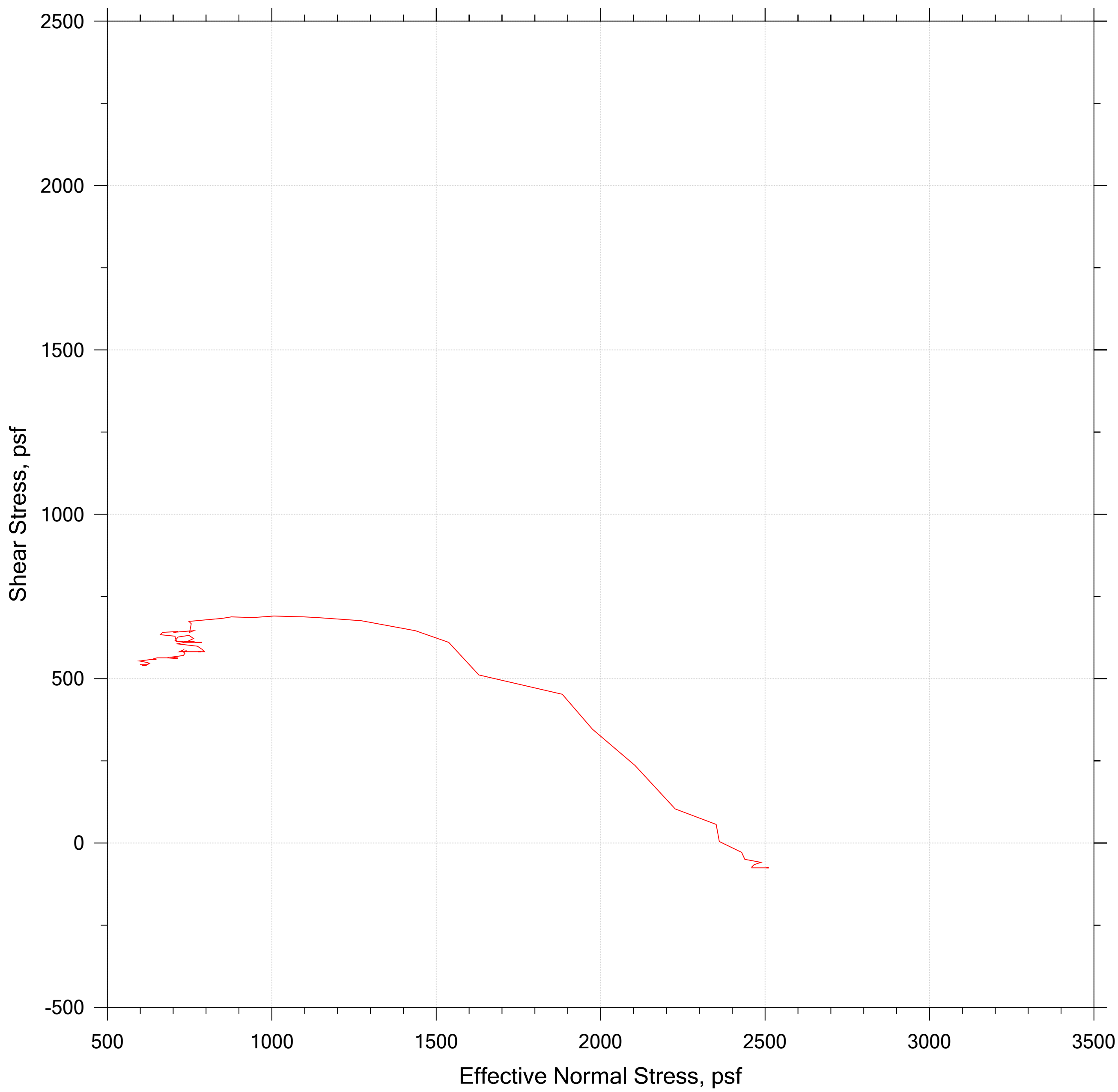
Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-201	Tester: SJR	Checker: sjr
	Sample Number: 2U	Test Date: 11/2/2020	Depth: 21.3
	Test Number: DSS 119	Preparation: wet	Elevation: 18.3
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2500 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

Direct Simple Shear Test by ASTM D6528



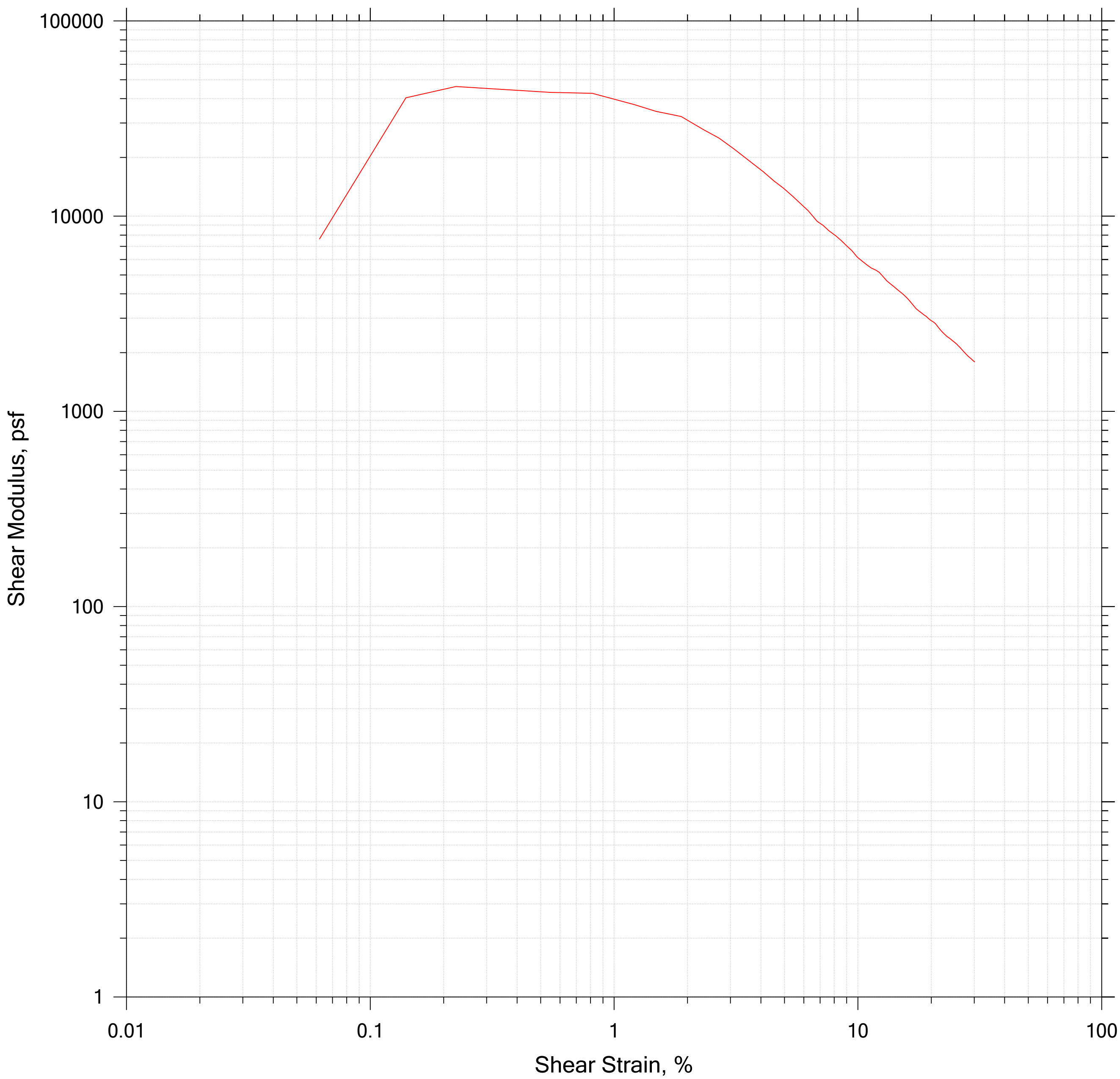
Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-201	Tester: SJR	Checker: sjr
	Sample Number: 2U	Test Date: 11/2/2020	Depth: 21.3
	Test Number: DSS 119	Preparation: wet	Elevation: 18.3
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2500 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

Direct Simple Shear Test by ASTM D6528



Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-201	Tester: SJR	Checker: sjr
	Sample Number: 2U	Test Date: 11/2/2020	Depth: 21.3
	Test Number: DSS 119	Preparation: wet	Elevation: 18.3
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2500 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

Direct Simple Shear Test by ASTM D6528



Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-201	Tester: SJR	Checker: sjr
	Sample Number: 2U	Test Date: 11/2/2020	Depth: 21.3
	Test Number: DSS 119	Preparation: wet	Elevation: 18.3
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2500 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

Direct Simple Shear Test by ASTM D6528

Specimen Dimension, in: 2.50	Specific Gravity: 2.84 (Implied)	Liquid Limit: 0
Specimen Height, in: 1.00	Initial Void Ratio: 1.33	Plastic Limit: 0
Final Height, in: 0.98	Final Void Ratio: 1.29	Plasticity Index: 0

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	218	---		310
Mass Container, gm	36.97	0	0	60.33
Mass Container + Wet Soil, gm	157.18	143.42	142.66	202.99
Mass Container + Dry Soil, gm	121.48	98.06	98.06	158.39
Mass Dry Soil, gm	84.51	98.06	98.06	98.06
Water Content, %	42.24	46.26	45.48	45.48
Void Ratio	---	1.33	1.29	---
Degree of Saturation, %	---	98.64	100.00	---
Dry Unit Weight, pcf	---	75.981	77.31	---

Warning: The change in the sample wet weight during the test is not consistent with the change in the moisture content.

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: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-201	Tester: SJR	Checker: sjr
	Sample Number: 2U	Test Date: 11/2/2020	Depth: 21.3
	Test Number: DSS 119	Preparation: wet	Elevation: 18.3
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2500 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 1 of 7

Constant Load Step

Stress: 220 psf

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	-7.05	-1.156e-05	0.0000	0.000	1.33
0.017	0.132	54.1	0.002330	-0.002341	-0.234	1.34
0.034	0.185	101.	0.002457	-0.002351	-0.235	1.34
0.084	0.289	207.	0.002744	-0.002521	-0.252	1.34
0.100	0.317	219.	0.002775	-0.002486	-0.248	1.34
0.167	0.408	212.	0.002764	-0.002457	-0.245	1.34
0.251	0.501	216.	0.002772	-0.002448	-0.244	1.34
0.501	0.707	219.	0.002775	-0.002452	-0.245	1.34
1.000	1.000	219.	0.002775	-0.002402	-0.240	1.34
2.001	1.415	219.	0.002775	-0.002435	-0.243	1.34
4.001	2.000	219.	0.002775	-0.002402	-0.240	1.34
8.001	2.829	219.	0.002775	-0.002368	-0.236	1.34
15.000	3.873	216.	0.002772	-0.002298	-0.229	1.34
30.000	5.477	221.	0.002782	-0.002324	-0.232	1.34
45.000	6.708	219.	0.002778	-0.002354	-0.235	1.34
60.000	7.746	216.	0.002774	-0.002367	-0.236	1.34
60.054	7.749	219.	0.002778	-0.002388	-0.238	1.34

Soil Metrics LLC

Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
Boring Number: BB-FBR-201	Tester: SJR	Checker: sjr
Sample Number: 2U	Test Date: 11/2/2020	Depth: 21.3
Test Number: DSS 119	Preparation: wet	Elevation: 18.3
Description: Gray silty Clay		
Remarks: Sample consolidated to 2500 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 2 of 7

Constant Load Step

Stress: 330 psf

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	219.	0.002778	-0.002388	-0.238	1.34
0.017	0.129	240.	0.002833	-0.002426	-0.242	1.34
0.034	0.183	242.	0.002839	-0.002382	-0.238	1.34
0.084	0.289	296.	0.002986	-0.002411	-0.241	1.34
0.100	0.317	306.	0.003011	-0.002420	-0.241	1.34
0.167	0.408	324.	0.003062	-0.002287	-0.228	1.33
0.251	0.501	327.	0.003068	-0.002259	-0.225	1.33
0.501	0.708	327.	0.003068	-0.002259	-0.225	1.33
1.000	1.000	329.	0.003075	-0.002266	-0.226	1.33
2.000	1.414	327.	0.003071	-0.002262	-0.226	1.33
4.000	2.000	329.	0.003075	-0.002266	-0.226	1.33
8.001	2.829	329.	0.003075	-0.002283	-0.228	1.33
15.000	3.873	327.	0.003071	-0.002279	-0.227	1.33
30.001	5.477	329.	0.003075	-0.002316	-0.231	1.34
45.000	6.708	332.	0.003081	-0.002188	-0.218	1.33
60.000	7.746	329.	0.003077	-0.002201	-0.220	1.33
75.001	8.660	329.	0.003077	-0.002201	-0.220	1.33
90.001	9.487	329.	0.003077	-0.002168	-0.216	1.33
97.316	9.865	329.	0.003077	-0.002185	-0.218	1.33

Soil Metrics LLC			
	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-201	Tester: SJR	Checker: sjr
	Sample Number: 2U	Test Date: 11/2/2020	Depth: 21.3
	Test Number: DSS 119	Preparation: wet	Elevation: 18.3
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2500 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 3 of 7

Constant Load Step

Stress: 495 psf

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	329.	0.003077	-0.002168	-0.216	1.33
0.018	0.133	362.	0.003164	-0.002204	-0.220	1.33
0.033	0.183	390.	0.003240	-0.002264	-0.226	1.33
0.084	0.289	419.	0.003317	-0.002005	-0.200	1.33
0.100	0.317	435.	0.003361	-0.002016	-0.201	1.33
0.168	0.410	494.	0.003520	-0.001924	-0.192	1.33
0.251	0.501	484.	0.003505	-0.001859	-0.186	1.33
0.501	0.708	491.	0.003517	-0.001787	-0.178	1.33
1.000	1.000	494.	0.003520	-0.001774	-0.177	1.33
2.001	1.414	494.	0.003520	-0.001757	-0.175	1.33
4.000	2.000	494.	0.003520	-0.001774	-0.177	1.33
8.000	2.828	494.	0.003520	-0.001757	-0.175	1.33
15.001	3.873	494.	0.003520	-0.001774	-0.177	1.33
30.000	5.477	494.	0.003520	-0.001757	-0.175	1.33
45.001	6.708	494.	0.003520	-0.001740	-0.174	1.33
60.001	7.746	494.	0.003520	-0.001774	-0.177	1.33
60.089	7.752	494.	0.003520	-0.001774	-0.177	1.33

Soil Metrics LLC

Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
Boring Number: BB-FBR-201	Tester: SJR	Checker: sjr
Sample Number: 2U	Test Date: 11/2/2020	Depth: 21.3
Test Number: DSS 119	Preparation: wet	Elevation: 18.3
Description: Gray silty Clay		
Remarks: Sample consolidated to 2500 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 4 of 7

Constant Load Step

Stress: 743 psf

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	494.	0.003520	-0.001774	-0.177	1.33
0.017	0.130	550.	0.003673	-0.001893	-0.189	1.33
0.034	0.184	510.	0.003608	-0.001744	-0.174	1.33
0.084	0.290	618.	0.003858	-0.001726	-0.172	1.33
0.100	0.317	647.	0.003934	-0.001518	-0.151	1.33
0.167	0.408	738.	0.004183	-0.001398	-0.140	1.33
0.251	0.501	722.	0.004156	-0.001136	-0.113	1.33
0.501	0.708	736.	0.004179	-0.0009251	-0.0923	1.33
1.001	1.000	741.	0.004189	-0.0008851	-0.0883	1.33
2.001	1.414	741.	0.004189	-0.0008014	-0.0800	1.33
4.000	2.000	741.	0.004189	-0.0006507	-0.0649	1.33
8.000	2.828	741.	0.004189	-0.0006340	-0.0633	1.33
15.001	3.873	741.	0.004189	-0.0006507	-0.0649	1.33
30.000	5.477	741.	0.004189	-0.0006172	-0.0616	1.33
45.000	6.708	741.	0.004189	-0.0006507	-0.0649	1.33
60.000	7.746	741.	0.004189	-0.0006507	-0.0649	1.33
60.115	7.753	741.	0.004189	-0.0006340	-0.0633	1.33

Soil Metrics LLC			
	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-201	Tester: SJR	Checker: sjr
	Sample Number: 2U	Test Date: 11/2/2020	Depth: 21.3
	Test Number: DSS 119	Preparation: wet	Elevation: 18.3
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2500 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 5 of 7

Constant Load Step

Stress: 1114 psf

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	741.	0.004189	-0.0006340	-0.0633	1.33
0.018	0.133	722.	0.004158	-0.0005529	-0.0552	1.33
0.033	0.183	804.	0.004361	-0.0005547	-0.0554	1.33
0.083	0.289	945.	0.004743	-9.953e-05	-0.00993	1.33
0.100	0.317	983.	0.004845	4.976e-05	0.00497	1.33
0.168	0.409	1.11e+03	0.005109	-3.000e-05	-0.00299	1.33
0.250	0.500	1.08e+03	0.005092	0.0002210	0.0221	1.33
0.501	0.708	1.11e+03	0.005105	0.0007946	0.0793	1.33
1.000	1.000	1.11e+03	0.005108	0.001077	0.107	1.33
2.001	1.415	1.11e+03	0.005108	0.001211	0.121	1.33
4.001	2.000	1.11e+03	0.005108	0.001277	0.127	1.33
8.001	2.829	1.11e+03	0.005109	0.001343	0.134	1.33
15.000	3.873	1.11e+03	0.005109	0.001427	0.142	1.33
30.000	5.477	1.11e+03	0.005109	0.001544	0.154	1.33
45.001	6.708	1.11e+03	0.005109	0.001594	0.159	1.33
60.001	7.746	1.11e+03	0.005109	0.001645	0.164	1.33
60.128	7.754	1.11e+03	0.005109	0.001645	0.164	1.33

Soil Metrics LLC			
	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-201	Tester: SJR	Checker: sjr
	Sample Number: 2U	Test Date: 11/2/2020	Depth: 21.3
	Test Number: DSS 119	Preparation: wet	Elevation: 18.3
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2500 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 6 of 7

Constant Load Step

Stress: 1671 psf

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	1.11e+03	0.005109	0.001645	0.164	1.33
0.018	0.133	1.15e+03	0.005177	0.002078	0.207	1.32
0.033	0.183	1.25e+03	0.005379	0.002095	0.209	1.32
0.084	0.289	1.45e+03	0.005758	0.002402	0.240	1.32
0.100	0.317	1.50e+03	0.005858	0.002569	0.256	1.32
0.168	0.409	1.66e+03	0.006169	0.004318	0.431	1.32
0.251	0.501	1.62e+03	0.006150	0.004790	0.478	1.32
0.500	0.707	1.66e+03	0.006169	0.005356	0.535	1.32
1.001	1.000	1.66e+03	0.006183	0.005460	0.545	1.32
2.000	1.414	1.67e+03	0.006192	0.005551	0.554	1.32
4.000	2.000	1.67e+03	0.006191	0.005636	0.563	1.32
8.000	2.829	1.67e+03	0.006192	0.005752	0.574	1.32
15.000	3.873	1.67e+03	0.006192	0.005819	0.581	1.32
30.001	5.477	1.67e+03	0.006192	0.005936	0.592	1.32
45.000	6.708	1.67e+03	0.006192	0.005970	0.596	1.32
60.000	7.746	1.67e+03	0.006192	0.006238	0.623	1.32
75.000	8.660	1.67e+03	0.006192	0.006271	0.626	1.32
90.000	9.487	1.67e+03	0.006192	0.006271	0.626	1.32
101.452	10.072	1.67e+03	0.006192	0.006288	0.628	1.32

Soil Metrics LLC

Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
Boring Number: BB-FBR-201	Tester: SJR	Checker: sjr
Sample Number: 2U	Test Date: 11/2/2020	Depth: 21.3
Test Number: DSS 119	Preparation: wet	Elevation: 18.3
Description: Gray silty Clay		
Remarks: Sample consolidated to 2500 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 7 of 7

Constant Load Step

Stress: 2506 psf

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	1.67e+03	0.006192	0.006288	0.628	1.32
0.018	0.133	1.80e+03	0.006453	0.006329	0.632	1.31
0.034	0.183	1.96e+03	0.006754	0.006513	0.650	1.31
0.084	0.289	2.23e+03	0.007072	0.007418	0.740	1.31
0.100	0.317	2.29e+03	0.007127	0.007530	0.751	1.31
0.167	0.408	2.41e+03	0.007258	0.009124	0.911	1.31
0.251	0.501	2.43e+03	0.007280	0.01021	1.02	1.31
0.500	0.707	2.49e+03	0.007333	0.01113	1.11	1.30
1.001	1.000	2.49e+03	0.007340	0.01175	1.17	1.30
2.000	1.414	2.50e+03	0.007347	0.01217	1.21	1.30
4.000	2.000	2.50e+03	0.007347	0.01237	1.23	1.30
8.001	2.829	2.50e+03	0.007352	0.01261	1.26	1.30
15.000	3.873	2.50e+03	0.007352	0.01353	1.35	1.30
30.000	5.477	2.50e+03	0.007352	0.01407	1.40	1.30
45.000	6.708	2.50e+03	0.007352	0.01425	1.42	1.30
60.001	7.746	2.50e+03	0.007352	0.01464	1.46	1.30
75.001	8.660	2.50e+03	0.007352	0.01482	1.48	1.30
90.000	9.487	2.50e+03	0.007352	0.01492	1.49	1.29
105.001	10.247	2.50e+03	0.007351	0.01503	1.50	1.29
120.001	10.954	2.50e+03	0.007352	0.01514	1.51	1.29
135.001	11.619	2.50e+03	0.007352	0.01529	1.53	1.29
150.001	12.247	2.50e+03	0.007352	0.01531	1.53	1.29
165.000	12.845	2.50e+03	0.007352	0.01541	1.54	1.29
180.000	13.416	2.50e+03	0.007352	0.01549	1.55	1.29
195.001	13.964	2.50e+03	0.007352	0.01556	1.55	1.29
208.804	14.450	2.50e+03	0.007351	0.01561	1.56	1.29

Soil Metrics LLC			
	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-201	Tester: SJR	Checker: sjr
	Sample Number: 2U	Test Date: 11/2/2020	Depth: 21.3
	Test Number: DSS 119	Preparation: wet	Elevation: 18.3
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2500 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

Direct Simple Shear Test by ASTM D6528

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
0.00000	0.00000	-75.410	0.00000	0.00000	2504.2	0.00000
0.00028333	0.00000	-75.410	0.00000	0.00000	2504.2	0.00000
0.016867	0.0065092	-75.410	-1.1585e+06	0.0048475	2506.5	-0.00093897
0.033717	0.0065092	-75.410	-1.1585e+06	0.0043567	2511.2	-0.0028169
0.083883	0.0032546	-75.410	-2.3170e+06	0.0047796	2459.5	0.017840
0.10048	0.0032546	-75.410	-2.3170e+06	0.0047796	2459.5	0.017840
0.16670	0.0032546	-73.053	-2.2446e+06	0.0047796	2459.5	0.017840
0.25070	0.0097638	-65.983	-6.7580e+05	0.0025614	2466.5	0.015023
0.50025	0.016273	-58.914	-3.6203e+05	0.0043946	2487.7	0.0065728
1.0006	0.016273	-49.488	-3.0411e+05	0.0046440	2438.3	0.026291
2.0010	0.029291	-28.279	-96542.	0.0053382	2428.9	0.030047
4.0004	0.061837	4.7131	7621.8	0.012069	2360.7	0.057277
8.0003	0.13995	56.557	40413.	0.012763	2351.3	0.061033
15.000	0.22457	103.69	46172.	0.018566	2226.7	0.11080
30.000	0.54677	235.65	43099.	0.030986	2104.4	0.15962
45.000	0.81365	346.41	42575.	0.038496	1975.1	0.21127
60.000	1.2140	452.46	37271.	0.045646	1883.4	0.24789
75.000	1.4841	511.37	34457.	0.060745	1629.5	0.34930
90.001	1.8844	610.35	32389.	0.066197	1537.8	0.38592
105.00	2.3270	645.69	27747.	0.072209	1436.7	0.42629
120.00	2.6916	676.33	25128.	0.083692	1272.1	0.49202
135.00	3.1081	685.76	22063.	0.089964	1138.0	0.54554
150.00	3.5898	688.11	19168.	0.092340	1098.1	0.56150
165.00	4.0878	690.47	16891.	0.099490	1006.4	0.59812
180.00	4.5337	685.76	15126.	0.10758	942.88	0.62347
195.00	4.9600	688.11	13873.	0.11852	877.04	0.64977
210.00	5.4091	683.40	12634.	0.12321	848.83	0.66103
225.00	5.8355	673.97	11550.	0.14170	747.72	0.70141
240.00	6.2553	666.90	10661.	0.14052	754.78	0.69859
255.00	6.8086	640.98	9414.3	0.13961	750.07	0.70047
270.00	7.2089	645.69	8956.9	0.13766	761.83	0.69577
285.00	7.5995	640.98	8434.5	0.14781	700.69	0.72019
300.00	8.1398	643.34	7903.6	0.14377	714.80	0.71455
315.00	8.5694	640.98	7479.9	0.15328	667.78	0.73333
330.00	8.9957	633.91	7046.8	0.15445	660.72	0.73615
345.00	9.4546	629.20	6654.9	0.14703	705.40	0.71831
360.00	9.9493	612.70	6158.2	0.14794	710.10	0.71643
375.00	10.382	612.70	5901.5	0.14273	731.26	0.70798
390.00	10.896	612.70	5623.0	0.14260	721.86	0.71174
405.00	11.349	615.06	5419.6	0.14703	705.40	0.71831
420.00	11.840	626.84	5294.2	0.14547	714.80	0.71455
435.00	12.231	631.56	5163.6	0.14170	747.72	0.70141
450.00	12.696	622.13	4900.1	0.13935	761.83	0.69577
465.00	13.155	612.70	4657.5	0.13908	743.02	0.70329
480.00	13.640	612.70	4491.9	0.14234	733.61	0.70704
495.00	14.083	612.70	4350.8	0.13766	761.83	0.69577
510.00	14.571	610.35	4188.8	0.13818	768.88	0.69296
525.00	15.020	610.35	4063.6	0.13506	787.69	0.68545
540.00	15.440	610.35	3953.1	0.14234	733.61	0.70704
555.00	15.935	605.63	3800.8	0.14586	712.45	0.71549

Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-201	Tester: SJR	Checker: sjr
	Sample Number: 2U	Test Date: 11/2/2020	Depth: 21.3
	Test Number: DSS 119	Preparation: wet	Elevation: 18.3
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2500 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

Direct Simple Shear Test by ASTM D6528

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
570.00	16.393	598.56	3651.2	0.13740	773.59	0.69108
585.00	16.898	589.14	3486.5	0.13166	787.69	0.68545
600.00	17.298	582.07	3364.9	0.13389	794.75	0.68263
615.00	17.728	582.07	3283.4	0.13531	775.94	0.69014
630.00	18.170	582.07	3203.4	0.13375	785.34	0.68638
645.00	18.620	582.07	3126.1	0.14468	719.51	0.71268
660.00	19.085	584.42	3062.2	0.14287	740.67	0.70423
675.00	19.528	582.07	2980.7	0.14468	719.51	0.71268
690.00	19.980	582.07	2913.3	0.14468	719.51	0.71268
705.00	20.507	586.78	2861.3	0.14312	728.91	0.70892
720.00	20.869	584.42	2800.5	0.14351	726.56	0.70986
735.00	21.340	577.35	2705.5	0.14365	735.96	0.70610
750.00	21.780	570.28	2618.4	0.14273	731.26	0.70798
765.00	22.281	565.57	2538.4	0.14898	693.64	0.72300
780.00	22.730	563.22	2477.8	0.14755	712.45	0.71549
795.00	23.238	560.86	2413.6	0.14586	712.45	0.71549
810.00	23.664	563.22	2380.0	0.15093	681.88	0.72770
825.00	24.120	563.22	2335.1	0.15015	686.59	0.72582
840.00	24.536	563.22	2295.4	0.15144	658.37	0.73709
855.00	25.012	563.22	2251.8	0.15262	651.32	0.73991
870.00	25.444	560.86	2204.2	0.15757	641.91	0.74366
885.00	25.942	558.50	2152.9	0.15679	646.61	0.74178
900.00	26.359	558.50	2118.8	0.16083	632.51	0.74742
915.00	26.785	553.79	2067.5	0.16669	597.24	0.76150
930.00	27.277	549.08	2013.0	0.15939	620.75	0.75211
945.00	27.719	546.72	1972.3	0.15992	627.80	0.74930
960.00	28.185	542.01	1923.0	0.15978	618.40	0.75305
975.00	28.654	542.01	1891.6	0.16460	599.59	0.76056
990.00	29.112	542.01	1861.8	0.16109	620.75	0.75211
1005.0	29.623	539.65	1821.7	0.16187	616.05	0.75399
1020.0	30.043	539.65	1796.2	0.16343	606.64	0.75775
1026.8	30.225	542.01	1793.2	0.16343	606.64	0.75775

Soil Metrics LLC			
	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-201	Tester: SJR	Checker: sjr
	Sample Number: 2U	Test Date: 11/2/2020	Depth: 21.3
	Test Number: DSS 119	Preparation: wet	Elevation: 18.3
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2500 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

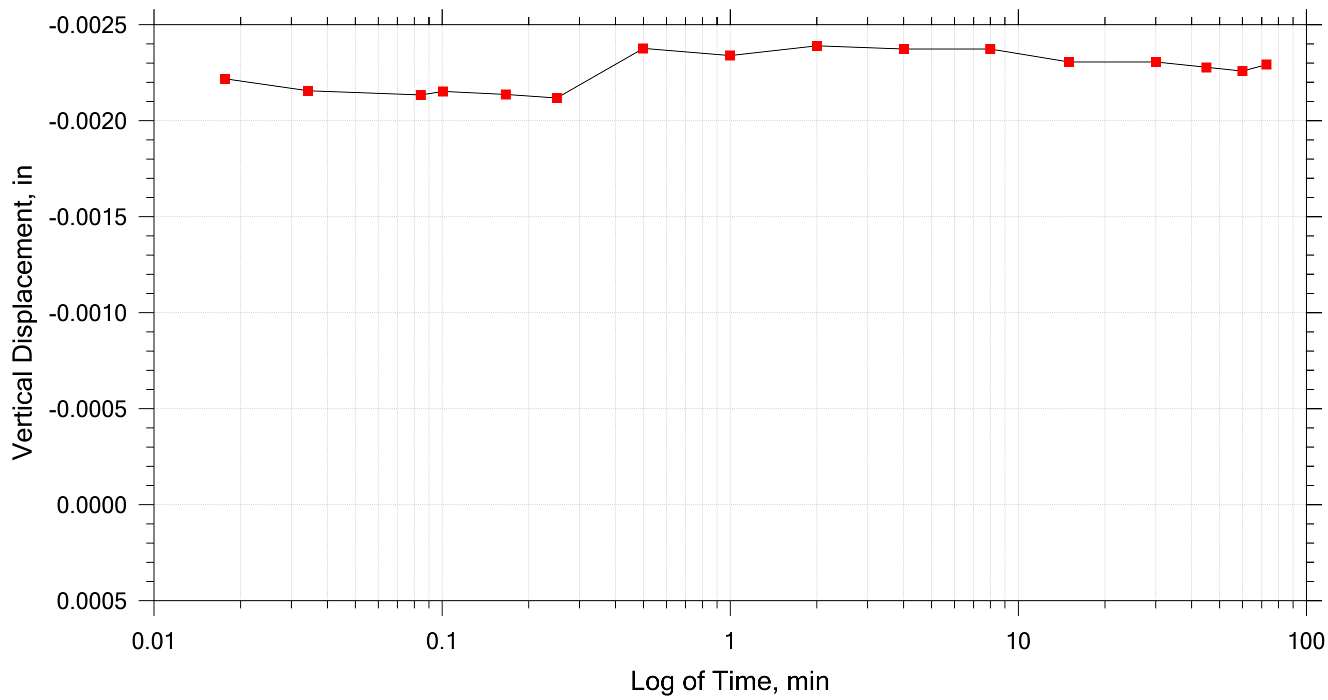
BB-FBR-202-1U
DSS 122

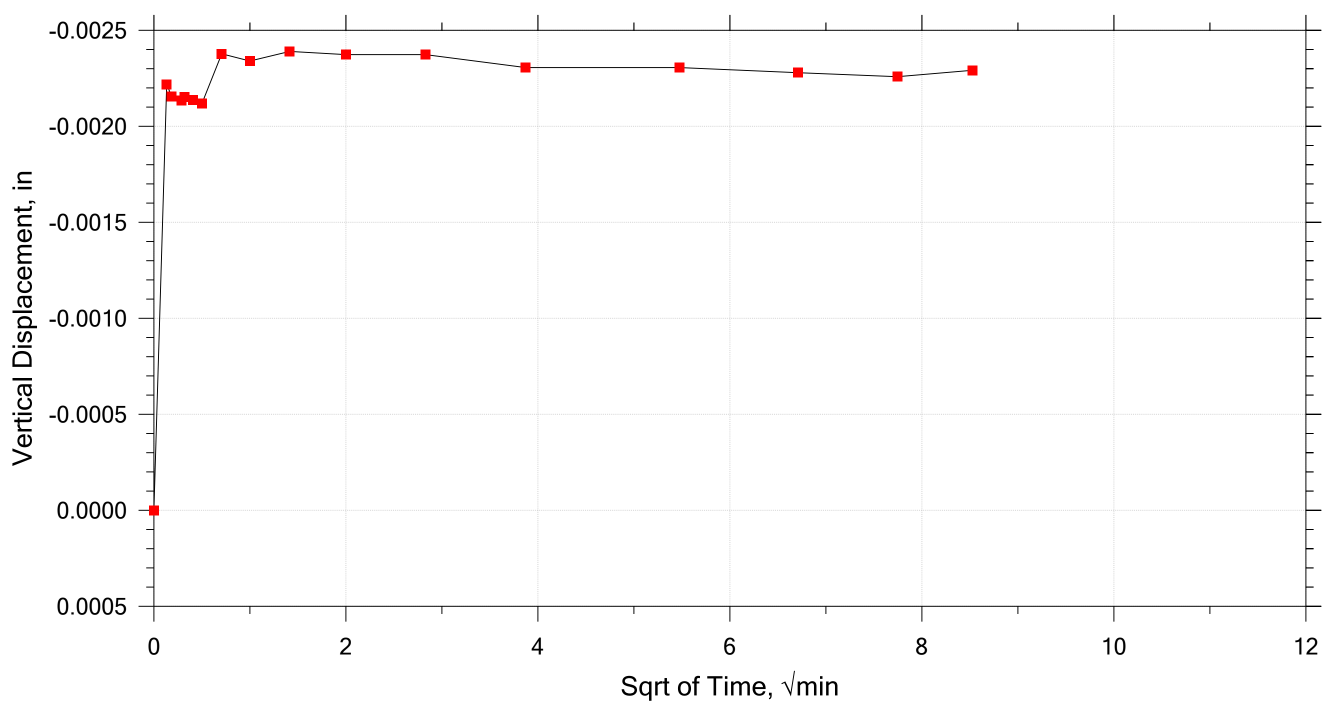
Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 1 of 7

Constant Load Step

Stress: 208 psf





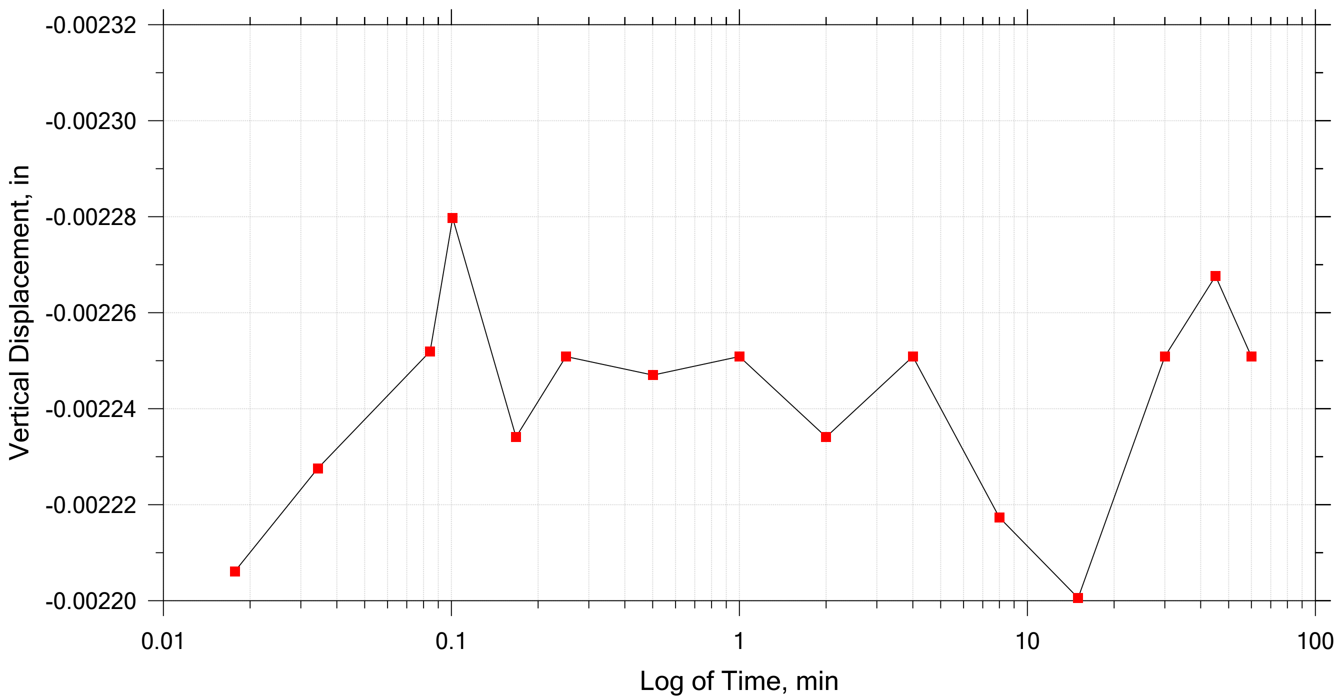
Soil Metrics LLC			
	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 1U	Test Date: 11/23/2020	Depth: 12.55
	Test Number: DSS 122	Preparation: wet	Elevation: 31.05
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2400 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

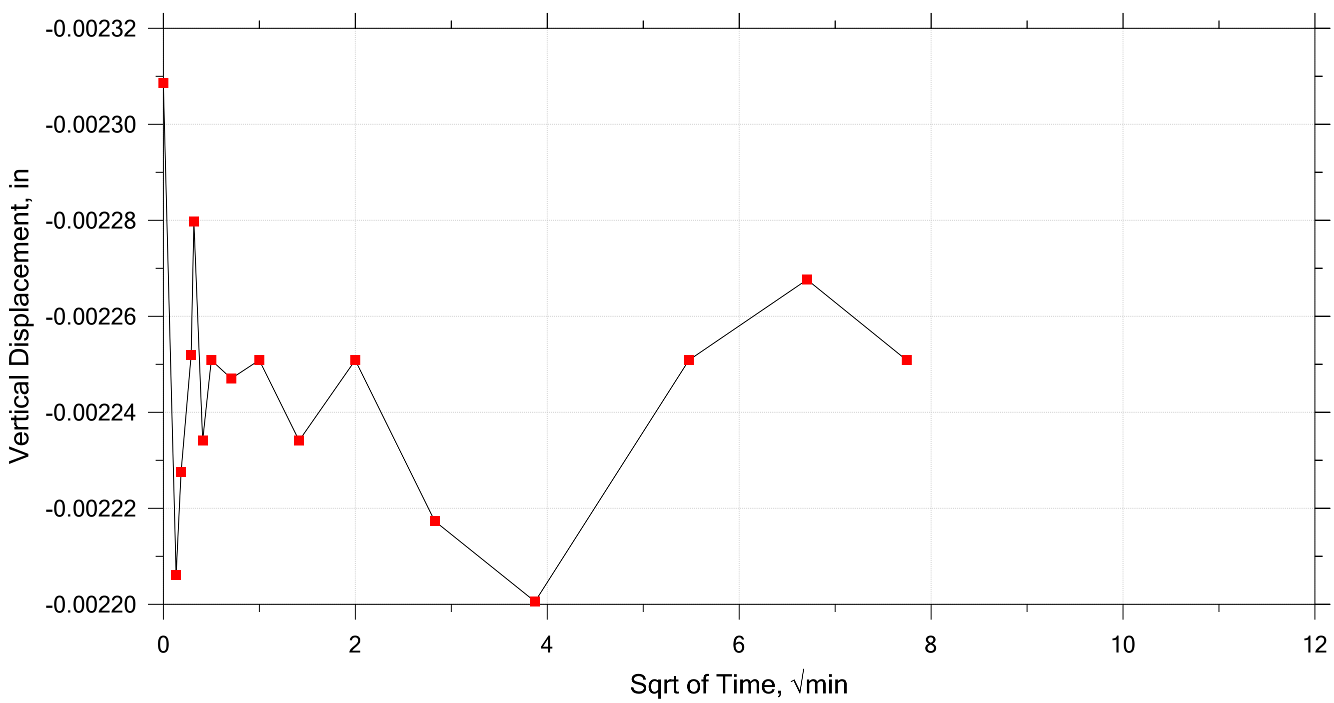
Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 2 of 7

Constant Load Step

Stress: 312 psf





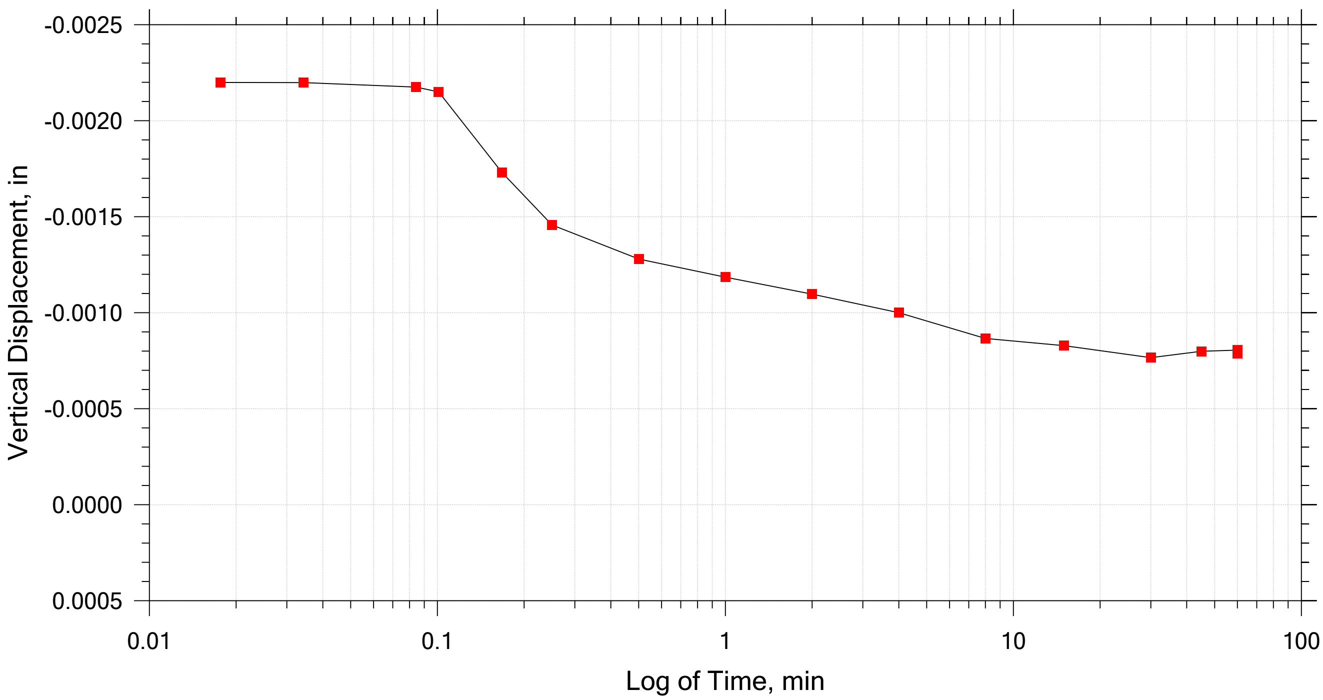
Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 1U	Test Date: 11/23/2020	Depth: 12.55
	Test Number: DSS 122	Preparation: wet	Elevation: 31.05
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2400 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

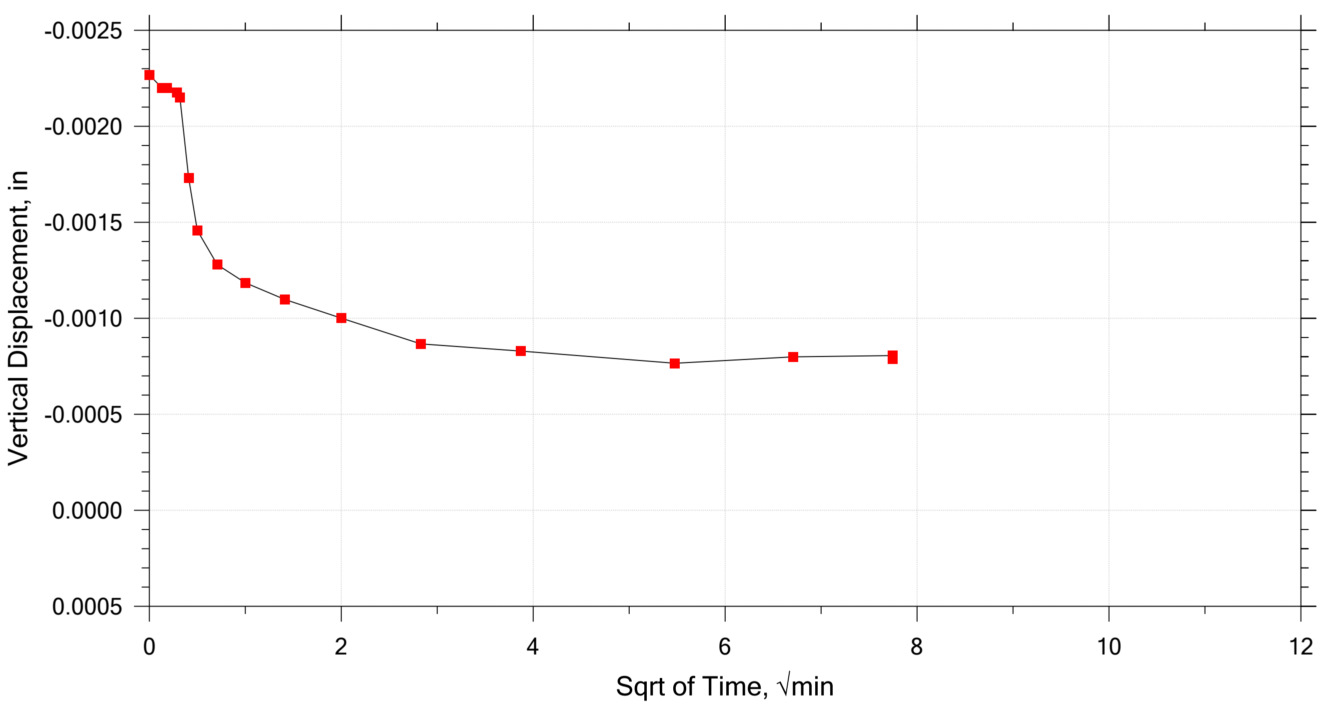
Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 3 of 7

Constant Load Step

Stress: 468 psf





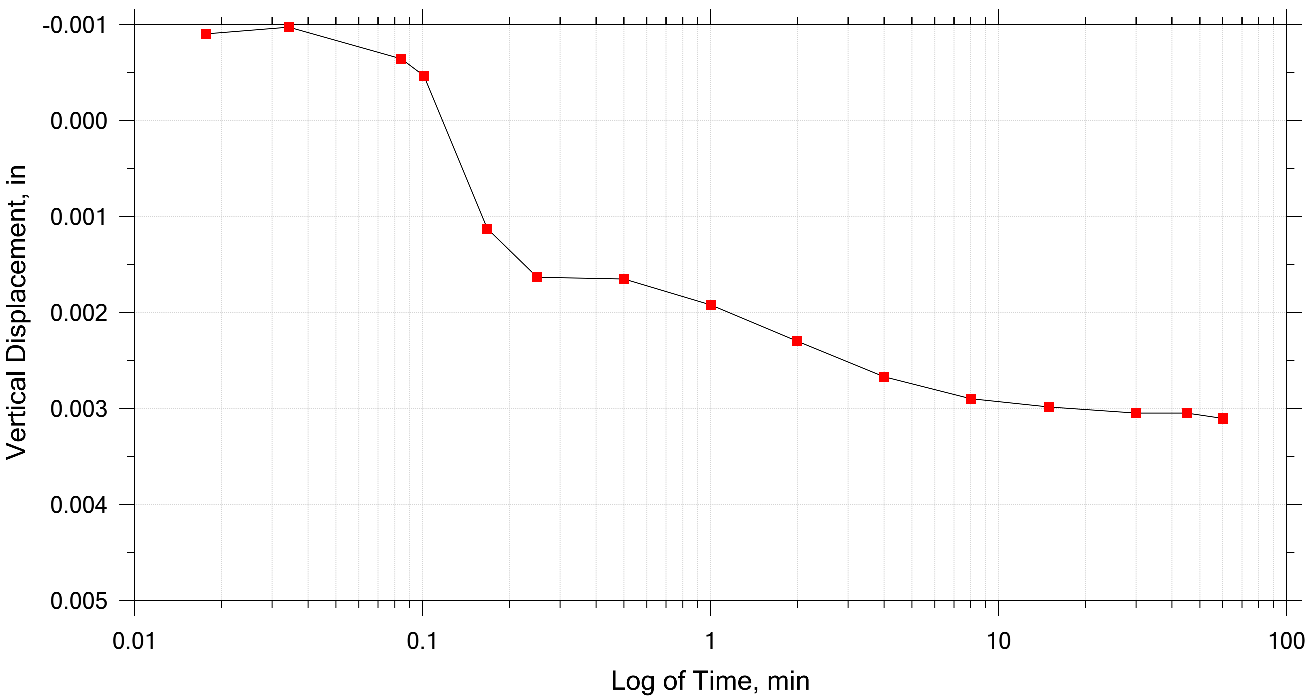
Soil Metrics LLC			
	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 1U	Test Date: 11/23/2020	Depth: 12.55
	Test Number: DSS 122	Preparation: wet	Elevation: 31.05
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2400 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

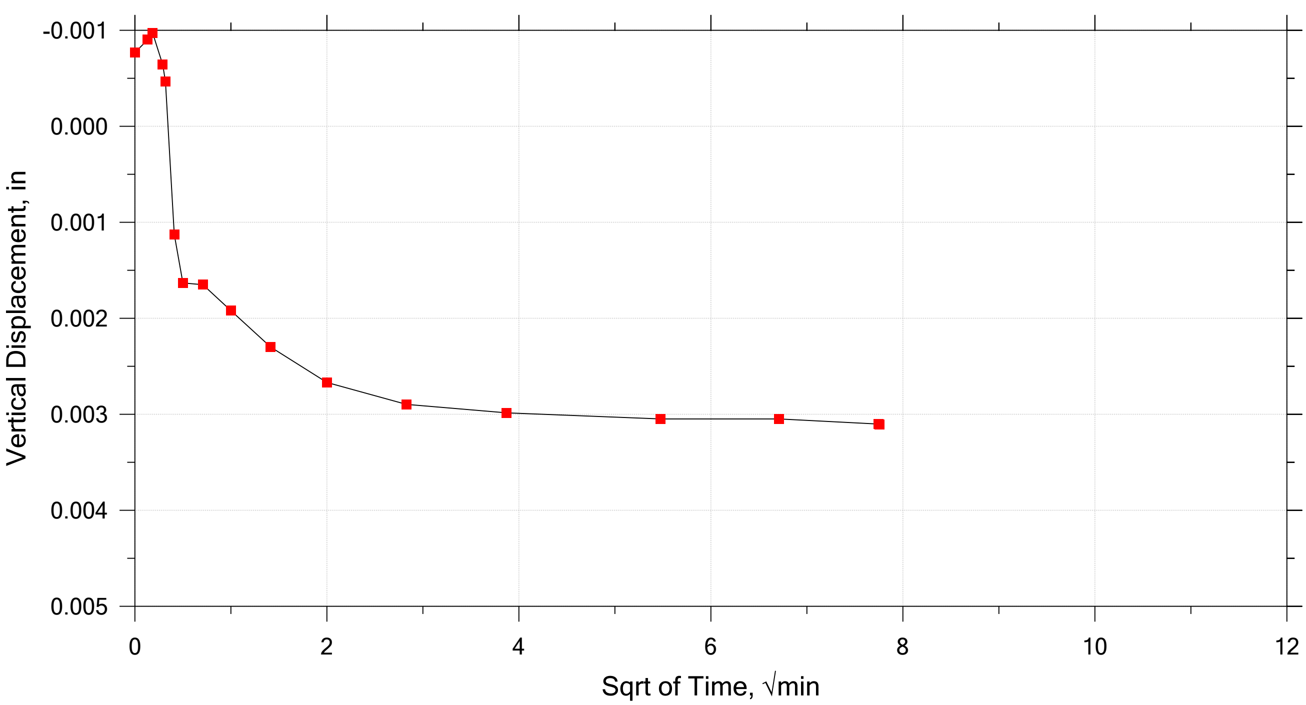
Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 4 of 7

Constant Load Step

Stress: 702 psf





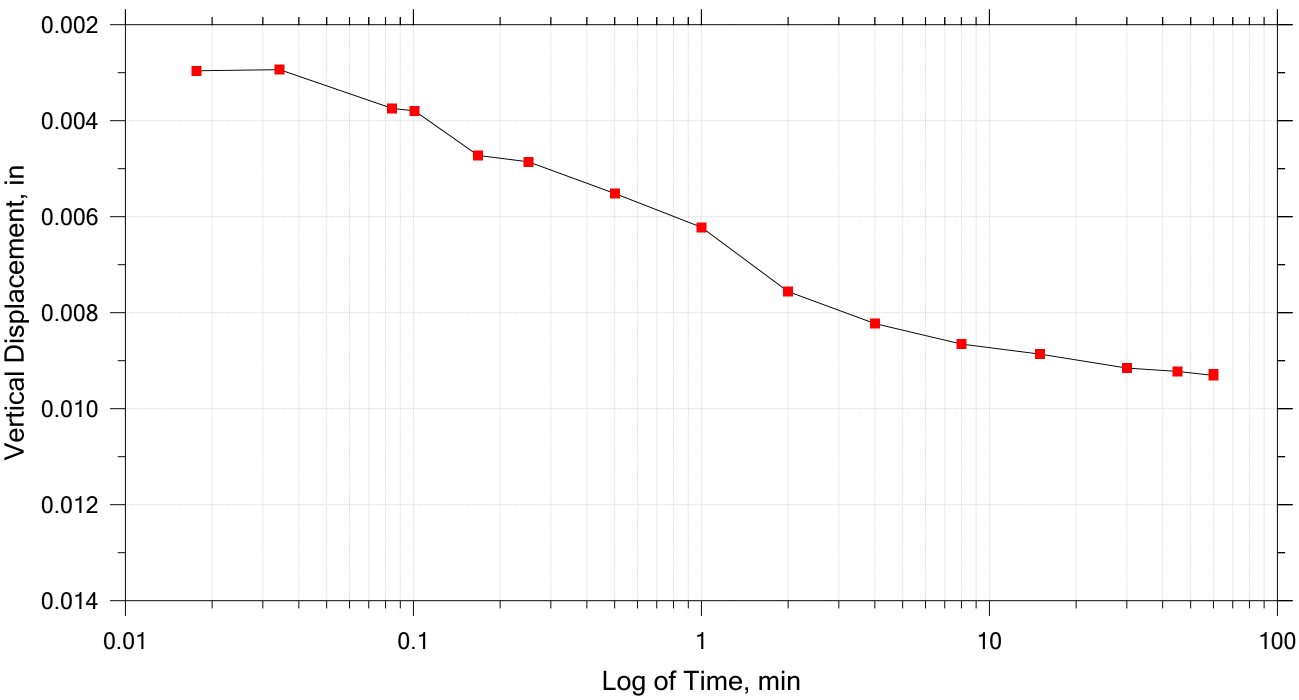
Soil Metrics LLC			
	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 1U	Test Date: 11/23/2020	Depth: 12.55
	Test Number: DSS 122	Preparation: wet	Elevation: 31.05
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2400 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

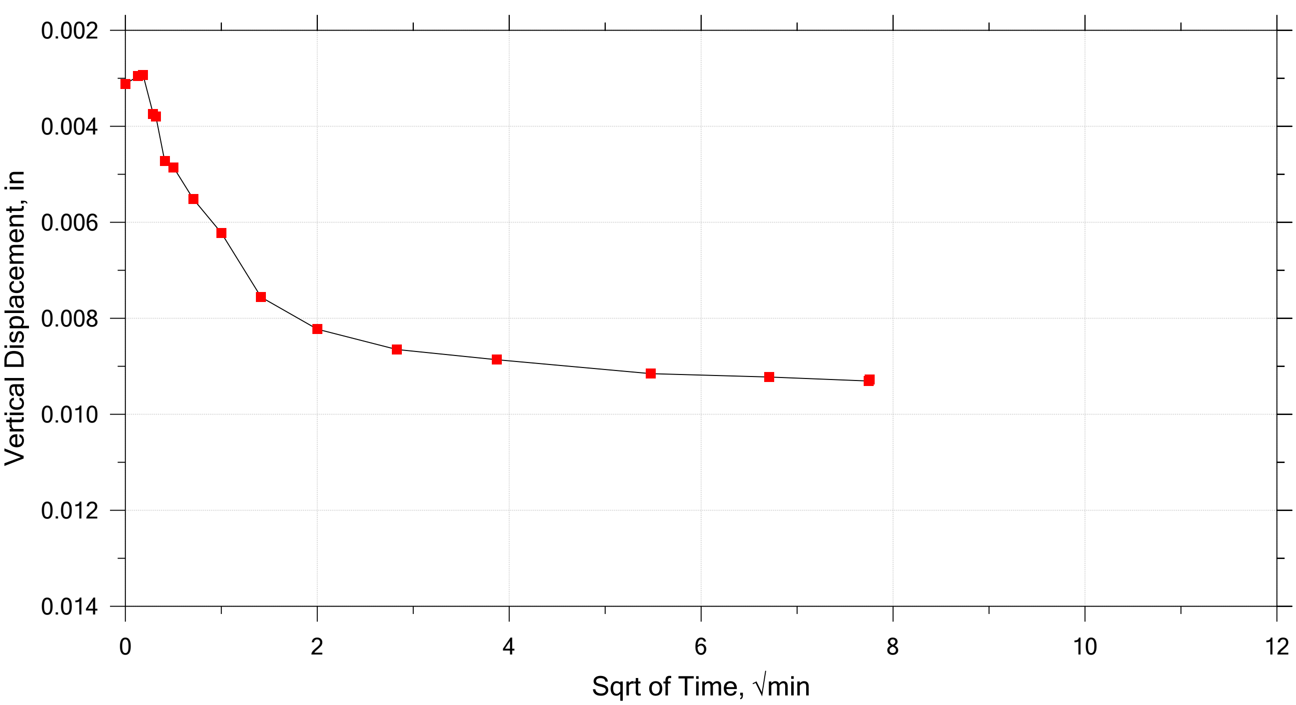
Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 5 of 7

Constant Load Step

Stress: 1.05e+03 psf





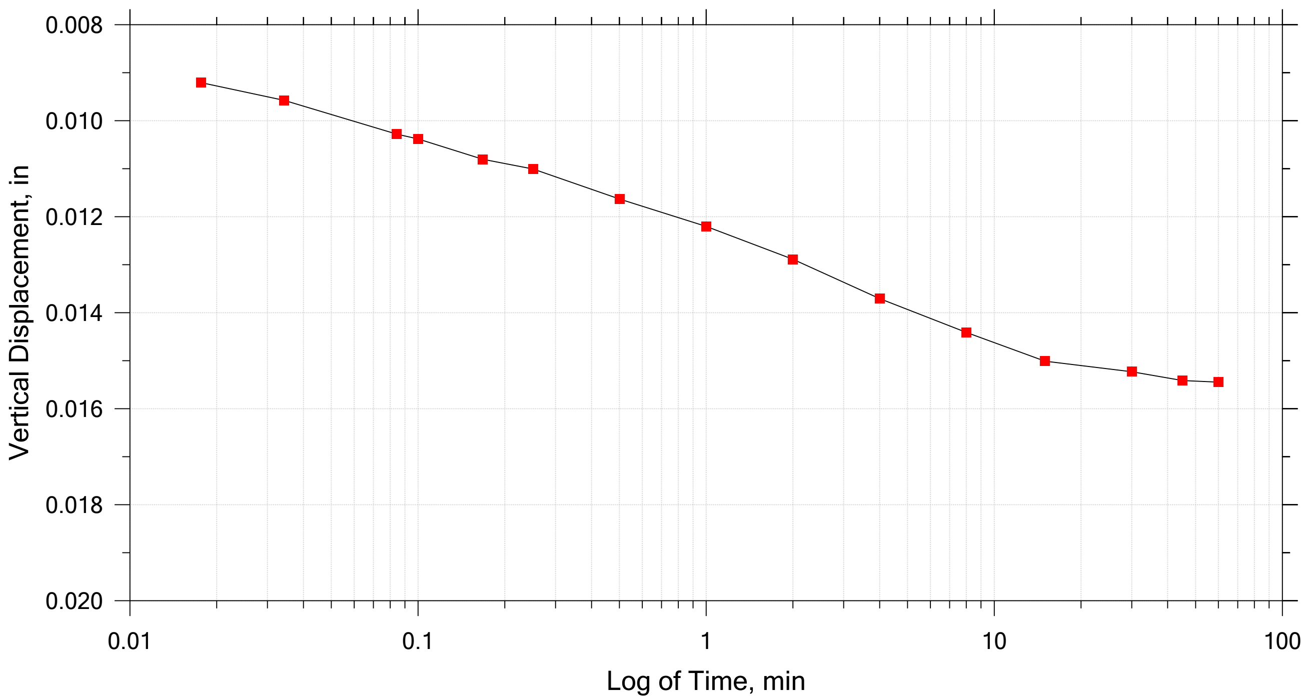
Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 1U	Test Date: 11/23/2020	Depth: 12.55
	Test Number: DSS 122	Preparation: wet	Elevation: 31.05
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2400 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

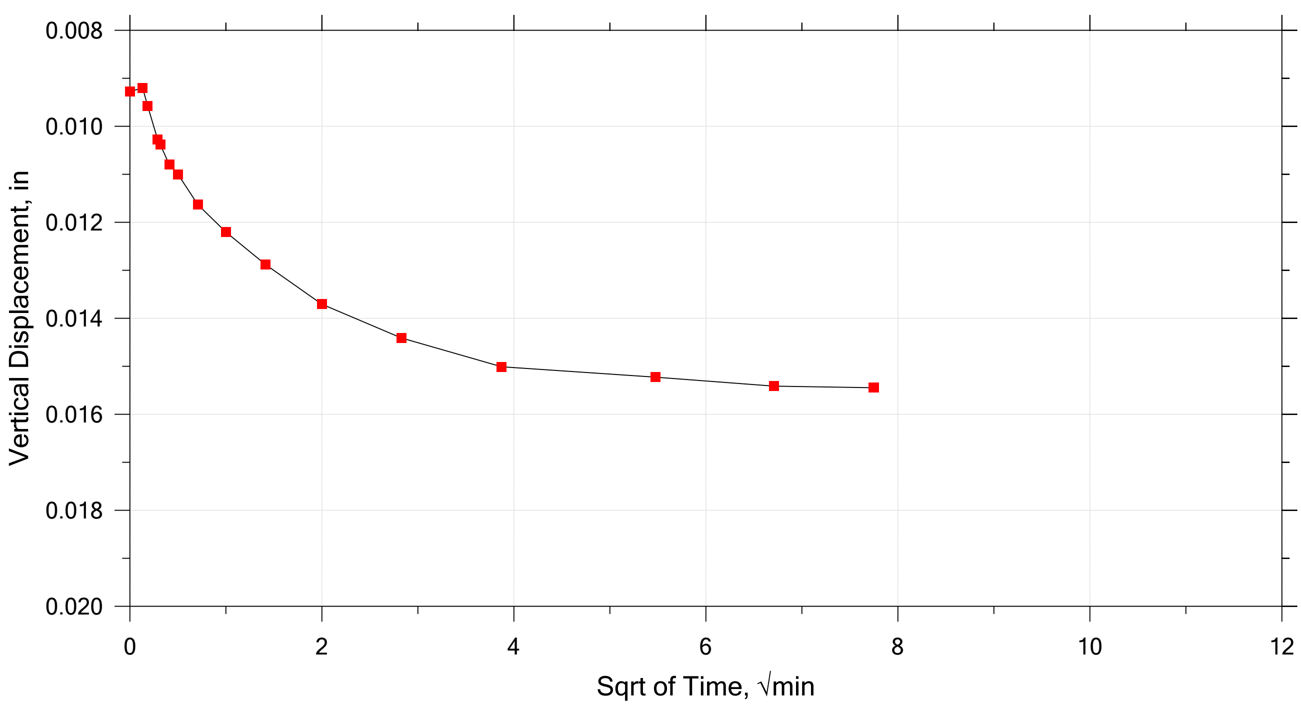
Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 6 of 7

Constant Load Step

Stress: 1.4e+03 psf





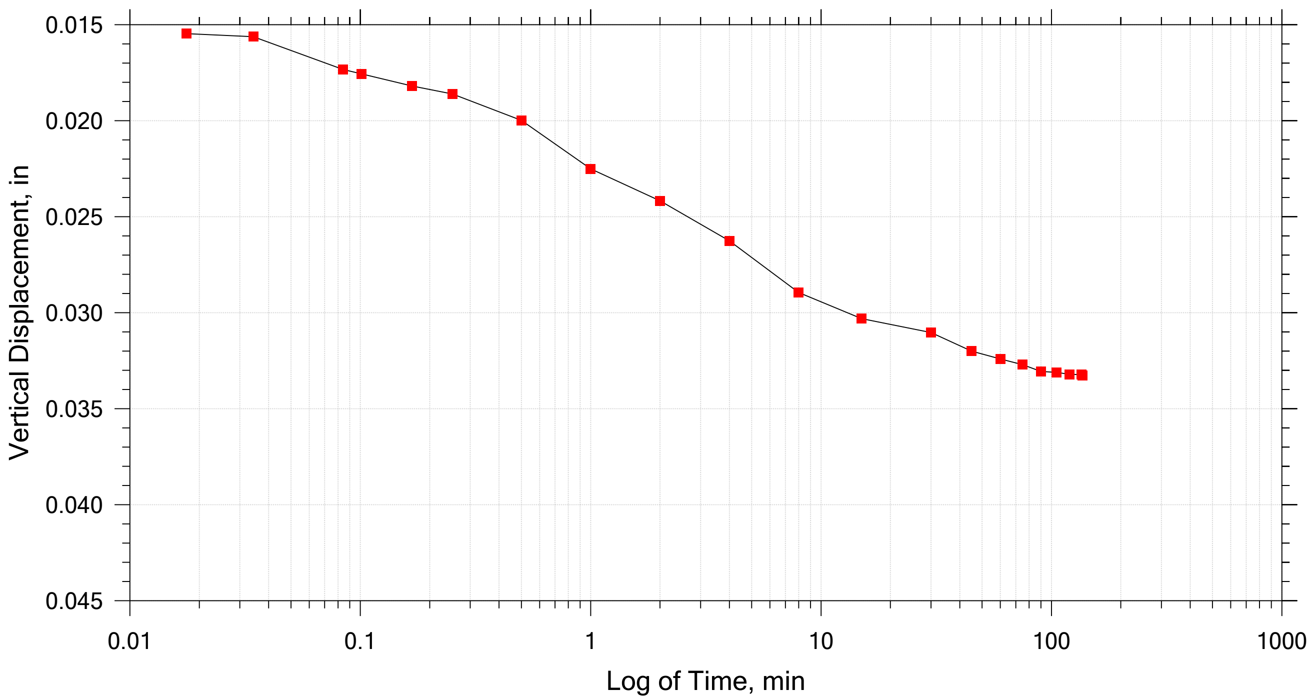
Soil Metrics LLC			
	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 1U	Test Date: 11/23/2020	Depth: 12.55
	Test Number: DSS 122	Preparation: wet	Elevation: 31.05
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2400 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

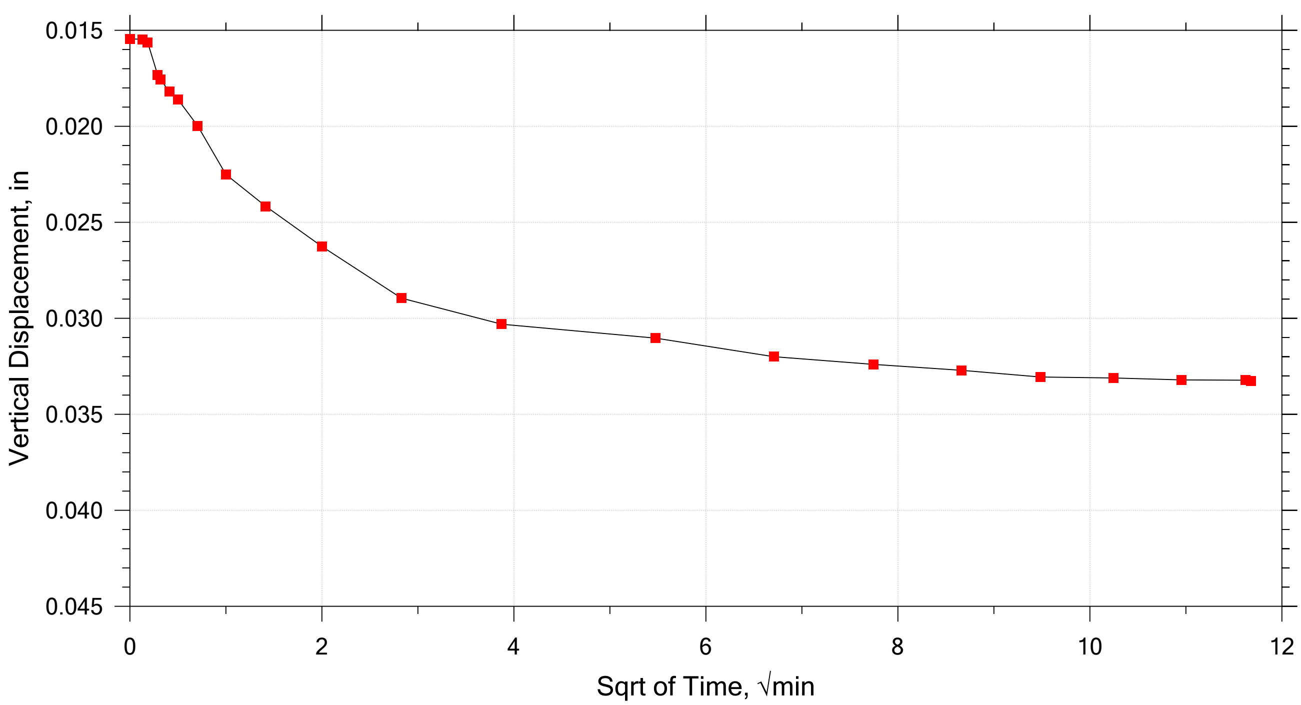
Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 7 of 7

Constant Load Step

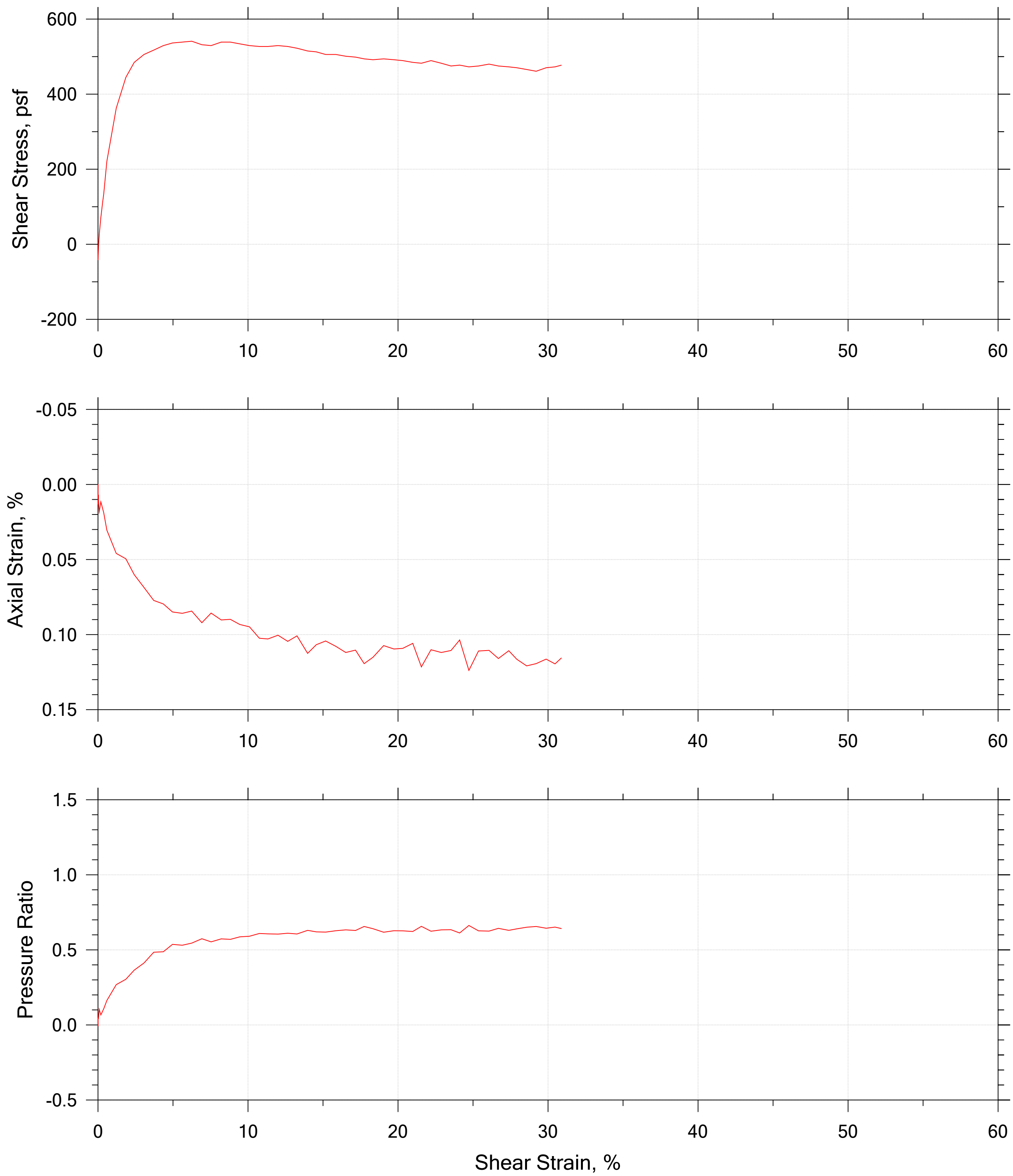
Stress: 2.4e+03 psf





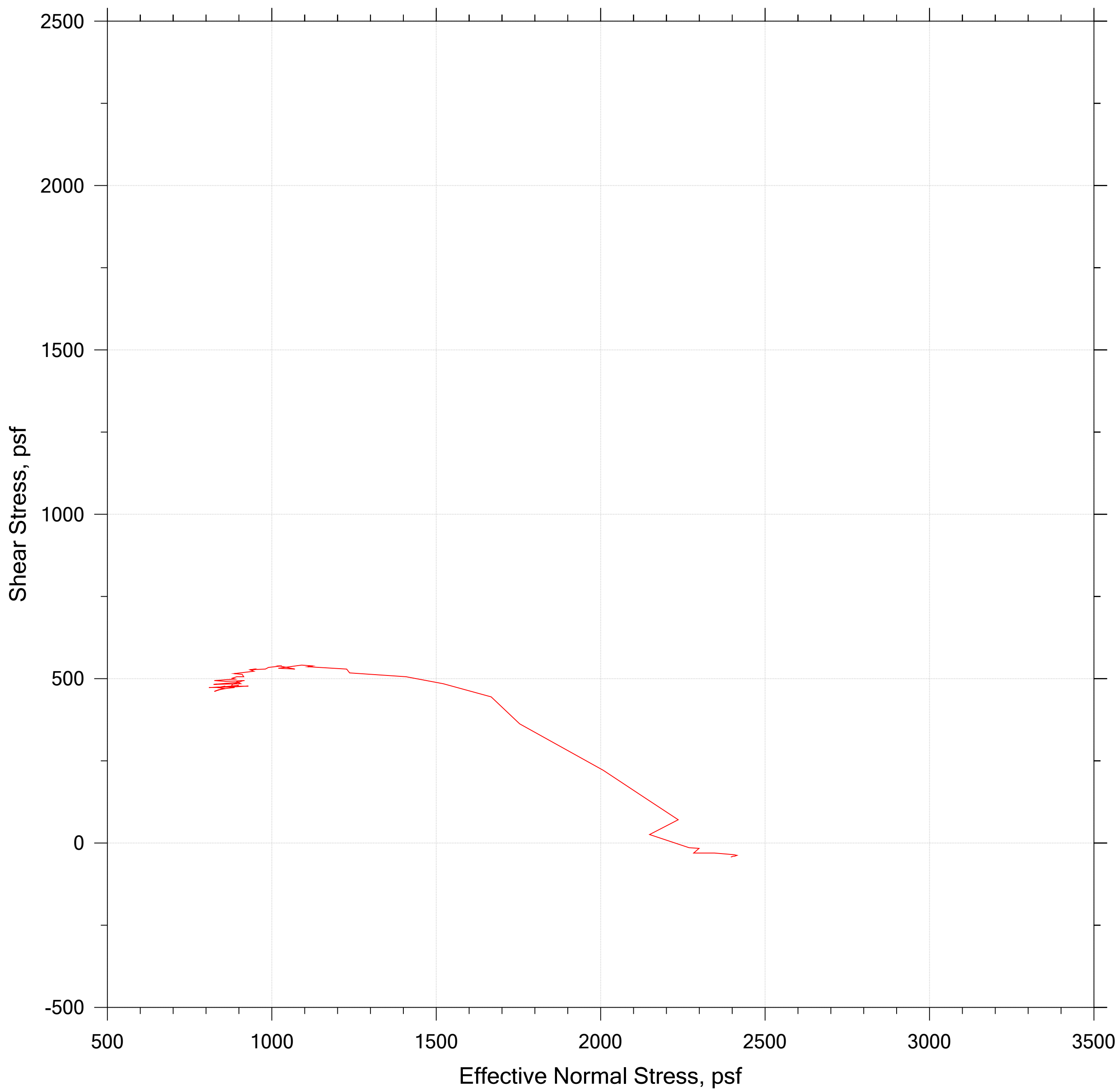
Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 1U	Test Date: 11/23/2020	Depth: 12.55
	Test Number: DSS 122	Preparation: wet	Elevation: 31.05
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2400 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

Direct Simple Shear Test by ASTM D6528



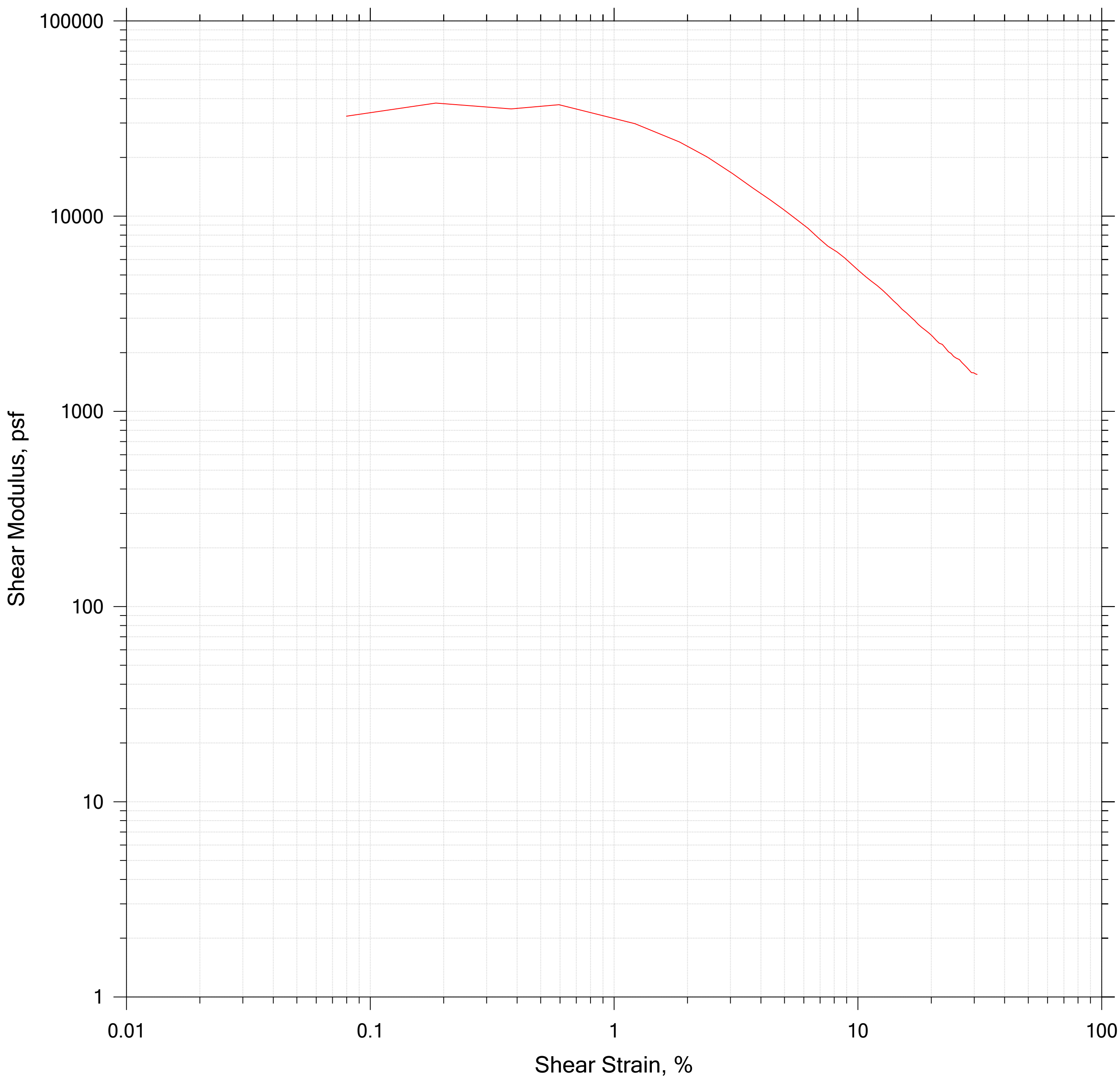
Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 1U	Test Date: 11/23/2020	Depth: 12.55
	Test Number: DSS 122	Preparation: wet	Elevation: 31.05
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2400 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

Direct Simple Shear Test by ASTM D6528



Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 1U	Test Date: 11/23/2020	Depth: 12.55
	Test Number: DSS 122	Preparation: wet	Elevation: 31.05
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2400 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

Direct Simple Shear Test by ASTM D6528



Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 1U	Test Date: 11/23/2020	Depth: 12.55
	Test Number: DSS 122	Preparation: wet	Elevation: 31.05
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2400 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

Direct Simple Shear Test by ASTM D6528

Specimen Dimension, in: 2.50	Specific Gravity: 2.70 (Implied)	Liquid Limit: 0
Specimen Height, in: 1.00	Initial Void Ratio: 1.08	Plastic Limit: 0
Final Height, in: 0.97	Final Void Ratio: 1.01	Plasticity Index: 0

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	204	---		303
Mass Container, gm	36.88	0	0	60.43
Mass Container + Wet Soil, gm	170.1	147.19	143.69	204.12
Mass Container + Dry Soil, gm	147.19	104.68	104.68	165.11
Mass Dry Soil, gm	110.31	104.68	104.68	104.68
Water Content, %	20.77	40.61	37.27	37.27
Void Ratio	---	1.08	1.01	---
Degree of Saturation, %	---	101.76	100.00	---
Dry Unit Weight, pcf	---	81.111	83.992	---

Warning: The change in the sample wet weight during the test is not consistent with the change in the moisture content.

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: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 1U	Test Date: 11/23/2020	Depth: 12.55
	Test Number: DSS 122	Preparation: wet	Elevation: 31.05
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2400 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 1 of 7

Constant Load Step

Stress: 208 psf

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	-9.40	-1.541e-05	0.0000	0.000	1.08
0.018	0.133	25.9	0.002253	-0.002218	-0.221	1.08
0.034	0.185	40.0	0.002291	-0.002156	-0.215	1.08
0.084	0.290	75.2	0.002387	-0.002134	-0.213	1.08
0.101	0.318	82.3	0.002406	-0.002153	-0.215	1.08
0.167	0.408	101.	0.002457	-0.002137	-0.213	1.08
0.250	0.500	113.	0.002489	-0.002119	-0.211	1.08
0.500	0.707	202.	0.002731	-0.002377	-0.237	1.08
1.000	1.000	207.	0.002744	-0.002340	-0.233	1.08
2.000	1.414	207.	0.002744	-0.002390	-0.239	1.08
4.000	2.000	207.	0.002744	-0.002373	-0.237	1.08
8.000	2.829	207.	0.002744	-0.002373	-0.237	1.08
15.000	3.873	207.	0.002744	-0.002306	-0.230	1.08
30.001	5.477	207.	0.002744	-0.002306	-0.230	1.08
45.000	6.708	209.	0.002750	-0.002279	-0.227	1.08
60.000	7.746	207.	0.002746	-0.002258	-0.225	1.08
72.676	8.525	207.	0.002746	-0.002292	-0.229	1.08

Soil Metrics LLC			
	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 1U	Test Date: 11/23/2020	Depth: 12.55
	Test Number: DSS 122	Preparation: wet	Elevation: 31.05
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2400 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 2 of 7

Constant Load Step

Stress: 312 psf

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	207.	0.002746	-0.002309	-0.230	1.08
0.018	0.133	226.	0.002794	-0.002206	-0.220	1.08
0.034	0.185	240.	0.002833	-0.002228	-0.222	1.08
0.084	0.290	280.	0.002941	-0.002252	-0.225	1.08
0.101	0.318	296.	0.002985	-0.002280	-0.228	1.08
0.168	0.410	310.	0.003024	-0.002234	-0.223	1.08
0.250	0.500	310.	0.003024	-0.002251	-0.225	1.08
0.501	0.708	308.	0.003020	-0.002247	-0.224	1.08
1.000	1.000	310.	0.003024	-0.002251	-0.225	1.08
2.001	1.414	310.	0.003024	-0.002234	-0.223	1.08
4.001	2.000	310.	0.003024	-0.002251	-0.225	1.08
8.001	2.829	310.	0.003024	-0.002217	-0.221	1.08
15.001	3.873	310.	0.003024	-0.002201	-0.220	1.08
30.000	5.477	310.	0.003024	-0.002251	-0.225	1.08
45.001	6.708	310.	0.003024	-0.002268	-0.226	1.08
60.000	7.746	310.	0.003024	-0.002251	-0.225	1.08
60.032	7.748	310.	0.003024	-0.002251	-0.225	1.08

Soil Metrics LLC			
	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 1U	Test Date: 11/23/2020	Depth: 12.55
	Test Number: DSS 122	Preparation: wet	Elevation: 31.05
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2400 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 3 of 7

Constant Load Step

Stress: 468 psf

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	310.	0.003024	-0.002268	-0.226	1.08
0.018	0.133	341.	0.003106	-0.002199	-0.220	1.08
0.034	0.185	371.	0.003189	-0.002198	-0.219	1.08
0.084	0.290	437.	0.003368	-0.002175	-0.217	1.08
0.101	0.318	447.	0.003393	-0.002151	-0.215	1.08
0.168	0.410	426.	0.003358	-0.001730	-0.173	1.08
0.250	0.500	463.	0.003438	-0.001457	-0.145	1.08
0.501	0.708	466.	0.003444	-0.001279	-0.128	1.08
1.001	1.000	468.	0.003450	-0.001185	-0.118	1.08
2.001	1.414	466.	0.003446	-0.001097	-0.109	1.08
4.001	2.000	468.	0.003450	-0.001000	-0.0998	1.08
8.001	2.829	468.	0.003450	-0.0008662	-0.0864	1.08
15.001	3.873	466.	0.003446	-0.0008288	-0.0827	1.08
30.001	5.477	468.	0.003450	-0.0007656	-0.0764	1.08
45.001	6.708	468.	0.003450	-0.0007991	-0.0798	1.08
60.001	7.746	470.	0.003457	-0.0008055	-0.0804	1.08
60.052	7.749	470.	0.003457	-0.0007887	-0.0787	1.08

Soil Metrics LLC			
	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 1U	Test Date: 11/23/2020	Depth: 12.55
	Test Number: DSS 122	Preparation: wet	Elevation: 31.05
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2400 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 4 of 7

Constant Load Step

Stress: 702 psf

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	468.	0.003453	-0.0007681	-0.0767	1.08
0.018	0.133	524.	0.003603	-0.0009016	-0.0900	1.08
0.034	0.185	569.	0.003724	-0.0009723	-0.0970	1.08
0.084	0.290	562.	0.003713	-0.0006421	-0.0641	1.08
0.101	0.318	574.	0.003737	-0.0004651	-0.0464	1.08
0.168	0.409	649.	0.003941	0.001126	0.112	1.07
0.250	0.500	672.	0.004004	0.001632	0.163	1.07
0.501	0.708	684.	0.004036	0.001651	0.165	1.07
1.001	1.000	696.	0.004068	0.001921	0.192	1.07
2.000	1.414	698.	0.004074	0.002300	0.230	1.07
4.001	2.000	698.	0.004074	0.002669	0.266	1.07
8.000	2.828	701.	0.004081	0.002897	0.289	1.07
15.000	3.873	698.	0.004077	0.002985	0.298	1.07
30.001	5.477	701.	0.004081	0.003048	0.304	1.07
45.000	6.708	701.	0.004081	0.003048	0.304	1.07
60.001	7.746	705.	0.004093	0.003103	0.310	1.07
60.151	7.756	694.	0.004074	0.003105	0.310	1.07

Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
Sample Number: 1U	Test Date: 11/23/2020	Depth: 12.55
Test Number: DSS 122	Preparation: wet	Elevation: 31.05
Description: Gray silty Clay		
Remarks: Sample consolidated to 2400 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 5 of 7

Constant Load Step

Stress: 1053 psf

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	696.	0.004078	0.003118	0.311	1.07
0.018	0.133	771.	0.004272	0.002958	0.295	1.07
0.034	0.185	842.	0.004463	0.002935	0.293	1.07
0.084	0.290	853.	0.004495	0.003741	0.373	1.07
0.101	0.318	908.	0.004641	0.003796	0.379	1.07
0.168	0.409	1.04e+03	0.004972	0.004723	0.471	1.07
0.251	0.501	1.02e+03	0.004958	0.004855	0.484	1.07
0.501	0.708	1.03e+03	0.004966	0.005517	0.551	1.07
1.000	1.000	1.03e+03	0.004967	0.006220	0.621	1.06
2.000	1.414	1.05e+03	0.004985	0.007561	0.755	1.06
4.000	2.000	1.05e+03	0.004990	0.008227	0.821	1.06
8.000	2.828	1.04e+03	0.004984	0.008652	0.863	1.06
15.000	3.873	1.05e+03	0.004990	0.008864	0.885	1.06
30.001	5.477	1.06e+03	0.005004	0.009152	0.913	1.06
45.001	6.708	1.05e+03	0.004999	0.009224	0.921	1.06
60.001	7.746	1.05e+03	0.004999	0.009308	0.929	1.06
60.134	7.755	1.05e+03	0.004998	0.009275	0.926	1.06

Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 1U	Test Date: 11/23/2020	Depth: 12.55
	Test Number: DSS 122	Preparation: wet	Elevation: 31.05
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2400 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 6 of 7

Constant Load Step

Stress: 1400 psf

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	1.05e+03	0.004999	0.009274	0.926	1.06
0.018	0.133	1.15e+03	0.005186	0.009204	0.919	1.06
0.034	0.185	1.06e+03	0.005134	0.009576	0.956	1.06
0.084	0.290	1.27e+03	0.005419	0.01028	1.03	1.06
0.100	0.316	1.31e+03	0.005488	0.01038	1.04	1.06
0.168	0.410	1.37e+03	0.005602	0.01080	1.08	1.05
0.251	0.501	1.36e+03	0.005600	0.01101	1.10	1.05
0.501	0.708	1.39e+03	0.005643	0.01163	1.16	1.05
1.001	1.000	1.38e+03	0.005642	0.01220	1.22	1.05
2.001	1.415	1.39e+03	0.005648	0.01289	1.29	1.05
4.000	2.000	1.40e+03	0.005666	0.01371	1.37	1.05
8.000	2.828	1.40e+03	0.005666	0.01441	1.44	1.05
15.001	3.873	1.40e+03	0.005671	0.01501	1.50	1.05
30.001	5.477	1.40e+03	0.005669	0.01523	1.52	1.05
45.000	6.708	1.40e+03	0.005669	0.01541	1.54	1.04
60.001	7.746	1.40e+03	0.005669	0.01545	1.54	1.04
60.113	7.753	1.40e+03	0.005669	0.01545	1.54	1.04

Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
Sample Number: 1U	Test Date: 11/23/2020	Depth: 12.55
Test Number: DSS 122	Preparation: wet	Elevation: 31.05
Description: Gray silty Clay		
Remarks: Sample consolidated to 2400 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 7 of 7

Constant Load Step

Stress: 2400 psf

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	1.40e+03	0.005669	0.01545	1.54	1.04
0.018	0.133	1.51e+03	0.005886	0.01547	1.54	1.04
0.034	0.185	1.66e+03	0.006178	0.01563	1.56	1.04
0.084	0.290	2.04e+03	0.006871	0.01733	1.73	1.04
0.101	0.318	2.14e+03	0.006982	0.01756	1.75	1.04
0.168	0.409	2.31e+03	0.007154	0.01819	1.82	1.04
0.251	0.501	2.29e+03	0.007140	0.01860	1.86	1.04
0.500	0.707	2.34e+03	0.007188	0.01998	1.99	1.04
1.000	1.000	2.38e+03	0.007226	0.02251	2.25	1.03
2.000	1.414	2.40e+03	0.007243	0.02417	2.41	1.03
4.001	2.000	2.39e+03	0.007236	0.02626	2.62	1.02
8.001	2.829	2.40e+03	0.007241	0.02895	2.89	1.02
15.001	3.873	2.40e+03	0.007241	0.03031	3.02	1.01
30.001	5.477	2.39e+03	0.007240	0.03103	3.10	1.01
45.001	6.708	2.40e+03	0.007246	0.03200	3.19	1.01
60.001	7.746	2.40e+03	0.007244	0.03240	3.23	1.01
75.001	8.660	2.40e+03	0.007244	0.03271	3.26	1.01
90.001	9.487	2.40e+03	0.007244	0.03306	3.30	1.01
105.001	10.247	2.40e+03	0.007242	0.03311	3.30	1.01
120.000	10.954	2.40e+03	0.007244	0.03321	3.31	1.01
135.001	11.619	2.40e+03	0.007244	0.03323	3.32	1.01
136.359	11.677	2.40e+03	0.007244	0.03326	3.32	1.01

Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
Sample Number: 1U	Test Date: 11/23/2020	Depth: 12.55
Test Number: DSS 122	Preparation: wet	Elevation: 31.05
Description: Gray silty Clay		
Remarks: Sample consolidated to 2400 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

Direct Simple Shear Test by ASTM D6528

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
0.00000	0.00000	-42.348	0.00000	0.00000	2395.8	0.00000
0.00035000	0.00000	-42.348	0.00000	-0.00017670	2398.1	-0.00098135
0.016717	0.0033183	-39.995	-1.2053e+06	0.0011280	2402.8	-0.0029441
0.033383	0.0033183	-39.995	-1.2053e+06	0.00062838	2407.5	-0.0049068
0.083400	0.0033183	-37.643	-1.1344e+06	0.0033414	2414.6	-0.0078508
0.10007	0.0033183	-35.290	-1.0635e+06	0.0040482	2405.2	-0.0039254
0.16673	0.0033183	-30.585	-9.2169e+05	0.0084656	2346.4	0.020608
0.25015	0.0099550	-30.585	-3.0723e+05	0.013236	2282.9	0.047105
0.50018	0.016592	-16.469	-99259.	0.0068059	2299.4	0.040236
1.0000	0.039820	-14.116	-35450.	0.012565	2268.8	0.052993
2.0000	0.079640	25.879	32496.	0.018114	2148.9	0.10304
4.0002	0.18583	70.580	37982.	0.011577	2235.9	0.066732
8.0006	0.37829	134.10	35450.	0.018821	2139.5	0.10697
15.001	0.59398	221.15	37232.	0.030448	2007.9	0.16192
30.001	1.2178	362.31	29751.	0.045955	1753.9	0.26791
45.001	1.8549	444.66	23971.	0.049490	1666.9	0.30422
60.001	2.4124	484.65	20090.	0.060046	1521.2	0.36506
75.000	3.0661	505.83	16497.	0.068610	1408.3	0.41217
90.001	3.7132	517.59	13939.	0.077269	1236.7	0.48381
105.00	4.3603	529.35	12140.	0.079570	1227.3	0.48773
120.00	4.9642	536.41	10806.	0.084955	1109.7	0.53680
135.00	5.6179	538.76	9590.1	0.085832	1123.8	0.53091
150.00	6.2484	541.12	8660.0	0.084363	1090.9	0.54465
165.00	6.9254	531.70	7677.7	0.092095	1020.4	0.57409
180.00	7.5426	529.35	7018.2	0.085644	1069.8	0.55348
195.00	8.2129	538.76	6560.0	0.090222	1022.7	0.57311
210.00	8.8201	538.76	6108.3	0.089795	1029.8	0.57017
225.00	9.4506	534.06	5651.0	0.093245	989.82	0.58685
240.00	10.101	529.35	5240.6	0.094835	980.42	0.59078
255.00	10.758	527.00	4898.7	0.10239	935.75	0.60942
270.00	11.322	527.00	4654.6	0.10293	942.80	0.60648
285.00	11.999	529.35	4411.6	0.10040	947.50	0.60451
300.00	12.653	527.00	4165.1	0.10452	933.39	0.61040
315.00	13.263	522.29	3937.9	0.10080	945.15	0.60550
330.00	13.977	515.24	3686.4	0.11247	886.37	0.63003
345.00	14.548	512.88	3525.6	0.10676	909.88	0.62022
360.00	15.178	505.83	3332.6	0.10424	914.59	0.61825
375.00	15.862	505.83	3189.0	0.10782	893.43	0.62709
390.00	16.519	501.12	3033.7	0.11193	879.32	0.63297
405.00	17.169	498.77	2905.0	0.11034	888.72	0.62905
420.00	17.743	494.06	2784.5	0.11935	825.24	0.65554
435.00	18.330	491.71	2682.5	0.11511	860.51	0.64082
450.00	19.037	494.06	2595.2	0.10730	916.94	0.61727
465.00	19.727	491.71	2492.5	0.10955	893.43	0.62709
480.00	20.318	489.36	2408.5	0.10915	895.78	0.62610
495.00	20.985	484.65	2309.5	0.10583	905.18	0.62218
510.00	21.559	482.30	2237.1	0.12148	822.89	0.65653
525.00	22.196	489.36	2204.7	0.11009	900.48	0.62414
540.00	22.887	482.30	2107.3	0.11193	879.32	0.63297
555.00	23.534	475.24	2019.4	0.11060	876.97	0.63395

Soil Metrics LLC			
	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 1U	Test Date: 11/23/2020	Depth: 12.55
	Test Number: DSS 122	Preparation: wet	Elevation: 31.05
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2400 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

Direct Simple Shear Test by ASTM D6528

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
570.00	24.104	477.59	1981.4	0.10358	928.69	0.61237
585.00	24.722	472.89	1912.9	0.12386	808.79	0.66241
600.00	25.369	475.24	1873.3	0.11088	895.78	0.62610
615.00	26.069	479.95	1841.1	0.11048	898.13	0.62512
630.00	26.696	475.24	1780.2	0.11591	855.81	0.64279
645.00	27.386	472.89	1726.7	0.11074	886.37	0.63003
660.00	27.917	470.54	1685.5	0.11645	862.86	0.63984
675.00	28.577	465.83	1630.1	0.12082	837.00	0.65064
690.00	29.205	461.12	1578.9	0.11935	825.24	0.65554
705.00	29.875	470.54	1575.0	0.11631	853.46	0.64377
720.00	30.466	472.89	1552.2	0.11949	834.65	0.65162
731.01	30.904	477.59	1545.4	0.11551	858.16	0.64181

Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 1U	Test Date: 11/23/2020	Depth: 12.55
	Test Number: DSS 122	Preparation: wet	Elevation: 31.05
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2400 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

BB-FBR-202-3U

DSS 120

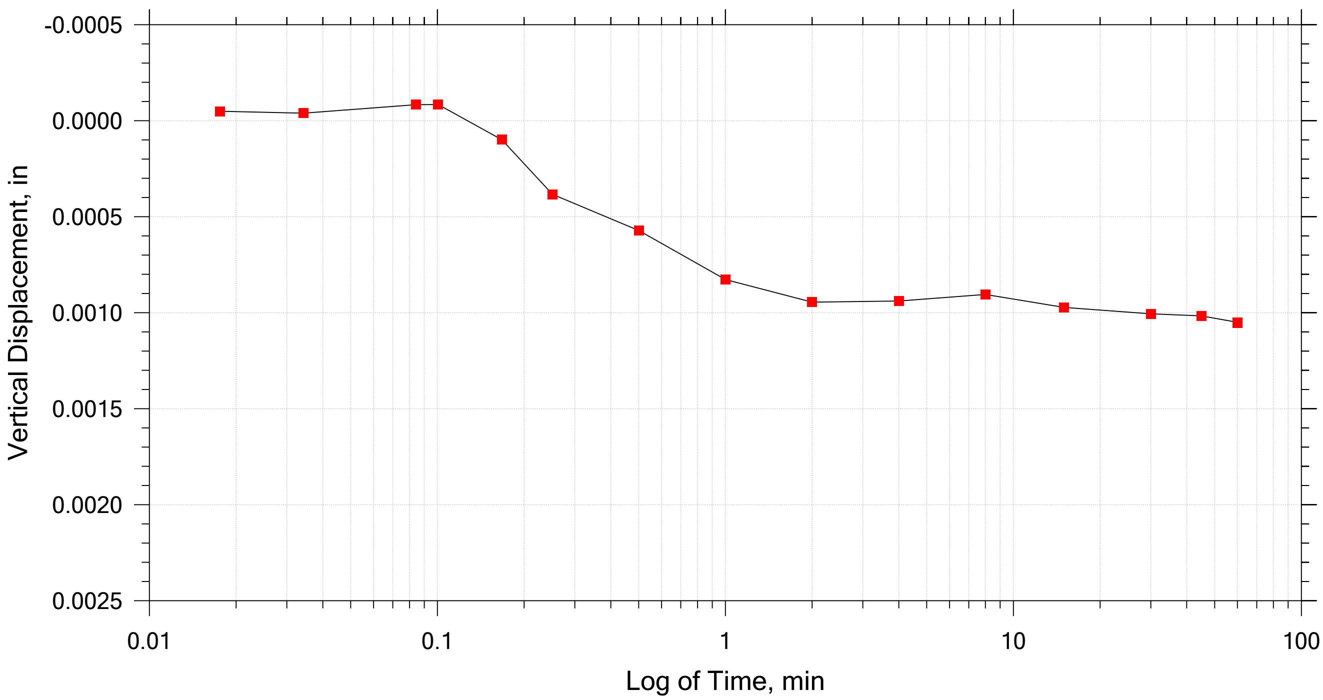
DSS 121

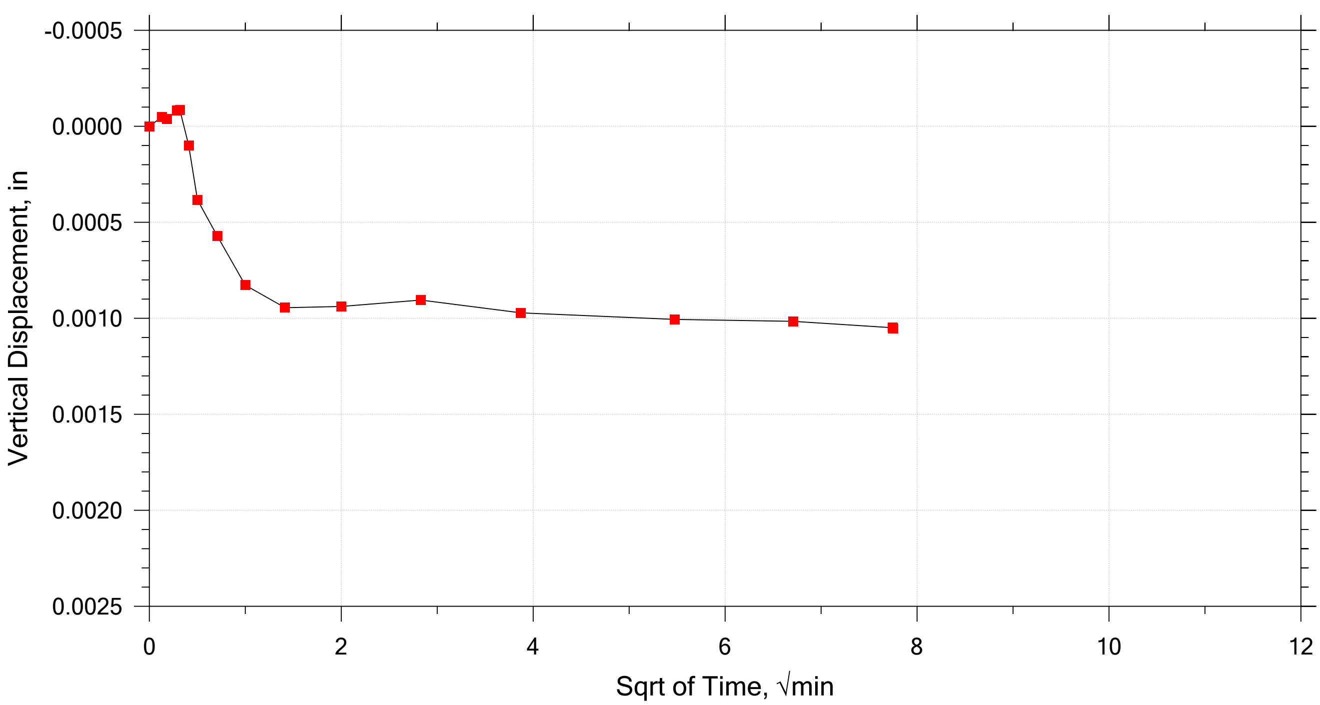
Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 1 of 7

Constant Load Step

Stress: 208 psf





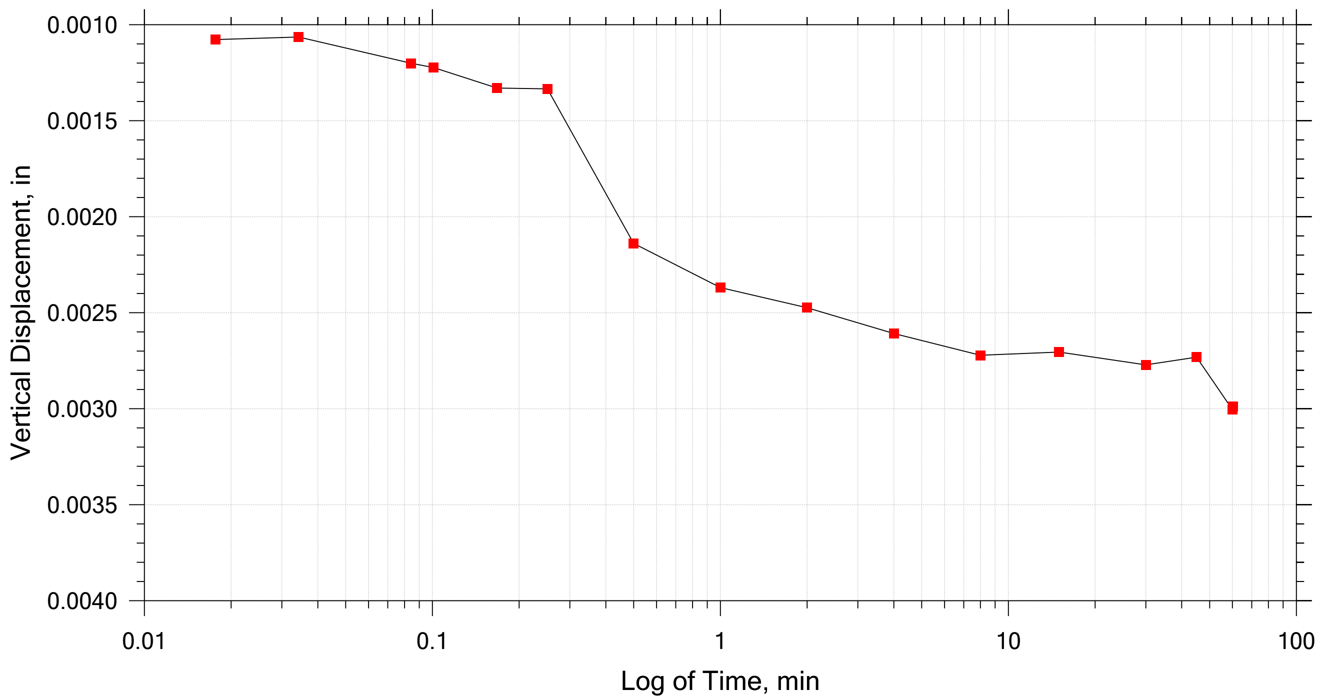
Soil Metrics LLC			
	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/5/2020	Depth: 21.15
	Test Number: DSS 120	Preparation: wet	Elevation: 22.45
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2550 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

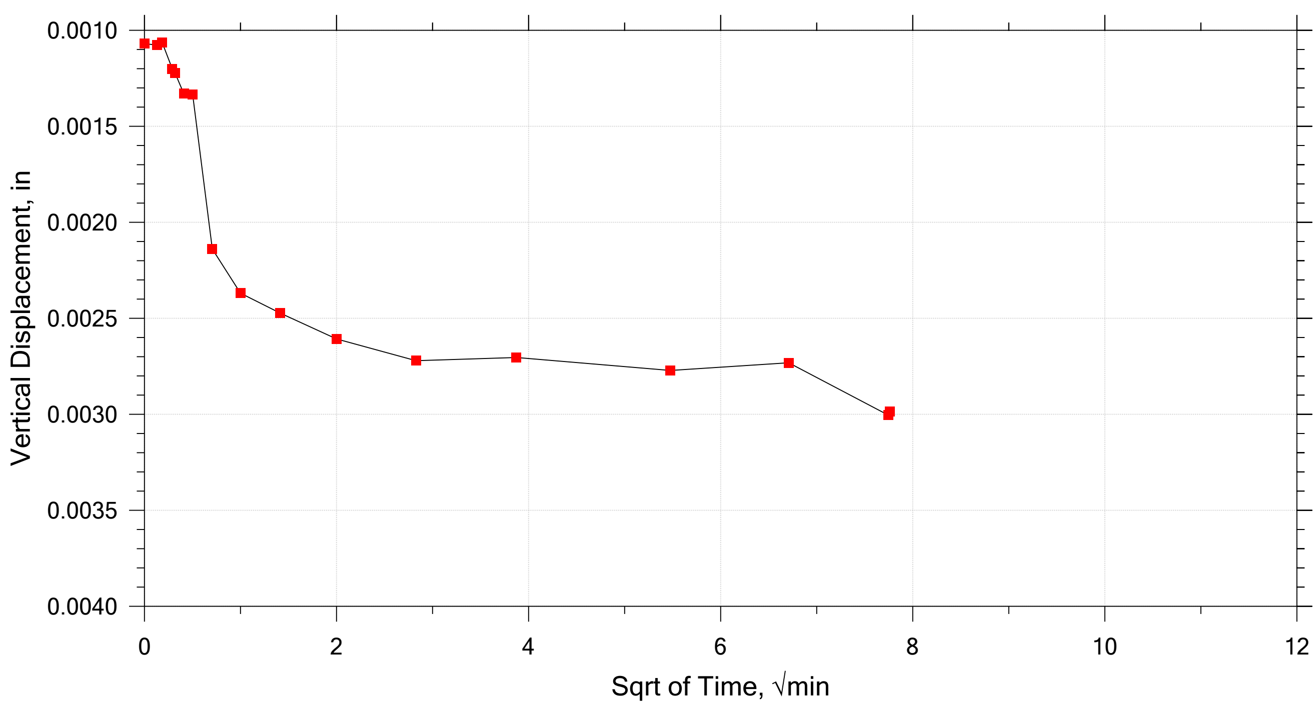
Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 2 of 7

Constant Load Step

Stress: 312 psf

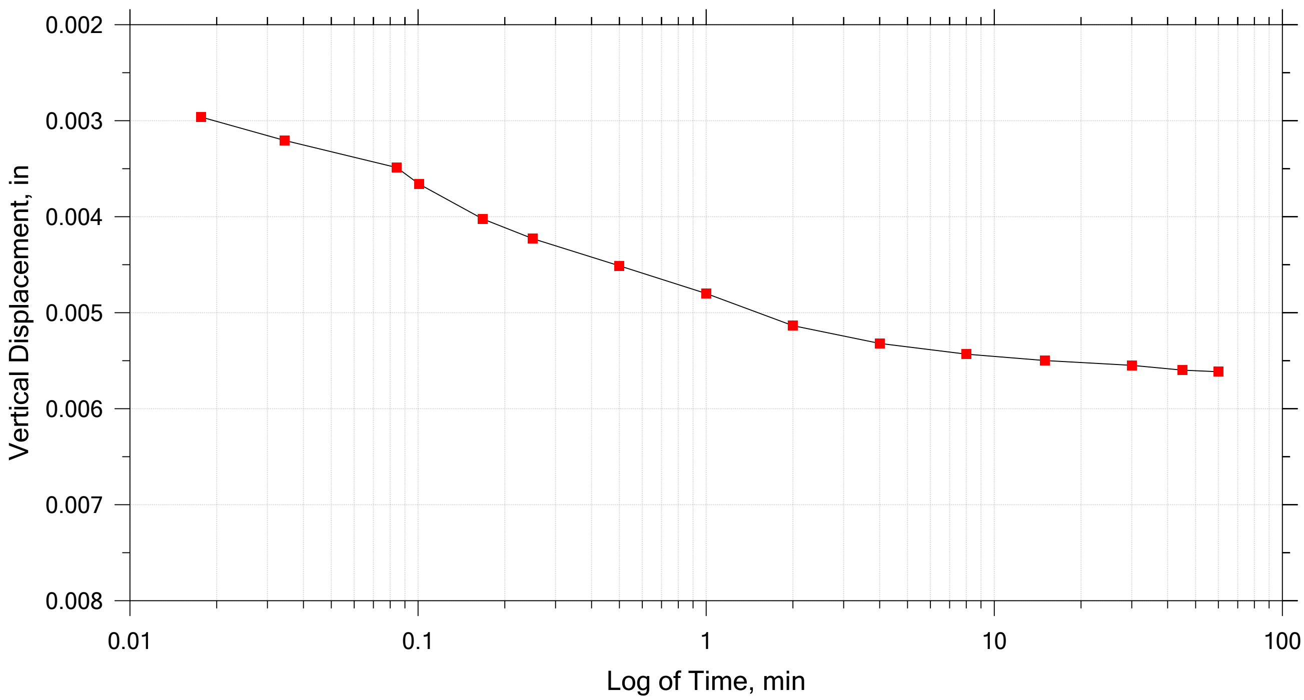


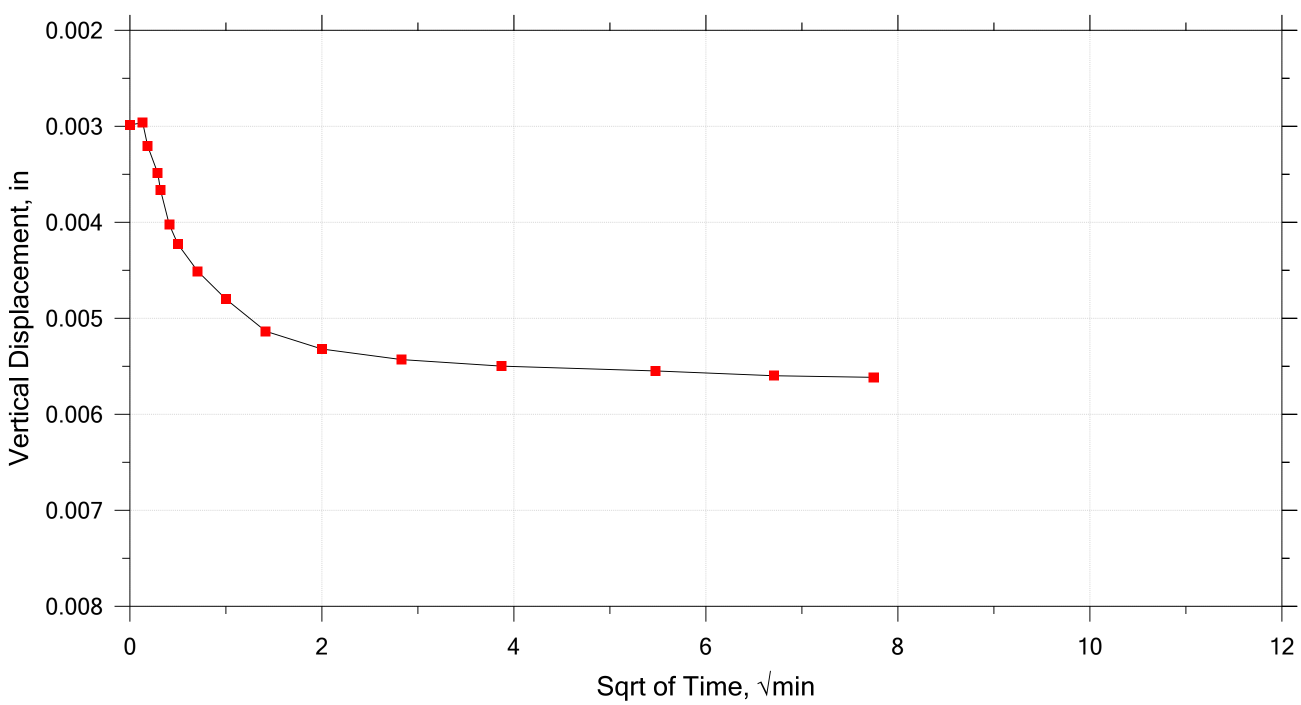


Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/5/2020	Depth: 21.15
	Test Number: DSS 120	Preparation: wet	Elevation: 22.45
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2550 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 3 of 7
Constant Load Step
Stress: 468 psf





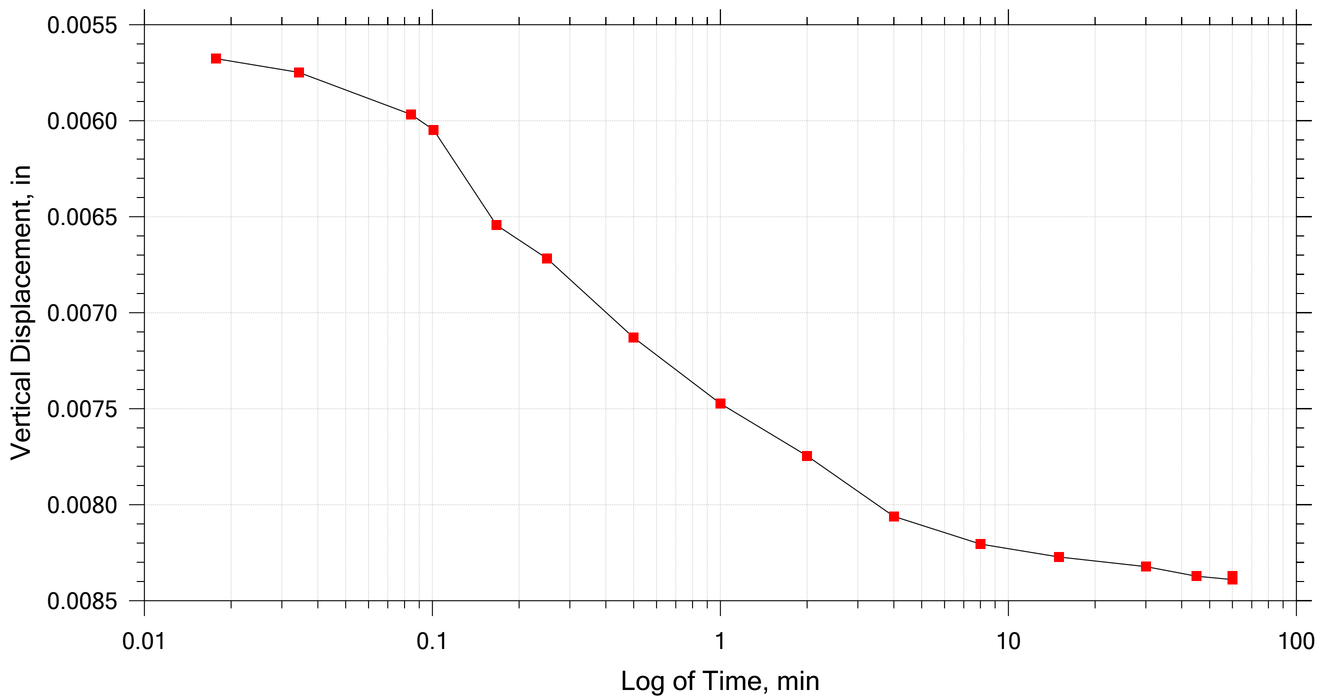
Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/5/2020	Depth: 21.15
	Test Number: DSS 120	Preparation: wet	Elevation: 22.45
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2550 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

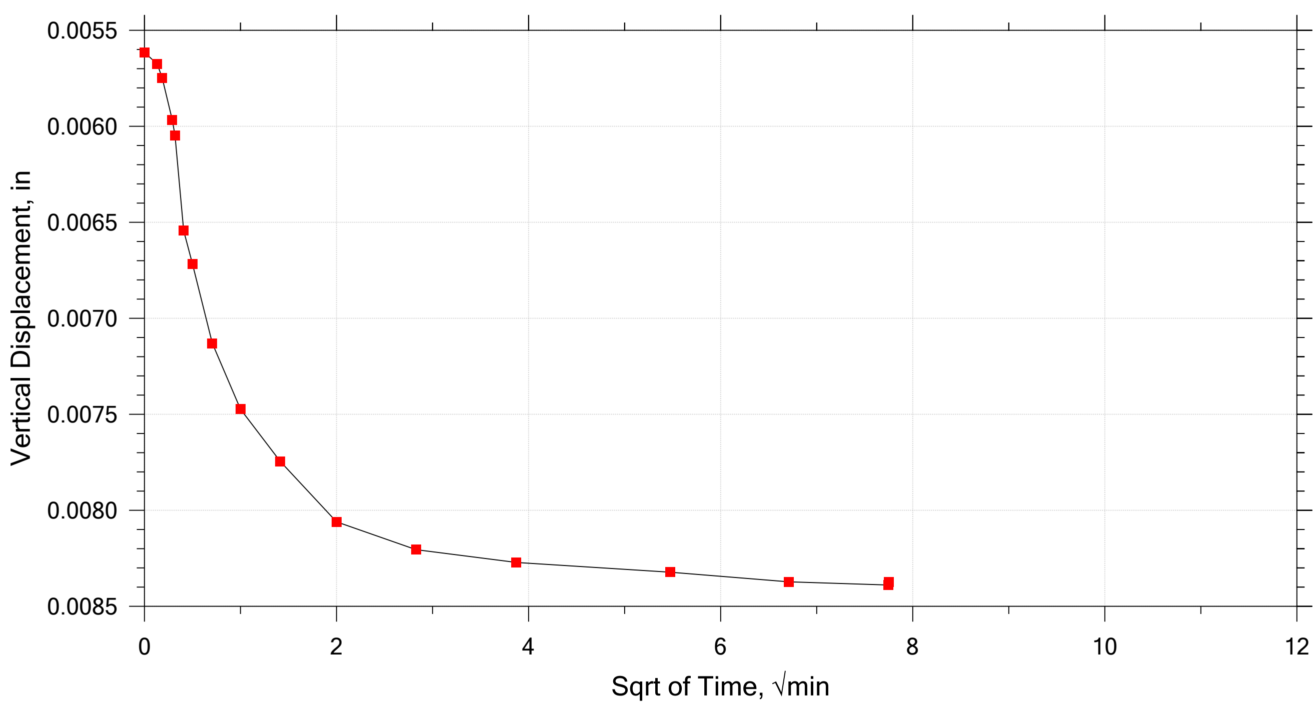
Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 4 of 7

Constant Load Step

Stress: 702 psf





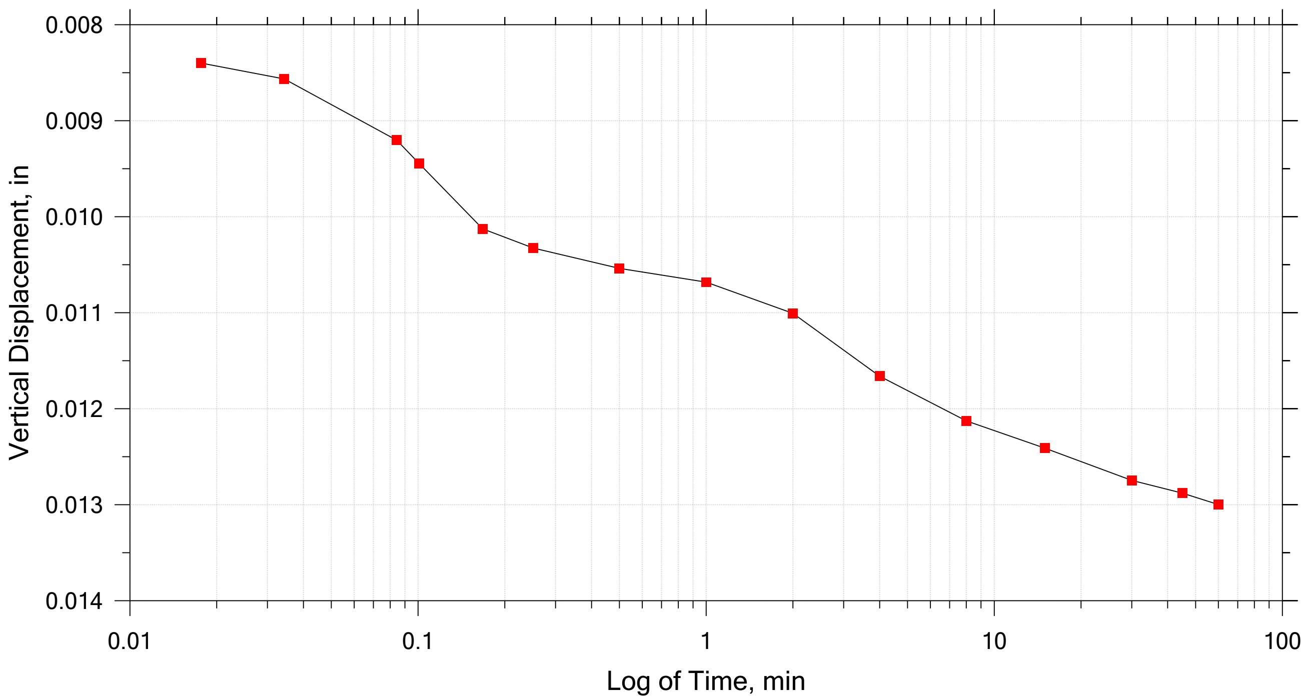
Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/5/2020	Depth: 21.15
	Test Number: DSS 120	Preparation: wet	Elevation: 22.45
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2550 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

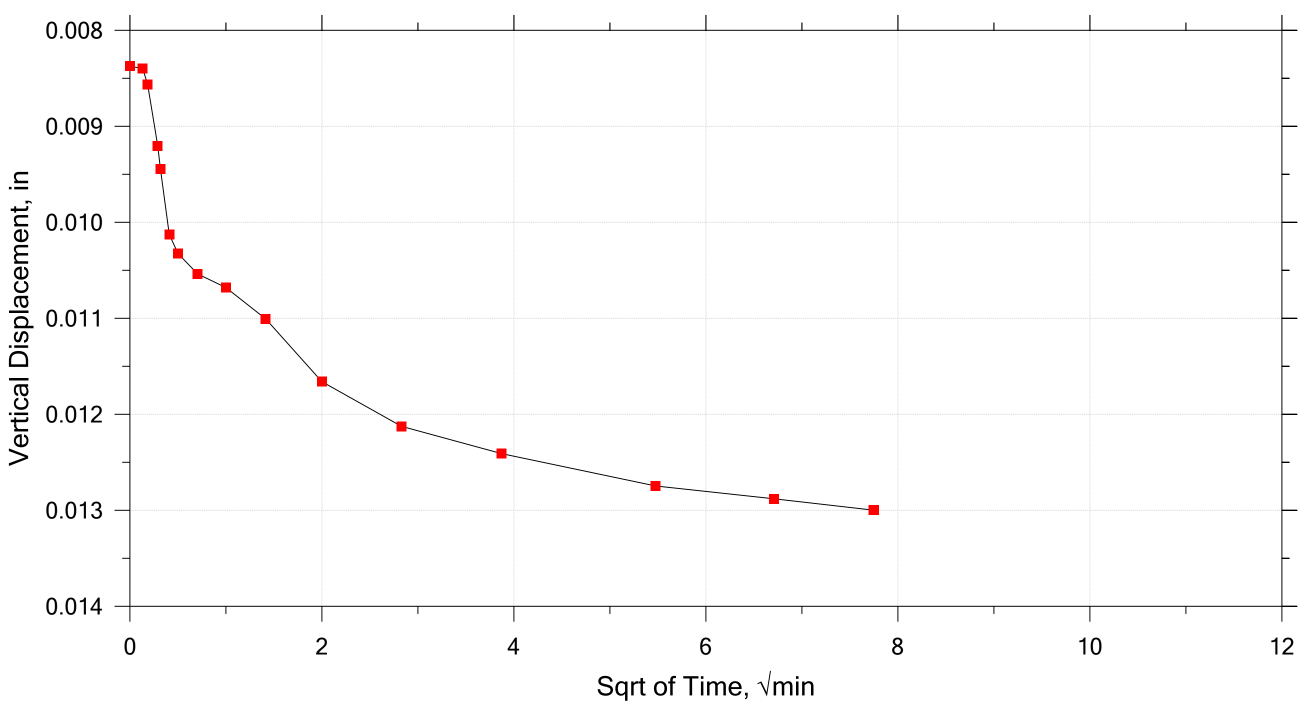
Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 5 of 7

Constant Load Step

Stress: 1.05e+03 psf





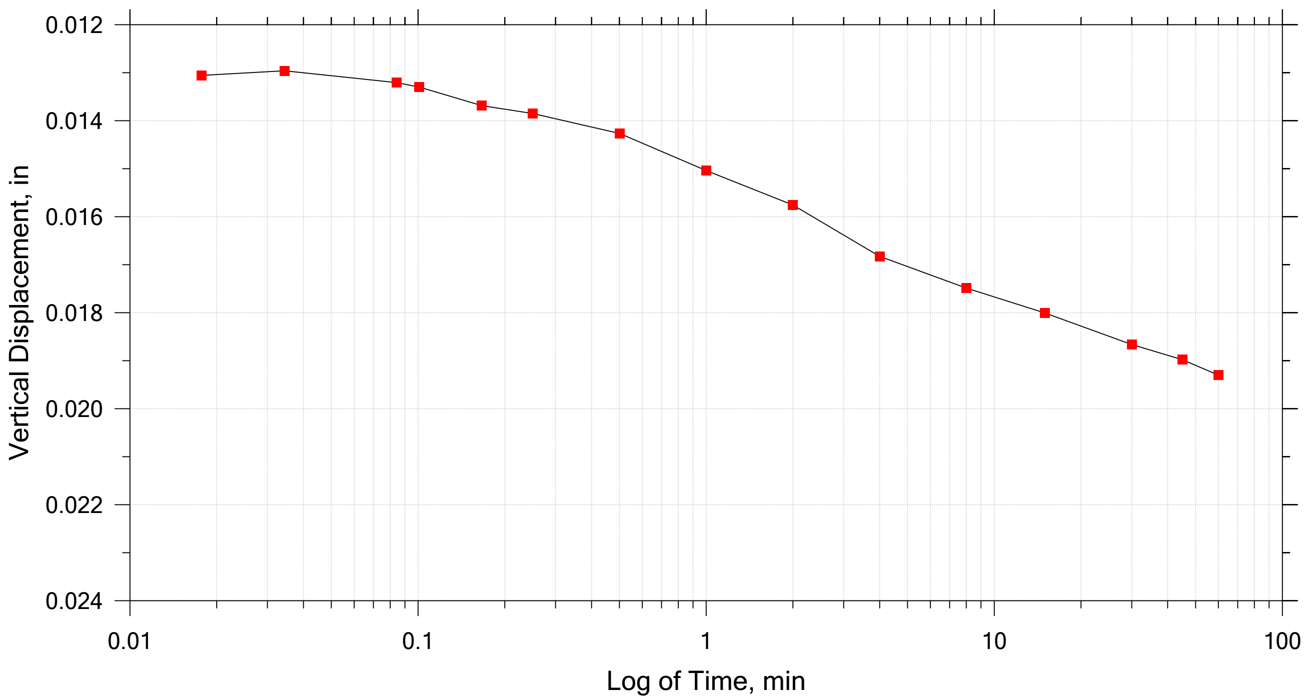
Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/5/2020	Depth: 21.15
	Test Number: DSS 120	Preparation: wet	Elevation: 22.45
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2550 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

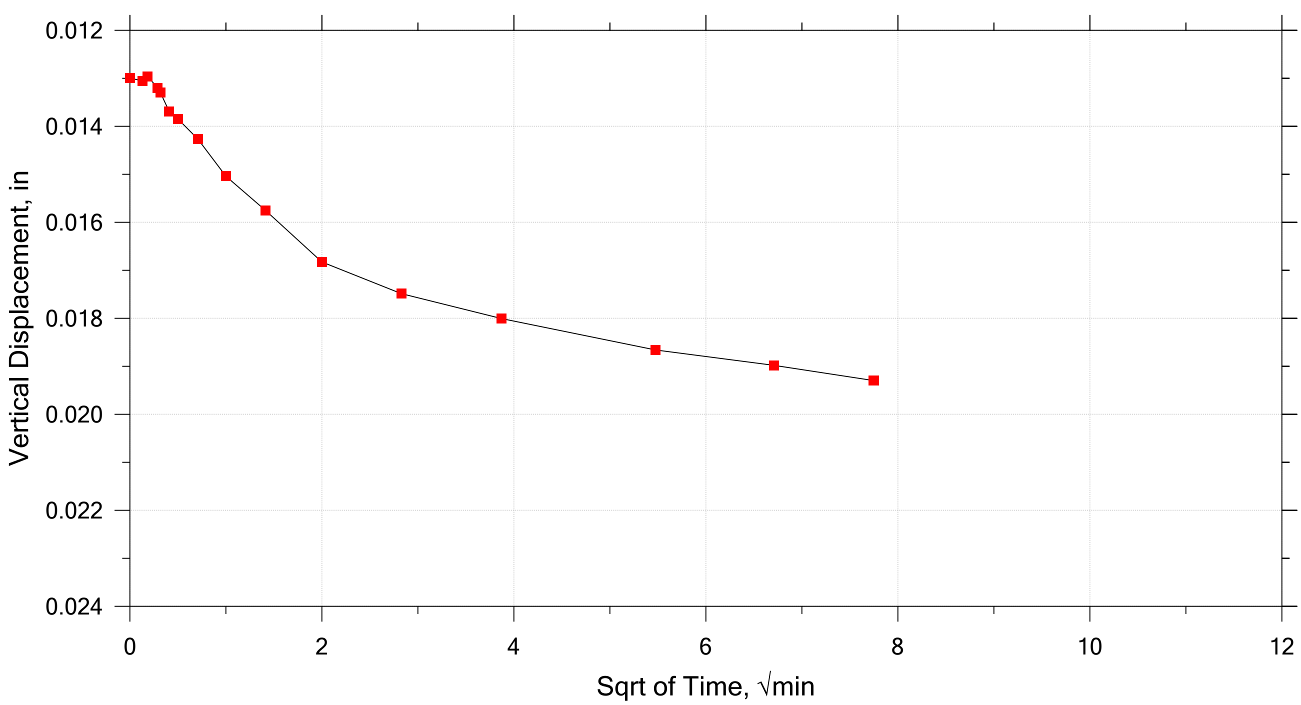
Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 6 of 7

Constant Load Step

Stress: 1.58e+03 psf





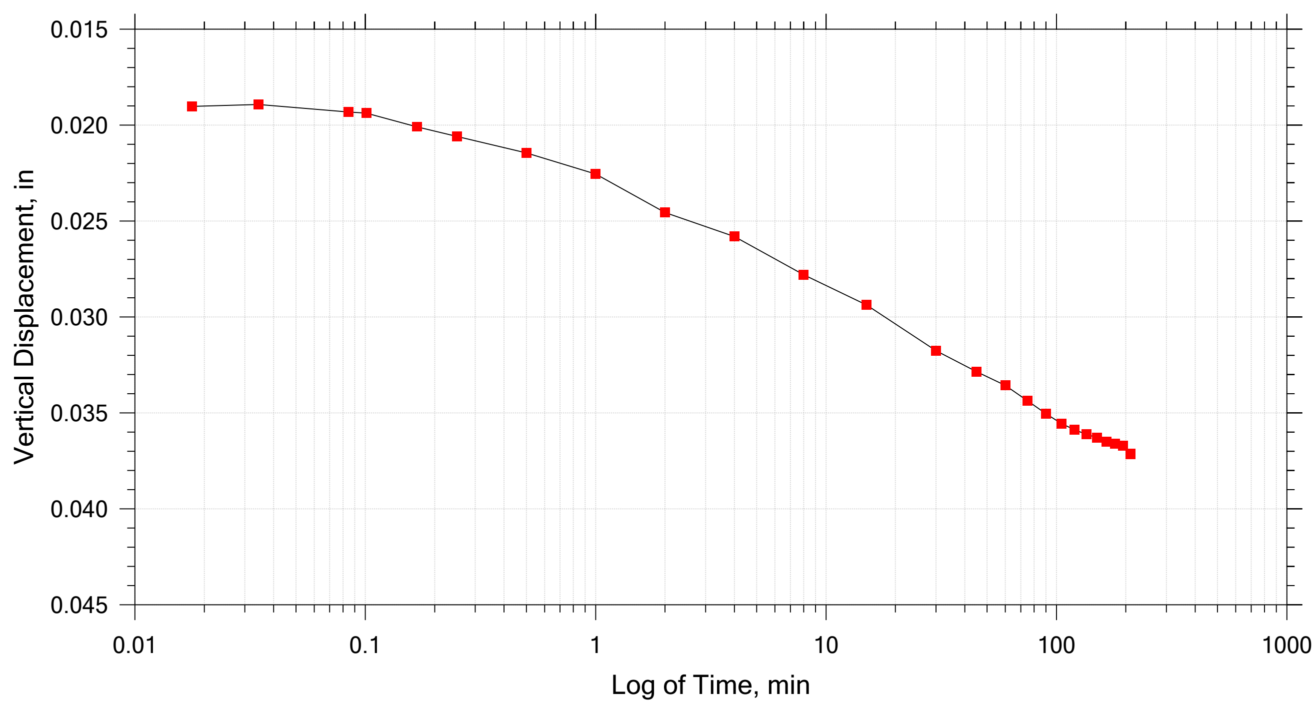
Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/5/2020	Depth: 21.15
	Test Number: DSS 120	Preparation: wet	Elevation: 22.45
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2550 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

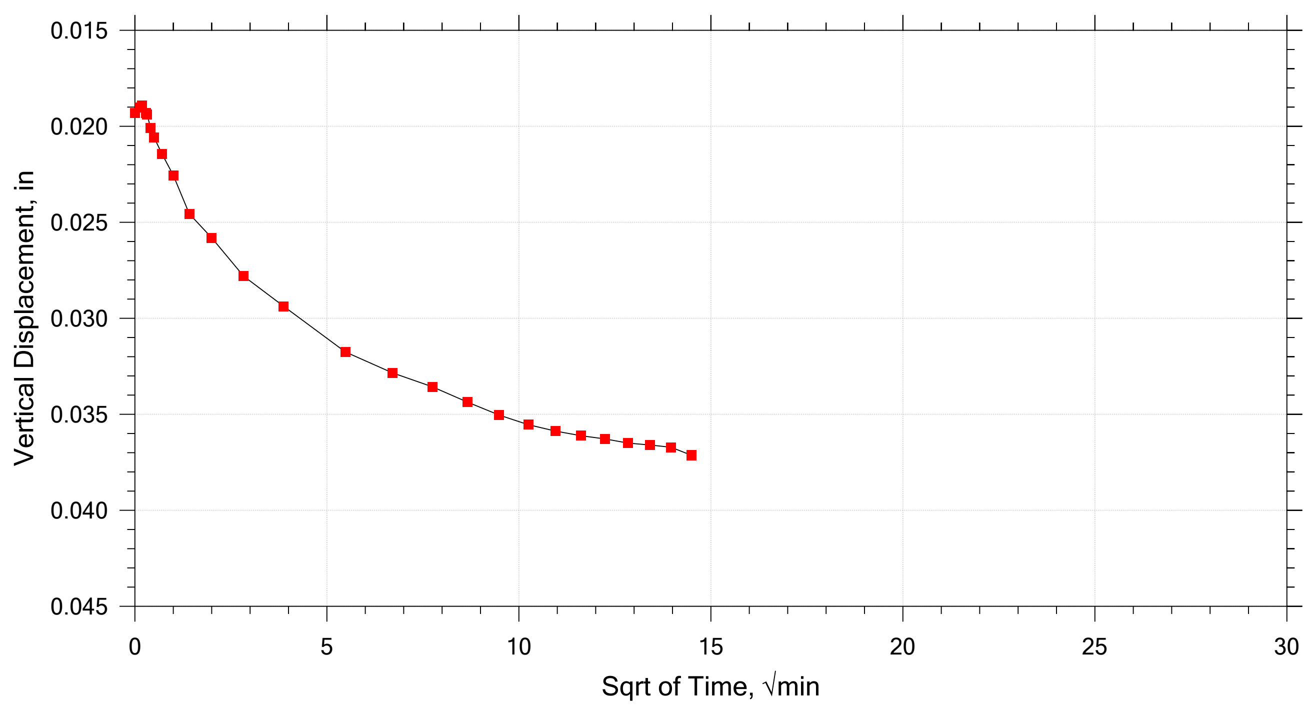
Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 7 of 7

Constant Load Step

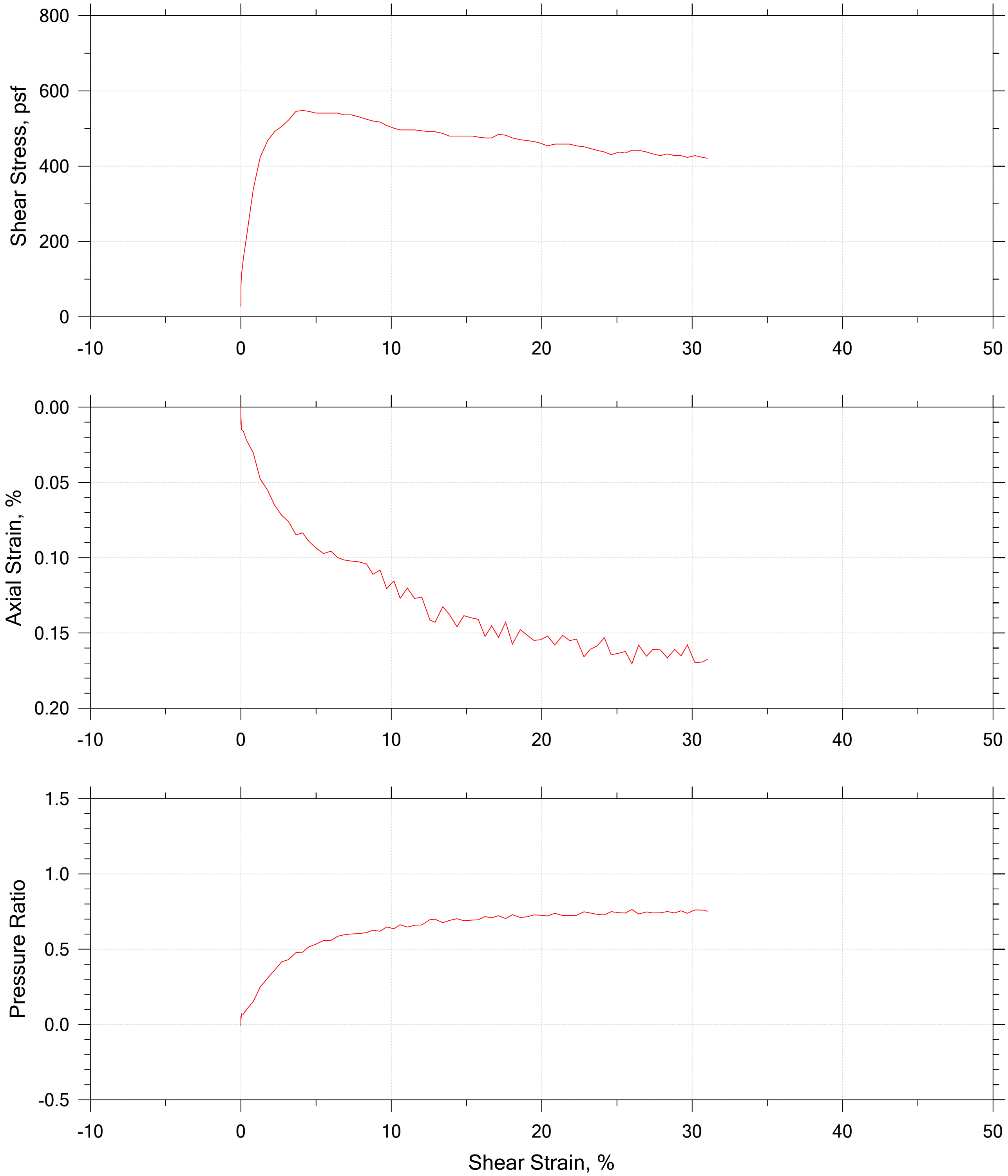
Stress: 2.55e+03 psf





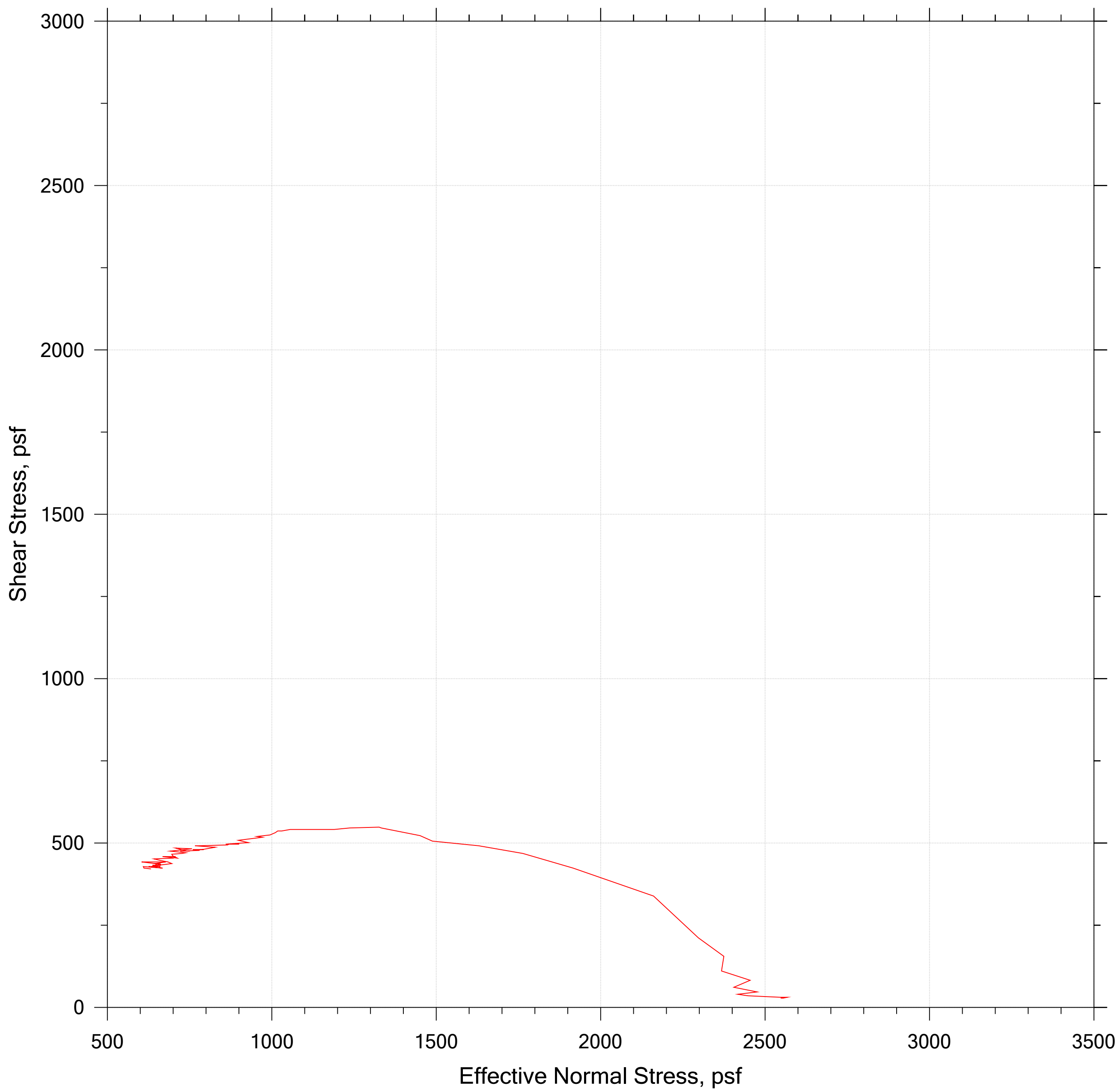
Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/5/2020	Depth: 21.15
	Test Number: DSS 120	Preparation: wet	Elevation: 22.45
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2550 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

Direct Simple Shear Test by ASTM D6528



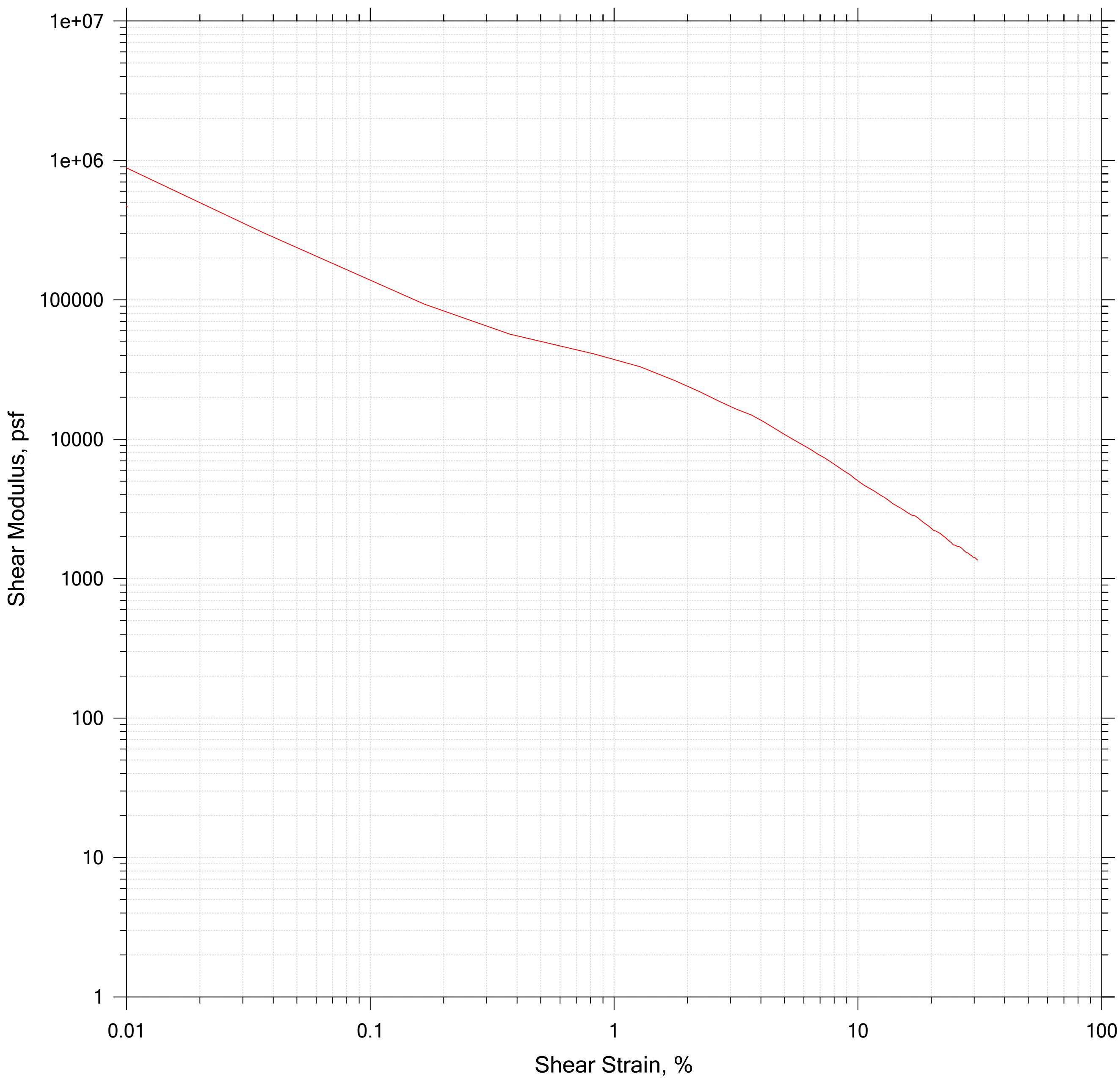
Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
Sample Number: 3U	Test Date: 11/5/2020	Depth: 21.15
Test Number: DSS 120	Preparation: wet	Elevation: 22.45
Description: Gray silty Clay		
Remarks: Sample consolidated to 2550 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

Direct Simple Shear Test by ASTM D6528



Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/5/2020	Depth: 21.15
	Test Number: DSS 120	Preparation: wet	Elevation: 22.45
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2550 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

Direct Simple Shear Test by ASTM D6528



Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/5/2020	Depth: 21.15
	Test Number: DSS 120	Preparation: wet	Elevation: 22.45
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2550 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

Direct Simple Shear Test by ASTM D6528

Specimen Dimension, in: 2.50	Specific Gravity: 2.79 (Implied)	Liquid Limit: 0
Specimen Height, in: 1.00	Initial Void Ratio: 1.18	Plastic Limit: 0
Final Height, in: 0.96	Final Void Ratio: 1.1	Plasticity Index: 0

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	215	---		307
Mass Container, gm	36.77	0	0	60.45
Mass Container + Wet Soil, gm	160.39	146.6	143.44	203.89
Mass Container + Dry Soil, gm	125.32	102.94	102.94	163.39
Mass Dry Soil, gm	88.55	102.94	102.94	102.94
Water Content, %	39.60	42.41	39.34	39.34
Void Ratio	---	1.18	1.10	---
Degree of Saturation, %	---	100.10	100.00	---
Dry Unit Weight, pcf	---	79.762	82.97	---

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: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/5/2020	Depth: 21.15
	Test Number: DSS 120	Preparation: wet	Elevation: 22.45
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2550 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 1 of 7

Constant Load Step

Stress: 208 psf

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	2.35	0.002190	0.0000	0.000	1.18
0.018	0.133	32.9	0.002272	-4.923e-05	-0.00491	1.18
0.034	0.185	54.1	0.002330	-3.945e-05	-0.00394	1.18
0.084	0.290	120.	0.002508	-8.357e-05	-0.00834	1.18
0.101	0.317	139.	0.002559	-8.419e-05	-0.00840	1.18
0.167	0.409	176.	0.002661	9.904e-05	0.00988	1.18
0.251	0.501	195.	0.002712	0.0003835	0.0383	1.18
0.501	0.708	200.	0.002724	0.0005720	0.0571	1.18
1.001	1.000	205.	0.002737	0.0008276	0.0826	1.18
2.000	1.414	205.	0.002737	0.0009450	0.0943	1.18
4.001	2.000	207.	0.002744	0.0009387	0.0937	1.18
8.000	2.828	207.	0.002744	0.0009051	0.0903	1.18
15.001	3.873	207.	0.002744	0.0009722	0.0970	1.18
30.001	5.477	207.	0.002744	0.001006	0.100	1.18
45.000	6.708	209.	0.002750	0.001016	0.101	1.18
60.001	7.746	209.	0.002750	0.001050	0.105	1.18
60.099	7.752	207.	0.002746	0.001054	0.105	1.18

Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
Sample Number: 3U	Test Date: 11/5/2020	Depth: 21.15
Test Number: DSS 120	Preparation: wet	Elevation: 22.45
Description: Gray silty Clay		
Remarks: Sample consolidated to 2550 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 2 of 7

Constant Load Step

Stress: 312 psf

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	207.	0.002746	0.001070	0.107	1.18
0.018	0.133	212.	0.002756	0.001077	0.107	1.18
0.034	0.185	216.	0.002769	0.001064	0.106	1.18
0.084	0.290	205.	0.002750	0.001201	0.120	1.18
0.101	0.318	212.	0.002761	0.001223	0.122	1.18
0.168	0.409	223.	0.002788	0.001330	0.133	1.18
0.251	0.501	247.	0.002852	0.001334	0.133	1.18
0.500	0.707	296.	0.002985	0.002139	0.213	1.18
1.000	1.000	310.	0.003024	0.002369	0.236	1.18
2.000	1.414	308.	0.003020	0.002474	0.247	1.17
4.001	2.000	308.	0.003020	0.002608	0.260	1.17
8.000	2.829	310.	0.003024	0.002721	0.272	1.17
15.000	3.873	310.	0.003024	0.002705	0.270	1.17
30.000	5.477	310.	0.003024	0.002772	0.277	1.17
45.000	6.708	313.	0.003030	0.002732	0.273	1.17
60.001	7.746	310.	0.003026	0.003004	0.300	1.17
60.225	7.760	310.	0.003026	0.002987	0.298	1.17

Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/5/2020	Depth: 21.15
	Test Number: DSS 120	Preparation: wet	Elevation: 22.45
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2550 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 3 of 7

Constant Load Step

Stress: 468 psf

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	310.	0.003026	0.002987	0.298	1.17
0.018	0.133	346.	0.003119	0.002961	0.296	1.17
0.034	0.185	320.	0.003077	0.003205	0.320	1.17
0.084	0.290	374.	0.003196	0.003489	0.348	1.17
0.101	0.318	390.	0.003240	0.003662	0.365	1.17
0.168	0.410	449.	0.003399	0.004023	0.401	1.17
0.250	0.500	447.	0.003396	0.004228	0.422	1.17
0.500	0.707	461.	0.003431	0.004511	0.450	1.17
1.000	1.000	466.	0.003444	0.004800	0.479	1.17
2.000	1.414	466.	0.003444	0.005135	0.513	1.17
4.001	2.000	466.	0.003444	0.005320	0.531	1.17
8.000	2.828	468.	0.003450	0.005431	0.542	1.17
15.000	3.873	468.	0.003450	0.005498	0.549	1.17
30.000	5.477	468.	0.003450	0.005548	0.554	1.17
45.000	6.708	468.	0.003450	0.005599	0.559	1.17
60.001	7.746	468.	0.003450	0.005615	0.560	1.17
60.107	7.753	468.	0.003450	0.005615	0.560	1.17

Soil Metrics LLC			
	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/5/2020	Depth: 21.15
	Test Number: DSS 120	Preparation: wet	Elevation: 22.45
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2550 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 4 of 7

Constant Load Step

Stress: 702 psf

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	468.	0.003450	0.005615	0.560	1.17
0.018	0.133	470.	0.003457	0.005676	0.566	1.17
0.034	0.185	505.	0.003552	0.005748	0.574	1.17
0.084	0.290	604.	0.003820	0.005967	0.596	1.17
0.101	0.318	630.	0.003890	0.006048	0.604	1.17
0.167	0.408	689.	0.004049	0.006543	0.653	1.17
0.250	0.500	675.	0.004026	0.006717	0.670	1.17
0.500	0.707	689.	0.004049	0.007130	0.712	1.16
1.000	1.000	698.	0.004074	0.007474	0.746	1.16
2.001	1.414	696.	0.004070	0.007746	0.773	1.16
4.000	2.000	698.	0.004074	0.008060	0.804	1.16
8.001	2.829	701.	0.004081	0.008205	0.819	1.16
15.001	3.873	701.	0.004081	0.008272	0.826	1.16
30.001	5.477	701.	0.004081	0.008322	0.831	1.16
45.001	6.708	701.	0.004081	0.008373	0.836	1.16
60.000	7.746	701.	0.004081	0.008390	0.837	1.16
60.101	7.752	701.	0.004081	0.008373	0.836	1.16

Soil Metrics LLC			
	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/5/2020	Depth: 21.15
	Test Number: DSS 120	Preparation: wet	Elevation: 22.45
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2550 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 5 of 7

Constant Load Step

Stress: 1053 psf

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	701.	0.004081	0.008373	0.836	1.16
0.018	0.133	741.	0.004189	0.008399	0.838	1.16
0.034	0.185	797.	0.004342	0.008565	0.855	1.16
0.084	0.290	945.	0.004743	0.009203	0.918	1.16
0.101	0.318	985.	0.004851	0.009447	0.943	1.16
0.168	0.410	1.02e+03	0.004926	0.01013	1.01	1.16
0.251	0.501	1.03e+03	0.004944	0.01033	1.03	1.16
0.500	0.707	1.04e+03	0.004967	0.01054	1.05	1.16
1.000	1.000	1.04e+03	0.004976	0.01068	1.07	1.16
2.001	1.415	1.05e+03	0.004985	0.01101	1.10	1.16
4.001	2.000	1.05e+03	0.004985	0.01166	1.16	1.15
8.000	2.828	1.05e+03	0.004990	0.01213	1.21	1.15
15.001	3.873	1.05e+03	0.004990	0.01241	1.24	1.15
30.000	5.477	1.05e+03	0.004990	0.01275	1.27	1.15
45.001	6.708	1.05e+03	0.004990	0.01288	1.29	1.15
60.001	7.746	1.05e+03	0.004990	0.01300	1.30	1.15
60.101	7.752	1.05e+03	0.004990	0.01300	1.30	1.15

Soil Metrics LLC			
	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/5/2020	Depth: 21.15
	Test Number: DSS 120	Preparation: wet	Elevation: 22.45
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2550 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 6 of 7

Constant Load Step

Stress: 1580 psf

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	1.05e+03	0.004990	0.01300	1.30	1.15
0.018	0.133	1.14e+03	0.005168	0.01305	1.30	1.15
0.034	0.185	1.23e+03	0.005346	0.01296	1.29	1.15
0.084	0.290	1.46e+03	0.005790	0.01320	1.32	1.15
0.101	0.318	1.53e+03	0.005913	0.01330	1.33	1.15
0.167	0.408	1.52e+03	0.005912	0.01369	1.37	1.15
0.250	0.500	1.55e+03	0.005968	0.01385	1.38	1.15
0.501	0.708	1.56e+03	0.005986	0.01427	1.42	1.15
1.001	1.000	1.57e+03	0.006000	0.01504	1.50	1.15
2.000	1.414	1.57e+03	0.006004	0.01576	1.57	1.15
4.001	2.000	1.58e+03	0.006009	0.01683	1.68	1.14
8.000	2.828	1.58e+03	0.006018	0.01749	1.75	1.14
15.000	3.873	1.58e+03	0.006018	0.01801	1.80	1.14
30.000	5.477	1.58e+03	0.006018	0.01866	1.86	1.14
45.001	6.708	1.58e+03	0.006018	0.01898	1.89	1.14
60.001	7.746	1.58e+03	0.006018	0.01930	1.93	1.14
60.098	7.752	1.58e+03	0.006018	0.01930	1.93	1.14

Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/5/2020	Depth: 21.15
	Test Number: DSS 120	Preparation: wet	Elevation: 22.45
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2550 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 7 of 7

Constant Load Step

Stress: 2550 psf

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	1.58e+03	0.006018	0.01930	1.93	1.14
0.018	0.133	1.81e+03	0.006461	0.01902	1.90	1.14
0.034	0.185	2.00e+03	0.006832	0.01892	1.89	1.14
0.084	0.290	2.38e+03	0.007224	0.01932	1.93	1.14
0.101	0.318	2.45e+03	0.007301	0.01937	1.93	1.14
0.168	0.409	2.45e+03	0.007294	0.02009	2.00	1.14
0.250	0.500	2.50e+03	0.007347	0.02059	2.05	1.14
0.500	0.707	2.54e+03	0.007388	0.02145	2.14	1.13
1.000	1.000	2.55e+03	0.007398	0.02255	2.25	1.13
2.001	1.415	2.53e+03	0.007381	0.02456	2.45	1.13
4.001	2.000	2.54e+03	0.007391	0.02581	2.58	1.12
8.001	2.829	2.55e+03	0.007396	0.02780	2.77	1.12
15.001	3.873	2.55e+03	0.007398	0.02937	2.93	1.12
30.001	5.477	2.55e+03	0.007398	0.03175	3.17	1.11
45.001	6.708	2.55e+03	0.007398	0.03284	3.28	1.11
60.000	7.746	2.55e+03	0.007398	0.03357	3.35	1.11
75.001	8.660	2.55e+03	0.007398	0.03437	3.43	1.11
90.001	9.487	2.55e+03	0.007398	0.03504	3.50	1.10
105.001	10.247	2.55e+03	0.007398	0.03555	3.55	1.10
120.000	10.954	2.55e+03	0.007398	0.03588	3.58	1.10
135.001	11.619	2.55e+03	0.007398	0.03612	3.60	1.10
150.000	12.247	2.55e+03	0.007398	0.03628	3.62	1.10
165.000	12.845	2.55e+03	0.007398	0.03650	3.64	1.10
180.001	13.416	2.55e+03	0.007398	0.03660	3.65	1.10
195.001	13.964	2.55e+03	0.007398	0.03672	3.66	1.10
210.001	14.491	2.55e+03	0.007398	0.03714	3.71	1.10
210.233	14.499	2.55e+03	0.007398	0.03712	3.70	1.10

Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
Sample Number: 3U	Test Date: 11/5/2020	Depth: 21.15
Test Number: DSS 120	Preparation: wet	Elevation: 22.45
Description: Gray silty Clay		
Remarks: Sample consolidated to 2550 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

Direct Simple Shear Test by ASTM D6528

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
0.00000	0.00000	30.585	0.00000	0.00000	2548.6	0.00000
0.00041667	0.0033316	28.232	8.4740e+05	0.00000	2548.6	0.00000
0.017550	0.0033316	28.232	8.4740e+05	0.00098571	2555.7	-0.0027675
0.034200	0.00000	28.232	0.00000	0.00098571	2555.7	-0.0027675
0.084233	0.00000	30.585	0.00000	0.0032079	2567.4	-0.0073801
0.10090	-0.0033316	30.585	0.00000	0.0065427	2546.3	0.00092251
0.16760	-0.0033316	35.290	0.00000	0.010517	2447.5	0.039668
0.25095	0.0033316	39.995	1.2005e+06	0.011086	2417.0	0.051661
0.50105	0.0099948	47.054	4.7078e+05	0.0066504	2475.7	0.028598
1.0001	0.0066632	61.170	9.1802e+05	0.011973	2405.2	0.056273
2.0001	0.0066632	82.344	1.2358e+06	0.0082471	2454.6	0.036900
4.0008	0.036648	110.58	3.0173e+05	0.014811	2367.6	0.071033
8.0007	0.16658	155.28	93214.	0.016017	2374.6	0.068266
15.000	0.37314	211.74	56746.	0.021871	2297.0	0.098708
30.001	0.82624	338.79	41003.	0.030423	2160.7	0.15221
45.000	1.2793	423.48	33102.	0.047663	1916.2	0.24815
60.000	1.7857	468.18	26218.	0.055213	1763.3	0.30812
75.001	2.2388	491.71	21963.	0.065097	1629.3	0.36070
90.000	2.7153	505.83	18629.	0.071934	1488.3	0.41605
105.00	3.1684	522.29	16485.	0.075958	1450.6	0.43081
120.00	3.6681	545.82	14880.	0.084842	1333.1	0.47694
135.00	4.1112	548.17	13334.	0.083532	1326.0	0.47970
150.00	4.5043	545.82	12118.	0.088963	1236.7	0.51476
165.00	4.9874	541.12	10850.	0.093559	1189.7	0.53321
180.00	5.4972	541.12	9843.5	0.097275	1128.5	0.55720
195.00	5.9869	541.12	9038.3	0.095679	1126.2	0.55812
210.00	6.4433	541.12	8398.1	0.099967	1055.7	0.58579
225.00	6.8598	536.41	7819.6	0.10154	1029.8	0.59594
240.00	7.3329	536.41	7315.1	0.10225	1018.0	0.60055
255.00	7.8026	531.70	6814.4	0.10268	1011.0	0.60332
270.00	8.3490	524.65	6283.9	0.10420	994.52	0.60978
285.00	8.7788	519.94	5922.7	0.11099	954.55	0.62546
300.00	9.2519	517.59	5594.4	0.10820	971.01	0.61900
315.00	9.6883	508.18	5245.3	0.12057	898.13	0.64760
330.00	10.171	501.12	4926.7	0.11538	928.69	0.63561
345.00	10.588	496.41	4688.5	0.12696	860.51	0.66236
360.00	11.068	496.41	4485.3	0.12017	900.48	0.64668
375.00	11.551	496.41	4297.7	0.12710	869.91	0.65867
390.00	12.024	494.06	4109.0	0.12616	865.21	0.66052
405.00	12.567	491.71	3912.8	0.14133	775.87	0.69557
420.00	12.910	491.71	3808.7	0.14293	766.47	0.69926
435.00	13.423	487.00	3628.1	0.13255	827.59	0.67528
450.00	13.856	479.95	3463.8	0.13760	787.63	0.69096
465.00	14.363	479.95	3341.6	0.14586	759.41	0.70203
480.00	14.822	479.95	3238.0	0.13854	792.33	0.68911
495.00	15.399	479.95	3116.8	0.14013	782.92	0.69280
510.00	15.775	477.59	3027.5	0.14093	778.22	0.69465
525.00	16.235	475.24	2927.3	0.15225	721.79	0.71679
540.00	16.671	475.24	2850.6	0.14518	742.95	0.70849
555.00	17.128	484.65	2829.6	0.15291	707.69	0.72232

Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
Sample Number: 3U	Test Date: 11/5/2020	Depth: 21.15
Test Number: DSS 120	Preparation: wet	Elevation: 22.45
Description: Gray silty Clay		
Remarks: Sample consolidated to 2550 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

Direct Simple Shear Test by ASTM D6528

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
570.00	17.601	482.30	2740.2	0.14279	757.06	0.70295
585.00	18.054	475.24	2632.3	0.15744	691.23	0.72878
600.00	18.574	470.54	2533.3	0.14772	738.25	0.71033
615.00	19.024	468.18	2461.1	0.15145	726.50	0.71494
630.00	19.487	465.83	2390.5	0.15490	695.93	0.72694
645.00	19.916	461.12	2315.3	0.15450	698.28	0.72601
660.00	20.386	454.07	2227.3	0.15211	712.39	0.72048
675.00	20.873	458.77	2198.0	0.15796	667.72	0.73801
690.00	21.389	458.77	2144.9	0.15157	705.34	0.72325
705.00	21.855	458.77	2099.1	0.15504	705.34	0.72325
720.00	22.305	454.07	2035.7	0.15410	700.63	0.72509
735.00	22.812	451.71	1980.2	0.16582	641.86	0.74815
750.00	23.218	447.01	1925.3	0.16089	660.66	0.74077
765.00	23.668	442.30	1868.8	0.15864	684.18	0.73155
780.00	24.168	437.60	1810.7	0.15316	695.93	0.72694
795.00	24.614	430.54	1749.2	0.16448	639.50	0.74908
810.00	25.137	437.60	1740.8	0.16343	655.96	0.74262
825.00	25.557	435.24	1703.0	0.16223	663.02	0.73985
840.00	25.990	442.30	1701.8	0.17047	604.24	0.76292
855.00	26.440	442.30	1672.9	0.15810	677.12	0.73432
870.00	26.969	437.60	1622.6	0.16542	644.21	0.74723
885.00	27.386	432.89	1580.7	0.16089	660.66	0.74077
900.00	27.896	428.19	1535.0	0.16129	658.31	0.74170
915.00	28.352	432.89	1526.8	0.16662	637.15	0.75000
930.00	28.845	428.19	1484.4	0.16089	660.66	0.74077
945.00	29.268	428.19	1463.0	0.16514	625.40	0.75461
960.00	29.688	423.48	1426.4	0.15796	667.72	0.73801
975.00	30.184	428.19	1418.6	0.16967	608.94	0.76107
990.00	30.697	423.48	1379.5	0.16927	611.29	0.76015
1000.2	31.037	421.13	1356.8	0.16742	632.45	0.75185

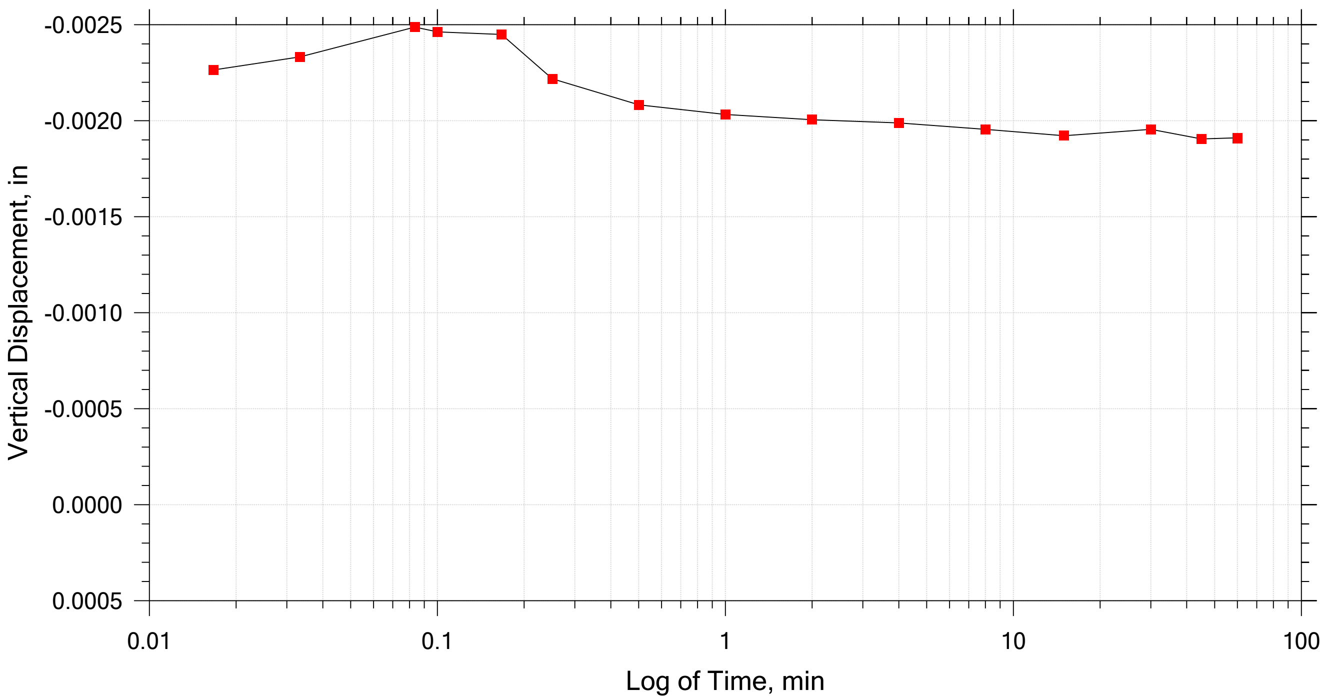
Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/5/2020	Depth: 21.15
	Test Number: DSS 120	Preparation: wet	Elevation: 22.45
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2550 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control.		

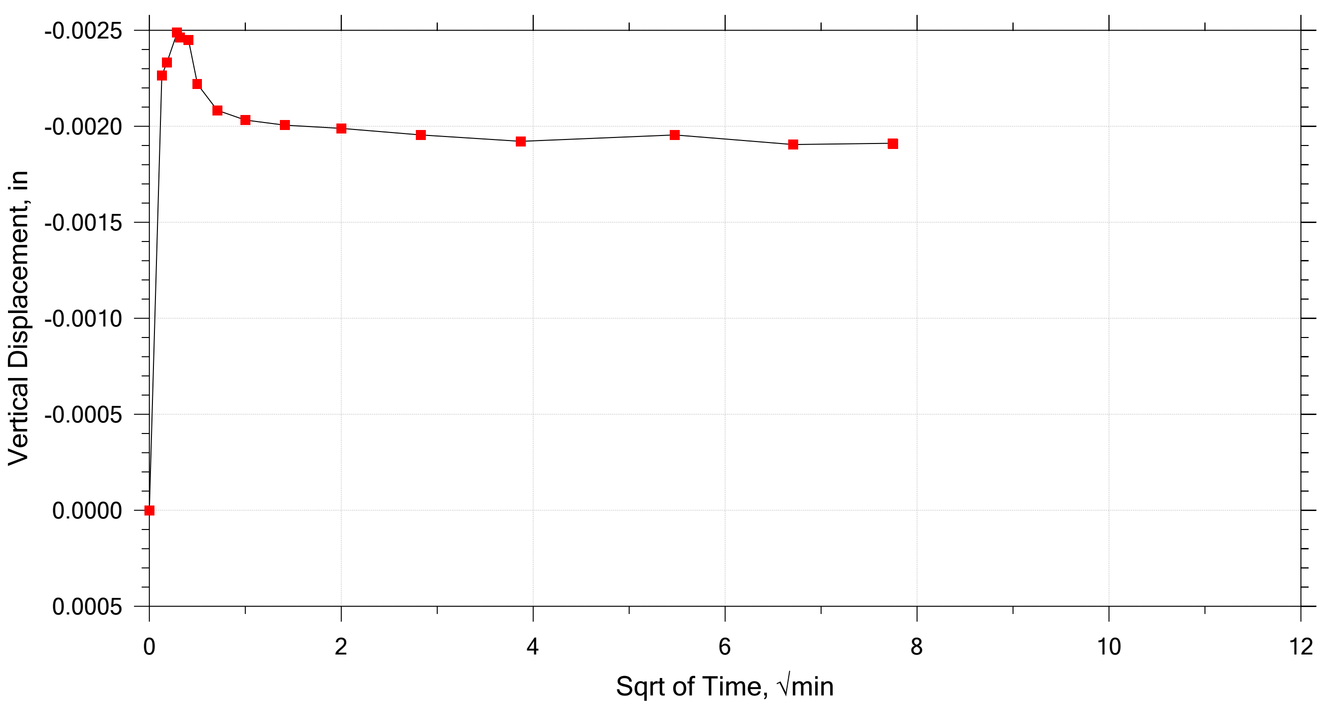
Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 1 of 7

Constant Load Step

Stress: 208 psf





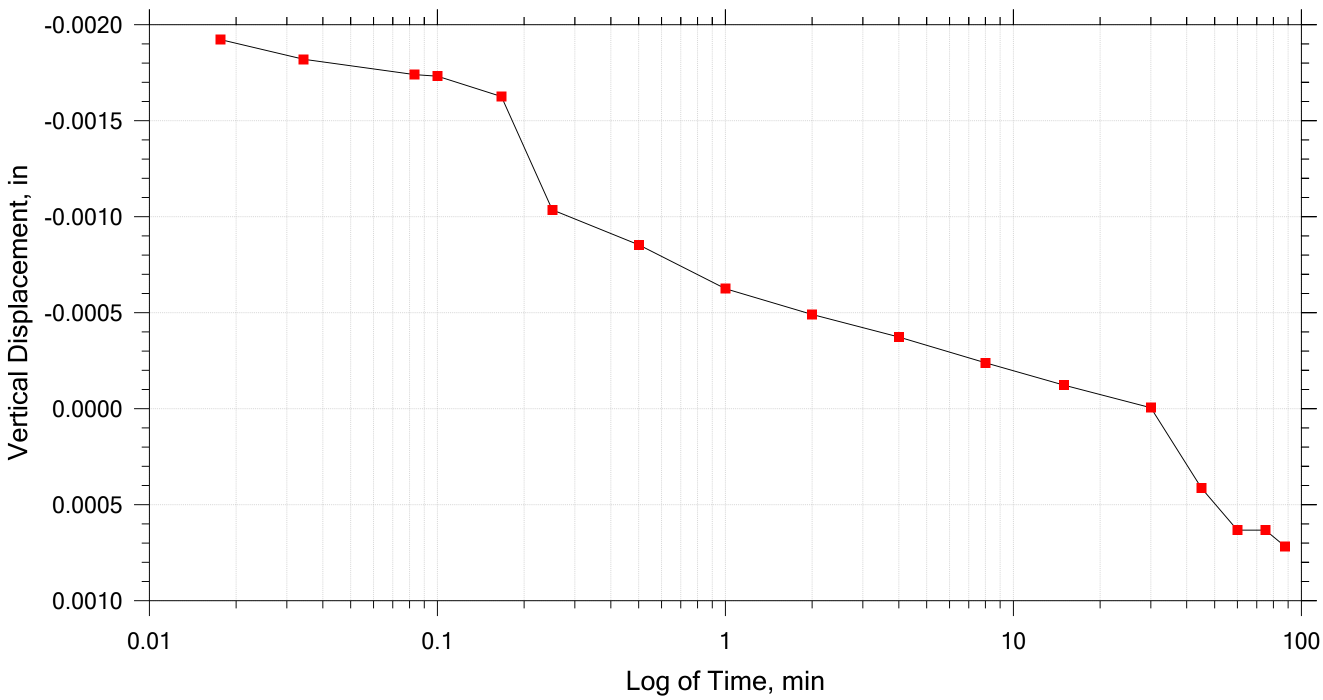
Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/14/2020	Depth: 20.65
	Test Number: DSS 121	Preparation: wet	Elevation: 22.95
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2350 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

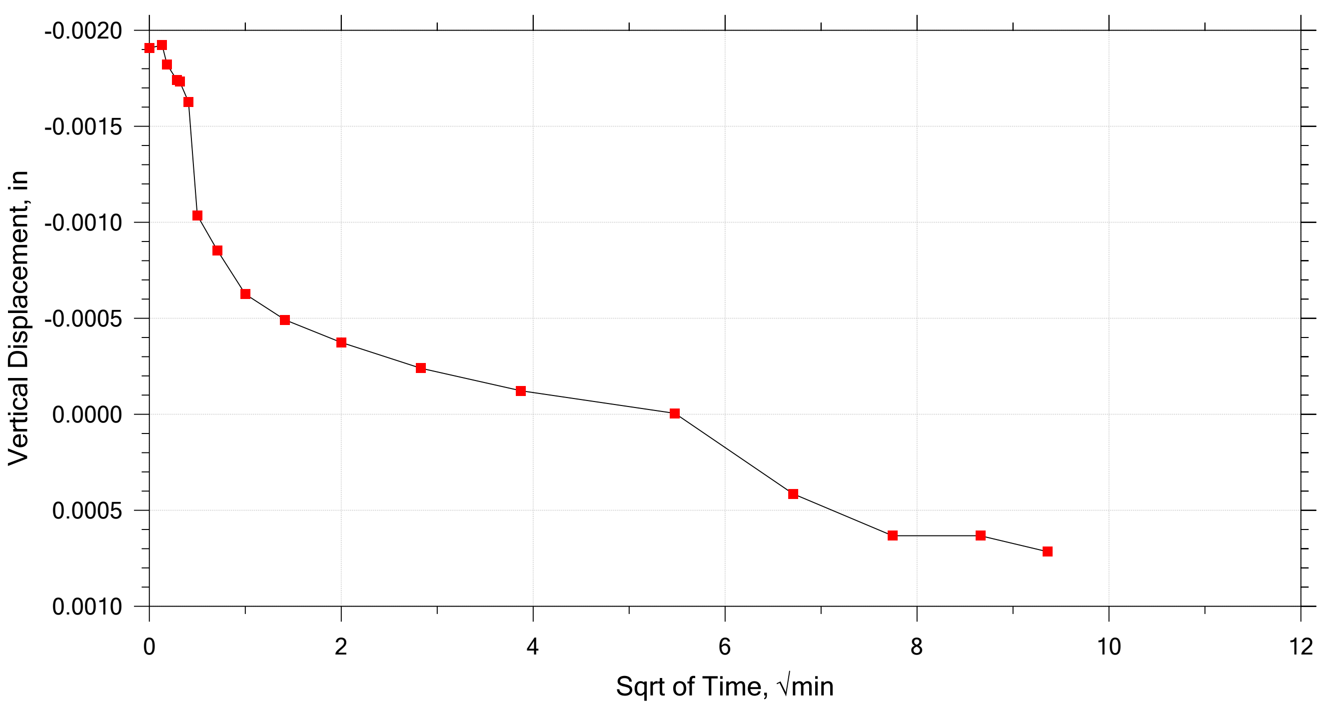
Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 2 of 7

Constant Load Step

Stress: 312 psf





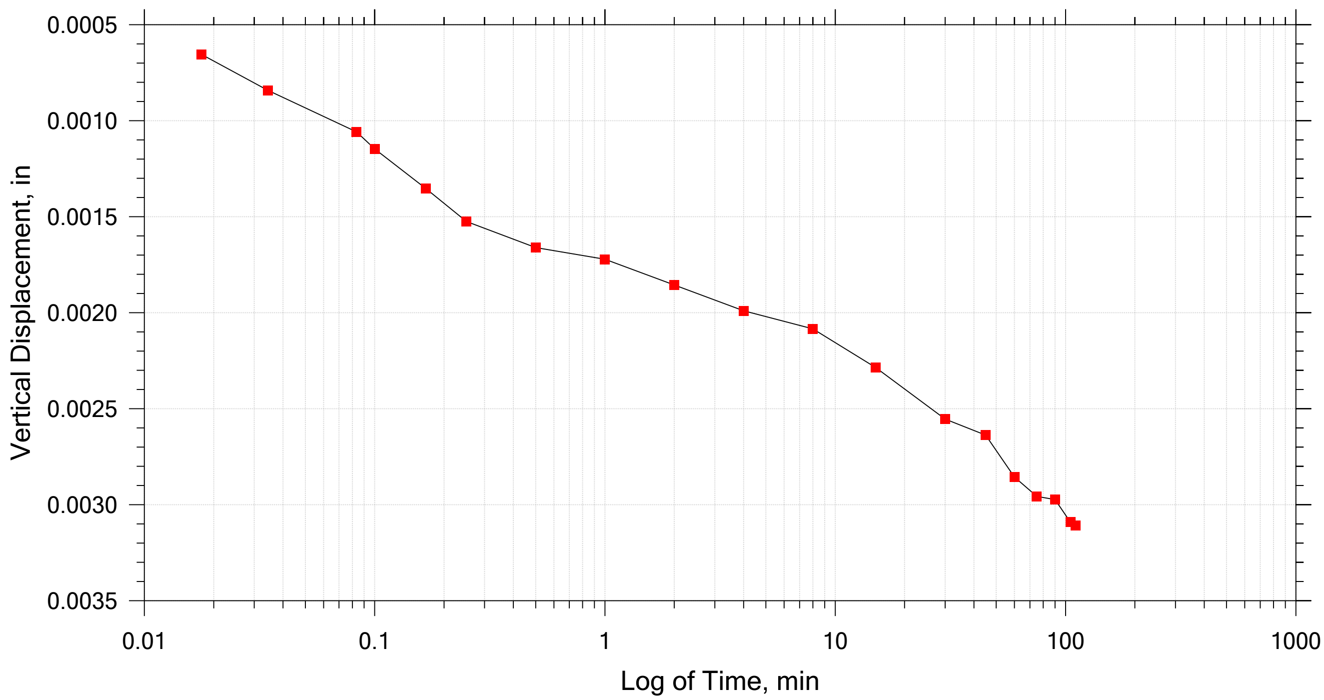
Soil Metrics LLC			
	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/14/2020	Depth: 20.65
	Test Number: DSS 121	Preparation: wet	Elevation: 22.95
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2350 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

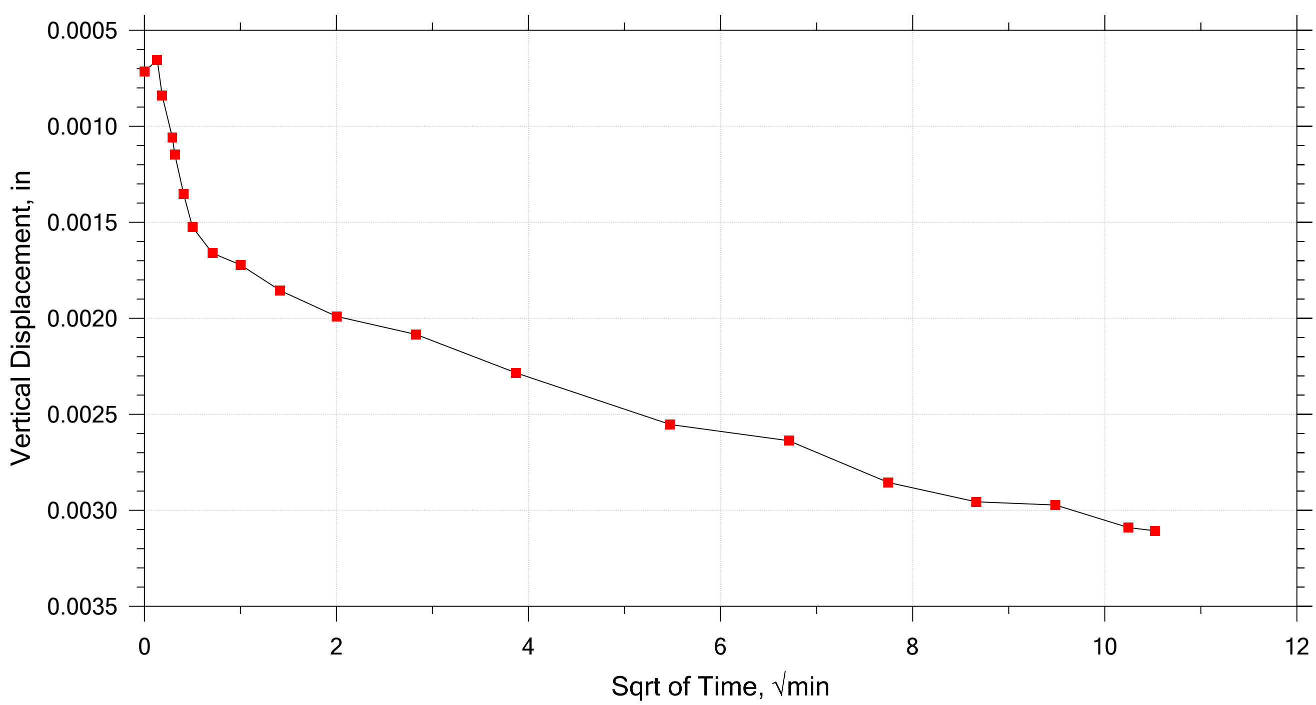
Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 3 of 7

Constant Load Step

Stress: 468 psf





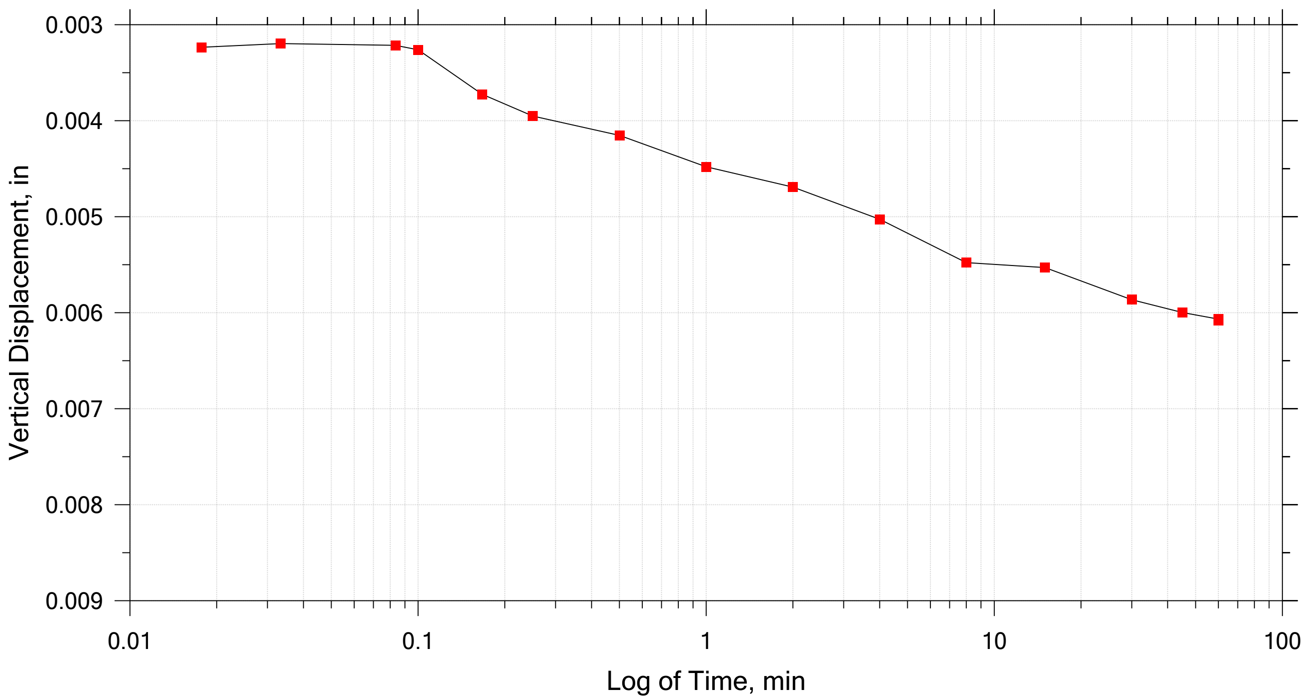
Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/14/2020	Depth: 20.65
	Test Number: DSS 121	Preparation: wet	Elevation: 22.95
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2350 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

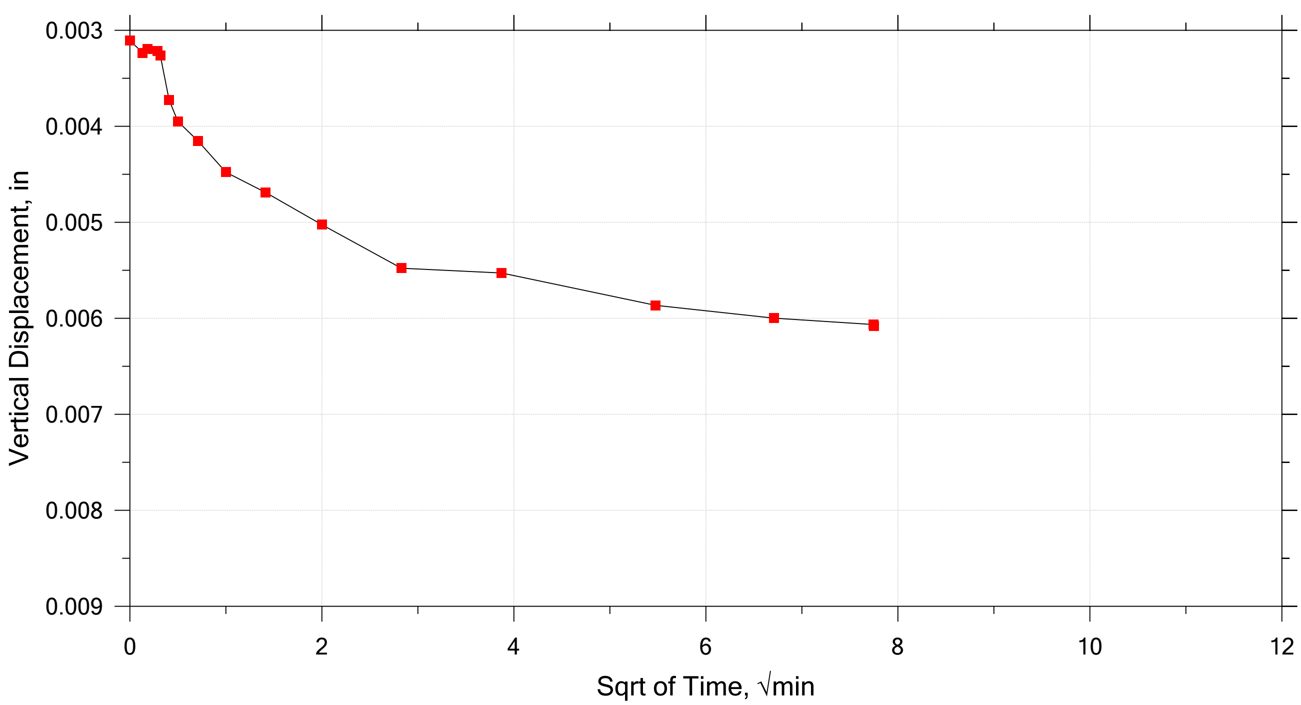
Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 4 of 7

Constant Load Step

Stress: 702 psf





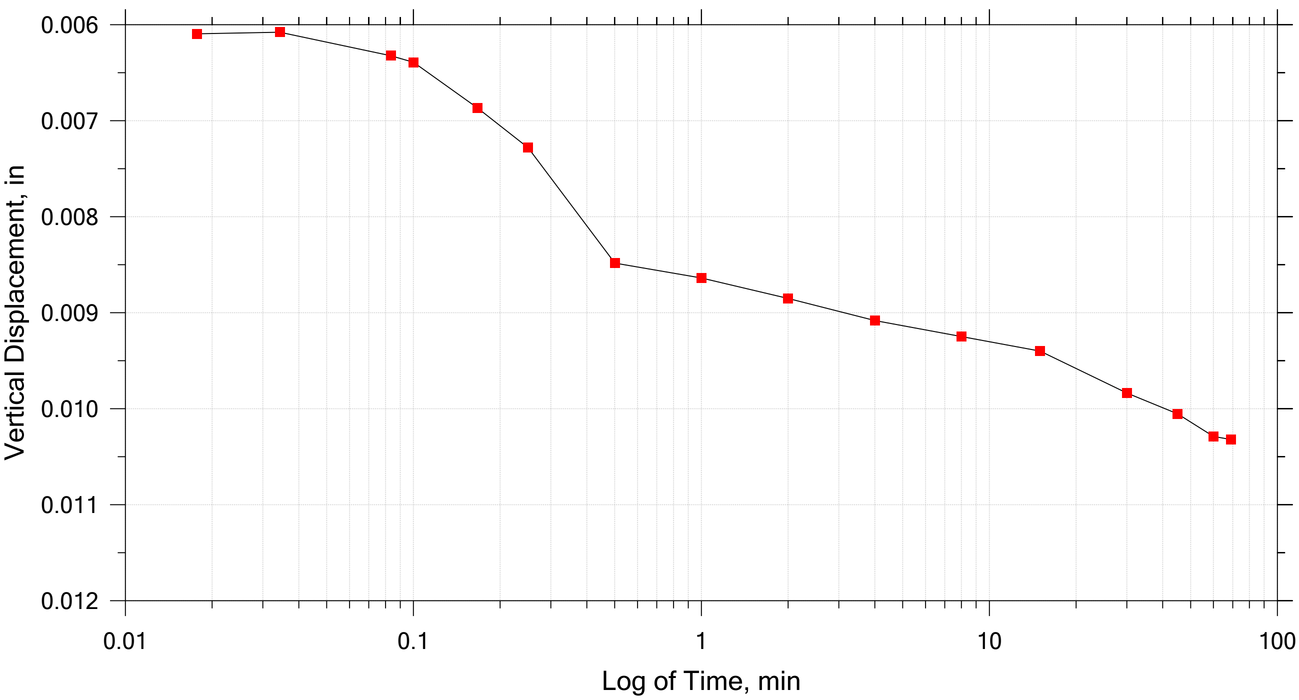
Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/14/2020	Depth: 20.65
	Test Number: DSS 121	Preparation: wet	Elevation: 22.95
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2350 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

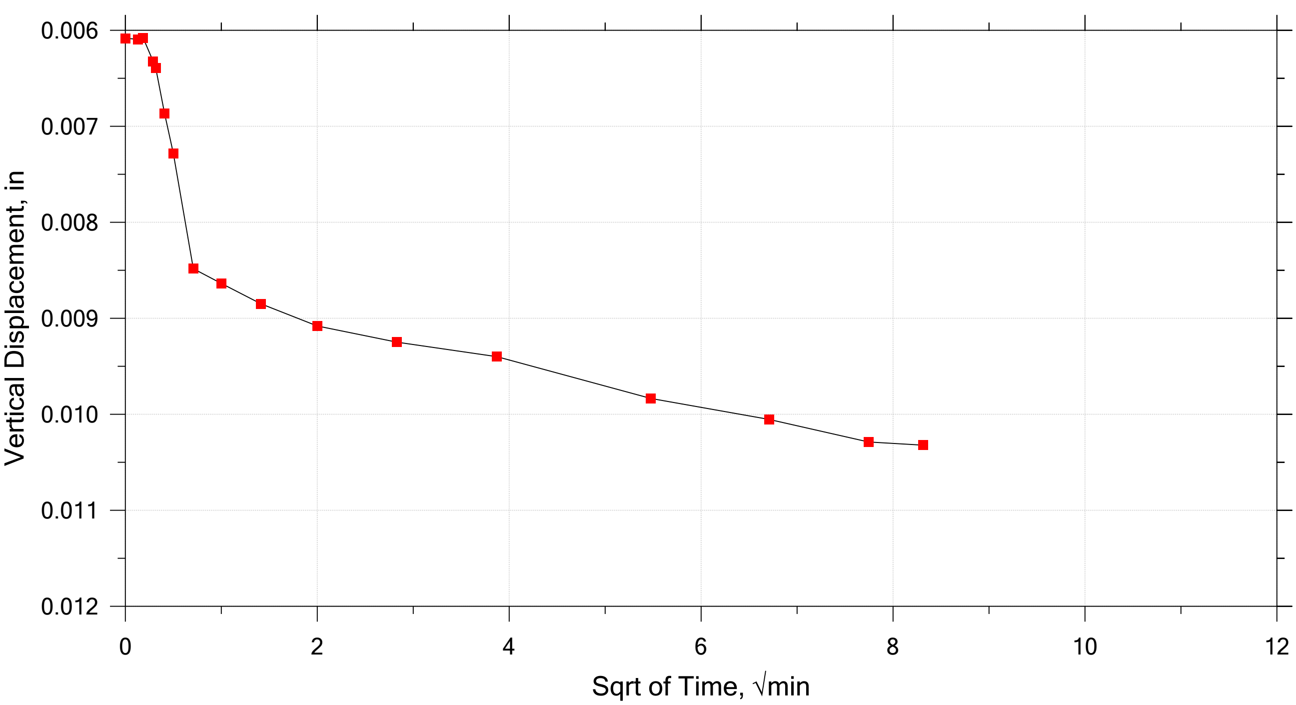
Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 5 of 7

Constant Load Step

Stress: 1.05e+03 psf





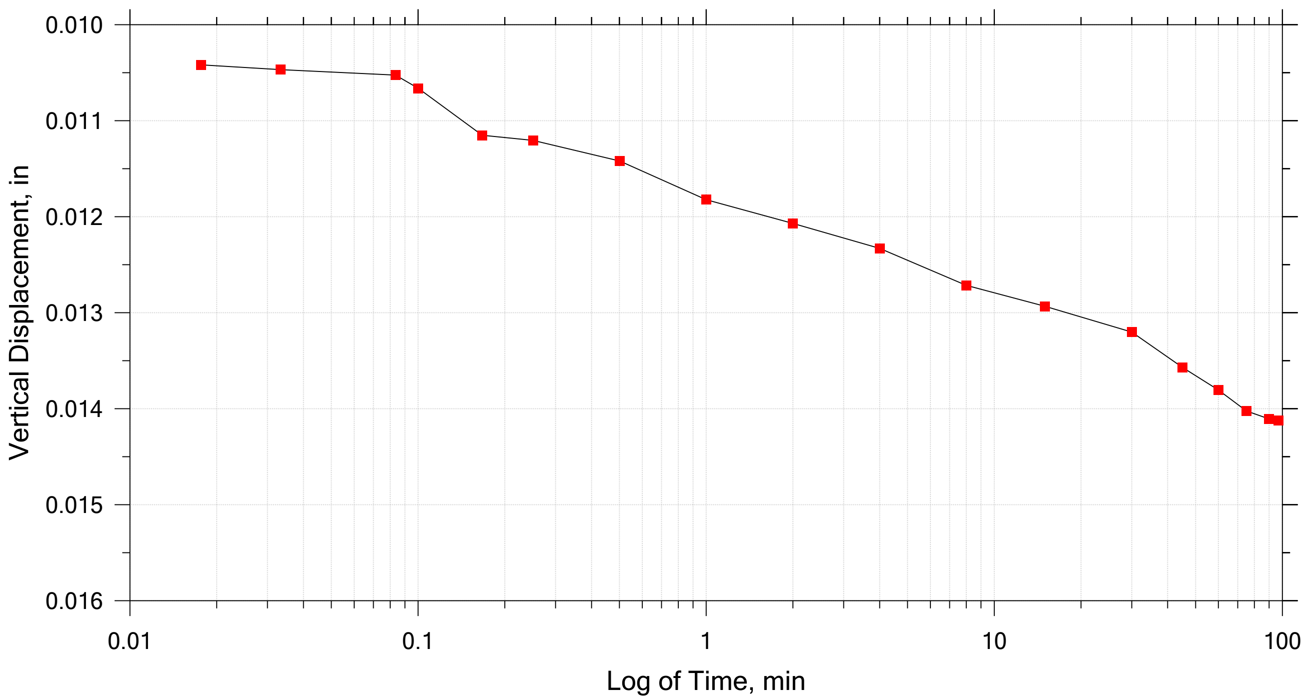
Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/14/2020	Depth: 20.65
	Test Number: DSS 121	Preparation: wet	Elevation: 22.95
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2350 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

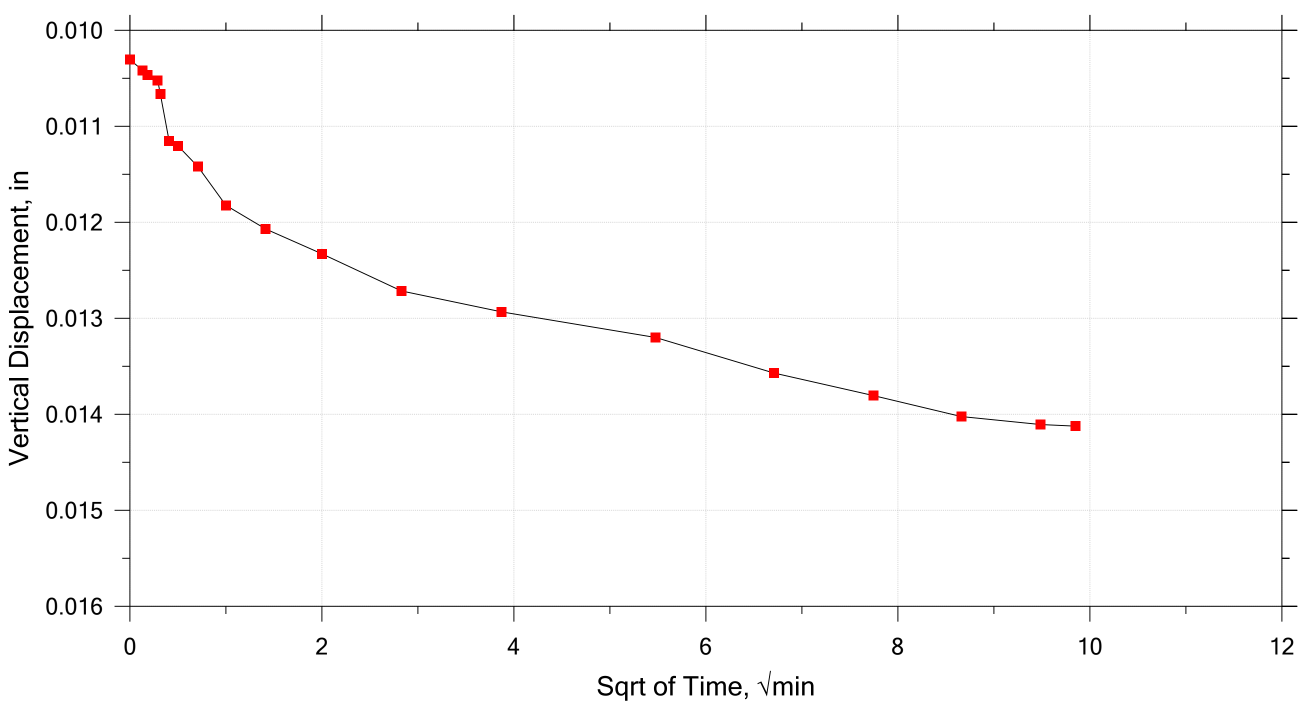
Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 6 of 7

Constant Load Step

Stress: 1.4e+03 psf





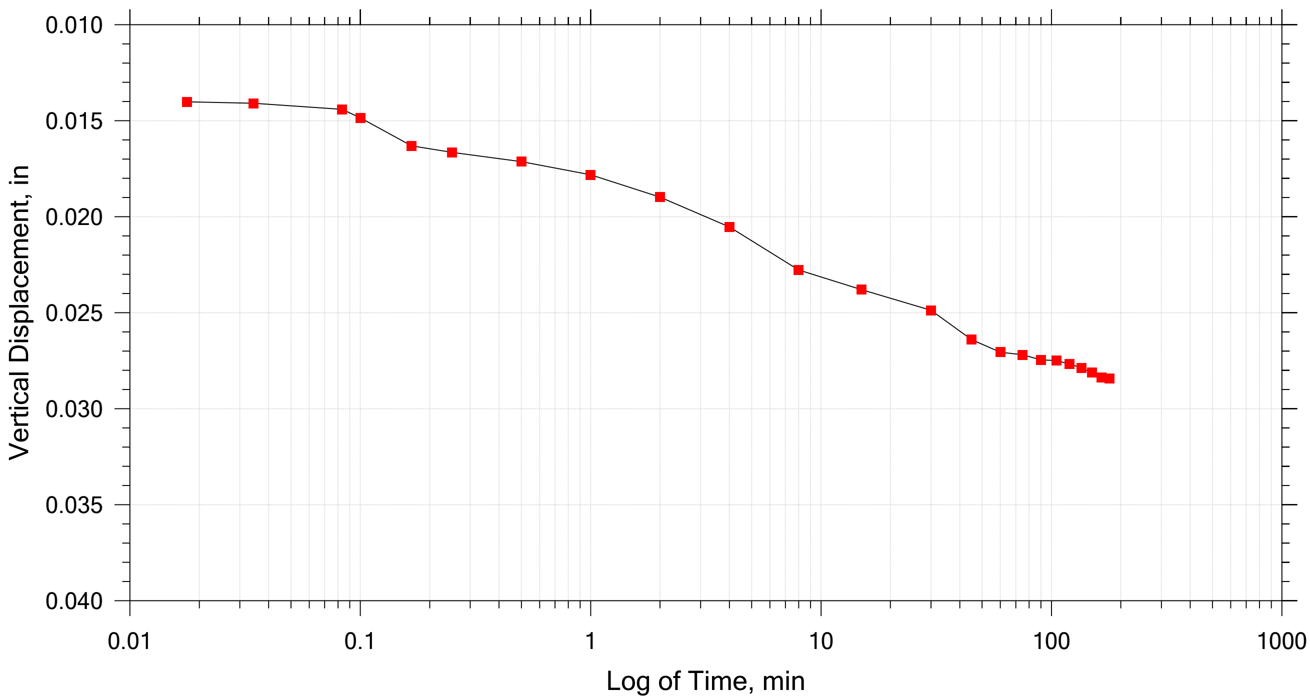
Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/14/2020	Depth: 20.65
	Test Number: DSS 121	Preparation: wet	Elevation: 22.95
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2350 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

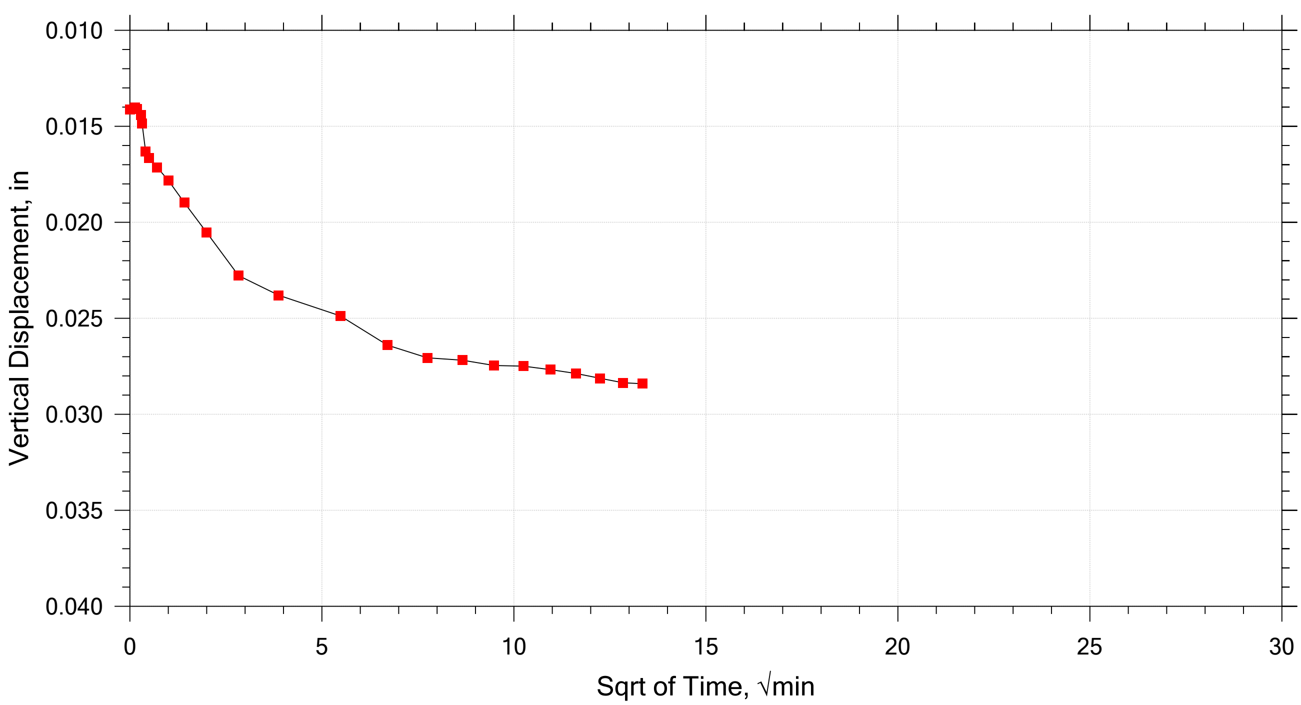
Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 7 of 7

Constant Load Step

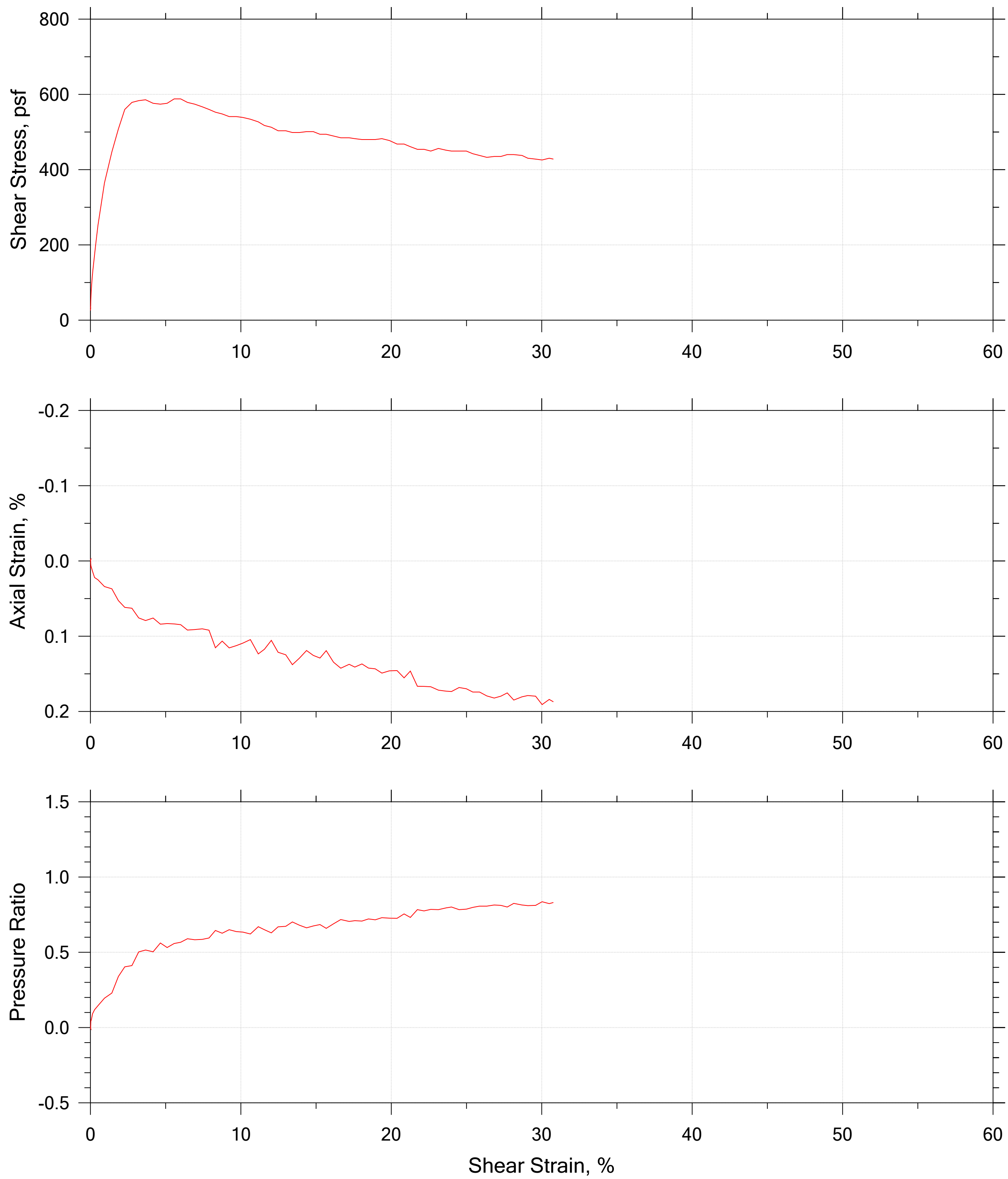
Stress: 2.35e+03 psf





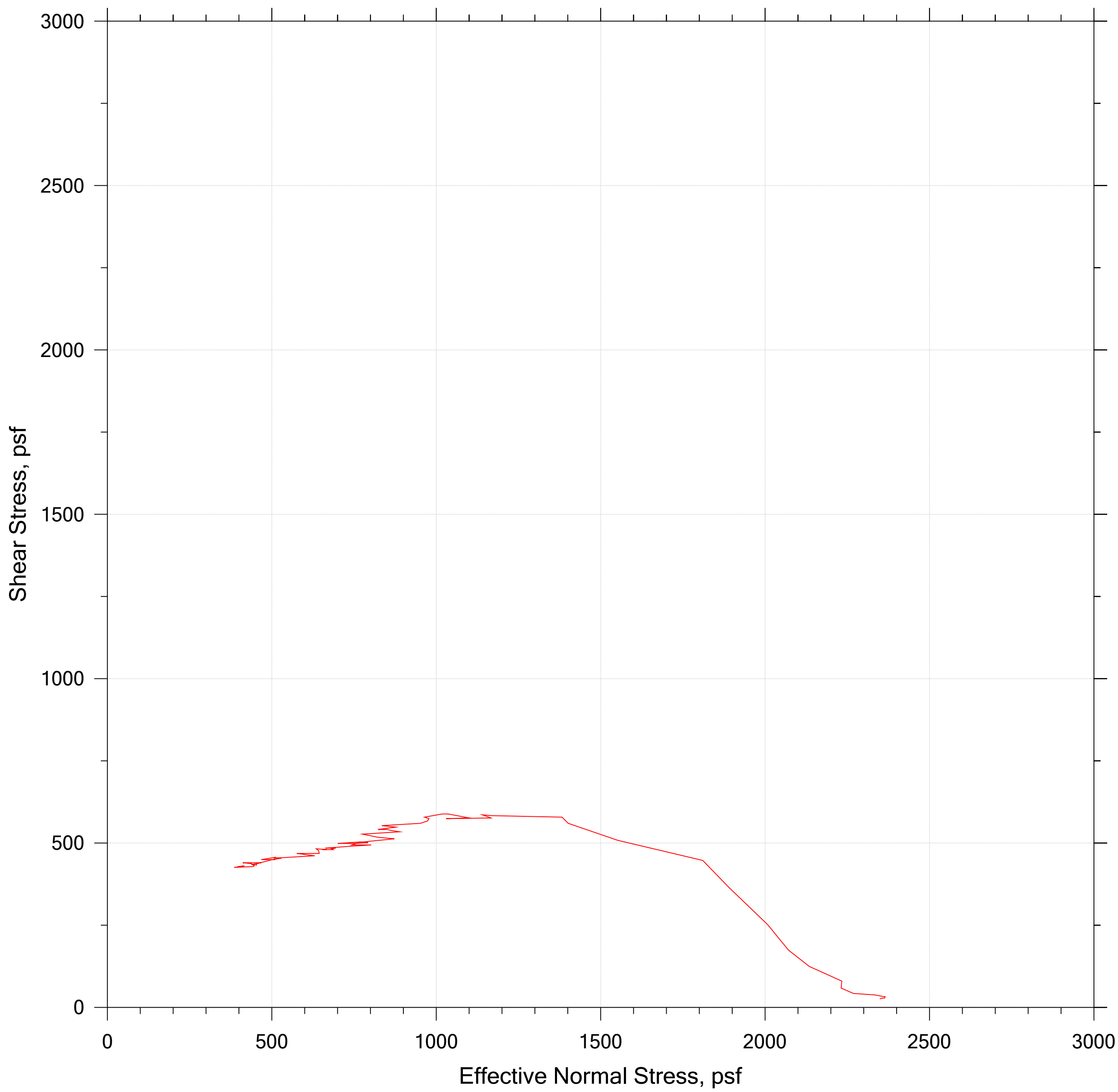
Soil Metrics LLC			
	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/14/2020	Depth: 20.65
	Test Number: DSS 121	Preparation: wet	Elevation: 22.95
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2350 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

Direct Simple Shear Test by ASTM D6528



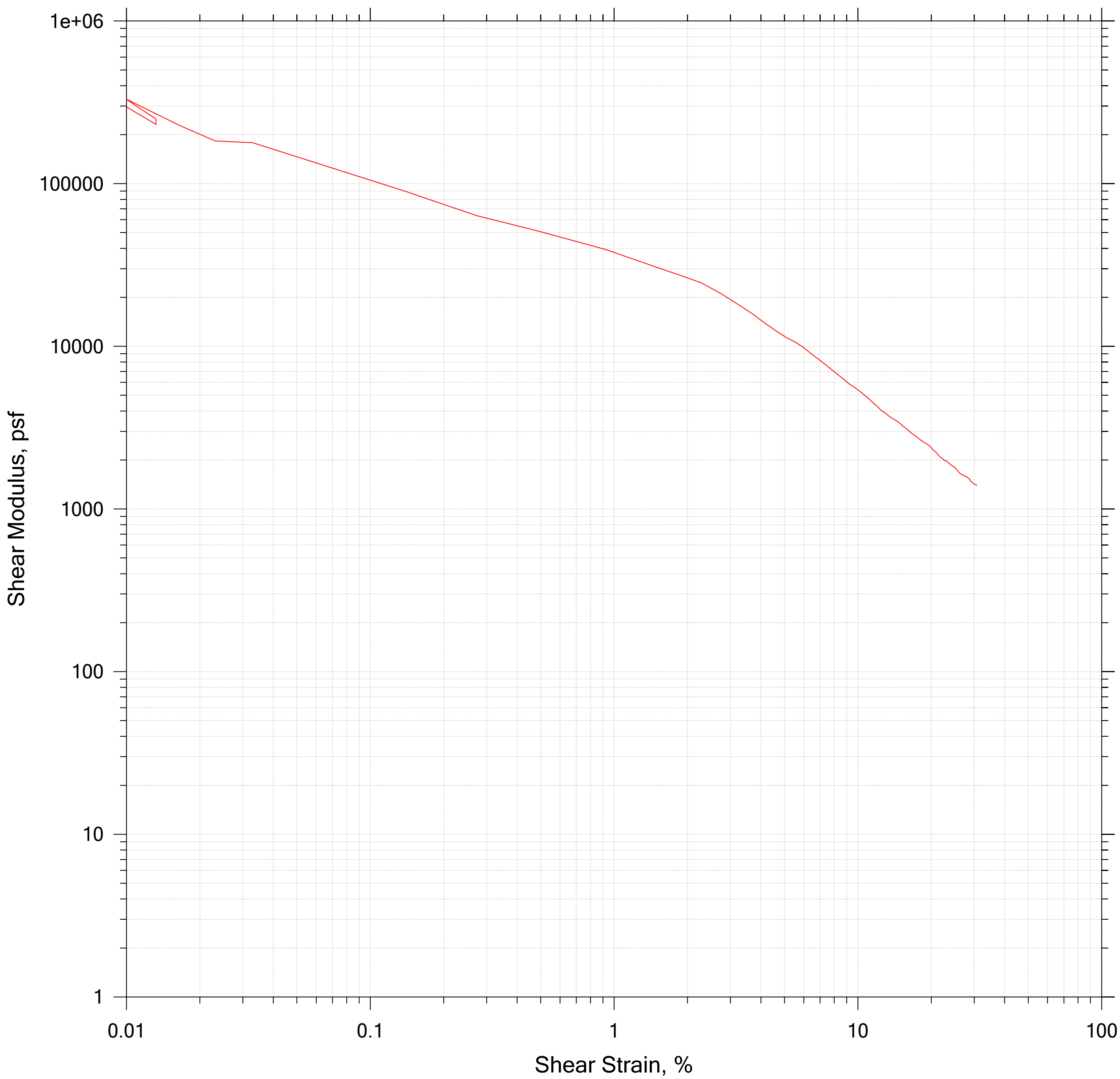
Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/14/2020	Depth: 20.65
	Test Number: DSS 121	Preparation: wet	Elevation: 22.95
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2350 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

Direct Simple Shear Test by ASTM D6528



Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/14/2020	Depth: 20.65
	Test Number: DSS 121	Preparation: wet	Elevation: 22.95
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2350 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

Direct Simple Shear Test by ASTM D6528



Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/14/2020	Depth: 20.65
	Test Number: DSS 121	Preparation: wet	Elevation: 22.95
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2350 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

Direct Simple Shear Test by ASTM D6528

Specimen Dimension, in: 2.50	Specific Gravity: 2.81 (Implied)	Liquid Limit: 0
Specimen Height, in: 1.00	Initial Void Ratio: 1.17	Plastic Limit: 0
Final Height, in: 0.97	Final Void Ratio: 1.11	Plasticity Index: 0

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	217	---		305
Mass Container, gm	36.9	0	0	60.73
Mass Container + Wet Soil, gm	142.52	147.09	145.19	205.92
Mass Container + Dry Soil, gm	113.41	104.12	104.12	164.85
Mass Dry Soil, gm	76.51	104.12	104.12	104.12
Water Content, %	38.05	41.27	39.44	39.44
Void Ratio	---	1.17	1.11	---
Degree of Saturation, %	---	98.78	100.00	---
Dry Unit Weight, pcf	---	80.677	83.187	---

Warning: The change in the sample wet weight during the test is not consistent with the change in the moisture content.

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: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/14/2020	Depth: 20.65
	Test Number: DSS 121	Preparation: wet	Elevation: 22.95
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2350 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 1 of 7

Constant Load Step

Stress: 208 psf

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	0.000	0.0000	0.0000	0.000	1.17
0.017	0.129	42.3	0.002298	-0.002264	-0.226	1.18
0.033	0.183	79.9	0.002400	-0.002333	-0.233	1.18
0.083	0.289	143.	0.002572	-0.002488	-0.248	1.18
0.100	0.317	153.	0.002597	-0.002463	-0.246	1.18
0.167	0.409	179.	0.002667	-0.002449	-0.244	1.18
0.251	0.500	193.	0.002705	-0.002219	-0.221	1.18
0.501	0.708	205.	0.002737	-0.002083	-0.208	1.18
1.001	1.000	205.	0.002737	-0.002033	-0.203	1.18
2.001	1.414	207.	0.002744	-0.002006	-0.200	1.18
4.000	2.000	207.	0.002744	-0.001989	-0.198	1.18
8.001	2.829	207.	0.002744	-0.001955	-0.195	1.18
15.001	3.873	207.	0.002744	-0.001922	-0.192	1.18
30.001	5.477	207.	0.002744	-0.001955	-0.195	1.18
45.000	6.708	207.	0.002744	-0.001905	-0.190	1.18
60.001	7.746	209.	0.002750	-0.001911	-0.191	1.18
60.073	7.751	207.	0.002746	-0.001908	-0.190	1.18

Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
Sample Number: 3U	Test Date: 11/14/2020	Depth: 20.65
Test Number: DSS 121	Preparation: wet	Elevation: 22.95
Description: Gray silty Clay		
Remarks: Sample consolidated to 2350 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 2 of 7

Constant Load Step

Stress: 312 psf

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	207.	0.002746	-0.001908	-0.190	1.18
0.018	0.133	226.	0.002794	-0.001922	-0.192	1.18
0.034	0.185	205.	0.002760	-0.001821	-0.182	1.18
0.083	0.289	233.	0.002814	-0.001740	-0.174	1.18
0.100	0.316	242.	0.002839	-0.001732	-0.173	1.18
0.167	0.408	277.	0.002935	-0.001626	-0.162	1.18
0.250	0.500	301.	0.002998	-0.001036	-0.103	1.18
0.501	0.708	308.	0.003017	-0.0008539	-0.0852	1.18
1.000	1.000	310.	0.003024	-0.0006254	-0.0624	1.17
2.000	1.414	310.	0.003024	-0.0004913	-0.0490	1.17
4.000	2.000	310.	0.003024	-0.0003739	-0.0373	1.17
8.001	2.829	310.	0.003024	-0.0002397	-0.0239	1.17
15.001	3.873	310.	0.003024	-0.0001223	-0.0122	1.17
30.000	5.477	310.	0.003024	-4.916e-06	-0.000491	1.17
45.000	6.708	310.	0.003024	0.0004144	0.0414	1.17
60.001	7.746	310.	0.003024	0.0006324	0.0631	1.17
75.000	8.660	310.	0.003024	0.0006324	0.0631	1.17
87.649	9.362	310.	0.003024	0.0007162	0.0715	1.17

Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
Sample Number: 3U	Test Date: 11/14/2020	Depth: 20.65
Test Number: DSS 121	Preparation: wet	Elevation: 22.95
Description: Gray silty Clay		
Remarks: Sample consolidated to 2350 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 3 of 7

Constant Load Step

Stress: 468 psf

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	310.	0.003024	0.0007162	0.0715	1.17
0.018	0.133	346.	0.003119	0.0006543	0.0653	1.17
0.034	0.185	334.	0.003100	0.0008412	0.0840	1.17
0.083	0.289	376.	0.003202	0.001058	0.106	1.17
0.100	0.316	393.	0.003247	0.001147	0.115	1.17
0.167	0.408	447.	0.003393	0.001353	0.135	1.17
0.250	0.500	451.	0.003406	0.001525	0.152	1.17
0.501	0.708	463.	0.003438	0.001661	0.166	1.17
1.001	1.000	466.	0.003444	0.001722	0.172	1.17
2.000	1.414	466.	0.003444	0.001856	0.185	1.17
4.000	2.000	466.	0.003444	0.001990	0.199	1.17
8.001	2.829	468.	0.003450	0.002084	0.208	1.17
15.001	3.873	468.	0.003450	0.002285	0.228	1.17
30.000	5.477	468.	0.003450	0.002554	0.255	1.17
45.001	6.708	468.	0.003450	0.002638	0.263	1.17
60.000	7.746	468.	0.003450	0.002856	0.285	1.17
75.000	8.660	468.	0.003450	0.002956	0.295	1.17
90.001	9.487	468.	0.003450	0.002973	0.297	1.17
105.000	10.247	468.	0.003450	0.003090	0.308	1.17
110.684	10.521	468.	0.003450	0.003107	0.310	1.17

Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
Sample Number: 3U	Test Date: 11/14/2020	Depth: 20.65
Test Number: DSS 121	Preparation: wet	Elevation: 22.95
Description: Gray silty Clay		
Remarks: Sample consolidated to 2350 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 4 of 7

Constant Load Step

Stress: 702 psf

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	468.	0.003450	0.003107	0.310	1.17
0.018	0.133	470.	0.003457	0.003235	0.323	1.17
0.033	0.183	503.	0.003546	0.003196	0.319	1.17
0.083	0.289	583.	0.003762	0.003214	0.321	1.17
0.100	0.316	609.	0.003832	0.003262	0.326	1.17
0.167	0.409	679.	0.004023	0.003725	0.372	1.17
0.250	0.500	675.	0.004016	0.003951	0.394	1.16
0.501	0.708	689.	0.004049	0.004152	0.414	1.16
1.000	1.000	698.	0.004074	0.004479	0.447	1.16
2.001	1.415	701.	0.004081	0.004691	0.468	1.16
4.001	2.000	701.	0.004081	0.005026	0.502	1.16
8.000	2.828	701.	0.004081	0.005479	0.547	1.16
15.001	3.873	701.	0.004081	0.005529	0.552	1.16
30.000	5.477	701.	0.004081	0.005865	0.585	1.16
45.000	6.708	701.	0.004081	0.005999	0.599	1.16
60.001	7.746	701.	0.004081	0.006066	0.605	1.16
60.118	7.754	701.	0.004081	0.006083	0.607	1.16

Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
Sample Number: 3U	Test Date: 11/14/2020	Depth: 20.65
Test Number: DSS 121	Preparation: wet	Elevation: 22.95
Description: Gray silty Clay		
Remarks: Sample consolidated to 2350 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 5 of 7

Constant Load Step

Stress: 1053 psf

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	701.	0.004081	0.006083	0.607	1.16
0.018	0.133	734.	0.004170	0.006094	0.608	1.16
0.034	0.185	783.	0.004304	0.006078	0.607	1.16
0.083	0.289	903.	0.004628	0.006323	0.631	1.16
0.100	0.316	933.	0.004711	0.006391	0.638	1.16
0.167	0.408	1.03e+03	0.004958	0.006866	0.685	1.16
0.250	0.500	1.01e+03	0.004944	0.007282	0.727	1.16
0.501	0.708	1.04e+03	0.004967	0.008483	0.847	1.16
1.001	1.000	1.05e+03	0.004981	0.008637	0.862	1.15
2.000	1.414	1.05e+03	0.004985	0.008851	0.883	1.15
4.001	2.000	1.05e+03	0.004990	0.009081	0.906	1.15
8.001	2.829	1.05e+03	0.004990	0.009249	0.923	1.15
15.001	3.873	1.05e+03	0.004990	0.009400	0.938	1.15
30.001	5.477	1.05e+03	0.004990	0.009836	0.982	1.15
45.000	6.708	1.05e+03	0.004990	0.01005	1.00	1.15
60.001	7.746	1.05e+03	0.004990	0.01029	1.03	1.15
69.126	8.314	1.05e+03	0.004990	0.01032	1.03	1.15

Soil Metrics LLC			
	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/14/2020	Depth: 20.65
	Test Number: DSS 121	Preparation: wet	Elevation: 22.95
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2350 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 6 of 7

Constant Load Step

Stress: 1400 psf

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	1.05e+03	0.004990	0.01031	1.03	1.15
0.018	0.133	1.11e+03	0.005095	0.01042	1.04	1.15
0.033	0.183	1.17e+03	0.005214	0.01047	1.04	1.15
0.083	0.289	1.30e+03	0.005474	0.01053	1.05	1.15
0.100	0.317	1.33e+03	0.005538	0.01066	1.06	1.15
0.167	0.409	1.37e+03	0.005602	0.01115	1.11	1.15
0.251	0.501	1.37e+03	0.005616	0.01121	1.12	1.15
0.501	0.708	1.39e+03	0.005653	0.01142	1.14	1.15
1.001	1.000	1.39e+03	0.005653	0.01182	1.18	1.15
2.000	1.414	1.39e+03	0.005657	0.01207	1.20	1.15
4.001	2.000	1.40e+03	0.005666	0.01233	1.23	1.15
8.001	2.829	1.40e+03	0.005666	0.01271	1.27	1.15
15.000	3.873	1.40e+03	0.005666	0.01293	1.29	1.15
30.000	5.477	1.40e+03	0.005666	0.01320	1.32	1.14
45.001	6.708	1.40e+03	0.005666	0.01357	1.35	1.14
60.000	7.746	1.40e+03	0.005666	0.01380	1.38	1.14
75.000	8.660	1.40e+03	0.005666	0.01402	1.40	1.14
90.000	9.487	1.40e+03	0.005666	0.01411	1.41	1.14
97.069	9.852	1.40e+03	0.005666	0.01412	1.41	1.14

Soil Metrics LLC			
	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/14/2020	Depth: 20.65
	Test Number: DSS 121	Preparation: wet	Elevation: 22.95
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2350 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

Direct Simple Shear Test by ASTM D6528

Consolidation Time Curve 7 of 7

Constant Load Step

Stress: 2350 psf

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	1.40e+03	0.005666	0.01412	1.41	1.14
0.018	0.133	1.58e+03	0.006027	0.01401	1.40	1.14
0.034	0.185	1.72e+03	0.006288	0.01409	1.41	1.14
0.083	0.289	2.01e+03	0.006841	0.01441	1.44	1.14
0.100	0.316	2.09e+03	0.006924	0.01485	1.48	1.14
0.167	0.408	2.28e+03	0.007125	0.01630	1.63	1.14
0.250	0.500	2.27e+03	0.007114	0.01665	1.66	1.14
0.501	0.708	2.33e+03	0.007168	0.01713	1.71	1.14
1.001	1.000	2.33e+03	0.007175	0.01781	1.78	1.13
2.000	1.414	2.34e+03	0.007185	0.01898	1.89	1.13
4.001	2.000	2.35e+03	0.007190	0.02053	2.05	1.13
8.001	2.829	2.35e+03	0.007192	0.02278	2.27	1.12
15.000	3.873	2.35e+03	0.007191	0.02380	2.38	1.12
30.001	5.477	2.35e+03	0.007191	0.02488	2.48	1.12
45.001	6.708	2.35e+03	0.007191	0.02640	2.63	1.12
60.001	7.746	2.35e+03	0.007191	0.02706	2.70	1.11
75.001	8.660	2.35e+03	0.007192	0.02719	2.71	1.11
90.001	9.487	2.35e+03	0.007192	0.02746	2.74	1.11
105.001	10.247	2.35e+03	0.007192	0.02749	2.74	1.11
120.000	10.954	2.35e+03	0.007191	0.02768	2.76	1.11
135.001	11.619	2.35e+03	0.007192	0.02788	2.78	1.11
150.000	12.247	2.35e+03	0.007192	0.02813	2.81	1.11
165.000	12.845	2.35e+03	0.007192	0.02836	2.83	1.11
178.189	13.349	2.35e+03	0.007192	0.02841	2.84	1.11

Soil Metrics LLC			
	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/14/2020	Depth: 20.65
	Test Number: DSS 121	Preparation: wet	Elevation: 22.95
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2350 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

Direct Simple Shear Test by ASTM D6528

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
0.00000	0.00000	25.879	0.00000	0.00000	2348.8	0.00000
0.00025000	0.00000	25.879	0.00000	0.00000	2348.8	0.00000
0.017683	0.0033018	28.232	8.5505e+05	-0.0024683	2355.8	-0.0030030
0.034350	0.0066036	28.232	4.2752e+05	-0.0014914	2362.9	-0.0060060
0.083367	0.013207	30.585	2.3158e+05	-0.0017400	2365.2	-0.0070070
0.10002	0.013207	32.937	2.4939e+05	-0.0017400	2365.2	-0.0070070
0.16682	0.0099054	32.937	3.3252e+05	-0.0013884	2360.5	-0.0050050
0.25027	0.016509	37.643	2.2801e+05	0.00054564	2334.7	0.0060060
0.50067	0.023113	42.348	1.8322e+05	0.0071911	2268.8	0.034034
1.0004	0.033018	58.817	1.7814e+05	0.0065590	2231.2	0.050050
2.0002	0.059433	79.991	1.3459e+05	0.0081058	2233.6	0.049049
4.0003	0.13868	124.69	89916.	0.013768	2134.8	0.091091
8.0006	0.27405	174.10	63528.	0.021960	2071.3	0.11812
15.001	0.49527	251.74	50828.	0.024984	2007.9	0.14515
30.000	0.92781	364.66	39304.	0.033923	1890.3	0.19520
45.001	1.4264	447.01	31339.	0.037015	1810.4	0.22923
60.001	1.8556	508.18	27386.	0.052594	1551.7	0.33934
75.000	2.2782	559.94	24578.	0.061659	1401.3	0.40340
90.000	2.7537	578.76	21017.	0.062792	1382.5	0.41141
105.00	3.2028	583.46	18218.	0.075680	1168.5	0.50250
120.00	3.6650	585.82	15984.	0.079102	1140.3	0.51451
135.00	4.1636	576.41	13844.	0.075822	1166.2	0.50350
150.00	4.6522	574.05	12339.	0.084036	1029.8	0.56156
165.00	5.0947	576.41	11314.	0.083232	1100.3	0.53153
180.00	5.5635	588.17	10572.	0.083611	1036.8	0.55856
195.00	5.9961	588.17	9809.2	0.084744	1018.0	0.56657
210.00	6.4517	578.76	8970.6	0.091821	963.96	0.58959
225.00	6.9305	574.05	8283.0	0.091170	978.07	0.58358
240.00	7.4291	566.99	7632.1	0.090239	973.36	0.58559
255.00	7.8847	559.94	7101.5	0.092077	952.20	0.59459
270.00	8.3040	552.88	6657.9	0.11530	834.65	0.64464
285.00	8.7597	548.17	6257.9	0.10646	876.97	0.62663
300.00	9.2220	541.12	5867.7	0.11556	822.89	0.64965
315.00	9.7007	541.12	5578.1	0.11253	851.11	0.63764
330.00	10.130	538.76	5318.5	0.10923	860.51	0.63363
345.00	10.629	534.06	5024.8	0.10448	888.72	0.62162
360.00	11.157	527.00	4723.6	0.12347	775.87	0.66967
375.00	11.570	517.59	4473.7	0.11728	822.89	0.64965
390.00	12.022	512.88	4266.2	0.10553	872.27	0.62863
405.00	12.471	503.47	4037.2	0.12135	778.22	0.66867
420.00	12.979	503.47	3879.0	0.12466	768.82	0.67267
435.00	13.425	498.77	3715.2	0.13785	700.63	0.70170
450.00	13.891	498.77	3590.7	0.12915	752.36	0.67968
465.00	14.366	501.12	3488.2	0.11898	792.33	0.66266
480.00	14.819	501.12	3381.7	0.12545	764.11	0.67467
495.00	15.254	494.06	3238.8	0.12901	742.95	0.68368
510.00	15.670	494.06	3152.8	0.11912	801.73	0.65866
525.00	16.159	489.36	3028.4	0.13443	731.20	0.68869
540.00	16.644	484.65	2911.8	0.14246	663.02	0.71772
555.00	17.196	484.65	2818.4	0.13732	693.58	0.70470

Soil Metrics LLC	Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
	Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
	Sample Number: 3U	Test Date: 11/14/2020	Depth: 20.65
	Test Number: DSS 121	Preparation: wet	Elevation: 22.95
	Description: Gray silty Clay		
	Remarks: Sample consolidated to 2350 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

Direct Simple Shear Test by ASTM D6528

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
570.00	17.572	482.30	2744.7	0.14102	681.82	0.70971
585.00	18.048	479.95	2659.3	0.13678	686.53	0.70771
600.00	18.484	479.95	2596.6	0.14232	653.61	0.72172
615.00	18.936	479.95	2534.6	0.14339	667.72	0.71572
630.00	19.372	482.30	2489.7	0.14893	634.80	0.72973
645.00	19.877	477.59	2402.8	0.14602	641.86	0.72673
660.00	20.385	468.18	2296.7	0.14563	644.21	0.72573
675.00	20.851	468.18	2245.4	0.15538	576.02	0.75475
690.00	21.264	461.12	2168.6	0.14628	630.10	0.73173
705.00	21.729	454.07	2089.7	0.16645	510.19	0.78278
720.00	22.175	454.07	2047.7	0.16674	529.00	0.77477
735.00	22.621	449.36	1986.5	0.16725	505.49	0.78478
750.00	23.129	456.42	1973.3	0.17162	510.19	0.78278
765.00	23.644	451.71	1910.5	0.17293	481.98	0.79479
780.00	23.998	449.36	1872.5	0.17358	467.87	0.80080
795.00	24.506	449.36	1833.7	0.16818	510.19	0.78278
810.00	24.988	449.36	1798.3	0.16976	500.79	0.78679
825.00	25.414	442.30	1740.4	0.17411	474.93	0.79780
840.00	25.870	437.60	1691.5	0.17423	453.77	0.80681
855.00	26.348	432.89	1643.0	0.17940	453.77	0.80681
870.00	26.840	435.24	1621.6	0.18216	437.31	0.81381
885.00	27.280	435.24	1595.5	0.17965	442.01	0.81181
900.00	27.705	439.95	1588.0	0.17530	467.87	0.80080
915.00	28.138	439.95	1563.5	0.18479	411.45	0.82482
930.00	28.689	437.60	1525.3	0.18044	437.31	0.81381
945.00	29.079	430.54	1480.6	0.17886	446.71	0.80981
960.00	29.591	428.19	1447.0	0.17965	442.01	0.81181
975.00	30.027	425.83	1418.2	0.19087	385.58	0.83584
990.00	30.499	430.54	1411.7	0.18400	416.15	0.82282
999.38	30.773	428.19	1391.4	0.18717	397.34	0.83083

Soil Metrics LLC

Project Name: Bucknam Road	Location: Falmouth, ME	Project Number: 166-14
Boring Number: BB-FBR-202	Tester: SJR	Checker: sjr
Sample Number: 3U	Test Date: 11/14/2020	Depth: 20.65
Test Number: DSS 121	Preparation: wet	Elevation: 22.95
Description: Gray silty Clay		
Remarks: Sample consolidated to 2350 psf then held for 2 hours before shearing. CKoDSS Test - Constant volume control. 2nd test		

GeoTesting EXPRESS

Client:	GZA GeoEnvironmental, Inc.		
Project:	Replace Bucknam Rd Bridge No. 5830		
Location:	Falmouth, ME	Project No:	GTX-310291
Boring ID: ---	Sample Type: ---	Tested By:	md
Sample ID: ---	Test Date: 08/08/19	Checked By:	bfs
Depth : ---	Test Id: 514120		

Moisture Content of Soil and Rock - ASTM D2216

Boring ID	Sample ID	Depth	Description	Moisture Content,%
BB-FBR-102	1U	34-36	Moist, dark greenish gray clay	39.6
BB-FBR-102	2U	44-46	Moist, dark gray clay	38.1
BB-FBR-104	1U	39-41	Moist, gray clay	40.7
BB-FBR-104	2U	51-53	Moist, dark gray clay	40.7
BB-FBR-104	3U	59-61	Moist, dark greenish gray clay	30.6
BB-FBR-106	1U	34-36	Moist, dark gray clay	42.8
BB-FBR-106	2U	55-57	Moist, dark greenish gray clay	31.5

Notes: Temperature of Drying : 110º Celsius

Client:	GZA GeoEnvironmental, Inc.				
Project:	Replace Bucknam Rd Bridge No. 5830				
Location:	Falmouth, ME			Project No:	GTX-310291
Boring ID:	BB-FBR-103A	Sample Type:	tube	Tested By:	md
Sample ID:	1U	Test Date:	10/04/19	Checked By:	n/a
Depth :	34-36	Test Id:	524074		
Test Comment:	---				
Visual Description:	Moist, gray clay				
Sample Comment:	---				

Moisture Content of Soil and Rock - ASTM D2216

Boring ID	Sample ID	Depth	Description	Moisture Content,%
BB-FBR-103A	1U	34-36	Moist, gray clay	33.0

Notes: Temperature of Drying : 110º Celsius

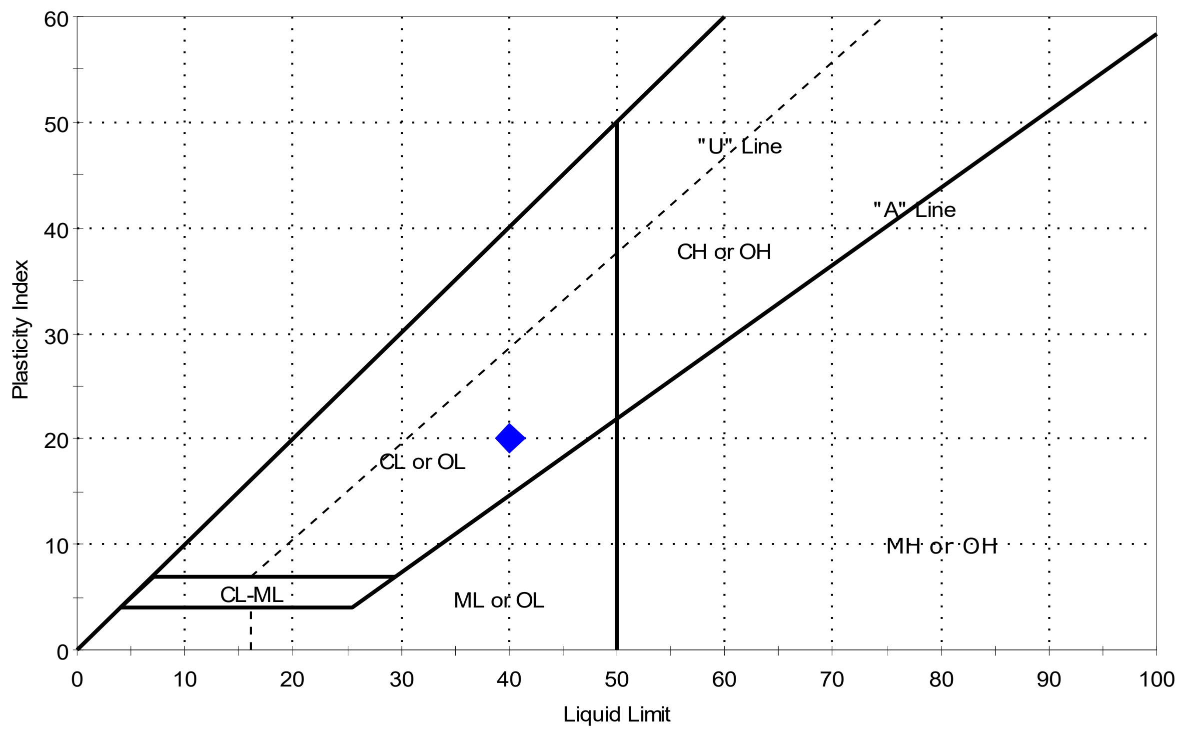
printed 10/4/2019 5:03:39 PM

GeoTesting EXPRESS

Client:	GZA GeoEnvironmental, Inc.				
Project:	Replace Bucknam Rd Bridge No. 5830				
Location:	Falmouth, ME			Project No:	GTX-310291
Boring ID:	BB-FBR-102	Sample Type:	tube	Tested By:	cam
Sample ID:	1U	Test Date:	08/06/19	Checked By:	bfs
Depth :	34-36	Test Id:	514107		
Test Comment:	---				
Visual Description:	Moist, dark greenish gray clay				
Sample Comment:	---				

Atterberg Limits - ASTM D4318

Plasticity Chart



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	1U	B-FBR-10	34-36	40	40	20	20	1	

Sample Prepared using the WET method

Dry Strength: VERY HIGH

Dilatancy: SLOW

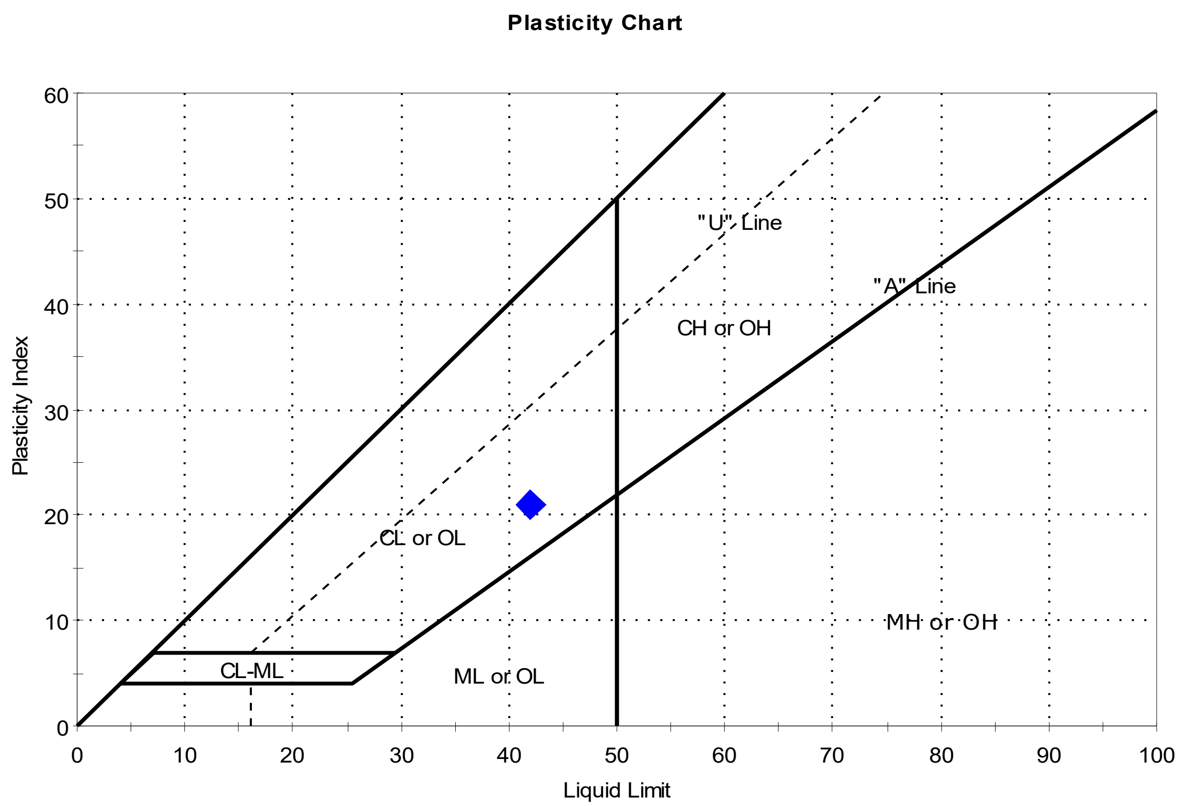
Toughness: LOW

printed 8/9/2019 1:26:36 PM

Client:	GZA GeoEnvironmental, Inc.				
Project:	Replace Bucknam Rd Bridge No. 5830				
Location:	Falmouth, ME			Project No:	GTX-310291
Boring ID:	BB-FBR-102	Sample Type:	tube	Tested By:	cam
Sample ID:	2U	Test Date:	08/07/19	Checked By:	bfs
Depth :	44-46	Test Id:	514108		

Test Comment:	---
Visual Description:	Moist, dark gray clay
Sample Comment:	---

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	2U	B-FBR-10	44-46	38	42	21	21	0.8	

Sample Prepared using the WET method

Dry Strength: VERY HIGH

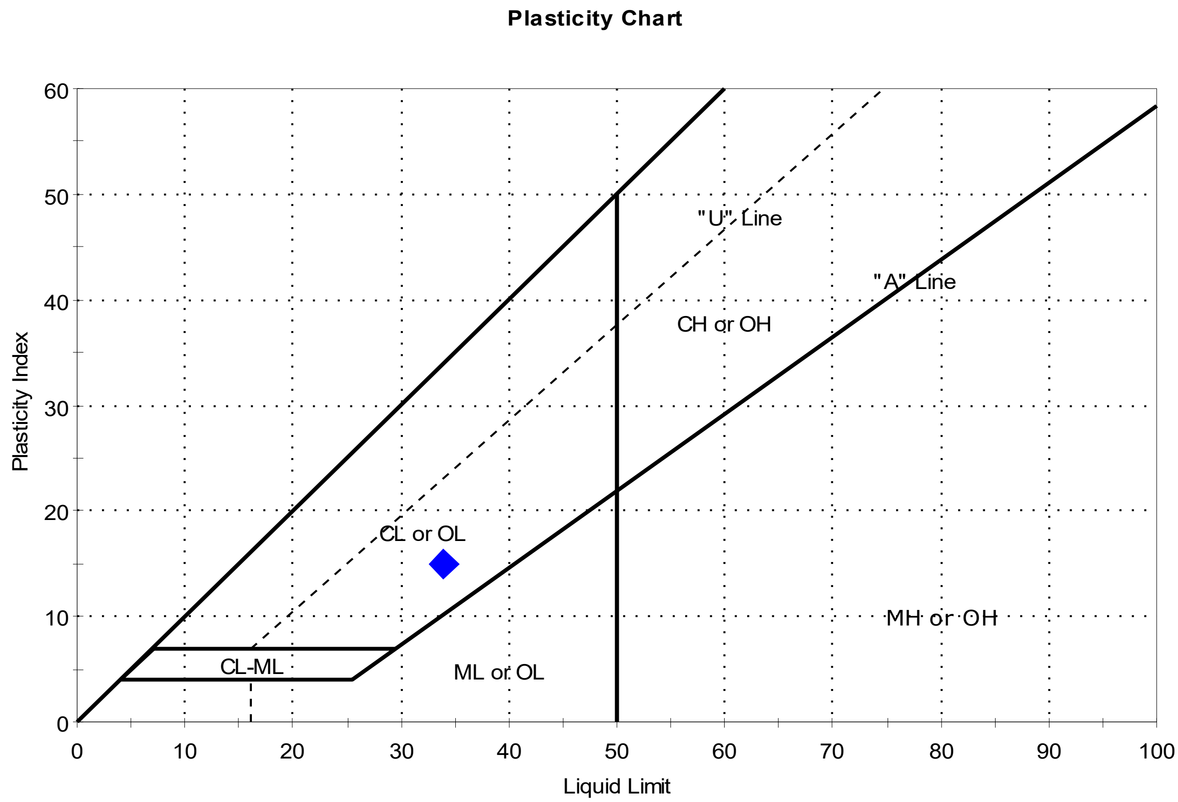
Dilatancy: SLOW

Toughness: LOW

printed 8/9/2019 1:26:37 PM

Client:	GZA GeoEnvironmental, Inc.
Project:	Replace Bucknam Rd Bridge No. 5830
Location:	Falmouth, ME
Project No:	GTX-310291
Boring ID:	BB-FBR-103A
Sample Type:	tube
Tested By:	cam
Sample ID:	1U
Test Date:	09/23/19
Checked By:	emm
Depth :	34-36
Test Id:	524071
Test Comment:	---
Visual Description:	Moist, gray clay
Sample Comment:	---

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	1U	3-FBR-103	34-36	33	34	19	15	0.9	

Sample Prepared using the WET method

Dry Strength: VERY HIGH

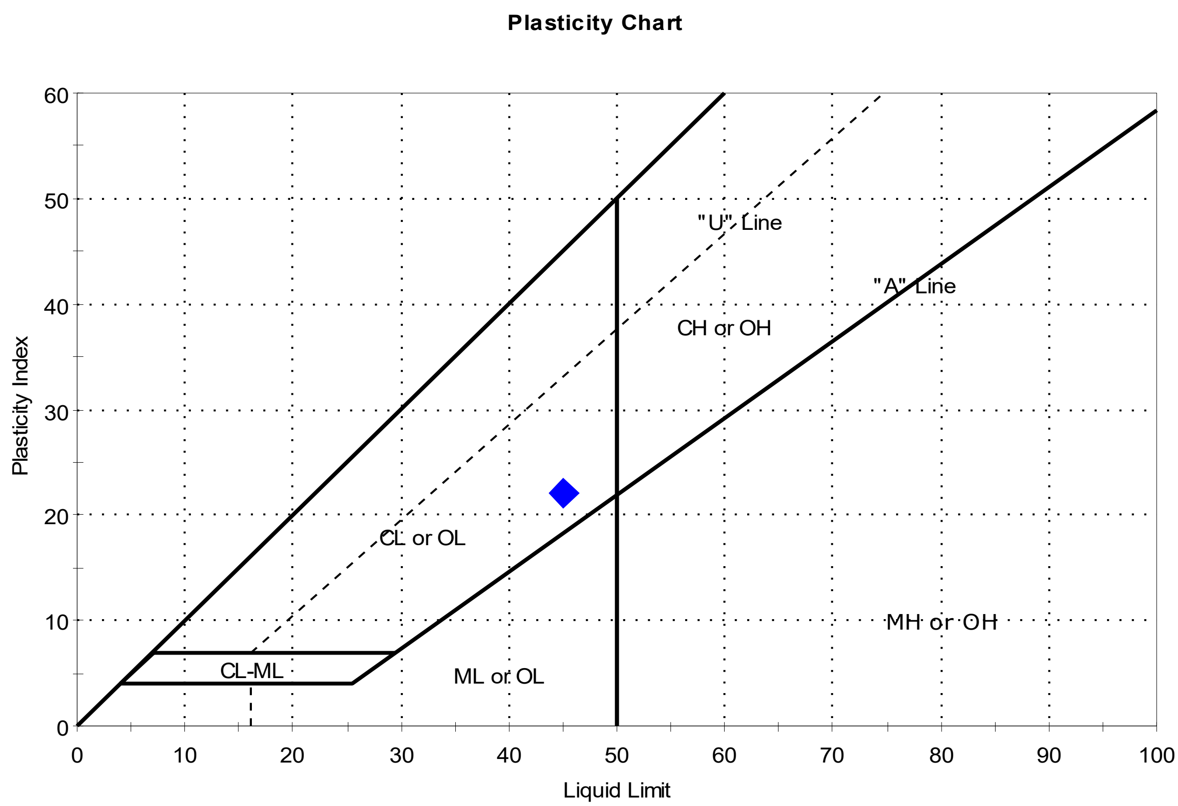
Dilatancy: SLOW

Toughness: LOW

printed 10/4/2019 5:03:02 PM

Client:	GZA GeoEnvironmental, Inc.				
Project:	Replace Bucknam Rd Bridge No. 5830				
Location:	Falmouth, ME			Project No:	GTX-310291
Boring ID:	BB-FBR-104	Sample Type:	tube	Tested By:	cam
Sample ID:	1U	Test Date:	08/06/19	Checked By:	bfs
Depth :	39-41	Test Id:	514109		
Test Comment:	---				
Visual Description:	Moist, gray clay				
Sample Comment:	---				

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	1U	B-FBR-10	39-41	41	45	23	22	0.8	

Sample Prepared using the WET method

Dry Strength: VERY HIGH

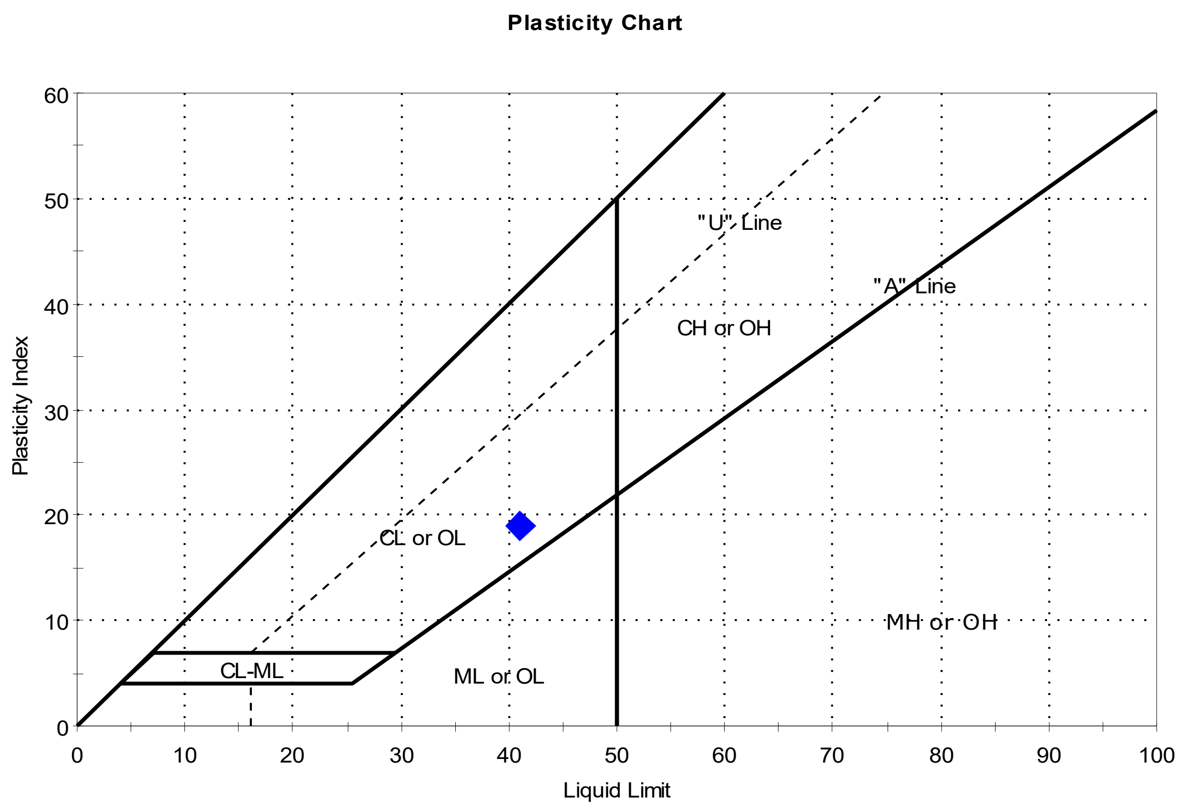
Dilatancy: SLOW

Toughness: LOW

printed 8/9/2019 1:26:37 PM

Client:	GZA GeoEnvironmental, Inc.		
Project:	Replace Bucknam Rd Bridge No. 5830		
Location:	Falmouth, ME	Project No:	GTX-310291
Boring ID: BB-FBR-104	Sample Type: tube	Tested By:	cam
Sample ID: 2U	Test Date: 08/06/19	Checked By:	bfs
Depth : 51-53	Test Id: 514110		
Test Comment:	---		
Visual Description:	Moist, dark gray clay		
Sample Comment:	---		

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	2U	B-FBR-10	51-53	41	41	22	19	1	

Sample Prepared using the WET method

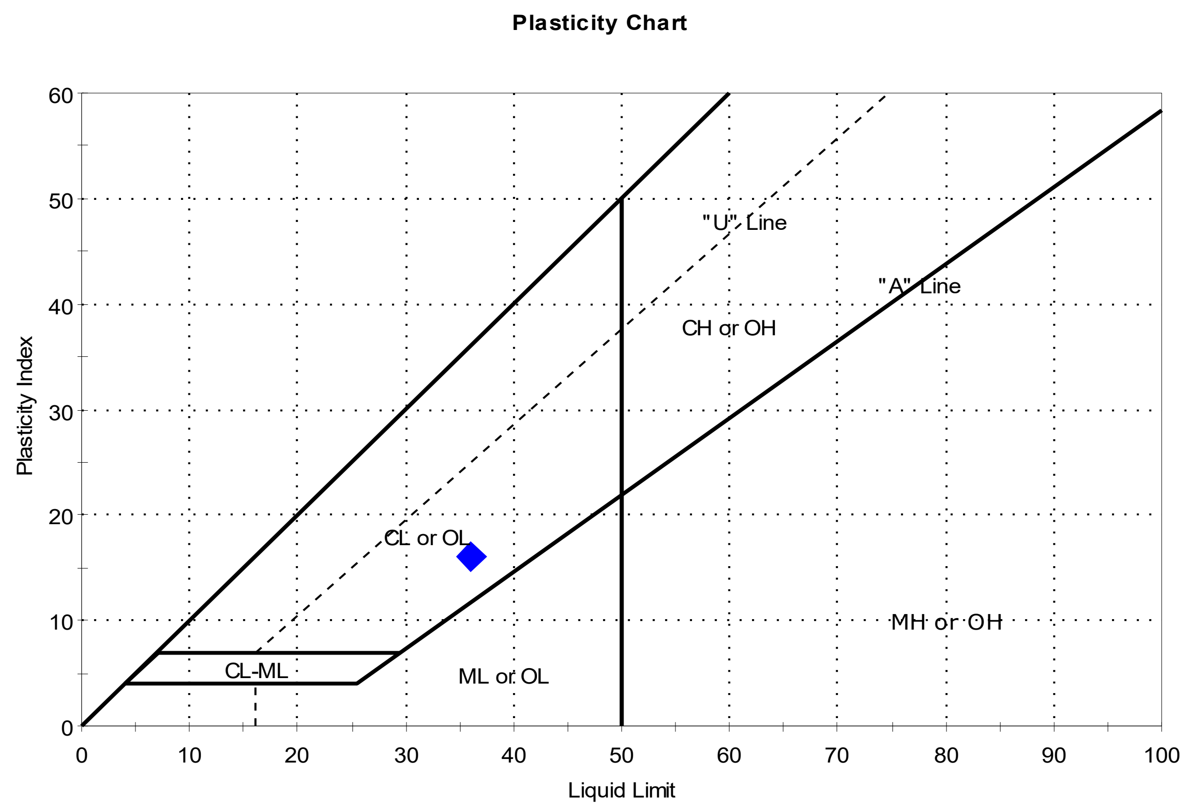
Dry Strength: VERY HIGH

Dilatancy: SLOW

Toughness: LOW

Client:	GZA GeoEnvironmental, Inc.				
Project:	Replace Bucknam Rd Bridge No. 5830				
Location:	Falmouth, ME			Project No:	GTX-310291
Boring ID:	BB-FBR-104	Sample Type:	tube	Tested By:	cam
Sample ID:	3U	Test Date:	08/06/19	Checked By:	bfs
Depth :	59-61	Test Id:	514111		
Test Comment:	---				
Visual Description:	Moist, dark greenish gray clay				
Sample Comment:	---				

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	3U	B-FBR-10	59-61	31	36	20	16	0.7	

Sample Prepared using the WET method

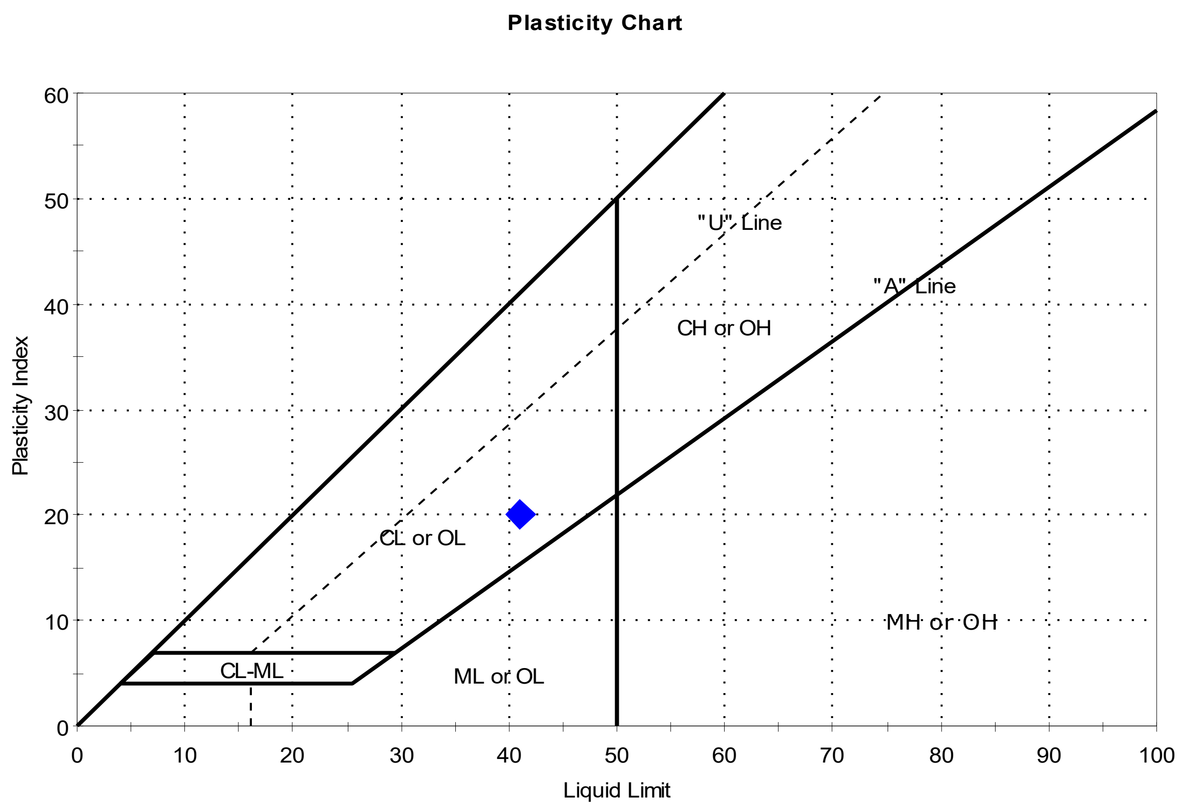
Dry Strength: VERY HIGH

Dilatancy: SLOW

Toughness: LOW

Client:	GZA GeoEnvironmental, Inc.		
Project:	Replace Bucknam Rd Bridge No. 5830		
Location:	Falmouth, ME	Project No:	GTX-310291
Boring ID: BB-FBR-106	Sample Type: tube	Tested By:	cam
Sample ID: 1U	Test Date: 08/06/19	Checked By:	bfs
Depth : 34-36	Test Id: 514112		
Test Comment:	---		
Visual Description:	Moist, dark gray clay		
Sample Comment:	---		

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	1U	B-FBR-10	34-36	43	41	21	20	1.1	

Sample Prepared using the WET method

Dry Strength: VERY HIGH

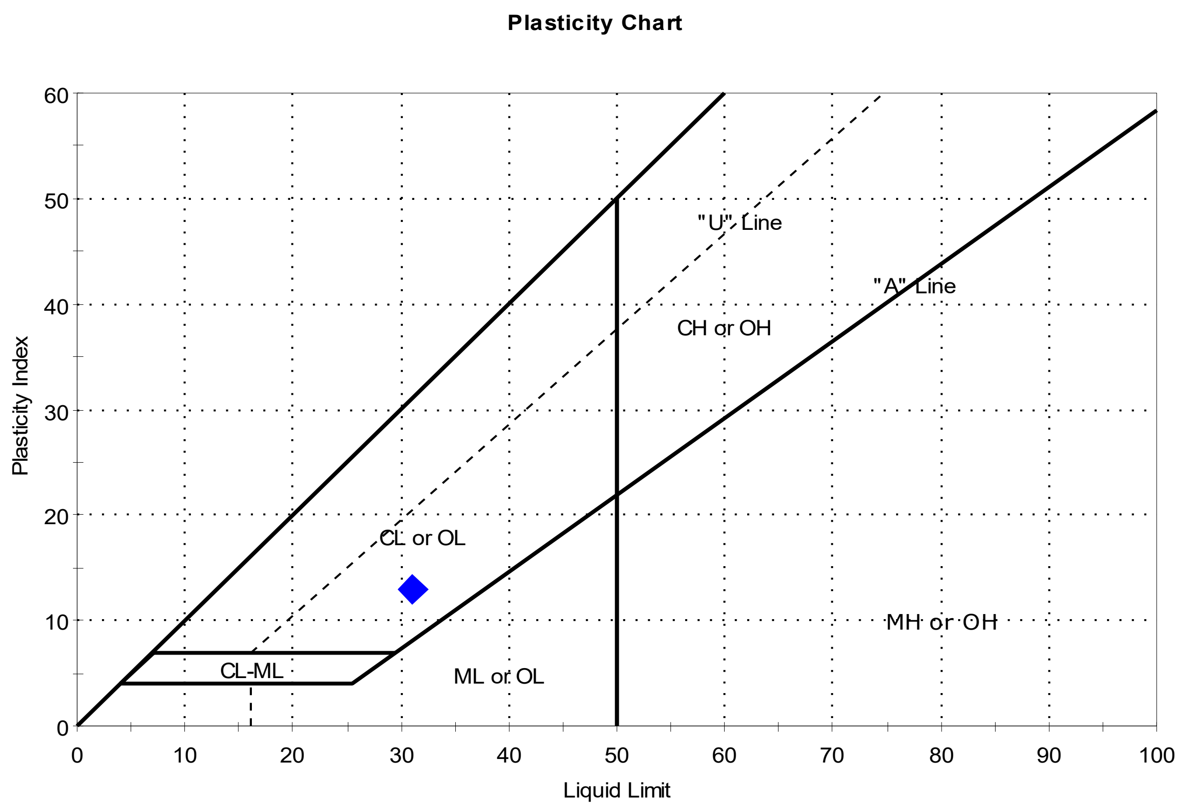
Dilatancy: SLOW

Toughness: LOW

printed 8/9/2019 1:26:38 PM

Client:	GZA GeoEnvironmental, Inc.				
Project:	Replace Bucknam Rd Bridge No. 5830				
Location:	Falmouth, ME			Project No:	GTX-310291
Boring ID:	BB-FBR-106	Sample Type:	tube	Tested By:	cam
Sample ID:	2U	Test Date:	08/06/19	Checked By:	bfs
Depth :	55-57	Test Id:	514113		
Test Comment:	---				
Visual Description:	Moist, dark greenish gray clay				
Sample Comment:	---				

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	2U	B-FBR-10	55-57	32	31	18	13	1	

Sample Prepared using the WET method

Dry Strength: VERY HIGH

Dilatancy: SLOW

Toughness: LOW

printed 8/9/2019 1:26:39 PM

Consolidated Undrained Direct Simple Shear Testing of Cohesive Soils by ASTM D6528

Client: GZA GeoEnvironmental, Inc. GTX#: 310291
Project Name: Replace Bucknam Rd Bridge No. 5830 Test Date: 8/01/19
Project Location: Norridgewock, ME

Boring ID: BB-FBR-102
Sample ID: 1U
Depth, ft: 34-36

Visual Description: Moist, dark greenish gray clay

Test Equipment: Top and bottom box (circular) = 2.50 in diameter. Load cells and LVDT's connected to data acquisition system for shear force, normal load, horizontal and vertical displacement; surface area = 4.91 in^2, soil height = 1 inch. Stacked rings used. Set up included porous stones with pins.

Test Condition: Inundated prior to consolidation

Sample Type and Preparation: Extruded from tube, cut, trimmed and placed into apparatus at as-received density and moisture

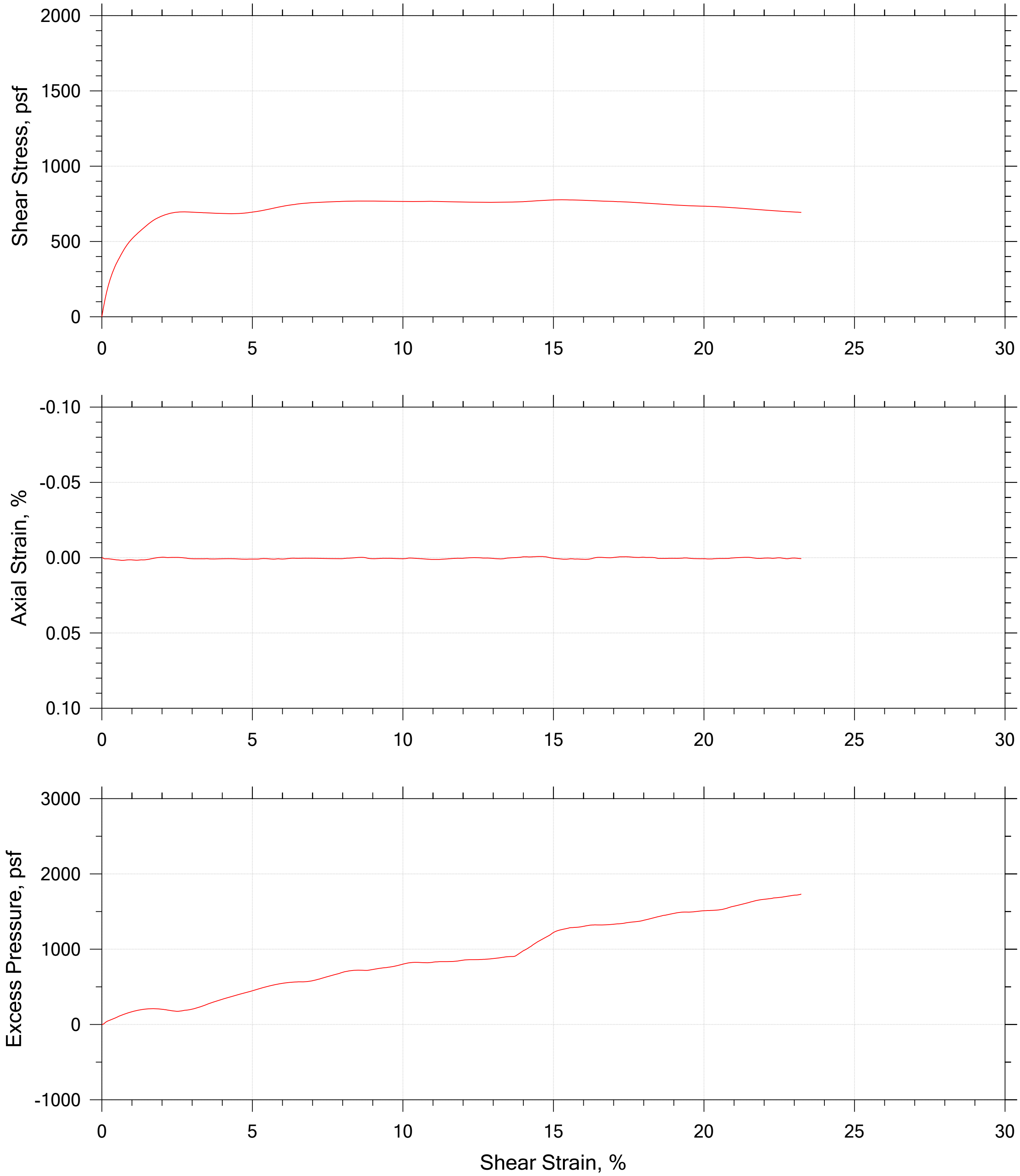
Parameter	Point 1	Point 2	Point 3	Point 4	Point 5
Test No.	DSS-2				
Initial Moisture Content, %	41.0				
Initial Dry Density, pcf	80.5				
Nominal Rate of Shear Strain, %/hr	5.0				
Maximum Vertical Consolidation Stress, psf	3,500				
Final Moisture Content, %	37.1				
Measured Peak Shear Stress, psf	777				
Shear Strain at Peak Shear Stress, %	15.2				
Membrane Correction, psf	58				
Corrected Peak Shear Stress, psf	719				
S_u / σ'_{vc}	0.21				

Comments:

Tested By: md Checked By: njh

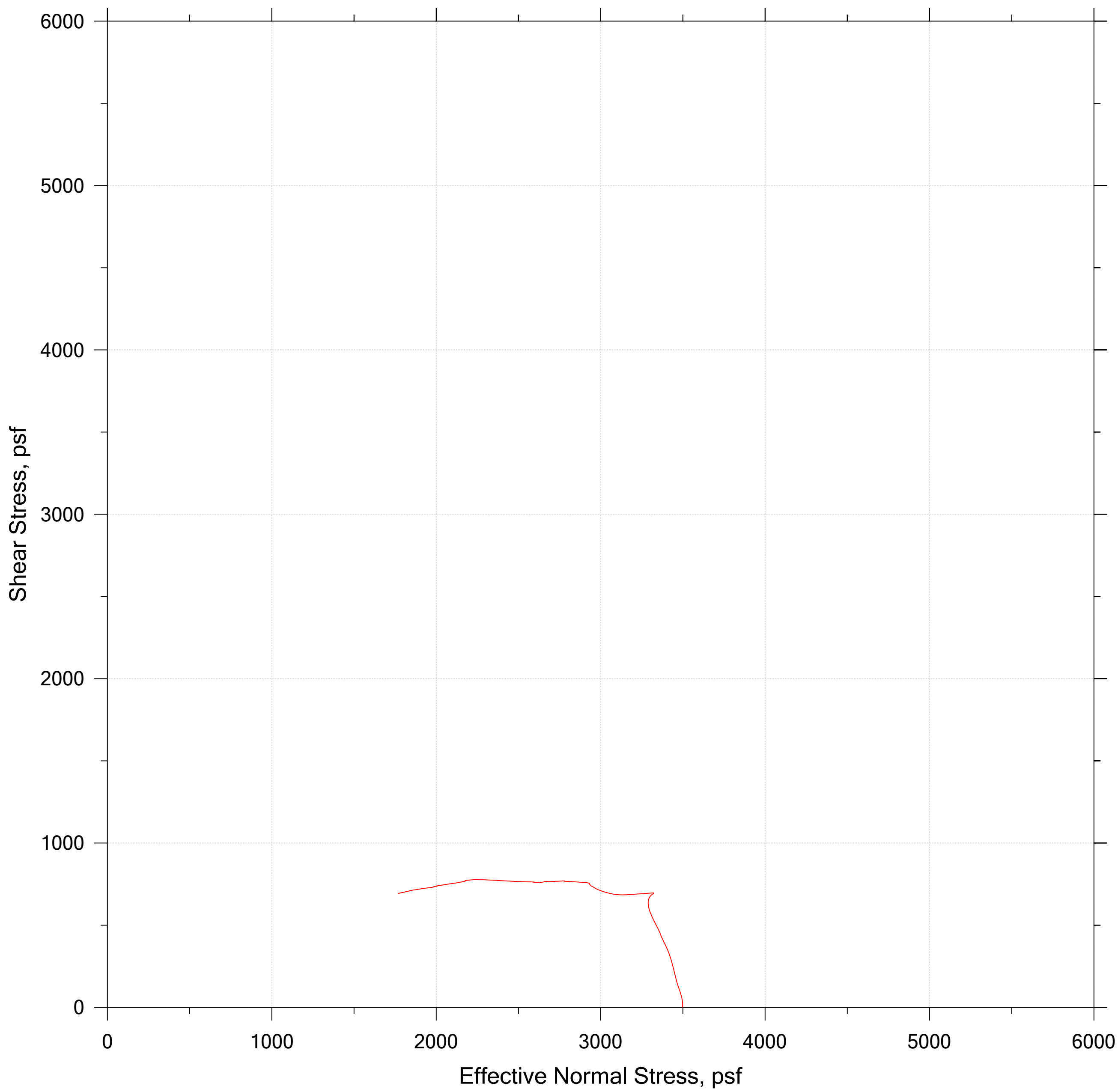
Notes: These results apply only to the sample tested for the specific test conditions. The test procedures employed follow accepted industry practice and the indicated test method. GeoTesting Express has no specific knowledge as to conditioning, origin, sampling procedure or intended use of the material.

DIRECT SIMPLE SHEAR TEST by ASTM D6528



GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
	Boring No.: BB-FBR-102	Tested By: md	Checked By: njh
	Sample No.: 1U	Test Date: 08/01/19	Depth: 34-36 ft
	Test No.: DSS-2	Sample Type: intact	Elevation: ---
	Description: Moist, dark greenish gray clay		
	Remarks: System M		

DIRECT SIMPLE SHEAR TEST by ASTM D6528



GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
	Boring No.: BB-FBR-102	Tested By: md	Checked By: njh
	Sample No.: 1U	Test Date: 08/01/19	Depth: 34-36 ft
	Test No.: DSS-2	Sample Type: intact	Elevation: ---
	Description: Moist, dark greenish gray clay		
	Remarks: System M		

GeoTesting EXPRESS

Consolidated Undrained Direct Simple Shear Testing of Cohesive Soils by ASTM D6528

Client:	GZA GeoEnvironmental, Inc.	GTX#:	310291
Project Name:	Replace Bucknam Rd Bridge No. 5830	Test Date:	9/19/19
Project Location:	Falmouth, ME		

Boring ID: BB-FBR-102
Sample ID: 2U
Depth, ft: 44-46

Visual Description: Moist, dark gray clay

Test Equipment: Top and bottom box (circular) = 2.50 in diameter. Load cells and LVDT's connected to data acquisition system for shear force, normal load, horizontal and vertical displacement; surface area = 4.91 in^2, soil height = 1 inch. Stacked rings used. Set up included porous stones with pins.

Test Condition: Inundated prior to consolidation

Sample Type and Preparation: density: Extruded from tube, cut, trimmed and placed into apparatus at as-received and moisture

Parameter	Point 1	Point 2	Point 3	Point 4	Point 5
Test No.	DSS-5				
Initial Moisture Content, %	38.7				
Initial Dry Density, pcf	83.6				
Nominal Rate of Shear Strain, %/hr	5.0				
Maximum Vertical Consolidation Stress, psf	3,400				
Final Moisture Content, %	28.4				
Measured Peak Shear Stress, psf	826				
Shear Strain at Peak Shear Stress, %	7.1				
Membrane Correction, psf	52				
Corrected Peak Shear Stress, psf	774				
S_u / σ'_{vc}	0.23				

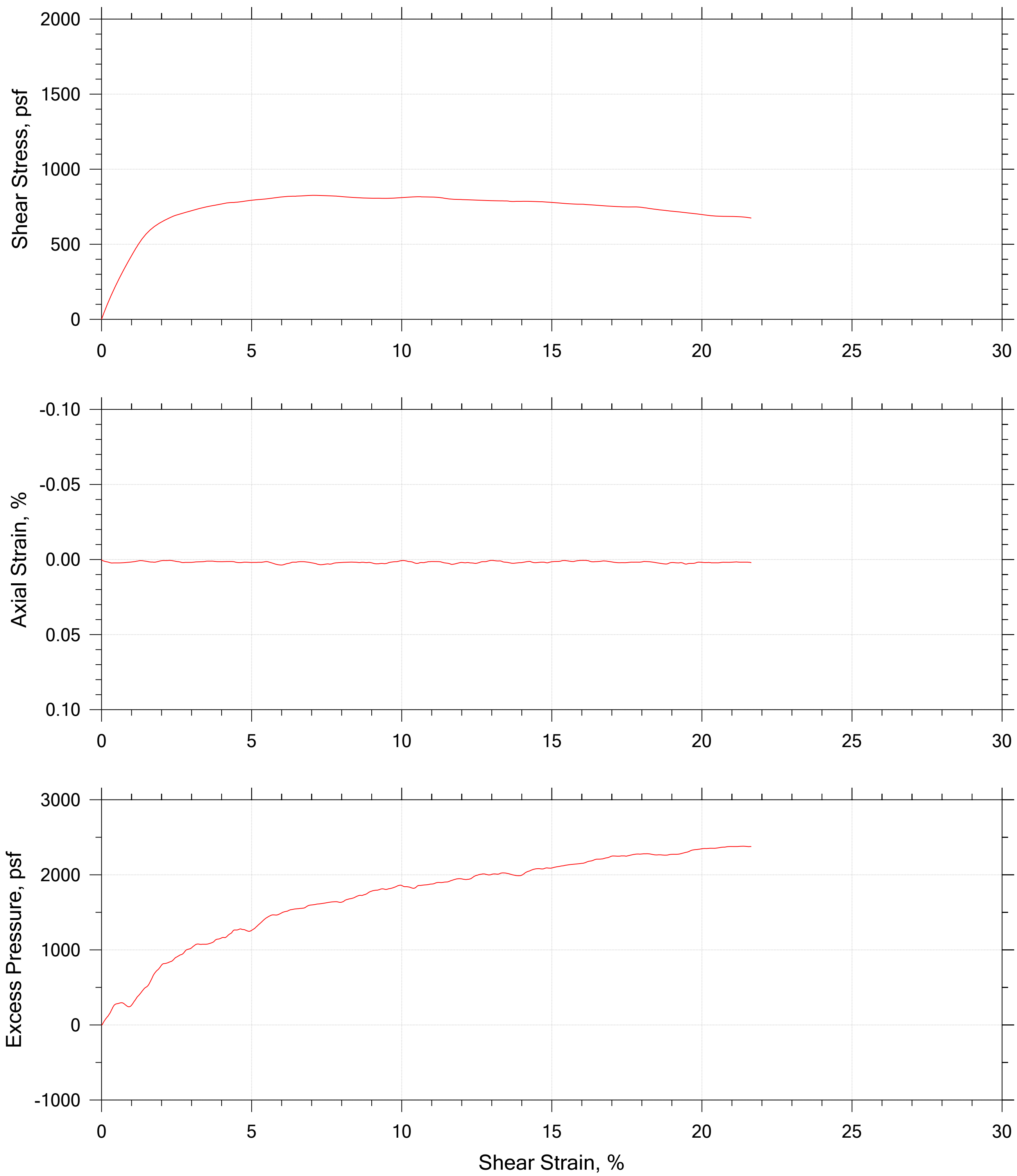
Comments:

Tested By: md

Checked By: njh

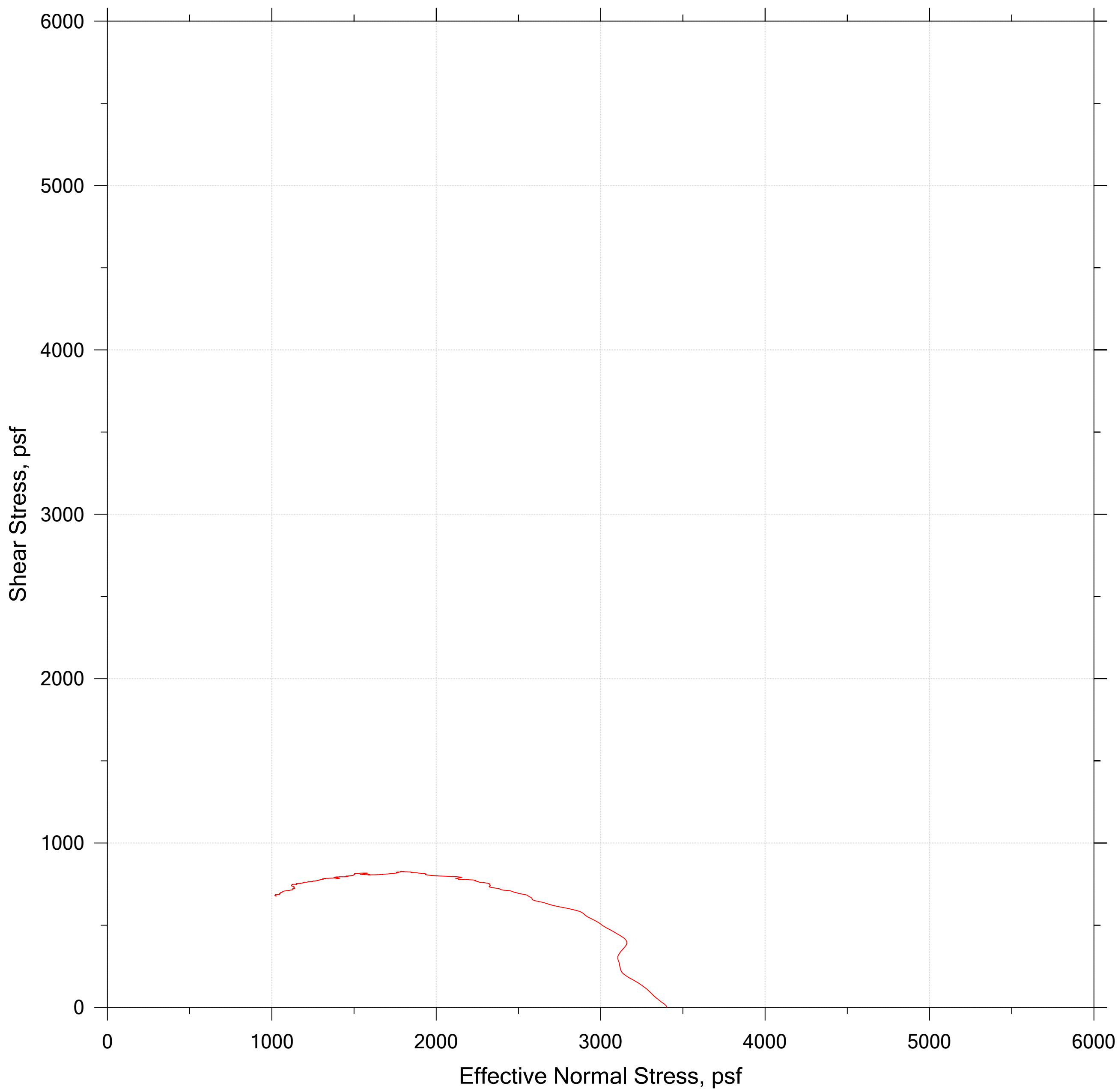
Notes: These results apply only to the sample tested for the specific test conditions. The test procedures employed follow accepted industry practice and the indicated test method. GeoTesting Express has no specific knowledge as to conditioning, origin, sampling procedure or intended use of the material.

DIRECT SIMPLE SHEAR TEST



GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
	Boring No.: BB-FBR-102	Tested By: md	Checked By: njh
	Sample No.: 2U	Test Date: 09/19/19	Depth: 44-46 ft
	Test No.: DSS-5	Sample Type: intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks:		

DIRECT SIMPLE SHEAR TEST



GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
	Boring No.: BB-FBR-102	Tested By: md	Checked By: njh
	Sample No.: 2U	Test Date: 09/19/19	Depth: 44-46 ft
	Test No.: DSS-5	Sample Type: intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks:		
			Page 3 of 3

GeoTesting EXPRESS

Consolidated Undrained Direct Simple Shear Testing of Cohesive Soils by ASTM D6528

Client:	GZA GeoEnvironmental, Inc.	GTX#:	310291
Project Name:	Replace Bucknam Rd Bridge No. 5830	Test Date:	9/24/19
Project Location:	Falmouth, ME		

Boring ID: BB-FBR-103A
Sample ID: 1U
Depth, ft: 34-36

Visual Description: Moist, gray clay

Test Equipment: Top and bottom box (circular) = 2.50 in diameter. Load cells and LVDT's connected to data acquisition system for shear force, normal load, horizontal and vertical displacement; surface area = 4.91 in^2, soil height = 1 inch. Stacked rings used. Set up included porous stones with pins.

Test Condition: Inundated prior to consolidation

Sample Type and Preparation: Extruded from tube, cut, trimmed and placed into apparatus at as-received density and moisture

Parameter	Point 1	Point 2	Point 3	Point 4	Point 5
Test No.	DSS-6				
Initial Moisture Content, %	31.8				
Initial Dry Density, pcf	87.2				
Nominal Rate of Shear Strain, %/hr	5.0				
Maximum Vertical Consolidation Stress, psf	1,950				
Final Moisture Content, %	27.4				
Measured Peak Shear Stress, psf	336				
Shear Strain at Peak Shear Stress, %	20.0				
Membrane Correction, psf	49				
Corrected Peak Shear Stress, psf	287				
S_u / σ'_{vc}	0.15				

Apparent disturbed sample, disregard

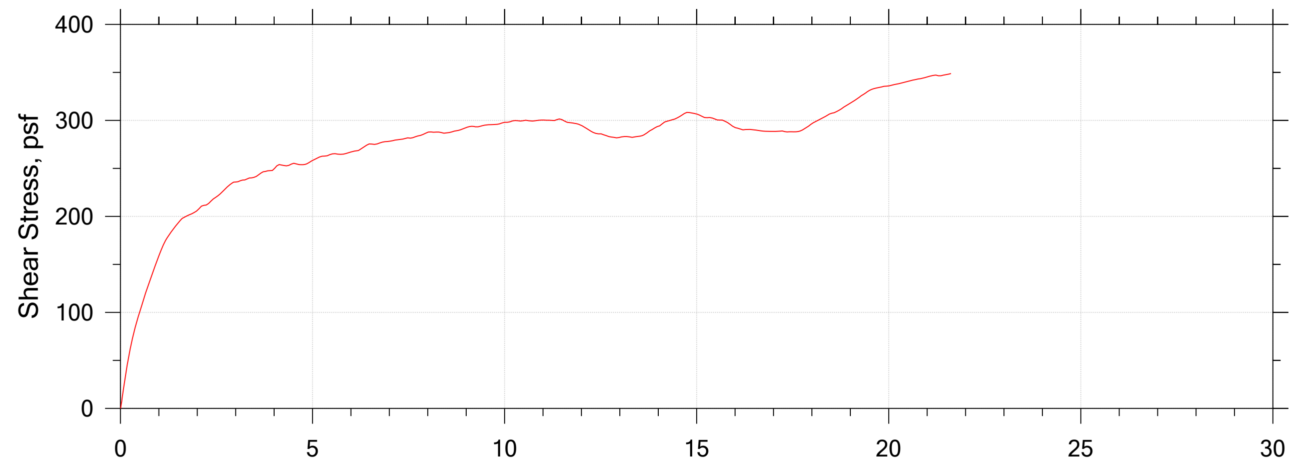
Comments:

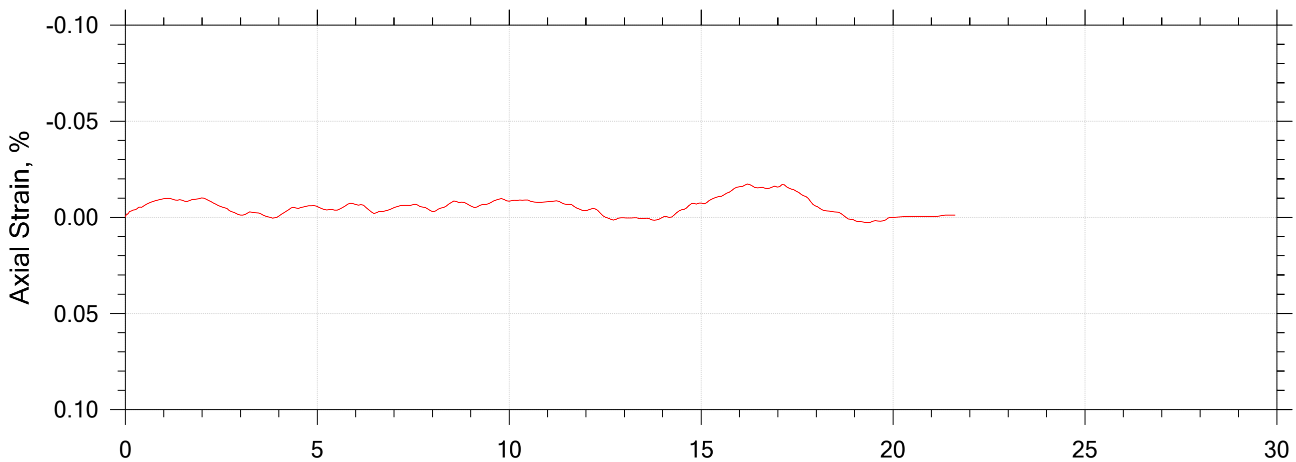
Tested By: md

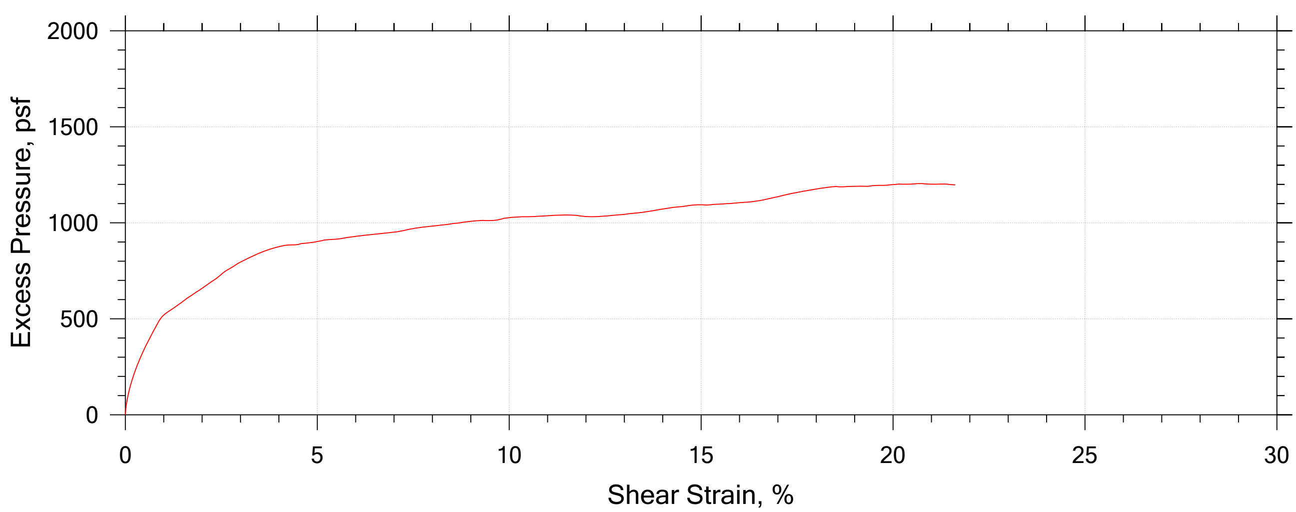
Checked By: njh

Notes: These results apply only to the sample tested for the specific test conditions. The test procedures employed follow accepted industry practice and the indicated test method. GeoTesting Express has no specific knowledge as to conditioning, origin, sampling procedure or intended use of the material.

DIRECT SIMPLE SHEAR TEST

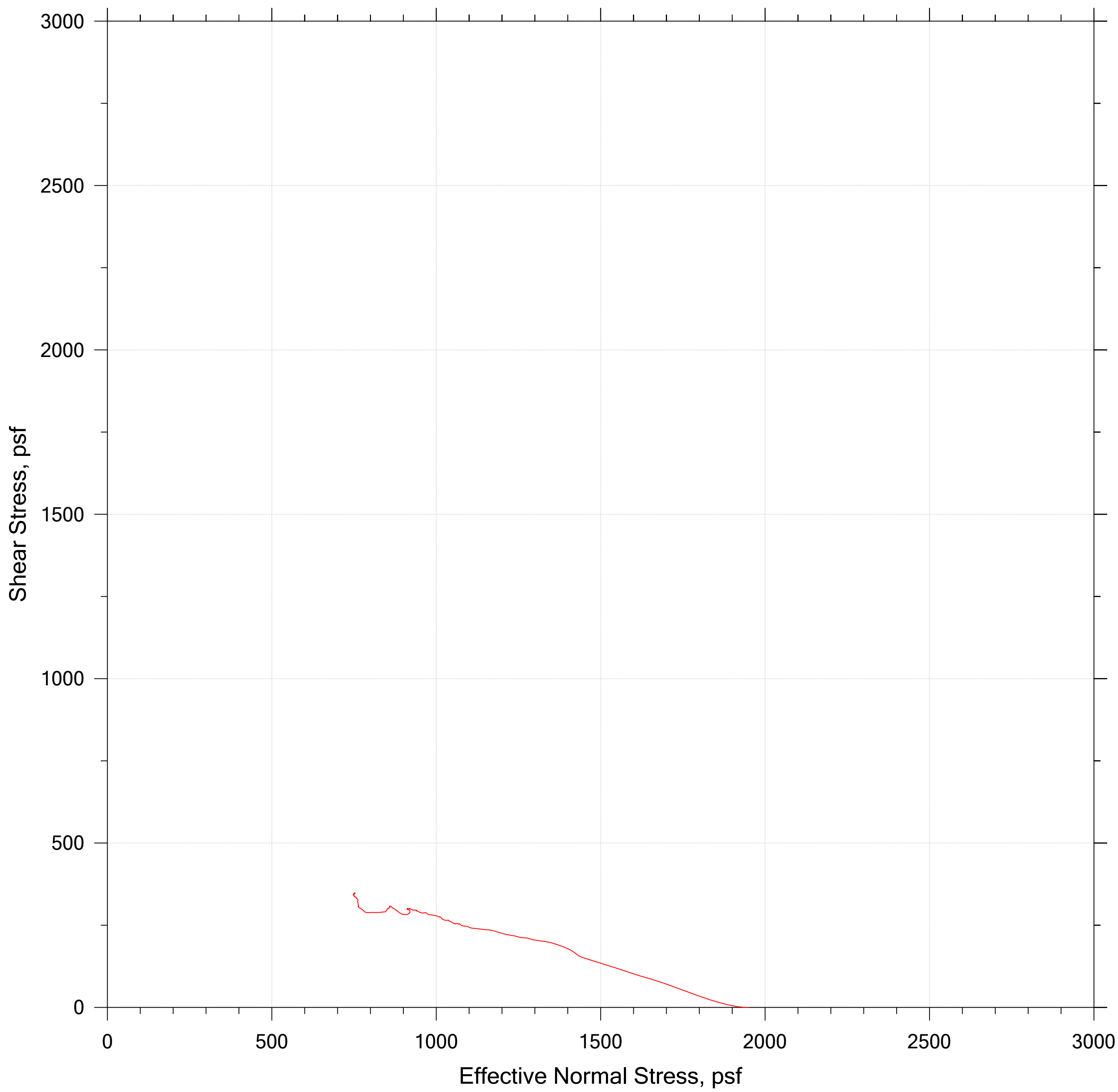






GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-3310291
	Boring No.: BB-FBR-103A	Tested By: md	Checked By: njh
	Sample No.: 1U	Test Date: 09/24/19	Depth: 34-36 ft
	Test No.: DSS-6	Sample Type: Intact	Elevation: ---
	Description: Moist, gray clay		
	Remarks: System HH		
			Page 2 of 3

DIRECT SIMPLE SHEAR TEST



Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-3310291
Boring No.: BB-FBR-103A	Tested By: md	Checked By: njh
Sample No.: 1U	Test Date: 09/24/19	Depth: 34-36 ft
Test No.: DSS-6	Sample Type: Intact	Elevation: ---
Description: Moist, gray clay		
Remarks: System HH		

GeoTesting EXPRESS

Consolidated Undrained Direct Simple Shear Testing of Cohesive Soils by ASTM D6528

Client:	GZA GeoEnvironmental, Inc.	GTX#:	310291
Project Name:	Replace Bucknam Rd Bridge No. 5830	Test Date:	8/08/19
Project Location:	Norridgewock, ME		

Boring ID: BB-FBR-104
Sample ID: 1U
Depth, ft: 39-41

Visual Description: Moist, gray clay

Test Equipment: Top and bottom box (circular) = 2.50 in diameter. Load cells and LVDT's connected to data acquisition system for shear force, normal load, horizontal and vertical displacement; surface area = 4.91 in^2, soil height = 1 inch. Stacked rings used. Set up included porous stones with pins.

Test Condition: Inundated prior to consolidation

Sample Type and Preparation: Extruded from tube, cut, trimmed and placed into apparatus at as-received density and moisture

Parameter	Point 1	Point 2	Point 3	Point 4	Point 5
Test No.	DSS-4				
Initial Moisture Content, %	44.3				
Initial Dry Density, pcf	77.6				
Nominal Rate of Shear Strain, %/hr	5.0				
Maximum Vertical Consolidation Stress, psf	3,500				
Final Moisture Content, %	39.5				
Measured Peak Shear Stress, psf	753				
Shear Strain at Peak Shear Stress, %	16.8				
Membrane Correction, psf	55				
Corrected Peak Shear Stress, psf	698				
S_u / σ'_{vc}	0.20				

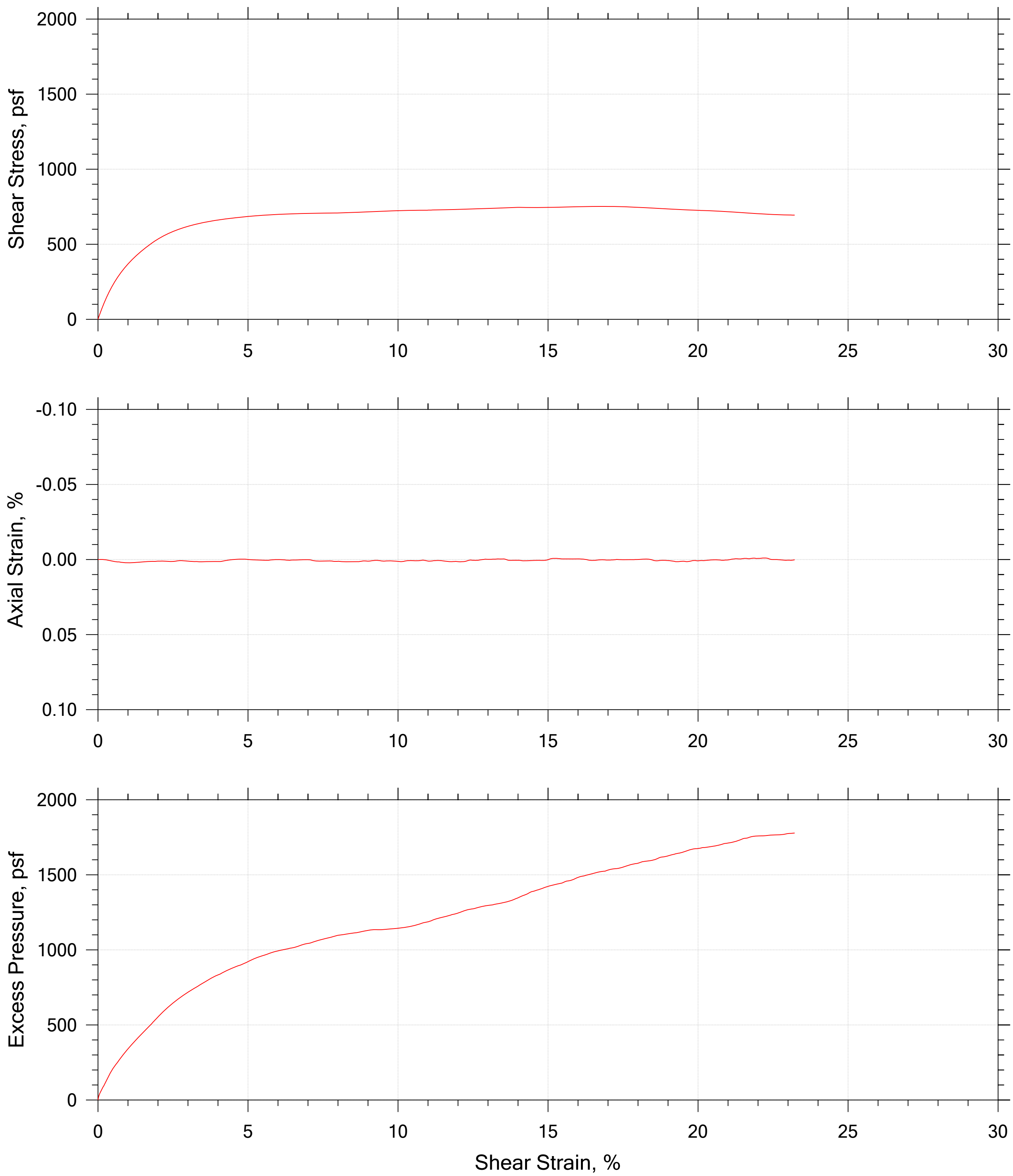
Comments:

Tested By: md

Checked By: njh

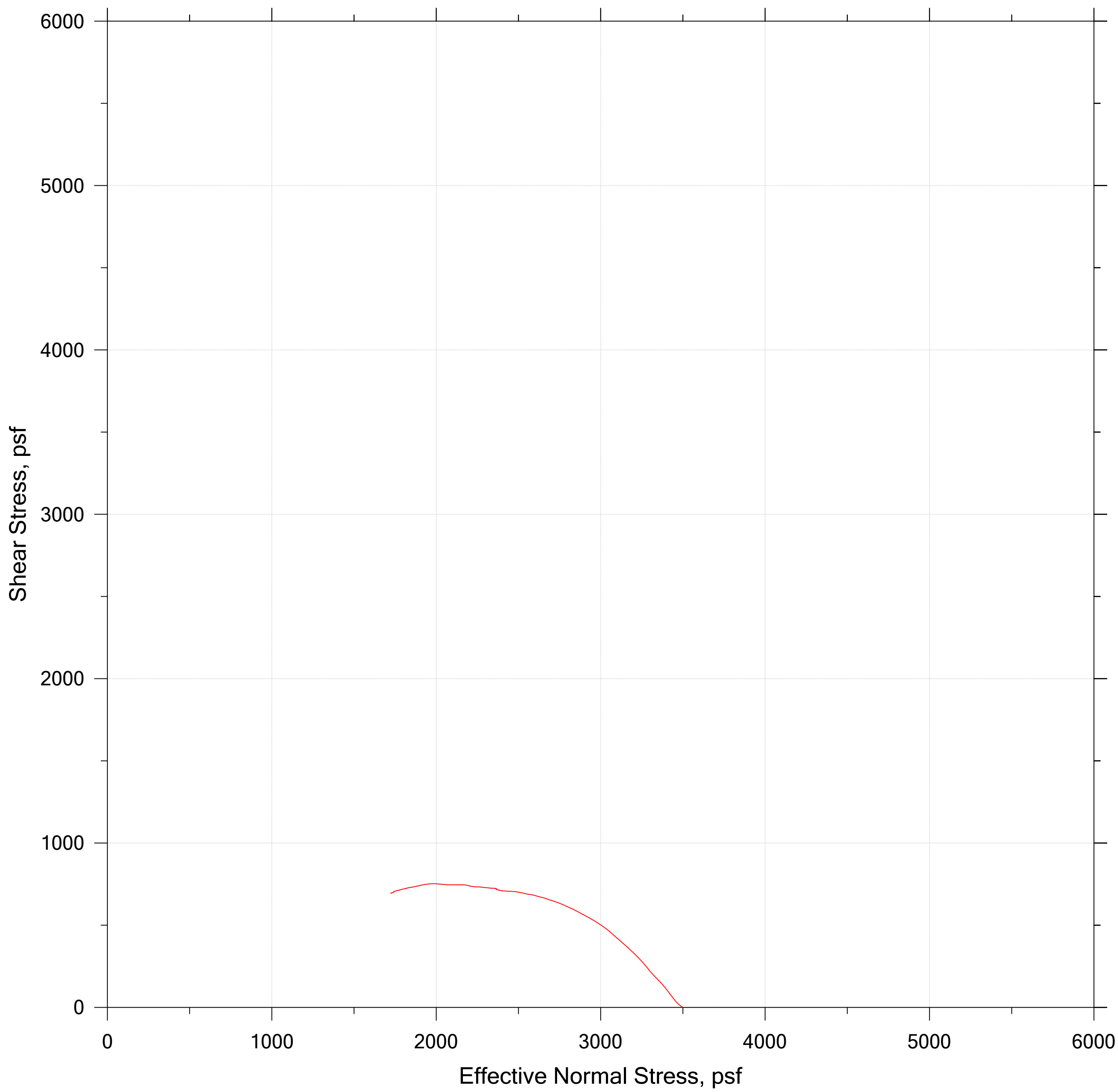
Notes: These results apply only to the sample tested for the specific test conditions. The test procedures employed follow accepted industry practice and the indicated test method. GeoTesting Express has no specific knowledge as to conditioning, origin, sampling procedure or intended use of the material.

DIRECT SIMPLE SHEAR TEST by ASTM D6528



GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
	Boring No.: BB-FBR-104	Tested By: md	Checked By: njh
	Sample No.: 1U	Test Date: 08/08/19	Depth: 39-41 ft
	Test No.: DSS-4	Sample Type: intact	Elevation: ---
	Description: Moist, gray clay		
	Remarks: System N		
			Page 2 of 3

DIRECT SIMPLE SHEAR TEST by ASTM D6528



GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
	Boring No.: BB-FBR-104	Tested By: md	Checked By: njh
	Sample No.: 1U	Test Date: 08/08/19	Depth: 39-41 ft
	Test No.: DSS-4	Sample Type: intact	Elevation: ---
	Description: Moist, gray clay		
	Remarks: System N		

Consolidated Undrained Direct Simple Shear Testing of Cohesive Soils by ASTM D6528

Client: GZA GeoEnvironmental, Inc.
Project Name: Replace Bucknam Rd Bridge No. 5830
Project Location: Falmouth, ME

GTX#: 310291
Test Date: 9/27/19

Boring ID: BB-FBR-104
Sample ID: 2U
Depth, ft: 51-53

Visual Description: Moist, dark gray clay

Test Equipment: Top and bottom box (circular) = 2.50 in diameter. Load cells and LVDT's connected to data acquisition system for shear force, normal load, horizontal and vertical displacement; surface area = 4.91 in^2, soil height = 1 inch. Stacked rings used. Set up included porous stones with pins.

Test Condition: Inundated prior to consolidation

Sample Type and Preparation: Extruded from tube, cut, trimmed and placed into apparatus at as-received density and moisture

Parameter	Point 1	Point 2	Point 3	Point 4	Point 5
Test No.	DSS-7				
Initial Moisture Content, %	39.0				
Initial Dry Density, pcf	77.9				
Nominal Rate of Shear Strain, %/hr	5.0				
Maximum Vertical Consolidation Stress, psf	3,700				
Final Moisture Content, %	37.1				
Measured Peak Shear Stress, psf	954				
Shear Strain at Peak Shear Stress, %	8.5				
Membrane Correction, psf	59				
Corrected Peak Shear Stress, psf	895				
S_u / σ'_{vc}	0.24				

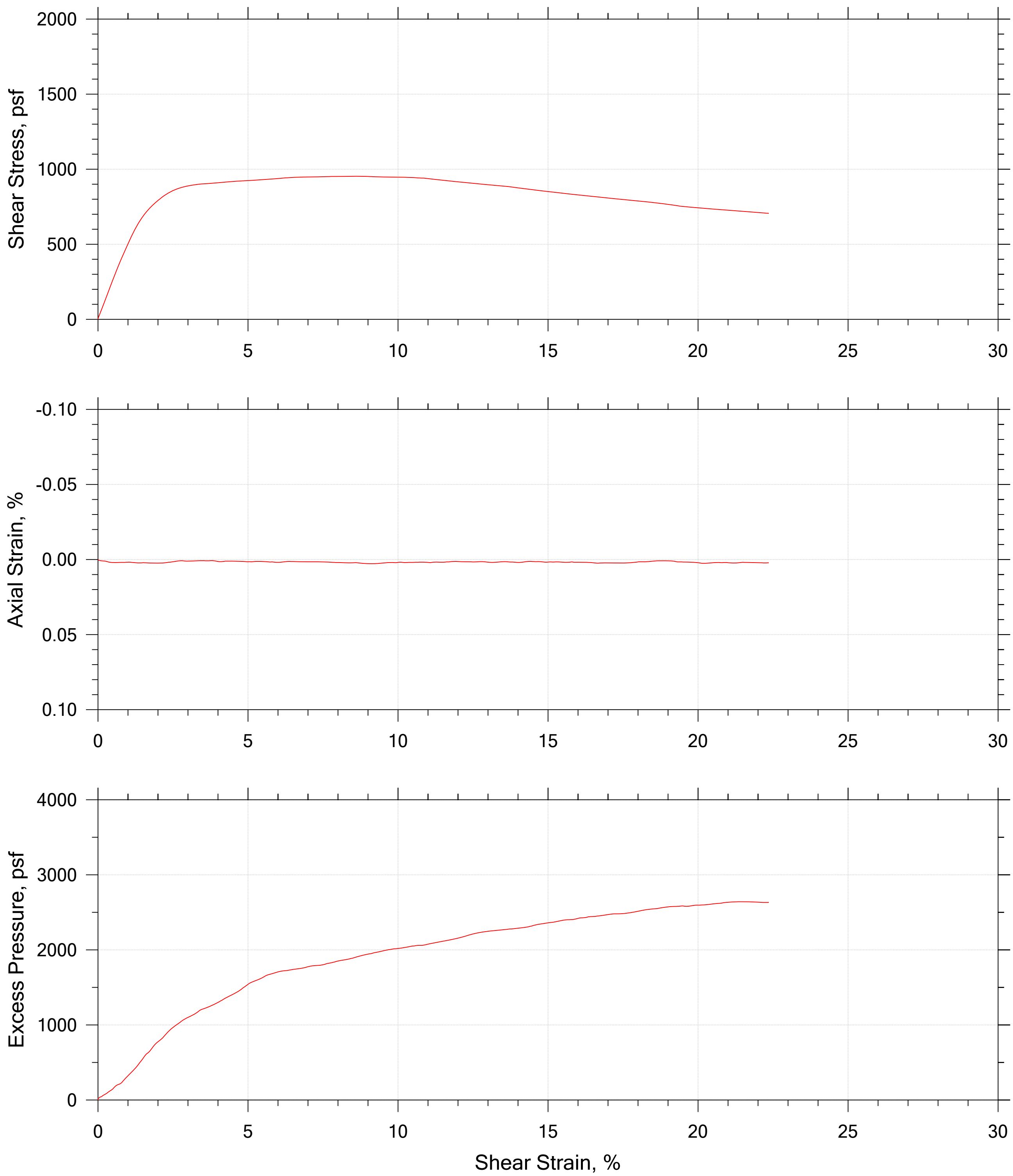
Comments:

Tested By: md

Checked By: njh

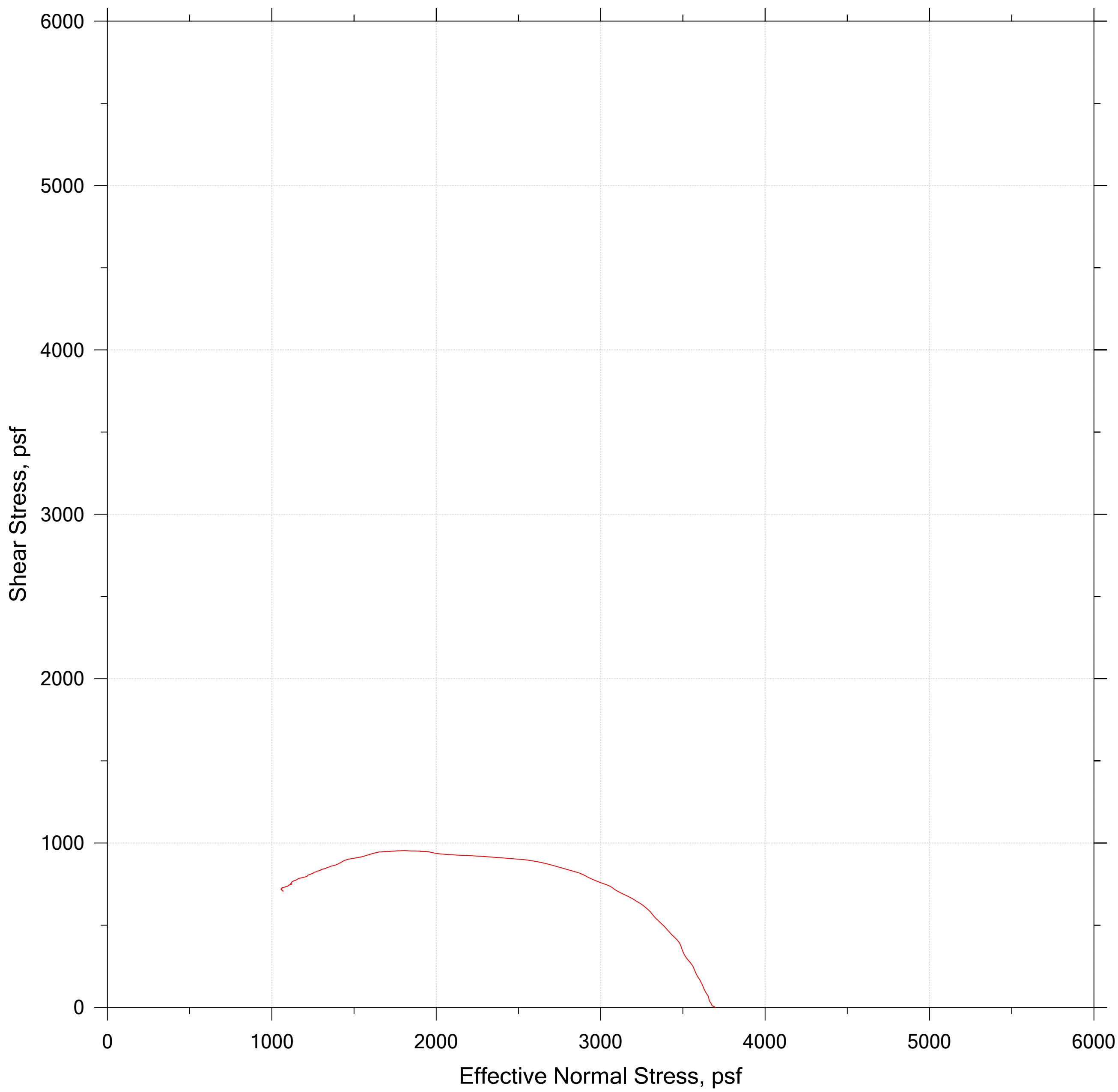
Notes: These results apply only to the sample tested for the specific test conditions. The test procedures employed follow accepted industry practice and the indicated test method. GeoTesting Express has no specific knowledge as to conditioning, origin, sampling procedure or intended use of the material.

DIRECT SIMPLE SHEAR TEST



GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
	Boring No.: BB-FBR-104	Tested By: md	Checked By: njh
	Sample No.: 2U	Test Date: 09/27/19	Depth: 51-53 ft
	Test No.: DSS-7	Sample Type: intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System SS		

DIRECT SIMPLE SHEAR TEST



Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
Boring No.: BB-FBR-104	Tested By: md	Checked By: njh
Sample No.: 2U	Test Date: 09/27/19	Depth: 51-53 ft
Test No.: DSS-7	Sample Type: intact	Elevation: ---
Description: Moist, dark gray clay		
Remarks: System SS		

GeoTesting EXPRESS

Consolidated Undrained Direct Simple Shear Testing of Cohesive Soils by ASTM D6528

Client:	GZA GeoEnvironmental, Inc.	GTX#:	310291
Project Name:	Replace Bucknam Rd Bridge No. 5830	Test Date:	8/06/19
Project Location:	Norridgewock, ME		

Boring ID: BB-FBR-106
Sample ID: 1U
Depth, ft: 34-36

Visual Description: Moist, dark gray clay

Test Equipment: Top and bottom box (circular) = 2.50 in diameter. Load cells and LVDT's connected to data acquisition system for shear force, normal load, horizontal and vertical displacement; surface area = 4.91 in^2, soil height = 1 inch. Stacked rings used. Set up included porous stones with pins.

Test Condition: Inundated prior to consolidation

Sample Type and Preparation: density — Extruded from tube, cut, trimmed and placed into apparatus at as-received and moisture

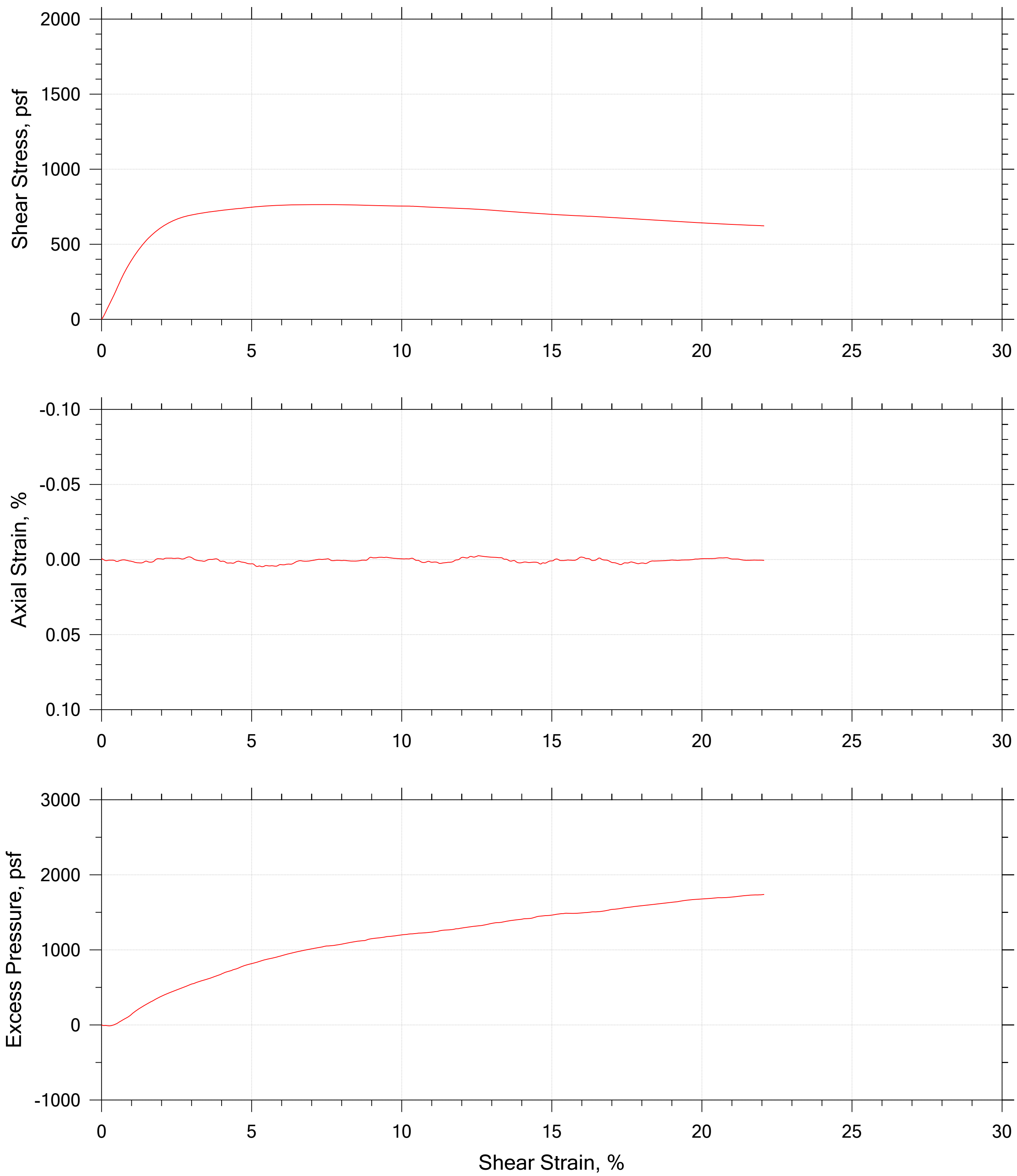
Parameter	Point 1	Point 2	Point 3	Point 4	Point 5
Test No.	DSS-3				
Initial Moisture Content, %	41.9				
Initial Dry Density, pcf	80.7				
Nominal Rate of Shear Strain, %/hr	5.0				
Maximum Vertical Consolidation Stress, psf	3,000				
Final Moisture Content, %	39.7				
Measured Peak Shear Stress, psf	765				
Shear Strain at Peak Shear Stress, %	7.9				
Membrane Correction, psf	56				
Corrected Peak Shear Stress, psf	709				
S_u / σ'_{vc}	0.24				

Comments:

Tested By: md   Checked By: njh

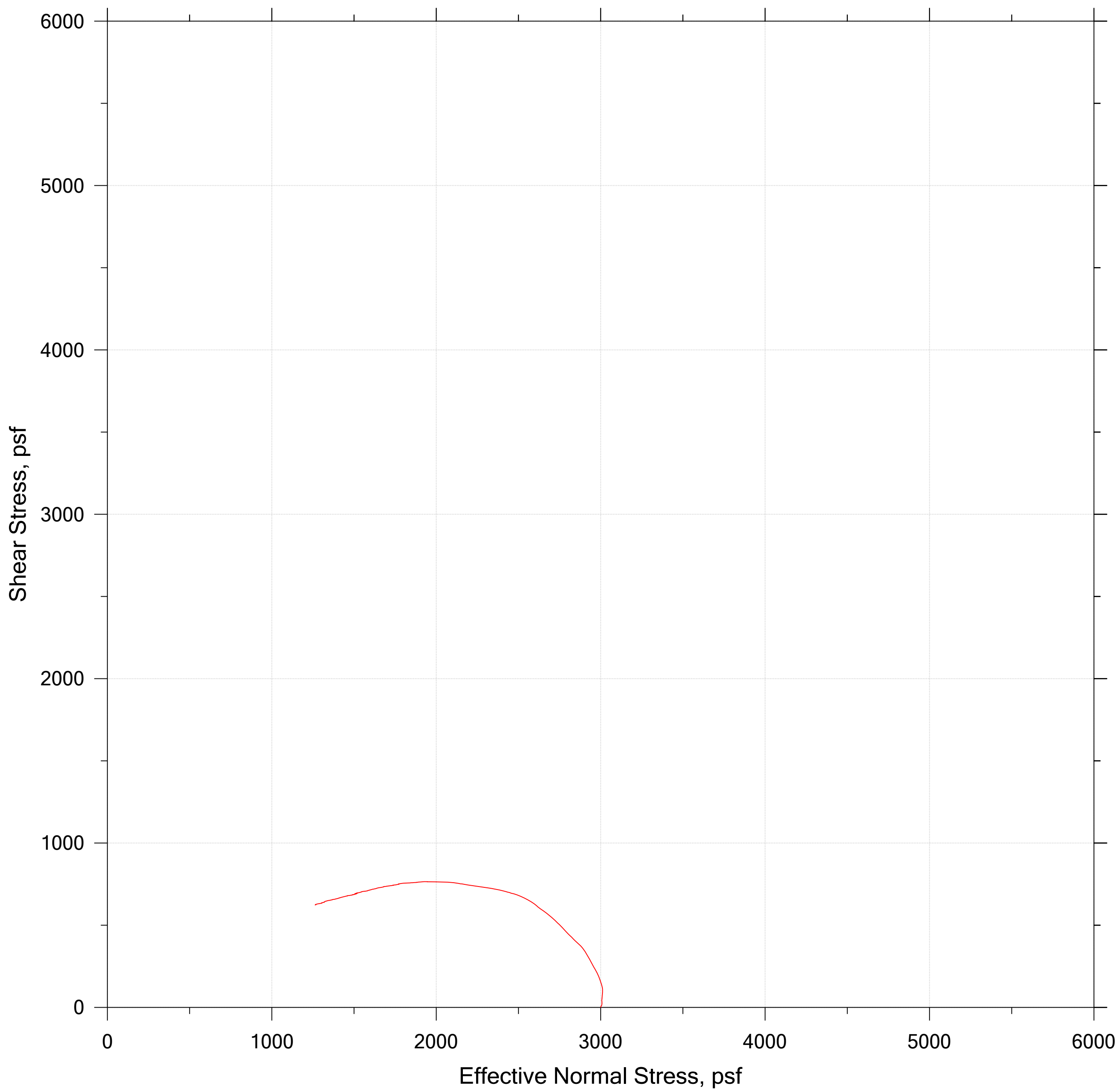
Notes: These results apply only to the sample tested for the specific test conditions. The test procedures employed follow accepted industry practice and the indicated test method. GeoTesting Express has no specific knowledge as to conditioning, origin, sampling procedure or intended use of the material.

DIRECT SIMPLE SHEAR TEST by ASTM D6528



GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
	Boring No.: BB-FBR-106	Tested By: md	Checked By: njh
	Sample No.: 1U	Test Date: 08/06/19	Depth: 34-36 ft
	Test No.: DSS-3	Sample Type: intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System N		

DIRECT SIMPLE SHEAR TEST by ASTM D6528



GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
	Boring No.: BB-FBR-106	Tested By: md	Checked By: njh
	Sample No.: 1U	Test Date: 08/06/19	Depth: 34-36 ft
	Test No.: DSS-3	Sample Type: intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System N		
			Page 3 of 3

GeoTesting EXPRESS

Consolidated Undrained Direct Simple Shear Testing of Cohesive Soils by ASTM D6528

Client:	GZA GeoEnvironmental, Inc.	GTX#:	310291
Project Name:	Replace Bucknam Rd Bridge No. 5830	Test Date:	8/01/19
Project Location:	Norridgewock, ME		

Boring ID: BB-FBR-106
Sample ID: 2U
Depth, ft: 55-57

Visual Description: Moist, dark greenish gray clay

Test Equipment: Top and bottom box (circular) = 2.50 in diameter. Load cells and LVDT's connected to data acquisition system for shear force, normal load, horizontal and vertical displacement; surface area = 4.91 in^2, soil height = 1 inch. Stacked rings used. Set up included porous stones with pins.

Test Condition: Inundated prior to consolidation

Sample Type and Preparation: Extruded from tube, cut, trimmed and placed into apparatus at as-received density and moisture

Parameter	Point 1	Point 2	Point 3	Point 4	Point 5
Test No.	DSS-1				
Initial Moisture Content, %	31.4				
Initial Dry Density, pcf	90.1				
Nominal Rate of Shear Strain, %/hr	5.0				
Maximum Vertical Consolidation Stress, psf	4,300				
Final Moisture Content, %	32.8				
Measured Peak Shear Stress, psf	1,157				
Shear Strain at Peak Shear Stress, %	12.6				
Membrane Correction, psf	62				
Corrected Peak Shear Stress, psf	1,095				
S_u / σ'_{vc}	0.25				

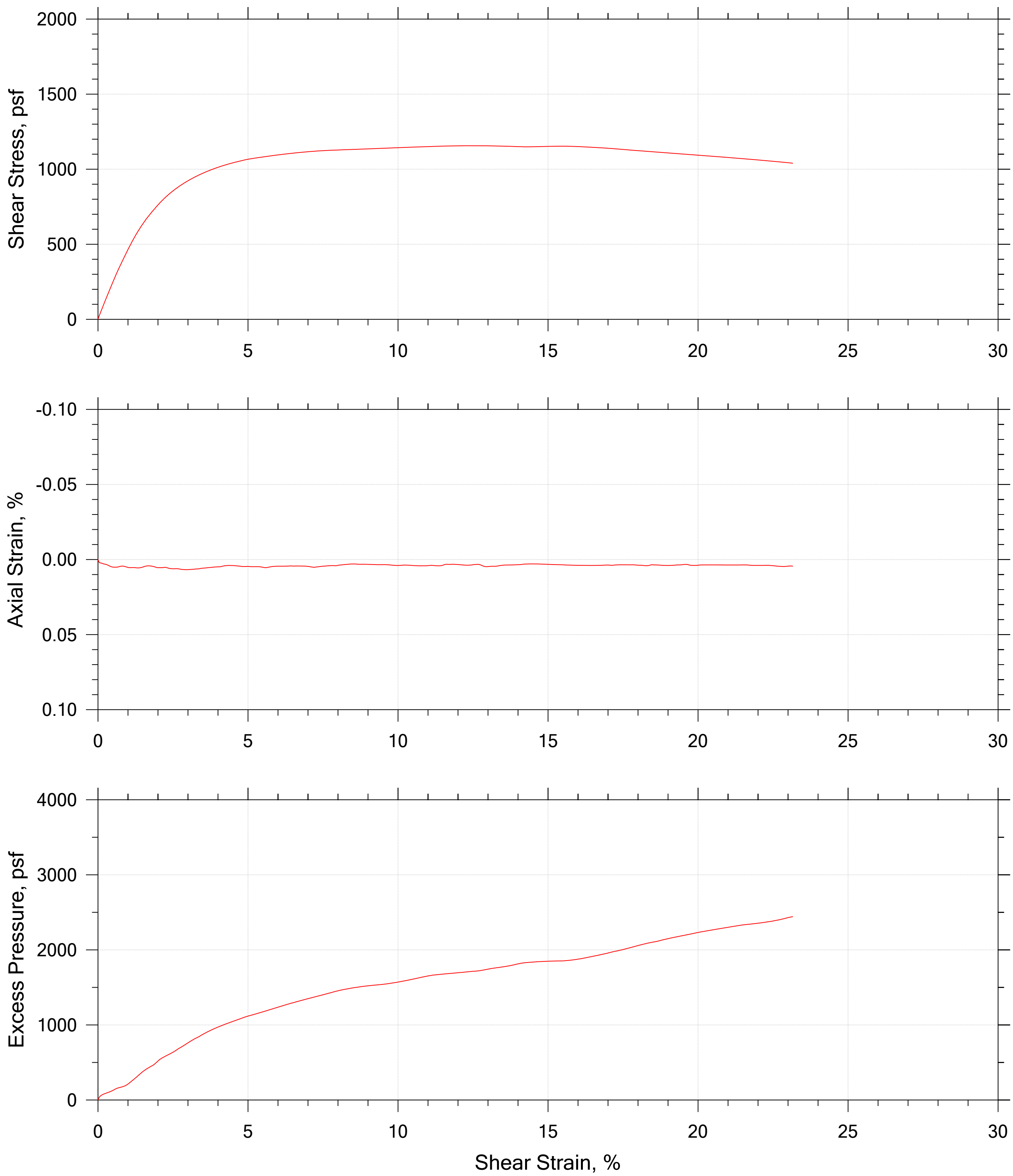
Comments:

Tested By: md

Checked By: njh

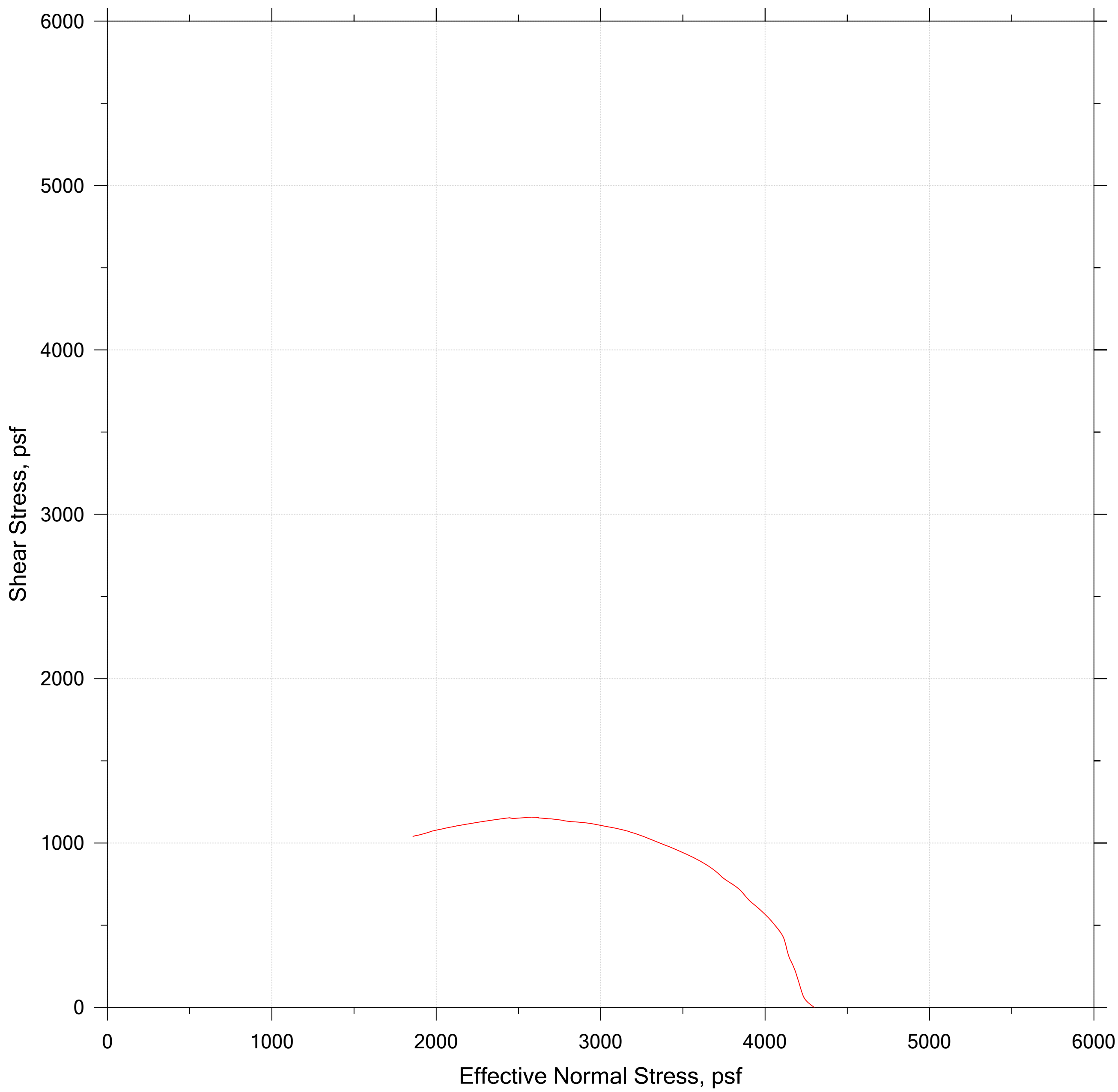
Notes: These results apply only to the sample tested for the specific test conditions. The test procedures employed follow accepted industry practice and the indicated test method. GeoTesting Express has no specific knowledge as to conditioning, origin, sampling procedure or intended use of the material.

DIRECT SIMPLE SHEAR TEST by ASTM D6528



GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
	Boring No.: BB-FBR-106	Tested By: md	Checked By: njh
	Sample No.: 2U	Test Date: 08/01/19	Depth: 55-57 ft
	Test No.: DSS-1	Sample Type: intact	Elevation: ---
	Description: Moist, dark greenish gray clay		
	Remarks: System N		
			Page 2 of 3

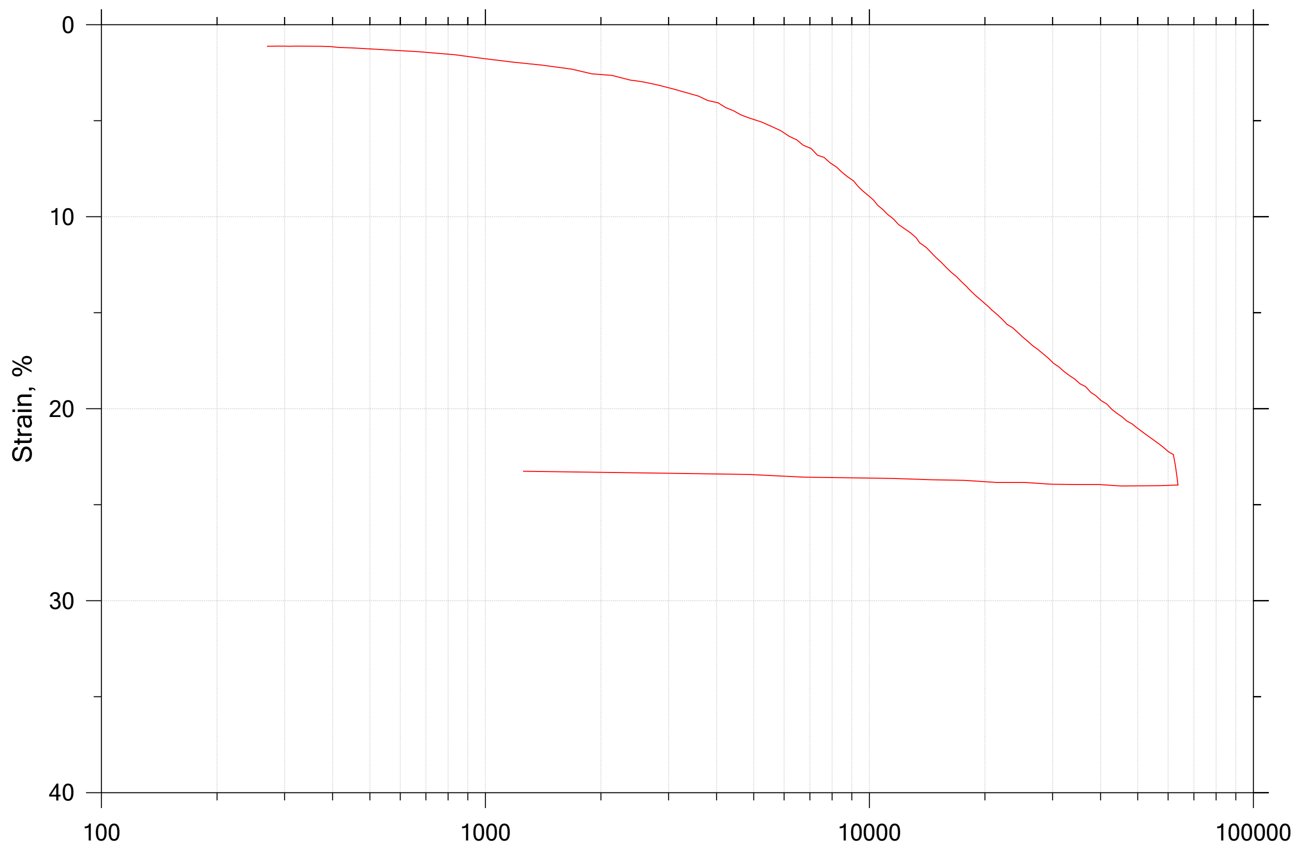
DIRECT SIMPLE SHEAR TEST by ASTM D6528

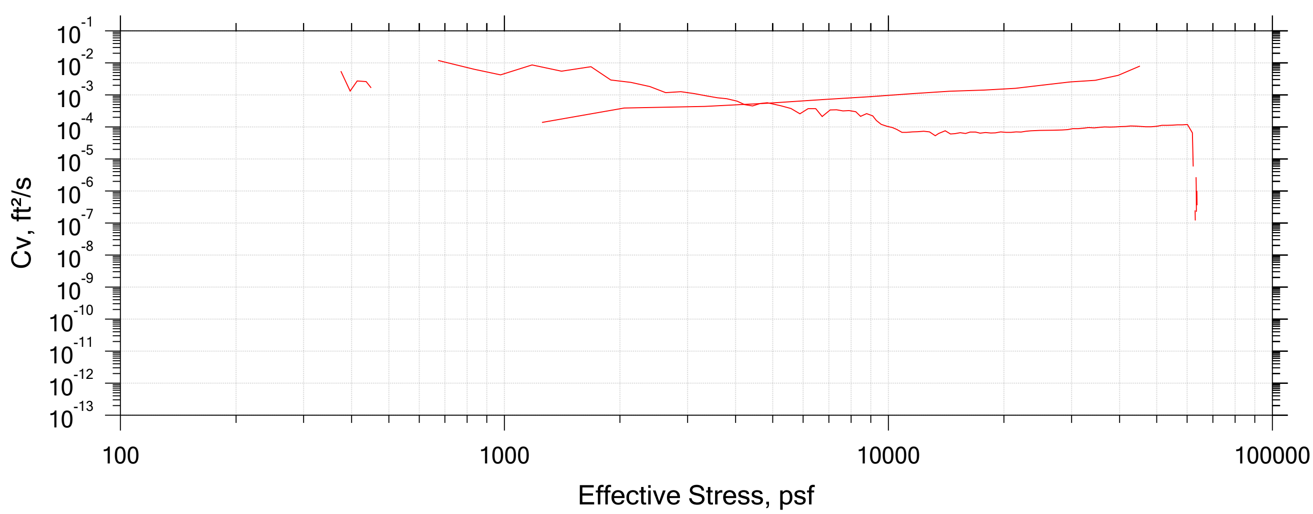


GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
	Boring No.: BB-FBR-106	Tested By: md	Checked By: njh
	Sample No.: 2U	Test Date: 08/01/19	Depth: 55-57 ft
	Test No.: DSS-1	Sample Type: intact	Elevation: ---
	Description: Moist, dark greenish gray clay		
	Remarks: System N		

CRC Test

Summary

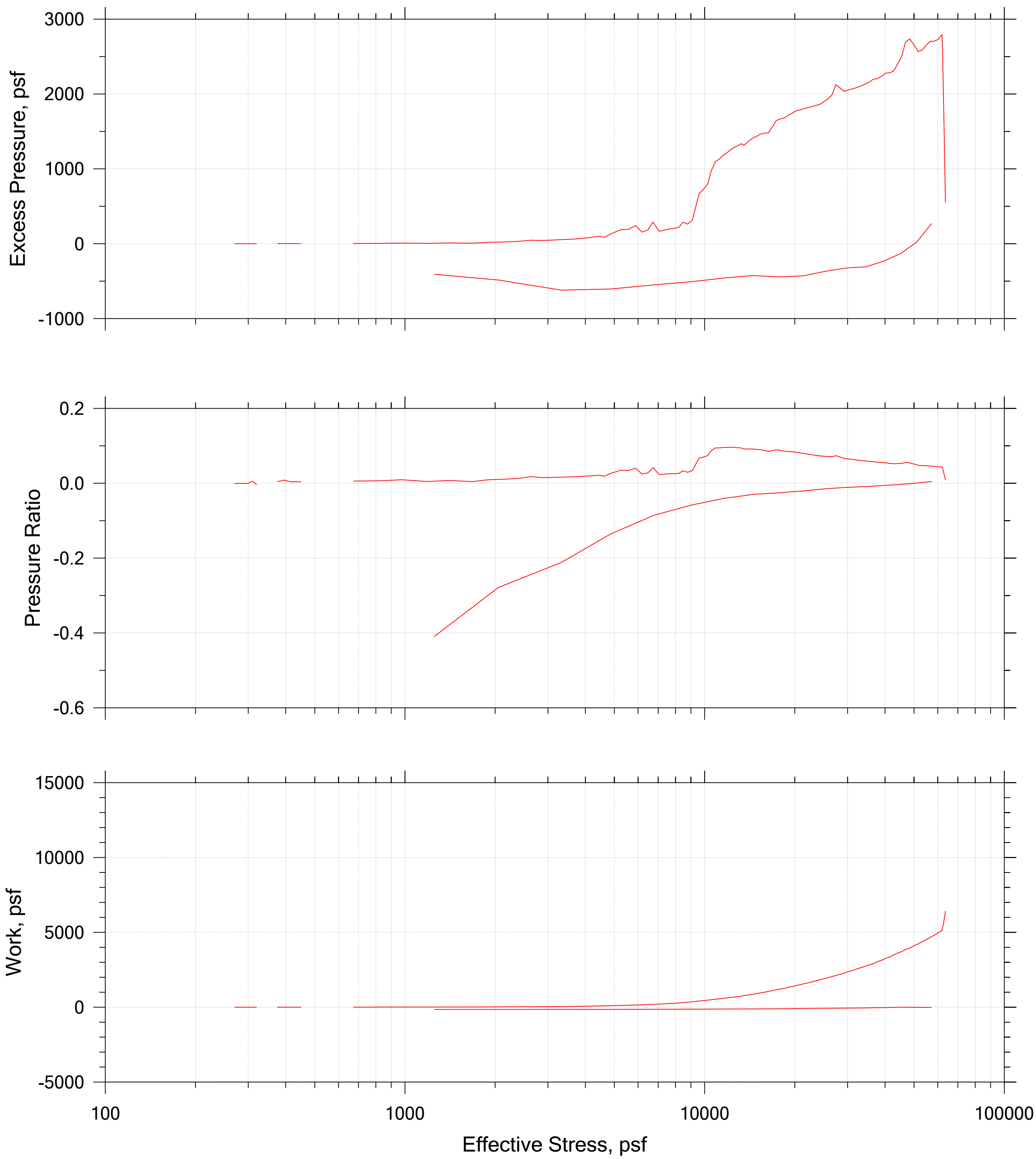




GeoTesting EXPRESS	Project Name: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project Number: GTX-310291
	Boring Number: BB-FBR-102	Tester: md	Checker: njh
	Sample Number: 1U	Test Date: 07/26/19	Depth: 34-36 ft
	Test Number: CRC-3	Preparation: intact	Elevation: ---
	Description: Moist, dark greenish gray clay		
	Remarks: System W		
			Page 1 of 3

CRC Test

Pressure Curves



GeoTesting EXPRESS	Project Name: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project Number: GTX-310291
	Boring Number: BB-FBR-102	Tester: md	Checker: njh
	Sample Number: 1U	Test Date: 07/26/19	Depth: 34-36 ft
	Test Number: CRC-3	Preparation: intact	Elevation: ---
	Description: Moist, dark greenish gray clay		
	Remarks: System W		

CRC Test

Specimen Diameter, in: 2.50	Specific Gravity: 2.79 (Estimated)	Liquid Limit: 40
Specimen Height, in: 1.00	Initial Void Ratio: 1.1	Plastic Limit: 20
Final Height, in: 0.78	Final Void Ratio: 0.641	Plasticity Index: 20

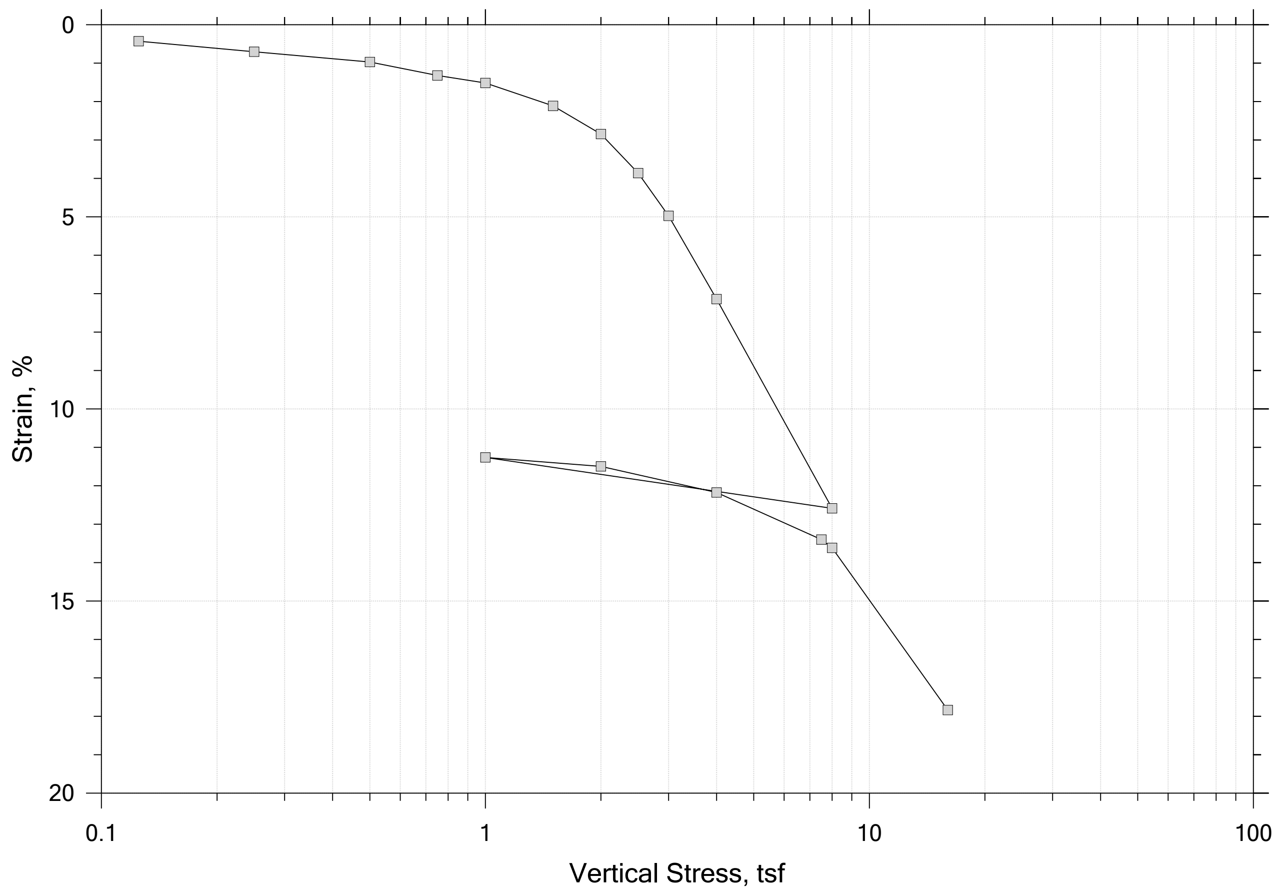
	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	A-2138	---		B-2568
Mass Container, gm	9.22	110.86	110.86	9.23
Mass Container + Wet Soil, gm	167.34	259.45	242.02	141.1
Mass Container + Dry Soil, gm	122.52	217.5	217.5	116.45
Mass Dry Soil, gm	113.3	106.64	106.64	107.22
Water Content, %	39.56	39.33	22.99	22.99
Void Ratio	---	1.10	0.64	---
Degree of Saturation, %	---	99.37	100.00	---
Dry Unit Weight, pcf	---	82.764	106.11	---

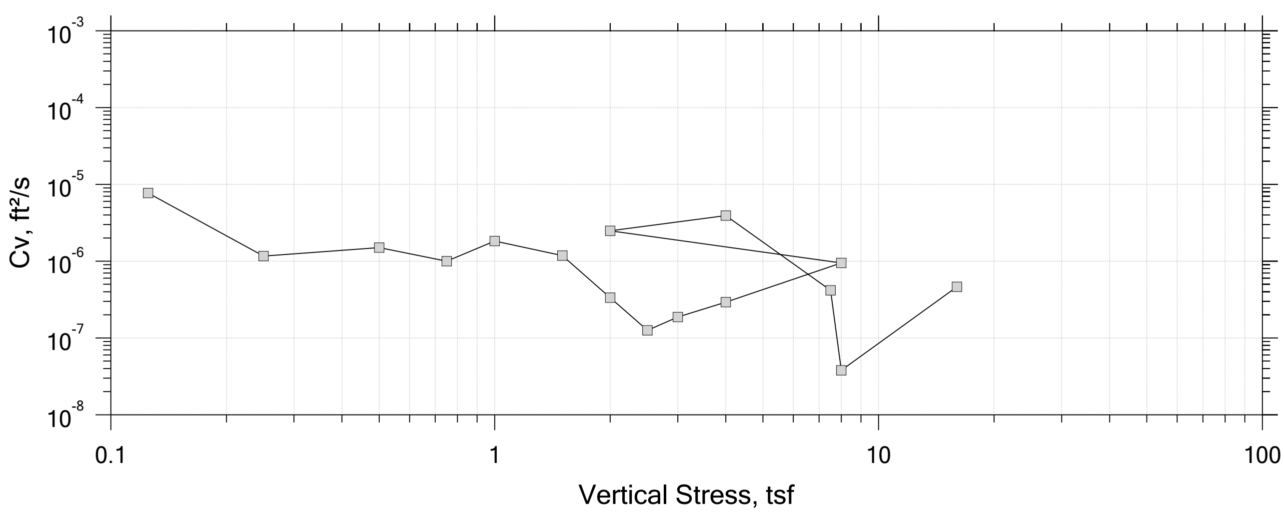
Note: Specific Gravity and Void Ratios are calculated assuming the degree of saturation equals 100% at the end of the test.
Therefore, values may not represent actual values for the specimen.

GeoTesting EXPRESS	Project Name: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project Number: GTX-310291
	Boring Number: BB-FBR-102	Tester: md	Checker: njh
	Sample Number: 1U	Test Date: 07/26/19	Depth: 34-36 ft
	Test Number: CRC-3	Preparation: intact	Elevation: ---
	Description: Moist, dark greenish gray clay		
	Remarks: System W		

One-Dimensional Consolidation by ASTM D2435 - Method B

Summary Report





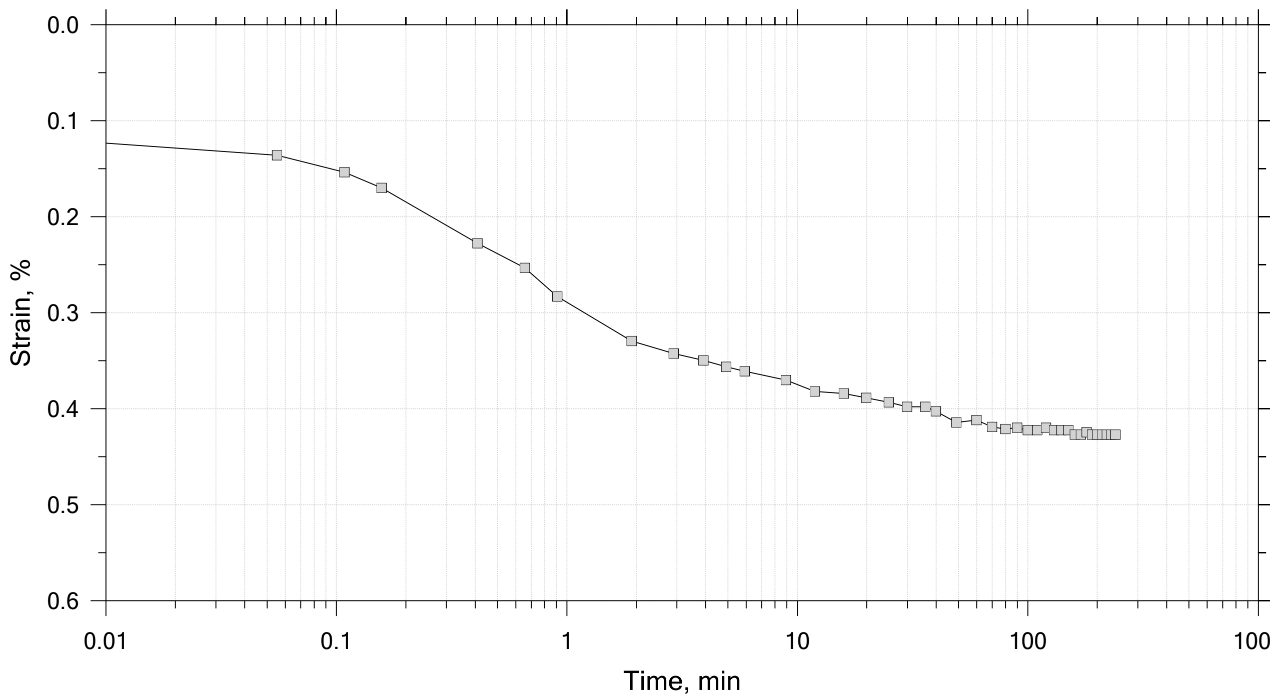
GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-102	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 44-46 ft
	Test No.: IP-2	Sample Type: Intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System V,		
	Displacement at End of Increment		

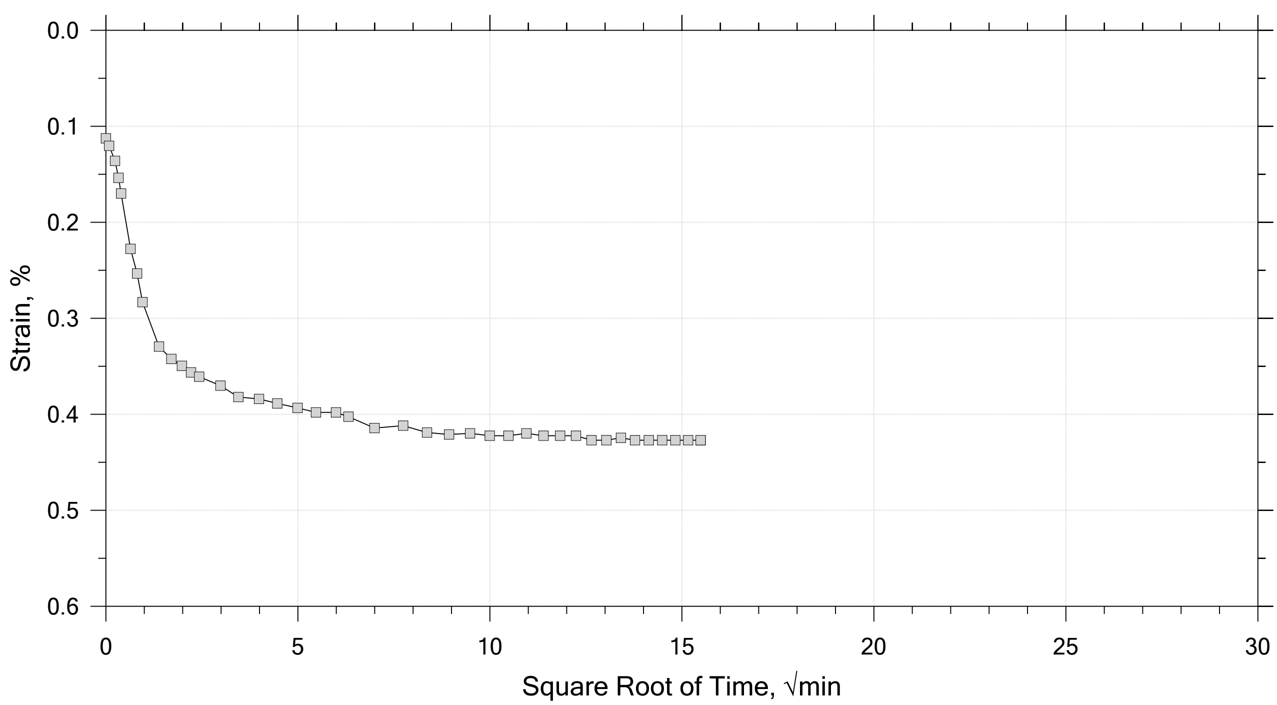
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 1 of 17

Constant Load Step

Stress: 0.125 tsf

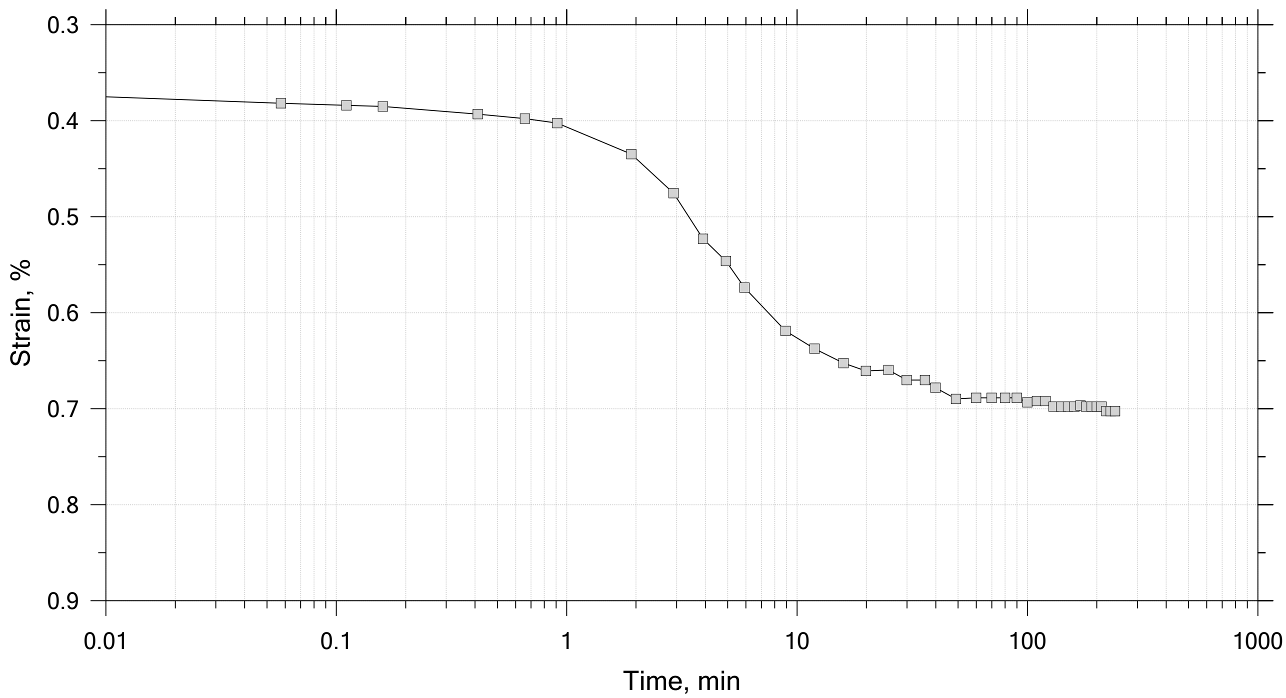


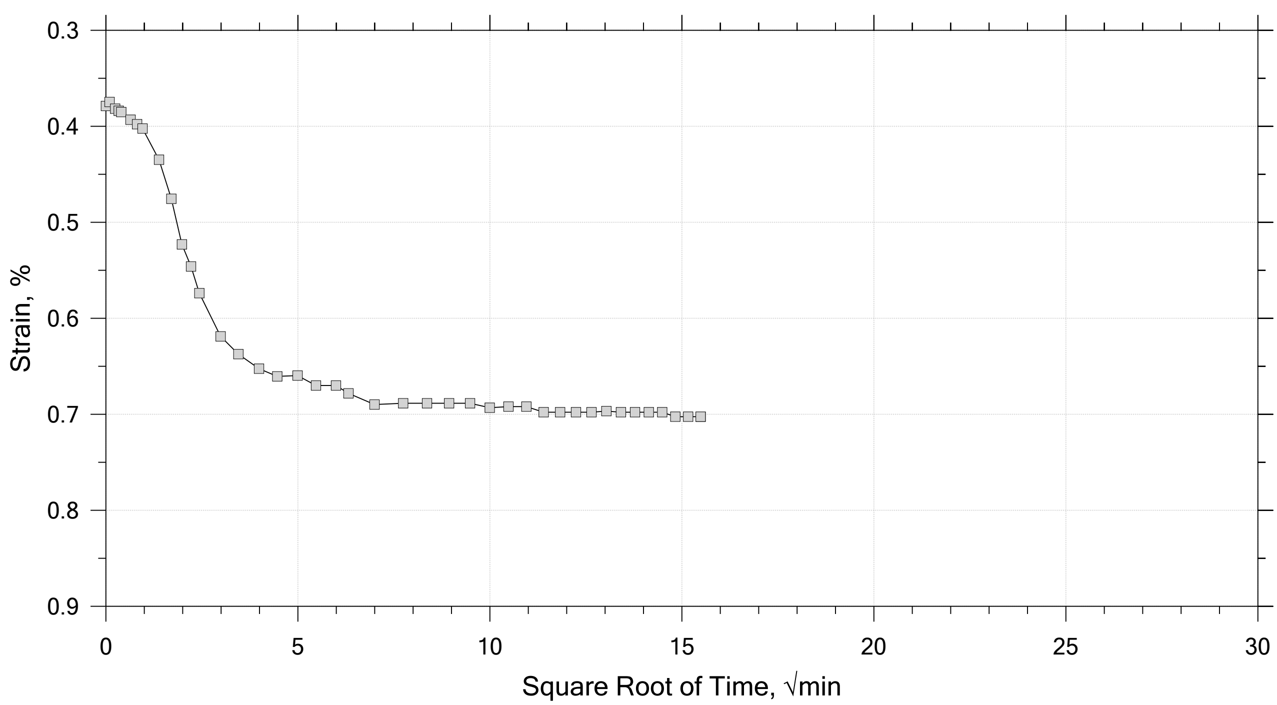


GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-102	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 44-46 ft
	Test No.: IP-2	Sample Type: Intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System V,		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 2 of 17
Constant Load Step
Stress: 0.25 tsf





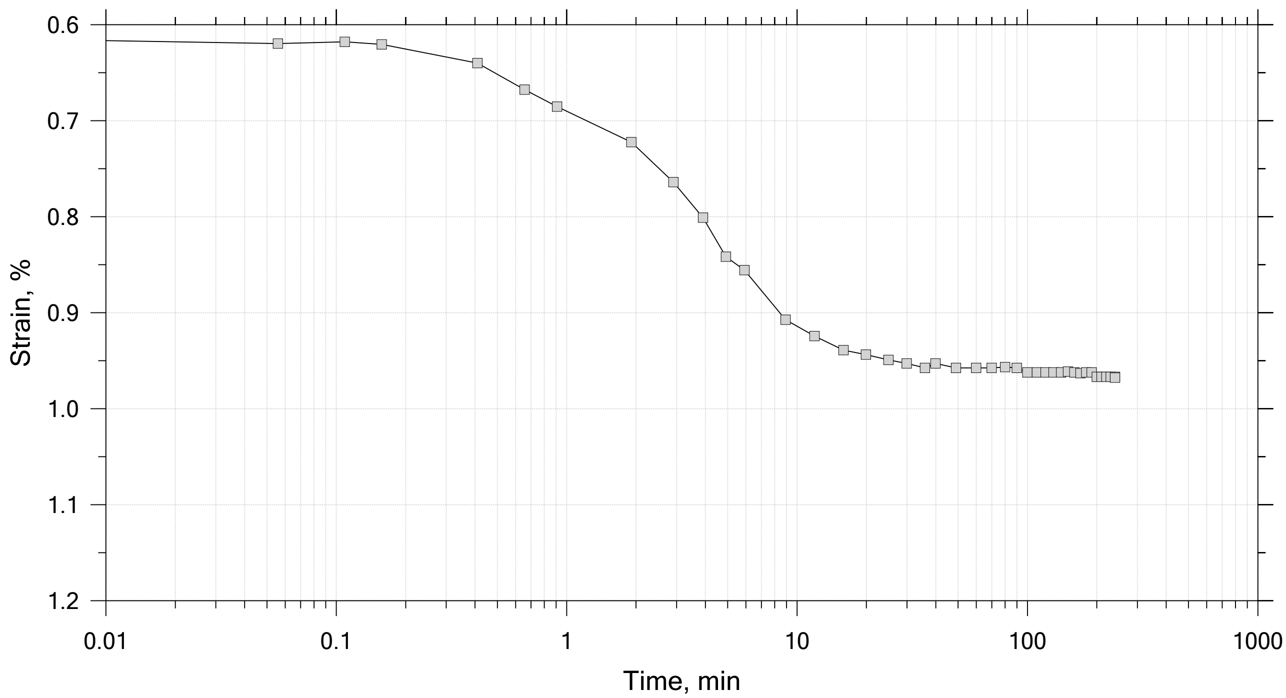
GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-102	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 44-46 ft
	Test No.: IP-2	Sample Type: Intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System V,		

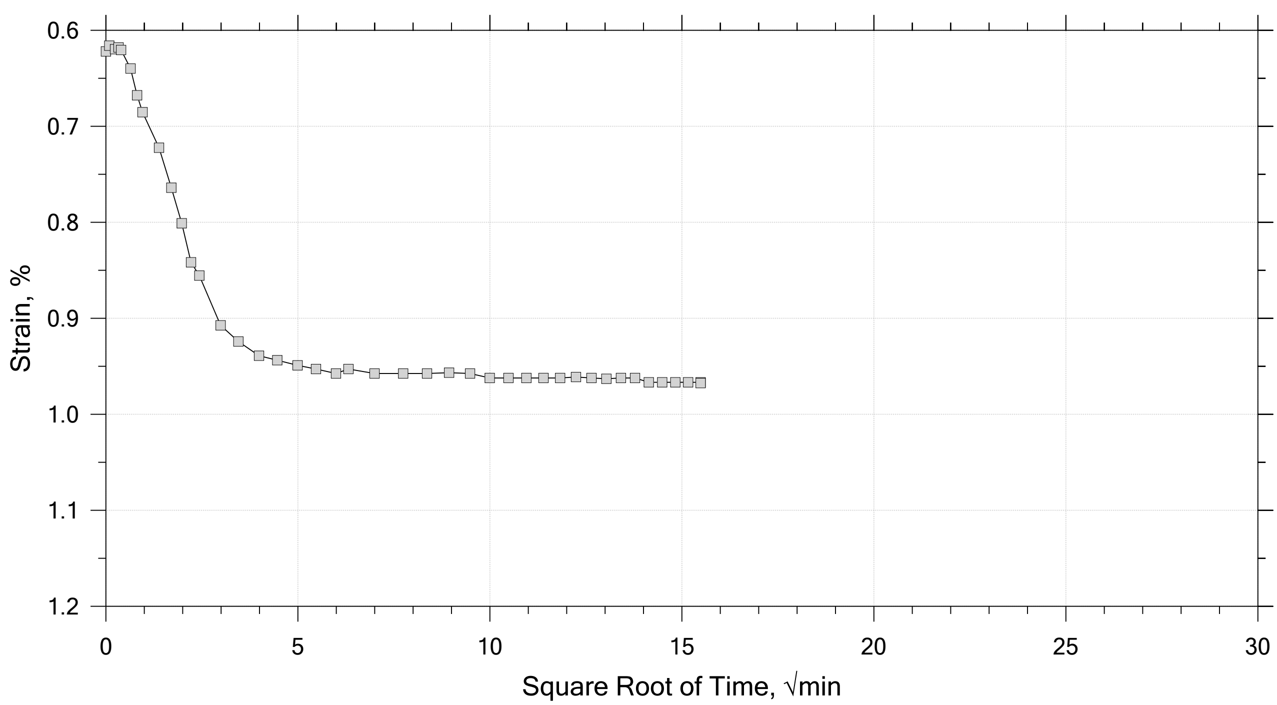
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 3 of 17

Constant Load Step

Stress: 0.5 tsf





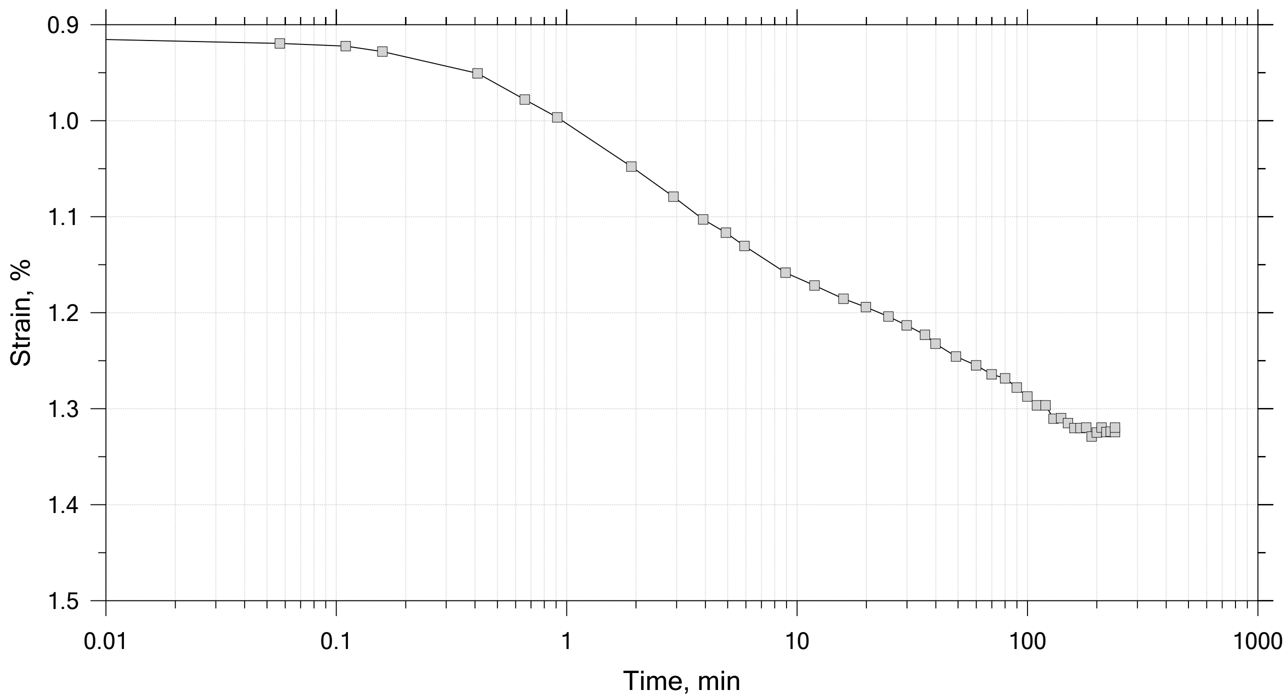
GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-102	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 44-46 ft
	Test No.: IP-2	Sample Type: Intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System V,		

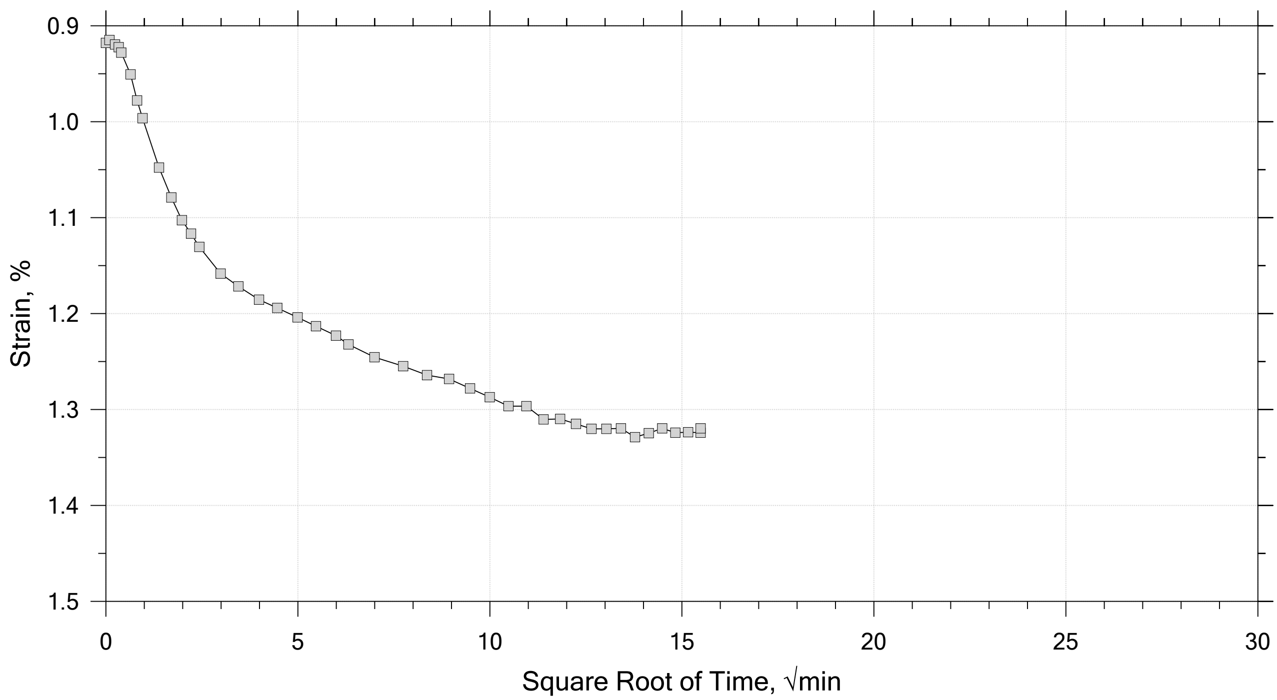
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 4 of 17

Constant Load Step

Stress: 0.75 tsf





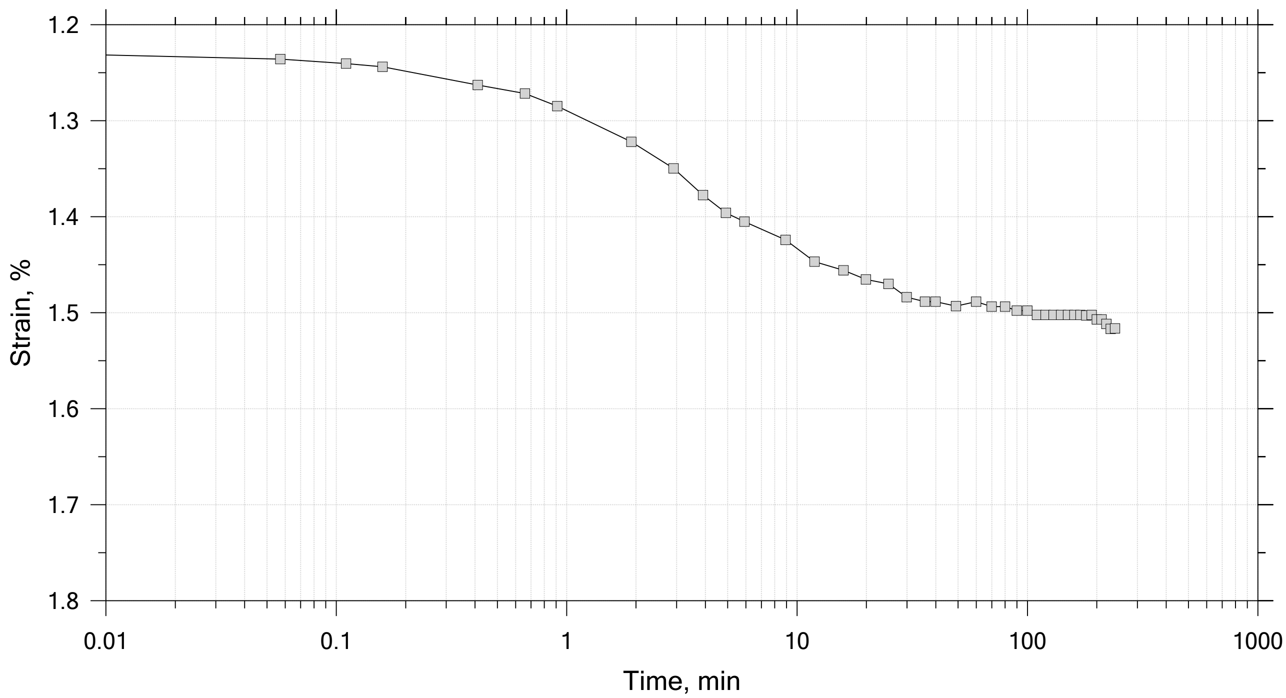
GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-102	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 44-46 ft
	Test No.: IP-2	Sample Type: Intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System V,		

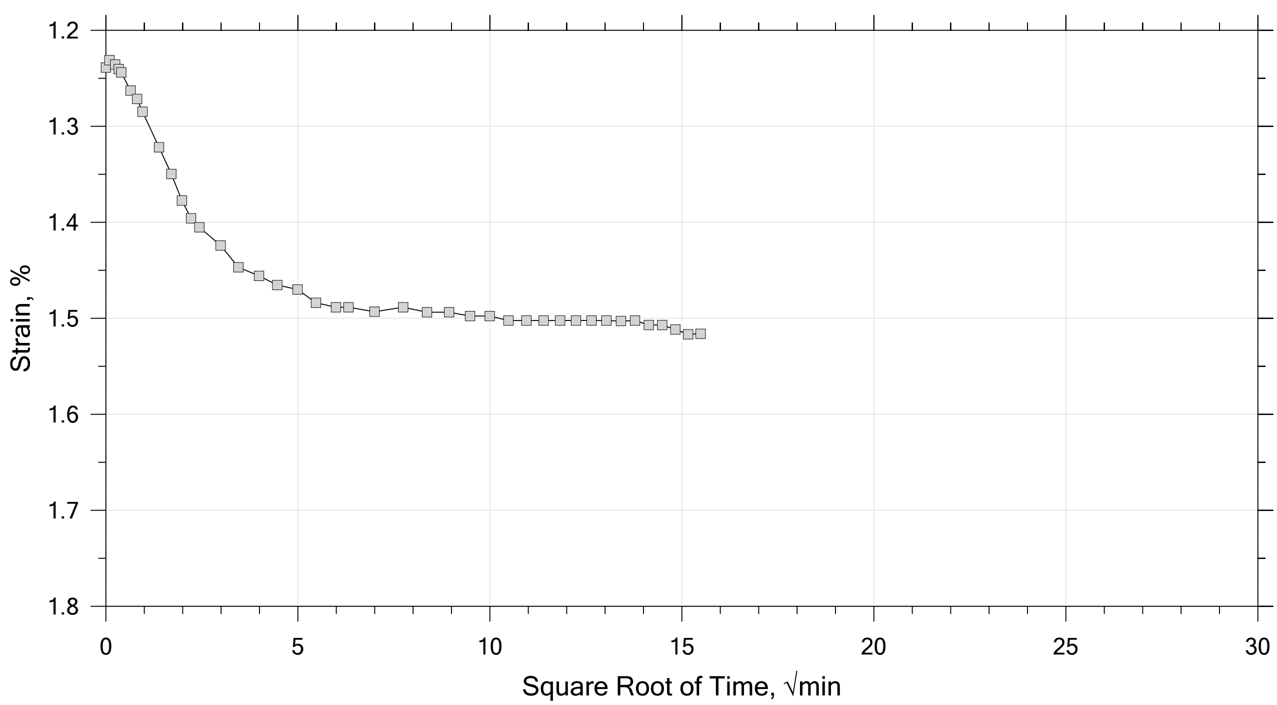
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 5 of 17

Constant Load Step

Stress: 1 tsf

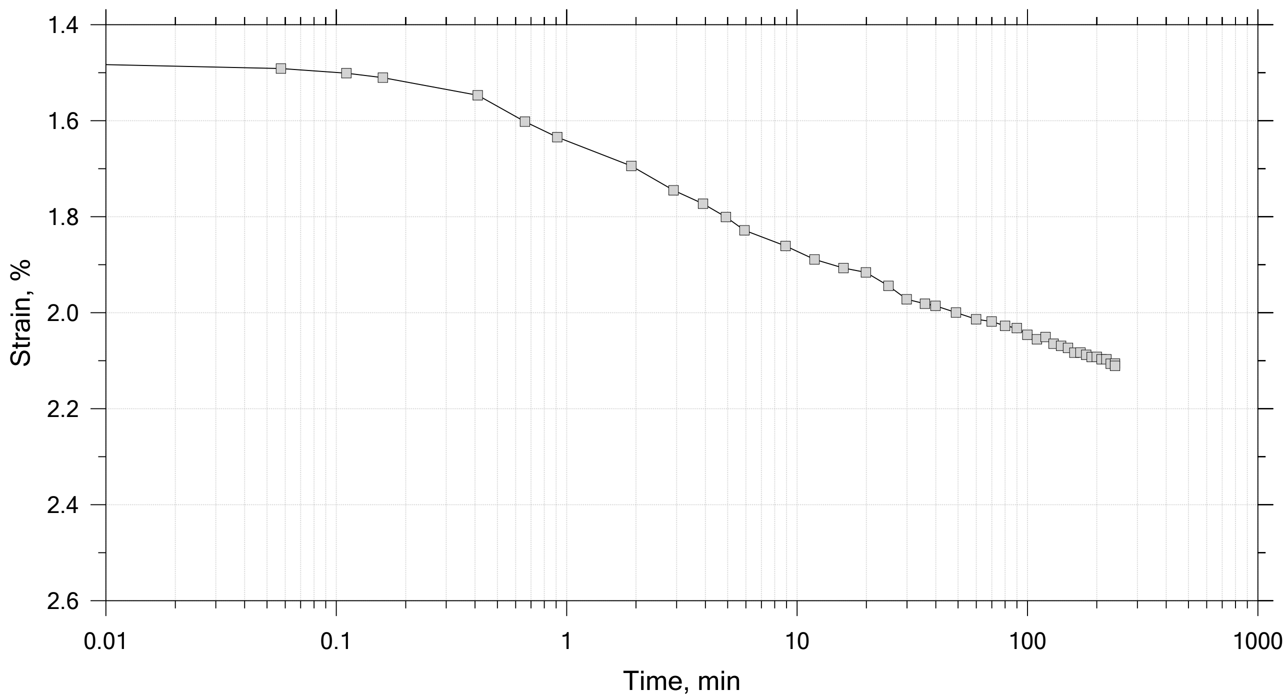


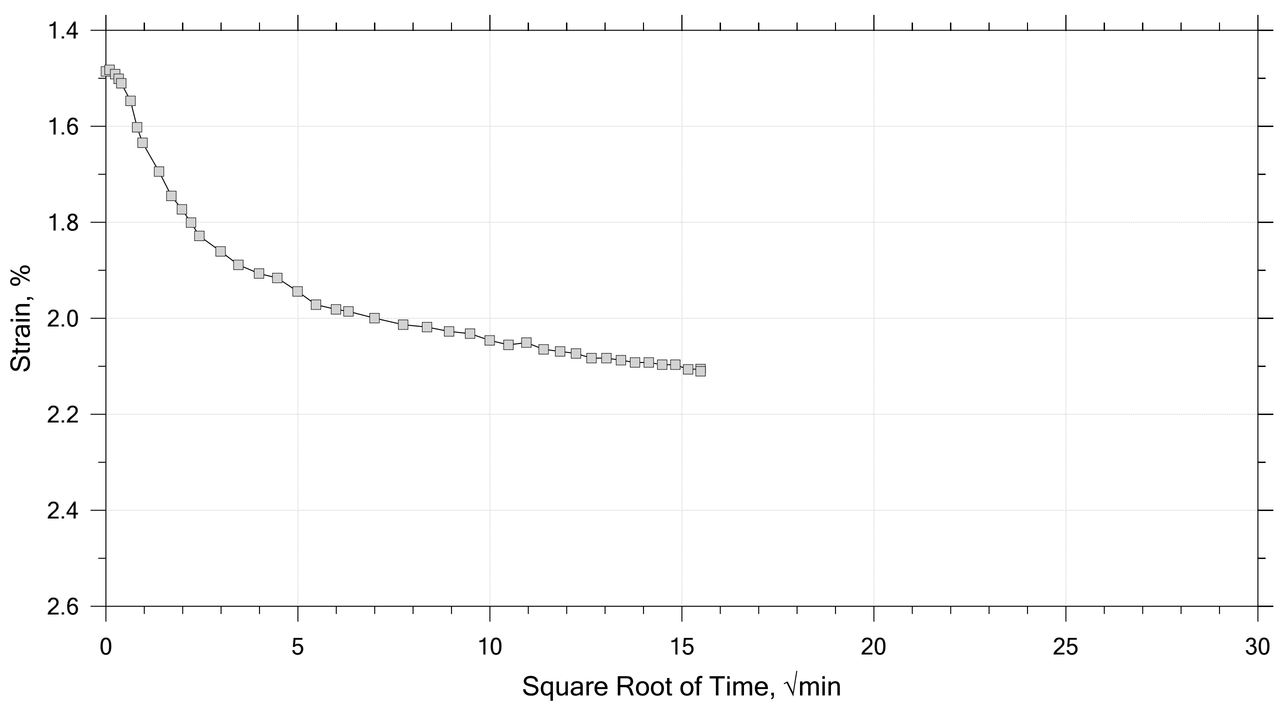


GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-102	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 44-46 ft
	Test No.: IP-2	Sample Type: Intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System V,		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 6 of 17
Constant Load Step
Stress: 1.5 tsf





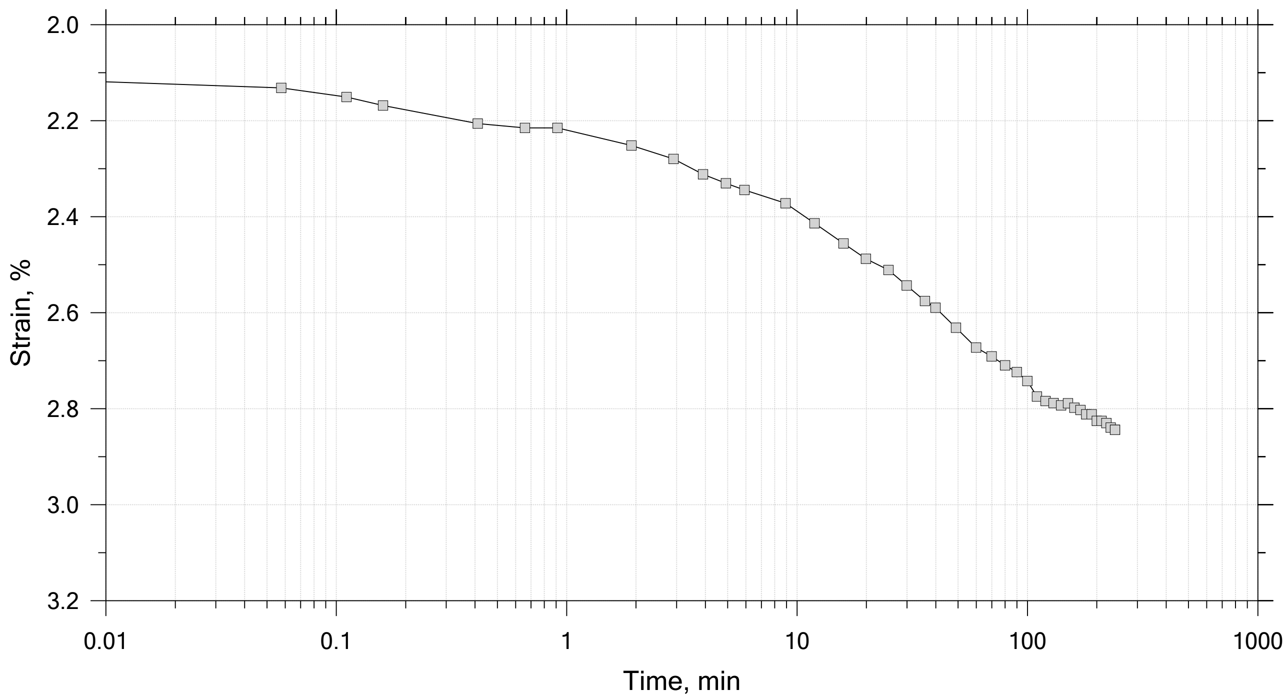
GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-102	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 44-46 ft
	Test No.: IP-2	Sample Type: Intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System V,		

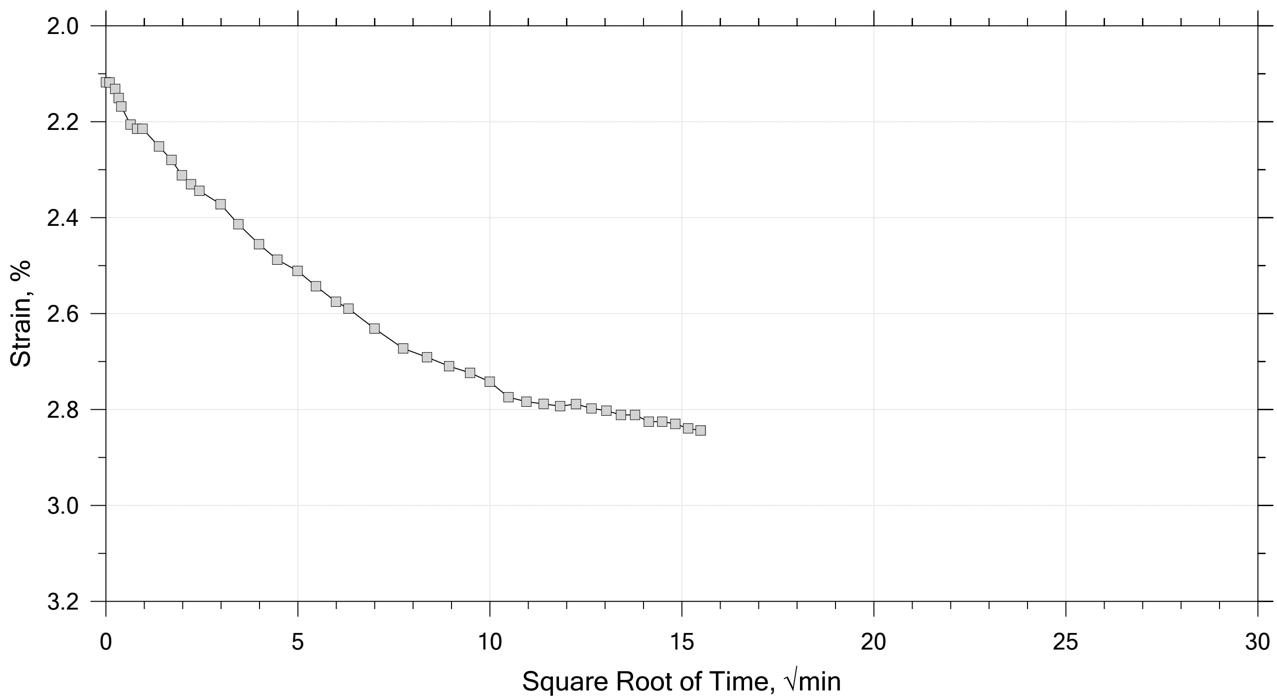
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 7 of 17

Constant Load Step

Stress: 2 tsf





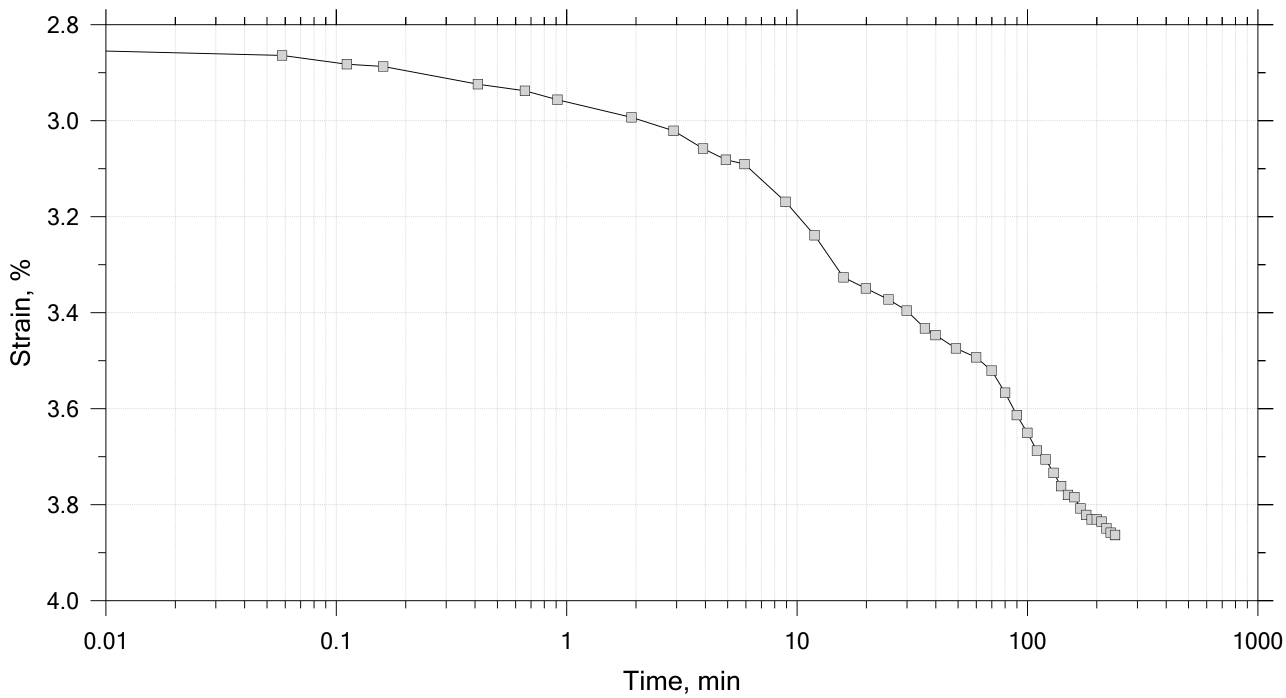
GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-102	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 44-46 ft
	Test No.: IP-2	Sample Type: Intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System V,		

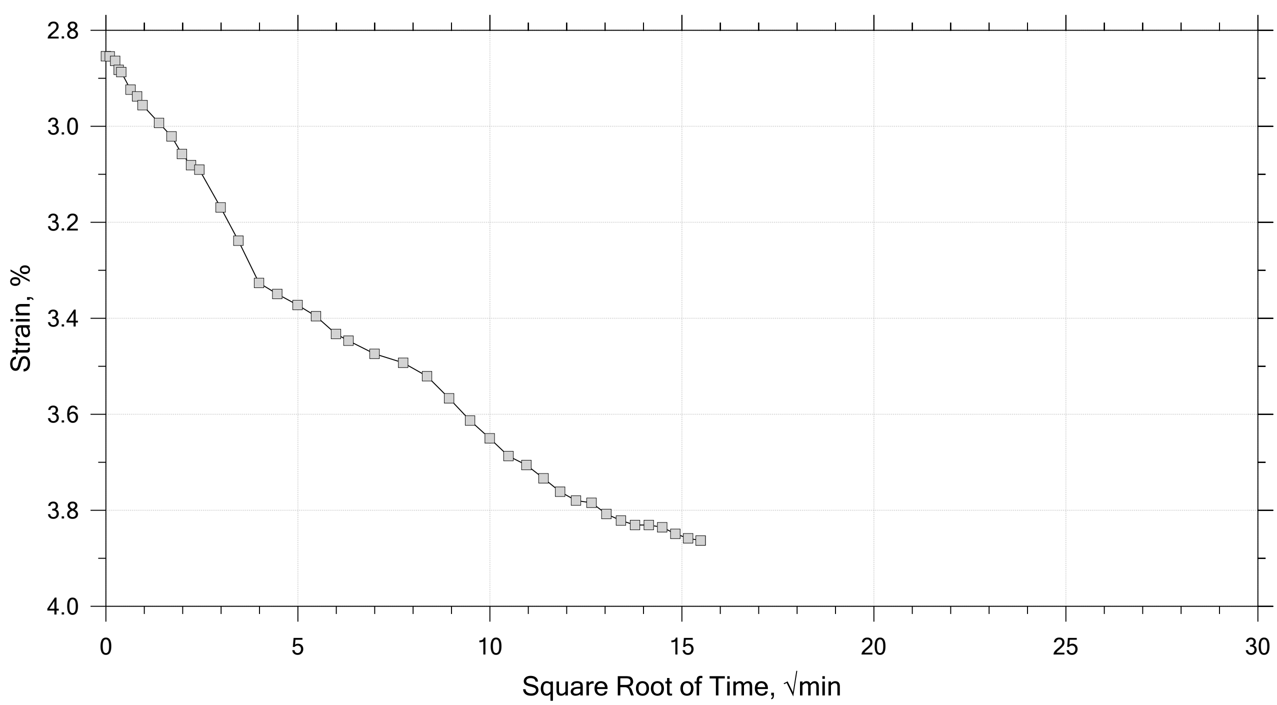
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 8 of 17

Constant Load Step

Stress: 2.5 tsf





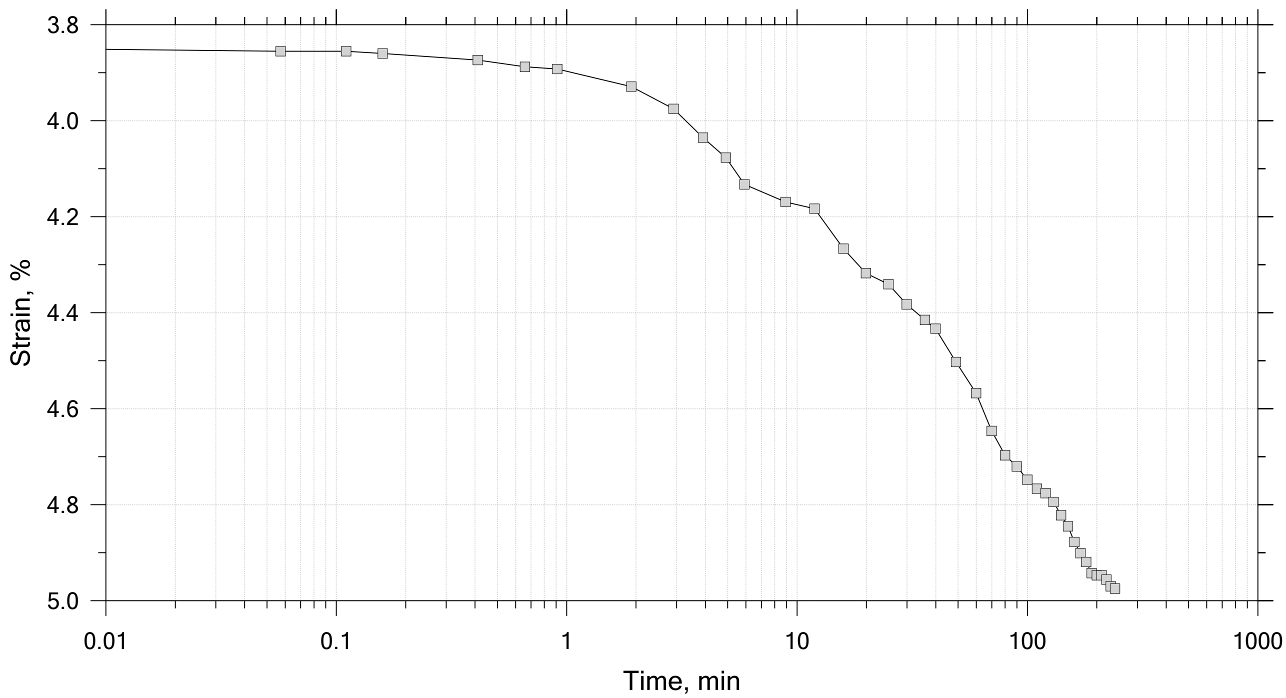
GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-102	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 44-46 ft
	Test No.: IP-2	Sample Type: Intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System V,		

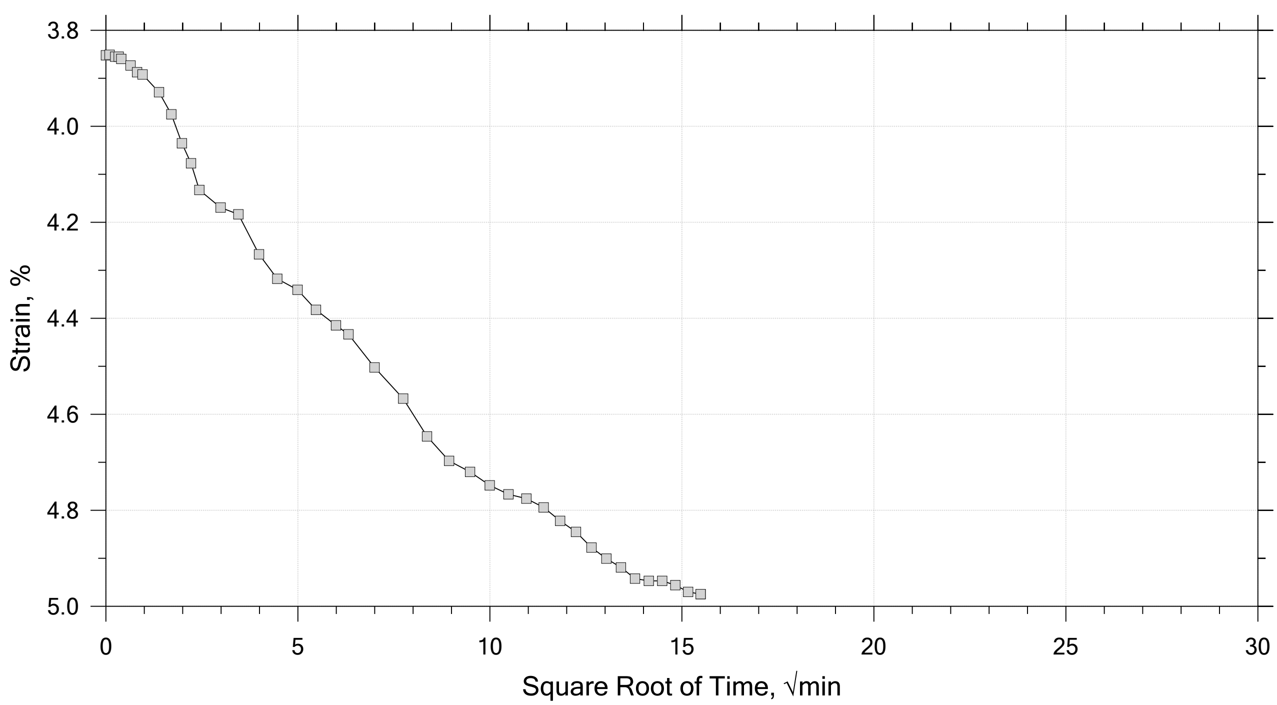
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 9 of 17

Constant Load Step

Stress: 3 tsf

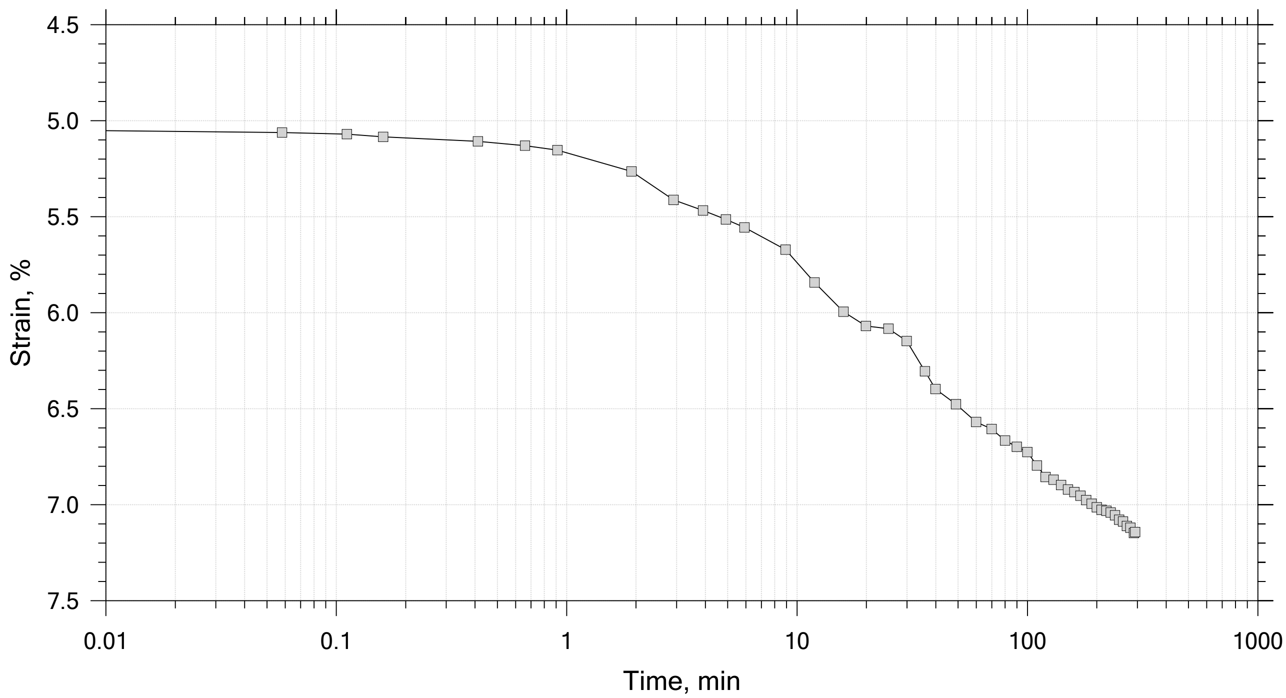


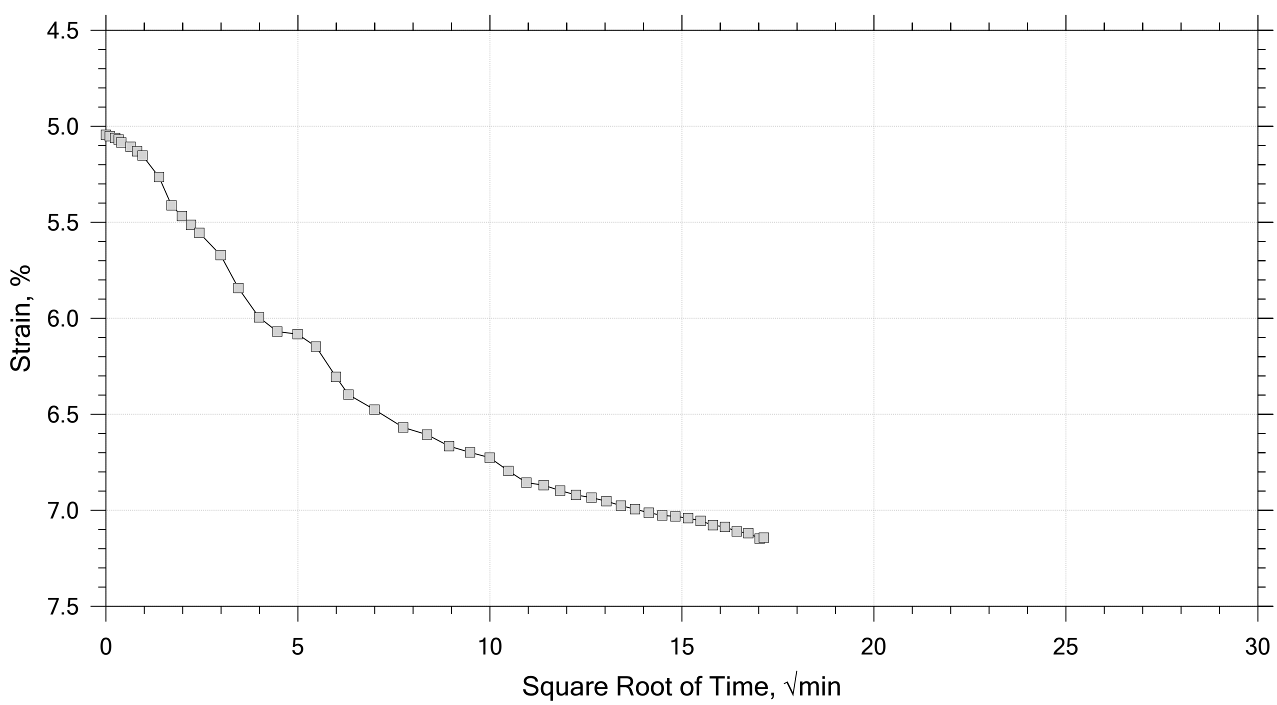


GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-102	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 44-46 ft
	Test No.: IP-2	Sample Type: Intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System V,		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 10 of 17
Constant Load Step
Stress: 4 tsf





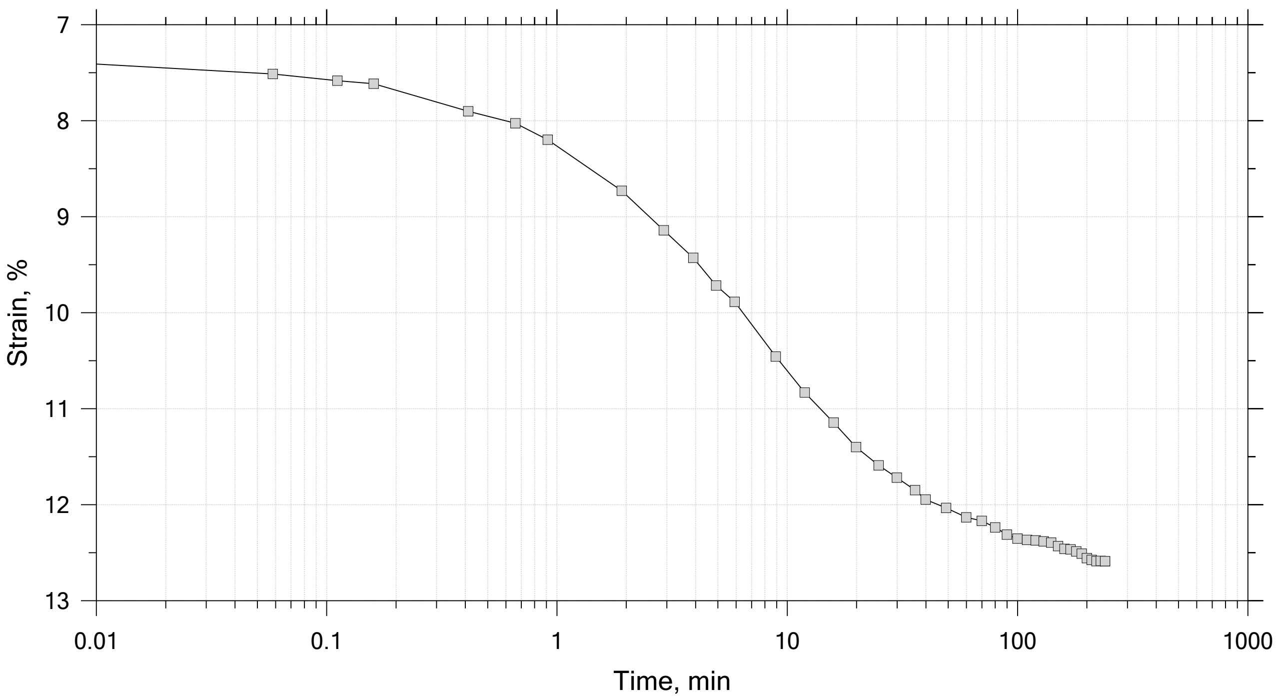
GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-102	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 44-46 ft
	Test No.: IP-2	Sample Type: Intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System V,		

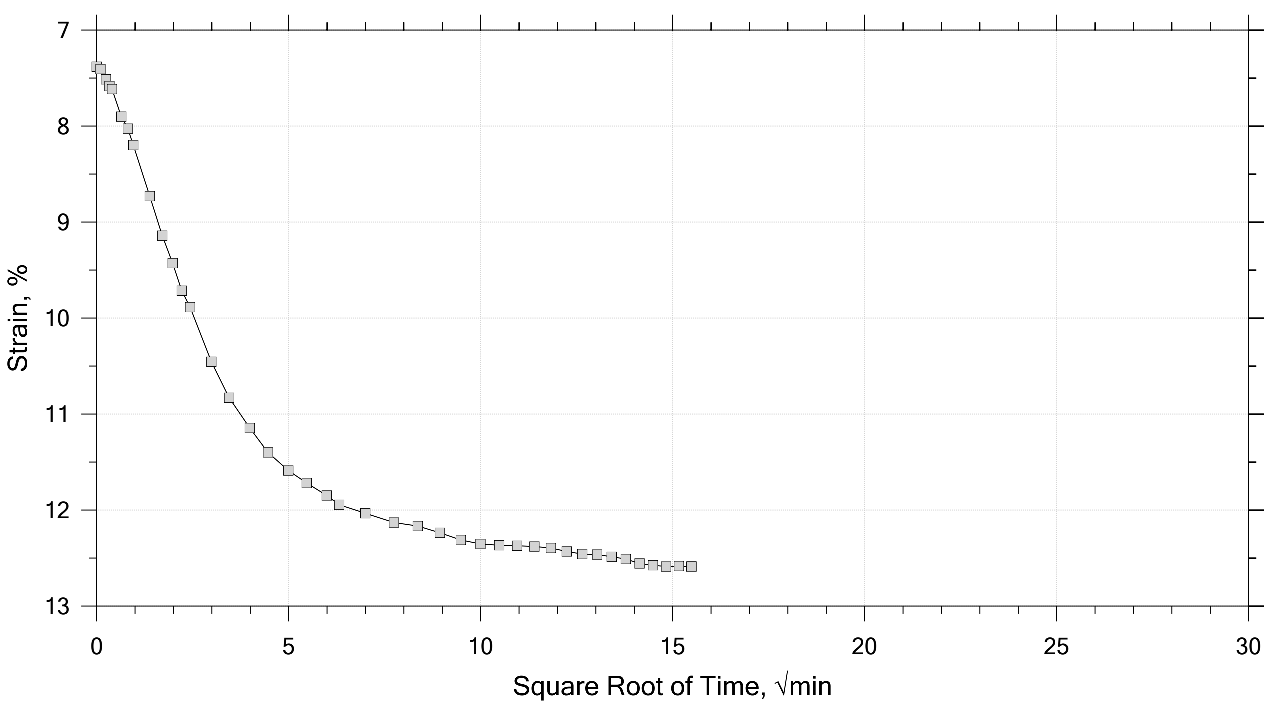
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 11 of 17

Constant Load Step

Stress: 8 tsf





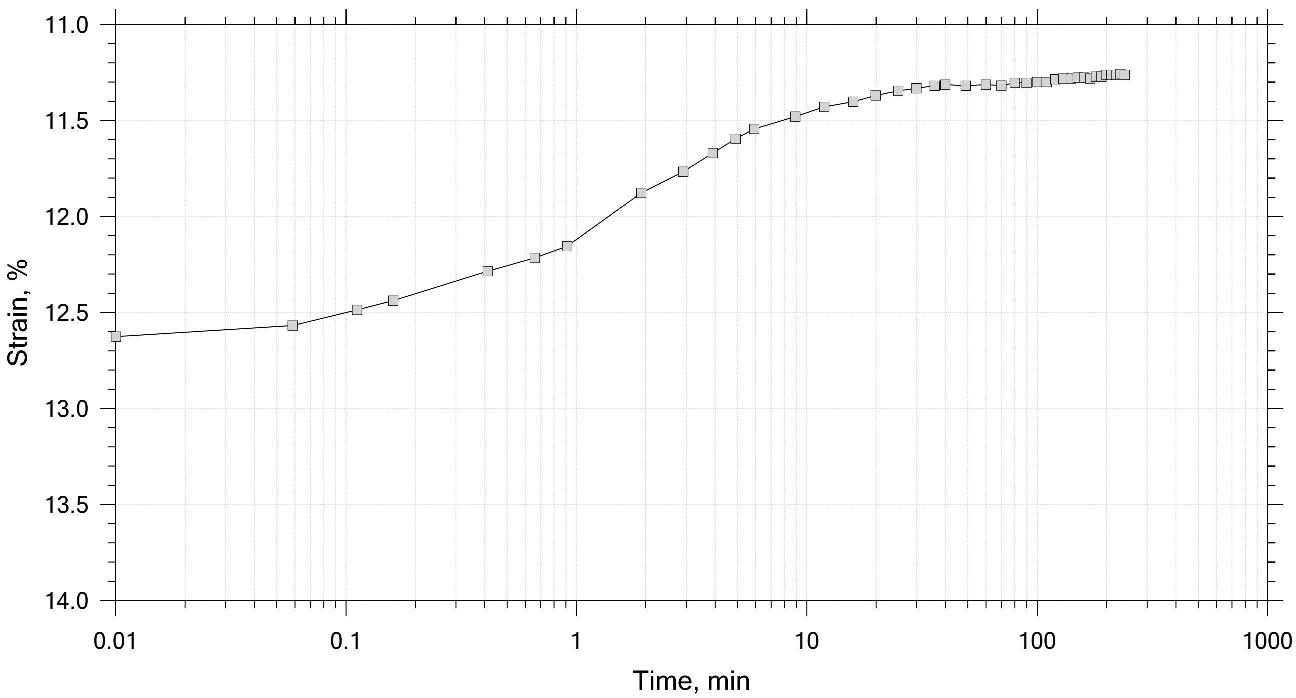
Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
Boring No.: BB-FBR-102	Tested By: md	Checked By: mcm
Sample No.: 2U	Test Date: 07/22/19	Depth: 44-46 ft
Test No.: IP-2	Sample Type: Intact	Elevation: ---
Description: Moist, dark gray clay		
Remarks: System V,		

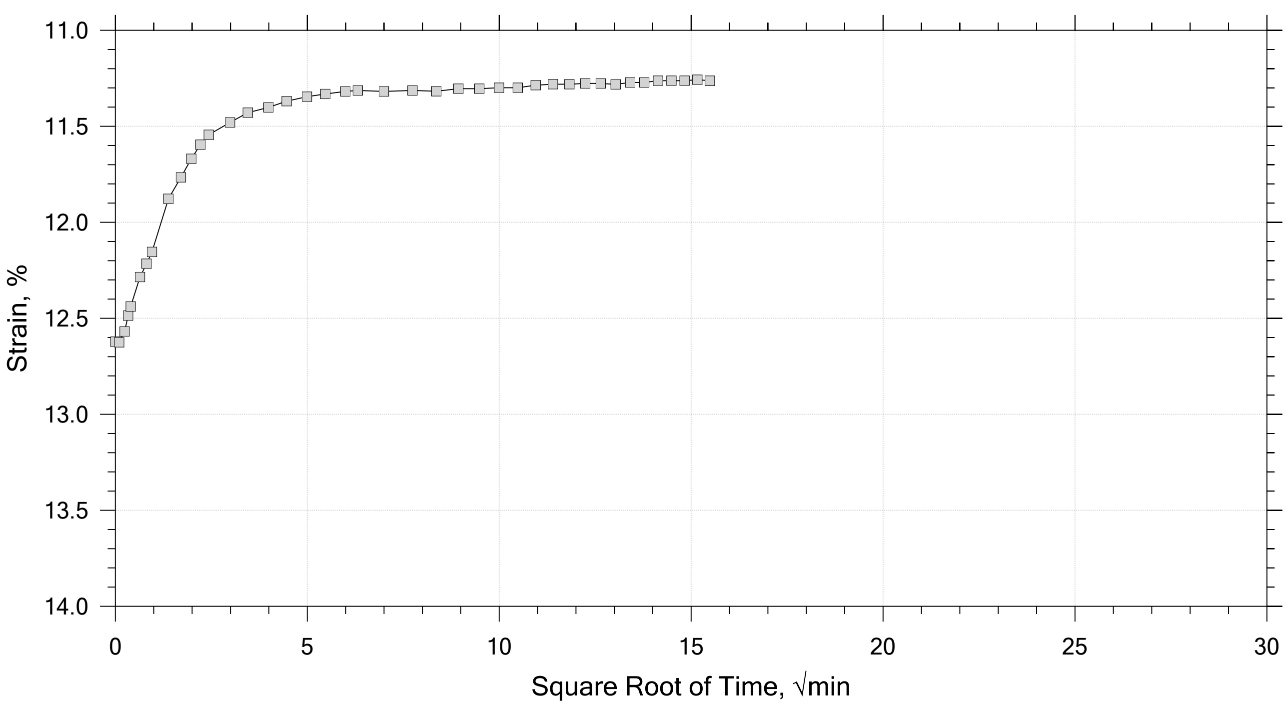
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 12 of 17

Constant Load Step

Stress: 1 tsf





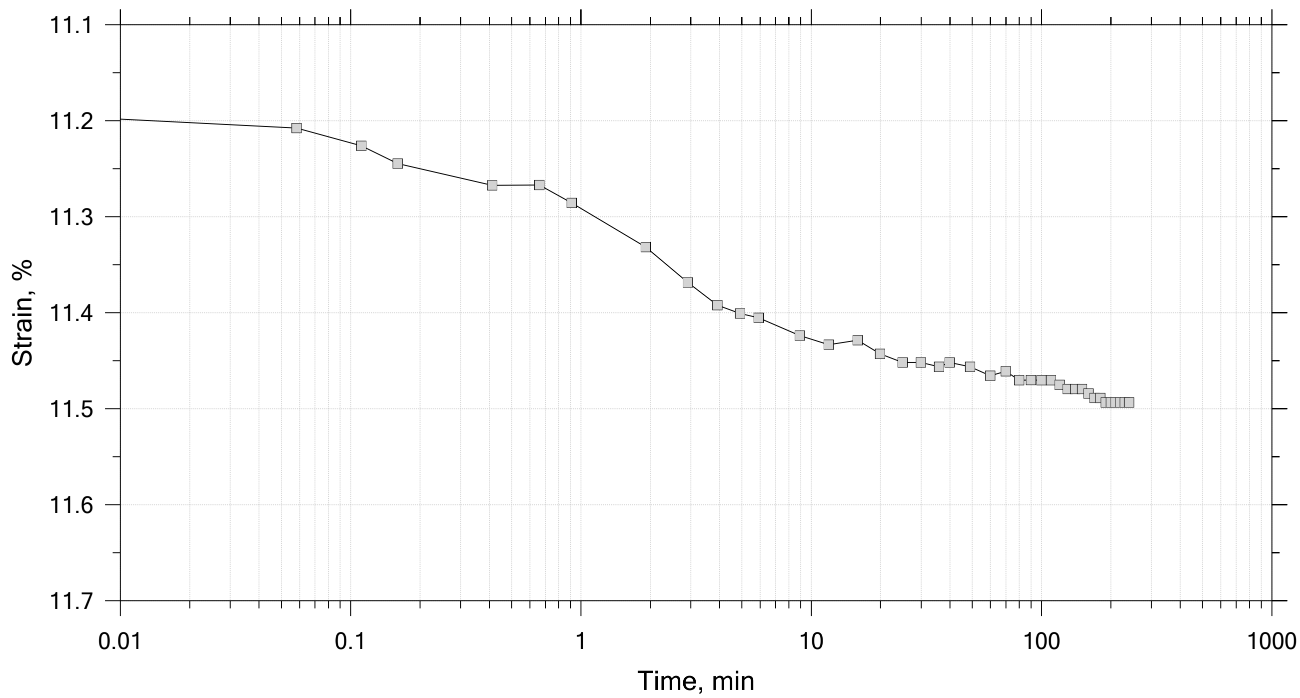
GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-102	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 44-46 ft
	Test No.: IP-2	Sample Type: Intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System V,		

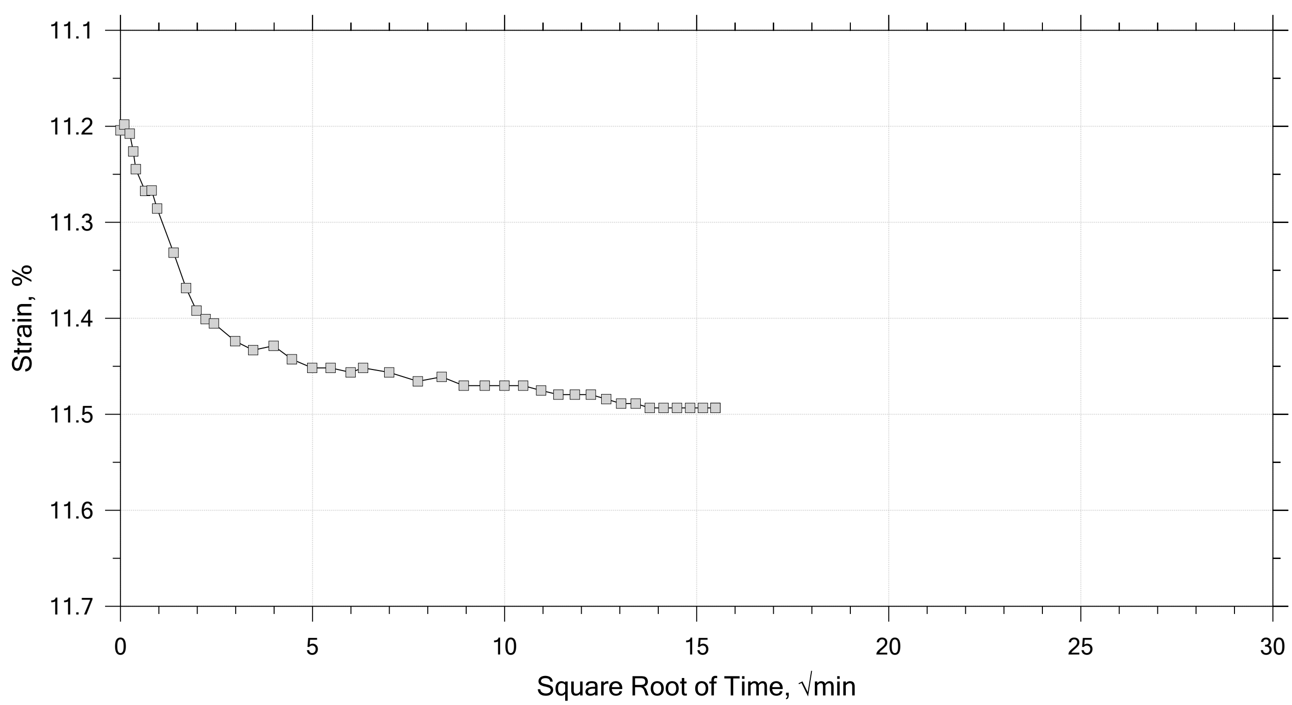
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 13 of 17

Constant Load Step

Stress: 2 tsf





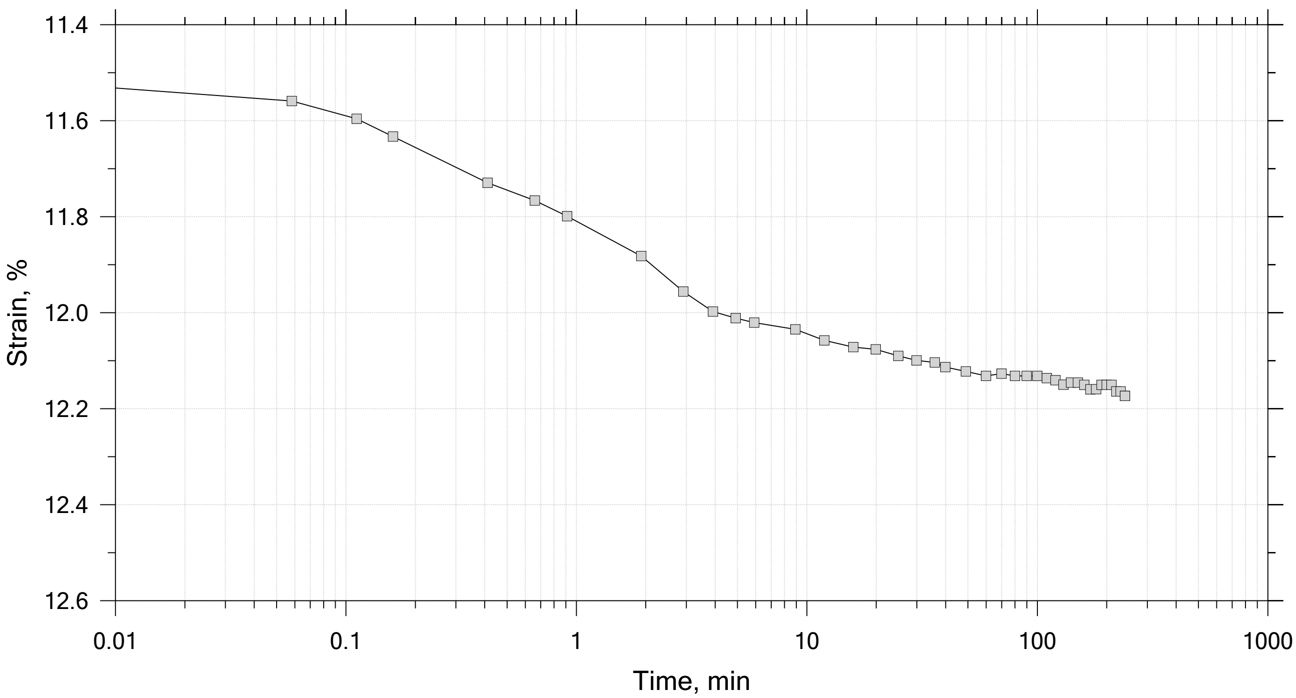
GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-102	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 44-46 ft
	Test No.: IP-2	Sample Type: Intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System V,		

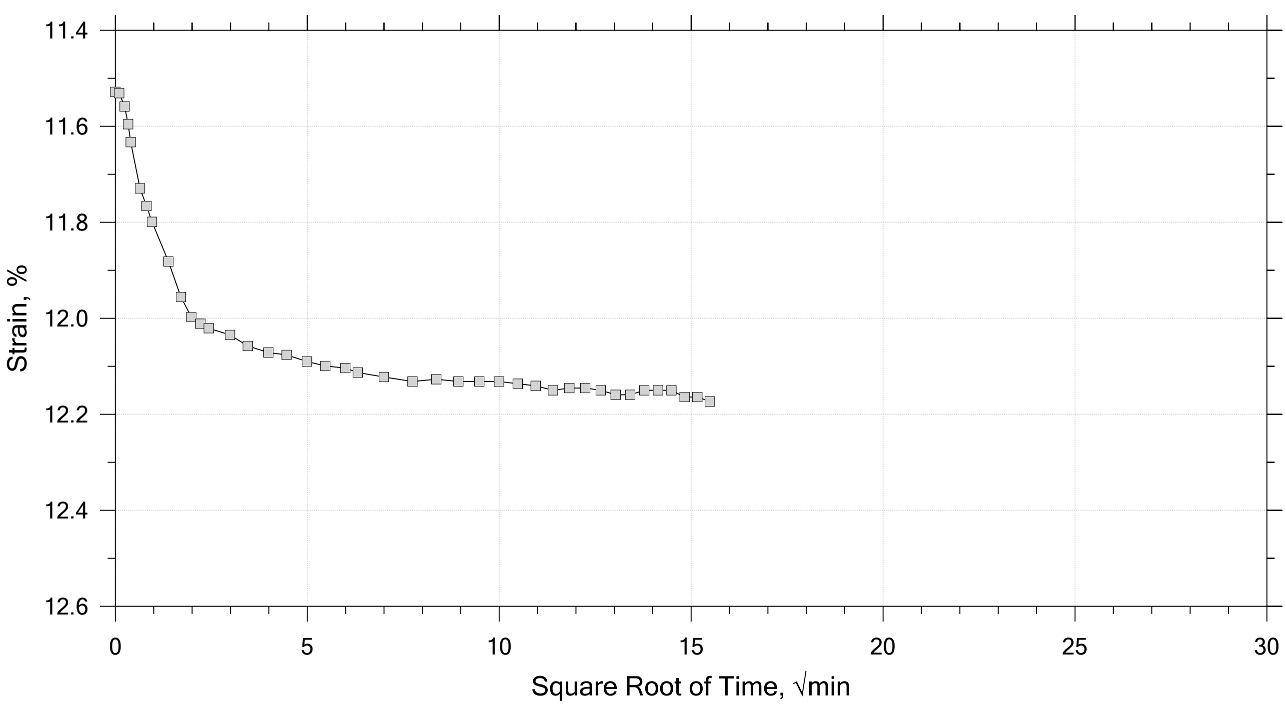
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 14 of 17

Constant Load Step

Stress: 4 tsf

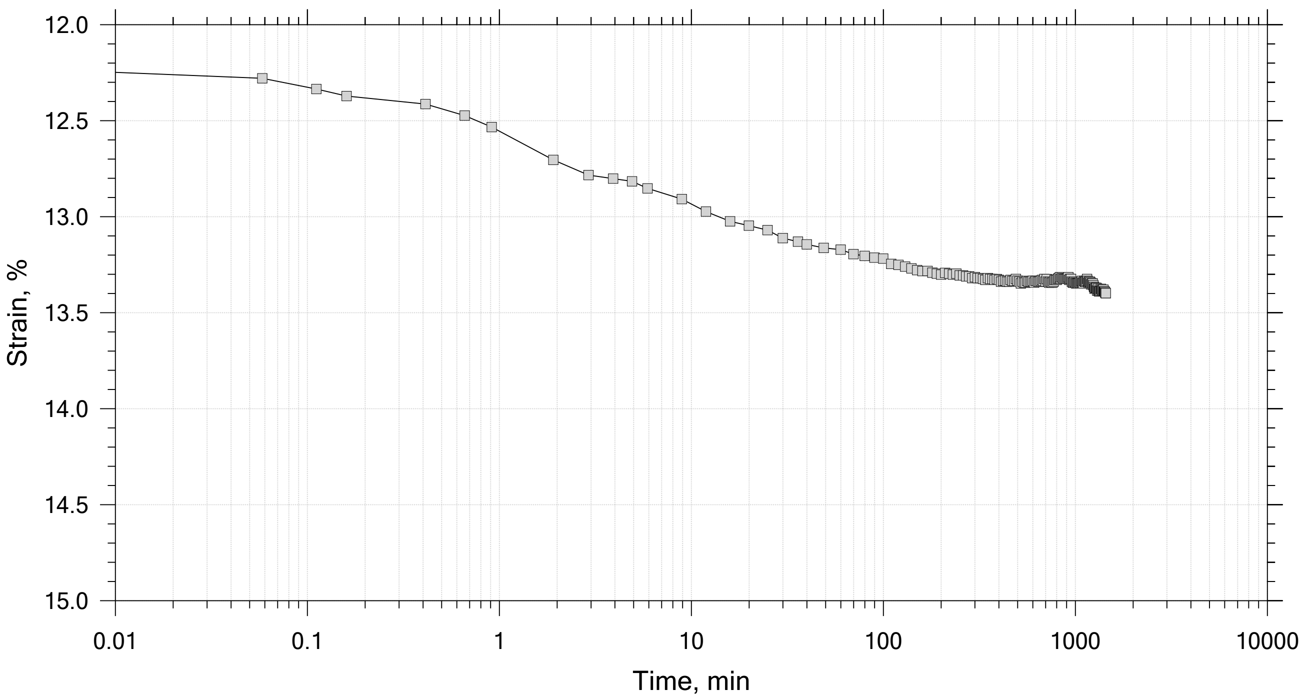


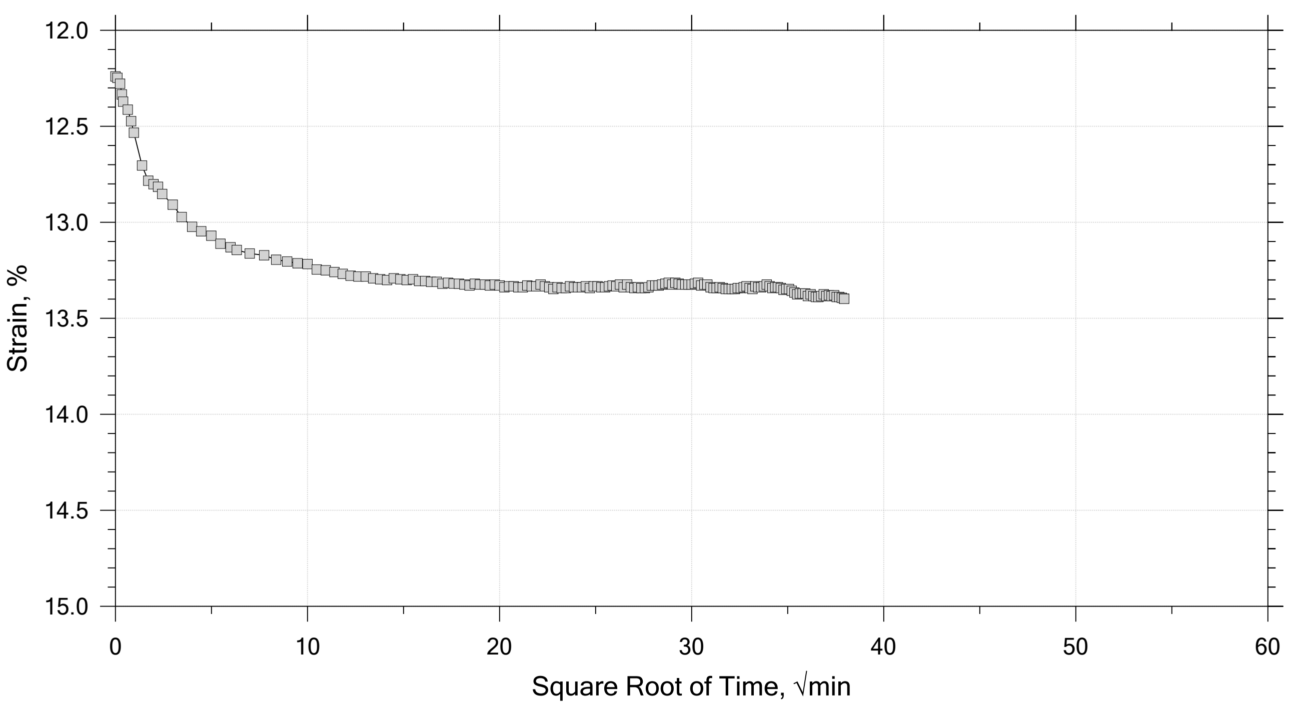


GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-102	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 44-46 ft
	Test No.: IP-2	Sample Type: Intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System V,		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 15 of 17
Constant Load Step
Stress: 7.5 tsf





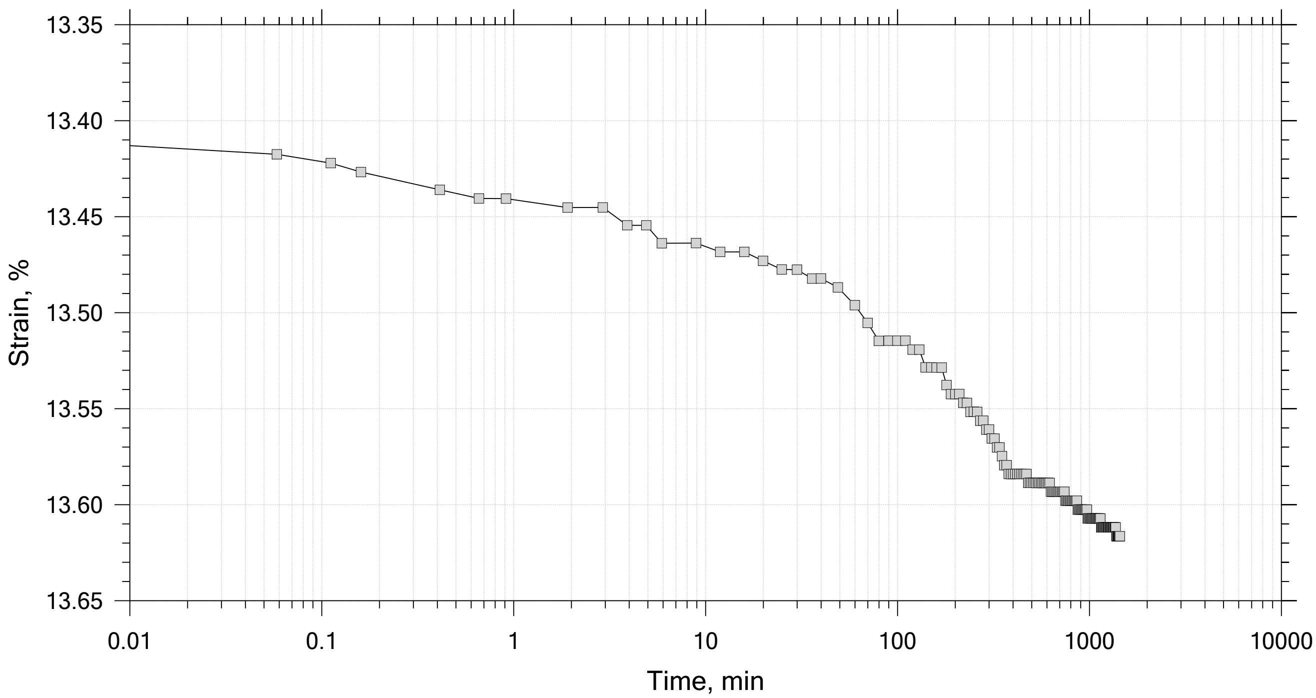
GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-102	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 44-46 ft
	Test No.: IP-2	Sample Type: Intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System V,		

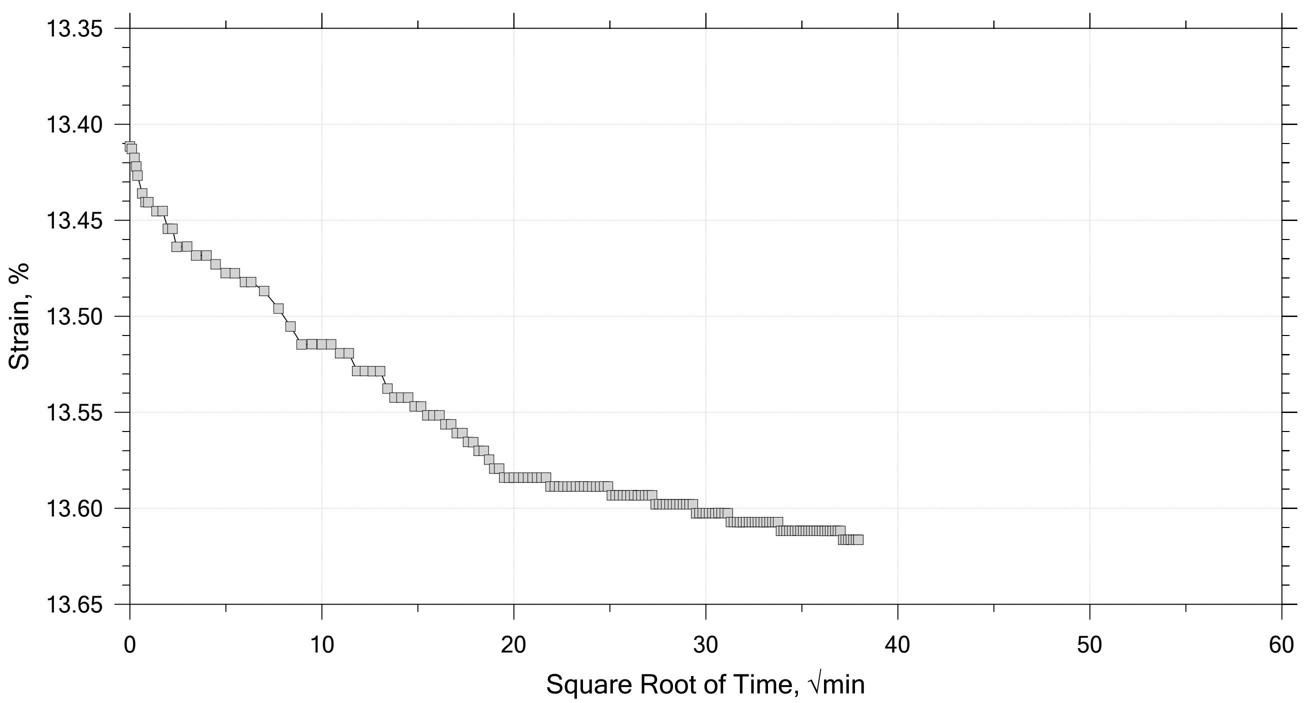
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 16 of 17

Constant Load Step

Stress: 8 tsf





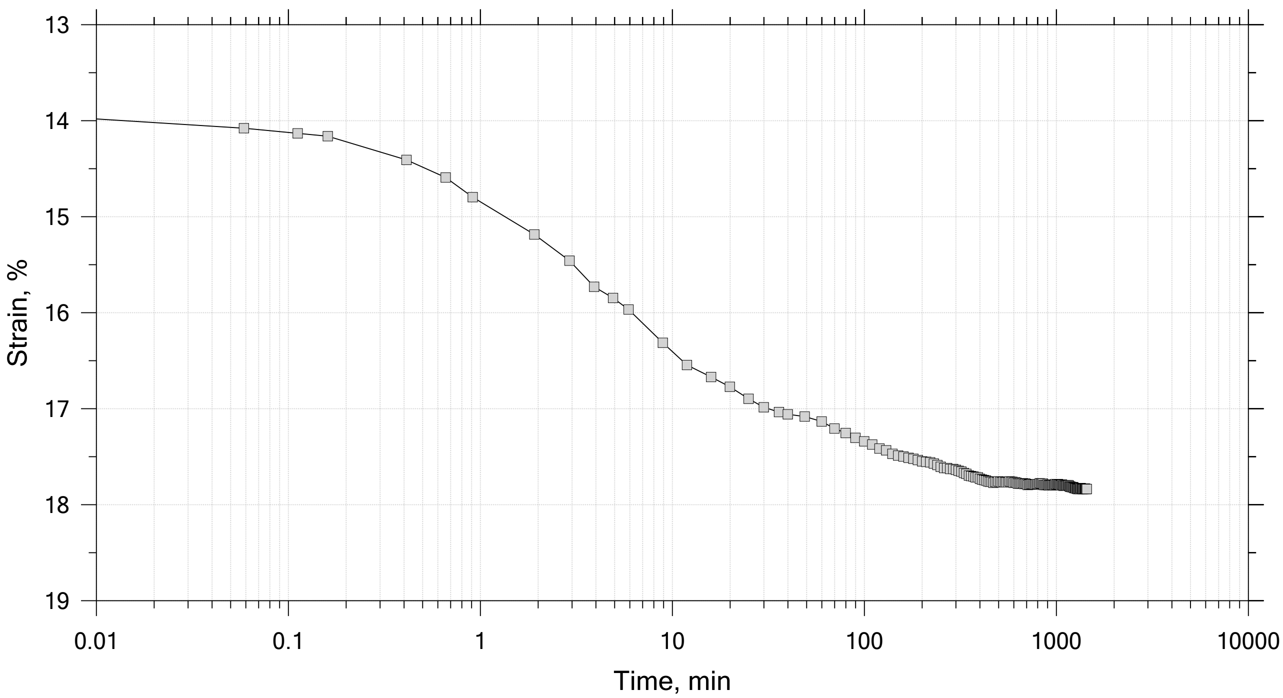
GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-102	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 44-46 ft
	Test No.: IP-2	Sample Type: Intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System V,		

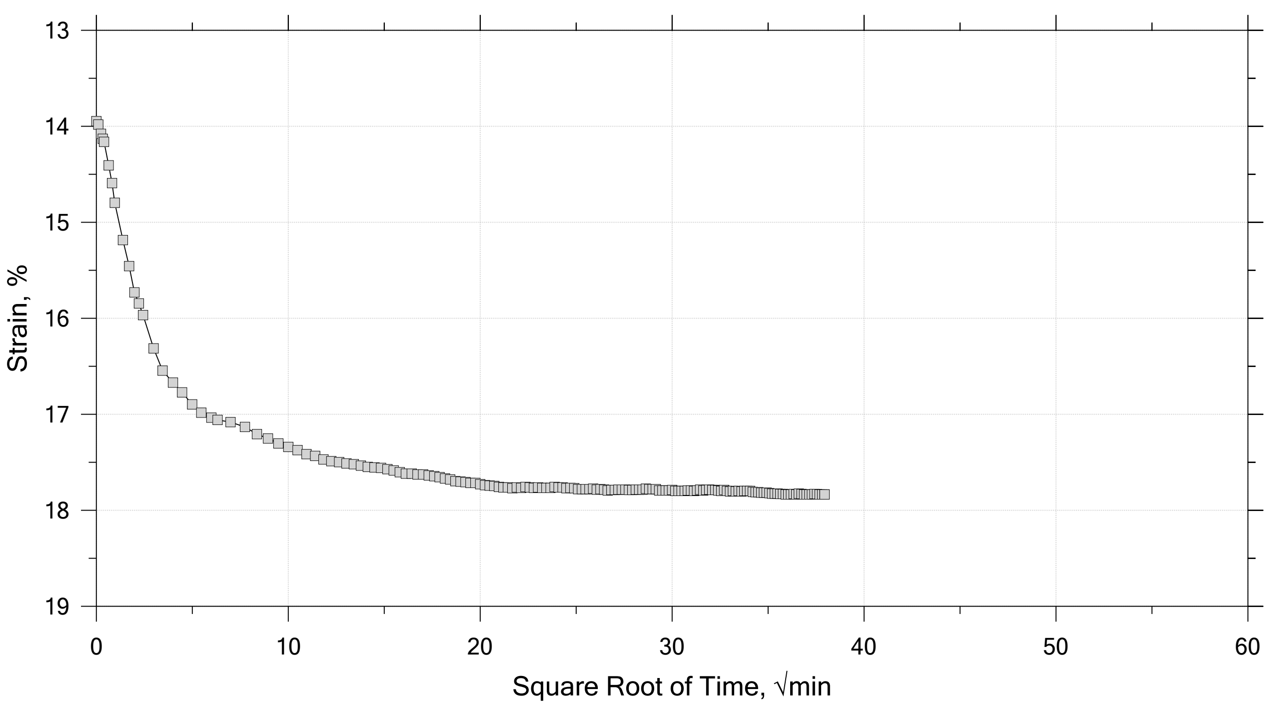
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 17 of 17

Constant Load Step

Stress: 16 tsf





GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-102	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 44-46 ft
	Test No.: IP-2	Sample Type: Intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System V,		

One-Dimensional Consolidation by ASTM D2435 - Method B

Specimen Diameter: 2.50 in	Estimated Specific Gravity: 2.76	Liquid Limit: 42
Initial Height: 1.00 in	Initial Void Ratio: 0.955	Plastic Limit: 21
Final Height: 0.82 in	Final Void Ratio: 0.606	Plasticity Index: 21

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	A-3062	RING		C-3016
Mass Container, gm	8.38	108.83	108.83	9.25
Mass Container + Wet Soil, gm	127.75	260.77	247.53	147.8
Mass Container + Dry Soil, gm	94.79	222.58	222.58	122.88
Mass Dry Soil, gm	86.41	113.75	113.75	113.63
Water Content, %	38.14	33.57	21.93	21.93
Void Ratio	---	0.95	0.61	---
Degree of Saturation, %	---	97.18	100.00	---
Dry Unit Weight, pcf	---	88.282	107.45	---

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.

GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-102	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 44-46 ft
	Test No.: IP-2	Sample Type: Intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System V,		

One-Dimensional Consolidation by ASTM D2435 - Method B

Log of Time Coefficients

Step	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	Log T50 min	Cv ft²/s	Mv 1/tsf	k ft/day	Ca %
1	0.125	0.004270	0.947	0.427	0.784	7.24e-06	3.42e-02	6.67e-04	0.00e+00
2	0.250	0.007025	0.941	0.702	0.000	0.00e+00	2.20e-02	0.00e+00	0.00e+00
3	0.500	0.009676	0.936	0.968	3.496	1.60e-06	1.06e-02	4.59e-05	0.00e+00
4	0.750	0.01320	0.929	1.32	0.000	0.00e+00	1.41e-02	0.00e+00	0.00e+00
5	1.00	0.01516	0.925	1.52	2.873	1.93e-06	7.86e-03	4.09e-05	0.00e+00
6	1.50	0.02110	0.914	2.11	2.556	2.15e-06	1.19e-02	6.89e-05	0.00e+00
7	2.00	0.02844	0.899	2.84	19.512	2.78e-07	1.47e-02	1.10e-05	0.00e+00
8	2.50	0.03863	0.879	3.86	0.000	0.00e+00	2.04e-02	0.00e+00	0.00e+00
9	3.00	0.04975	0.858	4.97	0.000	0.00e+00	2.22e-02	0.00e+00	0.00e+00
10	4.00	0.07143	0.815	7.14	19.918	2.53e-07	2.17e-02	1.48e-05	0.00e+00
11	8.00	0.1259	0.709	12.6	4.426	1.05e-06	1.36e-02	3.84e-05	0.00e+00
12	1.00	0.1126	0.735	11.3	1.605	2.76e-06	1.89e-03	1.41e-05	0.00e+00
13	2.00	0.1149	0.730	11.5	2.022	2.21e-06	2.31e-03	1.38e-05	0.00e+00
14	4.00	0.1217	0.717	12.2	1.251	3.54e-06	3.40e-03	3.25e-05	0.00e+00
15	7.50	0.1340	0.693	13.4	0.000	0.00e+00	3.50e-03	0.00e+00	0.00e+00
16	8.00	0.1362	0.689	13.6	0.000	0.00e+00	4.36e-03	0.00e+00	0.00e+00
17	16.0	0.1784	0.606	17.8	0.000	0.00e+00	5.27e-03	0.00e+00	0.00e+00

Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
Boring No.: BB-FBR-102	Tested By: md	Checked By: mcm
Sample No.: 2U	Test Date: 07/22/19	Depth: 44-46 ft
Test No.: IP-2	Sample Type: Intact	Elevation: ---
Description: Moist, dark gray clay		
Remarks: System V,		
Displacement at End of Increment		

One-Dimensional Consolidation by ASTM D2435 - Method B

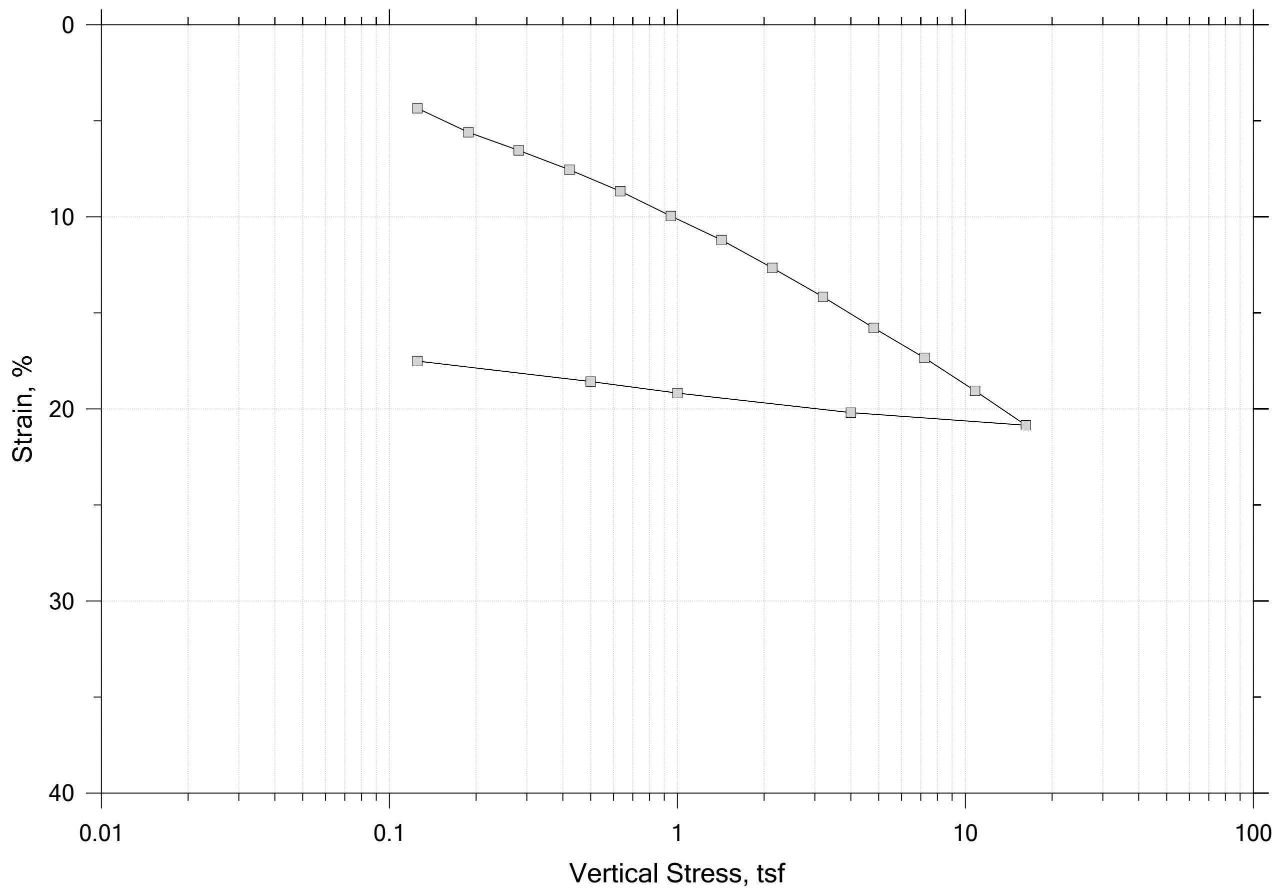
Square Root of Time Coefficients

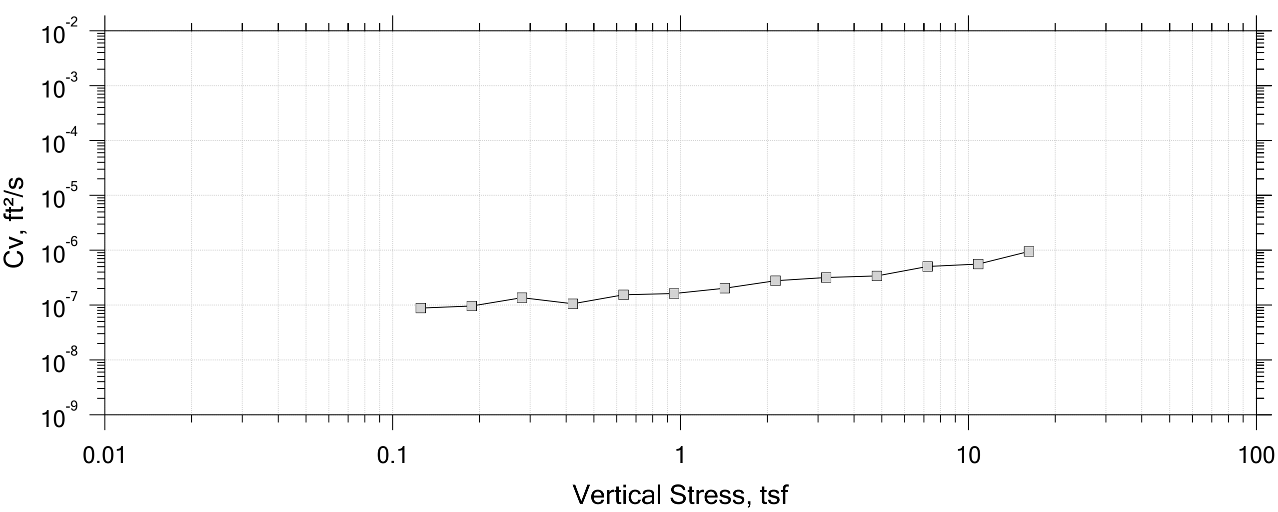
Step	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	Sq.Rt. T90 min	Cv ft²/s	Mv 1/tsf	k ft/day
1	0.125	0.004270	0.947	0.427	4.040	6.05e-06	3.42e-02	5.57e-04
2	0.250	0.007025	0.941	0.702	19.716	1.23e-06	2.20e-02	7.31e-05
3	0.500	0.009676	0.936	0.968	17.796	1.36e-06	1.06e-02	3.88e-05
4	0.750	0.01320	0.929	1.32	26.895	8.92e-07	1.41e-02	3.39e-05
5	1.00	0.01516	0.925	1.52	14.794	1.61e-06	7.86e-03	3.42e-05
6	1.50	0.02110	0.914	2.11	35.336	6.69e-07	1.19e-02	2.15e-05
7	2.00	0.02844	0.899	2.84	52.893	4.41e-07	1.47e-02	1.75e-05
8	2.50	0.03863	0.879	3.86	225.001	1.02e-07	2.04e-02	5.60e-06
9	3.00	0.04975	0.858	4.97	110.792	2.02e-07	2.22e-02	1.21e-05
10	4.00	0.07143	0.815	7.14	73.678	2.94e-07	2.17e-02	1.72e-05
11	8.00	0.1259	0.709	12.6	24.303	8.20e-07	1.36e-02	3.01e-05
12	1.00	0.1126	0.735	11.3	6.848	2.78e-06	1.89e-03	1.42e-05
13	2.00	0.1149	0.730	11.5	6.607	2.92e-06	2.31e-03	1.82e-05
14	4.00	0.1217	0.717	12.2	5.035	3.79e-06	3.40e-03	3.47e-05
15	7.50	0.1340	0.693	13.4	130.904	1.43e-07	3.50e-03	1.35e-06
16	8.00	0.1362	0.689	13.6	379.910	4.83e-08	4.36e-03	5.68e-07
17	16.0	0.1784	0.606	17.8	128.021	1.36e-07	5.27e-03	1.94e-06

GeoTesting EXPRESS			
	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-102	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 44-46 ft
	Test No.: IP-2	Sample Type: Intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System V,		
	Displacement at End of Increment		

One-Dimensional Consolidation by ASTM D2435 - Method B

Summary Report





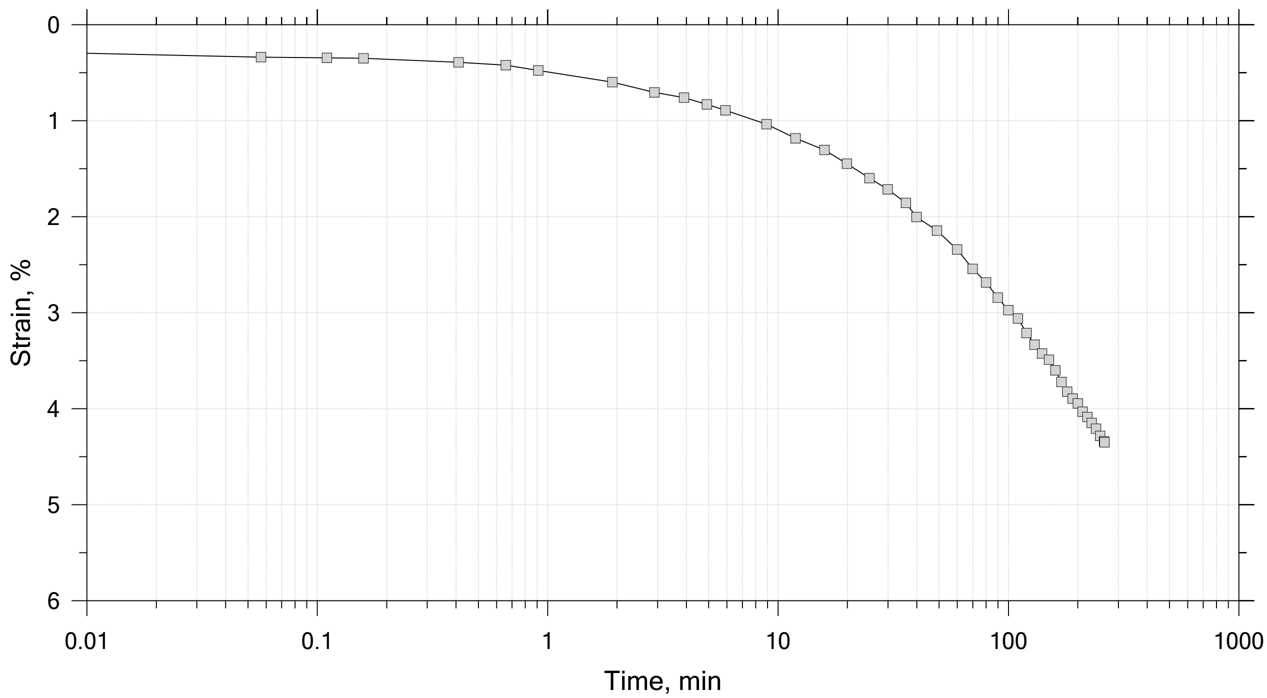
GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
	Boring No.: BB-FBR-103A	Tested By: trm	Checked By: njh/anm
	Sample No.: 1U	Test Date: 9/18/19	Depth: 34-36 ft
	Test No.: IP-3	Sample Type: intact	Elevation: ---
	Description: Moist, gray clay		
	Remarks: System O		
	Displacement at End of Increment		

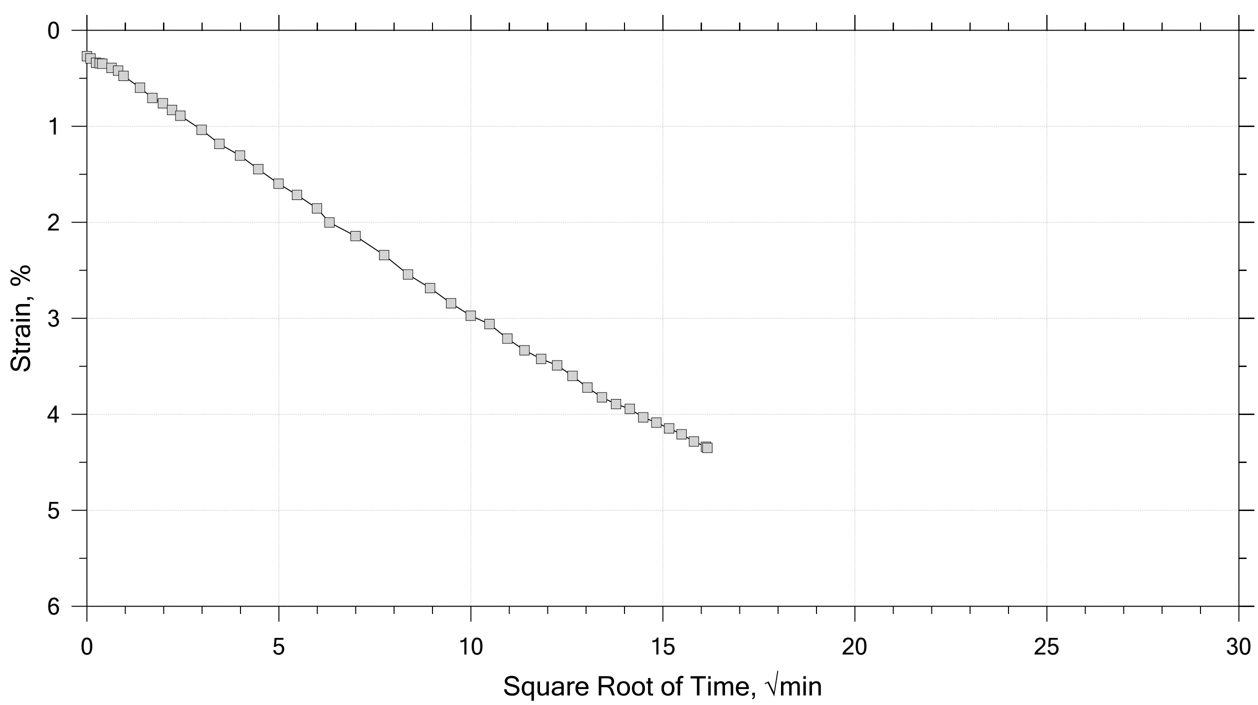
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 1 of 17

Constant Load Step

Stress: 0.125 tsf





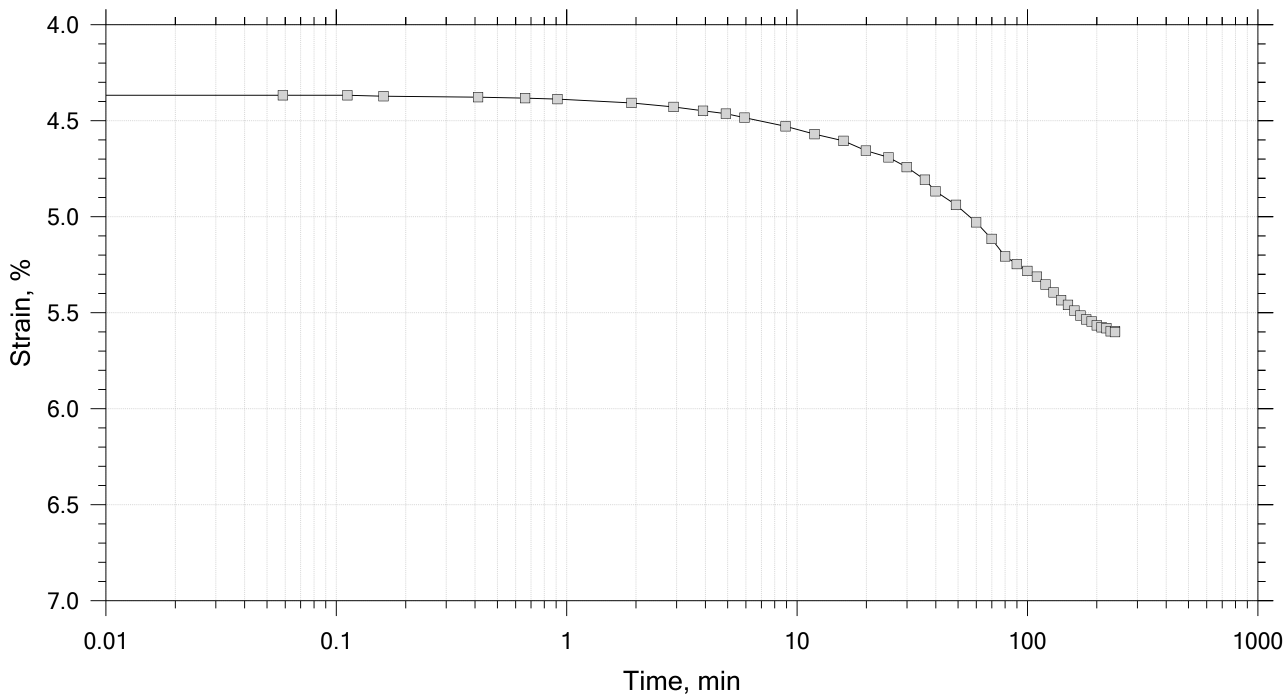
GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
	Boring No.: BB-FBR-103A	Tested By: trm	Checked By: njh/anm
	Sample No.: 1U	Test Date: 9/18/19	Depth: 34-36 ft
	Test No.: IP-3	Sample Type: intact	Elevation: ---
	Description: Moist, gray clay		
	Remarks: System O		

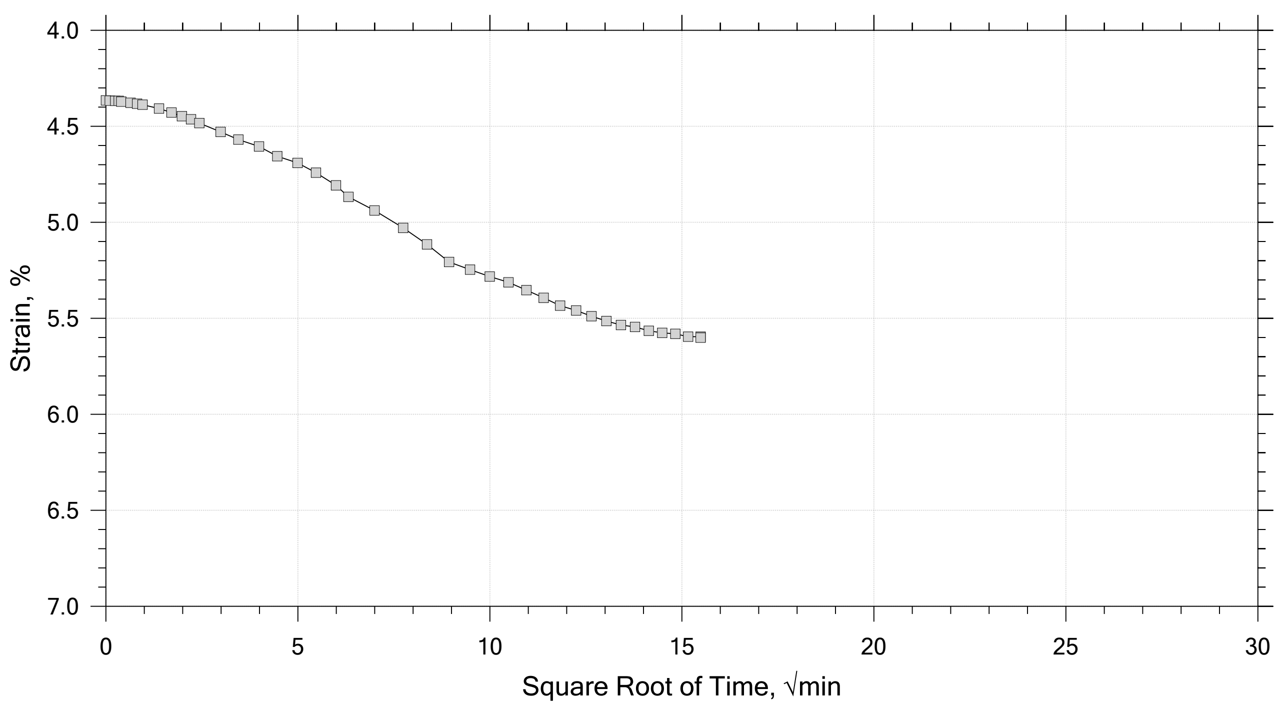
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 2 of 17

Constant Load Step

Stress: 0.188 tsf





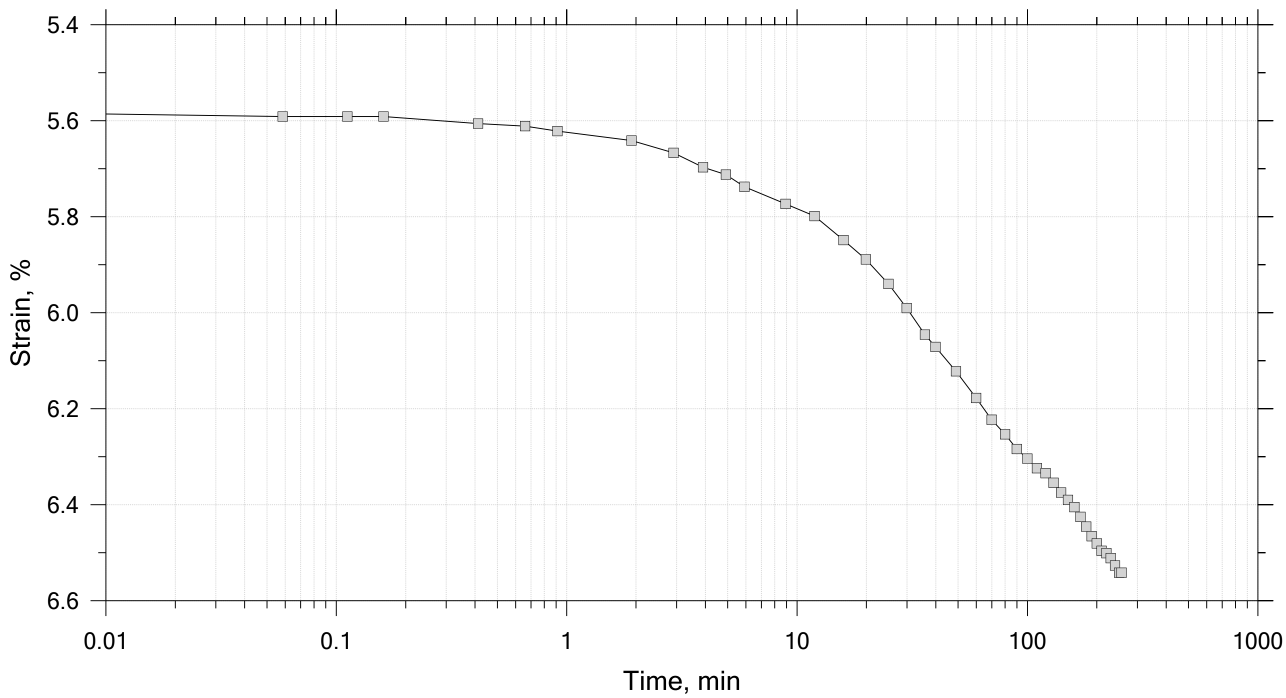
Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
Boring No.: BB-FBR-103A	Tested By: trm	Checked By: njh/anm
Sample No.: 1U	Test Date: 9/18/19	Depth: 34-36 ft
Test No.: IP-3	Sample Type: intact	Elevation: ---
Description: Moist, gray clay		
Remarks: System O		

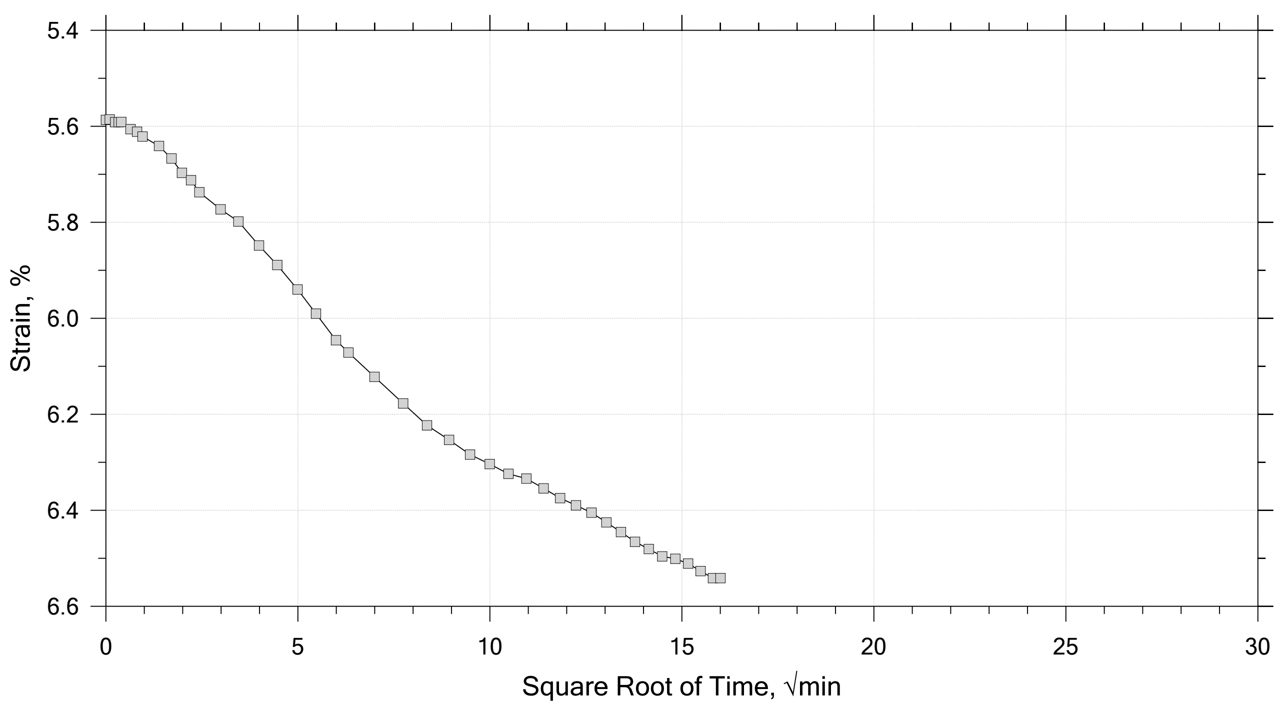
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 3 of 17

Constant Load Step

Stress: 0.281 tsf





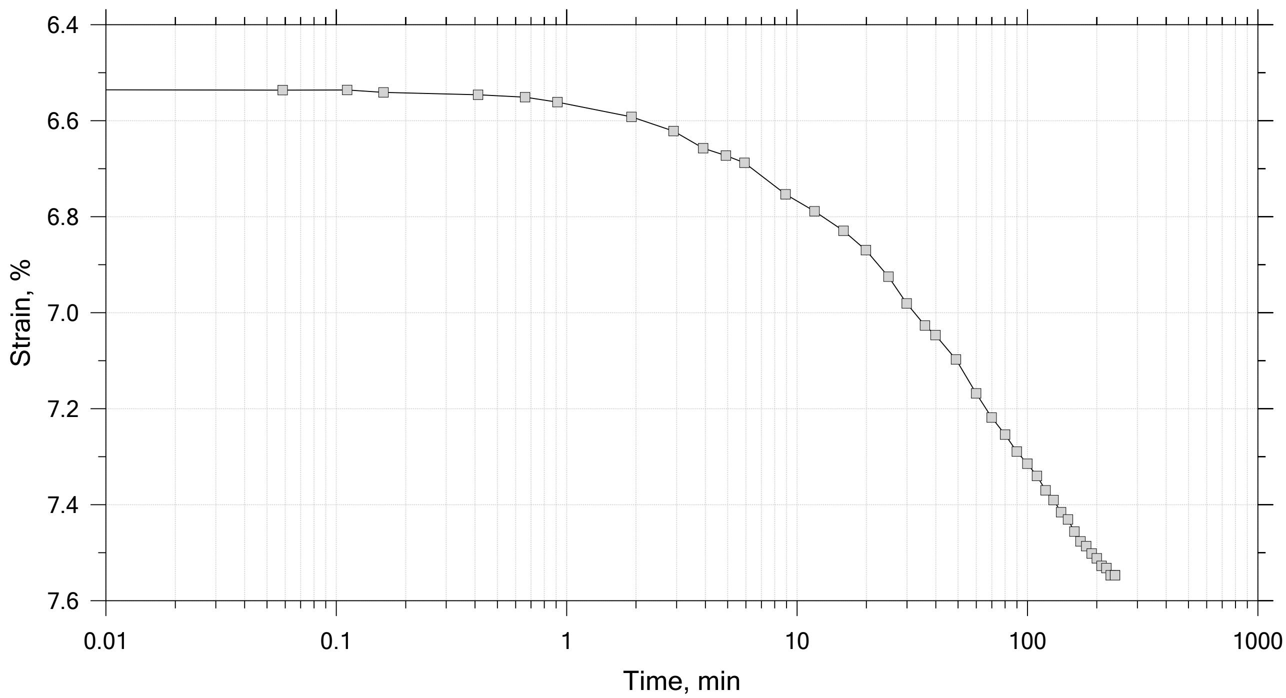
GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
	Boring No.: BB-FBR-103A	Tested By: trm	Checked By: njh/anm
	Sample No.: 1U	Test Date: 9/18/19	Depth: 34-36 ft
	Test No.: IP-3	Sample Type: intact	Elevation: ---
	Description: Moist, gray clay		
	Remarks: System O		

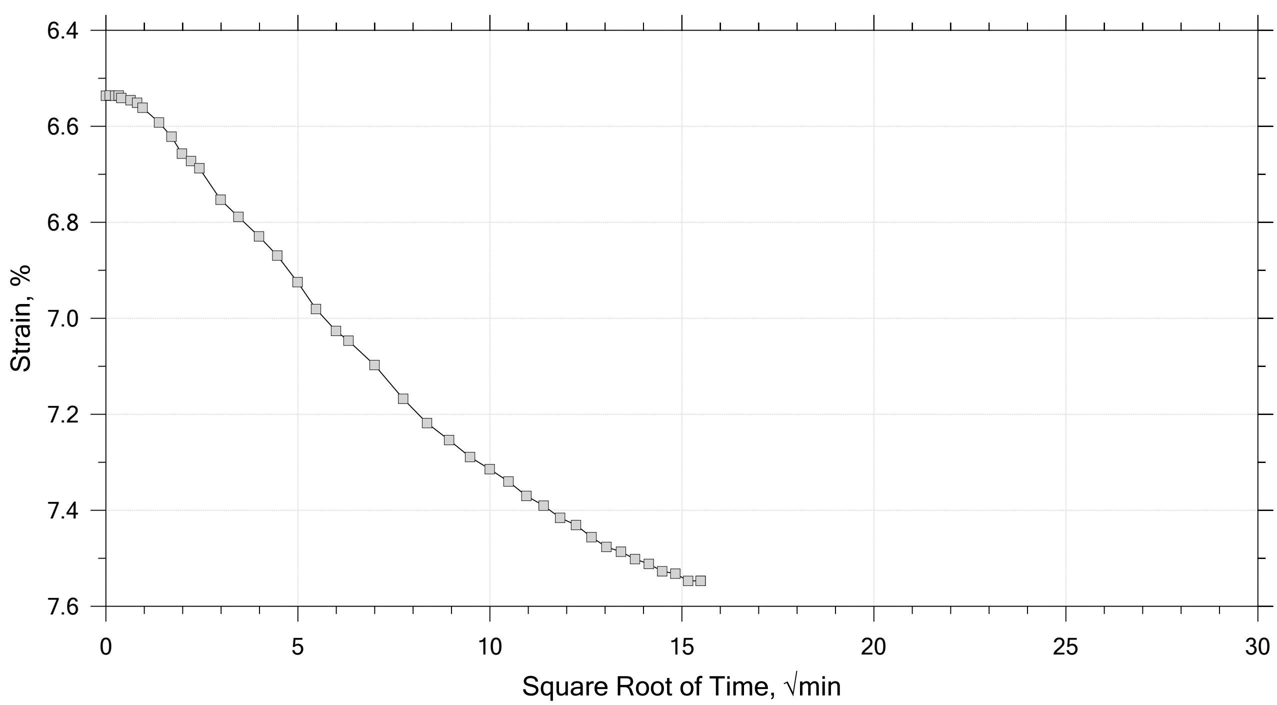
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 4 of 17

Constant Load Step

Stress: 0.422 tsf





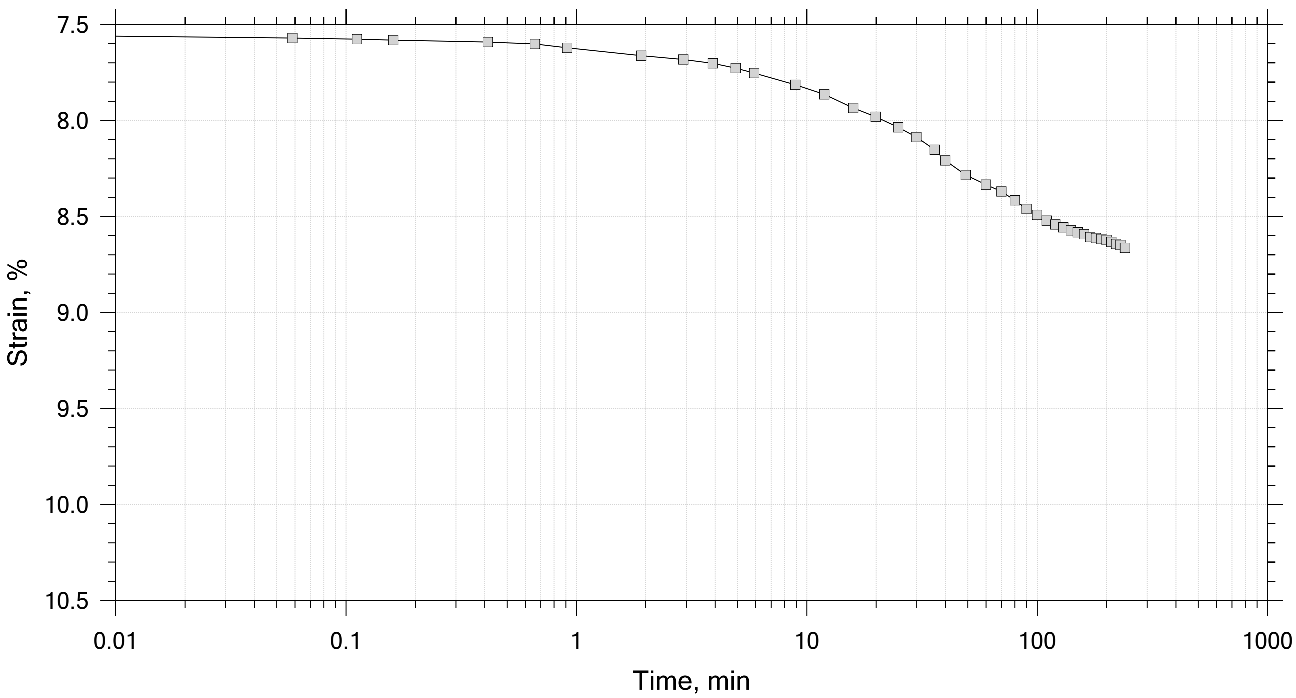
GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
	Boring No.: BB-FBR-103A	Tested By: trm	Checked By: njh/anm
	Sample No.: 1U	Test Date: 9/18/19	Depth: 34-36 ft
	Test No.: IP-3	Sample Type: intact	Elevation: ---
	Description: Moist, gray clay		
	Remarks: System O		

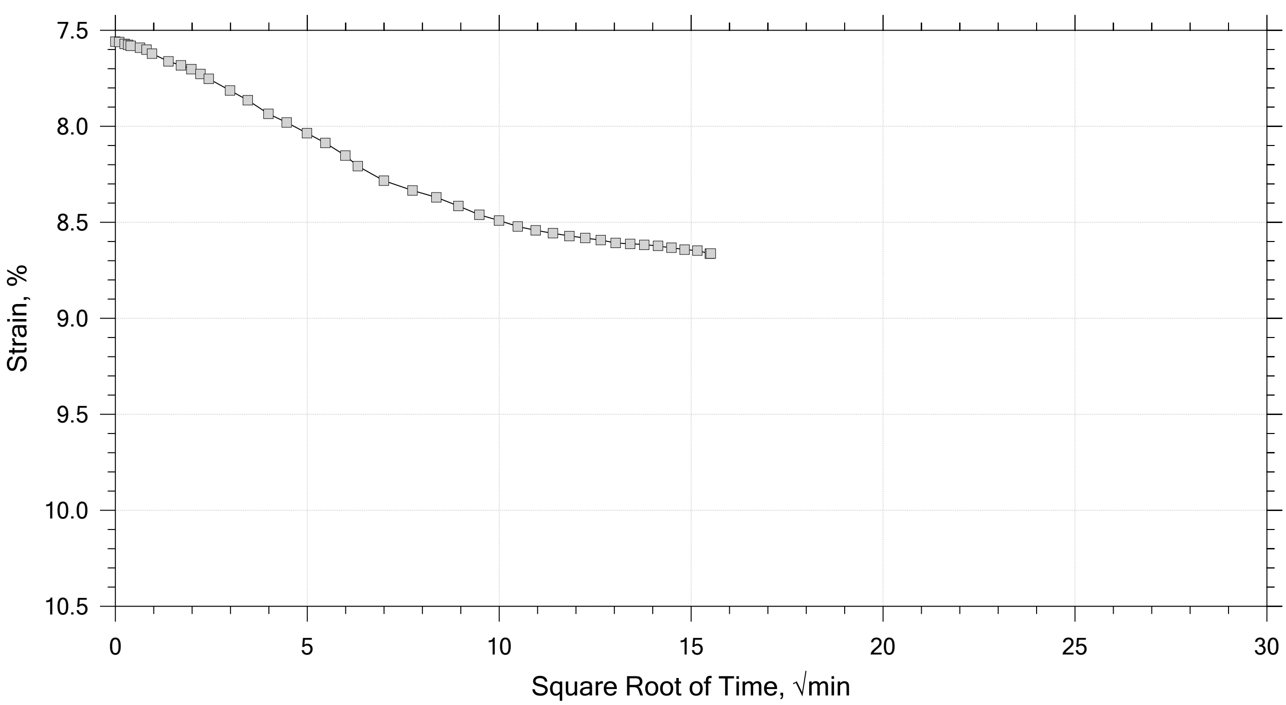
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 5 of 17

Constant Load Step

Stress: 0.633 tsf





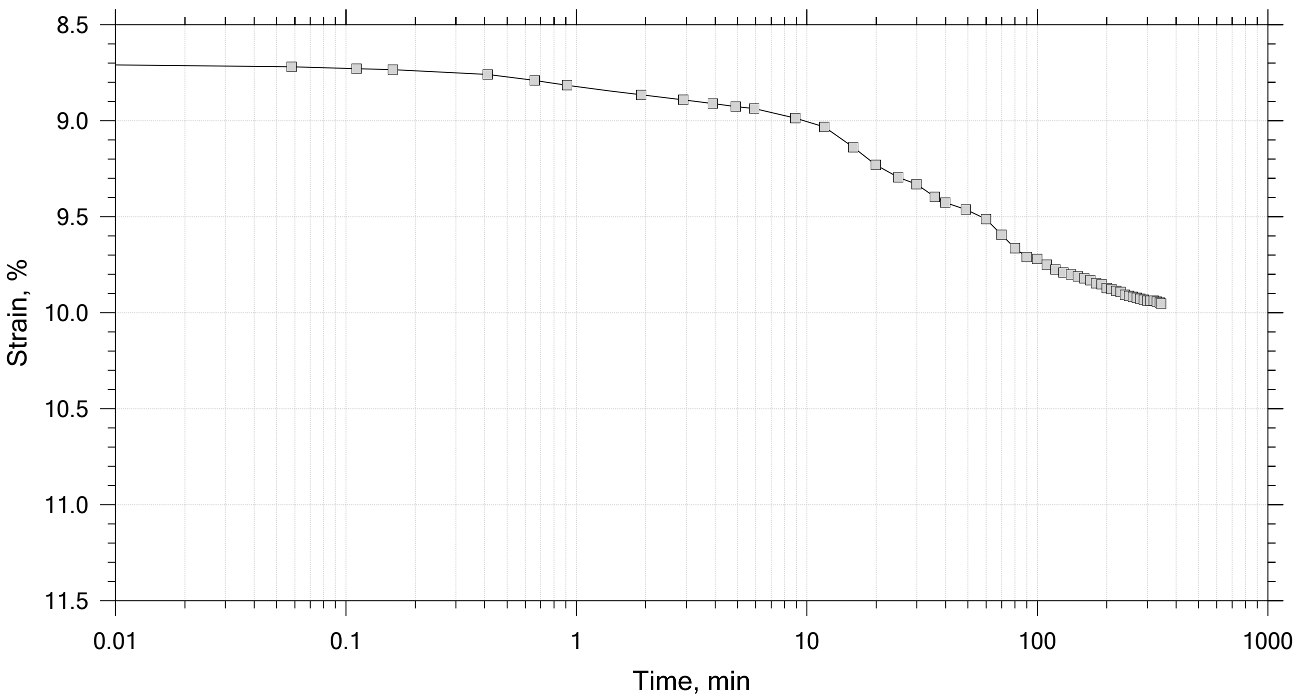
GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
	Boring No.: BB-FBR-103A	Tested By: trm	Checked By: njh/anm
	Sample No.: 1U	Test Date: 9/18/19	Depth: 34-36 ft
	Test No.: IP-3	Sample Type: intact	Elevation: ---
	Description: Moist, gray clay		
	Remarks: System O		

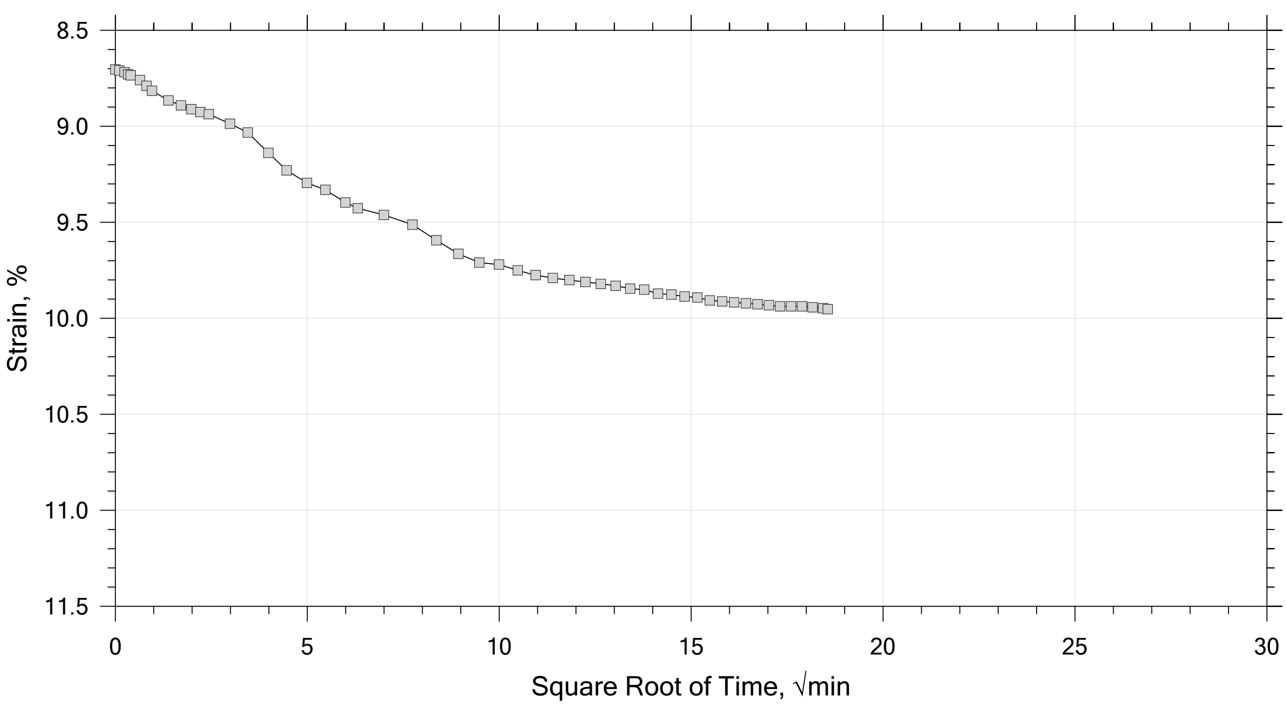
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 6 of 17

Constant Load Step

Stress: 0.949 tsf

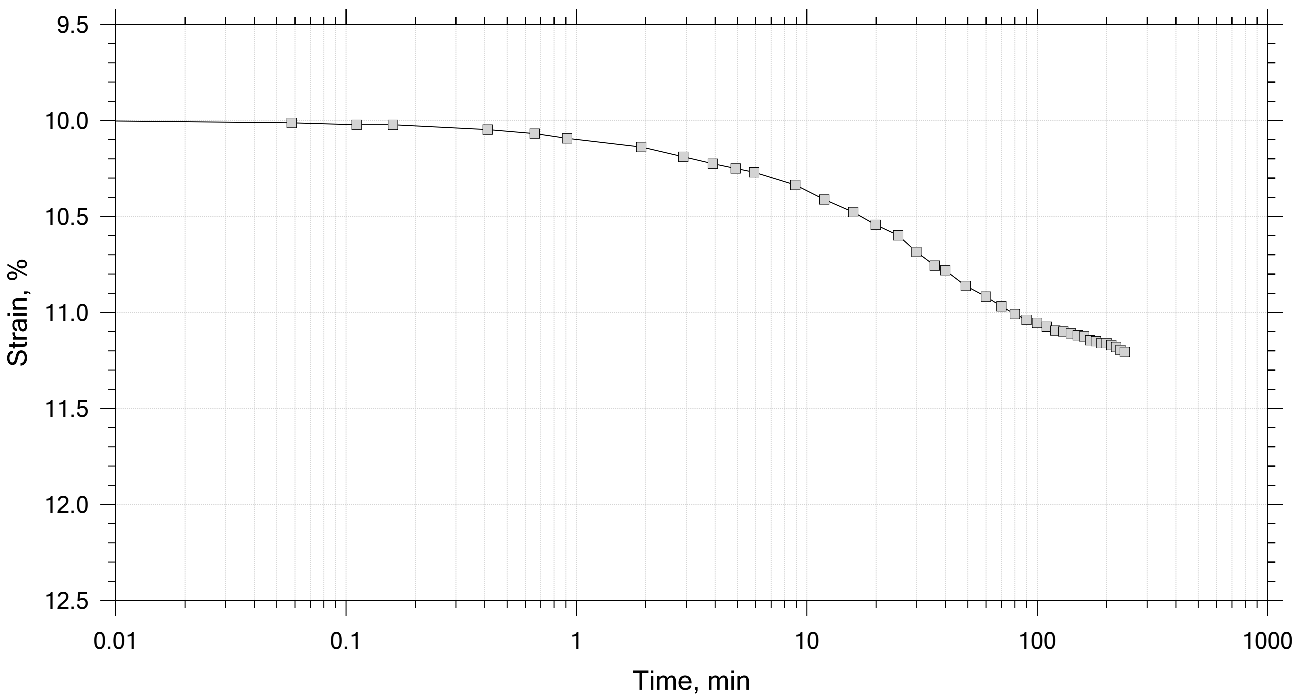


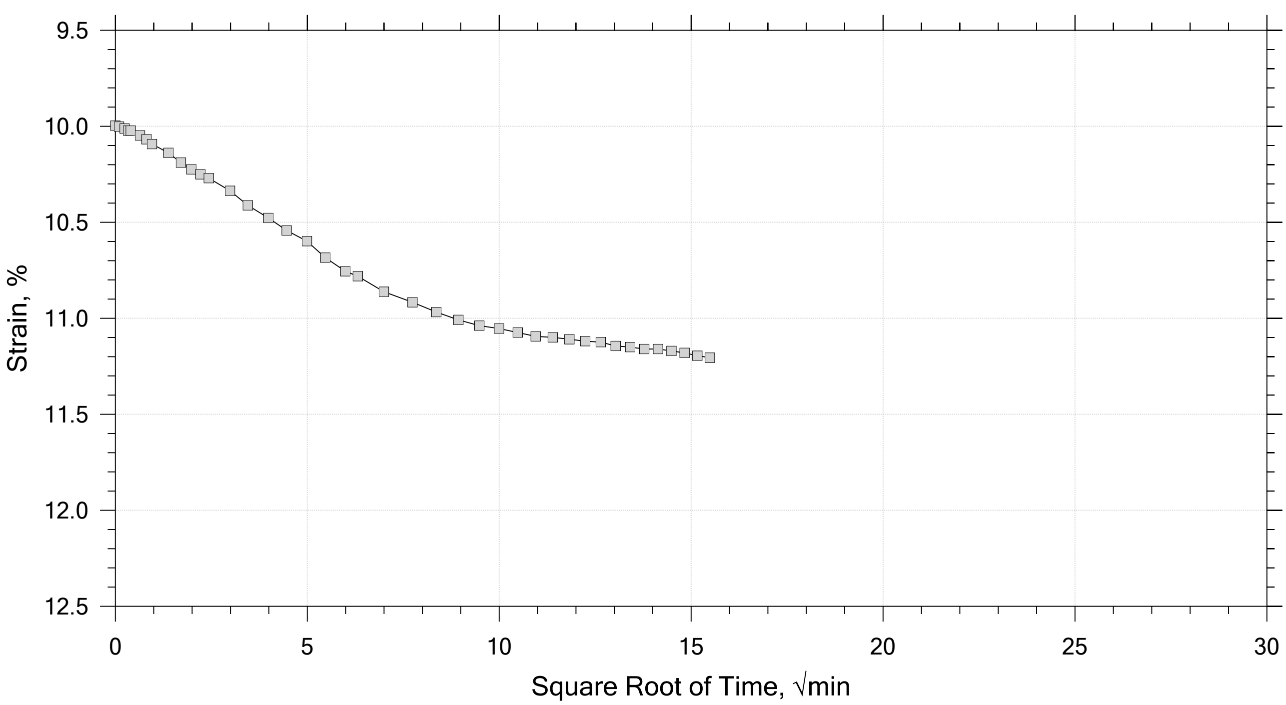


	Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
	Boring No.: BB-FBR-103A	Tested By: trm	Checked By: njh/anm
	Sample No.: 1U	Test Date: 9/18/19	Depth: 34-36 ft
	Test No.: IP-3	Sample Type: intact	Elevation: ---
	Description: Moist, gray clay		
	Remarks: System O		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 7 of 17
Constant Load Step
Stress: 1.42 tsf





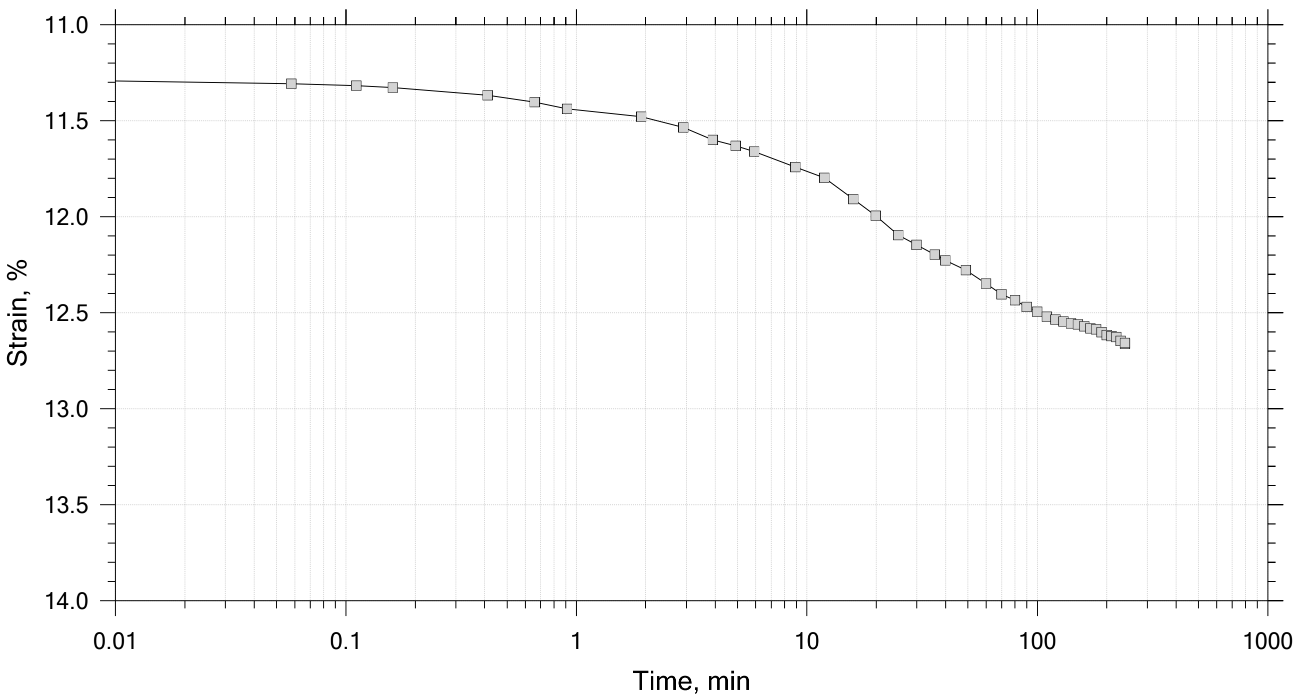
GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
	Boring No.: BB-FBR-103A	Tested By: trm	Checked By: njh/anm
	Sample No.: 1U	Test Date: 9/18/19	Depth: 34-36 ft
	Test No.: IP-3	Sample Type: intact	Elevation: ---
	Description: Moist, gray clay		
	Remarks: System O		

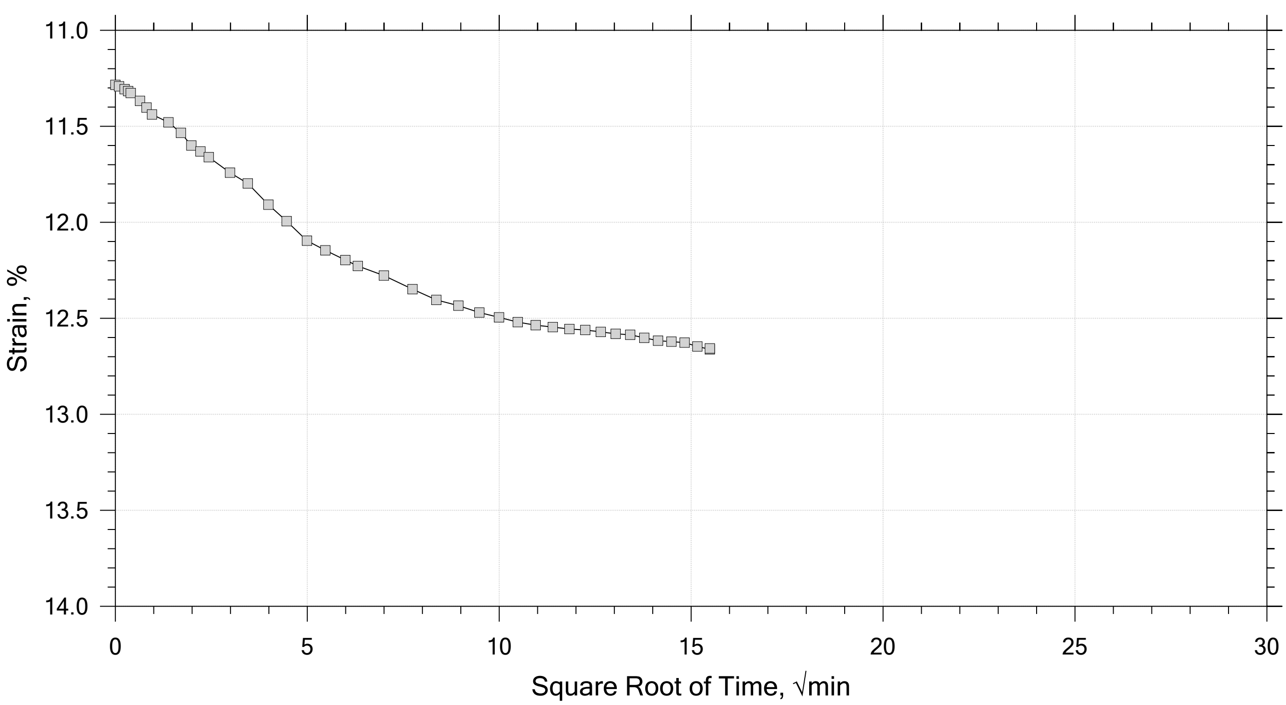
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 8 of 17

Constant Load Step

Stress: 2.14 tsf





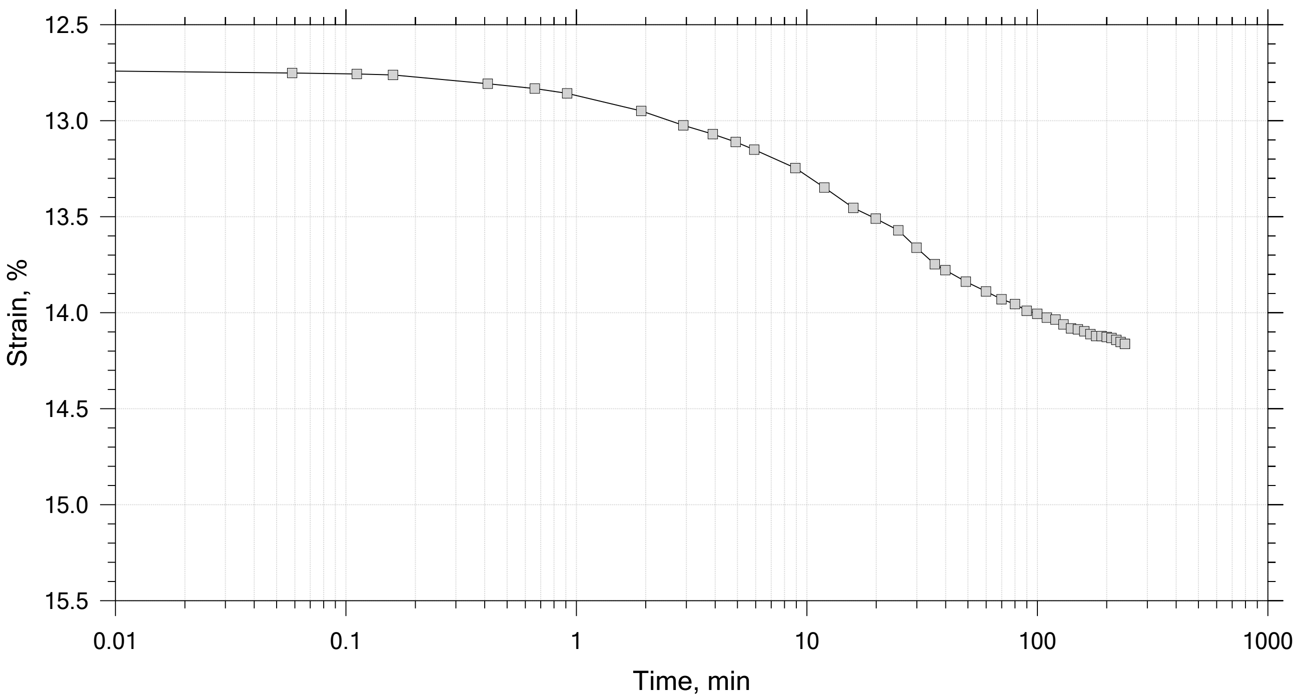
GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
	Boring No.: BB-FBR-103A	Tested By: trm	Checked By: njh/anm
	Sample No.: 1U	Test Date: 9/18/19	Depth: 34-36 ft
	Test No.: IP-3	Sample Type: intact	Elevation: ---
	Description: Moist, gray clay		
	Remarks: System O		

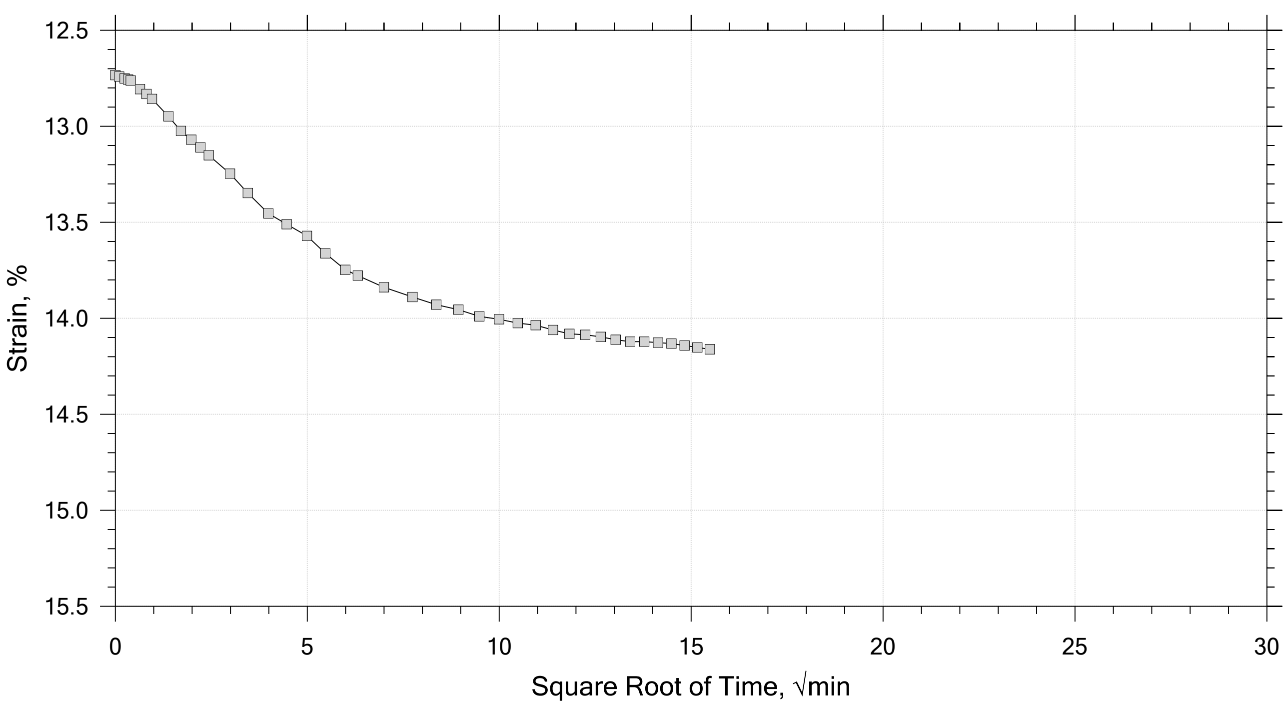
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 9 of 17

Constant Load Step

Stress: 3.2 tsf





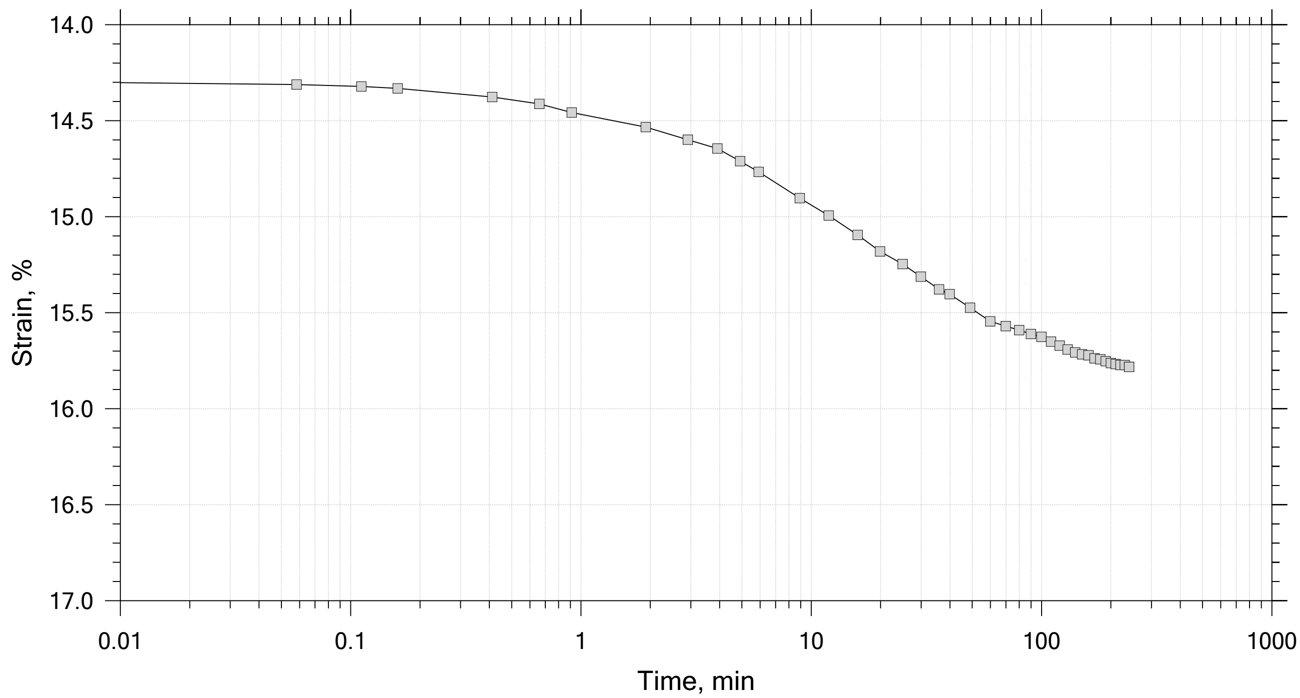
GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
	Boring No.: BB-FBR-103A	Tested By: trm	Checked By: njh/anm
	Sample No.: 1U	Test Date: 9/18/19	Depth: 34-36 ft
	Test No.: IP-3	Sample Type: intact	Elevation: ---
	Description: Moist, gray clay		
	Remarks: System O		

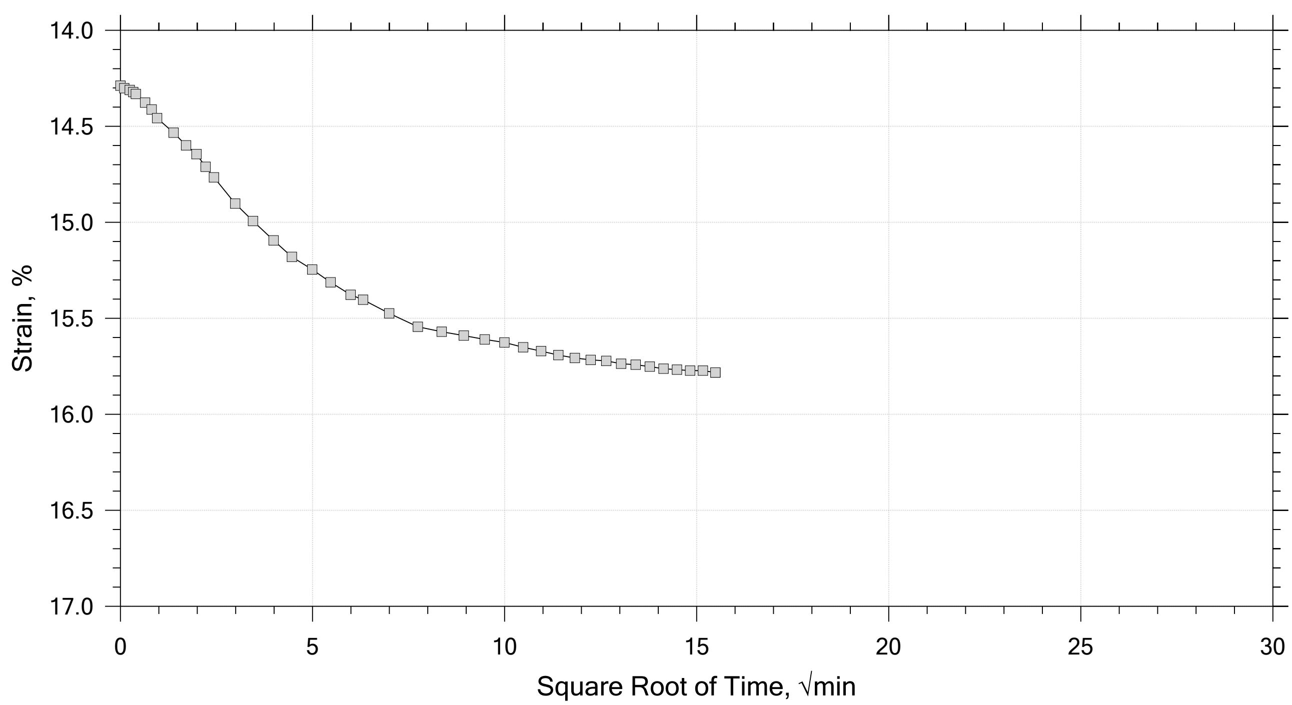
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 10 of 17

Constant Load Step

Stress: 4.8 tsf

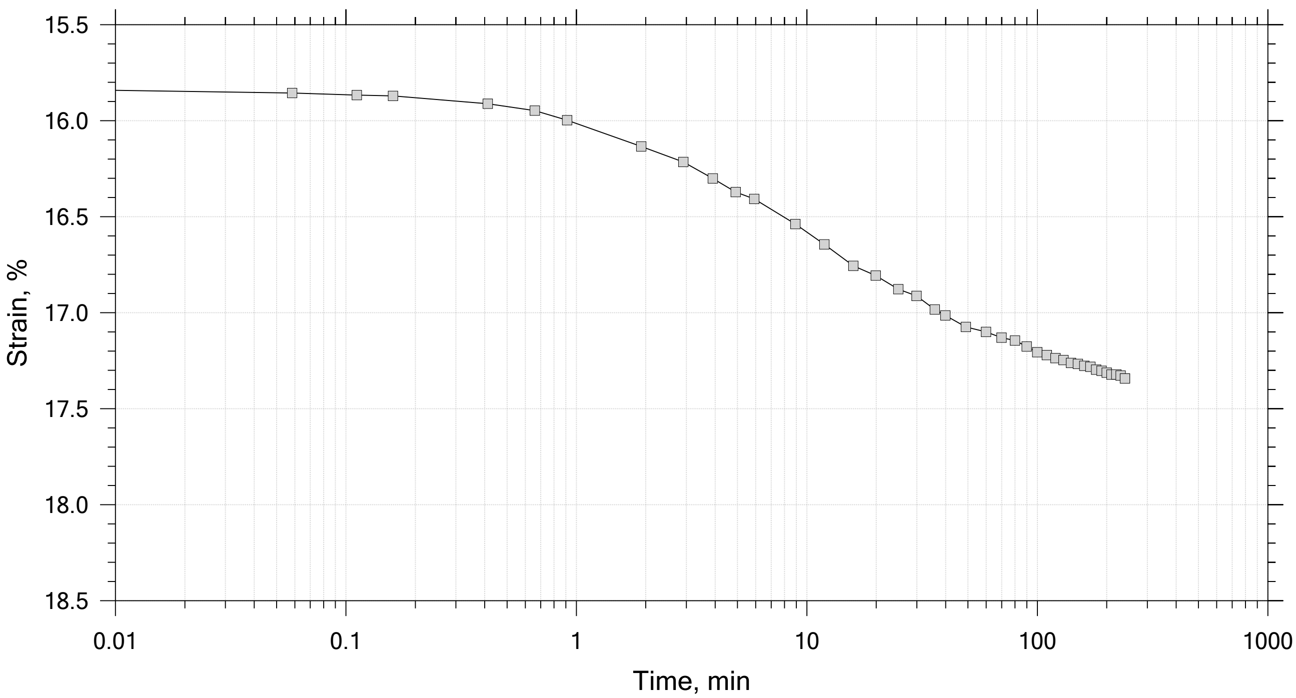


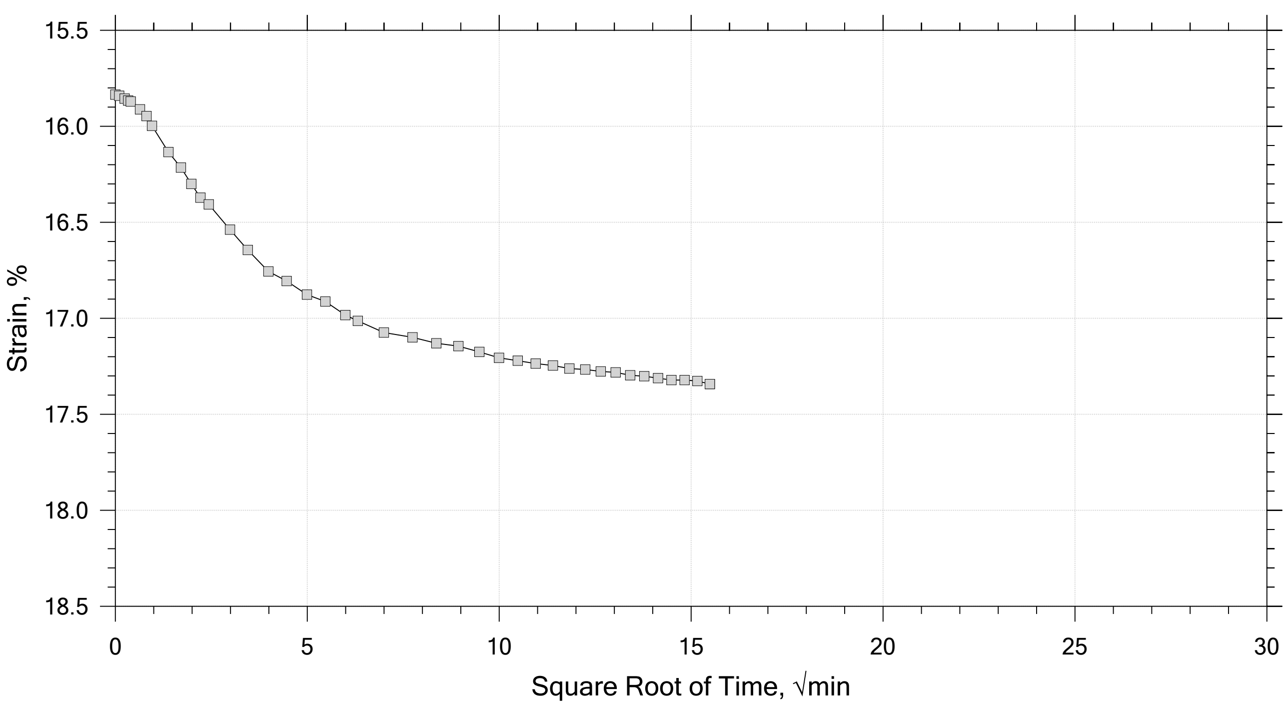


GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
	Boring No.: BB-FBR-103A	Tested By: trm	Checked By: njh/anm
	Sample No.: 1U	Test Date: 9/18/19	Depth: 34-36 ft
	Test No.: IP-3	Sample Type: intact	Elevation: ---
	Description: Moist, gray clay		
	Remarks: System O		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 11 of 17
Constant Load Step
Stress: 7.21 tsf

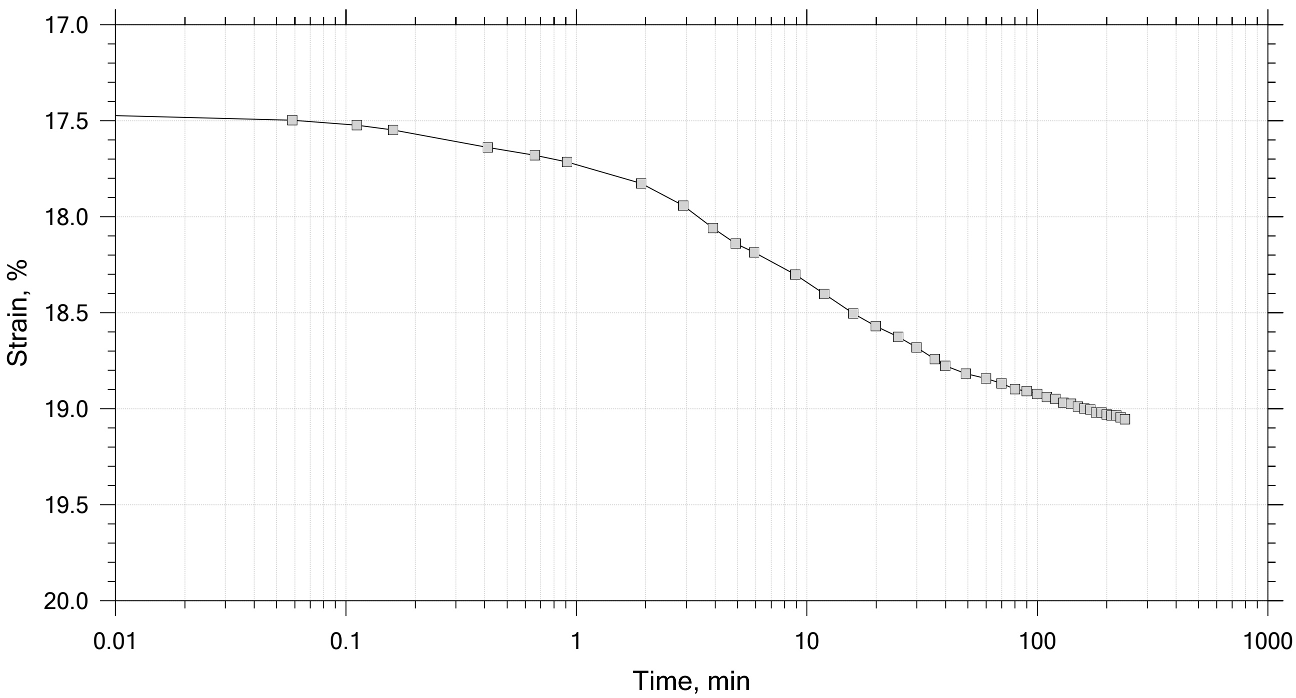


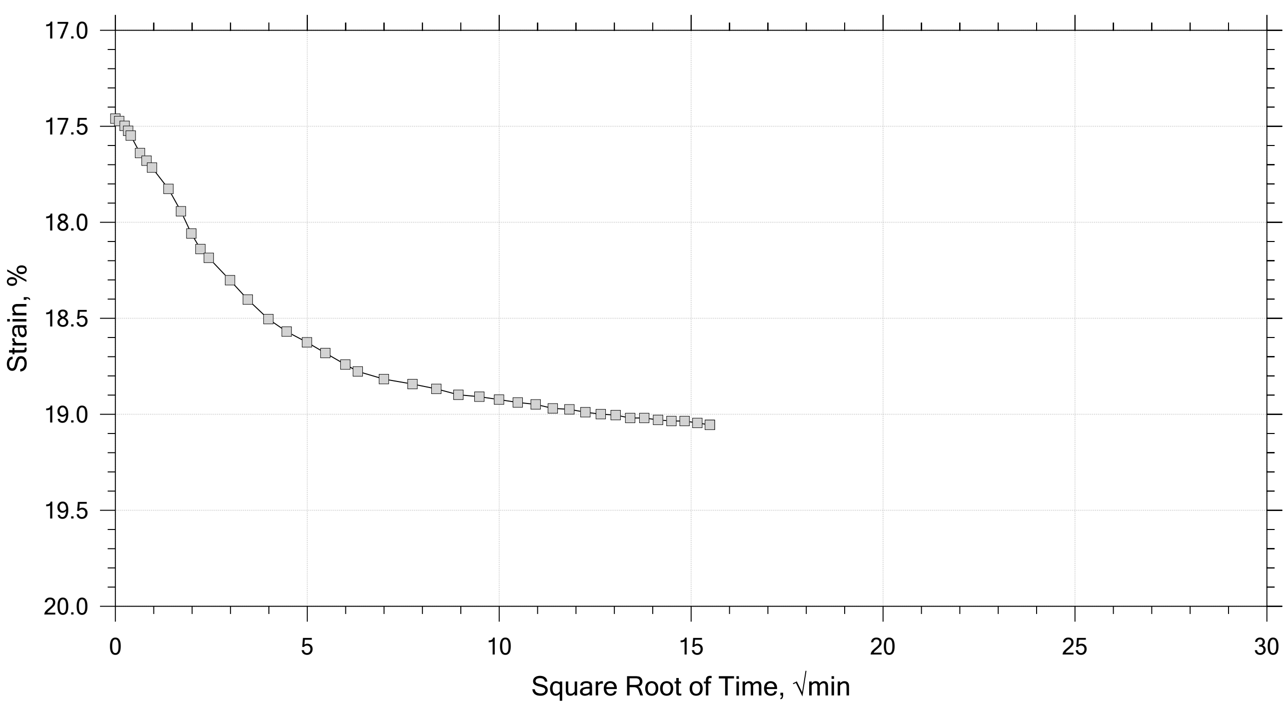


GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
	Boring No.: BB-FBR-103A	Tested By: trm	Checked By: njh/anm
	Sample No.: 1U	Test Date: 9/18/19	Depth: 34-36 ft
	Test No.: IP-3	Sample Type: intact	Elevation: ---
	Description: Moist, gray clay		
	Remarks: System O		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 12 of 17
Constant Load Step
Stress: 10.8 tsf

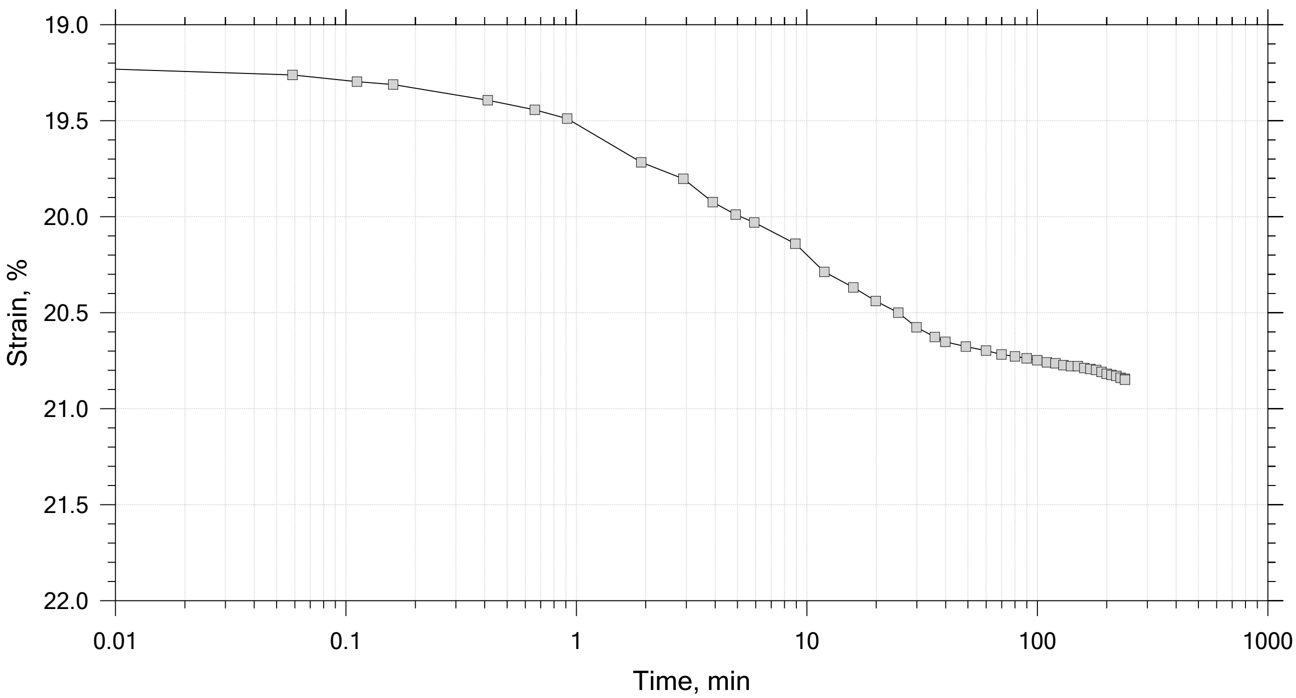


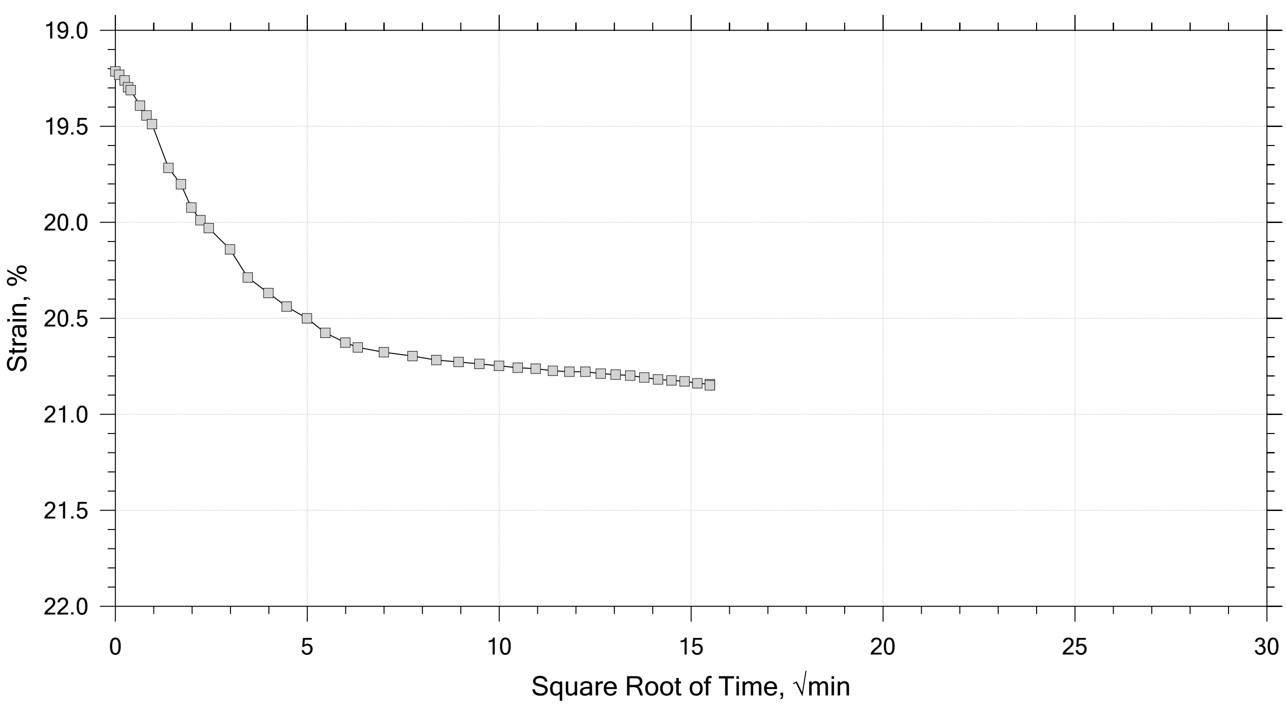


GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
	Boring No.: BB-FBR-103A	Tested By: trm	Checked By: njh/anm
	Sample No.: 1U	Test Date: 9/18/19	Depth: 34-36 ft
	Test No.: IP-3	Sample Type: intact	Elevation: ---
	Description: Moist, gray clay		
	Remarks: System O		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 13 of 17
Constant Load Step
Stress: 16.2 tsf

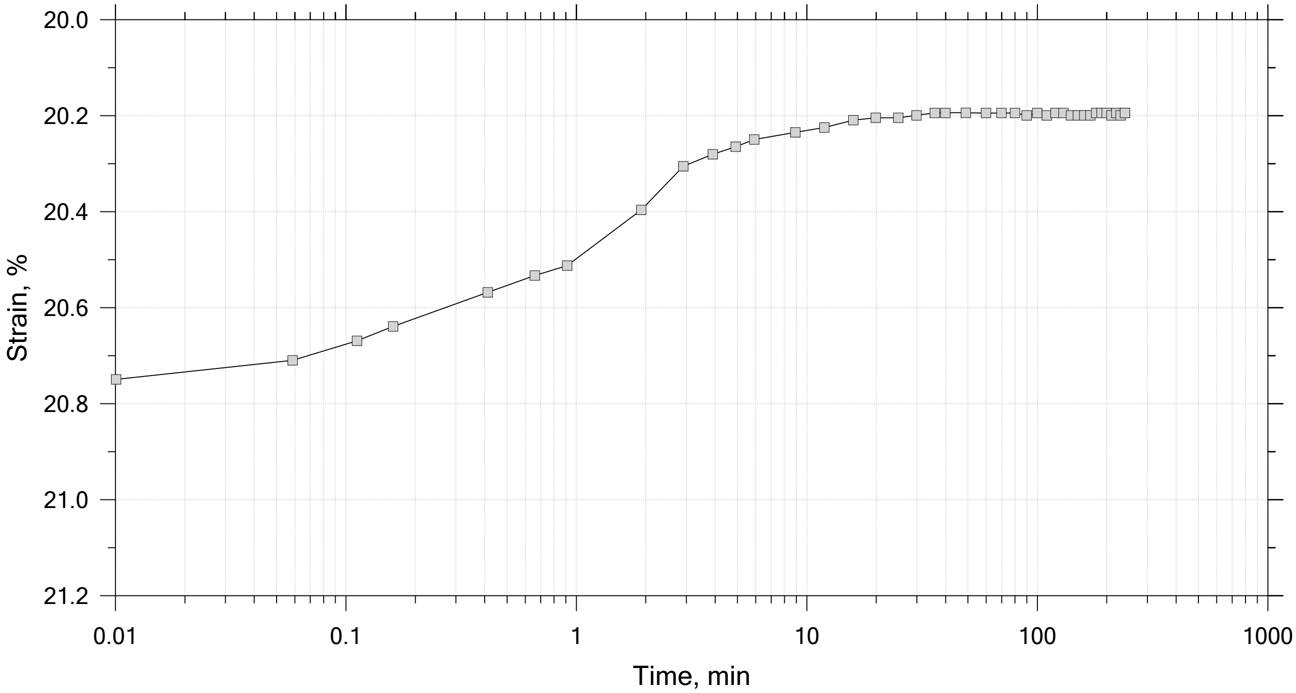


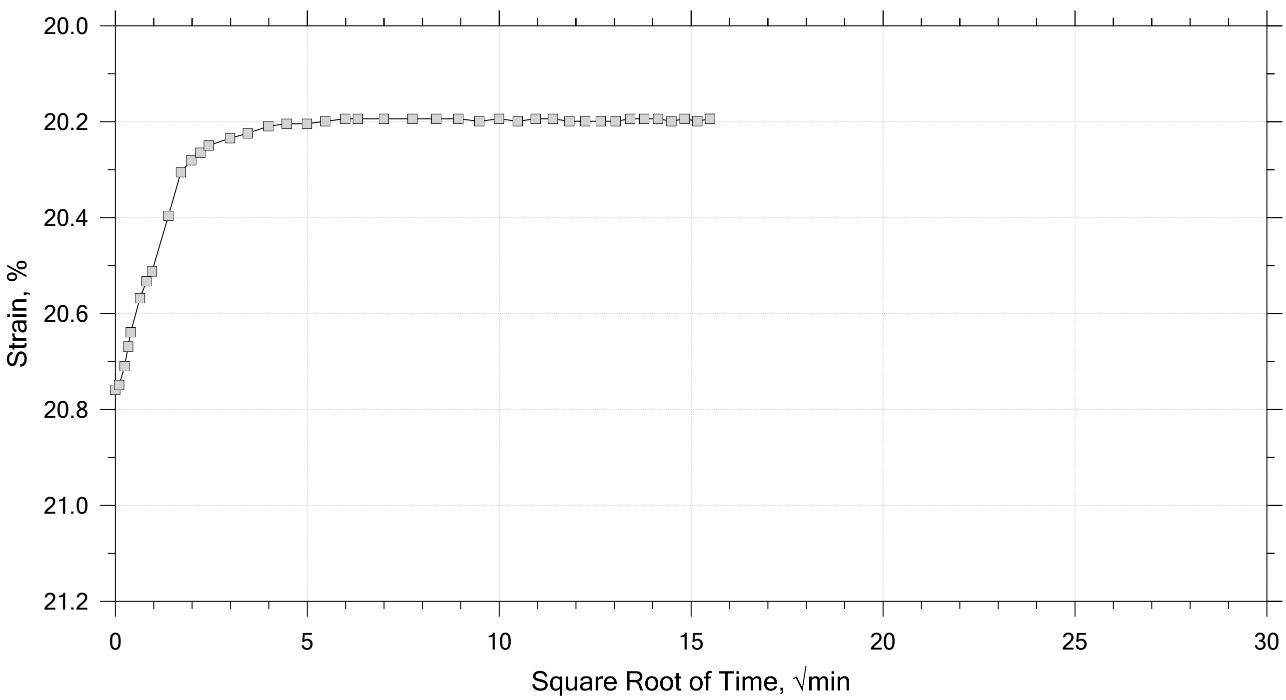


GeoTesting EXPRESS			
	Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
	Boring No.: BB-FBR-103A	Tested By: trm	Checked By: njh/anm
	Sample No.: 1U	Test Date: 9/18/19	Depth: 34-36 ft
	Test No.: IP-3	Sample Type: intact	Elevation: ---
	Description: Moist, gray clay		
	Remarks: System O		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 14 of 17
Constant Load Step
Stress: 4 tsf

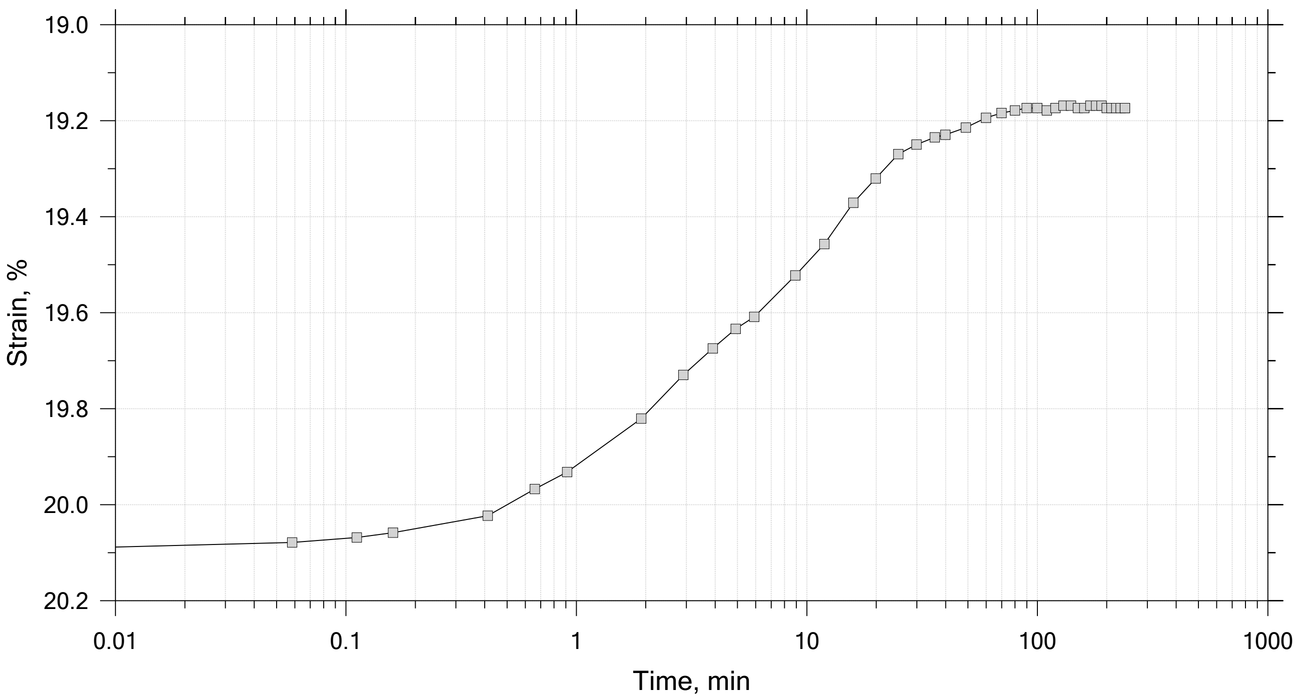


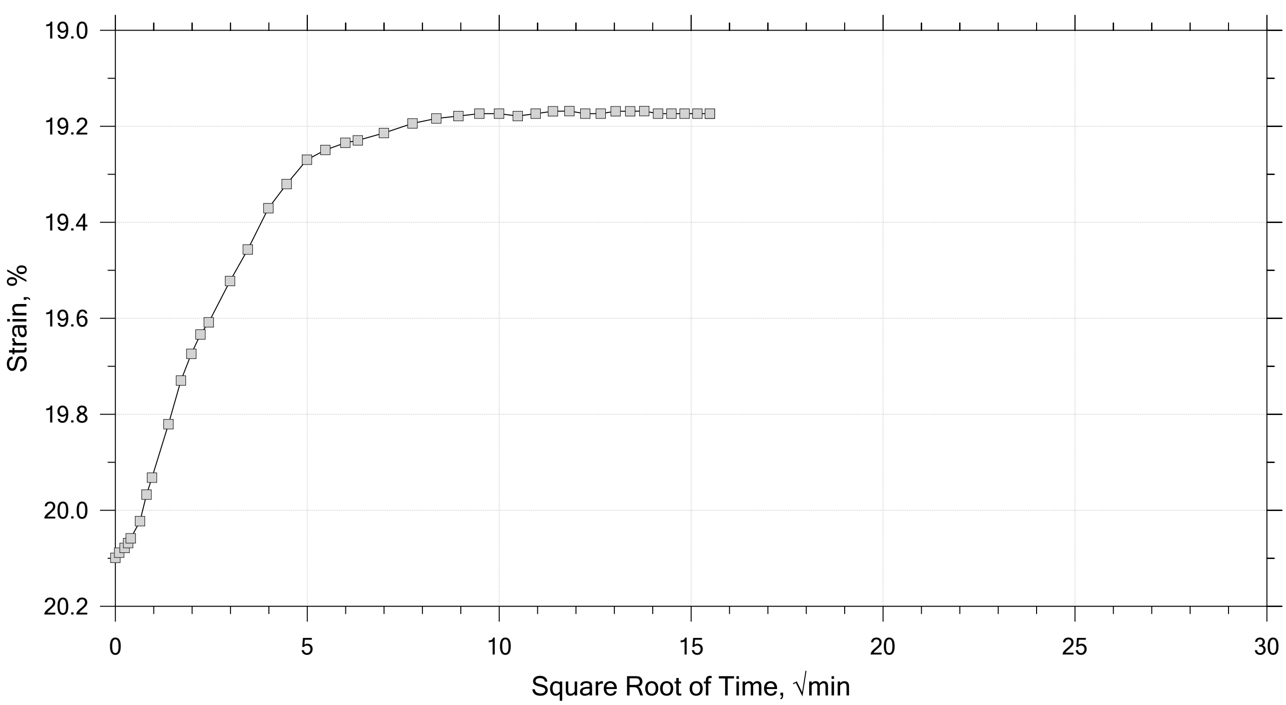


GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
	Boring No.: BB-FBR-103A	Tested By: trm	Checked By: njh/anm
	Sample No.: 1U	Test Date: 9/18/19	Depth: 34-36 ft
	Test No.: IP-3	Sample Type: intact	Elevation: ---
	Description: Moist, gray clay		
	Remarks: System O		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 15 of 17
Constant Load Step
Stress: 1 tsf

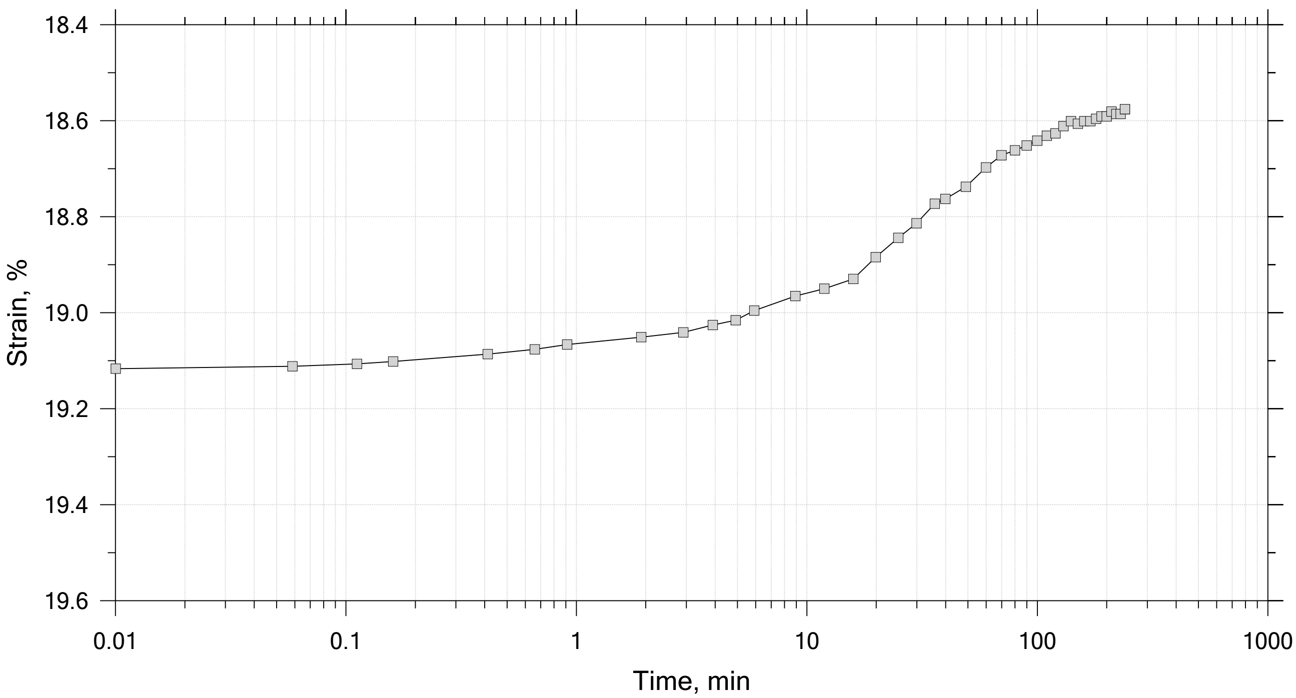


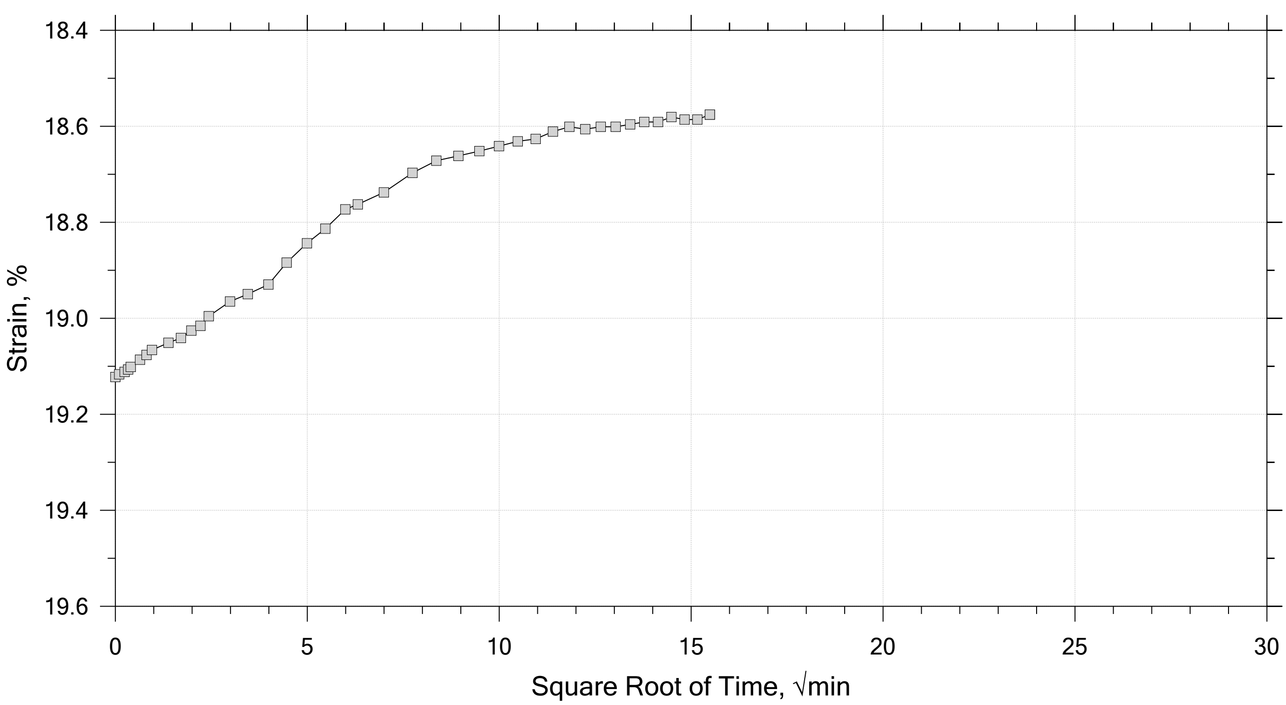


GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
	Boring No.: BB-FBR-103A	Tested By: trm	Checked By: njh/anm
	Sample No.: 1U	Test Date: 9/18/19	Depth: 34-36 ft
	Test No.: IP-3	Sample Type: intact	Elevation: ---
	Description: Moist, gray clay		
	Remarks: System O		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 16 of 17
Constant Load Step
Stress: 0.5 tsf

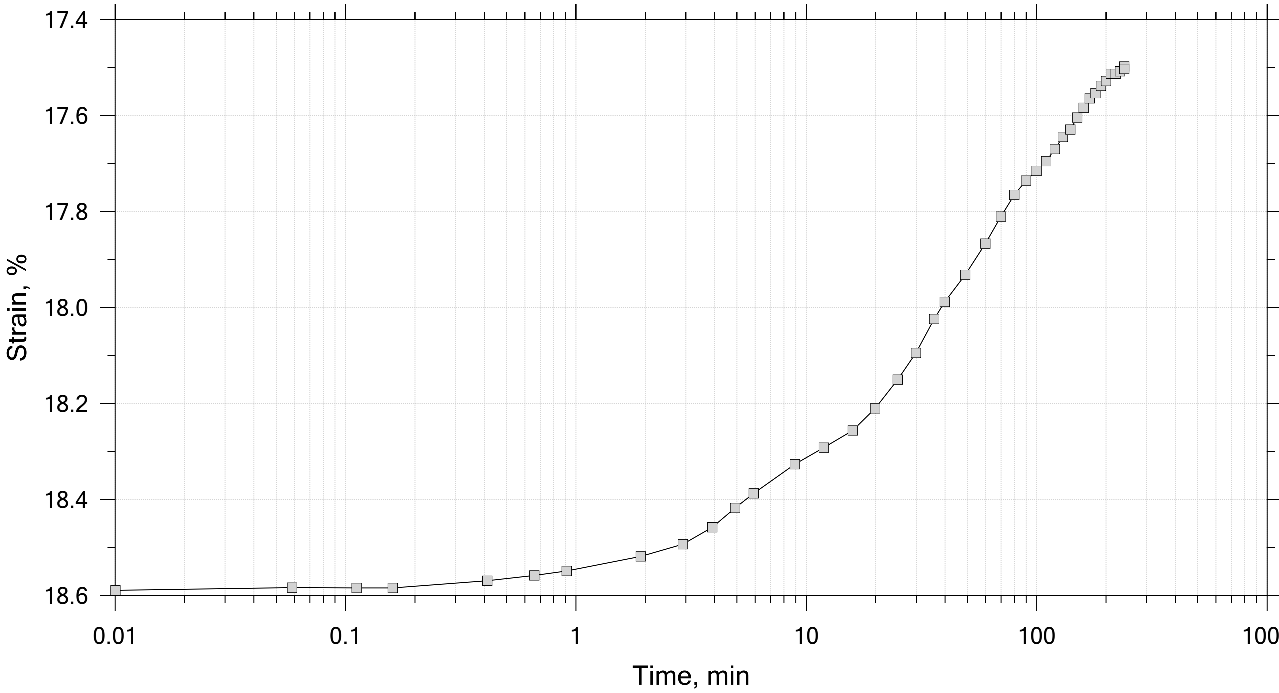


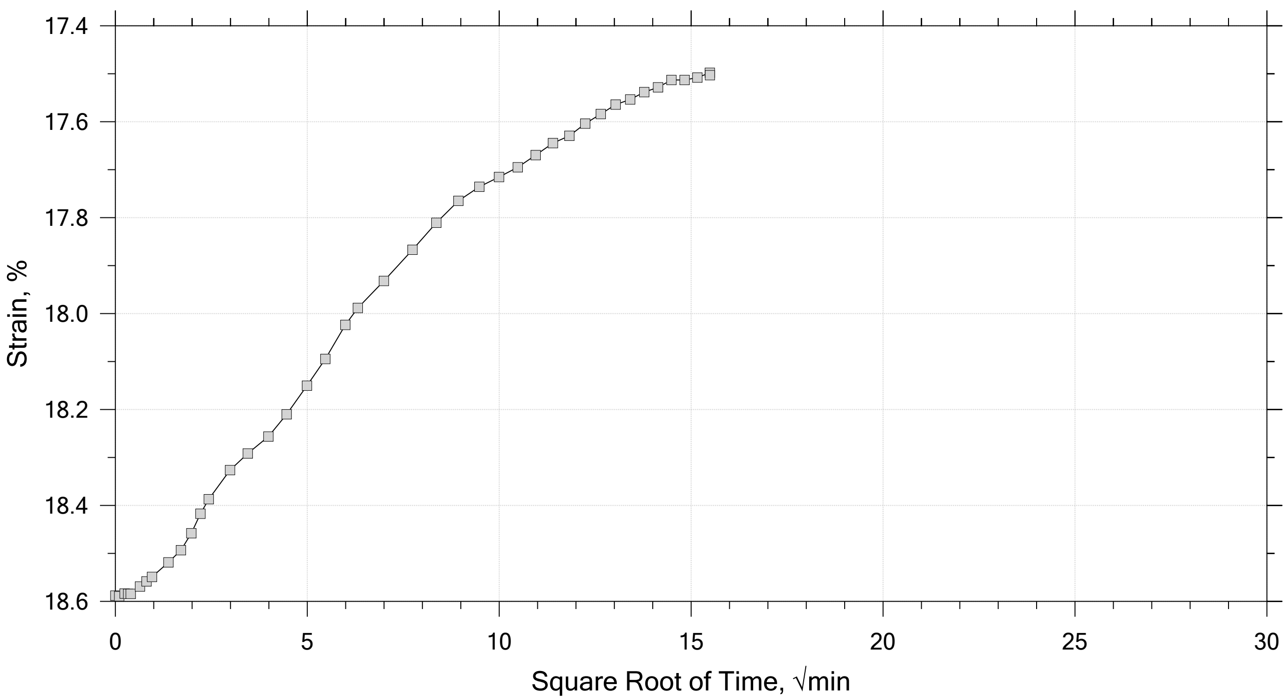


GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
	Boring No.: BB-FBR-103A	Tested By: trm	Checked By: njh/anm
	Sample No.: 1U	Test Date: 9/18/19	Depth: 34-36 ft
	Test No.: IP-3	Sample Type: intact	Elevation: ---
	Description: Moist, gray clay		
	Remarks: System O		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 17 of 17
Constant Load Step
Stress: 0.125 tsf





GeoTesting EXPRESS			
	Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
	Boring No.: BB-FBR-103A	Tested By: trm	Checked By: njh/anm
	Sample No.: 1U	Test Date: 9/18/19	Depth: 34-36 ft
	Test No.: IP-3	Sample Type: intact	Elevation: ---
	Description: Moist, gray clay		
	Remarks: System O		

One-Dimensional Consolidation by ASTM D2435 - Method B

Specimen Diameter: 2.50 in	Estimated Specific Gravity: 2.76	Liquid Limit: 34
Initial Height: 1.00 in	Initial Void Ratio: 0.835	Plastic Limit: 19
Final Height: 0.85 in	Final Void Ratio: 0.559	Plasticity Index: 15

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	D2174	RING		D2279
Mass Container, gm	8.53	112.4	112.4	8.49
Mass Container + Wet Soil, gm	148.83	270.17	258.11	152.13
Mass Container + Dry Soil, gm	114.04	233.58	233.58	127.95
Mass Dry Soil, gm	105.51	121.18	121.18	119.46
Water Content, %	32.97	30.19	20.24	20.24
Void Ratio	---	0.83	0.56	---
Degree of Saturation, %	---	99.98	100.00	---
Dry Unit Weight, pcf	---	94.047	110.64	---

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.

GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
	Boring No.: BB-FBR-103A	Tested By: trm	Checked By: njh/anm
	Sample No.: 1U	Test Date: 9/18/19	Depth: 34-36 ft
	Test No.: IP-3	Sample Type: intact	Elevation: ---
	Description: Moist, gray clay		
	Remarks: System O		

One-Dimensional Consolidation by ASTM D2435 - Method B

Log of Time Coefficients

Step	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	Log T50 min	Cv ft²/s	Mv 1/tsf	k ft/day	Ca %
1	0.125	0.04350	0.755	4.35	0.000	0.00e+00	3.48e-01	0.00e+00	0.00e+00
2	0.188	0.05601	0.732	5.60	44.027	1.17e-07	1.99e-01	6.26e-05	0.00e+00
3	0.281	0.06542	0.715	6.54	0.000	0.00e+00	1.01e-01	0.00e+00	0.00e+00
4	0.422	0.07547	0.696	7.55	0.000	0.00e+00	7.13e-02	0.00e+00	0.00e+00
5	0.633	0.08663	0.676	8.66	28.916	1.66e-07	5.29e-02	2.37e-05	0.00e+00
6	0.949	0.09952	0.652	9.95	0.000	0.00e+00	4.08e-02	0.00e+00	0.00e+00
7	1.42	0.1121	0.629	11.2	21.170	2.15e-07	2.64e-02	1.53e-05	0.00e+00
8	2.14	0.1266	0.602	12.7	15.644	2.83e-07	2.04e-02	1.55e-05	0.00e+00
9	3.20	0.1416	0.575	14.2	13.669	3.13e-07	1.41e-02	1.19e-05	0.00e+00
10	4.80	0.1578	0.545	15.8	12.971	3.18e-07	1.01e-02	8.67e-06	0.00e+00
11	7.21	0.1734	0.516	17.3	8.694	4.56e-07	6.49e-03	7.99e-06	0.00e+00
12	10.8	0.1905	0.485	19.1	8.742	4.36e-07	4.75e-03	5.59e-06	0.00e+00
13	16.2	0.2085	0.452	20.8	0.000	0.00e+00	3.32e-03	0.00e+00	0.00e+00
14	4.00	0.2019	0.464	20.2	0.000	0.00e+00	5.36e-04	0.00e+00	0.00e+00
15	1.00	0.1917	0.483	19.2	0.000	0.00e+00	3.40e-03	0.00e+00	0.00e+00
16	0.500	0.1858	0.494	18.6	21.392	1.75e-07	1.20e-02	5.66e-06	0.00e+00
17	0.125	0.1750	0.514	17.5	27.529	1.39e-07	2.86e-02	1.07e-05	0.00e+00

Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
Boring No.: BB-FBR-103A	Tested By: trm	Checked By: njh/anm
Sample No.: 1U	Test Date: 9/18/19	Depth: 34-36 ft
Test No.: IP-3	Sample Type: intact	Elevation: ---
Description: Moist, gray clay		
Remarks: System O		
Displacement at End of Increment		

One-Dimensional Consolidation by ASTM D2435 - Method B

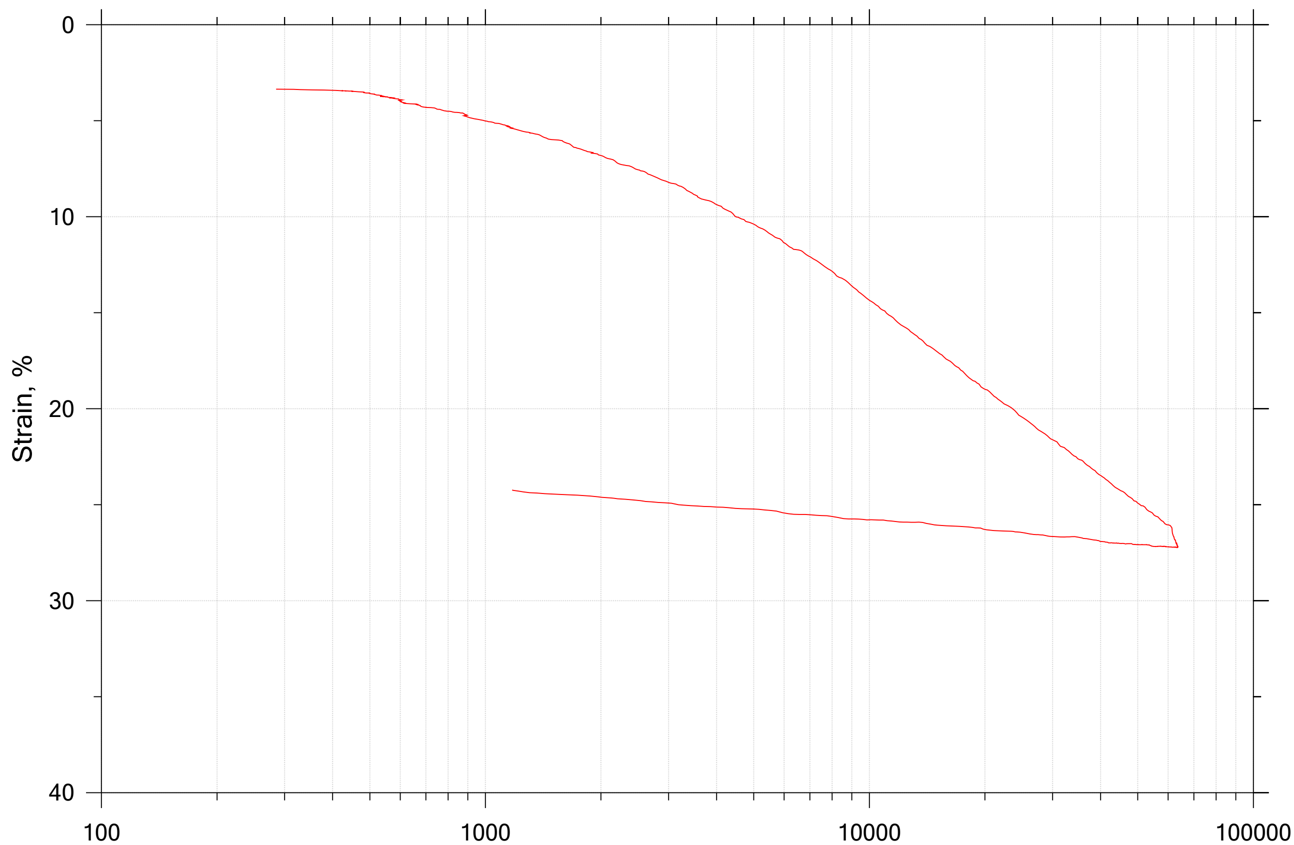
Square Root of Time Coefficients

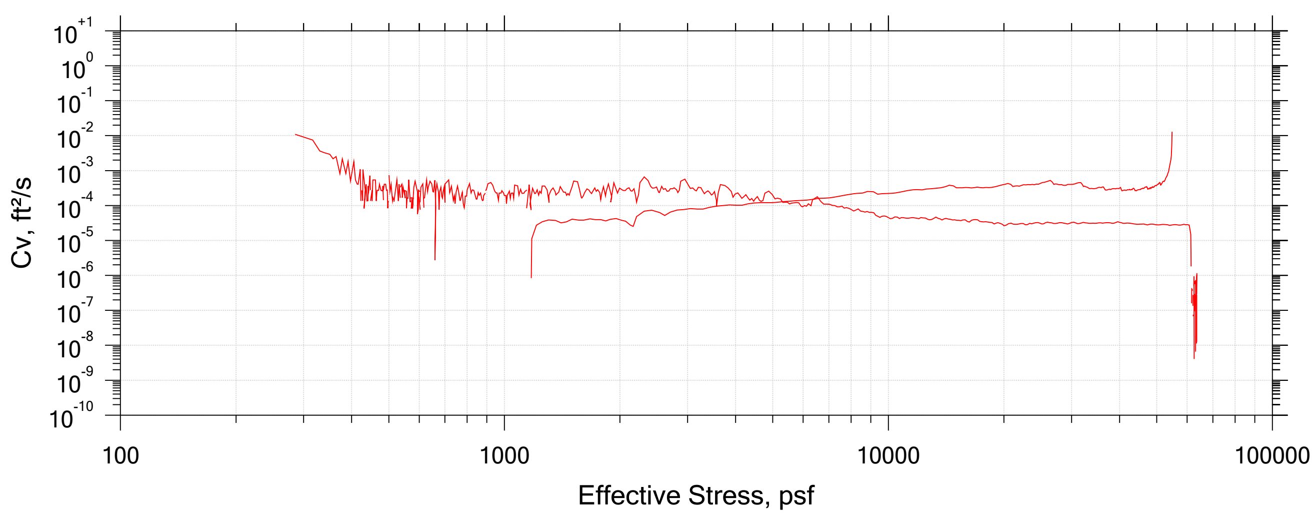
Step	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	Sq.Rt. T90 min	Cv ft²/s	Mv 1/tsf	k ft/day
1	0.125	0.04350	0.755	4.35	209.931	1.12e-07	3.48e-01	1.05e-04
2	0.188	0.05601	0.732	5.60	197.626	1.12e-07	1.99e-01	6.01e-05
3	0.281	0.06542	0.715	6.54	159.890	1.35e-07	1.01e-01	3.69e-05
4	0.422	0.07547	0.696	7.55	196.199	1.08e-07	7.13e-02	2.08e-05
5	0.633	0.08663	0.676	8.66	141.807	1.46e-07	5.29e-02	2.08e-05
6	0.949	0.09952	0.652	9.95	134.584	1.50e-07	4.08e-02	1.65e-05
7	1.42	0.1121	0.629	11.2	98.475	1.99e-07	2.64e-02	1.42e-05
8	2.14	0.1266	0.602	12.7	70.119	2.71e-07	2.04e-02	1.49e-05
9	3.20	0.1416	0.575	14.2	60.793	3.03e-07	1.41e-02	1.15e-05
10	4.80	0.1578	0.545	15.8	52.267	3.39e-07	1.01e-02	9.26e-06
11	7.21	0.1734	0.516	17.3	31.134	5.49e-07	6.49e-03	9.61e-06
12	10.8	0.1905	0.485	19.1	24.456	6.71e-07	4.75e-03	8.60e-06
13	16.2	0.2085	0.452	20.8	19.252	8.17e-07	3.32e-03	7.31e-06
14	4.00	0.2019	0.464	20.2	5.117	3.03e-06	5.36e-04	4.38e-06
15	1.00	0.1917	0.483	19.2	23.946	6.61e-07	3.40e-03	6.06e-06
16	0.500	0.1858	0.494	18.6	103.097	1.57e-07	1.20e-02	5.05e-06
17	0.125	0.1750	0.514	17.5	161.612	1.02e-07	2.86e-02	7.87e-06

Project: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project No.: GTX-310291
Boring No.: BB-FBR-103A	Tested By: trm	Checked By: njh/anm
Sample No.: 1U	Test Date: 9/18/19	Depth: 34-36 ft
Test No.: IP-3	Sample Type: intact	Elevation: ---
Description: Moist, gray clay		
Remarks: System O		
Displacement at End of Increment		

CRC Test

Summary

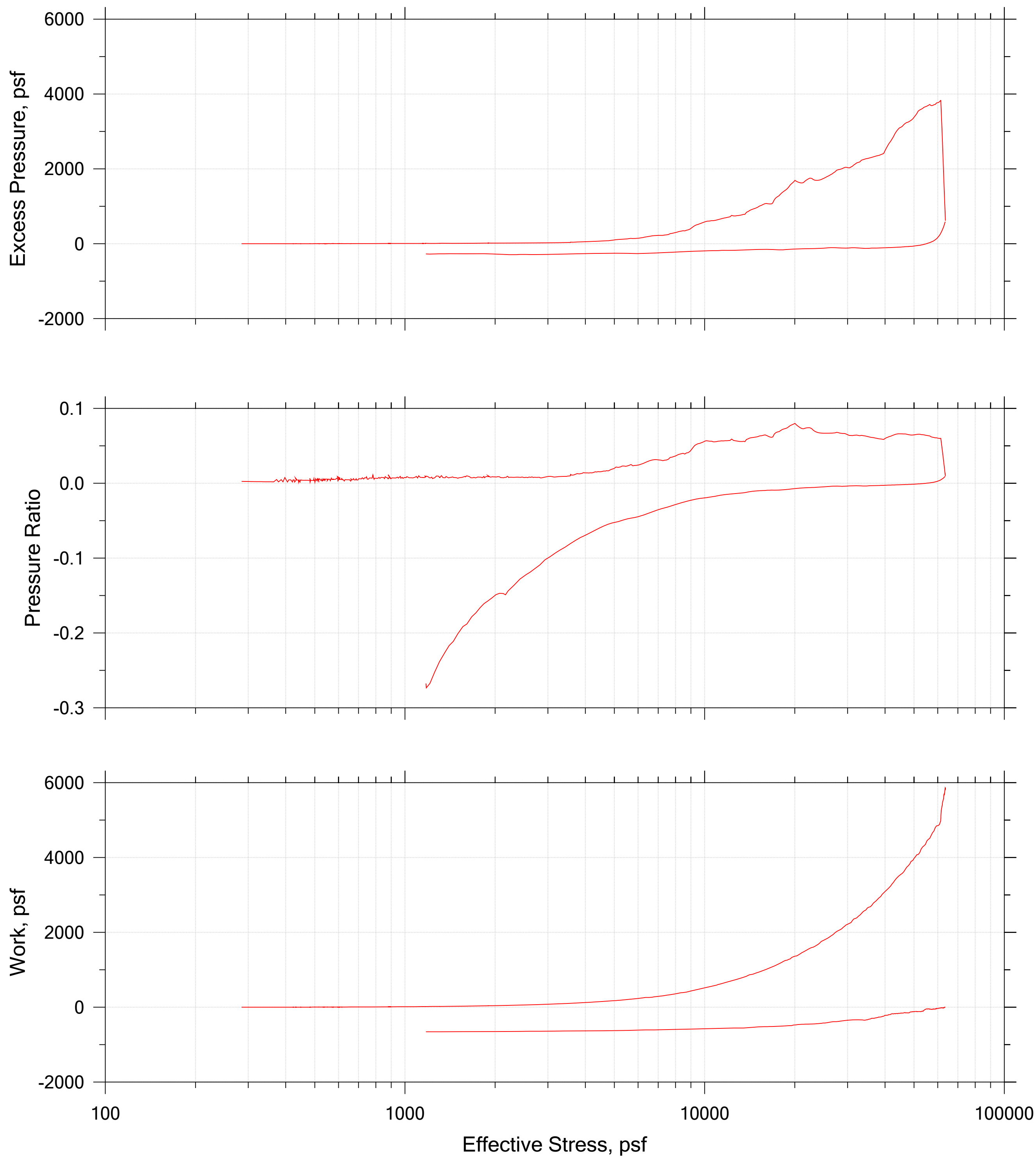




GeoTesting EXPRESS	Project Name: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project Number: GTX-310291
	Boring Number: BB-FBR-104	Tester: md	Checker: njh
	Sample Number: 1U	Test Date: 08/19/19	Depth: 39-41 ft
	Test Number: CRC-4A	Preparation: intact	Elevation: ---
	Description: Moist, gray clay		
	Remarks: System S		
			Page 1 of 3

CRC Test

Pressure Curves



GeoTesting EXPRESS	Project Name: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project Number: GTX-310291
	Boring Number: BB-FBR-104	Tester: md	Checker: njh
	Sample Number: 1U	Test Date: 08/19/19	Depth: 39-41 ft
	Test Number: CRC-4A	Preparation: intact	Elevation: ---
	Description: Moist, gray clay		
	Remarks: System S		

CRC Test

Specimen Diameter, in: 2.50	Specific Gravity: 2.77 (Estimated)	Liquid Limit: 45
Specimen Height, in: 1.00	Initial Void Ratio: 1.18	Plastic Limit: 23
Final Height, in: 0.79	Final Void Ratio: 0.722	Plasticity Index: 22

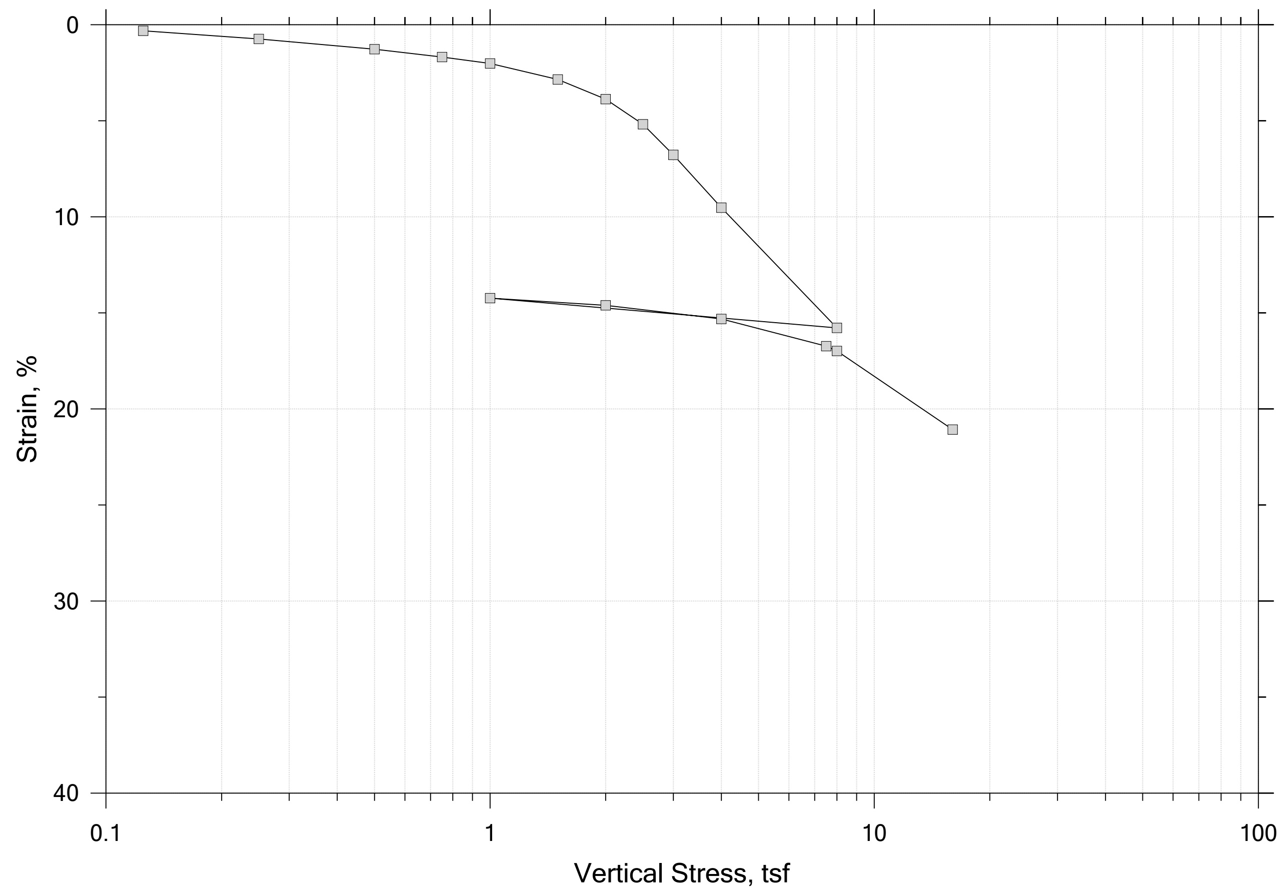
	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	C-2499	---		B-2904
Mass Container, gm	8.39	109.41	109.41	8.55
Mass Container + Wet Soil, gm	173.05	254.31	238.12	138.08
Mass Container + Dry Soil, gm	122.87	211.48	211.48	111.27
Mass Dry Soil, gm	114.48	102.07	102.07	102.72
Water Content, %	43.83	41.96	26.10	26.10
Void Ratio	---	1.18	0.72	---
Degree of Saturation, %	---	98.39	100.00	---
Dry Unit Weight, pcf	---	79.215	100.27	---

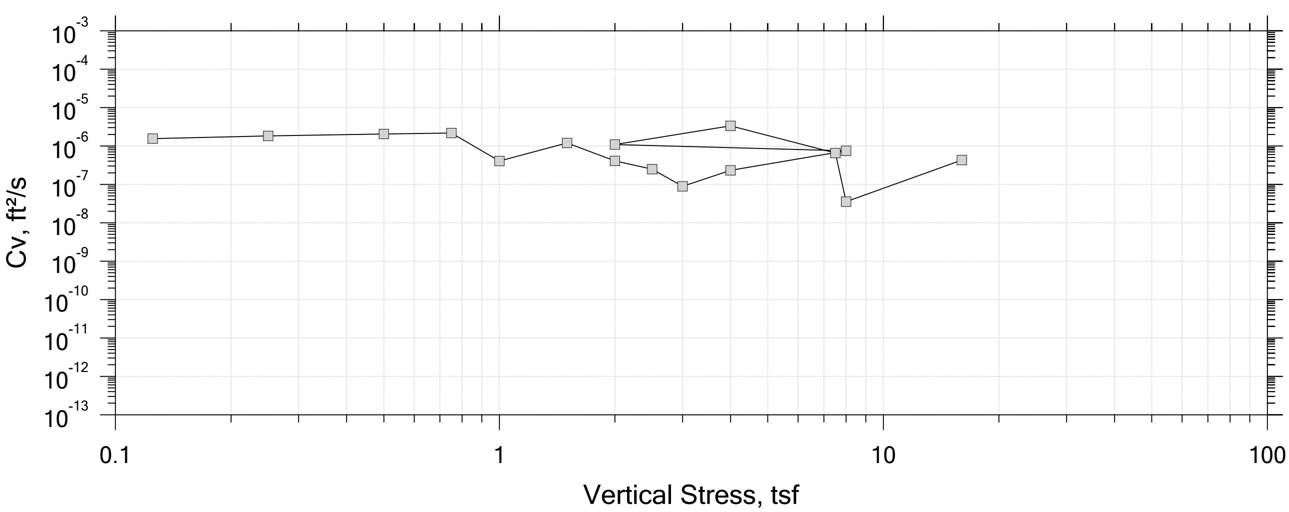
Note: Specific Gravity and Void Ratios are calculated assuming the degree of saturation equals 100% at the end of the test.
Therefore, values may not represent actual values for the specimen.

GeoTesting EXPRESS	Project Name: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project Number: GTX-310291
	Boring Number: BB-FBR-104	Tester: md	Checker: njh
	Sample Number: 1U	Test Date: 08/19/19	Depth: 39-41 ft
	Test Number: CRC-4A	Preparation: intact	Elevation: ---
	Description: Moist, gray clay		
	Remarks: System S		

One-Dimensional Consolidation by ASTM D2435 - Method B

Summary Report

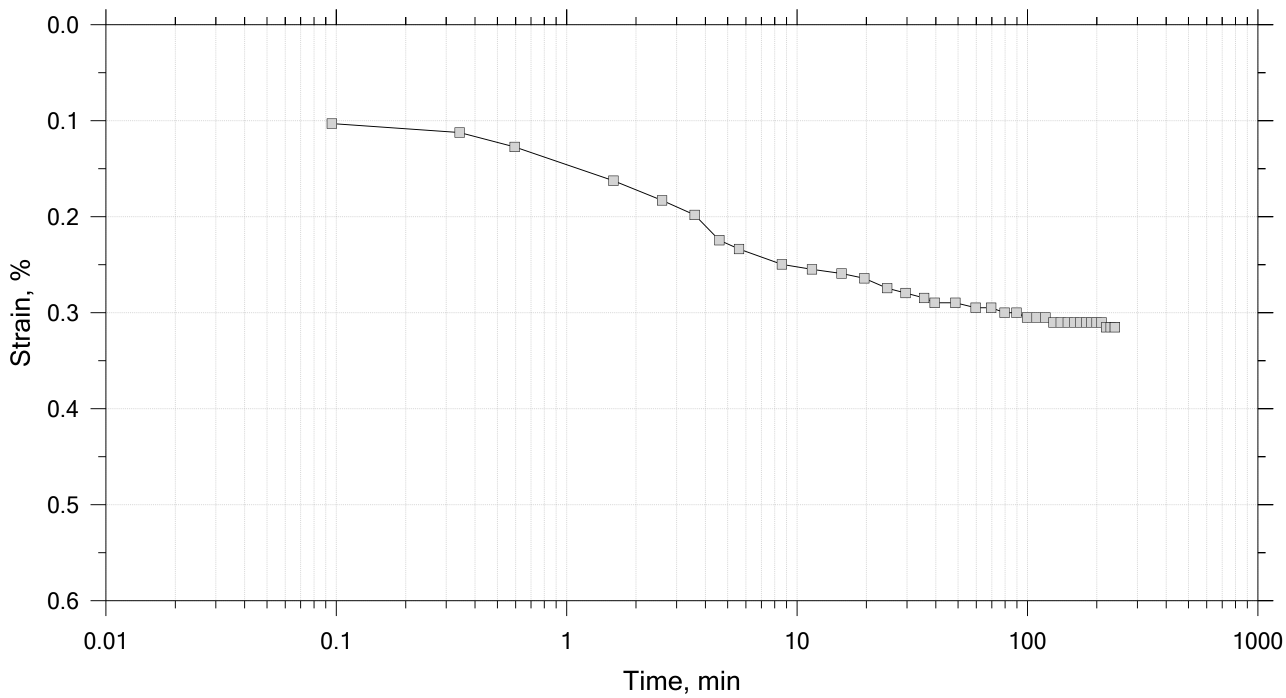


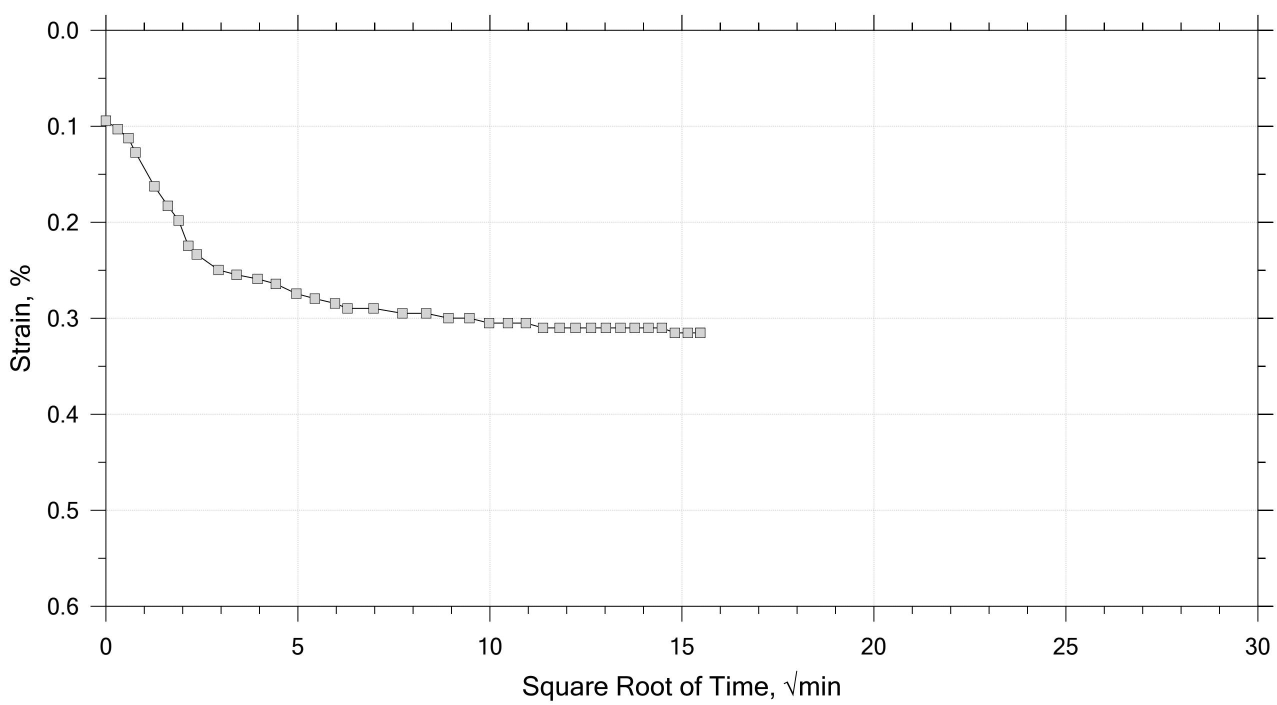


GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-104	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 51-53
	Test No.: IP-1	Sample Type: intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System T, Swell		
	Displacement at End of Increment		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 1 of 17
Constant Load Step
Stress: 0.125 tsf





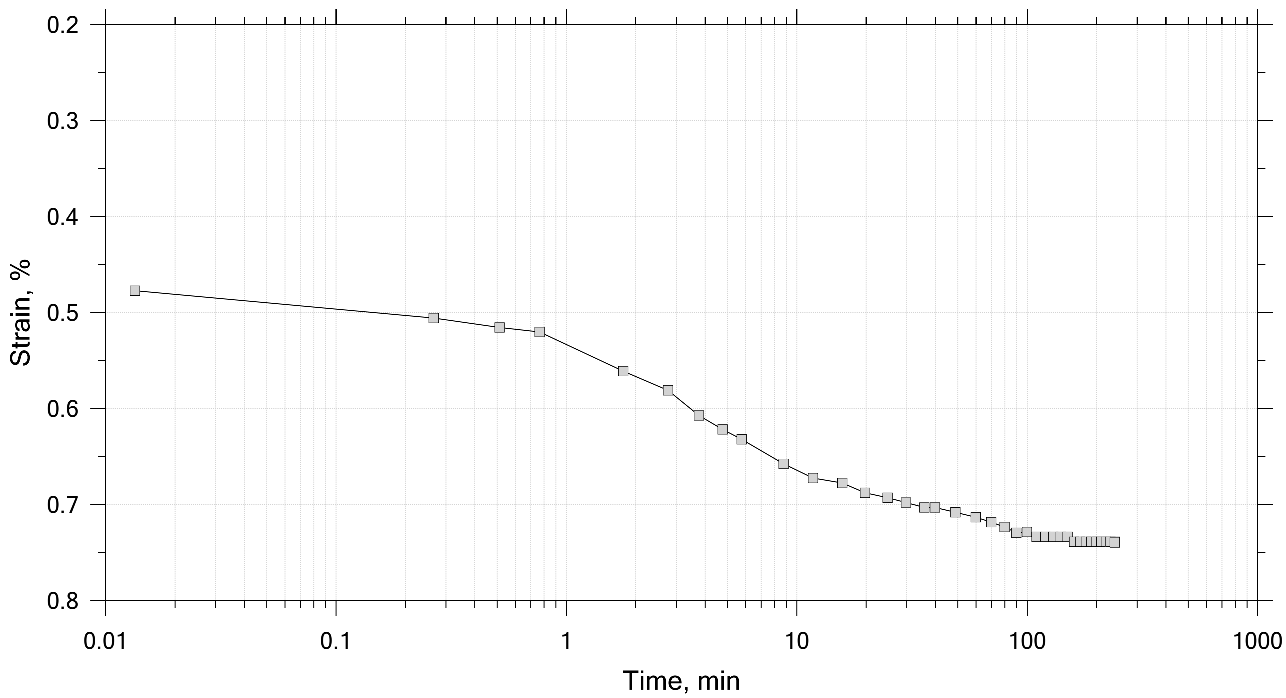
GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-104	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 51-53
	Test No.: IP-1	Sample Type: intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System T, Swell		

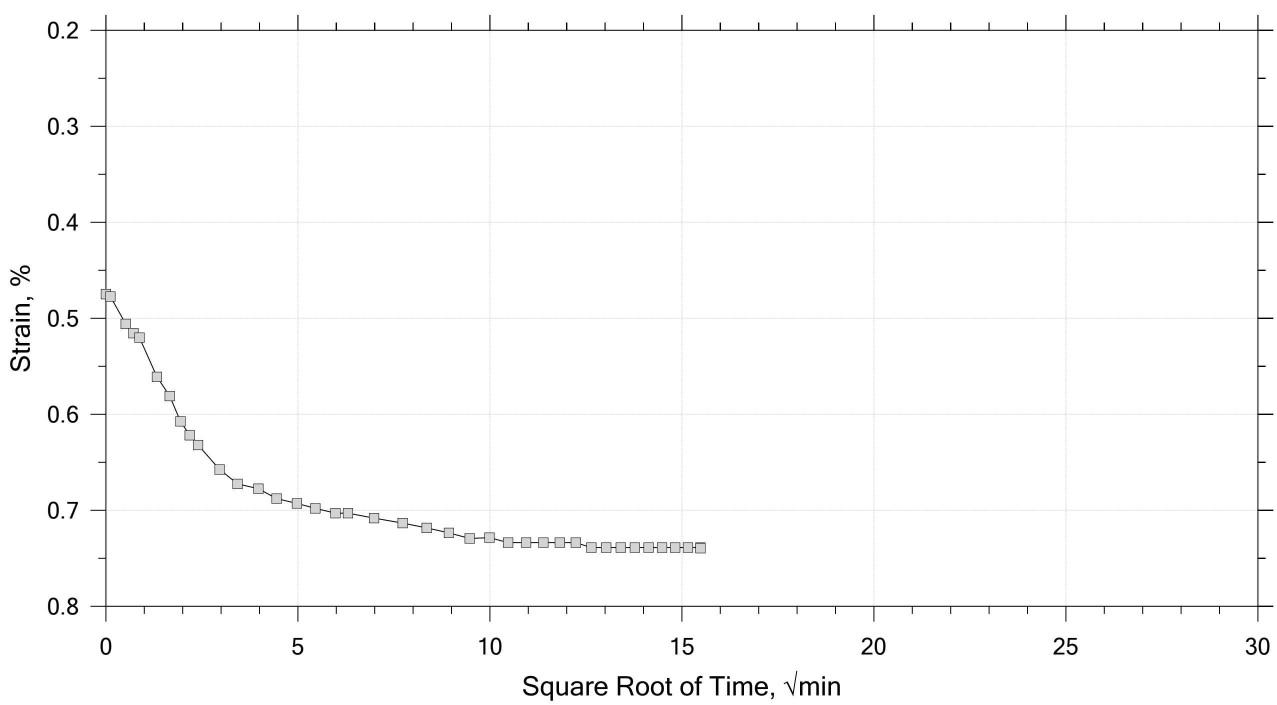
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 2 of 17

Constant Load Step

Stress: 0.25 tsf





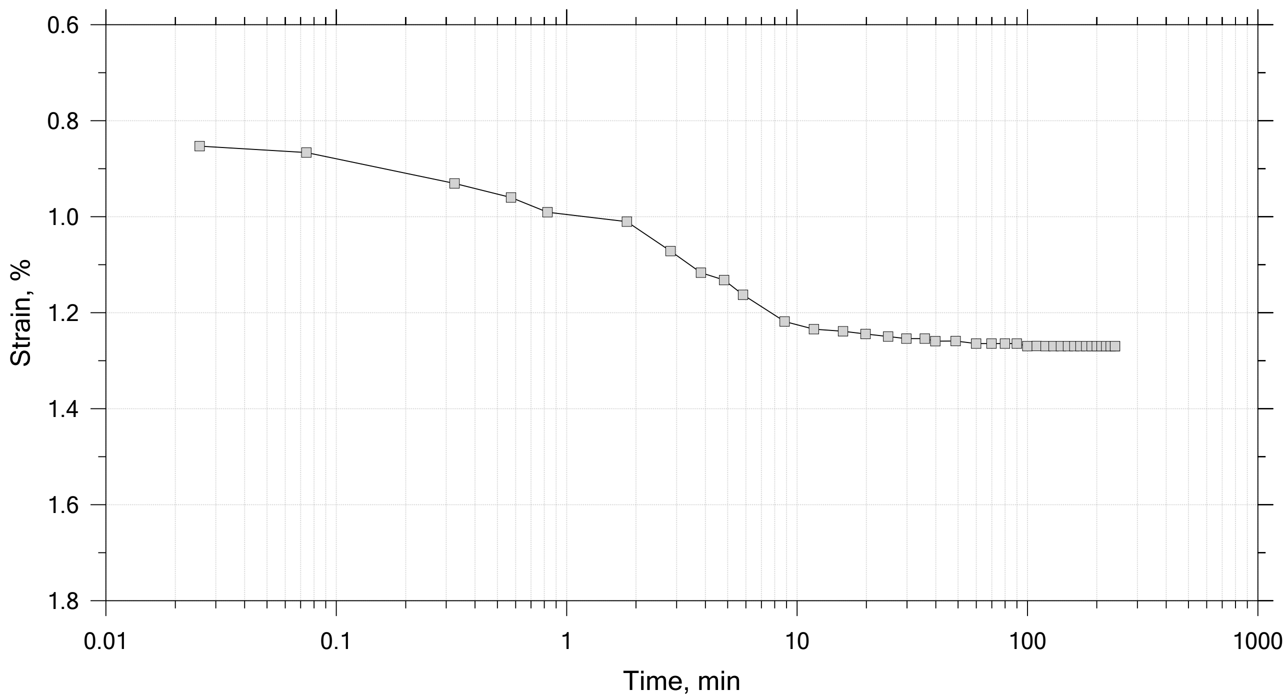
GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-104	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 51-53
	Test No.: IP-1	Sample Type: intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System T, Swell		

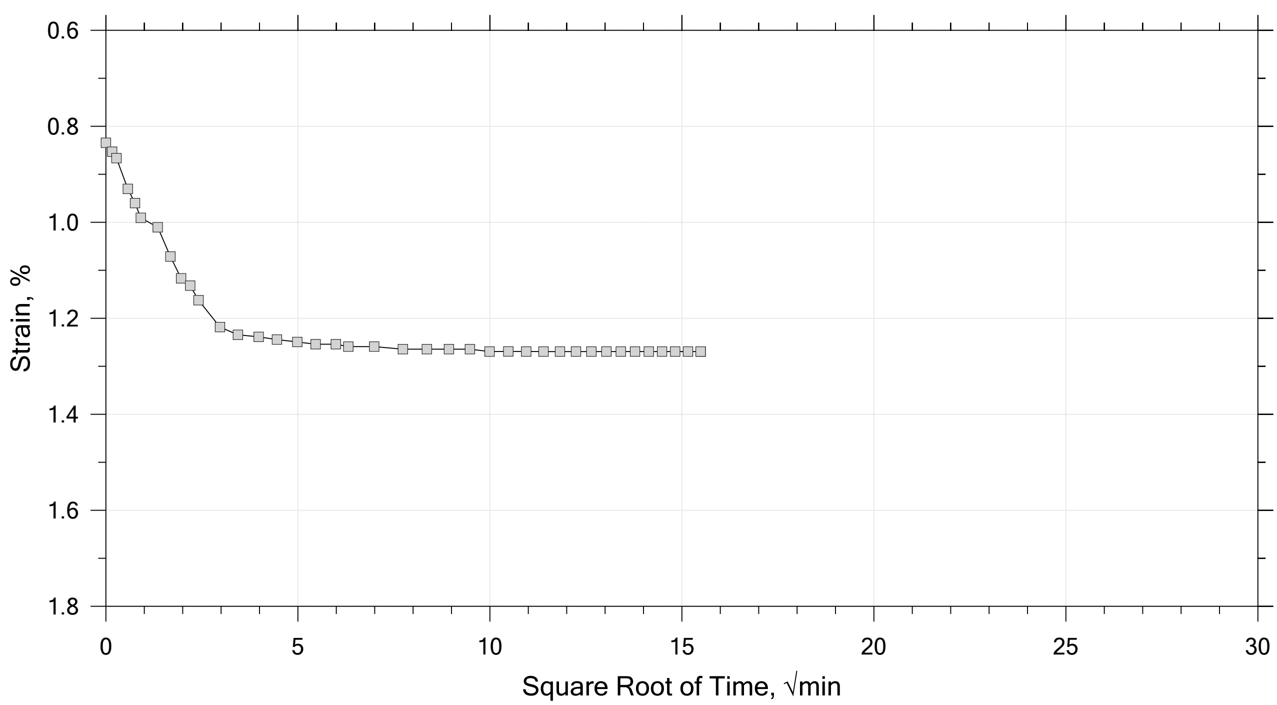
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 3 of 17

Constant Load Step

Stress: 0.5 tsf





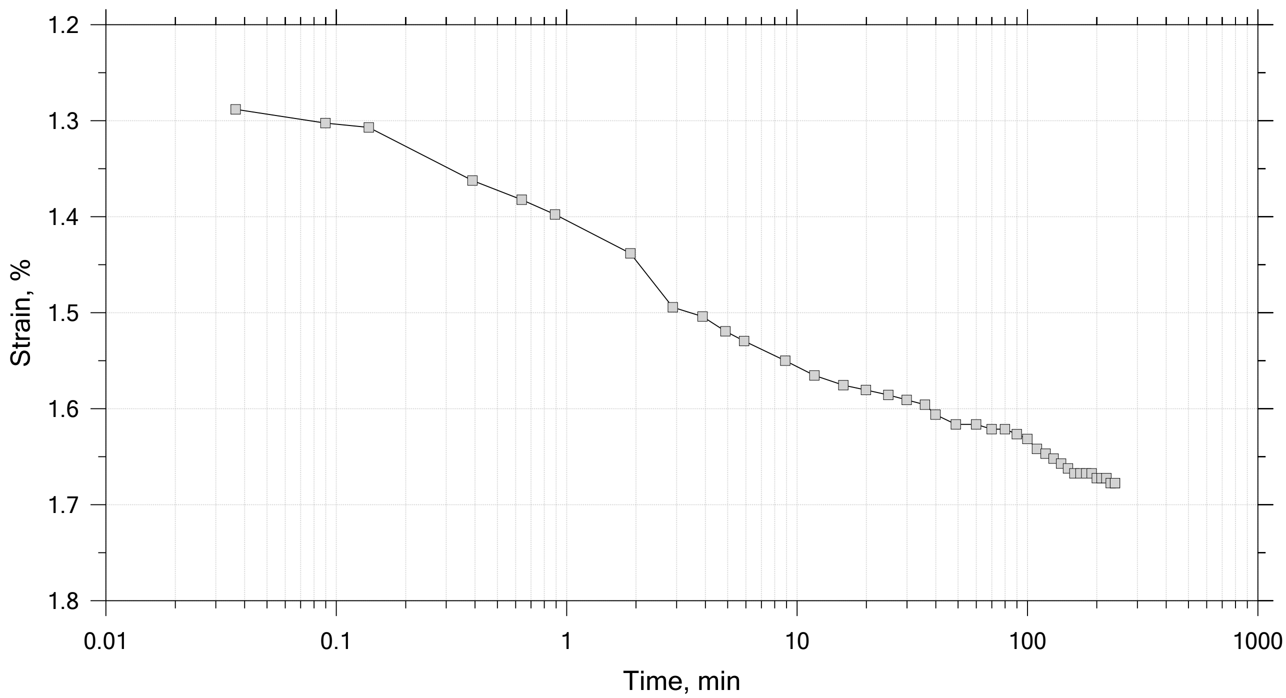
GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-104	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 51-53
	Test No.: IP-1	Sample Type: intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System T, Swell		

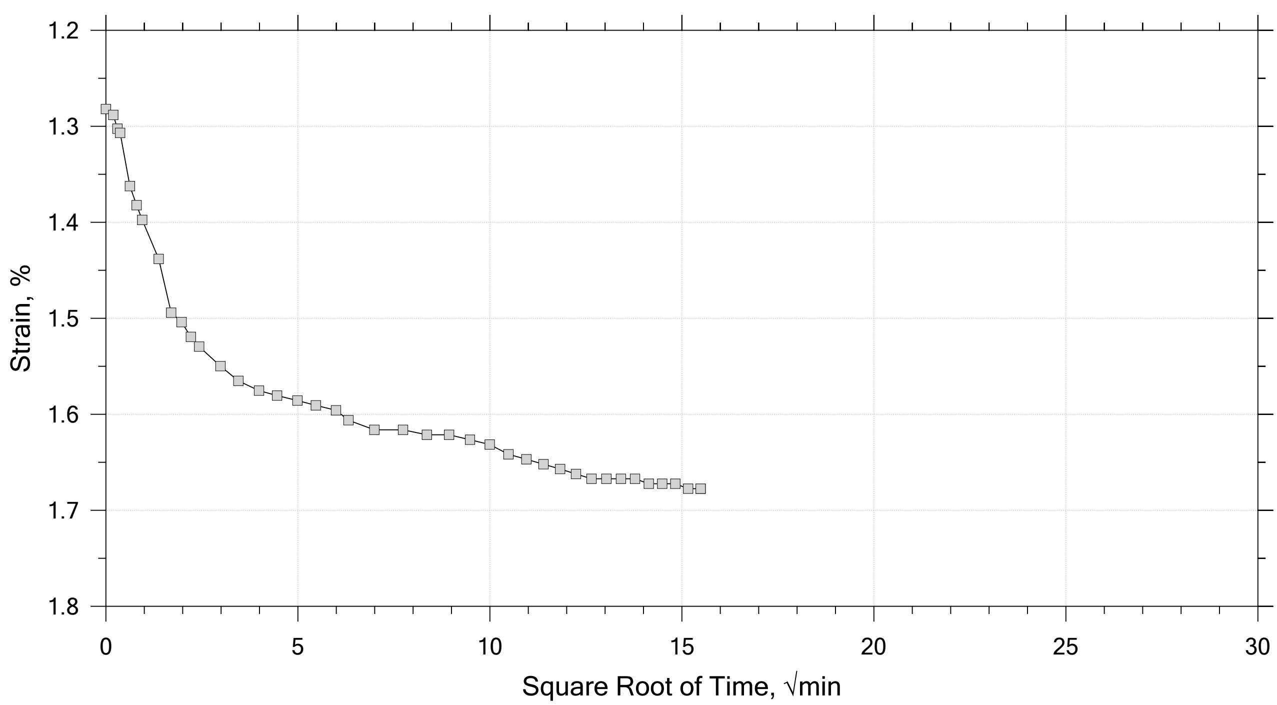
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 4 of 17

Constant Load Step

Stress: 0.75 tsf

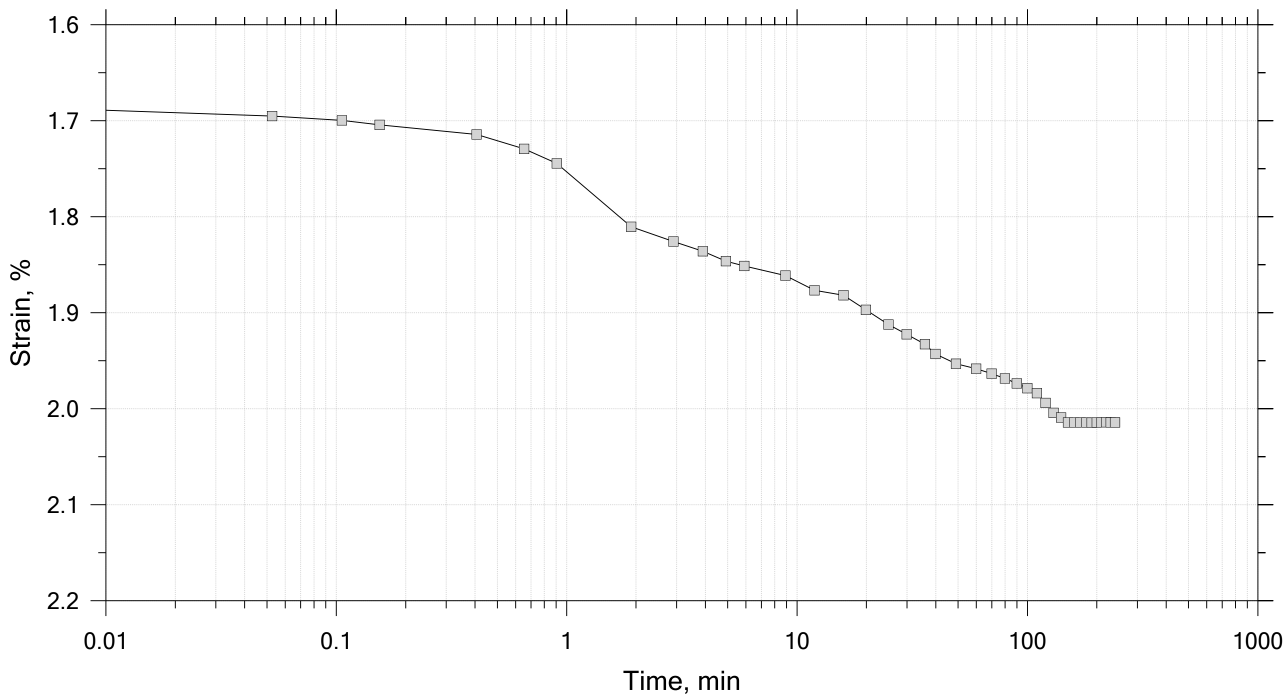


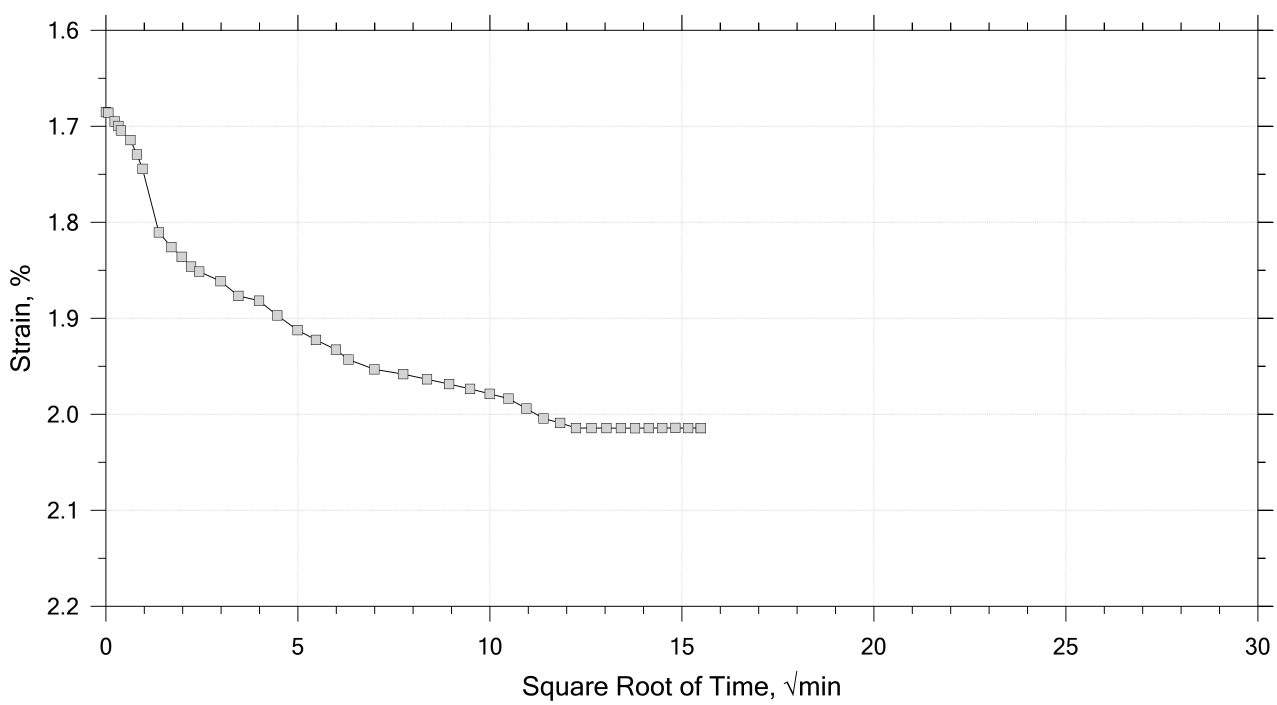


GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-104	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 51-53
	Test No.: IP-1	Sample Type: intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System T, Swell		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 5 of 17
Constant Load Step
Stress: 1 tsf

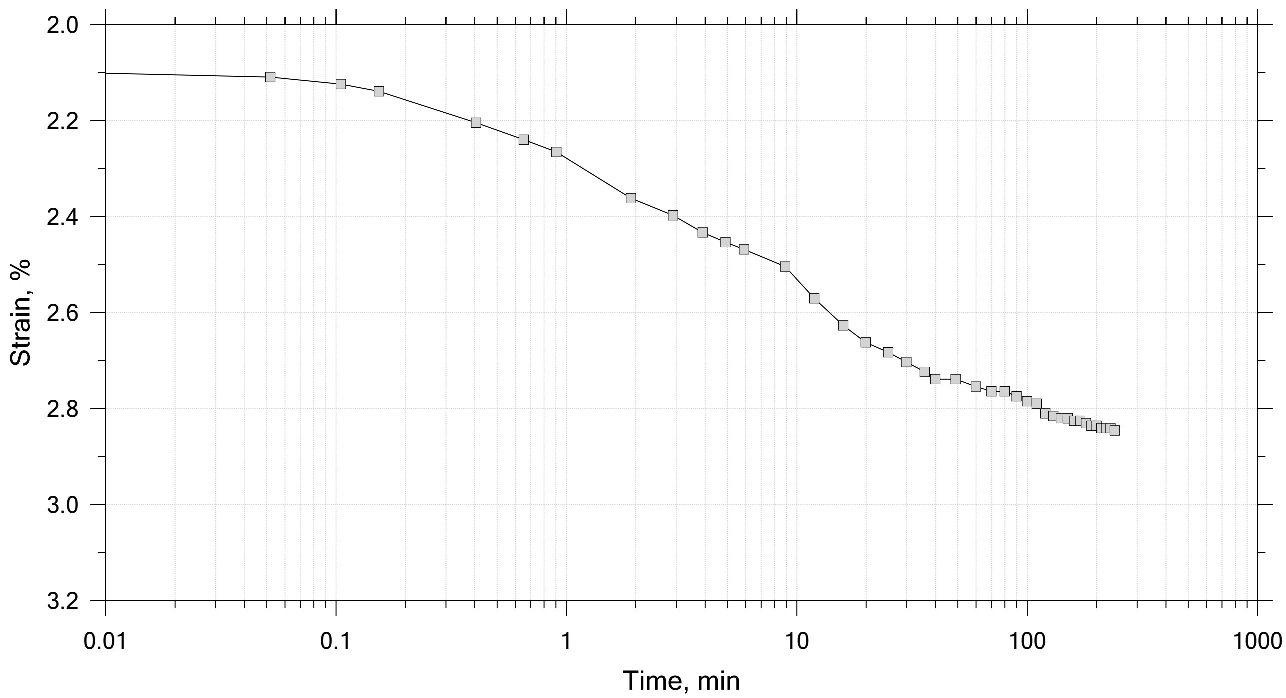


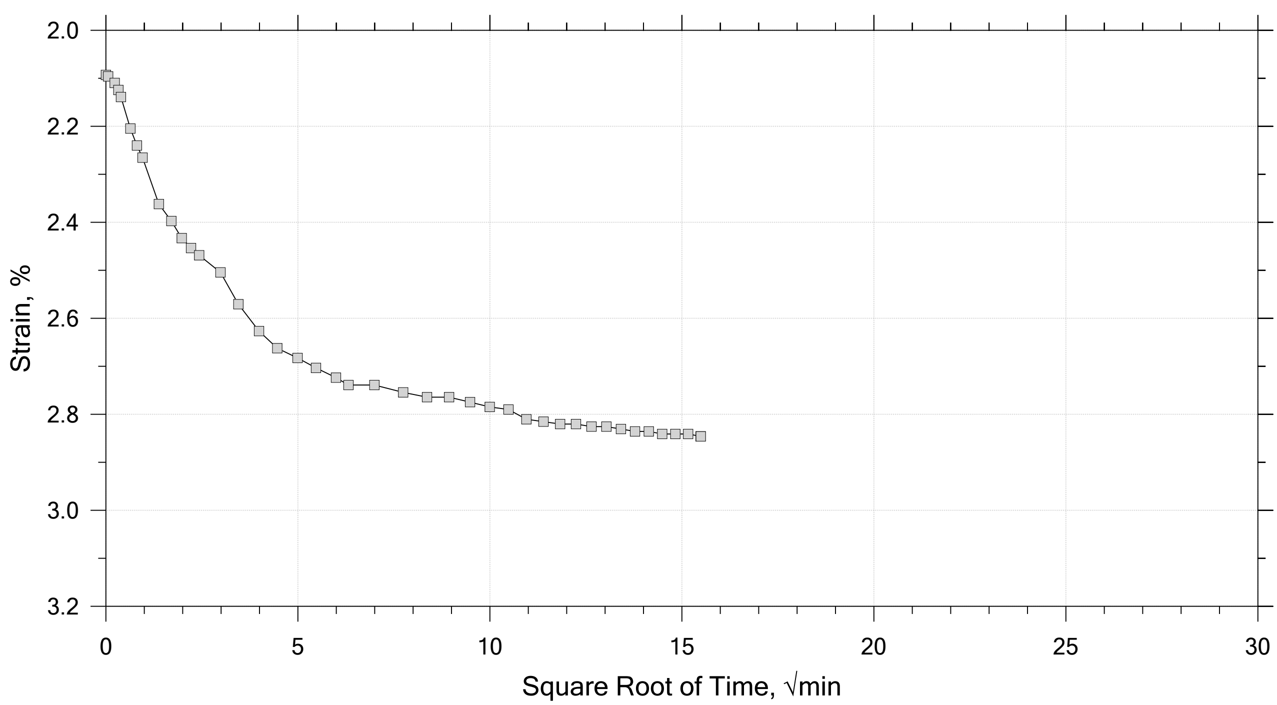


GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-104	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 51-53
	Test No.: IP-1	Sample Type: intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System T, Swell		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 6 of 17
Constant Load Step
Stress: 1.5 tsf





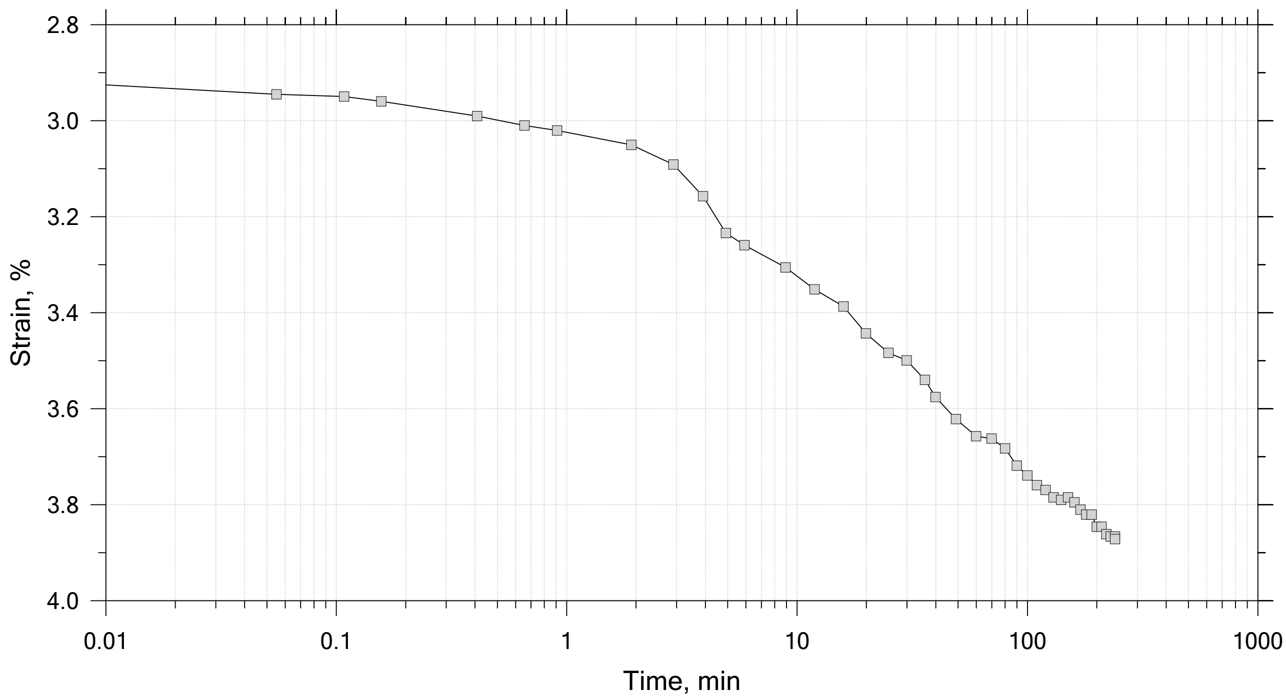
GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-104	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 51-53
	Test No.: IP-1	Sample Type: intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System T, Swell		

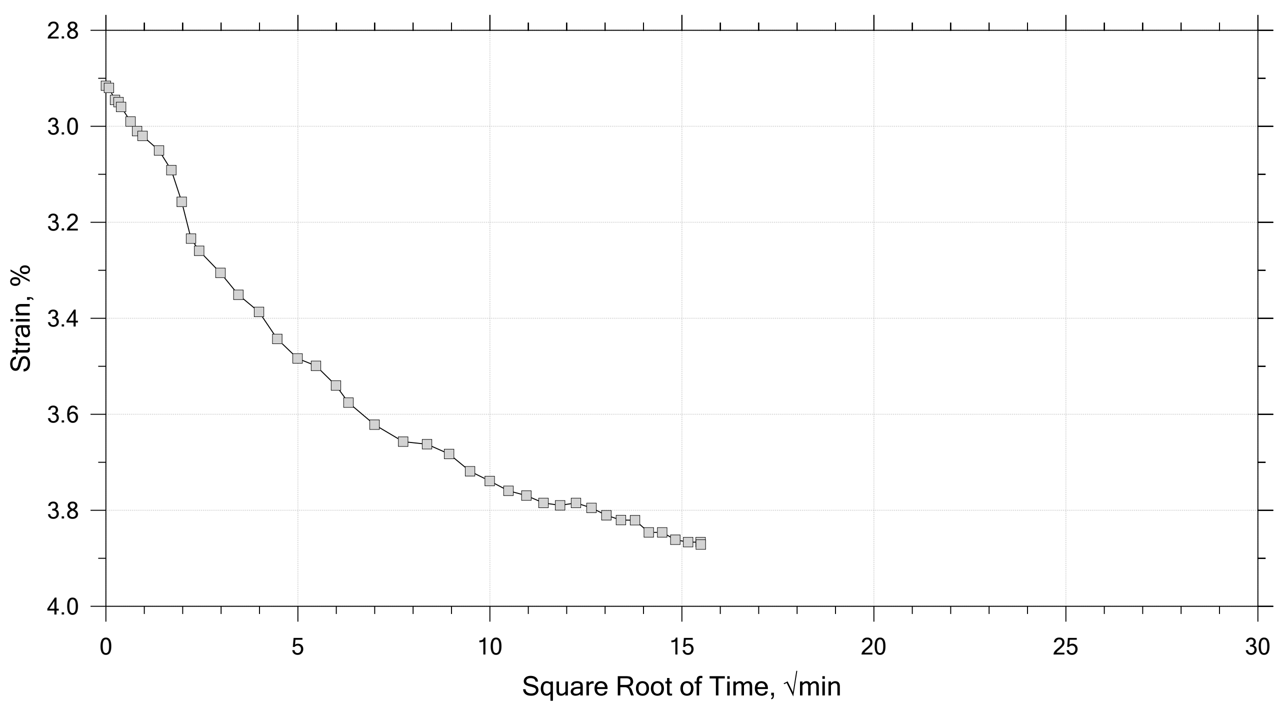
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 7 of 17

Constant Load Step

Stress: 2 tsf





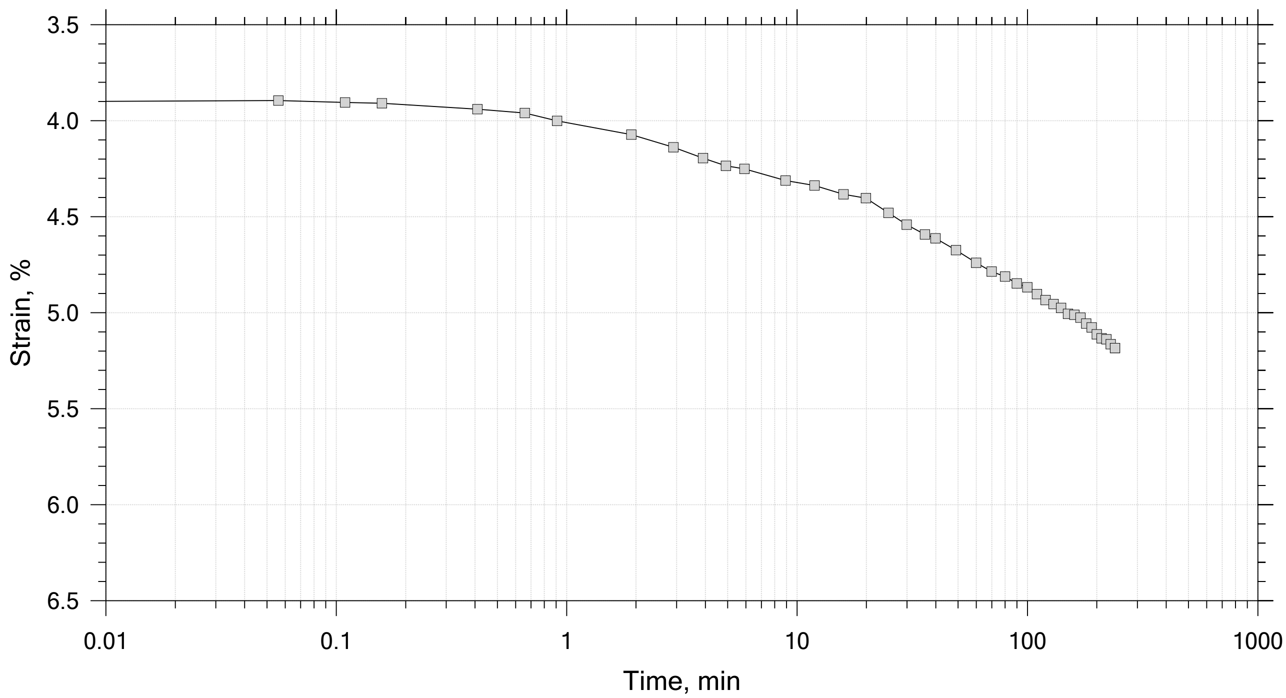
GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-104	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 51-53
	Test No.: IP-1	Sample Type: intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System T, Swell		

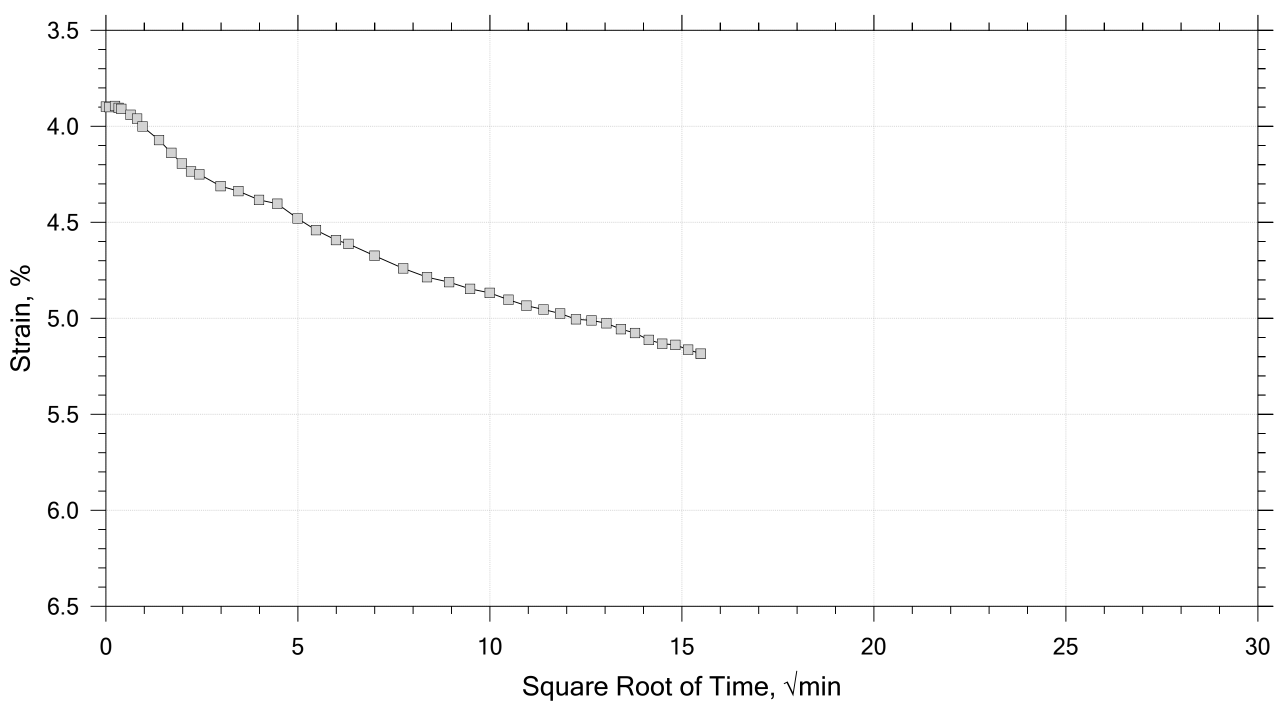
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 8 of 17

Constant Load Step

Stress: 2.5 tsf





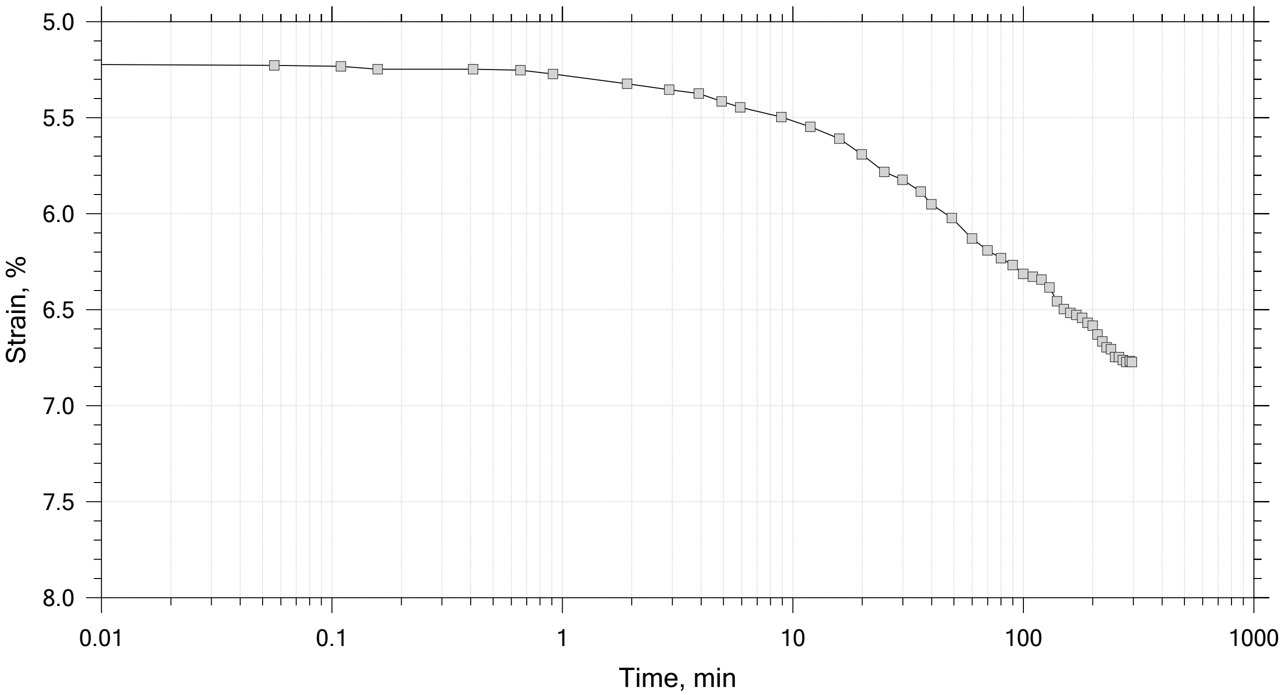
GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-104	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 51-53
	Test No.: IP-1	Sample Type: intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System T, Swell		

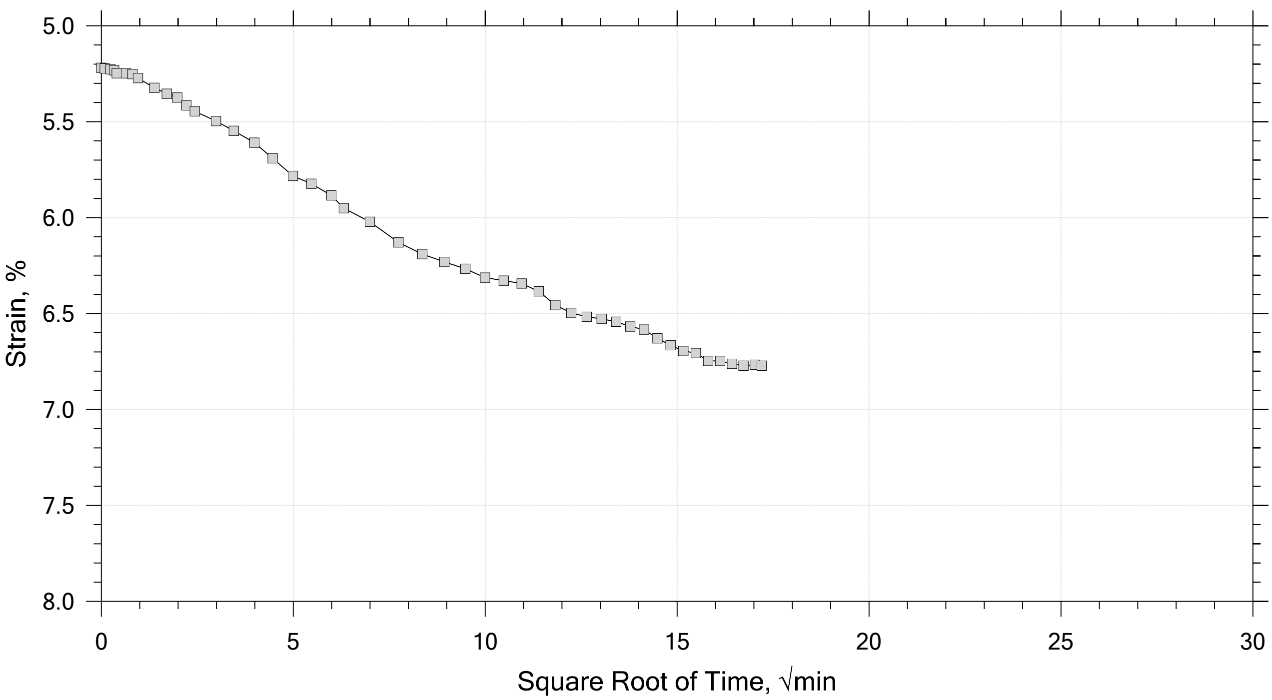
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 9 of 17

Constant Load Step

Stress: 3 tsf

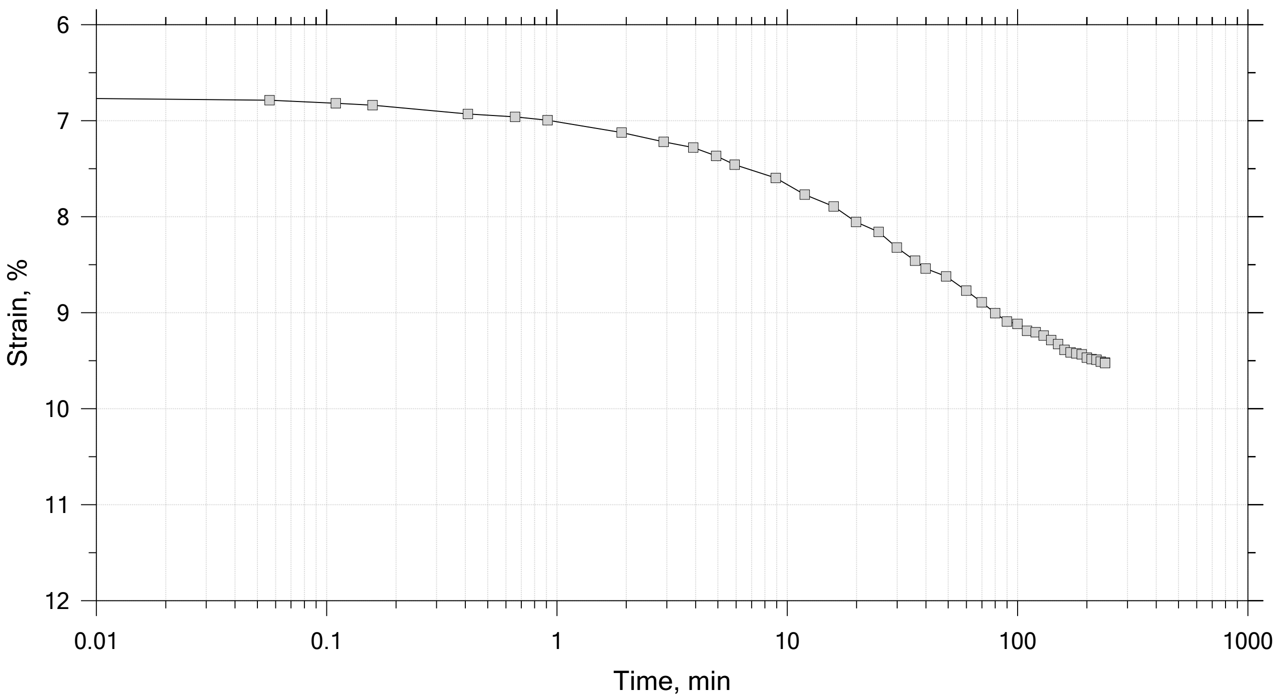


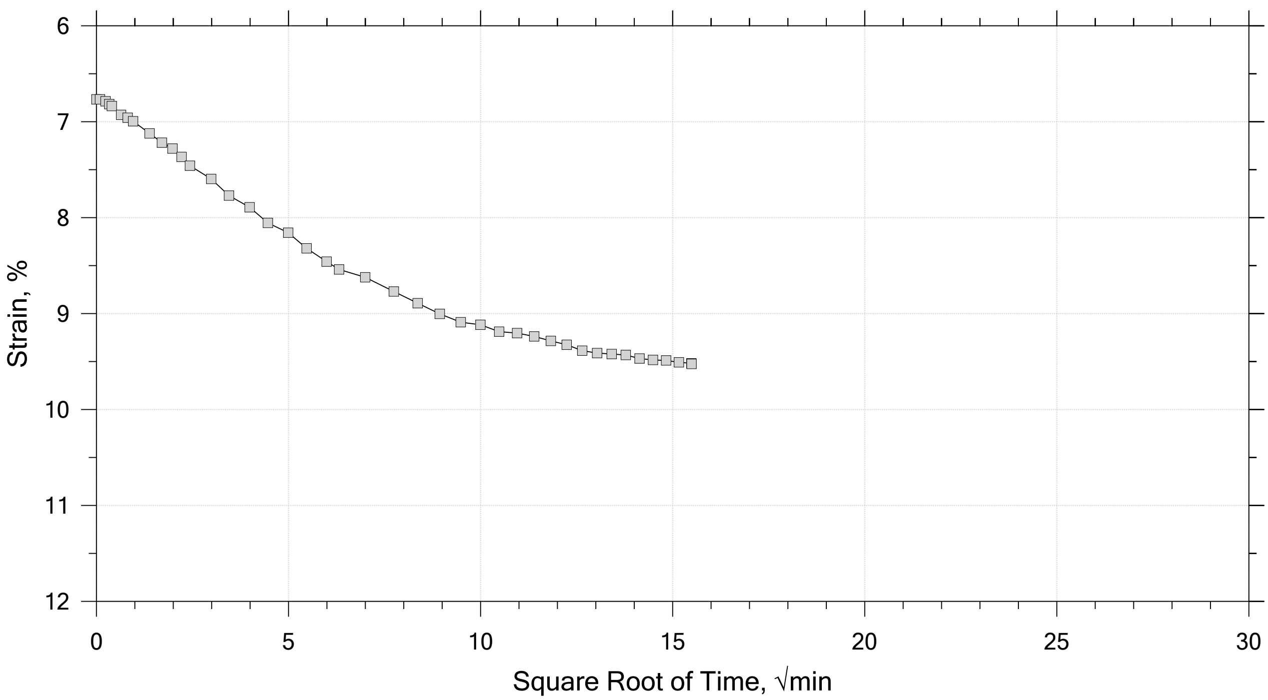


GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-104	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 51-53
	Test No.: IP-1	Sample Type: intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System T, Swell		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 10 of 17
Constant Load Step
Stress: 4 tsf





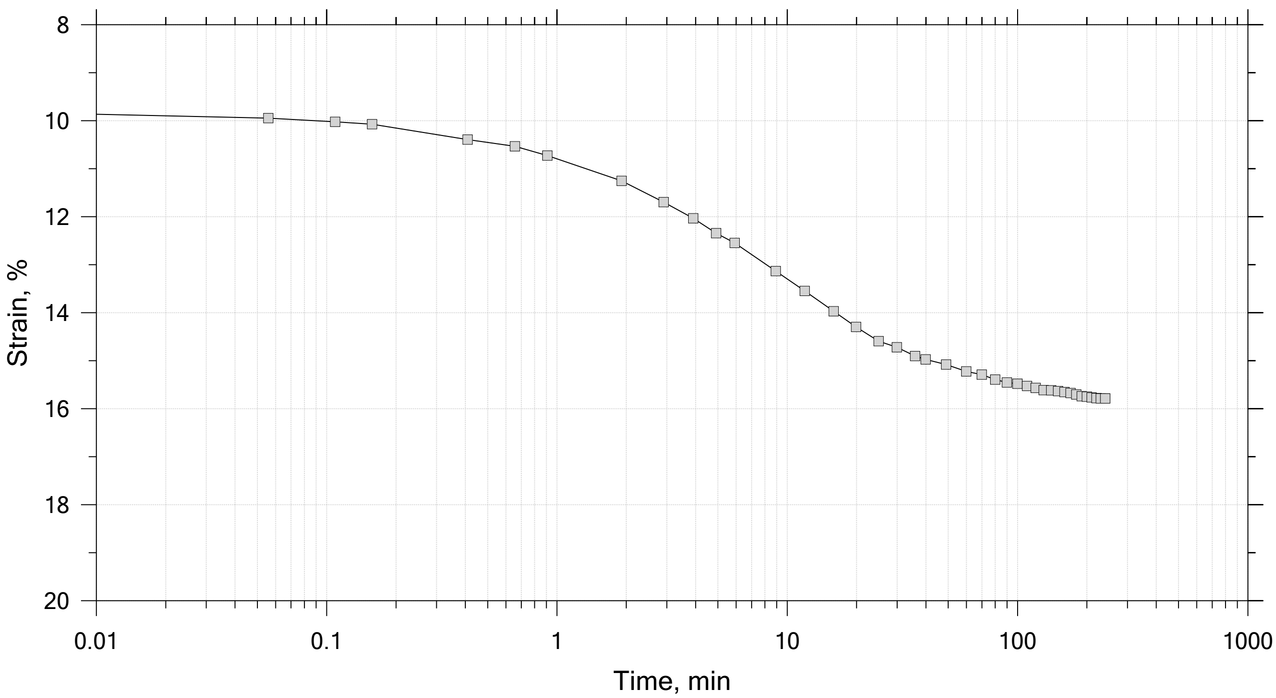
GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-104	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 51-53
	Test No.: IP-1	Sample Type: intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System T, Swell		

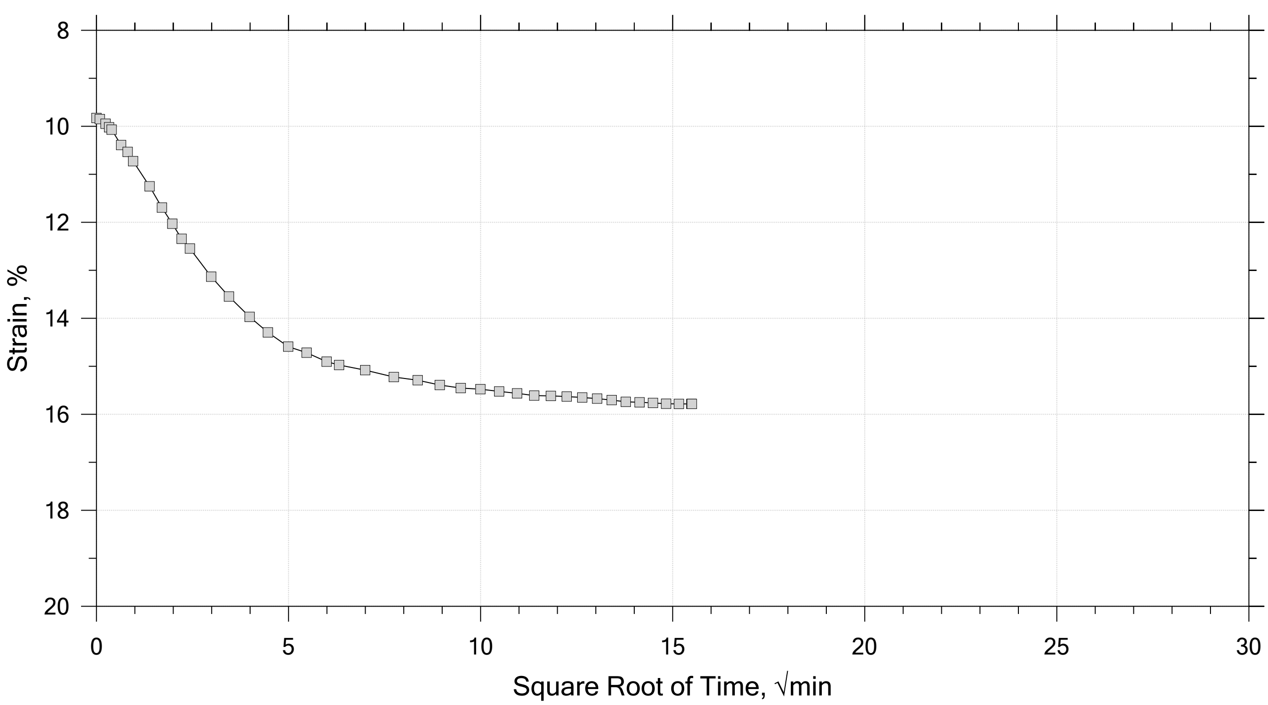
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 11 of 17

Constant Load Step

Stress: 8 tsf

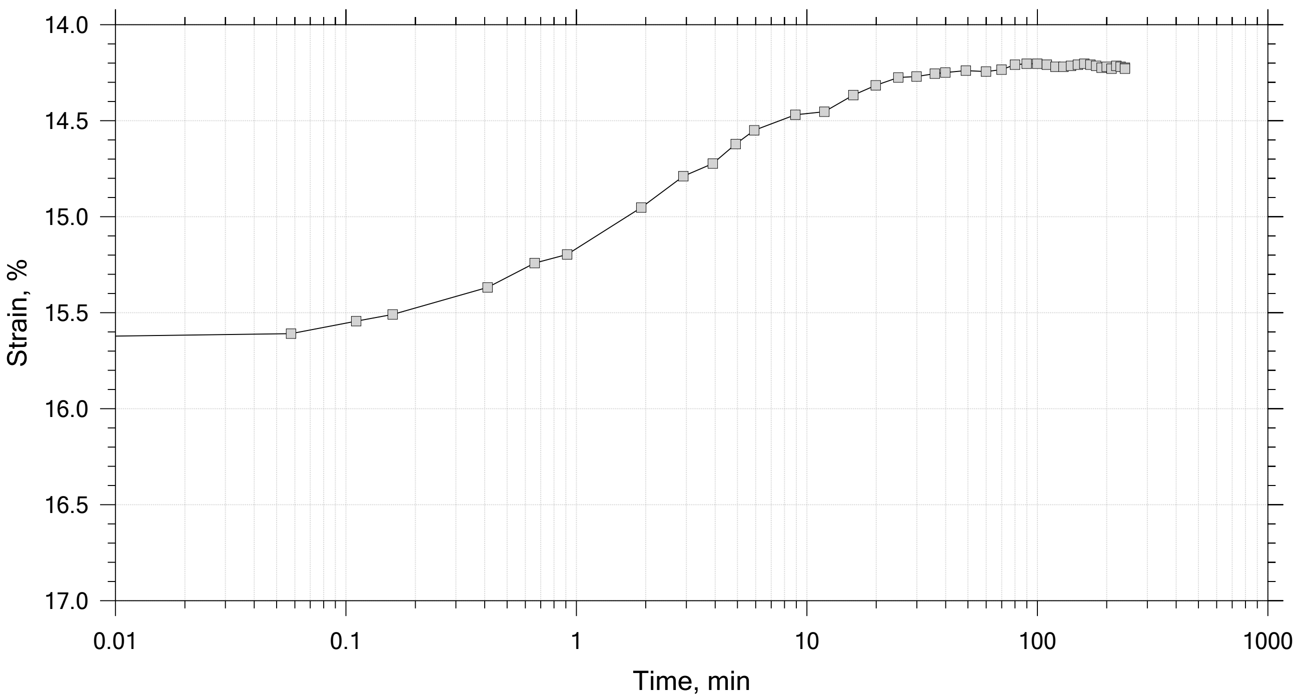


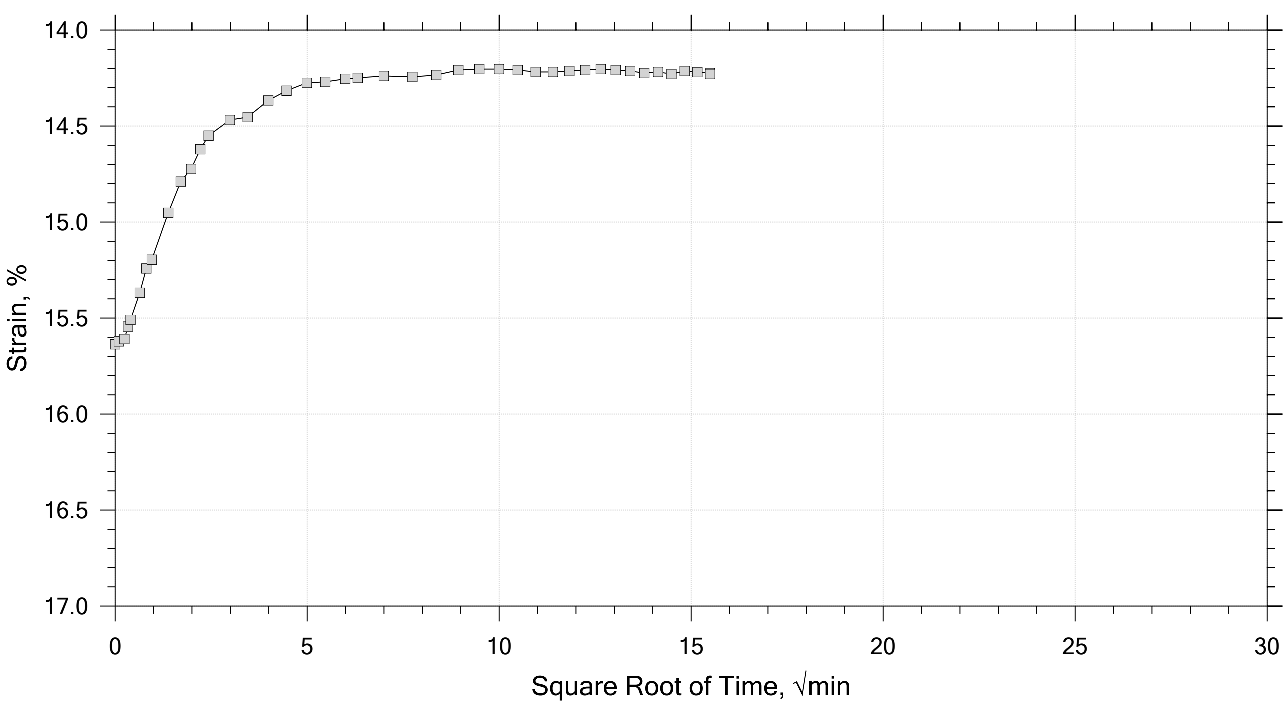


GeoTesting EXPRESS			
	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-104	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 51-53
	Test No.: IP-1	Sample Type: intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System T, Swell		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 12 of 17
Constant Load Step
Stress: 1 tsf





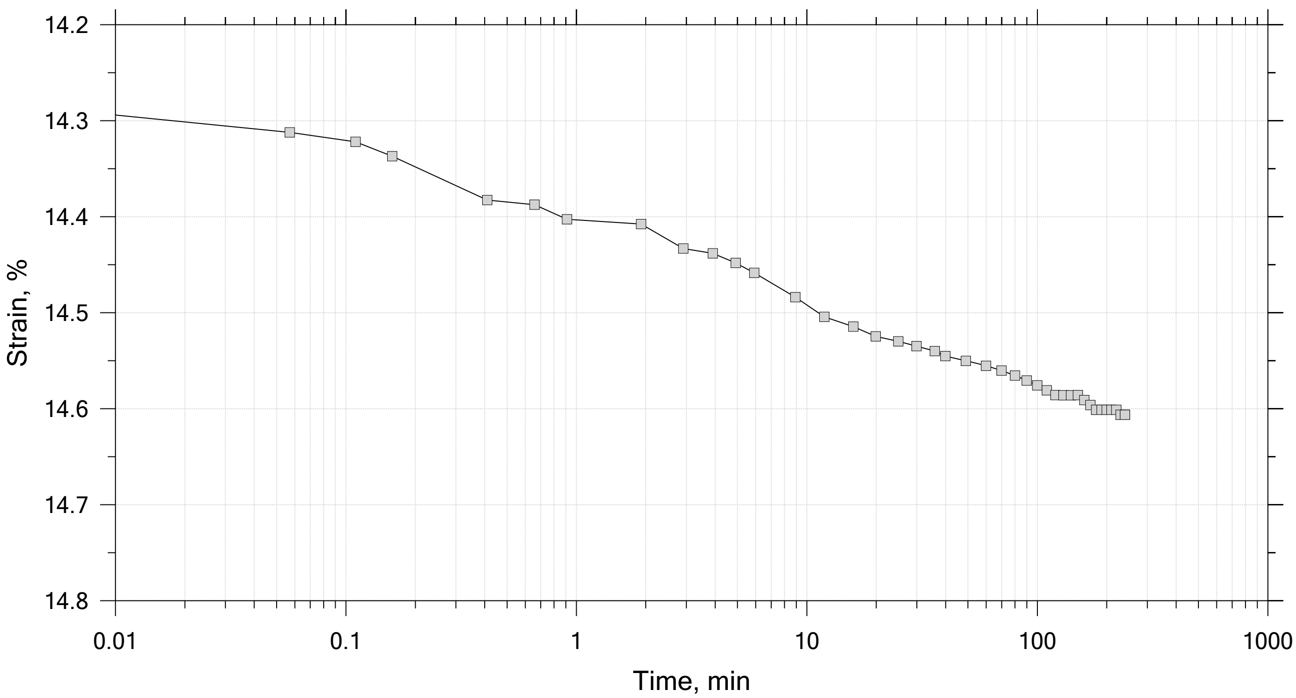
GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-104	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 51-53
	Test No.: IP-1	Sample Type: intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System T, Swell		

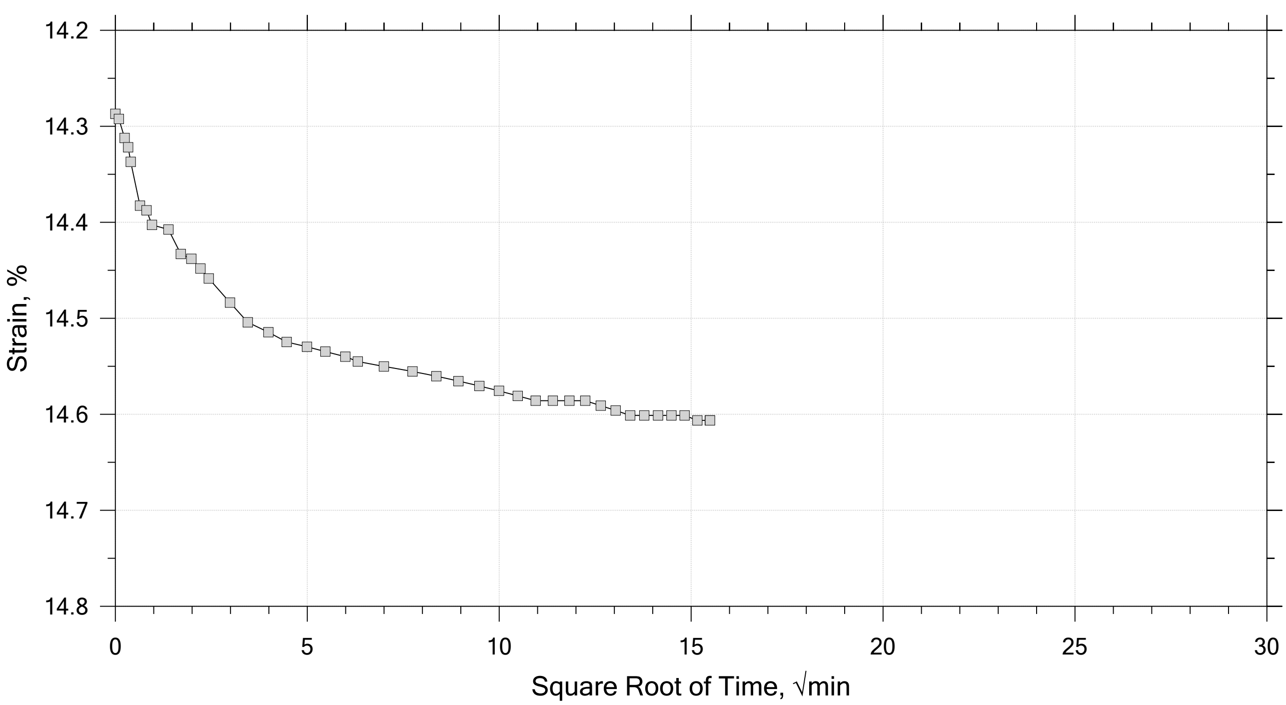
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 13 of 17

Constant Load Step

Stress: 2 tsf

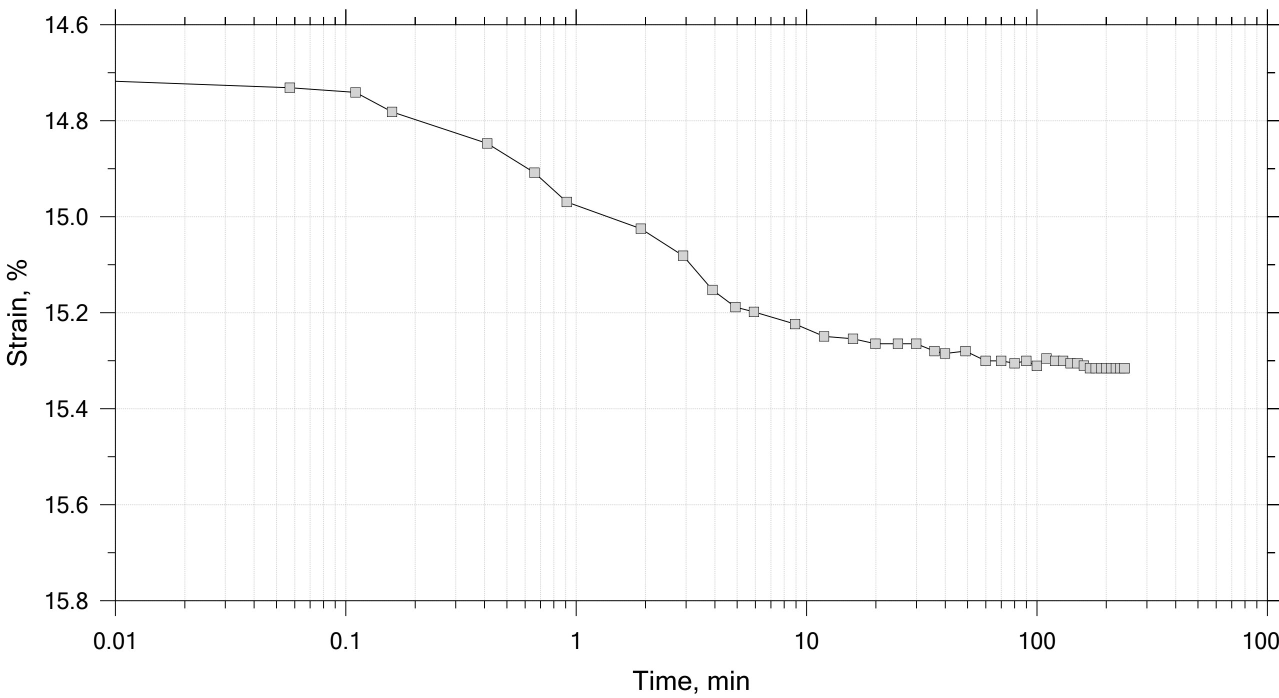


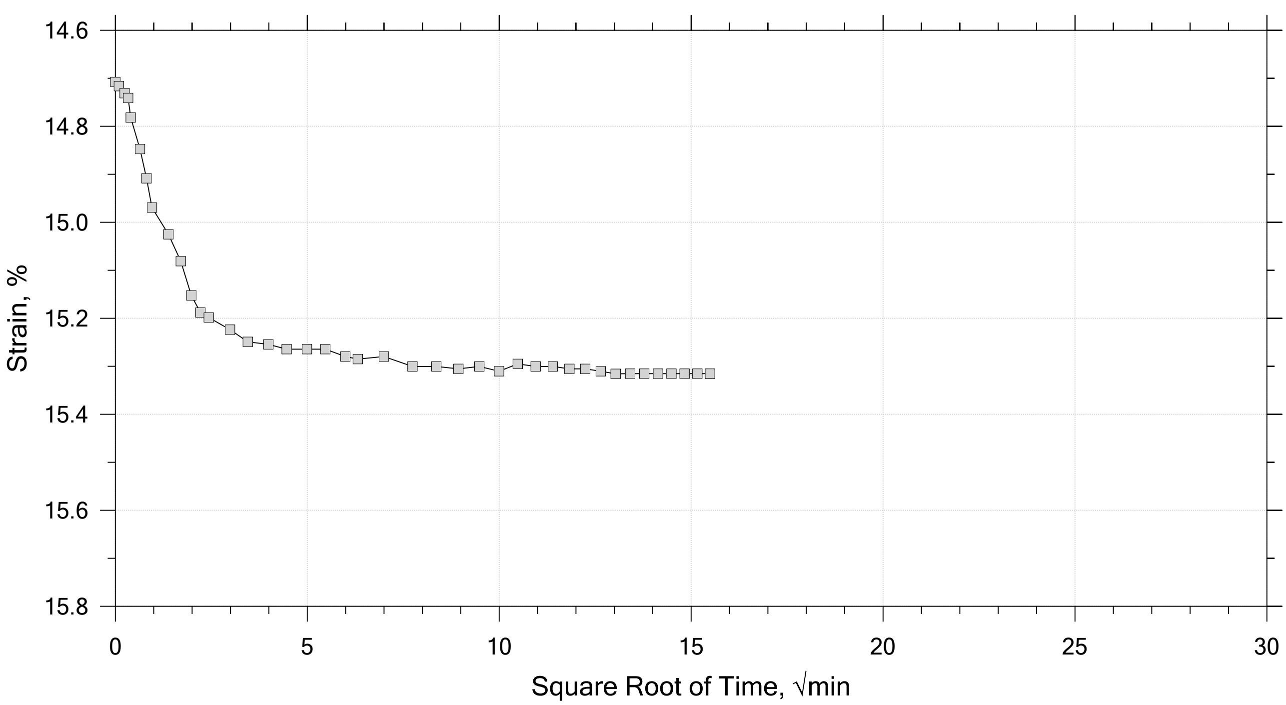


GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-104	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 51-53
	Test No.: IP-1	Sample Type: intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System T, Swell		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 14 of 17
Constant Load Step
Stress: 4 tsf





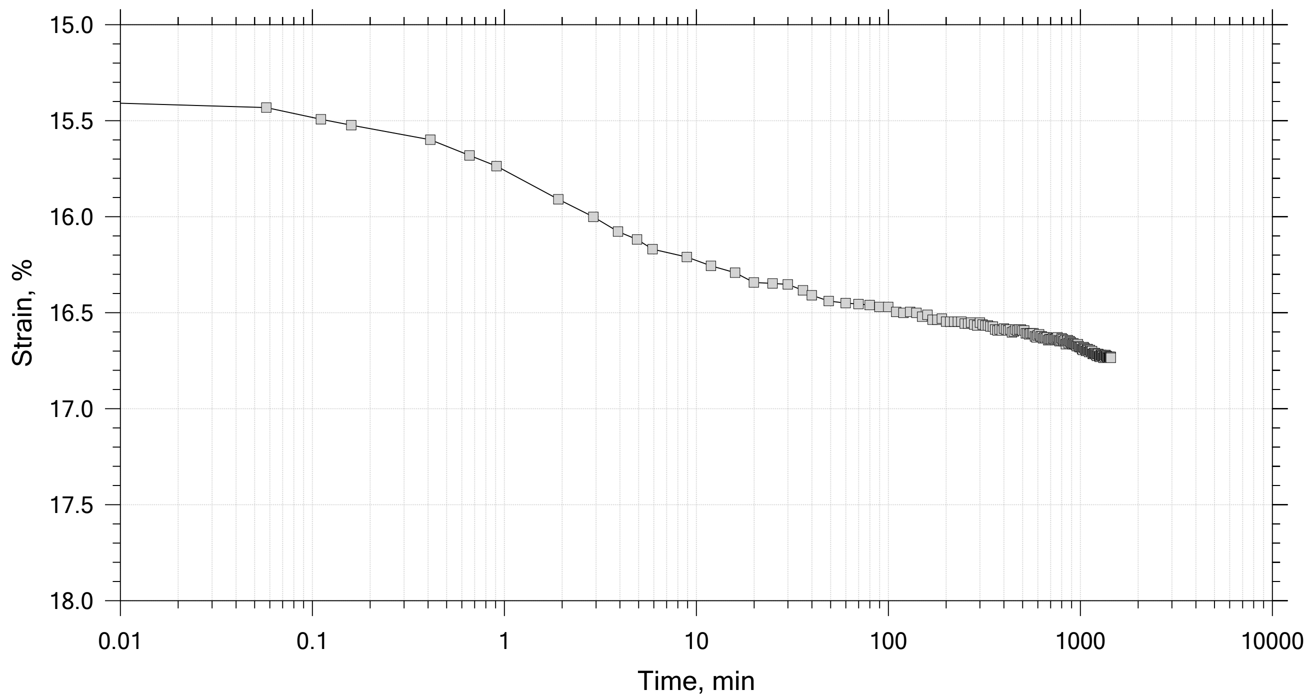
GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-104	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 51-53
	Test No.: IP-1	Sample Type: intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System T, Swell		

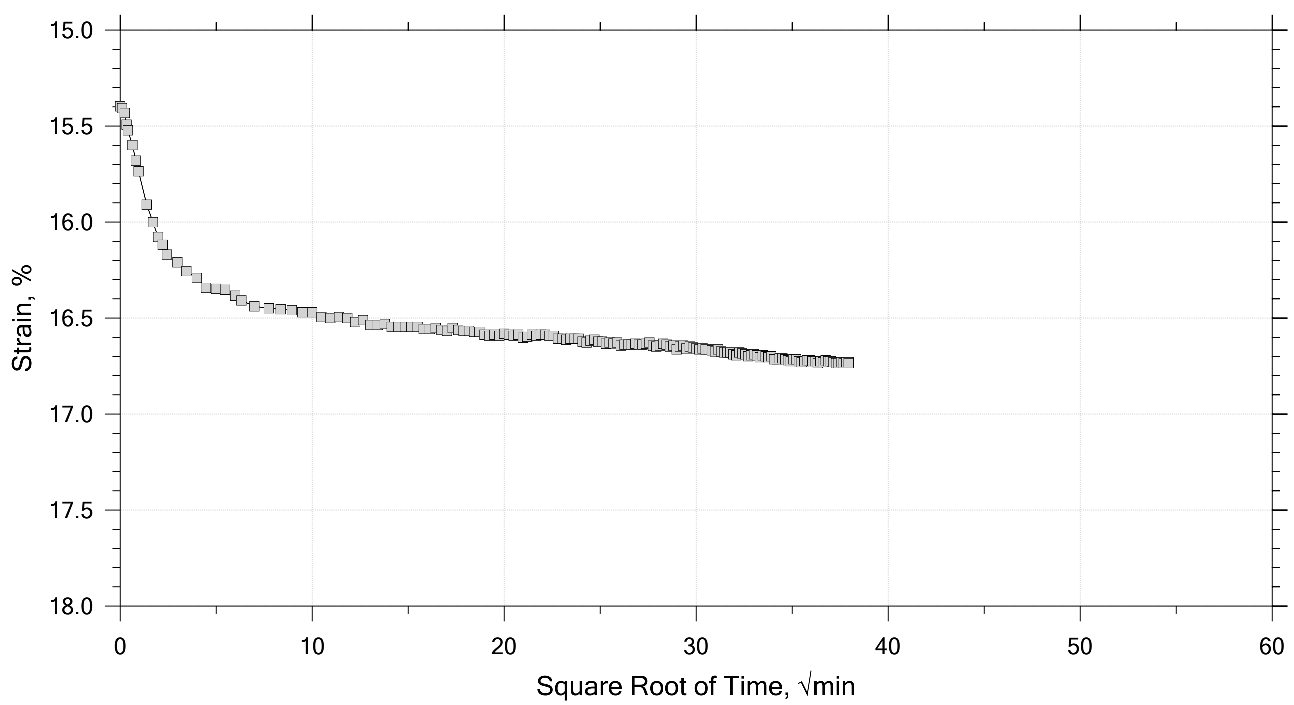
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 15 of 17

Constant Load Step

Stress: 7.5 tsf





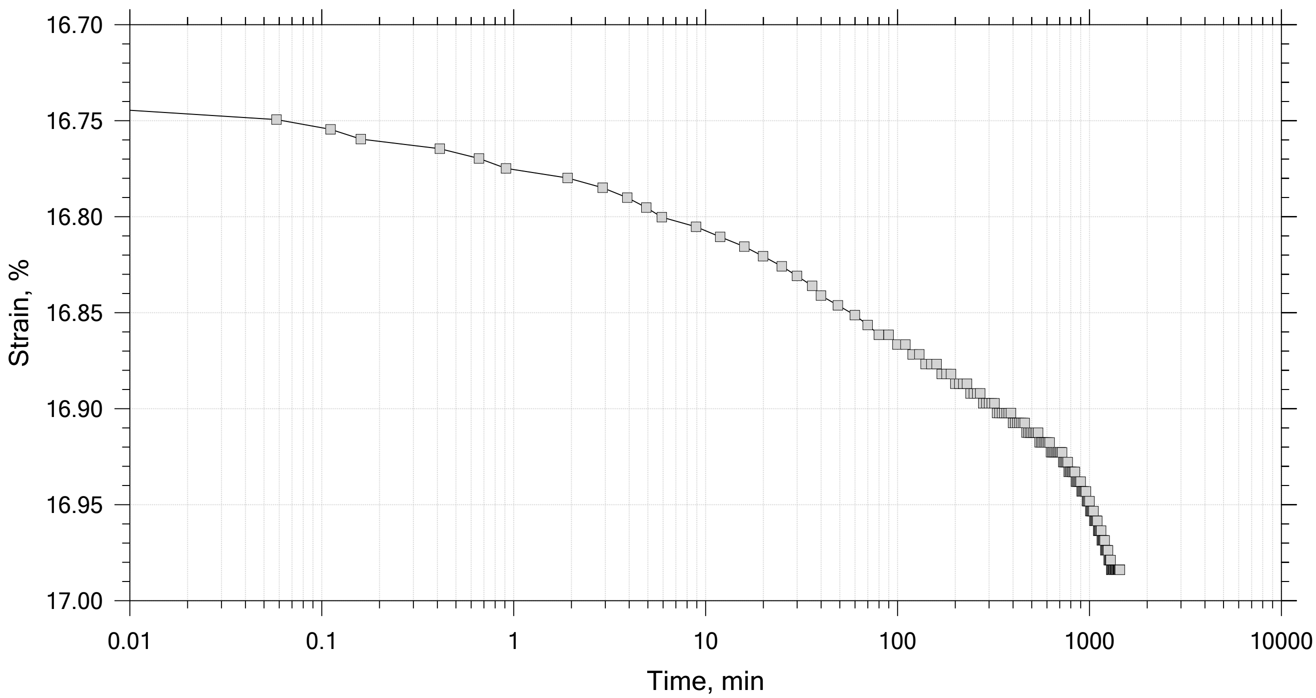
Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
Boring No.: BB-FBR-104	Tested By: md	Checked By: mcm
Sample No.: 2U	Test Date: 07/22/19	Depth: 51-53
Test No.: IP-1	Sample Type: intact	Elevation: ---
Description: Moist, dark gray clay		
Remarks: System T, Swell		

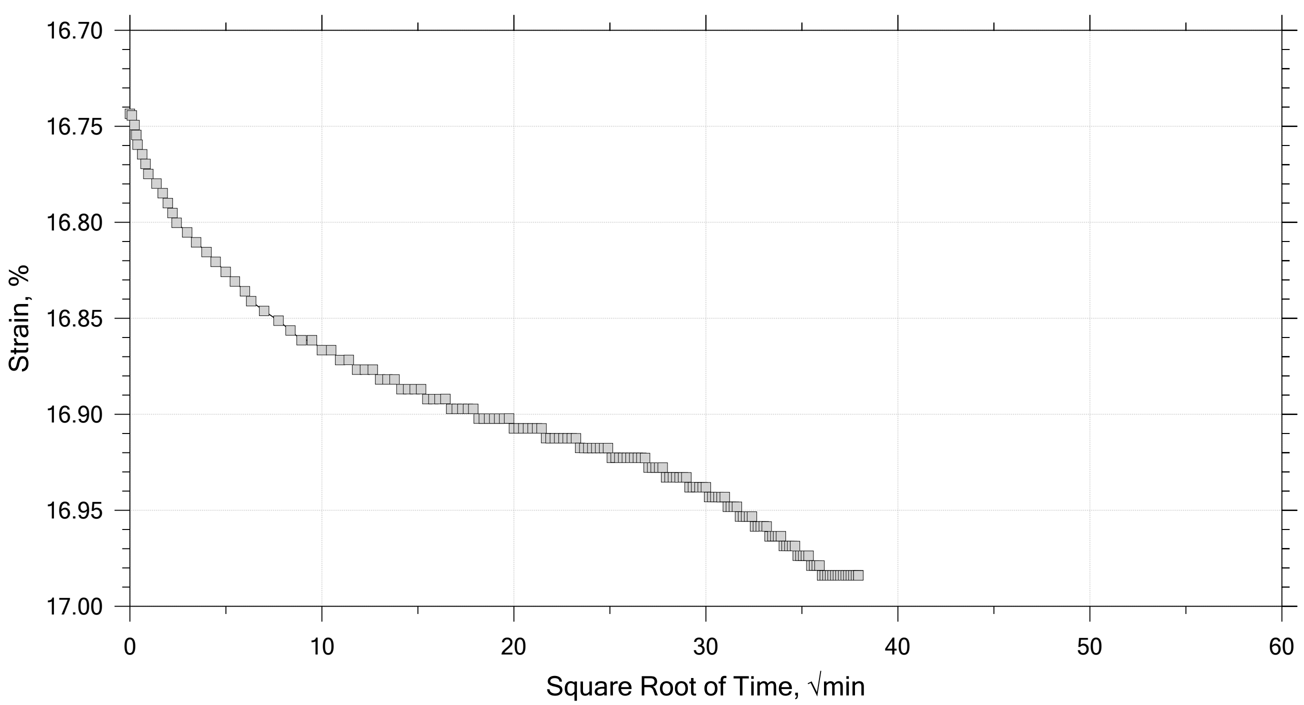
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 16 of 17

Constant Load Step

Stress: 8 tsf





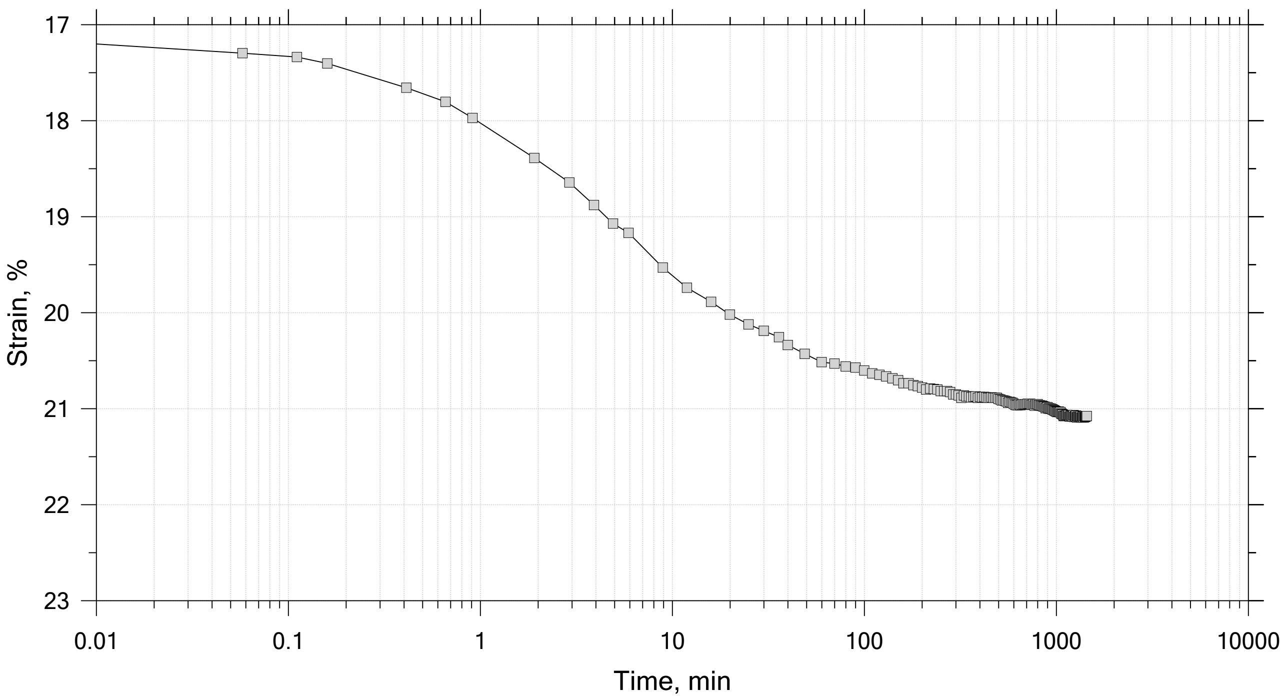
GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-104	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 51-53
	Test No.: IP-1	Sample Type: intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System T, Swell		

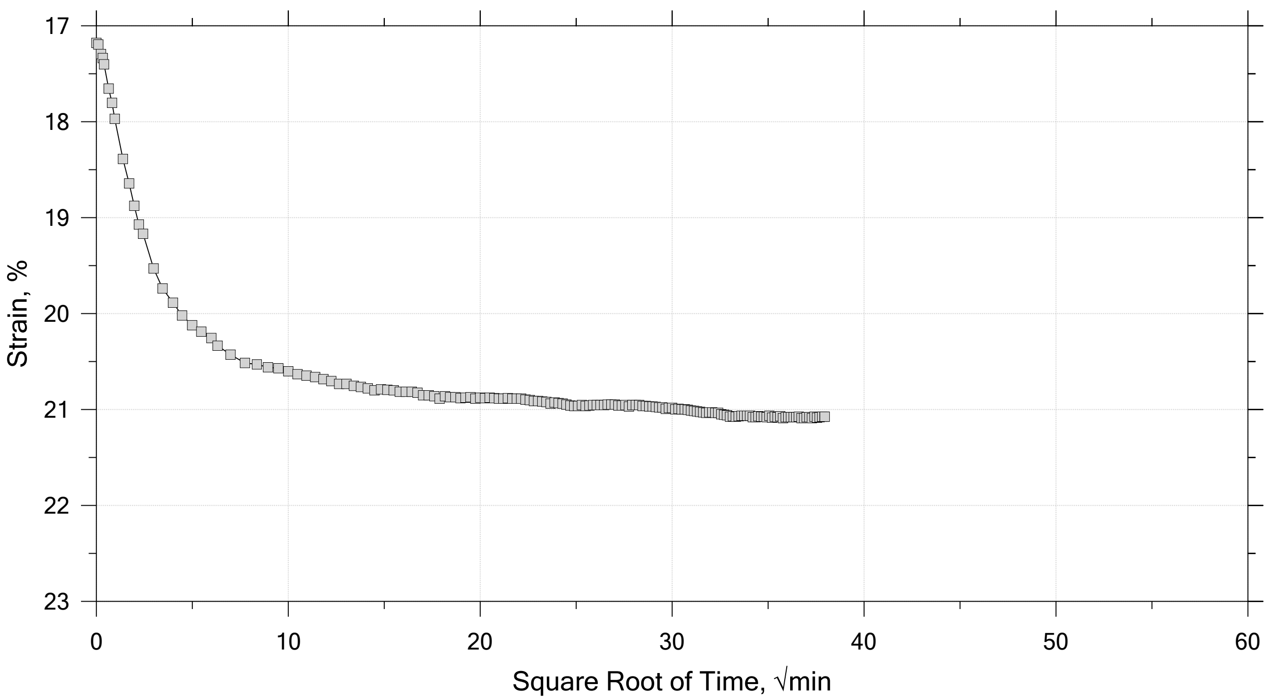
One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 17 of 17

Constant Load Step

Stress: 16 tsf





GeoTesting EXPRESS			
	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-104	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 51-53
	Test No.: IP-1	Sample Type: intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System T, Swell		

One-Dimensional Consolidation by ASTM D2435 - Method B

Specimen Diameter: 2.50 in	Estimated Specific Gravity: 2.77	Liquid Limit: 41
Initial Height: 1.00 in	Initial Void Ratio: 1.06	Plastic Limit: 22
Final Height: 0.82 in	Final Void Ratio: 0.692	Plasticity Index: 19

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	D-2303	RING		C2669
Mass Container, gm	8.41	111.2	111.2	8.38
Mass Container + Wet Soil, gm	163.05	260.04	246.15	142.83
Mass Container + Dry Soil, gm	118.35	219.18	219.18	115.96
Mass Dry Soil, gm	109.94	107.98	107.98	107.58
Water Content, %	40.66	37.84	24.98	24.98
Void Ratio	---	1.06	0.69	---
Degree of Saturation, %	---	98.58	100.00	---
Dry Unit Weight, pcf	---	83.801	102.2	---

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.

GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-104	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 51-53
	Test No.: IP-1	Sample Type: intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System T, Swell		

One-Dimensional Consolidation by ASTM D2435 - Method B

Log of Time Coefficients

Step	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	Log T50 min	Cv ft²/s	Mv 1/tsf	k ft/day	Ca %
1	0.125	0.003152	1.06	0.315	0.000	0.00e+00	2.52e-02	0.00e+00	0.00e+00
2	0.250	0.007396	1.05	0.740	0.000	0.00e+00	3.40e-02	0.00e+00	0.00e+00
3	0.500	0.01270	1.04	1.27	0.000	0.00e+00	2.12e-02	0.00e+00	0.00e+00
4	0.750	0.01677	1.03	1.68	0.000	0.00e+00	1.63e-02	0.00e+00	0.00e+00
5	1.00	0.02014	1.02	2.01	0.000	0.00e+00	1.35e-02	0.00e+00	0.00e+00
6	1.50	0.02846	1.00	2.85	0.000	0.00e+00	1.66e-02	0.00e+00	0.00e+00
7	2.00	0.03872	0.983	3.87	13.101	4.06e-07	2.05e-02	2.25e-05	0.00e+00
8	2.50	0.05184	0.956	5.18	0.000	0.00e+00	2.63e-02	0.00e+00	0.00e+00
9	3.00	0.06772	0.923	6.77	0.000	0.00e+00	3.18e-02	0.00e+00	0.00e+00
10	4.00	0.09525	0.867	9.52	21.564	2.23e-07	2.75e-02	1.66e-05	0.00e+00
11	8.00	0.1578	0.737	15.8	5.613	7.75e-07	1.57e-02	3.27e-05	0.00e+00
12	1.00	0.1423	0.770	14.2	0.000	0.00e+00	2.22e-03	0.00e+00	0.00e+00
13	2.00	0.1461	0.762	14.6	4.440	9.40e-07	3.77e-03	9.57e-06	0.00e+00
14	4.00	0.1532	0.747	15.3	0.000	0.00e+00	3.55e-03	0.00e+00	0.00e+00
15	7.50	0.1674	0.718	16.7	0.000	0.00e+00	4.06e-03	0.00e+00	0.00e+00
16	8.00	0.1698	0.713	17.0	0.000	0.00e+00	4.98e-03	0.00e+00	0.00e+00
17	16.0	0.2108	0.628	21.1	0.000	0.00e+00	5.11e-03	0.00e+00	0.00e+00

GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-104	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 51-53
	Test No.: IP-1	Sample Type: intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System T, Swell		
	Displacement at End of Increment		

One-Dimensional Consolidation by ASTM D2435 - Method B

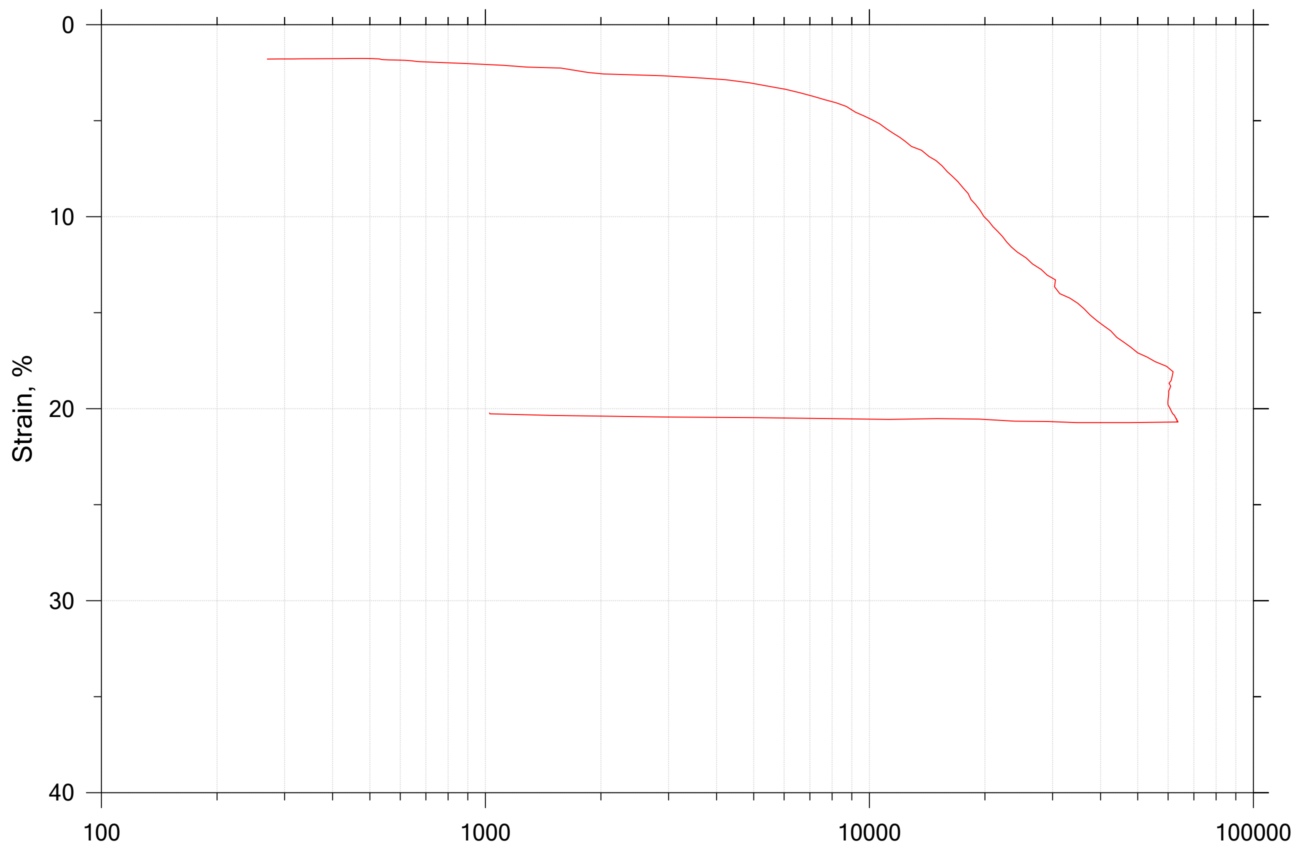
Square Root of Time Coefficients

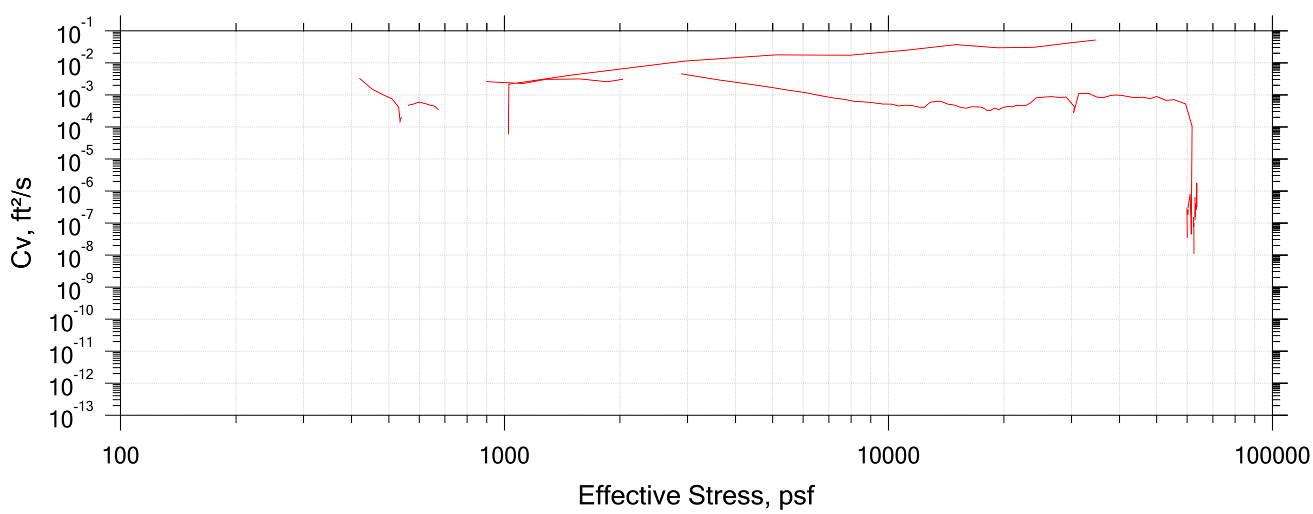
Step	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	Sq.Rt. T90 min	Cv ft²/s	Mv 1/tsf	k ft/day
1	0.125	0.003152	1.06	0.315	13.731	1.78e-06	2.52e-02	1.21e-04
2	0.250	0.007396	1.05	0.740	13.041	1.86e-06	3.40e-02	1.70e-04
3	0.500	0.01270	1.04	1.27	12.076	1.99e-06	2.12e-02	1.14e-04
4	0.750	0.01677	1.03	1.68	13.614	1.75e-06	1.63e-02	7.70e-05
5	1.00	0.02014	1.02	2.01	56.835	4.16e-07	1.35e-02	1.51e-05
6	1.50	0.02846	1.00	2.85	21.686	1.08e-06	1.66e-02	4.83e-05
7	2.00	0.03872	0.983	3.87	57.105	4.01e-07	2.05e-02	2.22e-05
8	2.50	0.05184	0.956	5.18	72.358	3.09e-07	2.63e-02	2.19e-05
9	3.00	0.06772	0.923	6.77	249.892	8.68e-08	3.18e-02	7.44e-06
10	4.00	0.09525	0.867	9.52	88.896	2.33e-07	2.75e-02	1.73e-05
11	8.00	0.1578	0.737	15.8	27.094	6.91e-07	1.57e-02	2.92e-05
12	1.00	0.1423	0.770	14.2	8.210	2.16e-06	2.22e-03	1.29e-05
13	2.00	0.1461	0.762	14.6	14.533	1.24e-06	3.77e-03	1.26e-05
14	4.00	0.1532	0.747	15.3	6.602	2.69e-06	3.55e-03	2.57e-05
15	7.50	0.1674	0.718	16.7	116.007	1.49e-07	4.06e-03	1.63e-06
16	8.00	0.1698	0.713	17.0	1103.271	1.54e-08	4.98e-03	2.06e-07
17	16.0	0.2108	0.628	21.1	124.836	1.29e-07	5.11e-03	1.78e-06

GeoTesting EXPRESS	Project: Replace Bucknam Rd Bridge	Location: Falmouth ME	Project No.: GTX-310291
	Boring No.: BB-FBR-104	Tested By: md	Checked By: mcm
	Sample No.: 2U	Test Date: 07/22/19	Depth: 51-53
	Test No.: IP-1	Sample Type: intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System T, Swell		
	Displacement at End of Increment		

CRC Test

Summary

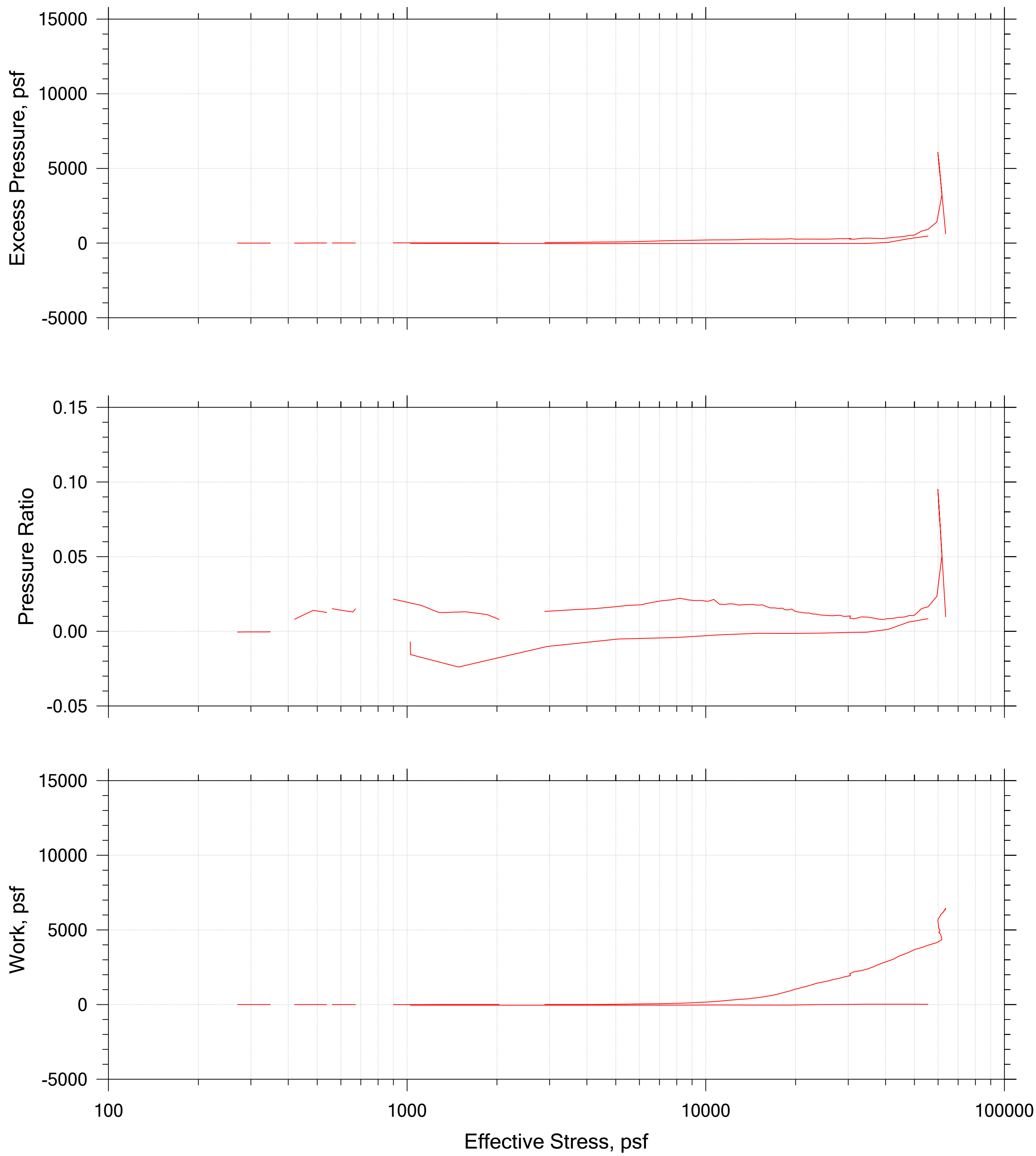




GeoTesting EXPRESS	Project Name: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project Number: GTX-310291
	Boring Number: BB-FBR-104	Tester: md	Checker: njh
	Sample Number: 3U	Test Date: 07/25/19	Depth: 59-61 ft
	Test Number: CRC-2	Preparation: intact	Elevation: ---
	Description: Moist, dark greenish gray clay		
	Remarks: System W		

CRC Test

Pressure Curves



GeoTesting EXPRESS	Project Name: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project Number: GTX-310291
	Boring Number: BB-FBR-104	Tester: md	Checker: njh
	Sample Number: 3U	Test Date: 07/25/19	Depth: 59-61 ft
	Test Number: CRC-2	Preparation: intact	Elevation: ---
	Description: Moist, dark greenish gray clay		
	Remarks: System W		
			Page 2 of 3

CRC Test

Specimen Diameter, in: 2.50	Specific Gravity: 2.75 (Estimated)	Liquid Limit: Unknown
Specimen Height, in: 1.00	Initial Void Ratio: 0.854	Plastic Limit: Unknown
Final Height, in: 0.82	Final Void Ratio: 0.52	Plasticity Index: Unknown

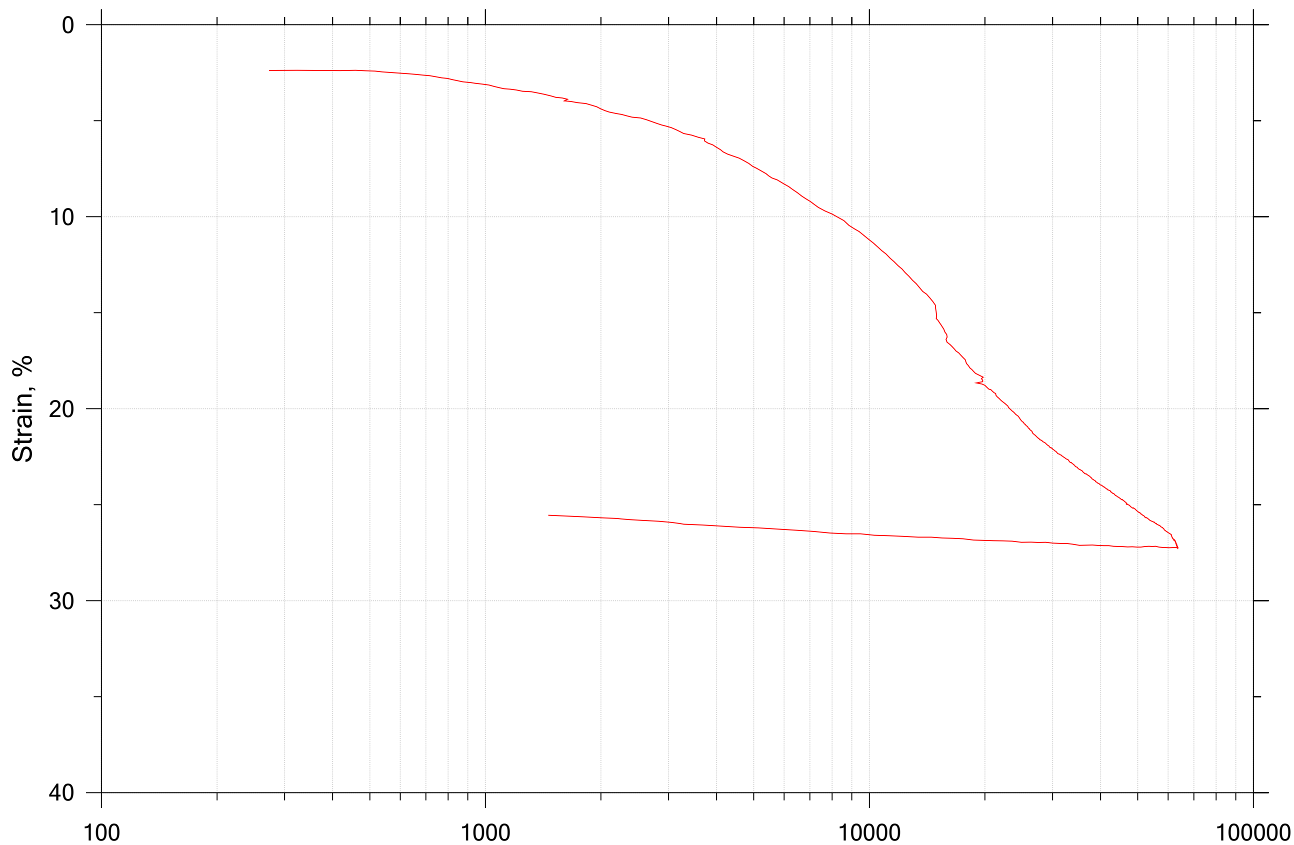
	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	B-2196	---		A-3069
Mass Container, gm	8.27	109.4	109.4	8.9
Mass Container + Wet Soil, gm	148.67	265.77	251.45	144.66
Mass Container + Dry Soil, gm	116.55	228.88	228.88	123.09
Mass Dry Soil, gm	108.28	119.48	119.48	114.19
Water Content, %	29.66	30.87	18.89	18.89
Void Ratio	---	0.85	0.52	---
Degree of Saturation, %	---	99.57	100.00	---
Dry Unit Weight, pcf	---	92.727	113.08	---

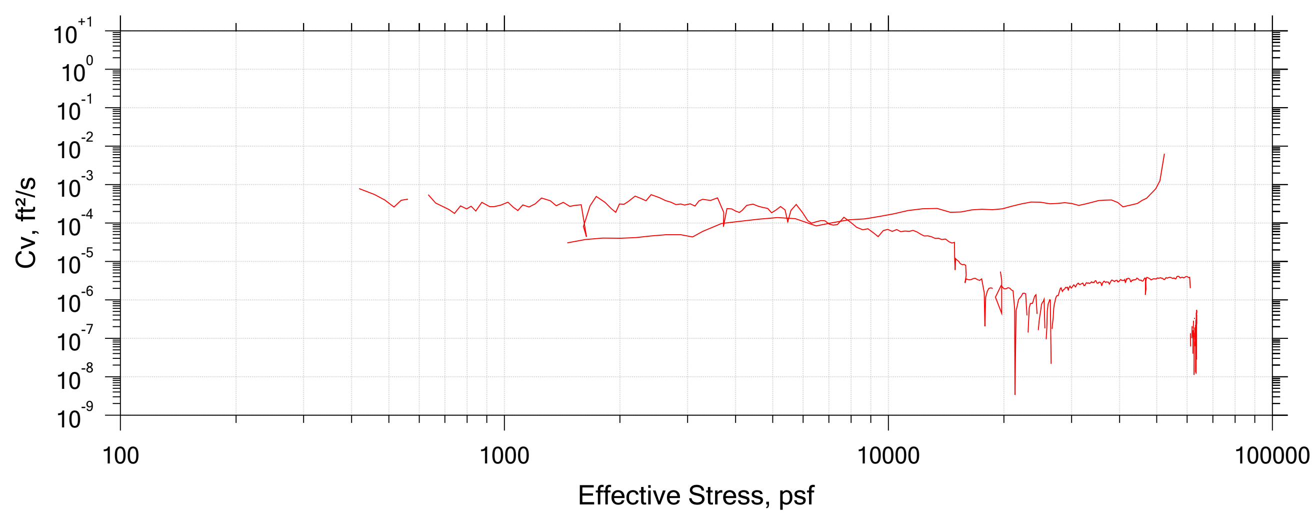
Note: Specific Gravity and Void Ratios are calculated assuming the degree of saturation equals 100% at the end of the test.
Therefore, values may not represent actual values for the specimen.

Project Name: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project Number: GTX-310291
Boring Number: BB-FBR-104	Tester: md	Checker: njh
Sample Number: 3U	Test Date: 07/25/19	Depth: 59-61 ft
Test Number: CRC-2	Preparation: intact	Elevation: ---
Description: Moist, dark greenish gray clay		
Remarks: System W		

CRC Test

Summary

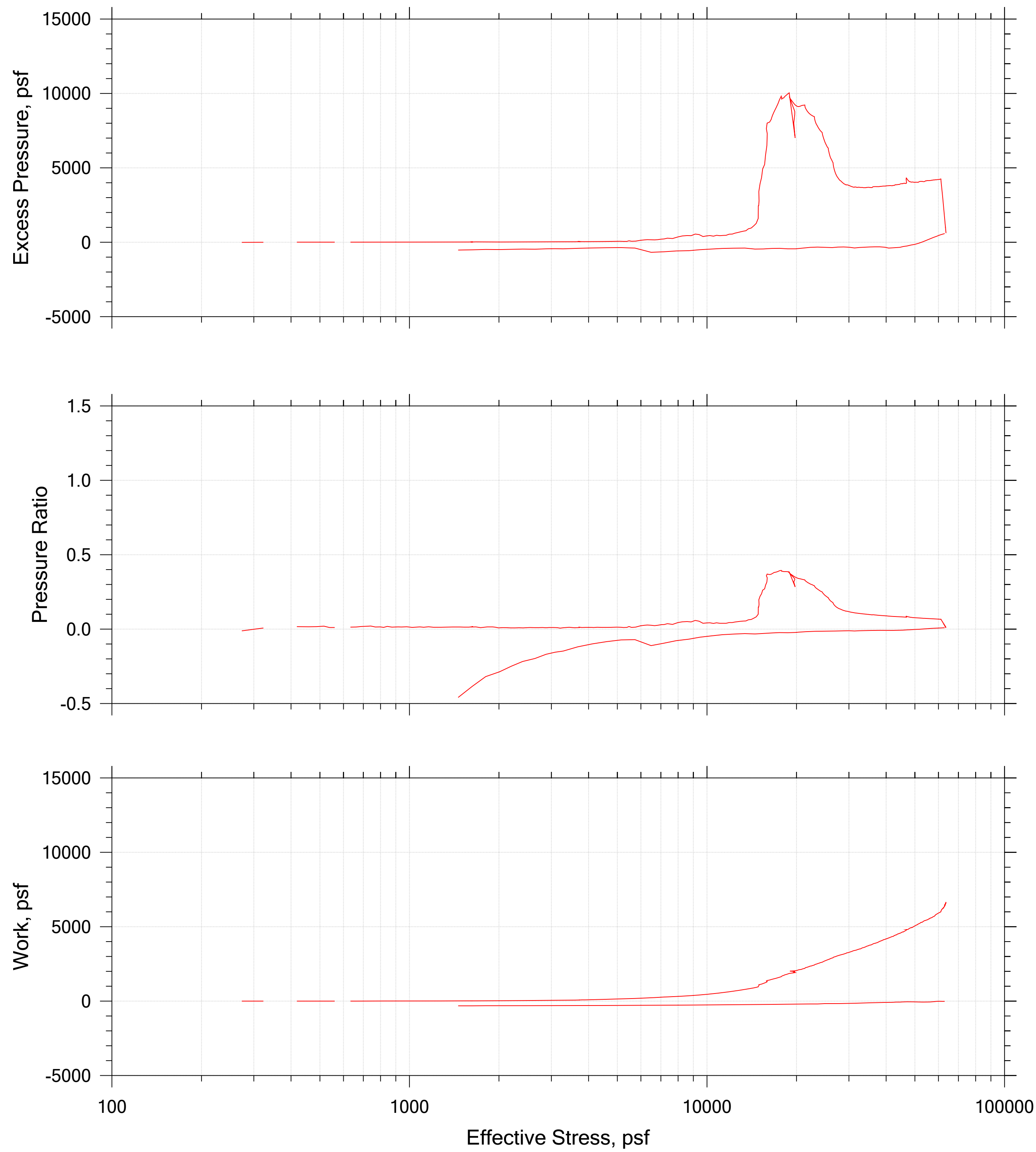




GeoTesting EXPRESS			
	Project Name: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project Number: GTX-310291
	Boring Number: BB-FBR-106	Tester: md	Checker: njh
	Sample Number: 1U	Test Date: 08/19/19	Depth: 34-36 ft
	Test Number: CRC-5A	Preparation: intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System R		

CRC Test

Pressure Curves



GeoTesting EXPRESS	Project Name: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project Number: GTX-310291
	Boring Number: BB-FBR-106	Tester: md	Checker: njh
	Sample Number: 1U	Test Date: 08/19/19	Depth: 34-36 ft
	Test Number: CRC-5A	Preparation: intact	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: System R		

CRC Test

Specimen Diameter, in: 2.50	Specific Gravity: 2.76 (Estimated)	Liquid Limit: 41
Specimen Height, in: 1.00	Initial Void Ratio: 1.26	Plastic Limit: 21
Final Height, in: 0.77	Final Void Ratio: 0.744	Plasticity Index: 20

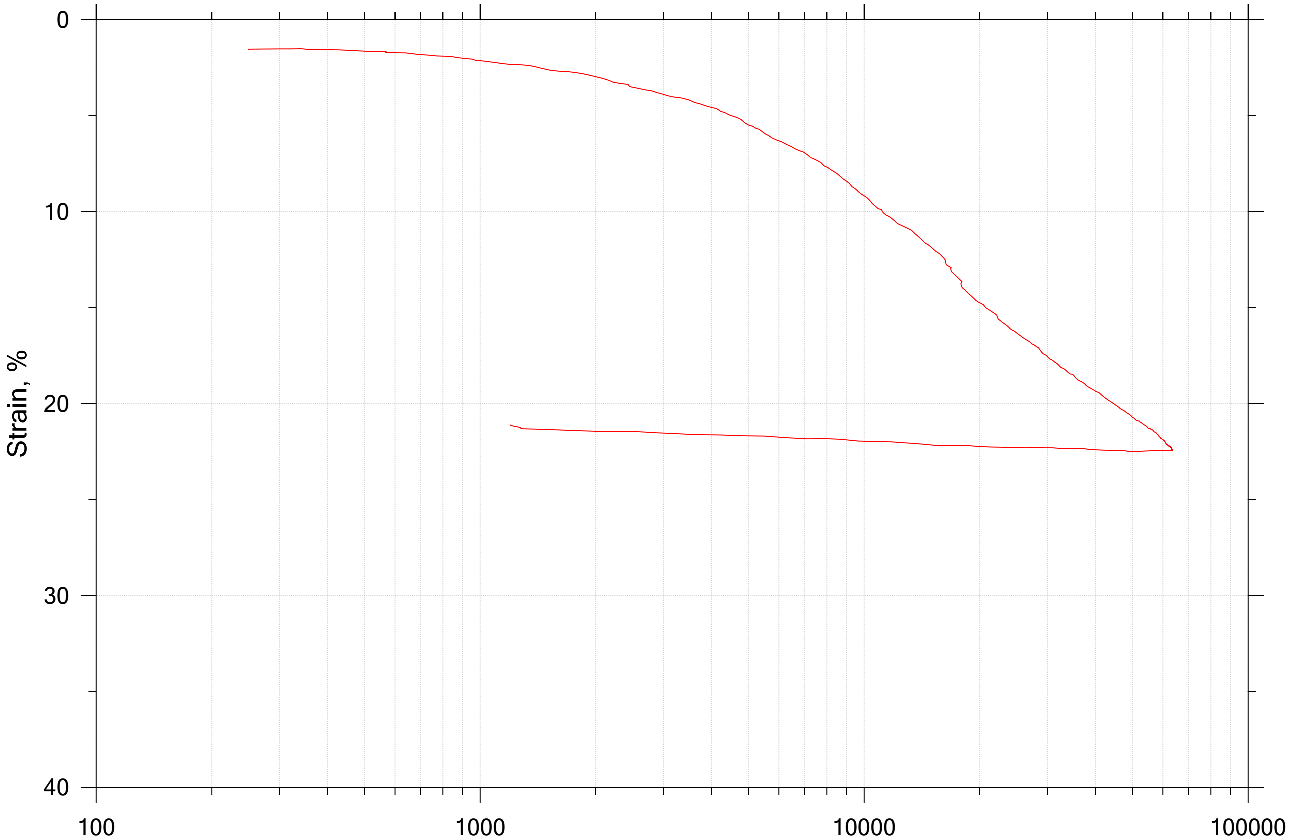
	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	B-2675	---		d-2328
Mass Container, gm	8.67	110.85	110.85	8.33
Mass Container + Wet Soil, gm	189.08	253.74	235.37	134.38
Mass Container + Dry Soil, gm	136.02	208.95	208.95	107.64
Mass Dry Soil, gm	127.35	98.105	98.105	99.31
Water Content, %	41.66	45.65	26.93	26.93
Void Ratio	---	1.26	0.74	---
Degree of Saturation, %	---	99.71	100.00	---
Dry Unit Weight, pcf	---	76.137	98.88	---

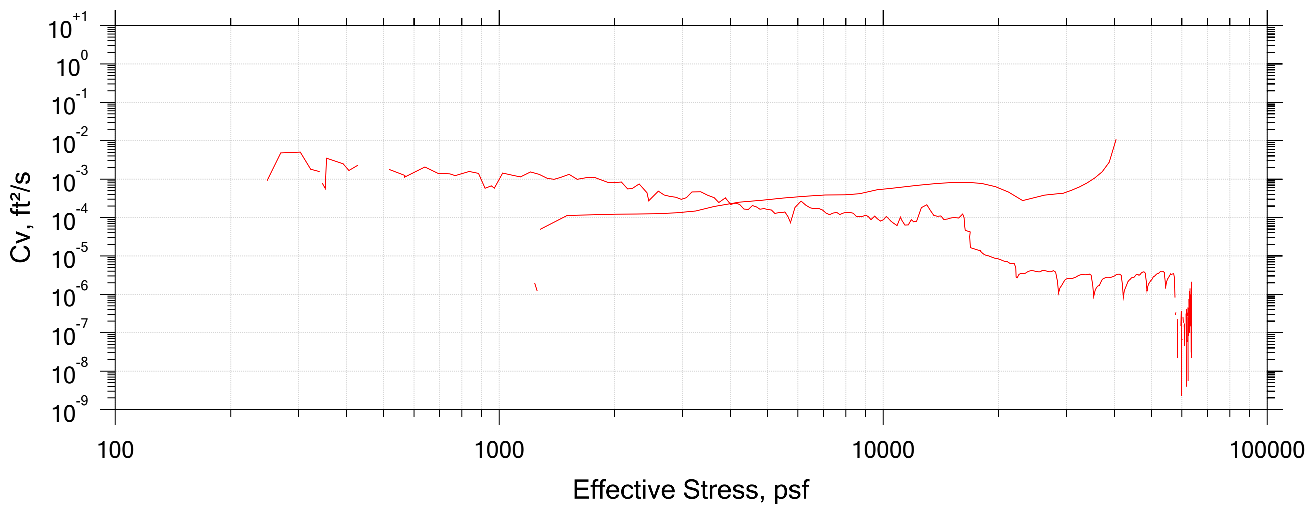
Note: Specific Gravity and Void Ratios are calculated assuming the degree of saturation equals 100% at the end of the test.
Therefore, values may not represent actual values for the specimen.

Project Name: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project Number: GTX-310291
Boring Number: BB-FBR-106	Tester: md	Checker: njh
Sample Number: 1U	Test Date: 08/19/19	Depth: 34-36 ft
Test Number: CRC-5A	Preparation: intact	Elevation: ---
Description: Moist, dark gray clay		
Remarks: System R		

CRC Test

Summary

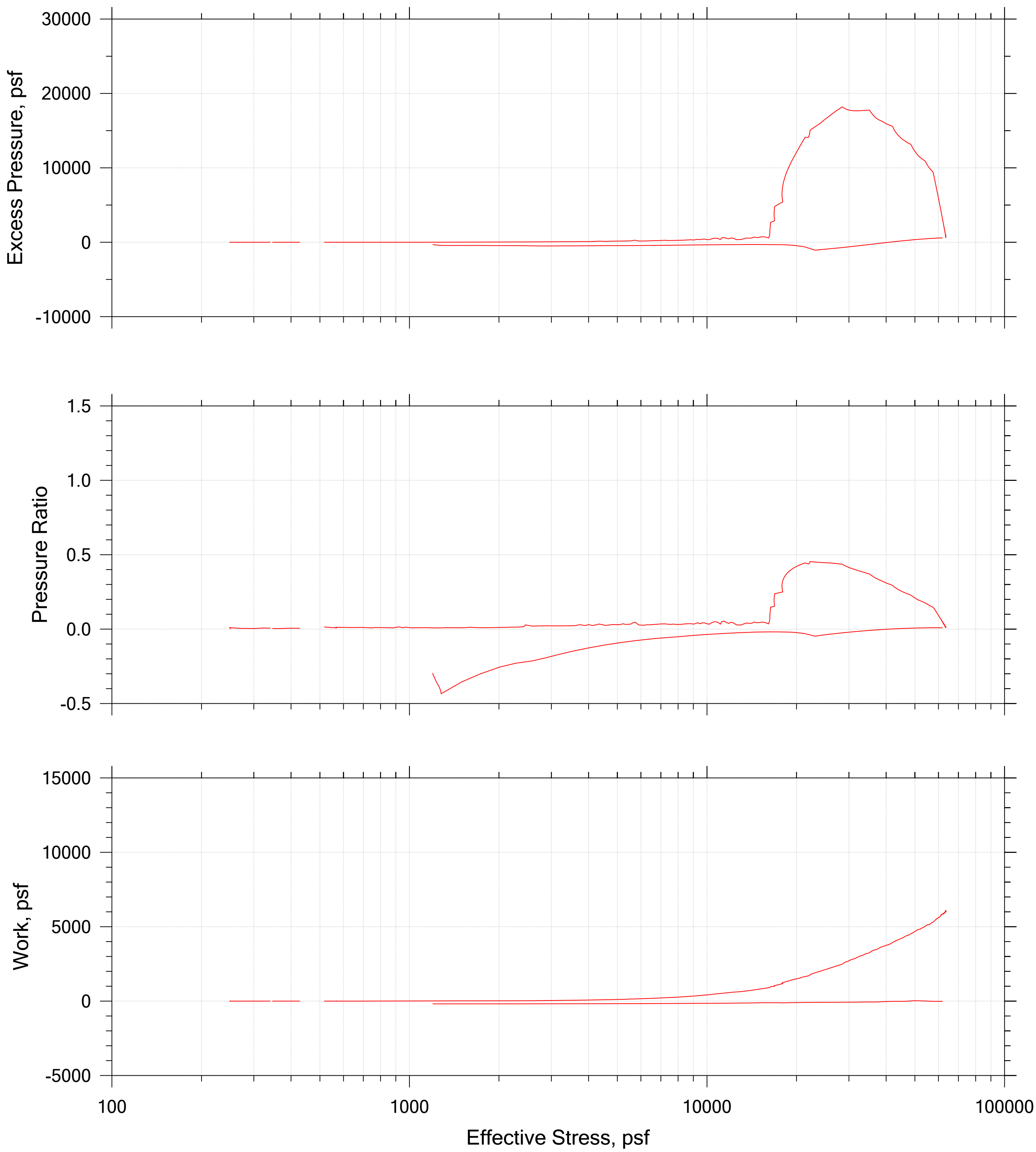




GeoTesting EXPRESS	Project Name: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project Number: GTX-310291
	Boring Number: BB-FBR-106	Tester: md	Checker: njh
	Sample Number: 2U	Test Date: 08/19/19	Depth: 55-57 ft
	Test Number: CRC-1A	Preparation: intact	Elevation: ---
	Description: Moist, dark greenish gray clay		
	Remarks: System F		

CRC Test

Pressure Curves



GeoTesting EXPRESS	Project Name: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project Number: GTX-310291
	Boring Number: BB-FBR-106	Tester: md	Checker: njh
	Sample Number: 2U	Test Date: 08/19/19	Depth: 55-57 ft
	Test Number: CRC-1A	Preparation: intact	Elevation: ---
	Description: Moist, dark greenish gray clay		
	Remarks: System F		
			Page 2 of 3

CRC Test

Specimen Diameter, in: 2.50	Specific Gravity: 2.77 (Estimated)	Liquid Limit: 31
Specimen Height, in: 1.00	Initial Void Ratio: 0.913	Plastic Limit: 18
Final Height, in: 0.81	Final Void Ratio: 0.549	Plasticity Index: 13

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	B-2751	---		A-1505
Mass Container, gm	8.26	108.93	108.93	8.41
Mass Container + Wet Soil, gm	166.73	263.78	248.53	148.43
Mass Container + Dry Soil, gm	126.78	225.43	225.43	125.26
Mass Dry Soil, gm	118.52	116.5	116.5	116.85
Water Content, %	33.71	32.92	19.83	19.83
Void Ratio	---	0.91	0.55	---
Degree of Saturation, %	---	99.91	100.00	---
Dry Unit Weight, pcf	---	90.413	111.62	---

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.

GeoTesting EXPRESS	Project Name: Replace Bucknam Rd Bridge	Location: Falmouth, ME	Project Number: GTX-310291
	Boring Number: BB-FBR-106	Tester: md	Checker: njh
	Sample Number: 2U	Test Date: 08/19/19	Depth: 55-57 ft
	Test Number: CRC-1A	Preparation: intact	Elevation: ---
	Description: Moist, dark greenish gray clay		
	Remarks: System F		

APPENDIX E – ENGINEERING CALCULATIONS

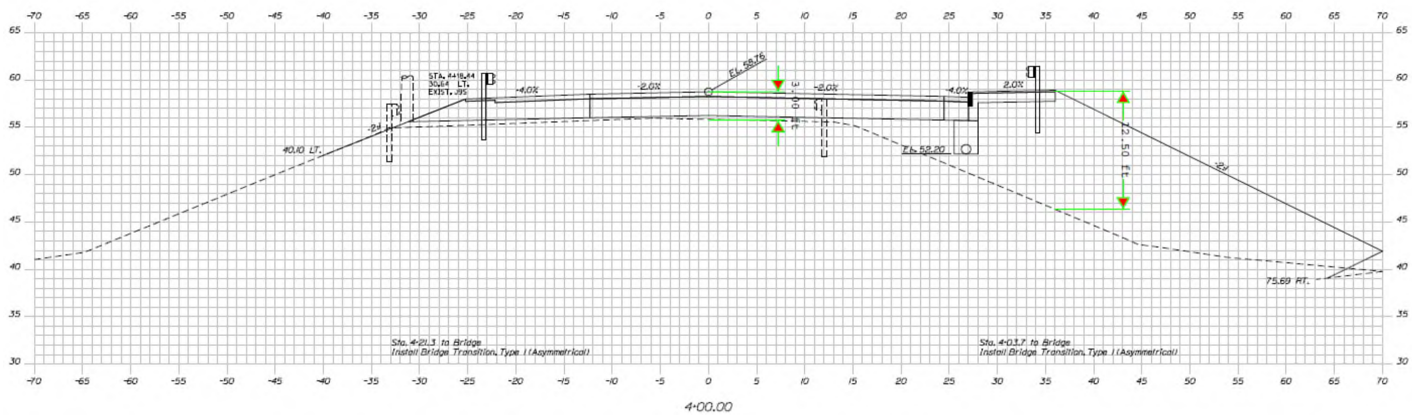
Settlement

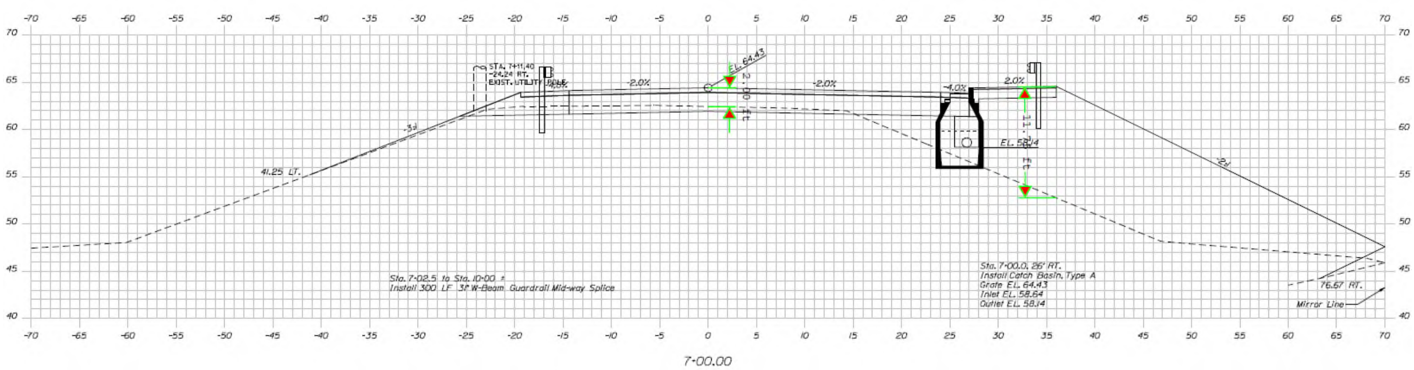
Objective

Evaluate the Settlement under the proposed grade raises and alignment configuration. GZA will evaluate settlement at 5- and 10 years post construction based on the settlement criteria that we understand has been adopted by MaineDOT, which is a maximum of 2 inches of pavement settlement within 100 feet of the abutment in the first 5 years, and an additional 2 inches in the next 5 years (total 4 inches in the first 10 years). GZA will also evaluate Total settlement for a total design life of 75 years understanding that shimming will be conducted typically every 15 years.

Abutment 1: Proposed fill heights in the vicinity of abutment 1 (Station 4+35) include approximately 3.5 feet at the centerline and up to 9.5 feet in the new widened shoulder to the north, as show in the figure below.

Abutment 2: Proposed fill heights in the vicinity of abutment 2 (Station 6+77) include approximately 1.5 feet at the centerline and up to 6.5 feet in the new widened shoulder to the north.





Methodology

1. Develop Settlement Properties and Settle3 Inputs.

2. Complete Settlement analysis using Settle3 for both no mitigation at 5, 10, and 75 years Post Construction and Lightweight fill alternative. (Primary Consolidation Settlement Only)

3. Calculate anticipated Secondary Settlement

4. Evaluate Total settlement at 5, 10, and 75 years.

1. Soil Properties

GZA developed consolidation properties for the Marine Clay deposit based on laboratory and measured field data which is presented on Page 6 (AB 1) and Page 7 (AB 2) and summarized below. The properties were developed to be consistent with conditions outside the existing embankment footprint since our model began prior to the existing embankment construction.
Settle3 inputs are provided on pages 15 through 62. The 5-year and 10-year settlement estimates are heavily influenced by the assumed rate of vertical consolidation (Cv). We evaluated the likely range of Cv values based on the consolidation data. The data indicated a range of Cv of about 0.01-0.15 ft2/day. During preliminary evaluations the faster consolidation rate of 0.15 did not meet the design requirements, therefore GZA utilized the 0.15ft/day for our evaluations.

Layers For Settlement Model	Soil Properties					
	CR	RR	Over Consolidated Margin (ksf)	Cv (ft^2/day)	Unit Weight (pcf)	Cα
Upper Marine Sand	--	--	--	--	125	--
Marine Clay Crust	0.23	0.02	3	0.15	118	0.002
AB 1 -Upper Marine Clay	0.23	0.02	1.1	0.15	115	0.007
AB 1 - Lower Marine Clay	0.23	0.02	1.5	0.15	115	0.007
AB 2 - Marine Clay	0.23	0.02	0.9	0.15	115	0.007
Lower Marine Sand	--	--	--	--	125	--

2. Settle3 Settlement Analysis (Primary Consolidation)

The Settle3 model Staging for the project is:

Year 0: Original Embankment Construction early 1960s
Year 62 (744 months): New Fills and temporary in place (2022),
Year 62.5 (750 months): final pavement (6 months after fill placement) removal of temporary fills
Year 67.5 (810 months): 5 years Post Construction
Year 72.5 (870 Months) 10 years Post Construction
Year 137.5 (1650 Months): 75 years Post Construction

GZA has identified inconsistencies with Settle3's calculation of secondary compression with a staged filling scenario. We have therefore utilized a separate calculation to estimate secondary compression.

Existing Embankment:

Considering GZA's model begins prior to the existing embankment, GZA estimated settlement from the 1960s to now and compared to boring data to check model. The model estimates that approximately 6 to 9 inches of consolidation settlement would have occured at the Abutment 1 approach and approximately 14 to 20 inches at the Abutment 2 appraoch. GZA assumes regular pavement shimming between 1960 and 2021 would have occured and the pavement thickness at the time of the borings were 12 inches and 16 inches. Historic plans indicate 3-inches of pavement was used therefore approximatey 9 inches of settlement has occured at Abutment 1 and 13 inches at Abutment 2. Therefore GZAs model is assume to reasonably estimate future settlements.

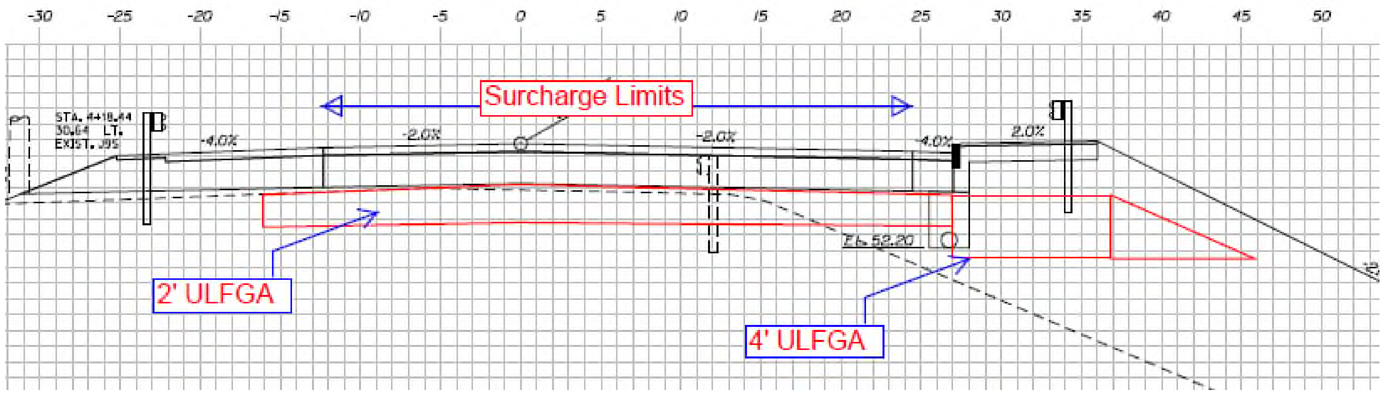
Abutment 1 New Fill:

No Mitigation

Settlement evaluations were conducted on the proposed embankment without settlement mitigation alternatives to estimate the primary consolidation settlement under the proposed fills at the periods indicated in the settlement criteria. The estimated maximum primary consolidation settlement of approximately 2.5 inches in 5 years was calculated at Station 3+62. The results are tabulated in the table on page 5 of this design package and on the Settle3 plots attached.

Ultra-Lightweight Foamed Glass Aggregate

Settlement evaluations were conducted for the preferred mitigation alternative of Ultra Lightweight Foamed Glass Aggregate (ULFGA). The ULFGA has an approximate in-place unit weight of 20 pcf. The limits extend from the back of the abutment to Station 3+35 to reduce settlment within 100 feet of the bridge. The section shown below presents the proposed typical configuration of the ULFGA including 2 feet within the roadway limits and a 4 feet in the widened shoulder. Maximum consolidation settlement under the proposed section was estimated to be .25 inch in 5 years with an additional 0.5 inches in the following 5 years at station 4+20.



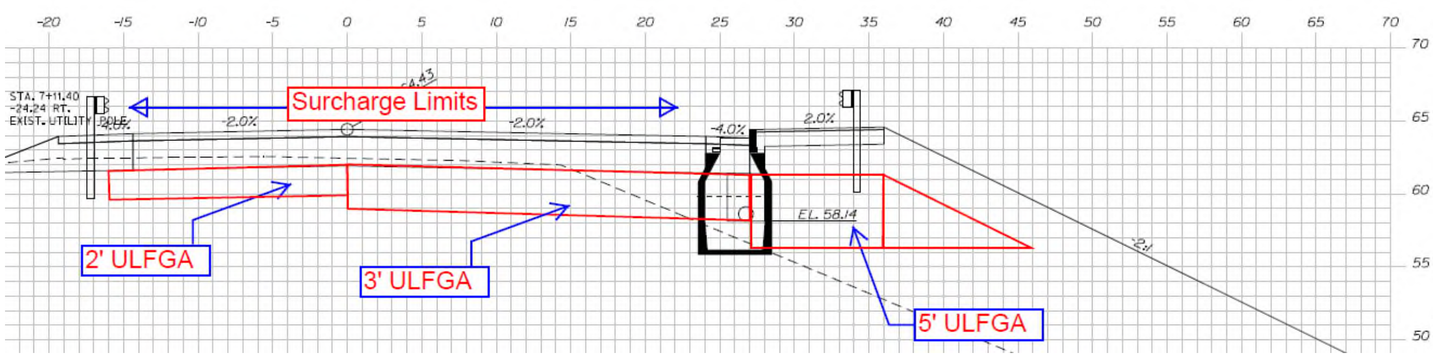
Abutment 2:

No Mitigation

Settlement evaluations were conducted on the proposed embankment at Abutment 2 without settlement mitigation alternatives to estimate the primary consolidation settlement under the proposed fills at the periods indicated in the settlement criteria. The estimated maximum primary consolidation settlement of approximately 1.75 inches in 5 years was calculated at Station 7+50. The results are tabulated in the table on page 5 of this design package and on the Settle3 plots attached.

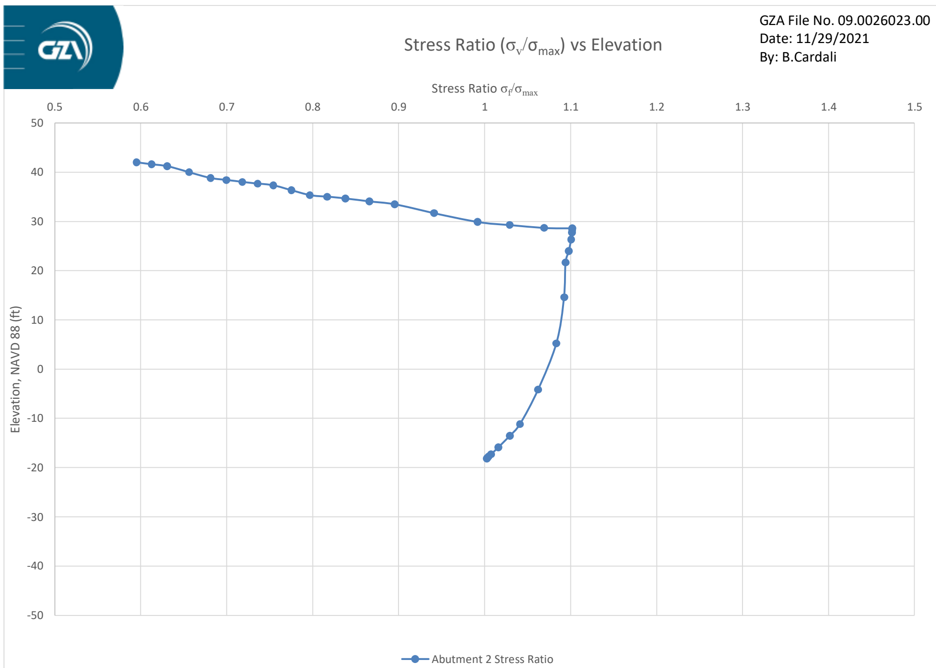
Ultra-Lightweight Foamed Glass Aggregate

Settlement evaluations were conducted for ULFGA with limits extending from the back of the abutment to Station 7+77 to reduce settlment within 100 feet of the bridge. The section shown below presents the proposed typical configuration of the ULFGA including 2 feet from centerline to 16 feet left, 3 feet from centerline to 27 feet right and 5 feet in the widened shoulder (27 feet right to 46 right). Maximum consolidation settlement under the proposed section was estimated to be .5 inch in 5 years with an additional 0.5 inches in the following 5 years at station 7+75.

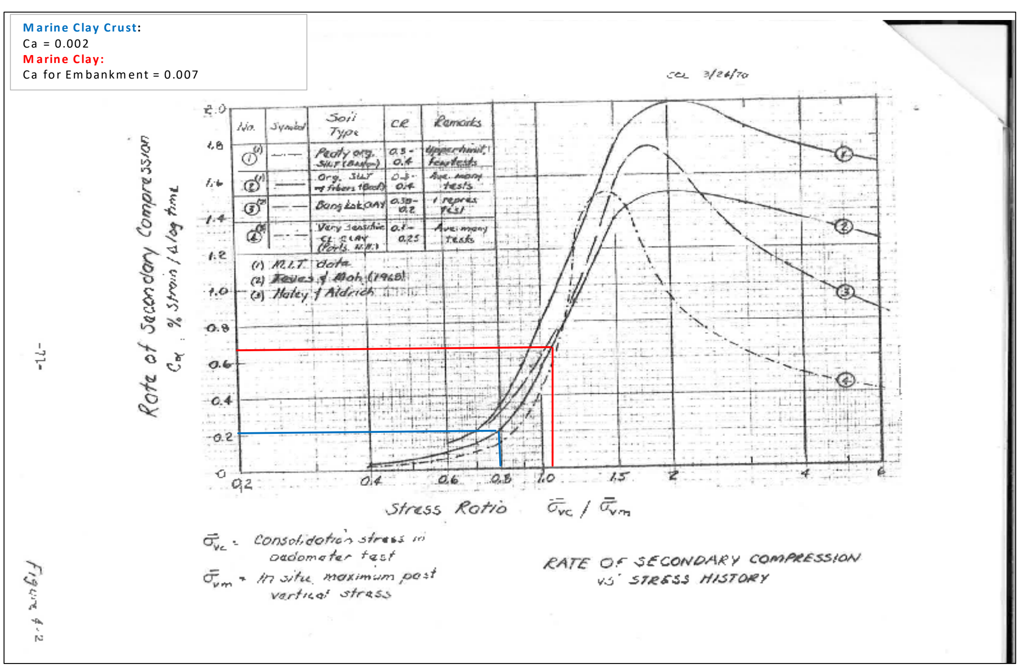


3. Secondary Compression

The Stress ratio is calculated by dividing the final effective stress by the maximum previous effective stress. The profile at Station 6+75 was considered and plotted in the following graph.



From the plot the average stress ratios were determined for the clay crust to be approximately 0.8 between Elevation 30 and 40. The underlying marine clay resulted in an average stress ratio of approximately 1.05. Utilizing the stress ratio vs Cα from the plot below, Cα was estimated to be 0.002 for the Clay Crust and 0.007 for the Marine Clay.



Time to end of primary consolidation was calculated for the deepest soil profile near both abutments. Under the proposed load, the time to achieve an average degree of consolidation of 90% is approximately 1 year for the Marine Clay Crust and 4 to 6 years for the Marine Clay. Secondary compression was then evaluated for the 5, 10, and the 75 year design life. The estimated secondary compression in the vicinity of each abutment is presented below:

Abutment 1 - Secondary Settlement

Layer	Layer Thickness (H_o) (ft)	H_{dr} (ft)	t_{90} (days)	Number of Log cycles at 5 yr	Number of Log cycles at 10 yr	Number of Log cycles at 75 yr	S_s per layer 5 yr	S_s per layer 10 yr	S_s per layer 75 yr
			$t_{90} = \frac{T_{90} * Hdr^2}{c_v}$	$\# \text{ Cycles} = \log \frac{t}{t_{90}}$			$S_s = H_o * c_\alpha * \log \frac{t}{t_{90}}$		
Marine Clay Crust	7	7	277	0.8	1.1	2.0	0.2	0.2	0.3
Marine Clay*	33.5	16.75	1586	0.1	0.4	1.2	0.1	1.0	3.5
						Total	**0.3**	**1.2**	**3.8**

Abutment 2 - Secondary Settlement

Layer	Layer Thickness (H_o) (ft)	H_{dr} (ft)	t_{90} (days)	Number of Log cycles at 5 yr	Number of Log cycles at 10 yr	Number of Log cycles at 75 yr	S_s per layer 5 yr	S_s per layer 10 yr	S_s per layer 75 yr
			$t_{90} = \frac{T_{90} * Hdr^2}{c_v}$	$\# \text{ Cycles} = \log \frac{t}{t_{90}}$			$S_s = H_o * c_\alpha * \log \frac{t}{t_{90}}$		
Marine Clay Crust	7.1	7.1	285	0.8	1.1	2.0	0.2	0.2	0.3
Marine Clay*	38.5	19.25	2095	-0.1	0.2	1.1	0.0	0.8	3.6
* indicates Layer is double drained						**Total**	**0.2**	**1.0**	**3.9**

4. Results

The Settlement with ULFGA vs. No Mitigation Summary Table below shows the estimated primary consolidation and secondary compression in 5, 10, and 75 years with no mitigation and using the ULFGA configuration shown in section 2 at various stations along the alignment.

Settlement Results

Settlement Mitigation Alternative			Maximum Settlement at Station within Roadway Limits (inches)					
			Abutment 1 Approach			Abutment 2 Approach		
			3+35	3+75	4+25 (Approach Slab)	6+87 (Approach Slab)	7+35	7+77
No Mitigation	5 Year Post Construction	Primary	1.25	1.75	1.75	1.75	2.5	1.75
		Secondary	0.3	0.3	0.3	0.2	0.3	0.3
		Total	1.6	2.1	2.1	2.0	2.8	2.1
No Mitigation	10 Year Post Construction	Primary	2	3	3	3	3.5	2.25
		Secondary	1.2	1.2	1.2	1.0	1.0	1.0
		Total	3.2	4.2	4.2	4.0	4.5	3.2
		Total (5 - 10 yr)*	1.7	2.2	2.2	2.0	1.7	1.2
Ultra Lightweight Foamed Glass Aggregate	5 Year Post Construction	Primary	0.5	0.25	0.25	0.25	0.25	0.75
		Secondary	0.3	0.3	0.3	0.2	0.2	0.2
		Total	0.8	0.6	0.6	0.5	0.5	1.0
Ultra Lightweight Foamed Glass Aggregate	10 Year Post Construction	Primary	0.75	0.75	0.75	0.5	0.75	1.25
		Secondary	1.2	1.2	1.2	1.0	1.0	1.0
		Total	2.0	2.0	2.0	1.5	1.7	2.2
		Total (5 - 10 yr)*	1.2	1.4	1.4	1.0	1.3	1.3
Ultra Lightweight Foamed Glass Aggregate	75 Year Post Construction	Primary	1.5	1.5	1.75	1.5	2	3
		Secondary	3.8	3.8	3.8	3.9	3.9	3.9
		Total	5.3	5.3	5.6	5.4	5.9	6.9
		Total (10 - 75 yr)*	4.2	3.9	4.2	4.4	4.7	5.7

Notes:
1. Primary Consolidation Settlement from Settle3 rounded to the nearest 0.25 inches.
2. Settlement criteria is less than 2 inches in the first five years, then another 2-inches in the following 5 years
3. "*" indicates the total settlement to date less the previous period total settlement. Use this total to compare to criteria identified in note 2.
4. 75 Year settlement results are included to show additional anticipated settlement within the remainder of the design life, It is anticpated that pavement shimming will be conducted in 15 year intervals to maintain long term settlements
5. Highlighted cell indicates settlment values exceed criteria within period.

5. Conclusions

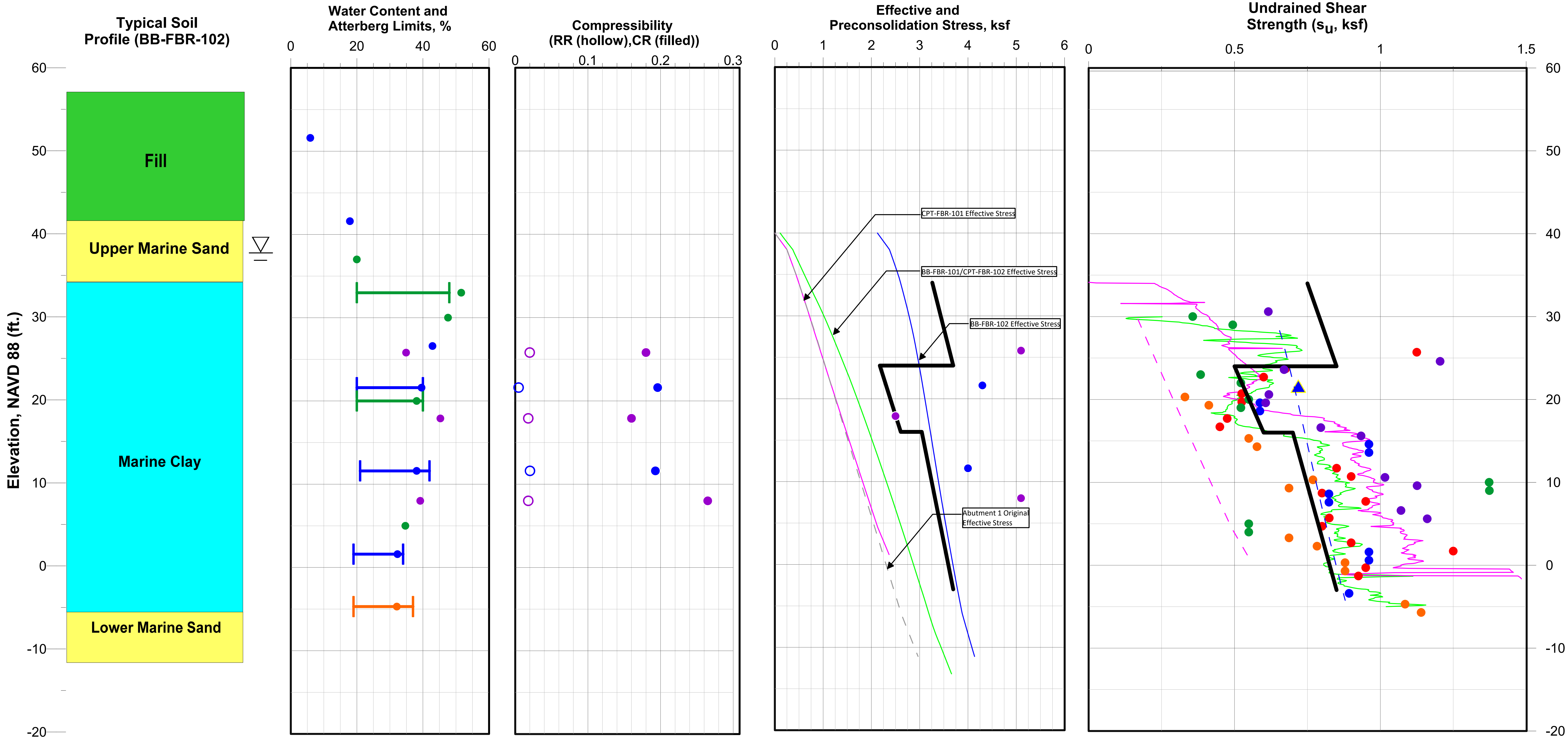
The No Mitigation results indicate that predicted settlements are very close to the project criteria. However, the settlement would be greater near the sidewalk to the south than at the north side of the road, which could affect the superelevation. In addition, the settlement would be more susceptible to local variations in clay thickness, timeline of new fill placement, and soil properties. Therefore, the lightweight fill scheme was considered to be appropriate.

The results show that the configuartion of Ultra light weight foamed glass aggregate shown on typical sections herein provide settlement mitigation to achieve the project settlement criteria of less than 2 inches in the first 5 years and another 2 inches between 5 and 10 years within 100 feet of the abutment, with predictions of approximately 1 inch in each of the criteria periods. Additionally, we predict greater than 0.5 inches of consolidation at the bridge abutments during the design life of the bridge, therefore downdrag needs to be considered in pile design.

6. Attachments

The attachments are described as follows:

- **Abutment 1 - GZA PLOT Water Content, Compressibility, Stress History and Strength of Cohesive Soils (page 7)**
- **Abutment 2 - GZA PLOT Water Content, Compressibility, Stress History and Strength of Cohesive Soils (page 8)**
- **Settle3 Plots (page 9-16)**
  - **Consolidation Settlement from 1960s to 2021**
  - **Consolidation Settlement No Mitigation at 5 Yr. Post-Construction**
  - **Consolidation Settlement No Mitigation at 10 Yr. Post-Construction**
  - **Consolidation Settlement No Mitigation at 75 Yr. Post-Construction**
  - **Consolidation Settlement with ULFGA at 5 Yr. Post-Construction**
  - **Consolidation Settlement with ULFGA at 10 Yr. Post-Construction**
  - **Consolidation Settlement with ULFGA at 75 Yr. Post-Construction**
  - **Time vs Consolidation settlement Plot**
- **Settle3 Input Report (page 16-56)**



NOTES:

1. DATA BASED ON TEST BORINGS (BB-FBR-102, -103, AND -103A) PERFORMED BY NEW ENGLAND BORING CONTRACTORS OF HERMON, MAINE BETWEEN JUNE 16 AND JUNE 17, 2019 AND TEST BORING BB-FBR-101 PERFORMED BY SUMMIT GEOENGINEERING OF ROCKLAND, MAINE ON MAY 23, 2019. BORINGS PERFORMED BY NEW ENGLAND BORING CONTRACOTRS WERE OBSERVED AND LOGGED BY GZA PERSONNEL.
2. CPT EXPLORATIONS (CPT-FBR-101 AND -102) PERFORMED BY SUMMIT GEOENGINEERING OF ROCKLAND, MAINE BETWEEN MAY 22 AND 23, 2019.
3. TYPICAL SOIL PROFILE BASED ON BORING BB-FBR-102.
4. WATER CONTENTS BASED ON LABORATORY TESTS PERFORMED ON SAMPLES TAKEN FROM RECENT BORINGS.
5. EFFECTIVE STRESS BASED ON INITIAL EFFECTIVE STRESS CALCULATED BY SETTLE3D BY ROCSCIENCE. EXISTING EMBANKMENT (FILL) MODELED AS AN EMBANKMENT LOAD OVER ORIGINAL GRADE. THEREFORE, EFFECTIVE STRESS ONLY CALCULATED BELOW EL. 40'.
6. PRECONSOLIDATION PRESSURE CALCULATED FROM CONSOLIDATION TESTS USING THE WORK METHOD.
7. CORRELATED UNDRAINED SHEAR STRENGTH FROM CPT DATA IS BASED ON N_{KT} = 28 (CPT-FBR-101) AND N_{KT} =22 (CPT-FBR-102).
8. IN LEGEND, FV=UNDRAINED SHEAR STRENGTH FROM IN-SITU FIELD VANE, CONSOL=LAB DATA FROM CONSOLIDATION TEST.

LEGEND

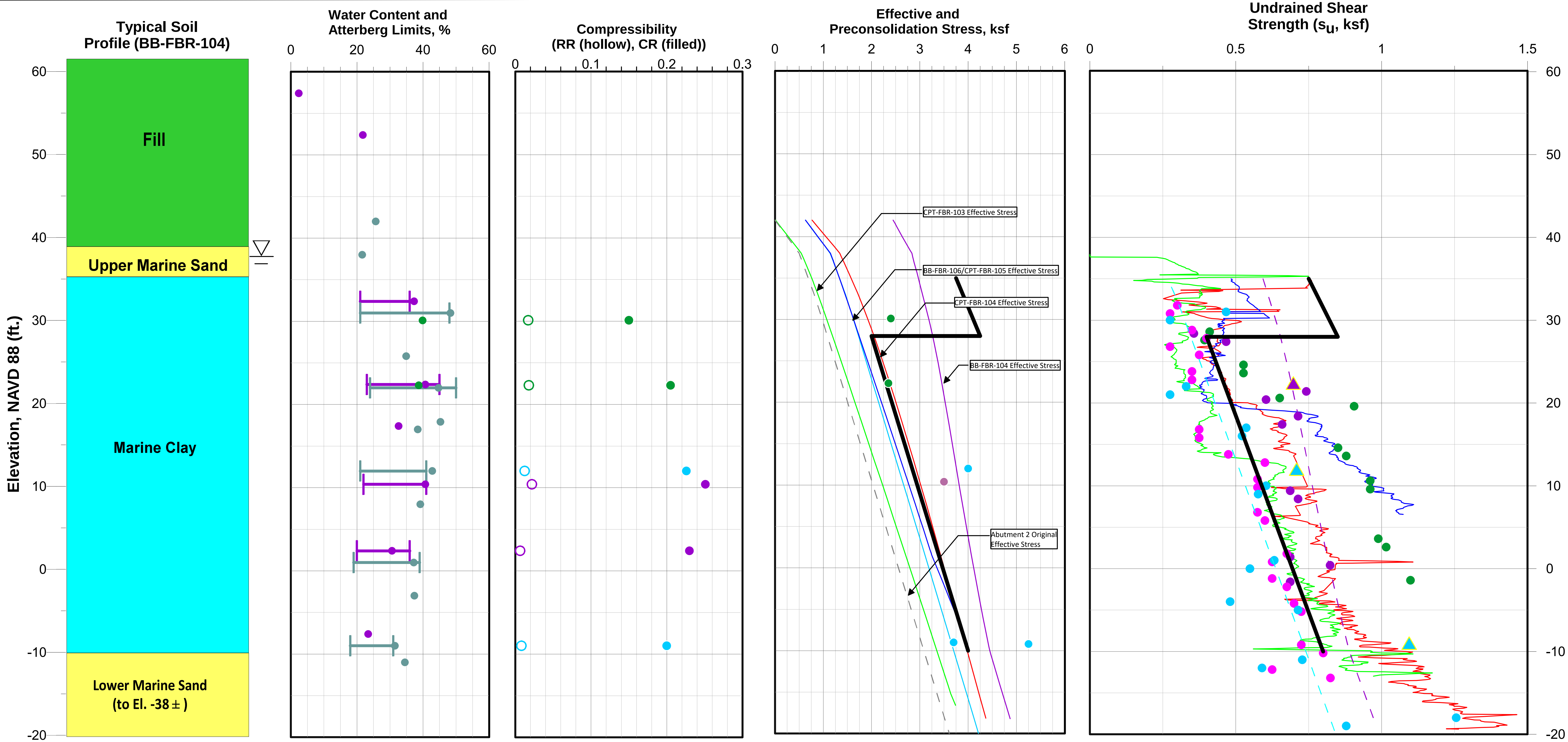
Plastic Limit, PL — Water Content, Wn — Liquid Limit, LL

- BB-FBR-101 (FV)
- BB-FBR-102 (FV,Consol)
- BB-FBR-103 (FV)
- BB-FBR-103A (FV)
- BB-FBR-201 (FV)
- CPT-FBR-101 (Nkt 22 Ndu 13)
- CPT-FBR-102 (Nkt 19 Ndu 13)
- DSS-1 (BB-FBR-102)
- BB-FBR-102 (Su/P=.23)
- CPT-FBR-101 (Su/P=.23)
- DESIGN Su PROFILE

BUCKNAM ROAD BRIDGE REPLACEMENT
FALMOUTH, ME

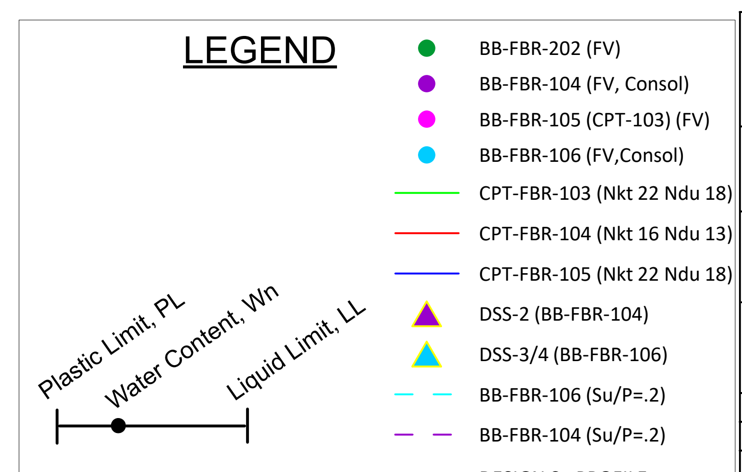
IN-SITU SOIL CONDITIONS VS. ELEVATION
Abutment 1 Approach

PREPARED BY:		PREPARED FOR:	
GZA GeoEnvironmental, Inc. Engineers & Scientists www.gza.com		MAINE DEPARTMENT OF TRANSPORTATION	
PROJ MGR: BMC	REVIEWED BY: ARB	CHECKED BY: CLS	FIGURE
DESIGNED BY: BMC	DRAWN BY: BMC	SCALE: N/A	3
DATE: 11/2/2020	PROJECT NUMBER: 09.0026023.00	REVISION NUMBER: 0	



NOTES:

1. DATA BASED ON TEST BORINGS (BB-FBR-104, AND -106) PERFORMED BY NEW ENGLAND BORING CONTRACTORS OF HERMON, MAINE BETWEEN JUNE 16 AND JUNE 26, 2019 AND TEST BORING BB-FBR-105 PERFORMED BY SUMMIT GEOENGINEERING OF ROCKLAND, MAINE ON MAY 22, 2019. BORINGS OBSERVED AND LOGGED BY GZA PERSONNEL.
2. CPT EXPLORATIONS (CPT-FBR-103, -104 AND -105) PERFORMED BY SUMMIT GEOENGINEERING OF ROCKLAND, MAINE BETWEEN MAY 21 AND 22, 2019.
3. TYPICAL SOIL PROFILE BASED ON BORING BB-FBR-104.
4. WATER CONTENTS BASED ON LABORATORY TESTS PERFORMED ON SAMPLES TAKEN FROM RECENT BORINGS.
5. EFFECTIVE STRESS BASED ON INITIAL EFFECTIVE STRESS CALCULATED BY SETTLE3D BY ROCSCIENCE. EXISTING EMBANKMENT (FILL) MODELED AS AN EMBANKMENT LOAD OVER ORIGINSL GRADE. THEREFORE, EFFECTIVE STRESS ONLY CALCULATED BELOW EL. 40'.
6. PRECONSOLIDATION PRESSURE CALCULATED FROM CONSOLIDATION TESTS USING THE WORK METHOD.
7. CORRELATED UNDRAINED SHEAR STRENGTH FROM CPT DATA IS BASED ON N_{KT} = 16 (CPT-FBR-104) AND N_{KT}=22 (CPT-FBR-103 AND -105).
8. IN LEGEND, FV=UNDRAINED SHEAR STRENGTH FROM IN-SITU FIELD VANE, CONSOL=LAB DATA FROM CONSOLIDATION TEST.

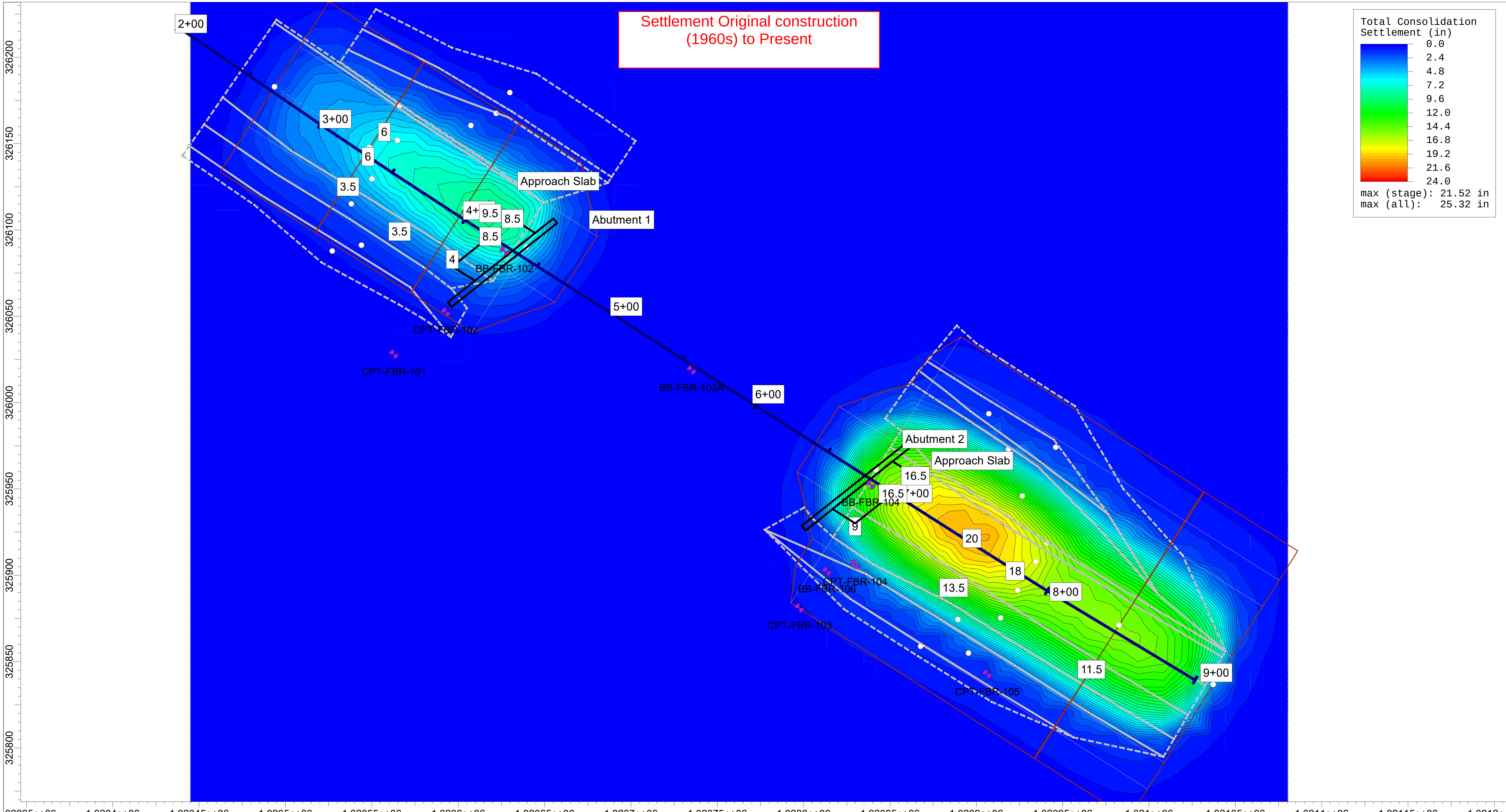


BUCKNAM ROAD BRIDGE REPLACEMENT
FALMOUTH, ME

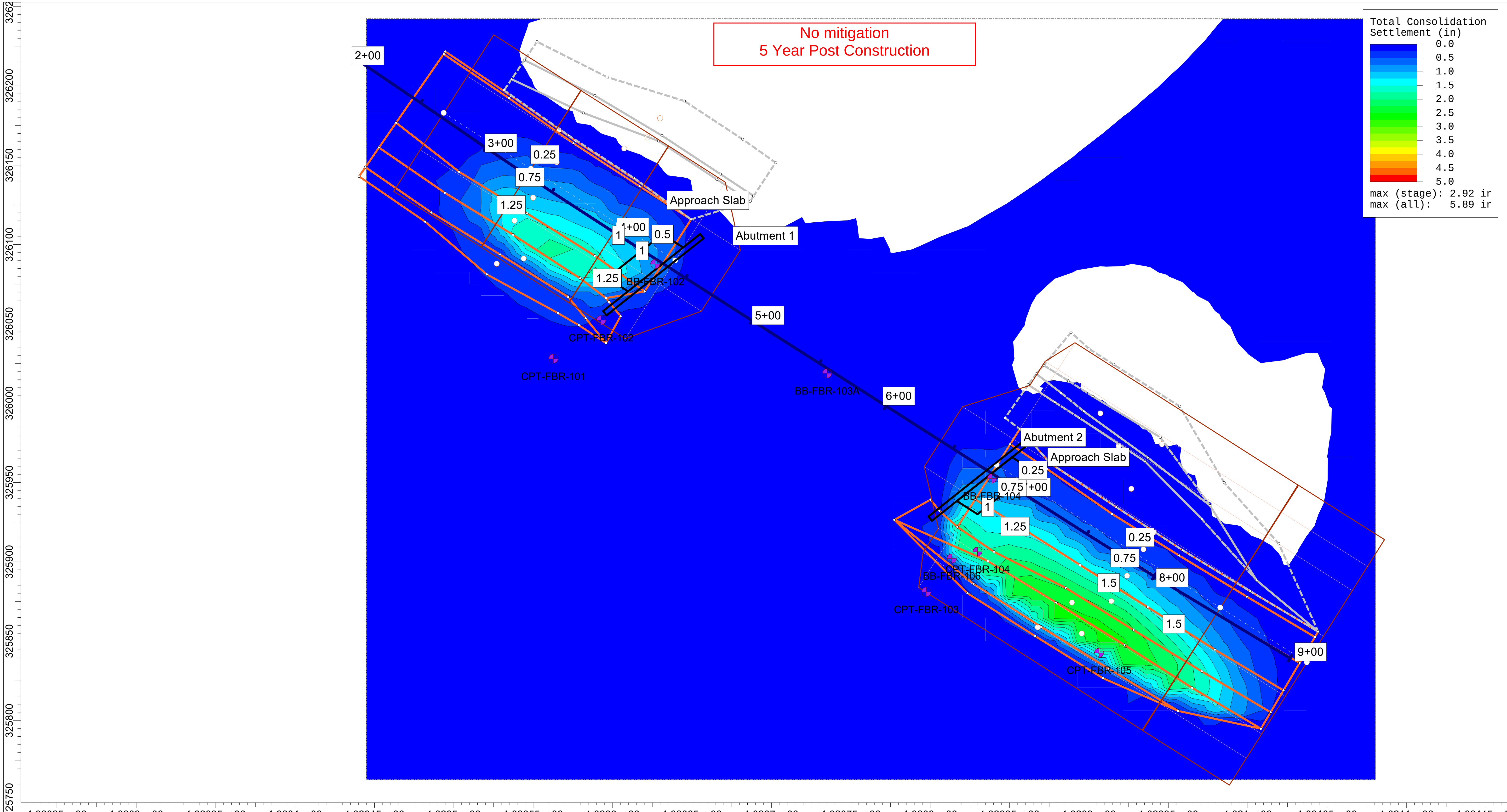
IN-SITU SOIL CONDITIONS VS. ELEVATION
Abutment 2 Approach

PREPARED BY: GZA GeoEnvironmental, Inc. Engineers & Scientists www.gza.com	PREPARED FOR: MAINE DEPARTMENT OF TRANSPORTATION

PROJ MGR: BMC	REVIEWED BY: ARB	CHECKED BY: CLS	FIGURE
DESIGNED BY: BMC	DRAWN BY: BMC	SCALE: N/A	4
DATE: 12/1/2021	PROJECT NUMBER: 09.0026023.00	REVISION NUMBER: 0	

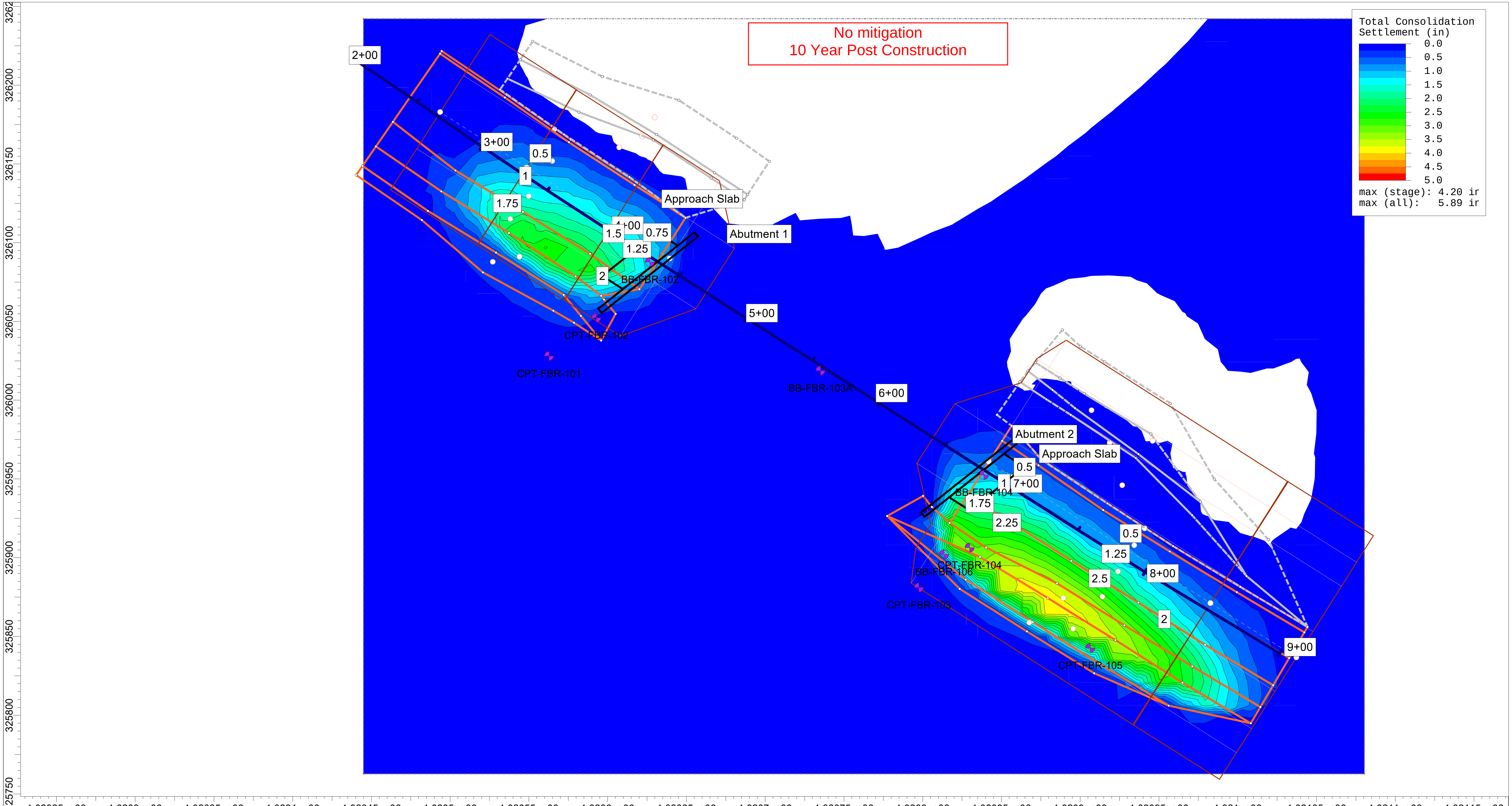


SETTLE3 5.013	Project	Bucknam Road Bridge Replacement	
	Analysis Description	No Mitigation	
	Drawn By	B.Cardali	Company: GZA GeoEnvironmental
	Date	9/4/2019, 1:58:06 PM	File Name: Bucknam Road 11 24 2021 no mitigation.s3z



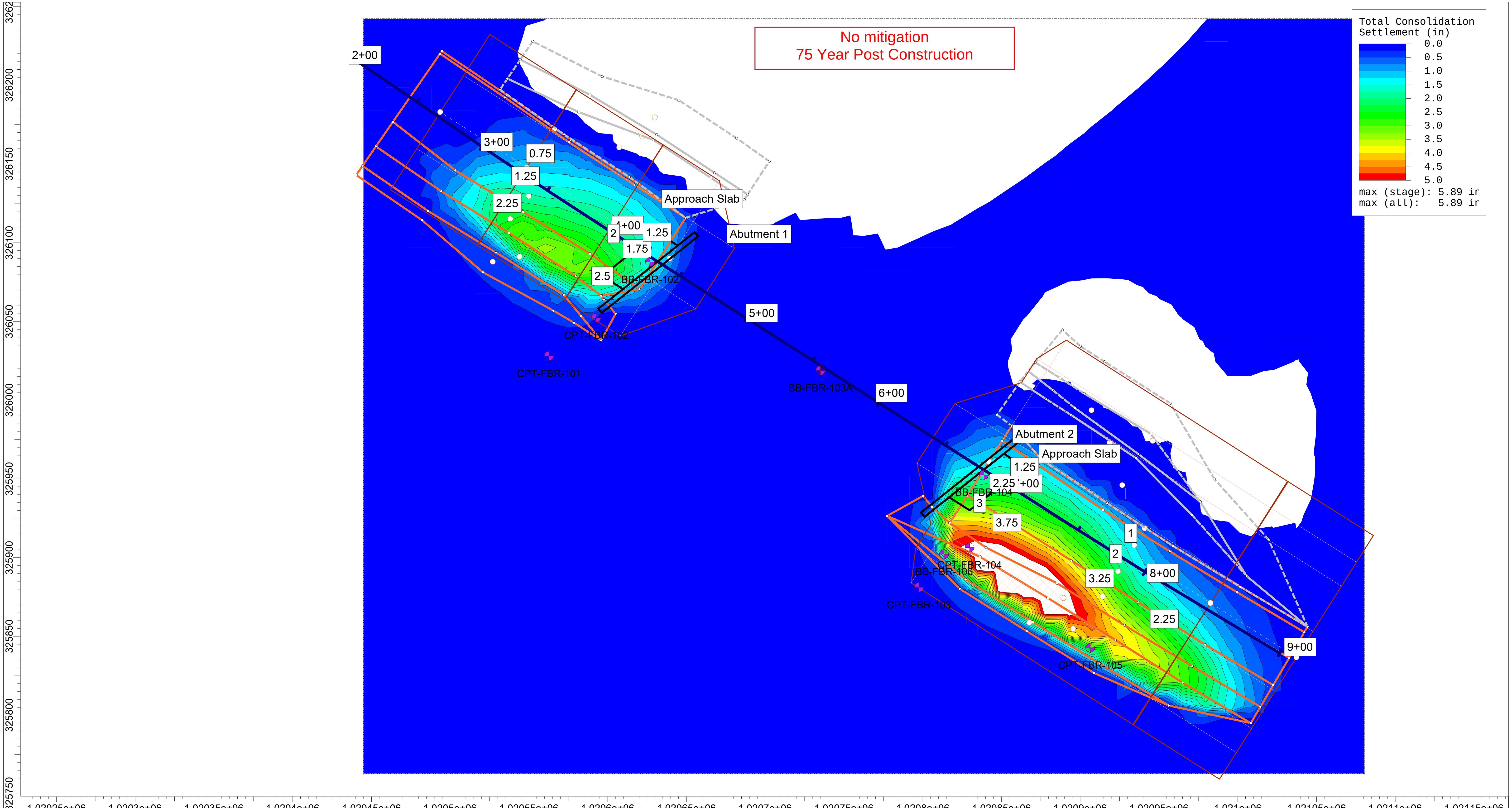
SETTLE3 5.012

Project	Bucknam Road Bridge Replacement		
Analysis Description	No Mitigation		
Drawn By	B.Cardali	Company	GZA GeoEnvironmental
Date	9/4/2019, 1:58:06 PM	File Name	Bucknam Road 11 17 2021 no mitigation.s3z



Project	Bucknam Road Bridge Replacement		
Analysis Description	No Mitigation		
Drawn By	B.Cardali	*Company*	GZA GeoEnvironmental
Date	9/4/2019, 1:58:06 PM	*File Name*	Bucknam Road 11 17 2021 no mitigation.s3z

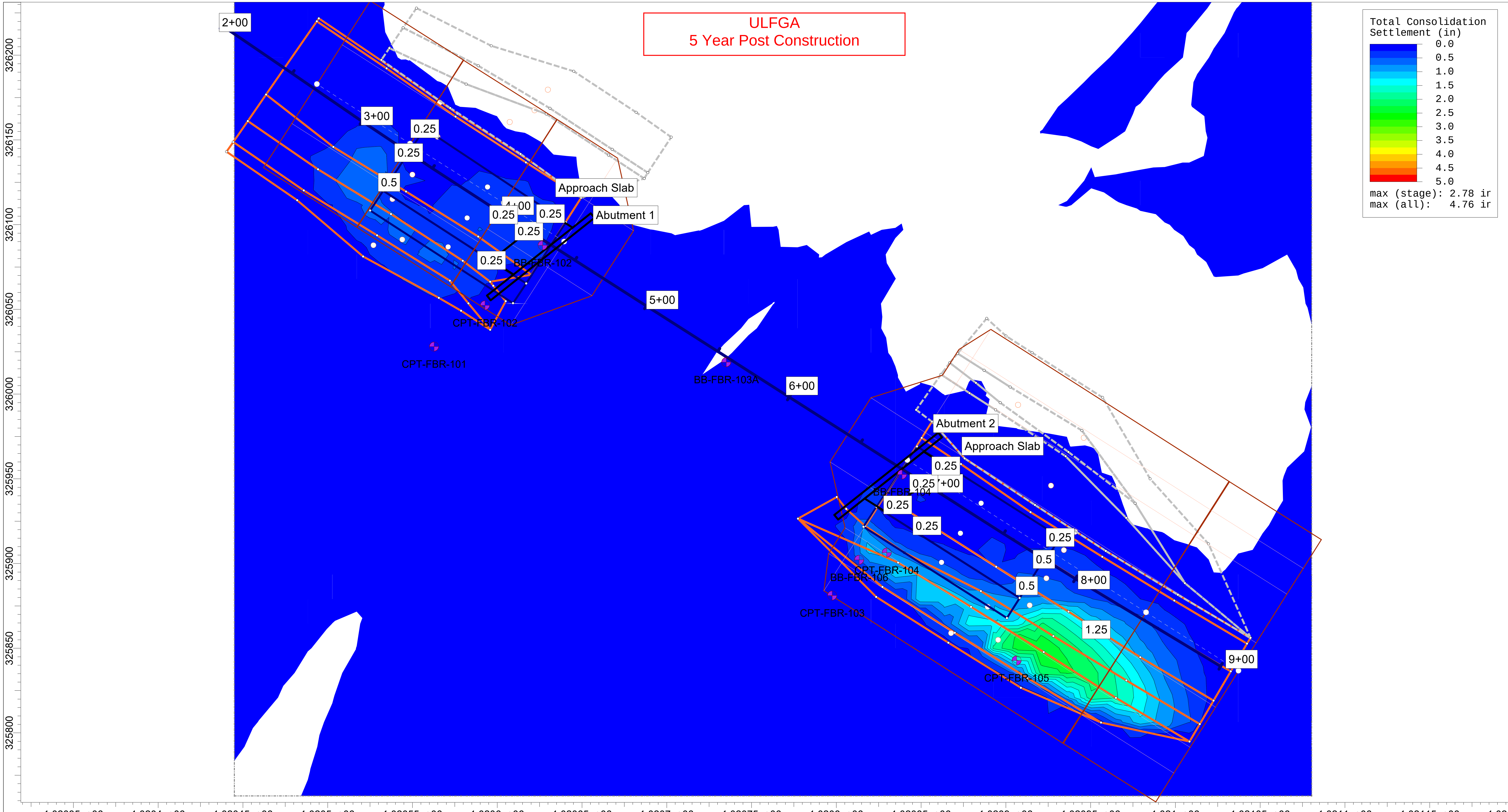
SETTLE3 5.012



rocscience

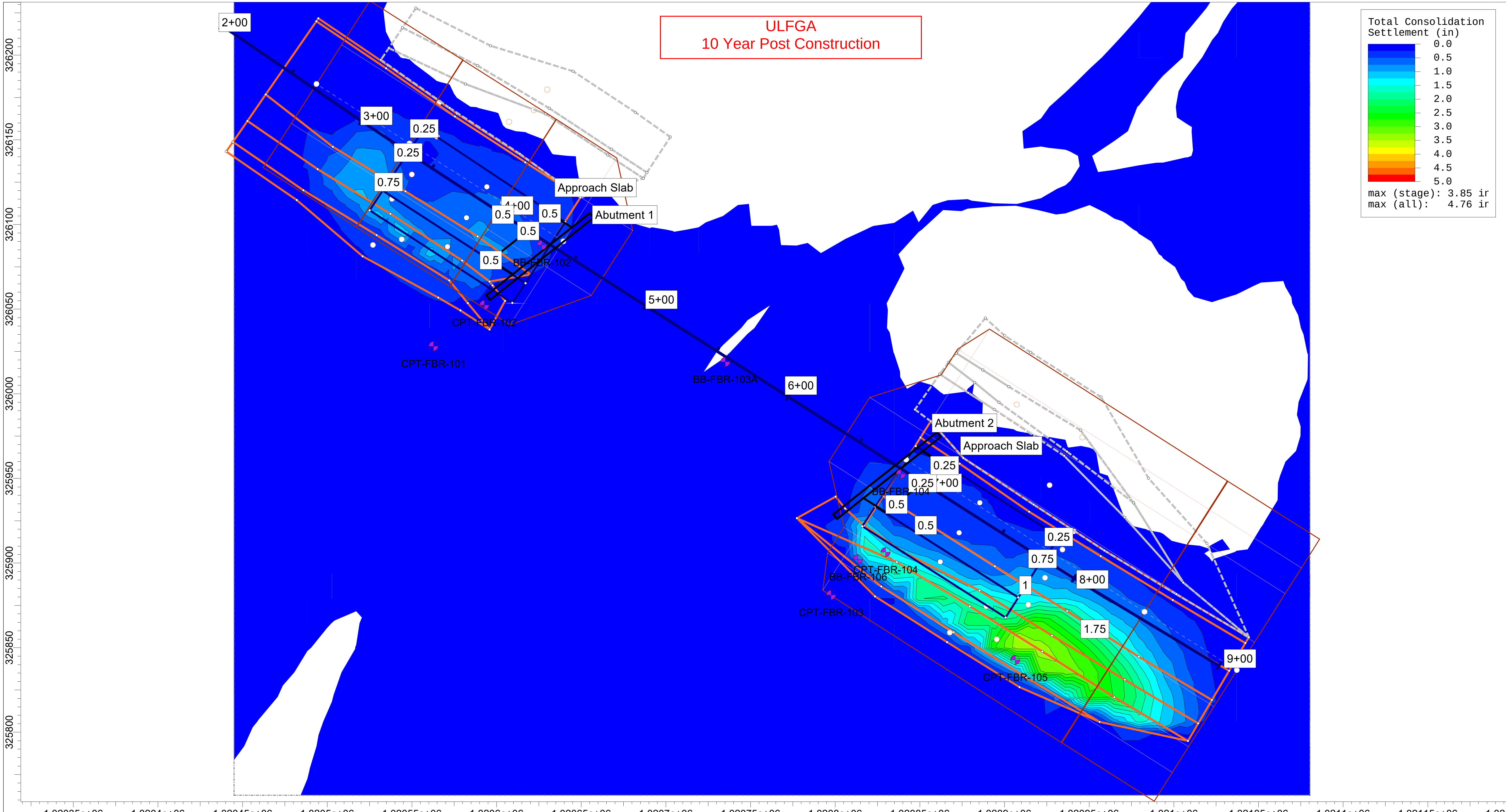
SETTLE3 5.012

Project	Bucknam Road Bridge Replacement
Analysis Description	No Mitigation
Drawn By B.Cardali	*Company* GZA GeoEnvironmental
Date 9/4/2019, 1:58:06 PM	*File Name* Bucknam Road 11 17 2021 no mitigation.s3z



Project	Bucknam Road Bridge Replacement		
Analysis Description	ULFGA		
Drawn By	B.Cardali	Company	GZA GeoEnvironmental
Date	9/4/2019, 1:58:06 PM	File Name	Bucknam Road 11 17 2021 LWF.s3z

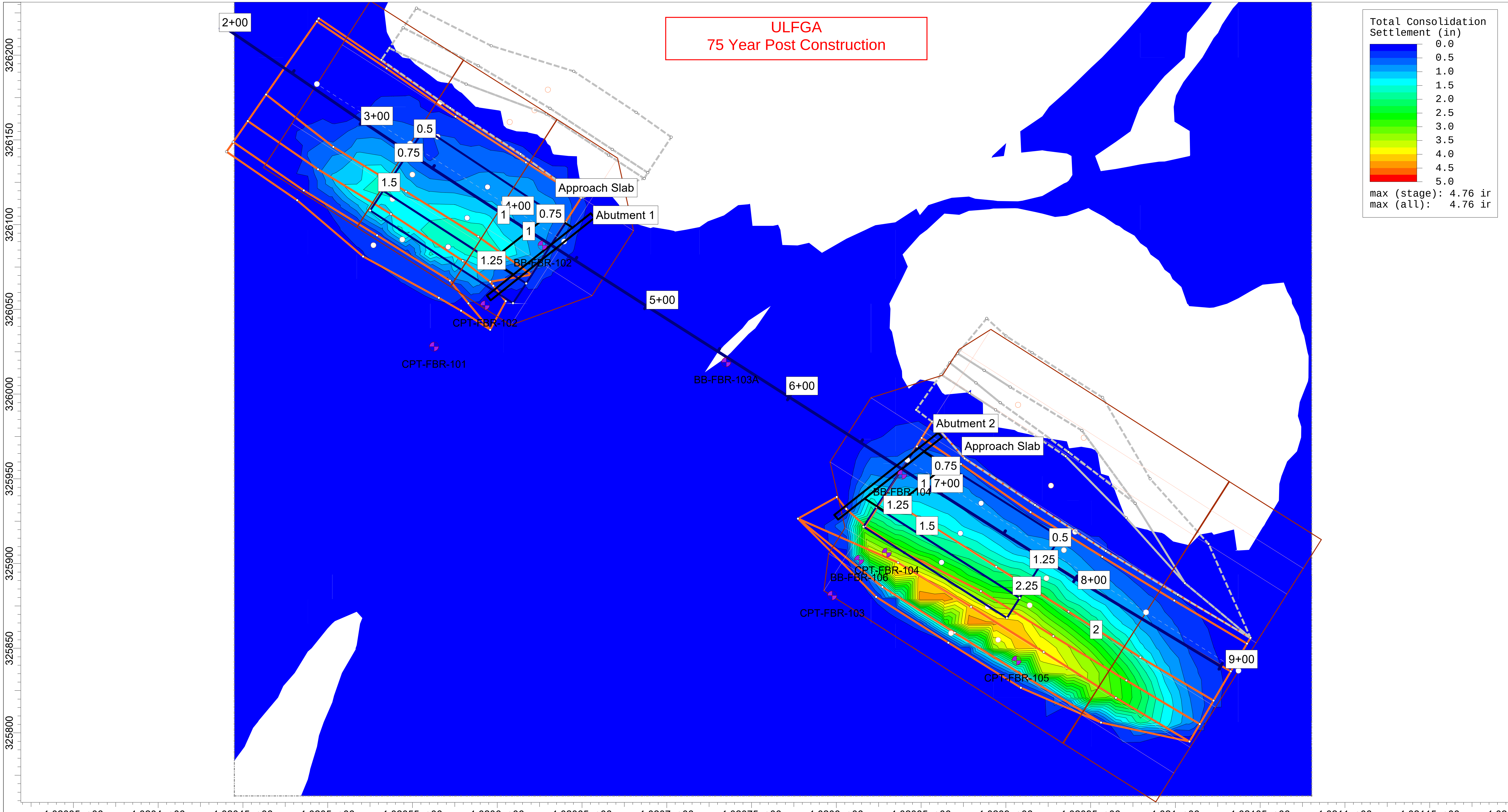
SETTLE3 5.012



rocscience

Project	Bucknam Road Bridge Replacement		
Analysis Description	ULFGA		
Drawn By	B.Cardali	*Company*	GZA GeoEnvironmental
Date	9/4/2019, 1:58:06 PM	*File Name*	Bucknam Road 11 17 2021 LWF.s3z

SETTLE3 5.012



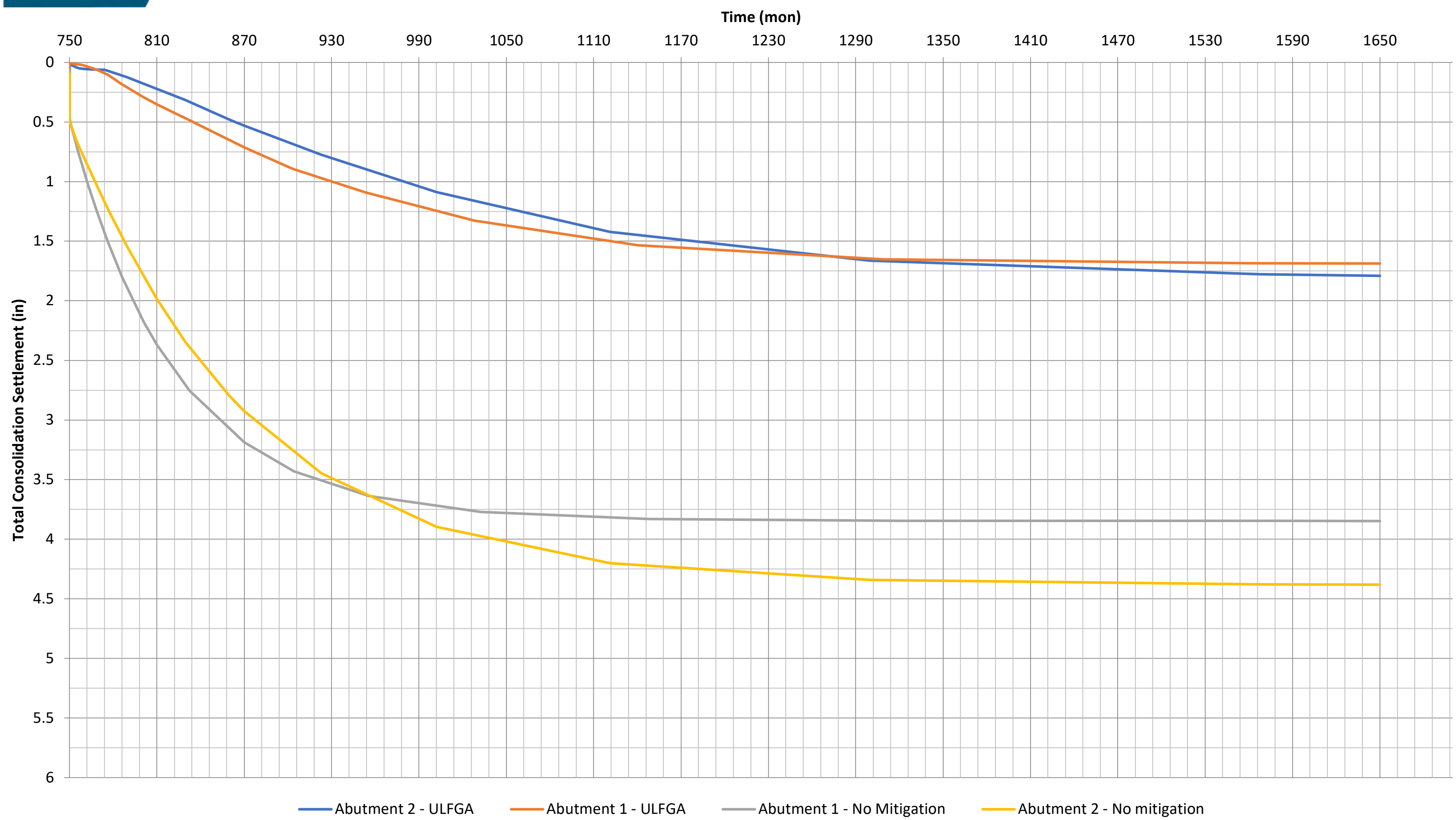
rocscience

SETTLE3 5.012

Project	Bucknam Road Bridge Replacement
Analysis Description	ULFGA
Drawn By	B.Cardali
Company	GZA GeoEnvironmental
Date	9/4/2019, 1:58:06 PM
File Name	Bucknam Road 11 17 2021 LWF.s3z

GZA File No. 09.0026023.00
Date: 2/18/2022
By: B.Cardali

Time vs. Total Consolidation Settlement



Bucknam Road Bridge Replacement
GZA GeoEnvironmental
Report Creation Date: 2021/11/29, 16:10:48

Table of Contents

Settle3 Analysis Information

Bucknam Road Bridge Replacement

Project Settings

Document Name	Bucknam Road 11 17 2021 LWF
Project Title	Bucknam Road Bridge Replacement
Author	B.Cardali
Company	GZA GeoEnvironmental
Date Created	9/4/2019, 1:58:06 PM
Stress Computation Method	Boussinesq
Time-dependent Consolidation Analysis	
Time Units	months
Permeability Units	feet/day
Minimum settlement ratio for subgrade modulus	0.9
Poisson ratio for Boussinesq stress computation	0.3
Calculate settlement with mean stress	
Use average poisson's ratio to calculate layered stresses	
Improve consolidation accuracy	
Ignore negative effective stresses in settlement calculations	

Stage Settings

Stage #	Name	Time [months]
1	Stage 1	0
2	Stage 2	1
3	Stage 3	744
4	Stage 4	745
5	Stage 5	750
6	Stage 6	750.1
7	Stage 7 - 2 yr	776.4
8	Stage 8 - 5 yr	810
9	Stage 9 - 10 yr	870
10	Stage 10 - 75 yr	1650

Loads

1. Fill Load: "AP 1.1"

Label	AP 1.1
Load Type	Flexible
Area of Load	336.318 ft2
Elevation	40 ft
Installation Stage	Stage 6 = 750.1 mon

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
1.02049e+06	326220	0
1.02053e+06	326192	0
1.02058e+06	326164	0.125
1.02062e+06	326137	0.25
1.02065e+06	326116	0.375
1.02062e+06	326138	0
1.02058e+06	326165	0
1.02054e+06	326194	0
1.02049e+06	326222	0

2. Fill Load: "AP 1.2"

Label	AP 1.2
Load Type	Flexible
Area of Load	6270.11 ft2
Elevation	40 ft
Installation Stage	Stage 6 = 750.1 mon

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
1.02047e+06	326192	0
1.02052e+06	326164	0
1.02056e+06	326136	0.1875
1.0206e+06	326109	0.3125
1.02063e+06	326088	0.375
1.02065e+06	326116	0.375
1.02062e+06	326137	0.25
1.02058e+06	326164	0.125
1.02053e+06	326192	0
1.02049e+06	326220	0

3. Fill Load: "AP 1.3"

Label	AP 1.3
Load Type	Flexible
Area of Load	3831.74 ft2
Elevation	40 ft
Installation Stage	Stage 6 = 750.1 mon

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
1.02046e+06	326177	0
1.0205e+06	326146	0
1.02055e+06	326120	0.125
1.02059e+06	326093	0.3125
1.02062e+06	326070	0.375
1.02063e+06	326088	0.375
1.0206e+06	326109	0.3125
1.02056e+06	326136	0.1875
1.02052e+06	326164	0
1.02047e+06	326192	0

4. Fill Load: "AP 1.4"

Label	AP 1.4
Load Type	Flexible
Area of Load	3028.37 ft2
Elevation	40 ft
Installation Stage	Stage 4 = 745 mon

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
1.02045e+06	326161	0
1.02049e+06	326133	0.75
1.02054e+06	326106	1.0625
1.02058e+06	326079	1.5
1.0206e+06	326066	1.5
1.02062e+06	326070	0.375
1.02059e+06	326093	0.3125
1.02055e+06	326120	0.125
1.0205e+06	326146	0
1.02046e+06	326177	0

5. Fill Load: "AP 1.5"

Label	AP 1.5
Load Type	Flexible
Area of Load	2855.45 ft2
Elevation	40 ft
Installation Stage	Stage 4 = 745 mon

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
1.02044e+06	326149	0
1.02049e+06	326120	0.5
1.02053e+06	326094	1
1.02057e+06	326067	1.4375
1.02058e+06	326054	0.75
1.0206e+06	326038	0
1.0206e+06	326055	0
1.0206e+06	326064	0.875
1.0206e+06	326066	1.5
1.02058e+06	326079	1.5
1.02054e+06	326106	1.0625
1.02049e+06	326133	0.75
1.02045e+06	326161	0

6. Fill Load: "AP 1.6"

Label	AP 1.6
Load Type	Flexible
Area of Load	1800.45 ft2
Elevation	40 ft
Installation Stage	Stage 4 = 745 mon

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
1.02048e+06	326114	0
1.02052e+06	326081	0
1.02057e+06	326057	0
1.02058e+06	326049	0
1.0206e+06	326038	0
1.02058e+06	326054	0.75
1.02057e+06	326067	1.375
1.02053e+06	326094	1
1.02049e+06	326120	0.5
1.02044e+06	326149	0
1.02044e+06	326143	0

7. Fill Load: "AP 2.1"

Label	AP 2.1
Load Type	Flexible
Area of Load	1060.02 ft2
Elevation	42 ft
Installation Stage	Stage 6 = 750.1 mon

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
1.02104e+06	325856	0
1.021e+06	325882	0
1.02096e+06	325907	0
1.02092e+06	325934	0
1.02088e+06	325962	0
1.02086e+06	325984	0
1.02085e+06	325974	0.3125
1.02087e+06	325959	0.3125
1.02091e+06	325930	0.1875
1.02096e+06	325904	0.125
1.021e+06	325878	0.0625
1.02104e+06	325853	0

8. Fill Load: "AP 2.2"

Label	AP 2.2
Load Type	Flexible
Area of Load	4438.46 ft2
Elevation	42 ft
Installation Stage	Stage 6 = 750.1 mon

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
1.02104e+06	325853	0
1.021e+06	325878	0.0625
1.02096e+06	325904	0.125
1.02091e+06	325930	0.1875
1.02087e+06	325959	0.3125
1.02085e+06	325974	0.3125
1.02084e+06	325956	0.3125
1.02086e+06	325941	0.3125
1.0209e+06	325914	0.25
1.02095e+06	325888	0.1875
1.02099e+06	325862	0.0625
1.02103e+06	325836	0

9. Fill Load: "AP 2.3"

Label	AP 2.3
Load Type	Flexible
Area of Load	4415.87 ft2
Elevation	42 ft
Installation Stage	Stage 6 = 750.1 mon

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
1.02103e+06	325836	0
1.02099e+06	325862	0.0625
1.02095e+06	325888	0.1875
1.0209e+06	325914	0.25
1.02086e+06	325941	0.3125
1.02084e+06	325956	0.3125
1.02083e+06	325939	0.3125
1.02085e+06	325925	0.3125
1.02089e+06	325898	0.3125
1.02094e+06	325872	0.25
1.02098e+06	325845	0.125
1.02102e+06	325819	0

10. Fill Load: "AP 2.4"

Label	AP 2.4
Load Type	Flexible
Area of Load	4061.02 ft2
Elevation	42 ft
Installation Stage	Stage 4 = 745 mon

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
1.02102e+06	325819	0
1.02098e+06	325845	0.125
1.02094e+06	325872	0.25
1.02089e+06	325898	0.3125
1.02085e+06	325925	0.3125
1.02083e+06	325939	0.3125
1.02082e+06	325922	1.375
1.02084e+06	325906	1.375
1.02089e+06	325884	1.375
1.02093e+06	325857	1.25
1.02097e+06	325831	1.0625
1.02101e+06	325805	0

11. Fill Load: "AP 2.5"

Label	AP 2.5
Load Type	Flexible
Area of Load	2966 ft2
Elevation	42 ft
Installation Stage	Stage 4 = 745 mon

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
1.02101e+06	325805	0
1.02097e+06	325831	1.0625
1.02093e+06	325857	1.25
1.02089e+06	325884	1.375
1.02084e+06	325906	1.375
1.02082e+06	325922	1.375
1.02081e+06	325932	0.875
1.0208e+06	325939	0
1.02078e+06	325926	0
1.02084e+06	325900	1.375
1.02088e+06	325874	1.3125
1.02092e+06	325848	1.25
1.02096e+06	325821	1
1.02101e+06	325795	0

12. Fill Load: "AP 2.6"

Label	AP 2.6
Load Type	Flexible
Area of Load	3647.16 ft2
Elevation	42 ft
Installation Stage	Stage 4 = 745 mon

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
1.02096e+06	325821	1
1.02092e+06	325848	1.25
1.02088e+06	325874	1.3125
1.02084e+06	325900	1.375
1.02078e+06	325926	0
1.02083e+06	325886	0.375
1.02087e+06	325859	0.25
1.02091e+06	325833	0.1875
1.02096e+06	325806	0
1.02101e+06	325795	0

13. Fill Load: "AP 2.7"

Label	AP 2.7
Load Type	Flexible
Area of Load	1106.78 ft2
Elevation	42 ft
Installation Stage	Stage 4 = 745 mon

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
1.02091e+06	325833	0.1875
1.02087e+06	325859	0.25
1.02083e+06	325886	0.375
1.02078e+06	325926	0
1.02082e+06	325880	0
1.02087e+06	325853	0
1.02091e+06	325827	0
1.02096e+06	325806	0

14. Fill Load: "A1T1"

Label	A1T1
Load Type	Flexible
Area of Load	3459.36 ft2

Advanced Staging

Stage	Load Factor	Bottom Elevation [ft]
Stage 1 = 0 mon	0	38.2623
Stage 2 = 1 mon	0	38.2623
Stage 3 = 744 mon	0	38.2623
Stage 4 = 745 mon	1	38.2623
Stage 5 = 750 mon	1	38.2623
Stage 6 = 750.1 mon	0	38.2623
Stage 7 - 2 yr = 776.4 mon	0	38.2623
Stage 8 - 5 yr = 810 mon	0	38.2623
Stage 9 - 10 yr = 870 mon	0	38.2623
Stage 10 - 75 yr = 1650 mon	0	38.2623

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
1.02065e+06	326190	0
1.0206e+06	326205	0
1.02055e+06	326228	0
1.02054e+06	326216	0
1.02059e+06	326194	0.9375
1.02063e+06	326169	1.6875
1.02067e+06	326144	1.6875
1.02069e+06	326131	0
1.0207e+06	326152	0
1.02068e+06	326166	0

15. Fill Load: "A1T2"

Label	A1T2
Load Type	Flexible
Area of Load	1373.14 ft2

Advanced Staging

Stage	Load Factor	Bottom Elevation [ft]
Stage 1 = 0 mon	0	40
Stage 2 = 1 mon	0	40
Stage 3 = 744 mon	0	40
Stage 4 = 745 mon	1	40
Stage 5 = 750 mon	1	40
Stage 6 = 750.1 mon	0	40
Stage 7 - 2 yr = 776.4 mon	0	40
Stage 8 - 5 yr = 810 mon	0	40
Stage 9 - 10 yr = 870 mon	0	40
Stage 10 - 75 yr = 1650 mon	0	40

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
1.02054e+06	326204	0
1.02058e+06	326183	1
1.02063e+06	326165	1.6875
1.02067e+06	326141	1.6875
1.02069e+06	326127	0
1.02069e+06	326131	0
1.02067e+06	326144	1.6875
1.02063e+06	326169	1.6875
1.02059e+06	326194	0.9375
1.02054e+06	326216	0

16. Fill Load: "A1T3"

Label	A1T3
Load Type	Flexible
Area of Load	3396.53 ft2

Advanced Staging

Stage	Load Factor	Bottom Elevation [ft]
Stage 1 = 0 mon	0	39.5057
Stage 2 = 1 mon	0	39.5057
Stage 3 = 744 mon	0	39.5057
Stage 4 = 745 mon	1	39.5057
Stage 5 = 750 mon	1	39.5057
Stage 6 = 750.1 mon	0	39.5057
Stage 7 - 2 yr = 776.4 mon	0	39.5057
Stage 8 - 5 yr = 810 mon	0	39.5057
Stage 9 - 10 yr = 870 mon	0	39.5057
Stage 10 - 75 yr = 1650 mon	0	39.5057

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
1.02053e+06	326197	0
1.02057e+06	326169	0
1.02061e+06	326142	0
1.02065e+06	326116	0
1.02069e+06	326127	0
1.02067e+06	326141	1.6875
1.02063e+06	326165	1.6875
1.02058e+06	326183	1
1.02054e+06	326204	0

17. Fill Load: "A2T1"

Label	A2T1
Load Type	Flexible
Area of Load	4773.04 ft2

Advanced Staging

Stage	Load Factor	Bottom Elevation [ft]
Stage 1 = 0 mon	0	42
Stage 2 = 1 mon	0	42
Stage 3 = 744 mon	0	42
Stage 4 = 745 mon	1	42
Stage 5 = 750 mon	1	42
Stage 6 = 750.1 mon	0	42
Stage 7 - 2 yr = 776.4 mon	0	42
Stage 8 - 5 yr = 810 mon	0	42
Stage 9 - 10 yr = 870 mon	0	42
Stage 10 - 75 yr = 1650 mon	0	42

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
1.02089e+06	326045	0
1.02087e+06	326024	0
1.02089e+06	326014	1.125
1.0209e+06	326004	1.125
1.02094e+06	325978	0.875
1.02098e+06	325935	1
1.02101e+06	325888	0.375
1.02104e+06	325856	0
1.02102e+06	325912	0
1.02099e+06	325950	0
1.02096e+06	325998	0
1.02092e+06	326024	0
1.0209e+06	326034	0

18. Fill Load: "A2T2"

Label	A2T2
Load Type	Flexible
Area of Load	1348.14 ft2

Advanced Staging

Stage	Load Factor	Bottom Elevation [ft]
Stage 1 = 0 mon	0	42
Stage 2 = 1 mon	0	42
Stage 3 = 744 mon	0	42
Stage 4 = 745 mon	1	42
Stage 5 = 750 mon	1	42
Stage 6 = 750.1 mon	0	42
Stage 7 - 2 yr = 776.4 mon	0	42
Stage 8 - 5 yr = 810 mon	0	42
Stage 9 - 10 yr = 870 mon	0	42
Stage 10 - 75 yr = 1650 mon	0	42

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
1.02087e+06	326018	0
1.02088e+06	326007	1.875
1.0209e+06	325995	1.875
1.02094e+06	325966	1.75
1.02098e+06	325935	1
1.02094e+06	325978	0.875
1.0209e+06	326004	1.125
1.02089e+06	326014	1.125
1.02087e+06	326024	0

19. Fill Load: "A2T3"

Label	A2T3
Load Type	Flexible
Area of Load	1034.79 ft2

Advanced Staging

Stage	Load Factor	Bottom Elevation [ft]
Stage 1 = 0 mon	0	42
Stage 2 = 1 mon	0	42
Stage 3 = 744 mon	0	42
Stage 4 = 745 mon	1	42
Stage 5 = 750 mon	1	42
Stage 6 = 750.1 mon	0	42
Stage 7 - 2 yr = 776.4 mon	0	42
Stage 8 - 5 yr = 810 mon	0	42
Stage 9 - 10 yr = 870 mon	0	42
Stage 10 - 75 yr = 1650 mon	0	42

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
1.02086e+06	326012	0
1.02088e+06	326001	1.75
1.02089e+06	325991	1.75
1.02094e+06	325963	1.75
1.02097e+06	325927	1.1875
1.02101e+06	325888	0.375
1.02098e+06	325935	1
1.02094e+06	325966	1.75
1.0209e+06	325995	1.875
1.02088e+06	326007	1.875
1.02087e+06	326018	0

20. Fill Load: "A2T4"

Label	A2T4
Load Type	Flexible
Area of Load	5197.74 ft2

Advanced Staging

Stage	Load Factor	Bottom Elevation [ft]
Stage 1 = 0 mon	0	42
Stage 2 = 1 mon	0	42
Stage 3 = 744 mon	0	42
Stage 4 = 745 mon	1	42
Stage 5 = 750 mon	1	42
Stage 6 = 750.1 mon	0	42
Stage 7 - 2 yr = 776.4 mon	0	42
Stage 8 - 5 yr = 810 mon	0	42
Stage 9 - 10 yr = 870 mon	0	42
Stage 10 - 75 yr = 1650 mon	0	42

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
1.02085e+06	325991	0
1.02086e+06	325984	0
1.02088e+06	325962	0
1.02092e+06	325934	0
1.02096e+06	325907	0
1.021e+06	325882	0
1.02104e+06	325856	0
1.02101e+06	325888	0.375
1.02097e+06	325927	1.1875
1.02094e+06	325963	1.75
1.02089e+06	325991	1.75
1.02088e+06	326001	1.75
1.02086e+06	326012	0

21. Polygonal Load: "Polygonal Load 15"

Label	Polygonal Load 15
Load Type	Flexible
Area of Load	1605.77 ft2
Load	-0.21 ksf
Elevation	42 ft
Installation Stage	Stage 6 = 750.1 mon

Coordinates

X [ft]	Y [ft]
1.02084e+06	325956
1.02092e+06	325902
1.02093e+06	325915
1.02085e+06	325969

22. Polygonal Load: "Polygonal Load 17"

Label	Polygonal Load 17
Load Type	Flexible
Area of Load	2690.05 ft2
Load	-0.315 ksf
Elevation	42 ft
Installation Stage	Stage 6 = 750.1 mon

Coordinates

X [ft]	Y [ft]
1.02082e+06	325933
1.02091e+06	325880
1.02092e+06	325902
1.02084e+06	325956

23. Polygonal Load: "Polygonal Load 24"

Label	Polygonal Load 24
Load Type	Flexible
Area of Load	1402.2 ft2
Load	-0.525 ksf
Elevation	42 ft
Installation Stage	Stage 6 = 750.1 mon

Coordinates

X [ft]	Y [ft]
1.0209e+06	325868
1.02091e+06	325880
1.02082e+06	325933
1.02082e+06	325922

24. Polygonal Load: "Polygonal Load 14"

Label	Polygonal Load 14
Load Type	Flexible
Area of Load	1656.18 ft2
Load	-0.21 ksf
Elevation	40 ft
Installation Stage	Stage 6 = 750.1 mon

Coordinates

X [ft]	Y [ft]
1.02064e+06	326101
1.02056e+06	326157
1.02055e+06	326142
1.02063e+06	326088

25. Polygonal Load: "Polygonal Load 25"

Label	Polygonal Load 25
Load Type	Flexible
Area of Load	2707.4 ft2
Load	-0.21 ksf
Elevation	40 ft
Installation Stage	Stage 6 = 750.1 mon

Coordinates

X [ft]	Y [ft]
1.02055e+06	326142
1.02053e+06	326120
1.02062e+06	326065
1.02063e+06	326088

26. Polygonal Load: "Polygonal Load 26"

Label	Polygonal Load 26
Load Type	Flexible
Area of Load	1407.6 ft2
Load	-0.42 ksf
Elevation	40 ft
Installation Stage	Stage 6 = 750.1 mon

Coordinates

X [ft]	Y [ft]
1.02052e+06	326108
1.02061e+06	326054
1.02062e+06	326065
1.02053e+06	326120

Embankments

1. Embankment: "Embankment Load 1"

Label	Embankment Load 1
Center Line	(1.02084e+06, 325961) to (1.02098e+06, 325871)
Near End Angle	27.8 degrees
Far End Angle	90 degrees
Number of Layers	2
Base Width	183

Layer	Stage	Left Bench Width (ft)	Left Angle (deg)	Height (ft)	Unit Weight (kips/ft3)	Right Angle (deg)	Right Bench Width (ft)
1	Stage 2 = 1 mon	0	14	5	0.125	14	0
2	Stage 2 = 1 mon	18	23.8	15	0.125	28.18	18

2. Embankment: "Embankment Load 2"

Label	Embankment Load 2
Center Line	(1.02098e+06, 325871) to (1.02104e+06, 325837)
Near End Angle	90 degrees
Far End Angle	90 degrees
Number of Layers	2
Base Width	183

Layer	Stage	Left Bench Width (ft)	Left Angle (deg)	Height (ft)	Unit Weight (kips/ft3)	Right Angle (deg)	Right Bench Width (ft)
1	Stage 2 = 1 mon	0	14	5	0.125	14	0
2	Stage 2 = 1 mon	18	23.8	15	0.125	28.18	18

3. Embankment: "Embankment Load 4"

Label	Embankment Load 4
Center Line	(1.0206e+06, 326113) to (1.02055e+06, 326148)
Near End Angle	90 degrees
Far End Angle	90 degrees
Number of Layers	1
Base Width	117

Layer	Stage	Left Bench Width (ft)	Left Angle (deg)	Height (ft)	Unit Weight (kips/ft3)	Right Angle (deg)	Right Bench Width (ft)
1	Stage 2 = 1 mon	0	25.8	15	0.125	25.8	0

4. Embankment: "Embankment Load 5"

Label				Embankment Load 5			
Center Line				(1.02055e+06, 326148) to (1.02049e+06, 326183)			
Near End Angle				90 degrees			
Far End Angle				90 degrees			
Number of Layers				1			
Base Width				117			
Layer	**Stage**	**Left Bench Width (ft)**	**Left Angle (deg)**	**Height (ft)**	**Unit Weight (kips/ft3)**	**Right Angle (deg)**	**Right Bench Width (ft)**
1	Stage 2 = 1 mon	0	22.8	13	0.125	22.8	0

5. Embankment: "Embankment Load 3"

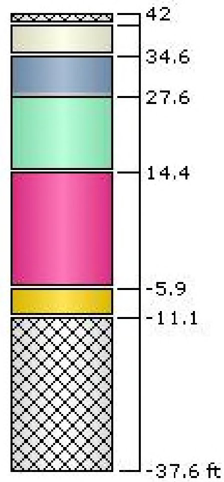
Label				Embankment Load 3			
Center Line				(1.02064e+06, 326090) to (1.0206e+06, 326113)			
Near End Angle				28.7 degrees			
Far End Angle				90 degrees			
Number of Layers				1			
Base Width				117			
Layer	**Stage**	**Left Bench Width (ft)**	**Left Angle (deg)**	**Height (ft)**	**Unit Weight (kips/ft3)**	**Right Angle (deg)**	**Right Bench Width (ft)**
1	Stage 2 = 1 mon	0	22.8	17	0.125	28.7	0

Soil Layers

Ground Surface Drained: Yes

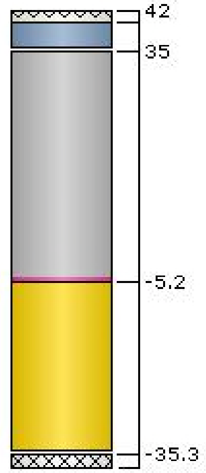
BB-FBR-102

XY Location:	BB-FBR-102: (1.02063e+06, 326088)			
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Upper Marine Sand	5.4	40	Yes
2	Marine Clay Crust	7	34.6	No
3	Abutment 2 Clay	0	27.6	Yes
4	Abutment 1 Upper Clay	13.2	27.6	No
5	Abutment 1 Lower Clay	20.3	14.4	Yes
6	Lower Marine Sand	5.2	-5.9	No



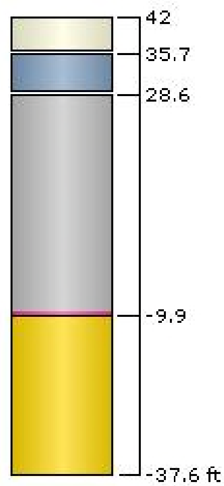
BB-FBR-103A

XY Location:		BB-FBR-103A: (1.02074e+06, 326019)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Upper Marine Sand	0	40	Yes
2	Marine Clay Crust	5	40	No
3	Abutment 2 Clay	40.2	35	Yes
4	Abutment 1 Upper Clay	0	-5.2	No
5	Abutment 1 Lower Clay	0	-5.2	Yes
6	Lower Marine Sand	30.1	-5.2	No



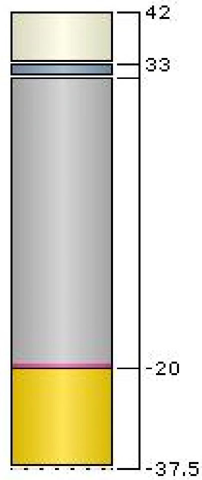
BB-FBR-104

XY Location:		BB-FBR-104: (1.02084e+06, 325952)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Upper Marine Sand	6.3	42	Yes
2	Marine Clay Crust	7.1	35.7	No
3	Abutment 2 Clay	38.5	28.6	Yes
4	Abutment 1 Upper Clay	0	-9.9	No
5	Abutment 1 Lower Clay	0	-9.9	Yes
6	Lower Marine Sand	27.7	-9.9	No



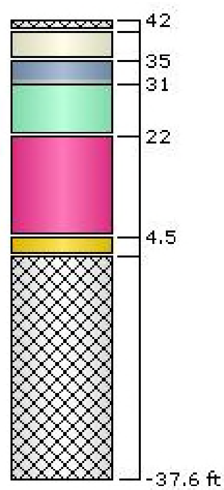
BB-FBR-106

XY Location:	BB-FBR-106: (1.02081e+06, 325902)			
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Upper Marine Sand	9	42	Yes
2	Marine Clay Crust	2.5	33	No
3	Abutment 2 Clay	50.5	30.5	Yes
4	Abutment 1 Upper Clay	0	-20	No
5	Abutment 1 Lower Clay	0	-20	Yes
6	Lower Marine Sand	17.5	-20	No



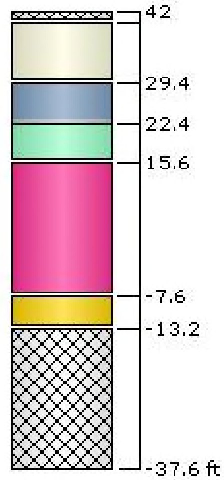
CPT-FBR-101

XY Location:	CPT-FBR-101: (1.02056e+06, 326028)			
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Upper Marine Sand	5	40	Yes
2	Marine Clay Crust	4	35	No
3	Abutment 2 Clay	0	31	Yes
4	Abutment 1 Upper Clay	9	31	No
5	Abutment 1 Lower Clay	17.5	22	Yes
6	Lower Marine Sand	3.3	4.5	No



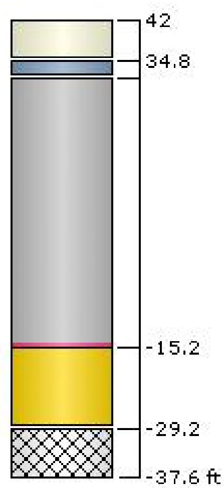
CPT-FBR-102

XY Location:		CPT-FBR-102: (1.02059e+06, 326052)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Upper Marine Sand	10.6	40	Yes
2	Marine Clay Crust	7	29.4	No
3	Abutment 2 Clay	0	22.4	Yes
4	Abutment 1 Upper Clay	6.8	22.4	No
5	Abutment 1 Lower Clay	23.2	15.6	Yes
6	Lower Marine Sand	5.6	-7.6	No



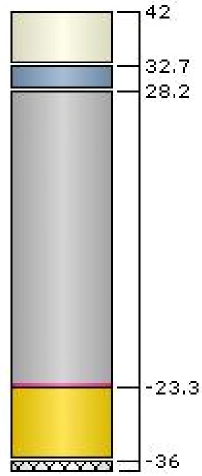
CPT-FBR-103

XY Location:		CPT-FBR-103: (1.0208e+06, 325881)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Upper Marine Sand	7.2	42	Yes
2	Marine Clay Crust	3	34.8	No
3	Abutment 2 Clay	47	31.8	Yes
4	Abutment 1 Upper Clay	0	-15.2	No
5	Abutment 1 Lower Clay	0	-15.2	Yes
6	Lower Marine Sand	14	-15.2	No



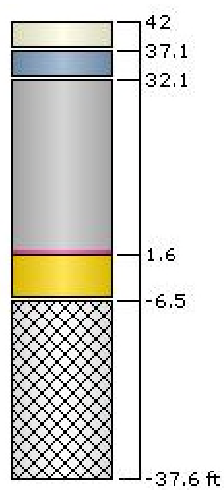
CPT-FBR-104

XY Location:		CPT-FBR-104: (1.02083e+06, 325906)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Upper Marine Sand	9.3	42	Yes
2	Marine Clay Crust	4.5	32.7	No
3	Abutment 2 Clay	51.5	28.2	Yes
4	Abutment 1 Upper Clay	0	-23.3	No
5	Abutment 1 Lower Clay	0	-23.3	Yes
6	Lower Marine Sand	12.7	-23.3	No



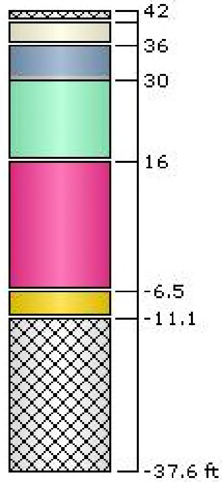
CPT-FBR-105

XY Location:		CPT-FBR-105: (1.02091e+06, 325843)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Upper Marine Sand	4.9	42	Yes
2	Marine Clay Crust	5	37.1	No
3	Abutment 2 Clay	30.5	32.1	Yes
4	Abutment 1 Upper Clay	0	1.6	No
5	Abutment 1 Lower Clay	0	1.6	Yes
6	Lower Marine Sand	8.1	1.6	No



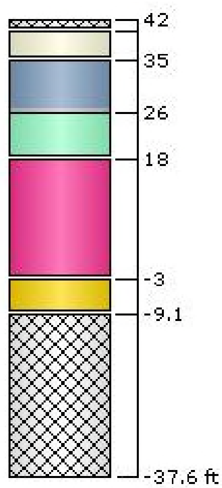
X1

XY Location:		X1: (1.02058e+06, 326242)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Upper Marine Sand	4	40	Yes
2	Marine Clay Crust	6	36	No
3	Abutment 2 Clay	0	30	Yes
4	Abutment 1 Upper Clay	14	30	No
5	Abutment 1 Lower Clay	22.5	16	Yes
6	Lower Marine Sand	4.6	-6.5	No



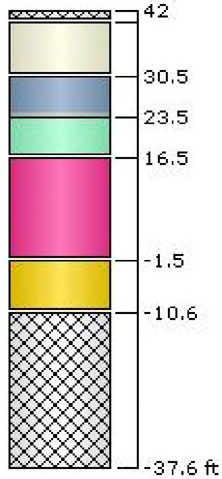
X2

XY Location:		X2: (1.02052e+06, 326161)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Upper Marine Sand	5	40	Yes
2	Marine Clay Crust	9	35	No
3	Abutment 2 Clay	0	26	Yes
4	Abutment 1 Upper Clay	8	26	No
5	Abutment 1 Lower Clay	21	18	Yes
6	Lower Marine Sand	6.1	-3	No



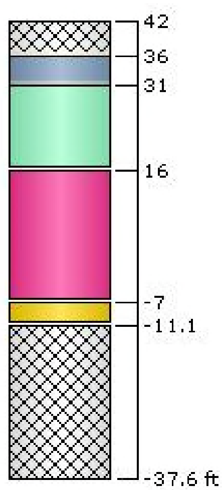
X3

XY Location:		X3: (1.02046e+06, 326072)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Upper Marine Sand	9.5	40	Yes
2	Marine Clay Crust	7	30.5	No
3	Abutment 2 Clay	0	23.5	Yes
4	Abutment 1 Upper Clay	7	23.5	No
5	Abutment 1 Lower Clay	18	16.5	Yes
6	Lower Marine Sand	9.1	-1.5	No



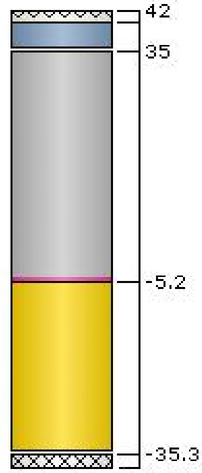
X4

XY Location:		X4: (1.02069e+06, 326170)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Upper Marine Sand	0	36	Yes
2	Marine Clay Crust	5	36	No
3	Abutment 2 Clay	0	31	Yes
4	Abutment 1 Upper Clay	15	31	No
5	Abutment 1 Lower Clay	23	16	Yes
6	Lower Marine Sand	4.1	-7	No



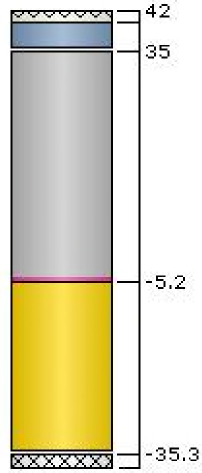
X5

XY Location:		X5: (1.02079e+06, 326074)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Upper Marine Sand	0	40	Yes
2	Marine Clay Crust	5	40	No
3	Abutment 2 Clay	40.2	35	Yes
4	Abutment 1 Upper Clay	0	-5.2	No
5	Abutment 1 Lower Clay	0	-5.2	Yes
6	Lower Marine Sand	30.1	-5.2	No



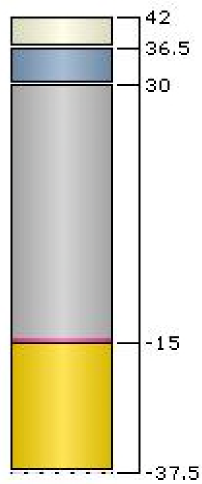
X6

XY Location:		X6: (1.02067e+06, 325973)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Upper Marine Sand	0	40	Yes
2	Marine Clay Crust	5	40	No
3	Abutment 2 Clay	40.2	35	Yes
4	Abutment 1 Upper Clay	0	-5.2	No
5	Abutment 1 Lower Clay	0	-5.2	Yes
6	Lower Marine Sand	30.1	-5.2	No



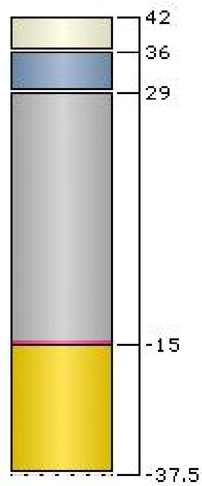
X7

XY Location:		X7: (1.02094e+06, 326009)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Upper Marine Sand	5.5	42	Yes
2	Marine Clay Crust	6.5	36.5	No
3	Abutment 2 Clay	45	30	Yes
4	Abutment 1 Upper Clay	0	-15	No
5	Abutment 1 Lower Clay	0	-15	Yes
6	Lower Marine Sand	22.5	-15	No



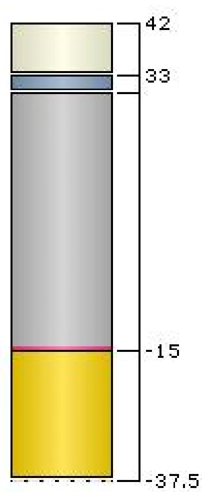
X8

XY Location:		X8: (1.02086e+06, 325944)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Upper Marine Sand	6	42	Yes
2	Marine Clay Crust	7	36	No
3	Abutment 2 Clay	44	29	Yes
4	Abutment 1 Upper Clay	0	-15	No
5	Abutment 1 Lower Clay	0	-15	Yes
6	Lower Marine Sand	22.5	-15	No



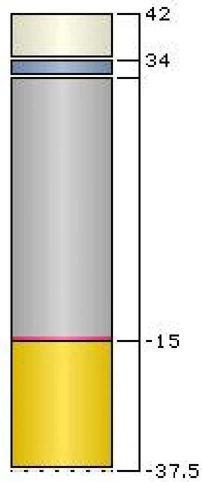
X9

XY Location:		X9: (1.02081e+06, 325916)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Upper Marine Sand	9	42	Yes
2	Marine Clay Crust	3	33	No
3	Abutment 2 Clay	45	30	Yes
4	Abutment 1 Upper Clay	0	-15	No
5	Abutment 1 Lower Clay	0	-15	Yes
6	Lower Marine Sand	22.5	-15	No



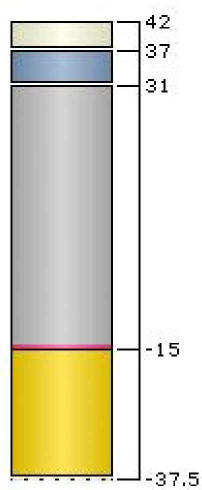
X10

XY Location:		X10: (1.02078e+06, 325892)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Upper Marine Sand	8	42	Yes
2	Marine Clay Crust	3	34	No
3	Abutment 2 Clay	46	31	Yes
4	Abutment 1 Upper Clay	0	-15	No
5	Abutment 1 Lower Clay	0	-15	Yes
6	Lower Marine Sand	22.5	-15	No



X11

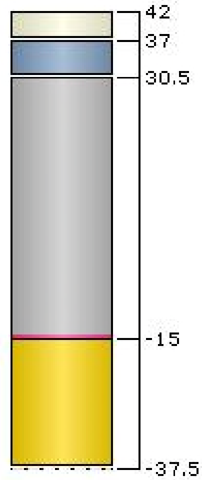
XY Location:		X11: (1.02097e+06, 325987)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Upper Marine Sand	5	42	Yes
2	Marine Clay Crust	6	37	No
3	Abutment 2 Clay	46	31	Yes
4	Abutment 1 Upper Clay	0	-15	No
5	Abutment 1 Lower Clay	0	-15	Yes
6	Lower Marine Sand	22.5	-15	No



X12

XY Location: X12: (1.0209e+06, 325917)

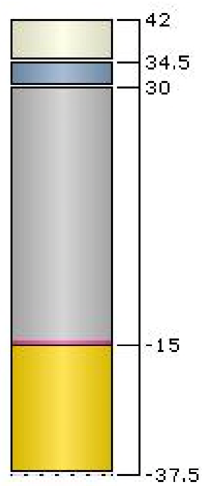
Layer #	Type	Thickness [ft]	Elevation [ft]	Drained at Bottom
1	Upper Marine Sand	5	42	Yes
2	Marine Clay Crust	6.5	37	No
3	Abutment 2 Clay	45.5	30.5	Yes
4	Abutment 1 Upper Clay	0	-15	No
5	Abutment 1 Lower Clay	0	-15	Yes
6	Lower Marine Sand	22.5	-15	No



X13

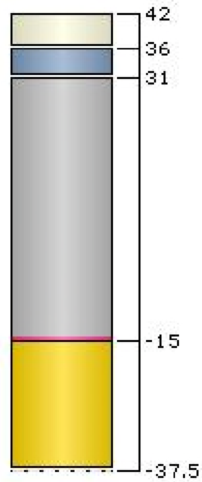
XY Location: X13: (1.02086e+06, 325883)

Layer #	Type	Thickness [ft]	Elevation [ft]	Drained at Bottom
1	Upper Marine Sand	7.5	42	Yes
2	Marine Clay Crust	4.5	34.5	No
3	Abutment 2 Clay	45	30	Yes
4	Abutment 1 Upper Clay	0	-15	No
5	Abutment 1 Lower Clay	0	-15	Yes
6	Lower Marine Sand	22.5	-15	No



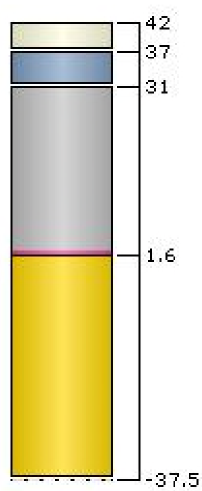
X14

XY Location:		X14: (1.02082e+06, 325861)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Upper Marine Sand	6	42	Yes
2	Marine Clay Crust	5	36	No
3	Abutment 2 Clay	46	31	Yes
4	Abutment 1 Upper Clay	0	-15	No
5	Abutment 1 Lower Clay	0	-15	Yes
6	Lower Marine Sand	22.5	-15	No



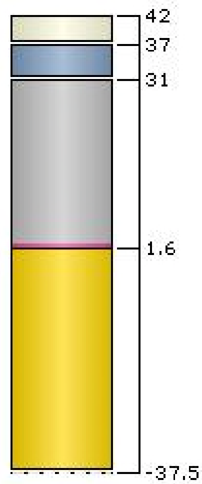
X15

XY Location:		X15: (1.02101e+06, 325962)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Upper Marine Sand	5	42	Yes
2	Marine Clay Crust	6	37	No
3	Abutment 2 Clay	29.4	31	Yes
4	Abutment 1 Upper Clay	0	1.6	No
5	Abutment 1 Lower Clay	0	1.6	Yes
6	Lower Marine Sand	39.1	1.6	No



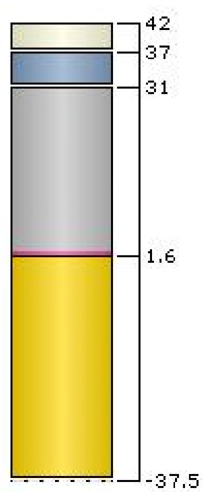
X16

XY Location:		X16: (1.02094e+06, 325891)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Upper Marine Sand	5	42	Yes
2	Marine Clay Crust	6	37	No
3	Abutment 2 Clay	29.4	31	Yes
4	Abutment 1 Upper Clay	0	1.6	No
5	Abutment 1 Lower Clay	0	1.6	Yes
6	Lower Marine Sand	39.1	1.6	No



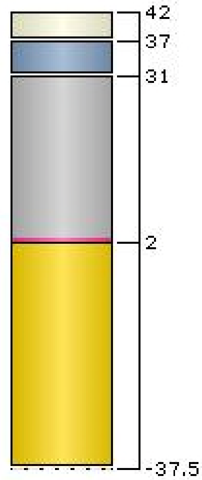
X17

XY Location:		X17: (1.02089e+06, 325820)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Upper Marine Sand	5	42	Yes
2	Marine Clay Crust	6	37	No
3	Abutment 2 Clay	29.4	31	Yes
4	Abutment 1 Upper Clay	0	1.6	No
5	Abutment 1 Lower Clay	0	1.6	Yes
6	Lower Marine Sand	39.1	1.6	No



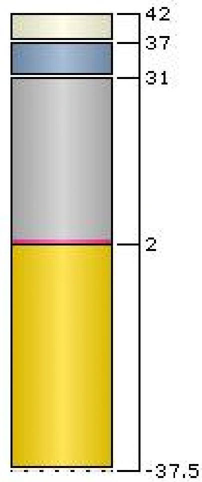
X18

XY Location:		X18: (1.02103e+06, 325944)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Upper Marine Sand	5	42	Yes
2	Marine Clay Crust	6	37	No
3	Abutment 2 Clay	29	31	Yes
4	Abutment 1 Upper Clay	0	2	No
5	Abutment 1 Lower Clay	0	2	Yes
6	Lower Marine Sand	39.5	2	No



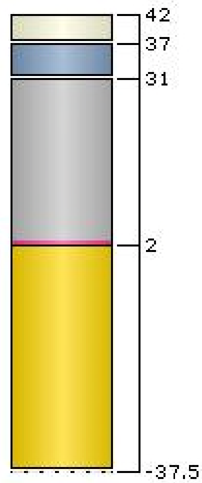
X19

XY Location:		X19: (1.02098e+06, 325865)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Upper Marine Sand	5	42	Yes
2	Marine Clay Crust	6	37	No
3	Abutment 2 Clay	29	31	Yes
4	Abutment 1 Upper Clay	0	2	No
5	Abutment 1 Lower Clay	0	2	Yes
6	Lower Marine Sand	39.5	2	No



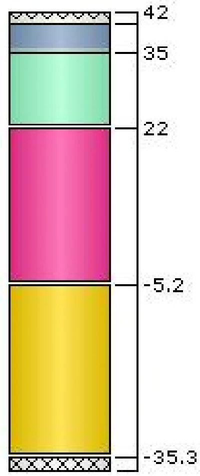
X20

XY Location:		X20: (1.02094e+06, 325789)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Upper Marine Sand	5	42	Yes
2	Marine Clay Crust	6	37	No
3	Abutment 2 Clay	29	31	Yes
4	Abutment 1 Upper Clay	0	2	No
5	Abutment 1 Lower Clay	0	2	Yes
6	Lower Marine Sand	39.5	2	No



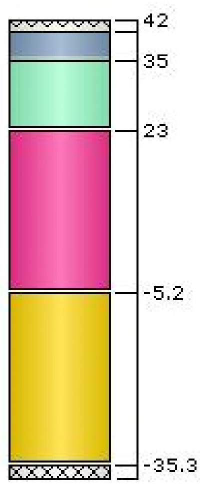
X5A

XY Location:		X5A: (1.02079e+06, 326077)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Upper Marine Sand	0	40	Yes
2	Marine Clay Crust	5	40	No
3	Abutment 2 Clay	0	35	Yes
4	Abutment 1 Upper Clay	13	35	No
5	Abutment 1 Lower Clay	27.2	22	Yes
6	Lower Marine Sand	30.1	-5.2	No



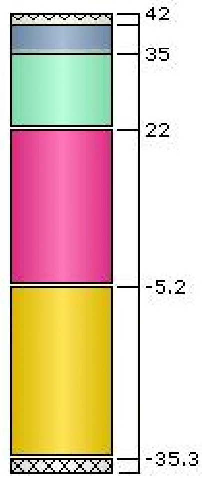
X6A

XY Location:		X6A: (1.02066e+06, 325977)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Upper Marine Sand	0	40	Yes
2	Marine Clay Crust	5	40	No
3	Abutment 2 Clay	0	35	Yes
4	Abutment 1 Upper Clay	12	35	No
5	Abutment 1 Lower Clay	28.2	23	Yes
6	Lower Marine Sand	30.1	-5.2	No



X21

XY Location:		X21: (1.02073e+06, 326023)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Upper Marine Sand	0	40	Yes
2	Marine Clay Crust	5	40	No
3	Abutment 2 Clay	0	35	Yes
4	Abutment 1 Upper Clay	13	35	No
5	Abutment 1 Lower Clay	27.2	22	Yes
6	Lower Marine Sand	30.1	-5.2	No



Soil Properties

Property	Upper Marine Sand	Marine Clay Crust	Abutment 2 Clay	Lower Marine Sand
Color				
Unit Weight [kips/ft3]	0.125	0.118	0.115	0.13
Saturated Unit Weight [kips/ft3]	0.125	0.118	0.115	0.13
Poisson's Ratio	0.3	0.3	0.3	0.35
K0	0.5	0.5	0.5	0.5
Primary Consolidation	Disabled	Enabled	Enabled	Disabled
Material Type		Non-Linear	Non-Linear	
Cce	-	0.23	0.23	-
Cre	-	0.02	0.02	-
e0	-	1.1	1.1	-
OCM [ksf]	-	3	0.9	-
Cv [ft2/d]	-	0.15	0.15	-
Cvr [ft2/d]	-	0.15	0.15	-
B-bar	-	1	1	-
Secondary Consolidation	Disabled	Standard	Standard	Disabled
Cae	-	0.008	0.008	-
Care	-	0.004	0.004	-
Undrained Su A [kips/ft2]	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8
Piezo Line ID	1	1	1	1

Property		Abutment 1 Upper Clay	Abutment 1 Lower Clay
Color			
Unit Weight [kips/ft3]		0.115	0.115
Saturated Unit Weight [kips/ft3]		0.115	0.115
Poisson's Ratio		0.3	0.3
K0		0.5	0.5
Primary Consolidation		Enabled	Enabled
Material Type		Non-Linear	Non-Linear
Cce		0.23	0.23
Cre		0.02	0.02
e0		1.1	1.1
OCM [ksf]	top	1.1	1.5
	bottom	-	1.2
Cv [ft2/d]		0.15	0.15
Cvr [ft2/d]		0.15	0.15
B-bar		1	1
Secondary Consolidation		Standard	Standard
Cae		0.008	0.008
Care		0.004	0.004
Undrained Su A [kips/ft2]		0	0
Undrained Su S		0.2	0.2
Undrained Su m		0.8	0.8
Piezo Line ID		1	1

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: 09.0026023.00
SUBJECT: Bucknam Road Bridge Stability Eval
SHEET: 1 OF 2
CALCULATED BY BMC 11/17/2021
CHECKED BY ARB 2/18/2022

Objective

Evaluate global stability of the proposed approach embankments at critical cross sections near the proposed abutments and in the longitudinal direction beneath each abutment using the profile and properties shown in the Interpretive Subsurface Profile and Design Profile and Cross Sections for the Bucknam Road Bridge replacement.

References

1. American Association of State Highway and Transportation Officials, AASHTO LRFD Bridge Design Specifications: Customary U.S. Units, 9th edition, 2020. (AASHTO LRFD)
2. Hynes-Griffin and Franklin (1984), "Rationalizing the seismic coefficient method," Miscellaneous Paper GL-84-13, U.S. Army Corps of Engineers Waterway Experiment Station, Vicksburg, Mississippi.
3. Kramer (1996), "Geotechnical Earthquake Engineering," Prentice-Hall, Inc., Upper Saddle River, NY.

Analysis

Soil Properties

Friction angles were developed for granular materials based on corrected N60 blow counts of existing materials or anticipated/MaineDOT BDG design properties of new fills. Shear strengths and unit weights of marine clay were developed based on laboratory testing, field vane testing, and CPT correlations, and are shown on Figures 3. 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.

Pseudostatic Analysis

The minimum factor of safety for global stability is selected as 1.0, which is recommended by Hynes-Griffin and Franklin (1984), referenced in Geotechnical Earthquake Engineering (1996). The pseudostatic analysis includes an additional earthquake load by incorporating the horizontal seismic coefficient, kh, as defined in AASHTO 11.6.5.2.2 and recommended by Hynes-Griffin and Franklin using the Newmark method as half of the maximum peak ground acceleration at the ground surface (see seismic analysis). This criterion is considered suitable to limit potential for large deformation of the embankments, which is considered suitable for this Extreme Event scenario.

GZA evaluated the stability of the proposed approach embankments using the computer analytical software *Slope/W 2020*, developed by Geo-Slope International, based on the Modified Bishop method.

Longitudinal Analysis

The analyzed profiles considered the interpreted typical subsurface conditions along the project baseline both with and without the beneficial reinforcing effect of the proposed new HP14x117 piles. Supporting Broms calculations are attached for the HP 14x117 in weak axis bending. 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
1	Static (no reinforcement)	1.4	1.5
1	Static (with reinforcement)	1.9	1.5
2	Static (no reinforcement)	1.4	1.5
2	Static (with reinforcement)	1.6	1.5

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

Based on these results, the longitudinal global stability is sufficient if the reinforcement of the abutment HP 14x117 piles spaced at 8.2 feet are included.

Cross Section Analysis

The highest embankment and/or steepest side slopes are at the Abutment 1 and Abutment 2 approaches. The analyzed sections considered 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 22 foot wide travelway and auxiliary lane with a traffic surcharge load placed over the travelway and side slopes of 2H:1V. Between Station 9+25 and 10+25, the southern slope is proposed to be 1.5H:1V with a Turf Reinforced Mat (TRM) on the surface to minimize slope impacts beyond the limits of the Right of Way. Therefore, a section at Station 9+25 was evaluated in the left to right direction. Type D subbase gravel was modelled with a friction angle of 36 degrees as provided for gravel borrow in the BDG.

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
4+00 Right to Left	Static	1.7	1.3
4+00 Left to Right	Static	1.5	1.3
7+00 Right to Left	Static	1.4	1.3
7+00 Left to Right	Static	1.3	1.3
7+00 Left to Right	Pseudostatic	1.1	1.0
9+25 Left to Right	Static	1.6	1.3

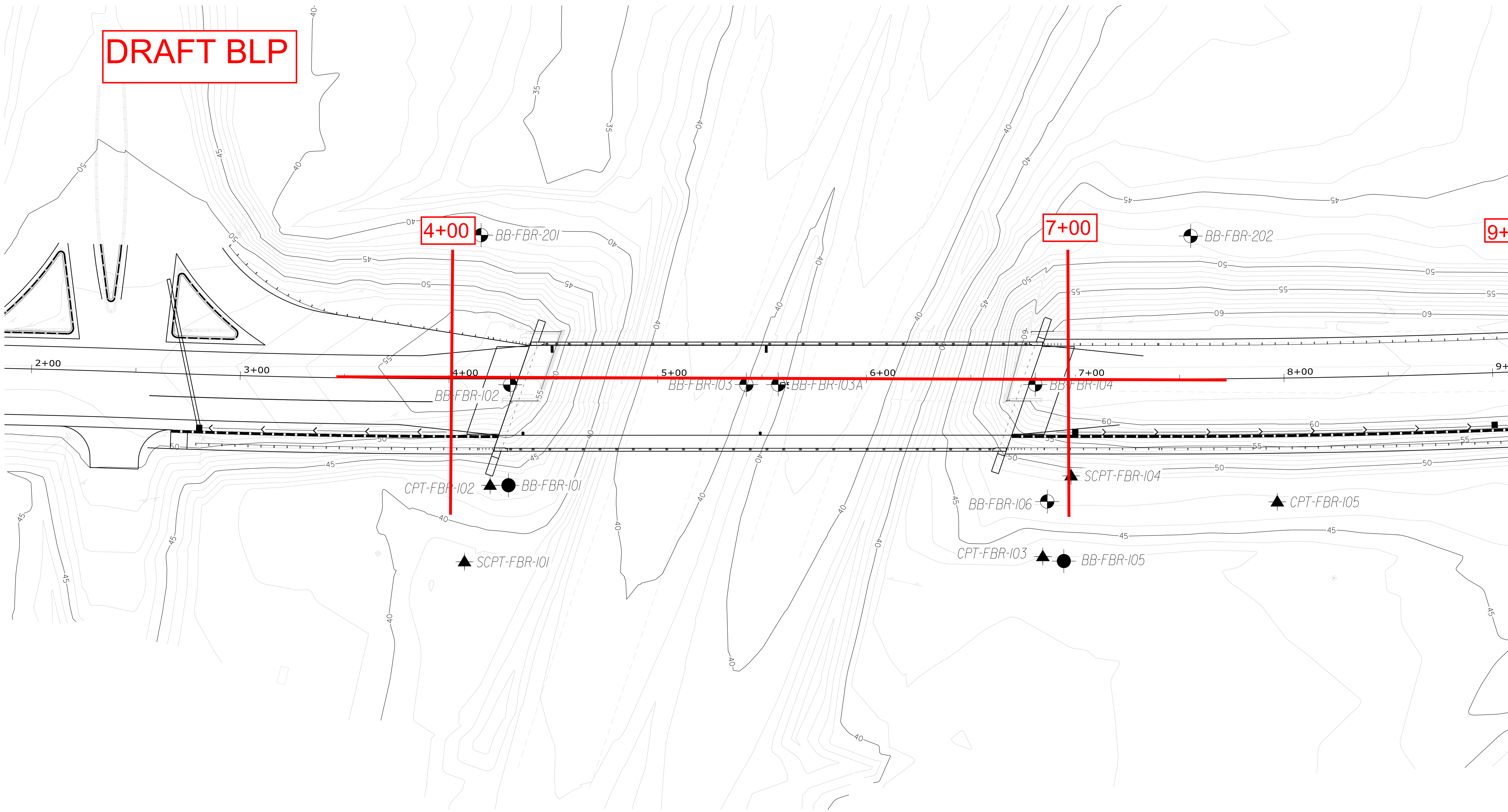
Based on these results, global stability is suitable for both approach embankments. Station 7+00 Left to Right was also analyzed for pseudostatic analysis.

Conclusion

1. Longitudinal: The global stability meets the minimum required criteria for static conditions in both directions if the reinforcement of the abutment HP 14x117 piles spaced at 8.2 feet are included.

2. Cross Sections (4+00 and 7+00): The global stability meets the minimum required criteria for static and pseudostatic conditions.

3**. Cross Sections (9+25 Left to Right):** Although the factor of safety for deep seated instability is greater than 1.3, the model predicts a factor of safety as low as 1.1 infinite slope-type surfaces through the Type D gravel, where surfaces with FS<1.3 extend approximately 2 feet beyond the slope face. In our opinion, the TRM will mitigate the potential for these shallow slip surfaces. It is also noted that the effective friction angle for compacted Type D gravel is likely 40 degrees or more, which would also mitigate instability of the 1.5:1 slope.



NOTES

1) Base map developed from electronic files (Files included Alignments.dgn, Bridge.dgn Points.dgn, text.dgn, topo.dgn, and contours.dgn) provided by Hoyle, Tanner & Associates, Inc October 29, 2021.

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

LEGEND

BB-FBR-106 — Indicates -100 series borings performed by New England Boring Contractors of Hermon, Maine between June 16, and June 26, 2019 and observed by GZA personnel.

BB-FBR-202 — Indicates -200 series borings performed by New England Boring Contractors of Hermon, Maine from September 1 to 2, 2020 and observed by GZA personnel.

BB-FBR-105 — Indicates borings performed by Summit Geoengineering Services, Inc. of Rockland, Maine between May 22, and May 23, 2019 and observed by GZA personnel.

CPT-FBR-105 — Indicates cone penetration tests (CPTs) performed by Summit Geoengineering Services, Inc. of Rockland, Maine between May 21, and May 23, 2019 ("S" indicates seismic testing was performed).

PLAN

25 0 25 50
Scale

Division: Bridge
Filename: ...\BLP\Bucknam BLP.dgn

Date: 11/11/2021
Username: BMC

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

021720.00

WIN 21720.00

BRIDGE NO. 5830

BRIDGE PLANS

SIGNATURE

P.E. NUMBER

DATE

PROJ. MANAGER
DESIGN-DETAILED
CHECKED-REVIEWED
DESIGN2-DETAILED2
DESIGN3-DETAILED3
REVISIONS 1
REVISIONS 2
REVISIONS 3
REVISIONS 4
FIELD CHANGES

BY: BMC

DATE: 11/2021

BUCKNAM ROAD BRIDGE
INTERSTATE 295
FALMOUTH CUMBERLAND COUNTY

BORING LOCATION PLAN

PREPARED BY:

SHEET NUMBER

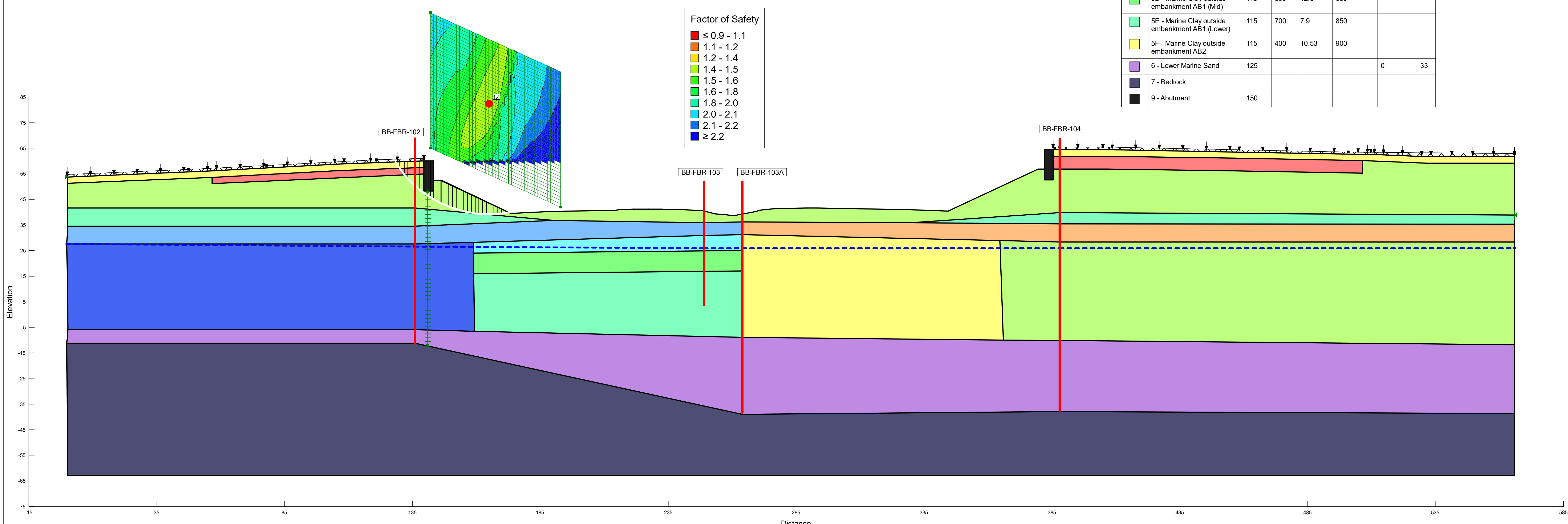
2

Abutment 1 - Static, Without Piles

File Name: Abutments 10.15.2021.gsz
Date: 11/19/2021
P:\09 Jobs\0026000s\09.0026023.00 - MEDOT - Bucknam Rd - Falmouth\Work\calcs\Stability\

Method: Morgenstern-Price
Surcharge (Unit Weight): 250 pcf (1 ft thick)

Color	Name	Unit Weight (pcf)	C-Top of Layer (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Cohesion' (psf)	Phi' (°)
	1 - New Fill	125				0	34
	1A - ULFGA	20				0	40
	2 - Existing Fill	125				0	31
	3 - Upper Marine Sand	120				0	32
	4A - Marine Clay Crust (AB 1)	118				1,000	0
	4A - Marine Clay Crust (AB 2)	118	750	14.29	870		
	5A - Marine Clay under embankment AB1	115	640	5.8	900		
	5B - Marine Clay under embankment AB2	115	620	5.7	1,000		
	5C - Marine Clay outside embankment AB1 (Upper)	115	750	10	850		
	5D - Marine Clay outside embankment AB1 (Mid)	115	500	12.5	650		
	5E - Marine Clay outside embankment AB1 (Lower)	115	700	7.9	850		
	5F - Marine Clay outside embankment AB2	115	400	10.53	900		
	6 - Lower Marine Sand	125				0	33
	7 - Bedrock						
	9 - Abutment	150					



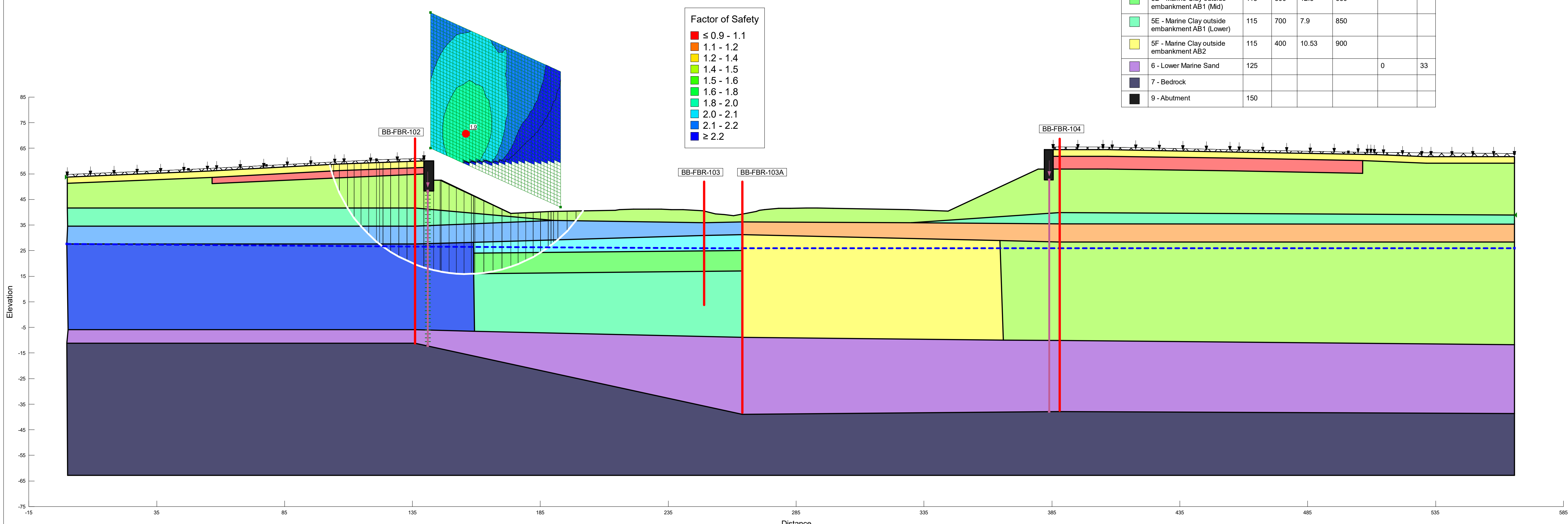
Abutment 1 - Static, With Piles

File Name: Abutments 10.15.2021.gsz
Date: 02/01/2022
P:\09 Jobs\0026000s\09.0026023.00 - MEDOT - Bucknam Rd - Falmouth\Work\calcs\Stability\

Method: Morgenstern-Price
Surcharge (Unit Weight): 250 pcf (1 ft thick)

Reinforcement Piles:
Shear Force: 44,500 lbf
Out-of-Plane Spacing: 8.2 ft

Color	Name	Unit Weight (pcf)	C-Top of Layer (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Cohesion' (psf)	Phi' (°)
	1 - New Fill	125				0	34
	1A - ULFGA	20				0	40
	2 - Existing Fill	125				0	31
	3 - Upper Marine Sand	120				0	32
	4A - Marine Clay Crust (AB 1)	118				1,000	0
	4A - Marine Clay Crust (AB 2)	118	750	14.29	870		
	5A - Marine Clay under embankment AB1	115	640	5.8	900		
	5B - Marine Clay under embankment AB2	115	620	5.7	1,000		
	5C - Marine Clay outside embankment AB1 (Upper)	115	750	10	850		
	5D - Marine Clay outside embankment AB1 (Mid)	115	500	12.5	650		
	5E - Marine Clay outside embankment AB1 (Lower)	115	700	7.9	850		
	5F - Marine Clay outside embankment AB2	115	400	10.53	900		
	6 - Lower Marine Sand	125				0	33
	7 - Bedrock						
	9 - Abutment	150					

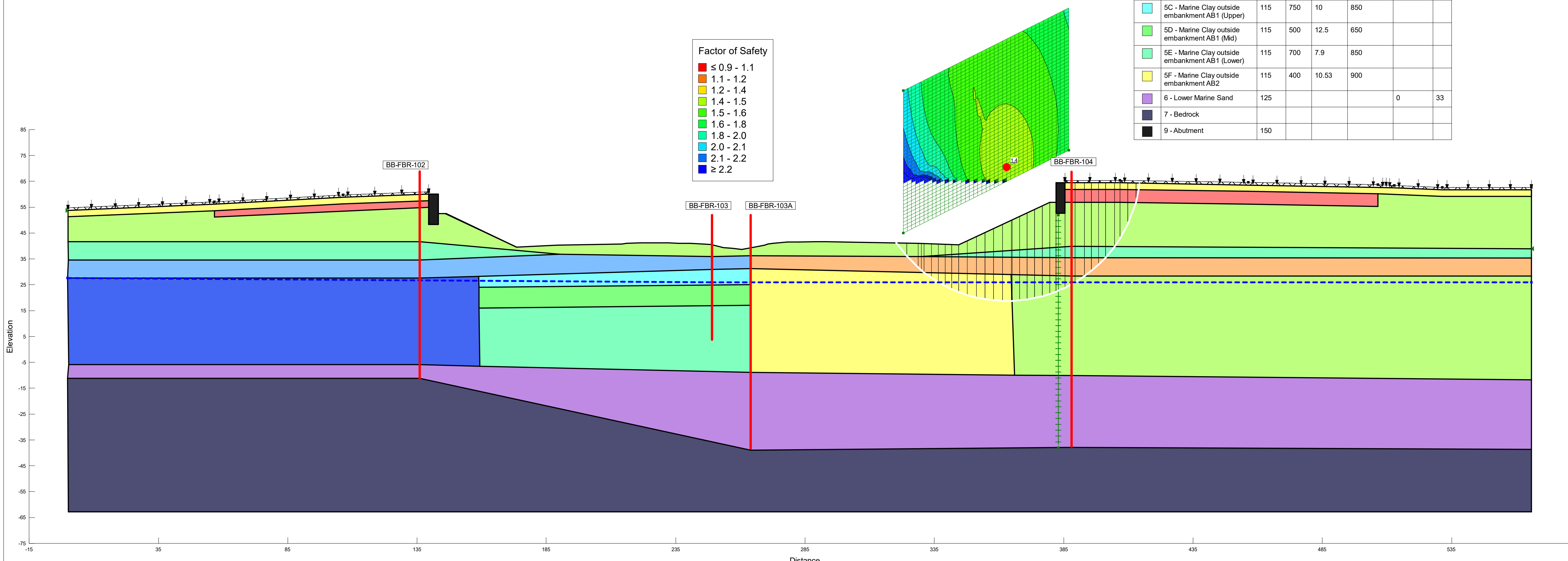


Abutment 2 - Static, Without Piles

File Name: Abutments 10.15.2021.gsz
Date: 11/19/2021
P:\09 Jobs\0026000s\09.0026023.00 - MEDOT - Bucknam Rd - Falmouth\Work\calcs\Stability\

Method: Morgenstern-Price
Surcharge (Unit Weight): 250 pcf (1 ft thick)

Color	Name	Unit Weight (pcf)	C-Top of Layer (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Cohesion' (psf)	Phi' (°)
	1 - New Fill	125				0	34
	1A - ULFGA	20				0	40
	2 - Existing Fill	125				0	31
	3 - Upper Marine Sand	120				0	32
	4A - Marine Clay Crust (AB 1)	118				1,000	0
	4A - Marine Clay Crust (AB 2)	118	750	14.29	870		
	5A - Marine Clay under embankment AB1	115	640	5.8	900		
	5B - Marine Clay under embankment AB2	115	620	5.7	1,000		
	5C - Marine Clay outside embankment AB1 (Upper)	115	750	10	850		
	5D - Marine Clay outside embankment AB1 (Mid)	115	500	12.5	650		
	5E - Marine Clay outside embankment AB1 (Lower)	115	700	7.9	850		
	5F - Marine Clay outside embankment AB2	115	400	10.53	900		
	6 - Lower Marine Sand	125				0	33
	7 - Bedrock						
	9 - Abutment	150					



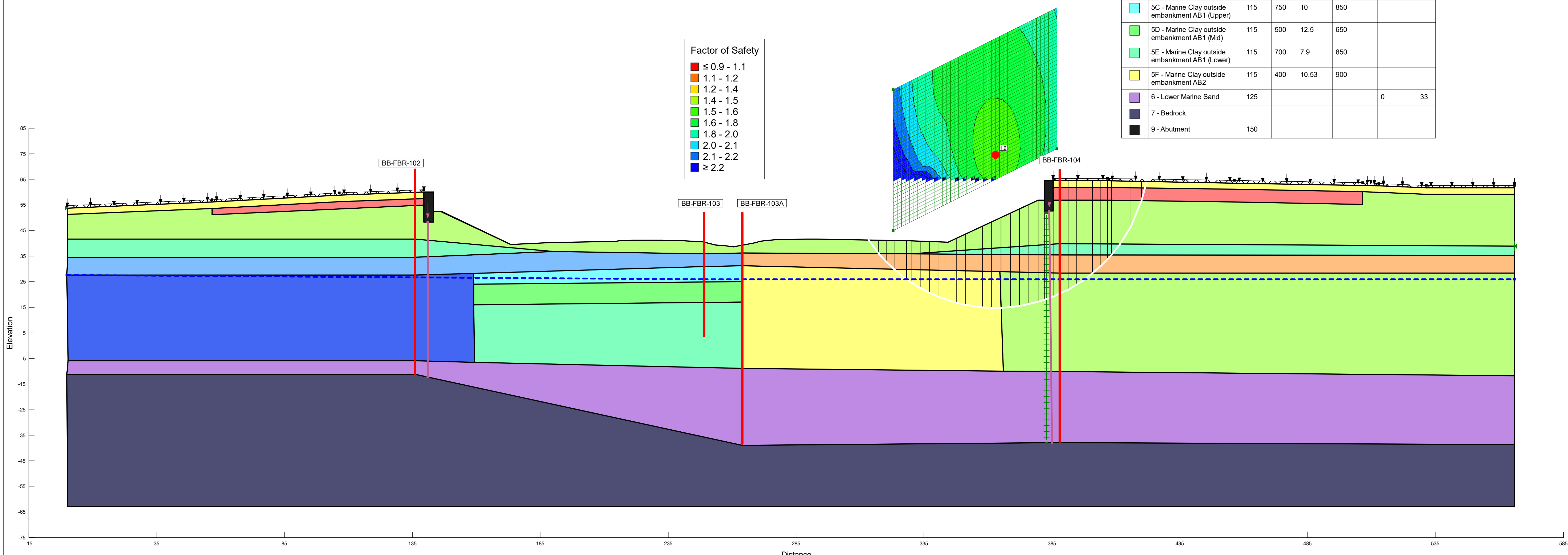
Abutment 2 - Static, With Piles

File Name: Abutments 10.15.2021.gsz
Date: 02/01/2022
P:\09 Jobs\0026000s\09.0026023.00 - MEDOT - Bucknam Rd - Falmouth\Work\calcs\Stability\

Method: Morgenstern-Price
Surcharge (Unit Weight): 250 pcf (1 ft thick)

Reinforcement Piles:
Shear Force: 44,500 lbf
Out-of-Plane Spacing: 8.2 ft

Color	Name	Unit Weight (pcf)	C-Top of Layer (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Cohesion' (psf)	Phi' (°)
	1 - New Fill	125				0	34
	1A - ULFGA	20				0	40
	2 - Existing Fill	125				0	31
	3 - Upper Marine Sand	120				0	32
	4A - Marine Clay Crust (AB 1)	118				1,000	0
	4A - Marine Clay Crust (AB 2)	118	750	14.29	870		
	5A - Marine Clay under embankment AB1	115	640	5.8	900		
	5B - Marine Clay under embankment AB2	115	620	5.7	1,000		
	5C - Marine Clay outside embankment AB1 (Upper)	115	750	10	850		
	5D - Marine Clay outside embankment AB1 (Mid)	115	500	12.5	650		
	5E - Marine Clay outside embankment AB1 (Lower)	115	700	7.9	850		
	5F - Marine Clay outside embankment AB2	115	400	10.53	900		
	6 - Lower Marine Sand	125				0	33
	7 - Bedrock						
	9 - Abutment	150					



GZA
GeoEnvironmental, Inc.
707 Sable Oaks Drive, Suite 150
South Portland, ME 04106
(207) 879-9190
http://www.gza.com

Engineers and Scientists

JOB 09.0026023.00 Bucknam Rd.

SHEET NO 1 OF 1

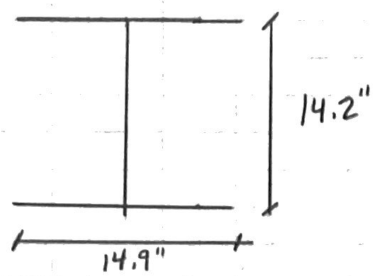
Calculated By B. CARDACI Date 2/1/22

Checked By ______ Date ______

Scale ______

EVALUATE LATERAL CAPACITY FOR NEW DRIVEN H-PILES

HP 14×117
(WEAK AXIS)



$\sigma_y = 50$ ksi

$I = 443\ in^4$

$C = \frac{14.9}{2} = 7.45$ in

FIND THE YIELD MOMENT

$$M_y = \frac{\sigma I}{C} = \frac{(50\ ksi)(443\ in^4)}{7.45\ in} = 2973.1\ k\text{-}in = 247.76\ k\text{-}Ft$$

FROM BROHMS METHOD FIGURE 16.8 FOR LONG PILES IN COHESIVE SOIL:

$$\text{ULTIMATE RESISTANCE MOMENT} = \frac{M_y}{S_u d^3} = \frac{247.76\ k\text{-}Ft}{(0.6\ ksf)\left(\frac{14.2}{12}\right)^3} = 249.2$$

FROM FIG 16.8:
(NEXT PAGE)

$$\frac{P_u}{S_u d^2} = 53 \implies P_u = (53)(0.6\ ksf)\left(\frac{14.2}{12}\right)^2 = 44.5\ kip$$

LATERAL CAPACITY OF NEW DRIVEN 14×117 PILE IS 44.5 kip. FOR THE 8.2 FT SPACING, THE RESULTING RESISTING FORCE IS APPROXIMATELY 5.4 kips PER FOOT APPLIED HORIZONTALLY AT THE POINT OF INTERSECTION WITH THE FAILURE SURFACE.

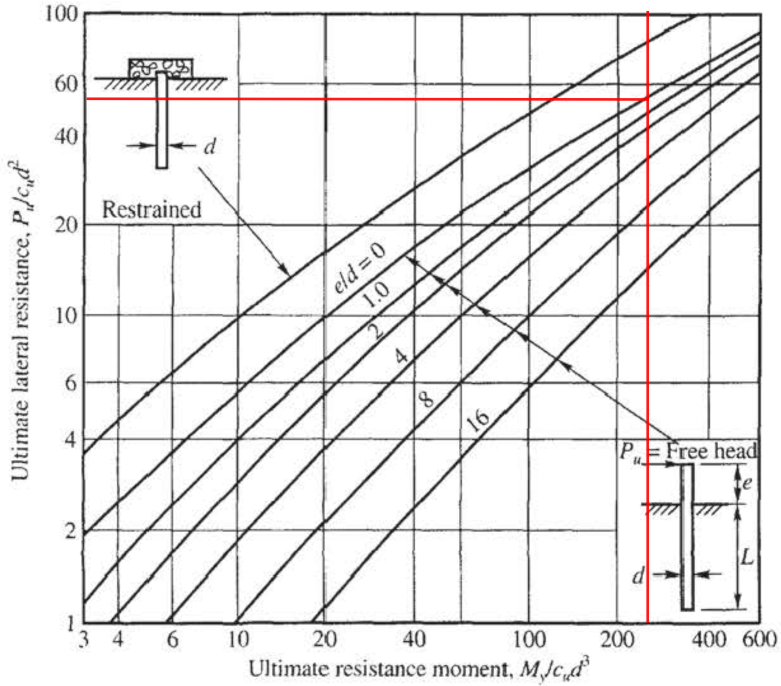


Figure 16.8 Ultimate lateral resistance of a long pile in cohesive soil related to embedded length (after Broms (1964a))

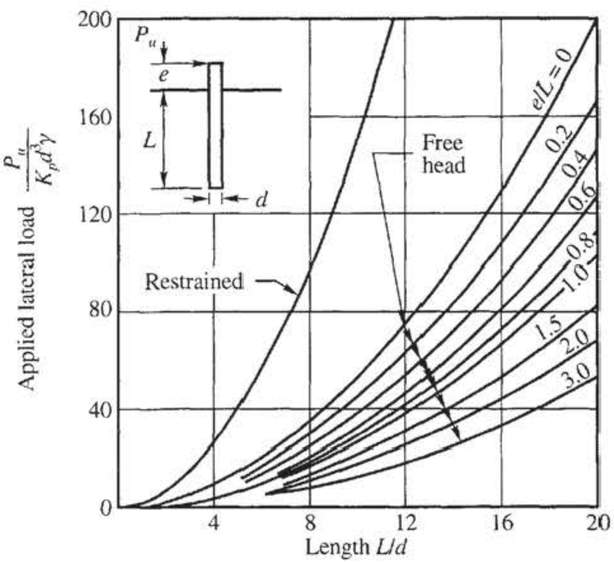


Figure 16.9 Ultimate lateral resistance of a short pile in cohesionless soil related to embedded length (after Broms (1964b))

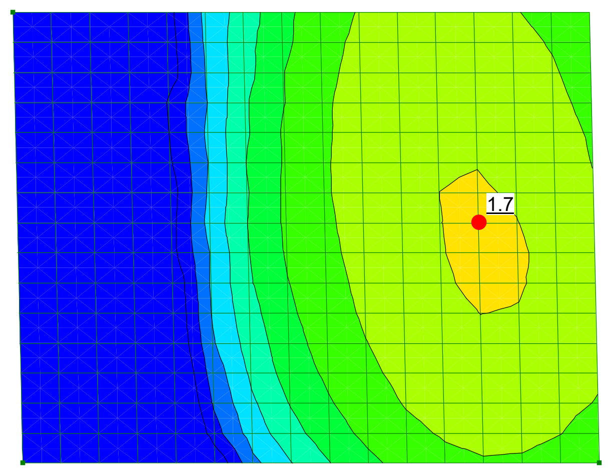
involves the yield moment M_y for the pile section. The equations suggested by Broms for computing M_y are as follows:

Marcel Dekker, Inc.
270 Madison Avenue, New York, New York 10016

Station 4+00 - Static

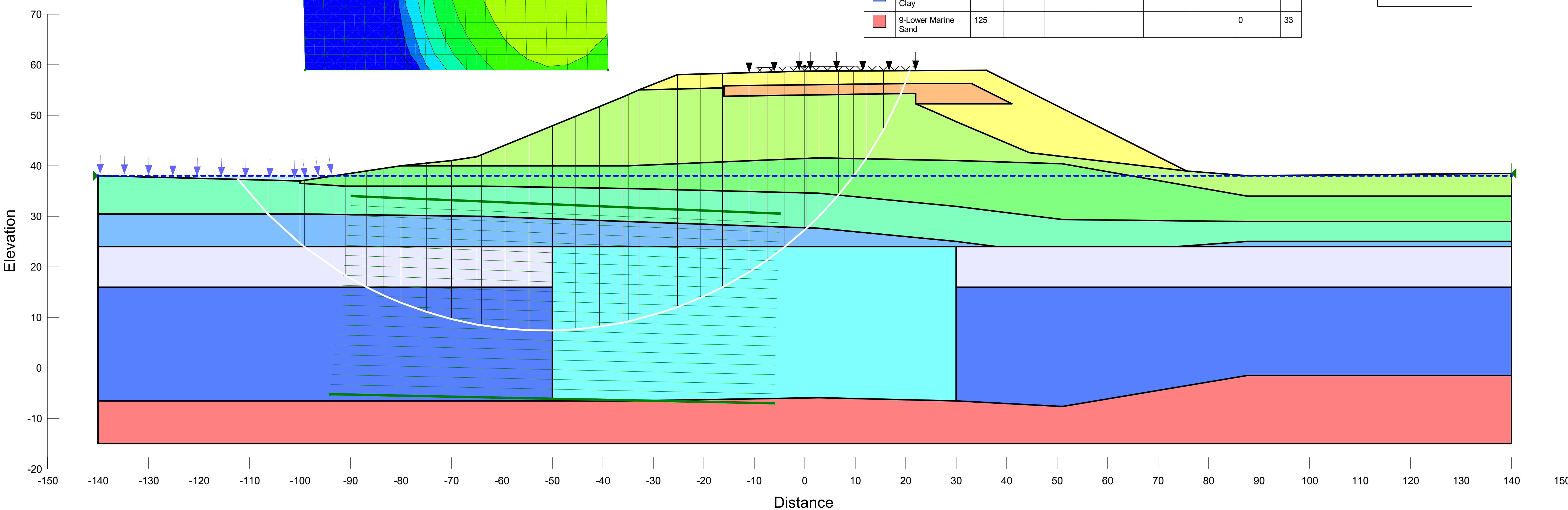
File Name: Bucknam Rd_AB 1_STA 4+00 - Slope Stability 10.15.2021.gsz
Date: 11/19/2021
P:\09 Jobs\0026000s\09.0026023.00 - MEDOT - Bucknam Rd - Falmouth\Work\calcs\Stability\

Method: Bishop
Surcharge (Unit Weight): 250 pcf (1 ft thick)



Color	Name	Unit Weight (pcf)	C-Datum (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Datum (Elevation) (ft)	Cohesion (psf)	Cohesion' (psf)	Phi' (°)
	10-ULFGA	25						0	40
	1-New Fill	125						0	34
	2-Existing Fill	125						0	31
	3-Upper Marine Sand	120						0	32
	4-Clay Crust	118					1,000		
	5-Marine Clay under Embankment	115	640	5.8	900	30			
	6-Upper Marine Clay	115	750	10	850	34			
	7-Mid Marine Clay	115	500	12.5	650	24			
	8-Lower Marine Clay	115	700	7.9	850	16			
	9-Lower Marine Sand	125						0	33

Factor of Safety
- ≤ 1.4 - 1.5
- 1.5 - 1.6
- 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

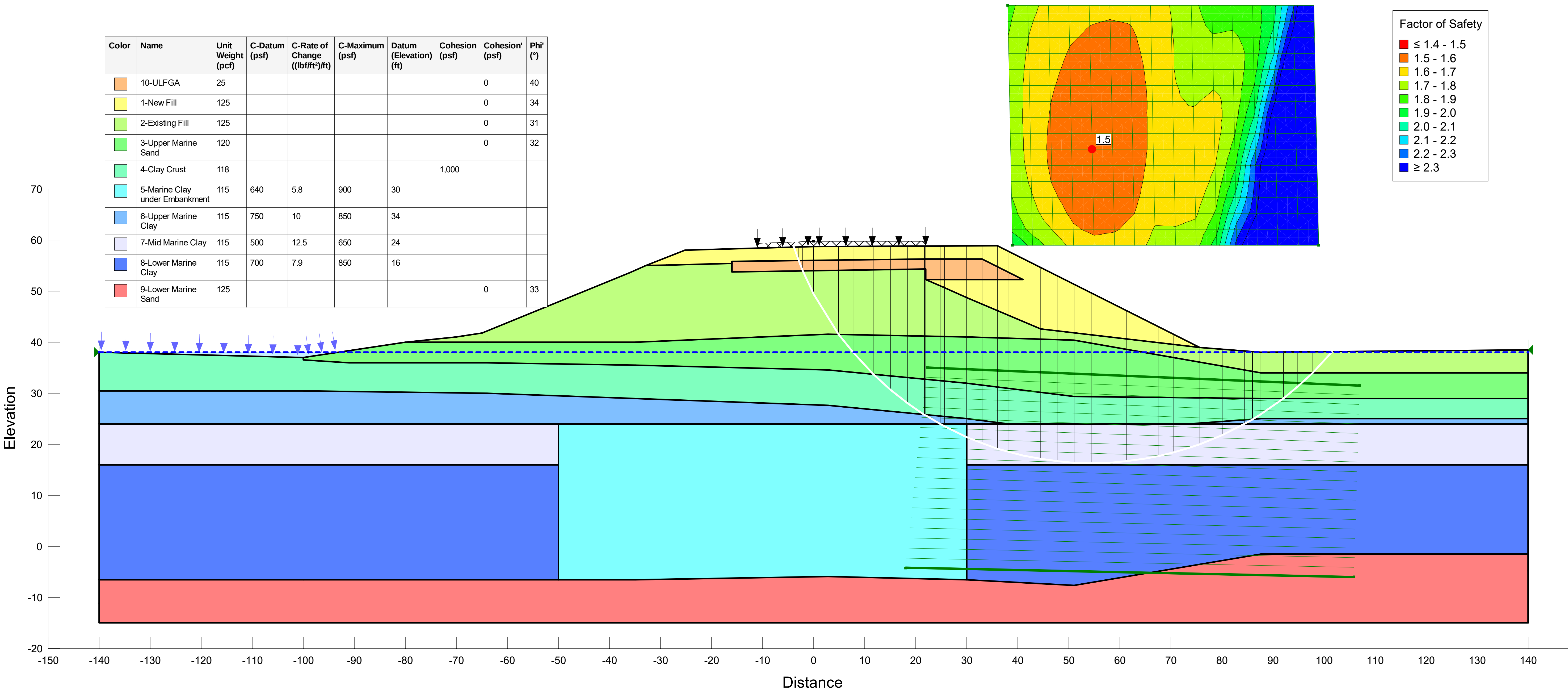


Station 4+00 - Static

File Name: Bucknam Rd_AB 1_STA 4+00 - Slope Stability 10.15.2021.gsz
Date: 11/19/2021
P:\09 Jobs\0026000s\09.0026023.00 - MEDOT - Bucknam Rd - Falmouth\Work\calcs\Stability\

Method: Bishop
Surcharge (Unit Weight): 250 pcf (1 ft thick)

Color	Name	Unit Weight (pcf)	C-Datum (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Datum (Elevation) (ft)	Cohesion (psf)	Cohesion' (psf)	Phi' (°)
	10-ULFGA	25						0	40
	1-New Fill	125						0	34
	2-Existing Fill	125						0	31
	3-Upper Marine Sand	120						0	32
	4-Clay Crust	118					1,000		
	5-Marine Clay under Embankment	115	640	5.8	900	30			
	6-Upper Marine Clay	115	750	10	850	34			
	7-Mid Marine Clay	115	500	12.5	650	24			
	8-Lower Marine Clay	115	700	7.9	850	16			
	9-Lower Marine Sand	125						0	33

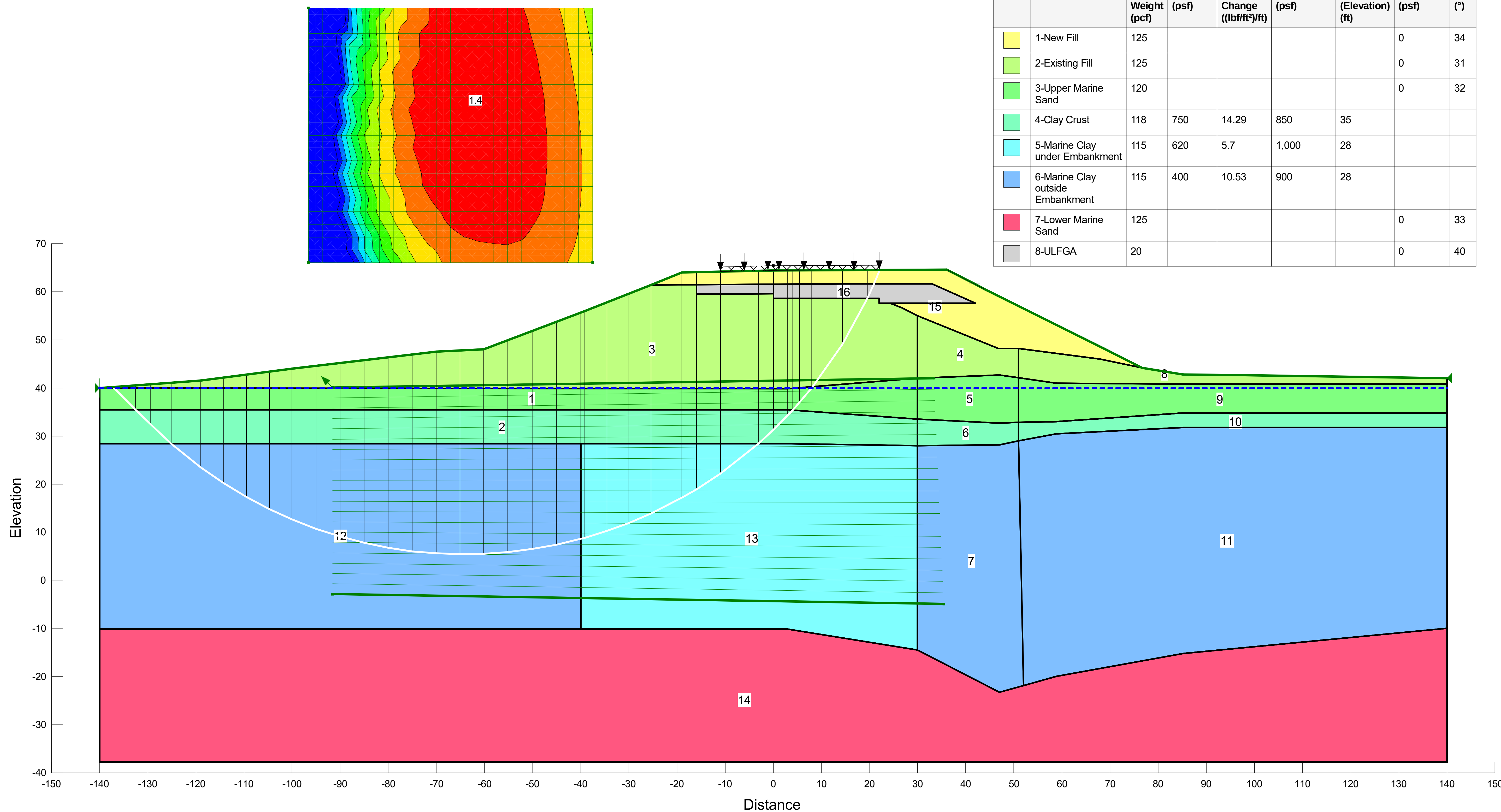


Station 7+00 - Static

File Name: Bucknam Rd_AB 2_STA 7+00 - Slope Stability 11.19.2021 V2.gsz
Date: 11/19/2021
P:\09 Jobs\0026000s\09.0026023.00 - MEDOT - Bucknam Rd - Falmouth\Work\calcs\Stability\

Method: Bishop
Surcharge (Unit Weight): 250 pcf (1 ft thick)

Color	Name	Unit Weight (pcf)	C-Datum (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Datum (Elevation) (ft)	Cohesion' (psf)	Phi' (°)
	1-New Fill	125					0	34
	2-Existing Fill	125					0	31
	3-Upper Marine Sand	120					0	32
	4-Clay Crust	118	750	14.29	850	35		
	5-Marine Clay under Embankment	115	620	5.7	1,000	28		
	6-Marine Clay outside Embankment	115	400	10.53	900	28		
	7-Lower Marine Sand	125					0	33
	8-ULFGA	20					0	40

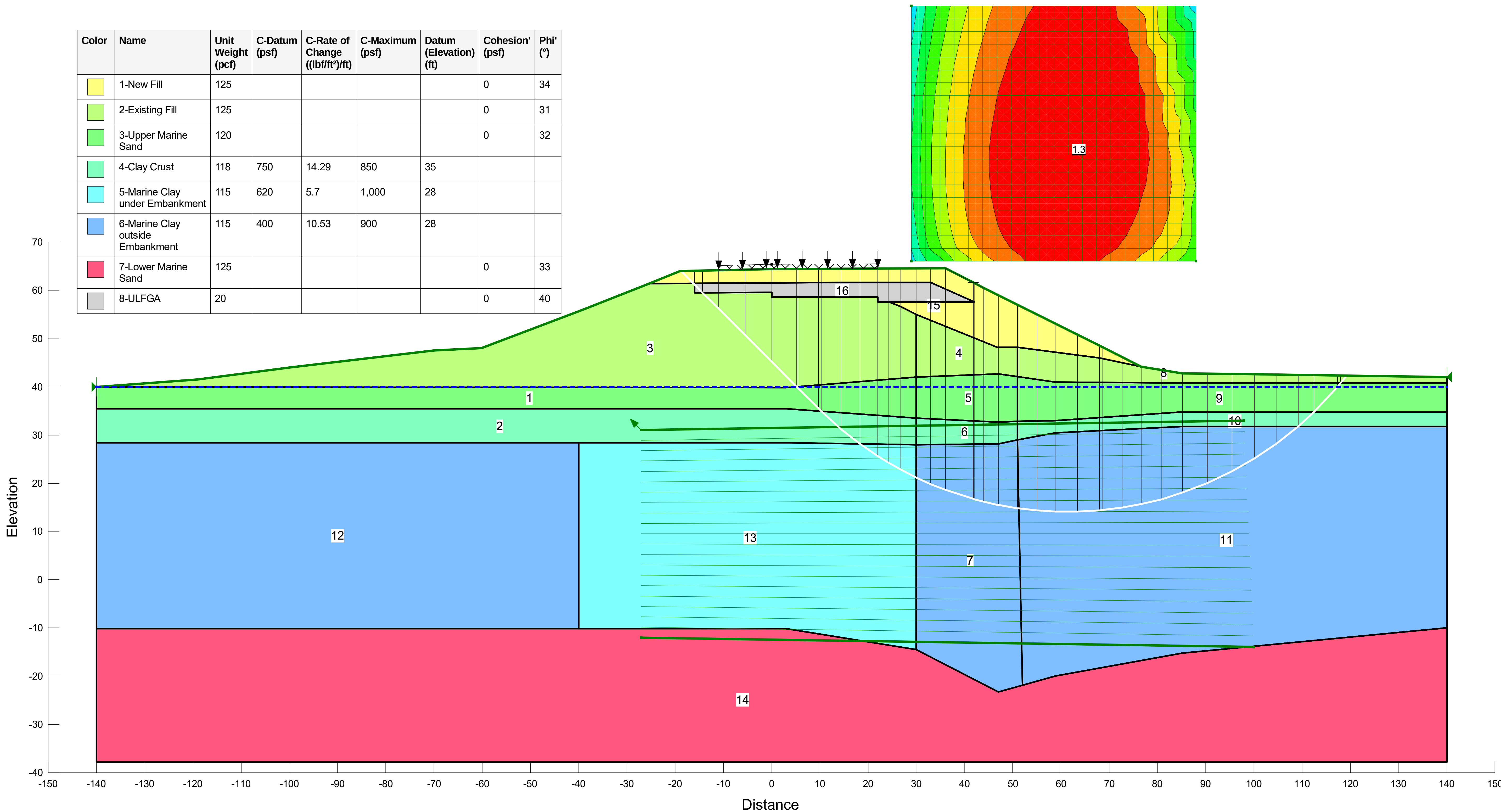


Station 7+00 - Static

File Name: Bucknam Rd_AB 2_STA 7+00 - Slope Stability 11.19.2021 V2.gsz
Date: 11/19/2021
P:\09 Jobs\0026000s\09.0026023.00 - MEDOT - Bucknam Rd - Falmouth\Work\calcs\Stability\

Method: Bishop
Surcharge (Unit Weight): 250 pcf (1 ft thick)

Color	Name	Unit Weight (pcf)	C-Datum (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Datum (Elevation) (ft)	Cohesion' (psf)	Phi' (°)
	1-New Fill	125					0	34
	2-Existing Fill	125					0	31
	3-Upper Marine Sand	120					0	32
	4-Clay Crust	118	750	14.29	850	35		
	5-Marine Clay under Embankment	115	620	5.7	1,000	28		
	6-Marine Clay outside Embankment	115	400	10.53	900	28		
	7-Lower Marine Sand	125					0	33
	8-ULFGA	20					0	40

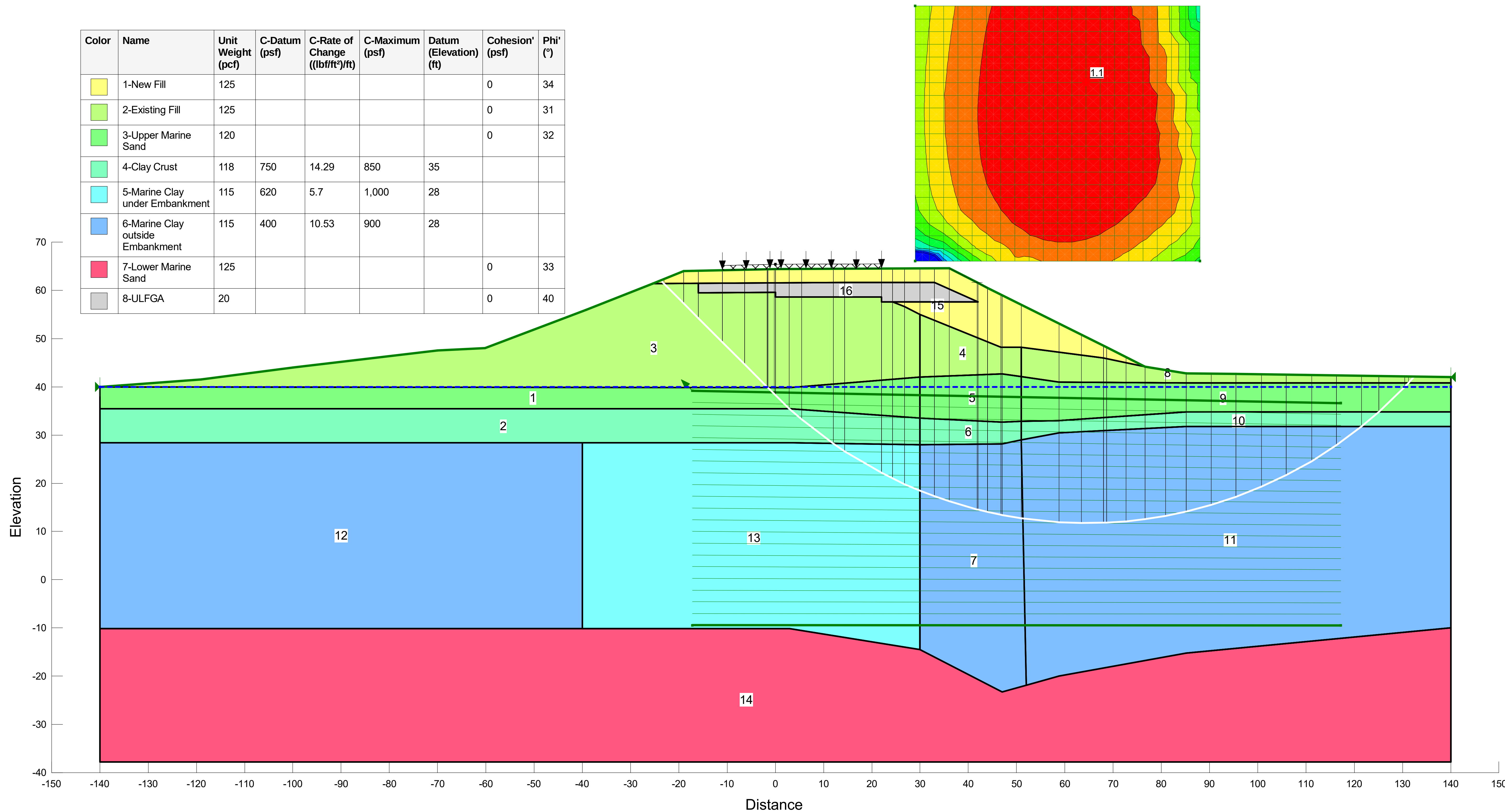


Station 7+00 - Pseudostatic

File Name: Bucknam Rd_AB 2_STA 7+00 - Slope Stability 11.19.2021 V2.gsz
Date: 11/19/2021
P:\09 Jobs\0026000s\09.0026023.00 - MEDOT - Bucknam Rd - Falmouth\Work\calcs\Stability\

Method: Bishop
Surcharge (Unit Weight): 250 pcf (1 ft thick)

Color	Name	Unit Weight (pcf)	C-Datum (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Datum (Elevation) (ft)	Cohesion' (psf)	Phi' (°)
	1-New Fill	125					0	34
	2-Existing Fill	125					0	31
	3-Upper Marine Sand	120					0	32
	4-Clay Crust	118	750	14.29	850	35		
	5-Marine Clay under Embankment	115	620	5.7	1,000	28		
	6-Marine Clay outside Embankment	115	400	10.53	900	28		
	7-Lower Marine Sand	125					0	33
	8-ULFGA	20					0	40

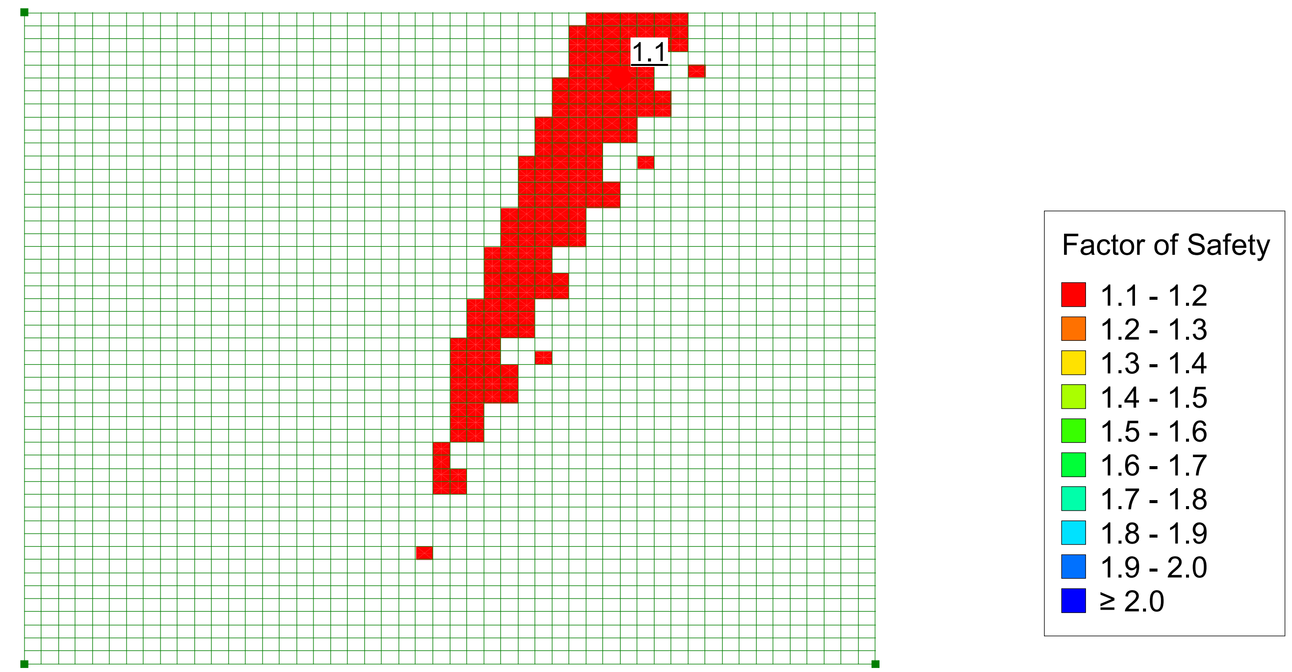


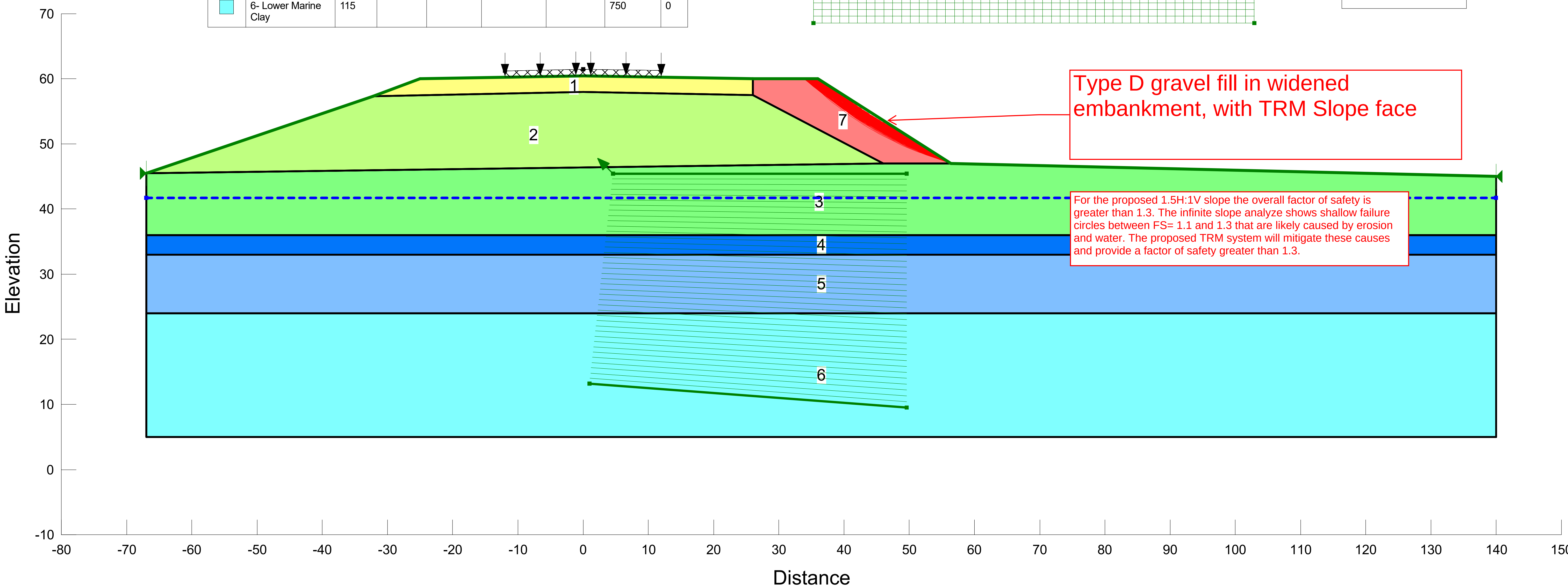
Station 9+25 - Static

File Name: Bucknam Rd_STA 9+25 - Slope Stability 11.11.2021.gsz
Date: 02/17/2022
P:\09 Jobs\0026000s\09.0026023.00 - MEDOT - Bucknam Rd - Falmouth\Work\calcs\Stability\

Method: Bishop
Surcharge (Unit Weight): 250 pcf (1 ft thick)

Color	Name	Unit Weight (pcf)	C-Datum (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Datum (Elevation) (ft)	Cohesion' (psf)	Phi' (°)
	1-New Fill	125					0	32
	1-New Fill (Type D Gravel)	135					0	36
	2-Existing Fill	125					0	32
	3-Upper Marine Sand	120					0	32
	4-Clay Crust	118					850	0
	5- Upper Marine Clay	115	400	10.53	900	28		
	6- Lower Marine Clay	115					750	0



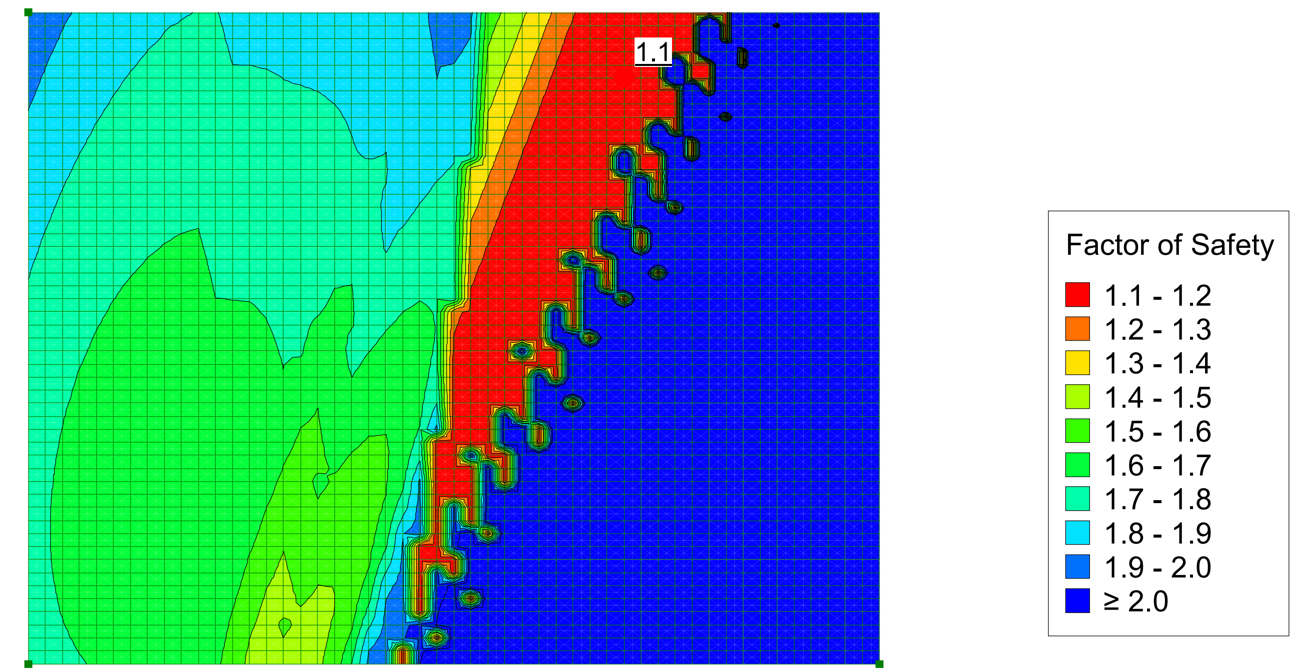


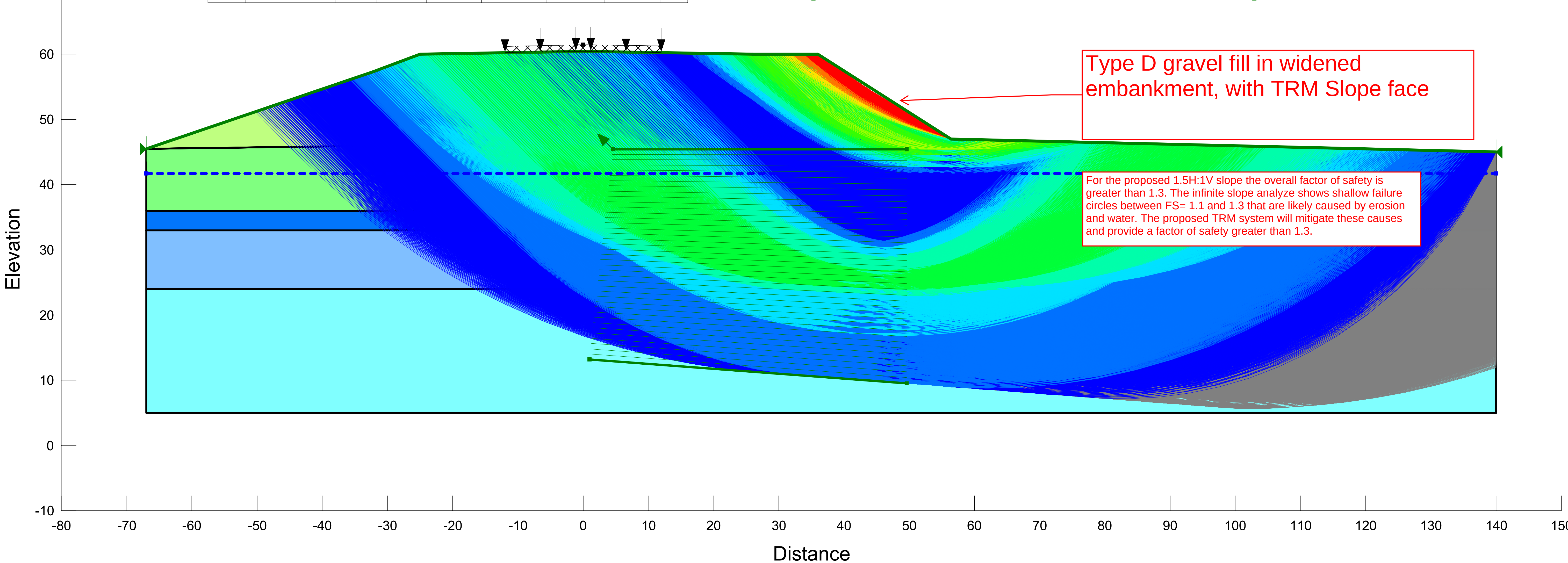
Station 9+25 - Static

File Name: Bucknam Rd_STA 9+25 - Slope Stability 11.11.2021.gsz
Date: 02/17/2022
P:\09 Jobs\0026000s\09.0026023.00 - MEDOT - Bucknam Rd - Falmouth\Work\calcs\Stability\

Method: Bishop
Surcharge (Unit Weight): 250 pcf (1 ft thick)

Color	Name	Unit Weight (pcf)	C-Datum (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Datum (Elevation) (ft)	Cohesion' (psf)	Phi' (°)
	1-New Fill	125					0	32
	1-New Fill (Type D Gravel)	135					0	36
	2-Existing Fill	125					0	32
	3-Upper Marine Sand	120					0	32
	4-Clay Crust	118					850	0
	5- Upper Marine Clay	115	400	10.53	900	28		
	6- Lower Marine Clay	115					750	0





Seismic

Seismic Site Class Calculation Summary

Project: Bucknam Road Bridge over I-295 **Project No.:** 09.0026023.00
Location: Falmouth, ME
Evaluated By/Date: ENT **Date** 11/8/2021
Checked By/Date: ARB **Date** 2/17/2022

Objective:
Determine seismic site class by performing calculations in accordance with the MaineDOT Bridge Manual 2003 Edition with updates in 2014, which references the AASHTO LRFD Seismic Bridge Design Specifications, 8th Edition.

Subsurface Data: CPT-FBR-101 through -105 were conducted by Summit Geoengineering Services between May 21 and 23, 2019. Downhole seismic testing was conducted at approximately 1-meter intervals in each CPT.

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 $\overline{N}$ and $\overline{s}_u$ 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 A 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	CPT-FBR-101	CPT-FBR-102	CPT-FBR-103	CPT-FBR-104	CPT-FBR-105
V_s	623	699	615	707.0	724.0

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.

Bucknam Road Bridge over I-295
Falmouth, ME

Calculated By: ENT Date: 11/8/2021
Checked By: ARB Date: 2/17/2022

INPUT

Exploration ID: **CPT-FBR-101** Ground Surface Elevation: 39.0 ft Depth of Boring: 43.8 ft

Depth to Bedrock: NE

CALCULATION

$\overline{V}$ = 622.9

Soil Strata	CPT Interval Depth Top, ft	Bottom, ft	SPT Elevation (mid-interval)	V_s	d_i	d_i / V_s	Comment
Marine Clay Crust	10.3	11.3	28.2	740	11.8	0.02	
	12.2	13.2	26.3	285	14.4	0.05	
Marine Clay	15.6	16.6	22.9	465	17.7	0.04	
	18.8	19.8	19.7	440	21.1	0.05	
	22.3	23.3	16.2	465	24.5	0.05	
	25.6	26.6	12.9	605	27.8	0.05	
	29.0	30.0	9.5	700	30.8	0.04	
	31.6	32.6	6.9	765	34.3	0.04	
	35.9	36.9	2.6	665	38.1	0.06	
	39.2	40.2	-0.7	740	41.4	0.06	
Lower Marine Sand	42.5	43.5	-4.0	620	43.4	0.07	
	43.3	44.3	-4.8	1170	44.1	0.04	
Bottom of Boring	43.8						

Bucknam Road Bridge over I-295
Falmouth, ME

Calculated By: ENT Date: 11/8/2021
Checked By: ARB Date: 2/17/2022

INPUT

Exploration ID: **CPT-FBR-102**   Ground Surface Elevation: 42.4 ft   Depth of Boring: 55.6 ft

Depth to Bedrock: NE

CALCULATION

$\overline{V}$ = 699.3

Soil Strata	CPT Interval Depth Top, ft	Bottom, ft	SPT Elevation (mid-interval)	V_s	d_i	d_i / V_s	Comment
Upper Marine Sand	10.1	11.1	31.8	575	12.1	0.02	
Marine Clay Crust	13.1	14.1	28.8	625	15.4	0.02	
	16.6	17.6	25.3	620	18.9	0.03	
Marine Clay	20.1	21.1	21.8	575	22.3	0.04	
	23.5	24.5	18.4	485	25.7	0.05	
	26.8	27.8	15.1	470	29.0	0.06	
	30.1	31.1	11.8	615	32.3	0.05	
	33.5	34.5	8.4	605	35.6	0.06	
	36.7	37.7	5.2	605	39.0	0.06	
	40.2	41.2	1.7	650	42.4	0.07	
	43.5	44.5	-1.6	765	45.6	0.06	
	46.7	47.7	-4.8	670	49.0	0.07	
Lower Marine Sand	50.2	51.2	-8.3	710	52.4	0.07	
	53.5	54.5	-11.6	960	54.8	0.06	
	55.1	56.1	-13.2	2305	55.9	0.02	
Bottom of Boring	55.6						

Bucknam Road Bridge over I-295
Falmouth, ME

Calculated By: ENT Date: 11/8/2021
Checked By: ARB Date: 2/17/2022

INPUT

Exploration ID: **CPT-FBR-103** Ground Surface Elevation: 42.8 ft Depth of Boring: 73.0 ft

Depth to Bedrock: NE

CALCULATION

$\overline{V}$ = 615.0

Soil Strata	CPT Interval Depth Top, ft	Bottom, ft	SPT Elevation (mid-interval)	V_s	d_i	d_i / V_s	Comment
Marine Clay	10.3	11.3	32.0	490	12.6	0.03	
	13.9	14.9	28.4	445	16.1	0.04	
	17.2	18.2	25.1	400	19.0	0.05	
	19.7	20.7	22.6	435	21.2	0.05	
	21.7	22.7	20.6	260	23.9	0.09	
	25.0	26.0	17.3	320	27.2	0.09	
	28.4	29.4	13.9	460	30.6	0.07	
	31.8	32.8	10.5	800	34.0	0.04	
	35.2	36.2	7.1	620	37.4	0.06	
	38.6	39.6	3.7	525	40.8	0.08	
	42.0	43.0	0.3	665	44.1	0.07	
	45.2	46.2	-2.9	510	47.4	0.09	
	48.6	49.6	-6.3	1090	50.8	0.05	
	51.9	52.9	-9.6	570	54.1	0.09	
	55.3	56.3	-13.0	440	57.5	0.13	
Lower Marine Sand	58.7	59.7	-16.4	765	60.8	0.08	
	61.9	62.9	-19.6	880	64.2	0.07	
	65.5	66.5	-23.2	650	67.7	0.10	
	68.9	69.9	-26.6	1185	71.1	0.06	
	72.2	73.2	-29.9	1260	73.1	0.06	
Bottom of Boring	73.0						

Bucknam Road Bridge over I-295
Falmouth, ME

Calculated By: ENT   Date: 11/8/2021
Checked By: ARB   Date: 2/17/2022

INPUT

Exploration ID: **CPT-FBR-104**   Ground Surface Elevation: 48.7 ft   Depth of Boring: 84.7 ft

Depth to Bedrock: NE

CALCULATION

$\overline{V}$ = 707.0

Soil Strata	CPT Interval Depth Top, ft	CPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	V_s	d_i	d_i / V_s	Comment
Upper Marine Sand	11.2	12.2	37.0	640	13.4	0.02	
	14.6	15.6	33.6	985	16.8	0.02	
Marine Clay Crust	18.0	19.0	30.2	700	20.3	0.03	
Marine Clay	21.5	22.5	26.7	530	23.8	0.04	
	25.0	26.0	23.2	470	27.1	0.06	
	28.1	29.1	20.1	475	30.4	0.06	
	31.7	32.7	16.5	470	33.9	0.07	
	35.1	36.1	13.1	605	37.3	0.06	
	38.4	39.4	9.8	540	40.7	0.08	
	41.9	42.9	6.3	630	44.2	0.07	
	45.4	46.4	2.8	620	47.5	0.08	
	48.6	49.6	-0.4	700	50.8	0.07	
	52.0	53.0	-3.8	615	54.3	0.09	
	55.5	56.5	-7.3	720	57.7	0.08	
	58.9	59.9	-10.7	695	61.1	0.09	
	62.3	63.3	-14.1	645	64.5	0.10	
	65.7	66.7	-17.5	955	67.9	0.07	
	69.1	70.1	-20.9	650	71.5	0.11	
Lower Marine Sand	72.8	73.8	-24.6	1110	75.0	0.07	
	76.1	77.1	-27.9	915	78.3	0.09	
	79.5	80.5	-31.3	810	81.7	0.10	
	82.8	83.8	-34.6	1085	84.3	0.08	
Bottom of Boring	84.7						

Bucknam Road Bridge over I-295
Falmouth, ME

Calculated By: ENT Date: 11/8/2021
Checked By: ARB Date: 2/17/2022

INPUT

Exploration ID: **CPT-FBR-105** Ground Surface Elevation: 47.1 ft Depth of Boring: 54.6 ft

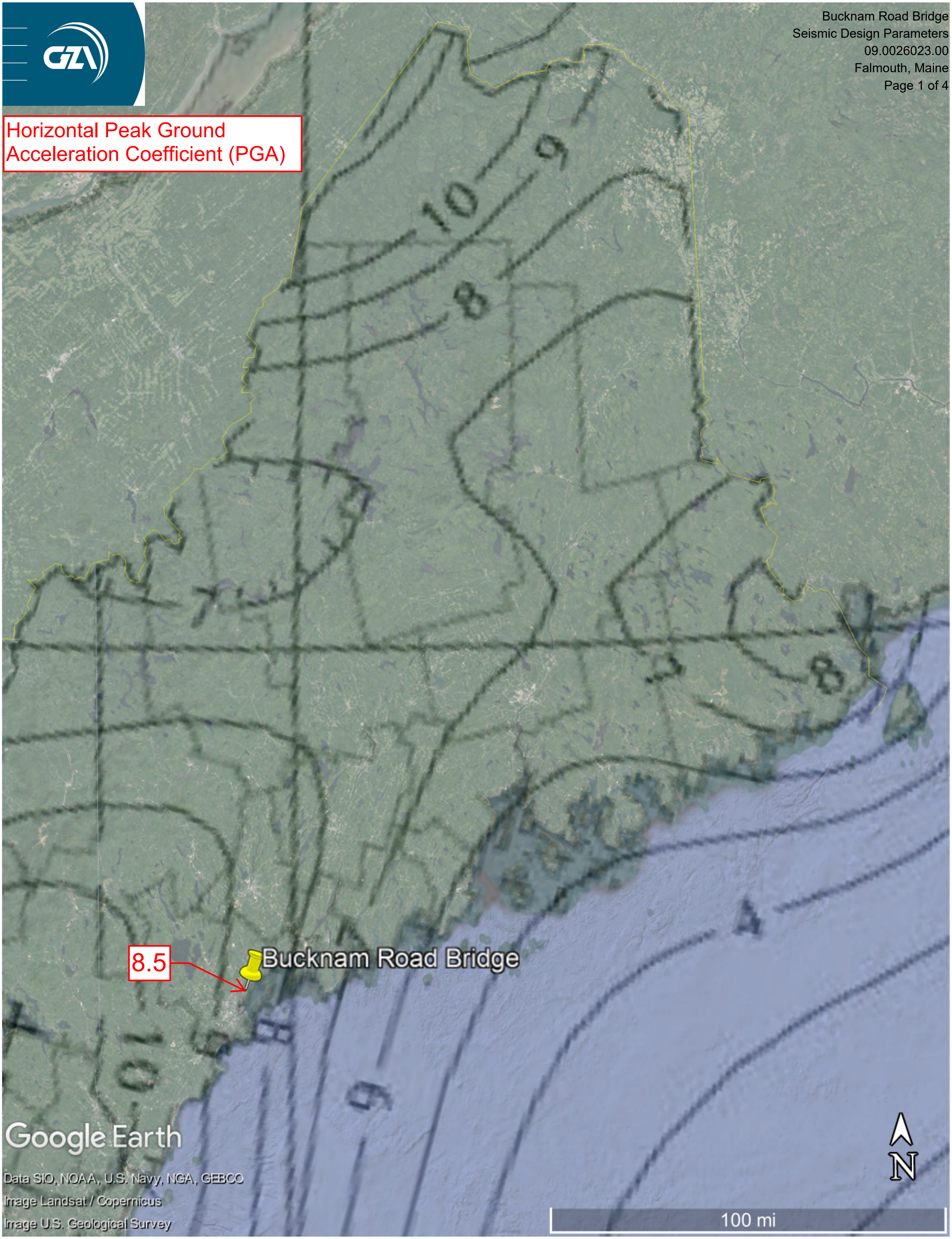
Depth to Bedrock: NE

CALCULATION

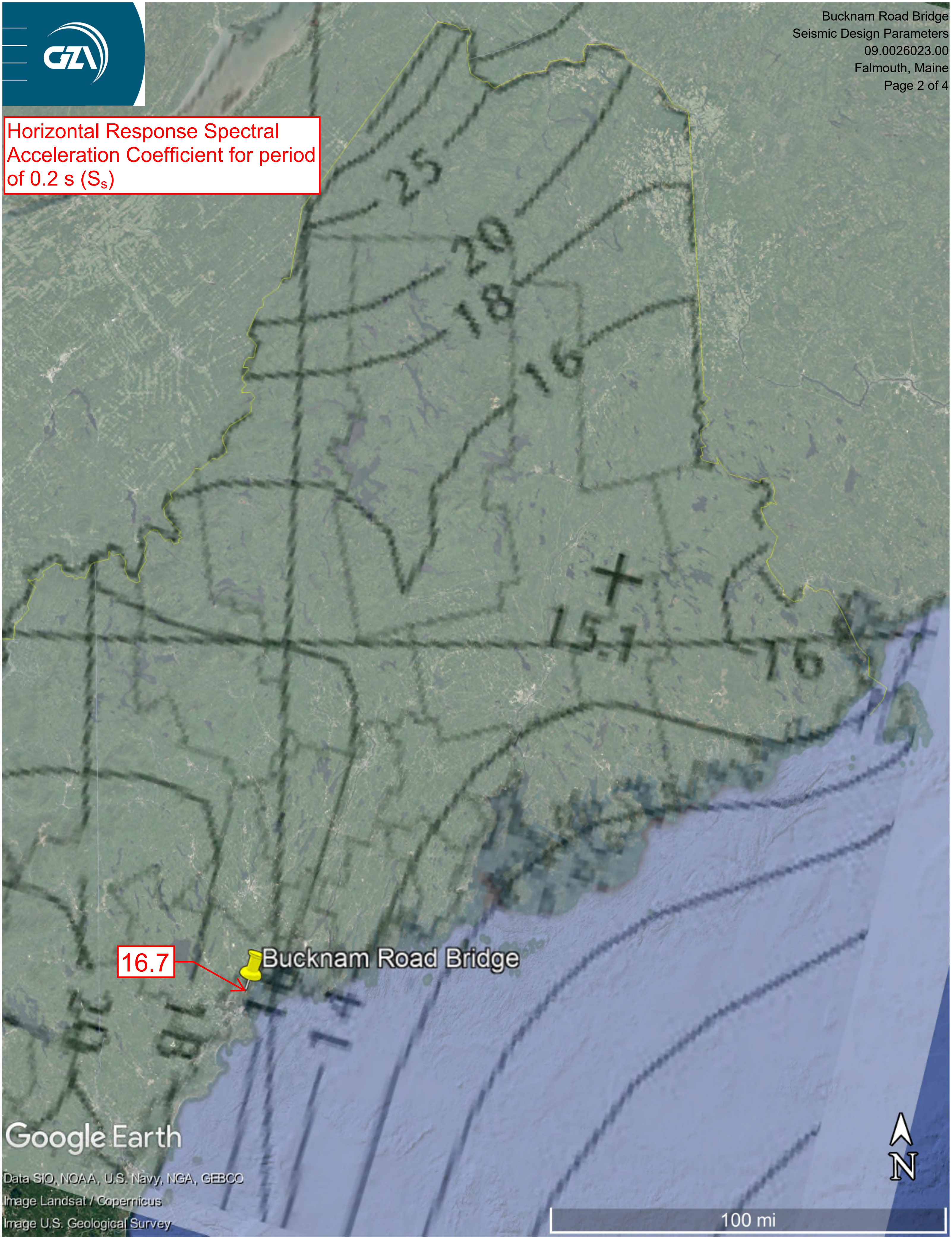
$\overline{V}$ = 724.0

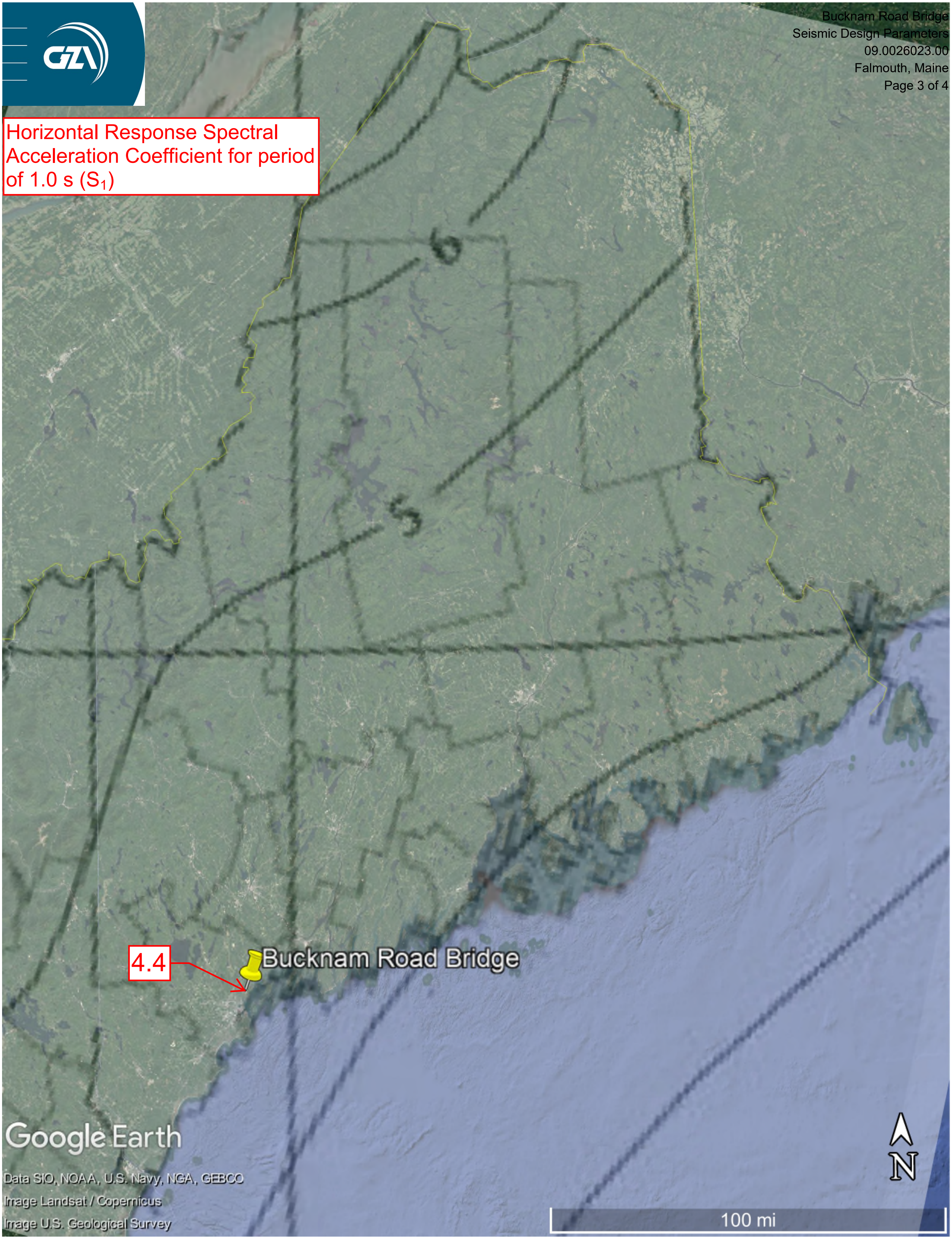
Soil Strata	CPT Interval Depth Top, ft	Bottom, ft	SPT Elevation (mid-interval)	V_s	d_i	d_i / V_s	Comment
Upper Marine Sand	10.2	11.2	36.4	1040	12.4	0.01	
	13.6	14.6	33.0	595	15.8	0.03	
Marine Clay Crust	17.0	18.0	29.6	565	19.2	0.03	
Marine Clay	20.4	21.4	26.2	565	22.6	0.04	
	23.7	24.7	22.9	540	25.9	0.05	
	27.1	28.1	19.5	485	29.3	0.06	
	30.5	31.5	16.1	600	32.7	0.05	
	33.8	34.8	12.8	615	36.1	0.06	
	37.3	38.3	9.3	790	39.5	0.05	
	40.6	41.6	6.0	755	42.9	0.06	
	44.1	45.1	2.5	775	46.3	0.06	
	47.4	48.4	-0.8	695	49.6	0.07	
	50.8	51.8	-4.2	1185	53.0	0.04	
	54.1	55.1	-7.5	1180	54.9	0.05	
Bottom of Boring	54.6						

Horizontal Peak Ground Acceleration Coefficient (PGA)



Horizontal Response Spectral Acceleration Coefficient for period of 0.2 s (S_s)




Bucknam Road Bridge
Seismic Design Parameters
09.0026023.00
Falmouth, Maine
Page 3 of 4
Horizontal Response Spectral Acceleration Coefficient for period of 1.0 s (S_1)
6
5
4.4
Bucknam Road Bridge
Google Earth
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus
Image U.S. Geological Survey
N
100 mi

Bucknam Road Bridge Seismic Interpolation for Coefficients		
Seismic Parameter	**Interpolated Value from Maps[1]**	**Design Parameter**
Horizontal Peak ground Acceleration Coefficient	8.5	$PGA = .085$
Horizontal Response Spectral Acceleration Coefficient for Period of 0.2s	16.7	$S_s = 0.167$
Horizontal Response Spectral Acceleration Coefficient for Period of 1.0s	4.4	$S_1 = .044$

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:

$$A_s = F_{PGA} \times PGA = 1.6 \times 0.085 = 0.14\ g$$

$$S_{DS} = F_a \times S_s = 1.6 \times 0.167 = 0.27\ g$$

$$S_{D1} = F_v \times S_1 = 2.4 \times 0.044 = 0.11\ g$$

Summary:

SITE CLASS E SEISMIC DESIGN PARAMETERS	
Parameter	**Design Value**
Fpga	1.6
Fa	1.6
Fv	2.4
As (Period = 0.0 sec)	0.14 g
SDs (Period = 0.2 sec)	0.27 g
SD1 (Period = 1.0 sec)	0.11 g

Downdrag

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: **Bucknam Road Bridge # 5830 Falmouth, ME**
GZA PROJECT NO: **09.0026023.00**
SUBJECT: **Downdrag Calculation, Abutment 2**
SHEET:
CALCULATED BY: **B. Cardali 11/26/2021**
CHECKED BY: **A. Blaisdell 11/26/2021**

Type of Pile	**HP14x117**	
Diameter of Pile	15	in
Perimeter of Pile	4.83	ft
Maximum Factored Pile Load (5 piles)	385	kips

No of HP14x89 Piles	Maximum Factored Axial Load per Pile (Σγi Qi)	Factored Load from Downdrag (γ_p DD)	Total Factored Load (Σγi Qi + γ_p DD)	Resistance Factor for Dynamic Pile Analysis (ϕ_{dyn})	Nominal Driving Resistance Required (Rn=Rndr)
7	385	131	516	0.65	794

NOTES:
1. Downdrag load calculated using b 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 Hoyle, Tanner.

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
GeoEnvironmental, Inc.
707 Sable Oaks Drive Suite 150
South Portland, Maine 04106
207-879-9190
Fax 207-879-0099
http://www.gza.com

JOB:	**Bucknam Road Bridge # 5830 Falmouth, ME**
GZA PROJECT NO:	**09.0026023.00**
SUBJECT:	**Downdrag Calculation, Abutment 2**
SHEET:	
CALCULATED BY:	**B. Cardali 11/26/2021**
CHECKED BY:	**A. Blaisdell 11/26/2021**

Type of Pile	**HP14x117**		
Finish Ground Surface Elevation	65.0	ft	
Pile Embedment below Ex. Grade	12.0	ft	
Elevation of Water Table	36.0	ft	
Depth of Water Table	29.0	ft	
Diameter of Pile	15	in	
Perimeter of Pile	4.83	ft	
Depth of Critical Effective Stress	24.2	ft	(20 times pile diameter)
Critical Total Stress	3021	psf	
Critical Effective Stress	3021	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 from Settle3 (inches)	Nominal Load from Downdrag (DD) (kip)
Fill	13	52.0	13	58.5	6.5	125	813	813	813	0.35	284	--			
Fill	12	40.0	25	46.0	19.0	125	2375	2375	2375	0.35	831	--	48	1	48
Upper Marine Sand	4	36.0	29	38.0	27.0	120	3305	3305	3021	0.35	1057	--	20	1	20
Clay Crust	7	29.0	36	32.5	32.5	118	3893	3675	3021	0.25	755	750	25	0.8	25
Clay - Upper	19	10.0	55	19.5	45.5	118	5369	4339	3021	0.23	695	400	37	0.6	37
Clay - Mid	10	0.0	65	5.0	60.0	118	7080	5146	3021	0.23	695	600	29	0.4	0
Clay - Lower	5	-5.0	70	-2.5	67.5	118	7965	5563	3021	0.23	695	700	17	0.2	0
												TOTAL	**177**		**131**

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. Settlement and final effective stresses were calculated using Settle3D.
6. Maximum settlement occurs at Abutment 2 because of thicker clay profile; Abutment 2 used as design basis.

Green is soil above top of pile, used to calculate effective stress only

Profile:
Sand Fill, 0-23
Upper Marine Sand, 23-27
Marine Clay Crust, 27-34
Marine Clay, 34-73

Lateral Pile Analysis
Abutments

Lpile/Group Input Parameters	GZA FILE NO.	09.0026023.00
Maine Department of Transportation. - Bucknam Road Bridge No. 5830	CALCULATED BY	B.Cardali 10/4/2021
Falmouth, Maine	CHECKED BY	A. Blaisdell 11/23/2021

Objective: To estimate the horizontal modulus of subgrade reaction (k) or E50 of subsurface strata for use in lateral analyses. K values are estimated using strata internal friction angles (ϕ') or shear strength.

Methods Correlations between the horizontal modulus of subgrade reaction and the soil internal friction angle of a given stratum are based on Figure 3-34 presented in the 2019 LPile Technical Manual.

Given Information: SPT measurements, In-situ vanes, and subsurface conditions in borings BB-FBR-102, -103, -104 and -206 performed by New England Borings Contractors between May 22, 2019 and June 25, 2019.

Abutment 1, Pile length = 59'

Stratum	Soil Model	Top of Layer Elevation (NAVD88 ft)	k (pci) / E50	ϕ' (deg)/ Su (psf)	γ_e (pcf)
Existing Fill	Reese Sand	48	65	31	125
Upper Marine Sand	Reese Sand	41.6	85	32	120
Marine Clay Crust**	Stiff Clay w/o free water	34.6	E_{50}=0.007	800	53
Marine Clay	Soft Clay	27.6	E_{50}=0.008	600	53
Lower Marine Sand	Reese Sand	-5.9	65	33	73
Top of Rock	--	-11	--	--	--

Center Pier, Pile length = 72'

Stratum	Soil Model	Top of Layer Elevation (NAVD88 ft)	k (pci) / E50	ϕ' (deg)/ Su (psf)	γ_e (pcf)
Marine Clay Crust**	Stiff Clay w/o free water	32.7	E_{50}=0.007	750	53
Marine Clay	Soft Clay	31.3	E_{50}=0.008	500	53
Lower Marine Sand	Reese Sand	-8.9	65	33	73
Top of Rock	--	-39	--	--	--

Notes: 1. Pile tip elevation should be assumed to be top of Rock.

2. ** indicates the top of layer is the approximate ground water elevation based on the boring logs.
3. pci = pounds per cubic inch, deg = degrees, psi =pounds per square inch, γe = effective unit weight, pcf = pounds per square 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 or less.
5. Lpile analyses were not performed for Abutment 2 considering the similarity of the soil in the upper 50 feet of the soil profile. Abutment 1 results are considered representative for both abutments.

Table 2 - LPile Output Summary
Bucknam Road Br No. 5830, Falmouth, ME
GZA GeoEnvironmental, Inc.

GZA FILE NO.	09.0026023.00
CALCULATED BY	B. Cardali, 11/8/21
CHECKED BY	A. Blaisdell, 11/23/21

Abutment 1, Pile Length = 59 feet							
Pile Section/ Orientation	**Axial Load (kips)**	**Shear Force for Lateral deflection at Pile head (kips)**	**Moment at Pile Head (kip-ft)**	**Depth below Pile Head to Fixity (ft)**	**Total Stress at Pile Head (ksi)**	**Bending Stress at Pile Head (ksi)**	**Axial Stress at Pile Head (ksi)**
HP 14x117 Weak Axis	385	74.1	-351.1	20	81.9	70.6	11.3

Notes:

1. Soil layering and properties are presented in Table 1.
2. The axial load is the maximum Factored Axial Load, excluding factored downdrag load, for the 5 Pile configuration.
3. Lpile model included imposed lateral deflection of 1.375 inches and zero rotation at the pile head.
4. The bending stress at pile head is calculated as the maximum moment divided by the pile section modulus.

Conclusion:
Initial Lateral pile analyses results presented above indicate the pile stresses are beyond the elastic range, therefore an additional plastic hinge evaluation was conducted on the HP14x117 section in the weak axis and is shown on pages 3 to 12 of this package.

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: 09.0026023.00
SUBJECT: Pile Evaluation for Integral Abutment
SHEET: 1 OF 9
CALCULATED BY B. Cardali 1/20/2022
CHECKED BY A.Blaisdell 2/17/2022

Integral Abutment LRFD Pile Design

Subject: Pile Design for the Bucknam Road Bridge Replacement in Falmouth, Maine. Abutment 1 parameters and results were used and are considered representative for both abutments considering the soil similarities.

Reference:

- AASHTO LRFD Bridge Design Specifications, 8th Edition, 2017
- Maine BDG Chapter 5 - Substructures 2014
- VTRANS Integral Abutment Bridge Design Guidelines 2008

Design Steps - Maine BDG

Step 1 - Determine the foundation displacements and the load effects (P_u and M_u) from the superstructure and substructure designs.

$P_u := 385.0 \cdot kip$ Maximum Factored Axial Load from Hoyle Tanner (HTA)

Initial LPile analyses were run based on the loading of 1.375 inches of thermal deflection and zero end rotation provided by HTA.

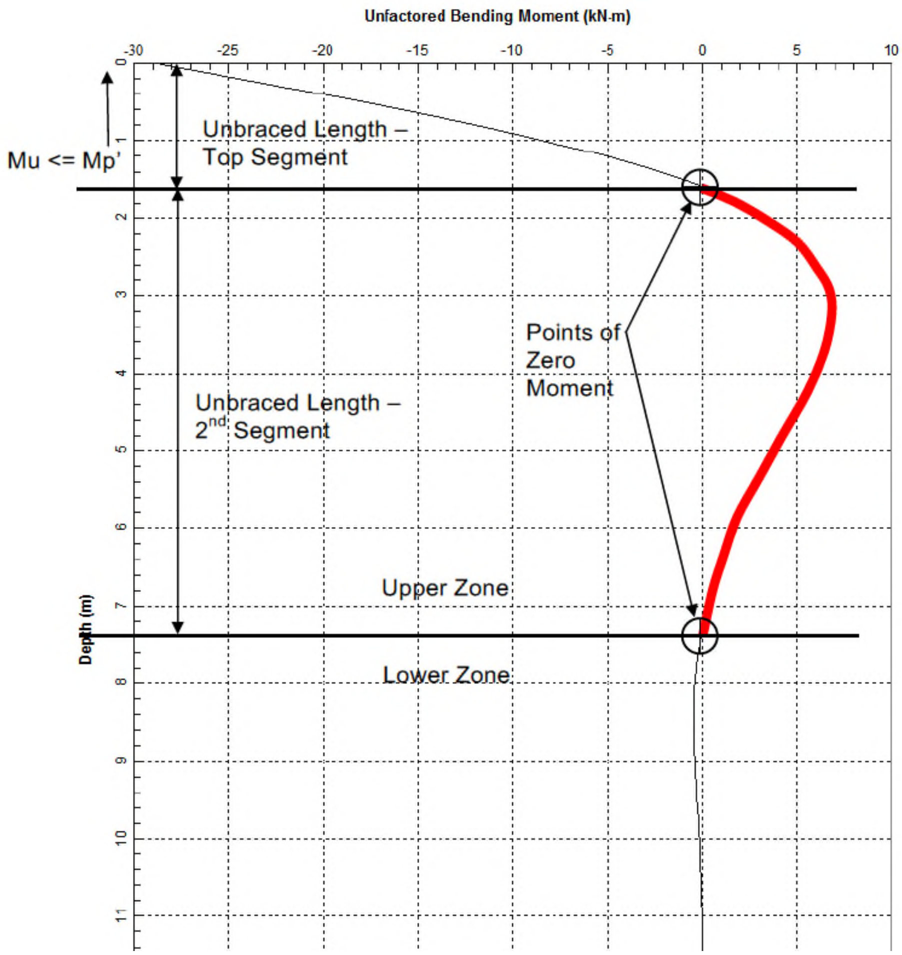
Step 2 - If applicable, determine the magnitude of scour. N / A

Step 3 - Select preliminary pile size.

HP14 x 117, Weak Axis Properties

Steel yield strength	$F_{y50} := 50ksi$
Modulus of elasticity for steel	$E := 29000ksi$
Cross sectoinal area of pile	$A_g := 34.4in^2$
Radius of gyration	$r_y := 3.59in$
Width of Flange	$b_f := 14.9 \cdot in$
Thickness of Flange	$t_f := 0.805 \cdot in$
Elastic Section Modulus	$S_y := 59.5 \cdot in^3$
Plastic Section Modulus	$Z_y := 91.4 \cdot in^3$

Step 4 - Determine the pile unbraced length and maximum moment at the top of the pile by running LPile software for top translation = 1.375 inches, P_u = 385.0 kip, and Live Load Rotation = 0 (Fixed against rotation)



Maximum moment from LPile output (page 22) $M_u := 4213.17\text{kip}\cdot\text{in} = 351.1\cdot\text{kip}\cdot\text{ft}$

Unbraced lengths from LPile output (page 22)

Upper segment $L_1 := 5.0\cdot\text{ft}$

Lower segment $L_2 := 14.8\cdot\text{ft}$

Step 5 - Determine if the applied moment on the pile will cause pile head plastic deformation considering the interaction of combined axial and flexural load effects on a single pile (LRFD 6.9.2.2)

a. Obtain the unbraced lengths of the top and lower segments of the pile and calculate the column slenderness factor (λ) for each segment.

See above for unbraced lengths (critical lengths L_1 and L_2).

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

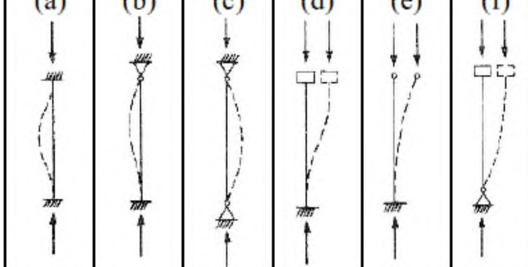
Upper segment slenderness factor

$$_1 := \frac{(L_1)}{r_y} = 16.713$$

Lower segment slenderness factor

$$_2 := \frac{(L_2)}{r_y} = 49.471$$

b. Determine K values for top and bottom of the pile per LRFD Table C4.6.2.5-1



	(a)	(b)	(c)	(d)	(e)	(f)
Buckled shape of column is shown by dashed line						
Theoretical *K* value	0.5	0.7	1.0	1.0	2.0	2.0
Design value of *K* when ideal conditions are approximated	0.65	0.80	1.0	1.2	2.1	2.0
End condition code		Rotation fixed Translation fixed Rotation free Translation fixed Rotation fixed Translation free Rotation free Translation free				

Upper segment K value (Type d)

$$K_1 := 1.2$$

Lower segment K value (Type c)

$$K_2 := 1$$

c. Calculate the nominal and factored structural pile resistance P_n, per AASHTO LRFD 6.9.4.1 using the λ values

Elastic critical buckling resistance, P_e, based on flexural buckling (AASHTO LRFD Eq. 6.9.4.1.2-1)

Upper P_e $$P_{e1} := \frac{\left(\ ^{2}\cdot E\right)\cdot A_g}{\left(K_1\cdot\ _1\right)^2} = 24478\cdot kip$$

Lower P_e $$P_{e2} := \frac{\left(\ ^{2}\cdot E\right)\cdot A_g}{\left(K_2\cdot\ _2\right)^2} = 4023\cdot kip$$

Nominal yield resistance, P_o $$P_o := F_{y50}\cdot A_g = 1720\cdot kip$$

Check that the ratio of Pe to Po is > 0.44

If $P_e/P_o > 0.44$ then use AASHTO LRFD Eq. 6.9.4.1.1-1
If $P_e/P_o < 0.44$ then use AASHTO LRFD Eq. 6.9.4.1.1-2

$$P_n = \left[0.658^{\left(\frac{P_o}{P_e}\right)}\right] P_o \qquad (6.9.4.1.1\text{-}1)$$

$$P_n = 0.877 P_e \qquad (6.9.4.1.1\text{-}2)$$

$$\frac{P_{e1}}{P_o} = 14.232 \qquad \frac{P_{e2}}{P_o} = 2.339$$

Both ratios are greater than 0.44, therefore, use AASHTO LRFD Eq. 6.9.4.1.1-1: Nominal structural Pile resistance, P_n for both segments

$$P_{n1} := \left[0.658^{\left(\frac{P_o}{P_{e1}}\right)}\right]\cdot P_o = 1670\cdot kip$$

$$P_{n2} := \left[0.658^{\left(\frac{P_o}{P_{e2}}\right)}\right]\cdot P_o = 1438\cdot kip$$

Factored structural Pile Resistance, $P_r = \varphi_c\,(P_n)$

$$_c := 0.7$$ for axial resistance according to AASHTO LRFD 6.5.4.2

$$P_{r1} := \ _c \cdot P_{n1} = 1169.1 \cdot kip$$

$$P_{r2} := \ _c \cdot P_{n2} = 1006.7 \cdot kip$$

d. Compare the ratio of P_u, the maximum factored axial load, to P_r, the structural resistance in the specified portion of the pile - the pile size should be such that the ratio is not less than 0.20.

Check for both segments

$$\frac{P_u}{P_{r1}} = 0.329$$ > 0.20, OK

$$\frac{P_u}{P_{r2}} = 0.382$$ > 0.20, OK

e. Determine the nominal and factored flexural resistance about H-Pile weak axis, (AASHTO LRFD Eq. 6.12.2.2)

Check slenderness ratio for flange, limiting slenderness ratio for compact flange, and limiting slenderness ratio for a noncompact flange.

$$_f := \frac{b_f}{2 \cdot t_f} = 9.255$$ slenderness ratio for flange (AASHTO LRFD Eq. 6.12.2.2.1-3)

$$_{pf} := 0.38 \cdot \left(\frac{E}{F_{y50}}\right)^{.5} = 9.152$$

$$_{rf} := 0.83 \cdot \left(\frac{E}{F_{y50}}\right)^{.5} = 19.989$$

If $\lambda_{pf} < \lambda_f < \lambda_{rf}$ Use ASSHTO LRFD Eq. 6.12.2.2.1-2 to find the nominal flexural resistance

$$M_n := \left[1 - \left(1 - \frac{S_y}{Z_y}\right) \cdot \left[\frac{_f - \ _{pf}}{0.45 \cdot \left(\frac{E}{F_{y50}}\right)^{.5}}\right]\right] \cdot F_{y50} \cdot Z_y = 379.57 \cdot ft \cdot kip$$

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

${}_f := 1.0$ for flexural resistance according to AASHTO LRFD 6.5.4.2

$M_r := M_n \cdot {}_f = 379.6 \cdot ft \cdot kip$

$M_u = 351.1 \cdot ft \cdot kip$

$\frac{P_u}{P_{r1}} + \frac{8}{9} \cdot \frac{M_u}{M_r} = 1.2$ If less than 1, remains in elastic zone. Since it exceeds 1, yielding is expected at the base of the pile cap.

j. Calculate the moment that will cause a plastic hinge at the top of the pile, M_p',
Note: M_p' will be lower than M_n due to the inclusion of the axial load in the interaction equation for pile overstresses

$$\frac{P_u}{P_r} + \frac{8.0}{9.0}\left(\frac{M_{ux}}{M_{rx}} + \frac{M_{uy}}{M_{ry}}\right) \leq 1.0$$

AASHTO LRFD Eq. 6.9.2.2 Interaction equation

Use the interaction equation to find the moment that will cause a plastic hinge at the top of the pile. Assume M_{ux} and M_{rx} = 0 (out-of-plane), $M_{ry} = M_r$ and $M_u = M_p$', solve for M_p'

$M_p := \left(\frac{9}{8}\right) \cdot \left[1 - \left(\frac{P_u}{P_{r1}}\right)\right] \cdot M_r = 286.4 \cdot ft \cdot kip$ $\quad M_p = 3436734 \cdot in \cdot lbf$

k. The calculated moment from LPile Run 1 (shown in step 4) exceeds the moment that would cause a plastic hinge (above), therefore a plastic hinge forms, and the moment (M_p') represents the limiting moment reaction at the pile top for the subsequent analysis.

Step 6 - For fixed head piles, run a second LPILE analysis with end conditions 1) Top moment = M_p', top translation = 1.375 in; and axial load equal to P_u. Recalculate unbraced lengths from the moment vs. depth curve.

New unbraced lengths were determined from the second LPile analysis

Upper segment $L_{1p} := 4.4 \cdot ft$

Lower segment $L_{2p} := 15 \cdot ft$

6a. Repeat steps 5a through 5d above.

6b - If the pile size is such that the ratio of Pu to structural resistance exceeds 0.2, check the upper segment of the pile with the interaction equation of AASHTO LRFD Eq. 6.9.2.2. If a plastic hinge forms at the top of the pile, the K value of the upper segment changes from 1.2, for a rotation fixed head condition, to 2.1, for a rotation free head condition. With the new K value and lengths repeat step 5.

5a.

Upper segment slenderness factor $$1p := \frac{(L_{1p})}{r_y} = 14.708$$

Lower segment slenderness factor $$2p := \frac{(L_{2p})}{r_y} = 50.139$$

5b.

Upper segment K value (Type e) $K_{1p} := 2.1$

Lower segment K value (Type c) $K_{2p} := 1$

5c.

Elastic critical buckling resistance, P_e, based on flexural buckling

Upper P_e $$P_{ep1} := \frac{\left({}^{2} \cdot E\right) \cdot A_g}{\left(K_{1p} \cdot \ {}_{1p}\right)^2} = 10321 \cdot kip$$

Lower P_e $$P_{ep2} := \frac{\left({}^{2} \cdot E\right) \cdot A_g}{\left(K_{2p} \cdot \ {}_{2p}\right)^2} = 3917 \cdot kip$$

Nominal yield resistance, P_o $P_o := F_{y50} \cdot A_g = 1720 \cdot kip$

Check that the ratio of Pe to Po is > 0.44

If $P_e/P_o > 0.44$ then use equation 6.9.4.1.1-1
If $P_e/P_o < 0.44$ then use equation 6.9.4.1.1-2

$$\frac{P_{ep1}}{P_o} = 6.001 \qquad \frac{P_{ep2}}{P_o} = 2.277$$

Both ratios are greater than 0.44, therefore, use eq. 6.9.4.1.1-1: Nominal structural Pile resistance, P_n for both segments

$$P_{np1} := \left[0.658^{\left(\frac{P_o}{P_{ep1}}\right)} \right] \cdot P_o = 1604 \cdot kip$$

$$P_{np2} := \left[0.658^{\left(\frac{P_o}{P_{ep2}}\right)} \right] \cdot P_o = 1431 \cdot kip$$

Factored structural Pile Resistance, $P_r = \varphi_c (P_n)$

$$P_{rp1} := {}_c \cdot P_{np1} = 1122.9 \cdot kip$$

$$P_{rp2} := {}_c \cdot P_{np2} = 1001.8 \cdot kip$$

d. Compare the ratio of P_u to the structural resistance in the upper portion of the pile - the pile size should be such that the ratio is not less than 0.20.

Check for both segments

$$\frac{P_u}{P_{rp1}} = 0.343 \quad > 0.20, \text{OK} \qquad \frac{P_u}{P_{rp2}} = 0.384 \quad > 0.20, \text{OK}$$

From VTrans Integral Abutment Design Section 4.5.2 - Check the axial capacity of the upper segment and the interaction equation for the second segment to assess suitability of pile section.

Upper Segment

Check that P_u/P_{rp1} is < 1

$$\frac{P_u}{P_{rp1}} = 0.343 \qquad < 1, \text{OK}$$

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

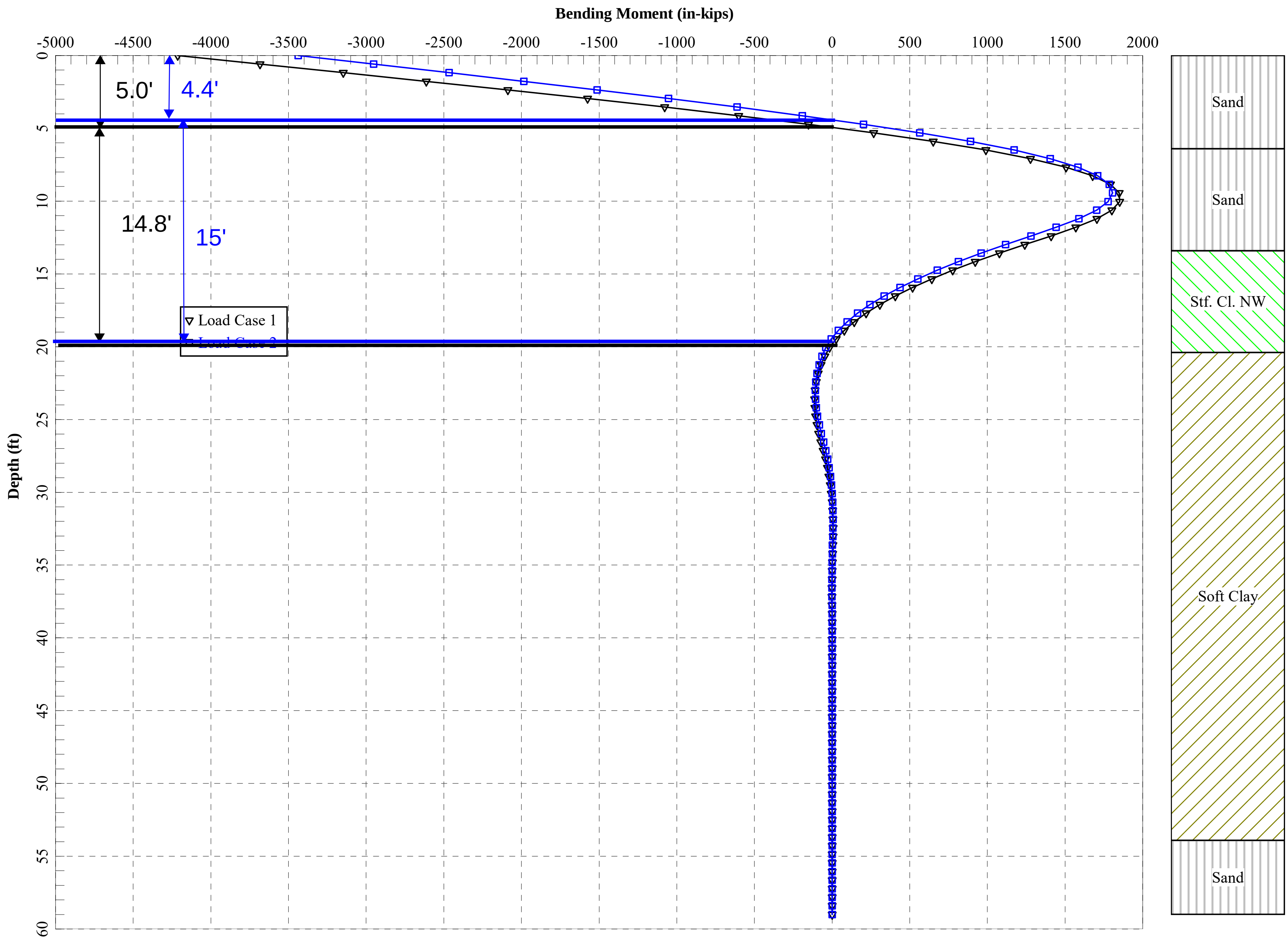
Lower Segment

Ultimate moment along the lower segment from LPile output

$$M_{maxp2} := 1805695 \cdot in \cdot lbf$$

$$\frac{P_u}{P_{rp2}} + \frac{8}{9} \cdot \frac{M_{maxp2}}{M_r} = 0.737$$

< 1, OK



Bending Moment (in-kips)
-5000
-4500
-4000
-3500
-3000
-2500
-2000
-1500
-1000
-500
0
500
1000
1500
2000
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
5.0'
4.4'
14.8'
15'
Load Case 1
Load Case 2
Sand
Sand
Stf. Cl. NW
Soft Clay
Sand

Initial Run Results Pages 17-18
Second Run Results Page 19

```
===============================================================================

                    LPile for Windows, Version 2019-11.002

                Analysis of Individual Piles and Drilled Shafts
               Subjected to Lateral Loading Using the p-y Method
                          © 1985-2019 by Ensoft, Inc.
                              All Rights Reserved

===============================================================================

This copy of LPile is being used by:

gza
portland

Serial Number of Security Device: 161635470

This copy of LPile is licensed for exclusive use by:

GZA GeoEnvironmental, Inc., Port

Use of this program by any entity other than GZA GeoEnvironmental, Inc., Port
is a violation of the software license agreement.

-------------------------------------------------------------------------------
                             Files Used for Analysis
-------------------------------------------------------------------------------

Path to file locations:
\09 Jobs\0026000s\09.0026023.00 - MEDOT - Bucknam Rd - Falmouth\Work\calcs\LPile\Abutment 1\14x117\

Name of input data file:
Bucknam AB 1_14x117 Weak axis - Plastic Hinge.lp11

Name of output report file:
Bucknam AB 1_14x117 Weak axis - Plastic Hinge.lp11

Name of plot output file:
Bucknam AB 1_14x117 Weak axis - Plastic Hinge.lp11

Name of runtime message file:
Bucknam AB 1_14x117 Weak axis - Plastic Hinge.lp11
```

```
-------------------------------------------------------------------------------
                            Date and Time of Analysis
-------------------------------------------------------------------------------

               Date:  January 14, 2022           Time:  10:56:50


-------------------------------------------------------------------------------
                                  Problem Title
-------------------------------------------------------------------------------

Project Name: Bucknam Road Bridge


Job Number: 09.0026023.00


Client: MaineDOT


Engineer: B.Cardali


Description: Abutment 1 - 14x117




-------------------------------------------------------------------------------
                           Program Options and Settings
-------------------------------------------------------------------------------

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
```

- Maximum number of iterations allowed = 500
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 100.0000 in
- Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
- Static loading specified

- Use of p-y modification factors for p-y curves not selected
- Analysis uses layering correction (Method of Georgiadis)
- No distributed lateral loads are entered
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 1
Total length of pile = 59.000 ft
Depth of ground surface below top of pile = 0.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	14.9000
2	59.000	14.9000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a H weak axis steel pile
Length of section = 59.000000 ft
Pile width = 14.200000 in
Shear capacity of section = 0.0000 lbs

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 5 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 0.0000 ft
Distance from top of pile to bottom of layer = 6.400000 ft
Effective unit weight at top of layer = 125.000000 pcf
Effective unit weight at bottom of layer = 125.000000 pcf

```
   Friction angle at top of layer                      =    31.000000 deg.
   Friction angle at bottom of layer                   =    31.000000 deg.
   Subgrade k at top of layer                          =    65.000000 pci
   Subgrade k at bottom of layer                       =    65.000000 pci


Layer 2 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =     6.400000 ft
   Distance from top of pile to bottom of layer        =    13.400000 ft
   Effective unit weight at top of layer               =   120.000000 pcf
   Effective unit weight at bottom of layer            =   120.000000 pcf
   Friction angle at top of layer                      =    32.000000 deg.
   Friction angle at bottom of layer                   =    32.000000 deg.
   Subgrade k at top of layer                          =    85.000000 pci
   Subgrade k at bottom of layer                       =    85.000000 pci


Layer 3 is stiff clay without free water

   Distance from top of pile to top of layer           =    13.400000 ft
   Distance from top of pile to bottom of layer        =    20.400000 ft
   Effective unit weight at top of layer               =    53.000000 pcf
   Effective unit weight at bottom of layer            =    53.000000 pcf
   Undrained cohesion at top of layer                  =   800.000000 psf
   Undrained cohesion at bottom of layer               =   800.000000 psf
   Epsilon-50 at top of layer                          =     0.007000
   Epsilon-50 at bottom of layer                       =     0.007000


Layer 4 is soft clay, p-y criteria by Matlock, 1970

   Distance from top of pile to top of layer           =    20.400000 ft
   Distance from top of pile to bottom of layer        =    53.900000 ft
   Effective unit weight at top of layer               =    53.000000 pcf
   Effective unit weight at bottom of layer            =    53.000000 pcf
   Undrained cohesion at top of layer                  =   600.000000 psf
   Undrained cohesion at bottom of layer               =   600.000000 psf
   Epsilon-50 at top of layer                          =     0.008000
   Epsilon-50 at bottom of layer                       =     0.008000


Layer 5 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =    53.900000 ft
   Distance from top of pile to bottom of layer        =    59.000000 ft
   Effective unit weight at top of layer               =    73.000000 pcf
   Effective unit weight at bottom of layer            =    73.000000 pcf
   Friction angle at top of layer                      =    33.000000 deg.
   Friction angle at bottom of layer                   =    33.000000 deg.
   Subgrade k at top of layer                          =    65.000000 pci
   Subgrade k at bottom of layer                       =    65.000000 pci

 (Depth of the lowest soil layer extends 0.000 ft below the pile tip)


--------------------------------------------------------------------------------
                        Summary of Input Soil Properties
--------------------------------------------------------------------------------
```

Layer Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Sand	0.00	125.0000	--	31.0000	--	65.0000
	(Reese, et al.)	6.4000	125.0000	--	31.0000	--	65.0000
2	Sand	6.4000	120.0000	--	32.0000	--	85.0000
	(Reese, et al.)	13.4000	120.0000	--	32.0000	--	85.0000
3	Stiff Clay	13.4000	53.0000	800.0000	--	0.00700	--
	w/o Free Water	20.4000	53.0000	800.0000	--	0.00700	--
4	Soft	20.4000	53.0000	600.0000	--	0.00800	--
	Clay	53.9000	53.0000	600.0000	--	0.00800	--
5	Sand	53.9000	73.0000	--	33.0000	--	65.0000
	(Reese, et al.)	59.0000	73.0000	--	33.0000	--	65.0000

```
--------------------------------------------------------------------------------
                              Static Loading Type
--------------------------------------------------------------------------------

Static loading criteria were used when computing p-y curves for all analyses.
```

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	5	y = 1.375000 in	S = 0.0000 in/in	385000.	N.A.	Yes
2	4	y = 1.375000 in	M = -3436734. in-lbs	385000.	N.A.	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness
----

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Dimensions and Properties of Steel H Weak Axis:

Length of Section	=	59.000000 ft
Flange Width	=	14.900000 in
Section Depth	=	14.200000 in
Flange Thickness	=	0.805000 in
Web Thickness	=	0.805000 in
Yield Stress of Pipe	=	50.000000 ksi
Elastic Modulus	=	29000. ksi
Cross-sectional Area	=	34.123950 sq. in.
Moment of Inertia	=	444.363799 in^4
Elastic Bending Stiffness	=	12886550. kip-in^2
Plastic Modulus, Z	=	91.398684in^3
Plastic Moment Capacity = Fy Z	=	4570.in-kip

Axial Structural Capacities:

Nom. Axial Structural Capacity = Fy As	=	1706.197 kips
Nominal Axial Tensile Capacity	=	-1706.197 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	385.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 385.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Total Stress ksi	Run Msg
0.00000448	57.6691571	12886018.	94.3817798	12.2396241	
0.00000895	115.3383142	12886018.	50.9158899	13.1968497	
0.00001343	173.0074713	12886018.	36.4272599	14.1540755	
0.00001790	230.6766284	12886018.	29.1829450	15.1113010	
0.00002238	288.3457855	12886018.	24.8363560	16.0685268	
0.00002685	346.0149426	12886018.	21.9386300	17.0257524	
0.00003133	403.6840997	12886018.	19.8688257	17.9829781	
0.00003580	461.3532568	12886018.	18.3164725	18.9402037	
0.00004028	519.0224139	12886018.	17.1090866	19.8974294	

0.00004475	576.6915710	12886018.	16.1431780	20.8546551	
0.00004923	634.3607281	12886018.	15.3528891	21.8118807	
0.00005370	692.0298852	12886018.	14.6943150	22.7691063	
0.00005818	749.6990423	12886018.	14.1370600	23.7263320	
0.00006265	807.3681993	12886018.	13.6594128	24.6835577	
0.00006713	865.0373564	12886018.	13.2454520	25.6407834	
0.00007161	922.7065135	12886018.	12.8832362	26.5980091	
0.00007608	980.3756706	12886018.	12.5636341	27.5552347	
0.00008056	1038.	12886018.	12.2795433	28.5124604	
0.00008503	1096.	12886018.	12.0253568	29.4696860	
0.00008951	1153.	12886018.	11.7965890	30.4269117	
0.00009398	1211.	12886018.	11.5896086	31.3841374	
0.00009846	1269.	12886018.	11.4014445	32.3413630	
0.0001029	1326.	12886018.	11.2296426	33.2985887	
0.0001074	1384.	12886018.	11.0721575	34.2558144	
0.0001119	1442.	12886018.	10.9272712	35.2130400	
0.0001164	1499.	12886018.	10.7935300	36.1702657	
0.0001208	1557.	12886018.	10.6696955	37.1274914	
0.0001253	1615.	12886018.	10.5547064	38.0847170	
0.0001298	1672.	12886018.	10.4476476	39.0419427	
0.0001343	1730.	12886018.	10.3477260	39.9991683	
0.0001387	1788.	12886018.	10.2542510	40.9563940	
0.0001432	1845.	12886018.	10.1666181	41.9136197	
0.0001477	1903.	12886018.	10.0842964	42.8708454	
0.0001522	1961.	12886018.	10.0068171	43.8280710	
0.0001566	2018.	12886018.	9.9337651	44.7852967	
0.0001611	2076.	12886018.	9.8647717	45.7425223	
0.0001656	2134.	12886018.	9.7995076	46.6997480	
0.0001701	2191.	12886018.	9.7376784	47.6569737	
0.0001745	2249.	12886018.	9.6790200	48.6141993	
0.0001835	2363.	12880885.	9.5709907	50.0000000	Y
0.0001924	2471.	12841218.	9.4778907	50.0000000	Y
0.0002014	2572.	12769293.	9.3982704	50.0000000	Y
0.0002103	2666.	12674722.	9.3298083	50.0000000	Y
0.0002193	2755.	12563497.	9.2708099	50.0000000	Y
0.0002282	2839.	12439514.	9.2200045	50.0000000	Y
0.0002372	2919.	12307750.	9.1759961	50.0000000	Y
0.0002461	2996.	12170544.	9.1378809	50.0000000	Y
0.0002551	3069.	12029601.	9.1049300	50.0000000	Y
0.0002640	3139.	11886808.	9.0764141	50.0000000	Y
0.0002730	3206.	11744039.	9.0516326	50.0000000	Y
0.0002819	3271.	11601548.	9.0302366	50.0000000	Y
0.0002909	3334.	11459824.	9.0118644	50.0000000	Y

0.0002998	3393.	11316551.	8.9953544	50.0000000	Y
0.0003088	3448.	11166303.	8.9792520	50.0000000	Y
0.0003177	3499.	11011051.	8.9634948	50.0000000	Y
0.0003267	3545.	10852315.	8.9479899	50.0000000	Y
0.0003356	3589.	10691476.	8.9327234	50.0000000	Y
0.0003446	3628.	10529466.	8.9179578	50.0000000	Y
0.0003536	3666.	10367967.	8.9034666	50.0000000	Y
0.0003625	3700.	10207409.	8.8890909	50.0000000	Y
0.0003715	3732.	10048299.	8.8749403	50.0000000	Y
0.0003804	3762.	9890660.	8.8612682	50.0000000	Y
0.0003894	3791.	9736067.	8.8477056	50.0000000	Y
0.0003983	3817.	9583956.	8.8346033	50.0000000	Y
0.0004073	3842.	9434464.	8.8216591	50.0000000	Y
0.0004162	3866.	9287584.	8.8087751	50.0000000	Y
0.0004252	3888.	9143956.	8.7963702	50.0000000	Y
0.0004341	3909.	9003650.	8.7841227	50.0000000	Y
0.0004431	3928.	8865724.	8.7719747	50.0000000	Y
0.0004520	3947.	8731607.	8.7602801	50.0000000	Y
0.0004610	3964.	8600165.	8.7484663	50.0000000	Y
0.0004699	3981.	8471713.	8.7371965	50.0000000	Y
0.0004789	3997.	8346697.	8.7258490	50.0000000	Y
0.0004878	4012.	8224189.	8.7148825	50.0000000	Y
0.0004968	4026.	8104844.	8.7041092	50.0000000	Y
0.0005057	4040.	7988578.	8.6932588	50.0000000	Y
0.0005147	4053.	7874658.	8.6829346	50.0000000	Y
0.0005236	4065.	7763742.	8.6726921	50.0000000	Y
0.0005326	4077.	7655536.	8.6623629	50.0000000	Y
0.0005684	4120.	7248021.	8.6234386	50.0000000	Y
0.0006042	4155.	6877698.	8.5869559	50.0000000	Y
0.0006400	4186.	6540836.	8.5529713	50.0000000	Y
0.0006758	4212.	6232946.	8.5206657	50.0000000	Y
0.0007116	4235.	5951541.	8.4901207	50.0000000	Y
0.0007474	4255.	5693327.	8.4613675	50.0000000	Y
0.0007832	4273.	5455744.	8.4343027	50.0000000	Y
0.0008190	4289.	5236580.	8.4085061	50.0000000	Y
0.0008548	4303.	5033498.	8.3838992	50.0000000	Y
0.0008906	4315.	4845271.	8.3606862	50.0000000	Y
0.0009264	4327.	4670730.	8.3385532	50.0000000	Y
0.0009622	4337.	4507365.	8.3174826	50.0000000	Y
0.0009980	4346.	4355172.	8.2974916	50.0000000	Y

Summary of Results for Nominal Moment Capacity for Section 1

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	385.0000000000	4346.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	0.00	0.00	N.A.	No	0.00	32491.
2	6.4000	6.1934	Yes	No	32491.	196525.
3	13.4000	29.2162	No	No	229016.	62554.
4	20.4000	47.0129	No	No	291570.	224742.
5	53.9000	20.7991	No	No	516312.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Initial Run: Pu=385 kips, 1.375 deflection, zero rotation

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 1

Max moment for calculation

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 1.375000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 385000.0 lbs

Stress Greater than Yield Stress, conduct plastic Hinge Analysis

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	1.3750	-4213171.	74171.	0.00	81918.	6.22E+09	0.00	0.00	0.00
0.5900	1.3580	-3684136.	73543.	-0.00450	73049.	6.22E+09	-72.3507	377.1989	0.00
1.1800	1.3113	-3147294.	72731.	-0.00753	64048.	1.19E+10	-156.9026	847.1268	0.00
1.7700	1.2514	-2613199.	71327.	-0.00920	55094.	1.27E+10	-239.8438	1357.	0.00
2.3600	1.1811	-2087164.	69354.	-0.01050	46275.	1.29E+10	-317.5140	1903.	0.00
2.9500	1.1027	-1573919.	66874.	-0.01150	37670.	1.29E+10	-382.8754	2458.	0.00
3.5400	1.0182	-1077510.	63942.	-0.01223	29347.	1.29E+10	-445.4084	3097.	0.00
4.1300	0.9295	-601813.	60507.	-0.01269	21372.	1.29E+10	-524.9540	3999.	0.00
4.7200	0.8385	-151528.	56485.	-0.01290	13823.	1.29E+10	-611.1446	5160.	0.00
5.3100	0.7468	268348.	51770.	-0.01287	15781.	1.29E+10	-720.9728	6835.	0.00
5.9000	0.6563	651683.	46175.	-0.01262	22208.	1.29E+10	-859.5935	9274.	0.00
6.4900	0.5682	990954.	39465.	-0.01216	27896.	1.29E+10	-1036.	12907.	0.00
7.0800	0.4840	1276817.	31947.	-0.01154	32689.	1.29E+10	-1088.	15910.	0.00
7.6700	0.4048	1506248.	24186.	-0.01078	36535.	1.29E+10	-1105.	19323.	0.00
8.2600	0.3314	1678045.	16374.	-0.00990	39416.	1.29E+10	-1102.	23544.	0.00
8.8500	0.2646	1792085.	8642.	-0.00895	41328.	1.29E+10	-1082.	28958.	0.00
9.4400	0.2047	1849197.	1117.	-0.00795	42285.	1.29E+10	-1044.	36094.	0.00
10.0300	0.1520	1851226.	-6031.	-0.00693	42319.	1.29E+10	-975.4405	45426.	0.00
10.6200	0.1066	1801588.	-12581.	-0.00593	41487.	1.29E+10	-874.8211	58127.	0.00
11.2100	0.06809	1705400.	-18289.	-0.00496	39874.	1.29E+10	-737.6442	76703.	0.00
11.8000	0.03625	1569683.	-22445.	-0.00407	37599.	1.29E+10	-436.3593	85215.	0.00
12.3900	0.01053	1409741.	-24461.	-0.00325	34917.	1.29E+10	-133.0404	89476.	0.00
12.9800	-0.00972	1241020.	-24476.	-0.00252	32089.	1.29E+10	128.6397	93736.	0.00

L1=4.9'

L2=19.7'-4.9'=14.8'

13.5700	-0.02513	1076888.	-23286.	-0.00188	29337.	1.29E+10	207.5790	58477.	0.00
14.1600	-0.03636	921548.	-21745.	-0.00133	26733.	1.29E+10	227.6504	44329.	0.00
14.7500	-0.04400	776240.	-20094.	-8.66E-04	24296.	1.29E+10	238.7695	38419.	0.00
15.3400	-0.04862	641738.	-18382.	-4.77E-04	22041.	1.29E+10	244.8079	35646.	0.00
15.9300	-0.05075	518546.	-16640.	-1.58E-04	19976.	1.29E+10	247.4428	34520.	0.00
16.5200	-0.05086	406980.	-14887.	9.64E-05	18106.	1.29E+10	247.5778	34465.	0.00
17.1100	-0.04938	307216.	-13141.	2.93E-04	16433.	1.29E+10	245.7669	35234.	0.00
17.7000	-0.04672	219311.	-11413.	4.37E-04	14959.	1.29E+10	242.3801	36734.	0.00
18.2900	-0.04319	143227.	-9713.	5.37E-04	13684.	1.29E+10	237.6804	38960.	0.00
18.8800	-0.03911	78842.	-8051.	5.98E-04	12604.	1.29E+10	231.8631	41970.	0.00
19.4700	-0.03473	25962.	-6434.	6.27E-04	11718.	1.29E+10	225.0762	45887.	0.00
20.0600	-0.03024	-15675.	-4867.	6.29E-04	11545.	1.29E+10	217.4314	50906.	0.00
20.6500	-0.02581	-46389.	-3660.	6.12E-04	12060.	1.29E+10	123.6452	33912.	0.00
21.2400	-0.02157	-70836.	-2810.	5.80E-04	12470.	1.29E+10	116.4619	38230.	0.00
21.8300	-0.01760	-89338.	-2012.	5.36E-04	12780.	1.29E+10	108.8327	43785.	0.00
22.4200	-0.01398	-102252.	-1270.	4.84E-04	12997.	1.29E+10	100.7921	51062.	0.00
23.0100	-0.01075	-109960.	-586.4038	4.25E-04	13126.	1.29E+10	92.3622	60828.	0.00
23.6000	-0.00795	-112874.	36.3166	3.64E-04	13175.	1.29E+10	83.5475	74374.	0.00
24.1900	-0.00560	-111431.	595.1778	3.02E-04	13151.	1.29E+10	74.3229	94046.	0.00
24.7800	-0.00367	-106095.	1087.	2.43E-04	13061.	1.29E+10	64.6039	124612.	0.00
25.3700	-0.00216	-97362.	1507.	1.87E-04	12915.	1.29E+10	54.1649	177652.	0.00
25.9600	-0.00103	-85769.	1849.	1.36E-04	12720.	1.29E+10	42.3391	292316.	0.00
26.5500	-2.26E-04	-71924.	2090.	9.32E-05	12488.	1.29E+10	25.8673	810613.	0.00
27.1400	2.94E-04	-56675.	2085.	5.78E-05	12233.	1.29E+10	-27.5315	663396.	0.00
27.7300	5.93E-04	-42721.	1863.	3.05E-05	11999.	1.29E+10	-34.9963	417750.	0.00
28.3200	7.26E-04	-30458.	1607.	1.04E-05	11793.	1.29E+10	-37.4910	365504.	0.00
28.9100	7.41E-04	-20028.	1340.	-3.44E-06	11618.	1.29E+10	-37.7640	360898.	0.00
29.5000	6.78E-04	-11461.	1077.	-1.21E-05	11475.	1.29E+10	-36.6690	383165.	0.00
30.0900	5.70E-04	-4715.	824.4024	-1.65E-05	11361.	1.29E+10	-34.6169	430213.	0.00
30.6800	4.43E-04	302.4449	589.1142	-1.77E-05	11287.	1.29E+10	-31.8487	508455.	0.00
31.2700	3.18E-04	3723.	375.4037	-1.66E-05	11345.	1.29E+10	-28.5215	634124.	0.00
31.8600	2.08E-04	5709.	186.8522	-1.40E-05	11378.	1.29E+10	-24.7416	842606.	0.00
32.4500	1.20E-04	6446.	26.4501	-1.07E-05	11390.	1.29E+10	-20.5697	1218207.	0.00
33.0400	5.63E-05	6142.	-102.9644	-7.25E-06	11385.	1.29E+10	-15.9881	2011402.	0.00
33.6300	1.69E-05	5027.	-197.3118	-4.18E-06	11367.	1.29E+10	-10.6638	4468013.	0.00
34.2200	-2.93E-06	3371.	-228.0889	-1.87E-06	11339.	1.29E+10	1.9696	4766687.	0.00
34.8100	-9.64E-06	1808.	-189.3437	-4.51E-07	11313.	1.29E+10	8.9753	6593790.	0.00
35.4000	-9.32E-06	691.9795	-126.2120	2.35E-07	11294.	1.29E+10	8.8585	6731729.	0.00
35.9900	-6.30E-06	19.2611	-67.3466	4.31E-07	11283.	1.29E+10	7.7702	8725702.	0.00
36.5800	-3.22E-06	-263.9964	-17.8913	3.64E-07	11287.	1.29E+10	6.2003	1.36E+07	0.00
37.1700	-1.16E-06	-236.0620	6.8163	2.26E-07	11286.	1.29E+10	0.7793	4766687.	0.00
37.7600	-1.57E-08	-168.7104	9.6124	1.15E-07	11285.	1.29E+10	0.01055	4766687.	0.00
38.3500	4.70E-07	-100.5772	8.5298	4.10E-08	11284.	1.29E+10	-0.3164	4766687.	0.00

38.9400	5.64E-07	-48.1510	6.0653	9.27E-11	11283.	1.29E+10	-0.3798	4766687.	0.00
39.5300	4.71E-07	-14.6932	3.5976	-1.72E-08	11283.	1.29E+10	-0.3172	4766687.	0.00
40.1200	3.21E-07	2.8848	1.7094	-2.04E-08	11282.	1.29E+10	-0.2161	4766687.	0.00
40.7100	1.82E-07	9.6238	0.5103	-1.70E-08	11283.	1.29E+10	-0.1226	4766687.	0.00
41.3000	8.06E-08	10.2026	-0.1159	-1.15E-08	11283.	1.29E+10	-0.05428	4766687.	0.00
41.8900	1.88E-08	8.0454	-0.3529	-6.52E-09	11283.	1.29E+10	-0.01266	4766687.	0.00
42.4800	-1.17E-08	5.2413	-0.3698	-2.87E-09	11282.	1.29E+10	0.00788	4766687.	0.00
43.0700	-2.18E-08	2.8243	-0.2899	-6.54E-10	11282.	1.29E+10	0.01469	4766687.	0.00
43.6600	-2.10E-08	1.1396	-0.1880	4.35E-10	11282.	1.29E+10	0.01411	4766687.	0.00
44.2500	-1.57E-08	0.1603	-0.1007	7.92E-10	11282.	1.29E+10	0.01054	4766687.	0.00
44.8400	-9.74E-09	-0.2906	-0.04017	7.57E-10	11282.	1.29E+10	0.00656	4766687.	0.00
45.4300	-4.95E-09	-0.4125	-0.00517	5.63E-10	11282.	1.29E+10	0.00333	4766687.	0.00
46.0200	-1.76E-09	-0.3669	0.01082	3.49E-10	11282.	1.29E+10	0.00119	4766687.	0.00
46.6100	-1.61E-12	-0.2613	0.01502	1.77E-10	11282.	1.29E+10	1.09E-06	4766687.	0.00
47.2000	7.41E-10	-0.1552	0.01326	6.23E-11	11282.	1.29E+10	-4.99E-04	4766687.	0.00
47.7900	8.80E-10	-0.07390	0.00939	0.00	11282.	1.29E+10	-5.93E-04	4766687.	0.00
48.3800	7.32E-10	-0.02220	0.00555	-2.71E-11	11282.	1.29E+10	-4.93E-04	4766687.	0.00
48.9700	4.97E-10	0.00484	0.00262	-3.18E-11	11282.	1.29E+10	-3.34E-04	4766687.	0.00
49.5600	2.81E-10	0.01511	7.69E-04	-2.64E-11	11282.	1.29E+10	-1.89E-04	4766687.	0.00
50.1500	1.24E-10	0.01588	-1.95E-04	-1.78E-11	11282.	1.29E+10	-8.32E-05	4766687.	0.00
50.7400	2.81E-11	0.01245	-5.56E-04	-1.01E-11	11282.	1.29E+10	-1.89E-05	4766687.	0.00
51.3300	-1.89E-11	0.00805	-5.78E-04	-4.43E-12	11282.	1.29E+10	1.27E-05	4766687.	0.00
51.9200	-3.46E-11	0.00428	-4.51E-04	-1.04E-12	11282.	1.29E+10	2.33E-05	4766687.	0.00
52.5100	-3.37E-11	0.00167	-2.88E-04	0.00	11282.	1.29E+10	2.27E-05	4766687.	0.00
53.1000	-2.62E-11	2.01E-04	-1.45E-04	1.11E-12	11282.	1.29E+10	1.77E-05	4766687.	0.00
53.6900	-1.80E-11	-3.87E-04	-3.96E-05	1.06E-12	11282.	1.29E+10	1.21E-05	4766687.	0.00
54.2800	-1.13E-11	-3.65E-04	5.06E-06	0.00	11282.	1.29E+10	4.78E-07	299756.	0.00
54.8700	-6.00E-12	-3.20E-04	7.66E-06	0.00	11282.	1.29E+10	2.57E-07	303014.	0.00
55.4600	-1.94E-12	-2.60E-04	8.87E-06	0.00	11282.	1.29E+10	8.38E-08	306272.	0.00
56.0500	1.11E-12	-1.97E-04	8.99E-06	0.00	11282.	1.29E+10	-4.85E-08	309531.	0.00
56.6400	3.39E-12	-1.35E-04	8.29E-06	0.00	11282.	1.29E+10	-1.50E-07	312789.	0.00
57.2300	5.15E-12	-8.09E-05	6.95E-06	0.00	11282.	1.29E+10	-2.30E-07	316047.	0.00
57.8200	6.59E-12	-3.81E-05	5.08E-06	0.00	11282.	1.29E+10	-2.97E-07	319305.	0.00
58.4100	7.88E-12	-1.01E-05	2.76E-06	0.00	11282.	1.29E+10	-3.59E-07	322563.	0.00
59.0000	9.13E-12	0.00	0.00	0.00	11282.	1.29E+10	-4.20E-07	162911.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

```
Output Summary for Load Case No. 1:

Pile-head deflection              =     1.37500000 inches
Computed slope at pile head       =       0.000000 radians
Maximum bending moment            =      -4213171. inch-lbs
Maximum shear force               =         74171. lbs
Depth of maximum bending moment   =       0.000000 feet below pile head
Depth of maximum shear force      =       0.000000 feet below pile head
Number of iterations              =             19
Number of zero deflection points  =              8
```

Second Run: Pu=385 kips, 1.375 deflection, Mp= -3436734 in-lbs

```
--------------------------------------------------------------------------------
                 Computed Values of Pile Loading and Deflection
                   for Lateral Loading for Load Case Number 2
--------------------------------------------------------------------------------

Pile-head conditions are Displacement and Moment (Loading Type 4)
Displacement of pile head                             =      1.375000 inches
Moment at pile head                                   =    -3436734.0 in-lbs
Axial load at pile head                               =      385000.0 lbs
```

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	1.3750	-3436734.	65867.	-0.00553	68901.	1.12E+10	0.00	0.00	0.00
0.5900	1.3282	-2952365.	65611.	-0.00755	60780.	1.12E+10	-72.3504	385.6733	0.00
1.1800	1.2681	-2466532.	64800.	-0.00916	52635.	1.28E+10	-156.9019	875.9919	0.00
1.7700	1.1984	-1984857.	63395.	-0.01039	44560.	1.29E+10	-239.8425	1417.	0.00
2.3600	1.1210	-1512233.	61422.	-0.01135	36636.	1.29E+10	-317.5123	2005.	0.00
2.9500	1.0378	-1053259.	58943.	-0.01205	28941.	1.29E+10	-382.8732	2612.	0.00
3.5400	0.9504	-611900.	56011.	-0.01251	21541.	1.29E+10	-445.4056	3318.	0.00
4.1300	0.8606	-191951.	52576.	-0.01273	14501.	1.29E+10	-524.9506	4319.	0.00
4.7200	0.7701	201971.	48554.	-0.01273	14669.	1.29E+10	-611.1404	5618.	0.00
5.3100	0.6804	564957.	43838.	-0.01252	20754.	1.29E+10	-720.9676	7502.	0.00
5.9000	0.5929	890957.	38243.	-0.01212	26220.	1.29E+10	-859.5869	10265.	0.00
6.4900	0.5088	1172535.	31788.	-0.01155	30941.	1.29E+10	-963.9114	13412.	0.00
7.0800	0.4293	1404039.	24852.	-0.01084	34822.	1.29E+10	-995.3332	16414.	0.00
7.6700	0.3553	1583548.	17760.	-0.01002	37831.	1.29E+10	-1008.	20086.	0.00
8.2600	0.2874	1710160.	10640.	-0.00912	39954.	1.29E+10	-1003.	24717.	0.00
8.8500	0.2262	1783909.	3606.	-0.00816	41191.	1.29E+10	-983.3722	30778.	0.00
9.4400	0.1719	1805695.	-3197.	-0.00717	41556.	1.29E+10	-938.5592	38649.	0.00
10.0300	0.1247	1777729.	-9580.	-0.00619	41087.	1.29E+10	-864.6074	49099.	0.00
10.6200	0.08433	1703761.	-15327.	-0.00523	39847.	1.29E+10	-758.8604	63708.	0.00
11.2100	0.05062	1589203.	-20063.	-0.00433	37926.	1.29E+10	-578.7929	80954.	0.00
11.8000	0.02309	1443252.	-23095.	-0.00349	35479.	1.29E+10	-277.8836	85215.	0.00
12.3900	0.00117	1281210.	-24131.	-0.00274	32763.	1.29E+10	-14.7885	89476.	0.00
12.9800	-0.01576	1116508.	-23445.	-0.00209	30001.	1.29E+10	208.7019	93736.	0.00
13.5700	-0.02835	960595.	-21949.	-0.00151	27387.	1.29E+10	213.8966	53410.	0.00
14.1600	-0.03721	813965.	-20381.	-0.00103	24929.	1.29E+10	228.9338	43562.	0.00
14.7500	-0.04290	677593.	-18731.	-6.17E-04	22643.	1.29E+10	237.2212	39154.	0.00
15.3400	-0.04595	552096.	-17037.	-2.79E-04	20539.	1.29E+10	241.3315	37187.	0.00
15.9300	-0.04685	437870.	-15324.	-7.39E-06	18624.	1.29E+10	242.5088	36648.	0.00
16.5200	-0.04605	335143.	-13611.	2.05E-04	16901.	1.29E+10	241.4665	37123.	0.00
17.1100	-0.04395	244019.	-11911.	3.64E-04	15374.	1.29E+10	238.6597	38448.	0.00
17.7000	-0.04090	164493.	-10237.	4.76E-04	14040.	1.29E+10	234.4015	40580.	0.00
18.2900	-0.03720	96470.	-8597.	5.48E-04	12900.	1.29E+10	228.9197	43564.	0.00
18.8800	-0.03314	39777.	-6999.	5.85E-04	11949.	1.29E+10	222.3862	47515.	0.00
19.4700	-0.02891	-5828.	-5451.	5.95E-04	11380.	1.29E+10	214.9332	52629.	0.00
20.0600	-0.02471	-40650.	-3958.	5.82E-04	11964.	1.29E+10	206.6605	59202.	0.00
20.6500	-0.02067	-65052.	-2821.	5.53E-04	12373.	1.29E+10	114.7798	39308.	0.00
21.2400	-0.01689	-83603.	-2034.	5.12E-04	12684.	1.29E+10	107.2884	44986.	0.00
21.8300	-0.01342	-96652.	-1303.	4.63E-04	12903.	1.29E+10	99.3827	52423.	0.00
22.4200	-0.01033	-104573.	-628.5586	4.07E-04	13036.	1.29E+10	91.0869	62399.	0.00
23.0100	-0.00765	-107772.	-14.3865	3.49E-04	13089.	1.29E+10	82.4080	76222.	0.00
23.6000	-0.00539	-106679.	536.9063	2.90E-04	13071.	1.29E+10	73.3244	96251.	0.00
24.1900	-0.00355	-101751.	1022.	2.33E-04	12988.	1.29E+10	63.7579	127248.	0.00
24.7800	-0.00210	-93474.	1437.	1.79E-04	12850.	1.29E+10	53.4963	180604.	0.00
25.3700	-0.00101	-82376.	1775.	1.31E-04	12663.	1.29E+10	41.9121	293665.	0.00
25.9600	-2.44E-04	-69054.	2015.	8.93E-05	12440.	1.29E+10	26.0109	754063.	0.00
26.5500	2.53E-04	-54324.	2013.	5.54E-05	12193.	1.29E+10	-26.5810	742663.	0.00
27.1400	5.40E-04	-40845.	1799.	2.92E-05	11967.	1.29E+10	-34.1116	447483.	0.00
27.7300	6.67E-04	-29015.	1548.	1.00E-05	11769.	1.29E+10	-36.5884	388302.	0.00
28.3200	6.82E-04	-18976.	1288.	-3.16E-06	11601.	1.29E+10	-36.8439	382670.	0.00
28.9100	6.22E-04	-10755.	1031.	-1.13E-05	11463.	1.29E+10	-35.7395	406549.	0.00
29.5000	5.21E-04	-4310.	785.6362	-1.55E-05	11355.	1.29E+10	-33.6871	457526.	0.00
30.0900	4.03E-04	453.7482	556.8980	-1.65E-05	11290.	1.29E+10	-30.9282	542788.	0.00
30.6800	2.87E-04	3666.	349.6332	-1.54E-05	11344.	1.29E+10	-27.6212	680645.	0.00
31.2700	1.85E-04	5488.	167.3375	-1.29E-05	11374.	1.29E+10	-23.8748	911394.	0.00
31.8600	1.05E-04	6106.	12.8865	-9.69E-06	11385.	1.29E+10	-19.7554	1332445.	0.00
32.4500	4.82E-05	5724.	-111.0626	-6.44E-06	11378.	1.29E+10	-15.2585	2240034.	0.00
33.0400	1.37E-05	4568.	-200.7991	-3.61E-06	11359.	1.29E+10	-10.0908	5196598.	0.00
33.6300	-2.96E-06	2900.	-215.9801	-1.56E-06	11331.	1.29E+10	5.8024	1.39E+07	0.00

L1=4.4'

Mmaxp2

L2=19.4'-4.4'=15'

34.2200	-8.39E-06	1519.	-165.8638	-3.49E-07	11308.	1.29E+10	8.3547	7052932.	0.00
34.8100	-7.91E-06	553.4419	-107.6353	2.20E-07	11292.	1.29E+10	8.0940	7248035.	0.00
35.4000	-5.27E-06	-6.7691	-54.9068	3.70E-07	11283.	1.29E+10	6.8011	9131833.	0.00
35.9900	-2.67E-06	-226.0554	-13.5239	3.06E-07	11286.	1.29E+10	4.8890	1.30E+07	0.00
36.5800	-9.38E-07	-199.9361	6.0193	1.89E-07	11286.	1.29E+10	0.6317	4766687.	0.00
37.1700	1.17E-08	-141.8536	8.2275	9.52E-08	11285.	1.29E+10	-0.00788	4766687.	0.00
37.7600	4.10E-07	-83.9535	7.2229	3.32E-08	11284.	1.29E+10	-0.2759	4766687.	0.00
38.3500	4.81E-07	-39.7585	5.0988	-8.16E-10	11283.	1.29E+10	-0.3241	4766687.	0.00
38.9400	3.98E-07	-11.7497	3.0023	-1.50E-08	11283.	1.29E+10	-0.2681	4766687.	0.00
39.5300	2.69E-07	2.8359	1.4109	-1.74E-08	11282.	1.29E+10	-0.1814	4766687.	0.00
40.1200	1.52E-07	8.3236	0.4072	-1.43E-08	11283.	1.29E+10	-0.1021	4766687.	0.00
40.7100	6.63E-08	8.6803	-0.1122	-9.68E-09	11283.	1.29E+10	-0.04461	4766687.	0.00
41.3000	1.46E-08	6.7877	-0.3050	-5.43E-09	11283.	1.29E+10	-0.00985	4766687.	0.00
41.8900	-1.06E-08	4.3914	-0.3146	-2.36E-09	11282.	1.29E+10	0.00714	4766687.	0.00
42.4800	-1.88E-08	2.3465	-0.2446	-5.07E-10	11282.	1.29E+10	0.01263	4766687.	0.00
43.0700	-1.78E-08	0.9312	-0.1575	3.94E-10	11282.	1.29E+10	0.01197	4766687.	0.00
43.6600	-1.32E-08	0.1148	-0.08364	6.81E-10	11282.	1.29E+10	0.00888	4766687.	0.00
44.2500	-8.14E-09	-0.2568	-0.03280	6.42E-10	11282.	1.29E+10	0.00548	4766687.	0.00
44.8400	-4.10E-09	-0.3532	-0.00362	4.74E-10	11282.	1.29E+10	0.00276	4766687.	0.00
45.4300	-1.43E-09	-0.3107	0.00954	2.92E-10	11282.	1.29E+10	9.60E-04	4766687.	0.00
46.0200	3.72E-11	-0.2196	0.01285	1.46E-10	11282.	1.29E+10	-2.50E-05	4766687.	0.00
46.6100	6.46E-10	-0.1295	0.01122	5.04E-11	11282.	1.29E+10	-4.35E-04	4766687.	0.00
47.2000	7.51E-10	-0.06101	0.00789	-1.95E-12	11282.	1.29E+10	-5.05E-04	4766687.	0.00
47.7900	6.18E-10	-0.01773	0.00463	-2.36E-11	11282.	1.29E+10	-4.16E-04	4766687.	0.00
48.3800	4.17E-10	0.00470	0.00216	-2.72E-11	11282.	1.29E+10	-2.81E-04	4766687.	0.00
48.9700	2.34E-10	0.01306	6.14E-04	-2.23E-11	11282.	1.29E+10	-1.57E-04	4766687.	0.00
49.5600	1.01E-10	0.01352	-1.85E-04	-1.50E-11	11282.	1.29E+10	-6.83E-05	4766687.	0.00
50.1500	2.17E-11	0.01052	-4.78E-04	-8.37E-12	11282.	1.29E+10	-1.46E-05	4766687.	0.00
50.7400	-1.71E-11	0.00679	-4.89E-04	-3.62E-12	11282.	1.29E+10	1.15E-05	4766687.	0.00
51.3300	-2.95E-11	0.00362	-3.78E-04	0.00	11282.	1.29E+10	1.99E-05	4766687.	0.00
51.9200	-2.79E-11	0.00144	-2.41E-04	0.00	11282.	1.29E+10	1.88E-05	4766687.	0.00
52.5100	-2.06E-11	1.95E-04	-1.26E-04	1.08E-12	11282.	1.29E+10	1.39E-05	4766687.	0.00
53.1000	-1.26E-11	-3.52E-04	-4.68E-05	1.03E-12	11282.	1.29E+10	8.47E-06	4766687.	0.00
53.6900	-5.94E-12	-4.74E-04	-2.64E-06	0.00	11282.	1.29E+10	4.00E-06	4766687.	0.00
54.2800	-1.14E-12	-3.94E-04	1.17E-05	0.00	11282.	1.29E+10	4.85E-08	299756.	0.00
54.8700	2.12E-12	-3.11E-04	1.16E-05	0.00	11282.	1.29E+10	-9.08E-08	303014.	0.00
55.4600	4.18E-12	-2.32E-04	1.06E-05	0.00	11282.	1.29E+10	-1.81E-07	306272.	0.00
56.0500	5.33E-12	-1.62E-04	9.12E-06	0.00	11282.	1.29E+10	-2.33E-07	309531.	0.00
56.6400	5.85E-12	-1.04E-04	7.38E-06	0.00	11282.	1.29E+10	-2.59E-07	312789.	0.00
57.2300	5.97E-12	-5.81E-05	5.52E-06	0.00	11282.	1.29E+10	-2.67E-07	316047.	0.00
57.8200	5.86E-12	-2.56E-05	3.64E-06	0.00	11282.	1.29E+10	-2.64E-07	319305.	0.00
58.4100	5.66E-12	-6.35E-06	1.80E-06	0.00	11282.	1.29E+10	-2.58E-07	322563.	0.00
59.0000	5.42E-12	0.00	0.00	0.00	11282.	1.29E+10	-2.50E-07	162911.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

```
Pile-head deflection            =     1.37500000 inches
Computed slope at pile head     =    -0.00552705 radians
Maximum bending moment          =      -3436734. inch-lbs
Maximum shear force             =         65867. lbs
Depth of maximum bending moment =       0.000000 feet below pile head
Depth of maximum shear force    =       0.000000 feet below pile head
Number of iterations            =             28
Number of zero deflection points =             8
```

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	y, in	1.3750	S, rad	0.00	385000.	1.3750	0.00	74171.	-4213171.
2	y, in	1.3750	M, in-lb	-3436734.	385000.	1.3750	-0.00553	65867.	-3436734.

Maximum pile-head deflection = 1.3750000000 inches

```
Maximum pile-head rotation   = -0.0055270496 radians = -0.316677 deg.

The analysis ended normally.
```

Pile Group Analysis
Pier

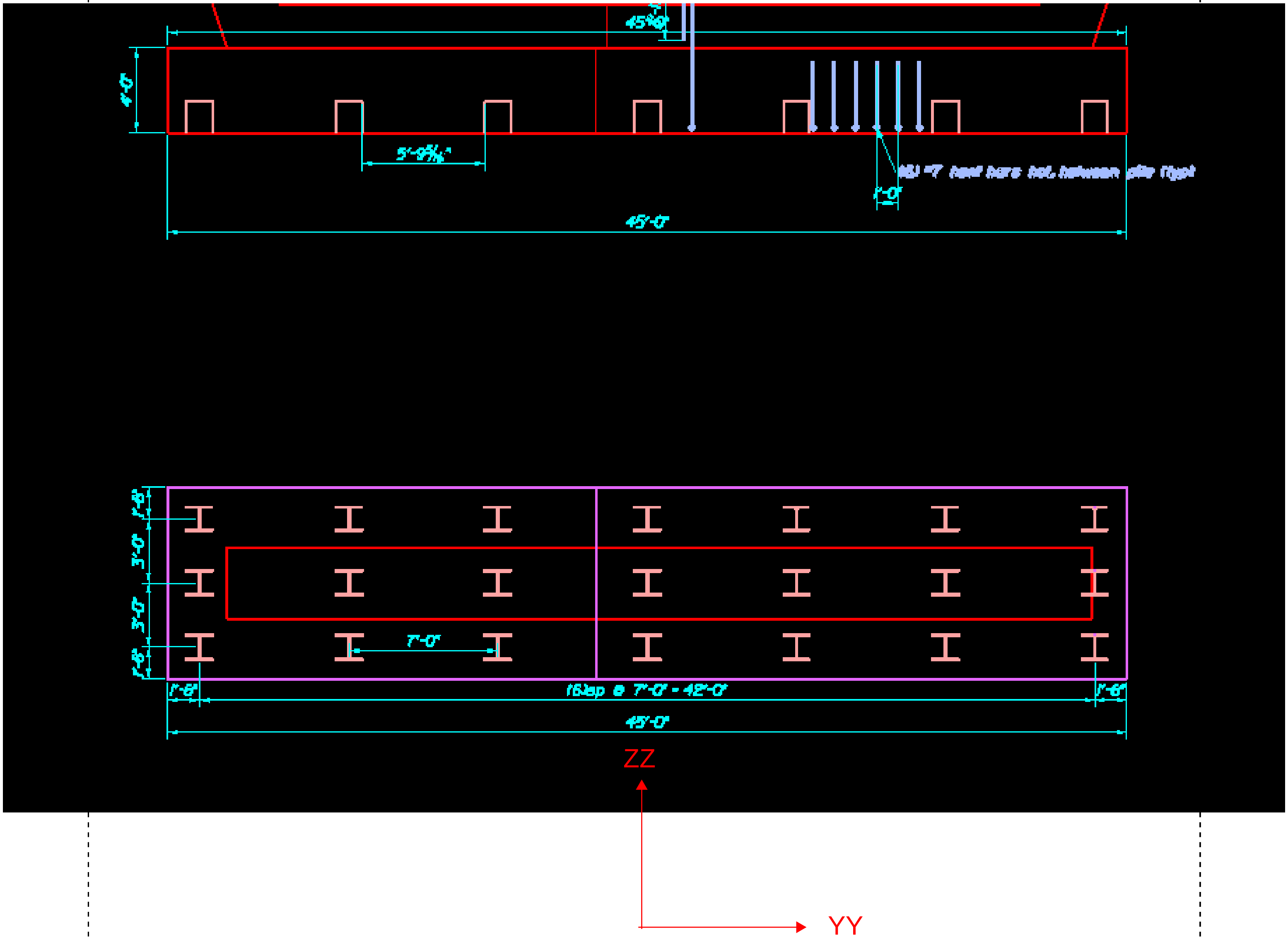
Bentley		Sheet #	6
		Job #	
Program: LEAP® Bridge Concrete CONNECT Edition	Hoyle Tanner & Associates Inc	Designed	
Module: Substructure	Copyright © Bentley Systems, Inc. 2016	Date	Jan/25/2022
Version: 21.01.00.22	www.bentley.com Phone: 1-800-778-4277	Checked	
File Name: **project.lbcx**		Date	

Two Way Shear

#	Bo ft	Ao ft^2	Comb	Avg. dv in	Vu kips	phi*Vc kips
Columns						
1	No Two Way Shear					
Piles - max						
16	19.18	23.00	3	43.55	312.5	2273.4
Piles - min						
1	7.80	15.19	3	43.55	312.5	923.9

Two Way Shear Note

TWO WAY SHEAR IN FOOTING IS NOT DESIGNED AND STIRRUPS ARE NOT CONSIDERED.



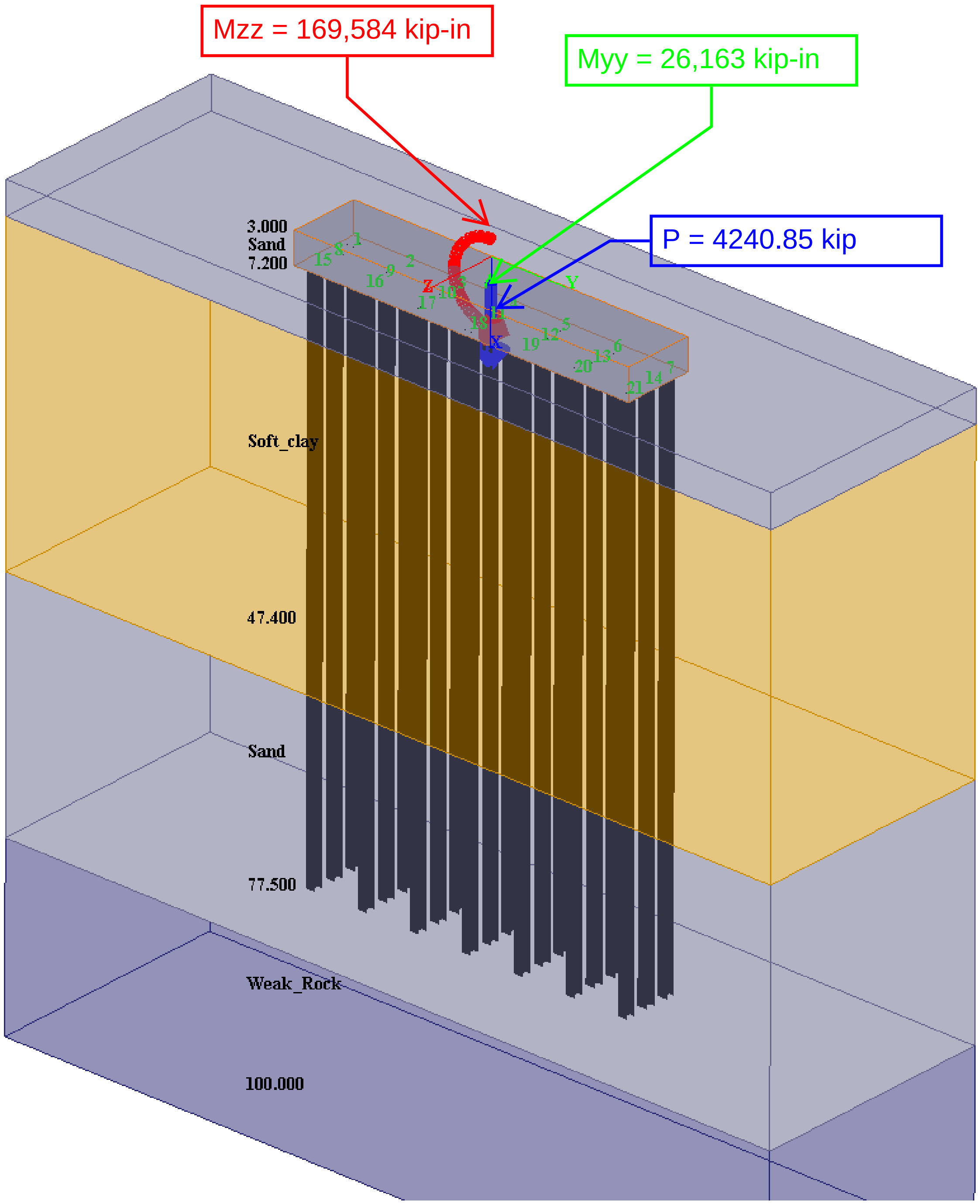
Units: US (English)
Design Code:

Bentley		Sheet #	3
		Job #	
Program: LEAP® Bridge Concrete CONNECT Edition	Hoyle Tanner & Associates Inc	Designed	
Module: Substructure	Copyright © Bentley Systems, Inc. 2016	Date	Jan/25/2022
Version: 21.01.00.22	www.bentley.com Phone: 1-800-778-4277	Checked	
File Name: **project.lbcx**		Date	

Myy for Group model

Pile Reactions, Factored **Load Effect @ Footing Bot.**

Pile	X in	Z in	Batter X degree	Batter Z degree	comb	Ovs	P kips	Mxx kft	Mzz kft	Pile Reac. kips
1	522.0	-36.0	-0	-0	2	---	-3984.08	-2130.38	-12119.20	302.27
					79	---	-2651.20	1818.96	9691.77	33.49
2	438.0	-36.0	-0	-0	2	---	-3984.08	-2130.38	-12119.20	281.66
					1546	---	-2533.81	1868.87	8047.97	48.79
3	354.0	-36.0	-0	-0	2	---	-3984.08	-2130.38	-12119.20	261.05
					1546	---	-2533.81	1868.87	8047.97	62.47
4	270.0	-36.0	-0	-0	1	---	-4240.85	-2130.38	3654.79	252.67
					207	---	-2137.65	1285.67	480.73	71.18
5	186.0	-36.0	-0	-0	3	---	-3984.08	-2130.38	14132.84	264.48
					1542	---	-2533.81	1846.38	-8635.56	62.01
6	102.0	-36.0	-0	-0	3	---	-3984.08	-2130.38	14132.84	288.51
					80	---	-2651.20	1818.96	-11490.78	43.85
7	18.0	-36.0	-0	-0	3	---	-3984.08	-2130.38	14132.84	312.55
					80	---	-2651.20	1818.96	-11490.78	24.31
8	522.0	36.0	-0	-0	7	---	-3984.08	1818.96	-14025.51	304.59
					74	---	-2651.20	-2130.38	11598.08	16.35
9	438.0	36.0	-0	-0	7	---	-3984.08	1818.96	-14025.51	280.73
					74	---	-2651.20	-2130.38	11598.08	36.07
10	354.0	36.0	-0	-0	7	---	-3984.08	1818.96	-14025.51	256.88
					1586	---	-2533.81	-2157.80	8742.86	54.41
11	270.0	36.0	-0	-0	6	---	-4240.85	1818.96	1748.47	245.25
					216	---	-2137.65	-1597.09	-373.43	63.77
12	186.0	36.0	-0	-0	8	---	-3984.08	1818.96	12226.52	253.82
					1592	---	-2533.81	-2180.29	-7940.67	55.24
13	102.0	36.0	-0	-0	8	---	-3984.08	1818.96	12226.52	274.61
					1592	---	-2533.81	-2180.29	-7940.67	41.74
14	18.0	36.0	-0	-0	8	---	-3984.08	1818.96	12226.52	295.41
					75	---	-2651.20	-2130.38	-9584.47	26.62
15	522.0	-0.0	-0	-0	7	---	-3984.08	1818.96	-14025.51	261.28
					74	---	-2651.20	-2130.38	11598.08	67.07
16	438.0	-0.0	-0	-0	7	---	-3984.08	1818.96	-14025.51	237.42
					74	---	-2651.20	-2130.38	11598.08	86.80
17	354.0	-0.0	-0	-0	7	---	-3984.08	1818.96	-14025.51	213.57
					211	---	-2137.65	234.84	1332.74	99.53
18	270.0	-0.0	-0	-0	1	---	-4240.85	-2130.38	3654.79	201.95
					207	---	-2137.65	1285.67	480.73	101.79
19	186.0	-0.0	-0	-0	3	---	-3984.08	-2130.38	14132.84	213.75
					220	---	-2137.65	-546.26	-1225.44	99.71
20	102.0	-0.0	-0	-0	3	---	-3984.08	-2130.38	14132.84	237.79
					80	---	-2651.20	1818.96	-11490.78	87.16
21	18.0	-0.0	-0	-0	3	---	-3984.08	-2130.38	14132.84	261.82
					80	---	-2651.20	1818.96	-11490.78	67.62



Mzz = 169,584 kip-in
Myy = 26,163 kip-in
P = 4240.85 kip
3.000
Sand
7.200
Soft_clay
47.400
Sand
77.500
Weak_Rock
100.000

```
========================================================================

                GROUP for Windows, Version 2016.10.13

                 Serial Number : 364300562

                 Analysis of A Group of Piles
               Subjected to Axial and Lateral Loading

                (c) Copyright ENSOFT, Inc., 1987-2015
                      All Rights Reserved

========================================================================


This program is licensed to :

GZA GeoEnvironmental, Inc.
Portland, ME

Path to file locations      : P:\09 Jobs\0026000s\09.0026023.00 - MEDOT - Bucknam Rd - Falmouth\Work\calcs\Group (Pier Piles)\Revised config 2 4 2022\
Name of input data file     : PierGroup.gp10r
Name of output echo file    : PierGroup.gp10e
Name of output results file : PierGroup.gp10o
Name of output summary file : PierGroup.gp10t
Name of plot output file    : PierGroup.gp10p
Name of runtime file        : PierGroup.gp10r


------------------------------------------------------------------------
                    Time and Date of Analysis
------------------------------------------------------------------------

          Date:  February 10, 2022     Time:  11:25:38





           *****     INPUT INFORMATION     *****


New Group

ANALYSIS TYPE = 3D ANALYSIS

ADJUST DEPTH FOR BATTER PILES

GENERATE LOAD-DISP (AND T-R) CURVES BASED ON SOIL PROFILE

EXTEND INTERPOLATION FOR L-DP (AND T-R) CURVES

UNITS SYSTEM  = ENGL






 * TABLE B *  PILE CAP OPTIONS

 LENGTH,YY    ( FT ) =    45.00
 WIDTH, ZZ    ( FT ) =    9.000
 THICKNESS,XX ( FT ) =    4.000

 * PILE CAP DIMENSIONS ARE NOT CONSIDERED
   FOR THE PILE GROUP ANALYSIS



 * TABLE C *  LOAD AND CONTROL PARAMETERS


 ** LOAD CASES **


 NUMBER OF LOAD CASES :    1


 LOAD CASE    :     1
 CASE NAME    : Max. Factored Load for Strength (HTA Output)
 LOAD TYPE    : Dead, DL
 SCALE FACTOR :       1.0000

 * CONCENTRATED LOADS *

NL  VERT.LOAD HR.LOAD Y HR.LOAD Z  MOMENT X  MOMENT Y  MOMENT Z   COORD X   COORD Y   COORD Z
       KIP       KIP       KIP      KIP-IN    KIP-IN    KIP-IN      FT        FT        FT
 1   4.24E+03      0.00      0.00      0.00 -2.62E+04  1.70E+05      3.00      0.00      0.00


 * EQUIVALENT CONCENTRATED LOAD AT ORIGIN *

       VER.LOAD X,KIP     HOR.LOAD Y,KIP     HOR.LOAD Z,KIP
             4240.85           0.00000           0.00000

       MOMENT X,KIP-IN    MOMENT Y,KIP-IN    MOMENT Z,KIP-IN
             0.00000          -26163.5       1.69594E+05


 * THE LOADING IS STATIC *


 * CONTROL PARAMETERS *
     TOLERANCE ON CONVERGENCE OF PILE CAP MOVEMENT        =  1.00000E-04
     TOLERANCE ON DETERMINATION OF PILE DEFLECTIONS       =  1.00000E-03 IN
     MAX NO OF ITERATIONS ALLOWED FOR FOUNDATION ANALYSIS =      100
     MAXIMUM NO OF ITERATIONS ALLOWED FOR PILE ANALYSIS   =      100
     FACTOR TO APPLY THE LOAD IN INCREMENTS               =   1.0000
     MINIMUM FACTOR FOR LOAD INCREMENTS                   =   1.0000
     PRINT RESULTS AT PILE CAP AND PILE HEADS
```

* TABLE D *   ARRANGEMENT OF PILE GROUPS

GROUP	CONN.Z-Z	CONN.Y-Y	PILE PROP	P-Y CURVE	L-S CURVE	T-R CURVE	R-F-L SET
1	FIX	FIX	1	0	1 G	1 G	0
2	FIX	FIX	1	0	1 G	1 G	0
3	FIX	FIX	1	0	1 G	1 G	0
4	FIX	FIX	1	0	1 G	1 G	0
5	FIX	FIX	1	0	1 G	1 G	0
6	FIX	FIX	1	0	1 G	1 G	0
7	FIX	FIX	1	0	1 G	1 G	0
8	FIX	FIX	1	0	1 G	1 G	0
9	FIX	FIX	1	0	1 G	1 G	0
10	FIX	FIX	1	0	1 G	1 G	0
11	FIX	FIX	1	0	1 G	1 G	0
12	FIX	FIX	1	0	1 G	1 G	0
13	FIX	FIX	1	0	1 G	1 G	0
14	FIX	FIX	1	0	1 G	1 G	0
15	FIX	FIX	1	0	1 G	1 G	0
16	FIX	FIX	1	0	1 G	1 G	0
17	FIX	FIX	1	0	1 G	1 G	0
18	FIX	FIX	1	0	1 G	1 G	0
19	FIX	FIX	1	0	1 G	1 G	0
20	FIX	FIX	1	0	1 G	1 G	0
21	FIX	FIX	1	0	1 G	1 G	0

GROUP	CorX,FT	CorY,FT	CorZ,FT	ALPHA,DEG	BETA,DEG	THETA,DEG	GROUND,FT	SPz,KIP-IN	SPy,KIP-IN
1	7.000	-21.00	-3.000	0.000	90.00	0.000	-4.000	0.000	0.000
2	7.000	-14.00	-3.000	0.000	90.00	0.000	-4.000	0.000	0.000
3	7.000	-7.000	-3.000	0.000	90.00	0.000	-4.000	0.000	0.000
4	7.000	0.000	-3.000	0.000	90.00	0.000	-4.000	0.000	0.000
5	7.000	7.000	-3.000	0.000	90.00	0.000	-4.000	0.000	0.000
6	7.000	14.00	-3.000	0.000	90.00	0.000	-4.000	0.000	0.000
7	7.000	21.00	-3.000	0.000	90.00	0.000	-4.000	0.000	0.000
8	7.000	-21.00	0.000	0.000	90.00	0.000	-4.000	0.000	0.000
9	7.000	-14.00	0.000	0.000	90.00	0.000	-4.000	0.000	0.000
10	7.000	-7.000	0.000	0.000	90.00	0.000	-4.000	0.000	0.000
11	7.000	0.000	0.000	0.000	90.00	0.000	-4.000	0.000	0.000
12	7.000	7.000	0.000	0.000	90.00	0.000	-4.000	0.000	0.000
13	7.000	14.00	0.000	0.000	90.00	0.000	-4.000	0.000	0.000
14	7.000	21.00	0.000	0.000	90.00	0.000	-4.000	0.000	0.000
15	7.000	-21.00	3.000	0.000	90.00	0.000	-4.000	0.000	0.000
16	7.000	-14.00	3.000	0.000	90.00	0.000	-4.000	0.000	0.000
17	7.000	-7.000	3.000	0.000	90.00	0.000	-4.000	0.000	0.000
18	7.000	0.000	3.000	0.000	90.00	0.000	-4.000	0.000	0.000
19	7.000	7.000	3.000	0.000	90.00	0.000	-4.000	0.000	0.000
20	7.000	14.00	3.000	0.000	90.00	0.000	-4.000	0.000	0.000
21	7.000	21.00	3.000	0.000	90.00	0.000	-4.000	0.000	0.000

* TABLE E *   PILE GEOMETRY AND PROPERTIES
PILE TYPE = 1 - DRIVEN PILE
= 2 - DRILLED SHAFT

PROP	SECTS	INC	PILE TYPE	LENGTH, FT
1	1	100	1	70.500

* PILE SECTIONS *

PROP	SECT	FROM,FT	TO,FT	CROSS SECT
1	1	0.00000	70.5000	1

* PILE CROSS SECTIONS *

```
CROSS SECTION       :     1
SECTION NAME        : Section
TYPE                :  ELASTIC
CROSS SECTION TYPE  : AISC SECTION (HP)
AISC SECTION NAME   : HP14X89
EQUIVALENT DIAMETER :       14.2500 IN
EXTERNAL WIDTH      :       14.7000 IN
EXTERNAL DEPTH      :       13.8000 IN
FLANGE THICKNESS    :       0.61500 IN
WEB THICKNESS       :       0.61500 IN
YOUNG MODULUS       :       29000.0 KIP/IN**2
SHEAR MODULUS       :       11153.8 KIP/IN**2
```

* PILE CROSS SECTIONS PROPERTIES *

ELASTIC SECTIONS

SECT	DIAM,IN	AREA,IN**2	Iz,IN**4	Iy,IN**4	GJ,KIP-IN**2	Mn,KIP-IN	Vn,KIP
1	14.250	26.100	326.00	904.00	4.0043E+04	0.0000	0.0000

* TABLE F *   SOIL DATA

SOILS INFORMATION

GROUND SURFACE   =   0.00000 FT

4 LAYER(S) OF SOIL

LAYER 1
THE SOIL IS A SAND

		TOP OF LAYER	BOTTOM OF LAYER
X COORDINATE	(FT)	0.00000	7.20000
EFFECTIVE UNIT WEIGHT	(KIP/FT**3)	0.0630000	0.0630000
FRICTION ANGLE	(DEGREES)	32.0000	32.0000
P-Y SUBGRADE MODULUS	(KIP/IN**3)	0.0450000	0.0450000
ULTIMATE UNIT SIDE FRICTION	(KIP/FT**2)	2.14142E-03 (P)	0.18502 (P)
ULTIMATE UNIT TIP RESISTANCE	(KIP/FT**2)	0.00000	0.00000

LAYER 2
THE SOIL IS A SOFT CLAY

```
                                                  TOP OF LAYER    BOTTOM OF LAYER
    X COORDINATE                        (FT)        7.20000          47.4000
    EFFECTIVE UNIT WEIGHT         (KIP/FT**3)      0.0530000        0.0530000
    UNDRAINED COHESION, C         (KIP/FT**2)       0.50000          0.50000
    STRAIN AT 50% STRESS                          8.00000E-03      8.00000E-03
    ULTIMATE UNIT SIDE FRICTION   (KIP/FT**2)       0.24399 (P)      0.56835 (P)
    ULTIMATE UNIT TIP RESISTANCE  (KIP/FT**2)       0.00000          0.00000

    LAYER  3
    THE SOIL IS A SAND
                                                  TOP OF LAYER    BOTTOM OF LAYER
    X COORDINATE                        (FT)        47.4000          77.5000
    EFFECTIVE UNIT WEIGHT         (KIP/FT**3)      0.0730000        0.0730000
    FRICTION ANGLE                  (DEGREES)       33.0000          33.0000
    P-Y SUBGRADE MODULUS          (KIP/IN**3)      0.0650000        0.0650000
    ULTIMATE UNIT SIDE FRICTION   (KIP/FT**2)       1.09994 (P)      2.03520 (P)
    ULTIMATE UNIT TIP RESISTANCE  (KIP/FT**2)       82.6957 (R)      153.010 (R)

    LAYER  4
    THE LAYER IS A WEAK ROCK
                                                  TOP OF LAYER    BOTTOM OF LAYER
    X COORDINATE                        (FT)        77.5000          100.000
    EFFECTIVE UNIT WEIGHT         (KIP/FT**3)       0.10800          0.10800
    UNIAXIAL COMPRESSIVE STRENGTH (KIP/IN**2)       0.60000          0.60000
    YOUNG MODULUS,ER              (KIP/IN**2)       24.0000          24.0000
    KRM                                             0.00000          0.00000
    RQD                                  (%)        0.50000          0.50000
    ULTIMATE UNIT SIDE FRICTION   (KIP/FT**2)       8.64000 (P)      8.64000 (P)
    ULTIMATE UNIT TIP RESISTANCE  (KIP/FT**2)       777.600 (R)      777.600 (R)

  Notes :  Program estimated values for listed parameters
           if zero input values were entered:
           (P) ULTIMATE UNIT SIDE FRICTION for Driven Piles
           (R) ULTIMATE UNIT TIP RESISTANCE for Driven Piles
```

* TABLE H *   AXIAL LOAD VS DISPLACEMENT

AXIAL LOAD-DISPLACEMENT CURVES GENERATED INTERNALLY

NUM OF CURVES 1

CURVE 1   NUM OF POINTS 19

DISPLACEMENT, IN	AXIAL LOAD,KIP
-2.15527	-207.975
-1.14295	-194.286
-0.63678	-187.442
-0.18422	-129.197
-0.11238	-105.909
-0.0273354	-32.7011
-0.0135899	-15.9478
-2.71708E-03	-3.17933
-2.71715E-04	-0.31794
0.00000	0.00000
2.56764E-03	3.61225
7.57317E-03	10.1471
0.0301418	40.4465
0.0506083	66.7454
0.15224	145.736
0.23880	183.526
0.75414	304.147
1.30409	354.527
2.37013	421.629

* TABLE I *   TORS. MOM. VS ANGLE ROT.

TORQUE-ROTATION CURVES GENERATED INTERNALLY

NUM OF CURVES 1

CURVE 1   NUM OF POINTS 19

ROT. ANGLE,Rad.	TORS.MOMEN,KIP-IN
-22.2531	-1524.59
-21.6529	-1502.07
-21.2656	-1486.34
-19.8790	-1420.98
-19.1729	-1386.38
-17.4463	-1299.91
-16.6899	-1261.19
-14.8350	-1163.99
-12.3927	-1030.31
0.00000	0.00000
12.3927	1030.31
14.8350	1163.99
16.6899	1261.19
17.4463	1299.91
19.1729	1386.38
19.8790	1420.98
21.2656	1486.34
21.6529	1502.07
22.2531	1524.59

* TABLE J *   MOMENT CURVATURE SETS

USER DEFINED MOMENT CURVATURE

NUM OF SETS : 1

CURVE SET 1   NUM OF CURVES 1

CURVE 1 AXIAL LOAD 0.000E+00KIPS

POINT	MOMENT KIPS-IN	CURVATURE RADIAN/IN
1	0.00000	0.00000

* TABLE K * REDUCTION FACTORS

AVERAGE DIAMETER IS USED TO GET RATIO S/B

REDUCTION FACTORS FOR CLOSELY-SPACED PILE GROUPS ALONG Y-DIRECTION
ESTIMATED ASSUMING MOVEMENT IN THE DIRECTION OF Y-FORCE (+)

GROUP NO	P-FACTOR	Y-FACTOR
1	0.8070	1.0000
2	0.8070	1.0000
3	0.8070	1.0000
4	0.8070	1.0000
5	0.8070	1.0000
6	0.8070	1.0000
7	0.8771	1.0000
8	0.6915	1.0000
9	0.6915	1.0000
10	0.6915	1.0000
11	0.6915	1.0000
12	0.6915	1.0000
13	0.6915	1.0000
14	0.7692	1.0000
15	0.8070	1.0000
16	0.8070	1.0000
17	0.8070	1.0000
18	0.8070	1.0000
19	0.8070	1.0000
20	0.8070	1.0000
21	0.8771	1.0000

REDUCTION FACTORS FOR CLOSELY-SPACED PILE GROUPS ALONG Z-DIRECTION
ESTIMATED ASSUMING MOVEMENT IN THE DIRECTION OF Z-FORCE (+)

GROUP NO	P-FACTOR	Y-FACTOR
1	0.6039	1.0000
2	0.6013	1.0000
3	0.6013	1.0000
4	0.6013	1.0000
5	0.6013	1.0000
6	0.6013	1.0000
7	0.6039	1.0000
8	0.6055	1.0000
9	0.6029	1.0000
10	0.6029	1.0000
11	0.6029	1.0000
12	0.6029	1.0000
13	0.6029	1.0000
14	0.6055	1.0000
15	0.8907	1.0000
16	0.8907	1.0000
17	0.8907	1.0000
18	0.8907	1.0000
19	0.8907	1.0000
20	0.8907	1.0000
21	0.8907	1.0000

===

GROUP for Windows, Version 2016.10.13

Serial Number : 364300562

Analysis of A Group of Piles
Subjected to Axial and Lateral Loading

===

Time and Date of Analysis

Date: February 10, 2022 Time: 11:25:38

***** COMPUTATION RESULTS *****

New Group

***** LOAD CASES RESULTS *****

LOAD CASE : 1
CASE NAME : Max. Factored Load for Strength (HTA Output)
LOAD TYPE : Dead, DL

REDUCTION FACTORS FOR CLOSELY-SPACED PILE GROUPS, COMBINED Y AND Z DIRECTIONS
ESTIMATED USING MOVEMENT IN THE DIRECTION OF PILE CAP DISPLACEMENTS

GROUP NO	P-FACTOR	Y-FACTOR
1	0.8889	1.0000
2	0.8802	1.0000
3	0.8802	1.0000
4	0.8802	1.0000
5	0.8802	1.0000
6	0.8802	1.0000
7	0.8802	1.0000
8	0.6294	1.0000
9	0.6153	1.0000
10	0.6153	1.0000
11	0.6153	1.0000
12	0.6153	1.0000
13	0.6153	1.0000
14	0.6174	1.0000
15	0.6463	1.0000
16	0.6321	1.0000
17	0.6321	1.0000
18	0.6321	1.0000
19	0.6321	1.0000
20	0.6321	1.0000
21	0.6342	1.0000

* TABLE L * COMPUTATION ON PILE CAP

* EQUIVALENT CONCENTRATED LOAD AT ORIGIN *

VERT. LOAD,KIPS	HOR. LOAD Y,KIPS	HOR. LOAD Z,KIPS
4240.85	0.00000	0.00000

MOMENT X ,KIP-IN	MOMENT Y,KIP-IN	MOMENT Z,KIP-IN
0.00000	-26163.5	1.69594E+05

* DISPLACEMENT OF GROUPED PILE FOUNDATION AT ORIGIN *

VERTICAL ,IN	HORIZONTAL Y,IN	HORIZONTAL Z,IN
0.35347	-0.11697	-0.30120

ANGLE ROT. X,RAD	ANGLE ROT. Y,RAD	ANGLE ROT. Z,RAD
2.05421E-06	-2.21588E-03	9.21673E-04

* TABLE M * COMPUTATION ON INDIVIDUAL PILE

THE GLOBAL STRUCTURAL COORDINATE SYSTEM
----

* PILE TOP DISPLACEMENTS *

PILE GROUP	DISP. X,IN	DISP. Y,IN	DISP. Z,IN	ROT. X,RAD	ROT. Y,RAD	ROT. Z,RAD
**********	***********	***********	***********	***********	***********	***********
1	0.6655	-0.039480	-0.1156	2.0542E-06	-2.2159E-03	9.2167E-04
2	0.5881	-0.039480	-0.1154	2.0542E-06	-2.2159E-03	9.2167E-04
3	0.5107	-0.039480	-0.1152	2.0542E-06	-2.2159E-03	9.2167E-04
4	0.4332	-0.039480	-0.1151	2.0542E-06	-2.2159E-03	9.2167E-04
5	0.3558	-0.039480	-0.1149	2.0542E-06	-2.2159E-03	9.2167E-04
6	0.2784	-0.039480	-0.1147	2.0542E-06	-2.2159E-03	9.2167E-04

7	0.2010	-0.039480	-0.1145	2.0542E-06	-2.2159E-03	9.2167E-04
8	0.5857	-0.039554	-0.1156	2.0542E-06	-2.2159E-03	9.2167E-04
9	0.5083	-0.039554	-0.1154	2.0542E-06	-2.2159E-03	9.2167E-04
10	0.4309	-0.039554	-0.1152	2.0542E-06	-2.2159E-03	9.2167E-04
11	0.3535	-0.039554	-0.1151	2.0542E-06	-2.2159E-03	9.2167E-04
12	0.2761	-0.039554	-0.1149	2.0542E-06	-2.2159E-03	9.2167E-04
13	0.1986	-0.039554	-0.1147	2.0542E-06	-2.2159E-03	9.2167E-04
14	0.1212	-0.039554	-0.1145	2.0542E-06	-2.2159E-03	9.2167E-04
15	0.5060	-0.039628	-0.1156	2.0542E-06	-2.2159E-03	9.2167E-04
16	0.4285	-0.039628	-0.1154	2.0542E-06	-2.2159E-03	9.2167E-04
17	0.3511	-0.039628	-0.1152	2.0542E-06	-2.2159E-03	9.2167E-04
18	0.2737	-0.039628	-0.1151	2.0542E-06	-2.2159E-03	9.2167E-04
19	0.1963	-0.039628	-0.1149	2.0542E-06	-2.2159E-03	9.2167E-04
20	0.1189	-0.039628	-0.1147	2.0542E-06	-2.2159E-03	9.2167E-04
21	0.041437	-0.039628	-0.1145	2.0542E-06	-2.2159E-03	9.2167E-04
MINIMUM	0.041437	-0.039628	-0.1156	2.0542E-06	-2.2159E-03	9.2167E-04
Pile N.	21	15	1	1	1	1
MAXIMUM	0.6655	-0.039480	-0.1145	2.0542E-06	-2.2159E-03	9.2167E-04
Pile N.	1	1	7	1	1	1

* PILE TOP REACTIONS *

PILE GROUP	FOR. X,KIP	FOR. Y,KIP	FOR. Z,KIP	MOM X,KIP-IN	MOM Y,KIP-IN	MOM Z,KIP-IN
**********	***********	***********	***********	***********	***********	***********
1	283.40	-0.1966	-0.9920	1.7079E-04	-569.53	105.88
2	265.28	-0.1928	-0.9336	1.7079E-04	-572.47	106.22
3	247.16	-0.2006	-0.9239	1.7079E-04	-574.52	106.39
4	229.04	-0.2084	-0.9141	1.7079E-04	-576.58	106.56
5	210.92	-0.2163	-0.9042	1.7079E-04	-578.64	106.74
6	192.79	-0.2241	-0.8942	1.7079E-04	-580.70	106.91
7	167.01	-0.2345	-0.8899	1.7079E-04	-583.04	107.17
8	264.73	0.1322	0.4361	1.7079E-04	-595.41	110.21
9	246.61	0.1438	0.5205	1.7079E-04	-598.63	110.63
10	228.49	0.1368	0.5274	1.7079E-04	-600.58	110.83
11	210.37	0.1299	0.5344	1.7079E-04	-602.54	111.03
12	192.24	0.1229	0.5415	1.7079E-04	-604.50	111.23
13	165.99	0.1134	0.5430	1.7079E-04	-606.79	111.53
14	121.62	0.095337	0.5200	1.7079E-04	-609.62	112.03
15	246.06	0.096660	0.3300	1.7079E-04	-594.63	109.84
16	227.94	0.1084	0.4152	1.7079E-04	-597.88	110.27
17	209.81	0.1014	0.4223	1.7079E-04	-599.84	110.47
18	191.69	0.094374	0.4295	1.7079E-04	-601.81	110.67
19	164.96	0.084621	0.4307	1.7079E-04	-604.12	110.97
20	119.79	0.069042	0.4190	1.7079E-04	-607.16	111.51
21	54.961	0.044422	0.3821	1.7079E-04	-610.79	112.25
MINIMUM	54.961	-0.2345	-0.9920	1.7079E-04	-610.79	105.88
Pile N.	21	7	1	1	21	1
MAXIMUM	283.40	0.1438	0.5430	1.7079E-04	-569.53	112.25
Pile N.	1	9	13	1	1	21

THE PILE COORDINATE SYSTEM (LOCAL AXES)
----

* PILE TOP DISPLACEMENTS *

PILE GROUP	DISP. x,IN	DISP. y,IN	DISP. z,IN	ROT. x,RAD	ROT. y,RAD	ROT. z,RAD
**********	***********	***********	***********	***********	***********	***********
1	0.6655	-0.039480	-0.1156	2.0542E-06	-2.2159E-03	9.2167E-04
2	0.5881	-0.039480	-0.1154	2.0542E-06	-2.2159E-03	9.2167E-04
3	0.5107	-0.039480	-0.1152	2.0542E-06	-2.2159E-03	9.2167E-04
4	0.4332	-0.039480	-0.1151	2.0542E-06	-2.2159E-03	9.2167E-04
5	0.3558	-0.039480	-0.1149	2.0542E-06	-2.2159E-03	9.2167E-04
6	0.2784	-0.039480	-0.1147	2.0542E-06	-2.2159E-03	9.2167E-04
7	0.2010	-0.039480	-0.1145	2.0542E-06	-2.2159E-03	9.2167E-04
8	0.5857	-0.039554	-0.1156	2.0542E-06	-2.2159E-03	9.2167E-04
9	0.5083	-0.039554	-0.1154	2.0542E-06	-2.2159E-03	9.2167E-04
10	0.4309	-0.039554	-0.1152	2.0542E-06	-2.2159E-03	9.2167E-04
11	0.3535	-0.039554	-0.1151	2.0542E-06	-2.2159E-03	9.2167E-04
12	0.2761	-0.039554	-0.1149	2.0542E-06	-2.2159E-03	9.2167E-04
13	0.1986	-0.039554	-0.1147	2.0542E-06	-2.2159E-03	9.2167E-04
14	0.1212	-0.039554	-0.1145	2.0542E-06	-2.2159E-03	9.2167E-04
15	0.5060	-0.039628	-0.1156	2.0542E-06	-2.2159E-03	9.2167E-04
16	0.4285	-0.039628	-0.1154	2.0542E-06	-2.2159E-03	9.2167E-04
17	0.3511	-0.039628	-0.1152	2.0542E-06	-2.2159E-03	9.2167E-04
18	0.2737	-0.039628	-0.1151	2.0542E-06	-2.2159E-03	9.2167E-04
19	0.1963	-0.039628	-0.1149	2.0542E-06	-2.2159E-03	9.2167E-04
20	0.1189	-0.039628	-0.1147	2.0542E-06	-2.2159E-03	9.2167E-04
21	0.041437	-0.039628	-0.1145	2.0542E-06	-2.2159E-03	9.2167E-04
MINIMUM	0.041437	-0.039628	-0.1156	2.0542E-06	-2.2159E-03	9.2167E-04
Pile N.	21	15	1	1	1	1
MAXIMUM	0.6655	-0.039480	-0.1145	2.0542E-06	-2.2159E-03	9.2167E-04
Pile N.	1	1	7	1	1	1

* PILE TOP REACTIONS *

PILE GROUP	AXIAL,KIP	LAT. y,KIP	LAT. z,KIP	MOM x,KIP-IN	MOM y,KIP-IN	MOM z,KIP-IN
**********	***********	***********	***********	***********	***********	***********
1	283.40	-0.1966	-0.9920	1.7079E-04	-569.53	105.88
2	265.28	-0.1928	-0.9336	1.7079E-04	-572.47	106.22
3	247.16	-0.2006	-0.9239	1.7079E-04	-574.52	106.39
4	229.04	-0.2084	-0.9141	1.7079E-04	-576.58	106.56
5	210.92	-0.2163	-0.9042	1.7079E-04	-578.64	106.74
6	192.79	-0.2241	-0.8942	1.7079E-04	-580.70	106.91
7	167.01	-0.2345	-0.8899	1.7079E-04	-583.04	107.17
8	264.73	0.1322	0.4361	1.7079E-04	-595.41	110.21
9	246.61	0.1438	0.5205	1.7079E-04	-598.63	110.63
10	228.49	0.1368	0.5274	1.7079E-04	-600.58	110.83
11	210.37	0.1299	0.5344	1.7079E-04	-602.54	111.03
12	192.24	0.1229	0.5415	1.7079E-04	-604.50	111.23
13	165.99	0.1134	0.5430	1.7079E-04	-606.79	111.53
14	121.62	0.095337	0.5200	1.7079E-04	-609.62	112.03
15	246.06	0.096660	0.3300	1.7079E-04	-594.63	109.84
16	227.94	0.1084	0.4152	1.7079E-04	-597.88	110.27
17	209.81	0.1014	0.4223	1.7079E-04	-599.84	110.47
18	191.69	0.094374	0.4295	1.7079E-04	-601.81	110.67
19	164.96	0.084621	0.4307	1.7079E-04	-604.12	110.97

20	119.79	0.069042	0.4190	1.7079E-04	-607.16	111.51
21	54.961	0.044422	0.3821	1.7079E-04	-610.79	112.25
MINIMUM	54.961	-0.2345	-0.9920	1.7079E-04	-610.79	105.88
Pile N.	21	7	1	1	21	1
MAXIMUM	283.40	0.1438	0.5430	1.7079E-04	-569.53	112.25
Pile N.	1	9	13	1	1	21

max axial load

Rn=283.4 k/0.65 = 436 kips

PILE GROUP	STRESS,KIP/IN**2
**********	***************
1	15.908
2	15.238
3	14.560
4	13.882
5	13.204
6	12.526
7	11.557
8	15.418
9	14.750
10	14.072
11	13.393
12	12.715
13	11.728
14	10.052
15	14.693
16	14.026
17	13.347
18	12.669
19	11.664
20	9.9600
21	7.5088
MINIMUM	7.5088
Pile N.	21
MAXIMUM	15.908
Pile N.	1

* EFFECTS FOR LATERALLY LOADED PILE *

* MINIMUM VALUES AND LOCATIONS *

PILE	DISPL. y-DIR IN	DISPL. z-DIR IN	MOMENT z-DIR KIP-IN	MOMENT y-DIR KIP-IN	SHEAR y-DIR KIP	SHEAR z-DIR KIP	SOIL REACT y-DIR KIP/IN	SOIL REACT z-DIR KIP/IN	TOTAL STRESS KIP/IN**2	FLEX. RIG. z-DIR KIP-IN**2	FLEX. RIG. y-DIR KIP-IN**2
******	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
1	-0.039480	-0.1156	-108.66	-582.63	-0.083898	-0.7171	-0.036497	-0.1069	10.858	9.4540E+06	2.6216E+07
x(FT)	0.0000	0.0000	1.4100	1.4100	19.035	21.150	0.0000	0.0000	65.565	0.0000	0.0000
2	-0.039480	-0.1154	-108.72	-584.10	-0.083925	-0.7176	-0.036165	-0.1057	10.164	9.4540E+06	2.6216E+07
x(FT)	0.0000	0.0000	1.4100	1.4100	19.035	21.150	0.0000	0.0000	56.400	0.0000	0.0000
3	-0.039480	-0.1152	-108.77	-585.38	-0.083696	-0.7159	-0.036192	-0.1056	9.4696	9.4540E+06	2.6216E+07
x(FT)	0.0000	0.0000	1.4100	1.4100	19.035	21.150	0.0000	0.0000	56.400	0.0000	0.0000
4	-0.039480	-0.1151	-108.81	-586.65	-0.083470	-0.7142	-0.036219	-0.1056	8.7753	9.4540E+06	2.6216E+07
x(FT)	0.0000	0.0000	1.4100	1.4100	19.035	21.150	0.0000	0.0000	56.400	0.0000	0.0000
5	-0.039480	-0.1149	-108.86	-587.93	-0.083247	-0.7125	-0.036246	-0.1055	8.0811	9.4540E+06	2.6216E+07
x(FT)	0.0000	0.0000	1.4100	1.4100	19.035	21.150	0.0000	0.0000	56.400	0.0000	0.0000
6	-0.039480	-0.1147	-108.93	-589.20	-0.083028	-0.7108	-0.036274	-0.1054	7.3868	9.4540E+06	2.6216E+07
x(FT)	0.0000	0.0000	0.7050	1.4100	19.035	21.150	0.0000	0.0000	56.400	0.0000	0.0000
7	-0.039480	-0.1145	-109.09	-590.60	-0.082667	-0.7086	-0.036301	-0.1053	6.3990	9.4540E+06	2.6216E+07
x(FT)	0.0000	0.0000	0.7050	1.4100	19.035	21.150	0.0000	0.0000	56.400	0.0000	0.0000
8	-0.039554	-0.1156	-110.21	-595.41	-0.086544	-0.7295	-0.025886	-0.075640	10.143	9.4540E+06	2.6216E+07
x(FT)	0.0000	0.0000	0.0000	0.0000	19.740	21.855	0.0000	0.0000	70.500	0.0000	0.0000
9	-0.039554	-0.1154	-110.63	-598.63	-0.086050	-0.7250	-0.025324	-0.073889	9.4486	9.4540E+06	2.6216E+07
x(FT)	0.0000	0.0000	0.0000	0.0000	19.740	21.855	0.0000	0.0000	70.500	0.0000	0.0000
10	-0.039554	-0.1152	-110.83	-600.58	-0.085766	-0.7243	-0.025343	-0.073834	8.7543	9.4540E+06	2.6216E+07
x(FT)	0.0000	0.0000	0.0000	0.0000	19.740	21.855	0.0000	0.0000	70.500	0.0000	0.0000
11	-0.039554	-0.1151	-111.03	-602.54	-0.085486	-0.7237	-0.025362	-0.073778	8.0600	9.4540E+06	2.6216E+07
x(FT)	0.0000	0.0000	0.0000	0.0000	19.740	21.855	0.0000	0.0000	70.500	0.0000	0.0000
12	-0.039554	-0.1149	-111.23	-604.50	-0.085210	-0.7230	-0.025381	-0.073722	7.3657	9.4540E+06	2.6216E+07
x(FT)	0.0000	0.0000	0.0000	0.0000	19.740	21.855	0.0000	0.0000	70.500	0.0000	0.0000
13	-0.039554	-0.1147	-111.53	-606.79	-0.084721	-0.7214	-0.025400	-0.073667	6.3597	9.4540E+06	2.6216E+07
x(FT)	0.0000	0.0000	0.0000	0.0000	19.740	21.855	0.0000	0.0000	70.500	0.0000	0.0000
14	-0.039554	-0.1145	-112.03	-609.62	-0.083808	-0.7182	-0.025508	-0.073870	4.6597	9.4540E+06	2.6216E+07
x(FT)	0.0000	0.0000	0.0000	0.0000	19.740	21.855	0.0000	0.0000	70.500	0.0000	0.0000
15	-0.039628	-0.1156	-109.89	-594.63	-0.086358	-0.7312	-0.026627	-0.077663	9.4275	9.4540E+06	2.6216E+07
x(FT)	0.0000	0.0000	0.7050	0.0000	19.740	21.855	0.0000	0.0000	70.500	0.0000	0.0000
16	-0.039628	-0.1154	-110.27	-597.88	-0.085882	-0.7272	-0.026063	-0.075903	8.7332	9.4540E+06	2.6216E+07
x(FT)	0.0000	0.0000	0.0000	0.0000	19.740	21.855	0.0000	0.0000	70.500	0.0000	0.0000
17	-0.039628	-0.1152	-110.47	-599.84	-0.085619	-0.7265	-0.026082	-0.075846	8.0389	9.4540E+06	2.6216E+07
x(FT)	0.0000	0.0000	0.0000	0.0000	19.740	21.855	0.0000	0.0000	70.500	0.0000	0.0000
18	-0.039628	-0.1151	-110.67	-601.81	-0.085359	-0.7258	-0.026102	-0.075789	7.3446	9.4540E+06	2.6216E+07
x(FT)	0.0000	0.0000	0.0000	0.0000	19.740	21.855	0.0000	0.0000	70.500	0.0000	0.0000
19	-0.039628	-0.1149	-110.97	-604.12	-0.084878	-0.7241	-0.026121	-0.075732	6.3204	9.4540E+06	2.6216E+07
x(FT)	0.0000	0.0000	0.0000	0.0000	19.740	21.855	0.0000	0.0000	70.500	0.0000	0.0000
20	-0.039628	-0.1147	-111.51	-607.16	-0.083924	-0.7202	-0.026141	-0.075675	4.5897	9.4540E+06	2.6216E+07
x(FT)	0.0000	0.0000	0.0000	0.0000	19.740	21.855	0.0000	0.0000	70.500	0.0000	0.0000
21	-0.039628	-0.1145	-112.25	-610.79	-0.082531	-0.7145	-0.026247	-0.075868	2.1058	9.4540E+06	2.6216E+07
x(FT)	0.0000	0.0000	0.0000	0.0000	19.740	21.855	0.0000	0.0000	69.795	0.0000	0.0000
Min.	-0.039628	-0.1156	-112.25	-610.79	-0.086544	-0.7312	-0.036497	-0.1069	2.1058	9.4540E+06	2.6216E+07
Pile N.	15	1	21	21	8	15	1	1	21	1	1

* MAXIMUM VALUES AND LOCATIONS *

PILE	DISPL. y-DIR IN	DISPL. z-DIR IN	MOMENT z-DIR KIP-IN	MOMENT y-DIR KIP-IN	SHEAR y-DIR KIP	SHEAR z-DIR KIP	SOIL REACT y-DIR KIP/IN	SOIL REACT z-DIR KIP/IN	TOTAL STRESS KIP/IN**2	FLEX. RIG. z-DIR KIP-IN**2	FLEX. RIG. y-DIR KIP-IN**2
******	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
1	1.7175E-03	6.1952E-03	4.0903	35.363	1.3487	5.7443	0.025946	0.055017	16.028	9.4540E+06	2.6216E+07
x(FT)	9.8700	11.280	15.510	18.330	7.0500	7.7550	7.7550	11.985	1.4100	0.0000	0.0000
2	1.7234E-03	6.2211E-03	4.0834	35.355	1.3416	5.7248	0.025806	0.054618	15.345	9.4540E+06	2.6216E+07
x(FT)	9.8700	11.280	15.510	18.330	7.0500	7.7550	7.7550	11.985	1.4100	0.0000	0.0000
3	1.7176E-03	6.2152E-03	4.0719	35.312	1.3384	5.7235	0.025833	0.054592	14.660	9.4540E+06	2.6216E+07
x(FT)	9.8700	11.280	15.510	18.330	7.0500	7.7550	7.7550	11.985	1.4100	0.0000	0.0000
4	1.7119E-03	6.2094E-03	4.0604	35.269	1.3351	5.7222	0.025857	0.054566	13.975	9.4540E+06	2.6216E+07
x(FT)	9.8700	11.280	15.510	18.330	7.0500	7.7550	7.7550	11.985	1.4100	0.0000	0.0000
5	1.7062E-03	6.2035E-03	4.0491	35.227	1.3319	5.7209	0.025877	0.054539	13.290	9.4540E+06	2.6216E+07
x(FT)	9.8700	11.280	15.510	18.330	7.0500	7.7550	7.7550	11.985	1.4100	0.0000	0.0000
6	1.7006E-03	6.1977E-03	4.0380	35.184	1.3286	5.7197	0.025891	0.054512	12.605	9.4540E+06	2.6216E+07
x(FT)	9.8700	11.280	15.510	18.330	7.0500	7.7550	7.7550	11.985	1.4100	0.0000	0.0000
7	1.6920E-03	6.1845E-03	4.0199	35.105	1.3237	5.7144	0.025808	0.054459	11.628	9.4540E+06	2.6216E+07

x(FT)	9.8700	11.280	15.510	18.330	7.0500	7.7550	7.7550	11.985	1.4100	0.0000	0.0000
8	2.1668E-03	7.4497E-03	4.3198	37.780	1.2238	5.1685	0.020897	0.048198	15.418	9.4540E+06	2.6216E+07
x(FT)	9.8700	11.985	16.215	19.740	6.3450	7.7550	7.7550	20.445	0.0000	0.0000	0.0000
9	2.1922E-03	7.5406E-03	4.3142	37.924	1.2133	5.1345	0.020682	0.047563	14.750	9.4540E+06	2.6216E+07
x(FT)	9.8700	11.985	16.215	19.740	6.3450	7.7550	7.7550	20.445	0.0000	0.0000	0.0000
10	2.1833E-03	7.5314E-03	4.2992	37.869	1.2093	5.1332	0.020697	0.047632	14.072	9.4540E+06	2.6216E+07
x(FT)	9.8700	11.985	16.215	19.740	6.3450	7.7550	7.7550	20.445	0.0000	0.0000	0.0000
11	2.1743E-03	7.5223E-03	4.2844	37.814	1.2052	5.1319	0.020709	0.047702	13.393	9.4540E+06	2.6216E+07
x(FT)	9.8700	11.985	16.215	19.740	6.3450	7.7550	7.7550	20.445	0.0000	0.0000	0.0000
12	2.1655E-03	7.5131E-03	4.2697	37.759	1.2016	5.1306	0.020718	0.047775	12.715	9.4540E+06	2.6216E+07
x(FT)	9.8700	11.985	16.215	19.740	7.0500	7.7550	7.7550	20.445	0.0000	0.0000	0.0000
13	2.1518E-03	7.4940E-03	4.2458	37.658	1.1964	5.1253	0.020639	0.047764	11.728	9.4540E+06	2.6216E+07
x(FT)	9.8700	11.985	16.215	19.740	7.0500	7.7550	7.7550	20.445	0.0000	0.0000	0.0000
14	2.1221E-03	7.4372E-03	4.2007	37.422	1.1886	5.1161	0.020406	0.047675	10.052	9.4540E+06	2.6216E+07
x(FT)	9.8700	11.985	16.215	19.740	7.0500	7.7550	7.7550	20.445	0.0000	0.0000	0.0000
15	2.1140E-03	7.3125E-03	4.2845	37.423	1.2256	5.1978	0.020837	0.048712	14.693	9.4540E+06	2.6216E+07
x(FT)	9.8700	11.985	16.215	19.740	7.0500	7.7550	7.7550	20.445	0.0000	0.0000	0.0000
16	2.1378E-03	7.3991E-03	4.2800	37.576	1.2151	5.1641	0.020629	0.048173	14.026	9.4540E+06	2.6216E+07
x(FT)	9.8700	11.985	16.215	19.740	7.0500	7.7550	7.7550	20.445	0.0000	0.0000	0.0000
17	2.1291E-03	7.3900E-03	4.2654	37.520	1.2117	5.1628	0.020649	0.048239	13.347	9.4540E+06	2.6216E+07
x(FT)	9.8700	11.985	16.215	19.740	7.0500	7.7550	7.7550	20.445	0.0000	0.0000	0.0000
18	2.1205E-03	7.3810E-03	4.2511	37.464	1.2083	5.1615	0.020667	0.048306	12.669	9.4540E+06	2.6216E+07
x(FT)	9.8700	11.985	16.215	19.740	7.0500	7.7550	7.7550	20.445	0.0000	0.0000	0.0000
19	2.1069E-03	7.3616E-03	4.2272	37.359	1.2031	5.1559	0.020585	0.048285	11.664	9.4540E+06	2.6216E+07
x(FT)	9.8700	11.985	16.215	19.740	7.0500	7.7550	7.7550	20.445	0.0000	0.0000	0.0000
20	2.0826E-03	7.3203E-03	4.1832	37.150	1.1939	5.1412	0.020295	0.048074	9.9600	9.4540E+06	2.6216E+07
x(FT)	9.8700	11.985	16.215	19.740	7.0500	7.7550	7.7550	20.445	0.0000	0.0000	0.0000
21	2.0427E-03	7.2419E-03	4.1176	36.801	1.1814	5.1215	0.019807	0.047746	7.5088	9.4540E+06	2.6216E+07
x(FT)	9.8700	11.985	16.215	19.740	7.0500	7.7550	7.7550	20.445	0.0000	0.0000	0.0000
Max.	2.1922E-03	7.5406E-03	4.3198	37.924	1.3487	5.7443	0.025946	0.055017	16.028	9.4540E+06	2.6216E+07
Pile N.	9	9	8	9	1	1	1	1	1	1	1

***** SUMMARY FOR LOAD CASES AND COMBINATIONS *****

***** LOAD CASES RESULTS *****

LOAD CASE : 1

* TABLE L * COMPUTATION ON PILE CAP

* EQUIVALENT CONCENTRATED LOAD AT ORIGIN *

LOAD X,KIP	LOAD Y,KIP	LOAD Z,KIP	MOM X,KIP-IN	MOM Y,KIP-IN	MOM Z,KIP-IN
4240.85	0.00000	0.00000	0.00000	-26163.5	1.69594E+05

* DISPLACEMENT OF GROUPED PILE FOUNDATION AT ORIGIN *

DISP X,IN	DISP Y,IN	DISP Z,IN	ROT X,RAD	ROT Y,RAD	ROT Z,RAD
0.35347	-0.11697	-0.30120	2.05421E-06	-2.21588E-03	9.21673E-04

* TABLE M * COMPUTATION ON INDIVIDUAL PILE

* PILE TOP DISPLACEMENTS, GLOBAL *

	DISP. X,IN	DISP. Y,IN	DISP. Z,IN	ROT. X,RAD	ROT. Y,RAD	ROT. Z,RAD
	***********	***********	***********	***********	***********	***********
MINIMUM	0.041437	-0.039628	-0.1156	2.0542E-06	-2.2159E-03	9.2167E-04
Pile N.	21	15	1	1	1	1
MAXIMUM	0.6655	-0.039480	-0.1145	2.0542E-06	-2.2159E-03	9.2167E-04
Pile N.	1	1	7	1	1	1

* PILE TOP REACTIONS, GLOBAL *

	FOR. X,KIP	FOR. Y,KIP	FOR. Z,KIP	MOM X,KIP-IN	MOM Y,KIP-IN	MOM Z,KIP-IN
	***********	***********	***********	***********	***********	***********
MINIMUM	54.961	-0.2345	-0.9920	1.7079E-04	-610.79	105.88
Pile N.	21	7	1	1	21	1
MAXIMUM	283.40	0.1438	0.5430	1.7079E-04	-569.53	112.25
Pile N.	1	9	13	1	1	21

* PILE TOP DISPLACEMENTS, LOCAL *

	DISP. x,IN	DISP. y,IN	DISP. z,IN	ROT. x,RAD	ROT. y,RAD	ROT. z,RAD
	***********	***********	***********	***********	***********	***********
MINIMUM	0.041437	-0.039628	-0.1156	2.0542E-06	-2.2159E-03	9.2167E-04
Pile N.	21	15	1	1	1	1
MAXIMUM	0.6655	-0.039480	-0.1145	2.0542E-06	-2.2159E-03	9.2167E-04
Pile N.	1	1	7	1	1	1

* PILE TOP REACTIONS, LOCAL *

	AXIAL,KIP	LAT. y,KIP	LAT. z,KIP	MOM x,KIP-IN	MOM y,KIP-IN	MOM z,KIP-IN
	***********	***********	***********	***********	***********	***********
MINIMUM	54.961	-0.2345	-0.9920	1.7079E-04	-610.79	105.88
Pile N.	21	7	1	1	21	1
MAXIMUM	283.40	0.1438	0.5430	1.7079E-04	-569.53	112.25
Pile N.	1	9	13	1	1	21

* EFFECTS FOR LATERALLY LOADED PILE *

PILE	DISPL. y-DIR IN	DISPL. z-DIR IN	MOMENT z-DIR KIP-IN	MOMENT y-DIR KIP-IN	SHEAR y-DIR KIP	SHEAR z-DIR KIP	SOIL REACT y-DIR KIP/IN	SOIL REACT z-DIR KIP/IN	TOTAL STRESS KIP/IN**2
******	**********	**********	**********	**********	**********	**********	**********	**********	**********
Min.	-0.039628	-0.1156	-112.25	-610.79	-0.086544	-0.7312	-0.036497	-0.1069	2.1058
Pile N.	15	1	21	21	8	15	1	1	21
Max.	2.1922E-03	7.5406E-03	4.3198	37.924	1.3487	5.7443	0.025946	0.055017	16.028
Pile N.	9	9	8	9	1	1	1	1	1

Axial Pile Resistance

Objective

Evaluate the axial geotechnical resistance of the abutment and pier piles for the Bucknam Road Bridge in Falmouth, ME. Evaluations were conducted to assess a suitable driving system to install a pile to the required geotechnical nominal resistance of 794 kips for the HP 14x117 abutment piles and 436 kips for HP 14x89 piles at the pier .

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, 8th edition. (AASHTO LRFD)

Soil Properties

Consider Bucknam Road Bridge Interpretive Subsurface Profile (see Figure 3), subsurface layering and properties relative to pile design are presented in the Apile outputs attached.

Structural Properties

ASTM A572, Gr. 50 piles

Yield Strength of Steel $F_y := 50ksi$

Young's Modulus of Steel $E_s := 30000 \cdot ksi$

Abutments: HP14x117

Radius of gyration (weak axis) $r_{y.1} := 3.59in$

Area of section $A_{s.1} := 34.4in^2$

Pier: HP14x89

Radius of gyration (weak axis) $r_{y.2} := 3.53in$

Area of section $A_{s.2} := 26.1in^2$

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: $P_{n.1} := 0.66 \cdot F_y \cdot A_{s.1}$ $P_{n.1} = 1720 \cdot kip$ **Abutments: HP14x117**

$P_{n.2} := 0.66 \cdot F_y \cdot A_{s.2}$ $P_{n.2} = 1305 \cdot kip$ **Pier: HP14x89**

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 per AASHTO Eq. 6.9.2.1-1:

$P_{r.1} := {}_c \cdot P_{n.1} = 860 \cdot kip$ **Abutments: HP14x117**

$P_{r.2} := {}_c \cdot P_{n.2} = 652.5 \cdot kip$ **Pier: HP14x89**

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 per AASHTO Eq. 6.9.2.1-1 :

$P_{r.1} := \cdot P_{n.1} = 1720 \cdot kip$ **Abutments: HP14x117**

$P_{r.2} := \cdot P_{n.2} = 1305 \cdot kip$ **Pier: HP14x89**

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.

Abutments: Required nominal resistance of 794 kips for the pile configuration based on a maximum factored pile loads of 516 kips (max factored 385 kips and 131 kips downdrag) and a 0.65 resistance factor.

Pier: Required nominal resistance of 436 kips for the pile configuration based on a maximum factored pile loads of 283 kips and a 0.65 resistance factor.

The estimated % skin friction resistance is 10-20% for the 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 may be lower than the calculated static resistance.

5. Geotechnical Axial Resistance - Drivability Analysis

$\sigma_{dr} := 0.9 \cdot \phi_{da} \cdot f_y$ AASHTO Eq. 10.7.8.1

$f_y := 50\text{ksi}$ yield Strength of steel

$\phi_{da} := 1.0$ AASHTO Table 10.5.5.2.3-1 Refers to Article 6.5.4.2, Pg. 6-28

$\sigma_{dr} := 0.9 \cdot \phi_{da} \cdot f_y \qquad \sigma_{dr} = 45 \cdot \text{ksi}$ Driving Stress in pile cannot exceed 45 ksi

Abutment Piles - Drive pile plumb through 90 feet of soil to rock with toe quake representative of tip resistance in soft soil (0.1 in) and no plug. Model pile length as 95 feet (5 foot stickup at end of drive).

Drive abutment piles with a Delmag D46-32 open-ended diesel hammer with a maximum rated energy of 107,315 ft-lbs (fuel setting 2, one below maximum).

Pier Piles - Drive pile plumb through 72 feet of soil to rock with toe quake representative of tip resistance in soil (0.07 in) and no plug and representative of tip resistance on rock (0.04 in), to evaluate range of driving conditions. Model pile length as 77 feet (5 foot stickup at end of drive).

Drive pier piles with a Delmag D25-32 open-ended diesel hammer with a rated energy of 58,245 ft-lbs (fuel setting 4, three below max).

GRLWEAP Output is attached for the piles.

$R_{ndr1} := 794\text{kip}$ Required nominal geotechnical resistance:
Toe quake 0.1 inch (fuel setting 2) - pile driving stress=41 ksi, final penetration resistance=7 bpi.

$R_{ndr2} := 436\text{kip}$ Required nominal geotechnical resistance:
Toe quake 0.1 inch (fuel setting 4) - pile driving stress=25 ksi, final penetration resistance=7 bpi.

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

6. Factored Drivability Resistance - Strength Limit State:

Strength Limit State Factored Drivability Resistance:

PDA, WEAP and CAPWAP used to establishing driving criteria $\qquad dyn := 0.65$ $\qquad$ AASHTO Table 10.5.5.2.3-1

$$R_{ndr1\_factored} := R_{ndr1} \cdot dyn$$

$$R_{ndr1\_factored} = 516 \cdot kip$$

131 kips downdrag and 385 kips Axial load

$$R_{ndr2\_factored} := R_{ndr2} \cdot dyn$$

$$R_{ndr2\_factored} = 283 \cdot kip$$

7. Factored Drivability Resistance - Service/Extreme Limit States:

Service and Extreme Limit State Factored Drivability Resistance:

Resistance Factors for Extreme Limit States: $\qquad serv\_ext := 1$

From Article 10.5.5.1 and 10.5.5.3

Pier 1:

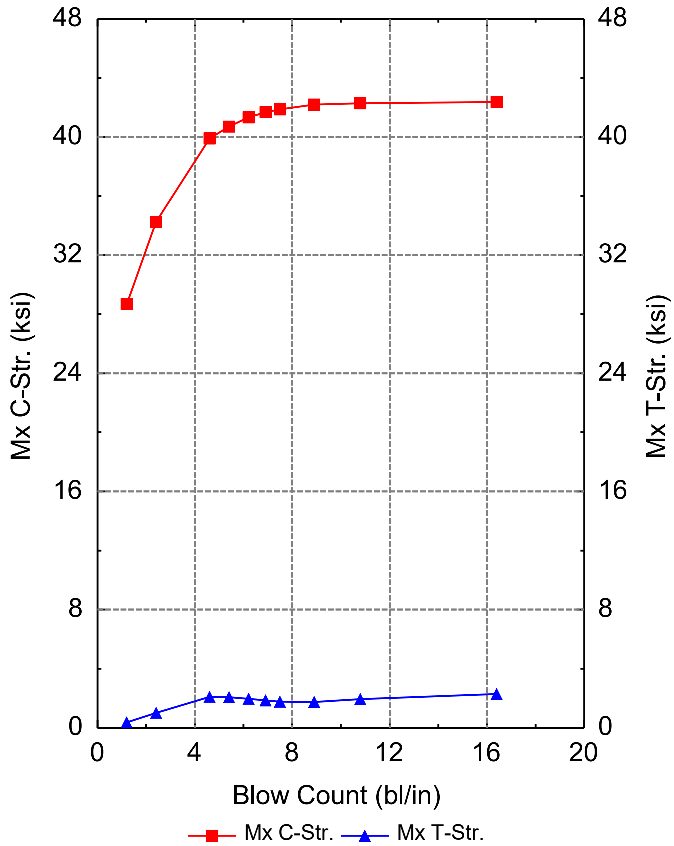
$$R_{ndr1\_serv\_ext} := R_{ndr1} \cdot serv\_ext$$

$$R_{ndr1\_serv\_ext} = 794 \cdot kip$$

$$R_{ndr2\_serv\_ext} := R_{ndr2} \cdot serv\_ext$$

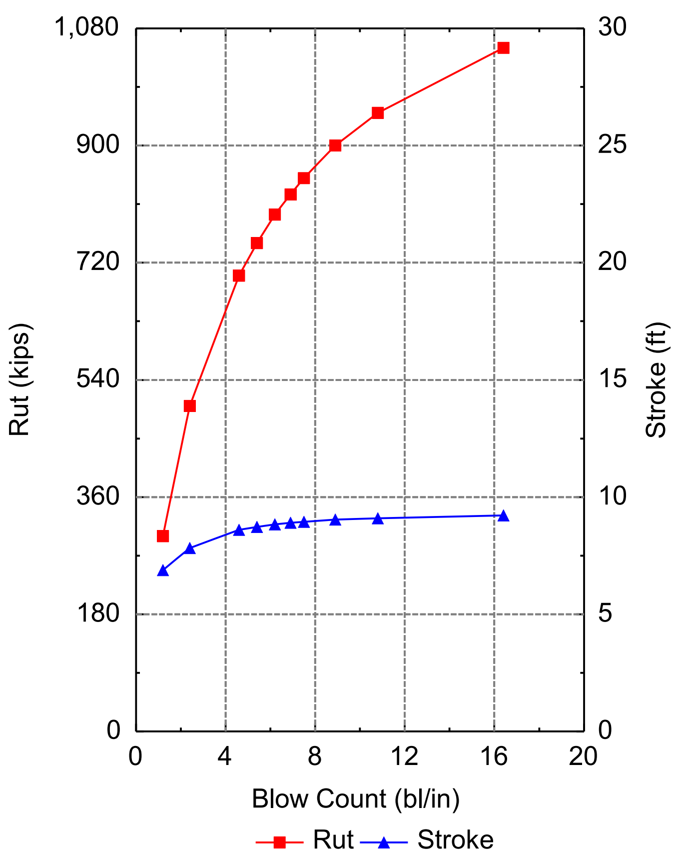
$$R_{ndr2\_serv\_ext} = 436 \cdot kip$$

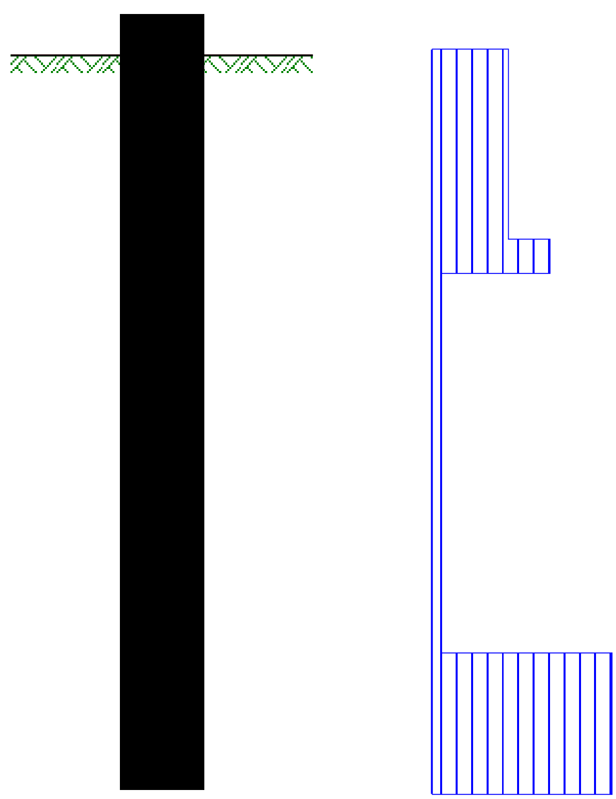
Since the driving stresses do not exceed the limiting driving stress of 45 ksi for ASTM A572 steel (50 ksi yield stress), and the calculated penetration resistance for both abutment and pier piles are within the MaineDOT preferred range of 6 to 15 blows per inch, the analyzed hammer system is judged acceptable to install the piles to the required nominal resistances.



DELMAG D 46-32

Ram Weight	10.14	kips
Efficiency	0.800	
Pressure	1415.0 (90%)	psi
Helmet Weight	3.100	kips
Hammer Cushion	109976.0	kips/in
COR of H.C.	0.800	
Skin Quake	0.100	in
Toe Quake	0.100	in
Skin Damping	0.200	s/ft
Toe Damping	0.150	s/ft
Pile Length	95.000	ft
Pile Penetration	90.000	ft
Pile Top Area	34.400	in²
RSA	No	



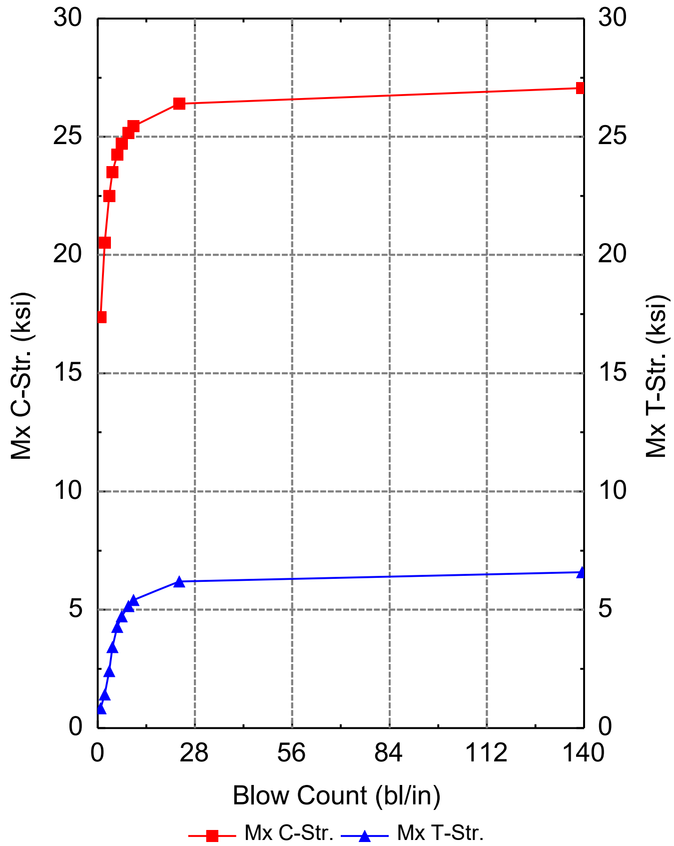


Pile Model

Shaft=15%
(Prop.)

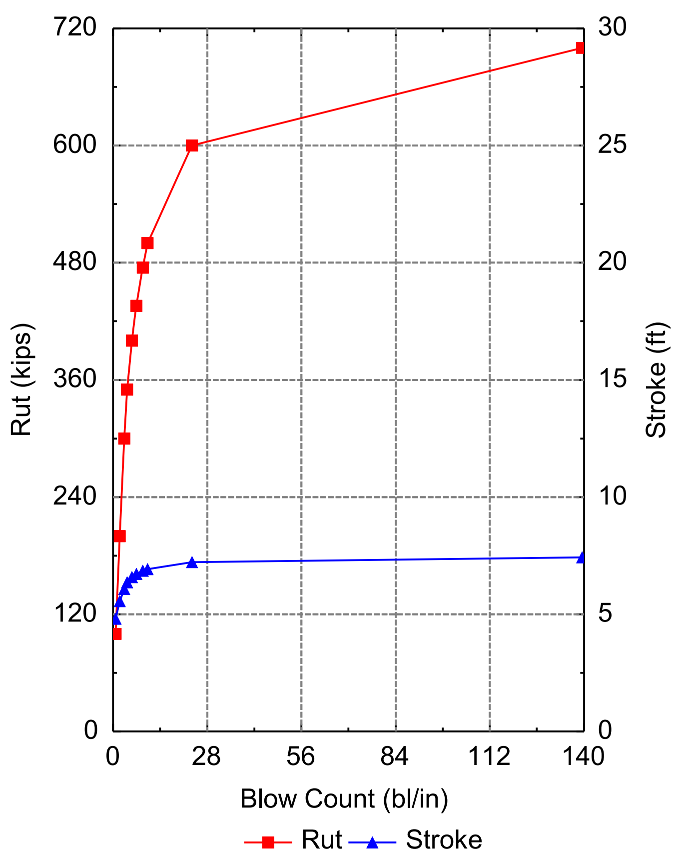
Bearing Graph Summary — DELMAG D 46-32

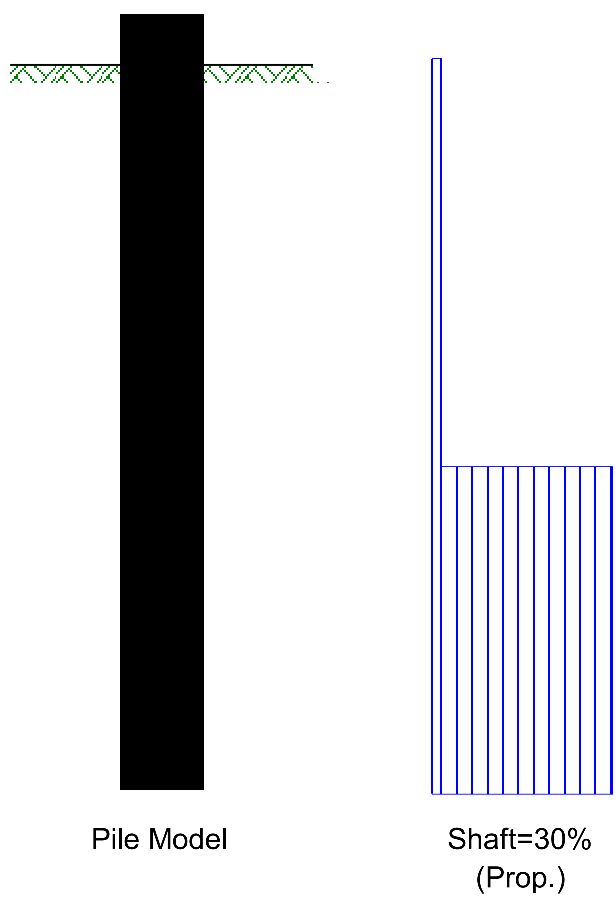
Rut	Mx C-Str.	Mx T-Str.	Blow Ct	Stroke	ENTHRU	Hammer
kips	ksi	ksi	bl/in	ft	kip-ft	-
300.0	28.67	0.37	1.2	6.89	49.20	D 46-32
500.0	34.24	1.02	2.4	7.83	51.56	D 46-32
700.0	39.89	2.09	4.6	8.61	55.88	D 46-32
750.0	40.70	2.08	5.4	8.73	56.61	D 46-32
794.0	41.33	1.97	6.2	8.84	57.11	D 46-32
825.0	41.67	1.86	6.9	8.90	57.41	D 46-32
850.0	41.86	1.77	7.5	8.95	57.60	D 46-32
900.0	42.18	1.74	8.9	9.04	58.13	D 46-32
950.0	42.28	1.94	10.8	9.09	58.33	D 46-32
1050.0	42.37	2.29	16.4	9.23	58.85	D 46-32



DELMAG D 25-32

Ram Weight	5.51	kips
Efficiency	0.800	
Pressure	1095.0 (73%)	psi
Helmet Weight	3.100	kips
Hammer Cushion	109976.0	kips/in
COR of H.C.	0.800	
Skin Quake	0.100	in
Toe Quake	0.100	in
Skin Damping	0.200	s/ft
Toe Damping	0.150	s/ft
Pile Length	77.000	ft
Pile Penetration	72.000	ft
Pile Top Area	26.100	in^2
RSA	No	





Bearing Graph Summary — DELMAG D 25-32

Rut	Mx C-Str.	Mx T-Str.	Blow Ct	Stroke	ENTHRU	Hammer
kips	ksi	ksi	bl/in	ft	kip-ft	-
100.0	17.37	0.84	0.8	4.81	19.49	D 25-32
200.0	20.53	1.42	2.0	5.56	18.59	D 25-32
300.0	22.49	2.40	3.3	6.07	19.71	D 25-32
350.0	23.51	3.41	4.2	6.37	20.72	D 25-32
400.0	24.24	4.28	5.6	6.58	21.42	D 25-32
436.0	24.71	4.73	6.9	6.72	21.90	D 25-32
475.0	25.17	5.15	8.8	6.86	22.36	D 25-32
500.0	25.45	5.41	10.3	6.93	22.64	D 25-32
600.0	26.40	6.19	23.5	7.23	23.58	D 25-32
700.0	27.06	6.59	139.5	7.43	24.23	D 25-32

Lateral Earth Pressure

GZA GeoEnvironmental, Inc
707 Sable Oaks Drive
Suite 150
South Portland, Maine 04106
207-879-9190
Fax 207-879-0099

Engineers and Scientists

Subject:

Evaluate lateral earth pressure coefficients

References:

1. MaineDOT Bridge Design Guide, Chapter 3
2. AASHTO LRFD Bridge Design Specifications, 8th Edition (2017)
3. Massachusetts Department of Transportation Highway Division LRFD Bridge Manual Part I, section 3.10.8

Input Parameters:

$:= 0\mathrm{deg}$ Angle of backfill to the horizontal

$:= 90\mathrm{deg}$ Angle of backface of wall to the horizontal

$:= 32\mathrm{deg}$ Effective angle of internal friction *(Granular borrow, Soil Type 4, BDG Table 3-3)*

$_f := 19.5\mathrm{deg}$ Average value of friction angle between, precast concrete and clean sand/silty sand-gravel mixture *(AASHTO LRFD Table 3.11.5.3-1)*

Passive Earth Pressure on Integral Backwall:

Per BDG Section 5.4.2.11, developing full passive pressure requires that ratio of lateral abutment movement (y) to abutment height (Hb) exceeds 0.005. If the calculated rotation is significantly less, Rankine earth pressure may be considered.

$y := 0.725\mathrm{in}$ Expansion deflection From structural engineer

$H_b := 11.25\mathrm{ft}$ Abutment Height

$\frac{y}{H_b} = 0.0054$ Ratio of lateral movement to abutment height.

Earth Pressure Coefficients:

Since the ratio of lateral movement is less than .005 but not significantly less, GZA evaluated the typical Coloumb values and compared values to the Massachusetts DOT methodology presented in section 3.1.8 for design of the Bucknam Road bridge.

MassDOT Section 3.10.8 presents the plot and calculation shown below for a gravel borrow material.

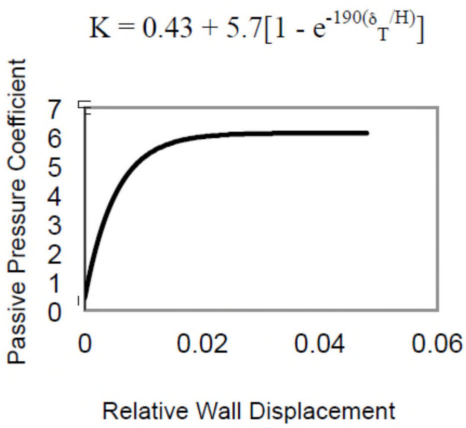


Figure 3.10.8-1: Plot of Passive Pressure Coefficient, K, vs. Relative Wall Displacement, δ_T/H.

$$:= \frac{y}{H_b} = 0.0054$$

$$K_{p.mass} := 0.43 + 5.7\left(1 - \exp\left(-190 \cdot \frac{y}{H_b}\right)\right) = 4.08$$

$$\boxed{K_{p.mass} = 4.08}$$

The passive earth pressure coefficient (Kp) for structural fill is 4.08 using the MassDOT methodology. We anticipate it would be equal or higher for the lightweight fill since the friction angle is higher. A range of 4.08 to 4.5 is appropriate for Kp for lightweight fill considering the MassDOT Methodology. We recommend using the Kp value for lightweight fill that creates the highest load scenario.

Frost Calculation

March 2014

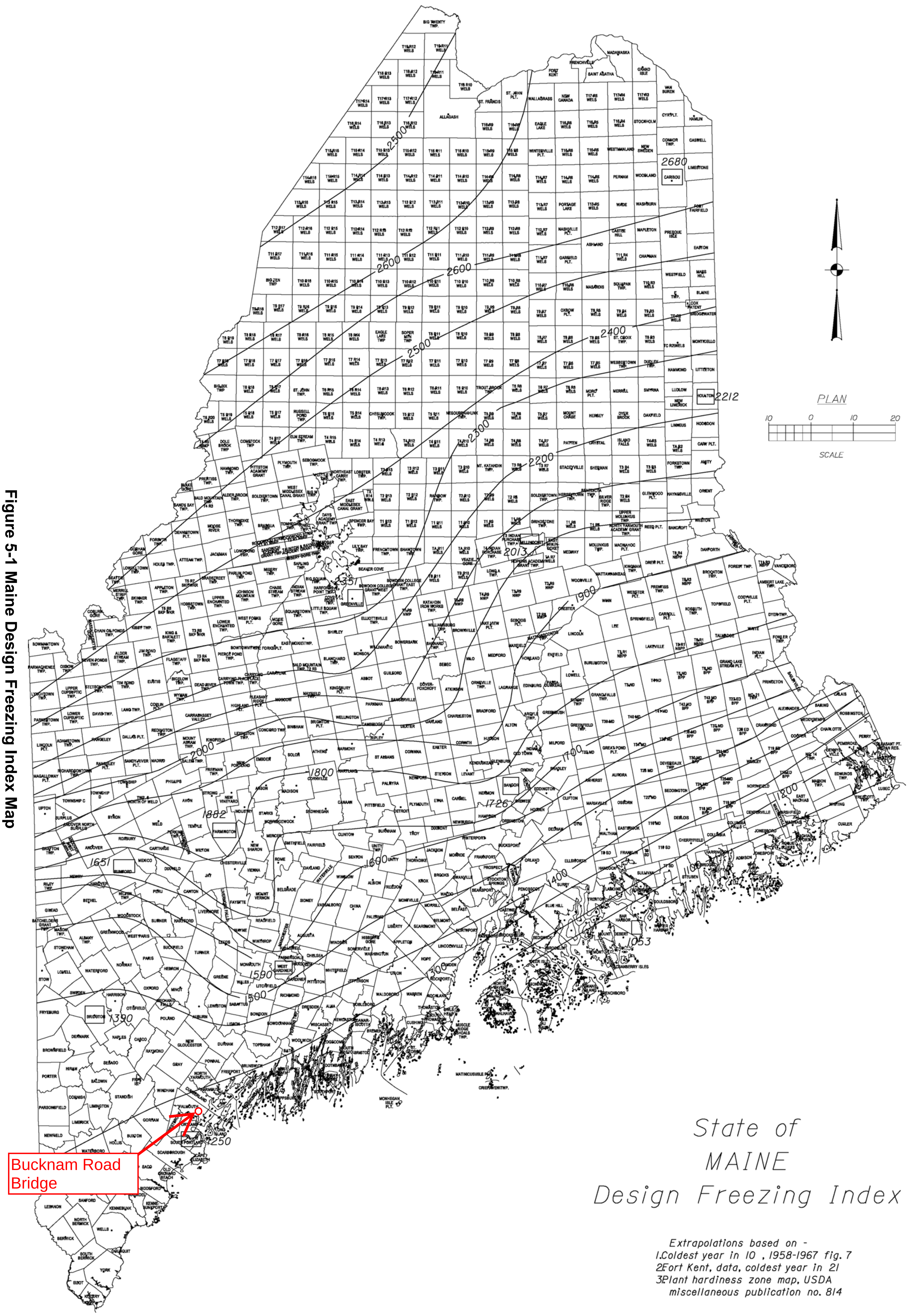


Figure 5-1 Maine Design Freezing Index Map

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	[illegible]	60.3	60.2	51.9	46.9
1700	87.5	[illegible]	62.2	[illegible]	[illegible]	48.4
1800	90.1	[illegible]	64.0	[illegible]	[illegible]	49.8
1900	92.6	[illegible]	65.7	[illegible]	[illegible]	51.1
2000	95.1	78.7	67.5	[illegible]	[illegible]	52.5
2100	97.6	80.7	69.2	69.3	59.7	53.8
2200	100.0	82.6	70.8	71.0	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

1275

5.75' for Abutment fills

average of coarse and fine grained 20% wc, 41.8"=4.5' at Pier, Pile cap is embedded below the top of clay and the ground water line but fill soils will be placed around the cap.

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: Granular materials with approximately 10 to 20 percent water content are anticipated near the abutment bearing elevations, therefore based on the freezing index of 1275 the estimated frost depth is 5.75 feet.

Pier: Marine clay deposit soils are anticipated to be present near the elevation of the pier pile caps but granular fill is anticipated to be placed adjacent to the pile cap. The granular material controls, therefore material is coarse-grained with water contents of approximately 30%. Based on the MaineDOT BDG, Section 5.2.1 and a Freezing Index of 1275 the estimated depth of frost penetration is 4.5 feet.